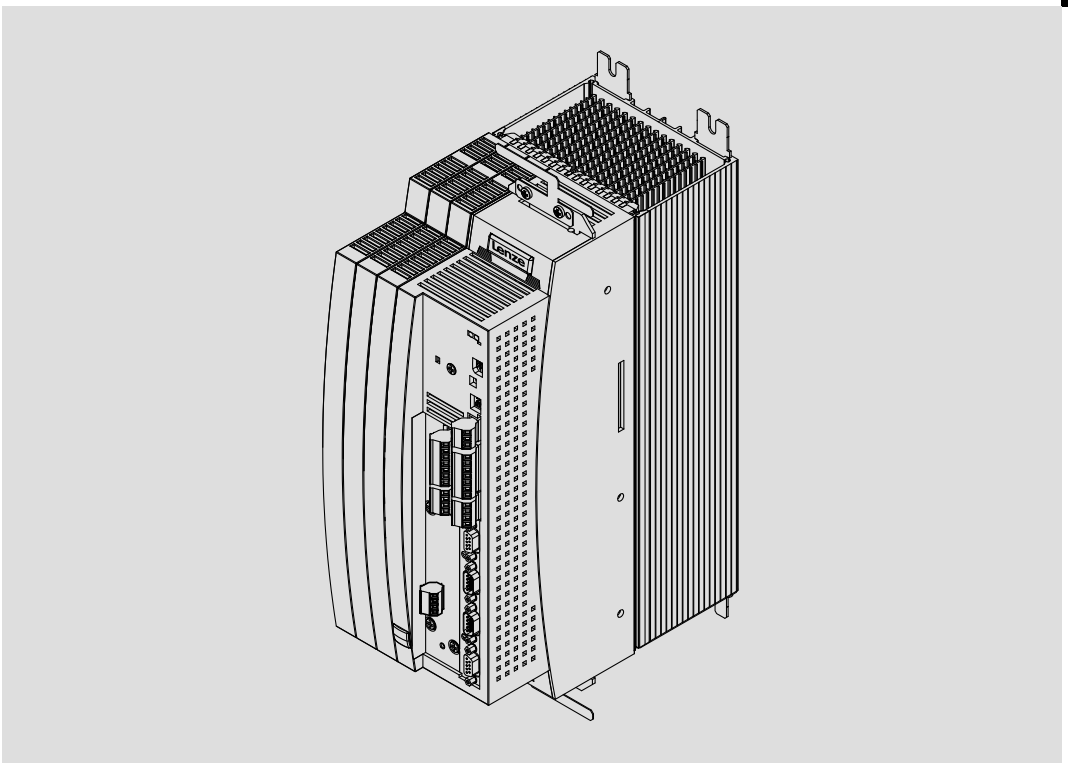
EDKVS93-01
13440647

Information for the operator of the machine

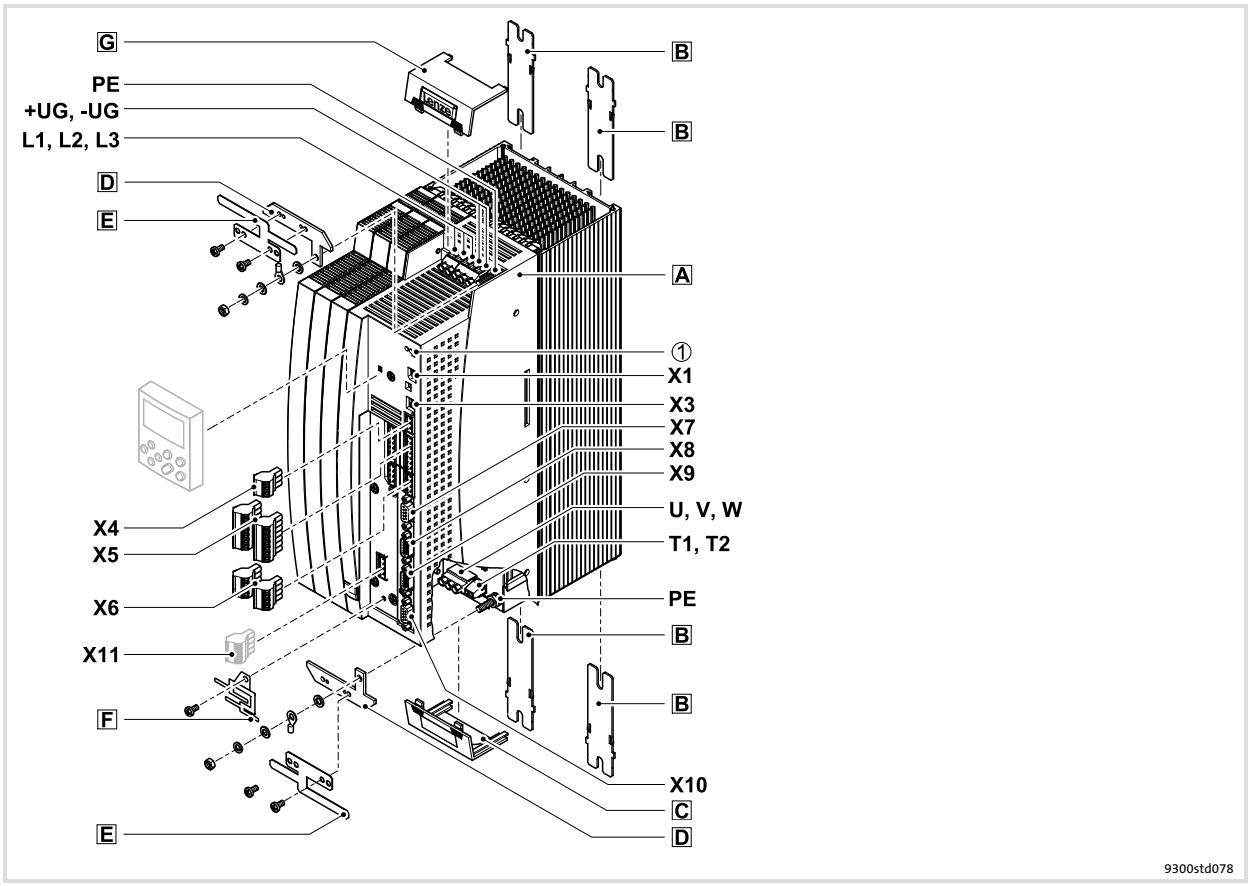
9300 *0.37 ... 11 kW*



EVS9321-xx ... EVS9326-xx

Servo controller

Lenze


G
PE
+UG, -UG
L1, L2, L3
D
E
B
B
A
①
X1
X3
X7
X8
X9
U, V, W
T1, T2
PE
B
B
X10
C
D
X4
X5
X6
X11
F
E
9300std078

Key for overview

Position	Description
A	Controller
B	Fixing rails for standard mounting
C	Cover for the motor connection
D	Shield connection support with fixing screws (2 items) 1 support for the shield sheet for the supply connections 1 support for the shield sheet for the motor cable
E	EMC shield sheet with fixing screws (2 items) 1 shield sheet for the supply connections 1 shield sheet for the motor cable and the feed cable for the motor temperature monitoring with PTC thermistor or thermal contact (NC contact)
F	EMC shield sheet with fixing screws for shielded control cables
G	Cover for the supply connections

Connections and interfaces

Position	Description
L1, L2, L3, PE	Mains connection
+UG, -UG	DC supply
U, V, W, PE	Motor connection
T1, T2	Connection of PTC thermistor or thermal contact (NC contact) of the motor
X1	AIF interface (automation interface) Slot for communication module (e. g. XT EMZ9371BC keypad)
X3	Jumper for setting analog input signal at X6/1, X6/2
X4	System bus (CAN) connection
X5	Connection of digital inputs and outputs
X6	Connection of analog inputs and outputs
X7	Connection of resolver and KTY temperature sensor of the motor
X8	Connection of incremental encoder with TTL level or SinCos encoder and KTY temperature sensor of the motor
X9	Connection of digital frequency input signal
X10	Connection of digital frequency output signal
X11	Connection of K_{SR} relay output for ”safe standstill” (for variants V004 and V104 only)

Status displays

Position	LED red	LED green	Operating status
①	Off	On	Controller enabled
	On	On	Mains is switched on and automatic start is inhibited
	Off	Blinking slowly	Controller inhibited
	Blinking quickly	Off	Undervoltage or overvoltage
	Blinking slowly	Off	Active fault

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1 About this documentation

Note!

This documentation contains all necessary information for the machine operator to be able to operate the servo controllers of the 9300 series installed in your machine/plant.

You can make further use of all information in this documentation without consulting Lenze if you do not make any changes to the contents.

1.1 Document history

What is new / what has changed?

Material number	Version			Description
13440647	3.0	07/2013	TD06	Error corrections
13330541	2.1	03/2010	TD23	Change of the company's address
13330541	2.0	03/2010	TD14	New edition due to reorganisation of the company UL-warnings updated Revision for software version 8x
13231631	1.0	11/2007	TD34	First edition

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.2 Target group

This documentation is directed at qualified skilled personnel according to IEC 60364.

Qualified skilled personnel are persons who have the required qualifications to carry out all activities involved in installing, mounting, commissioning, and operating the product.

1.3 Validity information

... 9300 servo controllers as of nameplate data:

	①						②	③	Nameplate
	EVS	93xx	–	x	x	Vxxx	1x	8x	

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW

Type

E = Panel-mounted unit

C = Built-in unit in ”cold plate” technique

Design

I = Servo PLC

K = Servo cam

P = Servo position controller

R = Register controller

S = Servo inverter

T = Servo PLC technology

Variant

– Standard

V003 = In ”cold plate” technique

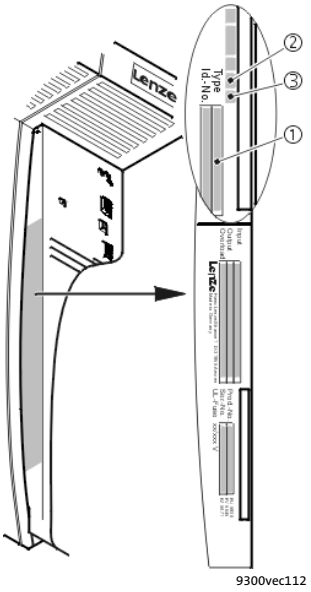
V004 = With ”safe standstill” function

V100 = For IT mains

V104 = With ”safe standstill” function and for IT mains

Hardware version

Software version



1.4 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	language-dependent	In each case, the signs typical for the target language are used as decimal separators. For example: 1234.56 or 1234,56
Warnings		
UL warnings	Ⓤ	Are only given in English.
UR warnings	Ⓤ	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference	☺	Reference to another documentation with additional information For example: ☺ EDKxxx = see documentation EDKxxx

1.5 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!
(characterises the type and severity of danger)
Note
(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

(in accordance with Low-Voltage Directive 2006/95/EC)

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material assets:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from Lenze.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - According to this basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
  - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
  - The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the particular applications. Lenze Automation GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- Depending on their degree of protection, some parts of the Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their accessory components can be live, moving and rotating during operation. Surfaces can be hot.
  - Non-authorised removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.
  - For more information, please see the documentation.
- High amounts of energy are produced in the controller. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

Application as directed

Controllers are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.

When controllers are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

The controllers meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonised standard EN 61800-5-1 applies to the controllers.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Warning: Controllers are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

Transport, storage

Please observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

Installation

The controllers must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

Controllers contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live controllers, observe the applicable national regulations for the prevention of accidents (e.g. VBG 4).

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation. The controllers must be installed in housings (e.g. control cabinets) to meet the limit values for radio interferences valid at the site of installation. The housings must enable an EMC-compliant installation. Observe in particular that e.g. the control cabinet doors have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Lenze controllers may cause a DC current in the PE conductor. If a residual current device (RCD) is used for protection against direct or indirect contact for a controller with three-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the controller. If the controller has a single-phase supply, a residual current device (RCD) of type A is also permissible. Apart from using a residual current device (RCD), other protective measures can be taken as well, e.g. electrical isolation by double or reinforced insulation or isolation from the supply system by means of a transformer.

Operation

If necessary, systems including controllers must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The controllers can be adapted to your application. Please observe the corresponding information given in the documentation.

After the controller has been disconnected from the supply voltage, all live components and power terminals must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.

All protection covers and doors must be shut during operation.

Notes for UL-approved systems with integrated controllers: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

Safety functions

Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”) according to the requirements of the EC Directive 2006/42/EC (Machinery Directive). The notes on the integrated safety system provided in this documentation must be observed.

Maintenance and servicing

The controllers do not require any maintenance if the prescribed operating conditions are observed.

Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

The product-specific safety and application notes given in these instructions must be observed!

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- ► I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- ► The calculated motor load is saved when the mains is switched.
- ► The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- ► However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- ► Adjustable response OC8 (TRIP, warning, off).
  - – The trigger threshold is set in C0127.
  - – The response is set in C0606.
  - – The response OC8, for instance, can be used for an advance warning.
- ► Fixed response OC6-TRIP.
  - – The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2 x t load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

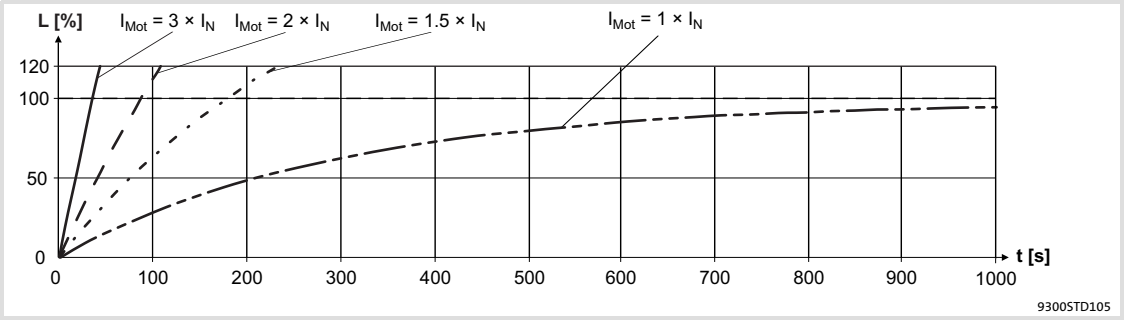


Fig. 2-1 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L I^2 x t load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

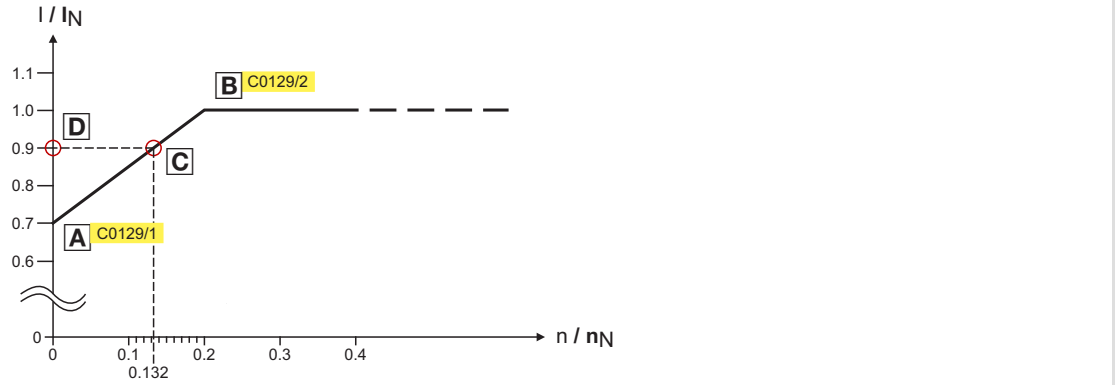


Fig. 2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1**and **C0129/2** (evaluation coefficient "y", 16).

Calculate release time and I^2 x t load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- Before working on the controller, check whether all power terminals are deenergised:
  - The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least three minutes after disconnection from the mains.
  - The power terminals L1, L2, L3; U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.
- The leakage current to earth (PE) is > 3.5 mA. According to EN 61800-5-1
  - a fixed installation is required.
  - a double PE connection is required or, if in single design, it must have a cable cross-section of at least 10 mm^2.
- The heatsink of the controller has an operating temperature of > 80 °C:
  - Contact with the heatsink results in burns.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xx and EVS9322-xx.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xx ... EVS9332-xx.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Protection of the machine/system

- Drives can reach dangerous overspeeds (e. g. setting of high output frequencies in connection with motors and machines not suitable for this purpose):
  - The drive controllers do not provide protection against such operating conditions. For this purpose, use additional components.

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9321 ... EVS9326:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by CC, J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +55 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 75 °C copper wire only.

3 Parameter setting

3.1 Parameter setting with the XT EMZ9371BC keypad

Description

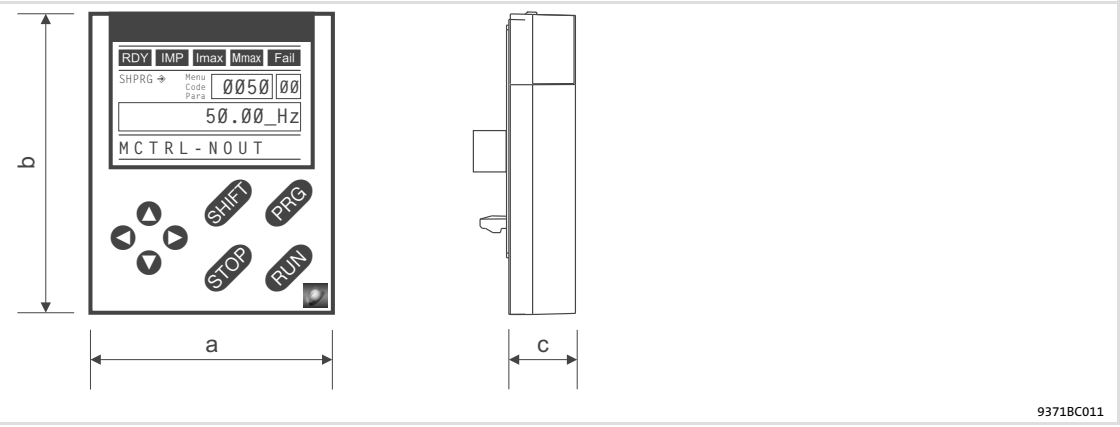
The keypad is available as an accessory. A full description of the keypad can be obtained from the Instructions included in the keypad delivery.

Plugging in the keypad

It is possible to plug the keypad into the AIF interface or remove it during operation.

As soon as the keypad is supplied with voltage, it carries out a self-test. The keypad is ready for operation if it is in display mode.

3.1.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm
Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)
Enclosure		IP 20

3.1.2 Installation and commissioning

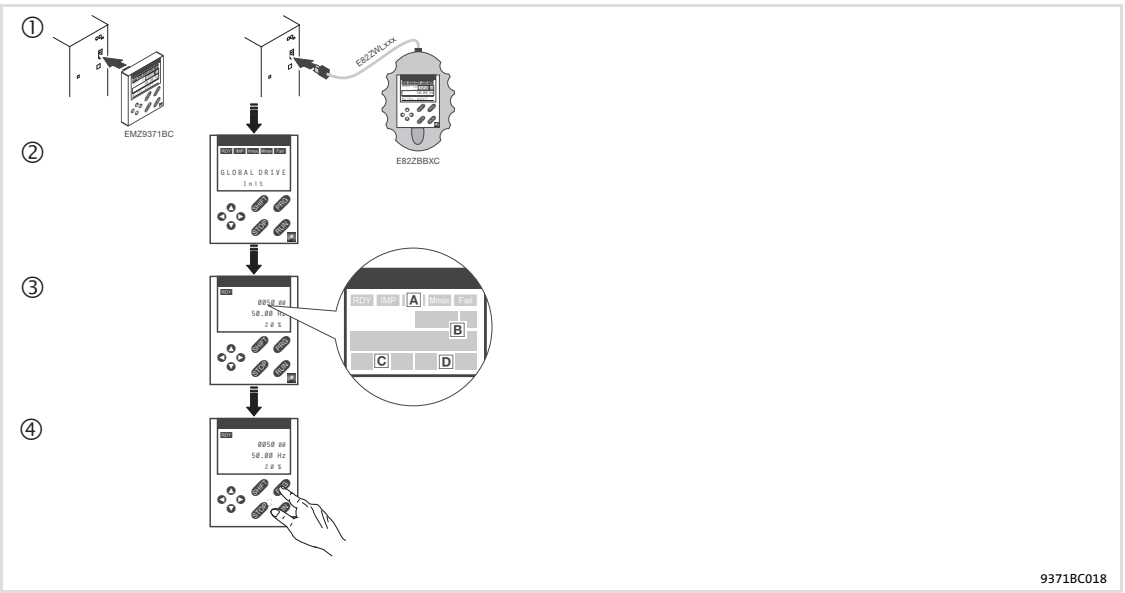


Fig. 3-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

A Current state of the standard device

B Memory location 1 of the user menu (C0517):
Code number, subcode number, and current value

C Active fault message or additional status message

D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

3.1.3 Display elements and function keys

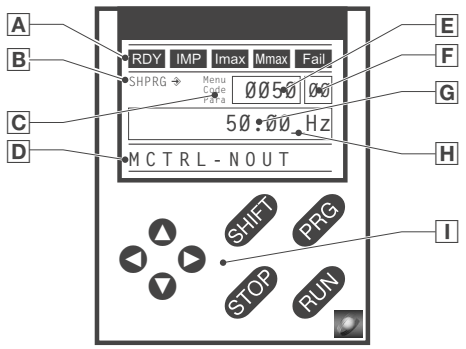


Fig. 3-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	**Status displays of standard device**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	
	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:

Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	**Code level**	**Parameter level**	**Operating level**
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations[1)]		Accept parameters when SHPRG → or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset): 1. Remove the cause of malfunction 2. Press STOP 3. Press RUN			

1) Only active for operation with standard devices of the 8200 vector or 8200 motec series

3.1.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept the parameter Display "OK"
	Display →		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the "loop" with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 "PAR SAVE" in the menu "Load/Store"
		B	PRG	Change to the parameter level Display "0" and "READY"
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set "1" "Save PS1"
				Save as parameter set 2: ⇨ Set "2" "Save PS2"
				Save as parameter set 3: ⇨ Set "3" "Save PS3"
				Save as parameter set 4: ⇨ Set "4" "Save PS4"
		D	SHIFT PRG	When "OK" is displayed, the settings are permanently saved in the selected parameter set.

Step			Key sequence	Action
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

1) The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

3.1.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

3.1.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ► ◄	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT + PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step		Key sequence	Action
1.	Connect the keypad to standard device 2		
2.	Inhibit controller		Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6		All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu	▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level	PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function		The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.		● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 25
		▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.		
		▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
			Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
			Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
			Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying	SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level		
	A	PRG	Display of the operating level
	B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.	▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6		
11.	Enable controller		Terminal X5/28 = HIGH The drive is running with the new settings.

3.1.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the ”USER menu”		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 ”MCTRL-NACT”
3.	Select C0094		▲	Display of code C0094 ”Password”
4.	Change to the parameter level		PRG	Display ”0” = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”
7.	Change to the ”USER menu”		◀ ◀ ▼	

The password protection is active now.
You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 ”Password”
3.	Change to the parameter level		PRG	Display ”9999” = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”

The password protection is deactivated now. All menus can be freely accessed again.

3.1.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

- monitoring the drive
- fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

3.1.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	Display	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

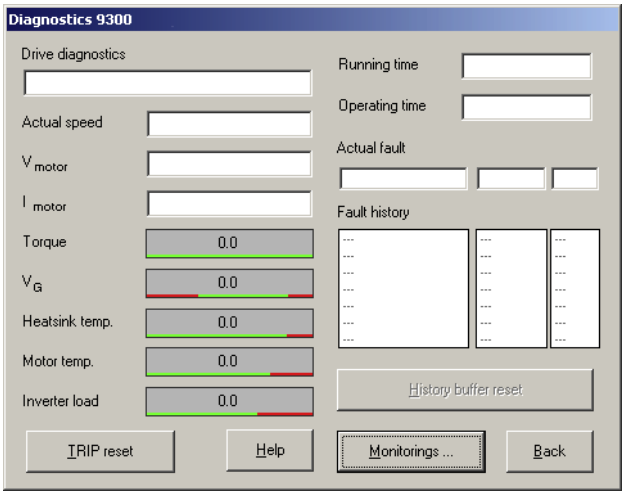
Main menu	Submenus	Description
Display	**Display**	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

4 Troubleshooting and fault elimination

4.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 4-1 ”Diagnostics” dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
  – the history buffer in Global Drive Control (GDC) (📖 34) or
  – the XT keypad
  – and with the ”General error messages” table in the ”System error messages” chapter.

► The ”General error messages” table provides tips on how to eliminate an error.

4.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

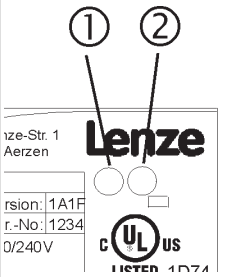
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 36)

4.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

LED		Operating status	
Red ①	**Green** ②		
Off	On	Controller enabled	
On	On	Mains switched on and automatic start inhibited	
Off	Blinking slowly	Controller inhibited	
Blinking quickly	Off	Undervoltage or overvoltage	
Blinking slowly	Off	Fault active	



4.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.

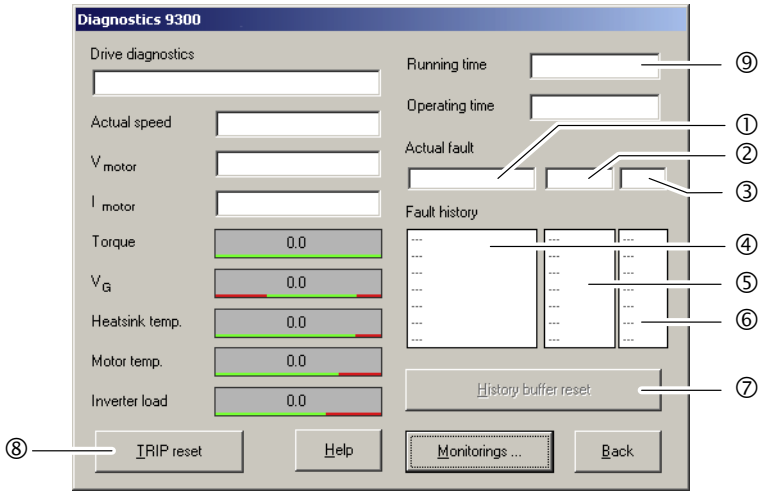


Fig. 4-2 ”Diagnostics” dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged: ● The content of memory units 1 ... 7 is shifted ”upwards” by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
④	⑤	⑥	2	Last fault	
			3	Next to last fault	
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

4.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Pulse inhibit (IMP)		
			Bit2	Not assigned		
			Bit3	Not assigned		
			Bit4	Not assigned		
			Bit5	Not assigned		
			Bit 6	n = 0		
			Bit 7	Controller inhibit (CINH)		
			Bit 8	Device status bit 1		
			Bit 9	Device status bit 2		
			Bit10	Device status bit 3		
			Bit11	Device status bit 4		
			Bit12	Warning		
			Bit13	Message		
			Bit14	Not assigned		
			Bit15	Not assigned		
C0155	Status word 2	0				Status word 2 (advanced status word) Display only
			0	{1}	65535	Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault		
			Bit 1	M_{max} reached		
			Bit 2	I_{max} reached		
			Bit 3	Pulse inhibit(IMP)		
			Bit 4	Ready for operation (RDY)		
			Bit 5	Controller inhibit (CINH)		
			Bit 6	TRIP active		
			Bit 7	Initialisation		
			Bit 8	Motor direction of rotation (Cw/CCw)		
			Bit 9	Not assigned		
			Bit 10	Not assigned		
			Bit 11	Not assigned		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		

4.3 System error messages

4.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
x066	CE5	Time-out of system bus (CAN) (communication error of gateway function)	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring of system bus (CAN). • Check CAN bus configuration.
0070	U15	Undervoltage of internal 15 V voltage supply		Check voltage supply.
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0073	PR2	Checksum error in parameter set 2 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 2.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 2.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0077	PR3	Checksum error in parameter set 3 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 3.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 3.

Fault message		Description	Cause	Remedy
No.	Display			
0078	PR4	Checksum error in parameter set 4 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 4.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 4.
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
0080	PR6	Too many user codes		Reduce the number of user codes.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!

Fault message		Description	Cause	Remedy
No.	Display			
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	● Check external encoder. ● Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	● Contact Lenze. ● Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	● Contact Lenze. ● Switch off the monitoring (C0588 = 3).
x151	P01	Error ”negative limit switch”.	Negative limit switch was reached.	● Control drive in positive direction ● Check wiring at X5/E2.
x152	P02	Error ”positive limit switch”.	Positive limit switch was reached.	● Control drive in negative direction ● Check wiring at X5/E1.
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	● Increase following error limit under C0255. ● Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x154	P04	Error ”negative position limit”.	Negative position limit (C1224) was not reached.	Find out why the value was not reached (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1224 if necessary.
x155	P05	Error ”positive position limit”.	Positive position limit (C1223) was exceeded.	Find out why the value was exceeded (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1223 if necessary.
x156	P06	No reference.	The reference point is not known. In the case of absolute positioning, no homing was performed before the first positioning.	Perform one of the following functions and restart: ● Manual homing. ● Start homing in the program. ● Set reference.
x157	P07	Parameter set mode is absolute instead of relative.	An absolute parameter set (C1311) was performed during relative positioning (position mode C1210).	Perform one of the following functions and restart: ● Change the parameter set from absolute to relative. ● Change position mode.
x158	P08	Error ”actual reference dimension offset”.	Actual reference dimension offset (C1226) outside the position limits. Error of the program function ”set position value”.	If necessary, adapt the position limit values or check whether the program function ”set position value” is to be applied.
x159	P09	Error in positioning program.	Impermissible programming	Check position program: ● A parameter set with final speed must be followed by a parameter set with positioning; it is not permissible to wait for input.

Fault message		Description	Cause	Remedy
No.	Display			
x162	P12	Error in the range of the encoder.	The range of the absolute encoder was exceeded.	● Return drive by manual positioning. ● Check position limits and adjustment of the encoder. ● Design and mount the absolute encoder in a way that does not exceed the traversing range.
x163	P13	Angle overrun.	● Phase controller limit reached ● Drive cannot follow the digital frequency (I_{max} limit).	● Enable drive ● Check drive dimensioning.
x164	P14	1. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/1.	● Increase current limit under C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/1
x165	P15	2. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/2.	● Increase current limit C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/2
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	● Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	● Check communication channel. ● Check baud rate, controller address. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.
x167	P17	Error ”touch probe control”.	Various function blocks use the touch probe input at the same time (e.g. FB DFSET and POS). A conflict arises.	● Configure another touch probe input for FB POS (not possible for FB DFSET). ● Switch off monitoring (C1289/1).

Fault message		Description	Cause	Remedy
No.	Display			
x168	P18	Internal limitation.	Arithmetic operation generated data cannot be varied arbitrarily. Wrongly specified values were automatically limited internally.	
			C1298 = 1: The negative position limit in C1223 is outside the possible display range of $1 \leq (C1223 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/10 and enter it in C1223 if necessary.
			C1298 = 2: The positive position limit in C1224 is outside the possible display range of $1 \leq (C1224 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/11 and enter it in C1224 if necessary.
			C1298 = 3: The maximum speed v_{max} in C1240 is outside the possible display range of $1 \leq (C1240 \times C1205 \times 16.384) \leq 2.14E9$ inc or v_{max} not $C1240 / C1204 \times 60 \leq 1.5 \times n_{max}$	Check the values in C0011, C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/12 and enter it in C1240 or adjust the value in C1240 to C0011 if necessary.
			C1298 = 4: The maximum acceleration a_{max} in C1250 is outside the possible display range of $1 \leq (C1250 \times C1205 \times 16.384 / 10\,00) \leq 2.8634E7$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/13 and enter it in C1250 if necessary.
			C1298 = 5: An internal value range has been exceeded for a speed standardisation. Valid range: $1 \leq (C0011 \times C1207/1 / C1207/2\ 65536 / 60000) \leq 32767$	Check the values in C0011, C1207/1, C1207/2 and correct them.
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x171	P21	Following error.	The phase difference between set and actual position is larger than the following error limit set under C1328.	• Extend the following error limit under C1328. • Switch off monitoring (C1329=3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).
0201	overrun Task1	Time-out in task 1 (ID 2)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
...	...	...		
0208	overrun Task8	Time-out in task 8 (ID 9)		

Fault message		Description	Cause	Remedy
No.	Display			
0209	float Sys-T	Float error in system task (ID 0)	Error in real calculation (e. g. division by 0)	Check calculations (program code).
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)		
0211	float Task1	Float error in task 1 (ID 2)		
...	...	...		
0218	float Task8	Float error in task 8 (ID 9)		
0219	overrun Cyc.-T	Time-out in cyclic task (PLC_PRG ID 1)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
0220	noT-Fkt Credit	Not enough technology units available.	A program with technology functions has been tried to be loaded to a controller not providing the corresponding units.	• Use technology variant of the controller. • Contact Lenze, if necessary.
x220	CDA	Data error	Attempt to transmit faulty profile data	Repeat profile data transfer.
x221	CDA-LOAD	Faulty checksum	The checksum of the transferred profile data is not correct.	Repeat profile data transfer and check for correctness.
0230	No Program	Missing PLC program	No PLC program loaded.	Load PLC program.
0231	Unallowed Lib	PLC program calls invalid library function.	In the PLC program a library function has been called which is not supported by the controller (e.g. because the corresponding hardware is missing).	• Remove library function or ensure that the corresponding hardware is available. • Contact Lenze, if necessary.
0232	NoCam Data	Motion profiles (cam data) are not available.	When calling functions of the function library **LenzeCamControl.lib** it was detected that there are no motion profiles (CAM data) loaded in the memory of the controller.	• Ensure that the valid cam data has been attached to the project via the DDS CAM support. • Reload the PLC program into the controller. (Possibly the command **Online→Reset (origin)** has been executed in DDS.)
x240	ovrTrans Queue	”Free CAN objects” error	Overflow of the transmit request memory	• Reduce the number of transmit requests. • Prolong the cycle time.
x241	ovr Receive		Too many receive telegrams	Reduce the number of telegrams on the system bus (CAN).
x250	2.Flash Err	Error when the FLASH memory is accessed	The PLC program tries to access non-available or defect FLASH memory	Make sure that the PLC has the corresponding FLASH memory. If not, please contact Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
x251	AddData CsErr	Error during FLASH memory access	Check sum error occurred when loading data into the FLASH memory	Check the checksum of the file to be loaded and repeat the data transfer.

Fault message		Description	Cause	Remedy
No.	Display			
x252	AddData DlErr	Error during FLASH memory access	An error occurred when downloading the data into the FLASH memory (e.g. time-out, transmission error, mains failure during transmission)	Check/repeat data transfer.
x260	Err Node Guard	”Life guarding event”	The controller configured as a CAN slave does not receive a ”Node Guarding” telegram from the CAN master within the ”Node Life Time”.	• Check wiring at X4. • Check CAN configuration. • Ensure that ”node guarding” has been activated in the CAN master • Adapt the ”node life time” (C0383) to CAN master setting.

Explanation of the error numbers:
x 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
e.g. ”2091”: An external monitoring has triggered the warning EEr

4.3.2 Resetting system error messages

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** If a TRIP/FAIL QSP source is still active, the pending TRIP/FAIL QSP cannot be reset. The TRIP/FAIL QSP can be reset by: • pressing ⇨ STOP on keypad XT EMZ9371 BC. Then, press RUN to re-enable the controller. • Set code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word system bus (CAN) / MotionBus (CAN) at ECSxS/P/M After the reset of the TRIP/FAIL QSP, the drive remains at standstill.
Message	**Danger!** The fault message is reset automatically after the fault has been eliminated, and the drive restarts automatically.
Warning	After the fault has been eliminated, the fault message is reset automatically.

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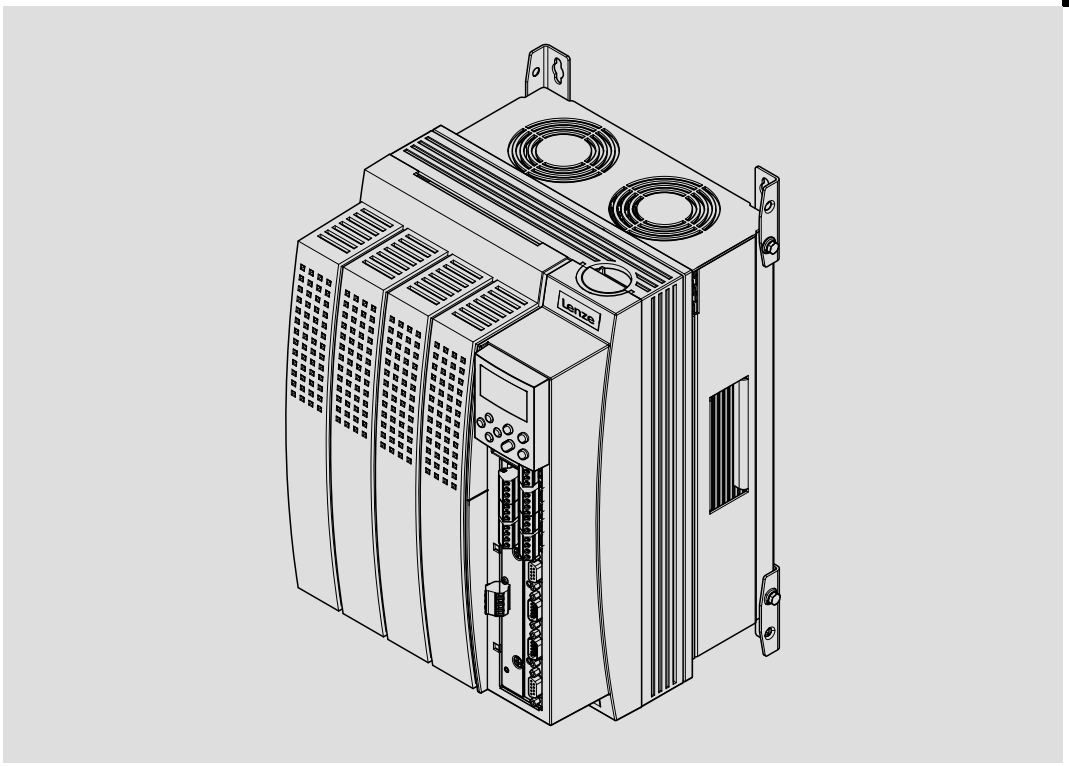
EDKVS93-01 ▪ 13440647 ▪ EN ▪ 3.0 ▪ TD06

10 9 8 7 6 5 4 3 2 1

EDKVS93-02
13440651

Information for the operator of the machine

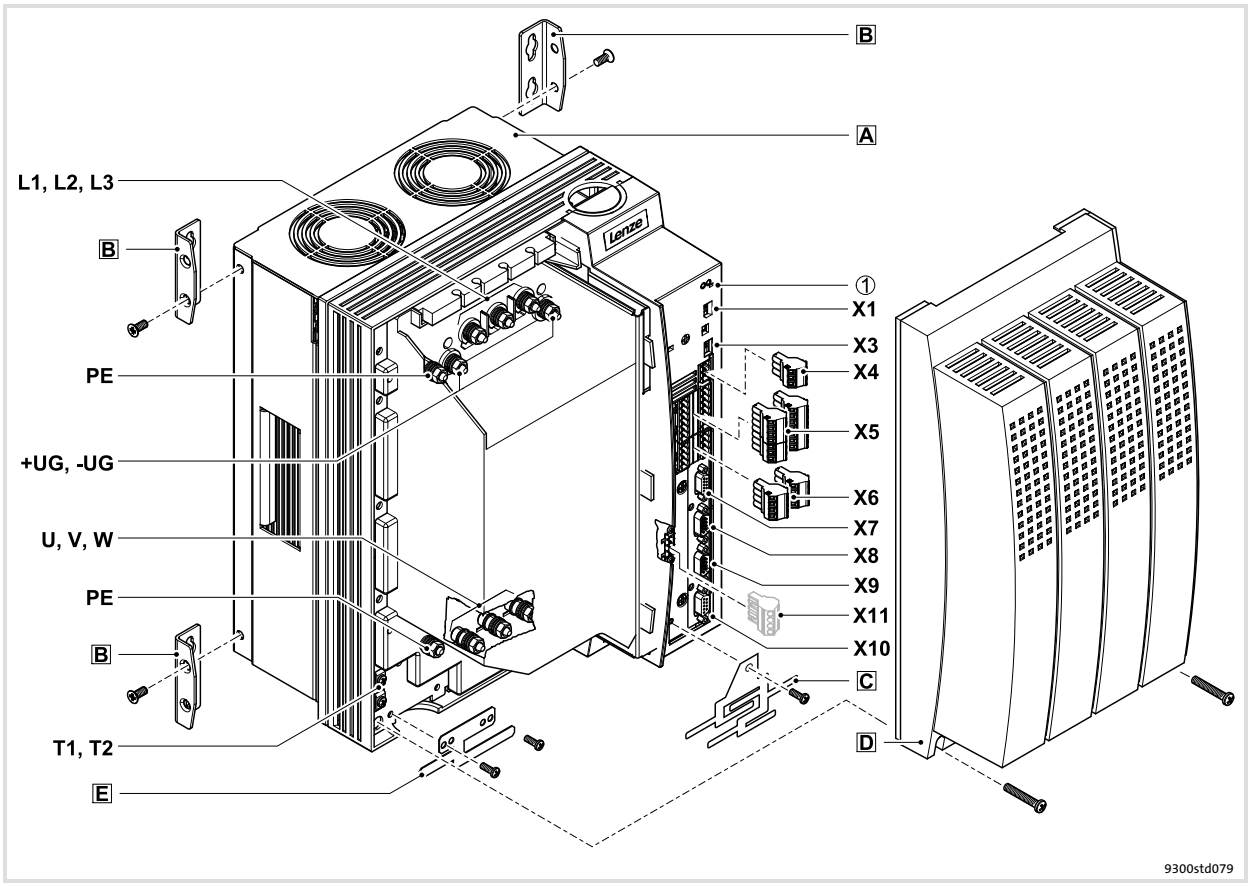
9300 *15 ... 30 kW*



EVS9327-xx ... EVS9329-xx

Servo controller

Lenze


B
A
L1, L2, L3
B
PE
+UG, -UG
U, V, W
PE
B
T1, T2
E
①
X1
X3
X4
X5
X6
X7
X8
X9
X11
X10
C
D
9300std079

Key for overview

Position	Description
A	Controller
B	Fixing bracket for standard mounting
C	EMC shield sheet with fixing screws for shielded control cables
D	Cover with fixing screws
E	EMC shield sheet for the motor cable and the feed cable for the motor temperature monitoring with PTC thermistor or thermal contact (NC contact)

Connections and interfaces

Position	Description
L1, L2, L3, PE	Mains connection
+UG, -UG	DC supply
U, V, W, PE	Motor connection
T1, T2	Connection of PTC thermistor or thermal contact (NC contact) of the motor
X1	AIF interface (automation interface) Slot for communication module (e. g. XT EMZ9371BC keypad)
X3	Jumper for setting analog input signal at X6/1, X6/2
X4	System bus (CAN) connection
X5	Connection of digital inputs and outputs
X6	Connection of analog inputs and outputs
X7	Connection of resolver and KTY temperature sensor of the motor
X8	Connection of incremental encoder with TTL level or SinCos encoder and KTY temperature sensor of the motor
X9	Connection of digital frequency input signal
X10	Connection of digital frequency output signal
X11	Connection of K_{SR} relay output for ”safe standstill” (for variants V004 and V104 only)

Status displays

Position	LED red	LED green	Operating status
①	Off	On	Controller enabled
	On	On	Mains is switched on and automatic start is inhibited
	Off	Blinking slowly	Controller inhibited
	Blinking quickly	Off	Undervoltage or overvoltage
	Blinking slowly	Off	Active fault

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1 About this documentation

Note!

This documentation contains all necessary information for the machine operator to be able to operate the servo controllers of the 9300 series installed in your machine/plant.

You can make further use of all information in this documentation without consulting Lenze if you do not make any changes to the contents.

1.1 Document history

What is new / what has changed?

Material number	Version			Description
13440651	3.0	07/2013	TD06	Error corrections
13330572	2.1	03/2010	TD23	Change of the company's address
13330572	2.0	03/2010	TD14	New edition due to reorganisation of the company UL-warnings updated Revision for software version 8x
13256371	1.0	06/2008	TD23	First edition

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.2 Target group

This documentation is directed at qualified skilled personnel according to IEC 60364.

Qualified skilled personnel are persons who have the required qualifications to carry out all activities involved in installing, mounting, commissioning, and operating the product.

1.3 Validity information

... 9300 servo controllers as of nameplate data:

	①					②	③	Nameplate
	EVS	93xx	–	x	x	Vxxx	1x	8x	

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9327 =	15 kW	18.5 kW
9328 =	22 kW	30 kW
9329 =	30 kW	37 kW

Type

E = Panel-mounted unit

C = Built-in unit in ”cold plate” technique

Design

I = Servo PLC

K = Servo cam

P = Servo position controller

R = Register controller

S = Servo inverter

T = Servo PLC technology

Variant

– Standard

V003 = In ”cold plate” technique

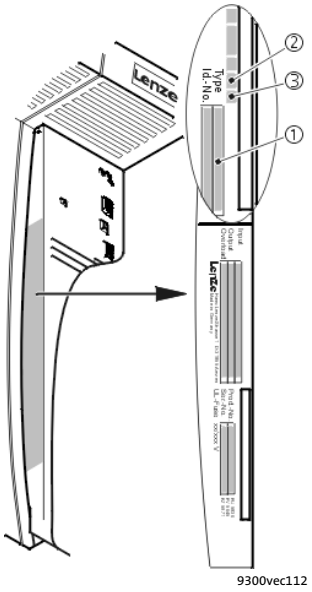
V004 = With ”safe standstill” function

V100 = For IT mains

V104 = With ”safe standstill” function and for IT mains

Hardware version

Software version



9300vec112

1.4 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	language-dependent	In each case, the signs typical for the target language are used as decimal separators. For example: 1234.56 or 1234,56
Warnings		
UL warnings	UL	Are only given in English.
UR warnings	UR	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	📖	Reference to another page with additional information For instance: 📖 16 = see page 16
Documentation reference	🕮	Reference to another documentation with additional information For example: 🕮 EDKxxx = see documentation EDKxxx

1.5 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!

(characterises the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

(in accordance with Low-Voltage Directive 2006/95/EC)

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material assets:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from Lenze.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - According to this basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
  - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
  - The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the particular applications. Lenze Automation GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- Depending on their degree of protection, some parts of the Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their accessory components can be live, moving and rotating during operation. Surfaces can be hot.
  - Non-authorised removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.
  - For more information, please see the documentation.
- High amounts of energy are produced in the controller. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

Application as directed

Controllers are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.

When controllers are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

The controllers meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonised standard EN 61800-5-1 applies to the controllers.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Warning: Controllers are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

Transport, storage

Please observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

Installation

The controllers must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

Controllers contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live controllers, observe the applicable national regulations for the prevention of accidents (e.g. VBG 4).

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation. The controllers must be installed in housings (e.g. control cabinets) to meet the limit values for radio interferences valid at the site of installation. The housings must enable an EMC-compliant installation. Observe in particular that e.g. the control cabinet doors have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Lenze controllers may cause a DC current in the PE conductor. If a residual current device (RCD) is used for protection against direct or indirect contact for a controller with three-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the controller. If the controller has a single-phase supply, a residual current device (RCD) of type A is also permissible. Apart from using a residual current device (RCD), other protective measures can be taken as well, e.g. electrical isolation by double or reinforced insulation or isolation from the supply system by means of a transformer.

Operation

If necessary, systems including controllers must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The controllers can be adapted to your application. Please observe the corresponding information given in the documentation.

After the controller has been disconnected from the supply voltage, all live components and power terminals must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.

All protection covers and doors must be shut during operation.

Notes for UL-approved systems with integrated controllers: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

Safety functions

Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”) according to the requirements of the EC Directive 2006/42/EC (Machinery Directive). The notes on the integrated safety system provided in this documentation must be observed.

Maintenance and servicing

The controllers do not require any maintenance if the prescribed operating conditions are observed.

Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

The product-specific safety and application notes given in these instructions must be observed!

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- ► I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- ► The calculated motor load is saved when the mains is switched.
- ► The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- ► However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- ► Adjustable response OC8 (TRIP, warning, off).
  - – The trigger threshold is set in C0127.
  - – The response is set in C0606.
  - – The response OC8, for instance, can be used for an advance warning.
- ► Fixed response OC6-TRIP.
  - – The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for $I^2 \times t$ monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the $I^2 \times t$ load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and $I^2 \times t$ load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for $I^2 \times t$ load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the $I^2 \times t$ load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the $I^2 \times t$ load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	$I^2 \times t$ load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

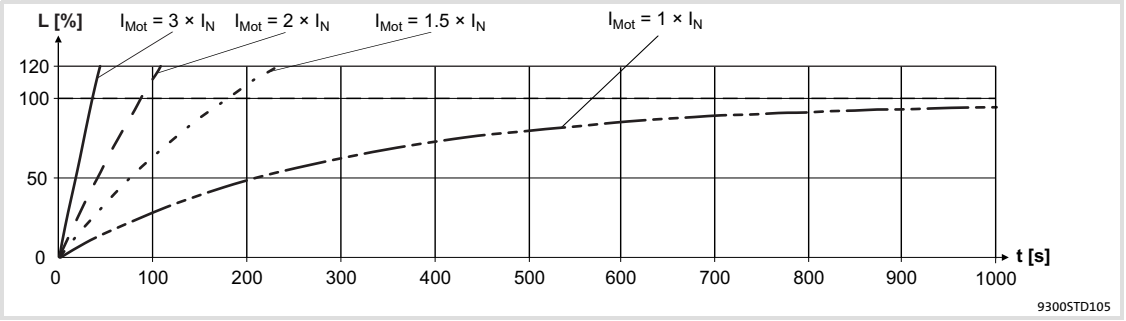


Fig. 2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L $I^2 \times t$ load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

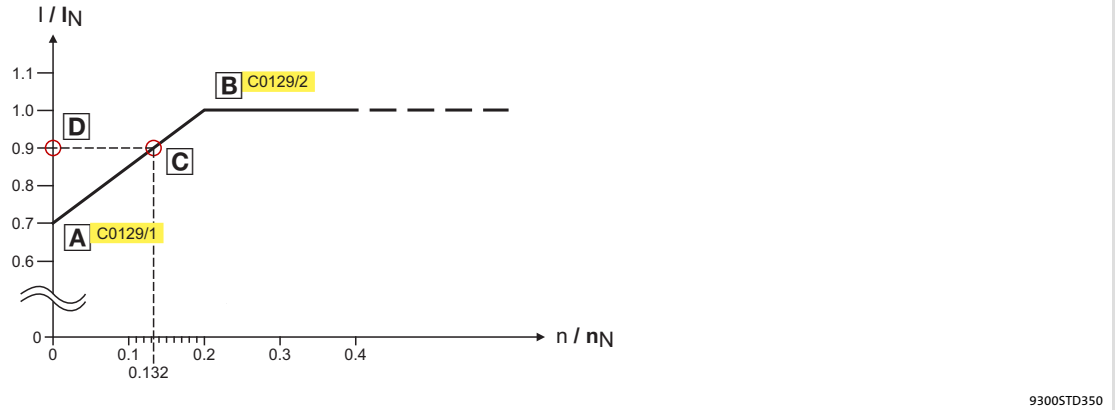


Fig. 2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1**and **C0129/2** (evaluation coefficient "y", 16).

Calculate release time and I^2 x t load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- Before working on the controller, check whether all power terminals are deenergised:
  - The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least three minutes after disconnection from the mains.
  - The power terminals L1, L2, L3; U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.
- The leakage current to earth (PE) is > 3.5 mA. According to EN 61800-5-1
  - a fixed installation is required.
  - a double PE connection is required or, if in single design, it must have a cable cross-section of at least 10 mm^2.
- The heatsink of the controller has an operating temperature of > 80 °C:
  - Contact with the heatsink results in burns.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xx and EVS9322-xx.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xx ... EVS9332-xx.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Protection of the machine/system

- Drives can reach dangerous overspeeds (e. g. setting of high output frequencies in connection with motors and machines not suitable for this purpose):
  - The drive controllers do not provide protection against such operating conditions. For this purpose, use additional components.

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9327 ... EVS9329:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +50 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 60/75 °C or 75 °C copper wire only.

3 Parameter setting

3.1 Parameter setting with the XT EMZ9371BC keypad

Description

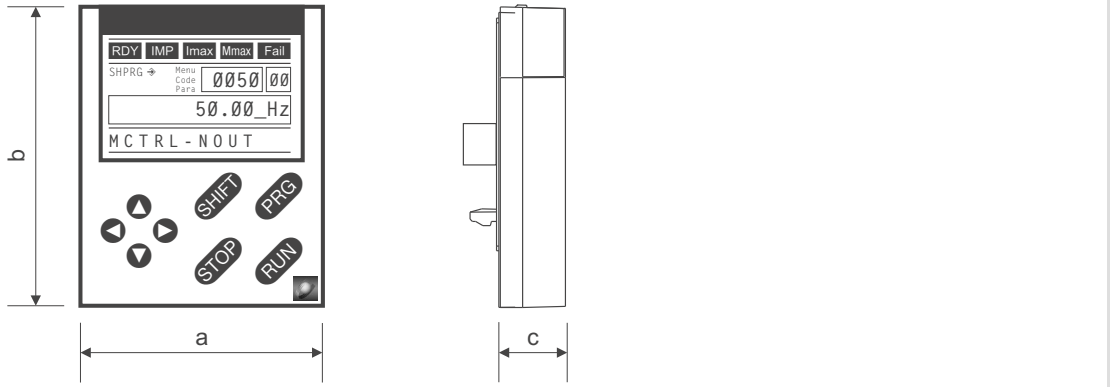
The keypad is available as an accessory. A full description of the keypad can be obtained from the Instructions included in the keypad delivery.

Plugging in the keypad

It is possible to plug the keypad into the AIF interface or remove it during operation.

As soon as the keypad is supplied with voltage, it carries out a self-test. The keypad is ready for operation if it is in display mode.

3.1.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm
Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)
Enclosure		IP 20

3.1.2 Installation and commissioning

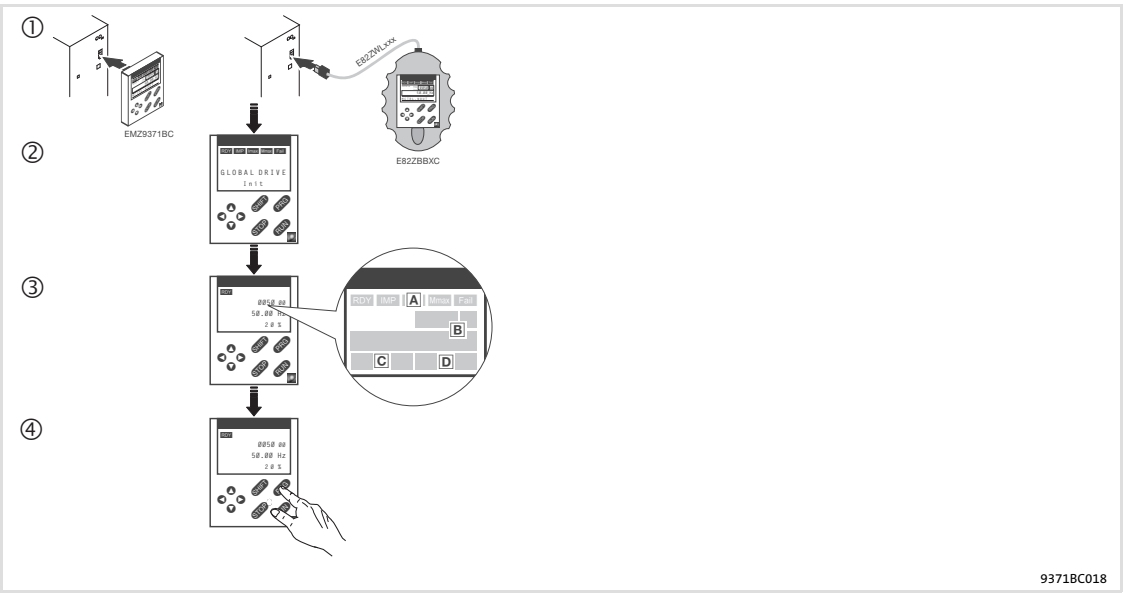


Fig. 3-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

A Current state of the standard device

B Memory location 1 of the user menu (C0517):
Code number, subcode number, and current value

C Active fault message or additional status message

D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

3.1.3 Display elements and function keys

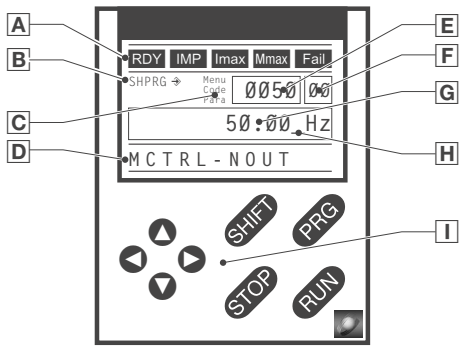


Fig. 3-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	**Status displays of standard device**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	
	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:

Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	**Code level**	**Parameter level**	**Operating level**
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations[1)]		Accept parameters when SHPRG → or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset): 1. Remove the cause of malfunction 2. Press STOP 3. Press RUN			

1) Only active for operation with standard devices of the 8200 vector or 8200 motec series

3.1.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept the parameter Display "OK"
	Display →		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the "loop" with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 "PAR SAVE" in the menu "Load/Store"
		B	PRG	Change to the parameter level Display "0" and "READY"
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set "1" "Save PS1"
				Save as parameter set 2: ⇨ Set "2" "Save PS2"
				Save as parameter set 3: ⇨ Set "3" "Save PS3"
				Save as parameter set 4: ⇨ Set "4" "Save PS4"
		D	SHIFT PRG	When "OK" is displayed, the settings are permanently saved in the selected parameter set.

Step			Key sequence	Action
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

1) The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

3.1.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

3.1.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ► ◄	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT + PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step		Key sequence	Action
1.	Connect the keypad to standard device 2		
2.	Inhibit controller		Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6		All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu	▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level	PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function		The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.		● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 25
		▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.		
		▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
			Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
			Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
			Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying	SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level		
	A	PRG	Display of the operating level
	B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.	▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6		
11.	Enable controller		Terminal X5/28 = HIGH The drive is running with the new settings.

3.1.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the ”USER menu”		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 ”MCTRL-NACT”
3.	Select C0094		▲	Display of code C0094 ”Password”
4.	Change to the parameter level		PRG	Display ”0” = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”
7.	Change to the ”USER menu”		◀ ◀ ▼	

The password protection is active now.
You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 ”Password”
3.	Change to the parameter level		PRG	Display ”9999” = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”

The password protection is deactivated now. All menus can be freely accessed again.

3.1.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

- monitoring the drive
- fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

3.1.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	Display	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

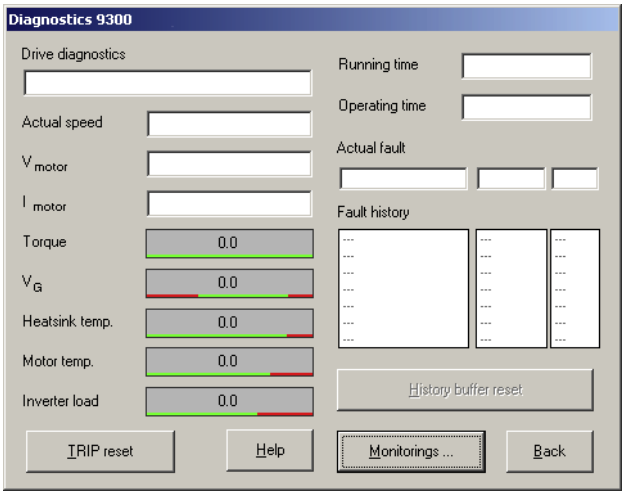
Main menu	Submenus	Description
Display	Display	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

4 Troubleshooting and fault elimination

4.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 4-1 ”Diagnostics” dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
  – the history buffer in Global Drive Control (GDC) (📖 34) or
  – the XT keypad
  – and with the ”General error messages” table in the ”System error messages” chapter.

► The ”General error messages” table provides tips on how to eliminate an error.

4.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

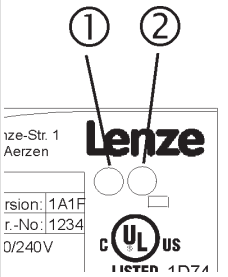
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 36)

4.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

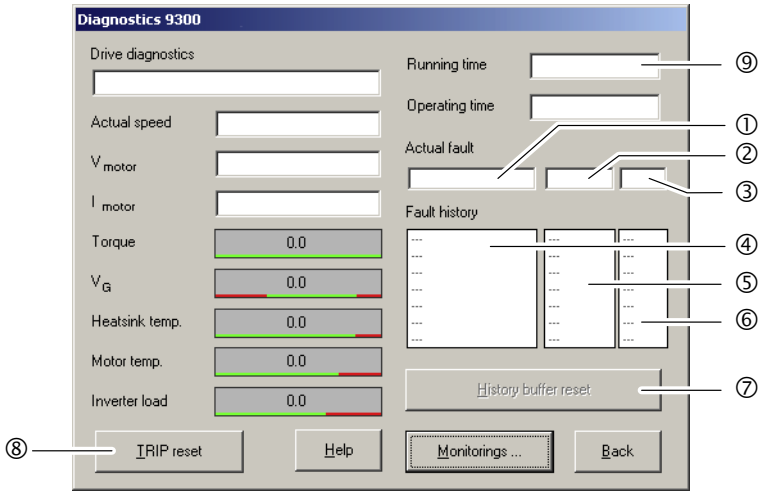
LED		Operating status	
Red ①	**Green** ②		
Off	On	Controller enabled	
On	On	Mains switched on and automatic start inhibited	
Off	Blinking slowly	Controller inhibited	
Blinking quickly	Off	Undervoltage or overvoltage	
Blinking slowly	Off	Fault active	



4.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 4-2 ”Diagnostics” dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged: ● The content of memory units 1 ... 7 is shifted ”upwards” by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
④	⑤	⑥	2	Last fault	
			3	Next to last fault	
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

4.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Pulse inhibit (IMP)		
			Bit2	Not assigned		
			Bit3	Not assigned		
			Bit4	Not assigned		
			Bit5	Not assigned		
			Bit 6	n = 0		
			Bit 7	Controller inhibit (CINH)		
			Bit 8	Device status bit 1		
			Bit 9	Device status bit 2		
			Bit10	Device status bit 3		
			Bit11	Device status bit 4		
			Bit12	Warning		
			Bit13	Message		
			Bit14	Not assigned		
			Bit15	Not assigned		
C0155	Status word 2	0				Status word 2 (advanced status word) Display only
			0	{1}	65535	Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault		
			Bit 1	M_{max} reached		
			Bit 2	I_{max} reached		
			Bit 3	Pulse inhibit(IMP)		
			Bit 4	Ready for operation (RDY)		
			Bit 5	Controller inhibit (CINH)		
			Bit 6	TRIP active		
			Bit 7	Initialisation		
			Bit 8	Motor direction of rotation (Cw/CCw)		
			Bit 9	Not assigned		
			Bit 10	Not assigned		
			Bit 11	Not assigned		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		

4.3 System error messages

4.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
x066	CE5	Time-out of system bus (CAN) (communication error of gateway function)	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring of system bus (CAN). • Check CAN bus configuration.
0070	U15	Undervoltage of internal 15 V voltage supply		Check voltage supply.
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0073	PR2	Checksum error in parameter set 2 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 2.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 2.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0077	PR3	Checksum error in parameter set 3 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 3.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 3.

Fault message		Description	Cause	Remedy
No.	Display			
0078	PR4	Checksum error in parameter set 4 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 4.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 4.
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
0080	PR6	Too many user codes		Reduce the number of user codes.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!

Fault message		Description	Cause	Remedy
No.	Display			
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	● Check external encoder. ● Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	● Contact Lenze. ● Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	● Contact Lenze. ● Switch off the monitoring (C0588 = 3).
x151	P01	Error ”negative limit switch”.	Negative limit switch was reached.	● Control drive in positive direction ● Check wiring at X5/E2.
x152	P02	Error ”positive limit switch”.	Positive limit switch was reached.	● Control drive in negative direction ● Check wiring at X5/E1.
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	● Increase following error limit under C0255. ● Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x154	P04	Error ”negative position limit”.	Negative position limit (C1224) was not reached.	Find out why the value was not reached (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1224 if necessary.
x155	P05	Error ”positive position limit”.	Positive position limit (C1223) was exceeded.	Find out why the value was exceeded (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1223 if necessary.
x156	P06	No reference.	The reference point is not known. In the case of absolute positioning, no homing was performed before the first positioning.	Perform one of the following functions and restart: ● Manual homing. ● Start homing in the program. ● Set reference.
x157	P07	Parameter set mode is absolute instead of relative.	An absolute parameter set (C1311) was performed during relative positioning (position mode C1210).	Perform one of the following functions and restart: ● Change the parameter set from absolute to relative. ● Change position mode.
x158	P08	Error ”actual reference dimension offset”.	Actual reference dimension offset (C1226) outside the position limits. Error of the program function ”set position value”.	If necessary, adapt the position limit values or check whether the program function ”set position value” is to be applied.
x159	P09	Error in positioning program.	Impermissible programming	Check position program: ● A parameter set with final speed must be followed by a parameter set with positioning; it is not permissible to wait for input.

Fault message		Description	Cause	Remedy
No.	Display			
x162	P12	Error in the range of the encoder.	The range of the absolute encoder was exceeded.	● Return drive by manual positioning. ● Check position limits and adjustment of the encoder. ● Design and mount the absolute encoder in a way that does not exceed the traversing range.
x163	P13	Angle overrun.	● Phase controller limit reached ● Drive cannot follow the digital frequency (I_{max} limit).	● Enable drive ● Check drive dimensioning.
x164	P14	1. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/1.	● Increase current limit under C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/1
x165	P15	2. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/2.	● Increase current limit C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/2
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	● Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	● Check communication channel. ● Check baud rate, controller address. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.
x167	P17	Error ”touch probe control”.	Various function blocks use the touch probe input at the same time (e.g. FB DFSET and POS). A conflict arises.	● Configure another touch probe input for FB POS (not possible for FB DFSET). ● Switch off monitoring (C1289/1).

Fault message		Description	Cause	Remedy
No.	Display			
x168	P18	Internal limitation.	Arithmetic operation generated data cannot be varied arbitrarily. Wrongly specified values were automatically limited internally.	
			C1298 = 1: The negative position limit in C1223 is outside the possible display range of $1 \leq (C1223 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/10 and enter it in C1223 if necessary.
			C1298 = 2: The positive position limit in C1224 is outside the possible display range of $1 \leq (C1224 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/11 and enter it in C1224 if necessary.
			C1298 = 3: The maximum speed v_{max} in C1240 is outside the possible display range of $1 \leq (C1240 \times C1205 \times 16.384) \leq 2.14E9$ inc or v_{max} not $C1240 / C1204 \times 60 \leq 1.5 \times n_{max}$	Check the values in C0011, C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/12 and enter it in C1240 or adjust the value in C1240 to C0011 if necessary.
			C1298 = 4: The maximum acceleration a_{max} in C1250 is outside the possible display range of $1 \leq (C1250 \times C1205 \times 16.384 / 10\,00) \leq 2.8634E7$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/13 and enter it in C1250 if necessary.
			C1298 = 5: An internal value range has been exceeded for a speed standardisation. Valid range: $1 \leq (C0011 \times C1207/1 / C1207/2\ 65536 / 60000) \leq 32767$	Check the values in C0011, C1207/1, C1207/2 and correct them.
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x171	P21	Following error.	The phase difference between set and actual position is larger than the following error limit set under C1328.	• Extend the following error limit under C1328. • Switch off monitoring (C1329=3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).
0201	overrun Task1	Time-out in task 1 (ID 2)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
...	...	...		
0208	overrun Task8	Time-out in task 8 (ID 9)		

Fault message		Description	Cause	Remedy
No.	Display			
0209	float Sys-T	Float error in system task (ID 0)	Error in real calculation (e. g. division by 0)	Check calculations (program code).
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)		
0211	float Task1	Float error in task 1 (ID 2)		
...	...	...		
0218	float Task8	Float error in task 8 (ID 9)		
0219	overrun Cyc.-T	Time-out in cyclic task (PLC_PRG ID 1)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
0220	noT-Fkt Credit	Not enough technology units available.	A program with technology functions has been tried to be loaded to a controller not providing the corresponding units.	• Use technology variant of the controller. • Contact Lenze, if necessary.
x220	CDA	Data error	Attempt to transmit faulty profile data	Repeat profile data transfer.
x221	CDA-LOAD	Faulty checksum	The checksum of the transferred profile data is not correct.	Repeat profile data transfer and check for correctness.
0230	No Program	Missing PLC program	No PLC program loaded.	Load PLC program.
0231	Unallowed Lib	PLC program calls invalid library function.	In the PLC program a library function has been called which is not supported by the controller (e.g. because the corresponding hardware is missing).	• Remove library function or ensure that the corresponding hardware is available. • Contact Lenze, if necessary.
0232	NoCam Data	Motion profiles (cam data) are not available.	When calling functions of the function library **LenzeCamControl.lib** it was detected that there are no motion profiles (CAM data) loaded in the memory of the controller.	• Ensure that the valid cam data has been attached to the project via the DDS CAM support. • Reload the PLC program into the controller. (Possibly the command **Online→Reset (origin)** has been executed in DDS.)
x240	ovrTrans Queue	”Free CAN objects” error	Overflow of the transmit request memory	• Reduce the number of transmit requests. • Prolong the cycle time.
x241	ovr Receive		Too many receive telegrams	Reduce the number of telegrams on the system bus (CAN).
x250	2.Flash Err	Error when the FLASH memory is accessed	The PLC program tries to access non-available or defect FLASH memory	Make sure that the PLC has the corresponding FLASH memory. If not, please contact Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
x251	AddData CsErr	Error during FLASH memory access	Check sum error occurred when loading data into the FLASH memory	Check the checksum of the file to be loaded and repeat the data transfer.

Fault message		Description	Cause	Remedy
No.	Display			
x252	AddData DlErr	Error during FLASH memory access	An error occurred when downloading the data into the FLASH memory (e.g. time-out, transmission error, mains failure during transmission)	Check/repeat data transfer.
x260	Err Node Guard	”Life guarding event”	The controller configured as a CAN slave does not receive a ”Node Guarding” telegram from the CAN master within the ”Node Life Time”.	• Check wiring at X4. • Check CAN configuration. • Ensure that ”node guarding” has been activated in the CAN master • Adapt the ”node life time” (C0383) to CAN master setting.

Explanation of the error numbers:
x 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
e.g. ”2091”: An external monitoring has triggered the warning EEr

4.3.2 Resetting system error messages

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** If a TRIP/FAIL QSP source is still active, the pending TRIP/FAIL QSP cannot be reset. The TRIP/FAIL QSP can be reset by: • pressing ⇨ STOP on keypad XT EMZ9371 BC. Then, press RUN to re-enable the controller. • Set code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word system bus (CAN) / MotionBus (CAN) at ECSxS/P/M After the reset of the TRIP/FAIL QSP, the drive remains at standstill.
Message	**Danger!** The fault message is reset automatically after the fault has been eliminated, and the drive restarts automatically.
Warning	After the fault has been eliminated, the fault message is reset automatically.

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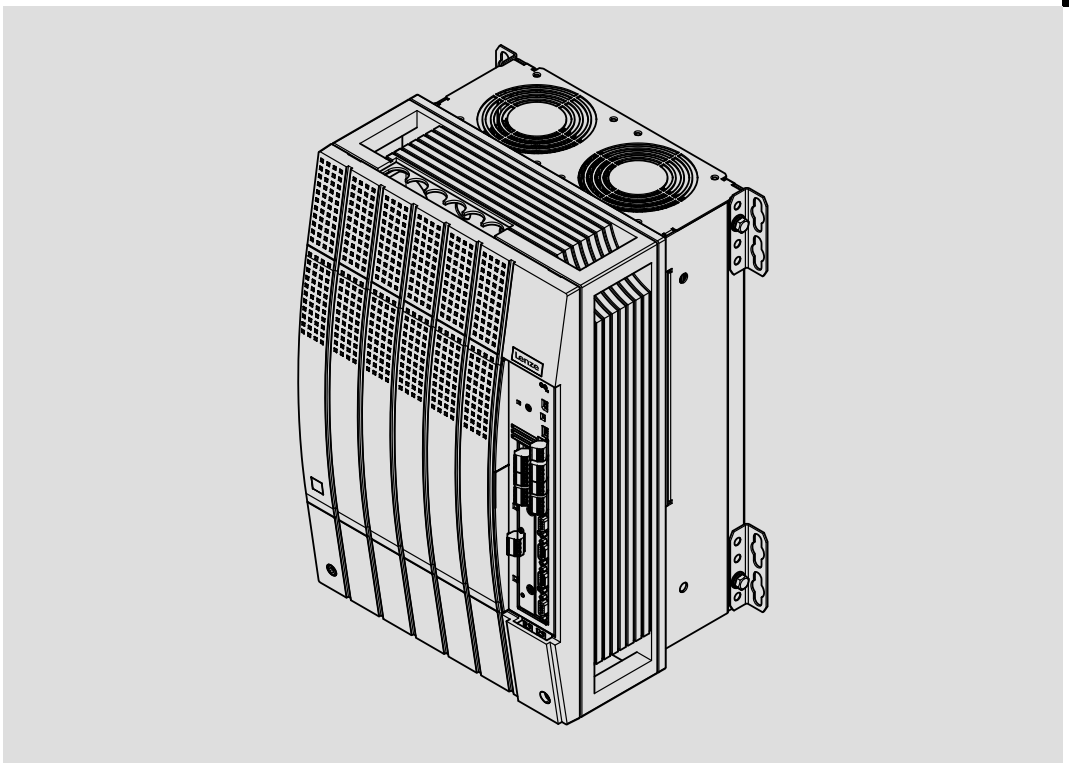
EDKVS93-02 ■ 13440651 ■ EN ■ 3.0 ■ TD06

10 9 8 7 6 5 4 3 2 1

EDKVS93-03
13440805

Information for the operator of the machine

9300 *45 ... 75 kW*

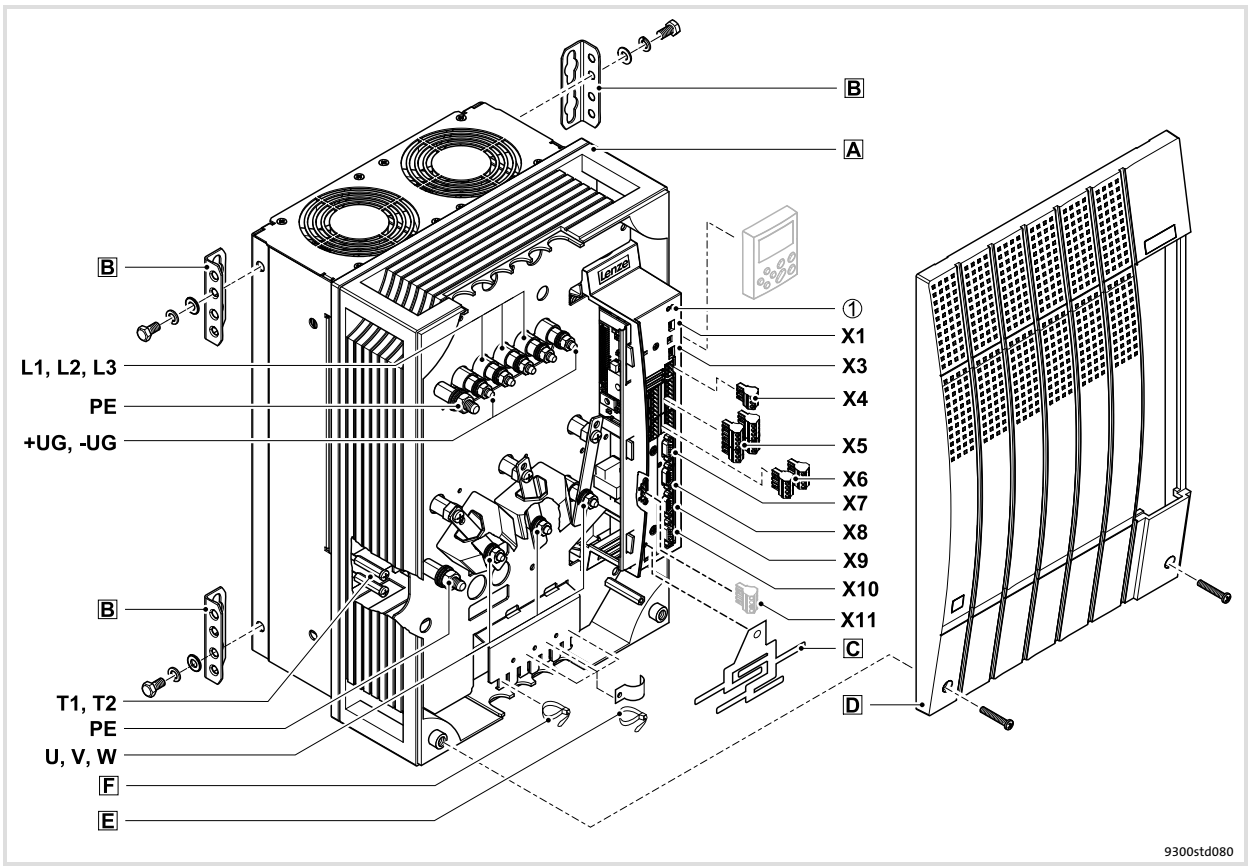


EVS9330-xx ... EVS9332-xx

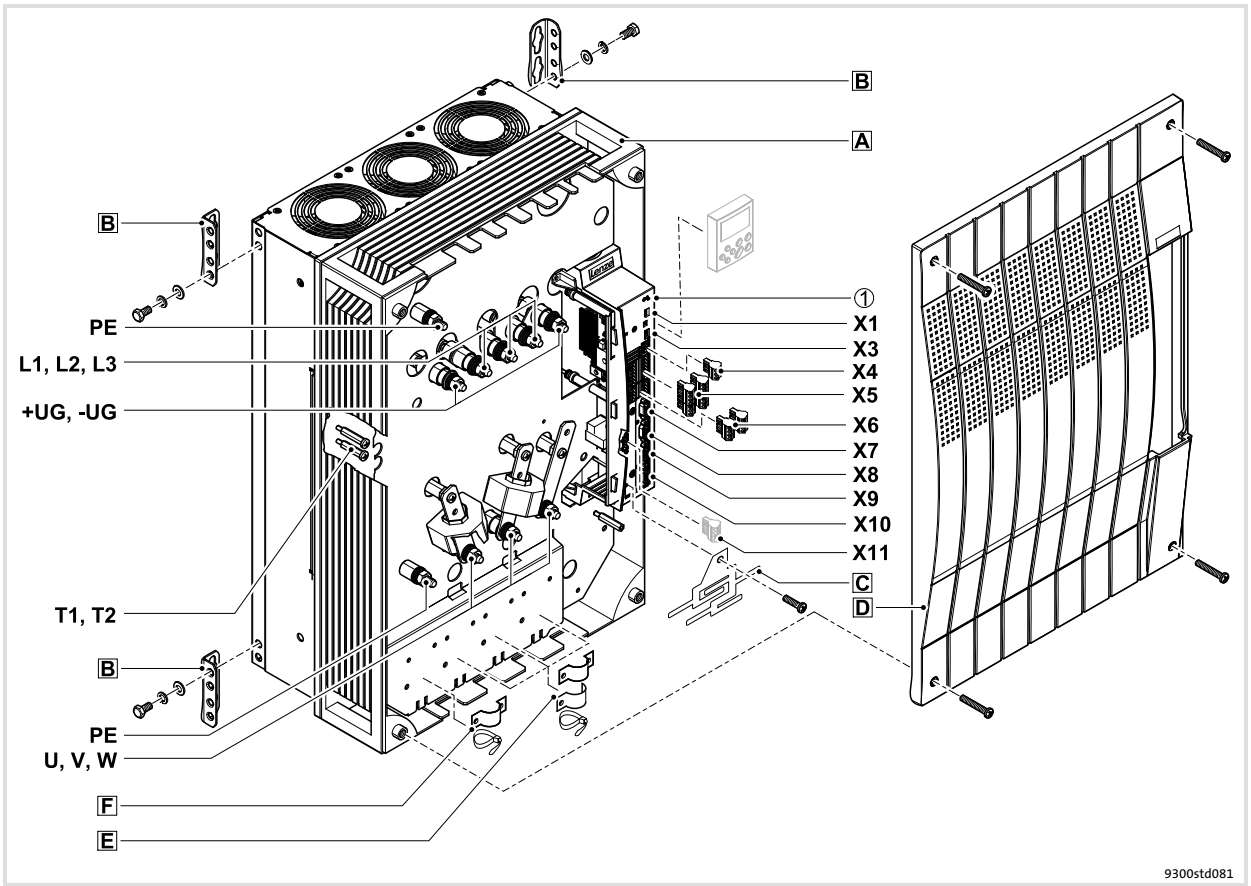
Servo controller

Lenze

EVS9330



EVS9331, EVS9332



Key for overview

Position	Description
A	Controller
B	Fixing bracket for standard mounting
C	EMC shield sheet with fixing screws for shielded control cables
D	Cover with fixing screws
E	Shield clamp and strain relief for the motor cable
F	Strain relief for the PE motor cable and the feed cable for the motor temperature monitoring with PTC thermistor or thermal contact (NC contact)

Connections and interfaces

Position	Description
L1, L2, L3, PE	Mains connection
+UG, -UG	DC supply
U, V, W, PE	Motor connection
T1, T2	Connection of PTC thermistor or thermal contact (NC contact) of the motor
X1	AIF interface (automation interface) Slot for communication module (e. g. XT EMZ9371BC keypad)
X3	Jumper for setting analog input signal at X6/1, X6/2
X4	System bus (CAN) connection
X5	Connection of digital inputs and outputs
X6	Connection of analog inputs and outputs
X7	Connection of resolver and KTY temperature sensor of the motor
X8	Connection of incremental encoder with TTL level or SinCos encoder and KTY temperature sensor of the motor
X9	Connection of digital frequency input signal
X10	Connection of digital frequency output signal
X11	Connection of K_{SR} relay output for ”safe standstill” (for variants V004 and V104 only)

Status displays

Position	LED red	LED green	Operating status
①	Off	On	Controller enabled
	On	On	Mains is switched on and automatic start is inhibited
	Off	Blinking slowly	Controller inhibited
	Blinking quickly	Off	Undervoltage or overvoltage
	Blinking slowly	Off	Active fault

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1 About this documentation

Note!

This documentation contains all necessary information for the machine operator to be able to operate the servo controllers of the 9300 series installed in your machine/plant.

You can make further use of all information in this documentation without consulting Lenze if you do not make any changes to the contents.

1.1 Document history

What is new / what has changed?

Material number	Version			Description
13440805	3.0	07/2013	TD06	Error corrections
13330573	2.1	03/2010	TD23	Change of the company's address
13330573	2.0	03/2010	TD14	New edition due to reorganisation of the company UL-warnings updated Revision for software version 8x
13256367	1.0	06/2008	TD23	First edition

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.2 Target group

This documentation is directed at qualified skilled personnel according to IEC 60364.

Qualified skilled personnel are persons who have the required qualifications to carry out all activities involved in installing, mounting, commissioning, and operating the product.

1.3 Validity information

... 9300 servo controllers as of nameplate data:

	①					②	③	Nameplate
	EVS	93xx	–	x	x	Vxxx	1x	8x	

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = Panel-mounted unit

C = Built-in unit in ”cold plate” technique

Design

I = Servo PLC

K = Servo cam

P = Servo position controller

R = Register controller

S = Servo inverter

T = Servo PLC technology

Variant

– Standard

V003 = In ”cold plate” technique

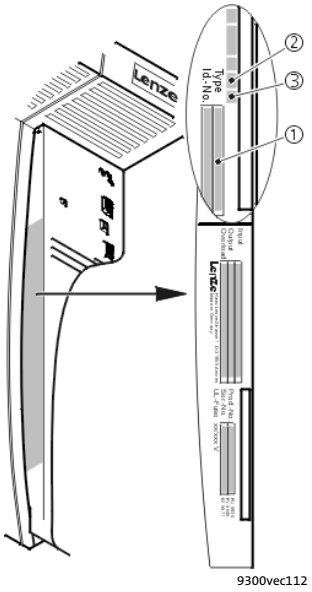
V004 = With ”safe standstill” function

V100 = For IT mains

V104 = With ”safe standstill” function and for IT mains

Hardware version

Software version



9300vec112

1.4 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	language-dependent	In each case, the signs typical for the target language are used as decimal separators. For example: 1234.56 or 1234,56
Warnings		
UL warnings	Ⓤ	Are only given in English.
UR warnings	Ⓤ	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference	Ⓓ	Reference to another documentation with additional information For example: Ⓓ EDKxxx = see documentation EDKxxx

1.5 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!

(characterises the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

(in accordance with Low-Voltage Directive 2006/95/EC)

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material assets:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from Lenze.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - According to this basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
  - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
  - The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the particular applications. Lenze Automation GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- Depending on their degree of protection, some parts of the Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their accessory components can be live, moving and rotating during operation. Surfaces can be hot.
  - Non-authorised removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.
  - For more information, please see the documentation.
- High amounts of energy are produced in the controller. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

Application as directed

Controllers are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.

When controllers are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

The controllers meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonised standard EN 61800-5-1 applies to the controllers.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Warning: Controllers are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

Transport, storage

Please observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

Installation

The controllers must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

Controllers contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live controllers, observe the applicable national regulations for the prevention of accidents (e.g. VBG 4).

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation. The controllers must be installed in housings (e.g. control cabinets) to meet the limit values for radio interferences valid at the site of installation. The housings must enable an EMC-compliant installation. Observe in particular that e.g. the control cabinet doors have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Lenze controllers may cause a DC current in the PE conductor. If a residual current device (RCD) is used for protection against direct or indirect contact for a controller with three-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the controller. If the controller has a single-phase supply, a residual current device (RCD) of type A is also permissible. Apart from using a residual current device (RCD), other protective measures can be taken as well, e.g. electrical isolation by double or reinforced insulation or isolation from the supply system by means of a transformer.

Operation

If necessary, systems including controllers must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The controllers can be adapted to your application. Please observe the corresponding information given in the documentation.

After the controller has been disconnected from the supply voltage, all live components and power terminals must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.

All protection covers and doors must be shut during operation.

Notes for UL-approved systems with integrated controllers: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

Safety functions

Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”) according to the requirements of the EC Directive 2006/42/EC (Machinery Directive). The notes on the integrated safety system provided in this documentation must be observed.

Maintenance and servicing

The controllers do not require any maintenance if the prescribed operating conditions are observed.

Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

The product-specific safety and application notes given in these instructions must be observed!

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- ► I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- ► The calculated motor load is saved when the mains is switched.
- ► The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- ► However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- ► Adjustable response OC8 (TRIP, warning, off).
  - – The trigger threshold is set in C0127.
  - – The response is set in C0606.
  - – The response OC8, for instance, can be used for an advance warning.
- ► Fixed response OC6-TRIP.
  - – The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for $I^2 \times t$ monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the $I^2 \times t$ load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and $I^2 \times t$ load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for $I^2 \times t$ load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the $I^2 \times t$ load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the $I^2 \times t$ load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	$I^2 \times t$ load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

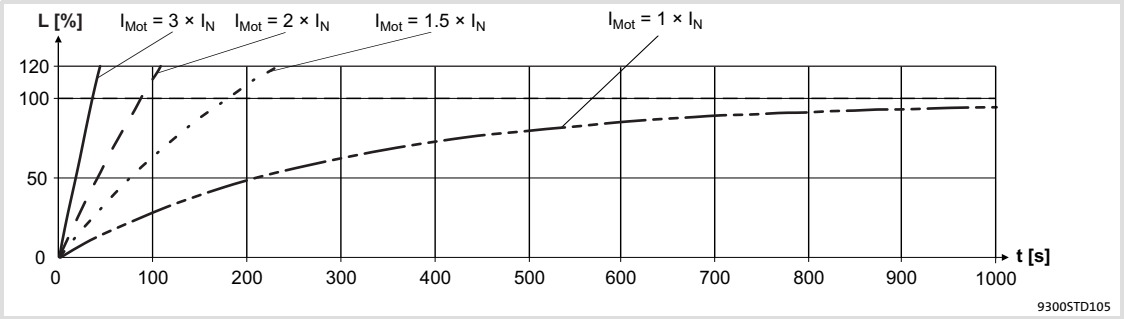


Fig. 2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L $I^2 \times t$ load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

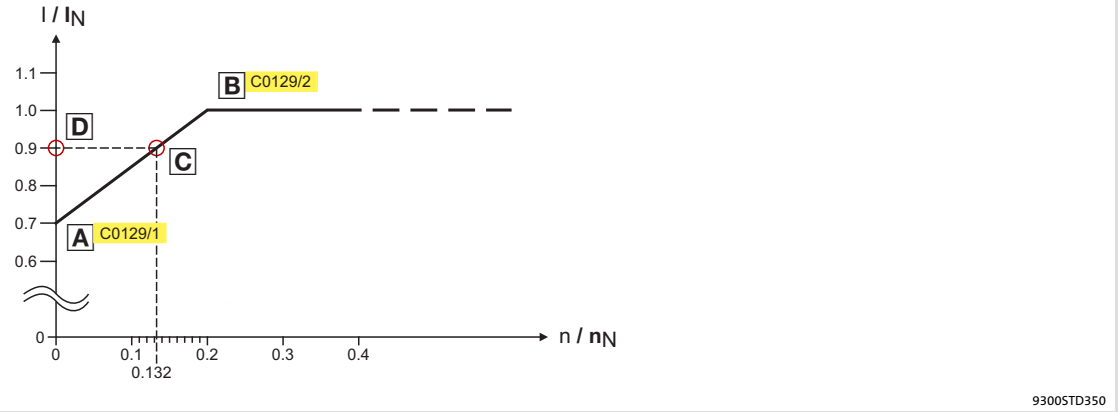


Fig. 2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1**and **C0129/2** (evaluation coefficient "y", 16).

Calculate release time and I^2 x t load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- Before working on the controller, check whether all power terminals are deenergised:
  - The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least three minutes after disconnection from the mains.
  - The power terminals L1, L2, L3; U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.
- The leakage current to earth (PE) is > 3.5 mA. According to EN 61800-5-1
  - a fixed installation is required.
  - a double PE connection is required or, if in single design, it must have a cable cross-section of at least 10 mm^2.
- The heatsink of the controller has an operating temperature of > 80 °C:
  - Contact with the heatsink results in burns.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xx and EVS9322-xx.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xx ... EVS9332-xx.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Protection of the machine/system

- Drives can reach dangerous overspeeds (e. g. setting of high output frequencies in connection with motors and machines not suitable for this purpose):
  - The drive controllers do not provide protection against such operating conditions. For this purpose, use additional components.

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9330 ... EVS9332:
  - – Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +50 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 60/75 °C or 75 °C copper wire only.

3 Parameter setting

3.1 Parameter setting with the XT EMZ9371BC keypad

Description

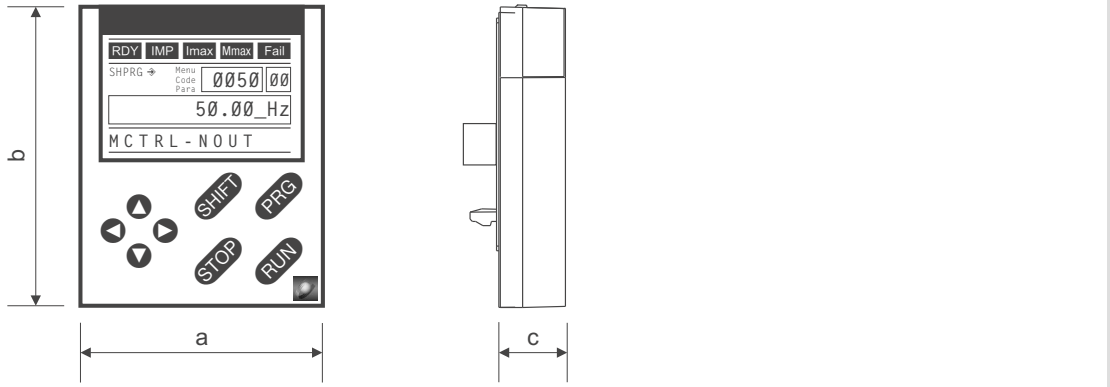
The keypad is available as an accessory. A full description of the keypad can be obtained from the Instructions included in the keypad delivery.

Plugging in the keypad

It is possible to plug the keypad into the AIF interface or remove it during operation.

As soon as the keypad is supplied with voltage, it carries out a self-test. The keypad is ready for operation if it is in display mode.

3.1.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)

Enclosure	IP 20

3.1.2 Installation and commissioning

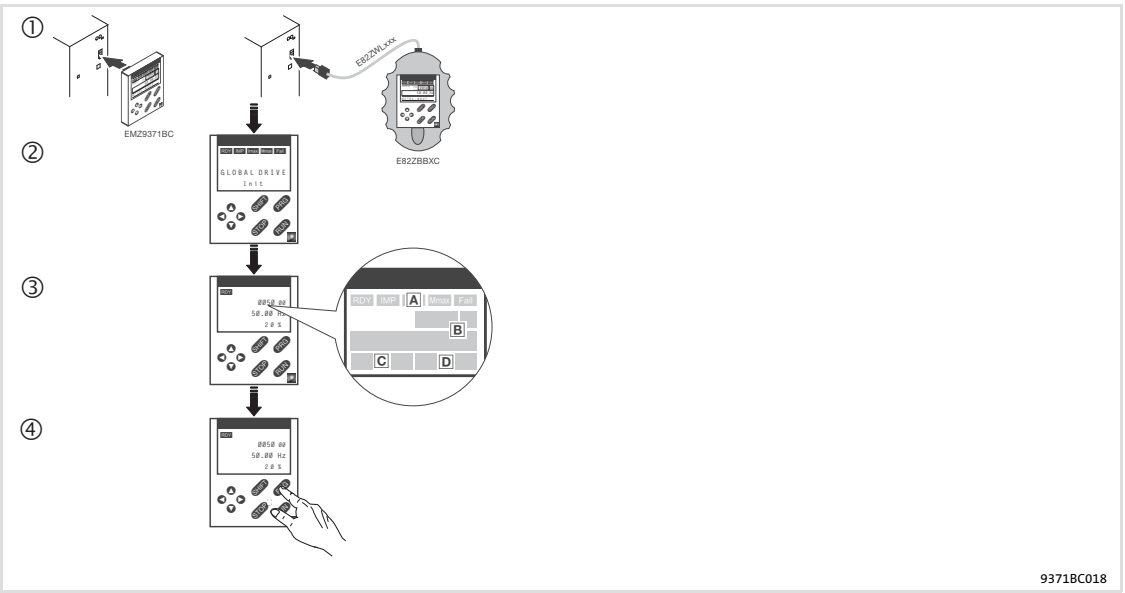


Fig. 3-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

A Current state of the standard device

B Memory location 1 of the user menu (C0517):
Code number, subcode number, and current value

C Active fault message or additional status message

D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

3.1.3 Display elements and function keys

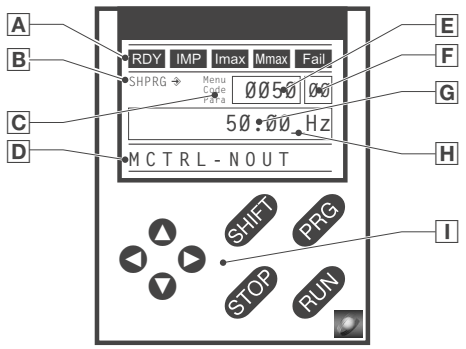


Fig. 3-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	**Status displays of standard device**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	
	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:

Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	**Code level**	**Parameter level**	**Operating level**
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations[1)]		Accept parameters when SHPRG → or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset): 1. Remove the cause of malfunction 2. Press STOP 3. Press RUN			

1) Only active for operation with standard devices of the 8200 vector or 8200 motec series

3.1.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept the parameter Display ”OK”
	Display →		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the ”loop” with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to the parameter level Display ”0” and ”READY”
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set ”1” ”Save PS1”
				Save as parameter set 2: ⇨ Set ”2” ”Save PS2”
				Save as parameter set 3: ⇨ Set ”3” ”Save PS3”
				Save as parameter set 4: ⇨ Set ”4” ”Save PS4”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved in the selected parameter set.
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

[1] The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

3.1.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

3.1.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ► ◄	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT + PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step		Key sequence	Action
1.	Connect the keypad to standard device 2		
2.	Inhibit controller		Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6		All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu	▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level	PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function		The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.		● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 25
		▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.		
		▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
			Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
			Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
			Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying	SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level		
	A	PRG	Display of the operating level
	B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.	▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6		
11.	Enable controller		Terminal X5/28 = HIGH The drive is running with the new settings.

3.1.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the ”USER menu”		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 ”MCTRL-NACT”
3.	Select C0094		▲	Display of code C0094 ”Password”
4.	Change to the parameter level		PRG	Display ”0” = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”
7.	Change to the ”USER menu”		◀ ◀ ▼	

The password protection is active now.
You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 ”Password”
3.	Change to the parameter level		PRG	Display ”9999” = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and ”Password”

The password protection is deactivated now. All menus can be freely accessed again.

3.1.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

- monitoring the drive
- fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

3.1.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	Display	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

Main menu	Submenus	Description
Display	**Display**	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

4 Troubleshooting and fault elimination

4.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.

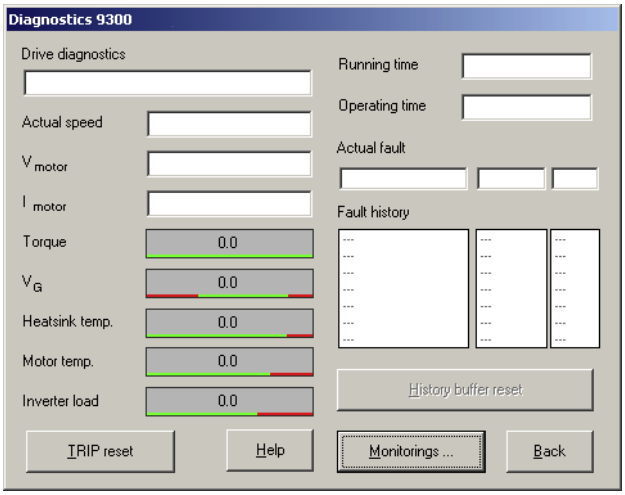


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Fig. 4-1 ”Diagnostics” dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
  – the history buffer in Global Drive Control (GDC) (📖 34) or
  – the XT keypad
  – and with the ”General error messages” table in the ”System error messages” chapter.

► The ”General error messages” table provides tips on how to eliminate an error.

4.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

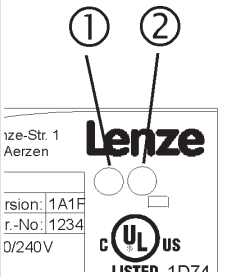
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 36)

4.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

LED		Operating status	
Red ①	**Green** ②		
Off	On	Controller enabled	
On	On	Mains switched on and automatic start inhibited	
Off	Blinking slowly	Controller inhibited	
Blinking quickly	Off	Undervoltage or overvoltage	
Blinking slowly	Off	Fault active	



4.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.

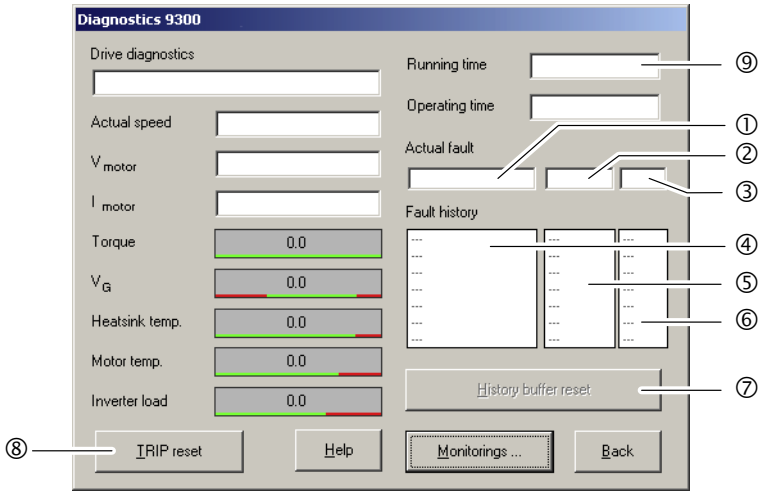


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Fig. 4-2 ”Diagnostics” dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged: ● The content of memory units 1 ... 7 is shifted ”upwards” by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
④	⑤	⑥	2	Last fault	
			3	Next to last fault	
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

4.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Pulse inhibit (IMP)		
			Bit2	Not assigned		
			Bit3	Not assigned		
			Bit4	Not assigned		
			Bit5	Not assigned		
			Bit 6	n = 0		
			Bit 7	Controller inhibit (CINH)		
			Bit 8	Device status bit 1		
			Bit 9	Device status bit 2		
			Bit10	Device status bit 3		
			Bit11	Device status bit 4		
			Bit12	Warning		
			Bit13	Message		
			Bit14	Not assigned		
			Bit15	Not assigned		
C0155	Status word 2	0				Status word 2 (advanced status word) Display only
			0	{1}	65535	Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault		
			Bit 1	M_{max} reached		
			Bit 2	I_{max} reached		
			Bit 3	Pulse inhibit(IMP)		
			Bit 4	Ready for operation (RDY)		
			Bit 5	Controller inhibit (CINH)		
			Bit 6	TRIP active		
			Bit 7	Initialisation		
			Bit 8	Motor direction of rotation (Cw/CCw)		
			Bit 9	Not assigned		
			Bit 10	Not assigned		
			Bit 11	Not assigned		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		

4.3 System error messages

4.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
x066	CE5	Time-out of system bus (CAN) (communication error of gateway function)	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring of system bus (CAN). • Check CAN bus configuration.
0070	U15	Undervoltage of internal 15 V voltage supply		Check voltage supply.
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0073	PR2	Checksum error in parameter set 2 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 2.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 2.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0077	PR3	Checksum error in parameter set 3 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 3.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 3.

Fault message		Description	Cause	Remedy
No.	Display			
0078	PR4	Checksum error in parameter set 4 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 4.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 4.
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
0080	PR6	Too many user codes		Reduce the number of user codes.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!

Fault message		Description	Cause	Remedy
No.	Display			
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	• Check external encoder. • Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x151	P01	Error ”negative limit switch”.	Negative limit switch was reached.	• Control drive in positive direction • Check wiring at X5/E2.
x152	P02	Error ”positive limit switch”.	Positive limit switch was reached.	• Control drive in negative direction • Check wiring at X5/E1.
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	• Increase following error limit under C0255. • Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x154	P04	Error ”negative position limit”.	Negative position limit (C1224) was not reached.	Find out why the value was not reached (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1224 if necessary.
x155	P05	Error ”positive position limit”.	Positive position limit (C1223) was exceeded.	Find out why the value was exceeded (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1223 if necessary.
x156	P06	No reference.	The reference point is not known. In the case of absolute positioning, no homing was performed before the first positioning.	Perform one of the following functions and restart: • Manual homing. • Start homing in the program. • Set reference.
x157	P07	Parameter set mode is absolute instead of relative.	An absolute parameter set (C1311) was performed during relative positioning (position mode C1210).	Perform one of the following functions and restart: • Change the parameter set from absolute to relative. • Change position mode.
x158	P08	Error ”actual reference dimension offset”.	Actual reference dimension offset (C1226) outside the position limits. Error of the program function ”set position value”.	If necessary, adapt the position limit values or check whether the program function ”set position value” is to be applied.
x159	P09	Error in positioning program.	Impermissible programming	Check position program: • A parameter set with final speed must be followed by a parameter set with positioning; it is not permissible to wait for input.

Fault message		Description	Cause	Remedy
No.	Display			
x162	P12	Error in the range of the encoder.	The range of the absolute encoder was exceeded.	● Return drive by manual positioning. ● Check position limits and adjustment of the encoder. ● Design and mount the absolute encoder in a way that does not exceed the traversing range.
x163	P13	Angle overrun.	● Phase controller limit reached ● Drive cannot follow the digital frequency (I_{max} limit).	● Enable drive ● Check drive dimensioning.
x164	P14	1. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/1.	● Increase current limit under C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/1
x165	P15	2. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/2.	● Increase current limit C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/2
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	● Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	● Check communication channel. ● Check baud rate, controller address. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.
x167	P17	Error ”touch probe control”.	Various function blocks use the touch probe input at the same time (e.g. FB DFSET and POS). A conflict arises.	● Configure another touch probe input for FB POS (not possible for FB DFSET). ● Switch off monitoring (C1289/1).

Fault message		Description	Cause	Remedy
No.	Display			
x168	P18	Internal limitation.	Arithmetic operation generated data cannot be varied arbitrarily. Wrongly specified values were automatically limited internally.	
			C1298 = 1: The negative position limit in C1223 is outside the possible display range of $1 \leq (C1223 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/10 and enter it in C1223 if necessary.
			C1298 = 2: The positive position limit in C1224 is outside the possible display range of $1 \leq (C1224 \times C1205) \leq 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/11 and enter it in C1224 if necessary.
			C1298 = 3: The maximum speed v_{max} in C1240 is outside the possible display range of $1 \leq (C1240 \times C1205 \times 16.384) \leq 2.14E9$ inc or v_{max} not $C1240 / C1204 \times 60 \leq 1.5 \times n_{max}$	Check the values in C0011, C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/12 and enter it in C1240 or adjust the value in C1240 to C0011 if necessary.
			C1298 = 4: The maximum acceleration a_{max} in C1250 is outside the possible display range of $1 \leq (C1250 \times C1205 \times 16.384 / 10\,00) \leq 2.8634E7$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/13 and enter it in C1250 if necessary.
			C1298 = 5: An internal value range has been exceeded for a speed standardisation. Valid range: $1 \leq (C0011 \times C1207/1 / C1207/2\ 65536 / 60000) \leq 32767$	Check the values in C0011, C1207/1, C1207/2 and correct them.
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x171	P21	Following error.	The phase difference between set and actual position is larger than the following error limit set under C1328.	• Extend the following error limit under C1328. • Switch off monitoring (C1329=3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).
0201	overrun Task1	Time-out in task 1 (ID 2)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
...	...	...		
0208	overrun Task8	Time-out in task 8 (ID 9)		

Fault message		Description	Cause	Remedy
No.	Display			
0209	float Sys-T	Float error in system task (ID 0)	Error in real calculation (e. g. division by 0)	Check calculations (program code).
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)		
0211	float Task1	Float error in task 1 (ID 2)		
...	...	...		
0218	float Task8	Float error in task 8 (ID 9)		
0219	overrun Cyc.-T	Time-out in cyclic task (PLC_PRG ID 1)	Task processing takes longer than the monitoring time set.	• Adjust the length of the task runtime. • Adjust monitoring time. • Determine the cause of time-out by checking the task runtime at the task monitor. • Swap out time-critical program parts in a slower task.
0220	noT-Fkt Credit	Not enough technology units available.	A program with technology functions has been tried to be loaded to a controller not providing the corresponding units.	• Use technology variant of the controller. • Contact Lenze, if necessary.
x220	CDA	Data error	Attempt to transmit faulty profile data	Repeat profile data transfer.
x221	CDA-LOAD	Faulty checksum	The checksum of the transferred profile data is not correct.	Repeat profile data transfer and check for correctness.
0230	No Program	Missing PLC program	No PLC program loaded.	Load PLC program.
0231	Unallowed Lib	PLC program calls invalid library function.	In the PLC program a library function has been called which is not supported by the controller (e.g. because the corresponding hardware is missing).	• Remove library function or ensure that the corresponding hardware is available. • Contact Lenze, if necessary.
0232	NoCam Data	Motion profiles (cam data) are not available.	When calling functions of the function library **LenzeCamControl.lib** it was detected that there are no motion profiles (CAM data) loaded in the memory of the controller.	• Ensure that the valid cam data has been attached to the project via the DDS CAM support. • Reload the PLC program into the controller. (Possibly the command **Online→Reset (origin)** has been executed in DDS.)
x240	ovrTrans Queue	”Free CAN objects” error	Overflow of the transmit request memory	• Reduce the number of transmit requests. • Prolong the cycle time.
x241	ovr Receive		Too many receive telegrams	Reduce the number of telegrams on the system bus (CAN).
x250	2.Flash Err	Error when the FLASH memory is accessed	The PLC program tries to access non-available or defect FLASH memory	Make sure that the PLC has the corresponding FLASH memory. If not, please contact Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
x251	AddData CsErr	Error during FLASH memory access	Check sum error occurred when loading data into the FLASH memory	Check the checksum of the file to be loaded and repeat the data transfer.

Fault message		Description	Cause	Remedy
No.	Display			
x252	AddData DlErr	Error during FLASH memory access	An error occurred when downloading the data into the FLASH memory (e.g. time-out, transmission error, mains failure during transmission)	Check/repeat data transfer.
x260	Err Node Guard	”Life guarding event”	The controller configured as a CAN slave does not receive a ”Node Guarding” telegram from the CAN master within the ”Node Life Time”.	• Check wiring at X4. • Check CAN configuration. • Ensure that ”node guarding” has been activated in the CAN master • Adapt the ”node life time” (C0383) to CAN master setting.

Explanation of the error numbers:
x 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
e.g. ”2091”: An external monitoring has triggered the warning EEr

4.3.2 Resetting system error messages

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** If a TRIP/FAIL QSP source is still active, the pending TRIP/FAIL QSP cannot be reset. The TRIP/FAIL QSP can be reset by: • pressing ⇨ STOP on keypad XT EMZ9371 BC. Then, press RUN to re-enable the controller. • Set code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word system bus (CAN) / MotionBus (CAN) at ECSxS/P/M After the reset of the TRIP/FAIL QSP, the drive remains at standstill.
Message	**Danger!** The fault message is reset automatically after the fault has been eliminated, and the drive restarts automatically.
Warning	After the fault has been eliminated, the fault message is reset automatically.

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EDKVS93-03 ▪ 13440805 ▪ EN ▪ 3.0 ▪ TD06

10 9 8 7 6 5 4 3 2 1

EDSVS9332S
13440809

Global Drive

System Manual

9300 *0.37 ... 75 kW*

EVS9321xS ... EVS9332xS

Servo inverters

Lenze

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1 Preface

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1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual addresses to all persons who dimension, install, commission, and set 9300 servo inverters.

Together with the System Manual (supplement), document number EDSVS9332S-EXT, and the catalogue, it provides the basis for project planning for the mechanical engineer and the plant constructor.

Contents

The System Manual provides the basis for the description of the 9300 servo inverter. Together with the System Manual (supplement), document number EDSVS9332S-EXT, a complete System Manual is available:

- ► The features and functions are described in detail.
- ► The parameterisation for typical applications is pointed up by the use of examples.
- ► In case of doubt always the mounting instructions supplied with the 9300 servo inverter are valid.

Contents of System Manual	Contents of System Manual (supplement)
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2 Safety	-
3 Technical data	-
4 Mounting the standard device	-
5 Wiring the standard device	-
6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
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-	4 Application examples
9 Troubleshooting and fault elimination	-
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How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.1.2 Products to which the System Manual applies

This documentation is valid for 9300 servo inverters as of nameplate data:

	①						②	③	Nameplate
	EVS	93xx	–	x	x	Vxx	6x	8x	

Product range

EVS = servo controller

Type no. / rated power

	400V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Design

E = built-in unit

C = built-in unit in ”cold plate” technology

Version

S = servo inverter

Variant

– standard

V003 = in ”cold plate” technology

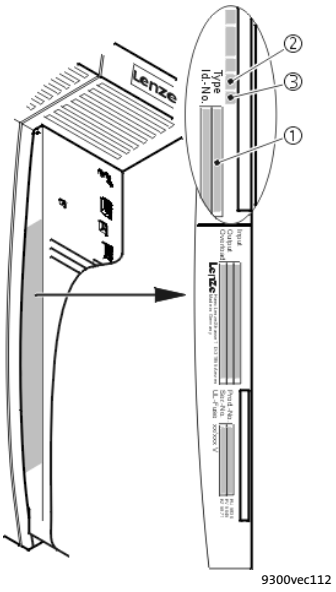
V004 = with ”safe torque off” function

V100 = for IT mains

V104 = with ”safe torque off” function and for IT mains

Hardware version (as of 6x)

Software version (as of 8.0)



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1.1.3 Document history

What is new / what has changed?

Material number	Version			Description
13440809	6.0	09/2013	TD06	Error corrections
13375723	5.3	08/2012	TD23	Error corrections
13375723	5.2	03/2012	TD23	Error corrections
13375723	5.1	04/2011	TD23	Chapter ”DC-bus operation” updated due to changes of DC fuses Error corrections
13270788	4.1	07/2010	TD23	New edition due to reorganisation of the company
13270788	4.0	05/2010	TD23	Extended by functions for software version 8.0 Complete editorial revision and error correction Division of the System Manual into 2 parts (EDSVS9332S and EDSVS9332S-EXT)
00481343	3.0	02/2004	TD23	Extended by functions for software version 6.2 Error correction
00465483	2.0	09/2003	TD23	Chapter ”Technical data” supplemented by information on circuit breakers for the types 9321 and 9322 Error correction

1.2 Legal regulations

Identification

Lenze controllers are unambiguously identified by the contents of the nameplate.

Manufacturer

Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen, Germany

CE conformity

In conformity with EC ”Low Voltage” Directive

Application as directed

9300 servo controllers and accessories

- ► may only be operated under the conditions specified in this System Manual.
- ► are components
  - – for open and closed loop control of variable speed drives with PM synchronous motors, asynchronous standard motors or asynchronous servo motors.
  - – for installation in a machine.
  - – for assembly with other components to form a machine.
- ► comply with the protection requirements of the EC ”Low Voltage” Directive.
- ► are not machines for the purpose of the EC ”Machinery” Directive.
- ► are not to be used as domestic appliances, but only for industrial purposes.

Drive systems with 9300 servo controllers

- ► comply with the EC ”Electromagnetic Compatibility” Directive if they are installed according to the guidelines of CE-typical drive systems.
- ► can be used
  - – for operation on public and non-public mains supplies.
  - – for operation in industrial premises and residential and commercial areas.
- ► The user is responsible for the compliance of the machine application with the EC Directives.

Any other use shall be deemed inappropriate!

Liability

The information, data and notes given in this System Manual met the state of the art at the time of printing. Claims on modifications referring to controllers and components which have already been supplied cannot be derived from the information, illustrations and descriptions contained in this manual.

The procedural notes and circuit details given in this System Manual are suggestions and their transferability to the respective application has to be checked. Lenze does not take any responsibility for the suitability of the given procedures and circuit suggestions.

The specifications given in this System Manual describe the product features without guaranteeing them.

Lenze does not accept any liability for damage and malfunctioning caused by:

- ► Disregarding the System Manual
- ► Unauthorised modifications to the controller
- ► Operating faults
- ► Improper working on and with the controller

Warranty

See terms of sales and delivery of Lenze Automation GmbH.

Warranty claims must be made to Lenze immediately after detecting the deficiency or fault.

The warranty is void in all cases where liability claims cannot be made.

1.3 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	language-dependent	In each case, the signs typical for the target language are used as decimal separators. For example: 1234.56 or 1234,56
Warnings		
UL warnings	UL	Are only given in English.
UR warnings	UR	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference	🕮	Reference to another documentation with additional information For example: 🕮 EDKxxx = see documentation EDKxxx

1.4 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!
(characterises the type and severity of danger)
Note
(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety instructions

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2.1 General safety information

Scope

The following general safety instructions apply to all Lenze drive and automation components.

The product-specific safety and application notes given in this documentation must be observed!

Note for UL-approved systems: UL warnings are notes which only apply to UL systems. The documentation contains specific notes with regard to UL.

For your own safety

Danger!

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

- Lenze drive and automation components ...
  - ... must only be used for the intended purpose.
  - ... must never be operated if damaged.
  - ... must never be subjected to technical modifications.
  - ... must never be operated unless completely assembled.
  - ... must never be operated without the covers/guards.
  - ... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.
- All specifications of the corresponding enclosed documentation must be observed.

  This is vital for a safe and trouble-free operation and for achieving the specified product features.

  The procedural notes and circuit details provided in this document are proposals which the user must check for suitability for his application. The manufacturer does not accept any liability for the suitability of the specified procedures and circuit proposals.
- Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.

  According to IEC 60364 or CENELEC HD 384, these are persons ...

  ... who are familiar with the installation, assembly, commissioning and operation of the product,

  ... possess the appropriate qualifications for their work,

  ... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.

Transport, storage

- Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.
  - – Protect against dust and shocks.
  - – Comply with climatic conditions according to the technical data.

Mechanical installation

- ▶ Install the product according to the regulations of the corresponding documentation. In particular observe the section ”Operating conditions” in the chapter ”Technical data”.
- ▶ Provide for a careful handling and avoid mechanical overload. During handling neither bend components, nor change the insulation distances.
- ▶ The product contains electrostatic sensitive devices which can easily be damaged by short circuit or static discharge (ESD). Thus, electronic components and contacts must not be touched unless ESD measures are taken beforehand.

Electrical installation

- ▶ Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in the documentation.
- ▶ When working on live products, observe the applicable national regulations for the prevention of accidents (e.g. BGV 3).
- ▶ The documentation contains information about EMC-compliant installation (shielding, earthing, arrangement of filters and laying cables). The system or machine manufacturer is responsible for compliance with the limit values required by EMC legislation.
  Warning: The controllers are products which can be used in category C2 drive systems as per EN 61800-3. These products may cause radio interference in residential areas. If this happens, the operator may need to take appropriate action.
- ▶ For compliance with the limit values for radio interference emission at the site of installation, the components - if specified in the technical data - have to be mounted in housings (e. g. control cabinets). The housings have to enable an EMC-compliant installation. In particular observe that for example control cabinet doors preferably have a circumferential metallic connection to the housing. Reduce openings or cutouts through the housing to a minimum.
- ▶ Only plug in or remove pluggable terminals in the deenergised state!

Commissioning

- ▶ If required, you have to equip the system with additional monitoring and protective devices in accordance with the respective valid safety regulations (e. g. law on technical equipment, regulations for the prevention of accidents).
- ▶ Before commissioning remove transport locking devices and keep them for later transports.

Operation

- ▶ Keep all protective covers and doors closed during operation.

Safety functions

- ▶ Without a higher-level safety system, the described product must neither be used for the protection of machines nor persons.
- ▶ Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”).
  The notes on the safety functions provided in the documentation of the versions must be observed.

Maintenance and servicing

- The components are maintenance-free if the required operating conditions are observed.
- If the cooling air is polluted, the cooling surfaces may be contaminated or the air vents may be blocked. Under these operating conditions, the cooling surfaces and air vents must be cleaned at regular intervals. Never use sharp objects for this purpose!
- Only replace defective fuses in the deenergised state to the type specified.
- After the system has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors may be charged. Please observe the corresponding notes on the device.

Disposal

- Recycle metals and plastic materials. Ensure professional disposal of assembled PCBs.

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for $I^2 \times t$ monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the $I^2 \times t$ load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for $I^2 \times t$ load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the $I^2 \times t$ load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the $I^2 \times t$ load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	$I^2 \times t$ load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

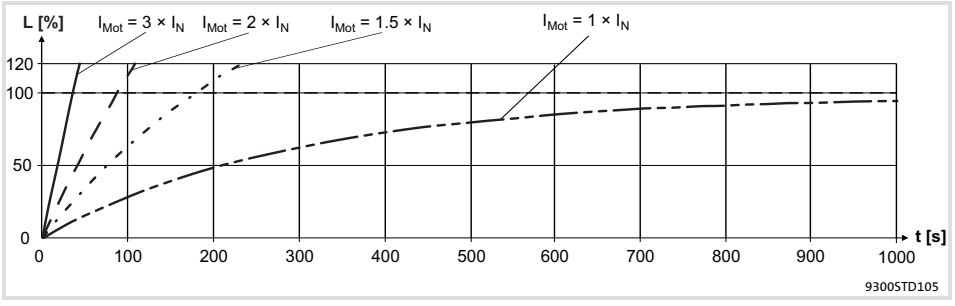

Fig. 2.2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L $I^2 \times t$ load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

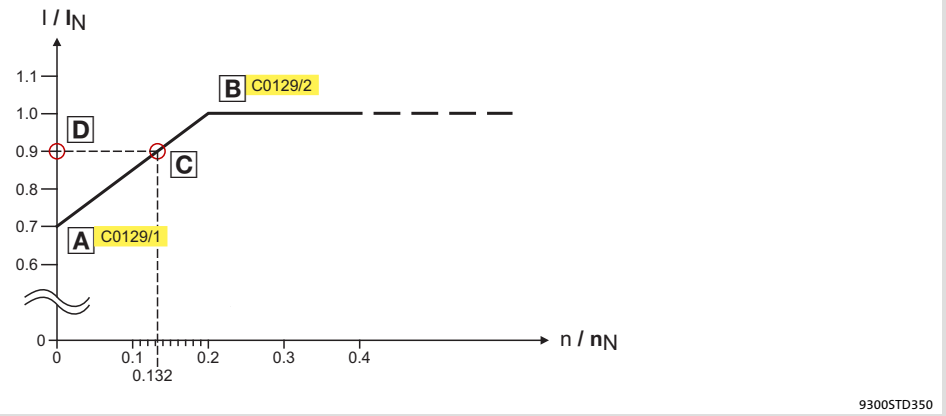

Fig. 2.2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2.2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2.2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1** and **C0129/2** (evaluation coefficient "y", 2.2-4).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	ln	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- According to their enclosure, Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their components can carry a voltage, or parts of the controllers can move or rotate during operation. Surfaces can be hot.
  - If the required cover is removed, the controllers are used inappropriately or installed or operated incorrectly, severe damage to persons or material assets can occur.
  - For more detailed information please see the documentation.
- There is a high amount of energy within the controller. Therefore always wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard) when working on the controller when it is live.
- Before working on the controller, check if no voltage is applied to the power terminals.
  - the power terminals U, V, W, +UG and -UG still carry dangerous voltage for at least 3 minutes after power-off.
  - the power terminals L1, L2, L3; U, V, W, +UG and -UG carry dangerous voltage when the motor is stopped.
- Before power-off during DC-bus operation, all controllers must be inhibited and disconnected from the mains.
- The discharge current to PE potential is > 3.5 mA. In accordance with EN 61800-5-1
  - a fixed installation is required.
  - the design of the PE conductor has to be double or, in the case of a single design, must have a cable cross-section of at least 10 mm^2.
- The controller can only be safely disconnected from the mains via a contactor on the input side.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

- Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side:
  - Type B for the connection to a three-phase system
  - Type A or type B for the connection to a single phase system

  Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xS and EVS9322-xS.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xS ... EVS9332-xS.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Motor protection

- For some controller settings, the connected motor may overheat (e.g. when operating the DC injection brake or a self-ventilated motor at low speed for longer periods).
  - Using an overcurrent relay or a temperature monitoring device provides a large degree of protection against overload.
  - We recommend to use PTC thermistors or thermal contacts for motor temperature monitoring. (Lenze three-phase AC motors are equipped with thermal contacts (NC contacts) as standard)
  - PTC thermistors or thermal contacts can be connected to the controller.
- Drives can attain dangerous overspeeds (e.g. setting of high output frequencies with motors and machines not qualified for this purpose).

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9321 ... EVS9326:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by CC, J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +55 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 75 °C copper wire only.
- ► EVS9327 ... EVS9329:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +50 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 60/75 °C or 75 °C copper wire only.

► EVS9330 ... EVS9332:
– Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
– Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
– Maximum surrounding air temperature: 0 ... +50 °C
– > +40 °C: reduce the rated output current by 2.5 %/°C
– Use 60/75 °C or 75 °C copper wire only.

3 Technical data

Contents

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3.1 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
	2004/108/EG	EMC Directive	
Approval			
UL	cULus	Power Conversion Equipment (File No. E132659)	

Protection of persons and equipment			
Type of protection	EN 60529	IP20	
		IP41 in case of thermally separated installation (push-through technique) between the control cabinet (inside) and the environment.	
	NEMA 250	Protection against accidental contact in accordance with type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe regulations and safety instructions!
Insulation of control circuits	EN 61800-5-1	Safe mains isolation by double (reinforced) insulation for terminals X1 and X5. Basic insulation (single isolating distance) for terminals X3, X4, X6, X7, X8, X9, X10 and X11.	
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Protective measures		Against short circuit, earth fault (earth-fault protected during mains connection, limited earth-fault protection during operation), overvoltage, motor overtemperature (input for PTC or thermal contact)	

EMC			
Noise emission	IEC/EN 61800-3	Cable-guided, up to 10 m motor cable length with mains filter A: category C2.	
		Radiation, with mains filter A and installation in control cabinet: category C2	
Interference immunity	IEC/EN 61800-3	Category C3	

Operating conditions

Ambient conditions			
Climatic			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +55 °C)	< 6 months
		1K3 (-25 ... +40 °C)	> 6 months > 2 years: anodise DC bus capacitors
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation			
EVS9321 ... EVS9326	IEC/EN 60721-3-3	3K3 (0 ... +55 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
EVS9327 ... EVS9332		3K3 (0 ... +50 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
Pollution	EN 61800-5-1	Degree of pollution 2	

Ambient conditions		
Site altitude		< 4000 m amsl > 1000 m amsl: reduce the rated output current by 5 %/ 1000 m
Mechanical		
Vibration resistance	EN 50178 EN 61800-5-1 Germanischer Lloyd, general conditions	Tested according to "General Vibration Stress Characteristic 1"
Electrical		
AC-mains connection		
Max. mains voltage range		320 V - 0 % ... 528 V + 0 %
Mains frequency		45 Hz - 0 % ... 65 Hz + 0 %
Power system TT, TN		Operation permitted without restrictions with earthed neutral.
Power system IT		Operation only permitted with the device variants V024 or V100. Operation permitted without restrictions with insulated neutral. Observe instructions on specific measures!
Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
		Total output at the mains: Compliance with the requirements [1)]
		< 1 kW: With mains choke.
		> 1 kW: Without additional measures.
		[1)] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!
DC-mains connection		
Max. mains voltage range		450 V - 0 % ... 740 V + 0 %
Operating conditions		DC voltage must be symmetrical to PE. The controller will be destroyed when $+U_G$ or $-U_G$ are earthed.
Motor connection		
Length of the motor cable		< 50 m No additional output filters are required at a rated mains voltage and a switching frequency of 8 kHz. If EMC requirements have to be met, the permissible cable length may be affected.

Mounting conditions		
Mounting place		In the control cabinet
Mounting position		Vertical
Free spaces Dimensions Weights		📖 4-1

3.2 Open and closed loop control

Open and closed loopcontrol		
Switching frequency	8 kHz or 16 kHz	
Digital setpoint selection		
Accuracy	± 0.005 Hz (= ± 100 ppm)	
Analog setpoint selection		
Linearity	± 0.15 %	Signal level: 5 V or 10 V
Temperature sensitivity	± 0.1 %	0 ... 50 °C
Offset	± 0.1 %	
Analog inputs Analog outputs	• 2 inputs (bipolar) • 2 outputs (bipolar)	
Digital inputs Digital outputs	• 5 inputs (freely assignable) • 1 input for controller inhibit • 4 outputs (freely assignable) • 1 resolver input; design: 9-pole Sub-D socket • 1 incremental encoder input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin) • 1 digital frequency input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin); can be optionally used as incremental encoder input (500 kHz, TTL level) • 1 digital frequency output (500 kHz, TTL level); design: 9-pole Sub-D socket	
Cycle times		
Digital inputs	1 ms	
Digital outputs	1 ms	
Analog inputs	1 ms	
Analog outputs	1 ms (smoothing time: τ= 2 ms)	

3.3 Rated data

Note!

The controllers EVS9324, EVS9326 and EVS9328 ... EVS9332 may only be operated with the prescribed mains chokes and mains filters.

3.3.1 Operation at 400 V

Basis of the data			
		Voltage	Frequency
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xS	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xS	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xS	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xS	7.0	–	3.0	4.0	**4.8**	0.75	200
EVS9325-xS	12.0	16.8	5.5	7.5	**9.0**	0	260
EVS9326-xS	20.5	–	11.0	15.0	**16.3**	0	390
EVS9327-xS	27.0	43.5	15.0	20.0	**22.2**	10	430
EVS9328-xS	44.0	–	22.0	30.0	**32.6**	4	640
EVS9329-xS	53.0	–	30.0	40.0	**40.9**	0	810
EVS9330-xS	78.0	–	45.0	60.0	**61.6**	5	1100
EVS9331-xS	100	–	55.0	75.0	**76.2**	0	1470
EVS9332-xS	135	–	75.0	100	**100.5**	0	1960

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency

2) Switching frequency of the inverter

3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xS	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xS	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xS	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xS	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xS	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xS	**23.5**	35.3	23.5	15.3	23.0	15.3
EVS9327-xS	**32.0**	48.0	32.0	20.8	31.2	20.8
EVS9328-xS	**47.0**	70.5	47.0	30.6	45.9	30.6
EVS9329-xS	**59.0**	88.5	52.0	38.0	57.0	33.0
EVS9330-xS	**89.0**	133.5	80.0	58.0	87.0	45.0
EVS9331-xS	**110**	165	110	70.0	105	70.0
EVS9332-xS	**145**	21.5	126	90.0	135	72.0

Bold print = Lenze setting

1) Switching frequency of the inverter

2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xS	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xS	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xS	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xS	7.0	–	3.0	4.0	**5.8**	0.75	200
EVS9325-xS	12.0	16.8	5.5	7.5	**10.8**	0	260
EVS9326-xS	20.5	–	11.0	15.0	**18.5**	0	390
EVS9327-xS	27.0	43.5	18.5	25.0	**25.0**	12	430
EVS9328-xS	44.0	–	30.0	40.0	**37.0**	4.8	640
EVS9329-xS	53.0	–	37.0	50.0	**46.6**	0	810
EVS9330-xS	78.0	–	45.0	60.0	**69.8**	6	1100
EVS9331-xS	100	–	55.0	75.0	**87.3**	0	1470
EVS9332-xS	135	–	90.0	125	**104**	6	1960

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xS	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xS	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xS	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xS	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xS	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xS	**22.3**	33.5	22.3	14.5	21.8	14.5
EVS9327-xS	**30.4**	45.6	30.4	19.2	28.8	19.2
EVS9328-xS	**44.7**	67.1	44.7	28.2	42.3	28.2
EVS9329-xS	**56.0**	84.0	49.0	35.0	52.5	25.0
EVS9330-xS	**84.0**	126	72.0	55.0	82.5	36.0
EVS9331-xS	**105**	157.5	105	65.0	97.5	58.0
EVS9332-xS	**125**	187.5	111	80.0	120	58.0

Bold print = Lenze setting
1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.3 Overcurrent operation

Under the operating conditions described here, the EVS9321-xS ... EVS9324-xS controllers can supply a rated output current which is up to twice as high.

Note!

If you enter values > 1.5 × rated output current under C0022, the controller switches to overcurrent operation.

- ► Switching between overcurrent operation and standard operation is only possible if the controller is inhibited (X5/28 = LOW).
- ► The continuous current is automatically reduced to 70 % of the rated output current.

3.3.3.1 Operation at 400 V

Basis of the data			
		Voltage	Frequency
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xS	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xS	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xS	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xS	7.0	–	3.0	4.0	**4.8**	0.75	200

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xS	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xS	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xS	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xS	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xS	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xS	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xS	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xS	7.0	–	3.0	4.0	**5.8**	0.75	200

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xS	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xS	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xS	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xS	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.4 Current characteristics

The maximum output current of the EVS9326 ... EVS9332 devices is limited under certain operating conditions:

- At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K > 40° C.
- The current limitation depends on the switching frequency.

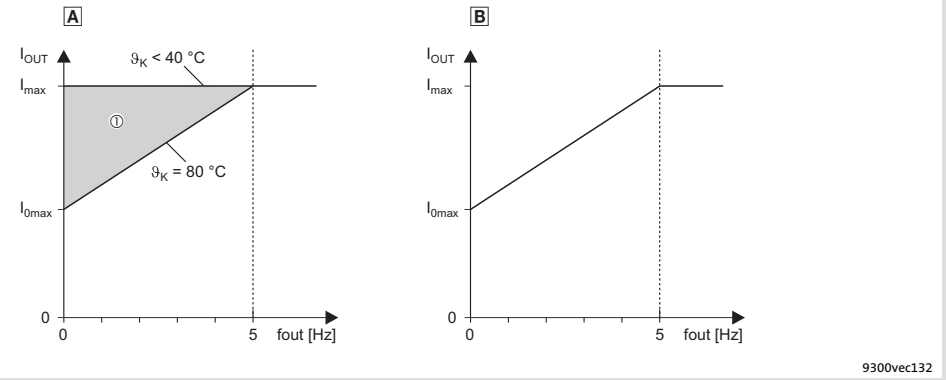

Fig. 3.4-1 Current derating characteristics

A Operation at switching frequency f_{chop} = 8 kHz (C0018 = 1)
The current limitation follows the characteristic curve
At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K = 40 ... 80 °C, the current limit is steplessly adjusted in the ① range

B Operation at switching frequency f_{chop} = 16 kHz (C0018 = 2)
The current limitation follows the characteristic curve and is independent of the heatsink temperature

At automatic change-over of the switching frequency (C0018 = 0), the controller operates at f_{chop} = 16 kHz. The current limitation follows the characteristic curve B.

If an increased torque is required (e.g. acceleration processes), the controller automatically switches over to f_{chop} = 8 kHz. The current limitation follows the characteristic curve A.

9300	I_{0max} [A] 1)		I_{0max} [A] 2)	
	f_{chop} = 8 kHz		f_{chop} = 16 kHz	
	U_{mains}		U_{mains}	
	400 V	480 V	400 V	480 V
EVS9326-xS	23.5	22.3	15.3	14.5
EVS9327-xS	32.0	30.4	20.8	19.2
EVS9328-xS	47.0	44.7	30.6	28.2
EVS9329-xS	52.0	49.0	33.0	25.0
EVS9330-xS	80.0	72.0	45.0	36.0
EVS9331-xS	110	105	70.0	58.0
EVS9332-xS	126	111	72.0	58.0

1) Maximum available output current at an output frequency f_{out} = |0 Hz| and heatsink temperature ϑ_K = 80 °C
2) Maximum available output current at an output frequency f_{out} = |0 Hz|

4 Installation of the standard device

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4.1 Standard devices in the power range 0.37 ... 11 kW

4.1.1 Important notes

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**S [kg]	EVS93xx-**C**S [kg]
EVS9321-xS	4.0	3.1
EVS9322-xS	4.0	3.1
EVS9323-xS	5.5	3.9
EVS9324-xS	5.5	3.9
EVS9325-xS	7.4	5.2
EVS9326-xS	7.4	5.2

4.1.2 Mounting with fixing rails (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity	
		EVS9321-ES ... EVS9324-ES	EVS9325-ES EVS9326-ES
Fixing rails	Drive controller fixing	2	4

Dimensions

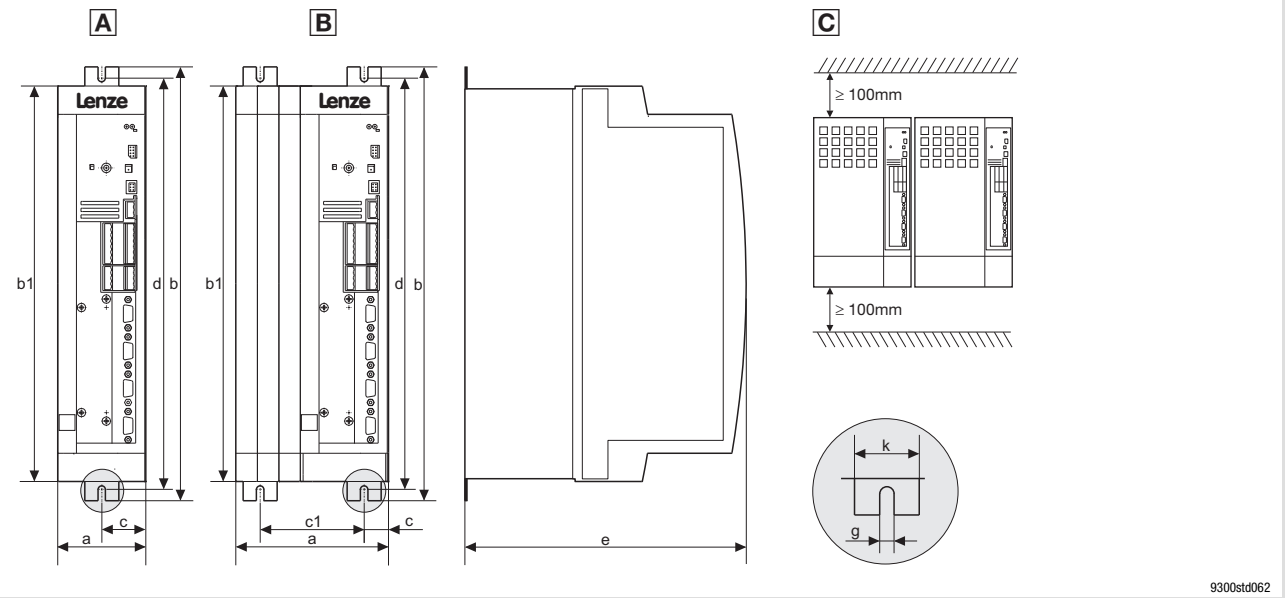


Fig. 4.1-1 Standard mounting with fixing rails 0.37 ... 11 kW

C Drive controllers can be mounted side by side without spacing

9300		Dimensions [mm]									
Type		a	b	b1	c	c1	d	d1	e [1]	g	k
EVS9321-ES EVS9322-ES	A	78	384	350	39	-	365	–	250	6.5	30
EVS9323-ES EVS9324-ES	A	97	384	350	48.5	-	365	–	250	6.5	30
EVS9325-ES EVS9326-ES	B	135	384	350	21.5	92	365	–	250	6.5	30

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing rails to the housing of the drive controller.

4.1.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique you have to use the controller type EVS93xx-**ES**. Additionally you will require the mounting set for push-through technique:

Type	Mounting set
EVS9321-ES, EVS9322-ES	EJ0036
EVS9323-ES, EVS9324-ES	EJ0037
EVS9325-ES, EVS9326-ES	EJ0038

Dimensions

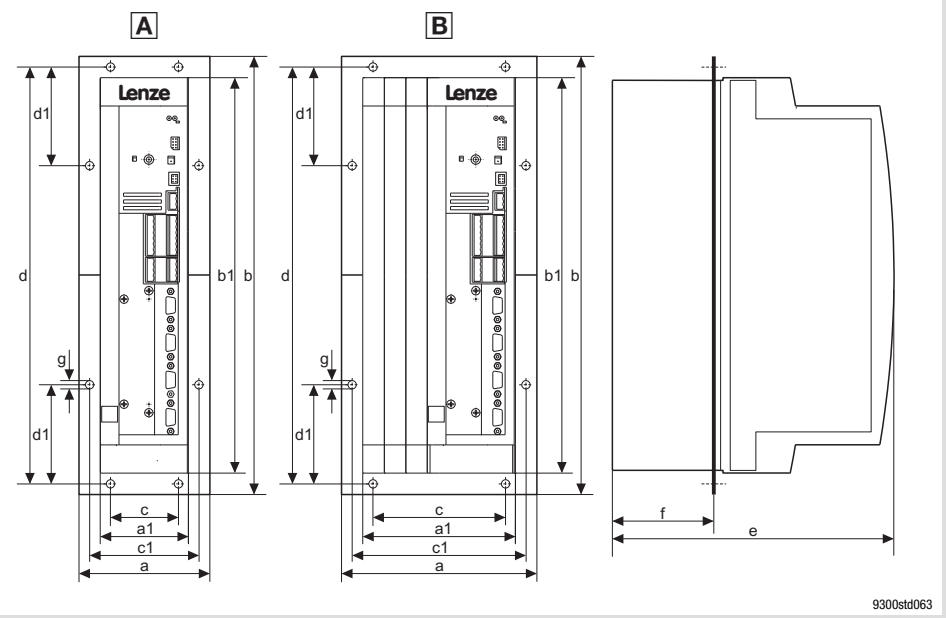


Fig. 4.1-2 Dimensions for thermally separated mounting 0.37 ... 11 kW

9300		Dimensions [mm]										
Type		a	a1	b	b1	c	c1	d	d1	e [1]	f	g
EVS9321-ES EVS9322-ES	A	112.5	78	385.5	350	60	95.5	365.5	105.5	250	92	6.5
EVS9323-ES EVS9324-ES	A	131.5	97	385.5	350	79	114.5	365.5	105.5	250	92	6.5
EVS9325-ES EVS9326-ES	B	169.5	135	385.5	350	117	152.5	365.5	105.5	250	92	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300		Dimensions [mm]	
Type		Width	Height
EVS9321-ES EVS9322-ES	A	82	350
EVS9323-ES EVS9324-ES	A	101	350
EVS9325-ES EVS9326-ES	B	139	350

4.1.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Sx must be used.

Mounting material required from the scope of supply:

Description	Use	Quantity		
		EVS9321-CS EVS9322-CS	EVS9323-CS EVS9324-CS	EVS9325-CS EVS9326-CS
Fixing bracket	Controller fixing	2	2	2
Sheet metal screw 3.5 × 13 mm (DIN 7981)	Mounting the fixing bracket to the controller	6	6	6

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- ► Good thermal connection to the cooler
  - – The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - – Plane contact surface, max. deviation 0.05 mm.
  - – When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- ► Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9321-CS	24	1.45
EVS9322-CS	42	0.85
EVS9323-CS	61	0.57
EVS9324-CS	105	0.33
EVS9325-CS	180	0.19
EVS9326-CS	360	0.10

Ambient conditions

- ► The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- ► Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

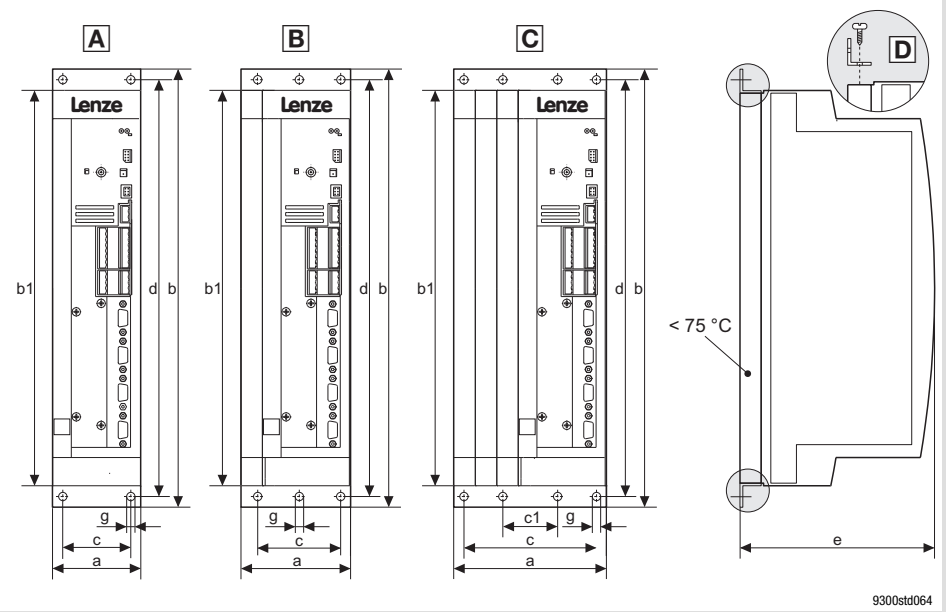


Fig. 4.1-3 Dimensions for mounting in "cold plate" technique 0.37 ... 11 kW

9300		Dimensions [mm]							
Type		a	b	b1	c	c1	d	e [1]	g
EVS9321-CS EVS9322-CS	A	78	381	350	48	–	367	168	6.5
EVS9323-CS EVS9324-CS	B	97	381	350	67	–	367	168	6.5
EVS9325-CS EVS9326-CS	C	135	381	350	105	38	367	168	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

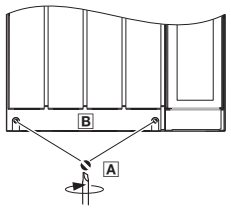
Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

1. Fasten the fixing bracket with sheet metal screws 3.5 × 13 mm at the top and bottom of the drive controller D.
2. Clean the contact surface of cooler and cooling plate with spirit.
3. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
4. Mount the drive controller on the cooler.

4.2 Standard devices in the power range 15 ... 30 kW

4.2.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**S [kg]	EVS93xx-**C**S [kg]
EVS9327-xS	13.5	9.5
EVS9328-xS	15.0	9.5
EVS9329-xS	15.0	–

4.2.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Raised countersunk head screw M5 × 10 mm (DIN 966)	Mounting of fixing bracket to the drive controller	4

Dimensions

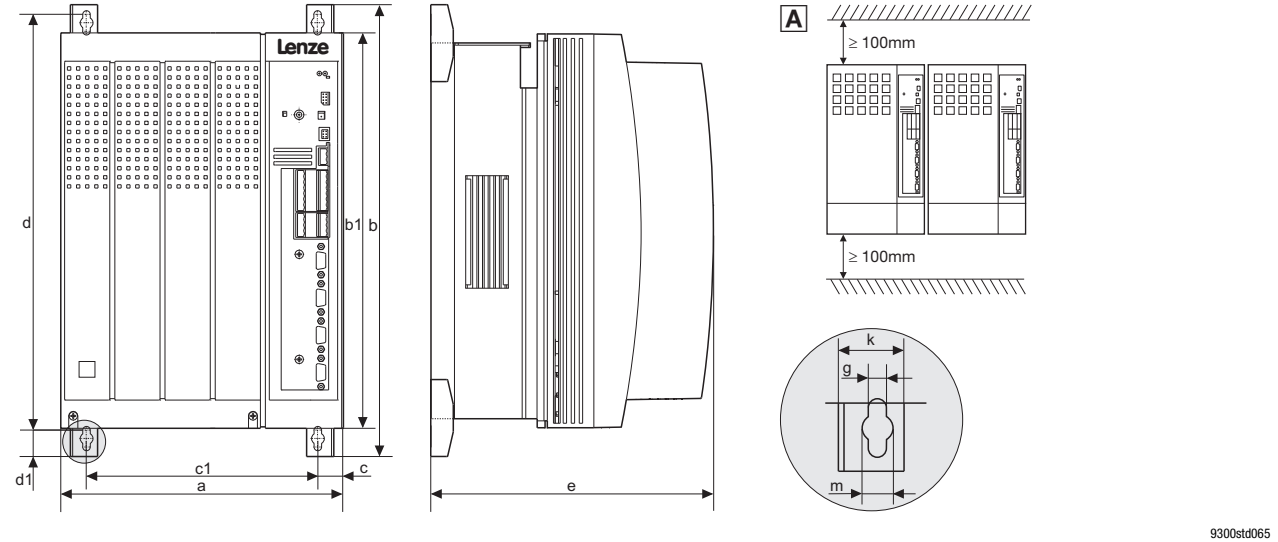


Fig. 4.2-1 Standard mounting with fixing brackets 15 ... 30 kW

A Drive controllers can be mounted side by side without spacing

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9327-ES EVS9328-ES EVS9329-ES	250	402	350	22	206	370	24	250	6.5	24	11

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.2.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Sx must be used. In addition, the mounting set EJ0011 for the push-through technique is required.

Dimensions

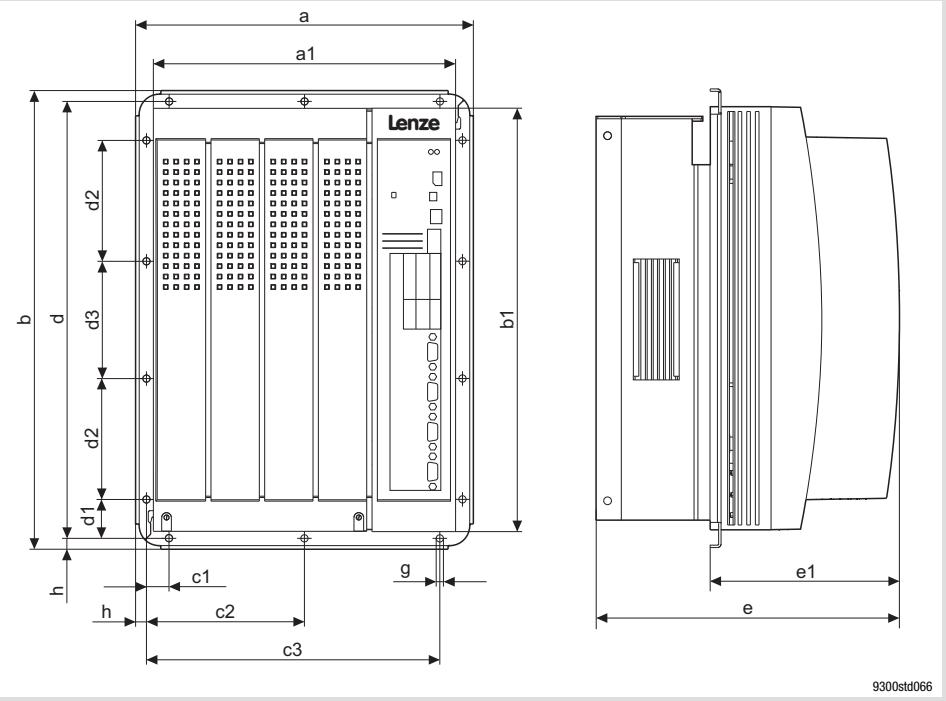


Fig. 4.2-2 Dimensions for thermally separated mounting 15 ... 30 kW

9300	Dimensions [mm]														
Type	a	a1	b	b1	c1	c2	c3	d	d1	d2	d3	e [1]	e1	g	h
EVS9327-ES EVS9328-ES EVS9329-ES	279.5	250	379.5	350	19	131	243	361.5	32	100	97	250	159.5	6	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9327-ES EVS9328-ES EVS9329-ES	236	336

4.2.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Sx must be used.

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- Good thermal connection to the cooler
  - The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - Plane contact surface, max. deviation 0.05 mm.
  - When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9327-CS	410	0.085
EVS9328-CS	610	0.057

Ambient conditions

- The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

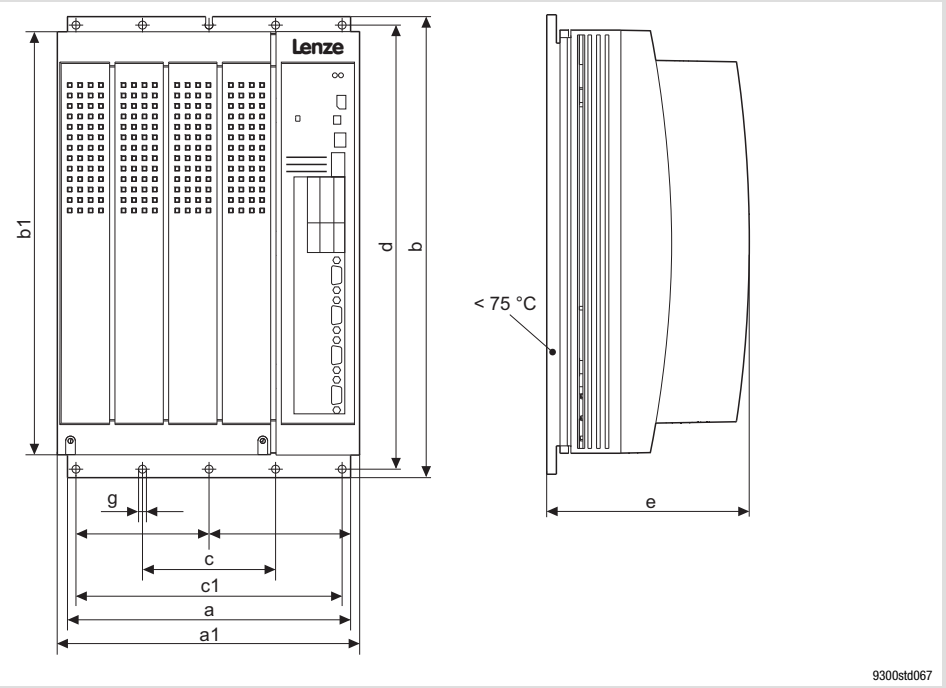


Fig. 4.2-3 Dimensions for mounting in "cold plate" technique 15 ... 22 kW

9300	Dimensions [mm]								
Type	a	a1	b	b1	c	c1	d	e [1)]	g
EVS9327-CS EVS9328-CS	234	250	381	350	110	220	367	171	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

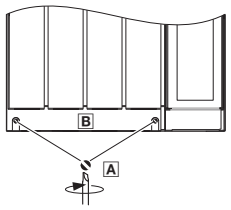
Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

1. Clean the contact surface of cooler and cooling plate with spirit.
2. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
3. Mount the drive controller on the cooler.

4.3 Standard devices with a power of 45 kW

4.3.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**S [kg]	EVS93xx-**C**S [kg]
EVS9330-xS	38.0	–

4.3.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	Mounting of fixing bracket to the drive controller	4
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	4
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	4

Dimensions

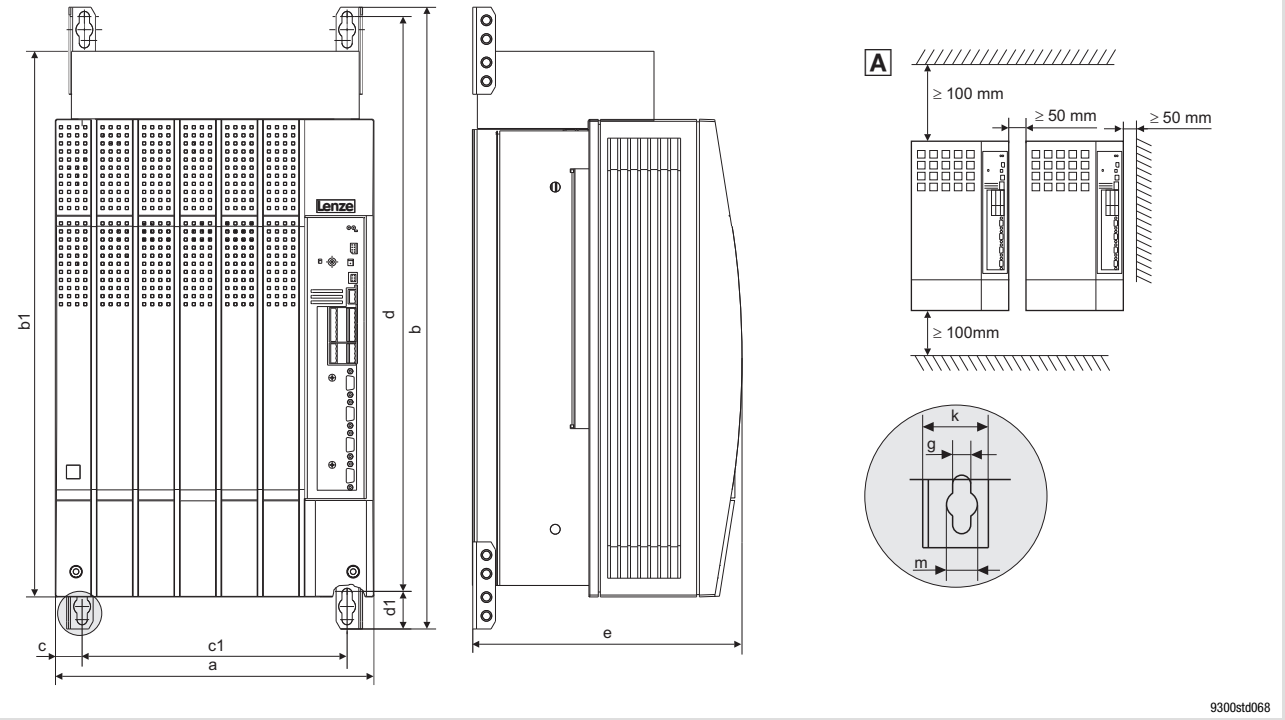


Fig. 4.3-1 Standard mounting with fixing brackets 45 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e 1)	g	k	m
EVS9330-ES	340	580	591	28.5	283	615	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.3.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Sx must be used. In addition, the mounting set EJ0010 for the push-through technique is required.

Dimensions

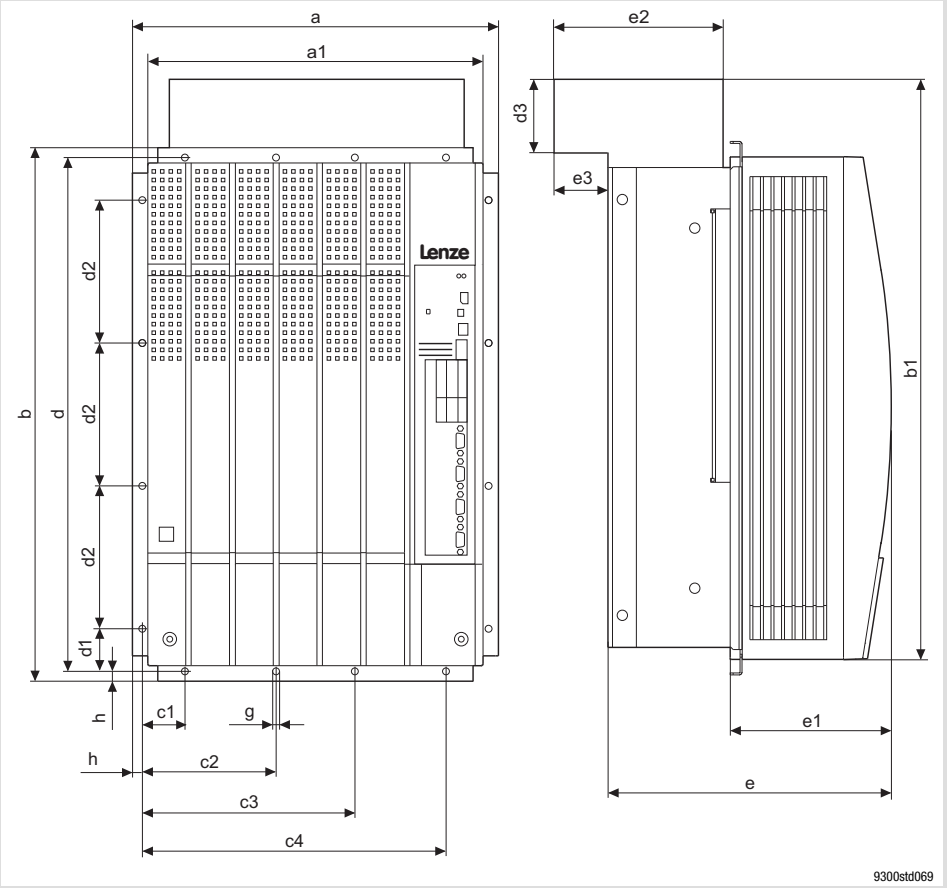


Fig. 4.3-2 Dimensions for thermally separated mounting 45 kW

9300	Dimensions [mm]																
Type	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	d3	e 1)	e1	e2	e3	g	h
EVS9330-ES	373	340	543	591	45	137.5	217.5	310	525	45	145	81	285	163.5	185	66	7	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9330-ES	320	515

4.3.4 Modification of the fan module for push-through technique

For thermally separated mounting the fan module has to be rotated by 180° so that the controller fits into the mounting cutout.

Removing the fan module

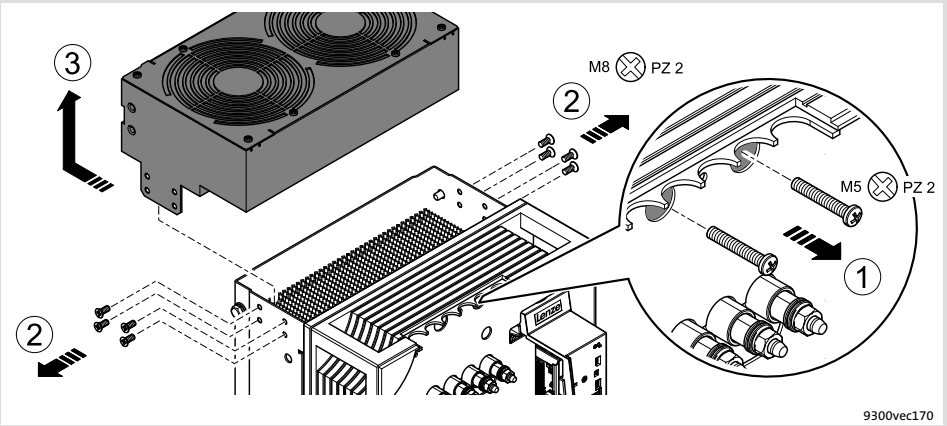


Fig. 4.3-3 Removing the fan module from the controller

1. Remove both screws.
   The screws connect the fans to the supply voltage.
2. Remove the 4 screws for fixing the fan module on each side.
3. Pull back the fan module and carefully remove it to the top.
   Make sure that the threaded sleeves do not touch the housing edge. They may break off.

Modifying the threaded sleeves on the fan module

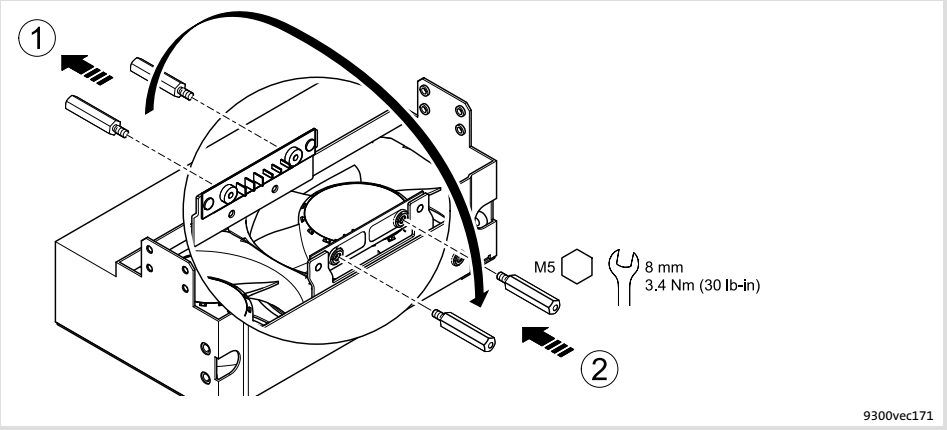


Fig. 4.3-4 Modifying the threaded sleeves for the voltage supply of the fans

1. Remove the threaded sleeves.
2. Screw-in the threaded sleeves on the opposite side and fasten them.

Plugging the fan connecting cable to another terminal on the fan module

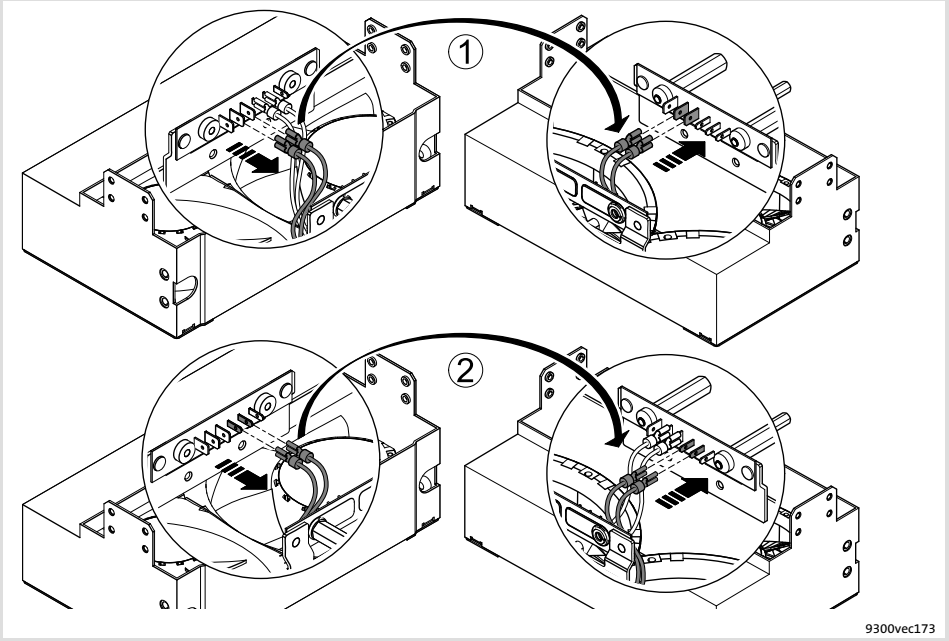


Fig. 4.3-5 Plugging the fan connecting cable for the voltage supply to another terminal

1. Remove the cable lugs of the two red connecting cables and plug them in again on the diagonally arranged side.
2. Remove the cable lugs of the two blue connecting cables and plug them in again on the diagonally arranged side.

Mounting the fan module in a manner rotated by 180°

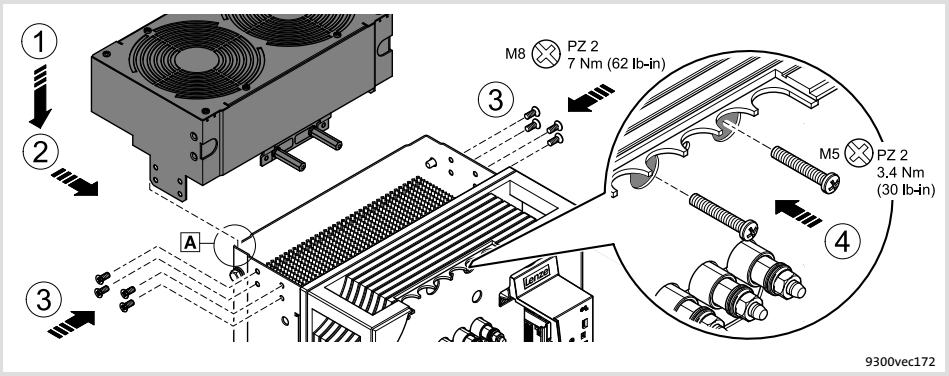


Fig. 4.3-6 Mounting the fan module on the controller

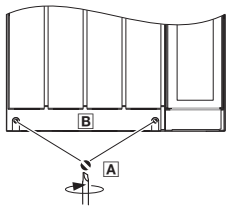
1. Place the fan module onto the controller. Insert the lugs at the back into the base plate A.

   Make sure that the threaded sleeves do not touch the housing edge. They may break off.
2. Push the fan module to the front.
3. Screw-in and fasten the 4 screws for fixing the fan module on each side.
4. Screw-in and fasten the two screws for the supply voltage.

4.4 Standard devices in the power range 55 ... 75 kW

4.4.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**S [kg]	EVS93xx-**C**S [kg]
EVS9331-xS	59.0	–
EVS9332-xS	59.0	–

4.4.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	For fixing bracket	8
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	8
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	8

Dimensions

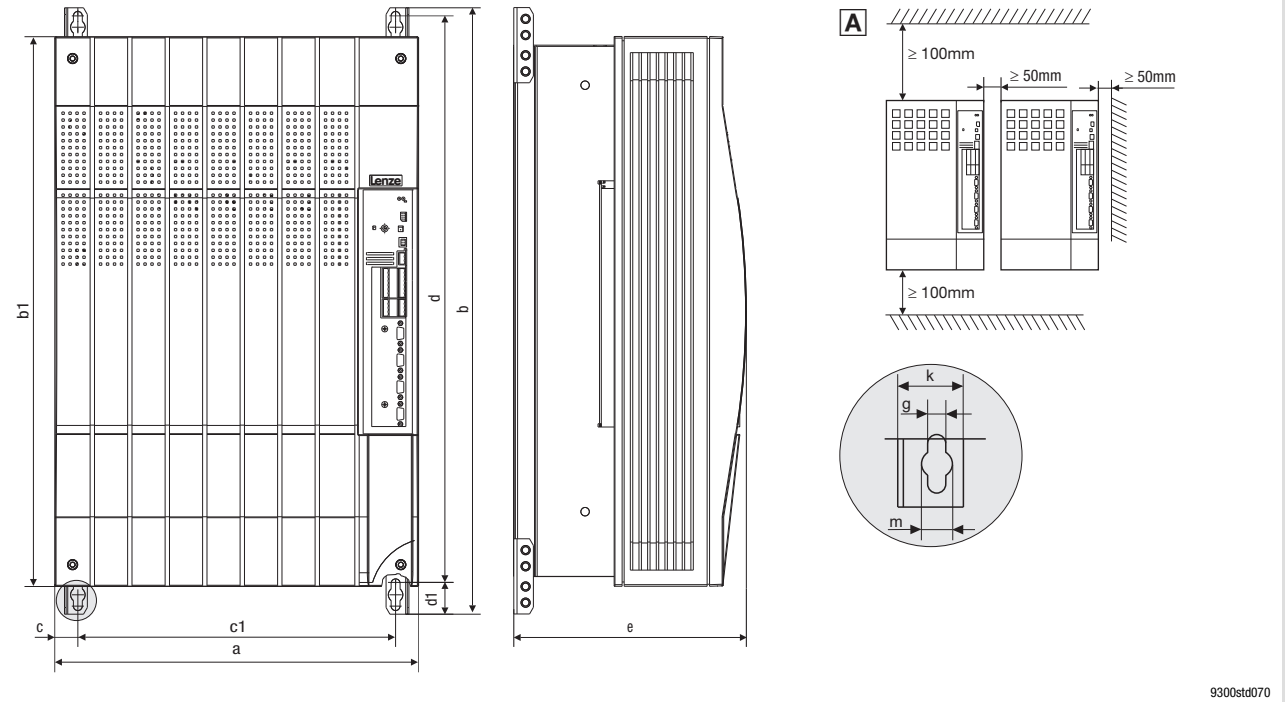


Fig. 4.4-1 Standard mounting with fixing brackets 55 ... 75 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9331-ES EVS9332-ES	450	750	680	28.5	393	702	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.4.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Sx must be used. In addition, the mounting set EJ0009 for the push-through technique is required.

Dimensions

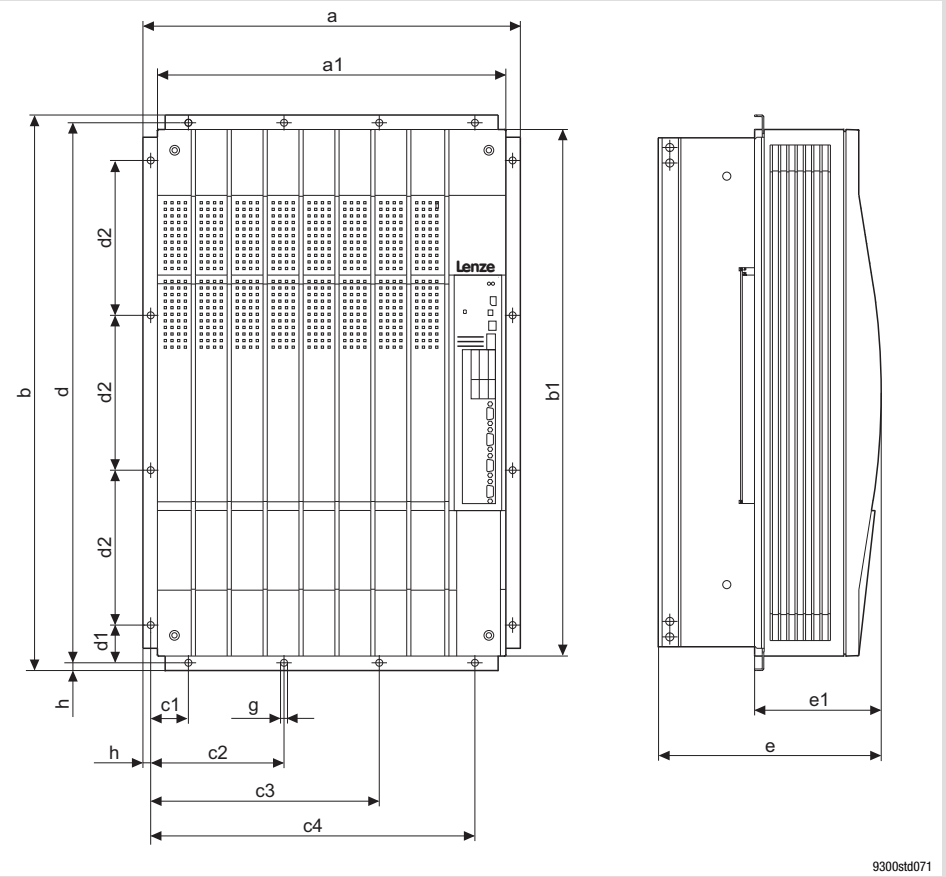


Fig. 4.4-2 Dimensions for thermally separated mounting 55 ... 75 kW

9300	Dimensions [mm]														
Typ	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	e [1)]	e1	g	h
EVS9331-ES EVS9332-ES	488	450	718	680	49	172.5	295.5	419	698	49	200	285	164	9	10

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	a1	b1
EVS9331-ES EVS9332-ES	428.5	660

5 Wiring of the standard device

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5.1 Important notes

Stop!

The drive controller contains electrostatically sensitive components.

The personnel must be free of electrostatic charge when carrying out assembly and service operations.

5.1.1 Protection of persons

Danger!

Before working on the controller, check that all power terminals are deenergised:

- The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least 3 minutes after disconnection from the mains.
- The power terminals L1, L2, L3, U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.

Pluggable terminal strips

Connect or disconnect all pluggable terminals only in the deenergised state!

Electrical isolation

The terminals X1 and X5 have double (reinforced) insulation according to EN50178. The protection against accidental contact is ensured without additional measured being taken.

Danger!

- ► The terminals X3, X4, X6, X7, X8, X9, X10, X11 have basic insulation (single isolating distance).
- ► In the event of a defective isolating distance, protection against accidental contact can only be guaranteed by taking external measures such as double insulation.
- ► If an external DC 24 V voltage source is used, the insulation degree of the controller depends on the insulation degree of the voltage source.

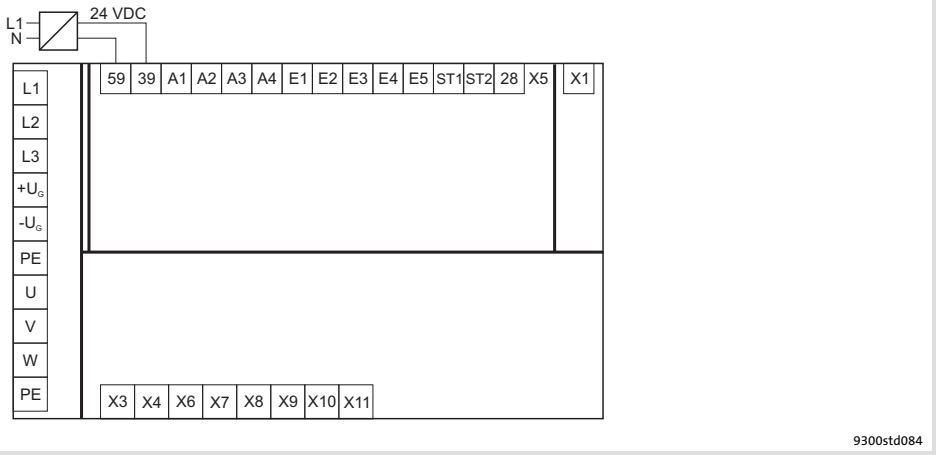


Fig. 5.1-1 Electrical isolation between power terminals, control terminals and housing

Double (reinforced) insulation
Basic insulation

Replacing defective fuses

Only replace defective fuses in the deenergised state to the type specified.

Disconnecting the controller from the mains

Only carry out the safety-related disconnection of the controller from the mains via a contactor on the input side or a manually operated toggle switch.

5.1.2 Device protection

- In the event of condensation, only connect the controller to the mains voltage after the humidity has evaporated.
- The controller is protected by external fuses.
- Drive controllers EVS9324-xS, EVS9326-xS and EVS9328-xS ... EVS9332-xS must only be operated with assigned mains choke / mains filter.
- Length of the screws for connecting the shield sheet for the control cables: **12 mm**.
- Provide unused control inputs and outputs with terminal strips. Cover unused Sub-D sockets with protective covers included in the scope of supply.
- Switching on the motor side of the controller is only permissible for safety shutdown (emergency-off).
- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xS and EVS9322-xS.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xS ... EVS9332-xS.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

5.1.3 Motor protection

- Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the I^2xt monitoring.
- Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min. $\hat{u}$ = 1.5 kV, min. du/dt = 5 kV/μs
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

5.2 Notes on project planning

5.2.1 Supply forms / electrical supply conditions

Observe the restrictions for the different supply forms!

Supply system	Operation of controller	Notes
Supply system: TT, TN (with earthed neutral)	Permitted without restrictions.	• Observe the rated data of the controller • RMS mains current: see chapter "Technical data".
Supply system: IT (with isolated neutral)	Possible if the controller is protected in the event of an earth fault in the supply system • by means of suitable devices which detect the earth fault and • immediately separate the controller from the supply system.	• Safe operation in the event of an earth fault at the inverter output cannot be guaranteed. • The variants V024 / V104 and V100 enable operation of the controller on IT systems.
DC supply via $+U_G/-U_G$	Permitted if the DC voltage is symmetrical to PE.	Earthing of the $+U_G$ or $-U_G$ conductor will destroy the controller.

5.2.2 Operation on public supply systems (compliance with EN 61000-3-2)

European standard EN 61000-3-2 defines limit values for the limitation of harmonic currents in the supply system. Non-linear consumers (e.g. frequency inverters) generate harmonic currents which "pollute" the supplying mains and may therefore interfere with other consumers. The standard aims at assuring the quality of public supply systems and reducing the mains load.

Note!

The standard only applies to public systems. Mains which are provided with a transformer substation of their own as in industrial plants are not public and not included in the application range of the standard.

If a device or machine consists of several components, the limit values of the standard apply to the entire unit.

Measures for compliance with the standard

With the measures described, the controllers comply with the limit values according to EN 61000-3-2.

Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
	Total power on the mains	Compliance with the requirements [1]
	< 1 kW	With mains choke
	> 1 kW	No measures required

[1] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!

5.2.3 Controllers in the IT system

Controllers in the V024, V104 or V100 variants are suitable for operation on insulated supply systems (IT systems). The controllers also have an insulated design. This avoids the activation of the insulation monitoring, even if several controllers are installed.

The electric strength of the controllers is increased so that damage to the controller are avoided if insulation or earth faults in the supply system occur. The operational reliability of the system remains intact.

Stop!

Only operate the controllers with the mains chokes assigned.

Operation with mains filters or RFI filters by Lenze is not permitted, as these modules contain components that are interconnected against PE. By this the protective design of the IT system would be cancelled out. The components are destroyed in the case of an earth fault.

Protect the IT system against earth fault at the controller.

Due to physical conditions, an earth fault on the motor side at the controller can interfere with or damage other devices on the same IT system. Therefore appropriate measures have to be implemented, by means of which the earth fault is detected and which disconnect the controller from the mains.

Permissible supply forms and electrical supply conditions

Mains	Operation of the controllers	Notes
With isolated star point (IT systems)	Possible, if the controller is protected in the event of an earth fault in the supplying mains. ● Possible, if appropriate earth fault detections are available and ● the controller is immediately disconnected from the mains.	Safe operation in the event of an earth fault at the inverter output cannot be guaranteed.

DC-bus operation of several drives

Central supply with 9340 regenerative power supply module is not possible.

Installation of the CE-typical drive system

For the installation of drives on IT systems, the same conditions apply as for the installation on systems with an earthed neutral point.

According to the binding EMC product standard EN61800-3, no limit values are defined for IT systems for noise emission in the high-frequency range.

5.2.4 Operation at earth-leakage circuit breaker (e.l.c.b.)

Danger!

The controllers are internally fitted with a mains rectifier. In case of a short circuit to frame a pulsating DC residual current can prevent the AC sensitive or pulse current sensitive earth-leakage circuit breakers from being activated, thus cancelling the protective function for the entire equipment being operated on this earth-leakage circuit breaker.

- For the protection of persons and farm animals (DIN VDE 0100), we recommend
  - pulse current sensitive earth-leakage circuit breakers for plants including controllers with a single-phase mains connection (L1/N).
  - universal-current sensitive earth-leakage circuit breakers for plants including controllers with a three-phase mains connection (L1/L2/L3).
- Only install the earth-leakage circuit breaker between supplying mains and drive controller.
- Earth-leakage circuit breakers may trigger a false alarm due to
  - capacitive compensation currents flowing in the cable shields during operation (particularly with long, shielded motor cables),
  - simultaneous connection of several inverters to the mains
  - the use of additional interference filters.

5.2.5 Interaction with compensation equipment

- Controllers only consume very little reactive power of the fundamental wave from the AC supply mains. Therefore, a compensation is not required.
- If the controllers are connected to a supply system with compensation equipment, this equipment must comprise chokes.
  - For this, contact the supplier of the compensation equipment.

5.2.6 Discharge current for mobile systems

Frequency inverters with internal or external RFI filters usually have a discharge current to PE potential that is higher than 3.5 mA AC or 10 mA DC.

Therefore, fixed installation as protection is required (see EN 61800-5-1). This must be indicated in the operational documents.

If a fixed installation is not possible for a mobile consumer although the discharge current to PE potential is higher than 3.5 mA AC or 10 mA DC, an additional two-winding transformer (isolating transformer) can be included in the current supply as a suitable countermeasure. Here, the PE conductor is connected to the PEs of the drive (filter, inverter, motor, shieldings) and also to one of the poles of the secondary winding of the isolating transformer.

Devices with a three-phase supply must have a corresponding isolating transformer with a secondary star connection, the star point being connected to the PE conductor.

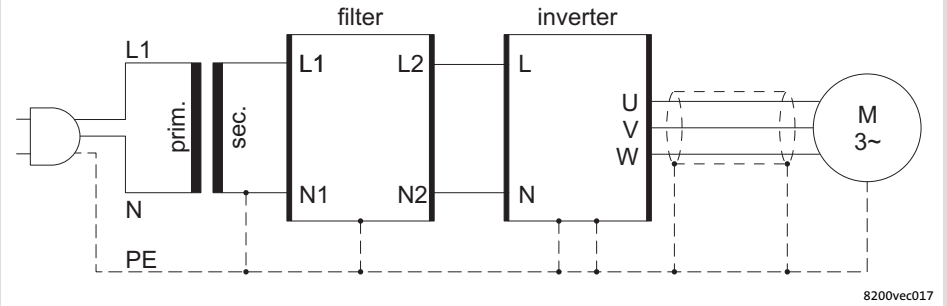


Fig. 5.2-1 Installation of a two-winding transformer (isolating transformer)

5.2.7 Optimisation of the controller and mains load

A mains choke is an inductance which can be included in the mains cable of the frequency inverter. As a result, the load of the supplying mains and the controller is optimised:

- Reduced system perturbation: The curved shape of the mains current approaches a sinusoidal shape.
- Reduced mains current: The effective mains current is reduced, i.e. the mains, cable, and fuse loads are reduced.
- Increased service life of the controller: The electrolytic capacitors in the DC bus have a considerably increased service life due to the reduced AC current load.

There are no restrictions for the combinations of mains chokes and RFI filters and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

Note!

- Some controllers must generally be operated with a mains choke or a mains filter.
- If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

5.2.8 Reduction of noise emissions

Due to internal switching operations, every controller causes noise emissions which may interfere with the functions of other consumers. Depending on the site of the frequency inverter, European standard EN 61800-3 defines limit values for these noise emissions:

Limit class C2: Limit class C2 is often required for industrial mains which are isolated from the mains of residential areas.

Limit class C1: If the controller is operated in a residential area, it may interfere with other devices such as radio and television receivers. Here, interference suppression measures according to limit class C1 are often required.

Limit class C1 is much more strict than limit class C2. Limit class C1 includes limit class C2.

For compliance with limit class C1 / C2, corresponding measures for the limitation of noise emissions are required, e.g. the use of RFI filters.

There are no restrictions for the combinations of RFI filters and mains chokes and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

The selection of the frequency inverter and the corresponding filters, if applicable, always depends on the application in question and is determined by e.g. the switching frequency of the controller, the motor cable length, or the protective circuit (e.g. earth-leakage circuit breakers).

Note!

- ► Some controllers must generally be operated with a mains choke or a mains filter.
- ► If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

The graphics below illustrates the maximum possible motor cable length based on the type of filter and the resulting interference voltage category according to EN 61800-3. Depending on the used motor cable, the used controller, and its switching frequency, the mentioned maximum motor cable lengths may vary.

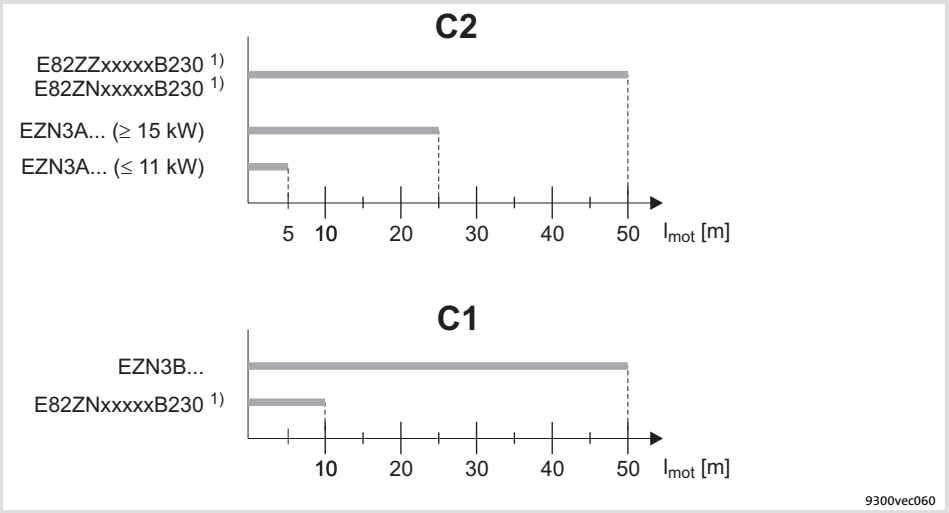


Fig. 5.2-2 Maximum motor cable lengths l_{mot} based on the type of filter for compliance with limit class C2 / C1

1) Use low-capacitance cables

5.2.9 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xS	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xS	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xS	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xS	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xS	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xS	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50
EVS9327-xS	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 1)	10
		E82ZN22334B230	50	EZN3B0110H030U 2)	50
		E82ZZ15334B230 1)	50		
EVS9328-xS	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xS	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50
EVS9330-xS	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 3)	25		
		E82ZN55334B230	50		
EVS9331-xS	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xS	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

1) RFI filter
2) Footprint filter
3) For controllers with thermal separation

5.2.10 Motor cable

Specification

- The used motor cables must
  - meet the requirements on site (e.g. EN 60204-1, UL),
  - comply with the following voltage data: EN 0.6/1 kV, UL 600 V.
- For shielded motor cables, only use cables with braid made of tinned or nickel-plated copper. Shields made of steel braid are not suitable.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90°.
- Use low-capacitance motor cables:

Power class	Capacitance per unit length	
	Core/core	Core/shield
3 ... 11 kW	from 2.5 mm² ≤100 pF/m	≤ 150 pF/m
15 ... 30 kW	≤ 140 pF/m	≤ 230 pF/m
45 ... 55 kW	≤ 190 pF/m	≤ 320 pF/m
75 ... 90 kW	≤ 250 pF/m	≤ 410 pF/m

Cable length

9300	Maximum permissible motor cable length			
	U_r = 400 V		U_r = 480 V	
Type	f_{chop} = 8 kHz	f_{chop} = 16 kHz	f_{chop} = 8 kHz	f_{chop} = 16 kHz
EVS9321-xS, EVS9322-xS	50 m	45 m	50 m	25 m
EVS9323-xS ... EVS9332-xS	50 m	50 m	50 m	50 m

Note!

- The motor cable must be as short as possible for having a positive effect on the drive behaviour.
- If EMC requirements must be met, the permissible cable length may be affected.
- EVS9321-xSand EVS9322-xS: At a mains voltage of 480 V and a switching frequency f_{chop} = 16 kHz, the maximum permissible cable length is reduced if the motor cable has more than a single core:
  - The following holds true for two parallel single cores: l_{max} = 17 m
  - The following holds true for three parallel single cores: l_{max} = 9 m

Cable cross-section

Note!

The cable cross-sections have been assigned to the permissible current loading of the motor cables under the following conditions:

- Compliance with IEC/EN 60204-1 for fixed cable installation
- Compliance with IEC 60354-2-52, table A.52-5 when using the cable in a trailing cable
- Laying system C
- Ambient temperature 45 °C
- Continuous motor operation at a
  - standstill current I_0 for servo motors or a
  - rated current I_R for three-phase asynchronous motors

The user is responsible for selecting a motor cable which complies with the requirements of the current conditions if different situations arise. Different situations may arise due to:

- Laws, standards, national and regional regulations
- Type of application
- Motor utilisation
- Ambient and operating conditions
- Laying system and bundling of cables
- Cable type

Motor cable			
permanently installed	for trailing cable	Cable cross-section	
I_M [A]	I_M [A]	[mm²]	[AWG]
10.0	11.8	1.0	18
13.8	17.3	1.5	16
19.1	23.7	2.5	14
25.5	30.9	4.0	12
32.8	41.0	6.0	10
45.5	55.5	10	8
60.1	75.5	16	6
76.4	92.8	25	4
94.6	115	35	2
114	140	50	1
146	179	70	00
177	217	95	000
205	252	120	0000

Note!

Information on the design of the motor cable is provided in the ”System cables and system connectors” manual.

5.3 Basics for wiring according to EMC

5.3.1 Shielding

The quality of shielding is determined by a good shield connection:

- ▶ Connect the shield with a large surface.
- ▶ Connect the shield directly to the intended shield sheet of the device.
- ▶ In addition, connect the shield to the conductive and earthed mounting plate with a large contact surface by using a conductive clamp.
- ▶ Unshielded cable ends must be as short as possible.

5.3.2 Mains connection, DC supply

- ▶ Controllers, mains chokes, or mains filters may only be connected to the mains via unshielded single cores or unshielded cables.
- ▶ When a mains filter or RFI filter is used, shield the cable between mains filter or RFI filter and controller if its length exceeds 300 mm. Unshielded cores must be twisted.
- ▶ In DC-bus operation or DC supply, use shielded cables.
- ▶ The cable cross-section must be dimensioned for the assigned fusing (observe national and regional regulations).

5.3.3 Motor cable

- ▶ Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  - – The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- ▶ The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- ▶ Shield the cable for motor temperature monitoring (PTC or thermal contact) and install it separately from the motor cable.
  - – In Lenze system cables, the cable for brake control is integrated into the motor cable. If this cable is not required for brake control, it can also be used to connect the motor temperature monitoring up to a length of 50 m.
- ▶ Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp.
- ▶ Connect the shield directly to the corresponding device shield sheet.
  - – If required, additionally connect the shield to the conductive and earthed mounting plate in the control cabinet.
- ▶ The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it only crosses mains cables and control cables at right angles,

– it is not interrupted.

► If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  – The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  – Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  – Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.

► Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  – Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

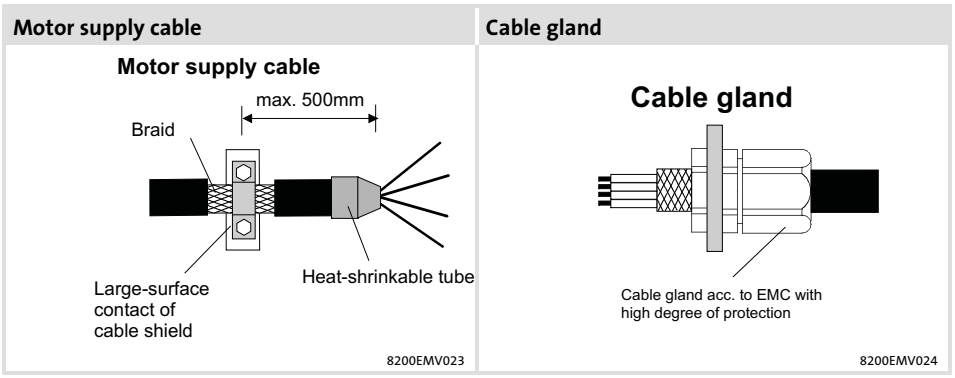


Fig. 5.3-1 Shielding of the motor cable

5.3.4 Control cables

- Control cables must be shielded to minimise interference injections.
- For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.
- Connect the shield correctly:
  - The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
- To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

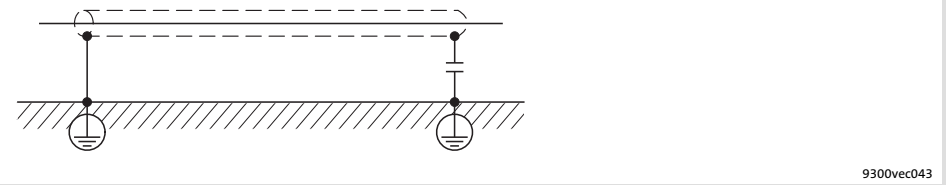


Fig. 5.3-2 Shielding of long, analog control cables

5.3.5 Installation in the control cabinet

Mounting plate requirements

- ▶ Only use mounting plates with conductive surfaces (zinc-coated or V2A-steel).
- ▶ Painted mounting plates are not suitable even if the paint is removed from the contact surfaces.
- ▶ If several mounting plates are used, ensure a large-surface connection between the mounting plates (e.g. by using earthing strips).

Mounting of the components

- ▶ Connect controllers, filters, and chokes to the earthed mounting plate with a surface as large as possible.

Optimum cable routing

- ▶ The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it crosses mains cables and control cables at right angles.
- ▶ Always install cables close to the mounting plate (reference potential), as freely suspended cables act like aerials.
- ▶ Lead the cables to the terminals in a straight line (avoid tangles of cables).
- ▶ Use separated cable channels for motor cables and control cables. Do not mix up different cable types in one cable channel.
- ▶ Minimise coupling capacities and coupling inductances by avoiding unnecessary cable lengths and reserve loops.
- ▶ Short-circuit unused cores to the reference potential.
- ▶ Install the positive and negative wires for DC 24 V close to each other over the entire length to avoid loops.

Earth connections

- ▶ Connect all components (drive controllers, chokes, filters) to a central earthing point (PE rail).
- ▶ Set up a star-shape earthing system.
- ▶ Comply with the corresponding minimum cable cross-sections.

5.3.6 Wiring outside of the control cabinet

Notes for cable routing outside the control cabinet:

- The longer the cables the greater the space between the cables must be.
- If cables for different signal types are routed in parallel, the interferences can be minimized by means of a metal barrier or separated cable ducts.

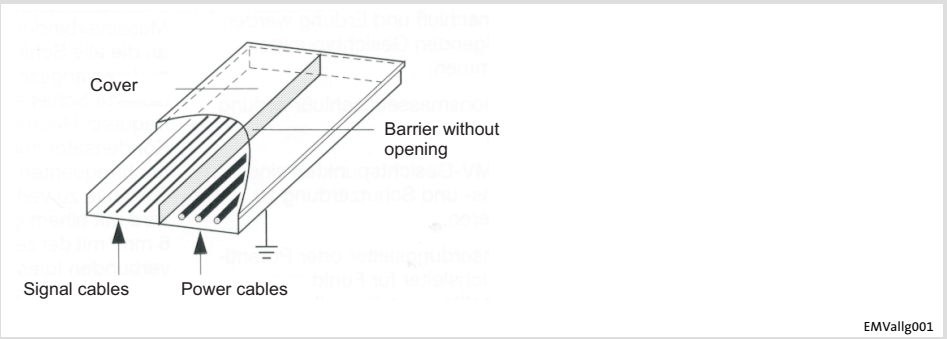


Fig. 5.3-3 Cable routing in the cable duct with barrier

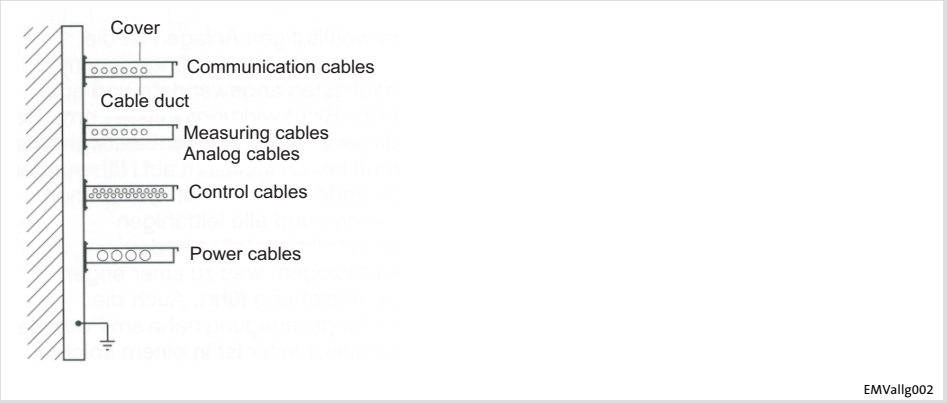


Fig. 5.3-4 Cable routing in separated cable ducts

5.3.7 Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	• Separate components from other component part with a minimum distance of 100 mm • Use motor choke/motor filter
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm
Conducted interference level is exceeded on the supply side	Terminal strips for the motor cable are directly located next to the mains terminals	Spatially separate the terminal strips for the motor cable from main terminals and other control terminals with a minimum distance of 100 mm
	Mounting plate varnished	Optimise PE connection: • Remove varnish • Use zinc-coated mounting plate
	HF short circuit	Check cable routing

5.4 Standard devices in the power range 0.37 ... 11 kW

5.4.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

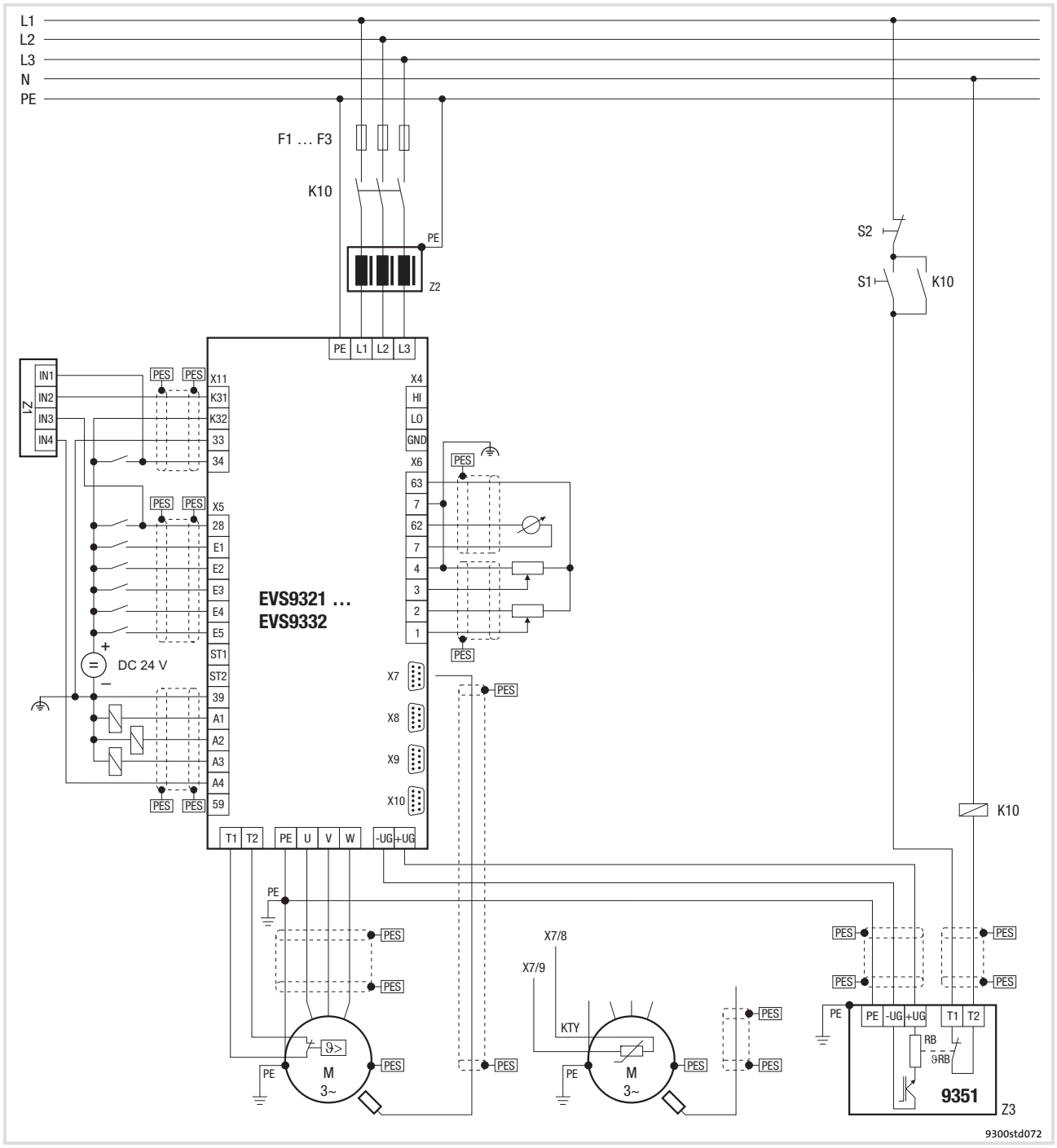


Fig. 5.4-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.4.2 Important notes

To gain access to the power connections, remove the covers:

- ► Release the cover for the mains connection with slight pressure on the front and pull it off to the top.
- ► Release the cover for the motor connection with slight pressure on the front and pull it off to the bottom.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield connection support	Support of the shield sheets for the supply cable and motor cable	2
Hexagon nut M5	Fastening of shield connection supports	4
Spring washer ∅ 5 mm (DIN 127)		2
Serrated lock washer ∅ 5.3 mm (DIN 125)		2
Shield sheet	Shield connections for supply cables, motor cable	2
Screw and washer assembly M4 × 10 mm (DIN 6900)	Fastening of shield sheets	4

5.4.3 Mains connection, DC supply

Note!

- ► If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- ► For DC-bus operation or DC supply, we recommend using shielded DC cables.

Shield sheet installation

Stop!

- ► To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- ► Do not use lugs as strain relief.

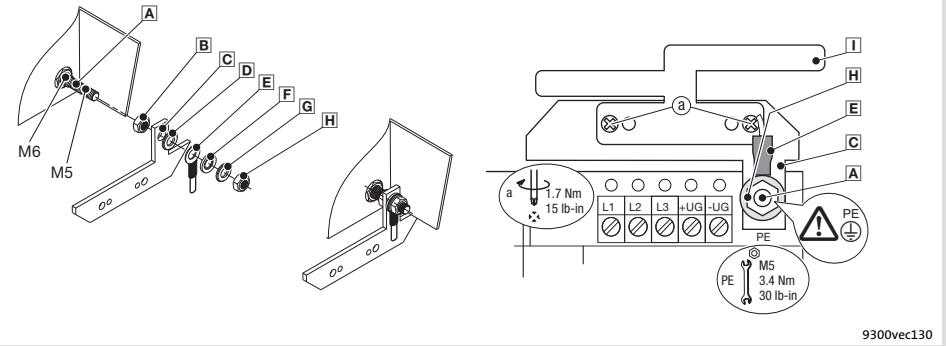


Fig. 5.4-2 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Mains connection, DC supply

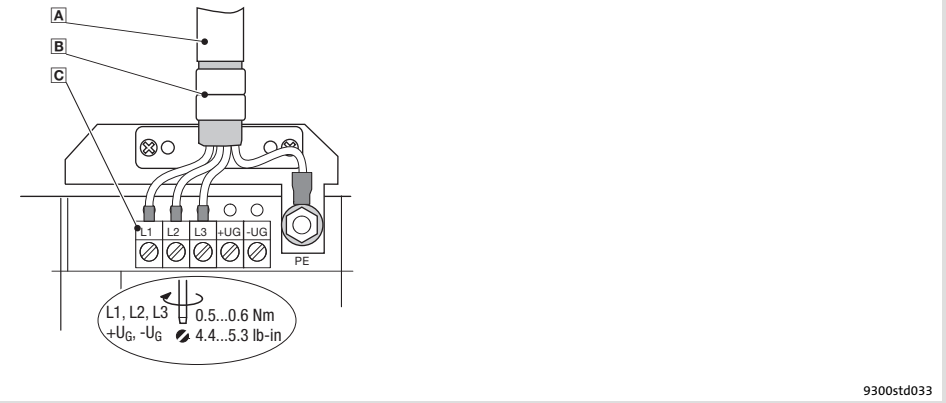


Fig. 5.4-3 Mains connection, DC supply for drive controllers 0.37 ... 11 kW

- A Mains cable
- B Shield sheet
  Securely clamp mains cable with the lugs
- C Mains and DC bus connection
  L1, L2, L3: Connection of mains cable
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)
  Cable cross-sections up to 4 mm^2: Use wire end ferrules for flexible cables
  Cable cross-sections > 4 mm^2: Use pin-end connectors

5.4.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9321-xS	6	C6, B6 [2]	1	1	300
EVS9322-xS	6	C6, B6 [2]	1	1	
EVS9323-xS	10	B10	1.5	1	
EVS9325-xS	25	B20	4	2.5	
Operation with mains choke/mains filter					
EVS9321-xS	6	C6, B6 [2]	1	1	300
EVS9322-xS	6	C6, B6 [2]	1	1	
EVS9323-xS	10	B10	1.5	1	
EVS9324-xS	10	B10	1.5	1	
EVS9325-xS	20	B16	2.5	2.5	
EVS9326-xS	32	B25	–	4	

1) Universal current-sensitive earth-leakage circuit breaker
2) For short-time mains interruptions, use circuit breakers with tripping characteristic "C"

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only in accordance with UL 248 ● System short-circuit current up to 5000 A_{rms} : All classes are permissible ● System short-circuit current up to 50000 A_{rms} : Only classes "CC", "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation without mains choke/mains filter		
EVS9321-xS	6	18
EVS9322-xS	6	18
EVS9323-xS	10	16
EVS9325-xS	25	10
Operation with mains choke/mains filter		
EVS9321-xS	6	18
EVS9322-xS	6	18
EVS9323-xS	10	16
EVS9324-xS	10	16
EVS9325-xS	25	10
EVS9326-xS	25	10

Max. connection cross-section of the terminal strip: AWG 12, with pin-end connector AWG 10

5.4.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xS	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xS	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xS	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xS	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xS	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xS	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50

5.4.6 Motor connection

Note!

- Fusing the motor cable is not required.
- The drive controller features 2 connections for motor temperature monitoring:
  - Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

- To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- Do not use lugs as strain relief.

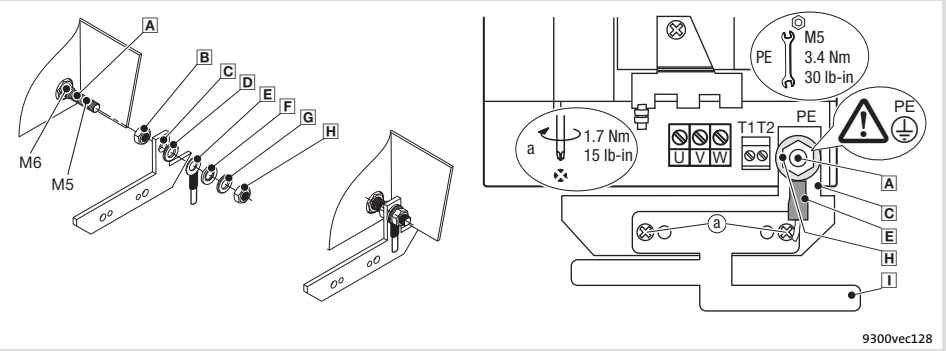


Fig. 5.4-4 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.

► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

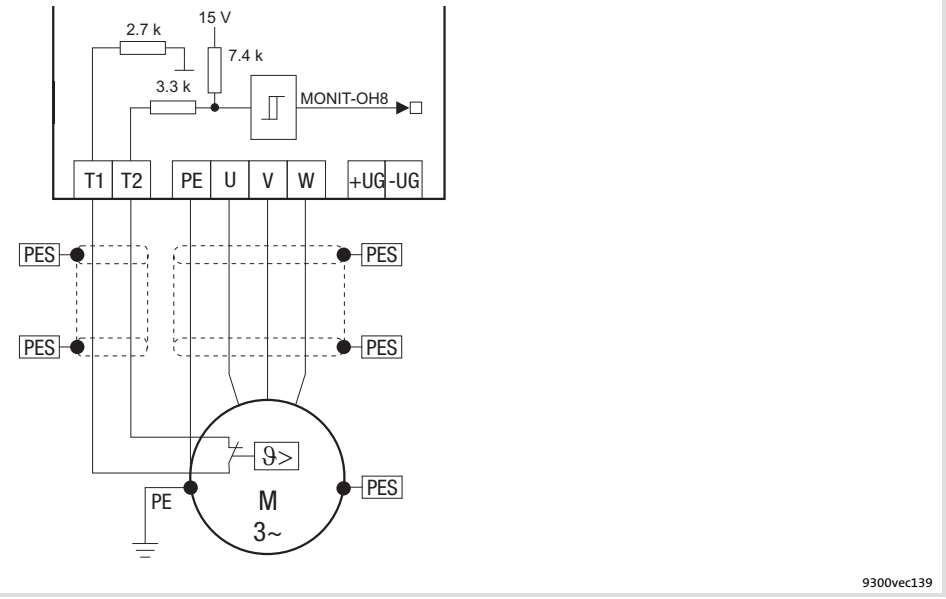


Fig. 5.4-5 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: $R\vartheta > 1600\ \Omega$ ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

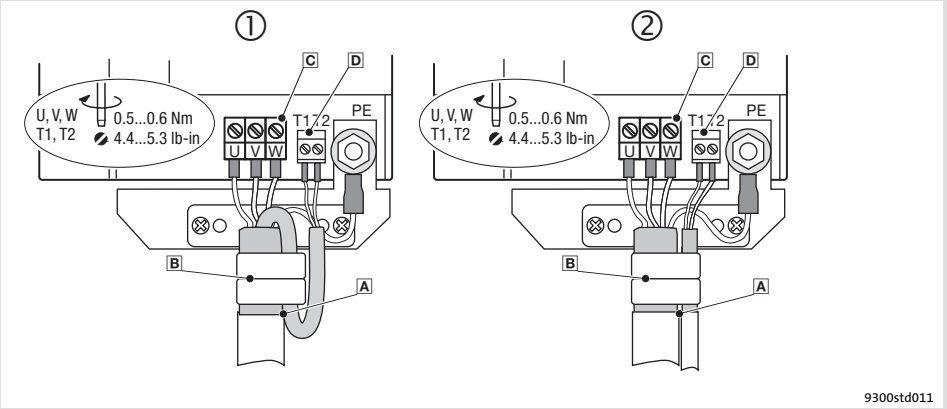


Fig. 5.4-6 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

D T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

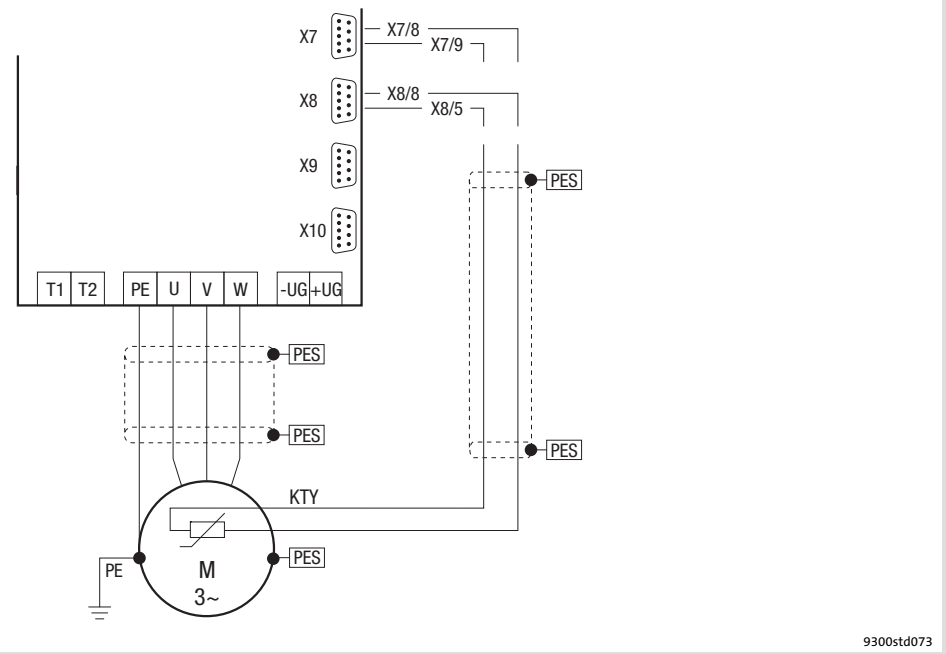


Fig. 5.4-7 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

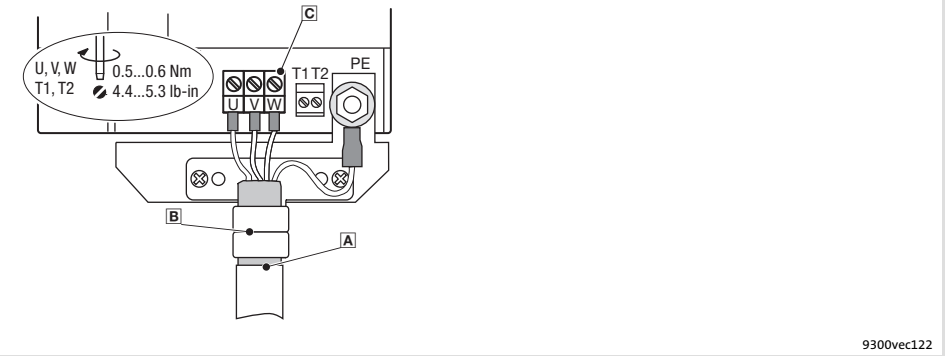


Fig. 5.4-8 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield sheet
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
  Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

5.5 Standard devices in the power range 15 ... 30 kW

5.5.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on "Electromagnetic Compatibility" if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter "Basics for wiring according to EMC"!

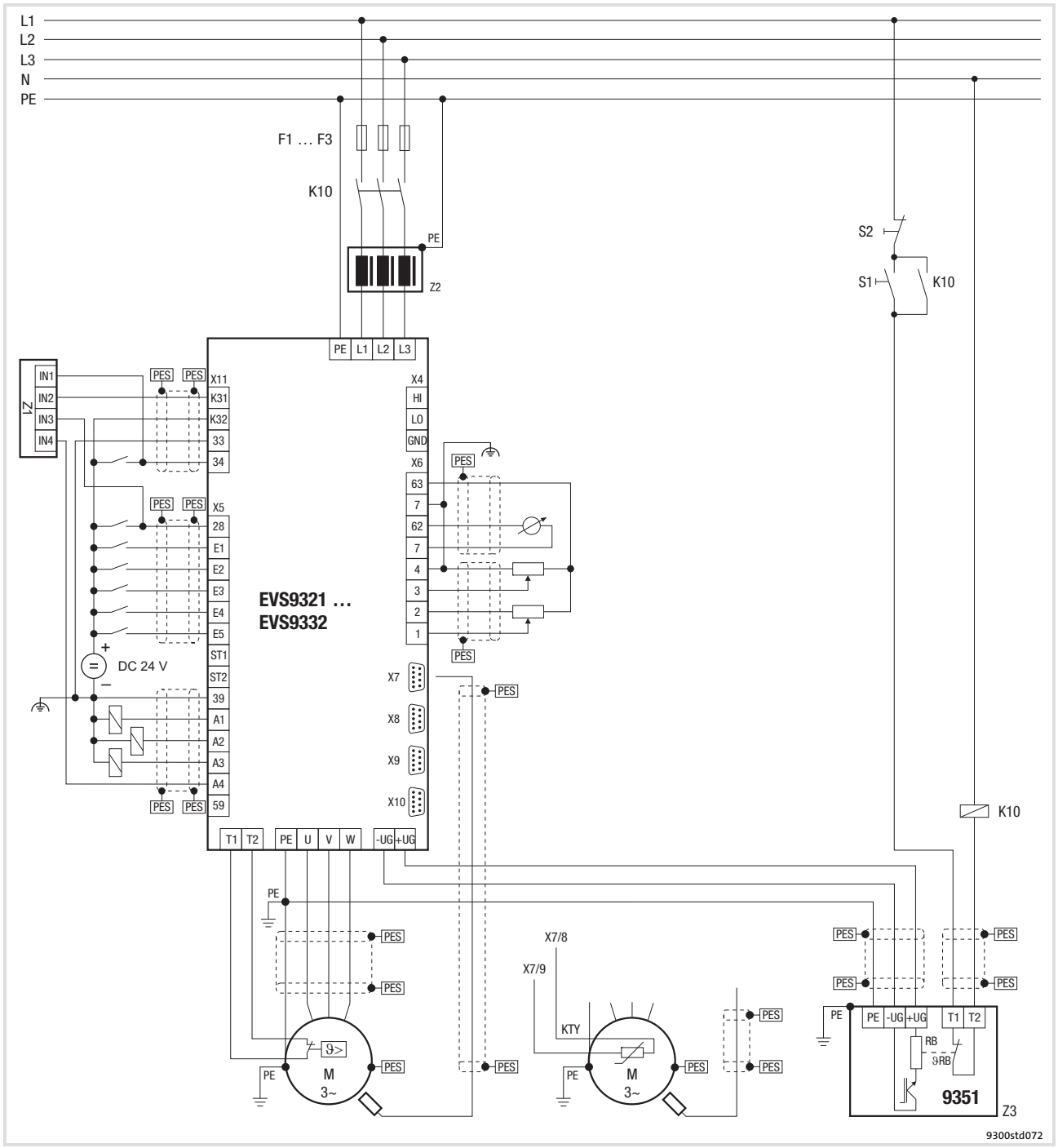


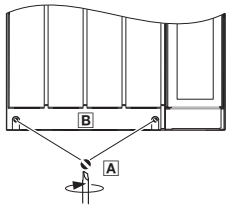
Fig. 5.5-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.5.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller



1. Remove the screws A
2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Hexagon nut M6 (DIN 934)	Connection of supply cables (mains, $+U_G$, $-U_G$) and motor cable to the stud bolts	10
Washer ∅ 6 mm (DIN 125)	For hexagon nut M6	10
Spring washer ∅ 6 mm (DIN 127)	For hexagon nut M6	10
Grommet	Motor cable	1
Shield connection support	Support of the shield sheet for motor cable	1
Self-tapping screw ∅ 4 × 14 mm	Fastening of shield connection support	2
Shield sheet	Shield connection for motor cable	1

5.5.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

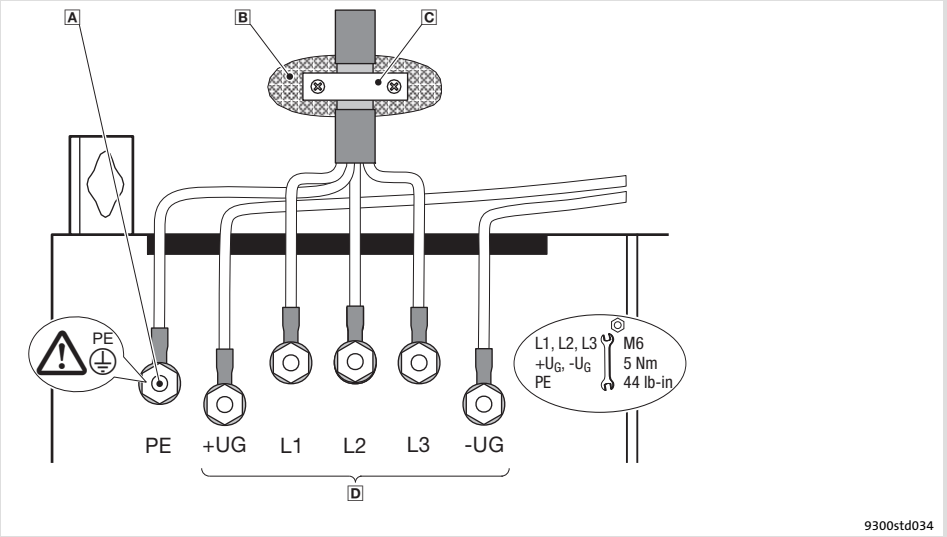


Fig. 5.5-2 Mains connection, DC supply for drive controllers 15 ... 30 kW

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.5.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9327-xS	63	–	16	16	300
Operation with mains choke/mains filter					
EVS9327-xS	40	–	10	10	300
EVS9328-xS	63	–	25	16	
EVS9329-xS	80	–	–	25	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 5000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9327-xS	35	8
EVS9328-xS	60	4
EVS9329-xS	80	4

5.5.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9327-xS	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 [1]	10
		E82ZN22334B230	50	EZN3B0110H030U [2]	50
		E82ZZ15334B230 [1]	50		
EVS9328-xS	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xS	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50

1) RFI filter
2) Footprint filter

5.5.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

Do not use lugs as strain relief.

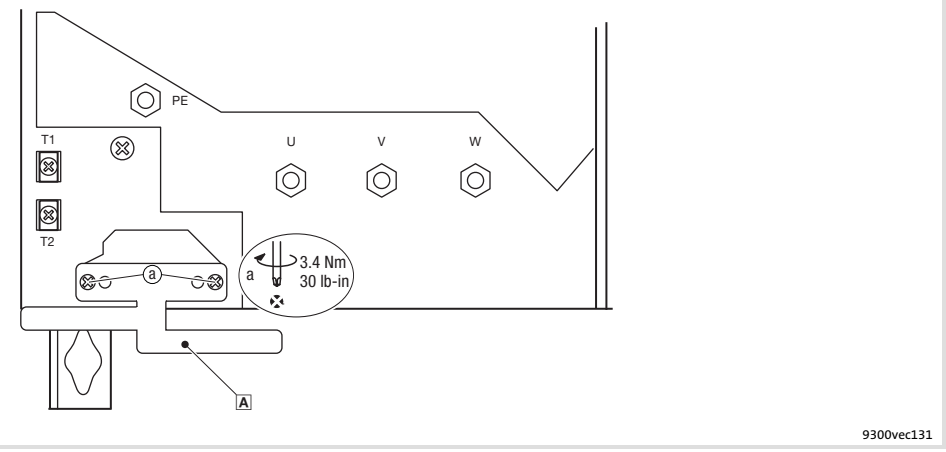


Fig. 5.5-3 Installation of shield sheet for drive controllers 15 ... 30 kW

A Fasten the shield sheet with two self-tapping screws ∅ 4 × 14 mm (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

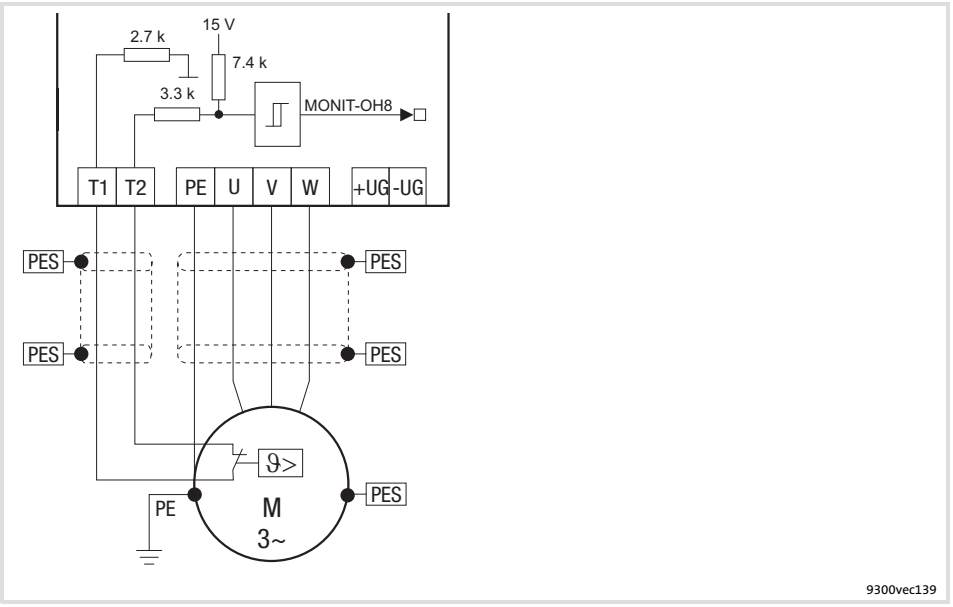


Fig. 5.5-4 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

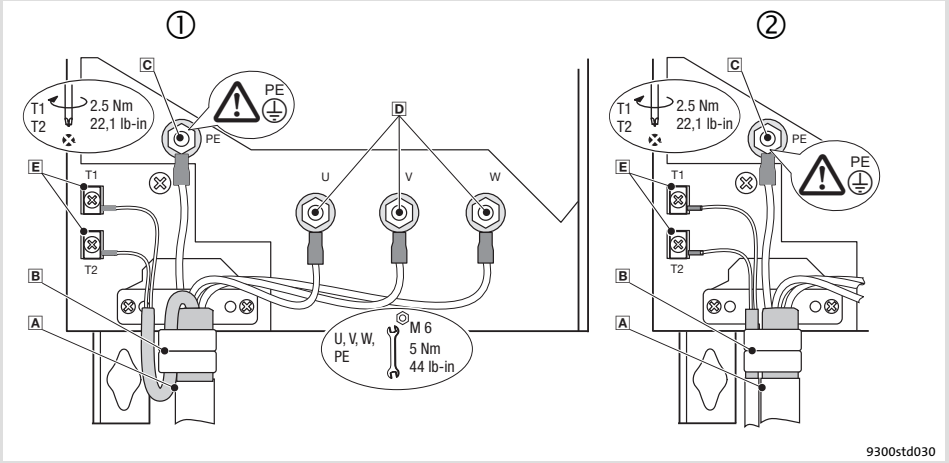


Fig. 5.5-5 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C PE stud
PE cable connection with ring cable lug

D U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable.
Max. connectable cable cross-section: 50 mm^2 with ring cable lug

E T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

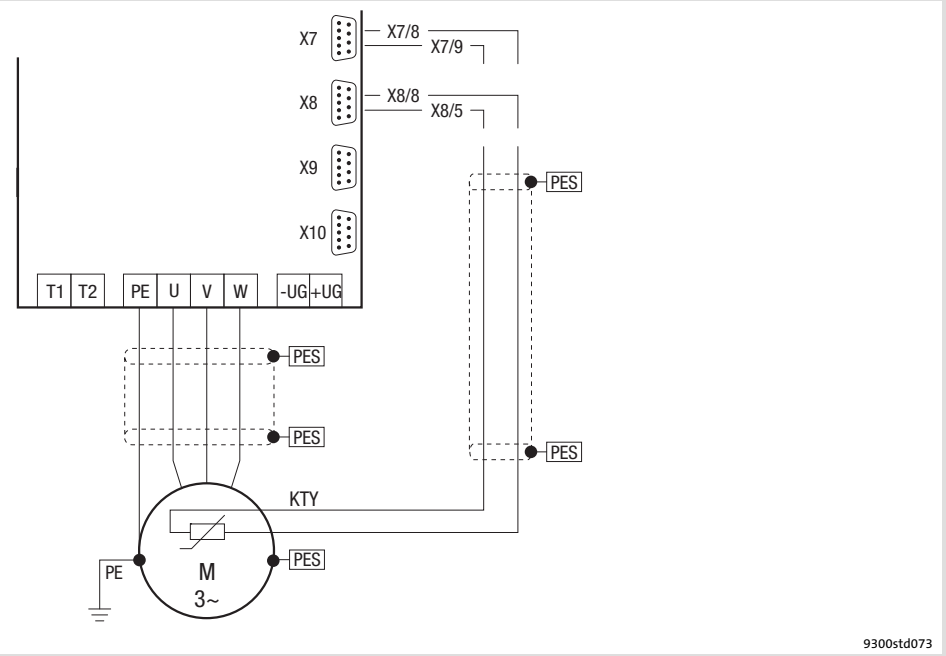


Fig. 5.5-6 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

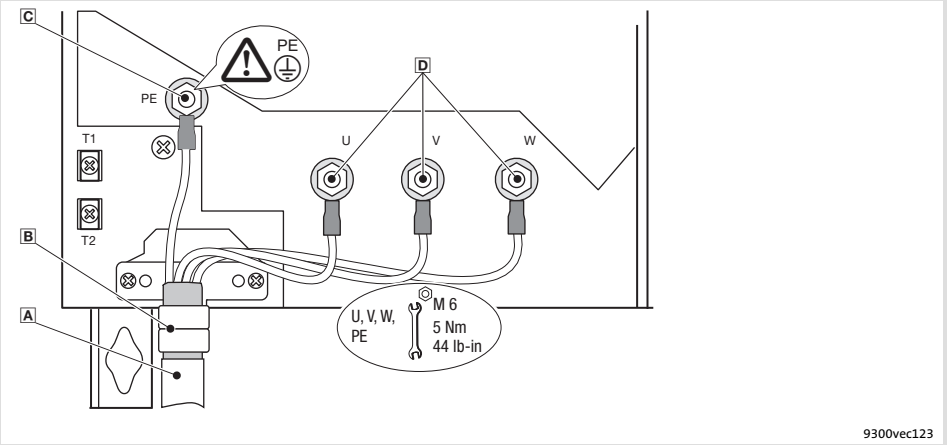


Fig. 5.5-7 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield connection
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C PE stud
  PE cable connection with ring cable lug
- D U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 50 mm^2 with ring cable lug

5.6 Standard devices with a power of 45 kW

5.6.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

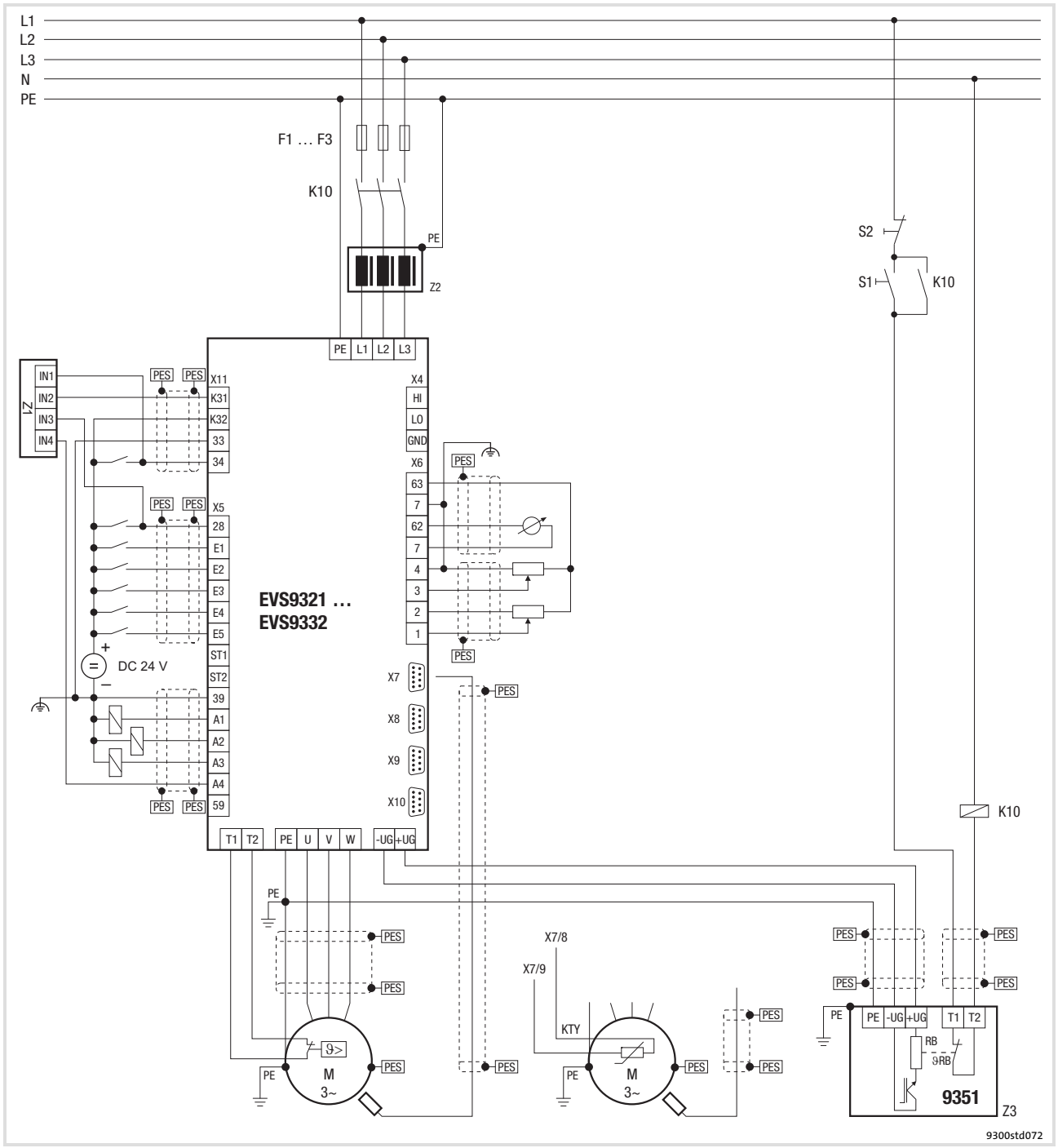
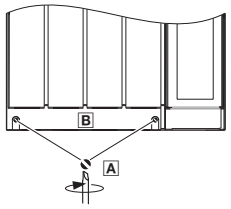


Fig. 5.6-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.6.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.6.3 Mains connection, DC supply

Note!

- ► If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- ► For DC-bus operation or DC supply, we recommend using shielded DC cables.

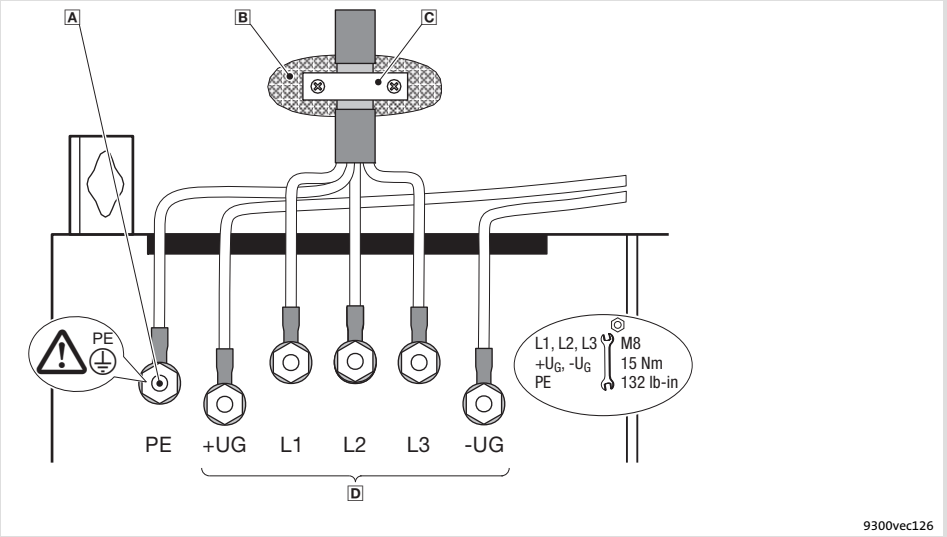


Fig. 5.6-2 Mains connection, DC supply for 45 kW controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.6.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9330-xS	100	–	–	35	300

[1] Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9330-xS	100	1

5.6.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9330-xS	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 [3)]	25		
		E82ZN55334B230	50		

[3)] For controllers with thermal separation

5.6.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

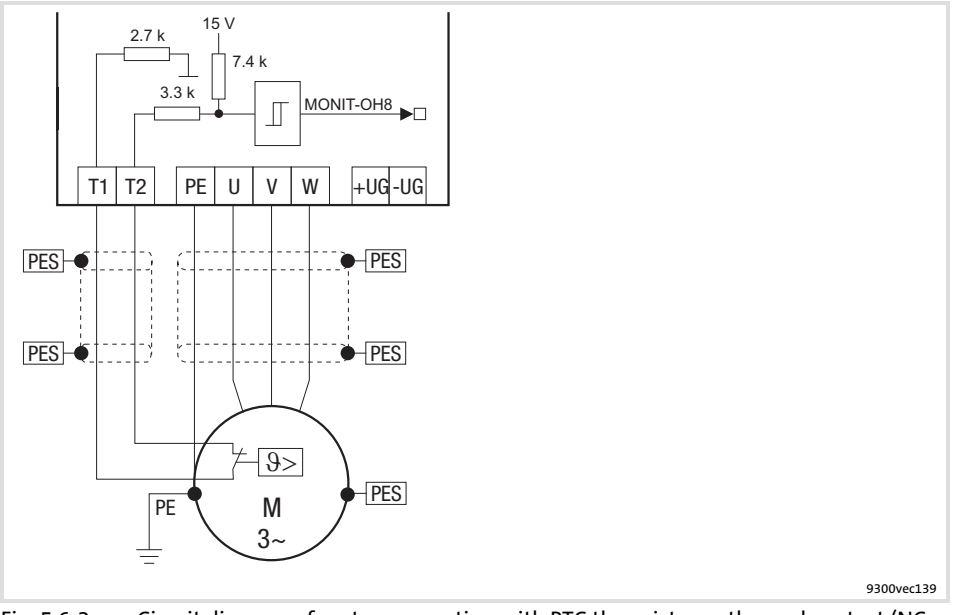


Fig. 5.6-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

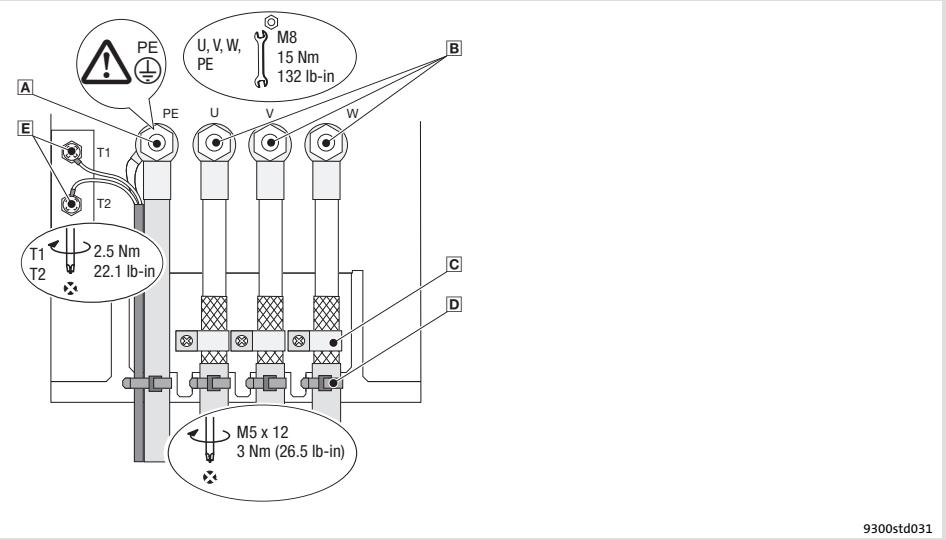


Fig. 5.6-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable
- E T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

► We recommend to use Lenze system cables for wiring.

► For self-made cables only use cables with shielded cores twisted in pairs.

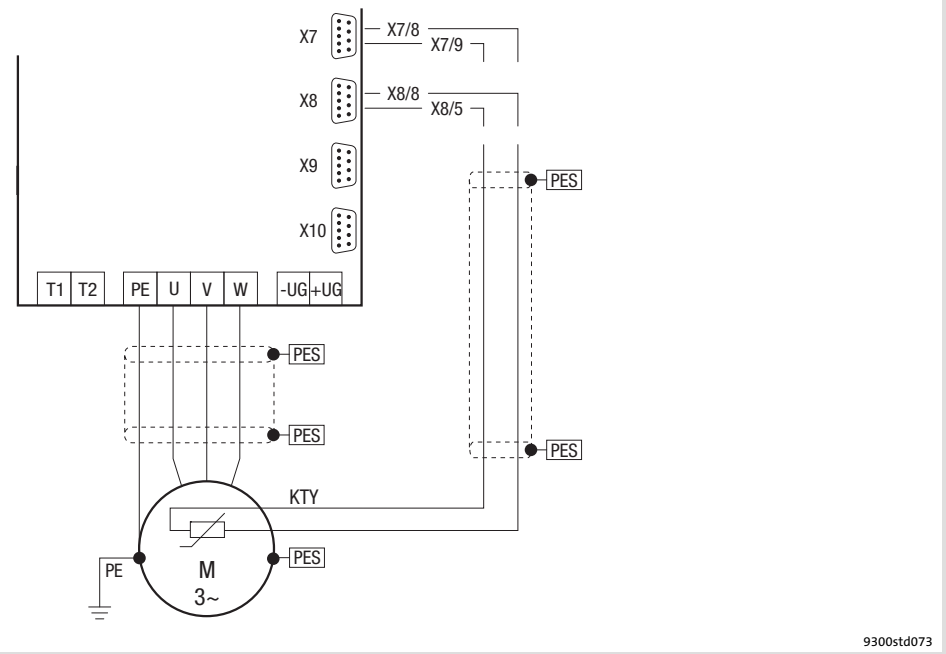


Fig. 5.6-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

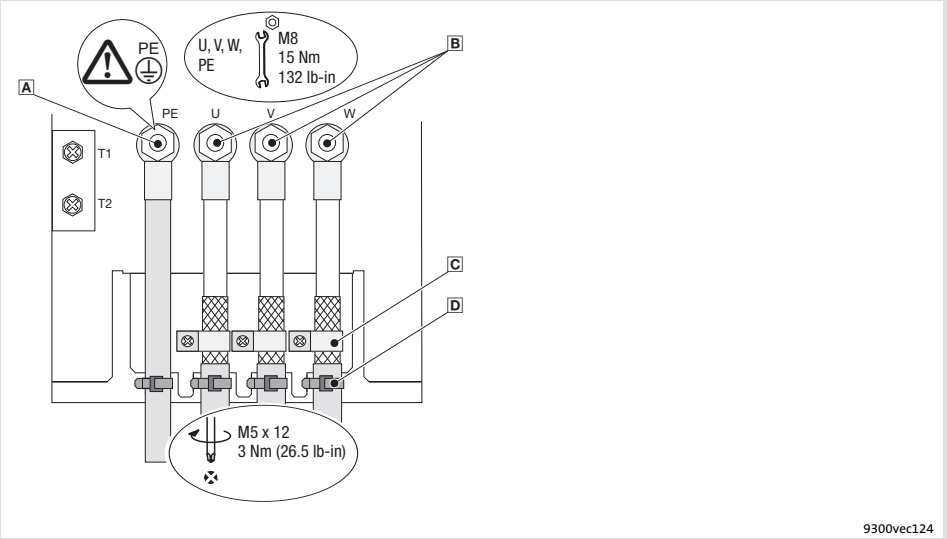


Fig. 5.6-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.7 Standard devices in the power range 55 ... 75 kW

5.7.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on "Electromagnetic Compatibility" if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter "Basics for wiring according to EMC"!

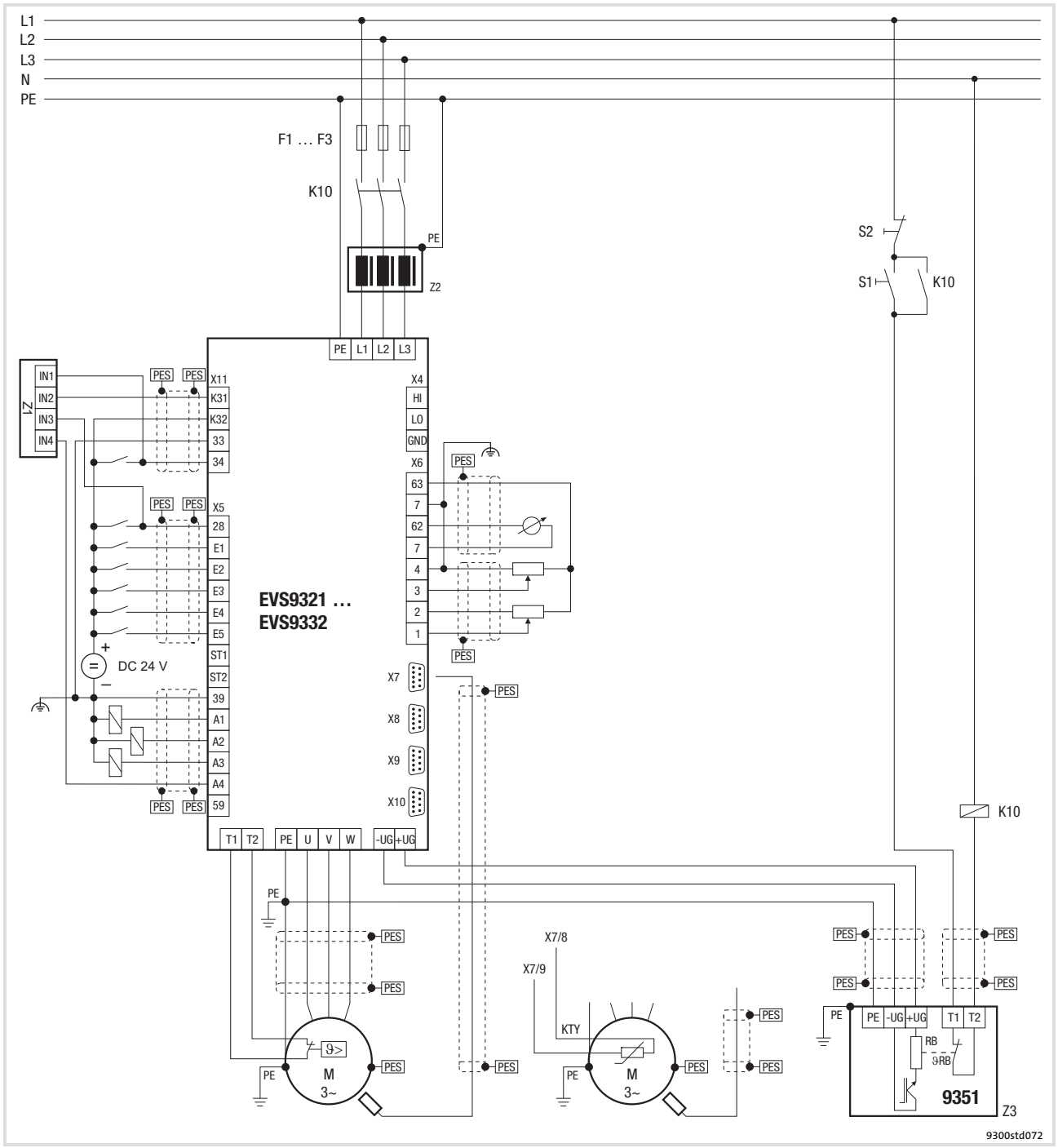
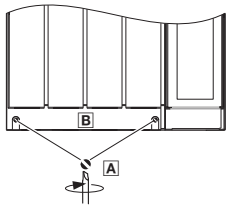


Fig. 5.7-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.7.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.7.3 Mains connection, DC supply

Note!

- ► If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- ► For DC-bus operation or DC supply, we recommend using shielded DC cables.

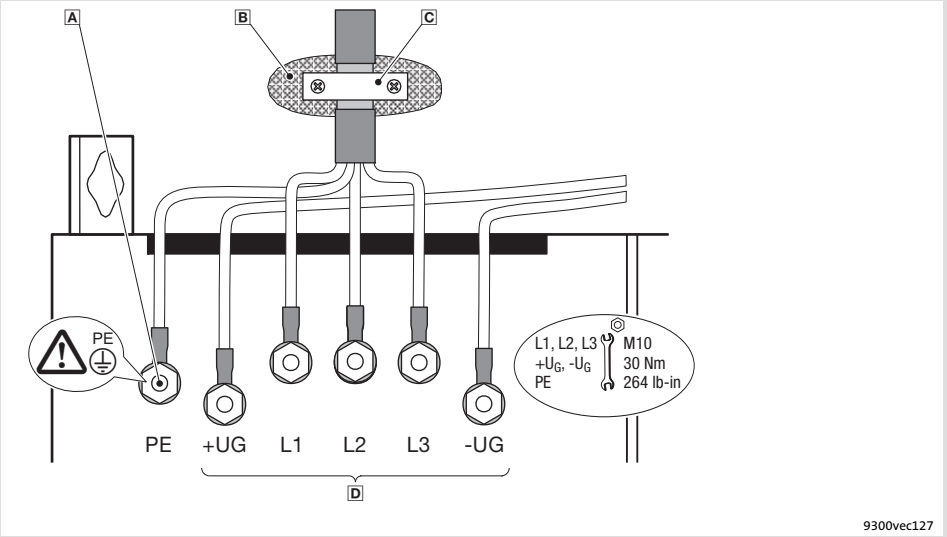


Fig. 5.7-2 Mains connection, DC supply for 55 ... 75 kW drive controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.7.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9331-xS	125	–	–	35	300
EVS9332-xS	160	–	–	70	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9331-xS	125	1/0
EVS9332-xS	175	2/0

5.7.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9331-xS	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xS	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

5.7.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

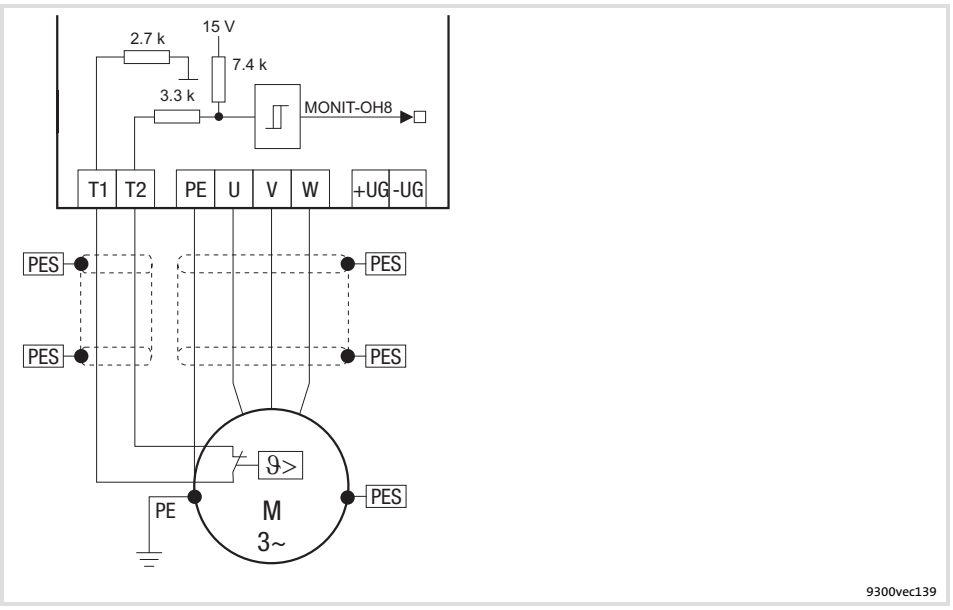


Fig. 5.7-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

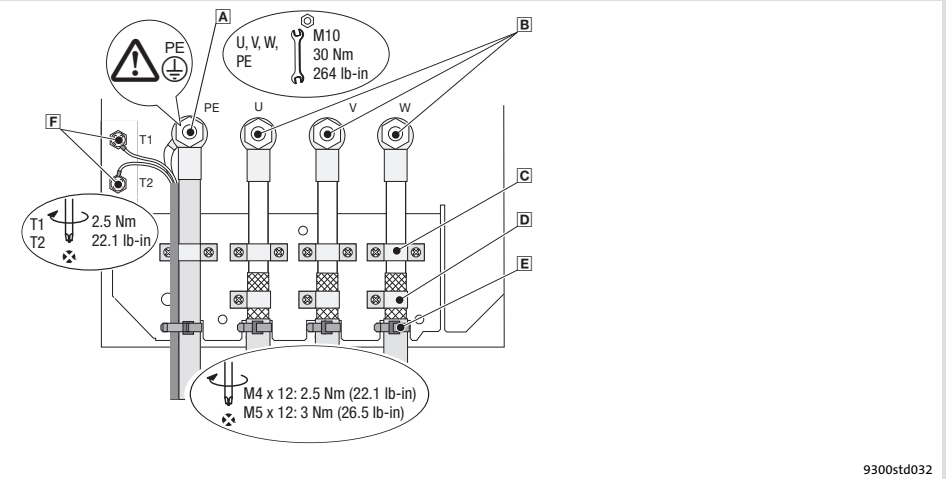


Fig. 5.7-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm² with ring cable lug
- C Cable clamps for strain relief of motor cable
  Fasten cable clamps with M4 × 12 mm screws
- D Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- E Cable ties for additional strain relief of motor cable
- F T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

► We recommend to use Lenze system cables for wiring.

► For self-made cables only use cables with shielded cores twisted in pairs.

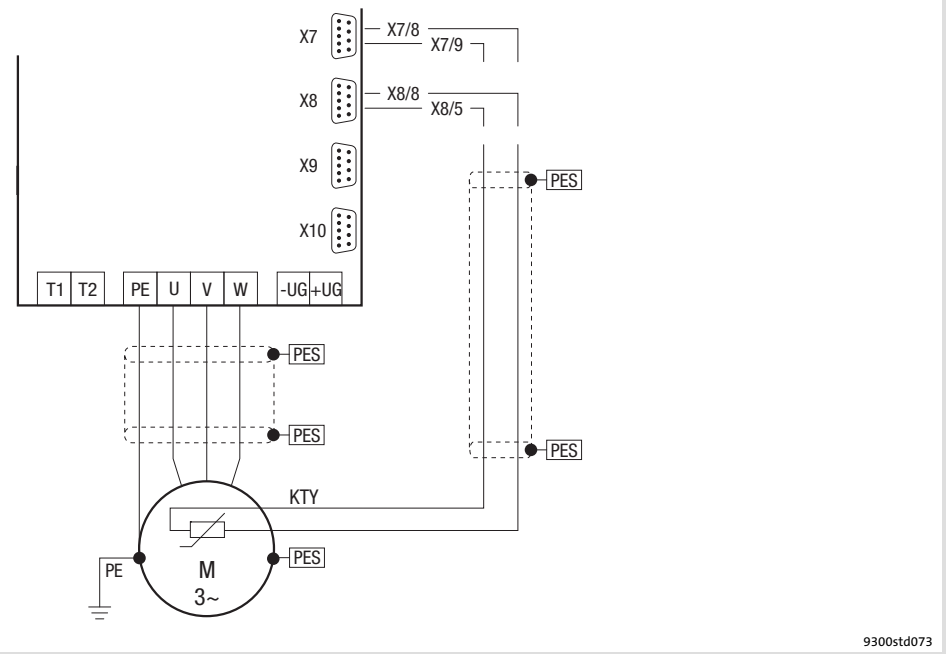


Fig. 5.7-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

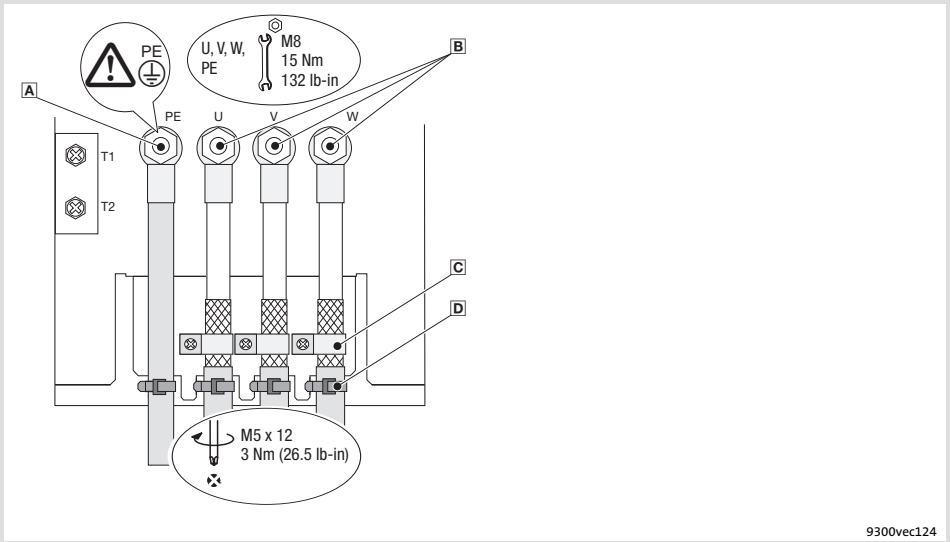


Fig. 5.7-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.8 Control terminals

5.8.1 Important notes

Stop!

The control card will be damaged if

- ► the voltage between X5/39 and PE or X6/7 and PE is greater than 50 V,
- ► the voltage between voltage source and X6/7 exceeds 10 V (common mode) in case of supply via external voltage source.

Limit the voltage before switching on the drive controller:

- ► Connect X5/39, X6/2, X6/4 and X6/7 directly to PE or
- ► use voltage-limiting components.

► For trouble-free operation, the control cables must be shielded:

- – Connect the shield of digital input and output cables at both ends.
- – Connect the shield of analog input and output cables at one end (at the drive controller).
- – For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield sheet	Shield connection for control cables	1
Screw M4 × 10 mm (DIN 7985)	Shield sheet fastening	1
Terminal strip, 4-pole (only for variants V004 and V024)	Connection of safety relay K_{SR} at X11	1
Terminal strip, 7-pole	Connection of digital inputs and outputs at X5	2
Terminal strip, 4-pole	Connection of analog inputs and outputs at X6	2

How to connect the shield

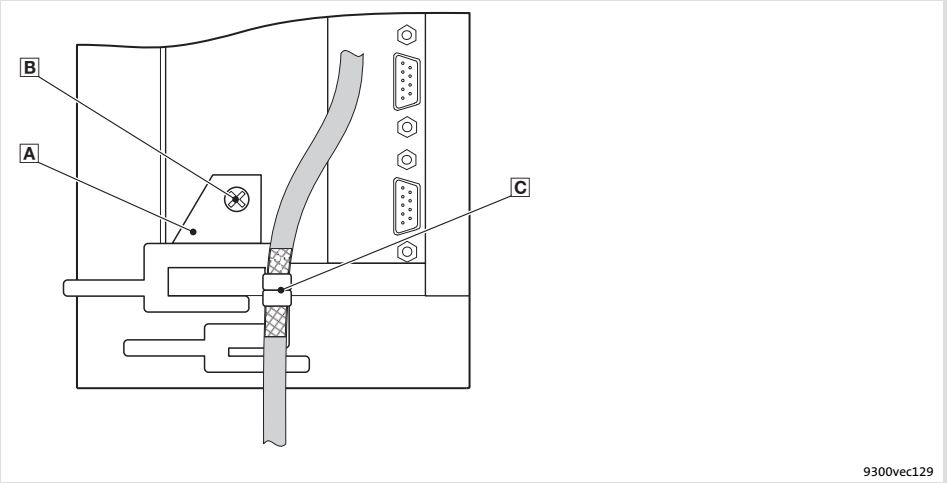


Fig. 5.8-1 Connection of cable shield to shield sheet

- A Shield sheet
- B Fasten shield sheet with M4 × 10 mm screw at the bottom of the control card
- C Securely clamp cable shield with lugs

Terminal data

Stop!

- ► Connect or disconnect the terminal strips only if the controller is disconnected from the mains!
- ► Wire the terminal strips before connecting them!
- ► Unused terminal strips must also be plugged on to protect the contacts.

Cable type		Wire end ferrule	Maximum cable cross-section	Tightening torque	Stripping length
	Rigid	–	2.5 mm² (AWG 14)	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	5 mm
	Flexible	Without wire end ferrule	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule without plastic sleeve	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule with plastic sleeve	2.5 mm² (AWG 14)		

5.8.2 Connection terminal of the control card

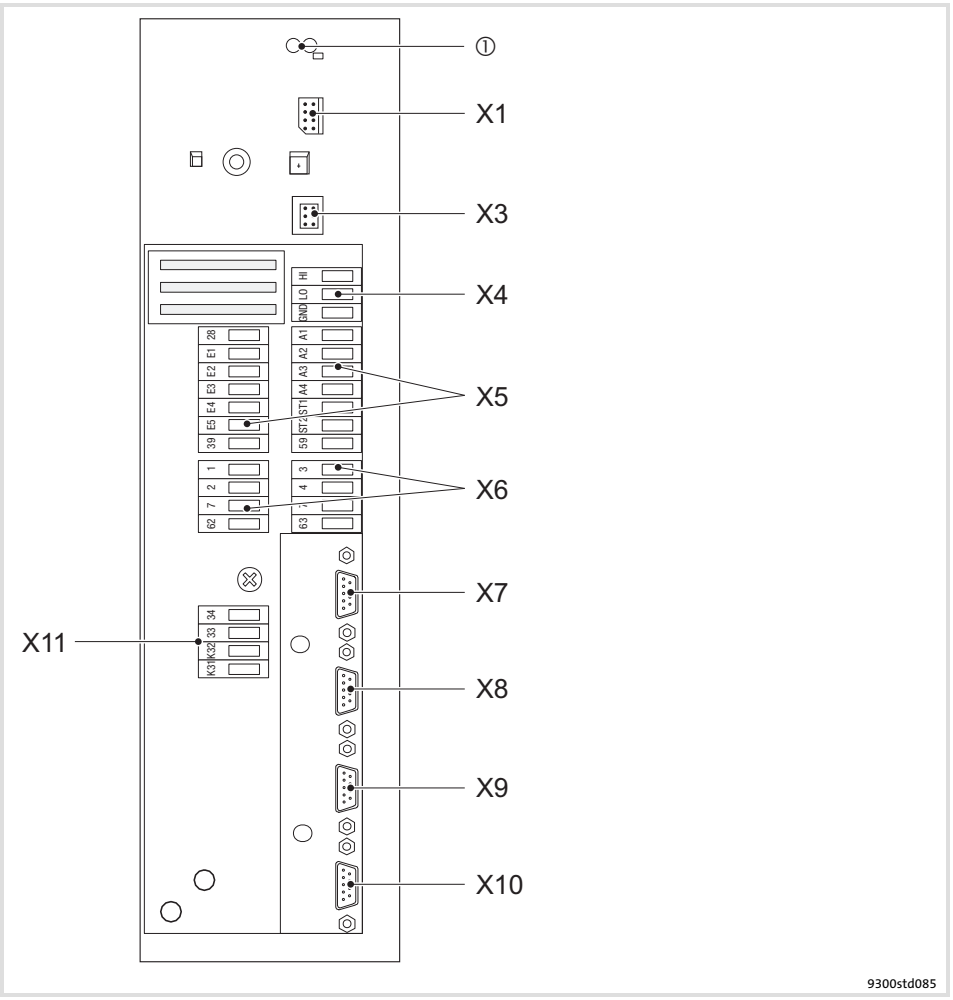


Fig. 5.8-2 Connection terminal of the control card

①	2 light-emitting diodes (red, green) for status display
X1	Automation interface (AIF) Slot for communication modules (e.g. keypad XT)
X3	Jumper for the preselection of the signal type for the input signal at X6/1, X6/2
X4	System bus (CAN) connection, terminal strip
X5	Connection of digital inputs and outputs, terminal strips
X6	Connection of analog inputs and outputs, terminal strips
X7	Resolver connection Plug-in connector: Socket, 9-pole, Sub-D
X8	Incremental encoder connection Plug-in connector: Pin, 9-pole, Sub-D
X9	Connection of digital frequency input signal Plug-in connector: Pin, 9-pole, Sub-D
X10	Connection of digital frequency output signal Plug-in connector: Socket, 9-pole, Sub-D
X11	Connection of safety relay K_{SR}, terminal strip

5.8.3 Device variant without ”Safe torque off” function

Internal voltage supply

- For the supply of the digital inputs (X5/E1 ... X5/E5) you have to set a freely assignable digital output (e. g. X5/A1) permanently to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

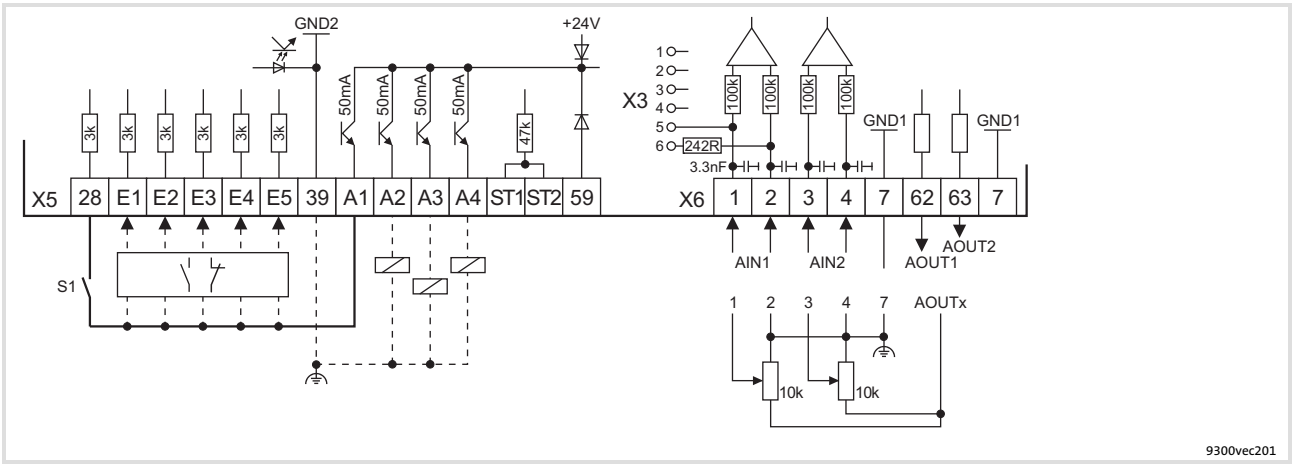


Fig. 5.8-3 Wiring of digital and analog inputs/outputs for internal voltage source

S1 Controller enable
NO contact or NC contact
Z Load
—— Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Supply via external voltage source

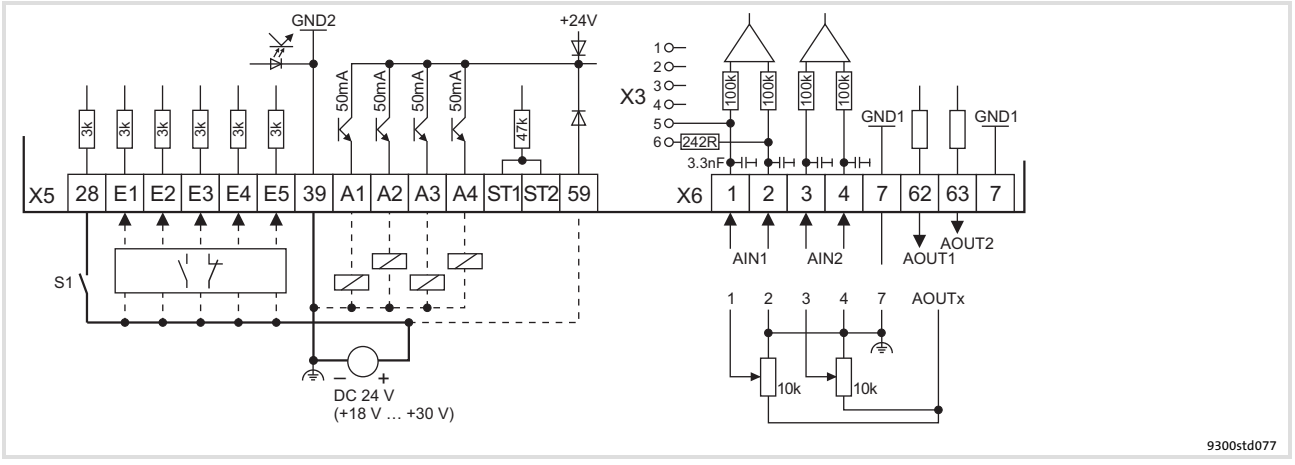


Fig. 5.8-4 Wiring of digital and analog inputs/outputs for external voltage source

S1 Controller enable
NO contact or NC contact
Z Load
—— Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

5.8.4 Device variant with ”Safe torque off” function

Safety instructions for the installation of the ”Safe torque off” function

- The installation and commissioning of the “Safe torque off” function must be carried out by skilled personnel only.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, for instance by a cable duct. Short circuits between the single cables must be ruled out!
- Wiring of the safety relay K_{SR} with insulated wire end ferrules or rigid cables is absolutely vital.
- The electrical reference point for the coil of the safety relay K_{SR} must be connected with the protective conductor system (DIN EN 60204-1 paragraph 9.4.3). Only this measure guarantees that the operation is protected against earth faults.

Tip!

A complete description can be found in the chapter ”Safe torque off”.

Internal voltage supply

- If a freely assignable digital output (e. g. X5/A1) is fixedly applied to HIGH level, it serves as an internal voltage source. An output can be loaded with a maximum of 50 mA.
  - Via a digital output you can supply the relay K_{SR} and two digital inputs (X5/28, and for instance X5/E1) with voltage.
  - For the maximum connection (relay K_{SR} and X5/E1 ... X5/E5) you have to connect two digital outputs in parallel and fixedly apply them to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

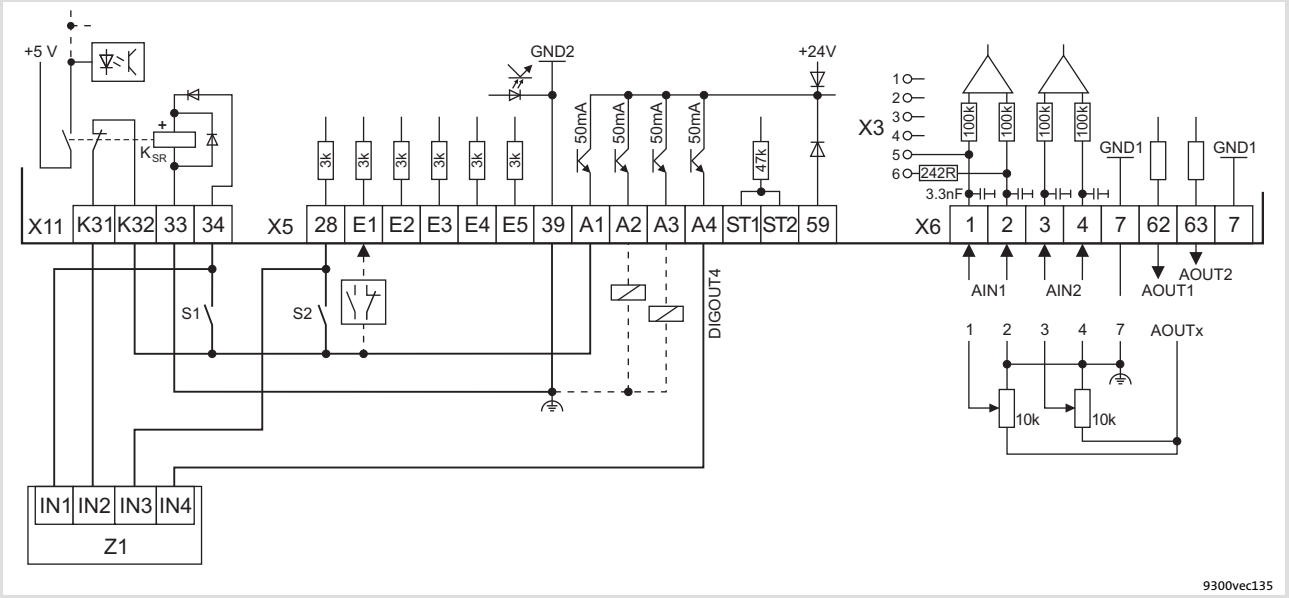


Fig. 5.8-5 Wiring of digital and analog inputs/outputs with active ”Safe torque off” function and internal voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the ”Safe torque off” function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

If you load a basic configuration C0005 = xx1x (e.g. 1010 for speed control with control via terminals), the following terminals are switched to a fixed signal level:

- Terminal X5/A1 to FIXED1 (corresponds to DC 24 V).
- Terminal X6/63 to FIXED100% (corresponds to 10 V).

Supply via external voltage source

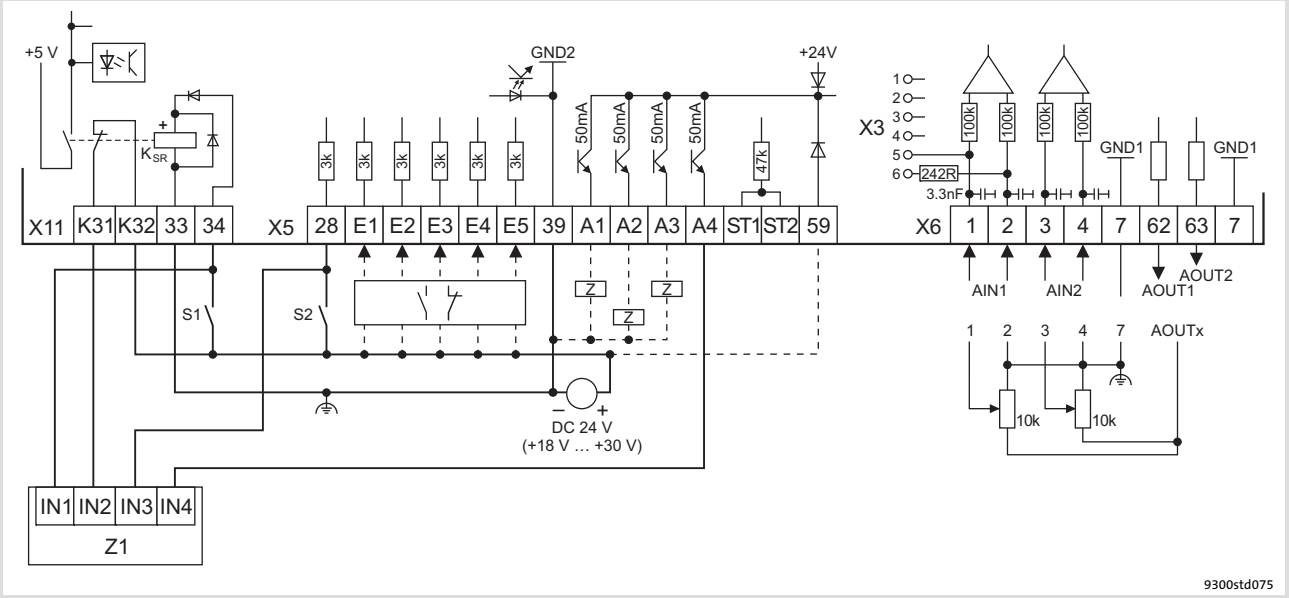


Fig. 5.8-6 Wiring of digital and analog inputs/outputs with active "Safe torque off" function and external voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the "Safe torque off" function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

Supplying the digital inputs via an external voltage source enables a **backup operation in the case of mains failure**. After switching off the mains voltage, all actual values are continued to be detected and processed.

- ► Connect the positive pole of the external voltage source with X5/59 to establish the backup operation in the event of mains failure.
- ► The external voltage source must be able to supply a current ≥ 1 A.
- ► The starting current of the external voltage source is not limited by the controller. Lenze recommends the use of voltage sources with current limitation or with an internal impedance of Z > 1 Ω.

5.8.5 State bus

Stop!

Destruction of the control card!

External voltage at X5/ST1, X5/ST2 destroys the control card.

Protective measure:

Do not connect an external voltage to X5/ST1, X5/ST2.

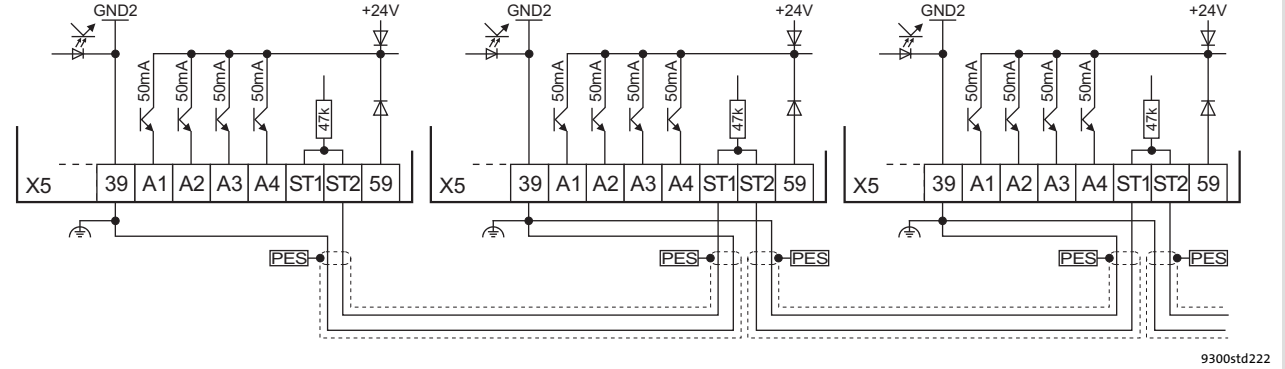


Fig. 5.8-7 Example for wiring a drive system to the STATE BUS

PES HF shield termination by large-surface connection to PE

5.8.6 Terminal assignment

Analog input configuration

Terminal	Jumper strip X3	Jumper setting	Possible levels
X6/1, X6/2		1-2 [1)]	-10 V ... +10 V [1)]
		3-4	-10 V ... +10 V
		5-6	-20 mA ... +20 mA

1) Lenze setting (delivery state)

Non-configurable control terminals

Terminal	Description	Function	Level / state
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Pulse inhibit feedback	Open contact: pulse inhibit is inactive (operation) Closed contact: pulse inhibit is active
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled
X5/ST1 X5/ST2		STATE-BUS	

Configurable control terminals (Lenze setting)

Terminal	Description	Function	Level
X5/E1	Digital inputs	Deactivate quick stop/ CW rotation	HIGH
X5/E2		Deactivate quick stop/ CCW rotation	HIGH
X5/E3		Activate fixed frequency 1	HIGH
X5/E4		Set error message (TRIP set)	LOW
X5/E5		Reset error message (TRIP reset)	LOW-HIGH edge
X5/A1	Digital outputs	Error message available	LOW
X5/A2		Switching threshold Q_{MIN}: actual speed < setpoint speed in C0017	LOW
X5/A3		Ready for operation (DCTRL-RDY)	HIGH
X5/A4		Maximum current reached (DCTRL-IMAX)	HIGH
X6/1, X6/2	Analog inputs	Main speed setpoint	-10 V ... +10 V
X6/3, X6/4		Additional speed setpoint	-10 V ... +10 V
X6/62	Analog outputs	Actual speed value	-10 V ... +10 V
X6/63		Torque setpoint	-10 V ... +10 V

5.8.7 Technical data

Safety relay K_{SR}

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

Digital inputs, digital outputs

Terminal	Description	Field	Values
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
X5/E1 X5/E2 X5/E3 X5/E4 X5/E5	Digital inputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Input current per input	8 mA for +24 V
		Cycle time	1 ms
X5/A1 X5/A2 X5/A3 X5/A4	Digital outputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Load capacity per output	Maximally 50 mA
		Load resistance	For +24 V at least 480 Ω
		Cycle time	1 ms
X5/39	GND2	Reference potential for digital signals Isolated to X6/7 (GND1)	
X5/59	Connection of external voltage source for backup operation of the drive controller in the case of mains failure	Input voltage	DC 24 V (+18 ... +30 V)
		Current consumption	Maximally 1 A for 24 V
X5/ST1 X5/ST2	STATE-BUS	Maximum number of nodes	20
		Maximum length of the bus cable	5 m

Analog inputs, analog outputs

Terminal	Description	Field	Values
X6/1 X6/2	Analog input 1	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
		Current range	
		Level	-20 mA ... +20 mA
		Resolution	20 µA (10 Bit + sign)
X6/3 X6/4	Analog input 2	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
X6/62	Analog output 1	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/63	Analog output 2	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/7	GND1	Reference potential for analog signals Isolated to X5/39 (GND2)	

5.9 Wiring of the system bus (CAN)

Wiring

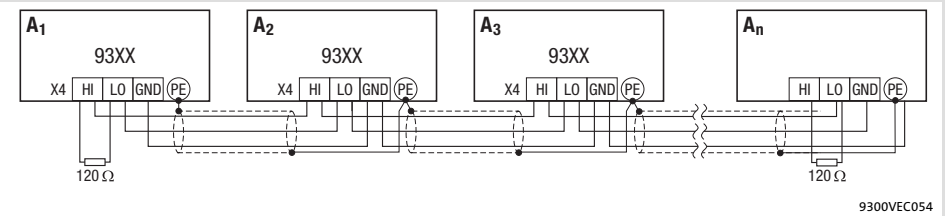


Fig. 5.9-1 System bus (CAN) wiring

A_1	Bus device 1 (controller)
A_2	Bus device 2 (controller)
A_3	Bus device 3 (controller)
A_n	Bus device n (e. g. PLC), n = max. 63
X4/GND	CAN-GND: System bus reference potential
X4/LO	CAN-LOW: System bus LOW (data line)
X4/HI	CAN-HIGH: System bus HIGH (data line)

Stop!

Connect a 120 Ω terminating resistor to the first and last bus device.

We recommend the use of CAN cables in accordance with ISO 11898-2:

CAN cable in accordance with ISO 11898-2	
Cable type	Paired with shielding
Impedance	120 Ω (95 ... 140 Ω)
Cable resistance/cross-section	
Cable length ≤ 300 m	≤ 70 mΩ/m / 0.25 ... 0.34 mm² (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm² (AWG20)
Signal propagation delay	≤ 5 ns/m

5.10 Wiring of the feedback system

5.10.1 Important notes

The feedback signal can either be supplied via input X7 or via input X8.

► At X7 a resolver can be connected.

► At X8 an encoder can be connected.
  – Incremental encoder TTL
  – SinCos encoder
  – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

► We recommend to use Lenze system cables for wiring.

► For self-made cables only use cables with shielded cores twisted in pairs.

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

5.10.2 Resolver at X7

Technical data

Field	Values
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Resolver type recommended	Receiver
Number of pole pairs of the resolver	1
Transmission ratio	0.3
Evaluation method	Voltage impression in the sine and cosine winding
Max. output voltage	± 10 V
Max. current consumption	50 mA per winding
Max. impedance [Z]	500 Ω per winding
Output frequency	4 kHz
Monitoring	Monitoring for open circuit of the resolver and the resolver cable (configurable)

Wiring

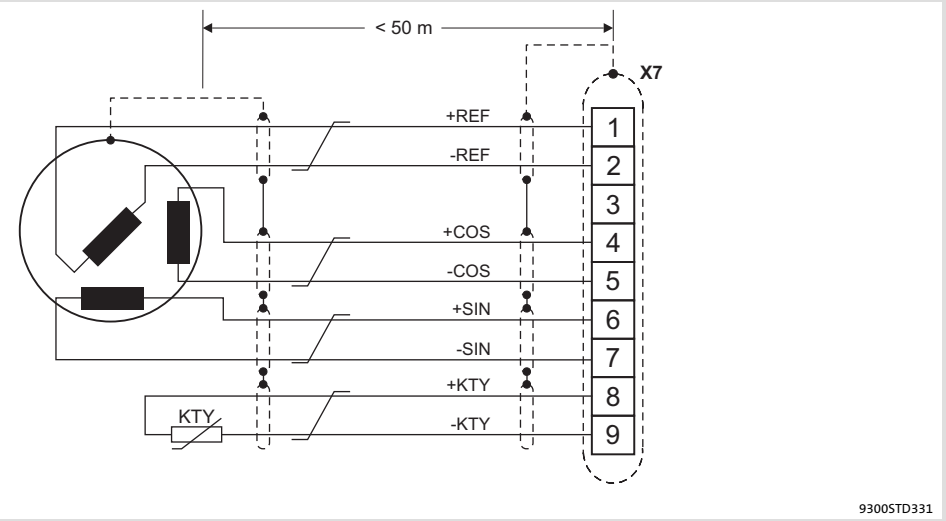


Fig. 5.10-1 Resolver connection

Cores twisted in pairs

X7 - Resolver Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	+REF	-REF	GND	+COS	-COS	+SIN	-SIN	+KTY	-KTY
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.10.3 Incremental encoder with TTL level at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable incremental encoder	Incremental encoder with TTL level ● Encoder with two 5 V complementary signals electrically offset by 90° ● Connection of zero track is possible (optional)
Input frequency	0 ... 500 kHz
Current consumption	6 mA per channel
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

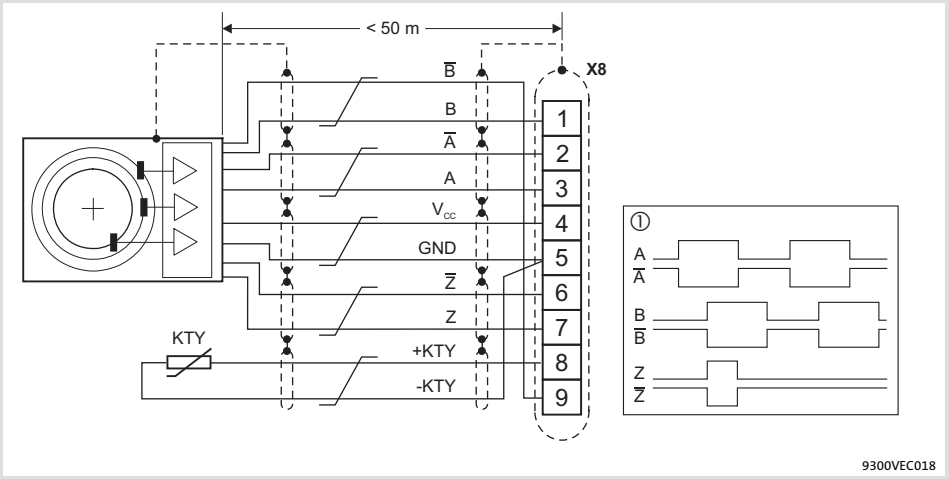


Fig. 5.10-2 Connection of incremental encoder with TTL level (RS-422)

① Signals for CW rotation
Cores twisted in pairs

X8 - Incremental encoder with TTL level Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (-KTY)	$\overline{Z}$	Z	+KTY	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.10.4 SinCos encoder at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable SinCos encoders	● SinCos encoders with a rated voltage from 5 V... 8 V. ● SinCos encoder of the company Stegmann with Hiperface® interface, Stegmann type SCS/SCM (prolongs the initialisation time of the controller to approx. 2 seconds)
Sine and cosine track voltage	1 V_{ss} ±0.2 V
Voltage RefSIN and RefCOS	+2.5 V
Internal resistance R_i	221 Ω
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

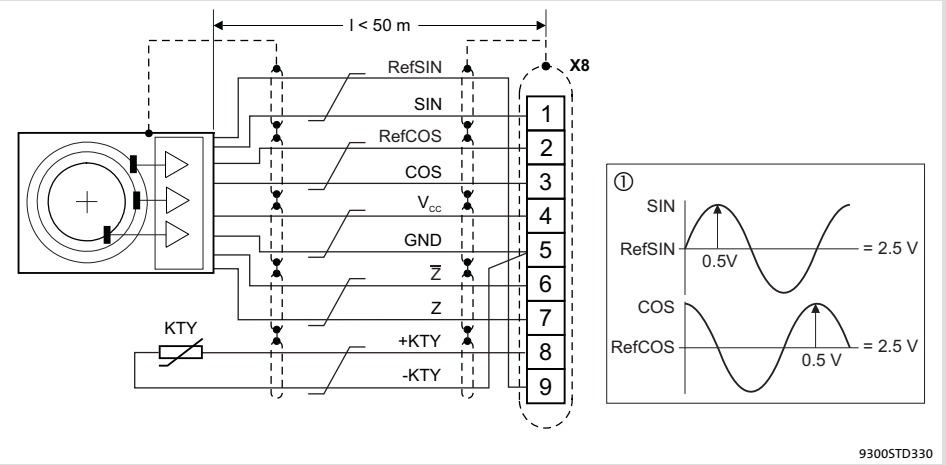


Fig. 5.10-3 SinCos encoder connection

① Signals for CW rotation
Cores twisted in pairs

X8 - SinCos encoder Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS	COS	V_{CC}	GND (-KTY)	$\overline{Z}$ or -RS485	Z or +RS485	+KTY	RefSIN
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

Note!

► For encoders with tracks SIN, $\overline{SIN}$, COS, $\overline{COS}$:
– Assign RefSIN with $\overline{SIN}$.
– Assign RefCOS with $\overline{COS}$.

5.11 Wiring of digital frequency input / digital frequency output

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

Technical data

Field	Digital frequency output X10
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Pin assignment	Dependent on the selected basic configuration
Output frequency	0 ... 500 kHz
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Load capacity	Max. 20 mA per channel (up to 3 slave drives can be connected)
Special features	The "Enable" output signal at X10/8 switches to LOW if the drive controller is not ready for operation (e.g. disconnected from mains). This can trip SD3 monitoring on the slave drive.
Internal voltage source (X10/4, X10/5)	DC 5 V / max. 50 mA Total current at X9/4, X9/5 and X10/4, X10/5: max. 200 mA

Field	Digital frequency input X9
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Input frequency	0 ... 500 kHz (TTL level)
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Signal evaluation	Via code C0427
Current consumption	Max. 5 mA
Special features	With activated SD3 monitoring, TRIP or warning is tripped if the "Lamp Control" input signal at X9/8 switches to LOW. Due to this the drive controller can respond if the master drive is not ready for operation.

Wiring

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

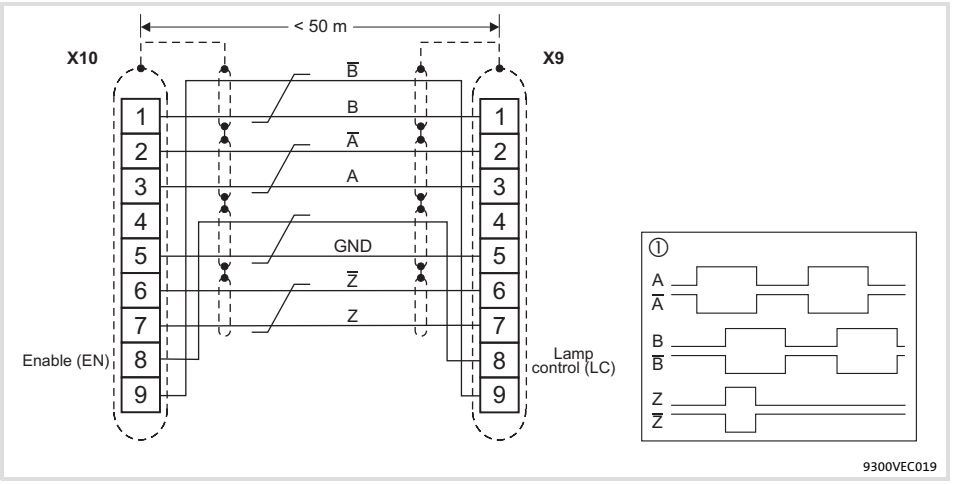


Fig. 5.11-1 Connection of digital frequency input (X9) / digital frequency output (X10)

X9 Slave drive
X10 Master drive
① Signals for CW rotation
Cores twisted in pairs

X9 - Digital frequency input Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	LC	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

X10 - Digital frequency output Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	EN	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

Adjustment

Evaluation of the input signals at X9		
Code	**Function**	
C0427 = 0	CW rotation	Track A leads track B by 90 ° (positive value at DFIN-OUT)
	CCW rotation	Track A lags track B by 90 ° (negative value at DFIN-OUT)
C0427 = 1	CW rotation	Track A transmits the speed Track B = LOW (positive value at DFIN-OUT)
	CCW rotation	Track A transmits the speed Track B = HIGH (negative value at DFIN-OUT)
C0427 = 2	CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT) Track B = LOW
	CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT) Track A = LOW

5.12 Communication modules

Communication manuals for the communication modules

Here you will find detailed information on how to wire and use the communication modules.

Possible communication modules

Communication module	Type/order number
Keypad XT	EMZ9371BC
LECOM-A/B (RS232/485)	EMF2102IBV001
LECOM-B (RS485)	EMF2102IBV002
LECOM-LI (optical fibre)	EMF2102IBV003
LON	EMF2141IB
INTERBUS	EMF2113IB
INTERBUS Loop	EMF2112IB
PROFIBUS-DP	EMF2133IB
DeviceNet/CANopen	EMF2175IB

Handling

Plug the communication module onto the AIF interface (X1) or pull it off from the interface. The communication module can also be connected/disconnected during operation.

6 Commissioning

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6.1 Important notes

Active loads

Stop!

For applications with active loads (e.g. hoists), you must set C0172 = 0 (OV reduce: threshold for activation of brake torque reduction before OV message) so that an overvoltage message (OV) can be generated.

- ► As long as the overvoltage message (OV) is active, pulse inhibit is set and the drive operates in zero-torque mode.
- ► The controller inhibit is also evaluated by the “holding brake (BRK)” function block.

»Global Drive Control« (GDC)

Use a PC with the »Global Drive Control« (GDC) PC software for commissioning. The full functionality of the servo cam profiler can only be obtained through GDC.

► Possible communication paths between GDC and controller including adapters and connection cables required:

Controller	**Connection**	**PC**	
Interface		PC adapter	Interface
Integrated system bus or CANopen communication module **EMF2175IB**	System bus cable (supplied with the system bus adapters)	System bus adapter **EMF2173IB**	Parallel (printer interface)
		System bus adapter **EMF2177IB**	USB
Communication module LECOM-A/B **EMF2102IBCV001**	Serial cable **EWL0020** **EWL0021**	A standard RS232 / RS485 converter and an RS485 connection cable are required for LECOM-B.	Serial (RS232)
Communication module LECOM-LI **EMF2102IBCV003**	Optical fibre **EWZ0006** **EWZ0007**	Optical fibre adapter **EMF2125IB** **EMF2126IB**	

6.2 Before switching on

Stop!

Special commissioning procedure after long-term storage

If controllers are stored for more than two years, the insulation resistance of the electrolyte may have changed.

Possible consequences:

► During initial switch-on, the DC-bus capacitors and hence the controller are damaged.

Protective measures:

► Form the DC-bus capacitors prior to commissioning. Instructions can be found on the Internet (www.Lenze.com).

Note!

► Keep to the switch-on sequence described.

► The chapter ”Troubleshooting and fault elimination” helps you to eliminate faults during commissioning.

To avoid injury to persons or damage to material assets ...

... before the mains supply is connected, check:

► The wiring for completeness, short circuit and earth fault.

► The ”EMERGENCY STOP” function of the entire system.

► The in-phase connection of the motor.

► The correct connection of the resolver or incremental encoder to prevent the motor from rotating in the wrong direction.

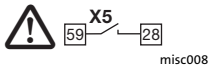
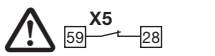
... check the setting of the most important drive parameters before enabling the controller:

► Is the U/f rated frequency adapted to the motor circuit configuration?

► Are the drive parameters relevant for your application set correctly?

► Is the configuration of the analog and digital inputs and outputs adapted to the wiring?

6.3 Switch-on sequence

Switch-on sequence			Note
1.	Ensure that controller inhibit is active after mains connection.		Terminal X5/28 = LOW
2.	Ensure that no external error is pending.		Terminal X5/E4 = HIGH
3.	Switch on controller.		
A	The control card is operated via an external voltage supply: Switch on the external DC 24 V supply voltage.		
B	The control card is operated via an internal voltage supply: Switch on the mains. The controller provides the DC 24 V supply.		
4.	After approx. 2 s the controller has initialised.		
5.	Switch on the PC and start GDC.		GDC starts in the online mode if the PC and the controller are connected. Information on the connection establishment can be found in the "Global Drive Control (GDC) - Getting started" manual.
6.	Enter the machine parameters in GDC.		
A	Select the basic configuration. Lenze setting: C0005 = 1000 (basic configuration "speed control").		📖 6.5-2
B	Adapt the controller to the mains.		📖 6.5-2
C	Enter motor data.		📖 6.5-3
D	Set temperature monitoring of the motor.		Motor with PTC or thermal contact: 📖 6.5-14 Motor with KTY: 📖 6.5-15
E	Select feedback system.		📖 6.6-1
7.	If required, carry out a current controller adjustment.		📖 6.7-1
8.	If required, carry out a rotor position adjustment.		📖 6.8-1
9.	Configure the function of the control terminals to adapt them to your application.		If an internal voltage supply is used, assign X5/x with "FIXED1" and X6/x with "FIXED100%". 📖 6.9-1
10.	Save the settings with mains failure protection in one of the 4 parameter sets (C0003). With C0003 = 1 the settings are saved in parameter set 1.		After connecting the DC 24 V supply or after mains connection, parameter set 1 is activated automatically. (See chapter "Parameterisation")
11.	Switch on the mains if previously only the external DC 24 V supply voltage was switched on.		
12.	Enable controller.		Terminal X5/28 = HIGH (see chapter "Commissioning" →"Controller inhibit")
13.	Define setpoint.	Analog setpoint selection: -10 ... +10 V via potentiometer at X6/1 and X6/2	
		Fixed speed: Activate JOG 1 with X5/E3 = HIGH	JOG 1 is parameterised in C0039/1.

Switch-on sequence			Note
14.	The drive is now running.		CW rotation: X5/E1 = HIGH and X5/E2 = LOW CCW rotation: X5/E1 = LOW and X5/E2 = HIGH

Note!

In the ”Diagnostics” menu, the most important drive parameters can be monitored.

6.4 Controller inhibit

Description

If the controller inhibit is active, the power outputs are inhibited.

- The drive coasts in zero-torque mode.
- Status display of keypad: Pulse inhibit IMP
- Status display at the controller: The green LED is blinking.

Danger!

Do not use the ”controller inhibit” function (DCTRL1-CINH) for emergency-off. The controller inhibit only inhibits the power outputs and does **not** disconnect the controller from the mains!

The drive could start again any time.

Activation

Via terminal X5/28:

- A LOW level at the terminal inhibits the controller (cannot be inverted)
- A HIGH level re-enables the controller

Via the keys of the keypad (if C0469 = 1):

- STOP inhibits the controller
- RUN re-enables the controller

Via code C0040:

- C0040 = 0 inhibits the controller
- C0040 = 1 re-enables the controller

Note!

- The sources for controller inhibit are ANDed, i.e. the drive only restarts if the controller inhibit signals of all signal sources have been eliminated.
- The restart starts with zero speed. If centrifugal masses are still rotating, this can lead to an overcurrent.

6.5 Basic settings

6.5.1 Changing the basic configuration

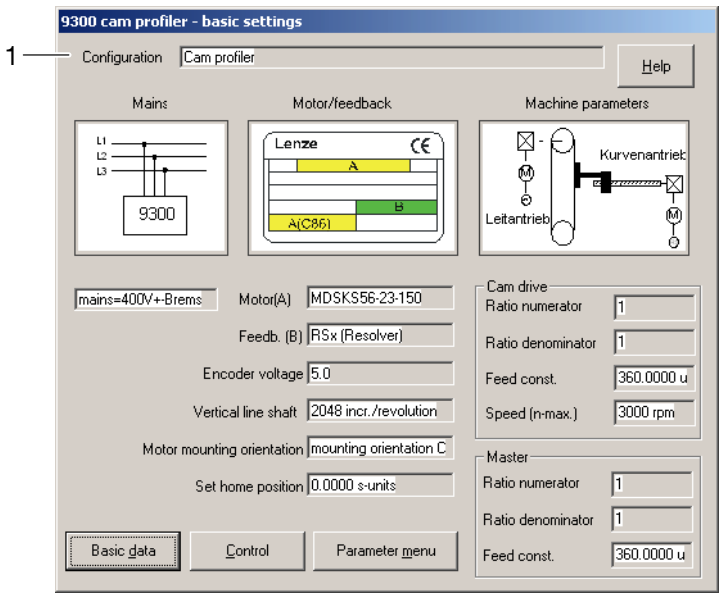


Fig. 6.5-1 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select a basic configuration suitable for your application, e.g.“10000” (Cam profiler)

6.5.2 Adapting the controller to the mains

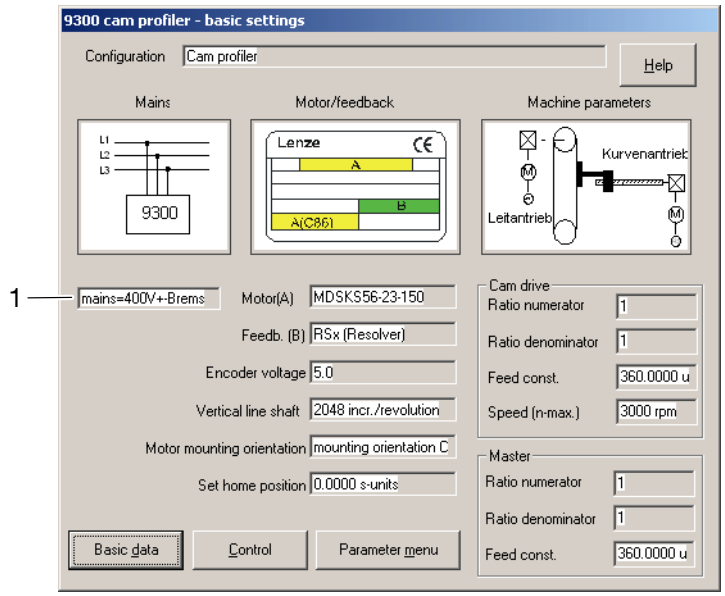


Fig. 6.5-2 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select the mains voltage and the supplementary component (if used).

6.5.3 Entry of motor data

For Lenze motors:

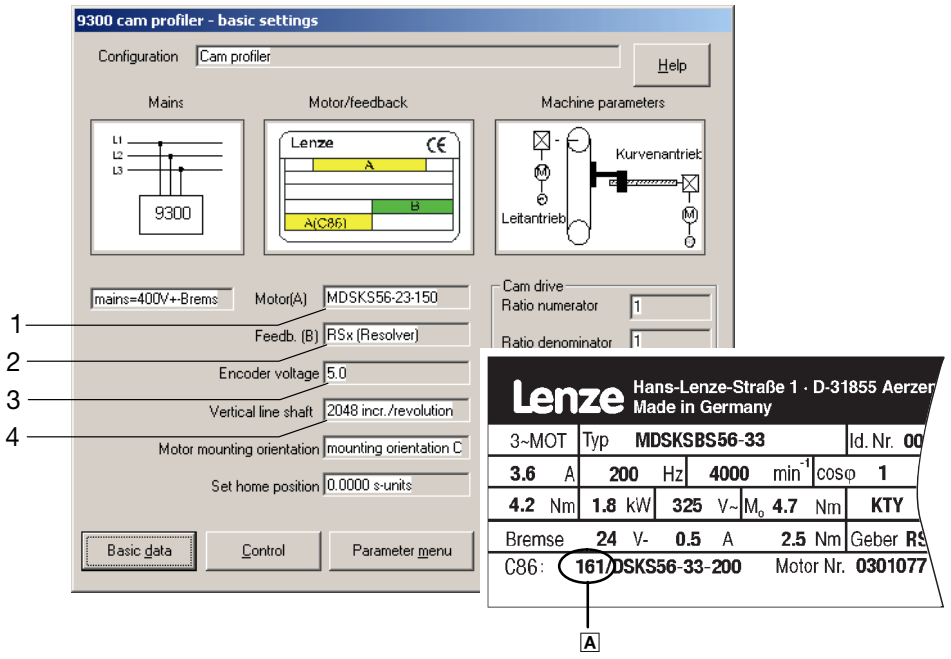


Fig. 6.5-3 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click into the field (1) and select the motor connected. Just select the number A specified on the nameplate of the motor from the open field. **Note!** A list of the motors available can be found in the chapter ”Motor selection list”. 📖 6.5-6
3.	Click into the field (2) and select the feedback system used.
4.	Click into the field (3) and, if required, set the voltage supply for the encoder at X8. **Important!** For C0025 = 309, 310, 311, 409, 410 or 411 you have to adapt the voltage to 8 V.
5.	Click into the field (4) and adapt the constant of the digital frequency input to the output signal of the encoder connected.

Enter the 8-digit resolver designation of the nameplate to achieve the highest accuracy.

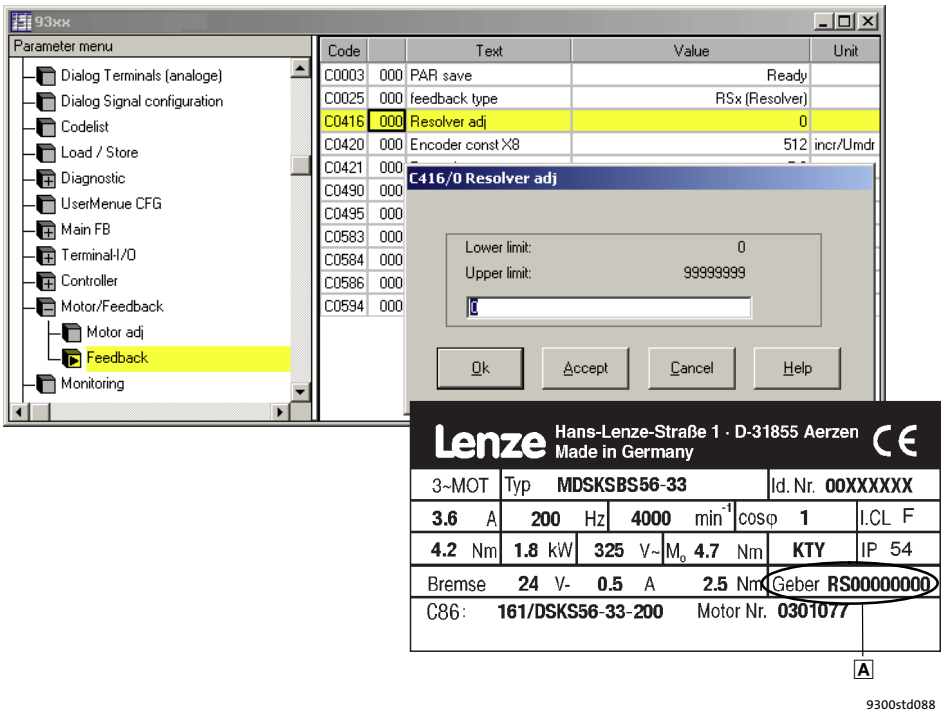
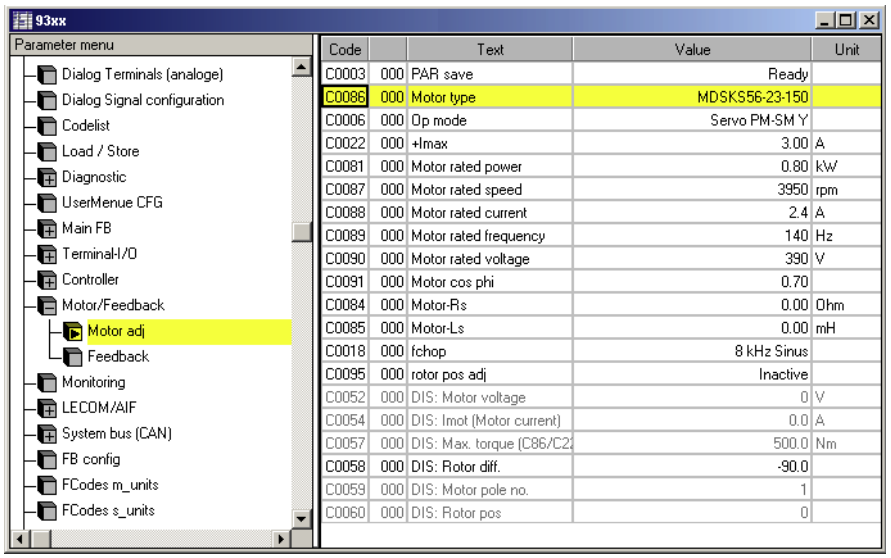


Fig. 6.5-4 ”Feedback” menu of the parameter menu

Procedure	
1.	Open the ”Parameter menu → Motor/Feedback → Feedback” menu.
2.	Click on C0416.
3.	Enter the 8-digit designation A of the motor nameplate in the dialog box.
4.	Confirm with ”OK”.
5.	Save the setting with C0003 = 1.

For non-Lenze motors or Lenze motors not listed under C0086



9300std089

Fig. 6.5-5 ”Motor adj” menu of the parameter menu

Procedure

1. Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
2. Click on C0086 and select the motor whose data corresponds best with the connected motor.
   Note!
   The available motors are listed in chapter ”Motor selection list”. 📖 6.5-6
3. Click on C0006 and select the motor control operating mode.
4. Enter the data of the connected motor in the following codes. The data can be found on the nameplate or the data sheet of the motor.

C0022	Maximum current I_{max} of the motor
C0081	Rated motor power
C0084	Stator resistance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0085	Leakage inductance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0087	Rated motor speed
C0088	Rated motor current
C0089	Rated motor frequency
C0090	Rated motor voltage
C0091	Cos φ.

5. Save the setting with C0003 = 1.

6.5.4 Motor selection list

Servo motors

The following table lists all servo motor which can be selected under C0086.

In the "Servo motor reference list" you can find the servo motors for which the motor data must be entered manually. (📖 6.5-8)

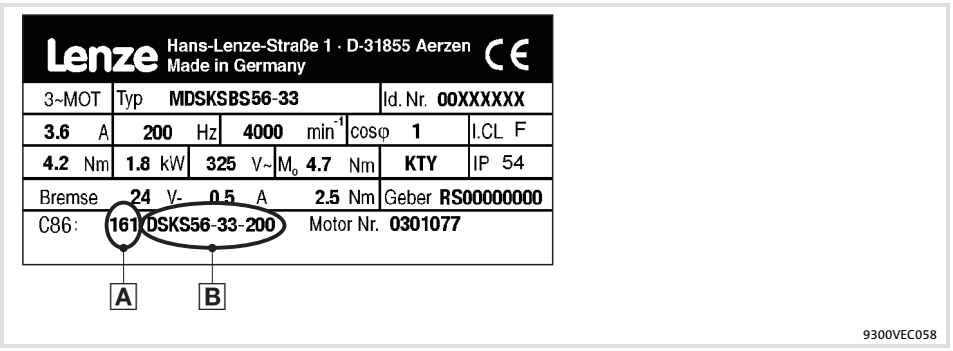


Fig. 6.5-6 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
10	MDSKA56-140	MDSKAXX056-22	0.80	3950	2.4	140		Asynchronous servo motor	KTY
11	MDFKA71-120	MDFKAXX071-22	2.20	3410	6.0	120			
12	MDSKA71-140	MDSKAXX071-22	1.70	4050	4.4	140			
13	MDFKA80-60	MDFKAXX080-22	2.10	1635	4.8	60			
14	MDSKA80-70	MDSKAXX080-22	1.40	2000	3.3	70	390		
15	MDFKA80-120	MDFKAXX080-22	3.90	3455	9.1	120			
16	MDSKA80-140	MDSKAXX080-22	2.30	4100	5.8	140			
17	MDFKA90-60	MDFKAXX090-22	3.80	1680	8.5	60			
18	MDSKA90-80	MDSKAXX090-22	2.60	2300	5.5	80			
19	MDFKA90-120	MDFKAXX090-22	6.90	3480	15.8	120			
20	MDSKA90-140	MDSKAXX090-22	4.10	4110	10.2	140	350		
21	MDFKA100-60	MDFKAXX100-22	6.40	1700	13.9	60			
22	MDSKA100-80	MDSKAXX100-22	4.00	2340	8.2	80	390		
23	MDFKA100-120	MDFKAXX100-22	13.20	3510	28.7	120			
24	MDSKA100-140	MDSKAXX100-22	5.20	4150	14.0	140	330		
25	MDFKA112-60	MDFKAXX112-22	11.00	1710	22.5	60			
26	MDSKA112-85	MDSKAXX112-22	6.40	2490	13.5	85	390		
27	MDFKA112-120	MDFKAXX112-22	20.30	3520	42.5	120			
28	MDSKA112-140	MDSKAXX112-22	7.40	4160	19.8	140	320		
30	DFQA100-50	MDFQAXX100-22	10.60	1420	26.5	50			
31	DFQA100-100	MDFQAXX100-22	20.30	2930	46.9	100			
32	DFQA112-28	MDFQAXX112-22	11.50	760	27.2	28			
33	DFQA112-58	MDFQAXX112-22	22.70	1670	49.1	58			
34	DFQA132-20	MDFQAXX132-32	17.00	555	45.2	20	360		
35	DFQA132-42	MDFQAXX132-32	35.40	1200	88.8	42			
40	DFQA112-50	MDFQAXX112-22	20.10	1425	43.7	50			
41	DFQA112-100	MDFQAXX112-22	38.40	2935	81.9	100			
42	DFQA132-36	MDFQAXX132-32	31.10	1035	77.4	36			
43	DFQA132-76	MDFQAXX132-32	60.10	2235	144.8	76	340		

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
50	DSVA56-140	DSVAXX056-22	0.80	3950	2.4	140	390	Asynchronous servo motor	Thermal contact
51	DFVA71-120	DFVAXX071-22	2.20	3410	6.0	120			
52	DSVA71-140	DSVAXX071-22	1.70	4050	4.4	140			
53	DFVA80-60	DFVAXX080-22	2.10	1635	4.8	60			
54	DSVA80-70	DSVAXX080-22	1.40	2000	3.3	70			
55	DFVA80-120	DFVAXX080-22	3.90	3455	9.1	120			
56	DSVA80-140	DSVAXX080-22	2.30	4100	5.8	140			
57	DFVA90-60	DFVAXX090-22	3.80	1680	8.5	60			
58	DSVA90-80	DSVAXX090-22	2.60	2300	5.5	80			
59	DFVA90-120	DFVAXX090-22	6.90	3480	15.8	120			
60	DSVA90-140	DSVAXX090-22	4.10	4110	10.2	140	350		
61	DFVA100-60	DFVAXX100-22	6.40	1700	13.9	60	390		
62	DSVA100-80	DSVAXX100-22	4.00	2340	8.2	80			
63	DFVA100-120	DFVAXX100-22	13.20	3510	28.7	120			
64	DSVA100-140	DSVAXX100-22	5.20	4150	14.0	140	330		
65	DFVA112-60	DFVAXX112-22	11.00	1710	22.5	60	390		
66	DSVA112-85	DSVAXX112-22	6.40	2490	13.5	85			
67	DFVA112-120	DFVAXX112-22	20.30	3520	42.5	120			
68	DSVA112-140	DSVAXX112-22	7.40	4160	19.8	140	320		
108	DSKS36-13-200	MDSKSXX036-13	0.25	4000	0.9	200	245	Synchronous servo motor	KTY
109	DSKS36-23-200	MDSKSXX036-23	0.54	4000	1.1	200	345		
110	MDSKS56-23-150	MDSKSXX056-23	0.60	3000	1.25	150	350		
111	MDSKS56-33-150	MDSKSXX056-33	0.91	3000	2.0	150	340		
112	MDSKS71-13-150	MDSKSXX071-13	1.57	3000	3.1	150	360		
113	MDFKS71-13-150	MDFKSXX071-13	2.29	3000	4.35	150	385		
114	MDSKS71-23-150	MDSKSXX071-23	2.33	3000	4.85	150	360		
115	MDFKS71-23-150	MDFKSXX071-23	3.14	3000	6.25	150	375		
116	MDSKS71-33-150	MDSKSXX071-33	3.11	3000	6.7	150	330		
117	MDFKS71-33-150	MDFKSXX071-33	4.24	3000	9.1	150	345		
160	DSKS56-23-190	MDSKSXX056-23	1.1	3800	2.3	190	330		
161	DSKS56-33-200	MDSKSXX056-33	1.8	4000	3.6	200	325		
162	DSKS71-03-170	MDSKSXX071-03	2.0	3400	4.2	170	330		
163	DFKS71-03-165	MDFKSXX071-03	2.6	3300	5.6	165	330		
164	DSKS71-13-185	MDSKSXX071-13	3.2	3700	7.0	185	325		
165	DFKS71-13-180	MDFKSXX071-13	4.1	3600	9.2	180	325		
166	DSKS71-33-180	MDSKSXX071-33	4.6	3600	10.0	180	325		
167	DFKS71-33-175	MDFKSXX071-33	5.9	3500	13.1	175	325		

Servo motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1000	MDSKA-71-22	54	3.75	0.88	8.4	34.98	1950	2.50	70	390	0.82	2	100	1.5	1.5
1001	MDFQA-112-12	33	42.60	12.90	0.45	4.3	1660	28.40	58	360	0.85	20	21	2	1
1002	MDFQA-112-12	41	70.50	21.80	0.45	4.3	2930	47.00	100	360	0.83	14	21	1.3	1
1003	MDSKA-56-22	50	6.75	1.57	2.25	6.5	6000	4.50	202	280	0.72	3	50	1.3	1.5
1004	MDSKS071-33-39	112	5.10	0.95	7.2	34.5	780	3.40	39	325	1.00	3	20	2.5	1.5
1005	MDSKS071-33-41	112	2.25	0.45	16.3	68	820	1.50	41	330	1.00	2	20	2.5	1.5
1076	MDSKS071-33-90	112	5.85	1.60	3.67	17.7	1800	3.90	90	310	1.00	10	20	0.7	1.7
1077	MDSKA-71-22	51	2.18	0.33	35.7	131.8	725	1.45	30	360	0.78	10	70	1.5	2
1103	SDSGA056-22	50	1.20	0.24	29.3	123	2790	0.80	100	390	0.71	14	150	0.35	1.8
1104	SDSGA056-22	40	2.55	0.24	29.3	123	2790	1.70	100	230	0.71	14	150	0.35	1.8
1105	SDSGA063-22	50	1.80	0.40	29.3	123	2800	1.20	100	390	0.70	14	150	0.35	1.8
1106	SDSGA063-22	40	3.15	0.40	29.3	123	2800	2.10	100	230	0.70	14	150	0.35	1.8
1107	SDSGA063-32	50	2.55	0.60	29.3	123	2800	1.70	100	390	0.70	14	150	0.35	1.8
1108	SDSGA063-32	40	4.50	0.6	29.3	123	2800	3	100	230	0.70	14	150	0.35	1.8
1109	MDSKS056-23-280	114	8.00	1.10	6.72	8.34	5600	2.30	280	320	1.00	10	20	1.3	1.5
1110	MDSKS056-23-310	114	9.00	1.10	5.42	6.78	6200	2.30	310	320	1.00	10	20	1.3	1.5
1111	MDSKS056-33-300	114	10.00	1.75	3.31	4.62	6000	3.60	300	320	1.00	10	20	1.3	1.5
1112	MDSKS056-33-265	114	8.00	1.72	4.1	5.73	5300	3.60	265	320	1.00	10	20	1.3	1.5
1113	MDSKS071-13-265	114	23.00	3.20	0.54	2.56	5300	7.00	265	320	1.00	10	20	1.3	1.5
1116	MDSKS071-33-270	114	25.00	5.70	0.38	1.91	5400	12.50	270	320	1.00	10	20	1.3	1.5

Three-phase asynchronous motors

The following table lists all asynchronous motors which can be selected under C0086.

In the "Asynchronous motor reference list" you can find the asynchronous motors for which the motor data must be entered manually. (📖 6.5-11)

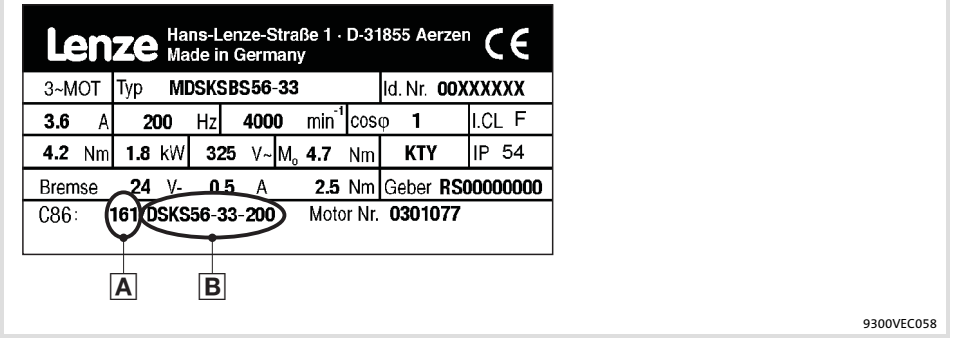


Fig. 6.5-7 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
210	DXRAXX071-12-50	DXRAXX071-12	0.25	1410	0.9	50	400	Asynchronous inverter motor (star connection)	Thermal contact
211	DXRAXX071-22-50	DXRAXX071-22	0.37	1398	1.2				
212	DXRAXX080-12-50	DXRAXX080-12	0.55	1400	1.7				
213	DXRAXX080-22-50	DXRAXX080-22	0.75	1410	2.3				
214	DXRAXX090-12-50	DXRAXX090-12	1.10	1420	2.7				
215	DXRAXX090-32-50	DXRAXX090-32	1.50	1415	3.6				
216	DXRAXX100-22-50	DXRAXX100-22	2.20	1425	4.8				
217	DXRAXX100-32-50	DXRAXX100-32	3.00	1415	6.6				
218	DXRAXX112-12-50	DXRAXX112-12	4.00	1435	8.3				
219	DXRAXX132-12-50	DXRAXX132-12	5.50	1450	11.0				
220	DXRAXX132-22-50	DXRAXX132-22	7.50	1450	14.6				
221	DXRAXX160-12-50	DXRAXX160-12	11.00	1460	21.0				
222	DXRAXX160-22-50	DXRAXX160-22	15.00	1460	27.8				
223	DXRAXX180-12-50	DXRAXX180-12	18.50	1470	32.8				
224	DXRAXX180-22-50	DXRAXX180-22	22.00	1456	38.8				
225	30kW-ASM-50	–	30.00	1470	52.0	50	400	Asynchronous inverter motor (star connection)	–
226	37kW-ASM-50	–	37.00	1470	66.0				
227	45kW-ASM-50	–	45.00	1480	82.0				
228	55kW-ASM-50	–	55.00	1480	93.0				
229	75kW-ASM-50	–	75.00	1480	132.0				
250	DXRAXX071-12-87	DXRAXX071-12	0.43	2525	1.5	87	400	Asynchronous inverter motor (delta connection)	Thermal contact
251	DXRAXX071-22-87	DXRAXX071-22	0.64	2515	2.0				
252	DXRAXX080-12-87	DXRAXX080-12	0.95	2515	2.9				
253	DXRAXX080-22-87	DXRAXX080-22	1.3	2525	4.0				
254	DXRAXX090-12-87	DXRAXX090-12	2.0	2535	4.7				
255	DXRAXX090-32-87	DXRAXX090-32	2.7	2530	6.2				
256	DXRAXX100-22-87	DXRAXX100-22	3.9	2535	8.3				
257	DXRAXX100-32-87	DXRAXX100-32	5.35	2530	11.4				
258	DXRAXX112-12-87	DXRAXX112-12	7.10	2545	14.3				
259	DXRAXX132-12-87	DXRAXX132-12	9.7	2555	19.1				
260	DXRAXX132-22-87	DXRAXX132-22	13.2	2555	25.4				
261	DXRAXX160-12-87	DXRAXX160-12	19.3	2565	36.5				
262	DXRAXX160-22-87	DXRAXX160-22	26.4	2565	48.4				
263	DXRAXX180-12-87	DXRAXX180-12	32.4	2575	57.8				
264	DXRAXX180-22-87	DXRAXX180-22	38.7	2560	67.4				

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
265	30kW-ASM-87	–	52.00	2546	90.0	87	400	Asynchronous inverter motor (delta connection)	–
266	37kW-ASM-87	–	64.00	2546	114.0				
267	45kW-ASM-87	–	78.00	2563	142.0				
268	55kW-ASM-87	–	95.00	2563	161.0				
269	75kW-ASM-87	–	130.00	2563	228.0				

Asynchronous motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
410	MDXMAXM-071-12	210	1.23	0.25	35.80	116.80	1400	0.82	50	400	0.70	6	300	1.5	10
411	MDXMAXM-071-32	211	1.80	0.37	27.00	112.70	1400	1.20	50	400	0.71	6	300	1.5	10
412	MDXMAXM-080-12	212	2.40	0.55	16.30	78.60	1400	1.60	50	400	0.72	6	300	1.5	10
413	MDXMAXM-080-32	213	3.00	0.75	11.20	59.30	1380	2.00	50	400	0.76	6	300	1.5	10
414	MDXMAXM-090-12	214	3.90	1.10	9.14	41.80	1410	2.60	50	400	0.80	6	300	1.5	10
415	MDXMAXM-090-32	215	5.25	1.50	5.10	27.70	1420	3.50	50	400	0.80	6	300	1.5	10
416	MDXMAXM-100-12	216	8.40	2.20	2.96	18.20	1400	5.60	50	400	0.78	6	300	1.5	10
417	MDXMAXM-100-32	217	10.95	3.00	2.20	13.40	1400	7.30	50	400	0.81	6	300	1.5	10
418	MDXMAXM-112-22	218	12.75	4.00	1.50	10.80	1430	8.50	50	400	0.85	6	300	1.5	10
440	MDXMAXM-071-12	250	2.10	0.43	35.8	116.80	2510	1.40	87	400	0.70	6	300	1.5	10
441	MDXMAXM-071-32	251	3.15	0.64	27.0	112.70	2510	2.10	87	400	0.71	6	300	1.5	10
442	MDXMAXM-080-12	252	4.20	0.95	16.3	78.60	2510	2.80	87	400	0.72	6	300	1.5	10
443	MDXMAXM-080-32	253	5.25	1.30	11.2	59.30	2490	3.50	87	400	0.76	6	300	1.5	10
444	MDXMAXM-090-12	254	6.75	2.00	9.14	41.80	2520	4.50	87	400	0.80	6	300	1.5	10
445	MDXMAXM-090-32	255	9.15	2.70	5.1	27.70	2530	6.10	87	400	0.78	6	300	1.5	10
446	MDXMAXM-100-12	256	14.55	3.90	2.96	18.20	2510	9.70	87	400	0.81	6	300	1.5	10
447	MDXMAXM-100-32	257	19.05	5.40	2.2	13.40	2510	12.70	87	400	0.85	6	300	1.5	10
448	MDXMAXM-112-22	258	22.20	7.10	1.5	10.80	2540	14.80	87	400	0.78	6	300	1.5	10
449	MDXMAXM-112-32	259	18.75	5.50	2.45	21.40	1440	12.50	50	400	0.78	6	300	1.5	10
450	MDXMAXM-132-22	259	25.20	7.50	1.42	15.00	1460	16.80	50	400	0.77	6	300	1.5	10
451	MDXMAXM-132-32	259	29.25	9.20	1.34	14.00	1450	19.50	50	400	0.85	6	300	1.5	10
1006	MDXMAxx-071-12	210	1.28	0.25	39.90	157.20	1355	0.85	50	400	0.70	6	300	3.6	2
1007	MDXMAxx-071-12	250	2.25	0.47	39.90	157.20	2475	1.50	87	400	0.66	6	300	2	2
1008	MDXMAxx-071-32	211	1.73	0.37	25.03	122.60	1345	1.15	50	400	0.74	6	300	3.4	2
1009	MDXMAxx-071-32	251	3.00	0.67	25.03	122.60	2470	2.00	87	400	0.70	6	300	2.5	2
1010	MDXMAxx-080-12	212	2.40	0.55	20.69	89.00	1370	1.60	50	400	0.78	6	300	3.2	2
1011	MDXMAxx-080-12	252	3.90	1.00	20.69	89.00	2480	2.60	87	400	0.73	6	300	1.6	2
1012	MDXMAxx-080-32	213	2.85	0.75	11.69	65.20	1390	1.90	50	400	0.80	6	300	3.5	2
1013	MDXMAxx-080-32	253	4.95	1.35	11.69	65.20	2510	3.30	87	400	0.77	6	300	1.9	3
1014	MDXMAxx-090-12	214	3.90	1.10	10.01	40.20	1405	2.60	50	400	0.80	6	300	2.5	2
1015	MDXMAxx-090-12	254	6.75	2.00	10.01	40.20	2520	4.50	87	400	0.77	6	300	2	2
1016	MDXMAxx-090-32	215	5.25	1.50	5.85	28.80	1410	3.50	50	400	0.78	6	300	2	2
1017	MDXMAxx-090-32	255	9.15	2.70	5.85	28.80	2525	6.10	87	400	0.76	6	300	1	2
1018	MDXMAxx-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1019	MDXMAxx-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.76	6	300	0.8	1.5
1020	MDXMAxx-100-32	217	9.75	3.00	2.10	17.00	1415	6.50	50	400	0.81	6	300	2.5	1.5
1021	MDXMAxx-100-32	257	17.10	5.40	2.10	17.00	2530	11.40	87	400	0.78	6	300	1.4	1.8
1022	MDXMAxx-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1023	MDXMAxx-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.83	6	300	1	2
1024	MDXMAxx-132-12	219	16.50	5.50	0.86	13.00	1450	11.00	50	400	0.84	6	300	1.5	2
1025	MDXMAxx-132-12	259	28.65	9.70	0.86	13.00	2555	19.10	87	400	0.83	6	300	1.3	2
1026	MDXMAxx-132-22	220	21.90	7.50	0.80	11.00	1450	14.60	50	400	0.85	6	300	1.5	2
1027	MDXMAxx-132-22	260	38.10	13.20	0.80	11.00	2555	25.40	87	400	0.84	6	300	0.95	1.8

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1028	MDXMAxx-160-22	221	31.50	11.00	0.50	7.00	1460	21.00	50	400	0.85	6	300	1.9	2.2
1029	MDXMAxx-160-22	261	54.75	19.30	0.50	7.00	2565	36.50	87	400	0.85	6	300	1	2
1030	MDXMAxx-160-32	222	41.70	15.00	0.40	5.50	1460	27.80	50	400	0.87	6	300	1.7	2.5
1031	MDXMAxx-160-32	262	72.60	26.40	0.40	5.50	2565	48.40	87	400	0.86	6	300	1	1.8
1032	MDXMAxx-180-12	223	49.20	18.50	0.40	4.00	1470	32.80	50	400	0.90	6	300	1.4	1.7
1033	MDXMAxx-180-12	263	86.70	32.40	0.40	4.00	2575	57.80	87	400	0.89	6	300	1	1.7
1034	MDXMAxx-180-22	224	58.20	22.00	0.20	3.80	1456	38.80	50	400	0.90	6	300	1	1.5
1035	MDXMAxx-180-22	264	101.1	38.70	0.20	3.80	2560	67.40	87	400	0.89	6	300	1	1.5
1036	MDXMAXM-63-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1037	MDXMAXM-63-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1038	MDXMAXM-63-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1039	MDXMAXM-63-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1040	MDXMAXM-112-32	219	18.75	5.50	0.86	7.20	1440	12.50	50	400	0.78	6	300	1.5	10
1041	MDXMAXM-112-32	259	32.55	9.60	0.86	7.20	2550	21.70	87	400	0.78	6	300	1.5	10
1042	MDXMAXM-132-22	220	25.20	7.50	0.54	4.80	1460	16.80	50	400	0.77	6	300	1.5	10
1043	MDXMAXM-132-22	260	43.80	13.10	0.54	4.80	2570	29.20	87	400	0.77	6	300	1.5	10
1044	MDXMAXM-132-32	221	29.25	9.20	0.46	4.70	1450	19.50	50	400	0.85	6	300	1.5	10
1045	MDXMAXM-132-32	261	50.70	16.00	0.46	4.70	2560	33.80	87	400	0.85	6	300	1.5	10
1046	MDXMAXM-160-22	260	31.50	11.00	1.27	18.97	1466	21.00	50	400	0.86	6	300	1.5	10
1047	MDXMAXM-160-32	260	42.30	15.00	0.87	14.28	1466	28.20	50	400	0.87	6	300	1.5	10
1048	MDXMAXM-180-22	260	54.60	18.50	0.40	4.00	1440	36.40	50	400	0.87	6	300	1.5	10
1049	MDXMAXM-180-32	260	66.15	22.00	0.20	3.80	1465	44.10	50	400	0.85	6	300	1.5	10
1050	MDXMAXM-200-32	260	90.00	30.00	0.17	3.50	1455	60.00	50	400	0.85	6	300	1.5	10
1051	MDXMAXM-225-12	260	108.0	37.00	0.15	2.00	1460	72.00	50	400	0.86	6	300	1.5	10
1052	MDXMAXM-225-22	260	128.25	45.00	0.15	2.00	1475	85.50	50	400	0.84	6	300	1.5	10
1053	MDXMAXM-063-11	210	1.43	0.18	51.00	273.7	2760	0.95	50	400	0.80	6	300	1.5	10
1054	MDXMAXM-063-31	210	1.65	0.25	33.00	93.4	2760	1.10	50	400	0.83	6	300	1.5	10
1055	MDXMAXM-071-11	211	1.50	0.37	22.50	90.2	2840	1.00	50	400	0.78	6	300	1.5	10
1056	MDXMAXM-071-31	212	2.25	0.55	16.90	62.9	2840	1.50	50	400	0.82	6	300	1.5	10
1057	MDXMAXM-080-11	213	2.85	0.75	11.36	47.4	2850	1.90	50	400	0.80	6	300	1.5	10
1058	MDXMAXM-080-31	214	4.20	1.10	6.86	33.4	2810	2.80	50	400	0.82	6	300	1.5	10
1059	MDXMAXM-090-11	215	4.80	1.50	5.10	22.2	2840	3.20	50	400	0.85	6	300	1.5	10
1060	MDXMAXM-090-31	216	7.20	2.20	3.20	14.5	2840	4.80	50	400	0.86	6	300	1.5	10
1061	MDXMAXM-100-31	217	9.30	3.00	1.81	10.7	2850	6.20	50	400	0.88	6	300	1.5	10
1062	MDXMAXM-100-41	218	12.75	4.00	1.45	8.6	2830	8.50	50	400	0.85	6	300	1.5	10
1063	MDXMAXM-112-31	250	18.30	5.50	3.10	17	2890	12.20	50	400	0.83	6	300	1.5	10
1064	MDXMAXM-112-41	250	23.25	7.50	1.96	12	2900	15.50	50	400	0.87	6	300	1.5	10
1065	MDXMAXM-132-21	250	28.05	9.00	1.41	11.292	2925	18.70	50	400	0.89	6	300	1.5	10
1066	MDXMAXM-071-13	210	1.13	0.18	58.93	342	870	0.75	50	400	0.71	6	300	1.5	10
1067	MDXMAXM-071-13	250	1.95	0.31	58.93	342	1610	1.30	87	400	0.71	6	300	1.5	10
1068	MDXMAXM-071-33	210	1.50	0.25	37.90	116.8	920	1.00	50	400	0.63	6	300	1.5	10
1069	MDXMAXM-071-33	250	2.55	0.43	37.90	116.8	1660	1.70	87	400	0.63	6	300	1.5	10
1070	MDXMAXM-080-13	211	2.10	0.37	28.00	112.7	900	1.40	50	400	0.67	6	300	1.5	10
1071	MDXMAXM-080-13	251	3.60	0.64	28.00	112.7	1640	2.40	87	400	0.67	6	300	1.5	10
1072	MDXMAXM-080-33	212	2.85	0.55	16.60	78.6	900	1.90	50	400	0.68	6	300	1.5	10
1073	MDXMAXM-080-33	252	4.95	0.95	16.60	78.6	1640	3.30	87	400	0.68	6	300	1.5	10
1078	MDFMAxx-250-22	224	147.75	55.00	0.04	1.92	1475	98.50	50	400	0.86	6	300	1	2
1079	MDFMAxx-250-22	264	255.90	95.00	0.04	1.92	2585	170.60	87	400	0.86	6	300	1	2
1080	MDEBAXM-063-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1081	MDEBAXM-063-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1082	MDEBAXM-063-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1083	MDEBAXM-063-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1084	MDEBAXM-071-12	210	1.35	0.25	39.90	157.20	1390	0.90	50	400	0.64	6	300	3.6	2

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1085	MDEBAXM-071-12	250	2.34	0.43	39.90	157.20	2500	1.56	87	400	0.64	6	300	2	2
1086	MDEBAXM-071-32	211	1.95	0.37	25.03	122.60	1380	1.30	50	400	0.64	6	300	3.4	2
1087	MDEBAXM-071-32	251	3.38	0.64	25.03	122.60	2490	2.25	87	400	0.64	6	300	2.5	2
1088	MDEBAXM-080-12	212	2.40	0.55	20.69	89.00	1400	1.60	50	400	0.68	6	300	3.2	2
1089	MDEBAXM-080-12	252	4.16	0.95	20.69	89.00	2510	2.77	87	400	0.68	6	300	1.6	2
1090	MDEBAXM-080-32	213	3.00	0.75	11.69	65.20	1400	2.00	50	400	0.72	6	300	3.5	2
1091	MDEBAXM-080-32	253	5.20	1.30	11.69	65.20	2510	3.46	87	400	0.72	6	300	1.9	3
1092	MDEBAXM-090-12	214	4.05	1.10	6.40	37.00	1420	2.70	50	400	0.77	6	300	2.5	2
1093	MDEBAXM-090-12	254	7.05	2.00	6.40	37.00	2535	4.70	87	400	0.77	6	300	2	2
1094	MDEBAXM-090-32	215	5.40	1.50	4.80	26.00	1415	3.60	50	400	0.77	6	300	2	2
1095	MDEBAXM-090-32	255	9.30	2.70	4.80	26.00	2530	6.20	87	400	0.77	6	300	1	2
1096	MDEBAXM-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1097	MDEBAXM-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.80	6	300	0.8	1.5
1098	MDEBAXM-100-32	217	9.90	3.00	2.10	17.00	1415	6.60	50	400	0.81	6	300	2.5	1.5
1099	MDEBAXM-100-32	257	17.10	5.35	2.10	17.00	2530	11.40	87	400	0.81	6	300	1.4	1.8
1100	MDEBAXM-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1101	MDEBAXM-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.82	6	300	1	2
1102	MDEBAXM-112-32	219	17.85	5.50	2.71	21.40	1425	11.90	50	400	0.84	6	300	1.5	10
1114	MDFMAxx-200-32	224	83.25	30.00			1465	55.50	50	400	0.85	6	300	1	2
1115	MDFMAxx-200-32	264	145.50	52.00			2575	97.00	87	400	0.85	6	300	1	2

6.5.5 Motor temperature monitoring with PTC or thermal contact

Description

PTC resistors according to DIN 44081 and DIN 44082 can be connected via the terminal inputs T1 and T2. The motor temperature is measured and integrated into the drive monitoring.

A thermal contact (NC contact) can also be connected to T1 and T2. Lenze three-phase AC motors provide thermal contacts as default.

When using motors equipped with PTC resistors or thermostats, we recommend to always activate the PTC input. This prevents the motor from being destroyed by overheating.

Stop!

- ► The motor temperature monitoring may only be connected to T1, T2 if the cable is terminated with a PTC or thermal contact (NC contact) on the motor side.
  - – An "open" cable acts like an antenna and can cause faults on the drive controller.
  - – Input signals at T1, T2 are processed with a delay of 2 s.
- ► The drive controller can only evaluate one PTC resistor! Do not connect several PTC resistors in series or in parallel:
  - – The motor temperature would be measured incorrectly.
  - – The motors could be destroyed by overheating.
- ► If you operate several motors on a drive controller, use thermal contacts (NC contacts) for motor temperature monitoring and connect these in series.
- ► To achieve full motor protection, an additional temperature monitoring with separate evaluation must be installed.

Activation

Note!

- ► In the Lenze setting the motor temperature monitoring is switched off!
- ► If you work with several parameter sets, the monitoring must be activated separately in each parameter set!

1. Connect the monitoring circuit of the motor to T1 and T2.
   – With 1.6 kΩ < R < 4 kΩ, the monitoring responds.
2. Set the controller reaction:
   – C0585 = 3: Temperature monitoring of the motor is switched off.
   – C0585 = 0: TRIP error message (display of keypad: OH8 Trip)
   – C0585 = 2: Warning signal (display of keypad: OH8 Warn)

Function test

Connect the PTC input with a fixed resistor:

- ► R > 4 kΩ: The fault message OH8 must be activated.
- ► R < 1 kΩ: Fault message must not be activated.

6.5.6 Motor temperature monitoring with KTY

Description

- There are two possibilities to connect a KTY resistor:
  - At the incremental encoder connection X8 (pins X8/5 and X8/8)
  - At the resolver connection X7 (pins X7/8 and X7/9)
- The motor temperature is measured and integrated into the drive monitoring.
- The KTY resistor is monitored for open and short circuit.
- When using motors equipped with KTY resistors, we recommend always to activate the KTY input. This prevents the motor from being destroyed by overheating.

Stop!

- The controller can only evaluate one KTY resistor! Do not use several KTY resistors connected in series or in parallel:
  - This would result in an incorrect measurement of the motor temperature.
  - The motors could be destroyed by overheating.
- If several motors are operated on a controller, use thermal contacts (NC contacts) for monitoring the motor temperature and connect theses contacts in series.
- To ensure full motor protection, an additional temperature monitoring with separate evaluation has to be installed.

Activation

Stop!

Overheating of the motor!

In the Lenze setting, temperature monitoring of the motor is deactivated (C0583 = 3). The motor temperature in C0063 shows 0 °C even if C0584 = 2 is set.

Possible consequences:

► The motor can be damaged by a too high motor temperature.

Protective measures:

► Activate the monitoring of the motor temperature via X7 or X8 with C0583 = 2 or C0584 = 2.

► Set C0594 = 2 or 3. Then the connection is additionally monitored with regard to short circuit and interruption.

► If you work with several parameter sets, you have to activate the monitoring separately in each parameter set.

1. Connect monitoring circuit of the motor to X7/8, X7/9 or X8/5, X8/8.
2. Set response of the controller for short circuit or interruption on the connection (monitoring of the motor temperature has to be activated):
   – C0594 = 3: monitoring is switched off.
   – C0594 = 0: TRIP error message (keypad display: Sd6 Trip)
   – C0594 = 2: warning signal (keypad display: Sd6 Warn)

Adjustment

Monitoring with a fixed operating temperature (150 °C)

1. Set response of the controller:
   – C0583 = 3: temperature monitoring of the motor switched off.
   – C0583 = 0: TRIP error message (keypad display: OH3 Trip)
   – C0583 = 2: warning signal (keypad display: OH3 Warn)

Monitoring with a variable operating temperature (45...150 °C)

1. Set the operating temperature in C0121.
2. Set response of the controller:
   – C0584 = 3: temperature monitoring of the motor switched off.
   – C0584 = 2: warning signal (keypad display: OH7 Warn)

Adjustment of KTY operating range

The temperature and resistance range can be adapted to the KTY used.

- ► C1190 = 0: Fixed operating range for KTY in Lenze motors (Lenze setting)
- ► C1190 = 1: Adjustable operating range

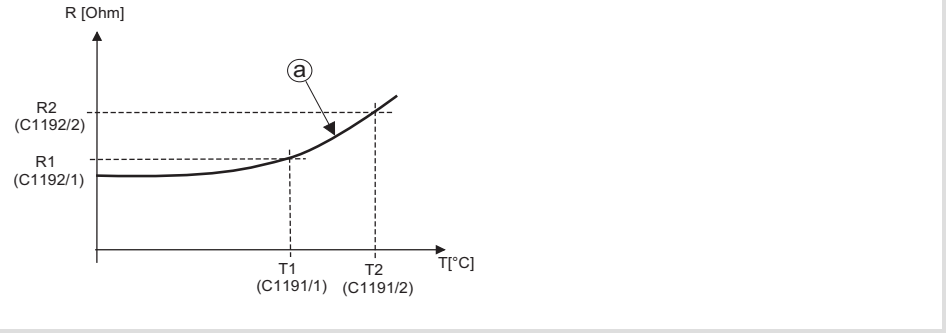


Fig. 6.5-8 Setting of the operating range for the KTY (C1190 = 1)

The operating range is specified by means of limit values and is in the almost linear section of the graph (a). The operating values are determined by interpolation.

C1191/1 C1191/2	Setting of the lower and upper temperature value (T1, T2) corresponding to the KTY used.
C1192/1 C1192/2	Setting of the lower and upper resistance value corresponding to the KTY used.

6.6 Setting the speed feedback

Description

The feedback signal can either be supplied via input X7 or via input X8.

- ► At X7 a resolver can be connected.
- ► At X8 an encoder can be connected.
  - – Incremental encoder TTL
  - – SinCos encoder
  - – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

- ► Use a SinCos encoder with serial communication (multi-turn) if homing of the drive is not possible. Please specify the motor/encoder combination in your order.
- ► You can only use 2 of the 3 interfaces X8, X9, X10 simultaneously. Due to this it may be possible that the incremental encoder input cannot be activated or the digital frequency input / digital frequency output does not work.
  - – This dependency does not apply if the digital frequency output X10 is set to reproduction of the input signals at X8 or X9 (C0540 = 4 or 5).
  - – To deactivate the digital frequency input, it may be necessary to delete the internal signal link from function block DFIN to the following function block. Remove the function block DFIN from the processing table.

6.6.1 Resolver at X7

Resolvers can be operated at X7. For the wiring diagram and the pin assignment of X7, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

- ► C0025 = 10 (Lenze setting)
- ► Monitoring (SD2) of the resolver and the resolver cable for open circuit:
  C0586 = 0 (TRIP, Lenze setting)
  C0586 = 2 (warning)
  C0586 = 3 (off)

6.6.2 Incremental encoder with TTL level at X8

Incremental encoders with TTL level can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

► C0025 = 110, 111, 112 or 113. The number of increments (512, 1024, 2048 or 4096) is set automatically.

Adjustment

The incremental encoder is supplied with voltage by the drive controller.

Stop!

If the supply voltage is too high, it may destroy the incremental encoder.

Under C0421 you can adjust the supply voltage V_{CC} (5 V) of the incremental encoder in order to compensate for the voltage drop along the incremental encoder cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{Inc}\,[A]$$

l	Length of the incremental encoder cable
R	Resistance of the incremental encoder cable
I_{Inc}	Current consumption of the incremental encoder

6.6.3 SinCos encoder at X8

SinCos encoders can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter "Wiring of the standard device" → "Wiring of the feedback system".

Activation

Stop!

Uncontrolled acceleration of the motor!

► If the SinCos encoder fails, the motor may accelerate in an uncontrolled manner.

Protective measures:

► Activate the monitoring for the SinCos encoder with C0580 = 0.

► SinCos encoder with 5 V supply voltage:
C0025 = 210, 211, 212, or 213. The number of increments (512, 1024, 2048 or 4096) is set automatically.

► Single-turn SinCos encoder with 8 V supply voltage:
C0025 = 309, 310, or 311. The number of increments (128, 512 or 1024) is set automatically.

► Multi-turn SinCos encoder with 8 V supply voltage:
C0025 = 409, 410, or 411. The number of increments (128, 512 or 1024) is set automatically.

► Monitoring (SD8) of the SinCos encoder:
C0580 = 0 (TRIP, Lenze setting)
C0580 = 3 (off)

Adjustment

The SinCos encoder is supplied with voltage by the controller.

Stop!

If the supply voltage is too high, the SinCos encoder may be damaged.

Under C0421 you can adjust the supply voltage V_{CC} (5 ... 8 V) of the SinCos encoder in order to compensate for the voltage drop along the cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{SINCOS}\,[A]$$

l	Length of the SinCos encoder cable
R	Resistance of the SinCos encoder cable
I_{SINCOS}	Current consumption of the SinCos encoder

6.7 Current controller adjustment

When is a current controller adjustment required?

- The motor data of the motor used is not contained in GDC (e.g. motors from other manufacturers).
- The application makes high demands on the dynamic performance of the drive controller (e.g. dynamic positioning, cross cutter).
- The motor/drive controller combination does conform to the standard power-based assignment. The basic current controller settings only match for a power-based assignment of the drive controller.

Preparations

Measure	Setting	Explanation
Reduce maximum current	Reduce the value in C0022	With the motor at standstill, the motor current of the motor phase U is measured (field frequency 0). This increases the motor current in the motor phase to 141% and the motor temperature rises significantly.
Generate maximum torque setpoint	Connect MCTRL-M-ADD with FIXED100%	For speed control or position control (MCTRL-N/M-SWT = 0)
	• Connect MCTRL-M-ADD with FIXED100% • Connect MCTRL-N-SET with FIXED100%	For torque control (MCTRL-N/M-SWT = 1)
Deactivate integral action component of current controller	Set C0076 = 2000 ms	The integral action component of the current controller is deactivated by setting the reset time T_n (C0076) to the longest time. The gain (C0075) remains unchanged (Lenze setting still valid).
Deactivate quick stop	Set X5/E1 = HIGH or X5/E2 = HIGH	By preselecting a direction of rotation the quick stop is deactivated.
Change the operation of the motor control	Set C0006 = 3	Even if an asynchronous motor is connected, set the motor control to 'synchronous motor'.
Set the rotor position setpoint	Set C0058 = -90°	Set the rotor displacement angle to -90°.
Set the actual value display of the rotor position to 0° under C0060	1. Select a TTL encoder under C0025 2. Save settings with C0003 = 1 3. If required, disconnect the encoder cable at X8 4. Switch off the mains supply and the external 24V supply (if required) and then on again.	After mains connection C0060 = 0° is displayed.
Connect the storage oscilloscope	Put the clamp-on ammeter around the motor phase U and connect it to the oscilloscope	Oscilloscope settings: • Time base: 400 µs/DIV • Auto-triggering

Adjustment

Stop!

Thermal destruction of the motor!

► If the controller is enabled for too long and the motor current is too high, the motor may be destroyed by overtemperature.

Protective measures:

► Reduce motor current under C0022 and enable the controller only for some seconds.

1. Inhibit the controller (X5/28 = LOW)
2. Deactivate quick stop (X5/E1 =HIGH or X5/E2 =HIGH)
3. Enable the controller for some seconds and then inhibit it again.
4. Record the current flowing in motor phase U with the controller being enabled.
5. Set the gain V_p (C0075) in such a way that the current rises rapidly.
6. Reduce the reset time T_n (C0076) so much that the transient response shows almost no overshoot and an optimum rise is achieved.
7. After each change of C0075 and C0076, the time course of the motor current must be recorded and checked again.

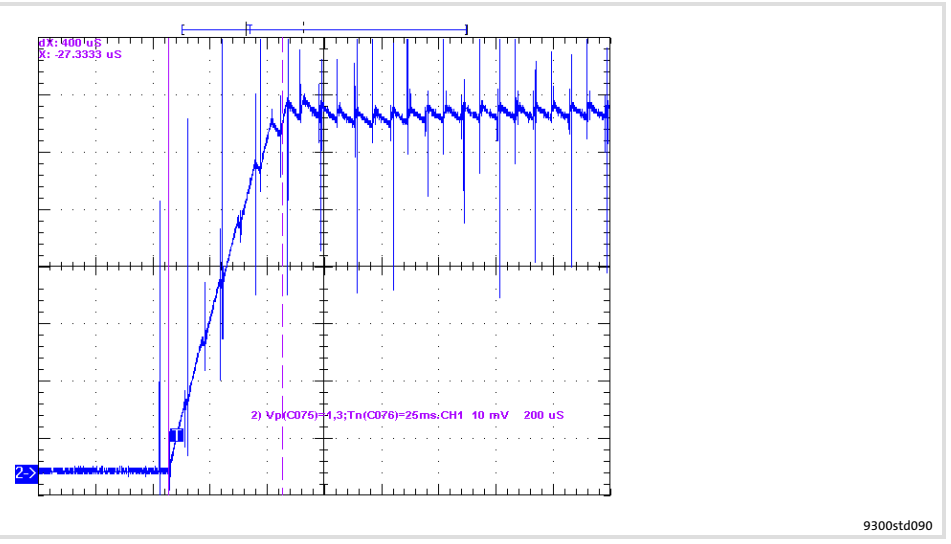


Fig. 6.7-1 Current characteristic for optimum controller adjustment
Time base 200 µs/DIV

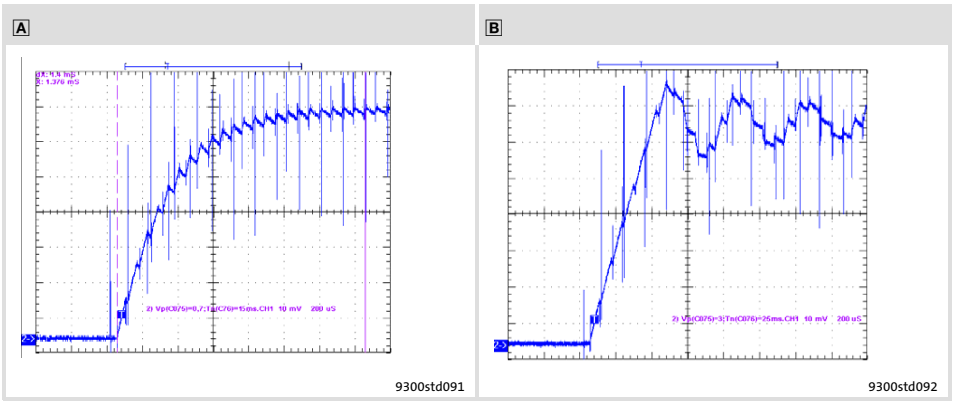


Fig. 6.7-2 Current characteristic for non-optimum controller adjustment

A Current rise of motor current too slow
Reset time T_n (C0076) too long and/or gain V_p (C0075) too small
Measured at time base 200 µs/DIV

B High-frequency oscillations of motor current, motor noises may occur
Reset time T_n (C0076) too short and/or gain V_p (C0075) too large
Measured at time base 200 µs/DIV

8. Check the transient response over a longer period of time (e.g. with time base 4000 µs/DIV). The motor current must reach the final steady-state value within the shortest possible time.

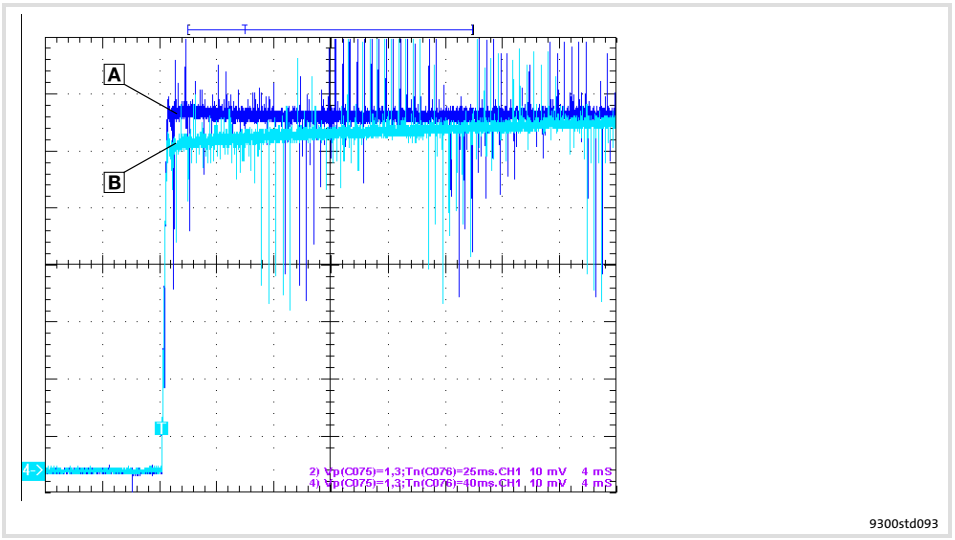


Fig. 6.7-3 Transient response of motor current over longer period of time

A Optimum transient response
B Final steady-state value is reached too slowly
Measured at time base 4000 µs/DIV

9. When the current controller adjustment is completed, reset the temporary settings:
   – Set the initial values again in C0006, C0022 and C0025. If necessary, reconnect the encoder cable to X8.
   – Connect the inputs MCTRL-M-ADD and MCTRL-N-SET with the initial signals.

6.8 Adjusting the rotor position

When is a rotor position adjustment required?

- A synchronous non-Lenze motor is used. The motor used is not included in GDC.
- Another encoder was mounted to the motor later on.
- A defective encoder was replaced.

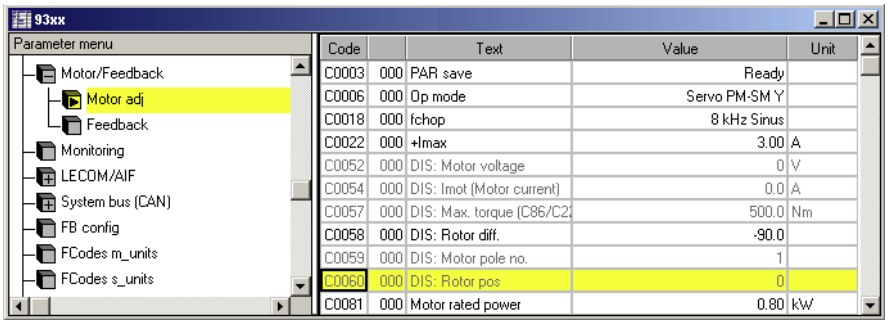
Note!

Only use single-pole resolvers or SinCos encoders (single-turn or multi-turn).

Preparatory work

- Inhibit the controller.
- Unload the motor mechanically.
  - Disconnect the motor from the gearbox/machine.
  - If necessary, remove toothed lock washers, gears, etc. from the motor shaft.
  - If necessary, support the holding torques provided by mounted motor brakes by means of locking devices.
- Deactivate the ”safe torque off” function so that the motor can be energised for the motor pole angle adjustment.
- Release the holding brake (if available).
- Adjust the current controller (see chapter ”Current controller adjustment”).
- Check resolver polarity.
- Set C0006 = 3.
  - For carrying out a rotor position adjustment, a synchronous motor must be selected.

Resolver polarity check



9300std200

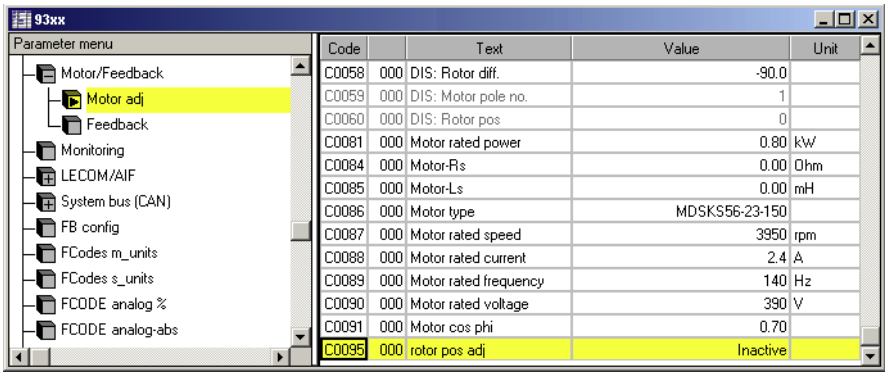
Fig. 6.8-1 ”Motor adj” menu of the parameter menu

Procedure

1. Inhibit the controller (X5/28 = LOW).
2. Disconnect the motor from the gearbox/machine.
3. Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
4. Turn the rotor to the right (when looking at the front end of the motor shaft). The value in C0060 must increase.
   - In C0060 the angle of rotation is displayed as a numerical value between 0 and 2047.

   Note!
   The actual value is only displayed if the selection cursor is placed on the code and [F6] is pressed.
5. If the value decreases, swap the signals at X7/6 and X7/7 (+SIN and -SIN).

Rotor position adjustment



9300std203

Fig. 6.8-2 ”Motor adj” menu of the parameter menu

Procedure

1. Inhibit controller (X5/28 = LOW).
2. Open the ”Parameter menu → Motor/feedback system → Motor setting” menu.
3. Select C0006 = 3.
   - A synchronous motor with feedback must be selected for pole position adjustment.
4. Click C0095 and activate the adjustment process by selecting C0095 = 1.
5. Enable controller (X5/28 = HIGH).
6. The position adjustment program of the controller is started.
   - The rotor rotates a full revolution in several steps.
   - Then C0095 is automatically set to 0.
7. C0058 displays the current rotor displacement angle.

   Note!
   - The current value will not be displayed until the bar cursor is on the code and [F6] is pressed.
   - For sin/cos encoders, C0058 always displays a value of 0 because the value is saved to the encoder.

Procedure	
8.	Inhibit controller (X5/28 = LOW).
9.	Reset C0006 to default setting if necessary.
10.	Click C0003 and save the setting by selecting C0003 = 1.
11.	Disconnect the mains and reconnect the motor to the machine.

Danger!

Uncontrolled movements of the drive after an ”Sd7” error in conjunction with absolute value encoders or in the case of a ”PL-TRIP” error.

If the rotor position adjustment was completed with an ”Sd7” or ”PL-TRIP” error (📖 9.3-1) it was not possible to assign the rotor position to the feedback system. In this case the drive may carry out uncontrolled movements after the controller has been enabled.

Possible consequences:

- ► Death or severe injuries.
- ► Destruction or damage to the machine.

Protective measures:

- ► Repeat rotor position adjustment (start with step 1).
- ► Check the wiring and the interference immunity of the encoder at X8.

6.9 Changing the assignment of the control terminals X5 and X6

Danger!

If you select a configuration in C0005, the signal assignment of the inputs and outputs will be overwritten with the corresponding basic assignment!

► Adapt the signal assignment to your wiring!

6.9.1 Free configuration of digital input signals

Description

► Internal digital signals can be freely linked with external digital signal sources. This serves to establish a freely configurable control of the drive controller.

– Digital inputs X5/E1 ... X5/E5

► A signal source can be linked with several targets. Ensure reasonable linkages for not activating functions that are mutually exclusive (e. g. linking a digital input with quick stop and DC injection braking at the same time).

Linking signals

The internal digital signal can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal digital signal.

Example

► C0787/2 =53 ⇨ signal source for JOG2 is terminal X5/E3

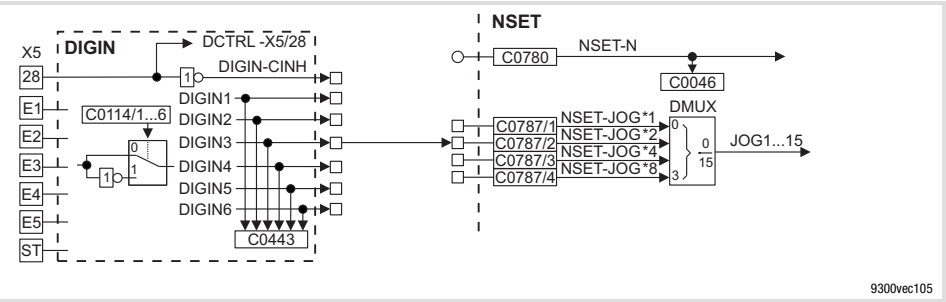


Fig. 6.9-1 Connecting digital signal JOG2 with terminal X5/E3

Tip!

► A list with all selection figures is included in the chapter ”Configuration” → ”Selection lists”.

► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Signal level

► Terminals (X5/E1 ... X5/E5):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0114 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/E1 ... X5/E5.

Example

► C0114/3 =1 ⇨ LOW level at X5/E3 activates JOG2

6.9.2 Free configuration of digital outputs

Description

► The digital outputs X5/A1 ... X5/A4 can be freely linked with internal digital signals.

► One signal source can be linked with several targets.

Linking signals

The digital outputs can be linked with internal digital signals by entering the selection figure of the internal signal into corresponding subcode of C0117.

Example

► C0117/2 = 505 ⇨ signal source for X5/A2 is the status message ”direction of rotation” (DCTRL-CW/CCW)

Signal level

► Terminals (X5/A1 ... X5/A4):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0118 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/A1 ... X5/A4.

Example

► C0118/2 =1 ⇨ With LOW level at X5/A2 the motor rotates in CW direction (with in-phase motor connection)

6.9.3 Free configuration of analog input signals

Description

- Internal analog signals can be freely linked with external analog signal sources:
  – Analog inputs X3/1, X3/2 and X3/3, X3/4
- One signal source can be linked with several targets.

Linking signals

The internal analog signals can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal analog signal.

Example

- C0780 = 50 ⇨ signal source for the main setpoint (NSET-N) is terminal X6/1, X6/2

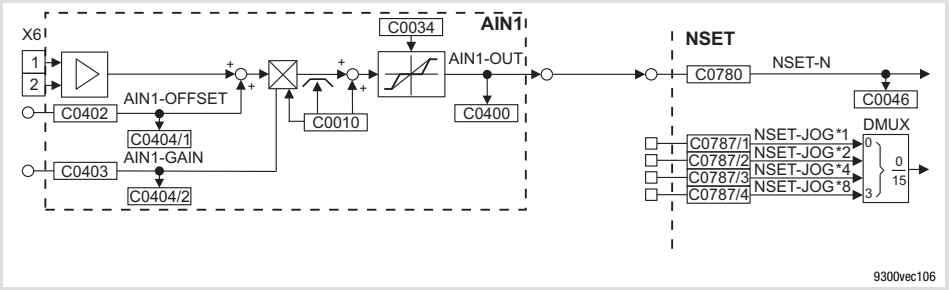


Fig. 6.9-2 Linking analog signal NSET-N with terminal X6/1, X6/2

Tip!

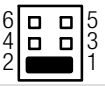
- A list with all selection figures is included in the chapter "Configuration" → "Selection lists".
- For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Gain and offset

Set gain (C0027) and offset (C0026) to adapt the input signal to the application.

Input range of X6/1, X6/2

Input range	C0034	Position of jumper at X3
-10 V ... +10 V	C0034 = 0	
+4 mA ... +20 mA	C0034 = 1	
-20 mA ... +20 mA	C0034 = 2	

Note!

Different settings in C0034 and of X3 result in a wrong input signal.

6.9.4 Free configuration of analog outputs

Description

- ► The analog outputs (X6/62, X6/63) can be freely linked with internal analog process or monitoring signals. The controller outputs a voltage proportional to the internal signal at the analog outputs.
- ► One signal source can be linked with several targets.

Linking signals

Analog outputs can be linked with internal analog signals by entering the selection figure of the internal signal into the code of C0431 (AOUT1, X6/62) or C0436 (AOUT2, X6/63).

Example

- ► C0436 = 5006 ⇨ signal source for X6/63 is the actual motor voltage

Tip!

- ► A list with all selection figures is included in the chapter "Configuration" → "Selection lists".
- ► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Set gain (C0108) and offset (C0109) to adapt the output signal to the application.

With an internal signal of 100 % and a gain of 1, a voltage of 10 V is output at the terminal.

7 Parameter setting

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7.1 Important notes

Adapting the controller functions to the application

The controller functions can be adapted to your applications by means of parameterisation. You can either parameterise via keypad, PC or via the parameter channel of a bus system.

The function library contains a detailed description of the functions, the signal flow diagrams contain all configurable signals.

Parameters and codes

The parameters for the functions are stored in numbered codes:

- Codes are marked in the text with a ”C” (e.g. C0002).
- The code table provides a quick overview of all codes. The codes are sorted according to their numbers and can be used as reference. (📖 8.4-1)

Parameter setting via keypad

A quick parameter setting is provided by the keypad XT. Moreover, it serves as status display, error diagnosis and transfer of parameters to other drive controllers.

	Keypad XT EMZ9371BC
Can be used with	8200 vector, 8200 motec, starttec, Drive PLC, 9300 vector, 9300 servo
Operator buttons	8
Plain text display	yes
Menu structure	yes
Configurable menu (“user menu”)	yes
Predefined basic configurations	yes
Non-volatile memory for parameter transfer	yes
Password protection	yes
Diagnosis terminal	Keypad XT in handheld design, IP 20 (E82ZBBXC)
Installation in control cabinet	no
Type of protection	IP 20
Detailed description	📖 7.2-1

Parameter setting via PC

You need the parameter setting / operating software »Global Drive Control« (GDC) or »Global Drive Control easy« (GDC easy) and an interface for communication:

- ► Interface for system bus (CAN) (preset in GDC):
  - – PC system bus adapter
- ► Serial interface for LECOM:
  - – Communication module LECOM-A/B (RS232/RS485) EMF2102IB-V001

The parameter setting /operating software of the Global Drive Control family are easy-to-understand and tools for the operation, parameter setting and diagnostics or Lenze drive controllers.

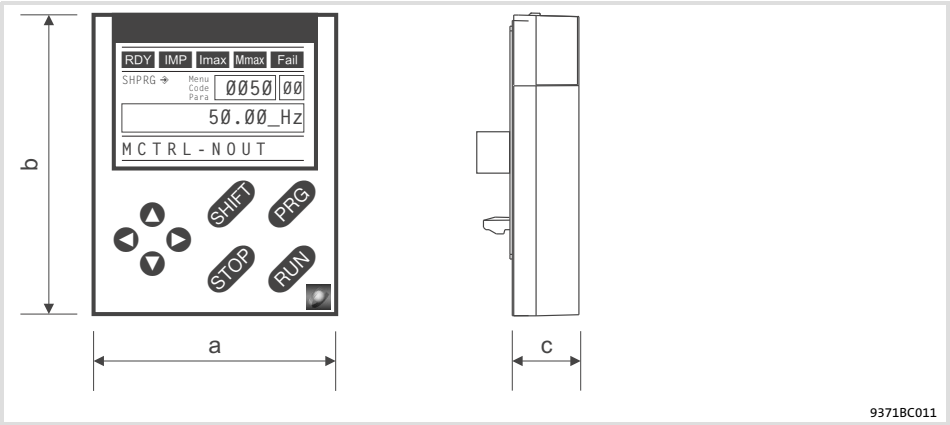
	GDC easy ESP-GDC2-E	**GDC ESP-GDC2**
Supply	Free download from the internet at www.lenze.com	Program package must be charged for
Operation in interactive mode	yes	yes
Comprehensive help functions	yes	yes
Menu ”Short setup”	yes	yes
Monitor windows for displaying operating parameters and for diagnostic purposes	yes	yes
Saving and printing of parameter settings as code list	yes	yes
Loading of parameter files from the controller to the PC	yes	yes
Storing of parameter files from the PC in the controller	yes	yes
Function block editor	no	yes
Technology functions for 9300 Servo	no	yes
Oscilloscope function for 9300 Servo and 9300 vector	no	yes
Detailed description	Online help of the program	Online help of the program

Parameter setting via bus system

Detailed information can be found in the documentation of the corresponding bus system.

7.2 Parameter setting with the XT EMZ9371BC keypad

7.2.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm
Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)
Enclosure		IP 20

7.2.2 Installation and commissioning

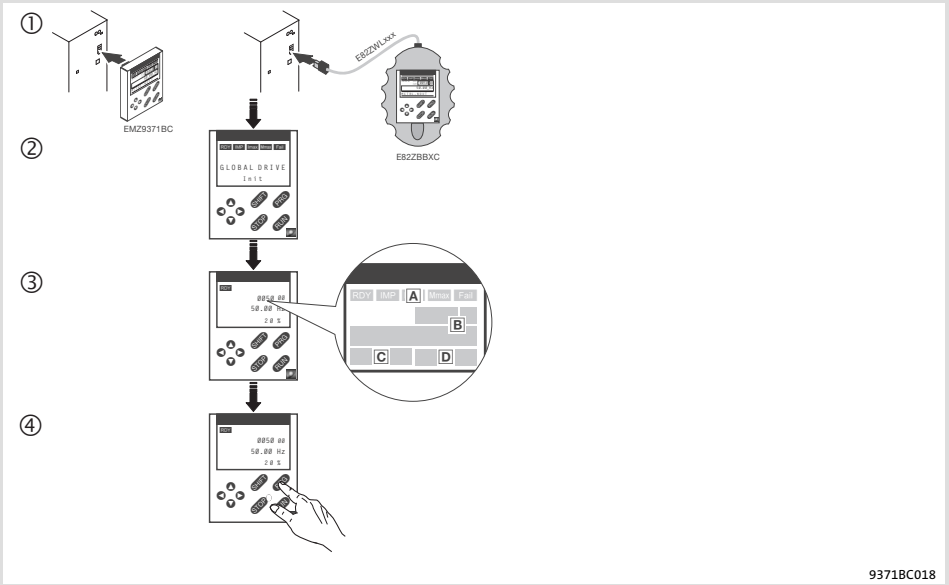


Fig. 7.2-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

- A Current state of the standard device
- B Memory location 1 of the user menu (C0517):
  Code number, subcode number, and current value
- C Active fault message or additional status message
- D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

7.2.3 Display elements and function keys

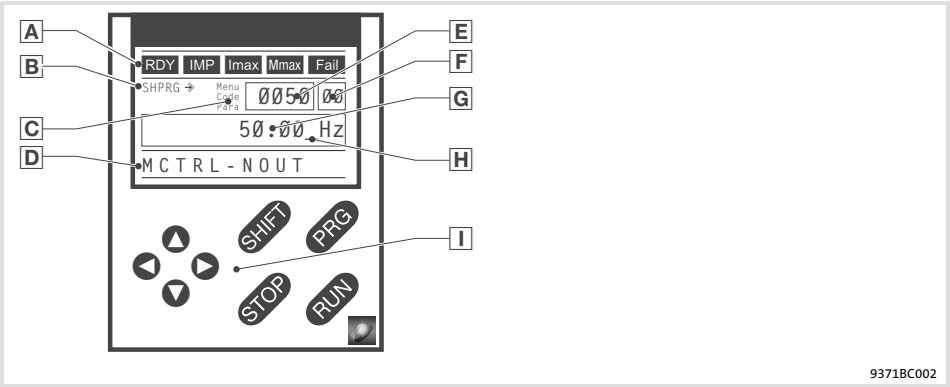


Fig. 7.2-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	**Status displays of standard device**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	
	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:
Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	**Code level**	**Parameter level**	**Operating level**
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations [1)]		Accept parameters when SHPRG → or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset):	1. Remove the cause of malfunction 2. Press STOP 3. Press RUN		

1) Only active for operation with standard devices of the 8200 vector or 8200 motec series

7.2.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG ⇢		SHIFT PRG	Confirm change to accept the parameter Display ”OK”
	Display ⇢		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the ”loop” with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to the parameter level Display ”0” and ”READY”
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set ”1” ”Save PS1”
				Save as parameter set 2: ⇨ Set ”2” ”Save PS2”
				Save as parameter set 3: ⇨ Set ”3” ”Save PS3”
				Save as parameter set 4: ⇨ Set ”4” ”Save PS4”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved in the selected parameter set.

Step			Key sequence	Action
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

1) The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

7.2.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

7.2.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ► ◄	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT + PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step			Key sequence	Action
1.	Connect the keypad to standard device 2			
2.	Inhibit controller			Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6			All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu		▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level		PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function			The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.			● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 7.2-7
			▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.			
			▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
				Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
				Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
				Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying		SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.		▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6			
11.	Enable controller			Terminal X5/28 = HIGH The drive is running with the new settings.

7.2.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the "USER menu"		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 "MCTRL-NACT"
3.	Select C0094		▲	Display of code C0094 "Password"
4.	Change to the parameter level		PRG	Display "0" = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"
7.	Change to the "USER menu"		◀ ◀ ▼	
The password protection is active now. You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.				

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 "Password"
3.	Change to the parameter level		PRG	Display "9999" = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"
The password protection is deactivated now. All menus can be freely accessed again.				

7.2.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

► monitoring the drive

► fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

7.2.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	**Display**	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

Main menu	Submenus	Description
Display	**Display**	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

8 Configuration

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8.1 Important notes

The chapter ”Configuration” consists of two parts.

System Manual

Contents of the chapter ”Configuration” in the System Manual:

- ► Monitoring
- ► Monitoring functions
- ► Code table
- ► Selection lists
- ► Table of attributes

System Manual (Extension)

Contents of the chapter ”Configuration” in the System Manual (Extension):

- ► Configuring with Global Drive Control (GDC)
- ► Basic configurations
- ► Operating modes

8.2 Monitoring

Different monitoring functions (📖 8.31) protect the drive system from impermissible operating conditions.

If a monitoring function responds,

► the set fault response is triggered to protect the drive and

► the fault message is entered position 1 in the fault history buffer (C0168/x, in case of ECSxP: C4168/x) (📖 9.2-1).

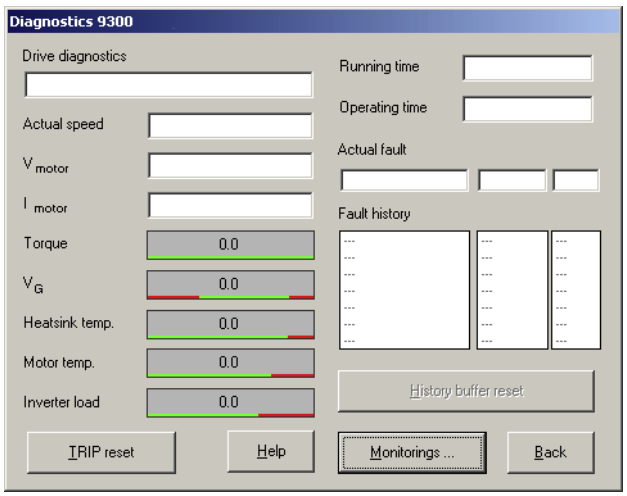
8.2.1 Fault responses

Depending on the failure, one or more of the following responses are possible:

Response	Effects on the drive and controller		Danger warnings
TRIP (highest priority)	● Switches the power outputs U, V, W to a high resistance until TRIP is reset ● The drive coasts (no control!). ● After TRIP reset, the drive accelerates to its setpoint on the ramps set.		
Message	Switches the power outputs U, V, W to a high resistance as long as the message is active.		**Danger!** The drive restarts automatically if the message is no longer available.
	● Short-time message ≤ 0.5 s	The drive coasts (no control) as long as the message is active. If the message is no longer available, the drive accelerates to its setpoint with maximum torque.	
	● Longer message > 0.5 s	The drive coasts (due to internal controller inhibit) as long as the message is active. If required, restart the drive.	
Warning	● Only display of the failure. ● The drive operates in a controlled manner.		**Stop!** As these responses have no effect on the drive behaviour, the drive can be destroyed.
Off	● No response on failures! Monitoring is deactivated.		

8.2.2 Setting of responses

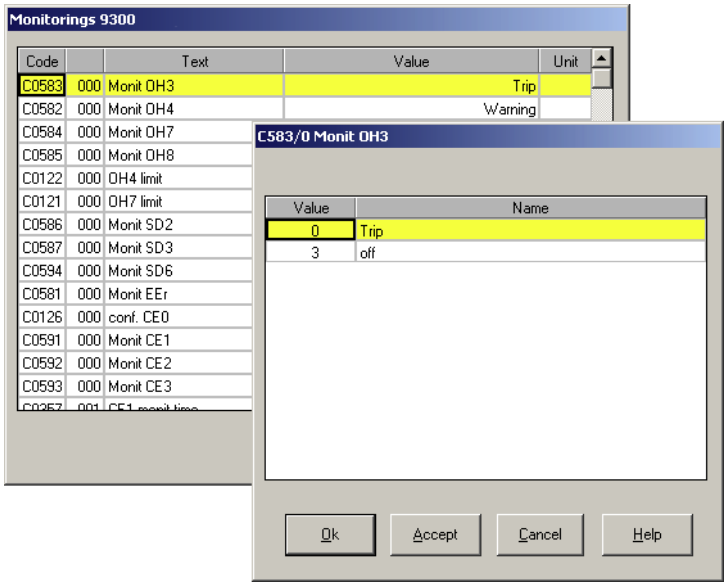
► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 8.2-1 ”Diagnostics” dialog box

► Click on the ”Monitorings” button.



9300std233

Fig. 8.2-2 ”Monitorings” dialog box

1. Click on a monitoring option. The configuration dialog box opens.
2. Select the desired response and confirm with ”OK”.

8.2.3 Monitoring times for process data input objects

Each process data input object can monitor whether a telegram has been received within a time set. As soon as a telegram arrives, the corresponding monitoring time (C0357) is restarted (”retriggerable monoflop” function).

The following assignments are valid:

Setting the response to the monitoring:

► C0591 for CAN1_IN (”CE1”)

► C0592 for CAN2_IN (”CE2”)

► C0593 for CAN3_IN (”CE3”)

The following can be set:

► 0 = error (TRIP) - controller sets controller inhibit (CINH)

► 2 = warning

► 3 = monitoring is switched off

You can also use the signals as binary output signals, e. g. for the assignment of the output terminal.

Bus off

If the controller disconnects from the CAN bus due to faulty telegrams, the ”BusOffState” (CE4) signal is set.

”BusOffState” can trigger an error (TRIP) or warning (like CE1, CE2, CE3). You can also switch the signal off. The response is set via C0595. You can also assign the terminal output.

Reset node

Changes with regard to the baud rates, the CAN node addresses, or the addresses of process data objects are only valid after a reset node.

The reset node can be effected by:

► A reconnection of the low-voltage supply

► Reset node via the bus system

► Reset node via C0358

8.2.4 Maximum speed

Stop!

Destruction of the drive!

- ► If the fault is triggered, the drive is without torque.
- ► In the event of an actual speed value encoder failure it is not guaranteed that the monitoring responds.

Protective measures:

- ► Use a mechanical brake if necessary.
- ► Special, system-specific measures are to be taken.

The NMAX fault is triggered if the system speed (MCTRL-NACT)

- ► exceeds the value set under C0596 or
- ► exceeds the maximum speed n_{max} (C0011) by twice the max. speed value.

A fault initiates TRIP NMAX. Other responses cannot be set.

8.2.5 Motor

Overcurrent in the motor cable (OC1)

Fault OC1 is triggered if the motor current exceeds the 2.25-fold rated controller current.

If a fault occurs, TRIP OC1 is triggered. Other responses cannot be set.

Earth fault in the motor cable (OC2)

The OC2 fault is triggered if

- ► the motor has a short circuit to the frame,
- ► one of the phases has a short circuit to the shield,
- ► one of the phases has a short circuit to PE,
- ► the capacitive charging current of the motor cable is too high.

A fault initiates TRIP OC2. Other responses cannot be set.

Failure of a motor phase (LP1)

If a current-carrying motor phase fails, a motor winding is broken or the current limit value set in C0599 is too high, the LP1 fault is triggered.

The monitoring is not appropriate for field frequencies > 480 Hz and when synchronous servo motors are used. Deactivate the monitoring at these conditions.

The response to exceeding the thresholds can be set under C0597.

Note!

The monitoring can only be activated if the function block MLP1 is entered in the processing table (C0465).

8.2.6 Controller current load (I x t monitoring)

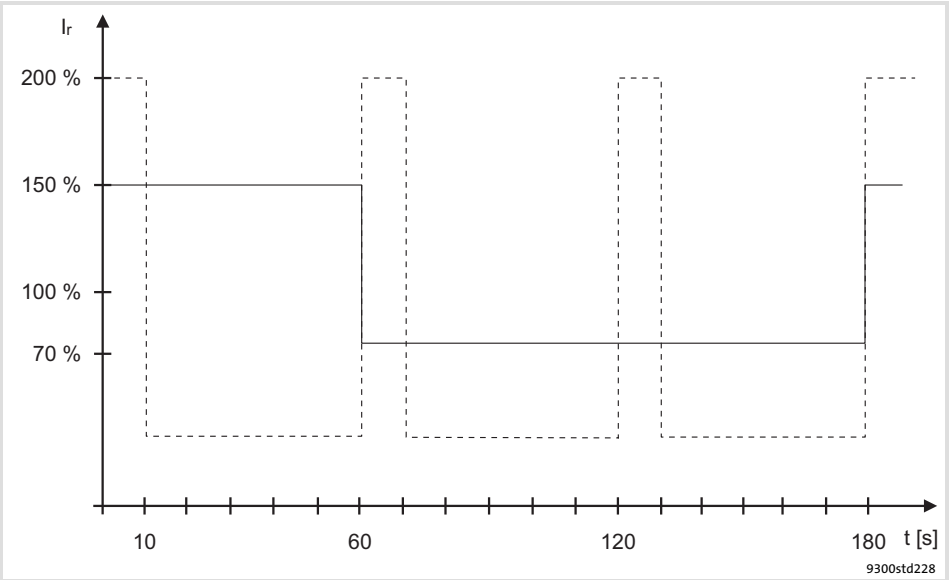


Fig. 8.2-3 I × t diagram

I_r	Device output current
———	100 % continuous thermal current at C0022 ≤ 1.5 I_r
- - - - - -	70 % continuous thermal current at C0022 > 1.5 I_r

The I × t monitoring monitors the current load of the controller. The current load is calculated from the mean value of the motor current over the acquisition period of 180 s.

The monitoring is set in such a way that the following operation modes are possible:

► Continuously with device output current = I_r.

► ≤ 60 s with device output current ≤ 1.5 x I_r.

A fault initiates TRIP OC5. Other responses cannot be set.

8.2.7 Motor temperature

KTY at X7 or X8

The motor temperature is monitored by means of a KTY. Connect the thermal sensor to the resolver cable at X7 or the encoder cable at X8.

► Warning threshold (OH7) can be set via C0121
  – The switch-on point is 5 °C below the threshold set.

► Fixed warning threshold (OH3) = 150 °C
  – The switch-on point is 135 °C.

The response for the case when the thresholds are exceeded can be defined in:

► C0584 (adjustable threshold)

► C0583 (fixed threshold)

Stop!

With the setting C0583 = 3, monitoring is deactivated. The motor temperature in C0063 shows 0 °C, even if C0584 = 2 (warning) is set.

Monitoring of the KTY at X7 or X8

The SD6 fault is triggered if there is a short or open circuit between X7/8 and X7/9 or X8/5 and X8/8.

The response can be set under C0594.

PTC thermistor or thermal contact (NC contact) at T1, T2

The motor temperature is monitored with a PTC thermistor or thermal contact. Wire the temperature sensor to T1, T2.

► Fixed warning threshold (OH8)
  – The switch-off threshold and the hysteresis depend on the temperature sensor (DIN 44081).

The response to exceeding the threshold can be set under C0585.

Stop!

Motor could be destroyed!

► If the responses ”Warning” or ”Off” are set, the motor could be destroyed by overload.

Protective measure:

► Set the response ”TRIP”.

8.2.8 Current load of motor (I^2 x t monitoring: OC6, OC8)

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

8.2.8.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

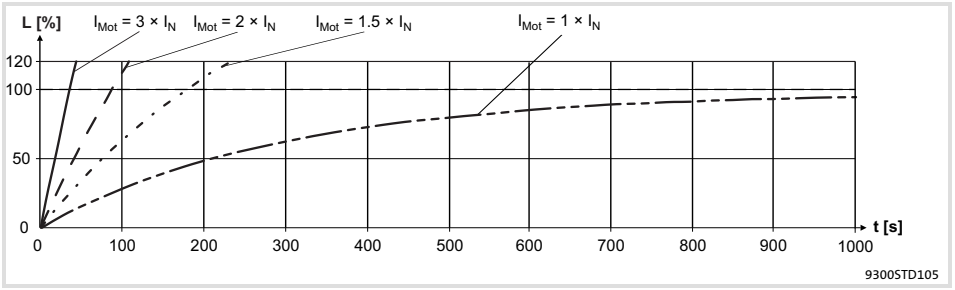


Fig. 8.2-4 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L I^2 x t load of the motor (display: C0066)
T Time

8.2.8.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

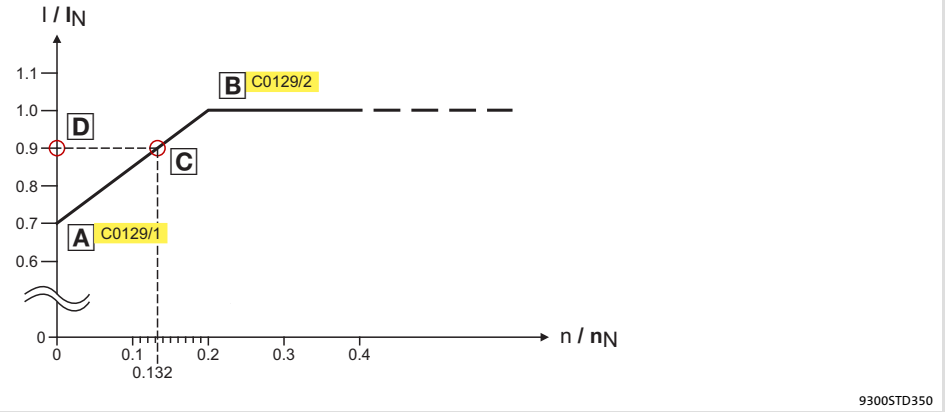


Fig. 8.2-5 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 8.2-5) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

► Point A: Definition with **C0129/1**

This value also enables an increase of the maximally permissible load.

► Point B: Definition with **C0129/2**

With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 8.2-5, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1** and **C0129/2** (evaluation coefficient "y", 📖 8.2-10).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient ”y”).

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

8.2.9 Heatsink temperature

Via a temperature threshold, the heatsink temperature of the controller can be monitored:

- ► Adjustable threshold (OH4) under C0122
  - – The reset point is 5° C below the adjusted threshold.
- ► Fixed threshold (OH) = 85° C
  - – The reset point is at 80° C.

The response for exceeding the adjustable threshold can be set under C0582.

8.2.10 DC-bus voltage

In C0173 the mains voltage and the DC-bus voltage are set. The switching thresholds for overvoltage and undervoltage are based on these settings.

Selection C0173	Mains voltage [V AC]	Braking unit	Message LU (undervoltage) Set [V DC]	Message LU (undervoltage) Reset [V DC]	Message OU (overvoltage) Set [V DC]	Message OU (overvoltage) Reset [V DC]
0	< 400	Yes / no	285	430	770	755
1	400	Yes / no	285	430	770	755
2	400 ... 460	Yes / no	328	473	770	755
3	480	No	342	487	770	755
4	480	Yes	342	487	800	785

C0173 = 1: Lenze setting

Overvoltage

If the DC-bus voltage exceeds the upper switch-off threshold set in C0173, the OU message is triggered.

Undervoltage

If the DC-bus voltage falls below the lower switch-off threshold set in C0173, the LU message is triggered.

- ► An undervoltage message > 3 seconds is interpreted as an operating state (e.g. mains switched off) and entered in the history buffer. The entry is, however, deleted as soon as the cause has been eliminated (e.g. mains switched on again).

  This operating state can occur if the control module is already supplied externally via terminals X5/39 and X5/59, but the mains voltage is not yet switched on.
- ► An undervoltage message < 3 seconds is interpreted as a fault (e.g. mains fault), entered in the history buffer and saved.

8.2.11 External error (EEr)

A HIGH signal at DCTRL-TRIP-SET triggers the EEr fault.

You can, for example, connect the digital input DCTRL-TRIP-SET with an input terminal (X5/Ex). In this way an external encoder can trigger the EEr fault.

The response can be set under C0581.

8.3 Overview of monitoring functions

The responses of monitoring functions can be partly parameterised via codes – in GDC in the parameter menu under **Monitoring** –.

Monitoring				Possible responses ● Lenze setting ✓ Setting possible				
Error message		**Description**	**Source**	CoDe	TRIP	Message	Warning	Off
0071	CCr	System fault	Internal		●			
x091	EEr	External monitoring (activated via DCTRL)	FWM	C0581	●	✓	✓	✓
Voltage supply								
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●		
1030	LU	Undervoltage in the DC bus (C0173)	MCTRL			●		
0107	H07	Internal fault (power section)	Internal		●			
Communication								
x061	CE0	Communication error on the automation interface (AIF)	AIF	C0126	✓		✓	●
x062	CE1	Communication error at process data input object CAN1_IN (monitoring time can be set with C0357/1)	CAN1_IN	C0591	✓		✓	●
x063	CE2	Communication error at process data input object CAN2_IN (monitoring time can be set with C0357/2)	CAN2_IN	C0592	✓		✓	●
x064	CE3	Communication error at process data input object CAN3_IN (monitoring time can be set with C0357/3)	CAN3_IN	C0593	✓		✓	●
x065	CE4	BUS-OFF state of the system bus (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓	●
x166	P16	Incorrect transmission of the sync telegram (CAN system bus)	Internal	C1290	✓		✓	●
Temperatures / sensors								
0050	OH	Heatsink temperature > 85° C	MCTRL		●			
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	✓		✓	●
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582			●	✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584			●	✓
x058	OH8	Motor temperature across inputs T1 and T2 is too high. **Please note: In the case of "Warning" (C0585 = 2) or "Off" (C0585 = 3), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0585	✓		✓	●
x086	Sd6	Thermal sensor error at motor (X7 or X8)	MCTRL	C0594	✓		✓	●
x110	H10	Thermal sensor error at heatsink	FWM	C0588	●		1)	1)
x111	H11	Thermal sensor error in the device interior	FWM	C0588	●		1)	1)
Motor / feedback system								
0011	OC1	Motor cable overcurrent	MCTRL		●			
0012	OC2	Motor cable earth fault	MCTRL		●			

Monitoring				Possible responses ● Lenze setting ✓ Setting possible				
Error message		**Description**	**Source**	CoDe	TRIP	Message	Warning	Off
0015	OC5	I x t overload	MCTRL		●			
0016	OC6	I^2 x t overload	MCTRL		●			
0018	OC8	I^2 x t overload advance warning	MCTRL	C0606	✓		●	✓
x032	LP1	Motor phase failure (current limit can be set in C0599) **Please note: Can only be used for asynchronous motors. The function block MLP1 has to be entered in C0465.**	MCTRL	C0597	✓		✓	●
x082	Sd2	Resolver error at X7 **Please note: If "Warning" (C0586 = 2) is displayed, the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0586	●		✓	✓
x083	Sd3	Interruption of the digital frequency coupling. The input signal "Lamp Control" at X9/8 is LOW **Please note: In the case of "Warning" (C0587 = 2), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0587	●		✓	✓
x085	Sd5	At analog input X6/1, X6/2, the input current is < 2 mA Monitoring only possible if C0034 = 1	MCTRL	C0598	✓		✓	●
x087	Sd7	Absolute value encoder error at X8	MCTRL		●			
x088	Sd8	SinCos encoder error at X8 (filter setting in C0575)	MCTRL	C0580	✓			●
Speed								
x190	nErr	Speed control error (speed window can be set in C0576)	MCTRL	C0579	✓			●
0200	NMAX	Maximum speed (C0596) has been exceeded.	MCTRL		●			
Time-out / overflow								
0105	H05	Intern fault (memory)	Internal		●			
x153	P03	Following error (digital frequency > C0255)	Internal	C0589	✓		●	✓
x163	P13	Overflow of the angle controller	Internal	C0590	●		✓	✓
x169	P19	Input signal at X9 is limited	Internal	C1292	✓		●	✓
Parameter setting								
0072	PR1	Checksum error in parameter set 1	Internal		●			
0074	PEr	Program error	Internal		●			
0075	PR0	Error in the parameter sets	Internal		●			
0079	PI	Fault during the parameter initialisation	Internal		●			
x089	PL	Error during rotor position adjustment	Internal		●			

Representation of the error number:
x 0 = TRIP, 1 = message, 2 = warning
E. g. "2091": An external monitoring has triggered EEr warning

1) Setting only permitted by Lenze service

8.4 Code table

How to read the code table

Column	Abbreviation		Meaning	
Code	Cxxxx		Code Cxxxx	• Parameter value of the code can be defined differently for each parameter set • Parameter value is accepted immediately (ONLINE)
	1		Subcode 1 of Cxxxx	
	2		Subcode 2 of Cxxxx	
	ENTER		Changed parameter of code or subcode is accepted after pressing SHIFT PRG	
	STOP		Changed parameter of code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited	
Designation			Designation of the code	
Lenze			Lenze setting (value at delivery or after restoring the delivery status with C0002)	
	→		The column "IMPORTANT" contains additional information	
	Disp		The code only displays a value. It cannot be configured.	
Selection	1	{%} 99	Min. value {unit} max. value	
IMPORTANT	-		Short, important explanation	

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0002 STOP	PAR LOAD	0		**Load parameter set**
			0 Default setting	Restore delivery status
			1 Load parameter set 1 2 Load parameter set 2 3 Load parameter set 3 4 Load parameter set 4	Load and activate parameter set saved in the controller • Parameter set 1 is loaded automatically after every mains connection.
			11 Load parameter set 1externally 12 Load parameter set 2 externally 13 Load parameter set 3 externally 14 Load parameter set 4externally	Load parameter set from the keypad in the controllerand activate it
			20	Load all parameter sets from the keypad in the EEPROM of the controller. • The current parameter set in the RAM of the controller is overwritten. Save the parameter set.
C0003	PAR SAVE	0		**Save parameter set**
			0 Executed	Saving completed
			1 Save parameter set 1 2 Save parameter set 2 3 Save parameter set 3 4 Save parameter set 4	Save the parameters loaded in the controller in the parameter set selected
			11 Save all parameter sets into keypad	Copying parameter sets from the standard device into the keypad XT
C0004	OP DISPLAY	56	0 {1} 1999	**Status display** Keypad shows selected code in the operating level if no other status messages from C0183 are active

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0005 STOP	SIGNAL CFG	1000			**Signal configuration** (predefined basic configurations)
			0	COMMON	Modified basic configuration
			1 2 11	86xx -1- 86xx -2- 86xx -11-	Compatible to 86xx frequency inverter
			20 21	922x -20- 922x -21-	Compatible to 922xx frequency inverter
C0005 STOP	SIGNAL CFG	1000	100	empty	All internal links are deleted
			1000	Speed control	The **first** digit indicates the predefined basic function, e. g.: ● 1xxx: Speed control ● 4xxx: Torque control with speed limitation The **second** digit indicates additional functions x0xx: No additional function x1xx: Brake control x9xx: In the case of quick stop, the complete drive system is brought to zero speed in a phase-controlled manner The **third** digit indicates the predefined voltage source for the control terminals: ● xx0x: External supply voltage ● xx1x: Internal supply voltage The fourth digit indicates the predefined device control: ● xxx0: Terminal control ● xxx1: RS232, RS485 or optical fibre ● xxx3: INTERBUS or PROFIBUS-DP ● xxx5: System bus (CAN)
			4000	Torque control with speed limitation	
			5000	Master for digital frequency coupling	
			6000	Slave to digital frequency bus	
			7000	Slave to digital frequency cascade	
C0006 STOP	OP MODE	→			**Motor control operation**
			1	SSC norm Y sensorless star standard motor	→ Depending on C0086 ● Change of C0086 resets value to the assigned default setting ● Change of C0006 sets C0086 = 0!
			2	Servo async. Y asynchronous motor, star	
			3	Servo PM-SM Y PM synchronous motor, star	
			11	SSC standard motor sensorless standard motor, delta	
			22	Servo asyn asychronous motor, delta	
C0009	LECOM ADDRESS	1	1 {1} 99		**LECOM device address** Bus device number when operated via interface ● 10, 20, ..., 90 reserved for broadcast to device groups for RS232, RS485, fibre optics.
C0011	NMAX	3000	500 {1 rpm} 16000		**Max speed N_{max}** Reference value for the absolute and relative setpoint selection for the acceleration and deceleration times. ● Parameter setting via interface: – Greater changes in one step should only be made when the controller is inhibited.

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0012	TIR (ACC)	0.000	0.000	{0.001 s}	999.900	**NSET** Acceleration time T_{ir} for the main setpoint of NSET (related to the speed variation 0 ... n_{max})
C0013	TIF (DEC)	0.000	0.000	{0.001 s}	999.900	NSET Deceleration time T_{if} for the main setpoint of NSET (related to the speed variation n_{max} ... 0)
C0017	FCODE (QMIN)	50	-16000	{1 rpm}	16000	**FCODE (Q_{min})** Switching threshold $n_{act.} < n_x$ n_{act} < C0017 activates the comparator output CMP1-OUT
C0018	FCHOP	1				**Chopper frequency f_{chop}**
			0	16/8 kHz		Noise optimised operation with automatic changeover to 8 kHz
			1	8 kHz sine		Noise optimised operation
			2	16 kHz sine		
C0019	THRESH NACT=0	0	0	{1 rpm}	16000	**Threshold n_{act} =0** Threshold is recognised at n_{act} = 0
C0021	SLIPCOMP	0.00	0.00	{0.01 %}	20.00	**Slip compensation** ● Only active with sensorless control below the value of C0291
C0022	IMAX CURRENT	→	0	{0.01 A}	1.50 I_N	**I_{max} limit current** → Depending on C0086 ● Change of C0086 resets value to the assigned factory setting (1.5×Imotor)
C0025 STOP	FEEDBACK TYPE	10				**Feedback** Input of the encoder specified on the nameplate of the Lenze motor: C0025 automatically changes C0420, C0490, C0495
			0	COMMON		C0420, C0490 or C0495 was changed subsequently
			1	Without feedback		Control without feedback system (sensorless control, SSC)
			10	RSx (Resolver)		The resolver is designated with RSxxxxxxxx. If a resolver is selected, the rotor displacement angle in C0058 is set to -90°.
			110	IT-512-5V		Incremental encoder with TTL level
			111	IT-1024-5V		
			112	IT-2048-5V		
			113	IT-4096-5V		
			210	IS-512-5V		Sin/cos encoder
			211	IS-1024-5V		
			212	IS-2048-5V		
			213	IS-4096-5V		
			309	AS-128-8V SKS		Single-turn SinCos encoder with RS485 interface Co. Stegmann (absolute value encoder) ● Enter the supply voltage in C0421.
			310	AS-512-8V SCS		
			311	AS-1024-8V SRS		
			409	AM-128-8V SKM		Multi-turn SinCos encoder with RS485 interface Co. Stegmann (absolute value encoder) ● Enter the supply voltage in C0421.
			410	AM-512-8V SCM		
			411	AM-1024-8V SRM		
						If an absolute value encoder is selected, an SD7 trip is triggered.

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0026			-199.99	{0.01 %}	199.99	**FCODE (AIN offset)** Freely configurable code for relative analog signals ● Used for: – Offset for terminal X6/1,2 – Offset for terminal X6/3,4
1	FCODE (OFFSET)	0.00				
2	FCODE (OFFSET)	0.00				
C0027			-199.99	{0.01 %}	199.99	**FCODE (AIN gain)** Freely configurable code for relative analog signals ● Used for: – Gain X6/1,2 – Gain X6/3,4
1	FCODE (GAIN)	100.00				
2	FCODE (GAIN)	100.00				
C0030	DFOUT CONST	3	0 1 2 3 4 5 6	256 inc/revolution 512 inc/revolution 1024 inc/revolution 2048 inc/revolution 4096 inc/revolution 8192 inc/revolution 16384 inc/revolution		**DFOUT constant** Constant for the digital frequency output in increments per revolution
C0032	FCODE GEARBOX	1	-32767	{1}	32767	**FCODE (gearbox factor numerator)** Freely configurable code
C0033	GEARBOX DENOM	1	1	{1}	32767	**Gearbox factor denominator**
C0034	MST CURRENT	0	0 1 2	-10 V ... + 10 V +4 mA ... +20 mA -20 mA ... +20 mA		**AIN input signal** Selection of the input signal for X6/1, X6/2
C0037	SET-VALUE RPM	0	-16000	{1 rpm}	16000	**Setpoint selection (rpm)**
C0039			-199.99	{0.01 %}	199.99	**NSET JOG setpoints** Fixed speeds (JOG setpoints) can be selected for NSET using digital inputs.
1	JOG SET-VALUE	100.00				
2	JOG SET-VALUE	75.00				
3	JOG SET-VALUE	50.00				
4	JOG SET-VALUE	25.00				
5	JOG SET-VALUE	0.00				
...	...	...				
14	JOG SET-VALUE	0.00				
15	JOG SET-VALUE	0.00				
C0040	CTRL ENABLE	1	0 1	Controller inhibited Controller enabled		**RFR controller enable**
C0042	QSP	Disp	1 2	QSP: Not active QSP: Active		**Quick stop**
C0043	TRIP RESET	0	0 1	TRIP RESET Active fault		**Reset fault** Reset of an active trip: ● Set C0043 = 0
C0045	ACT JOG	Disp	0 1 2 ... 15	Nset is active JOG 1 JOG 2 ... JOG 15		**NSET** JOG selection
C0046	NSET-N	Disp	-199.99	{0.01 %}	199.99	**NSET** Main setpoint
C0049	NSET-NADD	Disp	-199.99	{0.01 %}	199.99	**NSET** Additional setpoint
C0050	MCTRL-NSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL** n_{set} at speed controller input

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0051	MCTRL-NACT	Disp	-30000	{1 rpm}	30000	**Actual speed**
C0052	MCTRL-UMOT	Disp	0	{1 V}	800	**Motor voltage**
C0053	UG-VOLTAGE	Disp	0	{1 V}	900	**DC-bus voltage**
C0054	IMOT	Disp	0.0	{0.1 A}	300.0	**Current motor current I_{mot}** **MCTRLfunction block** ● Read only ● MCTRL-IACT = 100 % = C0022
C0056	MCTRL-MSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL-MSET2 (Mset)** Torque setpoint (n-controller output)
C0057	MAX TORQUE	Disp	0	{1 Nm}	500	**Maximum torque** Maximum possible torque of the drive configuration ● Depending on C0022, C0086
C0058	ROTOR DIFF	-90.0	-180.0	{0.1 °}	179.9	**Rotor displacement angle of motor (offset angle)** Zero phase of the rotor for synchronous motors (C0095). If a resolver is selected in C0025 or C0490, C0058 is set to -90°. ● Lenze motor with resolver: C0058 = -90° ● Lenze motor with absolute value encoder: C0058 = 0°
C0059	MOT POLE NO.	Disp	1	{1}	50	**Number of motor pole pairs**
C0060	ROTOR POS	Disp	0	{1}	2048	**Motor rotor position** ● 1 revolution = 2048 inc
C0061	HEATSINK TEMP	Disp	0	{1 °C}	100	**Heatsink temperature**
C0063	MOT TEMP	Disp	0	{1 °C}	200	**Motor temperature**
C0064	UTILIZATION	Disp	0	{1 %}	150	**Device utilisation I × t** of the last 180 s ● C0064 >100 % releases trip OC5 ● Trip reset is only possible if C0064 < 95 %
C0066	MOTOR LOAD	Disp	0	{1 %}	250	**I^2 × t utilisation of the motor**
C0067	ACT TRIP	Disp	All fault messages		→ Selection list 10	**Trip error message** Current fault message
C0070	VP SPEED CTRL	→	0.0	{0.5}	255.0	**V_{pn} speed controller** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0071	TN SPEED CTRL	→	1.0	{0.5 ms}	600.0	**T_{nn} speed controller** At >512 ms the function is deactivated → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0072	TD SPEED CTRL	0.0	0.0	{0.1 ms}	32.0	**T_{dn} speed controller**
C0075	VP CURR CTRL	0.35	0.00	{0.01}	15.99	**V_{pi} current controller** ● Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0076	TN CURR CTRL	1.8	0.5	{0.1 ms}	2000.0	**T_{ni} current controller** At 2000 ms the function is deactivated ● Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0077	VP FIELD CTRL	0.25	0.00	{0.01}	15.99	**V_{pF} field controller**
C0078	TN FIELD CTRL	15.0	1.0	{0.5 ms}	8000.0	**T_{nF} field controller** At 8000 ms the function is deactivated

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0081 STOP	MOT POWER	→	0.01	{0.01 kW}	150.00	**Rated motor power** acc. to nameplate → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting ● Change of C0081 sets C0086 = 0
C0084 STOP	MOT RS	→	0.00	{0.01 Ω}	150.00	**Motor stator resistance** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0085 STOP	MOT LS	→	0.00	{0.01 mH}	655.35	**Motor leakage inductance** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0086 STOP	MOT TYPE	→	See motor selection list			**Motor type selection** → Depending on the controller used ● Change of C0086 resets C0006, C0022, C0070, C0071, C0075, C0076, C0081, C0084, C0085, C0087, C0088, C0089, C0090, C0091 to the assigned Lenze setting
			Controller	Lenze setting	Motor type assigned	Lenze motor type
			EVS9321	110	MDSKS56-23-150	MDSKSXX056-23, f_r: 150 Hz
			EVS9322	111	MDSKS56-33-150	MDSKSXX056-33, f_r: 150Hz
			EVS9323	112	MDSKS71-13-150	MDSKSXX071-13, f_r: 150 Hz
			EVS9324	116	MDSKS71-33-150	MDSKSXX071-33, f_r: 150Hz
			EVS9325	15	MDFKA80-120	MDFKAXX080-22, f_r: 120Hz
			EVS9326	19	MDFKA90-120	MDFKAXX090-22, f_r: 120Hz
			EVS9327	23	MDFKA100-120	MDFKAXX100-22, f_r: 120Hz
			EVS9328	27	MDFKA112-120	MDFKAXX112-22, f_r: 120Hz
			EVS9329	225	30kW-ASM-50	–
			EVS9330	227	45kW-ASM-50	–
			EVS9331	228	55kW-ASM-50	–
			EVS9332	229	75kW-ASM-50	–
C0087 STOP	MOT SPEED	→	300	{1 rpm}	16000	**Rated motor speed** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0088 STOP	MOT CURRENT	→	0.2	{0.1 A}	500.0	**Rated motor current** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0089 STOP	MOT FREQUENCY	→	10	{1 Hz}	1000	**Rated motor frequency**
C0090 STOP	MOT VOLTAGE	→	50	{1 V}	500	**Rated motor voltage** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0091 STOP	MOT COS PHI	→	0.50	{0.01}	1.00	**Motor cos φ** → Depending on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0093	DRIVE IDENT	Disp	0 1 93xx	Defective power section No power section 93xx		**Controller identification** 93xx: type of servo inverter

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0094	PASSWORD	0	0	{1}	9999	**Password** ● Parameter access protection for the keypad. When the password is activated, only codes of the user menu can be accessed. For further possible selections see C0096
C0095 STOP	ROTOR POS ADJ	0	0 Inactive 1 Active			**Rotor position adjustment** of a synchronous motor ● C0058 displays the zero angle of the rotor ● C0095 = 1 starts position adjustment
C0096 STOP			0 No access protection 1 Read protection 2 Write protection 3 Read/write protection			Extended password protection for bus systems with activated password (C0094). ● All codes in the user menu can be accessed.
1	AIF PROTECT.	0				AIF access protection
2	CAN PROTECT.	0				CAN access protection
C0099	S/W VERSION	Disp	x.xx			Software version
C0101			0.000	{0.001 s}	999.900	**NSET** Additional acceleration for the main setpoint (based on speed variation 0...$n_{max.}$)
1	NSET-TIR (ACCELERATION)	0.000				
2	NSET TIR	0.000				
...	...	...				
15	NSET-TIR	0.000				
C0103			0.000	{0.001 s}	999.900	**NSET** Additional deceleration times for the main setpoint (based on speed variation 0...$n_{max.}$)
1	NSET-TIF	0.000				
2	NSET-TIF	0.000				
...	...	...				
15	NSET-TIF	0.000				
C0105	QSP TIF	0.000	0.000	{0.001 s}	999.900	**QSP deceleration time** Deceleration time for quick stop (QSP) (based on speed variation 0...$n_{max.}$)
C0108		100.00	-199.99	{0.01 %}	199.99	**FCODE (AOUT gain)**
1	FCODE (GAIN AOUT)					
2	FCODE (GAIN AOUT)					
C0109			-199.99	{0.01 %}	199.99	**FCODE (offset AOUT)**
1	FCODE (OFFSET AOUT)	0.00				
2	FCODE (OFFSET AOUT)	0.00				
C0114			0 HIGH active 1 LOW active			**DIGINterminal polarity**
1	DIGIN1 POL	0				X5/E1
2	DIGIN2 POL	0				X5/E2
3	DIGIN3 POL	0				X5/E3
4	DIGIN4 POL	1				X5/E4
5	DIGIN5 POL	0				X5/E5

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0116 STOP			→ Selection list 2	**Signal configuration of the free digital outputs** Free digital outputs can only be evaluated when they are linked to automation interfaces.
1	FDO-00	1000	FIXED0	
...	...	...	...	
32	FDO -31	1000	FIXED0	
C0117 STOP		→	→ Selection list 2	**Signal configuration DIGOUT** → Depending on C0005
1	DIGOUT1	15000	DCTRL-TRIP	X5/A1
2	DIGOUT2	10650	CMP1-OUT	X5/A2
3	DIGOUT3	500	DCTRL-RDY	X5/A3
4	DIGOUT4	5003	MCTRL-MMAX	X5/A4
C0118			0 HIGH active 1 LOW active	**Terminal polarity DIGOUT**
1	DIGOUT1 POL	1		X5/A1
2	DIGOUT2 POL	1		X5/A2
3	DIGOUT3 POL	0		X5/A3
4	DIGOUT4 POL	0		X5/A4
C0120	OC6 LIMIT	0	00 {1 %} 120	**Threshold for the $I^2 \times t$ monitoring (motor).** ● 0 = $I^2 \times t$ monitoring switched off ● $I^2 \times t$ > C0120 ⇨ trip OC6
C0121	OH7 LIMIT	150	45 {1 °C} 150	**Temperature for OH7** Threshold for motor temperature warning
C0122	OH4 LIMIT	85	45 {1 °C} 85	**Temperature for OH4** Warning threshold - heatsink temperature
C0125	BAUD RATE	0	0 9600 baud 1 4800 baud 2 2400 baud 3 1200 baud 4 19200 baud	**LECOM baud rate** LECOM baud rate for 2102 accessory module
C0126	MONIT CE0	3	0 TRIP 2 Warning 3 Off	**CE0monitoring** Configuration of communication error monitoring with CE0 automation interface
C0127	OC8 LIMIT	0	0 {1 %} 120	**Threshold for the $I^2 \times t$ advance warning (motor).** ● 0 = $I^2 \times t$ warning switched off ● $I^2 \times t$ > C0127 ⇨ OC8 fault message (response set in C606)
C0128	TAU MOTOR	5.0	0.1 {0.1 min} 50.0	**Thermal time constant of the motor** The time constant is required for calculating the $I^2 \times t$ disconnection.
C0130	ACT TI	Disp		**NSET** Active T_i times of NSET
C0134	RFG CHARAC	0	0 Linear 1 S-shaped	**NSET** Ramp function generator characteristic for main setpoint
C0135	CONTROL WORD	0	0 {1} 65535	**Control word** Device control word for LECOM-A/B/LI or keypad.
C0136		Disp		
1	CTRLWORD C135			**Control word C135**
2	CTRLWORD CAN			**Control word CAN**
3	CTRLWORD AIF			**Control word AIF**

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0141	FCODE (SETVAL)	0.0	-199.9 {0.1 %} 199.9	**Main setpoint**
C0142	START OPTIONS	1		**Start option**
			0 Start lock	● Automatic start inhibited after – Mains connection – Reset of a message (t > 0.5 s) – TRIP RESET ● Start after HIGH-LOW-HIGH level change at X5/28
			1 Auto start	Automatic start if X5/28 = HIGH
C0150	STATUS WORD	Disp	0 {1} 65535	**Status word** when linked to automation interfaces ● Binary interpretation indicates the bit states
C0151	FDO (DW)	Disp		Hexadecimal display of the free digital output signals configured in C0116 ● Binary interpretation indicates the bit states
C0155	STATUS WORD 2	Disp	Bit00 Fail Bit08 R/L Bit01 Mmax Bit09 – Bit02 Imax Bit10 – Bit03 IMP Bit11 – Bit04 RDY Bit12 – Bit05 RSP Bit13 – Bit06 Trip Bit14 – Bit07 Init Bit15 –	**Status word 2** Extended decimal status word ● Binary interpretation indicates the bit states
C0156 STOP			→ Selection list 2	Configuration of the free bits of the status word
1	STAT.B0	2000	DCTRL-PAR*1-O	
2	STAT.B2	5002	MCTRL-IMAX	
3	STAT.B3	5003	MCTRL-MMAX	
4	STAT.B4	5050	NSET-RFG I=O	
5	STAT.B5	10650	CMP1-OUT	
6	STAT.B14	505	DCTRL-CW/CCW	
7	STAT.B15	500	DCTRL-RDY	
C0157		Disp		Display of the freely definable bits of the status word
1	(C0156/1)			
...	...			
7	(C0156/7)			
C0161	ACT TRIP	Disp	All fault messages	**Trip error message** Current fault message (as in C0168/1)
C0167	RESET FAILMEM	0	0 No reset 1 Reset	**Reseterror message** C0167 = 1 deletes the history buffer
C0168		Disp	All fault messages	List of faults occurred
1	FAIL NO. ACT			Currently active fault
2	FAIL NO. OLD1			Last fault
...	...			...
8	FAIL NO. OLD7			Last but six fault

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0169		Disp	corresponding mains switch-on time			List of the times when the faults occurred under C0168 (based on C0179)
1	FAILTIME ACT					Currently active fault
2	FAILTIME OLD1					Last fault
...	...					...
8	FAILTIME OLD7					Last but six fault
C0170		Disp	corresponding mains switch-on time			List of how often the faults have occurred consecutively under C0168 History buffer
1	COUNTER ACT					Currently active fault
2	COUNTER OLD1					Last fault
...	..					...
8	COUNTER OLD7					Last but six fault
C0172 STOP	OV REDUCE	0	0	{10 V}	100	**OV reduce** Threshold for activating the brake torque reduction before OU message
C0173 STOP	UG LIMIT	1				**DC-bus voltage thresholds** Check during commissioning and adapt if necessary! All drive components in the interconnection must have the same thresholds!
			0	Mains<400V +-brake LU=285V, OU=770V-755V		Operation on mains <400 V with or without braking unit
			1	Mains=400V +-brake LU=285V, OU=770V-755V		Operation on 400 V mains with or without braking unit
			2	Mains=460V +-brake LU=328V, OU=770V-755V		Operation on 460 V mains with or without braking unit
			3	Mains=480V -brake LU=342V, OU=770V-755V		Operation on 480 V mains without braking unit
			4	Mains=480V +-brake LU=342V, OU=800V-785V		Operation on 480 V mains with braking unit
C0178	OP TIMER	Disp	0	{1 s}	4294967295	**Elapsed-time meter** ● Time when the controller was enabled
C0179	MAINS TIMER	Disp	0	{1 s}	4294967295	**Power-on time meter** ● Time during which the mains was switched on
C0182	TI S-SHAPED	20.00	0.01	{0.01 s}	50.00	**NSET** T_i time of the S-shaped ramp function generator (determines the shape of the S curve) ● Low values ⇒small S rounding ● High values ⇒large S rounding

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0183	DIAGNOSTICS	Disp				**Drive diagnostics** ● Indicates fault or status information ● If several items of fault or status information are to be shown, the information with the smallest number is displayed
			0	OK		No fault
			101	Initialisation		Initialisation phase
			102	TRIP/fault		TRIP active
			103	Emergency stop		Emergency stop was carried out
			104	IMP message		Message active
			105	Power OFF		Function is not supported
			111	BSP C135 operation inhibit		Operation inhibited
			112	BSP AIF operation inhibit		
			113	BSP CAN operation inhibit		
			121	CINH terminal 28 controller inhibit		Controller inhibited via X5/28
			122	CINH internal 1 controller inhibit		DCTRL-CINH1
			123	CINH internal 2 controller inhibit		DCTRL-CINH2
			124	CINH C135/STOP controller inhibit		STOP key at the keypad
			125	CINH AIF controller inhibit		Controller inhibited via AIF
			126	CINH CAN controller inhibit		Controller inhibited via system bus
			141	Switch-on inhibit		Restart protection active
			142	IMP inhibit Pulse inhibit		High-resistance power outputs
			151	QSP terminal ext. quick stop		Quick stop via MCTRL-QSP
			152	QSP-C135 quick stop		Quick stop via STOP key on the keypad
			153	QSP-AIF quick stop		Quick stop via AIF
			154	QSP-CAN quick stop		Quick stop via system bus
			250	Warning C168		Warning active
C0190	NSET ARIT	0	0 1 2 3 4 5	OUT = C46 C46 + C49 C46 - C49 C46 * C49 C46 / C49 C46/(100 - C49)		**NSET** Arithmetic block in NSET function block. Connects main setpoint C0046 and additional setpoint C0040.
C0195	BRK1 T ACT	99.9	0.0	{0.1 s}	99.9	**BRK1** Brake closing time. Engagement time of the mechanical holding brake. ● After the time under C0195 has elapsed, the ”mechanical brake closed” status is reached.
C0196	BRK T RELEASE	0.0	0.0	{0.1 s}	60.0	**BRK1** Brake opening time. Disengagement time of the mechanical holding brake (see technical data of the brake). ● After time has elapsed under C0195, the status ”mechanical brake opened” is reached.
C0200	S/W ID	Disp				**Software manufacturer’s product code** Software identification
C0201	S/W DATE	Disp				**Software generation** Creation date
C0203	COMM. NO.	Disp	x / xxxx / xxxxx			**Commission number**
C0204	SERIAL-NO.	Disp	0	{1}	65535	**Serial number**

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0206	PROD. DATE	Disp				**Production date**
C0207	DL INFO 1	Disp				**Download-Info 1**
C0208	DL INFO 2	Disp				**Download info 2**
C0209	DL INFO 3	Disp				**Download info 3**
C0220	NSET TIR ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Acceleration time T_{ir} of the additional setpoint for NSET (based on speed variation 0...$n_{max.}$)
C0221	NSET TIF ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Deceleration time T_{if} of the additional setpoint for NSET (based on speed variation 0...$n_{max.}$)
C0222	PCTRL VP	1.0	0.1	{0.1}	500.0	**PCTRL** V_p gain
C0223	PCTRL TN	400	20	{1 ms}	99999	**PCTRL** T_n I component 99999 ms: Switched off
C0224	PCTRL KD	0.0	0.0	{0.1}	5.0	**PCTRL** K_d differential component
C0241	CMP RFG-I = O	1.00	0.00	{0.01 %}	100.00	**NSET** Threshold ramp function generator for main setpoint Input = output, (100 % = n_{max})
C0244	BRK M SET	0	-100	{1 %}	100	**BRK1** Holding torque of the DC injection brake 100 % = value of C0057
C0250	FCODE 1BIT	0	0 Lower limit 1 Upper limit			**FCODE 1 bit digital**
C0252	ANGLE OFFSET	0	-245760000	{1 inc}	245760000	**DFSET** Anglular offset, fixed angular offset for digital frequency configurations ● 1 rev. = 65536 inc
C0253	ANGLE N-TRIM	→	-32767	{1 inc}	32767	**DFSET** Speed-dependent phase trimming → Depending on C0005, C0025, C0490 ● Change of C0005, C0025, or C0490 resets C0253 to the Lenze settingassigned ● 1 rev. = 65536 inc ● C0253 is reached at 15000 rpm
C0254	VP ANGLE CTRL	0.4000	0.0000	{0.0001}	3.9999	**MCTRL** V_p angle controller
C0255	THRESHOLD P03	32768	10	{1 inc}	1800000000	**Following error limit P03** ● 1 rev. = 65536 inc ● Following error > C0255 triggers fault "P03"
C0260	MPOT1 HIGH	100.00	-199.99	{0.01 %}	199.99	**MPOT1** Upper limit (condition: C0260 > C0261)
C0261	MPOT1 LOW	-100.0	-199.99	{0.01 %}	199.99	**MPOT1** Lower limit (condition: C0261 < C0260)
C0262	MPOT1 TIR	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Acceleration time (relating to change 0...100 %)
C0263	MPOT1 TIF	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Deceleration time (based on change 0...100 %)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0264	MPOT1 ON/OFF	0	0 1 2 3 4 5	No change Deceleration with T_{if} to 0% Deceleration with T_{if} to C0261 Skip with T_{if} = 0 to 0% Skip with T_{if} = 0 to C0261 Acceleration with T_{ir} to C0260		**MPOT1** Executable functions if motor potentiometer is deactivated via input MPOT1-INACTIVE.
C0265	MPOT1 INIT	0	0 1 2	Value during mains failure Lower limit value from C0261 0 %		**MPOT1** Initialisation Value which is accepted during mains switching and activated motor pot.
C0267 STOP			→ Selection list 2			**MPOT1** Configuration of digital input signals
1	UP	1000	FIXED0			
2	DOWN	1000	FIXED0			
C0268 STOP	MPOT1-INACT	1000	FIXED0	→ Selection list 2		**MPOT1** Configuraton of digital input signal
C0269		Disp				
1	(C0267/1)					
2	(C0267/2)					
3	(C0268)					
C0291	SSC OVERRIDE	0	0	{1 rpm}	16000	**SSC cutout frequency** Cutout frequency for the transition from sensorless control to controlled operation
C0292	SSC IM SET	0.00	0.00	{0.01 A}	500.00	**SSC Im setpoint** Motor current setpoint. For sensorless control, set 1.0 ... 1.1-fold rated motor current.
C0293	SSC DYNAMIC	0.00	0.00	{0.01 %}	199.00	**SSC dynamic constant**
C0294	VP FRQ CTRL	→	0.0	{0.1}	99.9	**Vp frequency controller** Proportional gain of frequency controller → Depending on C0086
C0295	TN FRQ CTRL	→	2	{1 ms}	20000	**Tn frequency controller** Adjustment time frequency controller → Depending on C0086
C0296	DYNAMIC CONST	100	0	{0.1}	32767	**Dynamic constant**
C0325	VP2 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL Adpation Vp2** Process controller adaptation gain (V_{p2})
C0326	VP3 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL adaptation Vp3** Process controller adaptation gain (V_{p3})
C0327	SET2 ADAPT	100.00	0.00	{0.01 %}	100.00	**PCTRL adaptation nset2** Set speed threshold of the process controller adaptation (condition: C0327 > C0328)
C0328	SET1 ADAPT	0.00	0.00	{0.01 %}	100.00	**PCTRL adaptation nset1** Set speed threshold of the process controller adaptation (condition: C0328 < C0327)
C0329	ADAPT ON/OFF	0	0 1 2 3	No process controller adaptation External via input Adaptation via setpoint Adaptation via control difference		**PCTRL Adaptation on/off** Activate process controller adaptation
C0332	PCTRL TIR	0.000	0.000	{0.001 s}	999.900	**PCTRL** Acceleration time T_{ir} (relating to setpoint change 0...100 %)
C0333	PCTRL TIF	0.000	0.000	{0.001 s}	999.900	**PCTRL** Deceleration time T_{if} (based on setpoint change 0...100 %)

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0336	ACT VP	Disp	0.0 {0.1} 500.0	**PCTRL** Current V_p
C0337	BI/UNIPOLAR	0	0 Bipolar 1 Unipolar	**PCTRL** Bipolar/unipolar range
C0338	ARIT1 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 4 OUT = IN1 / IN2 5 OUT = IN1/(100% - IN2)	**ARIT1** Function selection
C0339 STOP			→ Selection list 1	**ARIT1** Configuration - analog input signals
1	ARIT1-IN1	1000	FIXED0%	
2	ARIT1-IN2	1000	FIXED0%	
C0340		Disp		**ARIT1** Display of analog input signals
1	(C0339/1)			
2	(C0339/2)			
C0350	CAN ADDRESS	1	1 {1} 63	**CAN** System bus node address ● Change becomes effective after ”reset node” command
C0351	CAN BAUD RATE	0	0 500 kbps 1 250 kbps 2 125 kbps 3 50 kbps 4 1000 kbits/s	**CAN** System bus baud rate ● Change becomes effective after ”reset node” command
C0352	CAN MST	0	0 Slave 1 Master	**CAN** Configuration of system bus nodes ● Change becomes effective after ”reset node” command
C0353			0 C0350 1 C0354	**CAN** CAN-IN / CAN-OUT selection of the system bus address
1	IN/OUT1 ADR	0		CAN-IN1, CAN-OUT1
2	IN/OUT2 ADR	0		CAN-IN2, CAN-OUT2
3	IN/OUT3 ADR	0		CAN-IN3, CAN-OUT3
C0354			1 {1} 513	**CAN** CAN-IN / CAN-OUT node address 2 ● Individual addressing of the system bus process data objects
1	IN1 ADR2	1		CAN-IN1
2	OUT2 ADR2	129		CAN-OUT1
3	IN2 ADR2	257		CAN-IN2
4	OUT2 ADR2	258		CAN-OUT2
5	IN3 ADR2	385		CAN-IN3
6	OUT3 ADR2	386		CAN-OUT3
C0355		Disp	0 {1} 2047	**CAN** System bus identifiers
1	IN1 ID			
2	OUT1 ID			
3	IN2 ID			
4	OUT2 ID			
5	IN3 ID			
6	OUT3 ID			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0356			0	{1 ms}	65000	**CAN** System bus time settings
1	CAN BOOT UP	3000				Required for CAN interconnection without master
2	OUT2 CYCLE	0				0 = event-controlled process data transfer
3	OUT3 CYCLE	0				>0 = cyclic process data transfer
4	CAN DELAY	20				When the ”Operational” NMT status is reached (after ”Pre-operational” or ”Stopped”), the ”CANdelay” delay time is started. After the delay time has elapsed, the PDO’s CAN-OUT2 and CAN-OUT3 are transmitted for the first time.
C0357			0	{1 ms}	65000	**CAN** System bus monitoring times ● After a fault message, the CAN objects remain in receive position
1	CE1 MONIT TIME	3000				CAN-IN1
2	CE2 MONIT TIME	3000				CAN-IN2
3	CE3 MONIT TIME	3000				CAN-IN3
C0358	RESET NODE	0	0 1	No function CAN reset		**CAN** Establish nodal reset pointfor system bus
C0359	CAN STATE	Disp	0 1 2 3	Operational Pre-Operational Warning Bus off		**CAN** System bus status
C0360		Disp	0		65535	**CAN** Telegram counter (number of telegrams) Count values > 65535: Restart with 0
1	MESSAGE OUT					All telegrams sent
2	MESSAGE IN					All telegrams received
3	MESSAGE OUT1					Telegrams sent on CAN-OUT1
4	MESSAGE OUT2					Telegrams sent on CAN-OUT2
5	MESSAGE OUT3					Telegrams sent on CAN-OUT3
6	MESSAGE OUT1					Telegrams sent via parameter channel 1
7	MESSAGE OUT2					Telegrams sent on parameter channel 2
8	MESSAGE IN1					Telegrams received from CAN-IN1
9	MESSAGE IN2					Telegrams received from CAN-IN2
10	MESSAGE IN3					Telegrams received from CAN-IN3
11	MESSAGE IN1					Telegrams received from parameter channel 1
12	MESSAGE IN2					Telegrams received via parameter channel 2

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0361		Disp	0.00	{1.00 %}	100.00	**CAN** Bus load of system bus To ensure a perfect operation, the total bus load (all connected devices) should be less than 80%
1	LOAD OUT					All telegrams sent
2	LOAD IN					All telegrams received
3	LOAD OUT1					Telegrams sent on CAN-OUT1
4	LOAD OUT2					Telegrams sent on CAN-OUT2
5	LOAD OUT3					Telegrams sent on CAN-OUT3
6	LOAD OUT1					Telegrams sent via parameter channel 1
7	LOAD OUT2					Telegrams sent on parameter channel 2
8	LOAD IN1					Telegrams received from CAN-IN1
9	LOAD IN2					Telegrams received from CAN-IN2
10	LOAD IN3					Telegrams received from CAN-IN3
11	LOAD IN1					Telegrams received from parameter channel 1
12	LOAD IN2					Telegrams received via parameter channel 2
C0362	SYNC CYCLE	1.000	-32.000	{0.100 ms}	32.000	**CAN** Time between two sync telegrams on the system bus
C0363	SYNC CORR	1	1 0.8 µs 2 1.6 µs 3 2.4 µs 4 3.2 µs 5 4.0 µs			**CAN** Correction value for C0362
C0364 STOP	CAN ACTIVE	1000	FIXED0		→ Selection list 2	**CAN** Configuraton of digital input signal ● Switches system bus from ”Pre-operational” to ”Operational” via external signal
C0365	(C0364)	Disp				**CAN** System bus status
C0366	SYNC RESPONSE	1	0 No sync response 1 Sync response			**CAN** Response to sync telegram by master
C0367	SYNC RX ID	128	1	{1}	256	**CAN** Receive identifier (Rx) ● Sync identifier for grouping for accepting the data in CAN-IN1
C0368	SYNC TX ID	128	1	{1}	256	**CAN** Transmit identifier (Tx) ● Identifier for the generation of a sync telegram
C0369	SYNC TX TIME	0	0	{1}	65000	**CAN** Sync transmission time (Tx) ● Transmission interval of the object set under C0368
C0400	AIN1-OUT	Disp	-199.99	{0.01 %}	199.99	**AIN1** Display of the output signal
C0402 STOP	OFFSET	19502	FCODE-26/1		→ Selection list 1	**AIN1** Offset configuration
C0403 STOP	GAIN	19504	FCODE-27/1		→ Selection list 1	**AIN1** Gain configuration

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0404		Disp	-199.99		199.99	**AIN1** Display of analog input signals
1	(C0402)					
2	(C0403)					
C0405	OUT	Disp	-199.99		199.99	**AIN2** Display of the output signal
C0407 STOP	AIN2-OFFSET	19503	FCODE-26/2		→ Selection list 1	**AIN2** Offset configuration
C0408 STOP	AIN2-GAIN	19505	FCODE-27/2		→ Selection list 1	**AIN2** Gain configuration
C0409		Disp	-199.99	{0.01 %}	199.99	**AIN2** Display of analog input signals
1	(C0407)					
2	(C0408)					
C0416 STOP	RESOLVER ADJ	0	0	{1}	99999999	**Correction of resolver fault** For Lenze motors read out resolver errors from nameplate
C0420 STOP	ENCODER CONST	512	1	{1 inc/rev}	8192	• **Encoder constant for encoder input X8 in increments per revolution** • If an absolute value encoder is selected in C0025, an SD7 trip is triggered when the encoder constant is changed.
C0421 STOP	ENC VOLTAGE	5.00	5.00	{0.1 V}	8.00	**Encoder voltage** Set size of voltage for encoder • PLEASE NOTE: incorrect entry can destroy encoder
C0425	DFIN CONST	3	0 256 inc/rev 1 512 inc/rev 2 1024 inc/rev 3 2048 inc/rev 4 4096 inc/rev 5 8192 inc/rev 6 16384 inc/rev			**DFIN** Number of Increments of the digital frequency input
C0426	DFIN-OUT	Disp	-32767	{1 rpm}	32767	Output signal of DFIN
C0427	DFIN FUNCTION	0	0 2 phases 1 A pulse / B direction of rotation (right) 2 Pulse A or B			**DFIN** Selection of the digital frequency signal
C0429	TP5 DELAY	0	-32767	{1 inc}	32767	**DFSET, DFRFG** Dead time compensation for the touch probe function
C0431 STOP	IN	5001	MCTRL-NACT		→ Selection list 1	**AOUT1** Configuration of analog input signal
C0432 STOP	OFFSET	19512	FCODE-109/1		→ Selection list 1	**AOUT1** Offset configuration
C0433 STOP	GAIN	19510	FCODE-108/1		→ Selection list 1	**AOUT1** Gain configuration
C0434		Disp	-199.99	{0.01 %}	199.99	**AOUT1** Display of analog input signals
1	(C0431)					
2	(C0432)					
3	(C0433)					
C0436 STOP	IN	5002	MCTRL-MSET2		→ Selection list 1	**AOUT2** Configuration of analog input signal
C0437 STOP	OFFSET	19513	FCODE-109/2		→ Selection list 1	**AOUT2** Offset configuration
C0438 STOP	GAIN	19511	FCODE-108/2		→ Selection list 1	**AOUT2** Gain configuration

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0439		Disp	-199.99	{0.01 %}	199.99	**AOUT2** Display of analog input signals
1	(C0436)					
2	(C0437)					
3	(C0438)					
C0440 STOP	STATE-BUS	1000			→ Selection list 2	Configuration of state bus X5/ST
C0441	(C0440)	Disp				
C0443	DIGIN-OUT	Disp	0	{1}	255	Signals at X5/E1 to X5/E5, decimal value ● Binary interpretation indicates terminal signals
C0444	(C0118)	Disp	0		1	
C0450 STOP	NX	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration of analog input signal
C0451 STOP	SET	1000	FIXED0		→ Selection list 2	**BRK1** Configuraton of digital input signal
C0452 STOP	SIGN	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration of analog input signal
C0458		Disp	-199.99	{0.01 %}	199.99	**BRK1** Display of analog input signals
1	(C0450)					
2	(C0452)					
C0459	(C0451)	Disp				**BRK1** Display of digital input signal
C0464	CUSTOMER I/F	Disp	0 original 1 changed			**Customer interface** Status of selected basic configuration ● Reassignment of terminals in a basic configuration from C0005 does not change C0005 and sets C0464 = 1. ● Adding or removing of function blocks or changing the signal flow among the function blocks in a basic configuration of C0005 sets C0005 = 0 and C0464= 1

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0465 STOP	FB LIST	→		→ Selection list 5		**FB processing list** Includes the program for signal processing (sequence in which the function blocks are processed) → Depending on C0005. Change of C0005 loads assigned processing list → Valid for C0005 = 1000 ● After changing the signal flow the processing list must be adapted. Otherwise the device may work with wrong signals! ● The function blocks DIGIN, DIGOUT, AIF-IN, CAN-IN, and MCTRL are always processed and do not have to be entered in the list.
1		200				
2		0				
3		50				
4		0				
5		0				
6		55				
7		0				
8		0				
9		10250				
10		0				
11		0				
12		0				
13		5650				
14		0				
15		0				
16		5050				
...		0				
19		5700				
...		0				
22		10650				
...		0				
25		70				
..		0				
28		75				
...		0				
31		250				
...		0				
41		25000				
42		20000				
...		0				
49		0				
50		0				
C0466	CPU T REMAIN	Disp				**Remaining process time** For processing function blocks
C0469 STOP	KEY STOPFUNCTION	2	0 1 2	switched off set controller inhibit set quick stop		set function of the STOP key on the keypad
C0470			0	{1}	255	Freely configurable code for digital signals ● Data words C0470 and C0471 are in parallel and identical
0	FCODE 8BIT DIGITAL	0				
1	FCODE BIT 0-7	0				
2	FCODE BIT8-15	0				
3	FCODE BIT16-23	0				
4	FCODE BIT24-31	0				

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0471	FCODE 32 BIT	0	0	{1}	4294967296	**FCODE 32 bits digital** Freely configurable code for digital signals ● Data words C0470 and C0471 are in parallel and identical
C0472	FCODE ANALOG		-199.99	{0.01 %}	199.99	Freely configurable code for relative analog signals
1		0.00				
2		0.00				
3		100.00				
6		100.00				
...		...				
19		0.00				
20		0.00				
C0473	FCODE ABS		-32767	{1}	32767	**FCODE** Freely configurable code for absolute analog signals
1		1				
2		1				
3		0				
...		...				
9		0				
10		0				
C0474	FCODE PH		-2147483648	{1}	2147483647	**FCODE** Freely configurable code for angle singals 1 rev. = 65536 inc
1		0				
...		...				
5		0				
C0475	FCODE DF		-16000	{1 rpm}	16000	**FCODE** Freely configurable code for angular difference singals 1 rev. = 65536 inc
1		0				
2		0				
C0490 STOP	FEEDBACK POS	0				**Position feedback system** Feedback system for the position controller
			0	Resolver at X7		The feedback system can be combined with the settings C0495 = 0, 1, 2, 3, 4.
			1	Encoder TTL at X8		The selection also sets C0495 to the same value.
			2	Sin/cos encoder at X8		
			3	Hiperface absolute value encoder singleturn at X8		
			4	Hiperface absolute value encoder multiturn at X8		
C0495 STOP	FEEDBACK N	0				**Speed feedback system** Feedback system for the speed controller
			0	Resolver at X7		The feedback system can be combined with the settings C0490 = 0, 1, 2, 3, 4. ● The rotor displacement angle in C0058 is set to -90°.
			1	Encoder TTL at X8		The selection also sets C0490 to the same value.
			2	Encoder sin at X8		
			3	Absolute ST at X8		
			4	Absolute MT at X8		

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0497	NACT-FILTER	2.0	0.0 {0.1 ms} 50.0		**N_{act} filter time constant** Time constant for actual speed C0497 = 0 ms: Switched off
C0517			0.00 {0.01} 1999.00		**User menu** Up to 32 entries ● Under the subcodes the numbers of the desired code are entered. ● The input is effected in the format xxx.yy – xxx: Code number – yy: Subcode number ● It is not checked whether the code entered exists.
1	USER MENU	51.00	C0051/0 MCTRL-NACT		
2	USER MENU	54.00	C0054/0 Imot		
3	USER MENU	56.00	C0056/0 MCTRL-MSET2		
4	USER MENU	46.00	C0046/0 N		
5	USER MENU	49.00	C0049/0 NADD		
6	USER MENU	183.00	C0183/0 Diagnostics		
7	USER MENU	168.01	C0168/1 Fail no. act		
8	USER MENU	86.00	C0086/0 Mot type		
9	USER MENU	22.00	C0022/0 Imax current		
10	USER MENU	5.00	C005/0 signal cfg		
11	USER MENU	11.00	C0011/0 Nmax		
12	USER MENU	12.00	C0012/0 T_{ir}		
13	USER MENU	13.00	C0013/0 T_{if}		
14	USER MENU	105.00	C0105/0 QSP T_{if}		
15	USER MENU	39.01	C0039/1 JOG setpoint		
16	USER MENU	70.00	C0070/0 Vp speed CTRL		
17	USER MENU	71.00	C0071/0 Tn speed CTRL		
18	USER MENU	0	not assigned		
...	...	0	not assigned		
31	USER MENU	94.00	C0094/0 Password		
32	USER MENU	3.00	C0003/0 Par save		
C0520 STOP	IN	1000	FIXEDPHI-0	→ Selection list 4	**DFSET** Input signal configuration
C0521 STOP	VP-DIV	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of gain factor - numerator
C0522 STOP	RAT-DIV	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of gearbox factor - numerator
C0523 STOP	A-TRIM	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of phase trimming
C0524 STOP	N-TRIM	1000	FIXED0%	→ Selection list 1	**DFSET** Speed trimming of DFSET
C0525 STOP	0-PULSE	1000	FIXED0	→ Selection list 2	**DFSET** Configuration of one-time zero pulse activation
C0526 STOP	RESET	1000	FIXED0	→ Selection list 2	**DFSET** Reset integrators
C0527 STOP	SET	1000	FIXED0	→ Selection list 2	**DFSET** Configuration - set integrators

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0528		Disp	$-2 \cdot 10^9$	{1}	$2 \cdot 10^9$	**DFSET**
1	0-PULSE A					Angular difference between 2 zero pulses
2	OFFSET					Offset results from C0523 × C0529 + C0252
3	PULSE DIST SET					Number of increments between two set pulses at X5/E5. Code is available from software version 6.2.
4	PULSE DIST ACT					Number of increments between two actual pulses at X5/E4. Code is available from software version 6.2.
C0529	MULTIP OFFSET	1	-20000	{1}	20000	**Offset multiplier**
C0530	DF EVALUATION	0	0 1	With gearbox factor Without gearbox factor		**DFSET** Evaluation of the digital frequency
C0531	ACT 0 DIV	1	1	{1}	16384	**DFSET actual zero pulse scaler**
C0532	0-PULSE/TP	1	1 2 3	0-pulse Touch probe 0 pulse **and** touch probe		**DFSET zero pulse/touch probe** Selection of zero pulse, touch probe, or zero pulse **and** touch probe
C0533	VP DENOM	1	1	{1}	32767	**DFSET Vp denominator** Gain factor denominator
C0534	SYNC MODE	0	0 1 2 10 11 12 13	Inactive Continuous Continuously switchable Once, fast way Once, + direction Once, - direction Once, 2 × zero pulse		**DFSET** Mode for synchronising the zero pulse and/or touch probe
C0535	SET 0 DIV	1	1	{1}	16384	**DFSET** Setpoint zero pulse divider
C0536		Disp	-32767	{1}	32767	**DFSET** Display of analog input signals
1	(C0521)					
2	(C0522)					
3	(C0523)					
C0537	(C0524)	Disp	-199.99	{0.01 %}	199.99	**DFSET** Display of analog input signal
C0538		Disp				**DFSET** Display of digital input signals
1	(C0525)					
2	(C0526)					
3	(C0527)					
C0539	(C0520)	Disp	-32767	{1 rpm}	32767	**DFSET** Input signal display
C0540	FUNCTION	2	0 1 2 3 4 5	Analog input Phase difference input Resolver simulation + zero pulse Resolver simulation without zero pulse X10 = X9 X10 = X8		**DFOUT** Function of the encoder outputs
C0541 STOP	AN-IN	5001	MCTRL-NACT		→ Selection list 1	**DFOUT** Configuration of analog input
C0542 STOP	DF-IN	1000	FIXEDPHI-0		→ Selection list 4	**DFOUT** Configuration of the dig. frequency input
C0544 STOP	SYN-RDY	1000	FIXED0		→ Selection list 2	**DFOUT** Synchronisation signal for the zero pulse
C0545	PH OFFSET	0	0	{1 inc}	65535	**DFOUT** Angular offset

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0546	PULSE MIN SET	1000	1	{1 inc}	2147483647	**DFSET** Masking (suppressing) interference pulses at X5/E5 (set pulse of touch probe signal). The size of the masking window between two set pulses is set.
C0547	(C0541)	Disp	-199.99	{0.01 %}	199.99	**DFOUT** Display of analog input signal
C0548	(C0544)	Disp	0		1	**DFOUT** Display of digital input signal
C0549	(C0542)	Disp	-32767	{1 rpm}	32767	**DFOUT** Input signal display
C0551	PULSE MIN ACT	1000	1	{1 inc}	2147483647	**DFSET** Masking (suppressing) interference pulses at X5/E4 (actual pulse of touch probe signal). The size of the masking window between two actual pulses is set. Code is available from software version 6.2.
C0560	FIX SET-VALUE		-199.99	{0.01 %}	199.99	**Fixed setpoints**
1		100				
2		75				
3		50				
4		25				
5		0				
...		...				
15		0				
C0561 STOP	AIN	1000	FIXED0%		→ Selection list 1	**FIXSET1** Configuration of analog input signal
C0562 STOP					→ Selection list 2	**FIXSET1** Configuration of digital input signals
1	IN1	1000	FIXED0			
2	IN2	1000	FIXED0			
3	IN3	1000	FIXED0			
4	IN4	1000	FIXED0			
C0563	(C0561)	Disp	-199.99	{0.01 %}	199.99	**FIXSET1** Display of analog input signal
C0564		Disp				**FIXSET1** Display of digital input signals
1	(C0562/1)					
...	...					
4	(C0562/4)					
C0570 STOP	IN	1000	FIXED0%		→ Selection list 1	**S&H1** Configuration of analog input signal
C0571 STOP	LOAD	1000	FIXED0		→ Selection list 2	**S&H1 LOAD** Configuraton of digital input signal
C0572	(C0570)	Disp	-199.99	{0.01 %}	199.99	**S&H1** Display of analog input signal
C0573	(C0571)	Disp				**S&H1 LOAD** Display of digital input signal
C0575	SD8 FILTER	1	0	{1 ms}	200	**SD8 monitoring** Tripping delay of error message SD8
C0576		100.00	0.00	{0.01 %}	100.00	**nErr monitoringspeed window** Setting of the system deviation between actual speed value and speed setpoint
C0577	VP FLD WEAK	3.00	0.00	{0.01}	15.99	**Field weakening controller** V_{pgain}

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0578	TN FLD WEAK	50.0	2.0 {0.5 ms} 8192.0	**Field weakening controller** Reset time Tn C0578 = 8000 ms: Switched off
C0579	MONIT NERR	3	0 Trip 1 Message 2 Warning 3 Off	**NEERmonitoring** Configuration of "system deviation between actual speed value and speed setpoint" monitoring
C0580	MONIT SD8	3	0 Trip 3 Off	**SD8 monitoring** Configuration of "Encoder error at X8" monitoring
C0581	MONIT EER	0	0 Trip 1 Message 2 Warning 3 Off	**EEr monitoring** Configuration of "external fault" monitoring
C0582	MONIT OH4	2	2 Warning 3 Off	**OH4monitoring** Configuration of heatsink temperature monitoring
C0583	MONIT OH3	→	0 Trip 2 Warning 3 Off	**OH3 monitoring** Configuration of "fixed motor temperature" monitoring → Depending on C0086
C0584	MONIT OH7	→	2 Warning 3 Off	**OH7monitoring** Configuration of "adjustable motor temperature"monitoring → Depending on C0086 Temperature monitoring via resolver input
C0585	MONIT OH8	3	0 Trip 2 Warning 3 Off	**OH8 monitoring** Configuration of "adjustable motor temperature" monitoring Temperature monitoring via PTC input
C0586	MONIT SD2	0	0 Trip 2 Warning 3 Off	**SD2 monitoring** Configuration of resolver monitoring
C0587	MONIT SD3	3	0 Trip 2 Warning 3 Off	**SD3 monitoring** Configuration of "encoder at X9" monitoring
C0588	MONIT H10/H11	0	0 Trip	**H10 / H11 monitoring**
			2 Warning 3 Off	Setting C0588 = 2 or C0588 = 3 only allowed for Lenze service
C0589	MONIT P03	2	0 Trip 2 Warning 3 Off	**P03monitoring** Configuration of following error monitoring ● The following error is monitored by the DFSET function block. The monitoring is only active if DFSET is used.
C0590	MONIT P13	0	0 Trip 2 Warning 3 Off	**P13 monitoring** Configuration of angle error monitoring ● The following error is monitored by the DFSET function block. The monitoring is only active if DFSET is used.
C0591	MONIT CE1	3	0 Trip 2 Warning 3 Off	**CE1 monitoring** Configuration of "CAN-IN1 fault" monitoring
C0592	MONIT CE2	3	0 Trip 2 Warning 3 Off	**CE2monitoring** Configuration of "CAN-IN2 error" monitoring
C0593	MONIT CE3	3	0 Trip 2 Warning 3 Off	**CE3 monitoring** Configuration of "CAN-IN3 error" monitoring

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0594	MONIT SD6	→	0 Trip 2 Warning 3 Off	**SD6monitoring** Configuration of "motor temperature sensor" monitoring → Depending on C0086
C0595	MONIT CE4	3	0 Trip 2 Warning 3 Off	**CE4monitoring** Configuration of "CAN bus off" monitoring
C0596	NMAX LIMIT	5500	0 {1 rpm} 16000	**System speed monitoring**
C0597	MONIT LP1	3	0 Trip 2 Warning 3 Off	**LP1monitoring** Configuration of motor phase failure monitoring
C0598	MONIT SD5	3	0 Trip 2 Warning 3 Off	**SD5monitoring** Configuration monitoring master current at X5/1.2 < 2mA
C0599	LIMIT LP 1	5.0	1.0 {0.1 %} 10.0	**LP1monitoring** Current limit value for motor phase monitoring
C0600	FUNCTION	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 4 OUT = IN1 / IN2 5 OUT = IN1/(100% - IN2)	**ARIT2** Function selection
C0601 STOP	IN		→ Selection list 1	**ARIT2** Configuration - analog input signals
1		1000	FIXED0%	ARIT2-IN1
2		1000	FIXED0%	ARIT2-IN2
C0602		Disp	-199.99 {0.01 %} 199.99	**ARIT2** Display of analog input signals
1	(C0601/1)			
2	(C0601/2)			
C0606	MONIT OC8	2	0 Trip 2 Warning 3 Off	**Configuration of the $I^2 \times t$ advance warning** The threshold is set in C0127.
C0610 STOP	IN		→ × Selection list 1	**ADD** Configuration - analog input signals
1		1000	FIXED0%	ADD1-IN1
2		1000	FIXED0%	ADD1-IN2
3		1000	FIXED0%	ADD1-IN3
C0611		Disp	-199.99 {0.01 %} 199.99	**ADD** Display of analog input signals
1	(C0610/1)			
2	(C0610/2)			
3	(C0610/3)			
C0620	DB1 GAIN	1.00	-10.00 {0.01} 10.00	**DB1 gain** Gain of dead band component DB1
C0621	DB1 VALUE	1.00	0.00 {0.01 %} 100.00	**DB1 dead band** Dead band of DB1
C0622 STOP	DB1-IN	1000	FIXED0% → Selection list 1	**DB1** Configuration of analog input signal
C0623	(C0622)	Disp	-199.99 {0.01 %} 199.99	**DB1** Display of analog input signal
C0630	MAX LIMIT	100.00	-199.99 {0.01 %} 199.99	**LIM upper limit** Upper limit of limiter LIM1
C0631	MIN LIMIT	-100.0	-199.99 {0.01 %} 199.99	**LIM lower limit** Lower limit of limiter LIM1

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0632 STOP	LIM-IN	1000	FIXED0%		→ Selection list 1	**LIM1** Configuration of analog input signal
C0633	(C0632)	Disp	-199.99	{0.01 %}	199.99	**LIM1** Display of analog input signal
C0640	DELAY T	20.00	0.01	{0.01 s}	50.00	**PT1-1** Setting of the time constant
C0641 STOP	PT1-1-IN	1000	FIXED0%		→ Selection list 1	**PT1-1** Configuration of analog input signal
C0642	(C0641)	Disp	-199.99	{0.01 %}	199.99	**PT1-1** Display of analog input signal
C0650	DT1-1 GAIN	1.000	-320.00	{0.01}	320.00	**DT1-1** Gain
C0651	DELAY T	1.000	0.005	{0.001 s}	5.000	**DT1-1** Time constant
C0652 STOP	IN	1000	FIXED0%		→ Selection list 1	**DT1-1** Configuration of analog input signal
C0653	SENSIBILITY	1	1 15-bit 2 14-bit 3 13-bit 4 12-bit 5 11-bit 6 10-bit 7 9-bit			**DT1-1** Sensitivity
C0654	(C0652)	Disp	-199.99	{0.01 %}	199.99	
C0655	NUMERATOR	1	-32767	{1}	32767	**CONV5** Numerator
C0656	DENOMINATOR	1	1	{1}	32767	**CONV5** Denominator
C0657 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV5** Configuration of analog input signal
C0658	(C0657)	Disp	-199.99	{0.01 %}	199.99	**CONV5** Display of analog input signal
C0661 STOP	IN	1000	FIXED0%		→ Selection list 1	**ABS1** Configuration of analog input signal Input for absolute value generators
C0662	(C0661)	Disp	-199.99	{0.01 %}	199.99	**ABS1** Display of analog input signal
C0671	RFG1 TIR	0.000	0.000	{0.01 s}	999.900	**RFG1** Acceleration time T_{ir}
C0672	RFG1 TIF	0.000	0.000	{0.01 s}	999.900	**RFG1** Deceleration time T_{if}
C0673 STOP	IN	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration of analog input signal
C0674 STOP	SET	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration of analog input signal
C0675 STOP	LOAD	1000	FIXED0		→ Selection list 2	**RFG1** Configuraton of digital input signal
C0676		Disp	-199.99	{0.01 %}	199.99	**RFG1** Display of analog input signals
1	(C0673)					
2	(C0674)					
C0677	(C0675)	Disp				**RFG1** Display of digital input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0680	FUNCTION	6	1 IN1 = IN 2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP1** Selection of the function on how the inputs IN1 and IN2 are to be compared
C0681	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP1** Hysteresis
C0682	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP1** Window
C0683 STOP					→ Selection list 1	**CMP1** Configuration - analog input signals
1	CMP1-IN1	5001	MCTRL-NACT			
2	CMP1-IN2	19500	FCODE-17			
C0684		Disp	-199.99	{0.01 %}	199.99	**CMP1** Display of analog input signals
1	(C0683/1)					
2	(C0683/1)					
C0685	FUNCTION	1	1 IN1 = IN2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP2** Selection of the function on how the inputs IN1 and IN2 are to be compared
C0686	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP2** Hysteresis
C0687	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP2** Window
C0688 STOP					→ Selection list 1	**CMP2** Configuration - analog input signals
1	CMP2-IN1	1000	FIXED0%			
2	CMP2-IN2	1000	FIXED0%			
C0689		Disp	-199.99	{0.01 %}	199.99	**CMP2** Display of analog input signals
1	(C0688/1)					
2	(C0688/2)					
C0690	FUNCTION	1	1 IN1 = IN 2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP3** Selection of the function on how the inputs IN1 and IN2 are to be compared
C0691	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP3** Hysteresis
C0692	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP3** Window
C0693 STOP					→ Selection list 1	**CMP3** Configuration - analog input signals
1	CMP3-IN1	1000	FIXED0%			
2	CMP3-IN2	1000	FIXED0%			
C0694		Disp	-199.99	{0.01 %}	199.99	**CMP3** Display of analog input signals
1	(C0693/1)					
2	(C0693/2)					
C0695	FUNCTION	2	1 IN 1 < IN2 2 |IN1| < |IN2|			**PHCMP1** Selection of the function on how the inputs IN1 and IN2 are to be compared

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0697 STOP					→ Selection list 3	**PHCMP1** Input signal configuration
1	IN	1000	FIXED0INC			
2	IN	1000	FIXED0INC			
C0698		Disp	-2147483647	{1}	2147483647	**PHCMP1** Display of input signals
1	(C0697/1)					
2	(C0697/2)					
C0700 STOP	IN	19523	FCODE-472/3		→ Selection list 1	**ANEG1** Configuration of analog input signal
C0701	(C0700)	Disp	-199.99	{0.01 %}	199.99	
C0703 STOP	IN	1000	FIXED0%		→ Selection list 1	**ANEG2** Configuration of analog input signal
C0704	(C0703)	Disp	-199.99	{0.01 %}	199.99	
C0710	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS1** Signal evaluation In the case of a corresponding signal edge at IN, OUT switches to HIGH
C0711	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS1** Pulse time of TRANS1
C0713 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS1-IN** Configuraton of digital input signal
C0714	(C0713)	Disp				**TRANS1-IN** Display of digital input signal
C0715	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS2** Signal evaluation In the case of a corresponding signal edge at IN, OUT switches to HIGH
C0716	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS2** Pulse duration
C0718 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS2** Configuraton of digital input signal
C0719	(C0718)	Disp				**TRANS2** Display of digital input signal
C0720	FUNCTION	2	0 On delay 1 Off delay 2 On/off delay			**DIGDEL1** Function selection
C0721	DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL1** Setting of the delay time
C0723 STOP	IN	1000	FIXED0		→ Selection list 2	**DIGDEL1** Configuraton of digital input signal
C0724	(C0723)	Disp				**DIGDEL1** Display of digital input signal
C0725	FUNCTION	2	0 On delay 1 Off delay 2 On/off delay			**DIGDEL2** Function selection
C0726	DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL2** Setting of the delay time
C0728 STOP	IN	1000	FIXED0		→ Selection list 2	**DIGDEL2** Configuraton of digital input signal
C0729	(C0728)	Disp				**DIGDEL2** Display of digital input signal
C0730	OSZ MODUS	0	0 Start measurement 1 Stop measurement			**OSZ** Start / stop of the measured value recording

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0731	OSZ STATUS	0	0 Measurement completed 1 Measurement active 2 Trigger detected 3 Abort 4 Abort after trigger 5 Read memory	**OSZ** Current operating status
C0732 STOP			→ Selection list 1	**OSZ** Configuration - analog input signals
1	CHANNEL1	1000	FIXED0%	
2	CHANNEL2	1000	FIXED0%	
3	CHANNEL3	1000	FIXED0%	
4	CHANNEL4	1000	FIXED0%	
C0733			→ Selection list 2	**OSZ** Trigger input
1	TRIG INP	1000	FIXED0	
C0734	TRIG-SOURCE	1	0 Digital trigger input 1 Measuring channel 1 2 Measuring channel 2 3 Measuring channel 3 4 Measuring channel 4	**OSZ** Selection of trigger source
C0735	TRIGGER-LEVEL	0	-32767 {1} 32767	**OSZ** Set trigger level for channels 1 ... 4
C0736	TRIGGER-SLOPE	0	0 LOW-HIGH edge 1 HIGH-LOW edge	**OSZ** Selection of the trigger edge
C0737	TRIGGER DELAY	0.0	-100.0 {0.1 %} 999.9	**OSZ** Setting of pretriggering and posttriggering
C0738	PROBE PERIOD	3	3 1 ms 4 2 ms 5 5 ms 6 10 ms 7 20 ms 8 50 ms 9 100 ms 10 200 ms 11 500 ms 12 1 s 13 2 s 14 5 s 15 10 s 16 20 s 17 50 s 18 1 min 19 2 min 20 5 min 21 10 min	**OSZ** Selection of the sampling period
C0739	NUMBER OF CHANNELS	4	1 {1} 4	**OSZ** Number of channels to be measured
C0740	DATA READ	0		**OSZ**
1		0	0 {1} 65535	Define the starting point for reading the data memory. This enables a selective access to a memory block
2		0	0 Inhibit ”Read data” 1 Enable ”Read data”	Inhibit ”Read memory”

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0741						**OSZ**
1	VERSION OSZ	Disp				Version
2	LENGTH MEMORY					Memory size
3	DATA WIDTH					Data width
4	NO. CHANNELS					Number of channels
C0742	LENGTH OF DB	Disp				**OSZ** Show data block length
C0743	READ DB	Disp				**OSZ** Reading an 8 byte data block
C0744	MEM: DEPTH	2048	0 1 2 3 4 5 6	512 measured values 1024 measured values 1536 measured values 2048 measured values 3072 measured values 4096 measured values 8192 measured values		**OSZ** Adapt memory depth to the measuring task
C0749		Disp				**OSZ** Information on the storage of the measured values
1	BRK:OFF INDEX					
2	TRIGGER INDEX					
3	END INDEX					
C0750	VP DENOM	16	1 2 4 8 16 34 64 128 256 512 1024 2048 4096 8192 16384	Vp = 1 Vp = 1/2 Vp = 1/4 Vp = 1/8 Vp = 1/16 Vp = 1/32 Vp = 1/64 Vp = 1/128 Vp = 1/256 Vp = 1/512 Vp = 1/1024 Vp = 1/2048 Vp = 1/4096 Vp = 1/8192 Vp = 1/16384		**DFRFG1** Denominator of the position controller gain
C0751	DFRFG1 TIR	1.000	0.001	{0.001 s}	999.900	**DFRFG1** T_{ir} (acceleration time)
C0752	MAX SPEED	3000	1	{1 rpm}	16000	**DFRFG1** Maximum speed (here: maximum compensation speed)
C0753	DFRFG1 QSP	0.000	0.000	{0.001 s}	999.900	**DFRFG1** Deceleration time T_{if} for activation of the deceleration ramp
C0754	PH ERROR	$2 \cdot 10^9$	10	{1 inc}	$2 \cdot 10^9$	**DFRFG1** Following error
C0755	SYN WINDOW	100	0	{1 inc}	65535	**DFRFG1** Synchronisation window
C0756	OFFSET	0	$-1 \cdot 10^9$	{1 inc}	$1 \cdot 10^9$	**DFRFG1** Offset
C0757	FUNCTION	0	0 1	TP start inactive TP start active		**DFRFG1** Function
C0758 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**DFRFG1** Input signal configuration
C0759 STOP	QSP	1000	FIXED0		→ Selection list 2	**DFRFG1** Configuraton of digital input signal

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0760 STOP	STOP	1000	FIXED0 → Selection list 2	**DFRFG1-STOP** Configuraton of digital input signal "Ramp function generator stop"
C0761 STOP	RESET	1000	FIXED0 → Selection list 2	**DFRFG1** Configuraton of digital input signal Reset integrators
C0764		Disp		**DFRFG1** Display of digital input signals
1	(C0759)			
2	(C0760)			
3	(C0761)			
C0765	(C0758)	Disp	-32767 {1 rpm} 32767	**DFRFG1** Input signal display
C0766	SPEED DIR	1	1 both directions (cw/ccw) 2 positive direction only (cw) 3 negative direction only (ccw)	**DFRFG1** Define direction of rotation
C0770 STOP	D	1000	FIXED0 → Selection list 2	**FLIP1** Data input Configuraton of digital input signal
C0771 STOP	CLK	1000	FIXED0 → Selection list 2	**FLIP1** Configuration of clock input signal
C0772 STOP	CLR	1000	FIXED0 → Selection list 2	**FLIP1** Configuration of reset input signal
C0773		Disp		**FLIP1** Display of digital input signals
1	(C0770)			
2	(C0771)			
3	(C0772)			
C0775 STOP	D	1000	FIXED0 → Selection list 2	**FLIP2** Data input Configuraton of digital input signal
C0776 STOP	CLK	1000	FIXED0 → Selection list 2	**FLIP2** Configuration of clock input signal
C0777 STOP	CLR	1000	FIXED0 → Selection list 2	**FLIP2** Configuration of reset input signal
C0778		Disp		**FLIP1** Display of digital input signals
1	(C0775)			
2	(C0776)			
3	(C0777)			
C0780 STOP	N	50	AIN1-OUT → Selection list 1	**NSET** Configuration of input signal for main setpoint
C0781 STOP	N-INV	10251	R/L/Q-R/L → Selection list 2	**NSET** Configuration of input signal for main setpoint inversion
C0782 STOP	NADD	5650	ASW1-OUT → Selection list 1	**NSET** Configuration of input signal for additional setpoint
C0783 STOP	NADD-INV	1000	FIXED0 → Selection list 2	**NSET** Configuration of inversion of additional setpoint
C0784 STOP	CINH-VAL	5001	MCTRL-NACT → Selection list 1	**NSET** Configuration of output signal with inhibited controller

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0785 STOP	SET	5000	MCTRL-NSET2		→ Selection list 1	**NSET** Configuration of input signal for ramp function generator
C0786 STOP	LOAD	5001	MCTRL-QSP-OUT		→ Selection list 2	**NSET** Load configuration of digital input signal for ramp function generator
C0787 STOP					→ Selection list 2	**NSET** Configuration of JOG selection and JOG activation Binary interpretation
1	JOG*1	53	DIGIN3			
2	JOG*2	1000	FIXED0			
3	JOG*4	1000	FIXED0			
4	JOG*8	1000	FIXED0			
C0788 STOP					→ Selection list 2	**NSET** Configuration of Ti selection and Ti activation ● Binary interpretation ● T_{ir} and T_{if} are identical
1	TI*1	1000	FIXED0			
2	TI*2	1000	FIXED0			
3	TI*4	1000	FIXED0			
4	TI*8	1000	FIXED0			
C0789 STOP	RFG-0	1000	FIXED0		→ Selection list 2	**NSET** Configuration of digital input signal (ramp function generator 0)
C0790 STOP	RFG-STOP	1000	FIXED0		→ Selection list 2	**NSET** Configuration of digital input signal (ramp function generator stop)
C0798		Disp	-199.99	{0.01 %}	199.99	**NSET** Display of analog input signals
1	CINH-VAL					
2	SET					
C0799		Disp				**NSET** Display of digital input signals
1	(781)					
2	(783)					
3	(786)					
4	(787/1)					
5	(787/2)					
6	(787/3)					
7	(787/4)					
8	(788/1)					
9	(788/2)					
10	(788/3)					
11	(788/4)					
12	(789)					
13	(790)					
C0800 STOP	SET	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration - setpoint input signal
C0801 STOP	ACT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of actual value input signal
C0802 STOP	INFLU	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of evaluation input signal
C0803 STOP	ADAPT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration - adaptation input signal
C0804 STOP	INACT	1000	FIXED0		→ Selection list 2	**PCTRL1** Configuration - inactivation input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0805 STOP	I-OFF	1000	FIXED0		→ Selection list 2	**PCTRL1** Configuration of digital input signal (switch-off I component)
C0808		Disp	-199.99	{0.01 %}	199.99	**PCTRL1** Display of analog input signals
1	(C0800)					
2	(C0801)					
3	(C0802)					
4	(C0803)					
C0809		Disp				**PCTRL1** Display of digital input signals
1	(C0804)					
2	(C0805)					
C0810 STOP					→ Selection list 1	**ASW1** Configuration - analog input signals
1	IN	55	AIN2-OUT			
2	IN	1000	FIXED0%			
C0811 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW1** Configuraton of digital input signal
C0812		Disp	-199.99	{0.01 %}	199.99	**ASW1** Display of analog input signals
1	(C0810/1)					
2	(C0810/2)					
C0813	(C0811)	Disp				**ASW1** Display of digital input signal
C0815 STOP					→ Selection list 1	**ASW2** Configuration - analog input signals
1	IN	1000	FIXED0%			
2	IN	1000	FIXED0%			
C0816 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW2** Configuraton of digital input signal
C0817		Disp	-199.99	{0.01%}	199.99	**ASW2** Display of analog input signals
1	(C0815/1)					
2	(C0815/2)					
C0818	(C0816)	Disp				**ASW2** Display of digital input signal
C0820 STOP					→ Selection list 2	**AND1** Configuration of digital input signals
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			
C0821		Disp				**AND1** Display of digital input signals
1	(C0820/1)					
2	(C0820/2)					
3	(C0820/3)					
C0822 STOP		1000			→ Selection list 2	**AND2** Configuration of digital inputs
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0823		Disp		**AND2** Display of digital input signals
1	(C0822/1)			
2	(C0822/2)			
3	(C0822/3)			
C0824 STOP			→ Selection list 2	**AND3** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0825		Disp		**AND3** Display of digital input signals
1	(C0824/1)			
2	(C0824/2)			
3	(C0824/3)			
C0826 STOP			→ Selection list 2	**AND4** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0827		Disp		**AND4** Display of digital input signals
1	(C0826/1)			
2	(C0826/2)			
3	(C0826/3)			
C0828 STOP			→ Selection list 2	**AND5** Configuration of digital inputs
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0829		Disp		**AND5** Display of digital input signals
1	(C0828/1)			
2	(C0828/2)			
3	(C0828/3)			
C0830 STOP			→ Selection list 2	**OR1** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0831		Disp		**OR1** Display of digital input signals
1	(C0830/1)			
2	(C083021)			
3	(C0830/3)			
C0832 STOP			→ Selection list 2	**OR2** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0833		Disp		**OR2** Display of digital input signals
1	(C0832/1)			
2	(C0832/2)			
3	(C0832/3)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0834 STOP			→ Selection list 2	**OR3** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0835		Disp		**OR3** Display of digital input signals
1	(C0834/1)			
2	(C0834/2)			
3	(C0834/3)			
C0836 STOP			→ Selection list 2	**OR4** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0837		Disp		**OR4** Display of digital input signals
1	(C0836/1)			
2	(C0836/2)			
3	(C0836/3)			
C0838 STOP			→ Selection list 2	**OR5** Configuration of digital input signals
1	IN	1000	FIXED0	OR5-IN1
2	IN	1000	FIXED0	OR5-IN2
3	IN	1000	FIXED0	OR5-IN3
C0839		Disp		**OR5** Display of digital input signals
1	(C0838/1)			
2	(C0838/2)			
3	(C0838/3)			
C0840 STOP	IN	1000	FIXED0 → Selection list 2	**NOT1** Configuraton of digital input signal
C0841	(C0840)	Disp		**NOT1** Display of digital input signal
C0842 STOP	IN	1000	FIXED0 → Selection list 2	**NOT2** Configuraton of digital input signal
C0843	(C0842)	Disp		**NOT2** Display of digital input signal
C0844 STOP	IN	1000	FIXED0 → Selection list 2	**NOT3** Configuraton of digital input signal
C0845	(C0844)	Disp		**NOT3** Display of digital input signal
C0846 STOP	IN	1000	FIXED0 → Selection list 2	**NOT4** Configuraton of digital input signal
C0847	(C0846)	Disp		**NOT4** Display of digital input signal
C0848 STOP	IN	1000	FIXED0 → Selection list 2	**NOT5** Configuraton of digital input signal
C0849	(C0848)	Disp		**NOT5** Display of digital input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0850 STOP					→ Selection list 1	**AIF-OUT** Configuration process output words for automation interface AIF (X1)
1	OUT.W1	1000	FIXED0%			
2	OUT.W2	1000	FIXED0%			
3	OUT.W3	1000	FIXED0%			
C0851 STOP	OUT.D1	1000	FIXED0INC		→ Selection list 3	**AIF-OUT** Configuration of 32-bit angle information
C0852	TYPE OUT.W2	0	0 Analog signal 1 Digital 0-15 2 D1: LOW angle 3 D2: HIGH angle			**AIF-OUT** Configuration of process output word 2 for automation interface AIF (X1)
C0853	TYPE OUT.W3	0	0 Analog signal 1 Digital 16-31 2 High phase			**AIF-OUT** Configuration - process output word 3 for automation interface AIF (X1)
C0854	TYPE OUT.W1	0	0 Analog signal 3 D2: LOW phase			**AIF-OUT** Configuration process output word 1 for automation interface AIF (X1)
C0855		Disp				**AIF** Process input words hexadecimal for automation interface X1
1	IN (0-15)		Bit 00	{1}	Bit15	
2	IN (16-31)		16 bit	{1}	Bit 31	
C0856		Disp	-199.99	{0.01 %}	199.99	**AIF-IN** Decimal process input words Display: 100.00 % = 16384
1	IN.W1					
2	IN.W2					
3	IN.W3					
C0857	IN.D1	Disp	-2147483648	{1}	2147483647	**AIF-IN** 32-bit phase information
C0858		Disp	-199.99	{0.01 %}	199.99	**AIF-OUT** Process output words Display: 100 % = 16384
1	OUT.W1					
2	OUT.W2					
3	OUT.W3					
C0859	OUT.D1	Disp	-2147483648	{1}	2147483647	**AIF-OUT** 32-bit phase information
C0860 STOP					→ Selection list 1	**AIF**
1	OUT1.W1	5001				
2	OUT1.W2	1000	FIXED0%			
3	OUT1.W3	1000	FIXED0%			
4	OUT2.W1	1000	FIXED0%			
5	OUT2.W2	1000	FIXED0%			
6	OUT2.W3	1000	FIXED0%			
7	OUT2.W4	1000	FIXED0%			
8	OUT3.W1	1000	FIXED0%			
9	OUT3.W2	1000	FIXED0%			
10	OUT3.W3	1000	FIXED0%			
11	OUT3.W4	1000	FIXED0%			
C0861 STOP					→ Selection list 3	**AIF**
1	OUT1.D1	1000	FIXED0INC			
2	OUT2.D1	1000	FIXED0INC			
3	OUT3.D1	1000	FIXED0INC			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0863		Disp	0		1	AIF
1	IN1 (0-15)					
2	IN1 (16-31)					
3	IN2 (0-15)					
4	IN2 (16-31)					
5	IN3 (0-15)					
6	IN3 (16-31)					
C0864			0 Analog signal 1 Digital 0-15 2 LOW angle			CAN Configuration of process output words for system bus (CAN)
1	TYPEOUT1.W2	0				
2	TYPEOUT2.W1	0				
3	TYPEOUT3.W1	0				
C0865			0 Analog signal 1 Digital 16-31 2 High phase			CAN Configuration of process output words for system bus (CAN)
1	TYPEOUT1.W3	0				
2	TYPEOUT2.W2	0				
3	TYPEOUT3.W2	0				
C0866		Disp	-32768.00	{0.01%}	32767.00	CAN
1	IN1.W1					
2	IN1.W2					
3	IN1.W3					
4	IN2.W1					
5	IN2.W2					
6	IN2.W3					
7	IN2.W4					
8	IN3.W1					
9	IN3.W2					
10	IN3.W3					
11	IN3.W4					
C0867		Disp				CAN
1	IN1.D1					
2	IN2.D1					
3	IN3.D1					
C0868		Disp	-199.99	{0.01%}	199.99	CAN
1	OUT1.W1					
2	OUT1.W2					
3	OUT1.W3					
4	OUT2.W1					
5	OUT2.W2					
6	OUT2.W3					
7	OUT2.W4					
8	OUT3.W1					
9	OUT3.W2					
10	OUT3.W3					
11	OUT3.W4					
C0869		Disp	-2147483648	{1}	2147483647	CAN
1	OUT1.D1					
2	OUT2.D1					
3	OUT3.D1					

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0870 STOP			→ Selection list 2	**DCTRL** Configuration of digital input signals (inhibit controller)
1	CINH1	1000	FIXED0	
2	CINH2	1000	FIXED0	
C0871 STOP	TRIP-SET	54	DIGIN4 → Selection list 2	**DCTRL** Configuraton of digital input signal
C0876 STOP	TRIP-RES	55	DIGIN5 → Selection list 2	**DCTRL** Configuraton of digital input signal
C0878		Disp		**DCTRL** Display of digital input signals
1	(C0870/1)			
2	(C0870/2)			
3	(C0871)			
4	(C0876)			
C0879			0 No reset 1 Reset	**DCTRL** Reset control words
1	RESET C135	0		
2	RESET AIF	0		
3	RESET CAN	0		
C0880			→ Selection list 2	**DCTRL** Configuration of digital input signals
1	PAR*1	1000	FIXED0	
2	PAR*2	1000	FIXED0	
C0881	PAR-LOAD	1000	FIXED0 → Selection list 2	**DCTRL** Configuraton of digital input signal
C0884		Disp		**DCTRL** Display of digital input signals
1	PAR*1			
2	PAR*2			
3	PAR-LOAD			
C0885 STOP	R	51	DIGIN1 → Selection list 2	**R/L/Q** Configuraton of digital input signal(CW rotation)
C0886 STOP	L	52	DIGIN2 → Selection list 2	**R/L/Q** Configuraton of digital input signal(CCW rotation)
C0889		Disp		**R/L/Q** Display of digital input signals
1	(C0885)			
2	(C0886)			
C0890 STOP	N-SET	5050	NSET-NOUT → Selection list 1	**MCTRL** Configuration of input signal for speed setpoint
C0891 STOP	M-ADD	1000	FIXED0% → Selection list 1	**MCTRL** Configuration of input signal for torque setpoint
C0892 STOP	LO-M-LIM	5700	ANEG1-OUT → Selection list 1	**MCTRL** Configuration of input signal for lower torque limit
C0893 STOP	HI-M-LIM	19523	FCODE-472/3 → Selection list 1	**MCTRL** Configuration of input signal for upper torque limit
C0894 STOP	PHI-SET	1000	FIXED0INC → Selection list 3	**MCTRL** Configuration of input signal for rotor position setpoint
C0895 STOP	PHI-LIM	1006	FIXED100% → Selection list 1	**MCTRL** Configuration of input signal for angle controller limit

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0896 STOP	N2-LIM	1000	FIXED0%		→ Selection list 1	**MCTRL** Configuration of input signal for 2. speed limitation value
C0897 STOP	PHI-ON	1000	FIXED0		→ Selection list 2	**MCTRL** Configuration of switch-on signal for angle controller
C0898 STOP	FLD-WEAK	1006	FIXED100%		→ Selection list 1	**MCTRL** Configuration of input signal for field weakening
C0899 STOP	N/M-SWT	1000	FIXED0		→ Selection list 2	**MCTRL** Configuration of input signal for change-over between n and M control
C0900 STOP	QSP	10250	R/L/Q-QSP		→ Selection list 2	**MCTRL** Configuration of control signal for activation
C0901 STOP	I-SET	1000	FIXED0%		→ Selection list 1	**MCTRL** Configuration of input signal for loading the I component for the speed controller
C0902 STOP	I-LOAD	1000	FIXED0		→ Selection list 2	**MCTRL** Configuration of tripping signal for loading the I component for the speed controller
C0903 STOP	P-ADAPT	1006	FIXED0%		→ Selection list 1	**MCTRL** Configuration of input signal for adaptation of the angle controller
C0906		Disp	-199.99	{0.01 %}	199.99	**MCTRL** Display of analog input signals
1	(C0890)					
2	(C0891)					
3	(C0892)					
4	(C0893)					
5	(C0895)					
6	(C0896)					
7	(C0898)					
8	(C0901)					
9	(C0903)					
C0907		Disp				**MCTRL** Display of digital input signals
1	(C0897)					
2	(C0899)					
3	(C0900)					
4	(C0902)					
C0908	(C0894)	Disp	-2147483647	{1 inc}	2147483647	Set phase signal ● 1 rev. = 65536 inc
C0909	SPEED LIMIT	1	1 +/- 175 % 2 0 ... +175 % 3 -175 ... 0 %			Limitation of direction of rotation for the speed setpoint
C0920 STOP	REF-ON	1000	FIXED0		→ Selection list 2	**REF** Configuraton of digital input signal Activation of homing function
C0921 STOP	REF-MARK	1000	FIXED0		→ Selection list 2	**REF** Configuraton of digital input signal Digital reference switch
C0922 STOP	REF-PHI-IN	1000	FIXED0INC		→ Selection list 3	**REF** Configuration of angle input signal
C0923 STOP	REF-N-IN	1000	FIXED0%		→ Selection list 1	**REF** Configuration of speed input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0924 STOP	REF-POS-LOAD	1000	FIXED0		→ Selection list 2	**REF** Configuraton of digital input signal Control ”set position”
C0925 STOP	REF-ACTPOS-IN	1000	FIXED0INC		→ Selection list 3	**REF** Configuration of input signal for ”Set position”
C0926		Disp	-2147483647	{1 inc}	2147483647	**REF**
1	REF-ACTPOS-IN					Display of input signals
2	REF-PHI-IN					
3	REF-ACTPOS					Actual position
4	REF-TARGET					Target position
C0927		Disp				**REF** Display of digital input signals
1	REF-ON					
2	REF-MARK					
3	REF-POS-LOAD					
C0928	REF-PHI-IN	Disp	-2147483647	{1 inc}	2147483647	**REF** Angle signal (following error) ● 1 rev. = 65536 inc
C0929	REF-N-IN	Disp	-199.99	{0.01 %}	199.99	**REF** Display of analog input signal
C0930 STOP	REF-GEARBOX MOT	1	1	{1}	65535	**REF** Encoder/gearbox factor - numerator (on the motor side)
C0931 STOP	REF-GEARBOX ENC	1	1	{1}	65535	**REF** Encoder/gearbox factor - denominator (on the encoder side)
C0932	REF MODE	0				**REF** Homing function mode
			0	Mode 0		Positive direction, reference switch, zero pulse
			1	Mode 1		Negative direction, reference switch, zero pulse
			6	Mode 6		Positive direction, reference switch, touch probe
			7	Mode 7		Negative direction, reference switch, touch probe
			8	Mode 8		Positive direction, touch probe
			9	Mode 9		Negative direction, touch probe
			20	Mode 20		Direct homing
			21	Mode 21		Direct homing, save actual value
C0933	REF TRANS	0	0 1	Rising edge Falling edge		**REF** Reference signal edge
C0934	REF OFFSET	0	-2140000000	{1 inc}	2140000000	**REF** Home position offset
C0935	REF SPEED	2.000 0	0.0001	{0.0001 %}	100.0000	**REF** Homing speed Homing speed The value set is the percentage value of N_{max}
C0936	REF TI	1.00	0.01	{0.01 s}	990.00	**REF** Homing acceleration/deceleration time T_{ir} and T_{if} are identical
C0940	NUMERATOR	1	-32767	{1}	32767	**CONV1** Numerator

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0941	DENOMINATOR	1	1	{1}	32767	**CONV1** Denominator
C0942 STOP	CONV1-IN	1000	FIXED0%		→ Selection list 1	**CONV1** Configuration of analog input
C0943	(C0942)	Disp	-199.99	{0.01 %}	199.99	**CONV1** Display of analog input signal
C0945	NUMERATOR	1	-32767	{1}	32767	**CONV2** Numerator
C0946	DENOMINATOR	1	1	{1}	32767	**CONV2** Denominator
C0947 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV2** Configuration of analog input
C0948	(C0947)	Disp	-199.99	{0.01 %}	199.99	**CONV2** Display of analog input signal
C0950	NUMERATOR	1	-32767	{1}	32767	**CONV3** Numerator
C0951	DENOMINATOR	1	1	{1}	32767	**CONV3** Denominator
C0952 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV3** Configuration of analog input
C0953	(C0952)	Disp	-32767	{1 rpm}	32767	**CONV3** Display of analog input signal
C0955	NUMERATOR	1	-32767	{1}	32767	**CONV4** Numerator
C0956	DENOMINATOR	1	1	{1}	32767	**CONV4** Denominator
C0957 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV4** Configuration of analog input
C0958	(C0957)	Disp	-32767	{1 rpm}	32767	**CONV4** Display of analog input signal
C0960	FUNCTION	1	1 Characteristic 1 2 Characteristic 2 3 Characteristic 3			**CURVE** Selection of the characteristic function
C0961	Y0	0.00	0.00	{0.01 %}	199.99	**CURVE** Configuration of grid point
C0962	Y1	50.00	0.00	{0.01 %}	199.99	**CURVE** Configuration of grid point
C0963	Y2	75.00	0.00	{0.01 %}	199.99	**CURVE** Configuration of grid point
C0964	Y100	100.00	0.00	{0.01 %}	199.99	**CURVE** Configuration of grid point
C0965	X1	50.00	0.01	{0.01 %}	99.00	**CURVE** Configuration of grid point
C0966	X2	75.00	0.01	{0.01 %}	99.00	**CURVE** Configuration of grid point
C0967 STOP	IN	1000	FIXED0%		→ Selection list 1	**CURVE** Configuration of analog input
C0968	(C0967)	Disp	-199.99	{0.01 %}	199.99	**CURVE** Display of analog input signal
C0970 STOP	N-SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of speed input signal (setpoint path)
C0971 STOP	FAULT	1000	FIXED0		→ Selection list 2	**MFAIL** Configuration of digital input signal (activation of the mains failure control)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0972 STOP	RESET	1000	FIXED0		→ Selection list 2	**MFAIL** Configuration of digital input signal (reset of the mains failure control)
C0973 STOP	ADAPT	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for adaptation of the voltage controllerP gain
C0974 STOP	CONST	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for adaptation of the voltage controllerP gain
C0975 STOP	THRESHLD	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for restart protection for when speed threshold is under-run
C0976 STOP	NACT	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for comparison value for threshold function ● Start for V_2 controller
C0977 STOP	SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for speed starting value
C0978 STOP	DC-SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for DC-bus voltage setpoint
C0980	MFAIL VP	0.500	0.001	{0.001}	31.000	**MFAIL** Setting of gain V_p
C0981	MFAIL TN	100	20	{1 ms}	2000	**MFAIL** Setting of reset time T_n
C0982	MFAIL TIR	2.000	0.001	{0.001 s}	16.000	**MFAIL** Setting of acceleration time T_{ir}
C0983	RETRIGGER T	1.000	0.001	{0.001 s}	60.000	**MFAIL** Retrigger time
C0988		Disp	-199.99	{0.01 %}	199.99	**MFAIL** Display of analog input signals
1	(C0970)					
2	(C0973)					
3	(C0974)					
4	(C0975)					
5	(C0976)					
6	(C0977)					
7	(C0978)					
C0989		Disp				**MFAIL** Display of digital input signals
1	(C0971)					
2	(C0972)					
C0990 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT1** Input signal configuration
C0991 STOP	RESET	1000	FIXED0		→ Selection list 2	**PHINT1** Configuration - reset signal
C0992	(C0990)	Disp	-32767	{1}	32767	**PHINT1** Input signal display
C0993	(C0991)	Disp				**PHINT1** Display of digital input signal
C0995	DIVISION	0	-31	{1}	31	**PHDIV** Divisor in the power-of-two-format (2^{C0995})
C0996 STOP	IN	1000	FIXED0INC		→ Selection list 3	**PHDIV** Input signal configuration

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0997	(C0996)	Disp	-2147483647	{1}	2147483647	**PHDIV** Input signal display
C1000	DIVISION	1	0	{1}	31	**CONVPHA1** Divisor in the power-of-two-format (2^{C0995})
C1001 STOP	IN	1000	FIXED0INC		→ Selection list 3	Configuration input of CONVPHA1
C1002	(C1001)	Disp	-2147483647	{1}	2147483647	**CONVPHA1** Input signal display
C1010	ARITPH1 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 14 OUT = IN1 / IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)			**ARITPH1** Arithmetic function selection
C1011 STOP					→ Selection list 3	**ARITPH1** Input signal configuration
1	IN	1000	FIXED0INC			
2	IN	1000	FIXED0INC			
C1012		Disp	-2147483647	{1}	2147483647	**ARITPH1** Display of input signals
1	(C1011/1)					
2	(C1011/2)					
C1030 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT2** Input signal configuration
C1031 STOP	RESET	1000	FIXED0		→ Selection list 2	**PHINT2** Reset input
C1032	(C1030)	Disp	-32767	{1}	32767	**PHINT2** Display of input signals
C1033	(C1031)	Disp				**PHINT2** Display of digital input signal
C1040	ACCELARATION	100.00	0.001	{0.001}	5000.000	**SRFG1** Setting of acceleration
C1041	JERK	0.200	0.001	{0.001 s}	999.999	**SRFG1** Setting of jerk
C1042 STOP	IN	1000	FIXED0%		→ Selection list 1	**SRFG1** Input signal configuration
C1043 STOP	SET	1000	FIXED0%		→ Selection list 1	**SRFG1** Input signal configuration
C1044 STOP	LOAD	1000	FIXED0		→ Selection list 2	**SRFG1** Input signal configuration
C1045		Disp	-199.99	{0.01 %}	199.99	**SRFG1** Display of analog input signal
1	(C1042)					
2	(C1043)					
C1046	(C1044)	Disp				**SRFG1** Display of digital input signal
C1090	OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN1** Signal output
C1091	CODE	141	2	{1}	2000	**FEVAN1** Selection of the target code
C1092	SUBCODE	0	0	{1}	255	**FEVAN1** Selection of the target subcode
C1093	NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN1** Numerator

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1094	DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN1** Denominator
C1095	OFFSET	0	0	{1}	1000000000	**FEVAN1** Offset setting
C1096 STOP	IN	1000	FIXED0%		→ Selection list 1	**FEVAN1** Configuration of analog input signal
C1097 STOP	FEVAN1-LOAD	1000	FIXED0		→ Selection list 2	**FEVAN1** Configuraton of digital input signal
C1098	(C1096)	Disp	-32768	{1}	32767	**FEVAN1** Display of analog input signal
C1099	(C1097)	Disp				**FEVAN1** Display of digital input signal
C1100	FUNCTION	1				**FCNT1** Function selection
			1 Return			If |counter content| ≥ |FCNT1-CMP-Val|, FCNT1-EQUAL is set to HIGH for 1 ms
			2 Hold if >=			If |counter content| ≥ |FCNT1-CMP-Val|, the counter stops
			3 Hold if =			If |counter content| = |FCNT1-CMP-Val|, the counter stops
C1101 STOP					→ Selection list 1	**FCNT1** Configuration - analog input signals
1	LD-VAL	1000	FIXED0%			
2	CMP-VAL	1000	FIXED0%			
C1102 STOP					→ Selection list 2	**FCNT1** Configuration of digital input signals
1	CLKUP	1000	FIXED0			
2	CLKDWN	1000	FIXED0			
3	LOAD	1000	FIXED0			
C1103		Disp	-32768	{1}	32768	**FCNT1** Display of analog input signals
1	(C1101/1)					
2	(C1101/2)					
C1104		Disp				**FCNT1** Display of digital input signals
1	(C1102/1)					
2	(C1102/2)					
3	(C1102/3)					
C1120	SYNC MODE	2	0 Sync switched off 1 CAN sync activated 2 Terminal sync activated			**SYNC1** Function
C1121 STOP		2	0	{1 ms}	13	**SYNC1** The interpolation is restarted with every sync signal.
1	SYNC CYCLE	2				**SYNC1** Definition of the cycle time of the sync signals (in the slave); only for system bus
2	INTERPOL. CYCL	2				**SYNC1** Definition of the interpolation time between the sync signals (in the slave), only for terminal
C1122	SYNC TIME	0.460	0.000	{0.001 ms}	10.000	**SYNC1** Phase shift between CAN sync and internal control program cycle ● For system bus only ● Depends on baud rate and bus load

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1123			-0.450	{0.001 ms}	0.450	**SYNC1**
1	PHASESHIFT	0.000				Phase shift between terminal synch and internal program cycle, for terminal sync only.
2	SYNC WINDOW	0.200				Synchronisation window for the synchronisation edge of the terminal sync (LOW-HIGH edge). Only for terminal sync. If the sync signal transmitted is within the window, SYNCx-STAT switches to HIGH
C1124 STOP	IN1	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration of analog input signal
C1125 STOP	IN2	1000	FIXED0INC		→ Selection list 3	**SYNC1** Input signal configuration
C1126 STOP	IN3	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration of analog input signal
C1127	(C1124)	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal
C1128	(C1125)	Disp	-2147483647	{1}	2147483647	**SYNC1** Input signal display
C1129	(C1126)	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal
C1140	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS3** Selection of the edge evaluation
C1141	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS3** Setting of the pulse period
C1143 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS3** Display of digital input signal
C1144	(C1143)	Disp				**TRANS3** Configuraton of digital input signal
C1145	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS4** Selection of the edge evaluation
C1146	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS4** Setting of the pulse period
C1148 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS4** Configuraton of digital input signal
C1149	(C1148)	Disp				**TRANS4** Display of digital input signal
C1150	FUNCTION	0	0 Load permanent 1 Load edge 2 Compare & subtract			**PHINT3** Function selection
C1151	CMP. VALUE	$2 \cdot 10^9$	0	{1}	2000000000	**PHINT3** Setting of a comparison value
C1153 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT3** Configuration - speed input signal
C1154 STOP	LOAD	1000	FIXED0		→ Selection list 2	**PHINT3** Configuraton of digital input signal
C1155 STOP	SET	1000	FIXED0INC		→ Selection list 3	**PHINT3** Configuration - phase input signal
C1157	(C1153)	Disp	-32767	{1}	32767	**PHINT3** Input signal display
C1158	(C1154)	Disp				**PHINT3** Display of digital input signal
C1159	(C1155)	Disp	-2147483647	{1}	2147483647	**PHINT3** Input signal display

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1160 STOP					→ Selection list 1	**ASW3** Configuration - analog input signals
1	IN1	1000	FIXED0%			
2	IN2	1000	FIXED0%			
C1161 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW3** Configuraton of digital input signal
C1162		Disp	-199.99	{0.01 %}	199.99	**ASW3** Display of analog input signals
1	(C1160/1)					
2	(C1160/2)					
C1163	(C1161)	Disp				**ASW3** Display of digital input signal
C1165 STOP					→ Selection list 1	**ASW4** Configuration - analog input signals
1	IN1	1000	FIXED0%			
2	IN2	1000	FIXED0%			
C1166 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW4** Configuraton of digital input signal
C1167		Disp	-199.99	{0.01 %}	199.99	**ASW3** Display of analog input signals
1	(C1165/1)					
2	(C1165/2)					
C1168	(C1166)	Disp				**ASW4** Display of digital input signal
C1170	NUMERATOR	1	-32767		32767	**CONV6** Numerator
C1171	DENOMINATOR	1	1	{1}	32767	**CONV6** Denominator
C1172 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV6** Configuration of analog input signal
C1173	(C1172)	Disp	-199.99	{0.01 %}	199.99	**CONV6** Display of analog input signal
C1175 STOP					→ Selection list 2	**AND6** Configuration of digital input signals
1	IN1	1000	FIXED0			
2	IN2	1000	FIXED0			
3	IN3	1000	FIXED0			
C1176		Disp				**AND6** Display of digital input signals
1	(C1175/1)					
2	(C1175/2)					
3	(C1175/3)					
C1178 STOP					→ Selection list 2	**AND7** Configuration of digital input signals
1	IN1	1000	FIXED0			AND7-IN1
2	IN2	1000	FIXED0			AND7-IN2
3	IN3	1000	FIXED0			AND7-IN3
C1179		Disp				**AND7** Display of digital input signals
1	AND7-IN1					
2	AND7-IN1					
3	AND7-IN1					

Code		Possible settings					IMPORTANT
No.	Designation	Lenze	Selection				
C1190		0					**Temperature characteristic for PTC thermistors** Selection of the characteristic for PTC thermistors at X7 or X8 for detecting the motor temperature
			0	Standard			Characteristic for PTC thermistors in Lenze motors
			1	Characteristic			Characteristic for application-specific PTC thermistors
C1191			0		{1 °C}	255	**Temperature range for PTC thermistors** Define temperature points on the characteristic for PTC thermistors
1		100					Lower temperature T1
2		150					Upper temperature T2
C1192			0		{1 Ω}	3000	**Resistance range for PTC thermistors** Define resistance points on the characteristic for PTC thermistors
1		1670					Resistance R1 at T1
2		2225					Resistance R2 at T2
C1195 STOP	OUT.D2	1000	FIXED0INC			→ Selection list 3	**AIF-OUT** Configuration of angle input signal
C1196	(C1195)	Disp	-2147483647		{1}	2147483647	**AIF-OUT** Input signal display
C1197	IN.D2	Disp					**AIF-IN** Input signal display
C1200 STOP						→ Selection list 3	**PHADD1** Configuration - phase input signals
1	IN1	1000	FIXED0INC				
2	IN2	1000	FIXED0INC				
3	IN3	1000	FIXED0INC				
C1201		Disp	-2147483647		{1}	2147483647	**PHADD1** Display of input signals
1	IN1						
2	IN2						
3	IN3						
C1205 STOP						→ Selection list 3	**PHCMP2** Input signal configuration
1	IN1	1000	FIXED0INC				
2	IN2	1000	FIXED0INC				
C1206		Disp	-2147483647		{1}	2147483647	**PHCMP2** Display of input signals
1	IN1						
2	IN2						
C1207	FUNCTION	2	1	IN1 < IN2			**PHCMP2** Selection of the comparison operation
			2	|IN1| < |IN2|			
C1210 STOP						→ Selection list 2	**STORE1** Configuration of digital input signals
1	STORE1-RESET	1000	FIXED0				
2	STORE1-ENTP	1000	FIXED0				
3	STORE1-ENWIN	1000	FIXED0				
4	STORE1-LOAD0	1000	FIXED0				
5	STORE1-LOAD1	1000	FIXED0				

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1211 STOP					→ Selection list 4	**STORE1** Input signal configuration
1	STORE1-IN	1000	FIXEDPHI-0			
2	STORE1-MASKI	1000	FIXEDPHI-0			
C1212 STOP	MASKV	1000	FIXED0INC		→ Selection list 3	**STORE1** Input signal configuration
C1215		Disp				**STORE1** Display of digital input signals
1	(C1210/1)					
...	...					
5	(C1210/5)					
C1216		Disp	-32767	{1 rpm}	32767	**STORE1** Display of input signals
1	(C1211/1)					
2	(C1211/2)					
C1217	(C1212)	Disp	-2147483647		2147483647	**STORE1** Input signal display
C1220 STOP					→ Selection list 2	**STORE2** Configuration of digital input signals
1	STORE2-RESET	1000	FIXED0			
2	STORE2-ENTP	1000	FIXED0			
C1223		Disp				**STORE2** Display of digital input signals
1	(C1220/1)					
2	(C1220/2)					
C1230 STOP					→ Selection list 2	**PHDIFF1** Configuration of digital input signals
1	PHDIFF1-EN	1000	FIXED0			
2	PHDIFF1-RES	1000	FIXED0			
C1231 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHDIFF1** Input signal configuration
C1232 STOP					→ Selection list 3	**PHDIFF1** Input signal configuration
1	PHDIFF1-SET	1000	FIXED0INC			
2	PHDIFF1-ADD	1000	FIXED0INC			
C1235		Disp				**PHDIFF1** Display of digital input signals
1	(C1230/1)					
2	(C1230/2)					
C1236	(C1231)	Disp	-32767	{1 rpm}	32767	
C1237		Disp	-2147483647		2147483647	**PHDIFF1** Display of input signals
1	(C1232/1)					
2	(C1232/2)					
C1240 STOP					→ Selection list 1	**CONVPHPH1** Input signal configuration
1	CONVPHPH1-NUM	1000	FIXED0%			
2	CONVPHPH1-DEN	1000	FIXED0%			
C1241 STOP	CONVPHPH1-ACT	1000	FIXED0		→ Selection list 2	**CONVPHPH1** Input signal configuration
C1242 STOP	CONVPHPH1-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHPH1** Input signal configuration

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1245		Disp	-199.99	{0.01 %}	1999.99	**CONVPHPH1** Display of analog input signals
1	(C1240/1)					
2	(C1240/2)					
C1246	(C1241)	Disp				**CONVPHPH1** Display of digital input signal
C1247	(C1242)	Disp	-2147483647		2147483647	**CONVPHPH1** Input signal display
C1250 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONVPP1** Input signal configuration
C1251 STOP		1000			→ Selection list 3	**CONVPP1** Input signal configuration
1	CONVPP1-NUM		FIXED0INC			
2	CONVPP1-DEN		FIXED0INC			
C1253	(C1250)	Disp	-32767	{1 rpm}	32767	**CONVPP1** Input signal display
C1254		Disp	-2147483647	{1}	2147483647	**CONVPP1** Display of input signals
1	CONVPP1-NUM					
2	CONVPP1-DEN					
C1255 STOP	N-TRIM2	1000	FIXEDPHI-0		→ Selection list 4	**DFSET** Input signal configuration
C1258	(C1255)	Disp	-32767	{1 rpm}	32767	
C1260	OFFSET	0	-16383	{1}	16383	**GEARCOMP** Offset
C1261	NUM	1	-32767	{1}	32767	**GEARCOMP** Numerator
C1262	DENUM	1	1	{1}	32767	**GEARCOMP** Denominator
C1265 STOP	TORQUE	1000	FIXED0%		→ Selection list 1	**GEARCOMP** Configuration of input signal correction
C1266 STOP	PHI-IN	1000	FIXED0INC		→ Selection list 3	**GEARCOMP** Input signal configuration
C1268	(C1265)	Disp	-199.99	{0.01 %}	199.99	**GEARCOMP** Display of analog input signal
C1269	(C1266)	Disp	-2147483647	{1}	2147483647	**GEARCOMP** Input signal display
C1270 STOP					→ Selection list 3	**PHCMP3** Input signal configuration
1	PHCMP3-IN1	1000	FIXED0INC			
2	PHCMP3-IN2	1000	FIXED0INC			
C1271		Disp	-2147483647	{1}	2147483647	**PHCMP3** Display of input signals
1	(C1270/1)					
2	(C1270/2)					
C1272	FUNCTION	2	1 IN1 < IN2 2 |IN1| < |IN2|			**PHCMP3** Selection of the comparison operation
C1290	MONIT P16	3	0 Trip 2 Warning 3 Off			**P16 monitoring** Configuration of monitoring in the case of a sync error
C1292	MONIT P19	2	0 Trip 2 Warning 3 Off			**P19monitoring** Configuration of monitoring a limitation of the input value at DFIN

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1500	OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN2** Signal output
C1501	CODE	141	2	{1}	2000	**FEVAN2** Target code of FEVAN2
C1502	SUBCODE	0	0	{1}	255	**FEVAN2** Target subcode FEVAN2
C1503	NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN2** Numerator
C1504	DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN2** Denominator
C1505	OFFSET	0	0		1000000000	**FEVAN2** Offset
C1506 STOP	FEVAN2-IN	1000	FIXED0%		→ Selection list 1	**FEVAN2** Configuration of analog input signal
C1507 STOP	LOAD	1000	FIXED0		→ Selection list 2	**FEVAN2** Configuraton of digital input signal
C1508	(C1506)	Disp	-32768	{1}	32767	**FEVAN2** Display of analog input signal
C1509	(C1507)	Disp				**FEVAN2** Display of digital input signal
C1799		1250	20	{1}	1250	**DFOUT f_{max} (kHz)** 1250 corresponds to 500 kHz
C1810		Disp				**SW-EKZ LECOM**
C1811		Disp				**SW generation**

8.5 Selection lists

8.5.1 Selection list 1: Analog output signals

Parameter	Analog output signal (O)
000050	AIN1-OUT
000055	AIN2-OUT
000100	DFSET-NOUT
001000	FIXED0%
001006	FIXED100%
001007	FIXED-100%
005000	MCTRL-NSET2
005001	MCTRL-NACT
005002	MCTRL-MSET2
005003	MCTRL-MACT
005004	MCTRL-IACT
005005	MCTRL-DCVOLT
005009	MCTRL-PHI-ACT
005050	NSET-NOUT
005051	NSET-RFG-I
005100	MPOT1-OUT
005150	PCTRL1-OUT
005200	REF-N-SET
005500	ARIT1-OUT
005505	ARIT2-OUT
005550	ADD1-OUT
005600	RFG1-OUT
005610	SRFG1-OUT
005611	SRFG1-DIFF
005650	ASW1-OUT
005655	ASW2-OUT
005660	ASW3-OUT
005665	ASW4-OUT
005700	ANEG1-OUT
005705	ANEG2-OUT
005750	FIXSET1-OUT
005800	LIM1-OUT
005850	ABS1-OUT
005900	PT1-1-OUT
005950	DT1-1-OUT
006100	MFAIL-NOUT
006150	DB1-OUT
006200	CONV1-OUT
006205	CONV2-OUT
006210	CONV3-OUT
006215	CONV4-OUT
006230	CONVPHA1-OUT
006300	S&H1-OUT

Parameter	Analog output signal (O)
006350	CURVE1-OUT
006400	FCNT1-OUT
006600	SYNC1-OUT3
010000	BRK-M-SET
015028	UTILIZATION
015030	MCTRL-LOAD-I^2XT
019500	FCODE-17
019502	FCODE-26/1
019503	FCODE-26/2
019504	FCODE-27/1
019505	FCODE-27/2
019506	FCODE-32
019507	FCODE-37
019510	FCODE-108/1
019511	FCODE-108/2
019512	FCODE-109/1
019513	FCODE-109/2
019515	FCODE-141
019521	FCODE-472/1
019522	FCODE-472/2
019523	FCODE-472/3
019524	FCODE-472/4
019525	FCODE-472/5
019526	FCODE-472/6
019527	FCODE-472/7
019528	FCODE-472/8
019529	FCODE-472/9
019530	FCODE-472/10
019531	FCODE-472/11
019532	FCODE-472/12
019533	FCODE-472/13
019534	FCODE-472/14
019535	FCODE-472/15
019536	FCODE-472/16
019537	FCODE-472/17
019538	FCODE-472/18
019539	FCODE-472/19
019540	FCODE-472/20
019551	FCODE-473/1
019552	FCODE-473/2
019553	FCODE-473/3
019554	FCODE-473/4
019555	FCODE-473/5

Parameter	Analog output signal (O)
019556	FCODE-473/6
019557	FCODE-473/7
019558	FCODE-473/8
019559	FCODE-473/9
019560	FCODE-473/10
020101	CAN-IN1.W1
020102	CAN-IN1.W2
020103	CAN-IN1.W3
020201	CAN-IN2.W1
020202	CAN-IN2.W2
020203	CAN-IN2.W3
020204	CAN-IN2.W4
020301	CAN-IN3.W1
020302	CAN-IN3.W2
020303	CAN-IN3.W3
020304	CAN-IN3.W4
025101	AIF-IN.W1
025102	AIF-IN.W2
025103	AIF-IN.W3

8.5.2 Selection list 2: Digital output signals

Parameter	Digital output signal (□)
000051	DIGIN1
000052	DIGIN2
000053	DIGIN3
000054	DIGIN4
000055	DIGIN5
000060	STATE-BUS-O
000065	DIGIN-CINH
000100	DFSET-ACK
000500	DCTRL-RDY
000501	DCTRL-CINH
000502	DCTRL-INIT
000503	DCTRL-IMP
000504	DCTRL-NACT=0
000505	DCTRL-CW/CCW
001000	FIXED0
001001	FIXED1
002000	DCTRL-PAR*1-O
002001	DCTRL-PAR*2-O
002002	DCTRL-PARBUSY
005001	MCTRL-QSP-OUT
005002	MCTRL-IMAX
005003	MCTRL-MMAX
005050	NSET-RFG-I=0
005200	REF-OK
005201	REF-BUSY
006000	DFRFG1-FAIL
006001	DFRFG1-SYNC
006100	MFAIL-STATUS
006101	MFAIL-I-RESET
006400	FCNT1-EQUAL
006600	SYNC1-STAT
010000	BRK1-OUT
010001	BRK1-CINH
010002	BRK1-QSP
010003	BRK1-M-STORE
010250	R/L/Q-QSP
010251	R/L/Q-R/L
010500	AND1-OUT
010505	AND2-OUT
010510	AND3-OUT
010515	AND4-OUT
010520	AND5-OUT
010525	AND6-OUT
010530	AND7-OUT

Parameter	Digital output signal (□)
010550	OR1-OUT
010555	OR2-OUT
010560	OR3-OUT
010565	OR4-OUT
010570	OR5-OUT
010600	NOT1-OUT
010605	NOT2-OUT
010610	NOT3-OUT
010615	NOT4-OUT
010620	NOT5-OUT
010650	CMP1-OUT
010655	CMP2-OUT
010660	CMP3-OUT
010680	PHCMP1-OUT
010685	PHCMP2-OUT
010690	PHCMP3-OUT
010700	DIGDEL1-OUT
010705	DIGDEL2-OUT
010750	TRANS1-OUT
010755	TRANS2-OUT
010760	TRANS3-OUT
010765	TRANS4-OUT
010900	FLIP1-OUT
010905	FLIP2-OUT
012000	PHINT1-FAIL
012005	PHINT2-FAIL
012010	PHINT3-STAT
013000	FEVAN1-BUSY
013001	FEVAN1-FAIL
013005	FEVAN2-BUSY
013006	FEVAN2-FAIL
014050	STORE1-TP-INH
014055	STORE2-TP-INH
015000	DCTRL-TRIP
015001	DCTRL-MESS
015002	DCTRL-WARN
015003	DCTRL-FAIL
015010	MONIT-LU
015011	MONIT-OU
015012	MONIT-EEr
015013	MONIT-OC1
015014	MONIT-OC2
015015	MONIT-LP1
015016	MONIT-OH

Parameter	Digital output signal (□)
015017	MONIT-OH3
015018	MONIT-OH4
015019	MONIT-OH7
015020	MONIT-OH8
015021	MONIT-Sd2
015022	MONIT-Sd3
015023	MONIT-P03
015024	MONIT-P13
015026	MONIT-CE0
015027	MONIT-NMAX
015028	MONIT-OC5
015029	MONIT-SD5
015030	MONIT-SD6
015031	MONIT-SD7
015032	MONIT-H07
015033	MONIT-H10
015034	MONIT-H11
015040	MONIT-CE1
015041	MONIT-CE2
015042	MONIT-CE3
015043	MONIT-CE4
015044	MONIT-PL
015045	MONIT-P19
015047	MONIT-OC6
015048	MONIT-OC8
015320	MONIT-SD8
015321	MONIT-nErr
019500	FCODE-250
019521	FCODE-471.B0
019522	FCODE-471.B1
019523	FCODE-471.B2
019524	FCODE-471.B3
019525	FCODE-471.B4
019526	FCODE-471.B5
019527	FCODE-471.B6
019528	FCODE-471.B7
019529	FCODE-471.B8
019530	FCODE-471.B9
019531	FCODE-471.B10
019532	FCODE-471.B11
019533	FCODE-471.B12
019534	FCODE-471.B13
019535	FCODE-471.B14
019536	FCODE-471.B15
019537	FCODE-471.B16
019538	FCODE-471.B17
019539	FCODE-471.B18
019540	FCODE-471.B19

Parameter	Digital output signal (□)
019541	FCODE-471.B20
019542	FCODE-471.B21
019543	FCODE-471.B22
019544	FCODE-471.B23
019545	FCODE-471.B24
019546	FCODE-471.B25
019547	FCODE-471.B26
019548	FCODE-471.B27
019549	FCODE-471.B28
019550	FCODE-471.B29
019551	FCODE-471.B30
019552	FCODE-471.B31
019751	FCODE-135.B0
019752	FCODE-135.B1
019753	FCODE-135.B2
019755	FCODE-135.B4
019756	FCODE-135.B5
019757	FCODE-135.B6
019758	FCODE-135.B7
019763	FCODE-135.B12
019764	FCODE-135.B13
019765	FCODE-135.B14
019766	FCODE-135.B15
020001	CAN-CTRL.B0
020002	CAN-CTRL.B1
020003	CAN-CTRL.B2
020005	CAN-CTRL.B4
020006	CAN-CTRL.B5
020007	CAN-CTRL.B6
020008	CAN-CTRL.B7
020013	CAN-CTRL.B12
020014	CAN-CTRL.B13
020015	CAN-CTRL.B14
020016	CAN-CTRL.B15
020101	CAN-IN1.B0
020102	CAN-IN1.B1
020103	CAN-IN1.B2
020104	CAN-IN1.B3
020105	CAN-IN1.B4
020106	CAN-IN1.B5
020107	CAN-IN1.B6
020108	CAN-IN1.B7
020109	CAN-IN1.B8
020110	CAN-IN1.B9
020111	CAN-IN1.B10
020112	CAN-IN1.B11
020113	CAN-IN1.B12
020114	CAN-IN1.B13

Parameter	Digital output signal (□)
020115	CAN-IN1.B14
020116	CAN-IN1.B15
020117	CAN-IN1.B16
020118	CAN-IN1.B17
020119	CAN-IN1.B18
020120	CAN-IN1.B19
020121	CAN-IN1.B20
020122	CAN-IN1.B21
020123	CAN-IN1.B22
020124	CAN-IN1.B23
020125	CAN-IN1.B24
020126	CAN-IN1.B25
020127	CAN-IN1.B26
020128	CAN-IN1.B27
020129	CAN-IN1.B28
020130	CAN-IN1.B29
020131	CAN-IN1.B30
020132	CAN-IN1.B31
020201	CAN-IN2.B0
020202	CAN-IN2.B1
020203	CAN-IN2.B2
020204	CAN-IN2.B3
020205	CAN-IN2.B4
020206	CAN-IN2.B5
020207	CAN-IN2.B6
020208	CAN-IN2.B7
020209	CAN-IN2.B8
020210	CAN-IN2.B9
020211	CAN-IN2.B10
020212	CAN.IN2.B11
020213	CAN-IN2.B12
020214	CAN-IN2.B13
020215	CAN-IN2.B14
020216	CAN-IN2.B15
020217	CAN-IN2.B16
020218	CAN-IN2.B17
020219	CAN-IN2.B18
020220	CAN-IN2.B19
020221	CAN-IN2.B20
020222	CAN-IN2.B21
020223	CAN-IN2.B22
020224	CAN-IN2.B23
020225	CAN-IN2.B24
020226	CAN-IN2.B25
020227	CAN-IN2.B26
020228	CAN-IN2.B27
020229	CAN-IN2.B28
020230	CAN-IN2.B29

Parameter	Digital output signal (□)
020231	CAN-IN2.B30
020232	CAN-IN2.B31
020301	CAN-IN3.B0
020302	CAN-IN3.B1
020303	CAN-IN3.B2
020304	CAN-IN3.B3
020305	CAN-IN3.B4
020306	CAN-IN3.B5
020307	CAN-IN3.B6
020308	CAN-IN3.B7
020309	CAN-IN3.B8
020310	CAN-IN3.B9
020311	CAN-IN3.B10
020312	CAN-IN3.B11
020313	CAN-IN3.B12
020314	CAN-IN3.B13
020315	CAN-IN3.B14
020316	CAN-IN3.B15
020317	CAN-IN3.B16
020318	CAN-IN3.B17
020319	CAN-IN3.B18
020320	CAN-IN3.B19
020321	CAN-IN3.B20
020322	CAN-IN3.B21
020323	CAN-IN3.B22
020324	CAN-IN3.B23
020325	CAN-IN3.B24
020326	CAN-IN3.B25
020327	CAN-IN3.B26
020328	CAN-IN3.B27
020329	CAN-IN3.B28
020330	CAN-IN3.B29
020331	CAN-IN3.B30
020332	CAN-IN3.B31
025001	AIF-CTRL.B0
025002	AIF-CTRL.B1
025003	AIF-CTRL.B2
025005	AIF-CTRL.B4
025006	AIF-CTRL.B5
025007	AIF-CTRL.B6
025008	AIF-CTRL.B7
025013	AIF-CTRL.B12
025014	AIF-CTRL.B13
025015	AIF-CTRL.B14
025016	AIF-CTRL.B15
025101	AIF-IN.B0
025102	AIF-IN.B1
025103	AIF-IN.B2

Parameter	Digital output signal (□)
025104	AIF-IN.B3
025105	AIF-IN.B4
025106	AIF-IN.B5
025107	AIF-IN.B6
025108	AIF-IN.B7
025109	AIF-IN.B8
025110	AIF-IN.B9
025111	AIF-IN.B10
025112	AIF-IN.B11
025113	AIF-IN.B12
025114	AIF-IN.B13
025115	AIF-IN.B14
025116	AIF-IN.B15
025117	AIF-IN.B16
025118	AIF-IN.B17
025119	AIF-IN.B18
025120	AIF-IN.B19
025121	AIF-IN.B20
025122	AIF-IN.B21
025123	AIF-IN.B22
025124	AIF-IN.B23
025125	AIF-IN.B24
025126	AIF-IN.B25
025127	AIF-IN.B26
025128	AIF-IN.B27
025129	AIF-IN.B28
025130	AIF-IN.B29
025131	AIF-IN.B30
025132	AIF-IN.B31

8.5.3 Selection list 3: Angle signals

Parameter	Angle signal (▲)
000100	DFSET-PSET
000101	DFSET-PSET2
001000	FIXED0INC
005000	MCTRL-PHI-ANG
005200	REF-PSET
005520	ARITPH1-OUT
005580	PHADD1-OUT
005581	PHADD1-OUT2
006235	CONVPHPH1-OUT
006600	SYNC1-OUT2
012000	PHINT1-OUT
012005	PHINT2-OUT
012010	PHINT3-OUT
012050	PHDIV1-OUT
014000	PHDIFF1-OUT
014050	STORE1-PHACT
014051	STORE1-PH1
014052	STORE1-PH2
014053	STORE1-PHDIFF
014055	STORE2-PHACT
014056	STORE2-PH1
014057	STORE1-PH2
014100	GEARCOMP-OUT
019521	FCODE-474/1
019522	FCODE-474/2
019523	FCODE-474/3
019524	FCODE-474/4
019525	FCODE-474/5
020103	CAN-IN1.D1
020201	CAN-IN2.D1
020301	CAN-IN3.D1
025103	AIF-IN.D1
025104	AIF-IN.D2

8.5.4 Selection list 4: Speed signals

Parameter	Speed signal (△)
000050	DFIN-OUT
000100	DFSET-POUT
000250	DFOUT-OUT
001000	FIXEDPHI-0
005000	MCTRL-PHI-ACT
006000	DFRFG-OUT
006220	CONV5-OUT
006225	CONV6-OUT
006230	CONVPHA1-OUT2
006240	CONVPP1-OUT
006600	SYNC1-OUT1
019521	FCODE-475/1
019522	FCODE-475/2

8.5.5 Selection list 5: Function blocks

Parameter	Function block
000000	empty
000050	AIN1
000055	AIN2
000070	AOUT1
000075	AOUT2
000100	DFSET
000200	DFIN
000250	DFOUT
005050	NSET
005100	MPOT1
005150	PCTRL1
005200	REF
005500	ARIT1
005505	ARIT2
005520	ARITPH1
005550	ADD1
005580	PHADD1
005600	RFG1
005610	SRFG1
005650	ASW1
005655	ASW2
005660	ASW3
005665	ASW4
005700	ANEG1
005705	ANEG2
005750	FIXSET1
005800	LIM1
005850	ABS1
005900	PT1-1
005950	DT1-1
006000	DFRFG1
006100	MFAIL
006150	DB1

Parameter	Function block
006200	CONV1
006205	CONV2
006210	CONV3
006215	CONV4
006220	CONV5
006225	CONV6
006230	CONVPHA1
006235	CONVPHPH1
006240	CONVPP1
006300	S&H1
006350	CURVE1
006420	FCNT1
006600	SYNC1
010000	BRK1
010250	R/L/Q
010500	AND1
010505	AND2
010510	AND3
010515	AND4
010520	AND5
010525	AND6
010530	AND7
010550	OR1
010555	OR2
010560	OR3
010565	OR4
010570	OR5
010600	NOT1
010605	NOT2
010610	NOT3
010615	NOT4
010620	NOT5
010650	CMP1

Parameter	Function block
010655	CMP2
010660	CMP3
010680	PHCMP1
010685	PHCMP2
010690	PHCMP3
010700	DIGDEL1
010705	DIGDEL2
010750	TRANS1
010755	TRANS2
010760	TRANS3
010765	TRANS4
010900	FLIP1
010905	FLIP2
012000	PHINT1
012005	PHINT2
012010	PHINT3
012050	PHDIV1
013000	FEVAN1
013005	FEVAN2
013100	OSZ
014000	PHDIFF1
014050	STORE1
014055	STORE2
014100	GEARCOMP
015100	MLP1
020000	CAN-OUT
025000	AIF-OUT

8.5.6 Selection list 10: Error messages

Parameter	Error message
00000	No fail
00011	OC1-TRIP
00012	OC2-TRIP
00015	OC5-TRIP
00016	OC6-TRIP
00018	OC8-TRIP
00022	LUQ-TRIP
00032	LP1-TRIP
00050	OH-TRIP
00053	OH3-TRIP
00057	OH7-TRIP
00058	OH8-TRIP
00061	CE0-TRIP
00062	CE1-TRIP
00063	CE2-TRIP
00064	CE3-TRIP
00065	CE4-TRIP
00070	U15-TRIP
00071	CCr-TRIP
00072	Pr1-TRIP
00073	Pr2-TRIP
00074	PEr-TRIP
00075	Pr0-TRIP
00077	Pr3-TRIP
00078	Pr4-TRIP
00079	PI-TRIP
00082	Sd2-TRIP
00083	Sd3-TRIP
00085	Sd5-TRIP
00086	Sd6-TRIP
00087	Sd7-TRIP
00088	Sd8-TRIP
00089	PL-TRIP
00091	EEr-TRIP
00105	H05-TRIP
00107	H07-TRIP
00110	H10-TRIP
00111	H11-TRIP
00153	P03-TRIP
00163	P13-TRIP
00166	P16-TRIP
00169	P19-TRIP
00190	nErr-TRIP
00200	NMAX-TRIP
01020	OU message

Parameter	Error message
01030	LU message
01091	EEr message
01190	nEEr message
02018	OC8 warning
02032	LP1 warning
02053	OH3 warning
02054	OH4 warning
02057	OH7 warning
02058	OH8 warning
02061	CEO warning
02062	CE1 warning
02063	CE2 warning
02064	CE3 warning
02065	CE4 warning
02082	Sd2 warning
02083	Sd3 warning
02085	Sd5 warning
02086	Sd6 warning
02091	EER warning
02153	P03 warning
02163	P13 warning
02166	P16 warning
02169	P19 warning
02190	nEEr warning

8.6 Table of attributes

The attribute table describes the properties of the codes used. It enables you to create your own communication programs for the controller.

How to read the table of attributes

Column		Abbreviation	Meaning	
Code		Cxxxx	Name of the Lenze code	
Index	dec	24575 - Lenze code number	Index under which the parameter is addressed The subindex of array variables corresponds to the Lenze subcode number	Is only required for control via INTERBUS, PROFIBUS DP or system bus (CAN)
	hex	5FFFh - Lenze code number		
Data	DS	E	Data structure	Single variable (only one parameter element)
		A		Array variable (several parameter elements)
	DA	xx	Number of array elements (subcodes)	
	DT	B8	Data type	1 byte bit-coded
		B16		2 bytes bit-coded
		B32		4 bytes bit-coded
		FIX32		32-bit value with sign; decimal with four decimal places
		I32		4 bytes with sign
		U32		4 bytes without sign
		VS		ASCII string
	Format	VD	LECOM format (see also Operating Instructions of the bus module)	ASCII decimal format
		VH		ASCII hexadecimal format
		VS		String format
		VO		Octet string format for data blocks
	DL		Data length in byte	The column "Important" contains further information
Access	LCM-R/W	Ra	Access authorisation for LECOM	Reading is always permitted
		Wa		Writing is always permitted
		W		Writing is restricted
	Condition	CINH	Condition for writing	Writing permitted only when controller is inhibited

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0002	24573	5FFD	E	1	FIX32	VD	4	Ra/W	CINH
C0003	24572	5FFC	E	1	FIX32	VD	4	Ra/Wa	
C0004	24571	5FFB	E	1	FIX32	VD	4	Ra/Wa	
C0005	24570	5FFA	E	1	FIX32	VD	4	Ra/W	CINH
C0006	24569	5FF9	E	1	FIX32	VD	4	Ra/W	CINH
C0009	24566	5FF6	E	1	FIX32	VD	4	Ra/Wa	
C0011	24564	5FF4	E	1	FIX32	VD	4	Ra/Wa	
C0012	24563	5FF3	E	1	FIX32	VD	4	Ra/Wa	
C0013	24562	5FF2	E	1	FIX32	VD	4	Ra/Wa	
C0017	24558	5FEE	E	1	FIX32	VD	4	Ra/Wa	
C0018	24557	5FED	E	1	FIX32	VD	4	Ra/Wa	
C0019	24556	5FEC	E	1	FIX32	VD	4	Ra/Wa	
C0021	24554	5FEA	E	1	FIX32	VD	4	Ra/Wa	
C0022	24553	5FE9	E	1	FIX32	VD	4	Ra/Wa	
C0025	24550	5FE6	E	1	FIX32	VD	4	Ra/W	CINH
C0026	24549	5FE5	A	2	FIX32	VD	4	Ra/Wa	
C0027	24548	5FE4	A	2	FIX32	VD	4	Ra/Wa	
C0030	24545	5FE1	E	1	FIX32	VD	4	Ra/Wa	
C0032	24543	5FDF	E	1	FIX32	VD	4	Ra/Wa	
C0033	24542	5FDE	E	1	FIX32	VD	4	Ra/Wa	
C0034	24541	5FDD	E	1	FIX32	VD	4	Ra/Wa	
C0037	24538	5FDA	E	1	FIX32	VD	4	Ra/Wa	
C0039	24536	5FD8	A	15	FIX32	VD	4	Ra/Wa	
C0040	24535	5FD7	E	1	FIX32	VD	4	Ra/Wa	
C0042	24533	5FD5	E	1	FIX32	VD	4	Ra	
C0043	24532	5FD4	E	1	FIX32	VD	4	Ra/Wa	
C0045	24530	5FD2	E	1	FIX32	VD	4	Ra	
C0046	24529	5FD1	E	1	FIX32	VD	4	Ra	
C0049	24526	5FCE	E	1	FIX32	VD	4	Ra	
C0050	24525	5FCD	E	1	FIX32	VD	4	Ra	
C0051	24524	5FCC	E	1	FIX32	VD	4	Ra	
C0052	24523	5FCB	E	1	FIX32	VD	4	Ra	
C0053	24522	5FCA	E	1	FIX32	VD	4	Ra	
C0054	24521	5FC9	E	1	FIX32	VD	4	Ra	
C0056	24519	5FC7	E	1	FIX32	VD	4	Ra	
C0057	24518	5FC6	E	1	FIX32	VD	4	Ra	
C0058	24517	5FC5	E	1	FIX32	VD	4	Ra/Wa	
C0059	24516	5FC4	E	1	FIX32	VD	4	Ra	
C0060	24515	5FC3	E	1	FIX32	VD	4	Ra	
C0061	24514	5FC2	E	1	FIX32	VD	4	Ra	
C0063	24512	5FC0	E	1	FIX32	VD	4	Ra	
C0064	24511	5FBF	E	1	FIX32	VD	4	Ra	
C0066	24509	5FBD	E	1	FIX32	VD	4	Ra	
C0067	24508	5FBC	E	1	FIX32	VD	4	Ra	
C0070	24505	5FB9	E	1	FIX32	VD	4	Ra/Wa	
C0071	24504	5FB8	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0072	24503	5FB7	E	1	FIX32	VD	4	Ra/Wa	
C0075	24500	5FB4	E	1	FIX32	VD	4	Ra/Wa	
C0076	24499	5FB3	E	1	FIX32	VD	4	Ra/Wa	
C0077	24498	5FB2	E	1	FIX32	VD	4	Ra/Wa	
C0078	24497	5FB1	E	1	FIX32	VD	4	Ra/Wa	
C0081	24494	5FAE	E	1	FIX32	VD	4	Ra/W	CINH
C0084	24491	5FAB	E	1	FIX32	VD	4	Ra/W	CINH
C0085	24490	5FAA	E	1	FIX32	VD	4	Ra/W	CINH
C0086	24489	5FA9	E	1	FIX32	VD	4	Ra/W	CINH
C0087	24488	5FA8	E	1	FIX32	VD	4	Ra/W	CINH
C0088	24487	5FA7	E	1	FIX32	VD	4	Ra/W	CINH
C0089	24486	5FA6	E	1	FIX32	VD	4	Ra/W	CINH
C0090	24485	5FA5	E	1	FIX32	VD	4	Ra/W	CINH
C0091	24484	5FA4	E	1	FIX32	VD	4	Ra/W	CINH
C0093	24482	5FA2	E	1	FIX32	VD	4	Ra	
C0094	24481	5FA1	E	1	FIX32	VD	4	Ra/Wa	
C0095	24480	5FA0	E	1	FIX32	VD	4	Ra/W	CINH
C0096	24479	5F9F	A	2	FIX32	VD	4	Ra/Wa	
C0099	24476	5F9C	E	1	FIX32	VD	4	Ra	
C0101	24474	5F9A	A	15	FIX32	VD	4	Ra/Wa	
C0103	24472	5F98	A	15	FIX32	VD	4	Ra/Wa	
C0105	24470	5F96	E	1	FIX32	VD	4	Ra/Wa	
C0108	24467	5F93	A	2	FIX32	VD	4	Ra/Wa	
C0109	24466	5F92	A	2	FIX32	VD	4	Ra/Wa	
C0114	24461	5F8D	A	5	FIX32	VD	4	Ra/Wa	
C0116	24459	5F8B	A	32	FIX32	VD	4	Ra/W	CINH
C0117	24458	5F8A	A	4	FIX32	VD	4	Ra/W	CINH
C0118	24457	5F89	A	4	FIX32	VD	4	Ra/Wa	
C0120	24455	5F87	E	1	FIX32	VD	4	Ra/Wa	
C0121	24454	5F86	E	1	FIX32	VD	4	Ra/Wa	
C0122	24453	5F85	E	1	FIX32	VD	4	Ra/Wa	
C0125	24450	5F82	E	1	FIX32	VD	4	Ra/Wa	
C0126	24449	5F81	E	1	FIX32	VD	4	Ra/Wa	
C0127	24448	5F80	E	1	FIX32	VD	4	Ra/Wa	
C0128	24447	5F7F	E	1	FIX32	VD	4	Ra/Wa	
C0130	24445	5F7D	E	1	FIX32	VD	4	Ra	
C0134	24441	5F79	E	1	FIX32	VD	4	Ra/Wa	
C0135	24440	5F78	E	1	B16	VH	2		
C0136	24439	5F77	A	3	B16	VH	2	Ra	
C0141	24434	5F72	E	1	FIX32	VD	4	Ra/Wa	
C0142	24433	5F71	E	1	FIX32	VD	4	Ra/Wa	
C0150	24425	5F69	E	1	B16	VH	2	Ra	
C0151	24424	5F68	E	1	B32	VH	4	Ra	
C0155	24420	5F64	E	1	B16	VH	2	Ra	
C0156	24419	5F63	A	7	FIX32	VD	4	Ra/W	CINH
C0157	24418	5F62	A	7	FIX32	VD	4	Ra	
C0161	24414	5F5E	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0167	24408	5F58	E	1	FIX32	VD	4	Ra/Wa	
C0168	24407	5F57	A	8	FIX32	VD	4	Ra	
C0169	24406	5F56	A	8	U32	VH	4	Ra	
C0170	24405	5F55	A	8	FIX32	VD	4	Ra	
C0172	24403	5F53	E	1	FIX32	VD	4	Ra/Wa	
C0173	24402	5F52	E	1	FIX32	VD	4	Ra/Wa	
C0178	24397	5F4D	E	1	U32	VH	4	Ra	
C0179	24396	5F4C	E	1	U32	VH	4	Ra	
C0182	24393	5F49	E	1	FIX32	VD	4	Ra/Wa	
C0183	24392	5F48	E	1	FIX32	VD	4	Ra	
C0190	24385	5F41	E	1	FIX32	VD	4	Ra/Wa	
C0195	24380	5F3C	E	1	FIX32	VD	4	Ra/Wa	
C0196	24379	5F3B	E	1	FIX32	VD	4	Ra/Wa	
C0200	24375	5F37	E	1	VS	VS	14	Ra	
C0201	24374	5F36	E	1	VS	VS	20	Ra	
C0202	24373	5F35	E	1	FIX32	VD	4	Ra	
C0203	24372	5F34	E	1	VS	VS	12	Ra	
C0204	24371	5F33	E	1	FIX32	VD	4	Ra	
C0206	24369	5F31	E	1	VS	VS	13	Ra	
C0207	24368	5F30	E	1	VS	VS	14	Ra	
C0208	24367	5F2F	E	1	VS	VS	14	Ra	
C0209	24366	5F2E	E	1	VS	VS	14	Ra	
C0220	24355	5F23	E	1	FIX32	VD	4	Ra/Wa	
C0221	24354	5F22	E	1	FIX32	VD	4	Ra/Wa	
C0222	24353	5F21	E	1	FIX32	VD	4	Ra/Wa	
C0223	24352	5F20	E	1	FIX32	VD	4	Ra/Wa	
C0224	24351	5F1F	E	1	FIX32	VD	4	Ra/Wa	
C0241	24334	5F0E	E	1	FIX32	VD	4	Ra/Wa	
C0244	24331	5F0B	E	1	FIX32	VD	4	Ra/Wa	
C0250	24325	5F05	E	1	FIX32	VD	4	Ra/Wa	
C0252	24323	5F03	E	1	I32	VH	4	Ra/Wa	
C0253	24322	5F02	E	1	FIX32	VD	4	Ra/Wa	
C0254	24321	5F01	E	1	FIX32	VD	4	Ra/Wa	
C0255	24320	5F00	E	1	U32	VH	4	Ra/Wa	
C0260	24315	5EFB	E	1	FIX32	VD	4	Ra/Wa	
C0261	24314	5EFA	E	1	FIX32	VD	4	Ra/Wa	
C0262	24313	5EF9	E	1	FIX32	VD	4	Ra/Wa	
C0263	24312	5EF8	E	1	FIX32	VD	4	Ra/Wa	
C0264	24311	5EF7	E	1	FIX32	VD	4	Ra/Wa	
C0265	24310	5EF6	E	1	FIX32	VD	4	Ra/Wa	
C0267	24308	5EF4	A	2	FIX32	VD	4	Ra/W	CINH
C0268	24307	5EF3	E	1	FIX32	VD	4	Ra/W	CINH
C0269	24306	5EF2	A	3	FIX32	VD	4	Ra	
C0291	24284	5EDC	E	1	FIX32	VD	4	Ra/Wa	
C0292	24283	5EDB	E	1	FIX32	VD	4	Ra/Wa	
C0293	24282	5EDA	E	1	FIX32	VD	4	Ra/Wa	
C0294	24281	5ED9	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0295	24280	5ED8	E	1	FIX32	VD	4	Ra/Wa	
C0296	24279	5ED7	E	1	FIX32	VD	4	Ra/Wa	
C0325	24250	5EBA	E	1	FIX32	VD	4	Ra/Wa	
C0326	24249	5EB9	E	1	FIX32	VD	4	Ra/Wa	
C0327	24248	5EB8	E	1	FIX32	VD	4	Ra/Wa	
C0328	24247	5EB7	E	1	FIX32	VD	4	Ra/Wa	
C0329	24246	5EB6	E	1	FIX32	VD	4	Ra/Wa	
C0332	24243	5EB3	E	1	FIX32	VD	4	Ra/Wa	
C0333	24242	5EB2	E	1	FIX32	VD	4	Ra/Wa	
C0336	24239	5EAF	E	1	FIX32	VD	4	Ra	
C0337	24238	5EAE	E	1	FIX32	VD	4	Ra/Wa	
C0338	24237	5EAD	E	1	FIX32	VD	4	Ra/Wa	
C0339	24236	5EAC	A	2	FIX32	VD	4	Ra/W	CINH
C0340	24235	5EAB	A	2	FIX32	VD	4	Ra	
C0350	24225	5EA1	E	1	FIX32	VD	4	Ra/Wa	
C0351	24224	5EA0	E	1	FIX32	VD	4	Ra/Wa	
C0352	24223	5E9F	E	1	FIX32	VD	4	Ra/Wa	
C0353	24222	5E9E	A	3	FIX32	VD	4	Ra/Wa	
C0354	24221	5E9D	A	6	FIX32	VD	4	Ra/Wa	
C0355	24220	5E9C	A	6	FIX32	VD	4	Ra	
C0356	24219	5E9B	A	4	FIX32	VD	4	Ra/Wa	
C0357	24218	5E9A	A	3	FIX32	VD	4	Ra/Wa	
C0358	24217	5E99	E	1	FIX32	VD	4	Ra/Wa	
C0359	24216	5E98	E	1	FIX32	VD	4	Ra	
C0360	24215	5E97	A	12	FIX32	VD	4	Ra	
C0361	24214	5E96	A	12	FIX32	VD	4	Ra	
C0362	24213	5E95	E	1	FIX32	VD	4	Ra	
C0363	24212	5E94	E	1	FIX32	VD	4	Ra/Wa	
C0364	24211	5E93	E	1	FIX32	VD	4	Ra/W	CINH
C0365	24210	5E92	E	1	FIX32	VD	4	Ra	
C0366	24209	5E91	E	1	FIX32	VD	4	Ra/Wa	
C0367	24208	5E90	E	1	FIX32	VD	4	Ra/Wa	
C0368	24207	5E8F	E	1	FIX32	VD	4	Ra/Wa	
C0369	24206	5E8E	E	1	FIX32	VD	4	Ra/Wa	
C0400	24175	5E6F	E	1	FIX32	VD	4	Ra	
C0402	24173	5E6D	E	1	FIX32	VD	4	Ra/W	CINH
C0403	24172	5E6C	E	1	FIX32	VD	4	Ra/W	CINH
C0404	24171	5E6B	A	2	FIX32	VD	4	Ra	
C0405	24170	5E6A	E	1	FIX32	VD	4	Ra	
C0407	24168	5E68	E	1	FIX32	VD	4	Ra/W	CINH
C0408	24167	5E67	E	1	FIX32	VD	4	Ra/W	CINH
C0409	24166	5E66	A	2	FIX32	VD	4	Ra	
C0416	24159	5E5F	E	1	U32	VH	4	Ra/W	CINH
C0420	24155	5E5B	E	1	FIX32	VD	4	Ra/W	CINH
C0421	24154	5E5A	E	1	FIX32	VD	4	Ra/W	CINH
C0425	24150	5E56	E	1	FIX32	VD	4	Ra/Wa	
C0426	24149	5E55	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0427	24148	5E54	E	1	FIX32	VD	4	Ra/Wa	
C0429	24146	5E52	E	1	FIX32	VD	4	Ra/Wa	
C0431	24144	5E50	E	1	FIX32	VD	4	Ra/W	CINH
C0432	24143	5E4F	E	1	FIX32	VD	4	Ra/W	CINH
C0433	24142	5E4E	E	1	FIX32	VD	4	Ra/W	CINH
C0434	24141	5E4D	A	3	FIX32	VD	4	Ra	
C0436	24139	5E4B	E	1	FIX32	VD	4	Ra/W	CINH
C0437	24138	5E4A	E	1	FIX32	VD	4	Ra/W	CINH
C0438	24137	5E49	E	1	FIX32	VD	4	Ra/W	CINH
C0439	24136	5E48	A	3	FIX32	VD	4	Ra	
C0440	24135	5E47	E	1	FIX32	VD	4	Ra/W	CINH
C0441	24134	5E46	E	1	FIX32	VD	4	Ra	
C0443	24132	5E44	E	1	B8	VH	1	Ra	
C0444	24131	5E43	A	4	FIX32	VD	4	Ra	
C0450	24125	5E3D	E	1	FIX32	VD	4	Ra/W	CINH
C0451	24124	5E3C	E	1	FIX32	VD	4	Ra/W	CINH
C0452	24123	5E3B	E	1	FIX32	VD	4	Ra/W	CINH
C0458	24117	5E35	A	2	FIX32	VD	4	Ra	
C0459	24116	5E34	E	1	FIX32	VD	4	Ra	
C0464	24111	5E2F	E	1	FIX32	VD	4	Ra	
C0465	24110	5E2E	A	50	FIX32	VD	4	Ra/W	CINH
C0466	24109	5E2D	E	1	FIX32	VD	4	Ra	
C0469	24106	5E2A	E	1	FIX32	VD	4	Ra/W	CINH
C0470	24105	5E29	A	4	B8	VH	1	Ra/Wa	
C0471	24104	5E28	E	1	B32	VH	4	Ra/Wa	
C0472	24103	5E27	A	20	FIX32	VD	4	Ra/Wa	
C0473	24102	5E26	A	10	FIX32	VD	4	Ra/Wa	
C0474	24101	5E25	A	5	I32	VH	4	Ra/Wa	
C0475	24100	5E24	A	2	FIX32	VD	4	Ra/Wa	
C0490	24085	5E15	E	1	FIX32	VD	4	Ra/W	CINH
C0495	24080	5E10	E	1	FIX32	VD	4	Ra/W	CINH
C0497	24078	5E0E	E	1	FIX32	VD	4	Ra/Wa	
C0517	24058	5DFA	A	32	FIX32	VD	4	Ra/Wa	
C0520	24055	5DF7	E	1	FIX32	VD	4	Ra/W	CINH
C0521	24054	5DF6	E	1	FIX32	VD	4	Ra/W	CINH
C0522	24053	5DF5	E	1	FIX32	VD	4	Ra/W	CINH
C0523	24052	5DF4	E	1	FIX32	VD	4	Ra/W	CINH
C0524	24051	5DF3	E	1	FIX32	VD	4	Ra/W	CINH
C0525	24050	5DF2	E	1	FIX32	VD	4	Ra/W	CINH
C0526	24049	5DF1	E	1	FIX32	VD	4	Ra/W	CINH
C0527	24048	5DF0	E	1	FIX32	VD	4	Ra/W	CINH
C0528	24047	5DEF	A	4	I32	VH	4	Ra	
C0529	24046	5DEE	E	1	FIX32	VD	4	Ra/Wa	
C0530	24045	5DED	E	1	FIX32	VD	4	Ra/Wa	
C0531	24044	5DEC	E	1	FIX32	VD	4	Ra/Wa	
C0532	24043	5DEB	E	1	FIX32	VD	4	Ra/Wa	
C0533	24042	5DEA	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0534	24041	5DE9	E	1	FIX32	VD	4	Ra/Wa	
C0535	24040	5DE8	E	1	FIX32	VD	4	Ra/Wa	
C0536	24039	5DE7	A	3	FIX32	VD	4	Ra	
C0537	24038	5DE6	E	1	FIX32	VD	4	Ra	
C0538	24037	5DE5	A	3	FIX32	VD	4	Ra	
C0539	24036	5DE4	E	1	FIX32	VD	4	Ra	
C0540	24035	5DE3	E	1	FIX32	VD	4	Ra/Wa	
C0541	24034	5DE2	E	1	FIX32	VD	4	Ra/W	CINH
C0542	24033	5DE1	E	1	FIX32	VD	4	Ra/W	CINH
C0544	24031	5DDF	E	1	FIX32	VD	4	Ra/W	CINH
C0545	24030	5DDE	E	1	FIX32	VD	4	Ra/Wa	
C0546	24029	5DDD	E	1	U32	VH	4	Ra/Wa	
C0547	24028	5DDC	E	1	FIX32	VD	4	Ra	
C0548	24027	5DDB	E	1	FIX32	VD	4	Ra	
C0549	24026	5DDA	E	1	FIX32	VD	4	Ra	
C0551	24024	5DD8	E	1	U32	VH	4	Ra/Wa	
C0560	24015	5DCF	A	15	FIX32	VD	4	Ra/Wa	
C0561	24014	5DCE	E	1	FIX32	VD	4	Ra/W	CINH
C0562	24013	5DCD	A	4	FIX32	VD	4	Ra/W	CINH
C0563	24012	5DCC	E	1	FIX32	VD	4	Ra	
C0564	24011	5DCB	A	4	FIX32	VD	4	Ra	
C0570	24005	5DC5	E	1	FIX32	VD	4	Ra/W	CINH
C0571	24004	5DC4	E	1	FIX32	VD	4	Ra/W	CINH
C0572	24003	5DC3	E	1	FIX32	VD	4	Ra	
C0573	24002	5DC2	E	1	FIX32	VD	4	Ra	
C0575	24000	5DC0	E	1	FIX32	VD	4	Ra/Wa	
C0577	23998	5DBE	E	1	FIX32	VD	4	Ra/Wa	
C0578	23997	5DBD	E	1	FIX32	VD	4	Ra/Wa	
C0581	23994	5DBA	E	1	FIX32	VD	4	Ra/Wa	
C0582	23993	5DB9	E	1	FIX32	VD	4	Ra/Wa	
C0583	23992	5DB8	E	1	FIX32	VD	4	Ra/Wa	
C0584	23991	5DB7	E	1	FIX32	VD	4	Ra/Wa	
C0585	23990	5DB6	E	1	FIX32	VD	4	Ra/Wa	
C0586	23989	5DB5	E	1	FIX32	VD	4	Ra/Wa	
C0587	23988	5DB4	E	1	FIX32	VD	4	Ra/Wa	
C0588	23987	5DB3	E	1	FIX32	VD	4	Ra/Wa	
C0589	23986	5DB2	E	1	FIX32	VD	4	Ra/Wa	
C0590	23985	5DB1	E	1	FIX32	VD	4	Ra/Wa	
C0591	23984	5DB0	E	1	FIX32	VD	4	Ra/Wa	
C0592	23983	5DAF	E	1	FIX32	VD	4	Ra/Wa	
C0593	23982	5DAE	E	1	FIX32	VD	4	Ra/Wa	
C0594	23981	5DAD	E	1	FIX32	VD	4	Ra/Wa	
C0595	23980	5DAC	E	1	FIX32	VD	4	Ra/Wa	
C0596	23979	5DAB	E	1	FIX32	VD	4	Ra/Wa	
C0597	23978	5DAA	E	1	FIX32	VD	4	Ra/Wa	
C0598	23977	5DA9	E	1	FIX32	VD	4	Ra/Wa	
C0599	23976	5DA8	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0600	23975	5DA7	E	1	FIX32	VD	4	Ra/Wa	
C0601	23974	5DA6	A	2	FIX32	VD	4	Ra/W	CINH
C0602	23973	5DA5	A	2	FIX32	VD	4	Ra	
C0606	23969	5DA1	E	1	FIX32	VD	4	Ra/Wa	
C0610	23965	5D9D	A	3	FIX32	VD	4	Ra/W	CINH
C0611	23964	5D9C	A	3	FIX32	VD	4	Ra	
C0620	23955	5D93	E	1	FIX32	VD	4	Ra/Wa	
C0621	23954	5D92	E	1	FIX32	VD	4	Ra/Wa	
C0622	23953	5D91	E	1	FIX32	VD	4	Ra/W	CINH
C0623	23952	5D90	E	1	FIX32	VD	4	Ra	
C0630	23945	5D89	E	1	FIX32	VD	4	Ra/Wa	
C0631	23944	5D88	E	1	FIX32	VD	4	Ra/Wa	
C0632	23943	5D87	E	1	FIX32	VD	4	Ra/W	CINH
C0633	23942	5D86	E	1	FIX32	VD	4	Ra	
C0640	23935	5D7F	E	1	FIX32	VD	4	Ra/Wa	
C0641	23934	5D7E	E	1	FIX32	VD	4	Ra/W	CINH
C0642	23933	5D7D	E	1	FIX32	VD	4	Ra	
C0650	23925	5D75	E	1	FIX32	VD	4	Ra/Wa	
C0651	23924	5D74	E	1	FIX32	VD	4	Ra/Wa	
C0652	23923	5D73	E	1	FIX32	VD	4	Ra/W	CINH
C0653	23922	5D72	E	1	FIX32	VD	4	Ra/Wa	
C0654	23921	5D71	E	1	FIX32	VD	4	Ra	
C0655	23920	5D70	E	1	FIX32	VD	4	Ra/Wa	
C0656	23919	5D6F	E	1	FIX32	VD	4	Ra/Wa	
C0657	23918	5D6E	E	1	FIX32	VD	4	Ra/W	CINH
C0658	23917	5D6D	E	1	FIX32	VD	4	Ra	
C0661	23914	5D6A	E	1	FIX32	VD	4	Ra/W	CINH
C0662	23913	5D69	E	1	FIX32	VD	4	Ra	
C0671	23904	5D60	E	1	FIX32	VD	4	Ra/Wa	
C0672	23903	5D5F	E	1	FIX32	VD	4	Ra/Wa	
C0673	23902	5D5E	E	1	FIX32	VD	4	Ra/W	CINH
C0674	23901	5D5D	E	1	FIX32	VD	4	Ra/W	CINH
C0675	23900	5D5C	E	1	FIX32	VD	4	Ra/W	CINH
C0676	23899	5D5B	A	2	FIX32	VD	4	Ra	
C0677	23898	5D5A	E	1	FIX32	VD	4	Ra	
C0680	23895	5D57	E	1	FIX32	VD	4	Ra/Wa	
C0681	23894	5D56	E	1	FIX32	VD	4	Ra/Wa	
C0682	23893	5D55	E	1	FIX32	VD	4	Ra/Wa	
C0683	23892	5D54	A	2	FIX32	VD	4	Ra/W	CINH
C0684	23891	5D53	A	2	FIX32	VD	4	Ra	
C0685	23890	5D52	E	1	FIX32	VD	4	Ra/Wa	
C0686	23889	5D51	E	1	FIX32	VD	4	Ra/Wa	
C0687	23888	5D50	E	1	FIX32	VD	4	Ra/Wa	
C0688	23887	5D4F	A	2	FIX32	VD	4	Ra/W	CINH
C0689	23886	5D4E	A	2	FIX32	VD	4	Ra	
C0690	23885	5D4D	E	1	FIX32	VD	4	Ra/Wa	
C0691	23884	5D4C	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0692	23883	5D4B	E	1	FIX32	VD	4	Ra/Wa	
C0693	23882	5D4A	A	2	FIX32	VD	4	Ra/W	CINH
C0694	23881	5D49	A	2	FIX32	VD	4	Ra	
C0695	23880	5D48	E	1	FIX32	VD	4	Ra/Wa	
C0697	23878	5D46	A	2	FIX32	VD	4	Ra/W	CINH
C0698	23877	5D45	A	2	I32	VH	4	Ra	
C0700	23875	5D43	E	1	FIX32	VD	4	Ra/W	CINH
C0701	23874	5D42	E	1	FIX32	VD	4	Ra	
C0703	23872	5D40	E	1	FIX32	VD	4	Ra/W	CINH
C0704	23871	5D3F	E	1	FIX32	VD	4	Ra	
C0710	23865	5D39	E	1	FIX32	VD	4	Ra/Wa	
C0711	23864	5D38	E	1	FIX32	VD	4	Ra/Wa	
C0713	23862	5D36	E	1	FIX32	VD	4	Ra/W	CINH
C0714	23861	5D35	E	1	FIX32	VD	4	Ra	
C0715	23860	5D34	E	1	FIX32	VD	4	Ra/Wa	
C0716	23859	5D33	E	1	FIX32	VD	4	Ra/Wa	
C0718	23857	5D31	E	1	FIX32	VD	4	Ra/W	CINH
C0719	23856	5D30	E	1	FIX32	VD	4	Ra	
C0720	23855	5D2F	E	1	FIX32	VD	4	Ra/Wa	
C0721	23854	5D2E	E	1	FIX32	VD	4	Ra/Wa	
C0723	23852	5D2C	E	1	FIX32	VD	4	Ra/W	CINH
C0724	23851	5D2B	E	1	FIX32	VD	4	Ra	
C0725	23850	5D2A	E	1	FIX32	VD	4	Ra/Wa	
C0726	23849	5D29	E	1	FIX32	VD	4	Ra/Wa	
C0728	23847	5D27	E	1	FIX32	VD	4	Ra/W	CINH
C0729	23846	5D26	E	1	FIX32	VD	4	Ra	
C0750	23825	5D11	E	1	FIX32	VD	4	Ra/Wa	
C0751	23824	5D10	E	1	FIX32	VD	4	Ra/Wa	
C0752	23823	5D0F	E	1	FIX32	VD	4	Ra/Wa	
C0753	23822	5D0E	E	1	FIX32	VD	4	Ra/Wa	
C0754	23821	5D0D	E	1	U32	VH	4	Ra/Wa	
C0755	23820	5D0C	E	1	FIX32	VD	4	Ra/Wa	
C0756	23819	5D0B	E	1	I32	VH	4	Ra/Wa	
C0757	23818	5D0A	E	1	FIX32	VD	4	Ra/Wa	
C0758	23817	5D09	E	1	FIX32	VD	4	Ra/W	CINH
C0759	23816	5D08	E	1	FIX32	VD	4	Ra/W	CINH
C0760	23815	5D07	E	1	FIX32	VD	4	Ra/W	CINH
C0761	23814	5D06	E	1	FIX32	VD	4	Ra/W	CINH
C0764	23811	5D03	A	3	FIX32	VD	4	Ra	
C0765	23810	5D02	E	1	FIX32	VD	4	Ra	
C0766	23809	5D01	E	1	FIX32	VD	4	Ra/Wa	
C0770	23805	5CFD	E	1	FIX32	VD	4	Ra/W	CINH
C0771	23804	5CFC	E	1	FIX32	VD	4	Ra/W	CINH
C0772	23803	5CFB	E	1	FIX32	VD	4	Ra/W	CINH
C0773	23802	5CFA	A	3	FIX32	VD	4	Ra	
C0775	23800	5CF8	E	1	FIX32	VD	4	Ra/W	CINH
C0776	23799	5CF7	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0777	23798	5CF6	E	1	FIX32	VD	4	Ra/W	CINH
C0778	23797	5CF5	A	3	FIX32	VD	4	Ra	
C0780	23795	5CF3	E	1	FIX32	VD	4	Ra/W	CINH
C0781	23794	5CF2	E	1	FIX32	VD	4	Ra/W	CINH
C0782	23793	5CF1	E	1	FIX32	VD	4	Ra/W	CINH
C0783	23792	5CF0	E	1	FIX32	VD	4	Ra/W	CINH
C0784	23791	5CEF	E	1	FIX32	VD	4	Ra/W	CINH
C0785	23790	5CEE	E	1	FIX32	VD	4	Ra/W	CINH
C0786	23789	5CED	E	1	FIX32	VD	4	Ra/W	CINH
C0787	23788	5CEC	A	4	FIX32	VD	4	Ra/W	CINH
C0788	23787	5CEB	A	4	FIX32	VD	4	Ra/W	CINH
C0789	23786	5CEA	E	1	FIX32	VD	4	Ra/W	CINH
C0790	23785	5CE9	E	1	FIX32	VD	4	Ra/W	CINH
C0798	23777	5CE1	A	2	FIX32	VD	4	Ra	
C0799	23776	5CE0	A	13	FIX32	VD	4	Ra	
C0800	23775	5CDF	E	1	FIX32	VD	4	Ra/W	CINH
C0801	23774	5CDE	E	1	FIX32	VD	4	Ra/W	CINH
C0802	23773	5CDD	E	1	FIX32	VD	4	Ra/W	CINH
C0803	23772	5CDC	E	1	FIX32	VD	4	Ra/W	CINH
C0804	23771	5CDB	E	1	FIX32	VD	4	Ra/W	CINH
C0805	23770	5CDA	E	1	FIX32	VD	4	Ra/W	CINH
C0808	23767	5CD7	A	4	FIX32	VD	4	Ra	
C0809	23766	5CD6	A	2	FIX32	VD	4	Ra	
C0810	23765	5CD5	A	2	FIX32	VD	4	Ra/W	CINH
C0811	23764	5CD4	E	1	FIX32	VD	4	Ra/W	CINH
C0812	23763	5CD3	A	2	FIX32	VD	4	Ra	
C0813	23762	5CD2	E	1	FIX32	VD	4	Ra	
C0815	23760	5CD0	A	2	FIX32	VD	4	Ra/W	CINH
C0816	23759	5CCF	E	1	FIX32	VD	4	Ra/W	CINH
C0817	23758	5CCE	A	2	FIX32	VD	4	Ra	
C0818	23757	5CCD	E	1	FIX32	VD	4	Ra	
C0820	23755	5CCB	A	3	FIX32	VD	4	Ra/W	CINH
C0821	23754	5CCA	A	3	FIX32	VD	4	Ra	
C0822	23753	5CC9	A	3	FIX32	VD	4	Ra/W	CINH
C0823	23752	5CC8	A	3	FIX32	VD	4	Ra	
C0824	23751	5CC7	A	3	FIX32	VD	4	Ra/W	CINH
C0825	23750	5CC6	A	3	FIX32	VD	4	Ra	
C0826	23749	5CC5	A	3	FIX32	VD	4	Ra/W	CINH
C0827	23748	5CC4	A	3	FIX32	VD	4	Ra	
C0828	23747	5CC3	A	3	FIX32	VD	4	Ra/W	CINH
C0829	23746	5CC2	A	3	FIX32	VD	4	Ra	
C0830	23745	5CC1	A	3	FIX32	VD	4	Ra/W	CINH
C0831	23744	5CC0	A	3	FIX32	VD	4	Ra	
C0832	23743	5CBF	A	3	FIX32	VD	4	Ra/W	CINH
C0833	23742	5CBE	A	3	FIX32	VD	4	Ra	
C0834	23741	5CBD	A	3	FIX32	VD	4	Ra/W	CINH
C0835	23740	5CBC	A	3	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0836	23739	5CBB	A	3	FIX32	VD	4	Ra/W	CINH
C0837	23738	5CBA	A	3	FIX32	VD	4	Ra	
C0838	23737	5CB9	A	3	FIX32	VD	4	Ra/W	CINH
C0839	23736	5CB8	A	3	FIX32	VD	4	Ra	
C0840	23735	5CB7	E	1	FIX32	VD	4	Ra/W	CINH
C0841	23734	5CB6	E	1	FIX32	VD	4	Ra	
C0842	23733	5CB5	E	1	FIX32	VD	4	Ra/W	CINH
C0843	23732	5CB4	E	1	FIX32	VD	4	Ra	
C0844	23731	5CB3	E	1	FIX32	VD	4	Ra/W	CINH
C0845	23730	5CB2	E	1	FIX32	VD	4	Ra	
C0846	23729	5CB1	E	1	FIX32	VD	4	Ra/W	CINH
C0847	23728	5CB0	E	1	FIX32	VD	4	Ra	
C0848	23727	5CAF	E	1	FIX32	VD	4	Ra/W	CINH
C0849	23726	5CAE	E	1	FIX32	VD	4	Ra	
C0850	23725	5CAD	A	3	FIX32	VD	4	Ra/W	CINH
C0851	23724	5CAC	E	1	FIX32	VD	4	Ra/W	CINH
C0852	23723	5CAB	E	1	FIX32	VD	4	Ra/Wa	
C0853	23722	5CAA	E	1	FIX32	VD	4	Ra/Wa	
C0854	23721	5CA9	E	1	FIX32	VD	4	Ra/Wa	
C0855	23720	5CA8	A	2	B16	VH	2	Ra	
C0856	23719	5CA7	A	3	I32	VH	4	Ra	
C0857	23718	5CA6	E	1	I32	VH	4	Ra	
C0858	23717	5CA5	A	3	I32	VH	4	Ra	
C0859	23716	5CA4	E	1	I32	VH	4	Ra	
C0860	23715	5CA3	A	11	FIX32	VD	4	Ra/W	CINH
C0861	23714	5CA2	A	3	FIX32	VD	4	Ra/W	CINH
C0863	23712	5CA0	A	6	B16	VH	2	Ra	
C0864	23711	5C9F	A	3	FIX32	VD	4	Ra/Wa	
C0865	23710	5C9E	A	3	FIX32	VD	4	Ra/Wa	
C0866	23709	5C9D	A	11	FIX32	VD	4	Ra	
C0867	23708	5C9C	A	3	I32	VH	4	Ra	
C0868	23707	5C9B	A	11	FIX32	VD	4	Ra	
C0869	23706	5C9A	A	3	I32	VH	4	Ra	
C0870	23705	5C99	A	2	FIX32	VD	4	Ra/W	CINH
C0871	23704	5C98	E	1	FIX32	VD	4	Ra/W	CINH
C0876	23699	5C93	E	1	FIX32	VD	4	Ra/W	CINH
C0878	23697	5C91	A	4	FIX32	VD	4	Ra	
C0879	23696	5C90	A	3	FIX32	VD	4	Ra/Wa	
C0880	23695	5C8F	A	2	FIX32	VD	4	Ra/W	CINH
C0881	23694	5C8E	E	1	FIX32	VD	4	Ra/W	CINH
C0884	23691	5C8B	A	3	FIX32	VD	4	Ra	
C0885	23690	5C8A	E	1	FIX32	VD	4	Ra/W	CINH
C0886	23689	5C89	E	1	FIX32	VD	4	Ra/W	CINH
C0889	23686	5C86	A	2	FIX32	VD	4	Ra	
C0890	23685	5C85	E	1	FIX32	VD	4	Ra/W	CINH
C0891	23684	5C84	E	1	FIX32	VD	4	Ra/W	CINH
C0892	23683	5C83	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0893	23682	5C82	E	1	FIX32	VD	4	Ra/W	CINH
C0894	23681	5C81	E	1	FIX32	VD	4	Ra/W	CINH
C0895	23680	5C80	E	1	FIX32	VD	4	Ra/W	CINH
C0896	23679	5C7F	E	1	FIX32	VD	4	Ra/W	CINH
C0897	23678	5C7E	E	1	FIX32	VD	4	Ra/W	CINH
C0898	23677	5C7D	E	1	FIX32	VD	4	Ra/W	CINH
C0899	23676	5C7C	E	1	FIX32	VD	4	Ra/W	CINH
C0900	23675	5C7B	E	1	FIX32	VD	4	Ra/W	CINH
C0901	23674	5C7A	E	1	FIX32	VD	4	Ra/W	CINH
C0902	23673	5C79	E	1	FIX32	VD	4	Ra/W	CINH
C0903	23672	5C78	E	1	FIX32	VD	4	Ra/W	CINH
C0906	23669	5C75	A	9	FIX32	VD	4	Ra	
C0907	23668	5C74	A	4	FIX32	VD	4	Ra	
C0908	23667	5C73	E	1	I32	VH	4	Ra	
C0909	23666	5C72	E	1	FIX32	VD	4	Ra/Wa	
C0920	23655	5C67	E	1	FIX32	VD	4	Ra/W	CINH
C0921	23654	5C66	E	1	FIX32	VD	4	Ra/W	CINH
C0922	23653	5C65	E	1	FIX32	VD	4	Ra/W	CINH
C0923	23652	5C64	E	1	FIX32	VD	4	Ra/W	CINH
C0924	23651	5C63	E	1	FIX32	VD	4	Ra/W	CINH
C0925	23650	5C62	E	1	FIX32	VD	4	Ra/W	CINH
C0926	23649	5C61	A	4	I32	VH	4	Ra	
C0927	23648	5C60	A	3	FIX32	VD	4	Ra	
C0928	23647	5C5F	E	1	I32	VH	4	Ra	
C0929	23646	5C5E	E	1	FIX32	VD	4	Ra	
C0930	23645	5C5D	E	1	FIX32	VD	4	Ra/W	CINH
C0931	23644	5C5C	E	1	FIX32	VD	4	Ra/W	CINH
C0932	23643	5C5B	E	1	FIX32	VD	4	Ra/Wa	
C0933	23642	5C5A	E	1	FIX32	VD	4	Ra/Wa	
C0934	23641	5C59	E	1	I32	VH	4	Ra/Wa	
C0935	23640	5C58	E	1	FIX32	VD	4	Ra/Wa	
C0936	23639	5C57	E	1	FIX32	VD	4	Ra/Wa	
C0940	23635	5C53	E	1	FIX32	VD	4	Ra/Wa	
C0941	23634	5C52	E	1	FIX32	VD	4	Ra/Wa	
C0942	23633	5C51	E	1	FIX32	VD	4	Ra/W	CINH
C0943	23632	5C50	E	1	FIX32	VD	4	Ra	
C0945	23630	5C4E	E	1	FIX32	VD	4	Ra/Wa	
C0946	23629	5C4D	E	1	FIX32	VD	4	Ra/Wa	
C0947	23628	5C4C	E	1	FIX32	VD	4	Ra/W	CINH
C0948	23627	5C4B	E	1	FIX32	VD	4	Ra	
C0950	23625	5C49	E	1	FIX32	VD	4	Ra/Wa	
C0951	23624	5C48	E	1	FIX32	VD	4	Ra/Wa	
C0952	23623	5C47	E	1	FIX32	VD	4	Ra/W	CINH
C0953	23622	5C46	E	1	FIX32	VD	4	Ra	
C0955	23620	5C44	E	1	FIX32	VD	4	Ra/Wa	
C0956	23619	5C43	E	1	FIX32	VD	4	Ra/Wa	
C0957	23618	5C42	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0958	23617	5C41	E	1	FIX32	VD	4	Ra	
C0960	23615	5C3F	E	1	FIX32	VD	4	Ra/Wa	
C0961	23614	5C3E	E	1	FIX32	VD	4	Ra/Wa	
C0962	23613	5C3D	E	1	FIX32	VD	4	Ra/Wa	
C0963	23612	5C3C	E	1	FIX32	VD	4	Ra/Wa	
C0964	23611	5C3B	E	1	FIX32	VD	4	Ra/Wa	
C0965	23610	5C3A	E	1	FIX32	VD	4	Ra/Wa	
C0966	23609	5C39	E	1	FIX32	VD	4	Ra/Wa	
C0967	23608	5C38	E	1	FIX32	VD	4	Ra/W	CINH
C0968	23607	5C37	E	1	FIX32	VD	4	Ra	
C0970	23605	5C35	E	1	FIX32	VD	4	Ra/W	CINH
C0971	23604	5C34	E	1	FIX32	VD	4	Ra/W	CINH
C0972	23603	5C33	E	1	FIX32	VD	4	Ra/W	CINH
C0973	23602	5C32	E	1	FIX32	VD	4	Ra/W	CINH
C0974	23601	5C31	E	1	FIX32	VD	4	Ra/W	CINH
C0975	23600	5C30	E	1	FIX32	VD	4	Ra/W	CINH
C0976	23599	5C2F	E	1	FIX32	VD	4	Ra/W	CINH
C0977	23598	5C2E	E	1	FIX32	VD	4	Ra/W	CINH
C0978	23597	5C2D	E	1	FIX32	VD	4	Ra/W	CINH
C0980	23595	5C2B	E	1	FIX32	VD	4	Ra/Wa	
C0981	23594	5C2A	E	1	FIX32	VD	4	Ra/Wa	
C0982	23593	5C29	E	1	FIX32	VD	4	Ra/Wa	
C0983	23592	5C28	E	1	FIX32	VD	4	Ra/Wa	
C0988	23587	5C23	A	7	FIX32	VD	4	Ra	
C0989	23586	5C22	A	2	FIX32	VD	4	Ra	
C0990	23585	5C21	E	1	FIX32	VD	4	Ra/W	CINH
C0991	23584	5C20	E	1	FIX32	VD	4	Ra/W	CINH
C0992	23583	5C1F	E	1	FIX32	VD	4	Ra	
C0993	23582	5C1E	E	1	FIX32	VD	4	Ra	
C0995	23580	5C1C	E	1	FIX32	VD	4	Ra/Wa	
C0996	23579	5C1B	E	1	FIX32	VD	4	Ra/W	CINH
C0997	23578	5C1A	E	1	I32	VH	4	Ra	
C1000	23575	5C17	E	1	FIX32	VD	4	Ra/Wa	
C1001	23574	5C16	E	1	FIX32	VD	4	Ra/W	CINH
C1002	23573	5C15	E	1	I32	VH	4	Ra	
C1010	23565	5C0D	E	1	FIX32	VD	4	Ra/Wa	
C1011	23564	5C0C	A	2	FIX32	VD	4	Ra/W	CINH
C1012	23563	5C0B	A	2	I32	VH	4	Ra	
C1030	23545	5BF9	E	1	FIX32	VD	4	Ra/W	CINH
C1031	23544	5BF8	E	1	FIX32	VD	4	Ra/W	CINH
C1032	23543	5BF7	E	1	FIX32	VD	4	Ra	
C1033	23542	5BF6	E	1	FIX32	VD	4	Ra	
C1040	23535	5BEF	E	1	FIX32	VD	4	Ra/Wa	
C1041	23534	5BEE	E	1	FIX32	VD	4	Ra/Wa	
C1042	23533	5BED	E	1	FIX32	VD	4	Ra/W	CINH
C1043	23532	5BEC	E	1	FIX32	VD	4	Ra/W	CINH
C1044	23531	5BEB	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1045	23530	5BEA	A	2	FIX32	VD	4	Ra	
C1046	23529	5BE9	E	1	FIX32	VD	4	Ra	
C1090	23485	5BBD	E	1	I32	VH	4	Ra	
C1091	23484	5BBC	E	1	FIX32	VD	4	Ra/Wa	
C1092	23483	5BBB	E	1	FIX32	VD	4	Ra/Wa	
C1093	23482	5BBA	E	1	FIX32	VD	4	Ra/Wa	
C1094	23481	5BB9	E	1	FIX32	VD	4	Ra/Wa	
C1095	23480	5BB8	E	1	I32	VH	4	Ra/Wa	
C1096	23479	5BB7	E	1	FIX32	VD	4	Ra/W	CINH
C1097	23478	5BB6	E	1	FIX32	VD	4	Ra/W	CINH
C1098	23477	5BB5	E	1	FIX32	VD	4	Ra	
C1099	23476	5BB4	E	1	FIX32	VD	4	Ra	
C1100	23475	5BB3	E	1	FIX32	VD	4	Ra/Wa	
C1101	23474	5BB2	A	2	FIX32	VD	4	Ra/W	CINH
C1102	23473	5BB1	A	3	FIX32	VD	4	Ra/W	CINH
C1103	23472	5BB0	A	2	FIX32	VD	4	Ra	
C1104	23471	5BAF	A	3	FIX32	VD	4	Ra	
C1120	23455	5B9F	E	1	FIX32	VD	4	Ra/Wa	
C1121	23454	5B9E	A	2	FIX32	VD	4	Ra/Wa	
C1122	23453	5B9D	E	1	FIX32	VD	4	Ra/Wa	
C1123	23452	5B9C	A	2	FIX32	VD	4	Ra/Wa	
C1124	23451	5B9B	E	1	FIX32	VD	4	Ra/W	CINH
C1125	23450	5B9A	E	1	FIX32	VD	4	Ra/W	CINH
C1126	23449	5B99	E	1	FIX32	VD	4	Ra/W	CINH
C1127	23448	5B98	E	1	I32	VH	4	Ra	
C1128	23447	5B97	E	1	I32	VH	4	Ra	
C1129	23446	5B96	E	1	I32	VH	4	Ra	
C1140	23435	5B8B	E	1	FIX32	VD	4	Ra/Wa	
C1141	23434	5B8A	E	1	FIX32	VD	4	Ra/Wa	
C1143	23432	5B88	E	1	FIX32	VD	4	Ra/W	CINH
C1144	23431	5B87	E	1	FIX32	VD	4	Ra	
C1145	23430	5B86	E	1	FIX32	VD	4	Ra/Wa	
C1146	23429	5B85	E	1	FIX32	VD	4	Ra/Wa	
C1148	23427	5B83	E	1	FIX32	VD	4	Ra/W	CINH
C1149	23426	5B82	E	1	FIX32	VD	4	Ra	
C1150	23425	5B81	E	1	FIX32	VD	4	Ra/Wa	
C1151	23424	5B80	E	1	I32	VH	4	Ra/Wa	
C1153	23422	5B7E	E	1	FIX32	VD	4	Ra/W	CINH
C1154	23421	5B7D	E	1	FIX32	VD	4	Ra/W	CINH
C1155	23420	5B7C	E	1	FIX32	VD	4	Ra/W	CINH
C1157	23418	5B7A	E	1	FIX32	VD	4	Ra	
C1158	23417	5B79	E	1	FIX32	VD	4	Ra	
C1159	23416	5B78	E	1	I32	VH	4	Ra	
C1160	23415	5B77	A	2	FIX32	VD	4	Ra/W	CINH
C1161	23414	5B76	E	1	FIX32	VD	4	Ra/W	CINH
C1162	23413	5B75	A	2	FIX32	VD	4	Ra	
C1163	23412	5B74	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1165	23410	5B72	A	2	FIX32	VD	4	Ra/W	CINH
C1166	23409	5B71	E	1	FIX32	VD	4	Ra/W	CINH
C1167	23408	5B70	A	2	FIX32	VD	4	Ra	
C1168	23407	5B6F	E	1	FIX32	VD	4	Ra	
C1170	23405	5B6D	E	1	FIX32	VD	4	Ra/Wa	
C1171	23404	5B6C	E	1	FIX32	VD	4	Ra/Wa	
C1172	23403	5B6B	E	1	FIX32	VD	4	Ra/W	CINH
C1173	23402	5B6A	E	1	FIX32	VD	4	Ra	
C1175	23400	5B68	A	3	FIX32	VD	4	Ra/W	CINH
C1176	23399	5B67	A	3	FIX32	VD	4	Ra	
C1178	23397	5B65	A	3	FIX32	VD	4	Ra/W	CINH
C1179	23396	5B64	A	3	FIX32	VD	4	Ra	
C1190	23385	5B59	E	1	FIX32	VD	4	Ra/Wa	
C1191	23384	5B58	A	2	FIX32	VD	4	Ra/Wa	
C1192	23383	5B57	A	2	FIX32	VD	4	Ra/Wa	
C1195	23380	5B54	E	1	FIX32	VD	4	Ra/W	CINH
C1196	23379	5B53	E	1	I32	VH	4	Ra	
C1197	23378	5B52	E	1	I32	VH	4	Ra	
C1200	23375	5B4F	A	3	FIX32	VD	4	Ra/W	CINH
C1201	23374	5B4E	A	3	I32	VH	4	Ra	
C1205	23370	5B4A	A	2	FIX32	VD	4	Ra/W	CINH
C1206	23369	5B49	A	2	I32	VH	4	Ra	
C1207	23368	5B48	E	1	FIX32	VD	4	Ra/Wa	
C1210	23365	5B45	A	5	FIX32	VD	4	Ra/W	CINH
C1211	23364	5B44	A	2	FIX32	VD	4	Ra/W	CINH
C1212	23363	5B43	E	1	FIX32	VD	4	Ra/W	CINH
C1215	23360	5B40	A	5	FIX32	VD	4	Ra	
C1216	23359	5B3F	A	2	FIX32	VD	4	Ra	
C1217	23358	5B3E	E	1	I32	VH	4	Ra	
C1220	23355	5B3B	A	2	FIX32	VD	4	Ra/W	CINH
C1223	23352	5B38	A	2	FIX32	VD	4	Ra	
C1230	23345	5B31	A	2	FIX32	VD	4	Ra/W	CINH
C1231	23344	5B30	E	1	FIX32	VD	4	Ra/W	CINH
C1232	23343	5B2F	A	2	FIX32	VD	4	Ra/W	CINH
C1235	23340	5B2C	A	2	FIX32	VD	4	Ra	
C1236	23339	5B2B	E	1	FIX32	VD	4	Ra	
C1237	23338	5B2A	A	2	I32	VH	4	Ra	
C1240	23335	5B27	A	2	FIX32	VD	4	Ra/W	CINH
C1241	23334	5B26	E	1	FIX32	VD	4	Ra/W	CINH
C1242	23333	5B25	E	1	FIX32	VD	4	Ra/W	CINH
C1245	23330	5B22	A	2	FIX32	VD	4	Ra	
C1246	23329	5B21	E	1	FIX32	VD	4	Ra	
C1247	23328	5B20	E	1	I32	VH	4	Ra	
C1250	23325	5B1D	E	1	FIX32	VD	4	Ra/W	CINH
C1251	23324	5B1C	A	2	FIX32	VD	4	Ra/W	CINH
C1253	23322	5B1A	E	1	FIX32	VD	4	Ra	
C1254	23321	5B19	A	2	I32	VH	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1255	23320	5B18	E	1	FIX32	VD	4	Ra/W	CINH
C1258	23317	5B15	E	1	FIX32	VD	4	Ra	
C1260	23315	5B13	E	1	FIX32	VD	4	Ra/W	CINH
C1261	23314	5B12	E	1	FIX32	VD	4	Ra/W	CINH
C1262	23313	5B11	E	1	FIX32	VD	4	Ra/W	CINH
C1265	23310	5B0E	E	1	FIX32	VD	4	Ra/W	CINH
C1266	23309	5B0D	E	1	FIX32	VD	4	Ra/W	CINH
C1268	23307	5B0B	E	1	FIX32	VD	4	Ra	
C1269	23306	5B0A	E	1	I32	VH	4	Ra	
C1270	23305	5B09	A	2	FIX32	VD	4	Ra/W	CINH
C1271	23304	5B08	A	2	I32	VH	4	Ra	
C1272	23303	5B07	E	1	FIX32	VD	4	Ra/Wa	
C1290	23285	5AF5	E	1	FIX32	VD	4	Ra/Wa	
C1292	23283	5AF3	E	1	FIX32	VD	4	Ra/Wa	
C1500	23075	5A23	E	1	I32	VH	4	Ra	
C1501	23074	5A22	E	1	FIX32	VD	4	Ra/Wa	
C1502	23073	5A21	E	1	FIX32	VD	4	Ra/Wa	
C1503	23072	5A20	E	1	FIX32	VD	4	Ra/Wa	
C1504	23071	5A1F	E	1	FIX32	VD	4	Ra/Wa	
C1505	23070	5A1E	E	1	I32	VH	4	Ra/Wa	
C1506	23069	5A1D	E	1	FIX32	VD	4	Ra/W	CINH
C1507	23068	5A1C	E	1	FIX32	VD	4	Ra/W	CINH
C1508	23067	5A1B	E	1	FIX32	VD	4	Ra	
C1509	23066	5A1A	E	1	FIX32	VD	4	Ra	
C1799	22776	58F8	E	1	FIX32	VD	4	Ra/Wa	

9 Troubleshooting and fault elimination

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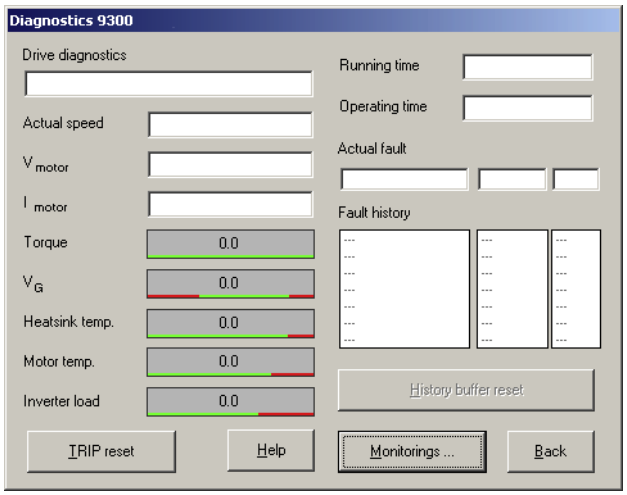
9.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 9.1-1 "Diagnostics" dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
- the history buffer in Global Drive Control (GDC) (📖 9.2-1) or
- the XT keypad
- and with the "General error messages" table in the "System error messages" chapter.

► The "General error messages" table provides tips on how to eliminate an error.

9.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

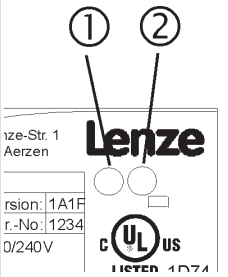
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 9.3-1)

9.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

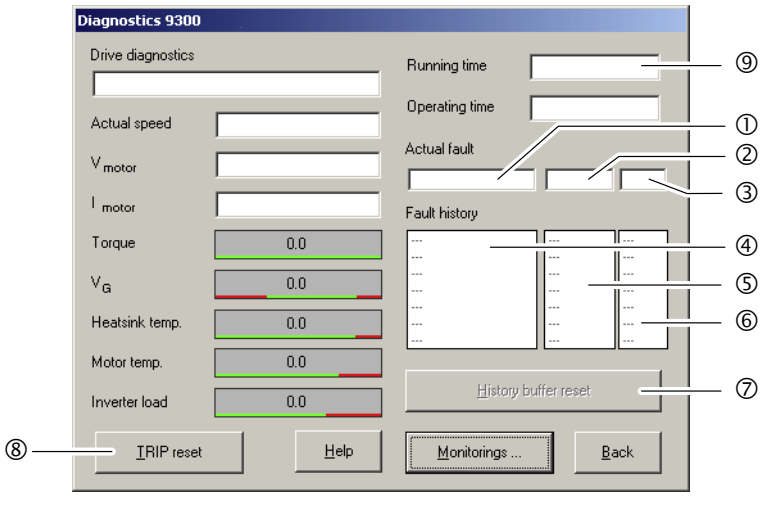
LED		Operating status
Red ①	**Green** ②	
Off	On	Controller enabled
On	On	Mains switched on and automatic start inhibited
Off	Blinking slowly	Controller inhibited
Blinking quickly	Off	Undervoltage or overvoltage
Blinking slowly	Off	Fault active



9.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 9.2-1 "Diagnostics" dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged:
			2	Last fault	

Field			History buffer location	Entry	Note
④	⑤	⑥	3	Next to last fault	● The content of memory units 1 ... 7 is shifted "upwards" by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

9.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only
			0 {1} 65535		Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned	
			Bit 1	Pulse inhibit (IMP)	
			Bit2	Not assigned	
			Bit3	Not assigned	
			Bit4	Not assigned	
			Bit5	Not assigned	
			Bit 6	n = 0	
			Bit 7	Controller inhibit (CINH)	
			Bit 8	Device status bit 1	
			Bit 9	Device status bit 2	
			Bit10	Device status bit 3	
			Bit11	Device status bit 4	
			Bit12	Warning	
			Bit13	Message	
			Bit14	Not assigned	
			Bit15	Not assigned	
C0155	Status word 2	0			Status word 2 (advanced status word) Display only
			0 {1} 65535		Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault	
			Bit 1	M_{max} reached	
			Bit 2	I_{max} reached	
			Bit 3	Pulse inhibit(IMP)	
			Bit 4	Ready for operation (RDY)	
			Bit 5	Controller inhibit (CINH)	
			Bit 6	TRIP active	
			Bit 7	Initialisation	
			Bit 8	Motor direction of rotation (Cw/CCw)	
			Bit 9	Not assigned	
			Bit 10	Not assigned	
			Bit 11	Not assigned	
			Bit 12	Not assigned	
			Bit 13	Not assigned	
			Bit 14	Not assigned	
			Bit 15	Not assigned	

9.3 System error messages

9.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. 📖 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!

Fault message		Description	Cause	Remedy
No.	Display			
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. 🕮 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	• Check external encoder. • Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	• Increase following error limit under C0255. • Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x163	P13	Angle overrun.	• Phase controller limit reached • Drive cannot follow the digital frequency (I_{max} limit).	• Enable drive • Check drive dimensioning.
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	• Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. • Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	• Check communication channel. • Check baud rate, controller address. • Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.

Fault message		Description	Cause	Remedy
No.	Display			
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).

Representation of the error number:
x 0 = TRIP, 1 = message, 2 = warning
E. g. ”2091”: An external monitoring function has triggered EEr warning

9.3.2 Resetting system error messages

Response	Measures for resetting the fault message
TRIP	**Note!** If a TRIP source is still active, the pending TRIP cannot be reset. Resetting the TRIP can be effected by: • Pressing the keypad XT EMZ9371 BC ⇨ STOP. Then press RUN to re-enable the controller. • Setting code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word of system bus (CAN) After resetting the TRIP, the drive remains at standstill.
Message	**Danger!** After elimination of the fault, the fault message is cancelled automatically and the drive restarts automatically.
Warning	After elimination of the fault, the fault message is cancelled automatically.

10 DC-bus operation

Contents

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10.2 Conditions for trouble-free DC-bus operation 10.2-1
10.3 Fuses and cable cross-sections 10.3-1
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10.1 Function

- DC-bus connections of drive systems enable the exchange of energy between connected controllers.
- If one or more controllers operate in generator mode (braking operation), the energy will be fed into the shared DC-voltage bus. The energy will then be available to the controllers which operate in motor mode.
- The use of braking units and supply units can be reduced.
- The energy consumption from the three-phase AC mains can be reduced.
- The number of mains supplies and the related expenses (e.g. wiring) can be perfectly adapted to your application.

10.2 Conditions for trouble-free DC-bus operation

- Distributed supply (parallel mains supply):
  - Always use the prescribed mains choke when connecting a controller to the mains.
  - Controllers of the EVx9321 ... EVx9333, 8200 and 8200 vector series must not be connected to the mains if they are operated in a DC-bus connection with EVx9335 ... EVx9338 and EVx9381 ... EVx9383 controllers.
- Only controllers with identical mains voltage/DC bus voltage ranges can be operated in a DC-bus connection:
  - Set the mains voltage/DC-bus voltage under C0173.
- 9340 regenerative power supply modules and 9360 DC input modules cannot be used together in the DC-bus connection.
- Read the documentation for the other controllers connected to the DC bus with regard to ”DC-bus operation”.

10.3 Fuses and cable cross-sections

Note!

- ► **All fuses specified here only have the purpose of disconnection after a short circuit.** For cable protection specific fuses must be used.
- ► In the following tables the rated currents of the Lenze fuses are listed. If other fuses are used, other fuse currents and cable cross-sections may result.
- ► We recommend using fuse holders with a signalling contact. Like this, the entire drive system can be switched off (inhibited) when a fuse fails.
- ► Always fuse DC cables using 2 poles ($+U_G$, $-U_G$).

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Mains	DC 460 ... 740 V
Fuses	• Only semiconductor fuses. • If you are using fuses other than those indicated, other fuse currents and cable cross-sections may result.
Cables	• DC cables ($+U_G$, $-U_G$) must always have two-pole insulation. • Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of cables or cores, three loaded cores. The information is a recommendation. Other designs/laying systems are possible (e.g. according to VDE 0298-4).
Observe all national and regional regulations!	

Inverter		DC fuse 14 × 51 (EFSGR0xx0AYHx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9321	3/PE 400 V	12	12	1.5	1.5
EVS9322		12	12	1.5	1.5
EVS9323		12	12	1.5	1.5
EVS9324		20	20	1.5	1.5
EVS9325		40	40	4.0	4.0
EVS9326		50	50	6.0 [1]	4.0

[1] Pin-end connector required, since a maximum cable cross-section of 4 mm² can be connected to the inverter.

Inverter		DC fuse NH1 (EFSGRxxx0ANVx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9327	3/PE 400 V	100	100	-	25
EVS9328		100	100	-	25
EVS9329		200	-	-	25
EVS9330		200	-	-	50
EVS9331		200	-	-	50

Inverter		DC fuse NH2 (EFSGRxxx0ANWx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9332	3/PE 400 V	250	-	-	95

10.4 Distributed supply (several supply points)

Basic circuit diagram

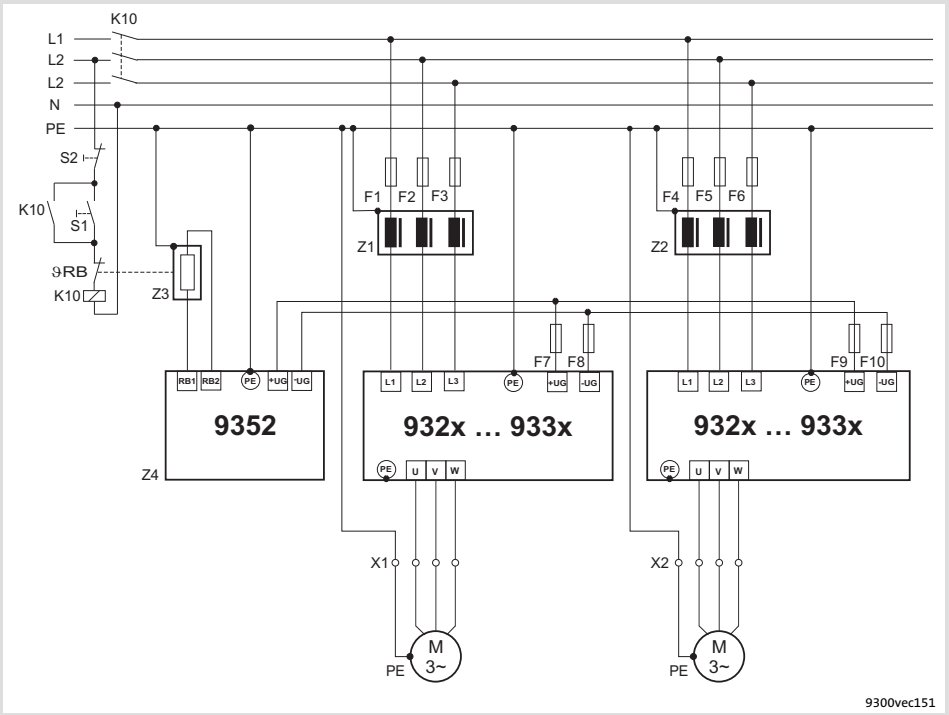

Fig. 10.4-1 Basic circuit diagram of a distributed supply with brake chopper

F1 ... F10	Fusing
K10	Mains contactor
Z1, Z2	Mains choke / mains filter
Z3	Brake resistor
Z4	Brake chopper
S1	Mains supply on
S2	Mains supply off

► Dimension the components according to the requirements of the DC-bus operation.

Stop!

Set the DC-bus voltage thresholds of the controller (C0173) and the brake chopper (see documentation of the brake chopper) to the same values.

10.5 Central supply (one supply point)

Basic circuit diagram

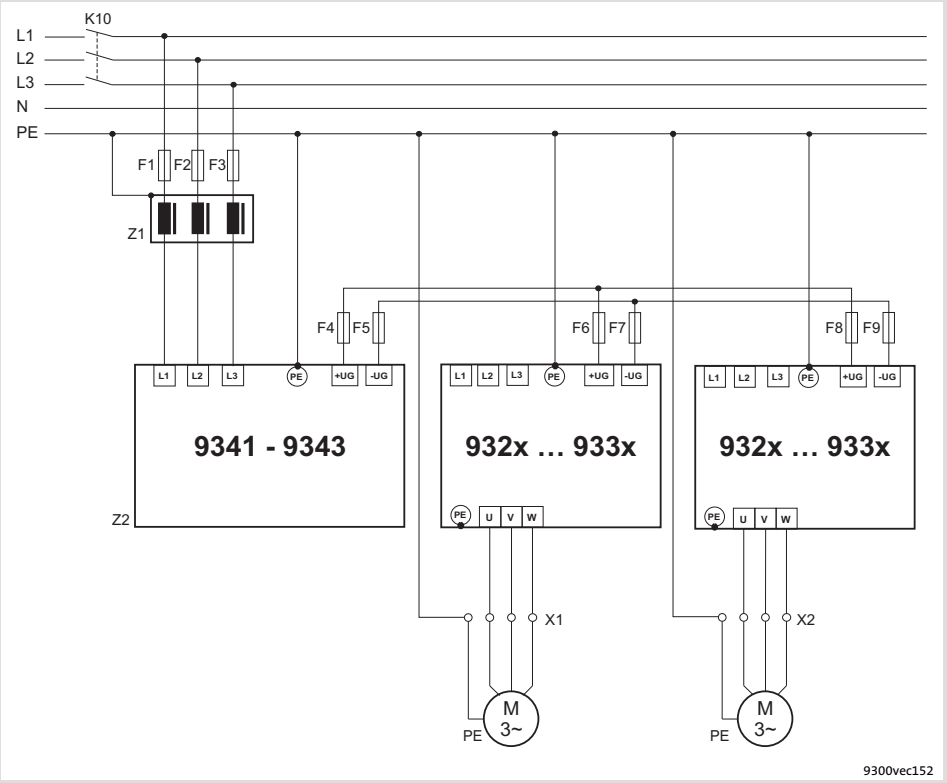

Fig. 10.5-1 Basic circuit diagram of a central supply with regenerative power supply module

F1 ... F9	Fusing
K10	Mains contactor
Z1	Mains choke / mains filter
Z2	Regenerative power supply module

► Dimension the components according to the requirements of the DC-bus operation.

Note!

► If the supply power of the regenerative power supply module is not sufficient, the system can be additionally supplied via the mains connection of further controllers.

► Before connecting the supply module and the controllers read the Operating Instructions of the regenerative power supply module.

11 Safety engineering

Contents

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11.1 Important notes

The controllers support the safety functions ”Safe torque off” (former designation ”Safe standstill”), ”Protection against unexpected start-up”, in accordance with the requirements of control category 3 of ISO 13849-1 (former EN 954-1). Depending on the external interconnection, a standard up to ”category 3” in accordance with ISO 13849-1 is achieved.

Note!

In order to comply with control category 3 in accordance with ISO 13849-1 (former EN 954-1), the two methods ”Pulse inhibit via safety relay K_{SR}” **and** ”Controller inhibit”, which are independent of each other, have to be used.

- Only qualified personnel may install and commission the “Safe torque off” function.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN ISO 13849-1 and EN ISO 13849-2. This includes among other things:
  - Control cabinet, switches, relays in enclosure IP54!
  - All other requirements can be found in EN ISO 13849-1 and EN ISO 13849-2!
- Wiring with insulated wire end ferrules or rigid cables is absolutely required.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. by a cable duct. It must be ensured that short circuits between the individual cables cannot occur!
- With the “Safe torque off” function no emergency stop can be effected without additional measures:
  - There is neither an electrical isolation between motor and controller nor a service or repair switch!
  - An ”Emergency stop” requires the electrical isolation of the conductor to the motor, e.g. by means of a central mains contactor with emergency stop wiring.
- If in the case of the ”Safe torque off” a force effect is to be expected from outside, (e.g. sagging of hanging loads), additional measures are required (e.g. mechanical brakes).
- After the installation the operator has to check the function of the ”Safe torque off” circuit.
  - The functional test must be repeated at regular intervals.
  - Basically, the inspection intervals depend on the application, the related risk analysis, and the overall system. The inspection intervals must not be longer than 1 year.

11.2 Operating mode

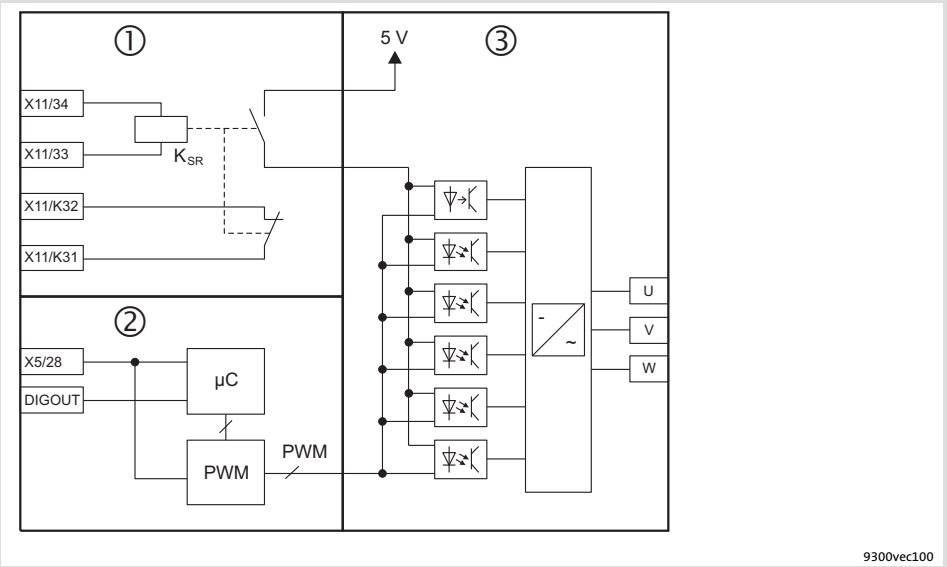

Fig. 11.2-1 Internal connection of the "Safe torque off" function with 3 electrically isolated circuits

Area ①: Pulse inhibit via safety relay K_{SR}; forcibly guided feedback for monitoring the safety relay

Area ②: Controller inhibit (X5/28), optional feedback via a digital output (DIGOUT)

Area ③: Power output stage

Activating "Safe torque off"

The "Safe torque off" status is activated via two different disconnecting paths which are independent of each other:

1. disconnecting path: Pulse inhibit via safety relay K_{SR} (terminal X11/33, X11/34)

- In the case of LOW level at terminals X11/33, X11/34, the safety relay K_{SR} is deactivated.The driver supply of the power section drivers is interrupted. The inverter no longer receives pulses.
- The disconnection of the safety relay K_{SR} has to be monitored externally, so that a failure of this disconnecting path can be detected. X11/K31, X11/K32 is a forcibly guided break contact, i. e. if the safety relay K_{SR} has been deactivated ("Safe torque off" activated), the contact is closed.

2. disconnecting path: Controller inhibit by input signal at terminal X5/28

- The input signal at X5/28 is fed to the microcontroller system and the PWM unit. In the case of LOW level at terminal X5/28, the output of pulses to the inverter is inhibited in the microcontroller system.
- The disconnecting path "Controller inhibit" can be evaluated optionally via a digital output. Further information can be gathered from the chapter "Functional test" (📖 11.5-1).

"Safe torque off" is activated if **both disconnecting paths are on LOW level**.

Deactivating "Safe torque off"

An AND operation of the disconnecting paths prevents the drive from restarting if only one disconnecting path is enabled.

"Safe torque off" is deactivated if **both disconnecting paths are on HIGH level**.

11.3 Safety relay K_{SR}

Technical data

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

11.4 Wiring

Wiring

Danger!

Faulty operation in case of earth faults possible

The correct functioning of the safety function is not ensured if an earth fault occurs.

Possible consequences:

► A failure of the safety function can lead to death, severe injuries or damage to material.

Protective measures:

The electrical reference point for the coil of the safety relay K_{SR} must be connected to the PE conductor system (EN 60204-1, paragraph 9.4.3)!

Terminal strip X11 | **Internal wiring / wiring of terminal strip X11**

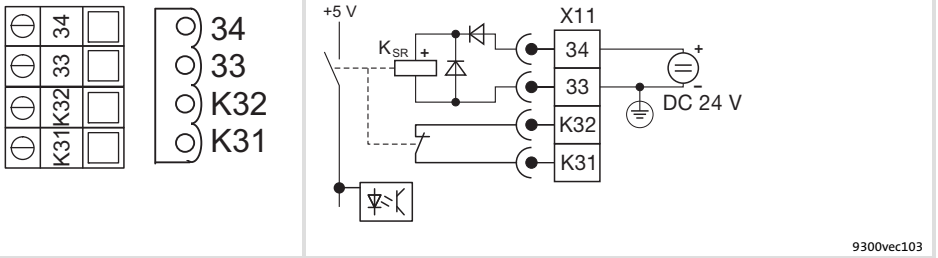

Fig. 11.4-1 Safety relay K_{SR}

Terminal		Function Bold print = **Lenze setting**	Level / state	Electrical data
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Feedback - pulse inhibit	Open contact: Pulse inhibit is inactive (operation) Closed contact: Pulse inhibit is active	See technical data of the safety relay K_{SR}
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active	
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)	
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled	LOW: 0 ... +3 V HIGH: +12 ... +30 V
				Input current at +24 V: 8 mA
				Reading and processing the input signals - 1/ms (mean value)

Terminal data

Wiring of the terminals X11/34, X11/33, X11/K32, X11/K31, X5/28:

Leitungstyp	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Rigid	–	2,5 mm² (AWG 14)	0,5 ... 0,6 Nm (4.4 ... 5.3 lb-in)	5 mm
Flexible	With plastic sleeve	2,5 mm² (AWG 14)		

11.5 Functional test

11.5.1 Important notes

Danger!

Unexpected start-up of the machine possible

The ”Safe torque off” safety function provides protection against an unexpected start-up of the drive and therefore is an important item within the safety concept for a machine. It has to be ensured that this function works correctly.

Possible consequences:

► Death, severe injury, or damage to material assets, when the safety function fails.

Protective measures:

After the installation and at regular intervals, the operator has to check the function of the ”Safe torque off” circuit.

► When doing this, check both disconnecting paths separately with regard to their disconnection capability.

► The functional test can be carried out manually or automatically via the PLC.

► Basically the inspection interval depends on the application and the corresponding risk analysis, as well as on the system as a whole. It should not exceed 1 year.

► If the functional test shows impermissible states,
  – the drive or the machine has to be shut down immediately.
  – commissioning is not permitted until the safety function operates correctly.

11.5.2 Manual safety function check

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

How to proceed during the test:

1. Alternately apply LOW and HIGH level to input X11/34 and check the states given in the table below.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

The individual tests are passed if the correct states given in the table result.

2. disconnecting path: Controller inihibit

Requirement for the test:

► "Quickstop" (QSP) function deactivated

► "Automatic DC injection brake" deactivated (C0019 = 0)

► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

How to proceed during the test:

1. Set controller inhibit (X5/28 = LOW).
2. Define a setpoint $n_{set} > 0$.
3. Check that the motor is not rotating.

The individual test is passed if the motor does not rotate.

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

► The drive or machine has to be shut down immediately.

► Commissioning is not permitted until the safety function operates correctly.

11.5.3 Monitoring the safety function with a PLC

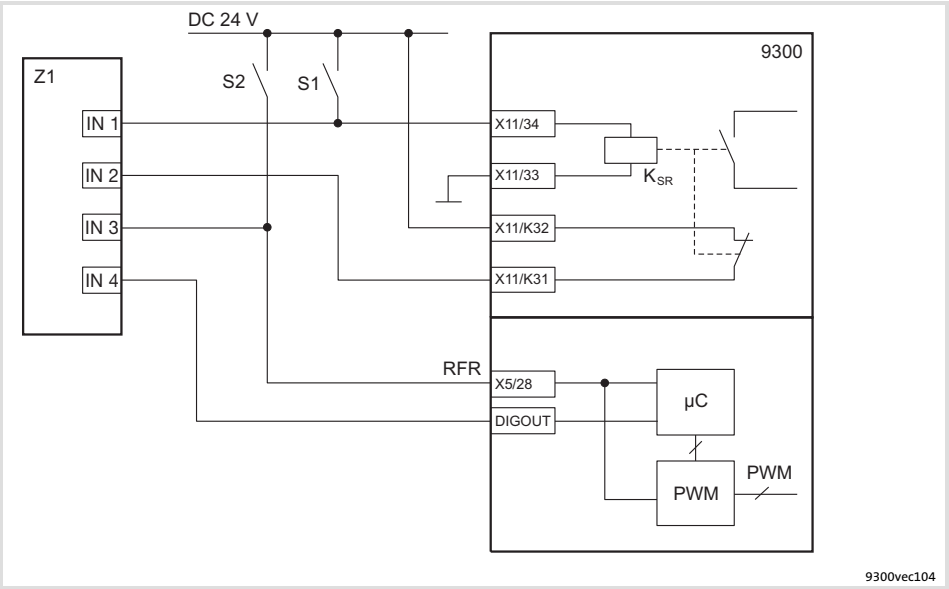

Fig. 11.5-1 Circuit diagram for monitoring the safety function with a PLC

S1, S2	Separate disconnection options of the two disconnecting paths
K_{SR}	Safety relay
X11/34	Safety relay control
X11/33	Safety relay control (GND)
X11/K32	Forcibly guided feedback contact (24 V)
X11/K31	Forcibly guided feedback contact
DIGOUT	Digital output for evaluating the motor current
X5/28	Controller inhibit
Z1	Programmable logic controller (PLC)
IN 1 - 4	Digital inputs

Requirements

The following conditions must be met:

- ► The PLC must be programmed such that the complete system is set to a safe state immediately when the function check leads to an impermissible state.
- ► The parameter setting of a digital output must be such that you can conclude to the output current I_{motor} of the drive (see parameterisation example).

Example: Parameterising a digital output

In the following we will show you a possibility of parameterising a digital output, so that a conclusion with regard to the motor current is provided.

Sequence		Parameter	Note
1.	Configure function block CMP3 (comparator)		
	• Connect CMP3-IN1 to MCTRL-IACT	C0693/1 = 5004	
	• Connect CMP3-IN2 to FCODE-472/1	C0693/2 = 19521	
	• Configure the function IN1 < IN2	C0690 = 3	
2.	Configure output signal of CMP3 • Connect DIGOUT4 to CMP3-OUT	C0117/4 = 10660	
3.	Enter function block CMP3 in the processing table		
	• Select a free space in the processing table In the Lenze setting, for instance space 2 of the processing table is free	C0465/2 = 10660	
4.	Set the current threshold • Set the current threshold for $I_{rated\ FI}$ to 2 %	C0472/1 = 2.00	$I_{Motor} = 0 \rightarrow$ DIGOUT4 = HIGH $I_{Motor} \neq 0 \rightarrow$ DIGOUT4 = LOW

Functional test within the inspection interval

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

The individual tests are passed if the correct states given in the table result.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

2. disconnecting path: Controller inihibit

Requirement for the test:

- ► "Quickstop" (QSP) function deactivated
- ► "Automatic DC injection brake" deactivated (C0019 = 0)
- ► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

The individual tests are passed if the correct states given in the table result.

	Specification		Correct status
Individual test	**X5/28**	**Setpoint**	**Output DIGOUT**
Controller inhibit	LOW	$n_{set} > 0$	HIGH
Controller enable	HIGH		LOW

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

- ► The drive or machine has to be shut down immediately.
- ► Commissioning is not permitted until the safety function operates correctly.

12 Accessories (overview)

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12.2 Type-specific accessories 12.2-1

12.1 General accessories

Accessories	Designation		Order number
Communication modules	LECOM-LI (optical fibre)		EMF2102IBCV003
	LECOM-B (RS485)		EMF2102IBCV002
	LECOM-A/B (RS232/485)		EMF2102IBCV001
	LON		EMF2141IB
	INTERBUS		EMF2113IB
	INTERBUS-Loop		EMF2112IB
	PROFIBUS-DP		EMF2133IB
	DeviceNet/CANopen		EMF2175IB
	Operating module keypad XT		EMZ9371BC
	Diagnosis terminal (keypad XT in handheld design, IP20) [1)]		E82ZBBXC
Other	Connecting cable	2.5 m	E82ZWL025
		5 m	E82ZWL050
		10 m	E82ZWL100
	Parameterisation/operating software »Global Drive Control« (GDC)		ESP-GDC2
	PC system bus adapter (Voltage supply via DIN connection)		EMF2173IB
	PC system bus adapter (Voltage supply via PS2 connection)		EMF2173IB-V002
	PC system bus adapter (Voltage supply via PS2 connection, electrical isolation)		EMF2173IB-V003
	PC system bus adapter USB		EMF2177IB
	CAN repeater		EMF2176IB
	PC system cable RS232	5 m	EWL0020
		10 m	EWL0021
	Optical fibre adapter (standard output power)		EMF2125IB
	Optical fibre adapter (increased output power)		EMF2126IB
	Power supply unit for optical fibre adapter		EJ0013
	Optical fibre, single-core, black PE sheath (basic protection), sold by the meter		EWZ0007
	Optical fibre, single-core, red PUR sheath (reinforced protection), sold by the meter		EWZ0006
	Setpoint potentiometer		ERPD0010k0001W
	Rotary knob for setpoint potentiometer		ERZ0001
	Scale for setpoint potentiometer		ERZ0002
	Digital display		EPD203
	Encoder cable	2.5 m	EWLE002GX-T
		5.0 m	EWLE005GX-T
		10.0 m	EWLE010GX-T
		15.0 m	EWLE015GX-T
		20.0 m	EWLE020GX-T
		25.0 m	EWLE025GX-T
		30.0 m	EWLE030GX-T
		35.0 m	EWLE035GX-T
		40.0 m	EWLE040GX-T
		45.0 m	EWLE045GX-T
		50.0 m	EWLE050GX-T

Accessories	Designation		Order number
	Connecting cable for digital frequency coupling	2.5 m	EWLD002GGBS93

1) Additional connecting cable required

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

12.2 Type-specific accessories

9300	EVS9321	EVS9322	EVS9323	EVS9324
Accessories	Order No.			
Mains choke	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Mains filter				
Category C2 EN 61800-3	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Category C1 EN 61800-3	EZN3B2400H002	EZN3B1500H003	EZN3B0900H004	EZN3B0500H007
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD180R300W	ERBD180R300W	ERBD082R600W	ERBD068R800W
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0016	EZZ0016
Mounting kit for push-through technique	EJ0036	EJ0036	EJ0037	EJ0037

9300	EVS9325	EVS9326	EVS9327	EVS9328
Accessories	Order No.			
Mains choke	EZN3A0300H013	ELN3-0150H024-001	ELN3-0088H035-001	ELN3-0075H045
Mains filter				
Category C2 EN 61800-3	EZN3A0300H013	EZN3A0150H024	EZN3A0110H030 E82ZN22334B230 E82ZZ15334B230 [1]	EZN3A0080H042 E82ZN22334B230
Category C1 EN 61800-3	EZN3B0300H013	EZN3B0150H024	E82ZN22334B230 E82ZZ15334B230 [1] EZN3B0110H030U [2]	E82ZN22334B230 EZN3B0080H042
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD047R01k2	ERBD047R01k2	ERBD033R02k0	ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0017	EZZ0017
Mounting kit for push-through technique	EJ0038	EJ0038	EJ0011	EJ0011

9300	EVS9329	EVS9330	EVS9331	EVS9332
Accessories	Order No.			
Mains choke	ELN3-0055H055	ELN3-0038H085	ELN3-0027H105	ELN3-0022H130
Mains filter				
Category C2 EN 61800-3	E82ZN30334B230 EZN3A0055H060	E82ZN55334B230 EZN3A0030H110 EZN3A0030H110N001 3)	E82ZN75334B230 EZN3A0022H150	E82ZN75334B230 EZN3A0022H150
Category C1 EN 61800-3	E82ZN30334B230 EZN3B0055H060	EZN3B0030H110	E82ZN75334B230 EZN3B0022H150	E82ZN75334B230 EZN3B0022H150
Brake chopper	EMB9352-E	2 × EMB9352-E	2 × EMB9352-E	3 × EMB9352-E
Brake resistor	ERBD018R03k0	2 × ERBD022R03k0	2 × ERBD022R03k0	3 × ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0017	–	–	–
Mounting kit for push-through technique	EJ0011	EJ0010	EJ0010	EJ0009

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13.1 Glossary

13.1.1 Terminology and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter

P_r [kW]	Rated motor power
R [Ω]	Resistance
S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)

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EDSVS9332S ▪ 13440809 ▪ EN ▪ 6.0-07/2013 ▪ TD06

EDSVS9332S-EXT
13375724

Global Drive

System Manual

(Extension)

9300 *0.37 ... 75 kW*

EVS9321xS ... EVS9332xS

Servo inverter

Lenze

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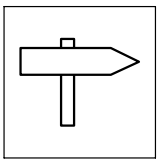

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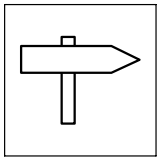

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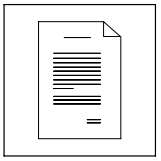

1 Preface

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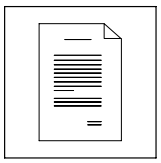
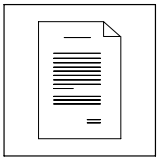




1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual addresses to all persons who dimension, install, commission, and set 9300 servo inverters.

Together with the System Manual, document no. EDSVS9332S, and the catalogue, it forms the basis for project planning for the manufacturer of plants and machinery.

Contents

The System Manual (Extension) completes the System Manual, document no. EDSVS9332S:

- The features and functions are described in detail.
- It describes additional possible applications in detail.
- Examples describe how to set the parameters for typical applications.
- In case of doubt always the mounting instructions supplied with the 9300 servo inverter are valid.

Contents of the System Manual	Contents of the System Manual (Extension)
1 Preface	1 Preface
2 Safety	-
3 Technical data	-
4 Mounting the standard device	-
5 Wiring the standard device	-
6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
8.1 Monitoring	2.1 Configuration with Global Drive Control
8.2 Monitoring functions	2.2 Basic configurations
8.3 Code table	2.3 Modes of operation
8.4 Selection lists	2.4 Change of the terminal assignment
8.5 Table of attributes	
-	3 Function library
-	4 Application examples
9 Troubleshooting and fault elimination	-
10 DC-bus operation	-
11 Safe standstill	-
12 Accessories	-
13 Appendix	5 Appendix

How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Note!

Information and tools concerning the Lenze products can be found in the download area under

http://www.Lenze.com

1.1.2 Document history

What is new / what has changed?

Material number	Version			Description
13375724	2.0	03/2012	TD23	Error corrections
13296208	1.0	05/2010	TD23	Extended by functions for software version 8.0 Error correction Division of the System Manual into 2 parts (EDSVS9332S and EDSVS9332S-EXT)

1.1.3 Products to which the System Manual applies

This documentation is valid for 9300 servo inverters as of nameplate data:

	①					②	③
	EVS	93xx	-	x	S	Vxx	1x	8x

Product series

EVS = Servo controller

Type no. / rated power

	400V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Design

E = Panel-mounted unit
C = Built-in unit in ”cold plate” technique

Model

S = Servo inverter

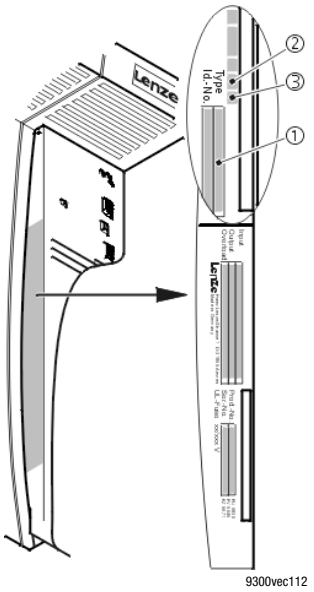
Variant

- = Standard
V003 = In ”cold plate” technique
V004 = With ”safe standstill” function
V100 = For IT systems
V104 = With ”safe standstill” function and for IT systems

Hardware version

Software version

Nameplate



1.2 Definition of notes used

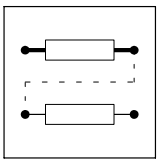
All safety information given in these instructions has the same layout:

Pictograph (indicates the type of danger)

Signal word! (indicates the severity of danger)

Note (describes the danger and explains how to avoid it)

Pictograph	Signal word		Consequences if disregarded
	Signal word	Meaning	
Dangerous electrical voltage General danger	**Danger!**	**Impending danger for persons**	Death or severe injuries
	Warning!	**Possible, very dangerous situation for persons**	Death or severe injuries
	Caution!	**Possible, dangerous situation for persons**	Injuries
	Stop!	**Possible damage to material**	Damage of the drive system or its environment
	Note!	**Useful tip** If you observe it, handling of the drive system will be easier.	



2 Configuration

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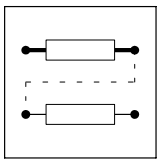
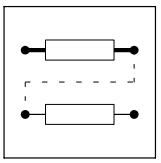


Configuration



2.1 Configuration with Global Drive Control

With Global Drive Control (GDC), a program for the PC, Lenze offers an easy-to-understand, clearly-laid-out and convenient tool for configuring your application-specific drive task.

Function block library

GDC provides a clear overview of the function blocks (FB) available in a library. GDC also lists the complete assignment of a function block.

Signal configuration

Signals can be configured in a single dialog box. This is a convenient way

- to display every FB as a block diagram.
- to see the assignment of all signal inputs at a glance.
- to enter the FB in the processing table.
- to print your signal configuration.

Terminal assignment

Freely assignable terminals can be configured using two dialog boxes:

- Dialog box - to link digital inputs and outputs.
- Dialog box - to link analog inputs and outputs.

2.2 Basic configurations

Stop!

It is possible to load predefined basic configurations via code C0005. If you load a configuration via C0005, the assignment of all inputs and outputs will be overwritten with the corresponding basic configuration.

Adapt the function assignment to the wiring.

The internal signal processing is adapted to the drive task by selecting a predefined basic configuration. You can, for instance, use the Lenze setting for speed control.

- A detailed description of the basic configurations with terminal assignments, signal flow diagrams, and application examples can be found in chapter ”Application examples”.
- Before loading a basic configuration via C0005, the controller must be inhibited.

Several predefined signal configurations can be loaded by using code C0005. The selection numbers have the following meaning:

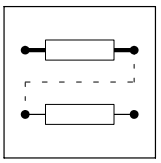
C0005 = X X X X

Control
0 - Terminal control
1 - Control via LECOM A/B/LI
3 - Control via AIF (INTERBUS,PROFIBUS)
5 - Control via system bus (CAN)

Voltage source for the control terminals
0 - External supply of control terminals
1 - Internal supply of control terminals

Additional function
0 - No additional function
1 - Brake control via digital output X5/A2
9 - At quick stop (QSP) deceleration of the complete drive system to zero speed in an angle-controlled mode

Basic function
1 - Speed control
4 - Torque control with speed limitation
5 - Master for digital frequency coupling
6 - Slave on digital frequency bus
7 - Slave on digital frequency cascade



2.2.1 Changing the basic configuration

If the basic configuration must be changed for a special application, proceed as follows:

1. Select a basic configuration via C0005 which largely meets the requirements.
2. Add functions by:
   – Reconfiguring inputs and/or outputs.
   – Setting parameters for function blocks. (📖 3-4)
   – Inserting or removing function blocks. (📖 3-10)

Note!

If you change the signal flow of the basic configuration, e. g. by adding function blocks, C0005 is set to 0. The display indicates ”COMMON”.

2.2.2 Speed control C0005 = 1XXX (1000)

For standard applications, with the default settings you can commission the drive immediately. In order to adapt it to specific requirements, observe the notes in the following sections.

2.2.2.1 Setpoint selection

Main setpoint

Via the setpoint n_{set} (display in C0046) the speed is defined, relating to the value n_{max} (C0011) which can be set. The setpoint is specified in a bipolar analog manner via input X6/1,2. By the settings carried out, the drive runs with the speed set in C0011 if a master voltage of 10 V is selected. If you want to actuate the drive at master voltages with low voltages you can adapt the system via codes C0026/1 (offset) and C0027/1 (gain).
Alternatively you can also specify the setpoints via

- Keyboard,
- Integrated system bus (CAN),
- Automation interface (LECOM, InterBus, Profibus DP, RS 232, RS 485, optical fibre).

Which input is active as setpoint source depends on the configuration selected in C0005, or the setpoint source can be set via configuration code C0780 in the NSET function block.

Current master value

If the analog main setpoint is to be specified as current master value via X6/1,2, you can select the current setting range with code C0034:

- For -20 mA … +20 mA: C0034 = 2
- For 4 … 20 mA: C0034 = 1 (can only be used in unipolar mode)

If the range 4…20 mA has been selected, the error message Sd5 appears when the value is lower than 2 mA.

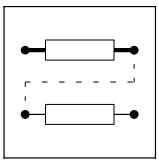
The signal conditioning for this is effected in function block AIN1.

The change-over from the voltage master value to the current master value (current load 242R) has to be effected via the jumper position at X3:

- Voltage master value/potentiometer:
  – Jumper X3 in the lower position (default setting)
- Current master value:
  – Jumper X3 in the upper position

JOG setpoints

If you require specific fixed settings as main setpoint, you can call parameterisable setpoints from the memory via the JOG inputs. JOG setpoints replace the main setpoint. The JOG setpoints are entered in a relative manner in % of n_{max}. If you set input E3 to HIGH signal, the main setpoint is switched off and at the same time the first JOG setpoint is activated. A total of 15 JOG setpoints can be selected.



Inverting the main setpoint

Via terminals E1 and E2 the main setpoint can be inverted (i.e. the sign of the input value is changed). The following applies:

E1	E2	Main setpoint
0	0	Drive executes QSP (quick stop)
1	0	Main setpoint not inverted
0	1	Main setpoint inverted
1	1	Drive maintains its previous state

Acceleration and deceleration times for the main setpoint path

The main setpoint is controlled via a ramp function generator. Like this, input steps can be converted to a ramp.

The acceleration time and deceleration time refer to a change in speed from 0 to n_{max} (0% to 100%). The calculation of the times T_{ir} (C0012) and T_{if} (C0013) to be set is described in the NSET function block description.

Additional acceleration and deceleration times

For the ramp function generator of the main setpoint (NSET-N/JOG setpoint) you can call additional acceleration and deceleration times from the memory via the NSET-TI*x inputs, e.g. to change over the acceleration speed of the drive from a specific speed. For this, these inputs have to be assigned to a signal source. A maximum of 15 additional acceleration and deceleration times can be programmed.

S-shaped ramp function generator characteristic

For the ramp function generator of the main setpoint you can select two different characteristics via C0134:

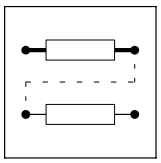
- Linear characteristic for all acceleration processes requiring a constant acceleration
- S-shaped characteristic for all acceleration processes requiring a jerk-free acceleration

Code	Parameter	Meaning
C0134	0 1	Linear characteristic S-shaped characteristic
C0182	0.01 … 50.0 s	T_i-time for the S-shaped ramp function generator
C0012	0.00 … 999.9 s	T_{ir}-time for the acceleration
C0013	0.00 … 999.9 s	T_{if}-time for the deceleration

Additional setpoint

Via input X6/3,4 (or also another signal source) an analog additional setpoint (bipolar) can be connected. The additional setpoint (display in C0049) internally first goes to the NSET function block via an analog switch. Here the additional setpoint first is lead across a facility for inversion. This facility for inversion is deactivated. Furthermore there is a ramp function generator (acceleration and deceleration times via C0220/C0221) before the additional setpoint is linked with the main setpoint in the arithmetic block. The additional setpoint for instance can be used as a correcting signal for grinding machines (for controlling a constant circumferential speed when the grinding wheel diameter is decreased).

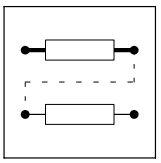
If you want to use the additional setpoint, set code C0190 to the desired arithmetic link. According to the default setting, code C0190 is parameterised to 0. Thus the additional setpoint is switched off.



Selection of direction of rotation

The selection of direction of rotation results from the sign of the speed setpoint at the input MCTRL-N-SET of the MCTRL function block.
In turn, the sign of this speed setpoint results from

- the sign of the main and additional setpoint,
- the level position at terminals E1 and E2,
- the selected link of the main and additional setpoint via the arithmetic block in the NSET function block



Limitation of the speed setpoint

The speed setpoint is always limited to 100% n_{max} (C0011) in the MCTRL function block. This means that the maximum speed is always specified to the greatest speed possible in C0011.

Example:

With this configuration a speed of 4500 rpm is to be travelled. The speed is to be corrected in the range from 0 to +10% using the additional setpoint. At inputs X6/1,2 and X6/3,4 a master voltage of 0 to +10 V is provided.

The following parameter setting results from this:

- C0011 = 5000 rpm, C0190 = 1 (addition)
- C0027/1 = 90%
- C0027/2 = 10%

Code C0909 presents another possibility of influencing the speed limit. Here the direction of rotation can be specified:

- C0909 = 0 → clockwise and counter-clockwise rotating direction permitted
- C0909 = 1 → only clockwise rotating direction permitted
- C0909 = 2 → only counter-clockwise rotating direction permitted

For systems that only permit one rotating direction this serves to prevent the drive from rotating backwards which would be caused by the setpoint.

Additional torque setpoint

For some applications it may be required to apply an additional torque setpoint.

Example: An acceleration connection for winding and positioning applications:

For this purpose, the input MCTRL-M-ADD is provided. This input is not active by default (is on FIXED0%). To use this input, an analog signal source has to be assigned to it.

Torque limitation

The torque can be limited in the range from 0 to +100% via code C0472/3.

Every other signal source can be assigned as well.

Actual speed value feedback

In this configuration all specified actual value encoders can be used. The corresponding actual value encoder can be selected via code C0025. An adjustment is not required.

Quick stop (QSP)

When the quick stop function is activated, the drive runs to speed 0 via the ramp set in C0105 and executes a holding torque with a drift-free standstill. The torque limitation and the additional torque setpoint have no effect. This means that the drive outputs the maximum possible torque (observe settings of motor data). When the QSP request is cancelled, the drive synchronises to the current speed.

Controller inhibit (CINH)

By setting controller inhibit the drive becomes torqueless, the machine coasts. When the controller inhibit request is cancelled, the drive synchronises to the current speed.

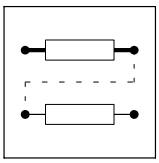
Shutting down the controller via TRIP (TRIP-SET)

With LOW signal at terminal X5/E4, the controller can be shut down via the monitoring function. This input mainly serves to evaluate external binary encoders.

The response to this input signal can be programmed.

Resetting a fault (TRIP-RESET)

With a LOW-HIGH edge at terminal X5/E5 a pending TRIP can be reset if the cause of the fault has been eliminated.



2.2.3 Torque control with speed limitation 4000

The drive is set to torque control with the configuration C0005 = 4XXX ”Torque control with speed limitation”. The torque can be provided in both directions.

The speed in the different operating cases is monitored using the n-controllers via a speed limitation.

2.2.3.1 Function

If the actual speed is within its limitation, the drive is torque-controlled. If one of the speed limits (CCW or CW rotation) is reached, the drive becomes speed-controlled.

2.2.3.2 Setpoint input

Torque setpoint

The torque setpoint is entered via the analog terminal X6/3,4. When all motor data are entered correctly, the drive provides 100 % of the possible torque (C0057) in the positive direction (CW) with an input voltage of +10 V (corresponding to 100 % in negative direction (CCW) with -10 V).

If you want to operate the controller with a lower master voltage, you can adapt the system via the codes C0026/2 (offset) and C0027/2 (gain).

Alternatively, you can also enter the setpoints via

- keypad,
- integrated system bus (CAN),
- automation interface (LECOM, InterBus, Profibus DP, RS 232, RS 485, fiber optics).

It depends on the selected configuration C0005, which of these inputs is active as a setpoint source. The signal source can also be set under the configuration C0891 (MCTRL-M-ADD) in the MCTRL function block.

Speed setpoint (speed limits)

The speed limitation is carried out via the n-controllers in the MCTRL function block. The first speed controller (main speed controller) is the upper speed limit and the second speed controller is the lower speed limit.

Example:

The speed can be within a range of ±5000 rpm.

+5000rpm (CW rotation) is the upper limit and -5000 rpm (CCW rotation) is the lower limit. The parameter setting is explained below.

The upper speed limit is provided via the analog terminal X6/1,2. This input can be used as a speed setpoint e.g. in the threading in winding systems, wire-drawing machines, etc.

Please observe:

- The torque cannot exceed the input at terminal X6/3,4.
  The input voltage must be set to 10 V, if necessary.
- The value cannot fall below the lower speed limit (code C0472/4).
- The setpoint speed is conditioned in the same way as for speed control (C0005=1000).

Reference values:

- When a master voltage of +10 V is entered, the setting under C0011 is the upper speed limit (CW rotation).
- If -10 V are provided, C0011 is the upper speed limit in CCW rotation.

The lower speed limit is entered under code C0472/4.

Reference values:

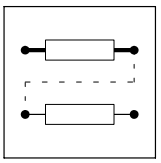
- If -100% are entered, the setting under C0011 is the lower speed limit in CCW rotation.

Quick stop (QSP) and controller inhibit (CINH)

See quick stop (QSP) and controller inhibit (CINH).

TRIP-SET and TRIP-RESET

See TRIP-SET and TRIP-RESET.



2.2.4 Master frequency coupling

2.2.4.1 General system description

The master frequency coupling described here provides a digital setpoint transmission and evaluation path between a setpoint source and one or several controllers. Here, the transmission path can either be used as bus or cascade (see later explanation) for:

- phase-synchronous running
- speed-synchronous running
- speed-ratio synchronism
- Positioning control with driftfree standstill

In each controller the setpoint can be evaluated with a factor and, electrically buffered, be output at the corresponding master frequency output.

The master frequency coupling is a purely digital setpoint transmission with all the advantages involved:

- driftfree
- high-precision
- increased interference immunity

A drive system consists of a master and several slaves. For implementing a master frequency coupling, three configurations are offered:

- master, C0005 = 5XXX (master integrator)
- slave for master frequency bus, C0005 = 6XXX (parallel connection)
- slave for master frequency cascade, C0005 = 7XXX (series connection)

Setpoint conditioning

In the setpoint arm the speed and phase setpoints are processed as absolute values.

Gearbox factors (C0032 and C0033)

The weighting factors C0032 and C0033 are in the setpoint channel of the corresponding drive (slave). Here, a gearbox factor can be set.

Setting range of factors:

- C0032 from -32767 ... +32767
- C0033 from +1 ... +32767

The quotient is limited to a maximum of ±32767.

2.2.4.2 Master configuration

Purpose

The master configuration serves to

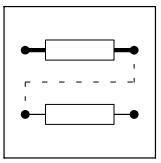
- activate the phase control, which is upstream to the speed controller and
- configure the drive as master drive for the master frequency coupling for generating the master frequency for the slave drives.

The phase control improves the control properties of the drive so that a driftfree standstill is achieved for e. g. positioning tasks, hoists etc.

Features

The features describe the basic properties of this configuration. Some of them, however, can only be used after reprogramming.

- Master with the option of signal conditioning as in the configurations C0005 = 1XXX, 4XXX except the setpoint inversion via terminal X5/E1, X5/E2
- Master frequency output signal is setpoint for slave 0 (master drive) and other slaves
- Setpoint evaluation for slave 0 with a factor (numerator/denominator) and gearbox adaptation (numerator/denominator). Can be set via
  - automation interface or system bus
  - motor potentiometer
  - other signal source
- External torque limitation possible by means of reconfiguration
- Emergency stop function for the entire drive system possible by means of reconfiguration (C0005 = 5900)
- Controller enable function causes a reloading of the setpoint integrator with the actual value of slave 0 (setpoint = actual value)
- Possible interventions for phase trimming and speed correction via
  - automation interface or system bus
  - analog terminal
  - one of the signal sources (function blocks)
- Message ”following error limit reached” can be set via code
- TRIP when reaching the phase controller limit
- Speed limit of slave 0 = C0011
- Phase controller influence can be set and switched off via the digital input
- Homing function is possible via zero track or touch probe
- Synchronising to a setpoint is possible via zero track or touch probe
- Synchronising characteristic can be set via ramp-function generator



Master integrator (setpoint generation)

The setpoint path is designed according to the configurations 1XXX and 4XXX, but without inverting the main setpoint via the terminals X5/E1,E2. This means:

- Main setpoint is generated by analogy via terminal X6/1, X6/2
- Additional setpoint is generated by analogy via terminal X6/3, X6/4 (when used, the additional setpoint must be enabled via C0190)

In this configuration, the setpoint selection refers to the frequency at the master frequency output X10.

Tip!

The resulting speed setpoint is output at the master frequency output X10. It is the setpoint in terms of amount and direction of rotation for the following slaves. At the same time it is considered to be the setpoint for slave 0 (included in the master drive), i.e. for the entire drive system.

The master drive consists of the master integrator and the slave 0. Slave 0 is the first drive at the master frequency.

Master frequency output X10

The master frequency output simulates an incremental encoder with two 5 V complementary signals shifted by 90°. The encoder constant (inc/rev.) can be set and scaled in code C0030. Here, the encoder type 2048 inc/rev. is set as standard.

The output frequency is determined by the speed set in C0011 (n_{max}) and the encoder constant.

Example:

C0011 = 5000 rpm, C0030 = 4 → 4096 inc/rev. setpoint = 100 %

The output frequency is 341.3 kHz (5000/60s × 4096).

With higher speeds, e. g. 8000 rpm in this setting, the output frequency is 564.1 kHz. In this case, the maximum possible output frequency of 500 kHz would be exceeded. Hence, an encoder constant with a smaller number of increments must be selected.

Tip!

In principle, the highest possible frequencies should be selected since the 400 kHz range provides the best resolution.

Setpoint conditioning

All settings that follow only refer to this drive, not to the entire drive system.

The setpoint is controlled via the function block DFSET. With this, essential adaptations to the drive tasks can be done.

The setpoint is evaluated with a factor (numerator/denominator). With this, the ratio can be set with which the drive is to run to its setpoint. For changing the direction of rotation of the drive, negative values can be set here.

The denominator is preset via code C0533. The numerator in this setting is selected via the free control code C0473/1, but can also be selected by every analog source by reprogramming (reconfiguring).

Another possible adaptation can be done via the gearbox factor (numerator/denominator). With this, the gearbox ratio of the drive can be set. The denominator is selected via C0033. The numerator is selected in this configuration via the free control code C0032, but can be selected by every analog source by reprogramming (reconfiguring).

Speed trimming (additional speed setpoint)

An additional setpoint can be added to the speed setpoint via the control code C0472/5. This serves to accelerate or decelerate the drive. The input is done in % of n_{max}. Here, however, every analog source can be used as signal source.

Purpose:

e. g. input for correction values

Phase trimming

Via the control code C0473/3 an additional setpoint can be added to the phase setpoint. This serves to move the rotor position forwards or backwards compared to the setpoint (leading or lagging). The input is done in increments. One revolution is split up into 65535 increments. The phase trimming can take place in the range $\pm$32767 (i.e. $\pm$1/2 revolution). Via C0529 a multiplicator can be set, which serves to expand the setting range.

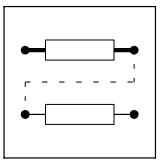
Example: Phase trimming = DFSET_A_TRIM * C0529

Here, every analog source can also be used as signal source.

100 % correspond to 1/4 revolution = 16383 inc.

Purpose:

e. g. input for correction values



Phase offset

Via C0252 a fixed phase offset can be added to the setpoint of the drive. This can be set in the range ±245760000 inc.

Reference:

see phase trimming

Phase adjustment

In some applications it is necessary that the phase leads or lags with increasing speed. For this, an adjustment of ±1/2 revolution can be entered under C0253. The phase adjustment set is reached at 15000 rpm (linear connection).

QSP at the master

If QSP is set at the master drive, the setpoint (C0050) for all drives is decelerated along the QSP ramp. The complete drive system can thus be stopped, led by the QSP integrator. If QSP is cancelled before the drives come to a standstill, the drive system starts to decelerate or accelerate with the value in C0050 to the speed setpoint at the setpoint integrator.

Unlike the configuration 5900, the phase synchronism between master and slave gets lost in the configuration 5000.

QSP at the slave 0 (master drive)

If the deceleration ramp is very short and can only be reached with I_{max}, the phase synchronism gets lost. A driftfree standstill is obtained. Switching QSP is a continuous operation for the downstream slaves so that a reversal is possible if the deceleration ramp set at the master is too short for one of the slave drives (e. g. to high centrifugal mass for the set deceleration ramp).

CINH at the master

If the master drive is inhibited, the actual value of slave 0 is used as setpoint for the other slaves. This could bring the entire drive system to a standstill led by the coasting slave 0. If the master is re-enabled before reaching the standstill, the drive system starts to accelerate with the actual speed.

When setting CINH, the phase difference is set to zero.

2.2.4.3 Slave for master frequency bus

Purpose

The configuration C0005 = 6XXX for the setpoint bus serves to

- activate the phase control, which is upstream to the speed controller
- change the setpoint signal path to master frequency coupling for phase or speed-synchronous operation

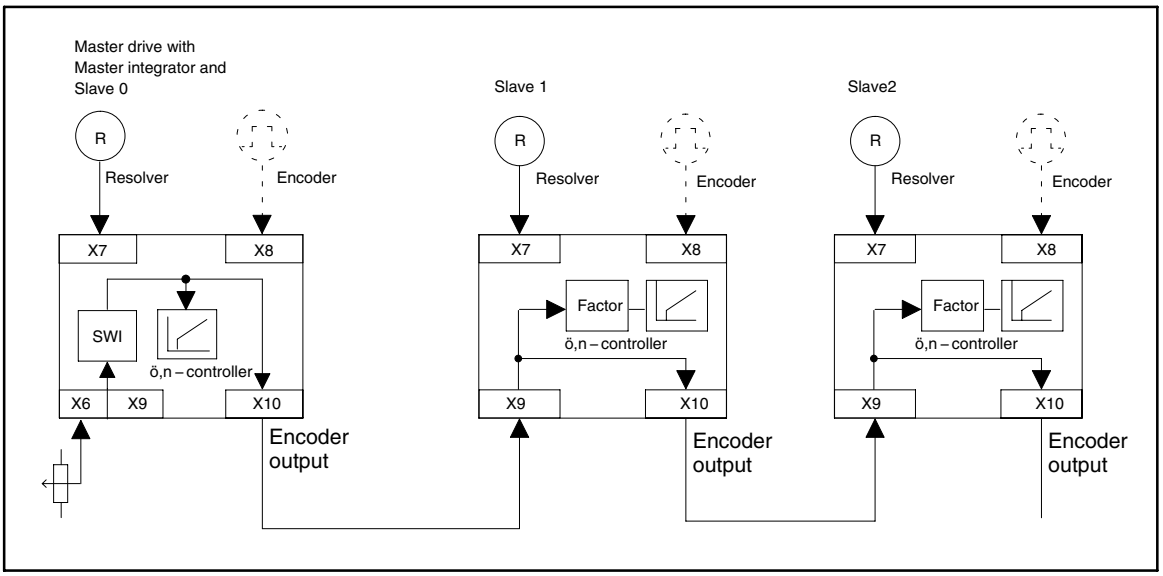
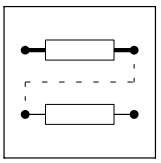


Fig. 2-1 Slave for master frequency bus



Features

The features describe the basic properties of this configuration. Some of them, however, can only be used by reprogramming.

- Hardware connection of the master frequency input with the master frequency output (so that any number of drives can be connected in series)
- Setpoint evaluation with a factor (numerator/denominator) for the corresponding slave (gearbox adaptation). Can be set via an analog signal source:
  - Terminal,
  - code or
  - function block.
- external torque limitation is possible
- QSP function for the individual drive. The setpoint is continued to be output.
- CINH function for the individual drive. The setpoint is continued to be output to the master frequency output.
- Possible interventions for phase trimming and speed correction via
  - LECOM
  - analog terminal
  - one of the signal sources (function blocks)
- Message ”following error limit reached” can be set via code
- TRIP when reaching the phase controller limit
- Speed limit of slave 0 = C0011
- Phase controller influence can be set and switched off via the digital input
- Homing function is possible via zero track or touch probe
- Synchronising to a setpoint is possible via zero track or touch probe
- Synchronising characteristic can be set via ramp-function generator

Cascading factor (C0473/1 and C0533)

This function is valid only if the configuration is not changed.

The following constants for the master frequency input (X9) can be set under C0425:

- 16384 inc/rev.
- 8192 inc/rev.
- 4096 inc/rev.
- 2048 inc/rev.
- 1024 inc/rev.
- 512 inc/rev.
- 256 inc/rev.

Cascading factors which cannot be raised to the power of two can be assigned via C0473/1 and C0533. The following connection applies:

$$\frac{\text{C0425}}{\text{Encoder constant}} = \frac{\text{C0473/1}}{\text{C0533}}$$

The quotient is limited to a maximum of ±32767.

Setting range of factors:

- C0473/1: -32767 ... +32767
- C0533: +1 ... +32767

Setpoint conditioning of the slave

The value read by the input Dig.-Set (X9) is the setpoint (speed and phase) for the internal control.

Differences compared to the speed control:

- No setpoint integrator in the setpoint channel
- Change to the JOG value is not possible
- The additional setpoint is not active
- The CW/CCW changeover must be performed via the sign of the gearbox factor

QSP at the slave

If you set QSP at the slave drive, the setpoint (C0050) is decelerated along the QSP ramp. Home positions get lost. A driftfree standstill is obtained since the set phase is led by the QSP integrator when switching QSP.

CINH at the slave

If a slave drive is inhibited, the motor is coasting at the friction torque. The master frequency output, however, continues to output the setpoint for the following slave. If the slave is enabled again, the drive accelerates to its setpoint. (possibly at the current limit). When CINH is set, the phase integrators are set to zero. Home positions get lost.

Exception:

If pulse inhibit (IMP) is released due to short-term mains undervoltage (< 500 ms), the phase integrators are not reset. After mains recovery, the drive is able to follow its setpoint again. A phase difference which emerged before is balanced.

2.2.4.4 Slave for master frequency cascade

Purpose

The configuration C0005 = 7XXX for the setpoint cascade serves to

- activate the phase control, which is upstream to the speed controller
- change the setpoint signal path to master frequency coupling for speed ratio synchronism

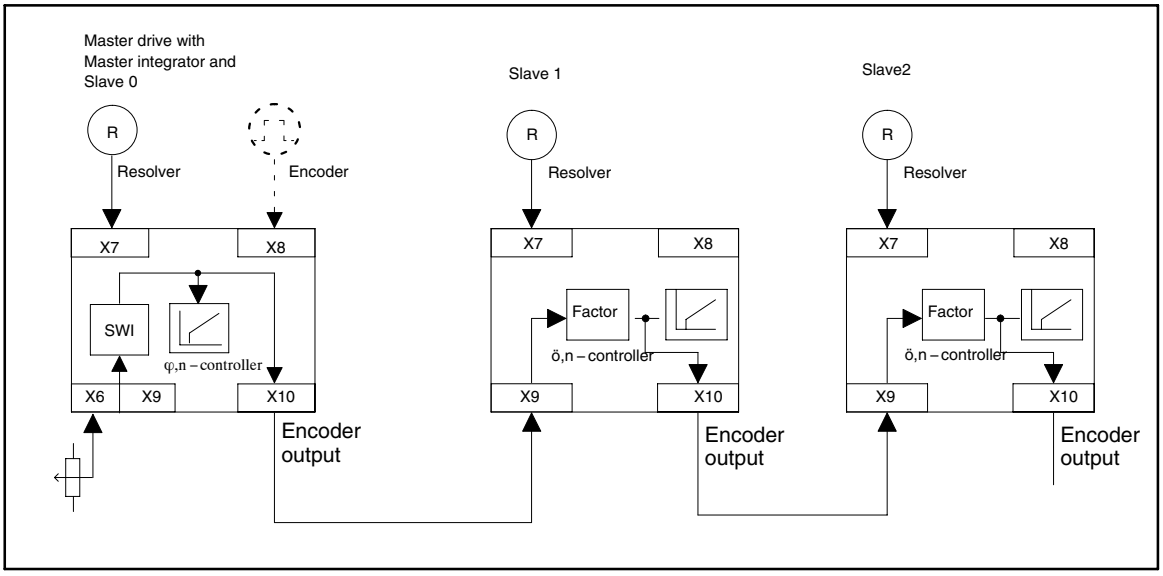
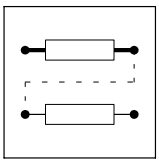


Fig. 2-2 Slave for master frequency cascade

Features

The features describe the basic properties of this configuration. Some of them, however, can only be used by reprogramming.

- **Resolver feedback is possible only**
- Evaluation of the setpoint (cascading factor) is possible with a factor (numerator/denominator) for the master frequency output (and thus for all following drives)
- Other evaluation of the setpoint is possible with a factor (numerator/denominator) for the corresponding slave (gearbox adaptation). Can be set via an analog signal source (standard: code C0032, C0033)
- External torque limitation is possible
- The QSP or CINH function in the individual drive do not influence the setpoint for the cascade.
- Possible interventions for phase trimming and speed correction via
  – LECOM,
  – analog terminal or
  – one of the signal sources (function blocks).
- Message ”following error limit reached” can be set via code
- TRIP when reaching the phase controller limit
- Speed limit of slave 0 = C0011
- Phase controller influence can be set and switched off via the digital input
- Homing function is possible via zero track or touch probe
- Synchronising to a setpoint is possible via zero track or touch probe
- Synchronising characteristic can be set via ramp-function generator



Cascading factor (C0473/1 and C0533)

This function is valid only if the configuration is not changed.

The following constants for the master frequency input (X9) can be set under C0425:

- 16384 inc/rev.
- 8192 inc/rev.
- 4096 inc/rev.
- 2048 inc/rev.
- 1024 inc/rev.
- 512 inc/rev.
- 256 inc/rev.

Cascading factors which cannot be raised to the power of two can be assigned via C0473/1 and C0533. The following connection applies:

The quotient is limited to a maximum of ±32767.

Setting range of factors:

- C0473/1: -32767 ... +32767
- C0533: +1 ... +32767

Setpoint conditioning of the slave

The value read from X9, evaluated with C0425, C0473/1 and C0533, is the setpoint (speed and phase) for the internal control and also the output value at the master frequency output X10.

The setpoint for the corresponding drive can be evaluated via the gearbox factor C0032 and C0033.

The direction of rotation of the corresponding slave can be set via the evaluation factors.

Differences compared to the speed control:

- As standard, there is no setpoint path in the setpoint integrator
- Change to the JOG value is not possible
- The additional setpoint is not active

Feedback system (X7)

Only the resolver can be selected as feedback system.

QSP at the slave

If you set QSP at the slave drive, the setpoint (C0050) is decelerated along the QSP ramp. Home positions get lost. A driftfree standstill is obtained since the set phase is led by the QSP integrator when switching QSP.

If the deceleration ramp is very short and can only be obtained with I_{max}, the phase synchronism gets lost (e.g. too high centrifugal mass for the set deceleration ramp).

The setpoint for the following slave(s) is continued to be output at the master frequency output.

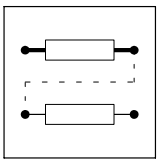
CINH at the slave

If a slave drive is inhibited, the motor is coasting at the friction torque. The master frequency output, however, continues to output the setpoint for the following slave. If the slave is enabled again, the drive accelerates to its setpoint (possibly at the current limit):

The phase difference is set to zero when switching CINH. Home positions get lost.

Exception:

If controller inhibit is released due to short-term mains undervoltage (< 500 ms), the phase difference is not reset. After mains recovery, the drive can follow again its set phase. A phase difference which emerged before is balanced. The setpoint for the slave(s) is continued to be output at the master frequency output.



2.2.5 Speed synchronism

2.2.5.1 How to select the correct configuration

The following slave configurations can be selected for the speed synchronism with the master configuration C0005 = 5XXX:

- Slave for setpoint bus C0005 = 6XXX;
  for only two drives or fixed speed relationships which must be set only once (commissioning)
- Slave for setpoint cascade C0005 = 7XXX;
  for more than two drives or simple change of the speed relationship with stretching factors in the running process

A correction value for the speed synchronism can be changed and displayed via the input DFSET-N-TRIM in the DFSET function block.

The input can be changed by reconfiguration via:

- analog terminal
- motor potentiometer
- keypad
- automation interface or system bus

The correction value is provided in % of C0011 (n_{max}).

Deactivate the phase controller for the speed synchronism. This means that the phase-synchronous running becomes a speed-synchronous running, which results in adding phase errors between the drives. The phase controller can be deactivated by setting code C0254 to zero.

2.2.5.2 Speed-synchronous running

Purpose

For material transports with very low stretching coefficients, such as paper, metal, etc., the tension can be set via the gearbox factor C0032/C0033 by oversynchonism in the ‰ range. A specified tension thus results from the stretching coefficient of the material. For a better operation and higher accuracy in the digital frequency coupling, we recommend the digital frequency cascade C0005 = 7XXX.

2.2.5.3 Speed ratio synchronism

Purpose

- Stretching systems
- Wire-drawing plants

Example

Extruder system with stretching of plastic threads by a speed ratio synchronism. The stretching is performed online during the process via a motor potentiometer function.

2.2.6 Angular synchronism

Purpose

- Drive concept for positive movements (e.g. packing of bottles on conveyor belts)
- Electrical shaft (e.g. vertical shaft, printing machines with embossing or printing rolls depending on the format).

Conditions

Configuration C0005 = 6XXX or 7XXX.

In the configurations C0005 = 5XXX the specifications only apply to the slave 0.

Angle-synchronous operation

When the angle controller is active, every controller can perform angle-synchronous, drift-free angular synchronism with regard to its setpoint. Since in the master frequency cascade the setpoint of the second slave is conditioned in the first slave and both systems are not synchronous, a fixed angular offset develops between the motor shafts which, however, does not add up over time.

2.2.6.1 Angle controller

Angle controller adaptation

A value at MCTRL-P-ADAPT affects the gain set in C0254.

Special features

The difference between setpoint and actual angle is supplied to the angle controller. With reference to the angle it is designed as P controller. Its influence can be set via C0254. C0254 = 0 means the complete disconnection of the angle controller from the controlled system.

Setting range of C0254 = 0.0001 ... 3.9999, C0254=1.00 and 16384 INC system deviation (1/4 revolution) correspond to a speed variation of n_{max}.

The output of the angle controller can be limited via C0472/6. The limitation can also be connected with another analog signal source.

Angle controller limit

The angle controller limit is fixed to an angular difference of 65531 revolutions. If this angular difference is exceeded, the angle controller cannot balance the setpoint angle anymore. When reaching the angle controller limit, a TRIP P13 is generated. The error message can be evaluated according to its priority.

Note!

When reaching the angle controller limit and monitoring is switched off, the sign at the angle controller output may reverse.When setting CINH, the angular difference is set to zero.

2.2.6.2 Angular trimming

The angular trimming can be changed via C0473/3. It is displayed via C0536/3. Angular trimming can also be carried out via another analog signal source:

- Analog output of a function block
- Motor potentiometer
- Analog terminal
- Keyboard
- Automation interface or system bus

The input of the angle trimming can be multiplied in C0529.

This serves to change the rotor position by up to 20000 revolutions:

- Negative values = CCW offset
- Positive values = CW offset

Resolution: 65536 inc/rev. = 1 rev. × C0529

2.2.6.3 Following error limit

The absolute value of the following error limit can be set in increments via C0255. The setting range is: 0 ... 1.8×10^9 increments.

When reaching the following error limit, a signal is generated which is evaluated via ”Monitoring”. This signal can be evaluated with the priority (TRIP, MESSAGE or WARNING) required by the user.

When setting CINH, the angular difference is set to zero. Thus, neither the signal ”following error limit” is generated any longer.

2.2.6.4 Processing of the zero pulse (flying synchronising)

If the zero pulses are not used for the master frequency processing, an angular synchronism with a constant phase offset is achieved.

Initial situation

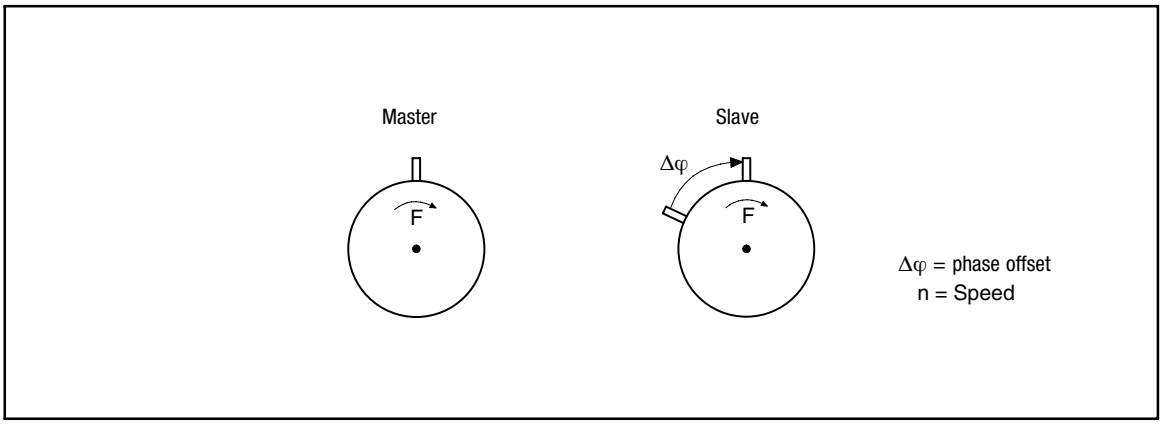


Fig. 2-3 Initial situation for zero pulse processing ($\Delta\varphi \neq 0$)

If this phase offset is to be corrected to 0, either

- homing is required or
- the zero pulses of the master frequency input and the feedback system are to be processed.

Target situation

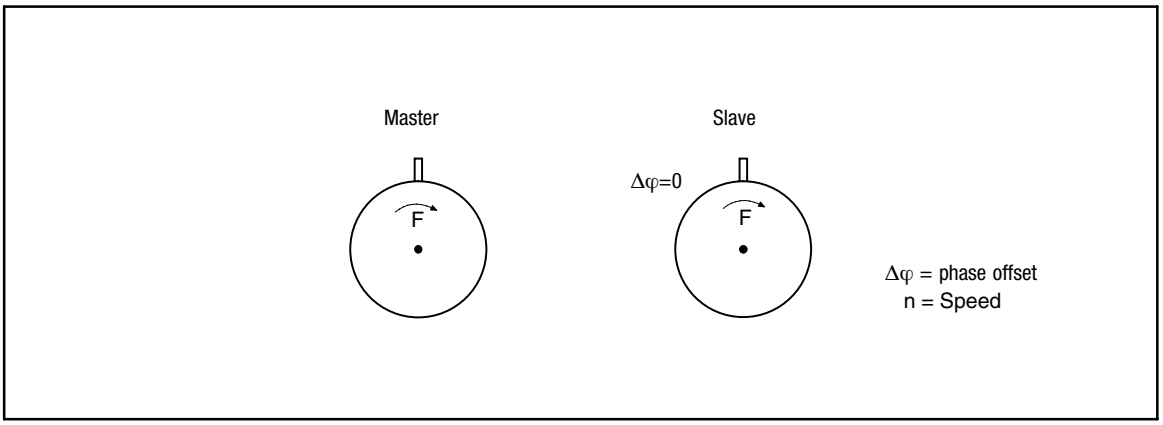


Fig. 2-4 Target situation for zero pulse processing ($\Delta\varphi = 0$)

Conditions for reaching the target situation:

- The function must be activated via code C0534 (function block DFSET)
- The input DFSET-0-PULSE must be triggered with a HIGH signal when the zero pulse is evaluated once (function block DFSET)
- The angle control must be activated (function block MCTRL)
- The zero pulses must be connected to the Sub-D connectors X9 and X8 (X8 when using an encoder)

Zero pulse at the setpoint

The set rotor position is specified via the setpoint zero pulse (i.e. when the drive system is running). It is only synchronised if one setpoint zero pulse and actual zero pulse have occurred before, i.e. not before the second zero pulse.

Control mode:

The phase offset is compensated via acceleration or deceleration. The direction (acceleration or deceleration) depends on the detected phase offset. If the rotor is leading in the range from 0 to 180 °, the drive is synchronised by deceleration. If the rotor is lagging in the range from 0 to 180 °, the drive is synchronised by acceleration.

Different synchronisation modes

In C0534 you can select between different synchronisation modes.

C0534	Synchronisation mode
1	Continuous synchronisation as described under "Zero pulse at the setpoint" (see page 2-28)
2	Same as selection 1, but DFSET-0-PULSE must be triggered with a LOW-HIGH edge
10	One-time synchronisation; control mode as described under "Zero pulse at the setpoint" (see page 2-28)
11	One-time synchronisation; the drive is always synchronised by clockwise rotation
12	One-time synchronisation; the drive is always synchronised by counter-clockwise rotation
13	One-time evaluation of the setpoint pulse and the actual pulse; the synchronisation direction results from the sign between setpoint pulse and actual pulse

Use of TOUCH-PROBE

Besides the zero pulses of the inputs X9 and the corresponding feedback system, the zero pulse evaluation can also be derived from the digital inputs X5/E4 (actual value) and X5/E5 (setpoint). The function is switched from zero pulse evaluation of the encoder (or resolver) to the evaluation of the inputs X5/E4 and X5/E5 by C0532 = 2.

IMPORTANT:

The inputs X5/E4 and X5/E5 are assigned with TRIP-Set or TRIP-Reset as standard. In this case, the input terminals must be removed from the function block DCTRL (drive control).

Use of zero pulse for the setpoint and TOUCH-PROBE for the actual value

The zero pulses can also be evaluated via a zero pulse at setpoint input X9 and a TOUCH-PROBE input X5/E4 (actual value). The function is switched on with C0532 = 3.

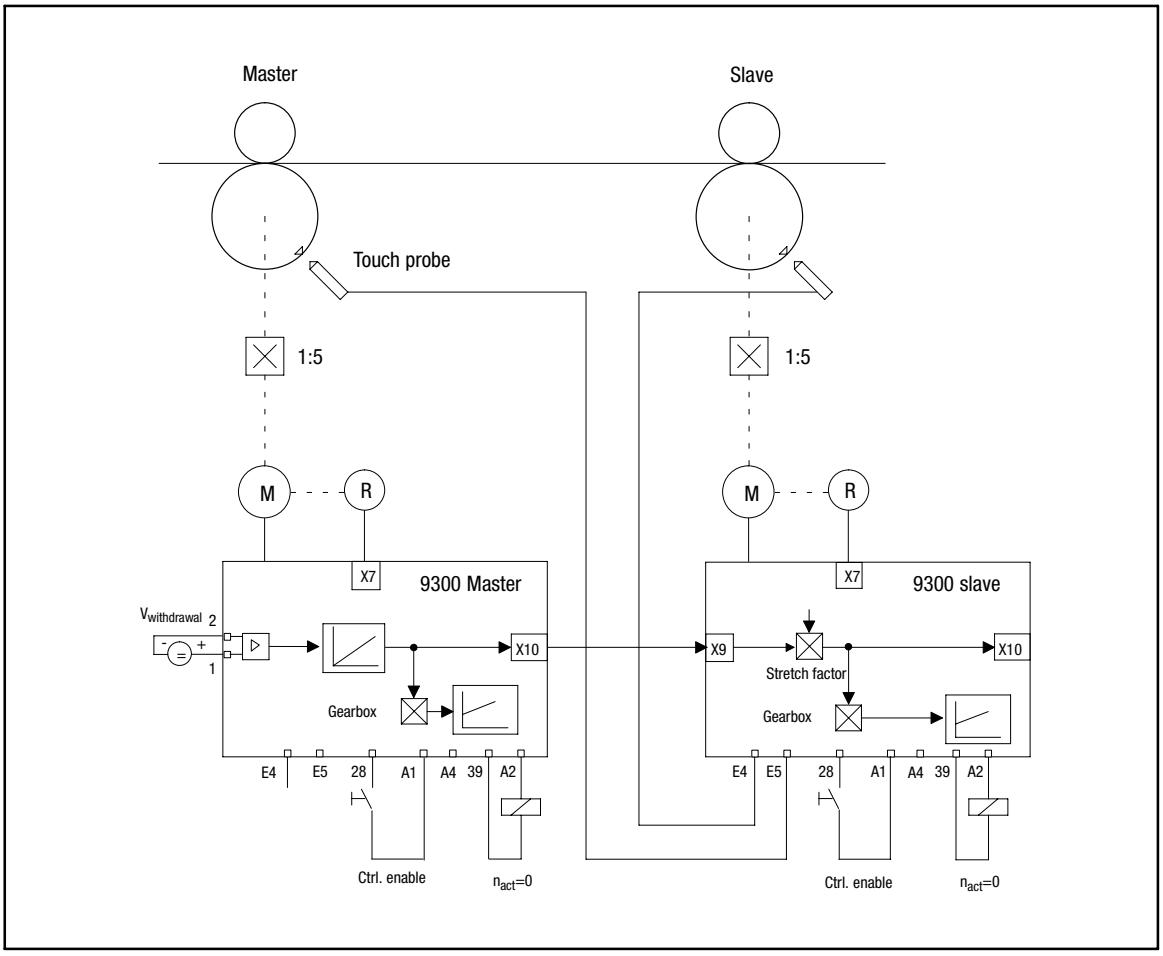


Fig. 2-5 Example for using TOUCH-PROBE

2.2.6.5 Referencing

The homing function is available with the configurations 5XXX, 6XXX and 7XXX.. The drive shaft can be positioned via the homing function. For this purpose, the drive is disconnected from the setpoint path and follows the profile generator.

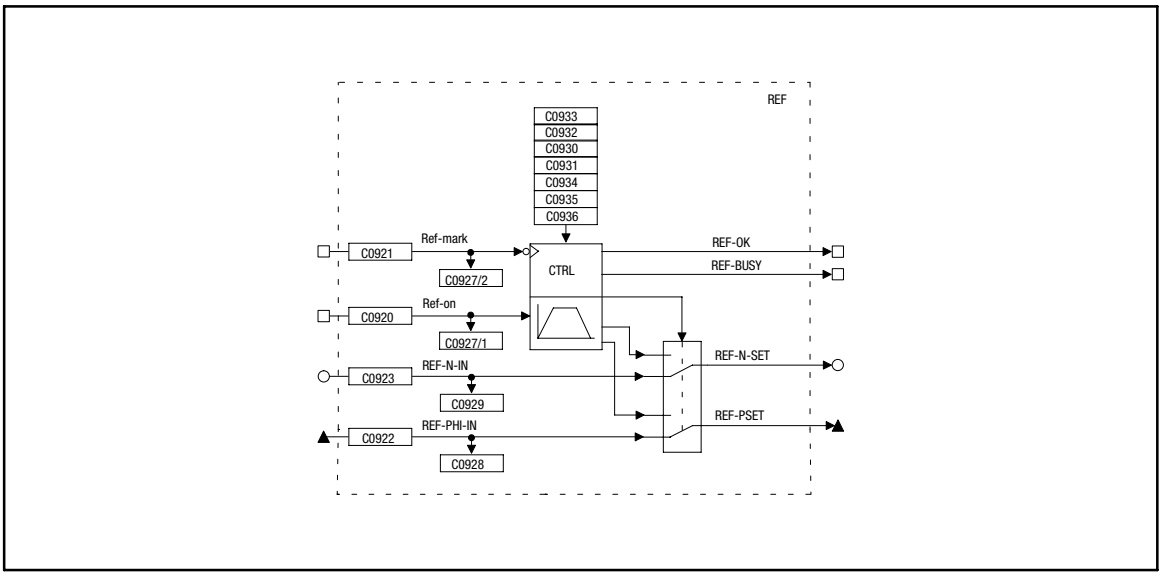


Fig. 2-6 Homing function block (REF)

Homing is started via a rising edge at the digital input ”REF-ON” (default setting is assigned to terminal X5/E3); this input must be applied until the end of the homing process.

After the negative edge has occurred at the input REF-MARK (default setting is assigned to terminal X5/E2), it is positioned to the home position. This input is intended for a reference switch. The speed travel profile is created via a profile generator which is integrated in the REF function block. Via this, the acceleration and deceleration times as well as the speed during the homing process can also be set.

The home position is defined as follows:

Next zero pulse after the negative edge of the reference switch plus the home position offset (C09334).

For position feedback via resolver, the zero position (depending on the resolver attachment to the motor) is used instead of the zero pulse. Accordingly, the touch probe angle is used for homing via touch probe.

The output signal ”REF-BUSY” indicates with HIGH signal, whether the homing function is active.

The output signal ”REF-OK” indicates with HIGH signal that homing is completed successfully. This signal can be scanned via the output terminal X5/A4.

The setpoint outputs for position and speed of the REF function block are connected with the corresponding setpoint inputs of the function block MCTRL (see signal flow diagram for the configurations 5XXX, 6XXX and 7XXX). If the homing function is active (input REF-ON = HIGH), the drive is disconnected from the setpoint path. The drive then follows the profile generator.

During the homing process the input DFSET-SET of the master frequency processing is active. This is done through the output REF-BUSY of the REF function block. After the homing process is completed, REF-BUSY=LOW is switched back to master frequency without jerk.

A renewed homing process requires an edge at the input REF-ON.

2.2.6.6 Homing modes

Mode 0

Homing with zero pulse/zero position.

Travel in clockwise rotation to the home position. The home position lies at the next zero pulse/zero position after the negative edge of the reference switch REF-MARK plus the home position offset.

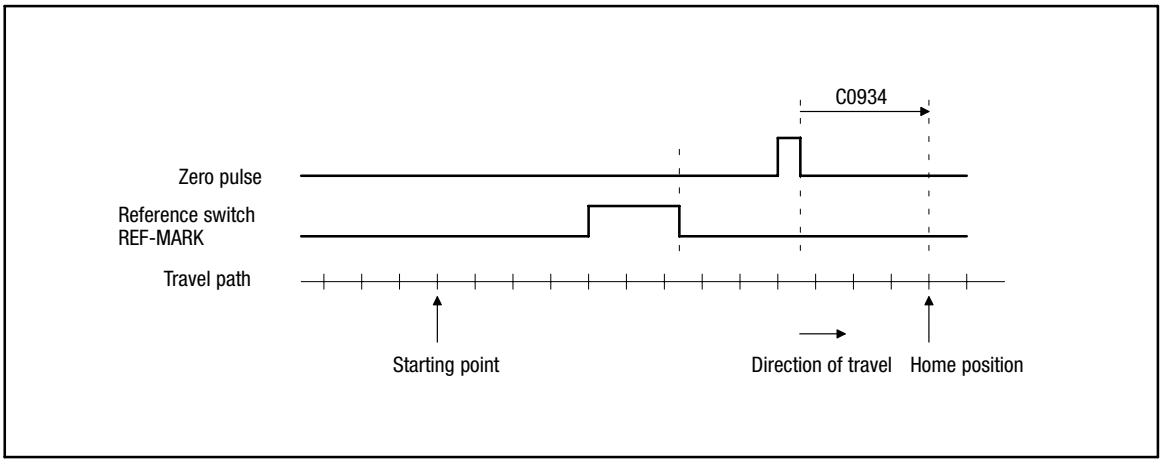


Fig. 2-7 Homing with zero pulse/zero position; approaching the home position in CW rotation

Mode 1

Homing with zero pulse/zero position.

Travel in counter-clockwise rotation to the home position. The home position lies at the next zero pulse/zero position after the negative edge of the reference switch REF-MARK plus the home position offset (C0934).

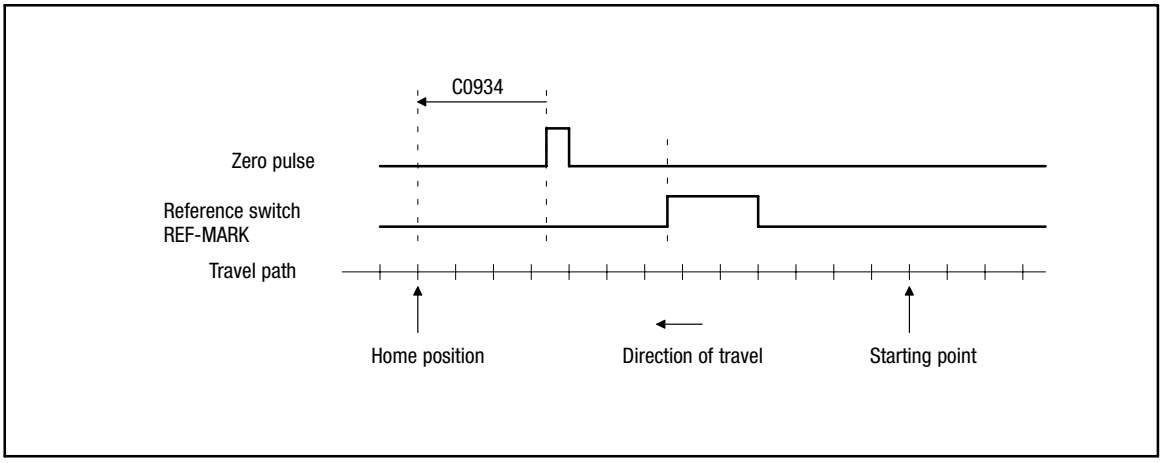


Fig. 2-8 Homing with zero pulse/zero position; approaching the home position in CCW rotation

Modes 2 ... 5

Modes 2 ... 5 are reserved.

Mode 6

Homing with touch probe.

Travel in clockwise rotation to the home position. The home position lies at the touch probe signal after the negative edge of the reference switch REF-MARK plus the home position offset (C0934).

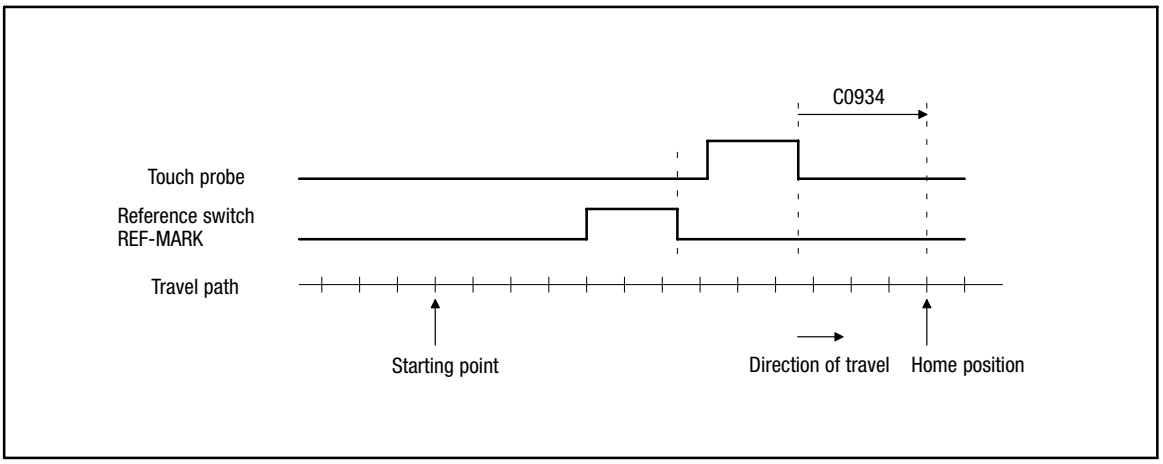


Fig. 2-9 Homing with touch probe; approaching the home position in CW rotation

Mode 7

Homing with touch probe.

Travel in counter-clockwise rotation to the home position. The home position lies at the TP signal after the negative edge of the reference switch plus the home position offset.

Mode 8

Homing with touch probe.

Travel in clockwise rotation to the home position. The home position lies at the next TP signal plus the home position offset.

Mode 9

Homing with touch probe.

Travel in counter-clockwise rotation to the home position. The home position lies at the next touch probe signal plus the home position offset.

Note concerning mode 6 to mode 9

In code C0933 you can select the edge of the zero pulse or touch probe signal (LOW → HIGH or HIGH → LOW) determining the home position.

2.2.6.7 Profile generator

The speed travel profile for homing is generated via a profile generator. During the homing process the target can be changed.

The profile generator generates a speed travel profile with linear ramps.

The following parameters must be entered:

Code	Meaning	Input
C0930	Gearbox ratio - numerator	1 ... 65535 Numerator of the gearbox ratio between motor and position encoder (motor side)
C0931	Gearbox ratio - denominator	1 ... 65535 Denominator of the gearbox ratio between motor and position encoder (encoder side)
C0934	Home position offset	-2,140,000,000 ... +2,140,000,000 inc Distance between zero pulse or touch probe and the home position during the homing process
C0935	Homing speed	0.0001 ... 100.0000 % n_{max} Motor speed during the homing process
C0936	Homing T_i time	0.01 ... 990.00 s Acceleration and deceleration time during the homing process. Reference: 0 ... n_{max} or n_{max} ... 0

The travel profile for homing is determined by entering a percentage speed and an integration time (T_i) for the ramps. The home position offset is directly entered in increments of the encoder system. (In this way, complex conversions and the entry of e. g. the feed constant can be avoided)

The home position can be approached in three ways:

- Case 1: High home position offset
- Case 2: Home position offset = 0; the zero pulse has not yet occurred during the homing process
- Case 3: Home position offset = 0; the zero pulse has occurred once during the homing process

High home position offset (case 1)

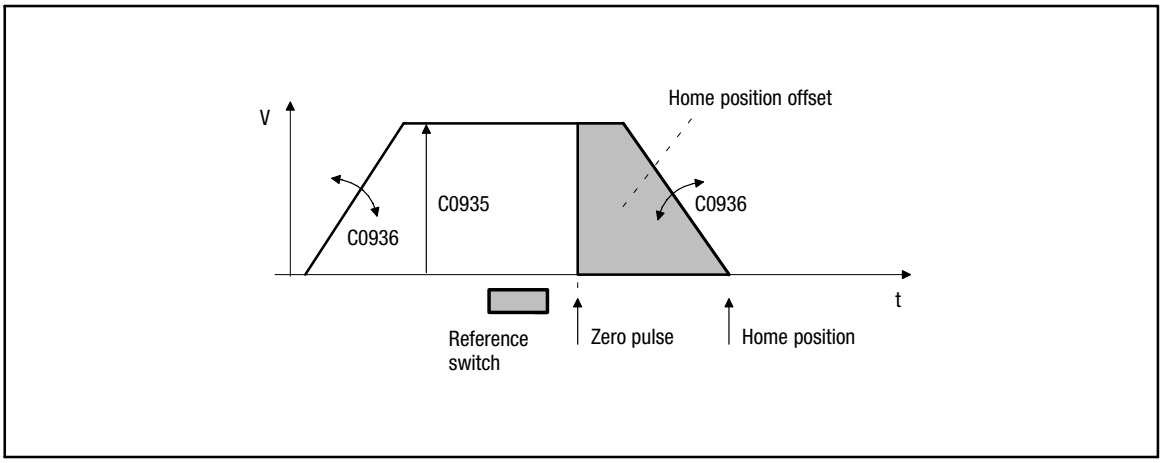


Fig. 2-10 Approaching the home position (case 1)

Home position offset = 0 (case 2)

The zero pulse has not yet occurred during the homing process (e.g. in case of incremental encoders, the position is only determined after one revolution):

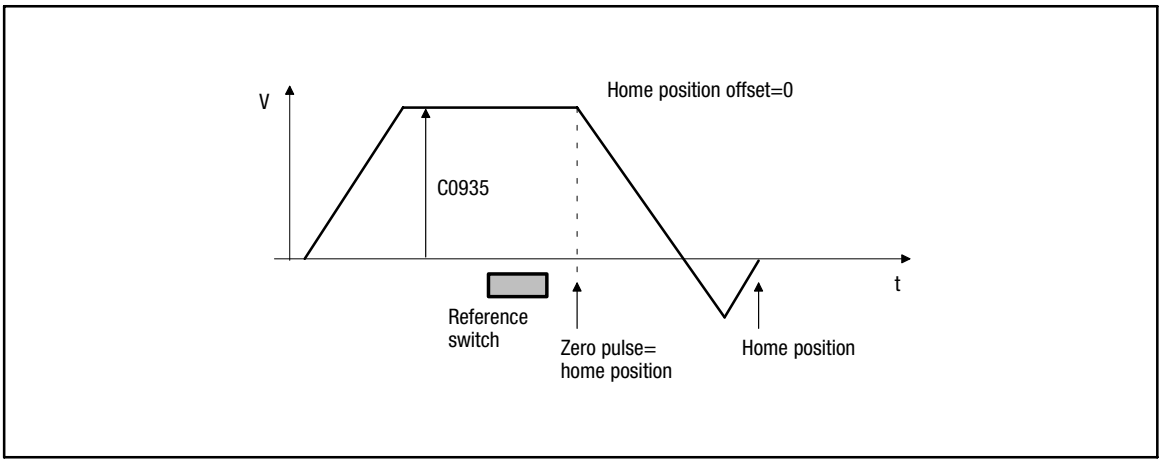


Fig. 2-11 Approaching the home position (case 2)

If the parameter setting or the position of the reference switch have been selected unfavourably, the drive is unable to directly approach the home position due to a too high moment of inertia. This means that the drive travels beyond the home position and then back again.

Reversing during the homing process can be prevented by setting the home position offset so that the path is long enough to decelerate into standstill. The reference switch and the subsequent zero pulse must be brought forward accordingly.

Home position offset = 0 (case 3)

The zero pulse has already occurred once during the homing process.

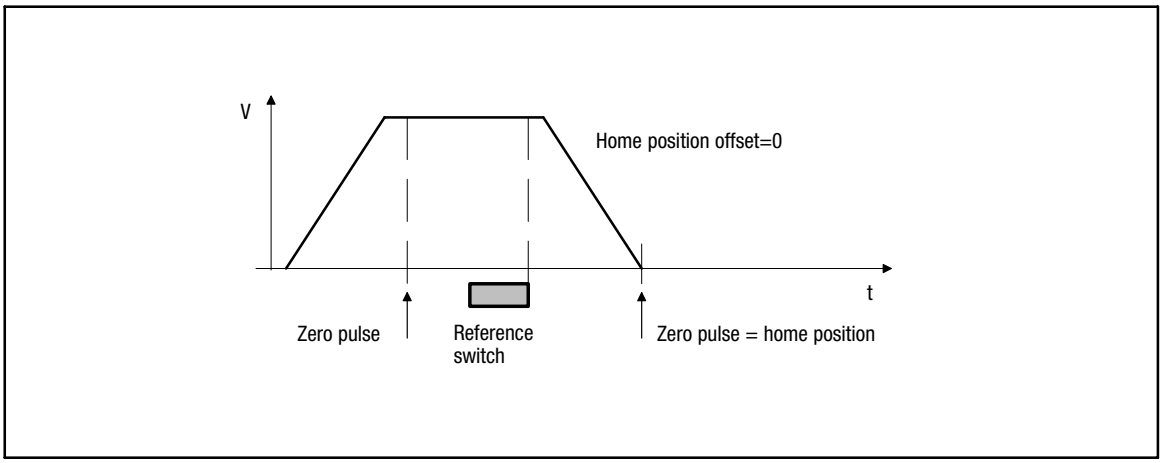


Fig. 2-12 Approaching the home position (case 3)

If the zero pulse has already occurred once during traversing or if an absolute value encoder (e.g. aresolver) is used as an actual value encoder, the drive traverses to its home position along the set ramp as described in Fig. 2-12Approaching….

Acceleration and deceleration time

The deceleration and acceleration time refers to a change of the output value from 0 to 100% (C0011). The time C0936 to be set can be calculated as follows:

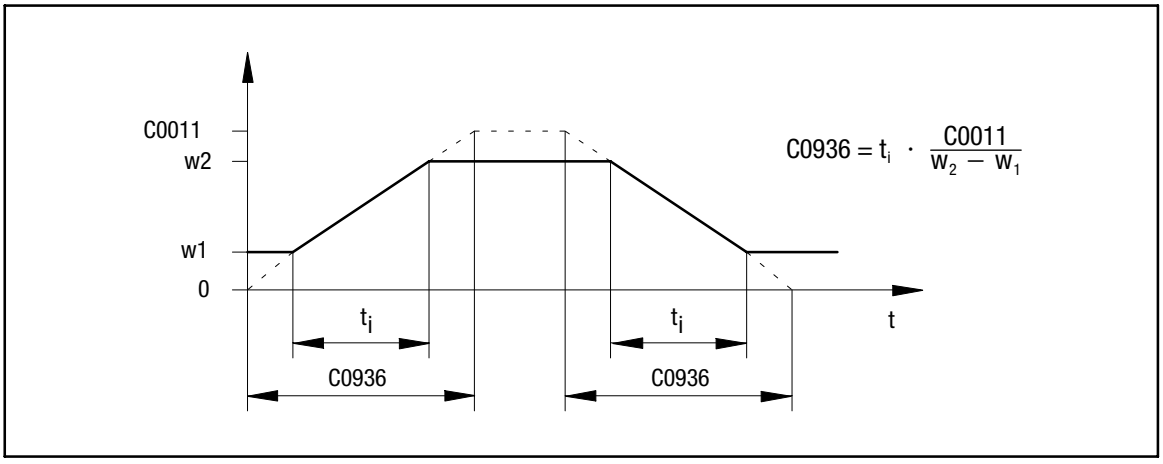


Fig. 2-13 Calculation of the acceleration and deceleration time

In this case the time desired for the change lies between w_1 and w_2.

The calculated time is to be entered into C0936.

2.3 Operating modes

By selecting the operating mode you can also select the interface you want to use for parameter setting or control of the controller.

C0005 contains predefined configurations which allow a very easy change of the operating mode.

2.3.1 Parameter setting

Parameters can be set with one of the following modules:

- Communication module
  - 2102 (LECOM A/B/LI)
  - 2111, 2113 (INTERBUS)
  - 2131, 2133 (PROFIBUS)
  - 2175 (CANopen/DeviceNet)
- PC system bus module (CAN)
  - 2173

2.3.2 Control

The drive controller can be controlled via terminals (X5 and X6), via the fieldbus module at X1 or via the system bus (X4). Mixed forms are also possible.

Example: C0005 = 1005

This configuration corresponds to a speed control with control via system bus (CAN).

If more inputs of the function blocks are to be controlled via an interface, proceed as follows:

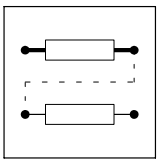
- Assign the function block inputs to be controlled to ”control objects” depending on the interface used (see System Manual):
  - Free control codes
    in case of control via LECOM A/B/LI (RS232, RS485 or optical fibre interface) or operating module.
  - AIF objects
    in case of control using InterBus S or Profibus DP.
  - CAN objects
    in case of control using system bus.
- Then the inputs can be controlled using these codes or input objects by accessing them via the interface.

Example for a distribution of the control on terminals and RS232:

The main speed setpoint in the configuration C0005=1000 is to be controlled via LECOM A/B/LI. All other inputs remain on terminal control.

1. Select C0780 via LECOM:
   - C0780 is the configuration code for the main setpoint NSET-N in the function block ”Speed setpoint conditioning” (NSET).
2. Assign a free control code via a selection number.
   - e.g. 19515 (control code C0141)

The main speed setpoint is now controlled by C0141.



2.4 Change of the terminal assignment

(see also chapter 3.1 ”Working with function blocks”)

If the configuration is changed via C0005, the assignment of all inputs and outputs is overwritten with the corresponding basic assignment. If necessary, the function assignment must be adapted to the wiring.

Tip!

Use the menu ”Terminal I/O” for the keypad 9371BB or the menu ”Terminal I/O” for Global Drive Control or LEMOC2.

Stop!

If you reassign an input, the signal source that has been assigned up to know will **not** be overwritten! Those active connections that are not required must be removed (see chapter 3.1.3).

2.4.1 Freely assignable digital inputs

Five freely assignable digital inputs are available (X5/E1 … X5/E5). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

Change assignment:

Tip!

Use the submenu ”DIGIN” for the keypad 9371BB or the submenu ”Digital inputs” for Global Drive Control or LEMOC2.

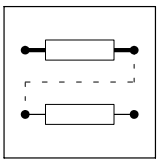
Example:
Menu "Terminal I/O; DIGIN" (terminal I/O; digital inputs)

Here are the most important aims for digital inputs

Valid for the basic configuration C0005 = 1000.

Code			controlled by			Note
CFG	Subcode	Signal name	Signal (interface)		Selection list 2	
C0885	000	R/L/Q-R	DIGIN1	(Term. X5/E1)	0051	HIGH = do not invert main setpoint (CW rotation)
C0886	000	R/L/Q-L	DIGIN2	(Term. X5/E2)	0052	HIGH = Invert main setpoint (CCW rotation)
C0787	001	NSET-JOG*1	DIGIN3	(Term. X5/E3)	0053	HIGH = Main setpoint is substituted by the fixed speed from C0039/x The signals are binary coded.
	002	NSET-JOG*2	FIXED0	-	1000	
	003	NSET-JOG*4	FIXED0	-	1000	
	004	NSET-JOG*8	FIXED0	-	1000	
C0788	001	NSET-TI*1	FIXED0	-	1000	Additional acceleration and deceleration times from C0101/x and C0103/x The signals are binary coded.
	002	NSET-TI*2	FIXED0	-	1000	
	003	NSET-TI*4	FIXED0	-	1000	
	004	NSET-TI*8	FIXED0	-	1000	
C0880	001	DCTRL-PAR*1	FIXED0	-	1000	Parameter set selection: The signals are binary coded.
	002	DCTRL-PAR*2	FIXED0	-	1000	
C0881	000	DCTRL-PAR-LOAD	FIXED0	-	1000	Signal LOW-HIGH loads selected parameter set with DCTRL-PAR*x
C0871	000	DCTRL-TRIP-SET	DIGIN4	(Term. X5/E4)	0054	LOW = Controller sets TRIP (EEr)
C0876	-	DCTRL-TRIP-RES	DIGIN5	(Term. X5/E5)	0055	Signal LOW-HIGH = Resets active trip
C0920	000	REF-ON	FIXED0	-	1000	HIGH = Start homing
C0921	000	REF-MARK	FIXED0	-	1000	LOW-HIGH edge = Stop homing

1. Select the input of the function blocks which is to be assigned to a new source under the configuration code CFG in the code level.
   – Example:
   C0787/2 (CFG/subcode) determines the source for the input "NSET-JOG*2" (signal name) in the function block "Speed setpoint conditioning" (NSET).
2. Change to the parameter level with PRG. Select the source (signal) from the indicated list. Ask yourself: Where does the signal for controlling this input is to come from?
   – Example:
   "NSET-JOG*2" is to be controlled by terminal X5/E5 (interface).
   – For this, select DIGIN5 (signal) and confirm with SHIFT + PRG.
3. Change to the code level with 2 * .
4. Determine the polarity of the input terminals X5/E1 to X5/E5 (HIGH active or LOW active) under code C0114 and subcode.
   – In the code level the terminal is selected via subcode.
   – Change to the parameter level using PRG and select the polarity.
   – Change to the code level by 2 * PRG.
5. Repeat steps 1. to 4. until all inputs required are assigned.
6. Remove undesired connections (see chapter 3.1.3). The connection so far of the terminal X5/E5 is not cancelled automatically. If the connection is to be cancelled:
   – Select C0876 in the code level (previous target of terminal X5/E5)
   – Change to the parameter level using PRG.
   – Select FIXED0 (signal) and acknowledge with SHIFT+PRG.



2.4.2 Freely assignable digital outputs

Four freely assignable digital outputs are available (X5/A1 … X5/A4). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

The most important codes can be found in the submenu: DIGOUT (digital outputs).

Change assignment:

1. Select the output which is to be assigned to another function via the subcode under C0117.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be output via the selected output terminal. Change to the code level with PRG.
3. Determine the polarity (HIGH active or LOW active) via the subcode of the output under C0118.
4. Repeat step 1. to 3., until all outputs desired are assigned.

2.4.3 Freely assignable analog inputs

The most important codes can be found in the submenu: AIN1 X6.1/2 or AIN2 X6.3/4 (analog input 1 (X6.1/2) or analog input 2 (X6.3/4))

Change assignment:

1. Select the input of the function block to be assigned to a new source in the code level.
   – Example
   Determine the source for the input ”Main setpoint” (NSET-N) in the function block ”Speed setpoint conditioning” (NSET) under C0780.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be used for the selected input.
3. Repeat steps 1. and 2. until all inputs required are assigned.
4. Remove unwanted links (see Chapter 3.1.3).

2.4.4 Freely assignable monitor outputs

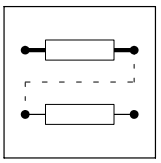
Use the monitor outputs X6/62 and X6/63 to output internal signals as voltage signals.

Under C0108 and C0109 the outputs can be adapted to e.g. a measuring device or a slave drive.

The most important codes can be found in the submenu: AOUT1 X6.62 or AIN2 X6.63 (analog output 1 (X6.62) or analog output 1 (X6.63))

Change assignment:

1. Select the output to be assigned to another signal (source) (e.g. C0431 for output X6/62) in the code level.
2. Change to the parameter level with PRG. Select the signal from the indicated list which is to be output via the monitor output.
3. If necessary, adjust an offset in the hardware under C0109
4. If necessary, the signal gain can be adapted to the hardware under C0108.
5. Repeat steps 1. to 4. to assign the second output.



3 Function library

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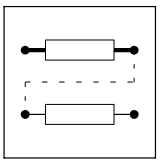


3.1 Working with function blocks

The signal flow of the controller can be configured by connecting function blocks. The controller can thus be easily adapted to diverse applications.

3.1.1 Signal types

Each function block has a certain number of inputs and outputs, which can be interlinked. Corresponding to their respective functions, only particular signal types occur at the inputs and outputs:

- Quasi analog signals
  - Symbol: O
  - Unit: %
  - Designation: a
  - Value range: ±16384 = ±100 %
  - Resolution: 16 bits, scaling: ±16384 ≙ ±100 %
- Digital signals
  - Symbol: □
  - Unit: binary, with HIGH or LOW level
  - Designation: d
  - Resolution: 1 bit
- Speed signals
  - Symbol: Δ
  - Unit: rpm (for display, internal representation in [inc/ms])
  - Designation: phd
  - Value range: $\pm 2^{15} - 1$
  - Resolution: 16 bit
- Angle signals
  - Symbol: ▲
  - Unit: inc
  - Designation: ph
  - Value range: $\pm 2^{31} - 1$
  - Resolution: 32 bits, scaling: 1 revolution ≙ 65536 inc

Only the same signal types can be connected with each other. Thus, an analog output signal of one function block can only be connected to the analog output of the other function block. If two different signal types are connected, the connection will be rejected.

3.1.2 Elements of a function block

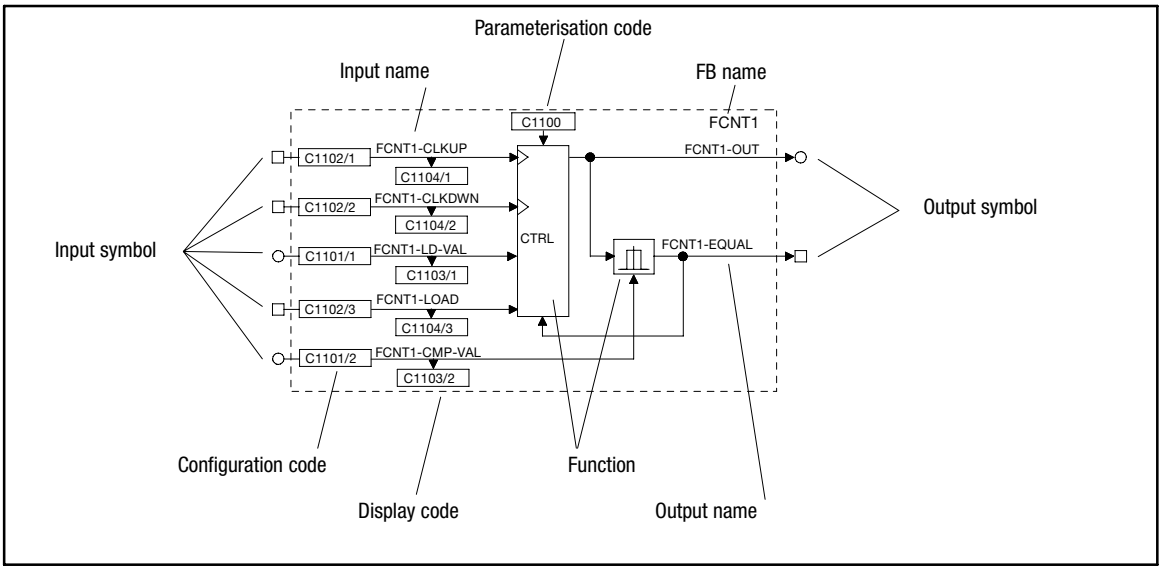


Fig. 3-1 Structure of a function block (FB) using the example of FCNT1

FB name

Clearly identifies the FB. The FB name is followed by a number distinguishing the function of the FB.

Each FB is defined via its selection number. For calculating the FB the input of the selection number into the processing table is always required. (📖 3-10)

The selection numbers are listed in selection list 5.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1 ≙ selection number 6400 (selection list 5).

Input symbol

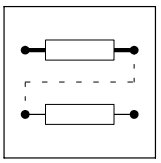
Indicates the signal type which can be used as a signal source for this input. (📖 3-3)

Note!

Only inputs led through the FB can be configured.

Input name

Consists of the FB name and a designation. Inputs with the same function are distinguished by the number that is added to the designation.



Configuration code

Configures the input with a signal source (e. g. terminal signal, control code, output of an FB, ...). Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are configured via the subcode.

It is not possible to connect an input with several signal sources.

Display code

Displays the current input value. Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are displayed via the subcode.

Display codes cannot be processed.

Function

Represents the mathematical function as a block diagram (see Fig. 3-1).

Parameterisation code

Adaptation of the function or behaviour to the drive task. Possible settings are described in the text editor and / or the line diagrams. (📖 3-12)

Output symbol

Designates the signal type. Connections with inputs of the same signal type are possible. (📖 3-3)

Each output is defined by a selection number. The selection numbers are divided into selection lists (1 ... 4) according to the different signal types.

An output is linked to an input by the selection numbers.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1-OUT ≙ selection number 6400 (analog signal, selection list 1).
- FCNT1-EQUAL ≙ selection number 6400 (digital signal, selection list 2).

Note!

Only outputs brought out of the FB can be configured.

Output name

Consists of the FB name and a designation. Outputs with the same function are distinguished by the number that is added to the designation.

3.1.3 Connecting function blocks

General rules

- Assign a signal source to an input.
- One input can have only one signal source.
- Inputs of different function blocks can have the same signal source.
- Only signals of the same type can be connected.

Stop!

Existing connections which are not required must be removed by reconfiguration. Otherwise the drive cannot perform the desired function.

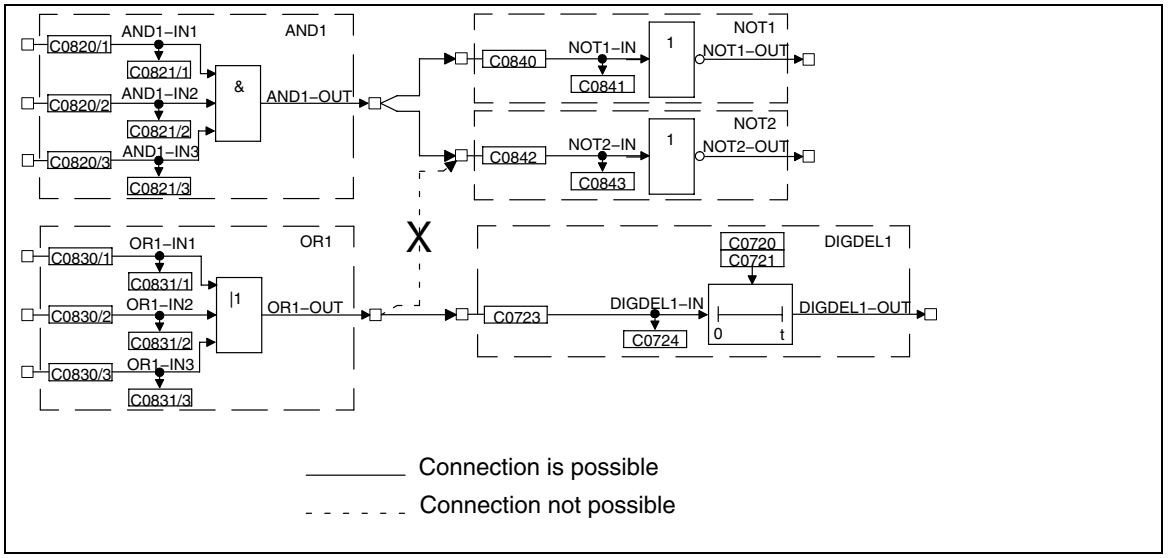


Fig. 3-2 Correct connection of function blocks

Basic procedure

1. Select the configuration code of the function block input which is to be changed.
2. Determine the source of the input signal for the selected input (e.g. from the output of another function block).
3. The function block input is assigned via a menu which contains only those signal sources which are of the same type as the function block input to be assigned.
4. Select and confirm the signal source.
5. Remove undesired connections, if any.
   – For this, select the corresponding signal assignment of the input via the configuration code (e.g. FIXED0, FIXED1, FIXED0%, ...).
6. Repeat 1. to 5. until the desired configuration is set.
7. Save modified configuration in the desired parameter set.

Example

- Condition:
  – Default setting
- Task:
  – Square the analog signal of X6/3, X6/4 and output to X6/62.
- Solution:
  – You need the function blocks AIN2, ARIT2 and AOUT2.

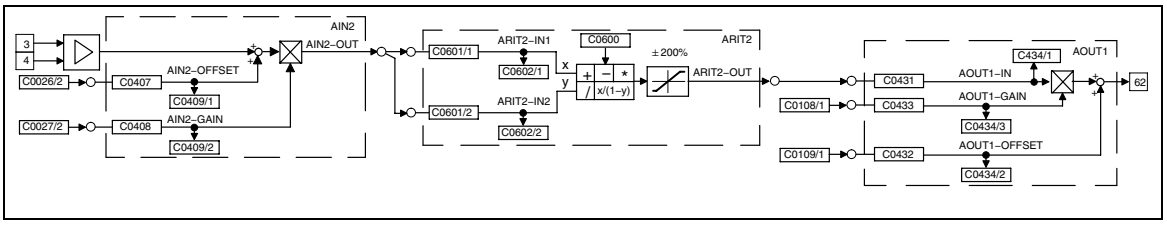


Fig. 3-3 Example of a simple configuration

Create connections

1. Determine the signal source for ARIT2-IN1:
   – Change to the code level using the arrow keys
   – Select C0601/1 using ▲ or ▼.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
2. Determine signal source for ARIT2-IN2:
   – Select C0601/2 using ▲.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
3. Parameterise ARIT2:
   – Select C0600 using ▼.
   – Change to the parameter level using PRG.
   – Select multiplication (selection number 3).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
4. Determine signal source for AOUT1:
   – Select C0431 using ▼.
   – Change to the parameter level using PRG.
   – Select output ARIT2-OUT (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
5. Enter function block ARIT2 in the processing table:
   – Select C0465 and subcode 8 using ▲.
   – Change to the parameter level using PRG.
   – Enter function block ARIT2 (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
   – The sequence of the FB processing is thus determined.

Remove connections

- Since a source can have several targets, there may be additional, unwanted signal connections.
- Example:
  - In the basic configuration C0005 = 1000, ASW1-IN1 and AIN2-OUT are connected.
  - This connection is not automatically removed by the settings described above! If you do not want this connection, remove it.

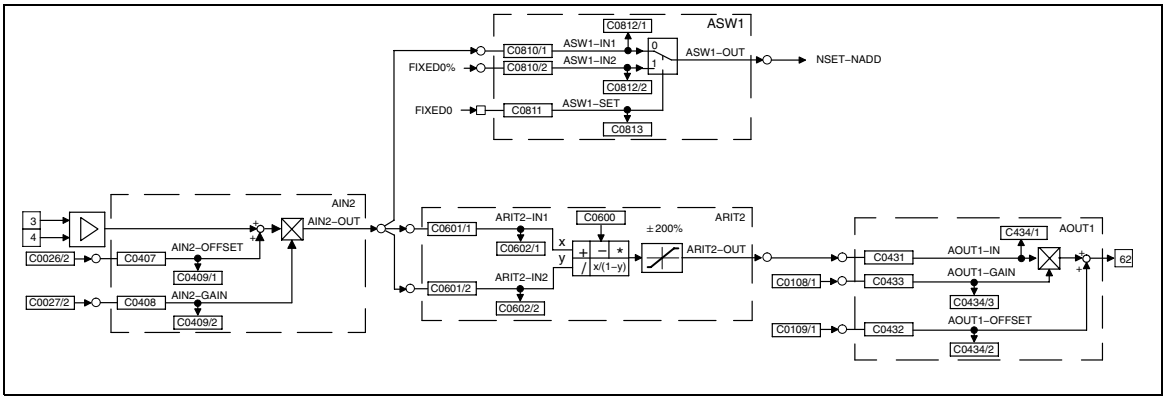


Fig. 3-4 Removing connections in a configuration

1. Remove connection between ASW1-IN1 and AIN2-OUT:
   - Select C0810/1 using ▲ or ▼.
   - Change to the parameter level using PRG.
   - Select the constant FIXED0% (selection number 1000) using ▲ or ▼.
   - Confirm using SH + PRG
   - Change to the code level again using PRG.

Now, the connection is removed.

2. Save new configuration, if desired:
   - If you do not want to lose the modifications after mains disconnection, save the new signal configuration under C0003 in one of the parameter sets.

3.1.4 Entries into the processing table

The 93XX drive controller provides a certain computing time for processing function blocks. Since the type and number of the function blocks used can vary considerably, not all function blocks available are permanently calculated. Therefore the code C0465 provides a processing table, in which only the FBs used are entered. This means that the drive system is perfectly adapted to the task to be solved. If further FBs are used in an extant configuration, they must be entered into the processing table.

The following aspects must be observed:

The number of FBs to be processed is limited

A maximum of 50 FBs can be integrated into a configuration. Each FB needs a certain processing time (operating time). The code C0466 shows the time still remaining for processing the FBs. If this time has elapsed, no further FBs can be integrated.

Sequence for entering FBs

Normally, the sequence of the entries into C0465 is discretionary, but it may be important for applications with a highly dynamic response. In general the most favourable sequence is adapted to the signal flow.

Example:

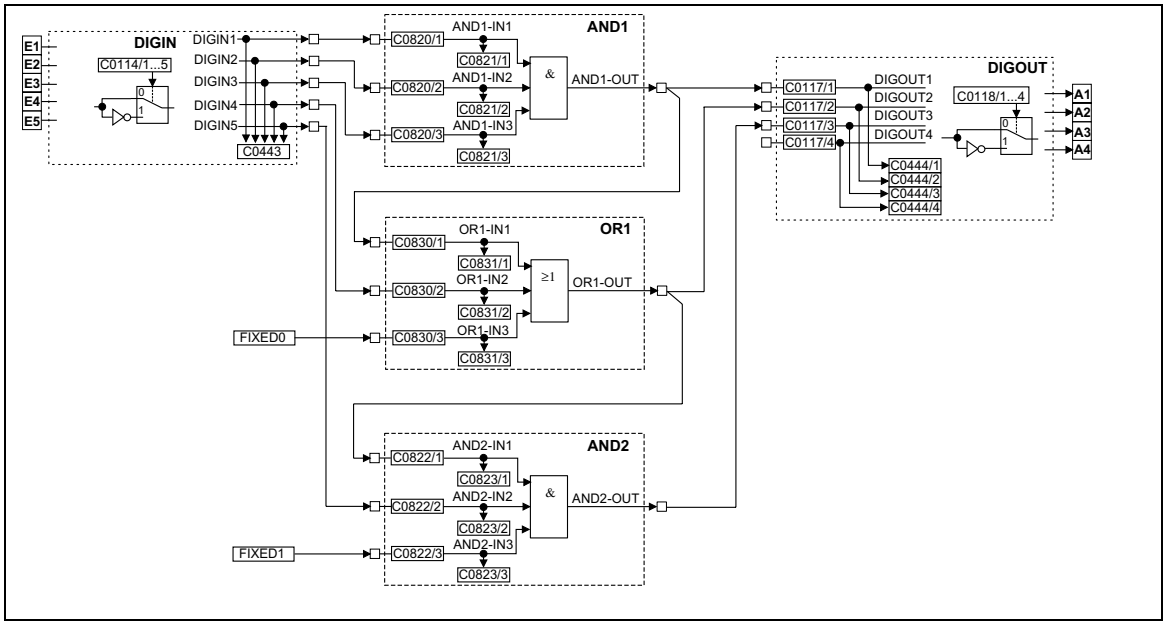
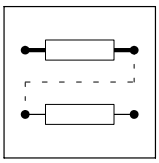


Fig. 3-5 Example of a configuration



Structure of the processing table for the configuration example Fig. 3-5:

1. DIGIN does not have to be entered into the processing table.
2. The first FB is AND1, since it receives its input signals from DIGIN and only has successors.
3. The second FB is OR1, since its signal source is the output of AND1 (predecessor). Hence, the output signal in AND1 must be generated first, before being processed in OR1. At the same time, OR1 has a successor. Hence, OR1 must be entered into the processing table before the successor.
4. The third FB is AND2, since it has a predecessor (see 3.)
5. The entries under C0465 are as follows:
   – Position 10: AND1 10500
   – Position 11: OR1 10550
   – Position 12: AND2 10505

This example was started with position 10, since these positions are not assigned in the default setting.

FBs do not have to be entered into the processing table directly one after the other. Empty positions in the processing table are permissible.

Note!

It is also possible that other FBs are entered between the FBs listed in the example.

FBs, which do not have to be entered into the processing table

The following signal sources are always executed and therefore do not need to be entered into the processing table:

- AIF-IN
- CANx-IN
- DIGIN
- DIGOUT
- FCODE (all free codes)
- MCTRL
- fixed signal sources (FIXED0, FIXED0%, etc.)

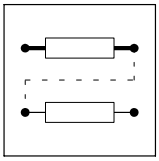
Frequent errors

Malfunction	Cause	Remedy
FB does not supply an output signal	FB was not entered into the processing table C0465	Enter FB
FB only supplies constant signals	FB was deleted from or overwritten in the processing table C0465	Enter FB again, possibly under a different subcode (list position)
The output signal does not arrive at the following FB	The connection between the FBs has not been established	Establish the connection (from the view of the following FB) via the configuration code (CFG)
FB cannot be entered into the table C0465	Residual processing time is too short (see C0466)	Delete unused FBs (e. g. inputs and outputs not used) In networked drives, functions may be assigned to other controllers
The drive controller transmits internally calculated signals with a delay to the outputs.	The FBs are processed in an incorrect sequence	Adapt the processing table under C0465 to the signal flow

3.2 Function blocks

3.2.1 Table of function blocks

Function block	Description	CPU time [µs]	used in basic configuration C0005						
			1000	4000	5000	6000	7000	20	21
ABS1	Absolute value generator	4						•	•
ADD1	Addition block	8							•
AIF-IN	Fieldbus	–	•	•	•	•	•		
AIF-OUT	Fieldbus	56	•	•	•	•	•		
AIN1	Analog input X6/1, X6/2	10	•	•	•	•	•	•	•
AIN2	Analog input X6/3, X6/4	28	•	•	•	•	•	•	•
AND1	Logic AND, block1	6						•	•
AND2	Logic AND, block2							•	•
AND3	Logic AND, block3							•	•
AND4	Logic AND, block4								•
AND5	Logic AND, block5								
AND6	Logic AND, block6								
AND7	Logic AND, block7								
ANEG1	Analog inverter 1	3	•	•	•	•	•	•	•
ANEG2	Analog inverter 2								•
AOUT1	Analog output X6/62	12	•	•	•	•	•	•	•
AOUT2	Analog output X6/63		•	•	•	•	•	•	•
ARIT1	Arithmetic block 1	11						•	•
ARIT2	Arithmetic block 2								
ARITPH1	32 Bit arithmetic block	15							
ASW1	Analog changeover 1	4	•		•			•	•
ASW2	Analog changeover 2							•	•
ASW3	Analog changeover 3								
ASW4	Analog changeover 4								
BRK	Trigger holding brake	15							
CAN-IN1	System bus	–							
CAN-IN2	System bus								
CAN-IN3	System bus								
CAN-OUT1	System bus	56	•	•	•	•	•		
CAN-OUT2	System bus								
CAN-OUT2	System bus								
CMP1	Comparator 1	15	•	•	•	•	•	•	•
CMP2	Comparator 2							•	•
CMP3	Comparator 3								•
CONV1	Conversion	8							
CONV2	Conversion								
CONV3	Conversion								•
CONV4	Conversion								
CONV5	Conversion								•
CONV6	Conversion								
CONVPHA1	32 bit conversion	6							
CONVPHPH1	32 bit conversion	80							
CONVPP1	32 bit / 16 bit conversion	55							
CURVE1	Characteristic function	15							
DB1	Dead band	7						•	
DCTRL	Device control	–	•	•	•	•	•	•	•
DFIN	Digital frequency input	5	•	•	•	•	•		•
DFOUT	Digital frequency output	35	•	•	•	•	•	•	•
DFRFG1	Digital frequency ramp function generator	40							
DFSET	Digital frequency processing	85			•	•	•		•
DIGDEL1	Binary delay element 1	9							
DIGDEL2	Binary delay element 2								



Function block	Description	CPU time [µs]	used in basic configuration C0005						
			1000	4000	5000	6000	7000	20	21
DIGIN	Input terminals X5/E1...X5/E5	–	•	•	•	•	•	•	•
DIGOUT	Output terminals X5/A1...X5/A4	–	•	•	•	•	•	•	•
DT1-1	Differential element	12							
FCNT1	Piece counter	11							
FEVAN1	Free analog input variable	4							
FEVAN2	Free analog input variable								
FDO	Free digital outputs	–							
FIXED	Constant signals	–	•	•	•	•	•	•	•
FIXSET1	Fixed setpoints	9							
FLIP1	D-flipflop 1	6						•	•
FLIP2	D-flipflop 2								
GEARCOMP	Gearbox torsion	1							
LIM1	Limiter	5						•	•
MCTRL	Motor control	–	•	•	•	•	•	•	•
MFAIL	Mains failure detection	40						•	•
MLP1	Motor phase failure detection	30							
MONIT	Monitoring	–	•	•	•	•	•	•	•
MPOT1	Motor potentiometer	20							
NOT1	Logic NOT, block1	4		•			•	•	•
NOT2	Logic NOT, block2							•	•
NOT3	Logic NOT, block3							•	•
NOT4	Logic NOT, block4								•
NOT5	Logic NOT, block5								•
NSET	Speed setpoint conditioning	70	•	•	•			•	•
OR1	Logic OR, block1	6			•	•	•	•	•
OR2	Logic OR, block2							•	•
OR3	Logic OR, block3							•	
OR4	Logic OR, block4								•
OR5	Logic OR, block5								•
OSZ	Oscilloscope function	70							
PCTRL1	Process controller	58							
PHADD1	32 bit addition block	10							
PHCMP1	Comparator	8							•
PHCMP2	Comparator								
PHCMP3	Comparator								
PHDIFF	32 bit setpoint/act. value comparison	10							
PHDIV1	Conversion	8							
PHINT1	Phase integrator	7							
PHINT2	Phase integrator								
PHINT3	Phase integrator	10							
PT1-1	1st order delay element	8							
CW/CCW/Q	QSP / setpoint inversion	8	•	•				•	•
REF	Homing function	100			•	•	•	•	•
RFG1	Ramp function generator	16							•
S&H	Sample and Hold	4							
SRFG1	S-shape ramp function generator	15							
STAT	Digital status signals	–	•	•	•	•	•	•	•
STATE-BUS	State bus	–							
STORE1	Memory 1	35							
STORE2	Memory 2	20							
SYNC1	Multi-axis positioning	55							
TRANS1	Binary edge evaluation	7							
TRANS2	Binary edge evaluation								
TRANS3	Binary edge evaluation								
TRANS4	Binary edge evaluation								

3.2.2 Table of free control codes

Function block	Description	CPU time [µs]	used in basic configuration C0005						
			1000	4000	5000	6000	7000	20	21
FCODE 17	Free control codes	–	•	•	•	•	•	•	•
FCODE 26/1			•	•	•	•	•	•	•
FCODE 26/2			•	•	•	•	•	•	•
FCODE 27/1			•	•	•	•	•	•	•
FCODE 27/2			•	•	•	•	•	•	•
FCODE 32					•	•	•		•
FCODE 37								•	•
FCODE 108/1			•	•	•	•	•	•	•
FCODE 108/2			•	•	•	•	•	•	•
FCODE 109/1			•	•	•	•	•	•	•
FCODE 109/2			•	•	•	•	•	•	•
FCODE 135									
FCODE 141								•	•
FCODE 250								•	•
FCODE 471								•	•
FCODE 472/1									
FCODE 472/2									
FCODE 472/3			•	•	•	•	•		
FCODE 472/4				•					
FCODE 472/5					•	•	•		
FCODE 472/6					•	•	•		
FCODE 472/7									
FCODE 472/8									
FCODE 472/9								•	•
FCODE 472/10								•	•
FCODE 472/11								•	•
FCODE 472/12									
FCODE 472/13									
FCODE 472/14									
FCODE 472/15									
FCODE 472/16									
FCODE 472/17									
“FCODE 472/18									
FCODE 472/19									
FCODE 472/20									
FCODE 473/1					•	•	•		•
FCODE 473/2					•	•	•		
FCODE 473/3					•	•	•		
FCODE 473/4									
FCODE 473/5									
FCODE 473/6									
FCODE 473/7									
FCODE 473/8									
FCODE 473/9									
FCODE 473/10									
FCODE 474/1									
FCODE 474/2									
FCODE 474/3									
FCODE 474/4									
FCODE 474/5									
FCODE 475/2									

Description

This function block converts bipolar signals to unipolar signals.

The absolute value is generated by the input signal and is provided at the output.

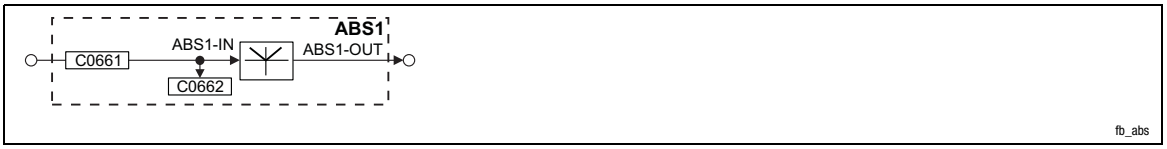


Fig. 3-6 Absolute value generator (ABS1)

3.2.3 Addition block (ADD)

Purpose

Adds or subtracts ”analog” signal depending on the input used.

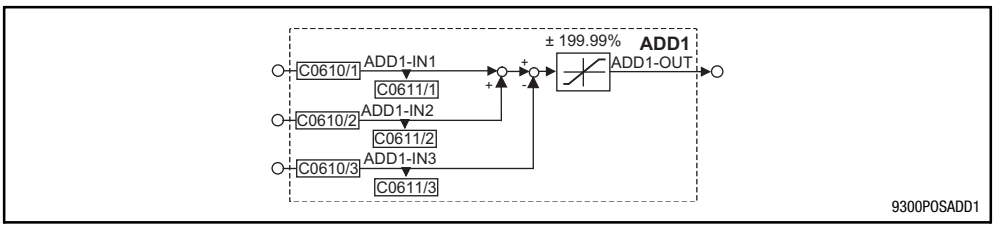


Fig. 3-7 Addition block (ADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADD1-IN1	a	C0611/1	dec [%]	C0610/1	1	1000	Addition input
ADD1-IN2	a	C0611/2	dec [%]	C0610/2	1	1000	Addition input
ADD1-IN3	a	C0611/3	dec [%]	C0610/3	1	1000	Subtraction input
ADD1-OUT	a	-	-	-	-	-	Limited to ±199.99%

Function

- Input ADD1-IN1 is added to input ADD1-IN2.
- The input ADD-IN3 is subtracted from the calculated result.
- Then, the result of the subtraction is limited to ±199.99 %.

3.2.4 Automation interface (AIF-IN)

Purpose

Interface for input signals of the plug-on fieldbus module (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog, or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

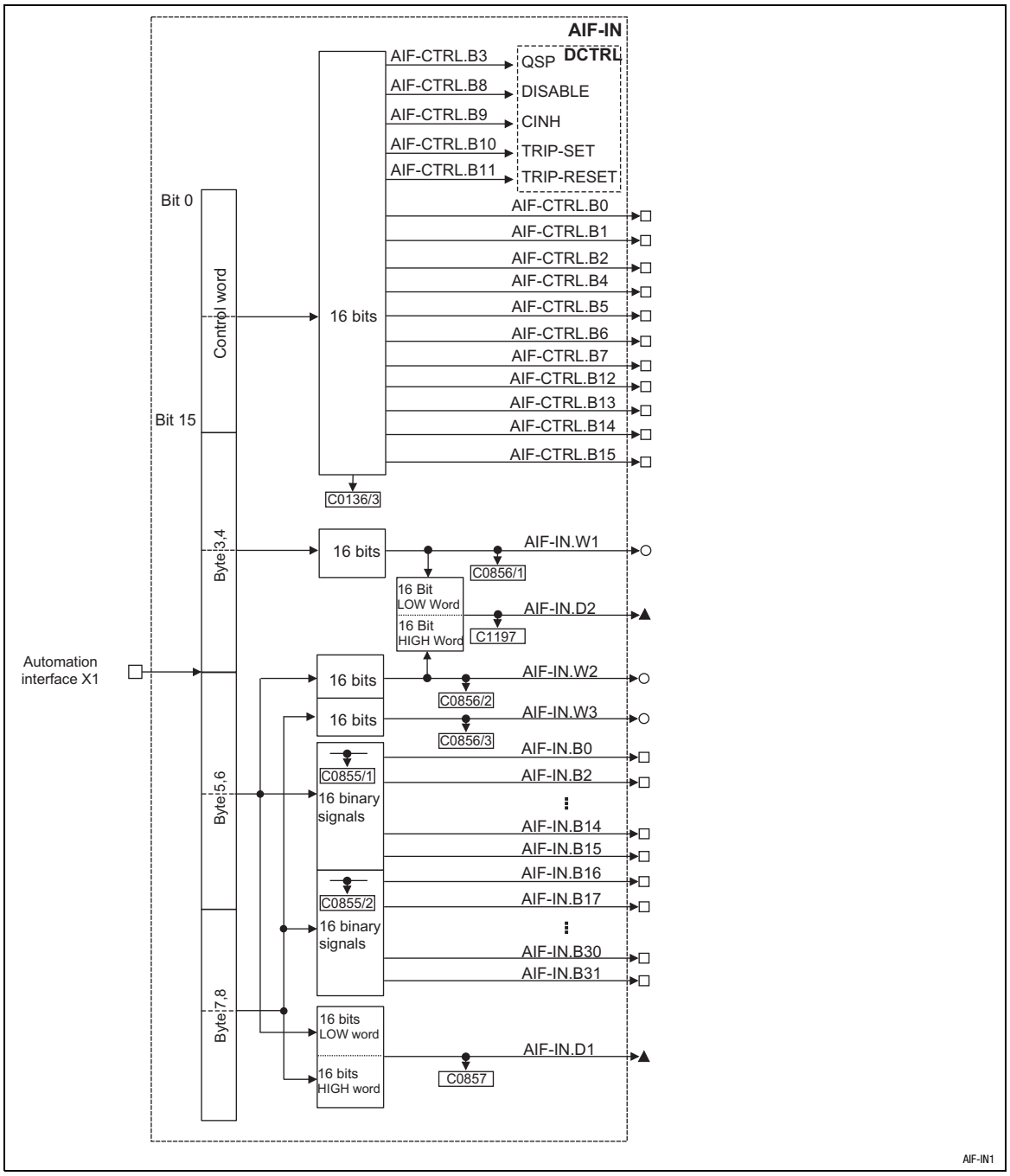
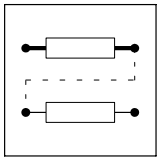
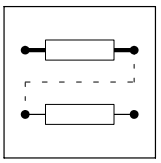


Fig. 3-8 Automation interface (AIF-IN)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-CTRL.B0	d	C0136/3	bin	-	-	-	
AIF-CTRL.B1	d	C0136/3	bin	-	-	-	
AIF-CTRL.B2	d	C0136/3	bin	-	-	-	
AIF-CTRL.B4	d	C0136/3	bin	-	-	-	
AIF-CTRL.B5	d	C0136/3	bin	-	-	-	
AIF-CTRL.B6	d	C0136/3	bin	-	-	-	
AIF-CTRL.B7	d	C0136/3	bin	-	-	-	
AIF-CTRL.B12	d	C0136/3	bin	-	-	-	
AIF-CTRL.B13	d	C0136/3	bin	-	-	-	
AIF-CTRL.B14	d	C0136/3	bin	-	-	-	
AIF-CTRL.B15	d	C0136/3	bin	-	-	-	
AIF-IN.W1	a	C0856/1	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W2	a	C0856/2	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W3	a	C0856/3	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.D1	ph	C0857	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.D2	ph	C1197	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.B0	d	C0855/1	hex	-	-	-	
AIF-IN.B1	d	C0855/1	hex	-	-	-	
AIF-IN.B2	d	C0855/1	hex	-	-	-	
AIF-IN.B3	d	C0855/1	hex	-	-	-	
AIF-IN.B4	d	C0855/1	hex	-	-	-	
AIF-IN.B5	d	C0855/1	hex	-	-	-	
AIF-IN.B6	d	C0855/1	hex	-	-	-	
AIF-IN.B7	d	C0855/1	hex	-	-	-	
AIF-IN.B8	d	C0855/1	hex	-	-	-	
AIF-IN.B9	d	C0855/1	hex	-	-	-	
AIF-IN.B10	d	C0855/1	hex	-	-	-	
AIF-IN.B11	d	C0855/1	hex	-	-	-	
AIF-IN.B12	d	C0855/1	hex	-	-	-	
AIF-IN.B13	d	C0855/1	hex	-	-	-	
AIF-IN.B14	d	C0855/1	hex	-	-	-	
AIF-IN.B15	d	C0855/1	hex	-	-	-	
AIF-IN.B16	d	C0855/2	hex	-	-	-	
AIF-IN.B17	d	C0855/2	hex	-	-	-	
AIF-IN.B18	d	C0855/2	hex	-	-	-	
AIF-IN.B19	d	C0855/2	hex	-	-	-	
AIF-IN.B20	d	C0855/2	hex	-	-	-	
AIF-IN.B21	d	C0855/2	hex	-	-	-	
AIF-IN.B22	d	C0855/2	hex	-	-	-	
AIF-IN.B23	d	C0855/2	hex	-	-	-	
AIF-IN.B24	d	C0855/2	hex	-	-	-	
AIF-IN.B25	d	C0855/2	hex	-	-	-	
AIF-IN.B26	d	C0855/2	hex	-	-	-	
AIF-IN.B27	d	C0855/2	hex	-	-	-	
AIF-IN.B28	d	C0855/2	hex	-	-	-	
AIF-IN.B29	d	C0855/2	hex	-	-	-	
AIF-IN.B30	d	C0855/2	hex	-	-	-	
AIF-IN.B31	d	C0855/2	hex	-	-	-	



Function

The input signals of the 8-byte user data of the AIF object are converted into corresponding signal types. The signals can be used via further function blocks.

Byte 1 and 2

Byte 1 and 2 form the control word for the controller. The bits 3, 8, 9, 10, and 11 of these bytes are directly transferred into the function block DCTRL where they are linked with further signals. The other 11 bits can be used to control further function blocks.

Byte 3 and 4

form the signal to AIF-IN.W1.

Byte 5, 6, 7, and 8

This user data can be interpreted as different signal types. According to the requirement this data can be evaluated as up to two analog signals, 32 digital signals or one angle signal. Mixed forms are also possible.

3.2.5 Automation interface (AIF-OUT)

Purpose

Interface for output signals of the plug-on fieldbus modules (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

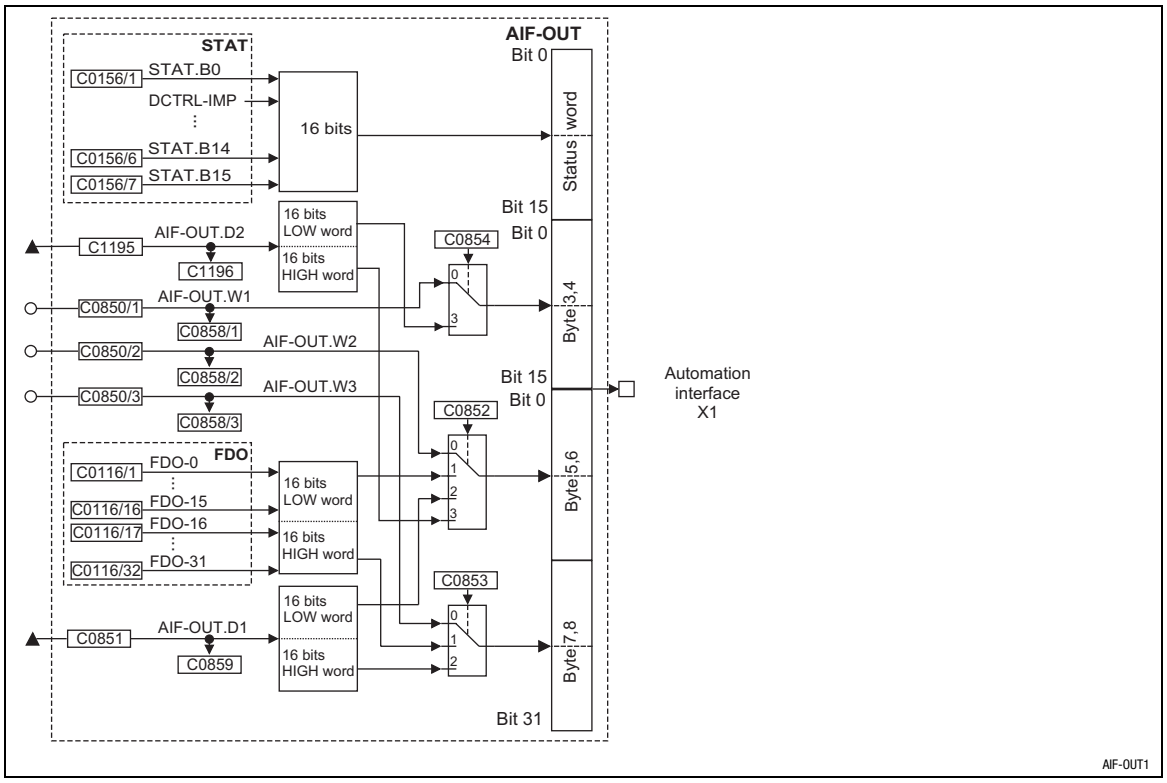
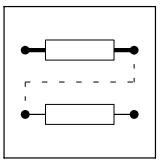


Fig. 3-9 Automation interface (AIF-OUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-OUT.W1	a	C0858/1	dec [%]	C0850/1	1	1000	+100 % = +16384
AIF-OUT.W2	a	C0858/2	dec [%]	C0850/2	1	1000	+100 % = +16384
AIF-OUT.W3	a	C0858/3	dec [%]	C0850/3	1	1000	+100 % = +16384
AIF-OUT.D1	ph	C0859	abs [inc]	C0851	4	1000	1 rev. = 65536
AIF-OUT.D2	ph	C1196	abs [inc]	C1195	4	1000	1 rev. = 65536



Function

The input signals of this function block are copied into the 8-byte user data of the AIF object and assigned to the plug-on fieldbus module. The meaning of the user data can be determined very easily with C0852 and C0853 and the corresponding configuration code (CFG).

Byte 1 and 2

Here, the status word from the function block STAT is mapped. Some of the bits are freely assignable (see description of the function block STAT in chapter 3.2.60)

Byte 3 and 4

- C0854 = 0
  – The analog signal at AIF-OUT.W1 is output.
- C0854 = 3
  – The LOW-WORD of AIF-OUT.D2 is output.

Byte 5 and 6

- C0852 = 0
  – The analog signal at AIF-OUT.W2 is output at bytes 5 and 6.
- C0852 = 1
  – The bits 0 ... 15 of FDO are output.
- C0852 = 2
  – The LOW-WORD of AIF-OUT.D1 is output.
- C0852 = 3
  – The HIGH-WORD of AIF-OUT.D2 is output.

Byte 7 and 8

- C0853 = 0
  – The analog signal at AIF-OUT.W3 is output.
- C0853 = 1
  – The bits 16 ... 31 of FDO are output.
- C0853 = 2
  – The HIGH-WORD of AIF-OUT.D1 is output.

Example

You want to output 16 digital signals of FDO and the LOW-WORD of AIF-OUT.D1:

- The LOW-WORD of AIF-OUT.D1 can only be output at bytes 5 and 6.
  – For this purpose, C0852 is set to 2. The angle signal at C0851 is output at bytes 5 and 6.
- For the digital signals, only the bits 16 ... 31 (bytes 7 and 8) are available (bytes 5 and 6 are assigned):
  – For this purpose, C0853 is set to 1. Bits 16 ... 31 (FDO) are output at bytes 7 and 8.

3.2.6 Analog inputs via terminal X6/1, X6/2 and X6/3, X6/4 (AIN)

Purpose

These function blocks are the interface for analog signals as the

- setpoint input,
- actual value input and
- parameter control.

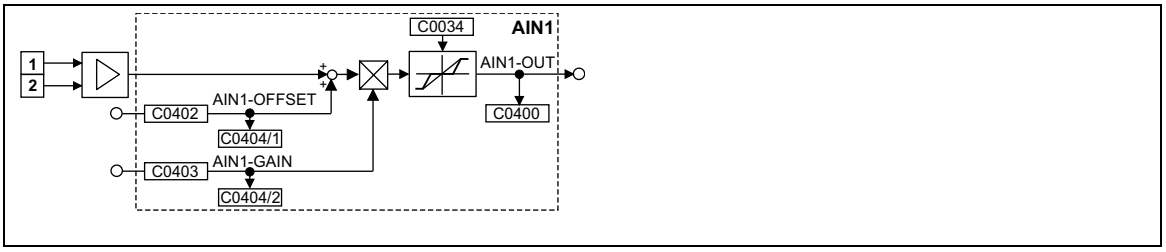


Fig. 3-10 Analog input via terminal X6/1, X6/2 (AIN1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN1-OFFSET	a	C0404/1	dec [%]	C0402	1	19502	-
AIN1-GAIN	a	C0404/2	dec [%]	C0403	1	19504	-
AIN1-OUT	a	C0400	-	-	-	-	-

Special features of AIN1

- A dead band element can be integrated into the output signal at AIN1 via code C0034. Together with the jumper position X2 (controller front) the function 4 ... 20 mA can be implemented as a master current value.
- The signal is read cyclically (1 ms).

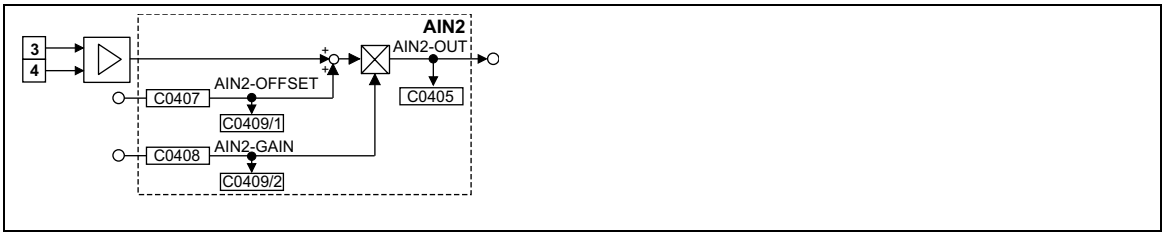


Fig. 3-11 Analog input via terminal X6/3, X6/4 (AIN2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN2-OFFSET	a	C0409/1	dec [%]	C0407	1	19503	-
AIN2-GAIN	a	C0409/2	dec [%]	C0408	1	19505	-
AIN2-OUT	a	C0405	-	-	-	-	-

Special feature of AIN2

- The signal is read cyclically every 250 µs.

Function

- The analog input value is added to the value at input AINx-OFFSET.
- The result of the addition is limited to ±200 %.
- The limited value is multiplied by the value which is applied to input AINx-GAIN.
- Then the signal is limited to ±200%.
- The signal is output at AINx-OUT.

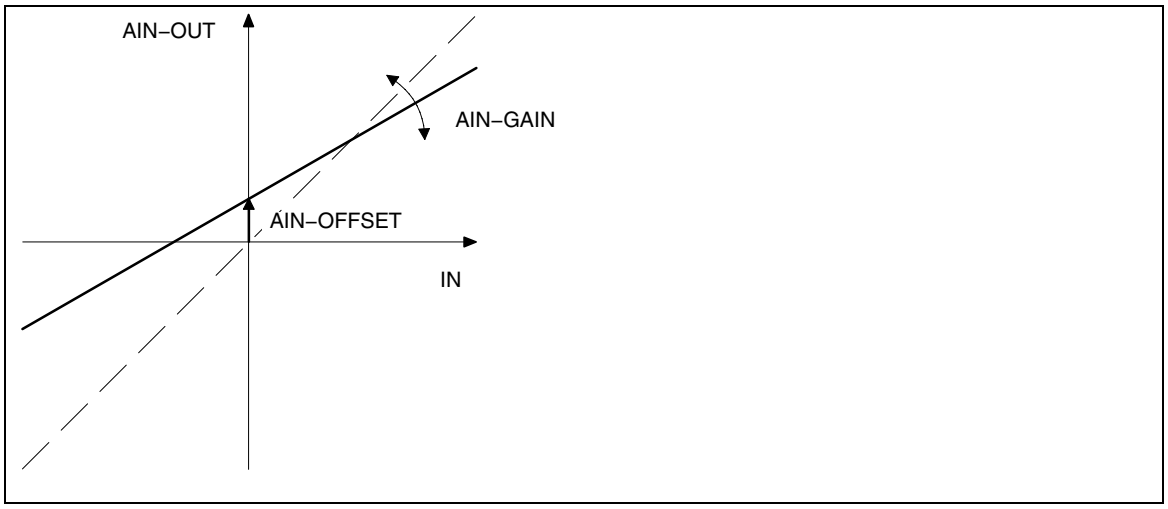


Fig. 3-12 Offset and gain of the analog input

3.2.7 AND operation (AND)

Purpose

With this function digital signals can be logically ANDed. These links can be used to control functions or to create status information.

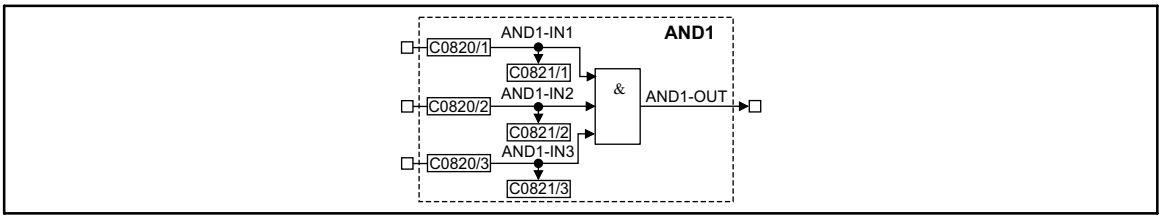


Fig. 3-13 AND operation (AND1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND1-IN1	d	C0821/1	bin	C0820/1	2	1000	-
AND1-IN2	d	C0821/2	bin	C0820/2	2	1000	-
AND1-IN3	d	C0821/3	bin	C0820/3	2	1000	-
AND1-OUT	d	-	-	-	-	-	-

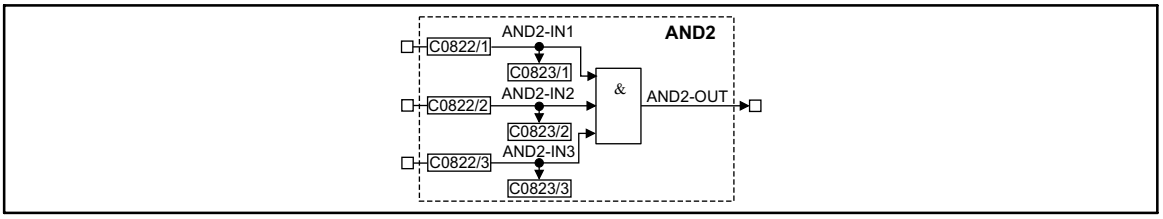


Fig. 3-14 AND operation (AND2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND2-IN1	d	C0823/1	bin	C0822/1	2	1000	-
AND2-IN2	d	C0823/2	bin	C0822/2	2	1000	-
AND2-IN3	d	C0823/3	bin	C0822/3	2	1000	-
AND2-OUT	d	-	-	-	-	-	-

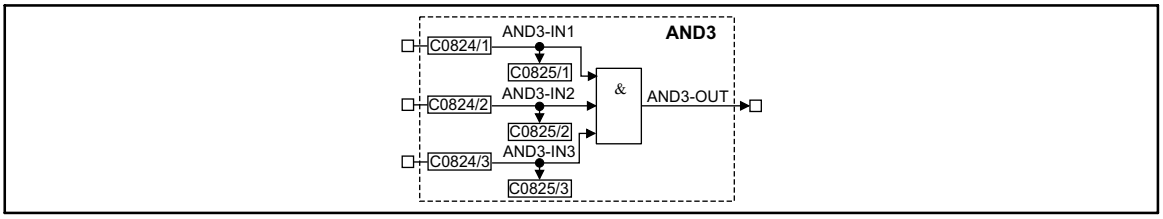


Fig. 3-15 AND operation (AND3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND3-IN1	d	C0825/1	bin	C0824/1	2	1000	-
AND3-IN2	d	C0825/2	bin	C0824/2	2	1000	-
AND3-IN3	d	C0825/3	bin	C0824/3	2	1000	-
AND3-OUT	d	-	-	-	-	-	-

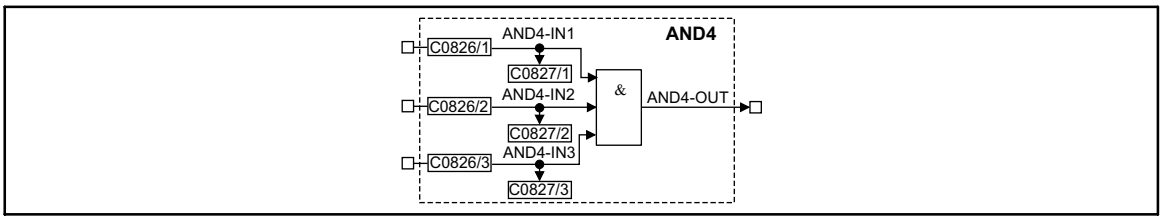


Fig. 3-16 AND operation (AND4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND4-IN1	d	C0827/1	bin	C0826/1	2	1000	-
AND4-IN2	d	C0827/2	bin	C0826/2	2	1000	-
AND4-IN3	d	C0827/3	bin	C0826/3	2	1000	-
AND4-OUT	d	-	-	-	-	-	-

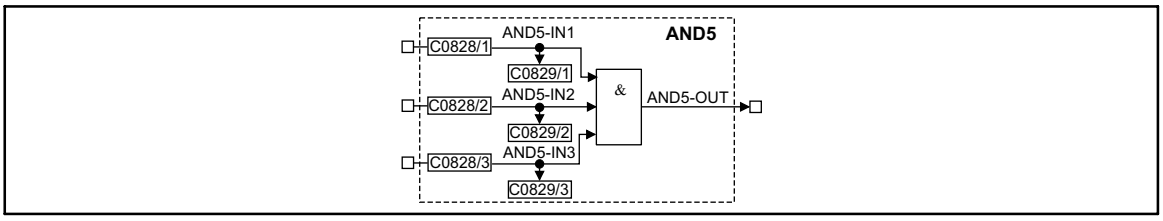


Fig. 3-17 AND operation (AND5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND5-IN1	d	C0829/1	bin	C0828/1	2	1000	-
AND5-IN2	d	C0829/2	bin	C0828/2	2	1000	-
AND5-IN3	d	C0829/3	bin	C0828/3	2	1000	-
AND5-OUT	d	-	-	-	-	-	-

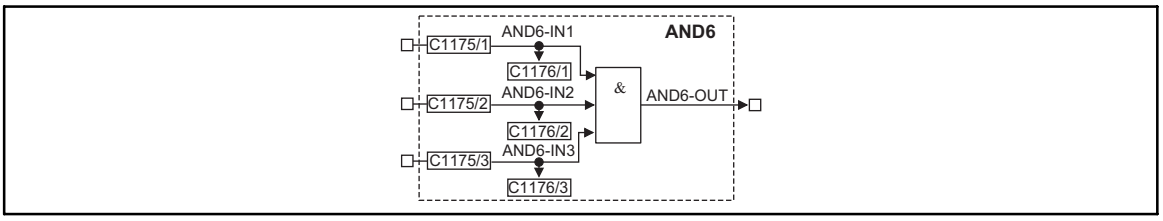


Fig. 3-18 AND operation (AND6)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND6-IN1	d	C1176/1	bin	C1175/1	2	1000	-
AND6-IN2	d	C1176/2	bin	C1175/2	2	1000	-
AND6-IN3	d	C1176/3	bin	C1175/3	2	1000	-
AND6-OUT	d	-	-	-	-	-	-

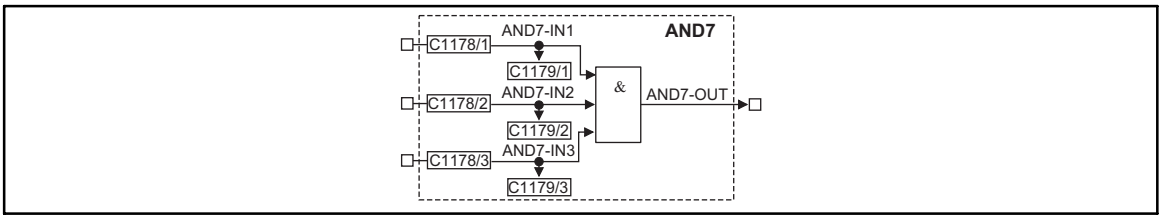


Fig. 3-19 AND operation (AND7)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND7-IN1	d	C1179/1	bin	C1178/1	2	1000	-
AND7-IN2	d	C1179/2	bin	C1178/2	2	1000	-
AND7-IN3	d	C1179/3	bin	C1178/3	2	1000	-
AND7-OUT	d	-	-	-	-	-	-

Function

ANDx-IN1	ANDx-IN2	ANDx-IN3	ANDx-OUT
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	1

The function corresponds to a series connection of normally-open contacts in a contactor control.

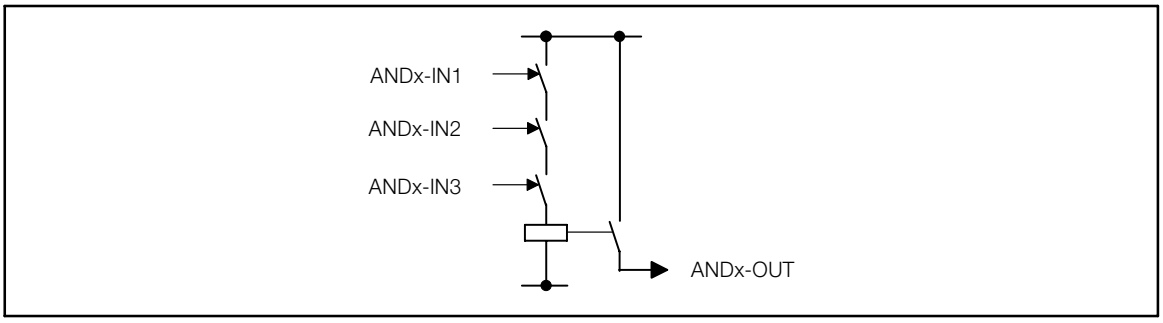


Fig. 3-20 AND function as a series connection of normally-open contacts

Tip!

If only two inputs are required, use the inputs ANDx-IN1 and ANDx-IN2. Assign the input ANDx-IN3 to the signal source FIXED1 via the configuration code.

3.2.8 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

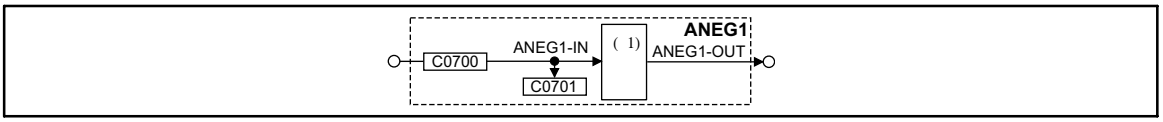


Fig. 3-21 Inverter (ANEG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG1-IN	a	C0701	dec [%]	C0700	1	19523	-
ANEG1-OUT	a	-	-	-	-	-	-

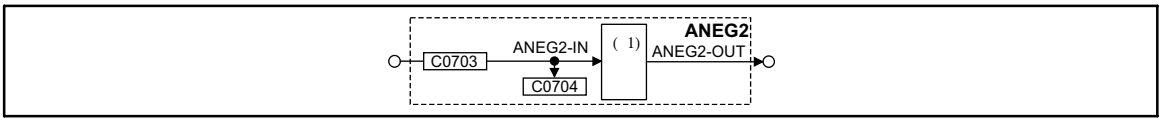


Fig. 3-22 Inverter (ANEG2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG2-IN	a	C0704	dec [%]	C0703	1	1000	-
ANEG2-OUT	a	-	-	-	-	-	-

Function

The input value is multiplied by -1 and then output again.

3.2.9 Analog output via terminal 62/63 (AOUT)

Purpose

AOUT1 and AOUT2 can be used as monitor outputs.

Internal analog signals can be output as voltage signals and be used e.g. as display values or setpoints for slaves.

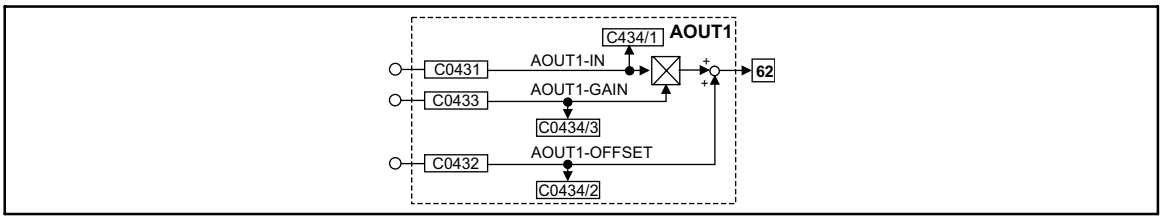


Fig. 3-23 Analog output via terminal X6/62 (AOUT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT1-IN	a	C0434/1	dec [%]	C0431	1	5001	-
AOUT1-GAIN	a	C0434/3	dec [%]	C0433	1	19510	-
AOUT1-OFFSET	a	C0434/2	dec [%]	C0432	1	19512	-

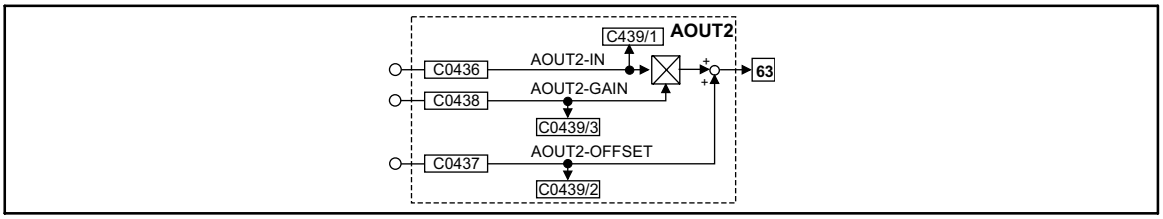


Fig. 3-24 Analog output via terminal X6/63 (AOUT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT2-IN	a	C0439/1	dec [%]	C0436	1	5002	-
AOUT2-GAIN	a	C0439/3	dec [%]	C0438	1	19511	-
AOUT2-OFFSET	a	C0439/2	dec [%]	C0437	1	19513	-

Function

- The value at input AOUTx-IN is multiplied by the value at input AOUTx-GAIN.
  – The formula for the multiplication is: 100% * 100% = 100%.
- The result of the multiplication is limited to ±200%.
- The limited value is added to the value which is applied at input AOUTx-OFFSET.
  – The formula for the addition is 50% + 10% = 60%. The result of the calculation is mapped in such a way that 100% = 10 V.
- The result of the addition is again limited to ±200%.
- The result of the calculation is mapped in such a way that 100% = 10 V and is output as a signal at terminal 62 or 63.

Example for an output value

AOUT1-IN = 50%, AOUT1-GAIN = 100%, AOUT1-OFFSET = 10%

Output terminal 62 = ((50% * 100% = 50%) + 10% = 60%) = 6 V

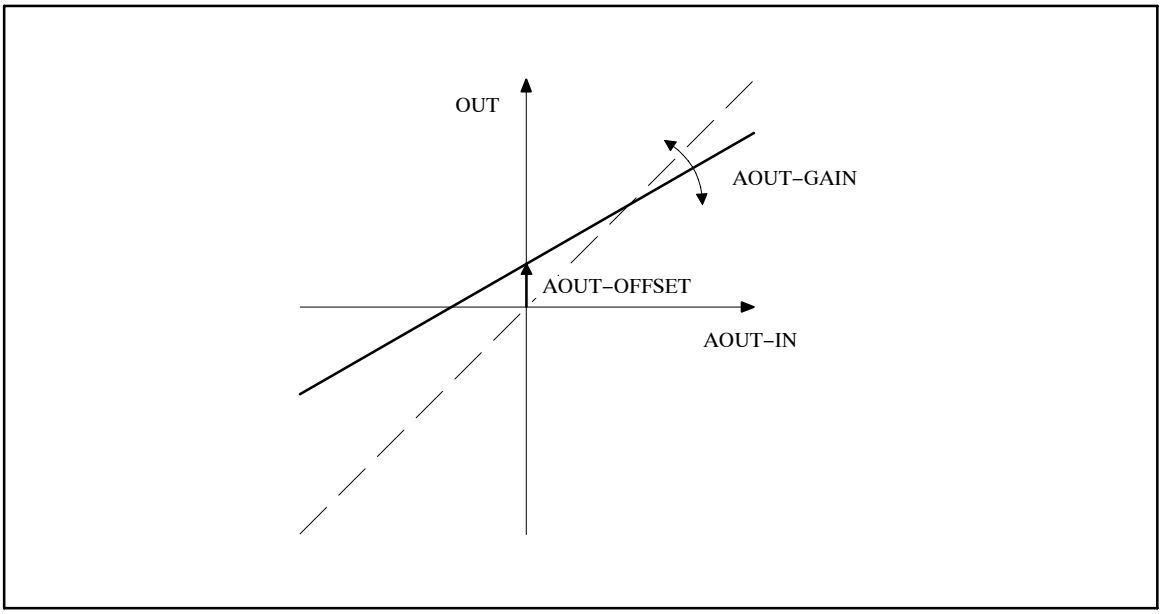


Fig. 3-25 Offset and gain of the analog output

3.2.10 Arithmetic block (ARIT)

Purpose

Arithmetic operation of two ”analog” signals.

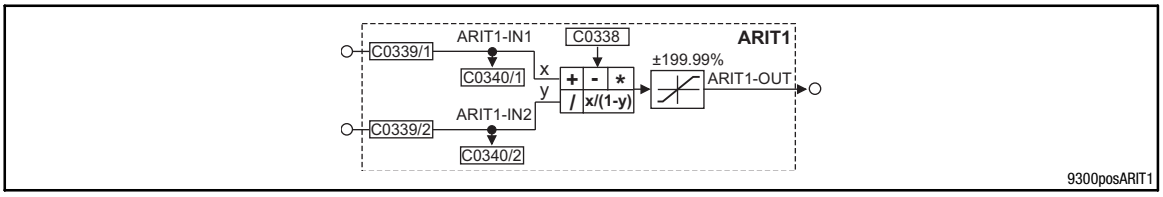


Fig. 3-26 Arithmetic block (ARIT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT1-IN1	a	C0340/1	dec [%]	C0339/1	1	1000	-
ARIT1-IN2	a	C0340/2	dec [%]	C0339/2	1	1000	-
ARIT1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

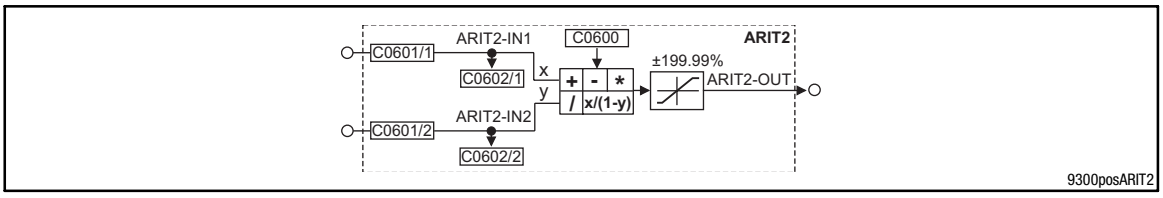


Fig. 3-27 Arithmetic block (ARIT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT2-IN1	a	C0602/1	dec [%]	C0601/1	1	1000	-
ARIT2-IN2	a	C0602/2	dec [%]	C0601/2	1	1000	-
ARIT2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

For both arithmetic blocks the following functions can be preselected:

Code	Subcode	Arithmetic function	Example
ARIT1: C0338	0	OUT = IN1 Note: IN2 will not be processed	
	1	OUT = IN1 + IN2	100% = 50% + 50%
	2	OUT = IN1 - IN2	50% = 100% - 50%
	3	OUT [inc] = IN1 [inc] ×IN2 [inc] ÷16384 OUT [%] = IN1 [%] × IN2 [%] ÷100	100% = 100% ×100% ÷(100)
	4	OUT [inc] = IN1 [inc] ×16384÷100 ÷ |IN2| [inc] OUT [%] = IN1 [%] ÷ |IN2| [%]	1% = 100% ÷100%
	5	OUT [inc] = IN1 [inc] ×16384 ÷ (16384 - IN2 [inc]) OUT [%] = IN1 [%] × 100 ÷ (100 - IN2 [%])	200% = 100% × (100) ÷ (100 - 50%)

Conversion: [inc] = [%] ÷100 × 16384

3.2.11 Arithmetic block (ARITPH)

Purpose

The FB ARITPH calculates a angle output signal from two angle input signals.

ARITPH1

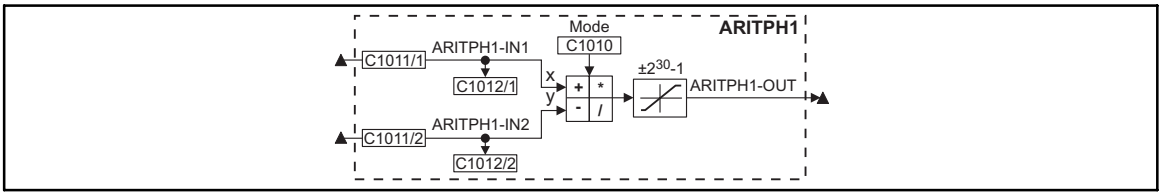


Fig. 3-28 Function block ARITPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH1-IN1	ph	C1012/1	dec [inc]	C1011/1	3	-
ARITPH1-IN2	ph	C1012/2	dec [inc]	C1011/2	3	-
ARITPH1-OUT	ph	-	-	-	-	

Function

- Selection of the arithmetic function with the code ARITPH mode.
- The function block limits the result (see table)

ARITPH mode	Arithmetic function	Limitation	
C1010 = 0	OUT = IN1	2^{30} -1	
C1010 = 1	OUT = IN1 + IN2	2^{30} -1	
C1010 = 2	OUT = IN1 - IN2	2^{30} -1	
C1010 = 3	OUT = (IN1 * IN2) / 2^{30}	2^{30} -1	(remainder not considered)
C1010 = 13	OUT = IN1 * IN2	2^{31}	
C1010 = 14	OUT = IN1 / IN2	2^{30} -1	(remainder not considered)
C1010 = 21	OUT = IN1 + IN2	without	with overflow
C1010 = 22	OUT = IN1 - IN2	without	with overflow

- The calculation is performed cyclically in the control program.

3.2.12 Analog signal changeover switch (ASW)

Purpose

This FB changes between two analog signals.

This FB enables you to change e.g. during a winding process between an initial diameter and a calculated diameter.

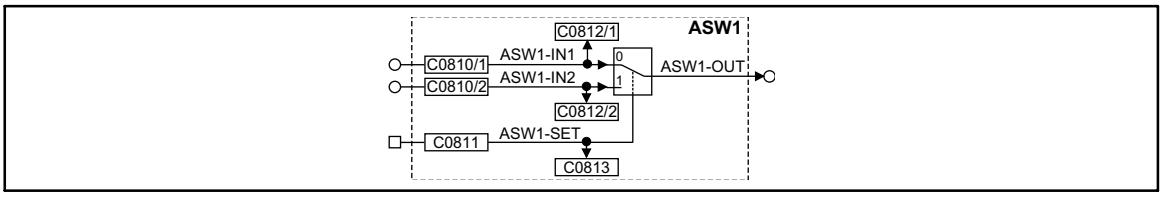


Fig. 3-29 Changeover switch for analog signals (ASW1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW1-IN1	a	C0812/1	dec [%]	C0810/1	1	55	-
ASW1-IN2	a	C0812/2	dec [%]	C0810/2	1	1000	-
ASW1-SET	d	C0813	bin	C0811	2	1000	-
ASW1-OUT	a	-	-	-	-	-	-

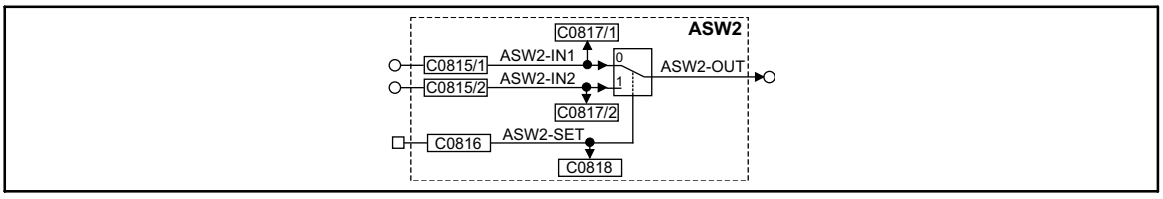


Fig. 3-30 Changeover switch for analog signals (ASW2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW2-IN2	a	C0817/1	dec [%]	C0815/1	1	1000	-
ASW2-IN1	a	C0817/2	dec [%]	C0815/2	1	1000	-
ASW2-SET	d	C0818	bin	C0816	2	1000	-
ASW2-OUT	a	-	-	-	-	-	-

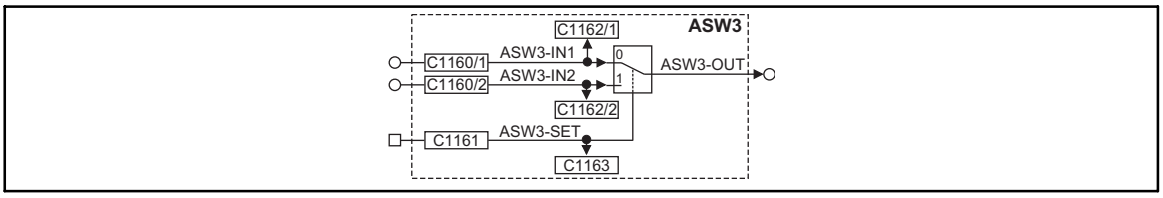


Fig. 3-31 Changeover switch for analog signals (ASW3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW3-IN2	a	C1162/1	dec [%]	C1160/1	1	1000	-
ASW3-IN1	a	C1162/2	dec [%]	C1160/2	1	1000	-
ASW3-SET	d	C1163	bin	C1161	2	1000	-
ASW3-OUT	a	-	-	-	-	-	-

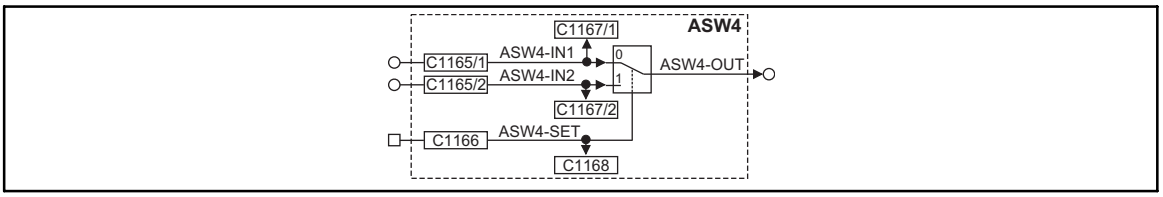


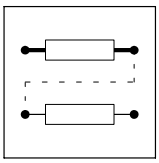
Fig. 3-32 Changeover switch for analog signals (ASW4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW4-IN2	a	C1167/1	dec [%]	C1165/1	1	1000	-
ASW4-IN1	a	C1167/2	dec [%]	C1165/2	1	1000	-
ASW4-SET	d	C1168	bin	C1166	2	1000	-
ASW4-OUT	a	-	-	-	-	-	-

Function

This FB is controlled via the binary input. Depending on the input signal, different signals are sent to the output:

- If a HIGH signal is applied at the binary input, the signal which is applied at the ASWx-IN2 input is sent to the output.
- If a LOW signal is applied, the signal which is applied at the ASW-IN2 input is sent to the output.



3.2.13 Holding brake (BRK)

Danger!

Condition for using the BRK function block

Triggering the holding brake solely via the function block BRK is not permissible!

The **safe** triggering of the holding brake additionally requires a second switch-off path. Unsafe triggering creates the risk of severe personal injury and danger to material assets!

Applications with active loads

When the DC-bus voltage increases (e.g. by braking processes), the torque limitation may be activated via code C0172. The torque limitation becomes active if for instance the brake resistor is defective or the switching threshold set on the brake chopper or the brake module is not correctly adjusted.

Code C0172 is a pre-stage of the monitoring function “OU” (overvoltage of the DC-bus voltage). Code C0172 defines the voltage difference to OU causing a reduction in torque. In the Lenze setting, the torque is reduced to ”0” if the DC-bus voltage reaches 760 V (770 V - 10 V):

- OU threshold = 770V (C0173 = 0...3)
  - Exception: OU threshold 800 V for C0173 = 4 (see description in code table)
- C0172 = 10 V
- No message is generated.

Only after the DC-bus voltage has decreased below the OU reconnection threshold, the torque is reconnected.

With unchanged basic conditions the continuously ”chopping” drive behaviour may lead to undefined motions.

Remedy

1. Set C0172 = 0 V
2. MONIT-OU has to generate EEr-TRIP (e.g. by C0871/0 = 15011).
   - By this, the standstill brake is engaged via controller inhibit (CINH) if the braking energy cannot be dissipated.

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traversing drives
- Active loads

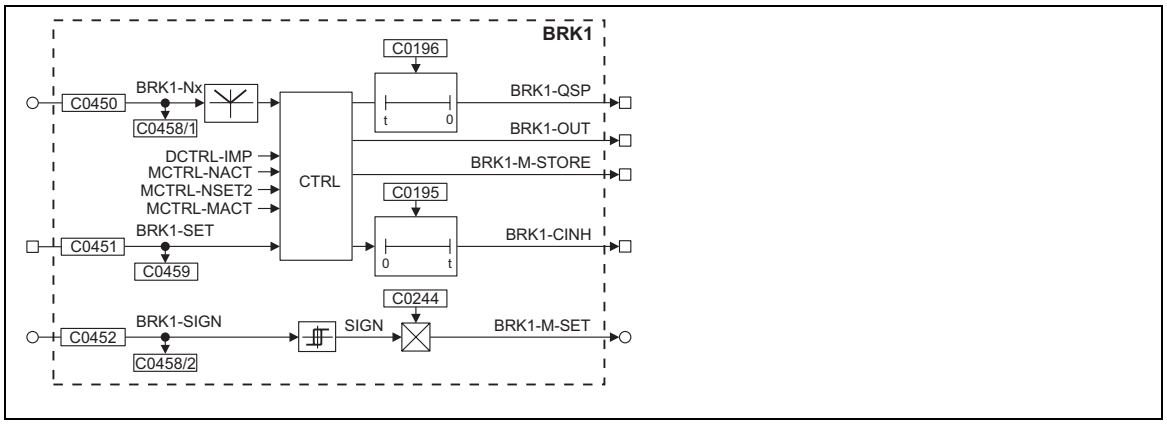


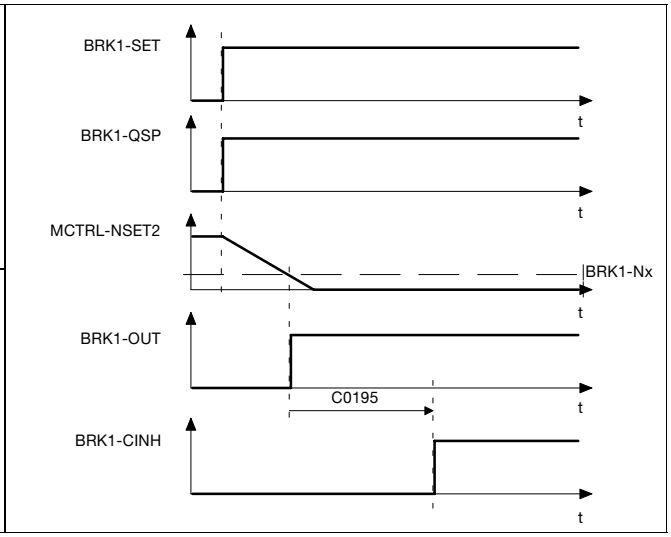
Fig. 3-33 Holding brake (BRK1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
BRK1-SET	d	C0459	bin	C0451	2	1000	-
BRK1-NX	a	C0458/1	dec [%]	C0450	1	1000	Speed threshold from which the drive may output the signal "Close brake". The signal source for this input can be a control code, a fixed value, or any other analog FB output. The input signal is processed internally as an absolute value.
BRK1-SIGN	a	C0458/2	dec [%]	C0452	1	1000	Direction of the torque with which the drive is to set up a torque against the brake. The signal source for this input can be a control code, a fixed value, or any other FB output.
BRK1-M-SET	a						Feedforward control torque for releasing the brake 100 % = value of C0057

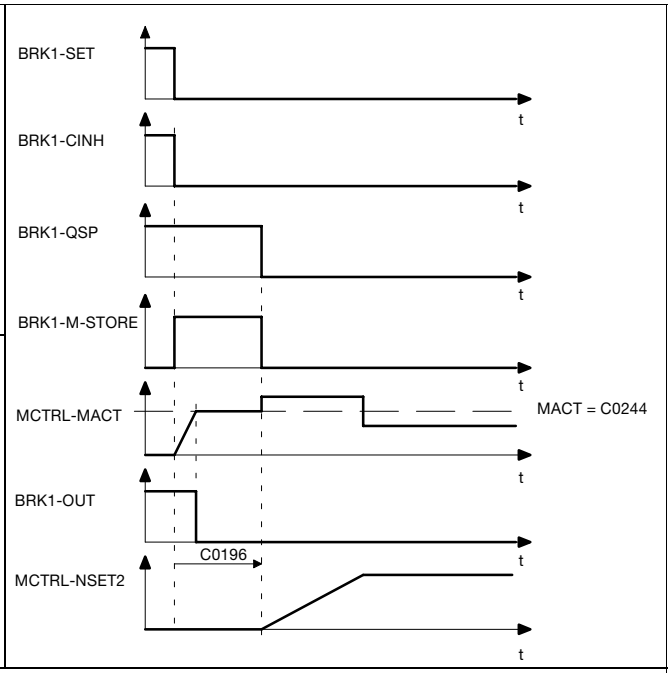
Note!

The internal signals MCTRL-NACT, MCTRL-MACT and MCTRL-NSET2 are processed as absolute values.

3.2.13.1 Engaging the brake

Purpose	A HIGH signal at the BRK1-SET input activates the function. The output BRK1-QSP is simultaneously switched to HIGH. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.	
Function	If the setpoint speed falls below the value set at the BRK1-Nx input, the output BRK1-OUT is set to HIGH. In order to ensure a fail-safe design this signal must be inverted at the output (e.g. via C0118).	

3.2.13.2 Disengaging (releasing) the brake

Purpose	A LOW signal at the BRK-SET input immediately sets the BRK-CINH output to LOW. At the same time the BRK1-M-STORE output is set to HIGH. This signal can be used to generate a defined torque against the brake. The drive thus takes over the torque while the brake is released. The signal is only reset after the time set under C0196 has elapsed.	
Function	As soon as the torque reaches the value set under C0244 (holding torque), the output BRK1-OUT is set to LOW. When the input is reset, a timing element is triggered. After the time set under C0196 has elapsed the BRK1-QSP output is reset. This signal serves to e.g. release the setpoint integrator after the brake release time has elapsed.	
Note	If an actual speed higher than the value at BRK1-Nx is detected before the brake release time (C0196) has elapsed, the signals BRK1-QSP and BRK1-M-STORE are reset immediately. The drive can operate in a speed or angle-controlled manner immediately. If the BRK1-QSP output acts on the QSP control word, then the drive is synchronised to the actual speed and follows its setpoint.	

3.2.13.3 Setting controller inhibit

Setting controller inhibit may for instance be required in the case of a fault (LU, OU, ...).

Function

When the controller is inhibited (CINH), the BRK1-OUT signal is set to HIGH immediately. The drive is then braked via the mechanical brake.

If the fault is eliminated quickly, i.e. the controller inhibit (CINH) is reset before the actual speed falls below the threshold value BRK1-Nx, the BRK1-OUT signal is set to LOW immediately. The drive is synchronised to the actual speed and follows its setpoint.

If the value falls below the threshold, the drive starts as described under ”Release brake”.

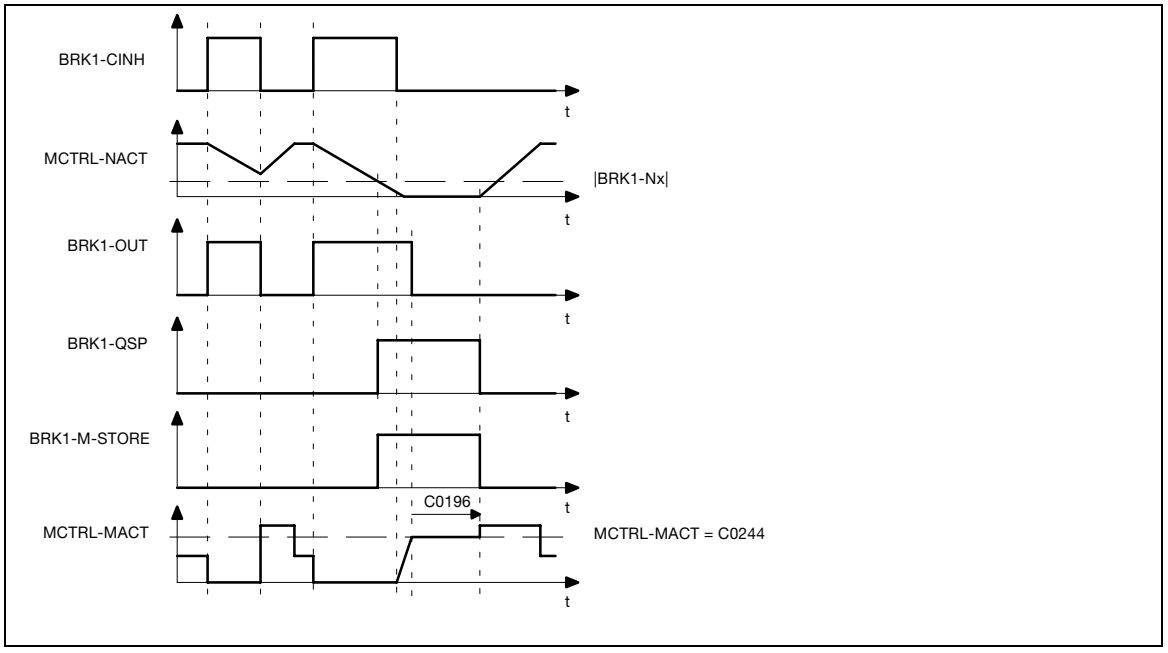


Fig. 3-34 Brake control with CINH

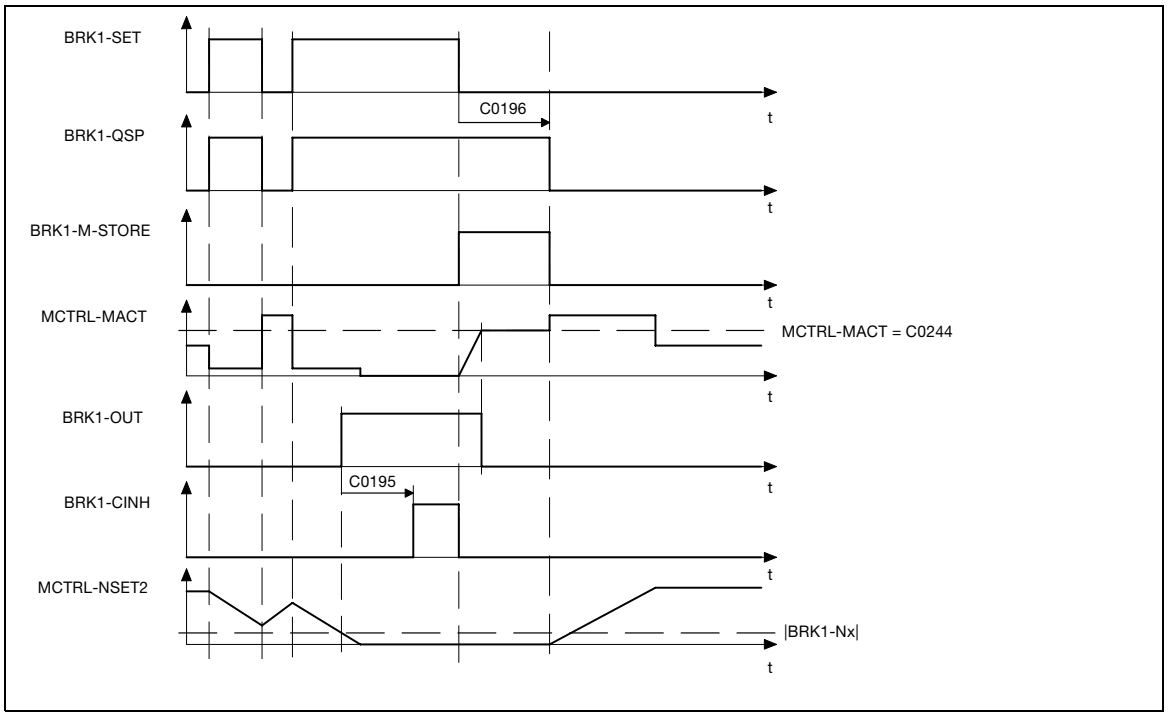
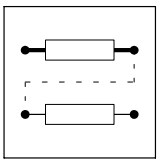


Fig. 3-35 Switching cycle when braking

3.2.14 System bus (CAN-IN)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.



3.2.15 System bus (CAN-OUT)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.2.16 Comparator (CMP)

Purpose

These FBs serve to compare two analog signals. Three comparators are available which serve to implement triggers.

CMP1

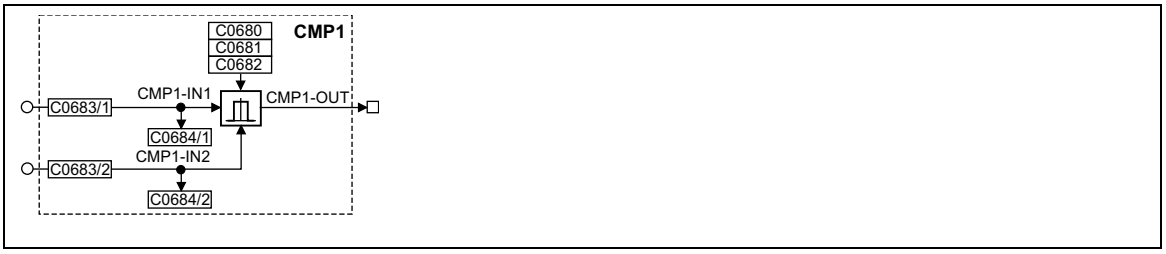


Fig. 3-36 Comparator (CMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP1-IN1	a	C0684/1	dec [%]	C0683/1	1	5001	-
CMP1-IN2	a	C0684/2	dec [%]	C0683/2	1	19500	-
CMP1-OUT	a	-	-	-	-	-	-

CMP2

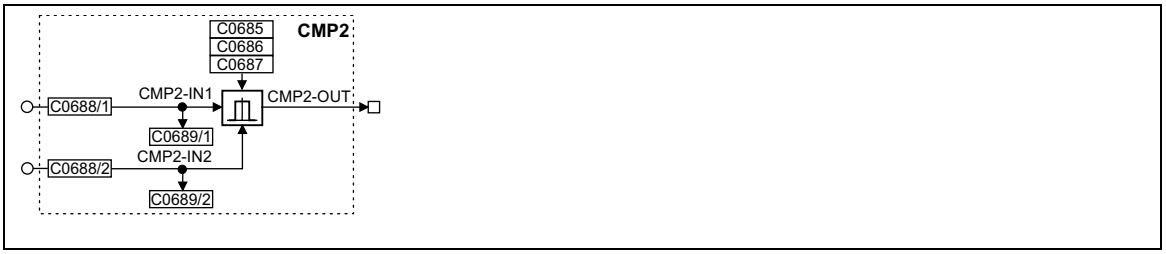


Fig. 3-37 Comparator (CMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP2-IN1	a	C0689/1	dec [%]	C0688/1	1	1000	-
CMP2-IN2	a	C0689/2	dec [%]	C0688/2	1	1000	-
CMP2-OUT	a	-	-	-	-	-	-

CMP3

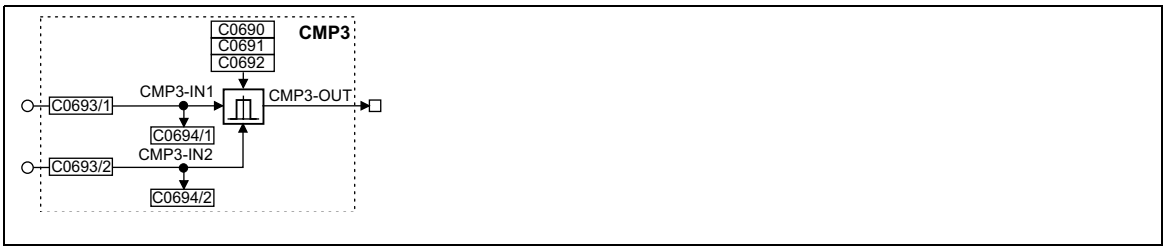


Fig. 3-38 Comparator (CMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP3-IN1	a	C0694/1	dec [%]	C0693/1	1	1000	-
CMP3-IN2	a	C0694/2	dec [%]	C0693/2	1	1000	-
CMP3-OUT	a	-		-	-	-	-

Function

The description uses the example of CMP1 and also applies to CMP2 and CMP3.

The function of these function blocks can be set via code C0680 (CMP1). The following comparison operations are available:

- CMP1-IN1 = CMP1-IN2
- CMP1-IN1 > CMP1-IN2
- CMP1-IN1 < CMP1-IN2
- |CMP1-IN1| = |CMP1-IN2|
- |CMP1-IN1| > |CMP1-IN2|
- |CMP1-IN1| < |CMP1-IN2|

3.2.16.1 Function 1: CMP1-IN1 = CMP1-IN2

This function serves to compare two signals with regard to equality. Hence, the comparison "actual speed equals setpoint speed ($n_{act} = n_{set}$)" can be carried out.

- Via code C0682 the window of equality can be set.
- Via code C0681 a hysteresis can be set if the input signals are not stable and cause the output to oscillate.

The exact function can be obtained from the line diagram.

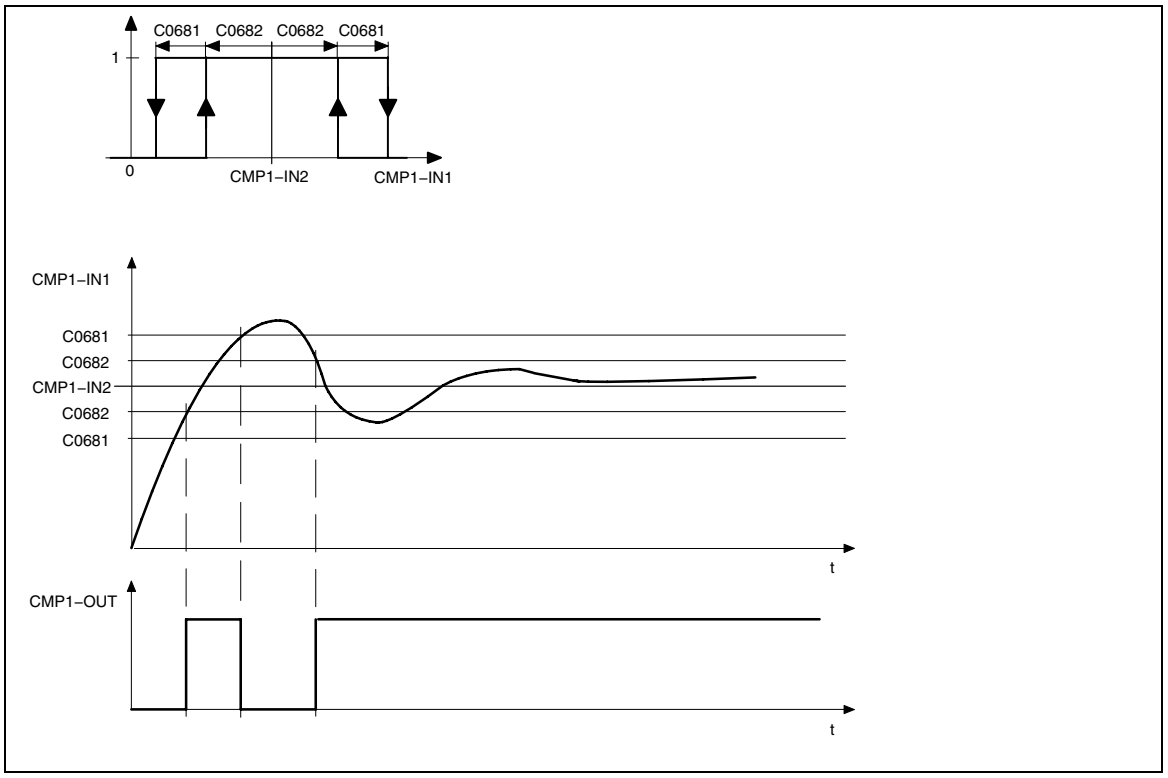


Fig. 3-39 Equality of signals (CMP1-IN1 = CMP1-IN2)

3.2.16.2 Function 2: CMP1-IN1 > CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is higher than a limit value ($n_{act} > n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 exceeds the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 falls below the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

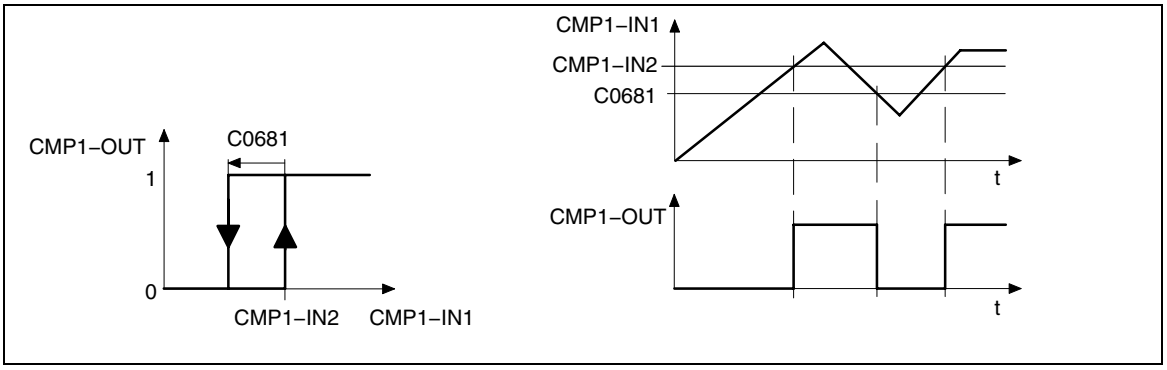


Fig. 3-40 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

3.2.16.3 Function 3: CMP1-IN1 < CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is lower than a limit value ($n_{act} < n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 falls below the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 exceeds the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

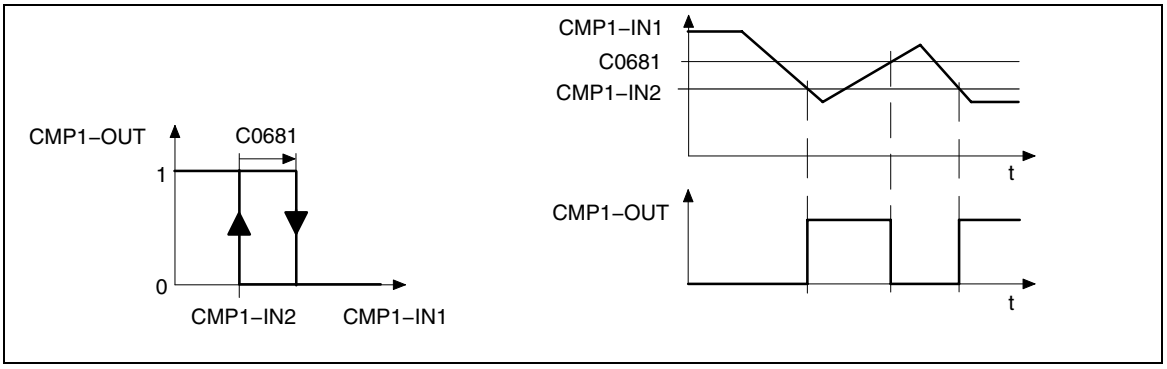


Fig. 3-41 Values falling below signal values (CMP1-IN1 CMP1-IN2)

3.2.16.4 Function 4: |CMP1-IN1| = |CMP1-IN2|

This function is the same as function 1. Before signal processing the absolute value of the input signals (without sign) is generated.

This can be used to implement the comparison "$n_{act} = 0$".

3.2.16.5 Function 5: |CMP1-IN1| > |CMP1-IN2|

This function is the same as function 3. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| > |n_x|$" irrespective of the direction of rotation.

3.2.16.6 Function 6: |CMP1-IN1| < |CMP1-IN2|

This function is the same as function 2. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| < |n_x|$" irrespective of the direction of rotation.

3.2.17 Signal conversion (CONV)

Purpose

These function blocks can be used to standardize signals or signal types or to convert signal types into different signal types.The conversion is very precise by providing the conversion factor as numerator and denominator.

CONV1

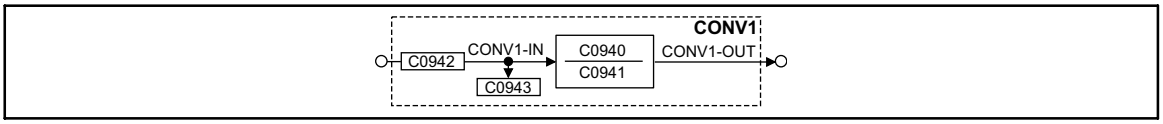


Fig. 3-42 Function block CONV1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV1-IN	a	C0943	dec [%]	C0942	1	1000	
CONV1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to multiply or divide analog signals.

The conversion is done according to the formula:

$$\text{CONV1–OUT} = \text{CONV1–IN} \cdot \frac{\text{C0940}}{\text{C0941}}$$

Example:

An analog signal is to be multiplied with 1.12.
For this, enter C0940 = 112 and C0941 = 100.

CONV2

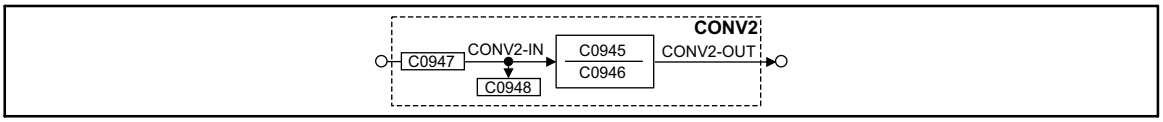


Fig. 3-43 Function block CONV2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV2-IN	a	C0948	dec [%]	C0947	1	1000	
CONV2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to multiply or divide analog signals.

The conversion is done according to the formula:

$$\text{CONV2–OUT} = \text{CONV2–IN} \cdot \frac{\text{C0945}}{\text{C0946}}$$

CONV3

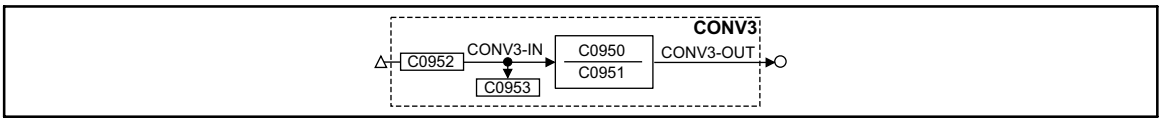


Fig. 3-44 Function block CONV3

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV3-IN	phd	C0953	dec [rpm]	C0952	4	1000	
CONV3-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to convert speed signals into analog signals.

The conversion is done according to the formula:

$$\text{CONV3-OUT} = \text{CONV3-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

CONV4

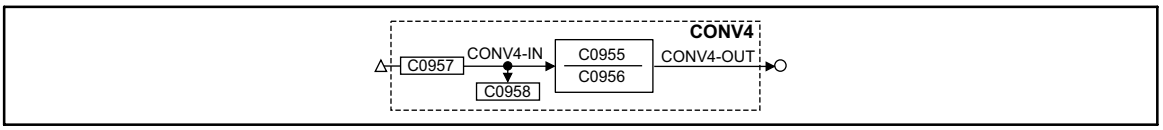


Fig. 3-45 Function block CONV4

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV4-IN	phd	C0958	dec [rpm]	C0957	4	1000	
CONV4-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to convert speed signals into analog signals.

The conversion is done according to the formula:

$$\text{CONV4-OUT} = \text{CONV4-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0955}}{\text{C0956}}$$

CONV5

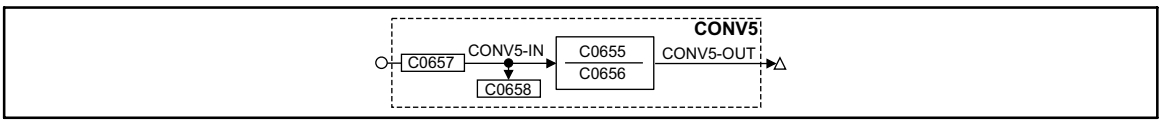


Fig. 3-46 Function block CONV5

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV5-IN	a	C0658	dec [%]	C0657	1	1000	
CONV5-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV5-OUT} = \text{CONV5-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C0655}}{\text{C0656}}$$

CONV6

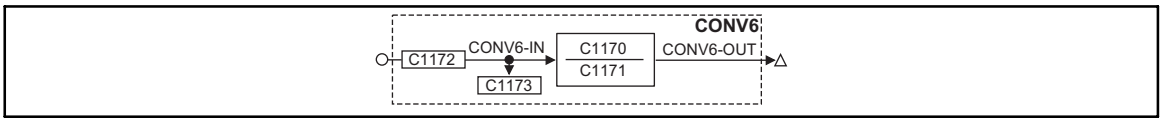


Fig. 3-47 Function block CONV6

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV6-IN	a	C1173	dec [%]	C1172	1	1000	
CONV6-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV6-OUT} = \text{CONV6-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C1170}}{\text{C1171}}$$

3.2.18 Angle conversion (CONVPHA)

Purpose

- Converts a angle signal into an analog signal

or

- converts a angle difference signal into a speed signal.

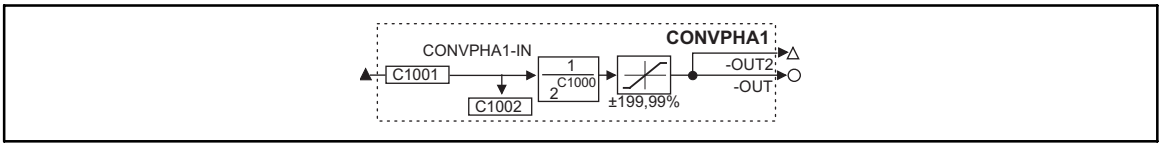


Fig. 3-48 Angle conversion (CONVPHA1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA1-IN	ph	C1002	dec [inc]	C1001	3	-
CONVPHA1-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder considered
CONVPHA1-OUT2	phd	-	-	-	-	Limited to ±32767 rpm, remainder considered

Function

- Conversion with adaptation using a divisor.
- Conversion according to formula:

$$\text{CONVPHA1-OUT [\%]} = \text{CONVPHA1-IN [inc]} \cdot \frac{100}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [rpm]} = \text{CONVPHA1-IN [inc]} \cdot \frac{15000}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [inc]} = \text{CONVPHA1-IN [inc]} \cdot \frac{1}{2^{C1000}}$$

3.2.19 Angle conversion (CONVPHPH)

Purpose

Conversion of a angle signal with dynamic fraction.

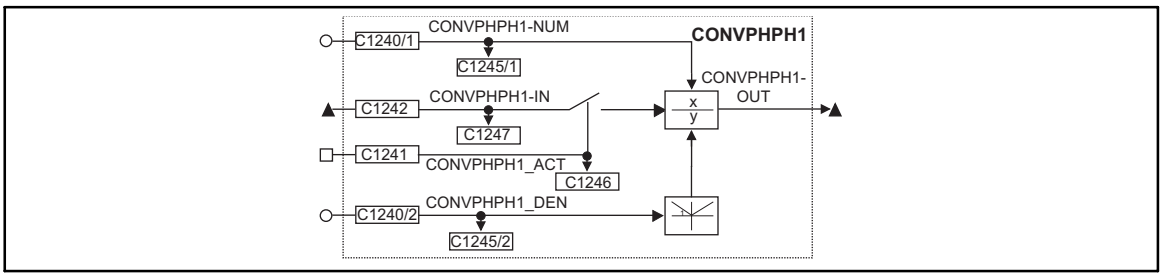


Fig. 3-49 Angle conversion (CONVPHPH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPH1-IN	ph	C1247	dec [inc]	C1242	3	-
CONVPHPH1-NUM	a	C1245/1	dec	C1240/1	1	Numerator
CONVPHPH1-DEN	a	C1245/2	dec	C1240/2	1	Denominator (with absolute value generation)
CONVPHPH1-ACT	d	C1246	bin	C1241	2	-
CONVPHPH1-OUT	ph	-	-	-	-	Without limitation, remainder considered

Function

Caution!

The conversion result is not limited. The result must therefore not exceed the range of ±2147483647.

- C1241 = HIGH
  – The angle signal at CONVPHPH1-IN is evaluated using the factor from C1245/1 / C1245/2.
- C1241 = LOW
  – The value 0 is evaluated using the factor from C1245/1 / C1245/2.

3.2.20 Speed conversion (CONVPP)

Purpose

Conversion of a speed signal with dynamic fraction.

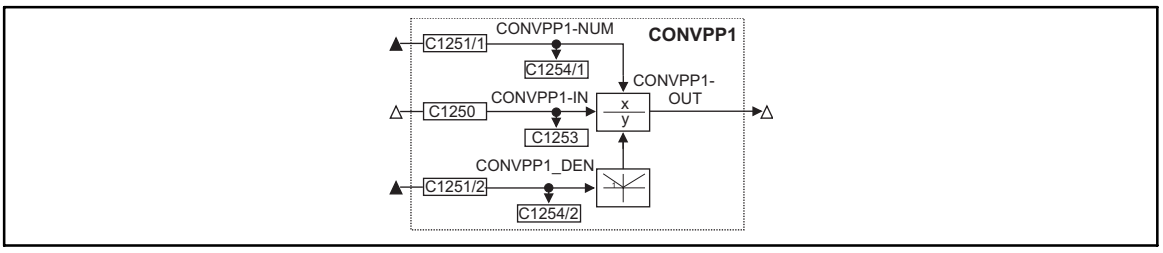


Fig. 3-50 Speed conversion (CONVPP1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPP1-IN	phd	C1253	dec [rpm]	C1250	4	-
CONVPP1-NUM	ph	C1254/1	dec [inc]	C1251/1	3	Numerator
CONVPP1-DEN	ph	C1254/2	dec [inc]	C1251/2	3	Denominator (with absolute value generation)
CONVPP1-OUT	phd	-	-	-	-	Without limitation, remainder considered

Function

Caution!

The conversion result is not limited. The result must therefore not exceed ±32767.

- The speed signal at CONVPP1-IN is evaluated using the factor from C1251/1 / C1251/2.

3.2.21 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

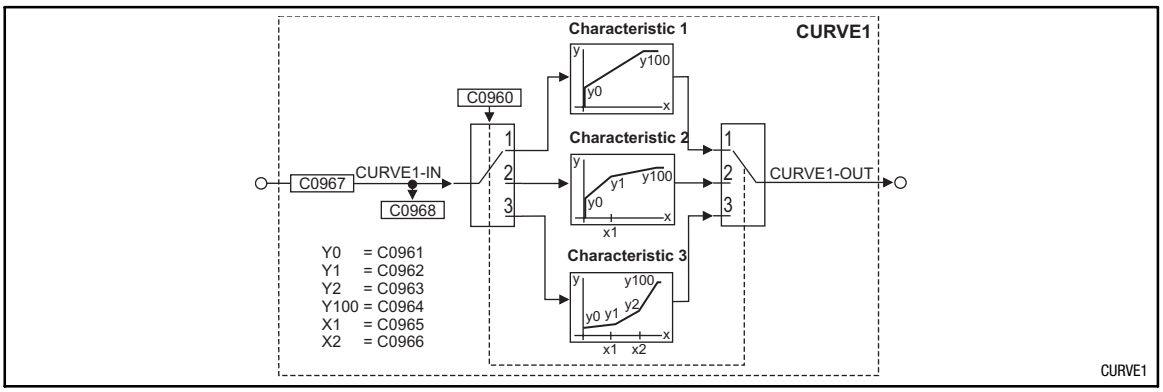


Fig. 3-51 Characteristic function (CURVE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CURVE1-IN	a	C0968	dec [%]	C0967	1	5001	-
CURVE1-OUT	a	-	-	-	-	-	-

Range of functions

Under C0960, you can select the function:

- Characteristic with two interpolation points
- Characteristic with three interpolation points
- Characteristic with four interpolation points

The codes for entering the interpolation points can be obtained from the line diagrams.

Linear interpolation between the points.

For negative input values at CURVEx-IN, the settings of the interpolation points are processed inversely (see line diagrams). If this is not desired:

- Connect an absolute value generator (ABS) before or behind the CURVE function block

or

- connect a limiter (LIM) before or behind the CURVE function block

3.2.21.1 Characteristic with two interpolation points

Set C0960 = 1.

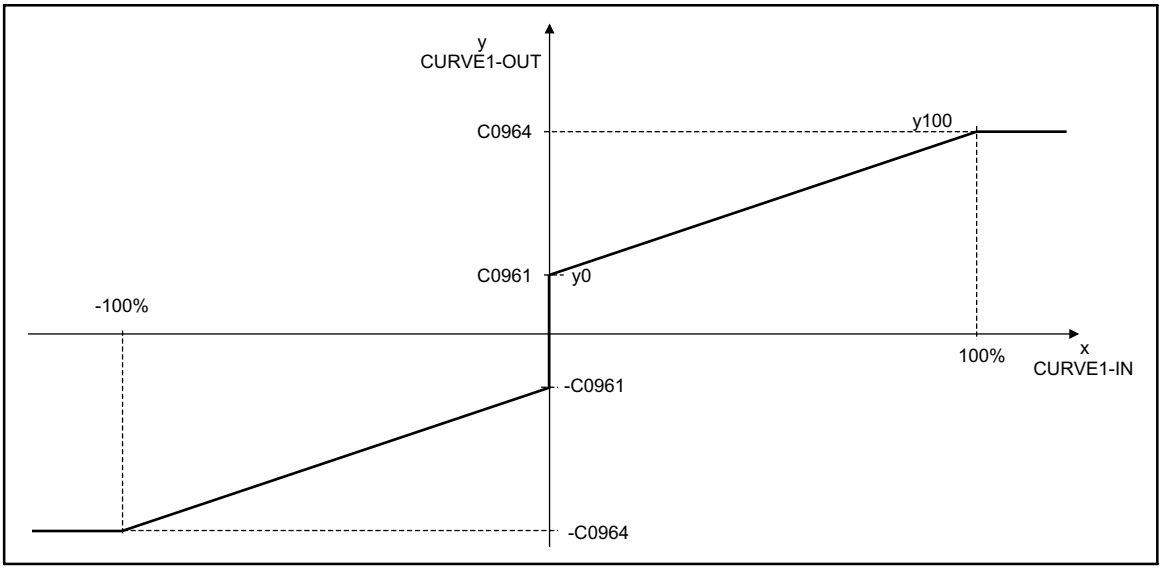


Fig. 3-52 Line diagram of characteristic with 2 interpolation points

3.2.21.2 Characteristic with three interpolation points

Set C0960 = 2.

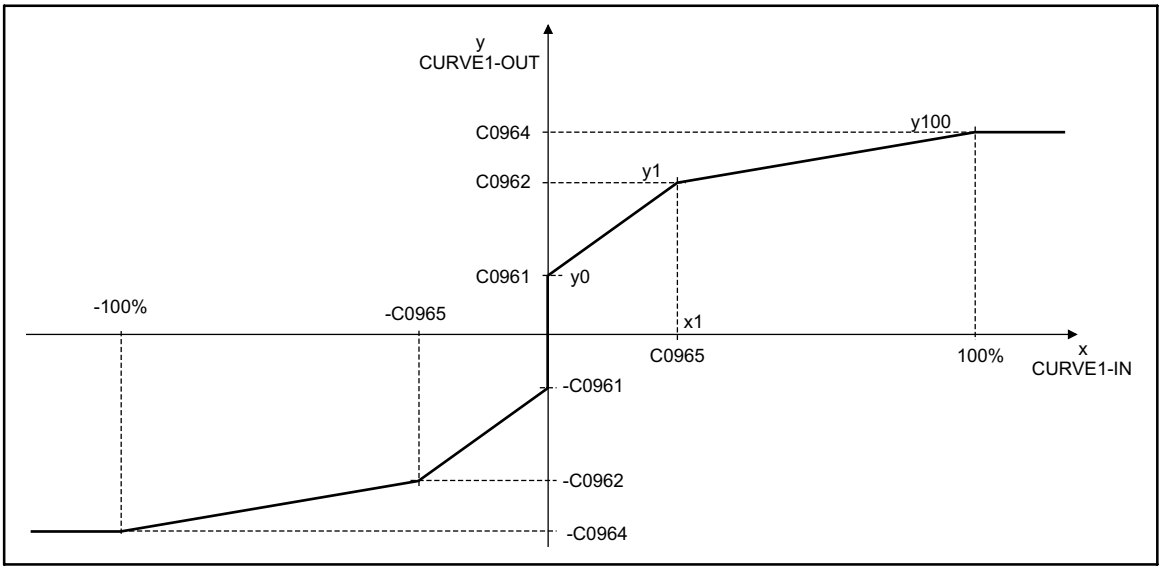


Fig. 3-53 Line diagram of characteristic with 3 interpolation points

3.2.21.3 Characteristic with four interpolation points

Set C0960 = 3.

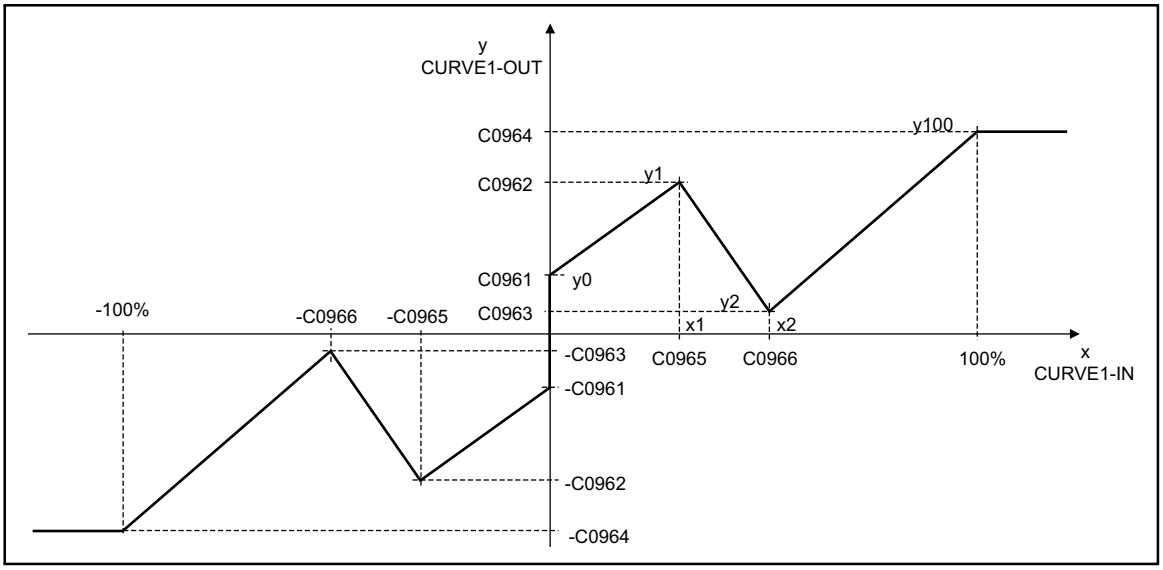


Fig. 3-54 Line diagram of characteristic with 4 interpolation points

3.2.22 Dead band (DB)

Purpose

The dead band element is used to set interfering influences around zero, e.g. interferences on analog input voltages, to digital zero.

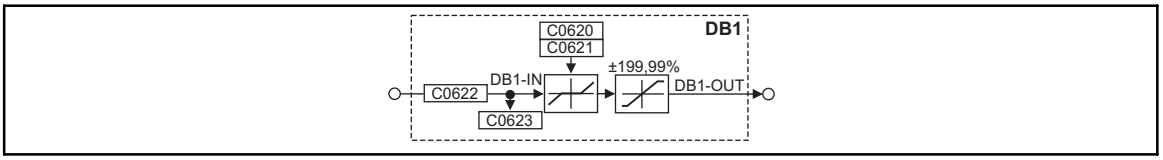


Fig. 3-55 Dead band element (DB1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DB1-IN	a	C0623	dec [%]	C0622	1	1000	-
DB1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The dead band is parameterised under C0621.
- The gain is set under C0620.

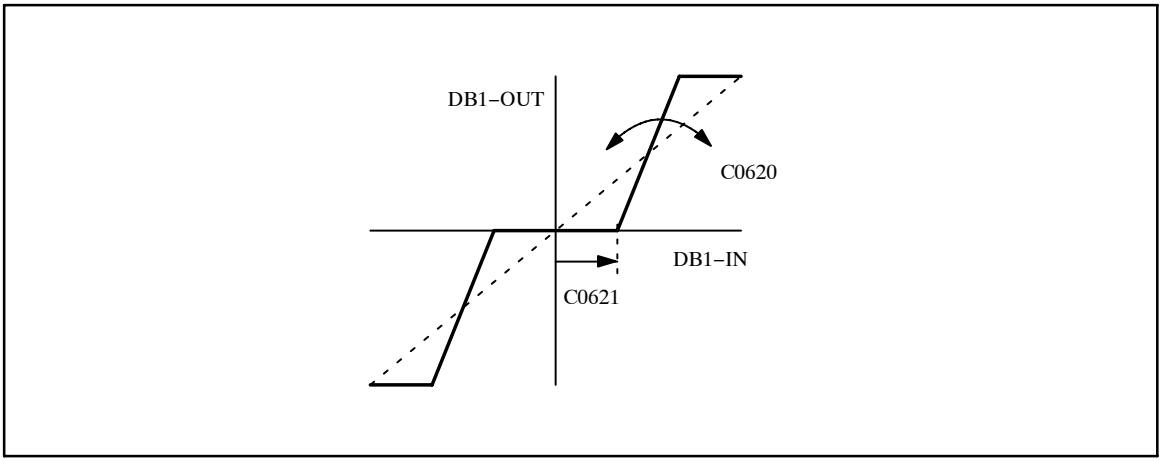


Fig. 3-56 Dead band and gain

3.2.23 Control of the drive controller (DCTRL)

Purpose

Directs the controller to certain states (e.g. trip, trip reset, quick stop or controller inhibit).

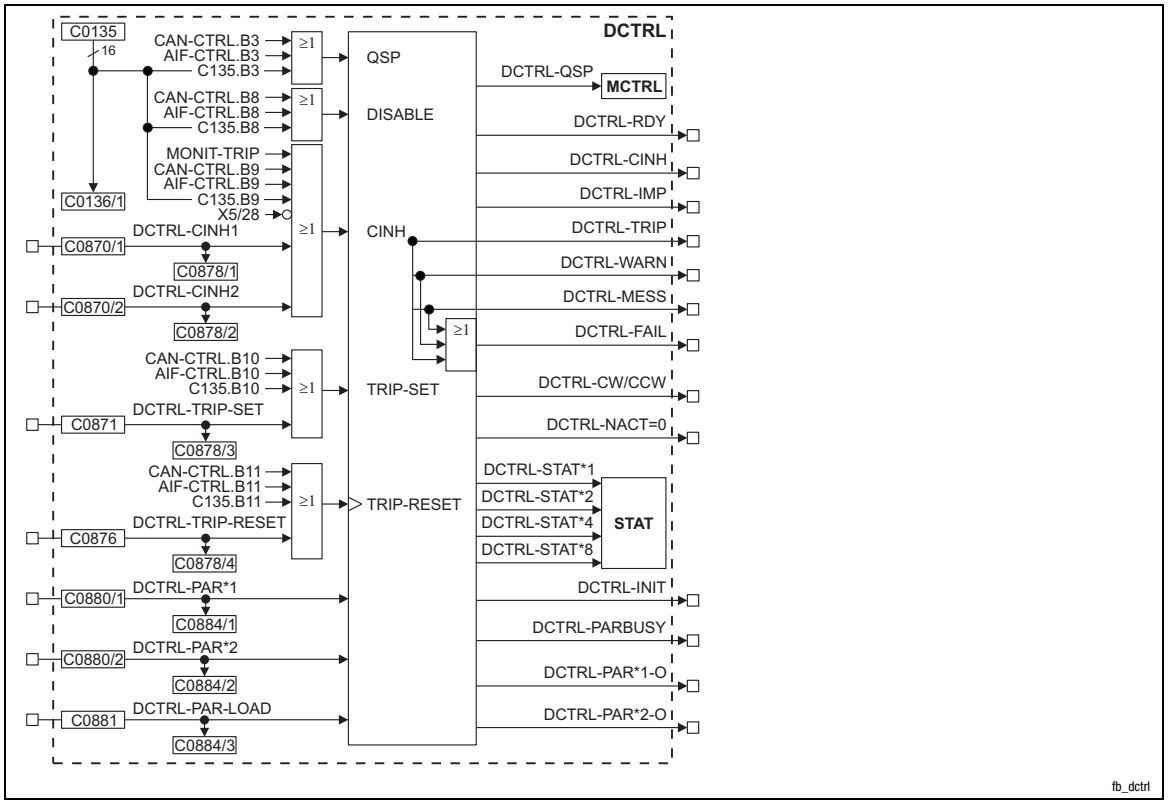


Fig. 3-57 Control of the drive controller (DCTRL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DCTRL-CINH1	d	C0878/1	bin	C0870/1	2	1000	HIGH = Inhibit controller
DCTRL-CINH2	d	C0878/2	bin	C0870/2	2	1000	HIGH = Inhibit controller
DCTRL-TRIP-SET	d	C0878/3	bin	C0871	2	54	HIGH = Fault signal EEr
DCTRL-TRIP-RESET	d	C0878/4	bin	C0876	2	55	LOW-HIGH signal = TRIP reset
DCTRL-PAR*1	d	C0884/1	bin	C0880/1	2	1000	Selecting a parameter set
DCTRL-PAR*2	d	C0884/2	bin	C0880/2	2	1000	Selecting a parameter set
DCTRL-PAR-LOAD	d	C0884/3	bin	C0881	2	1000	LOW-HIGH edge = Loading a parameter set
DCTRL-QSP	d	-	-	-	-	-	HIGH = Drive performs quick stop
DCTRL-RDY	d	-	-	-	-	-	HIGH = Ready for operation
DCTRL-CINH	d	-	-	-	-	-	HIGH = Controller reset
DCTRL-IMP	d	-	-	-	-	-	HIGH = High-resistance power output stages
DCTRL-TRIP	d	-	-	-	-	-	HIGH = Active fault
DCTRL-WARN	d	-	-	-	-	-	HIGH = Active warning
DCTRL-MESS	d	-	-	-	-	-	HIGH = Active message
DCTRL-FAIL	d	-	-	-	-	-	-
DCTRL-CW/CCW	d	-	-	-	-	-	LOW = CW rotation, HIGH = CCW rotation
DCTRL-NACT=0	d	-	-	-	-	-	HIGH = Motor speed < C0019
DCTRL-STAT*1	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*2	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*4	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*8	d	-	-	-	-	-	General status (binary coded)
DCTRL-INIT	d	-	-	-	-	-	-
DCTRL-PARBUSY	d	-		-	-	-	HIGH = Parameter set changeover is active
DCTRL-PAR*1-0	d	-	-	-	-	-	Parameter set X is active (binary coded)
DCTRL-PAR*2-0	d	-	-	-	-	-	Parameter set X is active (binary coded)

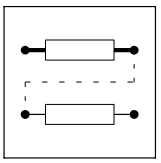
Function

- Quick stop (QSP)
- Operation inhibited (DISABLE)
- Controller inhibit (CINH)
- TRIP-set
- TRIP-RESET
- Change of parameter set (PAR)
- Controller state

3.2.23.1 Quick stop (QSP)

The drive is braked to standstill via the deceleration ramp C105 and generates a holding torque.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 3 of CAN-IN1
  - Control word AIF-CTRL bit 3 of AIF-IN
  - Control word C0135 bit 3
- All inputs are linked by an OR-operation.
- C0136/1 displays the control word C0135



3.2.23.2 Operation inhibit (DISABLE)

In this state the drive cannot be started by the ”Controller enable” command. The power output stages are inhibited. All controllers are reset.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 8 of CAN-IN1
  - Control word AIF-CTRL bit 8 of AIF-IN
  - Control word C0135 bit 8
- All inputs are linked by an OR-operation.
- C0136/1 displays the control word C0135

3.2.23.3 Controller inhibit (CINH)

The power output stages are inhibited. All controllers are reset.

- The function can be controlled by seven inputs:
  - Terminal X5/28 (LOW = controller inhibit)
  - Control word CAN-CTRL bit 9 of CAN-IN1
  - Control word AIF-CTRL bit 9 of AIF-IN
  - Control word C0135 bit 9
  - MONIT-TRIP (HIGH = in the function block MONIT a monitoring function configured to TRIP has been triggered)
  - Free input DCTRL-CINH1
  - Free input DCTRL-CINH2
- All inputs are linked by an OR-operation.
- C0136/1 displays the control word C0135

Note!

If an LU message or an OU message occurs, the CINH signal will not be set.

3.2.23.4 TRIP-SET

The drive is controlled into the state under code C0581 and indicates EEr (external monitoring).

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 10 of CAN-IN1
  - Control word AIF-CTRL bit 10 of AIF-IN
  - Control word C0135 bit 10
  - Free input DCTRL-TRIP-SET
- All inputs are linked by an OR-operation.
- C0136/1 displays the control word C0135

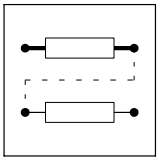
3.2.23.5 TRIP-RESET

Resets a pending trip as soon as the cause of malfunction has been removed. If the cause is still active, no reaction occurs.

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 11 of CAN-IN1
  - Control word AIF-CTRL bit 11 of AIF-IN
  - Control word C0135 bit 11
  - Free input DCTRL-TRIP-RESET
- All inputs are linked by an OR-operation.
- The function can only be performed by a LOW-HIGH edge of the signal resulting from the OR operation.
- C0136/1 displays the control word C0135

Note!

If one of the inputs is set to HIGH, it is not possible that a LOW-HIGH edge will occur on the resulting signal.



3.2.23.6 Parameter set changeover (PAR)

The controller loads and operates with the parameter set selected.

- The parameter set to be loaded is selected via the inputs DCTRL-PAR*1 and DCTRL-PAR*2. The inputs are binary coded (1 from 4).

PAR*2	PAR*1	Selected parameter set
0	0	Parameter set 1
0	1	Parameter set 2
1	0	Parameter set 3
1	1	Parameter set 4

- A LOW-HIGH edge at the input DCTRL-PAR-LOAD enables the controller to switch to the new parameter set.

Note!

If the parameter set to be loaded via the terminal X5/Ex is already selected before switching on the supply voltage, there is no need for the LOW-HIGH edge at the input DCTRL-PAR-LOAD. In this case, the controller loads the selected parameter set automatically.

- The controller is not ready for operation for approx. one second. During this period, DCTRL-RDY displays LOW.

3.2.23.7 Controller state

The binary-coded status of the controller is output via DCTRL-STAT*x. These outputs are connected to the STAT function block inside the device.

The status can be evaluated via the status word C0150, CAN status word and AIF status word.

STAT*8	STAT*4	STAT*2	STAT*1	Action of the controller
0	0	0	0	Initialisation after the supply voltage has been connected
0	0	0	1	Lock mode, restart protection is active C0142
0	0	1	1	Drive is in controller inhibit mode
0	1	1	0	Controller enabled
0	1	1	1	The release of a monitoring function resulted in a ”message”
1	0	0	0	The release of a monitoring function resulted in a ”trip”

3.2.23.8 Standstill message (DCTRL-NACT=0)

The standstill message (DCTRL-NACT=0) is set immediately if the actual speed (MCTRL-NACT) falls below the speed threshold (without any hysteresis effect) set in C0019.

The standstill message disappears if the actual speed (MCTRL-NACT) exceeds the sum of the speed threshold set in C0019 and the hysteresis. The hysteresis amounts to 1 % of the maximum speed set in C0011.

Note!

The hysteresis ensures a stable standstill signal even if the actual speed value jitters.

3.2.24 Master frequency input (DFIN)

Purpose

Converting and scaling a power pulse current at the digital frequency input X9 into a speed and phase setpoint. The digital frequency is transferred in a high-precision mode (with offset and gain errors).

Fig. 3-58 Digital frequency input (DFIN)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFIN-OUT	phd	C0426	dec [rpm]	-	-	

Function

- The input X9 is designed for signals with TTL level.
- In the event of digital frequency cascade or digital frequency rail, adapt the drive to the connected encoder or controller via C0425.
- The input of a zero track is optional.
- Via C0427 the following input signals can be evaluated:

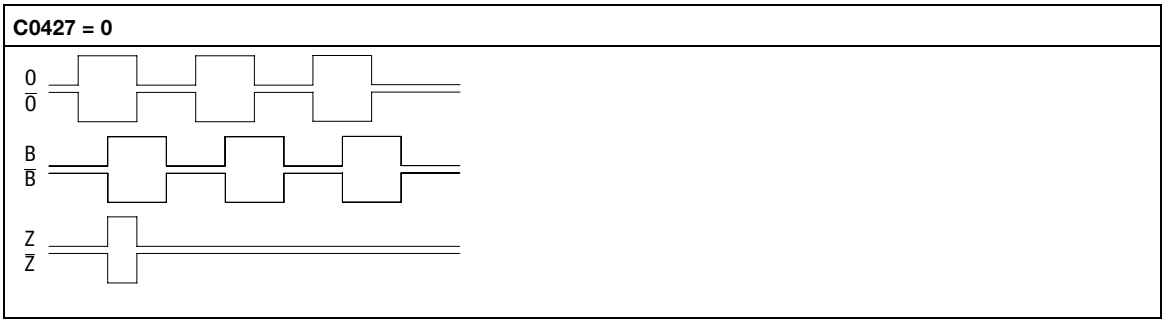
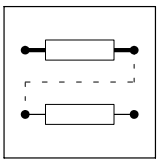


Fig. 3-59 Phase-delayed signal sequence (CW rotation)

CW rotation Track A is leading track B by 90 (positive value at DFIN-OUT).
CCW rotation Track A is lagging track B by 90 (negative value at DFIN-OUT).



C0427 = 1

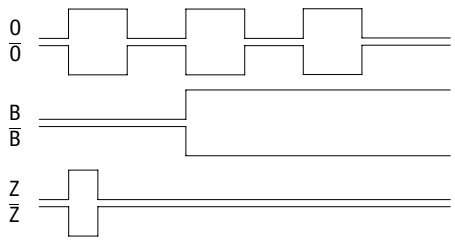


Fig. 3-60 Control of direction of rotation via track B

CW rotation	Track A transmits the speed
	Track B = LOW (positive value at DFIN-OUT)
CCW rotation	Track A transmits the speed
	Track B = HIGH (negative value at DFIN-OUT)

C0427 = 2

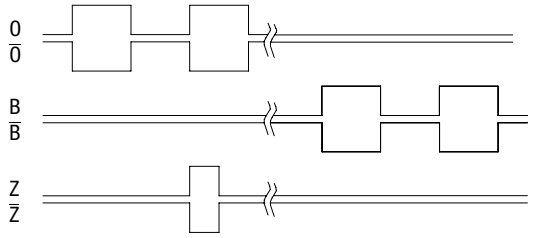


Fig. 3-61 Control of speed and direction of rotation via track A or track B

CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT)
	Track B = LOW
CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT)
	Track A = LOW

Transfer function

$$\text{DFIN-OUT [rpm]} = \text{f [Hz]} \cdot \frac{60}{\text{Number of increments from C0425}}$$

Example:

Input frequency = 200 kHz

C0425 = 3 ($\triangleq$ a number of increments of 2048 Inc/rev.)

$$\text{DFIN-OUT [rpm]} = 200000\ \text{Hz} \cdot \frac{60}{2048} = 5859\ \text{rpm}$$

Signal adaptation

Finer resolutions than the power-of-two format can be realised by connecting an FB (e.g. CONV3 or CONV4).

Example:

The FB CONV3 converts the speed signal into a quasi-analog signal. The conversion is done according to the formula:

$$\text{CONV3-OUT [\%]} = \text{f [Hz]} \cdot \frac{0,4}{\text{Number of increments from C0425}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

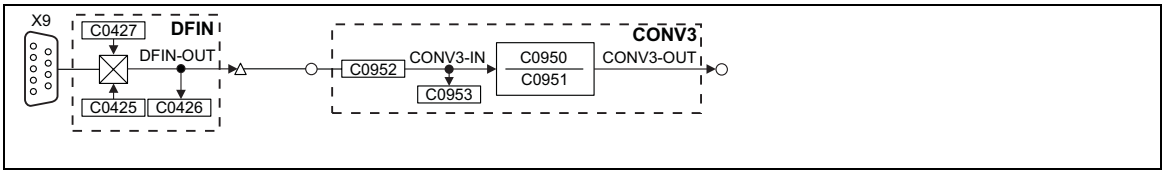


Fig. 3-62 Digital frequency input (DFIN) with connected converter

STOP!

If C0540 = 0, 1, 2, 3 and a feedback system C0025 > 10, you must not use the digital frequency input X9 anymore.

3.2.25 Digital frequency output (DFOUT)

Purpose

Converts internal speed signals into frequency signals and outputs them to subsequent drives. The transmission is highly precise (without offset and gain errors).

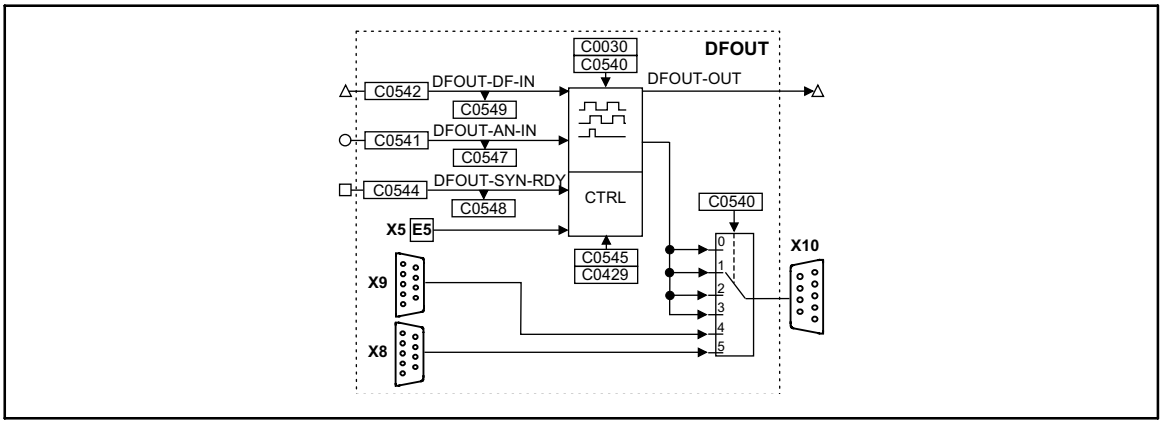


Fig. 3-63 Digital frequency output (DFOUT)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFOUT-DF-IN	phd	C0549	dec [rpm]	C0542	4	-
DFOUT-AN-IN	a	C0547	dec [%]	C0541	1	Input in [%] of nmax (C0011)
DFOUT-SYN-RDY	d	C0548	bin	C0544	2	-
DFOUT-OUT	phd	-	-	-	-	-

Function

- Output signals on X10
- Output of an analog signal
- Output of a speed signal
- Encoder simulation of the resolver with internal zero track
- Encoder simulation of the resolver with external zero track
- Direct output of X8
- Direct output of X9

3.2.25.1 Output signals on X10

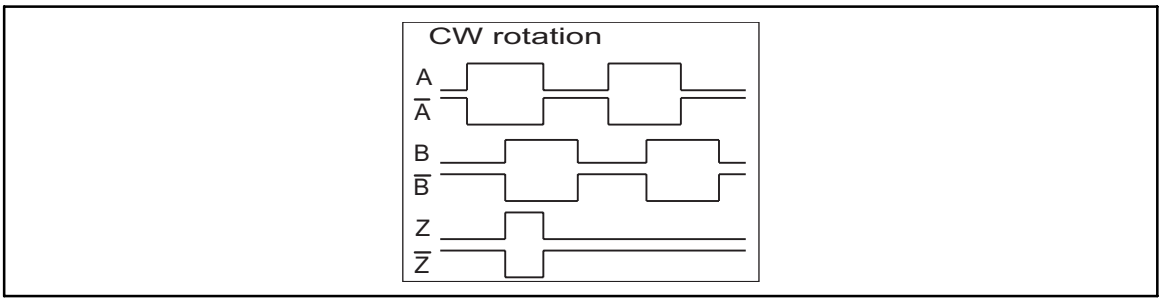


Fig. 3-64 Signal sequence for CW rotation (definition)

- The output signal corresponds to the simulation of an incremental encoder:
  - Track A, B and, if necessary, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  - The levels are TTL-compatible.
- Positive input values (CW rotation) result in the represented signal sequence.
- With negative input values (CCW rotation) track B is leading track A by 90° .
- The zero track is output according to the function set in C0540
- With C0030 the encoder constant of the encoder simulation is set.
- The function of the digital frequency output X10 is defined via C0540.

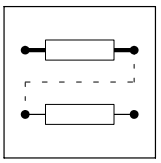
Stop!

C0540 = 0 to C0540 = 3 cannot be set if the connection to the digital frequency input DFIN X9 has been established and C0025 > 10 has been selected.

C0540	Signal at X10
0	DFOUT-AN-IN is output at X10; zero track can be input externally
1	DFOUT-DF-IN is output at X10; zero track can be input externally
2	Encoder simulation of the resolver with zero track in resolver zero position (mounted on the motor)
3	Encoder simulation of the resolver with external input of the zero track (terminal X5/E5)
4	The signal at input X9 is electrically amplified and directly output (C0030 is without function)
5	The signal at input X8 is electrically amplified and directly output (C0030 is without function)

Create zero track (Z track)

- Condition:
  - Set C0540 = 0, C0540 = 1 or C0540 = 3.
  - Encoder simulation must be active.
- Start creation:
  - The creation starts immediately with the first rising or falling edge on track A or track B.



3.2.25.2 Output of an analog signal

For this purpose, set code C0540 = 0. The value applied at input DFOUT-AN-IN is converted into a frequency.

Transfer function

$$f\,[Hz] = DFOUT - AN - IN\,[\%] \cdot \frac{\text{No. of increments from C0030}}{100} \cdot \frac{C0011}{60}$$

Example:

DFOUT-AN-IN = 50 %

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

C0011 = 3000 rpm

$$f\,[Hz] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ Hz$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Activate the function through a LOW → HIGH edge at the input DFOUT-SYN-RDY.
2. A LOW → HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse is automatically shifted by the value C0545.

Note!

This procedure must be done after every mains switching.

3.2.25.3 Output of a speed signal

- Set C0540 = 1.
  – This setting only converts the value at input DFOUT-DF-IN into a frequency.

Transfer function

$$f\,[Hz] = DFOUT\text{-}DF\text{-}IN\,[rpm] \cdot \frac{\text{No. of increments from C0030}}{60}$$

Example:

DFOUT-DF-IN = 3000 rpm

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

$$f\,[Hz] = 3000\,[rpm] \cdot \frac{2048}{60} = 102400\,[Hz]$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Set input DFOUT-SYN-RDY = edge from LOW → HIGH.
2. A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

3.2.25.4 Encoder simulation of the resolver

Set C0540 = 2 or C0540 = 3 (depending on the desired generation of the zero track)

- The function is used when a resolver is connected to X7.
- The encoder constant for output X10 is set in C0030.

Generating a zero pulse in resolver zero position (C0540 = 2)

The output of the zero pulse with regard to the rotor depends on how the resolver is mounted to the motor.

- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Generating an external zero pulse (C0540 = 3)

An artificial zero pulse can be generated for the output frequency.

- The function is activated through a LOW-HIGH edge at the input DFOUT-SYN-RDY.
- A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°.
  – After this, every 360° a zero pulse is generated according to the setting in C0030.
- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Note!

The procedure for generating an artificial zero pulse must be repeated after every mains switching and after every setting of C0540 = 3.

3.2.25.5 Direct output of X8 (C0540 = 5)

- The input signal at X8 is electrically amplified and directly output.
- The signals depend on the assignment of the input X8.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X8.

3.2.25.6 Direct output of X9 (C0540 = 4)

- The input signal at X9 is electrically amplified and directly output.
- The signals depend on the assignment of the input X9.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X9.

Note!

For directly outputting X8 or X9 to the digital frequency output X10 the function block DFOUT does not need to be entered into the processing table.

3.2.26 Digital frequency ramp function generator (DFRFG)

Purpose

The drive (motor shaft) is synchronised to a digital frequency (phase selection). The drive then performs a phase-synchronous operation with the digital frequency.

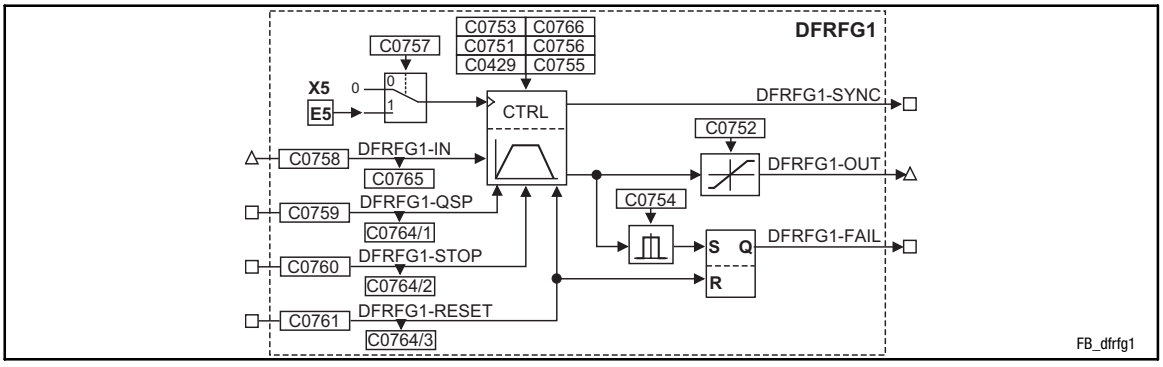


Fig. 3-65 Digital frequency ramp function generator (DFRFG1)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
DFRFG1-SET	phd	C0769	-	C0768	-	Initial speed
DFRFG1-IN	phd	C0765	dec [rpm]	C0758	4	Speed/Phase setpoint
DFRFG1-QSP	d	C0764/1	bin	C0759	2	HIGH = quick stop
DFRFG1-STOP	d	C0764/2	bin	C0760	2	HIGH = save setpoint
DFRFG1-RESET	d	C0764/3	bin	C0761	2	HIGH = reset
DFRFG1-OUT	phd	-	-	-	-	Speed/Phase setpoint
DFRFG1-SYNC	d	-	-	-	-	HIGH = drive runs synchronously
DFRFG1-FAIL	d	-	-	-	-	HIGH = phase difference exceeded

Function

- Profile generator
- Quick stop
- Ramp function generator stop
- RESET
- Detect phase difference
- Start via touch probe initiator (terminal X5/E5)
- Correction of the touch probe initiator (terminal X5/E5)

3.2.26.1 Profile generator

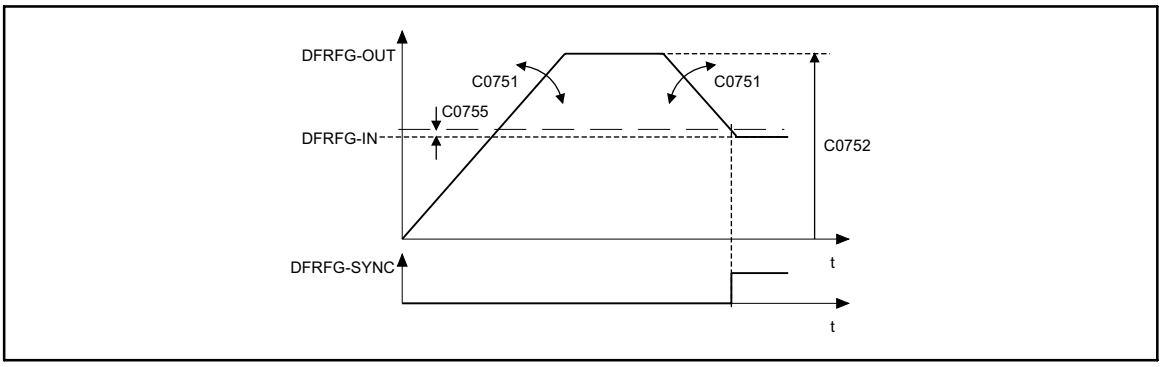


Fig. 3-66 Synchronisation on DFRFG

The profile generator generates ramps which lead the setpoint phase to its target position.

- Set acceleration and deceleration via C0751.
- Set max. speed via C0752.
- When the distance and speed reach their setpoints, the output switches DFRFG1-SYNC = HIGH. At the same time the FB switches the profile generator to ”inactive”.
- Set the switching point via C0755.

Stop!

Do not operate the drive with this function at the torque limitation M_{max}, I_{max}.

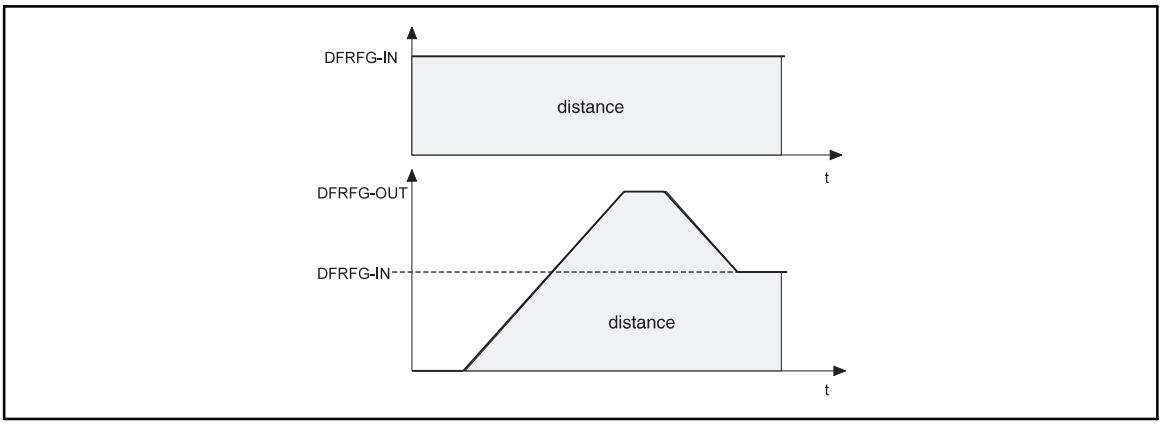


Fig. 3-67 Speed-time diagram DFRFG

The number of increments at DFRFG-IN (master drive) defines the target position. The target can be displayed as a path. The speed-time diagram shows the distance covered (angle) as the area below the speed profile. When synchronicity is reached, master and slave have covered the same distance (angle).

3.2.26.2 Quick stop

Removes the drive from the network and brakes it to standstill.

- Activate with DFRFG-QSP = HIGH.
- Set deceleration time via C0753.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the quick stop request.

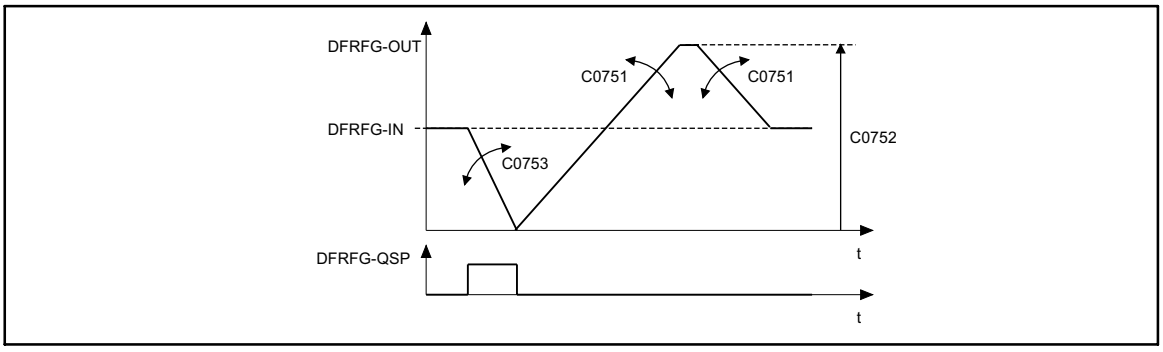


Fig. 3-68 Quick stop DFRFG

3.2.26.3 Ramp function generator stop

Maintains the state of the profile generator during operation.

- Activate with DFRFG-STOP = HIGH
- Output of the last state at DFRFG-OUT.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the stop request.

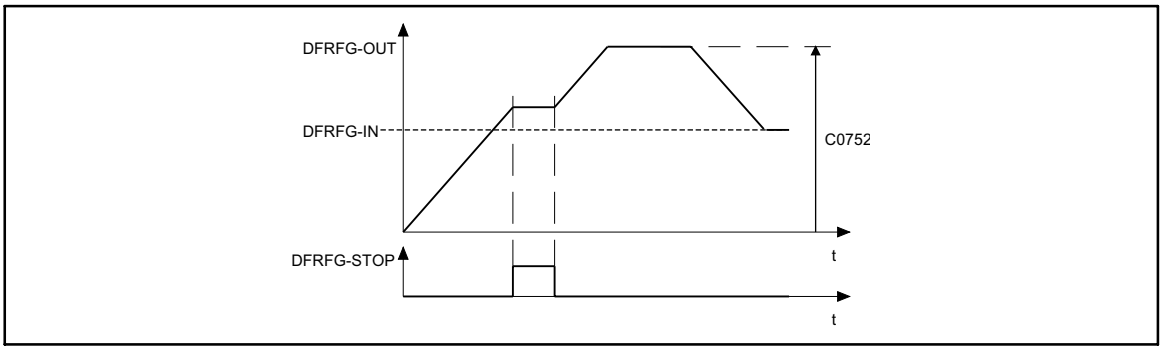


Fig. 3-69 Ramp function generator stop

3.2.26.4 RESET

DFRFG-RESET = HIGH:

- Resets setpoint phases which are internally added.
- Activates the profile generator.
- HIGH-LOW edge at DFRFG-RESET: Detecting the setpoint phase.

3.2.26.5 Detect phase difference

Monitoring the phase difference between input DFRFG-IN and output DFRFG-OUT.

- Set limit value of monitoring via C0754.
- Activates the monitoring: DFRFG-FAIL = HIGH
- Storing the signal until DFRFG-RESET = HIGH.
- The profile generator can accept a phase difference of up to ±2140000000 inc (= 32000 revolutions).

3.2.26.6 Start via touch probe initiator (terminal X5/E5)

Stop!

In the default setting the terminal X5/E5 is assigned to another function.

Function

- Set C0757 = 1.
- The function is activated by **simultaneously** setting the inputs:
  – DFRFG-QSP and DFRFG-RESET = HIGH.
- Starting procedure:
  – Signals at DFRFG-QSP and DFRFG-RESET = LOW.
  – Otherwise touch probe signals are ignored.
- A LOW-HIGH edge at terminal X5/E5 starts the process:

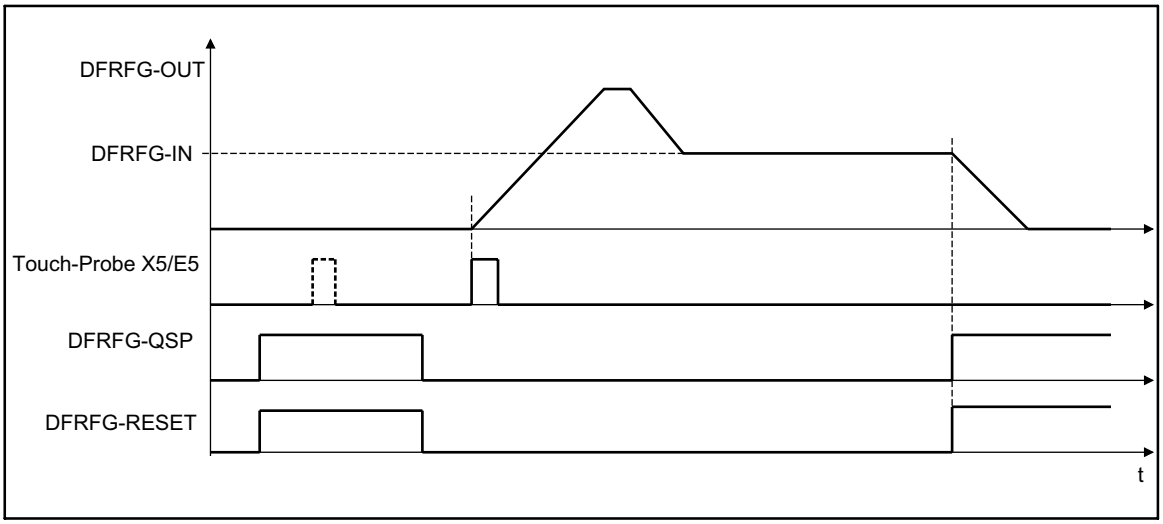


Fig. 3-70 Start via touch probe initiator (terminal X5/E5)

3.2.26.7 Correction of the touch probe initiator (terminal X5/E5)

Delay times during the activation of the initiator cause a speed-dependent phase offset (e.g. during positioning, synchronising).

In order to take this angular offset into account, the response time [ms] of the initiators as a function of the setpoint speed DFRFG-IN is converted to a phase angle correction and is then taken into consideration in the setpoint angle. For this, the response time [ms] has to be converted to a correction value [Inc.] first.

- Set correction value for the phase offset under C0429.
- Formula for input value in C0429:

$$\text{Input value C0429} = 16384 \times \text{response time [ms]}$$

- The response time [ms] can be gathered from the data sheet of the initiator or requested by the manufacturer.

3.2.26.8 Offset setting

The offset can be set with code C0756. The offset refers to the digital frequency input and is scaled to 1 revolution ($\triangleq$ 65536 increments).

The touch probe (TP) initiates the start of the ramp function generator. The leading of the master drive from the moment of starting or the resulting path/phase difference is taken up during the acceleration phase.

- Setting: positive offset values
  - Causes a time shift of the TP
  - This means that less time is necessary - compared to the setting with e.g. offset = 0 - to obtain synchronism with the master drive.

Tip!

With high offsets and low input speeds the drive may reverse. To avoid this, a direction of rotation can be selected for the output via C0766.

3.2.27 Digital frequency processing (DFSET)

Purpose

Conditions the digital frequency for the controller. Selection of stretch factor, gearbox factor and speed trimming or angular trimming.

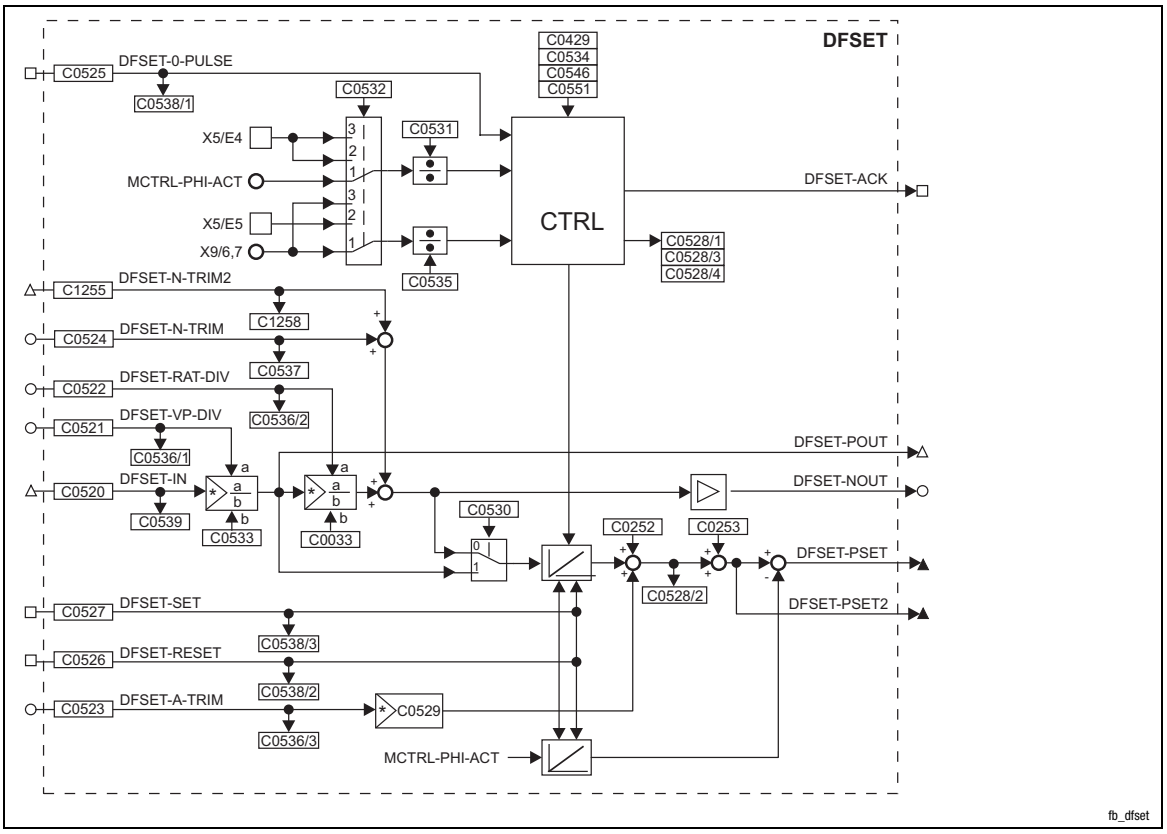


Fig. 3-71 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/angle setpoint
DFSET-N-TRIM	a	C0537	dec [%]	C0524	1	Speed trimming in [%] of C0011
DFSET-N-TRIM2	phd	C1258	dec [rpm]	C1255	4	Speed trimming in [rpm] of C0011
DFSET-A-TRIM	a	C0536/3	dec [inc]	C0523	1	Angular trimming 100% = 16384 inc
DFSET-VP-DIV	a	C0536/1	dec	C0521	1	Numerator of stretch factor 100 % = 16384 inc
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator of gearbox factor 100 % = 16384 inc
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = Enabling of zero pulse synchronisation
DFSET-SET	d	C0538/3	bin	C0527	2	• HIGH = Sets angle integrators to equal values • LOW-HIGH edge sets DFSET-PSET = 0 • HIGH-LOW edge sets DFSET-PSET = current value of MCTRL-PHI-SET • DFSET-SET has a higher priority than DFSET-RESET
DFSET-RESET	d	C0538/2	bin	C0526	2	• HIGH = Sets position difference = 0 • HIGH = Sets DFSET-PSET and DFSET-PSET2 = 0
DFSET-NOUT	a	-	-	-	-	In [%] of nmax (C0011)
DFSET-POUT	phd	-	-	-	-	Speed/angle setpoint
DFSET-PSET	ph	-	-	-	-	Following error for angle controller
DFSET-PSET2	ph	-	-	-	-	Angle setpoint 65536 inc = 1 revolution
DFSET-ACK	d	-	-	-	-	HIGH = Synchronising is performed

Function

- Setpoint conditioning with stretch and gearbox factor
- Processing of correction values
- Synchronising to zero track or touch probe (for resolver feedback touch probe only)
- Suppressing fault signals when synchronising via touch probe

3.2.27.1 Setpoint conditioning with stretch and gearbox factor

Stretch factor

The stretch factor defines the ratio between the drive in operation and its setpoint.

The evaluation is based on the setpoint at DFSET-IN. DFSET-POUT outputs the result.

$$\text{DFSET-POUT} = \text{DFSET-IN} \cdot \frac{\text{DFSET-VP-DIV}}{\text{C0533}}$$

The stretch factor results from numerator and denominator:

- The numerator (DFSET-VP-DIV) can be variable (provided by an analog signal source) or a constant value (provided by a code).
- The denominator must be set in C0533.

Gearbox factor

The gearbox factor defines the gearbox ratio of the drive. Enter the transmission ratio of the drive.

The evaluation is based on the setpoint at DFSET-IN multiplied by the stretch factor. DFSET-NOUT outputs the result.

$$\text{DFSET-NOUT} = \text{Reckfaktor} \cdot \frac{\text{DFSET-RAT-DIV}}{\text{C0033}}$$

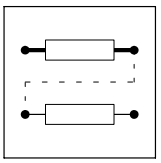
$$\text{DFSET-NOUT} = \text{DFSET-IN} \cdot \frac{\text{DFSET-VP-DIV}}{\text{C0533}} \cdot \frac{\text{DFSET-RAT-DIV}}{\text{C0033}}$$

The gearbox factor results from numerator and denominator.

- The numerator ca be variable (provided by an analog signal source) or a constant value (provided by a code).
- The denominator must be set in C0033.

Note!

With code C0530 you can deactivate the use of the gearbox factor and the DFSET-N-TRIM values as the basis for the setpoint angle integrator. When C0530 = 1, only the stretch factor is used for the calculation of the setpoint angle.



3.2.27.2 Processing of correction values

Speed trimming

This is used to add correction values, e.g. by a superimposed control loop. This enables the drive to accelerate or decelerate.

- Adds an analog value at DFSET-N-TRIM (see C0537) to the speed setpoint.
- Adds a speed value at DFSET-N-TRIM2 (see C1258) to the speed setpoint.
  – The speed trimming via this input is more precise.

Angular trimming

Adds a setpoint at DFSET-A-TRIM (see C0536/3) to the angle setpoint. The rotor position with respect to the setpoint can be changed in either direction by the defined number of increments (the drive is leading or lagging). The angle is trimmed within a range of ±32767 increments (corresponds to ±1/2 revolution). Every analog signal can be used as a source.

- The input is made in increments (one revolution corresponds to 65536 increments).
- When analog values are entered, 100% correspond to 1/4 revolution = 16384 increments.
- Extension of the setting range with a multiplier under C0529.

Angular offset

The angular offset (C0252) adds a constant angular offset to the setpoint of the drive.

Speed-proportional angle adjustment

With speed-proportional angle adjustment the angle lags or leads with rising speed.

- Enter a corresponding adjustment value in increments in C0253.
- The set angle adjustment is reached at 15000 rpm of the drive (linear relationship).

3.2.27.3 Synchronising to zero track or touch probe

Stop!

If synchronisation via terminals X5/E4 and X5/E5 (C0532 = 2) is activated, there must not be any other signal connections to the terminals. If you have selected a basic configuration via C0005, the terminals are subject to a basic assignment.

The synchronisation mode can be selected in C0532.

- C0532 = 1, zero pulse
  - Zero track of digital frequency input X9 and zero track by the feedback system set under C0490 (not for resolver evaluation).
- C0532 = 2, touch probe
  - Via terminals X5/E4 (actual pulse) and X5/E5 (setpoint pulse).
- C0532 = 3, zero pulse (setpoint) and touch probe (actual value)
  - Setpoint pulses of digital frequency input X9 and actual pulses via the touch probe input at terminal X5/E4.

Note!

For all three modes you can define a division factor for the actual pulses (code C0531) and for the setpoint pulses (code C0535).

- Example: For C0531 = 10 only every tenth actual pulse is evaluated. The other 9 pulses are ignored.
- Lenze setting: C0531 = 1, C0533 = 3

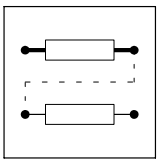
Correction of the touch probe initiator (terminal X5/E5)

Delay times during the activation of the initiator cause a speed-dependent angular offset (e.g. during positioning, synchronising). To compensate this angular offset, the response time [ms] of the initiators is converted into an angular correction value depending on the setpoint speed and then taken into account in the setpoint angle.

How to determine the angular correction value:

1. Use the below formula to convert the response time [ms] into a correction value [inc]:

   Angular correction value in C0429 = 16384 × response time [ms]
   - Please refer to the data sheet for the response time [ms] or contact the manufacturer of the initiator.
2. Set the angular correction value for the angular offset in C0429.



Synchronisation mode

For the synchronisation, different modes are available which can be set under C0534.

C0534	Synchronisation mode	Note
0	Inactive	Function inactive
1	Continuous synchronisation with correction in the shortest possible way	
2	Continuous synchronisation with correction in the shortest possible way	A LOW-HIGH edge at DFSET-0-Pulse initiates continuous synchronisation
10	One-time synchronisation, an angular deviation is corrected in the shortest possible way	
11	One-time synchronisation, an angular deviation is corrected in CW direction	A LOW-HIGH edge at DFSET-0-Pulse initiates a one-time synchronisation
12	One-time synchronisation, an angular deviation is corrected in CCW direction	
13	One-time synchronisation, an angular difference is determined between setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign	

Code C0528/1 displays the number of increments (angular difference) between the setpoint pulse and the actual pulse before the synchronisation.

3.2.27.4 Suppressing fault signals when synchronising via touch probe

Interference pulses which act on the actual pulse and setpoint pulse signal at the inputs X5/E4 and X5/E5 can cause unwanted transients and faulty functions.

As of software version 6.2 it is possible to filter interference pulses via masking windows, thus reducing interferences by up to 90%, depending on the application.

The masking windows can be set separately, for the actual pulses (X5/E4) via C0551 and for the setpoint pulses (X5/E5) via C0546.

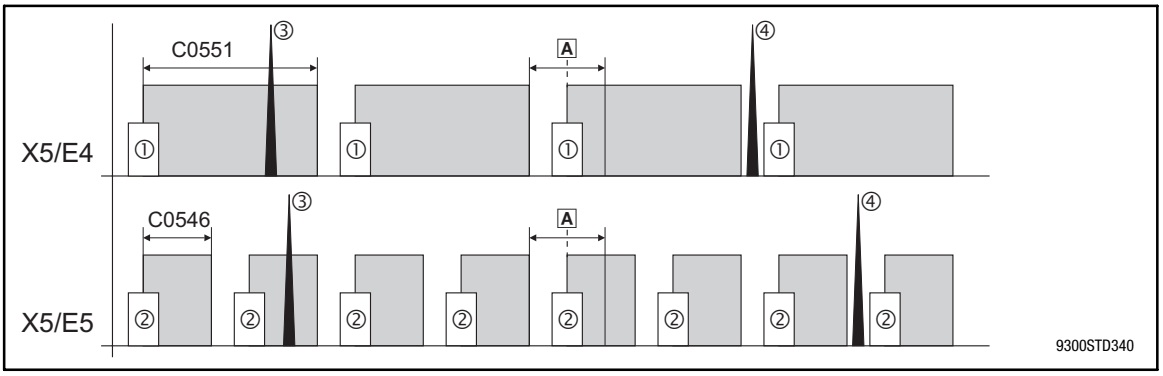


Fig. 3-72 Masking of interference pulses for setpoint and actual pulses

- A Variations of the actual / setpoint pulses
- ① Actual pulses at X5/E4
- ② Setpoint pulses at X5/E5
- ③ Interference pulse in the masked area is filtered out
- ④ Interference pulse in a non-masked area causes transients

Setting of masking window

1. Measure the number of increments between two pulses. Since the number varies depending on the application, the variation limits must be detected and considered when setting the masking windows.
   - C0528/4 displays the number of increments between 2 actual pulses at X5/E4 (e.g. motor increments).
   - C0528/3 displays the number of increments between 2 setpoint pulses at X5/E5 (e.g. master increments).
2. Set the size of the masking window, considering the variation limits. The higher the limits the smaller the masking window must be set.
   - In C0551 the size of the masking window between 2 actual pulses at X5/E4 can be set by entering the corresponding number of increments.
   - In C0546 the size of the masking window between 2 setpoint pulses at X5/E5 can be set by entering the corresponding number of increments.
   - Consider the division factors C0531 and C0535 when setting the masking windows.

Note!

- The range to be masked out (masking windows C0546 and C0551) starts with the first touch probe pulse and restarts with every new touch probe pulse. Modifications of the masking window via C0546 or C0551 are accepted immediately.
- If very low speeds are used, the masking window in C0551 should be set to 1 increment to prevent that actual pulses are classified as interference pulses.

3.2.28 Delay elements (DIGDEL)

Purpose

This function is used to delay digital signals. This function can be used for the control of functions or the generation of status information.

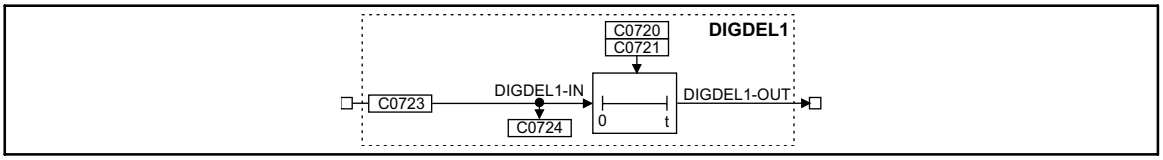


Fig. 3-73 Delay element (DIGDEL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL1-IN	d	C0724	bin	C0723	2	1000	-
DIGDEL1-OUT	d	-	-	-	-	-	-

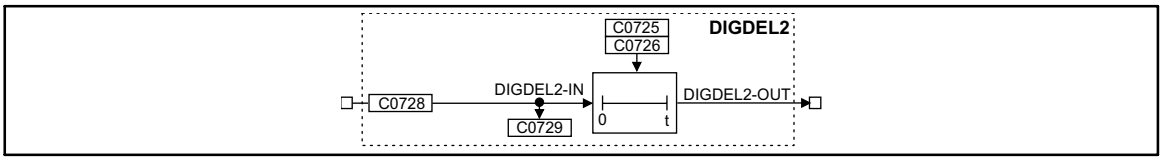


Fig. 3-74 Delay element (DIGDEL2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL2-IN	d	C0729	bin	C0728	2	1000	-
DIGDEL-OUT	d	-	-	-	-	-	-

Function

You can select the following functions under C0720 (DIGDEL1) and C0725 (DIGDEL2):

- On-delay
- Off-delay
- General delay

3.2.28.1 On-delay

If the on-delay is set, a signal change from LOW to HIGH at the input DIGDELx-IN is passed on to the DIGDELx-OUT output after the delay time set under C0721 or C0726 has elapsed.

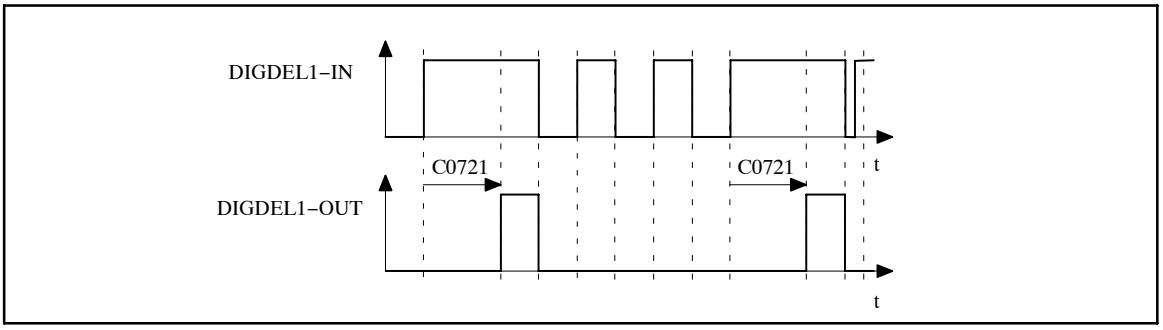


Fig. 3-75 On-delay (DIGDEL1)

In this function, the time element operates like a retriggerable monoflop:

- A LOW-HIGH edge at the input DIGDELx-IN starts the time element.
- If the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to HIGH.
- The time element is reset and the output DIGDELx-OUT is set to LOW with a HIGH-LOW edge at the input DIGDELx-IN.

3.2.28.2 Off-delay

An off-delay causes a signal change from HIGH to LOW at the input DIGDELx-IN to be passed on to the output DIGDELx-OUT after the delay time set under C0721 or C0726 has elapsed.

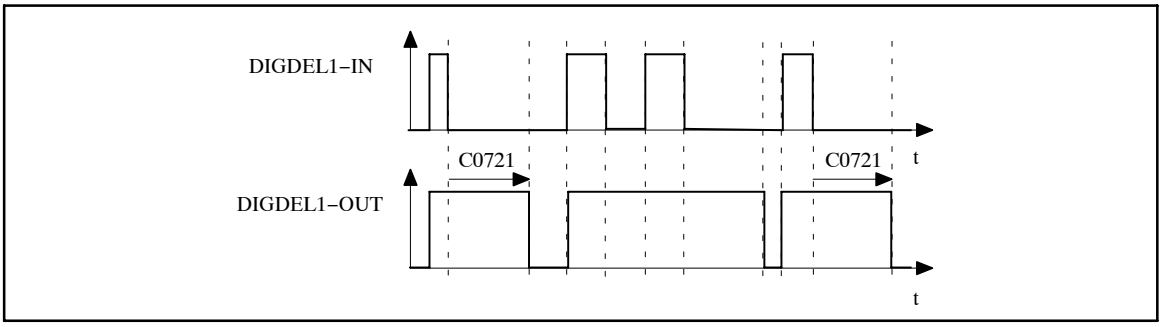


Fig. 3-76 Off-delay (DIGDEL1)

- A LOW-HIGH edge at the input DIGDELx-IN causes the output DIGDELx-OUT to be set to HIGH and the time element to be reset.
- The time element is started with a HIGH-LOW edge at the input DIGDELx-IN.
- After the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to LOW.

3.2.28.3 General delay

A general delay causes any signal change at the input DIGDELx-IN to be passed onto the output DIGDELx-OUT only after the time set under C0721 or C0726 has elapsed.

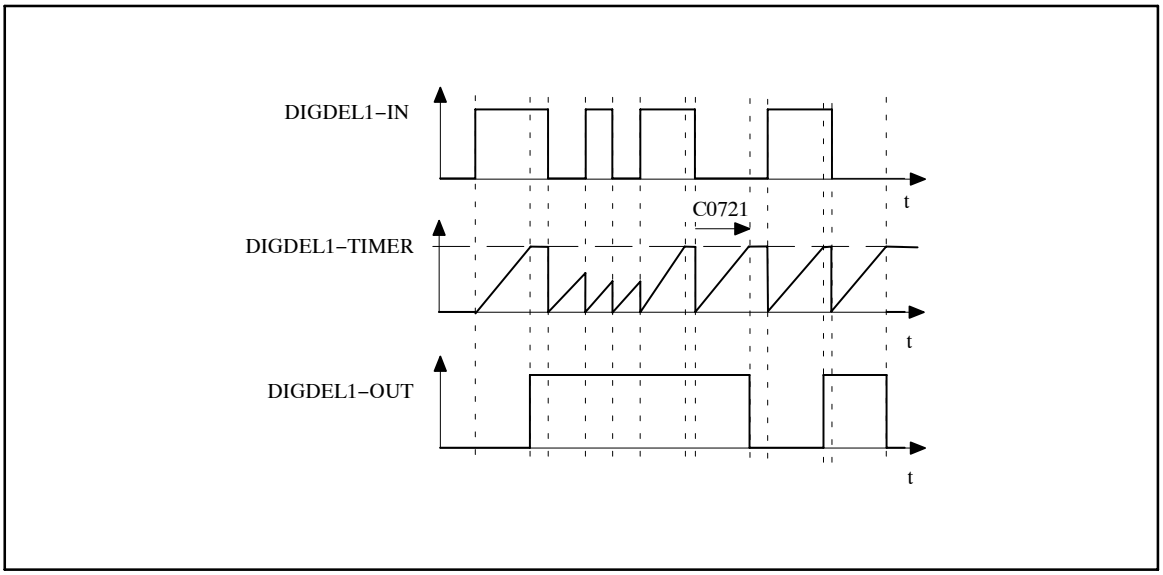


Fig. 3-77 General delay

- The time element is started with any edge at the input DIGDELx-IN.
- When the timer (can be set under C0721 or C0726) has reached the upper limit, the output DIGDELx-OUT is set to the same value as the input DIGDEL1-IN.

3.2.29 Freely assignable digital inputs (DIGIN)

Purpose

Reading and conditioning of the signals at the terminals X5/E1 to X5/E5.

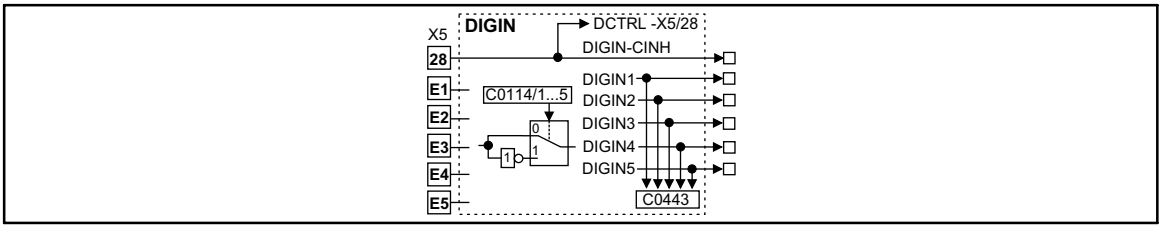


Fig. 3-78 Freely assignable digital inputs (DIGIN)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGIN-CINH	d	-	dec	-	-	-	Controller inhibit acts directly on the DCTRL control
DIGIN1	d	C0443	dec	-	-	-	-
DIGIN2	d	C0443	dec	-	-	-	-
DIGIN3	d	C0443	dec	-	-	-	-
DIGIN4	d	C0443	dec	-	-	-	-
DIGIN5	d	C0443	dec	-	-	-	-

Function

The terminals X5/E1 to X5/E5 are scanned every millisecond. The level for every input can be inverted. For this, proceed as follows:

- Select code C0114 with corresponding subcode (e.g. subcode 3 for input X5/E3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.2.30 Freely assignable digital outputs (DIGOUT)

Purpose

Conditioning of the digital signals and output at the terminals X5/A1 to X5/A4.

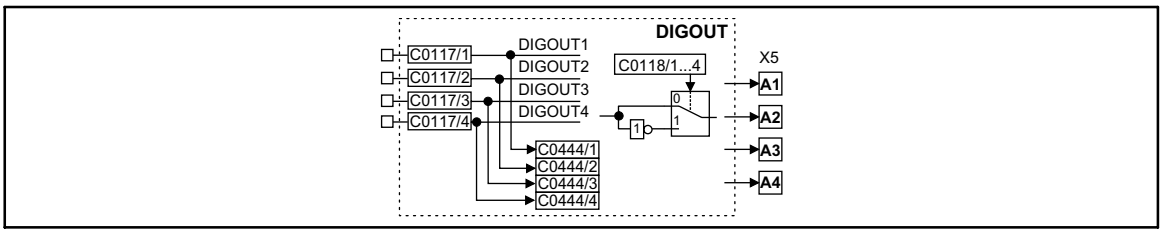


Fig. 3-79 Freely assignable digital outputs (DIGOUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGOUT1	d	C0444/1	bin	C0117/1	2	15000	-
DIGOUT2	d	C0444/2	bin	C0117/2	2	10650	-
DIGOUT3	d	C0444/3	bin	C0117/3	2	500	-
DIGOUT4	d	C0444/4	bin	C0117/4	2	5003	-

Function

The terminals X5/A1 to X5/A4 are updated every millisecond. The level for every output can be inverted. For this, proceed as follows:

- Select code C0118 with corresponding subcode (e.g. subcode 3 for output X5/A3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.2.31 First order derivative-action element (DT1)

Purpose

Derivative action on signals.

For instance, used for the acceleration processes (dv/dt).

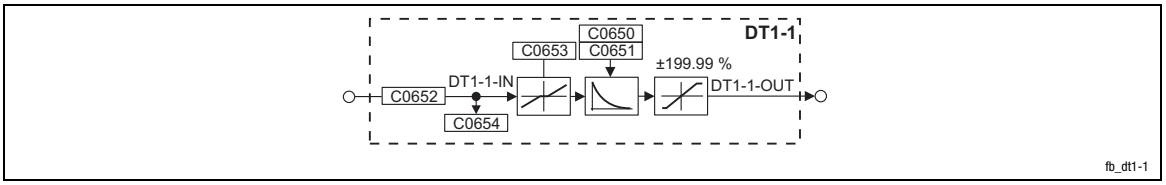


Fig. 3-80 First order derivative-action element (DT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DT1-1-IN	a	C0654	dec [%]	C0652	1	1000	-
DT1-1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The gain is set under C0650.
- The delay T_V is set under C0651.
- The input sensitivity of the DT1-1 element can be reduced under C0653.
- The FB only evaluates the specified most significant bits, according to the setting.

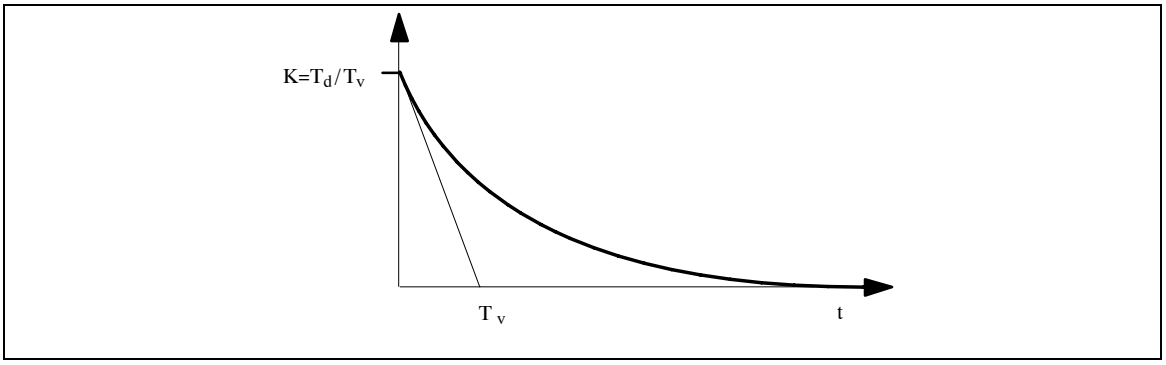


Fig. 3-81 Delay time T_V of the first order derivative-action element

3.2.32 Free piece counter (FCNT)

Purpose

Digital up/down counter

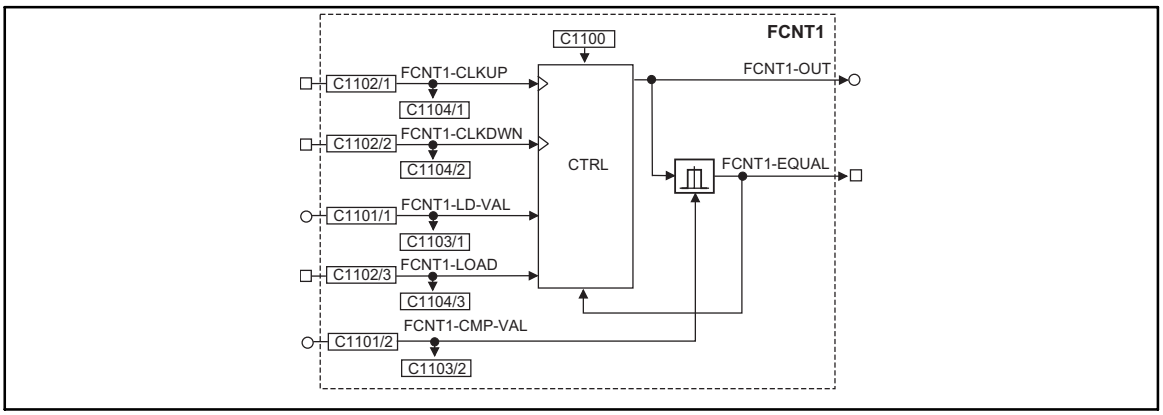


Fig. 3-82 Free piece counter (FCNT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT1-CLKUP	d	C1104/1	bin	C1102/1	2	LOW-HIGH edge = counts up by 1
FCNT1-CLKDWN	d	C1104/2	bin	C1102/2	2	LOW-HIGH edge = counts down by 1
FCNT1-LD-VAL	a	C1103/1	dec	C1101/1	1	Starting value
FCNT1-LOAD	d	C1104/3	bin	C1102/3	2	• HIGH = Accept starting value • The input has the highest priority
FCNT1-CMP-VAL	a	C1103/2	dec	C1101/2	1	Comparison value
FCNT1-OUT	a	-	-	-	-	Counter limited to ±199.99 % (≙ ±32767)
FCNT1-EQUAL	d	-	-	-	-	HIGH = comparison value reached

Function

- C1100 = 1
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), FCNT1-EQUAL is set = HIGH for 1 ms. Afterwards the counter is reset to the starting value (FCNT1-LD-VAL).

Note!

If the signal is to be available longer, e. g. for a query of the output via a PLC, you can prolong the signal via the TRANS function block.

- C1100 = 2
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
- C1100 = 3
  - If | counter content| = | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
  - FCNT1-OUT is limited to 32767 for counting upwards and to -32767 for counting downwards.

3.2.33 Free digital outputs (FDO)

Purpose

This function block can be used to connect digital signals via C0151, the function block AIF-OUT and function block CAN-OUT to the connected fieldbus systems.

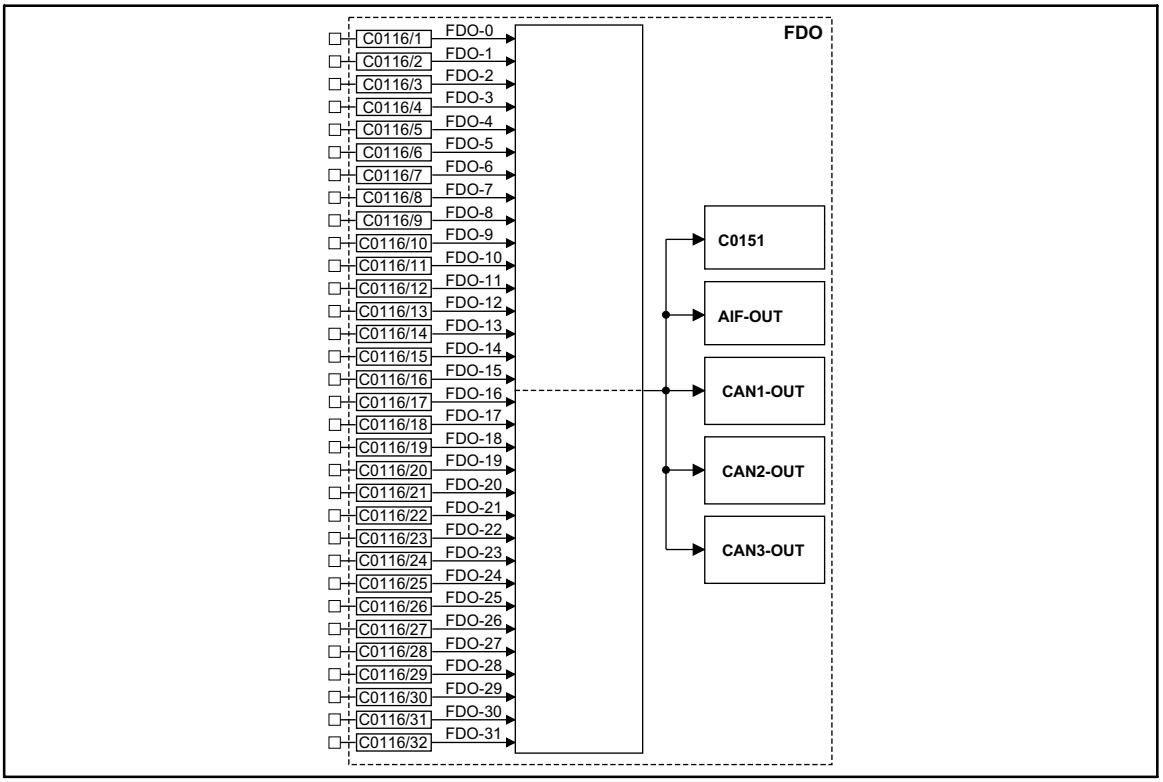
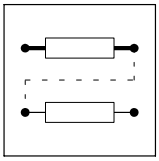


Fig. 3-83 Free digital outputs (FDO)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FDO-0	d	C0151	hex	C0116/1	2	1000	
FDO-1	d	C0151	hex	C0116/2	2	1000	
FDO-2	d	C0151	hex	C0116/3	2	1000	
FDO-3	d	C0151	hex	C0116/4	2	1000	
FDO-4	d	C0151	hex	C0116/5	2	1000	
FDO-5	d	C0151	hex	C0116/6	2	1000	
FDO-6	d	C0151	hex	C0116/7	2	1000	
FDO-7	d	C0151	hex	C0116/8	2	1000	
FDO-8	d	C0151	hex	C0116/9	2	1000	
FDO-9	d	C0151	hex	C0116/10	2	1000	
FDO-10	d	C0151	hex	C0116/11	2	1000	
FDO-11	d	C0151	hex	C0116/12	2	1000	
FDO-12	d	C0151	hex	C0116/13	2	1000	
FDO-13	d	C0151	hex	C0116/14	2	1000	
FDO-14	d	C0151	hex	C0116/15	2	1000	
FDO-15	d	C0151	hex	C0116/16	2	1000	
FDO-16	d	C0151	hex	C0116/17	2	1000	
FDO-17	d	C0151	hex	C0116/18	2	1000	
FDO-18	d	C0151	hex	C0116/19	2	1000	
FDO-19	d	C0151	hex	C0116/20	2	1000	
FDO-20	d	C0151	hex	C0116/21	2	1000	
FDO-21	d	C0151	hex	C0116/22	2	1000	
FDO-22	d	C0151	hex	C0116/23	2	1000	
FDO-23	d	C0151	hex	C0116/24	2	1000	
FDO-24	d	C0151	hex	C0116/25	2	1000	
FDO-25	d	C0151	hex	C0116/26	2	1000	
FDO-26	d	C0151	hex	C0116/27	2	1000	
FDO-27	d	C0151	hex	C0116/28	2	1000	
FDO-28	d	C0151	hex	C0116/29	2	1000	
FDO-29	d	C0151	hex	C0116/30	2	1000	
FDO-30	d	C0151	hex	C0116/31	2	1000	
FDO-31	d	C0151	hex	C0116/32	2	1000	

Function

You can freely select a digital signal source for every signal input.

- The corresponding bit in the data word (DWORD) is marked with FDO-x (e.g. FDO-0 for the LSB and FDO-31 for the MSB).
- The DWORD is transferred to code C0151 and to the function blocks AIF-OUT, CAN-OUT1, CAN-OUT2, and CAN-OUT3.

3.2.34 Freely assignable input variables (FEVAN)

Purpose

Transfer of analog signals to any code. At the same time, the FB converts the signal into the data format of the target code.

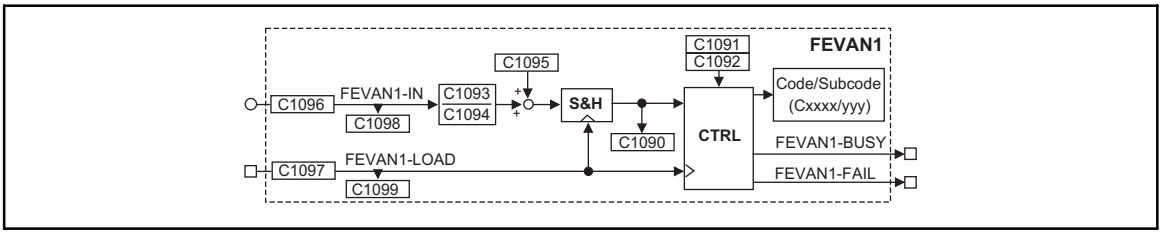


Fig. 3-84 Freely assignable input variables (FEVAN1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN1-IN	a	C1098	dec	C1096	1	Input value
FEVAN1-LOAD	d	C1099/1	bin	C1097/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN1-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN1-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN1-LOAD sets FEFAN1-FAIL = LOW.
-	-	C1090	-	-	-	Display of the converted signal

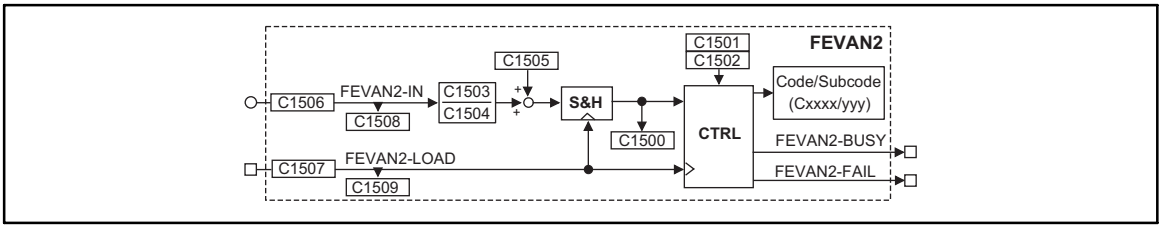


Fig. 3-85 Freely assignable input variables (FEVAN2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN2-IN	a	C1508	dec	C1506	1	Input value
FEVAN2-LOAD	d	C1509/1	bin	C1507/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN2-LOAD sets FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

Function

- Conversion of the read data via:
  - Numerator, denominator.
  - Offset.
- Selection of a target code for the read data.

Codes for the conversion of the read data and for the selection of the target code

				Selection of the target code		
Function block	**Numerator**	**Denominator**	**Offset**	**Code**	**Subcode**	**Examples**
FEVAN1	C1093	C1094	C1095	C1091	C1092	
FEVAN2	C1503	C1504	C1505	C1501	C1502	

Data transmission

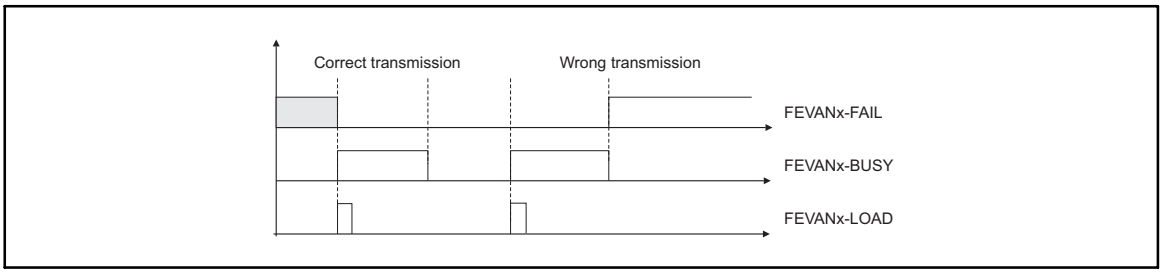


Fig. 3-86 Signal flow

Transmission errors may occur if

- no target code is available,
- no target subcode is available,
- the data transmitted are out of the target code limits,
- the target code is inhibited since it may only be written if the controller is inhibited. Inhibit the controller (see code table).

Cyclic data transmission

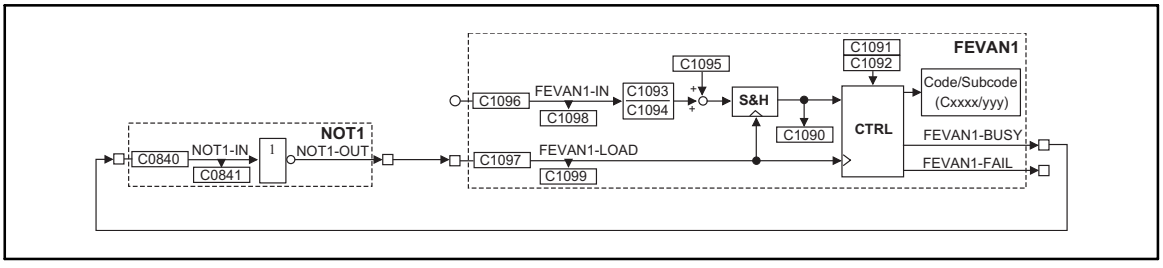


Fig. 3-87 Example for a cyclic data transmission to a target code

Conversion

In the example, the conversion is made at FB FEVAN1.

- The data format of the target code is important for the conversion (see attribute table).
- Adapt the input signal to the data format of the target code:
  - C1093 (numerator).
  - C1094 (denominator).
- C1094 also fixes the decimal positions of the target code:
  - Set C1094 according to the existing decimal positions of the target code. The number of decimal positions can be obtained from the code table.
  - 0.0001 ≙ no decimal positions.
  - 0.001 ≙ one decimal position.
  - 0.01 ≙ two decimal positions.
  - 0.1 ≙ three decimal positions.
  - 1 ≙ four decimal positions.
- For target codes with % scaling the formula for conversion must include a scaling factor (see example 1).

Example 1 (only for FIX32 format with % scaling):

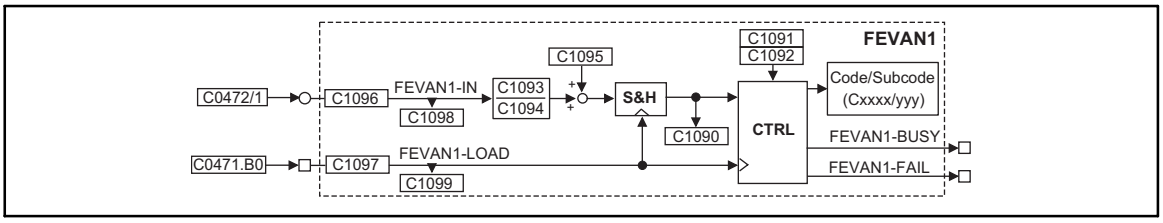


Fig. 3-88 Example of a circuit for FIX32 format with % scaling

Task:

- C0472/1 = 1.05 %. Write this value to C0141.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-472/1 (19521).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 141 (≙ C0141)
- Set C1092 = 0 (no subcode available)
- C1093 = calculate numerator
- Set C1094 = 0.01 (two decimal positions)
- Set C1095 = 0 (no offset).

Calculation:

$$\text{FEVAN1–IN [\%]} \cdot \underbrace{\frac{1}{10000}}_{\text{Scaling factor}} \cdot \underbrace{\frac{16384}{100}}_{\text{Scaling factor}} \cdot \frac{C1093}{C1094} + C1095 = C0141\ [\%]$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data are transmitted to the target code.

Example for converting to C1093:

$$\underbrace{1.05\ \%}_{\text{Setpoint in C0141}} \cdot 10000 \cdot \frac{100}{16384} \cdot C1094 \cdot \underbrace{\frac{1}{1.05\ \%}}_{\text{FEVAN1-IN}} = C1093 = 0.6103$$

Display:

- C0141 = 1.00 %

Example 2 (only for FIX32 format without % scaling):

Task:

- C0473/1 = 1000. Write this value to C0011.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-473/1 (19551).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 11 (≙ C0011)
- Set C1092 = 0 (no subcode available)
- Set C1093 = 1.0
- Set C1094 = 0.0001 (no decimal position)
- Set C1095 = 0 (no offset).

The source code has no unit. The scaling factor is dropped.

Calculation:

$$\text{FEVAN1–IN} \cdot \frac{1}{10000} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = \text{C0011 [rpm]}$$

Scaling factor

$$1000 \cdot \frac{1}{10000} \cdot \frac{1,0}{0.0001} + 0 = 1000 \text{ rpm}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data are transmitted to the target code.

Display:

- C0011 displays the value 1000 rpm.

The other formats are calculated with the following formula:

$$\text{FEVAN1–IN} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = x$$

3.2.35 Fixed setpoints (FIXSET)

Purpose

This FB serves to program up to 15 fixed setpoints which can be retrieved via digital terminals or control codes.

The fixed setpoints can e.g. be used for:

- different setpoint dancer positions for one dancer position control or
- different stretching ratios (gearbox factor) for a speed ratio control with digital frequency coupling

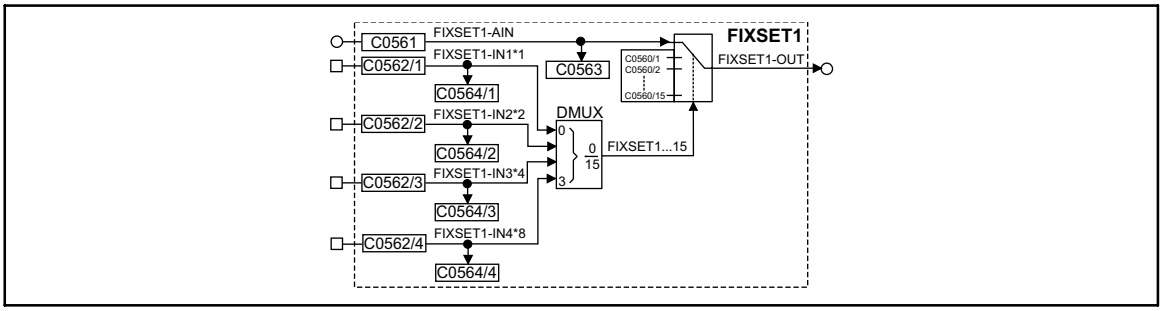


Fig. 3-89 Fixed setpoint (FIXSET1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FIXSET1-AIN	a	C0563	dec [%]	C0561	1	1000	The input is switched to the output if a LOW level is applied to all selection inputs FIXSET-INx.
FIXSET1-IN1*1	d	C0564/1	bin	C0562/1	2	1000	The number of the inputs to be assigned depends on the number of the FIXSET setpoints required.
FIXSET1-IN2*2	d	C0564/2	bin	C0562/2	2	1000	
FIXSET1-IN3*4	d	C0564/3	bin	C0562/3	2	1000	
FIXSET1-IN4*8	d	C0564/4	bin	C0562/4	2	1000	
FIXSET1-OUT	a	-	-	-	-	-	

Function

The FB output can be used as a setpoint source (signal source) for another FB (e.g. process controller, arithmetic block etc.). Parameter setting and handling are similar to JOG but independent of JOG (cp. FB NSET).

- Parameter setting of the fixed setpoints:
  - The single fixed setpoints are parameterised via the subcodes of C0560.
- Output of the fixed setpoint selected:
  - If the binary inputs are triggered with HIGH signal, a fixed setpoint from the table is switched to the output.
- Value range:
  - The values for the fixed setpoint can be set between -200% and +200%.

3.2.35.1 Release of the FIXSET1 setpoints

Number of the fixed setpoints required	Number of inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

System for decoding the binary input signals:

Output signal FIXSET1-OUT =	1st input FIXSET1-IN1	2nd input FIXSET1-IN2	3rd input FIXSET1-IN3	4th input FIXSET1-IN4
FIXSET1-Ain	0	0	0	0
C0560/1	1	0	0	0
C0560/2	0	1	0	0
C0560/3	1	1	0	0
C0560/4	0	0	1	0
C0560/5	1	0	1	0
C0560/6	0	1	1	0
C0560/7	1	1	1	0
C0560/8	0	0	0	1
C0560/9	1	0	0	1
C0560/10	0	1	0	1
C0560/11	1	1	0	1
C0560/12	0	0	1	1
C0560/13	1	0	1	1
C0560/14	0	1	1	1
C0560/15	1	1	1	1

3.2.36 Flipflop element (FLIP)

Purpose

This FB is a D flipflop. This function is used to evaluate and save digital signal edges.

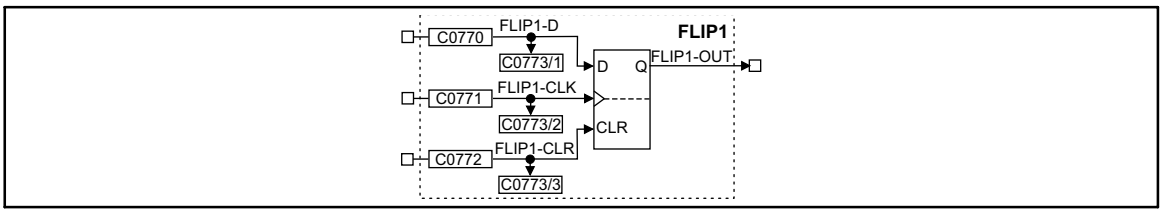


Fig. 3-90 Flipflop element (FLIP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP1-D	d	C0773/1	bin	C0770	2	1000	-
FLIP1-CLK	d	C0773/2	bin	C0771	2	1000	Evaluates LOW-HIGH edges only
FLIP1-CLR	d	C0773/3	bin	C0772	2	1000	Evaluates the input level only: input has highest priority
FLIP1-OUT	d	-	-	-	-	-	-

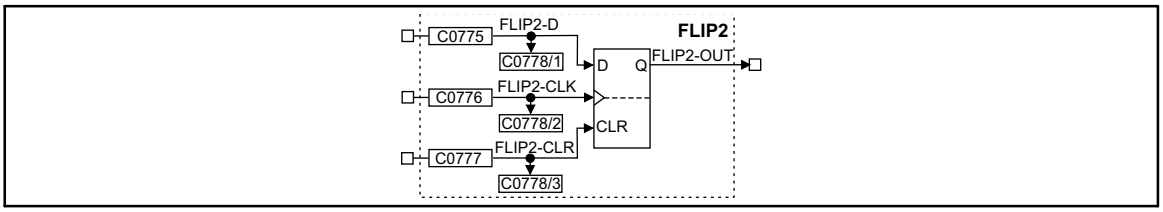


Fig. 3-91 Flipflop element (FLIP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP2-D	d	C0778/1	bin	C0775	2	1000	-
FLIP2-CLK	d	C0778/2	bin	C0776	2	1000	Evaluates LOW-HIGH edges only
FLIP2-CLR	d	C0778/3	bin	C0777	2	1000	Evaluates the input level only: input has highest priority
FLIP2-OUT	d	-	-	-	-	-	-

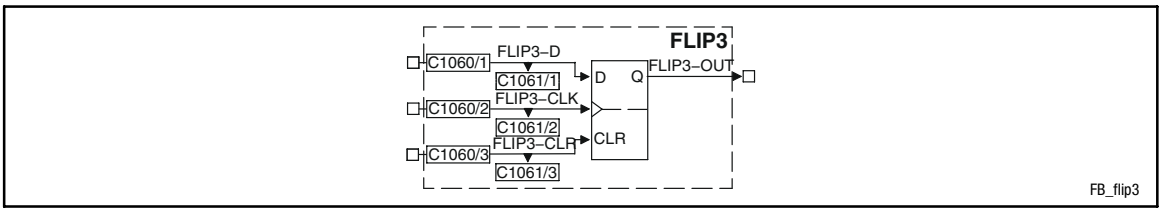


Fig. 3-92 Flipflop element (FLIP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP3-D	d	C1061/1	bin	C1060/1	2	1000	-
FLIP3-CLK	d	C1061/2	bin	C1060/2	2	1000	Evaluates LOW-HIGH edges only
FLIP3-CLR	d	C1061/3	bin	C1060/3	2	1000	Evaluates the input level only: input has highest priority
FLIP3-OUT	d	-	-	-	-	-	-

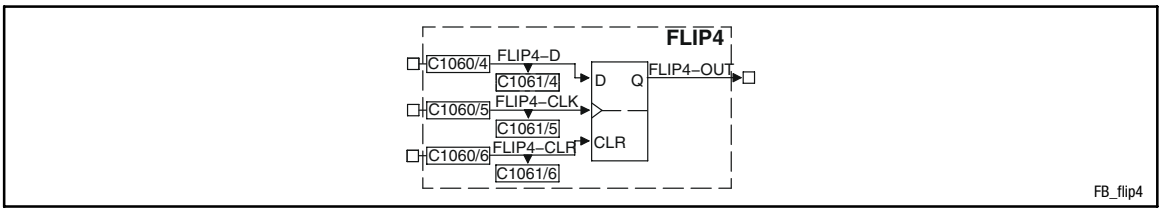


Fig. 3-93 Flipflop element (FLIP4)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP4-D	d	C1061/4	bin	C1060/4	2	1000	-
FLIP4-CLK	d	C1061/5	bin	C1060/5	2	1000	Evaluates LOW-HIGH edges only
FLIP4-CLR	d	C1061/6	bin	C1060/6	2	1000	Evaluates the input level only: input has highest priority
FLIP4-OUT	d	-	-	-	-	-	-

Function

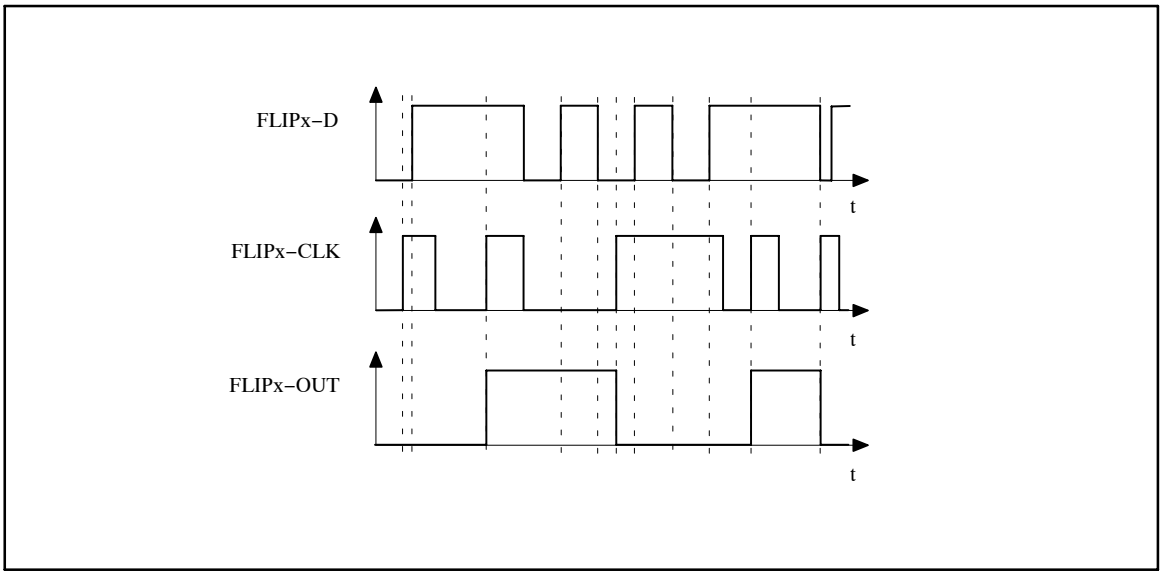


Fig. 3-94 Function sequence of a flipflop

- The input FLIPx-CLR always has priority.
- If a HIGH level is applied at the input FLIPx-CLR, the output FLIPx-OUT is set to and maintained at a LOW level al long as this input is at a HIGH level.
- With a LOW-HIGH edge at the input FLIPx-CLK, the level at the input FLIPx-D is switched to the output and saved until
  – another LOW-HIGH edge is applied at the input FLIPx-CLK or
  – the input FLIPx-CLR is set to a HIGH level.

3.2.37 Gearbox compensation (GEARCOMP)

Purpose

Compensates elasticities in the drive train (e.g. gearbox torsion).

Implementation of an adaptive linkage of e.g. the phase setpoint (32 bits) and the torque feedforward control (14 bits).

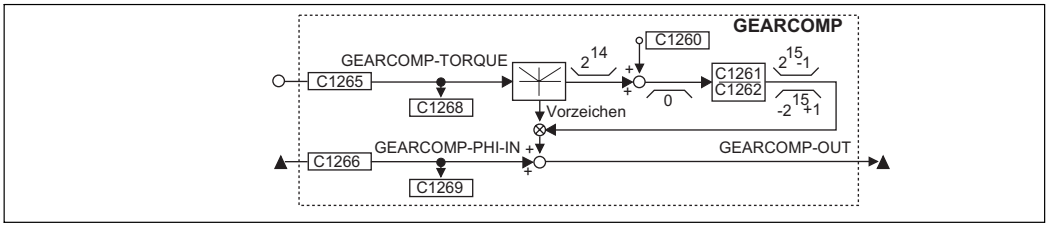


Fig. 3-95 Gearbox compensation (GEARCOMP)

Signal				Source		Comment
Name	Type	DIS	DIS format	CFG	List	
GEARCOMP-TORQUE	a	C1268	dec [%]	C1265	2	Input value
GEARCOMP-PHI-IN	ph	C1269	dec [inc]	C1266	3	
GEARCOMP-OUT	ph	-	-	-	-	Outputs the compensated phase setpoint.

Function

- The signal at GEARCOMP-TORQUE is broken down into the absolute value and the sign.
  – The absolute value is limited to 2^{14} (+16384) first.
- The absolute value is converted (via C1260, C1261, C1262).
- The result is evaluated with the sign and is added to the signal at GEARCOMP-PHI-IN.

Codes for the conversion of the absolute value:

Code	Function	Selection			Comment
C1260	Offset	-16383	{1}	16383	
C1261	Numerator	-32767	{1}	32767	Dynamic disconnection at C1261 = 0 (GEARCOMP-PHI-IN = GEARCOMP-OUT)
C1262	Denominator	1	{1}	32767	

3.2.38 Limiting element (LIM)

Purpose

This FB is used to limit signals to adjustable value ranges.

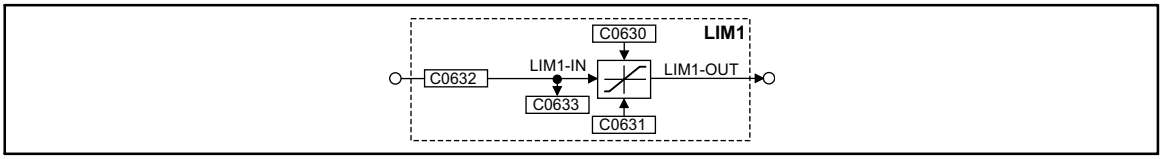


Fig. 3-96 Limiting element (LIM1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIM1-IN1	a	C0633	dec [%]	C0632	1	1000	-
LIM1-OUT	a	-	-	-	-	-	-

Function

- If the input signal exceeds the upper limit (C0630), the upper limit is effective.
- If the input signal falls below the lower limit (C0631), the lower limit is effective.

Tip!

The lower limit (C0631) must be smaller than the upper limit (C0630).

3.2.39 Internal motor control (MCTRL)

Purpose

This function block controls the drive machine consisting of angle controller, speed controller, and motor control.

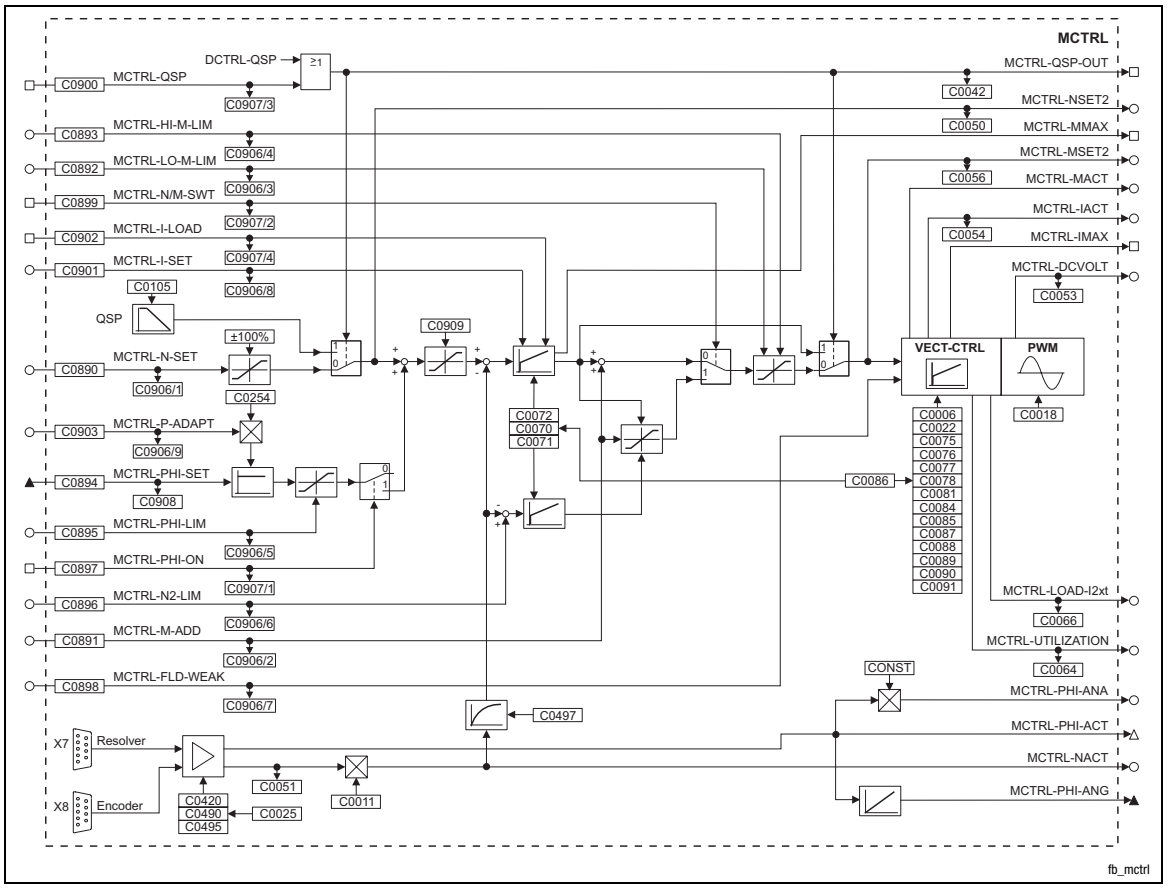
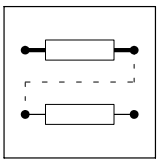


Fig. 3-97 Internal motor control (MCTRL)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MCTRL-PHI-SET	ph	C0908	dec [inc]	C0894	3	1000	Angle controller input for difference of setpoint angle to actual angle
MCTRL-N-SET	a	C0906/1	dec [%]	C0890	1	5050	Speed setpoint input
MCTRL-M-ADD	a	C0906/2	dec [%]	C0891	1	1000	Additional torque setpoint or torque setpoint
MCTRL-LO-MLIM	a	C0906/3	dec [%]	C0892	1	5700	Lower torque limitation in % of C0057
MCTRL-HI-MLIM	a	C0906/4	dec [%]	C0893	1	19523	Upper torque limitation in % of C0057
MCTRL-PHI-LIM	a	C0906/5	dec [%]	C0895	1	1006	Influence of angle controller in % of nmax C0011
MCTRL-N2-LIM	a	C0906/6	dec [%]	C0896	1	1000	Lower speed limit at speed limitation
MCTRL-FLDWEAK	a	C0906/7	dec [%]	C0898	1	1006	Motor excitation
MCTRL-I-SET	a	C0906/8	dec [%]	C0901	1	1006	Input for setting the I component of the speed controller
MCTRL-P-ADAPT	a	C0906/9	dec [%]	C0903	1	1006	Influence in % on V_P of C0254, the absolute value is processed (without sign)
MCTRL-PHI-ON	d	C0907/1	bin	C0897	2	1000	HIGH = Activation of angle controller
MCTRL-N/M-SWT	d	C0907/2	bin	C0899	2	1000	LOW = active speed control HIGH = active torque control
MCTRL-QSP	d	C0907/3	bin	C0900	2	10250	HIGH = drive performs QSP
MCTRL-I-LOAD	d	C0907/4	bin	C0902	2	1000	HIGH = I component of the n-controller is accepted by MCTRL-I-SET
MCTRL-QSP-OUT	d	-	-	-	-	-	HIGH = drive performs QSP
MCTRL-NSET2	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-MMAX	d	-	-	-	-	-	HIGH = speed controller operates within the limits
MCTRL-MSET2	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-MACT	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-IACT	a	-	-	-	-	-	MCTRL-IACT = 100 % = C0022
MCTRL-IMAX	d	-	-	-	-	-	HIGH = drive operates at the current limit C0022
MCTRL-DCVOLT	a	-	-	-	-	-	100 % = 1000 V
MCTRL-LOAD-I2xt	a	-	-	-	-	-	$I^2 \times t$ utilisation of the motor in %
MCTRL-UTILIZATION	a	-	-	-	-	-	Device utilisation $I \times t$ in %
MCTRL-PHI-ANA	a	-	-	-	-	-	Actual angle value as analog signal 90° = 100 %
MCTRL-PHI-ACT	phd	-	-	-	-	-	
MCTRL-NACT	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-PHI-ANG	ph	-	-	-	-	-	65536 inc = one revolution

Function

- Current controller
- Torque limitation
- Additional torque setpoint
- Speed controller
- Torque control with speed limitation
- Speed setpoint limitation
- Angle controller
- Quick stop QSP
- Field weakening
- Switching frequency changeover

3.2.39.1 Current controller

Adapt current controller via C0075 (proportional gain) and C0076 (reset time) to the machine connected.

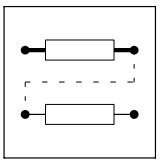
Note!

Use C0086 to select a suitable motor from the motor selection list. In this way, the parameters of the current controller are automatically set to the correct values.

3.2.39.2 Additional torque setpoint

The input MCTRL-M-ADD serves as torque setpoint or additional torque setpoint, depending on the control of the input MCTRL-N/M-SWT. The additional torque setpoint can be used e.g. for friction compensation or speed injection (dv/dt).

- When MCTRL-N/M-SWT = LOW the speed control is active.
  - MCTRL-M-ADD is added to the output of the n-controller.
  - The limits defined by the torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM cannot be exceeded.
- When MCTRL-N/M-SWT = HIGH, the torque control is active.
  - MCTRL-M-ADD acts as torque setpoint
  - The n-controllers have a monitoring function.
- The torque setpoint is specified in [%] of the max. possible torque (see C0057).
  - Negative values mean a torque with CCW rotation of the motor.
  - Positive values mean a torque with CW rotation of the motor.



3.2.39.3 Torque limitation

Via the inputs MCTRL-LO-M-LIM and MCTRL-HI-M-LIM an external torque limitation can be set. This serves to set different torques for the quadrants ”driving” and ”braking”.

- MCTRL-HI-M-LIM is the upper torque limit in [%] of the max. possible torque (C0057).
- MCTRL-LO-M-LIM is the lower torque limit in [%] of the max. possible torque (C0057).
- In case of quick stop (QSP) the torque limitation is deactivated.

Stop!

Only apply positive values to MCTRL-HI-M-LIM and negative values to MCTRL-LO-M-LIM. Otherwise the speed controller may lose control and the drive may rev up in an uncontrolled manner.

3.2.39.4 Speed controller

The speed controller is designed as an ideal PID controller.

Parameter setting

If you select a motor via C0086, the parameters are preset so that only a few (if any) adaptations to the application are necessary.

- Parameterisation of the proportional gain V_p in C0070:
  - Enter approx. 50 % of the speed setpoint
  - Increase C0070 until the drive becomes unstable (observe motor noises)
  - Reduce C0070 until the drive runs stable again
  - Reduce C0070 to approx. 50 %
- Parameterisation of the reset time T_n in C0071:
  - Reduce C0071 until the drive becomes unstable (observe motor noises)
  - Increase C0071 until the drive runs stable again
  - Set C0071 to the double value
- Parameterisation of the derivative gain T_d in C0072:
  - Increase C0072 during operation until an optimum behaviour is achieved.

Signal limitation

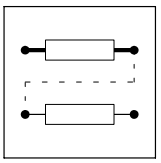
When the drive outputs the max. torque, the speed controller operates within the limits.

- The drive cannot follow the speed setpoint.
- This state is indicated with MCTRL-MMAX = HIGH.

Setting the integral component

To enter defined starting values for the torque the integral component of the n-controller can be set externally (e.g. when using the brake control).

- MCTRL-I-LOAD = HIGH
  - The n-controller accepts the value at input MCTRL-I-SET as its integral component.
  - The value at input MCTRL-I-SET acts as a torque setpoint for the motor control.
- MCTRL-I-LOAD = LOW
  - Function is switched off.



3.2.39.5 Torque control with speed limitation

This function is activated with MCTRL-N/M-SWT = HIGH. A second speed controller (auxiliary speed controller) is connected for the speed limitation.

- MCTRL-M-ADD acts as bipolar torque setpoint.
- The n-controller 1 is used to create the upper speed limit.
  - The upper speed limit is selected at the input MCTRL-N-SET in [%] of nmax (C0011) (pos. sign for CW rotation).
  - The upper speed limit is only to be used for CW rotation.
- The n-controller (auxiliary speed controller) is used to form the lower speed limit
  - The lower speed limit is selected at the input MCTRL-N2-LIM in [%] of nmax (C0011) (neg. sign for CCW rotation).
  - The lower speed limit is only to be used for CCW rotation.

3.2.39.6 Speed setpoint limitation

The speed setpoint is limited to ±100 % of nmax (C0011) at the MCTRL-N-SET input.

C0909 is used to set a limitation of the direction of rotation for the speed setpoint.

3.2.39.7 Angle controller

The angle controller is required to achieve angular synchronism and drift-free standstill.

Note!

Select a configuration with digital frequency coupling in C0005 since this serves to link all important signals automatically. On this basis the system can be optimised.

Activating the angle controller

1. Configure a signal source with C0894, which provides the angular difference between setpoint and actual angle (see ”Digital frequency configuration under C0005).
2. Select a value > 0 at the MCTRL-PHI-LIM input.
3. Trigger the input MCTRL-PHI-ON with HIGH (e.g. with FIXED1).
4. Set the gain of the angle controller > 0 in C0254 (see chapter 3.2.39.4)
   – Before setting C0254, select an as high as possible P-gain for the n-controller in C0070.
   – Increase C0254 during operation until the drive shows the required control response.

Influence of angle controller

The output of the angle controller is added to the speed setpoint.

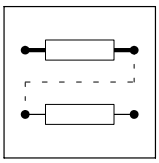
- If the actual angle is lagging, the drive is accelerated
- If the actual angle is leading the drive is decelerated until the required angular synchronism is achieved.

The influence of the angle controller consists of:

- Angular difference multiplied by the P-gain C0254
- Additional influence via analog signal at MCTRL-P-ADAPT
- Limitation of the angle controller output to ±MCTRL-PHI-LIM

Limitation of the angle controller output

This limits the max. speed-up of the drive at high angular differences.



3.2.39.8 Quick stop QSP

The QSP function is used to stop the drive within an adjustable time independently of the setpoint selection.

The QSP function is active

- if the input MCTRL-QSP is triggered with HIGH.
- if the controller is triggered via the control words (DCTRL).

Function:

- If torque control has been selected, it will be deactivated. The drive is controlled by the speed controller.
- The speed runs with the deceleration time set under C0105 to zero speed.
- The torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM are deactivated.
- The angle controller is activated. If the rotor position is shifted actively, the drive generates a torque against this displacement if:
  - C0254 is not zero
  - The input MCTRL-PHI-LIM is triggered with a value > 0 %.

Stop!

If the field is weakened manually (MCTRL-FLD-WEAK < 100%), the drive is unable to generate the max. torque.

3.2.39.9 Field weakening

The field weakening range does not need to be set if the motor type has been set in C0086. In this case all settings required are made automatically. The motor is operated in the field weakening mode if

- the output voltage of the controller exceeds the rated motor voltage set in C0090,
- the controller cannot increase the output voltage with rising speed any more because of the mains voltage / DC-bus voltage.

Manual field weakening

A manual field weakening is possible via the input MCTRL-FLD-WEAK. For reaching the maximum excitation this input must be triggered with +100 % (e.g. FIXED100%).

Stop!

The available torque is reduced by the field weakening.

3.2.39.10 Switching frequency changeover

The switching frequency of the inverter can be selected:

- 8 kHz fixed, for power-optimised operation (C0018 = 1)
  – maximum power output of the controller, but with audible pulse operation
- 16 kHz fixed, for noise-optimised operation (C0018 = 2)
  – inaudible pulse operation of the controller, but with reduced power output (torque)
- Automatic changeover between power-optimised and noise-optimised operation (C0018 = 0)

Automatic switching frequency changeover

The automatic switching frequency changeover can be used if the drive is to be operated in the noise-optimised range, but the available torque is not sufficient for acceleration processes.

Condition M = f(I)	Function
$M < M_{N16}$ (I_{N16})	Controller is operated with 16 kHz (noise-optimised)
M_{N16} (I_{N16}) $< M < M_{N8}$ (I_{N8})	Controller switches over to 8 kHz (power-optimised)
$M > M_{max8}$ (I_{max8})	Controller operates with 8 kHz in the current limitation

3.2.40 Mains failure control (MFAIL)

Purpose

If the supply voltage via L1, L2, L3 or +UG, -UG fails, the drive (drive network) can be decelerated (braked) in a controlled way. Without this function, the drive (drive network) would coast.

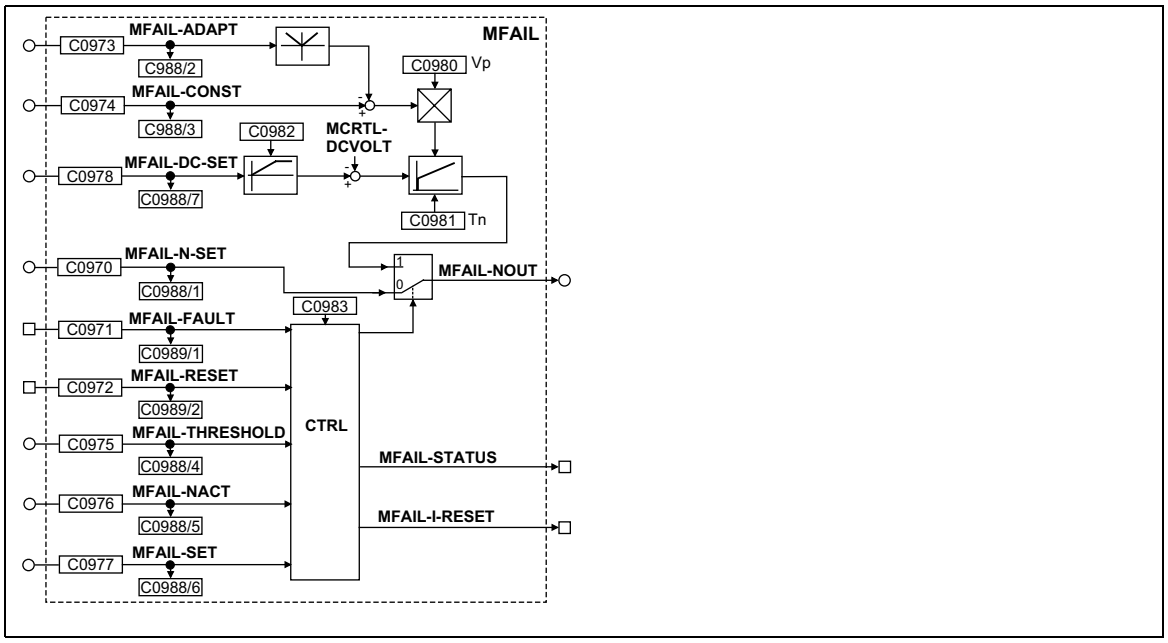


Fig. 3-98 Mains failure control (MFAIL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MFAIL-N-SET	a	C0988/1	dec [%]	C0970	1	1000	Speed setpoint in [%] of C0011
MFAIL-ADAPT	a	C0988/2	dec [%]	C0973	1	1000	Dynamic adaptation of the proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-KONST	a	C0988/3	dec [%]	C0974	1	1000	Proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-THRESHOLD	a	C0988/4	dec [%]	C0975	1	1000	Restart threshold in [%] of C0011
MFAIL-NACT	a	C0988/5	dec [%]	C0976	1	1000	Comparison value for the restart threshold in [%] of C0011
MFAIL-SET	a	C0988/6	dec [%]	C0977	1	1000	Speed start point for the deceleration in [%] of C0011
MFAIL-DC-SET	a	C0988/7	dec [%]	C0978	1	1000	Voltage setpoint on which the DC bus voltage is to be maintained, 100% = 1000V
MFAIL-FAULT	d	C0989/1	bin	C0971	2	1000	HIGH = activates the mains failure control
MFAIL-RESET	d	C0989/2	bin	C0972	2	1000	HIGH = reset
MFAIL-N-OUT	a	-	-	-	-	-	Speed setpoint in [%] of C0011
MFAIL-STATUS	d	-	-	-	-	-	HIGH = mains failure control active
MFAIL-I-RESET	d	-	-	-	-	-	HIGH = mains failure control active, the drive is braking

Range of functions

- Mains failure detection
- Mains failure control
- Restart protection
- Reset of the mains failure control
- Dynamic adaptation of the control parameters
- Fast mains recovery (KU)
- Application examples

3.2.40.1 Mains failure control

A failure of the controller's power section supply can be detected by

- evaluating the DC-bus voltage or
- an external system for mains failure detection (e.g. 934X module or voltage measuring relay).

It is possible to combine the two methods.

The type of the mains failure detection to be used depends on the drive system used.

DC-bus voltage evaluation

Use with single drives or multi-axis drives, which do not use external monitoring systems.

- For this you can use a comparator (e.g. CMP2). Set the following signal combinations:
  - C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - C0971 = 10655 (CMP2-OUT to MFAIL-FAULT)
  - Set function of the comparator CMP2 with C0685 = 3

Enter the function blocks CMP2 and MFAIL into free positions of the processing table in C0465.

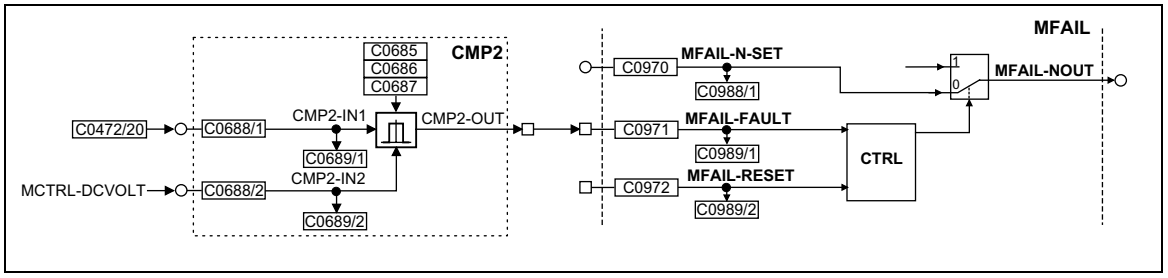


Fig. 3-99 Example of a mains failure detection with internal function blocks (section)

External system for mains failure detection (934x supply module)

- A digital output of the supply module 934x is applied to the function block MFAIL via the digital inputs DIGIN of the controller 93XX. In the example the input X5/E4 is used. For this purpose the signal combination must be set as follows:
  - C0971 = 54 (DIGIN4 to MFAIL-FAULT)
  - C0871 = 1000 (remove DCTRL-TRIP-SET from terminal X5/E4)
  - Select level (HIGH or LOW active) with C0114/4

Enter the function block MFAIL into a free position of the processing table in C0465.

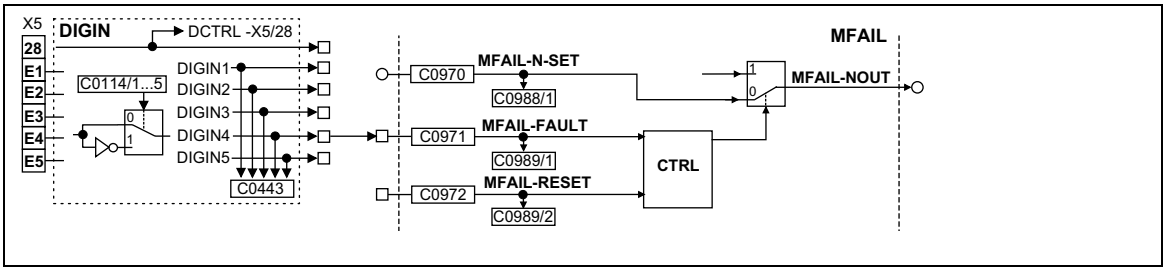


Fig. 3-100 Example of a mains failure detection by an external monitoring system

Combination of the two methods

- The combination of both processes is done via an OR operation with an internal function block. In the example, OR5 is used. For this, set the following signal combinations:
  - C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - Set function of the comparator CMP2 with C0685 = 3
  - C0838/1 = 10655 (CMP2-OUT to OR5-IN1)
  - C0838/2 = 54 (DIGIN5 to OR5-IN2)
  - C0971 = 10570 (OR5-OUT to MFAIL-FAULT)

Enter the function blocks CMP2, OR5 and MFAIL into free positions of the processing table in C0465.

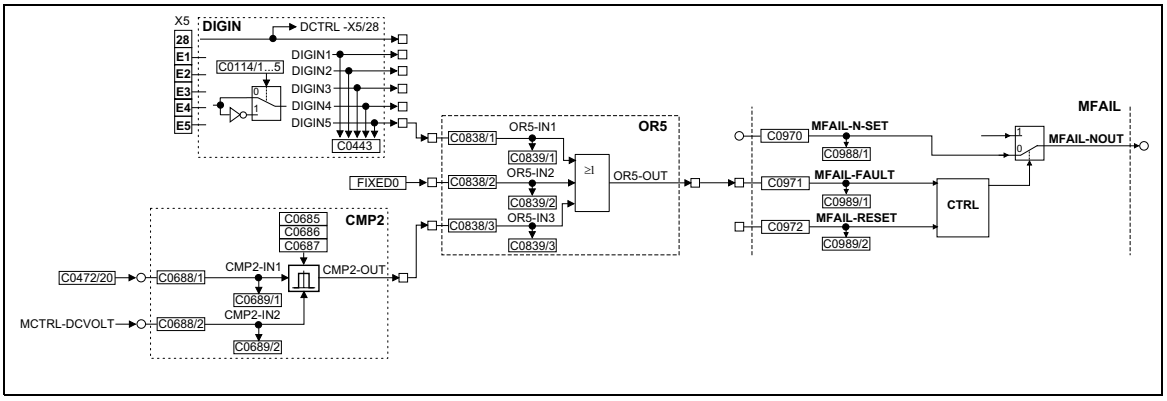


Fig. 3-101 Example of a mains failure detected by different sources

3.2.40.2 Mains failure control

Integration of the function block into the signal flow of the controller

As an example, the function block is integrated into the basic configuration C0005 = 1000 (speed control).

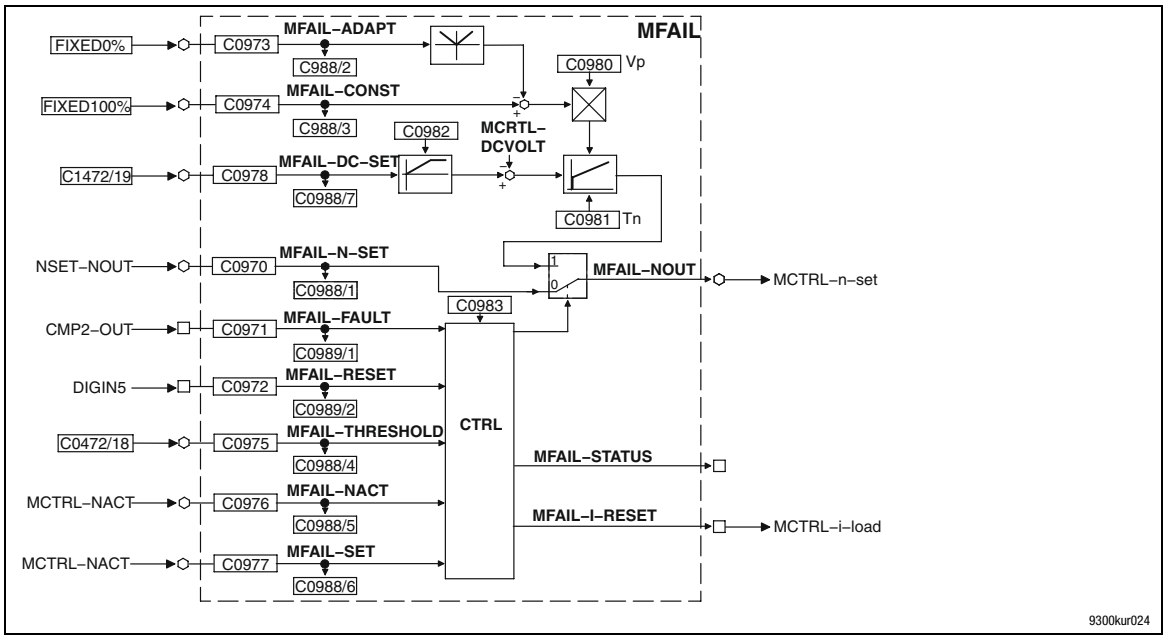
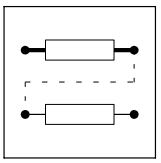


Fig. 3-102 Linkage for the base configuration C0005 = 1000

1. Create speed setpoint path	• C0970 = 5050 (NSET-NOUT to MFAIL-N-SET) • C0890 = 6100 (MFAIL-NOUT to MCTRL-N-SET)
2. Start value selection (here: act. speed value)	• C0977 = 6100 (MFAIL-NOUT to MFAIL-SET)
3. Selection of setpoint source for DC-bus voltage (here: by the freely connectable code FCODE C0472/19)	• C0978 = 19539 (C0472/19 to MFAIL-DC-SET)
4. Selection of source which activates the mains failure control	• see chapter 3.2.40.1
5. Adaptation of proportional gain and DC-bus voltage controller	• C0974 = 1006 (FIXED100% to MFAIL-CONST) • C0973 = 1000 (FIXED0% to MFAIL-ADAPT)
6. Achieve restart protection	• C0976 = 6100 (MFAIL-NACT to MCTRL-NACT) • C0975 = 19538 (C0472/18 to MFAIL-THRESHLD) • First enter approx. 2 % under C0472/18 (reference: nmax C0011)
7. Connect reset input (here with terminal X5/E5 TRIP-RESET)	• C0972 = 55 (DIGIN5 to MFAIL-RESET)
8. Enter all function blocks used (except for codes and digital inputs DIGIN) into free positions of the processing table in C0465.	

Note!

All settings must be saved non-volatile in a parameter set under C0003.



Activation

- MFAIL-FAULT = HIGH activates the mains failure control.
- MFAIL-FAULT = LOW triggers a timing element. After the time set under C0983 has elapsed, the mains failure control is completed/cancelled (see description of mains recovery, chapter 3.2.40.6).
  - The drive is accelerated to the speed setpoint if the restart protection is not active.
  - The drive is continued to be braked to zero speed if the restart protection is active (see description for restart protection, chapter 3.2.40.3).
  - If the restart protection is active, the drive can only be reset by a HIGH level signal at the MFAIL-RESET input.

Function

The controller generates the operational energy required from the rotational energy of the driving machine. The driving machine is braked via the power loss of the controller and the motor. Thus, the speed deceleration ramp is shorter than with a non-controlled system (coasting drive).

With the activation,

- the DC bus voltage is controlled to the value at the MFAIL-DC-SET input.
- An internally generated speed setpoint is output at output MFAIL-N-OUT. This serves to brake the drive (via the speed setpoint) to a speed of almost zero.
  - Starting value for the controlled deceleration is the value at input MFAIL-SET. This input is generally connected to the output MCTRL-NACT (actual speed value) or MCTRL-NSET2, MFAIL-NOUT (speed setpoint).
  - The speed deceleration ramp (and thus the brake torque) results from the moment of inertia of the driven machine(s), the power loss, and the parameterisation.

Stop!

- If a connected braking unit is activated, the drive is braked with the max. possible torque (Imax). In this case, the parameter setting can be adapted, if required (see description for parameter setting).
- If the power stage is not supplied, the drive cannot generate a standstill torque (important for active loads such as hoists).

Parameter setting

The parameters to be set depend strongly on the motor used, the inertia of the driven machine and the drive configuration (single drive, drive network, master/slave operation etc.). For this reason, this function must be adjusted to the prevailing application case.

The following specifications refer to chapter 3.2.40.1.

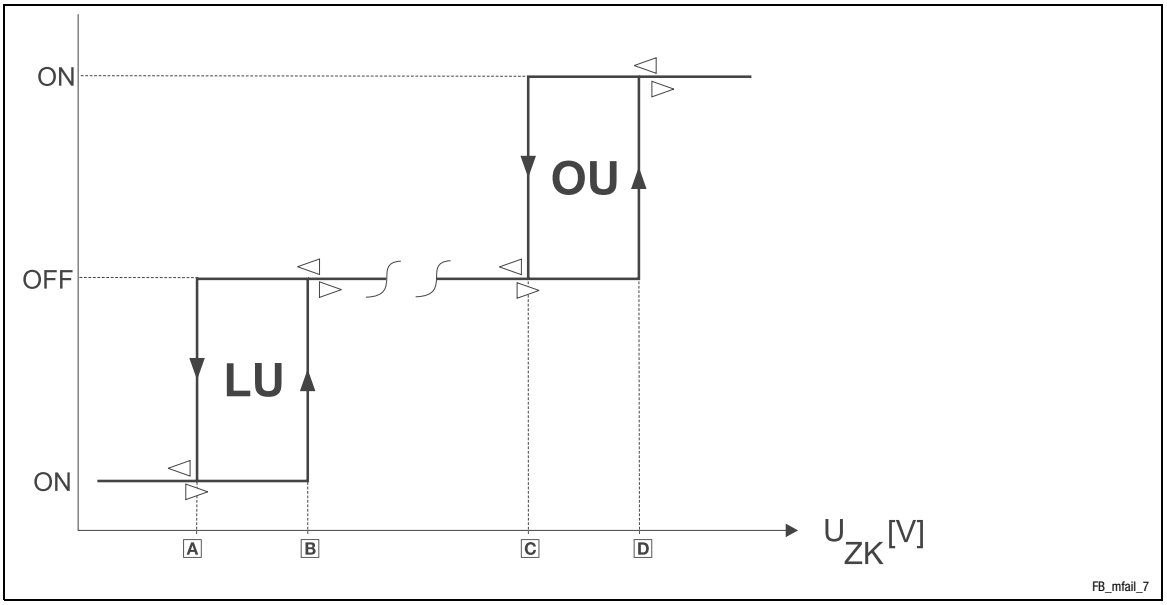
Important settings prior to the initial set-up:

1. Save the previous setting in a parameter set (e.g. parameter set 4)

Stop!

For the internal voltage supply of the terminals (C0005 = xx1x) the terminal X6/63 is used as a voltage source for external potentiometers. In this case, measure at the terminals +UG, -UG.

2. Measure the DC bus voltage with an oscilloscope (channel 1)
   – with a suitable voltage divider across terminals +UG, -UG. or
   – by outputting the DC-bus voltage e.g. to terminal X6/62. For this purpose set C0436 = 5005 (MCTRL-DCVOLT). 1 V at terminal X6/63 = 100 V to +UG, -UG.
3. Measure the speed with an oscilloscope (channel 2)
   – by outputting the speed e.g. to terminal X6/62. (Standard setting). For this purpose set C0431 = 5001 (MCTRL-NACT). 10 V to terminal X6/62 = nmax (C0011).
4. Defining the operating threshold for the mains failure detection in C0472/20. The definition depends on the setting in C0173.
   – Set the operating threshold approx. 50 V above the LU switch-off threshold (e.g. C0173 = 0, 1; C0472/20 = 48 % $\triangleq$ 480 V).



Mains voltage range	C0173	Message LU		Message OU	
		A	B	C	D
< 400 V	0	285 V	430 V	755 V	770 V
400 V	1	285 V	430 V	755 V	770 V
400 V ... 460 V	2	328 V	473 V	755 V	770 V
480 V without brake chopper	3	342 V	487 V	755 V	770 V
Operation with brake chopper (up to 480 V)	4	342 V	487 V	785 V	800 V
		DC-bus voltage (U_{ZK})			

Stop!

This setpoint must be below the operating threshold of a possibly connected braking unit. If a connected braking unit is activated, the drive will be braked with the max. possible torque (Imax). The desired operational performance gets lost.

5. Set the setpoint on which the DC bus voltage is to be controlled:
   – Set the setpoint to approx. 700 V (C0472/19 = 70 %).

Commissioning

The commissioning should be carried out with motors without load.

1. The drive can be started with a LOW-HIGH edge at X5/E5.
2. Set the acceleration time Tir:
   – Set speed setpoint to 100%, operate controller with maximum speed.
   – Inhibit controller via terminal X5/28 (you can also use any other controller inhibit source, CINH) and measure deceleration time until standstill.
   – Set approx. 1/10 of the deceleration time in C0982.
3. Setting the retrigger time

- In case of mains failure detection by detecting the DC bus voltage level:
  – Set measured deceleration time from item 2. under C0983.
- In case of mains failure detection via an external system (e.g. supply module 934X):
  – Under C0983, set the time in which the drive is to be continued to be braked in a controlled way for short-term mains recovery.

4. Switch off supply voltage (mains or DC bus).

The oscilloscope should display the following characteristic:

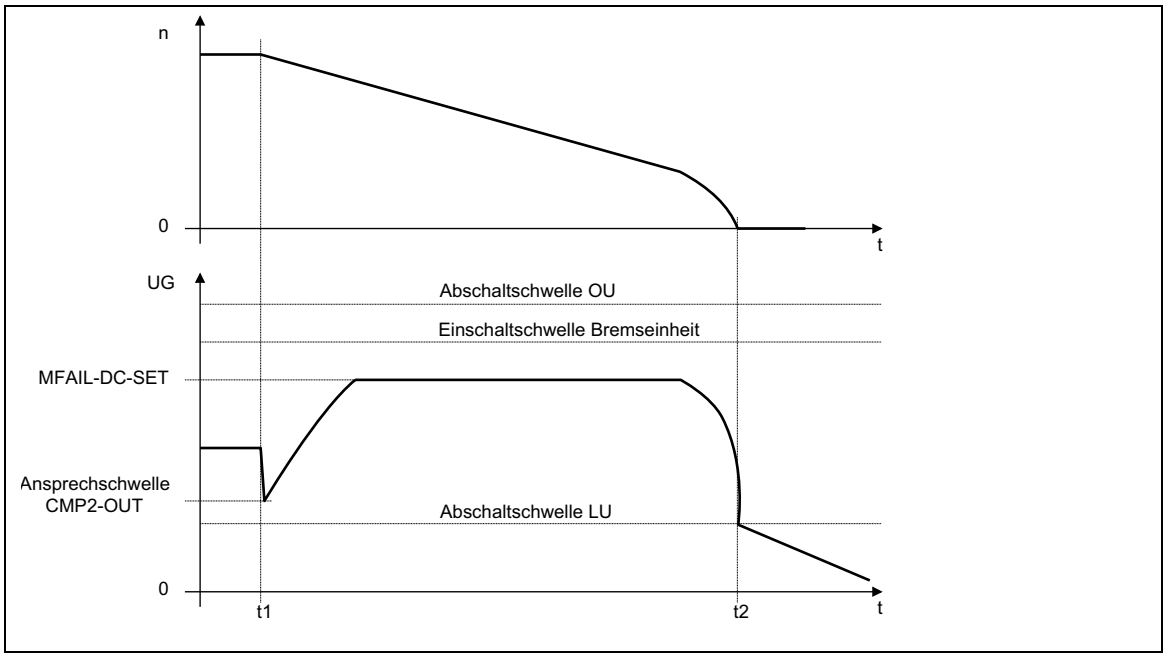


Fig. 3-103 Schematic representation with activated mains failure control (ideal characteristic)

t1 Mains failure
t2 Zero speed reached

Fine setting

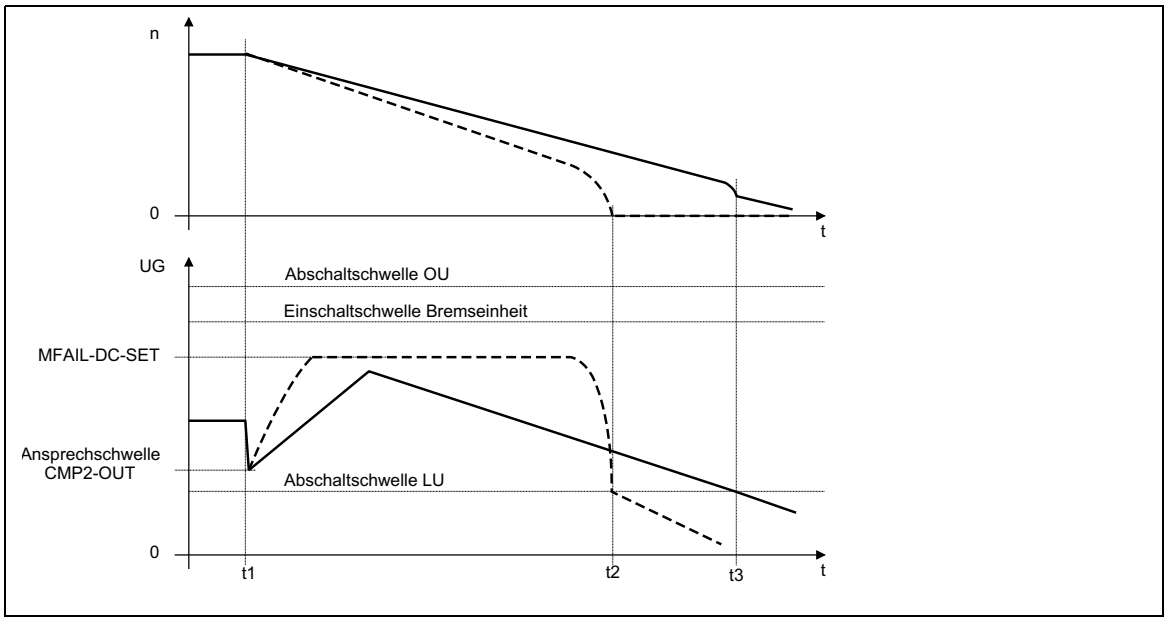


Fig. 3-104 Schematic with different brake torques

t = t1	Mains failure
t = t2	Zero speed with higher braking torque (short adjustment time)
t = t3	Drive reaches the LU switch-off threshold with lower brake torque (higher adjustment time) without reaching speed 0
t > t3	Drive is no longer controlled (is braked by friction)

Repeat the following steps several times.

1. Obtaining a very low final speed before the controller reaches the undervoltage threshold LU:
   – Increasing the proportional gain MFAIL V_p (C0980).
   – Decreasing the integral-action time MFAIL T_n (C0981).
2. Avoid activation of the brake unit or the overvoltage threshold:
   – Increasing the integral-action time MFAIL T_n (C0981) until the characteristic in Fig. 3-103 is almost reached.
   – Reduce additionally the setpoint of the DC bus voltage at the input MFAIL-DC-SET (in the example C0472/19), if necessary.

3. Increase of the deceleration time or reduction of the brake torque (see Fig. 3-104) is only possible with restrictions:
   – An increase of the acceleration time MFAIL T_{ir} (C0982) reduces the initial brake torque and increases the deceleration time.
   – Increasing the integral-action time MFAIL T_n (C0981) decreases the braking torque and simultaneously increases the deceleration time. If C0981 contains too high integral-action times, the controller runs into the LU threshold before speed 0 is reached. Thus, the drive is not controlled anymore.
4. Re-establish possibly required signal connections to the outputs of the controller (terminals X6).

Note!

All settings must be saved non-volatile in a parameter set under C0003.

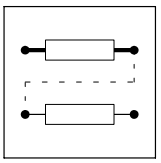
3.2.40.3 Restart protection

The integrated restart protection is to avoid a restart in the lower speed range, after the supply voltage was interrupted for a short time only (mains recovery before the drive has come to standstill).

- How to protect the drive from restart is explained in chapter 3.2.40.2.
- Go to C0472/18 and enter the threshold in [%] of nmax (C0011) if you do not want an automatic restart below this threshold after mains recovery.
  – Speed at mains recovery < threshold in C0472/18: Drive is continued to be braked in a controlled way. This function can only be completed by MFAIL-RESET = HIGH.
  – Speed after mains recovery > threshold in C0472/18 Drive accelerates to its setpoint along the set ramps.
- The function is deactivated by:
  – C0472/18 = 0 % or
  – C0975 = 1000 (FIXED0% to MFAIL-THRESHLD)
- Reset with MFAIL-RESET = HIGH
  – is required after every mains connection
  – is displayed by MFAIL-STATUS = HIGH, if MFAIL-FAULT = LOW

3.2.40.4 Reset of the mains failure control

- The mains failure control is reset with MFAIL-RESET = HIGH (in the example with terminal X5/E5).
- The reset pulse is always required if:
  – the restart protection is active.
  – the restart protection is used and the supply (mains or DC supply) was switched on.



3.2.40.5 Dynamic adaptation of the control parameters

In special cases a dynamic change of the proportional gain may be sensible. For this purpose, the function block MFAIL is provided with two inputs (MFAIL-CONST and MFAIL-ADAPT). The resulting proportional gain arises from:

$$V_p = C0980 \cdot \frac{\text{MFAIL-CONST} - |\text{MFAIL-ADAPT}|}{100\ \%}$$

3.2.40.6 Fast mains recovery (KU)

The fast mains recovery leads to the restart of the controller if the restart protection is not activated. Then the drive runs to its setpoint. If this is not required, the restart can be decelerated via the retrigger time C0983 or prevented in connection with the restart protection.

A fast mains recovery occurs:

- Due to the system, the mains recovery is indicated by the mains failure detection via the level of the DC bus voltage (see chapter 3.2.40.1).
- because of a ”short interrupt” (KU) of the utility company (e.g. in case of thunderstorms)
- because of faulty components in the supply cables

Set the retrigger time C0983 higher than the measured deceleration time during braking.

3.2.40.7 Application example

Drive network with pulse train coupling

Stop!

In drive networks which are connected via pulse trains (a master and one or more slaves):

- the mains failure detection may only be activated for the master.
  - the mains failure control must be integrated correspondingly into the signal flow.
- All controllers must be operated via the terminals +UG, -UG in the DC-bus connection. For this, the information in the ”Dimensioning” chapter must be observed.

Note!

Further information and predefined configurations can be obtained from Lenze.

3.2.41 Motor phase failure detection (MLP)

Purpose

Motor phase monitoring.

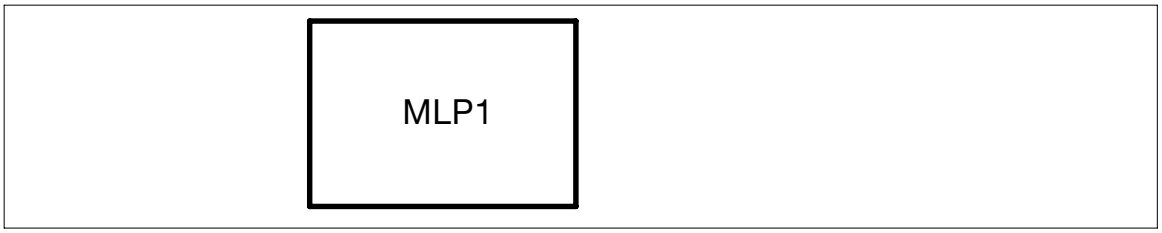


Fig. 3-105 Motor phase failure detection (MLP1)

Code	LCD	Possible settings					Important
		Lenze	Selection				
C0597	MONIT LP1	3	0 2 3	Trip Warning Off			**Conf. LP1** Configuration of motor phase failure monitoring
C0599	LIMIT LP 1	5.0	1.0		{0.1}	10.0	**Current limit LP1** Current limit for motor phase failure monitoring

Function

Detailed descriptions of monitoring systems and error messages can be found in the system manual, document number EDSVS9332P.

The function block MLP1 must be entered in the processing table if the motor phase failure detection is to be used.

3.2.42 Monitor outputs of monitoring system (MONIT)

Purpose

The monitoring functions output digital monitor signals.

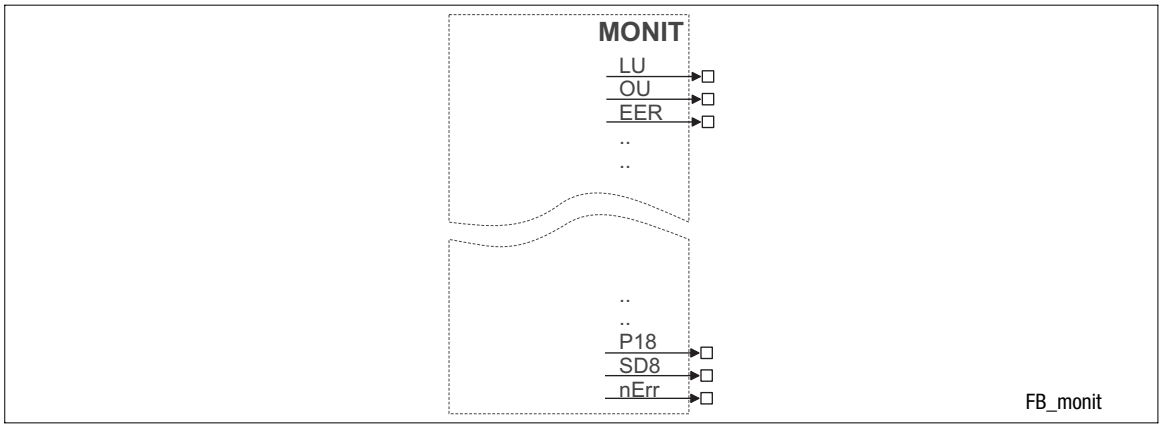


Fig. 3-106 Monitor outputs of the monitoring system (MONIT)

Function

The MONIT outputs switch to HIGH level if one of the monitoring functions responds.

The digital monitor signals respond dynamically, i.e.

- depending on the state of the monitoring function, but
- independently of the selected fault reaction (e.g. TRIP).

Example

MONIT-LP1 (motor phase monitoring) responds if a cable disruption is detected in a motor connection phase, although the fault reaction of LP1 is set to ”Off” (C0597 = 3).

Note!

- With appropriate signal conditioning, the MONIT outputs can be used to locate the cause of malfunction (e.g. by storing the MONIT output signal via the FLIP function block).
- More detailed descriptions of the monitoring functions / error messages can be found in the chapter ”Troubleshooting and fault elimination”.

MONIT outputs

MONIT output	Description
CE0	Communication error - automation interface (AIF)
CE1	Communication error - process data input object CAN1_IN
CE2	Communication error - process data input object CAN2_IN
CE3	Communication error - process data input object CAN3_IN
CE4	BUS-OFF state of system bus (CAN)
EEr	External monitoring, triggered via DCTRL
H05	Internal fault (memory)
H07	Internal fault (power section)
H10	Thermal sensor error - heatsink
H11	Thermal sensor error - inside the device
LP1	Motor phase failure
LU	Undervoltage in the DC bus
nErr	Speed control error
NMAX	Maximum speed (C0596) exceeded
OC2	Earth fault - motor cable
OC5	I x t overload
OC6	I^2 x t overload
OC8	I^2 x t overload advance warning
OH	Heatsink temperature > +90 °C
OH3	Motor temperature > +150 °C threshold (temperature detected via resolver or incremental value encoder)
OH4	Heatsink temperature > C0122
OH7	Motor temperature > C0121 (temperature detected via resolver or incremental value encoder)
OH8	Motor temperature measured via inputs T1 and T2 too high
OU	DC-bus overvoltage
P03	Following error
P16	Faulty transmission of sync telegram on system bus (CAN)
P19	Limitation of input values at X9
PL	Error during rotor position adjustment
Sd2	Resolver error at X7
Sd3	Encoder error at X9
Sd5	Encoder error at X6 pins 1 and 2
Sd6	Thermal sensor error - motor (X7 or X8)
Sd7	Absolute value encoder at X8 Initialisation error or communication error during rotor position adjustment
Sd8	Sin/cos encoder at X8 transmits no or inconsistent data

3.2.43 Motor potentiometer (MPOT)

Purpose

The FB replaces a hardware motor potentiometer.

The motor potentiometer is used as an alternative setpoint source, which is controlled via two terminals.

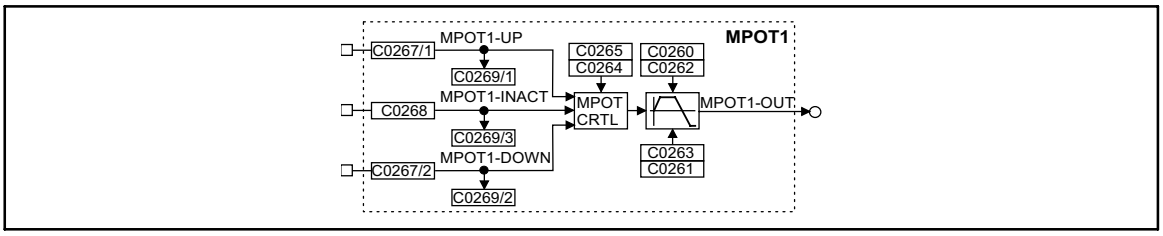


Fig. 3-107 Motor potentiometer (MPOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MPOT1-UP	d	C0269/1	bin	C0267/1	2	1000	-
MPOT1-INACT	d	C0269/3	bin	C0268	2	1000	-
MPOT1-DOWN	d	C0269/2	bin	C0267/2	2	1000	-
MPOT1-OUT	a	-	-	-	-		-

Function

Control of the motor potentiometer:

- MPOT1-UP = HIGH
  – The motor potentiometer approaches its upper limit value.
- MPOT1-DOWN = HIGH
  – The motor potentiometer approaches its lower limit value.
- MPOT1-UP = LOW and MPOT1-DOWN = LOW or
  MPOT1-UP = HIGH and MPOT1-DOWN = HIGH:
  – The motor potentiometer does not change the output signal.

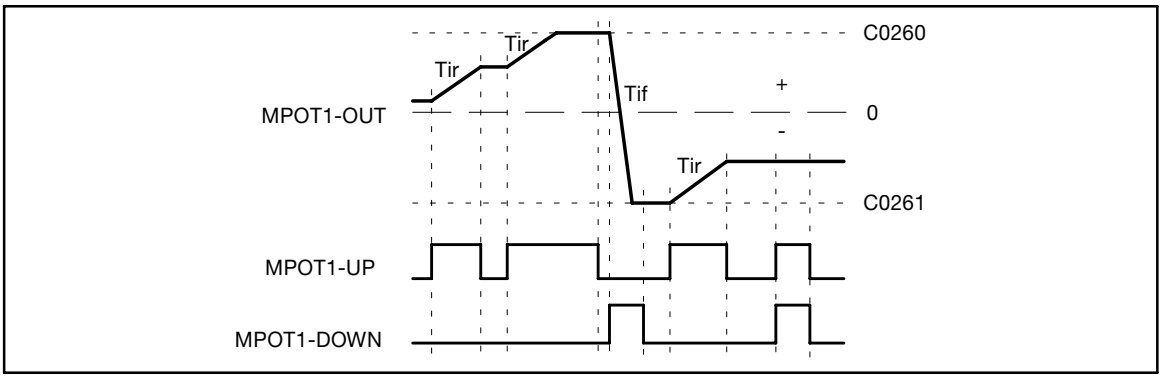


Fig. 3-108 Control signals of the motor potentiometer

In addition to the digital signals MPOT1-UP and MPOT1-DOWN another digital input exists (MPOT1-INACT). The input MPOT1-INACT is used to activate or deactivate the motor potentiometer function. Logic 1 at this input deactivates the motor potentiometer function. The input MPOT1-INACT has priority over the inputs MPOT1-UP and MPOT1-DOWN.

When the motor potentiometer is deactivated, the motor potentiometer output (MPOT1-OUT) follows the function set under C0264. The following functions can be set under C0264:

C0264 =	Meaning
0	No further action; the output MPOT1-OUT keeps its value
1	The motor potentiometer returns to 0 % with the corresponding deceleration time
2	The motor potentiometer approaches the lower limit value with the corresponding deceleration time (C0261)
3	The motor potentiometer immediately changes its output to 0%. **(Important for EMERGENCY-OFF function)**
4	The motor potentiometer immediately changes its output to the lower limit value (C0261)
5	The motor potentiometer approaches the upper limit value with the corresponding acceleration time (C0260)

If the motor potentiometer is activated (input MPOT1-INACT = 0), the subsequent function depends on

- the current output signal,
- the set limit values of the MPOT,
- the control signals UP and DOWN.

If the output value is out of the set limits, the MPOT approaches the next limit with the set T_i times. This function is independent of the control inputs MPOT1-UP and MPOT1-DOWN

If the output value is within the set limits, the output follows the selected control function UP, DOWN or no action.

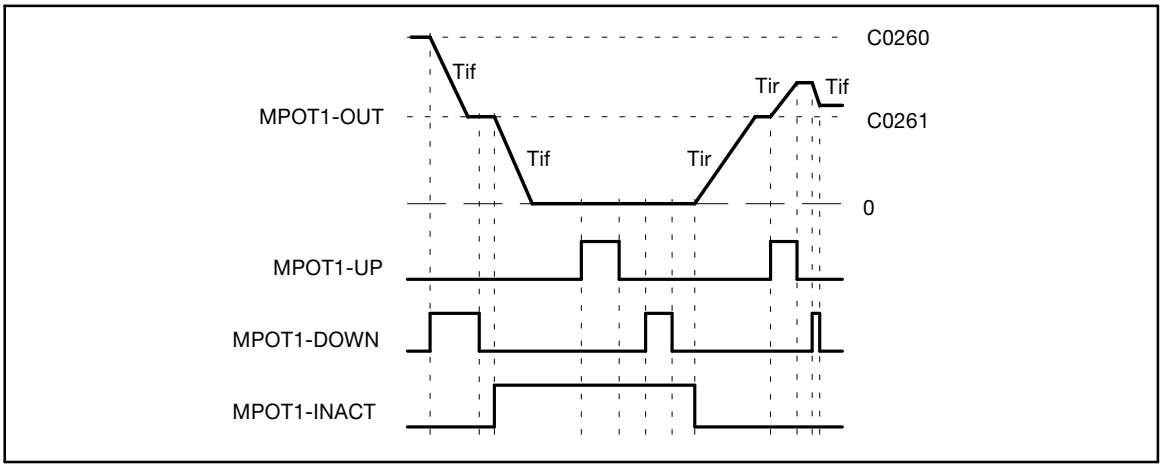


Fig. 3-109 Deactivation of the motor potentiometer via the input MPOT1-INACT

Initialisation

This function is used to store the output value of the MPOT non-volatilely in the internal memory of the device, when the mains is switched off. The value is saved automatically if this function was selected via the code. When the mains is switched on, the value is reloaded into the MPOT.

C0265 can be used to activate other initialisation functions (see code table).

When the initialisation is completed, the MPOT follows the applied control function.

3.2.44 Logic NOT

Purpose

Logic inversion of digital signals. The inversion can be used to control functions or generate status information.

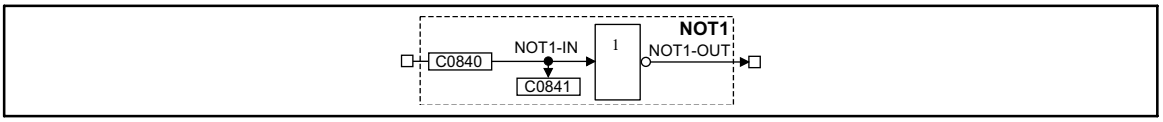


Fig. 3-110 Logic NOT (NOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT1-IN	d	C0841	bin	C0840	2	1000	-
NOT1-OUT	d	-	-	-	-	-	-

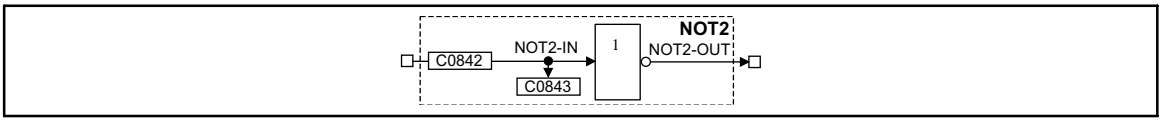


Fig. 3-111 Logic NOT (NOT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT2-IN	d	C0843	bin	C0842	2	1000	-
NOT2-OUT	d	-	-	-	-	-	-

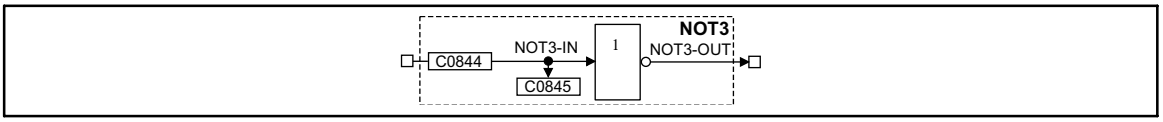


Fig. 3-112 Logic NOT (NOT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT3-IN	d	C0845	bin	C0844	2	1000	-
NOT3-OUT	d	-	-	-	-	-	-

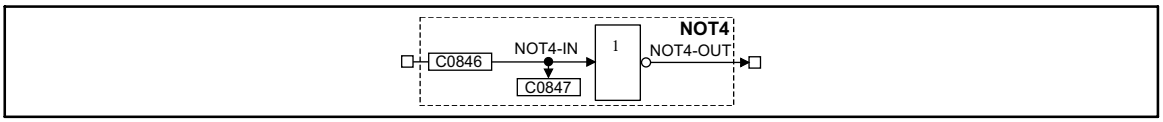


Fig. 3-113 Logic NOT (NOT4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT4-IN	d	C0847	bin	C0846	2	1000	-
NOT4-OUT	d	-	-	-	-	-	-

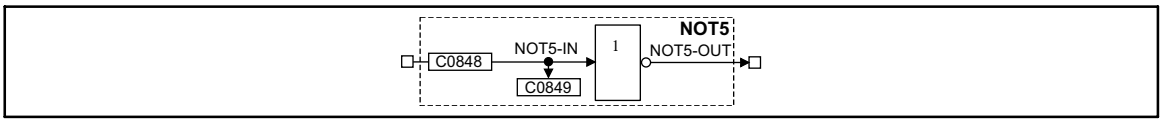


Fig. 3-114 Logic NOT (NOT5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT5-IN	d	C0849	bin	C0848	2	1000	-
NOT5-OUT	d	-	-	-	-	-	-

Function

NOTx-IN1	NOTx-OUT
0	1
1	0

The function corresponds to a change from an NO contact to an NC contact in a contactor control.

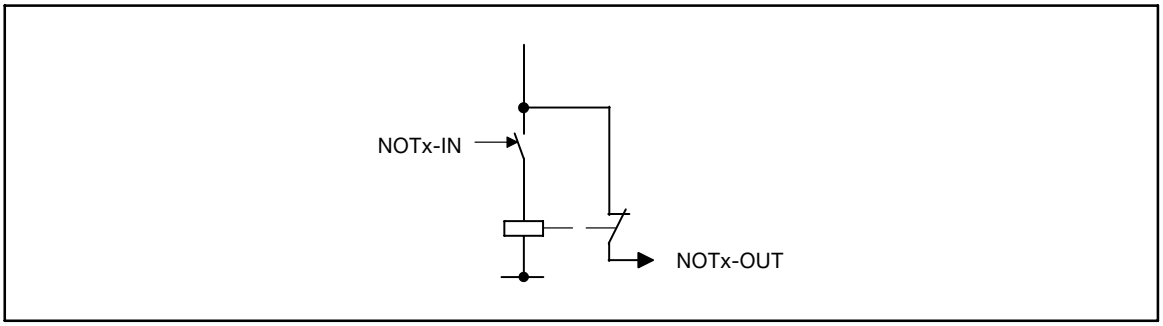


Fig. 3-115 Function of NOT when changing an NO contact to an NC contact.

3.2.45 Speed setpoint conditioning (NSET)

Purpose

This FB conditions

- the main speed setpoint and
- an additional setpoint (or other signals as well)

for the following control structure via ramp function generator or fixed speeds.

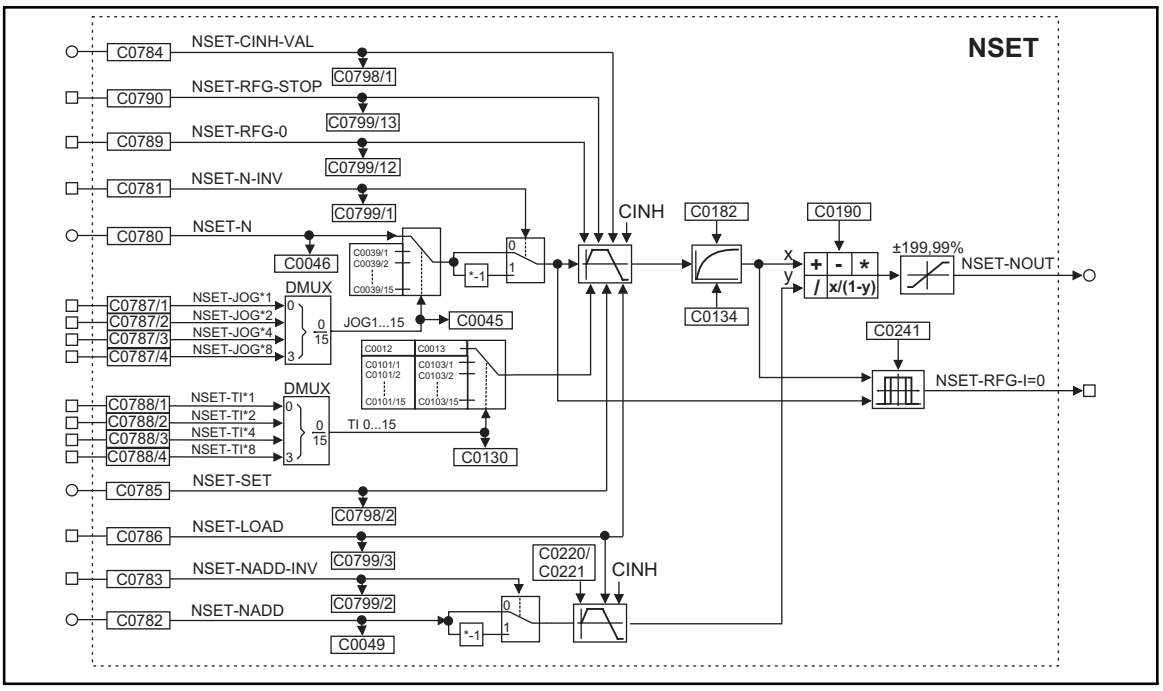
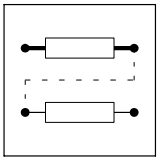


Fig. 3-116 Speed setpoint conditioning (NSET)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	0	C0046	dec [%]	C0780	1	50	Intended for main setpoint, other signals are permissible
NSET-NADD	0	C0047	dec [%]	C0782	1	5650	Intended for additional setpoint, other signals are permissible
NSET-JOG*1	d	C0799/4	bin	C0787/1	2	53	Selection and control of overriding "fixed setpoints" for the main setpoint
NSET-JOG*2	d	C0799/5	bin	C0787/2	2	1000	
NSET-JOG*4	d	C0799/6	bin	C0787/3	2	1000	
NSET-JOG*8	d	C0799/7	bin	C0787/4	2	1000	
NSET-TI*1	d	C0799/8	bin	C0788/1	2	1000	Selection and control of alternative acceleration and deceleration times for the main setpoint
NSET-TI*2	d	C0799/9	bin	C0788/2	2	1000	
NSET-TI*4	d	C0799/10	bin	C0788/3	2	1000	
NSET-TI*8	d	C0799/11	bin	C0788/4	2	1000	
NSET-N-INV	d	C0799/1	bin	C0781	2	10251	Control of the signal inversion for the main setpoint
NSET-NADD-INV	d	C0799/2	bin	C0783	2	1000	Control of the signal inversion for the additional setpoint
NSET-RFG-0	d	C0799/12	bin	C0789	2	1000	The main setpoint integrator is led to zero via the current T_i times.
NSET-RFG-STOP	d	C0799/13	bin	C0790	2	1000	Keeping (freezing) of the main setpoint integrator to its actual value.
NSET-CINH-VAL	0	C0798/1	dec [%]	C0784	1	5001	Here, the signal is applied which is to be accepted by the main setpoint integrator when the controller is inhibited
NSET-SET	0	C0798/2	dec [%]	C0785	1	5000	Here, the signal is applied which is to be accepted by the main setpoint integrator when the NSET-LOAD input is set
NSET-LOAD	d	C0799/3	bin	C0786	2	5001	Control of both ramp function generators in special situations, e.g. QSP
NSET-OUT	0	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

- Main setpoint path
- JOG setpoints
- Setpoint inversion
- S ramp

3.2.45.1 Main setpoint path

- The signals in the main setpoint path are limited to the value range ±199.99 %.
- The signal at input NSET-N is led via the function JOG selection.
- The JOG function has priority over the setpoint input NSET-N. This means a selected JOG value deactivates the input. The subsequent signal conditioning the JOG value instead.

3.2.45.2 JOG setpoints

- Are fixed values which are stored in the memory.
- JOG values can be called from the memory via the inputs NSET-JOG*x.
- The inputs NSET-JOG*x are binary coded so that 15 JOG values can be called.
- The decoding for enabling the JOG values (called from the memory) is carried out according to the following table:

Output signal	1st input NSET-JOG*1	2nd input NSET-JOG*2	3rd input NSET-JOG*4	4th input NSET-JOG*8
NSET-N	0	0	0	0
JOG 1	1	0	0	0
JOG 2	0	1	0	0
JOG 3	1	1	0	0
JOG 4	0	0	1	0
JOG 5	1	0	1	0
JOG 6	0	1	1	0
JOG 7	1	1	1	0
JOG 8	0	0	0	1
JOG 9	1	0	0	1
JOG 10	0	1	0	1
JOG 11	1	1	0	1
JOG 12	0	0	1	1
JOG 13	1	0	1	1
JOG 14	0	1	1	1
JOG 15	1	1	1	1

- When all inputs are assigned with 0, the input NSET-N is active.
- The number of inputs that must be assigned depends on the required number of JOG values. Four inputs and thus 15 possible selections are available. A digital signal source is assigned via C0787 and the corresponding subcode.

Number of required JOG setpoints	Number of inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

3.2.45.3 Setpoint inversion

The output signal of the JOG function is led via an inverter.

The sign of the setpoint is inverted, if the input NSET-N-INV is triggered with HIGH signal.

Ramp function generator for the main setpoint

The setpoint is then led via a ramp function generator with linear characteristic. Setpoint step-changes at the input are thus led into a ramp.

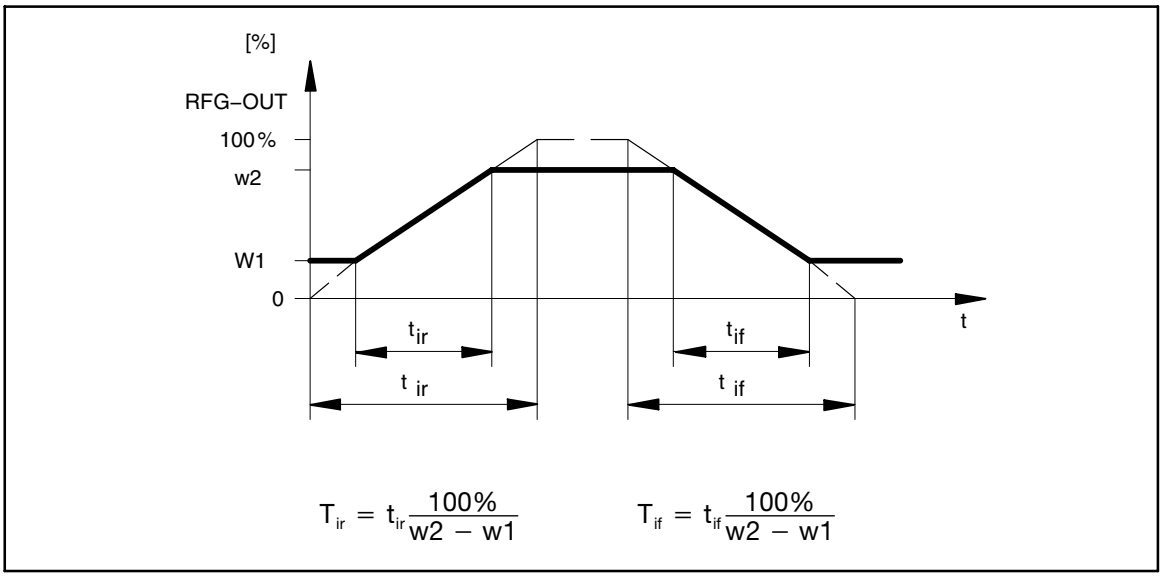


Fig. 3-117 Acceleration and deceleration times of the ramp function generator

- The ramps can be set separately for acceleration and deceleration.
  - Different acceleration and deceleration times can be activated via the inputs NSET-TI*x 16 (for table and function see JOG setpoints; the decoding must be done according to the signal graphic).
  - The T_i times can only be activated in pairs.
- When the controller is inhibited (CINH) the ramp function generator accepts the value that was applied to the input NSET-CINH-VAL and transmits it to the next function. This function has priority over all other functions.
- NSET-RFG-STOP = HIGH
  - The ramp function generator is stopped. Changes at the input of the ramp function generator have no effect on the output.
- NSET-RFG-0 = HIGH
  - The ramp function generator decelerates to zero along the deceleration ramp.
- It is also possible to load the ramp function generator online with a defined value. For this, the input NSET-LOAD must be set to HIGH. As long as this input is set, the value at input NSET-SET is accepted by the ramp function generator and provided the output.

Priorities:

CINH	NSET-LOAD	NSET-RFG-0	NSET-RFG-STOP	Function
0	0	0	0	RFG follows the input value via the set ramps
0	0	0	1	The value at the output of RFG is frozen
0	0	1	0	RFG decelerates to zero along the set deceleration time
0	0	1	1	
0	1	0	0	RFG accepts the value applied to input NSET-SET and provides it at its output
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	RFG accepts the value applied to input CINH-VAL and provides it at its output
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

3.2.45.4 S ramp

The linear ramp function generator is connected to a PT1 element. This arrangement implements an S ramp for an almost jerk-free acceleration and deceleration.

- The PT1 element is switched on and off via C0134.
- The time constant is set via C0182.

3.2.45.5 Arithmetic operation

The output value is led to an arithmetic module. This module links the main setpoint and the additional setpoint arithmetically. The arithmetic operation is selected via C0190 (see the following table).

C0190	Function	Example
0	Output = X (Y is not processed)	-
1	Output = X + Y	100 % = 50 % + 50 %
2	Output = X - Y	50 % = 100 % - 50%
3	Output = X * Y	100 % = 100 % * 100%
4	Output = X/|Y|	1 % = 100 % / 100%
5	Output = X/(100% - Y)	200 % = 100 % / (100 % - 50 %)

3.2.45.6 Additional setpoint

- An additional setpoint (e.g. a correction signal) can be linked with the main setpoint via the input NSET-NADD.
- The input signal can be inverted via the input NSET-NADD-INV before affecting the ramp function generator. The ramp function generator has a linear characteristic and an acceleration time and deceleration time each.
- With NSET-LOAD = HIGH the ramp function generator is set to zero and kept there without considering the T_i times.The same applies when the controller is inhibited.

3.2.46 OR operation (OR)

Purpose

Logical ORing of digital signals. The operations are used for controlling functions or creating status information.

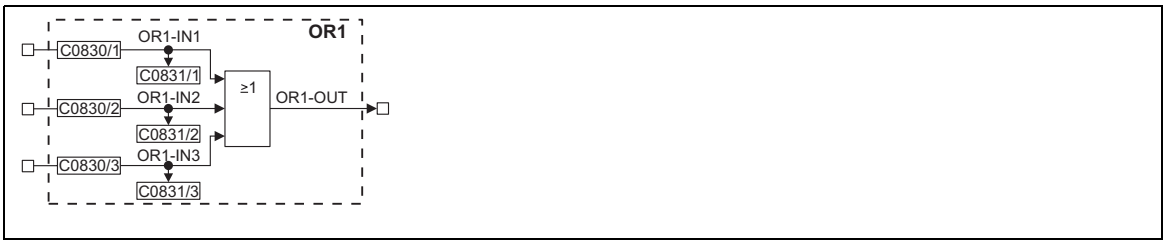


Fig. 3-118 OR operation (OR1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR1-IN1	d	C0831/1	bin	C0830/1	2	1000	-
OR1-IN2	d	C0831/2	bin	C0830/2	2	1000	-
OR1-IN3	d	C0831/3	bin	C0830/3	2	1000	-
OR1-OUT	d	-	-	-	-	-	-

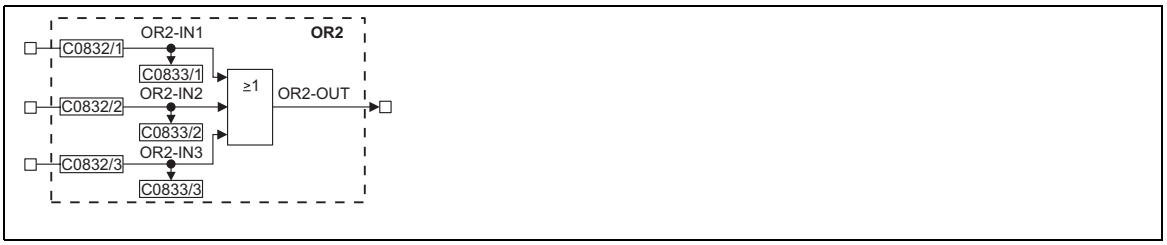


Fig. 3-119 OR operation (OR2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR2-IN1	d	C0833/1	bin	C0832/1	2	1000	-
OR2-IN2	d	C0833/2	bin	C0832/2	2	1000	-
OR2-IN	d	C0833/3	bin	C0832/3	2	1000	-
OR2-OUT	d	-	-	-	-	-	-

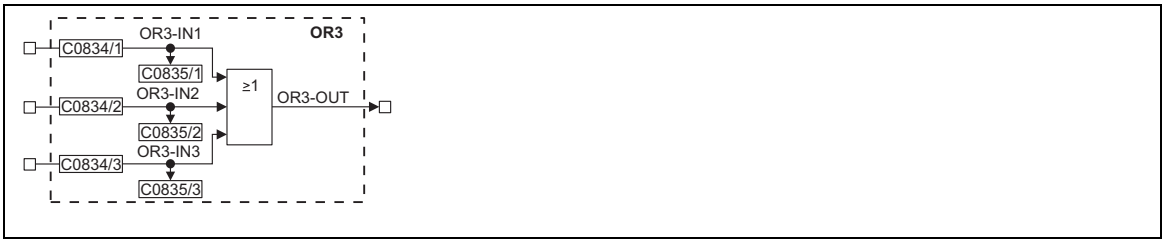


Fig. 3-120 OR operation (OR3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR3-IN1	d	C0835/1	bin	C0834/1	2	1000	-
OR3-IN2	d	C0835/2	bin	C0834/2	2	1000	-
OR3-IN3	d	C0835/3	bin	C0834/3	2	1000	-
OR3-OUT	d	-	-	-	-	-	-

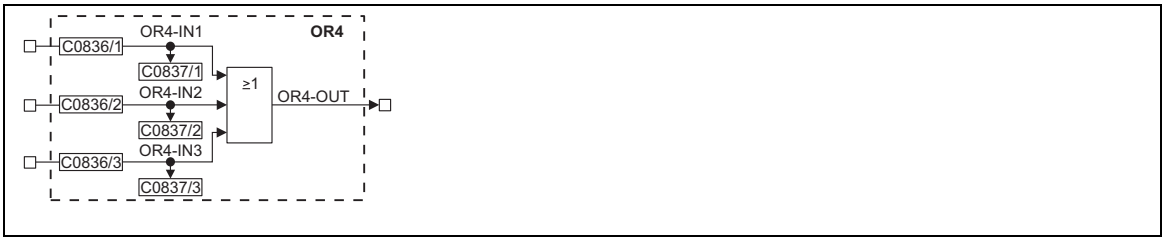


Fig. 3-121 OR operation (OR4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR4-IN1	d	C0837/1	bin	C0826/1	2	1000	-
OR4-IN2	d	C0837/2	bin	C0826/2	2	1000	-
OR4-IN3	d	C0837/3	bin	C0826/3	2	1000	-
OR4-OUT	d	-	-	-	-	-	-

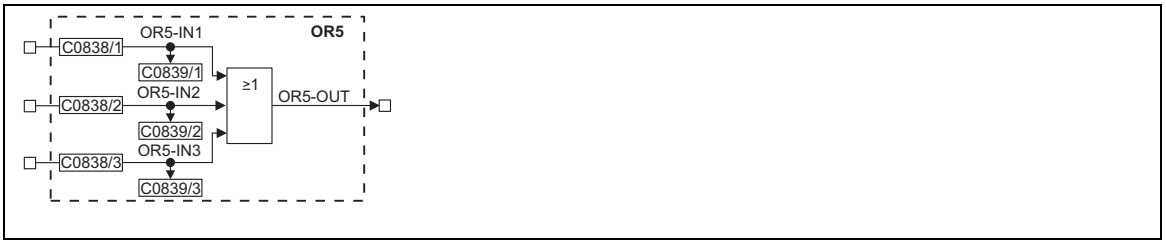


Fig. 3-122 OR operation (OR5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR5-IN1	d	C0839/1	bin	C0828/1	2	1000	-
OR5-IN2	d	C0839/2	bin	C0828/2	2	1000	-
OR5-IN3	d	C0839/3	bin	C0828/3	2	1000	-
OR5-OUT	d	-	-	-	-	-	-

Function of OR1 ... OR5

- ORx-OUT = ORx-IN1 ∨ ORx-IN2 ∨ ORx-IN3
- Equivalent network:

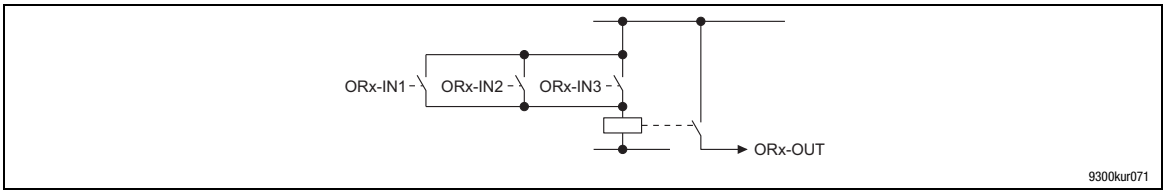


Fig. 3-123 Equivalent network of the OR operation for OR1 ... OR5

Note!

Connect inputs that are not used to FIXED0.

3.2.47 Oscilloscope function (OSZ)

Purpose

Detection of any measured variable (e. g. speed setpoint, actual speed, torque etc.). They are visualised in Global Drive Control.

Supports the commissioning of controllers and the troubleshooting.

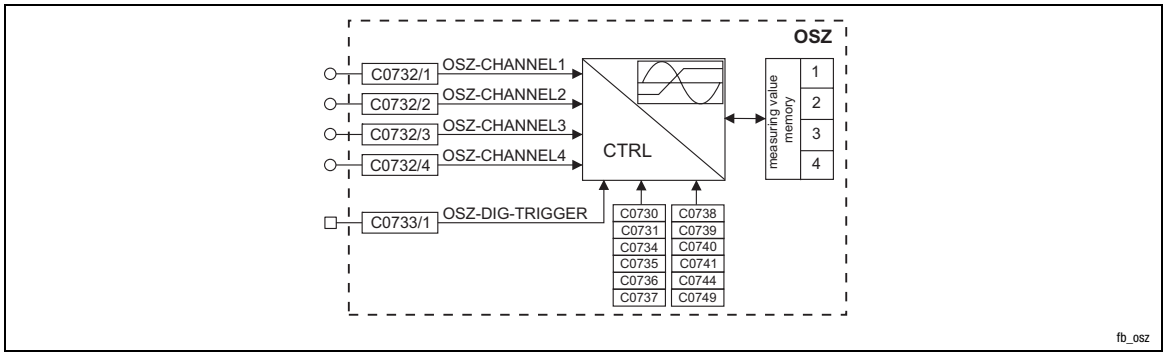


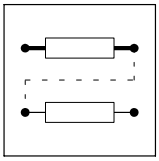
Fig. 3-124 Oscilloscope function (OSZ)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OSZ CHANNEL1	a	-	-	C0732/1	1	-	-
OSZ CHANNEL2	a	-	-	C0732/2	1	-	-
OSZ CHANNEL3	a	-	-	C0732/3	1	-	-
OSZ CHANNEL4	a	-	-	C0732/4	1	-	-
OSZ-DIG-TRIGGER	d	-	-	C0733/1	2	-	-

Function

The FB has three function units:

- Trigger check
  - Monitoring of the digital trigger source for a valid trigger event
- Processing of the measured signal
  - Linking the measurement inputs
  - Calculating the time base
  - Monitoring of the analog trigger source for a valid trigger event.
- Measuring value memory
  - Scaling the ring buffer
  - Filing the measured data in the ring buffer
  - Saving the measuring points for image generation



Functional description

Function	Code	Selection	Description
OSZ mode			Controls the measurement in the controller
	C0730	1	• Starts the recording of the measured values
		0	• Cancels a running measurement
OSZ status			Displays five different operating states
	C0731	1	• Measurement completed – The memory of the measured values is completely filled with measured data. The measured values can be accessed via the PC.
		2	• Measurement active – A measurement was started with C0730 = 1. The FB is waiting for a valid trigger event.
		3	• Trigger detected – The FB has detected a valid trigger event. Depending on the trigger delay the saving of the measured data is not yet completed. It is automatically completed with the entry into the last memory unit.
		4	• Measurement cancelled – Cancel of a running recording of the measured values (C0730 = 0). The memory of the measured values is filled with the data that has just been measured. The data can be accessed via the PC.
		5	• Read data memory – The measured data memory is being read at the moment. No settings are possible in this operating state.
Configuration OSZ channel 1 ... 4	C0732/1 to C0732/4		• Links the measuring channels of the FB with the signals of the process environment – The four measuring channels can be assigned with any analog signal. Enter the corresponding signal number into C0732/1 ... C0732/4. – Always start linking with channel 1, then channel 2 and so on. Unused channels are automatically assigned with signal FIXED 0%.
Configuration OSZ trigger	C0733/1		Links the digital trigger input with a digital signal in the process environment. – The trigger input can be assigned with any digital signal. Enter the corresponding signal number into C0733/1.
Trigger source			Defines the trigger source
	C0734	1	Source is one of the four measuring channels (C0734/1 ... C0734/4)
		0	Source is the digital trigger input (C0733/1)
Trigger level	C0735	-32767 ... 32767	• Defines the trigger level which activates the triggering when the level is exceeded. – The trigger level is only monitored when the triggering is done on one of the four channels. – The trigger level is not effective with digital triggering.
Trigger edge			Defines the trigger edge which activates the triggering. • Triggering on an analog input channel – With a LOW-HIGH trigger edge the analog trigger signal must exceed a defined trigger level to activate the triggering. – With a HIGH-LOW trigger edge the analog trigger signal must fall below a defined trigger level to activate the triggering. • Triggering on a digital trigger input – With a LOW-HIGH trigger edge the digital trigger signal must change from LOW to HIGH to activate the triggering. – With a HIGH-LOW trigger edge the digital trigger signal must change from HIGH to LOW to activate the triggering. Fig. 3-125 shows the triggering of an analog signal with a positive edge.
	C0736	1	– HIGH-LOW trigger edge
		0	LOW-HIGH trigger edge

Function	Code	Selection	Description
Trigger delay			The trigger delay defines when to begin with the saving of the measured values with regard to the trigger time.
	C0737	-100.0 % ... 0 %	• Negative trigger delay (pre-triggering) – Defines a percentage of the whole memory content. This part of the memory content is filled with measured values **before** the triggering (see Fig. 3-126).
		0 % ... 999.9 %	• Positive trigger delay (post-triggering) – Defines a percentage of the whole memory content. The saving of the measured values **after** triggering is delayed by this part of the memory content (Fig. 3-125).
Sampling period	C0738	1 ms ... 10 min	• Setting of the sampling period – The sampling period is the time between two measurements – The measurements are carried out simultaneously for all channels (e. g. value measured at channel 1 is measured at the same time as the measured value at channel 2, 3 or 4. – The sampling period can be set in steps of 1, 2 and 5.
Number of Channels	C0739		Number of channels used for measurements.
Read data memory			The code is required if the GDC is not used for the visualisation.
	C0740/1	0 ... 16383	• Defines the starting point for reading the data memory and thus enables the memory array to be selectively accessed. – In order to read the data memory bit by bit (e. g. reading only the measured values of one channel or reading with reduced memory depth), the starting point can be changed.
	C0740/2	1	• Enable “Read memory” – Enables the access to the memory to read the data
		0	• Inhibit “Read memory” – Inhibits the access to the memory. The access must be inhibited after every reading of the data
Information about the function block			Provides information on the function block
	C0741/1		Version of the function block (e. g. 120: Version 1.20)
	C0741/2		Data memory size (1024 ... 16384 bytes)
	C0741/3		Data width of the measured values (1 byte / 2 bytes)
	C0741/4		Number of the available measuring channels (1 ... 4)

Function	Code	Selection	Description
Memory size	C0744	0 ... 6	Set memory depth of the data memory – Max. size of the data memory: 8192 measured values ≙ 16384 bytes (C0744 = 6) – Min. size of the data memory: 512 measured values ≙ 1024 bytes (C0744 = 0) – Changing the memory depth from 512 to 8192 measured values/step – A memory depth which is optimally adapted to the corresponding measuring task reduces the data transmission time.
Information on saving			Information on saving the measured values in the data memory The FB saves the data in a ring format. For reconstructing the chronological signal sequence the following three "graphic points" are marked.
	C0749/1		Measured value no. of the instant of abortion
	C0749/2		Measured value no. of the instant of triggering
	C0749/3		Measured value no. of the instant of completion

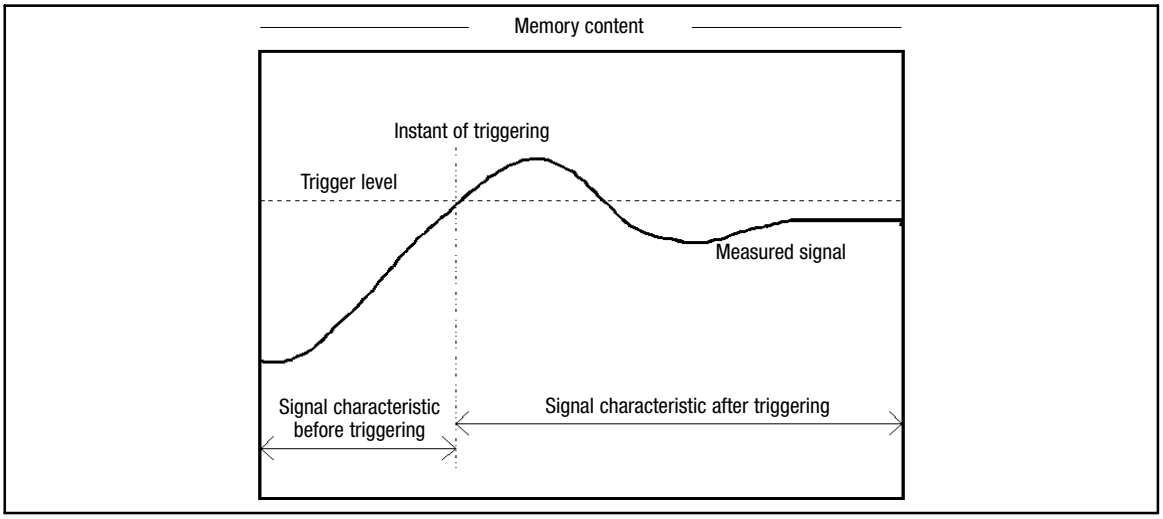


Fig. 3-125 Example: Trigger level and trigger delay with approx. -30 % of pre-triggering

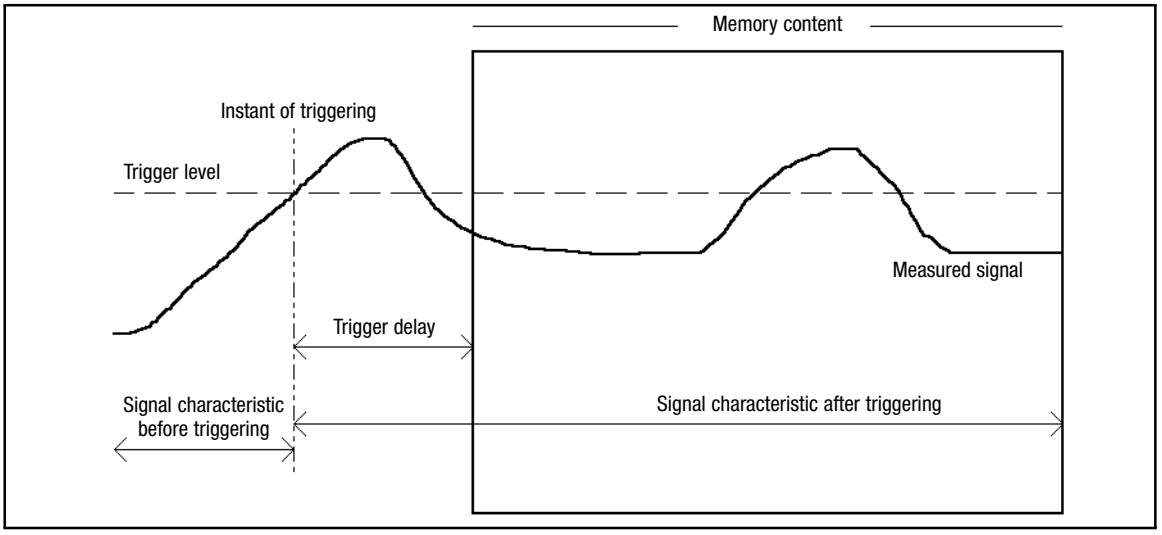


Fig. 3-126 Example: Trigger level and trigger delay with approx. -30 % of post-triggering

3.2.48 Process controller (PCTRL1)

Purpose

The FB is used, for instance, as a higher-level controller (dancer position controller, tension controller, pressure controller etc.).

The control characteristic follows the ideal PID algorithm, but it can also be changed over to a PI or P characteristic.

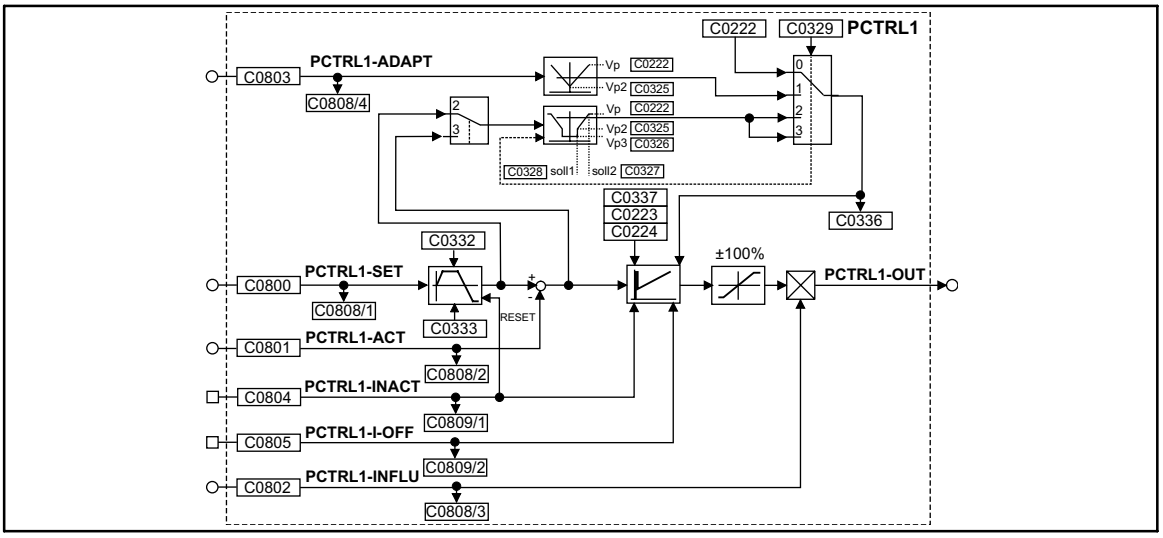


Fig. 3-127 Process controller (PCTRL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PCTRL1-SET	a	C0808/1	dec [%]	C0800	1	1000	Input of the process setpoint. Possible value range: ±200%. The time characteristic of step-change signals can be affected via the ramp function generator (C0332 for the acceleration time; C0333 for the deceleration time).
PCTRL1-ACT	a	C0808/2	dec [%]	C0801	1	1000	Actual value input; value range ±200%
PCTRL1-INFLU	a	C0808/3	dec [%]	C0802	1	1000	Evaluation or suppression of the output signal; value range ±200%
PCTRL1-ADAPT	a	C0808/4	dec [%]	C0803	1	1000	Online change of the P gain; value range ±200%
PCTRL1-INACT	d	C0809/1	bin	C0804	2	1000	Online deactivation of the process controller
PCTRL1-I-OFF	d	C0809/2	bin	C0805	2	1000	Online setting of the I component to zero
PCTRL1-OUT	a	-	-	-	-	-	-

Function

Setpoint and actual value are sent to the process controller via the corresponding inputs and processed according to the selected control algorithm (control chararacteristic).

3.2.48.1 Control characteristic

- In the default setting, the PID algorithm is active.
- The D-component can be deactivated by setting code C0224 to zero. Thus, the controller becomes a PI-controller (or P-controller if the I-component is also switched off).
- The I-component can be switched on or off online via the PCTRL-I-OFF input. For this, the input is assigned a digital signal source (e.g. one of the freely assignable digital input terminals). If the I-component is to be switched off permanently, the input is assigned the signal source ”FIXED1”.
  – PCTRL-I-OFF = HIGH switches off the I-component
  – PCTRL-I-OFF = LOW switches on the I-component
- The reset time is parameterised via C0223.
- The P-gain can be set in different ways. The function providing the P-gain is selected under C0329:
  – C0329 = 0
  The P-gain is entered under C0222.
  – C0329 = 1
  The P-gain is entered via the PCTRL-ADAPT input. The input value is led via a linear characteristic. The slope of the characteristic is set under C0222 (upper limit) and C0325 (lower limit). The value under C0222 is valid if the input value = +100 % or -100 %. The value under C0325 applies if the input value is 0 %.

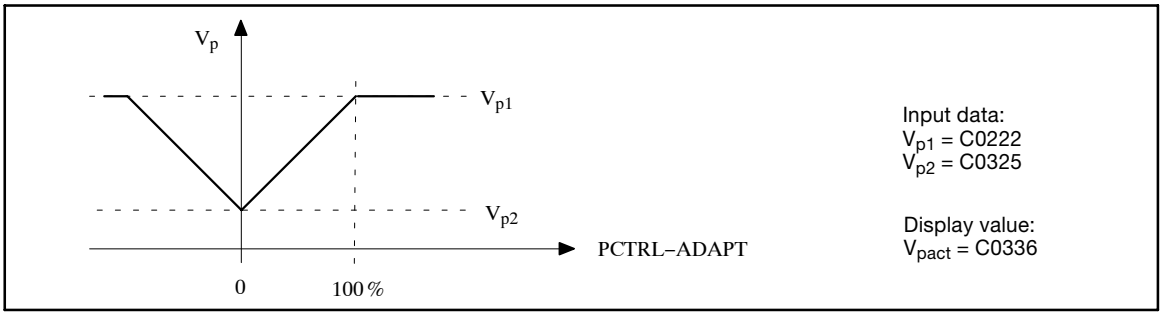


Fig. 3-128 Input of the P-gain via PCTRL-ADAPT input

  – C0329 = 2
  The P-gain is derived from the process setpoint PCTRL-SET. The setpoint is measured after the ramp function generator and calculated by means of a characteristic with three interpolation points.

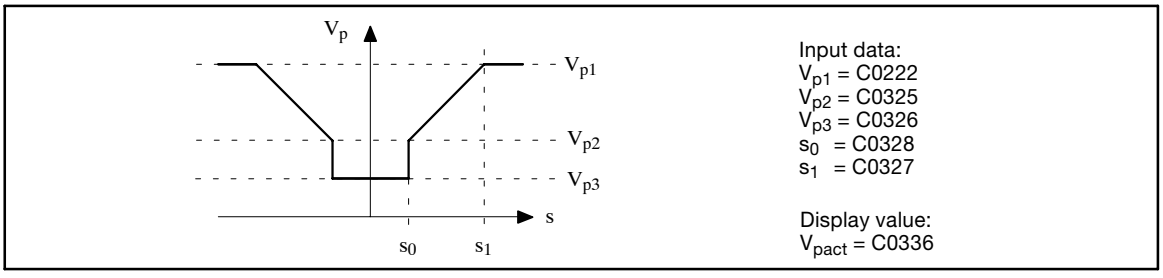


Fig. 3-129 P-gain derived from the PCTRL-SET process setpoint

  – C0329 = 3
  The P-gain is derived from the control difference and calculated by means of a characteristic as for C0329 = 2.

3.2.48.2 Ramp function generator

The setpoint PCTRL-SET is led via a ramp function generator with linear characteristic. Thus, setpoint step-changes at the input can be transformed into a ramp.

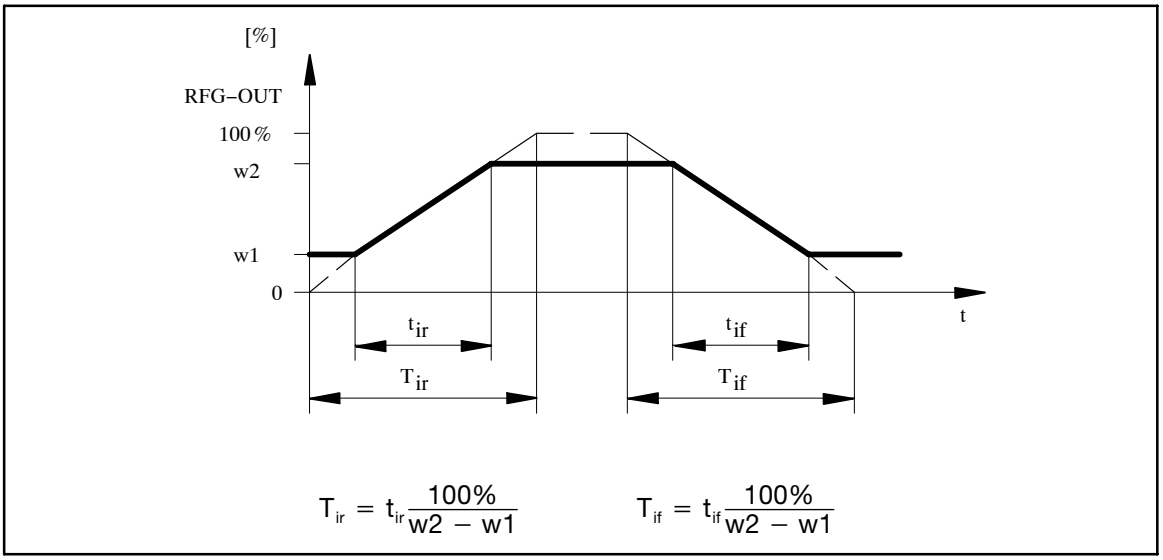


Fig. 3-130 Acceleration and deceleration times of the ramp function generator

- The ramps can be adjusted separately for acceleration and deceleration.
  - Acceleration time t_{ir} with C0332.
  - Deceleration time t_{if} with C0333.
- PCTRL-INACT = HIGH
  - The ramp function generator is immediately set to zero.

3.2.48.3 Value range of the output signal

- The process controller operates in bipolar mode in the default setting.
  - The output value is limited to ±100 %.
- The function can be set to unipolar mode under C0337.
  - The output value is limited to 0 ... +100 %.

3.2.48.4 Evaluation of the output signal

- The output signal can be evaluated after the limitation block via PCTRL-INFLU.
  - The process controller can be hidden or unhidden with this evaluation.
  - The calcuation is done according to the following formula:
    100 % (PCTRL-OUT) = 100 % * 100 % (PCTRL-INFLU).

3.2.48.5 Deactivation of the process controller

- PCTRL-INACT = HIGH deactivates the process controller
  - PCTRL-OUT is set to zero.
  - The I-component is set to zero.
  - The ramp function generator is set to zero.

3.2.49 Angle addition block (PHADD)

Purpose

Adds or subtracts angle signals depending on the input used.

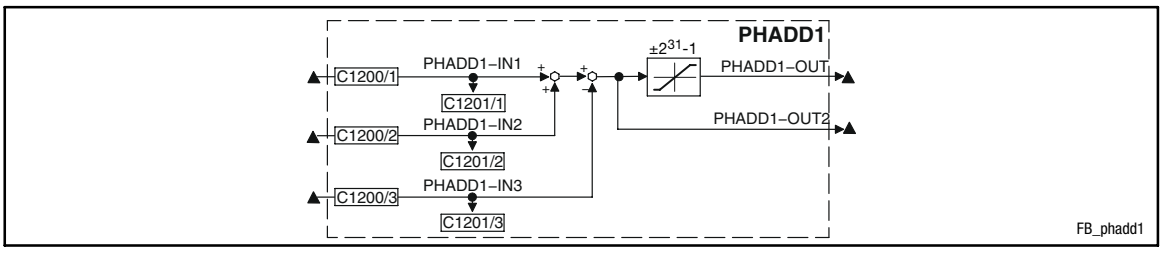


Fig. 3-131 Angle addition block (PHADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHADD1-IN1	ph	C1201/1	dec [inc]	C1200/1	3	1000	Addition input
PHADD1-IN2	ph	C1201/2	dec [inc]	C1200/2	3	1000	Addition input
PHADD1-IN3	ph	C1201/3	dec [inc]	C1200/3	3	1000	Subtraction input
PHADD1-OUT	ph	-	-	-	-	-	Limited to ±2147483647
PHADD1-OUT2	ph	-	-	-	-	-	-

Function

- Input PHADD1-IN1 is added to input PHADD1-IN2.
- The input PHADD-IN3 is subtracted from the calculated result.
- Then the result of the subtraction
  – is limited to ±2147483647 and output at PHADD1-OUT.
  – is output at PHADD1-OUT2 without limitations.

3.2.50 Angle comparator (PHCMP)

Purpose

Compares two angle signals (distances) with each other.

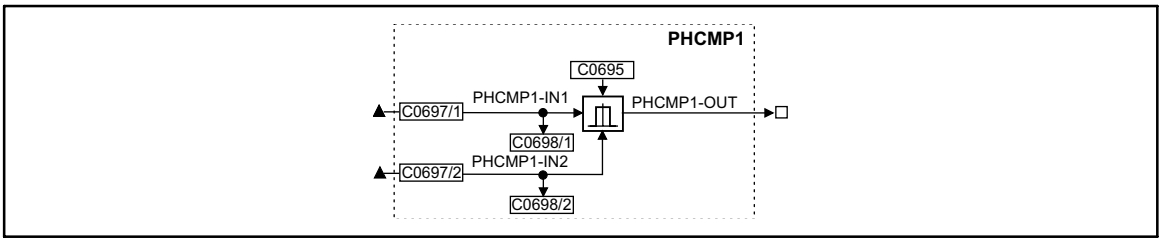


Fig. 3-132 Angle comparator (PHCMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP1-IN1	ph	C0698/1	dec [inc]	C0697/1	3	1000	Signal to be compared
PHCOMP1-IN2	ph	C0698/2	dec [inc]	C0697/2	3	1000	Comparison value
PHCOMP1-OUT	d	-	-	-	-	-	

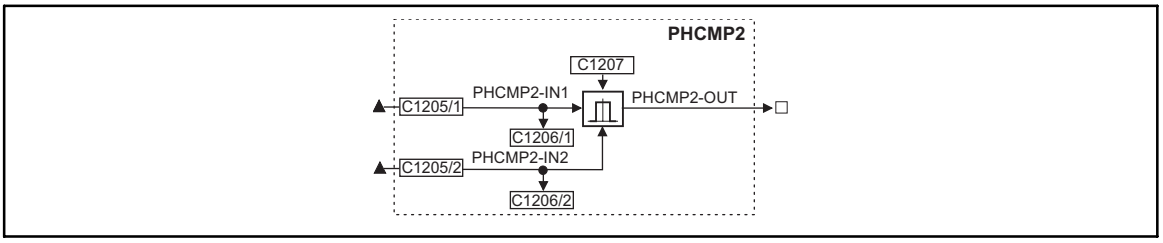


Fig. 3-133 Angle comparator (PHCMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP2-IN1	ph	C1206/1	dec [inc]	C1205/1	3	1000	Signal to be compared
PHCOMP2-IN2	ph	C1206/2	dec [inc]	C1205/2	3	1000	Comparison value
PHCOMP2-OUT	d	-	-	-	-	-	

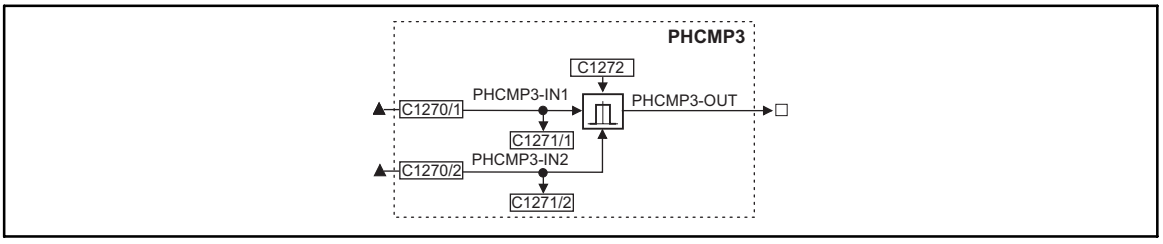


Fig. 3-134 Angle comparator (PHCMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP3-IN1	ph	C1271/1	dec [inc]	C1270/1	3	1000	Signal to be compared
PHCOMP3-IN2	ph	C1271/2	dec [inc]	C1270/2	3	1000	Comparison value
PHCOMP3-OUT	d	-	-	-	-	-	

Function

Function block	Code	Function	Note
PHCMP1	C0695 = 1	• If PHCMPx-IN1 < PHCMPx-IN2, PHCMPx-OUT switches to HIGH • If PHCMPx-IN1 ≥ PHCMPx-IN2, PHCMPx-OUT switches to LOW	
PHCMP2	C1207 = 1		
PHCMP3	C1272 = 1		
PHCMP1	C0695 = 2	• If | PHCMPx-IN1 | < | PHCMPx-IN2 |, PHCMPx-OUT switches to HIGH • If | PHCMPx-IN1 | ≥ | PHCMPx-IN2 |, PHCMPx-OUT switches to LOW	Compares the absolute values of the inputs
PHCMP2	C1207 = 2		
PHCMP3	C1272 = 2		

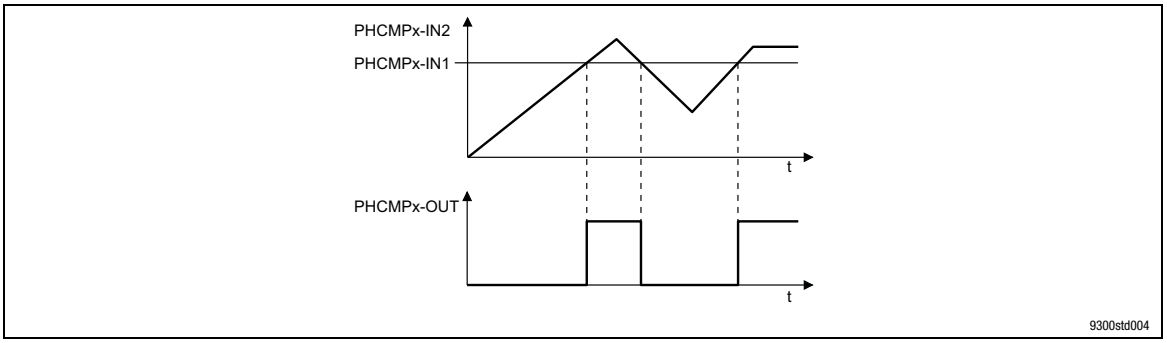


Fig. 3-135 Diagram of the function

3.2.51 Actual angle integrator (PHDIFF)

Purpose

Selective addition of a angle signal to the setpoint angle.

It is also possible to compare setpoint and actual angle signals.

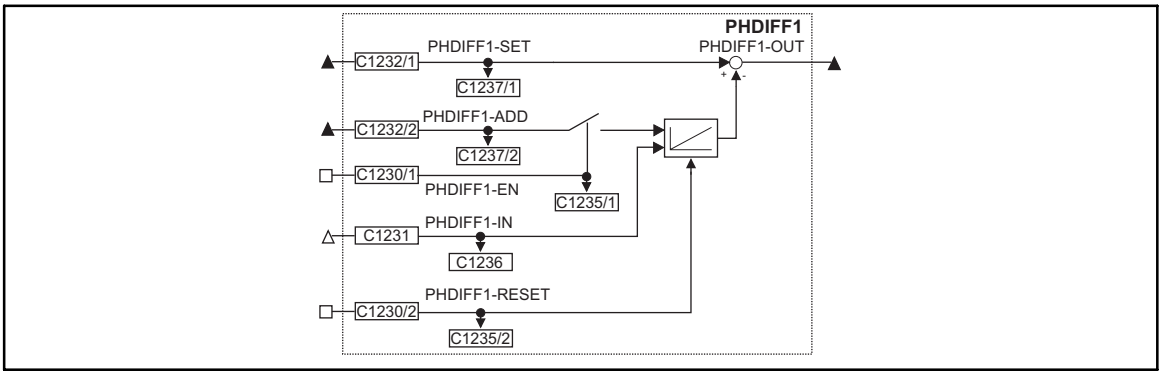


Fig. 3-136 Actual angle integrator (PHDIFF1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHDIFF1-IN	phd	C1236	dec [rpm]	C1231	4	-
PHDIFF1-SET	ph	C1237/1	dec [inc]	C1232/1	3	-
PHDIFF1-ADD	ph	C1237/2	dec [inc]	C1232/2	3	-
PHDIFF1-EN	d	C1235/1	bin	C1230/1	2	-
PHDIFF1-RESET	d	C1235/2	bin	C1230/2	2	HIGH = sets the actual angle integrator = 0
PHDIFF1-OUT	ph	-	-	-	-	Without limit

Function

C1230/1 = HIGH

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The angle signal at PHDIFF1-ADD is added to the integrated speed signal.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

C1230/1 = LOW

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

3.2.52 Signal adaptation for angle signals (PHDIV)

Purpose

Power-of-two division or multiplication of angle signals.

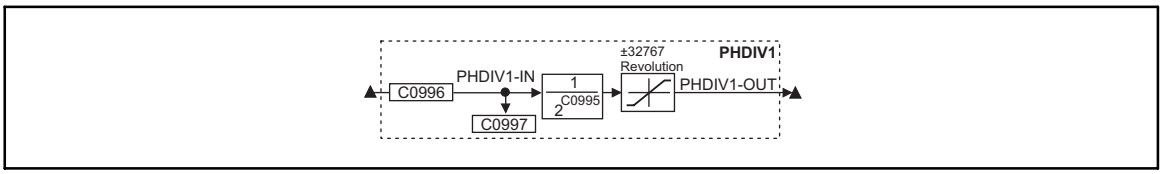


Fig. 3-137 Signal adaptation for angle signals (PHDIV1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHDIV1-IN	ph	C0997	dec [inc]	C0996	3	1000	
PHDIV1-OUT	ph	-	-	-	-	-	65536 inc = one encoder revolution

Function

- Arithmetic function:

$$\text{PHDIV1-OUT} = \frac{\text{PHDIV1-IN}}{2^{\text{C0995}}}$$

  – Positive values in C0995 result in a division.
  – Negative values in C0995 result in a multiplication.

- The output value is limited to $\pm(2^{31}-1)$ inc (corresponds to ±32767 encoder revolutions).
  – If the limit is exceeded, the output is kept at the limit value.

3.2.53 Phase integrator (PHINT)

Purpose

Integrates a speed or a velocity to a phase (distance). The integrator can maximally accept ±32000 encoder revolutions.

PHINT3 can recognise a relative distance.

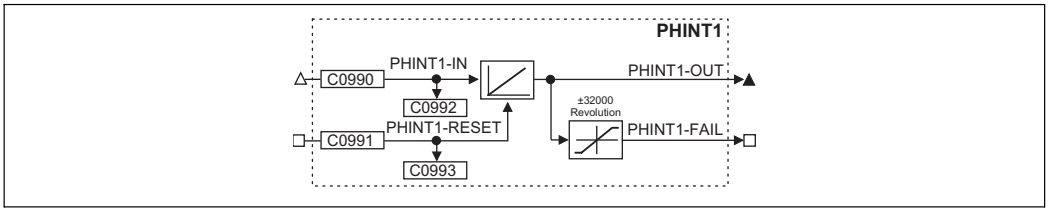


Fig. 3-138 Phase integrator (PHINT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT1-IN	phd	C0992	dec [rpm]	C0990	4	1 revolution = 65536 increments
PHINT1-RESET	d	C0993	bin	C0091	2	HIGH = sets the phase integrator to 0 and PHINT1-FAIL = LOW
PHINT1-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT1-FAIL	d	-	-	-	-	HIGH = overflow

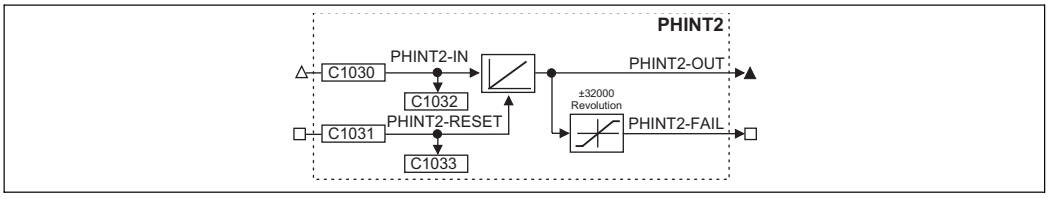


Fig. 3-139 Phase integrator (PHINT2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT2-IN	phd	C1032	dec [rpm]	C1030	4	1 revolution = 65536 increments
PHINT2-RESET	d	C1033	bin	C1031	2	HIGH = sets the phase integrator to 0 and PHINT2-FAIL = LOW
PHINT2-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT2-FAIL	d	-	-	-	-	HIGH = overflow

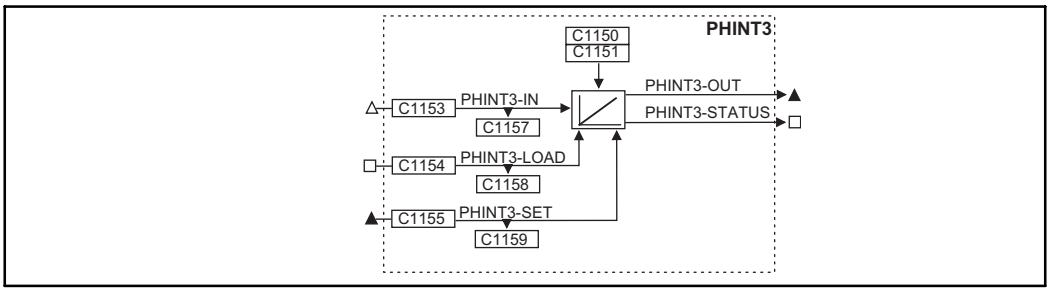


Fig. 3-140 Phase integrator (PHINT3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT3-IN	phd	C1157	dec [rpm]	C1153	4	1 revolution = 65536 increments
PHINT3-LOAD	d	C1158	bin	C1154	2	HIGH = sets the phase integrator to the input signals of PHINT3-IN and PHINT3-STATUS = LOW
PHINT3-SET	ph	C1159	dec [inc]	C1155	3	
PHINT3-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT3-STATUS	d	-	-	-	-	HIGH = Overflow or distance is processed

Function

- Constant input value (PHINT1, PHINT2 and PHINT3)
- Input value with sign reversal (PHINT3)
- Scaling of PHINTx-OUT

3.2.53.1 Constant input value (PHINT1 and PHINT2)

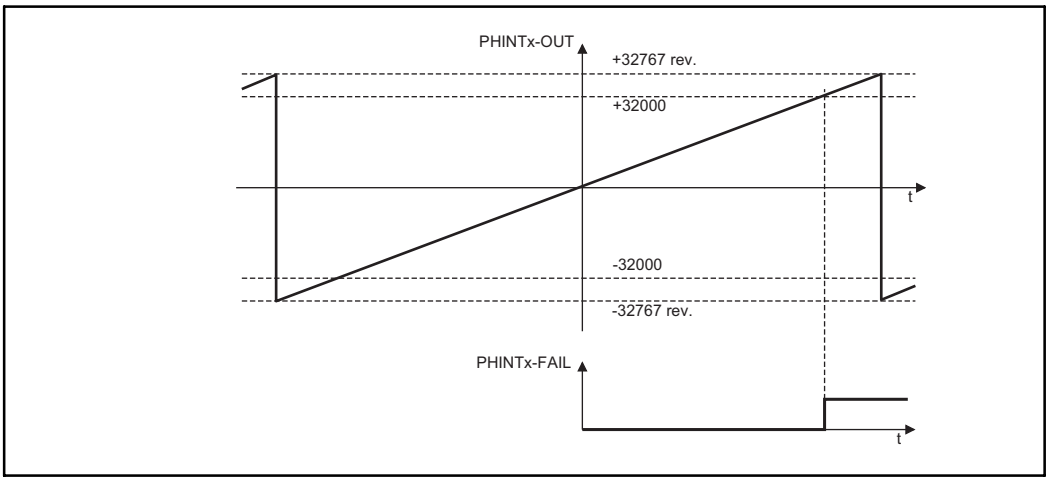


Fig. 3-141 Function of PHINTx with constant input value

- The FB integrates speed or velocity values at PHINTx-IN to a phase (distance).
- PHINTx-OUT outputs the count of the bipolar integrator.
  - A positive value at PHINTx-IN increments the integrator (count is increased).
  - A negative value at PHINTx-IN decrements the integrator (count is reduced).
- If the count exceeds the value of +32767 encoder revolutions ($\triangleq$ +2147483647 inc)
  - an overflow occurs. The counting is continued with the value -32768.
  - PHINTx-FAIL switches to HIGH when the value $\geq$ +32000 is reached. PHINTx-FAIL = HIGH.
- If the count falls below the value of -32768 encoder revolutions ($\triangleq$ -2147483648 inc)
  - an overflow occurs. The counting starts at the value +32767.
  - PHINTx-FAIL switches to HIGH when the value $\leq$ -32000 is reached.
- PHINTX-RESET = HIGH
  - sets the integrator to 0
  - sets PHINTx-OUT = 0, as long as a HIGH level is applied to PHINTx-IN.
  - sets PHINTx-FAIL = LOW.

3.2.53.2 Constant input value (PHINT3)

The FB PHINT3 has three modes which can be set via C1150.

Mode C1150 = 2 is in chapter. 3.2.53.3.

C1150 = 0	C1150 = 1
The input PHINT3-LOAD is state-controlled (HIGH level). • PHINT3-LOAD = HIGH – The integrator is loaded with the input value at PHINT3-SET. – Sets the output PHINT3-STATUS = LOW	The input PHINT3-LOAD is edge-triggered (LOW-HIGH edge). • PHINT3-LOAD = LOW-HIGH edge – The integrator is loaded with input value at PHINT3-SET and immediately starts to integrate – Sets the output PHINT3-STATUS = LOW

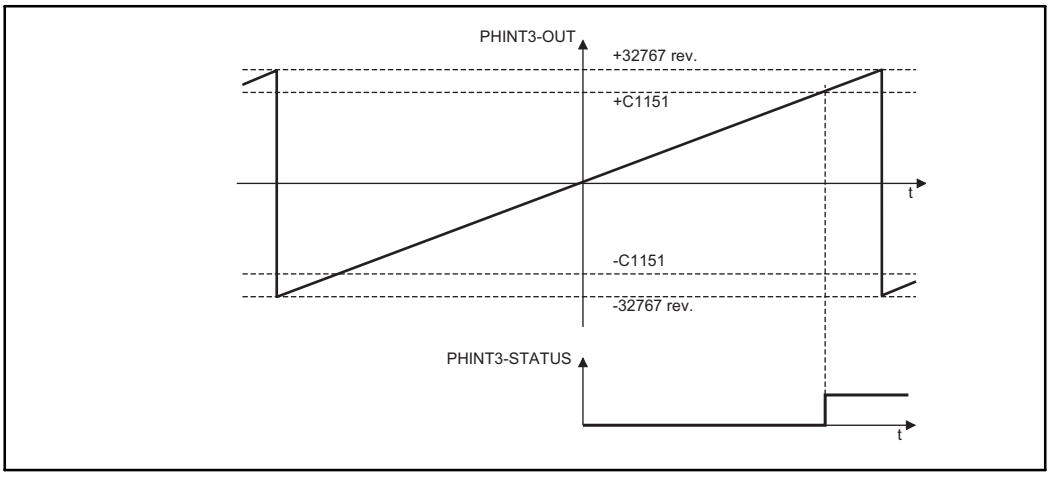


Fig. 3-142 Function of PHINT3 with constant input value at C1150 = 0 and C1150 = 1

- The FB integrates speed or velocity values at PHINT3-IN to a phase (distance).
- PHINT3-OUT outputs the count of the bipolar integrator.
  – A positive value at PHINT3-IN increments the integrator (count is increased).
  – A negative value at PHINT3-IN decrements the integrator (count is reduced).
- If the count exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  – an overflow occurs. The counting is continued with the value -32768,
  – PHINT3-STATUS switches to HIGH when the value of (+) C1151 is reached.
- If the count falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  – an overflow occurs. The counting starts at the value +32767,
  – PHINT3-STATUS switches to HIGH when the value of (-) C1151 is reached.

3.2.53.3 Input value with sign reversal (PHINT3)

C1150 = 2

The input PHINT3-LOAD is state-controlled (HIGH level).

- PHINT3-LOAD = HIGH
  - The integrator is loaded with the input value at PHINT3-SET.
  - Sets the output PHINT3-STATUS = LOW.

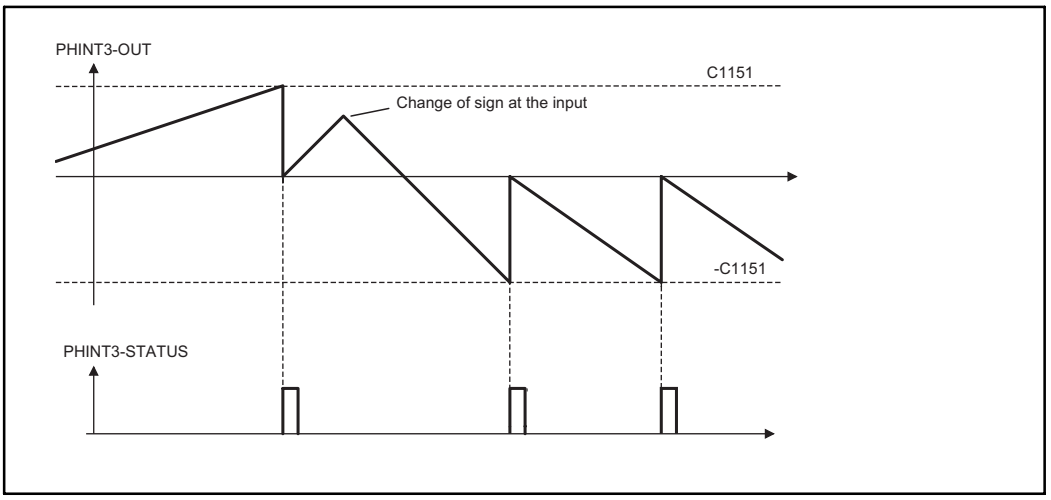
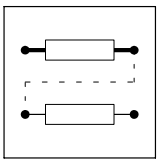


Fig. 3-143 Function of PHINT3 with sign reversal of the input value at C1150 = 2

- The FB integrates speed or velocity values at PHINT3-IN to a phase (distance).
- PHINT3-OUT outputs the count of the bipolar integrator.
  - A positive value at PHINT3-IN increments the integrator (count is increased).
  - A negative value at PHINT3-IN decrements the integrator (count is reduced).
- If the counter content exceeds the value of (+) C1151
  - the value of C1151 is subtracted from the counter content,
  - switches PHINT3-STATUS = HIGH for 1 ms.
- If the counter content falls below the value of () C1151
  - the value of C1151 is added to the counter content,
  - switches PHINT3-STATUS = HIGH for 1 ms.



3.2.53.4 Scaling of PHINTx-OUT

Mathematical description of PHINTx-OUT:

$$PHINTx - OUT[inc] = PHINTx - IN[rpm] \cdot t[s] \cdot 65536[inc/rev.]$$

t Integration time

Example:

You want to determine the count of the integrator with a certain speed at the input and a certain integration time.

- Given values:
  - PHINTx-IN = 1000 rpm
  - t = 10 s
  - Start value of the integrator = 0
- Solution:
  - Conversion of PHINTx-IN:

$$1000\ rpm = \frac{1000\ rev.}{60\ s}$$

  - Calculation of PHINTx-OUT:

$$PHINTx - OUT = \frac{1000\ rev.}{60\ s} \cdot 10\ s \cdot \frac{65536\ inc}{rev.} = 10922666\ inc$$

3.2.54 Delay element (PT1-1)

Purpose

Filtering and delaying of analog signals.

Fig. 3-144 Delay element (PT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PT1-1-IN	a	C0642	dec [%]	C0641	1	1000	-
PT1-1-OUT	a	-	-	-	-	-	-

Function

- The delay time T is set under C0640.
- The proportional coefficient is fixed at K = 1.

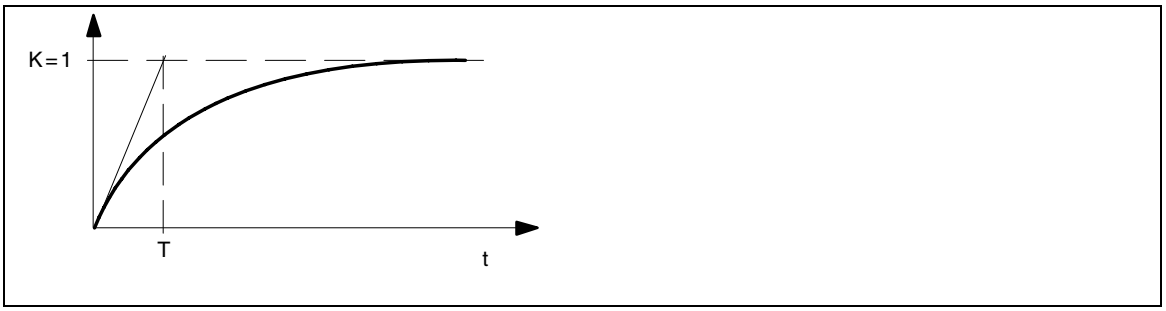


Fig. 3-145 Delay time T of the first order delay element

3.2.55 CW/CCW/QSP linking (R/L/Q)

Purpose

The FB provides a fail-safe connection for the selection of a rotation direction and the QSP function.

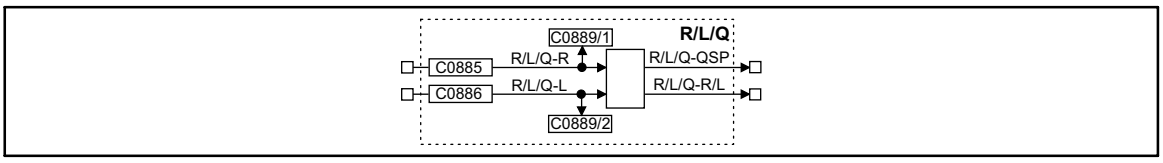


Fig. 3-146 CW/CCW/QSP linking (R/L/Q)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
R/L/Q-R	d	C0889/1	bin	C0885	2	51	-
R/L/Q-L	d	C0889/2	bin	C0886	2	52	-
R/L/Q-QSP	d	-	-	-	-	-	-
R/L/Q-R/L	d	-	-	-	-	-	-

Function

- After mains connection and simultaneous HIGH level at both inputs, the outputs are set as follows:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
1	1	0	1

- The following truth table results if one of the inputs is set to LOW once after mains connection:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
0	0	0	1
1	0	0	0
0	1	1	0
1	1	unchanged	unchanged

- If both inputs are set to HIGH during operation, the values at both outputs remain unchanged.

3.2.56 Homing function (REF)

Purpose

The homing function serves to bring the drive shaft to a defined position.

Note!

At first, select the predefined configuration in C0005, which already contains the REF function block. This ensures that all important signal connections are restored automatically. Then, adapt the configuration to your application.

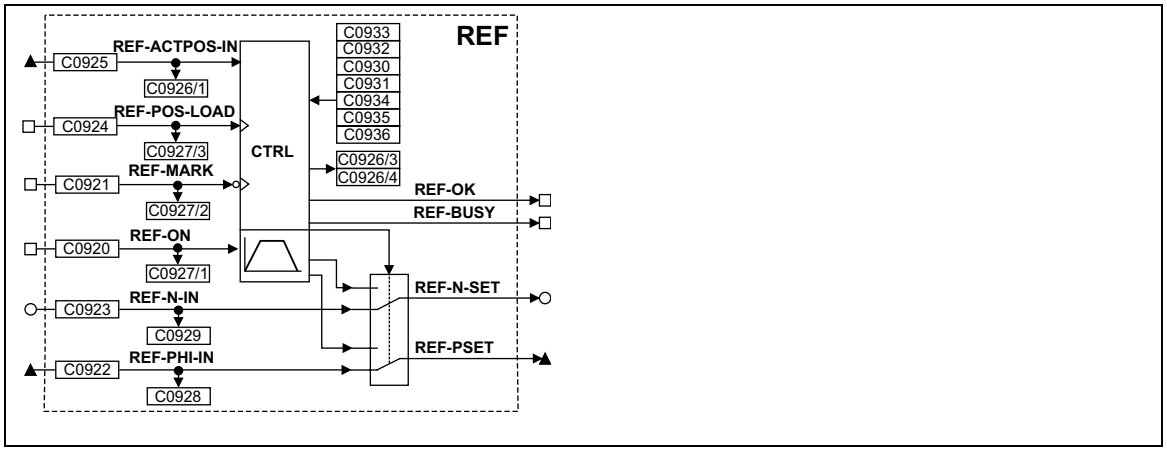


Fig. 3-147 Homing function (REF)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
REF-N-IN	a	C0929	dec [%]	C0923	1	1000	Speed setpoint in [%] of nmax C0011
REF-PHI-IN	ph	C0928 C0926/2	dec [inc]	C0922	3	1000	Angle setpoint (following error for angle controller in FB MCTRL)
REF-ACTPOS-IN	ph	C0926/1	dec [inc]	C0925	3	1000	Loading value for current position (REF-ACTPOS)
REF-ON	d	C0927/1	bin	C0920	2	1000	HIGH = Start homing
REF-MARK	d	C0927/2	bin	C0921	2	1000	Reference switch
REF-POS-LOAD	d	C0927/3	bin	C0924	2	1000	LOW-HIGH edge = Angle at the input REF-ACTPOS-IN is loaded in REF-ACTPOS (starting value)
REF-OK	d	-	-	-	-	-	HIGH = Homing completed/home position known
REF-BUSY	d	-	-	-	-	-	HIGH = Homing function active
REF-N-SET	a	-	-	-	-	-	Speed setpoint for n-controller
REF-PSET	ph	-	-	-	-	-	Angle setpoint (following error for angle controller in FB MCTRL)

Range of functions

- Profile generator
- Homing modes
- Control via input signals
- Output of status signals

3.2.56.1 Profile generator

The speed profile for homing can be adapted to the application.

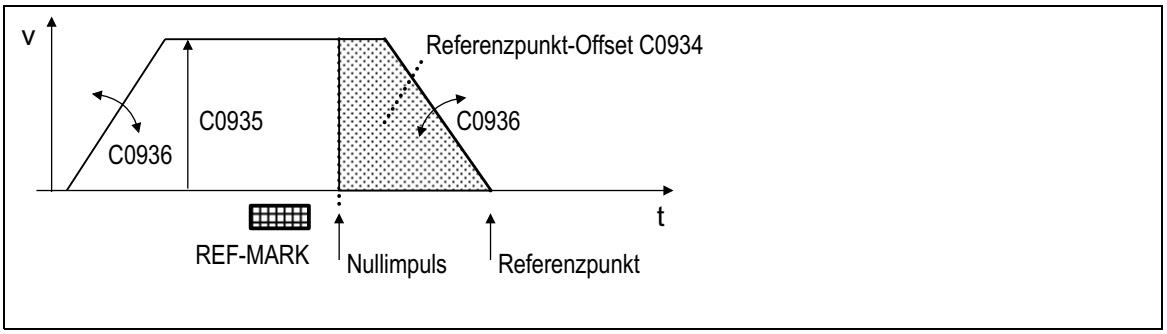


Fig. 3-148 Homing speed profile

Code	Meaning	Note
C0930	Encoder/gearbox factor - numerator (motor speed)	Setting only required if the actual value encoder is not mounted to the motor
C0931	Encoder/gearbox factor - denominator (encoder speed)	
C0933	Selection of the edge of the touch probe signal at X5/E4	The touch probe edge provides the bench mark for the home position offset to the homing modes that include touch probe.
C0934	Home position offset = number of increments after zero pulse	Reference: 65536 inc = 1 revolution. Max. entry: 2140000000 inc
C0935	Homing speed	Input in [%] of nmax (C0011)
C0936	Homing acceleration time, homing deceleration time	Linear ramps
C0926/3	REFC-ACTPOS, actual position value	Read only
C0926/4	REFC-TARGET, current target position	Read only

The profile generator calculates the speed profile from the set profile parameters.

- The parameters can be changed during homing.
  – C0935 and C0936 become active if REF-ON = LOW.
- The drive should not be driven at the torque limit (MCTRL-MMAX = HIGH), otherwise the drive cannot follow the speed profile.
  – Prolonging the acceleration / deceleration time until MCTRL-MMAX does not respond anymore.
- The angle controller in the MCTRL function block must be activated.

3.2.56.2 Homing modes

The home position is defined via

- the homing mode C0932
- the signal edge of the zero pulse or touch probe signal C0933
- the home position offset C0934

Note!

For position feedback via resolver, the zero position (depending on the resolver attachment to the motor) is used instead of the zero pulse. Accordingly, the touch probe angle is used for homing via touch probe.

Homing to zero pulse/zero position with reference switch

The home position is after the negative edge of the reference switch REF-MARK, at the next zero pulse/zero position plus the home position offset:

- Mode 0 (C0932 = 0):
  - Move to the home position in CW rotation.
  - Enter positive home position offset C0934.

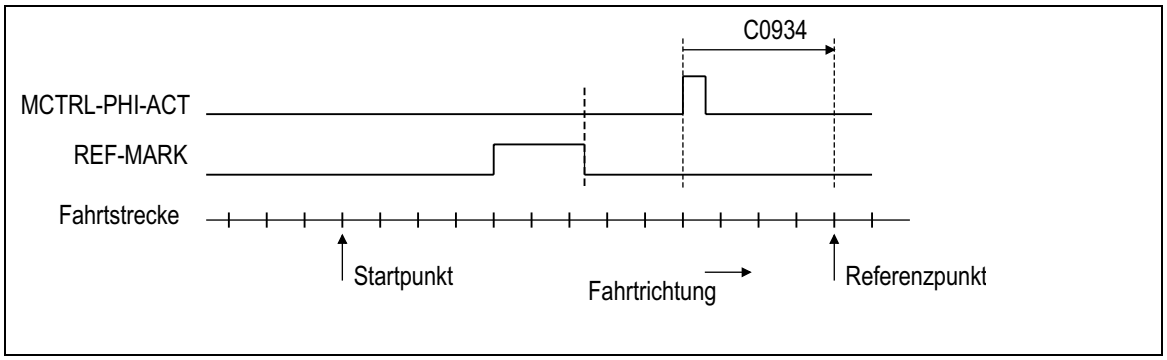


Fig. 3-149 Homing with zero pulse/zero position; approaching the home position in CW rotation

- Mode 1 (C0932 = 1):
  - Move to the home position in CCW rotation.
  - Enter negative home position offset C0934.

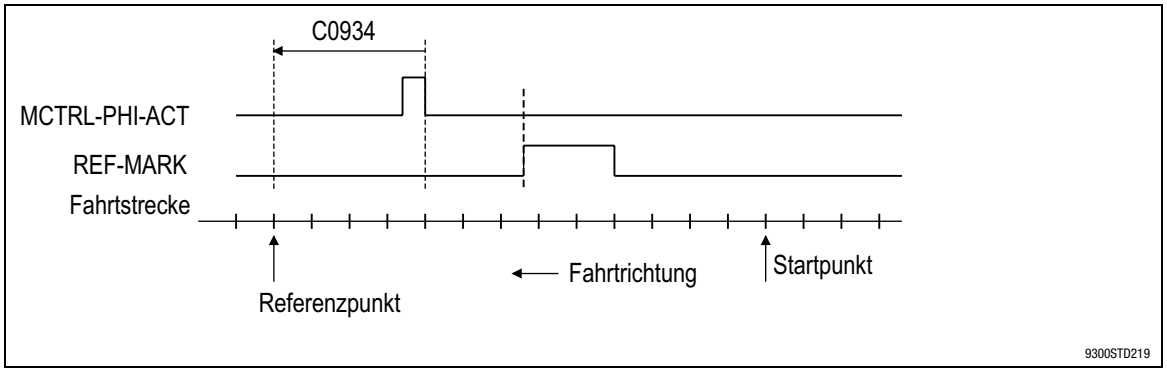


Fig. 3-150 Homing with zero pulse/zero position; approaching the home position in CW rotation

Homing with reference switch and touch probe (TP)

The home position is after the negative edge of the reference switch REF-MARK, at the touch probe signal (terminal X5/E4) plus the home position offset:

- Mode 6 (C0932 = 6):
  - Move to the home position in CW rotation.
  - Enter positive home position offset C0934.

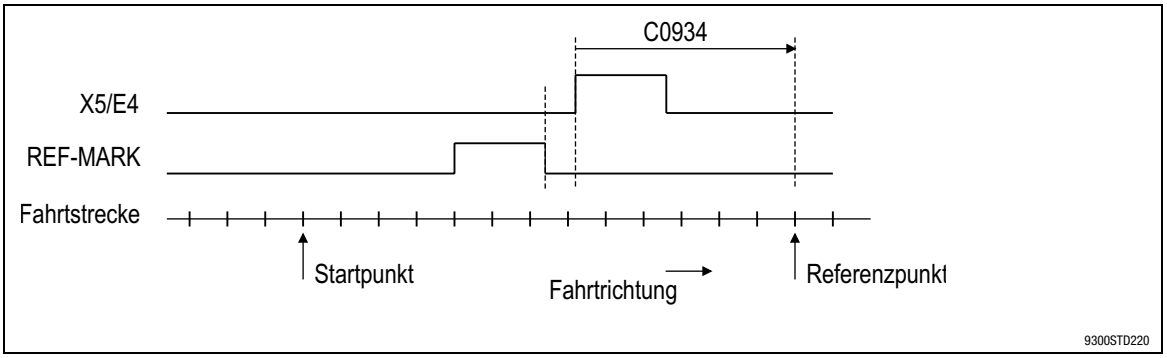


Fig. 3-151 Homing with touch probe; approaching the home position in CW rotation

- Mode 7 (C0932 = 7):
  - Move to the home position in CCW rotation.
  - Enter negative home position offset C0934.

Homing with touch probe (TP)

The home position is at the next touch probe signal (terminal X5/E4) plus the home position offset.

- Mode 8 (C0932 = 8):
  - Move to the home position in CW rotation.
  - Enter positive home position offset C0934.
- Mode 9 (C0932 = 9):
  - Move to the home position in CCW rotation.
  - Enter negative home position offset C0934.

Direct homing

The home position is on the home position offset.

- Mode 20 (C0932 = 20):
  - Directly after the activation (REF-ON = HIGH), the drive traverses from the actual position (REF-ACTPOS) to the home position.
  - Before that, the actual position (REF-ACTPOS) can be loaded with the input value REF-ACTPOS-IN (see chapter 3.2.56.3).
  - The route and direction of travel results from the actual position (REF-ACTPOS) and the home position offset (C0934) set.

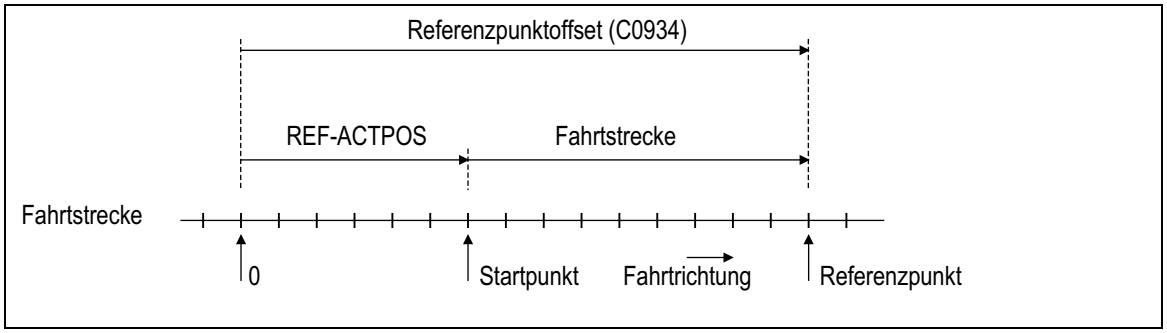
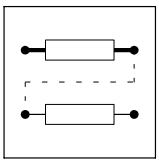


Fig. 3-152 Direct homing; approaching the home position in CW rotation

- Mode 21 (C0932 = 21) is the same as mode 20 but additionally features:
  - The actual position value (REF-ACTPOS) is stored when the mains is disconnected and reloaded when the mains is connected.

3.2.56.3 Control via input signals

- REF-ON = LOW-HIGH edge starts homing:
  - The input must remain on HIGH until the end of the homing process. Homing is aborted if the input is set to LOW before the home position is reached.
- REF-ON = LOW interrupts homing:
  - The drive is decelerated to zero speed along the ramp set under C0936.
  - The inputs REF-N-IN and REF-PHI-IN are switched to the outputs REF-N-SET and REF-PSET.
  - Has no effect if homing is already completed (REF-BUSY = LOW).
- REF-POS-LOAD = LOW-HIGH edge
  - The profile generator accepts the angle at the input REF-ACTPOS-IN as starting value in the actual position value REF-ACTPOS.
  - The function is only active if REF-ON = LOW
  - The function is only active in the modes 20 and 21.



3.2.56.4 Output of status signals

- REF-BUSY = HIGH: the homing function is active:
  - The profile generator is switched to the outputs REF-PSET and REF-N-SET.
- REF-BUSY = LOW: the homing function is not active nor is it completed:
  - The inputs REF-N-IN and REF-PHI-IN are switched to the outputs REF-N-SET and REF-PSET.
- REF-OK = HIGH: homing has been completed successfully:
  - Homing is completed when the setpoint of the profile generator has reached the home position.
  - If a following error is present, it is transferred into the function block DFSET and corrected (see chapter 3.2.56.5), provided that the drive is not operated within the torque limitation.
- REF-OK = LOW:
  - Homing is currently being executed or
  - the home position is no longer known, e.g. due to a failure, or
  - homing has been interrupted.

3.2.56.5 Function block interconnection

- REF-PSET provides the angle setpoint belonging to REF-N-SET (following error) for the angle controller in the function block MCTRL.
  - Faultless homing requires a processing of both signals (REF-PSET and REF-N-SET).
- The homing function must be connected to the function block DFSET (see signal flow diagram for the configurations 5000, 6000 and 7000).
  - Otherwise accumulating angle errors may occur.

3.2.57 Ramp function generator (RFG)

Purpose

The ramp function generator limits the rise of signals.

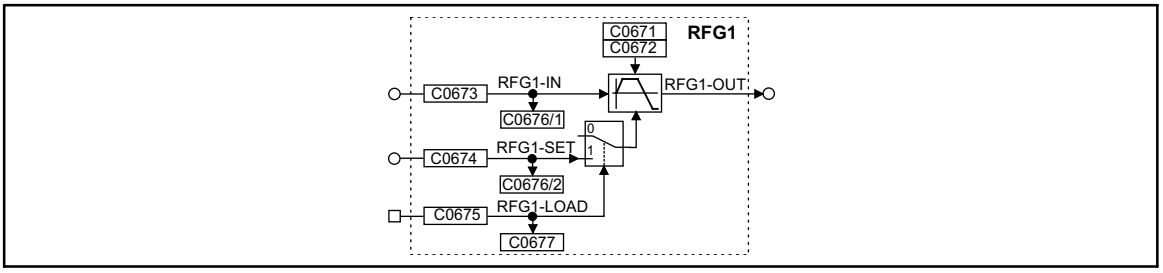


Fig. 3-153 Ramp function generator (RFG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

- Calculation and setting of the times T_{ir} and T_{if}
- Loading of the ramp function generator

3.2.57.1 Calculation and setting of the times T_{ir} and T_{if}

The acceleration time and deceleration time refer to a change of the output value from 0 to 100 %. The times T_{ir} and T_{if} to be set can be calculated as follows:

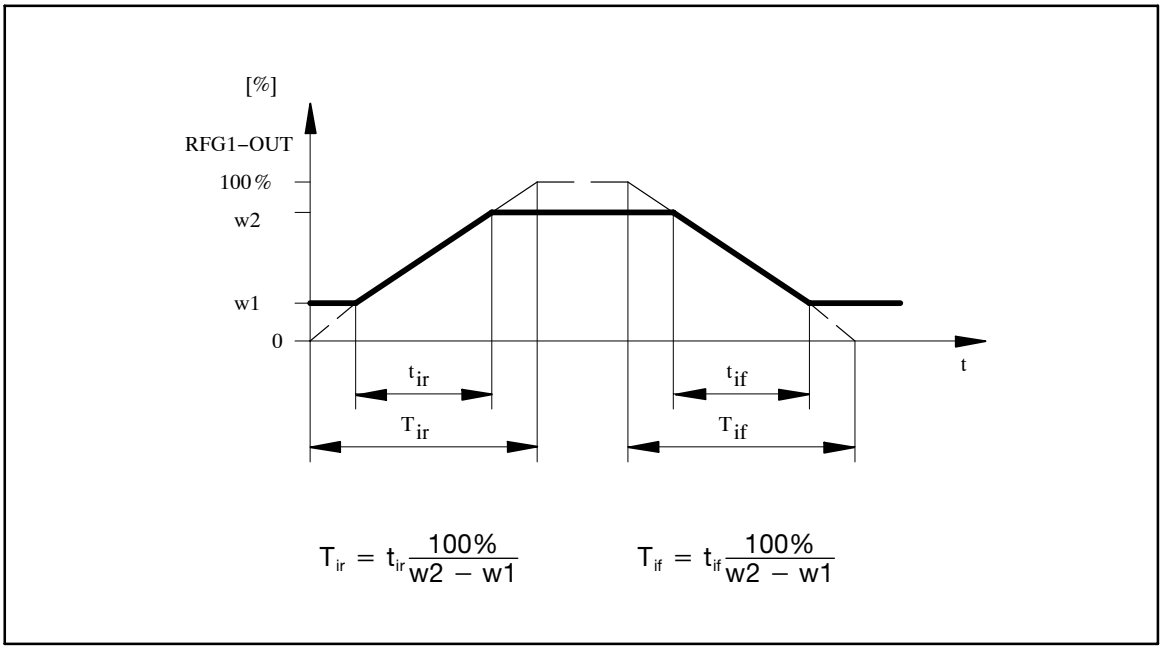


Fig. 3-154 Acceleration and deceleration times of the ramp function generator

t_{ir} and t_{if} are the times desired for the change between w_1 and w_2.The values for T_{ir} and T_{if} can be set under C0671 and C0672.

3.2.57.2 Loading of the ramp function generator

The ramp function generator can be initialised with defined values via the inputs RFG1-SET and RFG1-LOAD.

- As long as the input RFG1-LOAD = HIGH, the input RFG1-SET is switched to the output.
- If the input RFG1-LOAD = LOW, the ramp function generator accelerates/decelerates from this value to its input value within the set T_i times.

3.2.58 Sample and hold function (S&H)

Purpose

The FB can save analog signals. The saved value is also available after mains switching.

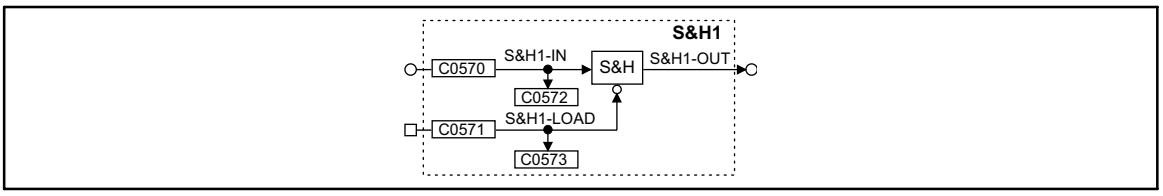


Fig. 3-155 Sample and hold function (S&H1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
S&H1-IN	a	C0572	dec [%]	C0570	1	1000	
S&H1-LOAD	d	C0573	bin	C0571	2	1000	LOW = save
S&H1-OUT	a	-	-	-	-	-	

Function

- With S&H1-LOAD = HIGH the signal at the input S&H1-IN is switched to the output S&H1-OUT.
- With S&H1-LOAD = LOW the output S&H1-OUT is disconnected from the input S&H1-IN and outputs the value which was last valid.

Saving in the case of mains disconnection:

- Keep S&H1-LOAD at LOW level when disconnecting the supply voltage (mains, DC bus or terminal 59).
- Keep S&H1-LOAD at LOW level when connecting the supply voltage (mains, DC bus or terminal 59).

3.2.59 S-shaped ramp function generator (SRFG)

Purpose

The function block serves to direct the input signal via a jerk-limited ramp generator (S shape) in order to avoid setpoint step-changes.

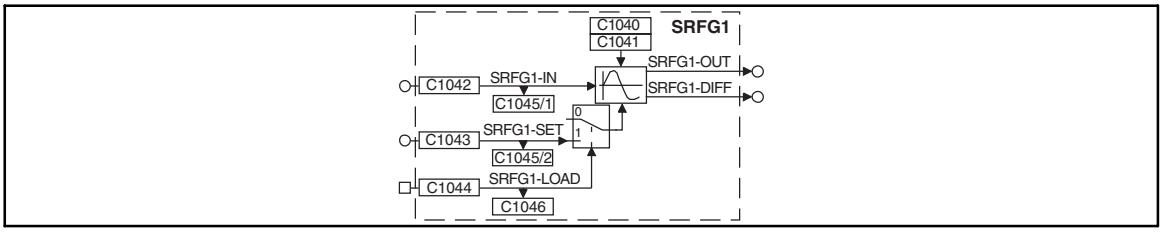


Fig. 3-156 S-shaped ramp function generator (SRFG1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SRFG1-IN	a	C1045/1	dec [%]	C1042	1	input
SRFG1-SET	a	C1045/2	dec [%]	C1043	1	Starting value for the ramp function generator, will be accepted if SRFG1-LOAD = High
SRFG1-LOAD	d	C1046	bin	C0144	2	HIGH = accepts the value at SRFG1-SET and provides it at SRFG1-OUT; SRFG1-DIFF always remains at 0 %
SRFG1-OUT	a	-	-	-	-	Output limited to ±100 %
SRFG1-DIFF	a	-	-	-	-	Output limited to ±100 %, provides the acceleration of the ramp function generator

SRFG1-LOAD

- Via digital input SRFG1-LOAD, the ramp function generator is loaded (set) with the signal from SRFG1-SET.
- This value is immediately accepted, i.e. there is no acceleration/deceleration via S shape (the output skips to this value).
- As long as SRFG-LOAD = HIGH, the ramp function generator remains inhibited.

Function

The maximum acceleration and the jerk can be set separately.

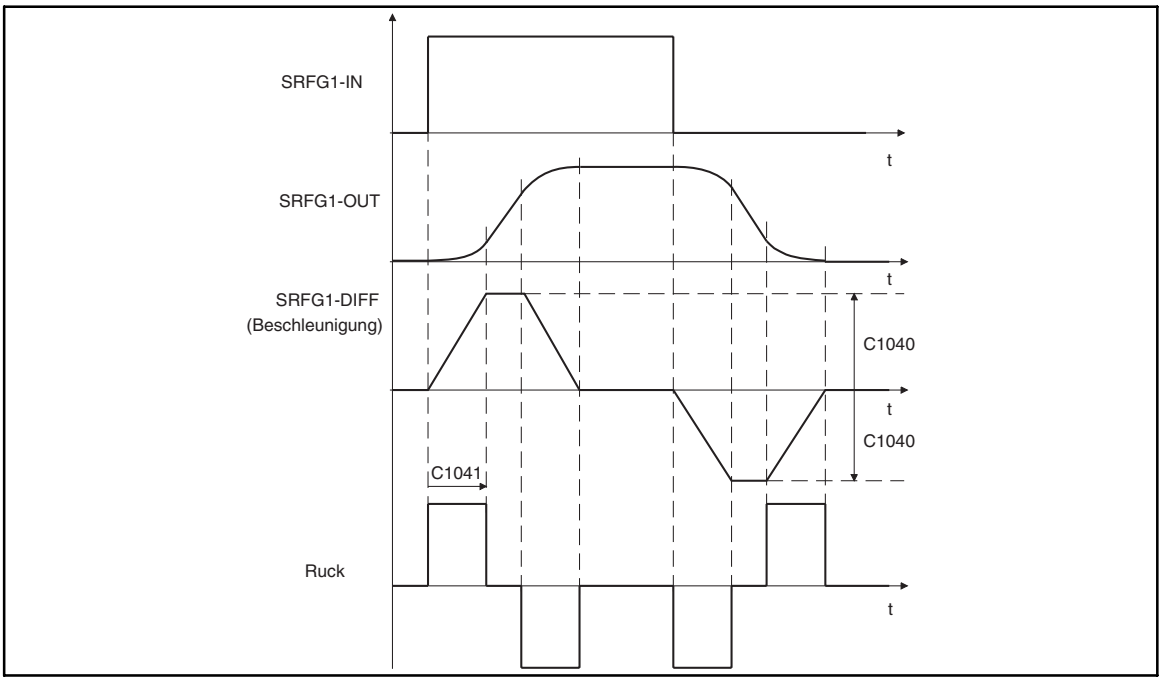
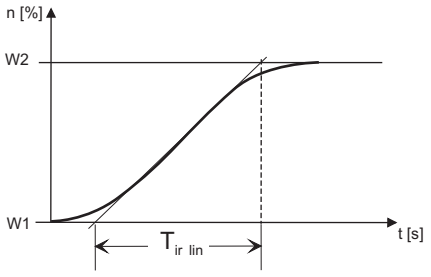


Fig. 3-157 Line diagram

- Max. acceleration:
  - C1040 applies to both the positive and the negative acceleration.
  - Setting according to formula:

$$T_{ir\ lin} = 1s \cdot \frac{W_2\ [\%] - W_1\ [\%]}{C1040\ [\%]}$$



- Jerk (C1041):
  - The jerk is selected in [s] until the ramp function generator operates at max. acceleration (see Fig. 3-157).

3.2.60 Output of digital status signals (STAT)

Purpose

The FB evaluates digital signals of function blocks and the status of the controller and passes them on to C0150 and FB AIF-OUT and CAN-OUT1.

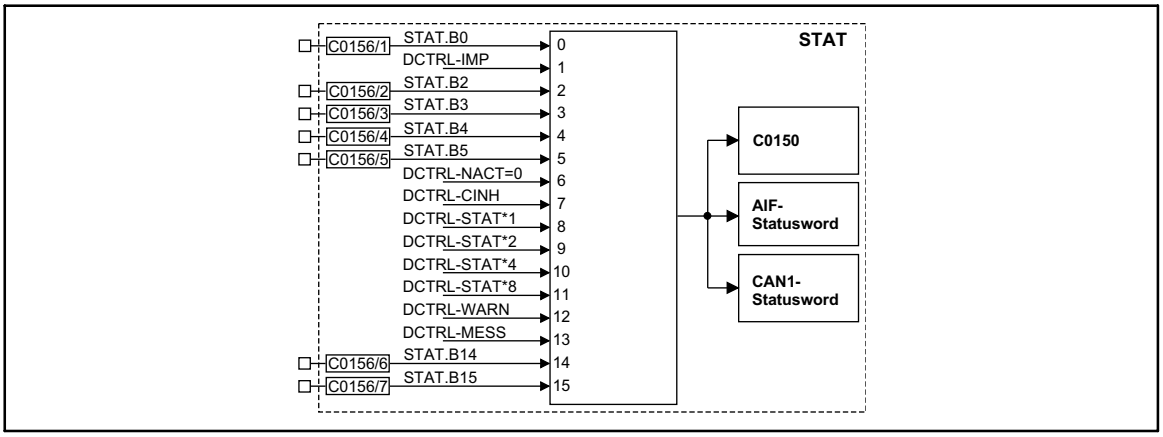


Fig. 3-158 Output of digital status signals (STAT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STAT.B0	d	-	bin	C0156/1	2	2000	
STAT.B2	d	-	bin	C0156/2	2	5002	
STAT.B3	d	-	bin	C0156/3	2	5003	
STAT.B4	d	-	bin	C0156/4	2	5050	
STAT.B5	d	-	bin	C0156/5	2	10650	
STAT.B14	d	-	bin	C0156/6	2	505	
STAT.B15	d	-	bin	C0156/7	2	500	

Function

The status word consists of some fixedly linked (DCTRL-xxxx-) and some freely linkable signal inputs (STAT.Bx).

- Digital signal sources can be freely assigned to the inputs STAT.Bx.
- The corresponding bit in the data word is marked with STAT.Bx (e.g. STAT.B0 for the LSB)
- The status word is transferred to code C0150 and to the function blocks AIF-OUT and CAN-OUT1.
- The inputs with the name DCTRL-xxxx are directly accepted from the function block DCTRL. (📖 3-57)

3.2.61 Control of a drive network (STATE-BUS)

Purpose

The FB controls the drive network to specified states (e.g. trip, quick stop or controller inhibit).

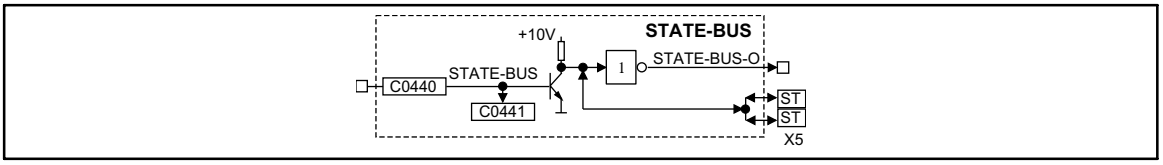


Fig. 3-159 Control of a function block STATE-BUS

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STATE-BUS	d	C0441	bin	C0440	2	1000	
STATE-BUS-0	d	-	-	-	-	-	
TERMINAL X5/ST	d	-	-	-	-	-	

Function

The STATE-BUS is a device-specific bus system which is designed for Lenze controllers only. The function block STATE-BUS acts on the terminals X5/ST or reacts on a LOW signal at these terminals (multi-master capable).

- Every connected controller can set these terminals to LOW.
- All connected controllers evaluate the signal level at these terminals and control the internally configured function blocks.
- Up to 20 controllers can be connected.

Stop!

Do not apply an external voltage at terminals X5/ST.

3.2.62 Storage block (STORE)

Purpose

Stores a set phase signal created from a speed signal. The storage process is activated via the TP input Ex.

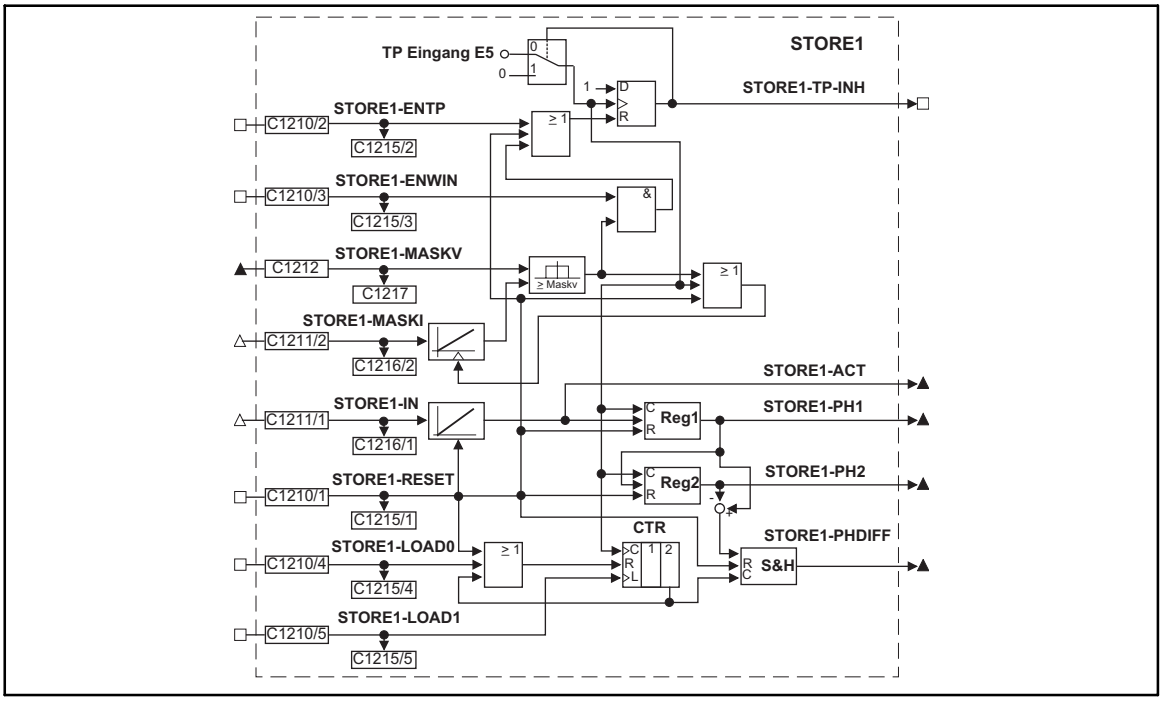


Fig. 3-160 Storage block (STORE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE1-IN	phd	C1216/1	dec [rpm]	C1211/1	4	1000	-
STORE1-RESET	d	C1215/1	bin	C1210/1	2	1000	HIGH = resets all functions
STORE1-ENTP	d	C1215/2	bin	C1210/2	2	1000	HIGH = enables the triggering via the TP input E5
STORE1-MASKI	phd	C1216/2	dec [rpm]	C1211/2	4	1000	-
STORE1-MASKV	ph	C1217	dec [inc]	C1212	3	1000	-
STORE1-ENWIN	d	C1215/3	bin	C1210/3	2	1000	HIGH = signal enable when | STORE1-MASKI | ≥ STORE1-MASKV
STORE1-LOAD0	d	C1215/4	bin	C1210/4	2	1000	HIGH = resets the counter which controls the output at STORE1-PHDIFF
STORE1-LOAD1	d	C1215/5	bin	C1012/5	2	1000	LOW-HIGH edge = sets the counter = 1 which controls the output to STORE1-PHDIFF

Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE1-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE1-PH1	ph	-	-	-	-	-	Outputs the last value stored by X5/E5
STORE1-PH2	ph	-	-	-	-	-	Outputs the last but one value stored by X5/E5
STORE1-PHDIFF	ph	-	-	-	-	-	Outputs the difference of STORE1-PH1 and STORE1-PH2
STORE1-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E5 has been done. For another triggering a positive edge must be activated at the input STORE1-ENTP.

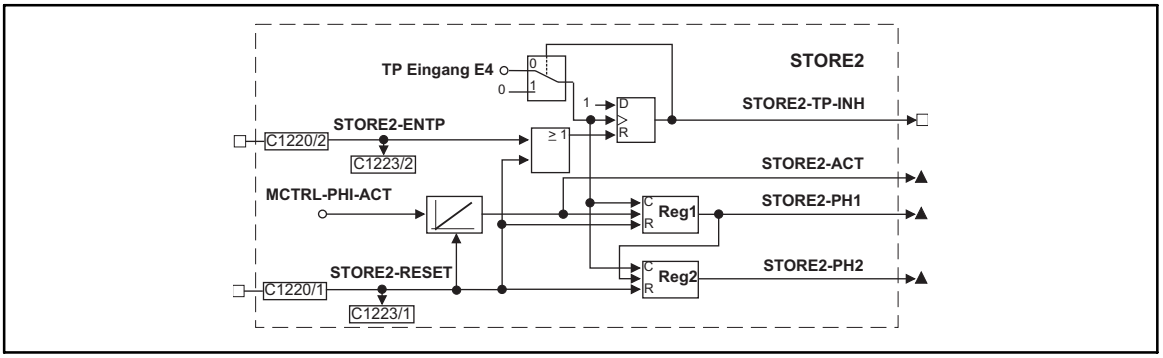
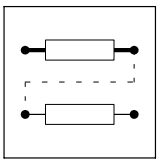


Fig. 3-161 Storage block (STORE2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE2-RESET	d	C1223/1	bin	C1220/1	2	1000	HIGH = resets all functions
STORE2-ENTP	d	C1223/2	bin	C1220/2	2	1000	HIGH = enables the triggering via the TP input E4 free
STORE2-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE2-PH1	ph	-	-	-	-	-	Outputs the last value stored by X5/E5
STORE2-PH2	ph	-	-	-	-	-	Outputs the last but one value stored by X5/E5
STORE2-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E4 has been done. For another triggering a positive edge must be activated at the input STORE1-ENTP.

Function

- STORE1 control via TP input E5
- Storing STORE1 phase signal
- Storing STORE2 phase signal



3.2.62.1 STORE1 control via TP input E5

The trigger signal STORE1-TP-INH indicates a triggering done via the TP input E5 with a HIGH signal (LOW-HIGH edge at X5/E5). At the same time it is signalled with STORE1-TP-INH that the triggering is deactivated and must be reset to the active state. This can be done via

- STORE1-RESET = HIGH
- STORE1-ENTP = LOW-HIGH edge
- STORE1-ENWIN = HIGH **and** the comparison of phase signals

Comparison of phase signals

A phase signal is created from the speed signal at STORE1-MASKI and is compared with the phase signal at STORE1-MASKV.

If the condition | STORE1-MASKI | ≥ STORE1-MASKV

is fulfilled,

- the TP input E5 is enabled for the next triggering with STORE1-ENWIN = HIGH,
- the integrator for the speed signal at STORE1-MASKI is reset.

3.2.62.2 Storing STORE1 phase signal

A phase signal is created from a speed signal at STORE1-IN. The following sequence shows, in addition to storing, the options of signal output

- The actual phase signal is output at STORE1-ACT.

1. A LOW-HIGH edge at the TP input E5 stores the last phase signal and outputs it at STORE1-PH1.
2. STORE1-ENTP = LOW-HIGH edge enables the TP input E5 for the next triggering.
3. A renewed LOW-HIGH edge at the TP input E5 stores the last phase signal.
   – STORE1-PH1 outputs this last phase signal.
   – STORE1-PH2 outputs the last but one phase signal.
   – STORE1-PHDIFF outputs the difference of STORE1-PH1 and STORE1-PH2.

- STORE1-RESET = HIGH resets memory, counter and integrators and activates the TP input for triggering.

Output of the difference between both phase signals stored

- A two-stage counter controls the output to STORE1-PHDIFF.
- Every second triggering via the TP input results in a new output to STORE1-PHDIFF.
- STORE1-LOAD0 = HIGH resets the counter.

Additional control

1. STORE1-LOAD1 = LOW-HIGH edge, sets the counter to the first stage (preparation for the output to STORE1-PHDIFF).
2. Triggering via TP input E5 sets the counter to the second stage (output to STORE1-PHDIFF is done).

Tip!

If STORE1-LOAD1 is set cyclically, STORE1-PHDIFF outputs a new difference signal after every triggering.

3.2.62.3 Storing STORE2 phase signal

A phase signal is created from a speed signal at MCTRL-PHI-ACT. The following sequence shows, in addition to storing, the options of signal output.

- The actual phase signal is output to STORE2-ACT.

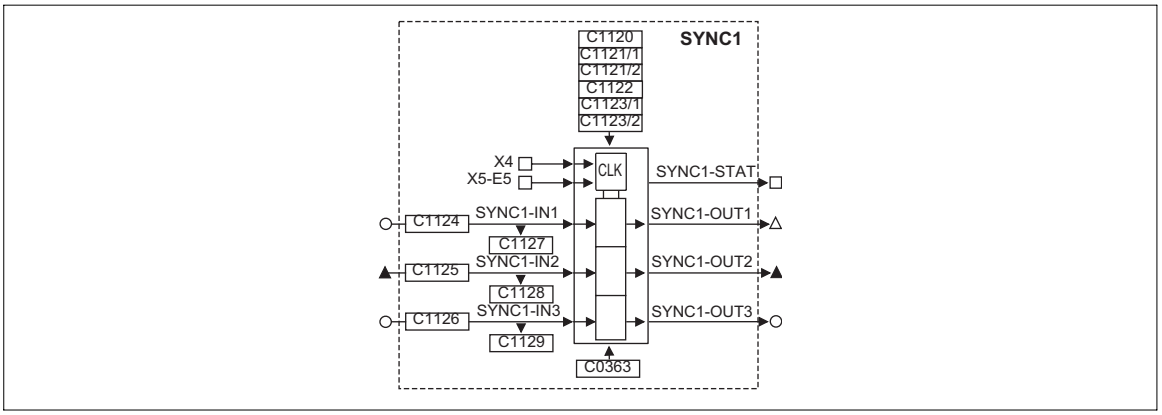
1. A LOW-HIGH edge at the TP input E4 stores the last phase signal and outputs it at STORE2-PH1.
2. STORE2-ENTP = LOW-HIGH edge activates the TP input E4 for the next triggering.
3. A renewed LOW-HIGH edge at the TP input E4 stores the last phase signal.
   – STORE2-PH1 outputs this last phase signal.
   – STORE2-PH2 outputs the last but one phase signal.

- STORE2-RESET = HIGH resets the memory and integrator and activates the TP input E4 for triggering.

3.2.63 Multi-axis synchronisation (SYNC1)

Purpose

Synchronises the control program cycle of the drives to the cycle of a master control.



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC1-IN1	a	C1127	dec [inc]	C1124	1	1000	-
SYNC1-IN2	ph	C1128	dec [inc]	C1125	3	1000	-
SYNC1-IN3	a	1129	dec	C1126	1	1000	
SYNC1-STAT	d	-	-	-	-	-	After the synchronisation is completed, SYNC1-STAT switches to HIGH. If the synchronisation is quit, SYNC1-STAT switches to LOW.
SYNC1-OUT1	phd	-	-	-	-	-	Cannot be used for angle-accurate speed/angle difference transmission
SYNC1-OUT2	ph	-	-	-	-	-	With interpolation, for cyclically synchronised position information
SYNC1-OUT3	a	-	-	-	-	-	With interpolation, for analog values

Function

- Possible axis synchronisations (chapter 3.2.63.1)
- Cycle times (chapter 3.2.63.2)
- Phase displacement (chapter 3.2.63.3)
- Synchronisation window for synchronisation via terminal (SYNC WINDOW) (chapter 3.2.63.4)
- Correction value of phase controller (SYNC CORRECT) (chapter 3.2.63.5)
- Fault indications (chapter 3.2.63.6)
- Configuration examples (chapter 3.2.63.7)
- Scaling (chapter 3.2.63.8)

3.2.63.1 Possible axis synchronisations

Operating mode

Code	Value	Function
C1120	0	FB without function. Assigns the data at the inputs directly to the outputs.
	1	CAN Sync active Synchronises the controllers to the sync telegram of the system bus.
	2	Terminal Sync active Synchronises the controllers to the sync signal of terminal X5/E5.

Synchronisation time

In addition to certain mains connection and initialisation time of the controller, the FB SYNC1 also requires a synchronisation time.

The synchronisation time depends on

- the baud rate of the system bus (CAN-SYNC),
- the starting time (reception of the first SYNC telegram / signal),
- the time between the SYNC telegrams,
- the SYNC correction factor (C0363),
- the operating mode of the FB SYNC1.

Axis synchronisation via system bus (CAN)

The system bus (CAN) transmits the sync telegram and the process signals.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via the system bus (CAN).

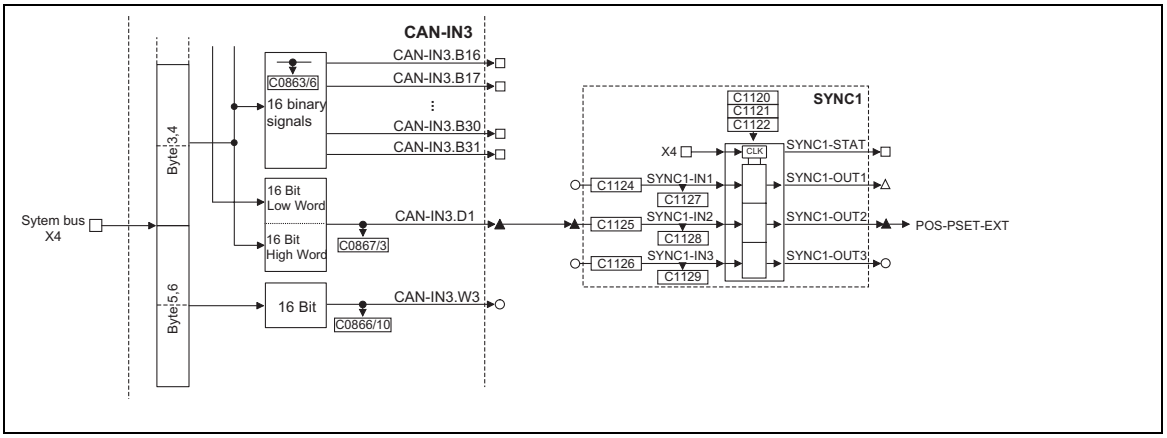


Fig. 3-162 Example for linking the FB SYNC1

Axis synchronisation via terminal control (X5/E5)

The transmission paths for the sync signal and the process signals are separated.

- The process signals are connected via a freely selectable input channel (e. g. AIF interface, DF input).
- The sync signal is injected via terminal X5/E5.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via other bus systems (e. g. Interbus).
- Synchronisation of the internal processing cycles of the FB to higher-level process controls.

3.2.63.2 Cycle times

Sync cycle time (SYNC CYCLE)

The master (e. g. PLC) sends the periodic sync telegram[1)] (sync signal[2)]).

The controllers (slaves) receive the sync telegram and compare the time between two LOW-HIGH edges of the signal with the selected cycle time (1121/1).

The cycle time is entered in integers (1 ms, 2 ms, 3 ms, ...).

1) Designation for the synchronisation via system bus (CAN)

2) Designation for the synchronisation via terminal

Code	Value	Function
C1121/1	1 ... 13 ms	Definition of the cycle time of the sync telegram (sync signal). Parameters must only be set for the slave. • C1120 = 1 (CAN sync) – Time between two sync telegrams of the master. Adapt the time to the master SYNC. C0362 indicates the time (CAN sync cycle) for the slave. Set the value in C1121/1 higher than the value in C0362. • C1120 = 2 (terminal SYNC) – Time between two sync signals of the master at X5/E5. Adapt the time to the master SYNC. Set the value in C1121/1 ≥ the cycle time of the master.

Interpolation cycle time (INTPOL. CYCLE)

The FB interpolates the input signals (C1124, C1125, C1126) between the sync telegrams or sync signals and transmits them to the corresponding output. This ensures an optimum signal course with regard to the internal processing cycle (e. g. minimising signal jumps in the output variable when operating with high sync cycles).

The interpolation is restarted with every sync signal (LOW-HIGH edge).

Code	Value	Function
C1121/2	1 ... 13 ms	Definition of the interpolation cycles/steps • C1120 = 1 – C1121/2 has no effect. – The interpolation cycles are derived from the sync cycle (C1121/1). • C1120 = 2 – The interpolation cycle can be selected irrespective of the sync cycle. – The parameter setting of C1121/2 must be selected according to the cycle of the process value input.

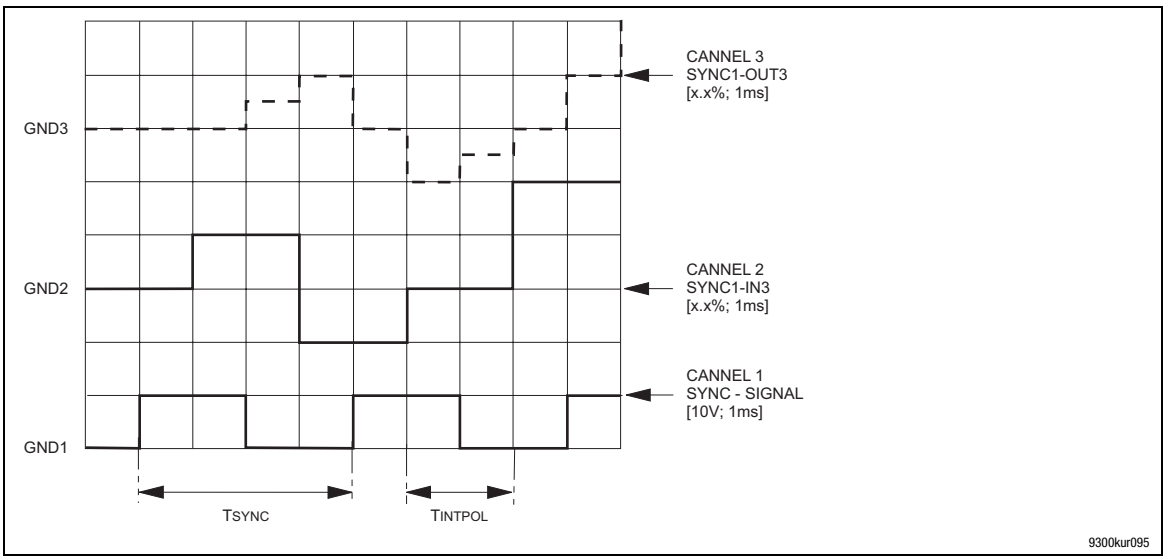


Fig. 3-163 Interpolation example

See Fig. 3-163:

An analog value at SYNC1-IN3 is output as an interpolated value at SYNC1-OUT3.

- Sync cycle (C1121/1) = 4 ms
- Interpol. cycle (C1121/2) = process cycle = 2 ms
- Phase displacement (C1123/1) = 0 ms

3.2.63.3 Phase displacement

Phase displacement for synchronisation via system bus (SYNC TIME)

Code	Value	Function
C1122	0 ...10.000 µs	• C1120 = 1 – Phase displacement between the sync telegram and the start of the internal control program. – The parameters are set automatically depending on the parameter setting of the system bus (CAN). • C1120 = 2 – C1122 has no effect.

Phase displacement for synchronisation via terminal (PHASESHIFT)

Code	Value	Function
C1123/1	-1.000 ms to +1.000 ms	• C1120 = 1 – C1123/1 has no effect. • C1120 = 2 – Phase displacement between the sync signal and the start of the internal control program (e. g. for compensating the effects of signal propagation delays/dead times for the sync signal of the single slave drives).

3.2.63.4 Time slot for synchronisation via terminal

Code	Value	Function
C1123/2	0 ... 1.000 ms	• C1120 = 1 – C1123/2 has no effect. • C1120 = 2 – Definition of a ”time slot” for the LOW-HIGH edges of the sync signal for the slave (defined via C1121/1). – If the sync signal sent by the master is within the ”time slot”, the SYNC1-STAT is switched to HIGH.

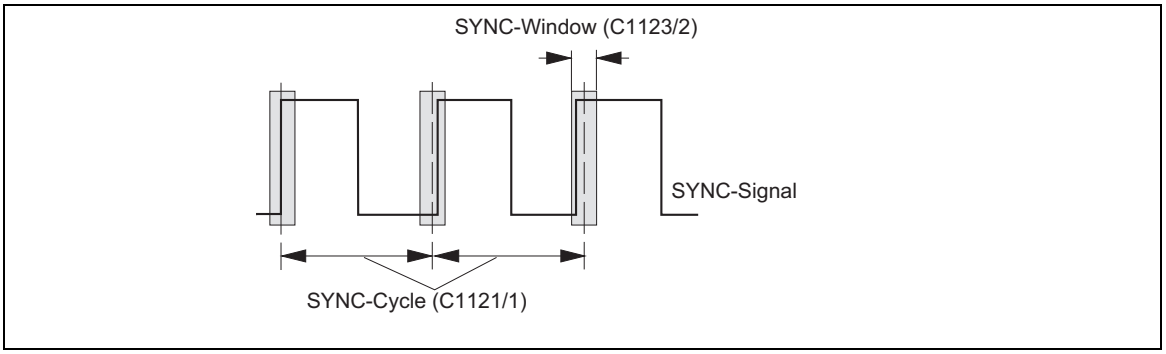
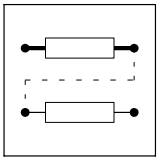


Fig. 3-164 “Time slot” for the LOW-HIGH edges of the sync signal

Tip!

A jitter of up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The size of the jitter affects the parameter setting of the ”time slot”.



3.2.63.5 Correction value of the phase controller

Code	Value	Function
C0363	1 ... 5	• Correction values for C0363 = 1 → 0.8 µs 2 → 1.6 µs 3 → 2.4 µs 4 → 3.2 µs 5 → 4.0 µs • C1120 = 1 – The value is automatically derived from the internal parameters of the system bus (CAN). • C1120 = 2 – Optimising the rise time of the phase controller depending on the frequency of the sync signal. – Increase the value if the frequency of the sync signal decreases. – A stable signal at SYNC1-STAT is an indicator for an optimal parameter setting.

3.2.63.6 Fault indications

Fault indications for the synchronisation via system bus

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	The time between two sync telegrams is faulty	C0362 indicates the time between two sync telegrams • Set the time in C1121/1 to the time in C0362 • Adapt the time interval of the sync telegram from the master

Fault indications for the synchronisation via terminal

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	Sync signal is missing	Connect sync signal with terminal X5/E5
	The period of the sync signal is not a multiple of 1 ms	Adapt the period
	Sync window is too small	Adapt C1123/2 to the conditions

3.2.63.7 Configuration examples

Configuration example CAN-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller and system bus without FB SYNC1
2.	-	Inhibit controller
3.	CAN master	Define the sequence of the telegrams 1. Send new setpoint to all slaves 2. Send sync telegram 3. All slaves must respond
4.	CAN slave drives	Enter FB SYNC1 into the first position of the processing table
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 1 (sync mode for FB SYNC1)
7.	CAN master	Start communication, send sync telegrams
8.	CAN slave drives	FB SYNC1 (CAN SYNC-CYCLE) • Retrieve cycle time of the SYNC telegram from the master via C0362
9.		FB SYNC1 (SYNC CYCLE) • Set C1121 according to the time interval of the sync telegrams from the control • Set C1121 ≥ C0362
10.		Parameterise the monitoring function P16 via C1290
11.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
12.		Via FB DIGOUT • Detect signal of SYNC1-STAT
13.		Only enable the controller when SYNC1-STAT = HIGH

Configuration example TERMINAL-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller without FB SYNC1
2.	-	Inhibit controller
3.	Slave drives	Enter FB SYNC1 into the first position of the processing table
4.		Apply sync signal to terminal X5/E5
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 2 (sync mode for FB SYNC1)
7.	Sync master	Start communication, send sync signals
8.	Slave drives	FB SYNC1 (SYNC CYCLE) • Parameterise the sync cycle time of the sending source via C1121
9.		Parameterise the monitoring function P16 via C1290
10.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
11.		Via FB DIGOUT • Output signal of SYNC1-STAT
12.		FB SYNC1 (SYNC WINDOW) • Enter the optimal size of the ”time slot” via C1123/2 • If the sync signal jitters strongly, increase the ”time slot”
13.		Only enable the controller when SYNC1-STAT = HIGH

3.2.63.8 Scaling

The signal at input is transmitted in a scaled form to SYNC1-OUT1.

Scaling formula:

$$\text{SYNC1-OUT1 [rpm]} = \text{SYNC1-IN1 [inc]} \cdot \frac{1875\ \text{rpm}}{2048\ \text{inc}}$$

The inputs SYNC1-IN2 and SYNC1-IN3 are not scaled. The FB transmits the data to SYNC1-OUT2 or SYNC1-OUT3 without any evaluation.

3.2.64 Edge evaluation (TRANS)

Purpose

This function is used to evaluate digital signal edges and convert them into pulses of a defined duration.

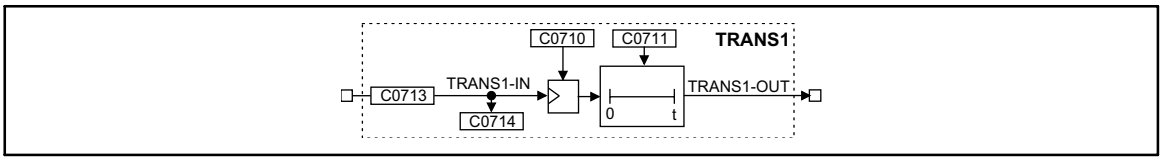


Fig. 3-165 Edge evaluation (TRANS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS1-IN	d	C0714	bin	C0713	2	1000	-
TRANS1-OUT	d	-	-	-	-	-	-

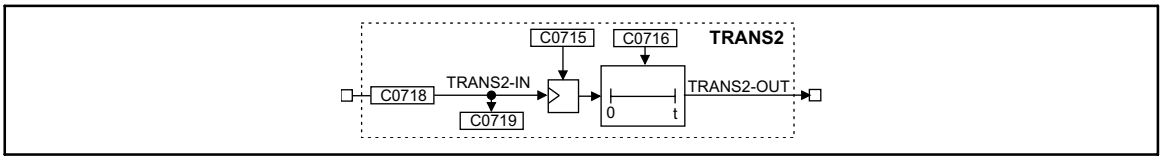


Fig. 3-166 Edge evaluation (TRANS2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS2-IN	d	C0719	bin	C0718	2	1000	-
TRANS2-OUT	d	-	-	-	-	-	-

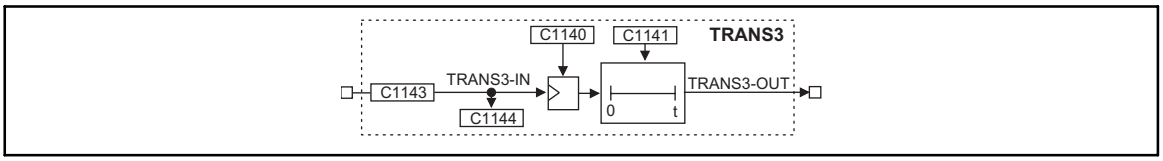


Fig. 3-167 Edge evaluation (TRANS3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS3-IN	d	C1144	bin	C1143	2	1000	-
TRANS3-OUT	d	-	-	-	-	-	-

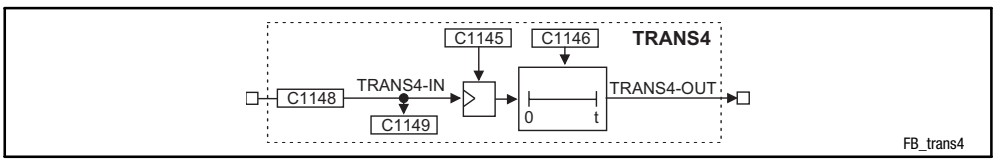


Fig. 3-168 Signal evaluation (TRANS4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS4-IN	d	C1149	bin	C1148	2	1000	-
TRANS4-OUT	d	-	-	-	-	-	-

Function

This FB is an edge evaluator which can be retriggered. This FB can react to different events. The following functions can be selected under code C0710 or C0716:

- Positive edge
- Negative edge
- Positive or negative edge

3.2.64.1 Evaluate positive edge

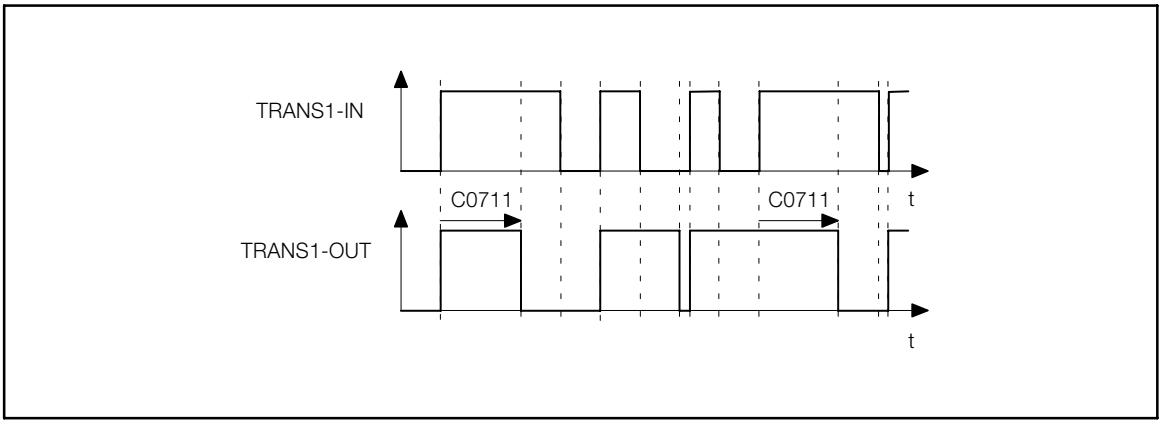


Fig. 3-169 Evaluation of positive edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another LOW-HIGH edge at the input.

3.2.64.2 Evaluate negative edge

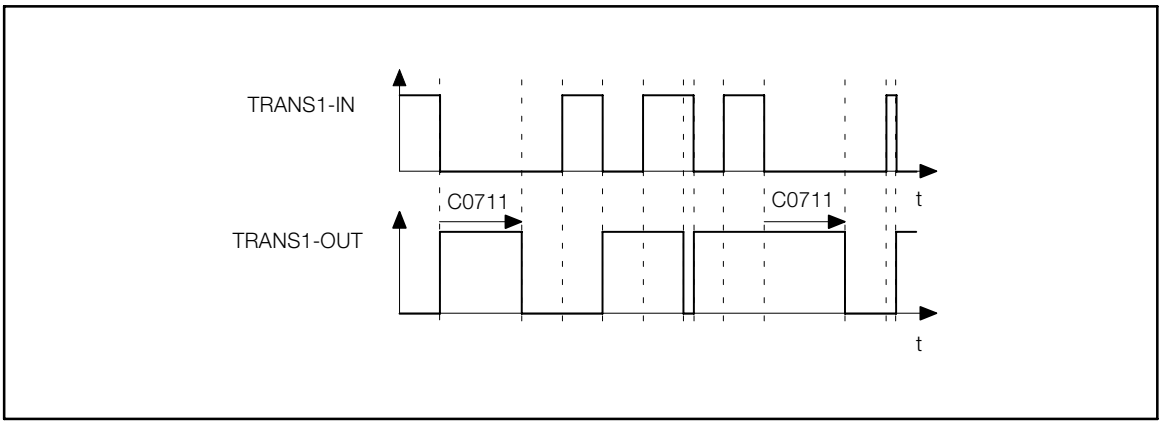


Fig. 3-170 Evaluation of negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW, unless there is another HIGH-LOW edge at the input.

3.2.64.3 Evaluate positive or negative edge

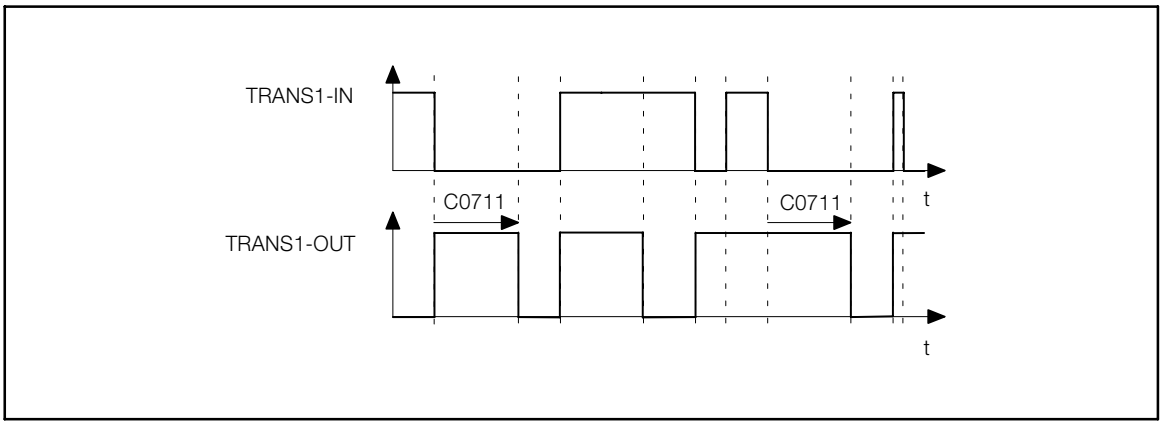
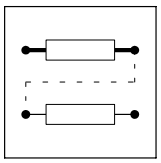


Fig. 3-171 Evaluation of positive and negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge or a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another HIGH-LOW edge or LOW-HIGH edge at the input.



4 Application examples

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4.3 Torque control with speed limitation (C0005 = 4000) 4-7
4.4 Master frequency - Master - Drive (C0005 = 5000) 4-9
4.5 Master frequency bus - slave - drive (C0005 = 6000) 4-12
4.6 Master frequency cascade - slave - drive (C0005 = 7000) 4-14

Application examples

4.1 Important notes

Signal processing in the controller is saved in basic configurations for common applications.

- You can select and activate the basic configurations via C0005 and adapt them with only a few settings to your application (short setup). (📖 2-4)
- The setting of the motor data and the adaptation of the motor control is generally independent of the configuration and is described in chapter ”Commissioning”.

Configuration	Basic function	
1xxx	Speed control	📖 4-4
4xxx	Torque control with speed limitation	📖 4-7
5xxx	Master for digital frequency coupling	📖 4-9
6xxx	Slave to digital frequency bus	📖 4-12
7xxx	Slave to digital frequency cascade	📖 4-14

Note!

The GDC and the keypad include the most important codes for the basic configurations in the “Short setup” menus.

4.2 Speed control (C0005 = 1000)

Tip!

The most important settings can be found in the menu: ”Short Setup / Speed mode” of the XT keypad or in the menu ”Short setup / Speed mode” in Global Drive Control.

Enter motor type (contains all nameplate data of the motor)

C0173	xxx	Enter UG limit (mains voltage)
C0086	000	Enter motor data manually

Enter maximum motor current

C0022	xxxA	Determine Imax

Enter controller configuration

C0005	1000	Select speed control
C0025	xxx	Enter feedback system

Speed setpoint settings

C0011	xxx rpm	Determine max. speed
C0012	xxx s	Set acceleration time
C0013	xxx s	Set deceleration time
C0105	xxx s	Set QSP deceleration time

Application parameters

C0070	xxx	Vp n-controller
C0071	xxx	Tn n-controller

Save parameters

C0003	xxx	Save all parameters

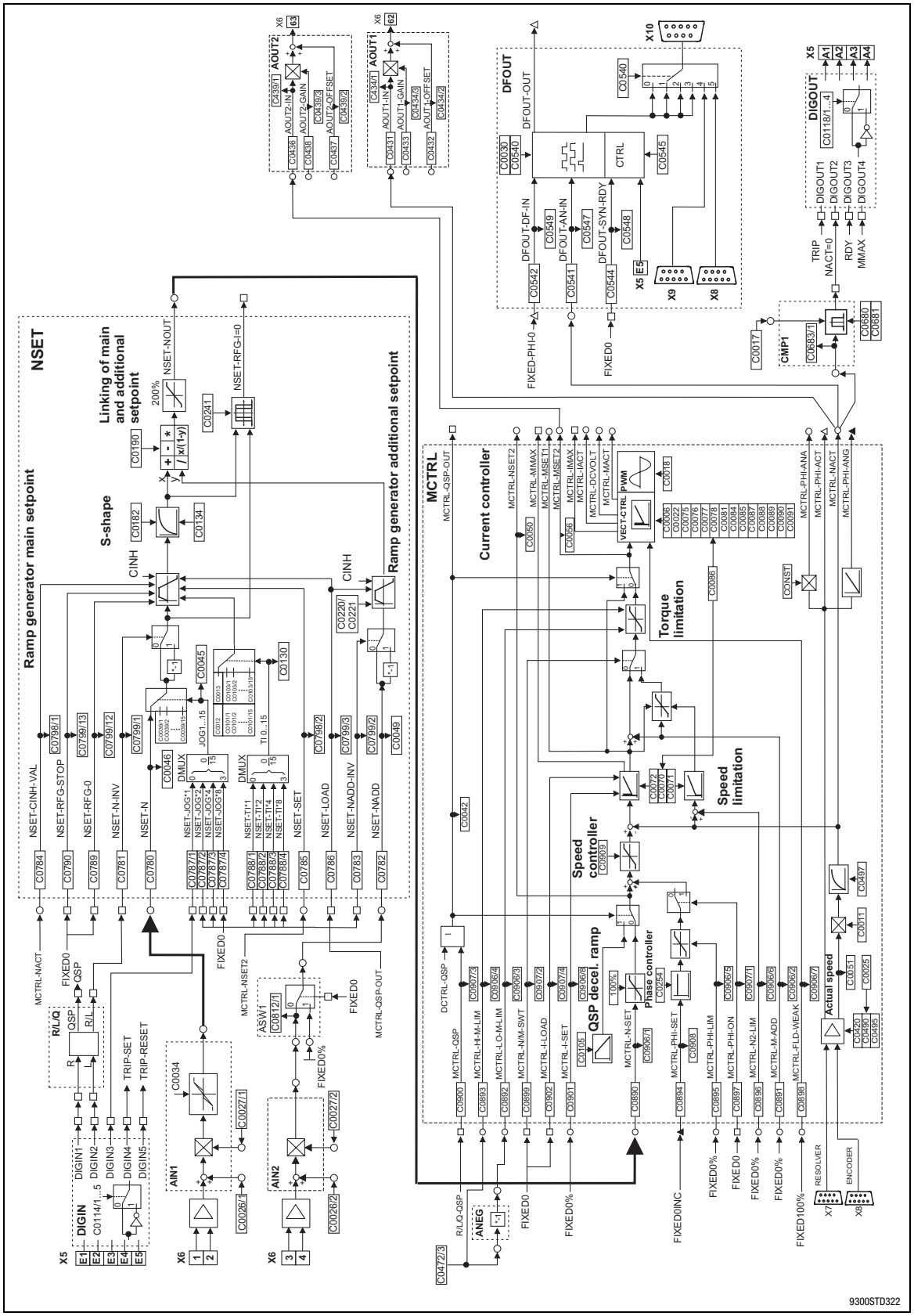


Fig. 4-1 Signal flow diagram for configuration 1000

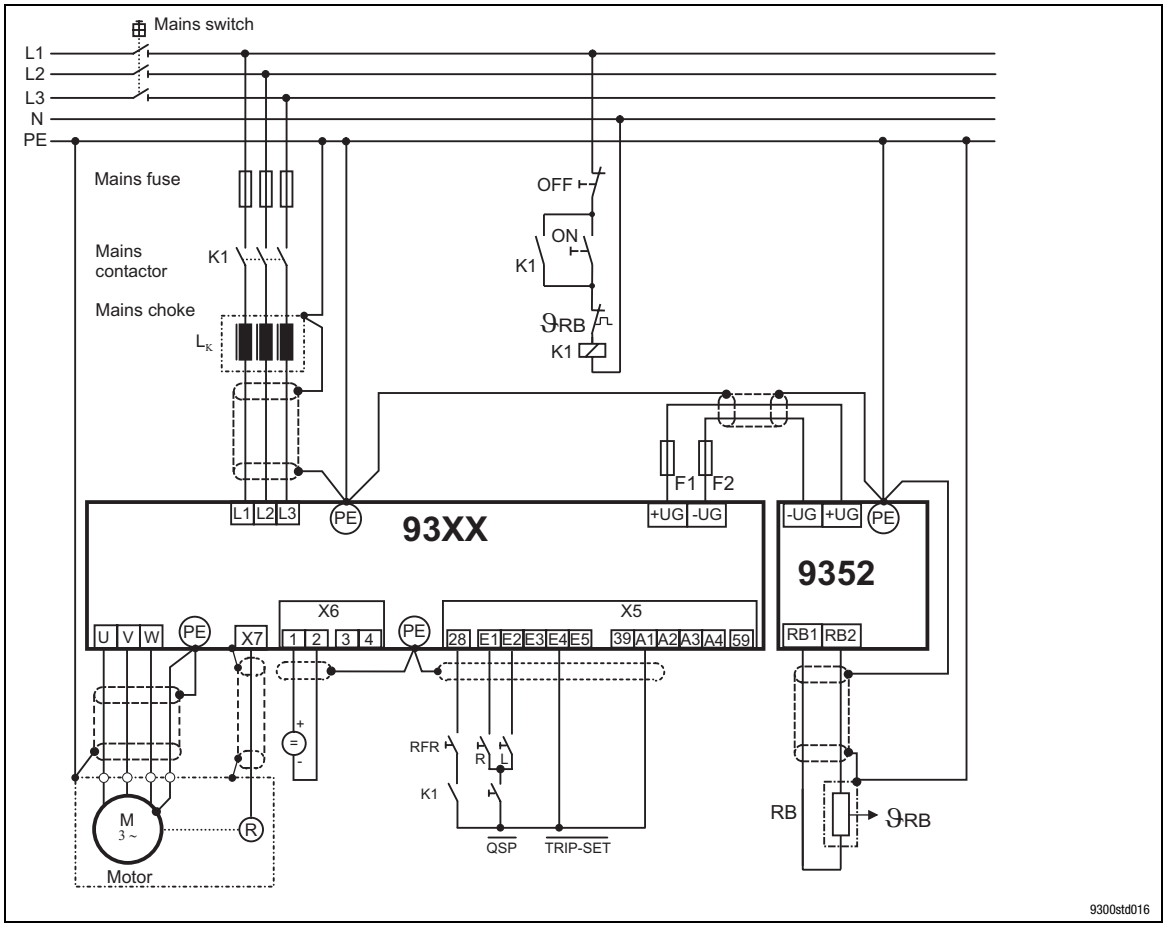


Fig. 4-2 Connection diagram of configuration 1000

Tip!

A braking unit is only required if the DC-bus voltage in the 93XX servo inverter exceeds the upper switch-off threshold set in C0173 when operating in generator mode (activation of the monitoring function ”OU”). The braking unit prevents ”OU” from being activated by converting the kinetic energy of the machine into heat which prevents the DC-bus voltage from exceeding the upper switch-off threshold.

4.3 Torque control with speed limitation (C0005 = 4000)

Tip!

The most important settings can be found in the menu: ”Short Setup / Speed mode” of the operating module or in the menu ”Short setup / Speed mode” in Global Drive Control.

Enter motor type (contains all nameplate data of the motor)

C0173	xxx	Enter UG limit (mains voltage)
C0086	000	Enter motor data manually

Enter maximum motor current

C0022	xxxA	Determine Imax

Enter controller configuration

C0005	4000	Select torque control
C0025	xxx	Enter feedback system

Speed setpoint settings

C0011	xxx rpm	Determine max. speed
C0105	xxx s	Set QSP deceleration time

Speed limitation

C0472/4	xxx % nmax	Determine lower speed limit

Application parameters

C0070	xxx	Vp n-controller
C0071	xxx	Tn n-controller

Save parameters

C0003	xxx	Save all parameters

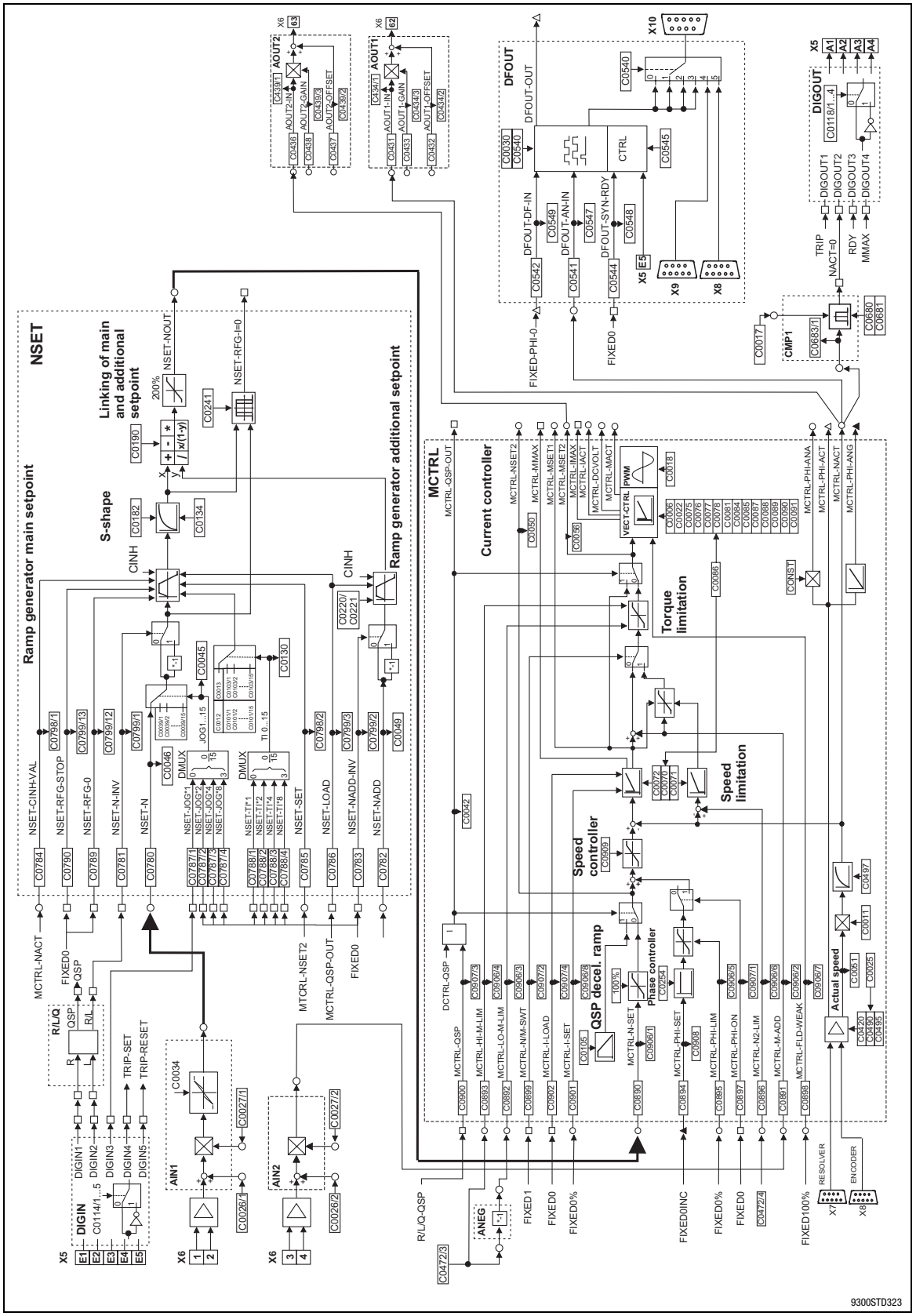


Fig. 4-3 Signal flow diagram of configuration 4000

4.4 Master frequency - Master - Drive (C0005 = 5000)

Tip!

The most important settings can be found in the menu: ”Short Setup / Speed mode” of the operating module or in the menu ”Short setup / Speed mode” in Global Drive Control.

Enter motor type (contains all nameplate data of the motor)

C0173	xxx	Enter UG limit (mains voltage)
C0086	000	Enter motor data manually

Enter maximum motor current

C0022	xxxA	Determine Imax

Enter controller configuration

C0005	5000	Master frequency - master - general drive
	5900	with emergency stop for the drive system with QSP
C0025	xxx	Enter feedback system

Speed setpoint settings

C0011	xxx rpm	Determine max. speed
C0012	xxx s	Set acceleration time
C0013	xxx s	Set deceleration time
C0105	xxx s	Set QSP deceleration time under C0005 = 5000
C0672	xxx s	Set QSP deceleration time under C0005 = 59xx
C0032	xxx	Numerator of gearbox factor
C0033	xxx	Denominator of gearbox factor
C0473/1	xxx	Numerator of stretching factor
C0533	xxx	Denominator of stretching factor

Application parameters

C0070	xxx	Vp n-controller
C0071	xxx	Tn n-controller
C0254	xxx	Gain of the angle controller

Save parameters

C0003	xxx	Save all parameters

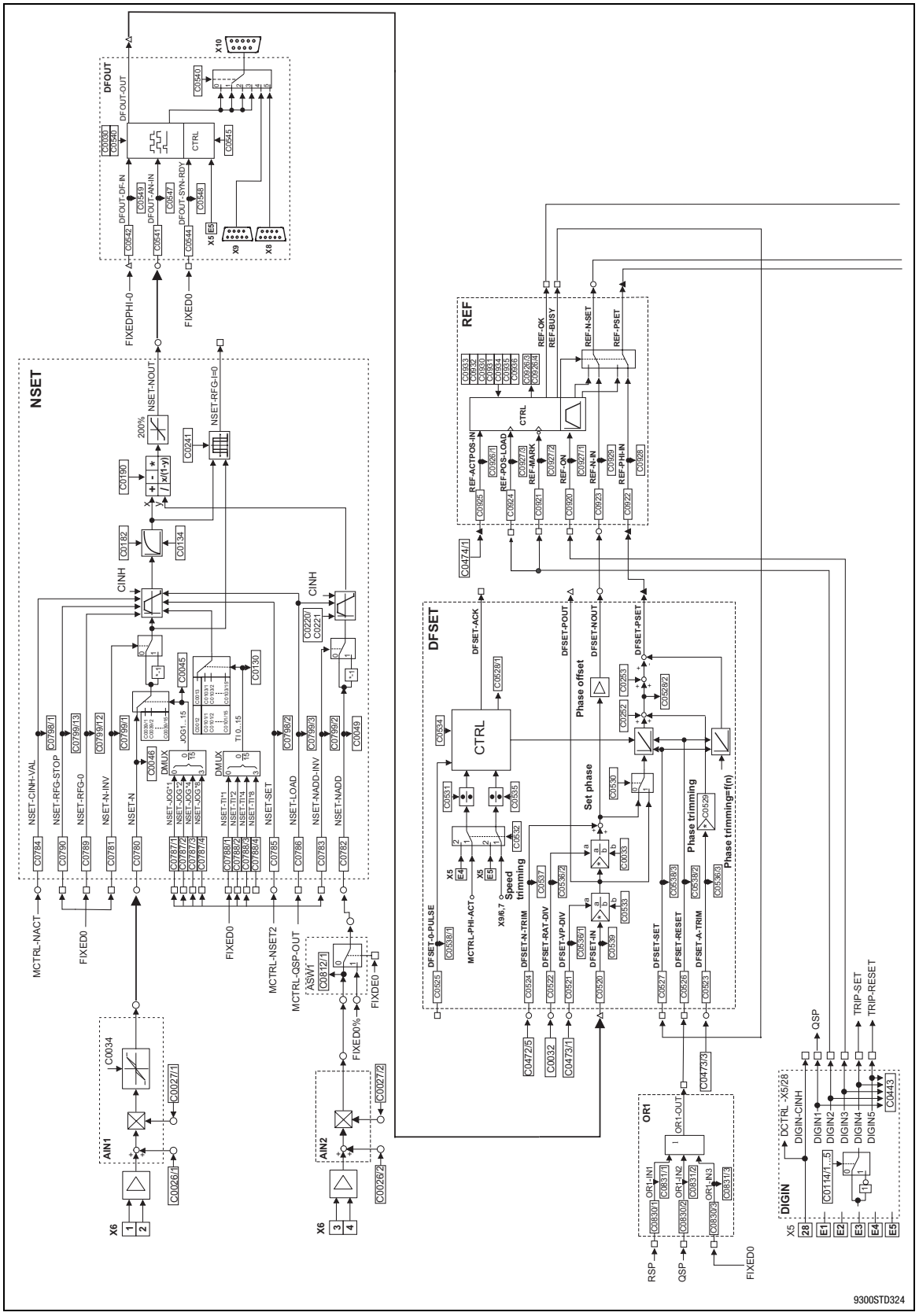
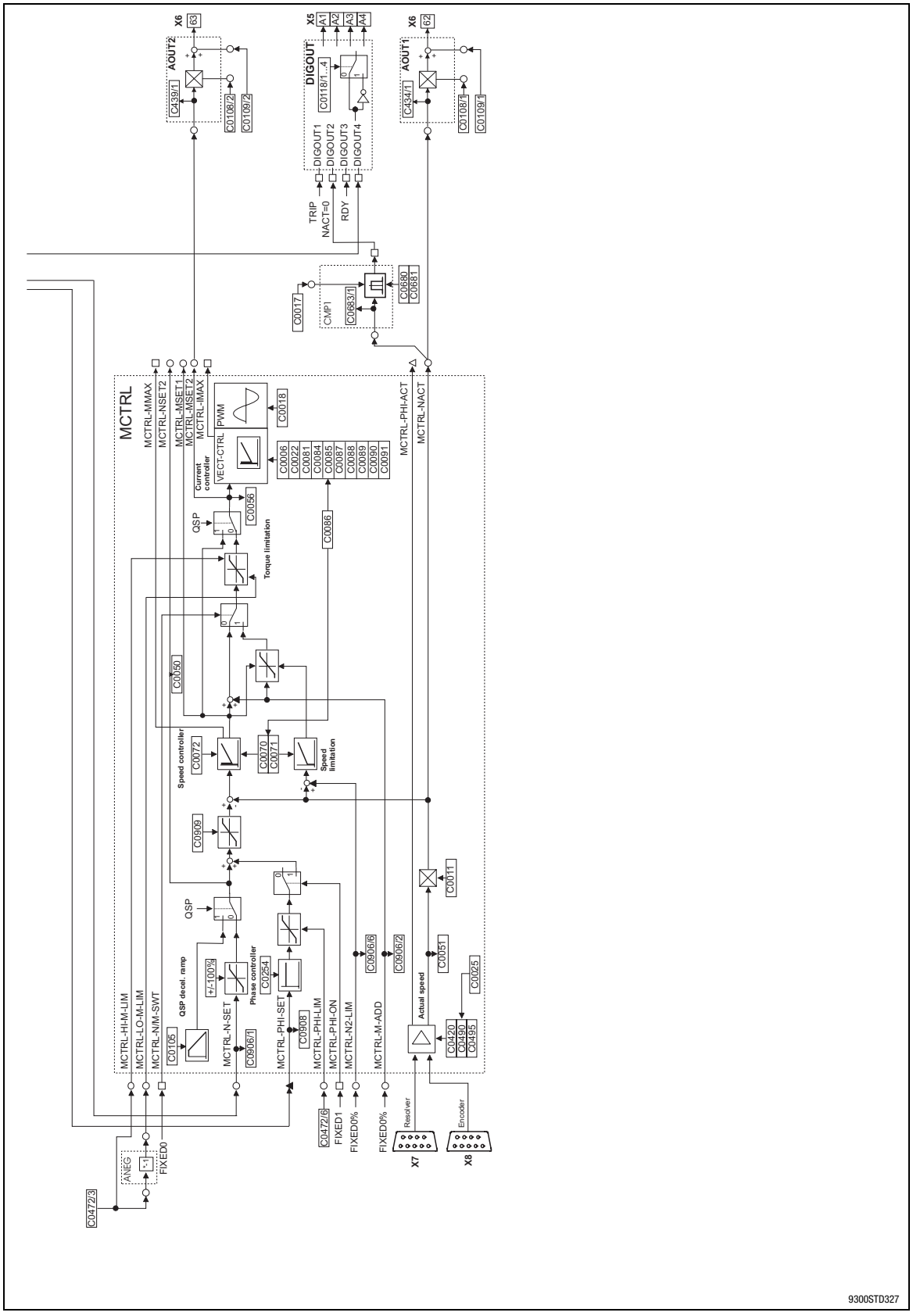


Fig. 4-4 Signal flow diagram for configuration 5000 (sheet 1)



9300STD327

Fig. 4-5 Signal flow diagram for configuration 5000 (sheet 2)

4.5 Master frequency bus - slave - drive (C0005 = 6000)

Tip!

The most important settings can be found in the menu: ”Short Setup / Speed mode” of the operating module or in the menu ”Short setup / Speed mode” in Global Drive Control.

Enter motor type (contains all nameplate data of the motor)

C0173	xxx	Enter UG limit (mains voltage)
C0086	000	Enter motor data manually

Enter maximum motor current

C0022	xxxA	Determine Imax

Enter controller configuration

C0005	6000	Select digital frequency cascade - slave
C0025	xxx	Enter feedback system

Speed setpoint settings

C0011	xxx rpm	Determine max. speed
C0032	xxx	Numerator of gearbox factor
C0033	xxx	Denominator of gearbox factor
C0425	xxx	Adjust encoder constant to the master

Application parameters

C0070	xxx	Vp n-controller
C0071	xxx	Tn n-controller
C0254	xxx	Gain of the angle controller

Save parameters

C0003	xxx	Save all parameters

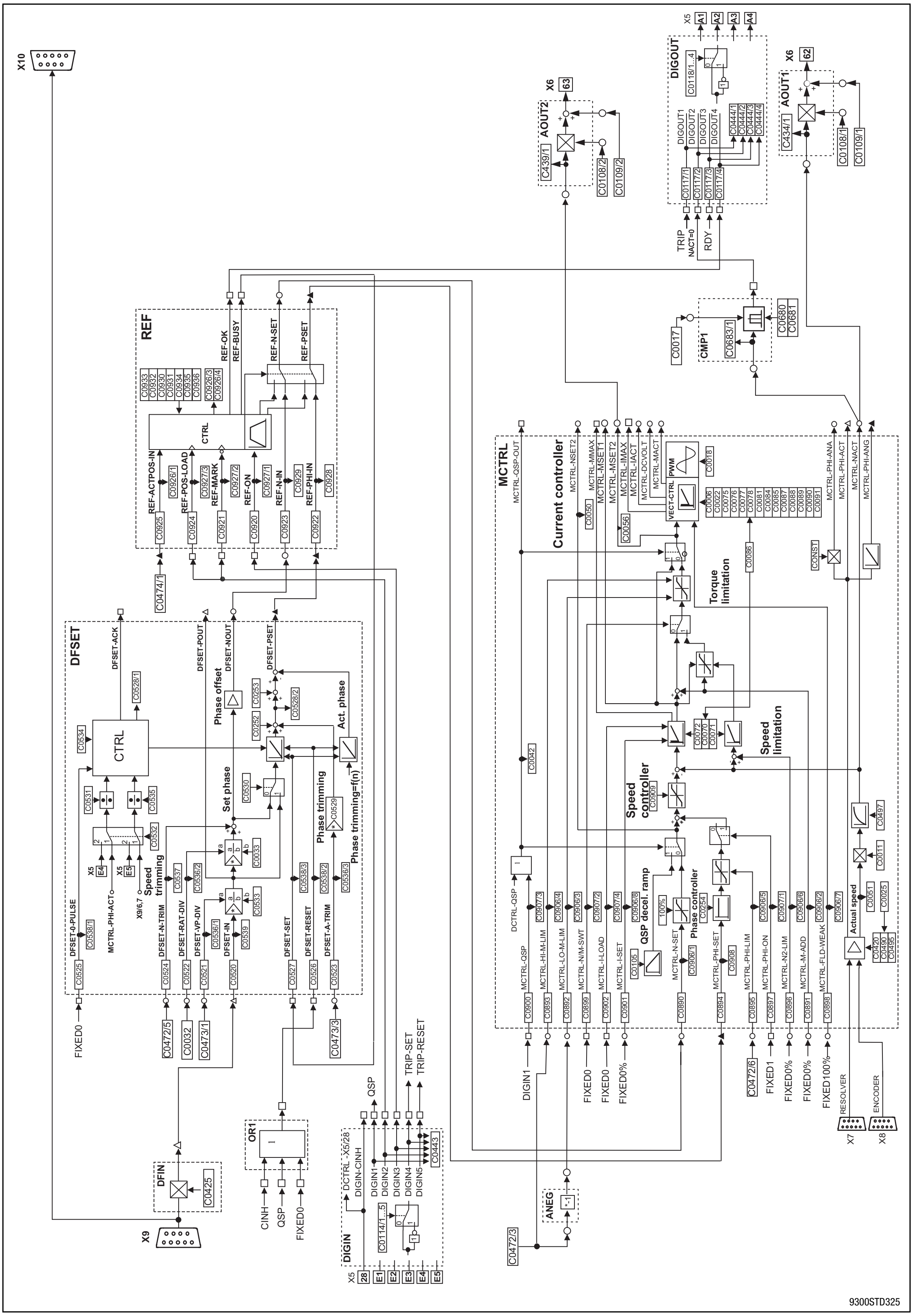


Fig. 4-6 Signal flow diagram for configuration 6000

4.6 Master frequency cascade - slave - drive (C0005 = 7000)

Tip!

The most important settings can be found in the menu: ”Short Setup / Speed mode” of the operating module or in the menu ”Short setup / Speed mode” in Global Drive Control.

Enter motor type (contains all nameplate data of the motor)

C0173	xxx	Enter UG limit (mains voltage)
C0086	000	Enter motor data manually

Enter maximum motor current

C0022	xxxA	Determine Imax

Enter controller configuration

C0005	7000	Select digital frequency cascade - slave

Speed setpoint settings

C0011	xxx rpm	Determine max. speed
C0032	xxx	Numerator of gearbox factor
C0033	xxx	Denominator of gearbox factor
C0425	xxx	Adjust encoder constant to the master
C0473/1	xxx	Numerator of stretching factor
C0533	xxx	Denominator of stretching factor

Application parameters

C0070	xxx	Vp n-controller
C0071	xxx	Tn n-controller
C0254	xxx	Gain of the angle controller

Save parameters

C0003	xxx	Save all parameters

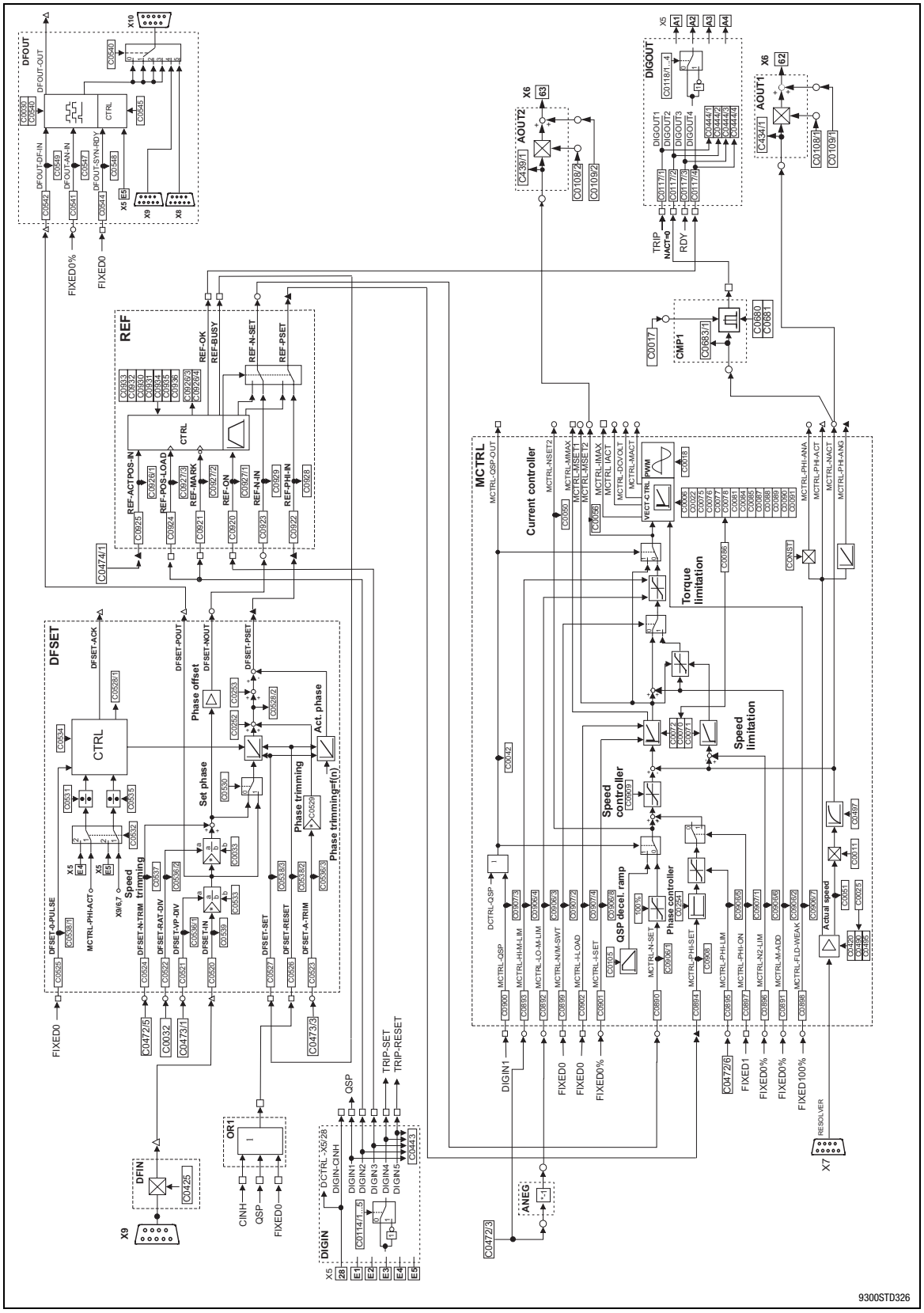


Fig. 4-7 Signal flow diagram for configuration 7000

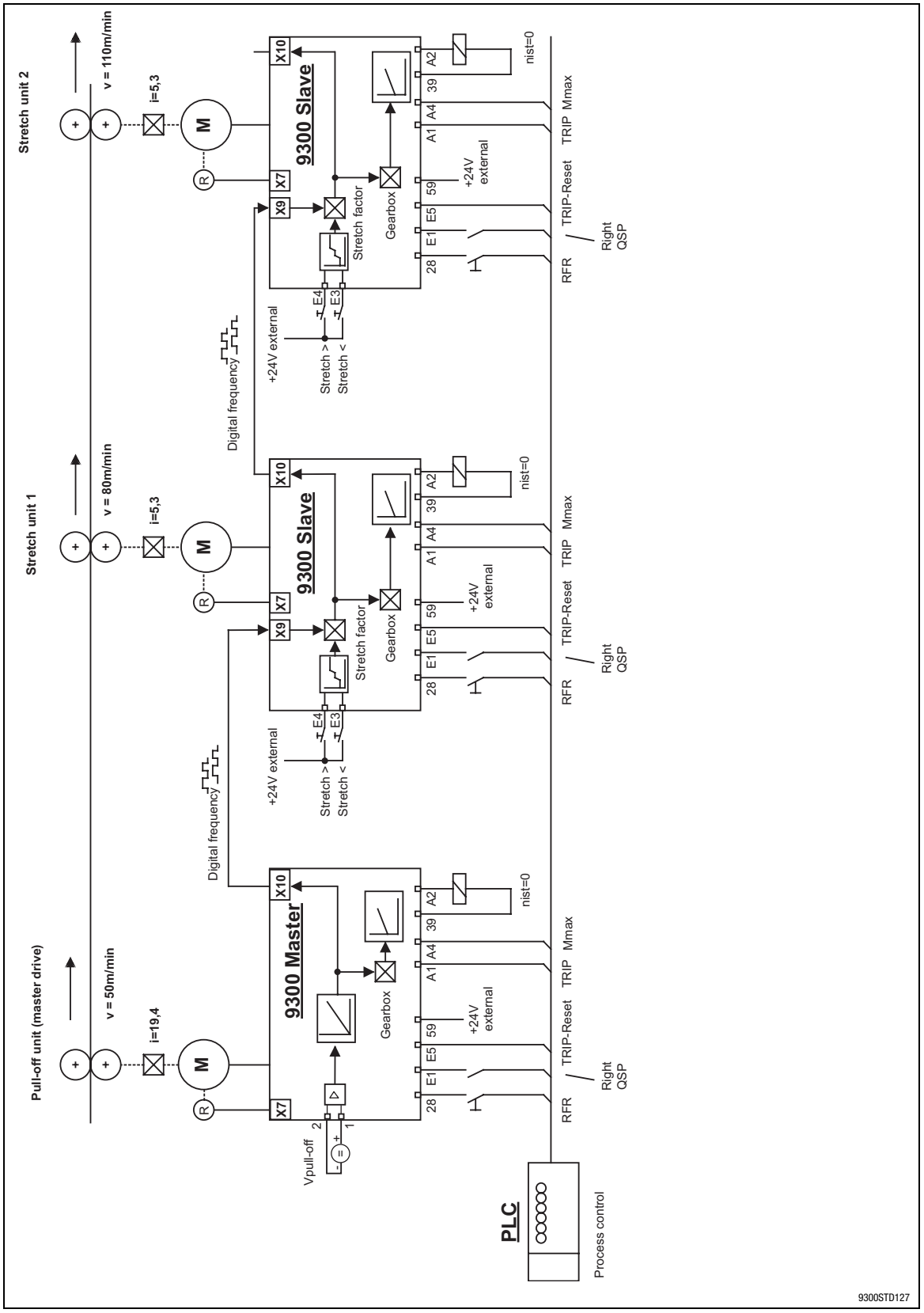
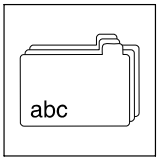


Fig. 4-8 Connection diagram of digital frequency configuration



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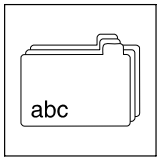

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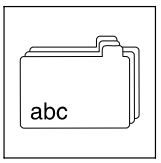
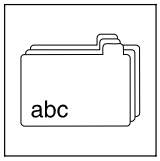


5.1 Glossary

5.1.1 Terminology and abbreviations used

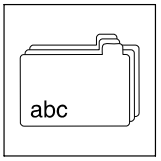
🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter
P_r [kW]	Rated motor power
R [Ω]	Resistance



Appendix

Glossary

S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)



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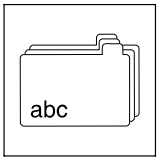

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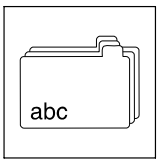

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EDSVS9332S-EXT ■ 13375724 ■ EN ■ 2.0 ■ TD23

10 9 8 7 6 5 4 3 2 1

EDSVS9332K
13440810

Global Drive

System Manual

9300 *0.37 ... 75 kW*

EVS9321xK ... EVS9332xK

Servo cam profiler

Lenze

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1 Preface

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1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual is directed at all persons who design, install, commission and adjust the 9300 servo cam profilers.

Together with the System Manual (Extension), document number EDSVS9332K-EXT, and the catalogue it forms the project planning basis for the manufacturer of plants and machinery.

Contents

The System Manual is the basis of the 9300 servo cam profiler's description. Together with the System Manual (Extension), document number EDSVS9332K-EXT, it provides a complete System Manual:

- The features and functions are described in detail.
- The parameter setting for typical applications is explained with the help of examples.
- In case of doubt, the Mounting Instructions supplied with the 9300 servo cam profiler are valid.

Contents of System Manual	Contents of System Manual (Extension)
1 Preface	1 Preface
2 Safety instructions	-
3 Technical data	-
4 Installation of the standard device	-
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How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.1.2 Products to which the System Manual applies

This documentation is valid for 9300 servo cam profilers as of nameplate data:

	①					②	③	Nameplate
	EVS	93xx	–	x	x	Vxx	1x	8x	

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = Panel-mounted unit

C = Built-in unit in ”cold plate” technique

Design

K = Servo cam profiler

Variant

– Standard

V003 = In ”cold plate” technique

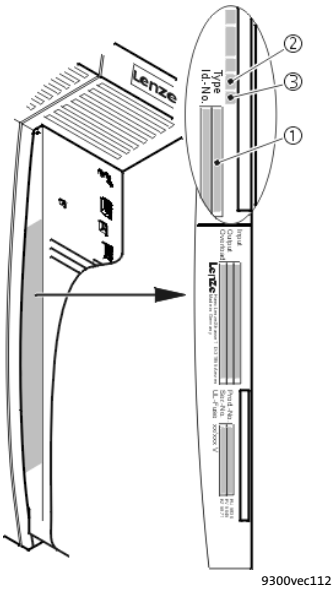
V004 = With ”safe standstill” function

V100 = For IT systems

V104 = With ”safe standstill” function and for IT systems

Hardware version

Software version



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1.1.3 Document history

What is new / what has changed?

Material number	Version			Description
13440810	8.0	07/2013	TD06	Error corrections
13375725	7.2	06/2011	TD23	Error corrections
13375725	7.1	06/2011	TD23	Chapter ”DC-bus operation” updated due to changes of DC fuses
13344178	6.1	09/2010	TD23	Error correction
13344178	6.0	07/2010	TD23	Added description about the fan module being modified for push-through technique on the 45 kW device Information about motor cable cross-section was updated
13167298	5.0	10/2006	TD23	Revision for software version 4.0 Complete editorial revision and fault correction Division of the System Manual into 2 parts (EDSVS9332K and EDSVS9332K-EXT)
00481341	4.0	02/2004	TD23	Revision for software version 3.4 Technical data supplemented by circuit-breaker specifications for EVS9321 and EVS9322 Error correction
00453265	3.0	02/2003	TD23	Revision for software version 3.3 Editorial revision and fault correction
00412939	2.0	02/2000	-	Revision for software version 2.0 Editorial revision
00403216	1.0	09/1998	-	First edition

1.2 Legal regulations

Identification

Lenze controllers are unambiguously identified by the contents of the nameplate.

Manufacturer

Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen, Germany

CE conformity

In conformity with EC ”Low Voltage” Directive

Application as directed

9300 servo controllers and accessories

- ► may only be operated under the conditions specified in this System Manual.
- ► are components
  - – for open and closed loop control of variable speed drives with PM synchronous motors, asynchronous standard motors or asynchronous servo motors.
  - – for installation in a machine.
  - – for assembly with other components to form a machine.
- ► comply with the protection requirements of the EC ”Low Voltage” Directive.
- ► are not machines for the purpose of the EC ”Machinery” Directive.
- ► are not to be used as domestic appliances, but only for industrial purposes.

Drive systems with 9300 servo controllers

- ► comply with the EC ”Electromagnetic Compatibility” Directive if they are installed according to the guidelines of CE-typical drive systems.
- ► can be used
  - – for operation on public and non-public mains supplies.
  - – for operation in industrial premises and residential and commercial areas.
- ► The user is responsible for the compliance of the machine application with the EC Directives.

Any other use shall be deemed inappropriate!

Liability

The information, data and notes given in this System Manual met the state of the art at the time of printing. Claims on modifications referring to controllers and components which have already been supplied cannot be derived from the information, illustrations and descriptions contained in this manual.

The procedural notes and circuit details given in this System Manual are suggestions and their transferability to the respective application has to be checked. Lenze does not take any responsibility for the suitability of the given procedures and circuit suggestions.

The specifications given in this System Manual describe the product features without guaranteeing them.

Lenze does not accept any liability for damage and malfunctioning caused by:

- ► Disregarding the System Manual
- ► Unauthorised modifications to the controller
- ► Operating faults
- ► Improper working on and with the controller

Warranty

See terms of sales and delivery of Lenze Automation GmbH.

Warranty claims must be made to Lenze immediately after detecting the deficiency or fault.

The warranty is void in all cases where liability claims cannot be made.

1.3 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	language-dependent	In each case, the signs typical for the target language are used as decimal separators. For example: 1234.56 or 1234,56
Warnings		
UL warnings	UL	Are only given in English.
UR warnings	UR	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	📖	Reference to another page with additional information For instance: 📖 16 = see page 16
Documentation reference	⚙	Reference to another documentation with additional information For example: ⚙ EDKxxx = see documentation EDKxxx

1.4 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!
(characterises the type and severity of danger)
Note
(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety instructions

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2.2.2 Self-ventilated motors 2.2-3
2.3 Residual hazards 2.3-1
2.4 Safety instructions for the installation according to UL 2.4-3

2.1 General safety information

Scope

The following general safety instructions apply to all Lenze drive and automation components.

The product-specific safety and application notes given in this documentation must be observed!

Note for UL-approved systems: UL warnings are notes which only apply to UL systems. The documentation contains specific notes with regard to UL.

For your own safety

Danger!

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

- Lenze drive and automation components ...
  - ... must only be used for the intended purpose.
  - ... must never be operated if damaged.
  - ... must never be subjected to technical modifications.
  - ... must never be operated unless completely assembled.
  - ... must never be operated without the covers/guards.
  - ... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.
- All specifications of the corresponding enclosed documentation must be observed.

  This is vital for a safe and trouble-free operation and for achieving the specified product features.

  The procedural notes and circuit details provided in this document are proposals which the user must check for suitability for his application. The manufacturer does not accept any liability for the suitability of the specified procedures and circuit proposals.
- Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.

  According to IEC 60364 or CENELEC HD 384, these are persons ...

  ... who are familiar with the installation, assembly, commissioning and operation of the product,

  ... possess the appropriate qualifications for their work,

  ... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.

Transport, storage

- Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.
  - – Protect against dust and shocks.
  - – Comply with climatic conditions according to the technical data.

Mechanical installation

- ▶ Install the product according to the regulations of the corresponding documentation. In particular observe the section ”Operating conditions” in the chapter ”Technical data”.
- ▶ Provide for a careful handling and avoid mechanical overload. During handling neither bend components, nor change the insulation distances.
- ▶ The product contains electrostatic sensitive devices which can easily be damaged by short circuit or static discharge (ESD). Thus, electronic components and contacts must not be touched unless ESD measures are taken beforehand.

Electrical installation

- ▶ Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in the documentation.
- ▶ When working on live products, observe the applicable national regulations for the prevention of accidents (e.g. BGV 3).
- ▶ The documentation contains information about EMC-compliant installation (shielding, earthing, arrangement of filters and laying cables). The system or machine manufacturer is responsible for compliance with the limit values required by EMC legislation.
  Warning: The controllers are products which can be used in category C2 drive systems as per EN 61800-3. These products may cause radio interference in residential areas. If this happens, the operator may need to take appropriate action.
- ▶ For compliance with the limit values for radio interference emission at the site of installation, the components - if specified in the technical data - have to be mounted in housings (e. g. control cabinets). The housings have to enable an EMC-compliant installation. In particular observe that for example control cabinet doors preferably have a circumferential metallic connection to the housing. Reduce openings or cutouts through the housing to a minimum.
- ▶ Only plug in or remove pluggable terminals in the deenergised state!

Commissioning

- ▶ If required, you have to equip the system with additional monitoring and protective devices in accordance with the respective valid safety regulations (e. g. law on technical equipment, regulations for the prevention of accidents).
- ▶ Before commissioning remove transport locking devices and keep them for later transports.

Operation

- ▶ Keep all protective covers and doors closed during operation.

Safety functions

- ▶ Without a higher-level safety system, the described product must neither be used for the protection of machines nor persons.
- ▶ Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”).
  The notes on the safety functions provided in the documentation of the versions must be observed.

Maintenance and servicing

- The components are maintenance-free if the required operating conditions are observed.
- If the cooling air is polluted, the cooling surfaces may be contaminated or the air vents may be blocked. Under these operating conditions, the cooling surfaces and air vents must be cleaned at regular intervals. Never use sharp objects for this purpose!
- Only replace defective fuses in the deenergised state to the type specified.
- After the system has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors may be charged. Please observe the corresponding notes on the device.

Disposal

- Recycle metals and plastic materials. Ensure professional disposal of assembled PCBs.

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for $I^2 \times t$ monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the $I^2 \times t$ load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for $I^2 \times t$ load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the $I^2 \times t$ load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the $I^2 \times t$ load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	$I^2 \times t$ load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

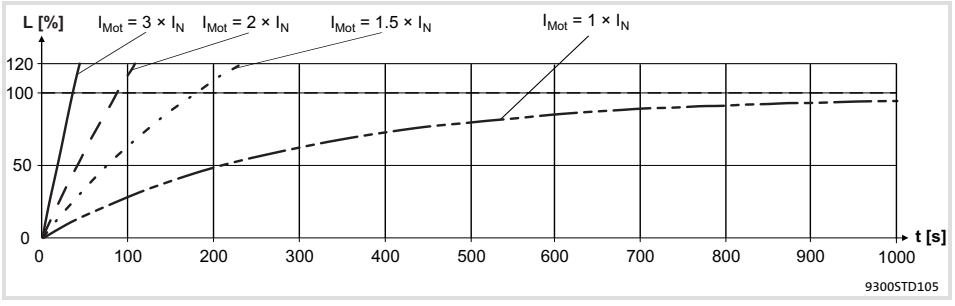

Fig. 2.2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L $I^2 \times t$ load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

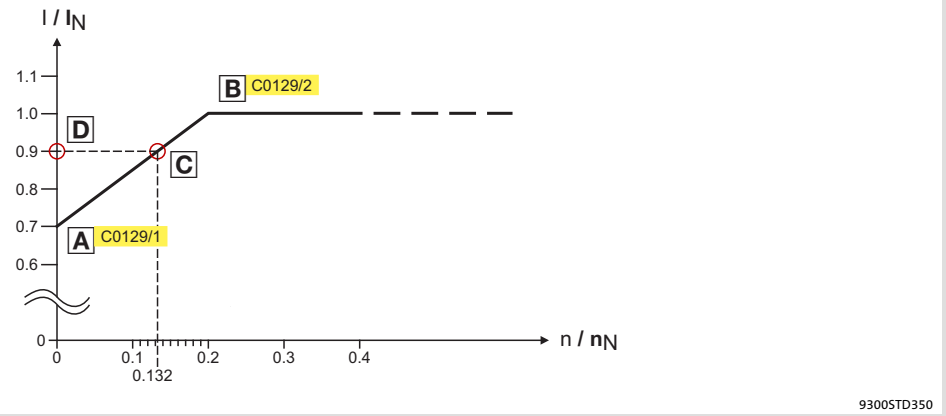

Fig. 2.2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2.2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2.2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1** and **C0129/2** (evaluation coefficient "y", 📖 2.2-4).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	ln	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- According to their enclosure, Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their components can carry a voltage, or parts of the controllers can move or rotate during operation. Surfaces can be hot.
  - If the required cover is removed, the controllers are used inappropriately or installed or operated incorrectly, severe damage to persons or material assets can occur.
  - For more detailed information please see the documentation.
- There is a high amount of energy within the controller. Therefore always wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard) when working on the controller when it is live.
- Before working on the controller, check if no voltage is applied to the power terminals.
  - the power terminals U, V, W, +UG and -UG still carry dangerous voltage for at least 3 minutes after power-off.
  - the power terminals L1, L2, L3; U, V, W, +UG and -UG carry dangerous voltage when the motor is stopped.
- Before power-off during DC-bus operation, all controllers must be inhibited and disconnected from the mains.
- The discharge current to PE potential is > 3.5 mA. In accordance with EN 61800-5-1
  - a fixed installation is required.
  - the design of the PE conductor has to be double or, in the case of a single design, must have a cable cross-section of at least 10 mm^2.
- The controller can only be safely disconnected from the mains via a contactor on the input side.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

- Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side:
  - Type B for the connection to a three-phase system
  - Type A or type B for the connection to a single phase system

  Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xK and EVS9322-xK.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xK ... EVS9332-xK.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Motor protection

- For some controller settings, the connected motor may overheat (e.g. when operating the DC injection brake or a self-ventilated motor at low speed for longer periods).
  - Using an overcurrent relay or a temperature monitoring device provides a large degree of protection against overload.
  - We recommend to use PTC thermistors or thermal contacts for motor temperature monitoring. (Lenze three-phase AC motors are equipped with thermal contacts (NC contacts) as standard)
  - PTC thermistors or thermal contacts can be connected to the controller.
- Drives can attain dangerous overspeeds (e.g. setting of high output frequencies with motors and machines not qualified for this purpose).

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9321 ... EVS9326:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by CC, J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +55 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 75 °C copper wire only.
- ► EVS9327 ... EVS9329:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +50 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 60/75 °C or 75 °C copper wire only.

► EVS9330 ... EVS9332:
– Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
– Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
– Maximum surrounding air temperature: 0 ... +50 °C
– > +40 °C: reduce the rated output current by 2.5 %/°C
– Use 60/75 °C or 75 °C copper wire only.

3 Technical data

Contents

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3.1 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
	2004/108/EG	EMC Directive	
Approval			
UL	cULus	Power Conversion Equipment (File No. E132659)	

Protection of persons and equipment			
Type of protection	EN 60529	IP20	
		IP41 in case of thermally separated installation (push-through technique) between the control cabinet (inside) and the environment.	
	NEMA 250	Protection against accidental contact in accordance with type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe regulations and safety instructions!
Insulation of control circuits	EN 61800-5-1	Safe mains isolation by double (reinforced) insulation for terminals X1 and X5. Basic insulation (single isolating distance) for terminals X3, X4, X6, X7, X8, X9, X10 and X11.	
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Protective measures		Against short circuit, earth fault (earth-fault protected during mains connection, limited earth-fault protection during operation), overvoltage, motor overtemperature (input for PTC or thermal contact)	

EMC			
Noise emission	IEC/EN 61800-3	Cable-guided, up to 10 m motor cable length with mains filter A: category C2.	
		Radiation, with mains filter A and installation in control cabinet: category C2	
Interference immunity	IEC/EN 61800-3	Category C3	

Operating conditions

Ambient conditions			
Climatic			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +55 °C)	< 6 months
		1K3 (-25 ... +40 °C)	> 6 months > 2 years: anodise DC bus capacitors
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation			
EVS9321 ... EVS9326	IEC/EN 60721-3-3	3K3 (0 ... +55 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
EVS9327 ... EVS9332		3K3 (0 ... +50 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
Pollution	EN 61800-5-1	Degree of pollution 2	

Ambient conditions		
Site altitude		< 4000 m amsl > 1000 m amsl: reduce the rated output current by 5 %/ 1000 m
Mechanical		
Vibration resistance	EN 50178 EN 61800-5-1 Germanischer Lloyd, general conditions	Tested according to "General Vibration Stress Characteristic 1"
Electrical		
AC-mains connection		
Max. mains voltage range		320 V - 0 % ... 528 V + 0 %
Mains frequency		45 Hz - 0 % ... 65 Hz + 0 %
Power system TT, TN		Operation permitted without restrictions with earthed neutral.
Power system IT		Operation only permitted with the device variants V024 or V100. Operation permitted without restrictions with insulated neutral. Observe instructions on specific measures!
Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
		Total output at the mains: Compliance with the requirements [1)]
		< 1 kW: With mains choke.
		> 1 kW: Without additional measures.
		[1)] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!
DC-mains connection		
Max. mains voltage range		450 V - 0 % ... 740 V + 0 %
Operating conditions		DC voltage must be symmetrical to PE. The controller will be destroyed when $+U_G$ or $-U_G$ are earthed.
Motor connection		
Length of the motor cable		< 50 m No additional output filters are required at a rated mains voltage and a switching frequency of 8 kHz. If EMC requirements have to be met, the permissible cable length may be affected.

Mounting conditions		
Mounting place		In the control cabinet
Mounting position		Vertical
Free spaces Dimensions Weights		📖 4-1

3.2 *Open and closed loop control*

Open and closed loopcontrol		
Switching frequency	8 kHz or 16 kHz	
Digital setpoint selection		
Accuracy	± 0.005 Hz (= ± 100 ppm)	
Analog setpoint selection		
Linearity	± 0.15 %	Signal level: 5 V or 10 V
Temperature sensitivity	± 0.1 %	0 ... 50 °C
Offset	± 0.1 %	
Analog inputs Analog outputs	• 2 inputs (bipolar) • 2 outputs (bipolar)	
Digital inputs Digital outputs	• 5 inputs (freely assignable) • 1 input for controller inhibit • 4 outputs (freely assignable) • 1 resolver input; design: 9-pole Sub-D socket • 1 incremental encoder input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin) • 1 digital frequency input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin); can be optionally used as incremental encoder input (500 kHz, TTL level) • 1 digital frequency output (500 kHz, TTL level); design: 9-pole Sub-D socket	
Cycle times		
Digital inputs	1 ms	
Digital outputs	1 ms	
Analog inputs	1 ms	
Analog outputs	1 ms (smoothing time: τ= 2 ms)	

3.3 Rated data

Note!

The controllers EVS9324, EVS9326 and EVS9328 ... EVS9333 may only be operated with the prescribed mains chokes and mains filters.

3.3.1 Operation at 400 V

Basis of the data			
		Voltage	Frequency
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xK	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xK	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xK	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xK	7.0	–	3.0	4.0	**4.8**	0.75	200
EVS9325-xK	12.0	16.8	5.5	7.5	**9.0**	0	260
EVS9326-xK	20.5	–	11.0	15.0	**16.3**	0	390
EVS9327-xK	27.0	43.5	15.0	20.0	**22.2**	10	430
EVS9328-xK	44.0	–	22.0	30.0	**32.6**	4	640
EVS9329-xK	53.0	–	30.0	40.0	**40.9**	0	810
EVS9330-xK	78.0	–	45.0	60.0	**61.6**	5	1100
EVS9331-xK	100	–	55.0	75.0	**76.2**	0	1470
EVS9332-xK	135	–	75.0	100	**100.5**	0	1960

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency

2) Switching frequency of the inverter

3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xK	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xK	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xK	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xK	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xK	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xK	**23.5**	35.3	23.5	15.3	23.0	15.3
EVS9327-xK	**32.0**	48.0	32.0	20.8	31.2	20.8
EVS9328-xK	**47.0**	70.5	47.0	30.6	45.9	30.6
EVS9329-xK	**59.0**	88.5	52.0	38.0	57.0	33.0
EVS9330-xK	**89.0**	133.5	80.0	58.0	87.0	45.0
EVS9331-xK	**110**	165	110	70.0	105	70.0
EVS9332-xK	**145**	21.5	126	90.0	135	72.0

Bold print = Lenze setting

1) Switching frequency of the inverter

2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xK	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xK	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xK	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xK	7.0	–	3.0	4.0	**5.8**	0.75	200
EVS9325-xK	12.0	16.8	5.5	7.5	**10.8**	0	260
EVS9326-xK	20.5	–	11.0	15.0	**18.5**	0	390
EVS9327-xK	27.0	43.5	18.5	25.0	**25.0**	12	430
EVS9328-xK	44.0	–	30.0	40.0	**37.0**	4.8	640
EVS9329-xK	53.0	–	37.0	50.0	**46.6**	0	810
EVS9330-xK	78.0	–	45.0	60.0	**69.8**	6	1100
EVS9331-xK	100	–	55.0	75.0	**87.3**	0	1470
EVS9332-xK	135	–	90.0	125	**104**	6	1960

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xK	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xK	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xK	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xK	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xK	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xK	**22.3**	33.5	22.3	14.5	21.8	14.5
EVS9327-xK	**30.4**	45.6	30.4	19.2	28.8	19.2
EVS9328-xK	**44.7**	67.1	44.7	28.2	42.3	28.2
EVS9329-xK	**56.0**	84.0	49.0	35.0	52.5	25.0
EVS9330-xK	**84.0**	126	72.0	55.0	82.5	36.0
EVS9331-xK	**105**	157.5	105	65.0	97.5	58.0
EVS9332-xK	**125**	187.5	111	80.0	120	58.0

Bold print = Lenze setting
1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.3 Overcurrent operation

Under the operating conditions described here, the EVS9321-xK ... EVS9324-xK controllers can supply a rated output current which is up to twice as high.

Note!

If you enter values > 1.5 × rated output current under C0022, the controller switches to overcurrent operation.

- ► Switching between overcurrent operation and standard operation is only possible if the controller is inhibited (X5/28 = LOW).
- ► The continuous current is automatically reduced to 70 % of the rated output current.

3.3.3.1 Operation at 400 V

Basis of the data			
		Voltage	Frequency
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	+U_G, -U_G [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xK	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xK	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xK	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xK	7.0	–	3.0	4.0	**4.8**	0.75	200

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xK	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xK	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xK	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xK	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	+U_G, -U_G [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xK	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xK	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xK	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xK	7.0	–	3.0	4.0	**5.8**	0.75	200

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xK	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xK	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xK	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xK	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.4 Current characteristics

The maximum output current of the EVS9326 ... EVS9332 devices is limited under certain operating conditions:

- At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K > 40° C.
- The current limitation depends on the switching frequency.

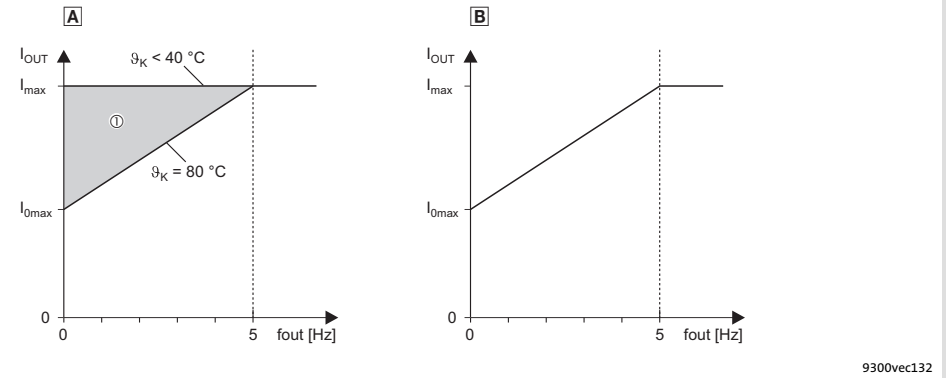

Fig. 3.4-1 Current derating characteristics

A Operation at switching frequency f_{chop} = 8 kHz (C0018 = 1)
The current limitation follows the characteristic curve
At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K = 40 ... 80 °C, the current limit is steplessly adjusted in the ① range

B Operation at switching frequency f_{chop} = 16 kHz (C0018 = 2)
The current limitation follows the characteristic curve and is independent of the heatsink temperature

At automatic change-over of the switching frequency (C0018 = 0), the controller operates at f_{chop} = 16 kHz. The current limitation follows the characteristic curve B.

If an increased torque is required (e.g. acceleration processes), the controller automatically switches over to f_{chop} = 8 kHz. The current limitation follows the characteristic curve A.

9300	I_{0max} [A] 1)		I_{0max} [A] 2)	
	f_{chop} = 8 kHz		f_{chop} = 16 kHz	
	U_{mains}		U_{mains}	
	400 V	480 V	400 V	480 V
EVS9326-xK	23.5	22.3	15.3	14.5
EVS9327-xK	32.0	30.4	20.8	19.2
EVS9328-xK	47.0	44.7	30.6	28.2
EVS9329-xK	52.0	49.0	33.0	25.0
EVS9330-xK	80.0	72.0	45.0	36.0
EVS9331-xK	110	105	70.0	58.0
EVS9332-xK	126	111	72.0	58.0

1) Maximum available output current at an output frequency f_{out} = |0 Hz| and heatsink temperature ϑ_K = 80 °C
2) Maximum available output current at an output frequency f_{out} = |0 Hz|

4 Installation of the standard device

Contents

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4.1 Standard devices in the power range 0.37 ... 11 kW

4.1.1 Important notes

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**K [kg]	EVS93xx-**C**K [kg]
EVS9321-xK	4.0	3.1
EVS9322-xK	4.0	3.1
EVS9323-xK	5.5	3.9
EVS9324-xK	5.5	3.9
EVS9325-xK	7.4	5.2
EVS9326-xK	7.4	5.2

4.1.2 Mounting with fixing rails (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity	
		EVS9321-EK ... EVS9324-EK	EVS9325-EK EVS9326-EK
Fixing rails	Drive controller fixing	2	4

Dimensions

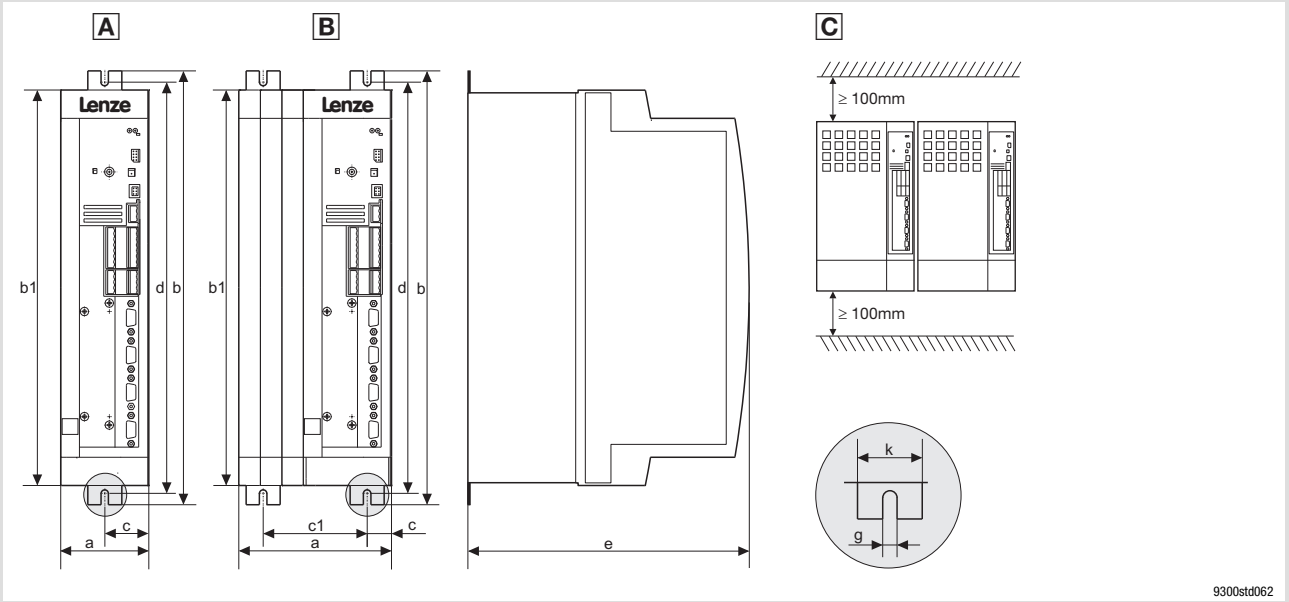


Fig. 4.1-1 Standard mounting with fixing rails 0.37 ... 11 kW

C Drive controllers can be mounted side by side without spacing

9300		Dimensions [mm]									
Type		a	b	b1	c	c1	d	d1	e [1]	g	k
EVS9321-EK EVS9322-EK	A	78	384	350	39	-	365	–	250	6.5	30
EVS9323-EK EVS9324-EK	A	97	384	350	48.5	-	365	–	250	6.5	30
EVS9325-EK EVS9326-EK	B	135	384	350	21.5	92	365	–	250	6.5	30

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing rails to the housing of the drive controller.

4.1.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique you have to use the controller type EVS93xx-**E**K. Additionally you will require the mounting set for push-through technique:

Type	Mounting set
EVS9321-EK, EVS9322-EK	EJ0036
EVS9323-EK, EVS9324-EK	EJ0037
EVS9325-EK, EVS9326-EK	EJ0038

Dimensions

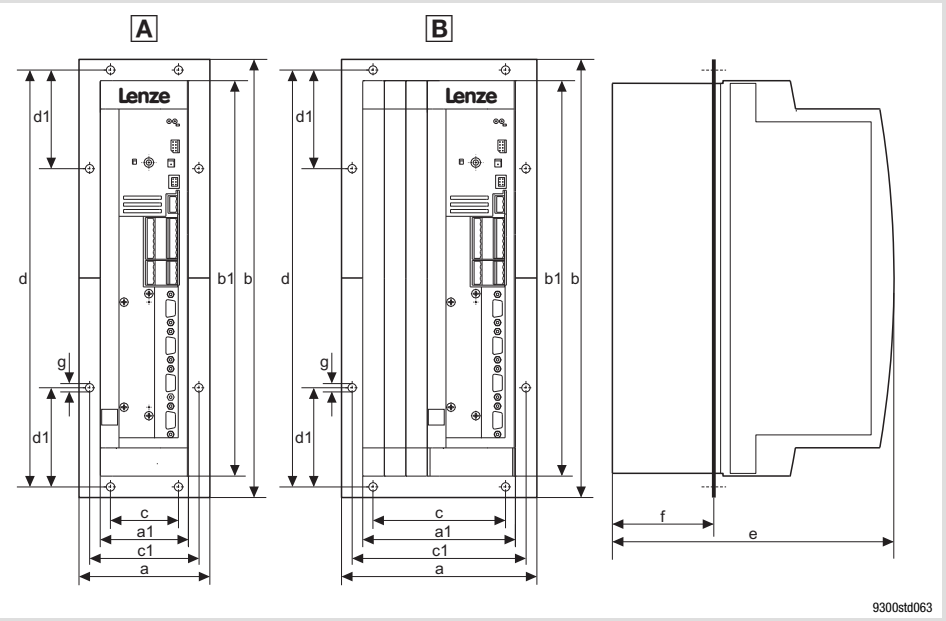


Fig. 4.1-2 Dimensions for thermally separated mounting 0.37 ... 11 kW

9300		Dimensions [mm]										
Type		a	a1	b	b1	c	c1	d	d1	e [1]	f	g
EVS9321-EK EVS9322-EK	A	112.5	78	385.5	350	60	95.5	365.5	105.5	250	92	6.5
EVS9323-EK EVS9324-EK	A	131.5	97	385.5	350	79	114.5	365.5	105.5	250	92	6.5
EVS9325-EK EVS9326-EK	B	169.5	135	385.5	350	117	152.5	365.5	105.5	250	92	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300		Dimensions [mm]	
Type		Width	Height
EVS9321-EK EVS9322-EK	A	82	350
EVS9323-EK EVS9324-EK	A	101	350
EVS9325-EK EVS9326-EK	B	139	350

4.1.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Kx must be used.

Mounting material required from the scope of supply:

Description	Use	Quantity		
		EVS9321-CK EVS9322-CK	EVS9323-CK EVS9324-CK	EVS9325-CK EVS9326-CK
Fixing bracket	Controller fixing	2	2	2
Sheet metal screw 3.5 × 13 mm (DIN 7981)	Mounting the fixing bracket to the controller	6	6	6

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- Good thermal connection to the cooler
  - The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - Plane contact surface, max. deviation 0.05 mm.
  - When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9321-CK	24	1.45
EVS9322-CK	42	0.85
EVS9323-CK	61	0.57
EVS9324-CK	105	0.33
EVS9325-CK	180	0.19
EVS9326-CK	360	0.10

Ambient conditions

- The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

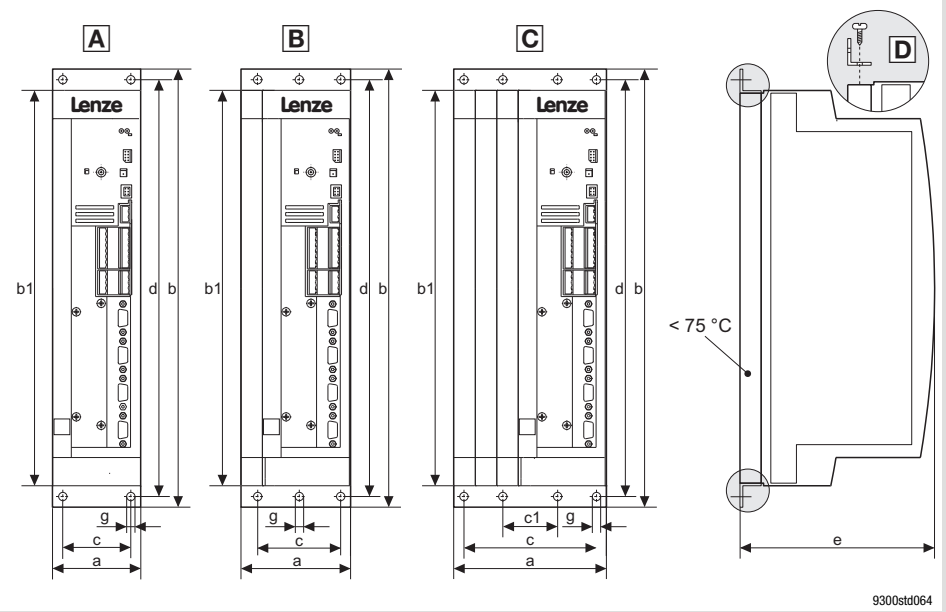


Fig. 4.1-3 Dimensions for mounting in "cold plate" technique 0.37 ... 11 kW

9300		Dimensions [mm]							
Type		a	b	b1	c	c1	d	e [1]	g
EVS9321-CK EVS9322-CK	A	78	381	350	48	–	367	168	6.5
EVS9323-CK EVS9324-CK	B	97	381	350	67	–	367	168	6.5
EVS9325-CK EVS9326-CK	C	135	381	350	105	38	367	168	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

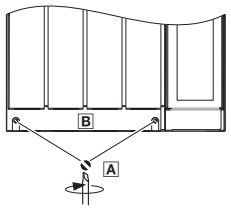
Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

1. Fasten the fixing bracket with sheet metal screws 3.5 × 13 mm at the top and bottom of the drive controller D.
2. Clean the contact surface of cooler and cooling plate with spirit.
3. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
4. Mount the drive controller on the cooler.

4.2 Standard devices in the power range 15 ... 30 kW

4.2.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**K [kg]	EVS93xx-**C**K [kg]
EVS9327-xK	13.5	9.5
EVS9328-xK	15.0	9.5
EVS9329-xK	15.0	–

4.2.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Raised countersunk head screw M5 × 10 mm (DIN 966)	Mounting of fixing bracket to the drive controller	4

Dimensions

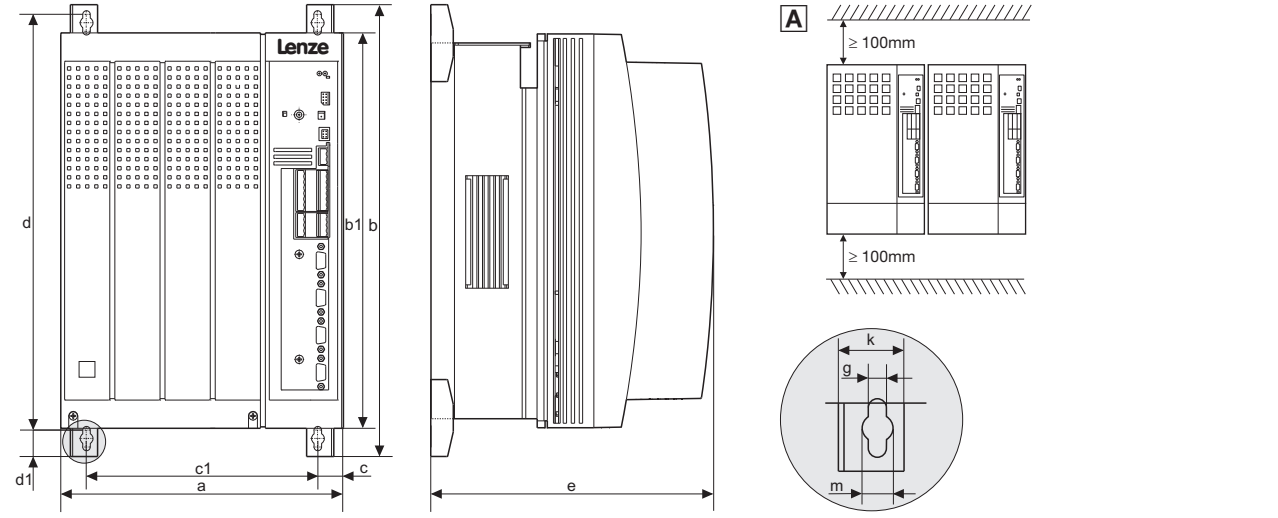


Fig. 4.2-1 Standard mounting with fixing brackets 15 ... 30 kW

A Drive controllers can be mounted side by side without spacing

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9327-EK EVS9328-EK EVS9329-EK	250	402	350	22	206	370	24	250	6.5	24	11

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.2.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Kx must be used. In addition, the mounting set EJ0011 for the push-through technique is required.

Dimensions

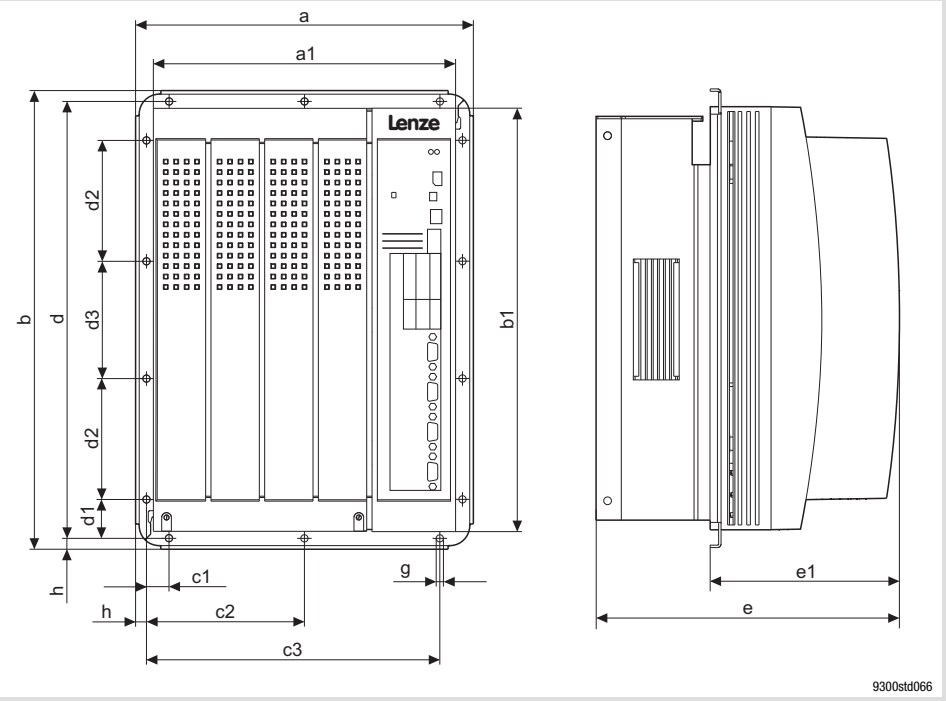


Fig. 4.2-2 Dimensions for thermally separated mounting 15 ... 30 kW

9300	Dimensions [mm]														
Type	a	a1	b	b1	c1	c2	c3	d	d1	d2	d3	e [1]	e1	g	h
EVS9327-EK EVS9328-EK EVS9329-EK	279.5	250	379.5	350	19	131	243	361.5	32	100	97	250	159.5	6	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9327-EK EVS9328-EK EVS9329-EK	236	336

4.2.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Kx must be used.

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- Good thermal connection to the cooler
  - The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - Plane contact surface, max. deviation 0.05 mm.
  - When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9327-CK	410	0.085
EVS9328-CK	610	0.057

Ambient conditions

- The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

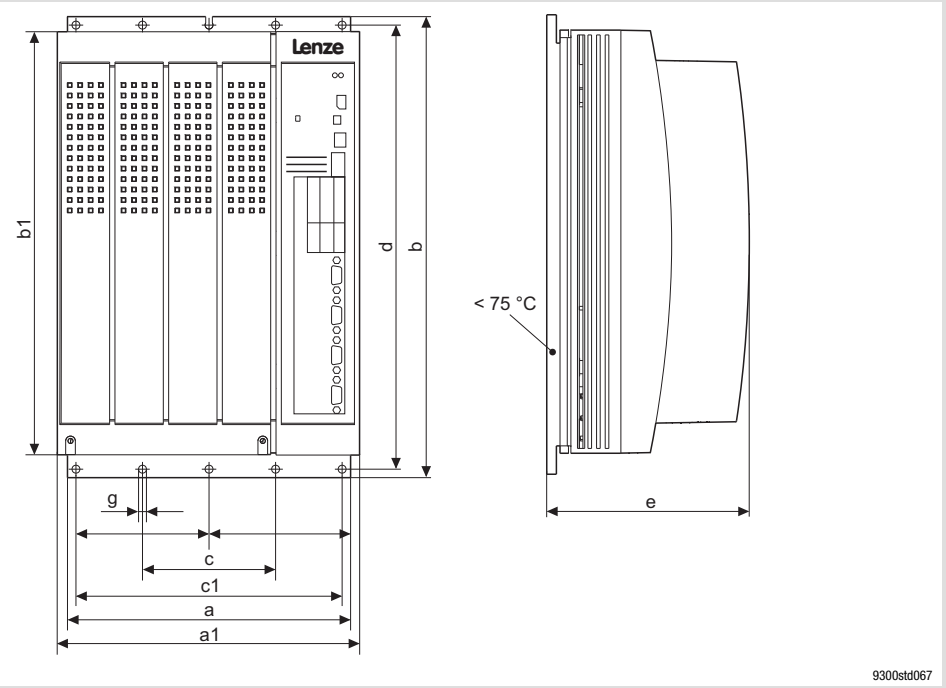


Fig. 4.2-3 Dimensions for mounting in "cold plate" technique 15 ... 22 kW

9300	Dimensions [mm]								
Type	a	a1	b	b1	c	c1	d	e [1)]	g
EVS9327-CK EVS9328-CK	234	250	381	350	110	220	367	171	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

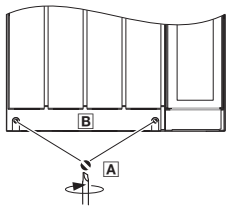
Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

1. Clean the contact surface of cooler and cooling plate with spirit.
2. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
3. Mount the drive controller on the cooler.

4.3 Standard devices with a power of 45 kW

4.3.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**K [kg]	EVS93xx-**C**K [kg]
EVS9330-xK	38.0	–

4.3.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	Mounting of fixing bracket to the drive controller	4
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	4
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	4

Dimensions

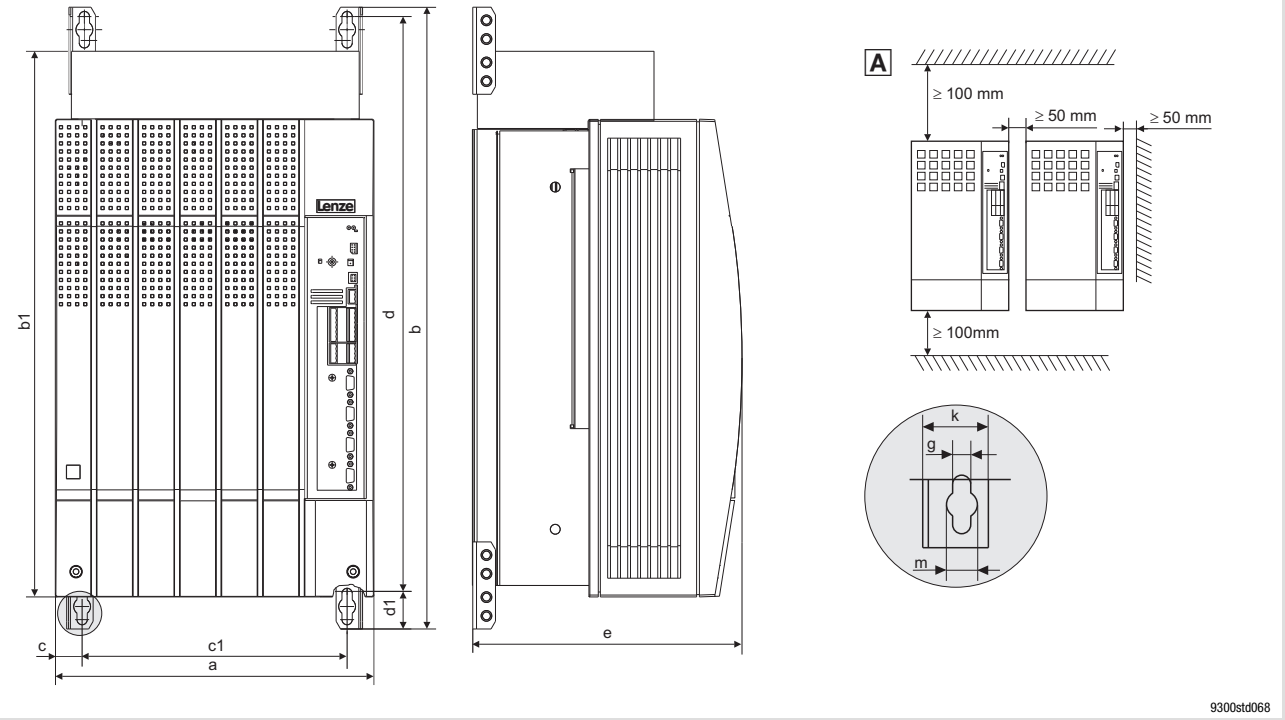


Fig. 4.3-1 Standard mounting with fixing brackets 45 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e 1)	g	k	m
EVS9330-EK	340	580	591	28.5	283	615	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.3.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Kx must be used. In addition, the mounting set EJ0010 for the push-through technique is required.

Dimensions

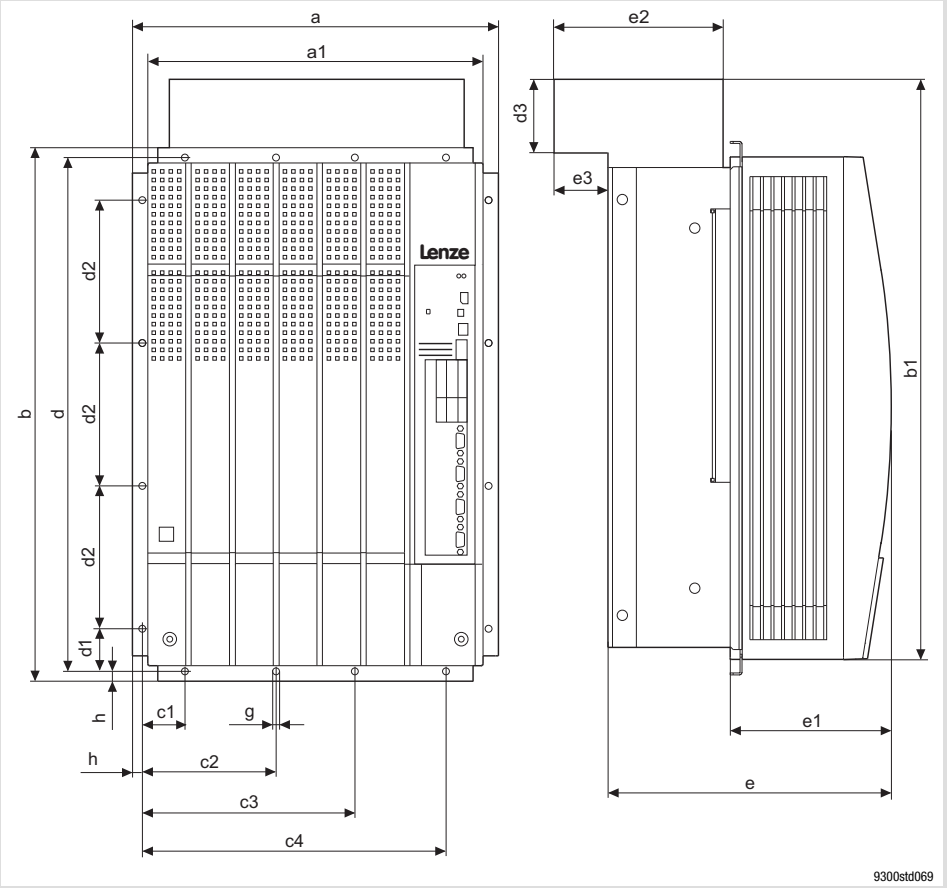


Fig. 4.3-2 Dimensions for thermally separated mounting 45 kW

9300	Dimensions [mm]																
Type	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	d3	e [1]	e1	e2	e3	g	h
EVS9330-EK	373	340	543	591	45	137.5	217.5	310	525	45	145	81	285	163.5	185	66	7	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9330-EK	320	515

4.3.4 Modification of the fan module for push-through technique

For thermally separated mounting the fan module has to be rotated by 180° so that the controller fits into the mounting cutout.

Removing the fan module

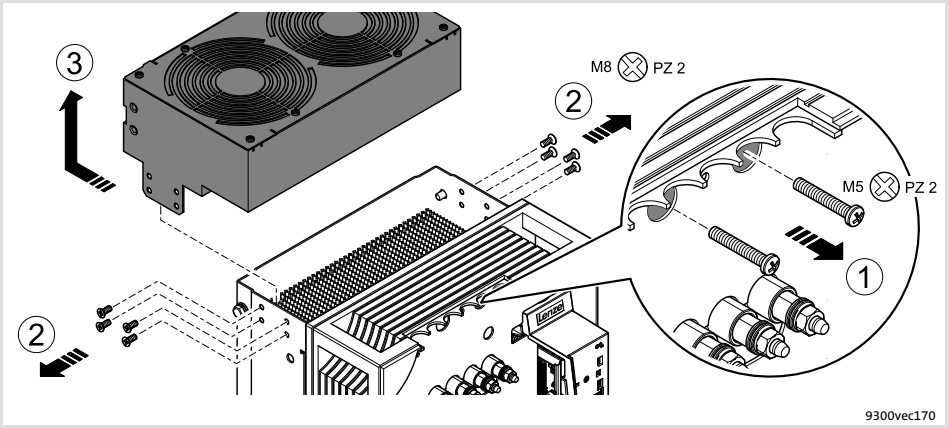


Fig. 4.3-3 Removing the fan module from the controller

1. Remove both screws.
   The screws connect the fans to the supply voltage.
2. Remove the 4 screws for fixing the fan module on each side.
3. Pull back the fan module and carefully remove it to the top.
   Make sure that the threaded sleeves do not touch the housing edge. They may break off.

Modifying the threaded sleeves on the fan module

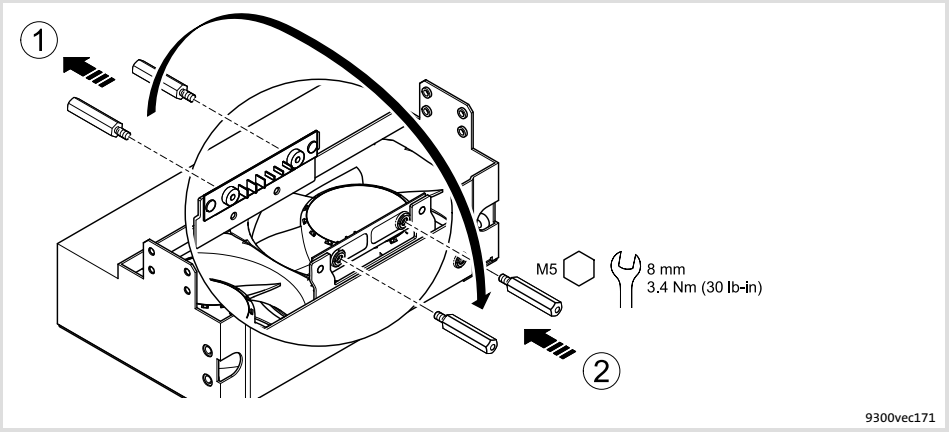


Fig. 4.3-4 Modifying the threaded sleeves for the voltage supply of the fans

1. Remove the threaded sleeves.
2. Screw-in the threaded sleeves on the opposite side and fasten them.

Plugging the fan connecting cable to another terminal on the fan module

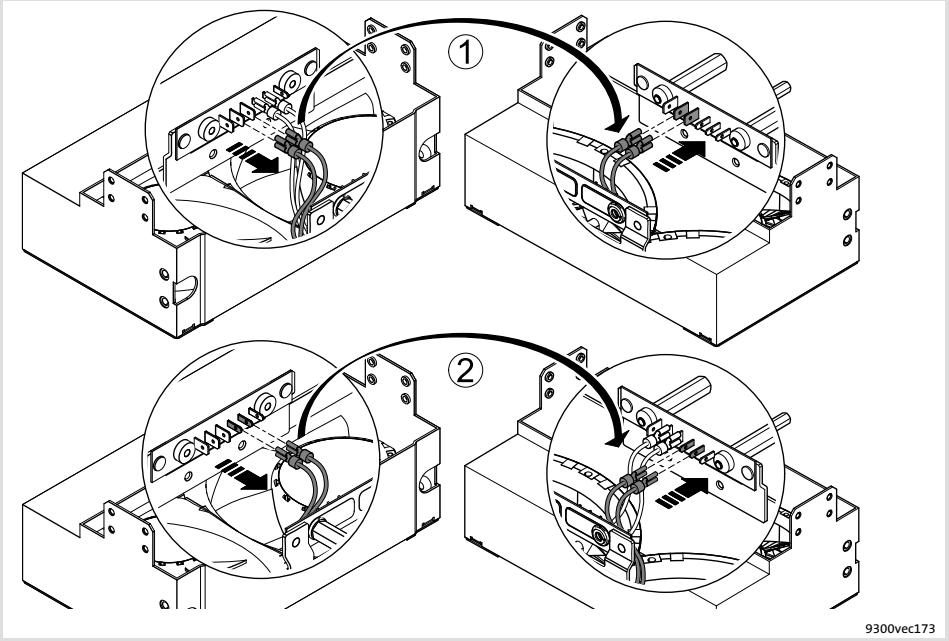


Fig. 4.3-5 Plugging the fan connecting cable for the voltage supply to another terminal

1. Remove the cable lugs of the two red connecting cables and plug them in again on the diagonally arranged side.
2. Remove the cable lugs of the two blue connecting cables and plug them in again on the diagonally arranged side.

Mounting the fan module in a manner rotated by 180°

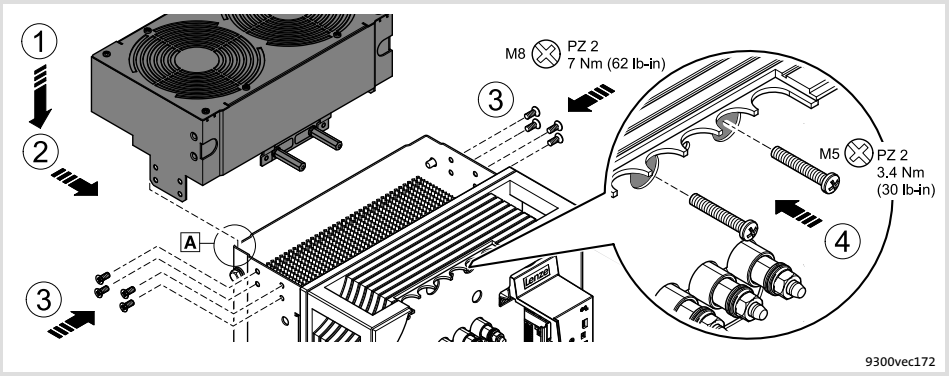


Fig. 4.3-6 Mounting the fan module on the controller

1. Place the fan module onto the controller. Insert the lugs at the back into the base plate A.

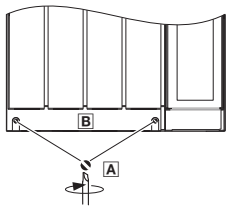
   Make sure that the threaded sleeves do not touch the housing edge. They may break off.
2. Push the fan module to the front.
3. Screw-in and fasten the 4 screws for fixing the fan module on each side.
4. Screw-in and fasten the two screws for the supply voltage.

4.4 Standard devices in the power range 55 ... 75 kW

4.4.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller



1. Remove the screws A
2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**K [kg]	EVS93xx-**C**K [kg]
EVS9331-xK	59.0	–
EVS9332-xK	59.0	–

4.4.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	For fixing bracket	8
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	8
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	8

Dimensions

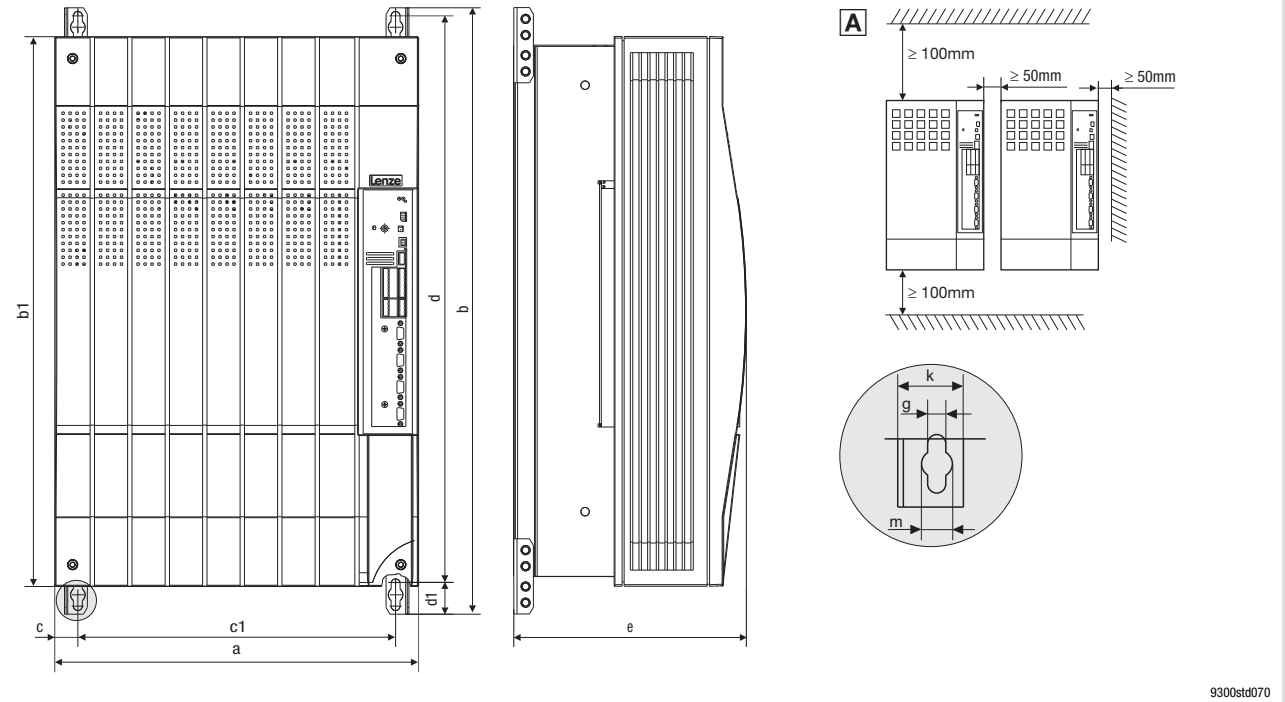


Fig. 4.4-1 Standard mounting with fixing brackets 55 ... 75 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9331-EK EVS9332-EK	450	750	680	28.5	393	702	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.4.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Kx must be used. In addition, the mounting set EJ0009 for the push-through technique is required.

Dimensions

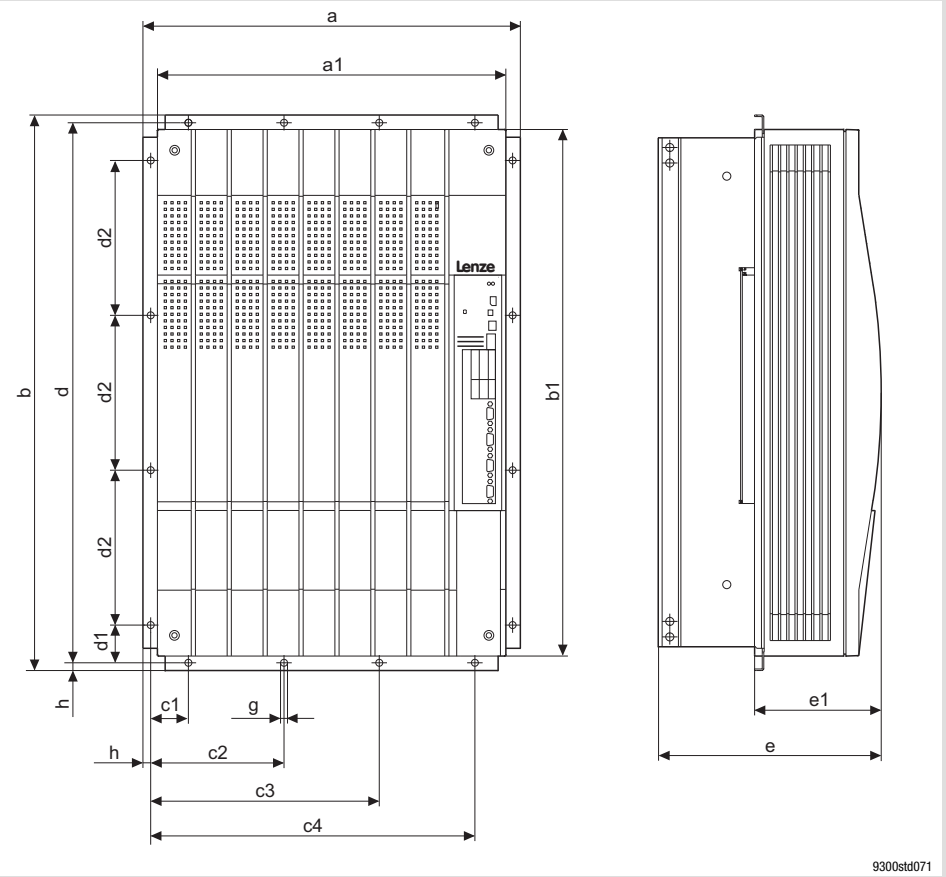


Fig. 4.4-2 Dimensions for thermally separated mounting 55 ... 75 kW

9300	Dimensions [mm]														
Typ	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	e [1)]	e1	g	h
EVS9331-EK EVS9332-EK	488	450	718	680	49	172.5	295.5	419	698	49	200	285	164	9	10

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	a1	b1
EVS9331-EK EVS9332-EK	428.5	660

5 Wiring of the standard device

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5.1 Important notes

Stop!

The drive controller contains electrostatically sensitive components.

The personnel must be free of electrostatic charge when carrying out assembly and service operations.

5.1.1 Protection of persons

Danger!

Before working on the controller, check that all power terminals are deenergised:

- The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least 3 minutes after disconnection from the mains.
- The power terminals L1, L2, L3, U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.

Pluggable terminal strips

Connect or disconnect all pluggable terminals only in the deenergised state!

Electrical isolation

The terminals X1 and X5 have double (reinforced) insulation according to EN50178. The protection against accidental contact is ensured without additional measured being taken.

Danger!

- ► The terminals X3, X4, X6, X7, X8, X9, X10, X11 have basic insulation (single isolating distance).
- ► In the event of a defective isolating distance, protection against accidental contact can only be guaranteed by taking external measures such as double insulation.
- ► If an external DC 24 V voltage source is used, the insulation degree of the controller depends on the insulation degree of the voltage source.

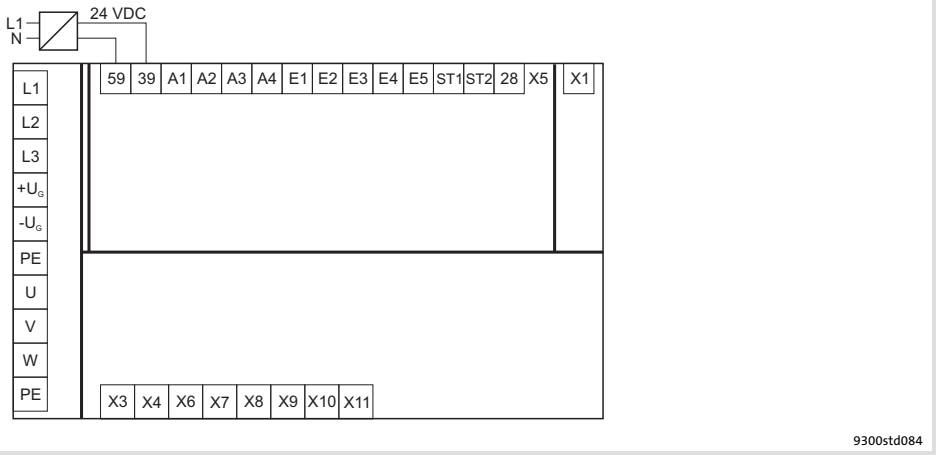


Fig. 5.1-1 Electrical isolation between power terminals, control terminals and housing

Double (reinforced) insulation
Basic insulation

Replacing defective fuses

Only replace defective fuses in the deenergised state to the type specified.

Disconnecting the controller from the mains

Only carry out the safety-related disconnection of the controller from the mains via a contactor on the input side or a manually operated toggle switch.

5.1.2 Device protection

- In the event of condensation, only connect the controller to the mains voltage after the humidity has evaporated.
- The controller is protected by external fuses.
- Drive controllers EVS9324-xK, EVS9326-xK and EVS9328-xK ... EVS9332-xK must only be operated with assigned mains choke / mains filter.
- Length of the screws for connecting the shield sheet for the control cables: **12 mm**.
- Provide unused control inputs and outputs with terminal strips. Cover unused Sub-D sockets with protective covers included in the scope of supply.
- Switching on the motor side of the controller is only permissible for safety shutdown (emergency-off).
- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xK and EVS9322-xK.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xK ... EVS9332-xK.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

5.1.3 Motor protection

- Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the I^2xt monitoring.
- Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min. $\hat{u}$ = 1.5 kV, min. du/dt = 5 kV/μs
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

5.2 Notes on project planning

5.2.1 Supply forms / electrical supply conditions

Observe the restrictions for the different supply forms!

Supply system	Operation of controller	Notes
Supply system: TT, TN (with earthed neutral)	Permitted without restrictions.	• Observe the rated data of the controller • RMS mains current: see chapter "Technical data".
Supply system: IT (with isolated neutral)	Possible if the controller is protected in the event of an earth fault in the supply system • by means of suitable devices which detect the earth fault and • immediately separate the controller from the supply system.	• Safe operation in the event of an earth fault at the inverter output cannot be guaranteed. • The variants V024 / V104 and V100 enable operation of the controller on IT systems.
DC supply via $+U_G/-U_G$	Permitted if the DC voltage is symmetrical to PE.	Earthing of the $+U_G$ or $-U_G$ conductor will destroy the controller.

5.2.2 Operation on public supply systems (compliance with EN 61000-3-2)

European standard EN 61000-3-2 defines limit values for the limitation of harmonic currents in the supply system. Non-linear consumers (e.g. frequency inverters) generate harmonic currents which "pollute" the supplying mains and may therefore interfere with other consumers. The standard aims at assuring the quality of public supply systems and reducing the mains load.

Note!

The standard only applies to public systems. Mains which are provided with a transformer substation of their own as in industrial plants are not public and not included in the application range of the standard.

If a device or machine consists of several components, the limit values of the standard apply to the entire unit.

Measures for compliance with the standard

With the measures described, the controllers comply with the limit values according to EN 61000-3-2.

Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
	Total power on the mains	Compliance with the requirements [1]
	< 1 kW	With mains choke
	> 1 kW	No measures required

[1] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!

5.2.3 Controllers in the IT system

Controllers in the V024, V104 or V100 variants are suitable for operation on insulated supply systems (IT systems). The controllers also have an insulated design. This avoids the activation of the insulation monitoring, even if several controllers are installed.

The electric strength of the controllers is increased so that damage to the controller are avoided if insulation or earth faults in the supply system occur. The operational reliability of the system remains intact.

Stop!

Only operate the controllers with the mains chokes assigned.

Operation with mains filters or RFI filters by Lenze is not permitted, as these modules contain components that are interconnected against PE. By this the protective design of the IT system would be cancelled out. The components are destroyed in the case of an earth fault.

Protect the IT system against earth fault at the controller.

Due to physical conditions, an earth fault on the motor side at the controller can interfere with or damage other devices on the same IT system. Therefore appropriate measures have to be implemented, by means of which the earth fault is detected and which disconnect the controller from the mains.

Permissible supply forms and electrical supply conditions

Mains	Operation of the controllers	Notes
With isolated star point (IT systems)	Possible, if the controller is protected in the event of an earth fault in the supplying mains. ● Possible, if appropriate earth fault detections are available and ● the controller is immediately disconnected from the mains.	Safe operation in the event of an earth fault at the inverter output cannot be guaranteed.

DC-bus operation of several drives

Central supply with 9340 regenerative power supply module is not possible.

Installation of the CE-typical drive system

For the installation of drives on IT systems, the same conditions apply as for the installation on systems with an earthed neutral point.

According to the binding EMC product standard EN61800-3, no limit values are defined for IT systems for noise emission in the high-frequency range.

5.2.4 Operation at earth-leakage circuit breaker (e.l.c.b.)

Danger!

The controllers are internally fitted with a mains rectifier. In case of a short circuit to frame a pulsating DC residual current can prevent the AC sensitive or pulse current sensitive earth-leakage circuit breakers from being activated, thus cancelling the protective function for the entire equipment being operated on this earth-leakage circuit breaker.

- For the protection of persons and farm animals (DIN VDE 0100), we recommend
  - pulse current sensitive earth-leakage circuit breakers for plants including controllers with a single-phase mains connection (L1/N).
  - universal-current sensitive earth-leakage circuit breakers for plants including controllers with a three-phase mains connection (L1/L2/L3).
- Only install the earth-leakage circuit breaker between supplying mains and drive controller.
- Earth-leakage circuit breakers may trigger a false alarm due to
  - capacitive compensation currents flowing in the cable shields during operation (particularly with long, shielded motor cables),
  - simultaneous connection of several inverters to the mains
  - the use of additional interference filters.

5.2.5 Interaction with compensation equipment

- Controllers only consume very little reactive power of the fundamental wave from the AC supply mains. Therefore, a compensation is not required.
- If the controllers are connected to a supply system with compensation equipment, this equipment must comprise chokes.
  - For this, contact the supplier of the compensation equipment.

5.2.6 Discharge current for mobile systems

Frequency inverters with internal or external RFI filters usually have a discharge current to PE potential that is higher than 3.5 mA AC or 10 mA DC.

Therefore, fixed installation as protection is required (see EN 61800-5-1). This must be indicated in the operational documents.

If a fixed installation is not possible for a mobile consumer although the discharge current to PE potential is higher than 3.5 mA AC or 10 mA DC, an additional two-winding transformer (isolating transformer) can be included in the current supply as a suitable countermeasure. Here, the PE conductor is connected to the PEs of the drive (filter, inverter, motor, shieldings) and also to one of the poles of the secondary winding of the isolating transformer.

Devices with a three-phase supply must have a corresponding isolating transformer with a secondary star connection, the star point being connected to the PE conductor.

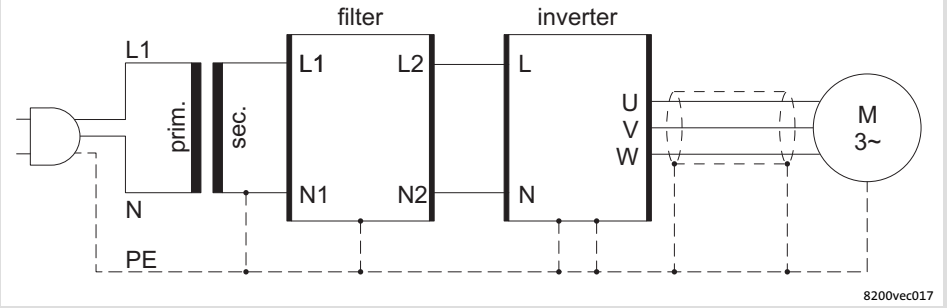


Fig. 5.2-1 Installation of a two-winding transformer (isolating transformer)

5.2.7 Optimisation of the controller and mains load

A mains choke is an inductance which can be included in the mains cable of the frequency inverter. As a result, the load of the supplying mains and the controller is optimised:

- Reduced system perturbation: The curved shape of the mains current approaches a sinusoidal shape.
- Reduced mains current: The effective mains current is reduced, i.e. the mains, cable, and fuse loads are reduced.
- Increased service life of the controller: The electrolytic capacitors in the DC bus have a considerably increased service life due to the reduced AC current load.

There are no restrictions for the combinations of mains chokes and RFI filters and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

Note!

- Some controllers must generally be operated with a mains choke or a mains filter.
- If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

5.2.8 Reduction of noise emissions

Due to internal switching operations, every controller causes noise emissions which may interfere with the functions of other consumers. Depending on the site of the frequency inverter, European standard EN 61800-3 defines limit values for these noise emissions:

Limit class C2: Limit class C2 is often required for industrial mains which are isolated from the mains of residential areas.

Limit class C1: If the controller is operated in a residential area, it may interfere with other devices such as radio and television receivers. Here, interference suppression measures according to limit class C1 are often required.

Limit class C1 is much more strict than limit class C2. Limit class C1 includes limit class C2.

For compliance with limit class C1 / C2, corresponding measures for the limitation of noise emissions are required, e.g. the use of RFI filters.

There are no restrictions for the combinations of RFI filters and mains chokes and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

The selection of the frequency inverter and the corresponding filters, if applicable, always depends on the application in question and is determined by e.g. the switching frequency of the controller, the motor cable length, or the protective circuit (e.g. earth-leakage circuit breakers).

Note!

- ► Some controllers must generally be operated with a mains choke or a mains filter.
- ► If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

The graphics below illustrates the maximum possible motor cable length based on the type of filter and the resulting interference voltage category according to EN 61800-3. Depending on the used motor cable, the used controller, and its switching frequency, the mentioned maximum motor cable lengths may vary.

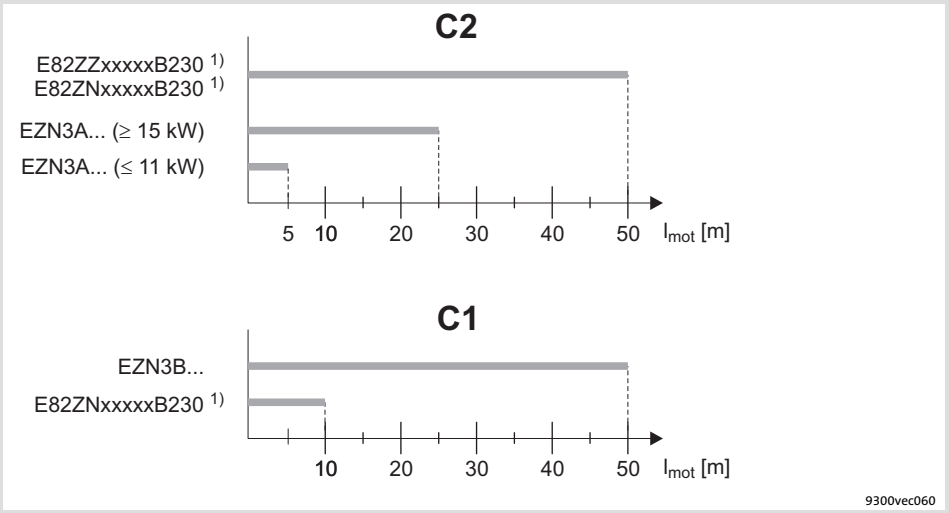


Fig. 5.2-2 Maximum motor cable lengths l_{mot} based on the type of filter for compliance with limit class C2 / C1

1) Use low-capacitance cables

5.2.9 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xK	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xK	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xK	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xK	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xK	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xK	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50
EVS9327-xK	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 1)	10
		E82ZN22334B230	50	EZN3B0110H030U 2)	50
		E82ZZ15334B230 1)	50		
EVS9328-xK	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xK	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50
EVS9330-xK	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 3)	25		
		E82ZN55334B230	50		
EVS9331-xK	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xK	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

1) RFI filter
2) Footprint filter
3) For controllers with thermal separation

5.2.10 Motor cable

Specification

- The used motor cables must
  - meet the requirements on site (e.g. EN 60204-1, UL),
  - comply with the following voltage data: EN 0.6/1 kV, UL 600 V.
- For shielded motor cables, only use cables with braid made of tinned or nickel-plated copper. Shields made of steel braid are not suitable.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90°.
- Use low-capacitance motor cables:

Power class	Capacitance per unit length	
	Core/core	Core/shield
3 ... 11 kW	from 2.5 mm² ≤100 pF/m	≤ 150 pF/m
15 ... 30 kW	≤ 140 pF/m	≤ 230 pF/m
45 ... 55 kW	≤ 190 pF/m	≤ 320 pF/m
75 ... 90 kW	≤ 250 pF/m	≤ 410 pF/m

Cable length

9300	Maximum permissible motor cable length			
	U_r = 400 V		U_r = 480 V	
Type	f_{chop} = 8 kHz	f_{chop} = 16 kHz	f_{chop} = 8 kHz	f_{chop} = 16 kHz
EVS9321-xK, EVS9322-xK	50 m	45 m	50 m	25 m
EVS9323-xK ... EVS9332-xK	50 m	50 m	50 m	50 m

Note!

- The motor cable must be as short as possible for having a positive effect on the drive behaviour.
- If EMC requirements must be met, the permissible cable length may be affected.
- EVS9321-xKand EVS9322-xK: At a mains voltage of 480 V and a switching frequency f_{chop} = 16 kHz, the maximum permissible cable length is reduced if the motor cable has more than a single core:
  - The following holds true for two parallel single cores: l_{max} = 17 m
  - The following holds true for three parallel single cores: l_{max} = 9 m

Cable cross-section

Note!

The cable cross-sections have been assigned to the permissible current loading of the motor cables under the following conditions:

- Compliance with IEC/EN 60204-1 for fixed cable installation
- Compliance with IEC 60354-2-52, table A.52-5 when using the cable in a trailing cable
- Laying system C
- Ambient temperature 45 °C
- Continuous motor operation at a
  - standstill current I_0 for servo motors or a
  - rated current I_R for three-phase asynchronous motors

The user is responsible for selecting a motor cable which complies with the requirements of the current conditions if different situations arise. Different situations may arise due to:

- Laws, standards, national and regional regulations
- Type of application
- Motor utilisation
- Ambient and operating conditions
- Laying system and bundling of cables
- Cable type

Motor cable			
permanently installed	for trailing cable	Cable cross-section	
I_M [A]	I_M [A]	[mm²]	[AWG]
10.0	11.8	1.0	18
13.8	17.3	1.5	16
19.1	23.7	2.5	14
25.5	30.9	4.0	12
32.8	41.0	6.0	10
45.5	55.5	10	8
60.1	75.5	16	6
76.4	92.8	25	4
94.6	115	35	2
114	140	50	1
146	179	70	00
177	217	95	000
205	252	120	0000

Note!

Information on the design of the motor cable is provided in the ”System cables and system connectors” manual.

5.3 Basics for wiring according to EMC

5.3.1 Shielding

The quality of shielding is determined by a good shield connection:

- Connect the shield with a large surface.
- Connect the shield directly to the intended shield sheet of the device.
- In addition, connect the shield to the conductive and earthed mounting plate with a large contact surface by using a conductive clamp.
- Unshielded cable ends must be as short as possible.

5.3.2 Mains connection, DC supply

- Controllers, mains chokes, or mains filters may only be connected to the mains via unshielded single cores or unshielded cables.
- When a mains filter or RFI filter is used, shield the cable between mains filter or RFI filter and controller if its length exceeds 300 mm. Unshielded cores must be twisted.
- In DC-bus operation or DC supply, use shielded cables.
- The cable cross-section must be dimensioned for the assigned fusing (observe national and regional regulations).

5.3.3 Motor cable

- Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  – The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- Shield the cable for motor temperature monitoring (PTC or thermal contact) and install it separately from the motor cable.
  – In Lenze system cables, the cable for brake control is integrated into the motor cable. If this cable is not required for brake control, it can also be used to connect the motor temperature monitoring up to a length of 50 m.
- Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp.
- Connect the shield directly to the corresponding device shield sheet.
  – If required, additionally connect the shield to the conductive and earthed mounting plate in the control cabinet.

- ► The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it only crosses mains cables and control cables at right angles,
  - – it is not interrupted.
- ► If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  - – The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  - – Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  - – Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.
- ► Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  - – Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

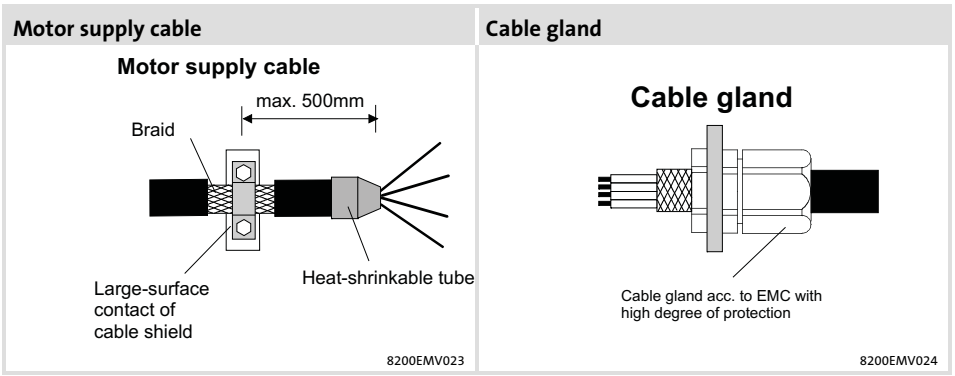


Fig. 5.3-1 Shielding of the motor cable

5.3.4 Control cables

- Control cables must be shielded to minimise interference injections.
- For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.
- Connect the shield correctly:
  - The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
- To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

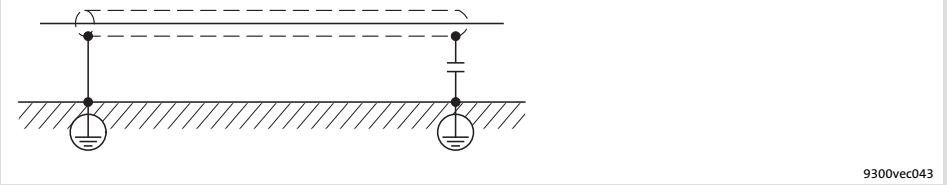


Fig. 5.3-2 Shielding of long, analog control cables

5.3.5 Installation in the control cabinet

Mounting plate requirements

- ▶ Only use mounting plates with conductive surfaces (zinc-coated or V2A-steel).
- ▶ Painted mounting plates are not suitable even if the paint is removed from the contact surfaces.
- ▶ If several mounting plates are used, ensure a large-surface connection between the mounting plates (e.g. by using earthing strips).

Mounting of the components

- ▶ Connect controllers, filters, and chokes to the earthed mounting plate with a surface as large as possible.

Optimum cable routing

- ▶ The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it crosses mains cables and control cables at right angles.
- ▶ Always install cables close to the mounting plate (reference potential), as freely suspended cables act like aerials.
- ▶ Lead the cables to the terminals in a straight line (avoid tangles of cables).
- ▶ Use separated cable channels for motor cables and control cables. Do not mix up different cable types in one cable channel.
- ▶ Minimise coupling capacities and coupling inductances by avoiding unnecessary cable lengths and reserve loops.
- ▶ Short-circuit unused cores to the reference potential.
- ▶ Install the positive and negative wires for DC 24 V close to each other over the entire length to avoid loops.

Earth connections

- ▶ Connect all components (drive controllers, chokes, filters) to a central earthing point (PE rail).
- ▶ Set up a star-shape earthing system.
- ▶ Comply with the corresponding minimum cable cross-sections.

5.3.6 Wiring outside of the control cabinet

Notes for cable routing outside the control cabinet:

- The longer the cables the greater the space between the cables must be.
- If cables for different signal types are routed in parallel, the interferences can be minimized by means of a metal barrier or separated cable ducts.

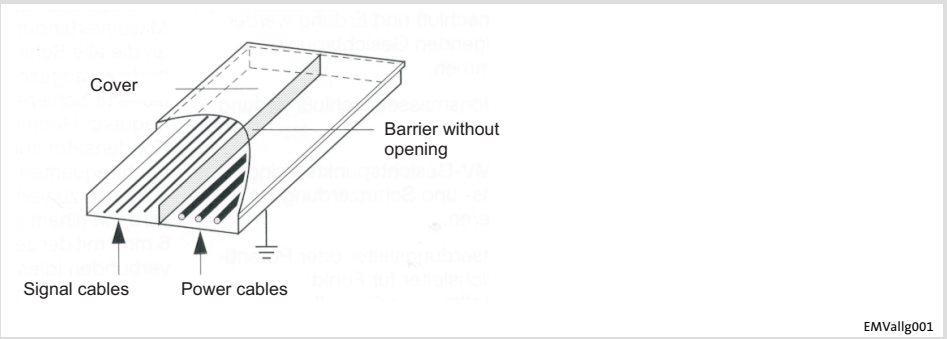


Fig. 5.3-3 Cable routing in the cable duct with barrier

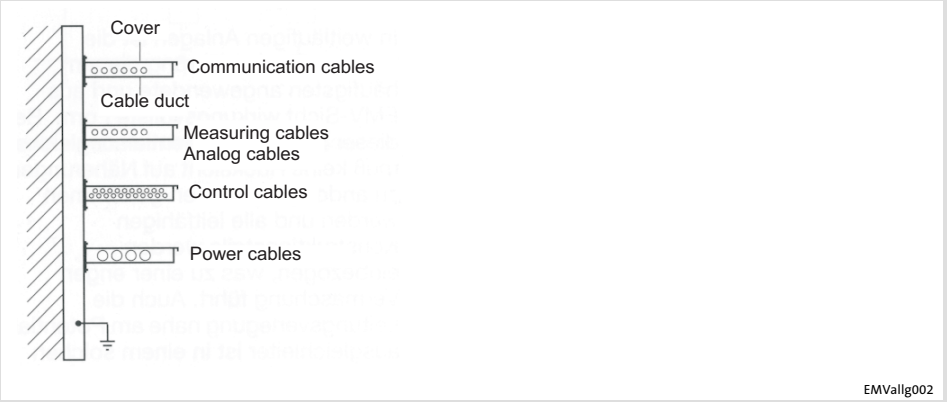


Fig. 5.3-4 Cable routing in separated cable ducts

5.3.7 Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	• Separate components from other component part with a minimum distance of 100 mm • Use motor choke/motor filter
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm
Conducted interference level is exceeded on the supply side	Terminal strips for the motor cable are directly located next to the mains terminals	Spatially separate the terminal strips for the motor cable from main terminals and other control terminals with a minimum distance of 100 mm
	Mounting plate varnished	Optimise PE connection: • Remove varnish • Use zinc-coated mounting plate
	HF short circuit	Check cable routing

5.4 Standard devices in the power range 0.37 ... 11 kW

5.4.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

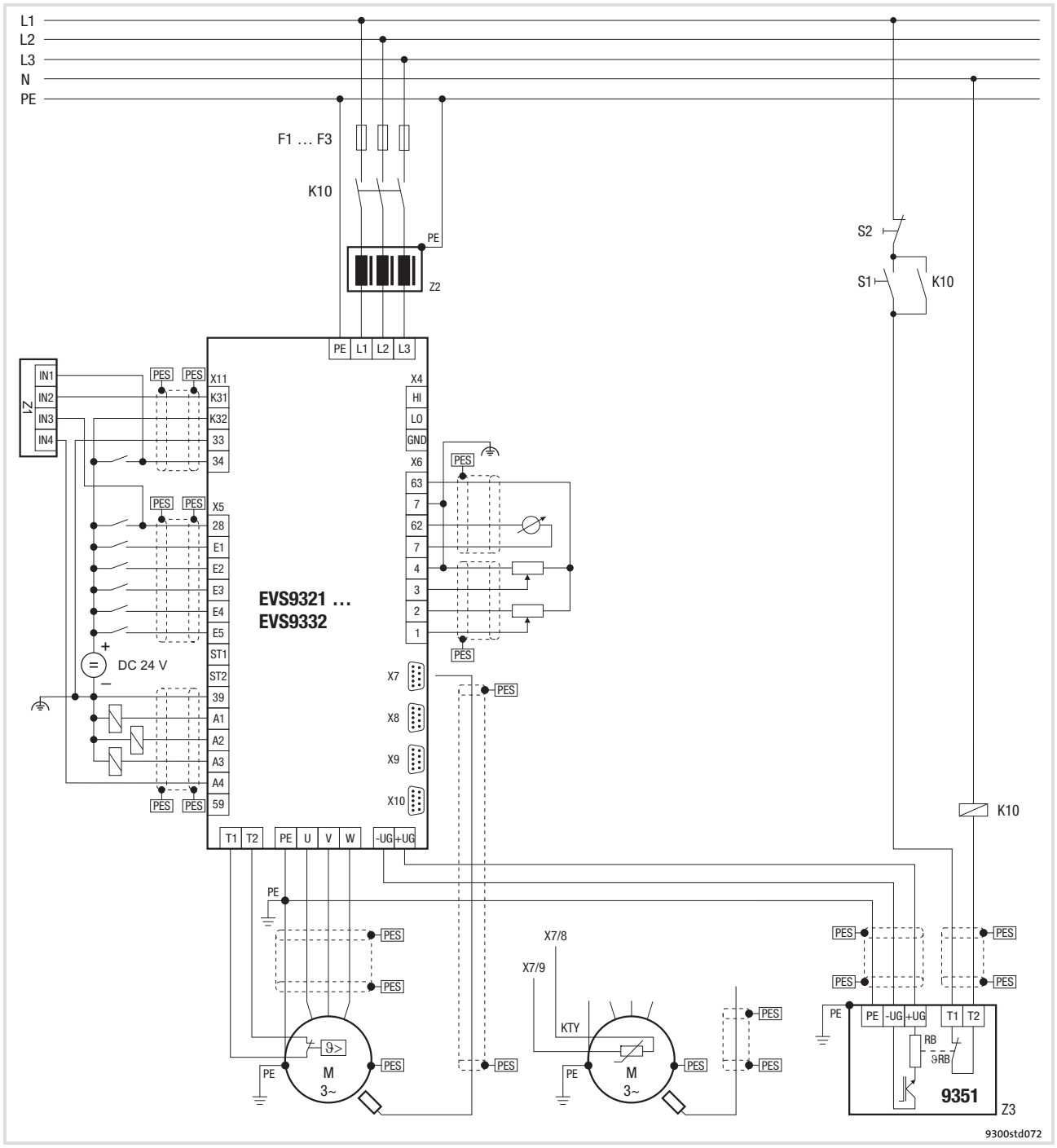


Fig. 5.4-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.4.2 Important notes

To gain access to the power connections, remove the covers:

- ► Release the cover for the mains connection with slight pressure on the front and pull it off to the top.
- ► Release the cover for the motor connection with slight pressure on the front and pull it off to the bottom.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield connection support	Support of the shield sheets for the supply cable and motor cable	2
Hexagon nut M5	Fastening of shield connection supports	4
Spring washer ∅ 5 mm (DIN 127)		2
Serrated lock washer ∅ 5.3 mm (DIN 125)		2
Shield sheet	Shield connections for supply cables, motor cable	2
Screw and washer assembly M4 × 10 mm (DIN 6900)	Fastening of shield sheets	4

5.4.3 Mains connection, DC supply

Note!

- ► If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- ► For DC-bus operation or DC supply, we recommend using shielded DC cables.

Shield sheet installation

Stop!

- ► To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- ► Do not use lugs as strain relief.

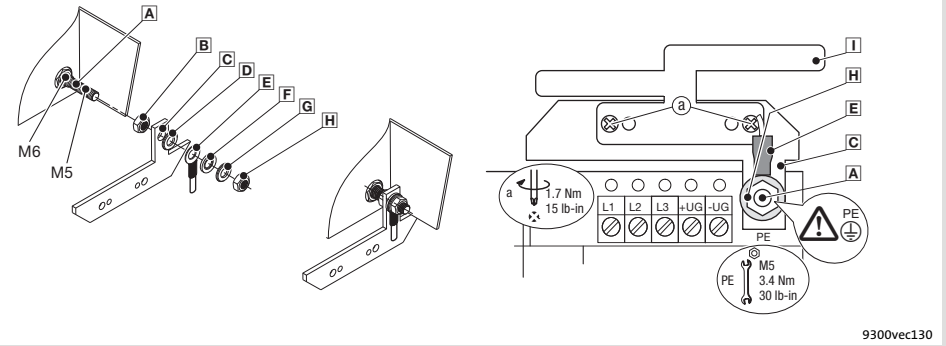


Fig. 5.4-2 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Mains connection, DC supply

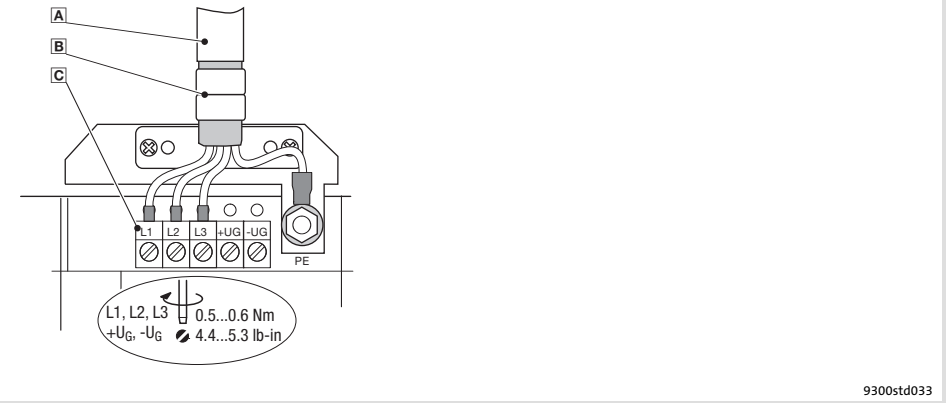


Fig. 5.4-3 Mains connection, DC supply for drive controllers 0.37 ... 11 kW

- A Mains cable
- B Shield sheet
  Securely clamp mains cable with the lugs
- C Mains and DC bus connection
  L1, L2, L3: Connection of mains cable
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)
  Cable cross-sections up to 4 mm^2: Use wire end ferrules for flexible cables
  Cable cross-sections > 4 mm^2: Use pin-end connectors

5.4.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9321-xK	6	C6, B6 [2]	1	1	300
EVS9322-xK	6	C6, B6 [2]	1	1	
EVS9323-xK	10	B10	1.5	1	
EVS9325-xK	25	B20	4	2.5	
Operation with mains choke/mains filter					
EVS9321-xK	6	C6, B6 [2]	1	1	300
EVS9322-xK	6	C6, B6 [2]	1	1	
EVS9323-xK	10	B10	1.5	1	
EVS9324-xK	10	B10	1.5	1	
EVS9325-xK	20	B16	2.5	2.5	
EVS9326-xK	32	B25	–	4	

1) Universal current-sensitive earth-leakage circuit breaker
2) For short-time mains interruptions, use circuit breakers with tripping characteristic "C"

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only in accordance with UL 248 ● System short-circuit current up to 5000 A_{rms} : All classes are permissible ● System short-circuit current up to 50000 A_{rms} : Only classes "CC", "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation without mains choke/mains filter		
EVS9321-xK	6	18
EVS9322-xK	6	18
EVS9323-xK	10	16
EVS9325-xK	25	10
Operation with mains choke/mains filter		
EVS9321-xK	6	18
EVS9322-xK	6	18
EVS9323-xK	10	16
EVS9324-xK	10	16
EVS9325-xK	25	10
EVS9326-xK	25	10

Max. connection cross-section of the terminal strip: AWG 12, with pin-end connector AWG 10

5.4.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xK	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xK	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xK	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xK	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xK	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xK	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50

5.4.6 Motor connection

Note!

- Fusing the motor cable is not required.
- The drive controller features 2 connections for motor temperature monitoring:
  - Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

- To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- Do not use lugs as strain relief.

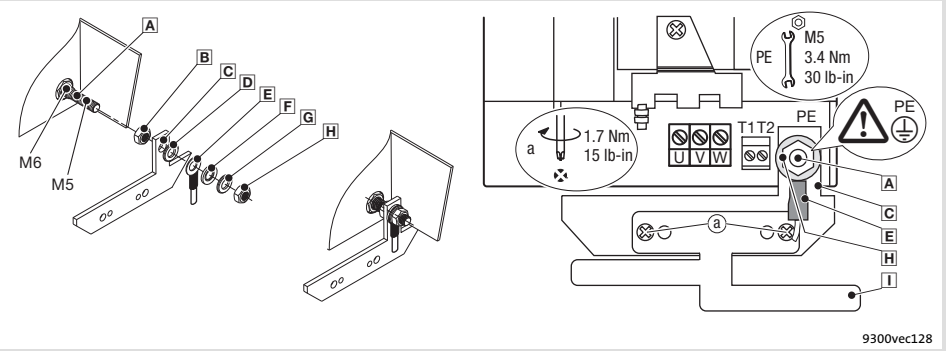


Fig. 5.4-4 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.

► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

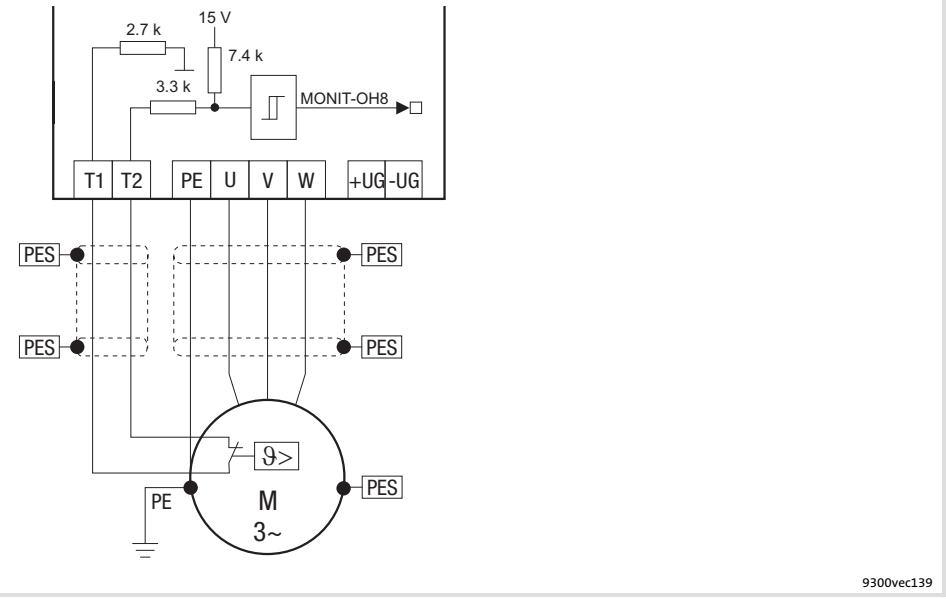


Fig. 5.4-5 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: $R\vartheta > 1600\ \Omega$ ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

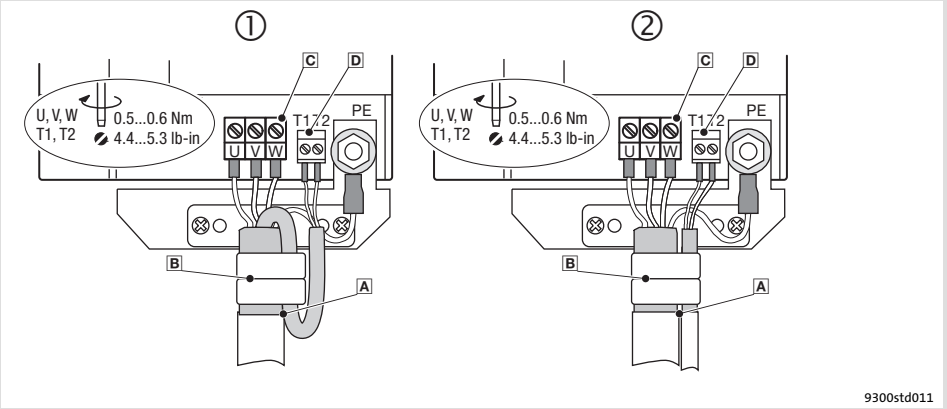


Fig. 5.4-6 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

D T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

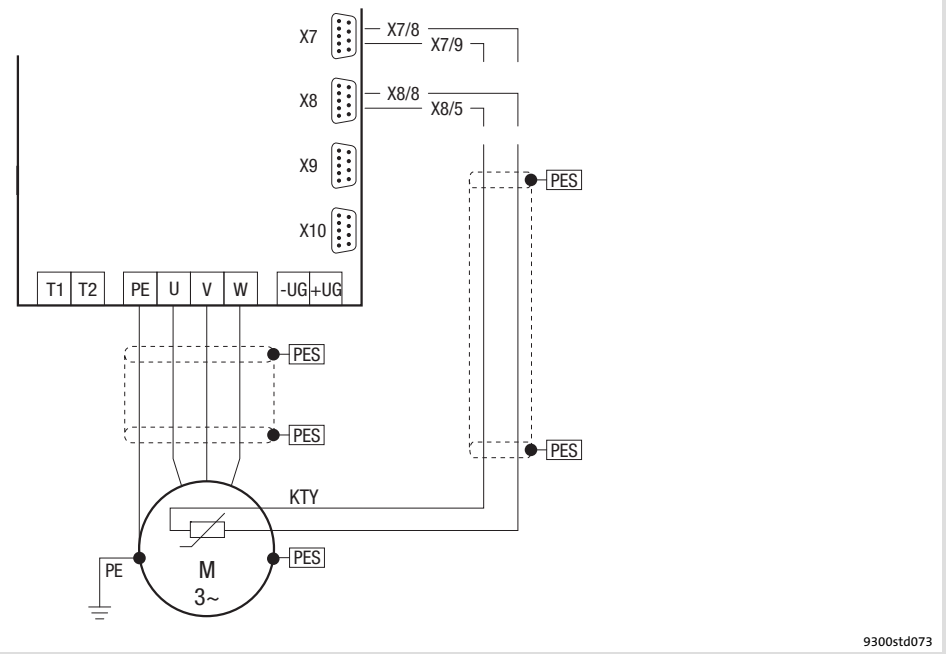


Fig. 5.4-7 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

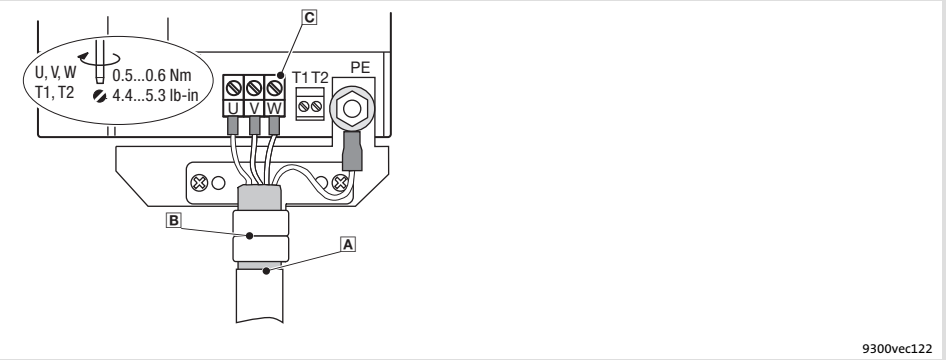


Fig. 5.4-8 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield sheet
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
  Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

5.5 Standard devices in the power range 15 ... 30 kW

5.5.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on "Electromagnetic Compatibility" if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter "Basics for wiring according to EMC"!

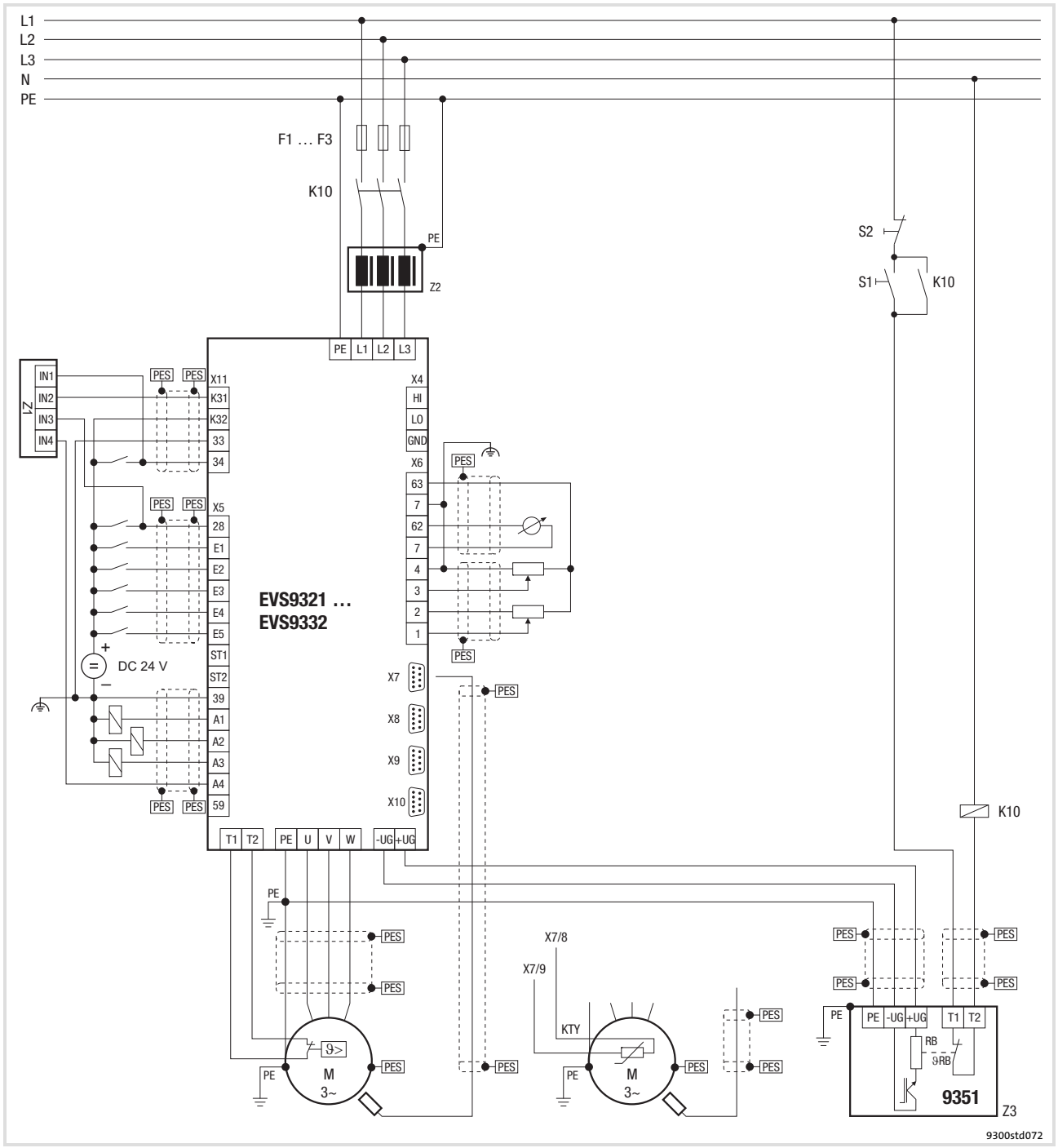
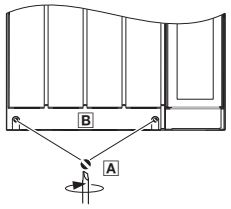


Fig. 5.5-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.5.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Hexagon nut M6 (DIN 934)	Connection of supply cables (mains, $+U_G$, $-U_G$) and motor cable to the stud bolts	10
Washer ∅ 6 mm (DIN 125)	For hexagon nut M6	10
Spring washer ∅ 6 mm (DIN 127)	For hexagon nut M6	10
Grommet	Motor cable	1
Shield connection support	Support of the shield sheet for motor cable	1
Self-tapping screw ∅ 4 × 14 mm	Fastening of shield connection support	2
Shield sheet	Shield connection for motor cable	1

5.5.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

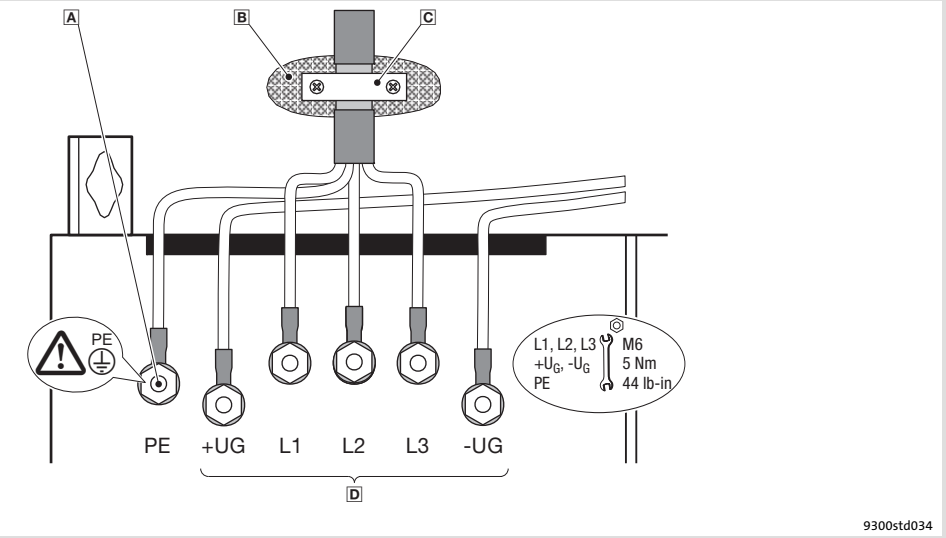


Fig. 5.5-2 Mains connection, DC supply for drive controllers 15 ... 30 kW

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.5.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9327-xK	63	–	16	16	300
Operation with mains choke/mains filter					
EVS9327-xK	40	–	10	10	300
EVS9328-xK	63	–	25	16	
EVS9329-xK	80	–	–	25	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 5000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9327-xK	35	8
EVS9328-xK	60	4
EVS9329-xK	80	4

5.5.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9327-xK	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 [1]	10
		E82ZN22334B230	50	EZN3B0110H030U [2]	50
		E82ZZ15334B230 [1]	50		
EVS9328-xK	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xK	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50

1) RFI filter
2) Footprint filter

5.5.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

Do not use lugs as strain relief.

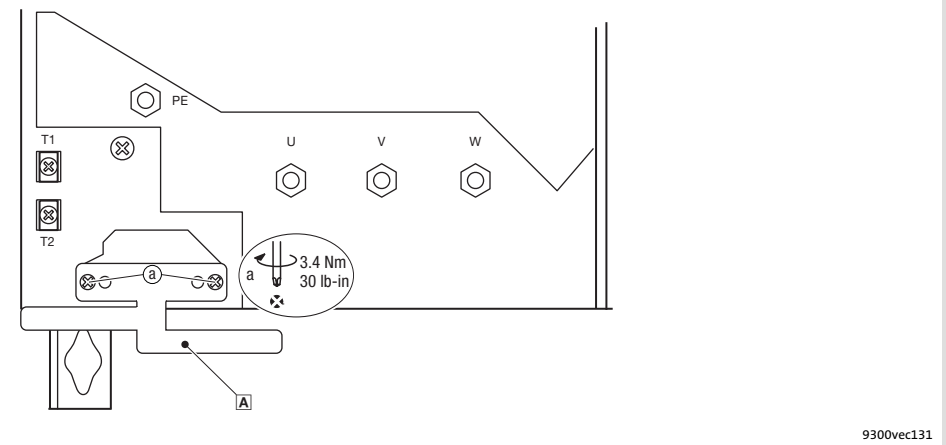


Fig. 5.5-3 Installation of shield sheet for drive controllers 15 ... 30 kW

A Fasten the shield sheet with two self-tapping screws ∅ 4 × 14 mm (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An "open" cable acts like an antenna and can cause faults on the drive controller.

Danger!

► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.

► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

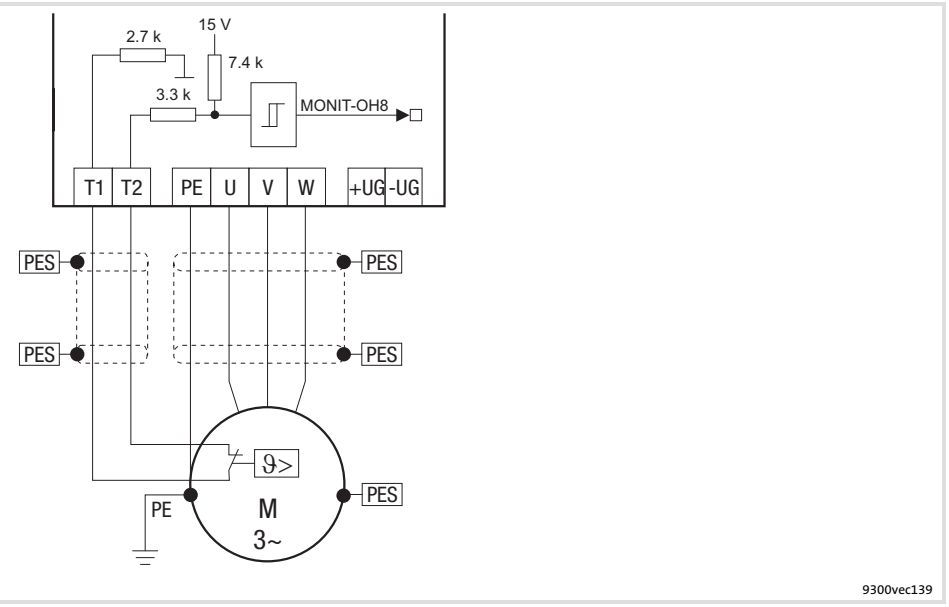


Fig. 5.5-4 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: $R\vartheta > 1600\ \Omega$ ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

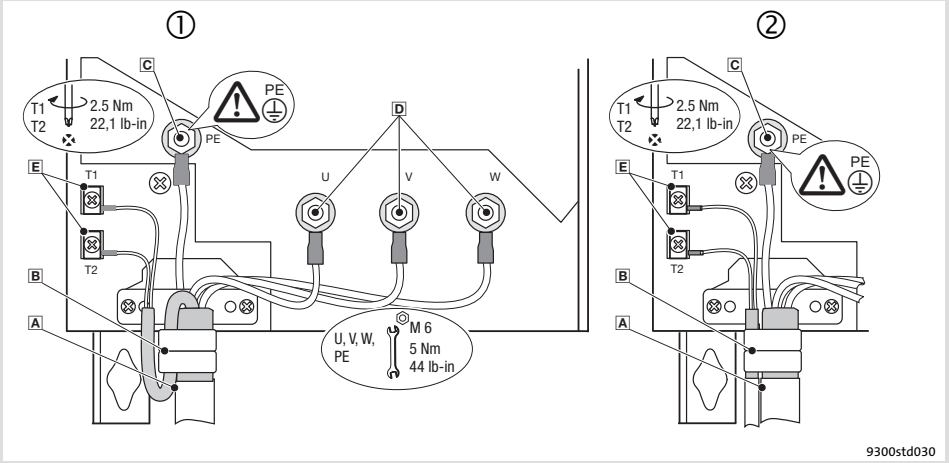


Fig. 5.5-5 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C PE stud
PE cable connection with ring cable lug

D U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable.
Max. connectable cable cross-section: 50 mm^2 with ring cable lug

E T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

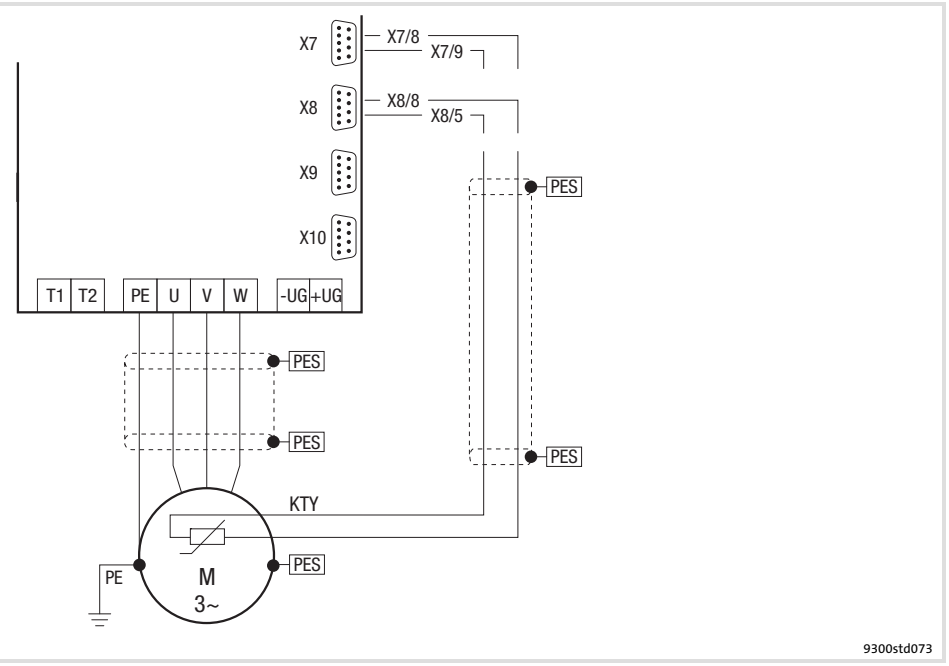


Fig. 5.5-6 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

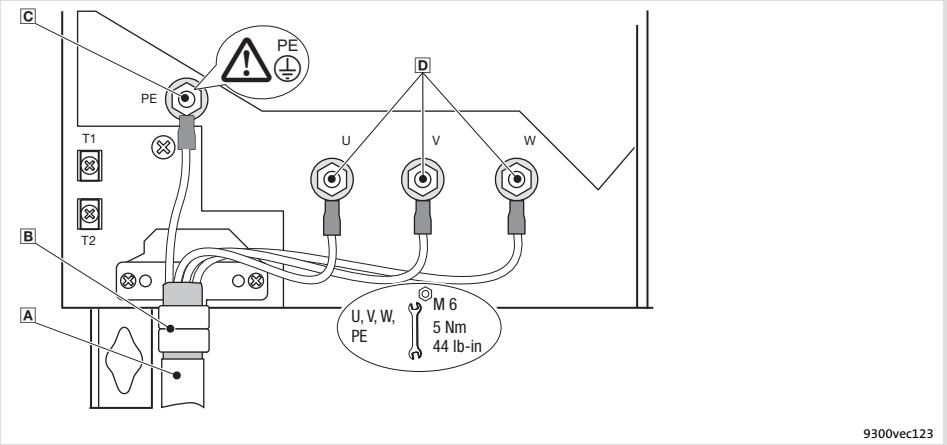


Fig. 5.5-7 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield connection
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C PE stud
  PE cable connection with ring cable lug
- D U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 50 mm^2 with ring cable lug

5.6 Standard devices with a power of 45 kW

5.6.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

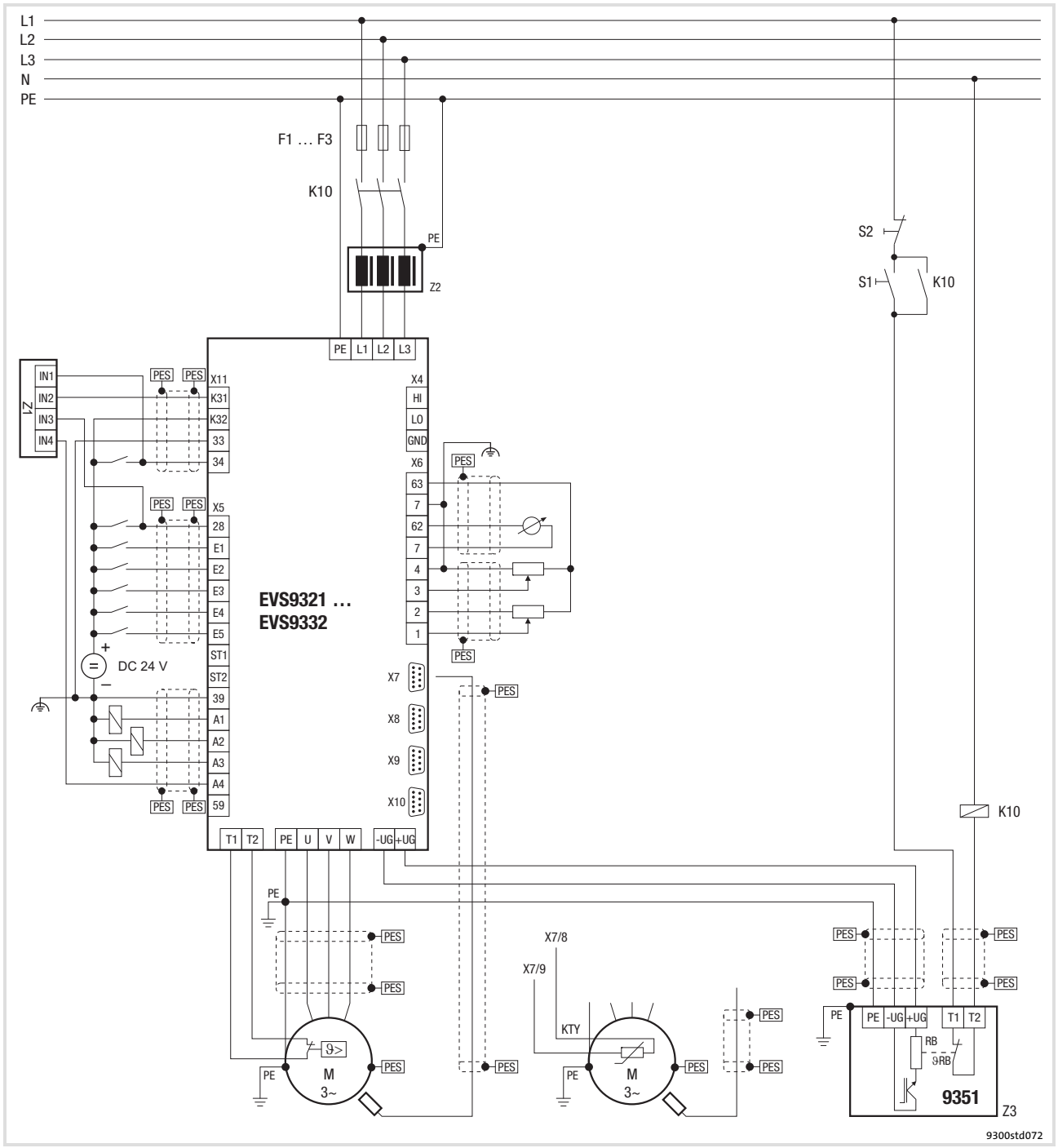
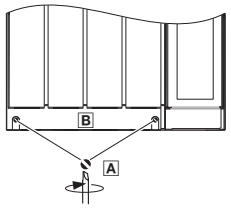


Fig. 5.6-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.6.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.6.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

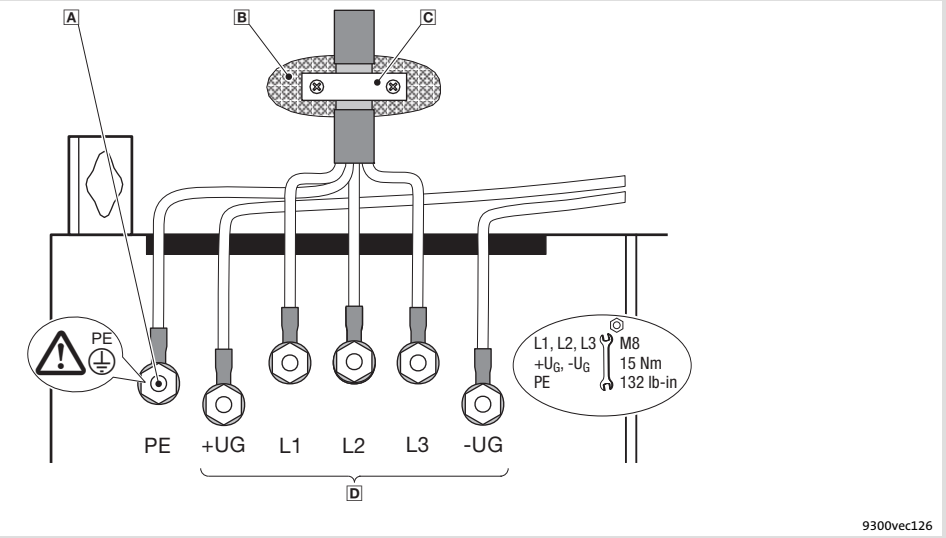


Fig. 5.6-2 Mains connection, DC supply for 45 kW controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.6.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9330-xK	100	–	–	35	300

[1] Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9330-xK	100	1

5.6.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9330-xK	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 [3)]	25		
		E82ZN55334B230	50		

[3)] For controllers with thermal separation

5.6.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

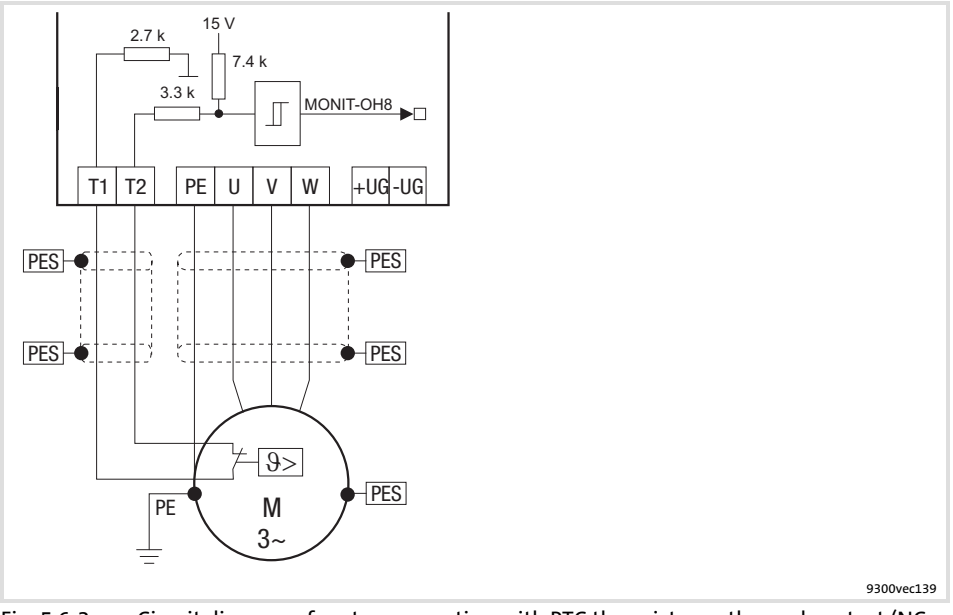


Fig. 5.6-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

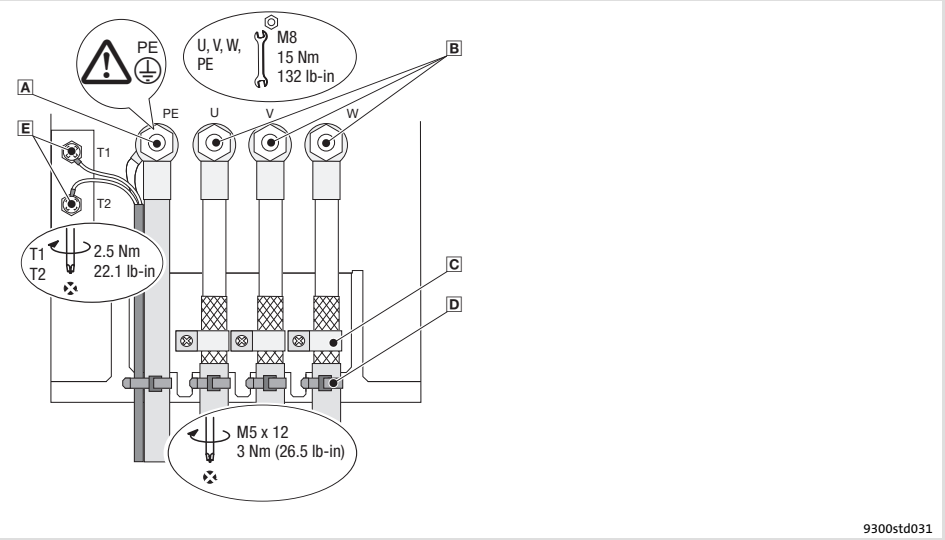


Fig. 5.6-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable
- E T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

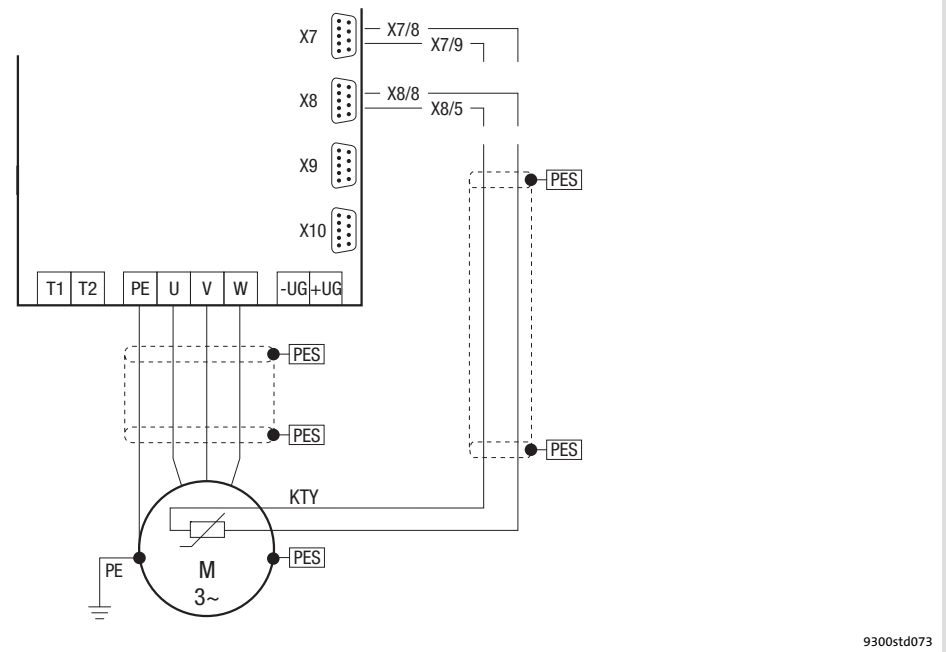


Fig. 5.6-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

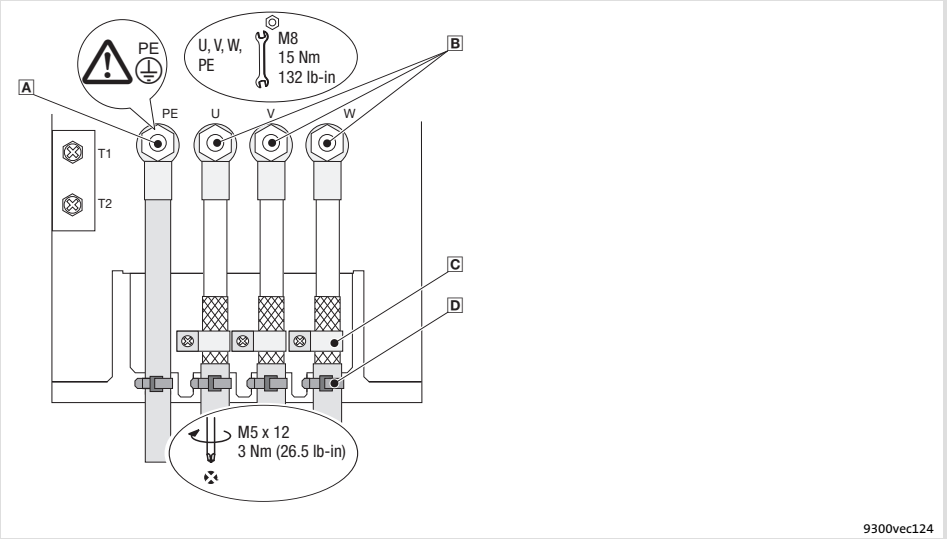


Fig. 5.6-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.7 Standard devices in the power range 55 ... 75 kW

5.7.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on "Electromagnetic Compatibility" if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter "Basics for wiring according to EMC"!

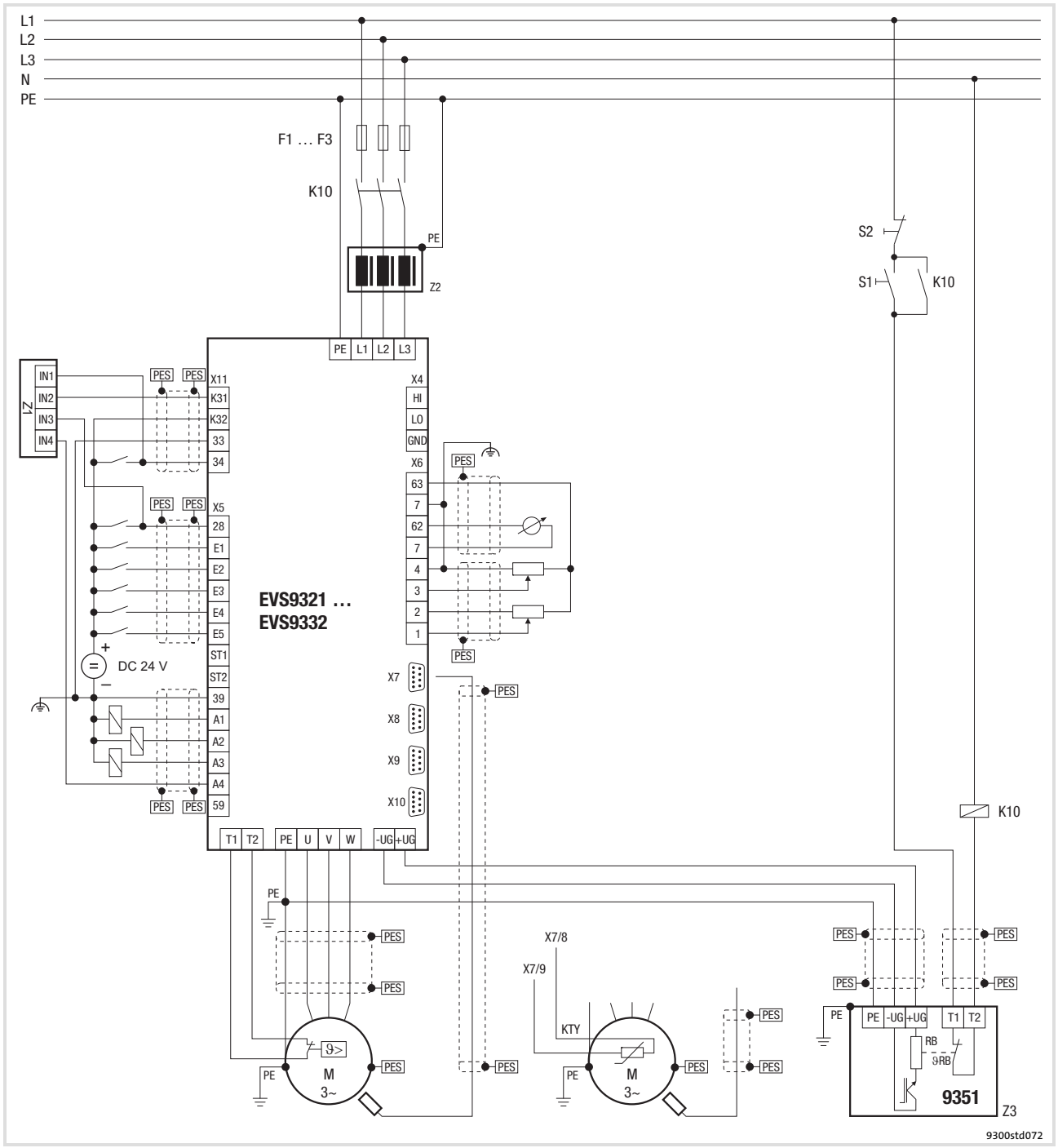
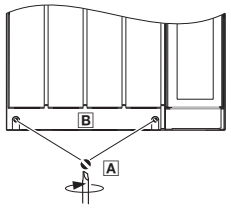


Fig. 5.7-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.7.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.7.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

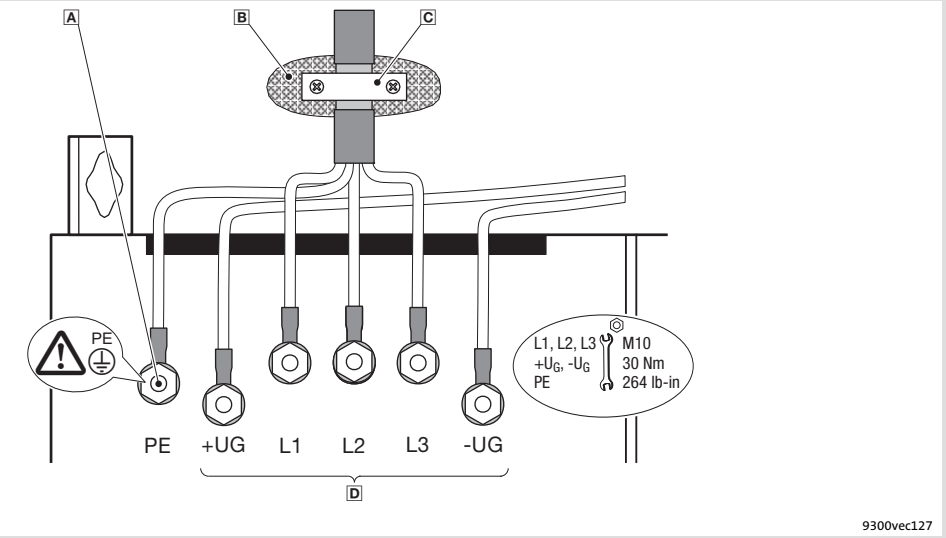


Fig. 5.7-2 Mains connection, DC supply for 55 ... 75 kW drive controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.7.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9331-xK	125	–	–	35	300
EVS9332-xK	160	–	–	70	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9331-xK	125	1/0
EVS9332-xK	175	2/0

5.7.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9331-xK	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xK	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

5.7.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

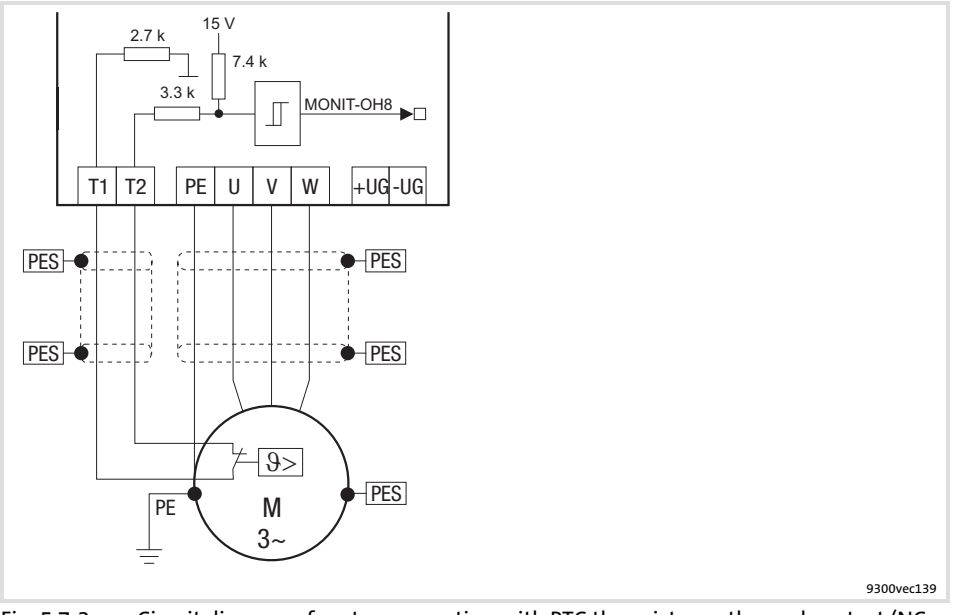


Fig. 5.7-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: $R\vartheta > 1600\ \Omega$ ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

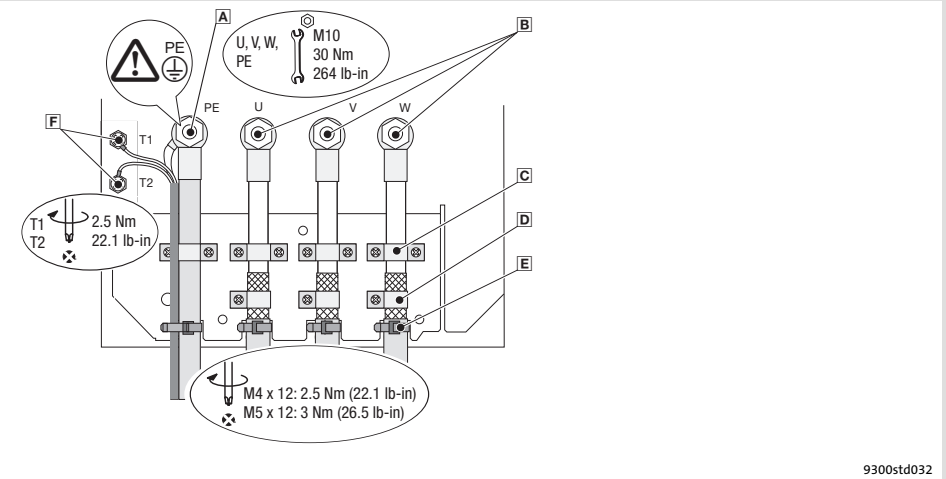


Fig. 5.7-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm^2 with ring cable lug
- C Cable clamps for strain relief of motor cable
  Fasten cable clamps with M4 × 12 mm screws
- D Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- E Cable ties for additional strain relief of motor cable
- F T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

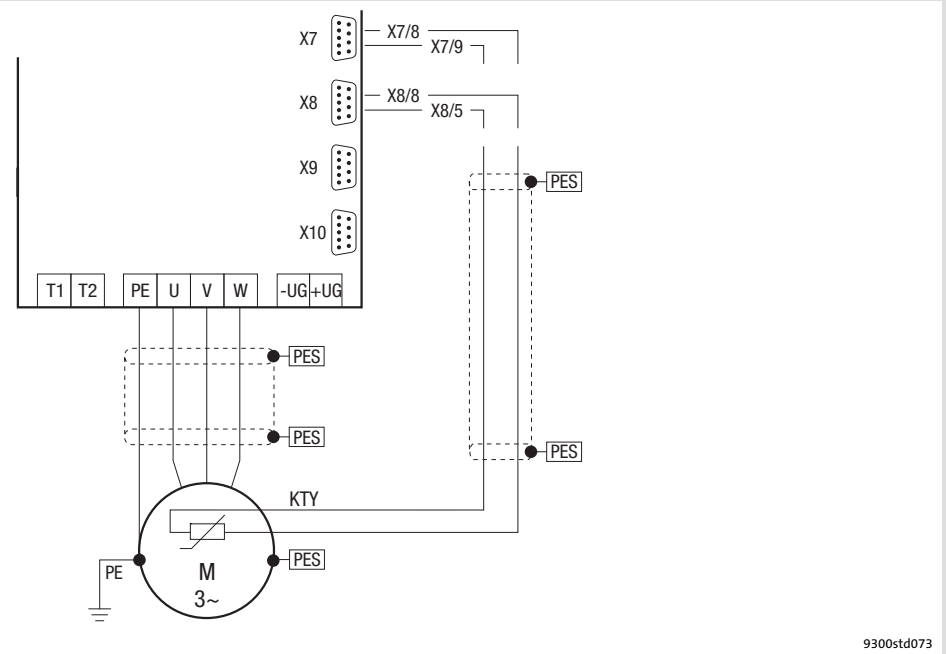


Fig. 5.7-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

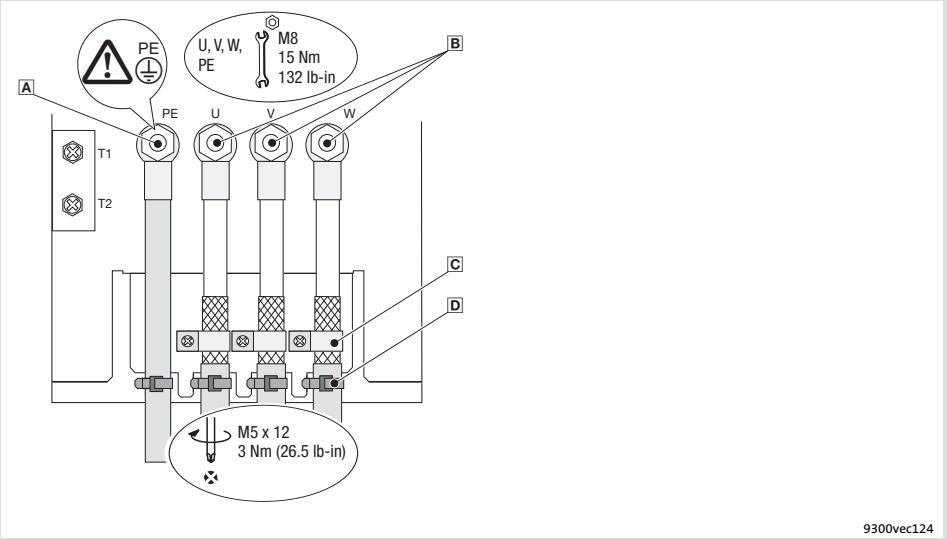


Fig. 5.7-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.8 Control terminals

5.8.1 Important notes

Stop!

The control card will be damaged if

- ► the voltage between X5/39 and PE or X6/7 and PE is greater than 50 V,
- ► the voltage between voltage source and X6/7 exceeds 10 V (common mode) in case of supply via external voltage source.

Limit the voltage before switching on the drive controller:

- ► Connect X5/39, X6/2, X6/4 and X6/7 directly to PE or
- ► use voltage-limiting components.

► For trouble-free operation, the control cables must be shielded:

- – Connect the shield of digital input and output cables at both ends.
- – Connect the shield of analog input and output cables at one end (at the drive controller).
- – For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield sheet	Shield connection for control cables	1
Screw M4 × 10 mm (DIN 7985)	Shield sheet fastening	1
Terminal strip, 4-pole (only for variants V004 and V024)	Connection of safety relay K_{SR} at X11	1
Terminal strip, 7-pole	Connection of digital inputs and outputs at X5	2
Terminal strip, 4-pole	Connection of analog inputs and outputs at X6	2

How to connect the shield

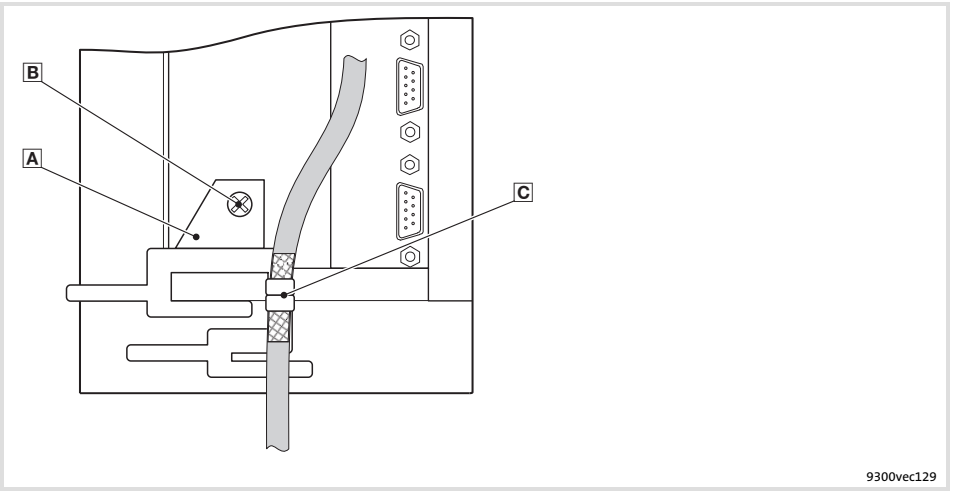


Fig. 5.8-1 Connection of cable shield to shield sheet

- A Shield sheet
- B Fasten shield sheet with M4 × 10 mm screw at the bottom of the control card
- C Securely clamp cable shield with lugs

Terminal data

Stop!

- ► Connect or disconnect the terminal strips only if the controller is disconnected from the mains!
- ► Wire the terminal strips before connecting them!
- ► Unused terminal strips must also be plugged on to protect the contacts.

Cable type		Wire end ferrule	Maximum cable cross-section	Tightening torque	Stripping length
	Rigid	–	2.5 mm² (AWG 14)	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	5 mm
	Flexible	Without wire end ferrule	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule without plastic sleeve	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule with plastic sleeve	2.5 mm² (AWG 14)		

5.8.2 Connection terminal of the control card

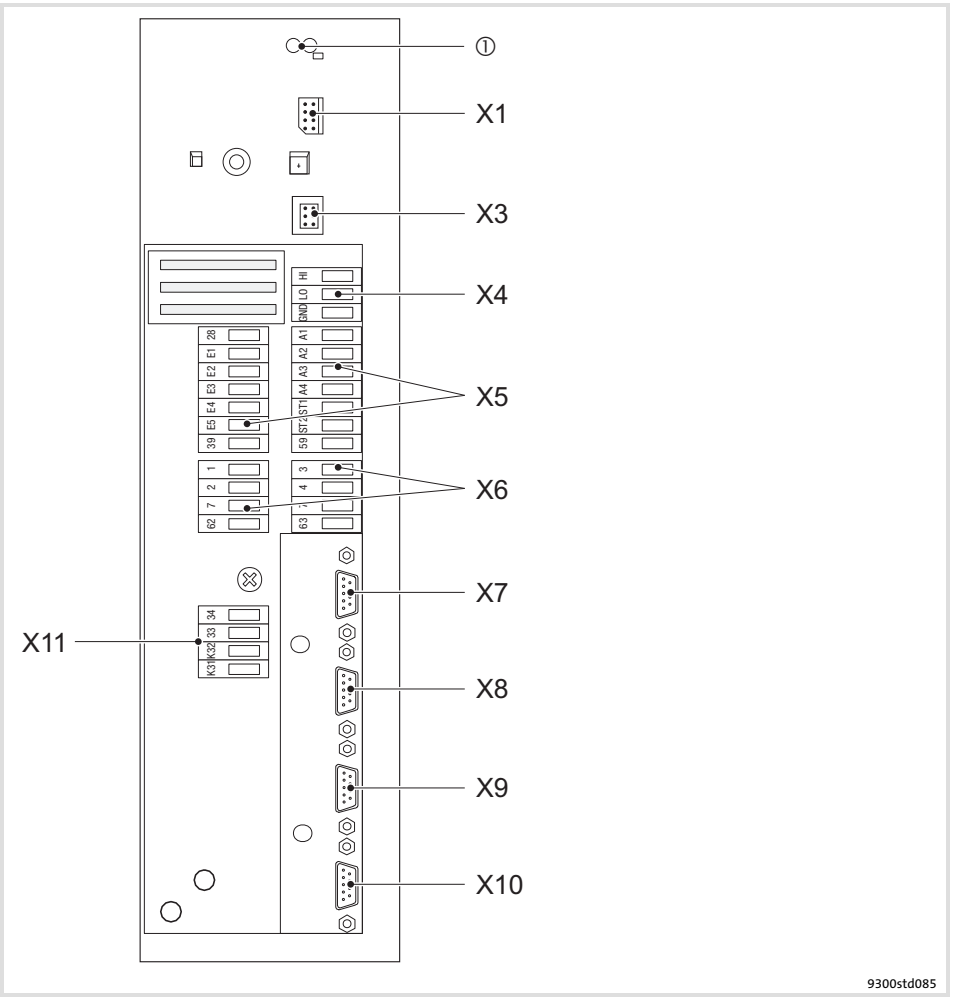


Fig. 5.8-2 Connection terminal of the control card

①	2 light-emitting diodes (red, green) for status display
X1	Automation interface (AIF) Slot for communication modules (e.g. keypad XT)
X3	Jumper for the preselection of the signal type for the input signal at X6/1, X6/2
X4	System bus (CAN) connection, terminal strip
X5	Connection of digital inputs and outputs, terminal strips
X6	Connection of analog inputs and outputs, terminal strips
X7	Resolver connection Plug-in connector: Socket, 9-pole, Sub-D
X8	Incremental encoder connection Plug-in connector: Pin, 9-pole, Sub-D
X9	Connection of digital frequency input signal Plug-in connector: Pin, 9-pole, Sub-D
X10	Connection of digital frequency output signal Plug-in connector: Socket, 9-pole, Sub-D
X11	Connection of safety relay K_{SR}, terminal strip

5.8.3 Device variant without ”Safe torque off” function

Internal voltage supply

- For the supply of the digital inputs (X5/E1 ... X5/E5) you have to set a freely assignable digital output (e. g. X5/A1) permanently to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

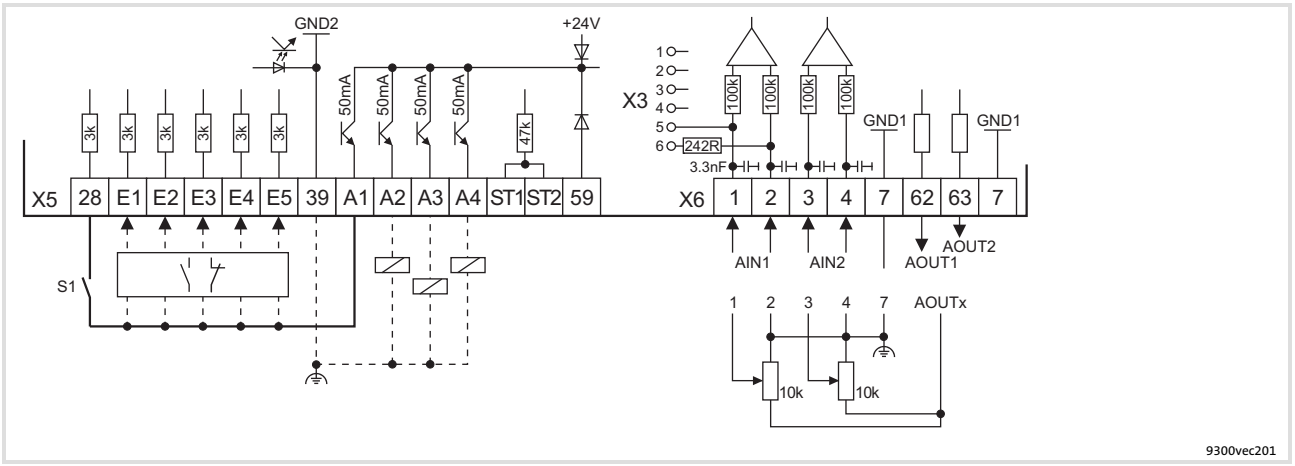


Fig. 5.8-3 Wiring of digital and analog inputs/outputs for internal voltage source

S1 Controller enable
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Supply via external voltage source

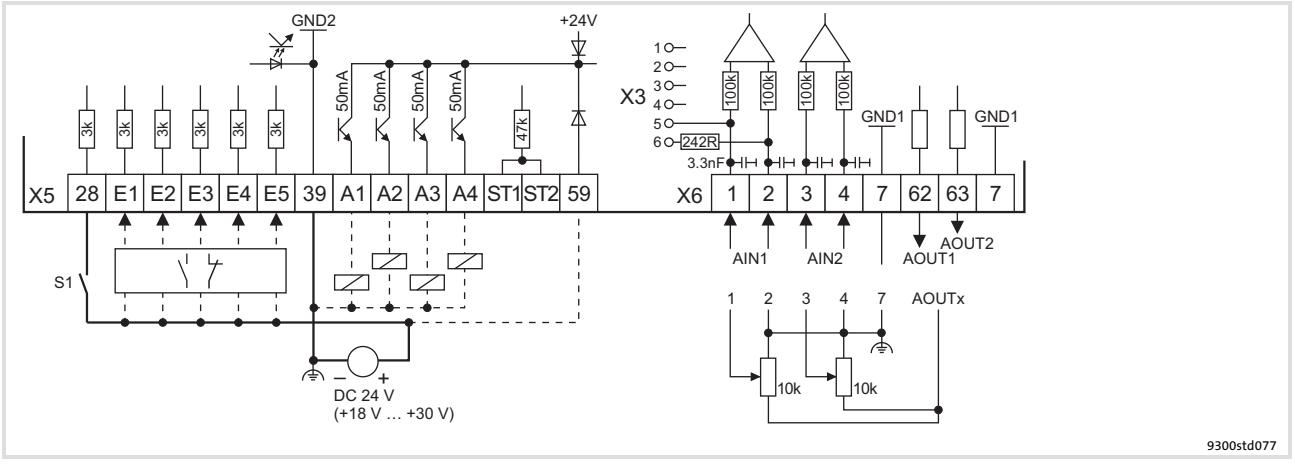


Fig. 5.8-4 Wiring of digital and analog inputs/outputs for external voltage source

S1 Controller enable
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

5.8.4 Device variant with ”Safe torque off” function

Safety instructions for the installation of the ”Safe torque off” function

- The installation and commissioning of the “Safe torque off” function must be carried out by skilled personnel only.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, for instance by a cable duct. Short circuits between the single cables must be ruled out!
- Wiring of the safety relay K_{SR} with insulated wire end ferrules or rigid cables is absolutely vital.
- The electrical reference point for the coil of the safety relay K_{SR} must be connected with the protective conductor system (DIN EN 60204-1 paragraph 9.4.3). Only this measure guarantees that the operation is protected against earth faults.

Tip!

A complete description can be found in the chapter ”Safe torque off”.

Internal voltage supply

- If a freely assignable digital output (e. g. X5/A1) is fixedly applied to HIGH level, it serves as an internal voltage source. An output can be loaded with a maximum of 50 mA.
  - Via a digital output you can supply the relay K_{SR} and two digital inputs (X5/28, and for instance X5/E1) with voltage.
  - For the maximum connection (relay K_{SR} and X5/E1 ... X5/E5) you have to connect two digital outputs in parallel and fixedly apply them to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

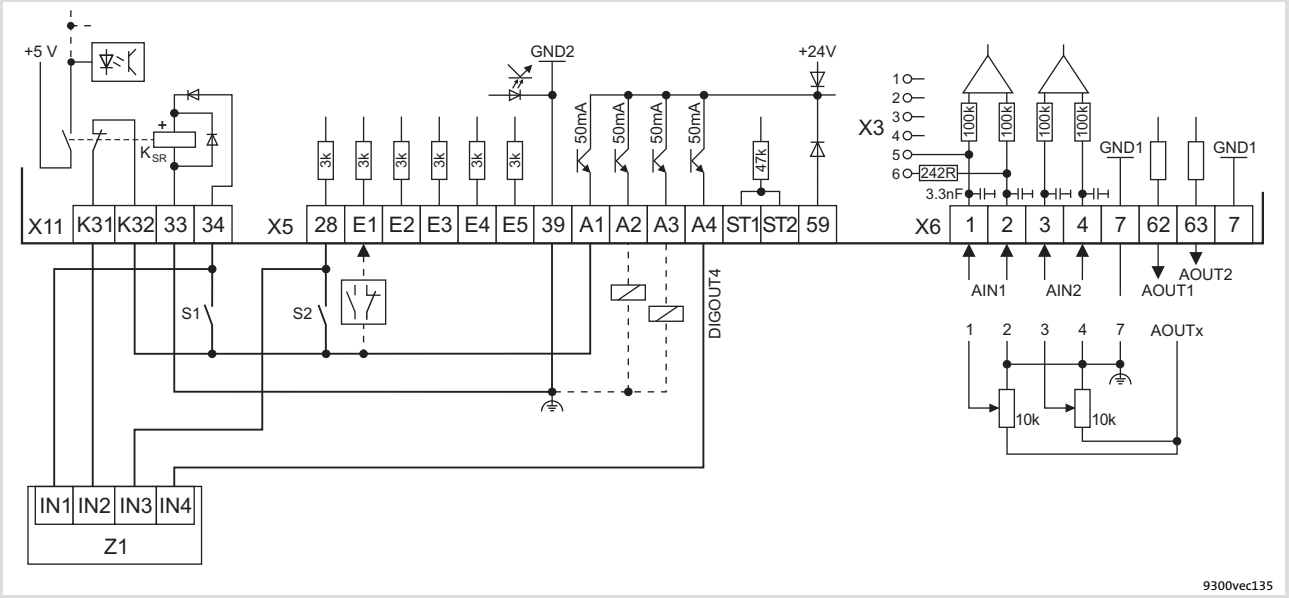


Fig. 5.8-5 Wiring of digital and analog inputs/outputs with active ”Safe torque off” function and internal voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the ”Safe torque off” function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

If you load a basic configuration C0005 = xx1x (e.g. 1010 for speed control with control via terminals), the following terminals are switched to a fixed signal level:

- Terminal X5/A1 to FIXED1 (corresponds to DC 24 V).
- Terminal X6/63 to FIXED100% (corresponds to 10 V).

Supply via external voltage source

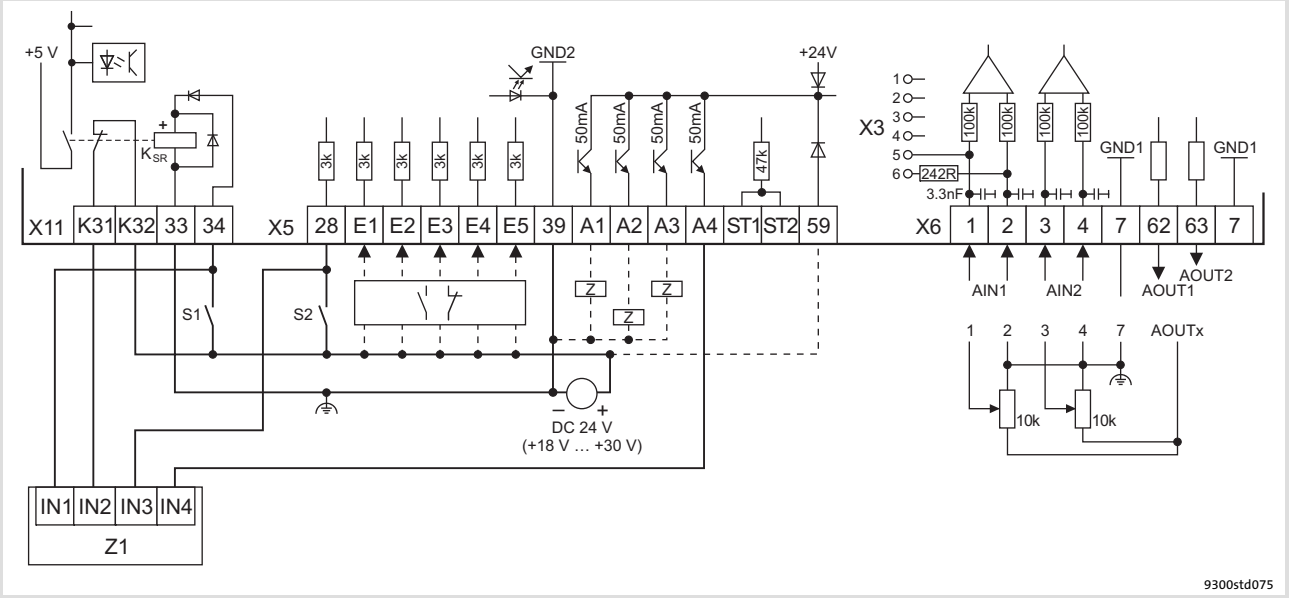


Fig. 5.8-6 Wiring of digital and analog inputs/outputs with active "Safe torque off" function and external voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the "Safe torque off" function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

Supplying the digital inputs via an external voltage source enables a **backup operation in the case of mains failure**. After switching off the mains voltage, all actual values are continued to be detected and processed.

- ► Connect the positive pole of the external voltage source with X5/59 to establish the backup operation in the event of mains failure.
- ► The external voltage source must be able to supply a current ≥ 1 A.
- ► The starting current of the external voltage source is not limited by the controller. Lenze recommends the use of voltage sources with current limitation or with an internal impedance of Z > 1 Ω.

5.8.5 State bus

Stop!

Destruction of the control card!

External voltage at X5/ST1, X5/ST2 destroys the control card.

Protective measure:

Do not connect an external voltage to X5/ST1, X5/ST2.

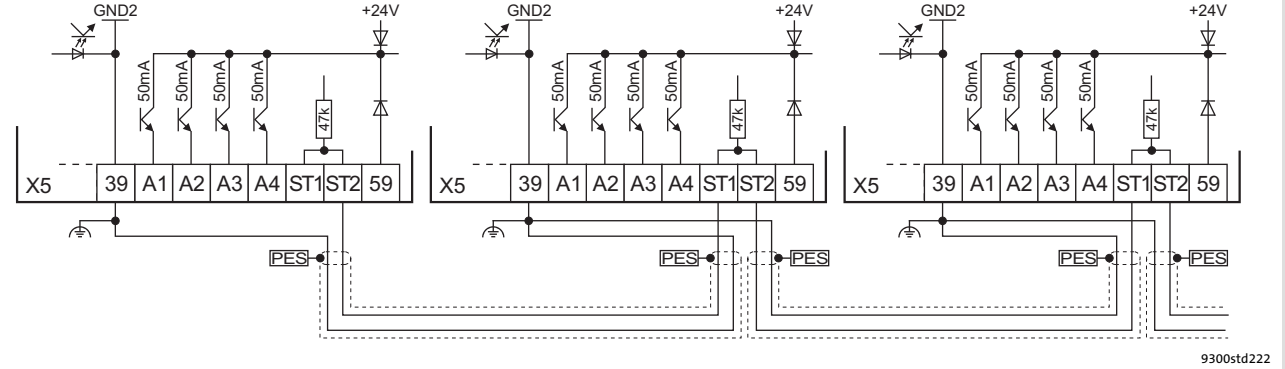


Fig. 5.8-7 Example for wiring a drive system to the STATE BUS

PES HF shield termination by large-surface connection to PE

5.8.6 Terminal assignment

Analog input configuration

Terminal	Jumper strip X3	Jumper setting	Possible levels
X6/1, X6/2		1-2 [1)]	-10 V ... +10 V [1)]
		3-4	-10 V ... +10 V
		5-6	-20 mA ... +20 mA

1) Lenze setting (delivery state)

Non-configurable control terminals

Terminal	Description	Function	Level / state
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Pulse inhibit feedback	Open contact: pulse inhibit is inactive (operation) Closed contact: pulse inhibit is active
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled
X5/ST1 X5/ST2		STATE-BUS	

Configurable control terminals (Lenze setting)

Terminal	Description	Function	Level
X5/E1	Digital inputs	Deactivate quick stop/ CW rotation	HIGH
X5/E2		Deactivate quick stop/ CCW rotation	HIGH
X5/E3		Activate fixed frequency 1	HIGH
X5/E4		Set error message (TRIP set)	LOW
X5/E5		Reset error message (TRIP reset)	LOW-HIGH edge
X5/A1	Digital outputs	Error message available	LOW
X5/A2		Switching threshold Q_{MIN}: actual speed < setpoint speed in C0017	LOW
X5/A3		Ready for operation (DCTRL-RDY)	HIGH
X5/A4		Maximum current reached (DCTRL-IMAX)	HIGH
X6/1, X6/2	Analog inputs	Main speed setpoint	-10 V ... +10 V
X6/3, X6/4		Additional speed setpoint	-10 V ... +10 V
X6/62	Analog outputs	Actual speed value	-10 V ... +10 V
X6/63		Torque setpoint	-10 V ... +10 V

5.8.7 Technical data

Safety relay K_{SR}

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

Digital inputs, digital outputs

Terminal	Description	Field	Values
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
X5/E1 X5/E2 X5/E3 X5/E4 X5/E5	Digital inputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Input current per input	8 mA for +24 V
		Cycle time	1 ms
X5/A1 X5/A2 X5/A3 X5/A4	Digital outputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Load capacity per output	Maximally 50 mA
		Load resistance	For +24 V at least 480 Ω
		Cycle time	1 ms
X5/39	GND2	Reference potential for digital signals Isolated to X6/7 (GND1)	
X5/59	Connection of external voltage source for backup operation of the drive controller in the case of mains failure	Input voltage	DC 24 V (+18 ... +30 V)
		Current consumption	Maximally 1 A for 24 V
X5/ST1 X5/ST2	STATE-BUS	Maximum number of nodes	20
		Maximum length of the bus cable	5 m

Analog inputs, analog outputs

Terminal	Description	Field	Values
X6/1 X6/2	Analog input 1	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
		Current range	
		Level	-20 mA ... +20 mA
		Resolution	20 µA (10 Bit + sign)
X6/3 X6/4	Analog input 2	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
X6/62	Analog output 1	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/63	Analog output 2	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/7	GND1	Reference potential for analog signals Isolated to X5/39 (GND2)	

5.9 Wiring of the system bus (CAN)

Wiring

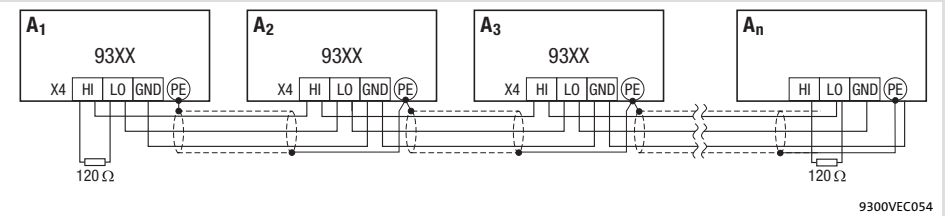


Fig. 5.9-1 System bus (CAN) wiring

A_1	Bus device 1 (controller)
A_2	Bus device 2 (controller)
A_3	Bus device 3 (controller)
A_n	Bus device n (e. g. PLC), n = max. 63
X4/GND	CAN-GND: System bus reference potential
X4/LO	CAN-LOW: System bus LOW (data line)
X4/HI	CAN-HIGH: System bus HIGH (data line)

Stop!

Connect a 120 Ω terminating resistor to the first and last bus device.

We recommend the use of CAN cables in accordance with ISO 11898-2:

CAN cable in accordance with ISO 11898-2	
Cable type	Paired with shielding
Impedance	120 Ω (95 ... 140 Ω)
Cable resistance/cross-section	
Cable length ≤ 300 m	≤ 70 mΩ/m / 0.25 ... 0.34 mm² (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm² (AWG20)
Signal propagation delay	≤ 5 ns/m

5.10 Wiring of the feedback system

5.10.1 Important notes

The feedback signal can either be supplied via input X7 or via input X8.

► At X7 a resolver can be connected.

► At X8 an encoder can be connected.
  – Incremental encoder TTL
  – SinCos encoder
  – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

► We recommend to use Lenze system cables for wiring.

► For self-made cables only use cables with shielded cores twisted in pairs.

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

5.10.2 Resolver at X7

Technical data

Field	Values
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Resolver type recommended	Receiver
Number of pole pairs of the resolver	1
Transmission ratio	0.3
Evaluation method	Voltage impression in the sine and cosine winding
Max. output voltage	± 10 V
Max. current consumption	50 mA per winding
Max. impedance [Z]	500 Ω per winding
Output frequency	4 kHz
Monitoring	Monitoring for open circuit of the resolver and the resolver cable (configurable)

Wiring

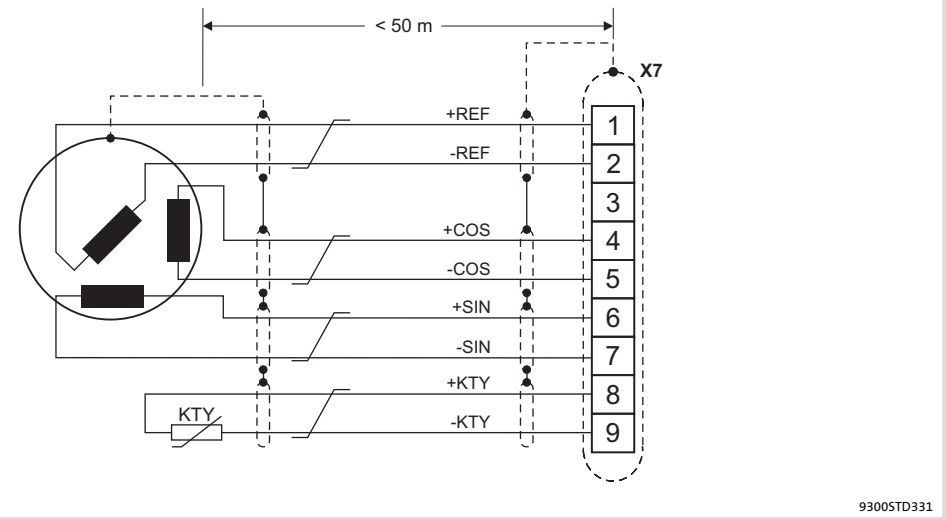


Fig. 5.10-1 Resolver connection

Cores twisted in pairs

X7 - Resolver Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	+REF	-REF	GND	+COS	-COS	+SIN	-SIN	+KTY	-KTY
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.10.3 Incremental encoder with TTL level at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable incremental encoder	Incremental encoder with TTL level ● Encoder with two 5 V complementary signals electrically offset by 90° ● Connection of zero track is possible (optional)
Input frequency	0 ... 500 kHz
Current consumption	6 mA per channel
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

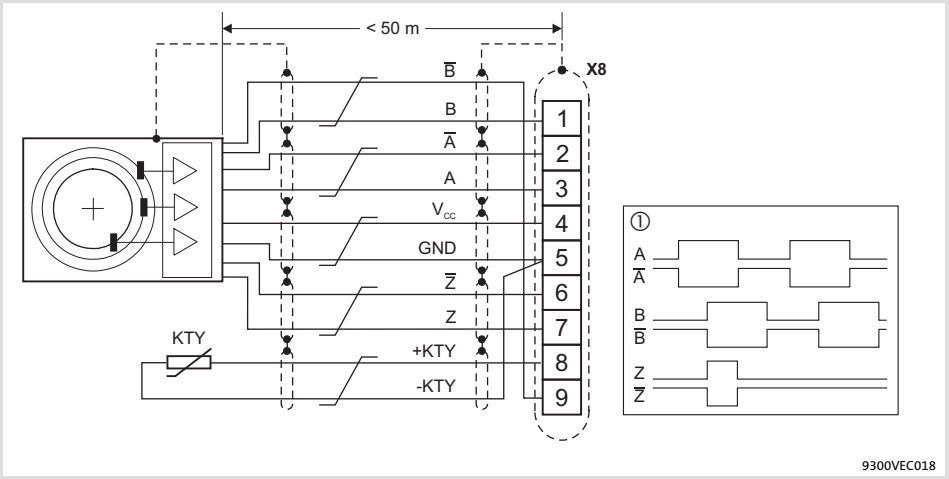


Fig. 5.10-2 Connection of incremental encoder with TTL level (RS-422)

① Signals for CW rotation
Cores twisted in pairs

X8 - Incremental encoder with TTL level Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (-KTY)	$\overline{Z}$	Z	+KTY	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.10.4 SinCos encoder at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable SinCos encoders	● SinCos encoders with a rated voltage from 5 V... 8 V. ● SinCos encoder of the company Stegmann with Hiperface® interface, Stegmann type SCS/SCM (prolongs the initialisation time of the controller to approx. 2 seconds)
Sine and cosine track voltage	1 V_{ss} ±0.2 V
Voltage RefSIN and RefCOS	+2.5 V
Internal resistance R_i	221 Ω
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

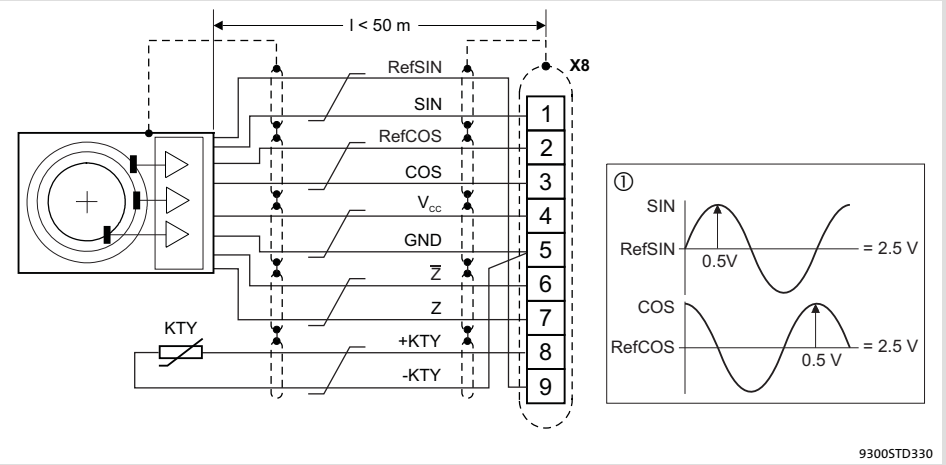


Fig. 5.10-3 SinCos encoder connection

① Signals for CW rotation
Cores twisted in pairs

X8 - SinCos encoder Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS	COS	V_{CC}	GND (-KTY)	$\overline{Z}$ or -RS485	Z or +RS485	+KTY	RefSIN
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

Note!

► For encoders with tracks SIN, $\overline{SIN}$, COS, $\overline{COS}$:
– Assign RefSIN with $\overline{SIN}$.
– Assign RefCOS with $\overline{COS}$.

5.11 Wiring of digital frequency input / digital frequency output

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

Technical data

Field	Digital frequency output X10
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Pin assignment	Dependent on the selected basic configuration
Output frequency	0 ... 500 kHz
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Load capacity	Max. 20 mA per channel (up to 3 slave drives can be connected)
Special features	The "Enable" output signal at X10/8 switches to LOW if the drive controller is not ready for operation (e.g. disconnected from mains). This can trip SD3 monitoring on the slave drive.
Internal voltage source (X10/4, X10/5)	DC 5 V / max. 50 mA Total current at X9/4, X9/5 and X10/4, X10/5: max. 200 mA

Field	Digital frequency input X9
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Input frequency	0 ... 500 kHz (TTL level)
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Signal evaluation	Via code C0427
Current consumption	Max. 5 mA
Special features	With activated SD3 monitoring, TRIP or warning is tripped if the "Lamp Control" input signal at X9/8 switches to LOW. Due to this the drive controller can respond if the master drive is not ready for operation.

Wiring

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

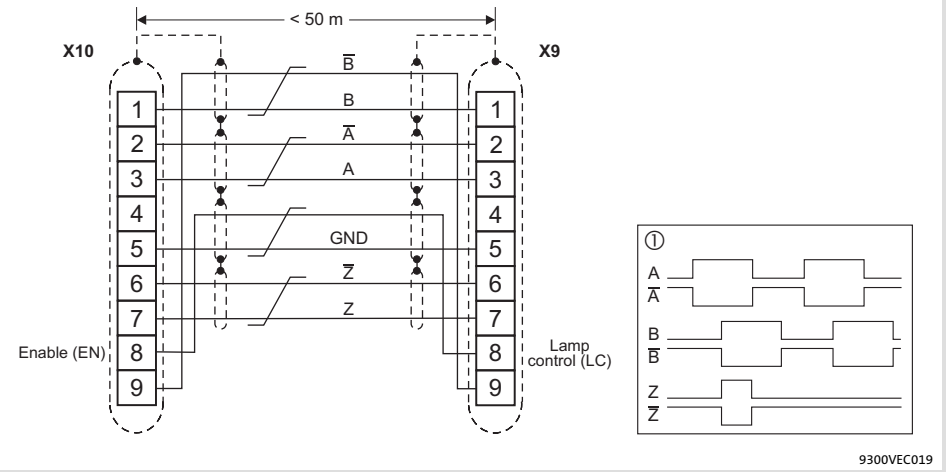


Fig. 5.11-1 Connection of digital frequency input (X9) / digital frequency output (X10)

X9 Slave drive
X10 Master drive
① Signals for CW rotation
Cores twisted in pairs

X9 - Digital frequency input Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	LC	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

X10 - Digital frequency output Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	EN	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

Adjustment

Evaluation of the input signals at X9		
Code	**Function**	
C0427 = 0	CW rotation	Track A leads track B by 90 ° (positive value at DFIN-OUT)
	CCW rotation	Track A lags track B by 90 ° (negative value at DFIN-OUT)
C0427 = 1	CW rotation	Track A transmits the speed Track B = LOW (positive value at DFIN-OUT)
	CCW rotation	Track A transmits the speed Track B = HIGH (negative value at DFIN-OUT)
C0427 = 2	CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT) Track B = LOW
	CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT) Track A = LOW

5.12 Communication modules

Further information ....

on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

Possible communication modules

Communication module	Type/order number
Keypad XT	EMZ9371BC
LECOM-A/B (RS232/485)	EMF2102IBV001
LECOM-B (RS485)	EMF2102IBV002
LECOM-LI (optical fibre)	EMF2102IBV003
LON	EMF2141IB
INTERBUS	EMF2113IB
INTERBUS Loop	EMF2112IB
PROFIBUS-DP	EMF2133IB
DeviceNet/CANopen	EMF2175IB

Handling

Plug the communication module onto the AIF interface (X1) or pull it off from the interface. The communication module can also be connected/disconnected during operation.

6 Commissioning

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6.1 Important notes

Active loads

Stop!

For applications with active loads (e.g. hoists), you must set C0172 = 0 (OV reduce: threshold for activation of brake torque reduction before OV message) so that an overvoltage message (OV) can be generated.

- ► As long as the overvoltage message (OV) is active, pulse inhibit is set and the drive operates in zero-torque mode.
- ► The controller inhibit is also evaluated by the “holding brake (BRK)” function block.

»Global Drive Control« (GDC)

Use a PC with the »Global Drive Control« (GDC) PC software for commissioning. The full functionality of the servo cam profiler can only be obtained through GDC.

► Which GDC version is required?

9300 servo cam profiler	**»Global Drive Control«**
Software version	Version
3.3	3.6 or higher
3.4	4.4 or higher
4.0	4.4 or higher

► Possible communication paths between GDC and controller including adapters and connection cables required:

Controller	**Connection**	**PC**	
Interface		PC adapter	Interface
Integrated system bus or CANopen communication module **EMF2175IB**	System bus cable (supplied with the system bus adapters)	System bus adapter **EMF2173IB**	Parallel (printer interface)
		System bus adapter **EMF2177IB**	USB
Communication module LECOM-A/B **EMF2102IBCV001**	Serial cable **EWL0020** **EWL0021**	A standard RS232 / RS485 converter and an RS485 connection cable are required for LECOM-B.	Serial (RS232)
Communication module LECOM-LI **EMF2102IBCV003**	Optical fibre **EWZ0006** **EWZ0007**	Optical fibre adapter **EMF2125IB** **EMF2126IB**	

6.2 Before switching on

Stop!

Special commissioning procedure after long-term storage

If controllers are stored for more than two years, the insulation resistance of the electrolyte may have changed.

Possible consequences:

► During initial switch-on, the DC-bus capacitors and hence the controller are damaged.

Protective measures:

► Form the DC-bus capacitors prior to commissioning. Instructions can be found on the Internet (www.Lenze.com).

Note!

► Keep to the switch-on sequence described.

► The chapter ”Troubleshooting and fault elimination” helps you to eliminate faults during commissioning.

To avoid injury to persons or damage to material assets ...

... before the mains supply is connected, check:

► The wiring for completeness, short circuit and earth fault.

► The ”EMERGENCY STOP” function of the entire system.

► The in-phase connection of the motor.

► The correct connection of the resolver or incremental encoder to prevent the motor from rotating in the wrong direction.

... check the setting of the most important drive parameters before enabling the controller:

► Is the U/f rated frequency adapted to the motor circuit configuration?

► Are the drive parameters relevant for your application set correctly?

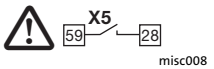
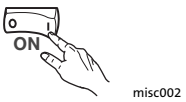
► Is the configuration of the analog and digital inputs and outputs adapted to the wiring?

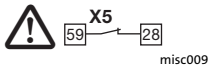
6.3 Switch-on sequence

Stop!

When commissioning is completed, do not enable the controller before

- ► CDATA-INIT-NOUT = LOW when using function block CDATA.
- ► CURVEC1-INIT-DFOUT = LOW when using function block CURVEC1.

Switch-on sequence			Note
1.	Ensure that the controller inhibit is active after mains connection		Terminal X5/28 = LOW
2.	Ensure that there is no external error		Terminal X5/E4 = HIGH
3.	Switch on controller		
A	The control card is operated via an external voltage supply: Switch on the external DC 24 V supply voltage		
B	The control card is operated via the internal voltage supply: Switch on the mains. The controller provides the DC 24 V supply.		
4.	The controller is initialised after approx. 2 s		
5.	Switch on the PC and start GDC		GDC starts in the online mode if the PC is connected to the controller. Information on how to establish a connection is given in the ”Global Drive Control (GDC) - Getting started” manual.
6.	Set the machine parameters in GDC		
A	Select the basic configuration Lenze setting: C0005 = 10000 (basic configuration ”Cam profiler”)		🕮 6.5-2
B	Adapt controller to the mains		🕮 6.5-2
C	Enter gearbox and feed constants		🕮 6.5-3
D	Enter motor data		🕮 6.5-5
E	Set the temperature monitoring of the motor		Motor with PTC or thermal contact: 🕮 6.5-17 Motor with KTY: 🕮 6.5-18
F	Select the feedback system		🕮 6.6-1
7.	Carry out a current controller adjustment if necessary		🕮 6.7-1
8.	Carry out a rotor position adjustment if necessary		🕮 6.8-1
9.	Configure the control terminal functions in order to adapt them to your application.		For internal voltage supply, assign X5/x with ”FIXED1”and X6/x with ”FIXED100%”. 🕮 6.9-1
10.	Create the motion profile		🕮 6.10-1
11.	Save the motion profile		🕮 6.10-6
12.	Transfer the motion profile to the controller		🕮 6.11-1
13.	Save the settings safe from power failure in one of the 4 parameter sets (C0003) With C0003 = 1 the settings are stored in parameter set 1.		After connecting the DC 24 V supply or after mains connection, parameter set 1 is activated automatically. (See chapter ”Parameter setting”)

Switch-on sequence			Note
14.	Switch on the mains if only the external DC 24 V supply voltage is switched on.		
15.	Enable controller		Terminal X5/28 = HIGH (see chapter "Commissioning" →"Controller inhibit")
16.	Select setpoint	Analog setpoint selection: -10 ... +10 V via potentiometer at X6/1 and X6/2	
		Fixed speed: Activate JOG 1 with X5/E3 = HIGH	JOG 1 is parameterised under C0039/1
17.	The drive should be running now!		CW rotation: X5/E1 = HIGH and X5/E2 = LOW CCW rotation: X5/E1 = LOW and X5/E2 = HIGH

Note!

The "Diagnostics" menu provides the possibility to monitor the most important drive parameters.

6.4 Controller inhibit

Description

If the controller inhibit is active, the power outputs are inhibited.

- The drive coasts in zero-torque mode.
- Status display of keypad: Pulse inhibit IMP
- Status display at the controller: The green LED is blinking.

Danger!

Do not use the ”controller inhibit” function (DCTRL1-CINH) for emergency-off. The controller inhibit only inhibits the power outputs and does **not** disconnect the controller from the mains!

The drive could start again any time.

Activation

Via terminal X5/28:

- A LOW level at the terminal inhibits the controller (cannot be inverted)
- A HIGH level re-enables the controller

Via the keys of the keypad (if C0469 = 1):

- STOP inhibits the controller
- RUN re-enables the controller

Via code C0040:

- C0040 = 0 inhibits the controller
- C0040 = 1 re-enables the controller

Note!

- The sources for controller inhibit are ANDed, i.e. the drive only restarts if the controller inhibit signals of all signal sources have been eliminated.
- The restart starts with zero speed. If centrifugal masses are still rotating, this can lead to an overcurrent.

6.5 Basic settings

6.5.1 Changing the basic configuration

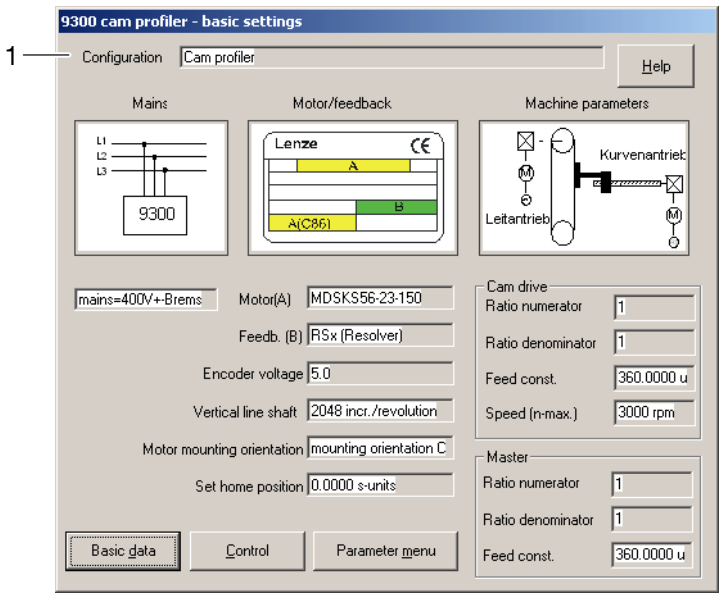
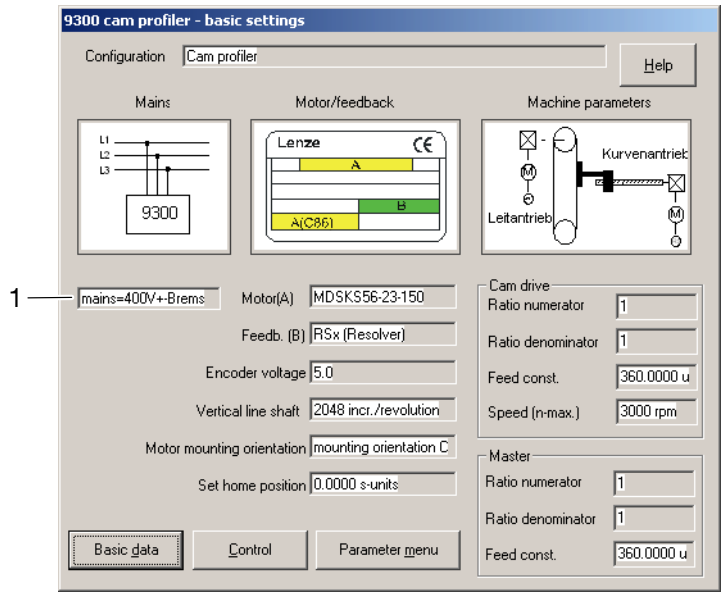


Fig. 6.5-1 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select a basic configuration suitable for your application, e.g.“10000” (Cam profiler)

6.5.2 Adapting the controller to the mains



9300kur006

Fig. 6.5-2 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select the mains voltage and the supplementary component (if used).

6.5.3 Entry of gearbox factors and feed constants

Stop!

Damage to the machine!

- ► Changing the gearbox or feed constants results in the controller losing the exact position of the tool.
- ► If you change gearbox factors or feed constants later, the profile data already transferred are no longer valid.

Protective measures:

- ► Repeat the profile data transfer to the drive.
- ► Execute the “Set reference” or “Homing” function (for detailed description see function block REFC in the System Manual Extension, Chapter ”Configuration”). When this function has been executed, the controller knows the exact position of the tool.

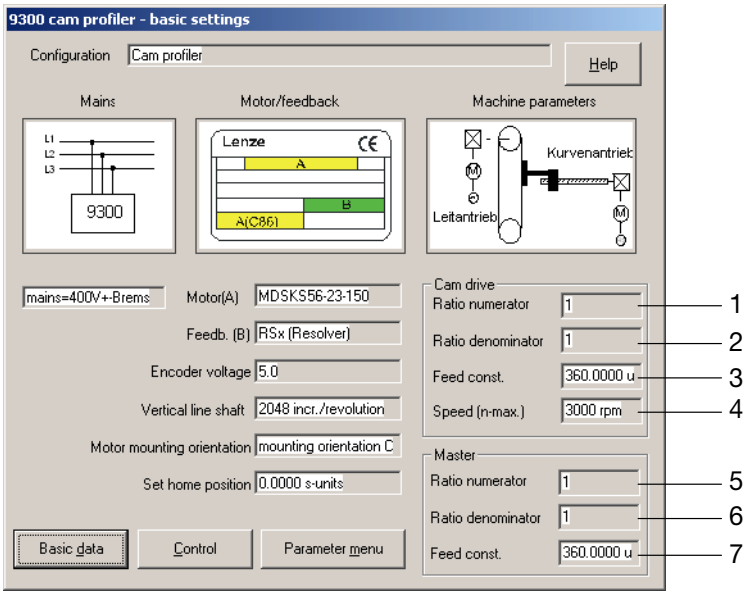


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Fig. 6.5-3 ”Basic settings” dialog box

Procedure	
1.	Click on field (1) and enter the numerator for the gearbox ratio of the cam drive.
2.	Click on field (2) and enter the denominator for the gearbox ratio of the cam drive.
3.	Click on field (3) and enter the output-side feed. ● ”units/r” means ”units/revolution”. By entering physical quantities uniformly, e.g. all dimensions in [mm], the uniformity of the entire system is guaranteed.
4.	Click on field (4) and enter the upper limit speed of the cam drive.
5.	Click on field (5) and enter the numerator for the gearbox ratio of the master drive.
6.	Click on field (6) and enter the denominator for the gearbox ratio of the master drive.
7.	Click on field (7) and enter the input-side feed. ● ”units/r” means ”units/revolution”. By entering physical quantities uniformly, e.g. all dimensions in [mm], the uniformity of the entire system is guaranteed.

Example

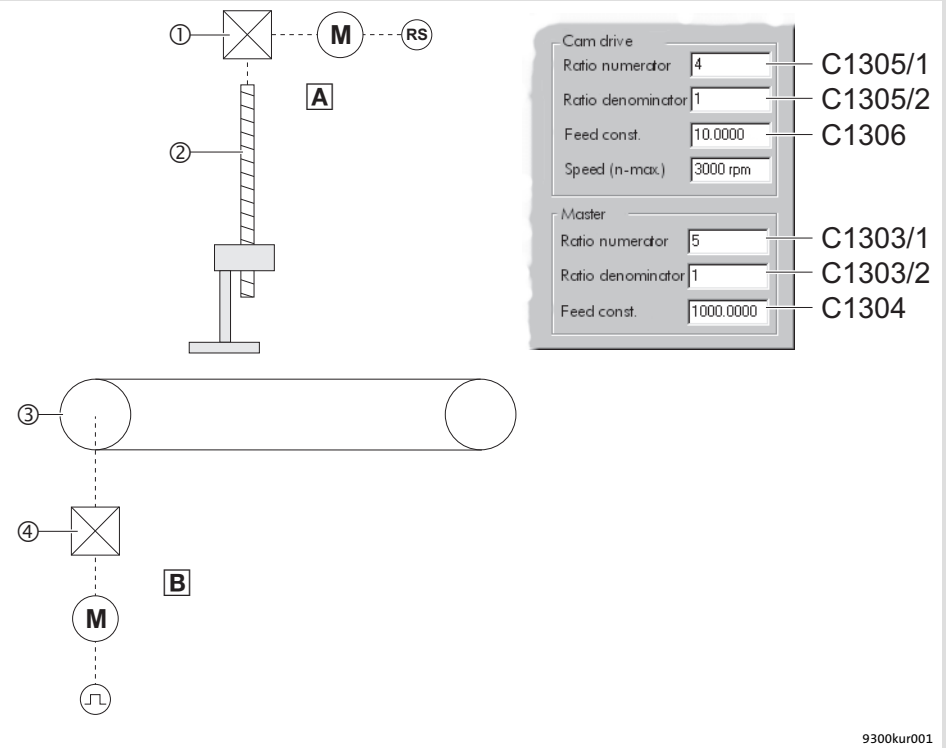


Fig. 6.5-4 Example of a cam drive and a master drive, entry of the constants

A	Cam drive (slave)		B	Master drive (master)	
	Component	Code		Component	Code
①	Gearbox ● i=4:1	C1305/1 = 4 C1305/2 = 1	③	Gearbox ● i=5:1	C1303/1 = 5 C1303/2 = 1
②	Leadscrew feed ● 10 mm/rev.	C1306 = 10	④	Toothed belt feed ● Number of teeth: 40 ● Tooth pitch: 25 mm	C1304 = 1000

Note!

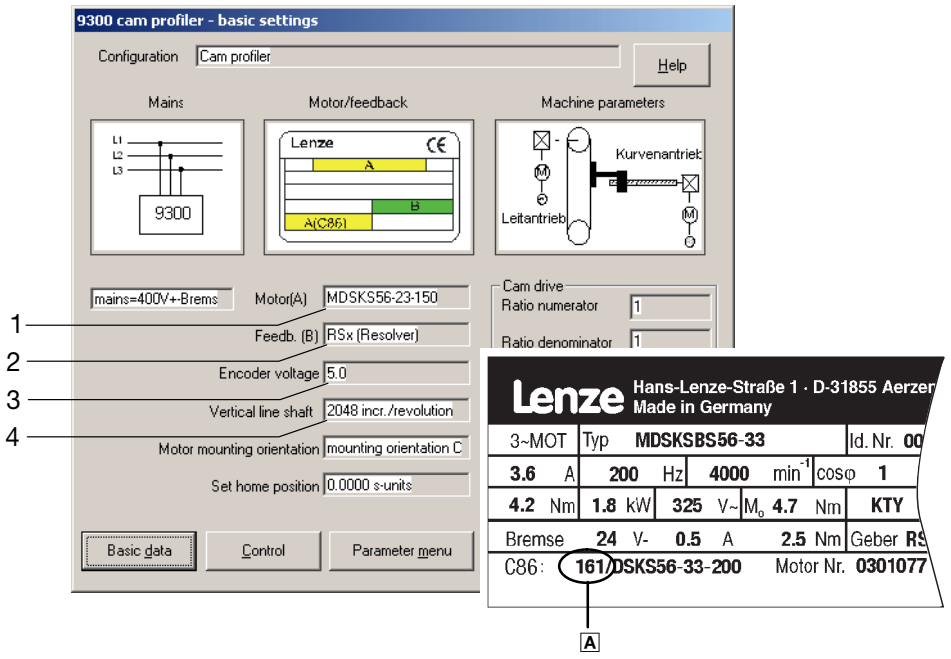
The gearbox constant results from the ratio of the numbers of teeth of

► one or more gearbox stages,

► toothed belt pulleys used to create an increase/reduction ratio

6.5.4 Entry of motor data

For Lenze motors:



9300kur006

Fig. 6.5-5 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click into the field (1) and select the motor connected. Just select the number Ⓐ specified on the nameplate of the motor from the open field. **Note!** A list of the motors available can be found in the chapter ”Motor selection list”. 🕮 6.5-9
3.	Click into the field (2) and select the feedback system used.
4.	Click into the field (3) and, if required, set the voltage supply for the encoder at X8. **Important!** For C0025 = 309, 310, 311, 409, 410 or 411 you have to adapt the voltage to 8 V.
5.	Click into the field (4) and adapt the constant of the digital frequency input to the output signal of the encoder connected.

Enter the 8-digit resolver designation of the nameplate to achieve the highest accuracy.

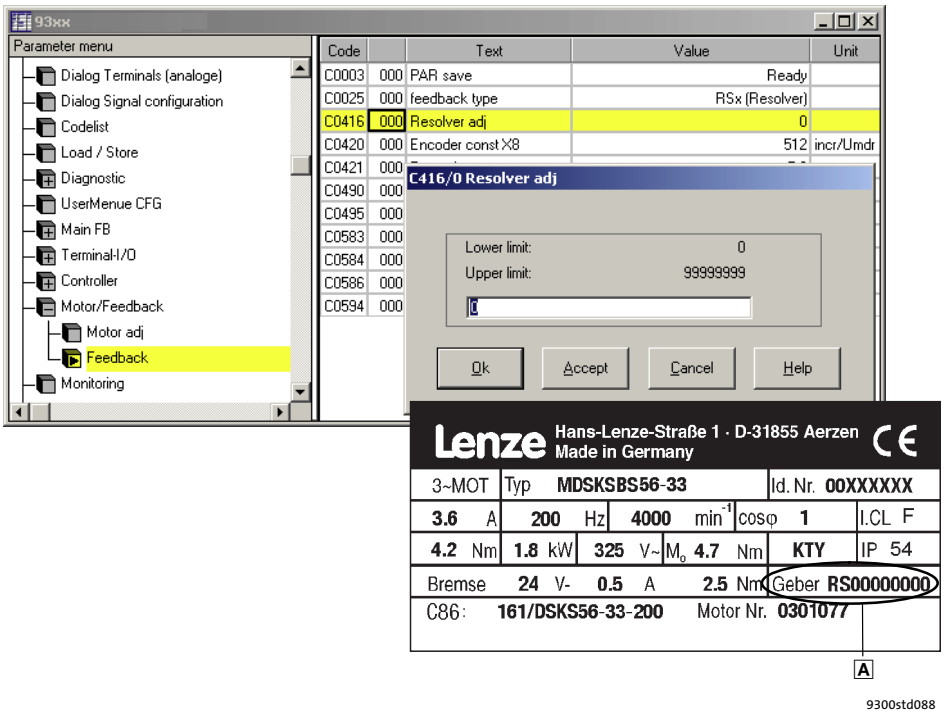
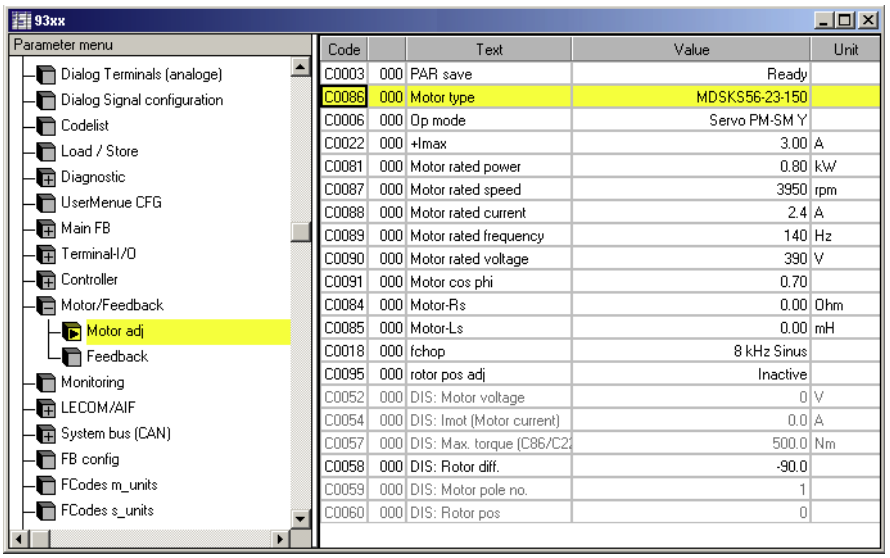


Fig. 6.5-6 ”Feedback” menu of the parameter menu

Procedure	
1.	Open the ”Parameter menu → Motor/Feedback → Feedback” menu.
2.	Click on C0416.
3.	Enter the 8-digit designation A of the motor nameplate in the dialog box.
4.	Confirm with ”OK”.
5.	Save the setting with C0003 = 1.

For non-Lenze motors or Lenze motors not listed under C0086



9300std089

Fig. 6.5-7 ”Motor adj” menu of the parameter menu

Procedure

1. Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
2. Click on C0086 and select the motor whose data corresponds best with the connected motor.
   Note!
   The available motors are listed in chapter ”Motor selection list”. 📖 6.5-9
3. Click on C0006 and select the motor control operating mode.
4. Enter the data of the connected motor in the following codes. The data can be found on the nameplate or the data sheet of the motor.

C0022	Maximum current I_{max} of the motor
C0081	Rated motor power
C0084	Stator resistance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0085	Leakage inductance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0087	Rated motor speed
C0088	Rated motor current
C0089	Rated motor frequency
C0090	Rated motor voltage
C0091	Cos φ.

5. Save the setting with C0003 = 1.

Motor mounting orientation

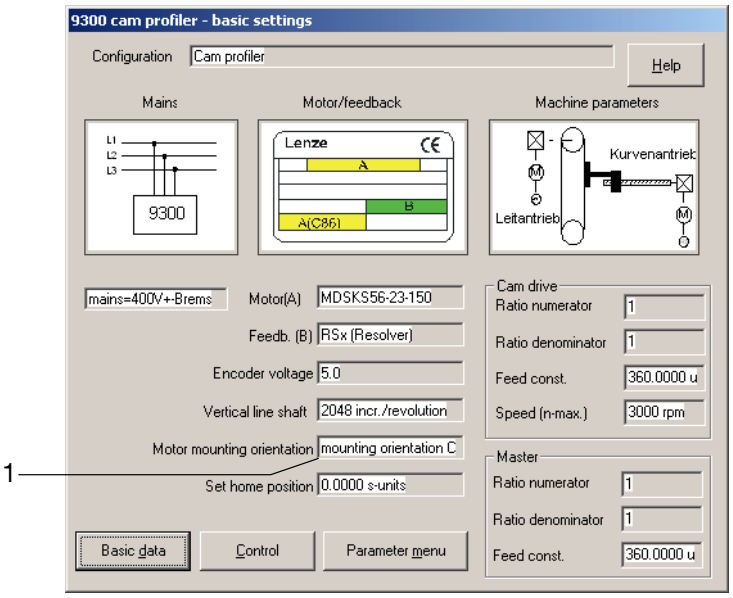
Stop!

Damage to the machine!

► Changes in C1368 affect the homing function and the rotation direction of the motor.

Protective measures:

► Execute the ”Set reference” or ”Homing” function when changes have been made (for detailed description see function block REFC in chapter ”Configuration”). When this function has been executed, the controller knows the exact position of the tool.



9300kur006

Fig. 6.5-8 ”Basic settings” dialog box

Procedure

1. Click on field (1) and select the motor mounting orientation.
   - The machine design determines which direction of motor rotation drives the machine in the “positive” effective direction.

Note!

Independently of the rotation direction of the motor, a positive value is displayed under C1339/1 (profile position) if the motor mounting orientation is correctly taken into account under C1368.

6.5.5 Motor selection list

Servo motors

The following table lists all servo motor which can be selected under C0086.

In the "Servo motor reference list" you can find the servo motors for which the motor data must be entered manually. (📖 6.5-11)

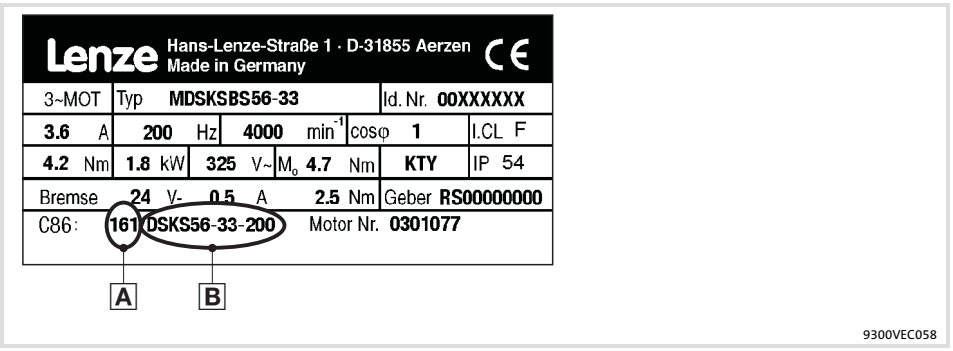


Fig. 6.5-9 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
10	MDSKA56-140	MDSKAXX056-22	0.80	3950	2.4	140		Asynchronous servo motor	KTY
11	MDFKA71-120	MDFKAXX071-22	2.20	3410	6.0	120			
12	MDSKA71-140	MDSKAXX071-22	1.70	4050	4.4	140			
13	MDFKA80-60	MDFKAXX080-22	2.10	1635	4.8	60			
14	MDSKA80-70	MDSKAXX080-22	1.40	2000	3.3	70	390		
15	MDFKA80-120	MDFKAXX080-22	3.90	3455	9.1	120			
16	MDSKA80-140	MDSKAXX080-22	2.30	4100	5.8	140			
17	MDFKA90-60	MDFKAXX090-22	3.80	1680	8.5	60			
18	MDSKA90-80	MDSKAXX090-22	2.60	2300	5.5	80			
19	MDFKA90-120	MDFKAXX090-22	6.90	3480	15.8	120			
20	MDSKA90-140	MDSKAXX090-22	4.10	4110	10.2	140	350		
21	MDFKA100-60	MDFKAXX100-22	6.40	1700	13.9	60			
22	MDSKA100-80	MDSKAXX100-22	4.00	2340	8.2	80	390		
23	MDFKA100-120	MDFKAXX100-22	13.20	3510	28.7	120			
24	MDSKA100-140	MDSKAXX100-22	5.20	4150	14.0	140	330		
25	MDFKA112-60	MDFKAXX112-22	11.00	1710	22.5	60			
26	MDSKA112-85	MDSKAXX112-22	6.40	2490	13.5	85	390		
27	MDFKA112-120	MDFKAXX112-22	20.30	3520	42.5	120			
28	MDSKA112-140	MDSKAXX112-22	7.40	4160	19.8	140	320		
30	DFQA100-50	MDFQAXX100-22	10.60	1420	26.5	50			
31	DFQA100-100	MDFQAXX100-22	20.30	2930	46.9	100			
32	DFQA112-28	MDFQAXX112-22	11.50	760	27.2	28			
33	DFQA112-58	MDFQAXX112-22	22.70	1670	49.1	58			
34	DFQA132-20	MDFQAXX132-32	17.00	555	45.2	20	360		
35	DFQA132-42	MDFQAXX132-32	35.40	1200	88.8	42			
40	DFQA112-50	MDFQAXX112-22	20.10	1425	43.7	50			
41	DFQA112-100	MDFQAXX112-22	38.40	2935	81.9	100			
42	DFQA132-36	MDFQAXX132-32	31.10	1035	77.4	36			
43	DFQA132-76	MDFQAXX132-32	60.10	2235	144.8	76	340		

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
50	DSVA56-140	DSVAXX056-22	0.80	3950	2.4	140	390	Asynchronous servo motor	Thermal contact
51	DFVA71-120	DFVAXX071-22	2.20	3410	6.0	120			
52	DSVA71-140	DSVAXX071-22	1.70	4050	4.4	140			
53	DFVA80-60	DFVAXX080-22	2.10	1635	4.8	60			
54	DSVA80-70	DSVAXX080-22	1.40	2000	3.3	70			
55	DFVA80-120	DFVAXX080-22	3.90	3455	9.1	120			
56	DSVA80-140	DSVAXX080-22	2.30	4100	5.8	140			
57	DFVA90-60	DFVAXX090-22	3.80	1680	8.5	60			
58	DSVA90-80	DSVAXX090-22	2.60	2300	5.5	80			
59	DFVA90-120	DFVAXX090-22	6.90	3480	15.8	120			
60	DSVA90-140	DSVAXX090-22	4.10	4110	10.2	140	350		
61	DFVA100-60	DFVAXX100-22	6.40	1700	13.9	60	390		
62	DSVA100-80	DSVAXX100-22	4.00	2340	8.2	80			
63	DFVA100-120	DFVAXX100-22	13.20	3510	28.7	120			
64	DSVA100-140	DSVAXX100-22	5.20	4150	14.0	140	330		
65	DFVA112-60	DFVAXX112-22	11.00	1710	22.5	60	390		
66	DSVA112-85	DSVAXX112-22	6.40	2490	13.5	85			
67	DFVA112-120	DFVAXX112-22	20.30	3520	42.5	120			
68	DSVA112-140	DSVAXX112-22	7.40	4160	19.8	140	320		
108	DSKS36-13-200	MDSKSXX036-13	0.25	4000	0.9	200	245	Synchronous servo motor	KTY
109	DSKS36-23-200	MDSKSXX036-23	0.54	4000	1.1	200	345		
110	MDSKS56-23-150	MDSKSXX056-23	0.60	3000	1.25	150	350		
111	MDSKS56-33-150	MDSKSXX056-33	0.91	3000	2.0	150	340		
112	MDSKS71-13-150	MDSKSXX071-13	1.57	3000	3.1	150	360		
113	MDFKS71-13-150	MDFKSXX071-13	2.29	3000	4.35	150	385		
114	MDSKS71-23-150	MDSKSXX071-23	2.33	3000	4.85	150	360		
115	MDFKS71-23-150	MDFKSXX071-23	3.14	3000	6.25	150	375		
116	MDSKS71-33-150	MDSKSXX071-33	3.11	3000	6.7	150	330		
117	MDFKS71-33-150	MDFKSXX071-33	4.24	3000	9.1	150	345		
160	DSKS56-23-190	MDSKSXX056-23	1.1	3800	2.3	190	330		
161	DSKS56-33-200	MDSKSXX056-33	1.8	4000	3.6	200	325		
162	DSKS71-03-170	MDSKSXX071-03	2.0	3400	4.2	170	330		
163	DFKS71-03-165	MDFKSXX071-03	2.6	3300	5.6	165	330		
164	DSKS71-13-185	MDSKSXX071-13	3.2	3700	7.0	185	325		
165	DFKS71-13-180	MDFKSXX071-13	4.1	3600	9.2	180	325		
166	DSKS71-33-180	MDSKSXX071-33	4.6	3600	10.0	180	325		
167	DFKS71-33-175	MDFKSXX071-33	5.9	3500	13.1	175	325		

Servo motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1000	MDSKA-71-22	54	3.75	0.88	8.4	34.98	1950	2.50	70	390	0.82	2	100	1.5	1.5
1001	MDFQA-112-12	33	42.60	12.90	0.45	4.3	1660	28.40	58	360	0.85	20	21	2	1
1002	MDFQA-112-12	41	70.50	21.80	0.45	4.3	2930	47.00	100	360	0.83	14	21	1.3	1
1003	MDSKA-56-22	50	6.75	1.57	2.25	6.5	6000	4.50	202	280	0.72	3	50	1.3	1.5
1004	MDSKS071-33-39	112	5.10	0.95	7.2	34.5	780	3.40	39	325	1.00	3	20	2.5	1.5
1005	MDSKS071-33-41	112	2.25	0.45	16.3	68	820	1.50	41	330	1.00	2	20	2.5	1.5
1076	MDSKS071-33-90	112	5.85	1.60	3.67	17.7	1800	3.90	90	310	1.00	10	20	0.7	1.7
1077	MDSKA-71-22	51	2.18	0.33	35.7	131.8	725	1.45	30	360	0.78	10	70	1.5	2
1103	SDSGA056-22	50	1.20	0.24	29.3	123	2790	0.80	100	390	0.71	14	150	0.35	1.8
1104	SDSGA056-22	40	2.55	0.24	29.3	123	2790	1.70	100	230	0.71	14	150	0.35	1.8
1105	SDSGA063-22	50	1.80	0.40	29.3	123	2800	1.20	100	390	0.70	14	150	0.35	1.8
1106	SDSGA063-22	40	3.15	0.40	29.3	123	2800	2.10	100	230	0.70	14	150	0.35	1.8
1107	SDSGA063-32	50	2.55	0.60	29.3	123	2800	1.70	100	390	0.70	14	150	0.35	1.8
1108	SDSGA063-32	40	4.50	0.6	29.3	123	2800	3	100	230	0.70	14	150	0.35	1.8
1109	MDSKS056-23-280	114	8.00	1.10	6.72	8.34	5600	2.30	280	320	1.00	10	20	1.3	1.5
1110	MDSKS056-23-310	114	9.00	1.10	5.42	6.78	6200	2.30	310	320	1.00	10	20	1.3	1.5
1111	MDSKS056-33-300	114	10.00	1.75	3.31	4.62	6000	3.60	300	320	1.00	10	20	1.3	1.5
1112	MDSKS056-33-265	114	8.00	1.72	4.1	5.73	5300	3.60	265	320	1.00	10	20	1.3	1.5
1113	MDSKS071-13-265	114	23.00	3.20	0.54	2.56	5300	7.00	265	320	1.00	10	20	1.3	1.5
1116	MDSKS071-33-270	114	25.00	5.70	0.38	1.91	5400	12.50	270	320	1.00	10	20	1.3	1.5

Three-phase asynchronous motors

The following table lists all asynchronous motors which can be selected under C0086.

In the "Asynchronous motor reference list" you can find the asynchronous motors for which the motor data must be entered manually. (📖 6.5-14)

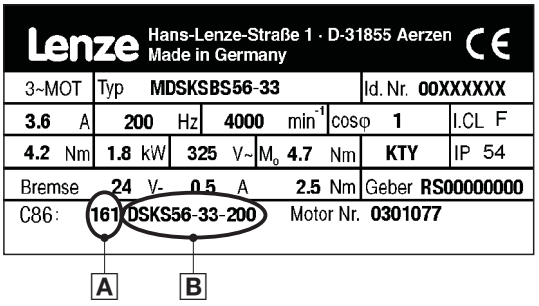


Fig. 6.5-10 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
210	DXRAXX071-12-50	DXRAXX071-12	0.25	1410	0.9	50	400	Asynchronous inverter motor (star connection)	Thermal contact
211	DXRAXX071-22-50	DXRAXX071-22	0.37	1398	1.2				
212	DXRAXX080-12-50	DXRAXX080-12	0.55	1400	1.7				
213	DXRAXX080-22-50	DXRAXX080-22	0.75	1410	2.3				
214	DXRAXX090-12-50	DXRAXX090-12	1.10	1420	2.7				
215	DXRAXX090-32-50	DXRAXX090-32	1.50	1415	3.6				
216	DXRAXX100-22-50	DXRAXX100-22	2.20	1425	4.8				
217	DXRAXX100-32-50	DXRAXX100-32	3.00	1415	6.6				
218	DXRAXX112-12-50	DXRAXX112-12	4.00	1435	8.3				
219	DXRAXX132-12-50	DXRAXX132-12	5.50	1450	11.0				
220	DXRAXX132-22-50	DXRAXX132-22	7.50	1450	14.6				
221	DXRAXX160-12-50	DXRAXX160-12	11.00	1460	21.0				
222	DXRAXX160-22-50	DXRAXX160-22	15.00	1460	27.8				
223	DXRAXX180-12-50	DXRAXX180-12	18.50	1470	32.8				
224	DXRAXX180-22-50	DXRAXX180-22	22.00	1456	38.8				
225	30kW-ASM-50	–	30.00	1470	52.0	50	400	Asynchronous inverter motor (star connection)	–
226	37kW-ASM-50	–	37.00	1470	66.0				
227	45kW-ASM-50	–	45.00	1480	82.0				
228	55kW-ASM-50	–	55.00	1480	93.0				
229	75kW-ASM-50	–	75.00	1480	132.0				
250	DXRAXX071-12-87	DXRAXX071-12	0.43	2525	1.5	87	400	Asynchronous inverter motor (delta connection)	Thermal contact
251	DXRAXX071-22-87	DXRAXX071-22	0.64	2515	2.0				
252	DXRAXX080-12-87	DXRAXX080-12	0.95	2515	2.9				
253	DXRAXX080-22-87	DXRAXX080-22	1.3	2525	4.0				
254	DXRAXX090-12-87	DXRAXX090-12	2.0	2535	4.7				
255	DXRAXX090-32-87	DXRAXX090-32	2.7	2530	6.2				
256	DXRAXX100-22-87	DXRAXX100-22	3.9	2535	8.3				
257	DXRAXX100-32-87	DXRAXX100-32	5.35	2530	11.4				
258	DXRAXX112-12-87	DXRAXX112-12	7.10	2545	14.3				
259	DXRAXX132-12-87	DXRAXX132-12	9.7	2555	19.1				
260	DXRAXX132-22-87	DXRAXX132-22	13.2	2555	25.4				
261	DXRAXX160-12-87	DXRAXX160-12	19.3	2565	36.5				
262	DXRAXX160-22-87	DXRAXX160-22	26.4	2565	48.4				
263	DXRAXX180-12-87	DXRAXX180-12	32.4	2575	57.8				
264	DXRAXX180-22-87	DXRAXX180-22	38.7	2560	67.4				

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
265	30kW-ASM-87	–	52.00	2546	90.0	87	400	Asynchronous inverter motor (delta connection)	–
266	37kW-ASM-87	–	64.00	2546	114.0				
267	45kW-ASM-87	–	78.00	2563	142.0				
268	55kW-ASM-87	–	95.00	2563	161.0				
269	75kW-ASM-87	–	130.00	2563	228.0				

Asynchronous motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
410	MDXMAXM-071-12	210	1.23	0.25	35.80	116.80	1400	0.82	50	400	0.70	6	300	1.5	10
411	MDXMAXM-071-32	211	1.80	0.37	27.00	112.70	1400	1.20	50	400	0.71	6	300	1.5	10
412	MDXMAXM-080-12	212	2.40	0.55	16.30	78.60	1400	1.60	50	400	0.72	6	300	1.5	10
413	MDXMAXM-080-32	213	3.00	0.75	11.20	59.30	1380	2.00	50	400	0.76	6	300	1.5	10
414	MDXMAXM-090-12	214	3.90	1.10	9.14	41.80	1410	2.60	50	400	0.80	6	300	1.5	10
415	MDXMAXM-090-32	215	5.25	1.50	5.10	27.70	1420	3.50	50	400	0.80	6	300	1.5	10
416	MDXMAXM-100-12	216	8.40	2.20	2.96	18.20	1400	5.60	50	400	0.78	6	300	1.5	10
417	MDXMAXM-100-32	217	10.95	3.00	2.20	13.40	1400	7.30	50	400	0.81	6	300	1.5	10
418	MDXMAXM-112-22	218	12.75	4.00	1.50	10.80	1430	8.50	50	400	0.85	6	300	1.5	10
440	MDXMAXM-071-12	250	2.10	0.43	35.8	116.80	2510	1.40	87	400	0.70	6	300	1.5	10
441	MDXMAXM-071-32	251	3.15	0.64	27.0	112.70	2510	2.10	87	400	0.71	6	300	1.5	10
442	MDXMAXM-080-12	252	4.20	0.95	16.3	78.60	2510	2.80	87	400	0.72	6	300	1.5	10
443	MDXMAXM-080-32	253	5.25	1.30	11.2	59.30	2490	3.50	87	400	0.76	6	300	1.5	10
444	MDXMAXM-090-12	254	6.75	2.00	9.14	41.80	2520	4.50	87	400	0.80	6	300	1.5	10
445	MDXMAXM-090-32	255	9.15	2.70	5.1	27.70	2530	6.10	87	400	0.78	6	300	1.5	10
446	MDXMAXM-100-12	256	14.55	3.90	2.96	18.20	2510	9.70	87	400	0.81	6	300	1.5	10
447	MDXMAXM-100-32	257	19.05	5.40	2.2	13.40	2510	12.70	87	400	0.85	6	300	1.5	10
448	MDXMAXM-112-22	258	22.20	7.10	1.5	10.80	2540	14.80	87	400	0.78	6	300	1.5	10
449	MDXMAXM-112-32	259	18.75	5.50	2.45	21.40	1440	12.50	50	400	0.78	6	300	1.5	10
450	MDXMAXM-132-22	259	25.20	7.50	1.42	15.00	1460	16.80	50	400	0.77	6	300	1.5	10
451	MDXMAXM-132-32	259	29.25	9.20	1.34	14.00	1450	19.50	50	400	0.85	6	300	1.5	10
1006	MDXMAxx-071-12	210	1.28	0.25	39.90	157.20	1355	0.85	50	400	0.70	6	300	3.6	2
1007	MDXMAxx-071-12	250	2.25	0.47	39.90	157.20	2475	1.50	87	400	0.66	6	300	2	2
1008	MDXMAxx-071-32	211	1.73	0.37	25.03	122.60	1345	1.15	50	400	0.74	6	300	3.4	2
1009	MDXMAxx-071-32	251	3.00	0.67	25.03	122.60	2470	2.00	87	400	0.70	6	300	2.5	2
1010	MDXMAxx-080-12	212	2.40	0.55	20.69	89.00	1370	1.60	50	400	0.78	6	300	3.2	2
1011	MDXMAxx-080-12	252	3.90	1.00	20.69	89.00	2480	2.60	87	400	0.73	6	300	1.6	2
1012	MDXMAxx-080-32	213	2.85	0.75	11.69	65.20	1390	1.90	50	400	0.80	6	300	3.5	2
1013	MDXMAxx-080-32	253	4.95	1.35	11.69	65.20	2510	3.30	87	400	0.77	6	300	1.9	3
1014	MDXMAxx-090-12	214	3.90	1.10	10.01	40.20	1405	2.60	50	400	0.80	6	300	2.5	2
1015	MDXMAxx-090-12	254	6.75	2.00	10.01	40.20	2520	4.50	87	400	0.77	6	300	2	2
1016	MDXMAxx-090-32	215	5.25	1.50	5.85	28.80	1410	3.50	50	400	0.78	6	300	2	2
1017	MDXMAxx-090-32	255	9.15	2.70	5.85	28.80	2525	6.10	87	400	0.76	6	300	1	2
1018	MDXMAxx-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1019	MDXMAxx-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.76	6	300	0.8	1.5
1020	MDXMAxx-100-32	217	9.75	3.00	2.10	17.00	1415	6.50	50	400	0.81	6	300	2.5	1.5
1021	MDXMAxx-100-32	257	17.10	5.40	2.10	17.00	2530	11.40	87	400	0.78	6	300	1.4	1.8
1022	MDXMAxx-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1023	MDXMAxx-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.83	6	300	1	2
1024	MDXMAxx-132-12	219	16.50	5.50	0.86	13.00	1450	11.00	50	400	0.84	6	300	1.5	2
1025	MDXMAxx-132-12	259	28.65	9.70	0.86	13.00	2555	19.10	87	400	0.83	6	300	1.3	2
1026	MDXMAxx-132-22	220	21.90	7.50	0.80	11.00	1450	14.60	50	400	0.85	6	300	1.5	2
1027	MDXMAxx-132-22	260	38.10	13.20	0.80	11.00	2555	25.40	87	400	0.84	6	300	0.95	1.8

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1028	MDXMAxx-160-22	221	31.50	11.00	0.50	7.00	1460	21.00	50	400	0.85	6	300	1.9	2.2
1029	MDXMAxx-160-22	261	54.75	19.30	0.50	7.00	2565	36.50	87	400	0.85	6	300	1	2
1030	MDXMAxx-160-32	222	41.70	15.00	0.40	5.50	1460	27.80	50	400	0.87	6	300	1.7	2.5
1031	MDXMAxx-160-32	262	72.60	26.40	0.40	5.50	2565	48.40	87	400	0.86	6	300	1	1.8
1032	MDXMAxx-180-12	223	49.20	18.50	0.40	4.00	1470	32.80	50	400	0.90	6	300	1.4	1.7
1033	MDXMAxx-180-12	263	86.70	32.40	0.40	4.00	2575	57.80	87	400	0.89	6	300	1	1.7
1034	MDXMAxx-180-22	224	58.20	22.00	0.20	3.80	1456	38.80	50	400	0.90	6	300	1	1.5
1035	MDXMAxx-180-22	264	101.1	38.70	0.20	3.80	2560	67.40	87	400	0.89	6	300	1	1.5
1036	MDXMAXM-63-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1037	MDXMAXM-63-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1038	MDXMAXM-63-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1039	MDXMAXM-63-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1040	MDXMAXM-112-32	219	18.75	5.50	0.86	7.20	1440	12.50	50	400	0.78	6	300	1.5	10
1041	MDXMAXM-112-32	259	32.55	9.60	0.86	7.20	2550	21.70	87	400	0.78	6	300	1.5	10
1042	MDXMAXM-132-22	220	25.20	7.50	0.54	4.80	1460	16.80	50	400	0.77	6	300	1.5	10
1043	MDXMAXM-132-22	260	43.80	13.10	0.54	4.80	2570	29.20	87	400	0.77	6	300	1.5	10
1044	MDXMAXM-132-32	221	29.25	9.20	0.46	4.70	1450	19.50	50	400	0.85	6	300	1.5	10
1045	MDXMAXM-132-32	261	50.70	16.00	0.46	4.70	2560	33.80	87	400	0.85	6	300	1.5	10
1046	MDXMAXM-160-22	260	31.50	11.00	1.27	18.97	1466	21.00	50	400	0.86	6	300	1.5	10
1047	MDXMAXM-160-32	260	42.30	15.00	0.87	14.28	1466	28.20	50	400	0.87	6	300	1.5	10
1048	MDXMAXM-180-22	260	54.60	18.50	0.40	4.00	1440	36.40	50	400	0.87	6	300	1.5	10
1049	MDXMAXM-180-32	260	66.15	22.00	0.20	3.80	1465	44.10	50	400	0.85	6	300	1.5	10
1050	MDXMAXM-200-32	260	90.00	30.00	0.17	3.50	1455	60.00	50	400	0.85	6	300	1.5	10
1051	MDXMAXM-225-12	260	108.0	37.00	0.15	2.00	1460	72.00	50	400	0.86	6	300	1.5	10
1052	MDXMAXM-225-22	260	128.25	45.00	0.15	2.00	1475	85.50	50	400	0.84	6	300	1.5	10
1053	MDXMAXM-063-11	210	1.43	0.18	51.00	273.7	2760	0.95	50	400	0.80	6	300	1.5	10
1054	MDXMAXM-063-31	210	1.65	0.25	33.00	93.4	2760	1.10	50	400	0.83	6	300	1.5	10
1055	MDXMAXM-071-11	211	1.50	0.37	22.50	90.2	2840	1.00	50	400	0.78	6	300	1.5	10
1056	MDXMAXM-071-31	212	2.25	0.55	16.90	62.9	2840	1.50	50	400	0.82	6	300	1.5	10
1057	MDXMAXM-080-11	213	2.85	0.75	11.36	47.4	2850	1.90	50	400	0.80	6	300	1.5	10
1058	MDXMAXM-080-31	214	4.20	1.10	6.86	33.4	2810	2.80	50	400	0.82	6	300	1.5	10
1059	MDXMAXM-090-11	215	4.80	1.50	5.10	22.2	2840	3.20	50	400	0.85	6	300	1.5	10
1060	MDXMAXM-090-31	216	7.20	2.20	3.20	14.5	2840	4.80	50	400	0.86	6	300	1.5	10
1061	MDXMAXM-100-31	217	9.30	3.00	1.81	10.7	2850	6.20	50	400	0.88	6	300	1.5	10
1062	MDXMAXM-100-41	218	12.75	4.00	1.45	8.6	2830	8.50	50	400	0.85	6	300	1.5	10
1063	MDXMAXM-112-31	250	18.30	5.50	3.10	17	2890	12.20	50	400	0.83	6	300	1.5	10
1064	MDXMAXM-112-41	250	23.25	7.50	1.96	12	2900	15.50	50	400	0.87	6	300	1.5	10
1065	MDXMAXM-132-21	250	28.05	9.00	1.41	11.292	2925	18.70	50	400	0.89	6	300	1.5	10
1066	MDXMAXM-071-13	210	1.13	0.18	58.93	342	870	0.75	50	400	0.71	6	300	1.5	10
1067	MDXMAXM-071-13	250	1.95	0.31	58.93	342	1610	1.30	87	400	0.71	6	300	1.5	10
1068	MDXMAXM-071-33	210	1.50	0.25	37.90	116.8	920	1.00	50	400	0.63	6	300	1.5	10
1069	MDXMAXM-071-33	250	2.55	0.43	37.90	116.8	1660	1.70	87	400	0.63	6	300	1.5	10
1070	MDXMAXM-080-13	211	2.10	0.37	28.00	112.7	900	1.40	50	400	0.67	6	300	1.5	10
1071	MDXMAXM-080-13	251	3.60	0.64	28.00	112.7	1640	2.40	87	400	0.67	6	300	1.5	10
1072	MDXMAXM-080-33	212	2.85	0.55	16.60	78.6	900	1.90	50	400	0.68	6	300	1.5	10
1073	MDXMAXM-080-33	252	4.95	0.95	16.60	78.6	1640	3.30	87	400	0.68	6	300	1.5	10
1078	MDFMAxx-250-22	224	147.75	55.00	0.04	1.92	1475	98.50	50	400	0.86	6	300	1	2
1079	MDFMAxx-250-22	264	255.90	95.00	0.04	1.92	2585	170.60	87	400	0.86	6	300	1	2
1080	MDEBAXM-063-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1081	MDEBAXM-063-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1082	MDEBAXM-063-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1083	MDEBAXM-063-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1084	MDEBAXM-071-12	210	1.35	0.25	39.90	157.20	1390	0.90	50	400	0.64	6	300	3.6	2

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1085	MDEBAXM-071-12	250	2.34	0.43	39.90	157.20	2500	1.56	87	400	0.64	6	300	2	2
1086	MDEBAXM-071-32	211	1.95	0.37	25.03	122.60	1380	1.30	50	400	0.64	6	300	3.4	2
1087	MDEBAXM-071-32	251	3.38	0.64	25.03	122.60	2490	2.25	87	400	0.64	6	300	2.5	2
1088	MDEBAXM-080-12	212	2.40	0.55	20.69	89.00	1400	1.60	50	400	0.68	6	300	3.2	2
1089	MDEBAXM-080-12	252	4.16	0.95	20.69	89.00	2510	2.77	87	400	0.68	6	300	1.6	2
1090	MDEBAXM-080-32	213	3.00	0.75	11.69	65.20	1400	2.00	50	400	0.72	6	300	3.5	2
1091	MDEBAXM-080-32	253	5.20	1.30	11.69	65.20	2510	3.46	87	400	0.72	6	300	1.9	3
1092	MDEBAXM-090-12	214	4.05	1.10	6.40	37.00	1420	2.70	50	400	0.77	6	300	2.5	2
1093	MDEBAXM-090-12	254	7.05	2.00	6.40	37.00	2535	4.70	87	400	0.77	6	300	2	2
1094	MDEBAXM-090-32	215	5.40	1.50	4.80	26.00	1415	3.60	50	400	0.77	6	300	2	2
1095	MDEBAXM-090-32	255	9.30	2.70	4.80	26.00	2530	6.20	87	400	0.77	6	300	1	2
1096	MDEBAXM-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1097	MDEBAXM-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.80	6	300	0.8	1.5
1098	MDEBAXM-100-32	217	9.90	3.00	2.10	17.00	1415	6.60	50	400	0.81	6	300	2.5	1.5
1099	MDEBAXM-100-32	257	17.10	5.35	2.10	17.00	2530	11.40	87	400	0.81	6	300	1.4	1.8
1100	MDEBAXM-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1101	MDEBAXM-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.82	6	300	1	2
1102	MDEBAXM-112-32	219	17.85	5.50	2.71	21.40	1425	11.90	50	400	0.84	6	300	1.5	10
1114	MDFMAxx-200-32	224	83.25	30.00			1465	55.50	50	400	0.85	6	300	1	2
1115	MDFMAxx-200-32	264	145.50	52.00			2575	97.00	87	400	0.85	6	300	1	2

6.5.6 Motor temperature monitoring with PTC or thermal contact

Description

PTC resistors according to DIN 44081 and DIN 44082 can be connected via the terminal inputs T1 and T2. The motor temperature is measured and integrated into the drive monitoring.

A thermal contact (NC contact) can also be connected to T1 and T2. Lenze three-phase AC motors provide thermal contacts as default.

When using motors equipped with PTC resistors or thermostats, we recommend to always activate the PTC input. This prevents the motor from being destroyed by overheating.

Stop!

- ► The motor temperature monitoring may only be connected to T1, T2 if the cable is terminated with a PTC or thermal contact (NC contact) on the motor side.
  - – An "open" cable acts like an antenna and can cause faults on the drive controller.
  - – Input signals at T1, T2 are processed with a delay of 2 s.
- ► The drive controller can only evaluate one PTC resistor! Do not connect several PTC resistors in series or in parallel:
  - – The motor temperature would be measured incorrectly.
  - – The motors could be destroyed by overheating.
- ► If you operate several motors on a drive controller, use thermal contacts (NC contacts) for motor temperature monitoring and connect these in series.
- ► To achieve full motor protection, an additional temperature monitoring with separate evaluation must be installed.

Activation

Note!

- ► In the Lenze setting the motor temperature monitoring is switched off!
- ► If you work with several parameter sets, the monitoring must be activated separately in each parameter set!

1. Connect the monitoring circuit of the motor to T1 and T2.
   – With 1.6 kΩ < R < 4 kΩ, the monitoring responds.
2. Set the controller reaction:
   – C0585 = 3: Temperature monitoring of the motor is switched off.
   – C0585 = 0: TRIP error message (display of keypad: OH8 Trip)
   – C0585 = 2: Warning signal (display of keypad: OH8 Warn)

Function test

Connect the PTC input with a fixed resistor:

- ► R > 4 kΩ: The fault message OH8 must be activated.
- ► R < 1 kΩ: Fault message must not be activated.

6.5.7 Motor temperature monitoring with KTY

Description

- There are two possibilities to connect a KTY resistor:
  - At the incremental encoder connection X8 (pins X8/5 and X8/8)
  - At the resolver connection X7 (pins X7/8 and X7/9)
- The motor temperature is measured and integrated into the drive monitoring.
- The KTY resistor is monitored for open and short circuit.
- When using motors equipped with KTY resistors, we recommend always to activate the KTY input. This prevents the motor from being destroyed by overheating.

Stop!

- The controller can only evaluate one KTY resistor! Do not use several KTY resistors connected in series or in parallel:
  - This would result in an incorrect measurement of the motor temperature.
  - The motors could be destroyed by overheating.
- If several motors are operated on a controller, use thermal contacts (NC contacts) for monitoring the motor temperature and connect theses contacts in series.
- To ensure full motor protection, an additional temperature monitoring with separate evaluation has to be installed.

Activation

Stop!

Overheating of the motor!

In the Lenze setting, temperature monitoring of the motor is deactivated (C0583 = 3). The motor temperature in C0063 shows 0 °C even if C0584 = 2 is set.

Possible consequences:

► The motor can be damaged by a too high motor temperature.

Protective measures:

► Activate the monitoring of the motor temperature via X7 or X8 with C0583 = 2 or C0584 = 2.

► Set C0594 = 2 or 3. Then the connection is additionally monitored with regard to short circuit and interruption.

► If you work with several parameter sets, you have to activate the monitoring separately in each parameter set.

1. Connect monitoring circuit of the motor to X7/8, X7/9 or X8/5, X8/8.
2. Set response of the controller for short circuit or interruption on the connection (monitoring of the motor temperature has to be activated):
   – C0594 = 3: monitoring is switched off.
   – C0594 = 0: TRIP error message (keypad display: Sd6 Trip)
   – C0594 = 2: warning signal (keypad display: Sd6 Warn)

Adjustment

Monitoring with a fixed operating temperature (150 °C)

1. Set response of the controller:
   – C0583 = 3: temperature monitoring of the motor switched off.
   – C0583 = 0: TRIP error message (keypad display: OH3 Trip)
   – C0583 = 2: warning signal (keypad display: OH3 Warn)

Monitoring with a variable operating temperature (45...150 °C)

1. Set the operating temperature in C0121.
2. Set response of the controller:
   – C0584 = 3: temperature monitoring of the motor switched off.
   – C0584 = 2: warning signal (keypad display: OH7 Warn)

Adjustment of KTY operating range

The temperature and resistance range can be adapted to the KTY used.

- ► C1190 = 0: Fixed operating range for KTY in Lenze motors (Lenze setting)
- ► C1190 = 1: Adjustable operating range

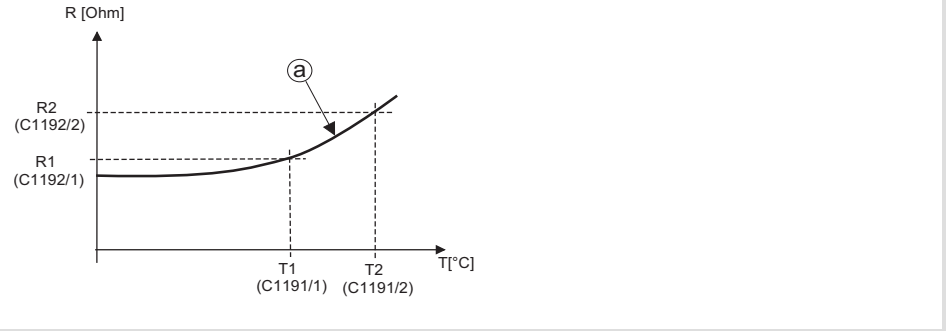


Fig. 6.5-11 Setting of the operating range for the KTY (C1190 = 1)

The operating range is specified by means of limit values and is in the almost linear section of the graph (a). The operating values are determined by interpolation.

C1191/1 C1191/2	Setting of the lower and upper temperature value (T1, T2) corresponding to the KTY used.
C1192/1 C1192/2	Setting of the lower and upper resistance value corresponding to the KTY used.

6.6 Setting the speed feedback

Description

The feedback signal can either be supplied via input X7 or via input X8.

- ► At X7 a resolver can be connected.
- ► At X8 an encoder can be connected.
  - – Incremental encoder TTL
  - – SinCos encoder
  - – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

- ► Use a SinCos encoder with serial communication (multi-turn) if homing of the drive is not possible. Please specify the motor/encoder combination in your order.
- ► You can only use 2 of the 3 interfaces X8, X9, X10 simultaneously. Due to this it may be possible that the incremental encoder input cannot be activated or the digital frequency input / digital frequency output does not work.
  - – This dependency does not apply if the digital frequency output X10 is set to reproduction of the input signals at X8 or X9 (C0540 = 4 or 5).
  - – To deactivate the digital frequency input, it may be necessary to delete the internal signal link from function block DFIN to the following function block. Remove the function block DFIN from the processing table.

6.6.1 Resolver at X7

Resolvers can be operated at X7. For the wiring diagram and the pin assignment of X7, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

- ► C0025 = 10 (Lenze setting)
- ► Monitoring (SD2) of the resolver and the resolver cable for open circuit:
  C0586 = 0 (TRIP, Lenze setting)
  C0586 = 2 (warning)
  C0586 = 3 (off)

6.6.2 Incremental encoder with TTL level at X8

Incremental encoders with TTL level can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

► C0025 = 110, 111, 112 or 113. The number of increments (512, 1024, 2048 or 4096) is set automatically.

Adjustment

The incremental encoder is supplied with voltage by the drive controller.

Stop!

If the supply voltage is too high, it may destroy the incremental encoder.

Under C0421 you can adjust the supply voltage V_{CC} (5 V) of the incremental encoder in order to compensate for the voltage drop along the incremental encoder cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{Inc}\,[A]$$

l	Length of the incremental encoder cable
R	Resistance of the incremental encoder cable
I_{Inc}	Current consumption of the incremental encoder

6.6.3 SinCos encoder at X8

SinCos encoders can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter "Wiring of the standard device" → "Wiring of the feedback system".

Activation

Stop!

Uncontrolled acceleration of the motor!

► If the SinCos encoder fails, the motor may accelerate in an uncontrolled manner.

Protective measures:

► Activate the monitoring for the SinCos encoder with C0580 = 0.

► SinCos encoder with 5 V supply voltage:
C0025 = 210, 211, 212, or 213. The number of increments (512, 1024, 2048 or 4096) is set automatically.

► Single-turn SinCos encoder with 8 V supply voltage:
C0025 = 309, 310, or 311. The number of increments (128, 512 or 1024) is set automatically.

► Multi-turn SinCos encoder with 8 V supply voltage:
C0025 = 409, 410, or 411. The number of increments (128, 512 or 1024) is set automatically.

► Monitoring (SD8) of the SinCos encoder:
C0580 = 0 (TRIP, Lenze setting)
C0580 = 3 (off)

Adjustment

The SinCos encoder is supplied with voltage by the controller.

Stop!

If the supply voltage is too high, the SinCos encoder may be damaged.

Under C0421 you can adjust the supply voltage V_{CC} (5 ... 8 V) of the SinCos encoder in order to compensate for the voltage drop along the cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{SINCOS}\,[A]$$

l	Length of the SinCos encoder cable
R	Resistance of the SinCos encoder cable
I_{SINCOS}	Current consumption of the SinCos encoder

6.7 Current controller adjustment

When is a current controller adjustment required?

- The motor data of the motor used is not contained in GDC (e.g. motors from other manufacturers).
- The application makes high demands on the dynamic performance of the drive controller (e.g. dynamic positioning, cross cutter).
- The motor/drive controller combination does conform to the standard power-based assignment. The basic current controller settings only match for a power-based assignment of the drive controller.

Preparations

Measure	Setting	Explanation
Reduce maximum current	Reduce the value in C0022	With the motor at standstill, the motor current of the motor phase U is measured (field frequency 0). This increases the motor current in the motor phase to 141% and the motor temperature rises significantly.
Generate maximum torque setpoint	Connect MCTRL-M-ADD with FIXED100%	For speed control or position control (MCTRL-N/M-SWT = 0)
	• Connect MCTRL-M-ADD with FIXED100% • Connect MCTRL-N-SET with FIXED100%	For torque control (MCTRL-N/M-SWT = 1)
Deactivate integral action component of current controller	Set C0076 = 2000 ms	The integral action component of the current controller is deactivated by setting the reset time T_n (C0076) to the longest time. The gain (C0075) remains unchanged (Lenze setting still valid).
Deactivate quick stop	Set X5/E1 = HIGH or X5/E2 = HIGH	By preselecting a direction of rotation the quick stop is deactivated.
Change the operation of the motor control	Set C0006 = 3	Even if an asynchronous motor is connected, set the motor control to 'synchronous motor'.
Set the rotor position setpoint	Set C0058 = -90°	Set the rotor displacement angle to -90°.
Set the actual value display of the rotor position to 0° under C0060	1. Select a TTL encoder under C0025 2. Save settings with C0003 = 1 3. If required, disconnect the encoder cable at X8 4. Switch off the mains supply and the external 24V supply (if required) and then on again.	After mains connection C0060 = 0° is displayed.
Connect the storage oscilloscope	Put the clamp-on ammeter around the motor phase U and connect it to the oscilloscope	Oscilloscope settings: • Time base: 400 µs/DIV • Auto-triggering

Adjustment

Stop!

Thermal destruction of the motor!

► If the controller is enabled for too long and the motor current is too high, the motor may be destroyed by overtemperature.

Protective measures:

► Reduce motor current under C0022 and enable the controller only for some seconds.

1. Inhibit the controller (X5/28 = LOW)
2. Deactivate quick stop (X5/E1 =HIGH or X5/E2 =HIGH)
3. Enable the controller for some seconds and then inhibit it again.
4. Record the current flowing in motor phase U with the controller being enabled.
5. Set the gain V_p (C0075) in such a way that the current rises rapidly.
6. Reduce the reset time T_n (C0076) so much that the transient response shows almost no overshoot and an optimum rise is achieved.
7. After each change of C0075 and C0076, the time course of the motor current must be recorded and checked again.

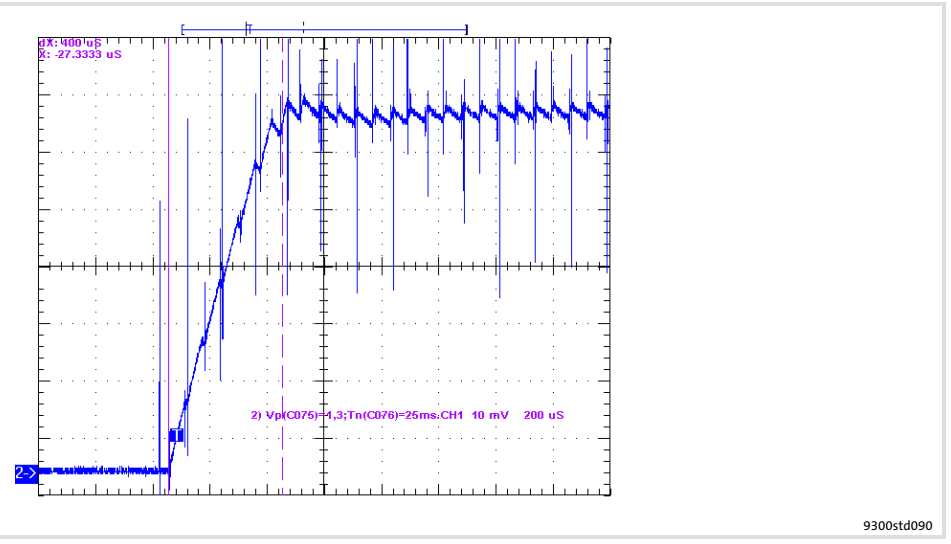


Fig. 6.7-1 Current characteristic for optimum controller adjustment
Time base 200 µs/DIV

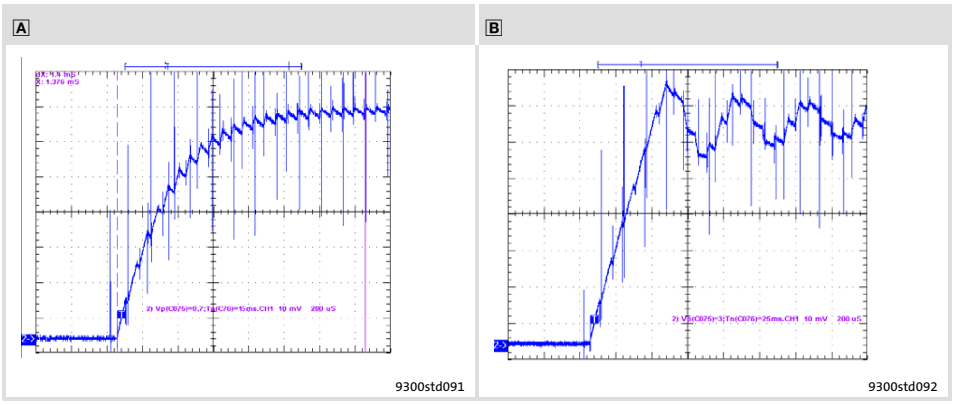


Fig. 6.7-2 Current characteristic for non-optimum controller adjustment

A Current rise of motor current too slow
Reset time T_n (C0076) too long and/or gain V_p (C0075) too small
Measured at time base 200 µs/DIV

B High-frequency oscillations of motor current, motor noises may occur
Reset time T_n (C0076) too short and/or gain V_p (C0075) too large
Measured at time base 200 µs/DIV

8. Check the transient response over a longer period of time (e.g. with time base 4000 µs/DIV). The motor current must reach the final steady-state value within the shortest possible time.

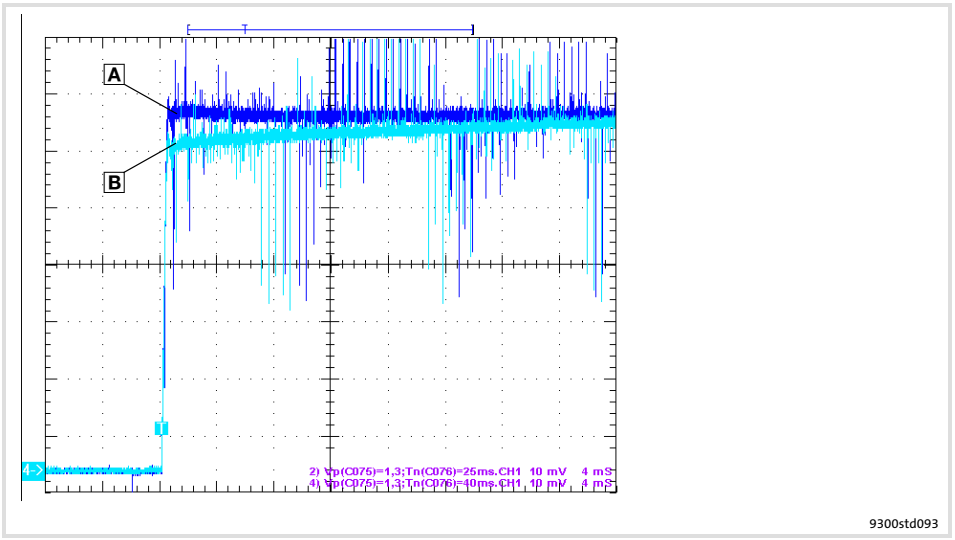


Fig. 6.7-3 Transient response of motor current over longer period of time

A Optimum transient response

B Final steady-state value is reached too slowly

Measured at time base 4000 µs/DIV

9. When the current controller adjustment is completed, reset the temporary settings:
   – Set the initial values again in C0006, C0022 and C0025. If necessary, reconnect the encoder cable to X8.
   – Connect the inputs MCTRL-M-ADD and MCTRL-N-SET with the initial signals.

6.8 Adjusting the rotor position

When is a rotor position adjustment required?

- A synchronous non-Lenze motor is used. The motor used is not included in GDC.
- Another encoder was mounted to the motor later on.
- A defective encoder was replaced.

Note!

Only use single-pole resolvers or SinCos encoders (single-turn or multi-turn).

Preparatory work

- Inhibit the controller.
- Unload the motor mechanically.
  - Disconnect the motor from the gearbox/machine.
  - If necessary, remove toothed lock washers, gears, etc. from the motor shaft.
  - If necessary, support the holding torques provided by mounted motor brakes by means of locking devices.
- Deactivate the ”safe torque off” function so that the motor can be energised for the motor pole angle adjustment.
- Release the holding brake (if available).
- Adjust the current controller (see chapter ”Current controller adjustment”).
- Check resolver polarity.
- Set C0006 = 3.
  - For carrying out a rotor position adjustment, a synchronous motor must be selected.

Resolver polarity check

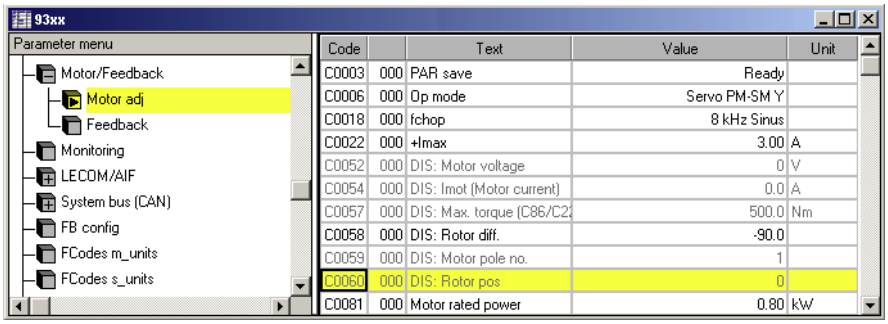
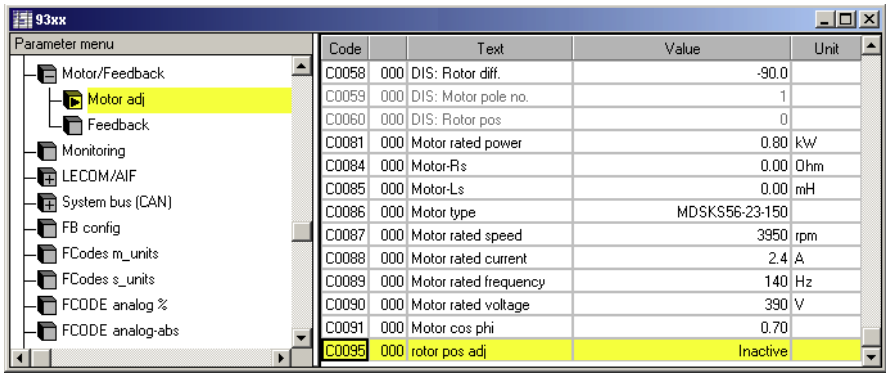


Fig. 6.8-1 ”Motor adj” menu of the parameter menu

Procedure	
1.	Inhibit the controller (X5/28 = LOW).
2.	Disconnect the motor from the gearbox/machine.
3.	Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
4.	Turn the rotor to the right (when looking at the front end of the motor shaft). The value in C0060 must increase. ● In C0060 the angle of rotation is displayed as a numerical value between 0 and 2047. **Note!** The actual value is only displayed if the selection cursor is placed on the code and [F6] is pressed.
5.	If the value decreases, swap the signals at X7/6 and X7/7 (+SIN and -SIN).

Rotor position adjustment



9300std203

Fig. 6.8-2 ”Motor adj” menu of the parameter menu

Procedure	
1.	Inhibit controller (X5/28 = LOW).
2.	Open the ”Parameter menu → Motor/feedback system → Motor setting” menu.
3.	Select C0006 = 3. ● A synchronous motor with feedback must be selected for pole position adjustment.
4.	Click C0095 and activate the adjustment process by selecting C0095 = 1.
5.	Enable controller (X5/28 = HIGH).
6.	The position adjustment program of the controller is started. ● The rotor rotates a full revolution in several steps. ● Then C0095 is automatically set to 0.
7.	C0058 displays the current rotor displacement angle. **Note!** ● The current value will not be displayed until the bar cursor is on the code and [F6] is pressed. ● For sin/cos encoders, C0058 always displays a value of 0 because the value is saved to the encoder.
8.	Inhibit controller (X5/28 = LOW).
9.	Reset C0006 to default setting if necessary.
10.	Click C0003 and save the setting by selecting C0003 = 1.
11.	Disconnect the mains and reconnect the motor to the machine.

Danger!

Uncontrolled movements of the drive after an ”Sd7” error in conjunction with absolute value encoders or in the case of a ”PL-TRIP” error.

If the rotor position adjustment was completed with an ”Sd7” or ”PL-TRIP” error (📖 9.3-1) it was not possible to assign the rotor position to the feedback system. In this case the drive may carry out uncontrolled movements after the controller has been enabled.

Possible consequences:

► Death or severe injuries.

► Destruction or damage to the machine.

Protective measures:

► Repeat rotor position adjustment (start with step 1).

► Check the wiring and the interference immunity of the encoder at X8.

6.9 Changing the assignment of the control terminals X5 and X6

Danger!

If you select a configuration in C0005, the signal assignment of the inputs and outputs will be overwritten with the corresponding basic assignment!

► Adapt the signal assignment to your wiring!

6.9.1 Free configuration of digital input signals

Description

► Internal digital signals can be freely linked with external digital signal sources. This serves to establish a freely configurable control of the drive controller.

– Digital inputs X5/E1 ... X5/E5

► A signal source can be linked with several targets. Ensure reasonable linkages for not activating functions that are mutually exclusive (e. g. linking a digital input with quick stop and DC injection braking at the same time).

Linking signals

The internal digital signal can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal digital signal.

Example

► C0787/2 =53 ⇨ signal source for JOG2 is terminal X5/E3

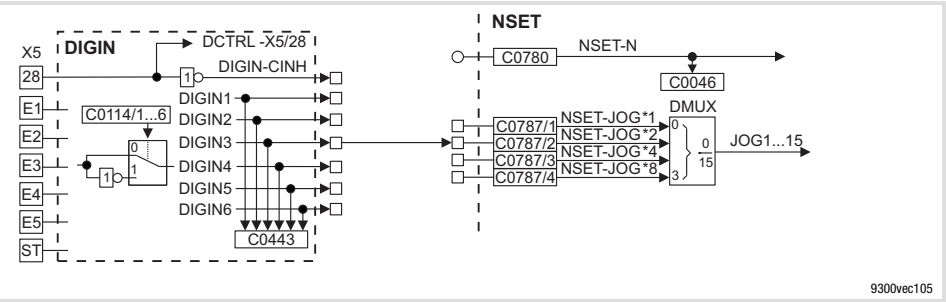


Fig. 6.9-1 Connecting digital signal JOG2 with terminal X5/E3

Tip!

► A list with all selection figures is included in the chapter ”Configuration” → ”Selection lists”.

► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Signal level

► Terminals (X5/E1 ... X5/E5):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0114 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/E1 ... X5/E5.

Example

► C0114/3 =1 ⇨ LOW level at X5/E3 activates JOG2

6.9.2 Free configuration of digital outputs

Description

► The digital outputs X5/A1 ... X5/A4 can be freely linked with internal digital signals.

► One signal source can be linked with several targets.

Linking signals

The digital outputs can be linked with internal digital signals by entering the selection figure of the internal signal into corresponding subcode of C0117.

Example

► C0117/2 = 505 ⇨ signal source for X5/A2 is the status message ”direction of rotation” (DCTRL-CW/CCW)

Signal level

► Terminals (X5/A1 ... X5/A4):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0118 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/A1 ... X5/A4.

Example

► C0118/2 =1 ⇨ With LOW level at X5/A2 the motor rotates in CW direction (with in-phase motor connection)

6.9.3 Free configuration of analog input signals

Description

- Internal analog signals can be freely linked with external analog signal sources:
  – Analog inputs X3/1, X3/2 and X3/3, X3/4
- One signal source can be linked with several targets.

Linking signals

The internal analog signals can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal analog signal.

Example

- C0780 = 50 ⇨ signal source for the main setpoint (NSET-N) is terminal X6/1, X6/2

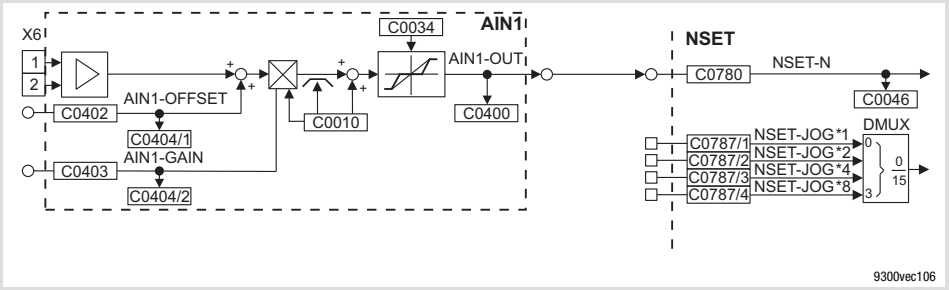


Fig. 6.9-2 Linking analog signal NSET-N with terminal X6/1, X6/2

Tip!

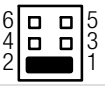
- A list with all selection figures is included in the chapter ”Configuration” → ”Selection lists”.
- For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Gain and offset

Set gain (C0027) and offset (C0026) to adapt the input signal to the application.

Input range of X6/1, X6/2

Input range	C0034	Position of jumper at X3
-10 V ... +10 V	C0034 = 0	
+4 mA ... +20 mA	C0034 = 1	
-20 mA ... +20 mA	C0034 = 2	

Note!

Different settings in C0034 and of X3 result in a wrong input signal.

6.9.4 Free configuration of analog outputs

Description

- ► The analog outputs (X6/62, X6/63) can be freely linked with internal analog process or monitoring signals. The controller outputs a voltage proportional to the internal signal at the analog outputs.
- ► One signal source can be linked with several targets.

Linking signals

Analog outputs can be linked with internal analog signals by entering the selection figure of the internal signal into the code of C0431 (AOUT1, X6/62) or C0436 (AOUT2, X6/63).

Example

- ► C0436 = 5006 ⇨ signal source for X6/63 is the actual motor voltage

Tip!

- ► A list with all selection figures is included in the chapter "Configuration" → "Selection lists".
- ► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Set gain (C0108) and offset (C0109) to adapt the output signal to the application.

With an internal signal of 100 % and a gain of 1, a voltage of 10 V is output at the terminal.

6.10 Generation of motion profiles

This chapter describes the generation of motion profiles in »Global Drive Control« (GDC).

6.10.1 Important notes

Stop!

If gearbox factors or feed constants are changed, you have to repeat the profile data transfer to the controller.

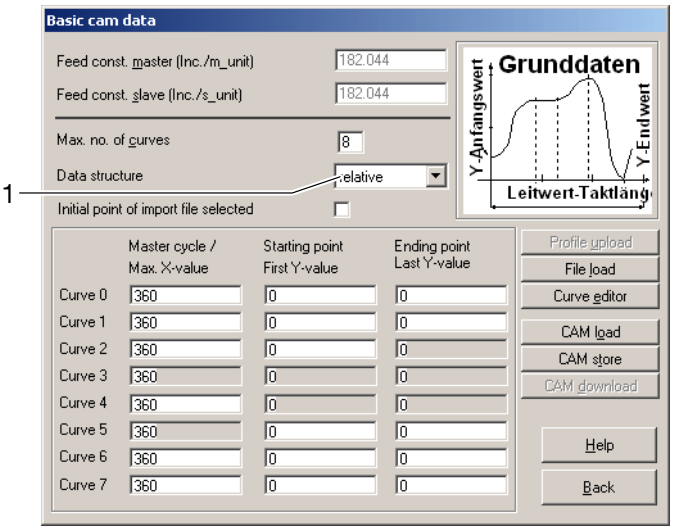
Options for generating motion profiles

- Profile editor of »Global Drive Control« (GDC)
  - Import of motion profiles (CAD data)
  - Mathematical input of the profile data
- »CamDesigner«
  - Import of motion profiles (CAD data)
  - Graphical input of the profile data
- »CamLoader«
  - Import of CAD data, data from GDC (profile editor) or »CamDesigner«
  - Download of motion profiles via interconnected axes

6.10.2 Definition of data model

Note!

Select the data model for the drive before entering the basic profile data in the ”Basic cam data” dialog box.



9300kur031

Fig. 6.10-1 ”Basic cam data” dialog box

Procedure

1. Click on field (1) and select the data model.

Relative data model

- For the relative data model, profile points cannot be changed later since they are saved in a compressed form because of the data volume.
- Compared with the absolute data model, the relative data model provides a higher number of interpolation points.
- The profile can be split into 5 sections. The interpolation points used per section are distributed equidistantly.

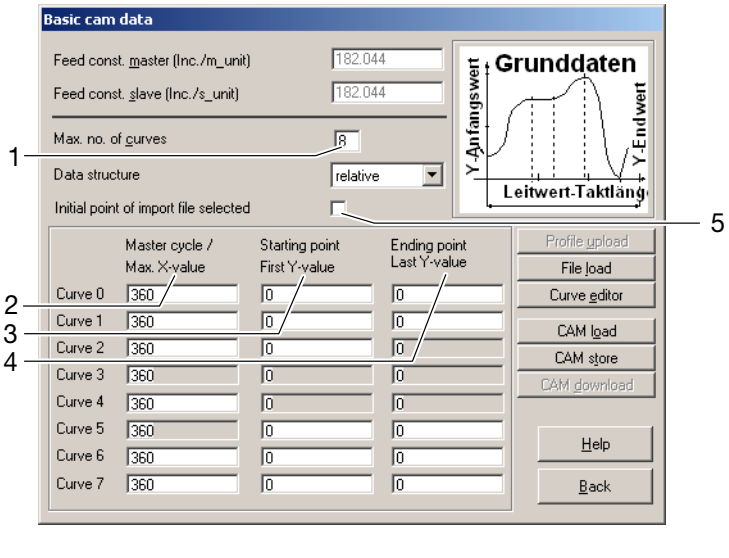
Absolute data model

- The absolute data model provides the possibility to change individual points of the profile later.
- The interpolation points can be distributed as you like.
- If the profile is split into different sections, an active section is not output at CDATA-SEC1 ... CDATA-SEC5.
- Profiles can be optimised through linear interpolation.

Number of interpolation points

Data model	Maximum number of interpolation points for ...			
	1 profile	2 profiles	4 profiles	8 profiles
Relative	2048	1024	512	256
Absolute	512	256	128	64

6.10.3 Entry of basic motion profile data



9300kur031

Fig. 6.10-2 ”Basic cam data” dialog box

Procedure

1. Click on field (1) and enter the number of profiles to be transferred to the drive.
   - A motion profile can consist of 1, 2, 4 or 8 profiles.
   - A profile can consist of a maximum of 5 sections.
2. Enter the length in X direction (cycle length) of each profile in the fields of column (2).
3. Enter the starting point in Y direction of each profile in the fields of column (3).
   - Unit: s_units
4. Enter the final profile value in Y direction of each profile in the fields of column (4).
   - Unit: s_units
5. Define the source for the starting point in Y direction.
   - The field “Initial point of import file selected” (5) is activated:
     – The first Y value of the import file is transferred to the field “Starting point: First Y-value” (3).
   - The field “Initial point of import file selected” (5) is not activated:
     – The value entered in field “Starting point: First Y-value” (3) is used.

Note!

Observe when distributing the interpolation points that not more than 2 $^{\text{interpolation points}}/_{\text{ms}}$ will be crossed at maximum system speed.

6.10.4 Profile data import

The profile data to be imported must be given in the form of interpolation point tables according to the VDI Guideline 2143 ”Motion rules for cam mechanisms”.

The files required can be generated using a CAD system, the Lenze CAMDesigner or a similar software.

► The profile data must be given in the form of an ASCII file with the ending *.txt.

- Each line contains the X and Y position of an interpolation point.
- For the decimal sign a comma or a point can be used.
- Between the two position specifications, there can be one or several separators (space or tab character).
- After the two position specifications, an optional comment can follow in the same line separated at least by a separator and two slashes (//).
- There can be space lines between the position specifications.
- The interpolation points must be sorted in ascending order of the X positions.
- The file must at least contain two interpolation points.

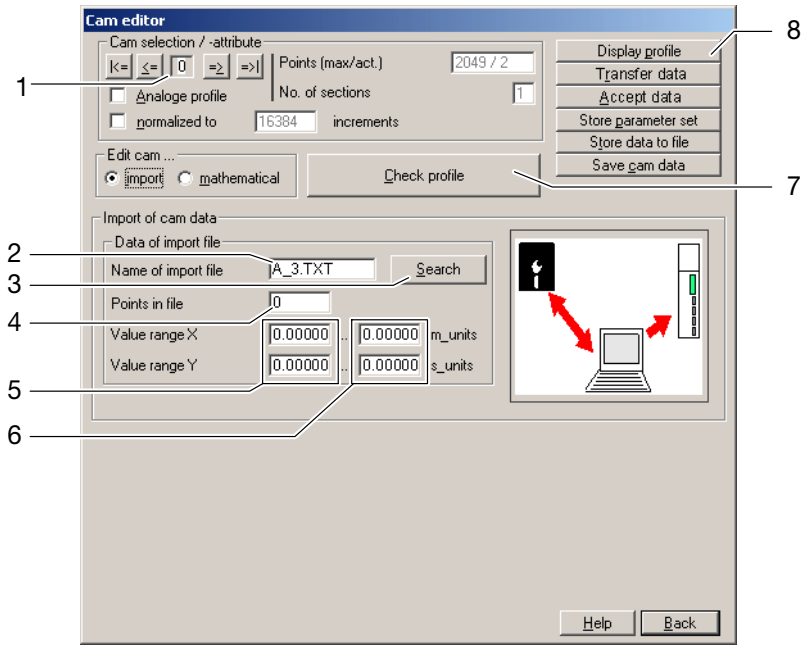


Fig. 6.10-3 “Cam editor” dialog box

Procedure

1. Click on field (1) and enter the number of the profile for which you want to import the data.
2. Select the ASCII file (*.txt) to be imported.
   - Enter the path and the file name in field (2) or
   - click on the ”Search” button (3). In the ”Select import file” dialog box you can select the file directly.

   After the file has been selected, the following is displayed:
   - Field (4): The number of value pairs (interpolation points) found.
   - Field (5): The minimum values in X and Y direction.
   - Field (6): The maximum values in X and Y direction
3. Click on button (8) to display the profiles in another dialog box. From this dialog box, the profiles can be printed.
4. Click on button (7) to calculate the profiles. At the same time it is checked whether there are faulty entries (e.g. discontinuity of the profile) and whether all required conditions are met.

6.10.5 Mathematical specification of profiles

Note!

For the mathematical selection the profile editor provides the cam profiles according to VDI 2143 (5th degree polynomial, inclined sinusoidal curve and rest phase).

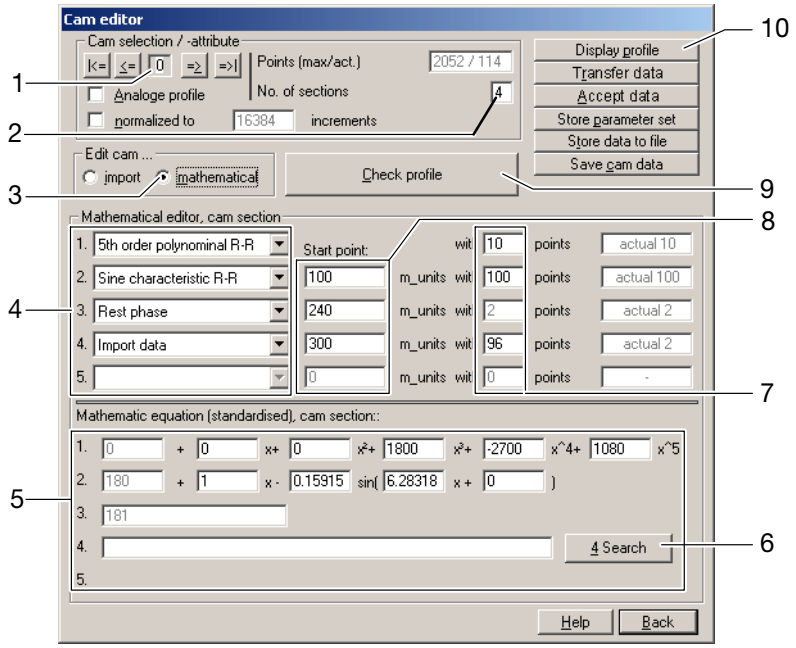


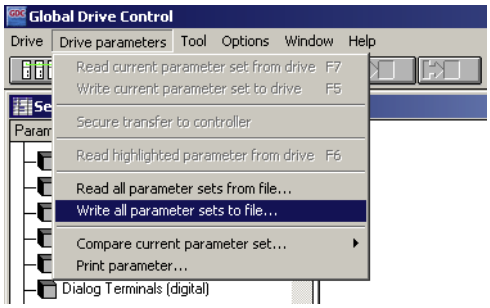
Fig. 6.10-4 “Cam editor” dialog box

Procedure

1. Activate the ”mathematical” selection (3).
2. Click on field (1) and enter the number of the profile you want to create.
3. Click on field (2) and enter the number of profile sections the profile is to have.
4. Select a profile shape for each profile section in fields (4).
5. Enter the length of each profile section in fields (8).
   - The first section always starts at X = 0. The last section ends at X = X_{max}.
6. Enter the number of interpolation points for each profile section in fields (7).
   Note!
   - The number of interpolation points available depends on the data model used.
   - For the “Rest phase” profile shape, the number of interpolation points is automatically selected.
7. In fields (5) enter the values in the mathematical functions for the profile shapes.
   - The sections are automatically joined to form a profile and converted to the motor motion in the background.
   - Click on the ”Display profile” button (10) to display the profile.
8. If you have selected ”Import data” for a profile section, click on the ”Search” button (6). In the ”Select import file” dialog box you can then select the file directly.
9. Click on the ”Check profile” button (9) to calculate the profiles. At the same time it is checked whether there are faulty entries (e.g. discontinuity of the profile) and whether all required conditions are met.

6.10.6 Saving of motion profiles

Saving of the motion profile in the profile editor using the parameter set



9300std232

Fig. 6.10-5 "Drive parameters" menu

- ► Execute **Drive parameters → Write all parameter sets to file ...** in the menu.
- ► Select the drive and the directory in which the parameter set is to be saved.
  - – The parameter set is saved in a GDC file.
  - – At the same time the profile data are saved in an LCA file.
- ► When you load a saved parameter set in GDC with the **Drive parameters → Read all parameter sets from file ...** command, you are automatically asked if you want to load the profile data from the corresponding LCA file.

External saving of the motion profile in the profile editor

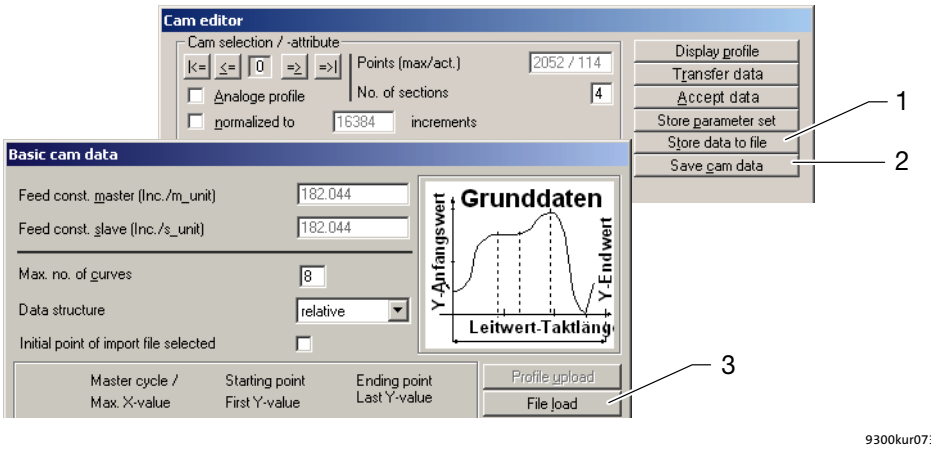


Fig. 6.10-6 Dialog boxes ”Cam editor” and ”Basic cam data”

► Saving the motion profile for the transfer from the PLC/IPC to the controller

Click on the ”Save cam data” button (2) to save the motion profile in an LC7 file.

– The profile data is saved in 64-bit format.

► Saving the motion profile independently of the parameter set in a file

Click on the ”Store data to file” button (1) to save the motion profile in an LCD file.

To reload a saved motion profile to the parameter set, click on the ”File load” button (3).

6.10.7 Application example - generation of feed profiles

Generation of a motion profile consisting of a single profile

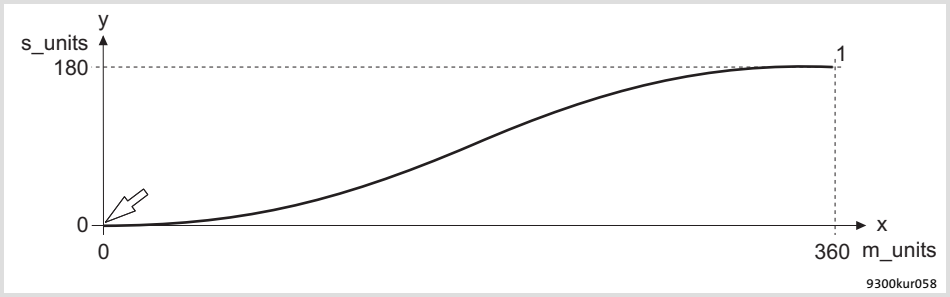


Fig. 6.10-7 Profile characteristic for a feed movement

To avoid jolts of the drive, do not start the motion profile with a starting point $y_0 \neq 0$. To ensure this, do not change the default value ”0” of the profile in the ”Starting point: First Y-value” column.

The factory-set motion profiles always start with $x_0 = 0$ / $y_0 = 0$ (see arrow).

Generation of a motion profile consisting of several profiles

Up to eight curve profiles can be combined in a motion profile. During operation, the motion profile is generated by cyclically processing the single curve profiles. Due to this, there may also be profile sections with starting values $y_0 \neq 0$ (Fig. 6.10-8).

Stop!

For a jerk-free transition, the lifting and the gradient of the cyclically successive profile sections must correspond.

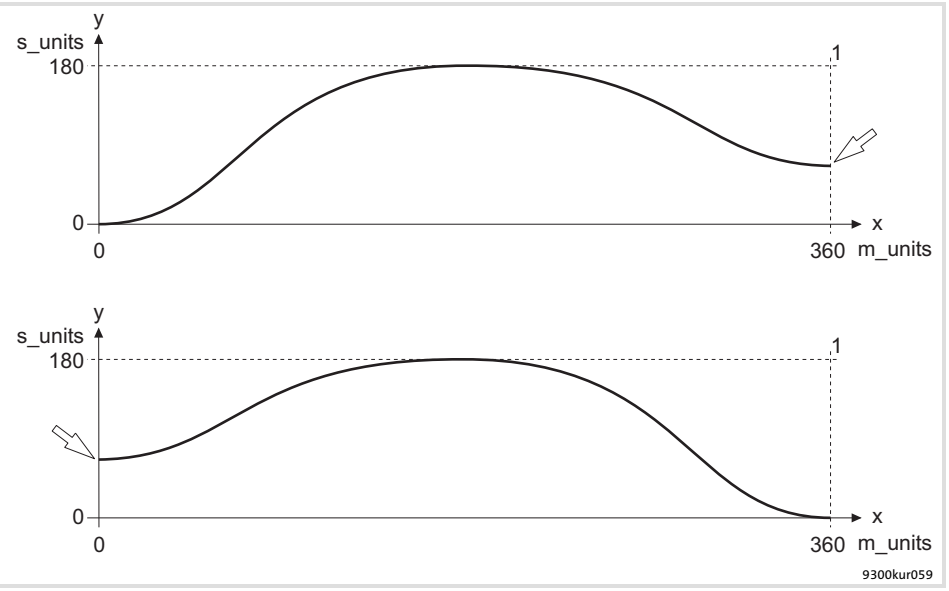


Fig. 6.10-8 Transition between two profiles processed cyclically one after the other

Procedure	
1.	Select a basic configuration that matches your application.
2.	Activate the automatic curve profile switching by setting CDATA-Cycle = HIGH (C1322/1 = Fixed1).
3.	Set the start profile under C1311 and the switching range under C1312.
4.	Deactivate the feed function by setting CDATA-REL-SEL = LOW (C1322/3 = Fixed0).
5.	Activate the asynchronous stretching/compression of the Y axis by setting C1313 = 0.

6.11 Transfer of motion profiles

6.11.1 Transfer methods

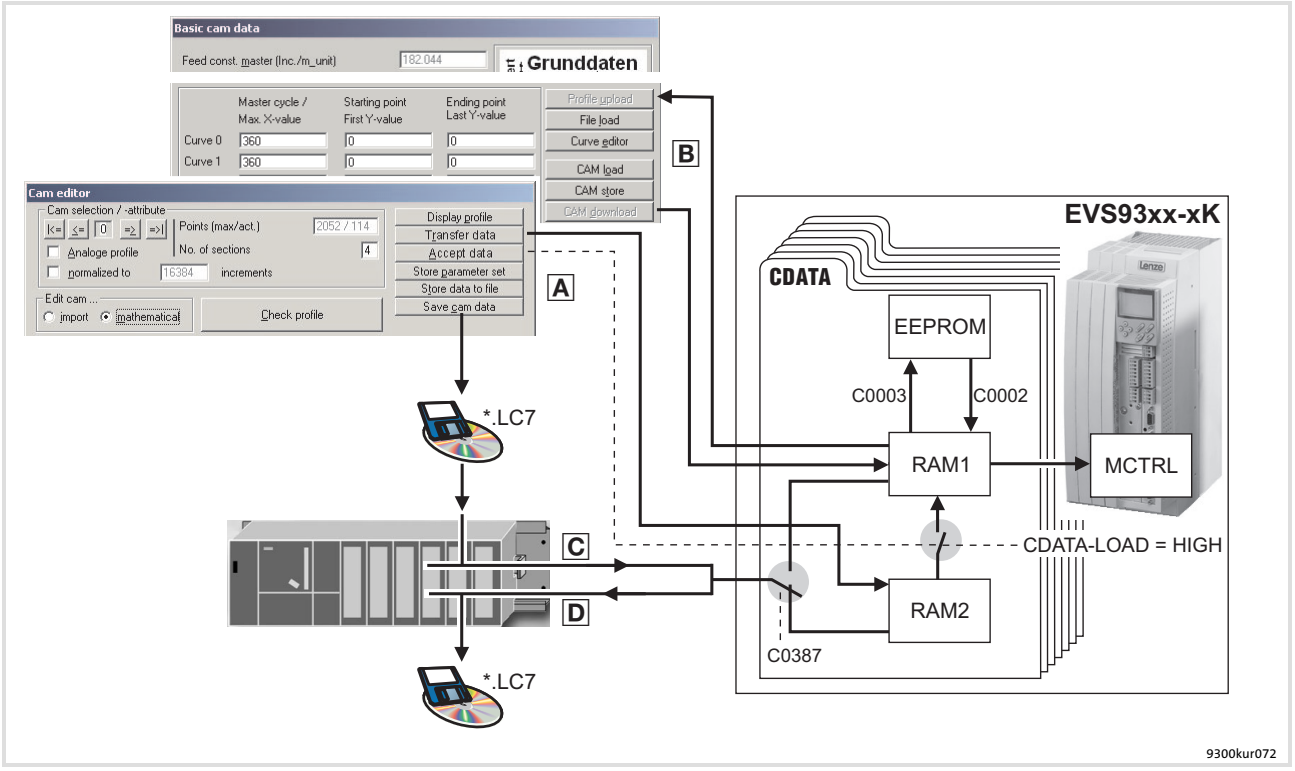


Fig. 6.11-1 Different transfer methods

Transfer of profile data			Description	
From		To		
GDC (cam editor)	⇒	Controller	A Transfer of profile data created in the ”cam editor” of GDC to the background data field (RAM2) of the controller. Subsequent transfer of data to the active data field (RAM1).	📖 6.11-3
GDC (basic data)	⇔	Controller	B Loading of profile data from the controller to GDC via the ”Basic cam data” dialog box. Subsequent transfer of data from GDC to other controllers.	📖 6.11-3
PLC/IPC	⇒	Controller	C Transfer of profile data from GDC (*.LC7) or CamDesigner (*.txt) to the PLC or IPC. Subsequent transfer of data to the controller:	📖 6.11-3
			• Block transfer	📖 6.11-4
			• Interpolation-point-oriented transfer	📖 6.11-6
			• Code-oriented transfer – Due to the complexity of this transfer method not recommended by Lenze.	📖 13.1-1
Controller	⇒	PLC/IPC	D Block transfer	📖 6.11-9

6.11.2 Background data field and active data field

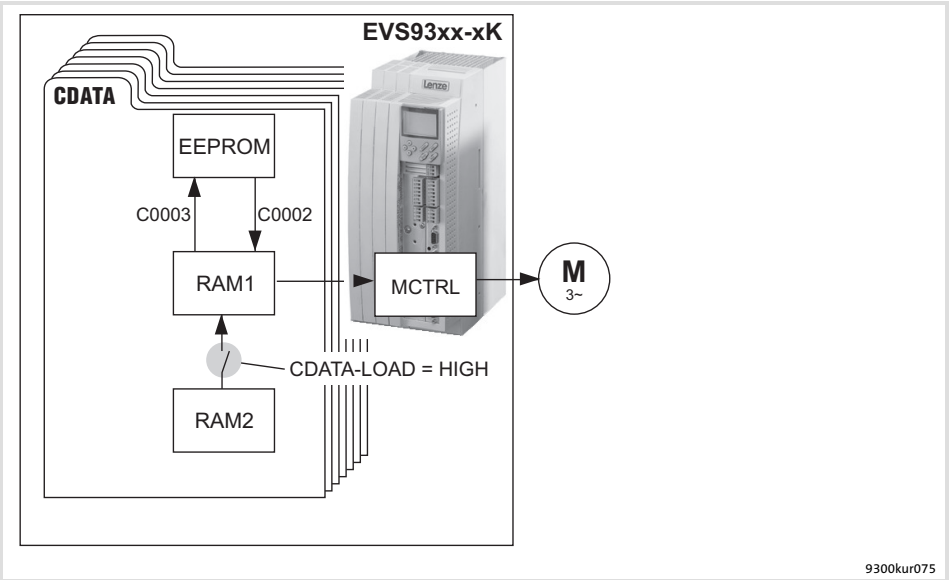


Fig. 6.11-2 Active data field (RAM1) and background data field (RAM2)

► Background data field (buffer storage RAM2)

During operation, the controller can already save new profile data in the buffer storage (e.g. for preparing a product change-over). This profile data is not yet active.

► Active data field (main memory RAM1)

Profile data in this data field is immediately active. If you accept profile data, the active data in the main memory will be overwritten.

Inhibit the controller (X5/28 = LOW) before loading profile data into the main memory to prevent uncontrolled motor movements.

As long as the controller is enabled, you may only accept profile data which - compared to the active profile data -

– has slightly changed in the start and end point,

– has the same number of interpolation points,

– has the same distribution of interpolation points,

– has the same data model.

6.11.3 Transfer of profile data from GDC to the controller

Transfer of data created with the cam editor to the controller

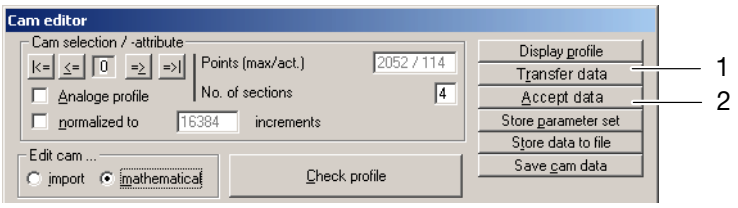


Fig. 6.11-3 “Cam editor” dialog box

Procedure

1. Click on the ”Transfer data” button (1) to transfer the profile data to the background data field (RAM2) of the controller.
   - The data of all profiles created are transferred. The transmission takes approx. 1 ... 2 minutes.

   Important!
   Transfer the parameter set with the gearbox and feed constants first and then the profile data.
2. Click on the ”Accept data” button (2) to accept the transferred profile data in the active data field (RAM1) of the controller.

   Note!
   Via PLC/IPC you can accept the profile data with the “CDATA-LOAD” command (C1322/7).

Data transfer between controllers

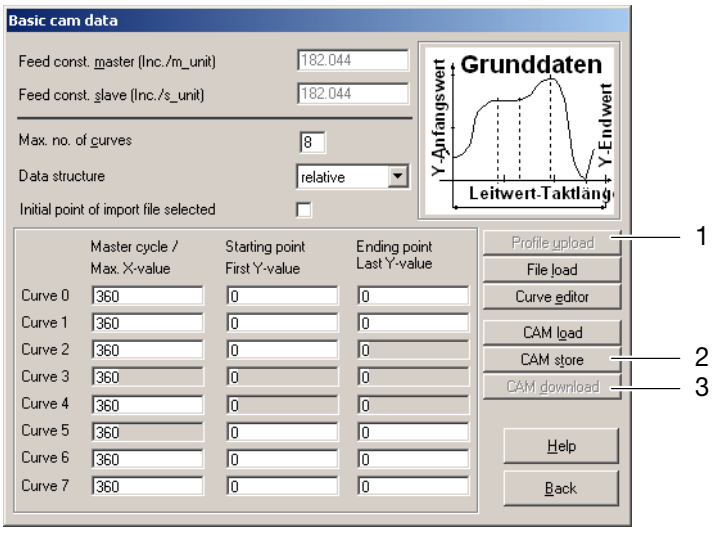


Fig. 6.11-4 ”Basic cam data” dialog box

Procedure

1. Click on the ”Profile upload” button (1) to transfer the profile data from the active data field (RAM1) of the controller to GDC.

   Important!
   Do not process the profile data in the editor!
   The conversion of profile data is inexact because in the controller the profile data is stored in the 32-bit format, while the editor works with the 64-bit format.
2. Click on the ”CAM download” button (3) to transfer the profile data to the active data field (RAM1) of a controller.
3. If required, click on the ”CAM store” button (2) to save the profile data in an LC7 file (formatted in ASCII).

6.11.4 Transfer of profile data from the PLC/IPC to the controller

Block transfer

For transferring data to the controller, the PLC / IPC needs the profile data to be provided in the ASCII format (*.LC7). The following sources can be used:

- ► Profile data generated with the cam editor
  - – The profile data generated with the cam editor can be saved in the LC7 format in an ASCII file. (📖 6.10-7)
- ► Profile data of the controller
  - – Load the profile data set of the active data field (RAM1) to GDC. (📖 6.11-3)
  - – This data transfer does not include the version identifier. The version identifier can be used to ensure that the profile data set matches the controller version.
  - – Read out the version identifier under C0506/1 and enter this value in the first line of the profile data set.

Profile data set (example)		
Line	**Data**	**Meaning**
1	100	Version identifier
2	4293787648	Profile data
3	4293853166	Profile data
...	...	Profile data
1234	4294641604	Profile data
...	...	Profile data
1242	0	Profile data
1243	55932	Checksum

Stop!

The drive may carry out uncontrolled movements if the version level of the profile data set to be transferred does not correspond with the version level under C0506/1.

Procedure

1. Use C0387 to select whether the profile data is to be transferred to the background data field or to the active data field of the controller.
2. Read out the version identifier under C0506/1 and compare this value with the value in line 1 of the *.LC7 file.

   The two values must be identical.
3. Transfer the value ”0” to C0505/2. This sets the pointer in the controller to the beginning of the profile data set.

   Then lines 2 ... 1242 of the profile data set are written to C0504/2 in the form of 32-bit values.

   The controller must acknowledge each transfer with the “ACK” message. Only then the next data can be transferred.
4. Check for correct transmission by using the checksum.

   Write the checksum of the transferred profile set (value in the last line) to

C0509 to check for correct transmission.

The controller compares the checksum entered under C0509 and the checksum of the received profile data set:

– Error-free transmission: CDATA-CHK-ERR = LOW

– Faulty transmission: CDATA-CHK-ERR = HIGH and message “CDA” (see chapter ”Troubleshooting and fault elimination”)

5. Check whether the last sent data has been transferred. Read out the value under C0504/2 and compare it with the value in the second-to-last line of the profile data set.

   This does not affect the pointer in the controller.

Note!

- ► C0505 can only be transferred by a control (PLC or Lenze Drive PLC). It cannot by addressed via GDC.
- ► With the exception of the version identifier and the checksum, every line must be transferred.
- ► Each line may only be transferred once because the pointer in the controller automatically jumps to the next element of the profile data table after a transfer.
- ► If an error occurs during transmission, the entire transmission process has to be repeated.

Interpolation-point-oriented transfer

Stop!

Damage to the cam drive!

► The acceptance of profile data in the active data field can cause uncontrolled movements of the cam drive.

Protective measures:

► Inhibit the controller (X5/28 = LOW) before accepting the profile data in the active data field.

Preparing the transfer

1. Set the ”absolute” data model for the basic data of GDC.
2. Create a motion profile with the required number of profiles in GDC. Transfer the motion profile to the controller.
3. Accept the profile data in the active data set. For this purpose set C0389 = 1.
4. Select the background data field with C0387 = 1.
   – Always change the profile data in the background data field to avoid damaging the cam drive. Profile data is only active if it is accepted in the active data field.
   – In the active data field (C0387 = 0) you may only change those profiles which are not being processed (see function block CDATA, output CDATA-ACTCAM).
   – See also chapter ”Acceptance of reloaded profile data”.
5. Only enter the number of profiles in C0390 if the number of profiles to be stored differs from the number defined in GDC.
6. Only enter the number of interpolation points in C0391 if the number of interpolation points required differs from the number defined in GDC.
7. Define the input format for the profile data:
   – User units [units]. This is a fixed point format with a maximum of 4 decimal places. Observe that the value must be multiplied by the factor 10000. The data is transferred to the controller in [units] and then converted to increments.
   – Increments [inc]

Transferring profile data

1. Select the profile to be changed (0 ... 7) under C0502/1.
2. Start the profile data download by entering the first interpolation point to be specified in X direction (C0505/3).
   – Constant overwriting of code C0505/3 or C0505/4 with the corresponding point number {(0 ... n-1) for n points} means that every point of the profile can be addressed separately.

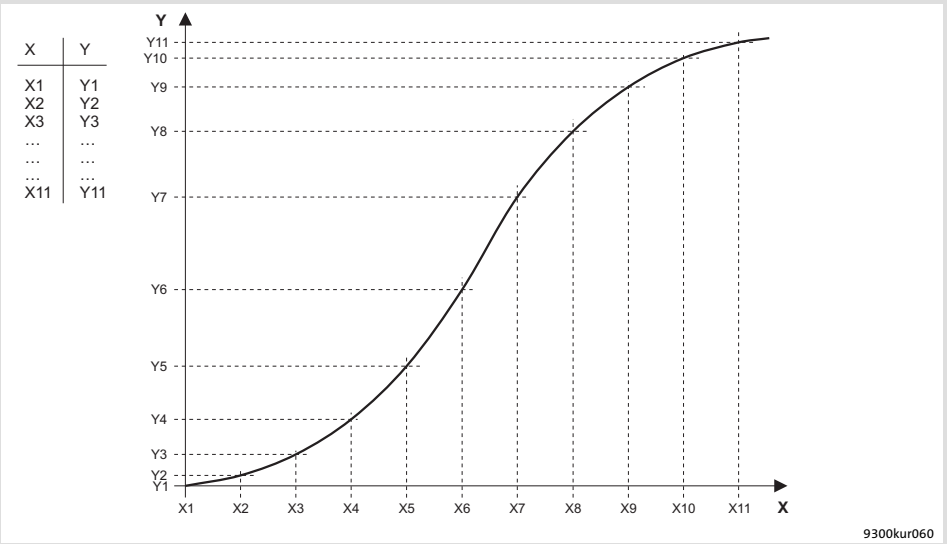


Fig. 6.11-5 Example of a profile with absolute data model (assignment of the X/Y value pairs)

3. Reading or writing of X data:
   – Writing as increments with C0504/3 or reading as increments with C0504/5.
   – Writing as units with C0511/1 or reading as units with C0511/2.
4. Enter the first interpolation point to be specified in Y direction (C0505/4)
   – Constant overwriting of code C0505/3 or C0505/4 with the corresponding point number {(0 ... n-1) for n points} means that every point of the profile can be addressed separately.
5. Reading or writing of Y data:
   – Writing as increments [inc] with C0504/4 or reading as increments with C0504/6.
   – Writing as user units [units] with C0512/1 or reading as user units with C0512/2.

Note!

Wait for "ACK" from the system before you write the next X value.

The next higher interpolation point is automatically addressed after a writing or reading process (auto increments).

You can either write all X values and then all Y values or write one each. Condition:

► X0 must always be zero. All other values will be rejected.

► Y0 is the starting point of the profile.

Checking the X axis

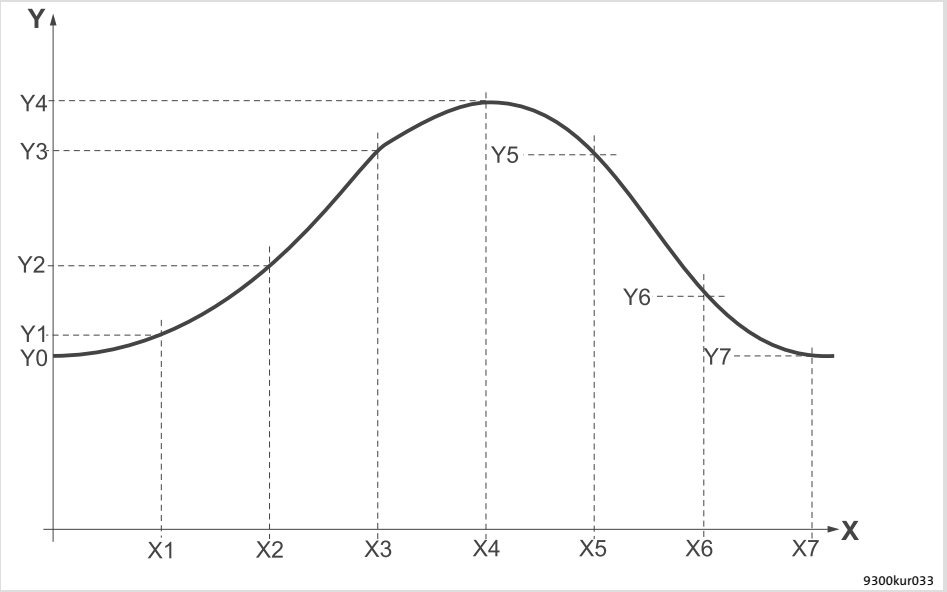


Fig. 6.11-6 Checking the X axis of the profile

Note!

The data for the X axis must be entered in ascending order. Otherwise the drive may operate incorrectly (e.g. CCR trip) or execute uncontrolled movements.

The entry of data in X direction is checked with code C0501/1 = 0:

- ► Correct entry: The controller responds with the ”ACK” message.
- ► Faulty entry: The controller responds with the ”INV_VALUE_RANGE” message (error number 13). Code C0501/1 contains the faulty interpolation point. Further error messages can be found in chapter ”Troubleshooting and fault elimination”.

Excerpt from the attribute table

Code	Index		DS	DA	DT	Format	DL	LCM-R /W	Condition
	dec	hex							
C0387	24188	5E7C	E	1	FIX32	VD	4	Ra/Wa	
C0389	24186	5E7A	E	1	FIX32	VD	4	Ra/Wa	
C0390	24185	5E79	A	1	I32	VH	4	Ra/Wa	
C0501	24074	5E0A	A	1	FIX32	VD	4	Ra/Wa	
C0502	24073	5E09	A	1	I32	VH	4	Ra/W	
C0504	24071	5E07	A	6	U32	VH	4	Ra/W	
C0505	24070	5E06	A	4	U32	VH	4	Ra/W	
C0511	24064	5E00	A	2	FIX32	VD	4	Ra/W	
C0512	24063	5DFF	A	2	FIX32	VD	4	Ra/W	
C1317	23258	5ADA	E	1	FIX32	VD	4	Ra/Wa	CINH

6.11.5 Transfer of profile data from the controller to the PLC/IPC

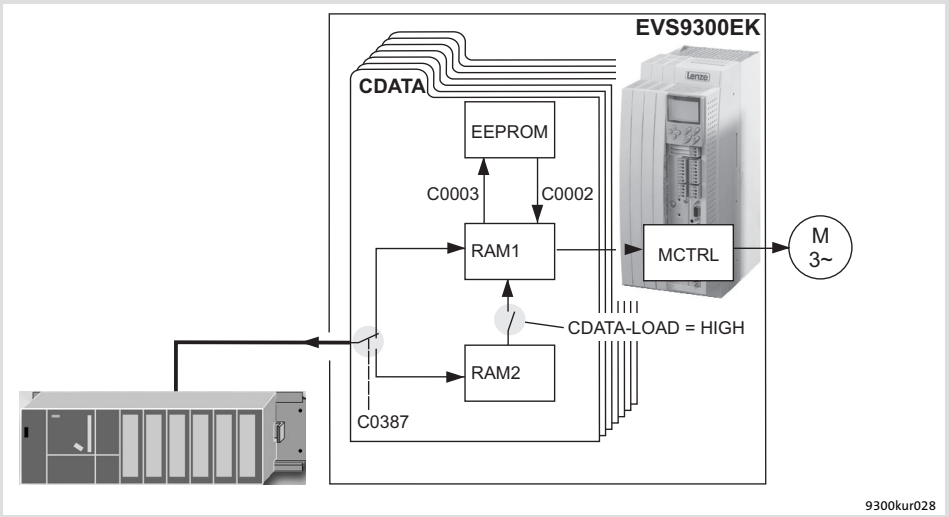


Fig. 6.11-7 Transfer of profile data from the controller to the PLC/IPC (principle)

1. Use C0387 to select whether the profile data in the background data field or in the active data field of the controller is to be read.
2. Read out the version identifier under C0506/1. Enter the version identifier in line 1 of the profile data set.
3. Transfer the value ”0” to C0505/1. This sets the pointer in the controller to the beginning of the profile data set.

   Then lines 2 to 1242 of the profile data set in C0504/1 are read as 32-bit values and written to the PLC / the IPC.

   The controller must acknowledge each transfer with the “ACK” message. Only then the next data can be requested.
4. Check for correct transmission by using the checksum.
5. Compare the checksum in C0509 with the value in the last line of the profile data set transferred. For fault-free transmission the two values are identical.

Profile data set (example)		
Line	**Data**	**Meaning**
1	100	Version identifier
2	4293787648	Profile data
3	4293853166	Profile data
...	...	Profile data
1234	4294641604	Profile data
...	...	Profile data
1242	0	Profile data
1243	55932	Checksum

Note!

- ► C0505 can only be transferred by a control (PLC or Lenze Drive PLC). C0505 cannot be addressed via GDC.
- ► Every line must be read.
- ► Each line may only be read once because the pointer in the controller automatically jumps to the next element of the profile data table after a transfer.
- ► Repeat the entire transmission process if an error occurs during the transmission.

Extract from the table of attributes

Code	Index		DS	DA	DT	Format	DL	LCM-R/W	Condition
	dec	hex							
C0387	24188	5E7Ch	E	1	FIX32	VD	4	RA/W	special
C0504/x	24071	5E07h	A	2	U32	VH	4	RA/W	special
C0505/x	24070	5E06h	A	2	B32	VH	4	RA/W	special
C0506/x	24069	5E05h	A	2	FIX32	VD	4	RA	
C0509	24066	5E02h	E	1	B32	VH	4	RA/W	

6.12 Acceptance of reloaded profile data

Stop!

When the controller is enabled, you may only transfer profile data from the background data field (RAM2) to the active data field (RAM1) if

- ► the new profile data has only been changed slightly,
- ► the number of profiles and the number of interpolation points remains unchanged.

Adjustment

In C1317 you can select the mode for the profile data being transferred from the background data field (RAM2) to the active data field (RAM1).

- ► C1317 = 0
  - – Profile data are accepted with the controller being inhibited (X5/28 = LOW) (Lenze setting).
- ► C1317 = 1
  - – Profile data are accepted with the controller being enabled (”set-up in the gap”).
  - – The drive may switch to the new profile via the following error (maximum torque). The best option for changeover is a rest phase or a phase in which the profile data remains unchanged.

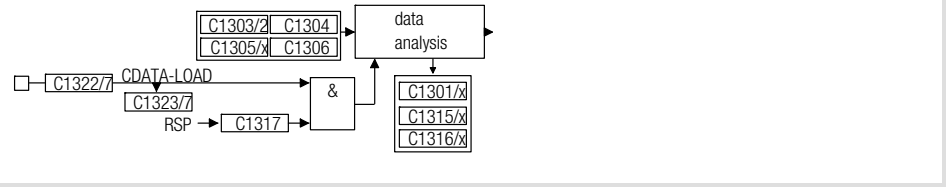


Fig. 6.12-1 Wiring of C1317 in the CDATA function block

- ► The profile data is accepted at CDATA-LOAD = HIGH. The signal must be applied for at least 50 ms.
- ► During the acceptance CDATA-BUSY-LOAD is HIGH
- ► The acceptance is completed when there is a HIGH-LOW edge at CDATA-BUSY-LOAD.

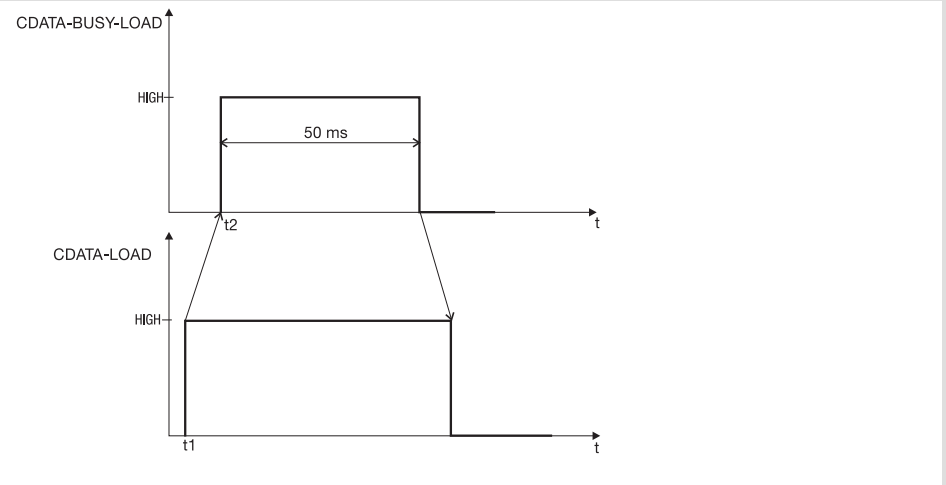


Fig. 6.12-2 Diagram for acceptance of profile data with CDATA-LOAD = HIGH

6.13 Activation/deactivation of password protection

6.13.1 Master PIN

Always assign a master pin if you want to ensure safe access protection for the profile data in the controller. Keep the master pin carefully.

With the master pin you can deactivate all types of access protection. It overrides the user pin.

Assignment of master pin

1. Enter a number between 1 and 65535 under C0503/2.
2. Save the master pin non-volatilely in the parameter set with C0003 = 1.

Deactivation of access protection

► Enter the master pin under C0503/2.

Note!

Code C0503/2 is not available in GDC. This code can be accessed via the PLC or the keypad.

6.13.2 User PIN

If the user pin (personal identification number) is activated, access to profile data is restricted or prevented completely.

► Select the access protection for the profile data under C0499:
- C0499 = 0: Writing and reading of profile data is not possible (Lenze setting).
- C0499 = 1: Reading of profile data is not possible.
- C0499 = 2: Writing of profile data is not possible.

Note!

Activate the read protection (C0499 = 1) for applications with more than 8 profiles. The profiles can then be reloaded (via an external control), but not be read out.

Activation of access protection

1. Enter a number between 1 and 65535 under C0503/1.
2. Save the user pin non-volatilely in the parameter set with C0003 = 1.

► Possible settings of C0503/1:
- C0503/1 = 9999: Access protection activated. No master pin assigned.
- C0503/1 = 9998: Access protection activated. Master pin assigned.
- C0503/1 = 0: Access protection deactivated.

Deactivation of access protection

1. Enter the user pin under C0503/1.
   – If the entry is correct, ”0” is displayed in C0503/1.
   – If the entry is not correct, ”9999” or ”9998” is displayed in C0503/1. Access is denied.

Note!

If you enter the user pin wrong two times, the access protection cannot be deactivated with the user pin anymore.

To deactivate the access protection proceed as follows:

► Enter the master pin under C0503/2. (📖 6.13-1)

► Load the Lenze setting.
   – All profile data in the controller is deleted!

6.14 Commissioning examples

6.14.1 Replacement of a mechanical cam

Description

A mechanical cam is to be replaced by the “electronic cam” technology function from Lenze. For this purpose, the outer dimensions of the ’mechanical’ cam must be numerically described by value pairs. These value pairs must then be stored in the controller.

The source data for the numerical description of the cam profile can be generated in two ways from already existing data:

► Profile import

► Mathematical profile specification

For this example the ”profile import” method is used. The source data comes from an already existing ASCII file. The X/Y value pairs contained in the file must be arranged in alternating order of X and Y values. The X/Y value pairs must be separated by tabulators, commas or semicolons (see also chapter ”Mathematical specification of profiles”).

All commissioning steps, including parameter setting, are carried out using the “Global Drive Control” (GDC) program.

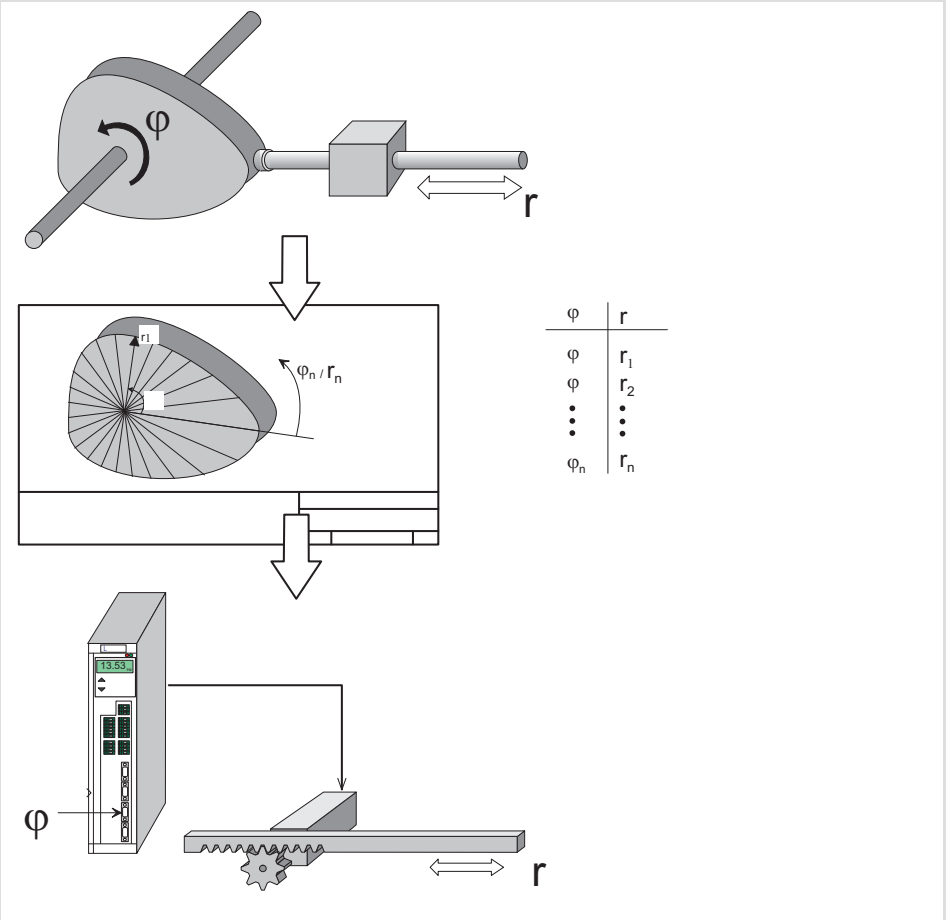


Fig. 6.14-1 Retrofitting of a mechanical cam

Adjustment

Stop!

- ► The sequence listed in the below table must be observed when commissioning the drive.
- ► Create or load the parameter set before the profile data are transferred!

Section	Action	Description
Switch on controller	1. Inhibit controller (X5/28 = LOW). 2. Apply digital terminal signals. 3. Apply analog input signals. 4. Switch on mains supply. The controller is ready for operation after approx. 1 s (2 s for drives with SinCos encoder with serial interface).	📖 6.3-1
Start GDC	5. Start GDC. 6. Set communication parameters for online operation in the ”Actual drive” dialog box and confirm with ”OK”. 7. Select controller in the ”Assign device description to the Basic Unit” dialog box. Confirm with ”OK”.	
Generate parameter set	8. Adapt controller to the mains. 9. Enter motor data. 10. Enter machine constants.	📖 6.5-2 📖 6.5-5 📖 6.5-3
Basic profile data	11. Define the data model. 12. Define the number of profiles required. 13. Enter all necessary data for the profiles required.	📖 6.10-2 📖 6.10-3
Create profiles	14. Open the ”Cam editor” dialog box of GDC. 15. Import the profile data / enter the mathematical formula for the description of the profile. 16. Save profile data to a storage medium 17. Protect profile data by password.	📖 6.10-3 📖 6.10-5
Load basic configuration	18. Load the basic ”Cam profiler” configuration with C0005 = 10000. 19. Adapt basic configuration to the application. 20. Save the settings in the controller with C0003 = 1.	

6.14.2 Multi-axis application

Important notes

- ► With the controllers of firmware version 2.2 and higher, multi-axis applications can be implemented.
- ► From GDC version 3.6 onwards, the ”Electronic cam” function is available.
- ► Load the basic configuration C0005 = 10xxx on all controllers.
- ► Always parameterise and configure only one controller at a time with GDC. GDC may then only communicate with this controller.
- ► Do not change the described commissioning sequence.
- ► Read the chapter ”Before switching on” before switching on the controller.

Description

- The line shaft is the connecting element between mechanical cams.
- With the 9300 servo cam profiler the connection between the drives is implemented via the system bus (CAN):
  - The motion sequence of the communicating drives resulting from the workpiece to be manufactured is identical.
  - The user benefits from a very flexible machine concept.

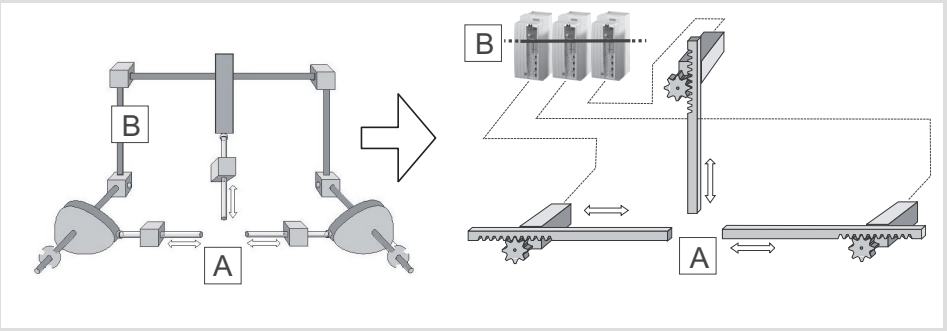


Fig. 6.14-2 Comparison between mechanical and electronic cam

A Workpiece to be machined
B Line shaft

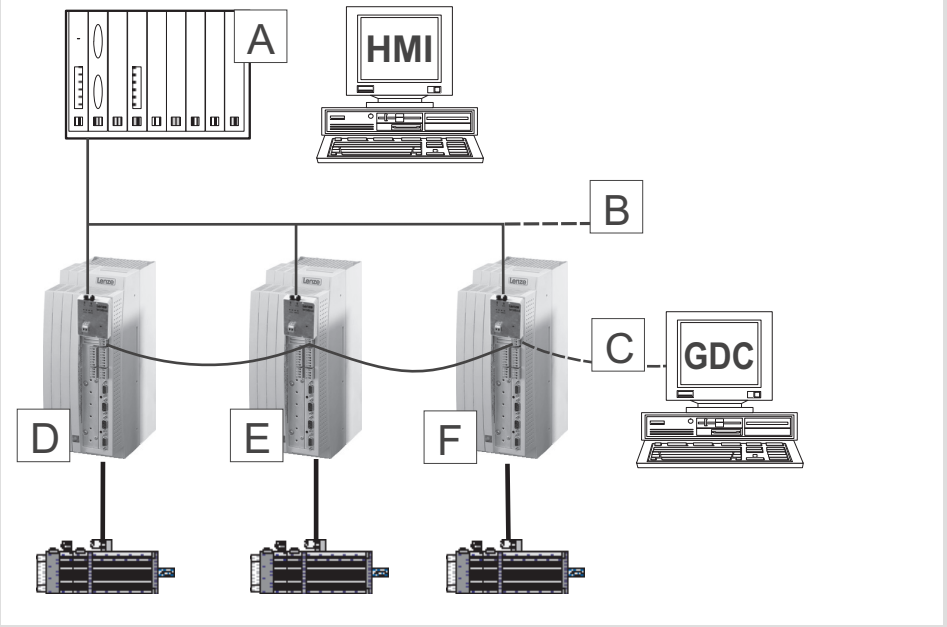
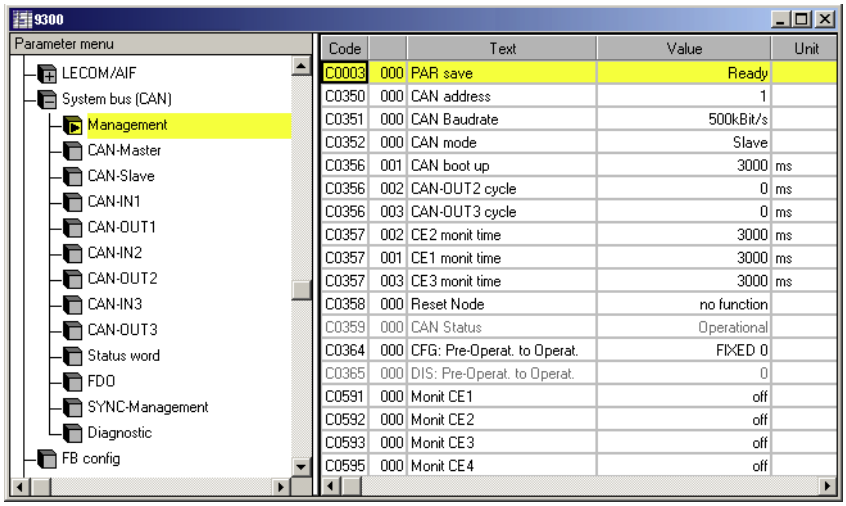


Fig. 6.14-3 Networking of master drive and slave drives via the system bus (CAN)

A Machine control (PLC or IPC)
B Fieldbus
C System bus (CAN)
D Master drive (virtual line shaft)
E Slave drive
F Slave drive

Basic settings for system bus (CAN)

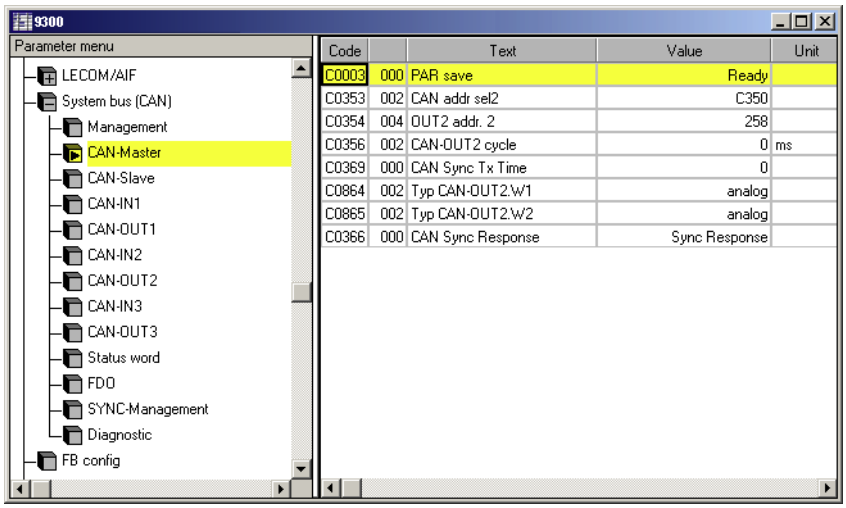


9300std225

Fig. 6.14-4 ”Management” menu of the parameter menu

Procedure	
1.	Change to the ”Management” menu.
2.	Set the node address of the controller under C0350. ● C0350 = 1: Master ● C0350 = 2: Slave 1. The address is increased by 1 for every further slave.
3.	Set the baud rate under C0351. ● The baud rate must be set identically for all controllers. (Recommended: 500 kbps for a cable length of up to 100 m)
4.	Set CAN master operation under C0352. ● C0352 = 1: Master ● C0352 = 0: Slave
5.	Save the settings with C0003 = 1.
6.	When the configuration has been completed, plug in terminal X4 on all controllers.
7.	Execute a ’reset node’ (C0358 = 1) via the master to make the settings effective. ● Alternatively you can switch off the mains and - if used - the external 24V supply and then switch the supply(ies) on again.
8.	Click on C0359 and check the bus state. ● If ”Operational” (C0359 = 0) is displayed, all parameters are set correctly.

Settings for CAN master



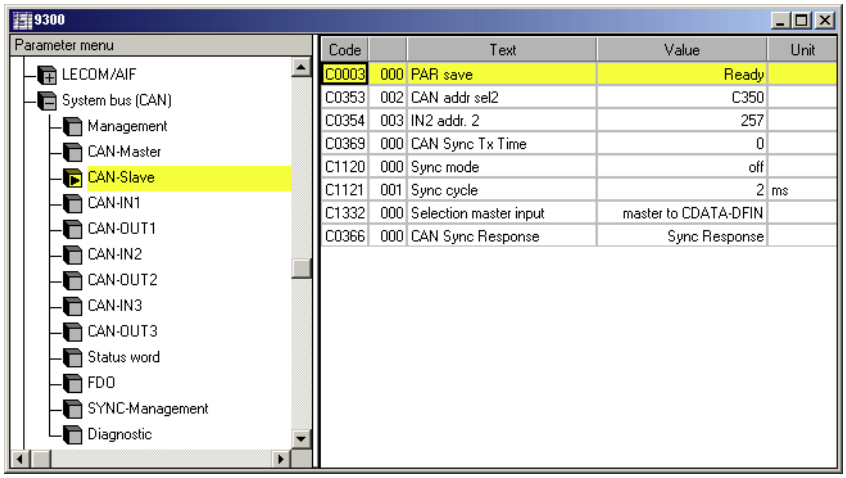
9300std226

Fig. 6.14-5 ”CAN-Master” menu of the parameter menu

Procedure	
1.	Change to the ”CAN-Master” menu.
2.	Set C0353/2 = 0 (own address C354).
3.	Set a cycle time of 1 ms under C0356/2.
4.	Set C0366 = 0 (no sync response). This reduces the load on the bus.
5.	Set the time interval between two sent sync telegrams under C0369. Rule of thumb: 5 ms
6.	Configure the CAN output word CAN-OUT2.W1 (low angle) under C864/2 and the CAN output word CAN-OUT2.W2 (high angle) under C0865/2 .
7.	If possible, locate the function block CAN-OUT2 at the end of the processing table.
8.	Link the output CDATA-X-ACT to the input CAN-OUT2-D1.
9.	Save the settings with C0003 = 1.

Settings for CAN slave

The following settings have to be carried out for all slaves.



9300std227

Fig. 6.14-6 ”CAN-Slave” menu of the parameter menu

Procedure	
1.	Change to the ”CAN-Slave” menu.
2.	Set C0353/2 = 1 (extra address C354). ● This setting ”links” the slaves to the address of the master.
3.	Enter the value from C0354/4 (CAN master) under C0354/3.
4.	Set C0366 = 0 (no sync response). This reduces the load on the bus.
5.	Set C0369 = 0. ● This setting prevents the slave drives from sending sync telegrams.
6.	Set C1120 = 1 (CAN sync activated). This setting activates the sync telegram synchronisation.
7.	Set the time interval at which the slave is to receive the sync telegrams from the master under C1121. ● The time interval must be identical to the time interval set under C0369 (“CAN Sync Tx time” of the master). ● See section ”Master settings”: 5 ms
8.	Set C1332 = 1. The master value is provided by CDATA-XIN.
9.	If possible, locate the function block SYNC2 at the beginning of the processing table.
10.	Link the output CAN-IN2.D1 to the input CDATA-XIN.
11.	If you do not use the function block CAN-OUTx, check that the CAN-OUT address used is not identical to the one used by the master. ● The function blocks CAN-INx are entered in the processing table by default.
12.	Save the settings with C0003 = 1.

6.15 Handwheel function

The handwheel function facilitates set-up and commissioning of the system.

To avoid damage of the machine, the line shaft is moved slowly by hand during the set-up process, while the operator checks the interaction of the axes coupled via the line shaft.

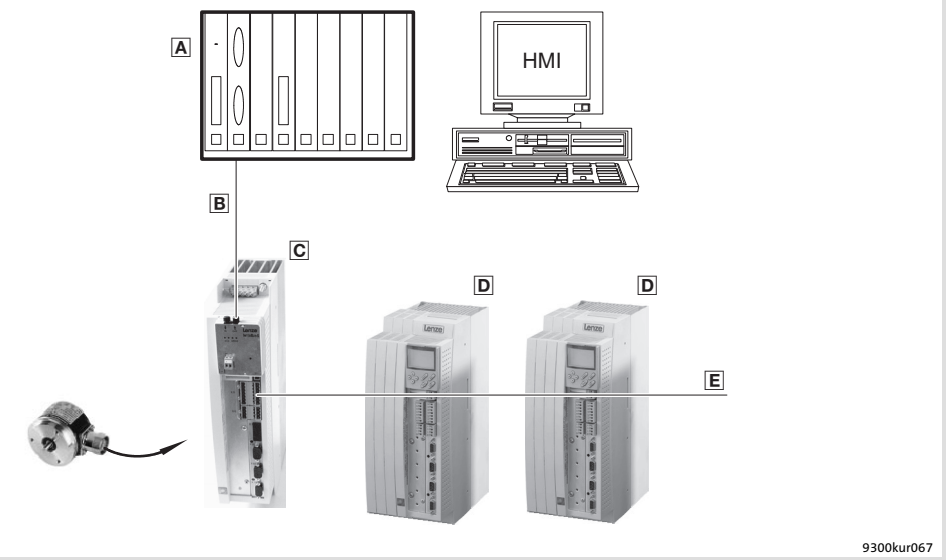


Fig. 6.15-1 Handwheel function of 9300 servo cam profiler

- A PLC/IPC
- B Fieldbus
- C Virtual master
- D Slave
- E System bus (CAN)

Handwheel function of the electronic cam:

- ► To X9 of the master, a simple incremental encoder is connected as a handwheel.
- ► In order to process the incremental encoder signals, function blocks have to be interconnected in the master (see Fig. 6.15-2).
  – It may be necessary to adapt the interconnection to your application.
- ► The handwheel determines the angle of rotation for master and slaves (“line shaft”).
- ► The cams similarly follow the rotation speed and direction of the handwheel.
- ► The 9300 servo cam profiler can be easily and quickly optimised for your application.

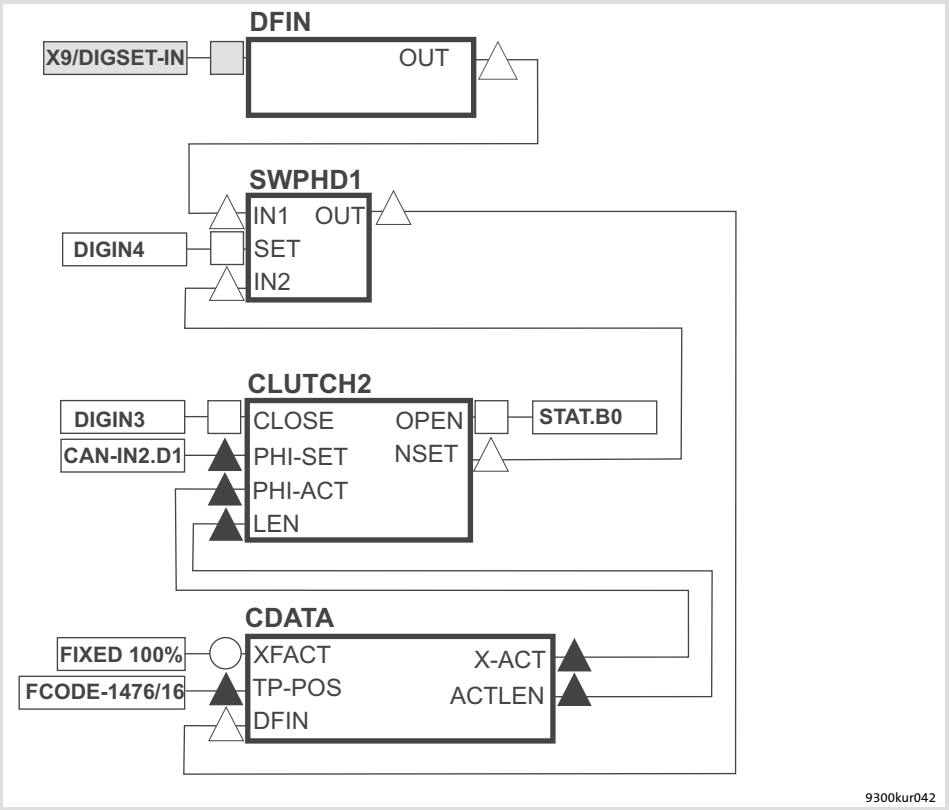


Fig. 6.15-2 Function block interconnection for handwheel function

7 Parameter setting

Contents

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7.2 Parameter setting with the XT EMZ9371BC keypad 7.2-1
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7.1 Important notes

Adapting the controller functions to the application

The controller functions can be adapted to your applications by means of parameterisation. You can either parameterise via keypad, PC or via the parameter channel of a bus system.

The function library contains a detailed description of the functions, the signal flow diagrams contain all configurable signals.

Parameters and codes

The parameters for the functions are stored in numbered codes:

- Codes are marked in the text with a ”C” (e.g. C0002).
- The code table provides a quick overview of all codes. The codes are sorted according to their numbers and can be used as reference. (📖 8.4-1)

Parameter setting via keypad

A quick parameter setting is provided by the keypad XT. Moreover, it serves as status display, error diagnosis and transfer of parameters to other drive controllers.

	Keypad XT EMZ9371BC
Can be used with	8200 vector, 8200 motec, starttec, Drive PLC, 9300 vector, 9300 servo
Operator buttons	8
Plain text display	yes
Menu structure	yes
Configurable menu (“user menu”)	yes
Predefined basic configurations	yes
Non-volatile memory for parameter transfer	yes
Password protection	yes
Diagnosis terminal	Keypad XT in handheld design, IP 20 (E82ZBBXC)
Installation in control cabinet	no
Type of protection	IP 20
Detailed description	📖 7.2-1

Parameter setting via PC

You need the parameter setting / operating software »Global Drive Control« (GDC) or »Global Drive Control easy« (GDC easy) and an interface for communication:

- ► Interface for system bus (CAN) (preset in GDC):
  - – PC system bus adapter
- ► Serial interface for LECOM:
  - – Communication module LECOM-A/B (RS232/RS485) EMF2102IB-V001

The parameter setting /operating software of the Global Drive Control family are easy-to-understand and tools for the operation, parameter setting and diagnostics or Lenze drive controllers.

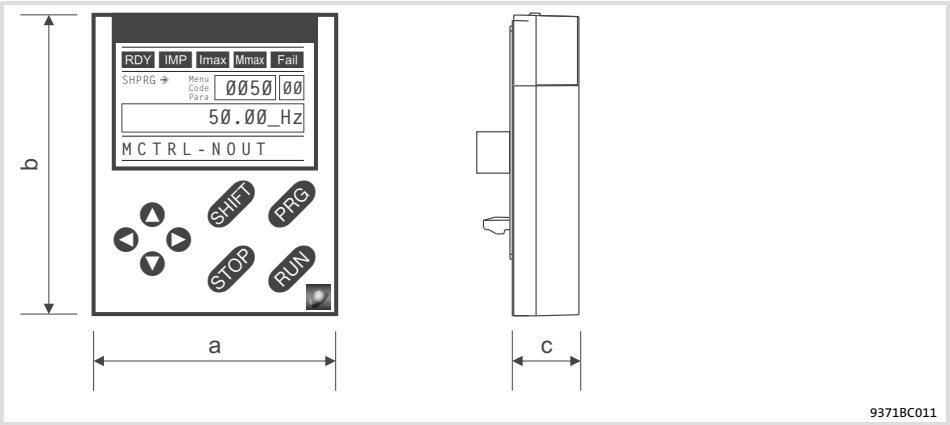
	GDC easy ESP-GDC2-E	**GDC ESP-GDC2**
Supply	Free download from the internet at www.lenze.com	Program package must be charged for
Operation in interactive mode	yes	yes
Comprehensive help functions	yes	yes
Menu ”Short setup”	yes	yes
Monitor windows for displaying operating parameters and for diagnostic purposes	yes	yes
Saving and printing of parameter settings as code list	yes	yes
Loading of parameter files from the controller to the PC	yes	yes
Storing of parameter files from the PC in the controller	yes	yes
Function block editor	no	yes
Technology functions for 9300 Servo	no	yes
Oscilloscope function for 9300 Servo and 9300 vector	no	yes
Detailed description	Online help of the program	Online help of the program

Parameter setting via bus system

Detailed information can be found in the documentation of the corresponding bus system.

7.2 Parameter setting with the XT EMZ9371BC keypad

7.2.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm
Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)
Enclosure		IP 20

7.2.2 Installation and commissioning

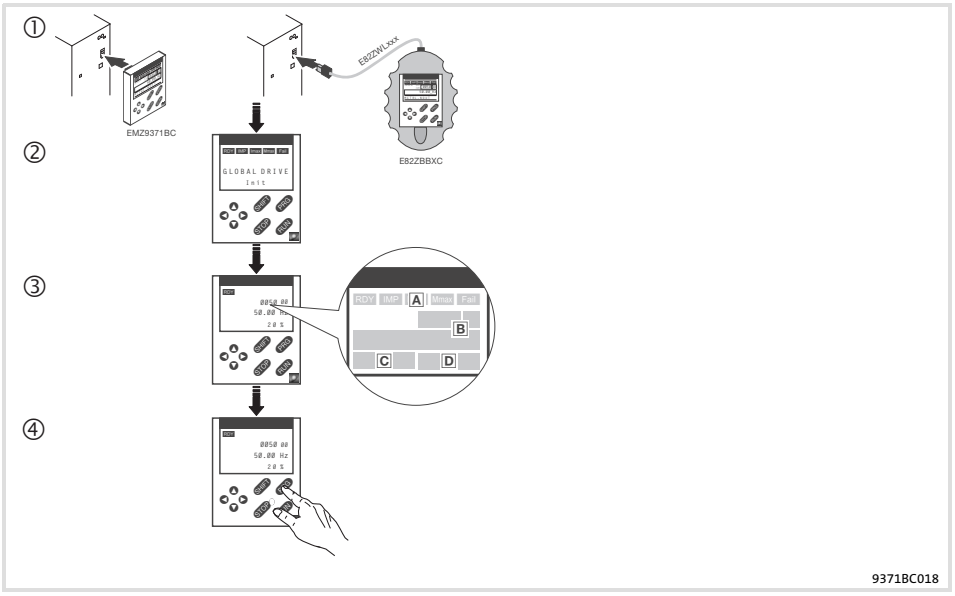


Fig. 7.2-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

- A Current state of the standard device
- B Memory location 1 of the user menu (C0517):
  Code number, subcode number, and current value
- C Active fault message or additional status message
- D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

7.2.3 Display elements and function keys

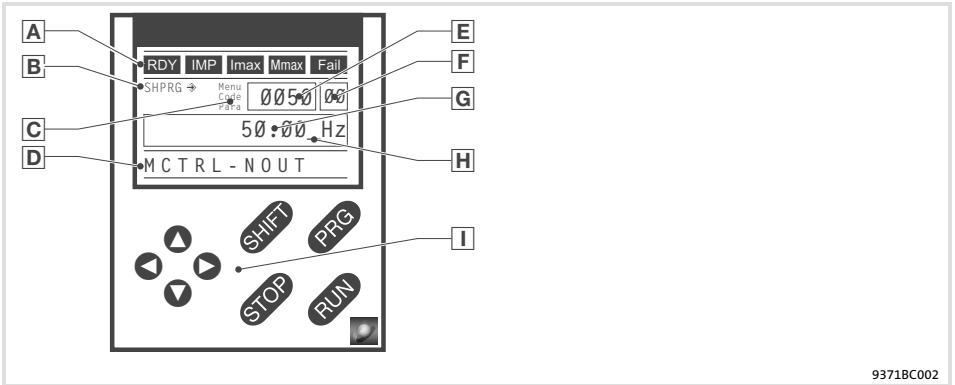


Fig. 7.2-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	Status displays of standard device		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	

	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	
E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:

Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	Code level	Parameter level	Operating level
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations [1]		Accept parameters when SHPRG ⇾ or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset):	1. Remove the cause of malfunction 2. Press STOP 3. Press RUN		

1) Only active for operation with standard devices of the 8200 vector or 8200 motec series

7.2.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit

Step			Key sequence	Action
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG ⇢		SHIFT PRG	Confirm change to accept the parameter Display ”OK”
	Display ⇢		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the ”loop” with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to the parameter level Display ”0” and ”READY”
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set ”1” ”Save PS1”
				Save as parameter set 2: ⇨ Set ”2” ”Save PS2”
				Save as parameter set 3: ⇨ Set ”3” ”Save PS3”
				Save as parameter set 4: ⇨ Set ”4” ”Save PS4”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved in the selected parameter set.
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

[1] The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

7.2.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

7.2.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step		Key sequence	Action
1.	Connect the keypad to standard device 2		
2.	Inhibit controller		Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6		All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu	▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level	PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function		The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.		● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 7.2-6
		▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.		
		▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
			Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
			Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
			Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying	SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level		
	A	PRG	Display of the operating level
	B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.	▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6		
11.	Enable controller		Terminal X5/28 = HIGH The drive is running with the new settings.

7.2.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the "USER menu"		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 "MCTRL-NACT"
3.	Select C0094		▲	Display of code C0094 "Password"
4.	Change to the parameter level		PRG	Display "0" = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"
7.	Change to the "USER menu"		◀ ◀ ▼	

The password protection is active now.
You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 "Password"
3.	Change to the parameter level		PRG	Display "9999" = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"

The password protection is deactivated now. All menus can be freely accessed again.

7.2.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

► monitoring the drive

► fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

7.2.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	**Display**	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

Main menu	Submenus	Description
Display	**Display**	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

8 Configuration

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8.1 Important notes

The chapter ”Configuration” consists of two parts.

System Manual

Contents of the chapter ”Configuration” in the System Manual:

- ► Monitoring
- ► Monitoring functions
- ► Code table
- ► Selection lists
- ► Table of attributes

System Manual (Extension)

Contents of the chapter ”Configuration” in the System Manual (Extension):

- ► Configuring with Global Drive Control (GDC)
- ► Basic configurations
- ► Operating modes

8.2 Monitoring

Different monitoring functions (📖 8.31) protect the drive system from impermissible operating conditions.

If a monitoring function responds,

► the set fault response is triggered to protect the drive and

► the fault message is entered position 1 in the fault history buffer (C0168/x, in case of ECSxP: C4168/x) (📖 9.2-2).

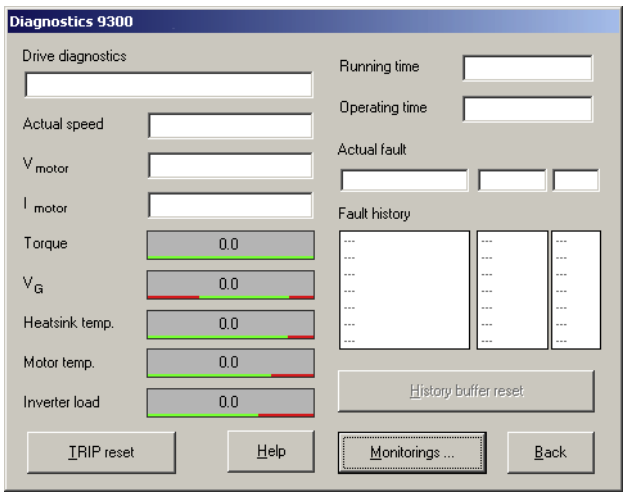
8.2.1 Fault responses

Depending on the failure, one or more of the following responses are possible:

Response	Effects on the drive and the controller		Danger warnings
TRIP (highest priority)	● Switches the power outputs U, V, W to a high resistance until TRIP is reset. ● The drive coasts (no control!). ● After TRIP reset, the drive accelerates to its setpoint on the ramps set.		
Message	Switches the power outputs U, V, W to a high resistance as long as the message is active.		**Danger!** The drive restarts automatically when the message is not pending anymore.
	● Short-term message ≤ 0.5 s	The drive coasts (no control!) as long as the message is active. When the message is not pending anymore, the drive accelerates to its setpoint with maximum torque.	
	● Longer message > 0.5 s	The drive coasts (due to internal controller inhibit) as long as the message is active. If required, restart the drive.	
FAIL-QSP	If a fault occurs, the drive brakes to standstill within the quick stop deceleration time (C0105).		
Warning	● Only display of the failure. ● The drive continues to operate in a controlled manner.		**Stop!** As these responses have no effect on the drive behaviour, the drive can be destroyed.
Off	● No response on failures! Monitoring is deactivated.		

8.2.2 Setting of responses

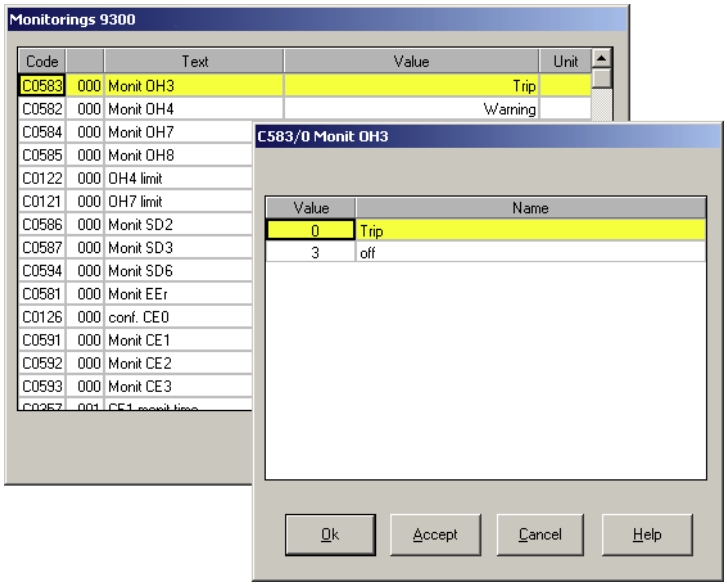
► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 8.2-1 ”Diagnostics” dialog box

► Click on the ”Monitorings” button.



9300std233

Fig. 8.2-2 ”Monitorings” dialog box

1. Click on a monitoring option. The configuration dialog box opens.
2. Select the desired response and confirm with ”OK”.

8.2.3 Monitoring times for process data input objects

Each process data input object can monitor whether a telegram has been received within a time set. As soon as a telegram arrives, the corresponding monitoring time (C0357) is restarted (”retriggerable monoflop” function).

The following assignments are valid:

Setting the response to the monitoring:

► C0591 for CAN1_IN (”CE1”)

► C0592 for CAN2_IN (”CE2”)

► C0593 for CAN3_IN (”CE3”)

The following can be set:

► 0 = error (TRIP) - controller sets controller inhibit (CINH)

► 2 = warning

► 3 = monitoring is switched off

You can also use the signals as binary output signals, e. g. for the assignment of the output terminal.

Bus off

If the controller disconnects from the CAN bus due to faulty telegrams, the ”BusOffState” (CE4) signal is set.

”BusOffState” can trigger an error (TRIP) or warning (like CE1, CE2, CE3). You can also switch the signal off. The response is set via C0595. You can also assign the terminal output.

Reset node

Changes with regard to the baud rates, the CAN node addresses, or the addresses of process data objects are only valid after a reset node.

The reset node can be effected by:

► A reconnection of the low-voltage supply

► Reset node via the bus system

► Reset node via C0358

8.2.4 Maximum speed

Stop!

Destruction of the drive!

- ► If the fault is triggered, the drive is without torque.
- ► In the event of an actual speed value encoder failure it is not guaranteed that the monitoring responds.

Protective measures:

- ► Use a mechanical brake if necessary.
- ► Special, system-specific measures are to be taken.

The NMAX fault is triggered if the system speed (MCTRL-NACT)

- ► exceeds the value set under C0596 or
- ► exceeds the maximum speed n_{max} (C0011) by twice the max. speed value.

A fault initiates TRIP NMAX. Other responses cannot be set.

8.2.5 Motor

Overcurrent in the motor cable (OC1)

Fault OC1 is triggered if the motor current exceeds the 2.25-fold rated controller current.

If a fault occurs, TRIP OC1 is triggered. Other responses cannot be set.

Earth fault in the motor cable (OC2)

The OC2 fault is triggered if

- ► the motor has a short circuit to the frame,
- ► one of the phases has a short circuit to the shield,
- ► one of the phases has a short circuit to PE,
- ► the capacitive charging current of the motor cable is too high.

A fault initiates TRIP OC2. Other responses cannot be set.

Failure of a motor phase (LP1)

If a current-carrying motor phase fails, a motor winding is broken or the current limit value set in C0599 is too high, the LP1 fault is triggered.

The monitoring is not appropriate for field frequencies > 480 Hz and when synchronous servo motors are used. Deactivate the monitoring at these conditions.

The response to exceeding the thresholds can be set under C0597.

Note!

The monitoring can only be activated if the function block MLP1 is entered in the processing table (C0465).

8.2.6 Controller current load (I x t monitoring)

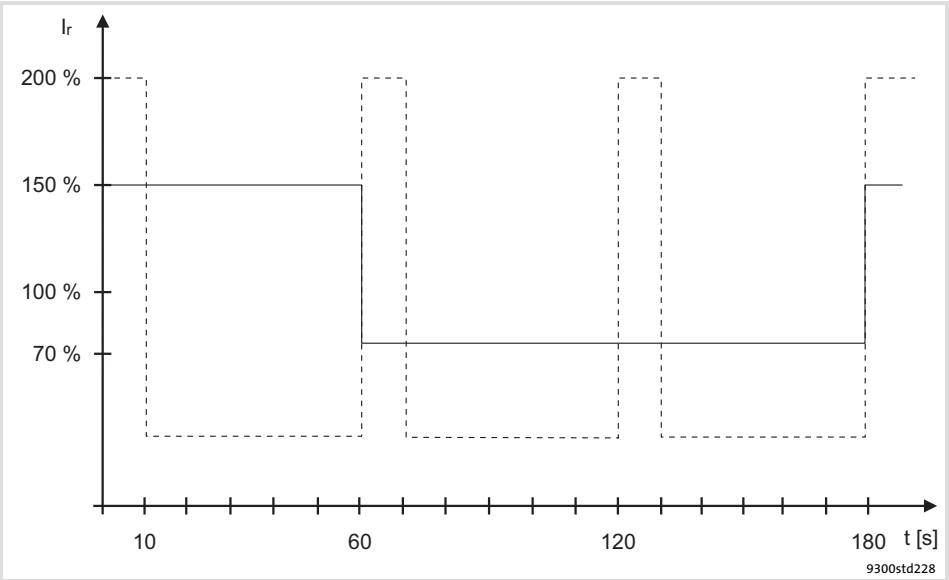


Fig. 8.2-3 I × t diagram

I_r	Device output current
———	100 % continuous thermal current at C0022 ≤ 1.5 I_r
- - - - - -	70 % continuous thermal current at C0022 > 1.5 I_r

The I × t monitoring monitors the current load of the controller. The current load is calculated from the mean value of the motor current over the acquisition period of 180 s.

The monitoring is set in such a way that the following operation modes are possible:

► Continuously with device output current = I_r.

► ≤ 60 s with device output current ≤ 1.5 x I_r.

A fault initiates TRIP OC5. Other responses cannot be set.

8.2.7 Motor temperature

KTY at X7 or X8

The motor temperature is monitored by means of a KTY. Connect the thermal sensor to the resolver cable at X7 or the encoder cable at X8.

► Warning threshold (OH7) can be set via C0121
  – The switch-on point is 5 °C below the threshold set.

► Fixed warning threshold (OH3) = 150 °C
  – The switch-on point is 135 °C.

The response for the case when the thresholds are exceeded can be defined in:

► C0584 (adjustable threshold)

► C0583 (fixed threshold)

Stop!

With the setting C0583 = 3, monitoring is deactivated. The motor temperature in C0063 shows 0 °C, even if C0584 = 2 (warning) is set.

Monitoring of the KTY at X7 or X8

The SD6 fault is triggered if there is a short or open circuit between X7/8 and X7/9 or X8/5 and X8/8.

The response can be set under C0594.

PTC thermistor or thermal contact (NC contact) at T1, T2

The motor temperature is monitored with a PTC thermistor or thermal contact. Wire the temperature sensor to T1, T2.

► Fixed warning threshold (OH8)
  – The switch-off threshold and the hysteresis depend on the temperature sensor (DIN 44081).

The response to exceeding the threshold can be set under C0585.

Stop!

Motor could be destroyed!

► If the responses ”Warning” or ”Off” are set, the motor could be destroyed by overload.

Protective measure:

► Set the response ”TRIP”.

8.2.8 Current load of motor (I^2 x t monitoring: OC6, OC8)

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

8.2.8.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

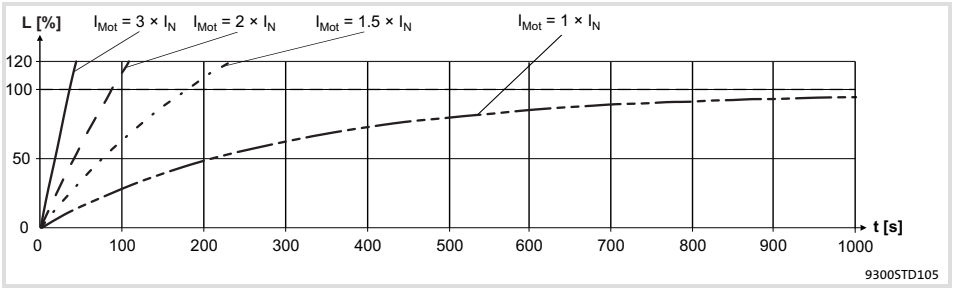


Fig. 8.2-4 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L I^2 x t load of the motor (display: C0066)
T Time

8.2.8.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

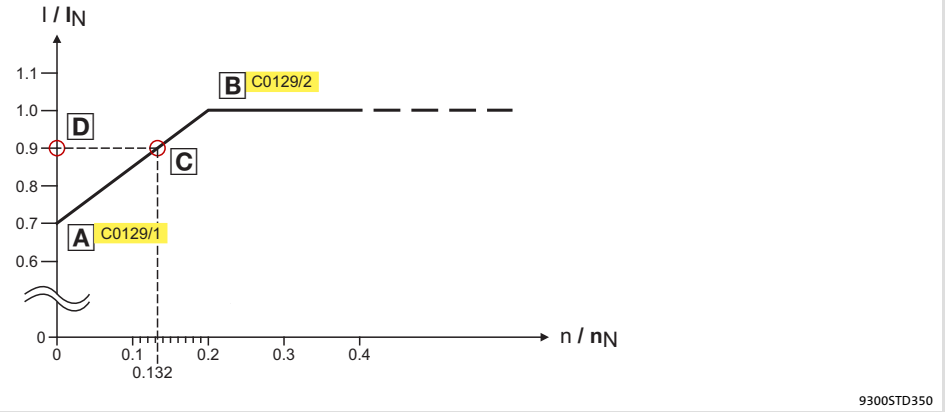


Fig. 8.2-5 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 8.2-5) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

► Point [A]: Definition with **C0129/1**

This value also enables an increase of the maximally permissible load.

► Point [B]: Definition with **C0129/2**

With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 8.2-5, the motor speed and the corresponding permissible motor torque ([D]) can be read for each working point ([C] on the characteristic ([A]) ... [B]). [D] can also be calculated using the values in **C0129/1** and **C0129/2** (evaluation coefficient "y", 📖 8.2-10).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient ”y”).

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

8.2.9 Heatsink temperature

Via a temperature threshold, the heatsink temperature of the controller can be monitored:

- ► Adjustable threshold (OH4) under C0122
  - – The reset point is 5° C below the adjusted threshold.
- ► Fixed threshold (OH) = 85° C
  - – The reset point is at 80° C.

The response for exceeding the adjustable threshold can be set under C0582.

8.2.10 DC-bus voltage

In C0173 the mains voltage and the DC-bus voltage are set. The switching thresholds for overvoltage and undervoltage are based on these settings.

Selection C0173	Mains voltage [V AC]	Braking unit	Message LU (undervoltage) Set [V DC]	Message LU (undervoltage) Reset [V DC]	Message OU (overvoltage) Set [V DC]	Message OU (overvoltage) Reset [V DC]
0	< 400	Yes / no	285	430	770	755
1	400	Yes / no	285	430	770	755
2	400 ... 460	Yes / no	328	473	770	755
3	480	No	342	487	770	755
4	480	Yes	342	487	800	785

C0173 = 1: Lenze setting

Overvoltage

If the DC-bus voltage exceeds the upper switch-off threshold set in C0173, the OU message is triggered.

Undervoltage

If the DC-bus voltage falls below the lower switch-off threshold set in C0173, the LU message is triggered.

- ► An undervoltage message > 3 seconds is interpreted as an operating state (e.g. mains switched off) and entered in the history buffer. The entry is, however, deleted as soon as the cause has been eliminated (e.g. mains switched on again).

  This operating state can occur if the control module is already supplied externally via terminals X5/39 and X5/59, but the mains voltage is not yet switched on.
- ► An undervoltage message < 3 seconds is interpreted as a fault (e.g. mains fault), entered in the history buffer and saved.

8.2.11 External error (EEr)

A HIGH signal at DCTRL-TRIP-SET triggers the EEr fault.

You can, for example, connect the digital input DCTRL-TRIP-SET with an input terminal (X5/Ex). In this way an external encoder can trigger the EEr fault.

The response can be set under C0581.

8.3 Monitoring functions

The responses of monitoring functions can be partly parameterised via codes – in GDC in the parameter menu under **Monitoring** –.

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x071	CCR	System fault	Internal		●				
x091	EEr	External monitoring (triggered via DCTRL)	FWM	C0581	●	✓	✓		✓
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus (C0173)	MCTRL			●			
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x061	CE0	Communication error on the automation interface (AIF)	AIF	C0126	✓		✓		●
x062	CE1	Communication error on the CAN1_IN process data input object (monitoring time adjustable via C0357/1)	CAN1_IN	C0591	✓		✓		●
x063	CE2	Communication error on the CAN2_IN process data input object (monitoring time adjustable via C0357/2)	CAN2_IN	C0592	✓		✓		●
x064	CE3	Communication error on the CAN3_IN process data input object (monitoring time adjustable via C0357/3)	CAN3_IN	C0593	✓		✓		●
x065	CE4	BUS-OFF state of the system bus (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x166	P16	Faulty transmission of the sync telegram (system bus CAN)	Internal	C1290/1	✓		✓	●	✓
Temperatures / sensors									
x050	OH	Heatsink temperature > 85° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582			●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584			●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high. **Caution: At "warning" (C0585 = 2) or "off" (C0585 = 3), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0585	✓		✓		●
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x110	H10	Thermal sensor error at the heatsink	FWM	C0588	●		1)		1)
x111	H11	Thermal sensor error in the device interior	FWM	C0588	●		1)		1)
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		Description	Source	Code	TRIP	Message	Warning	Fail-QSP	Off
0015	OC5	Device utilisation I x t (fix 100%)	MCTRL		●				
0016	OC6	I^2 x t overload	MCTRL		●				
0018	OC8	I^2 x t overload advance warning	MCTRL	C0606	✓		●		✓
x032	LP1	Failure of a motor phase (current limit adjustable under C0599) **Caution: Can only be used with asynchronous motors. The function block MLP1 must be entered in C0465.**	MCTRL	C0597	✓		✓		●
x082	Sd2	Resolver error at X7 **Note:** If monitoring is switched off or in the case of "Warning", the machine can reach very high speeds in the case of fault, which may result in the damage of the motor and the machine that is driven!	MCTRL	C0586	●		✓		✓
x083	Sd3	Interruption of the digital frequency coupling. The input signal "Lamp Control" at X9/8 is LOW **Please note: In the case of "Warning" (C0587 = 2), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0587	●		✓		✓
x085	Sd5	At analog input X6/1, X6/2, the input current is < 2 mA Monitoring only possible if C0034 = 1	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder error at X8	MCTRL		✓				●
x088	Sd8	SinCos encoder error at X8 (filter setting under C0575)	MCTRL	C0580	✓				●
Speed									
x190	nErr	Speed control error (speed window adjustable under C0576)	MCTRL	C0579	✓	✓	✓		●
x200	NMAX	Maximum speed (C0596) has been exceeded.	MCTRL		●				
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x153	P03	Following error (digital frequency > C0255)	Internal	C0589	✓		●		✓
x163	P13	Angle controller overflow	Internal	C0590	●		✓		✓
x169	P19	Input signal at X9 is limited	Internal	C1292	✓		●		✓
Parameter setting									
0072	PR1	Check sum error in parameter set 1	Internal		●				
0074	PEr	Program error	Internal		●				
0075	PR0	Error in the parameter sets	Internal		●				
0079	PI	Error during parameter initialisation	Internal		●				
x089	PL	Error during rotor position adjustment	Internal		●				

Explanation of the error numbers:

x 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
e.g. "2091": An external monitoring has triggered the warning EEr
1) May only be set by Lenze service personnel

8.4 Code table

How to read the code table

Column	Abbreviation		Meaning	
Code	Cxxxx		Code Cxxxx	• Parameter value of the code can be defined differently for each parameter set • Parameter value is accepted immediately (ONLINE)
	1		Subcode 1 of Cxxxx	
	2		Subcode 2 of Cxxxx	
	ENTER		Changed parameter of code or subcode is accepted after pressing SHIFT PRG	
	STOP		Changed parameter of code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited	
Designation			Designation of the code	
Lenze			Lenze setting (value at delivery or after restoring the delivery status with C0002)	
	→		The column "IMPORTANT" contains additional information	
	Disp		The code only displays a value. It cannot be configured.	
Selection	1 {%} 99		Min. value {unit} max. value	
IMPORTANT	-		Short, important explanation	

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0002 STOP	PAR LOAD	0			**Load parameter set**
			0	Default setting	Restore delivery status
			1	Load parameter set 1	Load and activate the parameter set stored in the controller • Parameter set 1 is loaded automatically after every mains connection.
			11	Load parameter set externally	Load parameter set from the keypad into the controller
C0003	PAR SAVE	0			**Save parameter set**
			0	Done	Saving completed
			1	Save parameter set 1	Save the parameters loaded into the controller in the parameter set
C0004	OP DISPLAY	56	0 {1} 1999		**Operating display** Keypad shows selected code in the operating level if no other status messages of C0183 are active

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0005 STOP	SIGNAL CFG	1000			**Signal configuration** (Predefined basic configurations)
			0	COMMON	Changed basic configuration
			100	Empty	All internal links are deleted
			1000	Speed control	The first two digits indicate the predefined basic function, e.g. ● 01xxx: speed control ● 10xxx: cam profiling The third digit indicates the additional function: ● xx0xx: no additional function ● xx1xx: homing function ● xx2xx: clutch function ● xx3xx: switching points ● xx4xx: mains failure control ● xx8xx: mark-controlled correction of the master value ● xx9xx: mark-controlled correction of the actual value The fourth digit indicates the predefined voltage source for the control terminals: ● xxx0x: external supply voltage ● xxx1x: internal supply voltage The fifth digit indicates the predefined device control: ● xxxx0: terminal control ● xxxx1: RS232, RS485 or optical fibre ● xxxx3: INTERBUS or PROFIBUS-DP ● xxxx5: system bus (CAN)
			10000	Cam	
			11000	Welding bar	
			12000	Cam with position storage	
			13000	Cam with virtual master	
			14000	Cam with virtual master and welding bar	
			15000	Cam with virtual master and position storage	
			16000	Cam with absolute master value	
			17000	Welding bar with absolute master value	
			18000	Cam with absolute master value and position storage	
C0006 STOP	OP MODE	→			**Motor control mode**
			1	SSC standard motor, sensorless, in star connection	→ Depending on C0086 ● Change of C0086 resets value to the assigned default setting ● Change of C0006 sets C0086 = 0!
			2	Asynchronous servo motor, in star connection	
			3	PM servo motor, synchronous, in star connection	
			11	SSC standard motor, sensorless, in delta connection	
			22	Asynchronous servo motor, in delta connection	
C0009	LECOM ADDRESS	1	1	{1} 99	**LECOM device address** Bus device number for operation via interface ● 10, 20, ..., 90 reserved for broadcast to device groups for RS232, RS485, fibre optics.
C0011	NMAX	3000	500	{1 rpm} 16000	**Max. speed Nmax** Reference value for the absolute and relative setpoint selection for the acceleration and deceleration times. ● For parameter setting via interface: – Greater changes in one step should only be made when the controller is inhibited.

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0012	TIR (ACC)	0.000	0.000	{0.001 s}	999.900	**NSET** Acceleration time T_{ir} for the main setpoint of NSET (referring to speed change 0 ... n_{max})
C0013	TIF (DEC)	0.000	0.000	{0.001 s}	999.900	NSET Deceleration time T_{if} Tif for the main setpoint of NSET (referring to speed change n_{max} ... 0)
C0017	FCODE (QMIN)	50	-16000	{1 rpm}	16000	**FCODE (Qmin)** Switching threshold $n_{act} < n_x$ n_{act} < C0017 activates the comparator output CMP1-OUT
C0018	FCHOP	1	0 1 2	16/8 kHz 8 kHz sine 16 kHz sine		**Switching frequency fchop** Noise-optimised operation with automatic changeover to 8 kHz
C0019	THRESH NACT=0	0	0	{1 rpm}	16000	**Threshold n_{act} =0** Threshold detection at n_{act} = 0
C0021	SLIPCOMP	0.00	0.00	{0.01 %}	20.00	**Slip compensation** ● Active only for sensorless control below the value entered under C0291
C0022	IMAX CURRENT	→	0	{0.01 A}	1.50 I_r	**I_{max} limit current** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting (1.5 × Imotor)
C0025 STOP	FEEDBACK TYPE	10				**Feedback** Input of the encoder specified on the nameplate of the Lenze motor: C0025 automatically changes C0420, C0490, C0495
			0	COMMON		C0420, C0490 or C0495 has been changed subsequently
			1	No feedback		Control without feedback system (sensorless control, SSC)
			10	RSx (resolver)		The resolver is labelled with RSxxxxxxxx. When a resolver is selected, the rotor displacement angle in C0058 is set to -90°.
			110	IT-512-5V		Incremental encoder with TTL level
			111	IT-1024-5V		
			112	IT-2048-5V		
			113	IT-4096-5V		
			210	IS-512-5V		SinCos encoder
			211	IS-1024-5V		
			212	IS-2048-5V		
			213	IS-4096-5V		
			309	AS-128-8V (SKS)		Single-turn SinCos encoder with RS485 interface from Stegmann ● Enter the supply voltage under C0421.
			310	AS-512-8V (SCS)		
			311	AS-1024-8V (SRS)		
			409	AM-128-8V (SKM)		Multi-turn SinCos encoder from Stegmann ● Enter the supply voltage under C0421.
			410	AM-512-8V (SCM)		
			411	AM-1024-8V (SRM)		
C0026			-199.99	{0.01 %}	199.99	**FCODE (OffsetAIN)** Freely assignable code for relative analog signals ● Used for: – Offset for terminal X6/1,2 – Offset for terminal X6/3,4
1	FCODE (OFFSET)	0.00				
2	FCODE (OFFSET)	0.00				

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0027			-199.99	{0.01 %}	199.99	**FCODE (gain AIN)** Freely assignable code for relative analog signals ● Used for: – Gain X6/1,2 – Gain X6/3,4
1	FCODE (GAIN)	100.00				
2	FCODE (GAIN)	100.00				
C0030	DFOUT CONST	3	0	256 inc./rev.		**DFOUT constant** Constant for the digital frequency output in increments per revolution
			1	512 inc./rev.		
			2	1024 inc./rev.		
			3	2048 inc./rev.		
			4	4096 inc./rev.		
			5	8192 inc./rev.		
			6	16384 inc./rev.		
C0032	FCODE GEARBOX	1	-32767	{1}	32767	**FCODE (gearbox factor numerator)** Freely assignable code
C0033	GEARBOX DENOM	1	1	{1}	32767	**Gearbox factor denominator**
C0034	MST CURRENT	0	0	-10 V ... + 10 V		**Master voltage/master current** Selection for setpoint entry
			1	+4 mA ... +20 mA		
			2	-20 mA ... +20 mA		
C0037	SET-VALUE RPM	0	-16000	{1 rpm}	16000	**Setpoint selection (rpm)**
C0039			-199.99	{0.01 %}	199.99	**NSET JOG setpoints** Fixed speeds (JOG setpoints) can be selected for NSET using digital inputs
1	JOG SET-VALUE	100.00				
2	JOG SET-VALUE	75.00				
3	JOG SET-VALUE	50.00				
4	JOG SET-VALUE	25.00				
5	JOG SET-VALUE	0.00				
...	...	...				
14	JOG SET-VALUE	0.00				
15	JOG SET-VALUE	0.00				
C0040	CTRL ENABLE	1	0	Controller inhibited		**Controller enable (RFR)**
			1	Controller enabled		
C0042	QSP	Disp	1	QSP: Inactive		**Quick stop**
			2	QSP: Active		
C0043	TRIP RESET	0	0	Trip reset		**Reset error** Reset of an active trip: ● Set C0043 = 0
			1	Error active		
C0045	ACT JOG	Disp	0	Nset is active		**NSET** JOG selection
			1	JOG 1		
			2	JOG 2		
			...	...		
			15	JOG 15		
C0046	NSET-N	Disp	-199.99	{0.01 %}	199.99	**NSET** Main setpoint
C0049	NSET-NADD	Disp	-199.99	{0.01 %}	199.99	**NSET** Additional setpoint
C0050	MCTRL-NSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL** n_{set} at speed controller input
C0051	MCTRL-NACT	Disp	-30000	{1 rpm}	30000	**Actual speed value**
C0052	MCTRL-UMOT	Disp	0	{1 V}	800	**Motor voltage**
C0053	UG-VOLTAGE	Disp	0	{1 V}	900	**DC-bus voltage**

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0054	IMOT	Disp	0.0	{0.1 A}	300.0	**Actual motor current I_{mot}** **MCTRL function block** ● Read only ● MCTRL-IACT = 100 % = C0022
C0056	MCTRL-MSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL-MSET2 (Mset)** Torque setpoint (output n-controller)
C0057	MAX TORQUE	Disp	0	{1 Nm}	500	**Maximum torque (C86/C22)** Maximum possible torque of the drive configuration ● Depending on C0022, C0086
C0058	ROTOR DIFF	-90.0	-180.0	{0.1 °}	179.9	**Rotor displacement angle** Zero phase of the rotor for synchronous motors (C0095) Is set to -90° when a resolver is selected in C0025 or C0495.
C0059	MOT POLE NO.	Disp	1	{1}	50	**Number of motor pole pairs**
C0060	ROTOR POS	Disp	0	{1}	2048	**Motor rotor position** ● 1 rev. = 2048 inc.
C0061	HEATSINK TEMP	Disp	0	{1 °C}	100	**Heatsink temperature**
C0063	MOT TEMP	Disp	0	{1 °C}	200	**Motor temperature**
C0064	UTILIZATION IXT	Disp	0	{1 %}	150	**Device utilisation Ixt** Utilisation of the most recent 180 s ● C0064 > 100 % releases Trip OC5 ● Trip reset is possible only if C0064 < 95 %
C0064	UTILIZATION I2XT	Disp	0	{1 %}	150	**I^2xt motor utilisation**
C0067	ACT TRIP	Disp	All fault messages		→ Selection list 10	**Error message TRIP** Current fault message
C0070	VP SPEED CTRL	→	0.0	{0.5}	255.0	**V_{pn} speed controller** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0071	TN SPEED CTRL	→	1.0	{0.5 ms}	600.0	**T_{nn} speed controller** For values > 512 ms the function is deactivated → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0072	TD SPEED CTRL	0.0	0.0	{0.1 ms}	32.0	**T_{dn} speed controller**
C0075	VP CURR CTRL	0.35	0.00	{0.01}	15.99	**V_{pi} current controller** ● Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0076	TN CURR CTRL	1.8	0.5	{0.1 ms}	2000.0	**T_{ni} current controller** Setting the value 2000 ms deactivates the function ● Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0077	VP FIELD CTRL	0.25	0.00	{0.01}	15.99	**V_{pF} field controller**
C0078	TN FIELD CTRL	15.0	1.0	{0.5 ms}	8000.0	**T_{nF} field controller** Setting the value 8000 ms deactivates the function

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0081 STOP	MOT POWER	→	0.01	{0.01 kW}	150.00	**Rated motor power** acc. to nameplate → Depending on C0086 ● Change of C0086 resets value to the assigned default setting ● Change of C0081 sets C0086 = 0
C0084 STOP	MOT RS	→	0.00	{0.01 Ω}	150.00	**Motor stator resistance** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0085 STOP	MOT LS	→	0.00	{0.01 mH}	655.35	**Motor leakage inductance** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0086 STOP	MOT TYPE	→			See motor selection list	**Motor type selection** → Depending on the controller used ● Change of C0086 resets C0006, C0022, C0070, C0071, C0075, C0076, C0081, C0084, C0085, C0087, C0088, C0089, C0090, C0091 to the assigned default setting
			Controller	Lenze setting	Assigned motor type	Lenze motor type
			EVS9321	110	MDSKS56-23-150	MDSKSXX056-23, f_r: 150Hz
			EVS9322	111	MDSKS56-33-150	MDSKSXX056-33, f_r: 150Hz
			EVS9323	112	MDSKS71-13-150	MDSKSXX071-13, f_r: 150Hz
			EVS9324	116	MDSKS71-33-150	MDSKSXX071-33, f_r: 150Hz
			EVS9325	15	MDFKA80-120	MDFKAXX080-22, f_r: 120Hz
			EVS9326	19	MDFKA90-120	MDFKAXX090-22, f_r: 120Hz
			EVS9327	23	MDFKA100-120	MDFKAXX100-22, f_r: 120Hz
			EVS9328	27	MDFKA112-120	MDFKAXX112-22, f_r: 120Hz
			EVS9329	225	30kW-ASM-50	–
			EVS9330	227	45kW-ASM-50	–
			EVS9331	228	55kW-ASM-50	–
			EVS9332	229	75kW-ASM-50	–
C0087 STOP	MOT SPEED	→	300	{1 rpm}	16000	**Rated motor speed** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0088 STOP	MOT CURRENT	→	0.2	{0.1 A}	500.0	**Rated motor current** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0089 STOP	MOT FREQUENCY	→	10	{1 Hz}	1000	**Rated motor frequency**
C0090 STOP	MOT VOLTAGE	→	50	{1 V}	500	**Rated motor voltage** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0091 STOP	MOT COS PHI	→	0.50	{0.01}	1.00	**Motor cos φ** → Depending on C0086 ● Change of C0086 resets value to the assigned default setting
C0093	DRIVE IDENT	Disp	0 1 93xx	Defective power section No power section 93xx		**Controller identification** 93xx: servo cam profiler type

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0094	PASSWORD	0	0	{1}	9999	**Password** ● Parameter access protection for the keypad. When the password is activated, only the codes of the user menu can be accessed. For further selection options see C0096
C0095 STOP	ROTOR POS ADJ	0	0 Inactive 1 Active			**Rotor position adjustment** for a synchronous motor ● C0058 displays the zero angle of the rotor ● C0095 = 1 starts position adjustment
C0096 STOP			0 No password protection 1 Read protection 2 Write protection 3 Read/write protection			Extended password protection for bus systems with activated password (C0094). ● All codes in the user menu can be fully accessed.
1	AIF PROTECT.	0				AIF access protection
2	CAN PROTECT.	0				CAN access protection
C0099	S/W VERSION	Disp	x.xx			Software version
C0100		Disp	0	{1 ns}	32767	Service code May only be set by Lenze service personnel
1	CDATA					
2	CCTRL					
3	VMAS					
4	YSET					
5	CLUTCH1					
6	CSEL					
7	CSEL					
8	CONVPHD1					
9						
10	MSEL1					
11	MSEL2					
12	CCTRL					
13	WELD					
14	RFGPH1					
15	CONVPHPHD1					
16	CURVEC1					
C0101			0.000	{0.001 s}	999.900	**NSET** Additional acceleration for the main setpoint (refers to speed change 0...$n_{max.}$)
1	NSET-TIR (HOCHLF.)	0.000				
2	NSET TIR	0.000				
...	...	...				
15	NSET-TIR	0.000				
C0103			0.000	{0.001 s}	999.900	**NSET** Additional deceleration times for the main setpoint (refers to speed change 0...$n_{max.}$)
1	NSET-TIF	0.000				
2	NSET-TIF	0.000				
...	...	...				
15	NSET-TIF	0.000				
C0105	QSP TIF	0.000	0.000	{0.001 s}	999.900	**QSP deceleration time** Deceleration time for quick stop (QSP) (refers to speed change 0...$n_{max.}$)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0108		100.00	-199.99	{0.01 %}	199.99	**FCOD (gain AOUT)**
1	FCOD (VERST.AOUT)					
2	FCOD (VERST.AOUT)					
C0109			-199.99	{0.01 %}	199.99	**FCODE (Offset AOUT)**
	FCODE (OFFSET)	0.00				
	FCODE (OFFSET)	0.00				
C0114			0 HIGH active 1 LOW active			**DIGIN polarity** Terminal polarity
1	DIGIN1 POL	0				X5/E1
2	DIGIN2 POL	0				X5/E2
3	DIGIN3 POL	0				X5/E3
4	DIGIN4 POL	1				X5/E4
5	DIGIN5 POL	0				X5/E5
C0116 STOP					→ Selection list 2	Signal configuration **FD0-xx** Free digital outputs can only be evaluated when networked with automation interfaces.
1	FDO-O0	1000	FIXED0			
...	...	...	...			
32	FDO -31	1000	FIXED0			
C0117 STOP		→			→ Selection list 2	**DIGOUTx** Signal configuration → Depending on C0005
1	DIGOUT1	15000	DCTRL-TRIP			X5/A1
2	DIGOUT2	10650	CMP1-OUT			X5/A2
3	DIGOUT3	500	DCTRL-RDY			X5/A3
4	DIGOUT4	5003	MCTRL-MMAX			X5/A4
C0118			0 HIGH active 1 LOW active			**DIGOUTx** Terminal polarity
1	DIGOUT1 POL	1				X5/A1
2	DIGOUT2 POL	1				X5/A2
3	DIGOUT3 POL	0				X5/A3
4	DIGOUT4 POL	0				X5/A4
C0120	OC6 LIMIT	0	0	{1 %}	120	**Threshold for $I^2 \times t$ monitoring (motor).** ● 0 = $I^2 \times t$ monitoring switched off ● $I^2 \times t$ > C0120 ⇨ Trip OC6
C0121	OH7 LIMIT	150	45	{1 °C}	150	**Temperature for OH7** Threshold for motor temperature warning
C0122	OH4 LIMIT	85	45	{1 °C}	85	**Temperature for OH4** Threshold for heatsink temperature warning
C0125	BAUDRATE	0	0 9600 baud 1 4800 baud 2 2400 baud 3 1200 baud 4 19200 baud			**LECOM baud rate** LECOM baud rate for 2102 module

Code		Possible settings					IMPORTANT
No.	Designation	Lenze	Selection				
C0126	MONIT CE0	3	0 2 3	TRIP Warning Off			**Configuration of CE0** Configuration of communication error monitoring with automation interface CE0
C0127	OC8 LIMIT	0	0	{1 %}		120	**Threshold for $I^2 \times t$ advance warning (motor)** ● 0 = $I^2 \times t$ advance warning switched off ● $I^2 \times t$ > C0127 ⇨ Fault message OC8 (response set in C606)
C0128	TAU MOTOR	5.0	0.1	{0.1 min}		50.0	**Thermal time constant of the motor** The time constant is required for calculating the $I^2 \times t$ disconnection.
C0130	ACT TI	Disp					**NSET act. Ti times** Active T_i times of NSET
C0134	RFG CHARAC	0	0 1	Linear S-shaped			**NSET RFG characteristic** Characteristic of ramp function generator for main setpoint
C0135	CONTROL WORD	0	0	{1}		65535	**Control word** Controller control word for LECOM-A/B/LI or keypad.
C0136		Disp					
1	CTRLWORD C135						**Control word C135**
2	CTRLWORD CAN						**Control word CAN**
3	CTRLWORD AIF						**Control word AIF**
C0141	FCODE (SETVAL)	0.0	-199.9	{0.1 %}		199.9	**Main setpoint**
C0142	START OPTIONS	1					**Start options**
			0	Start lock			● Automatic start inhibited after – mains connection – cancelling of a message (t > 0.5 s) – TRIP reset ● Start after HIGH-LOW-HIGH level change at X5/28
			1	Auto start			Automatic start when X5/28 = HIGH
C0150	STATUS WORD	Disp	0	{1}		65535	**Status word** when networked with automation interfaces ● Binary interpretation indicates the bit states
C0151	FDO (DW)	Disp					Display (hex.) of the free digital output signals configured with C0116 ● Binary interpretation indicates the bit states
C0155	STATUS WORD 2	Disp	Bit00	Fail	Bit08	CW/CCW	**Status word 2** Extended decimal status word ● Binary interpretation indicates the bit states
			Bit01	Mmax	Bit09	–	
			Bit02	Imax	Bit10	–	
			Bit03	IMP	Bit11	–	
			Bit04	RDY	Bit12	–	
			Bit05	CINH	Bit13	–	
			Bit06	Trip	Bit14	–	
			Bit07	Init	Bit15	–	

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0156 STOP			→ Selection list 2	Configuration of user-definable bits of the status word
1	STAT.B0	1000	DCTRL-PAR*1-O	
2	STAT.B2	5002	MCTRL-IMAX	
3	STAT.B3	5003	MCTRL-MMAX	
4	STAT.B4	5050	NSET-RFG I=O	
5	STAT.B5	10650	CMP1-OUT	
6	STAT.B14	505	DCTRL-CW/CCW	
7	STAT.B15	500	DCTRL-RDY	
C0157		Disp		Display of user-definable bits of the status word
1	(C0156/1)			
...	...			
7	(C0156/7)			
C0161	ACT TRIP	Disp	All fault messages	**Error message Trip** Current fault message (as under C0168/1)
C0167	RESET FAILMEM	0	0 No reset 1 Reset	**History buffer reset** C0167 = 1 deletes the history buffer
C0168		Disp	All fault messages	List of errors occurred
1	FAIL NO. ACT			Currently active fault
2	FAIL NO. OLD1			Last fault
...	...			...
8	FAIL NO. OLD7			Last but six fault
C0169		Disp	Corresponding mains switch-on time	List showing when the faults under C0168 occurred (referring to C0179)
1	FAILTIME ACT			Currently active fault
2	FAILTIME OLD1			Last fault
...	...			...
8	FAILTIME OLD7			Last but six fault
C0170		Disp	Corresponding mains switch-on time	List showing how often the faults under C0168 have occurred consecutively History buffer
1	COUNTER ACT			Currently active fault
2	COUNTER OLD1			Last fault
...	..			...
8	COUNTER OLD7			Last but six fault
C0172 STOP	OV REDUCE	0	0 {10 V} 100	**OV reduce** Threshold for activating the brake torque reduction before OU message

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0173 STOP	UG LIMIT	1				**Adaptation of DC-bus voltage thresholds** Check during commissioning and adapt if necessary! All interconnected drive components must have the same thresholds!
			0	Mains<400V +-brake LU=285V, OU=770V-755V		Operation on mains <400 V with or without brake unit
			1	Mains=400V +-brake LU=285V, OU=770V-755V		Operation on 400 V mains with or without brake unit
			2	Mains=460V +-brake LU=328V, OU=770V-755V		Operation on 460 V mains with or without brake unit
			3	Mains=480V -brake LU=342V, OU=770V-755V		Operation on 480 V mains without brake unit
			4	Mains=480V +brake LU=342V, OU=800V-785V		Operation on 480 V mains with brake unit
C0178	OP TIMER	Disp	0	{1 s}	4294967295	**Elapsed-hour meter** ● Time when the controller was enabled
C0179	MAINS TIMER	Disp	0	{1 s}	4294967295	**Power-on time meter** ● Time when the mains was switched on
C0182	TI S-SHAPED	20.00	0.01	{0.01 s}	50.00	**NSET** T_i time of the S-shaped ramp function generator (determines the shape of the S profile) ● Small values ⇒small S rounding ● Large values ⇒large S rounding

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0183	DIAGNOSTICS	Disp				**Drive diagnostics** ● Indicates fault or status information ● If several fault or status information units are active simultaneously, the information unit with the smallest number is displayed
			0	OK		No fault
			91	TRIP set C0135		TRIP via LECOM-A/B/LI or keypad
			92	Trip-Set AIF		TRIP via AIF
			93	Trip set CAN		TRIP via CAN
			101	Initialisation		Initialisation phase
			102	TRIP/fault		TRIP active
			103	Emergency stop		Emergency stop has been executed
			104	Pulse inhibit message		Message active
			105	Power OFF		Function is not supported
			111	Operation inhibit-C135		Operation inhibited
			112	Operation inhibit-AIF		
			113	Operation inhibit-CAN		
			121	Controller inhibit, terminal 28		Controller inhibited via X5/28
			122	Controller inhibit, internal 1		DCTRL-CINH1
			123	Controller inhibit, internal 2		DCTRL-CINH2
			124	Controller inhibit-C135/STOP		STOP key at the keypad
			125	Controller inhibit-AIF		Controller inhibited via AIF
			126	Controller inhibit-CAN		Controller inhibited via system bus
			141	Switch-on inhibit		Restart protection active
			142	Pulse inhibit		High-resistance power outputs
			151	QSP-terminal, external quick stop		Quick stop via MCTRL-QSP
			152	QSP-C135 quick stop		Quick stop via STOP key of the keypad
			153	QSP-AIF quick stop		Quick stop via AIF
			154	QSP-CAN quick stop		Quick stop via system bus
			250	Warning C168		Warning active
C0190	NSET ARIT	0	0 1 2 3 4 5	OUT = C46 C46 + C49 C46 - C49 C46 * C49 C46 / C49 C46/(100 - C49)		**NSET** Arithmetic block in the function block NSET Connects main setpoint C0046 and additional setpoint C0040
C0195	BRK1 T ACT	99.9	0.0	{0.1 s}	99.9	**BRK1 brake engagement time** Engagement time of the mechanical holding brake ● After the time under C0195 has elapsed, the status ”mechanical brake closed” is reached
C0196	BRK T RELEASE	0.0	0.0	{0.1 s}	60.0	**BRK1 brake disengagement time** Disengagement time of the mechanical holding brake (see technical data of the brake). ● After the time under C0196 has elapsed, the status ”mechanical brake open” is reached
C0200	S/W ID	Disp				**Software ID** Software identification
C0201	S/W DATE	Disp				**Software release** Date of software release

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0202	INTERNAL IO	Disp	0	{0.001}	100.000	**Internal identification**
C0203	KOMM.-NO.	Disp	x / xxxx / xxxxx			**Commission number**
C0204	SERIAL-NO.	Disp	0	{1}	65535	**Serial number**
C0206	PRODUCT DATE	Disp				**Production date of the device**
C0207	DL INFO 1	Disp				**Download info 1**
C0208	DL INFO 2	Disp				**Download info 2**
C0209	DL INFO 3	Disp				**Download info 3**
C0220	NSET TIR ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Acceleration time T_{ir} of the additional setpoint for NSET (refers to speed change 0...$n_{max.}$)
C0221	NSET TIF ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Deceleration time T_{if} of the additional setpoint for NSET (refers to speed change 0...$n_{max.}$)
C0222	PCTRL1 VP	1.0	0.1	{0.1}	500.0	**PCTRL1** V_p gain
C0223	PCTRL1 TN	400	20	{1 ms}	99999	**PCTRL1** T_n I component 99999 ms: Switched off
C0224	PCTRL1 KD	0.0	0.0	{0.1}	5.0	**PCTRL1** K_d differential component
C0241	CMP RFG-I = O	1.00	0.00	{0.01 %}	100.00	**NSET** Threshold of ramp function generator for main setpoint input = output, (100 % = n_{max})
C0244	BRK M SET	0	-100.00	{1.00 %}	100.00	**BRK1** Holding torque of the DC injection brake 100 % = value of C0057
C0250	FCODE 1BIT	0	0 Lower limit 1 Upper limit			**FCODE 1bit digital**
C0252	ANGLE OFFSET	0	-245760000	{1 inc}	245760000	**DFSET** Phase offset, constant angular offset for digital frequency configurations ● 1 rev = 65536 inc
C0253	ANGLE N-TRIM	→	-32767	{1 inc}	32767	**DFSET** Speed-dependent phase trimming → Depending on C0005, C0025, C0490 ● Change of C0005, C0025, or C0490 resets C0253 to the default setting ● 1 rev = 65536 inc ● C0253 is reached at 15000 rpm
C0254	VP ANGLE CTRL	0.4000	0.0000	{0.0001}	3.9999	**MCTRL** V_p phase controller
C0255	THRESHOLD P03	327680	10	{1 inc}	1800000000	**Following error limit P03** ● 1 rev = 65536 inc ● Following error > C0255 triggers fault "P03"
C0260	MPOT1 HIGH	100.00	-199.99	{0.01 %}	199.99	**MPOT1** Upper limit (condition: C0260 > C0261)
C0261	MPOT1 LOW	-100.0	-199.99	{0.01 %}	199.99	**MPOT1** Lower limit (condition: C0261 < C0260)
C0262	MPOT1 TIR	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Acceleration time (referring to change 0 ... 100 %)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0263	MPOT1 TIF	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Deceleration time (referring to change 0 ... 100 %)
C0264	MPOT1 ON/OFF	0	0 1 2 3 4 5	No change Deceleration with T_{if} to 0% Deceleration with T_{if} to C0261 Jump with T_{if} = 0 to 0% Jump with T_{if} = 0 to C0261 Acceleration with T_{ir} to C0260		**MPOT1** Functions which can be executed when the motor potentiometer is deactivated via input MPOT1-INACTIVE.
C0265	MPOT1 INIT	0	0 1 2	Value during mains failure Lower limit of C0261 0 %		**MPOT1** Initialisation Value which is accepted at mains switching and activated motor potentiometer
C0267 STOP					→ Selection list 2	**MPOT1** Configuration of digital input signals
1	UP	1000	FIXED0			
2	DOWN	1000	FIXED0			
C0268 STOP	MPOT1-INACT	1000	FIXED0		→ Selection list 2	**MPOT1** Configuration of digital input signal
C0269		Disp				
1	(C0267/1)					
2	(C0267/2)					
3	(C0268)					
C0291	SSC OVERRIDE	0	0	{1 rpm}	16000	**SSC override frequency** Override frequency for the transition from sensorless control to controlled operation
C0292	SSC IM SET	0.00	0.00	{0.01 A}	500.00	**SSC Im setpoint** Motor current setpoint. For sensorless control, set 1.0 to 1.1-fold increased rated motor current.
C0293	SSC DYNAMIC	0.00	0.00	{0.01 %}	199.00	**SSC dynamic constant**
C0294	VP FRQ CTRL	→	0.0	{0.1}	99.9	**Vp frequency controller** Proportional gain of frequency controller → Depending on C0086
C0295	TN FRQ CTRL	→	2	{1 ms}	20000	**Tn frequency controller** Reset time of frequency controller → Depending on C0086
C0296	DYNAMIC CONST	100	0	{0.1}	32767	**Dynamic constant**
C0325	VP2 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL1 Adaptation Vp2** Process controller adaptation gain (V_{p2})
C0326	VP3 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL1 Adaptation Vp3** Process controller adaptation gain (V_{p3})
C0327	SET2 ADAPT	100.00	0.00	{0.01 %}	100.00	**PCTRL1 Adaptation nset2** Speed setpoint threshold of process controller adaptation (condition: C0327 > C0328)
C0328	SET1 ADAPT	0.00	0.00	{0.01 %}	100.00	**PCTRL1 Adaptation nset1** Speed setpoint threshold of process controller adaptation (condition: C0328 < C0327)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0329	ADAPT ON/OFF	0	0 1 2 3	no process controller adaptation (C0222) PCTRL1-ADAPT + linear characteristic PCTRL1-ADAPT + 3-point characteristic System deviation + 3-point characteristic		**PCTRL1 Adaptation On/Off** Activation of process controller adaptation
C0332	PCTRL1 TIR	0.000	0.000	{0.001 s}	999.900	**PCTRL1** Acceleration time Tir (referring to setpoint change 0 ... 100 %)
C0333	PCTRL1 TIF	0.000	0.000	{0.001 s}	999.900	**PCTRL1** Deceleration time Tif (referring to setpoint change 0 ... 100 %)
C0336	ACT VP	Disp	0.0	{0.1}	500.0	**PCTRL1** Actual V_p
C0337	BI/UNIPOLAR	0	0 1	Bipolar Unipolar		**PCTRL1** Bipolar/unipolar range of action
C0338	ARIT1 FUNCT	1	0 1 2 3 4 5 15	OUT = IN1 OUT = IN1 + IN2 OUT = IN1 - IN2 OUT = IN1 × IN2 OUT = IN1 / IN2 OUT = IN1 / (100% – IN2) OUT = IN1 % IN2		**ARIT1** Function selection
C0339 STOP			→ Selection list 1			**ARIT1** Configuration of analog input signals
1	ARIT1-IN1	1000	FIXED0%			
2	ARIT1-IN2	1000	FIXED0%			
C0340		Disp				**ARIT1** Display of analog input signals
1	(C0339/1)					
2	(C0339/2)					
C0350	CAN ADDRESS	1	1	{1}	63	**CAN** System bus node address ● Change becomes effective after ”reset node” command
C0351	CAN BAUDRATE	0	0 1 2 3 4	500 kbps 250 kbps 125 kbps 50 kbps 1000 kbps		**CAN** System bus baud rate ● Change becomes effective after ”reset node” command
C0352	CAN MST	0	0 1	Slave Master		**CAN** Configuration of system bus node ● Change becomes effective after ”reset node” command
C0353			0 1	C0350 C0354		**CAN** Source for system bus address
1	CAN ADDR SEL1	0				CAN-IN1, CAN-OUT1
2	CAN ADDR SEL2	0				CAN-IN2, CAN-OUT2
3	CAN ADDR SEL3	0				CAN-IN3, CAN-OUT3

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0354			1	{1}	513	**CAN** Selective system bus address ● Individual addressing of system bus process data objects
1	IN1 ADDR2	129				CAN-IN1
2	OUT2 ADDR2	1				CAN-OUT1
3	IN2 ADDR2	257				CAN-IN2
4	OUT2 ADDR2	258				CAN-OUT2
5	IN3 ADDR2	385				CAN-IN3
6	OUT2 ADDR2	386				CAN-OUT3
C0355		Disp	0	{1}	2047	**CAN** System bus identifier
1	IN1 ID					
2	OUT1 ID					
3	IN2 ID					
4	OUT2 ID					
5	IN3 ID					
6	OUT3 ID					
C0356			0	{1 ms}	65000	**CAN** System bus time settings
1	CAN BOOT UP	3000				Required for CAN network without master
2	OUT2 CYCLE	0				0 = event-controlled process data transfer
3	OUT3 CYCLE	0				>0 = cyclic process data transfer
4	CAN DELAY	20				The delay time ”CANdelay” starts when the NMT status ”operational” has been reached (after ”pre-operational” or ”stopped”). When the delay time has elapsed, the PDOs CAN-OUT2 and CAN-OUT3 are sent for the first time.
C0357			0	{1 ms}	65000	**CAN** System bus monitoring times ● The CAN objects will stay in receive mode after a fault message
1	CE1 MONIT TIME	3000				CAN-IN1
2	CE2 MONIT TIME	3000				CAN-IN2
3	CE3 MONIT TIME	3000				CAN-IN3
C0358	RESET NODE	0	0 1	No function CAN reset		**CAN** Establishment of a system bus reset node
C0359	CAN STATE	Disp	0 1 2 3	Operational Pre-operational Warning Bus OFF		**CAN** System bus status

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0360		Disp	0		65535	**CAN** Telegram counter (number of telegrams) Count values > 65535: Restart with 0
1	MESSAGE OUT					All sent telegrams
2	MESSAGE IN					All received telegrams
3	MESSAGE OUT1					Telegrams sent on CAN-OUT1
4	MESSAGE OUT2					Telegrams sent on CAN-OUT2
5	MESSAGE OUT3					Telegrams sent on CAN-OUT3
6	MESSAGE OUT1					Telegrams sent on parameter channel 1
7	MESSAGE OUT2					Telegrams sent on parameter channel 2
8	MESSAGE IN1					Telegrams received from CAN-IN1
9	MESSAGE IN2					Telegrams received from CAN-IN2
10	MESSAGE IN3					Telegrams received from CAN-IN3
11	MESSAGE IN1					Telegrams received from parameter channel 1
12	MESSAGE IN2					Telegrams received from parameter channel 2
C0361		Disp	0.00	{1.00 %}	100.00	**CAN** Bus load of system bus To ensure a perfect operation, the total bus load (all connected devices) should be less than 80%
1	LOAD OUT					All sent telegrams
2	LOAD IN					All received telegrams
3	LOAD OUT1					Telegrams sent on CAN-OUT1
4	LOAD OUT2					Telegrams sent on CAN-OUT2
5	LOAD OUT3					Telegrams sent on CAN-OUT3
6	LOAD OUT1					Telegrams sent on parameter channel 1
7	LOAD OUT2					Telegrams sent on parameter channel 2
8	LOAD IN1					Telegrams received from CAN-IN1
9	LOAD IN2					Telegrams received from CAN-IN2
10	LOAD IN3					Telegrams received from CAN-IN3
11	LOAD IN1					Telegrams received from parameter channel 1
12	LOAD IN2					Telegrams received from parameter channel 2
C0362	SYNC CYCLE	1.000	-32.000	{0.100 ms}	32.000	**CAN** Time between two sync telegrams on the system bus
C0363	SYNC CORR	1	1 0.8 µs 2 1.6 µs 3 2.4 µs 4 3.2 µs 5 4.0 µs			**CAN** Correction value for C0362
C0364 STOP	CAN ACTIV	1000	FIXED0		→ Selection list 2	**CAN** Configuration of digital input signal ● Switches the system bus from ”pre-operational” to ”operational” via an external signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0365	(C0364)	Disp				**CAN** State of the system bus
C0366	SYNC RESPONSE	1	0 1	No sync response Sync response		**CAN** Response to sync telegram from the master
C0367	SYNC RX ID	128	1	{1}	256	**CAN** Receive identifier (Rx) ● Sync identifier used for grouping for data acceptance in CAN-IN1
C0368	SYNC TX ID	128	1	{1}	256	**CAN** Transmit identifier (Tx) ● Identifier for generating a sync telegram
C0369	SYNC TX TIME	0	0	{1}	65000	**CAN** Sync transmission interval (Tx) ● Transmission interval for the object set under C0368
C0387	-	0	0 1	Active data field Background data field		**Profile data field**
C0389	-	0	0 1	CAM-DATA offline CAM-DATA online		**Profile data**
C0400	AIN1-OUT	Disp	-199.99	{0.01 %}	199.99	**AIN1** Display of output signal
C0402 STOP	OFFSET	19502	FCODE-26/1		→ Selection list 1	**AIN1** Offset configuration
C0403 STOP	GAIN	19504	FCODE-27/1		→ Selection list 1	**AIN1** Gain configuration
C0404		Disp	-199.99		199.99	**AIN1** Display of analog input signals
1	(C0402)					
2	(C0403)					
C0405	OUT	Disp	-199.99		199.99	**AIN2** Display of output signal
C0407 STOP	AIN2-OFFSET	19503	FCODE-26/2		→ Selection list 1	**AIN2** Offset configuration
C0408 STOP	AIN2-GAIN	19505	FCODE-27/2		→ Selection list 1	**AIN2** Gain configuration
C0409		Disp	-199.99	{0.01 %}	199.99	**AIN2** Display of analog input signals
1	(C0407)					
2	(C0408)					
C0416 STOP	RESOLVER ADJ	0	0	{1}	99999999	**Correction of the resolver error** For Lenze motors, read resolver error from the nameplate
C0420 STOP	ENCODER CONST	512	1	{1 inc/rev}	8192	Encoder constant for **encoder input X8** in increments per revolution
C0421 STOP	ENC VOLTAGE	5.00	5.00	{0.1 V}	8.00	**Encoder voltage** Setting of the encoder supply voltage ● CAUTION: Incorrect input may destroy the encoder
C0425	DFIN CONST	3	0 1 2 3 4 5 6	256 inc./rev. 512 inc./rev. 1024 inc./rev. 2048 inc./rev. 4096 inc./rev. 8192 inc./rev. 16384 inc./rev.		**DFIN** Number of increments of the digital frequency input
C0426	DFIN-OUT	Disp	-32767	{1 rpm}	32767	Output signal of DFIN

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0427	DFIN FUNCTION	0	0 2-phase 1 A pulse / B direction 2 Pulses A or B			**DFIN** Selection of the digital frequency signal
C0430			0.000	{0.001 ms}	2.000	Delay of the touch-probe signal
1	TP1 DELAY	0.218				Touch-probe signal at X5/E1
2	TP2 DELAY	0.218				Touch-probe signal at X5/E2
3	TP3 DELAY	0.218				Touch-probe signal at X5/E3
4	TP4 DELAY	0.218				Touch-probe signal at X5/E4
5	TP5 DELAY	0.218				Touch-probe signal at X5/E5
C0431 STOP	IN	5001	MCTRL-NACT		→ Selection list 1	**AOUT1** Configuration of analog input signal
C0432 STOP	OFFSET	19512	FCODE-109/1		→ Selection list 1	**AOUT1** Offset configuration
C0433 STOP	GAIN	19510	FCODE-108/1		→ Selection list 1	**AOUT1** Gain configuration
C0434		Disp	-199.99	{0.01 %}	199.99	**AOUT1** Display of analog input signals
1	(C0431)					
2	(C0432)					
3	(C0433)					
C0436 STOP	IN	5002	MCTRL-MSET2		→ Selection list 1	**AOUT2** Configuration of analog input signal
C0437 STOP	OFFSET	19513	FCODE-109/2		→ Selection list 1	**AOUT2** Offset configuration
C0438 STOP	GAIN	19511	FCODE-108/2		→ Selection list 1	**AOUT2** Gain configuration
C0439		Disp	-199.99	{0.01 %}	199.99	**AOUT2** Display of analog input signals
1	(C0436)					
2	(C0437)					
3	(C0438)					
C0440 STOP	STATE-BUS	1000			→ Selection list 2	Configuration of state bus X5/ST
C0441	(C0440)	Disp				
C0443	DIGIN-OUT	Disp	0	{1}	255	Signals at X5/E1 to X5/E5, decimal value ● Binary interpretation indicates terminal signals
C0444	(C0118)	Disp	0		1	
C0450 STOP	NX	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration of analog input signal
C0451 STOP	SET	1000	FIXED0		→ Selection list 2	**BRK1** Configuration of digital input signal
C0452 STOP	SIGN	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration of analog input signal
C0458		Disp	-199.99	{0.01 %}	199.99	**BRK1** Display of analog input signals
1	(C0450)					
2	(C0452)					
C0459	(C0451)	Disp				**BRK1** Display of digital input signal

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0464	CUSTOMER I/F	Disp	0 1	Original Changed	**Customer interface** Status of selected basic configuration ● Reassignment of terminals in a basic configuration of C0005 does not change C0005 and sets C0464 = 1 ● Adding or removing function blocks or changing the signal flow between the function blocks in a basic configuration of C0005 sets C0005 = 0 and C0464= 1
C0465 STOP	FB LIST	→		→ Selection list 5	**FB processing table** Contains the program for signal processing (sequence in which the function blocks are processed) → Depending on C0005. Changing C0005 loads the assigned processing table → Valid for C0005 = 1000 ● After changing the signal flow, the processing table must be adapted. Otherwise the controller may use the wrong signals! ● The function blocks DIGIN, DIGOUT, AIF-IN, CAN-IN and MCTRL are always processed and do not have to be entered in the table.
1		200			
2		0			
3		50			
4		0			
5		0			
6		55			
7		0			
8		0			
9		10250			
10		0			
11		0			
12		0			
13		5650			
14		0			
15		0			
16		5050			
...		0			
19		5700			
...		0			
22		10650			
...		0			
25		70			
..		0			
28		75			
...		0			
31		250			
...		0			
41		25000			
42		20000			
...		0			
49		0			
50		0			
C0466	CPU T REMAIN	Disp			**Remaining process time** Time remaining for processing function blocks
C0469 STOP	FUNKTION KEY STOP	2	0 1 2	Switched off Set controller inhibit Set quick stop	Setting the function of the keypad STOP key

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0470			0	{1}	255	Freely assignable code for digital signals ● The data words C0470 and C0471 are in parallel and are identical
0	FCODE 8BIT DIGITAL	0				
1	FCODE BIT 0-7	0				
2	FCODE BIT8-15	0				
3	FCODE BIT16-23	0				
4	FCODE BIT24-31	0				
C0471	FCODE 32 BIT	0	0	{1}	4294967296	**FCODE 32 bits digital** Freely assignable code for digital signals ● The data words C0470 and C0471 are in parallel and are identical
C0472	FCODE ANALOG		-199.99	{0.01 %}	199.99	Freely assignable code for relative analog signals
1		0.00				
2		0.00				
3		100.00				
6		100.00				
...		...				
19		0.00				
20		0.00				
C0473	FCODE ABS		-32767	{1}	32767	**FCODE** Freely assignable code for absolute analog signals
1		1				
2		1				
3		0				
...		...				
9		0				
10		0				
C0474	FCODE PH		-2147483647	{1}	2147483647	**FCODE** Freely assignable code for phase signals 1 rev = 65536 inc
1		0				
...		...				
10		0				
C0475	FCODE PHD		-16000	{1 rpm}	16000	**FCODE** Freely assignable code for speed signals/digital frequency signals
1		0				
2		0				
3		0				
4		0				
5		0				
C0490 STOP	FEEDBACK POS	0				**Position feedback system** Feedback system for the position controller
			0	Resolver at X7		The feedback system can be merged with the settings of C0495 = 0, 1, 2, 3, 4.
			1	Encoder TTL at X8		The selection also sets C0495 to the same value.
			2	Sin encoder at X8		
			3	Absolute value encoder ST at X8		
			4	Absolute value encoder MT at X8		

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0495 STOP	FEEDBACK N	0			**Speed feedback system** Feedback system for the speed controller
			0	Resolver at X7	The feedback system can be merged with the settings of C0490 = 0, 1, 2, 3, 4. ● A setting of C0495 = 0 sets the rotor displacement angle in C0058 to -90°
			1	Encoder TTL at X8	The selection also sets C0490 to the same value.
			2	Sin/cos encoder at X8	
			3	Hiperface single-turn absolute value encoder at X8	
			4	Hiperface multi-turn absolute value encoder at X8	
C0497	NACT-FILTER	2.0	0.0	{0.1 ms} 50.0	**Nact filter time constant** Time constant for actual speed value C0497 = 0 ms: Switched off
C0499		0			**Mode of profile data access protection**
			0	Read/write protection	
			1	Only read protection	
			2	Only write protection	
C0500	CAM CHECK ACTUAL CURVE	0			**CAM check of actual profile**
			0	No CAM check	
			1	CAM check of all data	
			2	CAM check, X axis only	
			3	CAM check, Y axis only	
C0503			0	{1} 65535	**Password** The allocation of passwords prevents unauthorised access to profile data and parameter set
1		0			PIN - profile data
2		0			Master PIN - profile data
C0506		Disp			
1					Version
2					Data field length

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0517			0.00	{0.01}	1999.00	**User menu** Up to 32 entries ● Under the subcode, the number of the desired code is entered. ● Input format: xxx.yy – xxx: Code number – yy: Subcode number ● There is no check for existence of entered code.
1	USER MENU	51.00	C0051/0 MCTRL-NACT			
2	USER MENU	54.00	C0054/0 Imot			
3	USER MENU	56.00	C0056/0 MCTRL-MSET2			
4	USER MENU	46.00	C0046/0 N			
5	USER MENU	49.00	C0049/0 NADD			
6	USER MENU	183.00	C0183/0 Diagnostics			
7	USER MENU	168.01	C0168/1 Fail no. act			
8	USER MENU	86.00	C0086/0 Mot type			
9	USER MENU	22.00	C0022/0 Imax current			
10	USER MENU	5.00	C005/0 Signal cfg			
11	USER MENU	11.00	C0011/0 Nmax			
12	USER MENU	12.00	C0012/0 T_{ir}			
13	USER MENU	13.00	C0013/0 T_{if}			
14	USER MENU	105.00	C0105/0 QSP T_{if}			
15	USER MENU	39.01	C0039/1 JOG setpoint			
16	USER MENU	70.00	C0070/0 Vp speed CTRL			
17	USER MENU	71.00	C0071/0 Tn speed CTRL			
18	USER MENU	0	Not assigned			
...	...	0	Not assigned			
31	USER MENU	94.00	C0094/0 Password			
32	USER MENU	3.00	C0003/0 Par save			
C0520 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**DFSET** Configuration of input signal
C0521 STOP	VP-DIV	1000	FIXED0%		→ Selection list 1	**DFSET** Configuration of gain factor numerator
C0522 STOP	RAT-DIV	1000	FIXED0%		→ Selection list 1	**DFSET** Configuration of gearbox factor numerator
C0523 STOP	A-TRIM	1000	FIXED0%		→ Selection list 1	**DFSET** Configuration of phase trimming
C0524 STOP	N-TRIM	1000	FIXED0%		→ Selection list 1	**DFSET** Speed trimming of DFSET
C0525 STOP	0-PULSE	1000	FIXED0		→ Selection list 2	**DFSET** Configuration of one-time zero pulse activation
C0526 STOP	RESET	1000	FIXED0		→ Selection list 2	**DFSET** Integrator resetting
C0527 STOP	SET	1000	FIXED0		→ Selection list 2	**DFSET** Configuration of integrator setting
C0528		Disp	$-2 \cdot 10^9$	{1}	$2 \cdot 10^9$	**DFSET**
1	0-PULSE A					Phase difference between 2 zero pulses
2	OFFSET					Offset results from C0523 × C0529 + C0252
C0529	MULTIP OFFSET	1	-20000	{1}	20000	**Offset multiplier**
C0530	DF EVALUATION	0	0 With gearbox factor 1 Without gearbox factor			**DFSET** Evaluation of the digital frequency
C0531	ACT 0 DIV	1	1	{1}	16384	**DFSET actual zero pulse divider**

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0532	0-PULSE/TP	1	1 2 3	0-pulse Touch probe 0-pulse **and** touch probe		**DFSET zero pulse/touch probe** Selecting zero pulse, touch probe or zero pulse **and** touch probe
C0533	VP DENOM	1	1	{1}	32767	**DFSET Vp denominator** Gain factor denominator
C0534	0 PULSE FCT	0	0 1 2 10 11 12 13	Inactive Continuous Cont. switchable Once, fast way Once, CW Once, CCW Once, 2 × zero pulse		**DFSET** Zero pulse function
C0535	SET 0 DIV	1	1	{1}	16384	**DFSET** Setpoint zero pulse divider
C0536		Disp	-32767	{1}	32767	**DFSET** Display of analog input signals
1	(C0521)					
2	(C0522)					
3	(C0523)					
C0537	(C0524)	Disp	-199.99	{0.01 %}	199.99	**DFSET** Display of analog input signal
C0538		Disp				**DFSET** Display of digital input signals
1	(C0525)					
2	(C0526)					
3	(C0527)					
C0539	(C0520)	Disp	-32767	{1 rpm}	32767	**DFSET** Display of input signal
C0540	FUNCTION	2	0 1 2 3 4 5	Analog input Phase difference input Resolver simulation + zero pulse Resolver simulation, no zero pulse X10 = X9 X10 = X8		**DFOUT** Function of the encoder output
C0541 STOP	AN-IN	5001	MCTRL-NACT		→ Selection list 1	**DFOUT** Configuration of analog input
C0542 STOP	DF-IN	1000	FIXEDPHI-0		→ Selection list 4	**DFOUT** Configuration of digital frequency input
C0544 STOP	SYN-RDY	1000	FIXED0		→ Selection list 2	**DFOUT** Synchronisation signal for zero pulse
C0545	PH OFFSET	0	0	{1 inc}	65535	**DFOUT** Phase offset
C0546	PULSE MIN SET	1000	1	{1inc}	2147483647	**DFOUT** Masking (suppression) of interference pulses at X5/E5 (setpoint pulse of the touch probe signal) ● The size of the masking window between two setpoint pulses is set
C0547	(C0541)	Disp	-199.99	{0.01 %}	199.99	**DFOUT** Display of analog input signal
C0548	(C0544)	Disp	0		1	**DFOUT** Display of digital input signal
C0549	(C0542)	Disp	-32767	{1 rpm}	32767	**DFOUT** Display of input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0560	FIX SET-VALUE		-199.99	{0.01 %}	199.99	**Fixed setpoints**
1		100				
2		75				
3		50				
4		25				
5		0				
...		...				
15		0				
C0561 STOP	AIN	1000	FIXED0%		→ Selection list 1	**FIXSET1** Configuration of analog input signal
C0562 STOP					→ Selection list 2	**FIXSET1** Configuration of digital input signals
1	IN1	1000	FIXED0			
2	IN2	1000	FIXED0			
3	IN3	1000	FIXED0			
4	IN4	1000	FIXED0			
C0563	(C0561)	Disp	-199.99	{0.01 %}	199.99	**FIXSET1** Display of analog input signal
C0564		Disp				**FIXSET1** Display of digital input signals
1	(C0562/1)					
...	...					
4	(C0562/4)					
C0570 STOP	IN	1000	FIXED0%		→ Selection list 1	**S&H1** Configuration of analog input signal
C0571 STOP	LOAD	1000	FIXED0		→ Selection list 2	**S&H1 LOAD** Configuration of digital input signal
C0572	(C0570)	Disp	-199.99	{0.01 %}	199.99	**S&H1** Display of analog input signal
C0573	(C0571)	Disp				**S&H1 LOAD** Display of digital input signal
C0575		1	0	{1 ms}	200	**SD8 monitoring** Tripping delay for error message SD8
C0576		100.00	0.00	{0.01 %}	100.00	**Speed window - nErr-monitoring** Setting the system deviation between actual speed value and speed setpoint
C0577	VP FLD WEAK	3.00	0.00	{0.01}	15.99	**Field weakening controller** Gain V_p
C0578	TN FLD WEAK	50.0	2.0	{0.5 ms}	8192.0	**Field weakening controller** Reset time T_n C0578 = 8000 ms: Switched off
C0579	MONIT NERR	3	0 Trip 1 Message 2 Warning 3 Off			**nEEr monitoring** Configuration of monitoring for ”system deviation between actual speed value and speed setpoint”
C0580	MONIT SD8	3	0 Trip 3 Off			**SD8 monitoring** Configuration of monitoring for encoder error at X8
C0581	MONIT EER	0	0 Trip 1 Message 2 Warning 3 Off			**EEr monitoring** Configuration of monitoring for ”external fault”

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0582	MONIT OH4	2	2 3	Warning Off		**OH4 monitoring** Configuration of heatsink temperature monitoring
C0583	MONIT OH3	→	0 2 3	Trip Warning Off		**OH3 monitoring** Configuration of monitoring for ”fixed motor temperature” → Depending on C0086
C0584	MONIT OH7	→	2 3	Warning Off		**OH7 monitoring** Configuration of monitoring for ”adjustable motor temperature” → Depending on C0086 Temperature monitoring via resolver input
C0585	MONIT OH8	3	0 2 3	Trip Warning Off		**OH8 monitoring** Configuration of monitoring for ”adjustable motor temperature” Temperature monitoring via PTC input
C0586	MONIT SD2	0	0 2 3	Trip Warning Off		**SD2 monitoring** Configuration of resolver monitoring
C0587	MONIT SD3	3	0 2 3	Trip Warning Off		**SD3 monitoring** Configuration of monitoring for ”encoder at X9”
C0588	MONIT H10/H11	0	0	Trip		**H10 / H11 monitoring**
			2 3	Warning Off		Only Lenze service personnel is permitted to set C0588 = 2 or C0588 = 3
C0589	MONIT P03	2	0 2 3	Trip Warning Off		**P03 monitoring** Configuration of following error monitoring ● Function block DFSET monitors the following error. Monitoring is only active if DFSET is used.
C0590	MONIT P13	0	0 2 3	Trip Warning Off		**P13 monitoring** Configuration of phase error monitoring ● Function block DFSET monitors the following error. Monitoring is only active if DFSET is used.
C0591	MONIT CE1	3	0 2 3	Trip Warning Off		**CE1 monitoring** Configuration of ”CAN-IN1 error” monitoring
C0592	MONIT CE2	3	0 2 3	Trip Warning Off		**CE2 monitoring** Configuration of ”CAN-IN2 error” monitoring
C0593	MONIT CE3	3	0 2 3	Trip Warning Off		**CE3 monitoring** Configuration of ”CAN-IN3 error” monitoring
C0594	MONIT SD6	→	0 2 3	Trip Warning Off		**SD6 monitoring** Configuration of ”motor temperature sensor” monitoring → Depending on C0086
C0595	MONIT CE4	3	0 2 3	Trip Warning Off		**CE4 monitoring** Configuration of ”CAN bus off” monitoring
C0596	NMAX LIMIT	5500	0	{1 rpm}	16000	**System speed monitoring**
C0597	MONIT LP1	3	0 2 3	Trip Warning Off		**LP1 monitoring** Configuration of motor phase failure monitoring
C0598	MONIT SD5	3	0 2 3	Trip Warning Off		**SD5 monitoring** Configuration of monitoring for master current at X5/1.2 < 2 mA

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0599	LIMIT LP 1	5.0	1.0	{0.1 %}	10.0	**LP1 monitoring** Current limit value for motor phase monitoring
C0600	FUNCTION	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 4 OUT = IN1 / IN2 5 OUT = IN1 / (100% – IN2) 15 OUT = IN1 % IN2			**ARIT2** Function selection
C0601 STOP	IN				→ Selection list 1	**ARIT2** Configuration of analog input signals
1		1000	FIXED0%			ARIT2-IN1
2		1000	FIXED0%			ARIT2-IN2
C0602		Disp	-199.99	{0.01 %}	199.99	**ARIT2** Display of analog input signals
1	(C0601/1)					
2	(C0601/2)					
C0606	MONIT-OC8	2	0 Trip 2 Warning 3 Off			**Configuration of the $I^2 \times t$ advance warning** The threshold is set in C0127
C0610 STOP	IN				→ × Selection list 1	**ADD** Configuration of analog input signals
1		1000	FIXED0%			ADD1-IN1
2		1000	FIXED0%			ADD1-IN2
3		1000	FIXED0%			ADD1-IN3
C0611		Disp	-199.99	{0.01 %}	199.99	**ADD** Display of analog input signals
1	(C0610/1)					
2	(C0610/2)					
3	(C0610/3)					
C0620	DB1 GAIN	1.00	-10.00	{0.01}	10.00	**DB1 gain** Gain of dead band component DB1
C0621	DB1 VALUE	1.00	0.00	{0.01 %}	100.00	**DB1 dead band** Dead band of DB1
C0622 STOP	DB1-IN	1000	FIXED0%		→ Selection list 1	**DB1** Configuration of analog input signal
C0623	(C0622)	Disp	-199.99	{0.01 %}	199.99	**DB1** Display of analog input signal
C0630	MAX LIMIT	100.00	-199.99	{0.01 %}	199.99	**LIM upper limit** Upper limit of limiter LIM1
C0631	MIN LIMIT	-100.0	-199.99	{0.01 %}	199.99	**LIM lower limit** Lower limit of limiter LIM1
C0632 STOP	LIM-IN	1000	FIXED0%		→ Selection list 1	**LIM1** Configuration of analog input signal
C0633	(C0632)	Disp	-199.99	{0.01 %}	199.99	**LIM1** Display of analog input signal
C0640	DELAY T	20.00	0.01	{0.01 s}	50.00	**PT1-1** Setting of the time constant
C0641 STOP	PT1-1-IN	1000	FIXED0%		→ Selection list 1	**PT1-1** Configuration of analog input signal
C0642	(C0641)	Disp	-199.99	{0.01 %}	199.99	**PT1-1** Display of analog input signal
C0643	DELAY T	0.005	0.003	{0.001 s}	5.000	**PT1-2** Setting of filter time constant

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0644 STOP					→ Selection list 4	**PT1-2** Configuration of input signal
1	PT1-2-DFIN	1000	FIXEDPHI-0			
C0645	(C0644)	Disp				**PT1-2** Display of input signal
C0646			0	{1 rpm}	16000	**PT1-2**
1		5				Compensation of the phase shift (compensation speed) when filter is on If C0646/1 = 0 is set, the position will be lost
2		15000				Compensation of the phase shift (compensation speed) when filter is off If C0646/2 = 0 is set, the position will be lost
C0647 STOP					→ Selection list 2	**PT1-2** Configuration of digital input signals
1	PT1-2-DISABLE FILTER	1000	FIXED0			LOW = filter on HIGH = filter off
2	PT1-2-RESET	1000	FIXED0			HIGH = filter reset
C0648		Disp				**PT1-2** Display of digital input signals
1	(C0647/1)					
2	(C0647/2)					
C0650	DT1-1 GAIN	1.000	-320.00	{0.001}	320.00	**DT1-1** Gain
C0651	DELAY T	1.00	0.003	{0.01 s}	5.000	**DT1-1** Time constant
C0652 STOP	IN	1000	FIXED0%		→ Selection list 1	**DT1-1** Configuration of analog input signal
C0653	SENSIBILITY	1	1 15-bit 2 14-bit 3 13-bit 4 12-bit 5 11-bit 6 10-bit 7 9-bit			**DT1-1** Sensitivity
C0654	(C0652)	Disp	-199.99	{0.01 %}	199.99	
C0655	NUMERATOR	1	-32767	{1}	32767	**CONV5** Numerator
C0656	DENOMINATOR	1	1	{1}	32767	**CONV5** Denominator
C0657 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV5** Configuration of analog input signal
C0658	(C0657)	Disp	-199.99	{0.01 %}	199.99	**CONV5** Display of analog input signal
C0661 STOP	IN	1000	FIXED0%		→ Selection list 1	**ABS1** Configuration of analog input signal Input for absolute value generator
C0662	(C0661)	Disp	-199.99	{0.01 %}	199.99	**ABS1** Display of analog input signal
C0671	RFG1 TIR	0.000	0.000	{0.01 s}	999.900	**RFG1** Acceleration time Tir
C0672	RFG1 TIF	0.000	0.000	{0.01 s}	999.900	**RFG1** Deceleration time Tif
C0673 STOP	IN	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration of analog input signal
C0674 STOP	SET	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration of analog input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0675 STOP	LOAD	1000	FIXED0		→ Selection list 2	**RFG1** Configuration of digital input signal
C0676		Disp	-199.99	{0.01 %}	199.99	**RFG1** Display of analog input signals
1	(C0673)					
2	(C0674)					
C0677	(C0675)	Disp				**RFG1** Display of digital input signal
C0680	FUNCTION	6	1 IN1 = IN 2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP1** Selection of the function for comparing inputs IN1 and IN2
C0681	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP1** Hysteresis
C0682	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP1** Window
C0683 STOP					→ Selection list 1	**CMP1** Configuration of analog input signals
1	CMP1-IN1	5001	MCTRL-NACT			
2	CMP1-IN2	19500	FCODE-17			
C0684		Disp	-199.99	{0.01 %}	199.99	**CMP1** Display of analog input signals
1	(C0683/1)					
2	(C0683/1)					
C0685	FUNCTION	1	1 IN1 = IN2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP2** Selection of the function for comparing inputs IN1 and IN2
C0686	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP2** Hysteresis
C0687	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP2** Window
C0688 STOP					→ Selection list 1	**CMP2** Configuration of analog input signals
1	CMP2-IN1	1000	FIXED0%			
2	CMP2-IN2	1000	FIXED0%			
C0689		Disp	-199.99	{0.01 %}	199.99	**CMP2** Display of analog input signals
1	(C0688/1)					
2	(C0688/2)					
C0690	FUNCTION	1	1 IN1 = IN 2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP3** Selection of the function for comparing inputs IN1 and IN2
C0691	HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP3** Hysteresis
C0692	WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP3** Window

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0693 STOP					→ Selection list 1	**CMP3** Configuration of analog input signals
1	CMP3-IN1	1000	FIXED0%			
2	CMP3-IN2	1000	FIXED0%			
C0694		Disp	-199.99	{0.01 %}	199.99	**CMP3** Display of analog input signals
1	(C0693/1)					
2	(C0693/2)					
C0695	FUNCTION	2	1 IN 1 < IN2 2 |IN1| < |IN2|			**PHCMP1** Selection of the function for comparing inputs IN1 and IN2
C0697 STOP					→ Selection list 3	**PHCMP1** Configuration of input signals
1	IN	1000	FIXED0INC			
2	IN	1000	FIXED0INC			
C0698		Disp	-2147483647	{1}	2147483647	**PHCMP1** Display of input signals
1	(C0697/1)					
2	(C0697/2)					
C0700 STOP	IN	19523	FCODE-472/3		→ Selection list 1	**ANEG1** Configuration of analog input signal
C0701	(C0700)	Disp	-199.99	{0.01 %}	199.99	
C0703 STOP	IN	1000	FIXED0%		→ Selection list 1	**ANEG2** Configuration of analog input signal
C0704	(C0703)	Disp	-199.99	{0.01 %}	199.99	
C0710	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS1** Edge evaluation With the corresponding signal edge at IN, OUT switches to HIGH
C0711	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS1** Pulse duration of TRANS1
C0713 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS1-IN** Configuration of digital input signal
C0714	(C0713)	Disp				**TRANS1-IN** Display of digital input signal
C0715	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS2** Edge evaluation With the corresponding signal edge at IN, OUT switches to HIGH
C0716	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS2** Pulse duration
C0718 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS2** Configuration of digital input signal
C0719	(C0718)	Disp				**TRANS2** Display of digital input signal
C0720	FUNCTION	2	0 On delay 1 Off delay 2 On/off delay			**DIGDEL1** Function selection
C0721	DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL1** Setting of the delay time
C0723 STOP	IN	1000	FIXED0		→ Selection list 2	**DIGDEL1** Configuration of digital input signal
C0724	(C0723)	Disp				**DIGDEL1** Display of digital input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0725	FUNCTION	2	0 1 2	On delay Off delay On/off delay		**DIGDEL2** Function selection
C0726	DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL2** Setting of the delay time
C0728 STOP	IN	1000	FIXED0		→ Selection list 2	**DIGDEL2** Configuration of digital input signal
C0729	(C0728)	Disp				**DIGDEL2** Display of digital input signal
C0730	OSZ MODUS	0	0 1	Start measurement Stop measurement		**OSZ** Start/stop of measured value recording
C0731	OSZ STATUS	0	0 1 2 3 4 5	Measurement completed Measurement active Trigger detected Cancel Cancel after trigger Read memory		**OSZ** Current operating state
C0732 STOP					→ Selection list 1	**OSZ** Configuration of analog input signals
1	KANAL1	1000	FIXED0%			
2	KANAL2	1000	FIXED0%			
3	KANAL3	1000	FIXED0%			
4	KANAL4	1000	FIXED0%			
C0733					→ Selection list 2	**OSZ** Trigger input
1	TRIG INP	1000	FIXED0			
C0734	TRIG-SOURCE	1	0 1 2 3 4	Digital trigger input Measuring channel 1 Measuring channel 2 Measuring channel 3 Measuring channel 4		**OSZ** Selection of trigger source
C0735	TRIGGER-LEVEL	0	-32767	{1}	32767	**OSZ** Adjustment of the trigger level for channel 1 ... 4
C0736	TRIGGER-SLOPE	0	0 1	LOW/HIGH edge HIGH/LOW edge		**OSZ** Selection of the trigger edge
C0737	TRIGGER-DELAY	0.0	-100.0	{0.1 %}	999.9	**OSZ** Setting of pretriggering and posttriggering
C0738	PROBE PERIOD	3	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	1 ms 2 ms 5 ms 10 ms 20 ms 50 ms 100 ms 200 ms 500 ms 1 s 2 s 5 s 10 s 20 s 50 s 1 min 2 min 5 min 10 min		**OSZ** Selection of the sampling period

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0739	KANALANZAHL	4	1	{1}	4	**OSZ** Number of channels to be measured
C0740	DATA READ	0				**OSZ**
1		0	0	{1}	65535	Selection of the starting point for reading out the data memory. Allows selective access to a memory block
2		0	0 Data reading inhibited 1 Data reading enabled			Inhibit "Read memory"
C0741						**OSZ**
1	VERSION OSZ	Disp				Version
2	LENGTH MEMORY					Memory size
3	DATA WIDTH					Data width
4	NO. CHANNELS					Number of channels
C0742	LENGTH OF DB	Disp				**OSZ** Display of data block length
C0743	READ DB	Disp				**OSZ** Reading of an 8-byte data block
C0744	MEM: DEPTH	2048	0 512 measured values 1 1024 measured values 2 1536 measured values 3 2048 measured values 4 3072 measured values 5 4096 measured values 6 8192 measured values			**OSZ** Adaptation of the memory size to the measurement task
C0749		Disp				**OSZ** Information on measured value storage
1	BRK:OFF INDEX					
2	TRIGGER INDEX					
3	END INDEX					
C0750	VP DENOM	16	1 Vp = 1 2 Vp = 1/2 4 Vp = 1/4 8 Vp = 1/8 16 Vp = 1/16 34 Vp = 1/32 64 Vp = 1/64 128 Vp = 1/128 256 Vp = 1/256 512 Vp = 1/512 1024 Vp = 1/1024 2048 Vp = 1/2048 4096 Vp = 1/4096 8192 Vp = 1/8192 16384 Vp = 1/16384			**DFRFG1** Denominator of the position controller gain
C0751	DFRFG1 TIR	1.000	0.001	{0.001 s}	999.900	**DFRFG1** T_{ir} (acceleration time)
C0752	MAX SPEED	3000	1	{1 rpm}	16000	**DFRFG1** Maximum speed (here: maximum catch-up speed)
C0753	DFRFG1 QSP	0.000	0.000	{0.001 s}	999.900	**DFRFG1** Deceleration time T_{if} when deceleration ramp is activated
C0754	PH ERROR	$2 \cdot 10^9$	10	{1 inc}	$2 \cdot 10^9$	**DFRFG1** Following error
C0755	SYN WINDOW	100	0	{1 inc}	65535	**DFRFG1** Synchronisation window

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0756	OFFSET	0	$-1 \cdot 10^9$ {1 inc} $1 \cdot 10^9$	**DFRFG1** Offset
C0757	FUNCTION	0	0 TP start inactive 1 TP start active	**DFRFG1** Function
C0758 STOP	IN	1000	FIXEDPHI-0 → Selection list 4	**DFRFG1** Configuration of input signal
C0759 STOP	QSP	1000	FIXED0 → Selection list 2	**DFRFG1** Configuration of digital input signal
C0760 STOP	STOP	1000	FIXED0 → Selection list 2	**DFRFG1-STOP** Configuration of digital input signal "Ramp function generator stop"
C0761 STOP	RESET	1000	FIXED0 → Selection list 2	**DFRFG1** Configuration of digital input signal Reset of integrators
C0764		Disp		**DFRFG1** Display of digital input signals
1	(C0759)			
2	(C0760)			
3	(C0761)			
C0765	(C0758)	Disp	-32767 {1 rpm} 32767	**DFRFG1** Display of input signal
C0766	SPEED DIR	1	1 both directions (CW/CCW) 2 positive direction only (CW) 3 negative direction only (CCW)	**DFRFG1** Selection of the direction of rotation
C0768 STOP	SET	1000	FIXEDPHI-0 → Selection list 4	**DFRFG1** Configuration of input signal Start speed
C0769	(C0768)	Disp		**DFRFG1** Display of input signal
C0770 STOP	D	1000	FIXED0 → Selection list 2	**FLIP1** Data input Configuration of digital input signal
C0771 STOP	CLK	1000	FIXED0 → Selection list 2	**FLIP1** Configuration of clock input signal
C0772 STOP	CLR	1000	FIXED0 → Selection list 2	**FLIP1** Configuration of reset input signal
C0773		Disp		**FLIP1** Display of digital input signals
1	(C0770)			
2	(C0771)			
3	(C0772)			
C0775 STOP	D	1000	FIXED0 → Selection list 2	**FLIP2** Data input Configuration of digital input signal
C0776 STOP	CLK	1000	FIXED0 → Selection list 2	**FLIP2** Configuration of clock input signal
c0777 STOP	CLR	1000	FIXED0 → Selection list 2	**FLIP2** Configuration of reset input signal
C0778		Disp		**FLIP1** Display of digital input signals
1	(C0775)			
2	(C0776)			
3	(C0777)			
C0780 STOP	N	50	AIN1-OUT → Selection list 1	**NSET** Configuration of input signal for main setpoint

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0781 STOP	N-INV	10251	R/L/Q-R/L		→ Selection list 2	**NSET** Configuration of input signal for main setpoint inversion
C0782 STOP	NADD	5650	ASW1-OUT		→ Selection list 1	**NSET** Configuration of input signal for additional setpoint
C0783 STOP	NADD-INV	1000	FIXED0		→ Selection list 2	**NSET** Configuration of additional setpoint inversion
C0784 STOP	CINH-VAL	5001	MCTRL-NACT		→ Selection list 1	**NSET** Configuration of output signal with the controller being inhibited
C0785 STOP	SET	5000	MCTRL-NSET2		→ Selection list 1	**NSET** Configuration of input signal for ramp function generator
C0786 STOP	LOAD	5001	MCTRL-QSP-OUT		→ Selection list 2	**NSET** Configuration of digital input signal for loading the ramp function generator
C0787 STOP					→ Selection list 2	**NSET** Configuration of JOG selection and JOG activation Binary interpretation
1	JOG*1	53	DIGIN3			
2	JOG*2	1000	FIXED0			
3	JOG*4	1000	FIXED0			
4	JOG*8	1000	FIXED0			
C0788 STOP					→ Selection list 2	**NSET** Configuration of Ti selection and Ti activation ● Binary interpretation ● T_{ir} and T_{if} pairs are identical
1	TI*1	1000	FIXED0			
2	TI*2	1000	FIXED0			
3	TI*4	1000	FIXED0			
4	TI*8	1000	FIXED0			
C0789 STOP	RFG-0	1000	FIXED0		→ Selection list 2	**NSET** Configuration of digital input signal (ramp function generator 0)
C0790 STOP	RFG-STOP	1000	FIXED0		→ Selection list 2	**NSET** Configuration of digital input signal (ramp function generator stop)
C0798		Disp	-199.99	{0.01 %}	199.99	**NSET** Display of analog input signals
1	CINH-VAL					
2	SET					

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0799		Disp				**NSET** Display of digital input signals
1	(781)					
2	(783)					
3	(786)					
4	(787/1)					
5	(787/2)					
6	(787/3)					
7	(787/4)					
8	(788/1)					
9	(788/2)					
10	(788/3)					
11	(788/4)					
12	(789)					
13	(790)					
C0800 STOP	SET	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of setpoint input signal
C0801 STOP	ACT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of actual value input signal
C0802 STOP	INFLU	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of evaluation input signal
C0803 STOP	ADAPT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of adaptation input signal
C0804 STOP	INACT	1000	FIXED0		→ Selection list 2	**PCTRL1** Configuration of inactivation input signal
C0805 STOP	I-OFF	1000	FIXED0		→ Selection list 2	**PCTRL1** Configuration of digital input signal (switch off I-component)
C0808		Disp	-199.99	{0.01 %}	199.99	**PCTRL1** Display of analog input signals
1	(C0800)					
2	(C0801)					
3	(C0802)					
4	(C0803)					
C0809		Disp				**PCTRL1** Display of digital input signals
1	(C0804)					
2	(C0805)					
C0810 STOP					→ Selection list 1	**ASW1** Configuration of analog input signals
1	IN	55	AIN2-OUT			
2	IN	1000	FIXED0%			
C0811 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW1** Configuration of digital input signal
C0812		Disp	-199.99	{0.01 %}	199.99	**ASW1** Display of analog input signals
1	(C0810/1)					
2	(C0810/2)					
C0813	(C0811)	Disp				**ASW1** Display of digital input signal
C0815 STOP					→ Selection list 1	**ASW2** Configuration of analog input signals
1	IN	1000	FIXED0%			
2	IN	1000	FIXED0%			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0816 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW2** Configuration of digital input signal
C0817		Disp	-199.99	{0.01%}	199.99	**ASW2** Display of analog input signals
1	(C0815/1)					
2	(C0815/2)					
C0818	(C0816)	Disp				**ASW2** Display of digital input signal
C0820 STOP					→ Selection list 2	**AND1** Configuration of digital input signals
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			
C0821		Disp				**AND1** Display of digital input signals
1	(C0820/1)					
2	(C0820/2)					
3	(C0820/3)					
C0822 STOP		1000			→ Selection list 2	**AND2** Configuration of digital inputs
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			
C0823		Disp				**AND2** Display of digital input signals
1	(C0822/1)					
2	(C0822/2)					
3	(C0822/3)					
C0824 STOP					→ Selection list 2	**AND3** Configuration of digital input signals
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			
C0825		Disp				**AND3** Display of digital input signals
1	(C0824/1)					
2	(C0824/2)					
3	(C0824/3)					
C0826 STOP					→ Selection list 2	**AND4** Configuration of digital input signals
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			
C0827		Disp				**AND4** Display of digital input signals
1	(C0826/1)					
2	(C0826/2)					
3	(C0826/3)					
C0828 STOP					→ Selection list 2	**AND5** Configuration of digital inputs
1	IN	1000	FIXED0			
2	IN	1000	FIXED0			
3	IN	1000	FIXED0			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0829		Disp		**AND5** Display of digital input signals
1	(C0828/1)			
2	(C0828/2)			
3	(C0828/3)			
C0830 STOP			→ Selection list 2	**OR1** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0831		Disp		**OR1** Display of digital input signals
1	(C0830/1)			
2	(C083021)			
3	(C0830/3)			
C0832 STOP			→ Selection list 2	**OR2** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0833		Disp		**OR2** Display of digital input signals
1	(C0832/1)			
2	(C0832/2)			
3	(C0832/3)			
C0834 STOP			→ Selection list 2	**OR3** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0835		Disp		**OR3** Display of digital input signals
1	(C0834/1)			
2	(C0834/2)			
3	(C0834/3)			
C0836 STOP			→ Selection list 2	**OR4** Configuration of digital input signals
1	IN	1000	FIXED0	
2	IN	1000	FIXED0	
3	IN	1000	FIXED0	
C0837		Disp		**OR4** Display of digital input signals
1	(C0836/1)			
2	(C0836/2)			
3	(C0836/3)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0838 STOP			→ Selection list 2	**OR5, OR6, OR7** Configuration of digital input signals
1	IN	1000	FIXED0	OR5-IN1
2	IN	1000	FIXED0	OR5-IN2
3	IN	1000	FIXED0	OR5-IN3
4	IN	1000	FIXED0	OR6-IN1
5	IN	1000	FIXED0	OR6-IN2
6	IN	1000	FIXED0	OR6-IN3
7	IN	1000	FIXED0	OR6-IN4
8	IN	1000	FIXED0	OR6-IN5 (NOT)
9	IN	1000	FIXED0	OR7-IN1
10	IN	1000	FIXED0	OR7-IN2
11	IN	1000	FIXED0	OR7-IN3
12	IN	1000	FIXED0	OR7-IN4
13	IN	1000	FIXED0	OR7-IN5 (NOT)
C0839	(C0838)	Disp		**OR5, OR6, OR7** Display of digital input signals
1				
...				
13				
C0840 STOP	IN	1000	FIXED0 → Selection list 2	**NOT1** Configuration of digital input signal
C0841	(C0840)	Disp		**NOT1** Display of digital input signal
C0842 STOP	IN	1000	FIXED0 → Selection list 2	**NOT2** Configuration of digital input signal
C0843	(C0842)	Disp		**NOT2** Display of digital input signal
C0844 STOP	IN	1000	FIXED0 → Selection list 2	**NOT3** Configuration of digital input signal
C0845	(C0844)	Disp		**NOT3** Display of digital input signal
C0846 STOP	IN	1000	FIXED0 → Selection list 2	**NOT4** Configuration of digital input signal
C0847	(C0846)	Disp		**NOT4** Display of digital input signal
C0848 STOP	IN	1000	FIXED0 → Selection list 2	**NOT5** Configuration of digital input signal
C0849	(C0848)	Disp		**NOT5** Display of digital input signal
C0850 STOP			→ Selection list 1	**AIF-OUT** Configuration of process output words for the automation interface AIF (X1)
1	OUT.W1	1000	FIXED0%	
2	OUT.W2	1000	FIXED0%	
3	OUT.W3	1000	FIXED0%	
C0851 STOP	OUT.D1	1000	FIXED0INC → Selection list 3	**AIF-OUT** Configuration of 32-bit phase information
C0852	TYPE OUT.W2	0	0 Analog signal 1 Digital 0-15 2 D1: LOW phase 3 D2: HIGH phase	**AIF-OUT** Configuration of process output word 2 for the automation interface AIF (X1)

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0853	TYPE OUT.W3	0	0 1 2	Analog signal Digital 16-31 High phase		**AIF-OUT** Configuration of process output word 3 for the automation interface AIF (X1)
C0854	TYPE OUT.W1	0	0 3	Analog signal D2: LOW phase		**AIF-OUT** Configuration of process output word 1 for the automation interface AIF (X1)
C0855	IN	Disp				**AIF** Hexadecimal process input words for the automation interface X1
1			Bit 00	{1}	Bit 15	AIF-IN
2			Bit 16	{1}	Bit 31	AIF-IN
C0856		Disp	-199	{1 %}	199	**AIF-IN** Decimal process input words Display: 100.00 % = 16384
1	IN.W1					
2	IN.W2					
3	IN.W3					
C0857	IN.D1	Disp	-2147483648	{1}	2147483647	**AIF-IN** 32-bit phase information
C0858		Disp	-199.99	{0.01 %}	199.99	**AIF-OUT** Process output words Display: 100 % = 16384
1	OUT.W1					
2	OUT.W2					
3	OUT.W3					
C0859	OUT.D1	Disp	-2147483648	{1}	2147483647	**AIF-OUT** 32-bit phase information
C0860 STOP					→ Selection list 1	**AIF**
1	OUT1.W1	5001				
2	OUT1.W2	1000	FIXED0%			
3	OUT1.W3	1000	FIXED0%			
4	OUT2.W1	1000	FIXED0%			
5	OUT2.W2	1000	FIXED0%			
6	OUT2.W3	1000	FIXED0%			
7	OUT2.W4	1000	FIXED0%			
8	OUT3.W1	1000	FIXED0%			
9	OUT3.W2	1000	FIXED0%			
10	OUT3.W3	1000	FIXED0%			
11	OUT3.W4	1000	FIXED0%			
C0861 STOP					→ Selection list 3	**AIF**
1	OUT1.D1	1000	FIXED0INC			
2	OUT2.D1	1000	FIXED0INC			
3	OUT3.D1	1000	FIXED0INC			
C0863		Disp	0		1	**AIF**
1	IN1 (0-15)					
2	IN1 (16-31)					
3	IN2 (0-15)					
4	IN2 (16-31)					
5	IN3 (0-15)					
6	IN3 (16-31)					

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0864			0 Analog signal 1 Digital 0-15 2 Low phase			**CAN** Configuration of process output words for system bus (CAN)
1	TYPEOUT1.W2	0				
2	TYPEOUT2.W1	0				
3	TYPEOUT3.W1	0				
C0865			0 Analog signal 1 Digital 16-31 2 High phase			**CAN** Configuration of process output words for system bus (CAN)
1	TYPEOUT1.W3	0				
2	TYPEOUT2.W2	0				
3	TYPEOUT3.W2	0				
C0866		Disp	-32768.00	{0.01%}	32767.00	**CAN**
1	IN1.W1					
2	IN1.W2					
3	IN1.W3					
4	IN2.W1					
5	IN2.W2					
6	IN2.W3					
7	IN2.W4					
8	IN3.W1					
9	IN3.W2					
10	IN3.W3					
11	IN3.W4					
C0867		Disp				**CAN**
1	IN1.D1					
2	IN2.D1					
3	IN3.D1					
C0868		Disp	-199.99	{0.01%}	199.99	**CAN**
1	OUT1.W1					
2	OUT1.W2					
3	OUT1.W3					
4	OUT2.W1					
5	OUT2.W2					
6	OUT2.W3					
7	OUT2.W4					
8	OUT3.W1					
9	OUT3.W2					
10	OUT3.W3					
11	OUT3.W4					
C0869		Disp	-2147483648	{1}	2147483647	**CAN**
1	OUT1.D1					
2	OUT2.D1					
3	OUT3.D1					
C0870 STOP					→ Selection list 2	**DCTRL** Configuration of digital input signals (inhibit controller)
1	CINH1	1000	FIXED0			
2	CINH2	1000	FIXED0			
C0871 STOP	TRIP-SET	54	DIGIN4		→ Selection list 2	**DCTRL** Configuration of digital input signal
C0876 STOP	TRIP-RES	55	DIGIN5		→ Selection list 2	**DCTRL** Configuration of digital input signal

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C0878		Disp		**DCTRL** Display of digital input signals
1	(C0870/1)			
2	(C0870/2)			
3	(C0871)			
4	(C0876)			
C0879			0 No reset 1 Reset	Reset control words
1	RESET C135	0		
2	RESET AIF	0		
3	RESET CAN	0		
C0885 STOP	R	51	DIGIN1 → Selection list 2	**R/L/Q** Configuration of digital input signal (CW rotation)
C0886 STOP	L	52	DIGIN2 → Selection list 2	**R/L/Q** Configuration of digital input signal (CCW rotation)
C0889		Disp		**R/L/Q** Display of digital input signals
1	(C0885)			
2	(C0886)			
C0890 STOP	N-SET	5050	NSET-NOUT → Selection list 1	**MCTRL** Configuration of input signal for speed setpoint
C0891 STOP	M-ADD	1000	FIXED0% → Selection list 1	**MCTRL** Configuration of input signal for torque setpoint
C0892 STOP	LO-M-LIM	5700	ANEG1-OUT → Selection list 1	**MCTRL** Configuration of input signal for lower torque limit
C0893 STOP	HI-M-LIM	19523	FCODE-472/3 → Selection list 1	**MCTRL** Configuration of input signal for upper torque limit
C0894 STOP	PHI-SET	1000	FIXED0INC → Selection list 3	**MCTRL** Configuration of input signal for rotor position setpoint
C0895 STOP	PHI-LIM	1006	FIXED100% → Selection list 1	**MCTRL** Configuration of input signal for phase controller limit
C0896 STOP	N2-LIM	1000	FIXED0% → Selection list 1	**MCTRL** Configuration of input signal for 2nd speed limit value
C0897 STOP	PHI-ON	1000	FIXED0 → Selection list 2	**MCTRL** Configuration of phase controller switch-on signal
C0898 STOP	FLD-WEAK	1006	FIXED100% → Selection list 1	**MCTRL** Configuration of input signal for field weakening
C0899 STOP	N/M-SWT	1000	FIXED0 → Selection list 2	**MCTRL** Configuration of input signal for changeover between speed and torque control
C0900 STOP	QSP	10250	R/L/Q-QSP → Selection list 2	**MCTRL** Configuration of control signal for release
C0901 STOP	I-SET	1000	FIXED0% → Selection list 1	**MCTRL** Configuration of input signal for loading I-component of speed controller

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0902 STOP	I-LOAD	1000	FIXED0		→ Selection list 2	**MCTRL** Configuration of activation signal for loading I-component of speed controller
C0903 STOP	P-ADAPT	1006	FIXED0%		→ Selection list 1	**MCTRL** Configuration of input signal for adaptation of phase controller
C0906		Disp	-199.99	{0.01 %}	199.99	**MCTRL** Display of analog input signals
1	(C0890)					
2	(C0891)					
3	(C0892)					
4	(C0893)					
5	(C0895)					
6	(C0896)					
7	(C0898)					
8	(C0901)					
9	(C0903)					
C0907		Disp				**MCTRL** Display of digital input signals
1	(C0897)					
2	(C0899)					
3	(C0900)					
4	(C0902)					
C0908	(C0894)	Disp	-2147483647	{1 inc}	2147483647	Set phase signal ● 1 rev. = 65536 inc.
C0909	SPEED LIMIT	1	1 +/- 175 % 2 0 ... +175 % 3 -175 ... 0 %			Limitation of direction of rotation for the speed setpoint
C0920 STOP	REFC-ON	1000	FIXED0		→ Selection list 2	**REFC** Configuration of digital input signal Activation of homing function
C0921 STOP	REFC-MARK	1000	FIXED0		→ Selection list 2	**REFC** Configuration of digital input signal Digital reference switch
C0922 STOP	REFC-PHI-IN	1000	DFSET-PSET		→ Selection list 3	**REFC** Configuration of phase input signal
C0923 STOP	REFC-N-IN	1000	DFSET-NOUT		→ Selection list 1	**REFC** Configuration of speed input signal
C0924 STOP	REFC-POS-LOAD	1000	FIXED0		→ Selection list 2	**REFC** Configuration of digital input signal Control "Set position"
C0925 STOP	REFC-ACTPOS-I	1000	FIXED0INC		→ Selection list 3	**REFC** Configuration of input signal for "Set position"
C0926		Disp	-2147483647	{1 inc}	2147483647	**REFC** Display of input signals
1	(C0925)					
2	(C0922)					
3	ACTPOS					Actual position
4	TARGET					Target position
C0927		Disp				**REFC** Display of digital input signals
1	(C0920)					
2	(C0921)					
3	(C0924)					

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0928	(C0922)	Disp	-2147483647	{1 inc}	2147483647	**REFC** Phase signal (following error) ● 1 rev = 65536 inc
C0929	(C0923)	Disp	-199.99	{0.01 %}	199.99	**REFC** Display of analog input signal
C0930 STOP	GEARBOX MOT	1	1	{1}	65535	**REFC** Encoder-gearbox factor numerator (on the motor side)
C0931 STOP	GEARBOX ENC	1	1	{1}	65535	**REFC** Encoder-gearbox factor denominator (on the encoder side)
C0932	REF MODE	0				**REFC** Homing mode
			0 Mode 0			Positive direction, reference switch, zero pulse
			1 Mode 1			Negative direction, reference switch, zero pulse
			6 Mode 6			Positive direction, reference switch, touch probe
			7 Mode 7			Negative direction, reference switch, touch probe
			8 Mode 8			Positive direction, touch probe
			9 Mode 9			Negative direction, touch probe
			20 Mode 20			Direct homing
			21 Mode 21			Direct homing, store actual value
C0933	REF TRANS	0	0 Rising edge 1 Falling edge			**REFC** Edge of homing signal
C0934	REF OFFSET	0	-2140000000	{1 inc}	2140000000	**REFC** Home position offset
C0935	REF SPEED	2.000 0	0.0001	{0.0001 %}	100.0000	**REFC** Homing speed Speed used for homing run The value set is the percentage value of N_{max}
C0936	REF TI	1.00	0.01	{0.01 s}	990.00	**REFC** Homing acceleration/deceleration time T_{ir} and T_{if} are identical
C0937 STOP	REFC-DFIN	1000	FIXEDPHI-0		→ Selection list 4	**REFC** Input configuration
C0938	(C0937)	Disp				**REFC** Display of input signal
C0940	NUMERATOR	1	-32767	{1}	32767	**CONV1** Numerator
C0941	DENOMITATOR	1	1	{1}	32767	**CONV1** Denominator
C0942 STOP	CONV1-IN	1000	FIXED0%		→ Selection list 1	**CONV1** Configuration of analog input
C0943	(C0942)	Disp	-199.99	{0.01 %}	199.99	**CONV1** Display of analog input signal
C0945	NUMERATOR	1	-32767	{1}	32767	**CONV2** Numerator
C0946	DENOMINATO R	1	1	{1}	32767	**CONV2** Denominator
C0947 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV2** Configuration of analog input

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0948	(C0947)	Disp	-199.99	{0.01 %}	199.99	**CONV2** Display of analog input signal
C0950	NUMERATOR	1	-32767	{1}	32767	**CONV3** Numerator
C0951	DENOMINATOR	1	1	{1}	32767	**CONV3** Denominator
C0952 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV3** Configuration of analog input
C0953	(C0952)	Disp	-32767	{1 rpm}	32767	**CONV3** Display of analog input signal
C0955	NUMERATOR	1	-32767	{1}	32767	**CONV4** Numerator
C0956	DENOMINATOR	1	1	{1}	32767	**CONV4** Denominator
C0957 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV4** Configuration of analog input
C0958	(C0957)	Disp	-32767	{1 rpm}	32767	**CONV4** Display of analog input signal
C0960	FUNCTION	1	1 Characteristic 1 2 Characteristic 2 3 Characteristic 3			**CURVE1** Selection of the characteristic function
C0961	Y0	0.00	0.00	{0.01 %}	199.99	**CURVE1** Interpolation point configuration
C0962	Y1	50.00	0.00	{0.01 %}	199.99	**CURVE1** Interpolation point configuration
C0963	Y2	75.00	0.00	{0.01 %}	199.99	**CURVE1** Configuration - grid point
C0964	Y100	100.00	0.00	{0.01 %}	199.99	**CURVE1** Configuration - grid point
C0965	X1	50.00	0.01	{0.01 %}	99.00	**CURVE1** Configuration - grid point
C0966	X2	75.00	0.01	{0.01 %}	99.00	**CURVE1** Configuration - grid point
C0967 STOP	IN	1000	FIXED0%		→ Selection list 1	**CURVE1** Configuration of analog input
C0968	(C0967)	Disp	-199.99	{0.01 %}	199.99	**CURVE1** Display of analog input signal
C0970 STOP	N-SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of speed input signal (setpoint path)
C0971 STOP	FAULT	1000	FIXED0		→ Selection list 2	**MFAIL** Configuration of digital input signal (activation of mains failure control)
C0972 STOP	RESET	1000	FIXED0		→ Selection list 2	**MFAIL** Configuration of digital input signal (reset of mains failure control)
C0973 STOP	ADAPT	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for adaptation of voltage controller P-gain
C0974 STOP	CONST	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for adaptation of voltage controller P-gain
C0975 STOP	THRESHLD	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for restart protection when the value falls below the speed threshold

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0976 STOP	NACT	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for comparison value of threshold function ● Starting point for U_2 controller
C0977 STOP	SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for speed start value
C0978 STOP	DC-SET	1000	FIXED0%		→ Selection list 1	**MFAIL** Configuration of input signal for DC-bus voltage setpoint
C0980	MFAIL VP	0.500	0.001	{0.001}	31.000	**MFAIL** Setting of the gain V_p
C0981	MFAIL TN	100	20	{1 ms}	2000	**MFAIL** Setting of reset time T_n
C0982	MFAIL TIR	2.000	0.001	{0.001 s}	16.000	**MFAIL** Setting of the acceleration time T_{ir}
C0983	RETRIGGER T	1.000	0.001	{0.001 s}	60.000	**MFAIL** Retrigger time
C0988		Disp	-199.99	{0.01 %}	199.99	**MFAIL** Display of analog input signals
1	(C0970)					
2	(C0973)					
3	(C0974)					
4	(C0975)					
5	(C0976)					
6	(C0977)					
7	(C0978)					
C0989		Disp				**MFAIL** Display of digital input signals
1	(C0971)					
2	(C0972)					
C0990 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT1** Configuration of input signal
C0991 STOP	RESET	1000	FIXED0		→ Selection list 2	**PHINT1** Configuration of reset signal
C0992	(C0990)	Disp	-32767	{1}	32767	**PHINT1** Display of input signal
C0993	(C0991)	Disp				**PHINT1** Display of digital input signal
C0995	DIVISION	0	-31	{1}	31	**PHDIV** Divisor in the power-of-two format (2^{C0995})
C0996 STOP	IN	1000	FIXED0INC		→ Selection list 3	**PHDIV** Configuration of input signal
C0997	(C0996)	Disp	-2147483647	{1}	2147483647	**PHDIV** Display of input signal
C1000	DIVISION	1	0	{1}	31	**CONVPHA1** Divisor in the power-of-two format (2^{C0995})
C1001 STOP	IN	1000	FIXED0INC		→ Selection list 3	Configuration of CONVPHA1 input
C1002	(C1001)	Disp	-2147483647	{1}	2147483647	**CONVPHA1** Display of input signal

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1010	ARITPH1 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH1** Arithmetic function selection
C1011 STOP			→ Selection list 3	**ARITPH1** Configuration of input signals
1	IN	1000	FIXED0INC	
2	IN	1000	FIXED0INC	
C1012		Disp	-2147483647 {1} 2147483647	**ARITPH1** Display of input signals
1	(C1011/1)			
2	(C1011/2)			
C1020	ARITPH2 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH2** Arithmetic function selection
C1021 STOP			→ Selection list 3	**ARITPH2** Configuration of input signals
1	IN	1000	FIXED0INC	
2	IN	1000	FIXED0INC	
C1022		Disp	-2147483647 {1} 2147483647	**ARITPH2** Display of input signals
1	(C1021/1)			
2	(C1021/2)			
C1025	ARITPH3 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH3** Arithmetic function selection
C1026 STOP			→ Selection list 3	**ARITPH3** Configuration of input signals
1	IN	1000	FIXED0INC	
2	IN	1000	FIXED0INC	
C1027		Disp	-2147483647 {1} 2147483647	**ARITPH3** Display of input signals
1	(C1026/1)			
2	(C1026/2)			
C1030 STOP	IN	1000	FIXEDPHI-0 → Selection list 4	**PHINT2** Configuration of input signal
C1031 STOP	RESET	1000	FIXED0 → Selection list 2	**PHINT2** Reset input
C1032	(C1030)	Disp	-32767 {1} 32767	**PHINT2** Display of input signals

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1033	(C1031)	Disp				**PHINT2** Display of digital input signal
C1040	ACCELARATION	100.00	0.001	{0.001}	5000.000	**SRFG1** Setting of acceleration
C1041	JERK	0.200	0.001	{0.001 s}	999.999	**SRFG1** Setting of jerk
C1042 STOP	IN	1000	FIXED0%		→ Selection list 1	**SRFG1** Configuration of input signal
C1043 STOP	SET	1000	FIXED0%		→ Selection list 1	**SRFG1** Configuration of input signal
C1044 STOP	LOAD	1000	FIXED0		→ Selection list 2	**SRFG1** Configuration of input signal
C1045		Disp	-199.99	{0.01 %}	199.99	**SRFG1** Display of analog input signal
1	(C1042)					
2	(C1043)					
C1046	(C1044)	Disp				**SRFG1** Display of digital input signal
C1060 STOP					→ Selection list 2	**FLIP3, FLIP4** Configuration of input signals
1		1000	FIXED0			FLIP3-D
2		1000	FIXED0			FLIP3-CLK
3		1000	FIXED0			FLIP3-CLR
4		1000	FIXED0			FLIP4-D
5		1000	FIXED0			FLIP4-CLK
6		1000	FIXED0			FLIP4-CLR
C1061		Disp				**FLIP3, FLIP4** Display of digital input signals
1	(C1060/1)					
...	...					
6	(C1060/6)					
C1070 STOP					→ Selection list 2	**RFGPH2, RFGPH3** Configuration of digital input signals
1		1000	FIXED0			RFGPH2-RESET
2		1000	FIXED0			RFGPH2-STOP
3		1000	FIXED0			RFGPH2-RFG-0
4		1000	FIXED0			RFGPH2-REL-SEL
5		1000	FIXED0			RFGPH3-RESET
6		1000	FIXED0			RFGPH3-STOP
7		1000	FIXED0			RFGPH3-RFG-0
8		1000	FIXED0			RFGPH3-REL-SEL
C1071		Disp				**RFGPH2, RFGPH3** Display of digital input signals
1	(C1070/1)					
...	...					
8	(C1070/8)					

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1072 STOP				→ Selection list 3		**RFGPH2, RFGPH3** Configuration of input signals
1	CFG: RFGPH2-SET	1000	FIXED0INC			
2	CFG: RFGPH2-ACT	1000	FIXED0INC			
3	CFG: RFGPH3-SET	1000	FIXED0INC			
4	CFG: RFGPH3-ACT	1000	FIXED0INC			
C1073		Disp				**RFGPH2, RFGPH3** Display of input signals
1	(C1072/1)					
...	...					
4	(C1072/4)					
C1074			0 1 2	RFGPHx-PHOUT = 0 RFGPHx-PHOUT = ACT RFGPHx-PHOUT = SET		**RFGPH2, RFGPH3** Mode for reset
1		0				RFGPH2-PHOUT
2		0				RFGPH3-PHOUT
C1075						**RFGPH2** Mode
			0	Without limit stop		The output signal at RFGPH2-PHOUT continuously follows the setpoint at RFGPH2-SET
			1	With limit stop		The output signal at RFGPH2-PHOUT follows the setpoint at RFGPH2-SET for the length of a positioning process. After a HIGH-LOW edge at RFGPH2-STOP, the output signal continues to follow the setpoint again.
C1076						**RFGPH3** Mode
			0	Without limit stop		The output signal at RFGPH3-PHOUT continuously follows the setpoint at RFGPH3-SET
			1	With limit stop		The output signal at RFGPH3-PHOUT follows the setpoint at RFGPH3-SET for the length of a positioning process. After a HIGH-LOW edge at RFGPH3-STOP, the output signal continues to follow the setpoint again.
C1077			0	{1 inc}	32767	**RFGPH2, RFGPH3**
1		5				RFGPH2: Catch
2		5				RFGPH3: Catch
C1078			0	{0.0001 rpm}	14000.0000	**RFGPH2, RFGPH3**
1		200.0000				RFGPH2: $N_{max.}$ forward
2		200.0000				RFGPH2: $N_{max.}$ return
3		200.0000				RFGPH3: $N_{max.}$ forward
4		200.0000				RFGPH3: $N_{max.}$ return

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1079			0.010	{0.001 s}	130.000	**RFGPH2, RFGPH3**
1		1.000				RFGPH2: STOP ramp
2		1.000				RFGPH2: Acceleration ramp
3		1.000				RFGPH2: Deceleration ramp
4		1.000				RFGPH3: STOP ramp
5		1.000				RFGPH3: Acceleration ramp
6		1.000				RFGPH3: Deceleration ramp
C1080 STOP					→ Selection list 2	**LIMPHD1** Configuration of digital input signals
1	CFG: LIMPHD1-RESET	1000	FIXED0			
2	CFG: LIMPHD1-NO-LIM	1000	FIXED0			
C1081		Disp				**LIMPHD1** Display of digital input signals
1	(C1080/1)					
2	(C1080/2)					
C1082 STOP	CFG: LIMPHD1-DFIN	1000	FIXEDPHI-0		→ Selection list 4	**LIMPHD1** Configuration of input signal
C1083	(C1082)	Disp				**LIMPHD1** Display of input signal
C1084			-16000.0000	{0.0001 rpm}	16000.0000	**LIMPHD1**
1		1000				Upper limit of $N_{max.}$
2		1000				Lower limit of $N_{max.}$
C1085	NO-LIM-Mode	0				**LIMPHD1** Code is available from software version 3.4 onwards
			0	Clear overflow buffer		If LIMPHD1-NO-LIM = HIGH, the overflow buffer is cleared. The position is lost.
			1	Empty overflow buffer		If LIMPHD1-NO-LIM = HIGH, the overflow buffer is emptied. The increments are output at LIMPHD1-DFOUT. The position is not lost.
C1090	OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN1** Signal output
C1091	CODE	141	2	{1}	2000	**FEVAN1** Selection of the target code
C1092	SUBCODE	0	0	{1}	255	**FEVAN1** Selection of the target subcode
C1093	NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN1** Numerator
C1094	DENOMIATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN1** Denominator
C1095	OFFSET	0	0	{1}	1000000000	**FEVAN1** Offset setting
C1096 STOP	IN	1000	FIXED0%		→ Selection list 1	**FEVAN1** Configuration of analog input signal
C1097 STOP	FEVAN1-LOAD	1000	FIXED0		→ Selection list 2	**FEVAN1** Configuration of digital input signal
C1098	(C1096)	Disp	-32768	{1}	32767	**FEVAN1** Display of analog input signal
C1099	(C1097)	Disp				**FEVAN1** Display of digital input signal

Code		Possible settings					IMPORTANT
No.	Designation	Lenze	Selection				
C1100	FUNCTION	1					**FCNT1** Function selection
			1	Return			If |counter content| ≥ |FCNT1-CMP-Val|, FCNT1-EQUAL is set to HIGH for 1 ms
			2	Hold if >=			If |counter content| ≥ |FCNT1-CMP-Val|, the counter stops
			3	Hold if =			If |counter content| = |FCNT1-CMP-Val|, the counter stops
C1101 STOP						→ Selection list 1	**FCNT1** Configuration of analog input signals
1	LD-VAL	1000	FIXED0%				
2	CMP-VAL	1000	FIXED0%				
C1102 STOP						→ Selection list 2	**FCNT1** Configuration of digital input signals
1	CLKUP	1000	FIXED0				
2	CLKDWN	1000	FIXED0				
3	LOAD	1000	FIXED0				
C1103		Disp	-32768		{1}	32768	**FCNT1** Display of analog input signals
1	(C1101/1)						
2	(C1101/2)						
C1104		Disp					**FCNT1** Display of digital input signals
1	(C1102/1)						
2	(C1102/2)						
3	(C1102/3)						
C1106 STOP						→ Selection list 2	**SWPH1, SWPH2** Configuration of digital input signals
1	CFG: SWPH1-SET	1000	FIXED0				
2	CFG: SWPH2-SET	1000	FIXED0				
C1107		Disp					**SWPH1, SWPH2** Display of digital input signals
1	(C1106/1)						
2	(C1106/2)						
C1108		1000				→ Selection list 3	**SWPH1, SWPH2** Configuration of input signals
1	SWPH1-IN1	1000	FIXED0INC				
2	SWPH1-IN2	1000	FIXED0INC				
3	SWPH2-IN1	1000	FIXED0INC				
4	SWPH2-IN2	1000	FIXED0INC				
C1109		Disp					**SWPH1, SWPH2** Display of input signals
1	(C1108/1)						
...	...						
4	(C1108/4)						
C1120	SYNC MODE	2	0 1 2	Sync off CAN sync activated Terminal sync activated			**SYNC1, SYNC2** Function

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1121 STOP		2	0	{1 ms}	13	**SYNC1, SYNC2** The interpolation is restarted with every sync signal
1	SYNC CYCLE	2				**SYNC1, SYNC2** Definition of the cycle time of sync signals (in the slave); for system bus only
2	INTERPOL. CYCL	2				**SYNC1, SYNC2** Definition of the interpolation time between the sync signals (in the slave); for terminal only
C1122	SYNC TIME	0.460	0.000	{0.001 ms}	10.000	**SYNC1, SYNC2** Phase shift between CAN sync and internal control program cycle. ● For system bus only ● Depending on the baud rate and bus load
C1123			-0.450	{0.001 ms}	0.450	**SYNC1, SYNC2**
1	PHASESHIFT	0.000				Phase shift between terminal sync and internal control program cycle; for terminal sync only
2	SYNC WINDOW	0.200				Synchronisation window for the synchronisation edge of the terminal sync (LOW/HIGH edge). For terminal sync only. SYNCx-STAT = HIGH if the sent sync signal is within the window.
C1124 STOP	IN1	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration of analog input signal
C1125 STOP	IN2	1000	FIXED0INC		→ Selection list 3	**SYNC1** Configuration of input signal
C1126 STOP	IN3	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration of analog input signal
C1127	(C1124)	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal
C1128	(C1125)	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of input signal
C1129	(C1126)	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal
C1140	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS3** Selection of edge evaluation
C1141	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS3** Setting of the pulse duration
C1143 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS3** Display of digital input signal
C1144	(C1143)	Disp				**TRANS3** Configuration of digital input signal
C1145	FUNCTION	0	0 Rising edge 1 Falling edge 2 Both edges			**TRANS4** Selection of edge evaluation
C1146	PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS4** Setting of the pulse duration
C1148 STOP	IN	1000	FIXED0		→ Selection list 2	**TRANS4** Configuration of digital input signal
C1149	(C1148)	Disp				**TRANS4** Display of digital input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1150	FUNCTION	0	0 Load permanent 1 Load edge 2 Compare & subtract			**PHINT3** Function selection
C1151	CMP. VALUE	$2 \cdot 10^9$	0	{1}	2000000000	**PHINT3** Setting of a comparison value
C1153 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT3** Configuration of speed input signal
C1154 STOP	LOAD	1000	FIXED0		→ Selection list 2	**PHINT3** Configuration of digital input signal
C1155 STOP	SET	1000	FIXED0INC		→ Selection list 3	**PHINT3** Configuration of phase input signal
C1157	(C1153)	Disp	-32767	{1}	32767	**PHINT3** Display of input signal
C1158	(C1154)	Disp				**PHINT3** Display of digital input signal
C1159	(C1155)	Disp	-2147483647	{1}	2147483647	**PHINT3** Display of input signal
C1160 STOP					→ Selection list 1	**ASW3** Configuration of analog input signals
1	IN1	1000	FIXED0%			
2	IN2	1000	FIXED0%			
C1161 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW3** Configuration of digital input signal
C1162		Disp	-199.99	{0.01 %}	199.99	**ASW3** Display of analog input signals
1	(C1160/1)					
2	(C1160/2)					
C1163	(C1161)	Disp				**ASW3** Display of digital input signal
C1165 STOP					→ Selection list 1	**ASW4** Configuration of analog input signals
1	IN1	1000	FIXED0%			
2	IN2	1000	FIXED0%			
C1166 STOP	SET	1000	FIXED0		→ Selection list 2	**ASW4** Configuration of digital input signal
C1167		Disp	-199.99	{0.01 %}	199.99	**ASW3** Display of analog input signals
1	(C1165/1)					
2	(C1165/2)					
C1168	(C1166)	Disp				**ASW4** Display of digital input signal
C1170	NUMERATOR	1	-32767		32767	**CONV6** Numerator
C1171	DENOMINATOR	1	1	{1}	32767	**CONV6** Denominator
C1172 STOP	IN	1000	FIXED0%		→ Selection list 1	**CONV6** Configuration of analog input signal
C1173	(C1172)	Disp	-199.99	{0.01 %}	199.99	**CONV6** Display of analog input signal
C1175 STOP					→ Selection list 2	**AND6** Configuration of digital input signals
1	IN1	1000	FIXED0			
2	IN2	1000	FIXED0			
3	IN3	1000	FIXED0			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1176		Disp		**AND6** Display of digital input signals
1	(C1175/1)			
2	(C1175/2)			
3	(C1175/3)			
C1178 STOP			→ Selection list 2	**AND7, AND8, AND9** Configuration of digital input signals
1	IN	1000	FIXED0	AND7-IN1
2	IN	1000	FIXED0	AND7-IN2
3	IN	1000	FIXED0	AND7-IN3
4	IN	1000	FIXED0	AND8-IN1
5	IN	1000	FIXED0	AND8-IN2
6	IN	1000	FIXED0	AND8-IN3
7	IN	1000	FIXED0	AND8-IN4
8	IN	1000	FIXED0	AND8-IN5 (NOT)
9	IN	1000	FIXED0	AND9-IN1
10	IN	1000	FIXED0	AND9-IN2
11	IN	1000	FIXED0	AND9-IN3
12	IN	1000	FIXED0	AND9-IN4
13	IN	1000	FIXED0	AND9-IN5 (NOT)
C1179		Disp		**AND7, AND8, AND9** Display of digital input signals
1	(C1178/1)			
...	...			
13	(C1178/13)			
C1180 STOP			→ Selection list 2	**PHINT4, PHINT5** Configuration of digital input signals
1	LOAD	1000	FIXED0	PHINT4-LOAD
2	RESET	1000	FIXED0	PHINT4-RESET
3	RESET	1000	FIXED0	PHINT5-RESET
4	LOAD	1000	FIXED0	PHINT5-LOAD
5	TP-ENABLE	1000	FIXED0	PHINT5-TP-ENABLE
6	TP-EDGE-SELECT	1000	FIXED0	PHINT5-TP-EDGE-SELECT
C1181		Disp		**PHINT4, PHINT5** Display of digital input signals
1	(C1180/1)			
...	...			
6	(C1180/6)			
C1182 STOP			→ Selection list 3	**PHINT4, PHINT5** Configuration of phase input signals
1	H-VALUE	1000	FIXED0INC	PHINT4-H-VALUE
2	L-VALUE	1000	FIXED0INC	PHINT4-L-VALUE
3	SET	1000	FIXED0INC	PHINT4-SET
4	SET	1000	FIXED0INC	PHINT5-SET
5	H-VALUE	1000	FIXED0INC	PHINT5-H-VALUE
6	TP-POS	1000	FIXED0INC	PHINT5-TP-POS
7	X-OFFSET	1000	FIXED0INC	PHINT5-X-OFFSET

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1183		Disp				**PHINT4, PHINT5** Display of input signals
1	(C1182/1)					
...	...					
7	(C1182/7)					
C1184 STOP				→ Selection list 4		**PHINT4** Configuration of speed input signals
1	DFIN	1000	FIXEDPHI-0			PHINT4-DFIN
2	DFIN	1000	FIXEDPHI-0			PHINT5-DFIN
3	TP-SPEED-LIM	1000	FIXEDPHI-0			PHINT5-TP-SPEED-LIM
C1185		Disp				**PHINT4** Display of input signals
1	(C1184/1)					
2	(C1184/2)					
3	(C1184/3)					
C1186		1				**PHINT5** Touch probe mode
			0	X7/X8 + X5/E4, immediate compensation		
			1	X9 + X5/E5, immediate compensation		
			2	DFIN + X5/E5, compensation after zero crossing		
C1188 STOP				→ Selection list 1		**PHINT5** Configuration of analog input signals
1	NUM	1000	FIXED0%			
2	DENOM	1000	FIXED0%			
C1189		Disp				**PHINT5** Display of analog input signals
1	(C1188/1)					
2	(C1188/2)					
C1190		0				**Temperature characteristic for PTC thermistor** Selection of the characteristic for the PTC thermistor at X7 or X8 for motor temperature detection
			0	Standard		Characteristic for PTC thermistors used in Lenze motors
			1	Characteristic		Characteristic for application-specific PTC thermistors
C1191			0	{1 °C}	255	**PTC thermistor temperature range** Definition of temperature points on the PTC thermistor characteristic
1		100				Lower temperature point T1
2		150				Upper temperature point T2
C1192			0	{1 Ω}	3000	**PTC thermistor resistance range** Definition of resistance points on the PTC thermistor characteristic
1		1670				Resistance point R1 for T1
2		2225				Resistance point R2 for T2
C1195 STOP	OUT.D2	1000	FIXED0INC		→ Selection list 3	**AIF-OUT** Configuration of phase input signal
C1196	(C1195)	Disp	-2147483647	{1}	2147483647	**AIF-OUT** Display of input signal
C1197	IN.D2	Disp				**AIF-IN** Display of input signal

Code		Possible settings					IMPORTANT
No.	Designation	Lenze	Selection				
C1200 STOP						→ Selection list 3	**PHADD1** Configuration of phase input signals
1	IN1	1000	FIXED0INC				
2	IN2	1000	FIXED0INC				
3	IN3	1000	FIXED0INC				
C1201		Disp	-2147483647	{1}		2147483647	**PHADD1** Display of input signals
1	(C1200/1)						
2	(C1200/2)						
3	(C1200/3)						
C1205 STOP						→ Selection list 3	**PHCMP2** Configuration of input signals
1	PHCMP2-IN1	1000	FIXED0INC				
2	PHADD1-IN2	1000	FIXED0INC				
C1206		Disp	-2147483647	{1}		2147483647	**PHADD1** Display of input signals
1	(C1205/1)						
2	(C1205/2)						
C1207	FUNCTION	2	1 IN1 < IN2 2 |IN1| < |IN2|				**PHCMP2** Selection of the comparison operation
C1210 STOP						→ Selection list 2	**STORE1** Configuration of digital input signals
1	STORE1-RESET	1000	FIXED0				
2	STORE1-ENTP	1000	FIXED0				
3	STORE1-ENWIN	1000	FIXED0				
4	STORE1-LOAD0	1000	FIXED0				
5	STORE1-LOAD1	1000	FIXED0				
C1211 STOP						→ Selection list 4	**STORE1** Configuration of input signals
1	STORE1-IN	1000	FIXEDPHI-0				
2	STORE1-MASKI	1000	FIXEDPHI-0				
C1212 STOP	MASKV	1000	FIXED0INC			→ Selection list 3	**STORE1** Configuration of input signal
C1215		Disp					**STORE1** Display of digital input signals
1	(C1210/1)						
...	...						
5	(C1210/5)						
C1216		Disp	-32767	{1 rpm}		32767	**STORE1** Display of input signals
1	(C1211/1)						
2	(C1211/2)						
C1217	(C1212)	Disp	-2147483647			2147483647	**STORE1** Display of input signal
C1220 STOP						→ Selection list 2	**STORE2** Configuration of digital input signals
1	STORE2-RESET	1000	FIXED0				
2	STORE2-ENTP	1000	FIXED0				
C1223		Disp					**STORE2** Display of digital input signals
1	(C1220/1)						
2	(C1220/2)						

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1230 STOP					→ Selection list 2	**PHDIFF1** Configuration of digital input signals
1	PHDIFF1-EN	1000	FIXED0			
2	PHDIFF1-RES	1000	FIXED0			
C1231 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**PHDIFF1** Configuration of input signals
C1232 STOP					→ Selection list 3	**PHDIFF1** Configuration of input signals
1	PHDIFF1-SET	1000	FIXED0INC			
2	PHDIFF1-ADD	1000	FIXED0INC			
C1235		Disp				**PHDIFF1** Display of digital input signals
1	(C1230/1)					
2	(C1230/2)					
C1236	(C1231)	Disp	-32767	{1 rpm}	32767	
C1237		Disp	-2147483647		2147483647	**PHDIFF1** Display of input signals
1	(C1232/1)					
2	(C1232/2)					
C1240 STOP					→ Selection list 1	**CONVPHPH1** Configuration of input signals
1	CONVPHPH1-NUM	1000	FIXED0%			
2	CONVPHPH1-DEN	1000	FIXED0%			
C1241 STOP	CONVPHPH1-ACT	1000	FIXED0		→ Selection list 2	**CONVPHPH1** Configuration of input signals
C1242 STOP	CONVPHPH1-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHPH1** Configuration of input signals
C1245		Disp	-199.99	{0.01 %}	1999.99	**CONVPHPH1** Display of analog input signals
1	(C1240/1)					
2	(C1240/2)					
C1246	(C1241)	Disp				**CONVPHPH1** Display of digital input signal
C1247	(C1242)	Disp	-2147483647		2147483647	**CONVPHPH1** Display of input signal
C1250 STOP	IN	1000	FIXEDPHI-0		→ Selection list 4	**CONVPP1** Configuration of input signals
C1251 STOP		1000			→ Selection list 3	**CONVPP1** Configuration of input signals
1	CONVPP1-NUM		FIXED0INC			
2	CONVPP1-DEN		FIXED0INC			
C1253	(C1250)	Disp	-32767	{1 rpm}	32767	**CONVPP1** Display of input signal
C1254		Disp	-2147483647	{1}	2147483647	**CONVPP1** Display of input signals
1	(C1251/1)					
2	(C1251/2)					
C1255 STOP	N-TRIM2	1000	FIXEDPHI-0		→ Selection list 4	**DFSET** Configuration of input signal
C1258	(C1255)	Disp	-32767	{1 rpm}	32767	
C1260	OFFSET	0	-16383	{1}	16383	**GEARCOMP** Offset

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1261	NUM	1	-32767	{1}	32767	**GEARCOMP** Numerator
C1262	DENUM	1	1	{1}	32767	**GEARCOMP** Denominator
C1265 STOP	TORQUE	1000	FIXED0%		→ Selection list 1	**GEARCOMP** Configuration of correction input signal
C1266 STOP	PHI-IN	1000	FIXED0INC		→ Selection list 3	**GEARCOMP** Configuration of input signal
C1268	(C1265)	Disp	-199.99	{0.01 %}	199.99	**GEARCOMP** Display of analog input signal
C1269	(C1266)	Disp	-2147483647	{1}	2147483647	**GEARCOMP** Display of input signal
C1270 STOP					→ Selection list 3	**PHCMP3** Configuration of input signal
1	PHCMP3-IN1	1000	FIXED0INC			
2	PHCMP3-IN2	1000	FIXED0INC			
C1271		Disp	-2147483647	{1}	2147483647	**PHCMP3** Display of input signals
1	(C1270/1)					
2	(C1270/2)					
C1272	FUNCTION	2	1 IN1 < IN2 2 |IN1| < |IN2|			**PHCMP3** Selection of the comparison operation
C1290	MONIT P16	3	0 Trip 2 Warning 3 Off			**P16 monitoring** Configuration of sync error monitoring
C1292	MONIT P19	2	0 Trip 2 Warning 3 Off			**P19 monitoring** Configuration of monitoring with limited input value at DFIN
C1295		0	0 Limited to ±29999			**CDATA** CDATA-NOUT limitation mode C1295 must be set to 1 to prevent positioning errors caused by the input signal for the stretching and compressing function at YSET1-FACT being > 100 %.
			1 Limited to ±14999			
C1296		0	0 C1331/1 1 Input CDATA-TP-SPEED-LIM			**CDATA** Selection of the signal source for limiting the TP catch-up speed
C1297		0				**CDATA** Mode for CDATA-NOUT
			0 NOUT follows continuously			Output signal at CDATA-NOUT follows positioning jumps
			1 NOUT follows, NOUT=0 if X-RESET=1			If CDATA-REL-SEL = 0 and CDATA-X-RESET = 1, CDATA-NOUT is set to 0
C1298		Disp				**Resolution of master value** Unit: [inc./s-units]
C1299		Disp				**Resolution of drive** Unit: [inc./s-units]
C1300		Disp	1 ... 8			**CDATA** Number of profiles used
C1301		Disp	0	{1}	2048	**CDATA** Number of grid points → Depending on the number of profiles
1	CURVE 0					
...	..					
8	CURVE 7					

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1303			1	{1}	65535	Gearbox factor
1		1				Gearbox factor numerator - master value
2		1				Gearbox factor denominator - master value
C1304		360.0000	0.0001	{0.0001 units/rev.}	214000.0000	**Output-side feed constant - master value** Output-side feed constant - master value
C1305			1	{1}	65535	**Gearbox factor**
1		1				Gearbox factor numerator - actual value
2		1				Gearbox factor denominator - actual value
C1306		360.0000	0.0001	{0.0001 units/rev.}	214000.0000	**Output-side feed constant - actual value** Output-side feed constant - actual value
C1307		0				**CDATA** Mode of profile change-over for input CDATA-RESET
			0	Init CAM via LH edge at RESET		A LOW/HIGH edge at CDATA-RESET is used to change between profiles.
			1	Init CAM via HIGH edge at RESET		The level at CDATA-RESET is evaluated. Changing between profiles is possible when the level is HIGH.
C1308	WELD MODE	0				**WELD1** If FB WELD1 is used, C1308 must be set to 1.
			0	Without WELD function		When selecting a configuration **without** FB WELD1, C1308 is automatically set to 0.
			1	With WELD function		When selecting a configuration **with** FB WELD1, C1308 is automatically set to 1.
C1309		100	1	{1 inc.}	$18 \cdot 10^8$	**CDATA** Window for zero crossing of the master value
C1310		0	0	{1}	7	**CURVEC1** Profile selection
C1311		0	0 1 2 3 4 5 6 7	Profile 1 Profile 2 Profile 3 Profile 4 Profile 5 Profile 6 Profile 7 Profile 8		**CDATA** Start profile for cyclic profile switching. Input CDATA-CYCLE must be HIGH. Is internally limited to one profile.
C1312 STOP		1	0	{1}	7	**CDATA** Range of profile switching More x profiles (starting with C1311) will be processed
C1313 STOP		0	0 1	Asynchronous stretching/compression Synchronous stretching/compression		**CDATA** Stretching/compression (actual value)
C1314 STOP		0	0 1	CW rotation CCW rotation		**CDATA** Direction of rotation of master value ● Set C1313 = 0 if the YSET1 FB is not used
C1315		Disp		{1 inc}		**CDATA** Clock pulse length of the master value
1	Curve 0					
...	...					
8	Curve 7					

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1316		Disp	{1 inc}	**CDATA** Final Y value
1	Curve 0			
...	...			
8	Curve 7			
C1317		0		**CDATA**
			0 Load with ctrl. inhibit	Reloading profiles with controller inhibit
			1 Load without ctrl. inhibit	Reloading profiles without controller inhibit
C1318		0	0 Adapt stop value 1 Maintain stop value 2 Maintain sections	**TEACH mode**
C1319		0		**CDATA** Stretching/compression mode
			0 DFIN * XFACT / 100%	● Use of XFACT as multiplier: – XFACT = +100 % ● No stretching/compression: – XFACT = -100 % ● No stretching/compression but reversal of direction for X position. The profile will be processed from the end: – XFACT > 100 % ● Leads to compression: – XFACT < 100 %
			1 DFIN * 100% / XFACT	● Use of XFACT as divisor (reciprocal value): – Values < 1 % at input XFACT are internally limited to +1 % ● If stretching/compression is not wanted: – Connect XFACT with FIXED100% (default setting)
C1320 STOP			→ Selection list 1	**CDATA, CURVEC1**
1		1000	FIXED0%	CURVEC1-AIN
2		1006	FIXED100%	**CDATA** CDATA-XFACT Stretching/compression factor: ● +100 % = no stretching/compression ● >100 % = compression ● <100 % = stretching
3		1000	FIXED0%	**CDATA** CDATA-SEL Profile selection: 0 = profile 0 (1st profile)
C1321		Disp		
1	(C1320/1)			
2	(C1320/2)			
3	(C1320/3)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1322 STOP			→ Selection list 2	**CDATA, CURVEC1** Configuration of digital input signals
1	CDATA-CYCLE	1000	FIXED0	HIGH = Profiles under C1311 and C1312 are processed cyclically.
2	CDATA-RESET	1000	FIXED0	HIGH: If CDATA-CYCLE = LOW, the input CDATA-SEL is immediately evaluated; if CDATA-CYCLE = HIGH, the profile under C1311 is processed.
3	CDATA-REL-SEL	1000	FIXED0	HIGH: Feed function active
4	CDATA-XRESET	1000	FIXED0	HIGH: Sets master value integrator to 0
5	CDATA-X-TP	1000	FIXED0	HIGH: Sets master value integrator to TP-POS if input X-TP/E5 = LOW
6	CDATA-HOLD	1000	FIXED0	HIGH: Inhibits profile switching, input has priority
7	CDATA-LOAD	1000	FIXED0	LOW/HIGH edge activates reloaded/new profiles
8	CDATA-X-TP/E5	1000	FIXED0	Selection of TP initiator: LOW= Initiator at X-TP HIGH = Connect initiator to terminal X5/E5
9	CURVEC1-HOLD	1000	FIXED0	HIGH = Outputs AOUT and OUT are stored; DFOUT = 0
10	CURVEC1-SEL-IN	1000	FIXED0	Selection - input AIN ↔IN LOW = AIN HIGH = IN
11	CURVEC1-REL-SEL	1000	FIXED0	HIGH: feed function active (relative positioning)
12	CURVEC1-XRESET	1000	FIXED0	HIGH: sets the master value integrator to the value at input CDATA-X-START
13	CDATA-TEACH	1000	FIXED0	HIGH: Teach function is activated ● Contact Lenze
14	CDATA-TP-DISABLE	1000	FIXED0	HIGH: No evaluation of the touch-probe signals
15	CDATA-SEL-CAM-MODE	1000	FIXED0	Mode for changing-over between profiles: ● LOW: During operation, change-over between profiles takes place at the end of a profile ● HIGH: Change-over between profiles can take place while a motion profile is being processed – Only possible with the absolute data model – The interpolation points must have an absolutely equal distribution – The motion profiles must be congruent at the point of change-over – The change-over takes place immediately when a new profile number is selected
16	CDATA-TP-EDGE-SELECT	1000	FIXED0	HIGH: The LOW/HIGH edge of the touch-probe signal is evaluated LOW: The HIGH/LOW edge of the touch-probe signal is evaluated
C1323		Disp		**CDATA, CURVEC1** Display of digital input signals
1	(C1322/1)			
...	...			
16	(C1322/16)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1324 STOP			→ Selection list 3	**CDATA, CURVEC1** Configuration of input signals
1	CDATA-X-START	1000	FIXED0INC	
2	CDATA-XIN	1000	FIXED0INC	Input for master value position if C1332 = 1
3	CDATA-XOFFS	1000	FIXED0INC	Input for offset in X direction (only if C1332 = 0)
4	CDATA-TP-POS	19616	FCODE 1476/16	TP position of the master value
5	CURVEC1-IN	1000	FIXED0INC	Phase input
6	CADTA-YIN	1000	FIXED0INC	Y position input signal for the TEACH function
7	CDATA-OFFS-XIN	1000	FIXED0INC	Offset on the input signal at CDATA-XIN for C1338 = 1 or C1338 = 2
C1325		Disp	{1 inc}	**CDATA, CURVEC1** Display of input signals
1	(C1324/1)			
...	...			
7	(C1324/7)			
C1326 STOP			→ Selection list 3	**CDATA** Configuration of input signals
1	CDATA-DFIN	1000	FIXEDPHI-0	Input for digital frequency at C1332 = 0
2	CDATA-TP-SPEED-LIM	1000	FIXEDPHI-0	Speed selection for a touch probe correction ● The input can, for instance, be linked to an RFGPH2 function block to compensate a position deviation via a profile generator.
C1327		Disp		**CDATA** Display of input signals
1	(C1326/1)			
2	(C1326/2)			
C1329		Disp		**CDATA** Display of X values in [m/units]
1				X axis position CDATA-X-ACT
2				X integrator position CDATA-XPOS
3				Distance between two marks
4				Offset to mark
C1330		Disp		**CDATA** Display of X values in [s/units]
1				Profile position CDATA-YOUT
2				Profile position CDATA-YOUT-CYCLE
C1331		100	0 {1 rpm} 15000	**CDATA** Maximum TP catch-up speed. Only valid for: ● C1335 = 1 ● C1335 = 2
C1332		0		**CDATA** Selection of master value
			0 Master value from CDATA-DFIN	
			1 Master value from CDATA-XIN	
			2 Master value from CDATA-XPOS	
C1333		Disp	{1 inc}	**CDATA** Actual X position
C1334		Disp		**CDATA** Actual Y position
C1335		0	0 Without catch-up limitation 1 With catch-up limitation 2 Cross cutter	**CDATA** Effect on the catch-up speed during master axis synchronisation via touch probe

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1336		Disp		
1				DY
2				DX
C1337		Disp		**No. of interpolation point**
C1338	XIN-MODE	0		**CDATA**
			0 Without input CDATA-OFFS-XIN	• CDATA-XOFFS and CDATA-XFACT have no effect. • If master position > Xmax, CDATA-X > XMAX = HIGH is set. The master position is internally limited to Xmax. • If master position < 0, CDATA-X < 0 = HIGH is set. The master position is internally limited to 0.
			1 With input CDATA-OFFS-XIN	• This option is suitable if an absolute value encoders is used as a master position encoder. Thus, the profile can be shifted by maximally ± 1 profile clock pulse with respect to the encoder. • Offset connected to CDATA-OFFS-XIN: CDATA-XOFFS and CDATA-XFACT have no effect. • If master position + offset > Xmax ((XIN + OFFS-XIN > ACTLEN) * 2)), CDATA-X > XMAX = HIGH is set. The master position is internally limited to Xmax. • If master position < 0, CDATA-X < 0 = HIGH is set. The master position is internally limited to 0.
			2 With input CDATA-OFFS-XIN for CDATA-X-RESET	• Function same as C1338 = 1 if CDATA-X-RESET = HIGH. • The signal at CDATA-X-NOUT is output without pulse loss.
C1339		Disp		**CCTRL, CCTRL2** Display of Y values in [s_units]
1				Profile position CCTRL-PHI-SET
2				Second position setpoint CCTRL-PHI-SET2
3				Actual position value CCTRL-PHI-ACT
4				Actual following error CCTRL-POUT
C1340 STOP			→ Selection list 1	**CCTRL, CCTRL2** Configuration of analog input signals
1	CCTRL-NRED	1000	FIXED0%	Gain for speed setpoint feedforward control
2	CCTRL-MRED	1000	FIXED0%	Gain for torque setpoint feedforward control
3	CCTRL2-NRED	1000	FIXED0%	Gain for speed setpoint feedforward control
4	CCTRL2-MRED	1000	FIXED0%	Gain for torque setpoint feedforward control
C1341		Disp	-199.99 {0.01%} 199.99	**CCTRL, CCTRL2** Display of analog input signals
1	(C1340/1)			
...	...			
4	(C1340/4)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1342 STOP			→ Selection list 2	**CCTRL, CCTRL2** Configuration of digital input signals
1	CCTRL-RESET	1000	FIXED0	HIGH: Set phase = actual phase (CCTRL-POUT = 0)
2	CCTRL-TPIN	1000	FIXED0	HIGH: External mark for setting the position
3	CCTRL-N2-SET	1000	FIXED0	HIGH = Input CCTRL-NSET2 active
4	CCTRL-TPIN/E4	1000	FIXED0	HIGH: Touch probe initiator at X5/E4
5	CCTRL-SUB-Y-END	1000	FIXED0	Acceptance clock pulse for profile end
6	CCTRL-RESET-N2	1000	FIXED0	HIGH: Deletes the following error if CCTRL-N2-Set = 1
7	CCTRL-CLR-INTEG	1000	FIXED0	HIGH: Sets all integrators to 0
8	CCTRL2-RESET	1000	FIXED0	HIGH: Set phase = actual phase (CCTRL2-POUT = 0)
9	CCTRL2-TPIN	1000	FIXED0	HIGH: External mark for setting the position
10	CCTRL2-N2-SET	1000	FIXED0	HIGH = Input CCTRL2-NSET2 active
11	CCTRL2-TPIN/E4	1000	FIXED0	HIGH: Touch probe initiator at X5/E4
12	CCTRL2-SUB-Y-END	1000	FIXED0	Acceptance clock pulse for profile end
13	CCTRL2-RESET-N2	1000	FIXED0	HIGH: Deletes the following error if CCTRL2-N2-Set = 1
14	CCTRL2-CLR-INTEG	1000	FIXED0	HIGH: Sets all integrators to 0
15	CCTRL-TP-EDGE-SELECT	1000	FIXED0	HIGH: The LOW/HIGH edge of the touch-probe signal is evaluated LOW: The HIGH/LOW edge of the touch-probe signal is evaluated
C1343		Disp		**CCTRL, CCTRL2** Display of digital input signals
1	(C1342/1)			
...				
15	(C1342/15)			
C1344 STOP			→ Selection list 3	**CCTRL, CCTRL2** Configuration of input signals
1	CCTRL-Y-END	1000	FIXED0INC	Final value of the profile (only required for touch probe)
2	CCTRL-TP-POS	1000	FIXED0INC	Only with TP synchronisation. Position of the TP sensor in the traversing range
3	CCTRL2-Y-END	1000	FIXED0INC	Final value of the profile (only required for touch probe)
4	CCTRL2-TP-POS	1000	FIXED0INC	Only with TP synchronisation. Position of the TP sensor in the traversing range
C1345		Disp	{1 inc}	**CCTRL, CCTRL2** Display of input signals
1	(C1344/1)			
...	...			
4	(C1344/4)	Disp		

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1346 STOP			→ Selection list 4	**CCTRL, CCTRL2** Configuration of input signals
1	CCTRL-IN	1000	FIXEDPHI-0	Input for main setpoint
2	CCTRL-NSET2	1000	FIXEDPHI-0	Input for alternative setpoint (2nd setpoint)
3	CCTRL2-IN	1000	FIXEDPHI-0	Input for main setpoint
4	CCTRL2-NSET2	1000	FIXEDPHI-0	Input for alternative setpoint (2nd setpoint)
5	CCTRL2-TP-SPEED-LIM	1000	FIXEDPHI-0	Speed selection for compensating for a detected position deviation (touch probe). ● The input can, for instance, be linked to an RFGPH3 function block to compensate a position deviation via a profile generator.
C1347		Disp		**CCTRL, CCTRL2** Display of input signals
1	(C1346/1)			
...	...			
5	(C1346/5)			
C1348			1 {1} 32767	**CCTRL, CCTRL2** Adaptation of the torque feedforward control to the moment of inertia of the machine
1		100		Torque feedforward control - numerator
2		1		Torque feedforward control - denominator
C1349		1	0 CW rotation mode 1 CW/CCW rotation mode 2 Absolute value encoder mode 3 Homing mode	**CCTRL** Touch probe mode
C1350		0	0 CW rotation 1 CCW rotation	**YSET1** Actual value of direction of rotation
C1351		0	0 Without offset 1 With offset	**YSET1** Compression mode
C1352 STOP	YSET1-FACT	1000	FIXED0% → Selection list 1	**YSET1** Stretching/compression factor: +100 % = no stretching/compression >100 % = compression <100 % = stretching
C1353	(C1352)	Disp		**YSET1** Display of analog input signal
C1354 STOP			→ Selection list 2	**YSET1**
1	YSET1-RESET	1000	FIXED0	Reset of the -OFFS input
2	YSET1-SYNCH	1000	FIXED0	Clock pulse input for synchronous switching of the stretching/compression factor
C1355		Disp		**YSET1** Display of digital input signals
1	(C1354/1)			
2	(C1354/2)			
C1356 STOP	YSET1-OFFS	1000	FIXED0INC → Selection list 3	**YSET1** Offset value
C1357	(C1356)	Disp	{1 inc}	
C1358 STOP	-		→ Selection list 4	**YSET1** Configuration of input signals
1	YSET1-IN	1000	FIXEDPHI-0	
2	YSET1-IN-SYNCH	1000	FIXEDPHI-0	

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1359		Disp		**YSET1** Display of input signals
1	(C1358/1)			
2	(C1358/2)			
C1360 STOP			→ Selection list 3	**VTPOSC** Configuration of input signals
1	VTPOSC-IN1	1000	FIXED0INC	
2	VTPOSC-IN2	1000	FIXED0INC	
3	VTPOSC-IN3	1000	FIXED0INC	
4	VTPOSC-IN4	1000	FIXED0INC	
5	VTPOSC-IN5	1000	FIXED0INC	
6	VTPOSC-IN6	1000	FIXED0INC	
7	VTPOSC-IN7	1000	FIXED0INC	
8	VTPOSC-IN8	1000	FIXED0INC	
9	VTPOSC-IN9	1000	FIXED0INC	
10	VTPOSC-IN10	1000	FIXED0INC	
C1361		Disp		**VTPOSC** Display of input signals
1	(C1360/1)			
...	...			
10	(C1360/10)			
C1362 STOP		1000	→ Selection list 4	**ADDPHD1** Configuration of input signals
1	ADDPHD1-DFIN1		FIXEDPHI-0	Addition input
2	ADDPHD1-DFIN2		FIXEDPHI-0	Addition input
3	ADDPHD1-DFIN3		FIXEDPHI-0	Subtraction input
C1363		Disp		**ADDPHD1** Display of input signals
1	(C1362/1)			
2	(C1362/2)			
3	(C1362/3)			
C1364		0		**YSET1** OFFSET-RESET mode
			0 Y-Offset reset	Offset is internally stored with YSET1-RESET = HIGH
			1 y-Offset disable	Offset is internally set to ”0” with YSET1-RESET = HIGH
C1365			0.0000 {0.0001 rpm} 15000.0000	**CCTRL, CCTRL2** Maximum touch probe catch-up speed
1		100.0000		Function only possible with C1366 = 0 (without catch-up limitation)
C1366		0		**CCTRL** Selection of catch-up speed limitation
			0 Without catch-up limitation	
			1 With catch-up limitation	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1367 STOP			-214000.0000	{0.0001 s-units}	214000.0000	**CCTRL, CCTRL2**
1		0.0000				Set home position 1. When using an absolute value encoder as feedback: Enter the distance between tool and machine zero. 2. Switch off the controller and then on again to reinitialise the profile data. ● The home position must only be set once. After that, the controller is able to find the position after mains switching. ● The y value displayed refers to machine zero.
2		0.0000				Reset home position ● Writing a "0" resets the "Set reference" function executed under C1367/1. ● The encoders are no longer considered to be absolute, but relative encoders.
C1368		0	0 Motor mounted on the right-hand side 1 Motor mounted on the left-hand side			**CCTRL** Motor mounting direction
C1369		1	1	{1 ms}	100	**CCTRL** M-Tv-CCTRL-MOUT Rate time for torque feedforward control
C1370 STOP	EXTPOL1-AIN	1000	FIXED0%		→ Selection list 1	**EXTPOL1** Configuration of input signals
C1371	(C1370)	Disp				**EXTPOL1** Display of analog input signal
C1374 STOP					→ Selection list 3	**EXTPOL1/EXTPOL2** Configuration of input signals
1	EXTPOL1-PHIN	1000	FIXED0INC			
2	EXTPOL2-PHIN	1000	FIXED0INC			
C1375		Disp		{1 inc}		**EXTPOL1, EXTPOL2** Display of input signals
1	(C1374/1)					
2	(C1374/2)					
C1379		2	1	{1 ms}	127	**EXTPOL2** Maximum extrapolation cycles
C1380			10	{1 inc}	1800000000	**CERR1**
1		10				Hysteresis of fault signal (ERR output)
2		10				Hysteresis of warning signal (WARN output)
C1384 STOP	CERR1-WFAC	1000	FIXED0		→ Selection list 1	**CERR1** Reduction factor +100 % = No reduction <100 % = Reduction >100 % = Increase
C1385	(C1384)	Disp				**CERR1** Display of analog input signal
C1386 STOP	CERR1-DISABLE	1000	FIXED0%		→ Selection list 1	**CERR1** HIGH sets CERR1-WARN and CERR1-EER = 0
C1387	(C1386)	Disp				**CERR1** Display of analog input signal
C1388 STOP		1000			→ Selection list 4	**CERR1** Configuration of input signals
1	CERR1-PHI-IN		FIXED0INC			Input
2	CERR1-LIM		FIXED0INC			Switching threshold; the absolute value is generated from the input value

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1389		Disp	{1 inc}	**CERR1** Display of input signals
1	(C1388/1)			
2	(C1388/2)			
C1394 STOP			→ Selection list 2	**MSEL1, MSEL2** Configuration of digital input signals
1	MSEL1-EN-M1	1000	FIXED0	Activation of master value 1
2	MSEL1-EN-M2	1000	FIXED0	Activation of master value 2
3	MSEL1-EN-M3	1000	FIXED0	Activation of master value 3
4	MSEL1-EN-M4	1000	FIXED0	Activation of master value 4
5	MSEL1-LOCK	1000	FIXED0	Locking
6	MSEL2-EN-M1	1000	FIXED0	Activation of master position 1
7	MSEL2-EN-M2	1000	FIXED0	Activation of master position 2
8	MSEL2-EN-M3	1000	FIXED0	Activation of master position 3
9	MSEL2-EN-M4	1000	FIXED0	Activation of master position 4
10	MSEL2-LOCK	1000	FIXED0	Locking
C1395		Disp		**MSEL1, MSEL2** Display of digital input signals
1	(C1394/1)			
...	...			
10	(C1394/10)			
C1396 STOP			→ Selection list 3	**MSEL2**
1	MSEL2-M1POS	1000	FIXED0INC	Master position input 1
2	MSEL2-M2POS	1000	FIXED0INC	Master position input 2
3	MSEL2-M3POS	1000	FIXED0INC	Master position input 3
4	MSEL2-M4POS	1000	FIXED0INC	Master position input 4
C1397		Disp	{1 inc}	**MSEL2** Display of input signals
1	(C1396/1)			
...	...			
4	(C1396/4)			
C1398 STOP			→ Selection list 4	**MSEL1** Configuration of input signals
1	MSEL1-DFIN1	1000	FIXEDPHI-0	Master value input 1
2	MSEL1-DFIN2	1000	FIXEDPHI-0	Master value input 2
3	MSEL1-DFIN3	1000	FIXEDPHI-0	Master value input 3
4	MSEL1-DFIN4	1000	FIXEDPHI-0	Master value input 4
C1399		Disp		**MSEL1** Display of input signals
1	(C1398/1)			
...	...			
4	(C1398/4)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1400 STOP			→ Selection list 2	**RFGPH1**
1	RFGPH1-RESET	1000	FIXED0	• HIGH sets RFGPH1-OUT = 0 (jump) • LOW sets RFGPH1-OUT to the value at RFGPH1-IN according to the selected function • Input has priority over RFGPH1-RFG-0
2	RFGPH1-RFG-0	1000	FIXED0	• HIGH sets RFGPH1-OUT = 0 according to the selected function • LOW sets RFGPH1-OUT to the value at RFGPH1-IN according to the selected function
3	RFGPH1-T/DIST	1000	FIXED0	Function changeover: • HIGH = path-based path change • LOW = time-based path change
C1401		Disp		**RFGPH1** Display of digital input signals
1	(C1400/1)			
2	(C1400/2)			
3	(C1400/3)			
C1402 STOP			→ Selection list 3	**RFGPH1** Configuration of input signals
1	RFGPH1-IN	1000	FIXED0INC	Position setpoint (65536 inc. = 1 rev.)
2	RFGPH1-DIST	1000	FIXED0INC	Path difference by which the phase is to be changed at the input RFGPH1-IN (65536 inc. = 1 rev.)
C1403		Disp		**RFGPH1** Display of input signals
1	(C1402/2)			
2	(C1402/2)			
C1404 STOP	RFGPH1-DFIN	1000	FIXEDPHI-0 → Selection list 4	**RFGPH1** Configuration of digital frequency input signals
C1405	(C1404)	Disp		**RFGPH1** Display of input signal
C1408		300.0000	-16000.0000 {0.0001 rpm} 16000.0000	**RFGPH1** Speed
C1409 STOP		0	0 With absolute value generation 1 Without absolute value generation 2 Without absolute value with end	**RFGPH1** Mode
C1410 STOP		0	0 Directly engaged 1 To open position 2 To target position 3 Engage at set position	**CLUTCH1** Clutch mode
C1411		200.0000	1 {0.0000 rpm} 16000.0000	**CLUTCH1** Maximum speed
C1412			0.010 {0.010 s} 130.000	**CLUTCH1, CLUTCH2**
1		1.000		CLUTCH1: Disengagement time/ramp
2		1.000		CLUTCH1: Profile generator ramp
3		1.000		CLUTCH1: Overload time delay
4		1.000		CLUTCH2: Disengagement time
5		1.000		CLUTCH2: Profile generator ramp
C1413			5 {1 inc.} 32767	**CLUTCH1, CLUTCH2**
1		163		CLUTCH1: Catch hysteresis
2		163		CLUTCH2: Catch hysteresis

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1414			→ Selection list 1	**CLUTCH1** Configuration of analog input signals
1	CLUTCH1-MLIM	1000	FIXED0%	Threshold for overload monitoring
2	CLUTCH1-MACT	1000	FIXED0%	Act. value for overload monitoring
C1415		Disp		**CLUTCH1** Display of analog input signals
1	(C1414/1)			
2	(C1414/2)			
C1416 STOP			→ Selection list 2	**CLUTCH1, CLUTCH2** Configuration of digital input signals
1	CLUTCH1-CLOSE	1000	FIXED0	HIGH = Engage clutch LOW = Disengage clutch
2	CLUTCH1-OL-DET	1000	FIXED0	HIGH = Activate overload monitoring
3	CLUTCH2-CLOSE	1000	FIXED0	HIGH: Engage clutch LOW: Disengage clutch
4	CLUTCH2-SEL	1000	FIXED0	HIGH: Engage clutch immediately LOW: Wait for position setpoint, then engage
C1417		Disp		**CLUTCH1, CLUTCH2** Display of digital input signals
1	(C1416/1)			
...	...			
4	(C1416/4)			
C1418 STOP			→ Selection list 3	**CLUTCH1, CLUTCH2** Configuration of input signals
1	CLUTCH1-PHI-SET	1000	FIXED0INC	Set position of the drive
2	CLUTCH1-PHI-ACT	1000	FIXED0INC	Actual position of the drive
3	CLUTCH2-PHI-SET	1000	FIXED0INC	Set position of line shaft (X axis)
4	CLUTCH2-PHI-ACT	1000	FIXED0INC	Actual position of line shaft (X axis)
5	CLUTCH2-LEN	1000	FIXED0INC	Clock pulse length (X axis)
C1419		Disp	{1 inc.}	**CLUTCH1, CLUTCH2** Display of input signals
1	(C1418/1)			
...	...			
5	(C1418/5)			
C1420		0	0 Profile 0 1 Profile 1 2 Profile 2 3 Profile 3 4 Profile 4 5 Profile 5 6 Profile 6 7 KURVE 7	**CSEL1** Event profile
C1424 STOP			→ Selection list 2	**CSEL1** Configuration of digital input signals
1	CSEL1-CAM*1	1000	FIXED0	(Selection bit 0)
2	CSEL1-CAM*2	1000	FIXED0	Selection bit 1
3	CSEL1-CAM*4	1000	FIXED0	Selection bit 2
4	CSEL1-LOAD	1000	FIXED0	Acceptance signal = LOW->HIGH edge
5	CSEL1-EVENT	1000	FIXED0	Event profile

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1425		Disp		**CSEL1** Display of digital input signals
	(C1424/1)			
	...			
	(C1424/5)			
C1430			0.0000 {0.0001 units} 214000.0000	**PSAVE1**
1		1.0000		Window for master value comparison
2		1.0000		Window for actual value comparison
C1431		0	0 Compare MPOS and ACTPOS 1 Compare MPOS only 2 Compare ACTPOS only	**PSAVE1** Memory function
C1434 STOP			→ Selection list 2	**PSAVE1** Configuration of digital input signals
1	PSAVE1-ON	1000	FIEXED0	HIGH = Comparison of inputs PSAVE1-MPOS and PSAVE1-ACTPOS with saved values and difference output
2	PSAVE1-SAVE	1000	FIEXED0	HIGH = Acceptance of inputs PSAVE1-MPOS and PSAVE1-ACTPOS
C1435		Disp		**PSAVE1** Display of digital input signals
1	(C1434/1)			
2	(C1434/2)			
C1436 STOP			→ Selection list 3	**PSAVE1** Configuration of input signals
1	PSAVE1-MPOS	1000	FIXED0INC	Input for master position
2	PSAVE1-ACTPOS	1000	FIXED0INC	Input for actual position (e.g. rotor position)
C1437		Disp	{1 inc.}	**PSAVE1** Display of input signals
1	(C1436/1)			
2	(C1436/2)			
C1440 STOP			→ Selection list 2	**SWPHD1, SWPHD2** Configuration of digital input signals
1	SWPHD1-SET	1000	FIXED0	
2	SWPHD2-SET	1000	FIXED0	
C1441		Disp		**SWPHD1, SWPHD2** Display of digital input signals
1	(C1440/1)			
2	(C1440/2)			
C1442 STOP			→ Selection list 4	**SWPHD1/SWPHD2** Configuration of input signals
1	SWPHD1-IN1	1000	FIXEDPHI-0	
2	SWPHD1-IN2	1000	FIXEDPHI-0	
3	SWPHD2-IN1	1000	FIXEDPHI-0	
4	SWPHD2-IN2	1000	FIXEDPHI-0	
C1443		Disp		**SWPHD1, SWPHD2** Display of input signals
1	(C1442/1)			
...	...			
4	(C1442/4)			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1444 STOP			→ Selection list 3	**WELD1** Configuration of input signals
1	WELD1-XIN	1000	FIXED0INC	Input X position
2	WELD1-LEN-O	1000	FIXED0INC	Length of the closing phase
3	WELD1-LEN-C	1000	FIXED0INC	Length of the opening phase
4	WELD1-LEN	1000	FIXED0INC	Length of the profile
5	WELD1-TIME	1000	FIXED0INC	Welding time in ms (1 inc. = 1 ms)
C1445		Disp	{1 inc.}	**WELD1** Display of input signals
1	(C1444/1)			
...	...			
5	(C1444/5)			
C1446		0		**WELD1**
			0 Weld1 mode: Time	The value at input “Weld-Time” is interpreted as time.
			1 Weld1 mode: Distance	The value at input “Weld-Time” is interpreted as distance.
			2 Weld1 mode: Distance with saving	The value at input “Weld-Time” is interpreted as distance. “WELD-TIME” is saved for the further cycle when phase 2 of the profile is started.
C1448 STOP	CFG: WELD1-BREAK	1000	FIXED0 → Selection list 2	**WELD1** Configuration of digital input signal
C1449	(C1448)	Disp		**WELD1** Display of digital input signal
C1450 STOP			→ Selection list 3	**CONVPHPHD1, CONVPHPHD2** Configuration of input signals
1	CONVPHPHD1-IN	1000	FIXED0INC	
2	CONVPHPHD2-IN	1000	FIXED0INC	
C1451		Disp	{1 inc.}	**CONVPHPHD1, CONVPHPHD2** Display of input signals
1	(C1450/1)			
2	(C1450/2)			
C1452		1	-32767 {1} 32767	**CONVPHPHD1** Numerator
C1453		1	1 {1} 32767	**CONVPHPHD1** Denominator
C1454 STOP	CONVPHPHD2-RESET	1000	FIXED0 → Selection list 2	**CONVPHPHD2** Configuration of digital input signal
C1455	(C1454)	Disp		**CONVPHPHD2** Display of digital input signal
C1456 STOP	CONV7-DFIN	1000	FIXEDPHI-0 → Selection list 4	**CONV7** Configuration of input signals
C1457	(C1456)	Disp		**CONV7** Display of input signals
C1458		1	-32767 {1} 32767	**CONV7** Numerator
C1459		1	1 {1} 32767	**CONV7** Denominator
C1460		0	0 Analog setpoint 1 Digital frequency setpoint	**VMAS1** Setpoint source selection

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1461			-16000.0000	{0.0001 rpm}	16000.0000	**VMAS1**
1		300.0000				CW speed
2		300.0000				CCW speed
C1462			0.010	{0.001 s}	999.990	**VMAS1**
1		1.000				Acceleration time
2		1.000				Deceleration time
C1463			0	{1 rpm}	16000	**VMAS1**
1		100				Ramp function generator window
2		100				Ramp function generator hysteresis
C1466 STOP					→ Selection list 1	**VMAS1** Configuration of analog input signals
1	VMAS1-AIN	1000	FIXED0%			Analog setpoint
2	VMAS1-RED-VAL	1000	FIXED0%			Alternative analog setpoint, target for speed reduction
C1467		Disp				**VMAS1** Display of analog input signals
1	(C1466/1)					
2	(C1466/2)					
C1468 STOP					→ Selection list 2	**VMAS1** Configuration of digital input signals
1	VMAS1-EN-AIN	1000	FIXED0			HIGH = Activates the analog inputs VMAS1-AIN or VMAS1-DFIN (depending on the selection under C1460)
2	VMAS1-EN-RED	1000	FIXED0			HIGH = Activates the analog input VMAS1-RED-VAL
3	VMAS1-EN-RFG	1000	FIXED0			HIGH = Activates the ramp function generator LOW = Input values are processed directly
4	VMAS1-CW	1000	FIXED0			Input of CW rotation (activate speed under C1461/1)
5	VMAS1-CCW	1000	FIXED0			Input of CCW rotation (activate speed under C1461/2)
6	VMAS1-RFG=0	1000	FIXED0			HIGH: Set VMAS1-OUT to 0 rpm via the adjustable ramp in C1463/3. The function has priority over all other functions.
C1469		Disp				**VMAS1** Display of digital input signals
1	(C1468/1)					
...	...					
6	(C1468/6)					
C1472 STOP	VMAS1-DFIN	1000	FIXEDPHI-0		→ Selection list 4	**VMAS1** Configuration of input signal for master speed (digital frequency)
C1473	(C1472)	Disp				**VMAS1** Display of input signal
C1476			-214000.0000	{0.0001 m-units}	214000.0000	**FCODE master** Freely configurable code for master values [m-units]
1		0.0000				
...		0.0000				
16		0.0000				

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1477			-214000.0000	{0.0001 s-units}	214000.0000	**FCODE slave** Freely configurable code for actual values [s-units]
1		0.0000				
...		0.0000				
16		0.0000				
C1478			-214000.0000	{0.0001 z-units}	214000.0000	**FCODE Z** Freely configurable code for a freely definable system of units [z-units]. The unit system is set via C1680/x and C1681.
1		0.0000				
...		0.0000				
6		0.0000				
C1480 STOP		512	10	{1}	32767	**CONVPHD1** Encoder constant
C1486					→ Selection list 3	**CONVPHD1** Configuration of input signal
1	CONVPHD1-NOM	19521	FCODE-474/1			Stretch factor numerator, input limited to ±1000000
2	CONVPHD1-DEN	19522	FCODE-474/2			Stretch factor denominator, input limited to +1 ... +200000000
C1487		Disp				**CONVPHD1** Display of input signal
1	(C1486/1)					
2	(C1486/2)					
C1488 STOP	CONVPHD1-IN	1000	FIXEDPHI-0		→ Selection list 4	**CONVPHD1** Configuration of input signal (signal in rpm)
C1489	(C1488)	Disp				**CONVPHD1** Display of input signal
C1500	OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN2** Signal output
C1501	CODE	141	2	{1}	2000	**FEVAN2** Target code of FEVAN2
C1502	SUBCODE	0	0	{1}	255	**FEVAN2** Target subcode of FEVAN2
C1503	NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN2** Numerator
C1504	DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN2** Denominator
C1505	OFFSET	0	0		1000000000	**FEVAN2** Offset
C1506 STOP	FEVAN2-IN	1000	FIXED0%		→ Selection list 1	**FEVAN2** Configuration of analog input signal
C1507 STOP	LOAD	1000	FIXED0		→ Selection list 2	**FEVAN2** Configuration of digital input signal
C1508	(C1506)	Disp	-32768	{1}	32767	**FEVAN2** Display of analog input signal
C1509	(C1507)	Disp				**FEVAN2** Display of digital input signal

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1550	ARITPH4 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH4** Arithmetic function selection
C1551 STOP			→ Selection list 3	**ARITPH4** Configuration of input signals
1	ARITPH4-IN1	1000	FIXED0INC	
2	ARITPH4-IN2	1000	FIXED0INC	
C1552		Disp	-2147483647 {1 inc} 2147483647	**ARITPH4** Display of input signals
1	(C1551/1)			
2	(C1551/2)			
C1555	ARITPH5 FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH5** Arithmetic function selection
C1556 STOP			→ Selection list 3	**ARITPH5** Configuration of input signals
1	ARITPH5-IN1	1000	FIXED0INC	
2	ARITPH5-IN2	1000	FIXED0INC	
C1557		Disp	-2147483647 {1 inc} 2147483647	**ARITPH5** Display of input signals
1	(C1556/1)			
2	(C1556/2)			
C1560	ARITPH6-FUNCT	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH6** Arithmetic function selection
C1561 STOP		1000	→ Selection list 3	**ARITPH6** Configuration of input signals
1	ARITPH6-IN1	1000	FIXED0INC	
2	ARITPH6-IN2	1000	FIXED0INC	
C1562		Disp	-2147483647 {1 inc} 2147483647	**ARITPH6** Display of input signals
1	(C1561/1)			
2	(C1561/2)			
C1580 STOP	CONVAD1-IN	1000	FIXED0% → Selection list 1	**CONVAD1** Configuration of analog input signal
C1581	(C1580)	Disp	-32768 {1} 32767	**CONVAD1** Display of analog input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1582 STOP	CONVAD2-IN	1000	FIXED0%		→ Selection list 1	**CONVAD2** Configuration of analog input signal
C1583	(C1582)	Disp	-32768	{1}	32767	**CONVAD2** Display of analog input signal
C1590	NUMERAATOR	1	-32768	{1}	32767	**CONVAPH1** Numerator
C1591	DENUMERAATOR	1	1	{1}	32767	**CONVAPH1** Denominator
C1593 STOP	CONVAPH1-IN	1000	FIXED0%		→ Selection list 1	**CONVAPH1** Configuration of analog input signal
C1594	(C01593)					**CONVAPH1** Display of analog input signal
C1610		1	0	{1}	31	**CONVAPH1** Division factor
C1611 STOP	CONVPHA2-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHA2** Configuration of input signal
C1612	(C1611)	Disp		{1 inc.}		**CONVPHA2** Display of input signal
C1615		1	0	{1}	31	**CONVAPH2** Division factor
C1616 STOP	CONVPHA3-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHA3** Configuration of input signal
C1617	(C1616)	Disp		{1 inc.}		**CONVPHA3** Display of input signal
C1620 STOP					→ Selection list 3	**CONVPHAA1** Configuration of input signals
1	CONVPHAA1-PHIN	1000	FIXED0INC			
2	CONVPHAA2-PHIN	1000	FIXED0INC			
C1621		Disp		{1 inc.}		**CONVPHAA1** Display of input signals
1	(C1620/1)					
2	(C1620/2)					
C1640 STOP	RESET	1000	FIXED0		→ Selection list 2	**SPC1**

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1641			FCODE1476/x FCODE1477/x FCODE0474/x VTPOSC-No.x	**SPC1**
1	SPC1-VALUE 1-1	1		Switching point output STATUS-01
2	SPC1-VALUE 1-2	1		Switching point output STATUS-01
3	SPC1-VALUE 2-1	1		Switching point output STATUS-02
4	SPC1-VALUE 2-2	1		Switching point output STATUS-02
5	SPC1-VALUE 3-1	1		Switching point output STATUS-03
6	SPC1-VALUE 3-2	1		Switching point output STATUS-03
7	SPC1-VALUE 4-1	1		Switching point output STATUS-04
8	SPC1-VALUE 4-2	1		Switching point output STATUS-04
9	SPC1-VALUE 5-1	1		Switching point output STATUS-05
10	SPC1-VALUE 5-2	1		Switching point output STATUS-05
11	SPC1-VALUE 6-1	1		Switching point output STATUS-06
12	SPC1-VALUE 6-2	1		Switching point output STATUS-06
13	SPC1-VALUE 7-1	1		Switching point output STATUS-07
14	SPC1-VALUE 7-2	1		Switching point output STATUS-07
15	SPC1-VALUE 8-1	1		Switching point output STATUS-08
16	SPC1-VALUE 8-2	1		Switching point output STATUS-08
C1642 STOP	SPC1-L-IN	1000	FIXED0INC → Selection list 3	**SPC1** Configuration of input signal
C1643	(C1640)	Disp	0 1	**SPC1** Display of digital input signal
C1644	(C1642)	Disp	-1073741824 {1 inc} 1073741823	**SPC1** Display of input signal
C1645	MODE	0	0 On / off 1 Centre/range	**SPC1** Mode
C1650 STOP	SPC2-RESET	1000	FIXED0 → Selection list 2	**SPC2** Configuration of input signal

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1651			FCODE1476/1			**SPC2**
1	SPC2-VALUE 1-1	1				Switching point output STATUS-01
2	SPC2-VALUE 1-2	1				Switching point output STATUS-01
3	SPC2-VALUE 2-1	1				Switching point output STATUS-02
4	SPC2-VALUE 2-2	1				Switching point output STATUS-02
5	SPC2-VALUE 3-1	1				Switching point output STATUS-03
6	SPC2-VALUE 3-2	1				Switching point output STATUS-03
7	SPC2-VALUE 4-1	1				Switching point output STATUS-04
8	SPC2-VALUE 4-2	1				Switching point output STATUS-04
9	SPC2-VALUE 5-1	1				Switching point output STATUS-05
10	SPC2-VALUE 5-2	1				Switching point output STATUS-05
11	SPC2-VALUE 6-1	1				Switching point output STATUS-06
12	SPC2-VALUE 6-2	1				Switching point output STATUS-06
13	SPC2-VALUE 7-1	1				Switching point output STATUS-07
14	SPC2-VALUE 7-2	1				Switching point output STATUS-07
15	SPC2-VALUE 8-1	1				Switching point output STATUS-08
16	SPC2-VALUE 8-2	1				Switching point output STATUS-08
C1652 STOP	SPC2-L-IN	1000	FIXED0INC		→ Selection list 3	**SPC2** Configuration of input signal
C1653	(C1650)	Disp	0		1	**SPC2** Display of digital input signal
C1654	(C1652)	Disp	-1073741824	{1 inc}	1073741823	**SPC2** Display of input signal
C1655	MODE	0	0 On / off 1 Centre/range			**SPC2 mode**
C1657			-30000	{1 ms}	30000	**SPC2** Dead time
1	DEATH TIME	0				
...	...	0				
4	DEATH TIME	0				
C1658	HYSTERESIS	0	-32767	{1 inc}	32767	**SPC2** Hysteresis
C1659	FILTER	1	0 Filter off 1 Filter 1 ms 2 Filter 2 ms 4 Filter 4 ms 8 Filter 8 ms 16 Filter 16 ms			**SPC2** Filters
C1660	ACT.SEL.	Disp	0	{1}	8	**SELPH1** Display of actual selection

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1661 STOP	SELPH1-SELECT	1000	FIXED0%		→ Selection list 1	**SELPH1** Configuration of analog input signal
C1662 STOP					→ Selection list 3	**SELPH1** Configuration of input signals
1	SELPH1-IN1	1000	FIXED0INC			
...	...	1000	FIXED0INC			
8	SELPH1-IN8	1000	FIXED0INC			
C1663	(C1661)	Disp	-32768	{1}	32767	**SELPH1** Display of analog input signal
C1664	(C1662)	Disp	-2147483648	{1 inc}	147483648	**SELPH1** Display of input signals
1	(C1662/1)					
...	...					
8	(C1662/8)					
C1665	ACT.SEL.	Disp	0	{1}	88	**SELPH2** Display of actual selection
C1666 STOP	SELPH2-SELECT	1000	FIXED0%		→ Selection list 1	**SELPH2** Configuration of analog input signal
C1667 STOP					→ Selection list 3	**SELPH2** Configuration of input signals
1	SELPH2-IN1	1000	FIXED0INC			
...	...	1000	FIXED0INC			
8	SELPH2-IN8	1000	FIXED0INC			
C1668	(C1666)	Disp	-32768	{1}	32767	**SELPH2** Display of analog input signal
C1669		Disp	-2147483648	{1 inc}	2147483648	**SELPH2** Display of input signals
1	(C1667/1)					
...	...					
8	(C1667/8)					
C1680 STOP			1	{1}	65535	**FCODE Z**
1		1				Gearbox factor numerator for Z-axis
2		1				Gearbox factor denominator for Z-axis
C1681 STOP		360.0000	0.0001	{0.0001 untis/rev}	214000.0000	**FCODE Z** Feed constant for Z-axis
C1700 STOP					→ Selection list 2	**CLUTCH3** Configuration of digital input signals
1	CLUTCH3-OPEN-INSTANT	1000	FIXED0			HIGH: ● Reset fault messages ● Disengage clutch immediately
2	CLUTCH3	1000	FIXED0			Reserved
3	CLUTCH3-CLOSE	1000	FIXED0			HIGH: Engage LOW: Disengage. The function depends on the mode set under C1707
4	CLUTCH3-SEL	1000	FIXED0			Reserved
C1701		Disp				**CLUTCH3** Display of digital input signals
1	(C1700/1)					
...	...					
4	(C1700/4)					

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1702 STOP			→ Selection list 3	**CLUTCH3** Configuration of input signals
1	CLUTCH3-TARGET-POS	1000	FIXED0INC	The "disengage" function depends on the mode set under C1707: ● C1707 = 0: After CLUTCH3-CLOSE = LOW, the clutch opens along the set ramps and stops in the position applied to CLUTCH3-TARGET-POS. ● C1707 = 1: After CLUTCH3-CLOSE = LOW, the clutch runs synchronously until the position applied to CLUTCH3-TARGET-POS is reached and opens subsequently. The standstill position results from the speed and the set ramp.
2	CLUTCH3-DIST	1000	FIXED0INC	Reserved
3	CLUTCH3-PHI-SET	1000	FIXED0INC	Set position of the master shaft
4	CLUTCH3-PHI-ACT	1000	FIXED0INC	Actual position of the master shaft
5	CLUTCH3-LEN	1000	FIXED0INC	Clock pulse length (X axis)
C1703		Disp	{1 inc}	**CLUTCH3** Display of input signals
1	(C1702/1)			
...	...			
5	(C1702/5)			
C1704 STOP	CLUTCH3-LOW-VEL	1000	FIXEDPHI-0 → Selection list 4	**CLUTCH3** Configuration of input signal Selection of a minimum speed at which the drive is to rotate after disengaging.
C1705	(C1704)	Disp	-32767 32767	**CLUTCH3** Display of input signal
C1706			0.010 {0.01 s} 50.000	**CLUTCH3**
1	Open-Instant/Rampe	1.000		Deceleration time of the ramp at CLUTCH3-OPEN-INSTANT = HIGH (disengaging)
2	Öffnungszeit/Rampe	1.000		Deceleration time of the ramp at CLUTCH3-CLOSE = LOW (disengaging)
3	Schließzeit/Rampe	1.000		Acceleration time of the ramp at CLUTCH3-CLOSE = HIGH (engaging)
C1707 STOP		0		**CLUTCH3** Clutch mode
			0 Time-controlled: target = TARGET-POS	After CLUTCH3-CLOSE = LOW, the clutch opens along the set ramps and stops in the position applied to CLUTCH3-TARGET-POS.
			1 Time-controlled: start opening at TARGET-POS	After CLUTCH3-CLOSE = LOW, the clutch runs synchronously until the position applied to CLUTCH3-TARGET-POS is reached and opens subsequently. The standstill position results from the speed and the set ramp.
C1708			0 {1 rpm} 15000	**CLUTCH3**
1	Window of master speed in starting position	10		Speed window for master speed at the time of clutch-in (starting position)

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1718 STOP			→ Selection list 1	**STORE3** Configuration of analog input signals
1	STORE3-OFFSET	1000	FIXED0%	Selects the memory location the content of which is to be output
2	STORE3-FREE	1000	FIXED0%	Reserved
C1719		Disp		**STORE3** Configuration of analog input signals
1	(C1718/1)			
2	(C1718/2)			
C1720 STOP			→ Selection list 2	**STORE3** Configuration of digital input signals
1	STORE3-INIT	1000	FIXED0	Initialisation of all memory locations with the value applied to STORE3-INIT-POS. The input has the highest priority. ● LOW/HIGH edge: Starts the initialisation of all memory locations. The handshake signals at STORE3-BUSY and STORE3-RDY indicate the status of the initialisation. ● LOW: sets STORE3-RDY = 0 ● HIGH: inhibits all other functions
2	STORE3-LOAD-IN-POS	1000	FIXED0	● LOW/HIGH edge: Transfers the value at STORE3-IN-POS to the memory location STORE3-SEL-IN
3	STORE3-STORE-PHOUT	1000	FIXED0	STORE3-MODE = LOW: ● LOW/HIGH edge: Transfers the content of memory location STORE3-SEL-OUT to STORE3-PHOUT STORE3-MODE = HIGH: ● Input inactive
4	STORE3-MODE	1000	FIXED0	● LOW: The data of memory location STORE3-SEL-OUT is output to STORE3-STORE-PHOUT. ● HIGH: The memory location to be output to STORE3-PHOUT is calculated from STORE3-SEL-IN – STORE3-OFFSET. The output is continuous.
C1721		Disp		**STORE3** Display of digital input signals
1	(C1720/1)			
...	...			
4	(C1720/4)			
C1722 STOP			→ Selection list 3	**STORE3** Configuration of input signals
1	STORE3-INIT-POS	1000	FIXED0INC	Value for initialising all memory locations. ● The initialisation is started by a LOW/HIGH edge at STORE3-INIT.
2	STORE3-IN-POS	1000	FIXED0INC	Value to be transferred to the memory location selected with STORE3-SEL-IN. ● The value is transferred with a LOW/HIGH edge at STORE3-INIT.
C1723		Disp	{1 inc}	**STORE3** Display of input signals
1	(C1722/1)			
2	(C1722/2)			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C1726			-2147483647	{1 inc}	2147483647	**STORE3** Memory
1		0				Memory location 0
2		0				Memory location 1
...		0				...
16		0				Memory location 16
C1727		0	0	{1}	15	**STORE3** Initial value at STORE3-SEL-IN
C1735		0				**CCTRL2** Source for touch probe catch-up speed in the event of deviations
			0	Code 1365/1		• Detected deviations are compensate as fast as possible with the speed selected under C1365/1. • Value under C1365/1 = 0: No compensation of deviations.
			1	Input CCTRL2-TP-SPEED-LIM		• Detected deviations are compensated with the speed selected at CCTRL2-TP-SPEED-LIM. • Signal at CCTRL2-TP-SPEED-LIM = 0: No compensation of deviations. • The input is only active if CCTRL2-TP-SYNC-BUSY = High.
C1740		0				**PHINT5** Source for touch probe catch-up speed in the event of deviations
			0	Code 1741/1		• Detected deviations are compensated with the speed selected under C1741/1. • Value in C1741/1 = 0: no compensation of deviations.
			1	Input PHINT5-TP-SPEED-LIM		• Detected deviations are compensated with the speed selected at PHINT5-TP-SPEED-LIM. • Signal at PHINT5-TP-SPEED-LIM = 0: No compensation of deviations. • The input is only active if PHINT5-TP-SYNC-BUSY = HIGH.
C1741			0.0000	{0.0001 rpm}	15000.0000	**PHINT5** Maximum touch probe catch-up speed
1		10.0000				
C1799		1250	20	{1}	1250	**DFOUT f_{max} (kHz)** 1250 corresponds to 500 kHz
C1810		Disp				**SW identification LECOM**
C1811		Disp				**SW creation**

8.5 Selection lists

8.5.1 Selection list 1: Analog output signals

Parameter	Analog output signal (O)
00050	AIN1-OUT
00055	AIN2-OUT
00100	DFSET-NOUT
01000	FIXED0%
01006	FIXED100%
01007	FIXED-100%
05000	MCTRL-NSET2
05001	MCTRL-NACT
05002	MCTRL-MSET2
05003	MCTRL-MACT
05004	MCTRL-IACT
05005	MCTRL-DCVOLT
05009	MCTRL-PHI-ANA
05050	NSET-NOUT
05051	NSET-RFG-I
05100	MPOT1-OUT
05150	PCTRL1-OUT
05200	REFC-N-SET
05500	ARIT1-OUT
05505	ARIT2-OUT
05550	ADD1-OUT
05600	RFG1-OUT
05610	SRFG1-OUT
05611	SRFG1-DIFF
05650	ASW1-OUT
05655	ASW2-OUT
05660	ASW3-OUT
05665	ASW4-OUT
05700	ANEG1-OUT
05705	ANEG2-OUT
05750	FIXSET1-OUT
05800	LIM1-OUT
05850	ABS1-OUT
05900	PT1-1-OUT
05950	DT1-1-OUT
06100	MFAIL-NOUT
06150	DB1-OUT
06200	CONV1-OUT
06205	CONV2-OUT
06210	CONV3-OUT
06215	CONV4-OUT
06230	CONVPHA1-OUT
06232	CONVPHA2-OUT
06234	CONVPHA3-OUT

Parameter	Analog output signal (O)
06300	S&H1-OUT
06350	CURVE1-OUT
06400	FCNT1-OUT
06600	SYNC1-OUT3
10000	BRK1-M-SET
13301	CDATA-ACTCAM
13302	CURVEC1-AOUT
13303	CDATA-ERR-NR
13304	CDATA-LOAD-ERR-NR
13351	CCTRL-NOUT
13352	CCTRL-MOUT
13355	CCTRL2-NOUT
13356	CCTRL2-MOUT
13601	CSEL1-OUT
13701	MSEL1-MVAL
13711	MSEL2-MVAL
13920	CONVPHAA1-AOUT1
13921	CONVPHAA1-AOUT2
13925	CONVPHAA2-AOUT1
13926	CONVPHAA2-AOUT2
14800	STORE3-SEL-IN
14801	STORE3-SEL-OUT
15028	MCTRL utilisation
15030	MCTRL-LOAD-I2xt
19500	FCODE-SYS-17
19502	FCODE-SYS-26/1
19503	FCODE-SYS-26/2
19504	FCODE-SYS-27/1
19505	FCODE-SYS-27/2
19506	FCODE-SYS-32
19507	FCODE-SYS-37
19510	FCODE-SYS-108/1
19511	FCODE-SYS-108/2
19512	FCODE-SYS-109/1
19513	FCODE-SYS-109/2
19515	FCODE-SYS-141
19521	FCODE-%-472/1
19522	FCODE-%-472/2
19523	FCODE-%-472/3
19524	FCODE-%-472/4
19525	FCODE-%-472/5
19526	FCODE-%-472/6
19527	FCODE-%-472/7
19528	FCODE-%-472/8
19529	FCODE-%-472/9

Parameter	Analog output signal (O)
19530	FCODE-%-472/10
19531	FCODE-%-472/11
19532	FCODE-%-472/12
19533	FCODE-%-472/13
19534	FCODE-%-472/14
19535	FCODE-%-472/15
19536	FCODE-%-472/16
19537	FCODE-%-472/17
19538	FCODE-%-472/18
19539	FCODE-%-472/19
19540	FCODE-%-472/20
19551	FCODE-A-473/1
19552	FCODE-A-473/2
19553	FCODE-A-473/3
19554	FCODE-A-473/4
19555	FCODE-A-473/5
19556	FCODE-A-473/6
19557	FCODE-A-473/7
19558	FCODE-473/8
19559	FCODE-473/9
19560	FCODE-473/10
20101	CAN-IN1.W1
20102	CAN-IN1.W2
20103	CAN-IN1.W3
20201	CAN-IN2.W1
20202	CAN-IN2.W2
20203	CAN-IN2.W3
20204	CAN-IN2.W4
20301	CAN-IN3.W1
20302	CAN-IN3.W2
20303	CAN-IN3.W3
20304	CAN-IN3.W4
25101	AIF-IN.W1
25102	AIF-IN.W2
25103	AIF-IN.W3

8.5.2 Selection list 2: Digital output signals

Parameter	Digital output signal (□)
00051	DIGIN1
00052	DIGIN2
00053	DIGIN3
00054	DIGIN4
00055	DIGIN5
00060	STATE-BUS-O
00065	DIGIN-CINH
00100	DFSET-ACK
00500	DCTRL-RDY
00501	DCTRL-CINH
00502	DCTRL-INIT
00503	DCTRL-IMP
00504	DCTRL-NACT=0
00505	DCTRL-CW/CCW
01000	FIXED 0
01001	FIXED 1
05001	MCTRL-QSP-OUT
05002	MCTRL-IMAX
05003	MCTRL-MMAX
05050	NSET-RFG-I=0
05200	REFC-OK
05201	REFC-BUSY
05912	PT1-2-LIM
05913	PT1-2-MEM
06000	DFRFG1-FAIL
06001	DFRFG1-SYNC
06100	MFAIL-STATUS
06101	MFAIL-I-RESET
06400	FCNT1-EQUAL
06450	SPC1-STATUS-01
06451	SPC1-STATUS-02
06452	SPC1-STATUS-03
06453	SPC1-STATUS-04
06454	SPC1-STATUS-05
06455	SPC1-STATUS-06
06456	SPC1-STATUS-07
06457	SPC1-STATUS-08
06460	SPC2-STATUS-01
06461	SPC2-STATUS-02
06462	SPC2-STATUS-03
06463	SPC2-STATUS-04
06464	SPC2-STATUS-05
06465	SPC2-STATUS-06
06466	SPC2-STATUS-07
06467	SPC2-STATUS-08
06600	SYNC1-STAT

Parameter	Digital output signal (□)
07150	CONVAD1-0
07151	CONVAD1-1
07152	CONVAD1-2
07153	CONVAD1-3
07154	CONVAD1-4
07155	CONVAD1-5
07156	CONVAD1-6
07157	CONVAD1-7
07158	CONVAD1-8
07159	CONVAD1-9
07160	CONVAD1-10
07161	CONVAD1-11
07162	CONVAD1-12
07163	CONVAD1-13
07164	CONVAD1-14
07165	CONVAD1-SIGN
07170	CONVAD2-0
07171	CONVAD2-1
07172	CONVAD2-2
07173	CONVAD2-3
07174	CONVAD2-4
07175	CONVAD2-5
07176	CONVAD2-6
07177	CONVAD2-7
07178	CONVAD2-8
07179	CONVAD2-9
07180	CONVAD2-10
07181	CONVAD2-11
07182	CONVAD2-12
07183	CONVAD2-13
07184	CONVAD2-14
07185	CONVAD2-SIGN
10000	BRK1-OUT
10001	BRK1-CINH
10002	BRK1-QSP
10003	BRK1-M-STORE
10250	R/L/Q-QSP
10251	R/L/Q-R/L
10500	AND1-OUT
10505	AND2-OUT
10510	AND3-OUT
10515	AND4-OUT
10520	AND5-OUT
10525	AND6-OUT
10530	AND7-OUT
10535	AND8-OUT

Parameter	Digital output signal (□)
10540	AND9-OUT
10550	OR1-OUT
10555	OR2-OUT
10560	OR3-OUT
10565	OR4-OUT
10570	OR5-OUT
10575	OR6-OUT
10580	OR7-OUT
10600	NOT1-OUT
10605	NOT2-OUT
10610	NOT3-OUT
10615	NOT4-OUT
10620	NOT5-OUT
10650	CMP1-OUT
10655	CMP2-OUT
10660	CMP3-OUT
10680	PHCMP1-OUT
10685	PHCMP2-OUT
10690	PHCMP3-OUT
10700	DIGDEL1-OUT
10705	DIGDEL2-OUT
10750	TRANS1-OUT
10755	TRANS2-OUT
10760	TRANS3-OUT
10765	TRANS4-OUT
10900	FLIP1-OUT
10905	FLIP2-OUT
10910	FLIP3-OUT
10915	FLIP4-OUT
10920	FLIPT1-OUT
10925	FLIPT2-OUT
12000	PHINT1-FAIL
12005	PHINT2-FAIL
12010	PHINT3-STAT
12020	PHINT4-H-STAT
12021	PHINT4-L-STAT
12025	PHINT5-TP-SYNC-BUSY
12026	PHINT5-TP-RECOGN
12027	PHINT5-X0
12028	PHINT5-DFOUT-INIT
13000	FEVAN1-BUSY
13001	FEVAN1-FAIL
13005	FEVAN2-BUSY
13006	FEVAN2-FAIL
13301	CDATA-SEC1
13302	CDATA-SEC2
13303	CDATA-SEC3

Parameter	Digital output signal (□)
13304	CDATA-SEC4
13305	CDATA-SEC5
13306	CDATA-X0
13307	CDATA-X>XMAX
13308	CDATA-X<0
13309	CDATA-BUSY-LENx
13310	CDATA-LOAD-BUSY
13311	CDATA-CHK-ERR
13312	CURVEC1-X<0
13313	CURVEC1-X>Xmax
13314	CDATA-X0-CYCLE
13315	CDATA-BUSY
13316	CURVEC1-BUSY
13317	CDATA-TP-RECOGN
13318	CDATA-TEACH-BUSY
13319	CDATA-TEACH-ACTIVE
13320	CDATA-TP-SYNC-BUSY
13321	CDATA-CHK-BUSY
13322	CURVEC1-CAM-SEL-BUSY
13323	CDATA-INIT-NOUT
13324	CURVEC1-INIT-DFOUT
13325	CDATA-INIT-X-NOUT
13327	CDATA-LOAD-RDY
13328	CDATA-LOAD-ERR
13351	CCTRL-TP-RECOGN
13352	CCTRL-TP-SYNC-BUSY
13355	CCTRL2-TP-RECOGN
13356	CCTRL2-TP-SYNC-BUSY
13401	YSET1-LIM
13451	EXTPOL1-STAT
13461	EXTPOL2-STAT
13462	EXTPOL2-LIM
13463	EXTPOL2-X0
13501	CERR1-ERR
13502	CERR1-WARN
13551	CLUTCH1 -OPEN
13552	CLUTCH1-OL
13555	CLUTCH2-OPEN
13557	CLUTCH2-START
13558	CLUTCH2-DIR_ERR
13651	PSAVE1-M-HI
13652	PSAVE1-M-LO
13653	PSAVE1-ACT-HI
13654	PSAVE1-ACT-LO
13751	WELD1-T-ERR
13752	WELD1-ON
13753	WELD1-DIR-ERR

Parameter	Digital output signal (□)
13801	VMAS1-RFG-I=O
13911	CONVPHPHD1-FAIL
13915	CONVPHPHD2-LIM
13951	RFGPH1-RFG-I=O
13955	RFGPH2-RFG-I=O
13960	RFGPH3-RFG-I=O
14050	STORE1-TP-INH
14055	STORE2-TP-INH
14500	LIMPHD1-LIM
14600	ADDPHD1-LIM
14700	CLUTCH3-OPEN
14701	CLUTCH3-ACC/DEC
14702	CLUTCH3-DIR-ERR
14703	CLUTCH3-INIT
14704	CLUTCH3-ERR
14705	CLUTCH3-VEL-TO-LOW
14800	STORE3-INIT-BUSY
14801	STORE3-INIT-RDY
15000	DCTRL-TRIP
15001	DCTRL-MESS
15002	DCTRL-WARN
15003	DCTRL-FAIL
15010	MONIT-LU
15011	MONIT-OU
15012	MONIT-EEr
15013	MONIT-OC1
15014	MONIT-OC2
15015	MONIT-LP1
15016	MONIT-OH
15017	MONIT-OH3
15018	MONIT-OH4
15019	MONIT-OH7
15020	MONIT-OH8
15021	MONIT-Sd2
15022	MONIT-Sd3
15023	MONIT-P03
15024	MONIT-P13
15026	MONIT-CE0
15027	MONIT-NMAX
15028	MONIT-OC5
15029	MONIT-SD5
15030	MONIT-SD6
15031	MONIT-SD7
15032	MONIT-H07
15033	MONIT-H10
15034	MONIT-H11
15040	MONIT-CE1

Parameter	Digital output signal (□)
15041	MONIT-CE2
15042	MONIT-CE3
15043	MONIT-CE4
15044	MONIT-PL
15045	MONIT-P19
15047	MONIT-OC6
15048	MONIT-OC8
15320	MONIT-SD8
15321	MONIT-nErr
19500	FCODE-DIG-250
19521	FCODE-DIG-.B0
19522	FCODE-DIG-.B1
19523	FCODE-DIG-.B2
19524	FCODE-DIG-.B3
19525	FCODE-DIG-.B4
19526	FCODE-DIG-.B5
19527	FCODE-DIG-.B6
19528	FCODE-DIG-.B7
19529	FCODE-DIG-.B8
19530	FCODE-DIG-.B9
19531	FCODE-DIG-.B10
19532	FCODE-DIG-.B11
19533	FCODE-DIG-.B12
19534	FCODE-DIG-.B13
19535	FCODE-DIG-.B14
19536	FCODE-DIG-.B15
19537	FCODE-DIG-.B16
19538	FCODE-DIG-.B17
19539	FCODE-DIG-.B18
19540	FCODE-DIG-.B19
19541	FCODE-DIG-.B20
19542	FCODE-DIG-.B21
19543	FCODE-DIG-.B22
19544	FCODE-DIG-.B23
19545	FCODE-DIG-.B24
19546	FCODE-DIG-.B25
19547	FCODE-DIG-.B26
19548	FCODE-DIG-.B27
19549	FCODE-DIG-.B28
19550	FCODE-DIG-.B29
19551	FCODE-DIG-.B30
19552	FCODE-DIG-.B31
19751	FCODE-135.B0
19752	FCODE-135.B1
19753	FCODE-135.B2
19755	FCODE-135.B4
19756	FCODE-135.B5

Parameter	Digital output signal (□)
19757	FCODE-135.B6
19758	FCODE-135.B7
19763	FCODE-135.B12
19764	FCODE-135.B13
19765	FCODE-135.B14
19766	FCODE-135.B15
20001	CAN-IN1-CTRL.B0
20002	CAN-IN1-CTRL.B1
20003	CAN-IN1-CTRL.B2
20005	CAN-IN1-CTRL.B4
20006	CAN-IN1-CTRL.B5
20007	CAN-IN1-CTRL.B6
20008	CAN-IN1-CTRL.B7
20013	CAN-IN1-CTRL.B12
20014	CAN-IN1-CTRL.B13
20015	CAN-IN1-CTRL.B14
20016	CAN-IN1-CTRL.B15
20101	CAN-IN1.B0
20102	CAN-IN1.B1
20103	CAN-IN1.B2
20104	CAN-IN1.B3
20105	CAN-IN1.B4
20106	CAN-IN1.B5
20107	CAN-IN1.B6
20108	CAN-IN1.B7
20109	CAN-IN1.B8
20110	CAN-IN1.B9
20111	CAN-IN1.B10
20112	CAN-IN1.B11
20113	CAN-IN1.B12
20114	CAN-IN1.B13
20115	CAN-IN1.B14
20116	CAN-IN1.B15
20117	CAN-IN1.B16
20118	CAN-IN1.B17
20119	CAN-IN1.B18
20120	CAN-IN1.B19
20121	CAN-IN1.B20
20122	CAN-IN1.B21
20123	CAN-IN1.B22
20124	CAN-IN1.B23
20125	CAN-IN1.B24
20126	CAN-IN1.B25
20127	CAN-IN1.B26
20128	CAN-IN1.B27
20129	CAN-IN1.B28
20130	CAN-IN1.B29

Parameter	Digital output signal (□)
20131	CAN-IN1.B30
20132	CAN-IN1.B31
20201	CAN-IN2.B0
20202	CAN-IN2.B1
20203	CAN-IN2.B2
20204	CAN-IN2.B3
20205	CAN-IN2.B4
20206	CAN-IN2.B5
20207	CAN-IN2.B6
20208	CAN-IN2.B7
20209	CAN-IN2.B8
20210	CAN-IN2.B9
20211	CAN-IN2.B10
20212	CAN-IN2.B11
20213	CAN-IN2.B12
20214	CAN-IN2.B13
20215	CAN-IN2.B14
20216	CAN-IN2.B15
20217	CAN-IN2.B16
20218	CAN-IN2.B17
20219	CAN-IN2.B18
20220	CAN-IN2.B19
20221	CAN-IN2.B20
20222	CAN-IN2.B21
20223	CAN-IN2.B22
20224	CAN-IN2.B23
20225	CAN-IN2.B24
20226	CAN-IN2.B25
20227	CAN-IN2.B26
20228	CAN-IN2.B27
20229	CAN-IN2.B28
20230	CAN-IN2.B29
20231	CAN-IN2.B30
20232	CAN-IN2.B31
20301	CAN-IN3.B0
20302	CAN-IN3.B1
20303	CAN-IN3.B2
20304	CAN-IN3.B3
20305	CAN-IN3.B4
20306	CAN-IN3.B5
20307	CAN-IN3.B6
20308	CAN-IN3.B7
20309	CAN-IN3.B8
20310	CAN-IN3.B9
20311	CAN-IN3.B10
20312	CAN-IN3.B11
20313	CAN-IN3.B12

Parameter	Digital output signal (□)
20314	CAN-IN3.B13
20315	CAN-IN3.B14
20316	CAN-IN3.B15
20317	CAN-IN3.B16
20318	CAN-IN3.B17
20319	CAN-IN3.B18
20320	CAN-IN3.B19
20321	CAN-IN3.B20
20322	CAN-IN3.B21
20323	CAN-IN3.B22
20324	CAN-IN3.B23
20325	CAN-IN3.B24
20326	CAN-IN3.B25
20327	CAN-IN3.B26
20328	CAN-IN3.B27
20329	CAN-IN3.B28
20330	CAN-IN3.B29
20331	CAN-IN3.B30
20332	CAN-IN3.B31
25001	AIF-IN-CTRL.B0
25002	AIF-IN-CTRL.B1
25003	AIF-IN-CTRL.B2
25005	AIF-IN-CTRL.B4
25006	AIF-IN-CTRL.B5
25007	AIF-IN-CTRL.B6
25008	AIF-IN-CTRL.B7
25013	AIF-IN-CTRL.B12
25014	AIF-IN-CTRL.B13
25015	AIF-IN-CTRL.B14
25016	AIF-IN-CTRL.B15
25101	AIF-IN.B0
25102	AIF-IN.B1
25103	AIF-IN.B2
25104	AIF-IN.B3
25105	AIF-IN.B4

Parameter	Digital output signal (□)
25106	AIF-IN.B5
25107	AIF-IN.B6
25108	AIF-IN.B7
25109	AIF-IN.B8
25110	AIF-IN.B9
25111	AIF-IN.B10
25112	AIF-IN.B11
25113	AIF-IN.B12
25114	AIF-IN.B13
25115	AIF-IN.B14
25116	AIF-IN.B15
25117	AIF-IN.B16
25118	AIF-IN.B17
25119	AIF-IN.B18
25120	AIF-IN.B19
25121	AIF-IN.B20
25122	AIF-IN.B21
25123	AIF-IN.B22
25124	AIF-IN.B23
25125	AIF-IN.B24
25126	AIF-IN.B25
25127	AIF-IN.B26
25128	AIF-IN.B27
25129	AIF-IN.B28
25130	AIF-IN.B29
25131	AIF-IN.B30
25132	AIF-IN.B31

8.5.3 Selection list 3: Angle signals

Parameter	Angle signal (▲)
00100	DFSET-PSET
00101	DFSET-PSET2
01000	FIXED0INC
05000	MCTRL-PHI-ANG
05200	REFC-PSET
05520	ARITPH1-OUT
05525	ARITPH2-OUT
05530	ARITPH3-OUT
05535	ARITPH4-OUT
05540	ARITPH5-OUT
05545	ARITPH6-OUT
05580	PHADD1-OUT
05581	PHADD1-OUT2
05775	SELPH1-OUT
05780	SELPH2-OUT
05911	PT1-2-DIFF
06235	CONVPHPH1-OUT
06600	SYNC1-OUT2
07050	CONVAPH1-OUT
12000	PHINT1-OUT
12005	PHINT2-OUT
12010	PHINT3-OUT
12020	PHINT4-OUT
12025	PHINT5-OUT
12026	PHINT5-TP-DIFF
12027	PHINT5-TP-DIST
12028	PHINT5-X-DIFF
12050	PHDIV1-OUT
13301	CDATA-LEN1
13302	CDATA-LEN2
13303	CDATA-LEN3
13304	CDATA-LEN4
13305	CDATA-LEN5
13306	CDATA-ACTLEN
13307	CDATA-XPOS
13308	CDATA-YOUT
13309	CDATA-Y-END
13310	CDATA-X-ACT
13311	CDATA-YOUT-CYCLE
13312	CURVEC1-OUT
13313	CDATA-TP-DIFF
13314	CDATA-TP-DIST
13315	CDATA-X-DIFF
13351	CCTRL-POUT
13352	CCTRL-PHI-SET
13353	CCTRL-PHI-ACT

Parameter	Angle signal (▲)
13353	CCTRL-PHI-ACT
13354	CCTRL-PHI-SET2
13355	CCTRL-ACT-TP-DIFF
13356	CCTRL2-POUT
13357	CCTRL2-PHI-SET
13358	CCTRL2-PHI-ACT
13359	CCTRL2-PHI-SET2
13360	CCTRL2-ACT-TP-DIFF
13501	CERR1-W-LIM
13451	EXTPOL1-PHOUT
13461	EXTPOL2-PHOUT
13551	CLUTCH1-O-POS
13555	CLUTCH2-ACT-SET
13556	CLUTCH2-DIST
13557	CLUTCH2-PHOUT
13651	PSAVE1-M-DIFF
13652	PSAVE1-M-SAVE
13653	PSAVE1-ACT-DIFF
13654	PSAVE1-ACT-SAVE
13711	MSEL2-OUT
13751	WELD1-XOUT
13951	RFGPH1-OUT
13952	RFGPH1-IN-OLD
13955	RFGPH2-PHOUT
13960	RFGPH3-PHOUT
14000	PHDIFF1-OUT
14050	STORE1-PHACT
14051	STORE1-PH1
14052	STORE1-PH2
14053	STORE1-PHDIFF
14055	STORE2-PHACT
14056	STORE2-PH1
14057	STORE2-PH2
14100	GEARCOMP-OUT
14450	SWPH1-OUT
14455	SWPH2-OUT
14500	LIMPHD1-DIFF
14700	CLUTCH3-ACT-SET
14701	CLUTCH3-DIST
14702	CLUTCH3-PHOUT
14800	STORE3-PHOUT
19521	FCODE-PH-474/1
19522	FCODE-PH-474/2
19523	FCODE-PH-474/3
19524	FCODE-PH-474/4
19525	FCODE-PH-474/5

Parameter	Angle signal (▲)
19526	FCODE-PH-474/6
19527	FCODE-PH-474/7
19528	FCODE-PH-474/8
19529	FCODE-PH-474/9
19530	FCODE-PH-474/10
19601	FCODE-MASTER-1476/1
19602	FCODE-MASTER-1476/2
19603	FCODE-MASTER-1476/3
19604	FCODE-MASTER-1476/4
19605	FCODE-MASTER-1476/5
19606	FCODE-MASTER-1476/6
19607	FCODE-MASTER-1476/7
19608	FCODE-MASTER-1476/8
19609	FCODE-MASTER-1476/9
19610	FCODE-MASTER-1476/10
19611	FCODE-MASTER-1476/11
19612	FCODE-MASTER-1476/12
19613	FCODE-MASTER-1476/13
19614	FCODE-MASTER-1476/14
19615	FCODE-MASTER-1476/15
19616	FCODE-MASTER-1476/16
19701	FCODE-SLAVE-1477/1
19702	FCODE-SLAVE-1477/2
19703	FCODE-SLAVE-1477/3
19704	FCODE-SLAVE-1477/4
19705	FCODE-SLAVE-1477/5
19706	FCODE-SLAVE-1477/6
19707	FCODE-SLAVE-1477/7
19708	FCODE-SLAVE-1477/8
19709	FCODE-SLAVE-1477/9
19710	FCODE-SLAVE-1477/10
19711	FCODE-SLAVE-1477/11
19712	FCODE-SLAVE-1477/12
19713	FCODE-SLAVE-1477/13
19714	FCODE-SLAVE-1477/14
19715	FCODE-SLAVE-1477/15
19716	FCODE-SLAVE-1477/16
19720	FCODE-Z-1478/1
19721	FCODE-Z-1478/2
19722	FCODE-Z-1478/3
19723	FCODE-Z-1478/4
19724	FCODE-Z-1478/5
19725	FCODE-Z-1478/6
20103	CAN-IN1.D1
20201	CAN-IN2.D1
20202	CAN-IN2.D2
20301	CAN-IN3.D1
20302	CAN-IN3.D2
25103	AIF-IN.D1
25104	AIF-IN.D2

8.5.4 Selection list 4: Speed signals

Parameter	Speed signal (Δ)
00050	DFIN-OUT
00100	DFSET-POUT
00250	DFOUT-OUT
01000	FIXEDPHI-0
05000	MCTRL-PHI-ACT
05100	MPOT1-DFOUT
05200	REFC-DFOUT
05600	RFG1-DFOUT
05610	SRFG1-DFOUT
05910	PT1-2-DFOUT
06000	DFRFG1-OUT
06200	CONV1-DFOUT
06205	CONV2-DFOUT
06210	CONV3-DFOUT
06215	CONV4-DFOUT
06220	CONV5-OUT
06225	CONV6-OUT
06230	CONVPHA1-OUT2
06232	CONVPHA2-OUT2
06234	CONVPHA3-OUT2
06240	CONVPP1-OUT
06245	CONV7-DFOUT
06600	SYNC1-OUT1
12025	PHINT5-DFOUT
13301	CDATA-NOUT
13302	CDATA-N-SYNCH
13303	CDATA-X-NOUT
13312	CURVEC1-DFOUT
13351	CCTRL-DFOUT
13355	CCTRL2-DFOUT
13401	YSET1-OUT
13461	EXTPOL2-DFOUT
13551	CLUTCH1-NSET
13555	CLUTCH2-NSET
13701	MSEL1-OUT
13801	VMAS1-DFOUT
13851	CONVPHD1-OUT
13911	CONVPHPHD1-OUT
13915	CONVPHPHD2-OUT
13955	RFGPH2-NOUT
13960	RFGPH3-NOUT
14441	SWPHD1-OUT
14445	SWPHD2-OUT
14500	LIMPHD1-DFOUT
14600	ADDPHD1-DFOUT

Parameter	Speed signal (Δ)
14700	CLUTCH3-NSET
19521	FCODE-PHD-475/1
19522	FCODE-PHD-475/2
19523	FCODE-PHD-475/3
19524	FCODE-PHD-475/4
19525	FCODE-PHD-475/5

8.5.5 Selection list 5: Function blocks

Parameter	Function block
00000	empty
00050	AIN1
00055	AIN2
00070	AOUT1
00075	AOUT2
00100	DFSET
00200	DFIN
00250	DFOUT
05050	NSET
05100	MPOT1
05150	PCTRL1
05200	REFC
05500	ARIT1
05505	ARIT2
05520	ARITPH1
05525	ARITPH2
05530	ARITPH3
05535	ARITPH4
05540	ARITPH5
05545	ARITPH6
05550	ADD1
05580	PHADD1
05600	RFG1
05610	SRFG1
05650	ASW1
05655	ASW2
05660	ASW3
05665	ASW4
05700	ANEG1
05705	ANEG2
05750	FIXSET1
05775	SELPH1
05780	SELPH2
05800	LIM1
05850	ABS1
05900	PT1-1
05950	DT1-1
06000	DFRFG1
06100	MFAIL
06150	DB1
06200	CONV1
06205	CONV2
06210	CONV3
06215	CONV4
06220	CONV5
06225	CONV6

Parameter	Function block
06230	CONVPHA1
06232	CONVPHA2
06234	CONVPHA3
06235	CONVPHPH1
06240	CONVPP1
06245	CONV7
06300	S&H1
06350	CURVE1
06400	FCNT1
06450	SPC1
06460	SPC2
06600	SYNC1
06601	SYNC2
07050	CONVAPH1
07150	CONVAD1
07170	CONVAD2
10000	BRK1
10250	R/L/Q
10500	AND1
10505	AND2
10510	AND3
10515	AND4
10520	AND5
10525	AND6
10530	AND7
10535	AND8
10540	AND9
10550	OR1
10555	OR2
10560	OR3
10565	OR4
10570	OR5
10575	OR6
10580	OR7
10600	NOT1
10605	NOT2
10610	NOT3
10615	NOT4
10620	NOT5
10650	CMP1
10655	CMP2
10660	CMP3
10680	PHCMP1
10685	PHCMP2
10690	PHCMP3
10700	DIGDEL1

Parameter	Function block
10705	DIGDEL2
10750	TRANS1
10755	TRANS2
10760	TRANS3
10765	TRANS4
10900	FLIP1
10905	FLIP2
10910	FLIP3
10915	FLIP4
10920	FLIPT1
10925	FLIPT2
12000	PHINT1
12005	PHINT2
12010	PHINT3
12020	PHINT4
12025	PHINT5
12050	PHDIV1
13000	FEVAN1
13005	FEVAN2
13100	OSZ
13300	CDATA
13302	CURVEC1
13350	CCTRL
13351	CCTRL2
13400	YSET1
13450	EXTPOL1
13460	EXTPOL2
13500	CERR1
13550	CLUTCH1
13555	CLUTCH2
13600	CSEL1
13650	PSAVE1
13700	MSEL1
13710	MSEL2
13750	WELD1
13800	VMAS1
13850	CONVPHD1
13910	CONVPHPHD1
13915	CONVPHPHD2
13920	CONVPHAA1
13925	CONVPHAA2
13950	RFGPH1
13955	RFGPH2
13960	RFGPH3
14000	PHDIFF1
14050	STORE1
14055	STORE2

Parameter	Function block
14100	GEARCOMP
14440	SWPHD1
14445	SWPHD2
14450	SWPH1
14455	SWPH2
14500	LIMPHD1
14600	ADDPHD1
14700	CLUTCH3
14800	STORE3
15100	MLP1
20000	CAN-OUT
25000	AIF-OUT
31000	VTPOSC

8.5.6 Selection list 10: Error messages

Parameter	Error message
00000	No error
00011	OC1-TRIP
00012	OC2-TRIP
00015	OC5-TRIP
00032	LP1-TRIP
00050	OH-TRIP
00053	OH3-TRIP
00057	OH7-TRIP
00058	OH8-TRIP
00061	CE0-TRIP
00062	CE1-TRIP
00063	CE2-TRIP
00064	CE3-TRIP
00065	CE4-TRIP
00070	U15-TRIP
00071	CCr-TRIP
00072	Pr1-TRIP
00073	Pr2-TRIP
00074	PEr-TRIP
00075	Pr0-TRIP
00077	Pr3-TRIP
00078	Pr4-TRIP
00079	PI-TRIP
00082	Sd2-TRIP
00083	Sd3-TRIP
00085	Sd5-TRIP
00086	Sd6-TRIP
00087	Sd7-TRIP
00088	Sd8-TRIP
00089	PL-TRIP
00091	EEr-TRIP
00105	H05-TRIP
00107	H07-TRIP
00110	H10-TRIP
00111	H11-TRIP
00153	P03-TRIP
00163	P13-TRIP
00166	P16-TRIP
00169	P19-TRIP
00190	nErr-TRIP
00200	NMAX-TRIP
00220	CDA-TRIP
00221	CDA-LOAD-TRIP
01020	OU message
01030	LU message
01091	EEr message
02032	LP1 warning
02053	OH3 warning
02054	OH4 warning
02057	OH7 warning
02058	OH8 warning
02061	CEO warning
02062	CE1 warning
02063	CE2 warning
02064	CE3 warning
02065	CE4 warning
02082	Sd2 warning
02083	Sd3 warning
02085	Sd5 warning
02086	Sd6 warning
02091	EER warning
02153	P03 warning
02163	P13 warning
02166	P16 warning
02169	P19 warning
02220	CDA warning
02221	CDA-LOAD warning

8.6 Table of attributes

The attribute table describes the properties of the codes used. It enables you to create your own communication programs for the controller.

How to read the table of attributes

Column		Abbreviation	Meaning	
Code		Cxxxx	Name of the Lenze code	
Index	dec	24575 - Lenze code number	Index under which the parameter is addressed The subindex of array variables corresponds to the Lenze subcode number	Is only required for control via INTERBUS, PROFIBUS DP or system bus (CAN)
	hex	5FFFh - Lenze code number		
Data	DS	E	Data structure	Single variable (only one parameter element)
		A		Array variable (several parameter elements)
	DA	xx	Number of array elements (subcodes)	
	DT	B8	Data type	1 byte bit-coded
		B16		2 bytes bit-coded
		B32		4 bytes bit-coded
		FIX32		32-bit value with sign; decimal with four decimal places
		I32		4 bytes with sign
		U32		4 bytes without sign
		VS		ASCII string
	Format	VD	LECOM format (see also Operating Instructions of the bus module)	ASCII decimal format
		VH		ASCII hexadecimal format
		VS		String format
		VO		Octet string format for data blocks
	DL		Data length in byte	The column "Important" contains further information
Access	LCM-R/W	Ra	Access authorisation for LECOM	Reading is always permitted
		Wa		Writing is always permitted
		W		Writing is restricted
	Condition	CINH	Condition for writing	Writing permitted only when controller is inhibited

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0002	24573	5FFD	E	1	FIX32	VD	4	Ra/W	CINH
C0003	24572	5FFC	E	1	FIX32	VD	4	Ra/Wa	
C0004	24571	5FFB	E	1	FIX32	VD	4	Ra/Wa	
C0005	24570	5FFA	E	1	FIX32	VD	4	Ra/W	CINH
C0006	24569	5FF9	E	1	FIX32	VD	4	Ra/W	CINH
C0009	24566	5FF6	E	1	FIX32	VD	4	Ra/Wa	
C0011	24564	5FF4	E	1	FIX32	VD	4	Ra/Wa	
C0012	24563	5FF3	E	1	FIX32	VD	4	Ra/Wa	
C0013	24562	5FF2	E	1	FIX32	VD	4	Ra/Wa	
C0017	24558	5FEE	E	1	FIX32	VD	4	Ra/Wa	
C0018	24557	5FED	E	1	FIX32	VD	4	Ra/Wa	
C0019	24556	5FEC	E	1	FIX32	VD	4	Ra/Wa	
C0021	24554	5FEA	E	1	FIX32	VD	4	Ra/Wa	
C0022	24553	5FE9	E	1	FIX32	VD	4	Ra/Wa	
C0025	24550	5FE6	E	1	FIX32	VD	4	Ra/W	CINH
C0026	24549	5FE5	A	2	FIX32	VD	4	Ra/Wa	
C0027	24548	5FE4	A	2	FIX32	VD	4	Ra/Wa	
C0030	24545	5FE1	E	1	FIX32	VD	4	Ra/Wa	
C0032	24543	5FDF	E	1	FIX32	VD	4	Ra/Wa	
C0033	24542	5FDE	E	1	FIX32	VD	4	Ra/Wa	
C0034	24541	5FDD	E	1	FIX32	VD	4	Ra/Wa	
C0037	24538	5FDA	E	1	FIX32	VD	4	Ra/Wa	
C0039	24536	5FD8	A	15	FIX32	VD	4	Ra/Wa	
C0040	24535	5FD7	E	1	FIX32	VD	4	Ra/Wa	
C0042	24533	5FD5	E	1	FIX32	VD	4	Ra	
C0043	24532	5FD4	E	1	FIX32	VD	4	Ra/Wa	
C0045	24530	5FD2	E	1	FIX32	VD	4	Ra	
C0046	24529	5FD1	E	1	FIX32	VD	4	Ra	
C0049	24526	5FCE	E	1	FIX32	VD	4	Ra	
C0050	24525	5FCD	E	1	FIX32	VD	4	Ra	
C0051	24524	5FCC	E	1	FIX32	VD	4	Ra	
C0052	24523	5FCB	E	1	FIX32	VD	4	Ra	
C0053	24522	5FCA	E	1	FIX32	VD	4	Ra	
C0054	24521	5FC9	E	1	FIX32	VD	4	Ra	
C0056	24519	5FC7	E	1	FIX32	VD	4	Ra	
C0057	24518	5FC6	E	1	FIX32	VD	4	Ra	
C0058	24517	5FC5	E	1	FIX32	VD	4	Ra/Wa	
C0059	24516	5FC4	E	1	FIX32	VD	4	Ra	
C0060	24515	5FC3	E	1	FIX32	VD	4	Ra	
C0061	24514	5FC2	E	1	FIX32	VD	4	Ra	
C0063	24512	5FC0	E	1	FIX32	VD	4	Ra	
C0064	24511	5FBF	E	1	FIX32	VD	4	Ra	
C0067	24508	5FBC	E	1	FIX32	VD	4	Ra	
C0070	24505	5FB9	E	1	FIX32	VD	4	Ra/Wa	
C0071	24504	5FB8	E	1	FIX32	VD	4	Ra/Wa	
C0072	24503	5FB7	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0075	24500	5FB4	E	1	FIX32	VD	4	Ra/Wa	
C0076	24499	5FB3	E	1	FIX32	VD	4	Ra/Wa	
C0077	24498	5FB2	E	1	FIX32	VD	4	Ra/Wa	
C0078	24497	5FB1	E	1	FIX32	VD	4	Ra/Wa	
C0081	24494	5FAE	E	1	FIX32	VD	4	Ra/W	CINH
C0084	24491	5FAB	E	1	FIX32	VD	4	Ra/W	CINH
C0085	24490	5FAA	E	1	FIX32	VD	4	Ra/W	CINH
C0086	24489	5FA9	E	1	FIX32	VD	4	Ra/W	CINH
C0087	24488	5FA8	E	1	FIX32	VD	4	Ra/W	CINH
C0088	24487	5FA7	E	1	FIX32	VD	4	Ra/W	CINH
C0089	24486	5FA6	E	1	FIX32	VD	4	Ra/W	CINH
C0090	24485	5FA5	E	1	FIX32	VD	4	Ra/W	CINH
C0091	24484	5FA4	E	1	FIX32	VD	4	Ra/W	CINH
C0093	24482	5FA2	E	1	FIX32	VD	4	Ra	
C0094	24481	5FA1	E	1	FIX32	VD	4	Ra/Wa	
C0095	24480	5FA0	E	1	FIX32	VD	4	Ra/W	CINH
C0096	24479	5F9F	A	2	FIX32	VD	4	Ra/Wa	
C0099	24476	5F9C	E	1	FIX32	VD	4	Ra	
C0100	24475	5F9B	A	16	U32	VH	4	Ra/Wa	
C0101	24474	5F9A	A	15	FIX32	VD	4	Ra/Wa	
C0103	24472	5F98	A	15	FIX32	VD	4	Ra/Wa	
C0105	24470	5F96	E	1	FIX32	VD	4	Ra/Wa	
C0108	24467	5F93	A	2	FIX32	VD	4	Ra/Wa	
C0109	24466	5F92	A	2	FIX32	VD	4	Ra/Wa	
C0114	24461	5F8D	A	5	FIX32	VD	4	Ra/Wa	
C0116	24459	5F8B	A	32	FIX32	VD	4	Ra/W	CINH
C0117	24458	5F8A	A	4	FIX32	VD	4	Ra/W	CINH
C0118	24457	5F89	A	4	FIX32	VD	4	Ra/Wa	
C0121	24454	5F86	E	1	FIX32	VD	4	Ra/Wa	
C0122	24453	5F85	E	1	FIX32	VD	4	Ra/Wa	
C0125	24450	5F82	E	1	FIX32	VD	4	Ra/Wa	
C0126	24449	5F81	E	1	FIX32	VD	4	Ra/Wa	
C0130	24445	5F7D	E	1	FIX32	VD	4	Ra	
C0134	24441	5F79	E	1	FIX32	VD	4	Ra/Wa	
C0135	24440	5F78	E	1	B16	VH	2		
C0136	24439	5F77	A	3	B16	VH	2	Ra	
C0141	24434	5F72	E	1	FIX32	VD	4	Ra/Wa	
C0142	24433	5F71	E	1	FIX32	VD	4	Ra/Wa	
C0150	24425	5F69	E	1	B16	VH	2	Ra	
C0151	24424	5F68	E	1	B32	VH	4	Ra	
C0155	24420	5F64	E	1	B16	VH	2	Ra	
C0156	24419	5F63	A	7	FIX32	VD	4	Ra/W	CINH
C0157	24418	5F62	A	7	FIX32	VD	4	Ra	
C0161	24414	5F5E	E	1	FIX32	VD	4	Ra	
C0167	24408	5F58	E	1	FIX32	VD	4	Ra/Wa	
C0168	24407	5F57	A	8	FIX32	VD	4	Ra	
C0169	24406	5F56	A	8	U32	VH	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0170	24405	5F55	A	8	FIX32	VD	4	Ra	
C0172	24403	5F53	E	1	FIX32	VD	4	Ra/Wa	
C0173	24402	5F52	E	1	FIX32	VD	4	Ra/Wa	
C0178	24397	5F4D	E	1	U32	VH	4	Ra	
C0179	24396	5F4C	E	1	U32	VH	4	Ra	
C0182	24393	5F49	E	1	FIX32	VD	4	Ra/Wa	
C0183	24392	5F48	E	1	FIX32	VD	4	Ra	
C0190	24385	5F41	E	1	FIX32	VD	4	Ra/Wa	
C0195	24380	5F3C	E	1	FIX32	VD	4	Ra/Wa	
C0196	24379	5F3B	E	1	FIX32	VD	4	Ra/Wa	
C0200	24375	5F37	E	1	VS	VS	14	Ra	
C0201	24374	5F36	E	1	VS	VS	20	Ra	
C0203	24372	5F34	E	1	VS	VS	12	Ra	
C0204	24371	5F33	E	1	FIX32	VD	4	Ra	
C0207	24368	5F30	E	1	VS	VS	14	Ra	
C0208	24367	5F2F	E	1	VS	VS	14	Ra	
C0209	24366	5F2E	E	1	VS	VS	14	Ra	
C0220	24355	5F23	E	1	FIX32	VD	4	Ra/Wa	
C0221	24354	5F22	E	1	FIX32	VD	4	Ra/Wa	
C0222	24353	5F21	E	1	FIX32	VD	4	Ra/Wa	
C0223	24352	5F20	E	1	FIX32	VD	4	Ra/Wa	
C0224	24351	5F1F	E	1	FIX32	VD	4	Ra/Wa	
C0241	24334	5F0E	E	1	FIX32	VD	4	Ra/Wa	
C0244	24331	5F0B	E	1	FIX32	VD	4	Ra/Wa	
C0250	24325	5F05	E	1	FIX32	VD	4	Ra/Wa	
C0252	24323	5F03	E	1	I32	VH	4	Ra/Wa	
C0253	24322	5F02	E	1	FIX32	VD	4	Ra/Wa	
C0254	24321	5F01	E	1	FIX32	VD	4	Ra/Wa	
C0255	24320	5F00	E	1	U32	VH	4	Ra/Wa	
C0260	24315	5EFB	E	1	FIX32	VD	4	Ra/Wa	
C0261	24314	5EFA	E	1	FIX32	VD	4	Ra/Wa	
C0262	24313	5EF9	E	1	FIX32	VD	4	Ra/Wa	
C0263	24312	5EF8	E	1	FIX32	VD	4	Ra/Wa	
C0264	24311	5EF7	E	1	FIX32	VD	4	Ra/Wa	
C0265	24310	5EF6	E	1	FIX32	VD	4	Ra/Wa	
C0267	24308	5EF4	A	2	FIX32	VD	4	Ra/W	CINH
C0268	24307	5EF3	E	1	FIX32	VD	4	Ra/W	CINH
C0269	24306	5EF2	A	3	FIX32	VD	4	Ra	
C0291	24284	5EDC	E	1	FIX32	VD	4	Ra/Wa	
C0292	24283	5EDB	E	1	FIX32	VD	4	Ra/Wa	
C0293	24282	5EDA	E	1	FIX32	VD	4	Ra/Wa	
C0294	24281	5ED9	E	1	FIX32	VD	4	Ra/Wa	
C0295	24280	5ED8	E	1	FIX32	VD	4	Ra/Wa	
C0296	24279	5ED7	E	1	FIX32	VD	4	Ra/Wa	
C0325	24250	5EBA	E	1	FIX32	VD	4	Ra/Wa	
C0326	24249	5EB9	E	1	FIX32	VD	4	Ra/Wa	
C0327	24248	5EB8	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0328	24247	5EB7	E	1	FIX32	VD	4	Ra/Wa	
C0329	24246	5EB6	E	1	FIX32	VD	4	Ra/Wa	
C0332	24243	5EB3	E	1	FIX32	VD	4	Ra/Wa	
C0333	24242	5EB2	E	1	FIX32	VD	4	Ra/Wa	
C0336	24239	5EAF	E	1	FIX32	VD	4	Ra	
C0337	24238	5EAE	E	1	FIX32	VD	4	Ra/Wa	
C0338	24237	5EAD	E	1	FIX32	VD	4	Ra/Wa	
C0339	24236	5EAC	A	2	FIX32	VD	4	Ra/W	CINH
C0340	24235	5EAB	A	2	FIX32	VD	4	Ra	
C0350	24225	5EA1	E	1	FIX32	VD	4	Ra/Wa	
C0351	24224	5EA0	E	1	FIX32	VD	4	Ra/Wa	
C0352	24223	5E9F	E	1	FIX32	VD	4	Ra/Wa	
C0353	24222	5E9E	A	3	FIX32	VD	4	Ra/Wa	
C0354	24221	5E9D	A	6	FIX32	VD	4	Ra/Wa	
C0355	24220	5E9C	A	6	FIX32	VD	4	Ra	
C0356	24219	5E9B	A	4	FIX32	VD	4	Ra/Wa	
C0357	24218	5E9A	A	3	FIX32	VD	4	Ra/Wa	
C0358	24217	5E99	E	1	FIX32	VD	4	Ra/Wa	
C0359	24216	5E98	E	1	FIX32	VD	4	Ra	
C0360	24215	5E97	A	12	FIX32	VD	4	Ra	
C0361	24214	5E96	A	12	FIX32	VD	4	Ra	
C0362	24213	5E95	E	1	FIX32	VD	4	Ra	
C0363	24212	5E94	E	1	FIX32	VD	4	Ra/Wa	
C0364	24211	5E93	E	1	FIX32	VD	4	Ra/W	CINH
C0365	24210	5E92	E	1	FIX32	VD	4	Ra	
C0366	24209	5E91	E	1	FIX32	VD	4	Ra/Wa	
C0367	24208	5E90	E	1	FIX32	VD	4	Ra/Wa	
C0368	24207	5E8F	E	1	FIX32	VD	4	Ra/Wa	
C0369	24206	5E8E	E	1	FIX32	VD	4	Ra/Wa	
C0387	24188	5E7C	E	1	FIX32	VD	4	Ra/Wa	
C0389	24186	5E7A	E	1	FIX32	VD	4	Ra/Wa	
C0390	24185	5E79	A	1	I32	VH	4	Ra/Wa	
C0392	24183	5E77h	A	128	I32	VH	4	RA/W	CINH
C0393	24182	5E76h	A	128	I32	VH	4	RA/W	CINH
C0394	24181	5E75h	A	128	I32	VH	4	RA/W	CINH
C0395	24180	5E74h	A	128	I32	VH	4	RA/W	CINH
C0396	24179	5E73h	A	128	I32	VH	4	RA/W	CINH
C0397	24178	5E72h	A	128	I32	VH	4	RA/W	CINH
C0398	24177	5E71h	A	128	I32	VH	4	RA/W	CINH
C0399	24176	5E70h	A	128	I32	VH	4	RA/W	CINH
C0400	24175	5E6F	E	1	FIX32	VD	4	Ra	
C0402	24173	5E6D	E	1	FIX32	VD	4	Ra/W	CINH
C0403	24172	5E6C	E	1	FIX32	VD	4	Ra/W	CINH
C0404	24171	5E6B	A	2	FIX32	VD	4	Ra	
C0405	24170	5E6A	E	1	FIX32	VD	4	Ra	
C0407	24168	5E68	E	1	FIX32	VD	4	Ra/W	CINH
C0408	24167	5E67	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0409	24166	5E66	A	2	FIX32	VD	4	Ra	
C0416	24159	5E5F	E	1	U32	VH	4	Ra/W	CINH
C0420	24155	5E5B	E	1	FIX32	VD	4	Ra/W	CINH
C0421	24154	5E5A	E	1	FIX32	VD	4	Ra/W	CINH
C0425	24150	5E56	E	1	FIX32	VD	4	Ra/Wa	
C0426	24149	5E55	E	1	FIX32	VD	4	Ra	
C0427	24148	5E54	E	1	FIX32	VD	4	Ra/Wa	
C0430	24145	5E51	A	5	FIX32	VD	4	Ra/Wa	
C0431	24144	5E50	E	1	FIX32	VD	4	Ra/W	CINH
C0432	24143	5E4F	E	1	FIX32	VD	4	Ra/W	CINH
C0433	24142	5E4E	E	1	FIX32	VD	4	Ra/W	CINH
C0434	24141	5E4D	A	3	FIX32	VD	4	Ra	
C0436	24139	5E4B	E	1	FIX32	VD	4	Ra/W	CINH
C0437	24138	5E4A	E	1	FIX32	VD	4	Ra/W	CINH
C0438	24137	5E49	E	1	FIX32	VD	4	Ra/W	CINH
C0439	24136	5E48	A	3	FIX32	VD	4	Ra	
C0440	24135	5E47	E	1	FIX32	VD	4	Ra/W	CINH
C0441	24134	5E46	E	1	FIX32	VD	4	Ra	
C0443	24132	5E44	E	1	B8	VH	1	Ra	
C0444	24131	5E43	A	4	FIX32	VD	4	Ra	
C0450	24125	5E3D	E	1	FIX32	VD	4	Ra/W	CINH
C0451	24124	5E3C	E	1	FIX32	VD	4	Ra/W	CINH
C0452	24123	5E3B	E	1	FIX32	VD	4	Ra/W	CINH
C0458	24117	5E35	A	2	FIX32	VD	4	Ra	
C0459	24116	5E34	E	1	FIX32	VD	4	Ra	
C0464	24111	5E2F	E	1	FIX32	VD	4	Ra	
C0465	24110	5E2E	A	50	FIX32	VD	4	Ra/W	CINH
C0466	24109	5E2D	E	1	FIX32	VD	4	Ra	
C0469	24106	5E2A	E	1	FIX32	VD	4	Ra/W	CINH
C0470	24105	5E29	A	4	B8	VH	1	Ra/Wa	
C0471	24104	5E28	E	1	B32	VH	4	Ra/Wa	
C0472	24103	5E27	A	20	FIX32	VD	4	Ra/Wa	
C0473	24102	5E26	A	10	FIX32	VD	4	Ra/Wa	
C0474	24101	5E25	A	10	I32	VH	4	Ra/Wa	
C0475	24100	5E24	A	5	FIX32	VD	4	Ra/Wa	
C0490	24085	5E15	E	1	FIX32	VD	4	Ra/W	CINH
C0495	24080	5E10	E	1	FIX32	VD	4	Ra/W	CINH
C0497	24078	5E0E	E	1	FIX32	VD	4	Ra/Wa	
C0499	24076	5E0C	E	1	FIX32	VD	4	Ra/Wa	
C0500	24075	5E0B	E	1	FIX32	VD	4	Ra/Wa	
C0501	24074	5E0A	A	1	FIX32	VD	4	Ra/Wa	
C0502	24073	5E09	A	1	I32	VH	4	Ra/W	
C0503	24072	5E08	A	2	FIX32	VD	4	Ra/Wa	
C0504	24071	5E07	A	6	U32	VH	4	Ra/W	
C0505	24070	5E06	A	4	U32	VH	4	Ra/W	
C0506	24069	5E05	A	2	I32	VD	4	Ra	
C0509	24066	5E02h	E	1	B32	VH	4	RA/W	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0511	24064	5E00	A	2	FIX32	VD	4	Ra/W	
C0512	24063	5DFF	A	2	FIX32	VD	4	Ra/W	
C0517	24058	5DFA	A	32	FIX32	VD	4	Ra/Wa	
C0520	24055	5DF7	E	1	FIX32	VD	4	Ra/W	CINH
C0521	24054	5DF6	E	1	FIX32	VD	4	Ra/W	CINH
C0522	24053	5DF5	E	1	FIX32	VD	4	Ra/W	CINH
C0523	24052	5DF4	E	1	FIX32	VD	4	Ra/W	CINH
C0524	24051	5DF3	E	1	FIX32	VD	4	Ra/W	CINH
C0525	24050	5DF2	E	1	FIX32	VD	4	Ra/W	CINH
C0526	24049	5DF1	E	1	FIX32	VD	4	Ra/W	CINH
C0527	24048	5DF0	E	1	FIX32	VD	4	Ra/W	CINH
C0528	24047	5DEF	A	2	I32	VH	4	Ra	
C0529	24046	5DEE	E	1	FIX32	VD	4	Ra/Wa	
C0530	24045	5DED	E	1	FIX32	VD	4	Ra/Wa	
C0531	24044	5DEC	E	1	FIX32	VD	4	Ra/Wa	
C0532	24043	5DEB	E	1	FIX32	VD	4	Ra/Wa	
C0533	24042	5DEA	E	1	FIX32	VD	4	Ra/Wa	
C0534	24041	5DE9	E	1	FIX32	VD	4	Ra/Wa	
C0535	24040	5DE8	E	1	FIX32	VD	4	Ra/Wa	
C0536	24039	5DE7	A	3	FIX32	VD	4	Ra	
C0537	24038	5DE6	E	1	FIX32	VD	4	Ra	
C0538	24037	5DE5	A	3	FIX32	VD	4	Ra	
C0539	24036	5DE4	E	1	FIX32	VD	4	Ra	
C0540	24035	5DE3	E	1	FIX32	VD	4	Ra/Wa	
C0541	24034	5DE2	E	1	FIX32	VD	4	Ra/W	CINH
C0542	24033	5DE1	E	1	FIX32	VD	4	Ra/W	CINH
C0544	24031	5DDF	E	1	FIX32	VD	4	Ra/W	CINH
C0545	24030	5DDE	E	1	FIX32	VD	4	Ra/Wa	
C0546	24029	5DDD	E	1	U32	VH	4	Ra/Wa	
C0547	24028	5DDC	E	1	FIX32	VD	4	Ra	
C0548	24027	5DDB	E	1	FIX32	VD	4	Ra	
C0549	24026	5DDA	E	1	FIX32	VD	4	Ra	
C0560	24015	5DCF	A	15	FIX32	VD	4	Ra/Wa	
C0561	24014	5DCE	E	1	FIX32	VD	4	Ra/W	CINH
C0562	24013	5DCD	A	4	FIX32	VD	4	Ra/W	CINH
C0563	24012	5DCC	E	1	FIX32	VD	4	Ra	
C0564	24011	5DCB	A	4	FIX32	VD	4	Ra	
C0570	24005	5DC5	E	1	FIX32	VD	4	Ra/W	CINH
C0571	24004	5DC4	E	1	FIX32	VD	4	Ra/W	CINH
C0572	24003	5DC3	E	1	FIX32	VD	4	Ra	
C0573	24002	5DC2	E	1	FIX32	VD	4	Ra	
C0577	23998	5DBE	E	1	FIX32	VD	4	Ra/Wa	
C0578	23997	5DBD	E	1	FIX32	VD	4	Ra/Wa	
C0581	23994	5DBA	E	1	FIX32	VD	4	Ra/Wa	
C0582	23993	5DB9	E	1	FIX32	VD	4	Ra/Wa	
C0583	23992	5DB8	E	1	FIX32	VD	4	Ra/Wa	
C0584	23991	5DB7	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0585	23990	5DB6	E	1	FIX32	VD	4	Ra/Wa	
C0586	23989	5DB5	E	1	FIX32	VD	4	Ra/Wa	
C0587	23988	5DB4	E	1	FIX32	VD	4	Ra/Wa	
C0588	23987	5DB3	E	1	FIX32	VD	4	Ra/Wa	
C0589	23986	5DB2	E	1	FIX32	VD	4	Ra/Wa	
C0590	23985	5DB1	E	1	FIX32	VD	4	Ra/Wa	
C0591	23984	5DB0	E	1	FIX32	VD	4	Ra/Wa	
C0592	23983	5DAF	E	1	FIX32	VD	4	Ra/Wa	
C0593	23982	5DAE	E	1	FIX32	VD	4	Ra/Wa	
C0594	23981	5DAD	E	1	FIX32	VD	4	Ra/Wa	
C0595	23980	5DAC	E	1	FIX32	VD	4	Ra/Wa	
C0596	23979	5DAB	E	1	FIX32	VD	4	Ra/Wa	
C0597	23978	5DAA	E	1	FIX32	VD	4	Ra/Wa	
C0598	23977	5DA9	E	1	FIX32	VD	4	Ra/Wa	
C0599	23976	5DA8	E	1	FIX32	VD	4	Ra/Wa	
C0600	23975	5DA7	E	1	FIX32	VD	4	Ra/Wa	
C0601	23974	5DA6	A	2	FIX32	VD	4	Ra/W	CINH
C0602	23973	5DA5	A	2	FIX32	VD	4	Ra	
C0610	23965	5D9D	A	3	FIX32	VD	4	Ra/W	CINH
C0611	23964	5D9C	A	3	FIX32	VD	4	Ra	
C0620	23955	5D93	E	1	FIX32	VD	4	Ra/Wa	
C0621	23954	5D92	E	1	FIX32	VD	4	Ra/Wa	
C0622	23953	5D91	E	1	FIX32	VD	4	Ra/W	CINH
C0623	23952	5D90	E	1	FIX32	VD	4	Ra	
C0630	23945	5D89	E	1	FIX32	VD	4	Ra/Wa	
C0631	23944	5D88	E	1	FIX32	VD	4	Ra/Wa	
C0632	23943	5D87	E	1	FIX32	VD	4	Ra/W	CINH
C0633	23942	5D86	E	1	FIX32	VD	4	Ra	
C0640	23935	5D7F	E	1	FIX32	VD	4	Ra/Wa	
C0641	23934	5D7E	E	1	FIX32	VD	4	Ra/W	CINH
C0642	23933	5D7D	E	1	FIX32	VD	4	Ra	
C0643	23932	5D7C	E	1	FIX32	VD	4	Ra/Wa	
C0644	23931	5D7B	A	1	FIX32	VD	4	Ra/Wa	CINH
C0645	23930	5D7A	A	1	FIX32	VD	4	RA	
C0646	23929	5D79	A	2	FIX32	VD	4	Ra/Wa	
C0647	23928	5D78	A	2	FIX32	VD	4	Ra/Wa	CINH
C0648	23927	5D77	A	2	FIX32	VD	4	Ra	
C0650	23925	5D75	E	1	FIX32	VD	4	Ra/Wa	
C0651	23924	5D74	E	1	FIX32	VD	4	Ra/Wa	
C0652	23923	5D73	E	1	FIX32	VD	4	Ra/W	CINH
C0653	23922	5D72	E	1	FIX32	VD	4	Ra/Wa	
C0654	23921	5D71	E	1	FIX32	VD	4	Ra	
C0655	23920	5D70	E	1	FIX32	VD	4	Ra/Wa	
C0656	23919	5D6F	E	1	FIX32	VD	4	Ra/Wa	
C0657	23918	5D6E	E	1	FIX32	VD	4	Ra/W	CINH
C0658	23917	5D6D	E	1	FIX32	VD	4	Ra	
C0661	23914	5D6A	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0662	23913	5D69	E	1	FIX32	VD	4	Ra	
C0671	23904	5D60	E	1	FIX32	VD	4	Ra/Wa	
C0672	23903	5D5F	E	1	FIX32	VD	4	Ra/Wa	
C0673	23902	5D5E	E	1	FIX32	VD	4	Ra/W	CINH
C0674	23901	5D5D	E	1	FIX32	VD	4	Ra/W	CINH
C0675	23900	5D5C	E	1	FIX32	VD	4	Ra/W	CINH
C0676	23899	5D5B	A	2	FIX32	VD	4	Ra	
C0677	23898	5D5A	E	1	FIX32	VD	4	Ra	
C0680	23895	5D57	E	1	FIX32	VD	4	Ra/Wa	
C0681	23894	5D56	E	1	FIX32	VD	4	Ra/Wa	
C0682	23893	5D55	E	1	FIX32	VD	4	Ra/Wa	
C0683	23892	5D54	A	2	FIX32	VD	4	Ra/W	CINH
C0684	23891	5D53	A	2	FIX32	VD	4	Ra	
C0685	23890	5D52	E	1	FIX32	VD	4	Ra/Wa	
C0686	23889	5D51	E	1	FIX32	VD	4	Ra/Wa	
C0687	23888	5D50	E	1	FIX32	VD	4	Ra/Wa	
C0688	23887	5D4F	A	2	FIX32	VD	4	Ra/W	CINH
C0689	23886	5D4E	A	2	FIX32	VD	4	Ra	
C0690	23885	5D4D	E	1	FIX32	VD	4	Ra/Wa	
C0691	23884	5D4C	E	1	FIX32	VD	4	Ra/Wa	
C0692	23883	5D4B	E	1	FIX32	VD	4	Ra/Wa	
C0693	23882	5D4A	A	2	FIX32	VD	4	Ra/W	CINH
C0694	23881	5D49	A	2	FIX32	VD	4	Ra	
C0695	23880	5D48	E	1	FIX32	VD	4	Ra/Wa	
C0697	23878	5D46	A	2	FIX32	VD	4	Ra/W	CINH
C0698	23877	5D45	A	2	I32	VH	4	Ra	
C0700	23875	5D43	E	1	FIX32	VD	4	Ra/W	CINH
C0701	23874	5D42	E	1	FIX32	VD	4	Ra	
C0703	23872	5D40	E	1	FIX32	VD	4	Ra/W	CINH
C0704	23871	5D3F	E	1	FIX32	VD	4	Ra	
C0710	23865	5D39	E	1	FIX32	VD	4	Ra/Wa	
C0711	23864	5D38	E	1	FIX32	VD	4	Ra/Wa	
C0713	23862	5D36	E	1	FIX32	VD	4	Ra/W	CINH
C0714	23861	5D35	E	1	FIX32	VD	4	Ra	
C0715	23860	5D34	E	1	FIX32	VD	4	Ra/Wa	
C0716	23859	5D33	E	1	FIX32	VD	4	Ra/Wa	
C0718	23857	5D31	E	1	FIX32	VD	4	Ra/W	CINH
C0719	23856	5D30	E	1	FIX32	VD	4	Ra	
C0720	23855	5D2F	E	1	FIX32	VD	4	Ra/Wa	
C0721	23854	5D2E	E	1	FIX32	VD	4	Ra/Wa	
C0723	23852	5D2C	E	1	FIX32	VD	4	Ra/W	CINH
C0724	23851	5D2B	E	1	FIX32	VD	4	Ra	
C0725	23850	5D2A	E	1	FIX32	VD	4	Ra/Wa	
C0726	23849	5D29	E	1	FIX32	VD	4	Ra/Wa	
C0728	23847	5D27	E	1	FIX32	VD	4	Ra/W	CINH
C0729	23846	5D26	E	1	FIX32	VD	4	Ra	
C0730	23845	5D25	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0731	23844	5D24	E	1	FIX32	VD	4	Ra	
C0732	23843	5D23	A	4	FIX32	VD	4	Ra/Wa	
C0733	23842	5D22	E	1	FIX32	VD	4	Ra/Wa	
C0734	23841	5D21	E	1	FIX32	VD	4	Ra/Wa	
C0735	23840	5D20	E	1	FIX32	VD	4	Ra/Wa	
C0736	23839	5D1F	E	1	FIX32	VD	4	Ra/Wa	
C0737	23838	5D1E	E	1	FIX32	VD	4	Ra/Wa	
C0738	23837	5D1D	E	1	FIX32	VD	4	Ra/Wa	
C0739	23836	5D1C	E	1	FIX32	VD	4	Ra/Wa	
C0740	23835	5D1B	A	2	FIX32	VD	4	Ra/Wa	
C0741	23834	5D1A	A	4	B32	VH	4	Ra	
C0742	23833	5D19	E	1	FIX32	VD	4	Ra/Wa	
C0743	23832	5D18	E	1	FIX32	VD	4	Ra	
C0744	23831	5D17	E	1	FIX32	VD	4	Ra/Wa	
C0749	23826	5D12	A	3	FIX32	VD	4	Ra	
C0750	23825	5D11	E	1	FIX32	VD	4	Ra/Wa	
C0751	23824	5D10	E	1	FIX32	VD	4	Ra/Wa	
C0752	23823	5D0F	E	1	FIX32	VD	4	Ra/Wa	
C0753	23822	5D0E	E	1	FIX32	VD	4	Ra/Wa	
C0754	23821	5D0D	E	1	U32	VH	4	Ra/Wa	
C0755	23820	5D0C	E	1	FIX32	VD	4	Ra/Wa	
C0756	23819	5D0B	E	1	I32	VH	4	Ra/Wa	
C0757	23818	5D0A	E	1	FIX32	VD	4	Ra/Wa	
C0758	23817	5D09	E	1	FIX32	VD	4	Ra/W	CINH
C0759	23816	5D08	E	1	FIX32	VD	4	Ra/W	CINH
C0760	23815	5D07	E	1	FIX32	VD	4	Ra/W	CINH
C0761	23814	5D06	E	1	FIX32	VD	4	Ra/W	CINH
C0764	23811	5D03	A	3	FIX32	VD	4	Ra	
C0765	23810	5D02	E	1	FIX32	VD	4	Ra	
C0766	23809	5D01	E	1	FIX32	VD	4	Ra/Wa	
C0768	23807	5CFF	E	1	FIX32	VD	4	Ra/W	CINH
C0769	23806	5CFE	E	1	FIX32	VD	4	Ra	
C0770	23805	5CFD	E	1	FIX32	VD	4	Ra/W	CINH
C0771	23804	5CFC	E	1	FIX32	VD	4	Ra/W	CINH
C0772	23803	5CFB	E	1	FIX32	VD	4	Ra/W	CINH
C0773	23802	5CFA	A	3	FIX32	VD	4	Ra	
C0775	23800	5CF8	E	1	FIX32	VD	4	Ra/W	CINH
C0776	23799	5CF7	E	1	FIX32	VD	4	Ra/W	CINH
c0777	23798	5CF6	E	1	FIX32	VD	4	Ra/W	CINH
C0778	23797	5CF5	A	3	FIX32	VD	4	Ra	
C0780	23795	5CF3	E	1	FIX32	VD	4	Ra/W	CINH
C0781	23794	5CF2	E	1	FIX32	VD	4	Ra/W	CINH
C0782	23793	5CF1	E	1	FIX32	VD	4	Ra/W	CINH
C0783	23792	5CF0	E	1	FIX32	VD	4	Ra/W	CINH
C0784	23791	5CEF	E	1	FIX32	VD	4	Ra/W	CINH
C0785	23790	5CEE	E	1	FIX32	VD	4	Ra/W	CINH
C0786	23789	5CED	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0787	23788	5CEC	A	4	FIX32	VD	4	Ra/W	CINH
C0788	23787	5CEB	A	4	FIX32	VD	4	Ra/W	CINH
C0789	23786	5CEA	E	1	FIX32	VD	4	Ra/W	CINH
C0790	23785	5CE9	E	1	FIX32	VD	4	Ra/W	CINH
C0798	23777	5CE1	A	2	FIX32	VD	4	Ra	
C0799	23776	5CE0	A	13	FIX32	VD	4	Ra	
C0800	23775	5CDF	E	1	FIX32	VD	4	Ra/W	CINH
C0801	23774	5CDE	E	1	FIX32	VD	4	Ra/W	CINH
C0802	23773	5CDD	E	1	FIX32	VD	4	Ra/W	CINH
C0803	23772	5CDC	E	1	FIX32	VD	4	Ra/W	CINH
C0804	23771	5CDB	E	1	FIX32	VD	4	Ra/W	CINH
C0805	23770	5CDA	E	1	FIX32	VD	4	Ra/W	CINH
C0808	23767	5CD7	A	4	FIX32	VD	4	Ra	
C0809	23766	5CD6	A	2	FIX32	VD	4	Ra	
C0810	23765	5CD5	A	2	FIX32	VD	4	Ra/W	CINH
C0811	23764	5CD4	E	1	FIX32	VD	4	Ra/W	CINH
C0812	23763	5CD3	A	2	FIX32	VD	4	Ra	
C0813	23762	5CD2	E	1	FIX32	VD	4	Ra	
C0815	23760	5CD0	A	2	FIX32	VD	4	Ra/W	CINH
C0816	23759	5CCF	E	1	FIX32	VD	4	Ra/W	CINH
C0817	23758	5CCE	A	2	FIX32	VD	4	Ra	
C0818	23757	5CCD	E	1	FIX32	VD	4	Ra	
C0820	23755	5CCB	A	3	FIX32	VD	4	Ra/W	CINH
C0821	23754	5CCA	A	3	FIX32	VD	4	Ra	
C0822	23753	5CC9	A	3	FIX32	VD	4	Ra/W	CINH
C0823	23752	5CC8	A	3	FIX32	VD	4	Ra	
C0824	23751	5CC7	A	3	FIX32	VD	4	Ra/W	CINH
C0825	23750	5CC6	A	3	FIX32	VD	4	Ra	
C0826	23749	5CC5	A	3	FIX32	VD	4	Ra/W	CINH
C0827	23748	5CC4	A	3	FIX32	VD	4	Ra	
C0828	23747	5CC3	A	3	FIX32	VD	4	Ra/W	CINH
C0829	23746	5CC2	A	3	FIX32	VD	4	Ra	
C0830	23745	5CC1	A	3	FIX32	VD	4	Ra/W	CINH
C0831	23744	5CC0	A	3	FIX32	VD	4	Ra	
C0832	23743	5CBF	A	3	FIX32	VD	4	Ra/W	CINH
C0833	23742	5CBE	A	3	FIX32	VD	4	Ra	
C0834	23741	5CBD	A	3	FIX32	VD	4	Ra/W	CINH
C0835	23740	5CBC	A	3	FIX32	VD	4	Ra	
C0836	23739	5CBB	A	3	FIX32	VD	4	Ra/W	CINH
C0837	23738	5CBA	A	3	FIX32	VD	4	Ra	
C0838	23737	5CB9	A	13	FIX32	VD	4	Ra/W	CINH
C0839	23736	5CB8	A	13	FIX32	VD	4	Ra	
C0840	23735	5CB7	E	1	FIX32	VD	4	Ra/W	CINH
C0841	23734	5CB6	E	1	FIX32	VD	4	Ra	
C0842	23733	5CB5	E	1	FIX32	VD	4	Ra/W	CINH
C0843	23732	5CB4	E	1	FIX32	VD	4	Ra	
C0844	23731	5CB3	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0845	23730	5CB2	E	1	FIX32	VD	4	Ra	
C0846	23729	5CB1	E	1	FIX32	VD	4	Ra/W	CINH
C0847	23728	5CB0	E	1	FIX32	VD	4	Ra	
C0848	23727	5CAF	E	1	FIX32	VD	4	Ra/W	CINH
C0849	23726	5CAE	E	1	FIX32	VD	4	Ra	
C0850	23725	5CAD	A	3	FIX32	VD	4	Ra/W	CINH
C0851	23724	5CAC	E	1	FIX32	VD	4	Ra/W	CINH
C0852	23723	5CAB	E	1	FIX32	VD	4	Ra/Wa	
C0853	23722	5CAA	E	1	FIX32	VD	4	Ra/Wa	
C0854	23721	5CA9	E	1	FIX32	VD	4	Ra/Wa	
C0855	23720	5CA8	A	2	B16	VH	2	Ra	
C0856	23719	5CA7	A	3	FIX32	VD	4	Ra	
C0857	23718	5CA6	E	1	I32	VH	4	Ra	
C0858	23717	5CA5	A	3	FIX32	VD	4	Ra	
C0859	23716	5CA4	E	1	I32	VH	4	Ra	
C0860	23715	5CA3	A	11	FIX32	VD	4	Ra/W	CINH
C0861	23714	5CA2	A	3	FIX32	VD	4	Ra/W	CINH
C0863	23712	5CA0	A	6	B16	VH	2	Ra	
C0864	23711	5C9F	A	3	FIX32	VD	4	Ra/Wa	
C0865	23710	5C9E	A	3	FIX32	VD	4	Ra/Wa	
C0866	23709	5C9D	A	11	FIX32	VD	4	Ra	
C0867	23708	5C9C	A	3	I32	VH	4	Ra	
C0868	23707	5C9B	A	11	FIX32	VD	4	Ra	
C0869	23706	5C9A	A	3	I32	VH	4	Ra	
C0870	23705	5C99	A	2	FIX32	VD	4	Ra/W	CINH
C0871	23704	5C98	E	1	FIX32	VD	4	Ra/W	CINH
C0876	23699	5C93	E	1	FIX32	VD	4	Ra/W	CINH
C0878	23697	5C91	A	4	FIX32	VD	4	Ra	
C0879	23696	5C90	A	3	FIX32	VD	4	Ra/Wa	
C0885	23690	5C8A	E	1	FIX32	VD	4	Ra/W	CINH
C0886	23689	5C89	E	1	FIX32	VD	4	Ra/W	CINH
C0889	23686	5C86	A	2	FIX32	VD	4	Ra	
C0890	23685	5C85	E	1	FIX32	VD	4	Ra/W	CINH
C0891	23684	5C84	E	1	FIX32	VD	4	Ra/W	CINH
C0892	23683	5C83	E	1	FIX32	VD	4	Ra/W	CINH
C0893	23682	5C82	E	1	FIX32	VD	4	Ra/W	CINH
C0894	23681	5C81	E	1	FIX32	VD	4	Ra/W	CINH
C0895	23680	5C80	E	1	FIX32	VD	4	Ra/W	CINH
C0896	23679	5C7F	E	1	FIX32	VD	4	Ra/W	CINH
C0897	23678	5C7E	E	1	FIX32	VD	4	Ra/W	CINH
C0898	23677	5C7D	E	1	FIX32	VD	4	Ra/W	CINH
C0899	23676	5C7C	E	1	FIX32	VD	4	Ra/W	CINH
C0900	23675	5C7B	E	1	FIX32	VD	4	Ra/W	CINH
C0901	23674	5C7A	E	1	FIX32	VD	4	Ra/W	CINH
C0902	23673	5C79	E	1	FIX32	VD	4	Ra/W	CINH
C0903	23672	5C78	E	1	FIX32	VD	4	Ra/W	CINH
C0906	23669	5C75	A	9	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0907	23668	5C74	A	4	FIX32	VD	4	Ra	
C0908	23667	5C73	E	1	I32	VH	4	Ra	
C0909	23666	5C72	E	1	FIX32	VD	4	Ra/Wa	
C0920	23655	5C67	E	1	FIX32	VD	4	Ra/W	CINH
C0921	23654	5C66	E	1	FIX32	VD	4	Ra/W	CINH
C0922	23653	5C65	E	1	FIX32	VD	4	Ra/W	CINH
C0923	23652	5C64	E	1	FIX32	VD	4	Ra/W	CINH
C0924	23651	5C63	E	1	FIX32	VD	4	Ra/W	CINH
C0925	23650	5C62	E	1	FIX32	VD	4	Ra/W	CINH
C0926	23649	5C61	A	4	I32	VH	4	Ra	
C0927	23648	5C60	A	3	FIX32	VD	4	Ra	
C0928	23647	5C5F	E	1	I32	VH	4	Ra	
C0929	23646	5C5E	E	1	FIX32	VD	4	Ra	
C0930	23645	5C5D	E	1	FIX32	VD	4	Ra/W	CINH
C0931	23644	5C5C	E	1	FIX32	VD	4	Ra/W	CINH
C0932	23643	5C5B	E	1	FIX32	VD	4	Ra/Wa	
C0933	23642	5C5A	E	1	FIX32	VD	4	Ra/Wa	
C0934	23641	5C59	E	1	I32	VH	4	Ra/Wa	
C0935	23640	5C58	E	1	FIX32	VD	4	Ra/Wa	
C0936	23639	5C57	E	1	FIX32	VD	4	Ra/Wa	
C0937	23638	5C56	A	1	FIX32	VD	4	Ra/W	CINH
C0938	23637	5C55	A	1	FIX32	VD	4	Ra	
C0940	23635	5C53	E	1	FIX32	VD	4	Ra/Wa	
C0941	23634	5C52	E	1	FIX32	VD	4	Ra/Wa	
C0942	23633	5C51	E	1	FIX32	VD	4	Ra/W	CINH
C0943	23632	5C50	E	1	FIX32	VD	4	Ra	
C0945	23630	5C4E	E	1	FIX32	VD	4	Ra/Wa	
C0946	23629	5C4D	E	1	FIX32	VD	4	Ra/Wa	
C0947	23628	5C4C	E	1	FIX32	VD	4	Ra/W	CINH
C0948	23627	5C4B	E	1	FIX32	VD	4	Ra	
C0950	23625	5C49	E	1	FIX32	VD	4	Ra/Wa	
C0951	23624	5C48	E	1	FIX32	VD	4	Ra/Wa	
C0952	23623	5C47	E	1	FIX32	VD	4	Ra/W	CINH
C0953	23622	5C46	E	1	FIX32	VD	4	Ra	
C0955	23620	5C44	E	1	FIX32	VD	4	Ra/Wa	
C0956	23619	5C43	E	1	FIX32	VD	4	Ra/Wa	
C0957	23618	5C42	E	1	FIX32	VD	4	Ra/W	CINH
C0958	23617	5C41	E	1	FIX32	VD	4	Ra	
C0960	23615	5C3F	E	1	FIX32	VD	4	Ra/Wa	
C0961	23614	5C3E	E	1	FIX32	VD	4	Ra/Wa	
C0962	23613	5C3D	E	1	FIX32	VD	4	Ra/Wa	
C0963	23612	5C3C	E	1	FIX32	VD	4	Ra/Wa	
C0964	23611	5C3B	E	1	FIX32	VD	4	Ra/Wa	
C0965	23610	5C3A	E	1	FIX32	VD	4	Ra/Wa	
C0966	23609	5C39	E	1	FIX32	VD	4	Ra/Wa	
C0967	23608	5C38	E	1	FIX32	VD	4	Ra/W	CINH
C0968	23607	5C37	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0970	23605	5C35	E	1	FIX32	VD	4	Ra/W	CINH
C0971	23604	5C34	E	1	FIX32	VD	4	Ra/W	CINH
C0972	23603	5C33	E	1	FIX32	VD	4	Ra/W	CINH
C0973	23602	5C32	E	1	FIX32	VD	4	Ra/W	CINH
C0974	23601	5C31	E	1	FIX32	VD	4	Ra/W	CINH
C0975	23600	5C30	E	1	FIX32	VD	4	Ra/W	CINH
C0976	23599	5C2F	E	1	FIX32	VD	4	Ra/W	CINH
C0977	23598	5C2E	E	1	FIX32	VD	4	Ra/W	CINH
C0978	23597	5C2D	E	1	FIX32	VD	4	Ra/W	CINH
C0980	23595	5C2B	E	1	FIX32	VD	4	Ra/Wa	
C0981	23594	5C2A	E	1	FIX32	VD	4	Ra/Wa	
C0982	23593	5C29	E	1	FIX32	VD	4	Ra/Wa	
C0983	23592	5C28	E	1	FIX32	VD	4	Ra/Wa	
C0988	23587	5C23	A	7	FIX32	VD	4	Ra	
C0989	23586	5C22	A	2	FIX32	VD	4	Ra	
C0990	23585	5C21	E	1	FIX32	VD	4	Ra/W	CINH
C0991	23584	5C20	E	1	FIX32	VD	4	Ra/W	CINH
C0992	23583	5C1F	E	1	FIX32	VD	4	Ra	
C0993	23582	5C1E	E	1	FIX32	VD	4	Ra	
C0995	23580	5C1C	E	1	FIX32	VD	4	Ra/Wa	
C0996	23579	5C1B	E	1	FIX32	VD	4	Ra/W	CINH
C0997	23578	5C1A	E	1	I32	VH	4	Ra	
C1000	23575	5C17	E	1	FIX32	VD	4	Ra/Wa	
C1001	23574	5C16	E	1	FIX32	VD	4	Ra/W	CINH
C1002	23573	5C15	E	1	I32	VH	4	Ra	
C1010	23565	5C0D	E	1	FIX32	VD	4	Ra/Wa	
C1011	23564	5C0C	A	2	FIX32	VD	4	Ra/W	CINH
C1012	23563	5C0B	A	2	I32	VH	4	Ra	
C1020	23555	5C03	E	1	FIX32	VD	4	Ra/Wa	
C1021	23554	5C02	A	2	FIX32	VD	4	Ra/W	CINH
C1022	23553	5C01	A	2	I32	VH	4	Ra	
C1025	23550	5BFE	E	1	FIX32	VD	4	Ra/Wa	
C1026	23549	5BFD	A	2	FIX32	VD	4	Ra/W	CINH
C1027	23548	5BFC	A	2	I32	VH	4	Ra	
C1030	23545	5BF9	E	1	FIX32	VD	4	Ra/W	CINH
C1031	23544	5BF8	E	1	FIX32	VD	4	Ra/W	CINH
C1032	23543	5BF7	E	1	FIX32	VD	4	Ra	
C1033	23542	5BF6	E	1	FIX32	VD	4	Ra	
C1040	23535	5BEF	E	1	FIX32	VD	4	Ra/Wa	
C1041	23534	5BEE	E	1	FIX32	VD	4	Ra/Wa	
C1042	23533	5BED	E	1	FIX32	VD	4	Ra/W	CINH
C1043	23532	5BEC	E	1	FIX32	VD	4	Ra/W	CINH
C1044	23531	5BEB	E	1	FIX32	VD	4	Ra/W	CINH
C1045	23530	5BEA	A	2	FIX32	VD	4	Ra	
C1046	23529	5BE9	E	1	FIX32	VD	4	Ra	
C1060	23515	5BDB	A	12	FIX32	VD	4	Ra/W	CINH
C1061	23514	5BDA	A	12	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1070	23505	5BD1	A	8	FIX32	VD	4	Ra/W	CINH
C1071	23504	5BD0	A	8	FIX32	VD	4	Ra	
C1072	23503	5BCF	A	4	FIX32	VD	4	Ra/W	CINH
C1073	23502	5BCE	A	4	I32	VH	4	Ra	
C1074	23501	5BCD	A	2	FIX32	VD	4	Ra/Wa	
C1075	23500	5BCC	E	1	FIX32	VD	4	Ra/Wa	
C1076	23499	5BCB	E	1	FIX32	VD	4	Ra/Wa	
C1077	23498	5BCA	A	2	B32	VH	4	Ra/Wa	
C1078	23497	5BC9	A	4	FIX32	VD	4	Ra/Wa	
C1079	23496	5BC8	A	6	FIX32	VD	4	Ra/Wa	
C1080	23495	5BC7	A	2	FIX32	VD	4	Ra/W	CINH
C1081	23494	5BC6	A	2	FIX32	VD	4	Ra	
C1082	23493	5BC5	A	1	FIX32	VD	4	Ra/W	CINH
C1083	23492	5BC4	A	1	FIX32	VD	4	Ra	
C1084	23491	5BC3	A	2	FIX32	VD	4	Ra/Wa	
C1085	23490	5BC2	E	1	FIX32	VD	4	Ra/Wa	
C1090	23485	5BBD	E	1	I32	VH	4	Ra	
C1091	23484	5BBC	E	1	FIX32	VD	4	Ra/Wa	
C1092	23483	5BBB	E	1	FIX32	VD	4	Ra/Wa	
C1093	23482	5BBA	E	1	FIX32	VD	4	Ra/Wa	
C1094	23481	5BB9	E	1	FIX32	VD	4	Ra/Wa	
C1095	23480	5BB8	E	1	I32	VH	4	Ra/Wa	
C1096	23479	5BB7	E	1	FIX32	VD	4	Ra/W	CINH
C1097	23478	5BB6	E	1	FIX32	VD	4	Ra/W	CINH
C1098	23477	5BB5	E	1	FIX32	VD	4	Ra	
C1099	23476	5BB4	E	1	FIX32	VD	4	Ra	
C1100	23475	5BB3	E	1	FIX32	VD	4	Ra/Wa	
C1101	23474	5BB2	A	2	FIX32	VD	4	Ra/W	CINH
C1102	23473	5BB1	A	3	FIX32	VD	4	Ra/W	CINH
C1103	23472	5BB0	A	2	FIX32	VD	4	Ra	
C1104	23471	5BAF	A	3	FIX32	VD	4	Ra	
C1106	23469	5BAD	A	2	FIX32	VD	4	Ra/W	CINH
C1107	23468	5BAC	A	2	FIX32	VD	4	Ra	
C1108	23467	5BAB	A	4	FIX32	VD	4	Ra/W	CINH
C1109	23466	5BAA	A	4	I32	VH	4	Ra	
C1120	23455	5B9F	E	1	FIX32	VD	4	Ra/Wa	
C1121	23454	5B9E	A	2	FIX32	VD	4	Ra/Wa	
C1122	23453	5B9D	E	1	FIX32	VD	4	Ra/Wa	
C1123	23452	5B9C	A	2	FIX32	VD	4	Ra/Wa	
C1124	23451	5B9B	E	1	FIX32	VD	4	Ra/W	CINH
C1125	23450	5B9A	E	1	FIX32	VD	4	Ra/W	CINH
C1126	23449	5B99	E	1	FIX32	VD	4	Ra/W	CINH
C1127	23448	5B98	E	1	I32	VH	4	Ra	
C1128	23447	5B97	E	1	I32	VH	4	Ra	
C1129	23446	5B96	E	1	I32	VH	4	Ra	
C1140	23435	5B8B	E	1	FIX32	VD	4	Ra/Wa	
C1141	23434	5B8A	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1143	23432	5B88	E	1	FIX32	VD	4	Ra/W	CINH
C1144	23431	5B87	E	1	FIX32	VD	4	Ra	
C1145	23430	5B86	E	1	FIX32	VD	4	Ra/Wa	
C1146	23429	5B85	E	1	FIX32	VD	4	Ra/Wa	
C1148	23427	5B83	E	1	FIX32	VD	4	Ra/W	CINH
C1149	23426	5B82	E	1	FIX32	VD	4	Ra	
C1150	23425	5B81	E	1	FIX32	VD	4	Ra/Wa	
C1151	23424	5B80	E	1	I32	VH	4	Ra/Wa	
C1153	23422	5B7E	E	1	FIX32	VD	4	Ra/W	CINH
C1154	23421	5B7D	E	1	FIX32	VD	4	Ra/W	CINH
C1155	23420	5B7C	E	1	FIX32	VD	4	Ra/W	CINH
C1157	23418	5B7A	E	1	FIX32	VD	4	Ra	
C1158	23417	5B79	E	1	FIX32	VD	4	Ra	
C1159	23416	5B78	E	1	I32	VH	4	Ra	
C1160	23415	5B77	A	2	FIX32	VD	4	Ra/W	CINH
C1161	23414	5B76	E	1	FIX32	VD	4	Ra/W	CINH
C1162	23413	5B75	A	2	FIX32	VD	4	Ra	
C1163	23412	5B74	E	1	FIX32	VD	4	Ra	
C1165	23410	5B72	A	2	FIX32	VD	4	Ra/W	CINH
C1166	23409	5B71	E	1	FIX32	VD	4	Ra/W	CINH
C1167	23408	5B70	A	2	FIX32	VD	4	Ra	
C1168	23407	5B6F	E	1	FIX32	VD	4	Ra	
C1170	23405	5B6D	E	1	FIX32	VD	4	Ra/Wa	
C1171	23404	5B6C	E	1	FIX32	VD	4	Ra/Wa	
C1172	23403	5B6B	E	1	FIX32	VD	4	Ra/W	CINH
C1173	23402	5B6A	E	1	FIX32	VD	4	Ra	
C1175	23400	5B68	A	3	FIX32	VD	4	Ra/W	CINH
C1176	23399	5B67	A	3	FIX32	VD	4	Ra	
C1178	23397	5B65	A	13	FIX32	VD	4	Ra/W	CINH
C1179	23396	5B64	A	13	FIX32	VD	4	Ra	
C1180	23395	5B63	A	6	FIX32	VD	4	Ra/Wa	CINH
C1181	23394	5B62	A	6	FIX32	VD	4	Ra	
C1182	23393	5B61	A	7	FIX32	VD	4	Ra/W	CINH
C1183	23392	5B60	A	7	I32	VH	4	Ra	
C1184	32391	5B5F	A	3	FIX32	VD	4	Ra/W	CINH
C1185	23390	5B5E	A	3	FIX32	VD	4	Ra	
C1186	23389	5B5D	E	1	FIX32	VD	4	Ra/Wa	
C1188	23387	5B5B	A	2	FIX32	VD	4	Ra/W	CINH
C1189	23386	5B5A	A	2	FIX32	VD	4	Ra	
C1190	23385	5B59	E	1	FIX32	VD	4	Ra/Wa	
C1191	23384	5B58	A	2	FIX32	VD	4	Ra/Wa	
C1192	23383	5B57	A	2	FIX32	VD	4	Ra/Wa	
C1195	23380	5B54	E	1	FIX32	VD	4	Ra/W	CINH
C1196	23379	5B53	E	1	I32	VH	4	Ra	
C1197	23378	5B52	E	1	I32	VH	4	Ra	
C1200	23375	5B4F	A	3	FIX32	VD	4	Ra/W	CINH
C1201	23374	5B4E	A	3	I32	VH	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1205	23370	5B4A	A	2	FIX32	VD	4	Ra/W	CINH
C1206	23369	5B49	A	2	I32	VH	4	Ra	
C1207	23368	5B48	E	1	FIX32	VD	4	Ra/Wa	
C1210	23365	5B45	A	5	FIX32	VD	4	Ra/W	CINH
C1211	23364	5B44	A	2	FIX32	VD	4	Ra/W	CINH
C1212	23363	5B43	E	1	FIX32	VD	4	Ra/W	CINH
C1215	23360	5B40	A	5	FIX32	VD	4	Ra	
C1216	23359	5B3F	A	2	FIX32	VD	4	Ra	
C1217	23358	5B3E	E	1	I32	VH	4	Ra	
C1220	23355	5B3B	A	2	FIX32	VD	4	Ra/W	CINH
C1223	23352	5B38	A	2	FIX32	VD	4	Ra	
C1230	23345	5B31	A	2	FIX32	VD	4	Ra/W	CINH
C1231	23344	5B30	E	1	FIX32	VD	4	Ra/W	CINH
C1232	23343	5B2F	A	2	FIX32	VD	4	Ra/W	CINH
C1235	23340	5B2C	A	2	FIX32	VD	4	Ra	
C1236	23339	5B2B	E	1	FIX32	VD	4	Ra	
C1237	23338	5B2A	A	2	I32	VH	4	Ra	
C1240	23335	5B27	A	2	FIX32	VD	4	Ra/W	CINH
C1241	23334	5B26	E	1	FIX32	VD	4	Ra/W	CINH
C1242	23333	5B25	E	1	FIX32	VD	4	Ra/W	CINH
C1245	23330	5B22	A	2	FIX32	VD	4	Ra	
C1246	23329	5B21	E	1	FIX32	VD	4	Ra	
C1247	23328	5B20	E	1	I32	VH	4	Ra	
C1250	23325	5B1D	E	1	FIX32	VD	4	Ra/W	CINH
C1251	23324	5B1C	A	2	FIX32	VD	4	Ra/W	CINH
C1253	23322	5B1A	E	1	FIX32	VD	4	Ra	
C1254	23321	5B19	A	2	I32	VH	4	Ra	
C1255	23320	5B18	E	1	FIX32	VD	4	Ra/W	CINH
C1258	23317	5B15	E	1	FIX32	VD	4	Ra	
C1260	23315	5B13	E	1	FIX32	VD	4	Ra/W	CINH
C1261	23314	5B12	E	1	FIX32	VD	4	Ra/W	CINH
C1262	23313	5B11	E	1	FIX32	VD	4	Ra/W	CINH
C1265	23310	5B0E	E	1	FIX32	VD	4	Ra/W	CINH
C1266	23309	5B0D	E	1	FIX32	VD	4	Ra/W	CINH
C1268	23307	5B0B	E	1	FIX32	VD	4	Ra	
C1269	23306	5B0A	E	1	I32	VH	4	Ra	
C1270	23305	5B09	A	2	FIX32	VD	4	Ra/W	CINH
C1271	23304	5B08	A	2	I32	VH	4	Ra	
C1272	23303	5B07	E	1	FIX32	VD	4	Ra/Wa	
C1290	23285	5AF5	E	1	FIX32	VD	4	Ra/Wa	
C1292	23283	5AF3	E	1	FIX32	VD	4	Ra/Wa	
C1295	23280	5AF0	E	1	FIX32	VD	4	Ra/Wa	
C1296	23279	5AEF	E	1	FIX32	VD	4	Ra/Wa	
C1297	23278	5AEE	E	1	FIX32	VD	4	Ra/Wa	
C1298	23277	5AED	E	1	FIX32	VD	4	Ra	
C1299	23276	5AEC	E	1	FIX32	VD	4	Ra	
C1300	23275	5AEB	A	2	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1301	23274	5AEA	A	8	I32	VH	4	Ra	
C1303	23272	5AE8	A	2	FIX32	VH	4	Ra/W	CINH
C1304	23271	5AE7	E	1	FIX32	VD	4	Ra/W	CINH
C1305	23270	5AE6	A	2	FIX32	VD	4	Ra/W	CINH
C1306	23269	5AE5	E	1	FIX32	VD	4	Ra/W	CINH
C1307	23268	5AE4	E	1	FIX32	VD	4	Ra/Wa	
C1308	23267	5AE3	E	1	FIX32	VD	4	Ra/Wa	
C1309	23266	5AE2	E	1	U32	VH	4	Ra/Wa	
C1310	23265	5AE1	E	1	FIX32	VD	4	Ra/Wa	
C1311	23264	5AE0	E	1	FIX32	VD	4	Ra/W	CINH
C1312	23263	5ADF	E	1	FIX32	VD	4	Ra/W	CINH
C1313	23262	5ADE	E	1	FIX32	VD	4	Ra/Wa	
C1314	23261	5ADD	E	1	FIX32	VD	4	Ra/W	CINH
C1315	23260	5ADC	A	8	I32	VH	4	Ra	
C1316	23259	5ADB	A	8	I32	VH	4	Ra	
C1317	23258	5ADA	E	1	FIX32	VD	4	Ra/Wa	
C1318	23257	5AD9	E	1	FIX32	VD	4	Ra/Wa	
C1319	23256	5AD8	E	1	FIX32	VD	4	Ra/Wa	
C1320	23255	5AD7	A	3	FIX32	VD	4	Ra/W	CINH
C1321	23254	5AD6	A	3	FIX32	VD	4	Ra	
C1322	23253	5AD5	A	16	FIX32	VD	4	Ra/W	CINH
C1323	23252	5AD4	A	16	FIX32	VD	4	Ra	
C1324	23251	5AD3	A	7	FIX32	VD	4	Ra/W	CINH
C1325	23250	5AD2	A	7	I32	VH	4	Ra	
C1326	23249	5AD1	A	2	FIX32	VD	4	Ra/W	CINH
C1327	23248	5AD0	A	2	FIX32	VD	4	Ra	
C1329	23246	5ACE	A	2	FIX32	VD	4	Ra	
C1330	23245	5ACD	A	2	FIX32	VD	4	Ra	
C1331	23244	5ACC	E	1	FIX32	VD	4	Ra/Wa	
C1332	23243	5ACB	E	1	FIX32	VD	4	Ra/Wa	
C1333	23242	5ACA	E	1	I32	VH	4	Ra	
C1334	23241	5AC9	E	1	I32	VH	4	Ra	
C1335	23240	5AC8	E	1	FIX32	VD	4	Ra/Wa	
C1336	23239	5AC7	A	2	I32	VH	4	Ra	
C1337	23238	5AC6	E	1	I32	VH	4	Ra	
C1338	23237	5AC5	E	1	FIX32	VD	4	Ra/Wa	
C1339	23236	5AC4	A	4	FIX32	VD	4	Ra	
C1340	23235	5AC3	A	4	FIX32	VD	4	Ra/W	CINH
C1341	23234	5AC2	A	4	FIX32	VD	4	Ra	
C1342	23233	5AC1	A	15	FIX32	VD	4	Ra/W	CINH
C1343	23232	5AC0	A	15	FIX32	VD	4	Ra	
C1344	23231	5ABF	A	4	FIX32	VD	4	Ra/W	CINH
C1345	23230	5ABE	A	4	I32	VH	4	Ra	
C1346	23229	5ABD	A	5	FIX32	VD	4	Ra/W	CINH
C1347	23228	5ABC	A	5	FIX32	VD	4	Ra	
C1348	23227	5ABB	A	2	FIX32	VD	4	Ra/Wa	
C1349	23226	5ABA	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1350	23225	5AB9	E	1	FIX32	VD	4	Ra/Wa	
C1351	23224	5AB8	E	1	FIX32	VD	4	Ra/Wa	
C1352	23223	5AB7	E	1	FIX32	VD	4	Ra/W	CINH
C1353	23222	5AB6	E	1	FIX32	VD	4	Ra	
C1354	23221	5AB5	A	2	FIX32	VD	4	Ra/W	CINH
C1355	23220	5AB4	A	2	FIX32	VD	4	Ra	
C1356	23219	5AB3	E	1	FIX32	VD	4	Ra/W	CINH
C1357	23218	5AB2	E	1	I32	VH	4	Ra	
C1358	23217	5AB1	A	2	FIX32	VD	4	Ra/W	CINH
C1359	23216	5AB0	A	2	FIX32	VD	4	Ra	
C1360	23215	5AAF	A	10	FIX32	VD	4	Ra/W	CINH
C1361	23214	5AAE	A	10	I32	VH	4	Ra	
C1362	23213	5AAD	A	3	FIX32	VD	4	Ra/W	CINH
C1363	23212	5AAC	A	3	FIX32	VD	4	Ra	
C1364	23211	5AAB	E	1	FIX32	VD	4	Ra/Wa	
C1365	23210	5AAA	E	1	FIX32	DV	4	Ra/Wa	
C1366	23209	5AA9	E	1	FIX32	VD	4	Ra/Wa	
C1367	23208	5AA8	A	1	FIX32	VD	4	Ra/Wa	CINH
C1368	23207	5AA7	E	1	FIX32	VD	4	Ra/Wa	
C1369	23206	5AA6	A	1	I32	VH	4	Ra/Wa	
C1370	23205	5AA5	E	1	FIX32	VD	4	Ra/W	CINH
C1371	23204	5AA4	E	1	FIX32	VD	4	Ra/Wa	
C1374	23201	5AA1	A	2	FIX32	VD	4	Ra/W	CINH
C1375	23200	5AA0	A	2	I32	VD	4	Ra	
C1379	23196	5A9C	E	1	I32	VD	4	Ra/Wa	
C1380	23195	5A9B	A	2	B32	VD	4	Ra/Wa	
C1384	23191	5A97	E	1	FIX32	VD	4	Ra/W	CINH
C1385	23190	5A96	E	1	FIX32	VD	4	Ra	
C1386	23189	5A95	E	1	FIX32	VD	4	Ra/W	CINH
C1387	23188	5A94	E	1	FIX32	VD	4	Ra	
C1388	23187	5A93	A	2	FIX32	VD	4	Ra/W	CINH
C1389	23186	5A92	A	2	I32	VD	4	Ra	
C1394	23181	5A8D	A	10	FIX32	VD	4	Ra/W	CINH
C1395	23180	5A8C	A	10	FIX32	VD	4	Ra	
C1396	23179	5A8B	A	4	FIX32	VD	4	Ra/W	CINH
C1397	23178	5A8A	A	4	I32	VH	4	Ra	
C1398	23177	5A89	A	4	FIX32	VD	4	Ra/W	CINH
C1399	23176	5A88	A	4	FIX32	VD	4	Ra	
C1400	23175	5A87	A	3	FIX32	VD	4	Ra/W	CINH
C1401	23174	5A86	A	3	FIX32	VD	4	Ra	
C1402	23173	5A85	A	2	FIX32	VD	4	Ra/W	CINH
C1403	23172	5A84	A	2	I32	VH	4	Ra	
C1404	23171	5A83	E	1	FIX32	VD	4	Ra/W	CINH
C1405	23170	5A82	E	1	FIX32	VD	4	Ra	
C1408	23167	5A7F	A	1	FIX32	VD	4	Ra/Wa	
C1409	23166	5A7E	E	1	FIX32	VD	4	Ra/W	CINH
C1410	23165	5A7D	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1411	23164	5A7C	A	1	FIX32	VD	4	Ra/Wa	
C1412	23163	5A7B	A	5	FIX32	VD	4	Ra/Wa	
C1413	23162	5A7A	A	2	U32	VH	4	Ra/Wa	
C1414	23161	5A79	A	2	FIX32	VD	4	Ra/W	CINH
C1415	23160	5A78	A	2	FIX32	VD	4	Ra	
C1416	23159	5A77	A	4	FIX32	VD	4	Ra/W	CINH
C1417	23158	5A76	A	4	FIX32	VD	4	Ra	
C1418	23157	5A75	A	5	FIX32	VD	4	Ra/W	CINH
C1419	23156	5A74	A	5	I32	VH	4	Ra	
C1420	23155	5A73	E	1	FIX32	VD	4		
C1424	23151	5A6F	A	5	FIX32	VD	4	Ra/W	CINH
C1425	23150	5A6E	A	5	FIX32	VD	4	Ra	
C1430	23145	5A69	A	2	FIX32	VD	4	Ra/Wa	
C1431	23144	5A68	E	1	FIX32	VD	4	Ra/Wa	
C1434	23141	5A65	A	2	FIX32	VD	4	Ra/W	CINH
C1435	23140	5A64	A	2	FIX32	VD	4	Ra	
C1436	23139	5A63	A	2	FIX32	VD	4	Ra/W	CINH
C1437	23138	5A62	A	2	I32	VH	4	Ra	
C1440	23135	5A5F	A	2	FIX32	VD	4	Ra/W	CINH
C1441	23134	5A5E	A	2	FIX32	VD	4	Ra	
C1442	23133	5A5D	A	4	FIX32	VD	4	Ra/W	CINH
C1443	23132	5A5C	A	4	FIX32	VD	4	Ra	
C1444	23131	5A5B	A	5	FIX32	VD	4	Ra/W	CINH
C1445	23130	5A5A	A	5	I32	VH	4	Ra	
C1446	23129	5A59	E	1	FIX32	VD	4	Ra/Wa	
C1448	23127	5A57	A	1	FIX32	VD	4	Ra/W	CINH
C1449	23126	5A56	A	1	FIX32	VD	4	Ra	
C1450	23125	5A55	A	2	FIX32	VD	4	Ra/W	CINH
C1451	23124	5A54	A	2	I32	VH	4	Ra	
C1452	23123	5A53	E	1	FIX32	VD	4	Ra/Wa	
C1453	23122	5A52	E	1	FIX32	VD	4	Ra/Wa	
C1454	23121	5A51	A	1	FIX32	VD	4	Ra/W	CINH
C1455	23120	5A50	A	1	FIX32	VD	4	Ra	
C1456	23119	5A4F	A	1	FIX32	VD	4	Ra/W	CINH
C1457	23118	5A4E	A	1	FIX32	VD	4	Ra	
C1458	23117	5A4D	E	1	FIX32	VD	4	Ra/Wa	
C1459	23116	5A4C	E	1	FIX32	VD	4	Ra/Wa	
C1460	23115	5A4B	E	1	FIX32	VD	4	Ra/Wa	
C1461	23114	5A4A	A	2	FIX32	VD	4	Ra/Wa	
C1462	23113	5A49	A	3	FIX32	VD	4	Ra/Wa	
C1463	23112	5A48	A	2	FIX32	VD	4	Ra/Wa	
C1466	23109	5A45	A	2	FIX32	VD	4	Ra/W	CINH
C1467	23108	5A44	A	2	FIX32	VD	4	Ra	
C1468	23107	5A43	A	6	FIX32	VD	4	Ra/W	CINH
C1469	23106	5A42	A	6	FIX32	VD	4	Ra	
C1472	23103	5A3F	A	1	FIX32	VD	4	Ra/W	CINH
C1473	23102	5A3E	A	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1476	23099	5A3B	A	16	FIX32	VD	4	Ra/Wa	
C1477	23098	5A3A	A	16	FIX32	VD	4	Ra/Wa	
C1478	23097	5A39	E	1	FIX32	VD	4	Ra/Wa	
C1480	23095	5A37	E	1	FIX32	VD	4	Ra/W	CINH
C1486	23089	5A31	A	2	FIX32	VD	4	Ra/W	CINH
C1487	23088	5A30	A	2	I32	VH	4	Ra	
C1488	23087	5A2F	A	1	FIX32	VD	4	Ra/W	CINH
C1489	23086	5A2E	A	1	FIX32	VD	4	Ra	
C1500	23075	5A23	E	1	I32	VH	4	Ra	
C1501	23074	5A22	E	1	FIX32	VD	4	Ra/Wa	
C1502	23073	5A21	E	1	FIX32	VD	4	Ra/Wa	
C1503	23072	5A20	E	1	FIX32	VD	4	Ra/Wa	
C1504	23071	5A1F	E	1	FIX32	VD	4	Ra/Wa	
C1505	23070	5A1E	E	1	I32	VH	4	Ra/Wa	
C1506	23069	5A1D	E	1	FIX32	VD	4	Ra/W	CINH
C1507	23068	5A1C	E	1	FIX32	VD	4	Ra/W	CINH
C1508	23067	5A1B	E	1	FIX32	VD	4	Ra	
C1509	23066	5A1A	E	1	FIX32	VD	4	Ra	
C1550	23025	59F1	E	1	FIX32	VD	4	Ra/Wa	
C1551	23024	59F0	A	2	FIX32	VD	4	Ra/W	CINH
C1552	23023	59EF	A	2	I32	VH	4	Ra	
C1555	23020	59EC	E	1	FIX32	VD	4	Ra/Wa	
C1556	23019	59EB	A	2	FIX32	VD	4	Ra/W	CINH
C1557	23018	59EA	A	2	I32	VH	4	Ra	
C1560	23015	59E7	E	1	FIX32	VD	4	Ra/Wa	
C1561	23014	59E6	A	2	FIX32	VD	4	Ra/W	CINH
C1562	23013	59E5	A	2	I32	VH	4	Ra	
C1580	22995	59D3	E	1	FIX32	VD	4	Ra/W	CINH
C1581	22994	59D2	E	1	FIX32	VD	4	Ra	
C1582	22993	59D1	E	1	FIX32	VD	4	Ra/W	CINH
C1583	22992	59D0	E	1	FIX32	VD	4	Ra	
C1590	22985	59C9	E	1	FIX32	VD	4	Ra/Wa	
C1591	22984	59C8	E	1	FIX32	VD	4	Ra/Wa	
C1593	22982	59C6	E	1	FIX32	VD	4	Ra/W	CINH
C1594	22981	59C5	E	1	FIX32	VD	4	Ra	
C1610	22965	59B5	E	1	FIX32	VD	4	Ra/Wa	
C1611	22964	59B4	E	1	FIX32	VD	4	Ra/Wa	
C1612	22963	59B3	E	1	I32	VH	4	Ra	
C1615	22960	59B0	E	1	FIX32	VD	4	Ra/Wa	
C1616	22959	59AF	E	1	FIX32	VD	4	Ra/W	CINH
C1617	22958	59AE	E	1	I32	VH	4	Ra	
C1620	22955	59AB	A	2	FIX32	VD	4	Ra/W	CINH
C1621	22954	59AA	A	2	I32	VH	4	Ra	
C1640	22935	5997	E	1	FIX32	VD	4	Ra/W	CINH
C1641	22934	5996	A	16	FIX32	VD	4	Ra/Wa	
C1642	22933	5995	E	1	FIX32	VD	4	Ra/W	CINH
C1643	22932	5994	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1644	22931	5993	E	1	I32	VH	4	Ra	
C1645	22930	5992	E	1	FIX32	VD	4	Ra/Wa	
C1650	22925	598D	E	1	FIX32	VD	4	Ra/W	CINH
C1651	22924	598C	A	16	FIX32	VD	4	Ra/Wa	
C1652	22923	598B	E	1	FIX32	VD	4	Ra/W	CINH
C1653	22922	598A	E	1	FIX32	VD	4	Ra	
C1654	22921	5989	E	1	I32	VH	4	Ra	
C1655	22920	5988	E	1	FIX32	VD	4	Ra/Wa	
C1657	22918	5986	A	4	FIX32	VD	4	Ra/Wa	
C1658	22917	5985	E	1	FIX32	VD	4	Ra/Wa	
C1659	22916	5984	E	1	FIX32	VD	4	Ra/Wa	
C1660	22915	5983	E	1	FIX32	VD	4	Ra	
C1661	22914	5982	E	1	FIX32	VD	4	Ra/W	CINH
C1662	22913	5981	A	8	FIX32	VD	4	Ra/W	CINH
C1663	22912	5980	E	1	FIX32	VD	4	Ra	
C1664	22911	597F	A	8	I32	VH	4	Ra	
C1665	22910	597E	E	1	FIX32	VD	4	Ra	
C1666	22909	597D	E	1	FIX32	VD	4	Ra/W	CINH
C1667	22908	597C	A	8	FIX32	VD	4	Ra/W	CINH
C1668	22907	597B	E	1	FIX32	VD	4	Ra	
C1669	22906	597A	A	8	I32	VH	4	Ra	
C1680	22895	596F	A	2	FIX32	VD	4	Ra/W	CINH
C1681	22894	596E	E	1	FIX32	VD	4	Ra/W	CINH
C1700	22875	595 B	A	4	FIX32	VD	4	Ra/W	CINH
C1701	22874	595 A	A	4	FIX32	VD	4	Ra	
C1702	22873	5959	A	5	FIX32	VD	4	Ra/W	CINH
C1703	22872	5958	A	5	I32	VH	4	Ra	
C1704	22871	5957	E	1	FIX32	VD	4	Ra	
C1705	22870	5956	E	1	FIX32	VD	4	Ra	
C1706	22869	5955	A	3	FIX32	VD	4	Ra/Wa	
C1707	22868	5954	E	1	FIX32	VD	4	Ra/W	CINH
C1708	22867	5953	A	2	FIX32	VD	4	Ra/Wa	
C1718	22857	5949	A	2	FIX32	VD	4	Ra/W	CINH
C1719	22856	5948	A	2	FIX32	VD	4	Ra	
C1720	22855	5947	A	4	FIX32	VD	4	Ra/W	CINH
C1721	22854	5946	A	4	FIX32	VD	4	Ra	
C1722	22853	5945	A	2	FIX32	VD	4	Ra/W	CINH
C1723	22852	5944	A	2	I32	VH	4	Ra	
C1726	22849	5941	A	16	I32	VH	4	Ra/Wa	
C1727	22848	5940	E	1	FIX32	VD	4	Ra/Wa	
C1799	22776	58F8	E	1	FIX32	VD	4	Ra/Wa	
C1810	22765	58ED	E	1	VS		4	Ra	
C1811	22764	58EC	E	1	VS		4	Ra	

9 Troubleshooting and fault elimination

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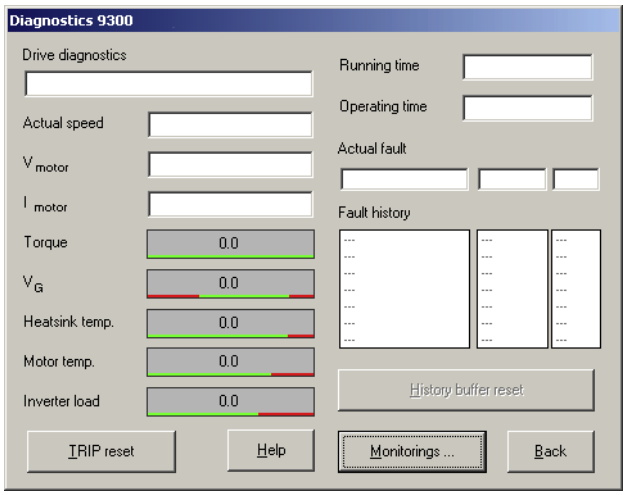
9.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 9.1-1 "Diagnostics" dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
- the history buffer in Global Drive Control (GDC) (📖 9.2-2) or
- the XT keypad
- and with the "General error messages" table in the "System error messages" chapter.

► The "General error messages" table provides tips on how to eliminate an error.

9.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

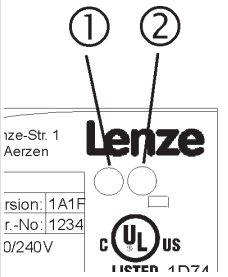
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 9.3-1)

9.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

LED		Operating status	
Red ①	**Green** ②		
Off	On	Controller enabled	
On	On	Mains switched on and automatic start inhibited	
Off	Blinking slowly	Controller inhibited	
Blinking quickly	Off	Undervoltage or overvoltage	
Blinking slowly	Off	Fault active	



9.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.

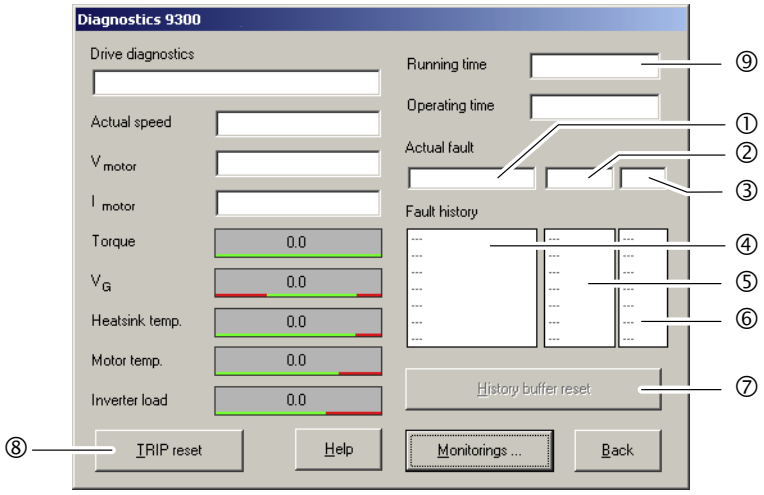


Fig. 9.2-1 "Diagnostics" dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged: ● The content of memory units 1 ... 7 is shifted "upwards" by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
④	⑤	⑥	2	Last fault	
			3	Next to last fault	
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

9.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only
			0	{1} 65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned	
			Bit 1	Pulse inhibit (IMP)	
			Bit2	Not assigned	
			Bit3	Not assigned	
			Bit4	Not assigned	
			Bit5	Not assigned	
			Bit 6	n = 0	
			Bit 7	Controller inhibit (CINH)	
			Bit 8	Device status bit 1	
			Bit 9	Device status bit 2	
			Bit10	Device status bit 3	
			Bit11	Device status bit 4	
			Bit12	Warning	
			Bit13	Message	
			Bit14	Not assigned	
			Bit15	Not assigned	
C0155	Status word 2	0			Status word 2 (advanced status word) Display only
			0	{1} 65535	Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault	
			Bit 1	M_{max} reached	
			Bit 2	I_{max} reached	
			Bit 3	Pulse inhibit(IMP)	
			Bit 4	Ready for operation (RDY)	
			Bit 5	Controller inhibit (CINH)	
			Bit 6	TRIP active	
			Bit 7	Initialisation	
			Bit 8	Motor direction of rotation (Cw/CCw)	
			Bit 9	Not assigned	
			Bit 10	Not assigned	
			Bit 11	Not assigned	
			Bit 12	Not assigned	
			Bit 13	Not assigned	
			Bit 14	Not assigned	
			Bit 15	Not assigned	

9.3 System error messages

9.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. 📖 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!

Fault message		Description	Cause	Remedy
No.	Display			
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. 📖 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	• Check external encoder. • Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	• Increase following error limit under C0255. • Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
x163	P13	Angle overrun.	• Phase controller limit reached • Drive cannot follow the digital frequency (I_{max} limit).	• Enable drive • Check drive dimensioning.
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	• Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. • Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	• Check communication channel. • Check baud rate, controller address. • Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.

Fault message		Description	Cause	Remedy
No.	Display			
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).
x220	CDA	Data error	Attempt to transmit faulty profile data	Repeat profile data transfer.
x221	CDA-LOAD	Faulty checksum	The checksum of the transferred profile data is not correct.	Repeat profile data transfer and check for correctness.

Explanation of the error numbers:
x 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
e.g. "2091": An external monitoring has triggered the warning EEr

9.3.2 Resetting system error messages

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** If a TRIP/FAIL QSP source is still active, the pending TRIP/FAIL QSP cannot be reset. The TRIP/FAIL QSP can be reset by: • pressing ⇨ STOP on keypad XT EMZ9371 BC. Then, press RUN to re-enable the controller. • Set code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word system bus (CAN) / MotionBus (CAN) at ECSxS/P/M After the reset of the TRIP/FAIL QSP, the drive remains at standstill.
Message	**Danger!** The fault message is reset automatically after the fault has been eliminated, and the drive restarts automatically.
Warning	After the fault has been eliminated, the fault message is reset automatically.

9.4 Error messages during profile download

During the profile download, the controller acknowledges a correctly received message with “ACK”.

An error message is sent back to the sender (PLC/IPC). The content of the error message depends on the communication profile used.

- ► The ”Error code sent” table assigns each fault message with a fault name.
- ► The ”Cause of fault and fault elimination” table helps you to detect and eliminate the possible fault cause by means of the fault name and the code concerned.

Error code sent

Fault name	2102	2111/2113	2131/2133		2171/72	2175	
	LECOM	INTERBUS	DRIVECOM	PROFIDRIVE	CAN	CANopen	Device-Net
E_SDF_...	(Read L-C0068)	Error class/code/Addcode	class/code/Addcode	Bytes 0/1/2/3			
ILL_OPERATING_ACCESS	60	Read: 8/00/0020 Write: 8/00/0021	Write: 8/00/0021 Read: 8/00/FF08	Write: FE/08/0/0 Read: FF/08/0/0	1008 0306	0800 0000	Status: 08
INV_LENGTH_RANGE	50	Read: 8/00/0020 Write: 6/05/0012	Write: 6/05/0012 Read: 8/00/FF0B	Write: FE/0B/0/0 Read: FF/0B/0/0	100B 0306	0504 0002	Status: 0B
INV_COLLISION_RANGE	50	Read: 8/00/0020 Write: 8/00/0040	Write: 8/00/0040 Read: 8/00/FF0C	Write: FE/0C/0/0 Read: FF/0C/0/0	100C 0306	0800 0000	Status: 0C
INV_VALUE_RANGE	50	Read: 8/00/0020 Write: 8/00/0030	Write: 8/00/0030 Read: 8/00/FF0D	Write: 2/0/0/0 Read: FF/0D/0/0	100D 0306	0609 0030	Status: 0D
INV_RANGE	50	Read: 8/00/0020 Write: 8/00/0030	Write: 8/00/0030 Read: 8/00/FF0E	Write: 2/0/0/0 Read: FF/0E/0/0	100E 0306	0800 0000	Status: 0E
NOK	F0	Read: 8/00/0020 Write: 8/00/0020	Write: 8/00/FEFF Read: 8/00/FFFF	Write: FE/FF/0/0 Read: FF/FF/0/0	10FF 0306	0800 0000	Status: FF

Cause of fault and fault elimination

Code	Fault name	Cause	Remedy
All	ILL_OPERATING_ ACCESS	Password is set. Profile data cannot be accessed.	• Deactivate password protection by entering the password (C0503/1). • Note: If the password is not known, the password protection can only be deactivated by loading the factory settings. This procedure will also delete function block links and profile data.
C0389/0	Enable for changing the number of profiles or interpolation points online		
	INV_COLLISION_ RANGE	Relative data model is used (Lenze setting)	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
	NOK	Controller inhibit is not set, controller inhibit must be set to enter data	Set controller inhibit (e.g. via terminal X5/28, GDC F9, ...) and repeat data entry.
C0390/0	Change number of profiles online		
	INV_COLLISION_ RANGE	Online access not enabled.	Set C0389/0 = 1.
		Relative data model is used (Lenze setting). The number of profiles can only be changed if the absolute data model is used.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
	INV_VALUE_RANGE	The number of profiles selected is incorrect.	Select a permissible number of profiles, 1, 2, 4 or 8.
	NOK	Controller inhibit is not set, controller inhibit must be set to enter data	Set controller inhibit (e.g. via terminal X5/28, GDC F9, ...)
C0391/x	Change number of interpolation points (/1: profile number 0, /2: profile number 1, etc.)		
	INV_COLLISION_ RANGE	Online access not enabled.	Set C0389/0 = 1.
		Relative data model is used (Lenze setting). The number of interpolation points can only be changed if the absolute data model is used.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
		Selected number of interpolation points is too large	Reduce the number of interpolation points according to the number of profiles (absolute data model): • 512 for 1 profile • 256 for 2 profiles • 128 for 4 profiles • 64 for 8 profiles
	INV_RANGE	Master axis (X) cannot be calculated. It is not possible to create consistent data.	Transfer a new profile from GDC. Increase the number of interpolation points if necessary.
C0392/x	INV_COLLISION_ RANGE	Relative data model is used (Lenze setting). Access is only possible if the absolute data model is used.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
C0393/x	INV_COLLISION_ RANGE	Online access not enabled.	Set C0389/0 = 1.
C0394/x	INV_COLLISION_ RANGE	Attempt to transfer a non-zero value as the first X value. The value has not been accepted.	The first X value of a profile must always be zero.
C0395/x	INV_COLLISION_ RANGE	The X values are not in ascending order.	Use GDC to create a profile with the X values being distributed correctly.
C0396/x	INV_COLLISION_ RANGE	Relative data model is used (Lenze setting). Access is only possible if the absolute data model is used.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.

Code	Fault name	Cause	Remedy
C0397/x	INV_COLLISION_ RANGE	Online access not enabled.	Set code C0389/0 = 1.
C0398/x			
C0399/x			
C0501/1	Check X values (ascending order)		
	INV_VALUE_RANGE	The X values are not in ascending order.	Check source data and repeat transfer.
C0502/1	Profile selection		
	INV_COLLISION_ RANGE	Attempt to write to a non-existing profile.	Read out the maximum number of existing profiles from code C0390/0.
C0504/2	Write data field as an *.LC7 file		
	INV_LENGTH_RANGE	Attempt to write beyond the data field.	● Limit the number of writing cycles. ● Set the pointer to the beginning of the data field (C0505/2 = 0)
C0504/3	Write the X values in increments with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to write beyond the data field.	● Limit the number of writing cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/3 = 0).
	INV_COLLISION_RAN GE	Relative data model is used (Lenze setting). The address pointer has not been incremented.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
	INV_VALUE_RANGE	Attempt to transfer a non-zero value as the first X value. The address pointer has not been incremented.	Enter “0” for the first X value.
C0504/4	Write the Y values in increments with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to write beyond the data field.	● Limit the number of writing cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/4 = 0).
	INV_VALUE_RANGE	The relative data model is selected. While writing the Y value, the representable value range has been exceeded .	● Observe the maximum permissible difference between Y values of ±32767 inc. ● This profile requires a larger number of interpolation points.
C0504/5	Read the X values in increments with automatic indexing of the address pointer (auto-increment)		
	INV_COLLISION_ RANGE	Attempt to read beyond the data field.	● Limit the number of reading cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/5 = 0).
C0504/6	Read the Y values in increments with automatic indexing of the address pointer (auto-increment)		
	INV_COLLISION_ RANGE	Attempt to read beyond the data field.	● Limit the number of reading cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/6 = 0).
C0505/3	Pointer on X values, selection of an interpolation point on the X axis		
	INV_LENGTH_RANGE	The selected interpolation point does not exist.	Observe the existing number of interpolation points under C0391/x.

Code	Fault name	Cause	Remedy
C0505/4	Pointer on Y values, selection of an interpolation point on the Y axis		
	INV_LENGTH_RANGE	The selected interpolation point does not exist.	Observe the existing number of interpolation points under C0391/x.
C0511/1	Write X values in physical units [m_units] with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to write beyond the data field.	● Limit the number of writing cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/3 = 0).
	INV_COLLISION_ RANGE	Relative data model is used (Lenze setting). The address pointer has not been incremented.	Use GDC to create a profile with the absolute data model, load it into the controller and accept it.
	INV_VALUE_RANGE	Attempt to transfer a non-zero value as the first X value	Enter “0” for the first X value.
C0511/2	Read X values in physical units [m_units] with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to read beyond the data field.	● Limit the number of reading cycles to the existing number of interpolation points (see C0391/x) ● Set the pointer to the beginning of the value table (C0505/5 = 0).
C0512/1	Write Y values in physical units [s_units] with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to write beyond the data field.	● Limit the number of writing cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/4 = 0).
	INV_VALUE_RANGE	The relative data model is selected. While writing the Y value, the representable value range has been exceeded .	● Observe the maximum permissible difference between Y values of ±32767 inc. ● This profile requires a larger number of interpolation points. ● Increase the number of interpolation points (via GDC) and completely repeat the transfer of the profile.
C0512/2	Read Y values in physical units [m_units] with automatic indexing of the address pointer (auto-increment)		
	INV_LENGTH_RANGE	Attempt to read beyond the data field.	● Limit the number of reading cycles to the existing number of interpolation points (see C0391/x). ● Set the pointer to the beginning of the value table (C0505/6 = 0).

10 DC-bus operation

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10.1 Function

- DC-bus connections of drive systems enable the exchange of energy between connected controllers.
- If one or more controllers operate in generator mode (braking operation), the energy will be fed into the shared DC-voltage bus. The energy will then be available to the controllers which operate in motor mode.
- The use of braking units and supply units can be reduced.
- The energy consumption from the three-phase AC mains can be reduced.
- The number of mains supplies and the related expenses (e.g. wiring) can be perfectly adapted to your application.

10.2 Conditions for trouble-free DC-bus operation

- Distributed supply (parallel mains supply):
  - Always use the prescribed mains choke when connecting a controller to the mains.
  - Controllers of the EVx9321 ... EVx9333, 8200 and 8200 vector series must not be connected to the mains if they are operated in a DC-bus connection with EVx9335 ... EVx9338 and EVx9381 ... EVx9383 controllers.
- Only controllers with identical mains voltage/DC bus voltage ranges can be operated in a DC-bus connection:
  - Set the mains voltage/DC-bus voltage under C0173.
- 9340 regenerative power supply modules and 9360 DC input modules cannot be used together in the DC-bus connection.
- Read the documentation for the other controllers connected to the DC bus with regard to ”DC-bus operation”.

10.3 Fuses and cable cross-sections

Note!

- ► **All fuses specified here only have the purpose of disconnection after a short circuit.** For cable protection specific fuses must be used.
- ► In the following tables the rated currents of the Lenze fuses are listed. If other fuses are used, other fuse currents and cable cross-sections may result.
- ► We recommend using fuse holders with a signalling contact. Like this, the entire drive system can be switched off (inhibited) when a fuse fails.
- ► Always fuse DC cables using 2 poles ($+U_G$, $-U_G$).

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Mains	DC 460 ... 740 V
Fuses	• Only semiconductor fuses. • If you are using fuses other than those indicated, other fuse currents and cable cross-sections may result.
Cables	• DC cables ($+U_G$, $-U_G$) must always have two-pole insulation. • Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of cables or cores, three loaded cores. The information is a recommendation. Other designs/laying systems are possible (e.g. according to VDE 0298-4).
Observe all national and regional regulations!	

Inverter		DC fuse 14 × 51 (EFSGR0xx0AYHx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9321	3/PE 400 V	12	12	1.5	1.5
EVS9322		12	12	1.5	1.5
EVS9323		12	12	1.5	1.5
EVS9324		20	20	1.5	1.5
EVS9325		40	40	4.0	4.0
EVS9326		50	50	6.0 [1]	4.0

[1] Pin-end connector required, since a maximum cable cross-section of 4 mm² can be connected to the inverter.

Inverter		DC fuse NH1 (EFSGRxxx0ANVx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9327	3/PE 400 V	100	100	-	25
EVS9328		100	100	-	25
EVS9329		200	-	-	25
EVS9330		200	-	-	50
EVS9331		200	-	-	50

Inverter		DC fuse NH2 (EFSGRxxx0ANWx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9332	3/PE 400 V	250	-	-	95

10.4 Distributed supply (several supply points)

Basic circuit diagram

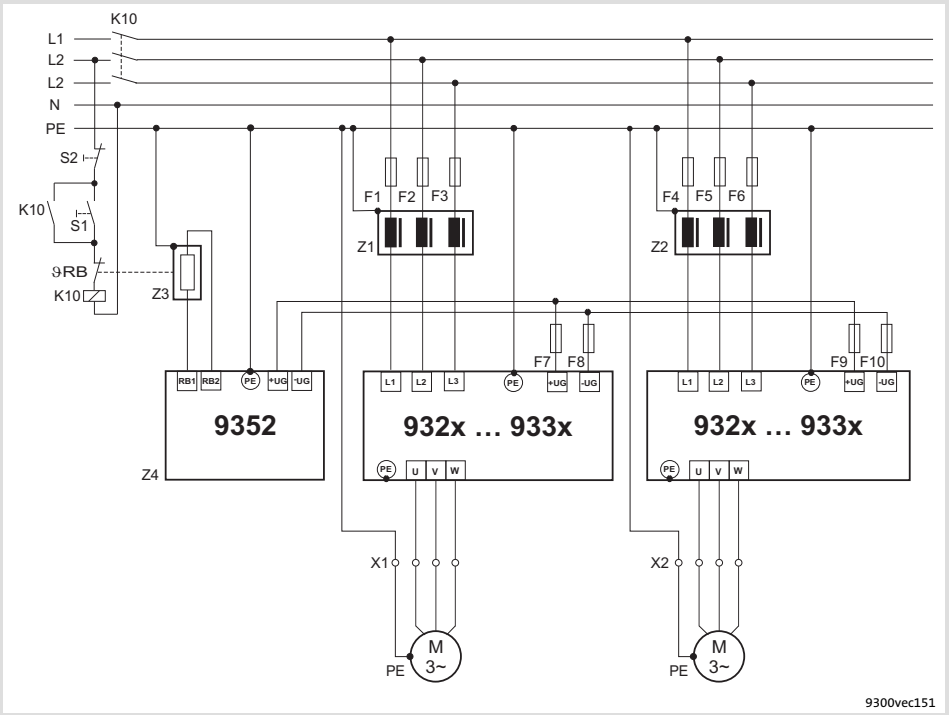

Fig. 10.4-1 Basic circuit diagram of a distributed supply with brake chopper

F1 ... F10	Fusing
K10	Mains contactor
Z1, Z2	Mains choke / mains filter
Z3	Brake resistor
Z4	Brake chopper
S1	Mains supply on
S2	Mains supply off

► Dimension the components according to the requirements of the DC-bus operation.

Stop!

Set the DC-bus voltage thresholds of the controller (C0173) and the brake chopper (see documentation of the brake chopper) to the same values.

10.5 Central supply (one supply point)

Basic circuit diagram

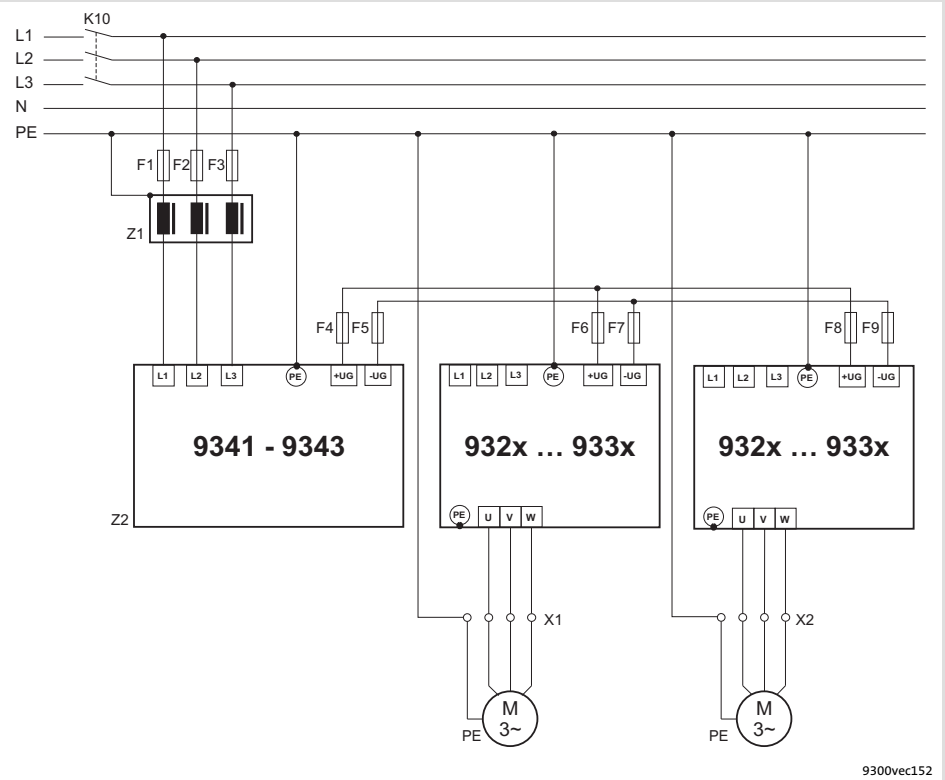

Fig. 10.5-1 Basic circuit diagram of a central supply with regenerative power supply module

F1 ... F9	Fusing
K10	Mains contactor
Z1	Mains choke / mains filter
Z2	Regenerative power supply module

► Dimension the components according to the requirements of the DC-bus operation.

Note!

► If the supply power of the regenerative power supply module is not sufficient, the system can be additionally supplied via the mains connection of further controllers.

► Before connecting the supply module and the controllers read the Operating Instructions of the regenerative power supply module.

11 Safety engineering

Contents

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11.1 Important notes

The controllers support the safety functions ”Safe torque off” (former designation ”Safe standstill”), ”Protection against unexpected start-up”, in accordance with the requirements of control category 3 of ISO 13849-1 (former EN 954-1). Depending on the external interconnection, a standard up to ”category 3” in accordance with ISO 13849-1 is achieved.

Note!

In order to comply with control category 3 in accordance with ISO 13849-1 (former EN 954-1), the two methods ”Pulse inhibit via safety relay K_{SR}” **and** ”Controller inhibit”, which are independent of each other, have to be used.

- Only qualified personnel may install and commission the “Safe torque off” function.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN ISO 13849-1 and EN ISO 13849-2. This includes among other things:
  - Control cabinet, switches, relays in enclosure IP54!
  - All other requirements can be found in EN ISO 13849-1 and EN ISO 13849-2!
- Wiring with insulated wire end ferrules or rigid cables is absolutely required.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. by a cable duct. It must be ensured that short circuits between the individual cables cannot occur!
- With the “Safe torque off” function no emergency stop can be effected without additional measures:
  - There is neither an electrical isolation between motor and controller nor a service or repair switch!
  - An ”Emergency stop” requires the electrical isolation of the conductor to the motor, e.g. by means of a central mains contactor with emergency stop wiring.
- If in the case of the ”Safe torque off” a force effect is to be expected from outside, (e.g. sagging of hanging loads), additional measures are required (e.g. mechanical brakes).
- After the installation the operator has to check the function of the ”Safe torque off” circuit.
  - The functional test must be repeated at regular intervals.
  - Basically, the inspection intervals depend on the application, the related risk analysis, and the overall system. The inspection intervals must not be longer than 1 year.

11.2 Operating mode

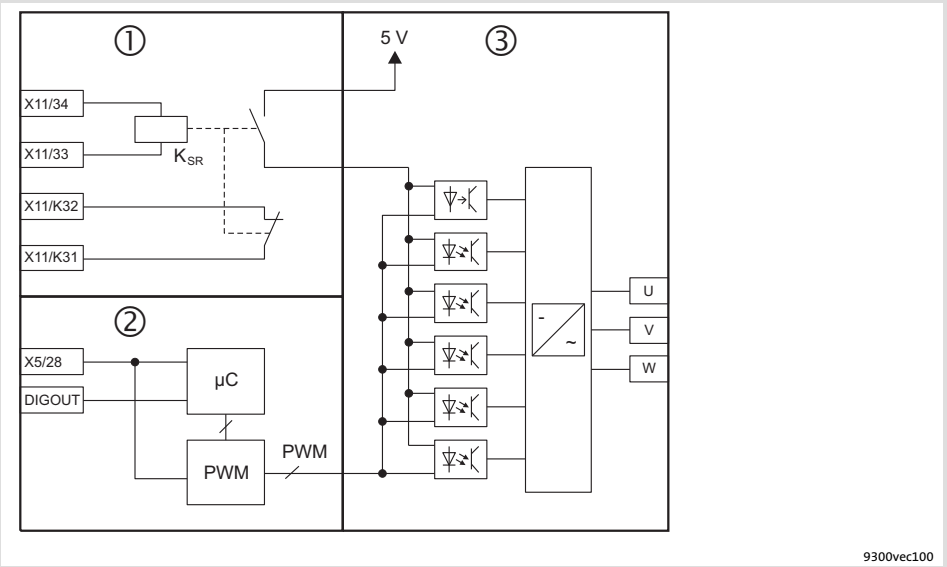

Fig. 11.2-1 Internal connection of the "Safe torque off" function with 3 electrically isolated circuits

Area ①: Pulse inhibit via safety relay K_{SR}; forcibly guided feedback for monitoring the safety relay

Area ②: Controller inhibit (X5/28), optional feedback via a digital output (DIGOUT)

Area ③: Power output stage

Activating "Safe torque off"

The "Safe torque off" status is activated via two different disconnecting paths which are independent of each other:

1. disconnecting path: Pulse inhibit via safety relay K_{SR} (terminal X11/33, X11/34)

- In the case of LOW level at terminals X11/33, X11/34, the safety relay K_{SR} is deactivated.The driver supply of the power section drivers is interrupted. The inverter no longer receives pulses.
- The disconnection of the safety relay K_{SR} has to be monitored externally, so that a failure of this disconnecting path can be detected. X11/K31, X11/K32 is a forcibly guided break contact, i. e. if the safety relay K_{SR} has been deactivated ("Safe torque off" activated), the contact is closed.

2. disconnecting path: Controller inhibit by input signal at terminal X5/28

- The input signal at X5/28 is fed to the microcontroller system and the PWM unit. In the case of LOW level at terminal X5/28, the output of pulses to the inverter is inhibited in the microcontroller system.
- The disconnecting path "Controller inhibit" can be evaluated optionally via a digital output. Further information can be gathered from the chapter "Functional test" (📖 11.5-1).

"Safe torque off" is activated if **both disconnecting paths are on LOW level**.

Deactivating "Safe torque off"

An AND operation of the disconnecting paths prevents the drive from restarting if only one disconnecting path is enabled.

"Safe torque off" is deactivated if **both disconnecting paths are on HIGH level**.

11.3 Safety relay K_{SR}

Technical data

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

11.4 Wiring

Wiring

Danger!

Faulty operation in case of earth faults possible

The correct functioning of the safety function is not ensured if an earth fault occurs.

Possible consequences:

► A failure of the safety function can lead to death, severe injuries or damage to material.

Protective measures:

The electrical reference point for the coil of the safety relay K_{SR} must be connected to the PE conductor system (EN 60204-1, paragraph 9.4.3)!

Terminal strip X11 | **Internal wiring / wiring of terminal strip X11**

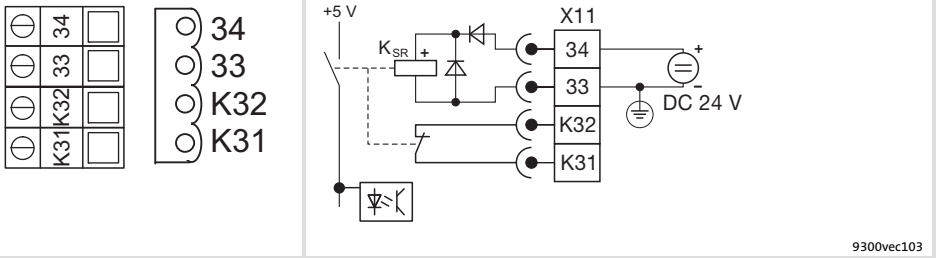

Fig. 11.4-1 Safety relay K_{SR}

Terminal		Function Bold print = **Lenze setting**	Level / state	Electrical data
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Feedback - pulse inhibit	Open contact: Pulse inhibit is inactive (operation) Closed contact: Pulse inhibit is active	See technical data of the safety relay K_{SR}
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active	
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)	
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled	LOW: 0 ... +3 V HIGH: +12 ... +30 V
				Input current at +24 V: 8 mA
				Reading and processing the input signals - 1/ms (mean value)

Terminal data

Wiring of the terminals X11/34, X11/33, X11/K32, X11/K31, X5/28:

Leitungstyp	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Rigid	–	2,5 mm² (AWG 14)	0,5 ... 0,6 Nm (4.4 ... 5.3 lb-in)	5 mm
Flexible	With plastic sleeve	2,5 mm² (AWG 14)		

11.5 Functional test

11.5.1 Important notes

Danger!

Unexpected start-up of the machine possible

The ”Safe torque off” safety function provides protection against an unexpected start-up of the drive and therefore is an important item within the safety concept for a machine. It has to be ensured that this function works correctly.

Possible consequences:

► Death, severe injury, or damage to material assets, when the safety function fails.

Protective measures:

After the installation and at regular intervals, the operator has to check the function of the ”Safe torque off” circuit.

► When doing this, check both disconnecting paths separately with regard to their disconnection capability.

► The functional test can be carried out manually or automatically via the PLC.

► Basically the inspection interval depends on the application and the corresponding risk analysis, as well as on the system as a whole. It should not exceed 1 year.

► If the functional test shows impermissible states,
  – the drive or the machine has to be shut down immediately.
  – commissioning is not permitted until the safety function operates correctly.

11.5.2 Manual safety function check

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

How to proceed during the test:

1. Alternately apply LOW and HIGH level to input X11/34 and check the states given in the table below.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

The individual tests are passed if the correct states given in the table result.

2. disconnecting path: Controller inihibit

Requirement for the test:

► "Quickstop" (QSP) function deactivated

► "Automatic DC injection brake" deactivated (C0019 = 0)

► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

How to proceed during the test:

1. Set controller inhibit (X5/28 = LOW).
2. Define a setpoint $n_{set} > 0$.
3. Check that the motor is not rotating.

The individual test is passed if the motor does not rotate.

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

► The drive or machine has to be shut down immediately.

► Commissioning is not permitted until the safety function operates correctly.

11.5.3 Monitoring the safety function with a PLC

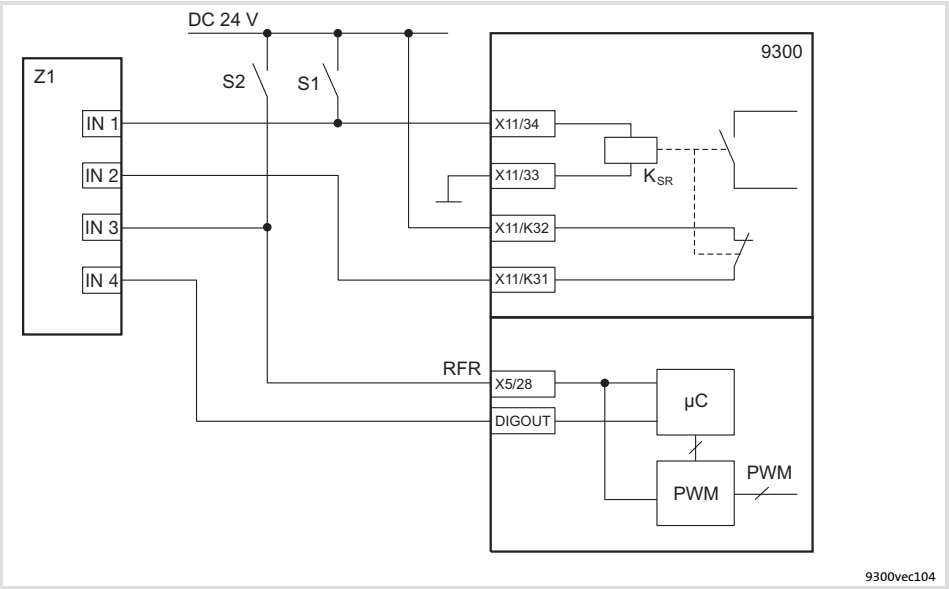

Fig. 11.5-1 Circuit diagram for monitoring the safety function with a PLC

S1, S2	Separate disconnection options of the two disconnecting paths
K_{SR}	Safety relay
X11/34	Safety relay control
X11/33	Safety relay control (GND)
X11/K32	Forcibly guided feedback contact (24 V)
X11/K31	Forcibly guided feedback contact
DIGOUT	Digital output for evaluating the motor current
X5/28	Controller inhibit
Z1	Programmable logic controller (PLC)
IN 1 - 4	Digital inputs

Requirements

The following conditions must be met:

- ► The PLC must be programmed such that the complete system is set to a safe state immediately when the function check leads to an impermissible state.
- ► The parameter setting of a digital output must be such that you can conclude to the output current I_{motor} of the drive (see parameterisation example).

Example: Parameterising a digital output

In the following we will show you a possibility of parameterising a digital output, so that a conclusion with regard to the motor current is provided.

Sequence		Parameter	Note
1.	Configure function block CMP3 (comparator)		
	• Connect CMP3-IN1 to MCTRL-IACT	C0693/1 = 5004	
	• Connect CMP3-IN2 to FCODE-472/1	C0693/2 = 19521	
	• Configure the function IN1 < IN2	C0690 = 3	
2.	Configure output signal of CMP3 • Connect DIGOUT4 to CMP3-OUT	C0117/4 = 10660	
3.	Enter function block CMP3 in the processing table		
	• Select a free space in the processing table In the Lenze setting, for instance space 2 of the processing table is free	C0465/2 = 10660	
4.	Set the current threshold • Set the current threshold for $I_{rated\ FI}$ to 2 %	C0472/1 = 2.00	$I_{Motor} = 0 \rightarrow$ DIGOUT4 = HIGH $I_{Motor} \neq 0 \rightarrow$ DIGOUT4 = LOW

Functional test within the inspection interval

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

The individual tests are passed if the correct states given in the table result.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

2. disconnecting path: Controller inihibit

Requirement for the test:

- ► "Quickstop" (QSP) function deactivated
- ► "Automatic DC injection brake" deactivated (C0019 = 0)
- ► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

The individual tests are passed if the correct states given in the table result.

	Specification		Correct status
Individual test	**X5/28**	**Setpoint**	**Output DIGOUT**
Controller inhibit	LOW	$n_{set} > 0$	HIGH
Controller enable	HIGH		LOW

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

- ► The drive or machine has to be shut down immediately.
- ► Commissioning is not permitted until the safety function operates correctly.

12 Accessories (overview)

Contents

12.1 General accessories 12.1-1
12.2 Type-specific accessories 12.2-1

12.1 General accessories

Accessories	Designation		Order number
Communication modules	LECOM-LI (optical fibre)		EMF2102IBCV003
	LECOM-B (RS485)		EMF2102IBCV002
	LECOM-A/B (RS232/485)		EMF2102IBCV001
	LON		EMF2141IB
	INTERBUS		EMF2113IB
	INTERBUS-Loop		EMF2112IB
	PROFIBUS-DP		EMF2133IB
	DeviceNet/CANopen		EMF2175IB
	Operating module keypad XT		EMZ9371BC
	Diagnosis terminal (keypad XT in handheld design, IP20) [1)]		E82ZBBXC
Other	Connecting cable	2.5 m	E82ZWL025
		5 m	E82ZWL050
		10 m	E82ZWL100
	Parameterisation/operating software »Global Drive Control« (GDC)		ESP-GDC2
	PC system bus adapter (Voltage supply via DIN connection)		EMF2173IB
	PC system bus adapter (Voltage supply via PS2 connection)		EMF2173IB-V002
	PC system bus adapter (Voltage supply via PS2 connection, electrical isolation)		EMF2173IB-V003
	PC system bus adapter USB		EMF2177IB
	CAN repeater		EMF2176IB
	PC system cable RS232	5 m	EWL0020
		10 m	EWL0021
	Optical fibre adapter (standard output power)		EMF2125IB
	Optical fibre adapter (increased output power)		EMF2126IB
	Power supply unit for optical fibre adapter		EJ0013
	Optical fibre, single-core, black PE sheath (basic protection), sold by the meter		EWZ0007
	Optical fibre, single-core, red PUR sheath (reinforced protection), sold by the meter		EWZ0006
	Setpoint potentiometer		ERPD0010k0001W
	Rotary knob for setpoint potentiometer		ERZ0001
	Scale for setpoint potentiometer		ERZ0002
	Digital display		EPD203
	Encoder cable	2.5 m	EWLE002GX-T
		5.0 m	EWLE005GX-T
		10.0 m	EWLE010GX-T
		15.0 m	EWLE015GX-T
		20.0 m	EWLE020GX-T
		25.0 m	EWLE025GX-T
		30.0 m	EWLE030GX-T
		35.0 m	EWLE035GX-T
		40.0 m	EWLE040GX-T
		45.0 m	EWLE045GX-T
		50.0 m	EWLE050GX-T

Accessories	Designation		Order number
	Connecting cable for digital frequency coupling	2.5 m	EWLD002GGBS93

1) Additional connecting cable required

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

12.2 Type-specific accessories

9300	EVS9321	EVS9322	EVS9323	EVS9324
Accessories	Order No.			
Mains choke	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Mains filter				
Category C2 EN 61800-3	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Category C1 EN 61800-3	EZN3B2400H002	EZN3B1500H003	EZN3B0900H004	EZN3B0500H007
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD180R300W	ERBD180R300W	ERBD082R600W	ERBD068R800W
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0016	EZZ0016
Mounting kit for push-through technique	EJ0036	EJ0036	EJ0037	EJ0037

9300	EVS9325	EVS9326	EVS9327	EVS9328
Accessories	Order No.			
Mains choke	EZN3A0300H013	ELN3-0150H024-001	ELN3-0088H035-001	ELN3-0075H045
Mains filter				
Category C2 EN 61800-3	EZN3A0300H013	EZN3A0150H024	EZN3A0110H030 E82ZN22334B230 E82ZZ15334B230 [1]	EZN3A0080H042 E82ZN22334B230
Category C1 EN 61800-3	EZN3B0300H013	EZN3B0150H024	E82ZN22334B230 E82ZZ15334B230 [1] EZN3B0110H030U [2]	E82ZN22334B230 EZN3B0080H042
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD047R01k2	ERBD047R01k2	ERBD033R02k0	ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0017	EZZ0017
Mounting kit for push-through technique	EJ0038	EJ0038	EJ0011	EJ0011

9300	EVS9329	EVS9330	EVS9331	EVS9332
Accessories	Order No.			
Mains choke	ELN3-0055H055	ELN3-0038H085	ELN3-0027H105	ELN3-0022H130
Mains filter				
Category C2 EN 61800-3	E82ZN30334B230 EZN3A0055H060	E82ZN55334B230 EZN3A0030H110 EZN3A0030H110N001 3)	E82ZN75334B230 EZN3A0022H150	E82ZN75334B230 EZN3A0022H150
Category C1 EN 61800-3	E82ZN30334B230 EZN3B0055H060	EZN3B0030H110	E82ZN75334B230 EZN3B0022H150	E82ZN75334B230 EZN3B0022H150
Brake chopper	EMB9352-E	2 × EMB9352-E	2 × EMB9352-E	3 × EMB9352-E
Brake resistor	ERBD018R03k0	2 × ERBD022R03k0	2 × ERBD022R03k0	3 × ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0017	–	–	–
Mounting kit for push-through technique	EJ0011	EJ0010	EJ0010	EJ0009

13 Appendix

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13.2 Glossary 13.2-1
13.2.1 Terminology and abbreviations used 13.2-1
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13.1 Code-oriented transfer mode

The mode is suitable for changing single codes. In contrast to the interpolation-point-oriented mode only incremental values are assigned.

Condition for online access

You can access the data stored in the controller online. Carry out the following steps:

1. Select a profile with the absolute data model.
2. Activate the online access with C0389 = 1.
   – Online access can only be activated if the controller is inhibited (X5/28 = HIGH).

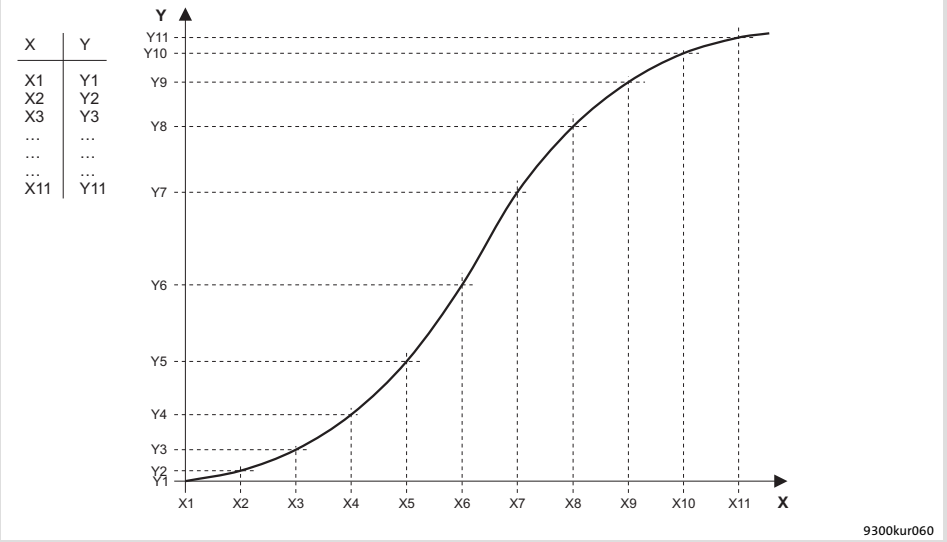

Fig. 13.1-1 Example of a profile with absolute data model (assignment of the X/Y value pairs)

Access to profile data

► Profile data can be accessed via codes. Access via GDC is not possible.

Code	Selection	Meaning	Important
C0389	0: CAM-DATA-offline (Lenze setting) 1: CAM-DATA-online	Profile data	Mode can only be changed 1. if the controller is inhibited, 2. if profile has been transferred with absolute data model, 3. if the profile data has been accepted in the main memory.
C0392/1 C0392/2 ... C0392/128	0 ... +2147483647	X coordinates 1st part	The coordinate is accessed via the subcode. Example: C0392/1 = X1, C0392/2 = X2, ... of profile 0 (entries for C0390/0 = 2) The values must be entered in ascending order, otherwise NAK.
C0393/1 C0393/2 ... C0393/128	0 ... +2147483647	X coordinates 2nd part	The coordinate is accessed via the subcode. Example: C0393/1 = X129, C0393/2 = X130, C393/3 = X131, ... of profile 0 (entries for C0390/0 = 2) The values must be entered in ascending order, otherwise NAK.
C0394/1 C0394/2 ... C0394/128	0 ... +2147483647	X coordinates 3rd part	The coordinate is accessed via the subcode. Example: C0394/1 = X1, C0394/2 = X2, ... of profile 1 (entries for C0390/0 = 2) The values must be entered in ascending order, otherwise NAK.
C0395/1 C0395/2 ... C0395/128	0 ... +2147483647	X coordinates 4th part	The coordinate is accessed via the subcode. Example: C0395/1 = X129, C0395/2 = X130, ... of profile 1 (entries for C0390/0 = 2) The values must be entered in ascending order, otherwise NAK.
C0396/1 C0396/2 ... C0396/128	±2147483647	Y coordinates 1st part	The coordinate is accessed via the subcode. Example: C0396/1 = Y1, C0364/2 = Y2, ... of profile 0 (entries for C0390/0 = 2)
C0397/1 C0397/2 ... C0397/128	±2147483647	Y coordinates 2nd part	The coordinate is accessed via the subcode. Example: C0397/1 = Y129, C0397/2 = Y130, ... of profile 0 (entries for C0390/0 = 2)
C0398/1 C0398/1 ... C0398/128	±2147483647	Y coordinates 3rd part	The coordinate is accessed via the subcode. Example: C0398/1 = Y1, C0398/2 = Y2, ... of profile 1 (entries for C0390/0 = 2)
C0399/1 C0399/1 ... C0399/128	±2147483647	Y coordinates 4th part	The coordinate is accessed via the subcode. Example: C0399/1 = Y129, C0399/2 = Y130, ... of profile 1 (entries for C0390/0 = 2)

Entry of coordinates

The coordinates are entered online into the codes and subcodes. Acceptance of the coordinates takes about 50 ms plus transmission time.

Values	Profiles		Code	Meaning
	Quantity	Number		
X values	1	0	C0392/1 ... C0392/128	X1 to X128
		0	C0393/1 ... C0393/128	X129 to X256
		0	C0394/1 ... C0394/128	X257 to X384
		0	C0395/1 ... C0395/128	X385 to X512
	2	0	C0392/1 ... C0392/128	X1 to X128
		0	C0393/1 ... C0393/128	X129 to X256
		1	C0394/1 ... C0394/128	X1 to X128
		1	C0395/1 ... C0395/128	X129 to X256
	4	0	C0392/1 ... C0392/128	X1 to X128
		1	C0393/1 ... C0393/128	X1 to X128
		2	C0394/1 ... C0394/128	X1 to X128
		3	C0395/1 ... C0395/128	X1 to X128
	8	0	C0392/1 ... C0392/64	X1 to X64
		1	C0392/65 ... C0392/128	X1 to X64
		2	C0393/1 ... C0393/64	X1 to X64
		3	C0393/65 ... C0393/128	X1 to X64
		4	C0394/1 ... C0394/64	X1 to X64
		5	C0394/65 ... C0394/128	X1 to X64
		6	C0395/1 ... C0395/64	X1 to X64
		7	C0395/65 ... C0395/128	X1 to X64
Y values	1	0	C0396/1 ... C0396/128	Y1 to Y128
		0	C0397/1 ... C0397/128	Y129 to Y256
		0	C0398/1 ... C0398/128	Y257 to Y384
		0	C0399/1 ... C0399/128	Y385 to Y512
	2	0	C0396/1 ... C0396/128	Y1 to Y128
		0	C0397/1 ... C0397/128	Y129 to Y256
		1	C0398/1 ... C0398/128	Y1 to Y128
		1	C0399/1 ... C0399/128	Y129 to Y256
	4	0	C0396/1 ... C0396/128	Y1 to Y128
		1	C0397/1 ... C0397/128	Y1 to Y128
		2	C0398/1 ... C0398/128	Y1 to Y128
		3	C0399/1 ... C0399/128	Y1 to Y128
	8	0	C0396/1 ... C0396/64	Y1 to Y64
		1	C0396/65 ... C0396/128	Y1 to Y64
		2	C0397/1 ... C0397/64	Y1 to Y64
		3	C0397/65 ... C0397/128	Y1 to Y64
		4	C0398/1 ... C0398/64	Y1 to Y64
		5	C0398/65 ... C0398/128	Y1 to Y64
		6	C0399/1 ... C0399/64	Y1 to Y64
		7	C0399/65 ... C0399/128	Y1 to Y64

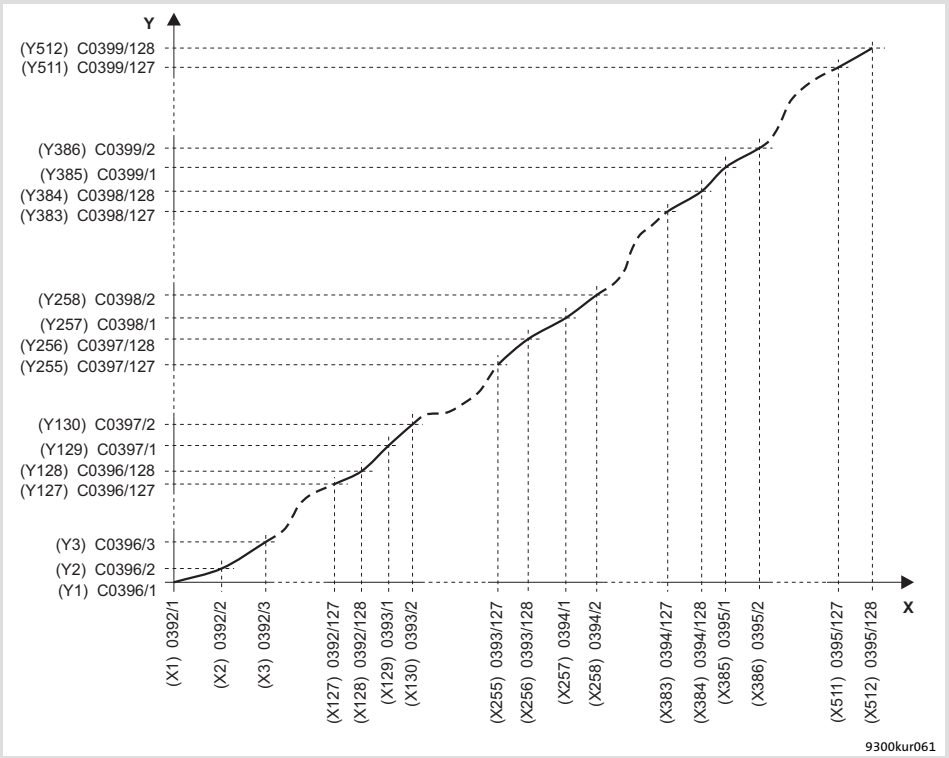

Fig. 13.1-2 Example of the access to 512 interpolation points if 1 profile is selected in GDC (spread view)

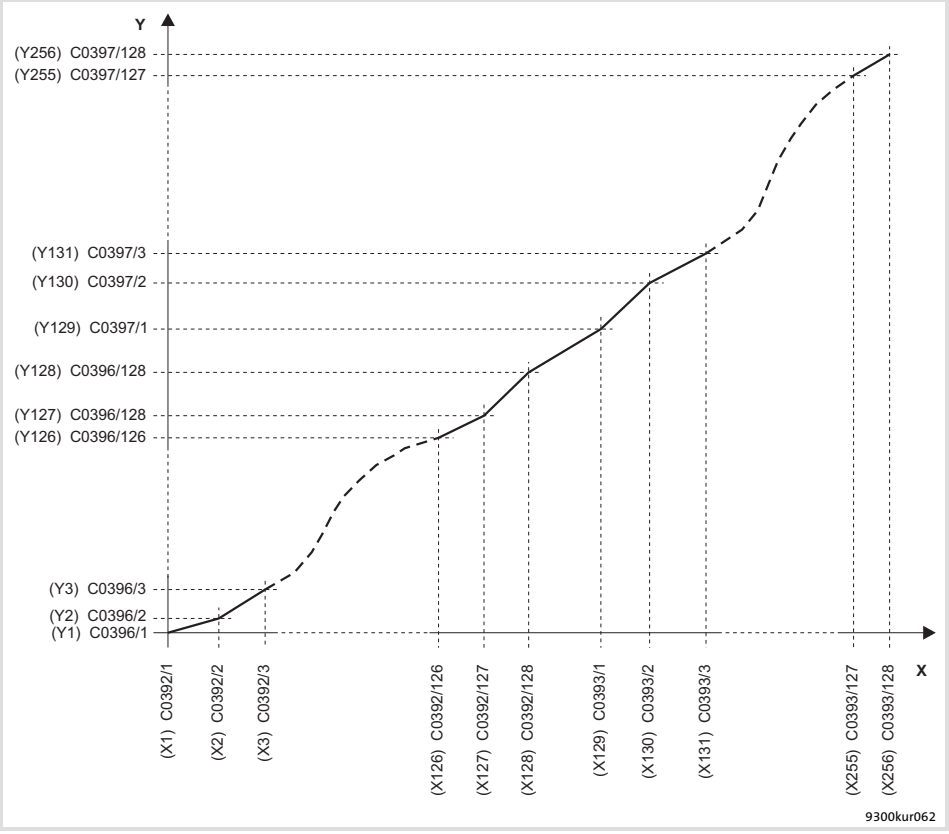

Fig. 13.1-3 Example of the access to 256 interpolation points if 2 profiles are selected in GDC (spread view)

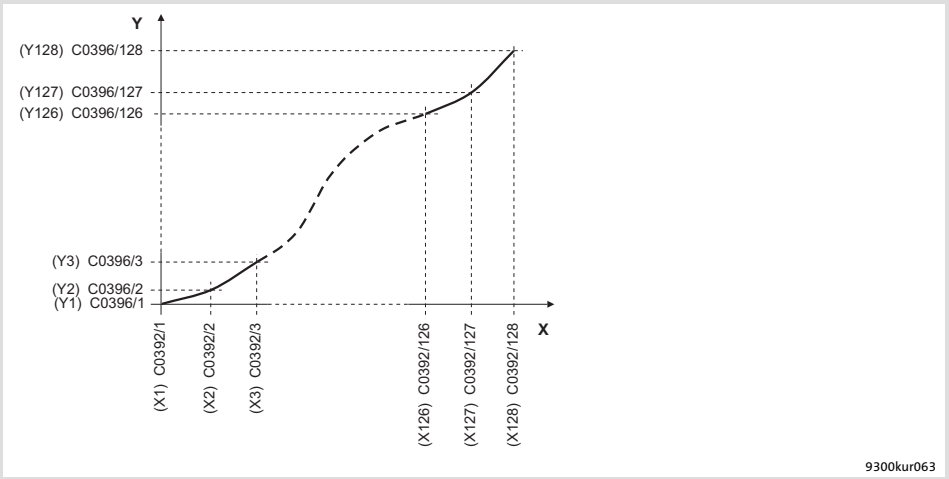

Fig. 13.1-4 Example of the access to 128 interpolation points if 4 profiles are selected in GDC (spread view)

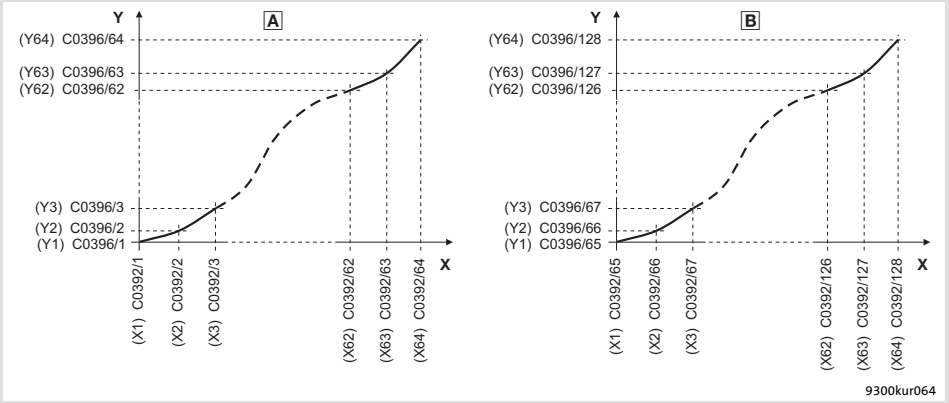

Fig. 13.1-5 Example of the access to 64 interpolation points if 8 profiles are selected in GDC (spread view)

A Profile 0 of 8
B Profile 1 of 8

X coordinates (master drive)

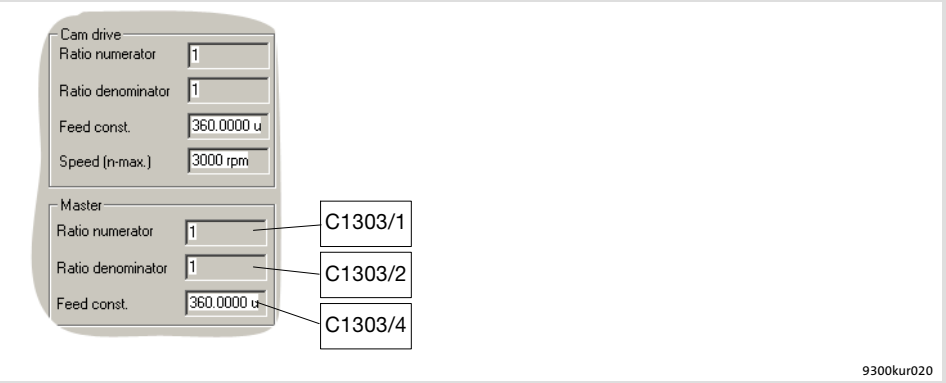

Fig. 13.1-6 Entry of the X coordinates in the "Basic settings" dialog box of GDC

$$\text{XPOS [inc]} = \text{XPOS [m\_units]} \cdot \frac{65536\ [\text{inc/rpm}] \cdot \text{C1303/1}}{\text{C1303/4}\ [\text{m\_units/rpm}] \cdot \text{C1303/2}}$$

XPOS	Target position
C1303/1	Gearbox numerator
C1303/2	Gearbox denominator
C1303/4	Feed constant

- Enter all values in [inc].
- A change of the profile clock pulse (last X value) will only be accepted with the next clock pulse (profile cycle).
- The 1st X value of a profile (C0392/1 and C0396/1) is always 0. All other values will be rejected with NAK.
- The X values have to be entered in ascending order, otherwise the entries will be rejected with NAK.

  Example: X1 < X2 < X3 < X4 < X5 < X6 < X7 < ...
- Permissible value range: 0 ... $+2^{31}$

Note!

Changing the X coordinates online only makes sense for a few applications. Generally, the distribution of the interpolation points over the X coordinates is already specified when defining the profile. This serves to set more interpolation points in critical areas than in less critical areas.

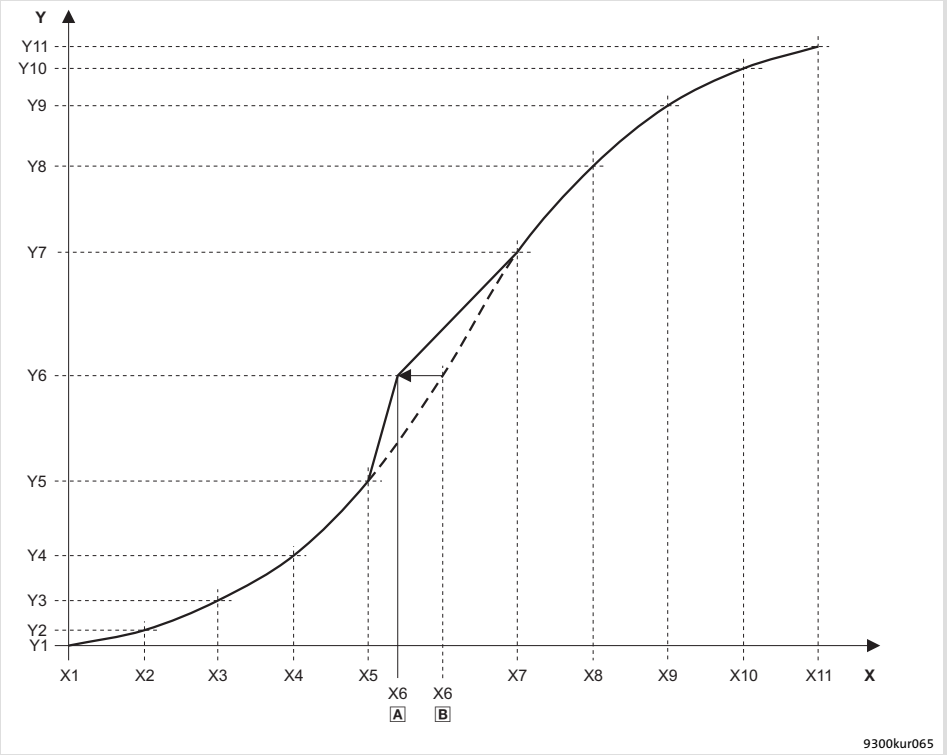

Fig. 13.1-7 Change of an X coordinate

Y coordinates (cam drive)

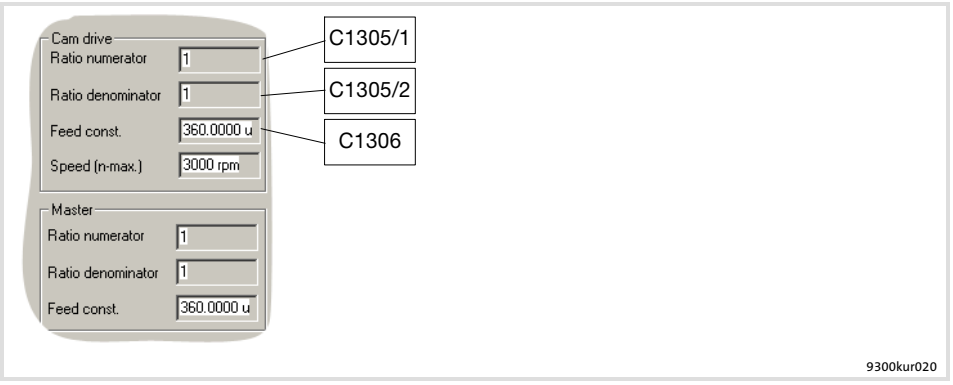

Fig. 13.1-8 Entry of the Y coordinates in the "Basic settings" dialog box of GDC

$$\text{YPOS [inc]} = \text{YPOS [s\_units]} \cdot \frac{65536\ \text{[inc/rpm]} \cdot \text{C1305/1}}{\text{C1306 [s\_units/rpm]} \cdot \text{C1305/2}}$$

YPOS = position target

YPOS	Target position
C1305/1	Gearbox numerator
C1305/2	Gearbox denominator
C1306	Feed constant

- ► Enter all values in [inc].
- ► Y values can be entered freely within the permissible value range.
- ► Permissible value range: $+2^{31}$ to -2^{31}

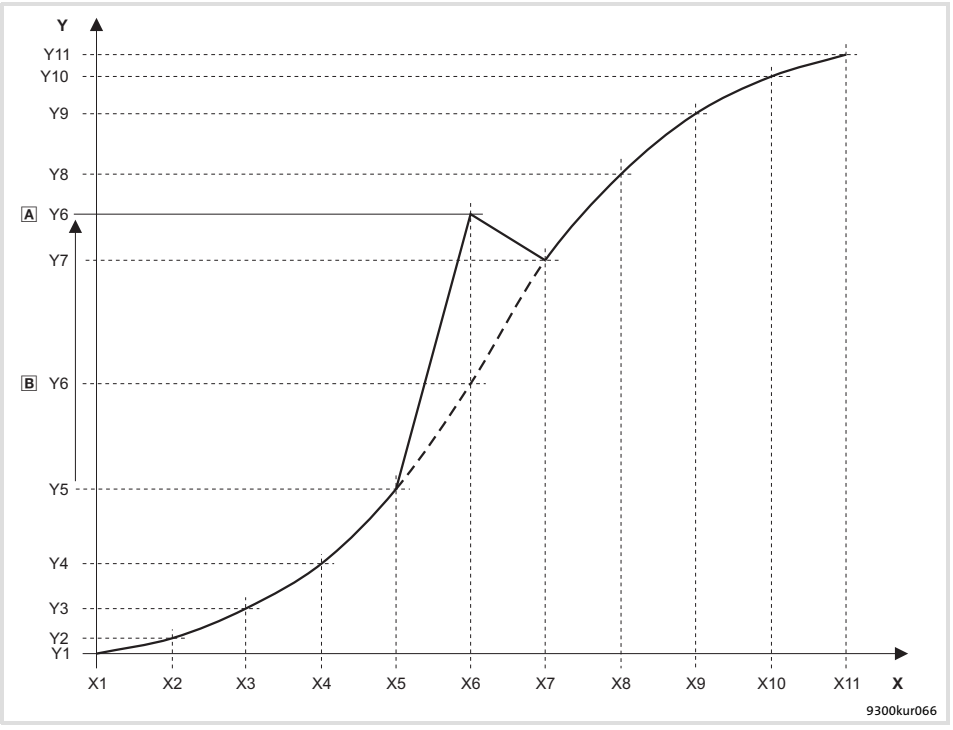

Fig. 13.1-9 Change of a Y coordinate

Excerpt from the attribute table

Code	Index		DS	DA	DT	Format	DL	LCM-R/W	Condition
	dec	hex							
C0389/0	24186	5E7Ah	E	1	FIX32	VD	4	RA/W	special
C0392/x	24183	5E77h	A	128	I32	VH	4	RA/W	special
C0393/x	24182	5E76h	A	128	I32	VH	4	RA/W	special
C0394/x	24181	5E75h	A	128	I32	VH	4	RA/W	special
C0395/x	24180	5E74h	A	128	I32	VH	4	RA/W	special
C0396/x	24179	5E73h	A	128	I32	VH	4	RA/W	special
C0397/x	24178	5E72h	A	128	I32	VH	4	RA/W	special
C0398/x	24177	5E71h	A	128	I32	VH	4	RA/W	special
C0399/x	24176	5E70h	A	128	I32	VH	4	RA/W	special

13.2 Glossary

13.2.1 Terminology and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter

P_r [kW]	Rated motor power
R [Ω]	Resistance
S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)

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EDSVS9332K ▪ 13440810 ▪ EN ▪ 8.0-07/2013 ▪ TD06

10 9 8 7 6 5 4 3 2 1

EDSVS9332K-EXT
13375727

Global Drive

System Manual

(Extension)

9300 *0,37 ... 75 kW*

EVS9321xK ... EVS9332xK

Servo cam profiler

Lenze

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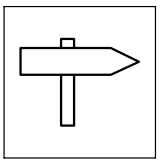

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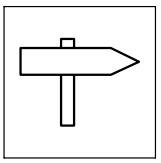

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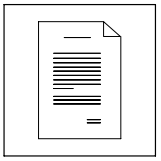

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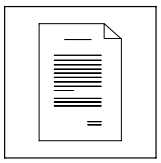

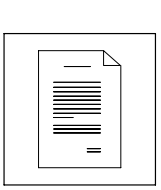

1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual is directed at all persons who design, install, commission and adjust the 9300 servo cam profilers.

Together with the System Manual, document number EDSVS9332K, and the catalogue, it forms the project planning basis for the manufacturer of plants and machinery.

Contents

The System Manual (Extension) completes the System Manual, document number EDSVS9332K:

- The features and functions are described in detail.
- It describes additional possible applications in detail.
- The parameter setting for typical applications is explained with the help of examples.
- In case of doubt, the Mounting Instructions supplied with the 9300 servo cam profiler are valid.

Contents of System Manual	Contents of System Manual (Extension)
1 Preface	1 Preface
2 Safety instructions	-
3 Technical data	-
4 Installation of the standard device	-
5 Wiring of the standard device	-
6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
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-	4 Application examples
9 Troubleshooting and fault elimination	-
10 DC-bus operation	-
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12 Accessories	-
13 Appendix	5 Appendix

How to find information

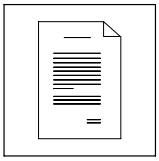
Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Note!

Information and tools concerning the Lenze products can be found in the download area under

http://www.Lenze.com



1.1.2 Document history

What is new / what has changed?

Material number	Version			Description
13375727	4.0	06/2011	TD23	Fault correction
13344177	3.0	07/2010	TD23	Extended by functions for software version 8.0 Fault correction
13190509	2.0	02/2007	TD23	Fault correction
13142002	1.0	06/2006	TD23	First edition for software version 7.0 Division of the System Manual into 2 parts (EDSVS9332K and EDSVS9332K-EXT)

1.1.3 Products to which the System Manual applies

This documentation is valid for 9300 servo cam profilers as of nameplate data:

	①					②	③
	EVS	93xx	-	x	x	Vxx	1x	8x

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = Panel-mounted unit

C = Built-in unit in "cold plate" technique

Design

K = Servo cam profiler

Variant

- = Standard

V003 = In "cold plate" technique

V004 = With "safe standstill" function

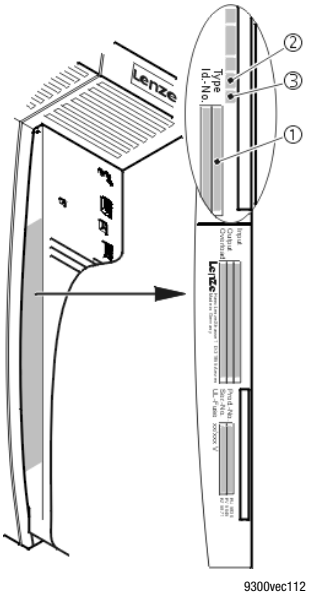
V100 = For IT systems

V104 = With "safe standstill" function and for IT systems

Hardware version

Software version

Nameplate



9300vec112

1.2 Definition of notes used

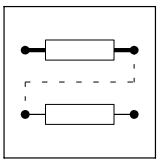
All safety information given in these instructions has the same layout:

Pictograph (indicates the type of danger)

Signal word! (indicates the severity of danger)

Note (describes the danger and explains how to avoid it)

Pictograph	Signal word		Consequences if disregarded
	Signal word	Meaning	
Dangerous electrical voltage	**Danger!**	**Impending danger for persons**	Death or severe injuries
	Warning!	**Possible, very dangerous situation for persons**	Death or severe injuries
General danger	**Caution!**	**Possible, dangerous situation for persons**	Injuries
	Stop!	**Possible damage to material**	Damage of the drive system or its environment
	Note!	**Useful tip** If you observe it, handling of the drive system will be easier.	



2 Configuration

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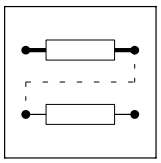
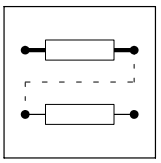


Configuration



2.1 Configuration with Global Drive Control

With Global Drive Control (GDC), Lenze offers an easy-to-understand, clearly-laid-out and convenient tool for the configuration of your specific drive task.

Function block library

GDC provides an easy-to-read library of available function blocks (FB). GDC also displays the complete assignment of an FB.

Signal configuration

The signal configuration is done with only one dialog box. It is a convenient way

- to display every FB as a block diagram.
- to see the assignment of all signal inputs at a glance.
- to enter the FB in the processing table.
- to print your signal configuration.

Terminal assignment

Freely assignable terminals can be configured using two dialog boxes:

- Dialog box - to link digital inputs and outputs.
- Dialog box - to link analog inputs and outputs.

2.2 Basic configurations

Stop!

It is possible to load predefined basic configurations via code C0005. If you load a configuration via C0005, the assignment of all inputs and outputs will be overwritten with the corresponding basic assignment.

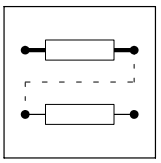
Adapt the function assignment to the wiring.

The internal signal processing is adapted to the drive task by selecting a predefined basic configuration. You can, for instance, use the Lenze setting for speed control.

- A detailed description of the basic configurations with terminal assignments, signal flow diagrams, and application examples can be found in the chapter ”Application examples”.
- Before loading a basic configuration via C0005, the controller must be inhibited.

Several predefined signal configurations can be loaded by using code C0005. The selection numbers have the following meaning:

C0005 =	1	X	X	X	X	
						Control 0 - Terminal control 1 - Control via LECOM A/B/LI 3 - Control via AIF (INTERBUS,PROFIBUS) 5 - Control via system bus (CAN)
						Terminal supply 0 - External supply of control terminals 1 - Internal supply of control terminals
						Additional functions (see chapter 2.2.2 ff.) 0 - None 1 - Homing function 2 - Clutch function 3 - Switching points 8 - Mark-controlled correction of the master value 9 - Mark-controlled correction of the act. value
						Operating mode 0 - Replacement of a mechanical cam* (see chapter 2.2.3) 1 - Welding bar drive* (see chapter 4.2) 2 - Operation with position storage* (see chapter 2.2.5) * - Incremental master value
						Identification 1 - Cam profile



Profile data

Before commissioning, the profile data must be generated with the Global Drive Control program and the transmitted to the drive. The below basic cam profiles are included in the Lenze setting. They are effective independently of the basic parameter setting.

Profile 1	Electronic gearbox (linear position profile)
Profile 2	Forward / backward movement with a standstill in the apex of the motion
Profile 3	Forward / backward movement with a standstill at the end of motion
Profile 4	Smooth feed
Profiles 5 - 8	No motion

Warning!

With Lenze setting, the motor must be operated at no-load (no mechanical connection to the machine).

2.2.1 Changing the basic configuration

If the basic configuration must be changed for a special application, proceed as follows:

1. Select a basic configuration via C0005 which largely meets the requirements.
2. Add functions by:
   - Reconfiguring inputs and/or outputs.
   - Setting parameters for function blocks. (📖 3-6)
   - Inserting or removing function blocks. (📖 3-12)

Note!

If you change the signal flow of the basic configuration, e. g. by adding function blocks, C0005 is set to 0. The display indicates ”COMMON”.

2.2.2 Basic configuration C0005 = 1xXxx

2.2.2.1 Basic configurations 1X0XX: No additional function

The signal flow corresponds to the basic functions described in chapters X.1 - X.3.

2.2.2.2 Basic configurations 1X1XX: Homing function

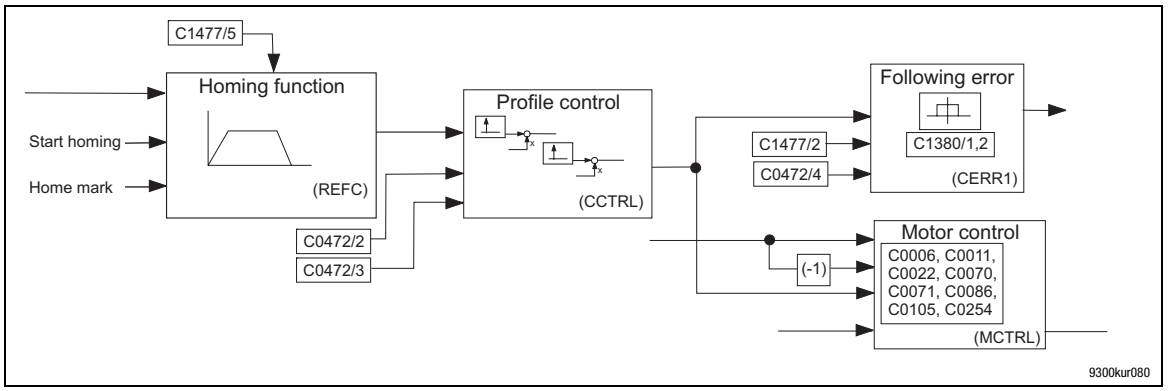


Fig. 2-1 Section of the signal flow diagram showing the basic configuration 1X1XX with homing function

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Start homing
	X5/E4	Home mark
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Reference O.K.
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional code	C1477/5	Home position
Parameter of FB REFC	C0011	Max. speed n_{max}

2.2.2.3 Basic configurations 1x2xx: Clutch function

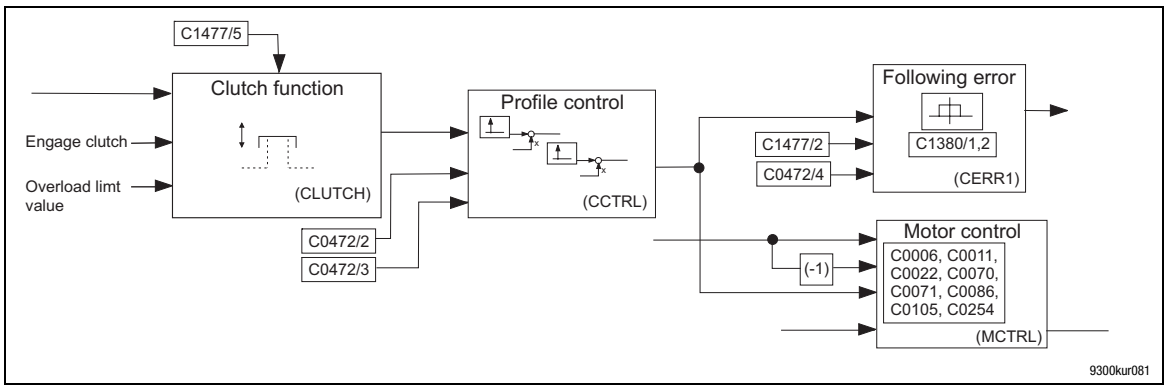


Fig. 2-2 Section of the signal flow diagram showing the basic configuration 1X2XX with clutch function

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Engage clutch
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Clutch disengaged
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional code	C1477/5	Home position
Parameters of FB CLUTCH	C1410	Clutch mode
	C1411	Max. velocity
	C1412/1	Ramp opening time
	C1412/2	Ramp profile generator
	C1412/3	Overload time delay
	C1413	Catch hysteresis

2.2.2.4 Basic configurations 1x3xx: Switching points (cam group)

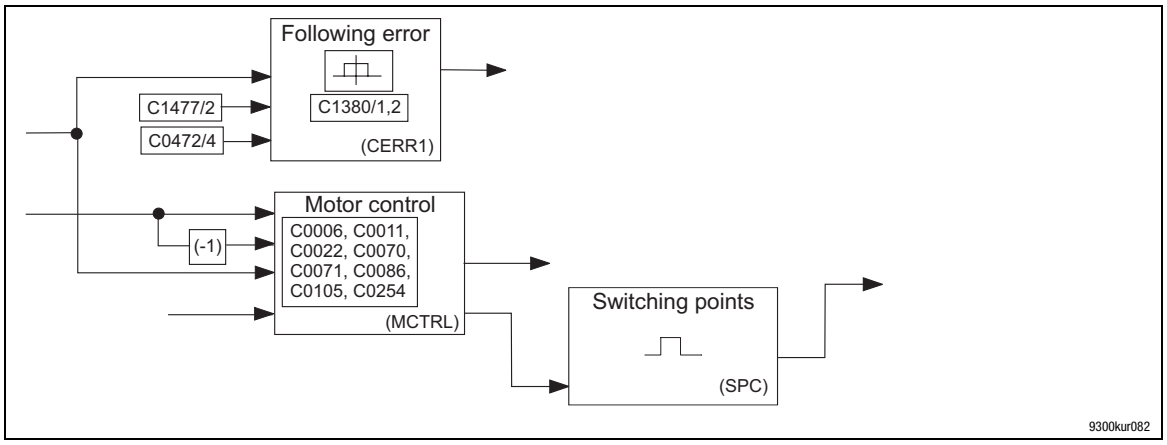


Fig. 2-3 Section of the signal flow diagram showing the basic configuration 1X3XX with switching points

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Profile *4
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Switching point 1
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional codes	C1476/x C1477/x	Codes can be used as switching point values
Parameters of FBs SPC1 and SPC2	C1645	SPC1 mode
	C1655	SPC2 mode
	C1657/1 to C1657/4	SPC2 dead time
	C1658	SPC2 hysteresis
	C1659	Filters

2.2.2.5 Basic configurations 1x8xx: Mark-controlled correction of master value

		Changed terminal assignment
Digital inputs	X5/E1	Event
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Trip reset / profile acceptance
	X5/E5	TOUCH-PROBE signal input
Additional code	C1476/16	TOUCH-PROBE position X

2.2.2.6 Basic configurations 1x9xx: Mark-controlled correction of actual value

		Changed terminal assignment
Digital inputs	X5/E1	Event
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	TOUCH-PROBE signal input X
	X5/E5	TOUCH-PROBE / profile acceptance Y
Additional code	C1476/16	TOUCH-PROBE position Y

2.2.3 Replacement of a mechanical cam (C0005 = 10000)

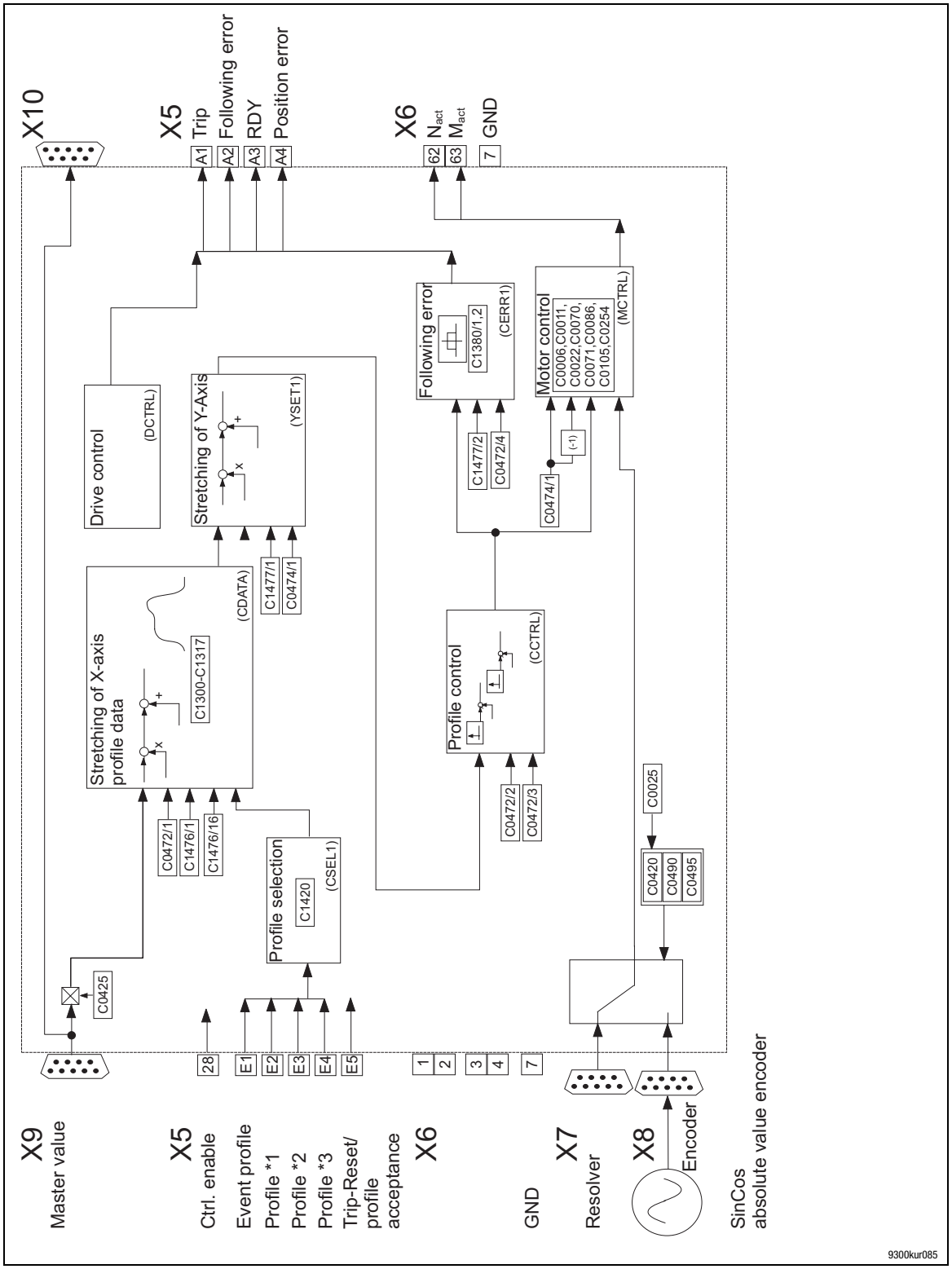


Fig. 2-4 Block diagram of the basic configuration C0005 = 10000 (cam)

	Code	Description
Basic configuration	C0005 = 10000	The configuration C0005 = 10000 provides an electronical solution for the demands on a mechanical cam. Additional functions such as stretching / compression / angle trimming in X-direction and Y-direction are available.
Master value	C0425	Encoder constant of the master value
Cam profile data	C1300-C1317	The cam profile data are determined with the generation of the profile. Usually, they do not have to be changed separately.
	C1420	Determines the profile to be used when an event input is activated (digital input X5/E1 = LOW).
Contouring error evaluation	C1380/1 and C1380/2	Determine comparison window and hysteresis of the contouring error evaluation.
Adjustment values	C0472/2	Influence of speed precontrol
	C0472/3	Influence of torque precontrol
	C1477/2	Contouring error limit (in s_units)
	C0472/4	Reduction factor for contouring error warning Warning limit: C0472/4 × C1477/2
Profile influence	C0472/1	Stretching/compression of X-axis (100 % = no stretching/compression)
	C1476/1	Angle trimming in X-direction
	C1477/1	Angle trimming in Y-direction
	C1476/16	TOUCH-PROBE position in X-direction
	C0472/9	Stretching/compression of Y-axis
	C0472/10	Torque limit value

2.2.4 Welding bar drive (C0005 = 11000)

See chapter 4.2. (📖 4-5)

2.2.5 Operation with position storage (C0005 = 12000)

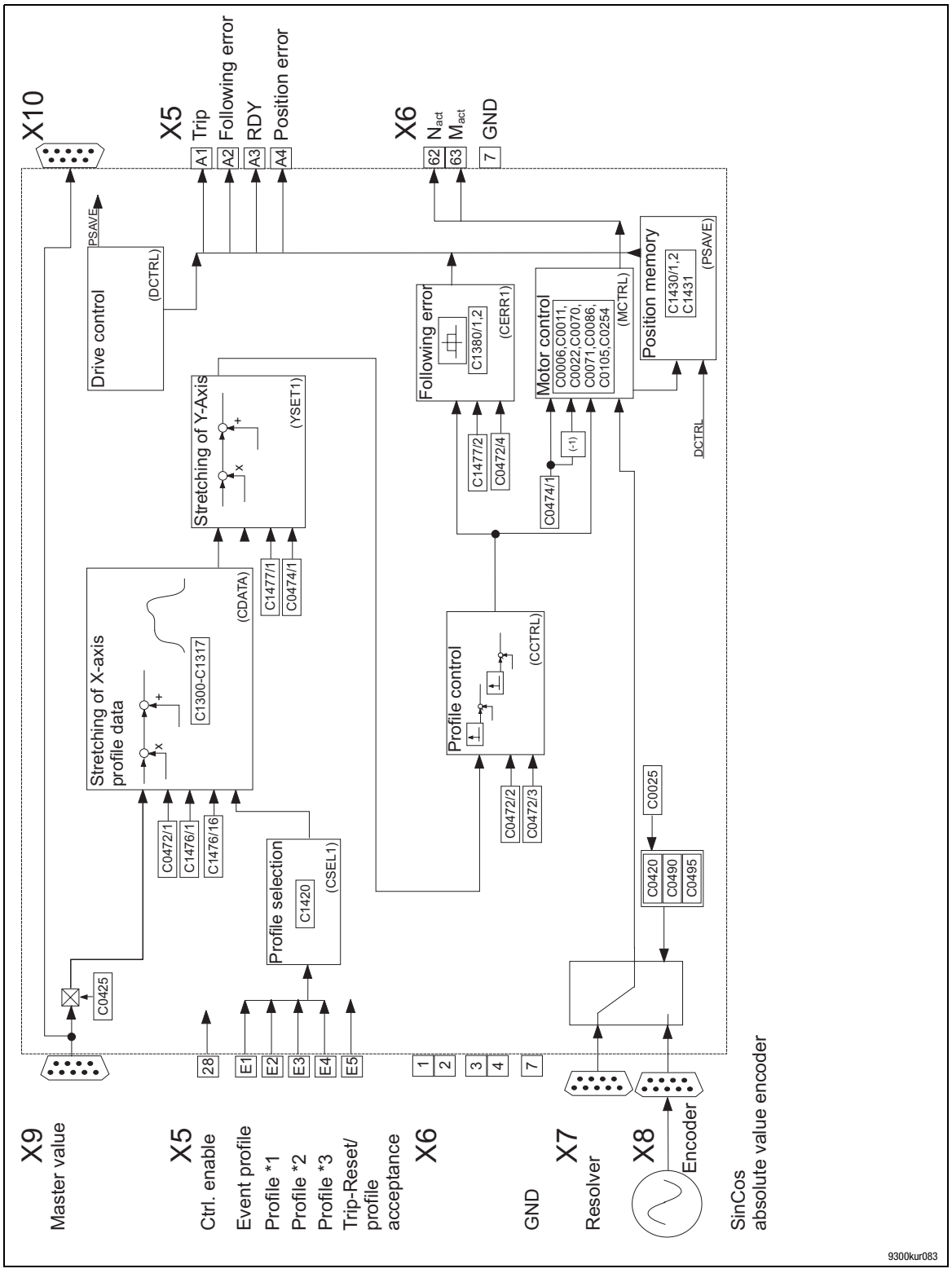
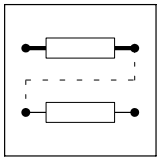
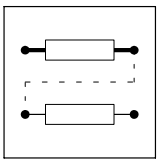


Fig. 2-5 Block diagram of the basic configuration C0005 = 12000 (cam with position storage)

An incremental encoder cannot be used as a feedback system with this configuration.



Code	Description
C0005 = 12000	With this configuration and an absolute feedback system (resolver or Sin/Cos absolute value encoder), the position values of the motor shaft can be stored when switching off the mains. When the mains is switched on again, the actual values are compared to the stored values.
• Master value	
C0425	Encoder constant of the master value
• Cam profile data	
C1300 ... C1317	The cam profile data are determined by the generation of the profile. Usually, they do not have to be changed separately.
C1420	Determines the profile to be used when an event input is activated (X5/E1 = LOW).
• Contouring error evaluation	
C1380/1 and C1380/2	Determine comparison window and hysteresis of the contouring error evaluation.
• Adjustment values	
C0472/2	Influence of speed precontrol
C0472/3	Influence of torque precontrol
C1477/2	Contouring error limit (in s/units)
C0472/4	Reduction factor for contouring error warning; warning limit = C0472/4 × C1477/2
• Profile influence	
C1472/1	Stretching/compression of X-axis (100 % = no stretching/compression)
C1476/1	Angle trimming in X-direction
C1477/1	Angle trimming in Y-direction
• Position memory	
C1430/1, C1430/2	Tolerance window of the comparison functions
C1431	Determination of values to be stored (master and/or actual value)
C1476/16	TOUCH-PROBE position in X-direction
C0472/9	Stretching/compression of Y-axis
C0472/10	Torque limit value



2.3 Operating modes

By selecting the operating mode you can also select the interface you want to use for parameter setting or control of the controller.

C0005 contains predefined configurations which allow a very easy change of the operating mode.

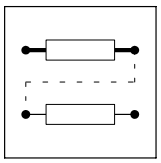
2.3.1 Parameter setting

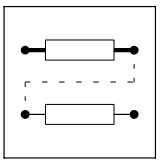
Parameters can be set with one of the following modules:

- Communication module
  - 2102 (LECOM A/B/LI)
  - 2111, 2113 (INTERBUS)
  - 2131, 2133 (PROFIBUS)
  - 2175 (CANopen/DeviceNet)
- PC system bus module (CAN)
  - 2173

2.3.2 Control

The drive controller can be controlled via terminals (X5 and X6), via the fieldbus module at X1 or via the system bus (X4). Mixed forms are also possible.





3 Function library

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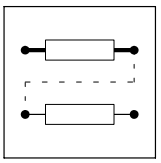

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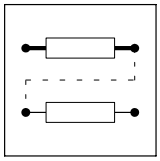
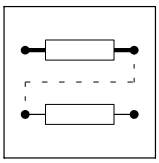


Function library



3.1 Working with function blocks

The signal flow of the controller can be configured by connecting function blocks. The controller can thus be easily adapted to diverse applications.

3.1.1 Signal types

Each function block is provided with a certain number of inputs and outputs which can be interlinked. Corresponding to their functions, there are only certain types of signals at the inputs and outputs:

- Quasi analog signals
  - Symbol: O
  - Unit: %
  - Designation: a
  - Value range: ±16384 = ±100 %
  - Resolution: 16 bits, scaling ±16384 ≙ ±100 %
- Digital signals
  - Symbol: □
  - Unit: binary, with HIGH or LOW level
  - Designation: d
  - Resolution: 1 bit
- Speed signals
  - Symbol: Δ
  - Unit: rpm (for display, internal representation in [inc/ms])
  - Designation: phd
  - Value range: $\pm 2^{15} - 1$
  - Resolution: 16 bits
- Angle signals
  - Symbol: ▲
  - Unit: inc
  - Designation: ph
  - Value range: $\pm 2^{31} - 1$
  - Resolution: 32 bits, scaling 1 revolution ≙ 65536 inc

Only the same signal types can be connected. Thus, an analog output signal of one function block can only be connected to the analog input of the other function block. If you try to connect two different signal types, the connection is rejected.

3.1.2 Elements of a function block

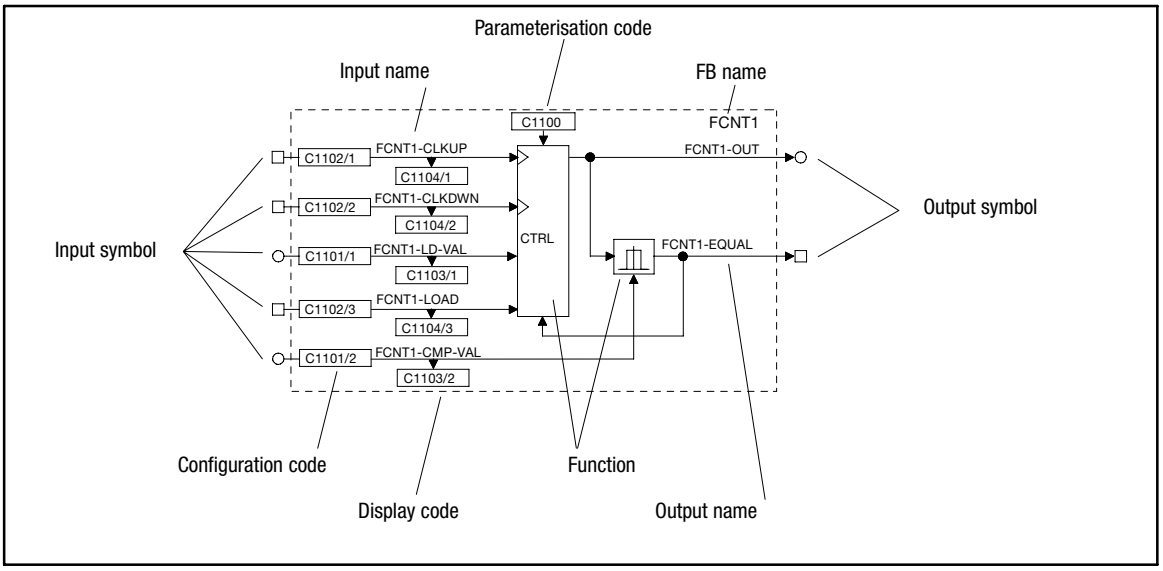


Fig. 3-1 Function block structure - using the example of FCNT1

FB name

Identifies fhe FB unambiguously. FBs with the same function are distinguished by a number behind the name.

Every FB is defined by a selection number. For calculating the FB, the selection number must be input into the processing table. (📖 3-12)

The selection numbers are listed in selection list 5.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1 ≙ selection number 6400 (selection list 5).

Input symbol

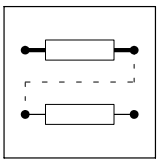
Designates the signal type which is allowed as signal source for this input. (📖 3-5)

Tip!

Only linked inputs can be configured.

Input name

Consists of the FB name and a designation. Inputs with the same function are distinguished by the number that is added to the designation.



Configuration code

Configures the input with a signal source (e. g. terminal signal, control code, output of an FB, ...). Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are configured via the subcode.

It is not possible to connect an input with several signal sources.

Display code

Displays the current input value. Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are displayed via the subcode.

Display codes cannot be processed.

Function

Represents the mathematical function as a block diagram (see Fig. 3-1).

Parameter setting code

Adaptation of the function or behaviour to the drive task. Possible settings are described in the text and/or the line diagram. (📖 3-14)

Output symbol

Designates the signal type. Connections with inputs of the same signal type are possible. (📖 3-5)

Each output is defined by a selection number. The selection numbers are divided into selection lists (1 ... 4) according to the different signal types.

An output is linked to an input by the selection numbers.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1-OUT ≙ selection number 6400 (analog signal, selection list 1).
- FCNT1-EQUAL ≙ selection number 6400 (digital signal, selection list 2).

Tip!

Only linked outputs can be configured.

Output name

Consists of the FB name and a designation. Outputs with the same function are distinguished by the number that is added to the designation.

3.1.3 Connection of function blocks

General rules

- Assign a signal source to an input.
- One input can have only one signal source.
- Inputs of different function blocks can have the same signal source.
- Only the same types of signals can be connected.

Stop!

Existing connections which are not required must be removed by reconfiguration. Otherwise the drive cannot perform the desired function.

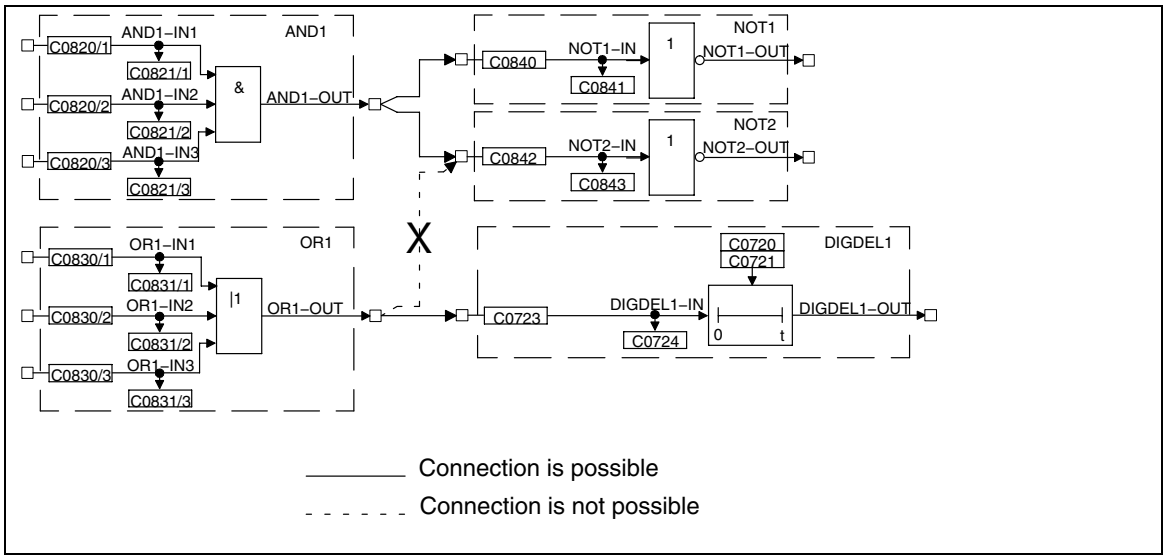


Fig. 3-2 Correct connection of function blocks

Basic procedure

1. Select the configuration code of the function block input which is to be changed.
2. Determine the source of the input signal for the selected input (e.g. from the output of another function block).
3. The function block input is assigned via a menu which contains only those signal sources which are of the same type as the function block input to be assigned.
4. Select and confirm the signal source.
5. Remove undesired connections, if any.
   – For this, select the corresponding signal assignment of the input via the configuration code (e.g. FIXED0, FIXED1, FIXED0%, ...).
6. Repeat 1. to 5. until the desired configuration is set.
7. Save modified configuration in the desired parameter set.

Example

- Condition:
  – Default setting
- Task:
  – Square the analog signal of X6/3, X6/4 and output to X6/62.
- Solution:
  – You need the function blocks AIN2, ARIT2 and AOUT2.

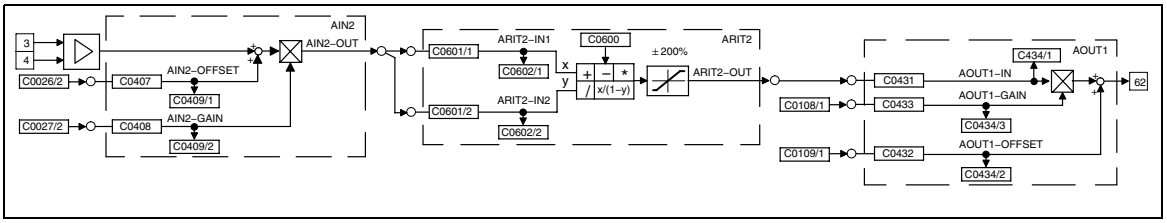


Fig. 3-3 Example of a simple configuration

Establish connections

1. Determine the signal source for ARIT2-IN1:
   – Change to the code level using the arrow keys
   – Select C0601/1 using ▲ or ▼.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
2. Determine signal source for ARIT2-IN2:
   – Select C0601/2 using ▲.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
3. Parameterise ARIT2:
   – Select C0600 using ▼.
   – Change to the parameter level using PRG.
   – Select multiplication (selection number 3).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
4. Determine signal source for AOUT1:
   – Select C0431 using ▼.
   – Change to the parameter level using PRG.
   – Select output ARIT2-OUT (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
5. Enter function block ARIT2 in the processing table:
   – Select C0465 and subcode 8 using ▲.
   – Change to the parameter level using PRG.
   – Enter function block ARIT2 (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
   – The sequence of the FB processing is thus determined.

Remove connections

- Since a source can have several targets, there may be further signal connections, which may not be wanted.
- Example:
  - In the default setting of the basic configuration C0005 = 1000 (speed control), ASW1-IN1 and AIN2-OUT are connected.
  - This connection is not automatically removed by the settings described above! If you do not want this connection, remove it.

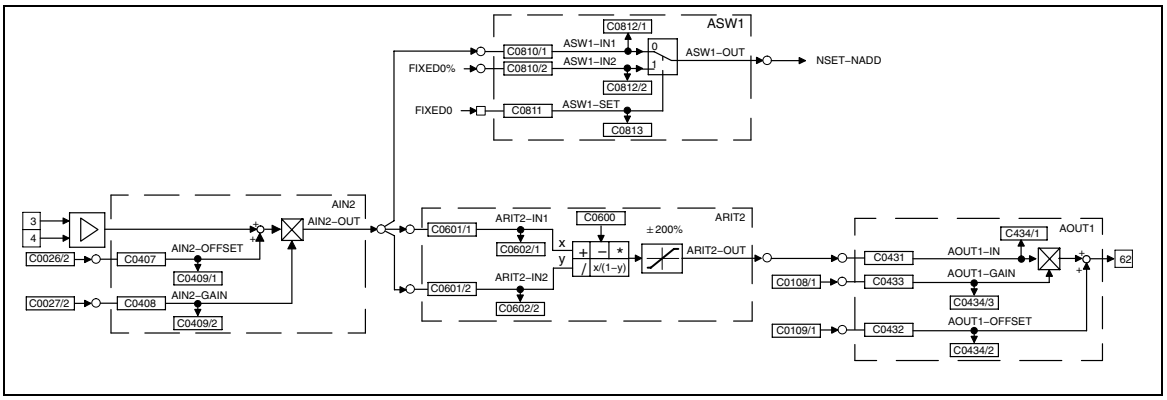


Fig. 3-4 Remove connections in a configuration

6. Remove connection between ASW1-IN1 and AIN2-OUT:
   - Select C0810/1 using ▲ or ▼.
   - Change to the parameter level using PRG.
   - Select the constant FIXED0% (selection number 1000) using ▲ or ▼ .
   - Confirm with SH + PRG
   - Change to the code level again using PRG.

Now the connection is removed.

7. Save new configuration, if desired:
   - If you do not want to lose the modifications after mains disconnection, save the new signal configuration in one of the parameter sets with C0003.

3.1.4 Entries into the processing table

The 93XX controller provides a certain calculating time for processing the FBs. Since the type and number of FBs to be used depends on the application and can vary strongly, not all available FBs are permanently calculated. A processing table is therefore provided under code C0465, where only the FBs used are listed. This means that the drive system is perfectly matched to the task. If further function blocks are integrated into an existing configuration, they must be listed in the processing table.

Several aspects must be observed:

The number of FBs to be processed is limited

A maximum of 50 FBs can be integrated into a configuration. Every FB requires a certain processing time. Code C0466 displays the residual time for the processing of FBs. If this time is used up, no further FBs can be integrated.

Entry sequence into the FBs

Normally, the entry sequence under C0465 is arbitrary, but it may be important for applications with high response. In general, the most favourable sequence is adapted to the signal flow.

Example:

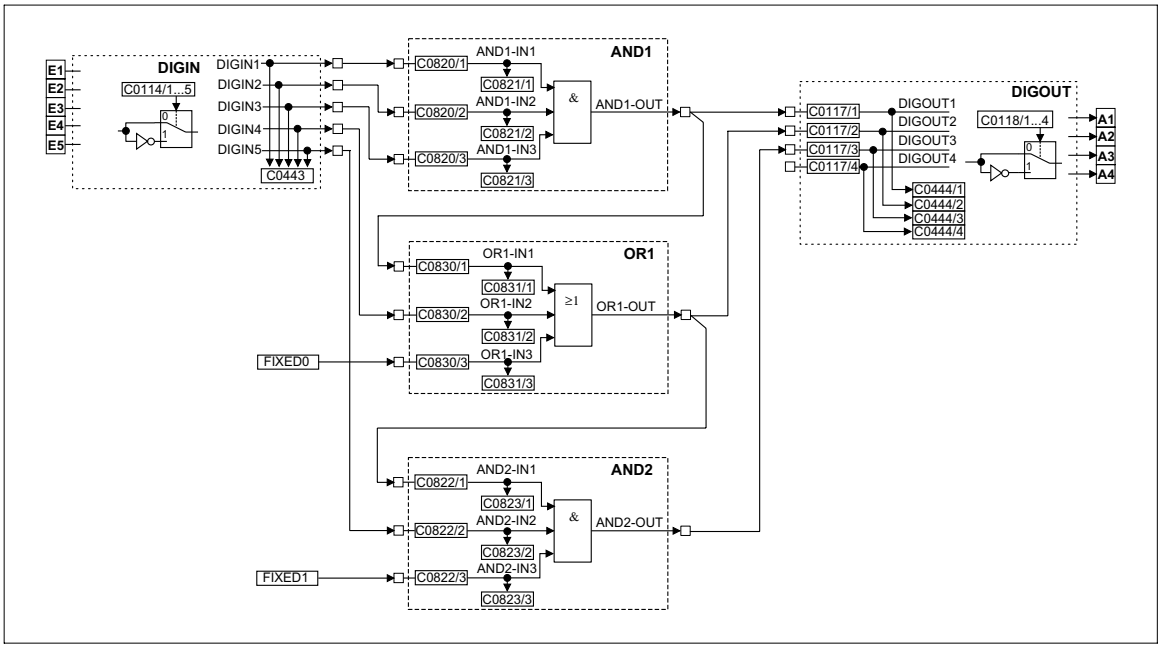
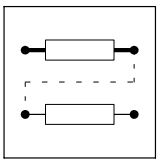


Fig. 3-5 Example of a configuration

Structure of the processing table for the configuration example of Fig. 3-5:

1. DIGIN does not have to be entered into the processing table
2. The first FB is AND1, since it receives its input signals from DIGIN and only has successors.
3. The second FB is OR1, since its signal source is the output of AND1 (predecessor). This means that the output signal in AND1 must be generated first, before it can be processed in OR1. At the same time, OR1 has a successor. This means that OR1 must be entered in the processing table before the successor.
4. The third FB is AND2, since it has a predecessor (see 3.)



5. The entries in C0465 are:
   – Position 10: AND1 10500
   – Position 11: OR1 10550
   – Position 12: AND2 10505

This example was started with position 10, because these positions are not assigned in the default setting.

FBs need not to be entered into the processing table one after the other. Empty positions in the processing table are permissible.

Tip!

It is also possible that other FBs are entered between the FBs listed in the example.

FBs which do not have to be entered into the processing table

The following signal sources are always executed and do not have to be entered into the processing table:

- AIF-IN
- CANx-IN
- DIGIN
- DIGOUT
- FCODE (all free codes)
- MCTRL
- fixed signal sources (FIXED0, FIXED0%, etc.)

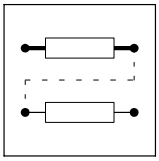
Frequent faults in the configuration

Malfunction	Cause	Remedy
FB does not supply an output signal	FB was not entered into the processing table C0465	Enter FB
FB only supplies constant signals	FB was deleted from or overwritten in the procesing table C0465.	Enter FB again, possibly under a different subcode (position)
The output signal does not arrive at the following FB.	No connection between the FBs	Make connection (from the view of the next FB) via the configuration code (CFG)
FB cannot be entered in the table C0465	Residual process time is too short (see C0466)	Remove FBs not used (e.g. inputs and outputs not used) In networked drives, functions may be relocated to other controllers
The controller outputs internally calculated signals with a delay	FBs are processed in an incorrect sequence	Adapt processing table under C0465 to the signal flow

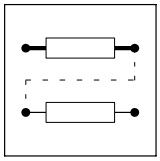
3.2 Function blocks

3.2.1 Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
ABS1	Absolute value generator	🕮 3-37	4		•	•	•
ADD1	Addition block	🕮 3-38	8				
ADDPHD1	Addition block	🕮 3-39	9				
AIF-IN	Fieldbus	🕮 3-40	60				
AIF-OUT	Fieldbus	🕮 3-43	56	•	•	•	•
AIN1	Analog input X6/1, X6/2	🕮 3-45	10				
AIN2	Analog input X6/3, X6/4		28				
AND1	Logic AND, block 1	🕮 3-47	6				
AND2	Logic AND, block 2						
AND3	Logic AND, block 3						
AND4	Logic AND, block 4						
AND5	Logic AND, block 5						
AND6	Logic AND, block 6						
AND7	Logic AND, block 7						
AND8	Logic AND, block 8		8				
AND9	Logic AND, block 9						
ANEG1	Analog inverter 1	🕮 3-52	3	•	•	•	•
ANEG2	Analog inverter 2						
AOUT1	Analog output X6/62	🕮 3-53	12	•	•	•	•
AOUT2	Analog output X6/63			•	•	•	•
ARIT1	Arithmetic block 1	🕮 3-55	11				
ARIT2	Arithmetic block 2						
ARITPH1	32-bit arithmetic block 1	🕮 3-56	15				
ARITPH2	32-bit arithmetic block 2						
ARITPH3	32-bit arithmetic block 3						
ARITPH4	32-bit arithmetic block 4						
ARITPH5	32-bit arithmetic block 5						
ARITPH6	32-bit arithmetic block 6						
ASW1	Analog changeover 1	🕮 3-59	4	•			
ASW2	Analog changeover 2						
ASW3	Analog changeover 3						
ASW4	Analog changeover 4						
BRK	Triggering of holding brake	🕮 3-61	15				
CAN-IN1	System bus	🕮 3-66	-				
CAN-IN2	System bus						
CAN-IN3	System bus						
CAN-OUT1	System bus	🕮 3-66	56	•	•	•	•
CAN-OUT2	System bus			•	•	•	•
CAN-OUT3	System bus			•	•	•	•
CCTRL	Setpoint conditioning	🕮 3-67	30		•	•	•
CCTRL2	Setpoint conditioning	🕮 3-74	45				
CDATA	Profile data conditioning	🕮 3-20	140		•	•	•
CERR	Following error monitoring	🕮 3-82	15		•	•	•
CLUTCH1	Virtual clutch 1	🕮 3-85	47				
CLUTCH2	Virtual clutch 2	🕮 3-89	30				
CLUTCH3	Virtual clutch 3	🕮 3-91	60				
CMP1	Comparator 1	🕮 3-103	15	•			
CMP2	Comparator 2						
CMP3	Comparator 3		15				



Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
CONV1	Conversion of analog signals	📖 3-108	8				
CONV2	Conversion of analog signals						
CONV3	Conversion of speed signals to analog signals						
CONV4	Conversion of speed signals to analog signals						
CONV5	Conversion of analog signals to speed signals						
CONVAD1	Analog/digital converter 1	📖 3-112	4				
CONVAD2	Analog/digital converter 2						
CONVAPH1	Analog/angle converter 1	📖 3-114	31				
CONVPHA1	Angle/analog converter 1	📖 3-115	6				
CONVPHD1	Conversion of stretch factor	📖 3-120	50				
CONVPHPH1	Angle converter 1	📖 3-122	80				
CONVPHPHD1	Conversion of angle change to speed	📖 3-123	27				
CONVPHPHD2	Conversion of angle change to speed	📖 3-124	7				
CONVPP1	32 bit / 16 bit conversion	📖 3-126	55				
CSEL1	Profile selection	📖 3-127	10		•	•	•
CURVE1	Characteristic function	📖 3-129	15				
CURVEC	Characteristic function	📖 3-132	75				
DB1	Dead band	📖 3-136	7				
DCTRL	Device control	📖 3-137	-	•			
DFIN	Digital frequency input	📖 3-141	5	•	•	•	•
DFOUT	Digital frequency output	📖 3-144	35	•		•	•
DFRFG1	Digital frequency ramp function generator	📖 3-148	40				
DFSET	Digital frequency processing	📖 3-154	85				
DIGDEL1	Binary delay element 1	📖 3-158	9				
DIGDEL2	Binary delay element 2						
DIGIN	Input terminals X5/E1…X5/E5	📖 3-161	-	•	•	•	•
DIGOUT	Output terminals X5/A1…X5/A4	📖 3-162	-	•	•	•	•
DT1	Derivative-action element	📖 3-163	12				
EXTPOL1	Extrapolation	📖 3-164	5				
EXTPOL2	Extrapolation	📖 3-167	10				
FCNT1	Free piece counter, block 1	📖 3-170	11				
FDO	Free digital outputs	📖 3-172	-				
FEVAN1	Free analog input variable	📖 3-174	4				
FEVAN2	Free analog input variable						
FIXSET1	Fixed setpoints	📖 3-179	9				
FLIP1	D-flipflop 1	📖 3-181	6				
FLIP2	D-flipflop 2						
FLIP3	D-flipflop 3						
FLIP4	D-flipflop 4						
GEARCOMP	Gearbox torsion	📖 3-186	1				
LIM1	Limiter	📖 3-187	5				
LIMPHD1	Speed limitation	📖 3-188	12				
MCTRL	Servo control	📖 3-190	-	•	•	•	•
MFAIL	Mains failure control	📖 3-199	40				
MLP	Motor phase failure	📖 3-210	30				
MONIT	Monitoring	📖 3-211	-	•	•	•	•
MPOT1	Motor potentiometer	📖 3-212	20				
MSEL1	Master selection	📖 3-215	12				
MSEL2	Master selection	📖 3-215	15				
NOT1	Logic NOT, block1	📖 3-218	4				•
NOT2	Logic NOT, block2						
NOT3	Logic NOT, block3						
NOT4	Logic NOT, block4						
NOT5	Logic NOT, block5						

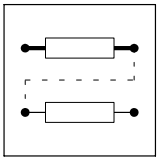


Function library

Function blocks

Table of function blocks

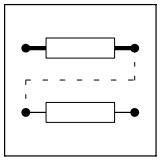
Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
NSET	Speed setpoint conditioning	📖 3-220	70	•			
OR1	Logic OR, block 1	📖 3-226	6				•
OR2	Logic OR, block 2						
OR3	Logic OR, block 3						
OR4	Logic OR, block 4						
OR5	Logic OR, block 5						
OR6	Logic OR, block 6		8				
OR7	Logic OR, block 7						
OSC	Oscilloscope function	📖 3-230	70				
PCTRL1	Process controller	📖 3-234	58				
PHADD1	32-bit addition block	📖 3-237	10				
PHCMP1	Comparator	📖 3-238	8				
PHCMP2	Comparator						
PHCMP3	Comparator						
PHDIFF1	32 bit setpoint/act. value comparison	📖 3-240	10				
PHDIV1	Conversion	📖 3-241	8				
PHINT1	Angle integrator	📖 3-242	7				
PHINT2	Angle integrator						
PHINT3	Angle integrator		10				
PHINT4	Angle integrator		11				
PHINT5	Master angle integrator	📖 3-249	60				
PSAVE1	Position memory	📖 3-255	10				•
PT1-1	1st order delay element	📖 3-257	8				
PT1-2	1st order delay element	📖 3-258	16				
CW/CCW/Q	QSP / setpoint inversion	📖 3-260	8	•			
REFC	Homing function	📖 3-261	100				
RFG1	Ramp function generator	📖 3-268	16				
RFGPH1	Ramp function generator for angle signals	📖 3-270	40				
RFGPH2	Profile generator (ramp function generator for angle signals)	📖 3-275	32				
RFGPH3	Profile generator (ramp function generator for angle signals)		16				
S&H1	Sample and Hold	📖 3-281	4				
SELPH1	Angle selection, block 1	📖 3-282	6				
SELPH2	Angle selection, block 2						
SPC1	Switch points	📖 3-284	80				
SPC2	Switch points		130				
SRFG1	S-shape ramp function generator	📖 3-290	15				
STAT	Output of digital status signals	📖 3-292	-				
STATE-BUS	Control of a drive network	📖 3-293	-				
STORE1	Storage block 1	📖 3-294	35				
STORE2	Storage block 2	📖 3-297	20				
STORE3	Shift register	📖 3-298	10				
SYNC1	Multi-axis positioning	📖 3-305	55				
SYNC2	Multi-axis positioning		20				
SWPH1	Angle changeover	📖 3-303	4				
SWPH2	Angle changeover						
SWPHD1	Digital frequency changeover switch	📖 3-304	4				
SWPHD2	Digital frequency changeover switch						
TRANS1	Binary edge evaluation	📖 3-314	7				
TRANS2	Binary edge evaluation						
TRANS3	Binary edge evaluation						
TRANS4	Binary edge evaluation						
VMAS1	Virtual master	📖 3-317	20				



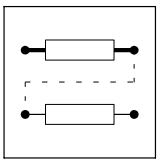
Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
VTPCSC	Cam positioning control	📖 3-321	45				
WELD1	Welding bar control	📖 3-323	20			•	
YSET1	Stretching, compression, offset in Y direction	📖 3-330	30		•		•

3.2.2 Table of free control codes

Code	Description	CPU time [µs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 17	Q_{min}	-	•			
FCODE26/1	AIN Offset		•	•	•	•
FCODE26/2	AIN offset		•	•	•	•
FCODE27/1	AIN gain		•	•	•	•
FCODE27/2	AIN gain		•	•	•	•
FCODE32	Gearbox factor (numerator)					
FCODE 37	Setpoint selection (rpm)					
FCODE 108/1	AOUT gain		•	•	•	•
FCODE 108/2	AOUT gain		•	•	•	•
FCODE 109/1	AOUT offset		•	•	•	•
FCODE 109/2	AOUT offset		•	•	•	•
FCODE 141	Main setpoint					
FCODE250	1 bit digital					
FCODE 470/1	Bits 0 ... 7 %					
FCODE 470/2	Bits 8 ... 15 %					
FCODE 470/3	Bits 16 ... 23 %					
FCODE 470/4	Bits 24 ... 31 %					
FCODE 471	32 bits digital					
FCODE 472/1	Analog - %			•	•	•
FCODE 472/2				•	•	•
FCODE 472/3			•	•	•	•
FCODE 472/4				•	•	•
FCODE 472/5						
FCODE 472/6						
FCODE 472/7						
FCODE 472/8						
FCODE 472/9						
FCODE 472/10				•	•	•
FCODE 472/11						
FCODE 472/12						
FCODE 472/13						
FCODE 472/14						
FCODE 472/15						
FCODE 472/16						
FCODE 472/17						
FCODE 472/18						
FCODE 472/19						
FCODE 472/20						
FCODE 473/1	Analog - absolute					
FCODE 473/2						
FCODE 473/3						
FCODE 473/4						
FCODE 473/5						
FCODE 473/6						
FCODE 473/7						



Code	Description	CPU time [µs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 473/8						
FCODE 473/9						
FCODE 473/10						
FCODE 474/1	Angle				•	
FCODE 474/2						
FCODE 474/3						
FCODE 474/4						
FCODE 474/5						
FCODE 472/6						
FCODE 474/7						
FCODE 474/8						
FCODE 474/9						
FCODE 474/10						
FCODE 475/1	Speed/digital frequency					
FCODE 475/2						
FCODE 475/3						
FCODE 475/4						
FCODE 475/5						
FCODE 1476/1	Master value [m_units]			•	•	•
FCODE 1476/2						
FCODE 1476/3						
FCODE 1476/4						
FCODE 1476/5						
FCODE 1476/6						
FCODE 1476/7						
FCODE 1476/8						
FCODE 1476/9						
FCODE 1476/10						
FCODE 1476/11						
FCODE 1476/12						
FCODE 1476/13						
FCODE 1476/14						
FCODE 1476/15						
FCODE 1476/16				•	•	•
FCODE 1477/1	Actual value [s_units]			•		•
FCODE 1477/2				•	•	•
FCODE 1477/3						
FCODE 1477/4						
FCODE 1477/5						
FCODE 1477/6						
FCODE 1477/7						
FCODE 1477/8						
FCODE 1477/9						
FCODE 1477/10						
FCODE 1477/11						
FCODE 1477/12						
FCODE 1477/13						
FCODE 1477/14						
FCODE 1477/15						
FCODE 1477/16						
FCODE 1478/1	[z_units]					
FCODE 1478/2						
FCODE 1478/3						
FCODE 1478/4						



Code	Description	CPU time [µs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 1478/5						
FCODE 1478/6						

3.2.3 Function block CDATA

Purpose

CDATA is a profile generator especially made for cam profile applications. Up to 8 different profiles can be managed.

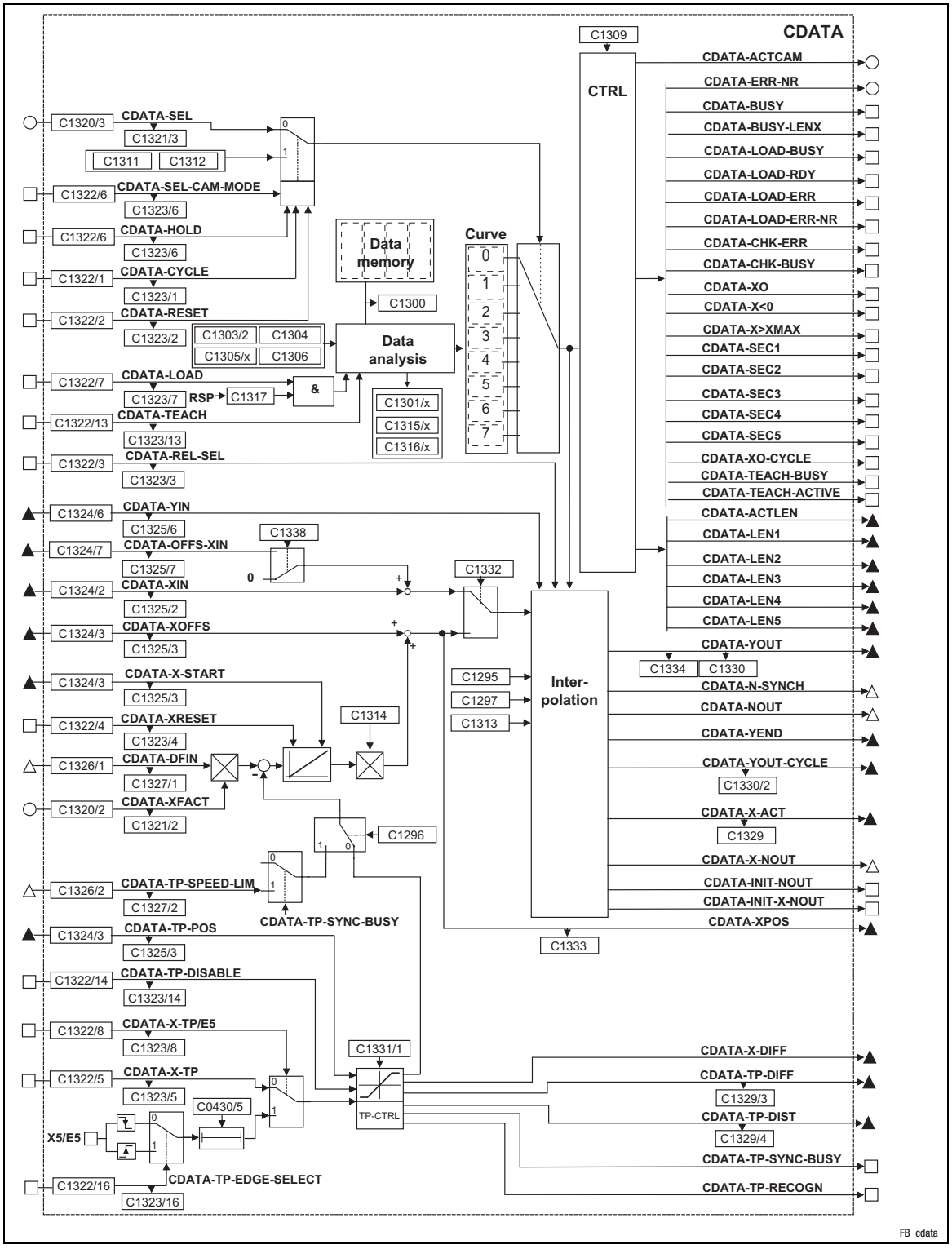
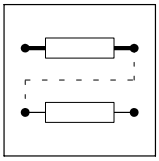
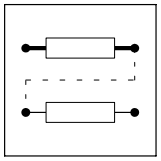


Fig. 3-6 Function block CDATA



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CDATA-SEL	a	C1321/3	dec [abs]	C1320/3	1	Profile selection, 0 = profile 0 (1st profile)
CDATA-SEL-CAM-MODE	d	C1323/15	bin	C132215	2	HIGH: profile changeover while travelling the profile. Hence, clutch functions can be implemented via profiles.
CDATA-HOLD	d	C1323/6	bin	C1322/6	2	HIGH: prevents profile switching, input has priority over CDATA-RESET
CDATA-CYCLE	d	C1323/1	bin	C1322/1	2	Automatic profile switching LOW: profile selection from input CDATA-SEL is active HIGH: the profiles from C1311 and C1312 are cyclically processed
CDATA-RESET	d	C1323/2	bin	C1322/2	2	If CDATA-RESET = HIGH and CDATA-CYCLE = LOW, the input CDATA-SEL is evaluated immediately If CDATA-RESET = HIGH and CDATA-CYCLE = HIGH, the profile from C1311 is processed
CDATA-LOAD	d	C1323/7	bin	C1322/7	2	Loaded profiles accepted with LOW-HIGH edge
CDATA-TEACH	d	C1323/13	bin	C1322/13	2	Teach function, contact Lenze
CDATA-REL-SEL	d	C1323/3	bin	C1322/3	2	HIGH: feed function active (relative positioning)
CDATA-YIN	ph	C1325/6	dec [inc]	C1324/6	3	Input for the teach function, contact Lenze
CDATA-OFFS-XIN	ph	C1325/7	dec [inc]	C1324/7	3	Offset on input CDATA-XIN if C1338 = 1 has been selected
CDATA-XIN	ph	C1325/2	dec [inc]	C1324/2	3	Input for master value position if C1332 = 1
CDATA-XOFFS	ph	C1325/3	dec [inc]	C1324/3	3	Input for offset in X direction (only if C1332 = 0)
CDATA-X-START	ph	C1325/1	dec [inc]	C1324/1	3	Input for the profile starting position on the X axis
CDATA-X-RESET	d	C1323/4	bin	C1322/4	2	HIGH: sets the master value integrator to the value at input CDATA-X-START
CDATA-DFIN	phd	C1327/1	dec [rpm]	C1326/1	4	Input for digital frequency if C1332 = 0
CDATA-XFACT	a	C1321/2	dec [%]	C1320/2	1	Stretching/compression factor +100 % = no compression/stretching, >100 % = compression, <100 % = stretching
CDATA-TP-SPEED-LIM	phd	C1327/2	dec [rpm]	C1326/2	4	Selection of a compensation speed. Input is activated via C1296. It is impermissible to select constant values, e.g. via free codes (FCODE).
CDATA-TP-POS	ph	C1325/4	dec [inc]	C1324/4	3	Touch probe position of the master value (only if C1332 = 0)
CDATA-TP-DISABLE	d	C1323/14		C1322/14		HIGH: suppression of touch probe
CDATA-X-TP/E5	d	C1323/8	-	-	-	Selection of the touch probe source (only for synchronisation) LOW: source CDATA-X-TP HIGH: terminal X5/E5
CDATA-X-TP	d	C1323/5	bin	C1322/5	2	LOW-HIGH edge sets master value integrator to position of input CDATA-TP-POS
CDATA-TP-EDGE-SELECT	d	C1323/16	bin	C1322/16	2	LOW: HIGH-LOW edge of the input signal at X5/E4 is evaluated. HIGH: LOW-HIGH edge of the input signal at X5/E5 is evaluated.
CDATA-ACTCAM	a					Output of the active profile
CDATA-ERR-NR	a					Display of the error number from the teach function
CDATA-BUSY	d					LOW-HIGH edge: the interpolation point distribution is not optimal, select fewer points
CDATA-BUSY-LENx	d					HIGH: CDATA-LENx and CDATA-Y-END are not valid and are being determined at present (e.g. profile switching)
CDATA-LOAD-BUSY	d					HIGH: new profile data is being accepted at present, the controller is inhibited (only if input CDATA-LOAD = HIGH)
CDATA-LOAD-RDY	d					Handshake signal for reloading profiles
CDATA-LOAD-ERR	d					HIGH: error in the current profile at check via C0500
CDATA-LOAD-ERR-NR	d					HIGH: error in the current profile at check via C0500
CDATA-CHK-ERR	d					HIGH: the checksum transferred to C0509 does not correspond to the profile data
CDATA-CHK-BUSY	d					HIGH: profile checksum checking is active and not yet completed
CDATA-X0	d					LOW-HIGH edge: zero crossing of the master value integrator
CDATA-X<0	d					HIGH: number range exceeded in X direction
CDATA-X>XMAX	d					HIGH: number range exceeded in X direction
CDATA-SEC1[1)]	d					HIGH: section 1 active
CDATA-SEC2[1)]	d					HIGH: section 2 active
CDATA-SEC3[1)]	d					HIGH: section 3 active
CDATA-SEC4[1)]	d					HIGH: section 4 active
CDATA-SEC5[1)]	d					HIGH: section 5 active
CDATA-X0-CYCLE	d					LOW-HIGH edge: zero crossing of the master value integrator when a profile cycle from C1311 and C1312 is processed.
CDATA-TEACH-BUSY	d					Teach function, contact Lenze
CDATA-TEACH-ACTIVE	d					Teach function, contact Lenze



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CDATA-ACTLEN	ph					Output of the actual master value clock pulse length (65536 inc. = 1 encoder rev.)
CDATA-LEN1[1)]	ph					Output of the actual X length of section 1 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN2[1)]	ph					Output of the actual X length of section 2 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN3[1)]	ph					Output of the actual X length of section 3 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN4[1)]	ph					Output of the actual X length of section 4 of the selected cam profile (65536 inc = 1 encoder rev.)
CDATA-LEN5[1)]	ph					Output of the actual X length of section 5 of the selected cam profile (65536 inc = 1 encoder rev.)
CDATA-YOUT	ph	C1334 C1330/1				Drive setpoint position (65536 inc. = 1 motor revolution)
CDATA-N-SYNCH	phd					Link for synchronised compression/stretching
CDATA-NOUT	phd					Drive setpoint speed For the "stretching and compression" function you have to preselect the limitation of the output signal in C1295. • Stretching and compression ≤ 100 % – Set C1295 = 0: the output signal is limited to ±29999 rpm (Lenze setting). • Stretching and compression > 100 % – Set C1295 = 1: the output signal is limited to ±14999 rpm.
CDATA-Y-END	ph					Y end value of the actual profile (65536 inc. = 1 motor revolution)
CDATA-YOUT-CYCLE	ph	C1330/2				Current value of the drive setpoint position within the limits of the profile (65536 inc. = 1 motor revolution)
CDATA-X-ACT	ph	C1329/1				Current position of the master shaft / master angle
CDATA-X-NOUT	phd					X-axis as speed, without jump back if C1332 = 0 (master value of CDATA-DFIN) is selected
CDATA-INIT-NOUT	d					**This output refers to the motor. Do not enable the drive after mains connection before CDATA-INIT-NOUT = LOW!** HIGH: the drive speed does not reach the setpoint defined by the position output. During this deviation which may last over several cycles, a great position change is output at the speed output. Increments do not get lost!
CDATA-INIT-X-NOUT	d					**This output refers to the master axis. Do not enable the drive after mains connection before CDATA-INIT-X-NOUT = LOW!** (for further description see CDATA-INIT-NOUT)
CDATA-XPOS	ph	C1333				Output of the master value integrator (65536 inc. = 1 encoder rev.)
CDATA-X-DIFF	ph					Outputs the difference between the integrator and the signal at CDATA-TP-POS if a touch probe pulse occurs.
CDATA-TP-DIFF	ph	C1329/3				Touch-Probe mode of cross cutter, current angular difference between TP position and actual X axis position
CDATA-TP-DIST	ph	C1329/4				Touch-Probe mode of cross cutter, distance between the last two TP positions
CDATA-TP-SYNC-BUSY	d					Compensation between TP position and current X axis position active (with adjusted compensation speed)
CDATA-TP-RECOGN[1)]	d					Output is HIGH for 1 ms if a HIGH-LOW edge occurs at X5/E5 and CDATA-X-TP/E5 = HIGH

1) The outputs will not be output when using the absolute data model

Range of functions

- Select X position for the cam drive (📖 3-23)
- Select X position directly (📖 3-23)
- Create X position from a digital frequency (📖 3-26)
- Change of direction (📖 3-28)
- Profile changeover in the middle of the motion profile (📖 3-29)
- Activation of profiles stored in the controller (📖 3-29)
- Selection of one profile (📖 3-30)
- Selection of several profiles (📖 3-30)
- Inhibition of the profile selection (📖 3-31)
- Online reloading of profiles (📖 3-32)
- Stretching, compression, offset of the X axis (📖 3-33)
- Synchronised stretching/compression in Y direction (📖 3-34)
- Feed drive with profiles (📖 3-35)
- Output of important status signals (📖 3-36)

3.2.3.1 Select X position for the cam drive

- Select X position directly through
  - the absolute shaft encoder (single-turn / multi-turn, programmable)
  - upstream master drive
  - calculation
- Create X position from a digital frequency (📖 3-26)
  - Synchronise X position and machine

3.2.3.2 Select X position directly

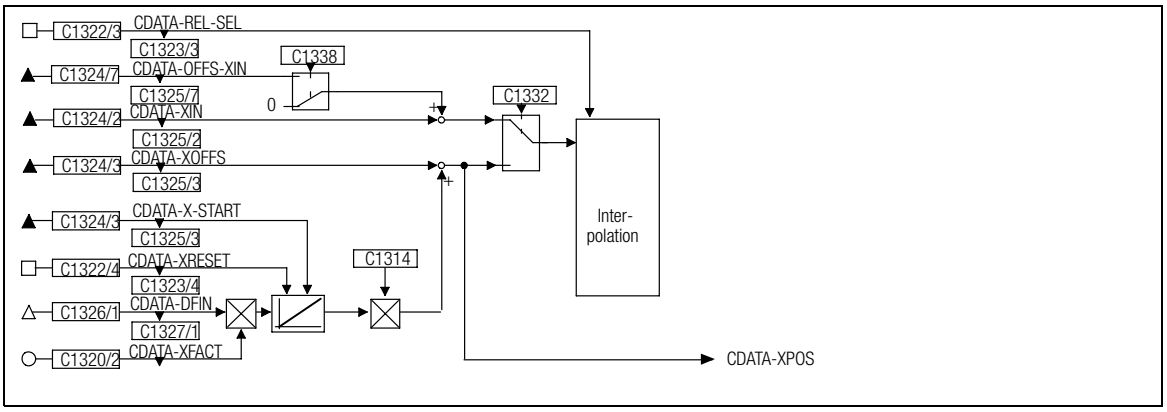


Fig. 3-7 Relevant section of function block CDATA

The absolute X position can be selected via the input CDATA-XIN - e.g. via a bus system:

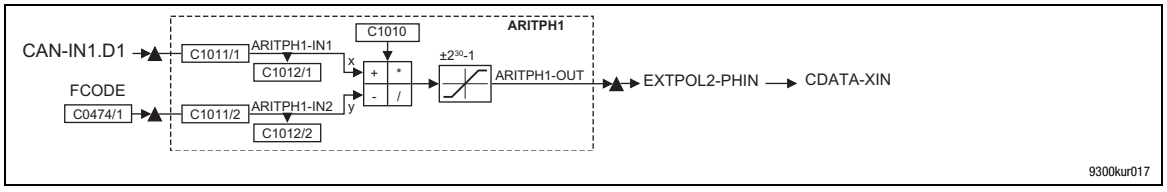
Selection of master value	Note
C1332 = 0	Master value source: CDATA-DFIN • Selection of a digital frequency
C1332 = 1	Master value source: CDATA-XIN • Selection of the absolute X position
C1332 = 2	Master value source: CDATA-XPOS • The output CDATA-XPOS is internally switched to the input CDATA-XIN. Therefore, the offset at CDATA-OFFS-XIN is effective.

CDATA-XIN input mode	Note
C1338 = 0	Without input CDATA-OFFS-XIN • The inputs CDATA-OFFS-XIN and CDATA-XFACT are not effective • If CDATA-XIN > CDATA-ACTLEN, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.
C1338 = 1	With input CDATA-OFFS-XIN • For absolute value encoder as master position encoder • If CDATA-XIN + CDATA-OFFS-XIN > CDATA-ACTLEN × 2, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.
C1338 = 2	With input CDATA-OFFS-XIN for CDATA-X-RESET • For absolute value encoder as master position encoder • If CDATA-XRESET = HIGH, CDATA-XIN is internally set to 0. CDATA-OFFS-XIN remains effective. • If CDATA-XIN + CDATA-OFFS-XIN > CDATA-ACTLEN × 2, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.

Create X axis through master angle encoder

If an external master angle encoder (programmable multi-turn or single-turn absolute value encoder) is used, the encoder must be adapted to the profile data:

- If possible, use an encoder with system bus (CAN) interface
- Use the following connection to adapt the encoder:



– ARITPH1: C1010=13, set multiplication

– FCODE C0474/1: 65536/enter encoder constant. (The encoder constant is indicated in “increments/revolution”, see data sheet, e.g. with encoder constant = 8192 increments/revolution the following results: C0474/1 = 8)

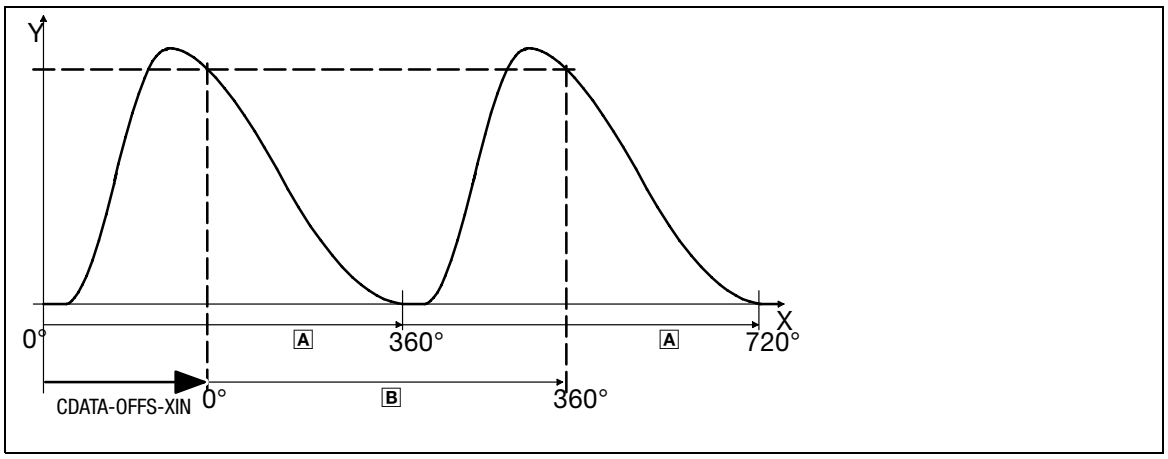
– EXTPOL2: Should be used to improve the smooth running of the motor.

Extract from the table of attributes:

Code	Index dec	Index hex	DS	DA	DT	Format	DL	LCM-R/W	Operation
C1338	23237	5AC5	E	1	FIX32	VD	4	Ra/Wa	

Synchronisation of absolute value encoder and profile

In the ideal case, the profile pulse and encoder pulse are identical. But more commonly the case shown in the graphics occurs:



A Profile pulse
B Encoder pulse

In order to adapt the curve profile to the machine, the starting point of the profile can be shifted towards the zero point of the encoder with the entry of code C1476/x. The profile can be shifted by max. one profile pulse (+) compared to the encoder.

- Apply offset to the input CDATA-OFFS-XIN. The inputs CDATA-XOFFS and CDATA-XFACT have no effect!

The pulse lengths of profile and encoder will not be changed!

Note!

The encoder pulse of single-turn absolute value encoders is 360°. This corresponds to the number of increments of the encoder constant, e.g. 8192 increments/revolution. Then, the pulse recurs. The process can also be represented as follows:

- 360° = 1 revolution
- 720° = 2 revolutions etc.

3.2.3.3 Create X position from a digital frequency

The digital frequency incoming at CDATA-DFIN is integrated to an X position. In this operating mode it can be necessary to synchronise the controller to the master value (see “synchronisation of X position and machine“).

- The integrator can be set to and held at CDATA-XSTART with CDATA-XRESET = HIGH.
- At the same time the output CDATA-XPOS is also set to CDATA-XSTART. Thus, the values pending at the input CDATA-XOFFS are ineffective (see Fig. 3-6). Proceeding with CDATA-XRESET = LOW

Synchronisation of X position and machine

Due to slipping material or non-integer pulse lengths, the angle difference between master and cam drive may be constant or even increase. A sensor (e. g. touch probe initiator) can be used to **continuously** synchronise the cam drive to the position of the machine master angle.

Note!

- If the material is slipping, the sensor used for synchronisation should be in direct contact with the material.
- The sensor should be set to a position where accelerations do not occur at synchronous running to avoid as many accelerations (positive or negative) as possible during the compensation phase.This, for instance, always happens during a rest phase.

Synchronisation of the master axis through touch probe

The master axes synchronisation via touch probe is, for instance, used for mark-controlled cross cutters. The master value is generated by an incremental encoder or via the digital frequency output of an upstream controller.

- A synchronisation of the drive and machine measuring system may be required for the following reasons:
  - After mains connection, the measuring system of the controller and that of the machine can diverge very much. The distance to be compensated in such cases often is very long.
  - During operation, slipping may arise in the system (e.g. in conveying belts). During resynchronisation, the distance to make up is relatively short.

A deviation to the setpoint detected via the touch probe signal (mark synchronisation) is output at CDATA-X-DIFF. This deviation can be compensated by means of a compensation speed:

- Activating the function of the compensation speed (CDATA-TP-SPEED-MODE):
  - C1335 = 0: without compensation limitation (Lenze setting).
  - C1335 = 1: with compensation limitation (we recommend this setting).
  - C1335 = 2: cross cutter (contact Lenze if you want to use this function).
- Selecting the source of the compensation speed (C1296 is only effective if C1335 = 1):
  - C1296 = 0 (Lenze setting): The compensation speed is defined via C1331.
  - C1296 = 1: the compensation process is controlled by selecting a profile at CDATA-TP-SPEED-LIM.

Note!

- The CDATA function block does not include a profile generator. The profiles must be generated via additional function blocks (e.g. RFGPH2 or RFGPH2)
  Also see example (📖 3-253)
- Do not select constant values at CDATA-TP-SPEED-LIM
  (e.g. via free codes FCODE).

Correction of the X position via the sensor

If the sensor switches,

- the value read in at CDATA-TP-POS is compared to the master angle and the compensation process selected is carried out and
- at the same time the corresponding Y position is output at CDATA-YOUT and CDATA-DFOUT (caution: the drive follows its position setpoint with the max. possible torque).

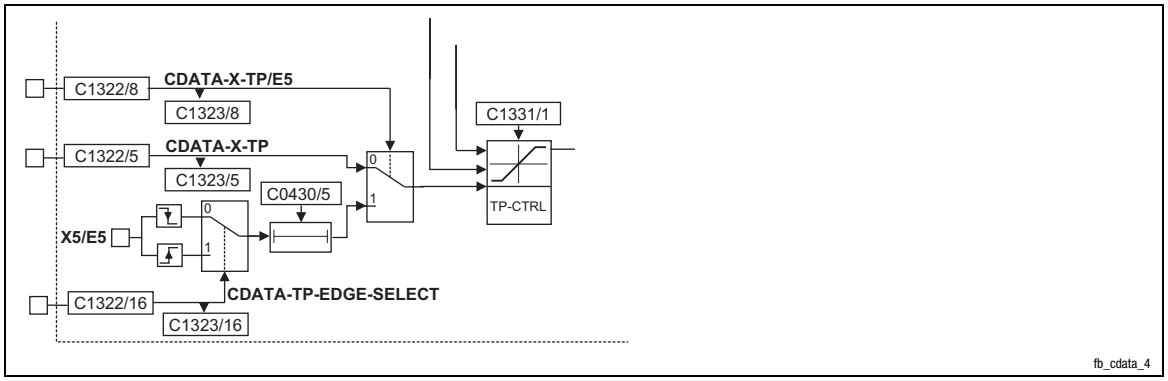


Fig. 3-8 Section of function block CDATA

1. Set CDATA-X-TP/E5 = HIGH to activate the function.
2. Connect the sensor X5/E5.
3. Define the edge of the sensor signal which is to be evaluated:
   – CDATA-TP-EDGE-SELECT = LOW: HIGH-LOW edge of the sensor signal is evaluated.
   – CDATA-TP-EDGE-SELECT = HIGH: LOW-HIGH edge of the sensor signal is evaluated.
4. Enter the position of the sensor at input CDATA-TP-POS (in the Lenze setting, the input is connected to C1476/16).

Note!

- For a synchronisation via touch probe, C1335 has to be set to 1.
- The input values at CDATA-TP-POS must correspond to the clock pulse (CDATA-ACTLEN):
  – For a clock pulse of e.g. 360°, only values in the range of -359° ... +719° may be selected at CDATA-TP-POS.
- Check the linking of terminal X5/E4 in the DIGIN function block. Where required, adapt the linking to your application.
- When responding, sensors may have delay times which cause a speed-dependent angular offset. This can be especially annoying at high speeds. The correction value for the angular offset can be entered in x.xxx[ms] via C0430/5.

One-time setting of X position

If slipping and non-integer pulse lengths can be ruled out, the X position must only be set **once**. Procedure:

- Set the master drive (machine) to the position applied to the input CDATA-TP-POS.
  – CDATA-X-TP/E5 = LOW
- X position is accepted with a LOW-HIGH edge at CDATA-X-TP.

3.2.3.4 Change of direction

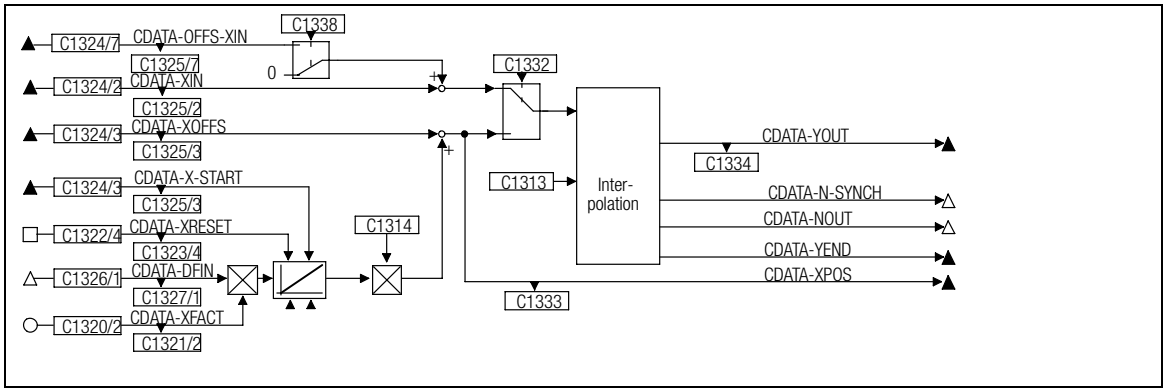
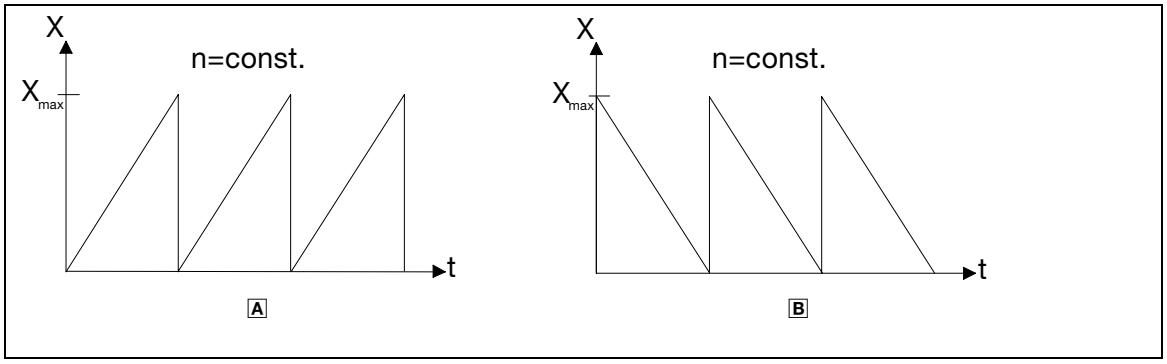


Fig. 3-9 Section of function block CDATA

The “direction” indicates the increase of the integrator (output CDATA-XPOS):

– With positive input values at CDATA-DFIN, the integrator runs from 0 to its clock pulse length (X cycle).
– With negative input values at CDATA-DFIN, the integrator runs from the clock pulse length (X cycle) to 0.



A Absolute value encoder, CW rotation or internal master angle integrator
B Absolute value encoder, CCW rotation or internal master angle integrator

Change of direction of rotation for connection at input CDATA-DFIN

(see also chapter 3.2.3.3)

This function is only available for the internal X integrator (C1332 = 0).

The direction can be reversed via code C1314 (see Fig. 3-9).

Stop!

The input CDATA-XOFFS is not affected by a reversal of the direction under C1314!

Change of direction of rotation for connection at input CDATA-XIN

(see also chapter 3.2.3.2)

Note!

The direction of rotation of an absolute shaft encoder connected to input CDATA-XIN (single-turn or programmable multi-turn) can only be reversed by changing the attachment.

3.2.3.5 Profile changeover in the middle of the motion profile

By means of 5th order polynomials you can implement a jerk-free, path-controlled clutch function. For this, motion profiles have to be changed over in the middle of a profile.

Requirements for trouble-free clutch function:

- The function can only be implemented with the absolute data model.
- The profiles between which the changeover is effected must be structured in the same manner:
  - Same clock pulse lengths in X direction
  - Same number of interpolation points
  - Same distribution of the interpolation points
  - Same lift at the changeover point

Activation of the clutch function:

- Set CDATA-SEL-CAM-MODE = HIGH.

3.2.3.6 Activation of profiles stored in the controller

The 9300 cam profiler provides the possibility to use one or several stored profiles for processing a product.

Depending on the profile(s) selected, the stored data is assigned to the actual master value position and output.

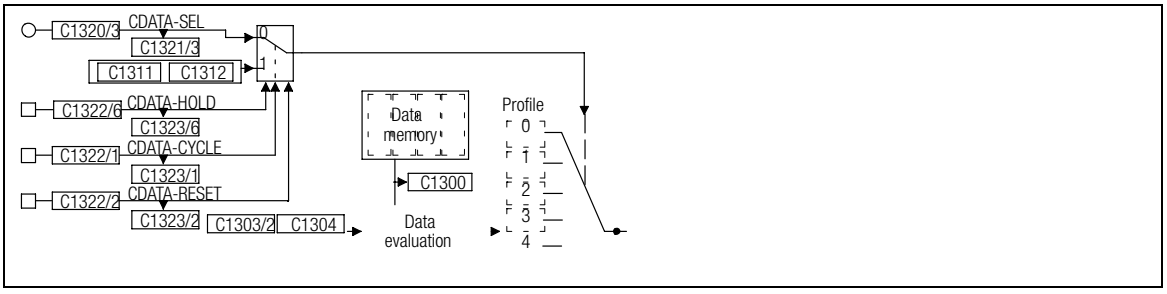


Fig. 3-10 Selection of one or several profiles

3.2.3.7 Selection of one profile

1. CDATA-CYCLE = LOW: deactivation of the automatic profile switching.
2. CDATA-SEL: Select the desired profile number (see Fig. 3-10).

3.2.3.8 Selection of several profiles

Permissible value range of CDATA-SEL:

- 0 to the number of profiles selected in the GDC dialog 'Basic cam data' or 'Cam editor'.

Note!

- Values at CDATA-SEL < 0 are interpreted as 0
- Values at CDATA-SEL ≥ maximum number of profiles are limited to the values displayed in C1300/0 minus 1. Example:
  – You have reserved four profiles. Thus, the profiles 0 ... 3 can be selected. If you enter, for example, the value 5 at the input CDATA-SEL, profile 3 is selected.

The value at CDATA-SEL is accepted

- during operation at zero crossing of the X position.
  – It is thus for instance possible to change to a new profile program via PLC without the usually necessary times required to change the system.
- immediately if CDATA-RESET = HIGH.

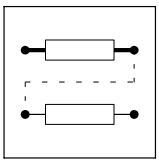
Profile processing when the order remains the same

1. CDATA-CYCLE = HIGH: activation of the automatic profile switching
2. Code C1311: Determine initial profile
3. Code C1312: Determine cycle range
   – The cycle range is limited by the profile number entered in GDC.

Stop!

- After, for instance, a fault, CDATA-RESET = HIGH activates the profile selected under C1311 at CDATA-SEL **immediately** without waiting for zero crossing!
- In some cases torque peaks may occur and damage the machine.

Example	Profiles 2, 3 and 4 are to be processed cyclically: C1311 = 2 (first profile) C1312 = 2 (range: 2 further profiles)
Result	With CW rotation, the profiles are processed in ascending order (2 → 3 → 4 → 2). When the last profile is reached, the process starts again with the first profile.
	With CCW rotation, the profiles are selected in descending order. When the first profile is reached, the process starts again with the profile: • First profile + range. In our example: 2 → 4 → 3 → 2 → 4 etc. – Profiles 0 and 1 cannot be reached with this setting!



Profile processing with any order

1. CDATA-CYCLE = LOW: deactivation of the automatic profile switching.
2. CDATA-SEL: Profile selection via this analog input

Note!

For this purpose, an external control must be programmed in such a way that the profile number required is available at the input CDATA-SEL at a certain time.

Stop!

After, for instance, a fault, CDATA-RESET = HIGH activates the profile selected at CDATA-SEL **immediately** without waiting for zero crossing!

In some cases torque peaks may occur and damage the machine.

3.2.3.9 Inhibition of the profile selection

- CDATA-HOLD = HIGH

The profile selection and the automatic profile switching can be inhibited by setting the input CDATA-HOLD = HIGH (see Fig. 3-10). The profile being activated at that time is then processed endlessly.

The input has priority over CDATA-RESET, CDATA-CYCLE and CDATA-SEL.

Is used, for instance, for rotary tables with target position selection. For this purpose, other function blocks must be interconnected accordingly.

3.2.3.10 Online reloading of profiles

This function serves to accept and activate reloaded profiles during operation. This function is available from software version 3.4.

Stop!

- In the initial range, the motion profiles must be almost identical, otherwise a compensating movement with the max. possible torque is carried out.
- The function can only be used for master angle/digital frequency with **CW rotation**.

- Condition:
  - Set code C1307 = 1 (permit online reloading of profiles)
  - Set code C1317 = 1 (reload profiles without controller inhibit)
  - Set input CDATA-CYCLE = LOW
- Initialisation
  - Each LOW-HIGH edge at CDATA-RESET initialises a profile.

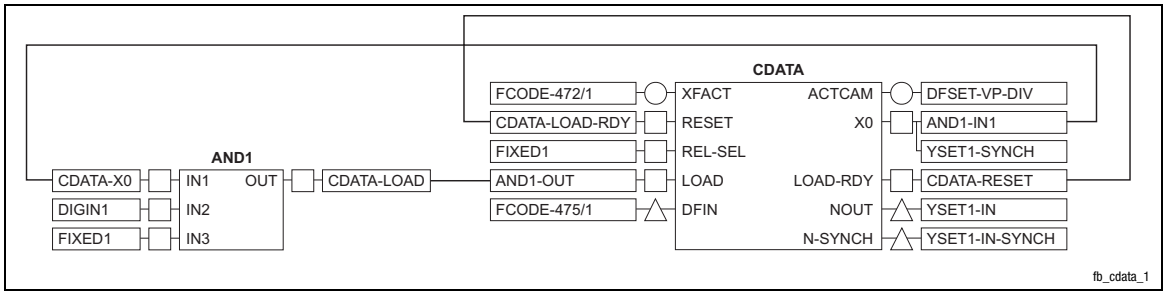


Fig. 3-11 Interconnection of the function block CDATA for initialising profiles online

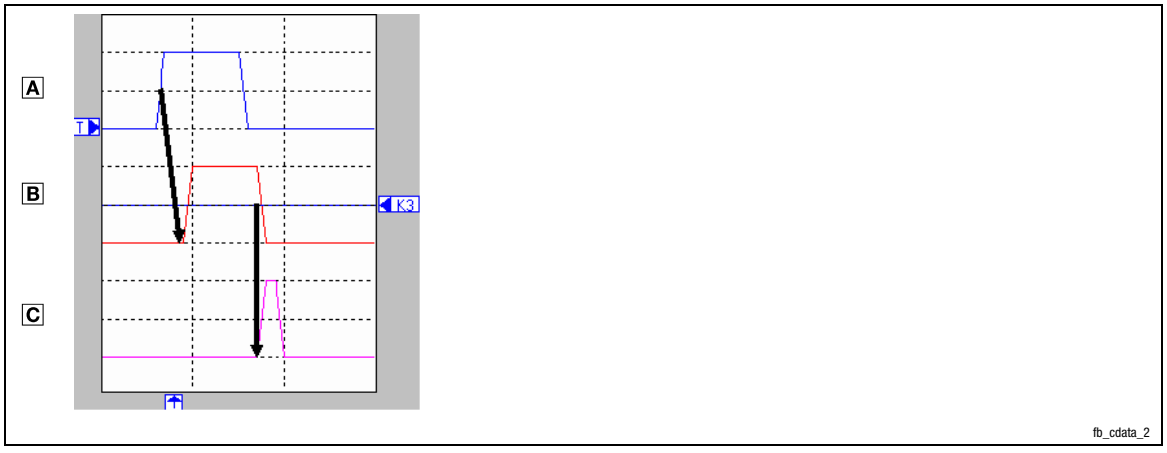
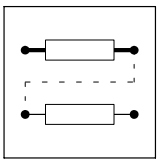


Fig. 3-12 Initialisation cycle, displayed with Global Drive Oscilloscope

A CDATA-X0, profile zero crossing
This causes the reloaded profile to be accepted. Reloading in the backup memory must be completed by then.

B CDATA-LOAD-BUSY
The acceptance of the reloaded profile in the foreground data field was activated via CDATA-LOAD (duration: approx. 50 ms)

C CDATA-LOAD-RDY
Displays that the acceptance was completed successfully. Now, CDATA-RESET = HIGH must be activated.



3.2.3.11 Stretching, compression, offset of the Y axis

Note!

This operating mode only works with digital frequency preselection (chapter 3.2.3.3), i.e. CDATA-DFIN must be selected with C1332 = 0.

Stretching / compression

The code C1319 serves to set the mode for stretching or compression. Two modes are used for differentiation:

C1319	Mode	Result if input CDATA-XFACT =			
		100 %	-100 %	>100%	<100%
0	$\frac{DFIN \cdot XFACT}{100\%}$	No stretching, no compression	No stretching, no compression, reversal of direction (profile is processed in backward direction)	Compression	Stretching
1	$\frac{DFIN \cdot 100\%}{XFACT}$		See TIP below	Stretching	Compression

Note!

- Values < 1% are internally limited to +1% at input XFACT via C1319=1 (compression).
- If you do not want a stretching or compression, connect CDATA-XFACT to FIXED100% (Lenze setting).

Offset

Use input CDATA-XOFFS to shift the X position by a constant value.

Stop!

The drive follows this position change with the max. possible torque! This is why
- CDATA-XOFFS should be changed while the drive is in a latch phase or
- a ramp function generator (e.g. RFGPHx) should be used.

3.2.3.12 Synchronised stretching/compression in Y direction

Stop!

- If input CDATA-X-RESET = 1, the stretching/compression factor must not be changed. Otherwise the drive may lose the synchronicity.
- If the FB YSET1 is not used, then set C1313 = 0 (asynchronous stretching/compression).
- Set C1295 = 1 for stretching/compression factors > 100 %.

This function is useful if more than 8 profiles are required for a lift changing process (Y axis) of the cam drive. The lift can be changed online via stretching and compression. The function is only valid for the cam drive, not for the master value.

Synchronised stretching/compression is required when the master value and the cam drive must run absolutely synchronously and the factor must be changed during operation.

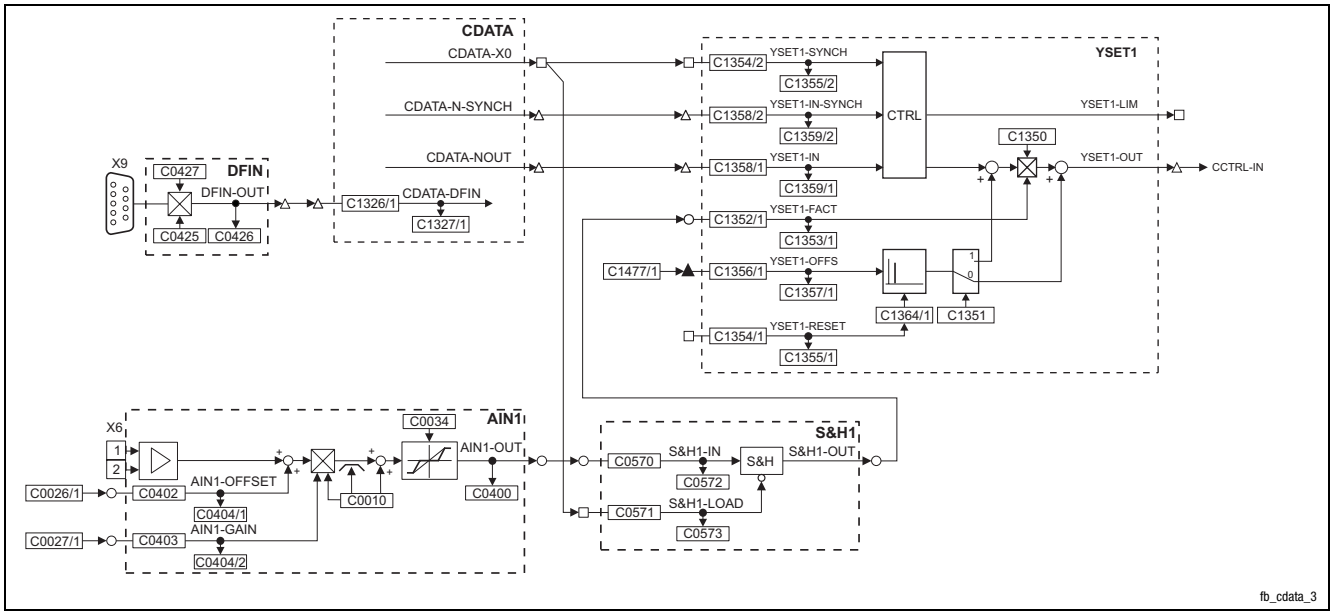


Fig. 3-13 Connection of the function blocks for the stretching/compression function in Y direction

The figure shows the minimum wiring. All function blocks used to generate the stretching/compression factor must be entered into the processing table between the function blocks CDATA and YSET1.

- The function is only active if C1313 = 1.
- The change-over between the stretching and compression factor is carried out during zero crossing of the profile.

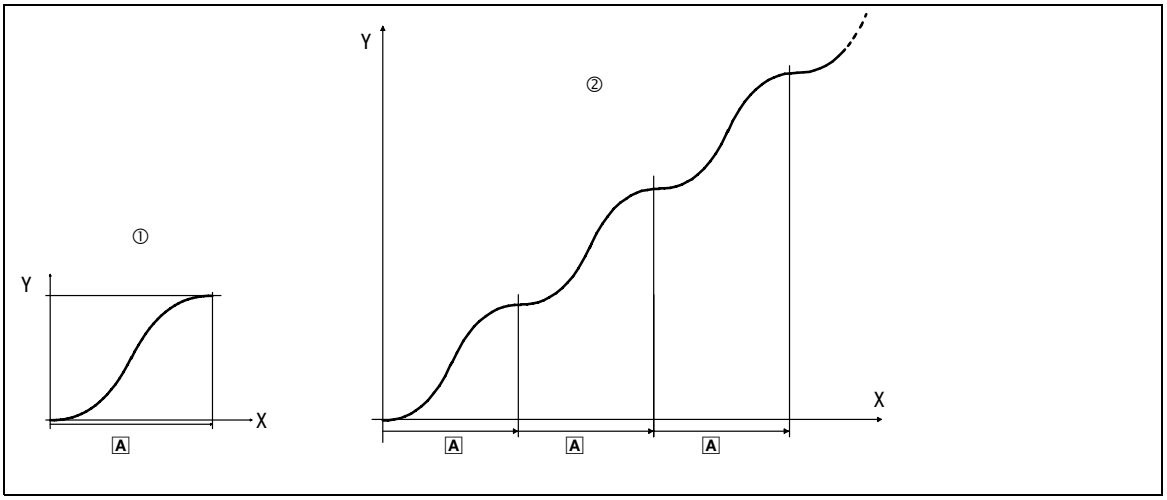
3.2.3.13 Feed drive with profiles

The main characteristic of such a profile is that initial and end value are not identical.

Application examples:

- Rotary table, conveying belt (movement in one direction), material guide

This function is selected with CDATA-REL-SEL = HIGH



① Individual profile
② Endless profile
A Profile length

Stop!

The input CDATA-REL-SEL must not be set to LOW with endless feeds.
In some cases torque peaks may occur and damage the machine.

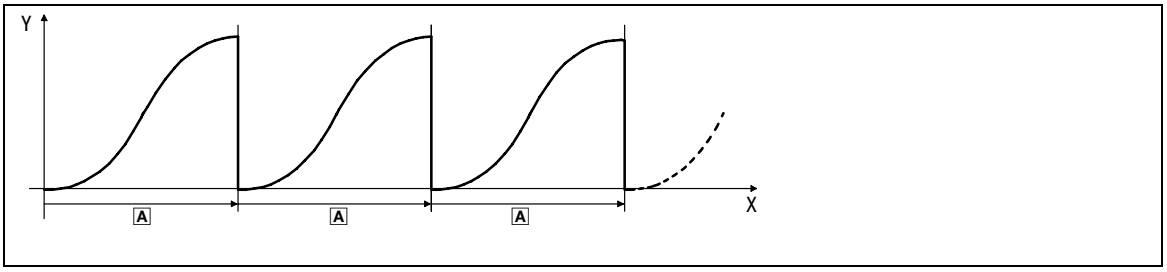


Fig. 3-14 CDATA_REL-SEL = LOW of an endless feed

A Profile length

Reset CDATA-NOUT

After a feeding process, the traverse path is backed with CDATA-REL-SEL = LOW (signal at CDATA-NOUT). In the case of long traverse paths, this procedure takes an accordingly long time.

You can set the signal at CDATA-NOUT to 0 directly:

1. Set C1297 = 1.
2. Set CDATA-REL-SEL = LOW and CDATA-X-RESET = HIGH.
   – The drive is disconnected from the CDATA function block, and the speed signal at CDATA-NOUT is reset to 0.

3.2.3.14 Output of important status signals

Display of the current profile section (only with relative data model)

The current profile section is indicated by the assigned digital outputs CDATA-SEC1 to CDATA-SEC5.

Section length / cycle length (only with relative data model)

The lengths of the individual sections are output at CDATA-LEN1 to CDATA-LEN5 in X direction. Added together they result in CDATA-ACTLEN.

The actual length of a master value cycle is output at CDATA-ACTLEN (image of code C1315/X).

Updating CDATA-LENx / CDATA-Y-END

CDATA-BUSY-LENx = HIGH indicates that the outputs CDATA-LENx and CDATA-Y-END are updated one after the other. They are not valid for the update period.

Profile processed currently

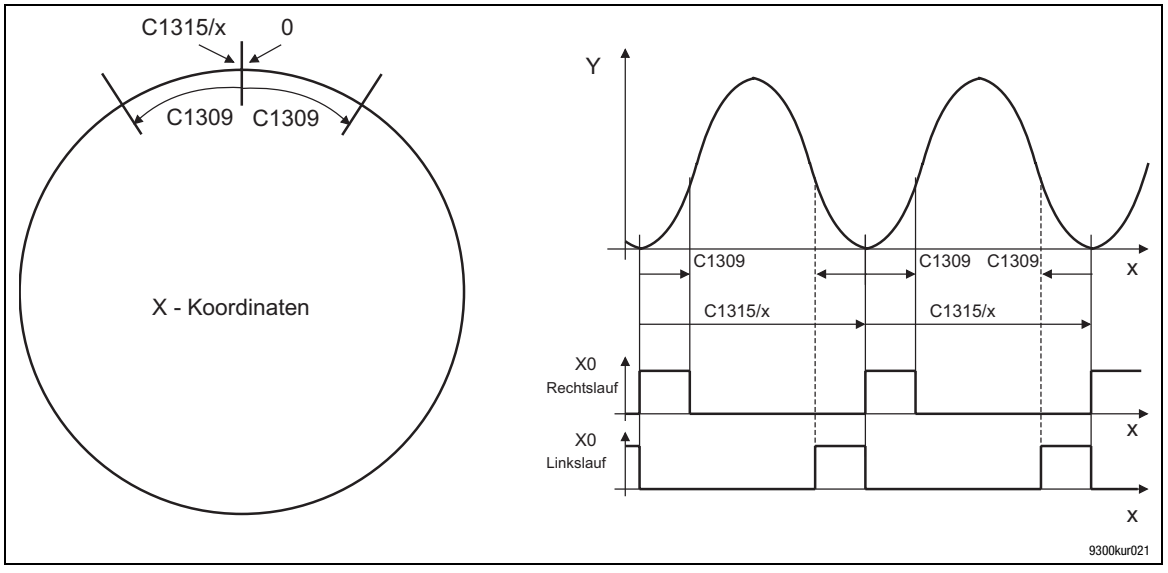
CDATA-ACTCAM indicates which profile is being processed.

Indication of profile zero crossing

CDATA-X0 signals a zero crossing of the master value. The window width for comparison is defined in C1309, the window is arranged symmetrically around the actual zero point of the master value.

Stop!

Observe when setting the X axis position to X0 = 0 within one cycle.
- if X position < 1/2 cycle, CDATA-X0 is not set.
- if X position >= 1/2 cycle, CDATA-X0 is set as for zero crossing.



3.2.4 Absolute value generator (ABS)

Purpose

This FB is used to convert bipolar signals into unipolar signals.

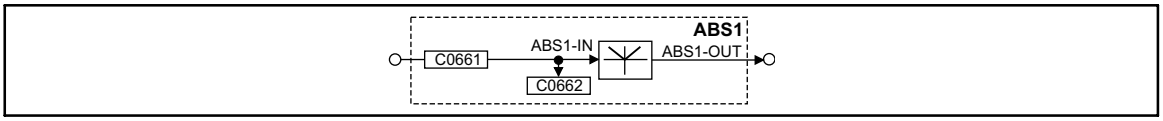


Fig. 3-15 Absolute value generator (ABS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ABS1-IN1	a	C0662	dec [%]	C0661	1	1000	-
ABS1-OUT	a	-	-	-	-	-	-

Function

The absolute value of the input signal is generated.

3.2.5 Addition block (ADD)

Purpose

Adds or subtracts ”analog” signal depending on the input used.

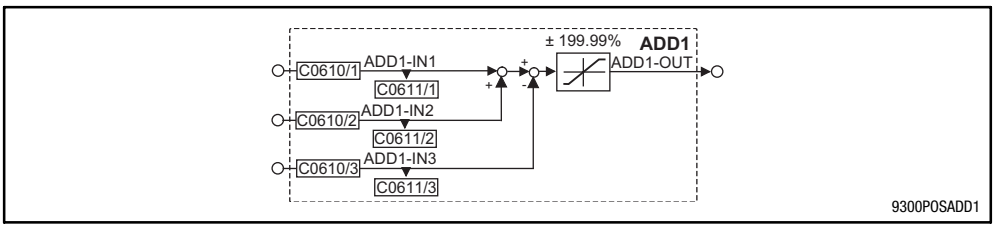


Fig. 3-16 Addition block (ADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADD1-IN1	a	C0611/1	dec [%]	C0610/1	1	1000	Addition input
ADD1-IN2	a	C0611/2	dec [%]	C0610/2	1	1000	Addition input
ADD1-IN3	a	C0611/3	dec [%]	C0610/3	1	1000	Subtraction input
ADD1-OUT	a	-	-	-	-	-	Limited to ±199.99%

Function

- Input ADD1-IN1 is added to input ADD1-IN2.
- The input ADD-IN3 is subtracted from the calculated result.
- Then, the result of the subtraction is limited to ±199.99 %.

3.2.6 Addition block (ADDPHD1)

Purpose

Superimposition of several curve profiles.

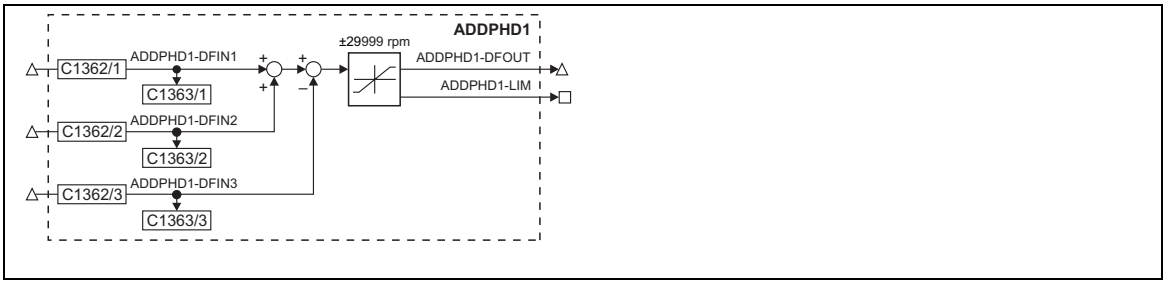


Fig. 3-17 Addition block (ADDPHD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADDPHD1-DFIN1	phd	C1363/1	[rpm]	C1362/1	1	1000	Addition input
ADDPHD1-DFIN2	phd	C1363/2	[rpm]	C1362/2	1	1000	Addition input
ADDPHD1-DFIN3	phd	C1363/3	[rpm]	C1362/3	1	1000	Subtraction input
ADDPHD1-DFOUT	phd	-	-	-	-	-	Signal is limited to ±29999 rpm No position loss when signal is limited
ADDPHD1-LIM	phd	-	-	-	-	-	HIGH = signal at ADDPHD1-DFOUT is limited (Function is available from software version 3.4 onwards)

Function

- The signals of the cam profiles at the inputs ADDPHD1-DFIN1 and ADDPHD1-DFIN2 are added.
- The cam profile at the input ADDPHD1-DFIN3 is subtracted from the sum of ADDPHD1-DFIN1 and ADDPHD1-DFIN2.
- The result is output as speed in [rpm] at ADDPHD1-OUT.

Note!

- The integrated overflow buffer prevents the increments from getting lost when the signal at ADDPHD1-OUT exceeds the limit of ±29999 rpm.
- The overflow buffer behaves according to the cycle of numbers (32 bits).

3.2.7 Automation interface (AIF-IN)

Purpose

Interface for input signals of the plug-on fieldbus module (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog, or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

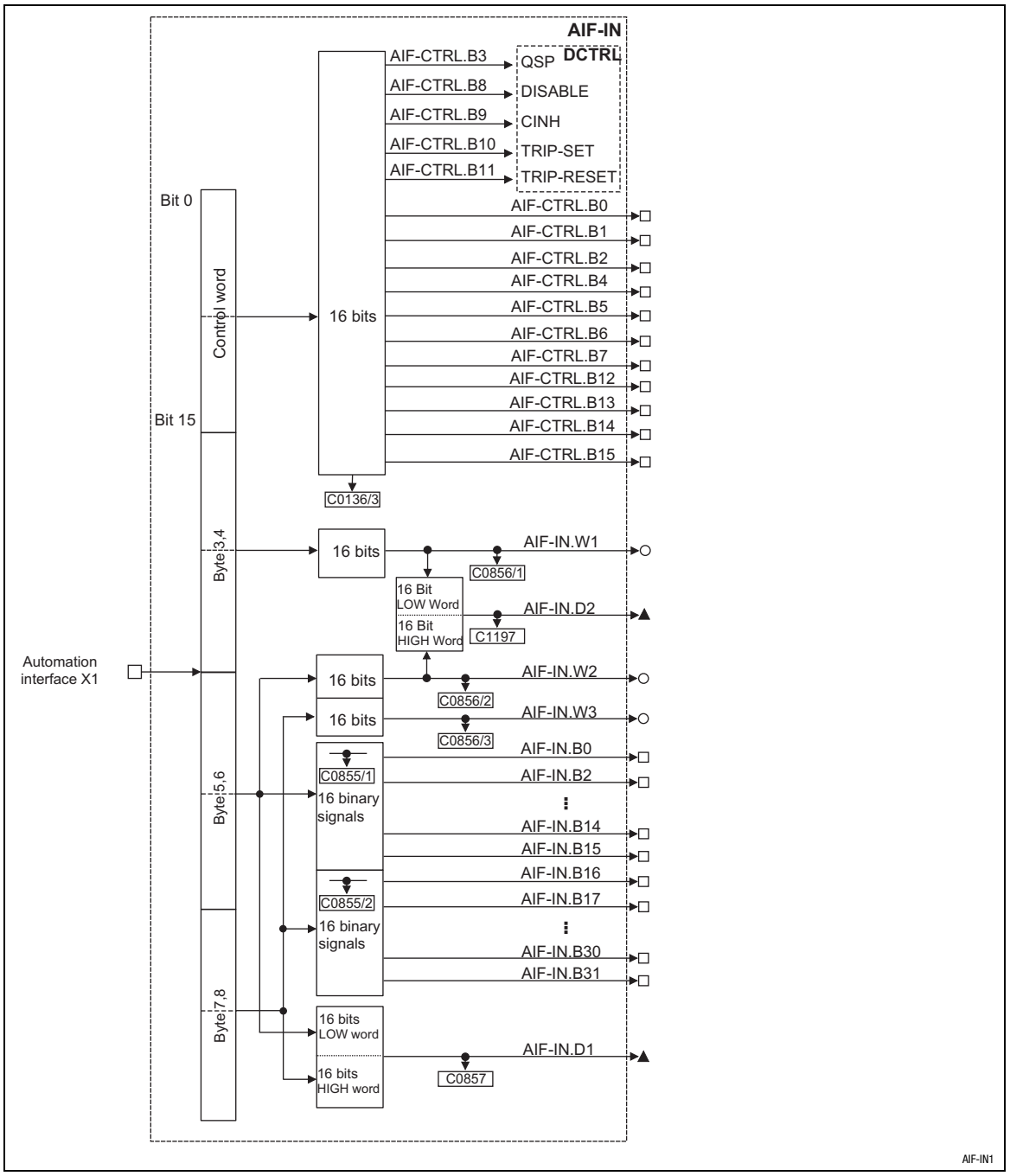
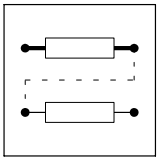


Fig. 3-18 Automation interface (AIF-IN)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-CTRL.B0	d	C0136/3	bin	-	-	-	
AIF-CTRL.B1	d	C0136/3	bin	-	-	-	
AIF-CTRL.B2	d	C0136/3	bin	-	-	-	
AIF-CTRL.B4	d	C0136/3	bin	-	-	-	
AIF-CTRL.B5	d	C0136/3	bin	-	-	-	
AIF-CTRL.B6	d	C0136/3	bin	-	-	-	
AIF-CTRL.B7	d	C0136/3	bin	-	-	-	
AIF-CTRL.B12	d	C0136/3	bin	-	-	-	
AIF-CTRL.B13	d	C0136/3	bin	-	-	-	
AIF-CTRL.B14	d	C0136/3	bin	-	-	-	
AIF-CTRL.B15	d	C0136/3	bin	-	-	-	
AIF-IN.W1	a	C0856/1	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W2	a	C0856/2	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W3	a	C0856/3	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.D1	ph	C0857	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.D2	ph	C1197	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.B0	d	C0855/1	hex	-	-	-	
AIF-IN.B1	d	C0855/1	hex	-	-	-	
AIF-IN.B2	d	C0855/1	hex	-	-	-	
AIF-IN.B3	d	C0855/1	hex	-	-	-	
AIF-IN.B4	d	C0855/1	hex	-	-	-	
AIF-IN.B5	d	C0855/1	hex	-	-	-	
AIF-IN.B6	d	C0855/1	hex	-	-	-	
AIF-IN.B7	d	C0855/1	hex	-	-	-	
AIF-IN.B8	d	C0855/1	hex	-	-	-	
AIF-IN.B9	d	C0855/1	hex	-	-	-	
AIF-IN.B10	d	C0855/1	hex	-	-	-	
AIF-IN.B11	d	C0855/1	hex	-	-	-	
AIF-IN.B12	d	C0855/1	hex	-	-	-	
AIF-IN.B13	d	C0855/1	hex	-	-	-	
AIF-IN.B14	d	C0855/1	hex	-	-	-	
AIF-IN.B15	d	C0855/1	hex	-	-	-	
AIF-IN.B16	d	C0855/2	hex	-	-	-	
AIF-IN.B17	d	C0855/2	hex	-	-	-	
AIF-IN.B18	d	C0855/2	hex	-	-	-	
AIF-IN.B19	d	C0855/2	hex	-	-	-	
AIF-IN.B20	d	C0855/2	hex	-	-	-	
AIF-IN.B21	d	C0855/2	hex	-	-	-	
AIF-IN.B22	d	C0855/2	hex	-	-	-	
AIF-IN.B23	d	C0855/2	hex	-	-	-	
AIF-IN.B24	d	C0855/2	hex	-	-	-	
AIF-IN.B25	d	C0855/2	hex	-	-	-	
AIF-IN.B26	d	C0855/2	hex	-	-	-	
AIF-IN.B27	d	C0855/2	hex	-	-	-	
AIF-IN.B28	d	C0855/2	hex	-	-	-	
AIF-IN.B29	d	C0855/2	hex	-	-	-	
AIF-IN.B30	d	C0855/2	hex	-	-	-	
AIF-IN.B31	d	C0855/2	hex	-	-	-	

Function

The input signals of the 8-byte user data of the AIF object are converted into corresponding signal types. The signals can be used via further function blocks.

Byte 1 and 2

Byte 1 and 2 form the control word for the controller. The bits 3, 8, 9, 10, and 11 of these bytes are directly transferred into the function block DCTRL where they are linked with further signals. The other 11 bits can be used to control further function blocks.

Byte 3 and 4

form the signal to AIF-IN.W1.

Byte 5, 6, 7, and 8

This user data can be interpreted as different signal types. According to the requirement this data can be evaluated as up to two analog signals, 32 digital signals or one angle signal. Mixed forms are also possible.

3.2.8 Automation interface (AIF-OUT)

Purpose

Interface for output signals of the plug-on fieldbus modules (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

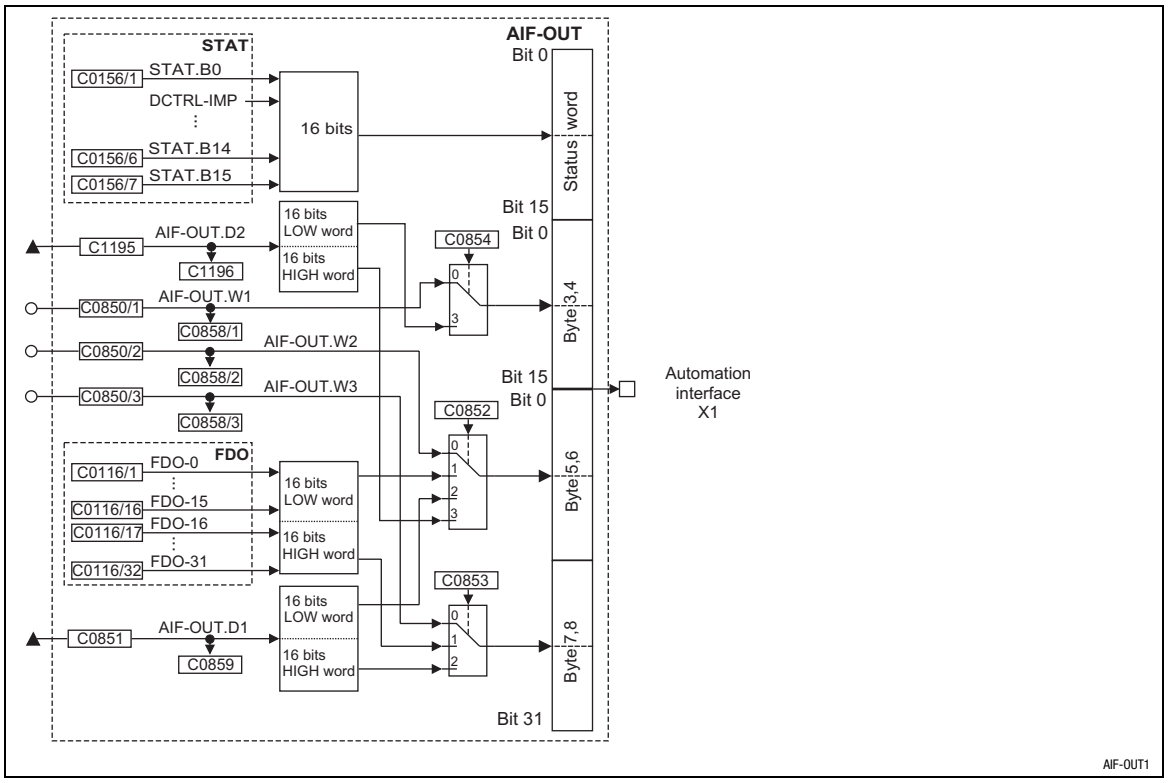


Fig. 3-19 Automation interface (AIF-OUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-OUT.W1	a	C0858/1	dec [%]	C0850/1	1	1000	+100 % = +16384
AIF-OUT.W2	a	C0858/2	dec [%]	C0850/2	1	1000	+100 % = +16384
AIF-OUT.W3	a	C0858/3	dec [%]	C0850/3	1	1000	+100 % = +16384
AIF-OUT.D1	ph	C0859	abs [inc]	C0851	4	1000	1 rev. = 65536
AIF-OUT.D2	ph	C1196	abs [inc]	C1195	4	1000	1 rev. = 65536

Function

The input signals of this function block are copied into the 8-byte user data of the AIF object and assigned to the plug-on fieldbus module. The meaning of the user data can be determined very easily with C0852 and C0853 and the corresponding configuration code (CFG).

Byte 1 and 2

Here, the status word from the function block STAT is mapped. Some of the bits are freely assignable (see description of the function block STAT in chapter 3.2.91)

Byte 3 and 4

- C0854 = 0
  – The analog signal at AIF-OUT.W1 is output.
- C0854 = 3
  – The LOW-WORD of AIF-OUT.D2 is output.

Byte 5 and 6

- C0852 = 0
  – The analog signal at AIF-OUT.W2 is output at bytes 5 and 6.
- C0852 = 1
  – The bits 0 ... 15 of FDO are output.
- C0852 = 2
  – The LOW-WORD of AIF-OUT.D1 is output.
- C0852 = 3
  – The HIGH-WORD of AIF-OUT.D2 is output.

Byte 7 and 8

- C0853 = 0
  – The analog signal at AIF-OUT.W3 is output.
- C0853 = 1
  – The bits 16 ... 31 of FDO are output.
- C0853 = 2
  – The HIGH-WORD of AIF-OUT.D1 is output.

Example

You want to output 16 digital signals of FDO and the LOW-WORD of AIF-OUT.D1:

- The LOW-WORD of AIF-OUT.D1 can only be output at bytes 5 and 6.
  – For this purpose, C0852 is set to 2. The angle signal at C0851 is output at bytes 5 and 6.
- For the digital signals, only the bits 16 ... 31 (bytes 7 and 8) are available (bytes 5 and 6 are assigned):
  – For this purpose, C0853 is set to 1. Bits 16 ... 31 (FDO) are output at bytes 7 and 8.

3.2.9 Analog inputs via terminal X6/1, X6/2 and X6/3, X6/4 (AIN)

Purpose

These function blocks are the interface for analog signals as the

- setpoint input,
- actual value input and
- parameter control.

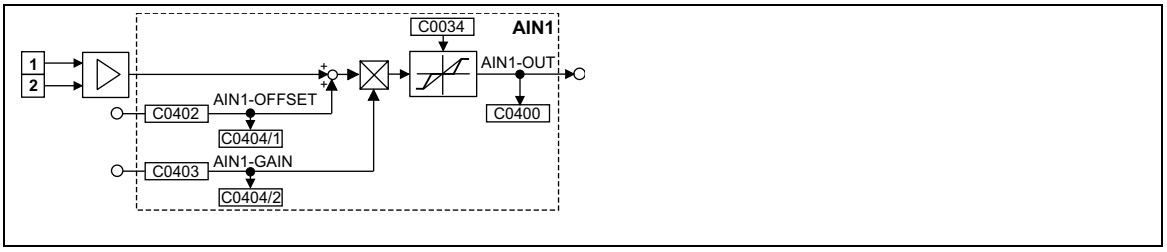


Fig. 3-20 Analog input via terminal X6/1, X6/2 (AIN1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN1-OFFSET	a	C0404/1	dec [%]	C0402	1	19502	-
AIN1-GAIN	a	C0404/2	dec [%]	C0403	1	19504	-
AIN1-OUT	a	C0400	-	-	-	-	-

Special features of AIN1

- A dead band element can be integrated into the output signal at AIN1 via code C0034. Together with the jumper position X2 (controller front) the function 4 ... 20 mA can be implemented as a master current value.
- The signal is read cyclically (1 ms).

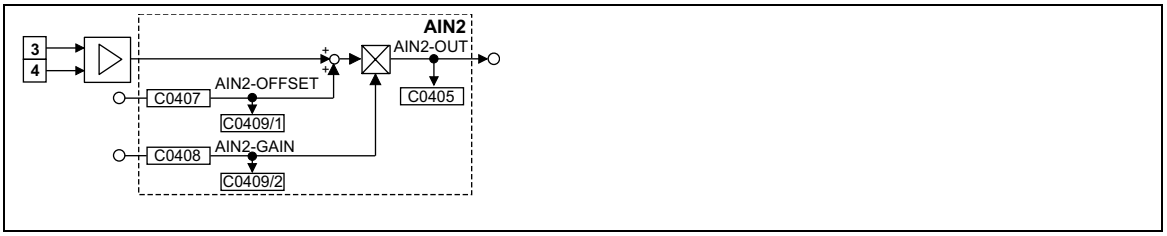


Fig. 3-21 Analog input via terminal X6/3, X6/4 (AIN2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN2-OFFSET	a	C0409/1	dec [%]	C0407	1	19503	-
AIN2-GAIN	a	C0409/2	dec [%]	C0408	1	19505	-
AIN2-OUT	a	C0405	-	-	-	-	-

Special feature of AIN2

- The signal is read cyclically every 250 µs.

Function

- The analog input value is added to the value at input AINx-OFFSET.
- The result of the addition is limited to ±200 %.
- The limited value is multiplied by the value which is applied to input AINx-GAIN.
- Then the signal is limited to ±200%.
- The signal is output at AINx-OUT.

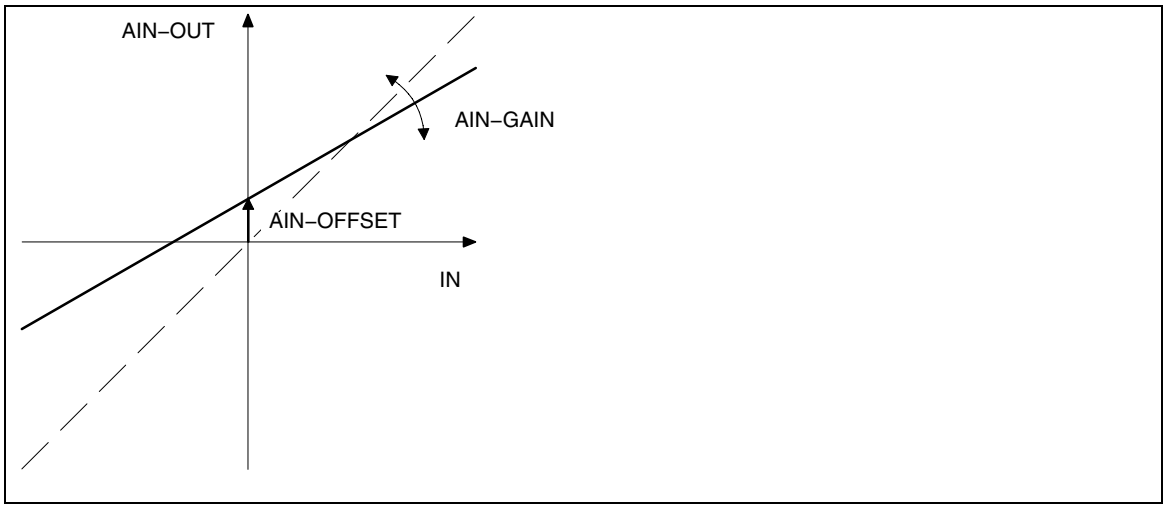


Fig. 3-22 Offset and gain of the analog input

3.2.10 AND operation (AND)

Purpose

With this function digital signals can be logically ANDed. These links can be used to control functions or to create status information.

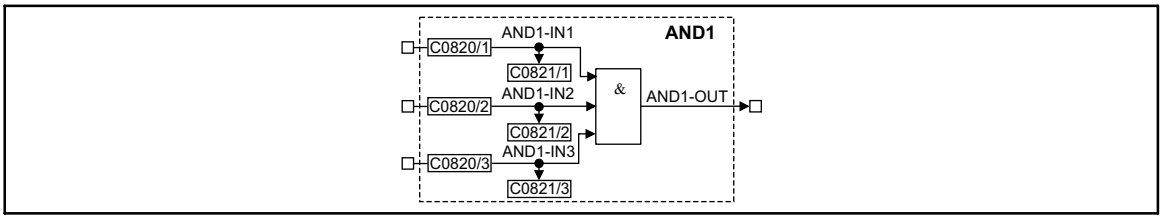


Fig. 3-23 AND operation (AND1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND1-IN1	d	C0821/1	bin	C0820/1	2	1000	-
AND1-IN2	d	C0821/2	bin	C0820/2	2	1000	-
AND1-IN3	d	C0821/3	bin	C0820/3	2	1000	-
AND1-OUT	d	-	-	-	-	-	-

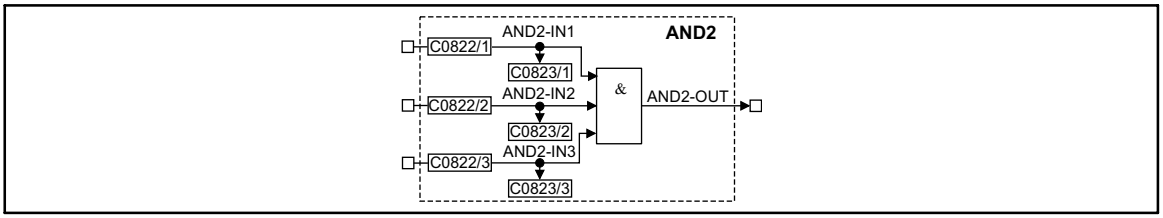


Fig. 3-24 AND operation (AND2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND2-IN1	d	C0823/1	bin	C0822/1	2	1000	-
AND2-IN2	d	C0823/2	bin	C0822/2	2	1000	-
AND2-IN3	d	C0823/3	bin	C0822/3	2	1000	-
AND2-OUT	d	-	-	-	-	-	-

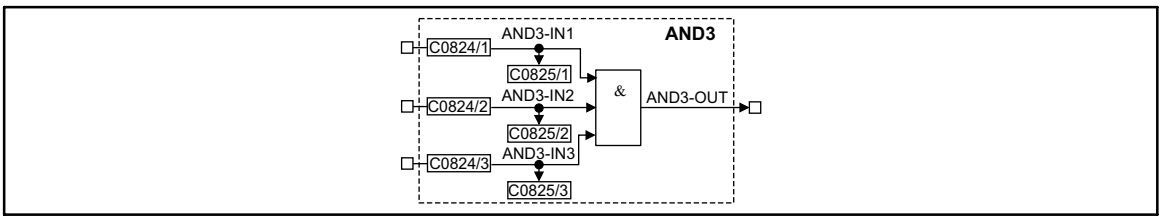


Fig. 3-25 AND operation (AND3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND3-IN1	d	C0825/1	bin	C0824/1	2	1000	-
AND3-IN2	d	C0825/2	bin	C0824/2	2	1000	-
AND3-IN3	d	C0825/3	bin	C0824/3	2	1000	-
AND3-OUT	d	-	-	-	-	-	-

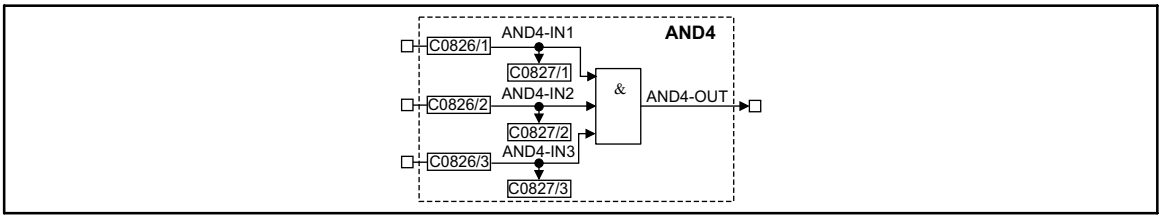


Fig. 3-26 AND operation (AND4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND4-IN1	d	C0827/1	bin	C0826/1	2	1000	-
AND4-IN2	d	C0827/2	bin	C0826/2	2	1000	-
AND4-IN3	d	C0827/3	bin	C0826/3	2	1000	-
AND4-OUT	d	-	-	-	-	-	-

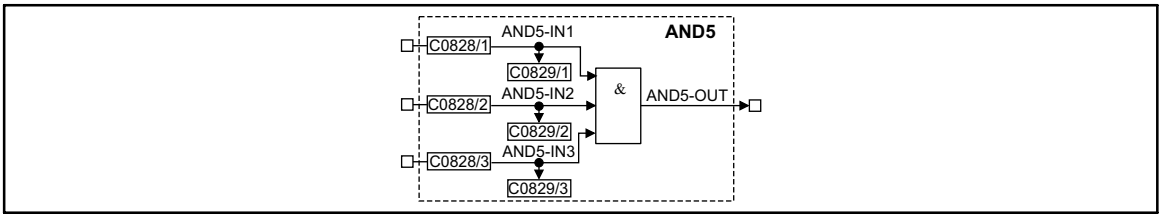


Fig. 3-27 AND operation (AND5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND5-IN1	d	C0829/1	bin	C0828/1	2	1000	-
AND5-IN2	d	C0829/2	bin	C0828/2	2	1000	-
AND5-IN3	d	C0829/3	bin	C0828/3	2	1000	-
AND5-OUT	d	-	-	-	-	-	-

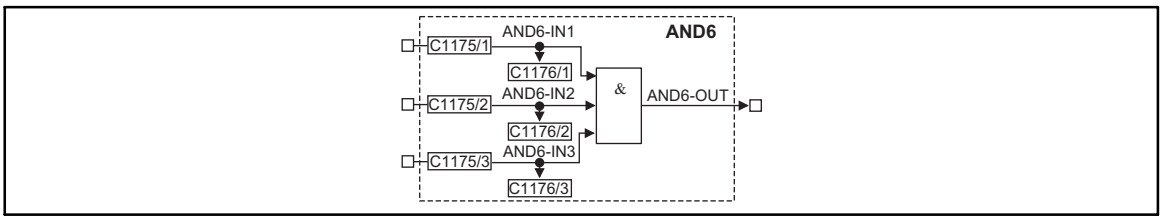


Fig. 3-28 AND operation (AND6)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND6-IN1	d	C1176/1	bin	C1175/1	2	1000	-
AND6-IN2	d	C1176/2	bin	C1175/2	2	1000	-
AND6-IN3	d	C1176/3	bin	C1175/3	2	1000	-
AND6-OUT	d	-	-	-	-	-	-

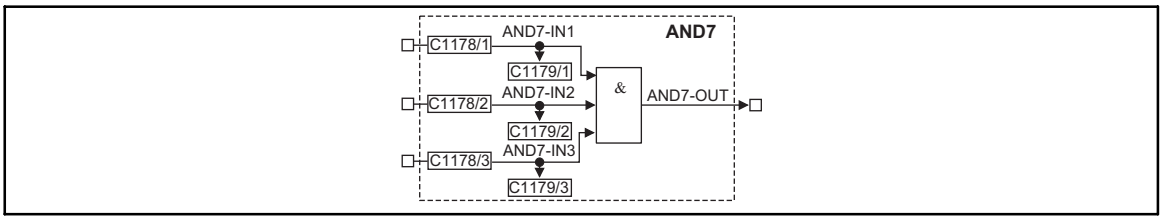


Fig. 3-29 AND operation (AND7)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND7-IN1	d	C1179/1	bin	C1178/1	2	1000	-
AND7-IN2	d	C1179/2	bin	C1178/2	2	1000	-
AND7-IN3	d	C1179/3	bin	C1178/3	2	1000	-
AND7-OUT	d	-	-	-	-	-	-

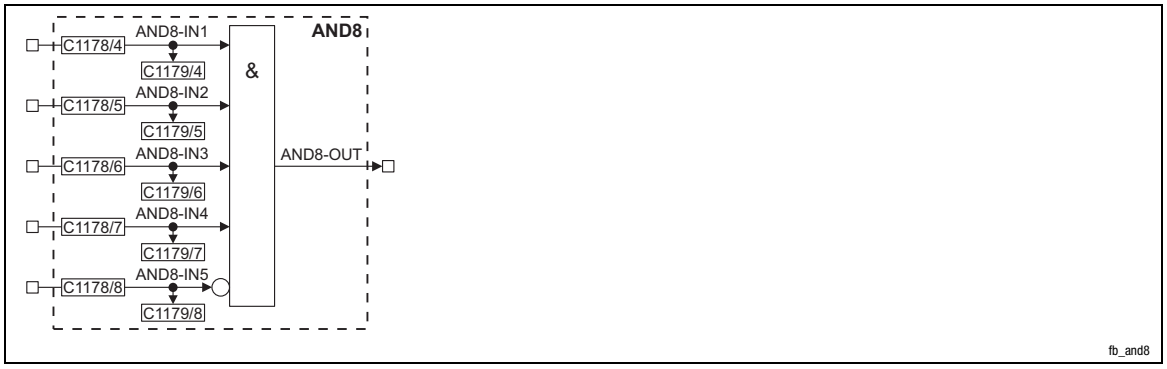


Fig. 3-30 AND operation (AND8)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND8-IN1	d	C1179/4	bin	C1178/4	2	1000	-
AND8-IN2	d	C1179/5	bin	C1178/5	2	1000	-
AND8-IN3	d	C1179/6	bin	C1178/6	2	1000	-
AND8-IN4	d	C1179/7	bin	C1178/7	2	1000	-
AND8-IN5	d	C1179/8	bin	C1178/8	2	1000	The input signal is inverted internally (NOT). The input does not have to be assigned to FIXED0 if it remains unused.
AND8-OUT	d	-	-	-	-	-	-

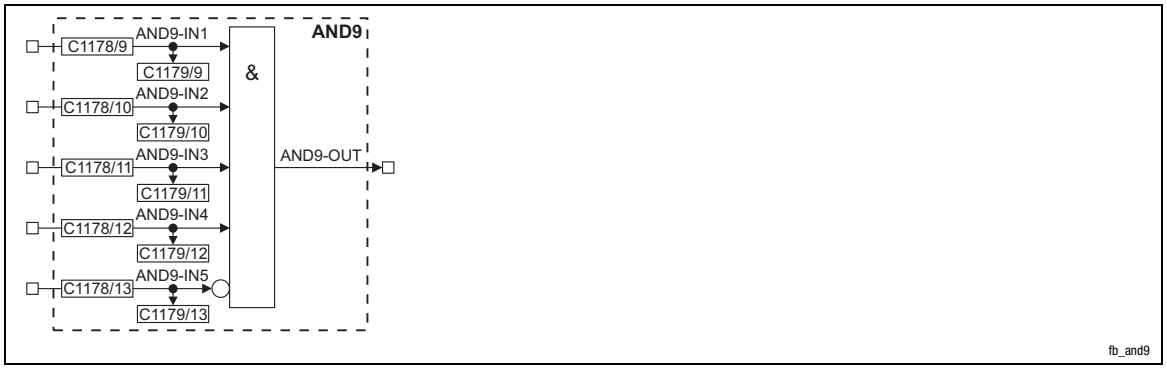


Fig. 3-31 AND operation (AND9)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND9-IN1	d	C1179/9	bin	C1178/9	2	1000	-
AND9-IN2	d	C1179/10	bin	C1178/10	2	1000	-
AND9-IN3	d	C1179/11	bin	C1178/11	2	1000	-
AND9-IN4	d	C1179/12	bin	C1178/12	2	1000	-
AND9-IN5	d	C1179/13	bin	C1178/13	2	1000	The input signal is inverted internally (NOT). The input does not have to be assigned to FIXED0 if it remains unused.
AND9-OUT	d	-	-	-	-	-	-

Function of AND1 ... AND7

- ANDx-OUT = ANDx-IN1 ∧ ANDx-IN2 ∧ ANDx-IN3
- Equivalent network:

Fig. 3-32 Equivalent network of the AND operation for AND1 ... AND7

Note!

Connect inputs that are not used to FIXED1.

Function of AND8, AND9

- ANDx-OUT = ANDx-IN1 ∧ ANDx-IN2 ∧ ANDx-IN3 ∧ ANDx-IN4 ∧ $\overline{\text{ANDx-IN5}}$
- Equivalent network:

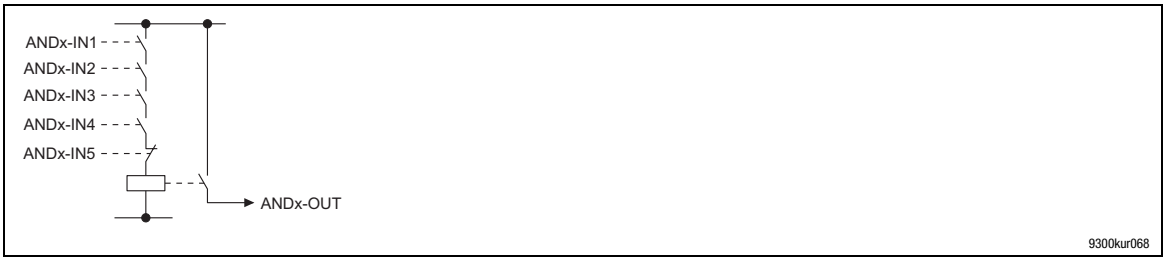


Fig. 3-33 Equivalent network of the AND operation for AND8 and AND9

Note!

- ANDx-IN1 ... ANDx-IN4: Connect inputs that are not used to FIXED1.
- Connect ANDx-IN5 to FIXED0 if you do not use the input.

3.2.11 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

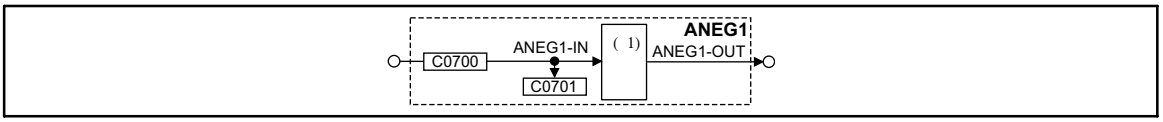


Fig. 3-34 Inverter (ANEG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG1-IN	a	C0701	dec [%]	C0700	1	19523	-
ANEG1-OUT	a	-	-	-	-	-	-

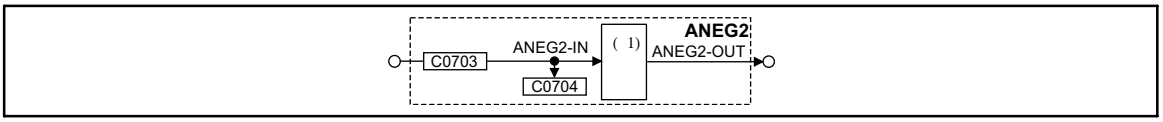


Fig. 3-35 Inverter (ANEG2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG2-IN	a	C0704	dec [%]	C0703	1	1000	-
ANEG2-OUT	a	-	-	-	-	-	-

Function

The input value is multiplied by -1 and then output again.

3.2.12 Analog output via terminal 62/63 (AOUT)

Purpose

AOUT1 and AOUT2 can be used as monitor outputs.

Internal analog signals can be output as voltage signals and be used e.g. as display values or setpoints for slaves.

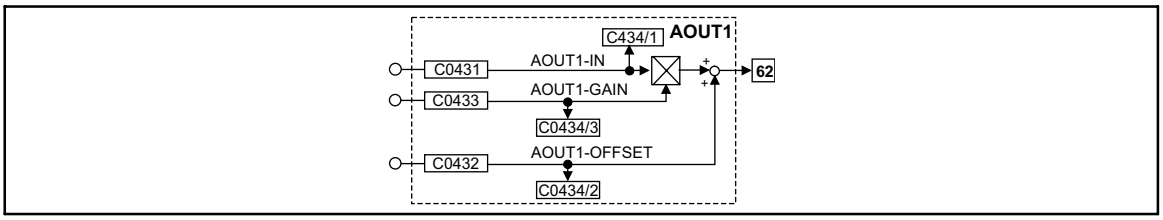


Fig. 3-36 Analog output via terminal X6/62 (AOUT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT1-IN	a	C0434/1	dec [%]	C0431	1	5001	-
AOUT1-GAIN	a	C0434/3	dec [%]	C0433	1	19510	-
AOUT1-OFFSET	a	C0434/2	dec [%]	C0432	1	19512	-

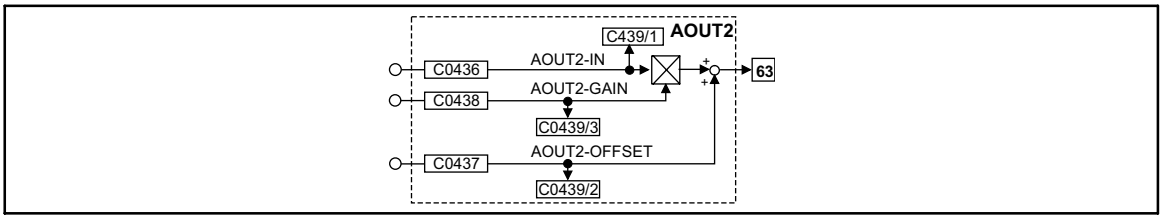


Fig. 3-37 Analog output via terminal X6/63 (AOUT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT2-IN	a	C0439/1	dec [%]	C0436	1	5002	-
AOUT2-GAIN	a	C0439/3	dec [%]	C0438	1	19511	-
AOUT2-OFFSET	a	C0439/2	dec [%]	C0437	1	19513	-

Function

- The value at input AOUTx-IN is multiplied by the value at input AOUTx-GAIN.
  – The formula for the multiplication is: 100% * 100% = 100%.
- The result of the multiplication is limited to ±200%.
- The limited value is added to the value which is applied at input AOUTx-OFFSET.
  – The formula for the addition is 50% + 10% = 60%. The result of the calculation is mapped in such a way that 100% = 10 V.
- The result of the addition is again limited to ±200%.
- The result of the calculation is mapped in such a way that 100% = 10 V and is output as a signal at terminal 62 or 63.

Example for an output value

AOUT1-IN = 50%, AOUT1-GAIN = 100%, AOUT1-OFFSET = 10%

Output terminal 62 = ((50% * 100% = 50%) + 10% = 60%) = 6 V

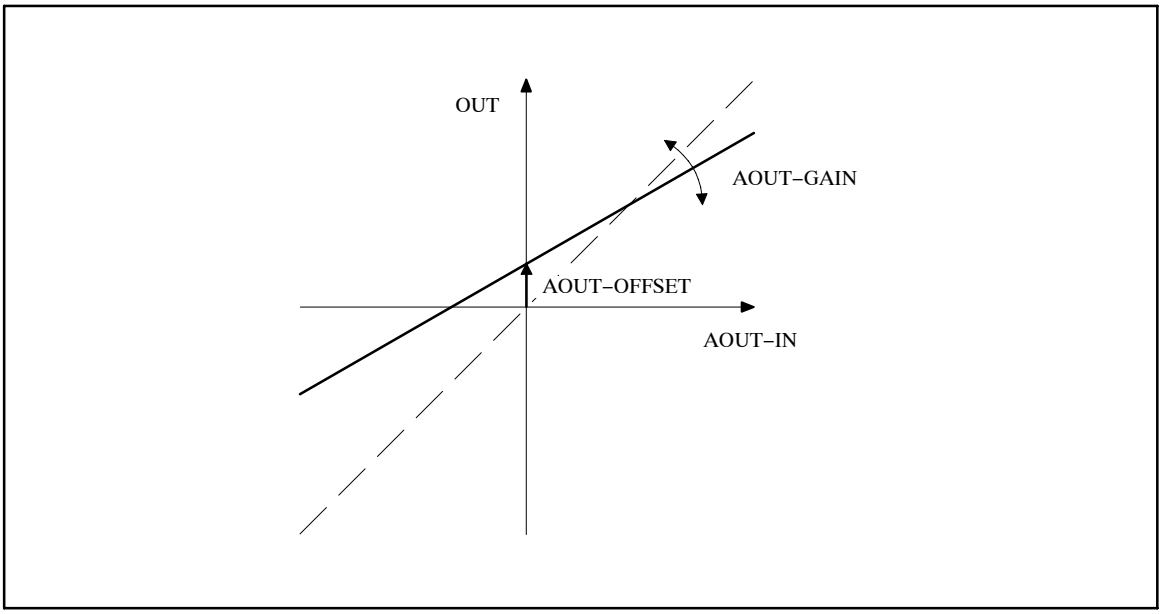


Fig. 3-38 Offset and gain of the analog output

3.2.13 Arithmetic block (ARIT)

Purpose

Arithmetic linking of two ”analog” signals.

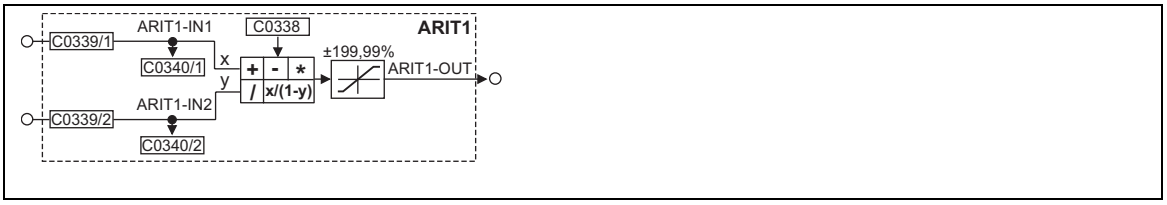


Fig. 3-39 Arithmetic block (ARIT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT1-IN1	a	C0340/1	dec [%]	C0339/1	1	1000	-
ARIT1-IN2	a	C0340/2	dec [%]	C0339/2	1	1000	-
ARIT1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

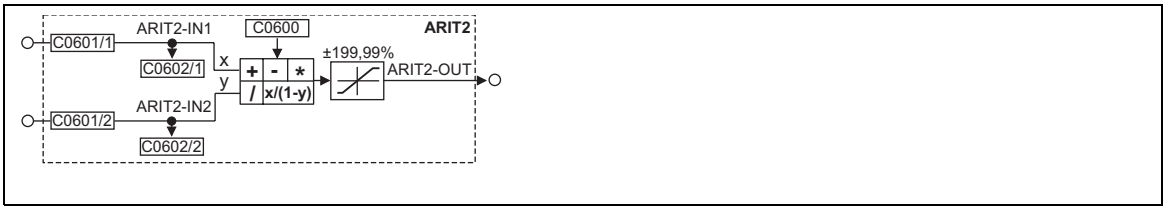


Fig. 3-40 Arithmetic block (ARIT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT2-IN1	a	C0602/1	dec [%]	C0601/1	1	1000	-
ARIT2-IN2	a	C0602/2	dec [%]	C0601/2	1	1000	-
ARIT2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

For both arithmetic blocks the following functions can be preselected:

Code	Subcode	Arithmetic function	Example	Note
ARIT1: C0338 ARIT2: C0600	0	OUT = IN1		IN2 is not processed
	1	OUT = IN1 + IN2	100% = 50% + 50%	
	2	OUT = IN1 - IN2	50% = 100% - 50%	
	3	OUT = IN1 × IN2	100% = 100% ×100%	
	4	OUT = IN1 ÷ | IN2 |	1% = 100% ÷100%	
	5	OUT = IN1 ÷ (100% - IN2)	200% = 100% ÷ (100% - 50%)	
	15	OUT = IN1 % IN2 % here means ”modulo”	• 20% = 200% [%] 60% • 40% = 160% [%] 60% • 0 = 180% [%] 60%	Remainder calculation: OUT = IN1 - (n × IN2) n = integer component of the quotient IN1 ÷ IN2

3.2.14 Arithmetic block (ARITPH)

Purpose

The FB ARITPH calculates a angle output signal from two angle input signals.

ARITPH1

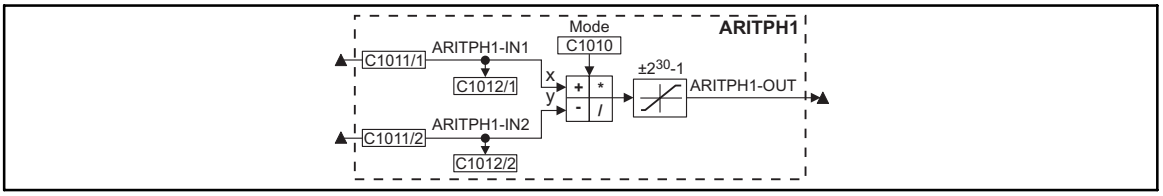


Fig. 3-41 Function block ARITPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH1-IN1	ph	C1012/1	dec [inc]	C1011/1	3	-
ARITPH1-IN2	ph	C1012/2	dec [inc]	C1011/2	3	-
ARITPH1-OUT	ph	-	-	-	-	

ARITPH2

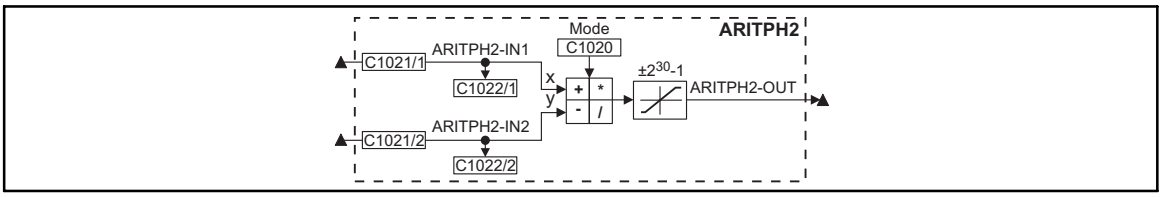


Fig. 3-42 Function block ARITPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH2-IN1	ph	C1022/1	dec [inc]	C1021/1	3	-
ARITPH2-IN2	ph	C1022/2	dec [inc]	C1021/2	3	-
ARITPH2-OUT	ph	-	-	-	-	

ARITPH3

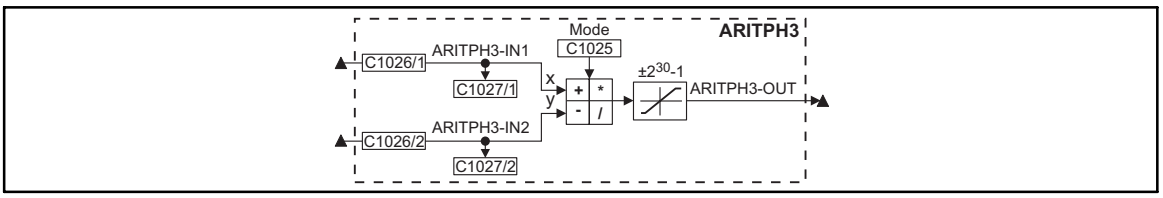


Fig. 3-43 Function block ARITPH3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH3-IN1	ph	C1027/1	dec [inc]	C1026/1	3	-
ARITPH3-IN2	ph	C1027/2	dec [inc]	C1026/2	3	-
ARITPH3-OUT	ph	-	-	-	-	

ARITPH4

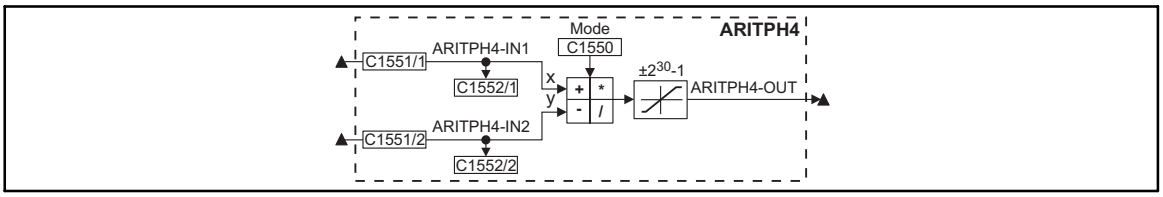


Fig. 3-44 Function block ARITPH4

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH4-IN1	ph	C1552/1	dec [inc]	C1551/1	3	-
ARITPH4-IN2	ph	C1552/2	dec [inc]	C1551/2	3	-
ARITPH4-OUT	ph	-	-	-	-	

ARITPH5

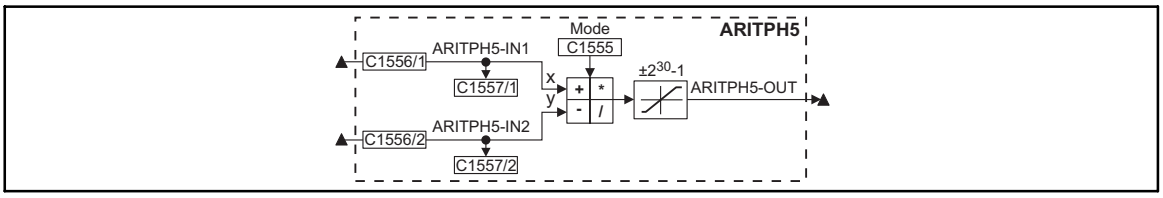


Fig. 3-45 Function block ARITPH5

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH5-IN1	ph	C1557/1	dec [inc]	C1556/1	3	-
ARITPH5-IN2	ph	C1557/2	dec [inc]	C1556/2	3	-
ARITPH5-OUT	ph	-	-	-	-	

ARITPH6

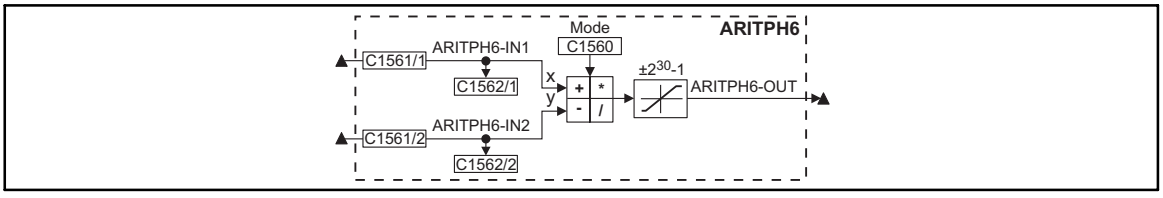


Fig. 3-46 Function block ARITPH6

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH6-IN1	ph	C1562/1	dec [inc]	C1561/1	3	-
ARITPH6-IN2	ph	C1562/2	dec [inc]	C1561/2	3	-
ARITPH6-OUT	ph	-	-	-	-	

Function

- Selection of the arithmetic function with code ARITPH mode.
- The calculation is performed cyclically in the control program.
- The function block limits the results (see table)

Code	Selection number	Arithmetic function	Limitation	Note
ARITPH1: C1010 ARITPH2: C1020 ARITPH3: C1025 ARITPH4: C1550 ARITPH5: C1555 ARITPH6: C1560	0	OUT = IN1		Without limitation
	1	OUT = IN1 + IN2	2^{30} -1	
	2	OUT = IN1 - IN2	2^{30} -1	
	3	OUT = (IN1 × IN2) ÷ 2^{30}	2^{30} -1	Remainder not considered
	13	OUT = IN1 × IN2	2^{31}	
	14	OUT = IN1 ÷ IN2	2^{30} -1	Remainder not considered
	15	OUT = IN1 % IN2		Remainder output (Modulo)
	21	OUT = IN1 + IN2	No limit	Without limitation
	22	OUT = IN1 - IN2	No limit	Without limitation

3.2.15 Analog signal changeover switch (ASW)

Purpose

This FB changes between two analog signals.

This FB enables you to change e.g. during a winding process between an initial diameter and a calculated diameter.

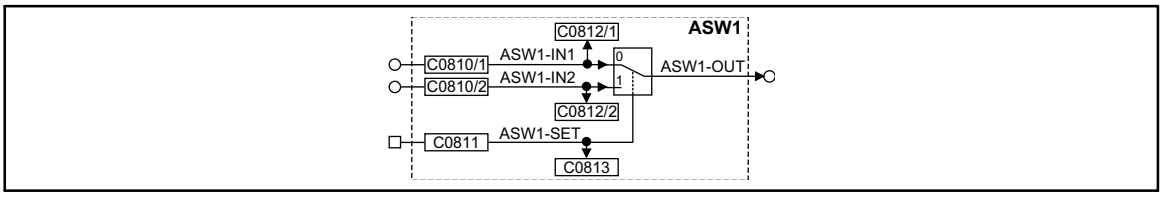


Fig. 3-47 Changeover switch for analog signals (ASW1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW1-IN1	a	C0812/1	dec [%]	C0810/1	1	55	-
ASW1-IN2	a	C0812/2	dec [%]	C0810/2	1	1000	-
ASW1-SET	d	C0813	bin	C0811	2	1000	-
ASW1-OUT	a	-	-	-	-	-	-

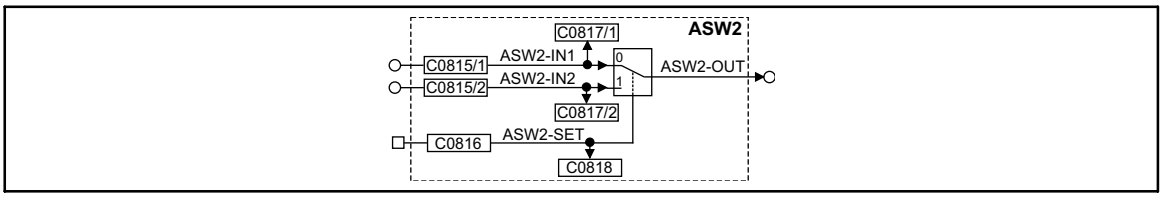


Fig. 3-48 Changeover switch for analog signals (ASW2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW2-IN2	a	C0817/1	dec [%]	C0815/1	1	1000	-
ASW2-IN1	a	C0817/2	dec [%]	C0815/2	1	1000	-
ASW2-SET	d	C0818	bin	C0816	2	1000	-
ASW2-OUT	a	-	-	-	-	-	-

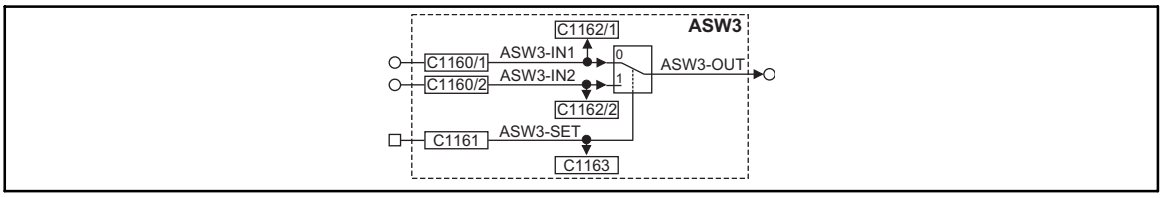


Fig. 3-49 Changeover switch for analog signals (ASW3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW3-IN2	a	C1162/1	dec [%]	C1160/1	1	1000	-
ASW3-IN1	a	C1162/2	dec [%]	C1160/2	1	1000	-
ASW3-SET	d	C1163	bin	C1161	2	1000	-
ASW3-OUT	a	-	-	-	-	-	-

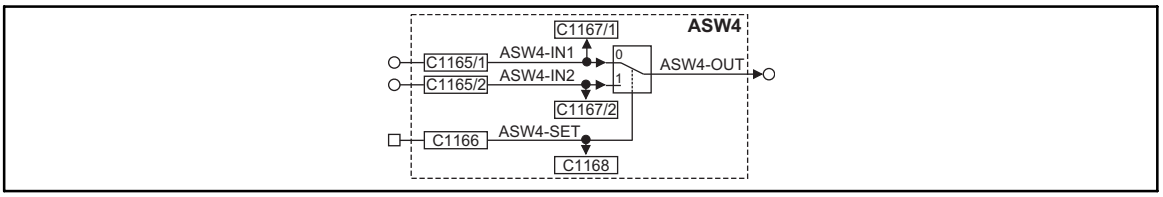


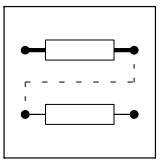
Fig. 3-50 Changeover switch for analog signals (ASW4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW4-IN2	a	C1167/1	dec [%]	C1165/1	1	1000	-
ASW4-IN1	a	C1167/2	dec [%]	C1165/2	1	1000	-
ASW4-SET	d	C1168	bin	C1166	2	1000	-
ASW4-OUT	a	-	-	-	-	-	-

Function

This FB is controlled via the binary input. Depending on the input signal, different signals are sent to the output:

- If a HIGH signal is applied at the binary input, the signal which is applied at the ASWx-IN2 input is sent to the output.
- If a LOW signal is applied, the signal which is applied at the ASW-IN2 input is sent to the output.



3.2.16 Holding brake (BRK)

Danger!

Condition for using the BRK function block

Triggering the holding brake solely via the function block BRK is not permissible!

The **safe** triggering of the holding brake additionally requires a second switch-off path. Unsafe triggering creates the risk of severe personal injury and danger to material assets!

Applications with active loads

When the DC-bus voltage increases (e.g. by braking processes), the torque limitation may be activated via code C0172. The torque limitation becomes active if for instance the brake resistor is defective or the switching threshold set on the brake chopper or the brake module is not correctly adjusted.

Code C0172 is a pre-stage of the monitoring function “OU” (overvoltage of the DC-bus voltage). Code C0172 defines the voltage difference to OU causing a reduction in torque. In the Lenze setting, the torque is reduced to ”0” if the DC-bus voltage reaches 760 V (770 V - 10 V):

- OU threshold = 770V (C0173 = 0...3)
  - Exception: OU threshold 800 V for C0173 = 4 (see description in code table)
- C0172 = 10 V
- No message is generated.

Only after the DC-bus voltage has decreased below the OU reconnection threshold, the torque is reconnected.

With unchanged basic conditions the continuously ”chopping” drive behaviour may lead to undefined motions.

Remedy

1. Set C0172 = 0 V
2. MONIT-OU has to generate EEr-TRIP (e.g. by C0871/0 = 15011).
   - By this, the standstill brake is engaged via controller inhibit (CINH) if the braking energy cannot be dissipated.

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traverse drives
- Active loads

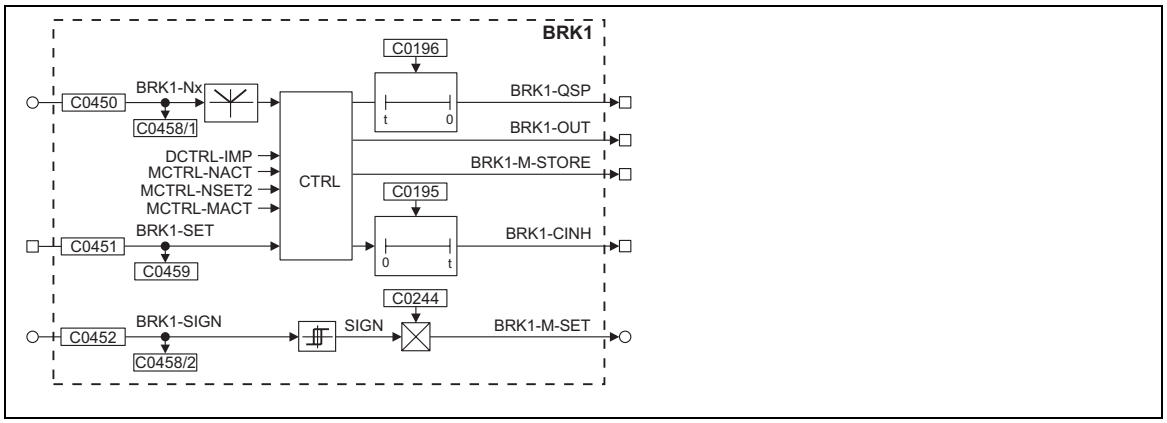


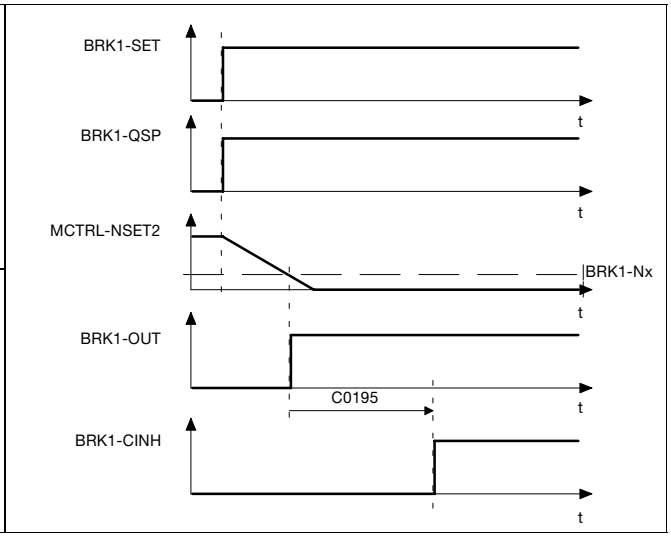
Fig. 3-51 Holding brake (BRK1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
BRK1-SET	d	C0459	bin	C0451	2	1000	-
BRK1-NX	a	C0458/1	dec [%]	C0450	1	1000	Speed threshold from which the drive may output the signal "Close brake". The signal source for this input can be a control code, a fixed value, or any other analog FB output. The input signal is processed internally as an absolute value.
BRK1-SIGN	a	C0458/2	dec [%]	C0452	1	1000	Direction of the torque with which the drive is to set up a torque against the brake. The signal source for this input can be a control code, a fixed value, or any other FB output.
BRK1-M-SET	a						Feedforward control torque for releasing the brake 100 % = value of C0057

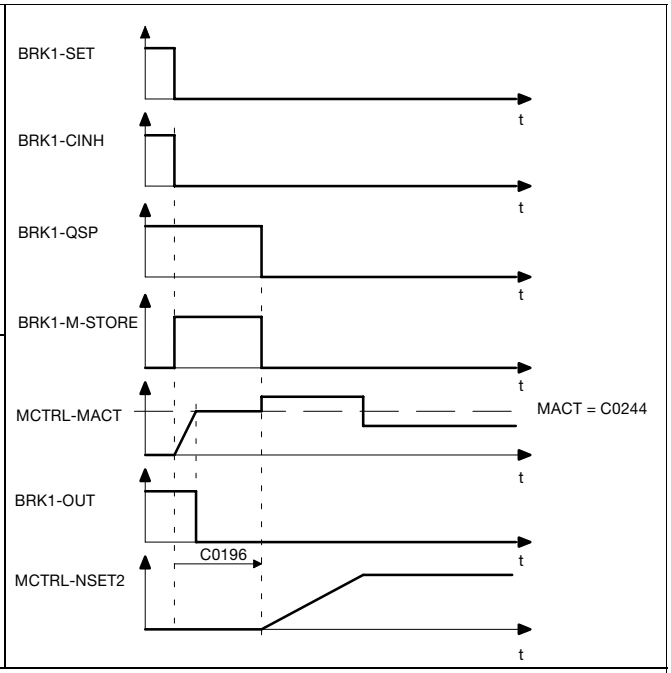
Note!

The internal signals MCTRL-NACT, MCTRL-MACT and MCTRL-NSET2 are processed as absolute values.

3.2.16.1 Engaging the brake

Purpose	A HIGH signal at the BRK1-SET input activates the function. The output BRK1-QSP is simultaneously switched to HIGH. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.	
Function	If the setpoint speed falls below the value set at the BRK1-Nx input, the output BRK1-OUT is set to HIGH. In order to ensure a fail-safe design this signal must be inverted at the output (e.g. via C0118).	

3.2.16.2 Disengaging (releasing) the brake

Purpose	A LOW signal at the BRK-SET input immediately sets the BRK-CINH output to LOW. At the same time the BRK1-M-STORE output is set to HIGH. This signal can be used to generate a defined torque against the brake. The drive thus takes over the torque while the brake is released. The signal is only reset after the time set under C0196 has elapsed.	
Function	As soon as the torque reaches the value set under C0244 (holding torque), the output BRK1-OUT is set to LOW. When the input is reset, a timing element is triggered. After the time set under C0196 has elapsed the BRK1-QSP output is reset. This signal serves to e.g. release the setpoint integrator after the brake release time has elapsed.	
Note	If an actual speed higher than the value at BRK1-Nx is detected before the brake release time (C0196) has elapsed, the signals BRK1-QSP and BRK1-M-STORE are reset immediately. The drive can operate in a speed or angle-controlled manner immediately. If the BRK1-QSP output acts on the QSP control word, then the drive is synchronised to the actual speed and follows its setpoint.	

3.2.16.3 Setting controller inhibit

Setting controller inhibit may for instance be required in the case of a fault (LU, OU, ...).

Function

When the controller is inhibited (CINH), the BRK1-OUT signal is set to HIGH immediately. The drive is then braked via the mechanical brake.

If the fault is eliminated quickly, i.e. the controller inhibit (CINH) is reset before the actual speed falls below the threshold value BRK1-Nx, the BRK1-OUT signal is set to LOW immediately. The drive is synchronised to the actual speed and follows its setpoint.

If the value falls below the threshold, the drive starts as described under ”Release brake”.

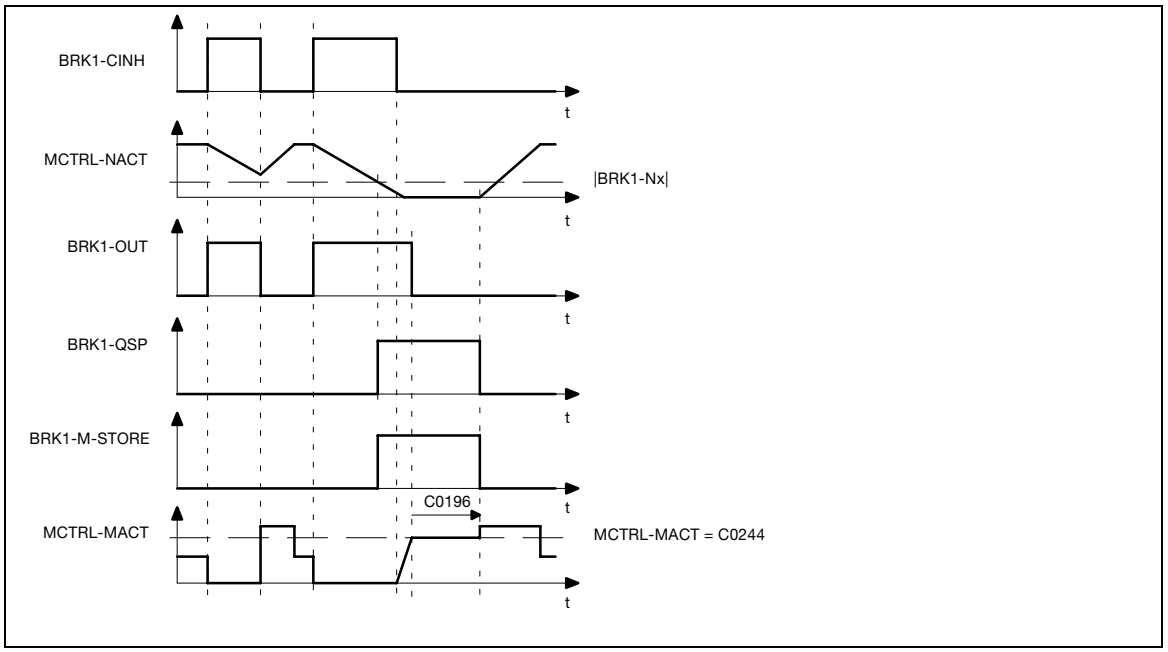


Fig. 3-52 Brake control with CINH

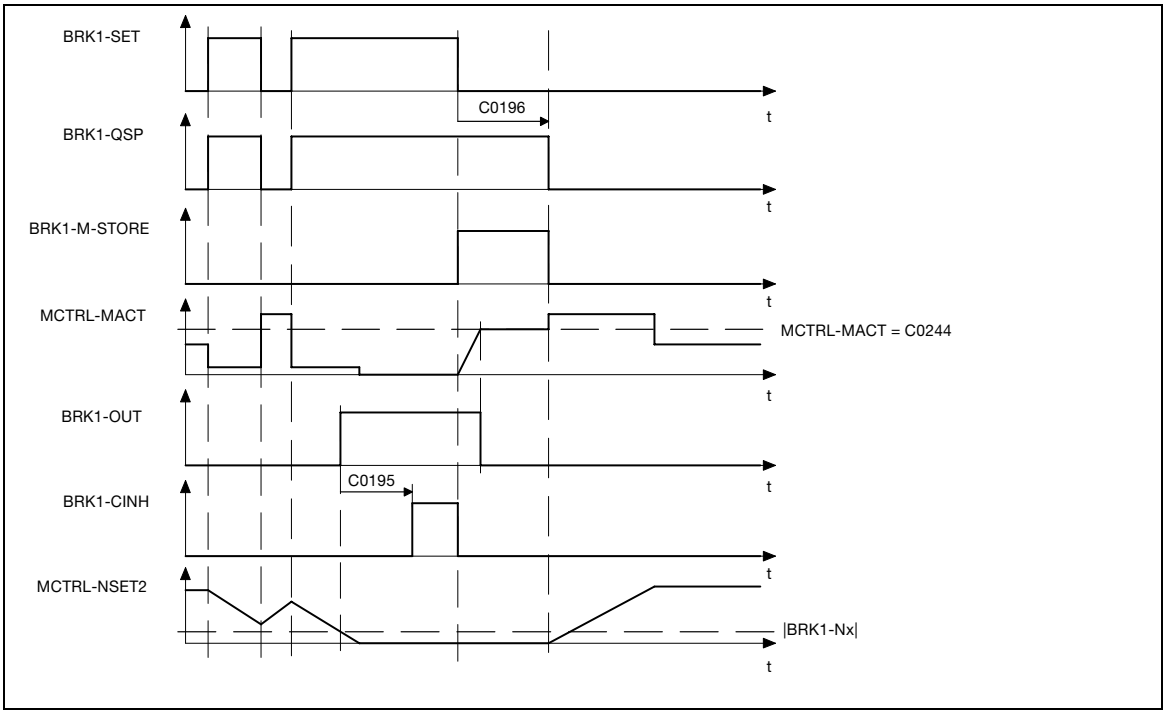


Fig. 3-53 Switching cycle when braking

3.2.17 System bus (CAN-IN)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.2.18 System bus (CAN-OUT)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.2.19 Setpoint conditioning (CCTRL)

Note!

For the CCTRL and CCTRL2 function blocks, partly the same codes are used. Therefore you may only use CCTRL or CCTRL2. On the basis of extended functions we recommend the use of CCTRL2.

Purpose

- Forming the set machine position (CCTRL-PHI-SET) from the set profile position (e. g. from the YSET1 function block).
- Additional functions like inching/manual jog, reference search (REFC), position override function with maintaining the set machine position from the cam via a second set machine position (CCTRL-PHI-SET2).
- Output of the actual machine position (CCTRL-PHI-ACT) after carrying out the ”Set reference” function.
- Touch probe synchronisation of the drive.
- Calculation of the speed and acceleration precontrol.

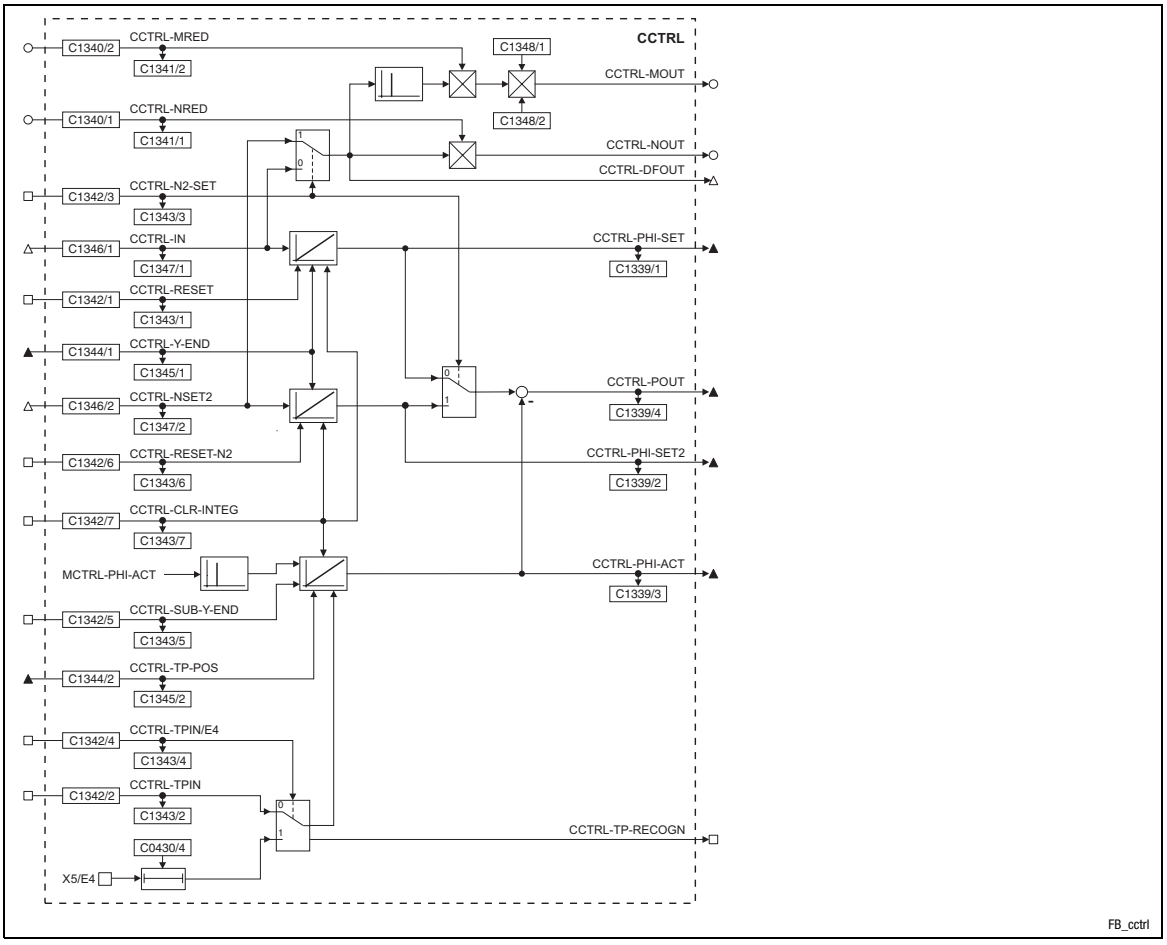


Fig. 3-54 Setpoint conditioning (CCTRL)

Signal				Source		Comment
Name	Type	DIS	DIS format	CFG	List	
CCTRL-MRED	a	C1341/2	dec [%]	C1340/2	1	Gain for the torque setpoint precontrol
CCTRL-NRED	a	C1341/1	dec [%]	C1340/1	1	Gain for the speed setpoint precontrol
CCTRL-N2-SET	d	C1343/3	bin	C1342/3	2	HIGH: input CCTRL-NSET2 active
CCTRL-IN	phd	C1347/1	rpm	C1346/1	4	Input for the set profile position
CCTRL-RESET	d	C1343/1	bin	C1342/1	2	HIGH: sets set angle = actual angle -> CCTRL-POUT = 0
CCTRL-Y-END	ph	C1345/1	inc	C1344/1	3	Final value of the profile (only required for touch probe)
CCTRL-NSET2	phd	C1347/2	rpm	C1346/2	4	Input for the second set machine position
CCTRL-RESET-N2	d	C1343/6	bin	C1342/6	2	Deletes the contouring error if CCTRL-N2-Set = HIGH
CCTRL-CLR-INTEG	d	C1343/7	bin	C1342/7	2	HIGH: Sets all integrators to 0
CCTRL-SUB-Y-END	d	C1343/5	bin	C1342/5	2	Only required for touch probe
CCTRL-TP-POS	d	C1345/2	bin	C1324/3	2	Only for synchronisation via touch probe. Position of the touch probe sensor in the traversing range
CCTRL-TPIN/E4	d	C1343/4	bin	C1342/4	2	HIGH: Touch probe is activated via terminal X5/E4 LOW: Touch probe is activated via CCTRL-TPIN
CCTRL-TPIN	d	C1343/2	bin	C1342/2	2	External mark for setting the position
CCTRL-MOUT	a				1	Torque setpoint for input MCTRL-M-ADD (torque feedforward control)
CCTRL-NOUT	a				1	Speed setpoint for input MCTRL-N-SET (speed feedforward control)
CCTRL-DFOUT	phd				4	Speed setpoint
CCTRL-PHI-SET	ph	C1339/1			3	Output of the set machine position
CCTRL-POUT	ph				3	Contouring error, input signal for MCTRL-PHI-SET
CCTRL-PHI-SET2	ph	C1339/2			3	Output of the set machine position of CCTRL-NSET2
CCTRL-PHI-ACT	ph	C1339/3			3	Output of the actual machine position
CCTRL-TP-RECOGN	d				2	Output is HIGH for 1 ms in the case of • a HIGH-LOW edge at terminal X5/E4 or • CCTRL-TPIN/E4 = HIGH

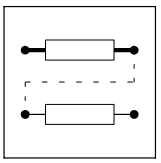
Function

- Set profile position and second set machine position (📖 3-68)
- Homing (📖 3-69)
- Set reference once (📖 3-71)
- Speed feedforward control (📖 3-73)
- Torque feedforward control (📖 3-73)

3.2.19.1 Set profile position and second set machine position

At CCTRL-IN, the set profile position is specified. The set machine position is output at CCTRL-PHI-SET. It is the reference value for controlling the cam.

For auxiliary functions like inching mode, position override function (e. g. approaching cleaning position) or homing, you can define a second set machine position at CCTRL-PHI-SET2. If a changeover to the second set machine position is effected, the set machine position at CCTRL-PHI-SET is maintained and can be approached again after the auxiliary function has been completed.



Activating set profile position at CCTRL-IN

Stop!

Destruction of the machine!

If the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET display different values when the set profile position is activated (CCTRL-N2-SET = LOW), this will result in uncontrolled machine movements due to following errors.

Protective measures:

Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to equal values before activating the set profile position. You have two possibilities:

- Direct the value at CCTRL-PHI-SET2 to the value at CCTRL-PHI-SET via the input signal at CCTRL-NSET2.
- Set CCTRL-RESET = HIGH. By this, CCTRL-PHI-SET is set = CCTRL-PHI-ACT.

- Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to equal values.
- Set CCTRL-N2-SET = LOW.
- The integrator for the second set machine position is reset. CCTRL-PHI-SET2 is set = CCTRL-PHI-ACT, in order to be able to traverse from the current position when the second set machine position is activated.

Activating the second set machine position at CCTRL-NSET2

- Set CCTRL-N2-SET = HIGH.

Resetting the set machine position

- CCTRL-PHI-SET = CCTRL-PHI-ACT is set with CCTRL-RESET = HIGH .

3.2.19.2 Homing

There are different possibilities of homing the drive:

- For commissioning, the reference is set once (reasonable for machines with risk of collision). (📖 3-71)
- After mains connection, homing is carried out once, so that the drive finds the home position. Possibilities for carrying out the homing process:
  - Via the REFC function block (📖 3-261)
  - Via the function ”Set reference dynamically” (see below).
- Permanent mark registration during running operation (mark synchronisation):
  - Synchronising via touch probe at terminal X5/E4. (📖 3-70)
  - Synchronisation via touch probe at CCTRL-TPIN. (📖 3-71)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with CCTRL-TPIN/E4 = LOW during homing. (📖 3-263)

Setting the reference dynamically

This function for instance can be used to traverse to the mark in the inching mode.

A) If you activate the function via the input CCTRL2-TPIN:

1. Set CCTRL-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Set CCTRL-TPIN/E4 = LOW.
4. A LOW-HIGH edge at CCTRL-TPIN activates ”Set reference”.

B) If you activate the function via terminal X5/E4:

1. Set CCTRL-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Set CCTRL-TPIN/E4 = HIGH.
4. A HIGH-LOW edge at terminal X5/E4 activates ”Set reference”.

Synchronisation via touch probe at terminal X5/E4

A touch probe signal at terminal X5/E4 is the quickest and most accurate mark registration and is suited for a cyclic synchronisation.

Application examples:

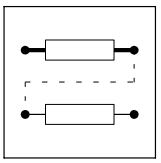
- For applications without a homing function.
- After mains connection, the measuring system of the controller and that of the machine can diverge very much. In the majority of cases the path to be compensated is very long.
- For applications (e. g. with conveying belts) an occurring slip has to be compensated by cyclic synchronisation. In the majority of cases the path to be compensated is relatively short.

Procedure:

1. Set CCTRL-TPIN/E4 = HIGH.
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Activate the compensation limitation with C1366 = 1.
4. Enter the value for the maximum compensation speed in C1365/1 (Lenze setting = 100 rpm).
5. A HIGH-LOW edge at terminal X5/E4 synchronises the drive to the set position which is output at CCTRL-PHI-SET.

Note!

- For applications with feed the final Y value of the profile must be assigned to the input CCTRL-Y-END (e.g. by the output CDATA-Y-END). The function is not suitable for stretching and compression.
- The input CCTRL-SUB-Y-END must be linked with the output CDATA-X0.
- Save the settings with C0003 = 1 and switch the mains voltage off and on again.
  – When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.



Synchronisation via touch probe at CCTRL2-TPIN.

The input CCTRL-TPIN is suitable for a one-time synchronisation and sets the position of the drive in standstill.

Procedure:

1. Set CCTRL-TPIN/E4 = LOW.
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. A LOW-HIGH edge at CCTRL-TPIN synchronises the drive to the set position which is output at CCTRL-PHI-SET.

3.2.19.3 Setting the reference once

Stop!

- If a parameter set is downloaded, C1367/1 is not transferred, as for **each** commissioning the actual, current position of the tool to the machine zero point has to be entered in the code. The position of the actual value encoder (multi-turn absolute value encoder) depends on the rotor position when the motor is mounted to the machine, and on the actual position of the tool. A new setting therefore is required as soon as a drive component is not tied positively anymore.
- If the feedback system is switched over, also the machine zero point has to be re-entered (the synchronisation always is effected via the feedback system and is specifically adapted to it).

The function “Set reference” only has to be carried out once:

1. Enter the current distance [s-units] of the tool to the machine zero point in C1367/1 (set reference).
2. Switch the controller off and then on again, in order to reinitialise the profile data.
   – After every mains connection, the controller automatically determines the current distance to the machine zero point, which is output at CCTRL-PHI-SET2 (C1339/2) and CCTRL-PHI-ACT (C1339/3).
   – The profile position is output at CCTRL-PHI-SET after mains connection.
3. Where required, position the drive to the profile via the RFGPH2 function block.

Frequent zero shifting

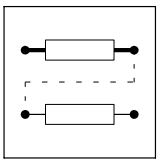
Procedure for applications with frequent zero shifting:

1. Disconnect the drive from the profile (CCTRL-N2-SET = HIGH)
2. Carry out function “Set reference” via touch probe
3. Set code C1349/0 to 2 (CCTRL-TP-MODE, absolute-value encoder)
4. Set input CCTRL-N2-SET to HIGH
5. Set input CCTRL-TPIN/E4 to LOW
6. Assign the current distance of the tool to the machine zero point to the input CCTRL-TP-POS.
   – Enter, for instance, a corresponding value via C1477/x [s-units] or C0474/x [inc].
7. Generate a LOW-HIGH edge at input CCTRL-TPIN and then reset the input to LOW.
   – The distance to the machine zero point is automatically saved with mains failure protection and is again available after mains connection.

Now the drive can be positioned to the profile position via the RFGPH2 or RFGPH3 function blocks. This function, however, must be configured manually since it is not included in the basic configuration.

Note!

- It is also possible to use absolute value encoders without homing function.
- Up to software version 3.3, the absolute value encoder must not have a zero crossing within the measuring system of the machine. If necessary, the motor must be turned during the commissioning procedure into the appropriate position before being mounted.
- From software version 3.4, the zero crossing is considered automatically.
- The following applies to all software versions:
  If the encoder is not supplied anymore (mains and DC 24 V are switched off), the encoder may only be turned within certain limits:
  – Single-turn absolute value encoders/resolvers by max. ±179.0 °
  – Multi-turn absolute value encoders by max. ±2079.9 revolutions



3.2.19.4 Speed feedforward control

Via the speed feedforward control the faster control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating.

- Via the input CCTRL-NRED the feedforward control can be decreased or increased proportionally to the angle setpoint change dφ/dt.
- Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
- Values < 100% decrease the feedforward control. If the gain is too low, the drives generates a following error (drive lags) during acceleration or braking (dynamic).

Note!

The input value at CCTRL-NRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.19.5 Torque feedforward control

Via the torque feedforward control the faster (internal) control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating. Where required, you have to increase the reset time of the n-controller.

Stop!

The torque feedforward control has a much more sensitive influence on the drive than the speed feedforward control.

- The feedforward control can be increased or decreased proportionally to the speed change dn/dt via the input CCTRL-MRED.
  - Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
  - Values < 100% decrease the feedforward control. If the gain is too low, the drives generates a following error (drive lags) during acceleration or braking (dynamic).
- With codes C1348/1 (numerator) and C1348/2 (denominator), the feedforward control can be adapted to the inertia of the machine.

Note!

The input value at CCTRL-MRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.20 Setpoint conditioning (CCTRL2)

Note!

For the CCTRL and CCTRL2 function blocks partly the same codes are used. Therefore you may only use CCTRL or CCTRL2. Due to its extended functions we recommend the use of CCTRL2.

Purpose

- Generation of the machine setpoint position (CCTRL2-PHI-SET) from the profile setpoint position (e.g. from the YSET1 function block).
- Additional functions like inching/manual jog, reference search (REFC), position override with maintaining the machine setpoint position from the cam via a second machine setpoint (CCTRL2-PHI-SET2).
- Output of the actual machine position (CCTRL2-PHI-ACT) after carrying out the ”Set reference” function.
- Touch probe synchronisation of the drive.
- Calculation of the speed and acceleration feedforword control.

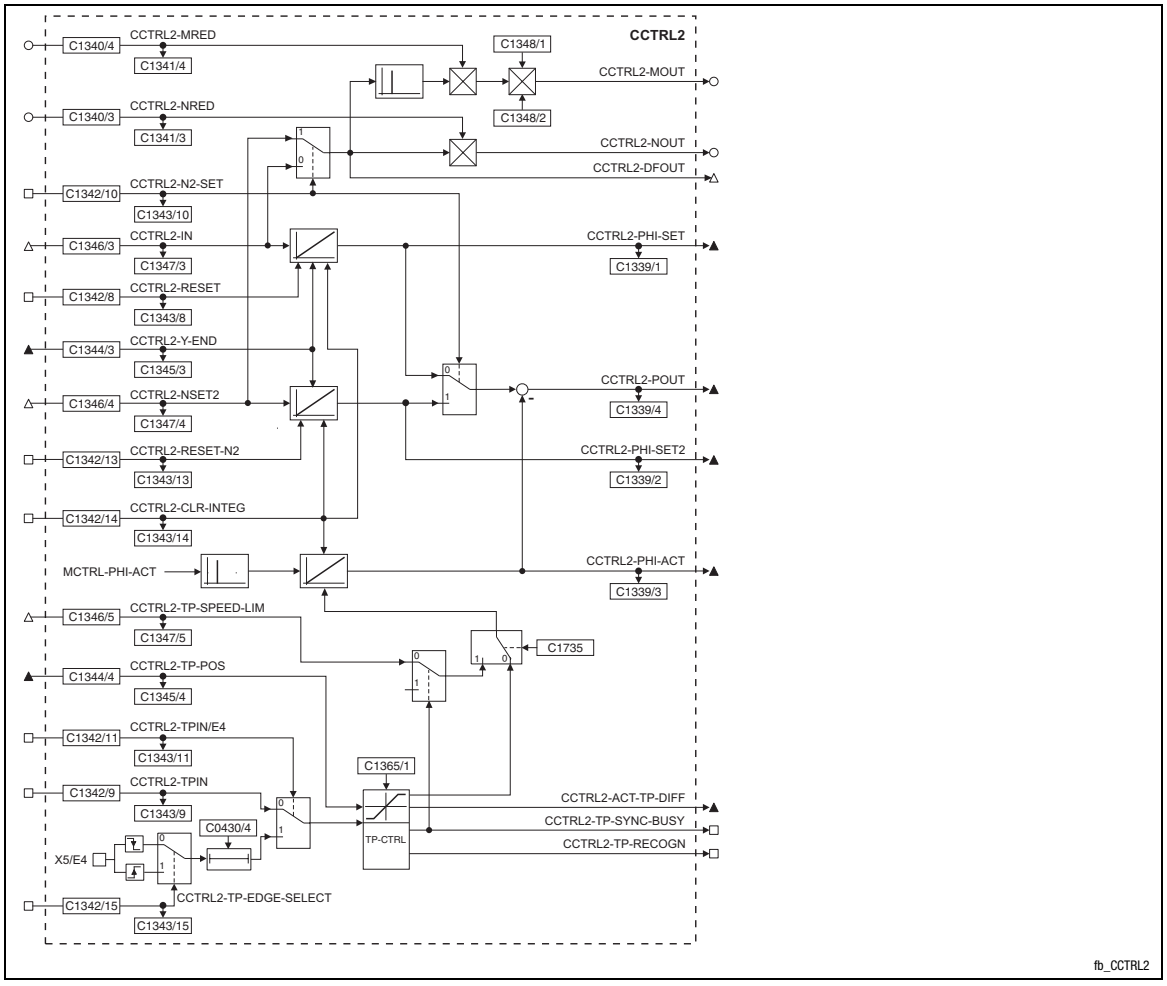
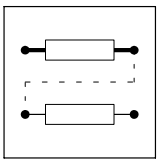


Fig. 3-55 Setpoint conditioning (CCTRL2)



Name	Signal			Source		Note
	Type	DIS	DIS format	CFG	List	
CCTRL2-MRED	a	C1341/4	dec [%]	C1340/4	1	Gain for the torque setpoint feedforward control
CCTRL2-NRED	a	C1341/3	dec [%]	C1340/3	1	Gain for the speed setpoint feedforward control
CCTRL2-N2-SET	d	C1343/10	bin	C1342/10	2	HIGH: Input CCTRL-NSET2 active
CCTRL2-IN	phd	C1347/3	rpm	C1346/3	4	Input for the profile setpoint position
CCTRL2-RESET	d	C1343/8	bin	C1342/8	2	HIGH: Sets setpoint phase = actual phase -> CCTRL2-POUT = 0
CCTRL2-Y-END	ph	C1345/3	inc	C1344/3	3	Final value of the profile (only required for touch probe)
CCTRL2-NSET2	phd	C1347/4	rpm	C1346/4	4	Input for the second machine setpoint position
CCTRL2-RESET-N2	d	C1343/13	bin	C1342/13	2	Deletes the following error if CCTRL2-N2-Set = HIGH
CCTRL2-CLR-INTEG	d	C1343/14	bin	C1342/14	2	HIGH: Sets all integrators to 0
CCTRL2-TP-POS	d	C1345/4	bin	C1344/4	2	Only for touch probe synchronisation. Position of the touch probe sensor in the traversing range
CCTRL2-TP-SPEED-LIM	phd	C1347/5	dec [rpm]	C1346/5	4	Selection of a compensation speed. The input signal is active if CCTRL2-TP-SYNC-BUSY = HIGH and C1735 = 1.
CCTRL2-TPIN/E4	d	C1343/11	bin	C1342/11	2	HIGH: Touch probe via terminal X5/E4 is activated LOW: Touch probe via input CCTRL2-TPIN is activated
CCTRL2-TPIN	d	C1343/9	bin	C1342/9	2	External mark for setting the position
CCTRL2-TP-EDGE-SELECT	d	C1345/15	bin	C1342/15	2	LOW: The HIGH-LOW edge of the input signal at X5/E4 is evaluated. LOW: The LOW-HIGH edge of the input signal at X5/E4 is evaluated.
CCTRL2-MOUT	a				1	Torque setpoint for input MCTRL-M-ADD (torque feedforward control)
CCTRL2-NOUT	a				1	Speed setpoint for input MCTRL-N-SET (speed feedforward control)
CCTRL2-PHI-SET	ph				3	Output of the machine setpoint position
CCTRL2-DFOUT	phd					Speed setpoint
CCTRL2-POUT	ph				3	Following error, input signal for MCTRL-PHI-SET
CCTRL2-PHI-SET2	ph				3	Output of the machine setpoint position of CCTRL-NSET2
CCTRL2-PHI-ACT	ph				3	Output of the actual machine position
CCTRL2-ACT-TP-DIFF	ph				3	Outputs the deviation between the output signal at CCTRL2-PHI-ACT and the input signal at CCTRL2-TP-POS.
CCTRL2-TP-SYNC-BUSY	d				2	Touch probe evaluation: LOW: No deviation measured, or the deviation has already been compensated HIGH: There is a deviation between the integrator and the input signal at CCTRL2-TP-POS that has not been compensated. The compensation speed at CCTRL2-TP-SPEED-LIM is activated if C1740 is set to 1. LOW-HIGH edge: Compensation process completed
CCTRL2-TP-RECOGN	d				2	Output is HIGH for 1 ms in the case of • a HIGH-LOW edge at terminal X5/E4 or • CCTRL2-TPIN/E4 = HIGH

Function

- Profile setpoint position and second machine setpoint (📖 3-76)
- Homing (📖 3-77)
- Set reference once (📖 3-79)
- Speed feedforward control (📖 3-81)
- Torque feedforward control (📖 3-81)

3.2.20.1 Profile setpoint position and second machine setpoint

At CCTRL2-IN, the profile setpoint position is specified. The machine setpoint position is output at CCTRL2-PHI-SET. It is the reference value for controlling the cam.

For auxiliary function like inching mode, position override setpoint (e.g. approaching the cleaning position) or homing, you can define a second machine setpoint position at CCTRL2-PHI-SET2. If a changeover to the second machine setpoint position is effected, the machine setpoint position at CCTRL2-PHI-SET is maintained and can be approached again after the auxiliary function has been completed.

Activating profile setpoint position at CCTRL2-IN

Stop!

Destruction of the machine!

If the outputs CCTRL2-PHI-SET2 and CCTRL2-PHI-SET output different values when the profile setpoint position is activated (CCTRL2-N2-SET = LOW), this will result in uncontrolled machine movements due to following errors.

Protective measures:

Set the outputs CCTRL2-PHI-SET2 and CCTRL2-PHI-SET to the same values before activating the profile setpoint position. You have two possibilities:

- Direct the value at CCTRL2-PHI-SET2 to the value at CCTRL2-PHI-SET via the input signal at CCTRL2-NSET2.
- Set CCTRL2-RESET = HIGH. By this, CCTRL2-PHI-SET is set = CCTRL2-PHI-ACT.

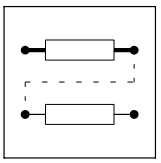
- Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to the same values.
- Set CCTRL2-N2-SET = LOW.
- The integrator for the second machine setpoint is reset. CCTRL2-PHI-SET2 is set = CCTRL2-PHI-ACT, in order to be able to traverse from the current position when the second machine setpoint is activated.

Activating the second machine setpoint at CCTRL2-NSET2

- Set CCTRL2-N2-SET = HIGH.

Resetting the machine setpoint

- Via CCTRL2-RESET = HIGH, CCTRL2-PHI-SET is set = CCTRL2-PHI-ACT.



3.2.20.2 Homing

There are different possibilities of homing the drive:

- For commissioning, the reference is set once (reasonable for machines with risk of collision). (📖 3-77)
- After mains connection, homing is carried out once, so that the drive finds the home position. Possibilities for carrying out the homing process:
  - Via the REFC function block (📖 3-261)
  - Via the function ”Set reference dynamically” (see below).
- Permanent mark registration during running operation (mark synchronisation):
  - Synchronising via touch probe at terminal X5/E4. (📖 3-78)
  - Synchronising via touch probe at CCTRL2-TPIN. (📖 3-79)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with CCTRL2-TPIN/E4 = LOW during homing. (📖 3-263)

Setting the reference dynamically

This function for instance can be used to traverse to the mark in the inching mode.

A) If you activate the function via the input CCTRL2-TPIN:

1. Set CCTRL2-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. Set CCTRL2-TPIN/E4 = LOW.
4. A LOW-HIGH edge at CCTRL2-TPIN activates ”Set reference dynamically”.

B) If you activate the function via terminal X5/E4:

1. Set CCTRL2-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. Set CCTRL2-TPIN/E4 = HIGH.
4. Select the signal edge for the input signal at terminal X5/E4:
   - In the case of CCTRL2-TP-EDGE-SELECT = LOW, HIGH-LOW edges are evaluated.
   - In the case of CCTRL2-TP-EDGE-SELECT = HIGH, LOW-HIGH edges are evaluated.
5. A corresponding signal edge at terminal X5/E4 activates ”Set reference dynamically”.

Synchronisation via touch probe at terminal X5/E4

A touch probe signal at terminal X5/E4 is the quickest and most accurate mark registration and is suited for a cyclic synchronisation.

By means of the touch probe signal, a deviation between CCTRL2-PHI-ACT and CCTRL2-TP-POS is measured. At CCTRL2-ACT-TP-DIFF the deviation is always output as the shortest way. The deviation can be compensated by a compensation speed.

Application examples:

- For applications without a homing function.
- After mains connection, the measuring system of the controller and that of the machine can diverge very much. In the majority of cases, the path to be compensated is very long.
- For applications (e. g. with conveying belts) an occurring slip has to be compensated by cyclic synchronisation. In the majority of cases, the path to be compensated is relatively short.

Procedure:

1. Set CCTRL2-TPIN/E4 = HIGH.
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
   – The input values have to correspond to the cycle (CCTRL2-Y-END). For example, for a cycle of 360 ° only values in the range of -359 ° ... +719 ° may be defined at CCTRL2-TP-POS.
3. Select the source for the compensation speed:
   – C1735 = 0: The compensation speed is defined via C1365/1 (Lenze setting).
   – C1735 = 1: The compensation process is controlled by selection of a profile at CCTRL2-TP-SPEED-LIM.

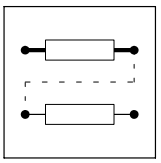
Note!

- The CCTRL2 function block does not contain a profile generator. The profiles have to be generated via additional function blocks (e.g. RFGPH2 or RFGPH3). See also example in fig. 3-205.
- Do not specify constant values at CCTRL2-TP-SPEED-LIM (e.g. via free codes (FCODE)).

4. Select the signal edge for the input signal at terminal X5/E4:
   – In the case of CCTRL2-TP-EDGE-SELECT = LOW, HIGH-LOW edges are evaluated.
   – In the case of CCTRL2-TP-EDGE-SELECT = HIGH, LOW-HIGH edges are evaluated.
5. A corresponding signal edge at terminal X5/E4 synchronises the drive to the set position which is output at CCTRL2-PHI-SET.

Note!

- The set profile position has to be activated (CCTRL2-N2-SET = LOW).
- For applications with feed, the final Y value of the profile must be assigned to the input CCTRL2-Y-END (e.g. by output CDATA2-Y-END). The function is not suitable for stretching and compression.
- Save the settings with C0003 = 1 and switch the mains voltage off and on again.
  – When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.



Synchronisation via touch probe at CCTRL2-TPIN.

The input CCTRL2-TPIN is suitable for a one-time synchronisation and sets the position of the drive in standstill.

Procedure:

1. Set CCTRL2-TPIN/E4 = LOW.
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. A LOW-HIGH edge at CCTRL2-TPIN synchronises the drive to the set position which is output at CCTRL2-PHI-SET.

3.2.20.3 Setting the reference once

Stop!

- If a parameter set is downloaded, C1367/1 is not transferred, as for **each** commissioning the actual, current position of the tool to the machine zero point has to be entered in the code. The position of the actual value encoder (multi-turn absolute value encoder) depends on the rotor position when the motor is mounted to the machine, and on the actual position of the tool. A new setting therefore is required as soon as a drive component is not tied positively anymore.
- If the feedback system is switched over, also the machine zero point has to be re-entered (the synchronisation always is effected via the feedback system and is specifically adapted to it).

The function “Set reference” only has to be carried out once:

1. Enter the current distance [s-units] of the tool to the machine zero point in C1367/1 (set reference).
2. Switch the controller off and then on again, in order to reinitialise the profile data.
   – After every mains connection, the controller automatically determines the current distance to the machine zero point, which is output at CCTRL2-PHI-SET2 (C1339/2) and CCTRL2-PHI-ACT (C1339/3).
   – The profile position is output at CCTRL2-PHI-SET after mains connection.
3. Where required, position the drive to the profile via the RFGPH2 function block.

Frequent zero shifting

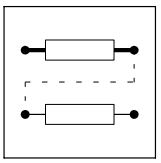
Procedure for applications with frequent zero shifting:

1. Disconnect the drive from the profile (CCTRL2-N2-SET = HIGH)
2. Carry out function “Set reference” via touch probe
3. Set input CCTRL2-N2-SET to HIGH
4. Set input CCTRL2-TPIN/E4 to LOW
5. Assign the current distance of the tool to the machine zero point to the input CCTRL2-TP-POS.
   – Enter, for instance, define a corresponding value via C1477/x [s-units] or C0474/x [inc].
6. Generate a LOW-HIGH edge at input CCTRL2-TPIN and then reset the input to LOW.
   – The distance to the machine zero point is automatically saved with mains failure protection and is again available after mains connection.

Now the drive can be positioned to the profile position via the RFGPH2 or RFGPH3 function blocks. This function, however, must be configured manually since it is not included in the basic configurations.

Note!

- It is also possible to use absolute value encoders without homing function.
- Up to software version 3.3, the absolute value encoder must not have a zero crossing within the measuring system of the machine. If necessary, the motor must be turned during the commissioning procedure into the appropriate position before being mounted.
- From software version 3.4, the zero crossing is considered automatically.
- The following applies to all software versions:
  If the encoder is not supplied anymore (mains and DC 24 V are switched off), the encoder may only be turned within certain limits:
  – Single-turn absolute value encoders/resolvers by max. ±179.0 °
  – Multi-turn absolute value encoders by max. ±2079.9 revolutions



3.2.20.4 Speed feedforward control

Via the speed feedforward control the faster control loops are activated earlier. Use this function if the drive generates a contouring error (negative or positive) when accelerating.

- Via the input CCTRL2-NRED the feedforward control can be decreased or increased proportionally to the phase setpoint change dφ/dt.
- Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
- Values < 100% decrease the feedforward control. If the gain is too low, the drive generates a following error (drive lags) during acceleration or braking (dynamic).

Note!

The input value at CCTRL2-NRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.20.5 Torque feedforward control

Via the torque feedforward control the faster (internal) control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating. Where required, you have to increase the reset time of the n-controller.

Stop!

The torque feedforward control has a much more sensitive influence on the drive than the speed feedforward control.

- The feedforward control can be increased or decreased proportionally to the speed change dn/dt via the input CCTRL2-MRED.
  - Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
  - Values < 100% decrease the feedforward control. If the gain is too low, the drive generates a following error (drive lags) during acceleration or braking (dynamic).
- With codes C1348/1 (numerator) and C1348/2 (denominator), the feedforward control can be adapted to the inertia of the machine.

Note!

The input value at CCTRL2-MRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.21 Following error monitoring (CERR)

One function block (CERR1) is available.

Purpose

Following error monitoring with pre-warning stage.

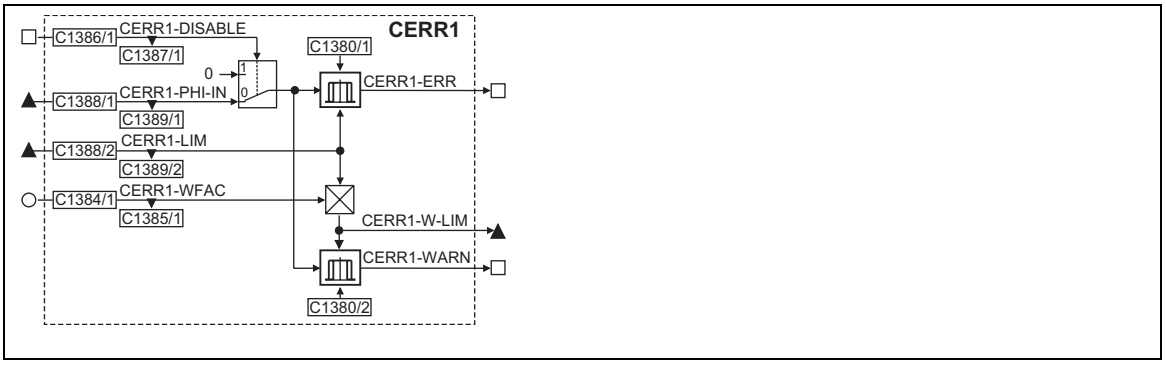


Fig. 3-56 Following error monitoring (CERR)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CERR1-WFAC	a	C1385/1	dec [%]	C1384/1	1	Reduction factor for CERR1-WARN: +100 % = no reduction <100 % = reduction >100 % = increase
CERR1-DISABLE	d	C1387/1	bin	C1386/1	1	HIGH sets CERR1-WARN and CERR1-EER = 0
CERR1-PHI-IN	ph	C1389/1	dec [inc]	C1388/1	4	Input
CERR1-LIM	ph	C1389/2	dec [inc]	C1388/2	4	Switching threshold, the absolute value is generated from the input value
CERR1-ERR	bin					Input value CERR1-PHI-IN has exceeded the limit CERR1-LIM
CERR1-WARN	bin					Input value CERR1-PHI-IN has exceeded the limit CERR1-LIM × CERR1-WFAC / 100 %
CERR1-WLIM	ph					Warning limit in inc

Function

- Evaluation of the following error
- Defenition of the following error limits
- Output of status signals
- Deactivation of the output

3.2.21.1 Evaluation of the following error

The actual following error signal is generated by the function block CCTRL (output CCTRL-POUT) and is read at CERR1-PHI-IN (see e.g. signal-flow diagramm, configuration 1000).

In the function block it is compared with the configurable following error limit CERR1-LIM. If the set limit is exceeded, the following error warning is output at CERR1-ERR.

Input signal		Output signal
CERR1-PHI-IN	Within the window	CERR1-ERR = LOW
	Outside the window	CERR1-ERR = HIGH

CERR1-LIM generates a window around 0 inc.

3.2.21.2 Definition of the following error limits

- The following error limit is defined at the input CERR1-LIM.
- The limit for the following error pre-warning is determined via the reduction value CERR1-WFAC.
  – Limit value calculation for the following error pre-warning:

$$|\text{CERR1-LIM}| \cdot \frac{|\text{CERR1-WFAC}|}{100\ \%}$$

Note!

The input values at CERR1-LIM are limited to a maximum of 4194300 inc (4194300 inc = 63.9 × motor revolutions).

3.2.21.3 Output of status signals

The digital outputs CERR1-ERR and CERR1-WARN indicate if the actual limit values for following errors and following error pre-warning are exceeded or fallen below.

Enter a hysteresis under codes C1380/1 and C1380/2 to avoid instable behaviour at the change over point.

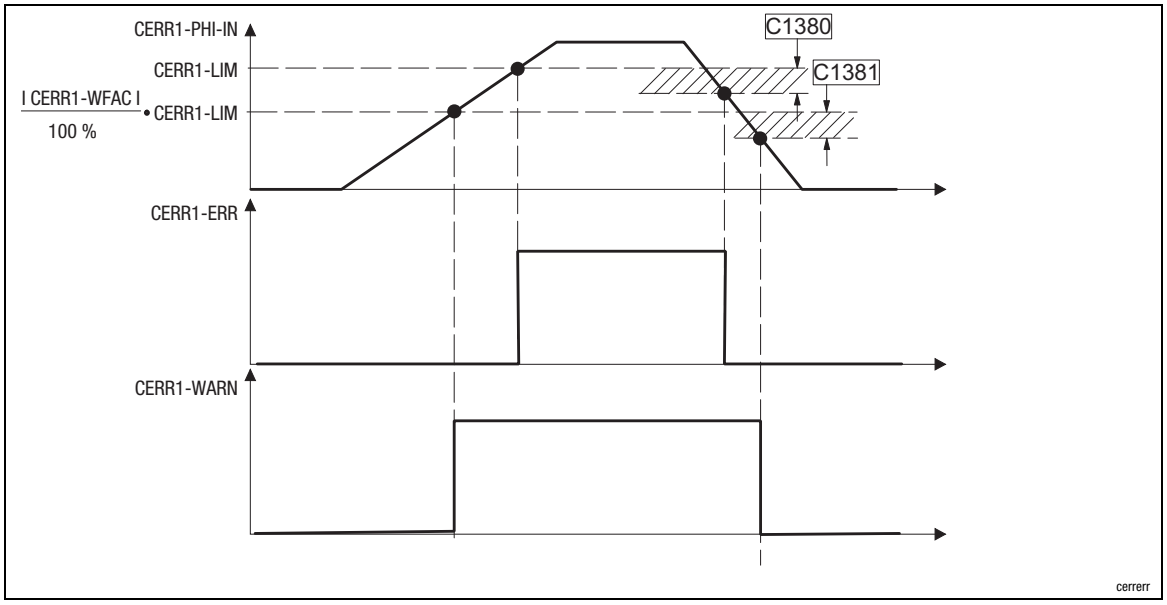


Fig. 3-57 Signal behaviour CERR1-ERR and CERR1-WARN

Code	Meaning	Note
C1380/1	Following error hysteresis	
C1380/2	Warning hysteresis	

3.2.21.4 Deactivating the output

The output of following errors and following error warnings can be deactivated with CERR1-DISABLE = HIGH.

3.2.22 Virtual clutch (CLUTCH1)

Purpose

Engagement and disenConnection and disengagement of the X or Y axis.

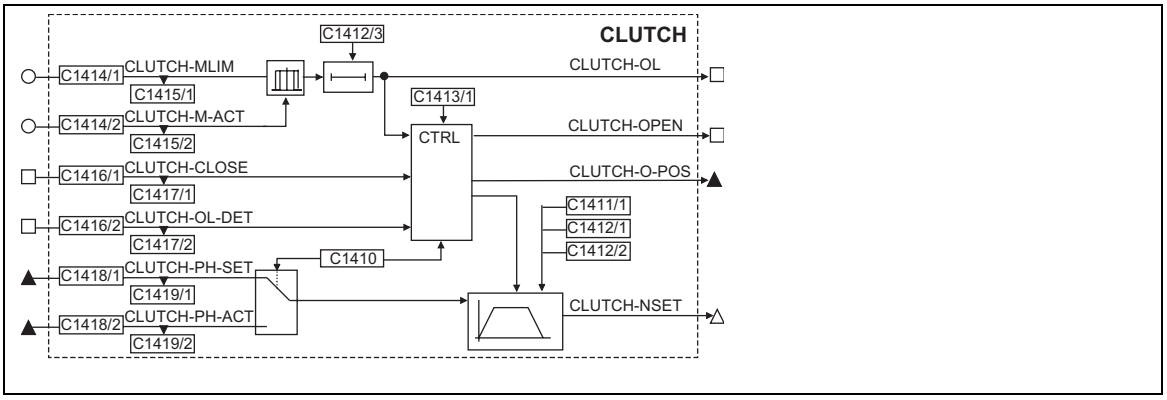


Fig. 3-58 Virtual clutch (CLUTCH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH1-MLIM	a	1415/1	dec [%]	1414/1	1	Threshold for "overload" monitoring
CLUTCH1-MACT	a	1415/2	dec [%]	1414/2	1	Act. value for "overload" monitoring
CLUTCH1-CLOSE	d	1417/1	bin	1416/1	2	HIGH: Close clutch LOW: Open clutch
CLUTCH1-OL-DET	d	1417/2	bin	1416/2	2	HIGH: Activate overload monitoring
CLUTCH1-PHI-SET	ph	1419/1	inc	1418/1	3	Set drive position
CLUTCH1-PHI-ACT	ph	1419/2	inc	1418/2	3	Actual drive position
CLUTCH1 -OPEN	d				1	HIGH: Clutch open
CLUTCH1-OL	d				1	HIGH: overload monitoring has responded
CLUTCH1-O-POS	ph				3	Position, in which the clutch has been disengaged (65536 inc = 1 motor rev.)
CLUTCH1-NSET	phd				4	Speed setpoint for: • Brake drive after command OPEN • Set drive to target position • Set drive to open-position

Function

- Overload monitoring (chapter. 3.2.22.1)
- Disengage clutch (chapter 3.2.22.2)
- Engage clutch (chapter 3.2.22.3)

3.2.22.1 Overload monitoring

The clutch function can be activated when overload occurs (e.g. torque overload).

Inputs for overload monitoring

- CLUTCH1-MACT
  - Assign the actual value of the value to be monitored (e.g. MCTRL-MACT). The input signal is processed as an absolute value.
- CLUTCH1-OL-DET = HIGH (e.g. assign FIXED1). Activating the overload monitoring.
  - CLUTCH1-OL-DET = LOW. Monitoring only sets the output CLUTCH1-OL = HIGH. **No** entry is made in the history buffer!
- CLUTCH1-MLIM
  - Definition of the monitoring threshold

Overload monitoring is active if

- CLUTCH1-MACT > CLUTCH1-MLIM
  - Output CLUTCH1-OL = HIGH (irrespective of input CLUTCH1-OL-DET). The output remains on HIGH until an L→H edge occurs at the input of CLUTCH1-CLOSE.
  - The clutch is disengaged when CLUTCH1-OL-DET=HIGH.

Note!

Code C1412/3 is used to set a delay time which has to expire before the time when the overload is indicated.

Monitoring will be reset if the load conditions go back to normal within the delay time set.

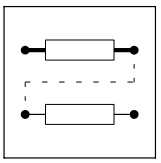
3.2.22.2 Disengage clutch

In contrast to the mechanical clutch, the clutch function CLUTCH1 only causes the drive to be really disconnected from the master value or profile shape. This serves to brake the drive to standstill in a controlled way.

- CLUTCH1-OPEN = HIGH (clutch open):
  - Input CLUTCH1-CLOSE = LOW or
  - Activation of the overload monitoring
- Speed control to standstill (CLUTCH1-NSET)

The output CLUTCH1-NSET provides a corresponding speed setpoint with which the drive is decelerated to standstill.

The deceleration time can be set under C1412/1.



3.2.22.3 Engage clutch

The function is activated with a HIGH signal at input CLUTCH1-CLOSE.

For the time required to start cam operation again, the function of the speed setpoint at CLUTCH1-NSET can be configured under C1410.The alternatives are as follows:

- Engage clutch immediately
- Set drive back to open-position, engage clutch
- Set drive to target position, engage clutch
- Latch at setpoint position

After the selected function has been processed the output CLUTCH1-OPEN is set to LOW.

Engage clutch immediately

- C1410 = 0
  - The output CLUTCH1-OPEN is immediately set to LOW.

Set drive back to open-position

- C1410 = 1
  - The actual position at input CLUTCH1-PHI-ACT is saved when the monitoring is responder or a HIGH LOW edge occurs at input CLUTCH1-CLOSE.

Note!

The actual position is **lost** after mains switching.

A LOW HIGH edge at input CLUTCH1-CLOSE starts a profile generator which can be used to set the drive back to the open-position.

- Acceleration/deceleration time adjustable under C1412/2
- Max. speed adjustable under C1411/1
- A corresponding speed setpoint is output at -NSET.

CLUTCH1-OPEN is set to LOW when the open-position is reached.

Set drive to target position

- C1410 = 2

A LOW→HIGH edge at the input CLUTCH1-CLOSE starts a profile generator which serves to take the drive to the target position. The target position must be defined at CLUTCH1-PHI-SET.

- Acceleration/deceleration time adjustable under C1412/2
- Max. speed adjustable under C1411/1

A corresponding speed setpoint is output at CLUTCH1-NSET.

CLUTCH1-OPEN is set to LOW when the target position is reached.

Latch at setpoint position

- C1410 = 3

The drive remains in standstill until CLUTCH - PHI-ACT = CLUTCH - PHI-SET.

After a LOW HIGH edge at input CLUTCH1-CLOSE

- the output CLUTCH1-NSET outputs the speed setpoint 0
- CLUTCH1-PHI-ACT = CLUTCH1-PHI-SET sets the output CLUTCH1-OPEN=LOW,
- the hysteresis is adjustable under C1413/1.

3.2.23 Virtual clutch (CLUTCH2)

Purpose

Position-accurate engagement of the X axis (line shaft) with adjustable acceleration and deceleration ramps.

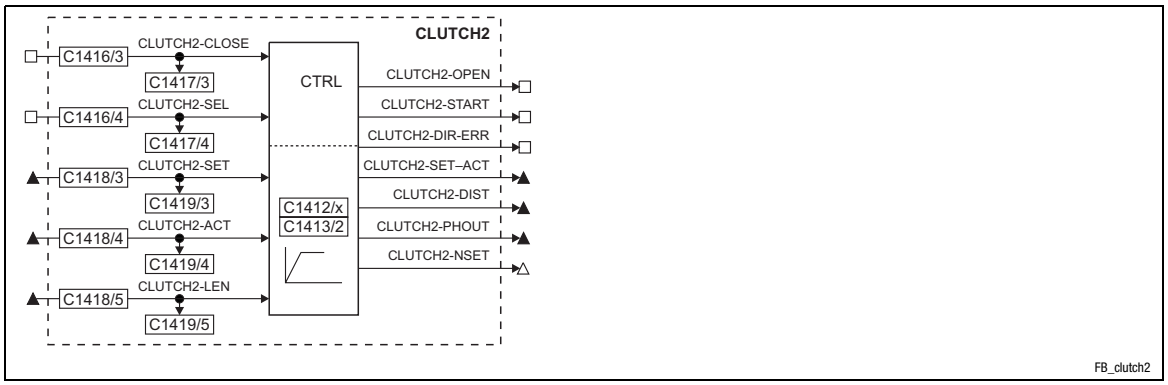


Fig. 3-59 Virtual clutch (CLUTCH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH2-CLOSE	d	1417/1	bin	1416/1	2	HIGH: Close clutch LOW: Open clutch
CLUTCH2-SEL	d	1417/2	bin	1416/2	2	HIGH: Close clutch immediately LOW: Wait for position setpoint, then close
CLUTCH2-SET	ph	1419/1	inc	1418/1	3	Setpoint position of X axis (line shaft)
CLUTCH2-ACT	ph	1419/2	inc	1418/2	3	Actual position of X axis (line shaft)
CLUTCH2-LEN	ph	1419/2	inc	1418/2	3	Clock pulse length (X axis)
CLUTCH2-OPEN	d	-	-	-	-	HIGH: Clutch open LOW: Clutch engaged
CLUTCH2-START	d	-	-	-	-	HIGH: Clutch received command to close
CLUTCH2-DIR-ERR	d	-	-	-	-	HIGH: Error of direction of rotation
CLUTCH2-SET–ACT	ph	-	-	-	-	Output of the differential signal of CLUTCH2-ACT – CLUTCH2-SET if CLUTCH2-CLOSE = HIGH • The output corresponds to the distance still to be compensated • The output refers to the set acceleration ramp and can take several clock pulses
CLUTCH2-DIST	ph	-	-	-	-	Distance required for acceleration
CLUTCH2-PHOUT	ph	-	-	-	-	Output of the ”internal” master angle position • The signal refers to one machine pulse (0 ... CDATA-ACTLEN) • Can be used as input signal for CDATA-XIN • The ”external” master angle is applied to CLUTCH2-SET. If the clutch is closed, the ”external” and ”internal” master angles are identical.
CLUTCH2-NSET	phd	-	-	-	-	Speed setpoint

Function

- Clutch engagement through ramp function with following synchronous running (chapter 3.2.23.1)
- Direct clutch engagement (chapter 3.2.23.2)
- Clutch disengagement (chapter 3.2.23.3)

3.2.23.1 Clutch engagement through ramp function with following synchronous running

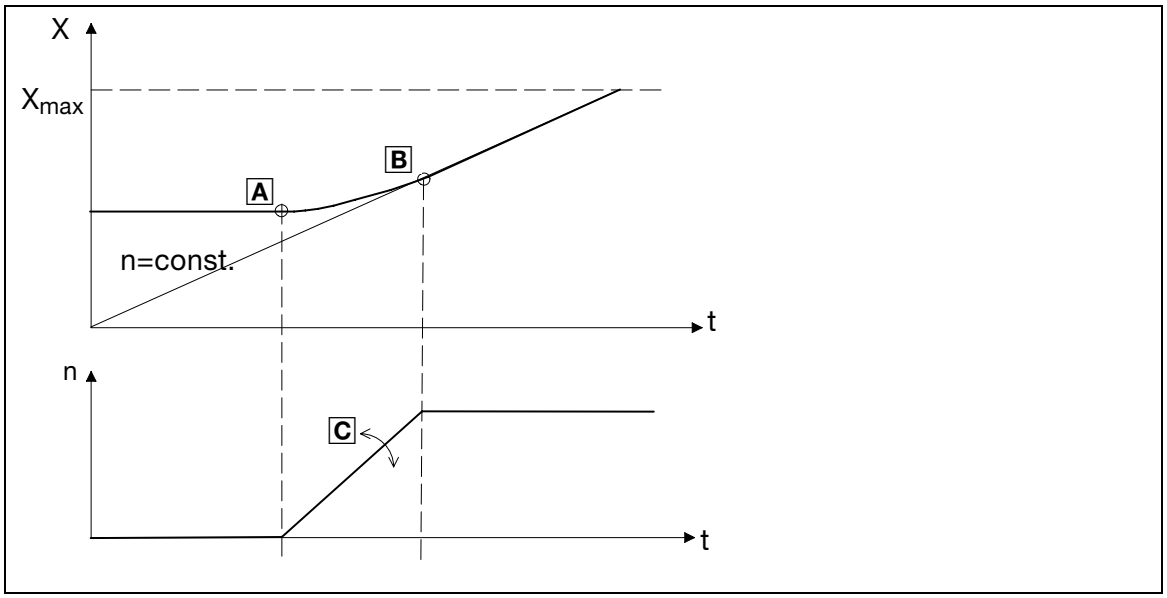


Fig. 3-60 Transition characteristic of a cam drive when engaging the clutch and then running synchronously

After the cam drive has paused - mostly process-related - it can be synchronized again to the process with a constantly operating master drive with CLUTCH2. At the time of engaging B both drives have synchronous speeds and the same positions.

In Fig. 3-60, A the catching-up process is started. The distance required at this time(CLUTCH2-DIST) is calculated from the following parameters:

- Ramp gradient, code C1412/5 (see Fig. 3-60, C)
- n_{max} of the cam drive

CLUTCH2-DIST is available at the output of the function block and is a measure for the distance still to be caught up. If CLUTCH2-DIST = 0, the clutch can be closed (CLUTCH2-CLOSE = HIGH) due to the synchronous behaviour of both drives (Fig. 3-60, B).

Note!

- Clutch engagement only possible when drive is rotating in CW direction.
- Connect the output CDATA-ACTLEN (function block CDATA) with the input CLUTCH2-LEN to determine the position of the X axis (master).

3.2.23.2 Direct clutch engagement

The clutch immediately closes when CLUTCH2-SEL = HIGH.

Note!

Please observe that the command CLUTCH2-SEL = HIGH has priority over all other commands at function block CLUTCH2.

This function is only suitable for drives at stand still.

3.2.23.3 Disengagement of the clutch

When CLUTCH2-CLOSE = LOW the clutch is opened immediately. The drive is braked to standstill via an adjustable ramp (C1412/4).

3.2.24 Clutch (CLUTCH 3)

Purpose

The CUTCH3 function block forms the interface between the external and internal master angle in synchronous systems. CLUTCH3 has the following features:

- Engaging and disengaging at positive or negative direction of rotation of the master angle.
- Disengaging with standstill at an adjustable target point or with synchronous running to a specified point.
- Engaging and disengaging in a time-controlled manner.
- Adjustable minimum speed in the disengaged state (e. g. for printing machines).

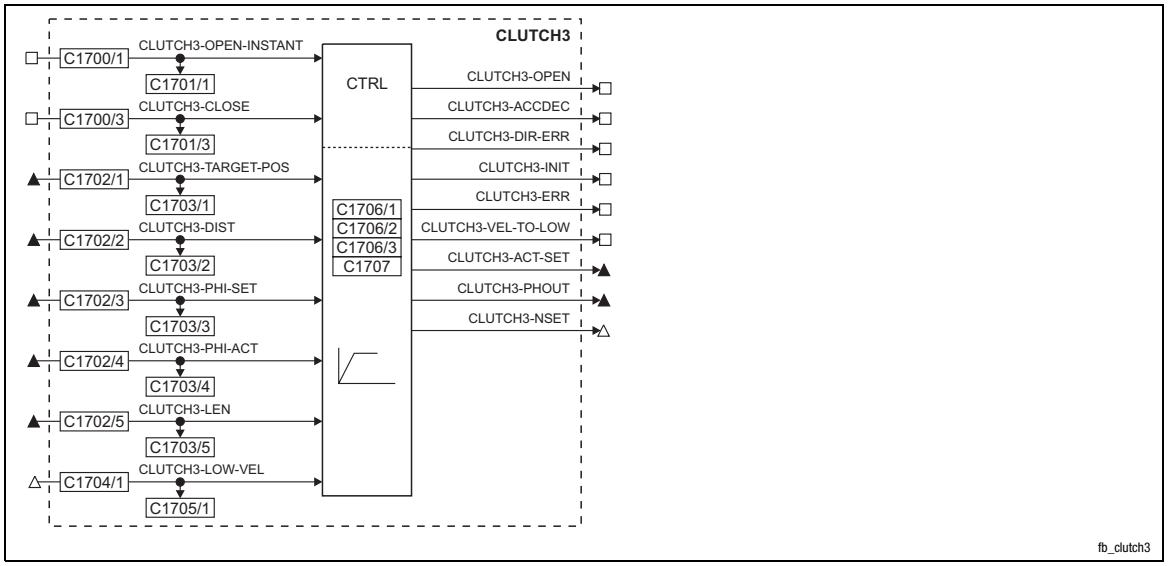
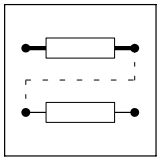


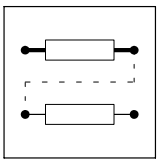
Fig. 3-61 Clutch (CLUTCH3)



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH3-OPEN-INSTANT	d	C1701/1	bin	C1700/1	2	HIGH: Disengage immediately, reset fault messages
CLUTCH3-CLOSE	d	C1701/3	bin	C1700/3	2	HIGH: Close clutch LOW: Open clutch
CLUTCH3-TARGET-POS	ph	C1703/1	dec [inc]	C1702/1	3	Specification of the target position
CLUTCH3-DIST	ph	C1703/2	dec [inc]	C1702/2	3	Reserved
CLUTCH3-PHI-SET	ph	C1703/3	dec [inc]	C1702/3	3	Setpoint position of the external master angle
CLUTCH3-PHI-ACT	ph	C1703/4	dec [inc]	C1702/4	3	Actual position of the internal master angle
CLUTCH3-LEN	ph	C1703/5	dec [inc]	C1702/5	3	Clock pulse length (X axis)
CLUTCH3-LOW-VEL	phd	C1705/1	dec [rpm]	C1704/1	4	Specification of a minimum speed with which the internal master angle is to rotate after disengaging
CLUTCH3-OPEN	d				2	HIGH: Clutch disengaged LOW: Clutch engaged
CLUTCH3-ACC/DEC	d				2	HIGH: Signal at CLUTCH3-PHOUT and CLUTCH3-NSET is accelerated LOW: Signal at CLUTCH3-PHOUT and CLUTCH3-NSET is decelerated
CLUTCH3-DIR-ERR	d				2	HIGH: The input signals at CLUTCH3-PHI-SET and CLUTCH3-PHI-ACT have an opposite direction of rotation
CLUTCH3-INIT	d				2	Reserved
CLUTCH3-ERR	d				2	General error message from CLUTCH3 • HIGH: The process of engaging the clutch has been started although the disengaging process had not yet been completed. • The value 0 is applied at CLUTCH3-LEN.
CLUTCH3-VEL-TO-LOW	d				2	HIGH: The process of engaging the clutch cannot be carried out, as the speed at CLUTCH3-PHI-SET is $< 4\ min^{-1}$
CLUTCH3-ACT-SET	ph				3	Differential signal between CLUTCH3-ACT-SET and CLUTCH3-PHI-SET if CLUTCH3-CLOSE is set = HIGH • The differential signal corresponds to the distance of the internal master angle still be compensated until it runs synchronously with the external master angle.
CLUTCH3-PHOUT	ph				3	Output of the internal master angle position • The signal refers to one machine clock pulse (CLUTCH3-LEN) • The signal can be linked to CDATA-XIN. • If the clutch is engaged, the external and internal master angles are running synchronously.
CLUTCH3-NSET	phd				4	Speed setpoint

Function

- Important notes (📖 3-93)
- Fault messages (📖 3-93)
- Disengage immediately (📖 3-93)
- Minimum speed after disengaging (📖 3-94)
- Time-controlled engaging (📖 3-95)
- Selection of the disengaging position (📖 3-96)
- Selection of the target position in the disengaged state (📖 3-97)
- Time-controlled disengaging in target position (📖 3-97)
- Time-controlled disengaging at the disengaging position (📖 3-99)
- Engaging the clutch at different positions of the external master angle (📖 3-100)
- Time-controlled engaging (📖 3-102)



3.2.24.1 Important notes

- A compensation function with an oversynchronous speed for engaging the clutch is not possible. This function can be implemented via the DFRFG function block.
- The following actions may only be carried out if the clutch is disengaged or engaged. During the process of engaging or disengaging the clutch, they will result in malfunctions.
  - Setting ramps in C1706/1 ... C1706/3
  - Altering clutch mode in C1707
  - Altering input value at CLUTCH3-DIST
  - Altering input value at CLUTCH3-LEN
  - Altering input value at CLUTCH3-LOW-VEL
  - Altering input value at CLUTCH3-TARGET-POS

3.2.24.2 Fault messages

If a fault occurs, the function block is automatically controlled to the status ”Declutch immediately“. The output CLUTCH3-PHOUT is directed to 0 at the ramp set in C1706/1.

Fault messages	Cause	Remedy	Note
CLUTCH3-DIR-ERR = HIGH	The master angles at CLUTCH3-PHI–SET and the actual angle at CLUTCH-PHI–ACT have an opposite direction of rotation.	• Apply signals with the same direction of rotation. • Check signal combination of the inputs. • Extend the speed window in C1708/1 if the master value is troubled or fluctuates.	Monitoring is only active during engaging the clutch.
CLUTCH3-ERR = HIGH	The process of engaging the clutch has been started although the declutching process had not yet been completed.	Wait until the declutching process is completed.	General error for requirements beyond the specification of the function block.
	The value 0 is applied at CLUTCH3-LEN.	Apply signal of the machine cycle or the register length. The value has to be > 0.	

- Fault messages are reset by CLUTCH3-OPEN-INSTANT = HIGH.

3.2.24.3 Disengaging immediately

Description

You can use the function for disengaging under normal operating conditions or for disengaging in the case of a fault.

Function sequence

- Start disengaging with CLUTCH3-OPEN-INSTANT = HIGH.
- The output CLUTCH3-PHOUT is directed immediately to the speed at CLUTCH3-LOW-VEL along the ramp set in C1706/1.
- In the case of speed variations at CLUTCH3-LOW-VEL, the output CLUTCH3-PHOUT is corrected along the ramp.

3.2.24.4 Minimum speed after disengaging

Description

For printing units, the drive may not be brought into standstill after disengaging, because the paint dries up. The printing unit has to continue rotating at a minimum speed.

Function sequence

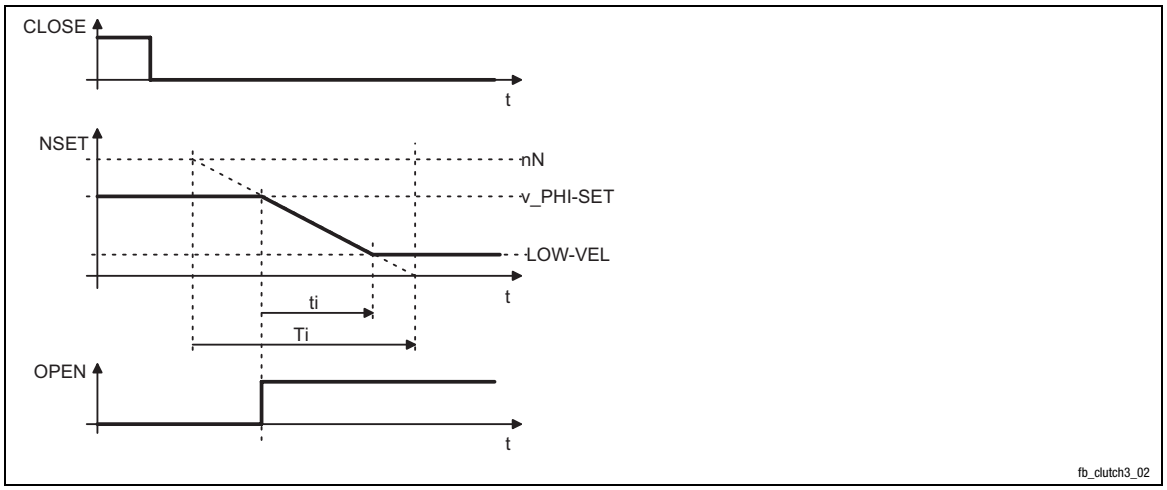


Fig. 3-62 Path-time diagram: Disengaging process

v_PHI-SET	Speed of the external master angle at CLUTCH3-PHI-SET
nN	Machine speed
NSET	Speed setpoint at CLUTCH3-NSET
LOW-VEL	The minimum speed which is taken up after disengaging is specified at CLUTCH3-LOW-VEL.
CLOSE	With CLUTCH3-CLOSE = LOW, the declutching process is started. After disengaging, all ramps are deactivated. In the case of speed variations at CLUTCH3-LOW-VEL, the output CLUTCH3-NSET is directly corrected.

3.2.24.5 Time-controlled engaging

Description

The engaging distance (acceleration distance), the start position and sync position result from the acceleration time Ti (C1706/3) or the deceleration time Ti (C1706/2) and from the speeds at CLUTCH3-PHI-SET and CLUTCH3-PHI–ACT.

The acceleration acts in accordance with the time Ti and therefore is independent of the machine speed.

The engaging distance depends on the machine speed. If the speed is high, the engaging distance and the duration of the asynchronism is longer than for a lower speed.

Function sequense

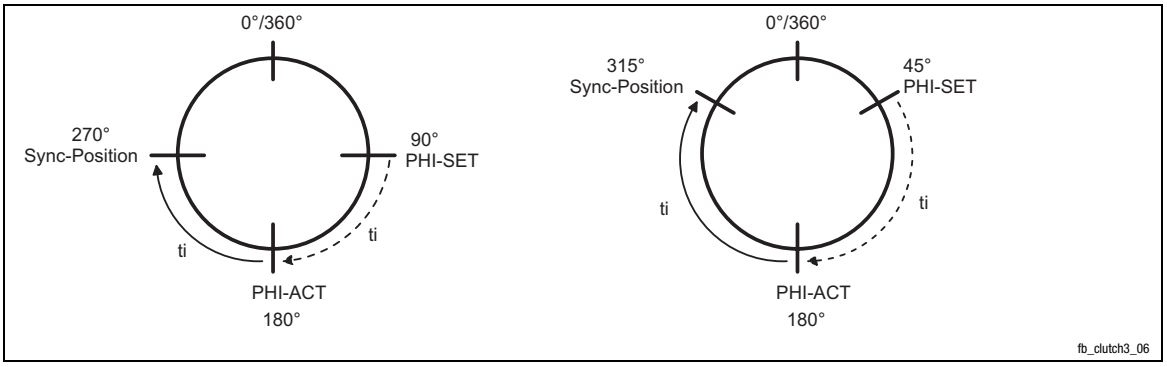


Fig. 3-63 Angle diagrams: Two clutch-engagement processes with different speeds

The two angle diagrams show two clutch-engagement processes at the start of synchronising with equal acceleration times Ti (C1706/3), but with different machine speeds. From this, different engaging distances result.

Engaging process for the angle diagram on the right:

- The internal master angle (PHI-ACT) is at 180 ° with a speed of 0 min^{-1}.
- On the basis of the Ti-time set and the speed of the external master angle (PHI-SET), an acceleration distance of 135 ° results.
- After the acceleration distance of 135 °, PHI-SET crosses the starting position and the process of engaging the clutch is automatically initiated if CLUTCH3-CLOSE = HIGH.
- In the sync position, PHI-SET and PHI-ACT are running synchronously with regard to speed and angle (position).
  – From the start position to the sync position, PHI-SET covers twice the distance of PHI-ACT.

Calculation of the ramps

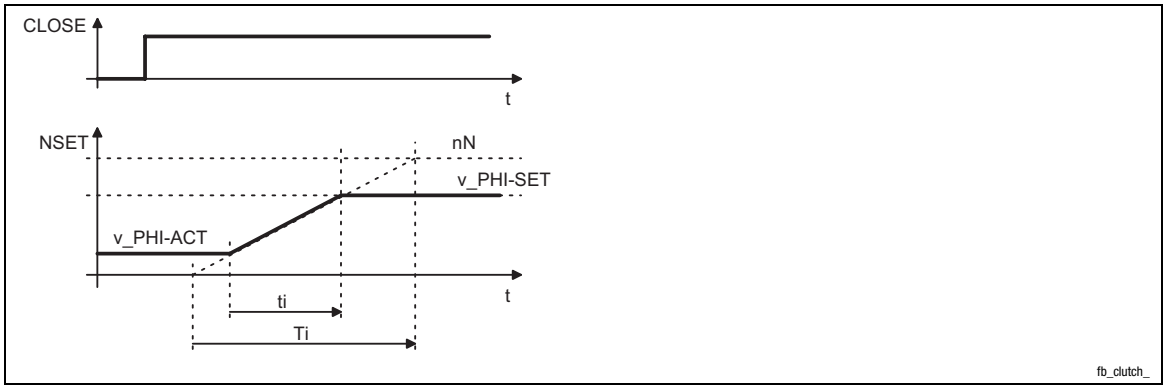


Fig. 3-64 Path-time diagram: Time-controlled engaging

$$ti = \frac{Ti \cdot nN}{(v\_PHI\text{-}SET - v\_PHI\text{-}ACT)}$$

ti	Actual duration of the process of engaging the clutch
Ti	Acceleration time of the ramp in C1706/3 for the clutch-engaging, relating to a speed variation from 0 to the machine speed nN
v_PHI-SET	Speed of the external master angle
v_PHI-ACT	Minimum speed at CLUTCH3-LOW-VEL (in the disengaged state, v_PHI-ACT is = CLUTCH3-LOW-VEL)

3.2.24.6 Selection of the disengaging position

Description

The disengaging position is specified if an operation has to be completed before the disengaging process may be initiated.

Function procedure

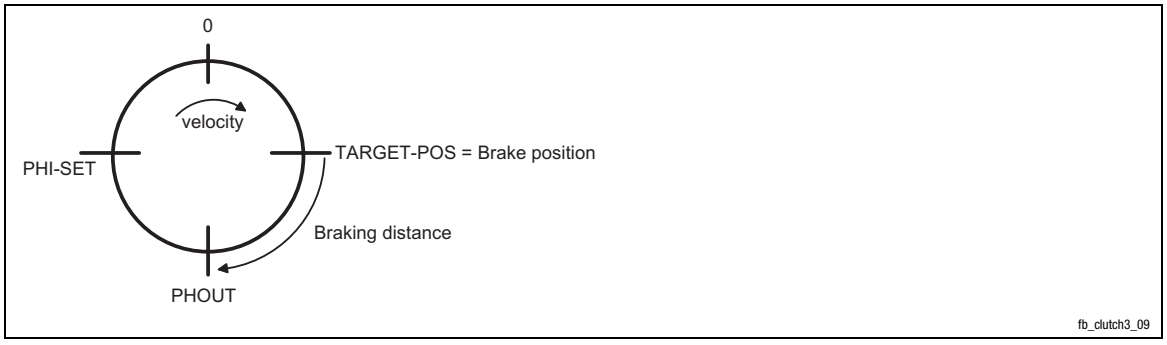


Fig. 3-65 Angle diagram: Disengaged status at zero speed

The internal master angle (PHOUT) is running synchronously to the external master angle (PHI-SET) until the position at CLUTCH3-TARGET-POS is crossed. Then drive is decelerated to the speed at CLUTCH3-LOW-VEL.

Adjustment

- Set C1707 = 1.
- Define the disengaging position at CLUTCH3-TARGET-POS.
- Start the disengaging process with CLUTCH3-CLOSE = LOW.

3.2.24.7 Selection of the target position in the disengaged state

Description

The target position is specified if the drive has to be set to a specific position in the disengaged state.

As the internal master angle corresponds to the target position, the tool position can be derived from the internal master angle.

Function sequence

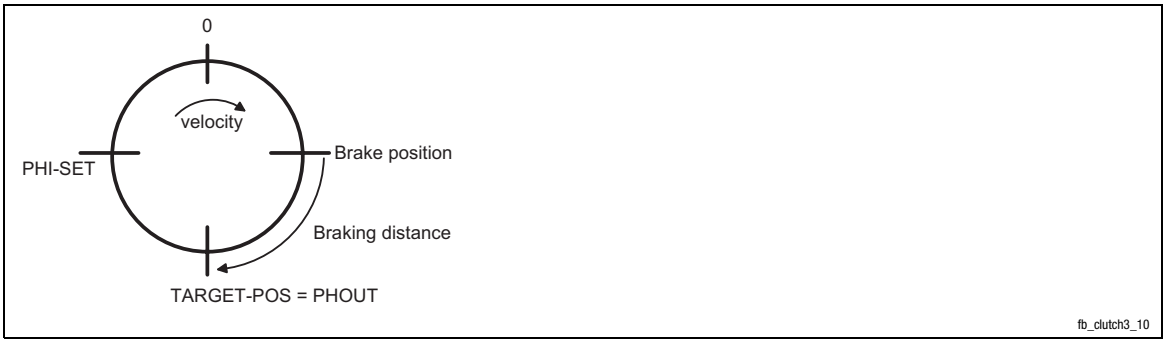


Fig. 3-66 Angle diagram: Disengaged status at zero speed

- The internal master angle (PHOUT) is running synchronously to the external master angle (PHI-SET) until the braking position has been crossed.
  - The braking position always is before the target position.
- If the braking position is crossed, the drive is celerated to the speed at CLUTCH3-LOW-VEL.
  - If CLUTCH3-LOW-VEL = 0, the internal master angle is exactly on the target position.

Adjustment

- Set C1707 = 0.
- Define the target position at CLUTCH3-TARGET-POS.
- Start the disengaging process with CLUTCH3-CLOSE = LOW.

3.2.24.8 Time-controlled disengaging in target position

Description

The function is required for applications with material transfer (e.g. placing caps on the bottles and screwing them).

If there are no bottles in the machine, no caps may be feeded. The cap feed is disengaged for one or several machine pulses, until bottles are available again. If disengaging is to be carried out, it may only be started with the following machine pulse. In the disengaged state, the cap feed has to be in a defined target position.

Function sequence

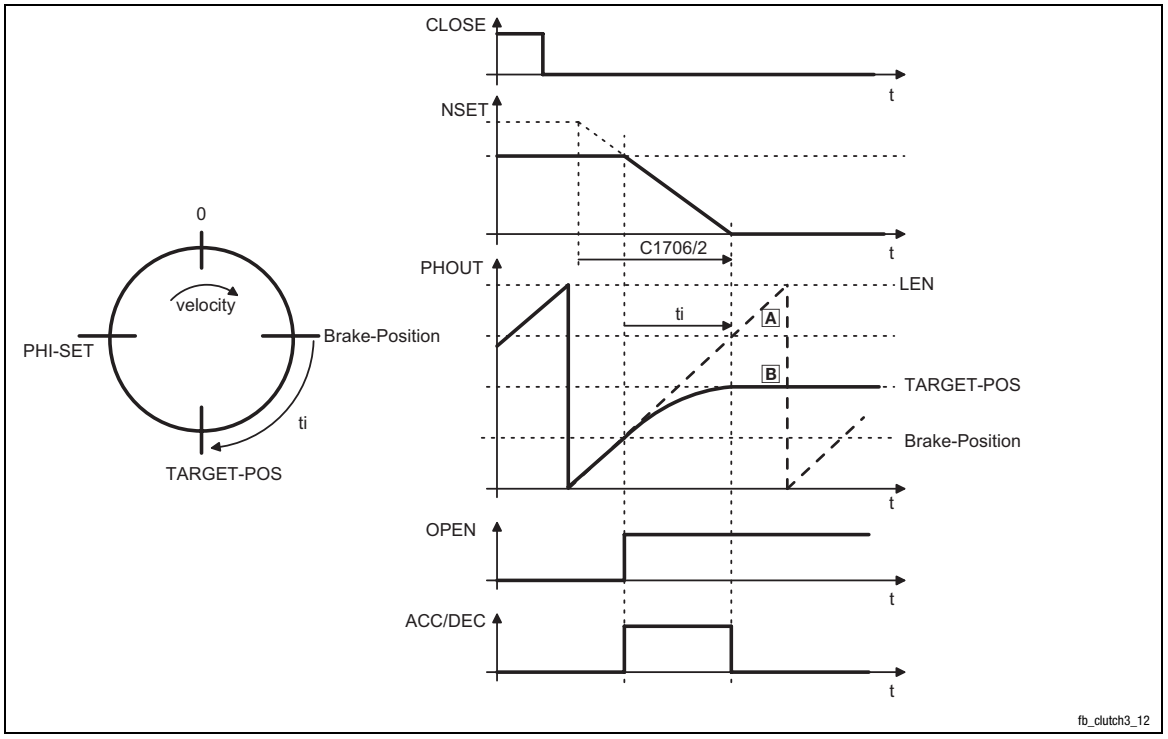


Fig. 3-67 Angle diagram and path-time diagram: Time-controlled disengaging in target position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET after completion of the disengaging process
TARGET-POS	Target position specified at CLUTCH3-TARGET-POS
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is disengaged
ACC/DEC	During the disengaging process, CLUTCH3-ACC/DEC = HIGH

- The internal master angle (PHOUT) synchronically follows the master value to the brake position. At the brake position the braking process is started.
  - The brake position is automatically calculated from the deceleration time Ti.
  - The brake position is variable and depends on the current machine speed.
- If the target position is reached, the braking process is completed.
- If CLUTCH3-LOW-VEL = 0, the internal master angle (PHOUT) is 0 at the target position.

Adjustment

- Set C1707 = 0.
- Define the target position at CLUTCH3-TARGET-POS.
- Set the deceleration time Ti [s] in C1706/2.
- Define the external master angle at CLUTCH3-PHI-SET.

3.2.24.9 Time-controlled disengaging at disengaging position

Description

In the case of printing machines, the last process (printing) must be completed before the tool or the drive may be disengaged.

Function sequence

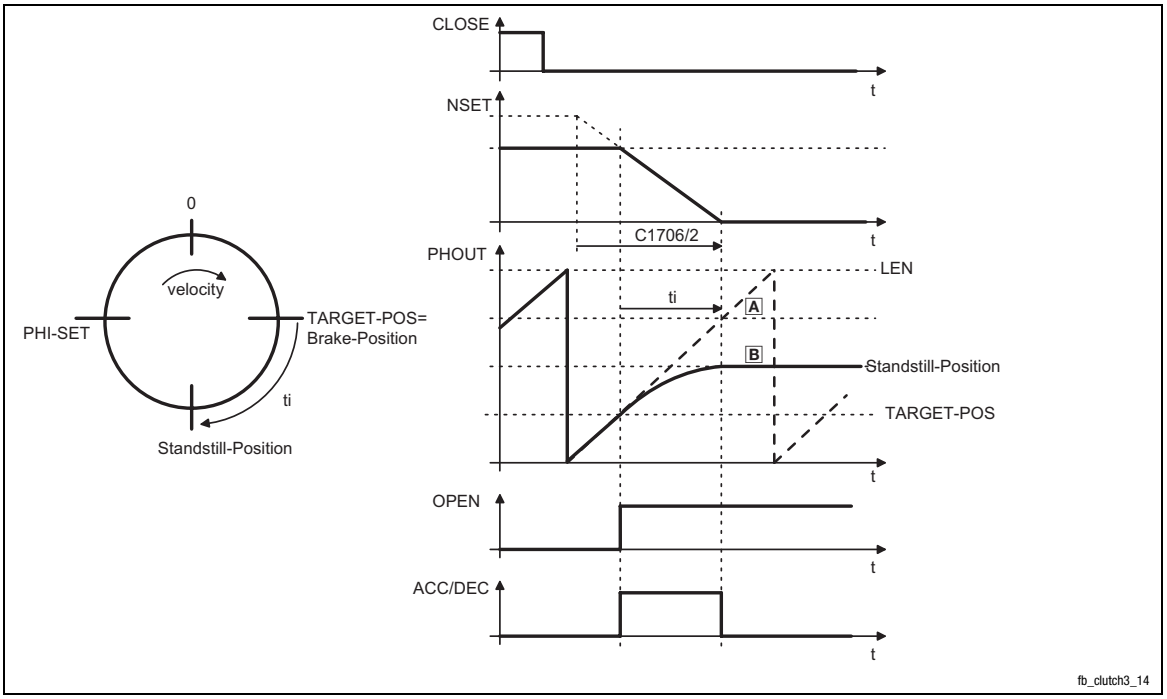


Fig. 3-68 Angle diagram and path-time diagram: Time-controlled disengaging at disengaging position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET after completion of the disengaging process
TARGET-POS	Disengaging position specified at CLUTCH3-TARGET-POS
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is disengaged
ACC/DEC	During the disengaging process, CLUTCH3-ACC/DEC = HIGH

- The external master angle (PHI-SET) and the internal master angle (PHOUT) run synchronously until the disengaging position is reached.
- If the external master angle (PHI-SET) crosses the disengaging position, the braking process is initiated.
- The position of the internal master angle (PHOUT) results from the deceleration time Ti and the machine speed.
- If CLUTCH3-LOW-VEL = 0, the internal master angle (PHOUT) is placed on the standstill position (PHOUT = 0), when the disengaging position has been crossed and the braking distance (DIST) has been travelld.

Adjustment

- Set C1707 = 1.
- Define the disengaging position at CLUTCH3-TARGET-POS.
- Set the deceleration time Ti [s] in C1706/2.
- Define the external master angle at CLUTCH3-PHI-SET.

3.2.24.10 Engaging the clutch at to different positions of the external master angle

Description

Engaging the clutch is effected by an advancing internal master angle (PHOUT). The required acceleration distance of the internal master angle (PHOUT) is automatically calculated from the machine speed and the acceleration time Ti. Thus the next possible start position is determined. Simultaneously the sync position results from this, from which the internal master angle (PHOUT) runs synchronously to the external master angle (PHI-SET). With CLUTCH3-CLOSE = HIGH, the engaging prcess is started. If the external master angle at CLUTCH3-PHI-SET crosses the start position, synchronising is started.

Engaging the clutch if the external master angle PHI-SET is before the start position

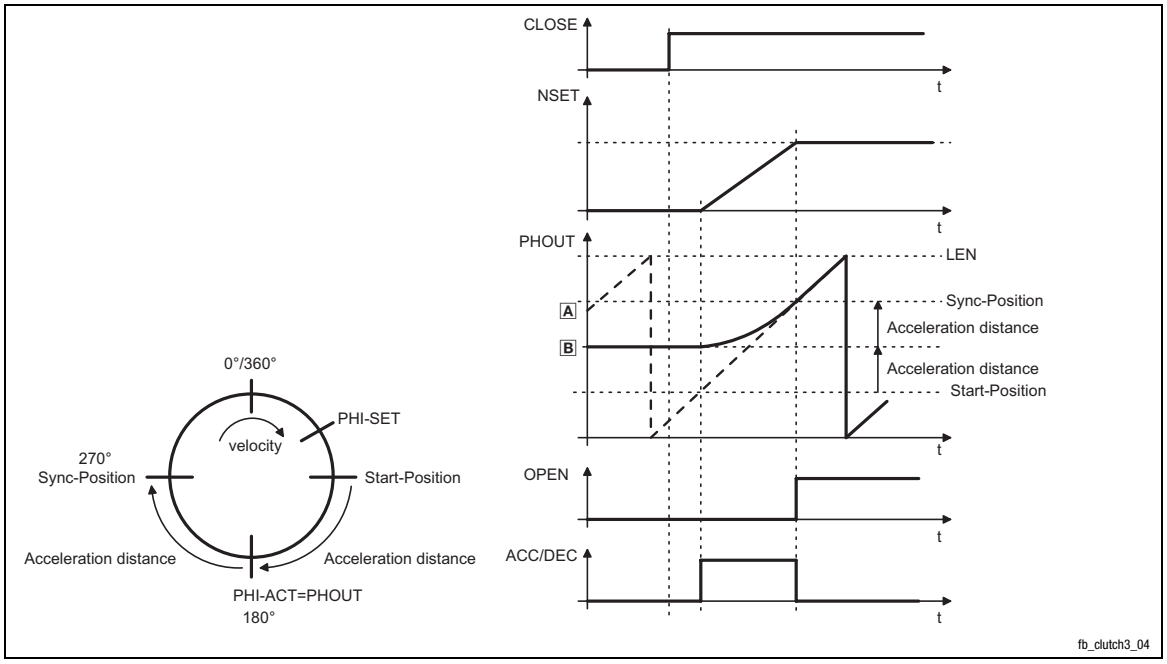


Fig. 3-69 Angle diagram and path-time diagram: Engaging the clutch if the external master angle is before the start position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of the engaging process (CLUTCH3-CLOSE = HIGH)
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of the engaging process (CLUTCH3-CLOSE = HIGH)
Start position	Position of the external master angle at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is engaged
ACC/DEC	During the process of engaging the clutch, CLUTCH3-ACC/DEC = HIGH

If CLUTCH3-CLOSE = HIGH, the external master angle is befor the start position calculated. The process of engaging the clutch is initiated during this clock pulse.

The internal master angle has to be synchronised to the external master angle with regard to position and angle. The external master angle runs at a constant speed. During the process of engaging the clutch, the internal master angle covers the ”Acceleration distance” to the sync position. The external master angle covers the ”Acceleration distance” twice.

Engaging the clutch if the external master angle PHI-SET is behind the start position

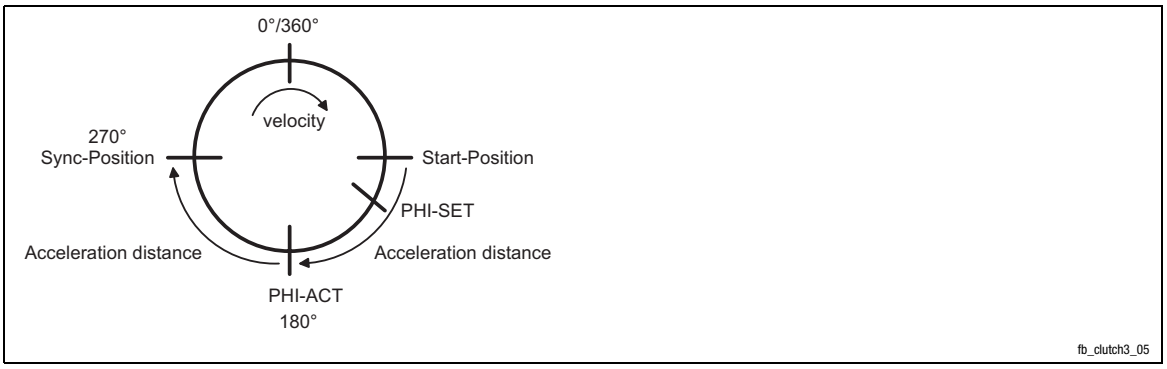


Fig. 3-70 Angle diagram: Engaging the clutch with external master angle being the calculated start position

PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of the process of engaging the clutch (CLUTCH3-CLOSE = HIGH)
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of the process of engaging the clutch (CLUTCH3-CLOSE = HIGH)
Start position	Position at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously

If CLUTCH3-CLOSE = HIGH, the external master angle is behind the start position calculated. The process of engaging the clutch is not started in this clock pulse. It automatically starts in the next clock, if CLUTCH3-CLOSE remains = HIGH.

3.2.24.11 Time-controlled engaging

Function sequence

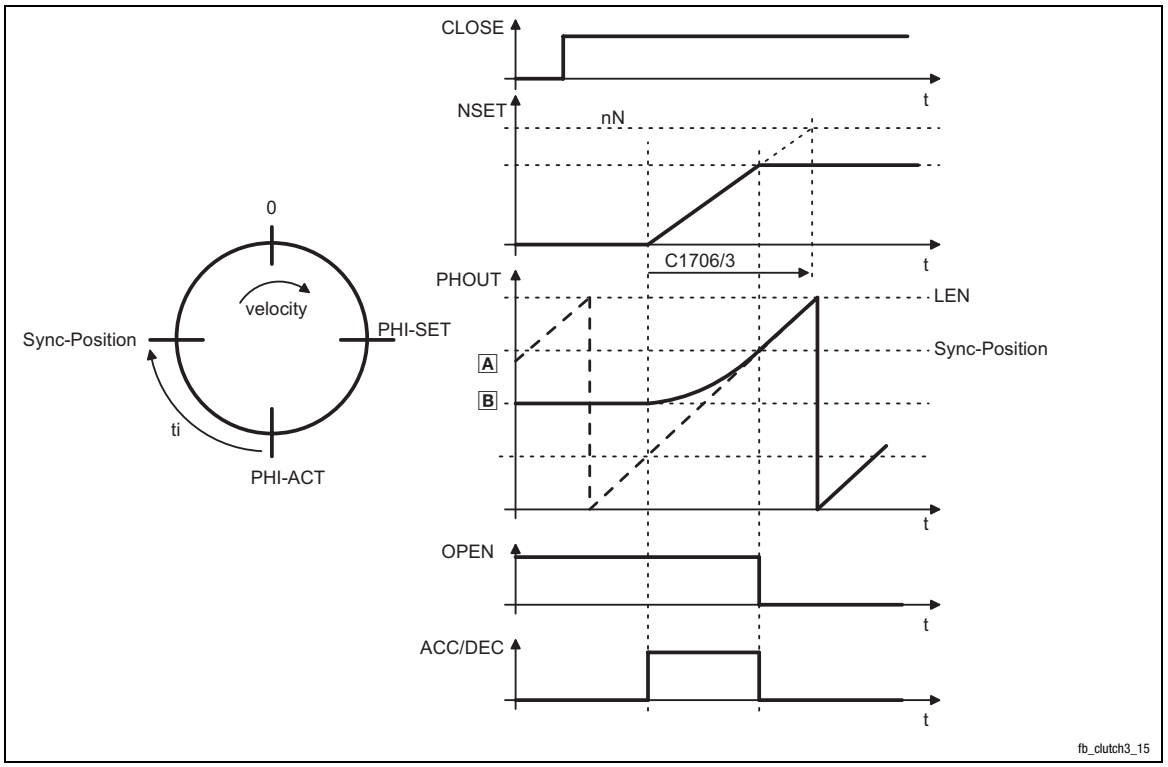


Fig. 3-71 Angle diagram and path-time diagram: Time-controlled engaging

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of synchronising
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of synchronising
Start position	Position of the external master angle at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously
OPEN	If CLUTCH3-OPEN switches to LOW, the clutch is engaged
ACC/DEC	During the process of engaging the clutch, CLUTCH3-ACC/DEC = HIGH

- The sync position is calculated from the acceleration (C1706/3) and the speed of the external master angle. From this, also the start position results.
- From the sync position, the external and internal master angles are synchronous with regard to speed and angle (position).

Adjustment

- Set C1707 = 0 or C1707 = 1. The process of engaging the clutch is the same for both modes.
- Set the desired acceleration in C1706/3.

3.2.25 Comparator (CMP)

Purpose

These FBs serve to compare two analog signals. Three comparators are available which serve to implement triggers.

CMP1

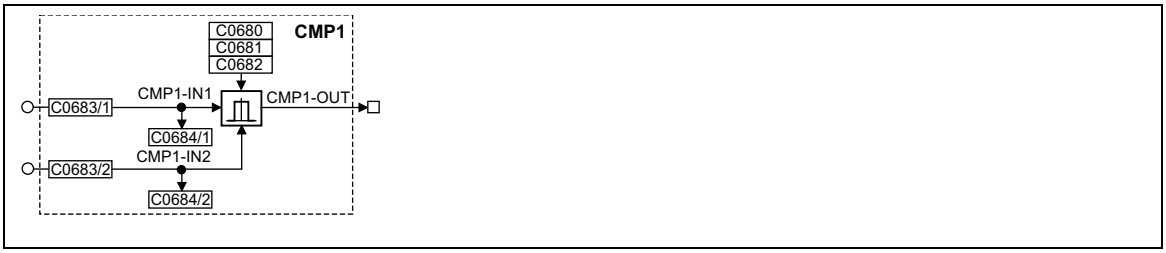


Fig. 3-72 Comparator (CMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP1-IN1	a	C0684/1	dec [%]	C0683/1	1	5001	-
CMP1-IN2	a	C0684/2	dec [%]	C0683/2	1	19500	-
CMP1-OUT	a	-	-	-	-	-	-

CMP2

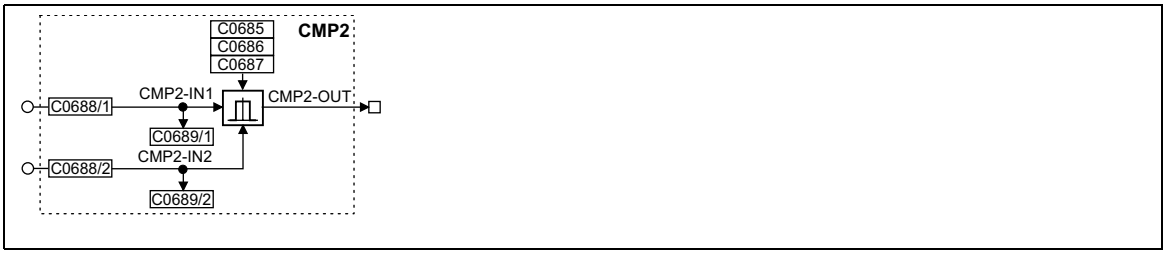


Fig. 3-73 Comparator (CMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP2-IN1	a	C0689/1	dec [%]	C0688/1	1	1000	-
CMP2-IN2	a	C0689/2	dec [%]	C0688/2	1	1000	-
CMP2-OUT	a	-	-	-	-	-	-

CMP3

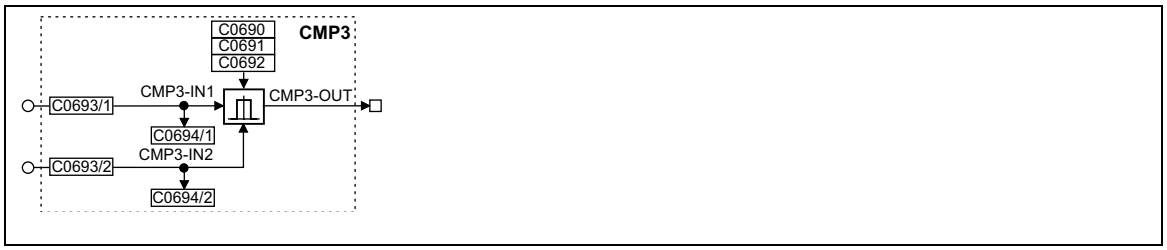


Fig. 3-74 Comparator (CMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP3-IN1	a	C0694/1	dec [%]	C0693/1	1	1000	-
CMP3-IN2	a	C0694/2	dec [%]	C0693/2	1	1000	-
CMP3-OUT	a	-		-	-	-	-

Function

The description uses the example of CMP1 and also applies to CMP2 and CMP3.

The function of these function blocks can be set via code C0680 (CMP1). The following comparison operations are available:

- CMP1-IN1 = CMP1-IN2
- CMP1-IN1 > CMP1-IN2
- CMP1-IN1 < CMP1-IN2
- |CMP1-IN1| = |CMP1-IN2|
- |CMP1-IN1| > |CMP1-IN2|
- |CMP1-IN1| < |CMP1-IN2|

3.2.25.1 Function 1: CMP1-IN1 = CMP1-IN2

This function serves to compare two signals with regard to equality. Hence, the comparison ”actual speed equals setpoint speed ($n_{act} = n_{set}$)” can be carried out.

- Via code C0682 the window of equality can be set.
- Via code C0681 a hysteresis can be set if the input signals are not stable and cause the output to oscillate.

The exact function can be obtained from the line diagram.

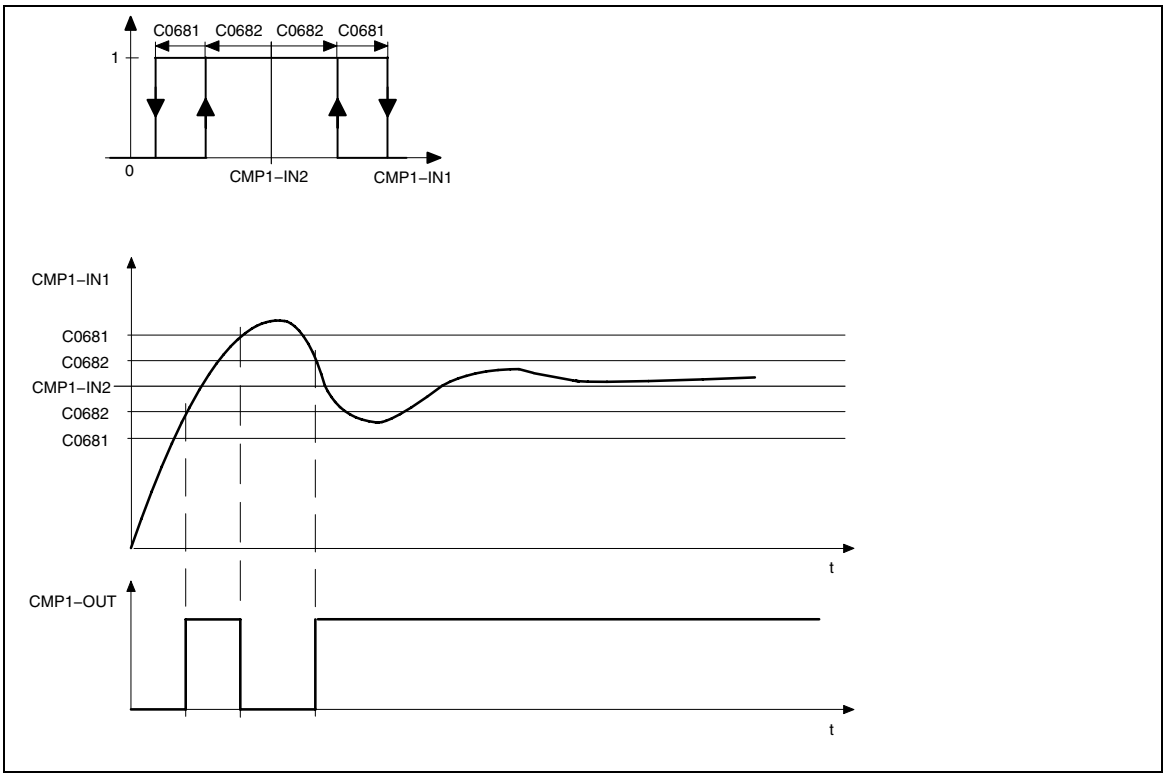


Fig. 3-75 Equality of signals (CMP1-IN1 = CMP1-IN2)

3.2.25.2 Function 2: CMP1-IN1 > CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is higher than a limit value ($n_{act} > n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 exceeds the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 falls below the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

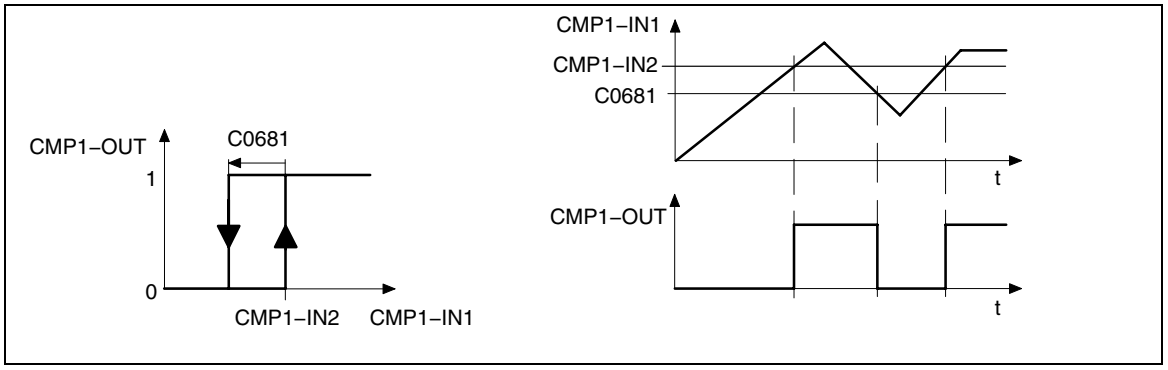


Fig. 3-76 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

3.2.25.3 Function 3: CMP1-IN1 < CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is lower than a limit value ($n_{act} < n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 falls below the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 exceeds the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

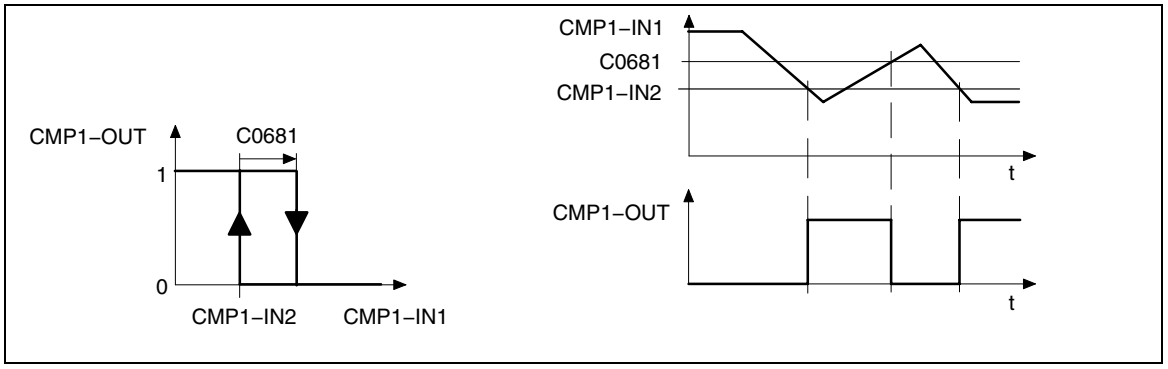


Fig. 3-77 Values falling below signal values (CMP1-IN1 CMP1-IN2)

3.2.25.4 Function 4: |CMP1-IN1| = |CMP1-IN2|

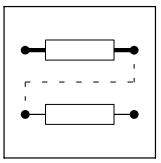
This function is the same as function 1. Before signal processing the absolute value of the input signals (without sign) is generated.

This can be used to implement the comparison "$n_{act} = 0$".

3.2.25.5 Function 5: |CMP1-IN1| > |CMP1-IN2|

This function is the same as function 3. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| > |n_x|$" irrespective of the direction of rotation.



3.2.25.6 Function 6: |CMP1-IN1| < |CMP1-IN2|

This function is the same as function 2. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| < |n_x|$" irrespective of the direction of rotation.

3.2.26 Signal conversion (CONV)

Purpose

These function blocks can be used to standardize signals or signal types or to convert signal types into different signal types.The conversion is very precise by providing the conversion factor as numerator and denominator.

CONV1

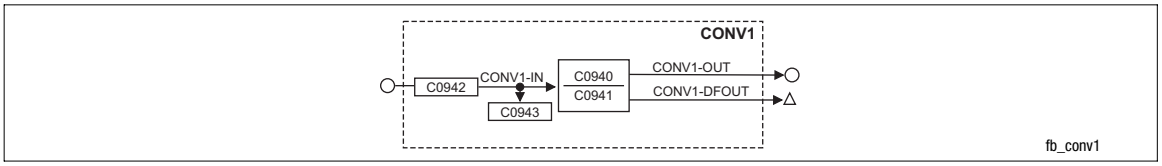


Fig. 3-78 Function block CONV1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV1-IN	a	C0943	dec [%]	C0942	1	1000	
CONV1-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV1-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to multiply or divide analog signals.

$$\text{CONV1-OUT} = \text{CONV1-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0940}}{\text{C0941}}$$

or

$$\text{CONV1-DFOUT} = \text{CONV1-IN} \cdot \frac{\text{C0940}}{\text{C0941}} \quad \textit{[rpm]}$$

Example:

An analog signal is to be multiplied by 1.12.
For this, enter C0940 = 112 and C0941 = 100.

CONV2

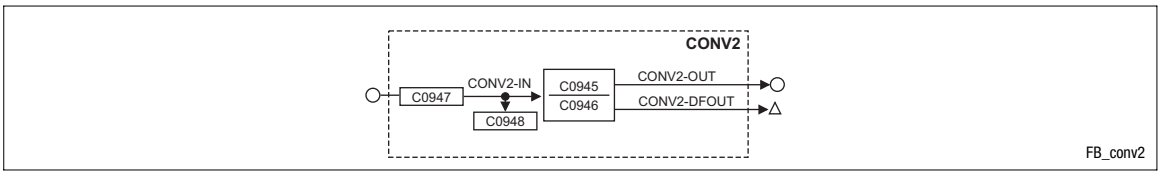


Fig. 3-79 Function block CONV2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV2-IN	a	C0948	dec [%]	C0947	1	1000	
CONV2-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV2-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to multiply or divide analog signals.

Conversion according to formula:

$$\text{CONV2-OUT} = \text{CONV2-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0945}}{\text{C0946}}$$

or

$$\text{CONV2-DFOUT} = \text{CONV2-IN} \cdot \frac{\text{C0945}}{\text{C0946}} \quad \textit{[rpm]}$$

CONV3

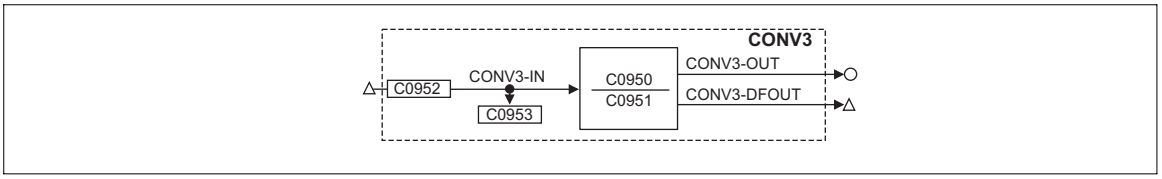


Fig. 3-80 Function block CONV3

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV3-IN	phd	C0953	dec [rpm]	C0952	4	1000	
CONV3-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV3-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert speed signals into analog signals.

Conversion according to formula:

$$\text{CONV3-OUT} = \text{CONV3-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

or

$$\text{CONV3-DFOUT} = \text{CONV3-IN} \cdot \frac{\text{C0950}}{\text{C0951}} \quad \textit{[rpm]}$$

CONV4

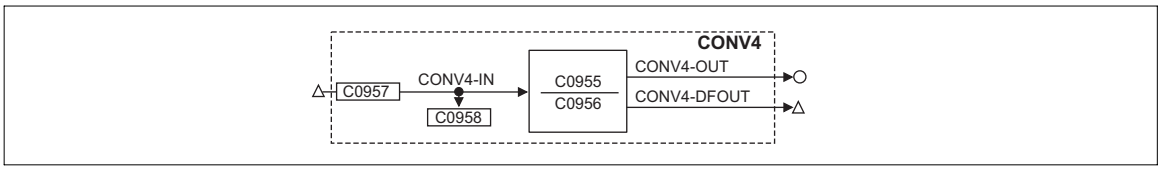


Fig. 3-81 Function block CONV4

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV4-IN	phd	C0958	dec [rpm]	C0957	4	1000	
CONV4-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV4-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert speed signals into analog signals.

Conversion according to formula:

$$\text{CONV4-OUT} = \text{CONV4-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0955}}{\text{C0956}}$$

or

$$\text{CONV4-DFOUT} = \text{CONV3-IN} \cdot \frac{\text{C0955}}{\text{C0956}} \quad \textit{[rpm]}$$

CONV5

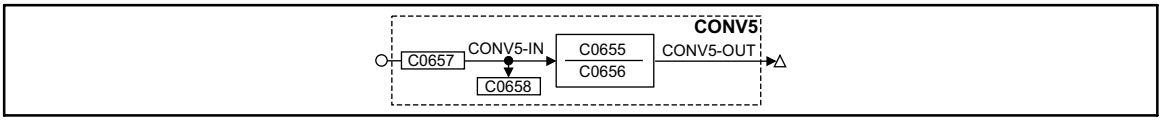


Fig. 3-82 Function block CONV5

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV5-IN	a	C0658	dec [%]	C0657	1	1000	
CONV5-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV5-OUT} = \text{CONV5-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C0655}}{\text{C0656}}$$

CONV6

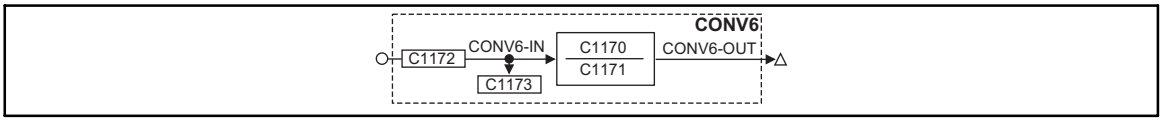


Fig. 3-83 Function block CONV6

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV6-IN	a	C1173	dec [%]	C1172	1	1000	
CONV6-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV6-OUT} = \text{CONV6-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C1170}}{\text{C1171}}$$

CONV7

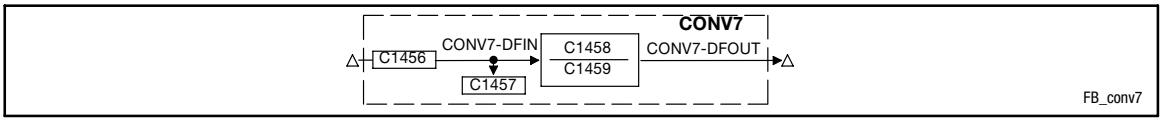


Fig. 3-84 Function block CONV7

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV7-DFIN	phd	C1457	dec [%]	C1456	1	1000	
CONV7-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV7-DFOUT} = \text{CONV7-DFIN} \cdot \frac{\text{C1458}}{\text{C1459}} \quad [\,rpm\,]$$

3.2.27 Analog/digital converter (CONVAD)

Conversion of an analog value into individual digital signals.

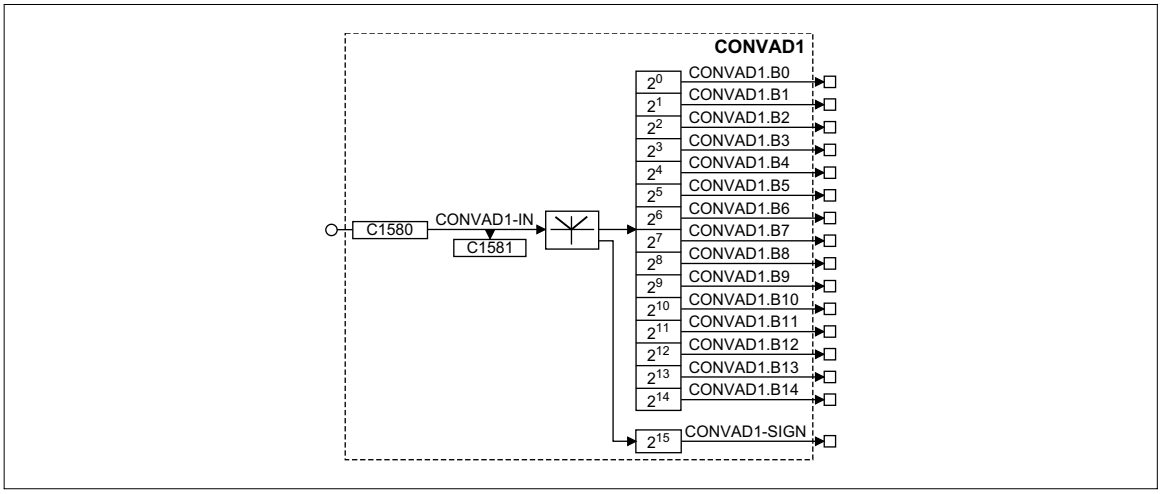


Fig. 3-85 Analog/digital converter (CONVAD1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD1-IN	a	C1581	dec	C1580	1	-
CONVAD1.B0 ... B14	d	-	-	-	-	-
CONVAD1-SIGN	d	-	-	-	-	Sign digit

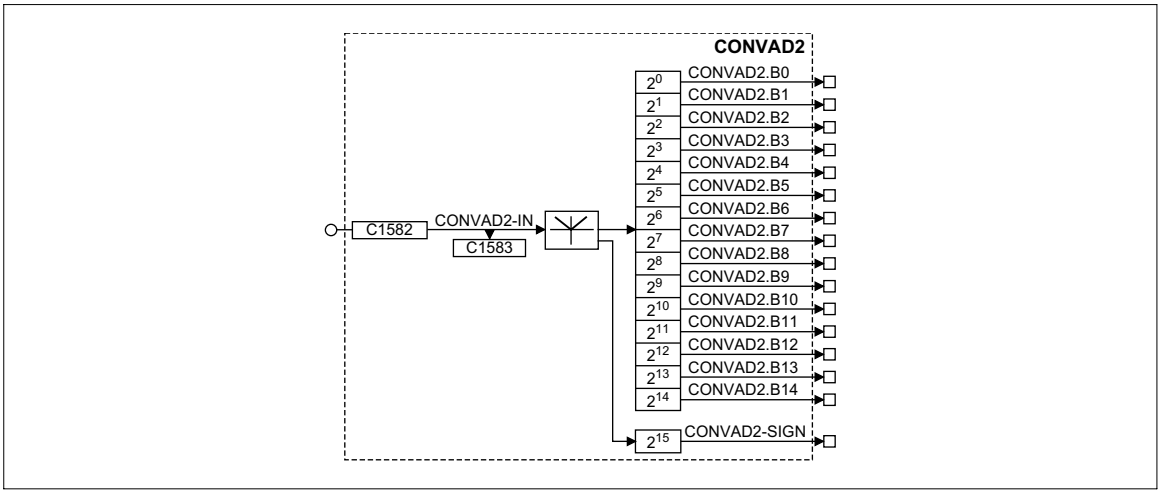


Fig. 3-86 Analog/digital converter (CONVAD2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD2IN	a	C1583	dec	C1582	1	-
CONVAD2.B0 ... B14	d	-	-	-	-	-
CONVAD2-SIGN	d	-	-	-	-	Sign digit

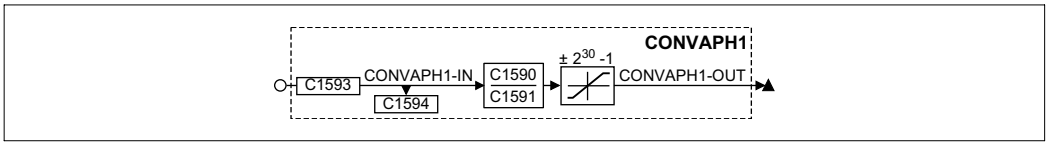
Function

- Represents the analog value as 16-bit binary word.
- Every binary digit is assigned to a digital output.
- The 16th bit (2^{15}) is the sign digit indicating whether it is a positive or negative analog value.

3.2.28 Analog/angle converter (CONVAPH)

Conversion of an analog value into a angle signal.

CONVAPH1



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH1-IN	a	C1594	dec	C1593	1	-
CONVAPH1-OUT	ph	-	-	-	-	Limited to $\pm 2^{30}$-1

Function

- Conversion with adaptation through multiplier and divisor.
- Conversion according to formula:

$$\text{CONVAPH1–OUT} = \text{CONVAPH1–IN} \cdot \frac{\text{C1590}}{\text{C1591}} \cdot \frac{16384}{100\%}$$

3.2.29 Angle conversion (CONVPHA)

Purpose

- Converts a angle signal into an analog signal

or

- converts a angle difference signal into a speed signal.

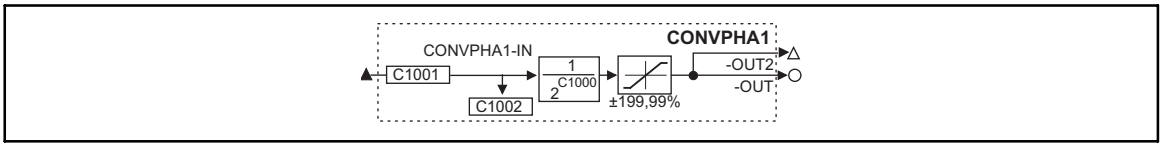


Fig. 3-87 Angle conversion (CONVPHA1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA1-IN	ph	C1002	dec [inc]	C1001	3	-
CONVPHA1-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder considered
CONVPHA1-OUT2	phd	-	-	-	-	Limited to ±32767 rpm, remainder considered

Function

- Conversion with adaptation using a divisor.
- Conversion according to formula:

$$\text{CONVPHA1-OUT [\%]} = \text{CONVPHA1-IN [inc]} \cdot \frac{100}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [rpm]} = \text{CONVPHA1-IN [inc]} \cdot \frac{15000}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [inc]} = \text{CONVPHA1-IN [inc]} \cdot \frac{1}{2^{C1000}}$$

CONVPHA2

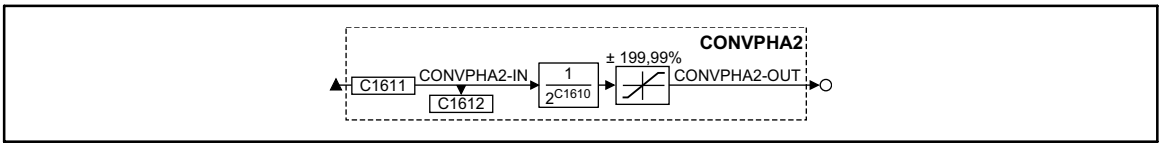


Fig. 3-88 Function block CONVPHA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA2-IN	ph	C1612	dec [inc]	C1611	3	-
CONVPHA2-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder not considered

Function

- Conversion with adaptation using divisor.
- Conversion according to formula:

$$\text{CONVPHA2–OUT} = \text{CONVPHA2–IN} \cdot \frac{1}{2^{C1610}} \cdot \frac{100\%}{16384}$$

CONVPHA3

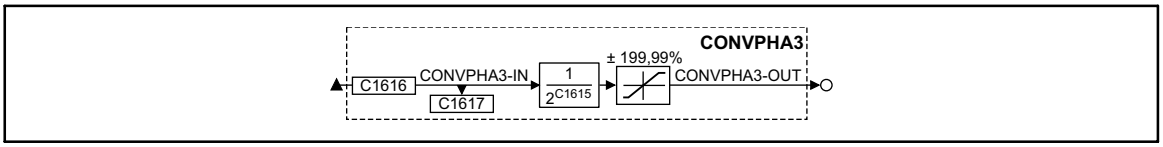


Fig. 3-89 Function block CONVPHA3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA3-IN	ph	C1617	dec [inc]	C1616	3	-
CONVPHA3-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder not considered

Function

- Conversion with adaptation using divisor.
- Conversion according to formula:

$$\text{CONVPHA3–OUT} = \text{CONVPHA3–IN} \cdot \frac{1}{2^{C1615}} \cdot \frac{100\%}{16384}$$

3.2.30 Position signal conversion (CONVPHAA)

Purpose

Simultaneous transfer of two position signals by means of a CAN object.

CONVPHAA1

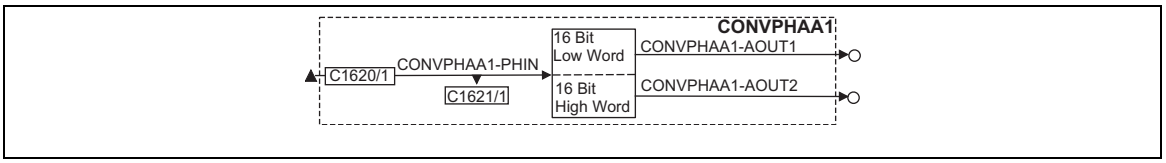


Fig. 3-90 Angle conversion (CONVPHAA1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHAA1-PHIN	ph	C1621/1	[inc]	C1620/1		-
CONVPHAA1-AOUT1	a	-	-	-	-	Low word (16 bits)
CONVPHAA1-AOUT2	a	-	-	-	-	High word (16 bits)

Function

The input signal is divided into a low word and a high word with 16 bits each.

The corresponding output signal can be processed as a position signal.

CONVPHAA2

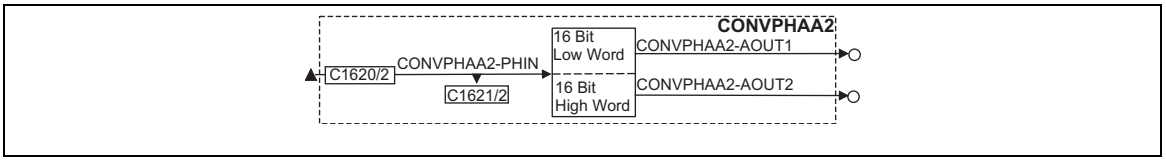


Fig. 3-91 Function block CONVPHAA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHAA2-PHIN	ph	C1621/2	[inc]	C1620/2		-
CONVPHAA2-AOUT1	a	-	-	-	-	Low word
CONVPHAA2-AOUT2	a	-	-	-	-	High word

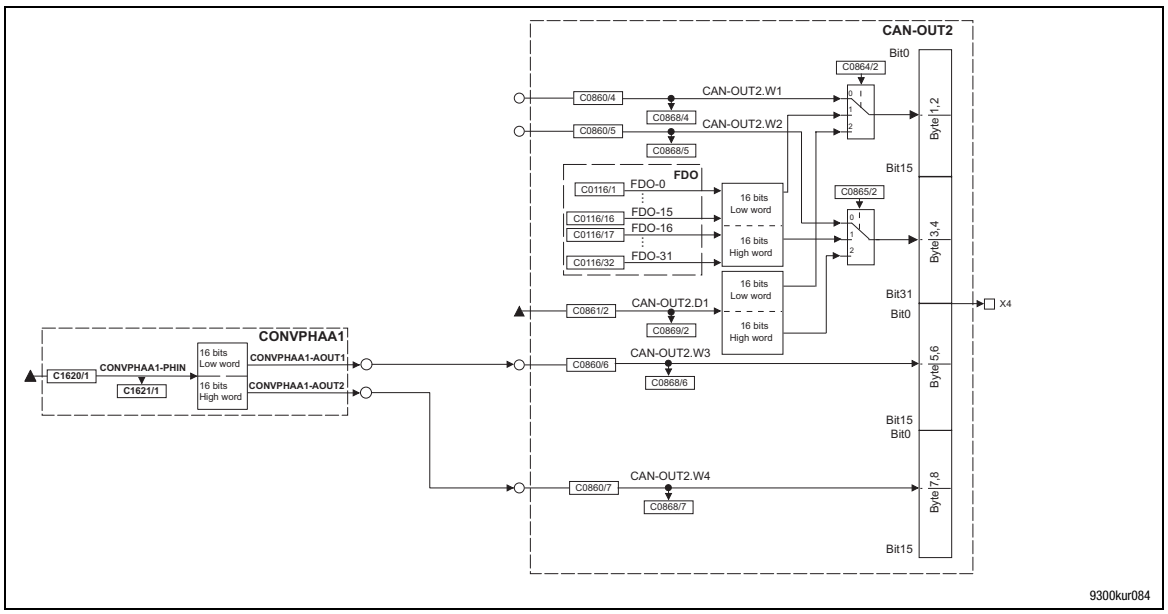
Function

The input signal is divided into a low word and a high word with 16 bits each.

The corresponding output signal can be processed as a position signal.

Use

If you want to transfer two position signals at the same time, the function block CONVPHAA1 or CONVPHAA2 must be linked with the CAN object (e.g. CAN-OUT2) as follows:

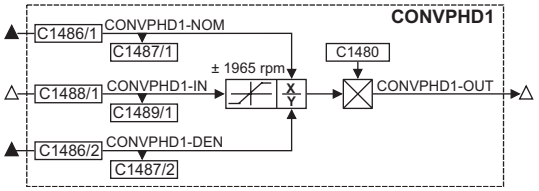


3.2.31 Conversion of stretch factor (CONVPHD)

One function block (CONVPHD1) is available.

Purpose

- Exact adaptation of the incremental encoder
- CONVPHD1 for the adjustment of the stretch factor via freely configurable inputs



Signal				Source		Note
Name	Type	DIS/selection	DIS format	CFG	List	
CONVPHD1-DEN	ph	1487/2	dec [inc]	1486/2	3	Stretch factor denominator, input limited to +1 to +200000000
CONVPHD1-IN	phd	1489/1	dec [inc]	1488/1	4	The input is limited to ±1965 rpm
CONVPHD1-NOM	ph	1487/1	dec [inc]	1486/1	3	Stretch factor numerator, input limited to ±1 to ±200000000
CONVPHD1-OUT	phd		-	-	-	Output in rpm

Function

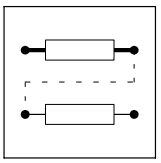
- Function block interconnection
- Encoder settings increments of one
- Stretch factor setting over 6 decades

3.2.31.1 Function block interconnection

The function block is connected directly after the digital frequency input DFIN.

STOP!

The DFIN code C0425 must be set to selection 6 to evaluate the encoder signals correctly.



3.2.31.2 Encoder adaptation

The encoder is adapted to the controller using the freely adjustable encoder constants

- C1480 in CONVPHD1

Using this function block, the encoder can be adapted in increments of one (1, 2, 3, 4... 32767) instead of in increments of 2^0, 2^1, 2^3 etc., when using DFIN.

3.2.31.3 Stretch factor setting over 6 decades

The function blocks can be used for fine adjustment of the stretch factor (6 decades).

The stretch factor is set:

- CONVPHD1:
  via freely connectable inputs

Tip!

If only the stretch factor is used (in this case the function block is positioned elsewhere in the circuit), set the encoder constant to 16384 inc/rev. Otherwise the signal will be additionally amplified (small values) or attenuated (higher values).

When setting negative values in the numerator, the output signal will be inverted.

3.2.32 Angle conversion (CONVPHPH)

Purpose

Conversion of a angle signal with dynamic fraction.

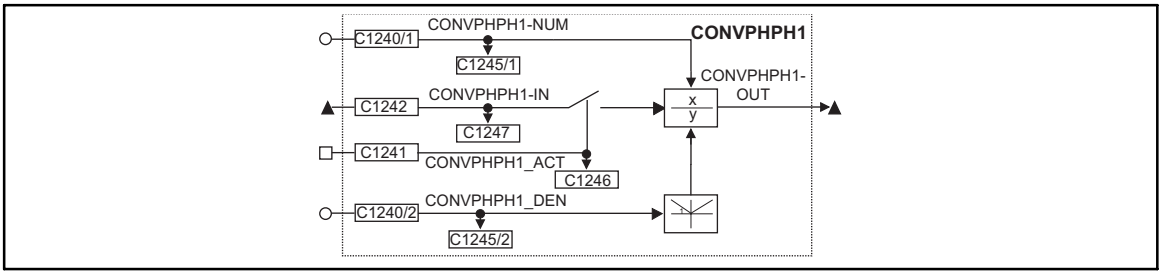


Fig. 3-92 Angle conversion (CONVPHPH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPH1-IN	ph	C1247	dec [inc]	C1242	3	-
CONVPHPH1-NUM	a	C1245/1	dec	C1240/1	1	Numerator
CONVPHPH1-DEN	a	C1245/2	dec	C1240/2	1	Denominator (with absolute value generation)
CONVPHPH1-ACT	d	C1246	bin	C1241	2	-
CONVPHPH1-OUT	ph	-	-	-	-	Without limitation, remainder considered

Function

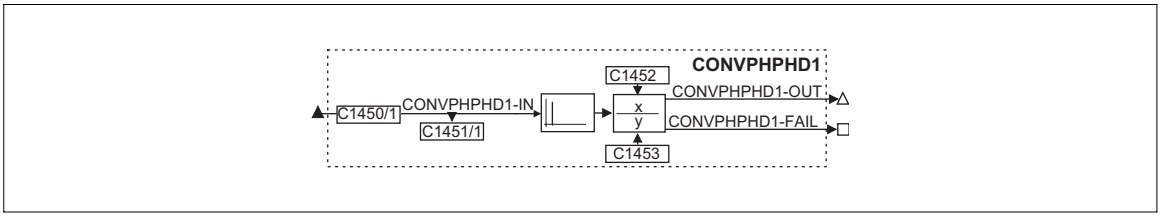
Caution!

The conversion result is not limited. The result must therefore not exceed the range of ±2147483647.

- C1241 = HIGH
  – The angle signal at CONVPHPH1-IN is evaluated using the factor from C1245/1 / C1245/2.
- C1241 = LOW
  – The value 0 is evaluated using the factor from C1245/1 / C1245/2.

3.2.33 Conversion (CONVPHPHD1)

A angle change is converted into a speed (digital frequency).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPHD1-IN	ph	1451/1	dec [inc]	1450/1	3	Angle input (ref.: 65536 inc = 1 motor revolution)
CONVPHPHD1-FAIL	d		-	-	-	HIGH: Resulting speed > 30000 rpm
CONVPHPHD1-OUT	phd		-	-	-	Output in rpm

Function

An angle change at input CONVPHPHD1-IN is converted into a speed.

- The speed at the output CONVPHPHD1-OUT can be adapted by means of a division ratio. The numerator (C1452) and denominator (C1453) can be set between -32767 and +32767.
- The output is limited to ±n = 30000 rpm.
- CONVPHPHD1-FAIL = HIGH for the time of limitation.

Note!

Angle errors can occur in the following function blocks if the output is limited. The profile position can thus be lost.

3.2.34 Conversion (CONVPHPHD2)

STOP!

This function block is not suitable for transmitting the virtual line shaft (electrical shaft).

Purpose

The function block converts a angle change into a speed (digital frequency).

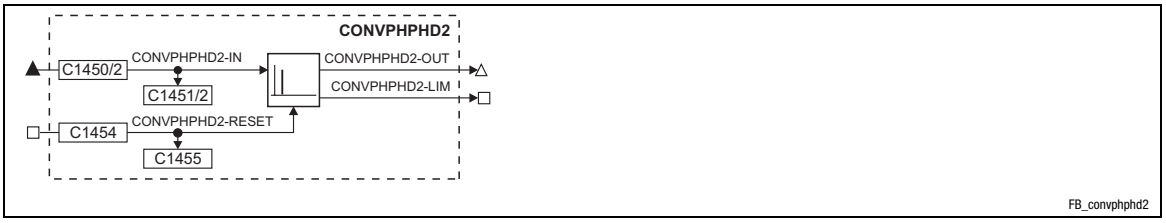
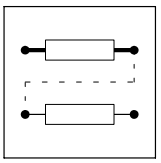


Fig. 3-93 Conversion (CONVPHPHD2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONVPHPHD2-IN	ph	1451/2	dec [inc]	1450/2	3	1000	Angle input (reference: 65536 inc = 1 revolution)
CONVPHPHD2-RESET	d	1455	dec [inc]	14554	2	1000	As long as CONVPHPHD2-RESET = HIGH, the signal at CONVPHPHD2-OUT is set to n = 0.
CONVPHPHD2-OUT	phd	-	-	-		-	Signal is limited to ±29999 rpm No position loss when signal is limited
CONVPHPHD2-LIM	d	-	-	-		-	HIGH = signal at CONVPHPHD2-OUT is limited (Function is available as of software version 3.4)

Function

An angle change at input CONVPHPHD2-IN is converted to a speed and output at CONVPHPHD2-OUT.



STOP!

The function block can evaluate signal jumps at the input CONVPHPHD2-IN up to max. 2147483647 inc (2^{31}-1). At higher signal jumps the sign of the output signal changes.

A position loss occurs which cannot be compensated anymore. You must carry out a reset (CONVPHPHD2-RESET = HIGH).

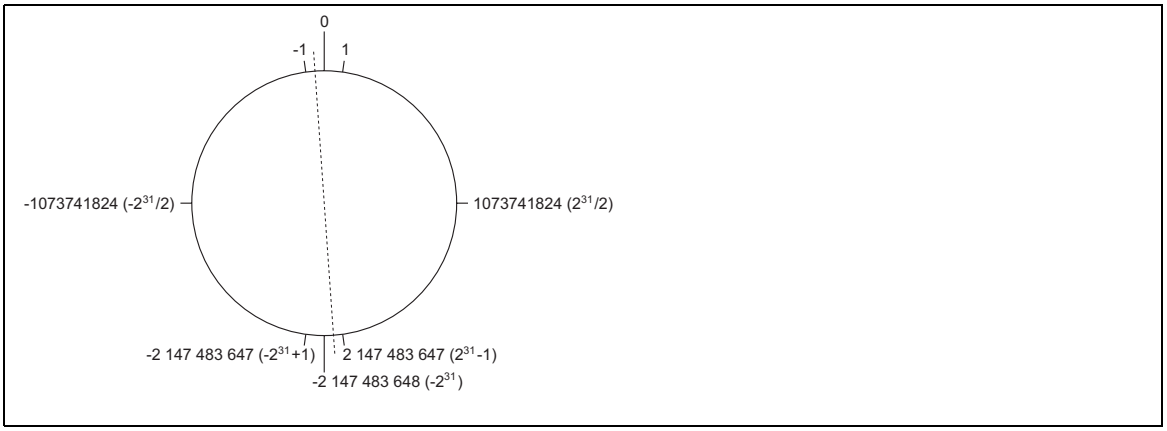


Fig. 3-94 32-bit data representation in the cycle of numbers

Example 1
1. The input signal at CONVPHPHD2-IN is 65536 inc.
2. Now it jumps to -65536 inc.
3. The output CONVPHPHD2-OUT outputs, as expected, negative values

Example 2
1. The input signal at CONVPHPHD2-IN is 65536 inc.
2. Now it jumps to -2^{31} -1 inc.
3. The output CONVPHPHD2-OUT, however, outputs positive values

3.2.35 Speed conversion (CONVPP)

Purpose

Conversion of a speed signal with dynamic fraction.

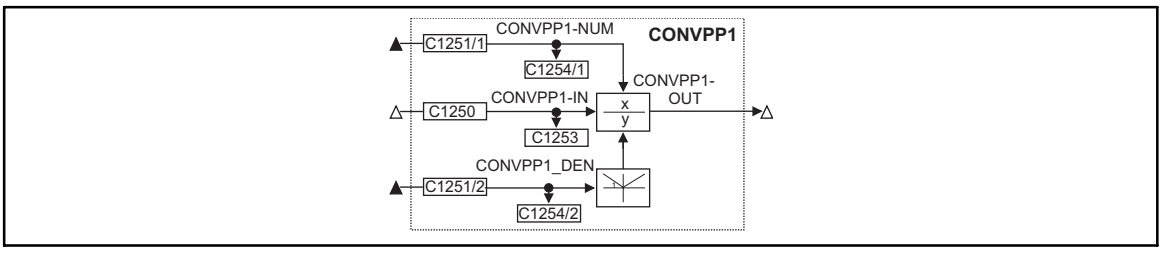


Fig. 3-95 Speed conversion (CONVPP1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPP1-IN	phd	C1253	dec [rpm]	C1250	4	-
CONVPP1-NUM	ph	C1254/1	dec [inc]	C1251/1	3	Numerator
CONVPP1-DEN	ph	C1254/2	dec [inc]	C1251/2	3	Denominator (with absolute value generation)
CONVPP1-OUT	phd	-	-	-	-	Without limitation, remainder considered

Function

Caution!

The conversion result is not limited. The result must therefore not exceed ±32767.

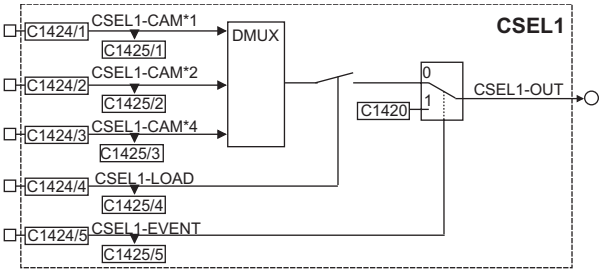
- The speed signal at CONVPP1-IN is evaluated using the factor from C1251/1 / C1251/2.

3.2.36 Profile selection (CSEL)

One function block (CSEL1) is available.

Purpose

- Selection of one profile out of eight possible profiles.
- Selection of an event profile



Signal				Source		Note
Name	Type	DIS/selection	DIS	CFG	List	
CSEL1-CAM*1	d	1425/1	bin	1424/1		Selection bit 0
CSEL1-CAM*2	d	1425/2	bin	1424/2		Selection bit 1
CSEL1-CAM*4	d	1425/3	bin	1424/3		Selection bit 2
CSEL1-LOAD	d	1425/4	bin	1424/4		Acceptance=LOW→HIGH edge
CSEL1-EVENT	d	1425/5	bin	1424/5		Event profile selection value
CSEL1-OUT	a	13651	-	-	-	

Function

- Conversion of a bit pattern into an analog value
- Acceptance of the converted value
- Event-dependent output of a fixed value

3.2.36.1 Change of the input bit pattern

1st input CSEL1-CAM*1	2nd input CSEL1-CAM*2	3rd input CSEL1-CAM*4	CSEL1-LOAD	CSEL1-Event	Output CSEL1-OUT
0	0	0	0 → 1	0	0
1	0	0	0 → 1	0	1
0	1	0	0 → 1	0	2
1	1	0	0 → 1	0	3
0	0	1	0 → 1	0	4
1	0	1	0 → 1	0	5
0	1	1	0 → 1	0	6
1	1	1	0 → 1	0	7
*	*	*	*	1	Value in C1420

* - Signal status has no meaning

- Depending on the number of profiles used, not all inputs must be assigned for the profile selection.

Number of profiles used (value of C1300)	Inputs to be assigned (CAM*1, CAM*2, CAM*4)
1 (only profile 0)	0
2 (profiles 0 and 1)	1 (CAM*1)
4 (profiles 0 to 3)	2 (CAM*1, CAM*2)
8 (profiles 0 to 7)	3 (CAM*1, CAM*2, CAM*4)

3.2.36.2 Acceptance of the converted value

Very often, a new profile is selected during operation. This new profile, i.e. the changed value, must only be accepted if the drive reaches a certain position. The acceptance is activated by a L→H edge at the input CSEL1-LOAD.

3.2.36.3 Event-dependent output of a fixed value

- The value entered under C1420 will be output at CSEL1-OUT (without signal edge at CSEL1-LOAD) when the input CSEL1-EVENT is selected.

Stop!

The activation of a cam profile, which has been additionally defined in CSEL but exceeds the number of profiles selected in the FB CDATA, will be ignored.
Example: Input in CDATA = 4 profiles; profile additionally defined in CSEL (profile 5).
The special profile would be ignored!

Code	Meaning	Note
C1420	Input of fixed values for the selection through CSEL1-EVENT	

If the signal at input CSEL1-EVENT = LOW, a L→H edge must again be set at the input CSEL1-LOAD to accept.

3.2.37 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

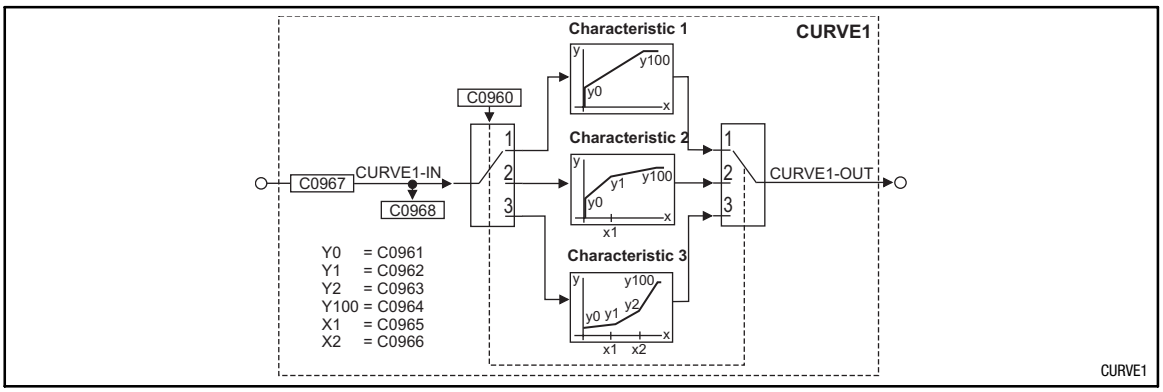


Fig. 3-96 Characteristic function (CURVE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CURVE1-IN	a	C0968	dec [%]	C0967	1	5001	-
CURVE1-OUT	a	-	-	-	-	-	-

Range of functions

Under C0960, you can select the function:

- Characteristic with two interpolation points
- Characteristic with three interpolation points
- Characteristic with four interpolation points

The codes for entering the interpolation points can be obtained from the line diagrams.

Linear interpolation between the points.

For negative input values at CURVEx-IN, the settings of the interpolation points are processed inversely (see line diagrams). If this is not desired:

- Connect an absolute value generator (ABS) before or behind the CURVE function block

or

- connect a limiter (LIM) before or behind the CURVE function block

3.2.37.1 Characteristic with two interpolation points

Set C0960 = 1.

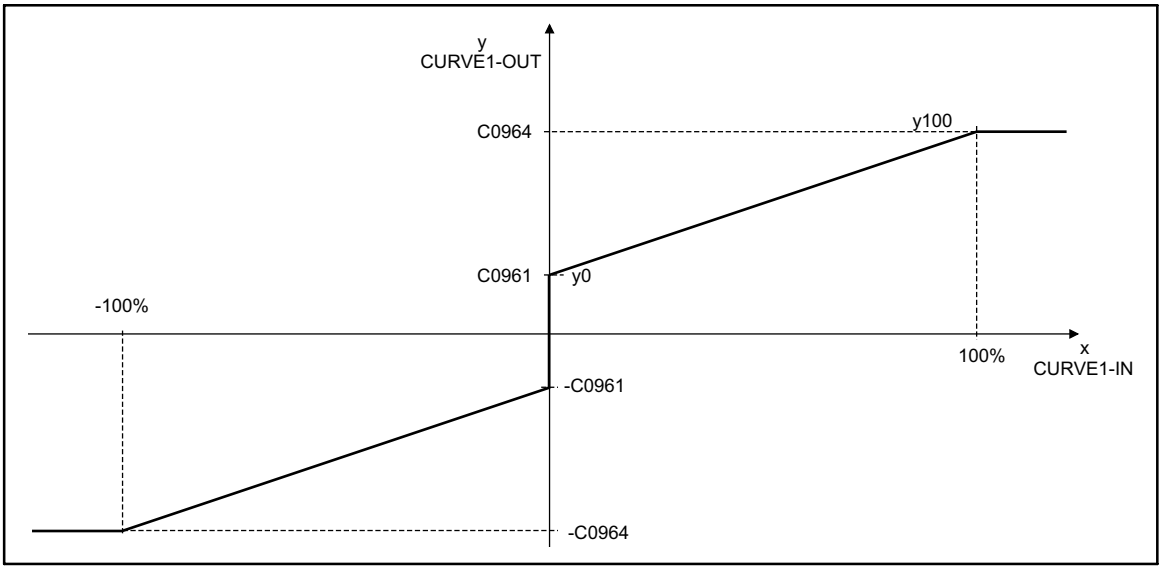


Fig. 3-97 Line diagram of characteristic with 2 interpolation points

3.2.37.2 Characteristic with three interpolation points

Set C0960 = 2.

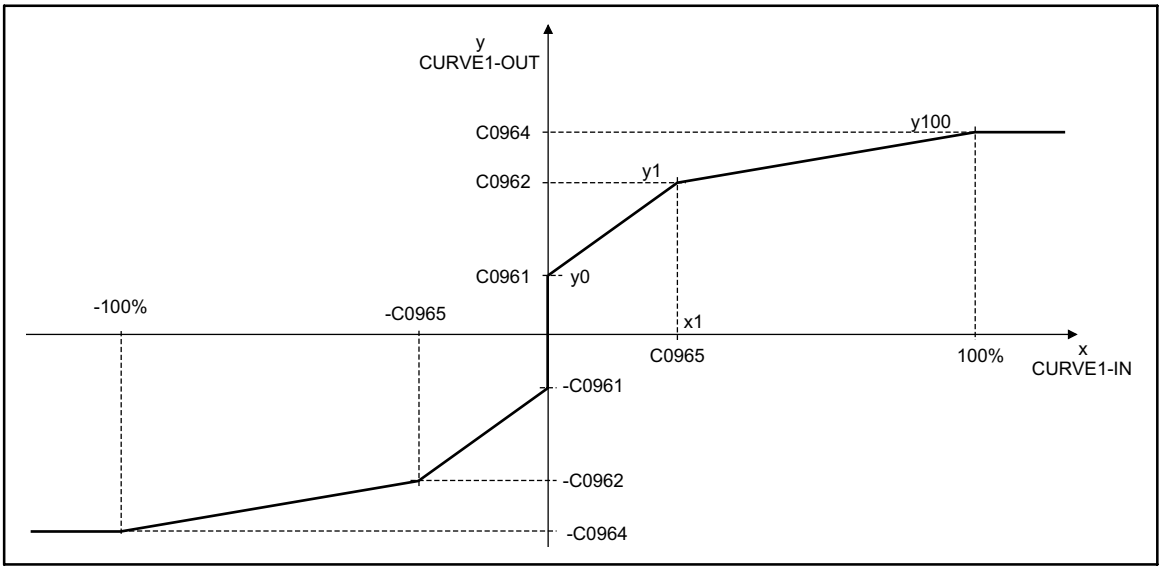


Fig. 3-98 Line diagram of characteristic with 3 interpolation points

3.2.37.3 Characteristic with four interpolation points

Set C0960 = 3.

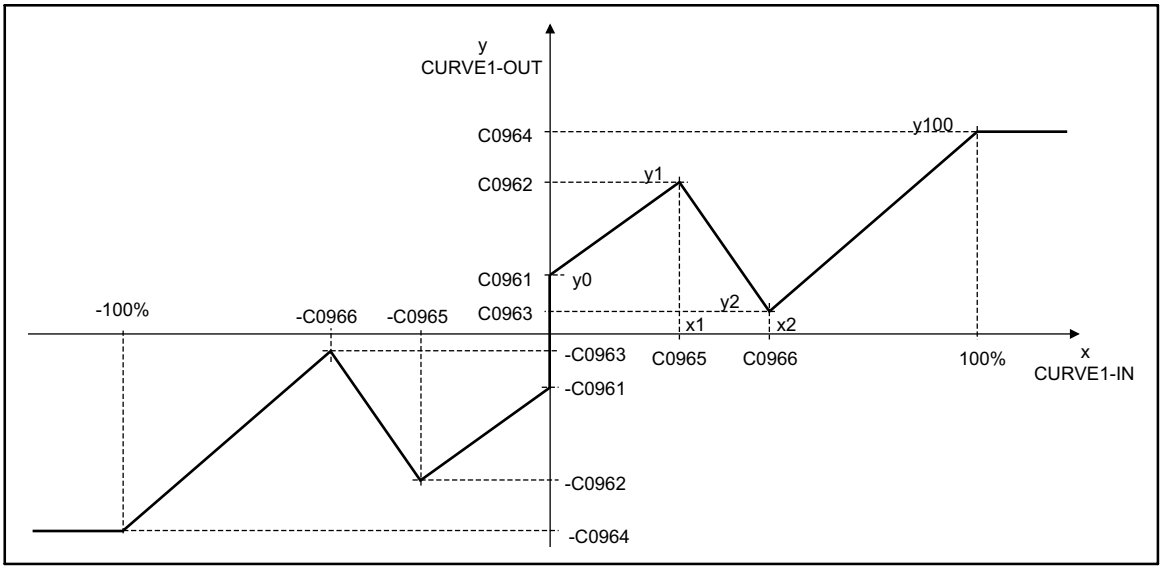


Fig. 3-99 Line diagram of characteristic with 4 interpolation points

3.2.38 Characteristic function (CURVEC)

Purpose

The function block serves to map analog profiles.

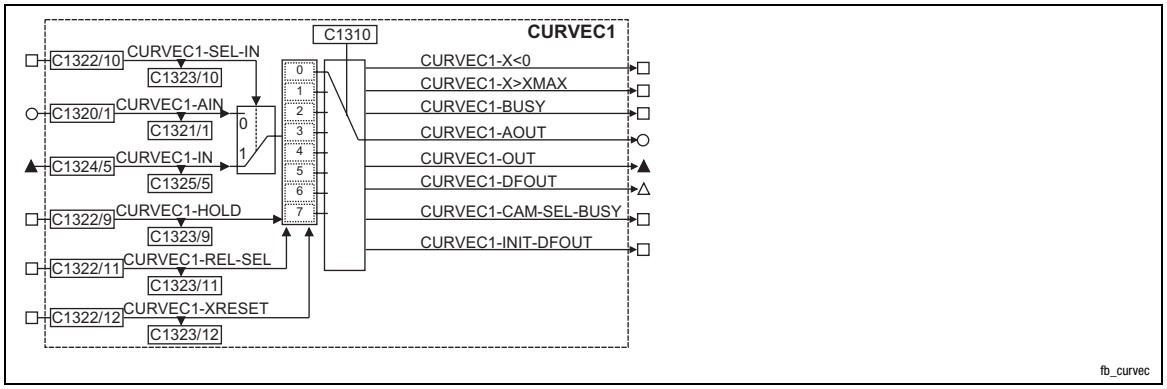
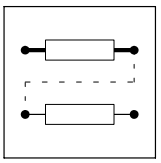


Fig. 3-100 Characteristic function (CURVEC)

Name	Signal Type	Signal DIS/selection	Signal DIS format	Source CFG	Source List	Note
CURVEC1-SEL-IN	d	C1323/10		C1322/10	2	HIGH = input CURVEC-IN active
CURVEC1-AIN	a	C1321/1		C1320/1	1	Analog input (analog profile)
CURVEC1-IN	ph	C1325/5		C1324/5	3	Angle input
CURVEC1-HOLD	d	C1323/9		C1322/9	1	HIGH = outputs CURVEC-OUT and CURVEC-AOUT are stored DFOUT = 0
CURVEC1-REL-SEL	d	C1323/11		C1322/11	1	HIGH = feed function
CURVEC1-XRESET	d	C1323/12		C1322/12	1	HIGH = sets the input values internally = 0. See notes about CURVEC1-CAM-SEL-BUSY.
CURVEC1-X<0	d					HIGH = input value < 0
CURVEC1-X>Xmax	d					HIGH = input value > X_{max}
CURVEC1-BUSY	d					LOW-HIGH edge = “The point distribution is not optimal, select less points”
CURVEC1-AOUT	a					Analog output
CURVEC1-OUT	ph					Angle output
CURVEC1-DFOUT	phd					DF/speed output
CURVEC1-CAM-SEL-BUSY	d					The output remains HIGH as long as the profile changeover (C1310) is not completed. During this procedure, the input CURVEC1-XRESET must be HIGH.
CURVEC1-INIT-DFOUT	d					HIGH= the drive speed does not reach the setpoint defined by the position output. During this deviation which may last over several cycles, a great position change is output at the speed output. Increments do not get lost! Therefore, the drive should only be enabled after switching-on if CURVEC-INIT-DFOUT = LOW !



Function

- Identical with FB CDATA, but with reduced functionality (cam position profile)
- General characteristic

Selection between general cam position profile and characteristic function

Via CURVEC1-SEL-IN you can select which input (-AIN or -IN) is to be processed.

It is possible to change between a (quasi) analog input (16-bit input) and an input for angle signals (32 bit input).

Thus it is possible to use the CURVEC function block

- to implement any function within the limits of ±199.99 % (e.g. Vp adaptation)

or

- to implement a mechanical cam function.

Note!

The input should be assigned to a FIXED value to avoid an unintentional change to another input.

Freezing of the output value

With CURVEC1-HOLD = HIGH the output signals remain the same as of the switching instant, irrespectively of possibly changing input values.

With CURVEC1-HOLD = LOW the outputs are activated again. The output values immediately change in accordance with the profile function to the input values pending now.

STOP!

This change occurs abruptly!

Profiles with relative feed

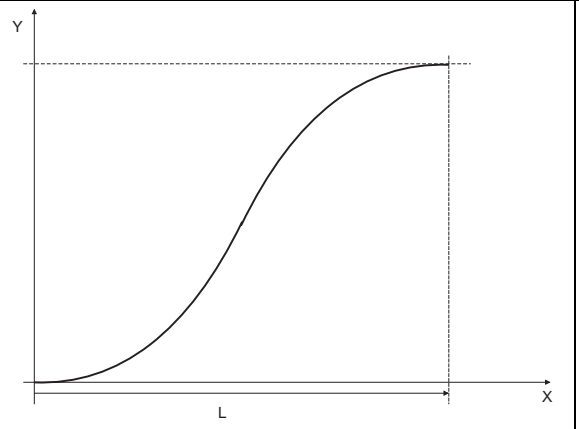
Profiles with relative feed are used in continuous drives. The final value of such profiles is not identical with its initial position.

Continuous drives are for instance:

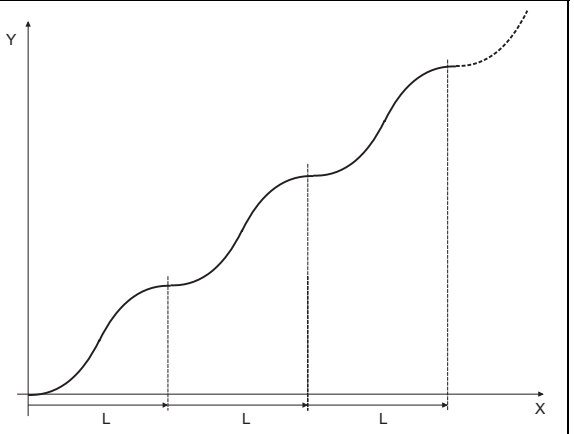
- conveyor belts
- rotary tables with feed along the entire revolution.

This function is selected with CURVEC1-REL-SEL = HIGH (e.g. FIXED 1)

Example 1



Example 2

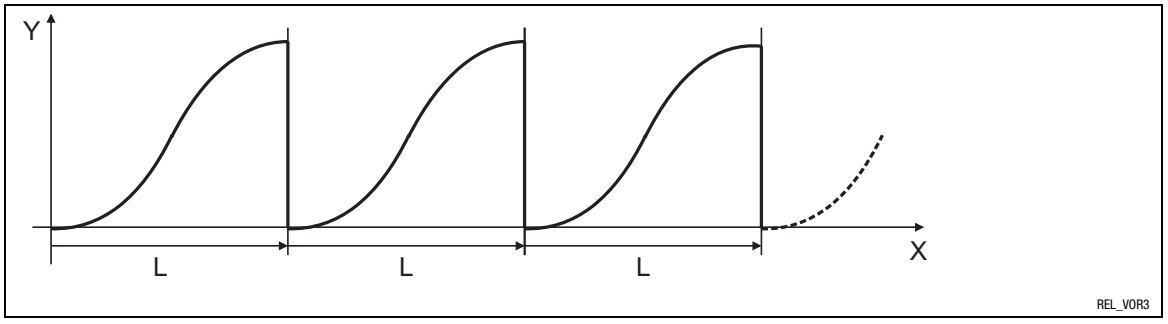


L Profile length

With CURVEC1-REL-SEL = LOW, the last Y value of the profile will not be stored!

STOP!

Depending on the cam profile data, this setting may result in a 'jump' of the drive to the new value (see fig. below).



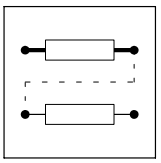
L Profile length

Negative input values

A fault is indicated for negative input values (X<0):

- CURVEC1-X < 0 = HIGH

Furthermore, the output will show the y value which would result from the profile function for x=0.



Max. permissible input value exceeded

A fault is indicated for input values X>Xmax:

- CURVEC1-X > X_{max} = HIGH

Furthermore, the output will show the y value which would result from the profile function for X=Xmax.

Note!

X_{max} is already determined when the profile is generated (GDC).

3.2.38.1 Selection of profiles stored in the controller

Procedure

1. Inhibit the controller or set CURVEC1-X-RESET = HIGH.

Note!

If you have neither inhibited the controller nor set CURVEC1-X-RESET = HIGH, it is not possible to change to another profile (error number 7; ILLEGAL_SYSTEM_ACCESS).

2. Select the new profile (e.g. with FEVAN)
3. Wait 20 ms for data transfer
4. Initialisation starts with CURVEC1-CAM-SEL-BUSY = HIGH
5. Wait (approx. 20 ms) until CURVEC1-CAM-SEL-BUSY = LOW
6. Then CURVEC1-X-RESET = LOW.

Note!

Even if the controller is not inhibited, the profile can be changed with CURVEC1-X-RESET = HIGH (e.g. via FEVAN).

During this procedure, the output CURVEC1-CAM-SEL-BUSY is HIGH.

3.2.39 Dead band (DB)

Purpose

The dead band element is used to set interfering influences around zero, e.g. interferences on analog input voltages, to digital zero.

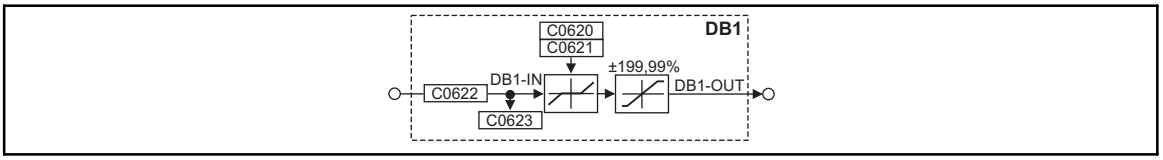


Fig. 3-101 Dead band element (DB1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DB1-IN	a	C0623	dec [%]	C0622	1	1000	-
DB1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The dead band is parameterised under C0621.
- The gain is set under C0620.

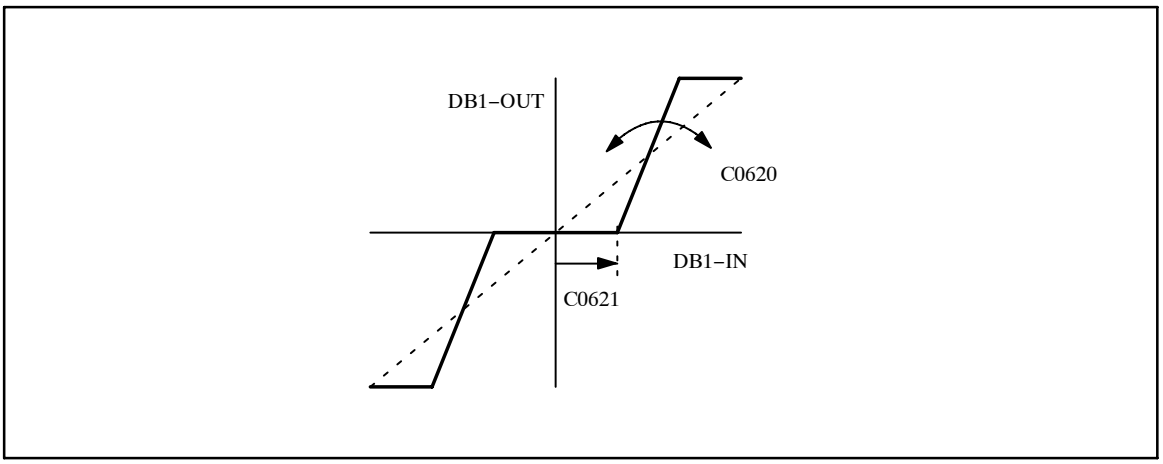


Fig. 3-102 Dead band and gain

3.2.40 Drive control (DCTRL)

Purpose

Sets certain controller states (e. g. trip, trip reset, quick stop or controller inhibit).

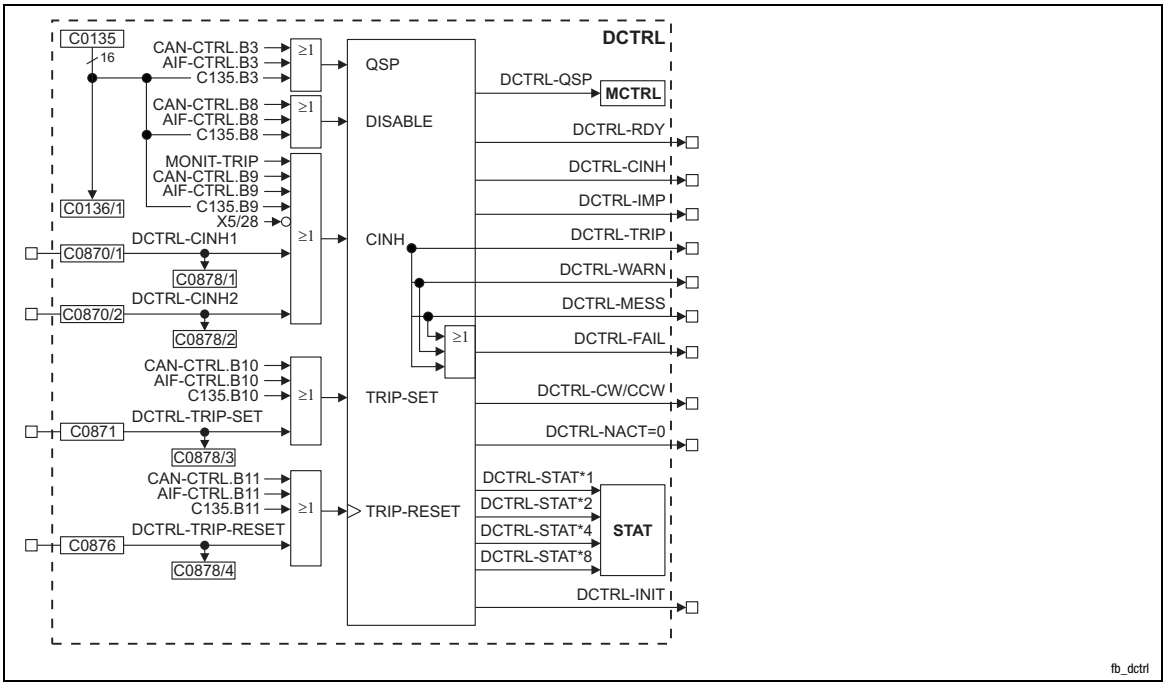


Fig. 3-103 Control of the controller (DCTRL)

Signal				Source			Note
Designation	Type	DIS	DIS format	CFG	List	Lenze	
DCTRL-CINH1	d	C0878/1	bin	C0870/1	2	1000	HIGH = inhibit controller
DCTRL-CINH2	d	C0878/2	bin	C0870/2	2	1000	HIGH = inhibit controller
DCTRL-TRIP-SET	d	C0878/3	bin	C0871	2	54	HIGH = error message EEr
DCTRL-TRIP-RESET	d	C0878/4	bin	C0876	2	55	LOW-HIGH signal = Trip reset
DCTRL-QSP	d	-	-	-	-	-	HIGH = drive performs quick stop
DCTRL-RDY	d	-	-	-	-	-	HIGH = Ready for operation
DCTRL-CINH	d	-	-	-	-	-	HIGH = Controller reset
DCTRL-IMP	d	-	-	-	-	-	HIGH = High-resistance power output stages
DCTRL-TRIP	d	-	-	-	-	-	HIGH = Fault active
DCTRL-WARN	d	-	-	-	-	-	HIGH = Active warning
DCTRL-MESS	d	-	-	-	-	-	HIGH = Active message
DCTRL-FAIL	d	-	-	-	-	-	-
DCTRL-CW/CCW	d	-	-	-	-	-	LOW = CW rotation, HIGH = CCW rotation
DCTRL-NACT=0	d	-	-	-	-	-	HIGH = Motor speed < C0019
DCTRL-STAT*1	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*2	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*4	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*8	d	-	-	-	-	-	General status (binary coded)
DCTRL-INIT	d	-	-	-	-	-	-

Function

- Quick stop (QSP)
- Operation inhibited (DISABLE)
- Controller inhibit (CINH)
- TRIP set
- TRIP reset
- Change of parameter set (PAR)
- Controller state

3.2.40.1 Quick stop (QSP)

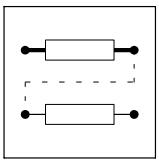
The drive is braked to standstill via the deceleration ramp C105 and generates a holding torque.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 3 of CAN-IN1
  - Control word AIF-CTRL bit 3 of AIF-IN
  - Control word C0135 bit 3
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.2 Operation inhibit (DISABLE)

In this state the drive cannot be started by the command: Controller enable. The power output stages are inhibited. All controllers are reset.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 8 of CAN-IN1
  - Control word AIF-CTRL bit 8 of AIF-IN
  - Control word C0135 bit 8
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135



3.2.40.3 Controller inhibit (CINH)

Note!

When the controller changes to an LU message or an OU message, the signal DCTRL-CINH is not set.

The power output stages are inhibited. All controllers are reset.

- The function can be controlled via seven inputs:
  - Terminal X5/28 (LOW = controller inhibit)
  - Control word CAN-CTRL bit 9 of CAN-IN1
  - Control word AIF-CTRL bit 9 of AIF-IN
  - Control word C0135 bit 9
  - MONIT-TRIP (HIGH = A monitoring function that is configured to TRIP has been activated in the MONIT function block)
  - Free input DCTRL-CINH1
  - Free input DCTRL-CINH2
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.4 TRIP-Set

The drive is lead to the state selected under code C0581 and indicates EEr (external monitoring).

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 10 of CAN-IN1
  - Control word AIF-CTRL bit 10 of AIF-IN
  - Control word C0135 bit 10
  - Free input DCTRL-TRIP-SET
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.5 TRIP RESET

Resets a pending trip if the cause of malfunction has been eliminated. If the cause of malfunction is still active, no response is effected.

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 11 of CAN-IN1
  - Control word AIF-CTRL bit 11 of AIF-IN
  - Control word C0135 bit 11
  - Free input DCTRL-TRIP-RESET
- All inputs are linked by an OR-operation.
- This function is only carried out by a LOW-HIGH edge of the signal resulting from the OR operation.
- C0136/1 indicates the control word C0135

Note!

If one of the inputs is set to HIGH, it is not possible that a LOW-HIGH edge occurs at the resulting signal.

3.2.40.6 Controller state

The status is binary coded via the outputs DCTRL-STAT*x. These outputs are connected with the STAT function block inside the device.

The status can be evaluated via the status word C0150, CAN status word, and AIF status word.

STAT*8	STAT*4	STAT*2	STAT*1	Action of the controller
0	0	0	0	Initialisation after the supply voltage has been connected
0	0	0	1	Switch-on inhibit (LOCK MODE), restart protection is active C0142
0	0	1	1	Drive is inhibited
0	1	1	0	Controller enabled
0	1	1	1	The activation of a monitoring function resulted in a ”message”
1	0	0	0	The activation of a monitoring function resulted in a ”trip”
1	0	1	0	The activation of a monitoring function resulted in a ”FAIL-QSP”

3.2.40.7 Speed threshold n_{act}=0rpm

The standstill message (DCTRL-NACT=1) is set if the actual speed (MCTRL-NACT) is lower than the threshold set in C0019.

The standstill message (DCTRL-NACT=0) is cancelled if the actual speed (MCTRL-NACT) exceeds a threshold from C0019 plus hysteresis. The amount of hysteresis corresponds to 1 % of the max. speed n_{max} from C0011.

Note!

The hysteresis provides for a stable standstill signal, even in the case of a jittering actual speed value. The hysteresis only has an effect during start-up and is not active during a stop process.

3.2.41 Digital frequency input (DFIN)

Purpose

Converting and scaling a pulsed current at the digital frequency input X9 into a speed and angle setpoint. The digital frequency is transferred in a high-precision mode (without offset and gain errors).

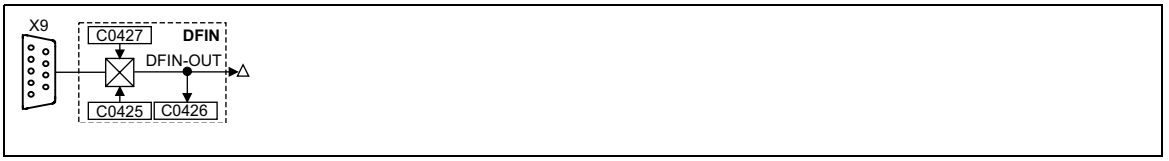


Fig. 3-104 Digital frequency input (DFIN)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFIN-OUT	phd	C0426	dec [rpm]	-	-	

Function

- The input X9 is designed for signals with TTL level.
- In the case of a digital frequency cascade or digital frequency bus, adapt the drive to the connected encoder or upstream controller via C0425.
- The input of a zero track is optional.
- Via C0427 the following input signals can be evaluated:

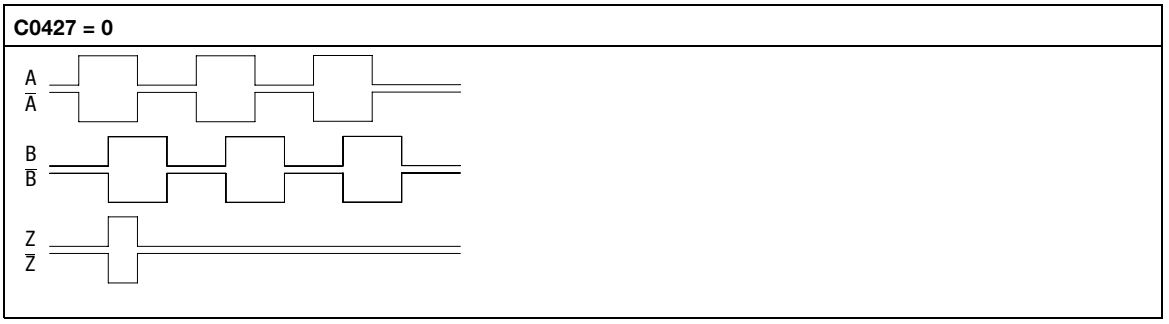


Fig. 3-105 Phase-shifted signal sequence (CW rotation)

CW rotation Track A is leading track B by 90° (positive value at DFIN-OUT).
CCW rotation Track A is lagging track B by 90° (negative value at DFIN-OUT).

C0427 = 1

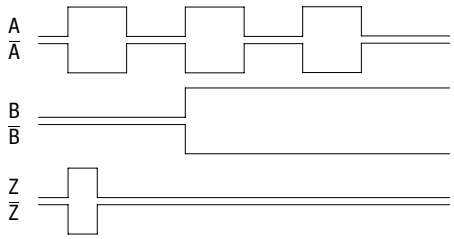


Fig. 3-106 Control of direction of rotation via track B

CW rotation	Track A transmits the speed
	Track B = LOW (positive value at DFIN-OUT)
CCW rotation	Track A transmits the speed
	Track B = HIGH (negative value at DFIN-OUT)

C0427 = 2

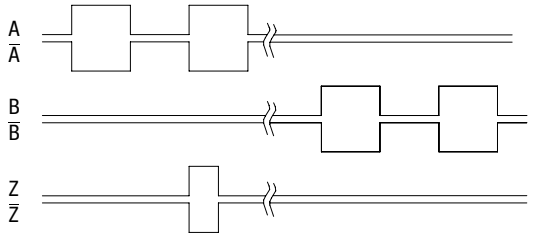


Fig. 3-107 Control of speed and direction of rotation via track A or track B

CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT)
	Track B = LOW
CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT)
	Track A = LOW

Transfer function

$$\text{DFIN-OUT [rpm]} = \text{f [Hz]} \cdot \frac{60}{\text{Number of increments from C0425}}$$

Example:

Input frequency = 200 kHz

C0425 = 3 ($\triangleq$ a number of increments of 2048 inc./rev.)

$$\text{DFIN-OUT [rpm]} = 200000\ \text{Hz} \cdot \frac{60}{2048} = 5859\ \text{rpm}$$

Signal adaptation

Finer resolutions than the power-of-two format can be implemented by the downstream connection of an FB (e.g. CONV3 or CONV4).

Example:

The FB CONV3 converts the speed signal into a quasi-analog signal. Conversion according to formula:

$$\text{CONV3-OUT [\%]} = \text{f [Hz]} \cdot \frac{0.4}{\text{Number of increments from C0425}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

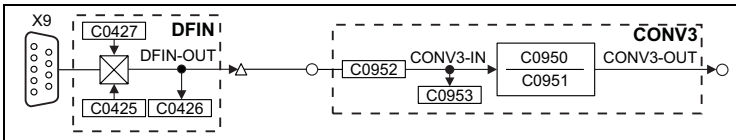


Fig. 3-108 Digital frequency input (DFIN) with downstream converter

STOP!

If C0540 = 0, 1, 2, 3 and feedback system C0025 > 10, you must not use the digital frequency input X9.

3.2.42 Digital frequency output (DFOUT)

Purpose

Converts internal speed signals into frequency signals and outputs them to subsequent drives. The transmission is highly precise (without offset and gain errors).

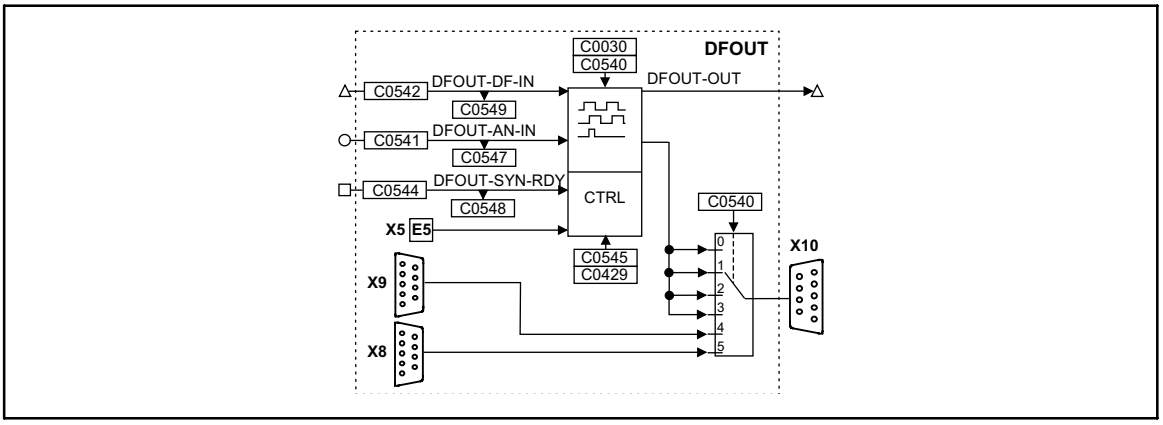


Fig. 3-109 Digital frequency output (DFOUT)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFOUT-DF-IN	phd	C0549	dec [rpm]	C0542	4	-
DFOUT-AN-IN	a	C0547	dec [%]	C0541	1	Input in [%] of nmax (C0011)
DFOUT-SYN-RDY	d	C0548	bin	C0544	2	-
DFOUT-OUT	phd	-	-	-	-	-

Function

- Output signals on X10
- Output of an analog signal
- Output of a speed signal
- Encoder simulation of the resolver with internal zero track
- Encoder simulation of the resolver with external zero track
- Direct output of X8
- Direct output of X9

3.2.42.1 Output signals on X10

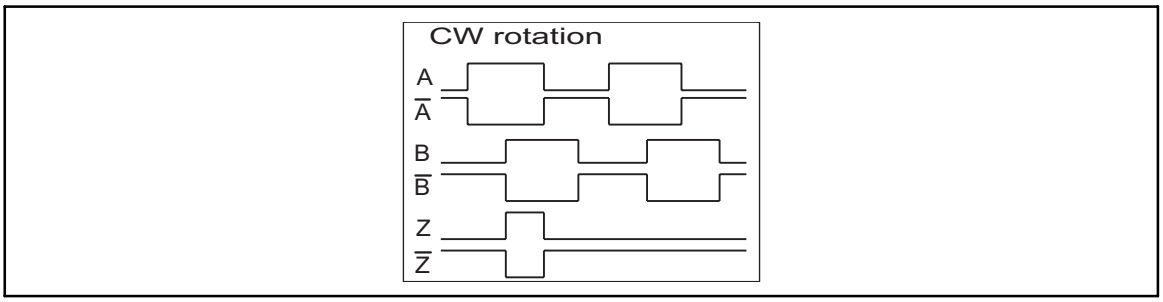


Fig. 3-110 Signal sequence for CW rotation (definition)

- The output signal corresponds to the simulation of an incremental encoder:
  - Track A, B and, if necessary, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  - The levels are TTL-compatible.
- Positive input values (CW rotation) result in the represented signal sequence.
- With negative input values (CCW rotation) track B is leading track A by 90° .
- The zero track is output according to the function set in C0540
- With C0030 the encoder constant of the encoder simulation is set.
- The function of the digital frequency output X10 is defined via C0540.

Stop!

C0540 = 0 to C0540 = 3 cannot be set if the connection to the digital frequency input DFIN X9 has been established and C0025 > 10 has been selected.

C0540	Signal at X10
0	DFOUT-AN-IN is output at X10; zero track can be input externally
1	DFOUT-DF-IN is output at X10; zero track can be input externally
2	Encoder simulation of the resolver with zero track in resolver zero position (mounted on the motor)
3	Encoder simulation of the resolver with external input of the zero track (terminal X5/E5)
4	The signal at input X9 is electrically amplified and directly output (C0030 is without function)
5	The signal at input X8 is electrically amplified and directly output (C0030 is without function)

Create zero track (Z track)

- Condition:
  - Set C0540 = 0, C0540 = 1 or C0540 = 3.
  - Encoder simulation must be active.
- Start creation:
  - The creation starts immediately with the first rising or falling edge on track A or track B.

3.2.42.2 Output of an analog signal

For this purpose, set code C0540 = 0. The value applied at input DFOUT-AN-IN is converted into a frequency.

Transfer function

$$f\,[Hz] = DFOUT - AN - IN\,[\%] \cdot \frac{\text{No. of increments from C0030}}{100} \cdot \frac{C0011}{60}$$

Example:

DFOUT-AN-IN = 50 %

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

C0011 = 3000 rpm

$$f\,[Hz] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ Hz$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Activate the function through a LOW → HIGH edge at the input DFOUT-SYN-RDY.
2. A LOW → HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse is automatically shifted by the value C0545.

Note!

This procedure must be done after every mains switching.

3.2.42.3 Output of a speed signal

- Set C0540 = 1.
  – This setting only converts the value at input DFOUT-DF-IN into a frequency.

Transfer function

$$f\,[Hz] = DFOUT\text{-}DF\text{-}IN\,[rpm] \cdot \frac{\text{No. of increments from C0030}}{60}$$

Example:

DFOUT-DF-IN = 3000 rpm

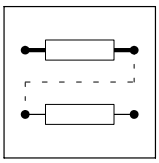
C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

$$f\,[Hz] = 3000\,[rpm] \cdot \frac{2048}{60} = 102400\,[Hz]$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Set input DFOUT-SYN-RDY = edge from LOW → HIGH.
2. A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).



3.2.42.4 Encoder simulation of the resolver

Set C0540 = 2 or C0540 = 3 (depending on the desired generation of the zero track)

- The function is used when a resolver is connected to X7.
- The encoder constant for output X10 is set in C0030.

Generating a zero pulse in resolver zero position (C0540 = 2)

The output of the zero pulse with regard to the rotor depends on how the resolver is mounted to the motor.

- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Generating an external zero pulse (C0540 = 3)

An artificial zero pulse can be generated for the output frequency.

- The function is activated through a LOW-HIGH edge at the input DFOUT-SYN-RDY.
- A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°.
  – After this, every 360° a zero pulse is generated according to the setting in C0030.
- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Note!

The procedure for generating an artificial zero pulse must be repeated after every mains switching and after every setting of C0540 = 3.

3.2.42.5 Direct output of X8 (C0540 = 5)

- The input signal at X8 is electrically amplified and directly output.
- The signals depend on the assignment of the input X8.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X8.

3.2.42.6 Direct output of X9 (C0540 = 4)

- The input signal at X9 is electrically amplified and directly output.
- The signals depend on the assignment of the input X9.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X9.

Note!

For directly outputting X8 or X9 to the digital frequency output X10 the function block DFOUT does not need to be entered into the processing table.

3.2.43 Digital frequency ramp function generator (DFRFG)

Purpose

The drive (motor shaft) is synchronised to a digital frequency (phase selection). The drive then performs a phase-synchronous operation with the digital frequency.

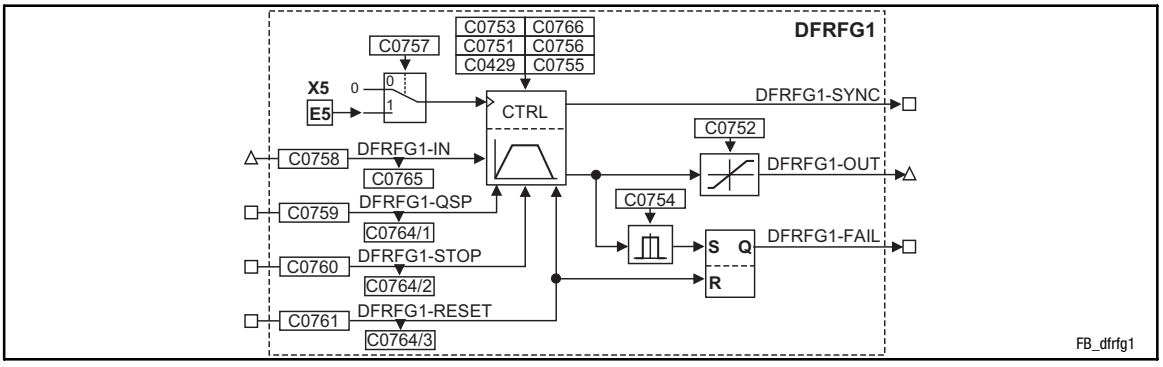


Fig. 3-111 Digital frequency ramp function generator (DFRFG1)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
DFRFG1-SET	phd	C0769	-	C0768	-	Initial speed
DFRFG1-IN	phd	C0765	dec [rpm]	C0758	4	Speed/Phase setpoint
DFRFG1-QSP	d	C0764/1	bin	C0759	2	HIGH = quick stop
DFRFG1-STOP	d	C0764/2	bin	C0760	2	HIGH = save setpoint
DFRFG1-RESET	d	C0764/3	bin	C0761	2	HIGH = reset
DFRFG1-OUT	phd	-	-	-	-	Speed/Phase setpoint
DFRFG1-SYNC	d	-	-	-	-	HIGH = drive runs synchronously
DFRFG1-FAIL	d	-	-	-	-	HIGH = phase difference exceeded

Function

- Profile generator
- Quick stop
- Ramp function generator stop
- RESET
- Detect phase difference
- Start via touch probe initiator (terminal X5/E5)
- Correction of the touch probe initiator (terminal X5/E5)

3.2.43.1 Profile generator

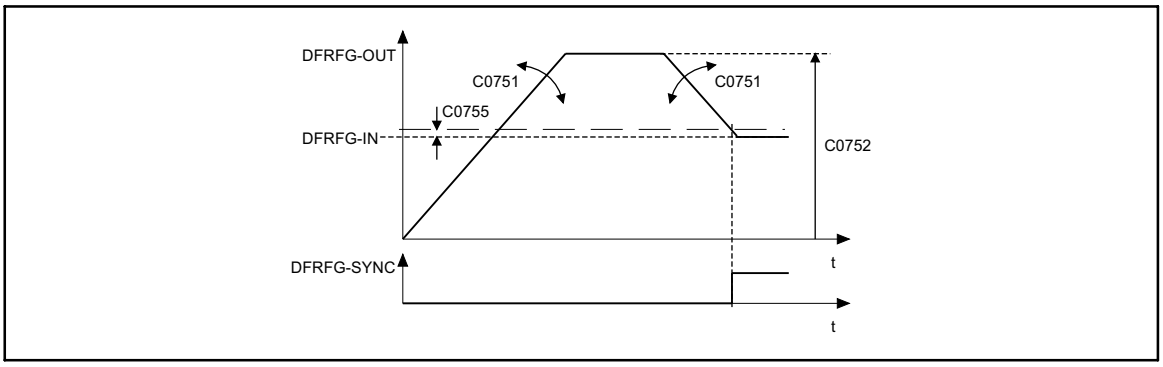


Fig. 3-112 Synchronisation on DFRFG

The profile generator generates ramps which lead the setpoint phase to its target position.

- Set acceleration and deceleration via C0751.
- Set max. speed via C0752.
- When the distance and speed reach their setpoints, the output switches DFRFG1-SYNC = HIGH. At the same time the FB switches the profile generator to ”inactive”.
- Set the switching point via C0755.

Stop!

Do not operate the drive with this function at the torque limitation M_{max}, I_{max}.

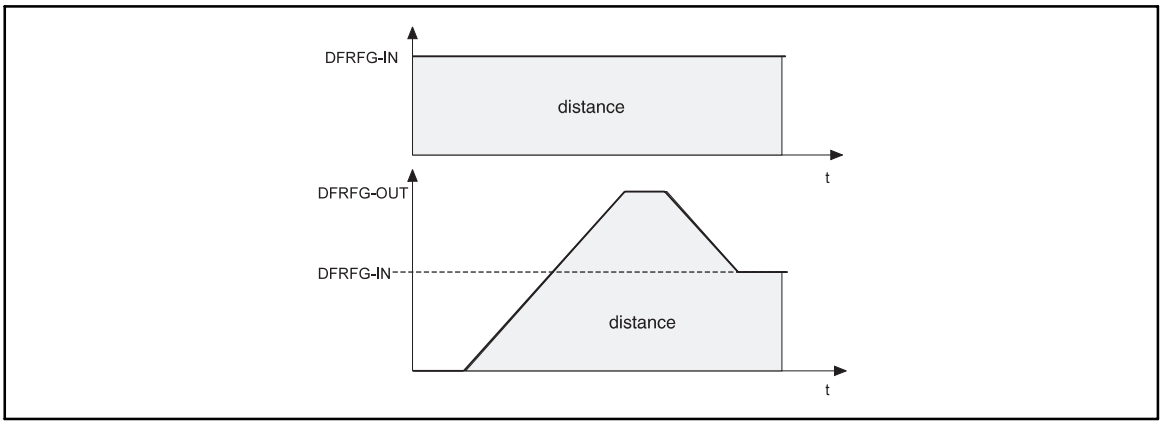


Fig. 3-113 Speed-time diagram DFRFG

The number of increments at DFRFG-IN (master drive) defines the target position. The target can be displayed as a path. The speed-time diagram shows the distance covered (angle) as the area below the speed profile. When synchronicity is reached, master and slave have covered the same distance (angle).

3.2.43.2 Quick stop

Removes the drive from the network and brakes it to standstill.

- Activate with DFRFG-QSP = HIGH.
- Set deceleration time via C0753.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the quick stop request.

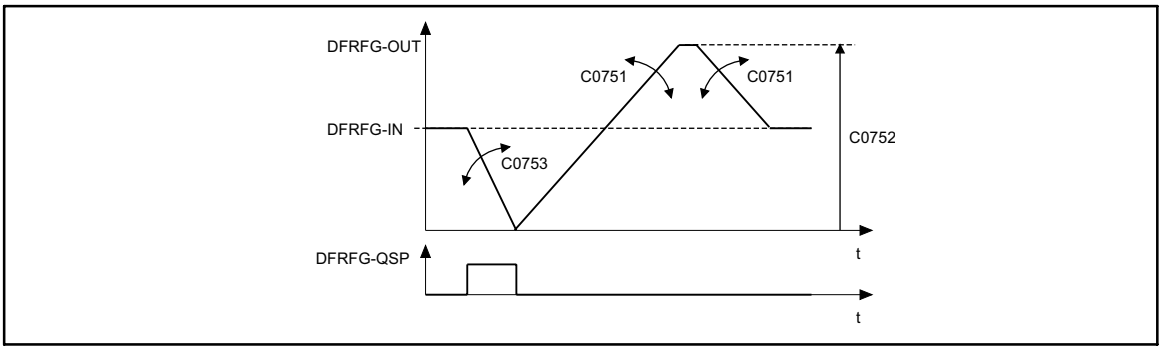


Fig. 3-114 Quick stop DFRFG

3.2.43.3 Ramp function generator stop

Maintains the state of the profile generator during operation.

- Activate with DFRFG-STOP = HIGH
- Output of the last state at DFRFG-OUT.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the stop request.

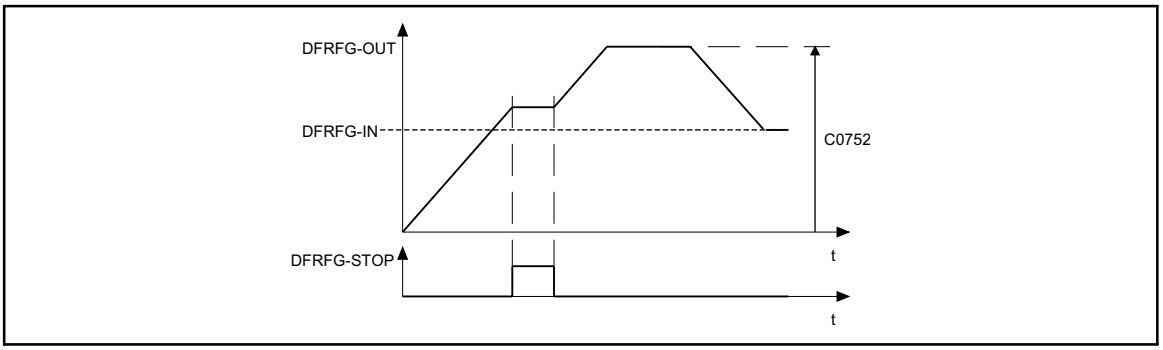
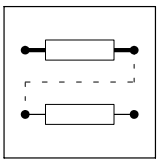


Fig. 3-115 Ramp function generator stop



3.2.43.4 RESET

DFRFG-RESET = HIGH:

- Resets setpoint phases which are internally added.
- Activates the profile generator.
- HIGH-LOW edge at DFRFG-RESET: Detecting the setpoint phase.

3.2.43.5 Detect phase difference

Monitoring the phase difference between input DFRFG-IN and output DFRFG-OUT.

- Set limit value of monitoring via C0754.
- Activates the monitoring: DFRFG-FAIL = HIGH
- Storing the signal until DFRFG-RESET = HIGH.
- The profile generator can accept a phase difference of up to ±2140000000 inc (= 32000 revolutions).

3.2.43.6 Start via touch probe initiator (terminal X5/E5)

Stop!

In the default setting the terminal X5/E5 is assigned to another function.

Function

- Set C0757 = 1.
- The function is activated by **simultaneously** setting the inputs:
  – DFRFG-QSP and DFRFG-RESET = HIGH.
- Starting procedure:
  – Signals at DFRFG-QSP and DFRFG-RESET = LOW.
  – Otherwise touch probe signals are ignored.
- A LOW-HIGH edge at terminal X5/E5 starts the process:

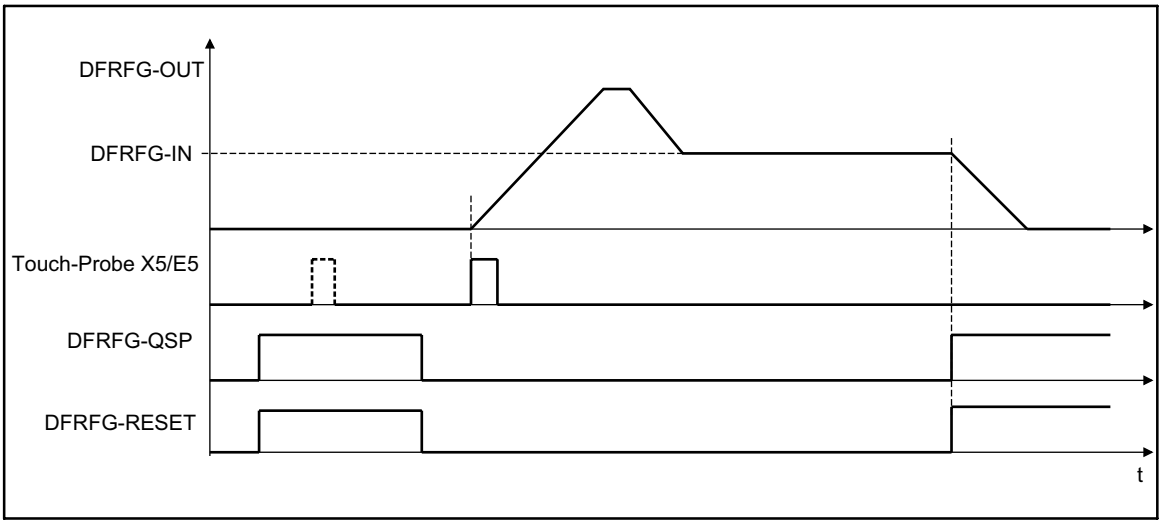
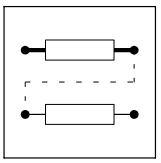


Fig. 3-116 Start via touch probe initiator (terminal X5/E5)



3.2.43.7 Correction of the touch probe initiator (terminal X5/E5)

Delay times during the activation of the initiator cause a speed-dependent phase offset (e.g. during positioning, synchronising).

In order to take this angular offset into account, the response time [ms] of the initiators as a function of the setpoint speed DFRFG-IN is converted to a phase angle correction and is then taken into consideration in the setpoint angle. For this, the response time [ms] has to be converted to a correction value [Inc.] first.

- Set correction value for the phase offset under C0429.
- Formula for input value in C0429:

$$\text{Input value C0429} = 16384 \times \text{response time [ms]}$$

- The response time [ms] can be gathered from the data sheet of the initiator or requested by the manufacturer.

3.2.43.8 Offset setting

The offset can be set with code C0756. The offset refers to the digital frequency input and is scaled to 1 revolution ($\triangleq$ 65536 increments).

The touch probe (TP) initiates the start of the ramp function generator. The leading of the master drive from the moment of starting or the resulting path/phase difference is taken up during the acceleration phase.

- Setting: positive offset values
  - Causes a time shift of the TP
  - This means that less time is necessary - compared to the setting with e.g. offset = 0 - to obtain synchronism with the master drive.

Tip!

With high offsets and low input speeds the drive may reverse. To avoid this, a direction of rotation can be selected for the output via C0766.

3.2.44 Digital frequency processing (DFSET)

Purpose

Conditions the digital frequency for the controller. Input of the stretch factor, gearbox factor, and speed or phase trimming.

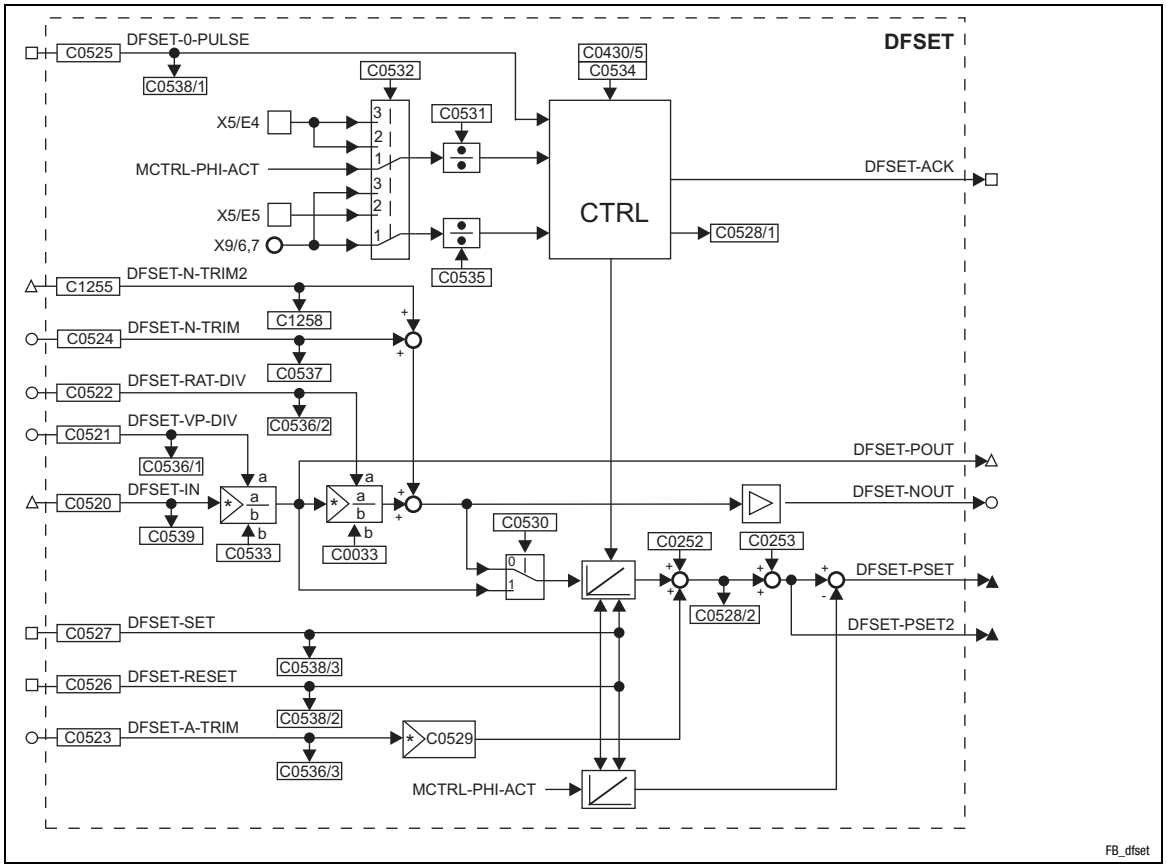
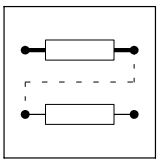


Fig. 3-117 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = release of zero pulse synchronising
DFSET-N-TRIM	a	C0537	dec [%]	C0524	1	Speed trimming in [%] of C0011
DFSET-N-TRIM2	phd	C1258	dec [rpm]	C1255	4	Speed trimming in [rpm] of C0011
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator of gearbox factor 100 % = 16384 inc
DFSET-VP-DIV	a	C0536/1	dec	C0521	1	Numerator of stretch factor 100 % = 16384 inc
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/Phase setpoint
DFSET-SET	d	C0538/3	bin	C0527	2	• HIGH = Set phase integrators to equal values • LOW-HIGH edge sets DFSET-PSET = 0 • HIGH-LOW edge sets DFSET-PSET = current value of MCTRL-PHI-SET • DFSET-SET has a higher priority than DFSET-RESET
DFSET-RESET	d	C0538/2	bin	C0526	2	• HIGH = sets position difference = 0 • HIGH = sets DFSET-PSET and DFSET-PSET2 = 0
DFSET-A-TRIM	a	C0536/3	dec [inc]	C0523	1	Phase trimming 100% = 16384 inc
DFSET-ACK	d	-	-	-	-	HIGH = synchronising is performed
DFSET-POUT	phd	-	-	-	-	Speed/Phase setpoint
DFSET-NOUT	a	-	-	-	-	in [%] of nmax (C0011)
DFSET-PSET	ph	-	-	-	-	Following error for phase controller
DFSET-PSET2	ph	-	-	-	-	Phase setpoint 65536 inc = 1 revolution



Function

- Setpoint conditioning with stretch and gearbox factor
- Processing of correction values
- Synchronising to zero track or touch probe (for resolver feedback touch probe only)

3.2.44.1 Setpoint conditioning with stretch and gearbox factor

Stretch factor

Defines the ratio between the drive and the setpoint.

- The stretch factor evaluates the setpoint at DFSET-IN. DFSET-POUT outputs the result.
- The stretch factor results from numerator and denominator.
  - Numerator is variable from analog signal source or fixed value by the code.
  - Input of the denominator under C0533.
- Relationship:

$$\text{DFSET–POUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}}$$

Gearbox factor

Defines the transmission ratio of the drive. Enter the ratio of the drive.

- The gearbox factor evaluates the setpoint at DFSET-IN multiplied by the stretch factor. DFSET-NOUT outputs the result.
- The gearbox factor results from numerator and denominator.
  - Numerator is variable from analog signal source or fixed value by the code.
  - Input of the denominator under C0033.
- Relationship:

$$\text{DFSET–NOUT} = \text{Reckfaktor} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

$$\text{DFSET–NOUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

Deactivate the gearbox factor and the DFSET-N-TRIM values as a basis for the setpoint angle integrator. If C0530 = 1, only the stretch factor is used for setpoint angle calculation.

3.2.44.2 Processing of correction values

Speed trimming

This is used to add correction values, e.g. by a superimposed control loop. This enables the drive to accelerate or decelerate.

- Adds an analog value at DFSET-N-TRIM to the setpoint speed.
  (see code C0537)
- Adds a speed value at DFSET-N-TRIM2 to the setpoint speed.
  - The speed trimming via this input is more precise.
    (see code C1258)

Phase trimming

This adds a setpoint at DFSET-A-TRIM to the phase setpoint (see code C0536/3) and changes the rotor position to the setpoint with the number of increments provided in either direction (drive is leading or lagging). The phase is trimmed within a range of ±32767 increments (≙ ±1/2 rev.). Every analog signal can be used as a source.

- The input is done in increments (one revolution ≙ 65536 increments).
- When analog values are entered, 100% correspond to 1/4 revolution = 16384 increments.
- Extension of the setting range with a multiplier under C0529.

Phase offset

Addition of a fixed phase offset under C0252 to the setpoint of the drive.

Speed-proportional phase setting

Leading or lagging of the phase with rising speed.

- Enter a suitable setting in increments under code C0253.
- The set phase offset is reached at 15000 rpm of the drive (linear relationship).

3.2.44.3 Synchronising to zero track or touch probe

The synchronisation is selected under C0532.

- C0532 = 1, index pulse
  - zero track of digital frequency input X9 and zero track by the feedback system set under C0490 (not for resolver evaluation).
- C0532 = 2, touch probe
  - via terminals X5/E4 (actual pulse) and X5/E5 (set pulse).
- C0532 = 3, zero pulse (setpoint) and TOUCH-PROBE (actual value)
  - Zero track from the digital frequency input X9 for the setpoint and touch probe initiator via terminal X5/E4 for the actual value.

Note!

All three modes provide the possibility to define a divisor factor for the actual pulses with codes C0531 as well as for the setpoint pulses with codes C0535 (default setting = 1). Hence, it is possible to e.g. evaluate every 10th actual pulse if C0531 = 10. The other 9 pulses are ignored.

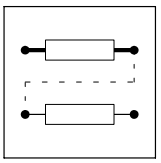
Touch probe initiators can have delay times which cause a speed-dependent phase offset.

To take this angular offset into account, the response time [ms] of the initiators is converted into an angular correction depending on setpoint speed DFSET-NOUT and then considered in the setpoint angle. For this purpose, the response time [ms] must be converted into a correction value [Inc.] first.

- Set correction value for the phase offset under C0430.
- Formula for the input value in C0430/x:

$$\text{Eingabewert in C0430/x} = 16384 \cdot \text{Ansprechzeit[ms]}$$

- Please take the response time [ms] from the data sheet of the initiator or contact the manufacturer.



Stop!

When the synchronisation via the terminals X5/E4 and X5/E5 (C0532 = 2) is activated, no further control signals must be taken from these terminals. Changing the configuration via C0005 assigns the terminals with a basic setting.

Synchronisation mode

For the synchronisation, different modes are available which can be set under C0534.

C0534	Synchronisation mode	Note
0	Inactive	Function inactive
1	Continuous synchronisation with correction in the shortest possible way	
2	Continuous synchronisation with correction in the shortest possible way	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out continuously if a HIGH level remains at DFSET-0-Pulse.
10	One synchronisation, a phase deviation is corrected in the shortest possible way	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
11	One synchronisation, a phase deviation is corrected in CW direction	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
12	One synchronisation, a phase deviation is corrected in CCW direction	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
13	Single synchronisation, a phase difference is determined between setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once

Code C0528/1 displays the number of increments (angular difference) between the setpoint pulse and the actual pulse prior to synchronisation.

Code C0528/2 displays the offset value from (C0523 x C0529 + C0252).

3.2.45 Delay elements (DIGDEL)

Purpose

This function is used to delay digital signals. This function can be used for the control of functions or the generation of status information.

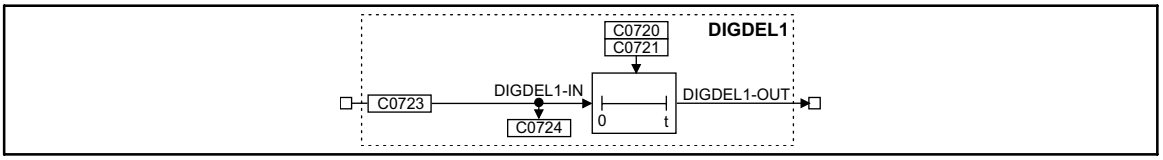


Fig. 3-118 Delay element (DIGDEL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL1-IN	d	C0724	bin	C0723	2	1000	-
DIGDEL1-OUT	d	-	-	-	-	-	-

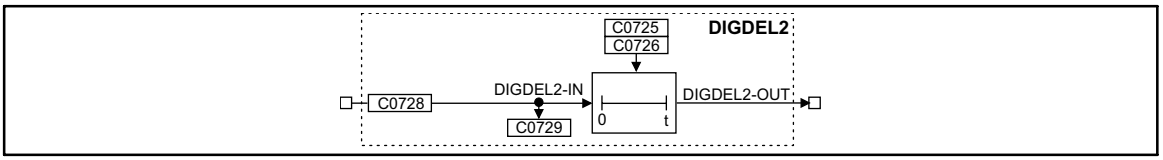


Fig. 3-119 Delay element (DIGDEL2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL2-IN	d	C0729	bin	C0728	2	1000	-
DIGDEL-OUT	d	-	-	-	-	-	-

Function

You can select the following functions under C0720 (DIGDEL1) and C0725 (DIGDEL2):

- On-delay
- Off-delay
- General delay

3.2.45.1 On-delay

If the on-delay is set, a signal change from LOW to HIGH at the input DIGDELx-IN is passed on to the DIGDELx-OUT output after the delay time set under C0721 or C0726 has elapsed.

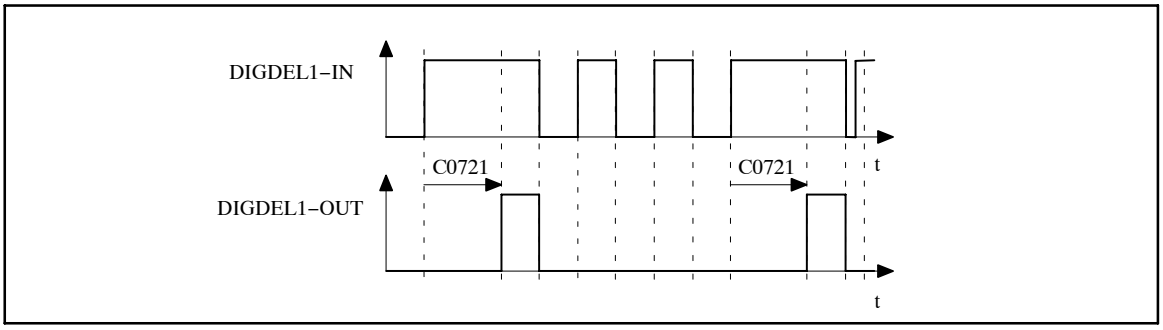


Fig. 3-120 On-delay (DIGDEL1)

In this function, the time element operates like a retriggerable monoflop:

- A LOW-HIGH edge at the input DIGDELx-IN starts the time element.
- If the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to HIGH.
- The time element is reset and the output DIGDELx-OUT is set to LOW with a HIGH-LOW edge at the input DIGDELx-IN.

3.2.45.2 Off-delay

An off-delay causes a signal change from HIGH to LOW at the input DIGDELx-IN to be passed on to the output DIGDELx-OUT after the delay time set under C0721 or C0726 has elapsed.

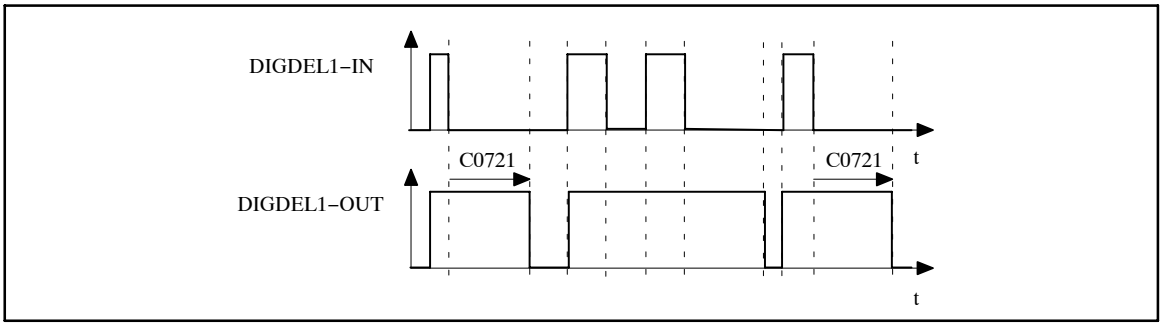


Fig. 3-121 Off-delay (DIGDEL1)

- A LOW-HIGH edge at the input DIGDELx-IN causes the output DIGDELx-OUT to be set to HIGH and the time element to be reset.
- The time element is started with a HIGH-LOW edge at the input DIGDELx-IN.
- After the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to LOW.

3.2.45.3 General delay

A general delay causes any signal change at the input DIGDELx-IN to be passed onto the output DIGDELx-OUT only after the time set under C0721 or C0726 has elapsed.

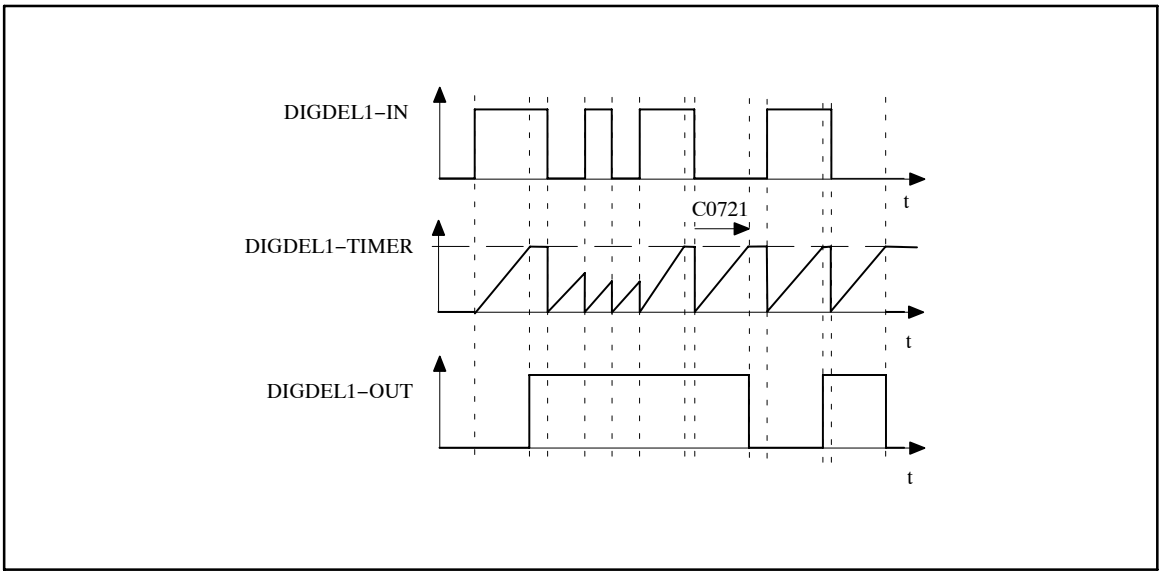


Fig. 3-122 General delay

- The time element is started with any edge at the input DIGDELx-IN.
- When the timer (can be set under C0721 or C0726) has reached the upper limit, the output DIGDELx-OUT is set to the same value as the input DIGDEL1-IN.

3.2.46 Freely assignable digital inputs (DIGIN)

Purpose

Reading and conditioning of the signals at the terminals X5/E1 to X5/E5.

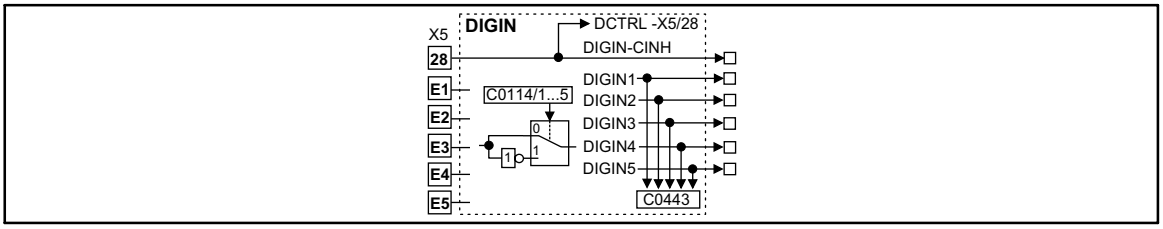


Fig. 3-123 Freely assignable digital inputs (DIGIN)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGIN-CINH	d	-	dec	-	-	-	Controller inhibit acts directly on the DCTRL control
DIGIN1	d	C0443	dec	-	-	-	-
DIGIN2	d	C0443	dec	-	-	-	-
DIGIN3	d	C0443	dec	-	-	-	-
DIGIN4	d	C0443	dec	-	-	-	-
DIGIN5	d	C0443	dec	-	-	-	-

Function

The terminals X5/E1 to X5/E5 are scanned every millisecond. The level for every input can be inverted. For this, proceed as follows:

- Select code C0114 with corresponding subcode (e.g. subcode 3 for input X5/E3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.2.47 Freely assignable digital outputs (DIGOUT)

Purpose

Conditioning of the digital signals and output at the terminals X5/A1 to X5/A4.

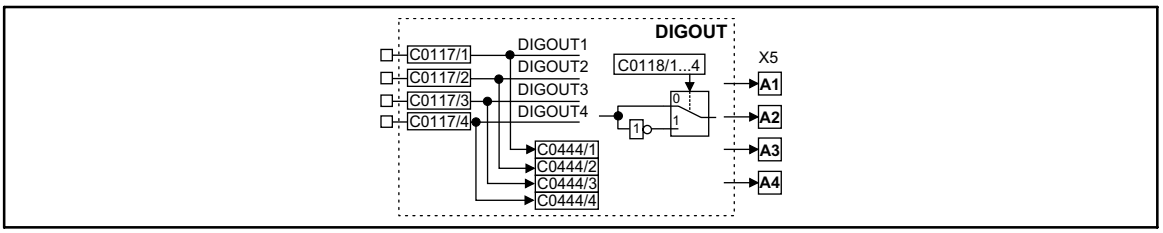


Fig. 3-124 Freely assignable digital outputs (DIGOUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGOUT1	d	C0444/1	bin	C0117/1	2	15000	-
DIGOUT2	d	C0444/2	bin	C0117/2	2	10650	-
DIGOUT3	d	C0444/3	bin	C0117/3	2	500	-
DIGOUT4	d	C0444/4	bin	C0117/4	2	5003	-

Function

The terminals X5/A1 to X5/A4 are updated every millisecond. The level for every output can be inverted. For this, proceed as follows:

- Select code C0118 with corresponding subcode (e.g. subcode 3 for output X5/A3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.2.48 First order derivative-action element (DT1)

Purpose

Derivative action on signals.

For instance, used for the acceleration processes (dv/dt).

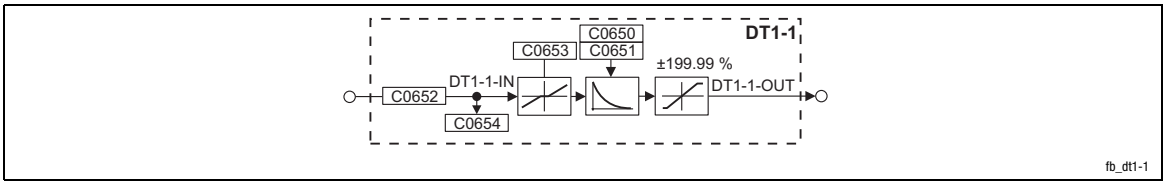


Fig. 3-125 First order derivative-action element (DT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DT1-1-IN	a	C0654	dec [%]	C0652	1	1000	-
DT1-1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The gain is set under C0650.
- The delay T_V is set under C0651.
- The input sensitivity of the DT1-1 element can be reduced under C0653.
- The FB only evaluates the specified most significant bits, according to the setting.

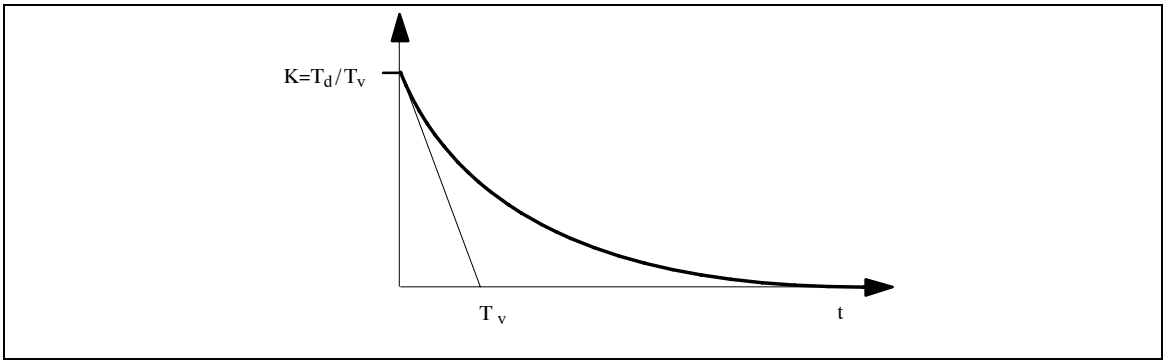
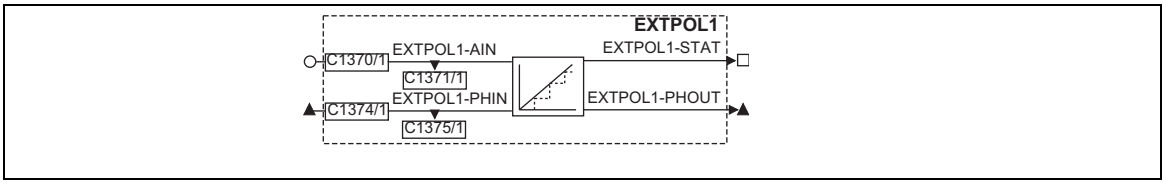


Fig. 3-126 Delay time T_V of the first order derivative-action element

3.2.49 Extrapolation (EXTPOL1)

Optimisation of running features



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
EXTPOL1-AIN	d	1371/1	bin	1370/1		Speed input
EXTPOL1-PHIN	ph	1375/1	ph	1374/1		Position input
EXTPOL1-STAT	d	13451	-	-	-	HIGH = extrapolation on LOW = new data at input PHIN
EXTPOL1-PHOUT	ph	13451	-	-	-	Extrapolated position of input PHIN

The function block EXTPOL1 is used when position information is exchanged between master and slave using a bus system.
The transfer cycle via a bus system is often longer than 1 ms, especially if

- for instance, a PLC or an industrial PC is connected to the bus
- the baud rate is < 1Mbaud (e.g. with cable lengths > 25 m)

The short response time required between setpoint and actual value of the controller is prolonged by the bus load. Especially when the position is changed, a linear speed characteristic is converted into a step-like characteristic. The suddenly changing speed results in corresponding torque peaks in all drive elements connected.

The function block EXTPOL1 smoothens this 'step' character by 'fine-interpolation' between the steps (see function block symbol). The improved smoothness of running can even be heard.

Function block interconnection

The function blocks must be connected in both drives (master and slave).

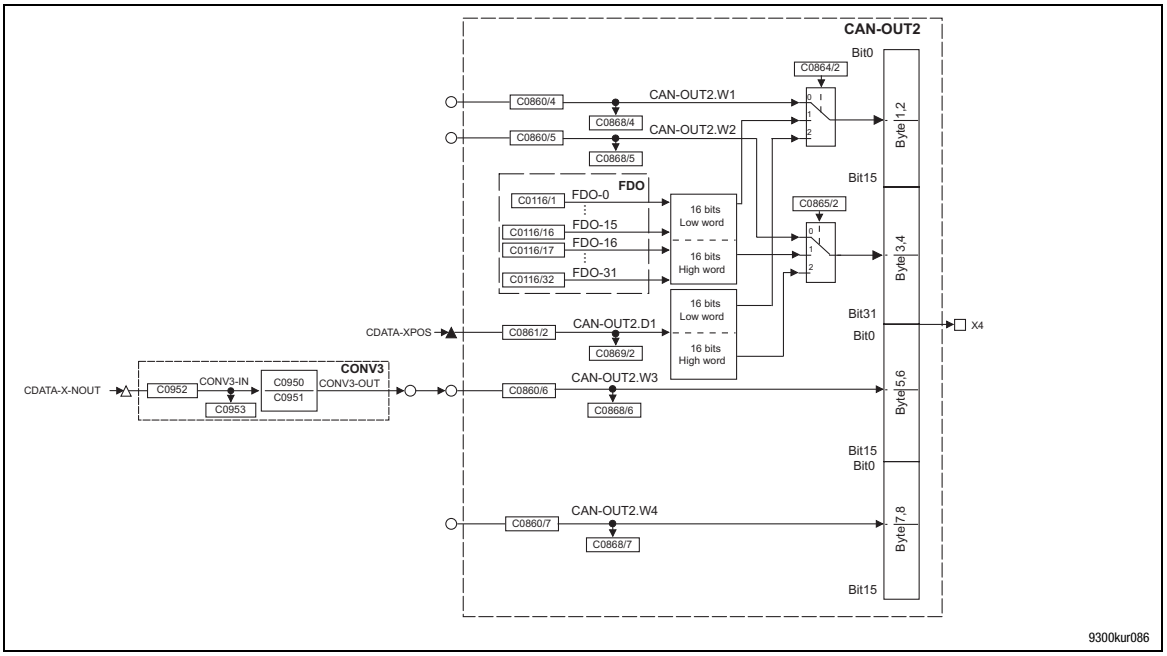


Fig. 3-127 Master connection

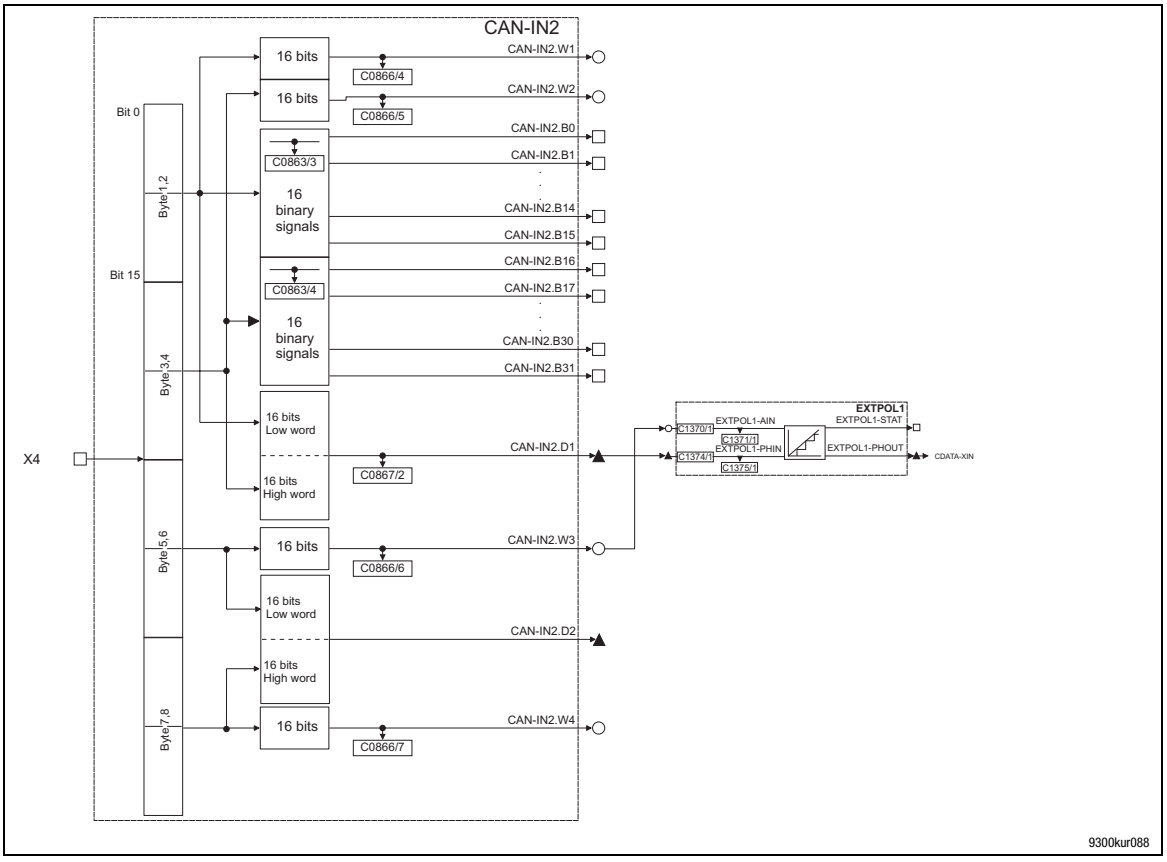


Fig. 3-128 Slave connection

Settings

Note!

FB EXTPOL1 does not require setting. It must however be ensured, that numerator (C0950) and denominator (C0951) are 1 in the function block CONV3 of the master.

Status signal

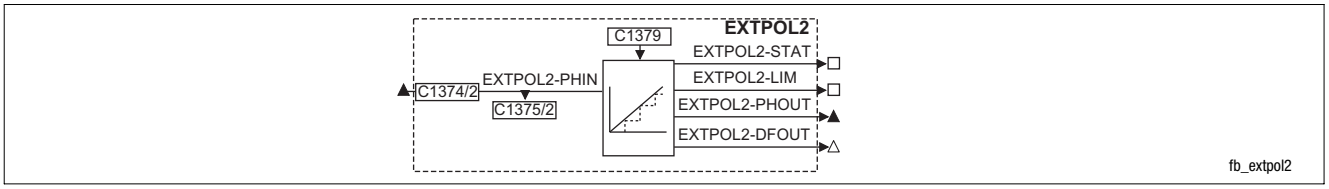
- EXTPOL1-STAT = HIGH
  – Function block extrapolates
- EXTPOL1-STAT = LOW
  – Input data is accepted directly.

3.2.50 Extrapolation (EXTPOL2)

Optimisation of running features (function like EXTPOL1)

Smoothing of a low-resolution absolute value encoder (angle encoder)

Position detection while “line shaft” crosses zero



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
EXTPOL2-PHIN	ph	1425/2	ph	1374/1		Position input
EXTPOL2-STAT	d	13461	-	-		HIGH = extrapolation on LOW = new data at input -PHIN
EXTPOL2-LIM	d	13462	-	-		HIGH = time limit of C1379 exceeded, extrapolation is cancelled or master angle is in standstill LOW = time limit not exceeded, master angle running
EXTPOL2-PHOUT	ph	13461	-	-		Extrapolated position of input PHIN
EXTPOL2-DFOUT	phd	-	-	-		Extrapolated speed difference signals The output may be only used up to max. 10 extrapolation cycles per ms (C1379 = max. 10 ms)

Tip!

Please observe the computing time of the FBs.

- 5 µs (EXTPOL1)
- 10 µs (EXTPOL2)

Function block interconnection

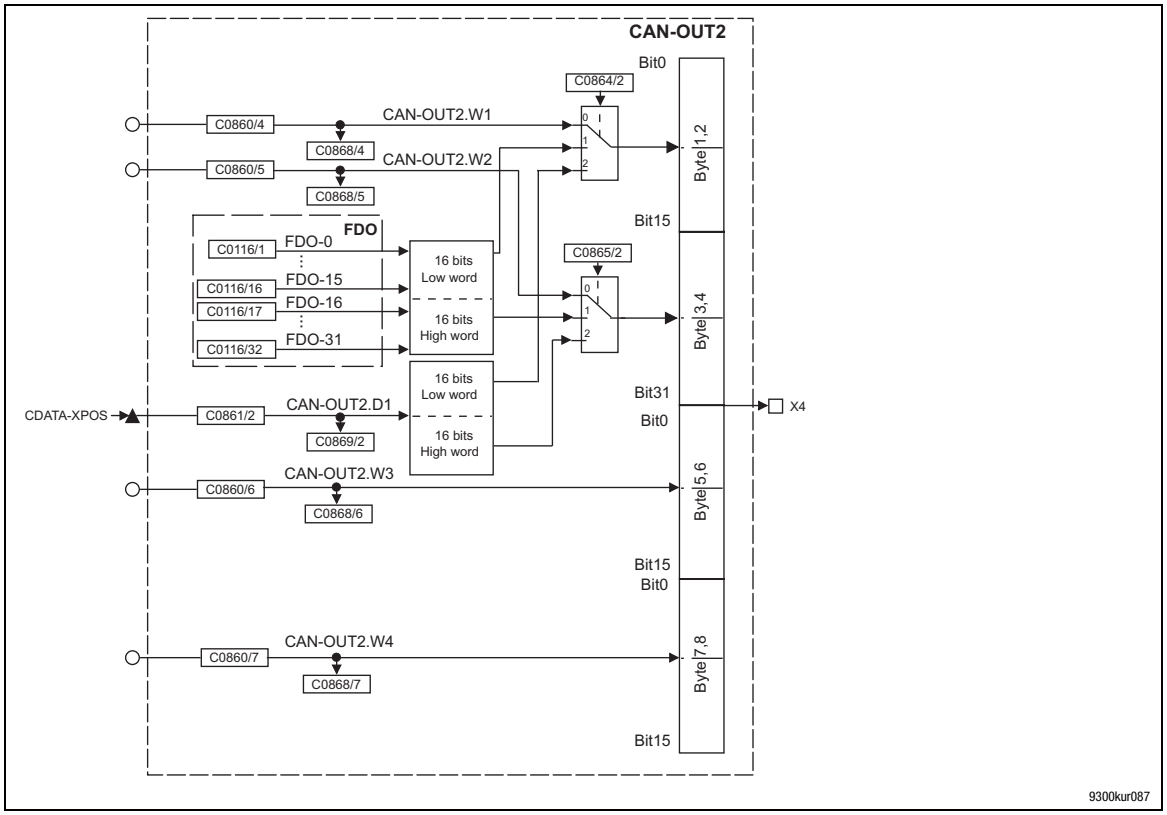


Fig. 3-129 Master connection

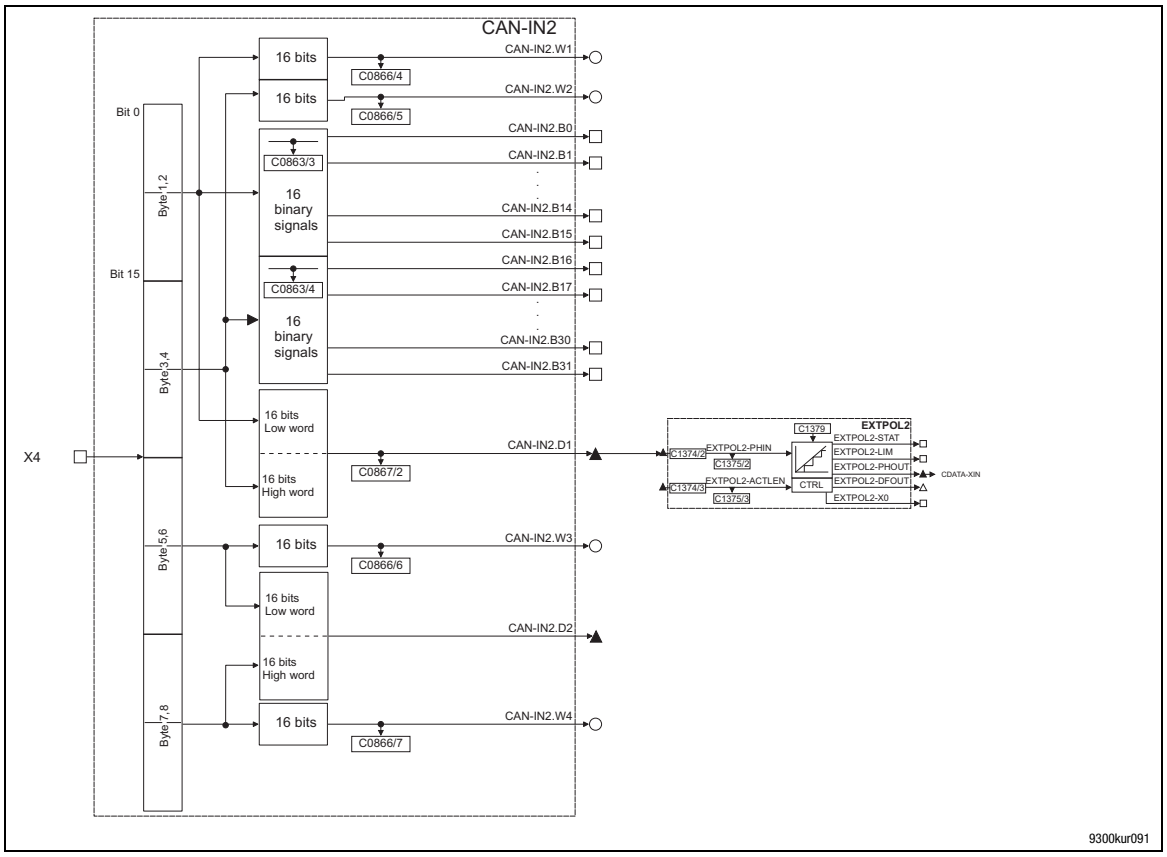
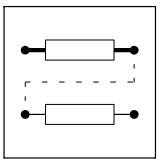


Fig. 3-130 Slave connection



Please see figures Fig. 3-129 and Fig. 3-130 for the interconnections of master and slave.

Differences to EXTPOL1:

- In the master only the X position (CDATA-X-POS) is sent
- The slave just receives the X position

Settings

- Code C1379
  – Use C1379 to adapt the number of extrapolation cycles per ms to the cycle time of the bus.

STOP!

This function does not replace the monitoring of the bus system. The bus system should be monitored with a ”toggle bit”.

Tip!

If, for instance, the transfer cycle is max. 5 ms, set at least 6 ms in C1379.

After the time set has been exceeded, the input EXTPOL2-PHIN is directly connected to the output EXTPOL2-PHOUT. Only when new positions are detected at the input, the extrapolation restarts.

3.2.51 Free piece counter (FCNT)

Purpose

Digital up/down counter

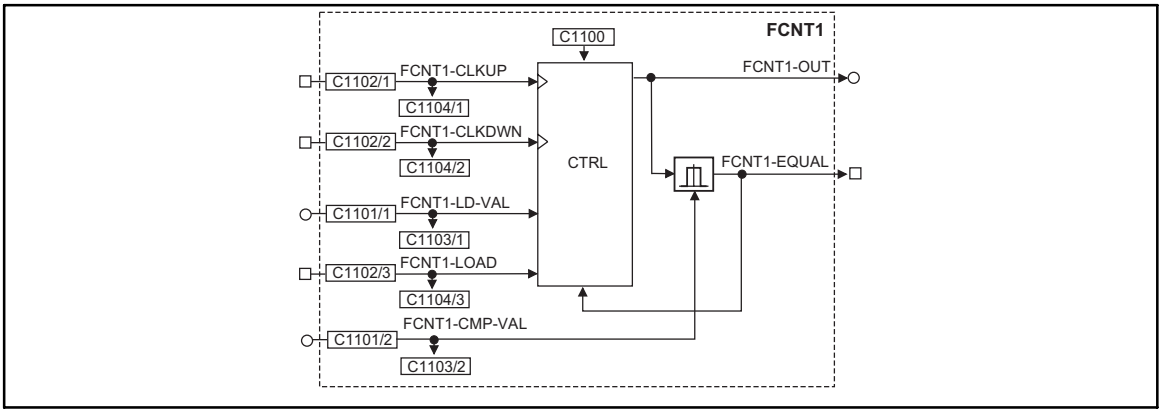


Fig. 3-131 Free piece counter (FCNT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT1-CLKUP	d	C1104/1	bin	C1102/1	2	LOW-HIGH edge = counts up by 1
FCNT1-CLKDWN	d	C1104/2	bin	C1102/2	2	LOW-HIGH edge = counts down by 1
FCNT1-LD-VAL	a	C1103/1	dec	C1101/1	1	Starting value
FCNT1-LOAD	d	C1104/3	bin	C1102/3	2	• HIGH = Accept starting value • The input has the highest priority
FCNT1-CMP-VAL	a	C1103/2	dec	C1101/2	1	Comparison value
FCNT1-OUT	a	-	-	-	-	Counter limited to ±199.99 % (≙ ±32767)
FCNT1-EQUAL	d	-	-	-	-	HIGH = comparison value reached

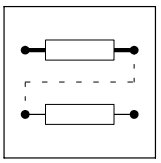
Function

- C1100 = 1
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), FCNT1-EQUAL is set = HIGH for 1 ms. Afterwards the counter is reset to the starting value (FCNT1-LD-VAL).

Note!

If the signal is to be available longer, e. g. for a query of the output via a PLC, you can prolong the signal via the TRANS function block.

- C1100 = 2
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
- C1100 = 3
  - If | counter content| = | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
  - FCNT1-OUT is limited to 32767 for counting upwards and to -32767 for counting downwards.



3.2.52 Free codes (FCODE) of the measuring systems

A measuring system is described via the gearbox factor (numerator and denominator) and the feed constant. These scaling factors have an effect on the conversion of units into increments.

The measuring systems have an effect on free codes.

Measuring system of the master phase (X axis)

- FCODE1476/1 ... FCODE1476/16
- Gearbox factor of the numerator: C1303/1
- Gearbox factor of the denomiator: C1303/2
- Feed constant: C1304
- The selection is effected in [m_units]

Measuring system of the actual value (Y axis)

- FCODE1477/1 ... FCODE1477/16
- Gearbox factor numerator: C1305/1
- Gearbox factor denomiator: C1305/2
- Feed constant: C1306
- The selection is effected in [s_units]

Measuring system Z (Z axis)

- FCODE1478/1 ... FCODE1478/6
- Gearbox factor numerator: C1680/1
- Gearbox factor denomiator: C1680/2
- Feed constant: C1681
- The selection is effected in [z_units]

Note!

The Z measuring system has no effect on the profiles and displays.

The profiles are calculated in PC programs. If you want to calculate profiles via the Z measuring system, you have to adapt the corresponding PC programs.

3.2.53 Free digital outputs (FDO)

Purpose

This function block can be used to connect digital signals via C0151, the function block AIF-OUT and function block CAN-OUT to the connected fieldbus systems.

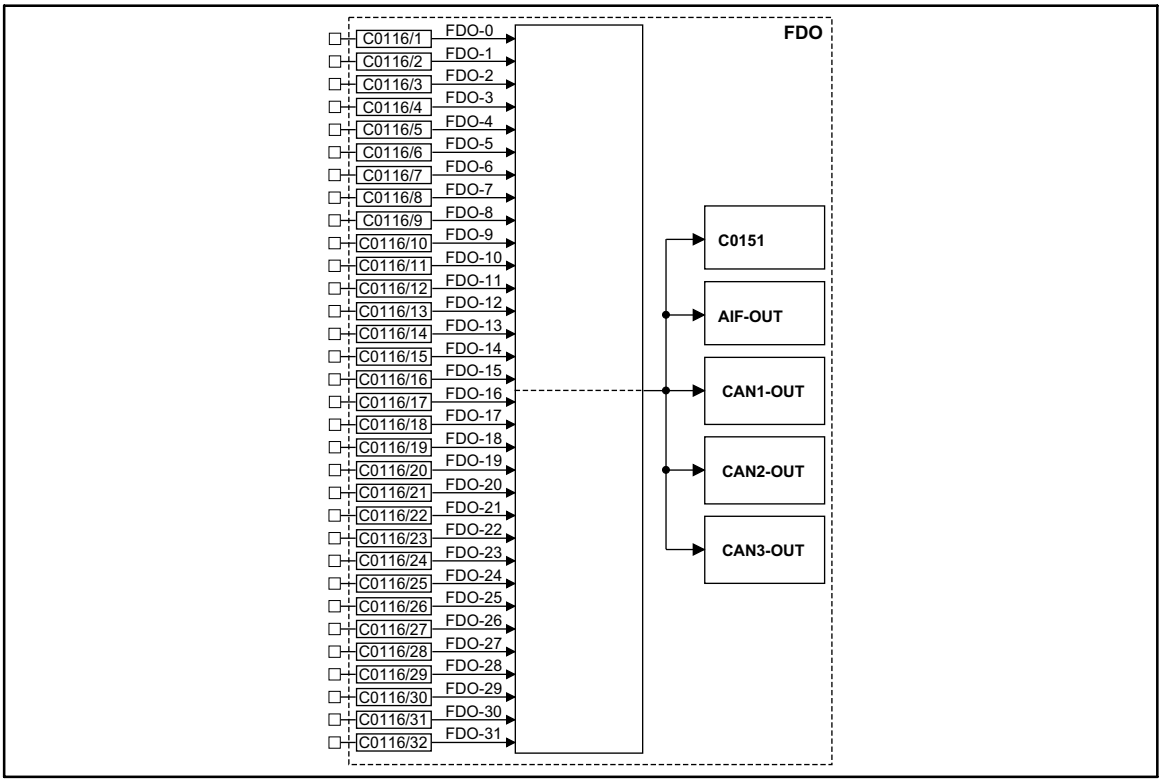
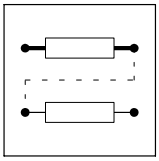


Fig. 3-132 Free digital outputs (FDO)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FDO-0	d	C0151	hex	C0116/1	2	1000	
FDO-1	d	C0151	hex	C0116/2	2	1000	
FDO-2	d	C0151	hex	C0116/3	2	1000	
FDO-3	d	C0151	hex	C0116/4	2	1000	
FDO-4	d	C0151	hex	C0116/5	2	1000	
FDO-5	d	C0151	hex	C0116/6	2	1000	
FDO-6	d	C0151	hex	C0116/7	2	1000	
FDO-7	d	C0151	hex	C0116/8	2	1000	
FDO-8	d	C0151	hex	C0116/9	2	1000	
FDO-9	d	C0151	hex	C0116/10	2	1000	
FDO-10	d	C0151	hex	C0116/11	2	1000	
FDO-11	d	C0151	hex	C0116/12	2	1000	
FDO-12	d	C0151	hex	C0116/13	2	1000	
FDO-13	d	C0151	hex	C0116/14	2	1000	
FDO-14	d	C0151	hex	C0116/15	2	1000	
FDO-15	d	C0151	hex	C0116/16	2	1000	
FDO-16	d	C0151	hex	C0116/17	2	1000	
FDO-17	d	C0151	hex	C0116/18	2	1000	
FDO-18	d	C0151	hex	C0116/19	2	1000	
FDO-19	d	C0151	hex	C0116/20	2	1000	
FDO-20	d	C0151	hex	C0116/21	2	1000	
FDO-21	d	C0151	hex	C0116/22	2	1000	
FDO-22	d	C0151	hex	C0116/23	2	1000	
FDO-23	d	C0151	hex	C0116/24	2	1000	
FDO-24	d	C0151	hex	C0116/25	2	1000	
FDO-25	d	C0151	hex	C0116/26	2	1000	
FDO-26	d	C0151	hex	C0116/27	2	1000	
FDO-27	d	C0151	hex	C0116/28	2	1000	
FDO-28	d	C0151	hex	C0116/29	2	1000	
FDO-29	d	C0151	hex	C0116/30	2	1000	
FDO-30	d	C0151	hex	C0116/31	2	1000	
FDO-31	d	C0151	hex	C0116/32	2	1000	

Function

You can freely select a digital signal source for every signal input.

- The corresponding bit in the data word (DWORD) is marked with FDO-x (e.g. FDO-0 for the LSB and FDO-31 for the MSB).
- The DWORD is transferred to code C0151 and to the function blocks AIF-OUT, CAN-OUT1, CAN-OUT2, and CAN-OUT3.

3.2.54 Freely assignable input variables (FEVAN)

Purpose

Transfer of analog signals to any code. At the same time, the FB converts the signal into the data format of the target code.

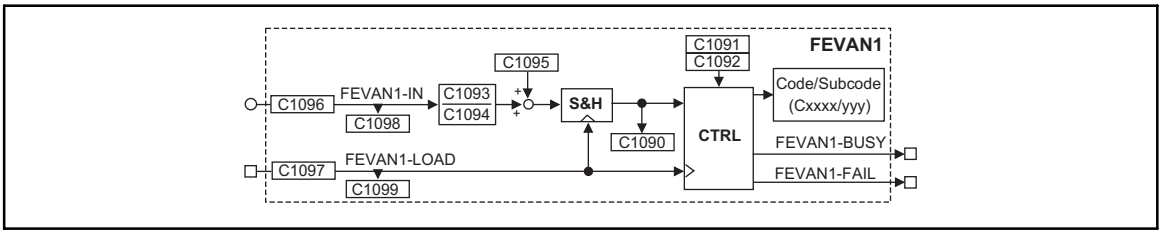


Fig. 3-133 Freely assignable input variables (FEVAN1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN1-IN	a	C1098	dec	C1096	1	Input value
FEVAN1-LOAD	d	C1099/1	bin	C1097/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN1-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN1-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN1-LOAD sets FEFAN1-FAIL = LOW.
-	-	C1090	-	-	-	Display of the converted signal

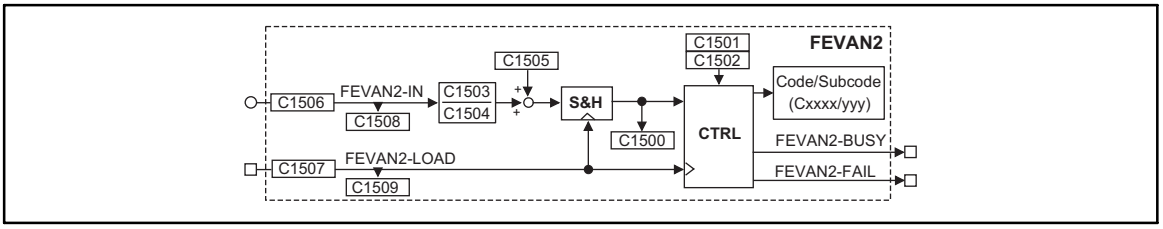


Fig. 3-134 Freely assignable input variables (FEVAN2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN2-IN	a	C1508	dec	C1506	1	Input value
FEVAN2-LOAD	d	C1509/1	bin	C1507/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN2-LOAD sets FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

Function

- Conversion of the read data via:
  - Numerator, denominator.
  - Offset.
- Selection of a target code for the read data.

Codes for the conversion of the read data and for the selection of the target code

				Selection of the target code		
Function block	**Numerator**	**Denominator**	**Offset**	**Code**	**Subcode**	**Examples**
FEVAN1	C1093	C1094	C1095	C1091	C1092	
FEVAN2	C1503	C1504	C1505	C1501	C1502	

Data transmission

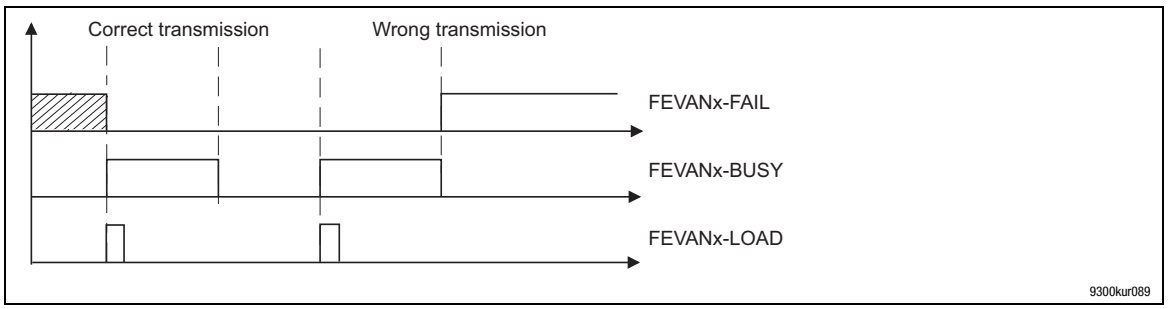


Fig. 3-135 Signal flow

Transmission errors may occur if

- the target code is not available,
- the target subcode is not available,
- the values transmitted are out of the target code limits,
- the target code is inhibited since it may only be written to if the controller is inhibited. Inhibit the controller (see code table).

Cyclic data transmission

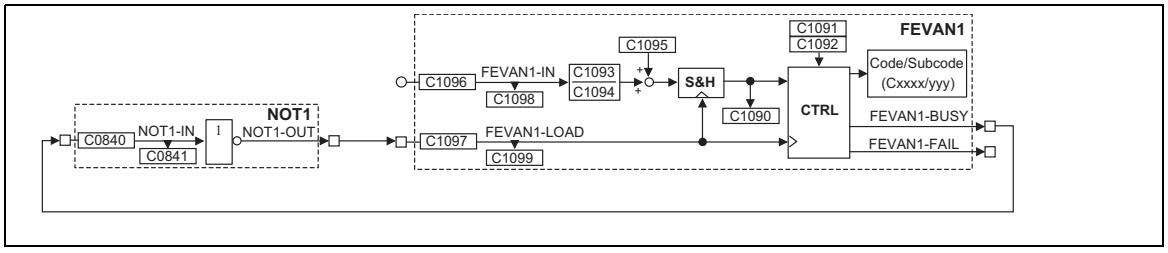


Fig. 3-136 Example for a cyclic data transmission to a target code

Conversion

Conversion at the example of FB FEVAN1.

- The data format of the target code is important for the conversion (see attribute table).
- Adapt the input signal to the data format of the target code with:
  - C1093 (numerator).
  - C1094 (denominator).
- C1094 also determines the decimal positions of the target code:
  - Set C1094 according to the existing decimal positions of the target code. The number of decimal positions can be obtained from the code table.
  - 0.0001 ≙ no decimal positions.
  - 0.001 ≙ one decimal position.
  - 0.01 ≙ two decimal positions.
  - 0.1 ≙ three decimal positions.
  - 1 ≙ four decimal positions.
- For target codes with % scaling the formula for conversion must include a scaling factor (see example 1).

Example 1 (only for FIX32 format with % scaling):

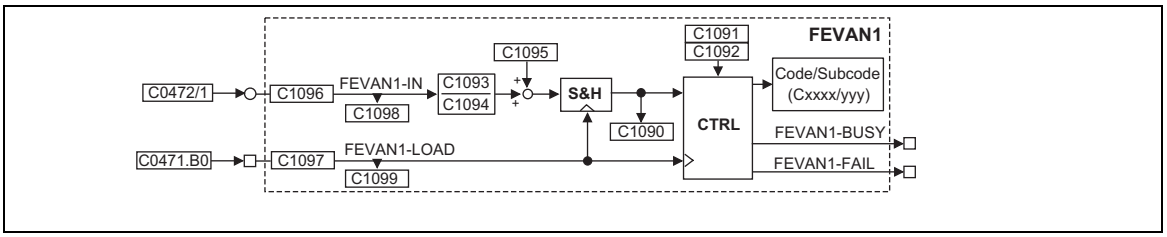


Fig. 3-137 Interconnection example of a circuit for FIX32 format with % scaling

Task:

- C0472/1 = 1.05 %. Write this value to C0141.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-472/1 (19521).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 141 (≙ C0141)
- Set C1092 = 0 (no subcode available)
- C1093 = calculate numerator
- Set C1094 = 0.01 (two decimal positions)
- Set C1095 = 0 (no offset).

Calculation:

$$\text{FEVAN1–IN [\%]} \cdot \underbrace{\frac{1}{10000}}_{\text{Scaling factor}} \cdot \underbrace{\frac{16384}{100}}_{\text{Unit scaling factor}} \cdot \frac{C1093}{C1094} + C1095 = C0141\ [\%]$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data is transmitted to the target code.

Example for converting to C1093:

$$1.05\ \% \cdot 10000 \cdot \frac{100}{16384} \cdot C1094 \cdot \frac{1}{1.05\ \%} = C1093 = 0.6103$$

Setpoint in C0141 — FEVAN1-IN

Display:

- C0141 = 1.00 %

Example 2 (only for FIX32 format without % scaling):

Task:

- C0473/1 = 1000. Write this value to C0011.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-473/1 (19551).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 11 (≙ C0011)
- Set C1092 = 0 (no subcode available)
- Set C1093 = 1.0
- Set C1094 = 0.0001 (no decimal position)
- Set C1095 = 0 (no offset).

The source code has no unit. The unit scaling factor is dropped.

Calculation:

$$\text{FEVAN1–IN} \cdot \frac{1}{10000} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = \text{C0011 [rpm]}$$

Scaling factor

$$1000 \cdot \frac{1}{10000} \cdot \frac{1.0}{0.0001} + 0 = 1000 \text{ rpm}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data is transmitted to the target code.

Display:

- C0011 displays the value 1000 rpm.

The other formats are calculated with the following formula:

$$\text{FEVAN1–IN} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = x$$

3.2.55 Fixed setpoints (FIXSET)

Purpose

This FB serves to program up to 15 fixed setpoints which can be retrieved via digital terminals or control codes.

The fixed setpoints can e.g. be used for:

- different setpoint dancer positions for one dancer position control or
- different stretching ratios (gearbox factor) for a speed ratio control with digital frequency coupling

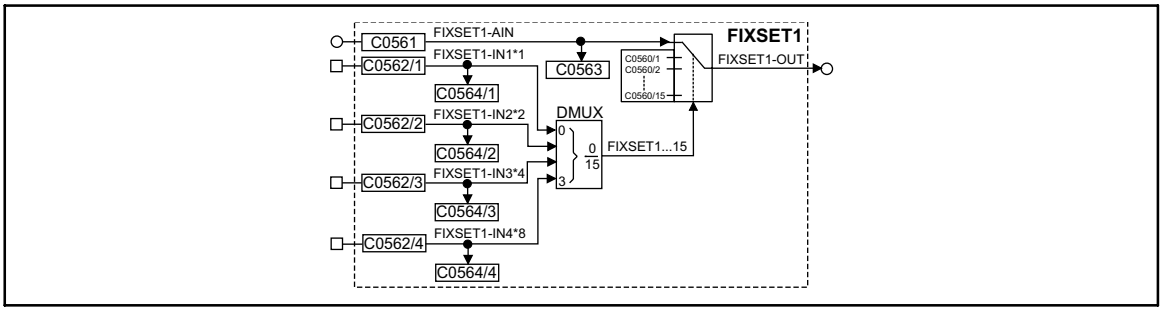


Fig. 3-138 Fixed setpoint (FIXSET1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FIXSET1-AIN	a	C0563	dec [%]	C0561	1	1000	The input is switched to the output if a LOW level is applied to all selection inputs FIXSET-INx.
FIXSET1-IN1*1	d	C0564/1	bin	C0562/1	2	1000	The number of the inputs to be assigned depends on the number of the FIXSET setpoints required.
FIXSET1-IN2*2	d	C0564/2	bin	C0562/2	2	1000	
FIXSET1-IN3*4	d	C0564/3	bin	C0562/3	2	1000	
FIXSET1-IN4*8	d	C0564/4	bin	C0562/4	2	1000	
FIXSET1-OUT	a	-	-	-	-	-	

Function

The FB output can be used as a setpoint source (signal source) for another FB (e.g. process controller, arithmetic block etc.). Parameter setting and handling are similar to JOG but independent of JOG (cp. FB NSET).

- Parameter setting of the fixed setpoints:
  - The single fixed setpoints are parameterised via the subcodes of C0560.
- Output of the fixed setpoint selected:
  - If the binary inputs are triggered with HIGH signal, a fixed setpoint from the table is switched to the output.
- Value range:
  - The values for the fixed setpoint can be set between -200% and +200%.

3.2.55.1 Release of the FIXSET1 setpoints

Number of the fixed setpoints required	Number of inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

System for decoding the binary input signals:

Output signal FIXSET1-OUT =	1st input FIXSET1-IN1	2nd input FIXSET1-IN2	3rd input FIXSET1-IN3	4th input FIXSET1-IN4
FIXSET1-Ain	0	0	0	0
C0560/1	1	0	0	0
C0560/2	0	1	0	0
C0560/3	1	1	0	0
C0560/4	0	0	1	0
C0560/5	1	0	1	0
C0560/6	0	1	1	0
C0560/7	1	1	1	0
C0560/8	0	0	0	1
C0560/9	1	0	0	1
C0560/10	0	1	0	1
C0560/11	1	1	0	1
C0560/12	0	0	1	1
C0560/13	1	0	1	1
C0560/14	0	1	1	1
C0560/15	1	1	1	1

3.2.56 Flipflop element (FLIP)

Purpose

This FB is a D flipflop. This function is used to evaluate and save digital signal edges.

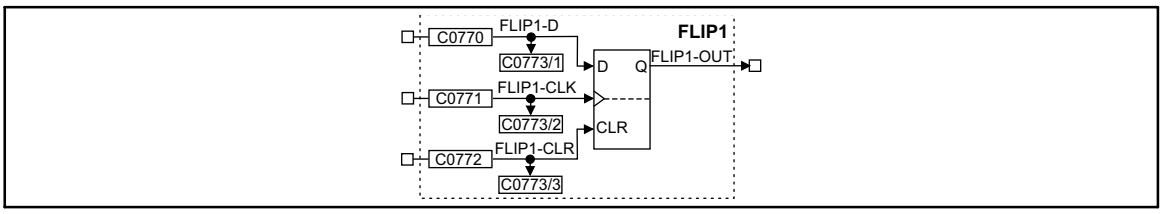


Fig. 3-139 Flipflop element (FLIP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP1-D	d	C0773/1	bin	C0770	2	1000	-
FLIP1-CLK	d	C0773/2	bin	C0771	2	1000	Evaluates LOW-HIGH edges only
FLIP1-CLR	d	C0773/3	bin	C0772	2	1000	Evaluates the input level only: input has highest priority
FLIP1-OUT	d	-	-	-	-	-	-

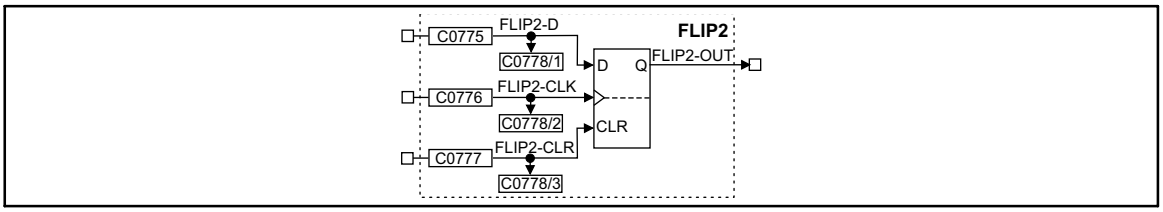


Fig. 3-140 Flipflop element (FLIP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP2-D	d	C0778/1	bin	C0775	2	1000	-
FLIP2-CLK	d	C0778/2	bin	C0776	2	1000	Evaluates LOW-HIGH edges only
FLIP2-CLR	d	C0778/3	bin	C0777	2	1000	Evaluates the input level only: input has highest priority
FLIP2-OUT	d	-	-	-	-	-	-

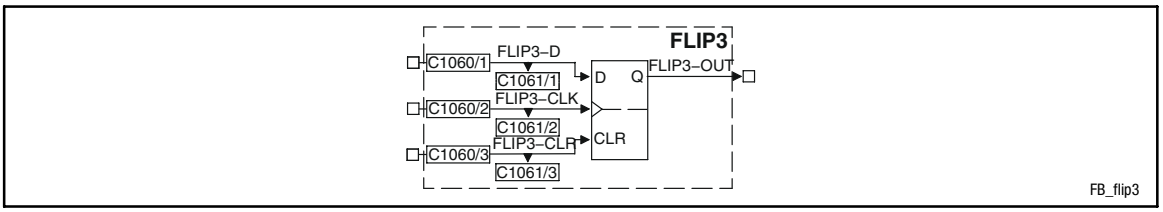


Fig. 3-141 Flipflop element (FLIP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP3-D	d	C1061/1	bin	C1060/1	2	1000	-
FLIP3-CLK	d	C1061/2	bin	C1060/2	2	1000	Evaluates LOW-HIGH edges only
FLIP3-CLR	d	C1061/3	bin	C1060/3	2	1000	Evaluates the input level only: input has highest priority
FLIP3-OUT	d	-	-	-	-	-	-

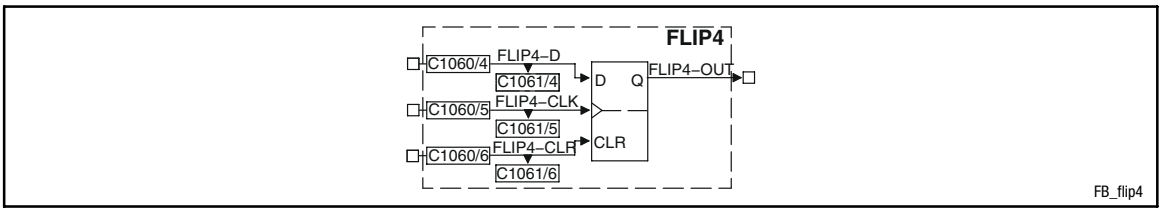


Fig. 3-142 Flipflop element (FLIP4)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP4-D	d	C1061/4	bin	C1060/4	2	1000	-
FLIP4-CLK	d	C1061/5	bin	C1060/5	2	1000	Evaluates LOW-HIGH edges only
FLIP4-CLR	d	C1061/6	bin	C1060/6	2	1000	Evaluates the input level only: input has highest priority
FLIP4-OUT	d	-	-	-	-	-	-

Function

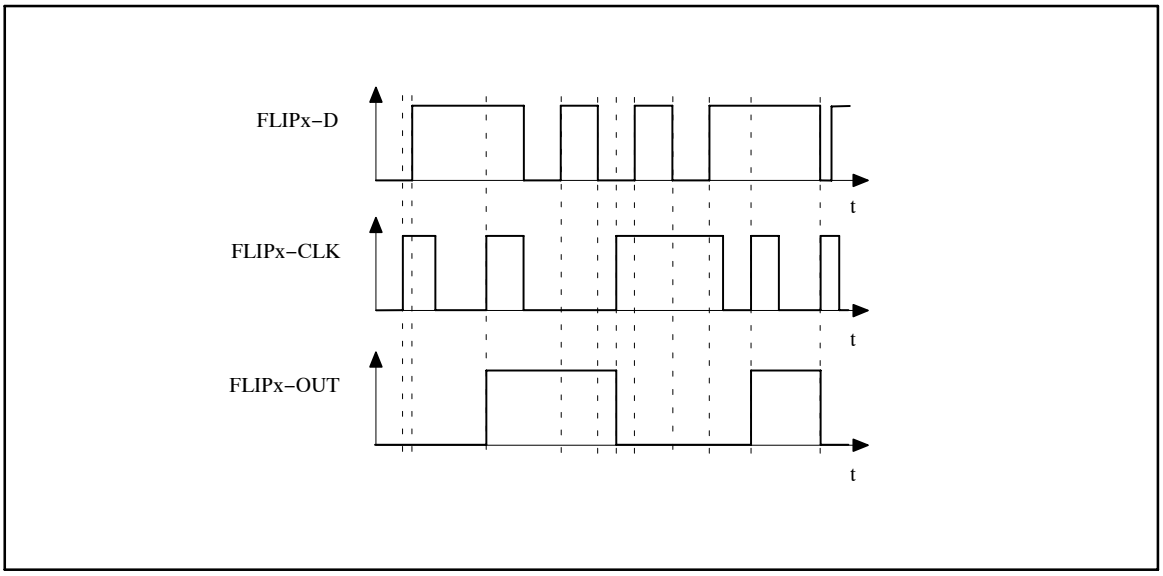


Fig. 3-143 Function sequence of a flipflop

- The input FLIPx-CLR always has priority.
- If a HIGH level is applied at the input FLIPx-CLR, the output FLIPx-OUT is set to and maintained at a LOW level al long as this input is at a HIGH level.
- With a LOW-HIGH edge at the input FLIPx-CLK, the level at the input FLIPx-D is switched to the output and saved until
  – another LOW-HIGH edge is applied at the input FLIPx-CLK or
  – the input FLIPx-CLR is set to a HIGH level.

3.2.57 Flipflop element (FLIPT)

Purpose

The function blockB is designed as D-flipflop. By means of this function, digital signal edges can be evaluated and saved.

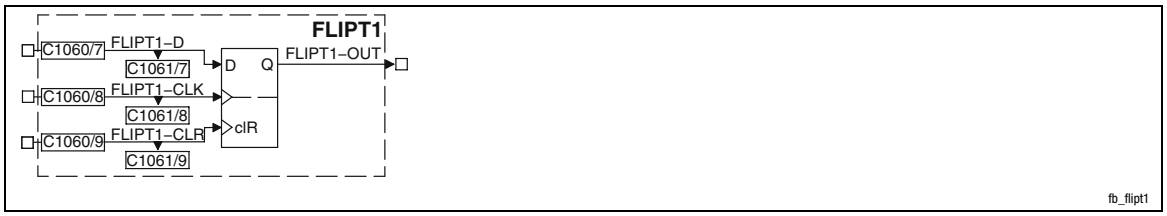


Fig. 3-144 Flipflop element (FLIPT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIPT1-D	d	C1061/7	bin	C1060/7	2	1000	-
FLIPT1-CLK	d	C1061/8	bin	C1060/8	2	1000	Evaluates LOW-HIGH edges only
FLIPT1-CLR	d	C1061/9	bin	C1060/9	2	1000	Evaluates LOW-HIGH edges only
FLIPT1-OUT	d	-	-	-	-	-	-

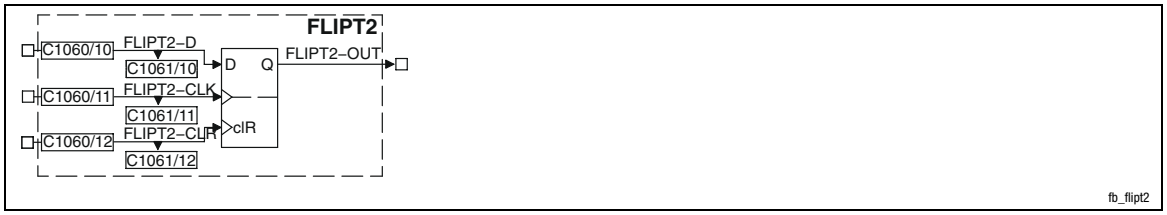


Fig. 3-145 Flipflop element (FLIPT2)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIPT2-D	d	C1061/10	bin	C1060/10	2	1000	-
FLIPT2-CLK	d	C1061/11	bin	C1060/11	2	1000	Evaluates LOW-HIGH edges only
FLIPT2-CLR	d	C1061/12	bin	C1060/12	2	1000	Evaluates LOW-HIGH edges only
FLIPT2-OUT	d	-	-	-	-	-	-

Function

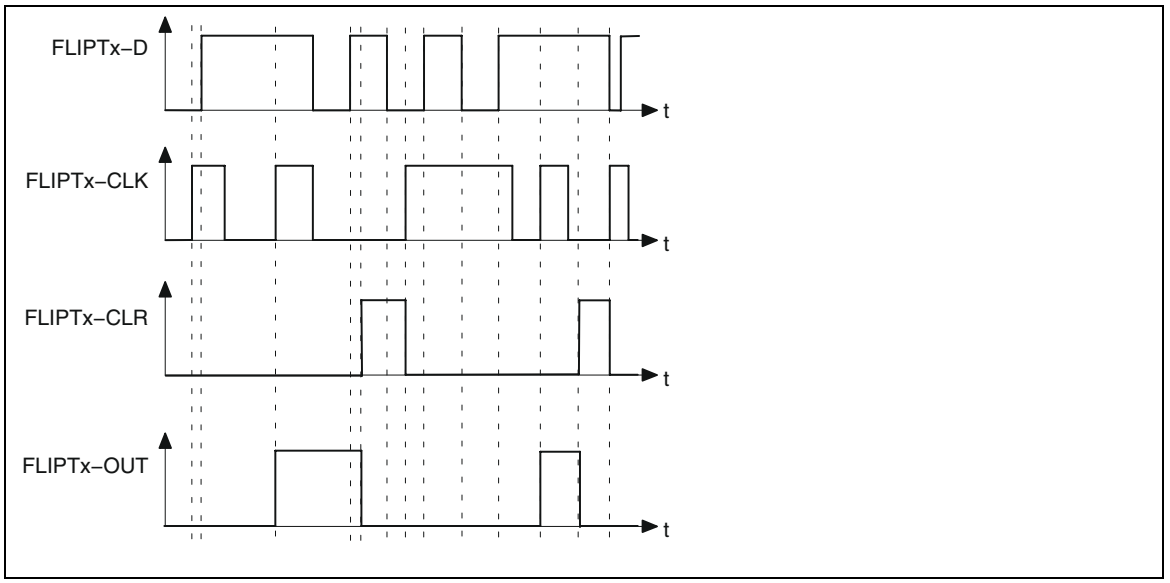


Fig. 3-146 Function sequence of the FLIPTx flipflop element

- Via a LOW-HIGH edge at input FLIPTx-CLK, the level at the input FLIPTx-D is switched to the output FLIPTx-OUT.
- The output FLIPTx-OUT is reset to LOW by means of a LOW-HIGH edge at input FLIPTx-CLR.

3.2.58 Gearbox compensation (GEARCOMP)

Purpose

Compensates elasticities in the drive train (e.g. gearbox torsion).

Implementation of an adaptive linkage of e.g. the phase setpoint (32 bits) and the torque feedforward control (14 bits).

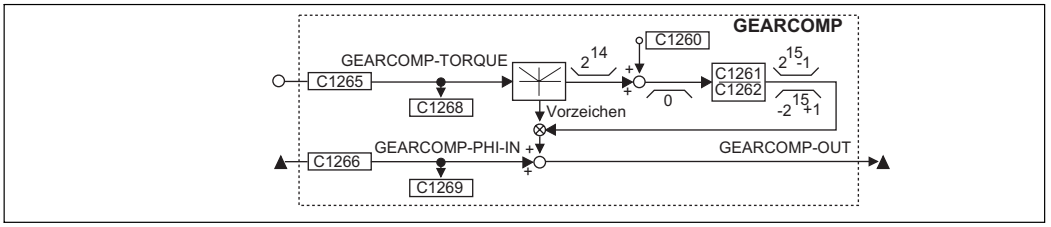


Fig. 3-147 Gearbox compensation (GEARCOMP)

Signal				Source		Comment
Name	Type	DIS	DIS format	CFG	List	
GEARCOMP-TORQUE	a	C1268	dec [%]	C1265	2	Input value
GEARCOMP-PHI-IN	ph	C1269	dec [inc]	C1266	3	
GEARCOMP-OUT	ph	-	-	-	-	Outputs the compensated phase setpoint.

Function

- The signal at GEARCOMP-TORQUE is broken down into the absolute value and the sign.
  – The absolute value is limited to 2^{14} (+16384) first.
- The absolute value is converted (via C1260, C1261, C1262).
- The result is evaluated with the sign and is added to the signal at GEARCOMP-PHI-IN.

Codes for the conversion of the absolute value:

Code	Function	Selection			Comment
C1260	Offset	-16383	{1}	16383	
C1261	Numerator	-32767	{1}	32767	Dynamic disconnection at C1261 = 0 (GEARCOMP-PHI-IN = GEARCOMP-OUT)
C1262	Denominator	1	{1}	32767	

3.2.59 Limiting element (LIM)

Purpose

This FB is used to limit signals to adjustable value ranges.

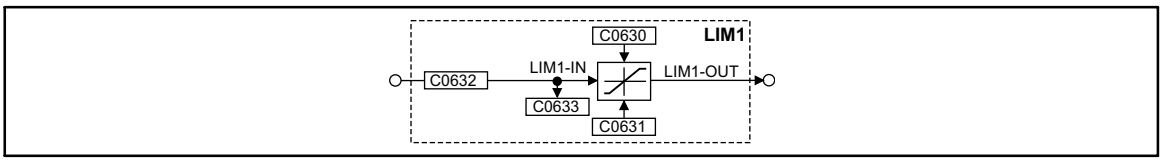


Fig. 3-148 Limiting element (LIM1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIM1-IN1	a	C0633	dec [%]	C0632	1	1000	-
LIM1-OUT	a	-	-	-	-	-	-

Function

- If the input signal exceeds the upper limit (C0630), the upper limit is effective.
- If the input signal falls below the lower limit (C0631), the lower limit is effective.

Tip!

The lower limit (C0631) must be smaller than the upper limit (C0630).

3.2.60 Limiting element (LIMPHD1)

Purpose

Speed limitation without position loss.

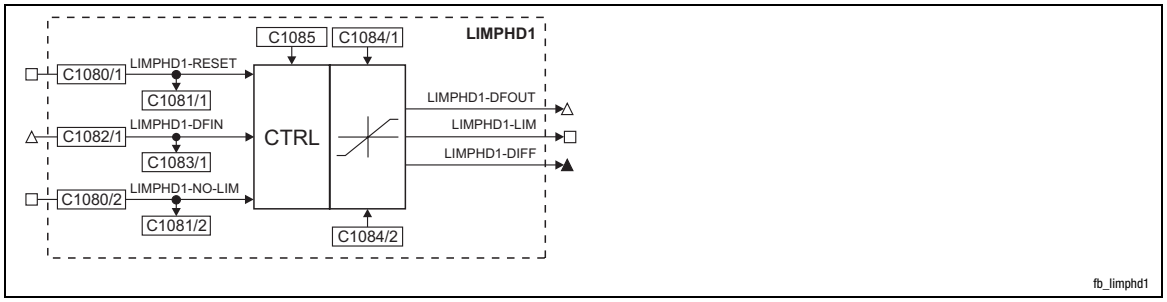
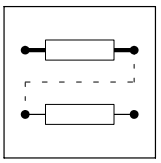


Fig. 3-149 Limiting element (LIMPHD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIMPHD1-RESET	d	C1081/1	bin	C1080/1	2	1000	HIGH = overflow buffer is cleared Input has the highest priority
LIMPHD1-NO-LIM	d	C1081/2	bin	C1080/2	2	1000	HIGH = The limitation set via C1084/1 and C1084/2 is switched off The overflow buffer is cleared. The position gets lost.
LIMPHD1-DFIN	phd	C1083/1	dec [rpm]	C1082/1	4	1000	Input of the speed setpoint
LIMPHD1-DFOUT	phd	-	-	-	-	-	Output of speed setpoint No position loss when signal is limited
LIMPHD1-LIM	d	-	-	-	-	-	HIGH = Signal at LIMPHD1-DFOUT is limited. Condition: LIMPHD1-NO-LIM = 0 and LIMPHD1-RESET = 0. (Function is available as of software version 3.4)
LIMPHD1-DIFF	ph	-	-	-	-	-	Output of the difference in position in [inc] between input signal at LIMPHD1-DFIN and output signal at LINPHD1-DFOUT (Function is available as of software version 3.4)



Function

An active speed limitation results in a position loss of the cam (e.g. compared with the master drive). While the speed limitation is active (asynchronous status), the overflow buffer is being filled.

The overflow buffer is cleared again if the signal at LIMPHD1-DFIN is lower then the upper and higher than the lower limit value.

- The speed limitation can be set via C1084/1 and C1084/2.
  - The speed is limited to the set maximum value via C1084/1.
  - The speed is limited to the set minimum value via C1084/2.
  - The lower limit (C1084/2) must be smaller than the upper limit (C1084/1).
- LIMPHD1-NO-LIM = HIGH is used to switch off the parameterisable limitation. The speed signal is limited to ±29999 rpm.
  - If C1085 = 0 (Lenze setting), the overflow buffer is cleared. The position gets lost.
  - If C1085 = 1, the overflow buffer is cleared. The increments at output LIMPHD1-DFOUT. The position is not lost.
  - Code C1085 is available from the software version 3.4.
- If LIMPHD1-RESET = HIGH, the overflow buffer is cleared. The input has the highest priority.
  - The limitations set via C1084/1 and C1084/2 remain active.

Note!

The overflow buffer behaves according to the cycle of numbers (32 bits).

3.2.61 Internal motor control (MCTRL)

Purpose

This function block controls the drive machine consisting of angle controller, speed controller, and motor control.

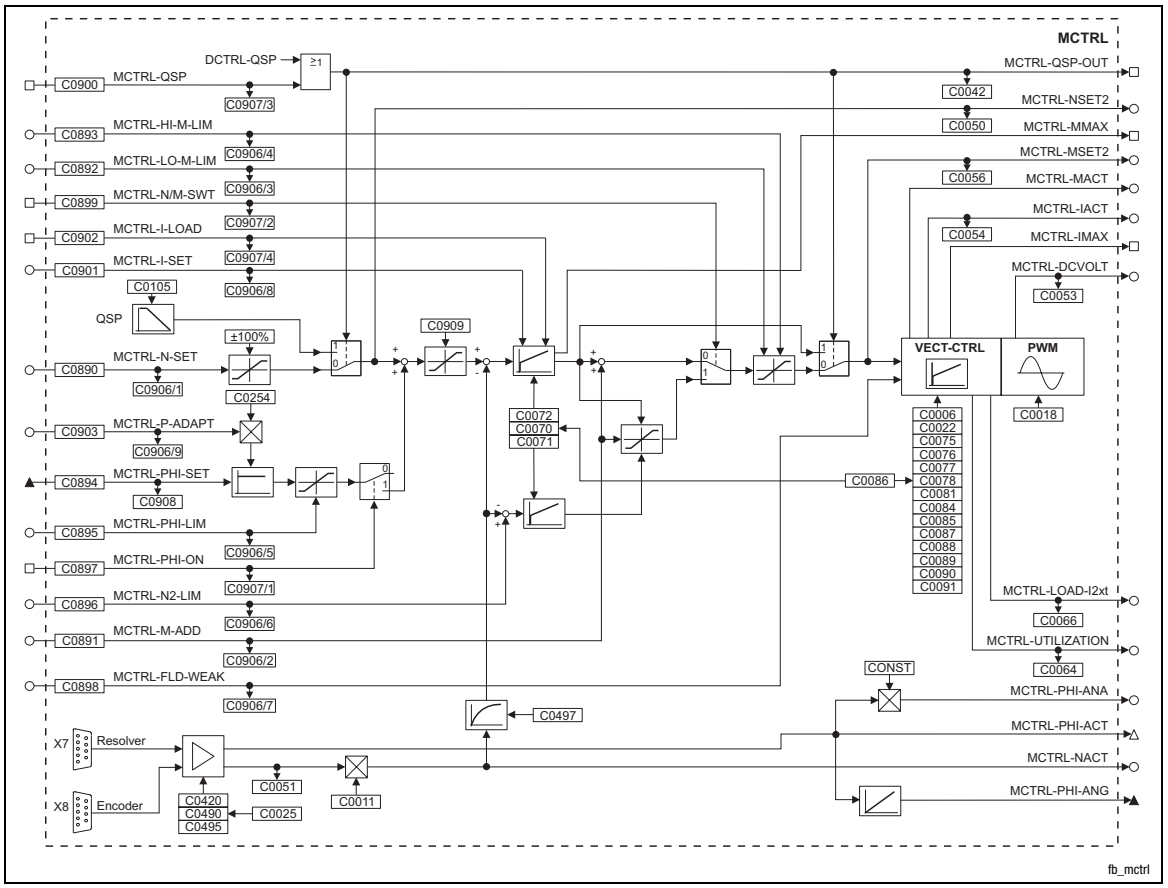
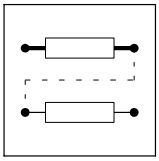


Fig. 3-150 Internal motor control (MCTRL)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MCTRL-PHI-SET	ph	C0908	dec [inc]	C0894	3	1000	Angle controller input for difference of setpoint angle to actual angle
MCTRL-N-SET	a	C0906/1	dec [%]	C0890	1	5050	Speed setpoint input
MCTRL-M-ADD	a	C0906/2	dec [%]	C0891	1	1000	Additional torque setpoint or torque setpoint
MCTRL-LO-MLIM	a	C0906/3	dec [%]	C0892	1	5700	Lower torque limitation in % of C0057
MCTRL-HI-MLIM	a	C0906/4	dec [%]	C0893	1	19523	Upper torque limitation in % of C0057
MCTRL-PHI-LIM	a	C0906/5	dec [%]	C0895	1	1006	Influence of angle controller in % of nmax C0011
MCTRL-N2-LIM	a	C0906/6	dec [%]	C0896	1	1000	Lower speed limit at speed limitation
MCTRL-FLDWEAK	a	C0906/7	dec [%]	C0898	1	1006	Motor excitation
MCTRL-I-SET	a	C0906/8	dec [%]	C0901	1	1006	Input for setting the I component of the speed controller
MCTRL-P-ADAPT	a	C0906/9	dec [%]	C0903	1	1006	Influence in % on V_P of C0254, the absolute value is processed (without sign)
MCTRL-PHI-ON	d	C0907/1	bin	C0897	2	1000	HIGH = Activation of angle controller
MCTRL-N/M-SWT	d	C0907/2	bin	C0899	2	1000	LOW = active speed control HIGH = active torque control
MCTRL-QSP	d	C0907/3	bin	C0900	2	10250	HIGH = drive performs QSP
MCTRL-I-LOAD	d	C0907/4	bin	C0902	2	1000	HIGH = I component of the n-controller is accepted by MCTRL-I-SET
MCTRL-QSP-OUT	d	-	-	-	-	-	HIGH = drive performs QSP
MCTRL-NSET2	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-MMAX	d	-	-	-	-	-	HIGH = speed controller operates within the limits
MCTRL-MSET2	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-MACT	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-IACT	a	-	-	-	-	-	MCTRL-IACT = 100 % = C0022
MCTRL-IMAX	d	-	-	-	-	-	HIGH = drive operates at the current limit C0022
MCTRL-DCVOLT	a	-	-	-	-	-	100 % = 1000 V
MCTRL-LOAD-I2xt	a	-	-	-	-	-	$I^2 \times t$ utilisation of the motor in %
MCTRL-UTILIZATION	a	-	-	-	-	-	Device utilisation $I \times t$ in %
MCTRL-PHI-ANA	a	-	-	-	-	-	Actual angle value as analog signal 90° = 100 %
MCTRL-PHI-ACT	phd	-	-	-	-	-	
MCTRL-NACT	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-PHI-ANG	ph	-	-	-	-	-	65536 inc = one revolution

Function

- Current controller
- Torque limitation
- Additional torque setpoint
- Speed controller
- Torque control with speed limitation
- Speed setpoint limitation
- Angle controller
- Quick stop QSP
- Field weakening
- Switching frequency changeover

3.2.61.1 Current controller

Adapt current controller via C0075 (proportional gain) and C0076 (reset time) to the machine connected.

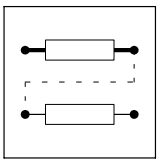
Note!

Use C0086 to select a suitable motor from the motor selection list. In this way, the parameters of the current controller are automatically set to the correct values.

3.2.61.2 Additional torque setpoint

The input MCTRL-M-ADD serves as torque setpoint or additional torque setpoint, depending on the control of the input MCTRL-N/M-SWT. The additional torque setpoint can be used e.g. for friction compensation or speed injection (dv/dt).

- When MCTRL-N/M-SWT = LOW the speed control is active.
  - MCTRL-M-ADD is added to the output of the n-controller.
  - The limits defined by the torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM cannot be exceeded.
- When MCTRL-N/M-SWT = HIGH, the torque control is active.
  - MCTRL-M-ADD acts as torque setpoint
  - The n-controllers have a monitoring function.
- The torque setpoint is specified in [%] of the max. possible torque (see C0057).
  - Negative values mean a torque with CCW rotation of the motor.
  - Positive values mean a torque with CW rotation of the motor.



3.2.61.3 Torque limitation

Via the inputs MCTRL-LO-M-LIM and MCTRL-HI-M-LIM an external torque limitation can be set. This serves to set different torques for the quadrants ”driving” and ”braking”.

- MCTRL-HI-M-LIM is the upper torque limit in [%] of the max. possible torque (C0057).
- MCTRL-LO-M-LIM is the lower torque limit in [%] of the max. possible torque (C0057).
- In case of quick stop (QSP) the torque limitation is deactivated.

Stop!

Only apply positive values to MCTRL-HI-M-LIM and negative values to MCTRL-LO-M-LIM. Otherwise the speed controller may lose control and the drive may rev up in an uncontrolled manner.

3.2.61.4 Speed controller

The speed controller is designed as an ideal PID controller.

Parameter setting

If you select a motor via C0086, the parameters are preset so that only a few (if any) adaptations to the application are necessary.

- Parameterisation of the proportional gain V_p in C0070:
  - Enter approx. 50 % of the speed setpoint
  - Increase C0070 until the drive becomes unstable (observe motor noises)
  - Reduce C0070 until the drive runs stable again
  - Reduce C0070 to approx. 50 %
- Parameterisation of the reset time T_n in C0071:
  - Reduce C0071 until the drive becomes unstable (observe motor noises)
  - Increase C0071 until the drive runs stable again
  - Set C0071 to the double value
- Parameterisation of the derivative gain T_d in C0072:
  - Increase C0072 during operation until an optimum behaviour is achieved.

Signal limitation

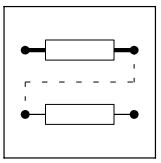
When the drive outputs the max. torque, the speed controller operates within the limits.

- The drive cannot follow the speed setpoint.
- This state is indicated with MCTRL-MMAX = HIGH.

Setting the integral component

To enter defined starting values for the torque the integral component of the n-controller can be set externally (e.g. when using the brake control).

- MCTRL-I-LOAD = HIGH
  - The n-controller accepts the value at input MCTRL-I-SET as its integral component.
  - The value at input MCTRL-I-SET acts as a torque setpoint for the motor control.
- MCTRL-I-LOAD = LOW
  - Function is switched off.



3.2.61.5 Torque control with speed limitation

This function is activated with MCTRL-N/M-SWT = HIGH. A second speed controller (auxiliary speed controller) is connected for the speed limitation.

- MCTRL-M-ADD acts as bipolar torque setpoint.
- The n-controller 1 is used to create the upper speed limit.
  - The upper speed limit is selected at the input MCTRL-N-SET in [%] of nmax (C0011) (pos. sign for CW rotation).
  - The upper speed limit is only to be used for CW rotation.
- The n-controller (auxiliary speed controller) is used to form the lower speed limit
  - The lower speed limit is selected at the input MCTRL-N2-LIM in [%] of nmax (C0011) (neg. sign for CCW rotation).
  - The lower speed limit is only to be used for CCW rotation.

3.2.61.6 Speed setpoint limitation

The speed setpoint is limited to ±100 % of nmax (C0011) at the MCTRL-N-SET input.

C0909 is used to set a limitation of the direction of rotation for the speed setpoint.

3.2.61.7 Angle controller

The angle controller is required to achieve angular synchronism and drift-free standstill.

Note!

Select a configuration with digital frequency coupling in C0005 since this serves to link all important signals automatically. On this basis the system can be optimised.

Activating the angle controller

1. Configure a signal source with C0894, which provides the angular difference between setpoint and actual angle (see ”Digital frequency configuration under C0005).
2. Select a value > 0 at the MCTRL-PHI-LIM input.
3. Trigger the input MCTRL-PHI-ON with HIGH (e.g. with FIXED1).
4. Set the gain of the angle controller > 0 in C0254 (see chapter 3.2.61.4)
   – Before setting C0254, select an as high as possible P-gain for the n-controller in C0070.
   – Increase C0254 during operation until the drive shows the required control response.

Influence of angle controller

The output of the angle controller is added to the speed setpoint.

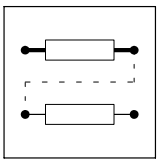
- If the actual angle is lagging, the drive is accelerated
- If the actual angle is leading the drive is decelerated until the required angular synchronism is achieved.

The influence of the angle controller consists of:

- Angular difference multiplied by the P-gain C0254
- Additional influence via analog signal at MCTRL-P-ADAPT
- Limitation of the angle controller output to ±MCTRL-PHI-LIM

Limitation of the angle controller output

This limits the max. speed-up of the drive at high angular differences.



3.2.61.8 Quick stop QSP

The QSP function is used to stop the drive within an adjustable time independently of the setpoint selection.

The QSP function is active

- if the input MCTRL-QSP is triggered with HIGH.
- if the controller is triggered via the control words (DCTRL).

Function:

- If torque control has been selected, it will be deactivated. The drive is controlled by the speed controller.
- The speed runs with the deceleration time set under C0105 to zero speed.
- The torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM are deactivated.
- The angle controller is activated. If the rotor position is shifted actively, the drive generates a torque against this displacement if:
  - C0254 is not zero
  - The input MCTRL-PHI-LIM is triggered with a value > 0 %.

Stop!

If the field is weakened manually (MCTRL-FLD-WEAK < 100%), the drive is unable to generate the max. torque.

3.2.61.9 Field weakening

The field weakening range does not need to be set if the motor type has been set in C0086. In this case all settings required are made automatically. The motor is operated in the field weakening mode if

- the output voltage of the controller exceeds the rated motor voltage set in C0090,
- the controller cannot increase the output voltage with rising speed any more because of the mains voltage / DC-bus voltage.

Manual field weakening

A manual field weakening is possible via the input MCTRL-FLD-WEAK. For reaching the maximum excitation this input must be triggered with +100 % (e.g. FIXED100%).

Stop!

The available torque is reduced by the field weakening.

3.2.61.10 Switching frequency changeover

The switching frequency of the inverter can be selected:

- 8 kHz fixed, for power-optimised operation (C0018 = 1)
  – maximum power output of the controller, but with audible pulse operation
- 16 kHz fixed, for noise-optimised operation (C0018 = 2)
  – inaudible pulse operation of the controller, but with reduced power output (torque)
- Automatic changeover between power-optimised and noise-optimised operation (C0018 = 0)

Automatic switching frequency changeover

The automatic switching frequency changeover can be used if the drive is to be operated in the noise-optimised range, but the available torque is not sufficient for acceleration processes.

Condition M = f(I)	Function
$M < M_{N16}$ (I_{N16})	Controller is operated with 16 kHz (noise-optimised)
M_{N16} (I_{N16}) $< M < M_{N8}$ (I_{N8})	Controller switches over to 8 kHz (power-optimised)
$M > M_{max8}$ (I_{max8})	Controller operates with 8 kHz in the current limitation

3.2.62 Mains failure control (MFAIL)

Purpose

If the supply voltage via L1, L2, L3 or +UG, -UG fails, the drive (drive network) can be decelerated (braked) in a controlled way. Without this function, the drive (drive network) would coast.

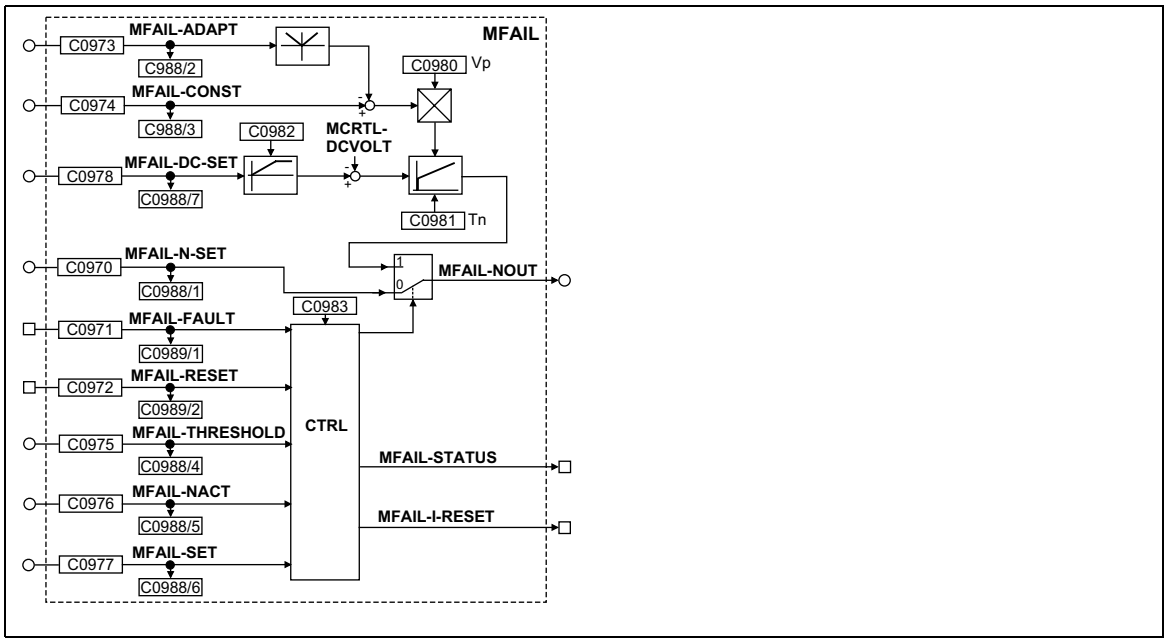


Fig. 3-151 Mains failure control (MFAIL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MFAIL-N-SET	a	C0988/1	dec [%]	C0970	1	1000	Speed setpoint in [%] of C0011
MFAIL-ADAPT	a	C0988/2	dec [%]	C0973	1	1000	Dynamic adaptation of the proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-KONST	a	C0988/3	dec [%]	C0974	1	1000	Proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-THRESHOLD	a	C0988/4	dec [%]	C0975	1	1000	Restart threshold in [%] of C0011
MFAIL-NACT	a	C0988/5	dec [%]	C0976	1	1000	Comparison value for the restart threshold in [%] of C0011
MFAIL-SET	a	C0988/6	dec [%]	C0977	1	1000	Speed starting point for the deceleration in [%] of C0011
MFAIL-DC-SET	a	C0988/7	dec [%]	C0978	1	1000	Voltage setpoint on which the DC bus voltage is to be maintained, 100% = 1000V
MFAIL-FAULT	d	C0989/1	bin	C0971	2	1000	HIGH = activates the mains failure control
MFAIL-RESET	d	C0989/2	bin	C0972	2	1000	HIGH = reset
MFAIL-N-OUT	a	-	-	-	-	-	Speed setpoint in [%] of C0011
MFAIL-STATUS	d	-	-	-	-	-	HIGH = mains failure control active
MFAIL-I-RESET	d	-	-	-	-	-	HIGH = mains failure control active, the drive is braking

Range of functions

- Mains failure detection
- Mains failure control
- Restart protection
- Reset of the mains failure control
- Dynamic adaptation of the control parameters
- Fast mains recovery (auto reclosure)
- Application examples

3.2.62.1 Mains failure detection

A failure of the controller's power supply can be detected by

- evaluating the DC-bus voltage or
- an external system for mains failure detection (e.g. 934X supply module or voltage measuring relay).

It is possible to combine the two methods.

The type of the mains failure detection to be used depends on the drive system used.

DC-bus voltage evaluation

Use with single drives or multi-axis drives, which do not use external monitoring systems.

- For this you can use a comparator (e.g. CMP2). Link the signals as follows:
  - C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - C0971 = 10655 (CMP2-OUT to MFAIL-FAULT)
  - Set function of the comparator CMP2 with C0685 = 3

Enter the function blocks CMP2 and MFAIL into free positions of the processing table in C0465.

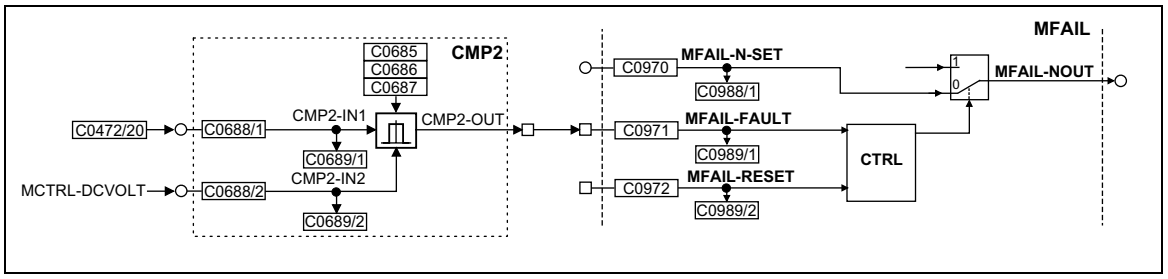


Fig. 3-152 Example of a mains failure detection with internal function blocks (section)

External system for mains failure detection (934x supply module)

- A digital output of the supply module 934x is connected to the function block MFAIL via the digital inputs DIGIN of the controller 93XX. In the example the input X5/E4 is used. For this purpose link the signals as follows:
  - C0971 = 54 (DIGIN4 to MFAIL-FAULT)
  - C0871 = 1000 (remove DCTRL-TRIP-SET from terminal X5/E4)
  - Select level (HIGH or LOW active) with C0114/4

Enter the function block MFAIL into a free position of the processing table in C0465.

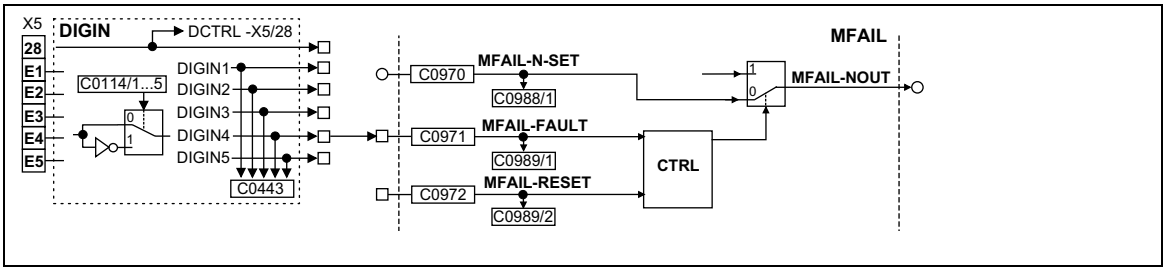


Fig. 3-153 Example of a mains failure detection by an external monitoring system

Combination of the two methods

- The combination of both processes is done via an OR operation with an internal function block. In the example, OR5 is used. For this, link the signals as follows:
  - C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - Set function of the comparator CMP2 with C0685 = 3
  - C0838/1 = 10655 (CMP2-OUT to OR5-IN1)
  - C0838/2 = 54 (DIGIN5 to OR5-IN2)
  - C0971 = 10570 (OR5-OUT to MFAIL-FAULT)

Enter the function blocks CMP2, OR5 and MFAIL into free positions of the processing table in C0465.

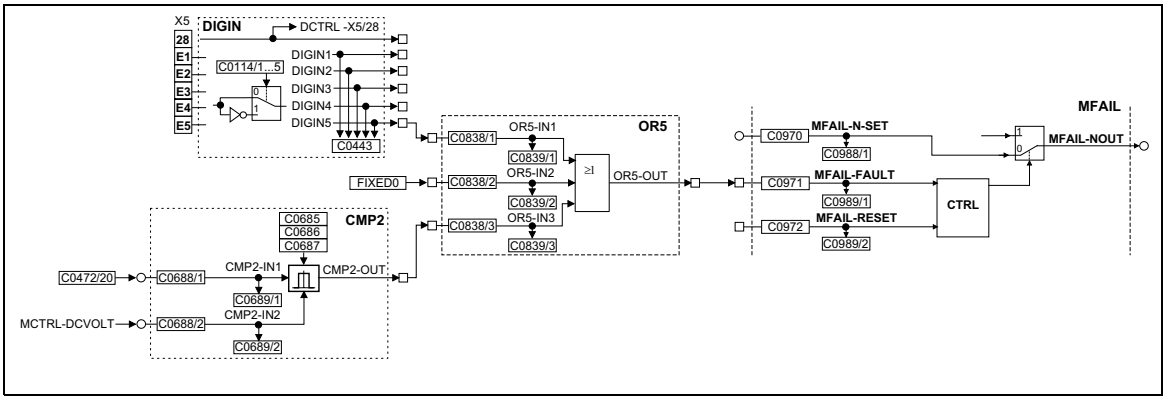


Fig. 3-154 Example of a mains failure detected by different sources

3.2.62.2 Mains failure control

Integration of the function block into the signal flow of the controller

As an example, the function block is integrated into the basic configuration C0005 = 1000 (speed control).

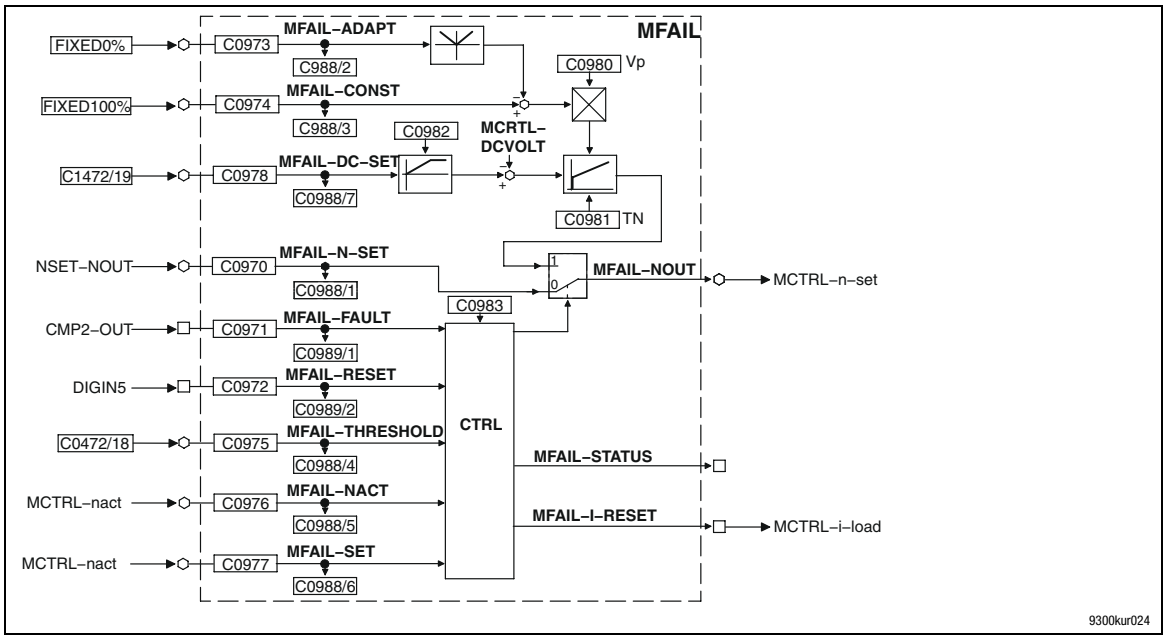
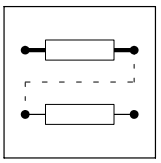


Fig. 3-155 Integration into basic configuration C0005 = 1000

1. Create speed setpoint path	• C0970 = 5050 (NSET-NOUT to MFAIL-N-SET) • C0890 = 6100 (MFAIL-NOUT to MCTRL-N-SET)
2. Start value selection (here: act. speed value)	• C0977 = 6100 (MFAIL-NOUT to MFAIL-SET)
3. Selection of setpoint source for DC-bus voltage (here: freely connectable code FCODE C0472/19)	• C0978 = 19539 (C0472/19 to MFAIL-DC-SET)
4. Selection of source which activates the mains failure control	• see chapter 3.2.62.1
5. Create proportional gain and adaptation DC-bus voltage controller	• C0974 = 1006 (FIXED100% to MFAIL-CONST) • C0973 = 1000 (FIXED0% to MFAIL-ADAPT)
6. Implement restart protection	• C0976 = 6100 (MFAIL-NACT to MCTRL-NACT) • C0975 = 19538 (C0472/18 to MFAIL-THRESHLD) • First enter approx. 2 % under C0472/18 (reference: nmax C0011)
7. Connect reset input (here with terminal X5/E5 TRIP-RESET)	• C0972 = 55 (DIGIN5 to MFAIL-RESET)
8. Enter all function blocks used (except for codes and digital inputs DIGIN) into free positions of the processing table in C0465.	

Note!

All settings must be saved non-volatilely in a parameter set under C0003.



Activation

- MFAIL-FAULT = HIGH activates the mains failure control.
- MFAIL-FAULT = LOW triggers a timing element. After the time set under C0983 has elapsed, the mains failure control is completed/cancelled (see description of mains recovery, chapter 3.2.62.6).
  - The drive is accelerated to the speed setpoint if the restart protection is not active.
  - The drive is continued to be braked to zero speed if the restart protection is active (see description for restart protection, chapter 3.2.62.3).
  - If the restart protection is active, the drive can only be reset by a HIGH level signal at the MFAIL-RESET input.

Function

The controller generates the operational energy required from the rotational energy of the driving machine. The driving machine is braked via the power loss of the controller and the motor. Thus, the speed deceleration ramp is shorter than with a non-controlled system (coasting drive).

With the activation,

- the DC bus voltage is controlled to the value at the MFAIL-DC-SET input.
- an internally generated speed setpoint is output at output MFAIL-N-OUT. This serves to brake the drive (via the speed setpoint) to a speed of almost zero.
  - Starting value for the controlled deceleration is the value at input MFAIL-SET. This input is generally connected to the output MCTRL-NACT (actual speed value) or MCTRL-NSET2, MFAIL-NOUT (speed setpoint).
  - The speed deceleration ramp (and thus the brake torque) results from the moment of inertia of the driven machine(s), the power loss of the drive (drive network), and the parameterisation.

STOP!

- If a connected braking unit is activated, the drive is braked with the max. possible torque (Imax). In this case, it may be necessary to adapt the parameter setting (see description for parameter setting).
- If the power stage is not supplied, the drive cannot generate a standstill torque (important for active loads such as hoists).

Parameter setting

The parameters to be set depend strongly on the motor used, the inertia of the driven machine and the drive configuration (single drive, drive network, master/slave operation etc.). For this reason, this function must be adjusted to the prevailing application case.

The following specifications refer to chapter 3.2.62.1.

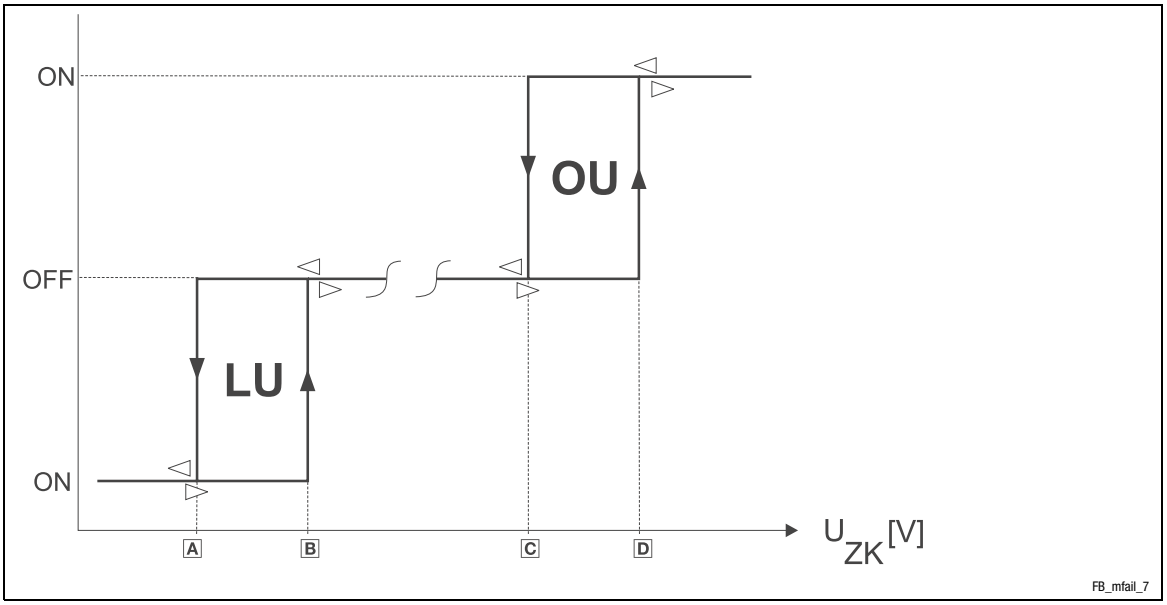
Important settings prior to the initial commissioning:

1. Save the previous setting in a parameter set (e.g. parameter set 4)

STOP!

For the internal voltage supply of the terminals (C0005 = xx1x), the terminal X6/63 is used as a voltage source for external potentiometers. In this case, measure at the terminals +UG, -UG.

2. Measure the DC-bus voltage with an oscilloscope (channel 1)
   - with a suitable voltage divider across terminals +UG, -UG. or
   - by outputting the DC-bus voltage e.g. to terminal X6/62. For this purpose set C0436 = 5005 (MCTRL-DCVOLT). 1 V at terminal X6/63 = 100 V across +UG, -UG.
3. Measure the speed with an oscilloscope (channel 2)
   - by outputting the speed e.g. to terminal X6/62 (standard setting). For this purpose set C0431 = 5001 (MCTRL-NACT). 10 V at terminal X6/62 = nmax (C0011).
4. Select the operating threshold for the mains failure detection in C0472/20. The selection depends on the setting in C0173.
   - Set the operating threshold approx. 50 V above the switch-off threshold LU (example for C0173 = 0.1; C0472/20 = 48 % $\triangleq$ 480 V).



Mains voltage range	C0173	Message LU		Message OU	
		A	B	C	D
< 400 V	0	285 V	430 V	755 V	770 V
400 V	1	285 V	430 V	755 V	770 V
400 V ... 460 V	2	328 V	473 V	755 V	770 V
480 V without brake chopper	3	342 V	487 V	755 V	770 V
Operation with brake chopper (up to 480 V)	4	342 V	487 V	785 V	800 V
		DC-bus voltage (U_{ZK})			

STOP!

This setpoint must be below the operating threshold of a possibly connected braking unit. If a connected braking unit is activated, the drive will be braked with the max. possible torque (Imax). The desired operational performance gets lost.

5. Set the setpoint to which the DC bus voltage is to be controlled:
   – Set the setpoint to approx. 700 V (C0472/19 = 70 %).

Commissioning

The commissioning should be carried out with motors without load.

1. The drive can be started with a LOW-HIGH edge at X5/E5.
2. Set the acceleration time Tir:
   – Set speed setpoint to 100%, operate controller with maximum speed.
   – Inhibit controller via terminal X5/28 (you can also use any other controller inhibit source, CINH) and measure deceleration time until standstill.
   – Set approx. 1/10 of the deceleration time in C0982.
3. Set the retrigger time

- In case of mains failure detection by detecting the DC bus voltage level:
  – Set measured deceleration time from (step 2.) under C0983.
- In case of mains failure detection via an external system (e.g. supply module 934X):
  – Under C0983, you can set the time in which the drive is to be continued to be braked in a controlled way for short-term mains recovery.

4. Switch off supply voltage (mains or DC bus).

The oscilloscope should display the following characteristic:

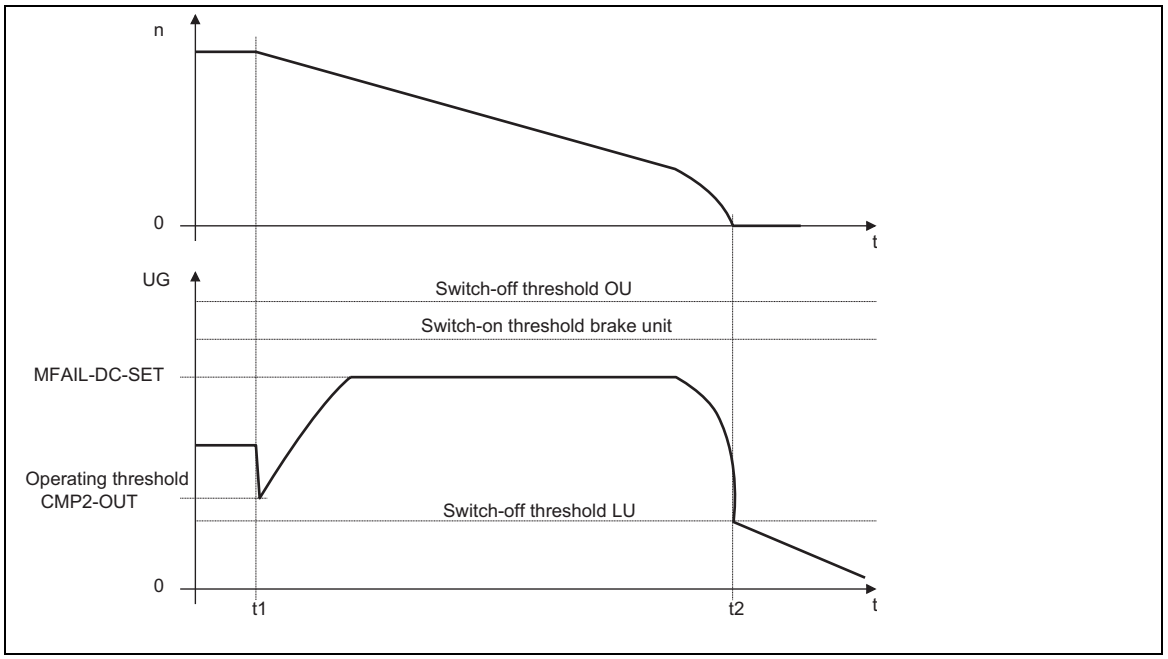


Fig. 3-156 Schematic representation with activated mains failure control (ideal characteristic)

t1 Mains failure
t2 Zero speed reached

Fine adjustment

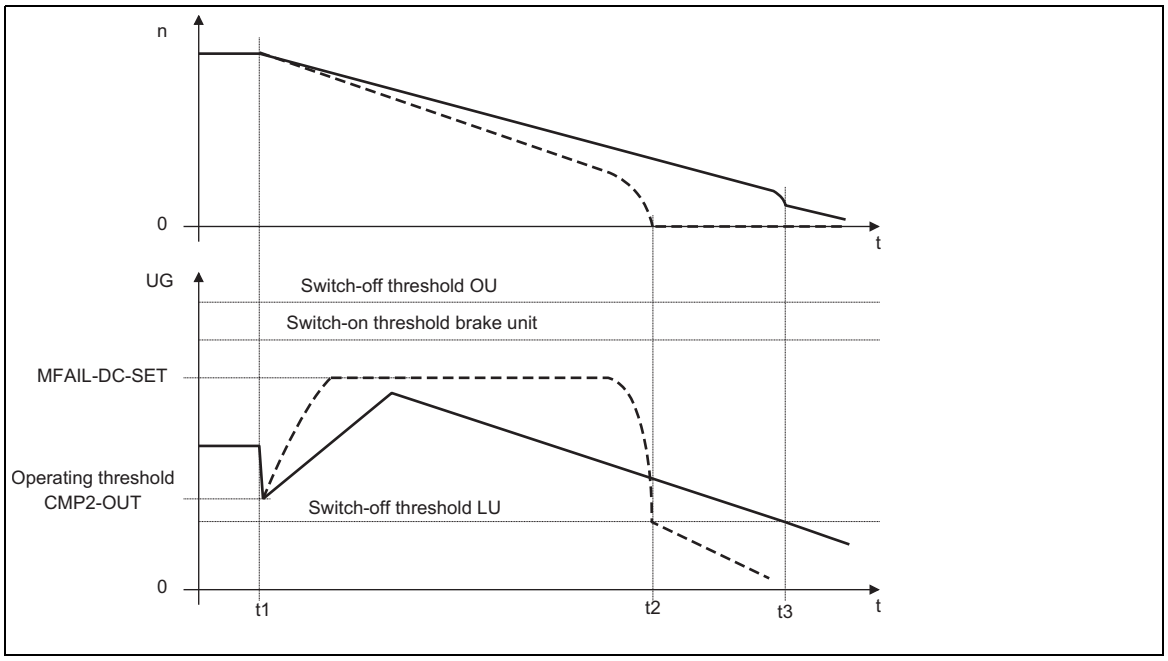


Fig. 3-157 Schematic representation with different brake torques

t = t1	Mains failure
t = t2	Zero speed with higher braking torque (short adjustment time)
t = t3	Drive reaches the LU switch-off threshold with lower brake torque (higher adjustment time) without reaching speed 0
t > t3	Drive is no longer controlled (is braked by friction)

Repeat the following steps several times.

1. Obtain a very low final speed before the controller reaches the undervoltage threshold LU:
   - Increase the proportional gain MFAIL V_p (C0980).
   - Decrease the reset time MFAIL T_n (C0981).
2. Avoid activation of the brake unit or the overvoltage threshold on:
   - Increase the reset time MFAIL T_n (C0981) until the characteristic in Fig. 3-156 is almost reached.
   - Additionally reduce the setpoint of the DC bus voltage at the input MFAIL-DC-SET (in the example C0472/19), if necessary.

3. Increase of the deceleration time or reduction of the brake torque (see Fig. 3-157) is only possible with restrictions:
   – An increase of the acceleration time MFAIL T_{ir} (C0982) reduces the initial brake torque and simultaneously increases the deceleration time.
   – Increasing the reset time MFAIL T_n (C0981) decreases the braking torque and simultaneously increases the deceleration time. If C0981 contains too high reset times, the controller runs into the LU threshold before speed 0 is reached. Thus, the drive is not controlled anymore.
4. If required, relink the signals to the outputs of the controller (terminals X6).

Note!

All settings must be saved non-volatilely in a parameter set under C0003.

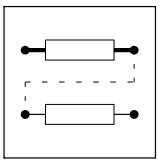
3.2.62.3 Restart protection

The integrated restart protection is to avoid a restart in the lower speed range, after the supply voltage was interrupted for a short time only (mains recovery before the drive has come to standstill).

- How to protect the drive from a restart is explained in chapter 3.2.62.2.
- In C0472/18 you can enter the threshold in [%] of nmax (C0011) below which you do not want the drive to restart.
  – Speed at mains recovery < threshold in C0472/18: Drive is continued to be braked in a controlled way. This function can only be terminated by MFAIL-RESET = HIGH.
  – Speed after mains recovery > threshold in C0472/18 Drive accelerates to its setpoint along the set ramps.
- The function is deactivated by:
  – C0472/18 = 0 % or
  – C0975 = 1000 (FIXED0% to MFAIL-THRESHLD)
- Reset with MFAIL-RESET = HIGH
  – is required after every mains connection
  – is displayed by MFAIL-STATUS = HIGH, if MFAIL-FAULT = LOW

3.2.62.4 Reset of the mains failure control

- The mains failure control is reset with MFAIL-RESET = HIGH (in the example with terminal X5/E5).
- The reset pulse is always required if:
  – the restart protection is active.
  – the restart protection is used and the supply (mains or DC supply) was switched on.



3.2.62.5 Dynamic adaptation of the control parameters

In special cases a dynamic change of the proportional gain may be useful. For this purpose, the function block MFAIL is provided with two inputs (MFAIL-CONST and MFAIL-ADAPT). The resulting proportional gain arises from:

$$V_p = C0980 \cdot \frac{\text{MFAIL-CONST} - |\text{MFAIL-ADAPT}|}{100\ \%}$$

3.2.62.6 Fast mains recovery (auto reclosure)

The fast mains recovery leads to the restart of the controller if the restart protection is not activated. Then the drive runs to its setpoint. If this is not desired, the restart can be delayed via the retrigger time C0983 or prevented in connection with the restart protection.

A fast mains recovery occurs:

- Due to the system, the mains recovery is indicated by the mains failure detection via the level of the DC bus voltage (see chapter 3.2.62.1).
- Because of an ”auto reclosure” of the power supply company (e.g. in case of thunderstorms)
- Because of faulty components in the supply cables (e.g. slip rings)

Set the retrigger time C0983 higher than the measured deceleration time during braking.

3.2.62.7 Application example

Drive network with digital frequency coupling

STOP!

In drive networks which are coupled via digital frequency (a master and one or more slaves):

- The mains failure detection and control may only be activated for the master.
  - The mains failure control must be integrated correspondingly into the signal flow.
- All controllers must be operated via the terminals +UG, -UG in the DC-bus connection. For this, the information in the ”Dimensioning” chapter must be observed.

Note!

Further information and predefined configurations can be obtained from Lenze.

3.2.63 Motor phase failure detection (MLP)

Purpose

Motor phase monitoring.

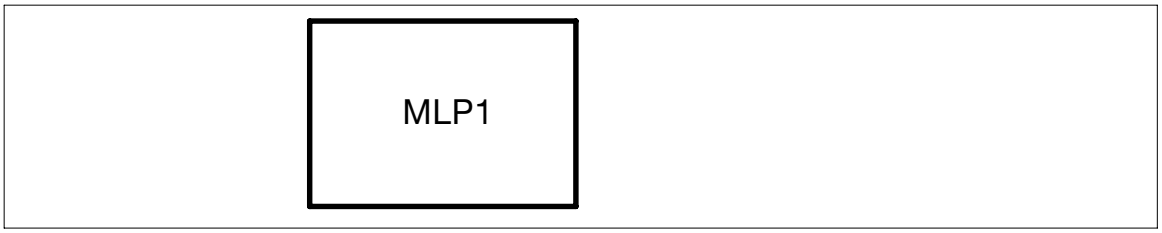


Fig. 3-158 Motor phase failure detection (MLP1)

Code	LCD	Possible settings					Important
		Lenze	Selection				
C0597	MONIT LP1	3	0 2 3	Trip Warning Off			**Conf. LP1** Configuration of motor phase failure monitoring
C0599	LIMIT LP 1	5.0	1.0		{0.1}	10.0	**Current limit LP1** Current limit for motor phase failure monitoring

Function

Detailed descriptions concerning monitoring/fault messages can be found in part E (Troubleshooting and fault elimination) of the System Manual.

The function block MLP1 must be entered into the processing table if the motor phase failure detection is to be used.

3.2.64 Monitor outputs of monitoring system (MONIT)

Purpose

The monitoring functions output digital monitor signals.

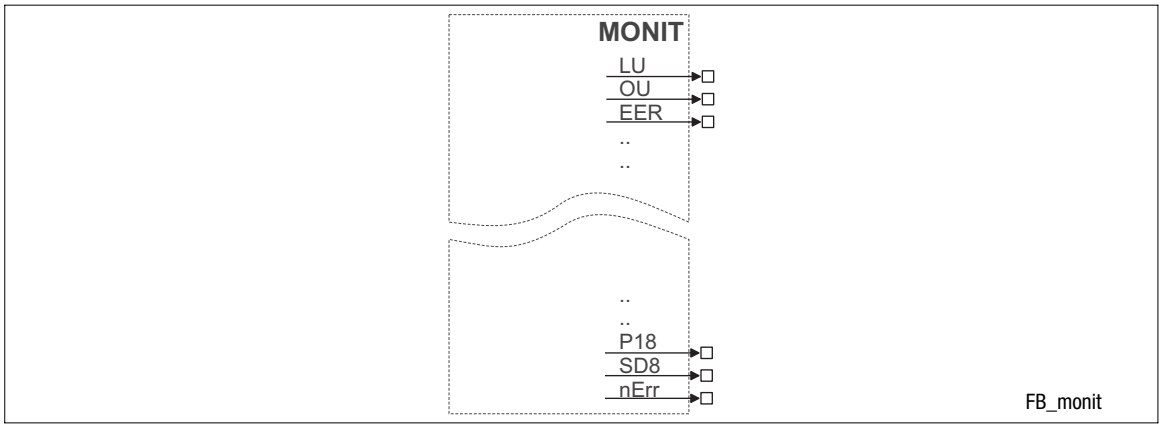


Fig. 3-159 Monitor outputs of the monitoring system (MONIT)

Function

The MONIT outputs switch to HIGH level if one of the monitoring functions responds.

The digital monitor signals switches dynamically, i.e.

- depending on the state of the monitoring function, but
- independent of the selected fault response (trip, fail-QSP, ...).

Example

MONIT-LP1 (motor phase monitoring) responds if an open circuit is detected in a motor connection phase, although the fault response of LP1 is set to ”Off” (C0597 = 3).

Tip!

- Only with a corresponding signal conditioning it is possible to use the MONIT outputs to detect the cause of malfunction afterwards (e.g. storing the signal by using function block FLIP).
- Detailed descriptions concerning monitoring /fault messages can be found in the chapter ”Troubleshooting and fault elimination”.

3.2.65 Motor potentiometer (MPOT)

Purpose

The FB replaces a hardware motor potentiometer.

The motor potentiometer is used as an alternative setpoint source, which is controlled via two terminals.

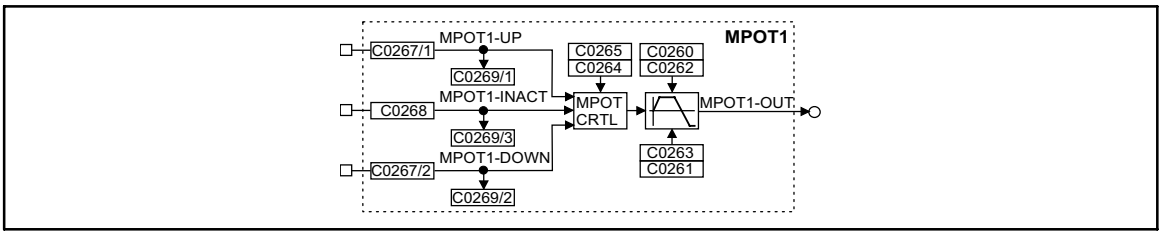
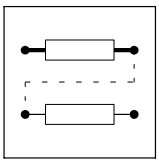


Fig. 3-160 Motor potentiometer (MPOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MPOT1-UP	d	C0269/1	bin	C0267/1	2	1000	-
MPOT1-INACT	d	C0269/3	bin	C0268	2	1000	-
MPOT1-DOWN	d	C0269/2	bin	C0267/2	2	1000	-
MPOT1-OUT	a	-	-	-	-		-



Function

Control of the motor potentiometer:

- MPOT1-UP = HIGH
  - The motor potentiometer approaches its upper limit value.
- MPOT1-DOWN = HIGH
  - The motor potentiometer approaches its lower limit value.
- MPOT1-UP = LOW and MPOT1-DOWN = LOW or
  MPOT1-UP = HIGH and MPOT1-DOWN = HIGH:
  - The motor potentiometer does not change the output signal.

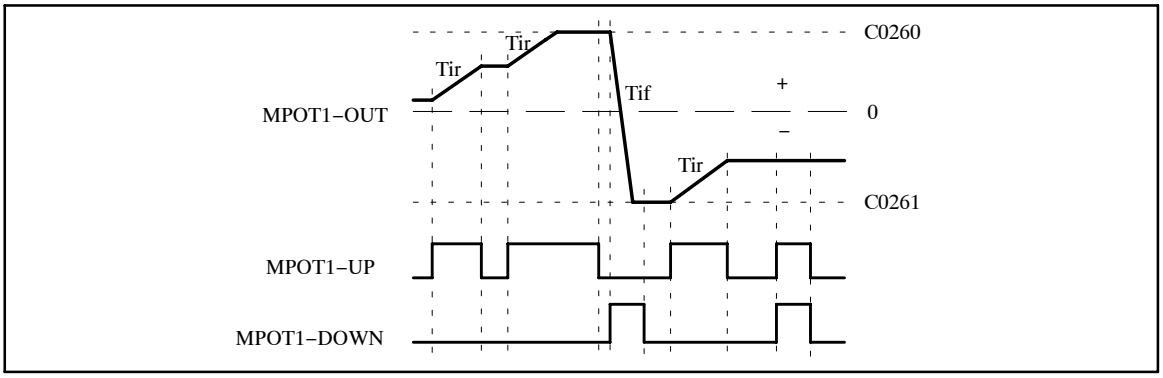


Fig. 3-161 Control signals of the motor potentiometer

In addition to the digital signals MPOT1-UP and MPOT1-DOWN another digital input exists (MPOT1-INACT). The input MPOT1-INACT is used to activate or deactivate the motor potentiometer function. Logic 1 at this input deactivates the motor potentiometer function. The input MPOT1-INACT has priority over the inputs MPOT1-UP and MPOT1-DOWN.

When the motor potentiometer is deactivated, the motor potentiometer output (MPOT1-OUT) follows the function set under C0264. The following functions can be set under C0264:

C0264 =	Meaning
0	No further action; the value of output MPOT1-OUT remains unchanged
1	The motor potentiometer returns to 0 % with the corresponding deceleration time
2	The motor potentiometer approaches the lower limit value with the corresponding deceleration time (C0261)
3	The motor potentiometer immediately changes its output to 0%. **(Important for EMERGENCY–OFF function)**
4	The motor potentiometer immediately changes its output to the lower limit value (C0261)
5	The motor potentiometer approaches the upper limit value with the corresponding acceleration time (C0260)

If the motor potentiometer is activated (input MPOT1-INACT = 0), the subsequent function depends on

- the current output signal,
- the set limit values of the MPOT,
- the control signals UP and DOWN.

If the output value is out of the set limits, the MPOT approaches the next limit with the set T_i times. This function is independent of the control inputs MPOT1-UP and MPOT1-DOWN

If the output value is within the set limits, the output follows the selected control function UP, DOWN or no action.

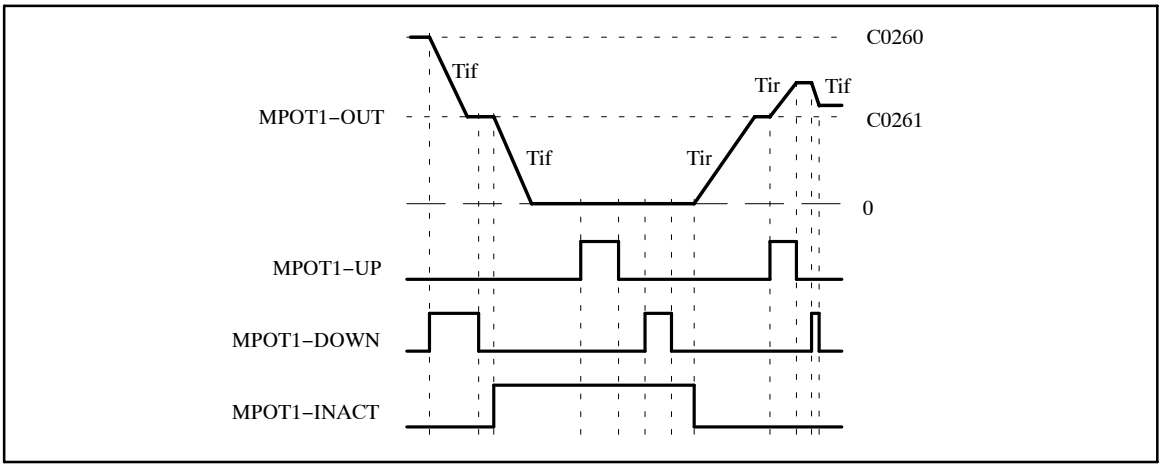


Fig. 3-162 Deactivation of the motor potentiometer via the input MPOT1-INACT

Initialisation

This function is used to save the output value of the MPOT non-volatilely in the internal memory of the device, when the mains is switched off. The value is saved automatically if this function was selected via the code. When the mains is switched on, the value is reloaded into the MPOT.

C0265 can be used to activate other initialisation functions (see code table).

When the initialisation is completed, the MPOT follows the applied control function.

3.2.66 Master selection (MSEL)

Two function blocks (MSEL1 and MSEL2) are available

Purpose

Selection of a master value source from four possible master values

- MSEL1: FB for digital frequency or speed signals
- MSEL2: FB for angle signals

MSEL1

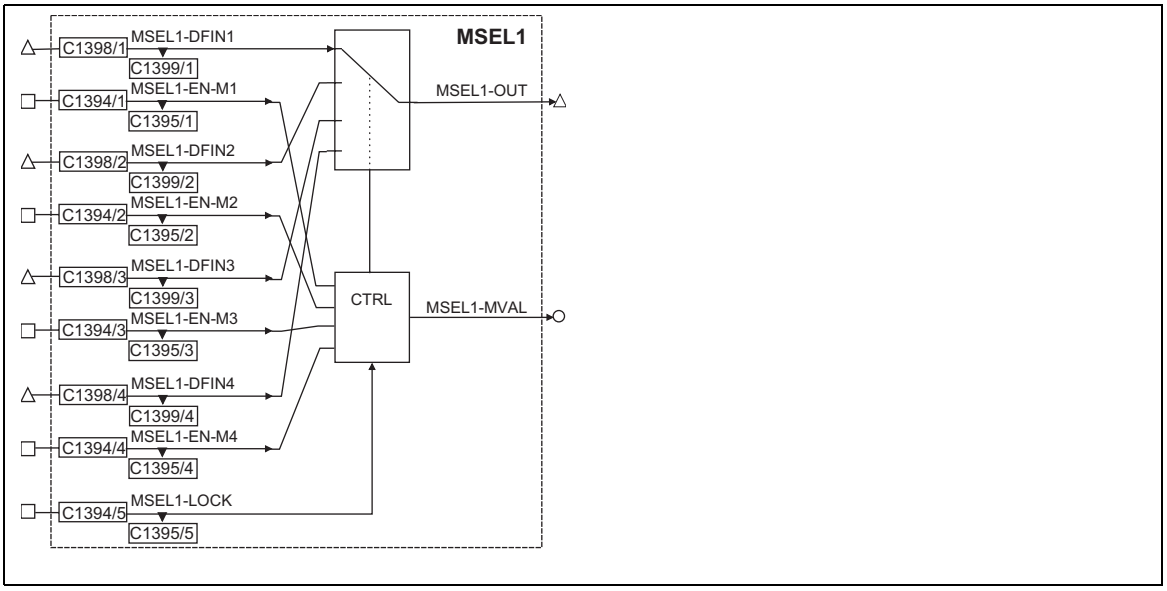


Fig. 3-163 Master selection (MSEL1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
MSEL1-EN-M1	d	1395/1	bin	1394/1	2	Activation of master value 1
MSEL1-EN-M2	d	1395/2	bin	1394/2	2	Activation of master value 2
MSEL1-EN-M3	d	1395/3	bin	1394/3	2	Activation of master value 3
MSEL1-EN-M4	d	1395/4	bin	1394/4	2	Activation of master value 4
MSEL1-LOCK	d	1395/5	bin	1394/5	2	Locking
MSEL1-DFIN1	phd	1399/1	dec [rpm]	1398/1	4	Master value input 1
MSEL1-DFIN2	phd	1399/2	dec [rpm]	1398/2	4	Master value input 2
MSEL1-DFIN3	phd	1399/3	dec [rpm]	1398/3	4	Master value input 3
MSEL1-DFIN4	phd	1399/4	dec [rpm]	1398/4	4	Master value input 4
MSEL1-OUT	phd	13701	-	-	-	Master value output
MSEL1-MVAL	a	13701	-	-	-	Currently selected master value input

MSEL2

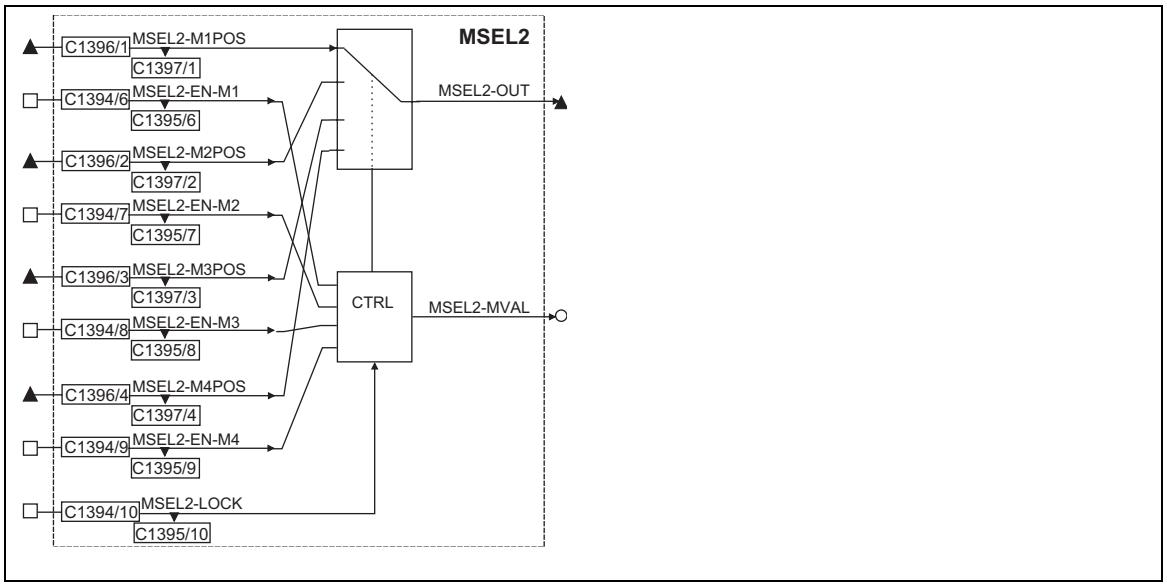
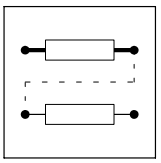


Fig. 3-164 Master selection (MSEL2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
MSEL2-EN-M1	d	1395/6	bin	1394/6	2	Activation of master value 1
MSEL2-EN-M2	d	1395/7	bin	1394/7	2	Activation of master value 2
MSEL2-EN-M3	d	1395/8	bin	1394/8	2	Activation of master value 3
MSEL2-EN-M4	d	1395/9	bin	1394/9	2	Activation of master value 4
MSEL2-LOCK	d	1395/10	bin	1394/10	2	Locking
MSEL2-M1POS	ph	1397/1	dec [inc]	1396/1	4	Master angle input 1
MSEL2-M2POS	ph	1397/2	dec [inc]	1396/2	4	Master angle input 2
MSEL2-M3POS	ph	1397/3	dec [inc]	1396/3	4	Master angle input 3
MSEL2-M4POS	ph	1397/4	dec [inc]	1396/4	4	Master angle input 4
MSEL2-OUT	ph	13711	-	-	-	Master angle output
MSEL2-MVAL	a	13711	-	-	-	Currently selected master angle input



Function

- 1 from 4 selection of the master value source
- Fixing the selection

The description applies to both function blocks. Please consider this for the following functional description of the MSEL1.

3.2.66.1 1 from 4 selection of the master value source

- One master value source each can be connected to the inputs MSEL1-DFIN(1...4). For selecting a master value source the assigned digital input MSEL1-EN-M(1...4) must be triggered with a LOW-HIGH edge. An input set once remains active until another master value source is selected.
- If two or more inputs are selected at the same time, the input with the lowest selection number is activated.
- The selected input value is directly connected to the output MSEL1-OUT.

If no input has been selected (inputs MSEL1-EN-M(1...4) = LOW), 0 inc is output a the output

3.2.66.2 Locking the selection

A change-over to a new source is prevented by a HIGH level at the input MSEL1-LOCK. The input channel last-output is locked until the input level at MSEL1-LOCK is reset to LOW.

3.2.67 Logic NOT

Purpose

Logic inversion of digital signals. The inversion can be used to control functions or generate status information.

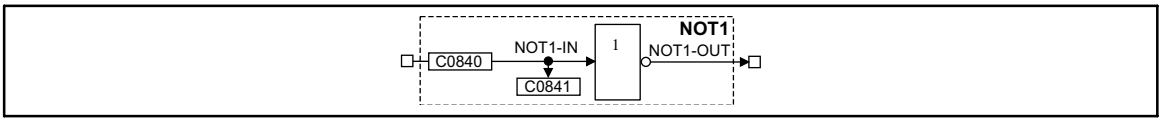


Fig. 3-165 Logic NOT (NOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT1-IN	d	C0841	bin	C0840	2	1000	-
NOT1-OUT	d	-	-	-	-	-	-

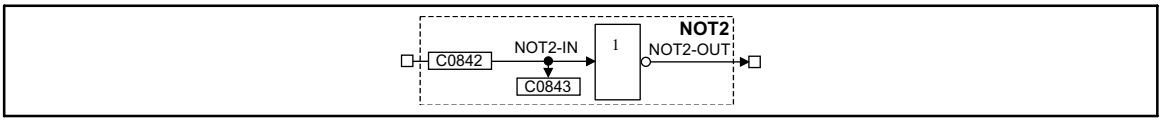


Fig. 3-166 Logic NOT (NOT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT2-IN	d	C0843	bin	C0842	2	1000	-
NOT2-OUT	d	-	-	-	-	-	-

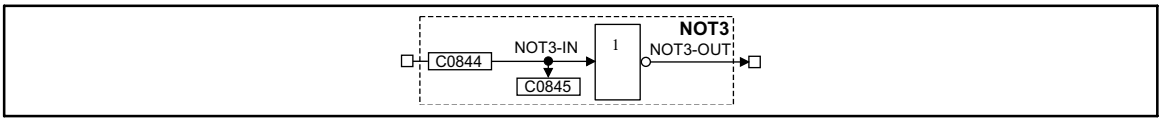


Fig. 3-167 Logic NOT (NOT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT3-IN	d	C0845	bin	C0844	2	1000	-
NOT3-OUT	d	-	-	-	-	-	-

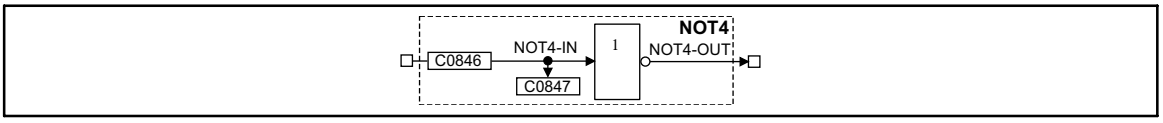


Fig. 3-168 Logic NOT (NOT4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT4-IN	d	C0847	bin	C0846	2	1000	-
NOT4-OUT	d	-	-	-	-	-	-

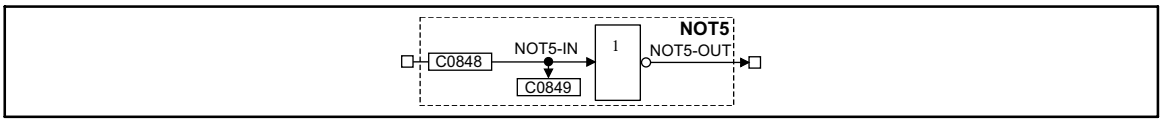


Fig. 3-169 Logic NOT (NOT5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT5-IN	d	C0849	bin	C0848	2	1000	-
NOT5-OUT	d	-	-	-	-	-	-

Function

NOTx-IN1	NOTx-OUT
0	1
1	0

The function corresponds to a change from an NO contact to an NC contact in a contactor control.

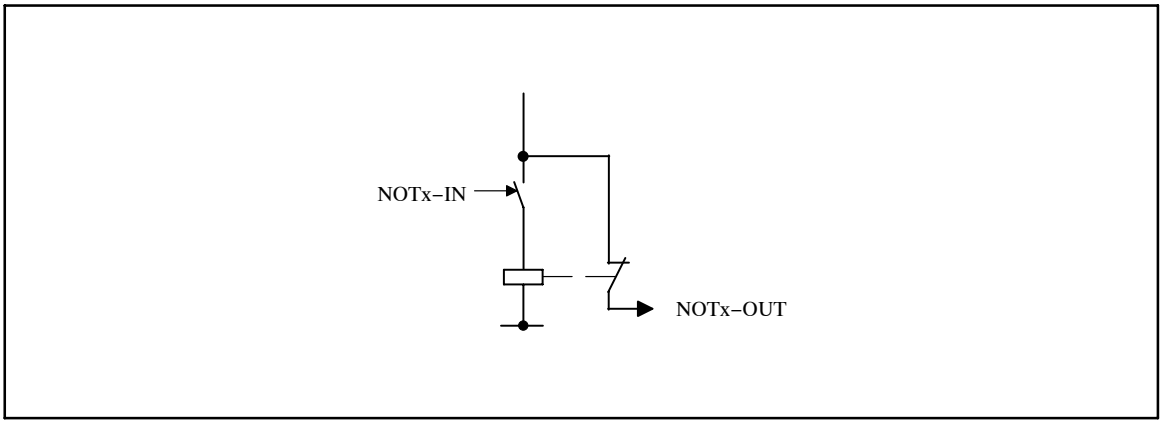


Fig. 3-170 Function of NOT when changing an NO contact to an NC contact.

3.2.68 Speed setpoint conditioning (NSET)

Purpose

This FB conditions

- the main speed setpoint and
- an additional setpoint (or other signals as well)

for the following control structure via ramp function generators or fixed speeds.

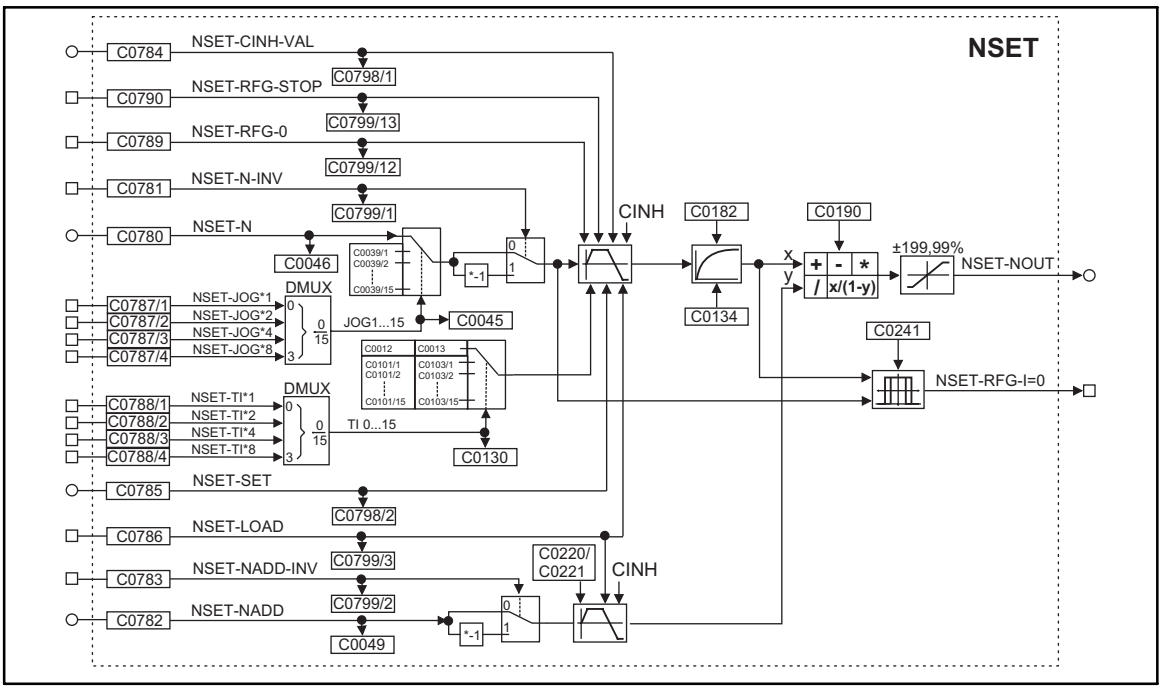
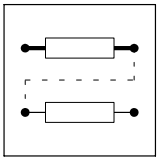


Fig. 3-171 Speed setpoint conditioning (NSET)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	a	C0046	dec [%]	C0780	1	50	Intended for main setpoint, other signals are permissible
NSET-NADD	a	C0047	dec [%]	C0782	1	5650	Intended for additional setpoint, other signals are permissible
NSET-JOG*1	d	C0799/4	bin	C0787/1	2	53	Selection and control of overriding "fixed setpoints" for the main setpoint
NSET-JOG*2	d	C0799/5	bin	C0787/2	2	1000	
NSET-JOG*4	d	C0799/6	bin	C0787/3	2	1000	
NSET-JOG*8	d	C0799/7	bin	C0787/4	2	1000	
NSET-TI*1	d	C0799/8	bin	C0788/1	2	1000	Selection and control of alternative "fixed setpoints" for the main setpoint
NSET-TI*2	d	C0799/9	bin	C0788/2	2	1000	
NSET-TI*4	d	C0799/10	bin	C0788/3	2	1000	
NSET-TI*8	d	C0799/11	bin	C0788/4	2	1000	
NSET-N-INV	d	C0799/1	bin	C0781	2	10251	Control of the signal inversion for the main setpoint
NSET-NADD-INV	d	C0799/2	bin	C0783	2	1000	Control of the signal inversion for the additional setpoint
NSET-RFG-0	d	C0799/12	bin	C0789	2	1000	The main setpoint integrator is led to zero via the current T_i times.
NSET-RFG-STOP	d	C0799/13	bin	C0790	2	1000	Keeping (freezing) of the main setpoint integrator to its actual value.
NSET-CINH-VAL	a	C0798/1	dec [%]	C0784	1	5001	Here, the signal is applied which is to be accepted by the main setpoint integrator when the controller is inhibited
NSET-SET	a	C0798/2	dec [%]	C0785	1	5000	Here, the signal is applied which is to be accepted by the main setpoint integrator when the NSET-LOAD input is set
NSET-LOAD	d	C0799/3	bin	C0786	2	5001	Control of both ramp function generators in special situations, e.g. QSP
NSET-OUT	a	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

- Main setpoint path
- JOG setpoints
- Setpoint inversion
- S ramp

3.2.68.1 Main setpoint path

- The signals in the main setpoint path are limited to the value range ±199.99 %.
- The signal at input NSET-N is led via the function JOG selection.
- The JOG function has priority over the setpoint input NSET-N. This means a selected JOG value deactivates the input. The subsequent signal conditioning uses the JOG value instead.

3.2.68.2 JOG setpoints

- Are fixed values which are saved in the memory.
- JOG values can be retrieved from the memory via the inputs NSET-JOG*x.
- The inputs NSET-JOG*x are binary coded so that 15 JOG values can be retrieved.
- The decoding for enabling the JOG values (retrieval from the memory) is carried out according to the following table:

Output signal	1st input NSET-JOG*1	2nd input NSET-JOG*2	3rd input NSET-JOG*4	4th input NSET-JOG*8
NSET-N	0	0	0	0
JOG 1	1	0	0	0
JOG 2	0	1	0	0
JOG 3	1	1	0	0
JOG 4	0	0	1	0
JOG 5	1	0	1	0
JOG 6	0	1	1	0
JOG 7	1	1	1	0
JOG 8	0	0	0	1
JOG 9	1	0	0	1
JOG 10	0	1	0	1
JOG 11	1	1	0	1
JOG 12	0	0	1	1
JOG 13	1	0	1	1
JOG 14	0	1	1	1
JOG 15	1	1	1	1

- When all inputs are assigned with 0, the input NSET-N is active.
- The number of inputs that must be assigned depends on the required number of JOG setpoints. Four inputs and thus 15 possible selections are available. A digital signal source is assigned via C0787 and the corresponding subcode.

Number of required JOG setpoints	Number of inputs to be assigned
1	At least 1
1 ... 3	At least 2
4 ... 7	At least 3
8 ... 15	4

3.2.68.3 Setpoint inversion

The output signal of the JOG function is led to an inverter.

The sign of the setpoint is inverted if the input NSET-N-INV is triggered with HIGH signal.

Ramp function generator for the main setpoint

The setpoint is then led to a ramp function generator with linear characteristic. Setpoint step-changes at the input are thus converted into a ramp.

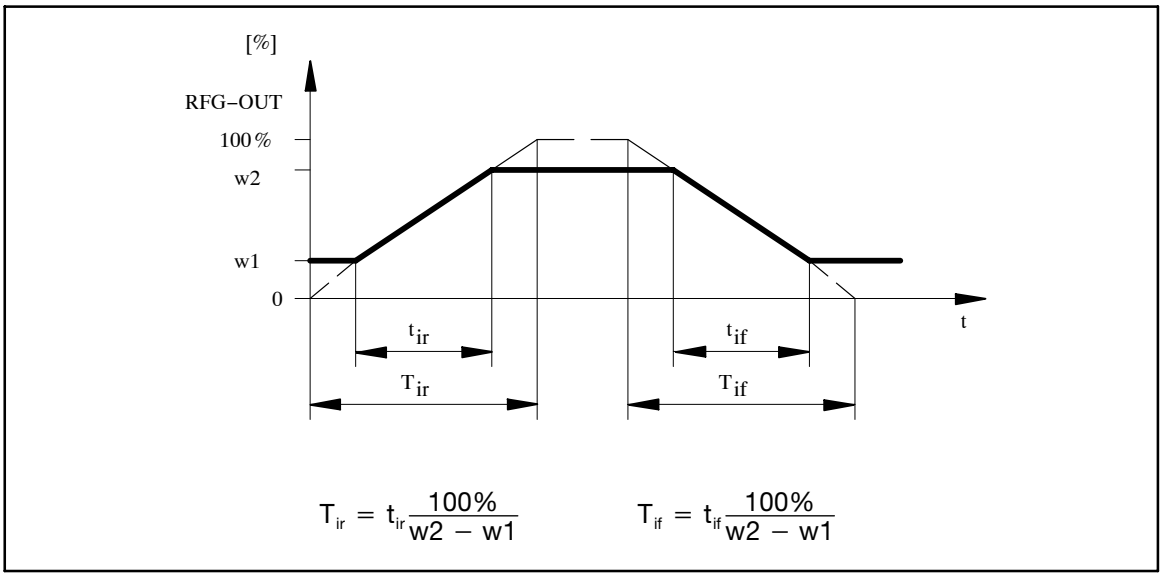


Fig. 3-172 Acceleration and deceleration times of the ramp function generator

- The ramps can be set separately for acceleration and deceleration.
  - Different acceleration and deceleration times can be activated via the inputs NSET-TI*x 16 (for table and function see JOG setpoints; the decoding must be done according to the signal graphic).
  - The T_i times can only be activated in pairs.
- When the controller is inhibited (CINH), the ramp function generator accepts the value applied to the input NSET-CINH-VAL and transmits it to the next function. This function has priority over all other functions.
- NSET-RFG-STOP = HIGH
  - The ramp function generator is stopped. Changes at the input of the ramp function generator have no effect on the output.
- NSET-RFG-0 = HIGH
  - The ramp function generator decelerates to zero along the deceleration ramp.
- It is also possible to load the ramp function generator online with a defined value. For this, the input NSET-LOAD must be set to HIGH. As long as this input is set, the value at input NSET-SET is accepted by the ramp function generator and passed to the output.

Priorities:

CINH	NSET-LOAD	NSET-RFG-0	NSET-RFG-STOP	Function
0	0	0	0	RFG follows the input value via the set ramps
0	0	0	1	The value at the output of RFG is frozen
0	0	1	0	RFG decelerates to zero within the set deceleration time
0	0	1	1	
0	1	0	0	RFG accepts the value applied to input NSET-SET and passes it to its output
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	RFG accepts the value applied to input CINH-VAL and passes it to its output
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

3.2.68.4 S ramp

The linear ramp function generator is connected to a PT1 element. This arrangement implements an S ramp for an almost jerk-free acceleration and deceleration.

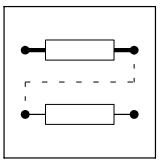
- The PT1 element is switched on and off via C0134.
- The time constant is set via C0182.

3.2.68.5 Arithmetic operation

The output value is led to an arithmetic FB. This FB links the main setpoint and the additional setpoint arithmetically. The arithmetic operation is selected via C0190 (see the following table).

C0190	Function	Example
0	Output = X (Y is not processed)	-
1	Output = X + Y	100 % = 50 % + 50 %
2	Output = X - Y	50 % = 100 % - 50%
3*	Output = X * Y	100 % = 100 % * 100%
4*	Output = X/|Y|	1 % = 100 % / 100%
5	Output = X/(100% - Y)	200 % = 100 % / (100 % - 50 %)

*) Please observe the note for C0190 = 3, 4 in the following chapter



3.2.68.6 Additional setpoint

- An additional setpoint (e. g. a correction signal) can be linked with the main setpoint via the input NSET-NADD.
- The input signal can be inverted via the input NSET-NADD-INV before affecting the ramp function generator. The ramp function generator has a linear characteristic and an acceleration time and deceleration time each.
- With NSET-LOAD = HIGH the ramp function generator is set to zero and kept there without considering the T_i times.The same applies when the controller is inhibited.

Tip!

Do not link the main setpoint with negative additional setpoints when C0190 = 3 or C0190 =4! Otherwise the drive may change its direction of rotation!

The drive behaviour depends on the times set for the main setpoint and additional setpoint at the ramp function generator.

3.2.69 OR operation (OR)

Purpose

Logical ORing of digital signals. The operations are used for controlling functions or creating status information.

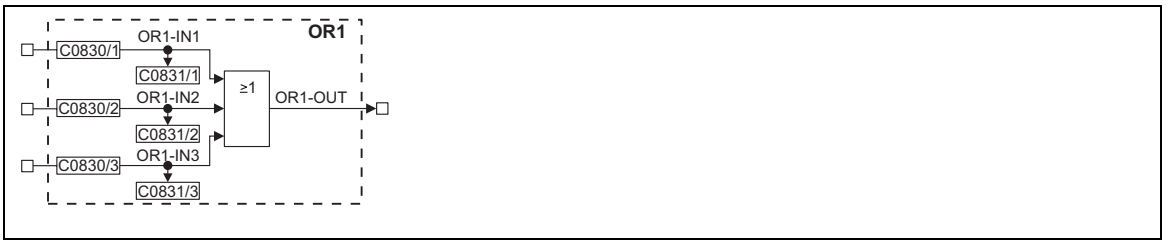


Fig. 3-173 OR operation (OR1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR1-IN1	d	C0831/1	bin	C0830/1	2	1000	-
OR1-IN2	d	C0831/2	bin	C0830/2	2	1000	-
OR1-IN3	d	C0831/3	bin	C0830/3	2	1000	-
OR1-OUT	d	-	-	-	-	-	-

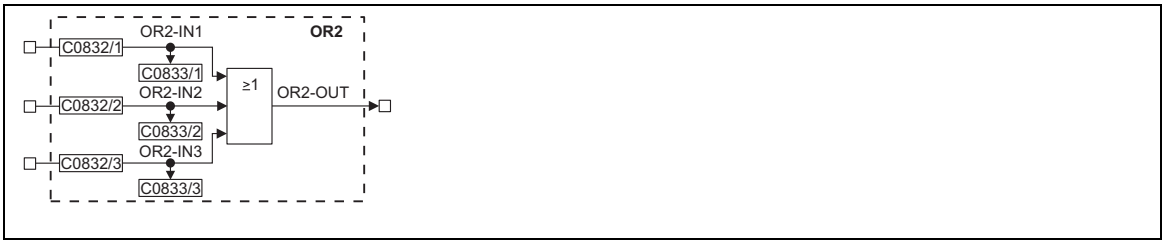


Fig. 3-174 OR operation (OR2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR2-IN1	d	C0833/1	bin	C0832/1	2	1000	-
OR2-IN2	d	C0833/2	bin	C0832/2	2	1000	-
OR2-IN	d	C0833/3	bin	C0832/3	2	1000	-
OR2-OUT	d	-	-	-	-	-	-

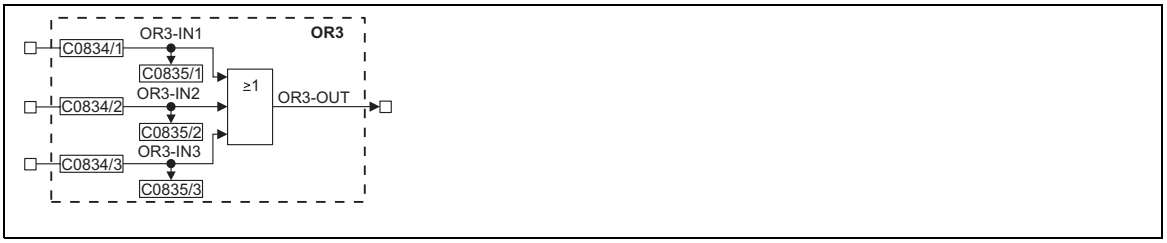


Fig. 3-175 OR operation (OR3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR3-IN1	d	C0835/1	bin	C0834/1	2	1000	-
OR3-IN2	d	C0835/2	bin	C0834/2	2	1000	-
OR3-IN3	d	C0835/3	bin	C0834/3	2	1000	-
OR3-OUT	d	-	-	-	-	-	-

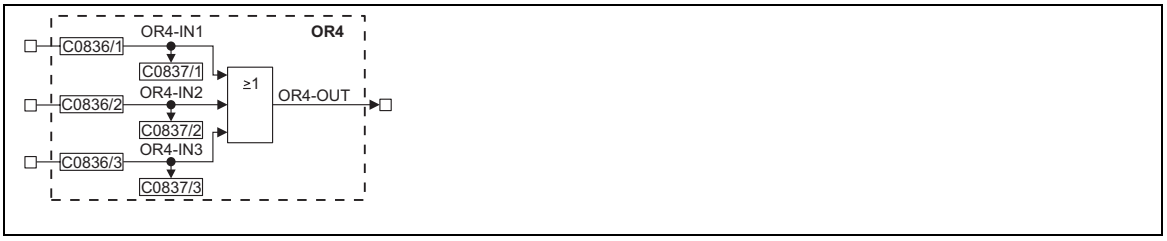


Fig. 3-176 OR operation (OR4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR4-IN1	d	C0837/1	bin	C0826/1	2	1000	-
OR4-IN2	d	C0837/2	bin	C0826/2	2	1000	-
OR4-IN3	d	C0837/3	bin	C0826/3	2	1000	-
OR4-OUT	d	-	-	-	-	-	-

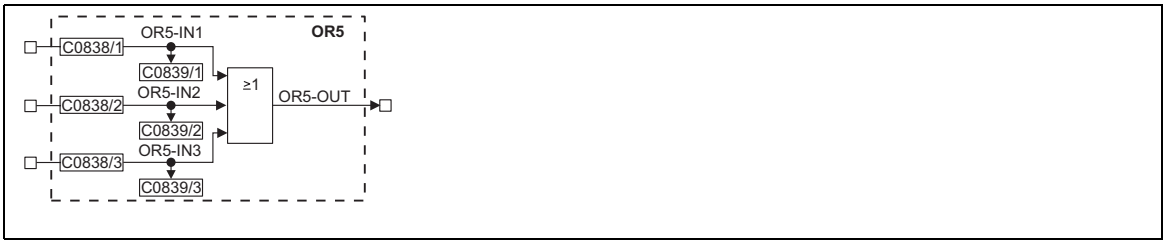


Fig. 3-177 OR operation (OR5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR5-IN1	d	C0839/1	bin	C0828/1	2	1000	-
OR5-IN2	d	C0839/2	bin	C0828/2	2	1000	-
OR5-IN3	d	C0839/3	bin	C0828/3	2	1000	-
OR5-OUT	d	-	-	-	-	-	-

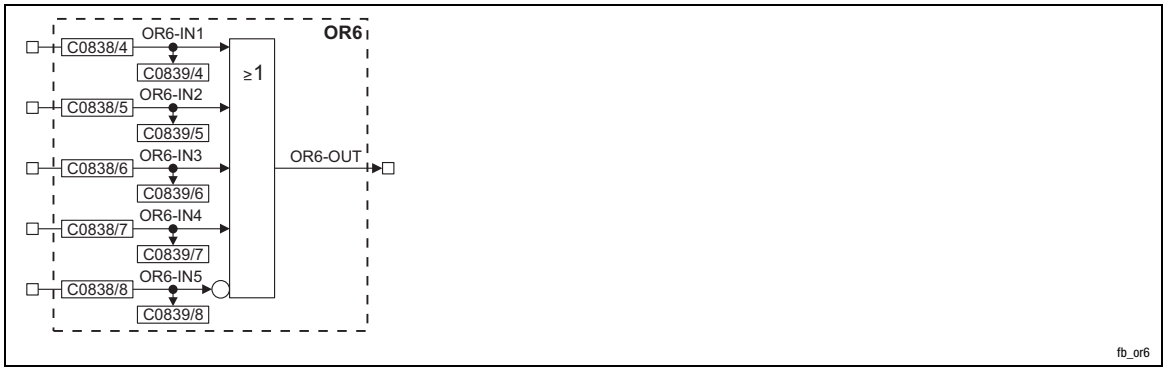


Fig. 3-178 OR operation (OR6)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR6-IN1	d	C0839/4	bin	C0838/4	2	1000	-
OR6-IN2	d	C0839/5	bin	C0838/5	2	1000	-
OR6-IN3	d	C0839/6	bin	C0838/6	2	1000	-
OR6-IN4	d	C0839/7	bin	C0838/7	2	1000	-
OR6-IN5	d	C0839/8	bin	C0838/8	2	1000	The input signal is inverted internally (NOT). The input has to be assigned to FIXED1 if it remains unused.
OR6-OUT	d	-	-	-	-	-	-

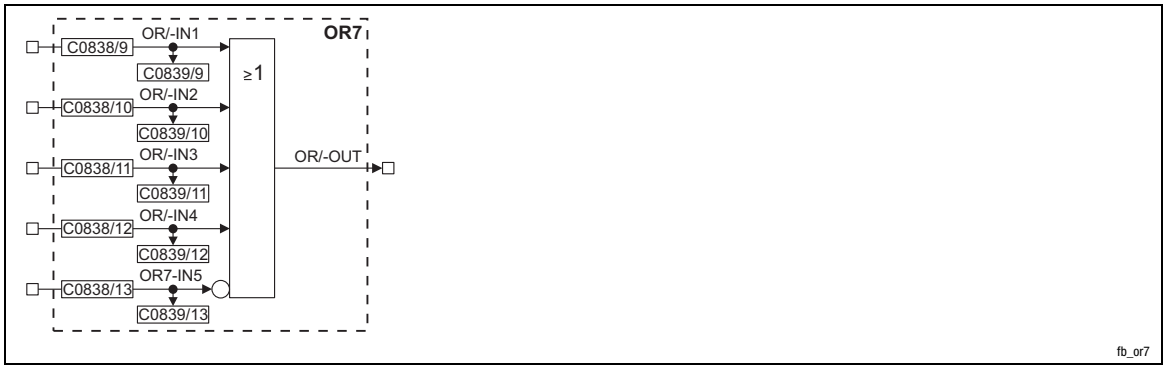


Fig. 3-179 OR operation (OR7)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR7-IN1	d	C0839/9	bin	C0838/9	2	1000	-
OR7-IN2	d	C0839/10	bin	C0838/10	2	1000	-
OR7-IN3	d	C0839/11	bin	C0838/11	2	1000	-
OR7-IN4	d	C0839/12	bin	C0838/12	2	1000	-
OR7-IN5	d	C0839/13	bin	C0838/13	2	1000	The input signal is inverted internally (NOT). The input has to be assigned to FIXED1 if it remains unused.
OR7-OUT	d	-	-	-	-	-	-

Function of OR1 ... OR5

- ORx-OUT = ORx-IN1 ∨ ORx-IN2 ∨ ORx-IN3
- Equivalent network:

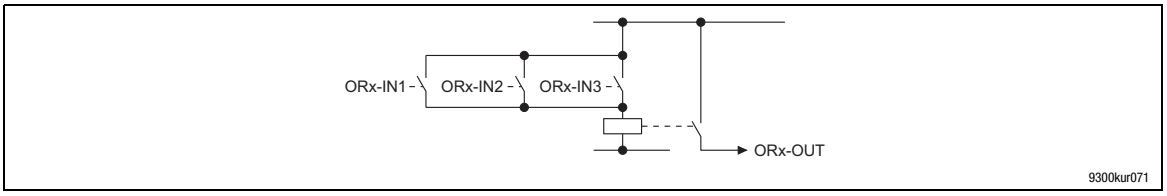


Fig. 3-180 Equivalent network of the OR operation for OR1 ... OR5

Note!

Connect inputs that are not used to FIXED0.

Function of OR6, OR7

- ORx-OUT = ORx-IN1 ∨ ORx-IN2 ∨ ORx-IN3 ∨ ORx-IN4 ∨ $\overline{\text{ORx-IN5}}$
- Equivalent network:

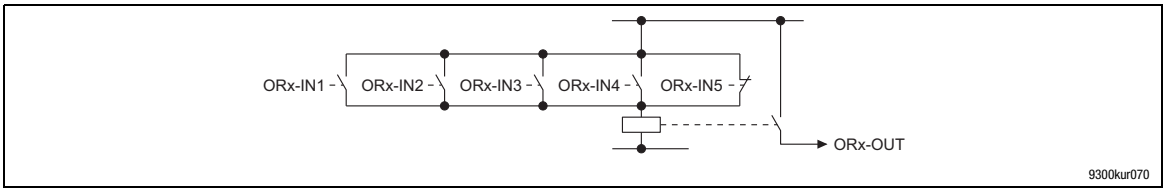


Fig. 3-181 Equivalent network of the OR operation for OR6 and OR7

Note!

- ORx-IN1 ... ORx-IN4: Assign FIXED0 to inputs that are not used.
- Connect ORx-IN5 to FIXED1 if you don't use the input.

3.2.70 Oscilloscope function (OSZ)

Purpose

Detection of any measured variable (e. g. speed setpoint, actual speed, torque etc.). They are visualised in Global Drive Control.

Supports the commissioning of controllers and the troubleshooting.

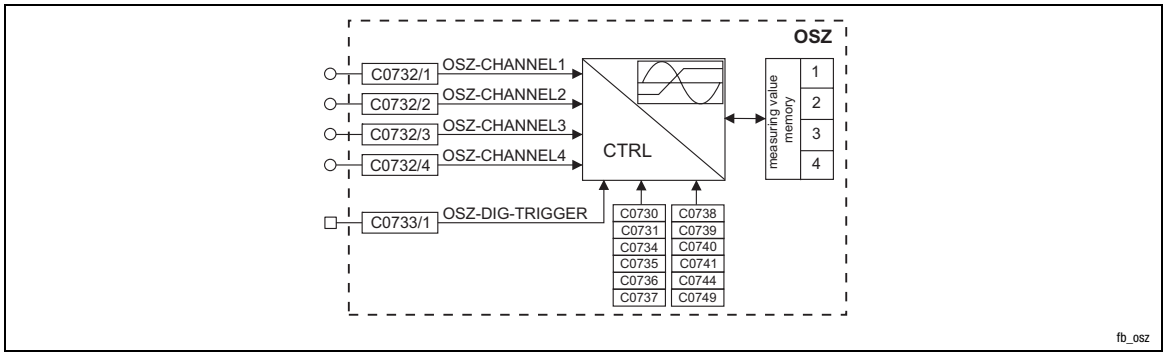


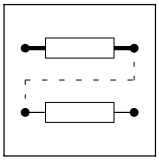
Fig. 3-182 Oscilloscope function (OSZ)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OSZ CHANNEL1	a	-	-	C0732/1	1	-	-
OSZ CHANNEL2	a	-	-	C0732/2	1	-	-
OSZ CHANNEL3	a	-	-	C0732/3	1	-	-
OSZ CHANNEL4	a	-	-	C0732/4	1	-	-
OSZ-DIG-TRIGGER	d	-	-	C0733/1	2	-	-

Function

The FB has three function units:

- Trigger check
  - Monitoring of the digital trigger source for a valid trigger event
- Processing of the measured signal
  - Linking the measurement inputs
  - Calculating the time base
  - Monitoring of the analog trigger source for a valid trigger event.
- Measuring value memory
  - Scaling the ring buffer
  - Filing the measured data in the ring buffer
  - Saving the measuring points for image generation



Functional description

Function	Code	Selection	Description
OSZ mode			Controls the measurement in the controller
	C0730	1	• Starts the recording of the measured values
		0	• Cancels a running measurement
OSZ status			Displays five different operating states
	C0731	1	• Measurement completed – The memory of the measured values is completely filled with measured data. The measured values can be accessed via the PC.
		2	• Measurement active – A measurement was started with C0730 = 1. The FB is waiting for a valid trigger event.
		3	• Trigger detected – The FB has detected a valid trigger event. Depending on the trigger delay the saving of the measured data is not yet completed. It is automatically completed with the entry into the last memory unit.
		4	• Measurement cancelled – Cancel of a running recording of the measured values (C0730 = 0). The memory of the measured values is filled with the data that has just been measured. The data can be accessed via the PC.
		5	• Read data memory – The measured data memory is being read at the moment. No settings are possible in this operating state.
Configuration OSZ channel 1 ... 4	C0732/1 to C0732/4		• Links the measuring channels of the FB with the signals of the process environment – The four measuring channels can be assigned with any analog signal. Enter the corresponding signal number into C0732/1 ... C0732/4. – Always start linking with channel 1, then channel 2 and so on. Unused channels are automatically assigned with signal FIXED 0%.
Configuration OSZ trigger	C0733/1		Links the digital trigger input with a digital signal in the process environment. – The trigger input can be assigned with any digital signal. Enter the corresponding signal number into C0733/1.
Trigger source			Defines the trigger source
	C0734	1	Source is one of the four measuring channels (C0734/1 ... C0734/4)
		0	Source is the digital trigger input (C0733/1)
Trigger level	C0735	-32767 ... 32767	• Defines the trigger level which activates the triggering when the level is exceeded. – The trigger level is only monitored when the triggering is done on one of the four channels. – The trigger level is not effective with digital triggering.
Trigger edge			Defines the trigger edge which activates the triggering. • Triggering on an analog input channel – With a LOW-HIGH trigger edge the analog trigger signal must exceed a defined trigger level to activate the triggering. – With a HIGH-LOW trigger edge the analog trigger signal must fall below a defined trigger level to activate the triggering. • Triggering on a digital trigger input – With a LOW-HIGH trigger edge the digital trigger signal must change from LOW to HIGH to activate the triggering. – With a HIGH-LOW trigger edge the digital trigger signal must change from HIGH to LOW to activate the triggering. Fig. 3-183 shows the triggering of an analog signal with a positive edge.
	C0736	1	– HIGH-LOW trigger edge
		0	LOW-HIGH trigger edge

Function	Code	Selection	Description
Trigger delay			The trigger delay defines when to begin with the saving of the measured values with regard to the trigger time.
	C0737	-100.0 % ... 0 %	• Negative trigger delay (pre-triggering) – Defines a percentage of the whole memory content. This part of the memory content is filled with measured values **before** the triggering (see Fig. 3-184).
		0 % ... 999.9 %	• Positive trigger delay (post-triggering) – Defines a percentage of the whole memory content. The saving of the measured values **after** triggering is delayed by this part of the memory content (Fig. 3-183).
Sampling period	C0738	1 ms ... 10 min	• Setting of the sampling period – The sampling period is the time between two measurements – The measurements are carried out simultaneously for all channels (e. g. value measured at channel 1 is measured at the same time as the measured value at channel 2, 3 or 4. – The sampling period can be set in steps of 1, 2 and 5.
Number of Channels	C0739		Number of channels used for measurements.
Read data memory			The code is required if the GDC is not used for the visualisation.
	C0740/1	0 ... 16383	• Defines the starting point for reading the data memory and thus enables the memory array to be selectively accessed. – In order to read the data memory bit by bit (e. g. reading only the measured values of one channel or reading with reduced memory depth), the starting point can be changed.
	C0740/2	1	• Enable “Read memory” – Enables the access to the memory to read the data
		0	• Inhibit “Read memory” – Inhibits the access to the memory. The access must be inhibited after every reading of the data
Information about the function block			Provides information on the function block
	C0741/1		Version of the function block (e. g. 120: Version 1.20)
	C0741/2		Data memory size (1024 ... 16384 bytes)
	C0741/3		Data width of the measured values (1 byte / 2 bytes)
	C0741/4		Number of the available measuring channels (1 ... 4)

Function	Code	Selection	Description
Memory size	C0744	0 ... 6	Set memory depth of the data memory – Max. size of the data memory: 8192 measured values ≙ 16384 bytes (C0744 = 6) – Min. size of the data memory: 512 measured values ≙ 1024 bytes (C0744 = 0) – Changing the memory depth from 512 to 8192 measured values/step – A memory depth which is optimally adapted to the corresponding measuring task reduces the data transmission time.
Information on saving			Information on saving the measured values in the data memory The FB saves the data in a ring format. For reconstructing the chronological signal sequence the following three "graphic points" are marked.
	C0749/1		Measured value no. of the instant of abortion
	C0749/2		Measured value no. of the instant of triggering
	C0749/3		Measured value no. of the instant of completion

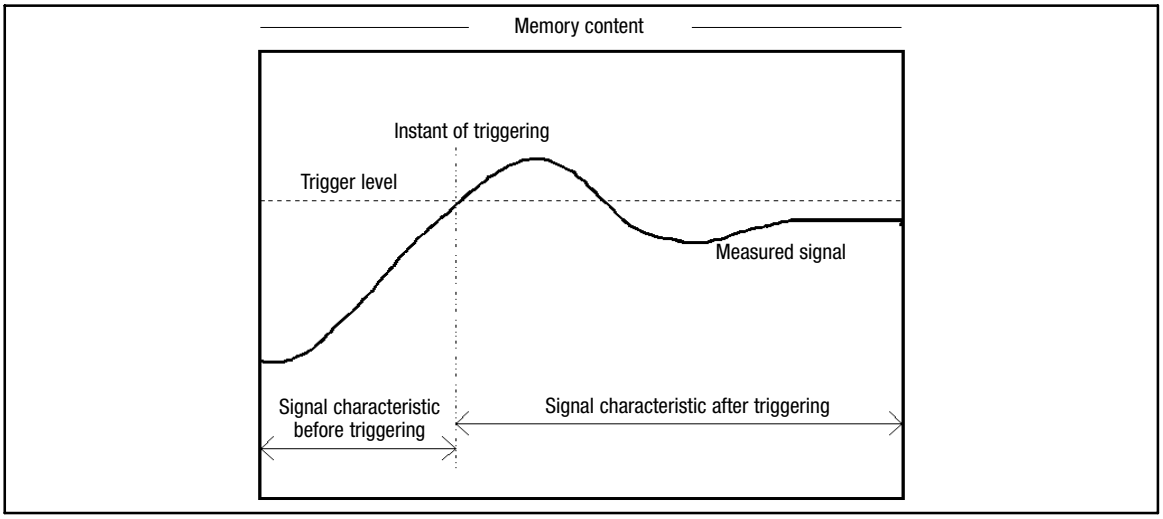


Fig. 3-183 Example: Trigger level and trigger delay with approx. -30 % of pre-triggering

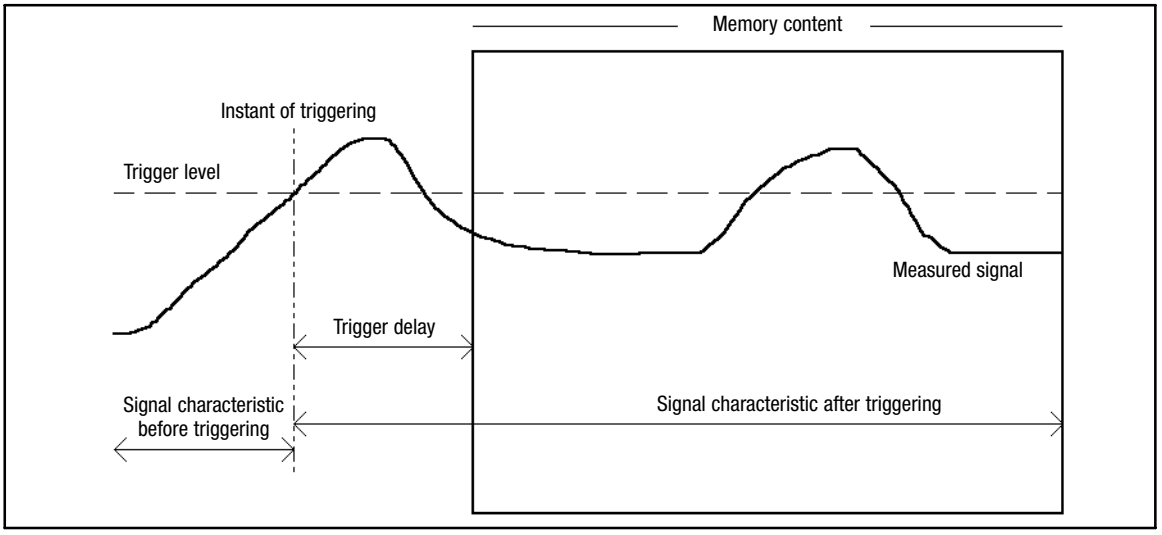


Fig. 3-184 Example: Trigger level and trigger delay with approx. -30 % of post-triggering

3.2.71 Process controller (PCTRL1)

Purpose

The FB is used, for instance, as a higher-level controller (dancer position controller, tension controller, pressure controller etc.).

The control characteristic follows the ideal PID algorithm, but it can also be changed over to a PI or P characteristic.

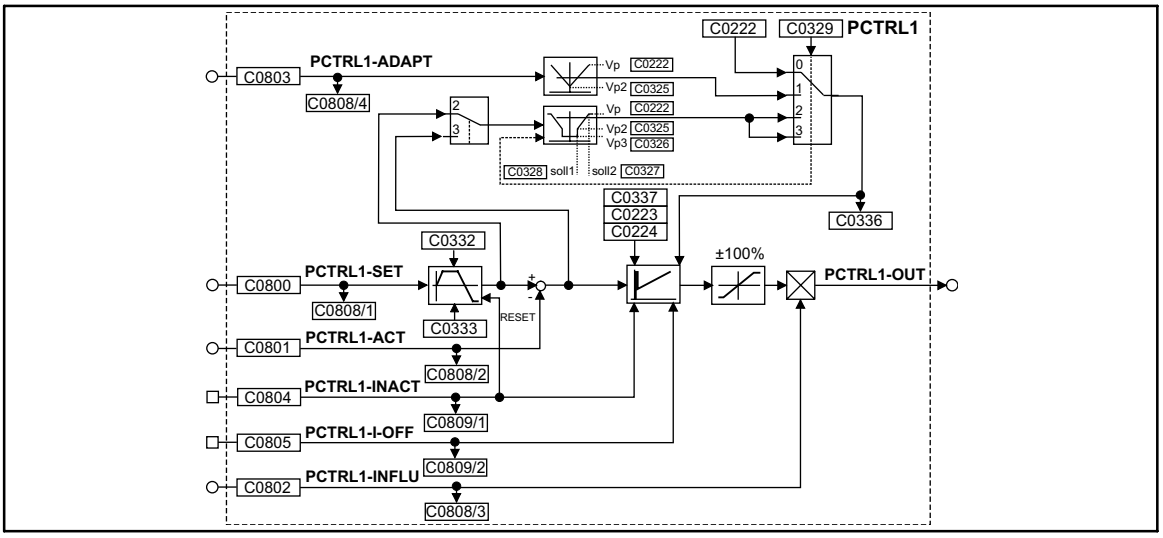


Fig. 3-185 Process controller (PCTRL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PCTRL1-SET	a	C0808/1	dec [%]	C0800	1	1000	Input of the process setpoint. Possible value range: ±200%. The time characteristic of step-change signals can be affected via the ramp function generator (C0332 for the acceleration time; C0333 for the deceleration time).
PCTRL1-ACT	a	C0808/2	dec [%]	C0801	1	1000	Actual value input; value range ±200%
PCTRL1-INFLU	a	C0808/3	dec [%]	C0802	1	1000	Evaluation or suppression of the output signal; value range ±200%
PCTRL1-ADAPT	a	C0808/4	dec [%]	C0803	1	1000	Online change of the P gain; value range ±200%
PCTRL1-INACT	d	C0809/1	bin	C0804	2	1000	Online deactivation of the process controller
PCTRL1-I-OFF	d	C0809/2	bin	C0805	2	1000	Online setting of the I component to zero
PCTRL1-OUT	a	-	-	-	-	-	-

Function

Setpoint and actual value are sent to the process controller via the corresponding inputs and processed according to the selected control algorithm (control chararacteristic).

3.2.71.1 Control characteristic

- In the default setting, the PID algorithm is active.
- The D-component can be deactivated by setting code C0224 to zero. Thus, the controller becomes a PI-controller (or P-controller if the I-component is also switched off).
- The I-component can be switched on or off online via the PCTRL-I-OFF input. For this, the input is assigned a digital signal source (e.g. one of the freely assignable digital input terminals). If the I-component is to be switched off permanently, the input is assigned the signal source ”FIXED1”.
  – PCTRL-I-OFF = HIGH switches off the I-component
  – PCTRL-I-OFF = LOW switches on the I-component
- The reset time is parameterised via C0223.
- The P-gain can be set in different ways. The function providing the P-gain is selected under C0329:
  – C0329 = 0
  The P-gain is entered under C0222.
  – C0329 = 1
  The P-gain is entered via the PCTRL-ADAPT input. The input value is led via a linear characteristic. The slope of the characteristic is set under C0222 (upper limit) and C0325 (lower limit). The value under C0222 is valid if the input value = +100 % or -100 %. The value under C0325 applies if the input value is 0 %.

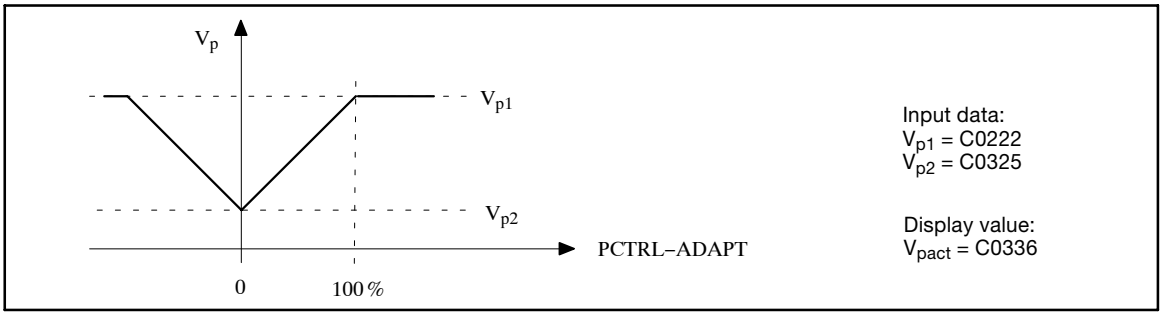


Fig. 3-186 Input of the P-gain via PCTRL-ADAPT input

  – C0329 = 2
  The P-gain is derived from the process setpoint PCTRL-SET. The setpoint is measured after the ramp function generator and calculated by means of a characteristic with three interpolation points.

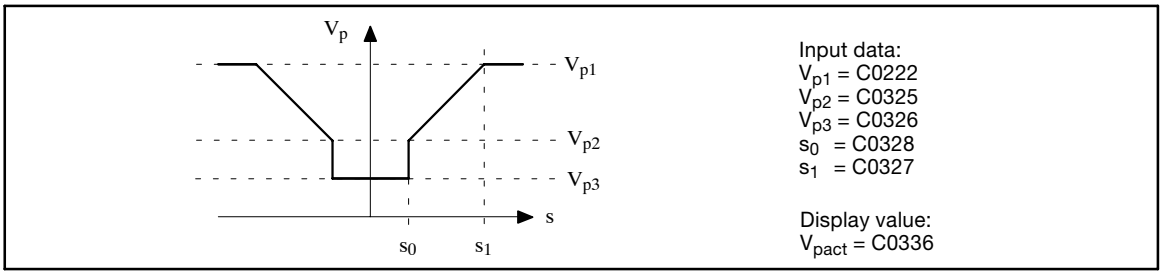


Fig. 3-187 P-gain derived from the PCTRL-SET process setpoint

  – C0329 = 3
  The P-gain is derived from the control difference and calculated by means of a characteristic as for C0329 = 2.

3.2.71.2 Ramp function generator

The setpoint PCTRL-SET is led via a ramp function generator with linear characteristic. Thus, setpoint step-changes at the input can be transformed into a ramp.

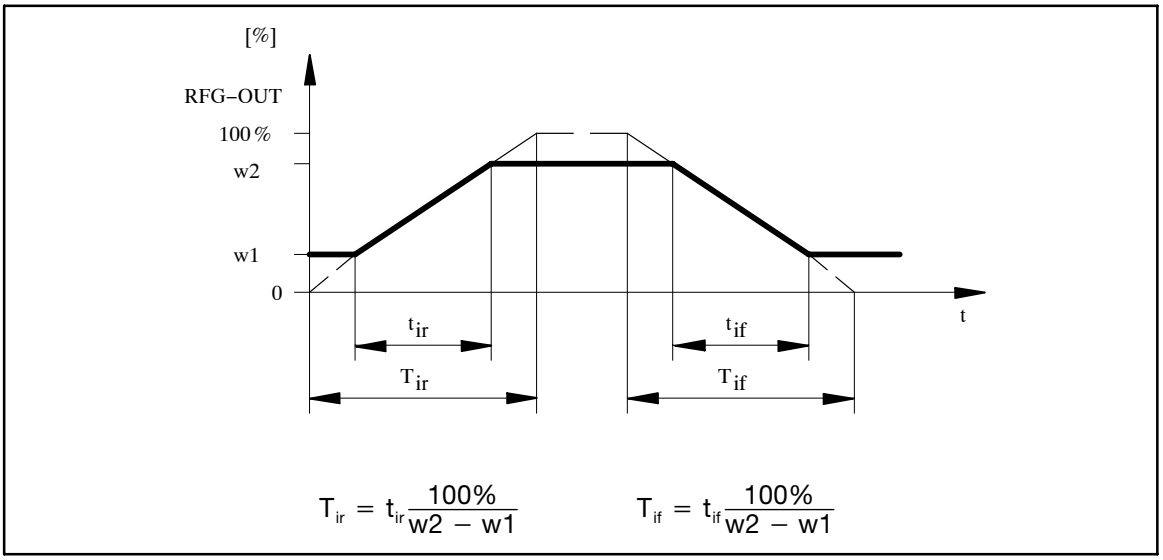


Fig. 3-188 Acceleration and deceleration times of the ramp function generator

- The ramps can be adjusted separately for acceleration and deceleration.
  - Acceleration time t_{ir} with C0332.
  - Deceleration time t_{if} with C0333.
- PCTRL-INACT = HIGH
  - The ramp function generator is immediately set to zero.

3.2.71.3 Value range of the output signal

- The process controller operates in bipolar mode in the default setting.
  - The output value is limited to ±100 %.
- The function can be set to unipolar mode under C0337.
  - The output value is limited to 0 ... +100 %.

3.2.71.4 Evaluation of the output signal

- The output signal can be evaluated after the limitation block via PCTRL-INFLU.
  - The process controller can be hidden or unhidden with this evaluation.
  - The calcuation is done according to the following formula:
    100 % (PCTRL-OUT) = 100 % * 100 % (PCTRL-INFLU).

3.2.71.5 Deactivation of the process controller

- PCTRL-INACT = HIGH deactivates the process controller
  - PCTRL-OUT is set to zero.
  - The I-component is set to zero.
  - The ramp function generator is set to zero.

3.2.72 Angle addition block (PHADD)

Purpose

Adds or subtracts angle signals depending on the input used.

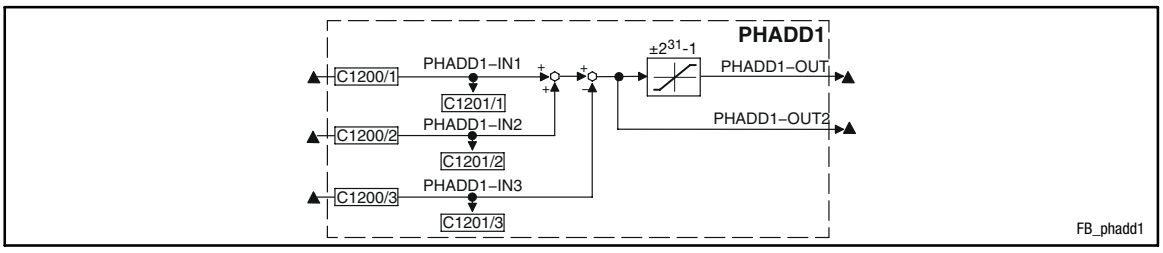


Fig. 3-189 Angle addition block (PHADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHADD1-IN1	ph	C1201/1	dec [inc]	C1200/1	3	1000	Addition input
PHADD1-IN2	ph	C1201/2	dec [inc]	C1200/2	3	1000	Addition input
PHADD1-IN3	ph	C1201/3	dec [inc]	C1200/3	3	1000	Subtraction input
PHADD1-OUT	ph	-	-	-	-	-	Limited to ±2147483647
PHADD1-OUT2	ph	-	-	-	-	-	-

Function

- Input PHADD1-IN1 is added to input PHADD1-IN2.
- The input PHADD-IN3 is subtracted from the calculated result.
- Then the result of the subtraction
  – is limited to ±2147483647 and output at PHADD1-OUT.
  – is output at PHADD1-OUT2 without limitations.

3.2.73 Angle comparator (PHCMP)

Purpose

Compares two angle signals (distances) with each other.

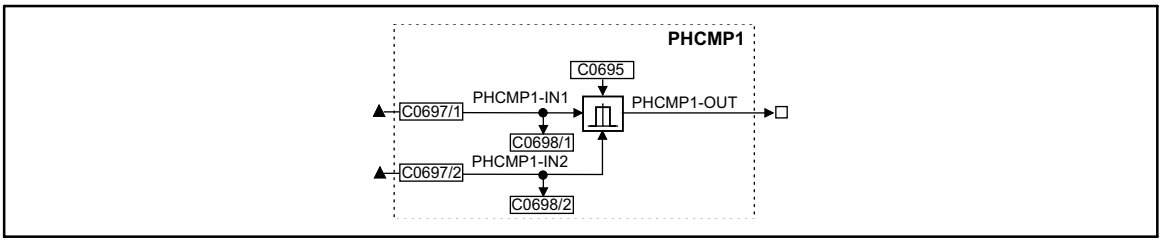


Fig. 3-190 Angle comparator (PHCMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP1-IN1	ph	C0698/1	dec [inc]	C0697/1	3	1000	Signal to be compared
PHCOMP1-IN2	ph	C0698/2	dec [inc]	C0697/2	3	1000	Comparison value
PHCOMP1-OUT	d	-	-	-	-	-	

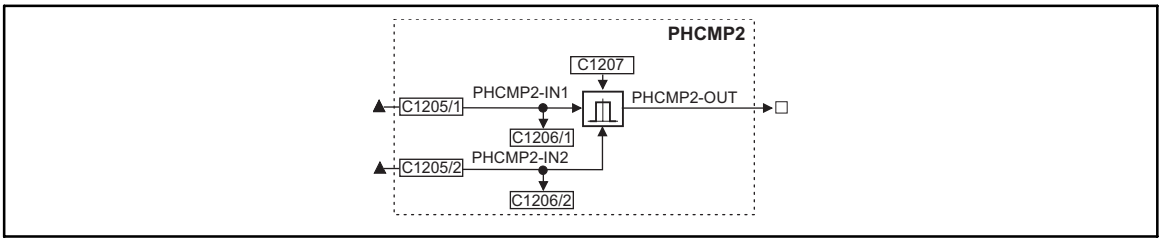


Fig. 3-191 Angle comparator (PHCMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP2-IN1	ph	C1206/1	dec [inc]	C1205/1	3	1000	Signal to be compared
PHCOMP2-IN2	ph	C1206/2	dec [inc]	C1205/2	3	1000	Comparison value
PHCOMP2-OUT	d	-	-	-	-	-	

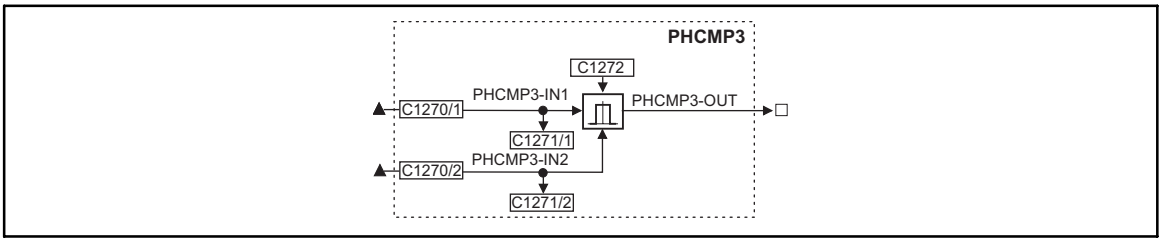


Fig. 3-192 Angle comparator (PHCMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP3-IN1	ph	C1271/1	dec [inc]	C1270/1	3	1000	Signal to be compared
PHCOMP3-IN2	ph	C1271/2	dec [inc]	C1270/2	3	1000	Comparison value
PHCOMP3-OUT	d	-	-	-	-	-	

Function

Function block	Code	Function	Note
PHCMP1	C0695 = 1	• If PHCMPx-IN1 < PHCMPx-IN2, PHCMPx-OUT switches to HIGH • If PHCMPx-IN1 ≥ PHCMPx-IN2, PHCMPx-OUT switches to LOW	
PHCMP2	C1207 = 1		
PHCMP3	C1272 = 1		
PHCMP1	C0695 = 2	• If | PHCMPx-IN1 | < | PHCMPx-IN2 |, PHCMPx-OUT switches to HIGH • If | PHCMPx-IN1 | ≥ | PHCMPx-IN2 |, PHCMPx-OUT switches to LOW	Compares the absolute values of the inputs
PHCMP2	C1207 = 2		
PHCMP3	C1272 = 2		

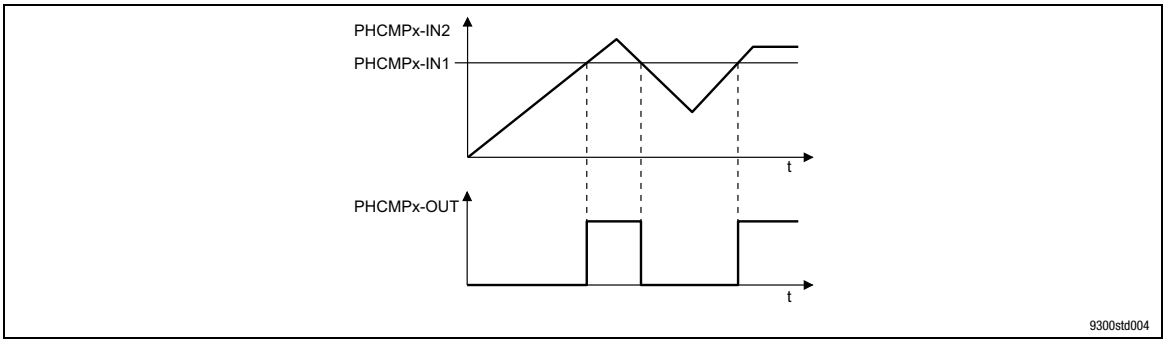


Fig. 3-193 Diagram of the function

3.2.74 Actual angle integrator (PHDIFF)

Purpose

Selective addition of a angle signal to the setpoint angle.

It is also possible to compare setpoint and actual angle signals.

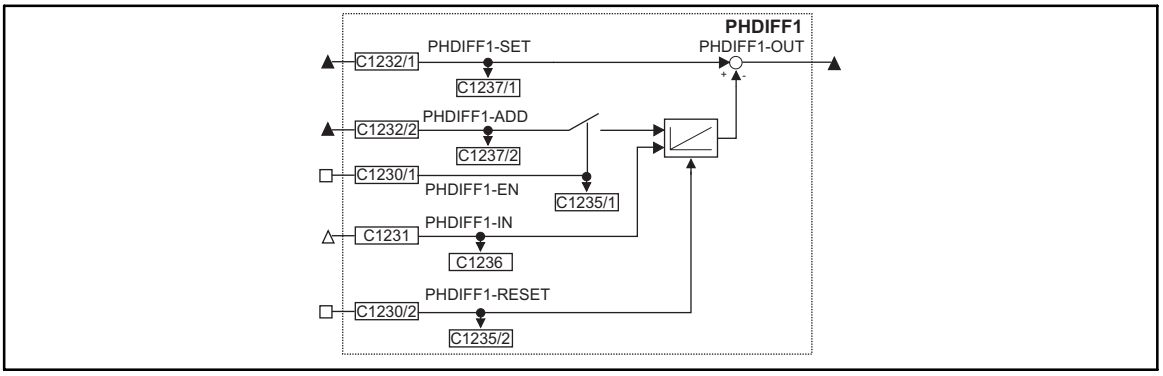


Fig. 3-194 Actual angle integrator (PHDIFF1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHDIFF1-IN	phd	C1236	dec [rpm]	C1231	4	-
PHDIFF1-SET	ph	C1237/1	dec [inc]	C1232/1	3	-
PHDIFF1-ADD	ph	C1237/2	dec [inc]	C1232/2	3	-
PHDIFF1-EN	d	C1235/1	bin	C1230/1	2	-
PHDIFF1-RESET	d	C1235/2	bin	C1230/2	2	HIGH = sets the actual angle integrator = 0
PHDIFF1-OUT	ph	-	-	-	-	Without limit

Function

C1230/1 = HIGH

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The angle signal at PHDIFF1-ADD is added to the integrated speed signal.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

C1230/1 = LOW

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

3.2.75 Signal adaptation for angle signals (PHDIV)

Purpose

Power-of-two division or multiplication of angle signals.

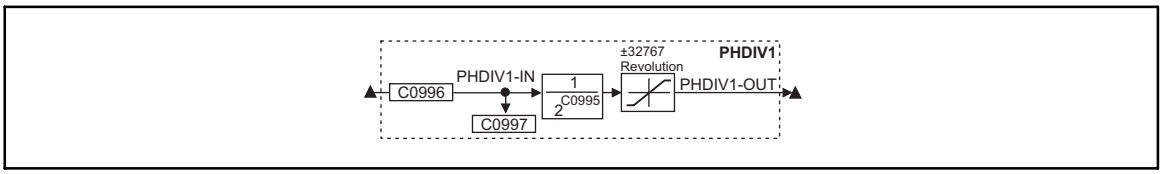


Fig. 3-195 Signal adaptation for angle signals (PHDIV1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHDIV1-IN	ph	C0997	dec [inc]	C0996	3	1000	
PHDIV1-OUT	ph	-	-	-	-	-	65536 inc = one encoder revolution

Function

- Arithmetic function:

$$\text{PHDIV1-OUT} = \frac{\text{PHDIV1-IN}}{2^{C0995}}$$

  – Positive values in C0995 result in a division.
  – Negative values in C0995 result in a multiplication.

- The output value is limited to ±(2^{31}-1) inc (corresponds to ±32767 encoder revolutions).
  – If the limit is exceeded, the output is kept at the limit value.

3.2.76 Angle integrator (PHINT1, PHINT2, PHINT3)

Integrates a speed or a velocity to a angle (distance).

The integrator can accept max. ±32000 encoder revolutions.

PHINT3 can recognise a relative distance.

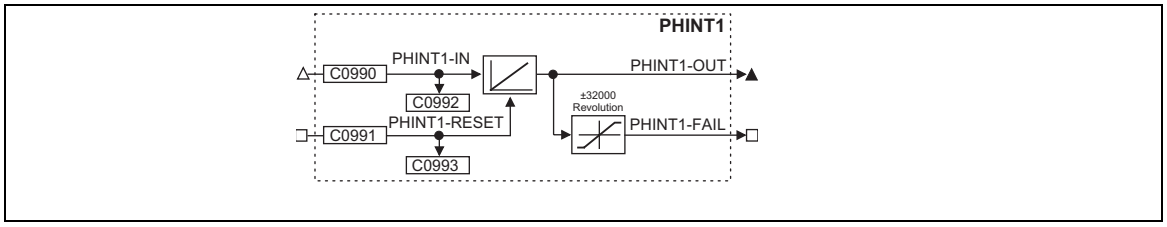


Fig. 3-196 Angle integrator (PHINT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT1-IN	phd	C0992	dec [rpm]	C0990	4	1 revolution = 65536 increments
PHINT1-RESET	d	C0993	bin	C0091	2	HIGH = sets the angle integrator to 0 and PHINT1-FAIL = LOW
PHINT1-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT1-FAIL	d	-	-	-	-	HIGH = overflow

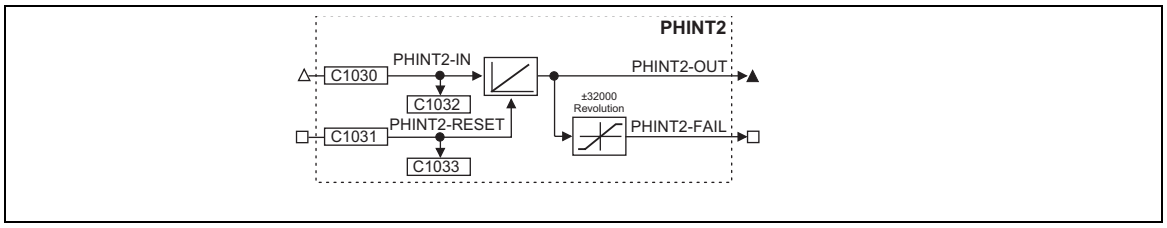


Fig. 3-197 Angle integrator (PHINT2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT2-IN	phd	C1032	dec [rpm]	C1030	4	1 revolution = 65536 increments
PHINT2-RESET	d	C1033	bin	C1031	2	HIGH = sets the angle integrator to zero and PHINT2-FAIL = LOW
PHINT2-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT2-FAIL	d	-	-	-	-	HIGH = overflow

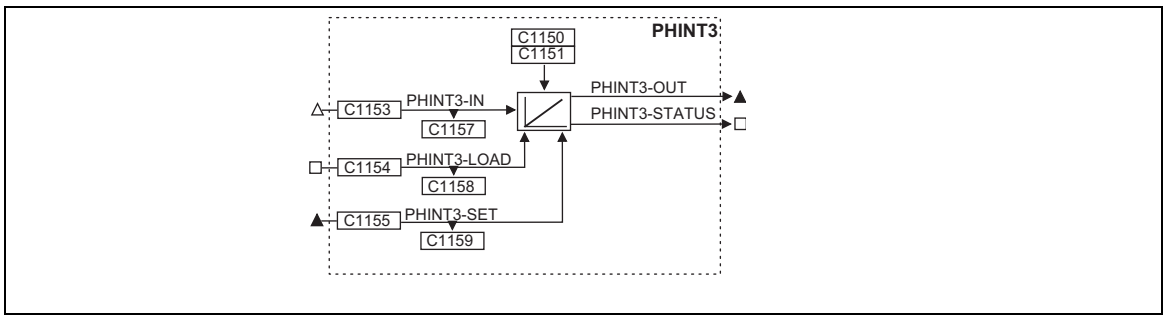
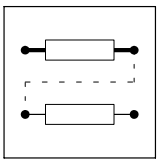


Fig. 3-198 Angle integrator (PHINT3)



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT3-IN	phd	C1157	dec [rpm]	C1153	4	1 revolution = 65536 increments
PHINT3-LOAD	d	C1158	bin	C1154	2	HIGH = sets the angle integrator to the input signal of PHINT3-IN and PHINT3-STATUS = LOW
PHINT3-SET	ph	C1159	dec [inc]	C1155	3	
PHINT3-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT3-STATUS	d	-	-	-	-	HIGH = overflow or processing of distance completed

Function

- Constant input value (PHINT1, PHINT2 and PHINT3)
- Input value with change of sign (PHINT3)
- Scaling of PHINTx-OUT

3.2.76.1 Constant input value (PHINT1 and PHINT2)

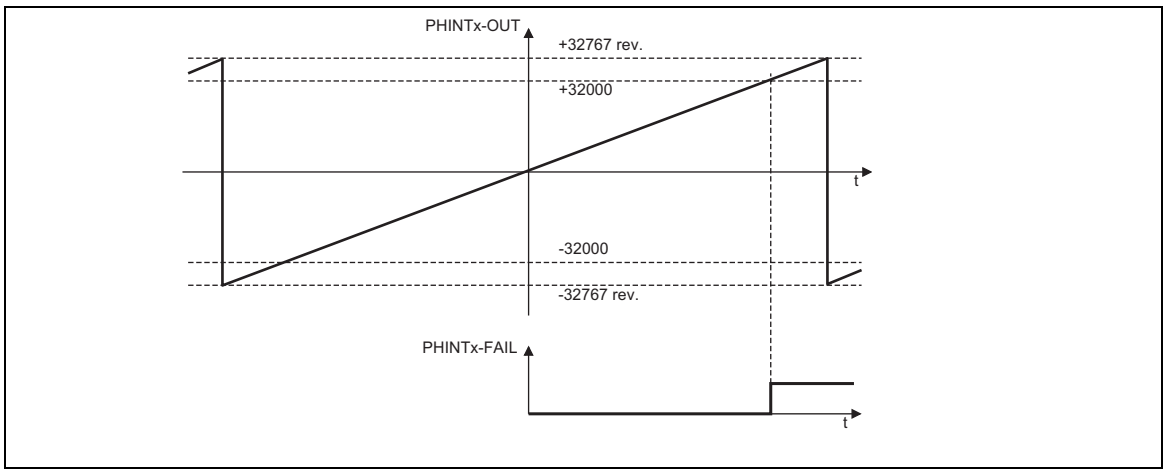


Fig. 3-199 Function of PHINTx with constant input value

- The FB integrates speed or velocity values at PHINTx-IN to a angle (distance).
- PHINTx-OUT outputs the counter content of the bipolar integrator.
  – A positive value at PHINTx-IN increments the integrator (counter content is increased).
  – A negative value at PHINTx-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  – an overflow occurs. The counting is continued with the value -32768.
  – PHINTx-FAIL switches to HIGH when the value ≥ +32000 is reached.
- If the counter content falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  – an overflow occurs. The counting starts at the value +32767.
  – PHINTx-FAIL switches to HIGH when the value ≤ -32000 is reached.
- PHINTX-RESET = HIGH
  – sets the integrator to 0
  – sets PHINTx-OUT = 0, as long as a HIGH level is applied to PHINTx-IN.
  – sets PHINTx-FAIL = LOW.

3.2.76.2 Constant input value (PHINT3)

The FB PHINT3 has three modes which can be set under C1150.

Mode C1150 = 2 is described in chapter 3.2.76.3.

C1150 = 0	C1150 = 1
The input PHINT3-LOAD is state-triggered (HIGH level). • PHINT3-LOAD = HIGH – The integrator is loaded with the input value at PHINT3-SET. – Sets the output PHINT3-STATUS = LOW	The input PHINT3-LOAD is edge-triggered (LOW-HIGH edge). • PHINT3-LOAD = LOW-HIGH edge – The integrator is loaded with the input value at PHINT3-SET and starts adding from this point – Sets the output PHINT3-STATUS = LOW

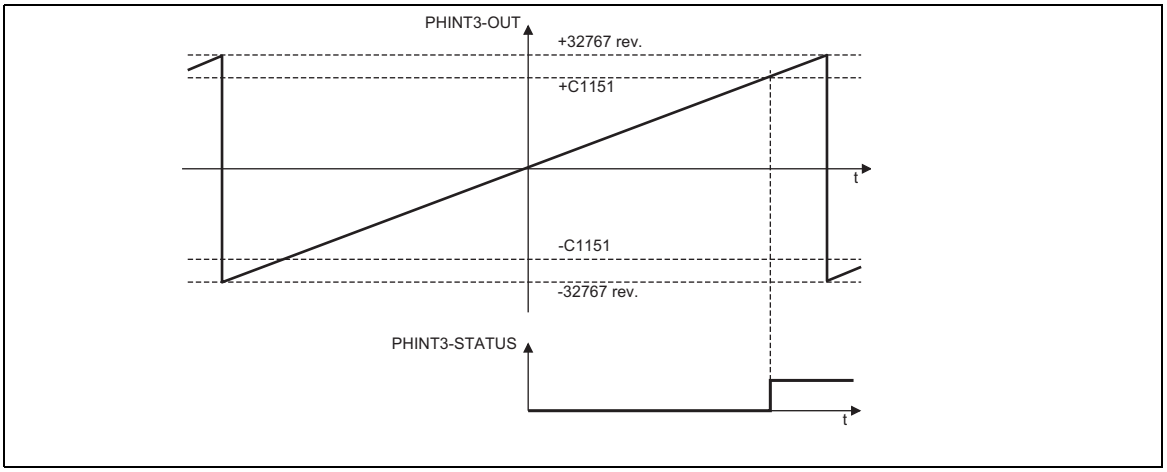


Fig. 3-200 Function of PHINT3 with constant input value when C1150 = 0 and C1150 = 1

- The FB integrates speed or velocity values at PHINT3-IN to a angle (distance).
- PHINT3-OUT outputs the counter content of the bipolar integrator.
  – A positive value at PHINT3-IN increments the integrator (counter content is increased).
  – A negative value at PHINT3-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  – an overflow occurs. The counting is continued with the value -32768,
  – PHINT3-STATUS switches to HIGH when the value (+) C1151 is reached
- If the counter content falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  – an overflow occurs. The counting starts at the value +32767,
  – PHINT3-STATUS switches to HIGH when the value (-) C1151 is reached

3.2.76.3 Input value with sign reversal (PHINT3)

C1150 = 2

The input PHINT3-LOAD is state-triggered (HIGH level).

- PHINT3-LOAD = HIGH
  - The integrator is loaded with the input value at PHINT3-SET.
  - Sets the output PHINT3-STATUS = LOW.

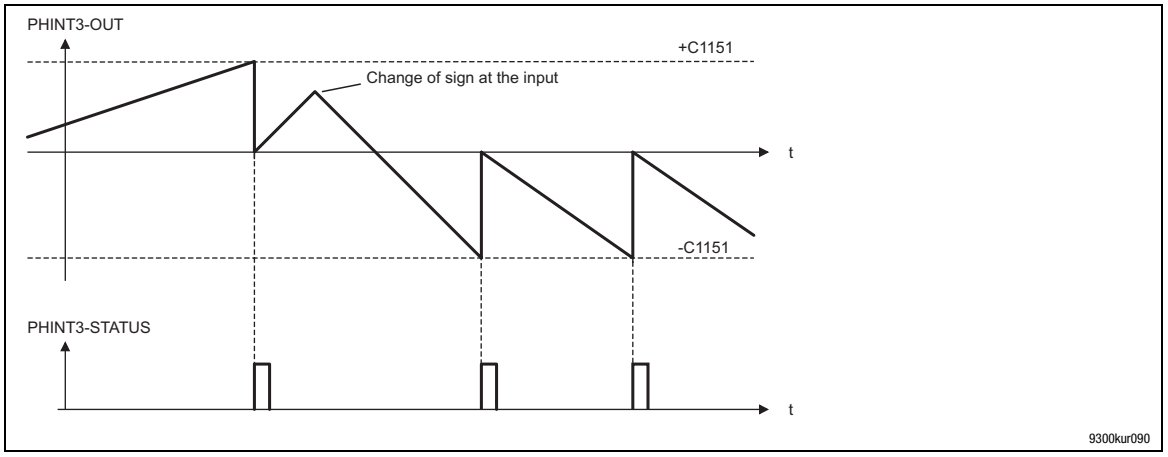
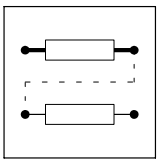


Fig. 3-201 Function of PHINT3 with sign reversal of the input value when C1150 = 2

- The FB integrates speed or velocity values at PHINT3-IN to a angle (distance).
- PHINT3-OUT outputs the counter content of the bipolar integrator.
  - A positive value at PHINT3-IN increments the integrator (counter content is increased).
  - A negative value at PHINT3-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of (+) C1151,
  - the value of C1151 is subtracted from the counter content
  - PHINT3-STATUS switches to HIGH for 1 ms.
- If the counter content falls below the value of (-) C1151,
  - the value of C1151 is added to the counter content
  - PHINT3-STATUS switches to HIGH for 1 ms.



3.2.76.4 Scaling of PHINTx-OUT

Mathematic description of PHINTx-OUT:

$$\text{PHINTx} - \text{OUT[inc]} = \text{PHINTx} - \text{IN[rpm]} \cdot \text{t[s]} \cdot 65536\text{[inc/rev.]}$$

t = integration time

Example:

You want to determine the counter content of the integrator at a certain speed at the input and a certain integration time.

- Given values:
  - PHINTx-IN = 1000 rpm
  - t = 10 s
  - Start value of the integrator = 0
- Solution:
  - Conversion of PHINTx-IN:

$$1000\ \text{rpm} = \frac{1000\ \text{rev.}}{60\ \text{s}}$$

  - Calculation of PHINTx-OUT:

$$\text{PHINTx} - \text{OUT} = \frac{1000\ \text{rev.}}{60\ \text{s}} \cdot 10\ \text{s} \cdot \frac{65536\ \text{inc}}{\text{rev.}} = 10922666\ \text{inc}$$

3.2.77 Angle integrator (PHINT4)

The function block simulates the basic function of the integrator in the CDATA function block.

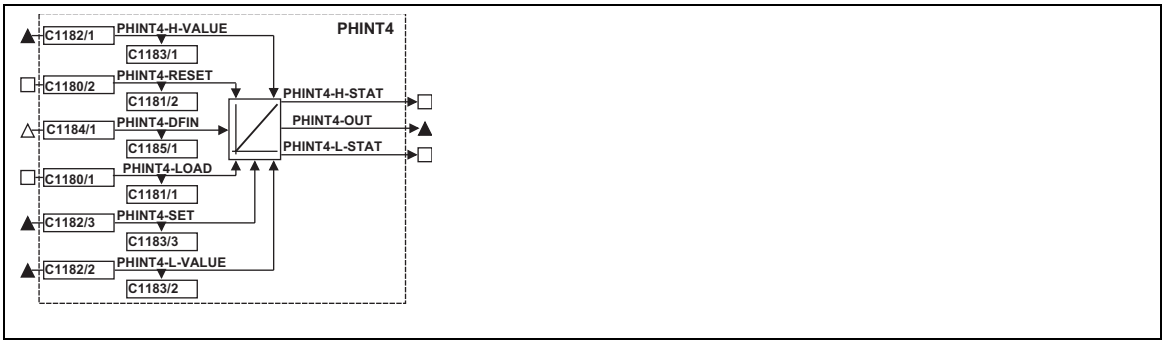


Fig. 3-202 Angle integrator (PHINT4)

Signal				Source	Note
Name	Type	DIS	DIS format	CFG	
PHINT4-LOAD	d	C1181/1	bin	C1180/1	A LOW→HIGH edge loads the integrator with the value at PHINT4-SET, then the integrator continues running immediately.
PHINT4-RESET	d	C1181/2	bin	C1180/2	HIGH: Continuously loads the integrator with the value of input PHINT4-SET. This input has priority
PHINT4-H-VALUE	ph	C1183/1	dec [inc]	C1182/1	Upper value for the return
PHINT4-L-VALUE	ph	C1183/2	dec [inc]	C1182/2	Lower value for the return
PHINT4-SET	ph	C1183/3	dec [inc]	C1182/3	Starting value
PHINT4-DFIN	phd	C1185/1	dec [rpm]	C1184/1	Master speed input • A positive value at PHINT4-DFIN increases the value at PHINT4-OUT • A negative value at PHINT4-DFIN decreases the value at PHINT4-OUT
PHINT4-H-STAT	d				1. LOW-HIGH edge: Integrator value has reached PHINT4-H-VALUE; the counting process is continued from PHINT4-L-VALUE 2. HIGH: Return is not possible, as PHINT4-H-VALUE is too low for the speed at PHINT4-DFIN
PHINT4-L-STAT	d				1. LOW-HIGH edge: Integrator value has reached PHINT4-L-VALUE; the counting process is continued from PHINT4-H-VALUE 2. HIGH: Return is not possible, as PHINT4-L-VALUE is too low for the speed at PHINT4-DFIN
PHINT4-OUT	ph				Output of the angle/position signal (65536 inc = 1 revolution)

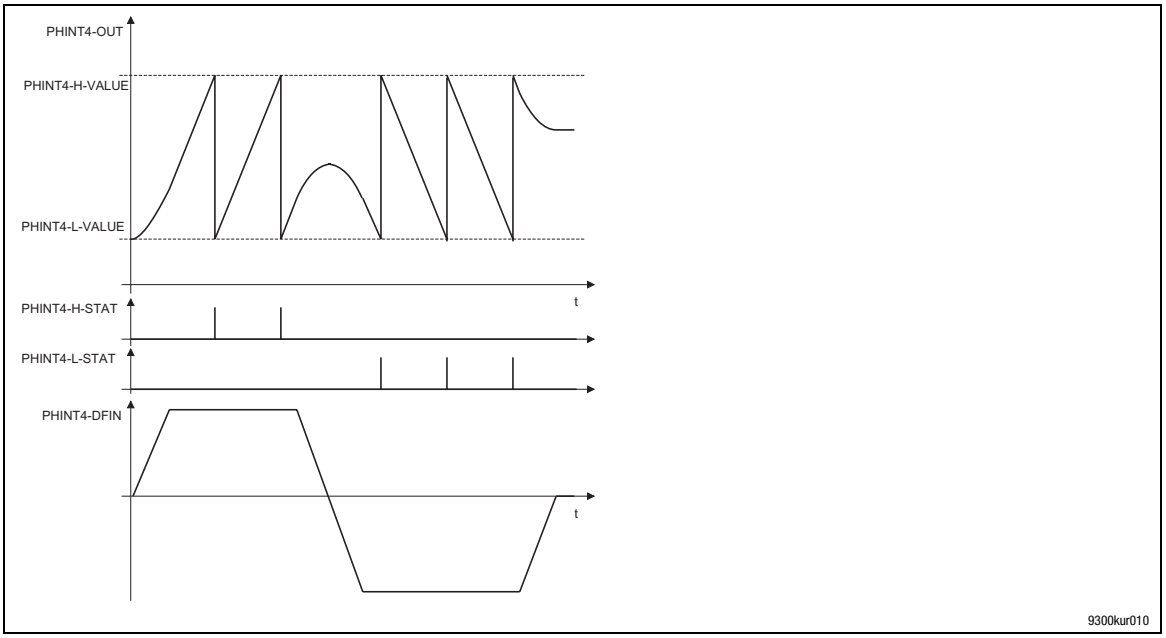


Fig. 3-203 Function of PHINT4

3.2.78 Phase integrator (PHINT5)

The PHINT5 function block is a master phase integrator without remainder considered and contains an integrated mark synchronisation.

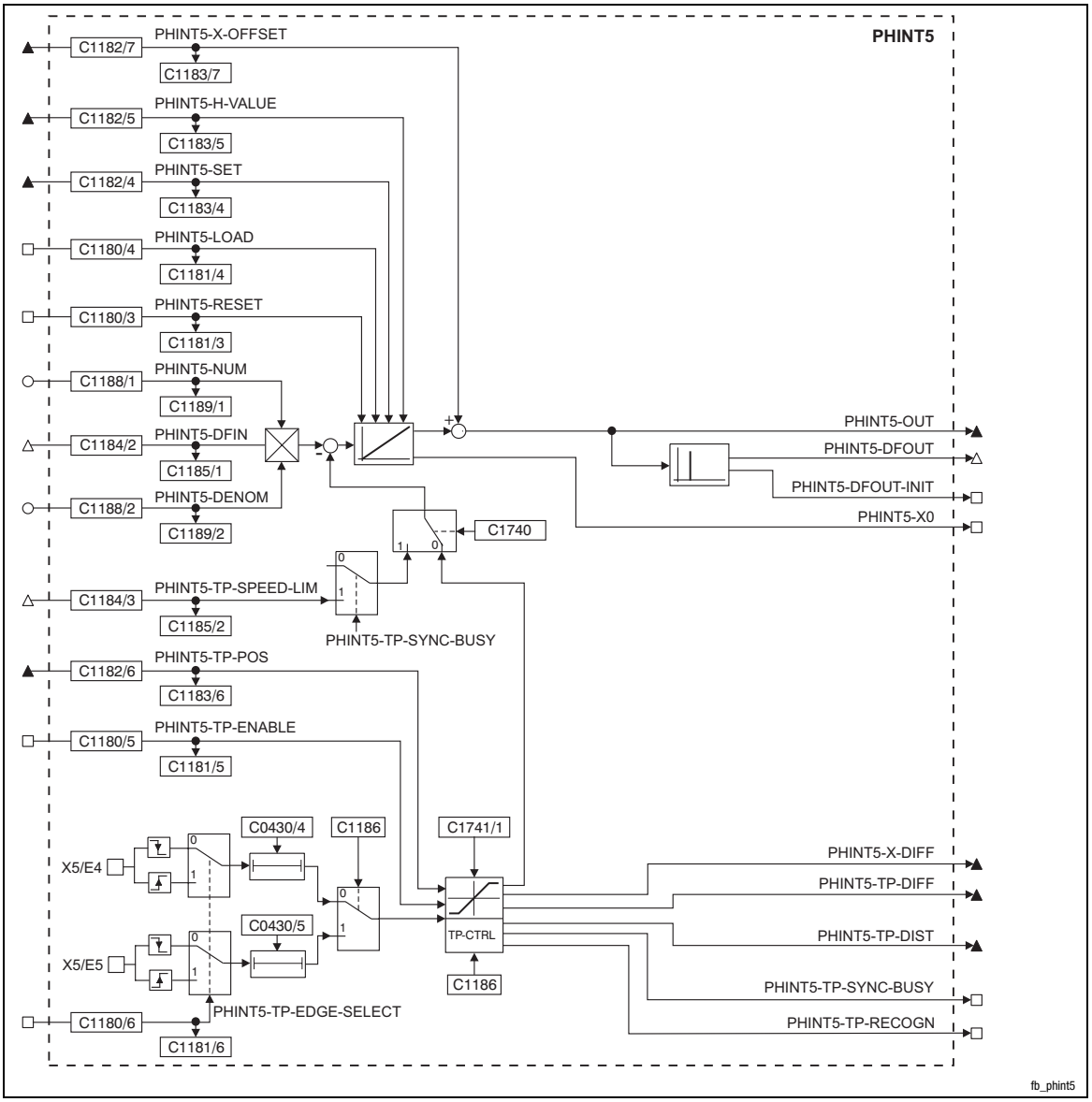
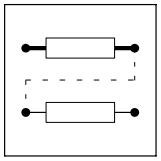
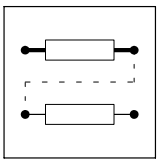


Fig. 3-204 Phase integrator (PHINT5)



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT5-X-OFFSET	ph	C1183/7	dec [inc]	C1182/7	3	Selection of an offset for the X direction
PHINT5-H-VALUE	ph	C1183/5	dec [inc]	C1182/5	3	Upper limit value of the integrator Only positive input values are permissible. A check for negative values is not carried out.
PHINT5-X-SET	ph	C1183/4	dec [inc]	C1182/4	3	Setpoint with which the integrator is to start.
PHINT5-LOAD	d	C1181/4	bin	C1180/4	2	A LOW-HIGH edge loads the integrator with the value at PHINT5-X-SET, then the integrator continues running immediately.
PHINT5-RESET	d	C1181/3	bin	C1180/3	2	HIGH: • The integrator is reset to the value at PHINT5-X-SET. • The touch probe function is deactivated. Available touch probe requirements are reset. • PHINT5-TP-SYNC-BUSY, PHINT5-X0, and PHINT5-TP-RECOGN are set to LOW.
PHINT5-NUM	a	C1189/1	dec [%]	C1188/1	1	Numerator for evaluation of the input signal at PHINT5-DFIN.
PHINT5-DFIN	phd	C1185/1	dec [rpm]	C1184/2	4	Master speed input • A positive value at PHINT5-DFIN increases the value at PHINT5-OUT • A negative value at PHINT5-DFIN decreases the value at PHINT5-OUT
PHINT5-DENOM	a	C1189/2	dec [%]	C1188/2	1	Denominator for evaluation of the input signal at PHINT5-DFIN.
PHINT5-TP-SPEED-LIM	phd	C1185/2	dec [rpm]	C1184/3	4	Selection of a compensation speed. The input signal is active if PHINT5-TP-SYNC-BUSY = HIGH and C1740 = 1. It is impermissible to select constant values (e.g. via free codes (FCODE)).
PHINT5-TP-POS	ph	C1183/6	dec [inc]	C1182/6	3	Distance of the touch probe position to the zero point of the integrator.
PHINT5-TP-ENABLE	d	C1181/5	bin	C1180/5	2	HIGH: The touch probe signal is evaluated. LOW: The touch probe signal is not evaluated.
PHINT5-TP-EDGE-SELECT	d	C1181/6	bin	C1180/6	2	LOW: The HIGH-LOW edge of the input signal at X5/E4 or X5/E5 is evaluated. HIGH: The LOW-HIGH edge of the input signal at X5/E4 or X5/E5 is evaluated.
PHINT5-OUT	ph					Integrator position + offset of PHINT5-X-Offset. The output signal is placed between 0 (fixedly) and the specified limit value at PHINT5-H-VALUE.
PHINT5-DFOUT	phd					Speed signal + offset of PHINT5-X-Offset.
PHINT5-DFOUT-INIT	d					HIGH: The output PHINT5-DFOUT is within the limitation ±29999 rpm
PHINT5-X0	d					LOW-HIGH edge: Zero crossing of the integrator. The zero crossing is only signalised for one cycle (1 ms).
PHINT5-X-DIFF	ph					Outputs the difference between the integrator and the signal at PHINT5-TP-POS if a touch probe pulse occurs. The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-DIFF	ph					Outputs the distance between 2 successive touch probe pulses (relating to the integrator) The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-DIST	ph					Outputs the distance of the touch probe pulse to the zero point of the integrator The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-SYNC-BUSY	d					Touch probe evaluation: LOW: No deviation measured, or the deviation has already been compensated HIGH: There is a deviation between the integrator and the input signal at PHINT5-TP-POS that has not been compensated. The compensation speed at PHINT5-TP-SPEED-LIM is activated if C1740 is set to 1. LOW-HIGH edge: compensation process completed
PHINT5-TP-RECOGN	d					Signalises a recognised touch probe pulse. LOW-HIGH edge: Compensation process completed. The signal is output for one cycle (1 ms).



Range of functions

- Select touch probe mode (📖 3-251)
- Evaluate touch probe signal edge (📖 3-251)
- Activate touch probe evaluation (📖 3-252)
- Compensate for a detected deviation(📖 3-252)
- Example of a mark synchronisation (📖 3-254)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with PHINT5-TP-ENABLE = LOW during homing. (📖 3-263)

3.2.78.1 Select touch probe mode

- C1186 = 0: terminal E4
  - The input for the touch probe signal is terminal X5/E4. The signal refers to the function block output MCTRL-PHI-ACT.
  - The compensation function is activated immediately.
- C1186 = 1: terminal E5
  - The input for the touch probe signal is terminal X5/E5. The signal refers to the master angle at X9 (DFIN function block).
  - The compensation function is activated immediately.
- C1186 = 2: rotary knife
  - The input for the touch probe signal is terminal X5/E5. The signal refers to the master angle at X9 (DFIN function block).
  - The compensation function is activated at zero crossing.
  - **Important:** For this function, you have to connect the input PHINT5-DFIN to the output DFIN-OUT.
  - Select this mode for applications with a rotary cutter.

Note!

Save the settings with C0003 = 1 and switch the mains voltage off and on again.

- When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.

3.2.78.2 Evaluate touch probe signal edge

Via the input PHINT5-TP-EDGE-SELECT you can set the edge evaluation for the terminals X5/E4 and X5/E5.

- PHINT5-TP-EDGE-SELECT = LOW
  - Only the HIGH-LOW edges of the touch probe signal are evaluated.
- PHINT5-TP-EDGE-SELECT = HIGH
  - Only the LOW-HIGH edges of the touch probe signal are evaluated.

3.2.78.3 Activate touch probe evaluation

Via the input PHINT5-ENABLE-TP you can activate or inhibit the evaluation of the touch probe signals.

- PHINT5-ENABLE-TP = HIGH
  - The touch probe signal is evaluated.
  - The evaluated signal is output at PHINT5-TP-DIFF, PHINT5-TP-DIST and PHINT5-X-DIFF.
- PHINT5-ENABLE-TP = LOW
  - The touch probe signal is not evaluated.
  - The output signals at PHINT5-TP-DIFF, PHINT5-TP-DIST and PHINT5-X-DIFF are not updated. The signal evaluated last is output.

3.2.78.4 Compensation of a recognised deviation

If a touch probe signal arrives, the deviation between the current value of the integrator and the signal is determined at PHINT5-TP-POS and is output at PHINT5-X-DIFF. In C1740 you can set the source for the compensation speed.

- C1740 = 0: code 1741/1
  - Deviations that are recognised are compensated directly and immediately with the speed defined in C1741/1.
  - Value in C1741/1 = 0: no compensation of deviations.
  - Via PHINT5-X-OFFSET you can apply an offset to the output signal at PHINT5-OUT.
- C1740 = 1: input PHINT5-TP-SPEED-LIM
  - Deviations that are recognised are compensated with the defined speed at PHINT5-TP-SPEED-LIM.
  - Signal at PHINT5-TP-SPEED-LIM = 0: no compensation of deviations.
  - The input only is active if PHINT5-TP-SYNC-BUSY = High.
  - The input signal solely takes effect on the integrator.
  - Via PHINT5-X-OFFSET you can apply an offset to the output signal at PHINT5-OUT.

Note!

- By separation of the functions ”Measure the deviation” and ”Compensate the deviation”, you can for instance measure material lengths.
- The compensation process can be controlled by selecting a profile at PHINT5-TP-SPEED-LIM.
- The PHINT5 function block does not contain a profile generator. The profiles have to be generated via additional function blocks (e.g. RFGPH2 or RFGPH3). See also example in fig. 3-205.
  - Do not specify constant values at PHINT5-TP-SPEED-LIM (e.g. via free codes (FCODE)).

RFGPH function block as profile generator for the compensation speed

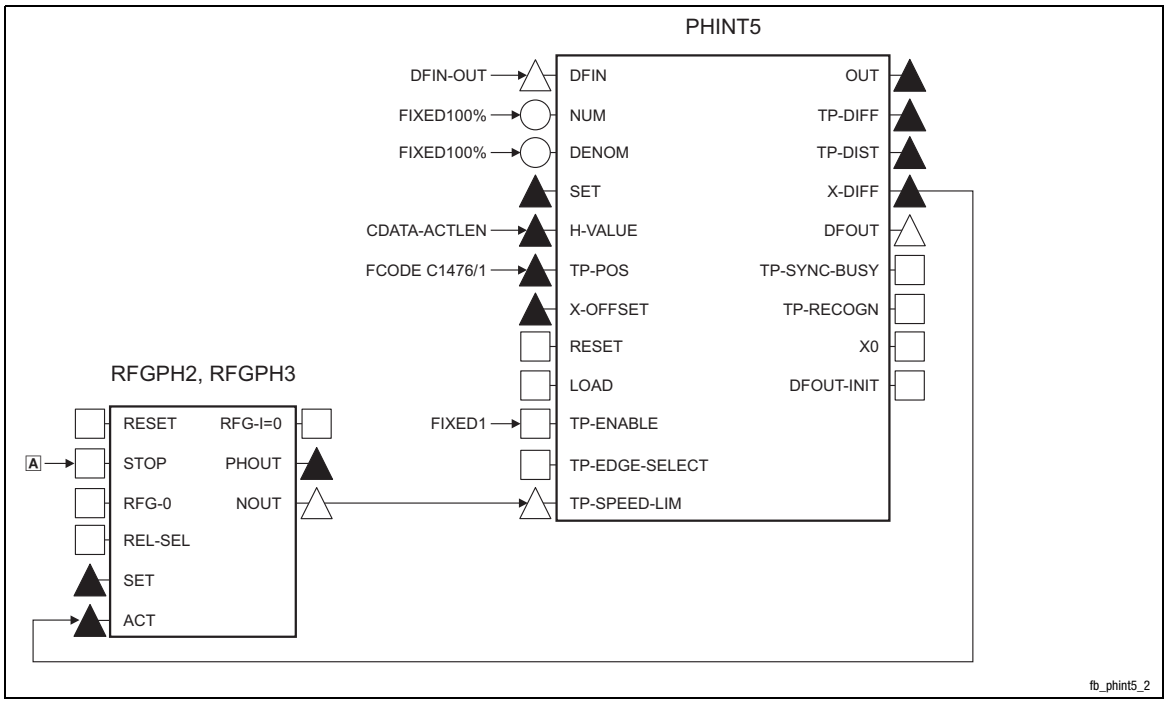


Fig. 3-205 RFGPH function block as profile generator for the compensation speed

- The deviation determined between the integrator and the defined touch probe position (input PHINT-TP-POS) is output as the shortest path at PHINT5-X-DIFF and is compensated via the RFGPH2 (or RFGPH3) function block.
- Apply the value to be compensated to the input RFGPHx-ACT and activate the profile generator by means of a HIGH-LOW edge A at the input RFGPHx-STOP.

3.2.78.5 Example of a mark synchronisation

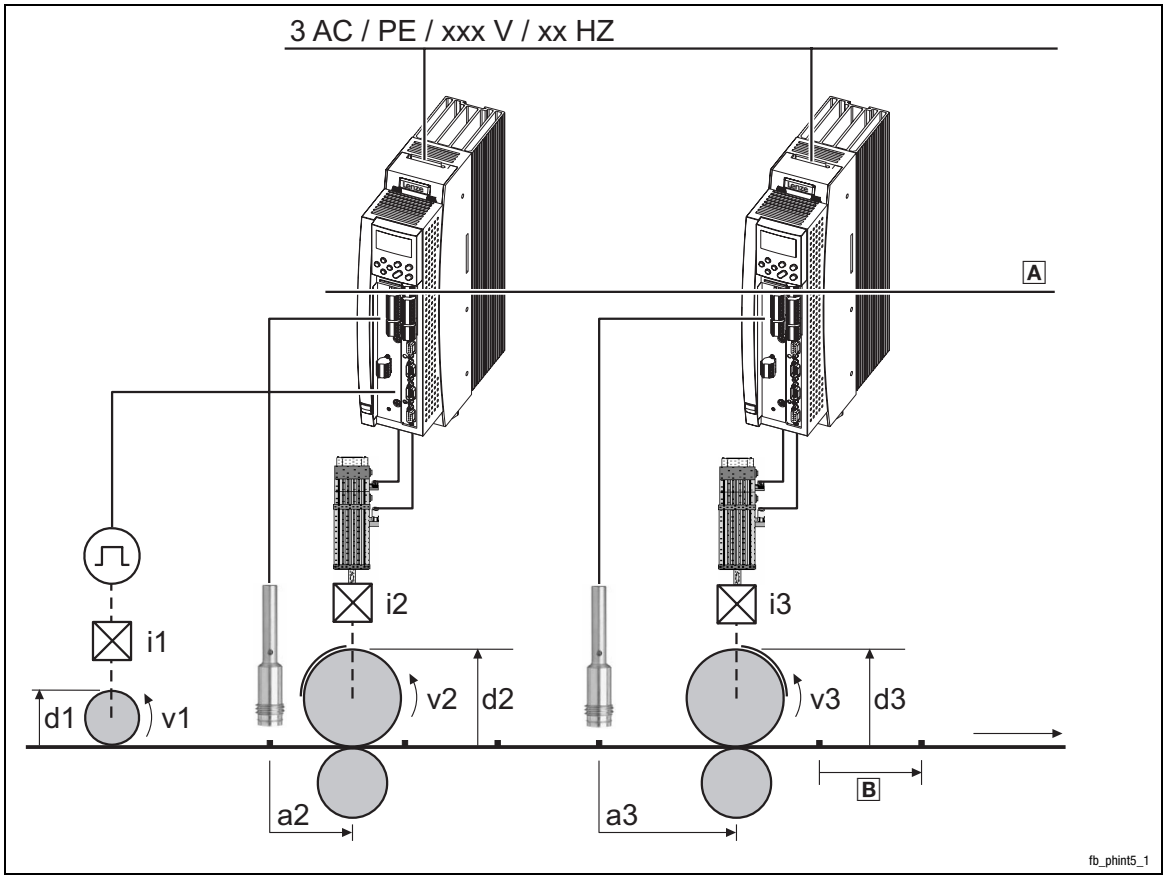


Fig. 3-206 Principle of the mark synchronisation

A	Transmission of the master angle via system bus (CAN) or digital frequency
B	Register
v1	Speed of the material path
v2, v3	Speed of the material path ± correction
d1, d2, d3	Roller diameters
a2, a3	Distance of the touch probe sensor to the zero point
i1, i2, i3	Gearbox

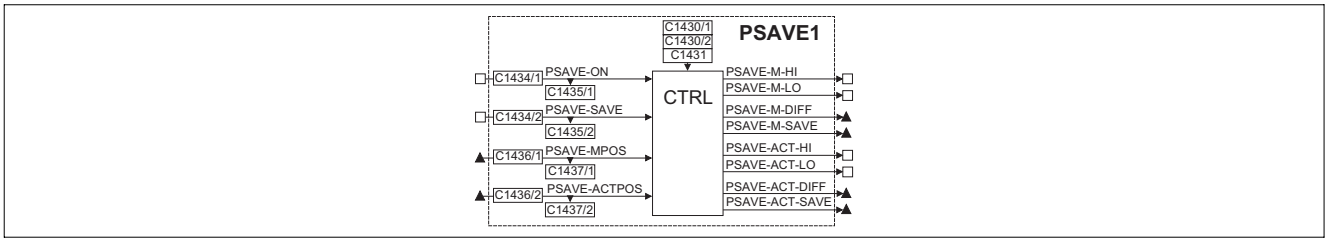
- At input PHINT5-TP-POS the distance of the touch probe sensor to the zero point of the integrator has to be set (a2, a3)
  – The value has to be between 0 and the value at PHINT5-H-VALUE.
- When the touch probe signal occurs, the deviation between the value of the integrator and the value at PHINT5-TP-POS is determined, is output at PHINT5-X-DIFF, and is compensated via the mode set in C1740.

3.2.79 Position memory (PSAVE)

One function block (PSAVE1) is available.

Purpose

Storage (mains-failure protected) of positions (master value and/or actual value) and comparison to the actual values. After mains connection it can be checked whether the master value position or the actual value position have changed. This is however only reasonable when using absolute value encoders (resolvers or SinCos encoders).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PSAVE1-ON	d	1435/1	bin	1434/1	2	HIGH = Comparison of inputs MPOS/ACTPOS with values saved and output of difference
PSAVE1-SAVE	d	1435/2	bin	1434/2	2	HIGH =
PSAVE-MPOS	ph	1437/1	dec[inc]	1436/1	3	Input for master position
PSAVE-ACTPOS	ph	1437/2	dec[inc]	1436/2	3	Input for actual position (e.g. rotor position)
PSAVE-M-HI	d		-	-	-	HIGH = Input value > stored position
PSAVE-M-LO	d		-	-	-	HIGH = Input value < stored position
PSAVE-ACT-HI	d		-	-	-	HIGH = Input value > stored position
PSAVE-ACT-LO	d		-	-	-	HIGH = Input value < stored position
PSAVE-M-DIFF	ph		-	-	-	Position difference = Stored position - input
PSAVE-M-SAVE	ph		-	-	-	Stored position of master drive
PSAVE-ACT-DIFF	ph		-	-	-	Position difference = Stored position - input
PSAVE-ACT-SAVE	ph		-	-	-	Stored position of cam drive

Function

- Store position value
- Compare actual position with values stored
- Output of status signals

3.2.79.1 Store position value

- With PSAVE-SAVE = HIGH data from the inputs PSAVE-MPOS and PSAVE-ACTPOS is accepted and output at PSAVE-M-SAVE and PSAVE-ACT-SAVE. The reading and writing processes are repeated cyclically (1000 $\frac{1}{s}$).
- The input data is stored if a H → L edge occurs at PSAVE-SAVE, i.e. they are available even if the controller has been disconnected from the mains.
- When the mains is switched on again, the data is transferred to the main memory of the controller and output at PSAVE-M-SAVE and PSAVE-ACT-SAVE.

3.2.79.2 Compare actual position with values stored

- PSAVE-ON = HIGH:
  - The inputs PSAVE-MPOS and PSAVE-ACTPOS are compared with the stored values. The deviations are output at PSAVE-M-DIFF or PSAVE-ACT-DIFF.

    $PSAVE\text{–}M\text{–}DIFF = stored\ value - \{PSAVE\text{–}MPOS\}$

    $PSAVE\text{–}ACT\text{–}DIFF = stored\ value - \{PSAVE\text{–}ACTPOS\}$
  - The evaluation of one of the channels can be suppressed by means of a code. In this case, PSAVE-DIFF = 0
- PSAVE-ON = LOW:
  - The outputs PSAVE-DIFF = 0.

3.2.79.3 Output of status signals

The digital outputs are set according to the difference calculated (PSAVE-DIFF) if PSAVE-ON = HIGH.

- A hysteresis can be set via code:
  - for MPOS C1430/1 in m-units
  - for ACTPOS C1430/2 in s-units
- As long as -DIFF < ±C1430/x:
  - -M-HI = LOW
  - -M-LO = LOW
  - ACT-HI = LOW
  - ACT-LO = LOW
- If -DIFF pos. and > +C1430/x
  - -M-LO = HIGH and/or
  - ACT-LO = HIGH
- If -DIFF neg. and < -C1430/x
  - -M-HI = HIGH and/or
  - ACT-HI = HIGH
- If one channel is suppressed through code C1431, the outputs of the corresponding channel are set to LOW.

3.2.80 Delay element (PT1-1)

Purpose

Filtering and delaying of analog signals.

Fig. 3-207 Delay element (PT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PT1-1-IN	a	C0642	dec [%]	C0641	1	1000	-
PT1-1-OUT	a	-	-	-	-	-	-

Function

- The delay time T is set under C0640.
- The proportional coefficient is fixed at K = 1.

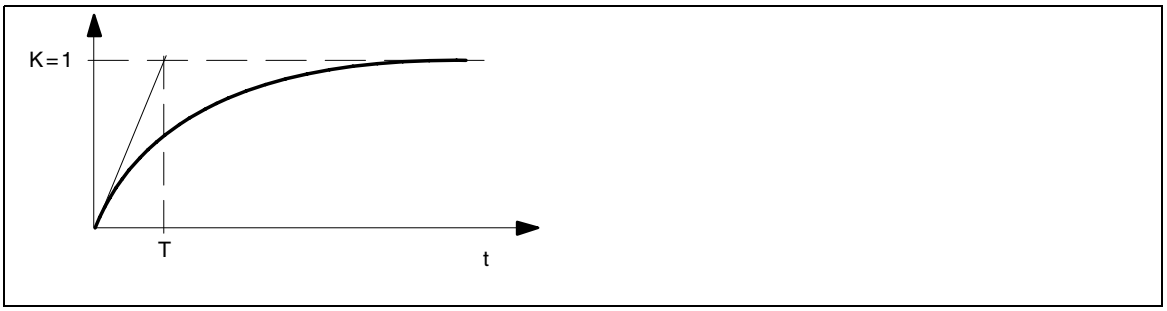


Fig. 3-208 Delay time T of the first order delay element

3.2.81 Delay element (PT1-2)

Purpose

The function block filters and smoothes speed signals. This serves to e.g. filter the digital frequency.

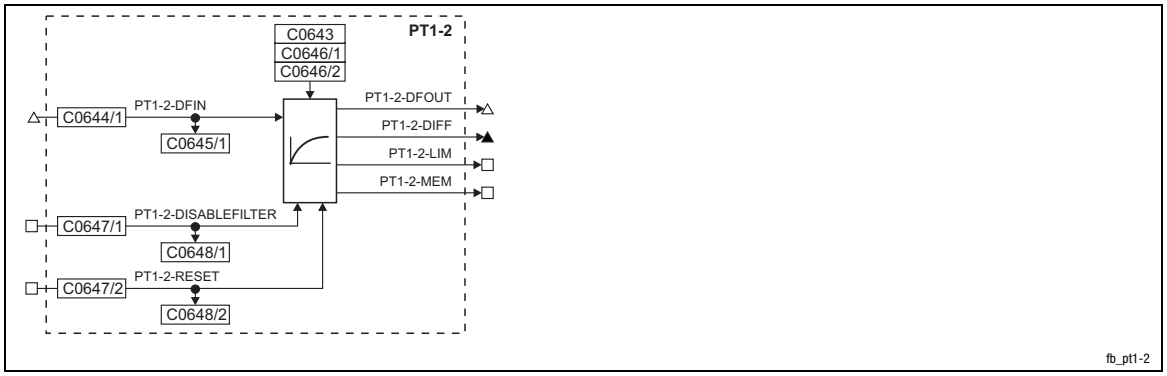


Fig. 3-209 Delay element (PT1-2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PT1-2-DFIN	phd	C0645/1	dec [rpm]	C0644/1	4	1000	-
PT1-2-DISABLEFILTER	d	C0648/1	bin	C0647/1	2	1000	LOW = filter is on HIGH = filter is off
PT1-2-RESET	d	C0648/2	bin	C0647/2	2	1000	HIGH = overflow buffer is cleared. PT1-2-DFOUT is immediately set to 0. The position gets lost. (Function is available as of software version 3.4)
PT1-2-DFOUT	phd	-	-	-	-	-	Signal is limited to ±29999 rpm
PT1-2-DIFF	ph	-	-	-	-	-	Outputs the phase displacement between input and output signal.
PT1-2-LIM	d	-	-	-	-	-	HIGH = signal at PT1-2-DFOUT is limited (Function is available as of software version 3.4)
PT1-2-MEM	d	-	-	-	-	-	HIGH = overflow buffer still contains values. A query is sensible if PT1-2-DISABLEFILTER = HIGH. (Function is available as of software version 3.4)

Function

Jumps and variations of the input signal are smoothed via the PT1 behaviour without pulse/position losses. An overflow buffer ensures that all increments of the input signal are output again at the output.

Note!

The overflow buffer behaves according to the cycle of numbers (32 bits).

Setting the filter time constant

C0643 serves to set the filter time constant T (delay time). The proportional coefficient is predefined as K = 1.

Setting information

- The higher the value set, the greater the filter effect.
- The higher the value set, the greater the phase displacement between input and output signal.

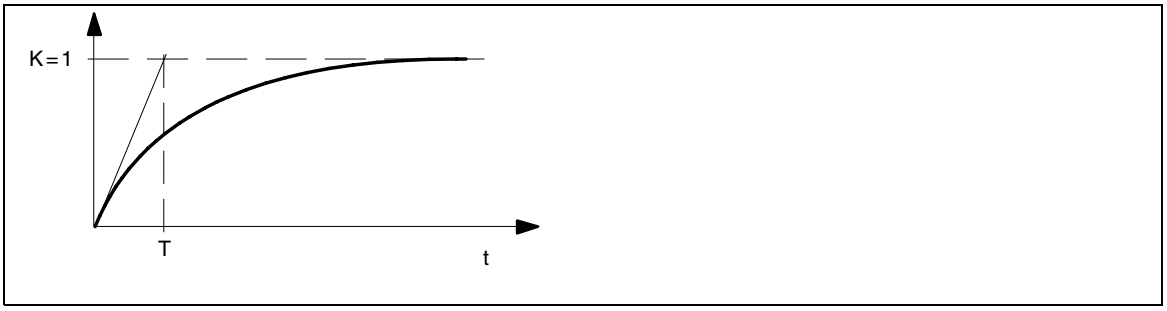


Fig. 3-210 Delay T of the first order delay element

Switching off filter and compensating phase displacement

The filter is switched on and off via the input PT1-2-DISABLEFILTER.

- PT1-2-DISABLEFILTER = LOW
  - The filter is switched on.
- PT1-2-DISABLEFILTER = HIGH
  - The filter is switched off. All increments in the filter and overflow buffer are still output.
  - The input signal is directly output at the output.

Note!

Always set the input PT1-2-DISABLEFILTER = HIGH
- when the controller is inhibited,
- during acceleration phases.

Compensation of the phase displacement when filter is on

C0646/1 serves to set the compensation of the phase displacement (compensating speed).

- Setting information
  - The higher the value set, the greater the dynamics.
  - The higher the value set, the worse the filter effect.
  - If C0646/1 = 0, the position will be lost.

Compensation of the phase displacement when filter is off

C0646/2 serves to set a compensating speed to compensate the phase displacement between input and output signal. The output phase displacement at PT1-2-DIFF is compensated ”smoothly”.

- Setting information
  - The smaller the value set, the slower the compensation of the phase displacement.
  - If C0646/2 = 0, the position will be lost.

3.2.82 CW/CCW/QSP linking (R/L/Q)

Purpose

The FB provides a fail-safe connection for the selection of a rotation direction and the QSP function.

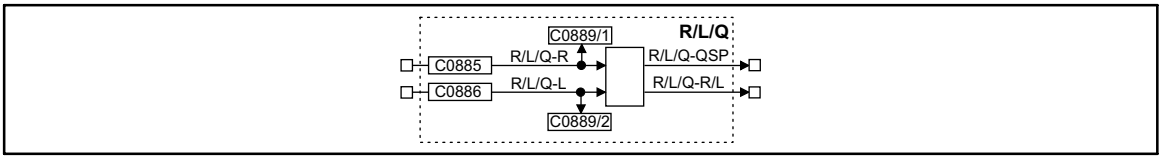


Fig. 3-211 CW/CCW/QSP linking (R/L/Q)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
R/L/Q-R	d	C0889/1	bin	C0885	2	51	-
R/L/Q-L	d	C0889/2	bin	C0886	2	52	-
R/L/Q-QSP	d	-	-	-	-	-	-
R/L/Q-R/L	d	-	-	-	-	-	-

Function

- After mains connection and simultaneous HIGH level at both inputs, the outputs are set as follows:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
1	1	0	1

- The following truth table results if one of the inputs is set to LOW once after mains connection:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
0	0	0	1
1	0	0	0
0	1	1	0
1	1	unchanged	unchanged

- If both inputs are set to HIGH during operation, the values at both outputs remain unchanged.

3.2.83 Homing function (REFC)

Purpose

The homing function is used to bring the drive shaft to a specific position.

Note!

First, select a predefined configuration in C0005 which already includes the REFC function block. This ensures that all important signal connections are created automatically. After this, adapt the configuration to your application.

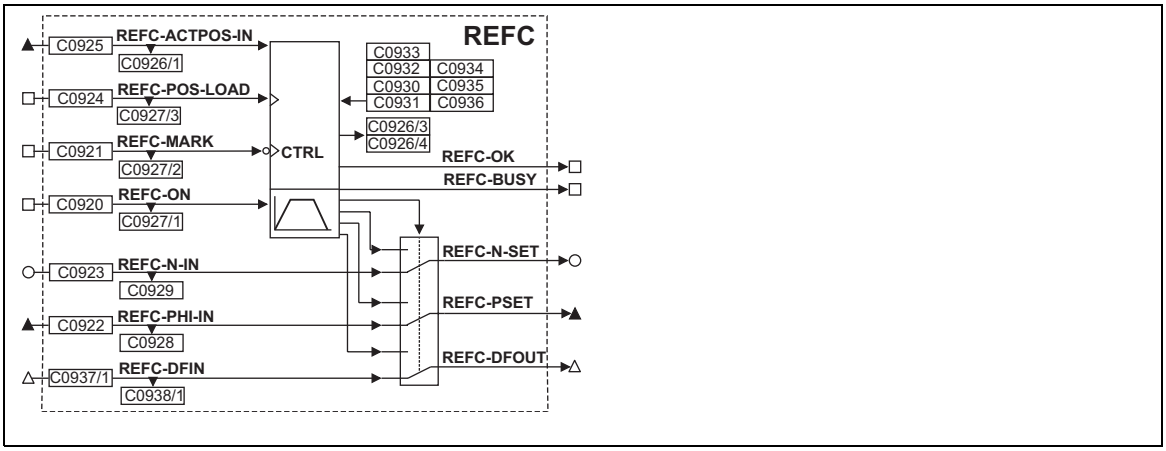


Fig. 3-212 Homing function (REFC)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
REFC-ACTPOS-IN	ph	C0926/1	dec [inc]	C0925	3	Loading value for the current position (REFC-ACTPOS)
REFC-DFIN	phd	C0938/1	dec [rpm]	C0937/1	4	Speed input
REFC-MARK	d	C0927/2	bin	C0921	2	Homing switch
REFC-N-IN	a	C0929	dec [%]	C0923	1	Speed setpoint in [%] of nmax C0011
REFC-ON	d	C0927/1	bin	C0920	2	HIGH = start homing
REFC-PHI-IN	ph	C0928 C0926/2	dec [inc]	C0922	3	Phase setpoint (contouring error for phase controller in FB MCTRL)
REFC-POS-LOAD	d	C0927/3	bin	C0924	2	LOW-HIGH edge = angle at the REFC-ACTPOS-IN input is loaded in REFC-ACTPOS (starting value)
REFC-PSET	ph	-	-	-	-	Phase setpoint (contouring error for phase controller in FB MCTRL)
REFC-BUSY	d	-	-	-	-	HIGH = homing function active
REFC-DFOUT	phd	-	-	-	4	Speed output
REFC-N-SET	a	-	-	-	-	Speed setpoint for n-controller
REFC-OK	d	-	-	-	-	HIGH = homing completed/homing known

Range of functions

- Homing
- Homing modes
- Control via input signals
- Output of status signals
- Speed/digital frequency input and output

3.2.83.1 Homing

There are different possibilities of homing the drive:

- ”Setting the reference once” is carried out for commissioning. For this, you enter the current distance [s-units] of the tool to the machine zero point in C1367/1. This proecedure is reasonable for machines with risk of collision).
  – The function is carried out via the CCTRL or CCTRL2 function blocks. (📖 3-71 or 3-79)
- A homing usually is carried out once after mains connection. By this, the home position of the drive is found automatically. A homing is carried out via
  – the REFC function block
  – the CCTRL or CCTRL2 function blocks with the function ”Set reference dynamically”. (📖 3-69 or 3-77)

Profile generator

The homing speed profile can be adapted to the application.

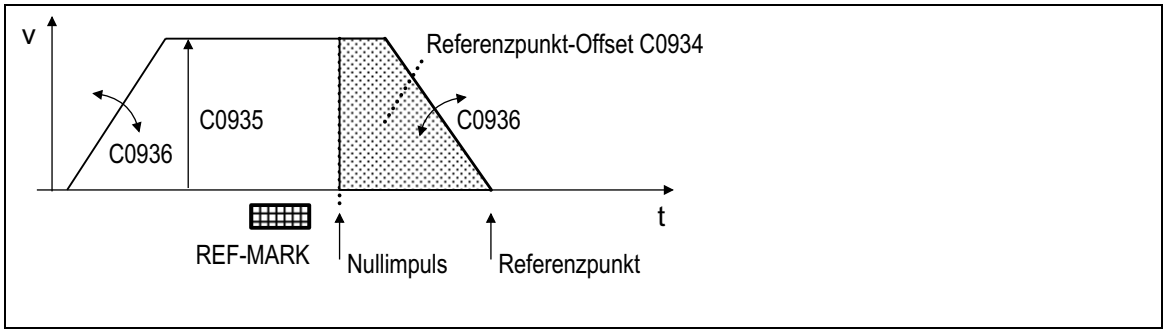


Fig. 3-213 Homing speed profile

Code	Meaning	Note
C0930	Encoder-gearbox factor numerator (motor speed)	Setting is required only if the actual value encoder is not mounted to the motor
C0931	Encoder-gearbox factor denominator (encoder speed)	
C0933	Selection of the edge of the touch probe signal at X5/E4	Regarding the homing modes with touch probe functionality, the TP edge is the reference point for the home position offset
C0934	Homing point offset = number of increments after the zero pulse	This reference applies: 65536 inc = 1 revolution. Selection up to 2140000000 inc possible
C0935	Homing speed	Entry in [%] of n_{max} (C0011)
C0936	Homing acceleration/deceleration time	Linear ramps
C0926/3	REFC-ACTPOS, current actual position	Read only
C0926/4	REFC-TARGET, current target position	Read only

The profile generator calculates the speed profile from the set profile parameters.

- Parameter changes are possible during homing.
  – C0935 and C0936 become effective if REFC-ON = LOW.
- The drive should not be operated at the torque limit (MCTRL-MMAX = HIGH), otherwise the drive cannot follow the speed profile.
  – Increase acceleration / deceleration time C0936 until MCTRL-MMAX is no longer activated.
- The phase controller in the MCTRL function block must be switched active.

3.2.83.2 Reference run modes

The home position is defined by:

- the homing mode C0932
- the signal edge of the zero pulse or touch probe signal C0933
- the home position offset C0934

Note!

For position feedback via resolver, the zero position (depending on the rotor attached to the motor) applies instead of the zero pulse, and, accordingly, the touch probe phase for homing via touch probe.

Precondition for an error-free homing function

Note!

Parameterising the signal edge via C0933 only is effective if the touch probe function of the PHINT5 and CCTRL or CCTRL2 function blocks is deactivated. Otherwise the signal edge for homing is not defined via C0933, but via the setting on the activated function blocks.

- The touch probe function is deactivated if PHINT5-TP-ENABLE and CCTRL-TPIN/E4, or CCTRL2-TPIN/E4 are set to LOW.
- Fig. 3-214 shows a connection example for deactivating the touch probe function during homing.

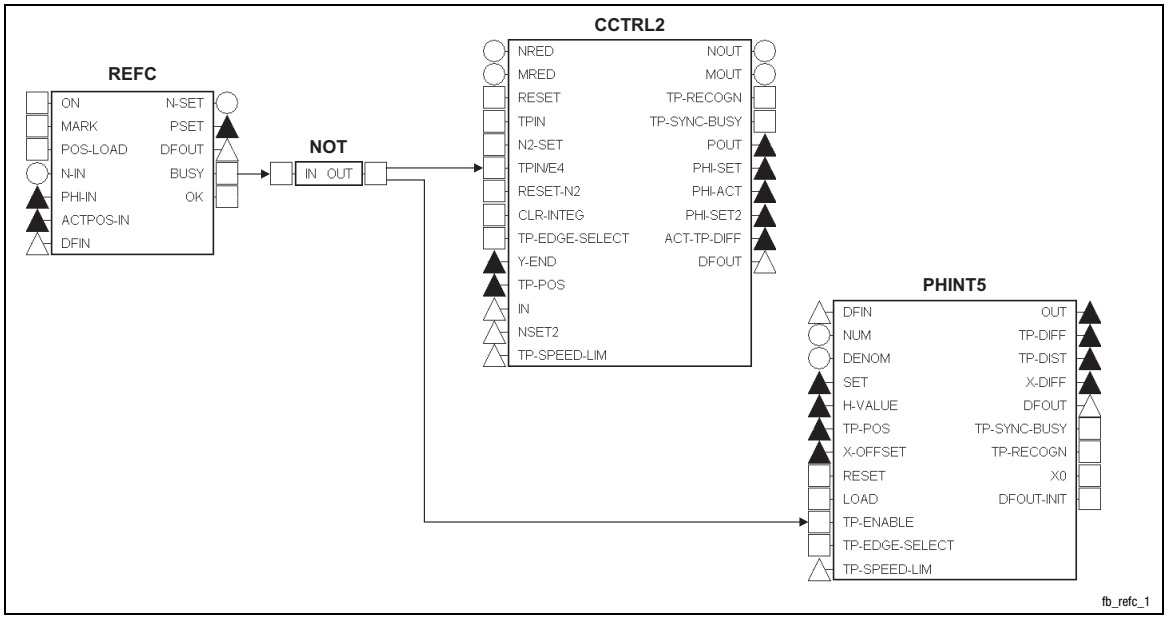


Fig. 3-214 Connection example for deactivating the touch probe function during homing

Homing with homing switch to zero pulse/zero position

Behind the negative edge of the homing switch REFC-MARK, the home position is at the next zero pulse/zero position plus the home position offset:

- Mode 0 (C0932 = 0):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.

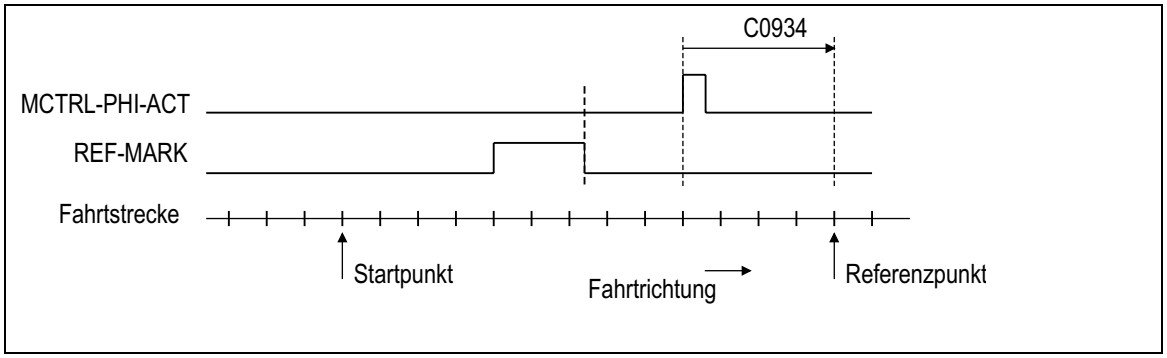


Fig. 3-215 Homing with zero pulse/zero position: mMve to the home position in CW rotation.

- Mode 1 (C0932 = 1):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

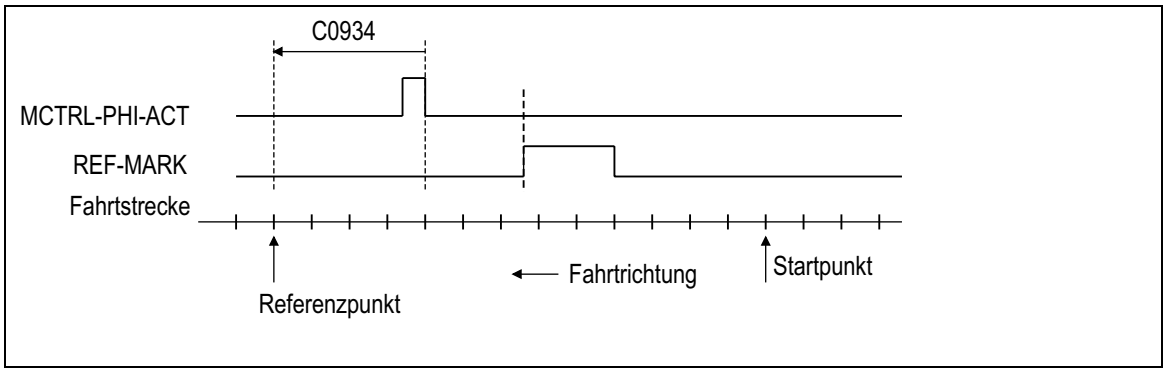


Fig. 3-216 Homing with zero pulse/zero position: mMve to the home position in CCW rotation.

Homing with home switch and touch probe (TP)

Behind the negative edge of the homing switch REFC-MARK, the home position is at the touch probe signal (terminal X5/E4) plus the home position offset:

- Mode 6 (C0932 = 6):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.

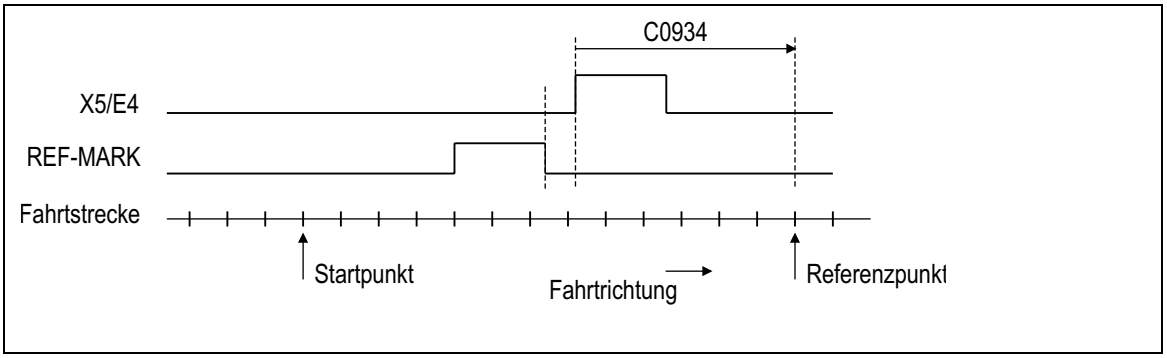


Fig. 3-217 Homing with touch probe: Move to the home position in CW rotation.

- Mode 7 (C0932 = 7):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

Homing with touch probe (TP)

The home position is at the next touch probe signal (terminal X5/E4) plus the home position offset.

- Mode 8 (C0932 = 8):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.
- Mode 9 (C0932 = 9):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

Direct homing

The home position is on the home position offset.

- Mode 20 (C0932 = 20):
  - The drive moves from the actual position (REF-ACTPOS) to the home position immediately after the activation (REFC-ON = HIGH).
  - The actual position (REFC-ACTPOS) can previously be loaded with the input value REFC-ACTPOS-IN.
  - The travel path and the direction of travel result from the actual position (REFC-ACTPOS) and the set home position offset (C0934).

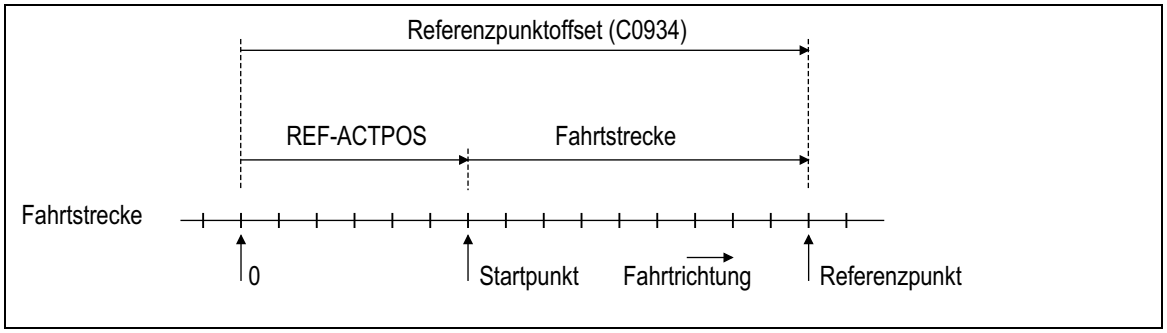
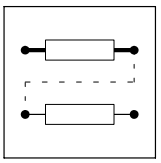


Fig. 3-218 Direct homing; move to the home position in CW rotation

- Mode 21 (C0932 = 21) as mode 20, but in addition:
  - The actual position (REFC-ACTPOS) is saved during mains disconnection and is loaded again at mains connection.

3.2.83.3 Control via input signals

- REFC-ON = LOW-HIGH edge starts homing
  - The input must remain on HIGH until the end of the homing mode. Homing is aborted when the input is set to LOW before reaching the home position.
- REFC-ON = LOW interrupts homing
  - The drive is decelerated to zero speed along the ramp set under C0936.
  - The inputs REFC-N-IN and REFC-PHI-IN are set for the outputs REFC-N-SET and REFC-PSET.
  - Has no effect if homing has already been completed (REFC-BUSY = LOW).
- REFC-POS-LOAD = LOW-HIGH edge
  - The profile generator accepts the phase applied at input REFC-ACTPOS-IN as starting value for the actual position REFC-ACTPOS.
  - The function is only effective if REFC-ON = LOW.
  - The function is only effective in modes 20 and 21.



3.2.83.4 Output of status signals

- REFC-BUSY = HIGH: the homing function is active.
  - The profile generator is connected to the outputs REFC-PSET and REFC-N-SET.
- REFC-BUSY = LOW: the homing function is not active or completed
  - The inputs REFC-PHI-IN and REFC-N-IN are set for the outputs REFC-PSET and REFC-N-SET.
- REFC-OK = HIGH: homing was completed successfully
  - Homing is completed if the setpoint of the profile generator has reached the home position.
- REFC-OK = LOW:
  - homing is currently executed or
  - the home position is no longer known, e.g. due to an interference or
  - homing was interrupted.

3.2.83.5 Speed/digital frequency input and output

The digital frequency/speed signal already contains phase and speed information.

3.2.83.6 Connection of the function block

- REFC-PSET supplies the phase setpoint belonging to REFC-N-SET (contouring error) for the phase controller in the MCTRL function block.
- REFC-DFOUT already includes the phase and speed information. Connect this signal to the signal CCTRL-IN.

3.2.84 Ramp function generator (RFG)

Purpose

The ramp function generator limits the rise of signals.

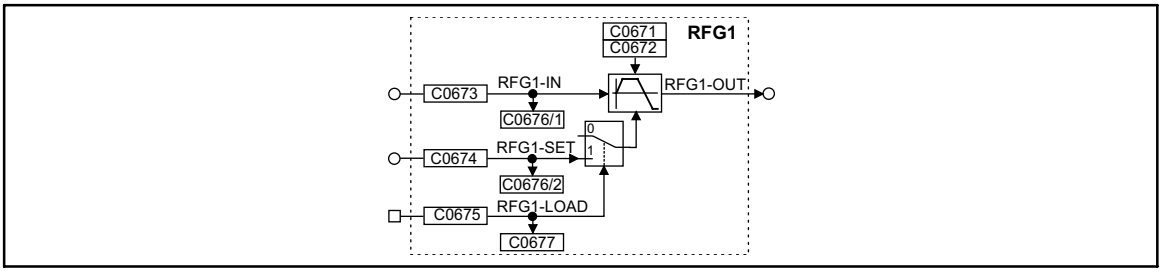


Fig. 3-219 Ramp function generator (RFG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

- Calculation and setting of the times T_{ir} and T_{if}
- Loading of the ramp function generator

3.2.84.1 Calculation and setting of the times T_{ir} and T_{if}

The acceleration time and deceleration time refer to a change of the output value from 0 to 100 %. The times T_{ir} and T_{if} to be set can be calculated as follows:

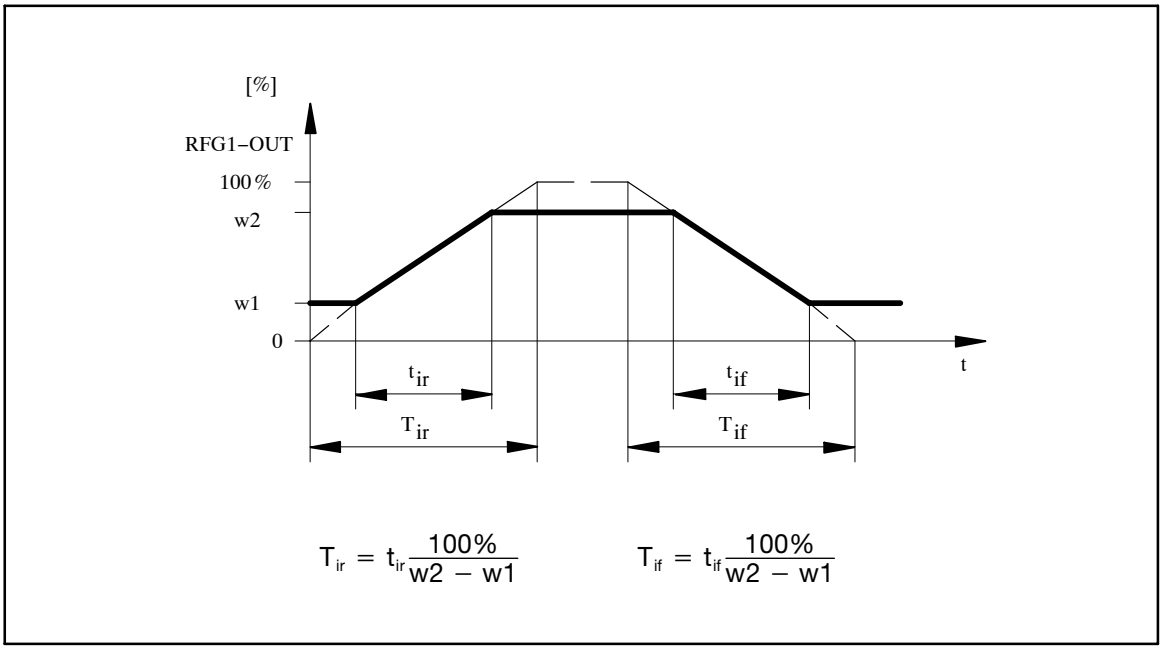


Fig. 3-220 Acceleration and deceleration times of the ramp function generator

t_{ir} and t_{if} are the times desired for the change between w_1 and w_2.The values for T_{ir} and T_{if} can be set under C0671 and C0672.

3.2.84.2 Loading of the ramp function generator

The ramp function generator can be initialised with defined values via the inputs RFG1-SET and RFG1-LOAD.

- As long as the input RFG1-LOAD = HIGH, the input RFG1-SET is switched to the output.
- If the input RFG1-LOAD = LOW, the ramp function generator accelerates/decelerates from this value to its input value within the set T_i times.

3.2.85 Ramp function generator for angle signals (RFGPH1)

Purpose

Path or time controlled (jump) application to change position/angle (e.g. offset) relative to the master drive.

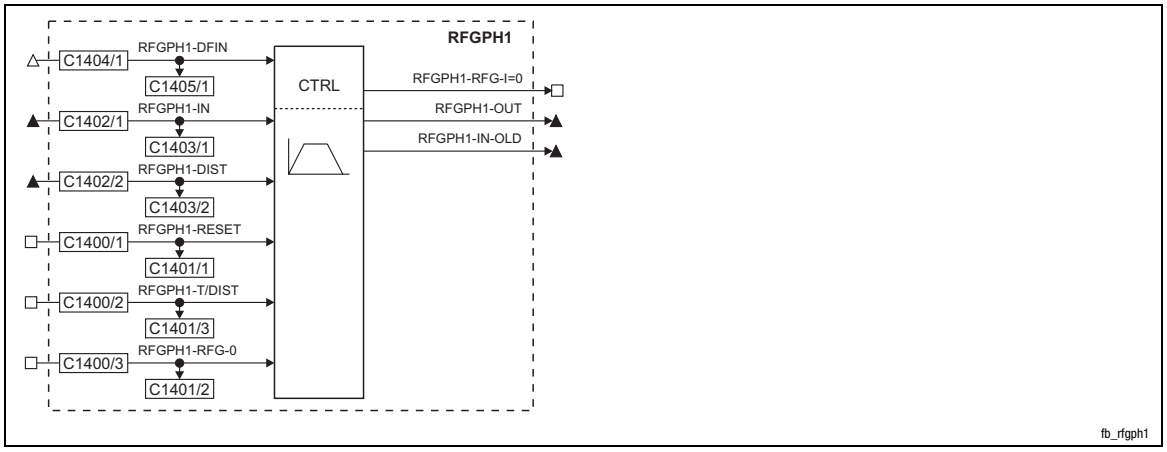


Fig. 3-221 Ramp function generator for phase signals (RFGPH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH1-RESET	d	1401/1	bin	1400/1	2	HIGH: Sets RFGPH1-OUT = 0 (jump) LOW : RFGPH1-OUT is set to the value at RFGPH1-IN according to the selected function Input has priority over RFGPH1-RFG-0
RFGPH1-RFG-0	d	1401/2	bin	1400/2	2	HIGH : proceeds according to the selected function RFGPH1-OUT = 0 LOW : RFGPH1-OUT is set to the value at RFGPH1-IN according to the selected function
RFGPH1-T/DIST	d	1401/3	bin	1400/3	2	Function changeover HIGH: Path based change LOW: Time-based change in path (position via defined speed)
RFGPH1-IN	ph	1403/1	dec [inc]	1402/1	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH1-DIST	ph	1403/2	dec [inc]	1402/2	3	Path difference by which the phase is to be changed at the input RFGPH1-IN (65536 inc. = 1 rev.) • Condition for accepting the value at RFGPH1-DIST: – RFGPH1-OUT = 0 or – the value at the RFGPH1-IN input is changing.
RFGPH1-DFIN	phd	1405/1	dec [inc]	1404/1	4	Digital frequency input Please observe that the modes to be set for this input are selected under C1409 (see "Phase/position to be changed through a defined path")
RFGPH1-RFG-I=0	d		-	-	-	HIGH: RFGPH1-OUT = RFGPH1-IN
RFGPH1-OUT	ph		-	-	-	Output
RFGPH1-IN-OLD	ph		-	-	-	Display of the value (65536 inc. = 1 rev.) last-applied at the input RFGPH1-IN

Range of functions

- Change phase/position through a defined speed (chapter 3.2.85.1)
- Change phase/position through a defined path (chapter 3.2.85.2)
- Output of status signals (chapter 3.2.85.3)

Description of functions by means of an example

The function block ”ramp function generator for phase signals” serves to adjust the path compared to the master drive. Before, it must be defined if the drive is to take the desired position

- at a predefined speed (RFGPH1-T/DIST = LOW) or
- after a certain distance (RFGPH1-T/DIST = HIGH) depending on the master drive speed.

The drive is to be moved by 5 m units starting with the 0 position of the profile. It is enabled via the terminal X5/E1.

Note!

m-units (master units) are units which can be directly measured in the system at the object to be displaced. These can be mm, m, phases etc.. With regard to the motor, these actual values become slave units (s-units). The s-units are converted to encoder increments in the controller.

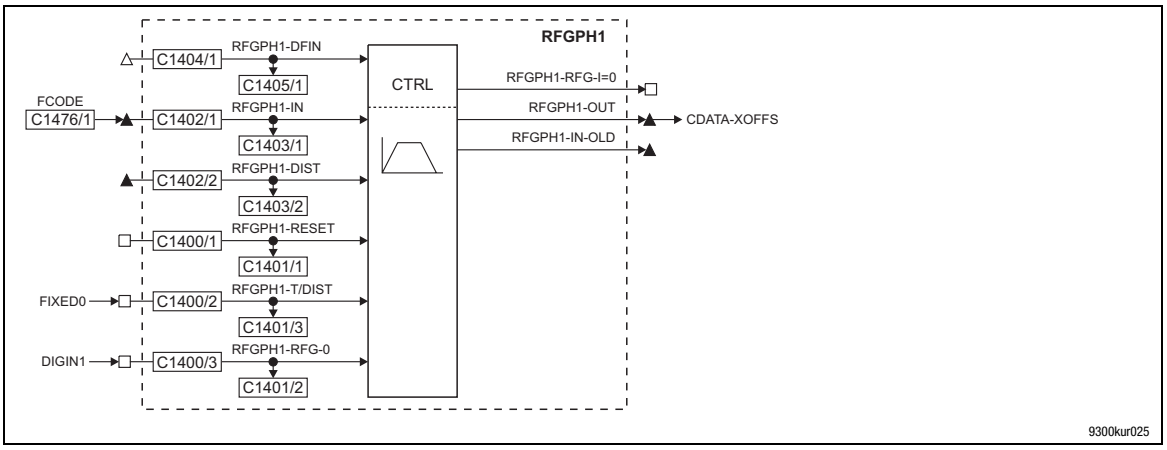


Fig. 3-222 Circuit proposal

The inputs not used do not need to be assigned.

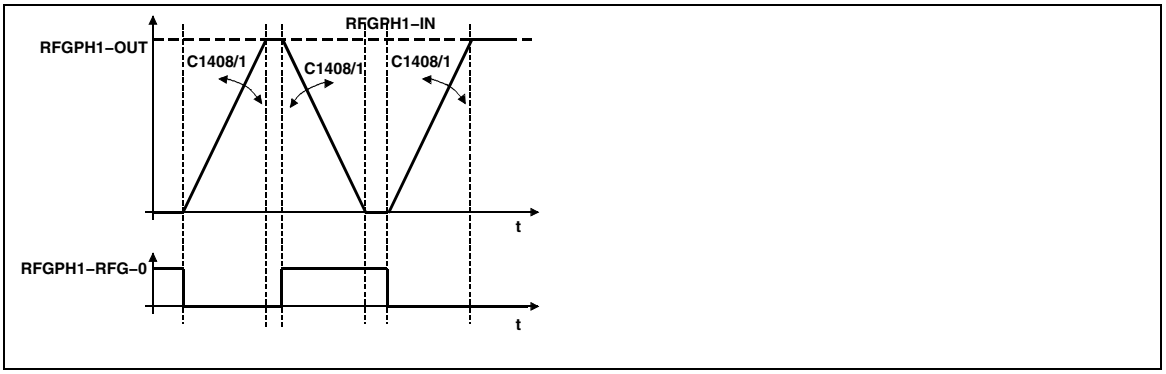
3.2.85.1 Change phase/position through a defined speed

Inputs for parameter setting:

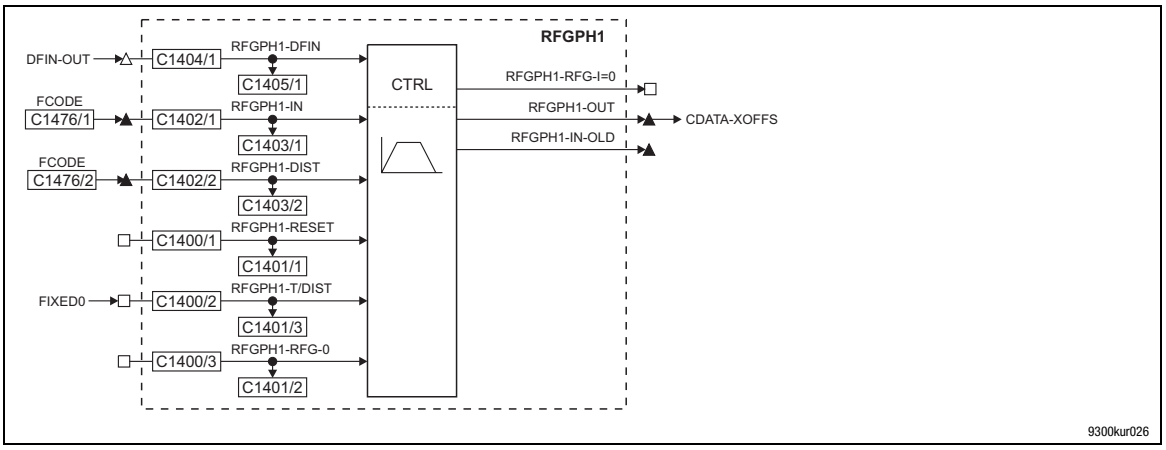
- FCODE C1476/1 = 5 m-units (position)
- C1408/1 = 200.0 rpm: the drive travels to the target position with a master value speed of 200 rpm.

Control:

- X5/E1 = HIGH: CDATA-XOFFS is traversed to 5 m-units at n = 200 rpm
- X5/E1 = LOW: CDATA-XOFFS is traversed to 0 m-units at n = 200 rpm
- The time required to reach the position results from the physical parameters selected.



3.2.85.2 Change phase/position through a defined path

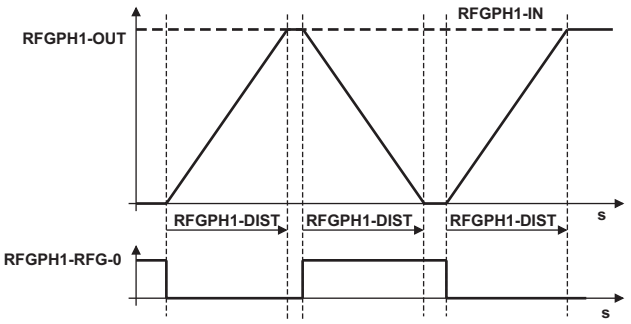


Wiring of the inputs:

- FCODE C1476/2 = 10 m-units (=RFGPH1-DIST)
- FCODE C1476/1 = 2.5 m-units (=RFGPH1-IN)
- Master value at RFGPH1-DFIN.

The following modes can be set with C1409 for this input:

C1409	Mode	Explanation
0	Absolute value generation (Default setting)	The output RFGPH1-OUT always reaches its end value (with negative and positive speeds).
1	Forward/backward movement	The output RFGPH1-OUT with positive values (speeds) at input RFGPH1-DFIN reaches its final value (value at the input RFGPH1-IN). The output RFGPH1-OUT runs with negative values (speed) at input RFGPH1-DFIN to the value which was pending at the RFGPH1-IN before. This is indicated at the output RFGPH1-IN-OLD. The gradient of the function is determined by the inputs IN/DIST.
2	Forward/backward movement with end value	This mode is similar to C1409=1, the only difference, however, is that if the output RFGPH1-OUT has reached the value at input RFGPH1-IN, the output keeps this value (even if a negative value occurs at RFGPH1-DFIN). Only if a new value is applied to the RFGPH1-IN input or if RFGPH1-RFG-0 = 1, the output may change again.

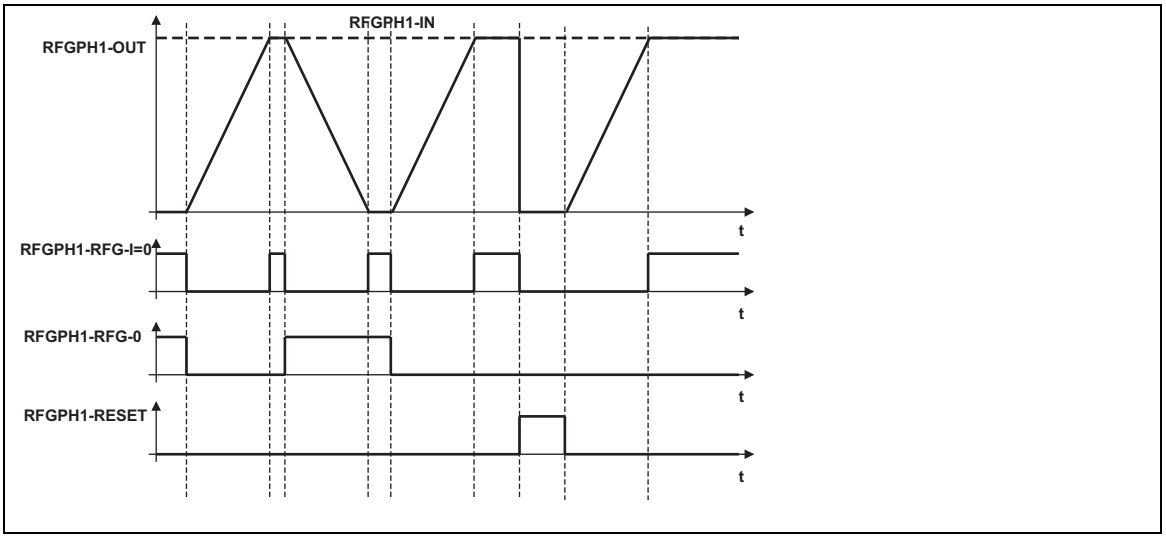


Note!

- Values at RFGPH1-IN are only permitted to change if RFGPH1-OUT = 0 or if the RFGPH1-OUT output is still approaching its final value at RFGPH1-IN.
- While the output signal at RFGPH1-OUT is approaching its final value, the sign of the setpoint at RFGPH1-IN must not be reversed.
- The drive to be adjusted must catch up a distance of 2.5 m-units set in RFGPH1-IN while the master drive covers a distance of 10 m-units. Its speed is determined by the speed of the master drive (RFGPH1-DFIN) and the path difference (RFGPH1-DIST).
- When the master value has covered the distance (RFGPH1-DIST), then RFGPH1-OUT = RFGPH1-IN. Hence, the process of position change is completed. Master drive and electronic cam run in synchronism again.

3.2.85.3 Status signals

RFGPH1-RFG-I=0 = HIGH indicates that the output RFGPH1-OUT has reached the end value selected (the output is not adjusted any more).



3.2.86 Ramp function generator for angle signals (RFGPH2 and RFGPH3)

Purpose

Easy positioning via linear profile generator

Note!

With RFGPH2 and RFGPH3 ”easy” positionings can be performed. Compared to the 9300 servo position controller, the following restrictions apply:

- No programmable positioning
- No positioning with velocity changeover
- No touch probe position

RFGPH2

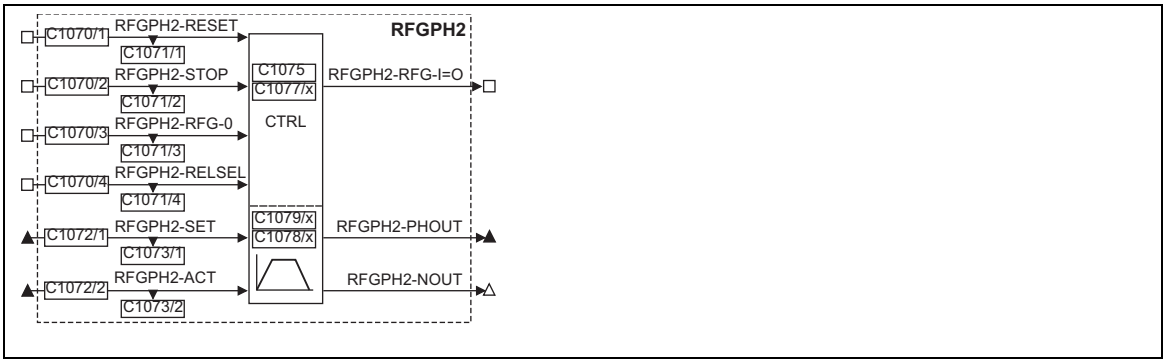


Fig. 3-223 Ramp function generator for angle signals (RFGPH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH2-RESET	d	1071/1	bin	1400/1	2	HIGH: Sets RFGPH2-OUT = 0 (jump) LOW: RFGPH2-PHOUT is set according to the input values RFGPH2-SET and RFGPH2-ACT The input has priority over all other inputs
RFGPH2-STOP	d	1071/2	bin	1070/2	2	HIGH: Output RFGPH2-NOUT is decelerated to 0 rpm along the ramp C1079/1, output RFGPH2-PHOUT remains the same. LOW: RFGPH2-PHOUT is set according to the input values RFGPH2-SET and RFGPH2-ACT. The input has priority over RFGPH2-RFG-0
RFGPH2-RFG-0	d	1071/3	bin	1070/3	2	HIGH: Traverses according to the ramp selected for RFGPH2-ACT = 0 LOW: RFGPH2-OUT is set according to the input values RFGPH2-SET and RFGPH2-ACT.
RFGPH2-REL-SEL	d	1071/4	bin	1070/4	2	HIGH: Relative positioning LOW: Absolute positioning
RFGPH2-SET	ph	1073/1	dec [inc]	1072/1	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH2-ACT	ph	1073/2	dec [inc]	1072/2	3	Position setpoint (65536 inc = 1 rev.)
RFGPH2-RFG-I=0	d		-	-	-	HIGH: RFGPH2-SET = RFGPH2-ACT
RFGPH2-PHOUT	ph		-	-	-	Output (65536 inc = 1 rev.)
RFGPH2-NOUT	phd		-	-	-	Output RFGPH2-PHOUT as speed

RFGPH3

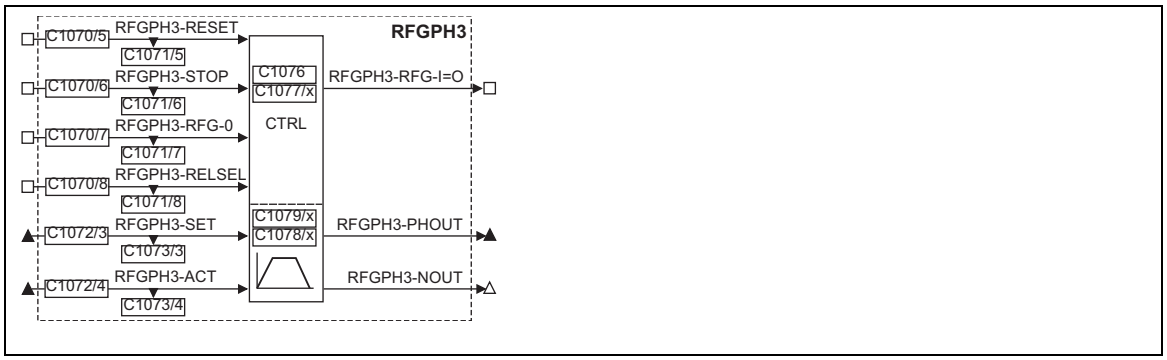


Fig. 3-224 Ramp function generator for angle signals (RFGPH3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH3-RESET	d	1071/5	bin	1400/4	2	HIGH: Sets RFGPH3-OUT = 0 (jump) LOW: RFGPH3-PHOUT is set according to the input values RFGPH3-SET and RFGPH3-ACT The input has priority over all other inputs.
RFGPH3-STOP	d	1071/6	bin	1070/5	2	HIGH: Output RFGPH3-NOUT is decelerated to 0 rpm along the ramp C1079/1, output RFGPH3-PHOUT remains the same. LOW: RFGPH3-PHOUT is set according to the input values RFGPH3-SET and RFGPH3-ACT. The input has priority over RFGPH3-RFG-0
RFGPH3-RFG-0	d	1071/7	bin	1070/6	2	HIGH: Traverses according to the ramp selected for RFGPH3-ACT = 0 LOW: RFGPH3-OUT is set according to the input values RFGPH3-SET and RFGPH3-ACT.
RFGPH3-REL-SEL	d	1071/8	bin	1070/8	2	HIGH: Relative positioning LOW: Absolute positioning
RFGPH3-SET	ph	1073/3	dec [inc]	1072/3	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH3-ACT	ph	1073/4	dec [inc]	1072/4	3	Position setpoint (65536 inc = 1 rev.)
RFGPH3-RFG-I=0	d		-	-	-	HIGH: RFGPH3-SET = RFGPH3-ACT
RFGPH3-PHOUT	ph		-	-	-	Output (65536 inc = 1 rev.)
RFGPH3-NOUT	phd		-	-	-	Output RFGPH3-PHOUT as speed

Table of attributes

Code	Index dec	Index hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1075	23500	5BCCh	E	1	FIX32	VD	4	Ra/Wa	
C1076	23499	5BCBh	E	1	FIX32	VD	4	Ra/Wa	
C1077	23498	5BCAh	A	2	U32	VH	4	Ra/Wa	
C1078	23497	5BC9h	A	4	FIX32	VD	4	Ra/Wa	
C1079	23496	5BC8h	A	6	FIX32	VD	4	Ra/Wa	

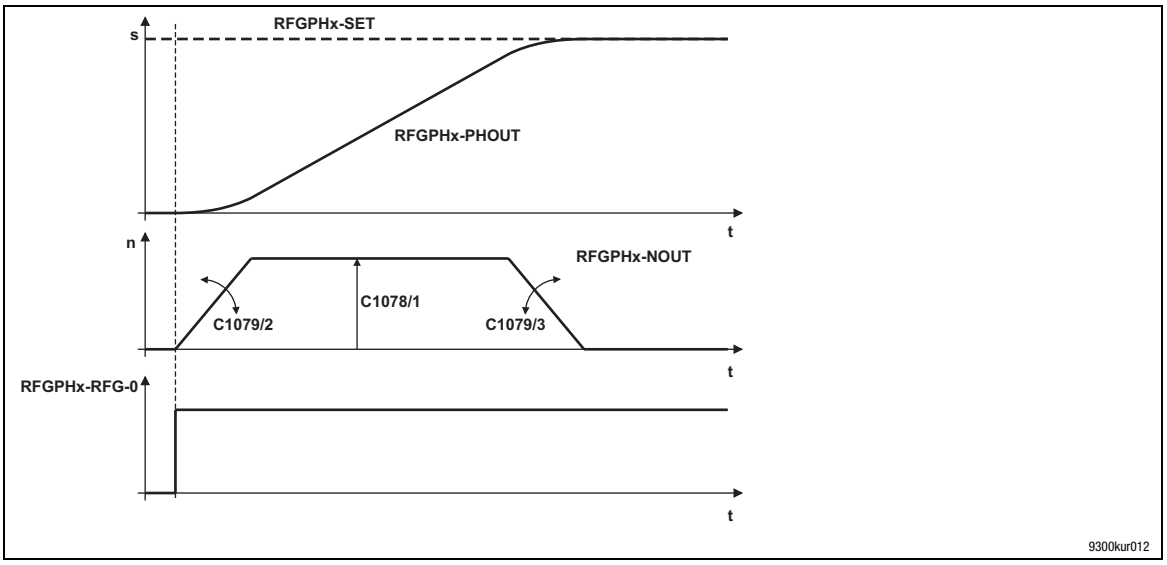
Range of functions

- Positioning of the X axis by means of X offset
- Positioning of the Y axis by means of Y offset
- Set the drive back to the profile position after MANUAL JOG (mode).
- Ensure save drive position
- Output of status signals

3.2.86.1 Description of functions by means of an example

Defining an offset for the Y axis

The following travel profile is to be implemented with RFGPH2:



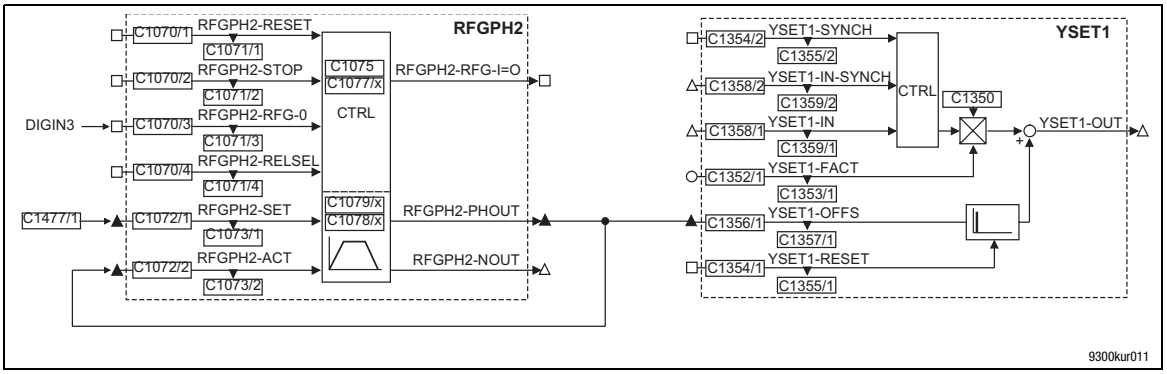


Fig. 3-225 Circuit proposal

Control:

Here, the set position is defined via the code C1477/1. The actual position is directly taken from the output RFGPH2-PHOUT. The digital input DIGIN3 serves to switch between the setpoint position = 0 (the setpoint position is internally set to 0) and the setpoint position defined via the input RFGPH2-SET.

The following parameter setting is required:

- Acceleration time: C1079/2
- Deceleration time: C1079/3
- Speed: C1078/1

The inputs not used do not have to be assigned.

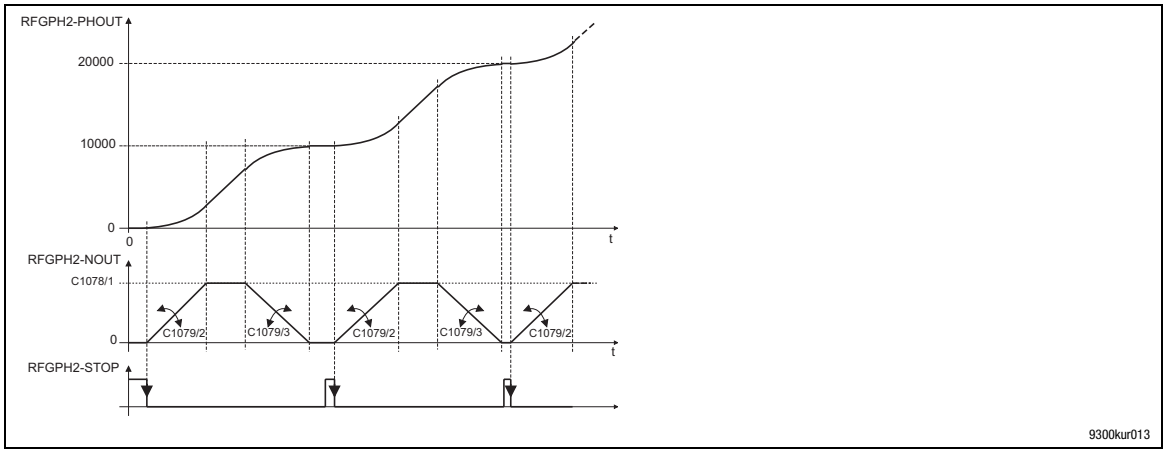
How to stop the positioning

The input RFGPH2-STOP serves to interrupt the positioning process. RFGPH2-STOP = HIGH serves to decelerate the speed at output RFGPH2-NOUT along the ramp C1079/1 and for RFGPH3-NOUT via C1079/4 until zero speed (standstill) is reached.

End switch off

The function blocks provide two modes. They are set via C1075 for RFGPH2 and C1076 for RFGPH3.

- Without limit stop
  - In this operating mode the outputs always follow the setpoint at RFGPHx-SET.
- With limit stop
  - In this operating mode the outputs follow the setpoint at RRFGPHx-SET **for one positioning**. If the setpoint position at RFGPH2-SET is changed, the outputs only follow the setpoint if a HIGH-LOW edge has occurred at the input RFGPH2-STOP. This edge is the start signal for the next positioning.



Relative positioning

In order to implement a relative positioning, the input RFGPHx-REL-SEL must be set to HIGH. This serves to process the value at RFGPH2-SET as “feed”.

This means, the profile generator continues running by the position value applied at RFGPH2-PHIN.

Condition: Mode “with limit stop” must be selected!

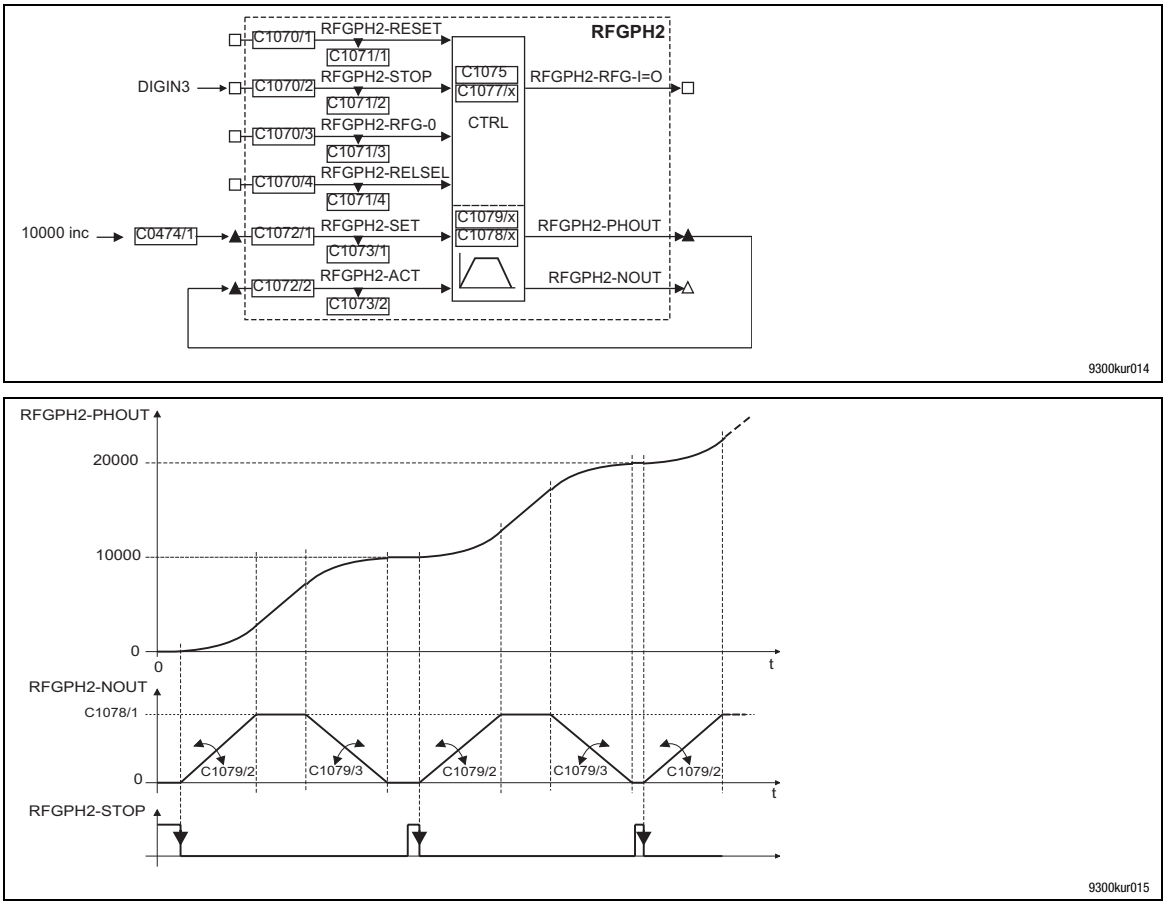


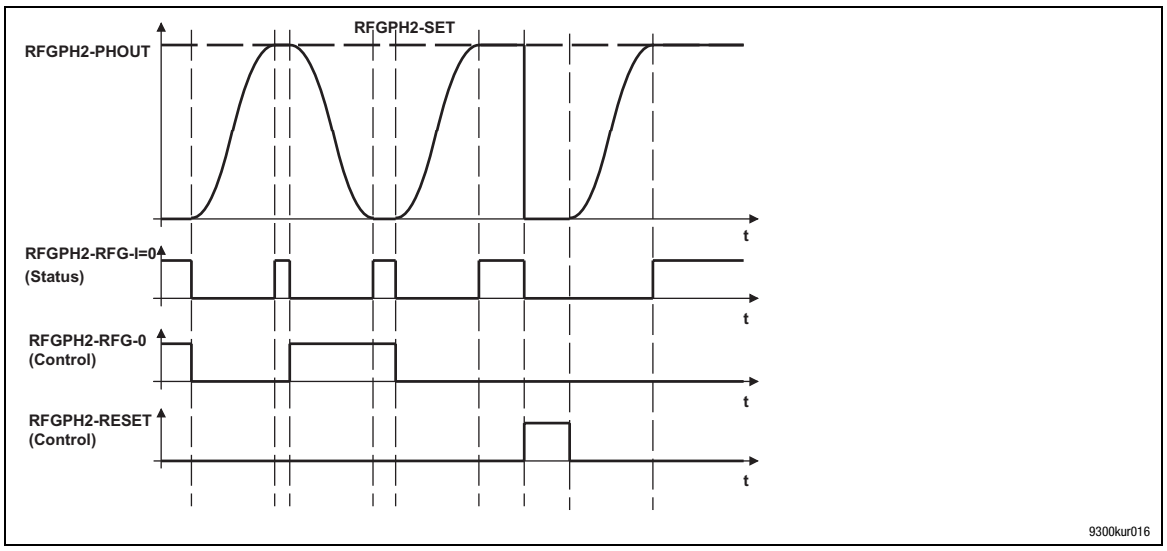
Fig. 3-226 Circuit proposal

Relative positioning

- With RFGPH2-STOP = HIGH the positioning process is only interrupted. With RFGPH2-STOP = LOW the residual path is travelled.
- The position value refers to the last start point if
  - the position value at input RFGPH2-SET changes during the positioning process or
  - the input RFGPH2-STOP changes from LOW → HIGH.
- The positioning process is completed when the target position has been reached. The level at output RFGPH2-RFG-I=0 is HIGH.

Status signals

RFGPH2-RFG-I=0 = HIGH indicates that the output RFGPH2-OUT has reached the final value selected (the output is not adjusted any more).



RESET mode

Use C1074/1 (RFGPH2) and C1074/2 (RFGPH3) to set the status for the output RFGPHx-PHOUT after a RESET command (RFGPHx-RESET = HIGH):

C1074/x	RFGPHx-POUT
0	0
1	ACT
2	SET

3.2.87 Sample and hold function (S&H)

Purpose

The FB can save analog signals. The saved value is also available after mains switching.

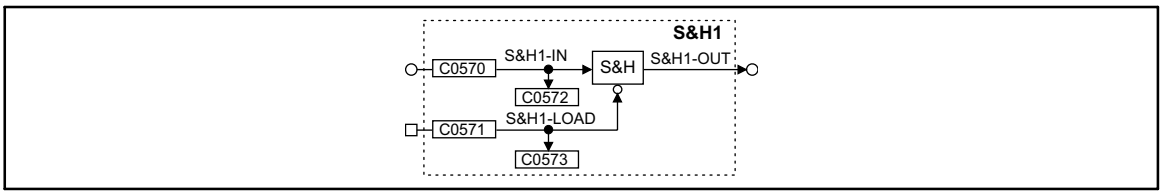


Fig. 3-227 Sample and hold function (S&H1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
S&H1-IN	a	C0572	dec [%]	C0570	1	1000	
S&H1-LOAD	d	C0573	bin	C0571	2	1000	LOW = save
S&H1-OUT	a	-	-	-	-	-	

Function

- With S&H1-LOAD = HIGH the signal at the input S&H1-IN is switched to the output S&H1-OUT.
- With S&H1-LOAD = LOW the output S&H1-OUT is disconnected from the input S&H1-IN and outputs the value which was last valid.

Saving in the case of mains disconnection:

- Keep S&H1-LOAD at LOW level when disconnecting the supply voltage (mains, DC bus or terminal 59).
- Keep S&H1-LOAD at LOW level when connecting the supply voltage (mains, DC bus or terminal 59).

3.2.88 Angle value selection (SELPH)

Two FBs (SELPH1, SELPH2) are available.

Purpose

Select one angle value from nine angle values and switch it to the output.

SELPH1

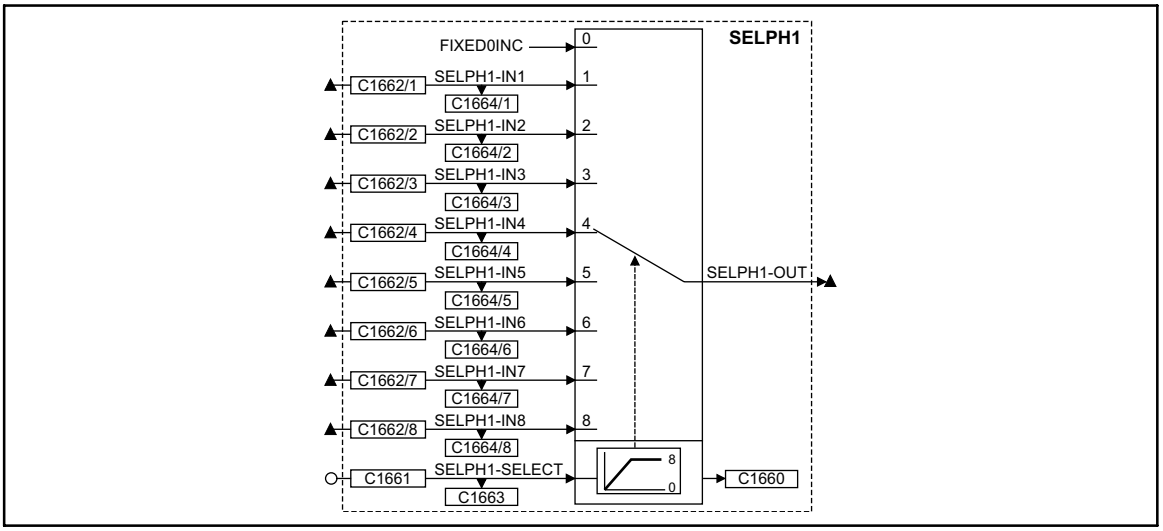


Fig. 3-228 Function block SELPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH1-SELECT	a	C1663	dec	C1661	1	-
SELPH1-IN1	ph	C1664/1	dec [inc]	C1662/1	3	-
SELPH1-IN2	ph	C1664/2	dec [inc]	C1662/2	3	-
SELPH1-IN3	ph	C1664/3	dec [inc]	C1662/3	3	-
SELPH1-IN4	ph	C1664/4	dec [inc]	C1662/4	3	-
SELPH1-IN5	ph	C1664/5	dec [inc]	C1662/5	3	-
SELPH1-IN6	ph	C1664/6	dec [inc]	C1662/6	3	-
SELPH1-IN7	ph	C1664/7	dec [inc]	C1662/7	3	-
SELPH1-IN8	ph	C1664/8	dec [inc]	C1662/8	3	-
SELPH1-OUT	ph	-	-	-	-	-
-	-	C1660	dec	-	-	Displays the current selection

SELPH2

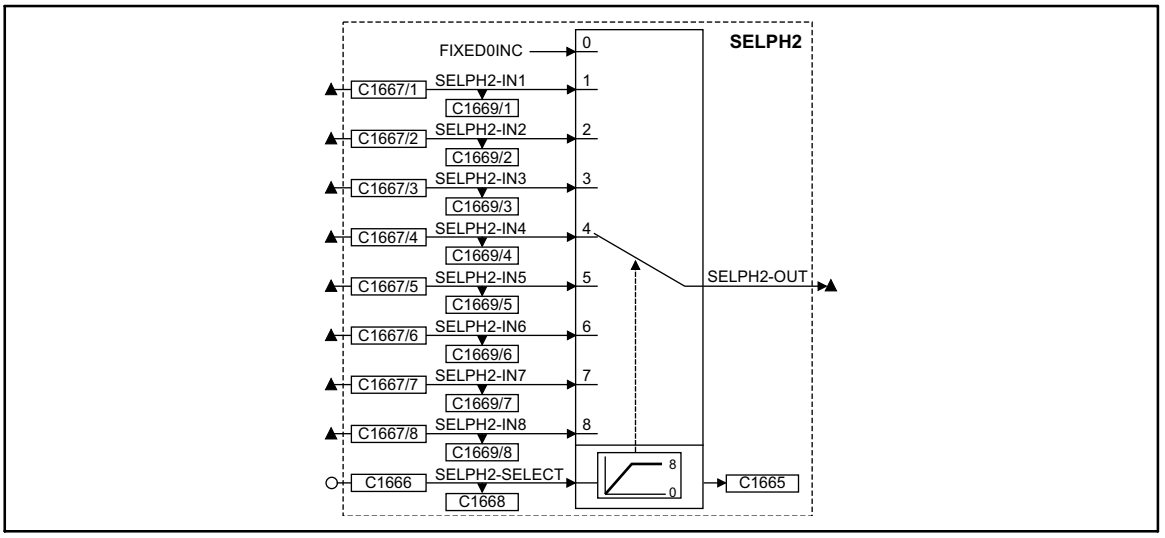


Fig. 3-229 Function block SELPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH2-SELECT	a	C1668	dec	C1666	1	-
SELPH2-IN1	ph	C1669/1	dec [inc]	C1667/1	3	-
SELPH2-IN2	ph	C1669/2	dec [inc]	C1667/2	3	-
SELPH2-IN3	ph	C1669/3	dec [inc]	C1667/3	3	-
SELPH2-IN4	ph	C1669/4	dec [inc]	C1667/4	3	-
SELPH2-IN5	ph	C1669/5	dec [inc]	C1667/5	3	-
SELPH2-IN6	ph	C1669/6	dec [inc]	C1667/6	3	-
SELPH2-IN7	ph	C1669/7	dec [inc]	C1667/7	3	-
SELPH2-IN8	ph	C1669/8	dec [inc]	C1667/8	3	-
SELPH2-OUT	ph	-	-	-	-	-
-	-	C1665	dec	-	-	Displays the current selection

Function

- An analog signal at SELPHx-SELECT directly selects an input and switches it to SELPHx-OUT.
  - If SELPHx-SELECT = 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT < 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT > 8, SELPHx-OUT switches to SELPHx-IN8.

Tip!

You can select an input via a digital signal by connecting the FB CONVDAx upstream of SELPHx-SELECT.

3.2.89 Position switch points (SPC)

Two function blocks (SPC1, SPC2) are available.

Purpose

Switches an output signal if the drive is within a defined position range (implementation of a cam group, control of injection nozzles).

SPC1

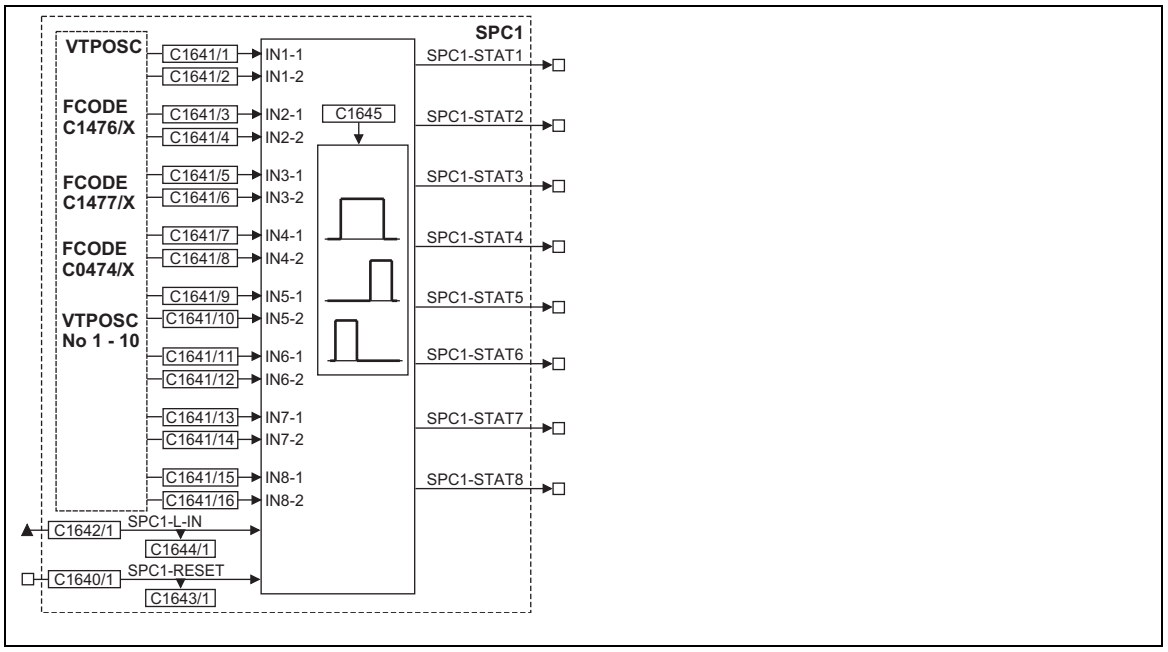


Fig. 3-230 Function block SPC1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SPC1-L-IN	ph	C1644/1	dec [inc]	C1642/1	3	65536 inc = 1 revolution
SPC1-RESET	d	C1643/1	bin	C1640/1	2	-
SPC1-STAT1	d	-	-	-	-	-
SPC1-STAT2	d	-	-	-	-	-
SPC1-STAT3	d	-	-	-	-	-
SPC1-STAT4	d	-	-	-	-	-
SPC1-STAT5	d	-	-	-	-	-
SPC1-STAT6	d	-	-	-	-	-
SPC1-STAT7	d	-	-	-	-	-
SPC1-STAT8	d	-	-	-	-	-

SPC2

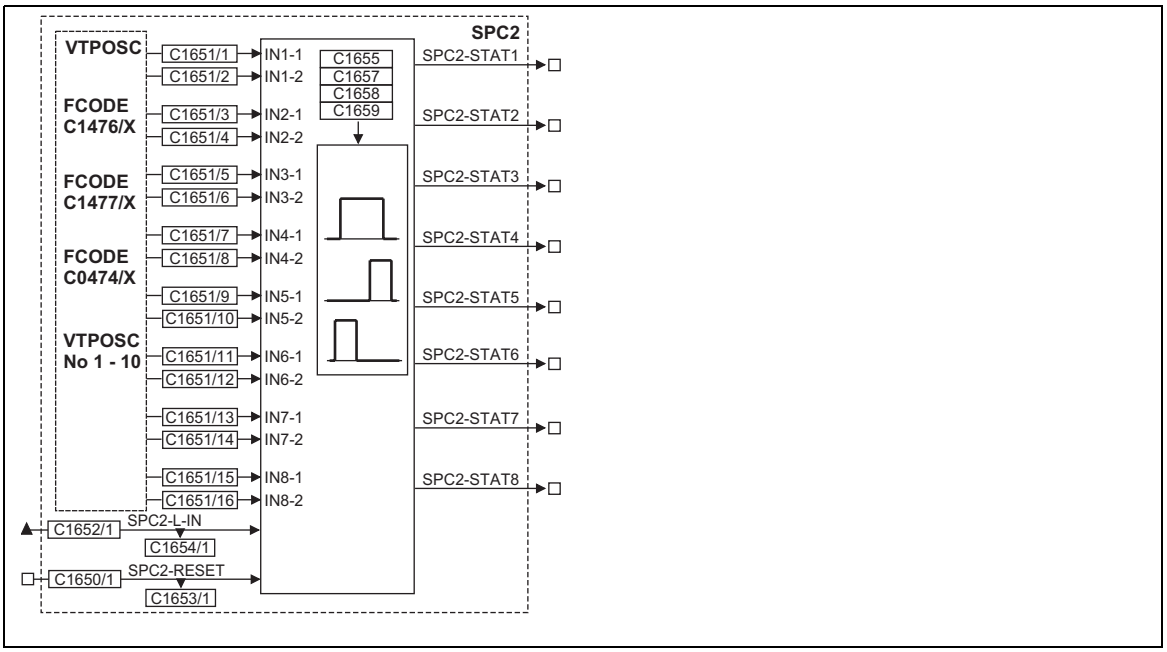


Fig. 3-231 Function block SPC2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SPC2-L-IN	ph	C1654/1	dec [inc]	C1652/1	3	65536 inc = 1 revolution
SPC2-RESET	d	C1653/1	bin	C1650/1	2	-
SPC2-STAT1	d	-	-	-	-	-
SPC2-STAT2	d	-	-	-	-	-
SPC2-STAT3	d	-	-	-	-	-
SPC2-STAT4	d	-	-	-	-	-
SPC2-STAT5	d	-	-	-	-	-
SPC2-STAT6	d	-	-	-	-	-
SPC2-STAT7	d	-	-	-	-	-
SPC2-STAT8	d	-	-	-	-	-

Function

- Switching points (start/end, centre/range)
- Switching hysteresis
- Switching dead time
- Switch filter time constant

3.2.89.1 Switching points

- Switching points can be set in two ways:
  - Mode 1: Start and end position
  - Mode 2: Centre with switching range
- The switching points are selected by means of the variable table VTPOSC.
  - Direct input of switch-on and switch-off positions, centre and switching range in VTPOSC.
- If the value at SPCx-L-IN is within the range of the switching points sets, SPCx-STATx = HIGH

Assignment of switch-on and switch-off positions for SPC1 (see Fig. 3-230):

Code	Subcode	Switching point	Output FB
C1641	1	IN1-1	SPC1-STAT1
	2	IN1-2	
...	...	...	...
C1641	15	IN8-1	SPC1-STAT8
	16	IN8-2	

Assignment of switch-on and switch-off positions for SPC2 (see Fig. 3-231):

Code	Subcode	Switching point	Output FB
C1651	1	IN1-1	SPC2-STAT1
	2	IN1-2	
...	...	...	...
C1651	15	IN8-1	SPC2-STAT8
	16	IN8-2	

Mode 1: Start and end position

C1645 = Set 0 (SPC1)

C1655 = Set 0 (SPC2)

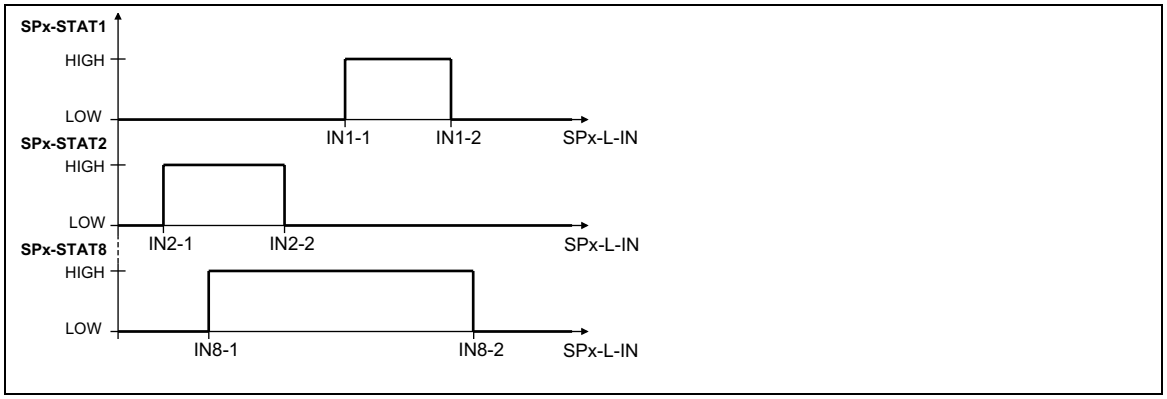


Fig. 3-232 Switch-on and switch-off positions for SPCx-STAT1, SPCx-STAT2 and SPCx-STAT8

Switch-on and switch-off positions depend on the travel direction:

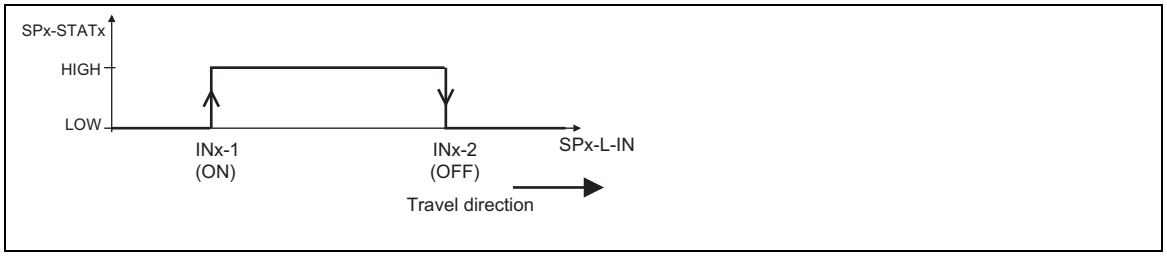


Fig. 3-233 Definition of a switch-on and switch-off position according to the travel direction

Mode 2: Centre with switching range

C1645 = Set 1 (SPC1)

C1655 = Set 1 (SPC2)

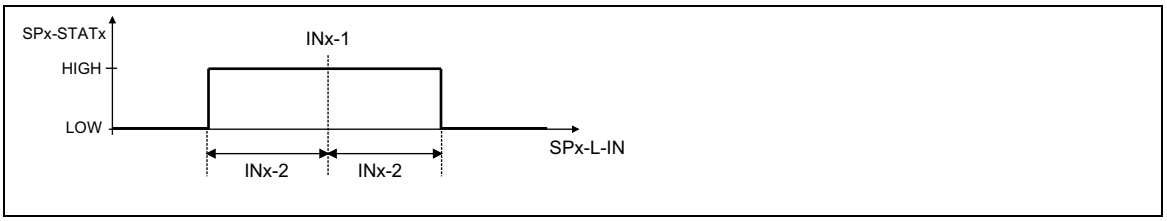


Fig. 3-234 Centre with switching range

- INx-1 determines the centre
- INx-2 determines the switching range with centre

3.2.89.2 Hysteresis

This function is only available for FB SPC2.

Purpose

Avoids undefined switching of the output signals (in standstill the drive is exactly on a switching point).

Function

- The hysteresis is selected under C1658.
  - The setting is valid for SPC2-STAT1 ... SPC2-STAT8.

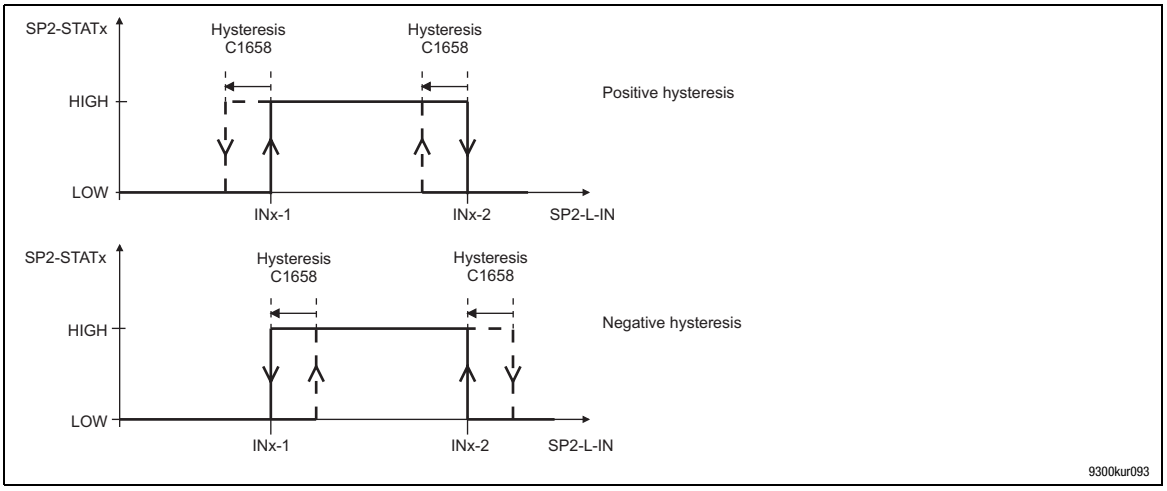


Fig. 3-235 Hysteresis for positive and negative values

3.2.89.3 Dead time

This function is only available for FB SPC2.

Purpose

Delayed activation of downstream components (e.g. injection nozzles).

Function

- The dead time is selected under C1657.
  - This setting is only possible for SPC2-STAT1 ... SPC2-STAT4.

Assignment of codes and outputs:

Code	Subcode	Output FB SPC2
C1657	1	SPC2-STAT1
	2	SPC2-stat2
	3	SPC2-stat3
	4	SPC2-stat4

- The dead time has an effect on the switching points and the hysteresis.

Positive dead time

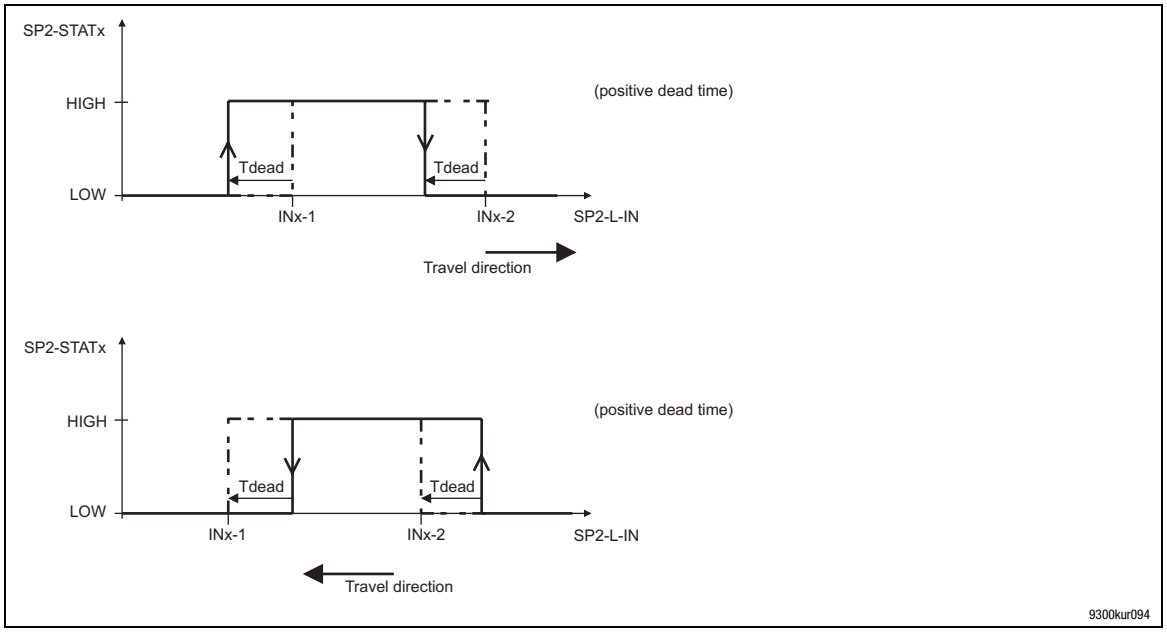


Fig. 3-236 Function of the positive dead time for different travel directions

- With a positive dead time, the switching of the output is advanced by the time set.

Negative dead time

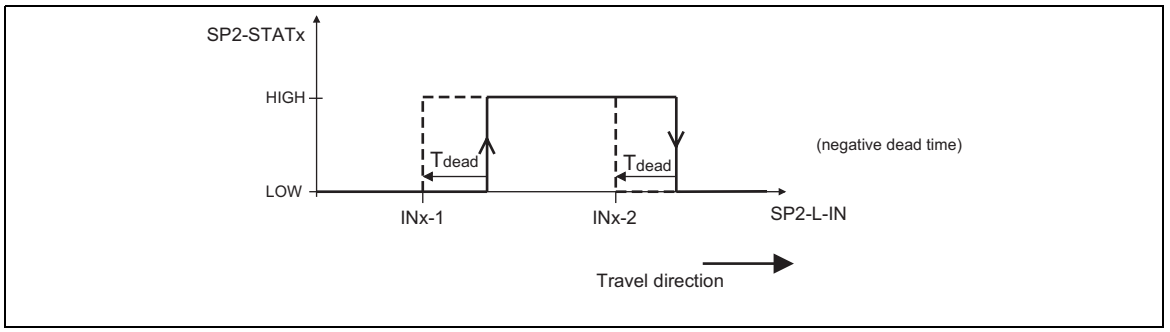


Fig. 3-237 Function of the negative dead time

- With a negative dead time, the switching of the output is delayed by the time set.

3.2.89.4 Filter time constant

This function is only available for FB SPC2.

Purpose

Avoids undefined switching of the output signals at SPC2-STAT1 ... SPC2-STAT4 when the motor is running at low speed.

Function

- The filter time constant is selected under C1659.
  - This setting is valid for SPC2-STAT1 ... SPC2-STAT4.

Assignment of code and filter time constants:

Code	Value	Filter time constant
C1659	0	Off
	1	1 ms
	2	2 ms
	4	4 ms
	8	8 ms
	16	16 ms

Note!

The correct setting can only be determined by testing. Basically, however, the following applies:

The lower the resolution of the actual position encoder and the lower the travel speed, the higher the filter time constant.

3.2.90 S-shaped ramp function generator (SRFG)

Purpose

The function block serves to direct the input signal via a jerk-limited ramp generator (S shape) in order to avoid setpoint step-changes.

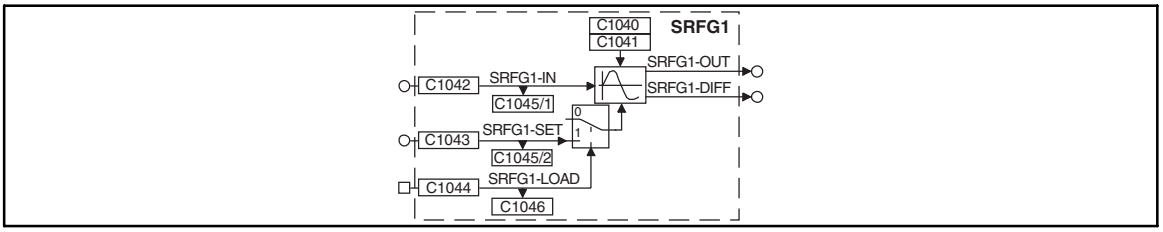


Fig. 3-238 S-shaped ramp function generator (SRFG1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SRFG1-IN	a	C1045/1	dec [%]	C1042	1	input
SRFG1-SET	a	C1045/2	dec [%]	C1043	1	Starting value for the ramp function generator, will be accepted if SRFG1-LOAD = High
SRFG1-LOAD	d	C1046	bin	C0144	2	HIGH = accepts the value at SRFG1-SET and provides it at SRFG1-OUT; SRFG1-DIFF always remains at 0 %
SRFG1-OUT	a	-	-	-	-	Output limited to ±100 %
SRFG1-DIFF	a	-	-	-	-	Output limited to ±100 %, provides the acceleration of the ramp function generator

SRFG1-LOAD

- Via digital input SRFG1-LOAD, the ramp function generator is loaded (set) with the signal from SRFG1-SET.
- This value is immediately accepted, i.e. there is no acceleration/deceleration via S shape (the output skips to this value).
- As long as SRFG-LOAD = HIGH, the ramp function generator remains inhibited.

Function

The maximum acceleration and the jerk can be set separately.

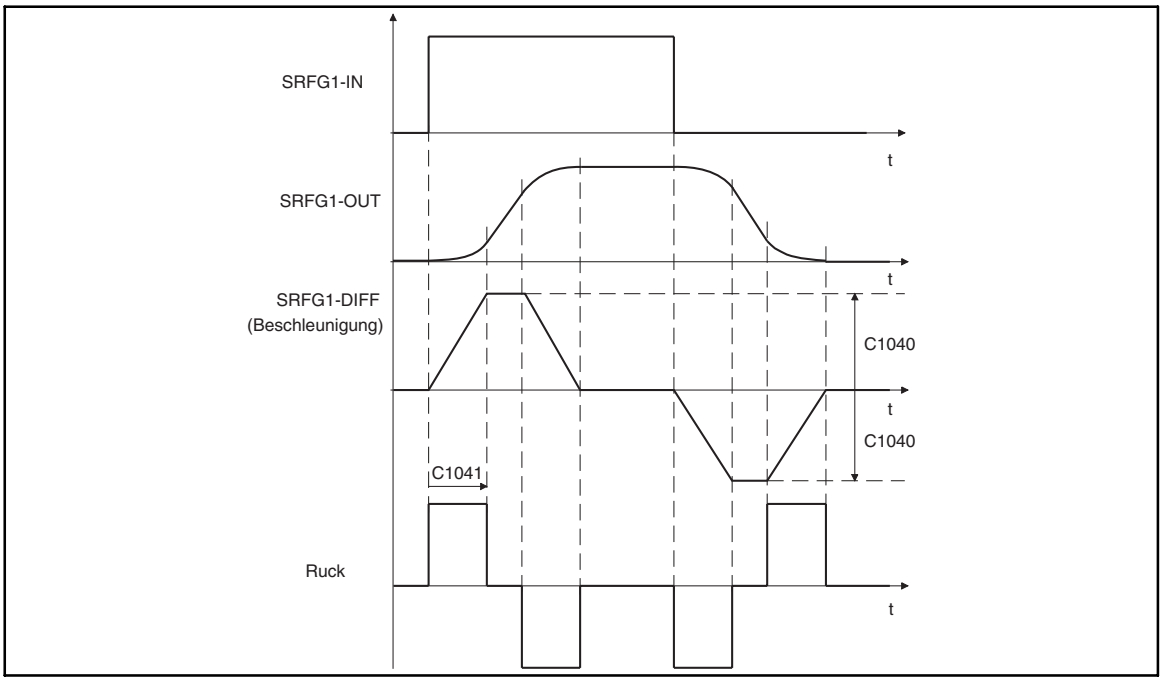
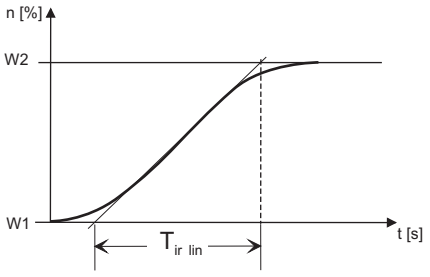


Fig. 3-239 Line diagram

- Max. acceleration:
  - C1040 applies to both the positive and the negative acceleration.
  - Setting according to formula:

$$T_{ir\,lin} = 1s \cdot \frac{W_2\,[\%] - W_1\,[\%]}{C1040\,[\%]}$$



- Jerk (C1041):
  - The jerk is selected in [s] until the ramp function generator operates at max. acceleration (see Fig. 3-239).

3.2.91 Output of digital status signals (STAT)

Purpose

The FB evaluates digital signals of function blocks and the status of the controller and passes them on to C0150 and FB AIF-OUT and CAN-OUT1.

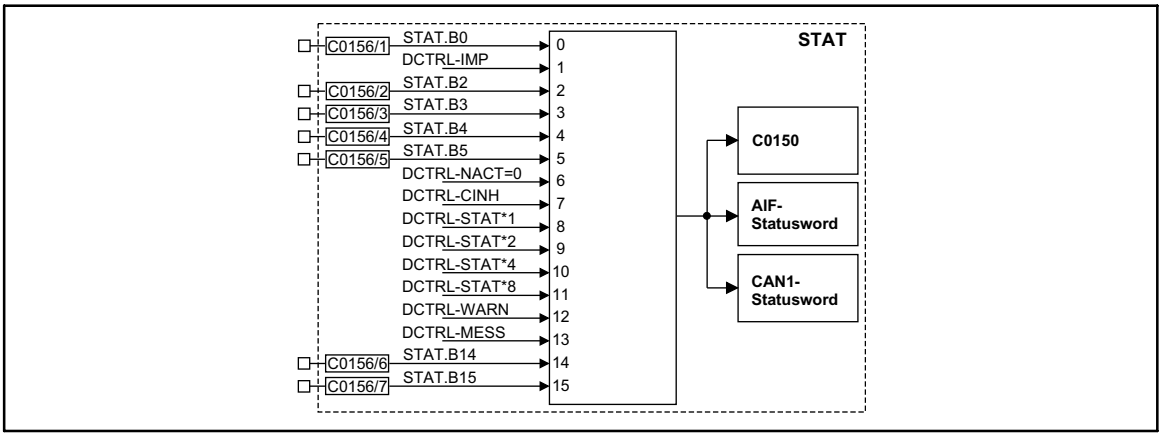


Fig. 3-240 Output of digital status signals (STAT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STAT.B0	d	-	bin	C0156/1	2	2000	
STAT.B2	d	-	bin	C0156/2	2	5002	
STAT.B3	d	-	bin	C0156/3	2	5003	
STAT.B4	d	-	bin	C0156/4	2	5050	
STAT.B5	d	-	bin	C0156/5	2	10650	
STAT.B14	d	-	bin	C0156/6	2	505	
STAT.B15	d	-	bin	C0156/7	2	500	

Function

The status word consists of some fixedly linked (DCTRL-xxxx-) and some freely linkable signal inputs (STAT.Bx).

- Digital signal sources can be freely assigned to the inputs STAT.Bx.
- The corresponding bit in the data word is marked with STAT.Bx (e.g. STAT.B0 for the LSB)
- The status word is transferred to code C0150 and to the function blocks AIF-OUT and CAN-OUT1.
- The inputs with the name DCTRL-xxxx are directly accepted from the function block DCTRL. (📖 3-137)

3.2.92 Control of a drive network (STATE-BUS)

Purpose

The FB controls the drive network to specified states (e.g. trip, quick stop or controller inhibit).

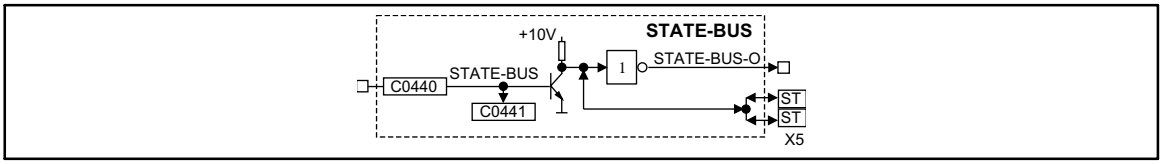


Fig. 3-241 Control of a function block STATE-BUS

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STATE-BUS	d	C0441	bin	C0440	2	1000	
STATE-BUS-0	d	-	-	-	-	-	
TERMINAL X5/ST	d	-	-	-	-	-	

Function

The STATE-BUS is a device-specific bus system which is designed for Lenze controllers only. The function block STATE-BUS acts on the terminals X5/ST or reacts on a LOW signal at these terminals (multi-master capable).

- Every connected controller can set these terminals to LOW.
- All connected controllers evaluate the signal level at these terminals and control the internally configured function blocks.
- Up to 20 controllers can be connected.

Stop!

Do not apply an external voltage at terminals X5/ST.

3.2.93 Storage block (STORE1)

Purpose

Stores a setpoint angle signal which is generated from a speed signal. The storage process is activated via the TP input X5/E5.

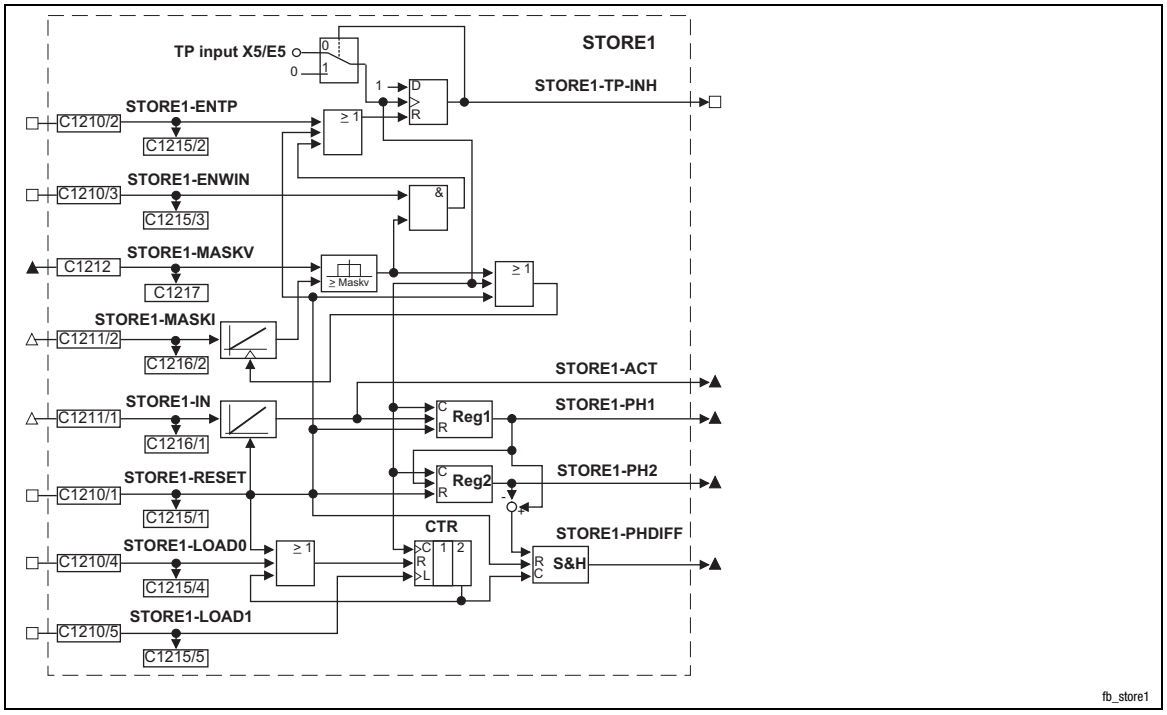
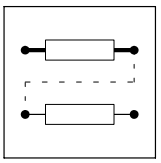


Fig. 3-242 Storage block (STORE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE1-IN	phd	C1216/1	dec [rpm]	C1211/1	4	1000	-
STORE1-RESET	d	C1215/1	bin	C1210/1	2	1000	HIGH = resets all functions
STORE1-ENTP	d	C1215/2	bin	C1210/2	2	1000	HIGH = releases triggering via the TP input E5
STORE1-MASKI	phd	C1216/2	dec [rpm]	C1211/2	4	1000	-
STORE1-MASKV	ph	C1217	dec [inc]	C1212	3	1000	-
STORE1-ENWIN	d	C1215/3	bin	C1210/3	2	1000	HIGH = releases the signal for | STORE1-MASKI | ≥ STORE1-MASKV
STORE1-LOAD0	d	C1215/4	bin	C1210/4	2	1000	HIGH = resets the counter which controls the output on STORE1-PHDIFF
STORE1-LOAD1	d	C1215/5	bin	C1012/5	2	1000	LOW-HIGH edge = sets the counter = 1 which controls the output on STORE1-PHDIFF
STORE1-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE1-PH1	ph	-	-	-	-	-	Outputs the last value saved by X5/E5
STORE1-PH2	ph	-	-	-	-	-	Outputs the next to last value saved by X5/E5
STORE1-PHDIFF	ph	-	-	-	-	-	Outputs the difference of STORE1-PH1 and STORE1-PH2
STORE1-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E5 has been effected. For further triggering, a positive edge has to occur at the input STORE1-ENTP.



Function

- Control via TP input X5/E5
- Saving the angle signal

3.2.93.1 Control via TP input X5/E5

The triggering signal STORE1-TP-INH indicates by means of a HIGH signal a triggering effected via the TP input E5 (LOW-HIGH edge on X5/E5). At the same time STORE1-TP-INH signalises that the triggering is deactivated and has to be reset to the active state. This can be effected via

- STORE1-RESET = HIGH
- STORE1-ENTP = LOW-HIGH edge
- STORE1-ENWIN = HIGH **and** the comparison of angle signals

Comparison of angle signals

The speed signal on STORE1-MASKI is integrated to a angle signal and is compared to the angle signal on STORE1-MASKV.

If the condition | STORE1-MASKI | ≥ STORE1-MASKV

is met,

- the TP input E5 is enabled for the next triggering process with STORE1-ENWIN = HIGH,
- the integrator for the speed signal on STORE1-MASKI is reset.

3.2.93.2 Saving the angle signal

A speed signal at input STORE1-IN is integrated to a angle signal. In addition to the saving, the following procedure shows the possibilities for the signal output.

- The current angle signal is output at STORE1-ACT.

1. A LOW-HIGH edge at the TP input E5 saves the last angle signal and outputs it at STORE1-PH1.
2. STORE1-ENTP = LOW-HIGH edge enables the TP input E5 for the next triggering process.
3. A new LOW-HIGH edge at the TP input E5 saves the last angle signal.
   – STORE1-PH1 outputs this last angle signal.
   – STORE1-PH2 outputs the next to last angle signal.
   – STORE1-PHDIFF outputs the difference of STORE1-PH1 and STORE1-PH2.

- STORE1-RESET = HIGH resets the memory, counters, and integrators and enables the TP input E5 for the triggering process.

Outputting the difference of the two angle signals saved

- A two-stage counter controls the output at STORE1-PHDIFF.
- Every second triggering via the TP input E5 results in a new output at STORE1-PHDIFF.
- STORE1-LOAD0 = HIGH resets the counter.

Additional control

1. STORE1-LOAD1 = LOW-HIGH edge resets the counter to the 1st stage (preparation of the output at STORE1-PHDIFF).
2. Triggering via the TP input E5 sets the counter to the 2nd stage (output at STORE1-PHDIFF is effected).

Note!

If STORE1-LOAD1 is set cyclically, STORE1-PHDIFF outputs a new differential signal after each triggering process.

3.2.94 Storage block (STORE2)

Purpose

Stores a setpoint angle signal which is generated from a speed signal. The storage process is activated via the TP input X5/E4.

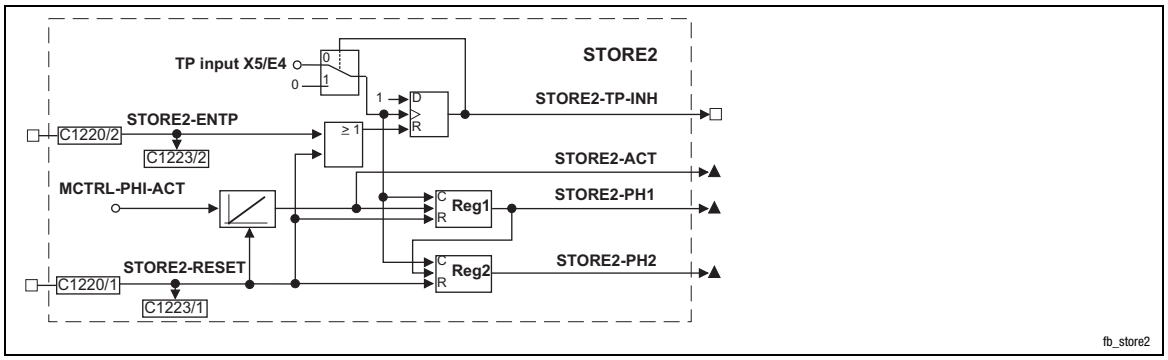


Fig. 3-243 Storage block (STORE2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE2-RESET	d	C1223/1	bin	C1220/1	2	1000	HIGH = resets all functions
STORE2-ENTP	d	C1223/2	bin	C1220/2	2	1000	HIGH = enables the triggering process via the TP input E4
STORE2-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE2-PH1	ph	-	-	-	-	-	Outputs the last value saved by X5/E5
STORE2-PH2	ph	-	-	-	-	-	Outputs the next to last value saved by X5/E5
STORE2-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E4 has been effected. For further triggering, a positive edge has to occur at the input STORE1-ENTP.

Saving the angle signal

A speed signal at MCTRL-PHI-ACT is integrated to a angle signal. In addition to the saving, the following procedure shows the possibilities for the signal output.

- The current angle signal is output at STORE2-ACT.

1. A LOW-HIGH edge at the TP input E4 saves the last angle signal and outputs it at STORE2-PH1.
2. STORE2-ENTP = LOW-HIGH edge enables the TP input E4 for the next triggering process.
3. A new LOW-HIGH edge at the TP input E4 saves the last angle signal.
   – STORE2-PH1 outputs this last angle signal.
   – STORE2-PH2 outputs the next to last angle signal.

- STORE2-RESET = HIGH resets the memory and the integrators and enables the TP input E4 for the triggering process.

3.2.95 Shift register (STORE3)

Description

The function block is a shift register with 16 memory locations. The shift register is designed as a ring buffer.

You can use the function block in cross cutter applications, where the mark sensor is mounted several format lengths away from the cutter.

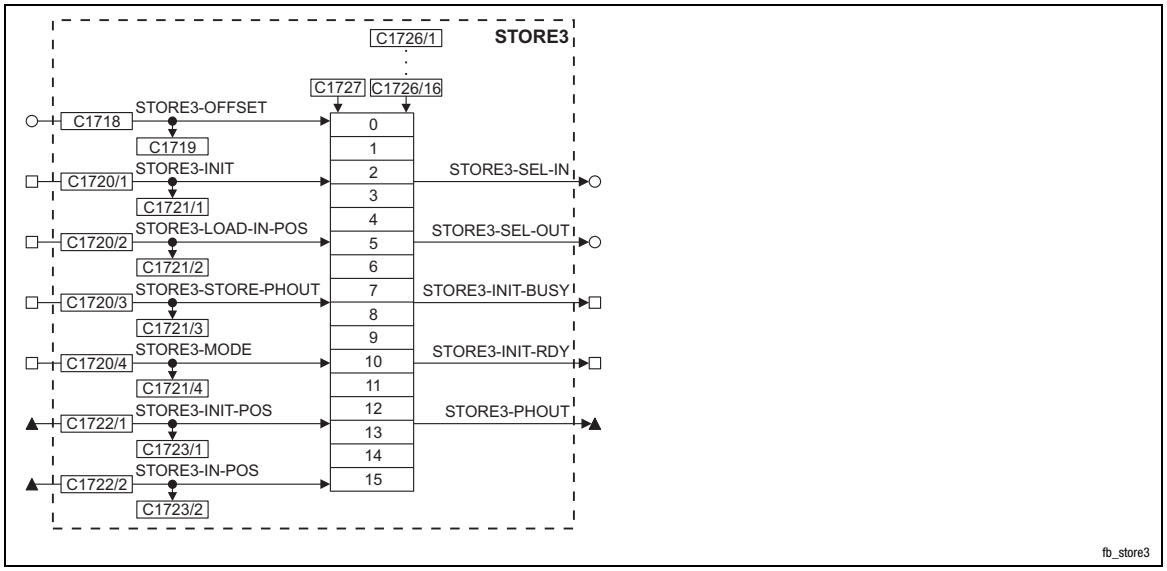
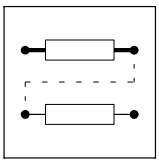


Fig. 3-244 Shift register (STORE3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE3-OFFSET	a	C1719	dec [%]	C1718	1	1000	Selects the memory to be output Memory location = SEL-IN-OFFSET The value is internally set to the correct memory location in the ring buffer
STORE3-INIT	d	C1721/1	bin	C1720/1	2	1000	Initialisation of all memory locations with the value at STORE3-INIT-POS. The input has the highest priority. LOW-HIGH edge: start initialisation LOW: sets STORE3-INIT-RDY = LOW HIGH: inhibits all other functions
STORE3-LOAD-IN-POS	d	C1721/2	bin	C1720/2	2	1000	LOW-HIGH edge: transfers the value of STORE3-IN-POS to the memory location STORE3-SEL-IN
STORE3-STORE-PHOUT	d	C1721/3	bin	C1720/3	2	1000	LOW: outputs the contents of the STORE3-SEL-OUT memory location at STORE3-PHOUT HIGH: inactive, no transmission Important: The function depends on the input signal at STORE3-Mode
STORE3-MODE	d	C1721/4	bin	C1720/4	2	1000	LOW: If STORE3-STORE-PHOUT = LOW, the contents of the STORE3-SEL-OUT memory location is output at STORE3-PHOUT HIGH: The memory location resulting from the calculation of STORE3-SEL-IN – STORE3-OFFSET is output at STORE3-PHOUT. The output is effected permanently.



Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE3-INIT-POS	ph	C1723/1	ph	C1722/1	3	1000	Value for initialising all memory locations. The value is accepted via a LOW-HIGH edge at STORE3-INIT.
STORE3-IN-POS	ph	C1723/2	ph	C1722/2	3	1000	Value for the transfer to the memory location which has been selected via STORE3-SEL-IN. The value is accepted with a LOW-HIGH edge at STORE3-INIT.
STORE3-SEL-IN	a						Memory location to which the next value at STORE3-IN-POS is written.
STORE3-SEL-OUT	a						Memory location from which the next value is output at STORE3-PHOUT.
STORE3-INIT-BUSY	d						Handshake signal HIGH: initialisation of the memories is active
STORE3-INIT-RDY	d						Handshake signal LOW: initialisation of the memories is active or STORE3-INIT = LOW HIGH: initialisation of the memories is completed
STORE3-PHOUT	ph						Output of the memory location values

Direct parameter setting of the memory locations

- Via C1726/1 ... C1726/16, you can write values [inc] directly into the memory locations 0 ... 15. Or you can have the registered values displayed via the codes.
- In code C1727/1 you can directly define a memory location. Save the setting with C0003 = 1.
  - Then the value at STORE3-IN-POS is written to the defined memory location with a LOW-HIGH edge at STORE3-LOAD-IN-POS after mains connection.

Initialising all memory locations with default values

Before starting, all memory locations with default values (e. g. set register lengths) have to be initialised. Mains power-up initialises all memory locations with the value ”0”. Data on the memory locations is not saved with mains failure protection (C0003).

The initialisation is effected in a slow task. The message to the higher-level control system is effected via STORE3-BUSY and STORE3-RDY (handshake signals).

Procedure:

1. Apply a default value to the input STORE3-INIT-POS.
2. Via a LOW-HIGH edge at STORE3-INIT the value at STORE3-INIT-POS is written to all 16 memory locations.
   – STORE3-BUSY is set to HIGH immediately.
   – As long as STORE3-INIT = HIGH, all other functions remain inhibited.
3. After the initialisation,
   – STORE3-BUSY is set to LOW,
   – STORE3-RDY is set to HIGH.
4. Set STORE3-INIT = LOW.
   – STORE3-RDY is set to LOW.

Note!

If different cutting lengths are lying between the point of cutting/register and the mark recognition, no initialisation can be effected.

In this case you have to enter the default values directly in C1726/1 ... C1726/16.

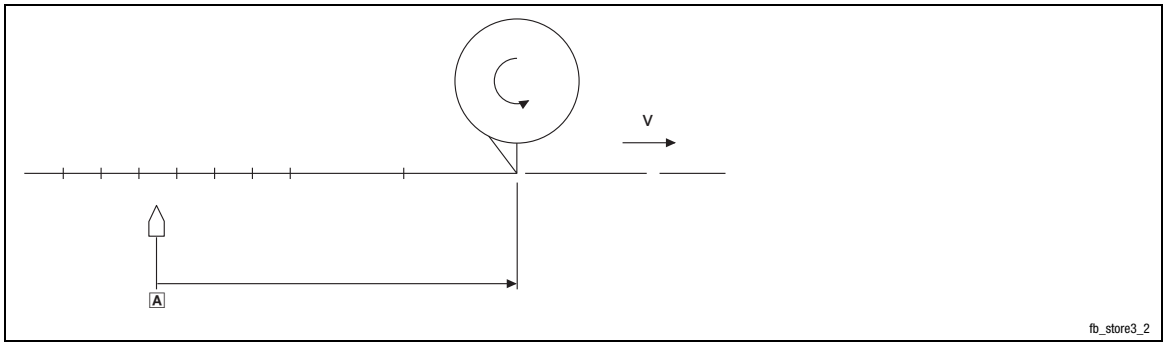


Fig. 3-245 Different cutting lengths between point of cutting and mark recognition (sensor)

A Mark recognition (sensor)

Writing data to a memory location (teaching)

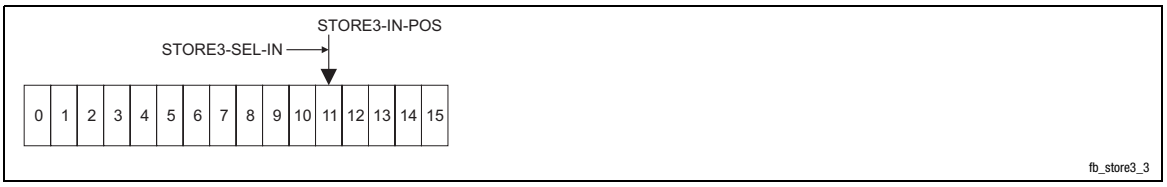


Fig. 3-246 Writing data to a memory location

1. Apply a value to STORE3-IN-POS. STORE3-SEL-IN shows the memory location which is to be written to (in Fig. 3-246 memory location 11).
2. Via a LOW-HIGH edge at STORE3-LOAD-IN-POS, the value is written to the memory location.
3. Afterwards the pointer STORE3-SEL-IN automatically is increased by one (in Fig. 3-246 from memory location 11 to 12).

Reading data from the memory location

- STORE3-MODE = LOW
  - The functions ”Write data to the memory location” and ”Read data from the memory location” are carried out independently of each other.
  - In this mode, a flying splice of the cutting lengths can be achieved.

Fig. 3-247 Reading data independently of writing data

1. STORE3-SEL-OUT indicates the memory location, the value of which is to be transmitted to STORE3-PHOUT.
2. Via a LOW-HIGH edge at STORE3-STORE-PHOUT, the value is read from the memory location.
3. Afterwards the pointer STORE3-SEL-OUT automatically is increased by one (in Fig. 3-247 from memory location 7 to 8).

- STORE3-MODE = HIGH
  - The functions ”Write data to the memory location” and ”Read data from the memory” are combined.

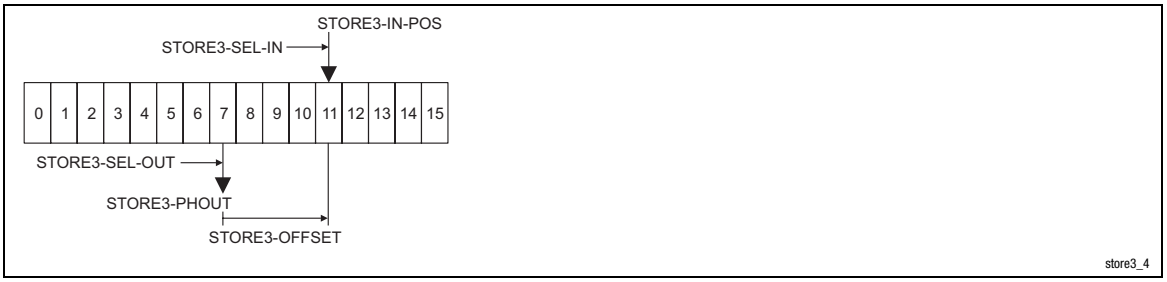


Fig. 3-248 Reading data combined with writing data

Application example

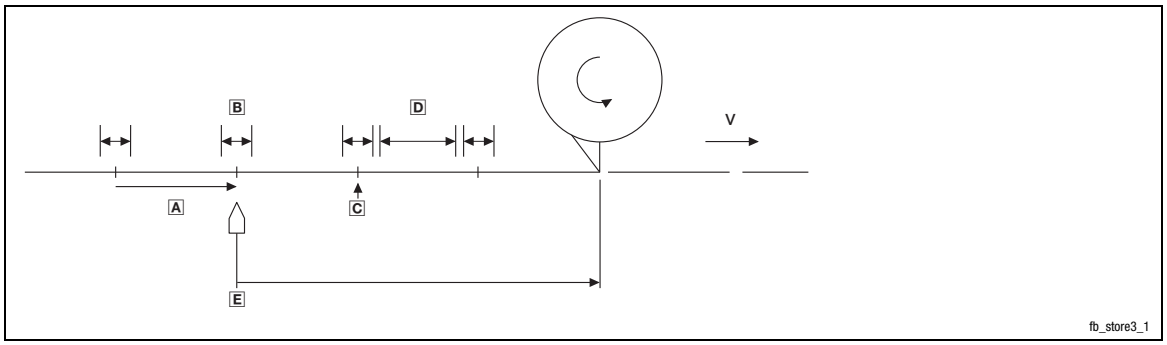


Fig. 3-249 Automatic detection of the formats via cutting marks

- A Format length
- B Window for cutting mark
- C Cutting mark
- D Print image
- E Mark recognition (sensor)

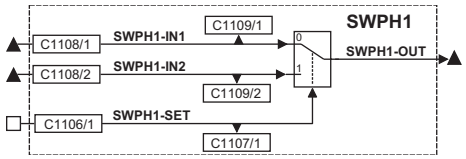
The distance between two cutting marks is the format length. STORE3 supports the automatic measurement of the format length. For this purpose, at least two cutting marks have to be detected via a sensor.

Between the sensor and cutter (cutting point) there can be 16 different format lengths at a maximum.

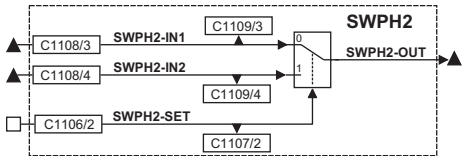
The product is cut if a cutting mark reaches the cutter.

3.2.96 Angle signal changeover switch (SWPH1 and SWPH2)

Changeover switch for selecting between two angle signals



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPH1-IN1	ph	C1109/1	dec [inc]	C1108/1	3	–
SWPH1-IN2	ph	C1109/2	dec [inc]	C1108/2	3	–
SWPH1-SET	d	C1107/1	bin	C1106/1	2	–
SWPH1-OUT	ph	–	–	–	–	–



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPH2-IN1	ph	C1109/3	dec [inc]	C1108/3	3	–
SWPH2-IN2	ph	C1108/4	dec [inc]	C1108/4	3	–
SWPH2-SET	d	C1106/2	bin	C1107/2	2	–
SWPH2-OUT	ph	–	–	–	–	–

Function

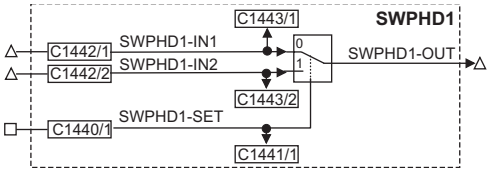
- Different signals are assigned to the inputs SWPHx-IN1 and -IN2. One of the signals can be assigned to the output SWPHx-OUT.
- The input is selected with SWPHx-SET
  - SWPHx-SET = LOW:
    Input SWPHx-IN1
  - SWPHx-SET = HIGH:
    Input SWPHx-IN2

3.2.97 Digital frequency changeover switch (SWPHD)

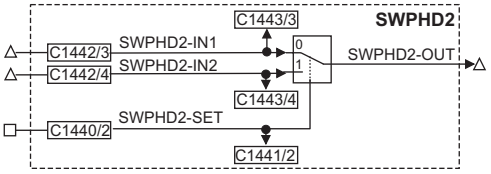
Two function blocks (SWPHD1, SWPHD2) are available

Purpose

Changeover switch for selecting between two speed signals



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPHD1-IN1	phd	C1443/1	dec [rpm]	C1442/1	4	–
SWPHD1-IN2	phd	C1443/2	dec [rpm]	C1442/2	4	–
SWPHD1-SET	d	C1441/1	bin	C1440/1	2	–
SWPHD1-OUT	phd	–	–	–	–	–



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPHD1-IN1	phd	C1443/3	dec [rpm]	C1442/3	4	–
SWPHD1-IN2	phd	C1443/4	dec [rpm]	C1442/4	4	–
SWPHD1-SET	d	C1441/2	bin	C1440/2	2	–
SWPHD1-OUT	phd	–	–	–	–	–

Function

- Different signals are assigned to the inputs SWPHDx-IN1 and -IN2. One of the signals can be assigned to the output SWPHDx-OUT.
- The input is selected with SWPHDx-SET
  - SWPHDx-SET = LOW:
    Input SWPHDx-IN1
  - SWPHDx-SET = HIGH:
    Input SWPHDx-IN2

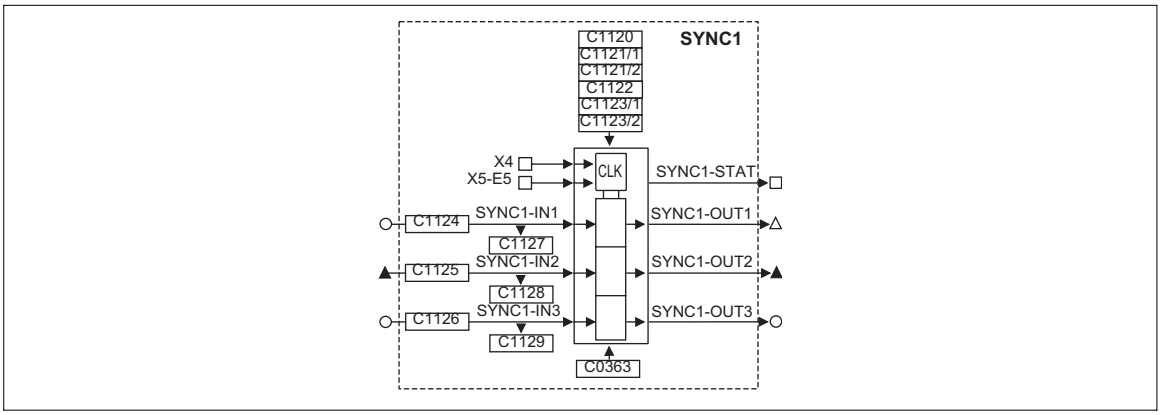
3.2.98 Multi-axis synchronisation (SYNC1 and SYNC2)

Purpose

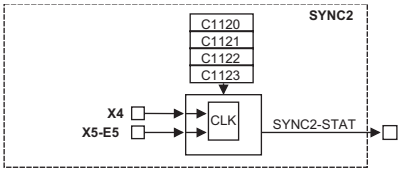
Synchronises the control program cycle of the drives to the cycle of a master control.

STOP!

Do **not** use both function blocks together for cam applications



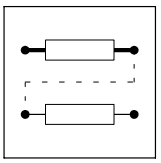
Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC1-IN1	a	C1127	dec [inc]	C1124	1	1000	-
SYNC1-IN2	ph	C1128	dec [inc]	C1125	3	1000	-
SYNC1-IN3	a	1129	dec	C1126	1	1000	
SYNC1-STAT	d	-	-	-	-	-	After the synchronisation is completed, SYNC1-STAT switches to HIGH. If the synchronisation is quit, SYNC1-STAT switches to LOW.
SYNC1-OUT1	phd	-	-	-	-	-	Cannot be used for angle-accurate speed/angle difference transmission
SYNC1-OUT2	ph	-	-	-	-	-	With interpolation, for cyclically synchronised position information
SYNC1-OUT3	a	-	-	-	-	-	With interpolation, for analog values



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC2-STAT	d	-	-	-	-	-	After completion of the synchronisation SYNC2-STAT switches to HIGH. If the synchronity is quit, SYNC2-STAT switches to LOW.

Tip!

- Communication via CAN bus
  - Use the function block SYNC2, when sending/receiving the data of the X or Y axis via the CAN bus. Observe the calculating times of both function blocks (see chapter ”Function block description”).
  - Enter the function block into the processing table when speed values are to be transferred via the CAN bus. The signals of the CAN bus must not be guided via the function block FB SYNC1 but must be used directly.
- If you use software versions >V2.2, please see the commissioning example “Multi-axis application” in part C of this Manual.



Function

- Possible axis synchronisations (chapter 3.2.98.1)
- Cycle times (chapter 3.2.98.2)
- Phase displacement (chapter 3.2.98.3)
- Synchronisation window for synchronisation via terminal (SYNC WINDOW) (chapter 3.2.98.4)
- Correction value of phase controller (SYNC CORRECT) (chapter 3.2.98.5)
- Fault indications (chapter 3.2.98.6)
- Configuration examples (chapter 3.2.98.7)
- Scaling (chapter 3.2.98.8)

3.2.98.1 Possible axis synchronisations

Operating mode

Code	Value	Function
C1120	0	FB without function. Assigns the data at the inputs directly to the outputs.
	1	CAN Sync active Synchronises the controllers to the sync telegram of the system bus.
	2	Terminal Sync active Synchronises the controllers to the sync signal of terminal X5/E5.

Synchronisation time

In addition to certain mains connection and initialisation time of the controller, the FB SYNC1 also requires a synchronisation time.

The synchronisation time depends on

- the baud rate of the system bus (CAN-SYNC),
- the starting time (reception of the first SYNC telegram / signal),
- the time between the SYNC telegrams,
- the SYNC correction factor (C0363),
- the operating mode of the FB SYNC1.

Axis synchronisation via system bus (CAN)

The system bus (CAN) transmits the sync telegram and the process signals.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via the system bus (CAN).

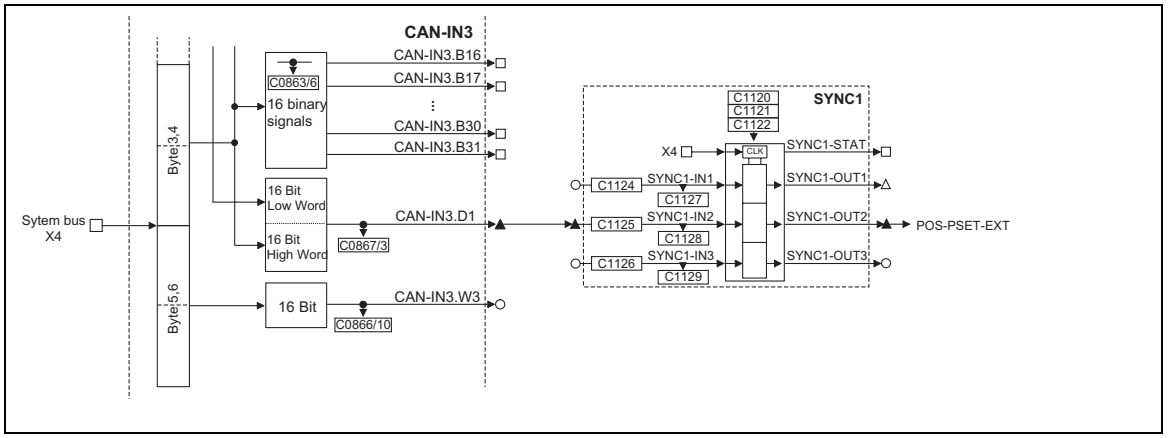


Fig. 3-250 Example for linking the FB SYNC1

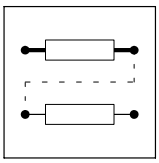
Axis synchronisation via terminal control (X5/E5)

The transmission paths for the sync signal and the process signals are separated.

- The process signals are connected via a freely selectable input channel (e. g. AIF interface, DF input).
- The sync signal is injected via terminal X5/E5.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via other bus systems (e. g. Interbus).
- Synchronisation of the internal processing cycles of the FB to higher-level process controls.



3.2.98.2 Cycle times

Sync cycle time (SYNC CYCLE)

The master (e. g. PLC) sends the periodic sync telegram[1)] (sync signal[2)]).

The controllers (slaves) receive the sync telegram and compare the time between two LOW-HIGH edges of the signal with the selected cycle time (1121/1).

The cycle time is entered in integers (1 ms, 2 ms, 3 ms, ...).

1) Designation for the synchronisation via system bus (CAN)

2) Designation for the synchronisation via terminal

Code	Value	Function
C1121/1	1 ... 13 ms	Definition of the cycle time of the sync telegram (sync signal). Parameters must only be set for the slave. • C1120 = 1 (CAN sync) – Time between two sync telegrams of the master. Adapt the time to the master SYNC. C0362 indicates the time (CAN sync cycle) for the slave. Set the value in C1121/1 higher than the value in C0362. • C1120 = 2 (terminal SYNC) – Time between two sync signals of the master at X5/E5. Adapt the time to the master SYNC. Set the value in C1121/1 ≥ the cycle time of the master.

Interpolation cycle time (INTPOL. CYCLE)

The FB interpolates the input signals (C1124, C1125, C1126) between the sync telegrams or sync signals and transmits them to the corresponding output. This ensures an optimum signal course with regard to the internal processing cycle (e. g. minimising signal jumps in the output variable when operating with high sync cycles).

The interpolation is restarted with every sync signal (LOW-HIGH edge).

Code	Value	Function
C1121/2	1 ... 13 ms	Definition of the interpolation cycles/steps • C1120 = 1 – C1121/2 has no effect. – The interpolation cycles are derived from the sync cycle (C1121/1). • C1120 = 2 – The interpolation cycle can be selected irrespective of the sync cycle. – The parameter setting of C1121/2 must be selected according to the cycle of the process value input.

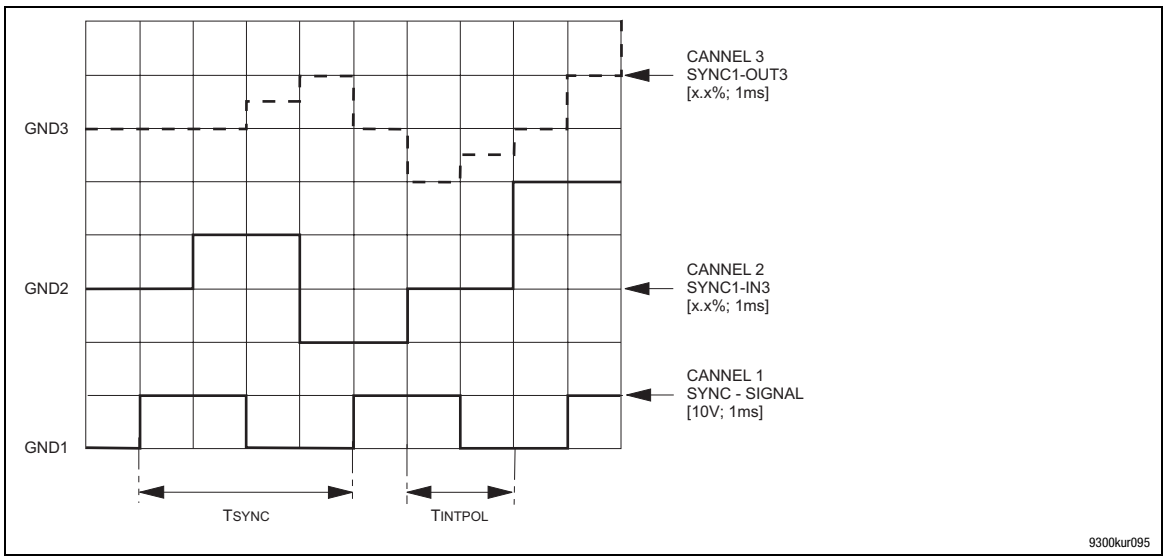


Fig. 3-251 Interpolation example

See Fig. 3-251:

An analog value at SYNC1-IN3 is output as an interpolated value at SYNC1-OUT3.

- Sync cycle (C1121/1) = 4 ms
- Interpol. cycle (C1121/2) = process cycle = 2 ms
- Phase displacement (C1123/1) = 0 ms

3.2.98.3 Phase displacement

Phase displacement for synchronisation via system bus (SYNC TIME)

Code	Value	Function
C1122	0 ...10.000 µs	• C1120 = 1 – Phase displacement between the sync telegram and the start of the internal control program. – The parameters are set automatically depending on the parameter setting of the system bus (CAN). • C1120 = 2 – C1122 has no effect.

Phase displacement for synchronisation via terminal (PHASESHIFT)

Code	Value	Function
C1123/1	-1.000 ms to +1.000 ms	• C1120 = 1 – C1123/1 has no effect. • C1120 = 2 – Phase displacement between the sync signal and the start of the internal control program (e. g. for compensating the effects of signal propagation delays/dead times for the sync signal of the single slave drives).

3.2.98.4 Time slot for synchronisation via terminal

Code	Value	Function
C1123/2	0 ... 1.000 ms	• C1120 = 1 – C1123/2 has no effect. • C1120 = 2 – Definition of a ”time slot” for the LOW-HIGH edges of the sync signal for the slave (defined via C1121/1). – If the sync signal sent by the master is within the ”time slot”, the SYNC1-STAT is switched to HIGH.

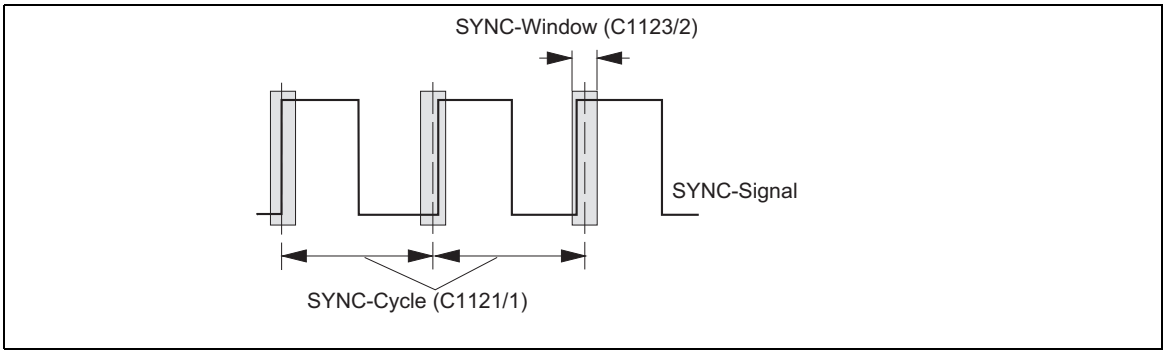


Fig. 3-252 “Time slot” for the LOW-HIGH edges of the sync signal

Tip!

A jitter of up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The size of the jitter affects the parameter setting of the ”time slot”.

3.2.98.5 Correction value of the phase controller

Code	Value	Function
C0363	1 ... 5	• Correction values for C0363 = 1 → 0.8 µs 2 → 1.6 µs 3 → 2.4 µs 4 → 3.2 µs 5 → 4.0 µs • C1120 = 1 – The value is automatically derived from the internal parameters of the system bus (CAN). • C1120 = 2 – Optimising the rise time of the phase controller depending on the frequency of the sync signal. – Increase the value if the frequency of the sync signal decreases. – A stable signal at SYNC1-STAT is an indicator for an optimal parameter setting.

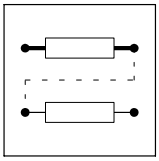
3.2.98.6 Fault indications

Fault indications for the synchronisation via system bus

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	The time between two sync telegrams is faulty	C0362 indicates the time between two sync telegrams • Set the time in C1121/1 to the time in C0362 • Adapt the time interval of the sync telegram from the master

Fault indications for the synchronisation via terminal

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	Sync signal is missing	Connect sync signal with terminal X5/E5
	The period of the sync signal is not a multiple of 1 ms	Adapt the period
	Sync window is too small	Adapt C1123/2 to the conditions



3.2.98.7 Configuration examples

Configuration example CAN-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller and system bus without FB SYNC1
2.	-	Inhibit controller
3.	CAN master	Define the sequence of the telegrams 1. Send new setpoint to all slaves 2. Send sync telegram 3. All slaves must respond
4.	CAN slave drives	Enter FB SYNC1 into the first position of the processing table
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 1 (sync mode for FB SYNC1)
7.	CAN master	Start communication, send sync telegrams
8.	CAN slave drives	FB SYNC1 (CAN SYNC-CYCLE) • Retrieve cycle time of the SYNC telegram from the master via C0362
9.		FB SYNC1 (SYNC CYCLE) • Set C1121 according to the time interval of the sync telegrams from the control • Set C1121 ≥ C0362
10.		Parameterise the monitoring function P16 via C1290
11.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
12.		Via FB DIGOUT • Detect signal of SYNC1-STAT
13.		Only enable the controller when SYNC1-STAT = HIGH

Configuration example TERMINAL-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller without FB SYNC1
2.	-	Inhibit controller
3.	Slave drives	Enter FB SYNC1 into the first position of the processing table
4.		Apply sync signal to terminal X5/E5
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 2 (sync mode for FB SYNC1)
7.	Sync master	Start communication, send sync signals
8.	Slave drives	FB SYNC1 (SYNC CYCLE) • Parameterise the sync cycle time of the sending source via C1121
9.		Parameterise the monitoring function P16 via C1290
10.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
11.		Via FB DIGOUT • Output signal of SYNC1-STAT
12.		FB SYNC1 (SYNC WINDOW) • Enter the optimal size of the ”time slot” via C1123/2 • If the sync signal jitters strongly, increase the ”time slot”
13.		Only enable the controller when SYNC1-STAT = HIGH

3.2.98.8 Scaling

The signal at input is transmitted in a scaled form to SYNC1-OUT1.

Scaling formula:

$$\text{SYNC1-OUT1 [rpm]} = \text{SYNC1-IN1 [inc]} \cdot \frac{1875\ \text{rpm}}{2048\ \text{inc}}$$

The inputs SYNC1-IN2 and SYNC1-IN3 are not scaled. The FB transmits the data to SYNC1-OUT2 or SYNC1-OUT3 without any evaluation.

3.2.99 Edge evaluation (TRANS)

Purpose

This function is used to evaluate digital signal edges and convert them into pulses of a defined duration.

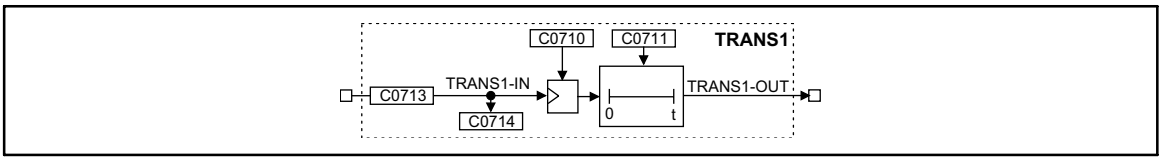


Fig. 3-253 Edge evaluation (TRANS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS1-IN	d	C0714	bin	C0713	2	1000	-
TRANS1-OUT	d	-	-	-	-	-	-

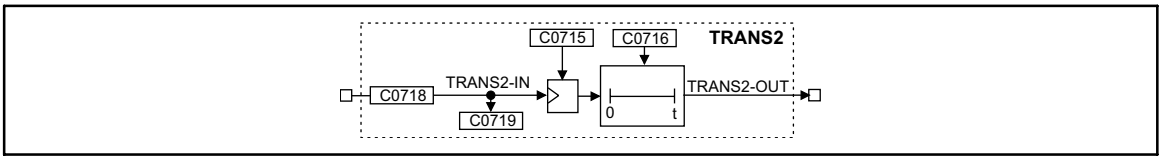


Fig. 3-254 Edge evaluation (TRANS2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS2-IN	d	C0719	bin	C0718	2	1000	-
TRANS2-OUT	d	-	-	-	-	-	-

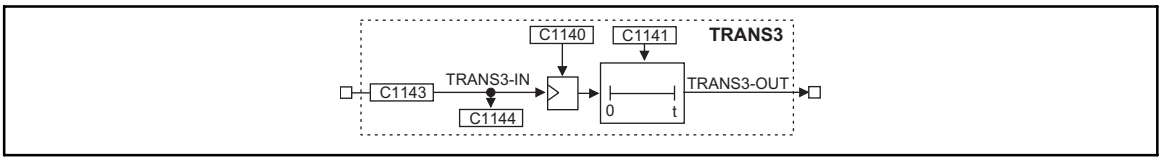


Fig. 3-255 Edge evaluation (TRANS3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS3-IN	d	C1144	bin	C1143	2	1000	-
TRANS3-OUT	d	-	-	-	-	-	-

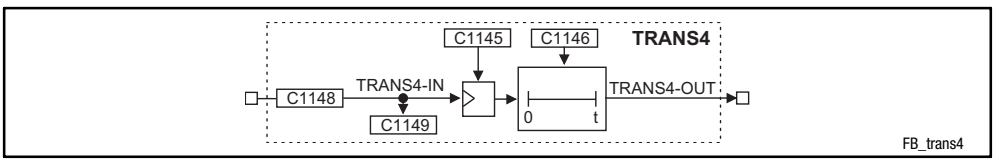


Fig. 3-256 Signal evaluation (TRANS4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS4-IN	d	C1149	bin	C1148	2	1000	-
TRANS4-OUT	d	-	-	-	-	-	-

Function

This FB is an edge evaluator which can be retriggered. This FB can react to different events. The following functions can be selected under code C0710 or C0716:

- Positive edge
- Negative edge
- Positive or negative edge

3.2.99.1 Evaluate positive edge

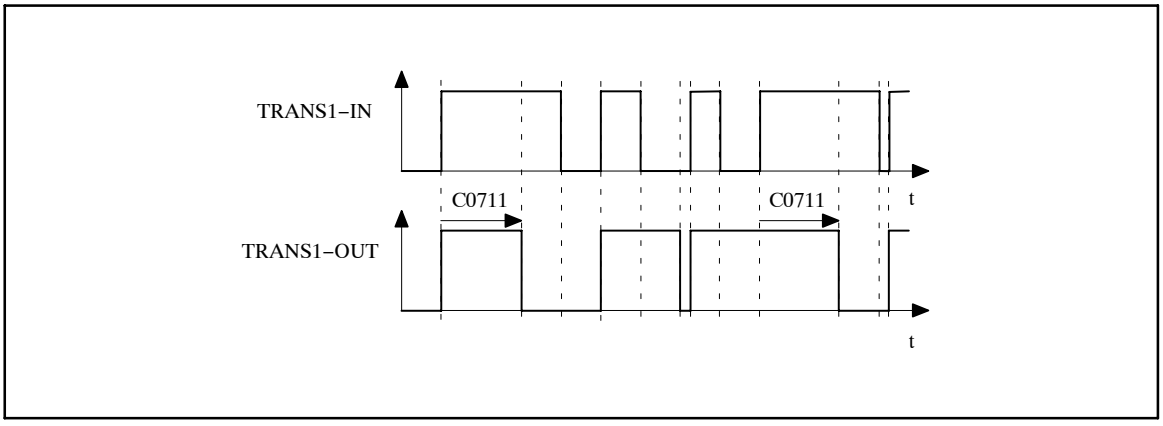


Fig. 3-257 Evaluation of positive edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another LOW-HIGH edge at the input.

3.2.99.2 Evaluate negative edge

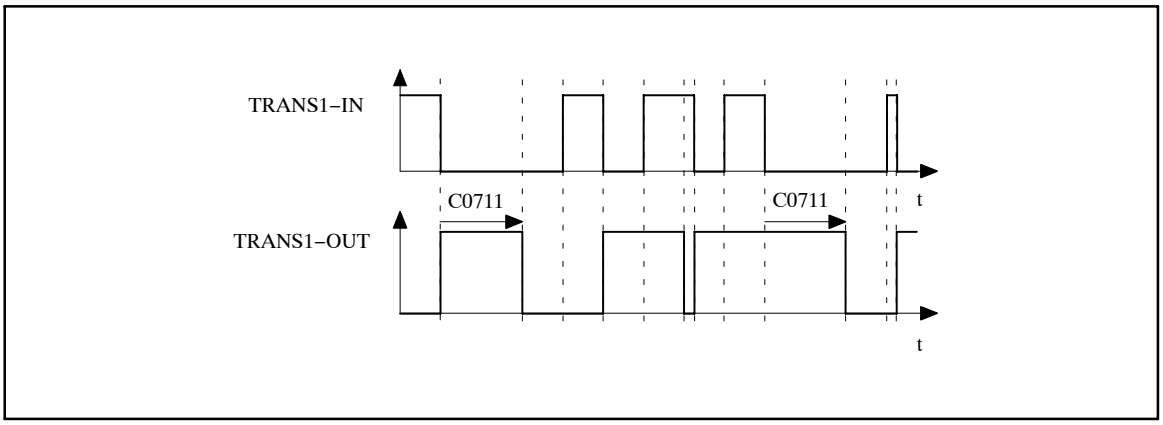


Fig. 3-258 Evaluation of negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW, unless there is another HIGH-LOW edge at the input.

3.2.99.3 Evaluate positive or negative edge

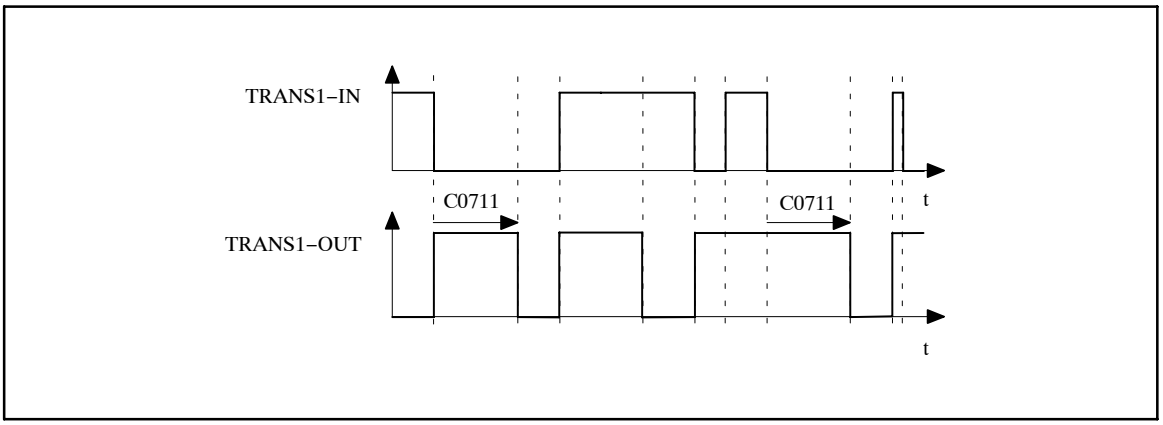


Fig. 3-259 Evaluation of positive and negative edges (TRANS1)

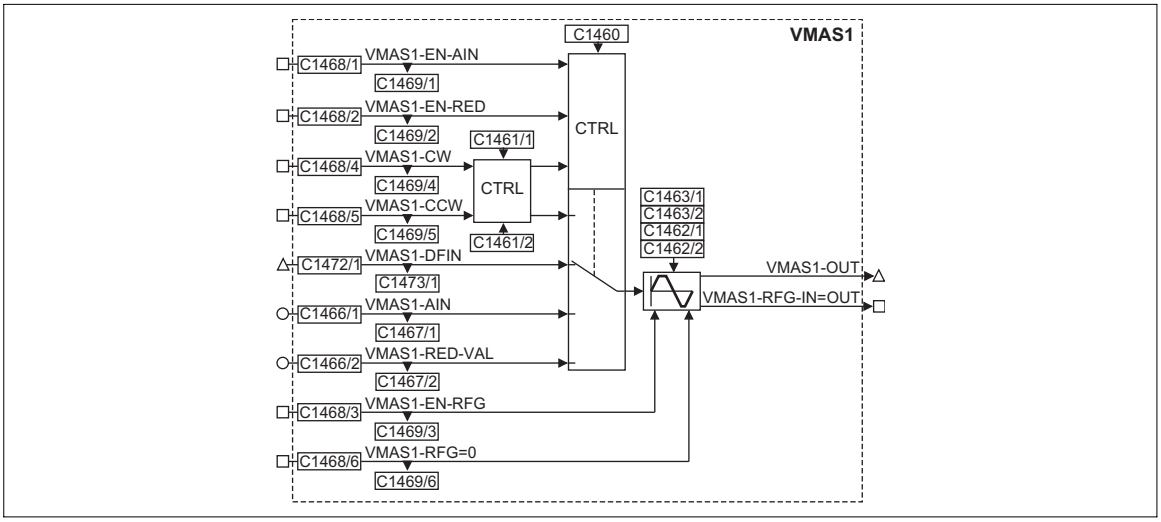
- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge or a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another HIGH-LOW edge or LOW-HIGH edge at the input.

3.2.100 Virtual master (VMAS)

Generation of a virtual digital frequency

Contents

- Generation of a virtual master value (digital frequency) (chapter 3.2.100.1)
- Digital frequency input (chapter 3.2.100.2)
- Switch to alternative master value (chapter 3.2.100.3)
- Inching mode (chapter 3.2.100.4)
- Ramp function generator (chapter 3.2.100.5)
- STOP function with VMAS1-RFG=0 (chapter 3.2.100.6)



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VMAS1-AIN	a	1467/1	dec [%]	1466/1		Analog setpoint
VMAS1-RED-VAL	a	1467/2	dec [%]	1466/2		Alternative analog setpoint, target for speed reduction
VMAS1-EN-AIN	d	1469/1	bin	1468/1		HIGH: Activates the analog input VMAS1-AIN or VMAS1-DFIN (depending on the selection under C1460)
VMAS1-EN-RED	d	1469/2	bin	1468/2		HIGH: Activates the analog input VMAS1-RED-VAL
VMAS1-EN-RFG	d	1469/3	bin	1468/3		HIGH: Activates the ramp function generator LOW: Input values are processed directly
VMAS1-CW	d	1469/4	bin	1468/4		Input CW rotation (set speed under C1461/1)
VMAS1-CCW	d	1469/5	bin	1468/5		Input CCW rotation (set speed under C1461/2)
VMAS1-DFIN	phd	1473/1	dec [rpm]	1472/1		Master speed input (digital frequency)
VMAS1-RFG-IN=0	d	1469/6	bin	1468/6		HIGH: Decelerates VMAS1-OUT to 0 rpm along the adjustable ramp C1463/3. The function has priority over all other functions.
VMAS1-RFG-IN=OUT	d	13851	bin	-		HIGH: RFG has accelerated (input = output)
VMAS1-DFOUT	phd	13851	-	-		Output of the digital frequency setpoint

3.2.100.1 Generation of a virtual master value

If, for instance, no master system is available, a virtual master value (potentiometer setpoint) can be applied to the input VMAS1-AIN. This can be the case when the drive is not operated in a system and thus no synchronous operation is required.

The input signal is switched to the output VMAS1-DFOUT if

- VMAS1-EN-AIN = HIGH and
- code C1460 = 0

The analog setpoint selection at VMAS1-AIN = 100% corresponds to the maximum motor speed, which is input in C0011 during commissioning (see Operating Instructions 9300 cam profiler).

3.2.100.2 Digital frequency input

As an alternative to the analog input VMAS1-AIN (input in [%]), a signal, which must be input as an absolute value [rpm], can be assigned to the digital frequency input VMAS1-DFIN.

The input signal is switched to the output VMAS1-DFOUT if

- VMAS1-EN-AIN = HIGH and
- code C1460 = 1

STOP!

When using the digital frequency input (-DFIN), pulse losses occur when the ramp function generator (VMAS1-EN-RFG = HIGH) is/will be activated. The drive loses the contact with its master. If a ramp function generator is required in connection with the digital frequency input, the FB DFRFG1 can be connected upstream of the input. For this purpose, VMAS1-EN-RFG must be set to LOW.

3.2.100.3 Changeover to alternative master value

This function, for instance, is required when a rough-running drive in the drive system creates an impermissibly high following error. Due to the arising asynchronous operation between master drive and cam the plant may be damaged.

The master speed (input -AIN) can be decreased by changing over to an alternative master value. Then, the drive setpoint is created by the input VMAS1-RED-VAL, e.g. via code, analog input, motor potentiometer, etc..... This master value input has priority over all other setpoint sources.

Before changeover, the input -RED-VAL must be activated:

- VMAS1-EN-RED = HIGH

Tip!

When VMAS1-EN-RFG = HIGH, the ramp function generator is activated. With this, the changeover to the alternative setpoint is made via adjustable ramps (C1462/1 and -/2).

3.2.100.4 Inching mode

- Activate: VMAS1-EN-AIN = LOW
- Activate inching speed from C1461/1:
  VMAS1-CW = HIGH and VMAS1-CCW = LOW
- Parameter setting for inching speed: C1461/1
- Activate inching speed from C1461/2:
- VMAS1-CCW = HIGH and VMAS1-CW = LOW
- Set inching speed n = 0: VMAS1-CCW = LOW and VMAS1-CW = LOW
- With VMAS1-CCW = HIGH and VMAS1-CW = HIGH the status remains the same.

Tip!

For inching, activate the ramp function generator by setting VMAS1-EN-RFG = HIGH.

Code	Meaning	Note
C1461/1	Speed for VMAS1-CW = HIGH	in rpm
C1461/2	Speed for VMAS1-CCW = HIGH	in rpm

3.2.100.5 Ramp function integrator

With the ramp function integrator the setpoint can be smoothly set to the target point.

- Activate: VMAS1-EN-RFG = HIGH

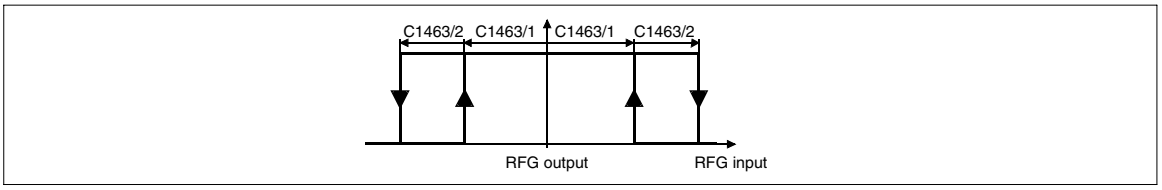
Code	Meaning	Note
C1462/1	Acceleration time	in seconds
C1462/2	Deceleration time	in seconds

The ramps set under C1462/1 and -/2 are assigned to the output VMAS1-DFOUT.

STOP!

If the ramp function generator is used together with the input VMAS-DFIN, pulse losses occur (no phase synchronism) and this drive loses the contact with the master.

The HIGH signal at the output VMAS1-RFG-IN=OUT indicates that the ramp function generator has reached its setpoint. For this status message a window (C1463/1) and a hysteresis (C1463/2) can be set.



3.2.100.6 STOP function with RFG=0

The STOP function (VMAS1-RFG=0 =HIGH) serves to decelerate the digital frequency setpoint (output VMAS1-DFOUT) to n=0 in a controlled way. For this, the ”braking time” of the ramp can be adjusted with code C1462/3.

The STOP function has priority over all other functions. Therefore, a LOW potential at the input VMAS1-EN-RFG has no influence.

STOP!

The output (VMAS1-DFOUT) jumps immediately to its end value if

- VMAS1-RFG=0 =LOW (STOP function deactivated)

and

- VMAS1-EN-RFG =LOW (ramp function generator switched off)

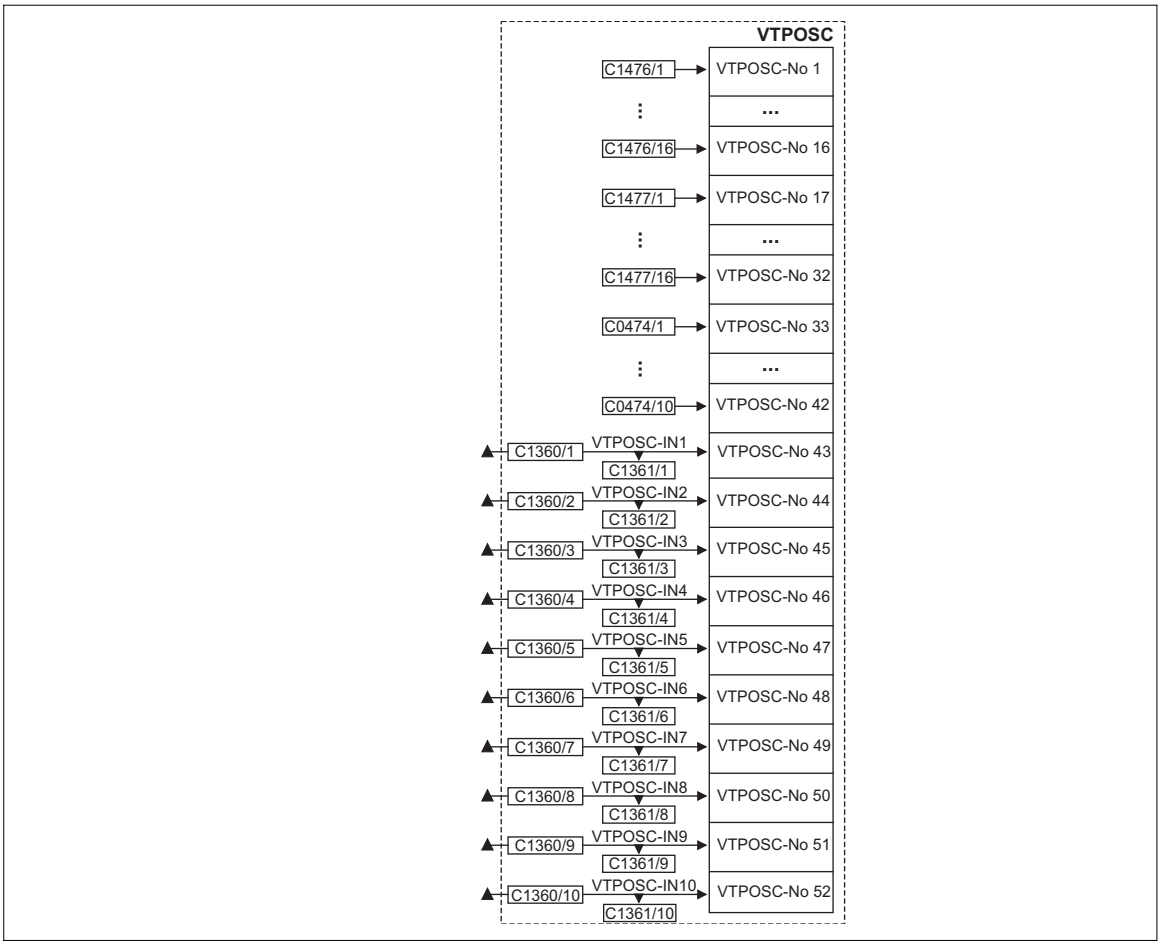
The status signal VMAS-RFG-I=O remains LOW, as long as VMAS1-EN-RFG =HIGH1!

3.2.101 Positioning control (VTPOSC)

One function block (VTPOSC) is available.

Purpose

The FB is similar to the FB VTPOSC of the servo position controller (see System Manual Servo Position Controller). Changes were made to adapt the FB to the cam profiler. It is used to provide the switching point positions for the switching point function blocks (SPC1/2).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTPOSC-IN1	ph	C1361/1	dec[inc]	C1360/1		VTPOSC-No 43
VTPOSC-IN2	ph	C1361/2	dec[inc]	C1360/2		VTPOSC-No 44
VTPOSC-IN3	ph	C1361/3	dec[inc]	C1360/3		VTPOSC-No 45
VTPOSC-IN4	ph	C1361/4	dec[inc]	C1360/4		VTPOSC-No 46
VTPOSC-IN5	ph	C1361/5	dec[inc]	C1360/5		VTPOSC-No 47
VTPOSC-IN6	ph	C1361/6	dec[inc]	C1360/6		VTPOSC-No 48
VTPOSC-IN7	ph	C1361/7	dec[inc]	C1360/7		VTPOSC-No 49
VTPOSC-IN8	ph	C1361/8	dec[inc]	C1360/8		VTPOSC-No 50
VTPOSC-IN9	ph	C1361/9	dec[inc]	C1360/9		VTPOSC-No 51
VTPOSC-IN10	ph	C1361/10	dec[inc]	C1360/10		VTPOSC-No 52

Function

52 table positions are available.

- Enter fixed position values in m_units under C1476/x
  - 16 table positions (VTPOSC-No1 ... VTPOSC-No16) are available.
- Enter fixed position values in s_units under C1477/x
  - 16 table positions (VTPOSC-No17 ... VTPOSC-No32) are available.
- Enter fixed position values in [inc] under C0474.
  - 10 table positions (VTPOSC-No33 ... VTPOSC-No42) are available.
- Enter variable position target values via VTPOS-INx.
  - 10 table positions (VTPOS-No43 ... VTPOS-No52) are available.
  - Signal input via function blocks
  - The position target values must be transmitted to the table positions before the corresponding program set starts and accesses these values.

Note!

Entries in the processing table are only required if FB inputs and outputs are used.

3.2.102 Welding bar control (WELD1)

Purpose

This function block is used for the implementation of a welding bar control.

Note!

If you use the function block WELD1:

- Profiles must be created in a relative data model. The data model can be set in GDC (parameter menu → basic data dialog).
- Code C1308 must be set to ”1”.
  - If you select a basic configuration **with** the FB WELD1, C1308 is automatically set to 1.
  - If you select a basic configuration **without** the FB WELD1, C1308 is automatically set to 0.

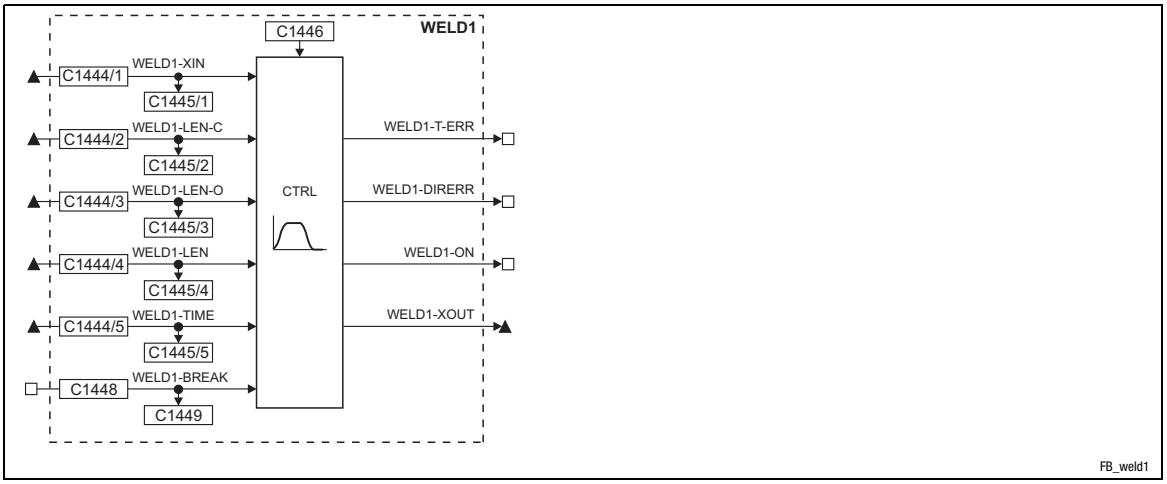


Fig. 3-260 Welding bar control (WELD1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
WELD1-XIN	ph	1445/1	dec [inc]	1444/1	3	Input X position
WELD1-LEN-C	ph	1445/2	dec [inc]	1444/3	3	Length of the closing phase
WELD1-LEN-O	ph	1445/3	dec [inc]	1444/2	3	Length of the opening phase
WELD1-LEN	ph	1445/4	dec [inc]	1444/4	3	Length of the cam profile
WELD1-TIME	ph	1445/5	dec [inc]	1444/5	3	The following modes can be selected under C1446: • “Time” – Welding time in [ms] (1 inc = 1 ms) • “Distance” – Option to shift the profile sections 2 and 3 by representing the parameter “WELD1-TIME” (C1445/5) as a distance (see explanation 🕮 3-328). • “Distance with storage” – Option to shift the profile sections 2 and 3 by representing the parameter “WELD1-TIME” (C1445/5) as distance. “WELD1-TIME” is kept constant for the further cycle at the time of transition into phase 2 (see explanation 🕮 3-329).
WELD1-BREAK		1449	bin	C1448	2	HIGH = Abort the welding process
WELD1-T-ERR	d	-	-	-	-	Welding time error
WELD1-DIR-ERR	d	-	-	-	-	Fault in the direction of rotation
WELD1-ON	d	-	-	-	-	Welding time active
WELD1-XOUT	ph	-		-	-	Output for profile control

Range of functions

- Basics of welding bar control
- Power-controlled welding bar
- Profile data selection
- Weld1 mode: Time (C1446 = 0)
- Weld1 mode: Distance (C1446 = 1)
- Weld1 mode: Distance with saving (C1446 = 2)

3.2.102.1 Basics of welding bar control

General

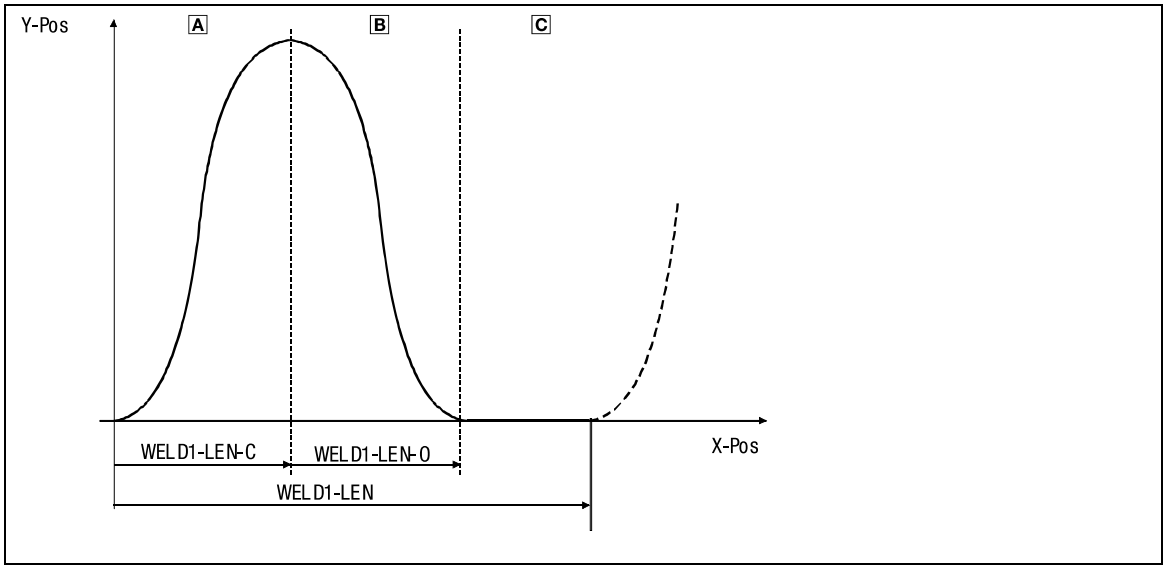
The feed drive positions the material. Then, the welding bar moves down and carries out the welding process with the preset time. After the time has elapsed, the welding bar is moved back into its waiting position and the interval time for a machining process is completed. The next cycle is initiated by a renewed material feed.

Generation of a cam profile for welding bar control

Because of the motion sequences described above a welding bar control can usually be divided into 3 or more sections (max. 5 for Lenze controllers).

Example for 3 sections:

- Phase 1 = Welding bar moves down on material (section 1)
- Phase 2 = Welding, drive remains in position
- Phase 3 = Welding bar is brought into waiting position (section 2)
- Phase 4 = Welding bar remains in waiting position (section 3).



A Section 1
B Section 2
C Section 3

3.2.102.2 Power-controlled welding bar

This function is available from software version 3.4.

The welding bar is controlled by an external control. This control determines the welding current and welding time. After the welding time has elapsed, the opening of the welding bar is forced by setting WELD1-BREAK = HIGH via the external control. The function block WELD1 only carries out the motion control via the profile sections.

Note!

The output WELD1-T-ERR must not be evaluated in this operating mode since the function is only implemented in connection with the internal welding time control. The level at WELD1-T-ERR is not defined.

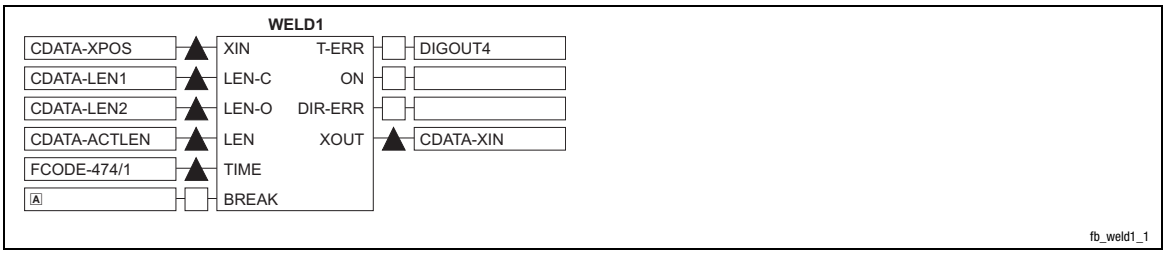


Fig. 3-261 Connection of WELD1 for power-controlled welding bar

WELD1-TIME At WELD1-TIME, you must set a higher value than the actual welding time will be. Only then the function block reacts to the input WELD1-BREAK.

The motion control is also ensured for very high values at WEDL1-TIME, even if no abort is requested (WELD1-BREAK = HIGH). The function block behaves as if a welding time error (WELD1-T-ERR) has occured.

A WELD1-BREAK is triggered by the external control, e.g. via input terminal (X5/Ex)

3.2.102.3 Profile data selection

Phase 1

Start position:

- X0 = 0 (master value) and Y0 = waiting position of the welding bar

End position

- X1 = WELD1-LEN-C (time until the welding bar contacts the material)
- Y1 = Welding bar in welding position (= start position of phase 2)

Note!

The slope of the profile should be dimensioned to the max. possible acceleration of the welding drive at max. line speed.

Phase 2

The drive is kept in the welding position for the time set at WELD1-TIME. For this purpose, a waiting phase (standstill phase) is automatically set at the transition from section 1 to section 2 (independently of the line speed). The waiting phase is **not** set when the profile data is created.

Phase 3

The end position must be selected such that the max. permissible acceleration of the welding drive at max. line speed will not be exceeded (see also description of phase 1).

Phase 4

Add a standstill phase at the end of the motion profile.

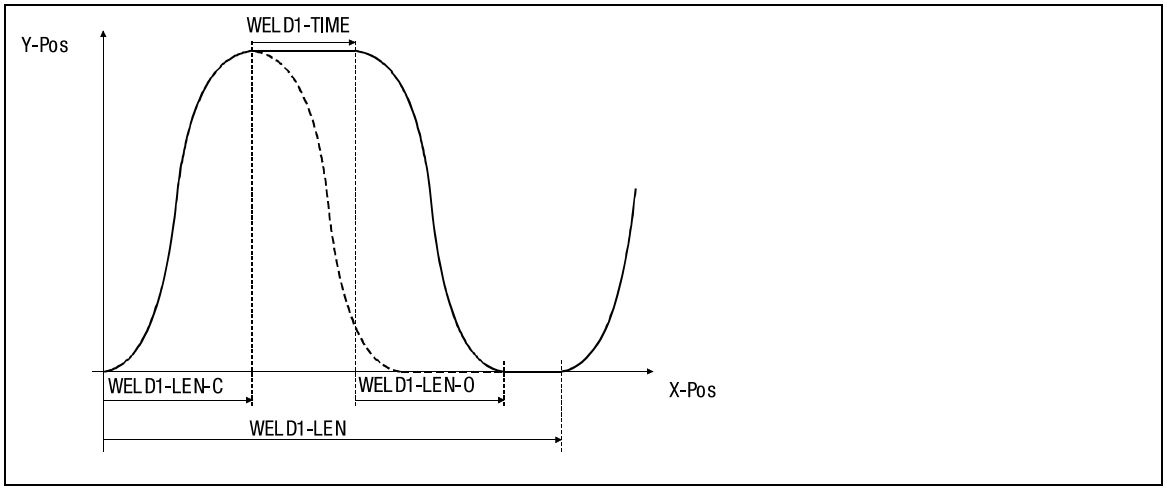


Fig. 3-262 Profile characteristic after entering the profile data at corresponding line speed

The selected welding time is converted to a distance.

Due to the welding time set (WELD1-TIME) the opening phase (WELD1-LEN-O) is automatically delayed by the preselected welding time. This automatically reduces the standstill phase at the end of the profile. The phases 1 and 3 are not influenced. When the line speed increases, the standstill phase at the end of the profile is automatically reduced.

Interconnection and parameterisation of the function blocks

For implementing the welding bar function, the function block CDATA is required with a profile stored accordingly. For this purpose, select the basic configuration C0005 = 11XXX. In this basic configuration the function blocks CDATA, WELD1 and CCTRL are already included:

- The profile data in CDATA determine the motion profile (path profile) of the welding bar.
- The function block WELD1 controls the welding time. The welding time set in WELD1-TIME serves to keep the welding bar in welding position, independent of the master speed.
- The function block CCTRL converts the path information to a rotor position at the motor.

Interconnection of inputs and outputs

STOP!

The welding bar control can only process positive master phases (see 1444/1 and 1445/1). If negative master angles are selected, the drive does not move!

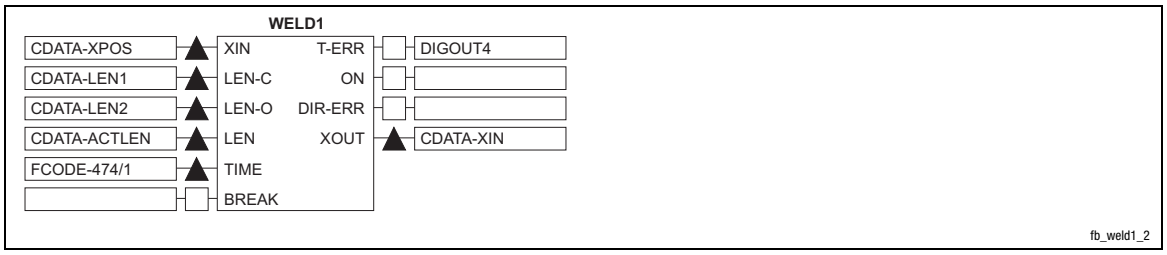


Fig. 3-263 Connection of WELD1 in the basic configuration C0005 = 11000

Input CDATA-XIN must be selected as master value input for function block CDATA.

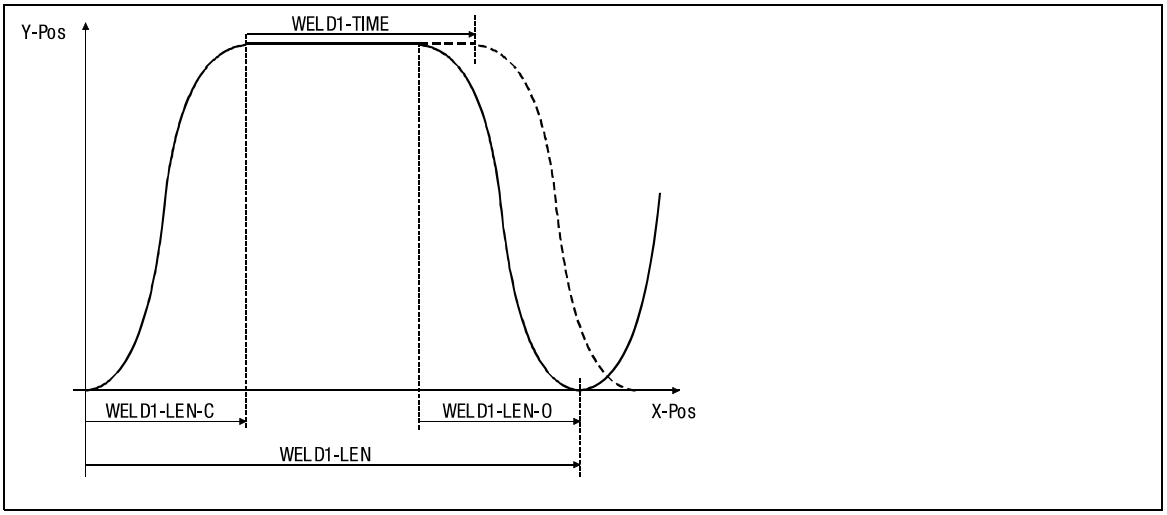
3.2.102.4 Weld1 mode: Time (C1446 = 0)

The value at the input WELD1-TIME is interpreted as a **time** value.

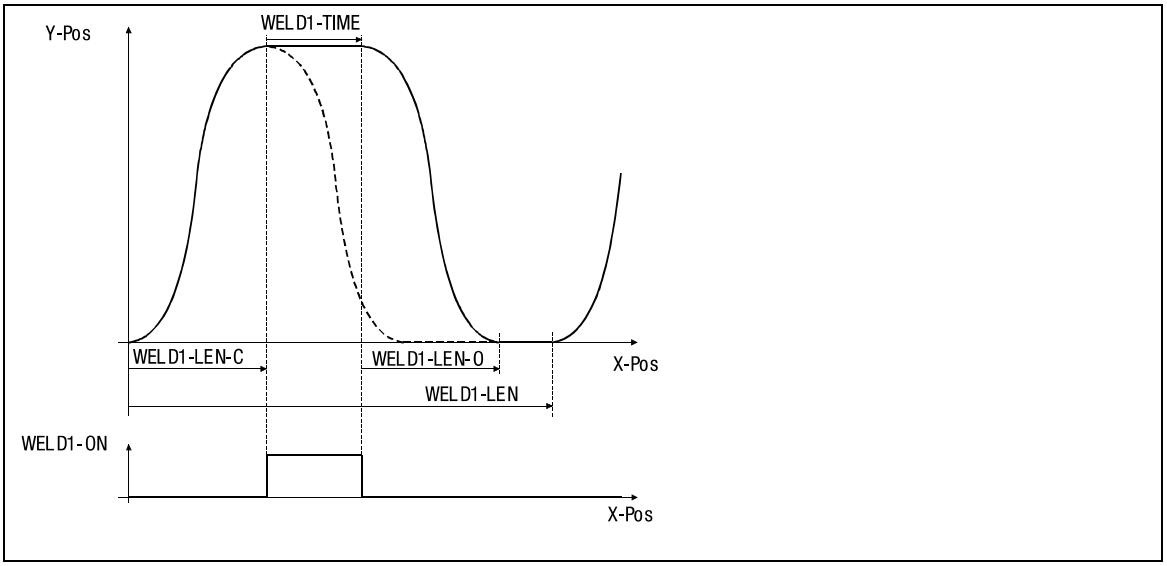
Output of status information

- WELD1-T-ERR = HIGH: The total length and the sum of times of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  - Wrong profile selection
  - Line speed too high

In such a case the welding time will be automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  - Invert master angle
  - Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



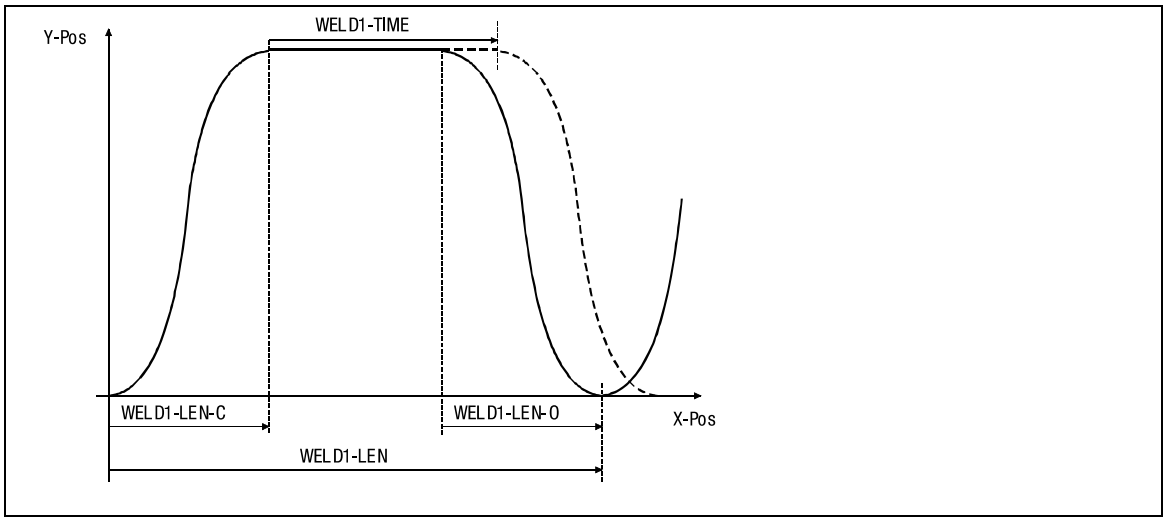
3.2.102.5 Weld1 mode: Distance (C1446 = 1)

The value at the input WELD1-TIME is interpreted as a **distance**.

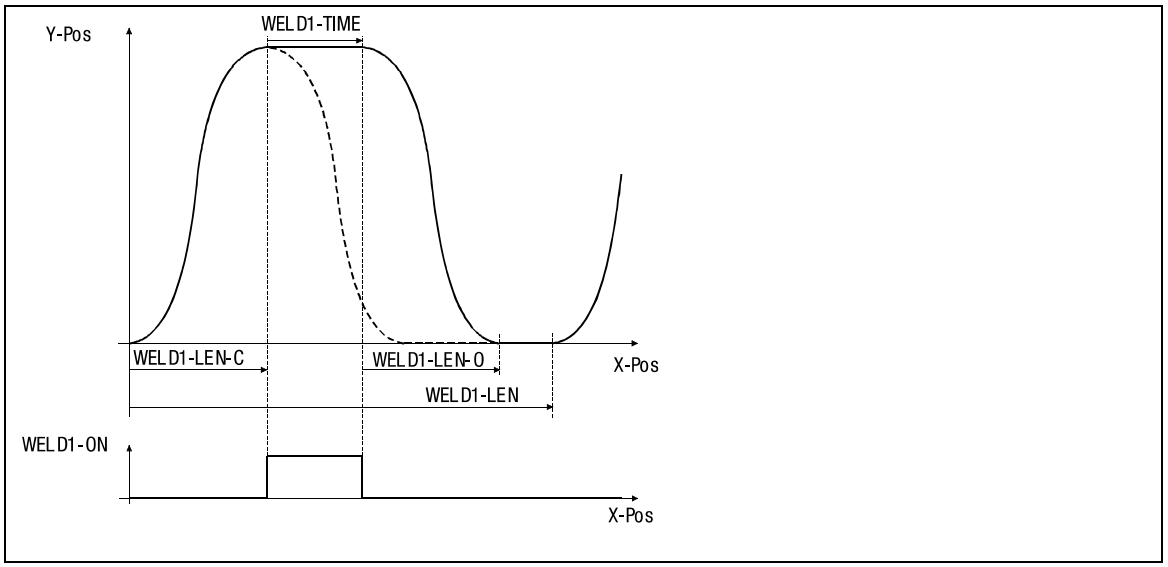
Output of status information

- WELD1-T-ERR = HIGH: The total length of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  - Wrong profile selection
  - Line speed too high

In this case the welding time is automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  - Invert master angle
  - Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



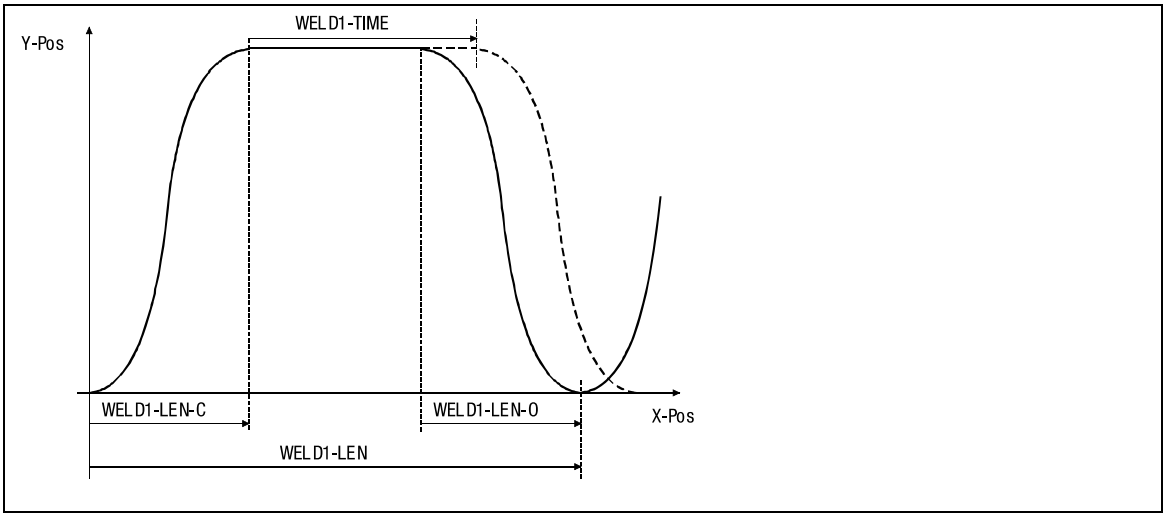
3.2.102.6 Weld1 mode: Distance with saving (C1446 = 2)

The value at the input WELD1-TIME is interpreted as a **distance**. WELD1-TIME is saved for the further cycle when phase 2 of the profile is started (see basics of welding bar control).

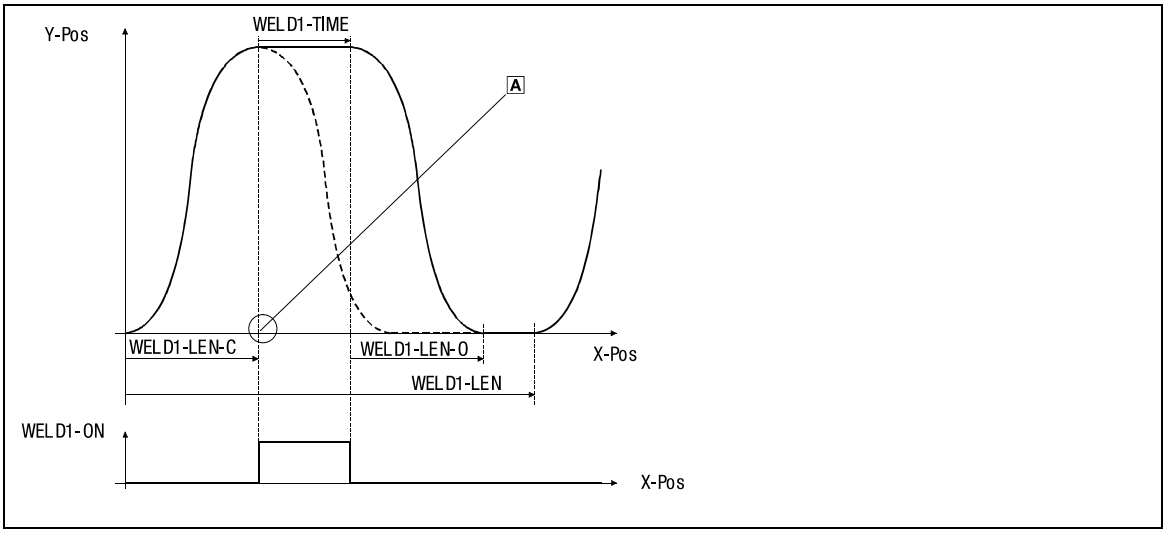
Output of status information

- WELD1-T-ERR = HIGH: The total length and the sum of times of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  – Wrong profile selection
  – Line speed too high

In this case the welding time is automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  – Invert master angle
  – Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



A WELD1-TIME is "frozen" when phase 2 is started by setting C1446 = 2 (distance with saving). The distance "WELD1-TIME" remains constant for the cycle.

3.2.103 Stretching, compression, offset in Y direction (YSET1)

Purpose

Evaluation of the setpoint position of the cam drive (stretching/compression/offset in Y direction).

Note!

If you do not use the function block YSET1, you must set C1313 = 0.

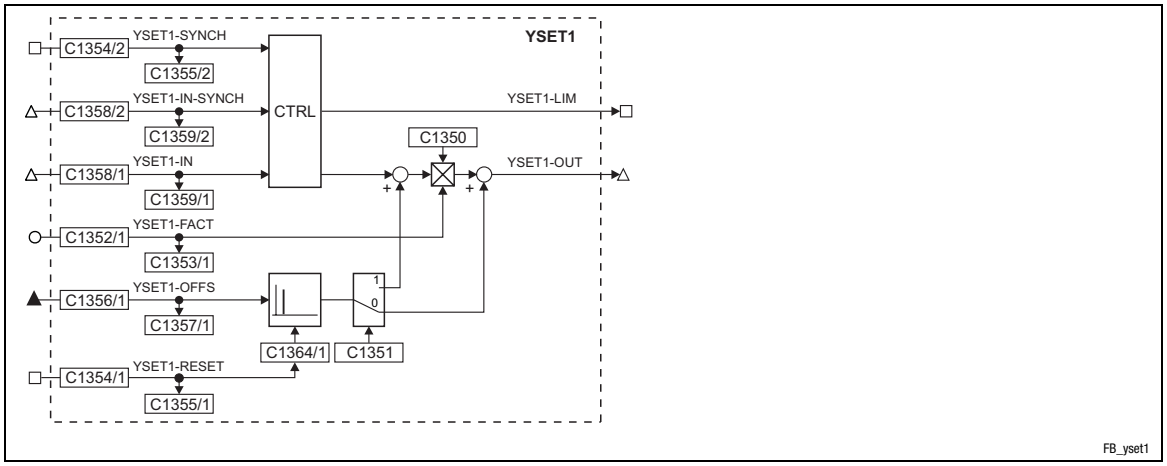


Fig. 3-264 Stretching, compression, offset in Y direction (YSET1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
YSET1-IN	phd	1359/1	dec [inc]	1358/1	4	1000	Input in [rpm]
YSET1-IN-SYNCH	phd	1359/2	dec [inc]	1358/2	4	1000	Input in [rpm]
YSET1-FACT	a	1353/1	dec [abs]	1352/1	1	1000	Stretching/compression factor: ±100 % = no stretching/compression >100 % = stretching < 100% = compression
YSET1-OFFS	ph	1357/1	dec [inc]	1356/1	3	1000	Offset value
YSET1-RESET	d	1355/1	dec [inc]	1354/1	2	1000	Reset of the YSET1-OFFS input
YSET1-SYNCH	d	1355/2	dec [inc]	1354/2	2	1000	Clock pulse input for synchronous switching of the stretching/compression factor
YSET1-LIM	d	-	-	-		-	HIGH = Signal at YSET1-OUT is within the limits (Function is available as of software version 3.4)
YSET1-OUT	phd	-	-	-		-	Setpoint speed of the cam drive Signal is limited to ±29999 rpm No position loss when signal is limited

Function

- Stretching/compression
- Offset
- Reset of the offset
- Stretching/compression of the offset
- Direction reversal

3.2.103.1 Stretching/compression

YSET1-FACT	Stretching/compression	Direction reversal
+100 %	No	No
-100%	No	Yes, in Y position
>100 %	Stretching	No
<100 %	Compression	No
FIXED100%	No	No

Synchronised stretching/compression of drive motion

Synchronised stretching/compression of the drive motion is required for the following:

- If master value and cam drive must run absolutely synchronously and
- the factor must be changed during operation.

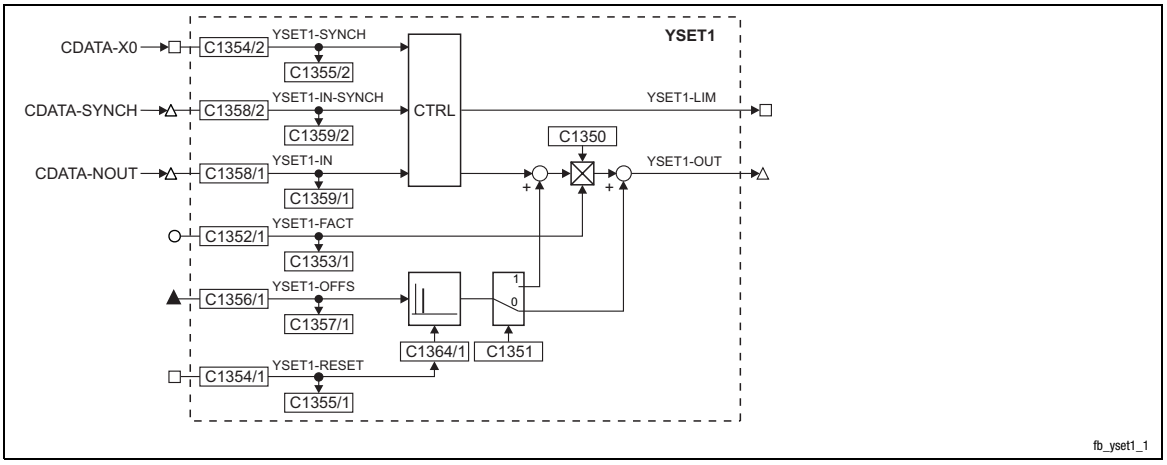
Note!

This function is only valid for the cam drive, not for the master drive!

This function should be used if more than 8 profiles are required to change the lift of the cam drive.

The lift can be changed online via stretching and compression.

Function block interconnection



Activate function

Activate function with C1313 = 1.

The changeover is carried out during zero crossing of the profile.

Note!

Stretching/compression in X direction can be carried out via the input CDATA-XFACT.

3.2.103.2 Offset

Use input YSET1-OFFS to shift the Y position by a constant value.

3.2.103.3 Reset of the offset

The function ”OFFS-RESET mode” has the following effect on the output signal YSET1-OUT:

- C1364/1 = 0: (Lenze setting). Output YSET1-OUT is not affected by
  - signal at input YSET1-RESET,
  - signal at YSET1-OFFS, as long as YSET1-RESET = HIGH.
- C1364/1 = 1: When YSET1-RESET = HIGH, the offset is subtracted from the output signal at YSET1-OUT.

3.2.103.4 Stretching/compression of the offset

With C1351 the offset is automatically adapted to the profile zero according to the extension factor.

- C1351 = 0: no stretching/compression of the offset (Lenze setting)
- C1351 = 1: stretching/compression of the offset

3.2.103.5 Direction reversal

There are two possibilities to reverse the direction of rotation:

1. Via C1350
   - CW rotation: C1350 = 0
   - CCW rotation: C1350 = 1
2. Application of a stretching/compression factor
   - YSET1-FACT = –100 % (see also table in chapter 3.2.103.1)

4 Application examples

Contents

4.1 Replacement of a mechanical cam 4-3
4.2 Welding bar 4-5
4.3 Filling process 4-8
4.4 Mark-controlled cam profile start 4-11

Application examples

4.1 Replacement of a mechanical cam

Select the basic configuration C0005 = 10000 for this application example.

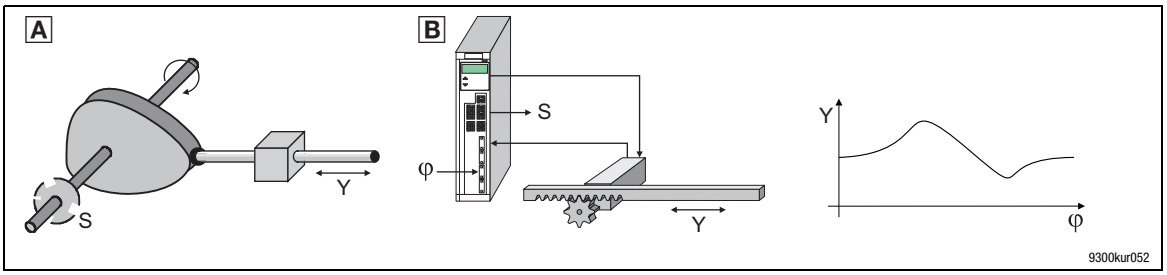


Fig. 4-1 Principle of the mechanical and electronic cam

- A Mechanical cam
- B Electronic cam
- φ Master angle
- Y Setpoint position
- S Camshaft controller

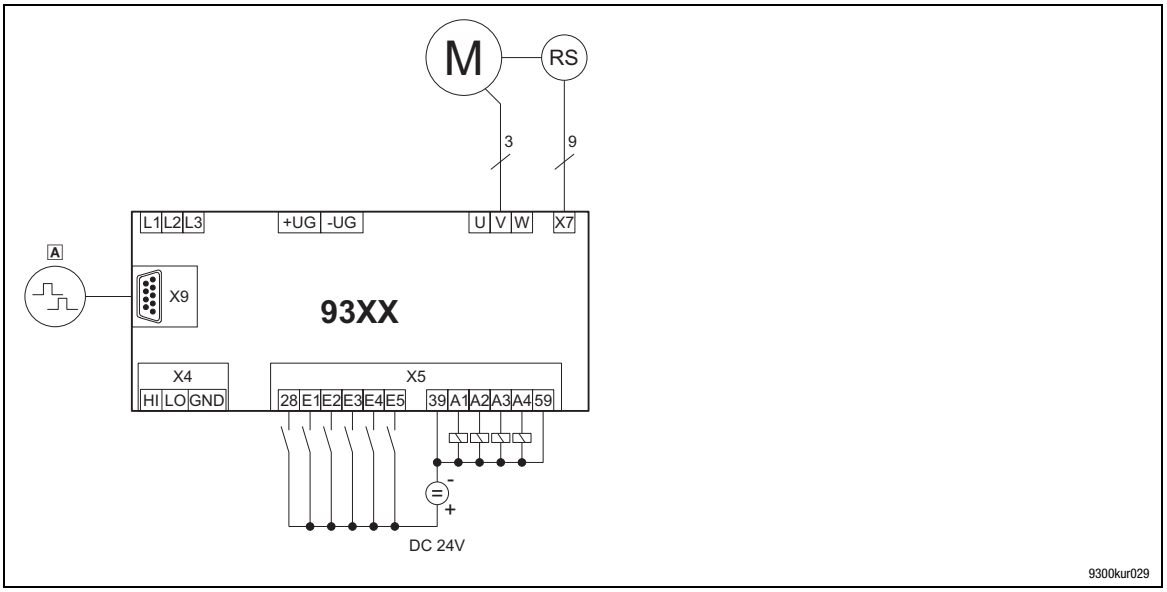


Fig. 4-2 Wiring principle for the controller

- A Master value encoder
- RS Resolver

Features

- Optimum adaptation of motion sequences to the process
- Easy changeover in the case of product changes
- Master value via incremental encoder

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals

Terminal	Function
Analog input 1: X6/1, X6/2	Not assigned
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Terminal layout for profile selection

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes

Code	Function
C0425	Encoder constant of the master value
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch-probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)

For the generation of profile data and its transmission to the controller please refer to the System Manual.

4.2 Welding bar

Select the basic configuration C0005 = 14000 for this application example.

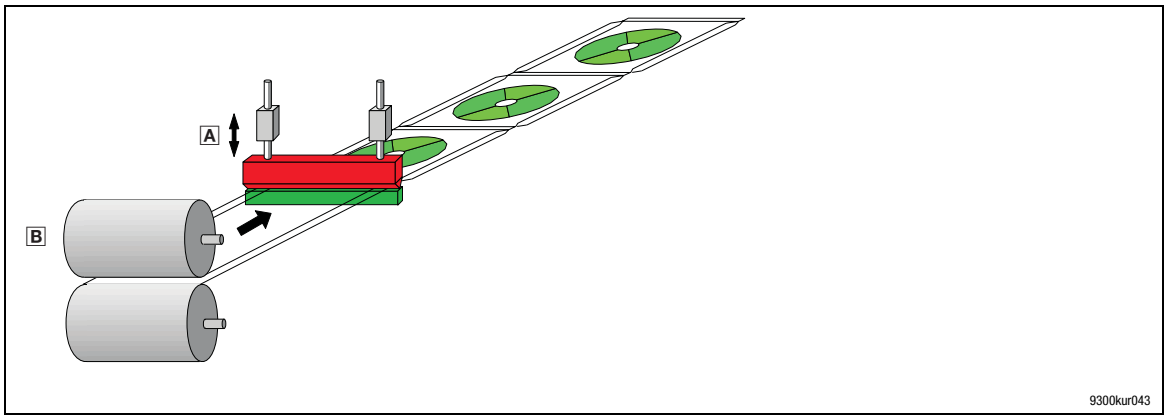


Fig. 4-3 Schematic diagram of a welding bar

- A Welding bar drive
- B Feed drive

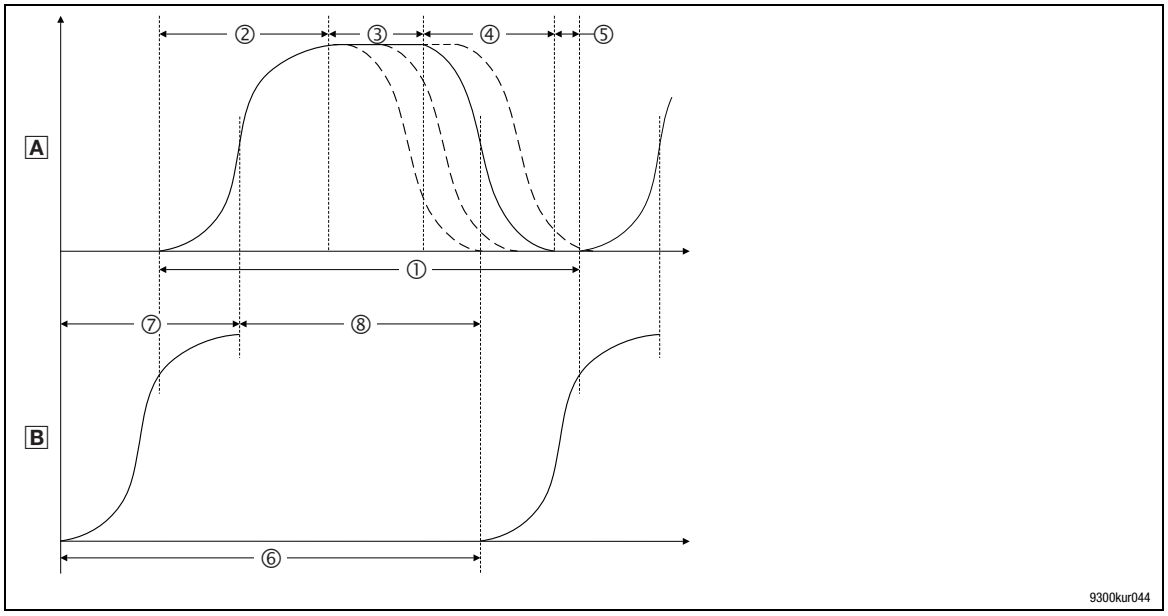


Fig. 4-4 Profiles (in principle)

- A Profile of welding bar drive
- B Profile of feed drive
- ① Machine cycle of welding bar drive
- ② Closing of welding bar (welding bar drive moves)
- ③ Welding time (welding bar drive is at standstill)
- ④ Opening of welding bar (welding bar drive moves)
- ⑤ Standstill phase (welding bar drive is at standstill)
- ⑥ Machine cycle of feed drive
- ⑦ Feed phase (feed drive moves)
- ⑧ Standstill phase (feed drive is at standstill)

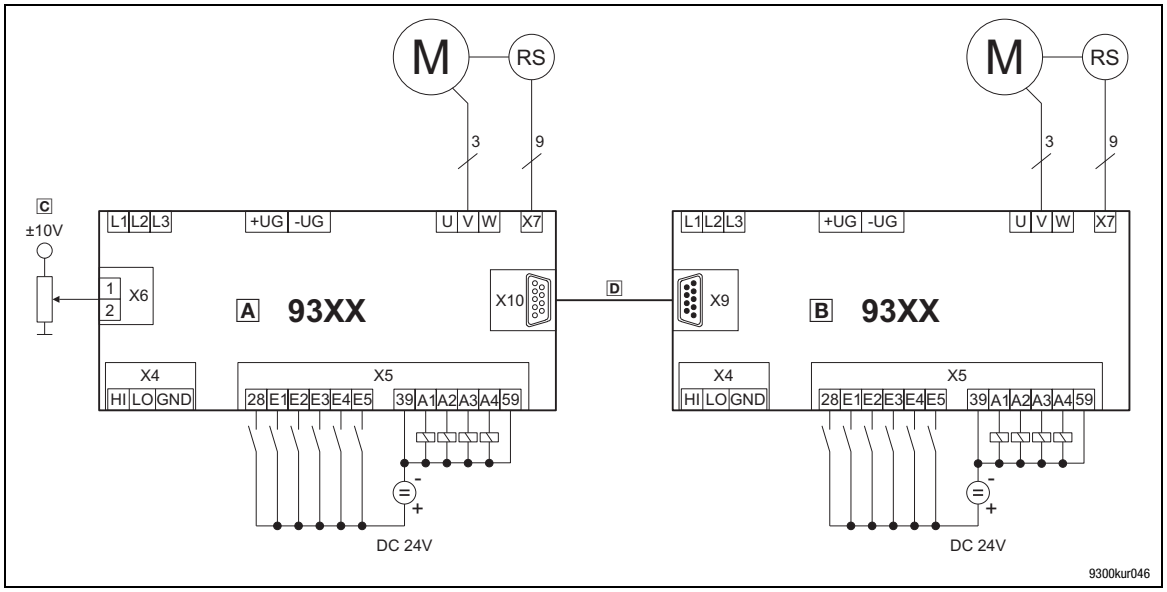


Fig. 4-5 Wiring principle for the controllers

- A Controller for welding bar drive
- B Controller for feed drive
- C Speed setpoint
- D Virtual master value
- RS Resolver

Features

- Speed-independent welding time
- Adjustable welding time
- Easy changeover in the event of material changes
- Material-specific feed
- Virtual master for coordination of feed and welding bar

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Welding time error

Analog signals

Terminal	Function
Analog input 1: X6/1, X6/2	Setpoint of the virtual master
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Digital frequency output X10: virtual master value

Terminal layout for profile selection

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes

Code	Function
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0250	Activation of the master value reduction (C0250 = 1 => reduction value C0472/7 active)
C0472/1	Stretching/compression of X-axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/7	Reduced master value
C0472/10	Torque limit value
C0474/1	Welding time (1 inc. = 1 ms)
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/2	Following error limit (in s_units)

4.3 Filling process

Select the basic configuration C0005 = 13000 or C0005 = 13300 for this application example.

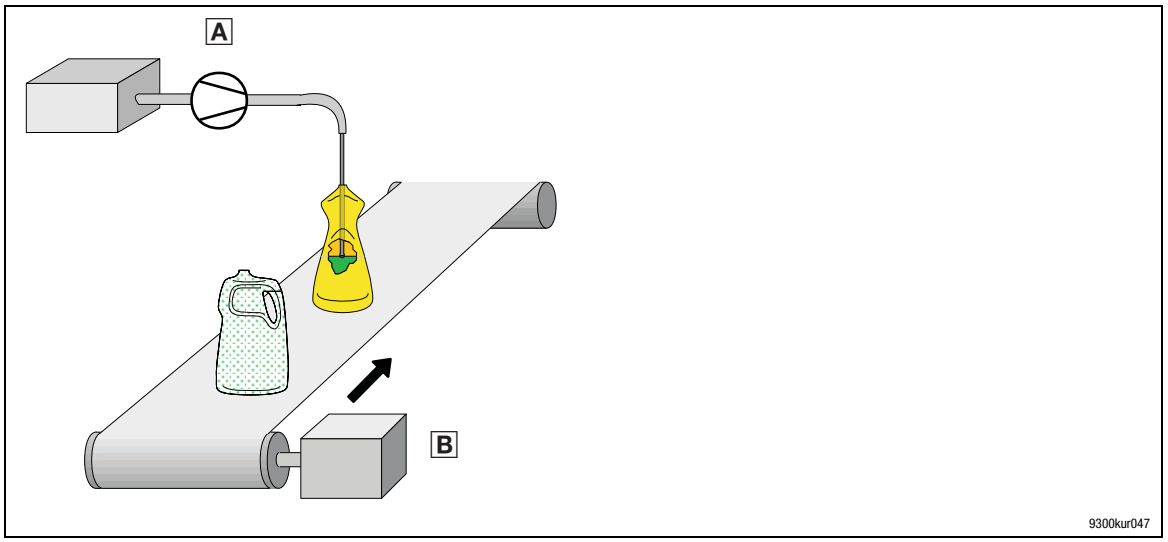


Fig. 4-6 Schematic diagram of a filling device

A Pump drive (cam drive)
B Feed drive

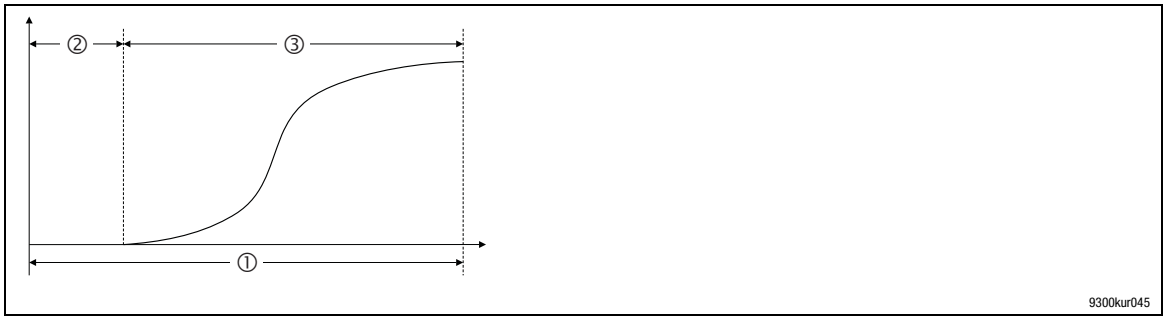


Fig. 4-7 Profile of the pump drive (in principle)

① Machine cycle of pump drive
② Pump drive: standstill phase (drive is at standstill)
Feed drive: feed phase (drive moves)
③ Filling process (pump drive moves)

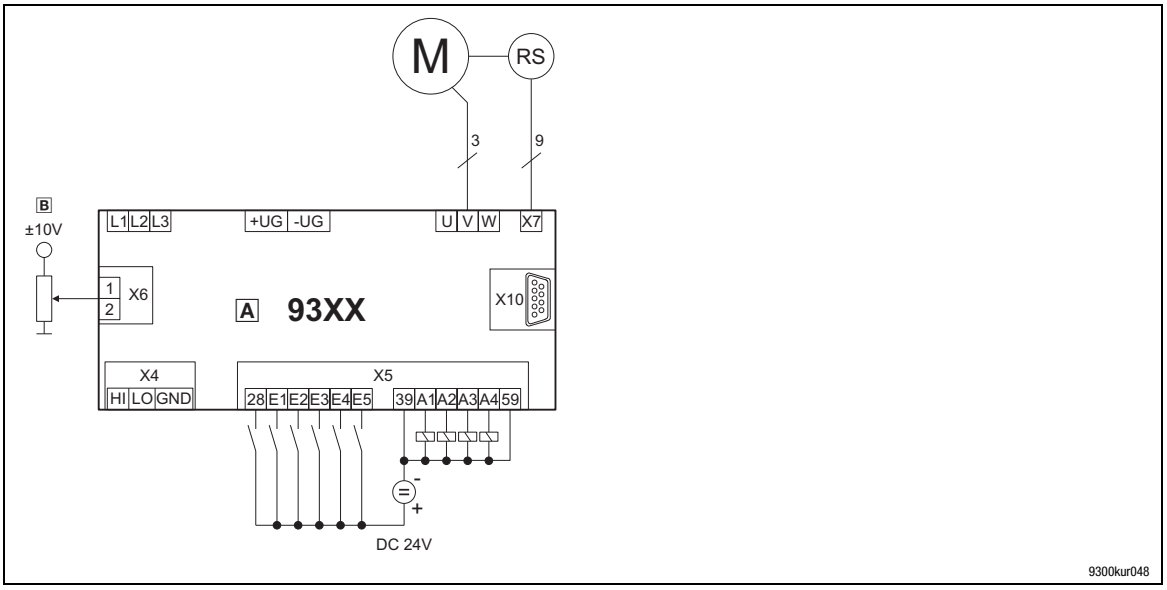


Fig. 4-8 Wiring principle for the controller

A Controller for pump drive
B Speed setpoint
RS Resolver

Features

- Product-specific filling with minimum bubble generation
- Virtual master value
- Product changes possible at every clock pulse
- Option: Switching point for handshake with conveyor belt

Digital signals (C0005 = 13000)

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals (C0005 = 13000)

Terminal	Function
Analog input 1: X6/1, X6/2	Setpoint of virtual master
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Digital frequency output X10: virtual master value

Terminal layout for profile selection (C0005 = 13000)

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes (C0005 = 13000)

Code	Function
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0250	Activation of the master value reduction (C0250 = 1 => reduction value C0472/7 active)
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/7	Reduced master value
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)

4.4 Mark-controlled cam profile start

Select the basic configuration C0005 = 10800 for this application example.

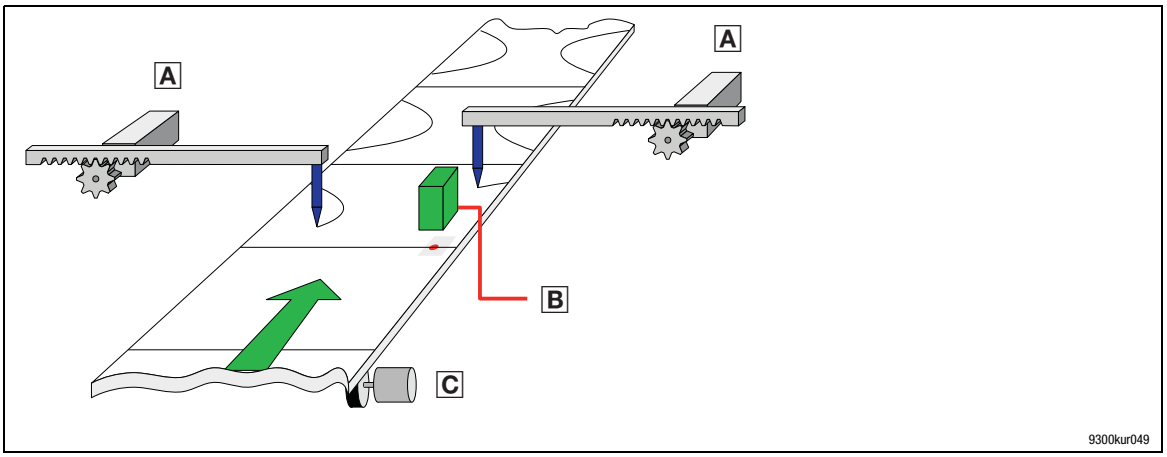


Fig. 4-9 Schematic diagram of a cutting drive

- A Cutting drive
- B Mark sensor
- C Master value encoder

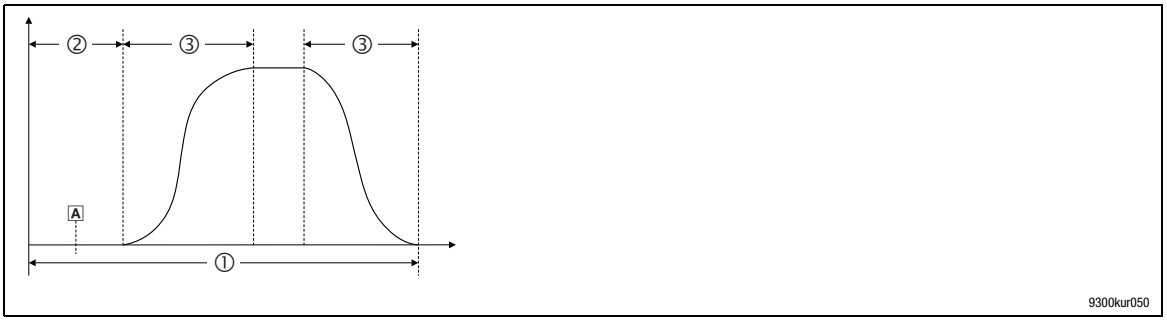


Fig. 4-10 Profile of the cutting drive (in principle)

- ① Machine cycle of cutting drive
- ② Standstill phase (cutting drive is at standstill)
- ③ Machining phase (cutting drive moves)
- A Position of mark sensor

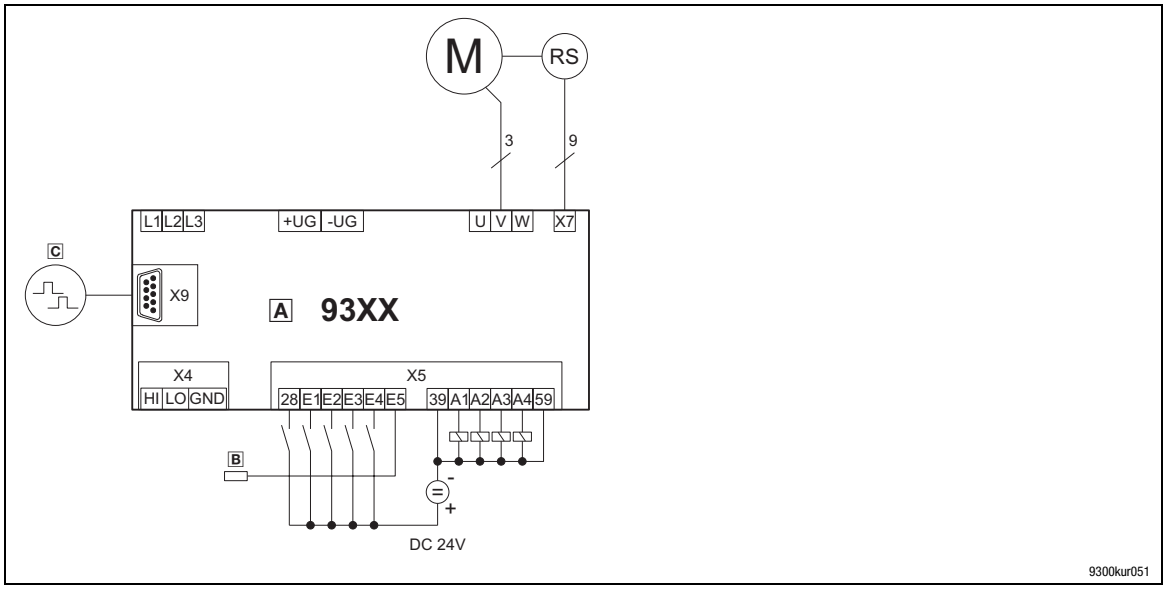


Fig. 4-11 Wiring principle for the controller

- A Controller for cutting drive
- B Mark sensor
- C Master value encoder
- RS Resolver

Features

- Mark-controlled start for the correct position for the cut
- Offset selection for the fine adjustment of the position
- Easy changeover in the case of format changes

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Error reset (TRIP reset) / profile acceptance
X5/E5	Mark signal touch probe X direction
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals

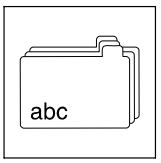
Terminal	Function
Analog input 1: X6/1, X6/2	Not assigned
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Terminal layout for profile selection

Profile no.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	Not selectable			
X5/E3	0	0	1	1				

Application-specific codes

Code	Function
C0425	Encoder constant of the master value
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)



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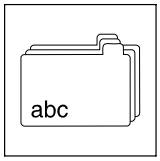

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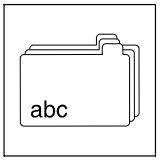
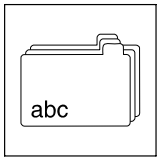


5.1 Glossary

5.1.1 Terminology and abbreviations used

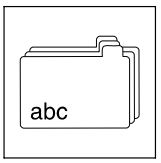
🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter
P_r [kW]	Rated motor power
R [Ω]	Resistance



Appendix

Glossary

S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)



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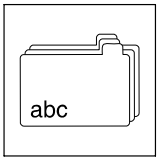

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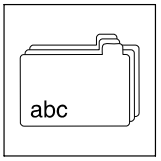

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EDSVS9332K-EXT ■ 13375727 ■ EN ■ 4.0 ■ TD23

10 9 8 7 6 5 4 3 2 1

EDSVS9332P
13440811

Global Drive

System Manual

9300 *0.37 ... 75 kW*

EVS9321xP ... EVS9332xP

Servo position controller

Lenze

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1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual addresses to all persons who dimension, install, commission, and set 9300 servo position controllers.

Together with the System Manual (extension), document number EDSVS9332P-EXT, and the catalogue, it provides the basis for project planning for the mechanical engineer and the plant constructor.

Contents

The System Manual provides the basis for the description of the 9300 servo position controller. Together with the System Manual (extension), document number EDSVS9332P-EXT, a complete System Manual is available:

- ► The features and functions are described in detail.
- ► The parameterisation for typical applications is explained by the use of examples.
- ► In case of doubt, the Mounting Instructions supplied with the 9300 servo position controller are always valid.

Contents of System Manual	Contents of the System Manual (extension)
1 Preface	1 Preface
2 Safety	-
3 Technical data	-
4 Mounting the standard device	-
5 Wiring the standard device	-
6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
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-	4 Application examples
9 Troubleshooting and fault elimination	-
10 DC-bus operation	-
11 Safety engineering	-
12 Accessories	-
13 Appendix	5 Appendix

How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.1.2 Products to which the System Manual applies

This documentation is valid for 9300 servo position controllers from nameplate data:

	①					②	③	Nameplate
	EVS	93xx	–	x	x	Vxx	6x	8x	

Product range

EVS = servo controller

Type no. / rated power

	400V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = panel-mounted unit

C = panel-mounted unit in ”cold plate” technology

Model

P = servo position controller

Variant

– standard

V003 = in ”cold plate” technology

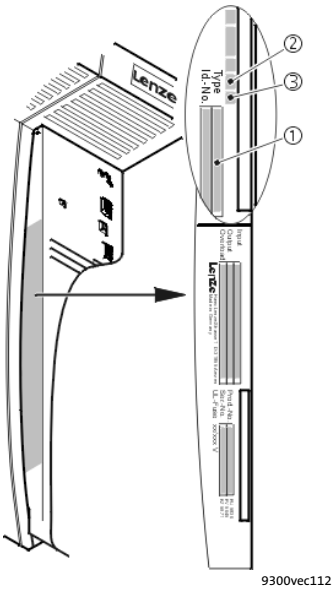
V004 = with ”safe torque off” function

V100 = for IT systems

V104 = with ”safe torque off” function and for IT systems

Hardware version (from 6x)

Software version (from 8.0)



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1.1.3 Document history

What is new / what has changed?

Material number	Version			Description
13440811	5.0	07/2013	TD06	Error corrections
13374993	4.2	03/2012	TD23	Error correction
13374993	4.1	05/2011	TD23	Error correction
13374993	4.0	04/2011	TD23	Extended by functions for software version 8.0 Complete editorial revision and error correction Division of the System Manual into 2 parts (EDSVS9332P and EDSVS9332P-EXT)
00463261	3.0	03/2003	TD23	Error correction and editorial revision
00406175	2.0	02/1999	-	Types 9321 to 9324 with a double overcurrent, new function “Automatic control parameter identification”
00397653	1.0	05/1997	-	First edition

1.2 Legal regulations

Identification

Lenze controllers are unambiguously identified by the contents of the nameplate.

Manufacturer

Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen, Germany

CE conformity

In conformity with EC ”Low Voltage” Directive

Application as directed

9300 servo controllers and accessories

- ► may only be operated under the conditions specified in this System Manual.
- ► are components
  - – for open and closed loop control of variable speed drives with PM synchronous motors, asynchronous standard motors or asynchronous servo motors.
  - – for installation in a machine.
  - – for assembly with other components to form a machine.
- ► comply with the protection requirements of the EC ”Low Voltage” Directive.
- ► are not machines for the purpose of the EC ”Machinery” Directive.
- ► are not to be used as domestic appliances, but only for industrial purposes.

Drive systems with 9300 servo controllers

- ► comply with the EC ”Electromagnetic Compatibility” Directive if they are installed according to the guidelines of CE-typical drive systems.
- ► can be used
  - – for operation on public and non-public mains supplies.
  - – for operation in industrial premises and residential and commercial areas.
- ► The user is responsible for the compliance of the machine application with the EC Directives.

Any other use shall be deemed inappropriate!

Liability

The information, data and notes given in this System Manual met the state of the art at the time of printing. Claims on modifications referring to controllers and components which have already been supplied cannot be derived from the information, illustrations and descriptions contained in this manual.

The procedural notes and circuit details given in this System Manual are suggestions and their transferability to the respective application has to be checked. Lenze does not take any responsibility for the suitability of the given procedures and circuit suggestions.

The specifications given in this System Manual describe the product features without guaranteeing them.

Lenze does not accept any liability for damage and malfunctioning caused by:

- ► Disregarding the System Manual
- ► Unauthorised modifications to the controller
- ► Operating faults
- ► Improper working on and with the controller

Warranty

See terms of sales and delivery of Lenze Automation GmbH.

Warranty claims must be made to Lenze immediately after detecting the deficiency or fault.

The warranty is void in all cases where liability claims cannot be made.

2 Safety instructions

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2.1 General safety information

Scope

The following general safety instructions apply to all Lenze drive and automation components.

The product-specific safety and application notes given in this documentation must be observed!

Note for UL-approved systems: UL warnings are notes which only apply to UL systems. The documentation contains specific notes with regard to UL.

For your own safety

Danger!

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

► Lenze drive and automation components ...

... must only be used for the intended purpose.

... must never be operated if damaged.

... must never be subjected to technical modifications.

... must never be operated unless completely assembled.

... must never be operated without the covers/guards.

... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.

► All specifications of the corresponding enclosed documentation must be observed.

This is vital for a safe and trouble-free operation and for achieving the specified product features.

The procedural notes and circuit details provided in this document are proposals which the user must check for suitability for his application. The manufacturer does not accept any liability for the suitability of the specified procedures and circuit proposals.

► Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.

According to IEC 60364 or CENELEC HD 384, these are persons ...

... who are familiar with the installation, assembly, commissioning and operation of the product,

... possess the appropriate qualifications for their work,

... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.

Transport, storage

► Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.

– Protect against dust and shocks.

– Comply with climatic conditions according to the technical data.

Mechanical installation

- Install the product according to the regulations of the corresponding documentation. In particular observe the section ”Operating conditions” in the chapter ”Technical data”.
- Provide for a careful handling and avoid mechanical overload. During handling neither bend components, nor change the insulation distances.
- The product contains electrostatic sensitive devices which can easily be damaged by short circuit or static discharge (ESD). Thus, electronic components and contacts must not be touched unless ESD measures are taken beforehand.

Electrical installation

- Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in the documentation.
- When working on live products, observe the applicable national regulations for the prevention of accidents (e.g. BGV 3).
- The documentation contains information about EMC-compliant installation (shielding, earthing, arrangement of filters and laying cables). The system or machine manufacturer is responsible for compliance with the limit values required by EMC legislation.
  Warning: The controllers are products which can be used in category C2 drive systems as per EN 61800-3. These products may cause radio interference in residential areas. If this happens, the operator may need to take appropriate action.
- For compliance with the limit values for radio interference emission at the site of installation, the components - if specified in the technical data - have to be mounted in housings (e. g. control cabinets). The housings have to enable an EMC-compliant installation. In particular observe that for example control cabinet doors preferably have a circumferential metallic connection to the housing. Reduce openings or cutouts through the housing to a minimum.
- Only plug in or remove pluggable terminals in the deenergised state!

Commissioning

- If required, you have to equip the system with additional monitoring and protective devices in accordance with the respective valid safety regulations (e. g. law on technical equipment, regulations for the prevention of accidents).
- Before commissioning remove transport locking devices and keep them for later transports.

Operation

- Keep all protective covers and doors closed during operation.

Safety functions

- Without a higher-level safety system, the described product must neither be used for the protection of machines nor persons.
- Certain controller versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”).
  The notes on the safety functions provided in the documentation of the versions must be observed.

Maintenance and servicing

- The components are maintenance-free if the required operating conditions are observed.
- If the cooling air is polluted, the cooling surfaces may be contaminated or the air vents may be blocked. Under these operating conditions, the cooling surfaces and air vents must be cleaned at regular intervals. Never use sharp objects for this purpose!
- Only replace defective fuses in the deenergised state to the type specified.
- After the system has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors may be charged. Please observe the corresponding notes on the device.

Disposal

- Recycle metals and plastic materials. Ensure professional disposal of assembled PCBs.

2.2 Thermal motor monitoring

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

2.2.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for $I^2 \times t$ monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the $I^2 \times t$ load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for $I^2 \times t$ load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the $I^2 \times t$ load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the $I^2 \times t$ load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	$I^2 \times t$ load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

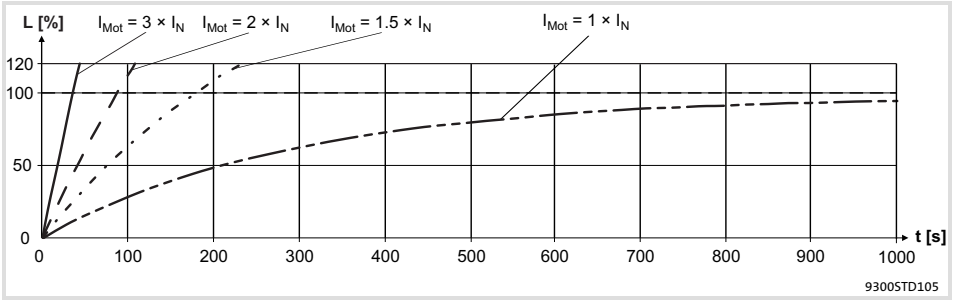

Fig. 2.2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L $I^2 \times t$ load of the motor (display: C0066)
T Time

2.2.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

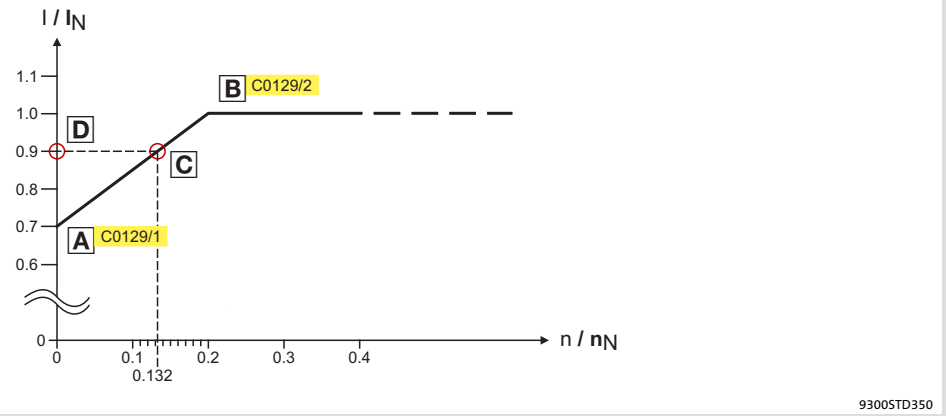

Fig. 2.2-2 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 2.2-2) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

- Point A: Definition with **C0129/1**
  This value also enables an increase of the maximally permissible load.
- Point B: Definition with **C0129/2**
  With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 2.2-2, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (C on the characteristic (A) ... B). D can also be calculated using the values in **C0129/1**and **C0129/2** (evaluation coefficient "y", 2.2-4).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient "y").

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	ln	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

2.3 Residual hazards

Protection of persons

- According to their enclosure, Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their components can carry a voltage, or parts of the controllers can move or rotate during operation. Surfaces can be hot.
  - If the required cover is removed, the controllers are used inappropriately or installed or operated incorrectly, severe damage to persons or material assets can occur.
  - For more detailed information please see the documentation.
- There is a high amount of energy within the controller. Therefore always wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard) when working on the controller when it is live.
- Before working on the controller, check if no voltage is applied to the power terminals.
  - the power terminals U, V, W, +UG and -UG still carry dangerous voltage for at least 3 minutes after power-off.
  - the power terminals L1, L2, L3; U, V, W, +UG and -UG carry dangerous voltage when the motor is stopped.
- Before power-off during DC-bus operation, all controllers must be inhibited and disconnected from the mains.
- The discharge current to PE potential is > 3.5 mA. In accordance with EN 61800-5-1
  - a fixed installation is required.
  - the design of the PE conductor has to be double or, in the case of a single design, must have a cable cross-section of at least 10 mm^2.
- The controller can only be safely disconnected from the mains via a contactor on the input side.
- During parameter set transfer the control terminals of the controller can have undefined states.
  - Therefore the connectors X5 and X6 must be disconnected from the controller before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

- Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side:
  - Type B for the connection to a three-phase system
  - Type A or type B for the connection to a single phase system

  Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer.

Device protection

- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xP and EVS9322-xP.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xP ... EVS9332-xP.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

Motor protection

- For some controller settings, the connected motor may overheat (e.g. when operating the DC injection brake or a self-ventilated motor at low speed for longer periods).
  - Using an overcurrent relay or a temperature monitoring device provides a large degree of protection against overload.
  - We recommend to use PTC thermistors or thermal contacts for motor temperature monitoring. (Lenze three-phase AC motors are equipped with thermal contacts (NC contacts) as standard)
  - PTC thermistors or thermal contacts can be connected to the controller.
- Drives can attain dangerous overspeeds (e.g. setting of high output frequencies with motors and machines not qualified for this purpose).

2.4 Safety instructions for the installation according to UL

Warnings!

- ► Motor Overload Protection
  - – For information on the protection level of the internal overload protection for a motor load, see the corresponding manuals or software helps.
  - – If the integral solid state motor overload protection is not used, external or remote overload protection must be provided.
- ► Branch Circuit Protection
  - – The integral solid state protection does not provide branch circuit protection.
  - – Branch circuit protection has to be provided externally in accordance with corresponding instructions, the National Electrical Code and any additional codes.
- ► Please observe the specifications for fuses and screw-tightening torques in these instructions.
- ► EVS9321 ... EVS9326:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by CC, J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +55 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 75 °C copper wire only.
- ► EVS9327 ... EVS9329:
  - – Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
  - – Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
  - – Maximum surrounding air temperature: 0 ... +50 °C
  - – > +40 °C: reduce the rated output current by 2.5 %/°C
  - – Use 60/75 °C or 75 °C copper wire only.

► EVS9330 ... EVS9332:
– Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 480 V maximum, when protected by fuses.
– Suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 V maximum, when protected by J, T or R class fuses.
– Maximum surrounding air temperature: 0 ... +50 °C
– > +40 °C: reduce the rated output current by 2.5 %/°C
– Use 60/75 °C or 75 °C copper wire only.

3 Technical data

Contents

3.1 General data and operating conditions 3.1-1
3.2 Open and closed loop control 3.2-1
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3.1 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
	2004/108/EG	EMC Directive	
Approval			
UL	cULus	Power Conversion Equipment (File No. E132659)	

Protection of persons and equipment			
Type of protection	EN 60529	IP20	
		IP41 in case of thermally separated installation (push-through technique) between the control cabinet (inside) and the environment.	
	NEMA 250	Protection against accidental contact in accordance with type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe regulations and safety instructions!
Insulation of control circuits	EN 61800-5-1	Safe mains isolation by double (reinforced) insulation for terminals X1 and X5. Basic insulation (single isolating distance) for terminals X3, X4, X6, X7, X8, X9, X10 and X11.	
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Protective measures		Against short circuit, earth fault (earth-fault protected during mains connection, limited earth-fault protection during operation), overvoltage, motor overtemperature (input for PTC or thermal contact)	

EMC			
Noise emission	IEC/EN 61800-3	Cable-guided, up to 10 m motor cable length with mains filter A: category C2.	
		Radiation, with mains filter A and installation in control cabinet: category C2	
Interference immunity	IEC/EN 61800-3	Category C3	

Operating conditions

Ambient conditions			
Climatic			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +55 °C)	< 6 months
		1K3 (-25 ... +40 °C)	> 6 months > 2 years: anodise DC bus capacitors
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation			
EVS9321 ... EVS9326	IEC/EN 60721-3-3	3K3 (0 ... +55 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
EVS9327 ... EVS9332		3K3 (0 ... +50 °C) > +40 °C: reduce the rated output current by 2.5 %/°C.	
Pollution	EN 61800-5-1	Degree of pollution 2	

Ambient conditions		
Site altitude		< 4000 m amsl > 1000 m amsl: reduce the rated output current by 5 %/ 1000 m
Mechanical		
Vibration resistance	EN 50178 EN 61800-5-1 Germanischer Lloyd, general conditions	Tested according to "General Vibration Stress Characteristic 1"
Electrical		
AC-mains connection		
Max. mains voltage range		320 V - 0 % ... 528 V + 0 %
Mains frequency		45 Hz - 0 % ... 65 Hz + 0 %
Power system TT, TN		Operation permitted without restrictions with earthed neutral.
Power system IT		Operation only permitted with the device variants V024 or V100. Operation permitted without restrictions with insulated neutral. Observe instructions on specific measures!
Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
		Total output at the mains: Compliance with the requirements [1)] < 1 kW: With mains choke. > 1 kW: Without additional measures.
		[1)] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!
DC-mains connection		
Max. mains voltage range		450 V - 0 % ... 740 V + 0 %
Operating conditions		DC voltage must be symmetrical to PE. The controller will be destroyed when $+U_G$ or $-U_G$ are earthed.
Motor connection		
Length of the motor cable		< 50 m No additional output filters are required at a rated mains voltage and a switching frequency of 8 kHz. If EMC requirements have to be met, the permissible cable length may be affected.

Mounting conditions		
Mounting place		In the control cabinet
Mounting position		Vertical
Free spaces Dimensions Weights		📖 4-1

3.2 *Open and closed loop control*

Open and closed loopcontrol		
Switching frequency	8 kHz or 16 kHz	
Digital setpoint selection		
Accuracy	± 0.005 Hz (= ± 100 ppm)	
Analog setpoint selection		
Linearity	± 0.15 %	Signal level: 5 V or 10 V
Temperature sensitivity	± 0.1 %	0 ... 50 °C
Offset	± 0.1 %	
Analog inputs Analog outputs	• 2 inputs (bipolar) • 2 outputs (bipolar)	
Digital inputs Digital outputs	• 5 inputs (freely assignable) • 1 input for controller inhibit • 4 outputs (freely assignable) • 1 resolver input; design: 9-pole Sub-D socket • 1 incremental encoder input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin) • 1 digital frequency input (500 kHz, TTL level); design: 9-pole Sub-D socket (pin); can be optionally used as incremental encoder input (500 kHz, TTL level) • 1 digital frequency output (500 kHz, TTL level); design: 9-pole Sub-D socket	
Cycle times		
Digital inputs	1 ms	
Digital outputs	1 ms	
Analog inputs	1 ms	
Analog outputs	1 ms (smoothing time: τ= 2 ms)	

3.3 Rated data

Note!

The controllers EVS9324, EVS9326 and EVS9328 ... EVS9333 may only be operated with the prescribed mains chokes and mains filters.

3.3.1 Operation at 400 V

Basis of the data			
		Voltage	**Frequency**
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	**Mains current [1]**		**Typical motor power**		**Output power**		**Power loss**
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xP	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xP	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xP	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xP	7.0	–	3.0	4.0	**4.8**	0.75	200
EVS9325-xP	12.0	16.8	5.5	7.5	**9.0**	0	260
EVS9326-xP	20.5	–	11.0	15.0	**16.3**	0	390
EVS9327-xP	27.0	43.5	15.0	20.0	**22.2**	10	430
EVS9328-xP	44.0	–	22.0	30.0	**32.6**	4	640
EVS9329-xP	53.0	–	30.0	40.0	**40.9**	0	810
EVS9330-xP	78.0	–	45.0	60.0	**61.6**	5	1100
EVS9331-xP	100	–	55.0	75.0	**76.2**	0	1470
EVS9332-xP	135	–	75.0	100	**100.5**	0	1960

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency

2) Switching frequency of the inverter

3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xP	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xP	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xP	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xP	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xP	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xP	**23.5**	35.3	23.5	15.3	23.0	15.3
EVS9327-xP	**32.0**	48.0	32.0	20.8	31.2	20.8
EVS9328-xP	**47.0**	70.5	47.0	30.6	45.9	30.6
EVS9329-xP	**59.0**	88.5	52.0	38.0	57.0	33.0
EVS9330-xP	**89.0**	133.5	80.0	58.0	87.0	45.0
EVS9331-xP	**110**	165	110	70.0	105	70.0
EVS9332-xP	**145**	21.5	126	90.0	135	72.0

Bold print = Lenze setting

1) Switching frequency of the inverter

2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xP	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xP	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xP	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xP	7.0	–	3.0	4.0	**5.8**	0.75	200
EVS9325-xP	12.0	16.8	5.5	7.5	**10.8**	0	260
EVS9326-xP	20.5	–	11.0	15.0	**18.5**	0	390
EVS9327-xP	27.0	43.5	18.5	25.0	**25.0**	12	430
EVS9328-xP	44.0	–	30.0	40.0	**37.0**	4.8	640
EVS9329-xP	53.0	–	37.0	50.0	**46.6**	0	810
EVS9330-xP	78.0	–	45.0	60.0	**69.8**	6	1100
EVS9331-xP	100	–	55.0	75.0	**87.3**	0	1470
EVS9332-xP	135	–	90.0	125	**104**	6	1960

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents					
	8 kHz [1]			16 kHz [1]		
	Rated current	Maximum current [2]	Standstill current	Rated current	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xP	**1.5**	2.25	2.3	1.1	1.65	1.7
EVS9322-xP	**2.5**	3.75	3.8	1.8	2.7	2.7
EVS9323-xP	**3.9**	5.85	5.9	2.9	4.35	4.4
EVS9324-xP	**7.0**	10.5	10.5	5.2	7.8	7.8
EVS9325-xP	**13.0**	19.5	19.5	9.7	14.6	14.6
EVS9326-xP	**22.3**	33.5	22.3	14.5	21.8	14.5
EVS9327-xP	**30.4**	45.6	30.4	19.2	28.8	19.2
EVS9328-xP	**44.7**	67.1	44.7	28.2	42.3	28.2
EVS9329-xP	**56.0**	84.0	49.0	35.0	52.5	25.0
EVS9330-xP	**84.0**	126	72.0	55.0	82.5	36.0
EVS9331-xP	**105**	157.5	105	65.0	97.5	58.0
EVS9332-xP	**125**	187.5	111	80.0	120	58.0

Bold print = Lenze setting
1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 1 minute overcurrent duration and 2 minutes base load duration at max. 75 % I_r

3.3.3 Overcurrent operation

Under the operating conditions described here, the EVS9321-xP ... EVS9324-xP controllers can supply a rated output current which is up to twice as high.

Note!

If you enter values > 1.5 × rated output current under C0022, the controller switches to overcurrent operation.

- ► Switching between overcurrent operation and standard operation is only possible if the controller is inhibited (X5/28 = LOW).
- ► The continuous current is automatically reduced to 70 % of the rated output current.

3.3.3.1 Operation at 400 V

Basis of the data			
		Voltage	Frequency
AC mains connection	[V_{rated}]	3/PE AC 320 V - 0 % ... 440 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC-mains connection (alternatively)	[U_{DC}]	DC 450 V - 0 % ... 620 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 approx. 94 % V_{rated}	–
Without mains choke		3 ~ 0 ... U_N	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xP	1.5	2.1	0.37	0.5	**1.0**	2.0	100
EVS9322-xP	2.5	3.5	0.75	1.0	**1.7**	0.75	110
EVS9323-xP	3.9	5.5	1.5	2.0	**2.7**	2.2	140
EVS9324-xP	7.0	–	3.0	4.0	**4.8**	0.75	200

Bold print = Lenze setting

1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xP	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xP	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xP	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xP	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.3.3.2 Operation at 480 V

Basis of the data			
		Voltage	Frequency
Supply			
3/PE 480 V AC	[U_r]	320 V - 0 % ... 528 V + 0 %	45 Hz - 0 % ... 65 Hz + 0 %
DC 678 V (alternatively)	[U_{DC}]	460 V - 0 % ... 740 V + 0 %	–
Output voltage			
With mains choke		3 ~ 0 ... approx. 94 % U_r	–
Without mains choke		3 ~ 0 ... U_r	–

9300	Mains current [1]		Typical motor power		Output power		Power loss
	With mains choke	Without mains choke	ASM (4-pole)		8 kHz [2] U, V, W	$+U_G$, $-U_G$ [3]	
Type	I_r [A]	I_r [A]	P_r [kW]	P_r [hp]	S_{r8} [kVA]	P_{DC} [kW]	P_V [W]
EVS9321-xP	1.5	2.1	0.37	0.5	**1.2**	2.0	100
EVS9322-xP	2.5	3.5	0.75	1.0	**2.1**	0.75	110
EVS9323-xP	3.9	5.5	1.5	2.0	**3.2**	2.2	140
EVS9324-xP	7.0	–	3.0	4.0	**5.8**	0.75	200

Bold print = Lenze setting
1) Mains currents at 8 kHz switching frequency
2) Switching frequency of the inverter
3) Power which can additionally be drawn from the DC bus at operation with power-adapted motor

9300	Output currents							
	8 kHz [1]				16 kHz [1]			
	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current	Rated current	Continuous thermal current [3]	Maximum current [2]	Standstill current
Type	I_{r8} [A]	I_{r8} [A]	I_{M8} [A]	I_{08} [A]	I_{r16} [A]	I_{r16} [A]	I_{M16} [A]	I_{016} [A]
EVS9321-xP	1.5	1.05	3.0	3.0	1.1	0.77	2.2	2.2
EVS9322-xP	2.5	1.75	5.0	5.0	1.8	1.26	3.6	3.6
EVS9323-xP	3.9	2.73	7.8	7.8	2.9	2.03	5.8	5.8
EVS9324-xP	7.0	4.9	14.0	14.0	5.2	3.64	10.4	10.4

1) Switching frequency of the inverter
2) The currents apply to a periodic load change cycle with max. 10 seconds overcurrent duration and 50 seconds base load duration at max. 44 % of the rated current
3) 70 % of the rated current

3.4 Current characteristics

The maximum output current of the EVS9326 ... EVS9332 devices is limited under certain operating conditions:

- At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K > 40° C.
- The current limitation depends on the switching frequency.

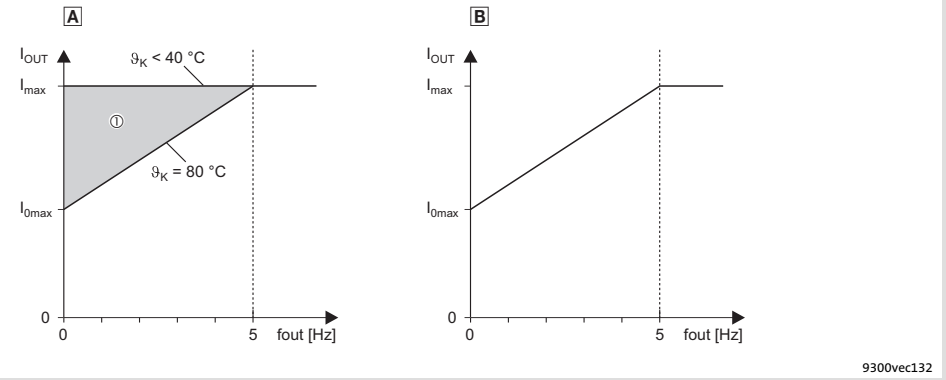

Fig. 3.4-1 Current derating characteristics

A Operation at switching frequency f_{chop} = 8 kHz (C0018 = 1)
The current limitation follows the characteristic curve
At output frequencies f_{out} < |5 Hz| and heatsink temperatures ϑ_K = 40 ... 80 °C, the current limit is steplessly adjusted in the ① range

B Operation at switching frequency f_{chop} = 16 kHz (C0018 = 2)
The current limitation follows the characteristic curve and is independent of the heatsink temperature

At automatic change-over of the switching frequency (C0018 = 0), the controller operates at f_{chop} = 16 kHz. The current limitation follows the characteristic curve B.

If an increased torque is required (e.g. acceleration processes), the controller automatically switches over to f_{chop} = 8 kHz. The current limitation follows the characteristic curve A.

9300	I_{0max} [A] 1)		I_{0max} [A] 2)	
	f_{chop} = 8 kHz		f_{chop} = 16 kHz	
	U_{mains}		U_{mains}	
	400 V	480 V	400 V	480 V
EVS9326-xP	23.5	22.3	15.3	14.5
EVS9327-xP	32.0	30.4	20.8	19.2
EVS9328-xP	47.0	44.7	30.6	28.2
EVS9329-xP	52.0	49.0	33.0	25.0
EVS9330-xP	80.0	72.0	45.0	36.0
EVS9331-xP	110	105	70.0	58.0
EVS9332-xP	126	111	72.0	58.0

1) Maximum available output current at an output frequency f_{out} = |0 Hz| and heatsink temperature ϑ_K = 80 °C
2) Maximum available output current at an output frequency f_{out} = |0 Hz|

4 Installation of the standard device

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4.1 Standard devices in the power range 0.37 ... 11 kW

4.1.1 Important notes

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**P [kg]	EVS93xx-**C**P [kg]
EVS9321-xP	4.0	3.1
EVS9322-xP	4.0	3.1
EVS9323-xP	5.5	3.9
EVS9324-xP	5.5	3.9
EVS9325-xP	7.4	5.2
EVS9326-xP	7.4	5.2

4.1.2 Mounting with fixing rails (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity	
		EVS9321-EP ... EVS9324-EP	EVS9325-EP EVS9326-EP
Fixing rails	Drive controller fixing	2	4

Dimensions

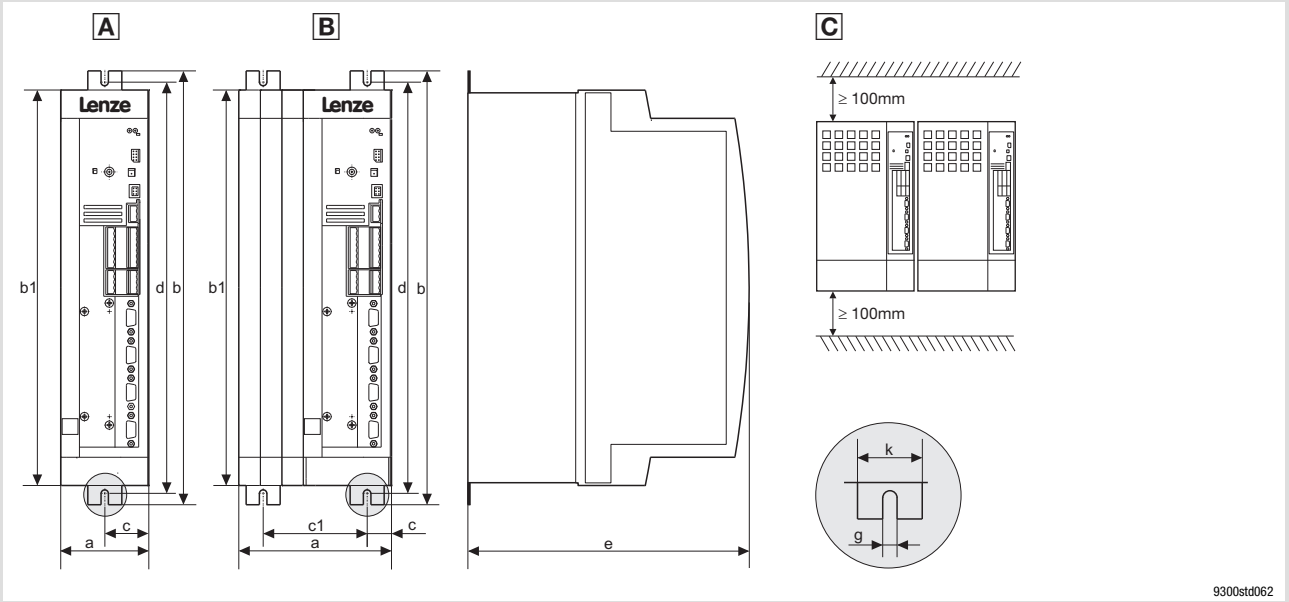


Fig. 4.1-1 Standard mounting with fixing rails 0.37 ... 11 kW

C Drive controllers can be mounted side by side without spacing

9300		Dimensions [mm]									
Type		a	b	b1	c	c1	d	d1	e [1]	g	k
EVS9321-EP EVS9322-EP	A	78	384	350	39	-	365	–	250	6.5	30
EVS9323-EP EVS9324-EP	A	97	384	350	48.5	-	365	–	250	6.5	30
EVS9325-EP EVS9326-EP	B	135	384	350	21.5	92	365	–	250	6.5	30

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing rails to the housing of the drive controller.

4.1.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique you have to use the controller type EVS93xx-**E**P. Additionally you will require the mounting set for push-through technique:

Type	Mounting set
EVS9321-EP, EVS9322-EP	EJ0036
EVS9323-EP, EVS9324-EP	EJ0037
EVS9325-EP, EVS9326-EP	EJ0038

Dimensions

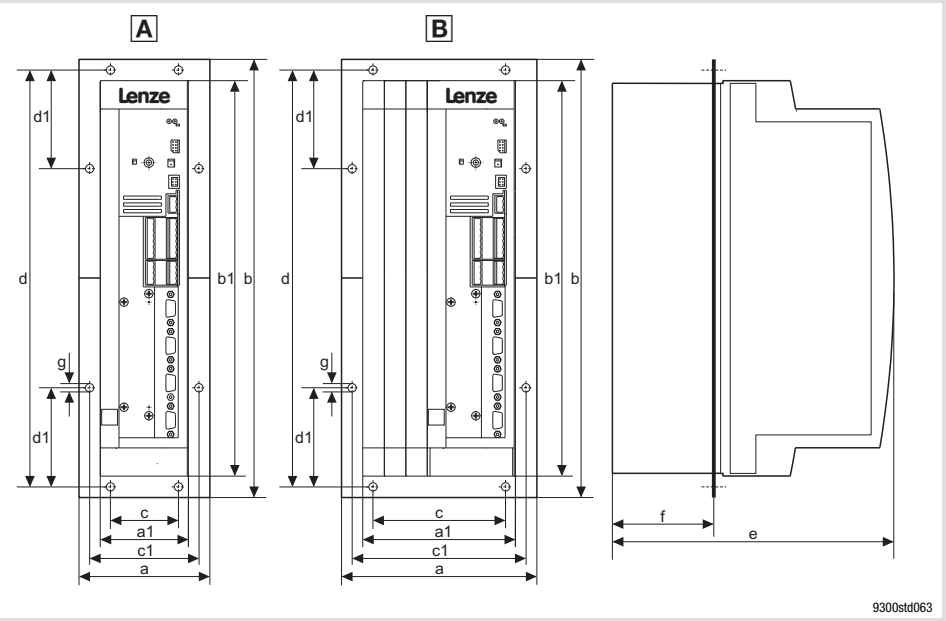


Fig. 4.1-2 Dimensions for thermally separated mounting 0.37 ... 11 kW

9300		Dimensions [mm]										
Type		a	a1	b	b1	c	c1	d	d1	e [1]	f	g
EVS9321-EP EVS9322-EP	A	112.5	78	385.5	350	60	95.5	365.5	105.5	250	92	6.5
EVS9323-EP EVS9324-EP	A	131.5	97	385.5	350	79	114.5	365.5	105.5	250	92	6.5
EVS9325-EP EVS9326-EP	B	169.5	135	385.5	350	117	152.5	365.5	105.5	250	92	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300		Dimensions [mm]	
Type		Width	Height
EVS9321-EP EVS9322-EP	A	82	350
EVS9323-EP EVS9324-EP	A	101	350
EVS9325-EP EVS9326-EP	B	139	350

4.1.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Px must be used.

Mounting material required from the scope of supply:

Description	Use	Quantity		
		EVS9321-CP EVS9322-CP	EVS9323-CP EVS9324-CP	EVS9325-CP EVS9326-CP
Fixing bracket	Controller fixing	2	2	2
Sheet metal screw 3.5 × 13 mm (DIN 7981)	Mounting the fixing bracket to the controller	6	6	6

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- ► Good thermal connection to the cooler
  - – The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - – Plane contact surface, max. deviation 0.05 mm.
  - – When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- ► Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9321-CP	24	1.45
EVS9322-CP	42	0.85
EVS9323-CP	61	0.57
EVS9324-CP	105	0.33
EVS9325-CP	180	0.19
EVS9326-CP	360	0.10

Ambient conditions

- ► The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- ► Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

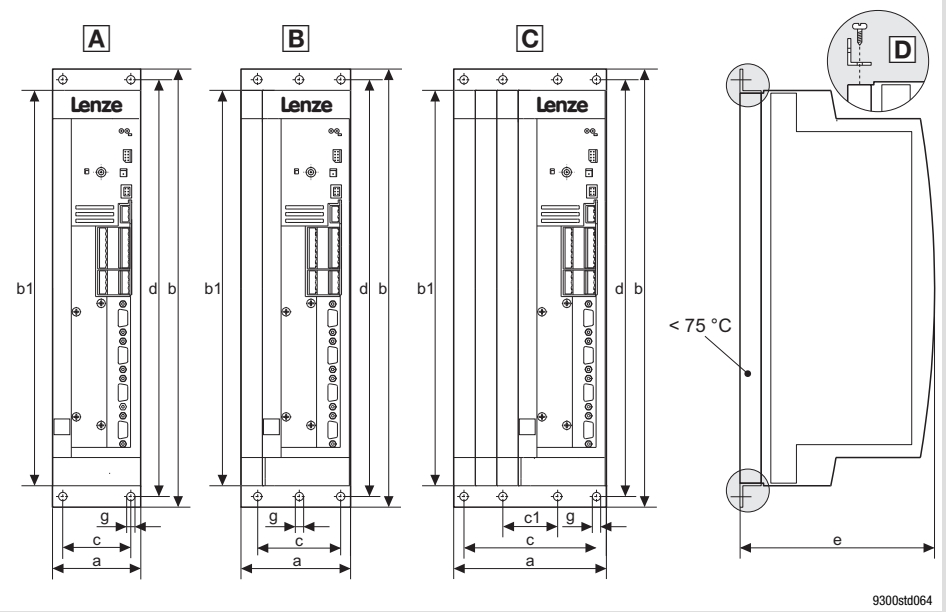


Fig. 4.1-3 Dimensions for mounting in "cold plate" technique 0.37 ... 11 kW

9300		Dimensions [mm]							
Type		a	b	b1	c	c1	d	e [1]	g
EVS9321-CP EVS9322-CP	A	78	381	350	48	–	367	168	6.5
EVS9323-CP EVS9324-CP	B	97	381	350	67	–	367	168	6.5
EVS9325-CP EVS9326-CP	C	135	381	350	105	38	367	168	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

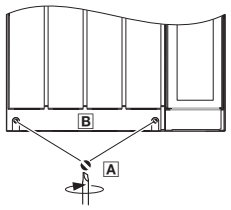
1. Fasten the fixing bracket with sheet metal screws 3.5 × 13 mm at the top and bottom of the drive controller D.
2. Clean the contact surface of cooler and cooling plate with spirit.
3. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
4. Mount the drive controller on the cooler.

4.2 Standard devices in the power range 15 ... 30 kW

4.2.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller



1. Remove the screws A
2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**P [kg]	EVS93xx-**C**P [kg]
EVS9327-xP	13.5	9.5
EVS9328-xP	15.0	9.5
EVS9329-xP	15.0	–

4.2.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Raised countersunk head screw M5 × 10 mm (DIN 966)	Mounting of fixing bracket to the drive controller	4

Dimensions

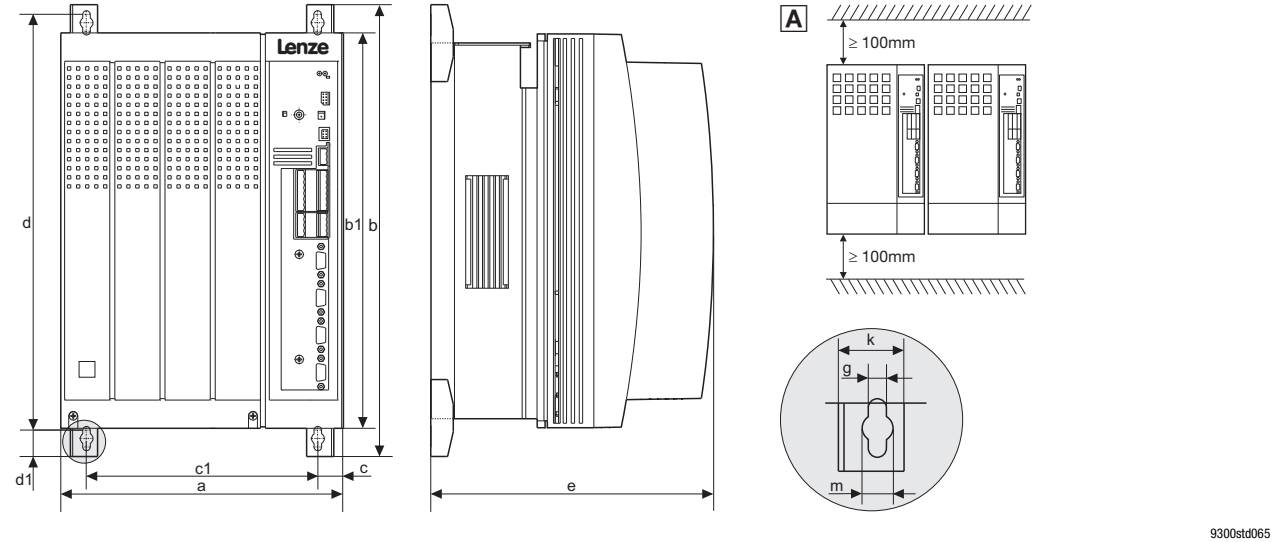


Fig. 4.2-1 Standard mounting with fixing brackets 15 ... 30 kW

A Drive controllers can be mounted side by side without spacing

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9327-EP EVS9328-EP EVS9329-EP	250	402	350	22	206	370	24	250	6.5	24	11

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.2.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Px must be used. In addition, the mounting set EJ0011 for the push-through technique is required.

Dimensions

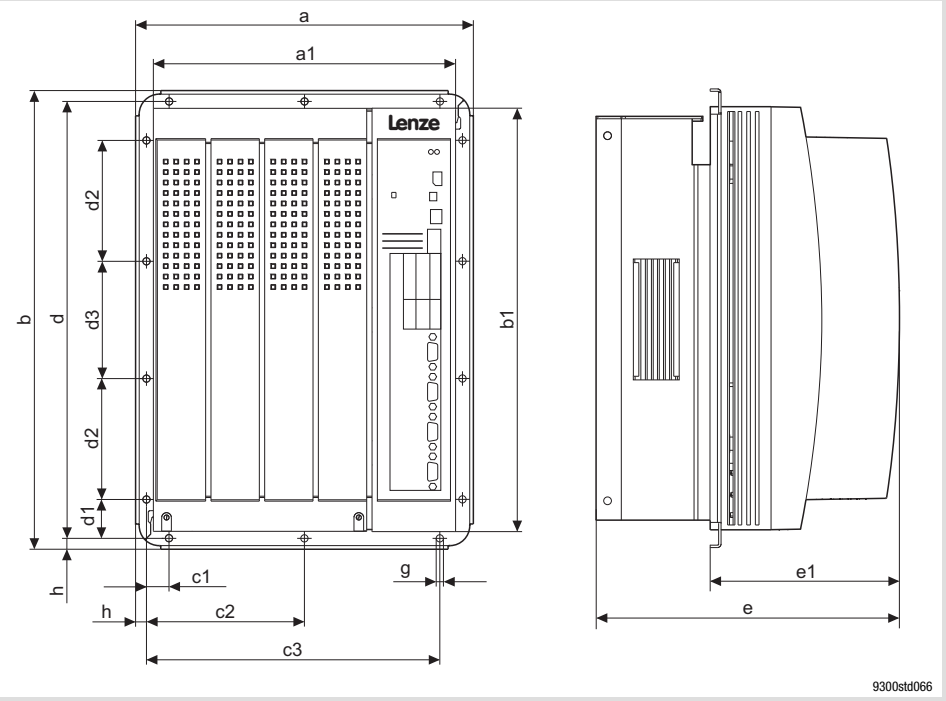


Fig. 4.2-2 Dimensions for thermally separated mounting 15 ... 30 kW

9300	Dimensions [mm]														
Type	a	a1	b	b1	c1	c2	c3	d	d1	d2	d3	e [1]	e1	g	h
EVS9327-EP EVS9328-EP EVS9329-EP	279.5	250	379.5	350	19	131	243	361.5	32	100	97	250	159.5	6	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9327-EP EVS9328-EP EVS9329-EP	236	336

4.2.4 Mounting in ”cold plate” technique

The drive controllers can be mounted in ”cold plate” technique, e.g. on collective coolers. For this purpose, the drive controllers of type EVS93xx-**C**Px must be used.

Requirements for collective coolers

The following points are important for safe and reliable operation of the controller:

- Good thermal connection to the cooler
  - The contact surface between the collective cooler and the controller must be at least as large as the cooling plate of the controller.
  - Plane contact surface, max. deviation 0.05 mm.
  - When attaching the collective cooler to the controller, make sure to use all specified screw connections.
- Observe the thermal resistance R_{th} given in the table. The values are valid for controller operation under rated conditions.

9300	Cooling path	
	Power to be dissipated	Heatsink - environment
Type	P_v [W]	R_{th} [K/W]
EVS9327-CP	410	0.085
EVS9328-CP	610	0.057

Ambient conditions

- The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- Temperature at the cooling plate of the drive controller: max. 75 °C.

Dimensions

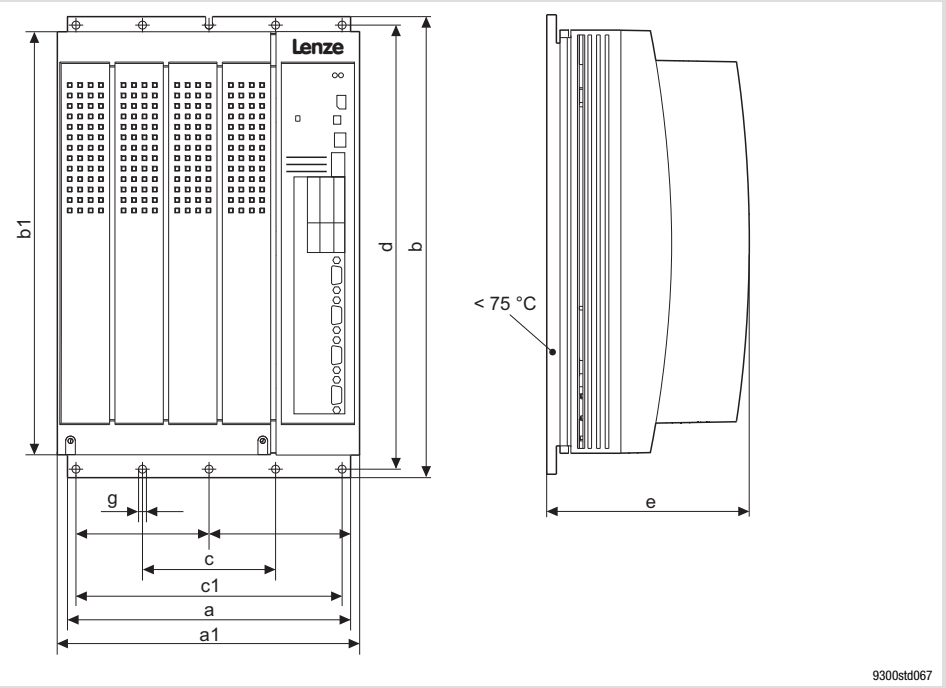


Fig. 4.2-3 Dimensions for mounting in "cold plate" technique 15 ... 22 kW

9300	Dimensions [mm]								
Type	a	a1	b	b1	c	c1	d	e [1)]	g
EVS9327-CP EVS9328-CP	234	250	381	350	110	220	367	171	6.5

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

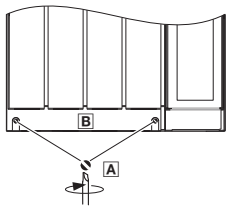
Apply heat conducting paste before screwing together the cooler and cooling plate of the drive controller so that the heat transfer resistance is as low as possible.

1. Clean the contact surface of cooler and cooling plate with spirit.
2. Apply a thin coat of heat conducting paste with a filling knife or brush.
   – The heat conducting paste in the accessory kit is sufficient for an area of approx. 1000 cm^2.
3. Mount the drive controller on the cooler.

4.3 Standard devices with a power of 45 kW

4.3.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**P [kg]	EVS93xx-**C**P [kg]
EVS9330-xP	38.0	–

4.3.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	Mounting of fixing bracket to the drive controller	4
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	4
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	4

Dimensions

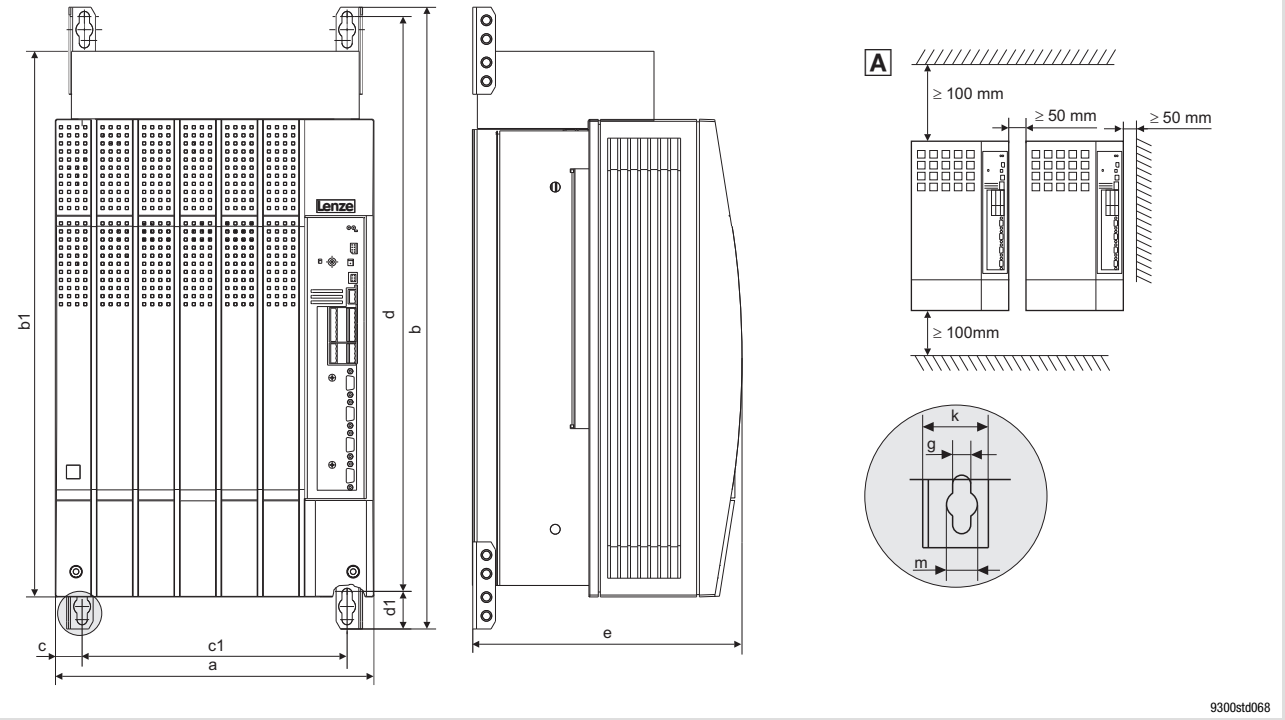


Fig. 4.3-1 Standard mounting with fixing brackets 45 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e 1)	g	k	m
EVS9330-EP	340	580	591	28.5	283	615	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.3.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Px must be used. In addition, the mounting set EJ0010 for the push-through technique is required.

Dimensions

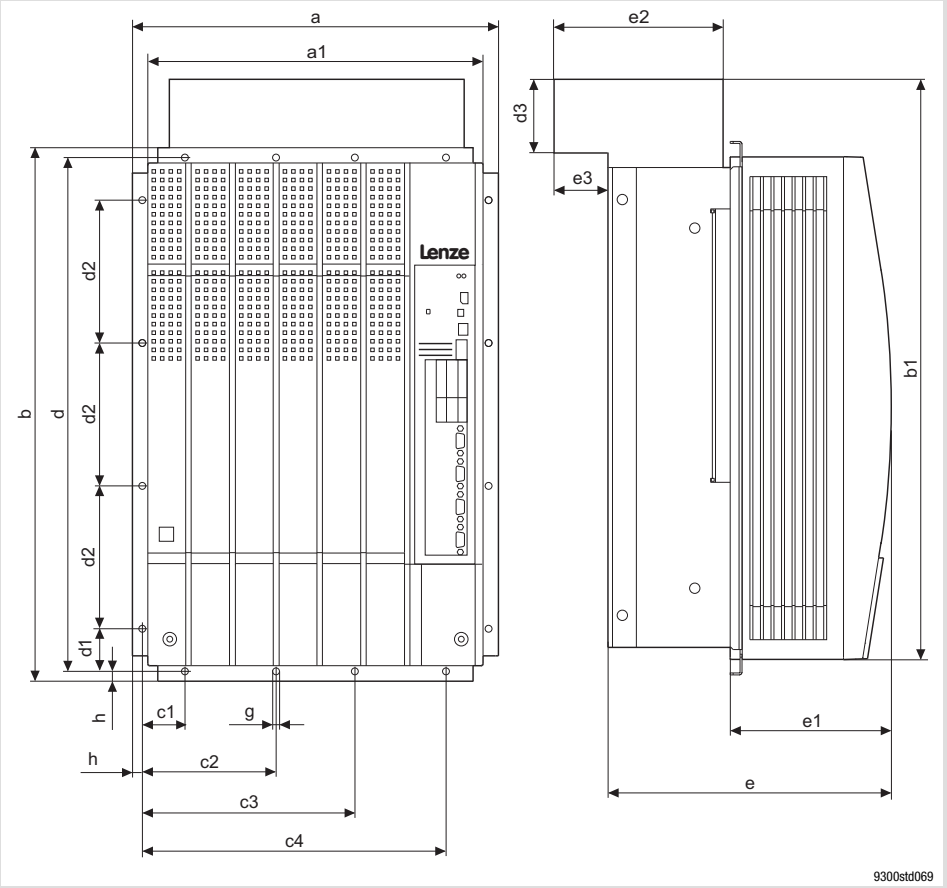


Fig. 4.3-2 Dimensions for thermally separated mounting 45 kW

9300	Dimensions [mm]																
Type	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	d3	e [1)]	e1	e2	e3	g	h
EVS9330-EP	373	340	543	591	45	137.5	217.5	310	525	45	145	81	285	163.5	185	66	7	9

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	Width	Height
EVS9330-EP	320	515

4.3.4 Modification of the fan module for push-through technique

For thermally separated mounting the fan module has to be rotated by 180° so that the controller fits into the mounting cutout.

Removing the fan module

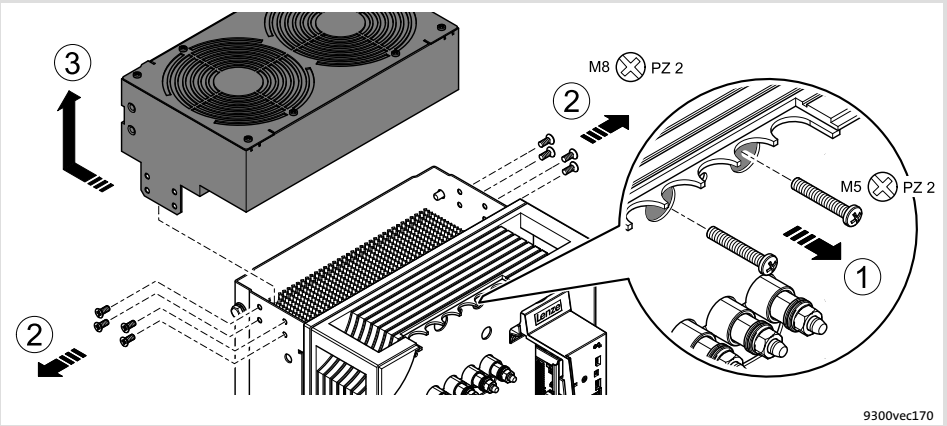


Fig. 4.3-3 Removing the fan module from the controller

1. Remove both screws.
   The screws connect the fans to the supply voltage.
2. Remove the 4 screws for fixing the fan module on each side.
3. Pull back the fan module and carefully remove it to the top.
   Make sure that the threaded sleeves do not touch the housing edge. They may break off.

Modifying the threaded sleeves on the fan module

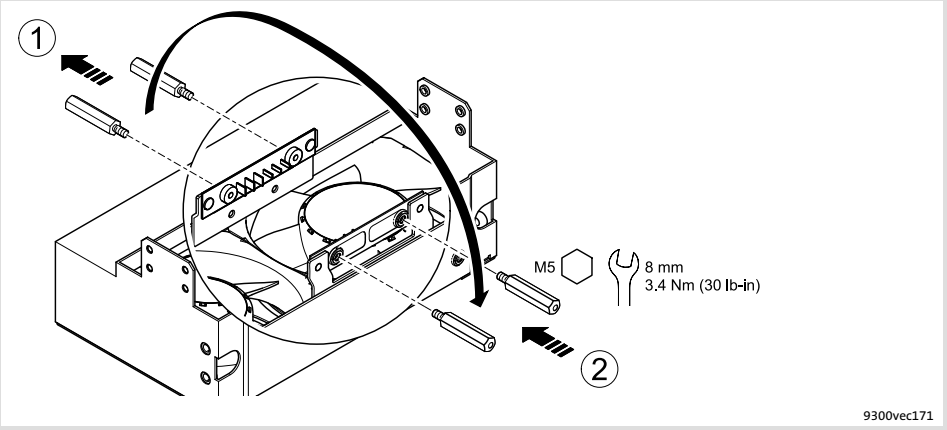


Fig. 4.3-4 Modifying the threaded sleeves for the voltage supply of the fans

1. Remove the threaded sleeves.
2. Screw-in the threaded sleeves on the opposite side and fasten them.

Plugging the fan connecting cable to another terminal on the fan module

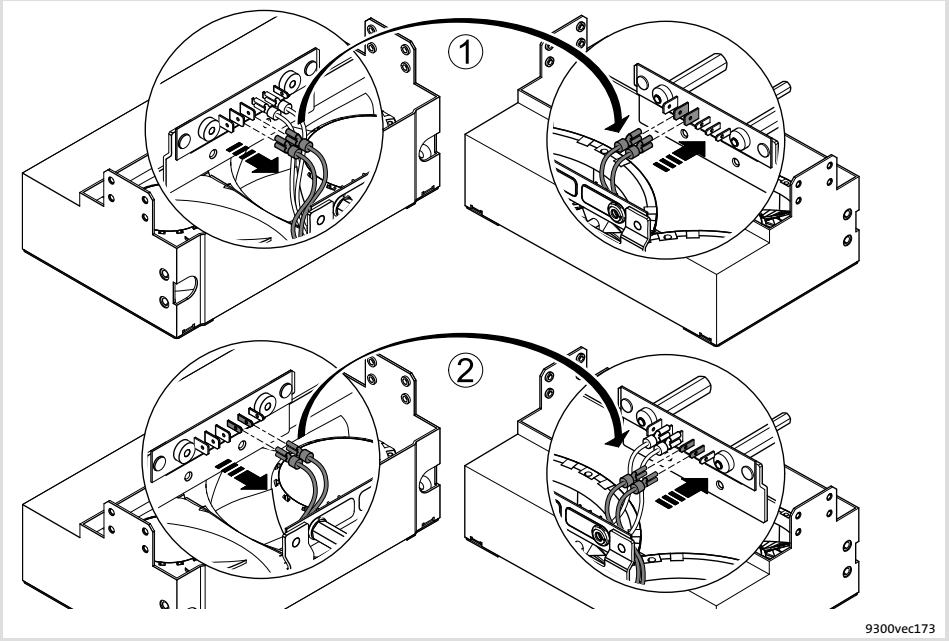


Fig. 4.3-5 Plugging the fan connecting cable for the voltage supply to another terminal

1. Remove the cable lugs of the two red connecting cables and plug them in again on the diagonally arranged side.
2. Remove the cable lugs of the two blue connecting cables and plug them in again on the diagonally arranged side.

Mounting the fan module in a manner rotated by 180°

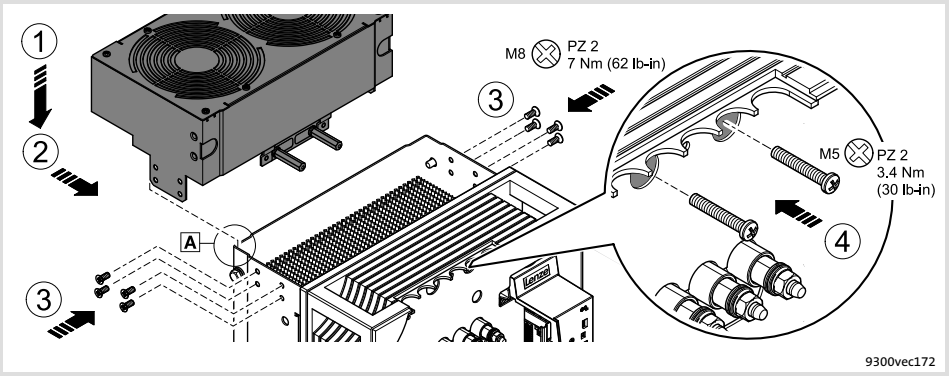


Fig. 4.3-6 Mounting the fan module on the controller

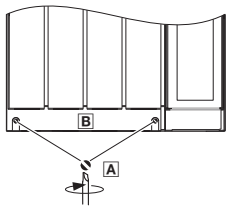
1. Place the fan module onto the controller. Insert the lugs at the back into the base plate A.

   Make sure that the threaded sleeves do not touch the housing edge. They may break off.
2. Push the fan module to the front.
3. Screw-in and fasten the 4 screws for fixing the fan module on each side.
4. Screw-in and fasten the two screws for the supply voltage.

4.4 Standard devices in the power range 55 ... 75 kW

4.4.1 Important notes

The accessory kit is located inside the controller.

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Mass of the devices

9300	Standard device	"Cold plate" device
Type	EVS93xx-**E**P [kg]	EVS93xx-**C**P [kg]
EVS9331-xP	59.0	–
EVS9332-xP	59.0	–

4.4.2 Mounting with fixing brackets (standard)

Mounting material required from the scope of supply:

Description	Use	Quantity
Fixing bracket	Drive controller fixing	4
Hexagon head cap screw M8 × 16 mm (DIN 933)	For fixing bracket	8
Washer ∅ 8.4 mm (DIN 125)	For hexagon head cap screw	8
Spring washer ∅ 8 mm (DIN 127)	For hexagon head cap screw	8

Dimensions

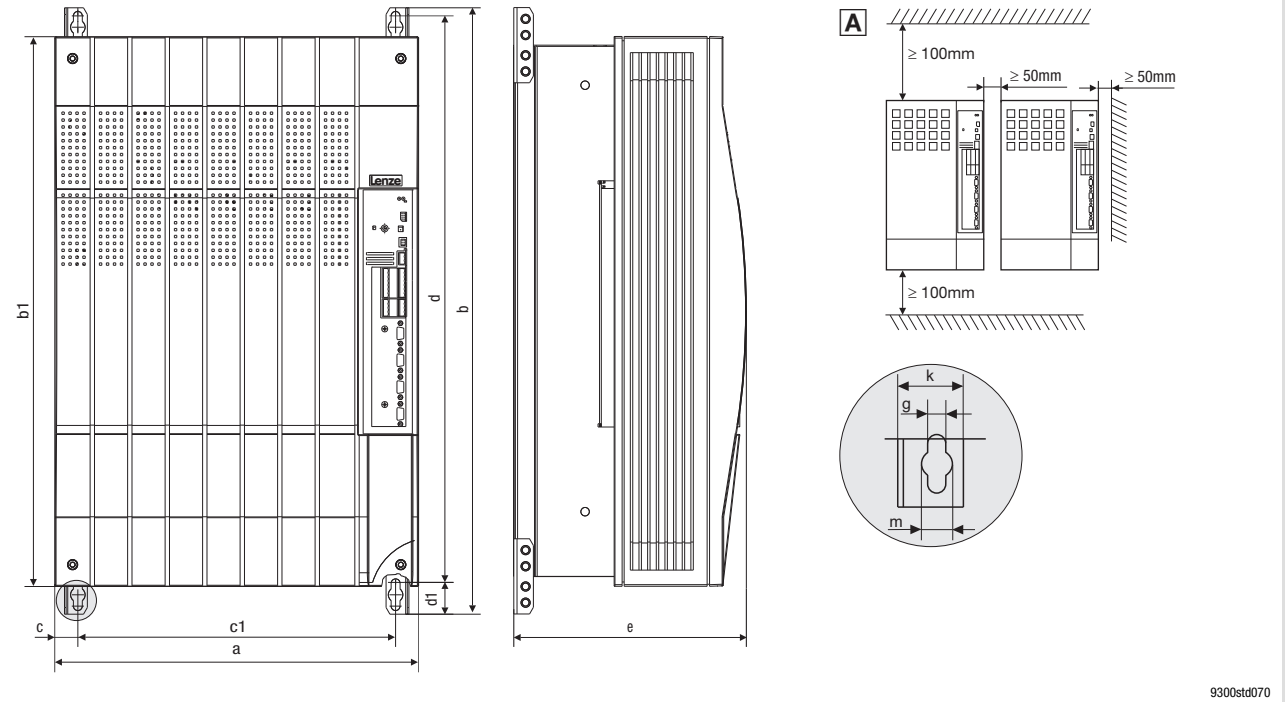


Fig. 4.4-1 Standard mounting with fixing brackets 55 ... 75 kW

A Arrange drive controllers in a row with spacing to be able to remove eye bolts

9300	Dimensions [mm]										
Type	a	b	b1	c	c1	d	d1	e [1)]	g	k	m
EVS9331-EP EVS9332-EP	450	750	680	28.5	393	702	38	285	11	28	18

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting

► Attach the fixing brackets to the heatsink plate of the drive controller.

4.4.3 Thermally separated mounting (push-through technique)

For mounting in push-through technique, the drive controller of type EVS93xx-**E**Px must be used. In addition, the mounting set EJ0009 for the push-through technique is required.

Dimensions

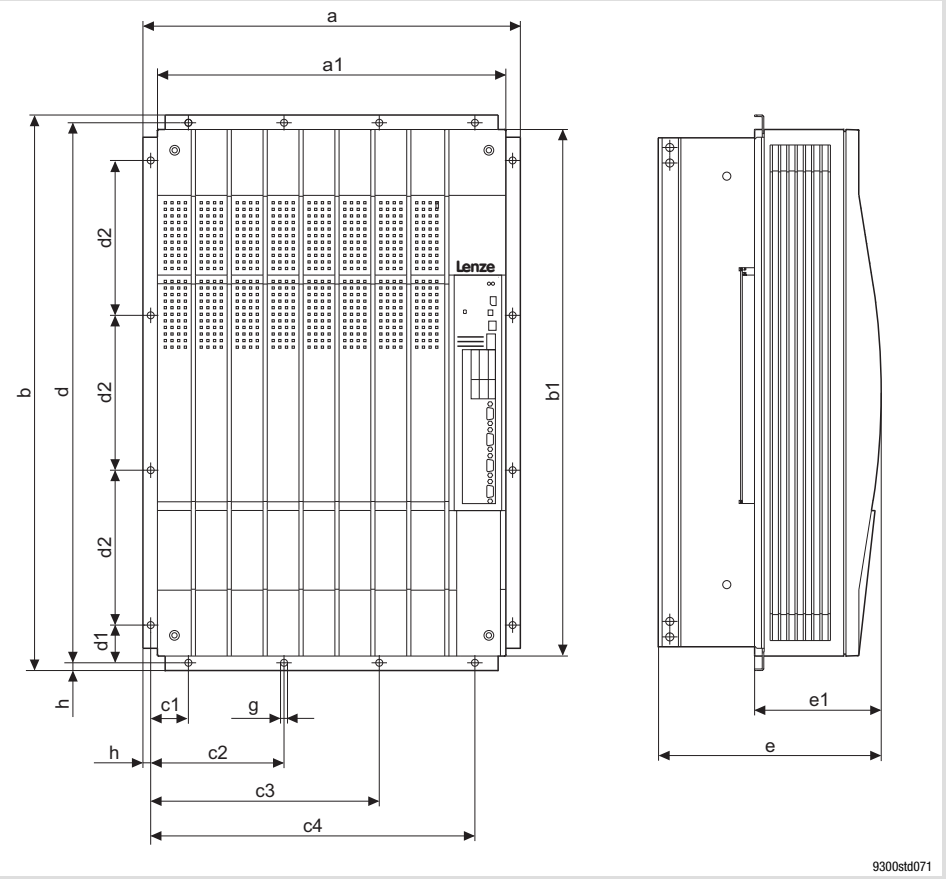


Fig. 4.4-2 Dimensions for thermally separated mounting 55 ... 75 kW

9300	Dimensions [mm]														
Typ	a	a1	b	b1	c1	c2	c3	c4	d	d1	d2	e [1)]	e1	g	h
EVS9331-EP EVS9332-EP	488	450	718	680	49	172.5	295.5	419	698	49	200	285	164	9	10

1) For a fieldbus module plugged onto X1, consider mounting space for connecting cables

Mounting cutout in control cabinet

9300	Dimensions [mm]	
Type	a1	b1
EVS9331-EP EVS9332-EP	428.5	660

5 Wiring of the standard device

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5.1 Important notes

Stop!

The drive controller contains electrostatically sensitive components.

The personnel must be free of electrostatic charge when carrying out assembly and service operations.

5.1.1 Protection of persons

Danger!

Before working on the controller, check that all power terminals are deenergised:

- ► The power terminals U, V, W, $+U_G$ and $-U_G$ remain live for at least 3 minutes after disconnection from the mains.
- ► The power terminals L1, L2, L3, U, V, W, $+U_G$ and $-U_G$ remain live when the motor is stopped.

Pluggable terminal strips

Connect or disconnect all pluggable terminals only in the deenergised state!

Electrical isolation

The terminals X1 and X5 have double (reinforced) insulation according to EN50178. The protection against accidental contact is ensured without additional measured being taken.

Danger!

- ► The terminals X3, X4, X6, X7, X8, X9, X10, X11 have basic insulation (single isolating distance).
- ► In the event of a defective isolating distance, protection against accidental contact can only be guaranteed by taking external measures such as double insulation.
- ► If an external DC 24 V voltage source is used, the insulation degree of the controller depends on the insulation degree of the voltage source.

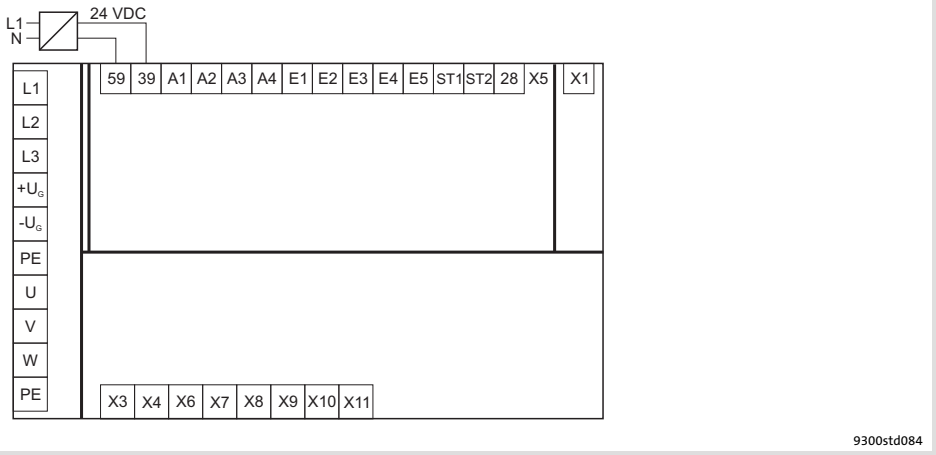


Fig. 5.1-1 Electrical isolation between power terminals, control terminals and housing

Double (reinforced) insulation
Basic insulation

Replacing defective fuses

Only replace defective fuses in the deenergised state to the type specified.

Disconnecting the controller from the mains

Only carry out the safety-related disconnection of the controller from the mains via a contactor on the input side or a manually operated toggle switch.

5.1.2 Device protection

- In the event of condensation, only connect the controller to the mains voltage after the humidity has evaporated.
- The controller is protected by external fuses.
- Drive controllers EVS9324-xP, EVS9326-xP and EVS9328-xP ... EVS9332-xP must only be operated with assigned mains choke / mains filter.
- Length of the screws for connecting the shield sheet for the control cables: **12 mm**.
- Provide unused control inputs and outputs with terminal strips. Cover unused Sub-D sockets with protective covers included in the scope of supply.
- Switching on the motor side of the controller is only permissible for safety shutdown (emergency-off).
- Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the drive controller:
  - At least 3 minutes must pass between switching off and restarting the devices EVS9321-xP and EVS9322-xP.
  - At least 3 minutes must pass between two starting procedures of the devices EVS9323-xP ... EVS9332-xP.
  - Use the ”safe torque off” safety function (STO) if safety-related mains disconnections occur frequently. The drive variants Vxx4 are equipped with this function.

5.1.3 Motor protection

- Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the I^2xt monitoring.
- Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min. $\hat{u}$ = 1.5 kV, min. du/dt = 5 kV/μs
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

5.2 Notes on project planning

5.2.1 Supply forms / electrical supply conditions

Observe the restrictions for the different supply forms!

Supply system	Operation of controller	Notes
Supply system: TT, TN (with earthed neutral)	Permitted without restrictions.	• Observe the rated data of the controller • RMS mains current: see chapter "Technical data".
Supply system: IT (with isolated neutral)	Possible if the controller is protected in the event of an earth fault in the supply system • by means of suitable devices which detect the earth fault and • immediately separate the controller from the supply system.	• Safe operation in the event of an earth fault at the inverter output cannot be guaranteed. • The variants V024 / V104 and V100 enable operation of the controller on IT systems.
DC supply via $+U_G/-U_G$	Permitted if the DC voltage is symmetrical to PE.	Earthing of the $+U_G$ or $-U_G$ conductor will destroy the controller.

5.2.2 Operation on public supply systems (compliance with EN 61000-3-2)

European standard EN 61000-3-2 defines limit values for the limitation of harmonic currents in the supply system. Non-linear consumers (e.g. frequency inverters) generate harmonic currents which "pollute" the supplying mains and may therefore interfere with other consumers. The standard aims at assuring the quality of public supply systems and reducing the mains load.

Note!

The standard only applies to public systems. Mains which are provided with a transformer substation of their own as in industrial plants are not public and not included in the application range of the standard.

If a device or machine consists of several components, the limit values of the standard apply to the entire unit.

Measures for compliance with the standard

With the measures described, the controllers comply with the limit values according to EN 61000-3-2.

Operation on public supply systems	EN 61000-3-2	Limitation of harmonic currents
	Total power on the mains	Compliance with the requirements [1]
	< 1 kW	With mains choke
	> 1 kW	No measures required

[1] The additional measures mentioned have the effect that solely the controllers meet the requirements of EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the requirements for the machine/system!

5.2.3 Controllers in the IT system

Controllers in the V024, V104 or V100 variants are suitable for operation on insulated supply systems (IT systems). The controllers also have an insulated design. This avoids the activation of the insulation monitoring, even if several controllers are installed.

The electric strength of the controllers is increased so that damage to the controller are avoided if insulation or earth faults in the supply system occur. The operational reliability of the system remains intact.

Stop!

Only operate the controllers with the mains chokes assigned.

Operation with mains filters or RFI filters by Lenze is not permitted, as these modules contain components that are interconnected against PE. By this the protective design of the IT system would be cancelled out. The components are destroyed in the case of an earth fault.

Protect the IT system against earth fault at the controller.

Due to physical conditions, an earth fault on the motor side at the controller can interfere with or damage other devices on the same IT system. Therefore appropriate measures have to be implemented, by means of which the earth fault is detected and which disconnect the controller from the mains.

Permissible supply forms and electrical supply conditions

Mains	Operation of the controllers	Notes
With isolated star point (IT systems)	Possible, if the controller is protected in the event of an earth fault in the supplying mains. ● Possible, if appropriate earth fault detections are available and ● the controller is immediately disconnected from the mains.	Safe operation in the event of an earth fault at the inverter output cannot be guaranteed.

DC-bus operation of several drives

Central supply with 9340 regenerative power supply module is not possible.

Installation of the CE-typical drive system

For the installation of drives on IT systems, the same conditions apply as for the installation on systems with an earthed neutral point.

According to the binding EMC product standard EN61800-3, no limit values are defined for IT systems for noise emission in the high-frequency range.

5.2.4 Operation at earth-leakage circuit breaker (e.l.c.b.)

Danger!

The controllers are internally fitted with a mains rectifier. In case of a short circuit to frame a pulsating DC residual current can prevent the AC sensitive or pulse current sensitive earth-leakage circuit breakers from being activated, thus cancelling the protective function for the entire equipment being operated on this earth-leakage circuit breaker.

- For the protection of persons and farm animals (DIN VDE 0100), we recommend
  - pulse current sensitive earth-leakage circuit breakers for plants including controllers with a single-phase mains connection (L1/N).
  - universal-current sensitive earth-leakage circuit breakers for plants including controllers with a three-phase mains connection (L1/L2/L3).
- Only install the earth-leakage circuit breaker between supplying mains and drive controller.
- Earth-leakage circuit breakers may trigger a false alarm due to
  - capacitive compensation currents flowing in the cable shields during operation (particularly with long, shielded motor cables),
  - simultaneous connection of several inverters to the mains
  - the use of additional interference filters.

5.2.5 Interaction with compensation equipment

- Controllers only consume very little reactive power of the fundamental wave from the AC supply mains. Therefore, a compensation is not required.
- If the controllers are connected to a supply system with compensation equipment, this equipment must comprise chokes.
  - For this, contact the supplier of the compensation equipment.

5.2.6 Discharge current for mobile systems

Frequency inverters with internal or external RFI filters usually have a discharge current to PE potential that is higher than 3.5 mA AC or 10 mA DC.

Therefore, fixed installation as protection is required (see EN 61800-5-1). This must be indicated in the operational documents.

If a fixed installation is not possible for a mobile consumer although the discharge current to PE potential is higher than 3.5 mA AC or 10 mA DC, an additional two-winding transformer (isolating transformer) can be included in the current supply as a suitable countermeasure. Here, the PE conductor is connected to the PEs of the drive (filter, inverter, motor, shieldings) and also to one of the poles of the secondary winding of the isolating transformer.

Devices with a three-phase supply must have a corresponding isolating transformer with a secondary star connection, the star point being connected to the PE conductor.

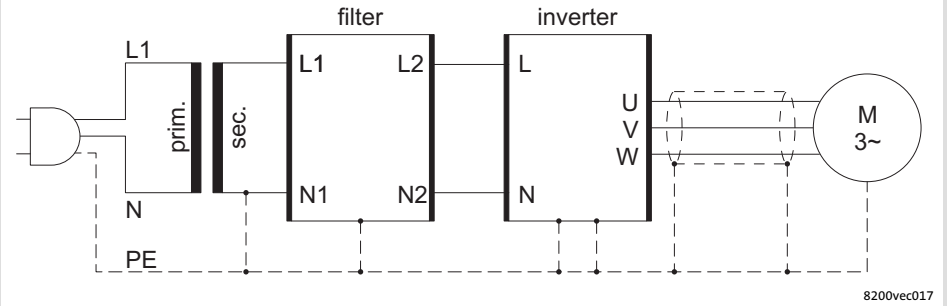


Fig. 5.2-1 Installation of a two-winding transformer (isolating transformer)

5.2.7 Optimisation of the controller and mains load

A mains choke is an inductance which can be included in the mains cable of the frequency inverter. As a result, the load of the supplying mains and the controller is optimised:

- Reduced system perturbation: The curved shape of the mains current approaches a sinusoidal shape.
- Reduced mains current: The effective mains current is reduced, i.e. the mains, cable, and fuse loads are reduced.
- Increased service life of the controller: The electrolytic capacitors in the DC bus have a considerably increased service life due to the reduced AC current load.

There are no restrictions for the combinations of mains chokes and RFI filters and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

Note!

- Some controllers must generally be operated with a mains choke or a mains filter.
- If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

5.2.8 Reduction of noise emissions

Due to internal switching operations, every controller causes noise emissions which may interfere with the functions of other consumers. Depending on the site of the frequency inverter, European standard EN 61800-3 defines limit values for these noise emissions:

Limit class C2: Limit class C2 is often required for industrial mains which are isolated from the mains of residential areas.

Limit class C1: If the controller is operated in a residential area, it may interfere with other devices such as radio and television receivers. Here, interference suppression measures according to limit class C1 are often required.

Limit class C1 is much more strict than limit class C2. Limit class C1 includes limit class C2.

For compliance with limit class C1 / C2, corresponding measures for the limitation of noise emissions are required, e.g. the use of RFI filters.

There are no restrictions for the combinations of RFI filters and mains chokes and/or motor filters. Alternatively, a mains filter can be used (combination of mains choke and RFI filter in a common housing).

The selection of the frequency inverter and the corresponding filters, if applicable, always depends on the application in question and is determined by e.g. the switching frequency of the controller, the motor cable length, or the protective circuit (e.g. earth-leakage circuit breakers).

Note!

- ► Some controllers must generally be operated with a mains choke or a mains filter.
- ► If a mains choke or a mains filter is used, the maximum possible output voltage does not reach the value of the mains voltage (typical voltage drop at the rated point 4 ... 6 %).

The graphics below illustrates the maximum possible motor cable length based on the type of filter and the resulting interference voltage category according to EN 61800-3. Depending on the used motor cable, the used controller, and its switching frequency, the mentioned maximum motor cable lengths may vary.

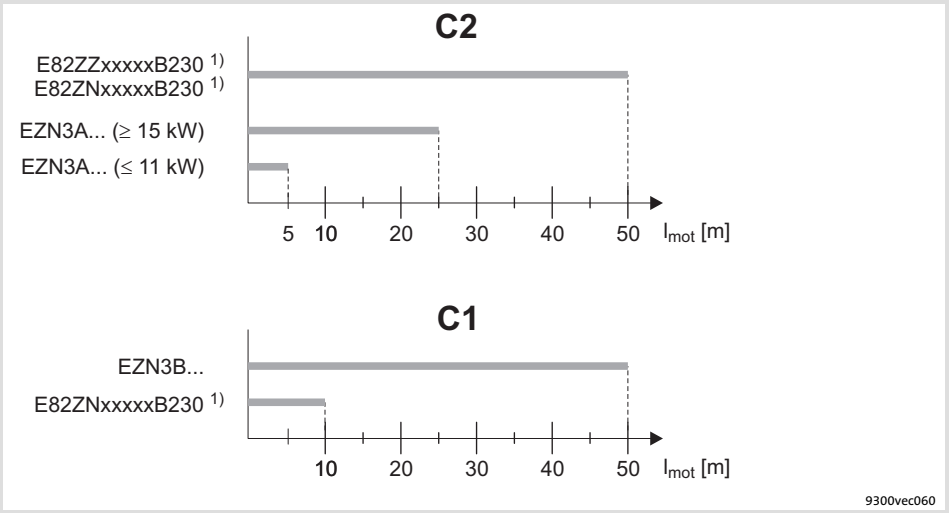


Fig. 5.2-2 Maximum motor cable lengths l_{mot} based on the type of filter for compliance with limit class C2 / C1

1) Use low-capacitance cables

5.2.9 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xP	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xP	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xP	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xP	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xP	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xP	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50
EVS9327-xP	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 1)	10
		E82ZN22334B230	50	EZN3B0110H030U 2)	50
		E82ZZ15334B230 1)	50		
EVS9328-xP	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xP	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50
EVS9330-xP	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 3)	25		
		E82ZN55334B230	50		
EVS9331-xP	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xP	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

1) RFI filter
2) Footprint filter
3) For controllers with thermal separation

5.2.10 Motor cable

Specification

- The used motor cables must
  - meet the requirements on site (e.g. EN 60204-1, UL),
  - comply with the following voltage data: EN 0.6/1 kV, UL 600 V.
- For shielded motor cables, only use cables with braid made of tinned or nickel-plated copper. Shields made of steel braid are not suitable.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90°.
- Use low-capacitance motor cables:

Power class	Capacitance per unit length	
	Core/core	Core/shield
3 ... 11 kW	from 2.5 mm² ≤100 pF/m	≤ 150 pF/m
15 ... 30 kW	≤ 140 pF/m	≤ 230 pF/m
45 ... 55 kW	≤ 190 pF/m	≤ 320 pF/m
75 ... 90 kW	≤ 250 pF/m	≤ 410 pF/m

Cable length

9300	Maximum permissible motor cable length			
	U_r = 400 V		U_r = 480 V	
Type	f_{chop} = 8 kHz	f_{chop} = 16 kHz	f_{chop} = 8 kHz	f_{chop} = 16 kHz
EVS9321-xP, EVS9322-xP	50 m	45 m	50 m	25 m
EVS9323-xP ... EVS9332-xP	50 m	50 m	50 m	50 m

Note!

- The motor cable must be as short as possible for having a positive effect on the drive behaviour.
- If EMC requirements must be met, the permissible cable length may be affected.
- EVS9321-xPand EVS9322-xP: At a mains voltage of 480 V and a switching frequency f_{chop} = 16 kHz, the maximum permissible cable length is reduced if the motor cable has more than a single core:
  - The following holds true for two parallel single cores: l_{max} = 17 m
  - The following holds true for three parallel single cores: l_{max} = 9 m

Cable cross-section

Note!

The cable cross-sections have been assigned to the permissible current loading of the motor cables under the following conditions:

- Compliance with IEC/EN 60204-1 for fixed cable installation
- Compliance with IEC 60354-2-52, table A.52-5 when using the cable in a trailing cable
- Laying system C
- Ambient temperature 45 °C
- Continuous motor operation at a
  - standstill current I_0 for servo motors or a
  - rated current I_R for three-phase asynchronous motors

The user is responsible for selecting a motor cable which complies with the requirements of the current conditions if different situations arise. Different situations may arise due to:

- Laws, standards, national and regional regulations
- Type of application
- Motor utilisation
- Ambient and operating conditions
- Laying system and bundling of cables
- Cable type

Motor cable			
permanently installed	for trailing cable	Cable cross-section	
I_M [A]	I_M [A]	[mm²]	[AWG]
10.0	11.8	1.0	18
13.8	17.3	1.5	16
19.1	23.7	2.5	14
25.5	30.9	4.0	12
32.8	41.0	6.0	10
45.5	55.5	10	8
60.1	75.5	16	6
76.4	92.8	25	4
94.6	115	35	2
114	140	50	1
146	179	70	00
177	217	95	000
205	252	120	0000

Note!

Information on the design of the motor cable is provided in the ”System cables and system connectors” manual.

5.3 Basics for wiring according to EMC

5.3.1 Shielding

The quality of shielding is determined by a good shield connection:

- ▶ Connect the shield with a large surface.
- ▶ Connect the shield directly to the intended shield sheet of the device.
- ▶ In addition, connect the shield to the conductive and earthed mounting plate with a large contact surface by using a conductive clamp.
- ▶ Unshielded cable ends must be as short as possible.

5.3.2 Mains connection, DC supply

- ▶ Controllers, mains chokes, or mains filters may only be connected to the mains via unshielded single cores or unshielded cables.
- ▶ When a mains filter or RFI filter is used, shield the cable between mains filter or RFI filter and controller if its length exceeds 300 mm. Unshielded cores must be twisted.
- ▶ In DC-bus operation or DC supply, use shielded cables.
- ▶ The cable cross-section must be dimensioned for the assigned fusing (observe national and regional regulations).

5.3.3 Motor cable

- ▶ Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  - – The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- ▶ The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- ▶ Shield the cable for motor temperature monitoring (PTC or thermal contact) and install it separately from the motor cable.
  - – In Lenze system cables, the cable for brake control is integrated into the motor cable. If this cable is not required for brake control, it can also be used to connect the motor temperature monitoring up to a length of 50 m.
- ▶ Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp.
- ▶ Connect the shield directly to the corresponding device shield sheet.
  - – If required, additionally connect the shield to the conductive and earthed mounting plate in the control cabinet.
- ▶ The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it only crosses mains cables and control cables at right angles,

– it is not interrupted.

► If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  – The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  – Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  – Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.

► Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  – Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

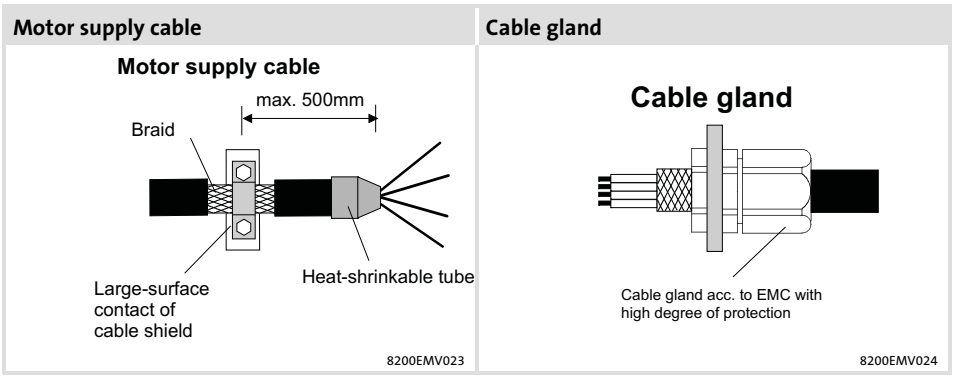


Fig. 5.3-1 Shielding of the motor cable

5.3.4 Control cables

- Control cables must be shielded to minimise interference injections.
- For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.
- Connect the shield correctly:
  - The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
- To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

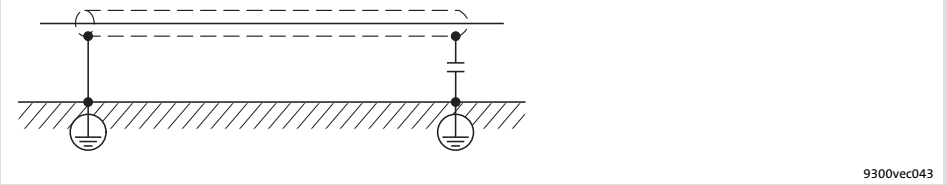


Fig. 5.3-2 Shielding of long, analog control cables

5.3.5 Installation in the control cabinet

Mounting plate requirements

- ▶ Only use mounting plates with conductive surfaces (zinc-coated or V2A-steel).
- ▶ Painted mounting plates are not suitable even if the paint is removed from the contact surfaces.
- ▶ If several mounting plates are used, ensure a large-surface connection between the mounting plates (e.g. by using earthing strips).

Mounting of the components

- ▶ Connect controllers, filters, and chokes to the earthed mounting plate with a surface as large as possible.

Optimum cable routing

- ▶ The motor cable is optimally installed if
  - – it is separated from mains cables and control cables,
  - – it crosses mains cables and control cables at right angles.
- ▶ Always install cables close to the mounting plate (reference potential), as freely suspended cables act like aerials.
- ▶ Lead the cables to the terminals in a straight line (avoid tangles of cables).
- ▶ Use separated cable channels for motor cables and control cables. Do not mix up different cable types in one cable channel.
- ▶ Minimise coupling capacities and coupling inductances by avoiding unnecessary cable lengths and reserve loops.
- ▶ Short-circuit unused cores to the reference potential.
- ▶ Install the positive and negative wires for DC 24 V close to each other over the entire length to avoid loops.

Earth connections

- ▶ Connect all components (drive controllers, chokes, filters) to a central earthing point (PE rail).
- ▶ Set up a star-shape earthing system.
- ▶ Comply with the corresponding minimum cable cross-sections.

5.3.6 Wiring outside of the control cabinet

Notes for cable routing outside the control cabinet:

- The longer the cables the greater the space between the cables must be.
- If cables for different signal types are routed in parallel, the interferences can be minimized by means of a metal barrier or separated cable ducts.

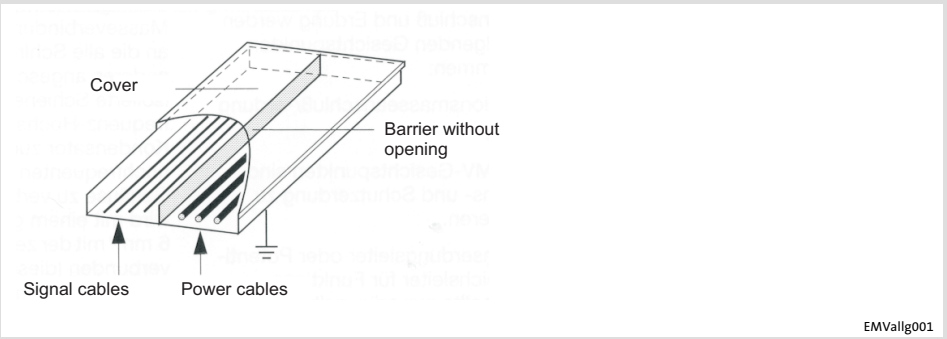


Fig. 5.3-3 Cable routing in the cable duct with barrier

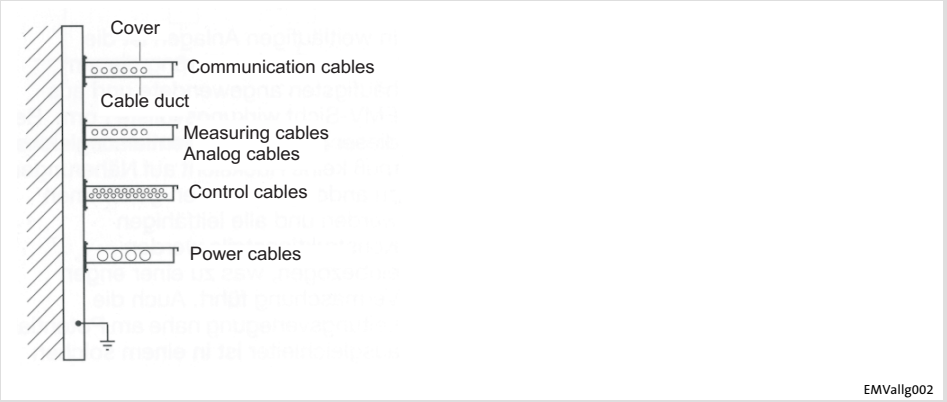


Fig. 5.3-4 Cable routing in separated cable ducts

5.3.7 Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	• Separate components from other component part with a minimum distance of 100 mm • Use motor choke/motor filter
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm
Conducted interference level is exceeded on the supply side	Terminal strips for the motor cable are directly located next to the mains terminals	Spatially separate the terminal strips for the motor cable from main terminals and other control terminals with a minimum distance of 100 mm
	Mounting plate varnished	Optimise PE connection: • Remove varnish • Use zinc-coated mounting plate
	HF short circuit	Check cable routing

5.4 Standard devices in the power range 0.37 ... 11 kW

5.4.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

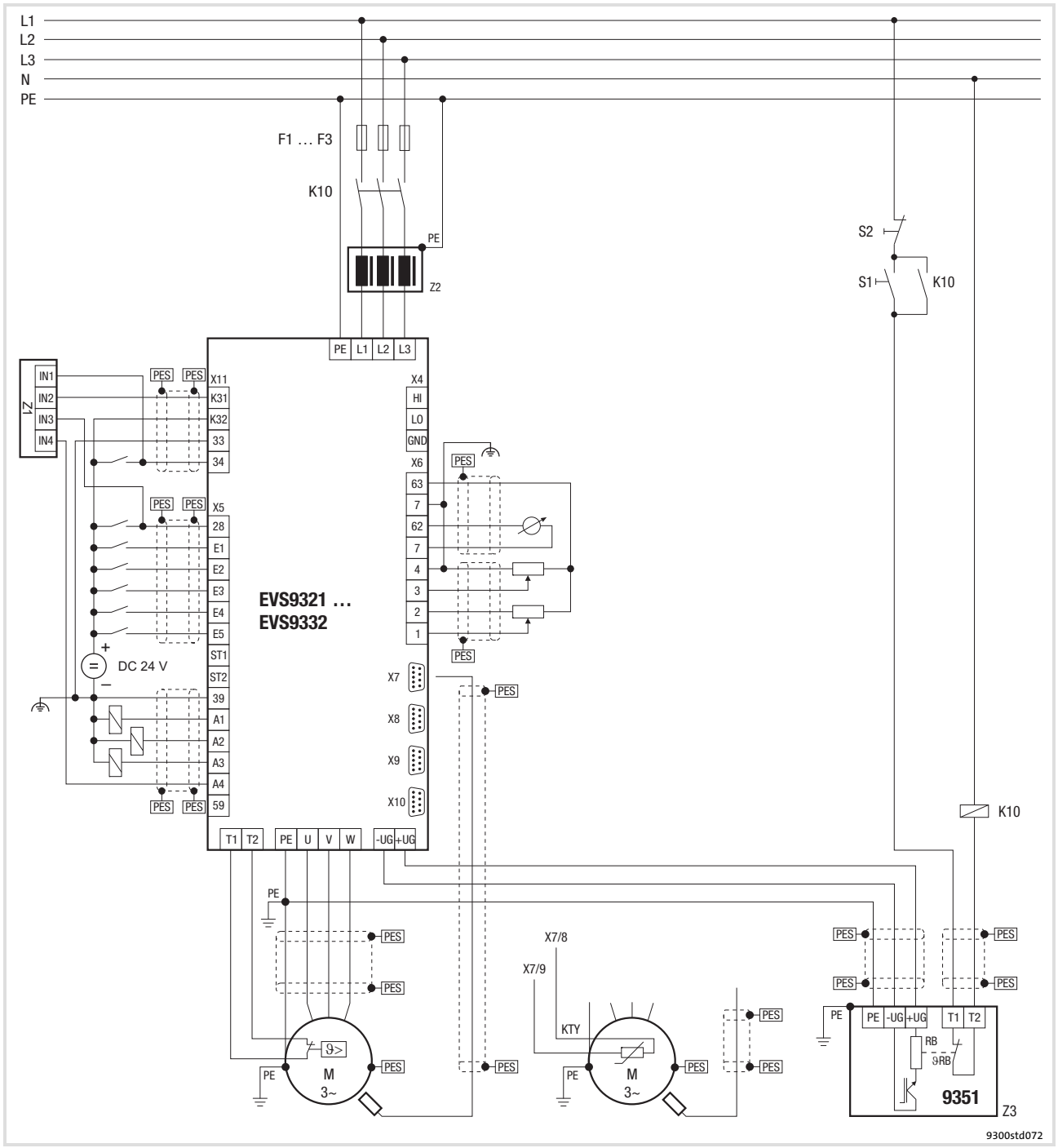


Fig. 5.4-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.4.2 Important notes

To gain access to the power connections, remove the covers:

- ► Release the cover for the mains connection with slight pressure on the front and pull it off to the top.
- ► Release the cover for the motor connection with slight pressure on the front and pull it off to the bottom.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield connection support	Support of the shield sheets for the supply cable and motor cable	2
Hexagon nut M5	Fastening of shield connection supports	4
Spring washer ∅ 5 mm (DIN 127)		2
Serrated lock washer ∅ 5.3 mm (DIN 125)		2
Shield sheet	Shield connections for supply cables, motor cable	2
Screw and washer assembly M4 × 10 mm (DIN 6900)	Fastening of shield sheets	4

5.4.3 Mains connection, DC supply

Note!

- ► If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- ► For DC-bus operation or DC supply, we recommend using shielded DC cables.

Shield sheet installation

Stop!

- ► To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- ► Do not use lugs as strain relief.

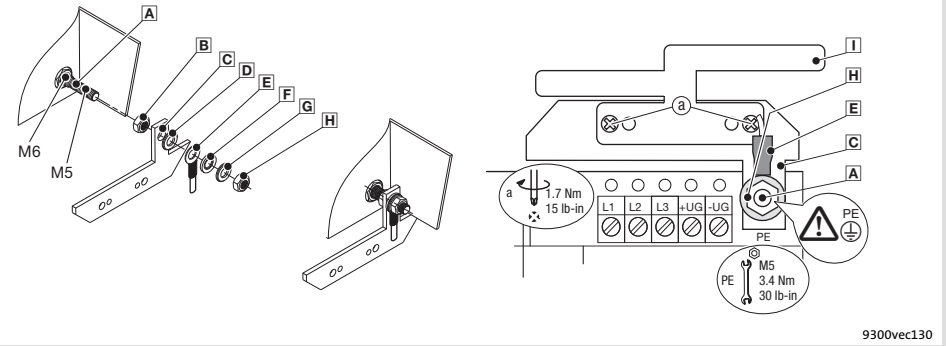


Fig. 5.4-2 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Mains connection, DC supply

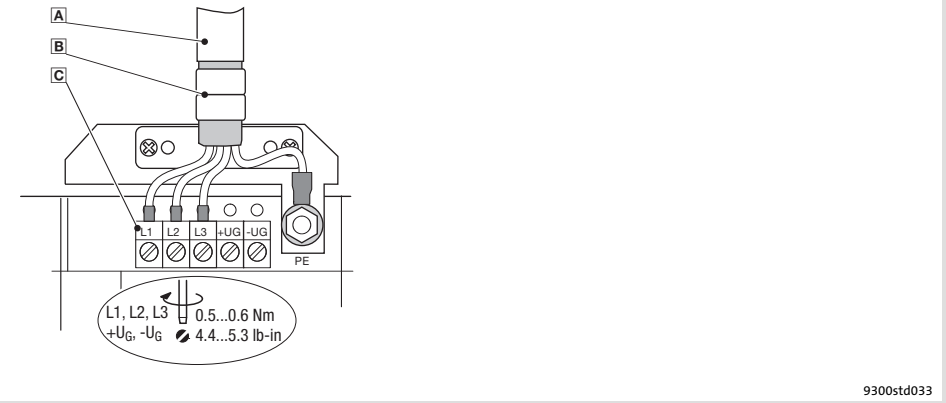


Fig. 5.4-3 Mains connection, DC supply for drive controllers 0.37 ... 11 kW

- A Mains cable
- B Shield sheet
  Securely clamp mains cable with the lugs
- C Mains and DC bus connection
  L1, L2, L3: Connection of mains cable
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)
  Cable cross-sections up to 4 mm^2: Use wire end ferrules for flexible cables
  Cable cross-sections > 4 mm^2: Use pin-end connectors

5.4.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9321-xP	6	C6, B6 [2]	1	1	300
EVS9322-xP	6	C6, B6 [2]	1	1	
EVS9323-xP	10	B10	1.5	1	
EVS9325-xP	25	B20	4	2.5	
Operation with mains choke/mains filter					
EVS9321-xP	6	C6, B6 [2]	1	1	300
EVS9322-xP	6	C6, B6 [2]	1	1	
EVS9323-xP	10	B10	1.5	1	
EVS9324-xP	10	B10	1.5	1	
EVS9325-xP	20	B16	2.5	2.5	
EVS9326-xP	32	B25	–	4	

1) Universal current-sensitive earth-leakage circuit breaker
2) For short-time mains interruptions, use circuit breakers with tripping characteristic "C"

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only in accordance with UL 248 ● System short-circuit current up to 5000 A_{rms} : All classes are permissible ● System short-circuit current up to 50000 A_{rms} : Only classes "CC", "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation without mains choke/mains filter		
EVS9321-xP	6	18
EVS9322-xP	6	18
EVS9323-xP	10	16
EVS9325-xP	25	10
Operation with mains choke/mains filter		
EVS9321-xP	6	18
EVS9322-xP	6	18
EVS9323-xP	10	16
EVS9324-xP	10	16
EVS9325-xP	25	10
EVS9326-xP	25	10

Max. connection cross-section of the terminal strip: AWG 12, with pin-end connector AWG 10

5.4.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9321-xP	EZN3A2400H002	EZN3A2400H002	5	EZN3B2400H002	50
EVS9322-xP	EZN3A1500H003	EZN3A1500H003	5	EZN3B1500H003	50
EVS9323-xP	EZN3A0900H004	EZN3A0900H004	5	EZN3B0900H004	50
EVS9324-xP	EZN3A0500H007	EZN3A0500H007	5	EZN3B0500H007	50
EVS9325-xP	EZN3A0300H013	EZN3A0300H013	5	EZN3B0300H013	50
EVS9326-xP	ELN3-0150H024-001	EZN3A0150H024	5	EZN3B0150H024	50

5.4.6 Motor connection

Note!

- Fusing the motor cable is not required.
- The drive controller features 2 connections for motor temperature monitoring:
  - Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

- To avoid damaging the PE stud, always install the shield sheet and the PE connection in the order displayed. The required parts are included in the accessory kit.
- Do not use lugs as strain relief.

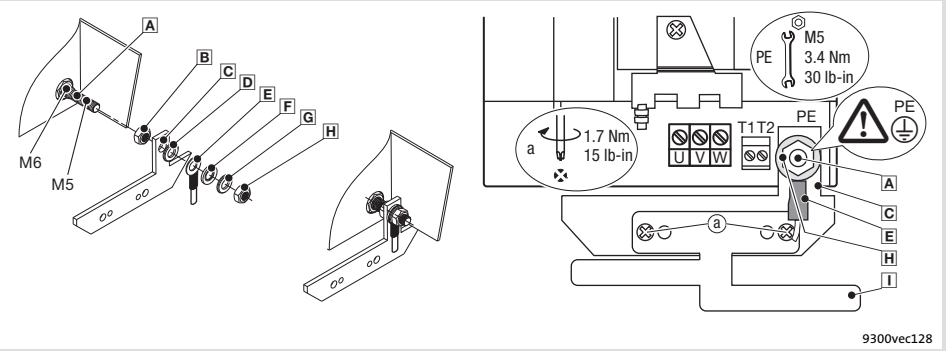


Fig. 5.4-4 Installation of shield sheet for drive controllers 0.37 ... 11 kW

- A PE stud
- B Screw on M5 nut and tighten hand-tight
- C Slide on fixing bracket for shield sheet
- D Slide on serrated lock washer
- E Slide on PE cable with ring cable lug
- F Slide on washer
- G Slide on spring washer
- H Screw on M5 nut and tighten it
- I Screw shield sheet on fixing bracket with two M4 screws (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.

► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

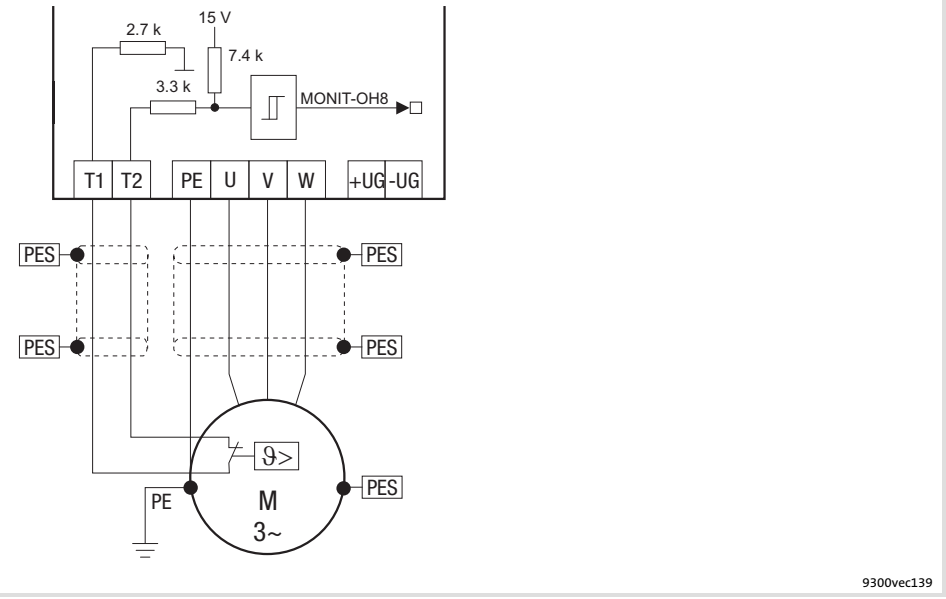


Fig. 5.4-5 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: $R\vartheta > 1600\ \Omega$ ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

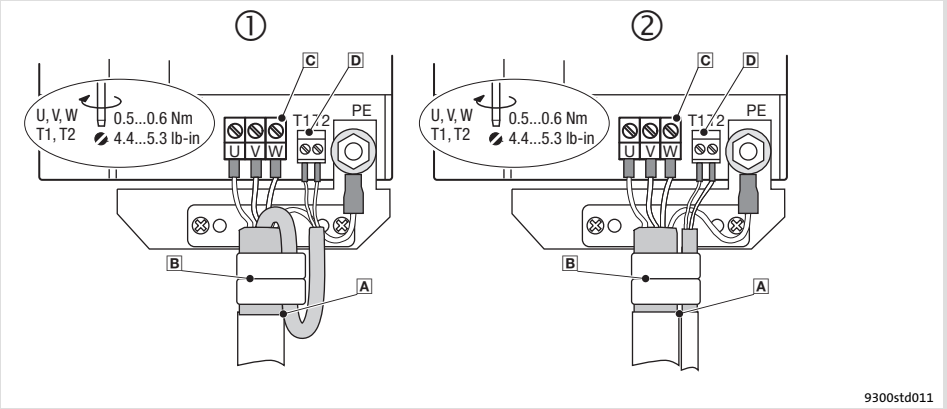


Fig. 5.4-6 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

D T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

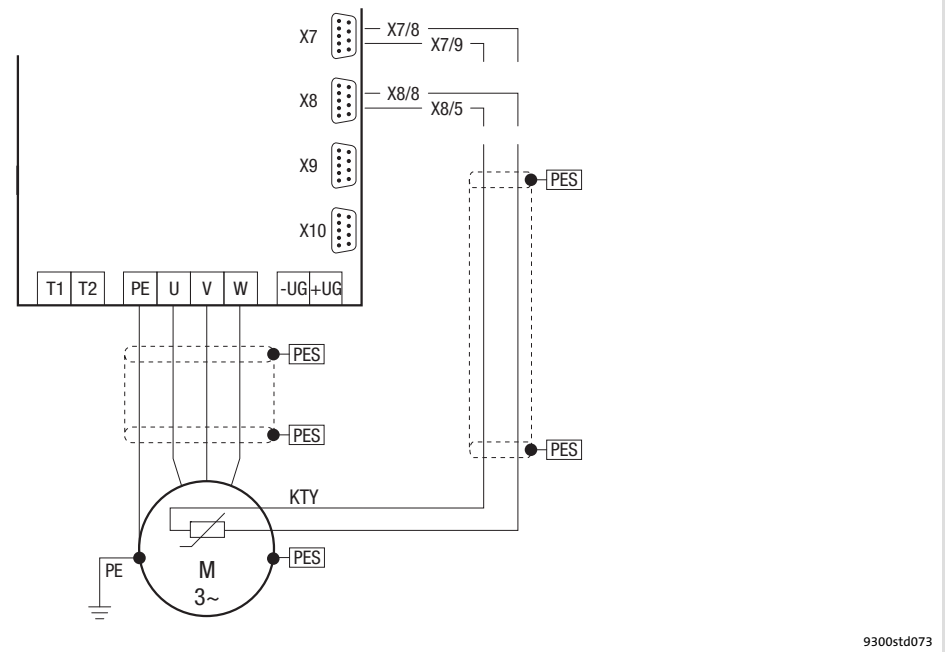


Fig. 5.4-7 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

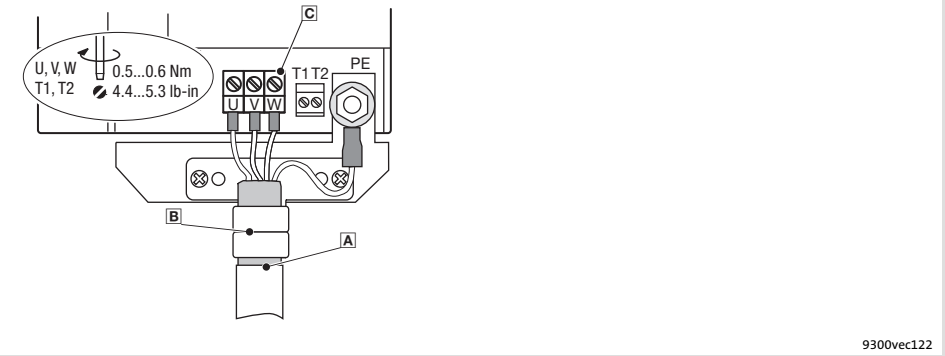


Fig. 5.4-8 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield sheet
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable. Use wire end ferrules for flexible cables.
  Max. connectable cable cross-section: 4 mm^2, with pin-end connector > 4 mm^2

5.5 Standard devices in the power range 15 ... 30 kW

5.5.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on "Electromagnetic Compatibility" if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter "Basics for wiring according to EMC"!

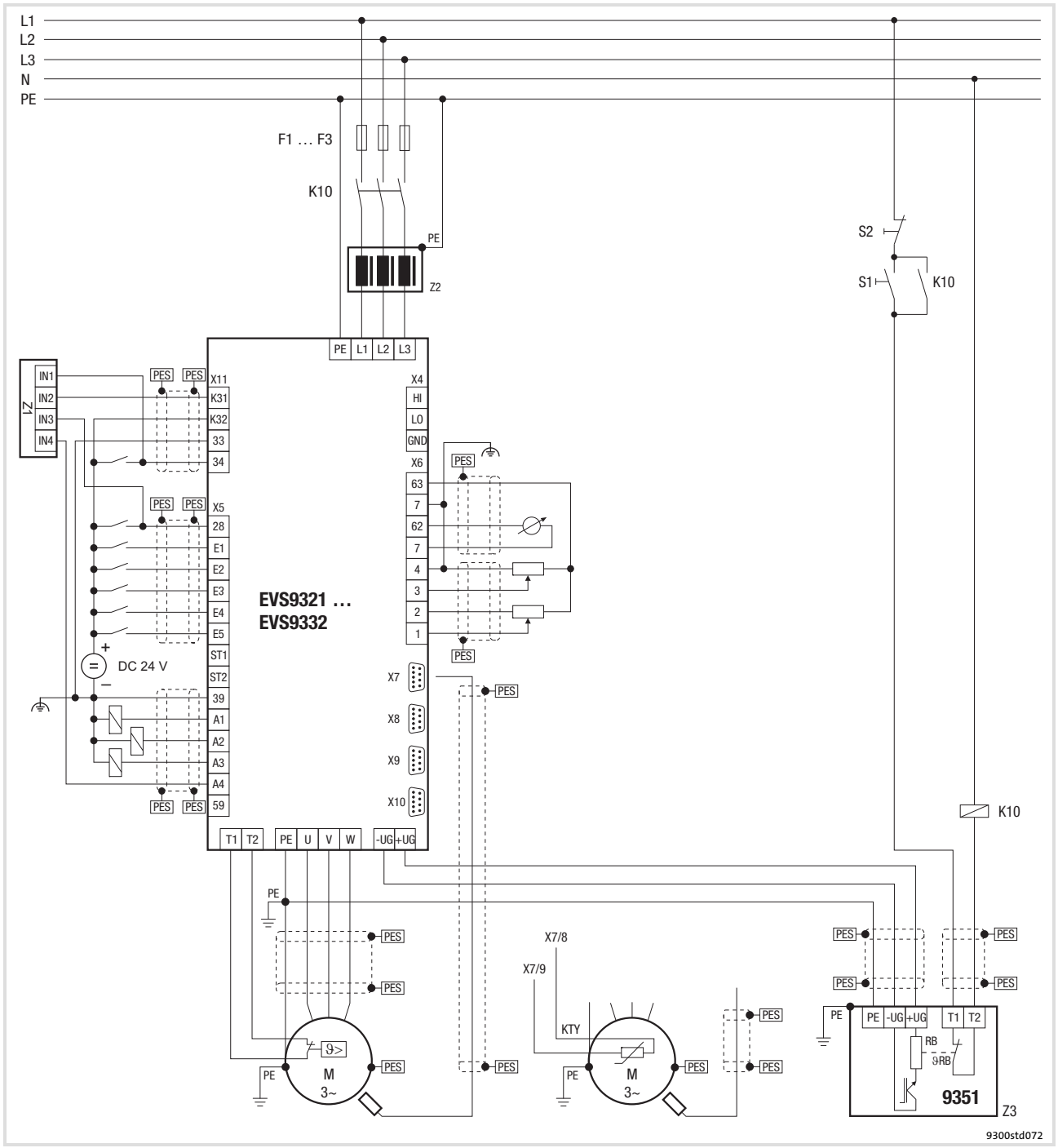


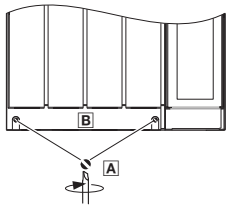
Fig. 5.5-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.5.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller



1. Remove the screws A
2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Hexagon nut M6 (DIN 934)	Connection of supply cables (mains, $+U_G$, $-U_G$) and motor cable to the stud bolts	10
Washer ∅ 6 mm (DIN 125)	For hexagon nut M6	10
Spring washer ∅ 6 mm (DIN 127)	For hexagon nut M6	10
Grommet	Motor cable	1
Shield connection support	Support of the shield sheet for motor cable	1
Self-tapping screw ∅ 4 × 14 mm	Fastening of shield connection support	2
Shield sheet	Shield connection for motor cable	1

5.5.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

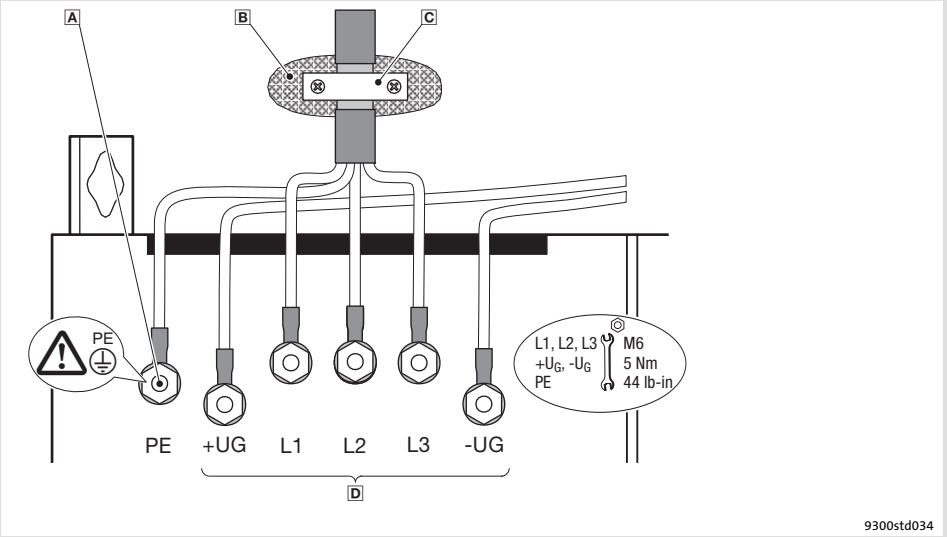


Fig. 5.5-2 Mains connection, DC supply for drive controllers 15 ... 30 kW

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.5.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation without mains choke/mains filter					
EVS9327-xP	63	–	16	16	300
Operation with mains choke/mains filter					
EVS9327-xP	40	–	10	10	300
EVS9328-xP	63	–	25	16	
EVS9329-xP	80	–	–	25	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 5000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9327-xP	35	8
EVS9328-xP	60	4
EVS9329-xP	80	4

5.5.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9327-xP	ELN3-0088H035-001	EZN3A0110H030	25	E82ZN22334B230	10
				E82ZZ15334B230 [1]	10
		E82ZN22334B230	50	EZN3B0110H030U [2]	50
		E82ZZ15334B230 [1]	50		
EVS9328-xP	ELN3-0075H045	EZN3A0080H042	25	E82ZN22334B230	10
		E82ZN22334B230	50	EZN3B0080H042	50
EVS9329-xP	ELN3-0055H055	EZN3A0055H060	25	E82ZN30334B230	10
		E82ZN30334B230	50	EZN3B0055H060	50

1) RFI filter
2) Footprint filter

5.5.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Shield sheet installation

Stop!

Do not use lugs as strain relief.

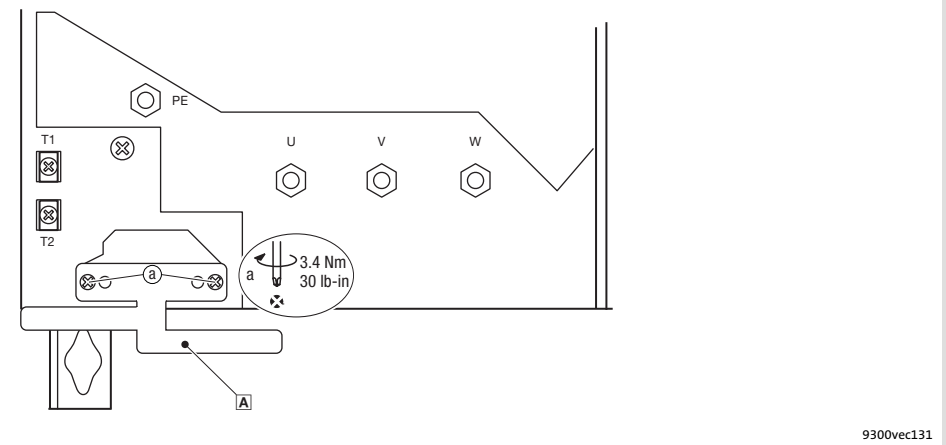


Fig. 5.5-3 Installation of shield sheet for drive controllers 15 ... 30 kW

A Fasten the shield sheet with two self-tapping screws ∅ 4 × 14 mm (a)

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

► An "open" cable acts like an antenna and can cause faults on the drive controller.

Danger!

► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.

► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

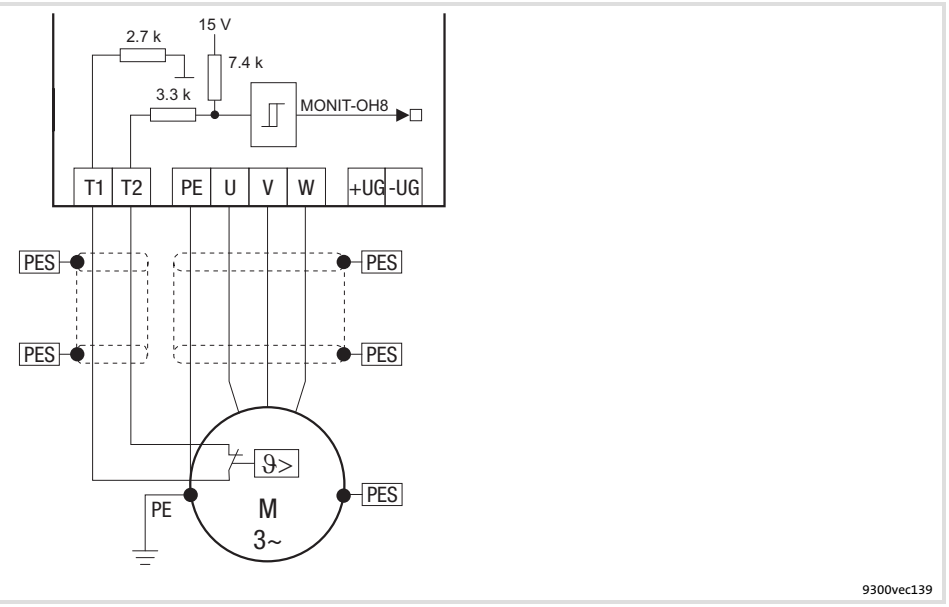


Fig. 5.5-4 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

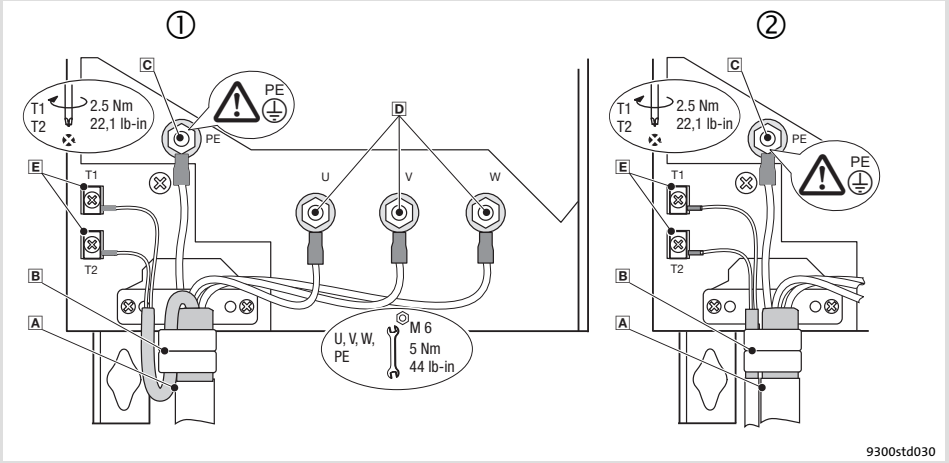


Fig. 5.5-5 Motor connection with PTC thermistor or thermal contact (NC contact)

① A Motor connection with Lenze system cable with integrated control cable for the motor temperature monitoring

B Shield sheet
Clamp entire shield **and** shield of the control cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

② A Motor cable connection and separate control cable for the motor temperature monitoring

B Shield sheet
Clamp shield of the motor cable **and** shield of the cable for the motor temperature monitoring with the straps. If required, fix by means of cable tie.

C PE stud
PE cable connection with ring cable lug

D U, V, W
Motor cable connection
Check the correct polarity. Observe maximum length of the motor cable.
Max. connectable cable cross-section: 50 mm^2 with ring cable lug

E T1, T2 for motor temperature monitoring
Cable connection for PTC thermistors or thermal contacts (NC contacts)

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

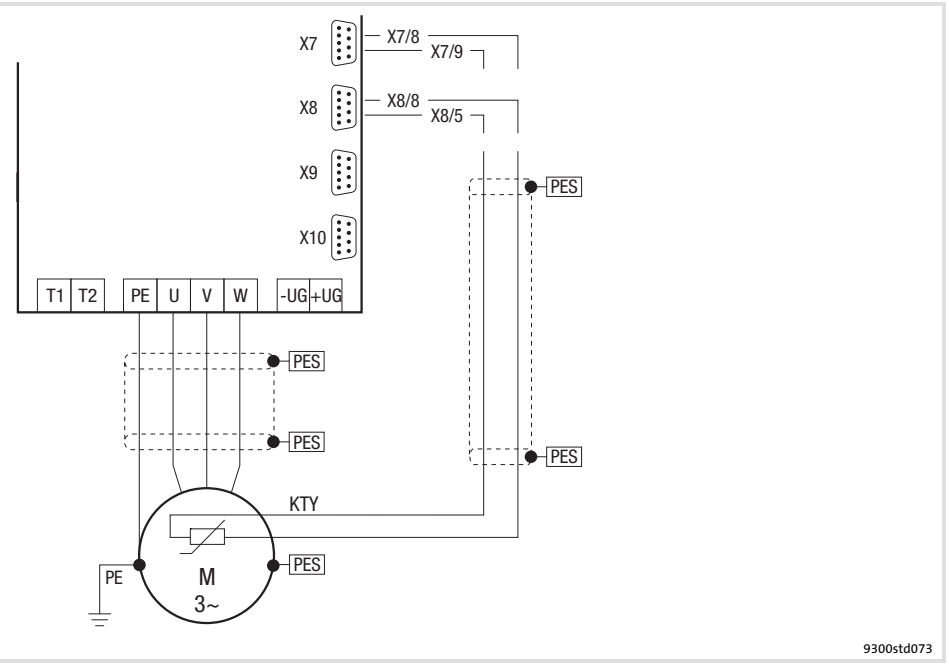


Fig. 5.5-6 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

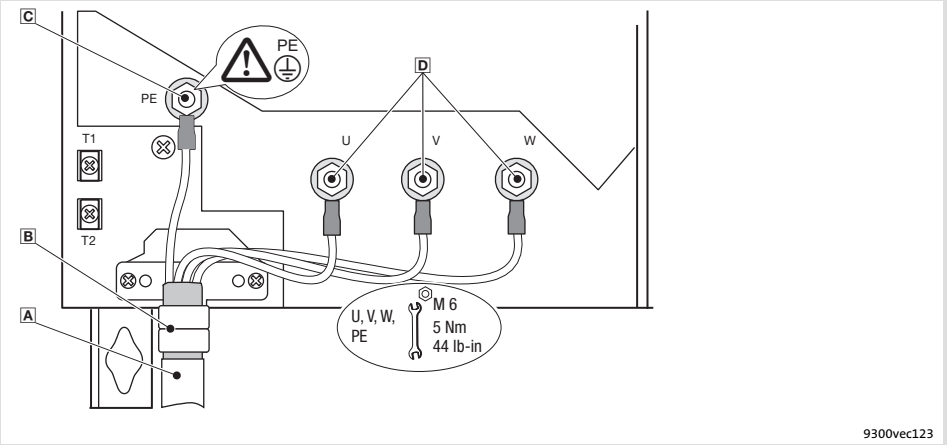


Fig. 5.5-7 Motor connection with KTY thermal sensor

- A Motor cable
- B Shield connection
  Clamp the motor cable shield with the straps. If required, fix by means of cable tie.
- C PE stud
  PE cable connection with ring cable lug
- D U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 50 mm^2 with ring cable lug

5.6 Standard devices with a power of 45 kW

5.6.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

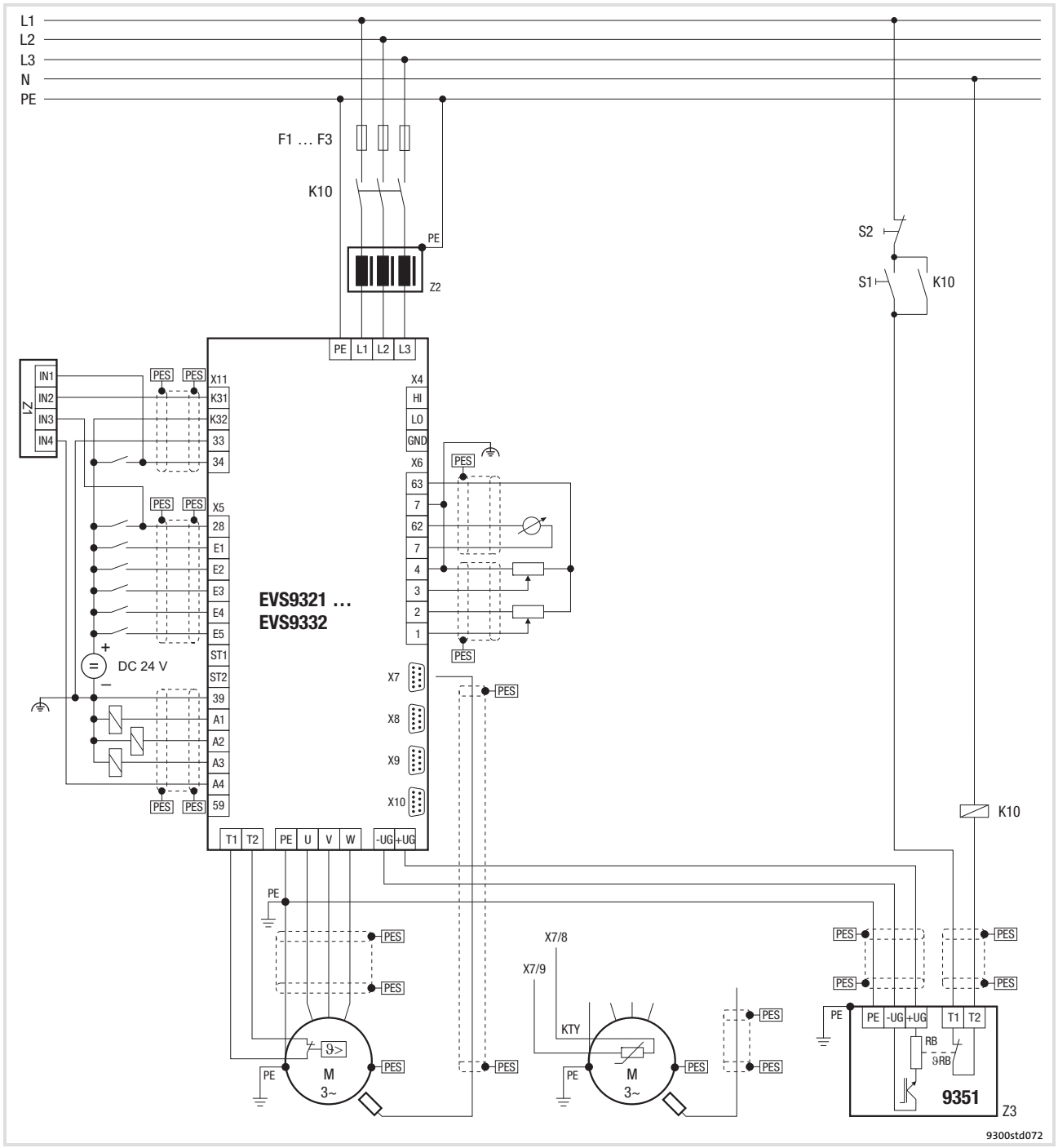
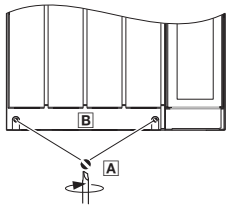


Fig. 5.6-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.6.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.6.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

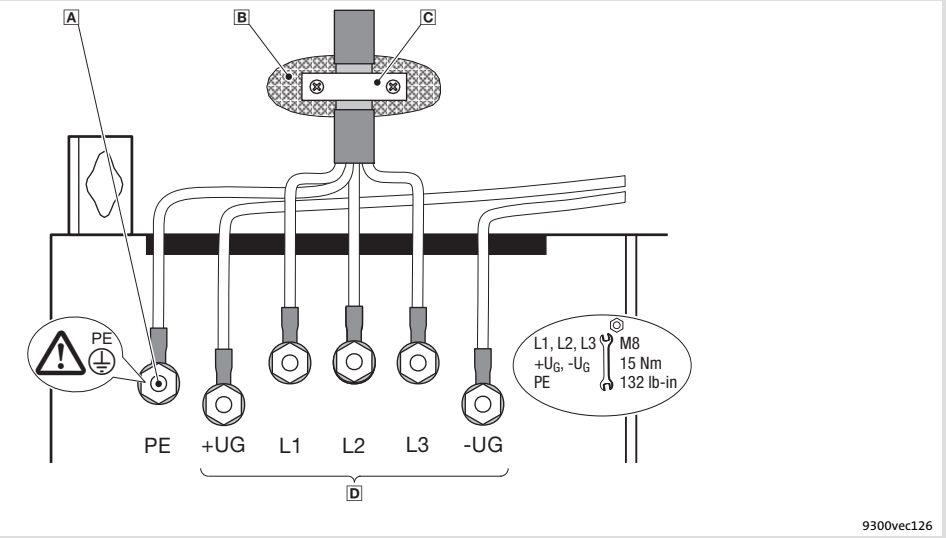


Fig. 5.6-2 Mains connection, DC supply for 45 kW controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.6.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9330-xP	100	–	–	35	300

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9330-xP	100	1

5.6.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9330-xP	ELN3-0038H085	EZN3A0030H110	25	EZN3B0030H110	50
		EZN3A0030H110N001 [3)]	25		
		E82ZN55334B230	50		

[3)] For controllers with thermal separation

5.6.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

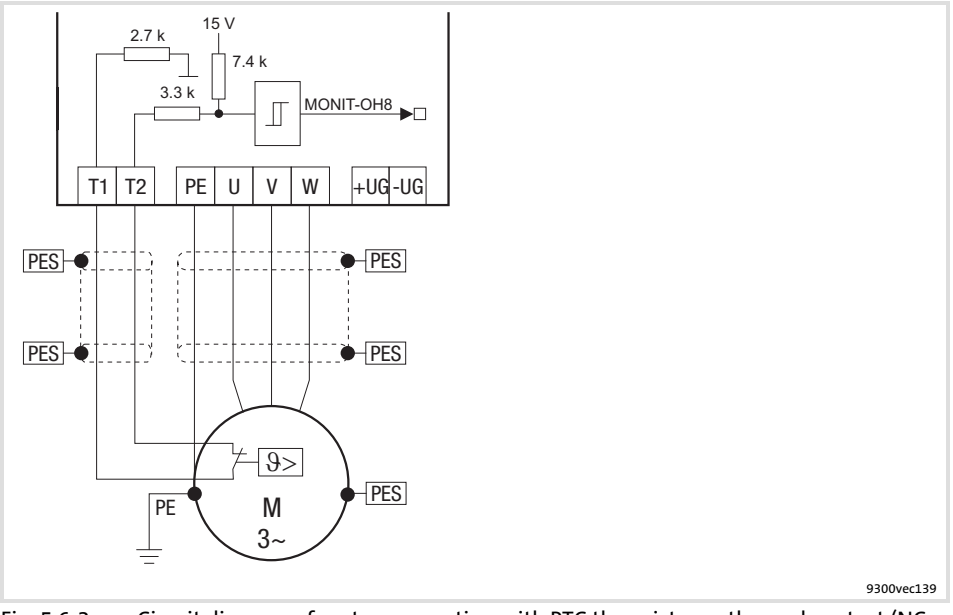


Fig. 5.6-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

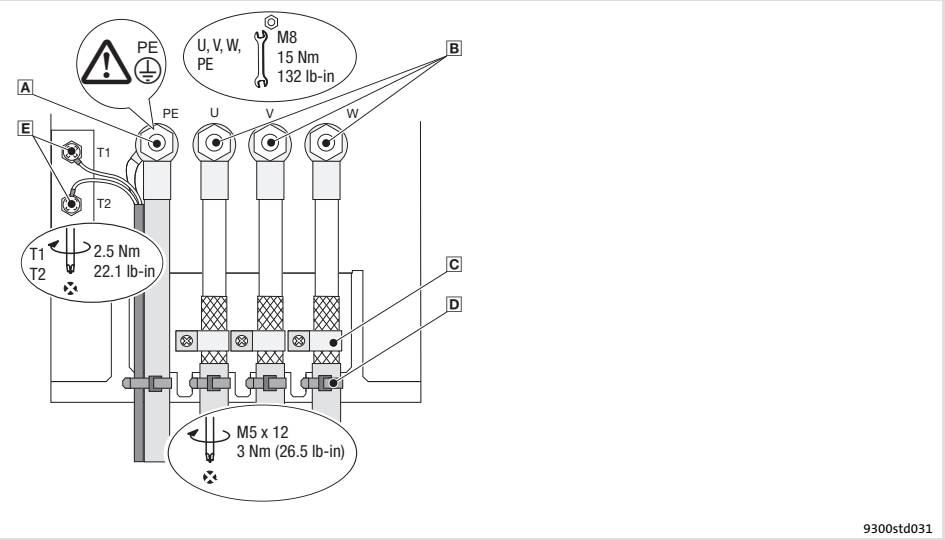


Fig. 5.6-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable
- E T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

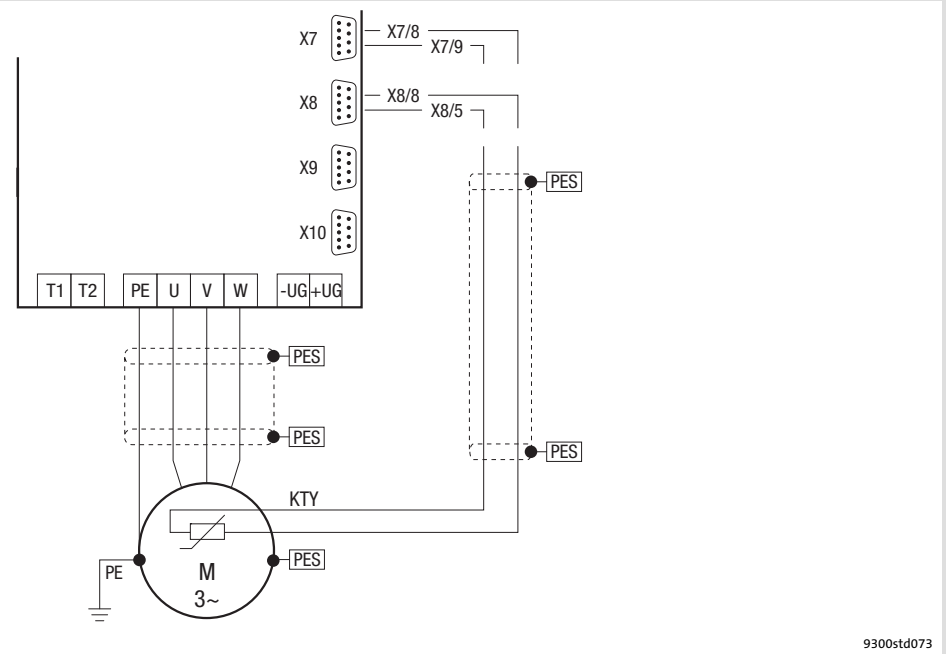


Fig. 5.6-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

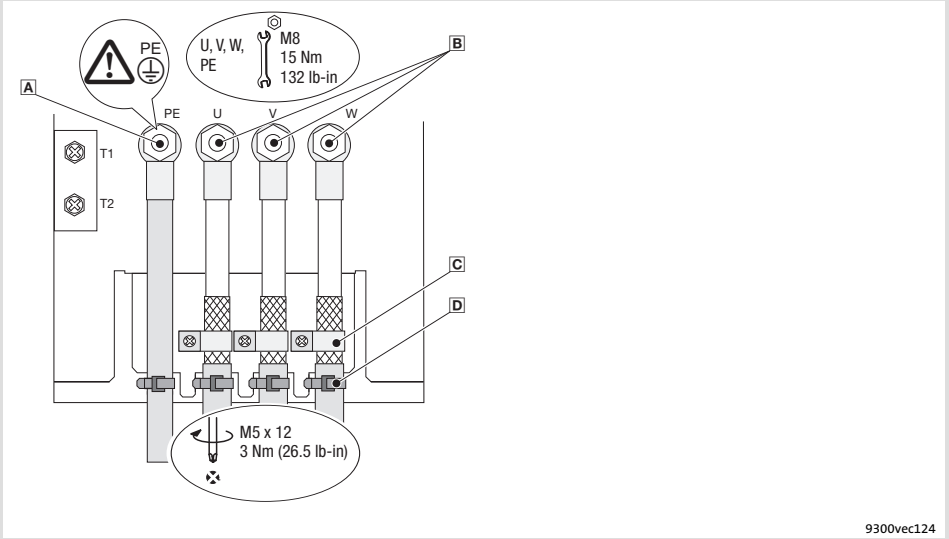


Fig. 5.6-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 120 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.7 Standard devices in the power range 55 ... 75 kW

5.7.1 Wiring according to EMC (CE-typical drive system)

The drives comply with the EC Directive on ”Electromagnetic Compatibility” if they are installed in accordance with the specifications for the CE-typical drive system. The user is responsible for the compliance of the machine application with the EC Directive.

Note!

Observe the notes given in the chapter ”Basics for wiring according to EMC”!

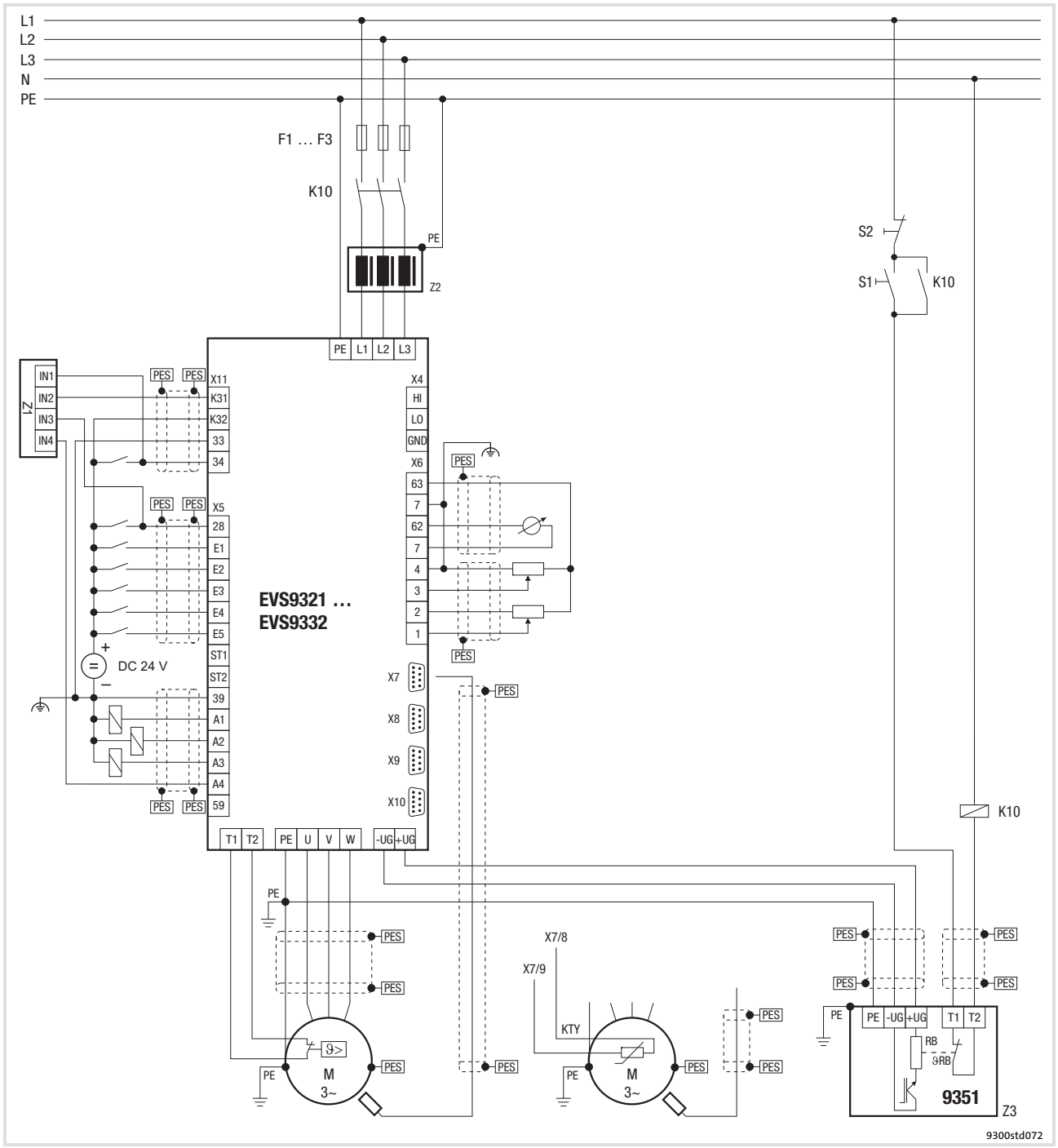
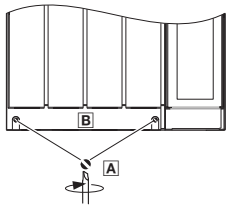


Fig. 5.7-1 Example for wiring in accordance with EMC regulations

F1 ... F3	Fuses
K10	Mains contactor
Z1	Programmable logic controller (PLC)
Z2	Mains choke or mains filter
Z3	EMB9351-E brake module
S1	Mains contactor on
S2	Mains contactor off
$+U_G$, $-U_G$	DC-bus connection
PES	HF shield termination through large-surface connection to PE

5.7.2 Important notes

To gain access to the power connections, remove the cover:

Remove the cover of the drive controller	
 9300vec113	1. Remove the screws A 2. Lift cover B up and detach it

Installation material required from the scope of supply:

Description	Use	Quantity
Cable ties 3.5 × 150 mm	Strain relief/shield connection for motor cable	4

5.7.3 Mains connection, DC supply

Note!

- If a mains filter or RFI filter is used and the cable length between mains/RFI filter and drive controller exceeds 300 mm, install a shielded cable.
- For DC-bus operation or DC supply, we recommend using shielded DC cables.

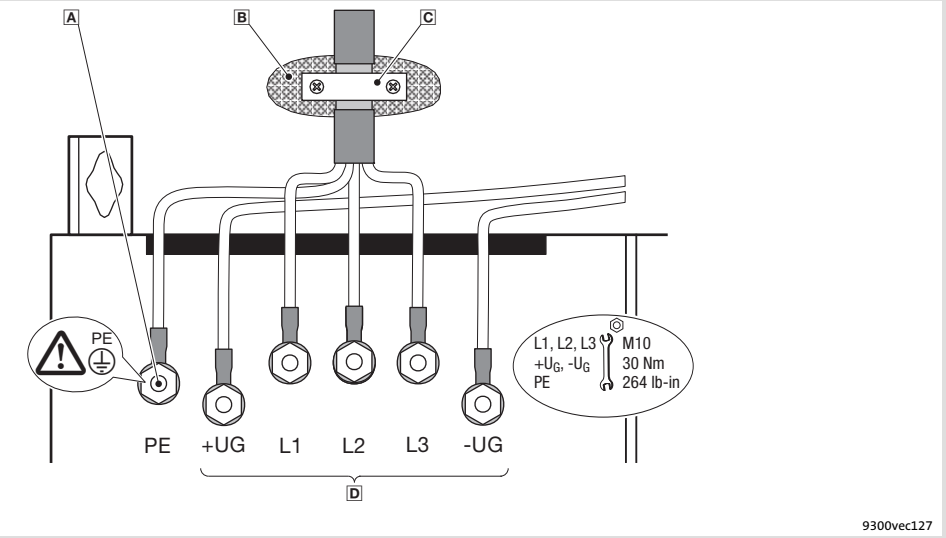


Fig. 5.7-2 Mains connection, DC supply for 55 ... 75 kW drive controller

- A PE stud
  Connect PE cable with ring cable lug
- B Conductive surface
- C Shield clamp
  Place shield with large surface on control cabinet mounting plate and fasten with shield clamp (shield clamp is not part of the scope of supply)
  To improve the shield connection, also place the shield on the PE stud
- D Mains and DC bus connection
  L1, L2, L3: Connection of mains cable with ring cable lugs
  $+U_G$, $-U_G$: Connection of DC-bus components or connection of the controller in the DC-bus system (see system manual)

5.7.4 Mains connection: Fuses and cable cross-sections

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Fuses	● Utilisation category: only gG/gL or gRL
Cables	Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of the cables or cores, three loaded cores. The data are recommendations. Other dimensionings/laying systems are possible (e.g. in accordance with VDE 0298-4).
RCCB	● Controllers can cause a DC current in the PE conductor. If a residual current device (RCD) or a fault current monitoring unit (RCM) is used for protection in the case of direct or indirect contact, only one RCD/RCM of the following type can be used on the current supply side: – Type B (universal-current sensitive) for connection to a three-phase system – Type A (pulse-current sensitive) or type B (universal-current sensitive) for connection to a 1-phase system Alternatively another protective measure can be used, like for instance isolation from the environment by means of double or reinforced insulation, or isolation from the supply system by using a transformer. ● Earth-leakage circuit breakers must only be installed between mains supply and controller.
Observe all national and regional regulations!	

9300	Rated fuse current		Cable cross-section		FI [1]
	Fuse	Circuit-breaker	Laying system L1, L2, L3, PE		
			B2	C	
Type	[A]	[A]	[mm²]	[mm²]	[mA]
Operation with mains choke/mains filter					
EVS9331-xP	125	–	–	35	300
EVS9332-xP	160	–	–	70	

1) Universal current-sensitive earth-leakage circuit breaker

Installation to UL

Supply conditions	
Range	Description
Fuses	● Only according to UL 248 ● Mains short-circuit current up to 10000 A_{rms}: All classes permissible ● Mains short-circuit current up to 50000 A_{rms}: Only classes "J", "T" or "R" permissible
Cables	● Only in accordance with UL ● The cable cross-sections specified in the following apply under the following conditions: – Conductor temperature < 60 °C – Ambient temperature < 40 °C
Observe all national and regional regulations!	

9300	Rated fuse current	Cable cross-section
	Fuse	L1, L2, L3, PE
Type	[A]	[AWG]
Operation with mains choke/mains filter		
EVS9331-xP	125	1/0
EVS9332-xP	175	2/0

5.7.5 Mains choke/mains filter assignment

9300	Mains choke	Interference voltage category according to EN 61800-3 and motor cable length			
		Component		Component	
Type		C2	max. [m]	C1	max. [m]
EVS9331-xP	ELN3-0027H105	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50
EVS9332-xP	ELN3-0022H130	EZN3A0022H150	25	E82ZN75334B230	10
		E82ZN75334B230	50	EZN3B0022H150	50

5.7.6 Motor connection

Note!

- ► Fusing the motor cable is not required.
- ► The drive controller features 2 connections for motor temperature monitoring:
  - – Terminals T1, T2 for connecting a PTC thermistor or thermal contact (NC contact).
  - – Pins X8/5 and X8/8 of the incremental encoder input (X8) for connecting a KTY thermal sensor.

Motor with PTC thermistor or thermal contact (NC contact)

Wire T1, T2 only if the motor is equipped with a PTC thermistor or thermal contact (NC contact).

- ► An ”open” cable acts like an antenna and can cause faults on the drive controller.

Danger!

- ► All control terminals only have basic insulation (single isolating distance) after connecting a PTC thermistor or a thermal contact.
- ► Protection against accidental contact in case of a defective isolating distance is only guaranteed through external measures, e.g. double insulation.

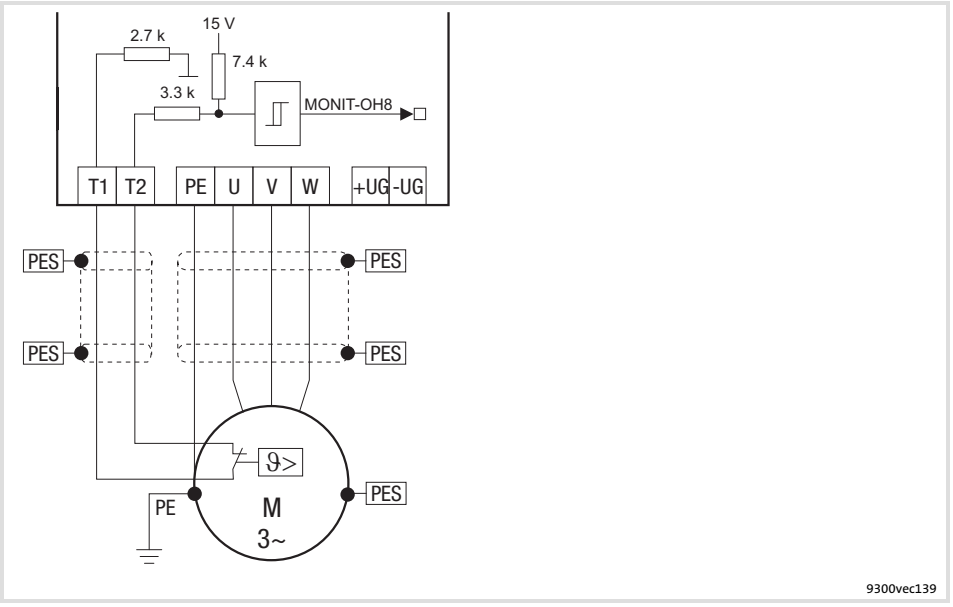


Fig. 5.7-3 Circuit diagram of motor connection with PTC thermistor or thermal contact (NC contact) at T1, T2

Characteristics of the connection for motor temperature monitoring:

Terminals T1, T2	
Connection	● PTC thermistor – PTC thermistor with defined tripping temperature (acc. to DIN 44081 and DIN 44082) ● Thermal contact (NC contact) – Thermostat as NC contact
Tripping point	● Fixed (depending on the PTC/thermal contact) ● PTC: Rϑ > 1600 Ω ● Configurable as warning or error (TRIP)
Notes	● Monitoring is not active in the Lenze setting. ● If you do not use a Lenze motor, we recommend the use of a PTC thermistor up to 150°C.

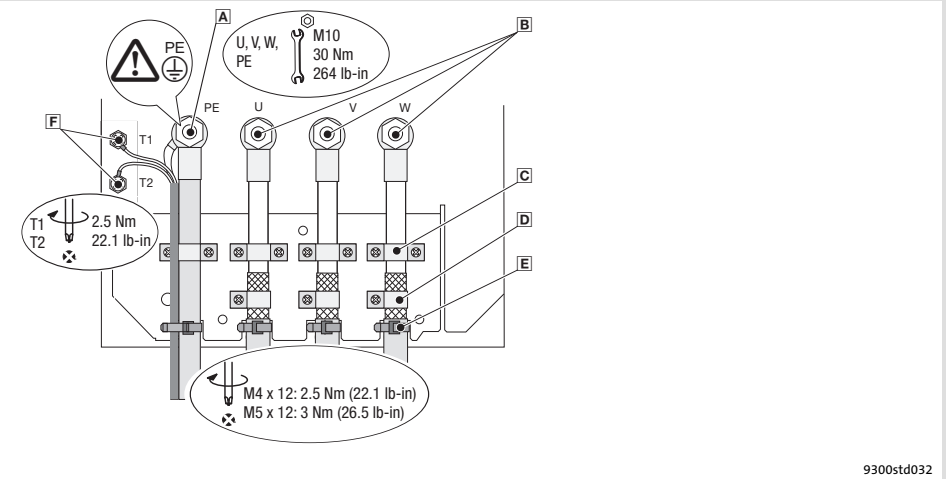


Fig. 5.7-4 Motor connection with PTC thermistor or thermal contact (NC contact)

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm² with ring cable lug
- C Cable clamps for strain relief of motor cable
  Fasten cable clamps with M4 × 12 mm screws
- D Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- E Cable ties for additional strain relief of motor cable
- F T1, T2 for motor temperature monitoring
  Cable connection for PTC thermistors or thermal contacts (NC contacts)
  Place shield with large surface on PE stud

Motor with KTY thermal sensor

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

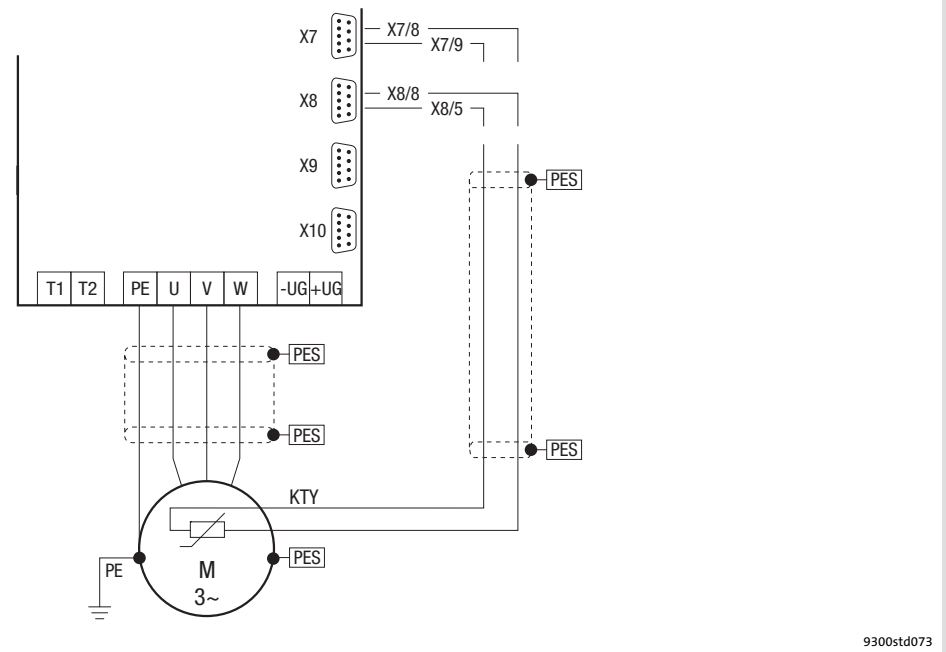


Fig. 5.7-5 Circuit diagram for the motor connection with KTY temperature sensor at X7 or X8

Features of the connection for motor temperature monitoring:

Pins X7/8, X7/9 of resolver input (X7), or pins X8/8, X8/5 of incremental encoder input (X8)	
Connection	Linear KTY temperature sensor
Tripping point	• Warning: adjustable • Error (TRIP): fixed at 150 °C
Notes	• Monitoring is not active in the Lenze setting. • The KTY temperature sensor is monitored with regard to interruption and short circuit.

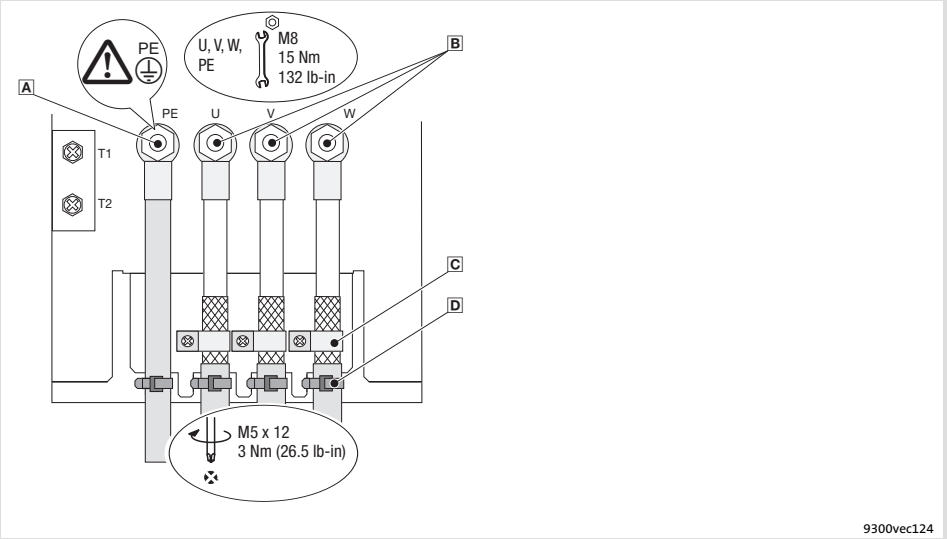


Fig. 5.7-6 Motor connection with KTY thermal sensor

- A PE stud
  PE cable connection with ring cable lug
- B U, V, W
  Motor cable connection
  Check the correct polarity. Observe maximum length of the motor cable.
  Max. connectable cable cross-section: 240 mm^2 with ring cable lug
- C Shield clamps
  Place shields of motor cable with large surface on the shield sheet and fasten with shield clamps and M5 × 12 mm screws
- D Cable ties
  Strain relief of motor cable

5.8 Control terminals

5.8.1 Important notes

Stop!

The control card will be damaged if

- the voltage between X5/39 and PE or X6/7 and PE is greater than 50 V,
- the voltage between voltage source and X6/7 exceeds 10 V (common mode) in case of supply via external voltage source.

Limit the voltage before switching on the drive controller:

- Connect X5/39, X6/2, X6/4 and X6/7 directly to PE or
- use voltage-limiting components.

- For trouble-free operation, the control cables must be shielded:
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
  - For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.

Installation material required from the scope of supply:

Description	Use	Quantity
Shield sheet	Shield connection for control cables	1
Screw M4 × 10 mm (DIN 7985)	Shield sheet fastening	1
Terminal strip, 4-pole (only for variants V004 and V024)	Connection of safety relay K_{SR} at X11	1
Terminal strip, 7-pole	Connection of digital inputs and outputs at X5	2
Terminal strip, 4-pole	Connection of analog inputs and outputs at X6	2

How to connect the shield

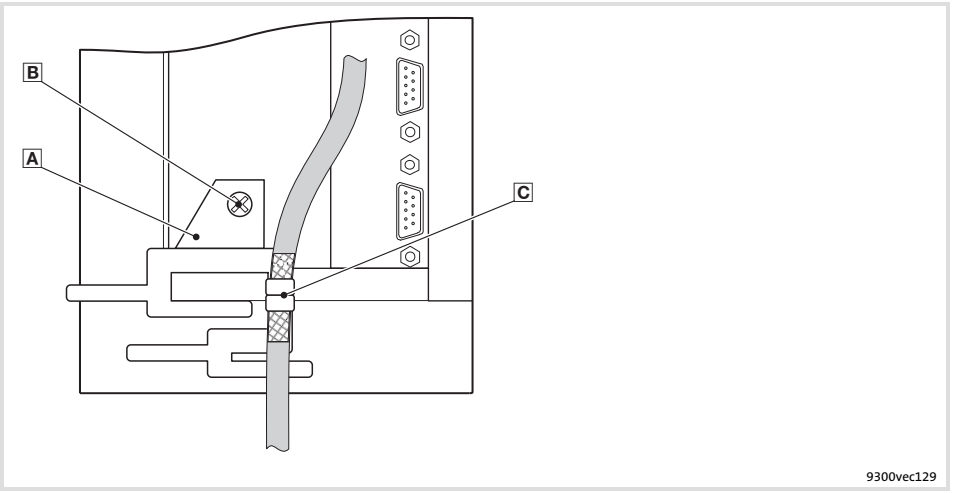


Fig. 5.8-1 Connection of cable shield to shield sheet

- A Shield sheet
- B Fasten shield sheet with M4 × 10 mm screw at the bottom of the control card
- C Securely clamp cable shield with lugs

Terminal data

Stop!

- ► Connect or disconnect the terminal strips only if the controller is disconnected from the mains!
- ► Wire the terminal strips before connecting them!
- ► Unused terminal strips must also be plugged on to protect the contacts.

Cable type		Wire end ferrule	Maximum cable cross-section	Tightening torque	Stripping length
	Rigid	–	2.5 mm² (AWG 14)	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	5 mm
	Flexible	Without wire end ferrule	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule without plastic sleeve	2.5 mm² (AWG 14)		
	Flexible	Wire end ferrule with plastic sleeve	2.5 mm² (AWG 14)		

5.8.2 Connection terminal of the control card

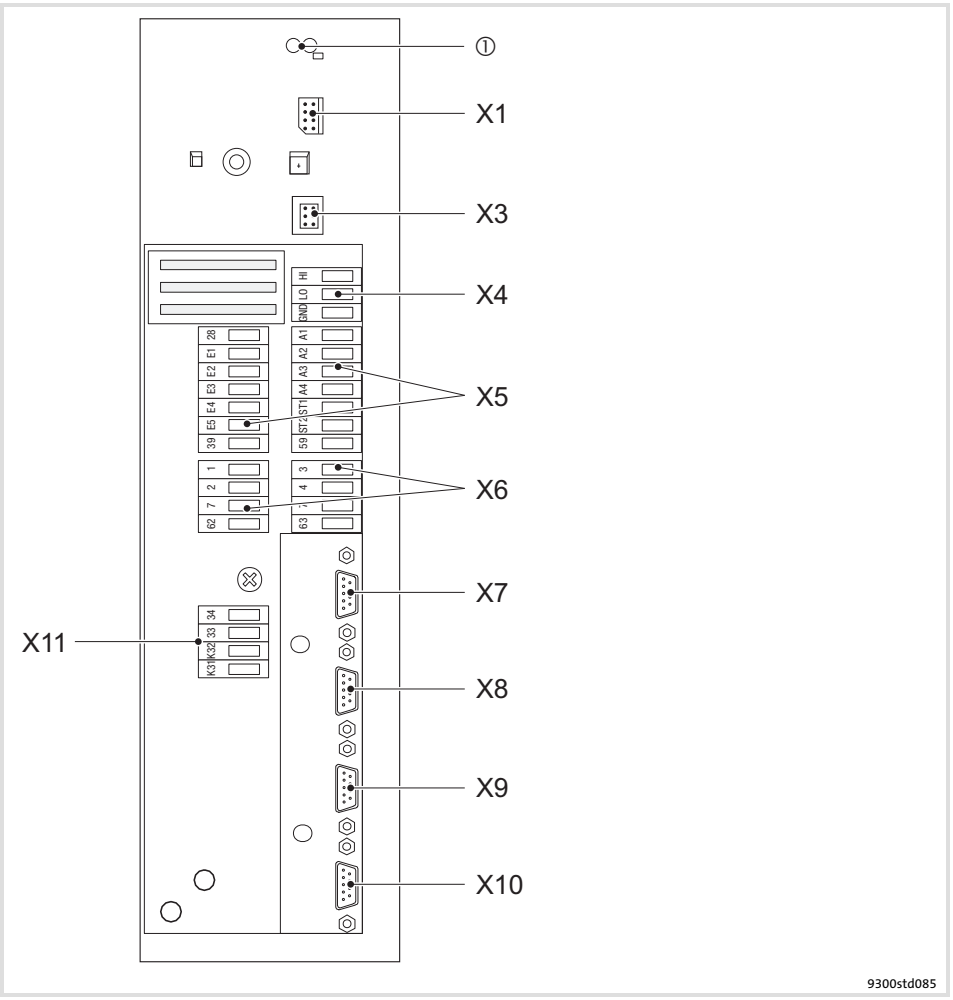


Fig. 5.8-2 Connection terminal of the control card

①	2 light-emitting diodes (red, green) for status display
X1	Automation interface (AIF) Slot for communication modules (e.g. keypad XT)
X3	Jumper for the preselection of the signal type for the input signal at X6/1, X6/2
X4	System bus (CAN) connection, terminal strip
X5	Connection of digital inputs and outputs, terminal strips
X6	Connection of analog inputs and outputs, terminal strips
X7	Resolver connection Plug-in connector: Socket, 9-pole, Sub-D
X8	Incremental encoder connection Plug-in connector: Pin, 9-pole, Sub-D
X9	Connection of digital frequency input signal Plug-in connector: Pin, 9-pole, Sub-D
X10	Connection of digital frequency output signal Plug-in connector: Socket, 9-pole, Sub-D
X11	Connection of safety relay K_{SR}, terminal strip

5.8.3 Device variant without ”Safe torque off” function

Internal voltage supply

- For the supply of the digital inputs (X5/E1 ... X5/E5) you have to set a freely assignable digital output (e. g. X5/A1) permanently to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

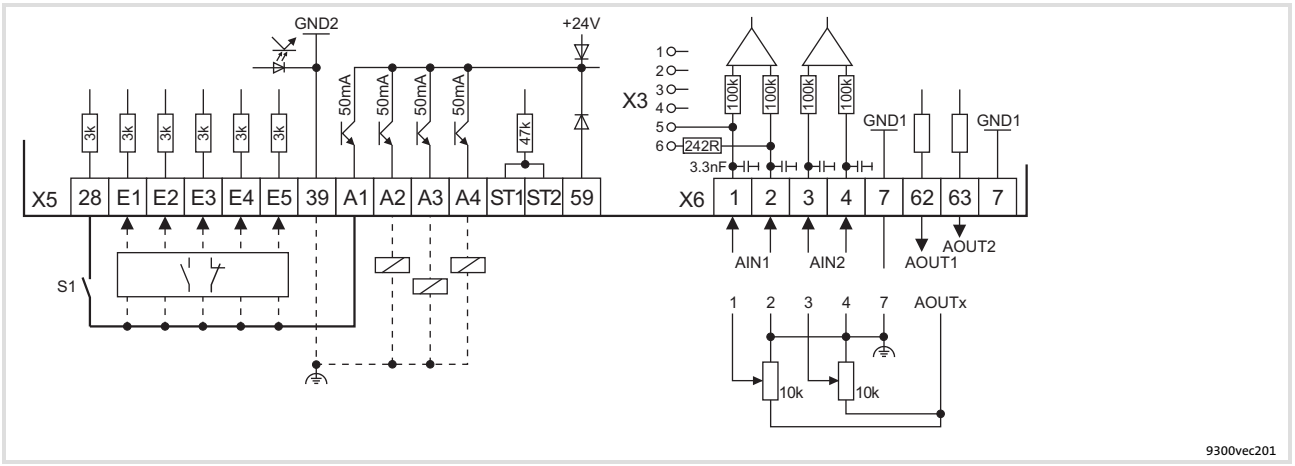


Fig. 5.8-3 Wiring of digital and analog inputs/outputs for internal voltage source

S1 Controller enable
NO contact or NC contact
Z Load
—— Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Supply via external voltage source

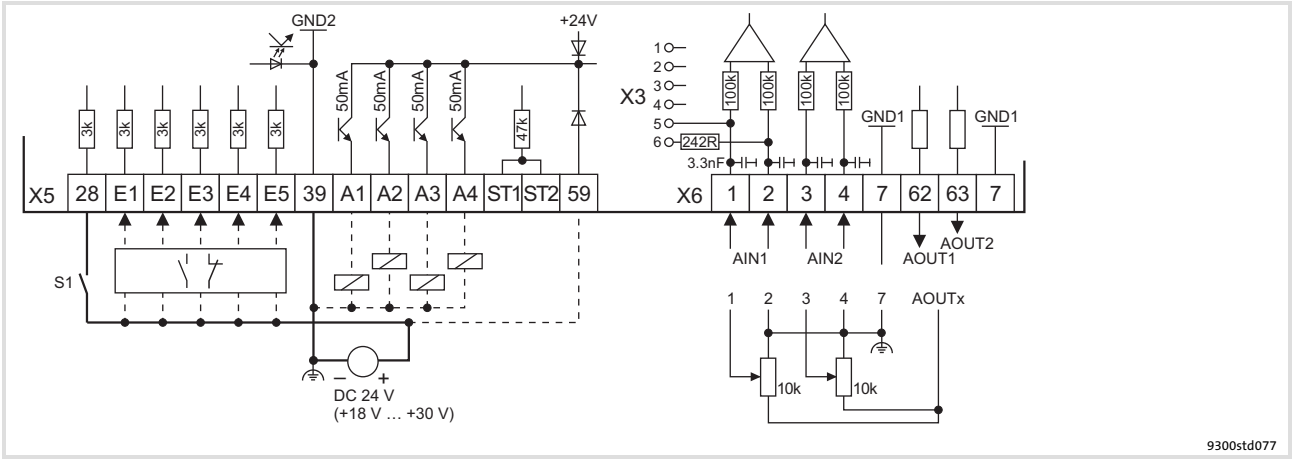


Fig. 5.8-4 Wiring of digital and analog inputs/outputs for external voltage source

S1 Controller enable
NO contact or NC contact
Z Load
—— Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

5.8.4 Device variant with ”Safe torque off” function

Safety instructions for the installation of the ”Safe torque off” function

- The installation and commissioning of the “Safe torque off” function must be carried out by skilled personnel only.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, for instance by a cable duct. Short circuits between the single cables must be ruled out!
- Wiring of the safety relay K_{SR} with insulated wire end ferrules or rigid cables is absolutely vital.
- The electrical reference point for the coil of the safety relay K_{SR} must be connected with the protective conductor system (DIN EN 60204-1 paragraph 9.4.3). Only this measure guarantees that the operation is protected against earth faults.

Tip!

A complete description can be found in the chapter ”Safe torque off”.

Internal voltage supply

- If a freely assignable digital output (e. g. X5/A1) is fixedly applied to HIGH level, it serves as an internal voltage source. An output can be loaded with a maximum of 50 mA.
  - Via a digital output you can supply the relay K_{SR} and two digital inputs (X5/28, and for instance X5/E1) with voltage.
  - For the maximum connection (relay K_{SR} and X5/E1 ... X5/E5) you have to connect two digital outputs in parallel and fixedly apply them to HIGH level.
- For the supply of the analog inputs (X6/1, X6/2 and X6/3, X6/4) you have to set a freely assignable analog output (e. g. X6/63) permanently to HIGH level.

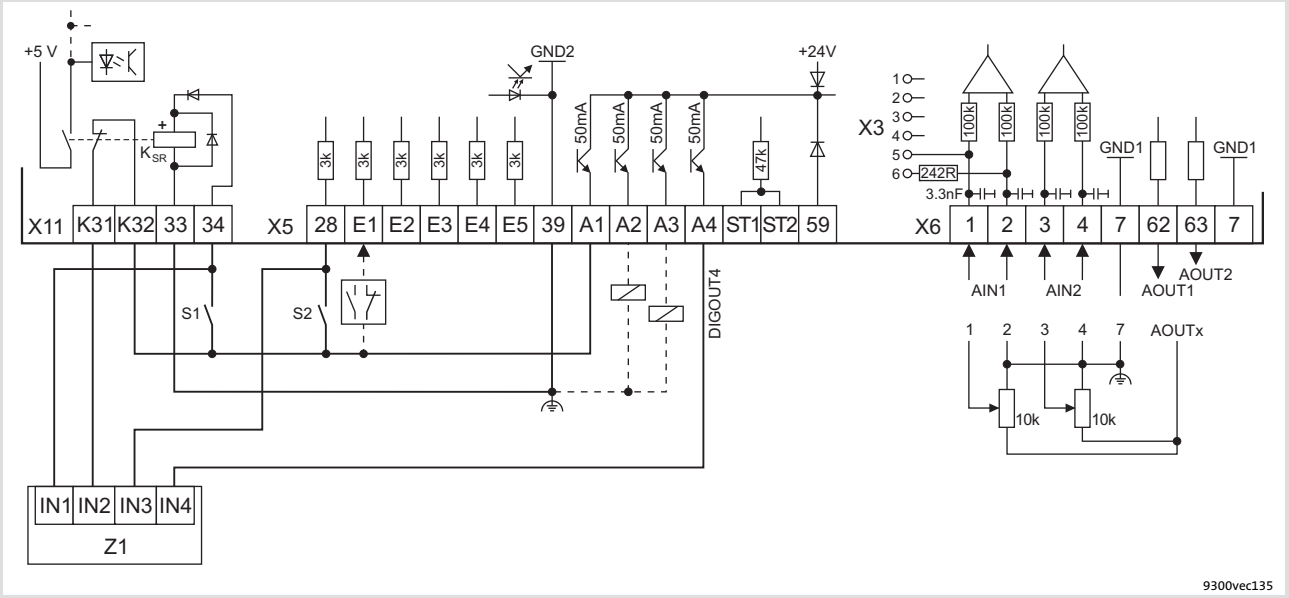


Fig. 5.8-5 Wiring of digital and analog inputs/outputs with active ”Safe torque off” function and internal voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the ”Safe torque off” function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

If you load a basic configuration C0005 = xx1x (e.g. 1010 for speed control with control via terminals), the following terminals are switched to a fixed signal level:

- Terminal X5/A1 to FIXED1 (corresponds to DC 24 V).
- Terminal X6/63 to FIXED100% (corresponds to 10 V).

Supply via external voltage source

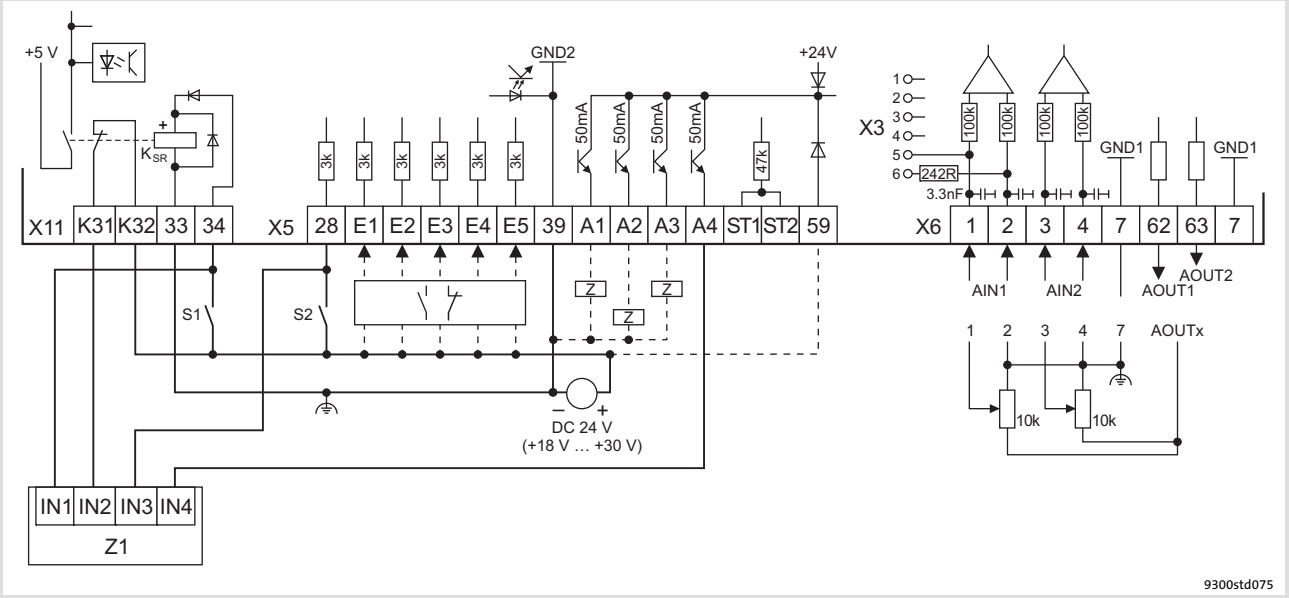


Fig. 5.8-6 Wiring of digital and analog inputs/outputs with active "Safe torque off" function and external voltage source

S1 Deactivate pulse inhibit (1st disconnecting path)
S2 Enable controller (2nd disconnecting path)
Z1 Programmable logic controller (PLC)
The PLC monitors the "Safe torque off" function
X5/A4 Feedback via a digital output (e. g. DIGOUT4)
NO contact or NC contact
Load
Minimum wiring required for operation
Terminal assignment in the Lenze setting: 📖 5.8-9

Note!

Supplying the digital inputs via an external voltage source enables a **backup operation in the case of mains failure**. After switching off the mains voltage, all actual values are continued to be detected and processed.

- ► Connect the positive pole of the external voltage source with X5/59 to establish the backup operation in the event of mains failure.
- ► The external voltage source must be able to supply a current ≥ 1 A.
- ► The starting current of the external voltage source is not limited by the controller. Lenze recommends the use of voltage sources with current limitation or with an internal impedance of Z > 1 Ω.

5.8.5 State bus

Stop!

Destruction of the control card!

External voltage at X5/ST1, X5/ST2 destroys the control card.

Protective measure:

Do not connect an external voltage to X5/ST1, X5/ST2.

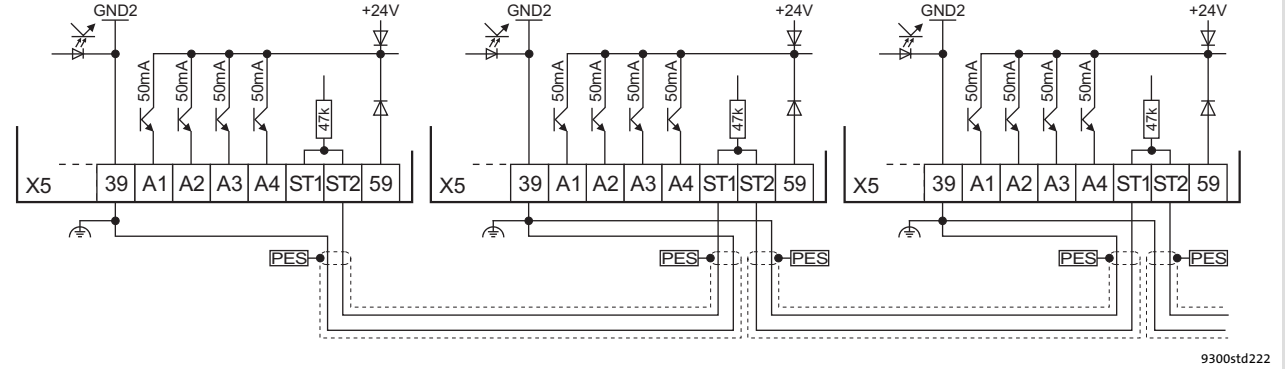


Fig. 5.8-7 Example for wiring a drive system to the STATE BUS

PES HF shield termination by large-surface connection to PE

5.8.6 Terminal assignment

Analog input configuration

Terminal	Jumper strip X3	Jumper setting	Possible levels
X6/1, X6/2		1-2 [1)]	-10 V ... +10 V [1)]
		3-4	-10 V ... +10 V
		5-6	-20 mA ... +20 mA

1) Lenze setting (delivery state)

Non-configurable control terminals

Terminal	Description	Function	Level / state
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Pulse inhibit feedback	Open contact: pulse inhibit is inactive (operation) Closed contact: pulse inhibit is active
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled
X5/ST1 X5/ST2		STATE-BUS	

Configurable control terminals (Lenze setting)

Terminal	Description	Function	Level
X5/E1	Digital inputs	Limit switch, negative side (POS-LIM-NEG)	LOW
X5/E2		Limit switch, positive side (POS-LIM-POS)	LOW
X5/E3		Start positioning program (POS-PRG-START)	LOW-HIGH edge
X5/E4		Reference switch (POS-REF-MARK) and touch probe input	HIGH
X5/E5		Reset TRIP error message (DCTRL-TRIP-RES)	LOW-HIGH edge
		Reset positioning program (PRG-RESET)	HIGH
		Activate manual operation (POS-MANUAL)	HIGH
X5/A1	Digital outputs	Reference known (POS-REF-OK)	HIGH
X5/A2		Position target reached (POS-IN-TARGET)	HIGH
X5/A3		Ready for operation (DCTRL-RDY)	HIGH
X5/A4		Program function output (POS-PFO1) (output can be switched via the positioning program)	HIGH
X6/1, X6/2	Analog inputs	None	-10 V ... +10 V
X6/3, X6/4		None	-10 V ... +10 V
X6/62	Analog outputs	Actual speed value (MCTRL-NACT)	-10 V ... +10 V
X6/63		Torque setpoint (MCTRL-MSET2)	-10 V ... +10 V

5.8.7 Technical data

Safety relay K_{SR}

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

Digital inputs, digital outputs

Terminal	Description	Field	Values
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
X5/E1 X5/E2 X5/E3 X5/E4 X5/E5	Digital inputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Input current per input	8 mA for +24 V
		Cycle time	1 ms
X5/A1 X5/A2 X5/A3 X5/A4	Digital outputs	PLC level, HTL	LOW: 0 ... +3 V HIGH: +12 ... +30 V
		Load capacity per output	Maximally 50 mA
		Load resistance	For +24 V at least 480 Ω
		Cycle time	1 ms
X5/39	GND2	Reference potential for digital signals Isolated to X6/7 (GND1)	
X5/59	Connection of external voltage source for backup operation of the drive controller in the case of mains failure	Input voltage	DC 24 V (+18 ... +30 V)
		Current consumption	Maximally 1 A for 24 V
X5/ST1 X5/ST2	STATE-BUS	Maximum number of nodes	20
		Maximum length of the bus cable	5 m

Analog inputs, analog outputs

Terminal	Description	Field	Values
X6/1 X6/2	Analog input 1	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
		Current range	
		Level	-20 mA ... +20 mA
		Resolution	20 µA (10 Bit + sign)
X6/3 X6/4	Analog input 2	Voltage range	
		Level	-10 V ... +10 V
		Resolution	5 mV (11 Bit + sign)
X6/62	Analog output 1	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/63	Analog output 2	Level	-10 V ... +10 V
		Load capacity	Maximum 2 mA
		Resolution	20 mV (9 bits + sign)
		Cycle time	1 ms (smoothing time τ = 2 ms)
X6/7	GND1	Reference potential for analog signals Isolated to X5/39 (GND2)	

5.9 Wiring of the system bus (CAN)

Wiring

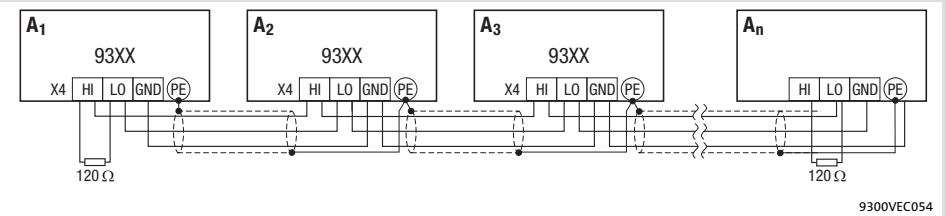


Fig. 5.9-1 System bus (CAN) wiring

A_1	Bus device 1 (controller)
A_2	Bus device 2 (controller)
A_3	Bus device 3 (controller)
A_n	Bus device n (e. g. PLC), n = max. 63
X4/GND	CAN-GND: System bus reference potential
X4/LO	CAN-LOW: System bus LOW (data line)
X4/HI	CAN-HIGH: System bus HIGH (data line)

Stop!

Connect a 120 Ω terminating resistor to the first and last bus device.

We recommend the use of CAN cables in accordance with ISO 11898-2:

CAN cable in accordance with ISO 11898-2	
Cable type	Paired with shielding
Impedance	120 Ω (95 ... 140 Ω)
Cable resistance/cross-section	
Cable length ≤ 300 m	≤ 70 mΩ/m / 0.25 ... 0.34 mm² (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm² (AWG20)
Signal propagation delay	≤ 5 ns/m

5.10 Wiring of the feedback system

5.10.1 Important notes

The feedback signal can either be supplied via input X7 or via input X8.

► At X7 a resolver can be connected.

► At X8 an encoder can be connected.
  – Incremental encoder TTL
  – SinCos encoder
  – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

► We recommend to use Lenze system cables for wiring.

► For self-made cables only use cables with shielded cores twisted in pairs.

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

5.10.2 Resolver at X7

Technical data

Field	Values
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Resolver type recommended	Receiver
Number of pole pairs of the resolver	1
Transmission ratio	0.3
Evaluation method	Voltage impression in the sine and cosine winding
Max. output voltage	± 10 V
Max. current consumption	50 mA per winding
Max. impedance [Z]	500 Ω per winding
Output frequency	4 kHz
Monitoring	Monitoring for open circuit of the resolver and the resolver cable (configurable)

Wiring

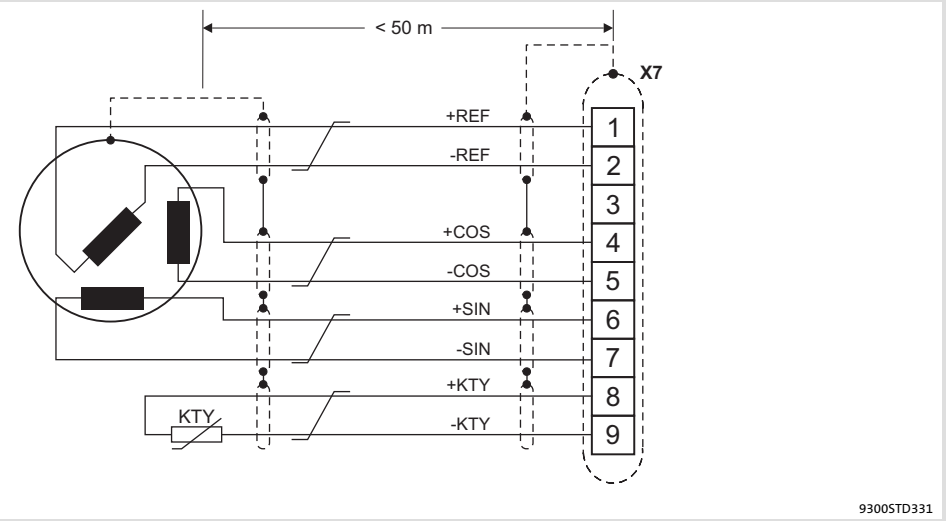


Fig. 5.10-1 Resolver connection

Cores twisted in pairs

X7 - Resolver Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	+REF	-REF	GND	+COS	-COS	+SIN	-SIN	+KTY	-KTY
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.10.3 Incremental encoder with TTL level at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable incremental encoder	Incremental encoder with TTL level ● Encoder with two 5 V complementary signals electrically offset by 90° ● Connection of zero track is possible (optional)
Input frequency	0 ... 500 kHz
Current consumption	6 mA per channel
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

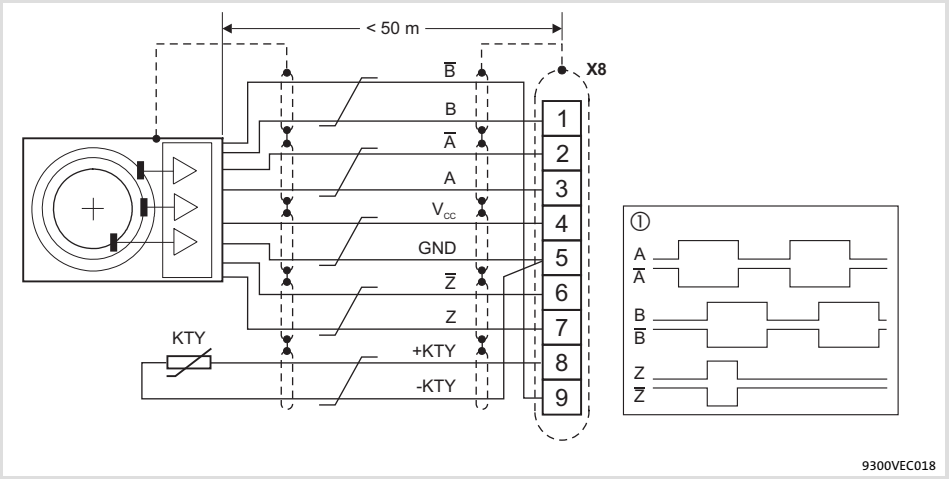


Fig. 5.10-2 Connection of incremental encoder with TTL level (RS-422)

① Signals for CW rotation
Cores twisted in pairs

X8 - Incremental encoder with TTL level Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (-KTY)	$\overline{Z}$	Z	+KTY	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.10.4 SinCos encoder at X8

Technical data

Field	Values
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Connectable SinCos encoders	● SinCos encoders with a rated voltage from 5 V... 8 V. ● SinCos encoder of the company Stegmann with Hiperface® interface, Stegmann type SCS/SCM (prolongs the initialisation time of the controller to approx. 2 seconds)
Sine and cosine track voltage	1 V_{ss} ±0.2 V
Voltage RefSIN and RefCOS	+2.5 V
Internal resistance R_i	221 Ω
Internal voltage source (X8/4, X8/5)	5 V DC / max. 200 mA

Wiring

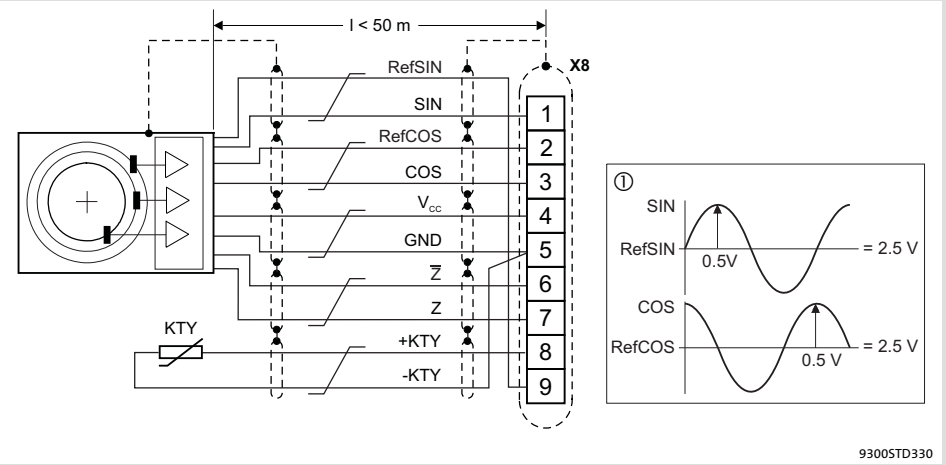


Fig. 5.10-3 SinCos encoder connection

① Signals for CW rotation
Cores twisted in pairs

X8 - SinCos encoder Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS	COS	V_{CC}	GND (-KTY)	$\overline{Z}$ or -RS485	Z or +RS485	+KTY	RefSIN
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

Note!

► For encoders with tracks SIN, $\overline{SIN}$, COS, $\overline{COS}$:
– Assign RefSIN with $\overline{SIN}$.
– Assign RefCOS with $\overline{COS}$.

5.11 Wiring of digital frequency input / digital frequency output

Installation material required from the scope of supply:

Description	Use	Quantity
Protective cover	Protection for unused Sub-D connections	4

Technical data

Field	Digital frequency output X10
Connection at drive controller	Connector: Socket, 9-pole, Sub-D
Pin assignment	Dependent on the selected basic configuration
Output frequency	0 ... 500 kHz
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Load capacity	Max. 20 mA per channel (up to 3 slave drives can be connected)
Special features	The "Enable" output signal at X10/8 switches to LOW if the drive controller is not ready for operation (e.g. disconnected from mains). This can trip SD3 monitoring on the slave drive.
Internal voltage source (X10/4, X10/5)	DC 5 V / max. 50 mA Total current at X9/4, X9/5 and X10/4, X10/5: max. 200 mA

Field	Digital frequency input X9
Connection at drive controller	Connector: Pin, 9-pole, Sub-D
Input frequency	0 ... 500 kHz (TTL level)
Signal	Two-track with inverse 5 V signals (RS422) and zero track
Signal evaluation	Via code C0427
Current consumption	Max. 5 mA
Special features	With activated SD3 monitoring, TRIP or warning is tripped if the "Lamp Control" input signal at X9/8 switches to LOW. Due to this the drive controller can respond if the master drive is not ready for operation.

Wiring

Note!

- ► We recommend to use Lenze system cables for wiring.
- ► For self-made cables only use cables with shielded cores twisted in pairs.

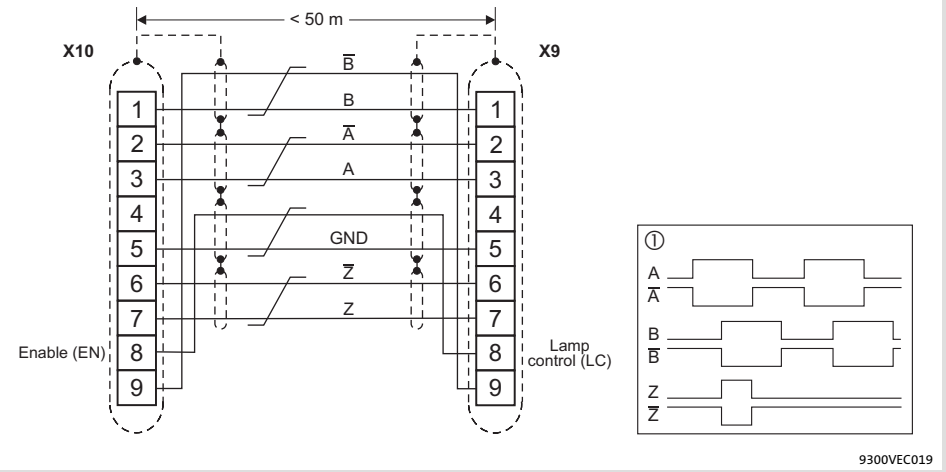


Fig. 5.11-1 Connection of digital frequency input (X9) / digital frequency output (X10)

X9 Slave drive
X10 Master drive
① Signals for CW rotation
Cores twisted in pairs

X9 - Digital frequency input Connector: Pin, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	LC	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

X10 - Digital frequency output Connector: Socket, 9-pole, Sub-D									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	+5 V	GND	$\overline{Z}$	Z	EN	$\overline{B}$
	0.14 mm² (AWG 26)			0.5 mm² (AWG 20)		0.14 mm² (AWG 26)		0.5 mm² (AWG 20)	0.14 mm² (AWG 26)

Adjustment

Evaluation of the input signals at X9		
Code	**Function**	
C0427 = 0	CW rotation	Track A leads track B by 90 ° (positive value at DFIN-OUT)
	CCW rotation	Track A lags track B by 90 ° (negative value at DFIN-OUT)
C0427 = 1	CW rotation	Track A transmits the speed Track B = LOW (positive value at DFIN-OUT)
	CCW rotation	Track A transmits the speed Track B = HIGH (negative value at DFIN-OUT)
C0427 = 2	CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT) Track B = LOW
	CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT) Track A = LOW

6 Commissioning

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6.1 Important notes

Active loads

Stop!

For applications with active loads (e.g. hoists), you must set C0172 = 0 (OV reduce: threshold for activation of brake torque reduction before OV message) so that an overvoltage message (OV) can be generated.

- ► As long as the overvoltage message (OV) is active, pulse inhibit is set and the drive operates in zero-torque mode.
- ► The controller inhibit is also evaluated by the “holding brake (BRK)” function block.

Commissioning sequence

Danger!

Do not change any settings on the controller which are not described in this chapter.

Carry out the commissioning systematically:

1. Carry out basic settings on the controller.
2. Carry out functional test of the manual control.
3. Enter travel profile parameters.
4. Reference the positioning application.
5. Control drive

»Global Drive Control« (GDC)

Use a PC with the »Global Drive Control« (GDC) PC software for commissioning. The full functionality of the servo cam profiler can only be obtained through GDC.

- ► Possible communication paths between GDC and controller including adapters and connection cables required:

Controller	Connection	PC	
Interface		PC adapter	Interface
Integrated system bus or CANopen communication module **EMF2175IB**	System bus cable (supplied with the system bus adapters)	System bus adapter **EMF2173IB**	Parallel (printer interface)
		System bus adapter **EMF2177IB**	USB
Communication module LECOM-A/B **EMF2102IBCV001**	Serial cable **EWL0020** **EWL0021**	A standard RS232 / RS485 converter and an RS485 connection cable are required for LECOM-B.	Serial (RS232)
Communication module LECOM-LI **EMF2102IBCV003**	Optical fibre **EWZ0006** **EWZ0007**	Optical fibre adapter **EMF2125IB** **EMF2126IB**	

6.2 Before switching on

Stop!

Special commissioning procedure after long-term storage

If controllers are stored for more than two years, the insulation resistance of the electrolyte may have changed.

Possible consequences:

► During initial switch-on, the DC-bus capacitors and hence the controller are damaged.

Protective measures:

► Form the DC-bus capacitors prior to commissioning. Instructions can be found on the Internet (www.Lenze.com).

Note!

► Keep to the switch-on sequence described.

► The chapter ”Troubleshooting and fault elimination” helps you to eliminate faults during commissioning.

To avoid injury to persons or damage to material assets ...

... before the mains supply is connected, check:

► The wiring for completeness, short circuit and earth fault.

► The ”EMERGENCY STOP” function of the entire system.

► The in-phase connection of the motor.

► The correct connection of the resolver or incremental encoder to prevent the motor from rotating in the wrong direction.

... check the setting of the most important drive parameters before enabling the controller:

► Is the U/f rated frequency adapted to the motor circuit configuration?

► Are the drive parameters relevant for your application set correctly?

► Is the configuration of the analog and digital inputs and outputs adapted to the wiring?

6.3 Switch-on sequence

6.3.1 Sequence diagram

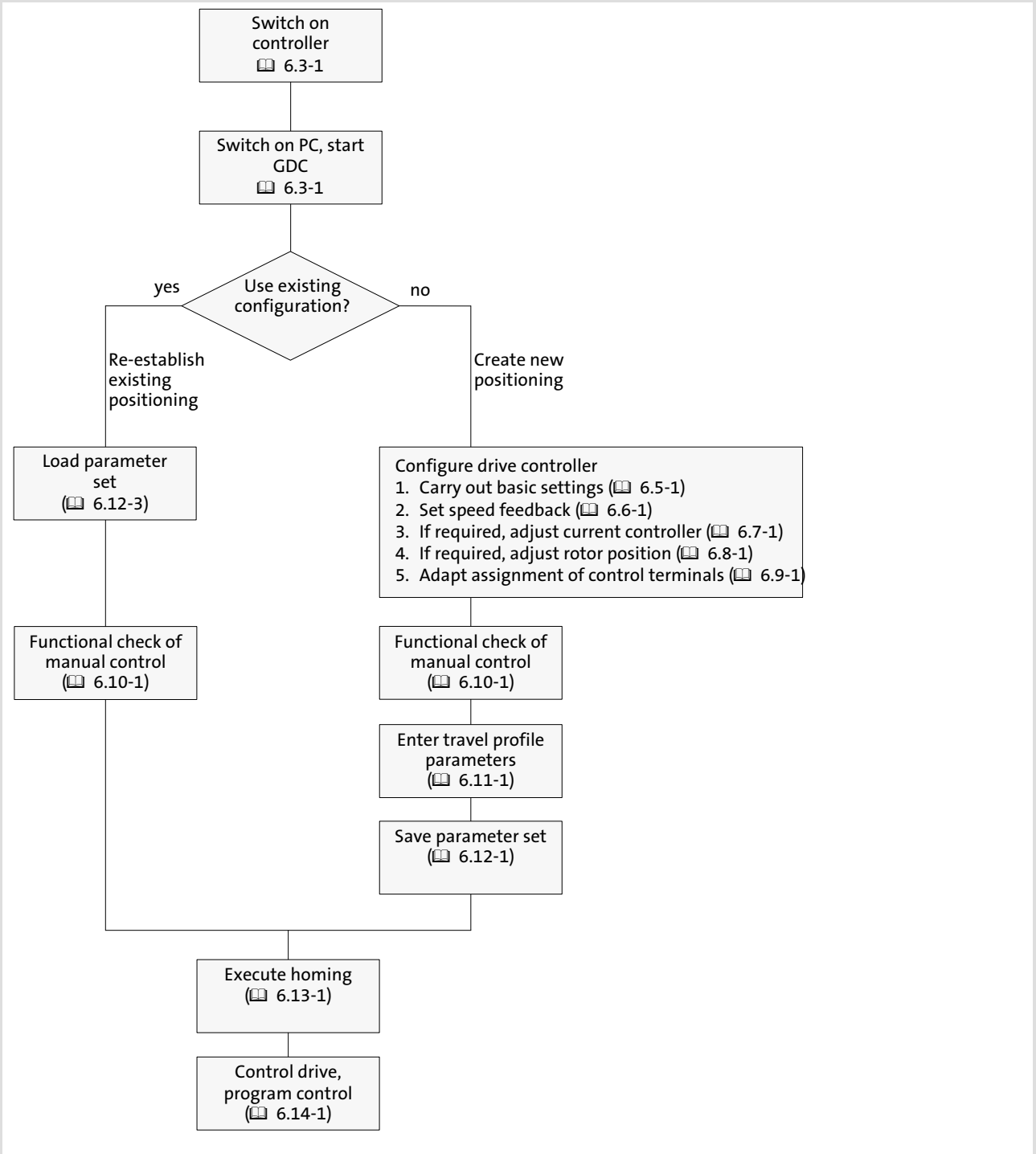
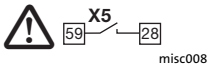
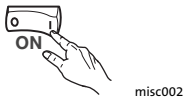
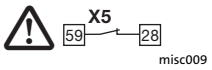


Fig. 6.3-1 Commissioning sequence

6.3.2 Commissioning steps

Switch-on sequence			Comment
1.	Ensure that controller inhibit is active after mains connection.		Terminal X5/28 = LOW
2.	Ensure that no external error is pending.		Terminal X5/E4 = HIGH
3.	Switch on controller.		
A	The control card is operated via an external voltage supply: Switch on the external DC 24 V supply voltage.		
B	The control card is operated via an internal voltage supply: Switch on the mains. The controller provides the DC 24 V supply.		
4.	After approx. 2 s the controller has initialised.		
5.	Switch on the PC and start GDC.		GDC starts in the online mode if the PC and the controller are connected to each other. Information on the connection establishment can be found in the ”Global Drive Control (GDC) - Getting started” manual.
6.	Do you want to use an existing configuration and positioning?		
A	Yes. Load the desired parameter set to the controller.		🕮 6.12-3 Then continue with step 11.
B	No. Configure controller and generate positioning.		Continue with step 7.
7.	Enter the machine parameters in GDC.		
A	Select the basic configuration. Lenze setting: C0005 = 1000 (basic configuration ”speed control”).		🕮 6.5-1
B	Adapt the controller to the mains.		🕮 6.5-1
C	Enter motor data.		🕮 6.5-3
D	Set temperature monitoring of the motor.		Motor with PTC or thermal contact: 🕮 6.5-12 Motor with KTY: 🕮 6.5-13
E	Select feedback system.		🕮 6.6-1
8.	If required, carry out a current controller adjustment.		🕮 6.7-1
9.	If required, carry out a rotor position adjustment.		🕮 6.8-1
10.	Configure the function of the control terminals to adapt them to your application.		If an internal voltage supply is used, assign ”FIXED1” to X5/x and ”FIXED100%” to X6/x. 🕮 6.9-1
11.	Check the travel range limit switches with the manual control.		🕮 6.10-1
12.	Enter the travel profile parameters.		🕮 6.11-1
13.	Save the settings with mains failure protection in one of the 4 parameter sets (C0003). With C0003 = 1 the settings are saved in parameter set 1.		After connecting the DC 24 V supply or after mains connection, parameter set 1 is activated automatically. (See chapter ”Parameterisation”)
14.	Carry out a homing.		🕮 6.13-1
15.	Switch on the mains if previously only the external DC 24 V supply voltage was switched on.		

Switch-on sequence			Comment
16.	Enable the controller.		Terminal X5/28 = HIGH (see chapter "Commissioning" →"Controller inhibit")
17.	Start the positioning program via the "Control" dialog box.		🕮 6.14-1
18.	The drive is now running.		

Note!

In the "Diagnostics" menu, the most important drive parameters can be monitored.

6.4 Controller inhibit

Description

If the controller inhibit is active, the power outputs are inhibited.

- The drive coasts in zero-torque mode.
- Status display of keypad: Pulse inhibit IMP
- Status display at the controller: The green LED is blinking.

Danger!

Do not use the ”controller inhibit” function (DCTRL1-CINH) for emergency-off. The controller inhibit only inhibits the power outputs and does **not** disconnect the controller from the mains!

The drive could start again any time.

Activation

Via terminal X5/28:

- A LOW level at the terminal inhibits the controller (cannot be inverted)
- A HIGH level re-enables the controller

Via the keys of the keypad (if C0469 = 1):

- STOP inhibits the controller
- RUN re-enables the controller

Via code C0040:

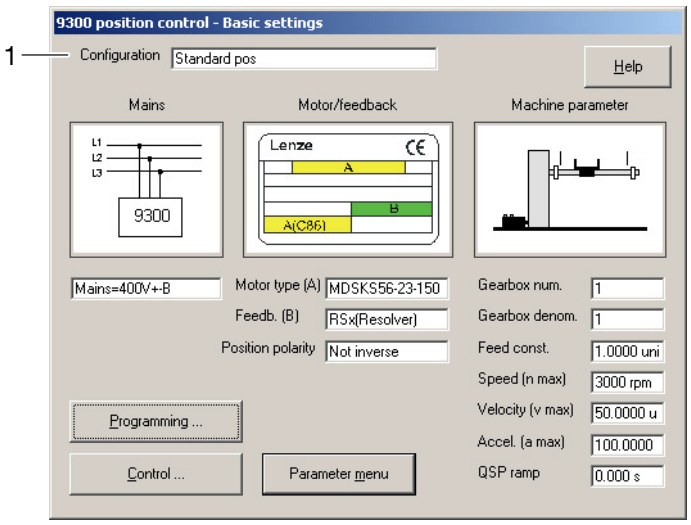
- C0040 = 0 inhibits the controller
- C0040 = 1 re-enables the controller

Note!

- The sources for controller inhibit are ANDed, i.e. the drive only restarts if the controller inhibit signals of all signal sources have been eliminated.
- The restart starts with zero speed. If centrifugal masses are still rotating, this can lead to an overcurrent.

6.5 Basic settings

6.5.1 Changing the basic configuration

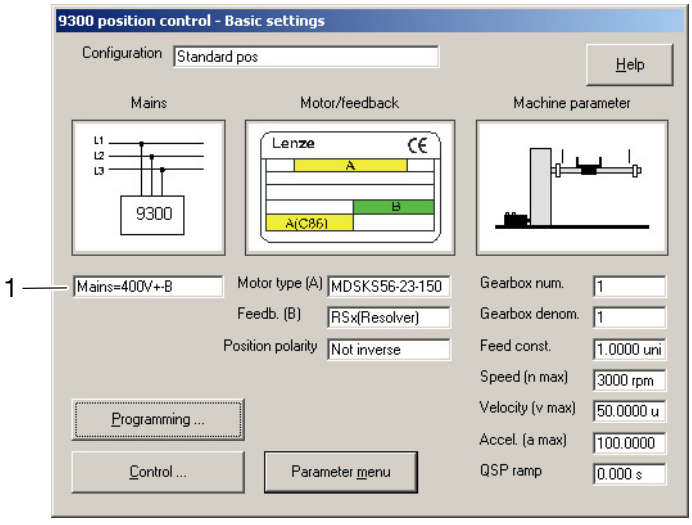


9300pos060

Fig. 6.5-1 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select a basic configuration suitable for your application, e.g.“10000” (Cam profiler)

6.5.2 Adapting the controller to the mains



9300pos060

Fig. 6.5-2 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click on field (1) and select the mains voltage and the supplementary component (if used).

6.5.3 Entry of gearbox factors and feed constants

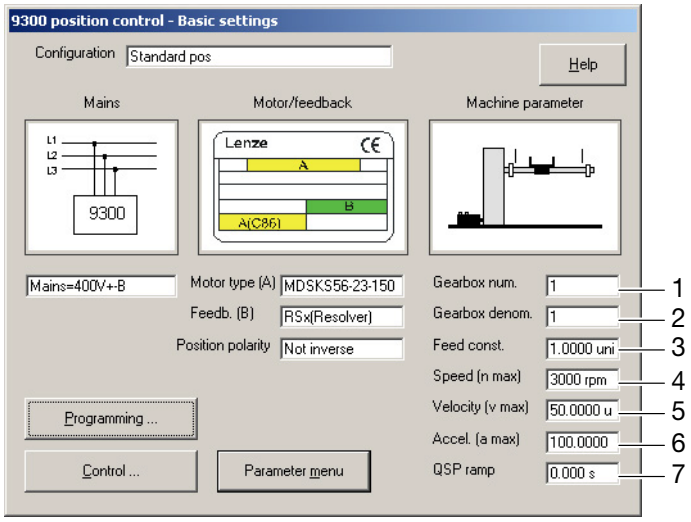
Stop!

Damage to the machine!

- ► Changing the gearbox or feed constants results in the controller losing the exact position of the tool.
- ► If you change gearbox factors or feed constants later, the positioning data already transferred are no longer valid.

Protective measures:

- ► Repeat the positioning data transfer to the drive.



9300pos060

Fig. 6.5-3 ”Basic settings” dialog box

Procedure	
1.	Click on field (1) and enter the numerator for the gearbox ratio of the drive.
2.	Click on field (2) and enter the denominator for the gearbox ratio of the drive.
3.	Click on field (3) and enter the feed at the output end. ● ”units/r” means ”units/revolution”. By entering physical quantities uniformly, e.g. all dimensions in [mm], the uniformity of the entire system is guaranteed.
4.	Click on field (4) and enter the upper limit speed of the drive.
5.	Click on field (5) and enter the max. travel speed of the drive.
6.	Click on field (6) and enter the max. permissible acceleration. ● In the event of faults, or if travel range limit switches are approached, a-max cannot be reached.
7.	Click on field (7) and enter a time for the QSP ramp. ● The value entered defines the time from triggering a fault or from approaching a travel range limit switch to the standstill of the drive.

6.5.4 Entry of motor data

For Lenze motors:

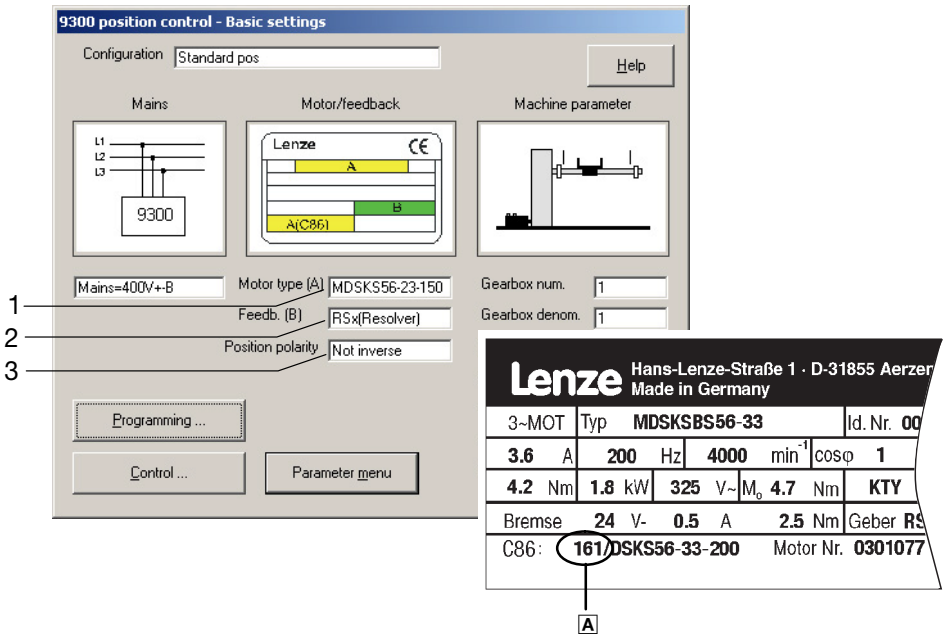


Fig. 6.5-4 ”Basic settings” dialog box

Procedure	
1.	Open the ”Basic settings” dialog box.
2.	Click into field (1) and select the motor connected. Just select the number A specified on the nameplate of the motor from the open field. **Note!** A list of the motors available can be found in the chapter ”Motor selection list”. 📖 6.5-6
3.	Click into field (2) and select the feedback system used.
4.	Click into field (3) and define the position polarity. If ”Inverted” is set, the travelling direction of the drive is inverted.

Enter the 8-digit resolver designation of the nameplate to achieve the highest accuracy.

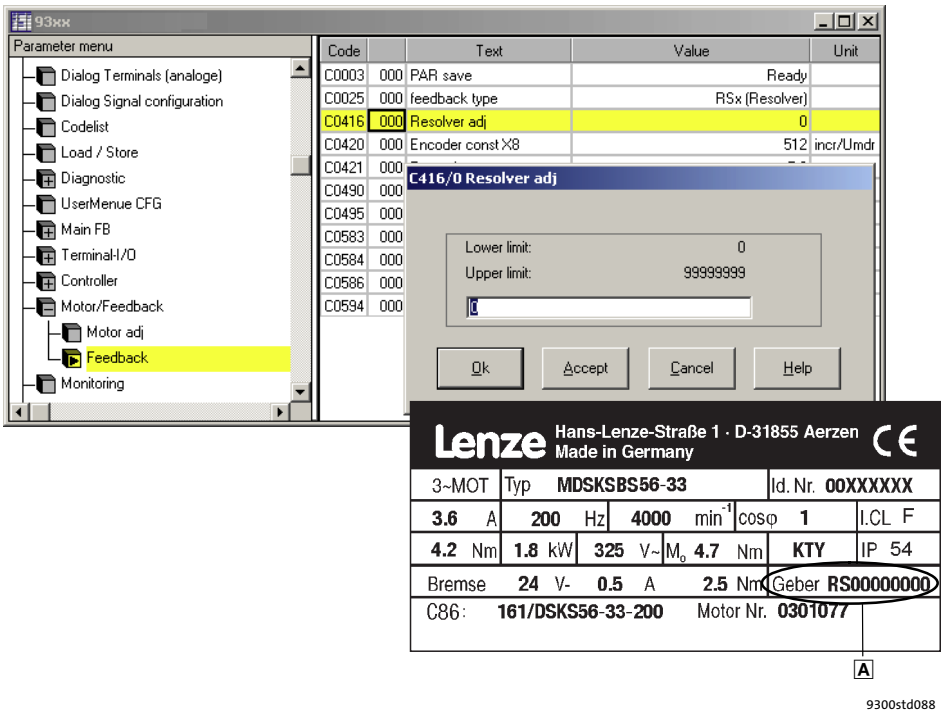
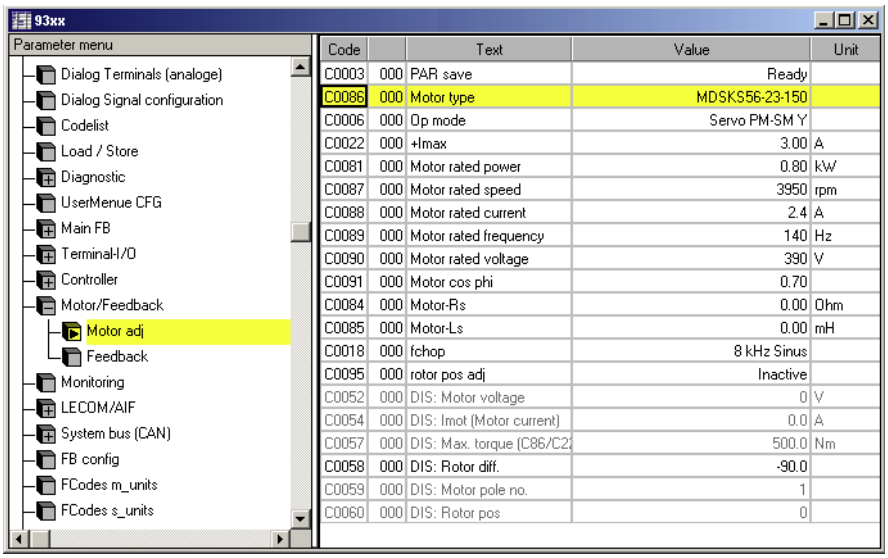


Fig. 6.5-5 ”Feedback” menu of the parameter menu

Procedure	
1.	Open the ”Parameter menu → Motor/Feedback → Feedback” menu.
2.	Click on C0416.
3.	Enter the 8-digit designation A of the motor nameplate in the dialog box.
4.	Confirm with ”OK”.
5.	Save the setting with C0003 = 1.

For non-Lenze motors or Lenze motors not listed under C0086



9300std089

Fig. 6.5-6 ”Motor adj” menu of the parameter menu

Procedure

1. Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
2. Click on C0086 and select the motor whose data corresponds best with the connected motor.
   Note!
   The available motors are listed in chapter ”Motor selection list”. 📖 6.5-6
3. Click on C0006 and select the motor control operating mode.
4. Enter the data of the connected motor in the following codes. The data can be found on the nameplate or the data sheet of the motor.

C0022	Maximum current I_{max} of the motor
C0081	Rated motor power
C0084	Stator resistance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0085	Leakage inductance of the motor (The setting is only required if the demands on the control characteristics are very high)
C0087	Rated motor speed
C0088	Rated motor current
C0089	Rated motor frequency
C0090	Rated motor voltage
C0091	Cos φ.

5. Save the setting with C0003 = 1.

6.5.5 Motor selection list

Servo motors

The following table lists all servo motor which can be selected under C0086.

In the "Servo motor reference list" you can find the servo motors for which the motor data must be entered manually. (📖 6.5-7)

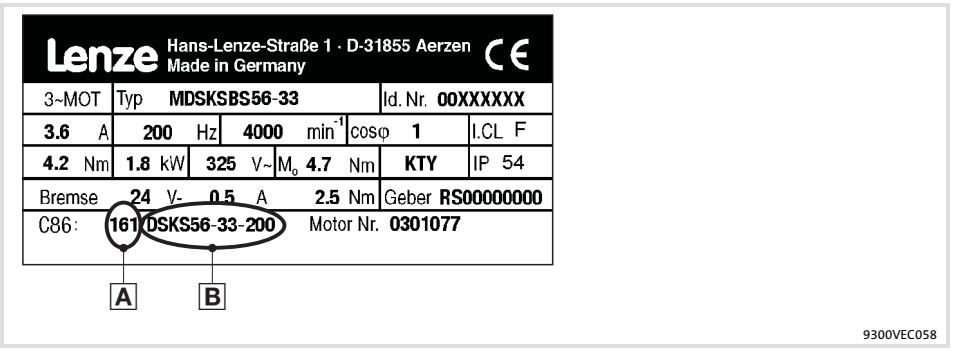


Fig. 6.5-7 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
10	MDSKA56-140	MDSKAXX056-22	0.80	3950	2.4	140			
11	MDFKA71-120	MDFKAXX071-22	2.20	3410	6.0	120			
12	MDSKA71-140	MDSKAXX071-22	1.70	4050	4.4	140			
13	MDFKA80-60	MDFKAXX080-22	2.10	1635	4.8	60			
14	MDSKA80-70	MDSKAXX080-22	1.40	2000	3.3	70	390		
15	MDFKA80-120	MDFKAXX080-22	3.90	3455	9.1	120			
16	MDSKA80-140	MDSKAXX080-22	2.30	4100	5.8	140			
17	MDFKA90-60	MDFKAXX090-22	3.80	1680	8.5	60			
18	MDSKA90-80	MDSKAXX090-22	2.60	2300	5.5	80			
19	MDFKA90-120	MDFKAXX090-22	6.90	3480	15.8	120			
20	MDSKA90-140	MDSKAXX090-22	4.10	4110	10.2	140	350		
21	MDFKA100-60	MDFKAXX100-22	6.40	1700	13.9	60			
22	MDSKA100-80	MDSKAXX100-22	4.00	2340	8.2	80	390		
23	MDFKA100-120	MDFKAXX100-22	13.20	3510	28.7	120			
24	MDSKA100-140	MDSKAXX100-22	5.20	4150	14.0	140	330	Asynchronous servo motor	KTY
25	MDFKA112-60	MDFKAXX112-22	11.00	1710	22.5	60			
26	MDSKA112-85	MDSKAXX112-22	6.40	2490	13.5	85	390		
27	MDFKA112-120	MDFKAXX112-22	20.30	3520	42.5	120			
28	MDSKA112-140	MDSKAXX112-22	7.40	4160	19.8	140	320		
30	DFQA100-50	MDFQAXX100-22	10.60	1420	26.5	50			
31	DFQA100-100	MDFQAXX100-22	20.30	2930	46.9	100			
32	DFQA112-28	MDFQAXX112-22	11.50	760	27.2	28			
33	DFQA112-58	MDFQAXX112-22	22.70	1670	49.1	58			
34	DFQA132-20	MDFQAXX132-32	17.00	555	45.2	20	360		
35	DFQA132-42	MDFQAXX132-32	35.40	1200	88.8	42			
40	DFQA112-50	MDFQAXX112-22	20.10	1425	43.7	50			
41	DFQA112-100	MDFQAXX112-22	38.40	2935	81.9	100			
42	DFQA132-36	MDFQAXX132-32	31.10	1035	77.4	36			
43	DFQA132-76	MDFQAXX132-32	60.10	2235	144.8	76	340		

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
50	DSVA56-140	DSVAXX056-22	0.80	3950	2.4	140	390	Asynchronous servo motor	Thermal contact
51	DFVA71-120	DFVAXX071-22	2.20	3410	6.0	120			
52	DSVA71-140	DSVAXX071-22	1.70	4050	4.4	140			
53	DFVA80-60	DFVAXX080-22	2.10	1635	4.8	60			
54	DSVA80-70	DSVAXX080-22	1.40	2000	3.3	70			
55	DFVA80-120	DFVAXX080-22	3.90	3455	9.1	120			
56	DSVA80-140	DSVAXX080-22	2.30	4100	5.8	140			
57	DFVA90-60	DFVAXX090-22	3.80	1680	8.5	60			
58	DSVA90-80	DSVAXX090-22	2.60	2300	5.5	80			
59	DFVA90-120	DFVAXX090-22	6.90	3480	15.8	120			
60	DSVA90-140	DSVAXX090-22	4.10	4110	10.2	140	350		
61	DFVA100-60	DFVAXX100-22	6.40	1700	13.9	60	390		
62	DSVA100-80	DSVAXX100-22	4.00	2340	8.2	80			
63	DFVA100-120	DFVAXX100-22	13.20	3510	28.7	120			
64	DSVA100-140	DSVAXX100-22	5.20	4150	14.0	140	330		
65	DFVA112-60	DFVAXX112-22	11.00	1710	22.5	60	390		
66	DSVA112-85	DSVAXX112-22	6.40	2490	13.5	85			
67	DFVA112-120	DFVAXX112-22	20.30	3520	42.5	120			
68	DSVA112-140	DSVAXX112-22	7.40	4160	19.8	140	320		
108	DSKS36-13-200	MDSKSXX036-13	0.25	4000	0.9	200	245	Synchronous servo motor	KTY
109	DSKS36-23-200	MDSKSXX036-23	0.54	4000	1.1	200	345		
110	MDSKS56-23-150	MDSKSXX056-23	0.60	3000	1.25	150	350		
111	MDSKS56-33-150	MDSKSXX056-33	0.91	3000	2.0	150	340		
112	MDSKS71-13-150	MDSKSXX071-13	1.57	3000	3.1	150	360		
113	MDFKS71-13-150	MDFKSXX071-13	2.29	3000	4.35	150	385		
114	MDSKS71-23-150	MDSKSXX071-23	2.33	3000	4.85	150	360		
115	MDFKS71-23-150	MDFKSXX071-23	3.14	3000	6.25	150	375		
116	MDSKS71-33-150	MDSKSXX071-33	3.11	3000	6.7	150	330		
117	MDFKS71-33-150	MDFKSXX071-33	4.24	3000	9.1	150	345		
160	DSKS56-23-190	MDSKSXX056-23	1.1	3800	2.3	190	330		
161	DSKS56-33-200	MDSKSXX056-33	1.8	4000	3.6	200	325		
162	DSKS71-03-170	MDSKSXX071-03	2.0	3400	4.2	170	330		
163	DFKS71-03-165	MDFKSXX071-03	2.6	3300	5.6	165	330		
164	DSKS71-13-185	MDSKSXX071-13	3.2	3700	7.0	185	325		
165	DFKS71-13-180	MDFKSXX071-13	4.1	3600	9.2	180	325		
166	DSKS71-33-180	MDSKSXX071-33	4.6	3600	10.0	180	325		
167	DFKS71-33-175	MDFKSXX071-33	5.9	3500	13.1	175	325		

Servo motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1000	MDSKA-71-22	54	3.75	0.88	8.4	34.98	1950	2.50	70	390	0.82	2	100	1.5	1.5
1001	MDFQA-112-12	33	42.60	12.90	0.45	4.3	1660	28.40	58	360	0.85	20	21	2	1
1002	MDFQA-112-12	41	70.50	21.80	0.45	4.3	2930	47.00	100	360	0.83	14	21	1.3	1

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1003	MDSKA-56-22	50	6.75	1.57	2.25	6.5	6000	4.50	202	280	0.72	3	50	1.3	1.5
1004	MDSKS071-33-39	112	5.10	0.95	7.2	34.5	780	3.40	39	325	1.00	3	20	2.5	1.5
1005	MDSKS071-33-41	112	2.25	0.45	16.3	68	820	1.50	41	330	1.00	2	20	2.5	1.5
1076	MDSKS071-33-90	112	5.85	1.60	3.67	17.7	1800	3.90	90	310	1.00	10	20	0.7	1.7
1077	MDSKA-71-22	51	2.18	0.33	35.7	131.8	725	1.45	30	360	0.78	10	70	1.5	2
1103	SDSGA056-22	50	1.20	0.24	29.3	123	2790	0.80	100	390	0.71	14	150	0.35	1.8
1104	SDSGA056-22	40	2.55	0.24	29.3	123	2790	1.70	100	230	0.71	14	150	0.35	1.8
1105	SDSGA063-22	50	1.80	0.40	29.3	123	2800	1.20	100	390	0.70	14	150	0.35	1.8
1106	SDSGA063-22	40	3.15	0.40	29.3	123	2800	2.10	100	230	0.70	14	150	0.35	1.8
1107	SDSGA063-32	50	2.55	0.60	29.3	123	2800	1.70	100	390	0.70	14	150	0.35	1.8
1108	SDSGA063-32	40	4.50	0.6	29.3	123	2800	3	100	230	0.70	14	150	0.35	1.8
1109	MDSKS056-23-280	114	8.00	1.10	6.72	8.34	5600	2.30	280	320	1.00	10	20	1.3	1.5
1110	MDSKS056-23-310	114	9.00	1.10	5.42	6.78	6200	2.30	310	320	1.00	10	20	1.3	1.5
1111	MDSKS056-33-300	114	10.00	1.75	3.31	4.62	6000	3.60	300	320	1.00	10	20	1.3	1.5
1112	MDSKS056-33-265	114	8.00	1.72	4.1	5.73	5300	3.60	265	320	1.00	10	20	1.3	1.5
1113	MDSKS071-13-265	114	23.00	3.20	0.54	2.56	5300	7.00	265	320	1.00	10	20	1.3	1.5
1116	MDSKS071-33-270	114	25.00	5.70	0.38	1.91	5400	12.50	270	320	1.00	10	20	1.3	1.5

Three-phase asynchronous motors

The following table lists all asynchronous motors which can be selected under C0086.

In the "Asynchronous motor reference list" you can find the asynchronous motors for which the motor data must be entered manually. (📖 6.5-9)

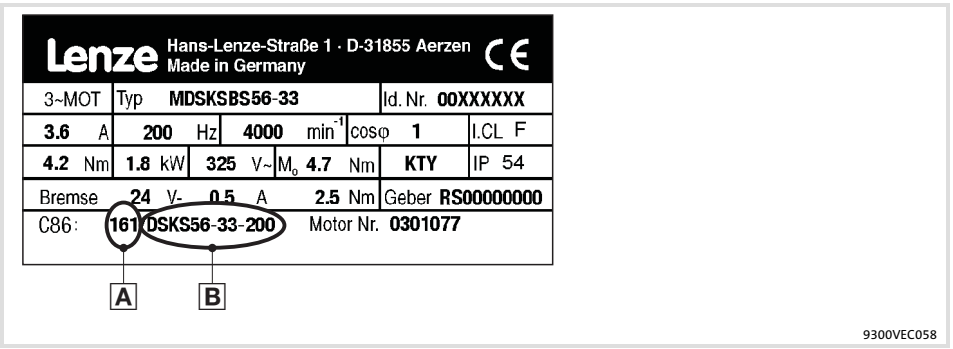


Fig. 6.5-8 Nameplate of a Lenze motor

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
210	DXRAXX071-12-50	DXRAXX071-12	0.25	1410	0.9	50	400	Asynchronous inverter motor (star connection)	Thermal contact
211	DXRAXX071-22-50	DXRAXX071-22	0.37	1398	1.2				
212	DXRAXX080-12-50	DXRAXX080-12	0.55	1400	1.7				
213	DXRAXX080-22-50	DXRAXX080-22	0.75	1410	2.3				
214	DXRAXX090-12-50	DXRAXX090-12	1.10	1420	2.7				
215	DXRAXX090-32-50	DXRAXX090-32	1.50	1415	3.6				
216	DXRAXX100-22-50	DXRAXX100-22	2.20	1425	4.8				
217	DXRAXX100-32-50	DXRAXX100-32	3.00	1415	6.6				
218	DXRAXX112-12-50	DXRAXX112-12	4.00	1435	8.3				
219	DXRAXX132-12-50	DXRAXX132-12	5.50	1450	11.0				
220	DXRAXX132-22-50	DXRAXX132-22	7.50	1450	14.6				
221	DXRAXX160-12-50	DXRAXX160-12	11.00	1460	21.0				
222	DXRAXX160-22-50	DXRAXX160-22	15.00	1460	27.8				
223	DXRAXX180-12-50	DXRAXX180-12	18.50	1470	32.8				
224	DXRAXX180-22-50	DXRAXX180-22	22.00	1456	38.8				

A	B	Lenze type	C0081 P_r [kW]	C0087 n_r [rpm]	C0088 I_r [A]	C0089 f_r [Hz]	C0090 U_r [V]	Motor type	Temperature sensor
225	30kW-ASM-50	–	30.00	1470	52.0	50	400	Asynchronous inverter motor (star connection)	–
226	37kW-ASM-50	–	37.00	1470	66.0				
227	45kW-ASM-50	–	45.00	1480	82.0				
228	55kW-ASM-50	–	55.00	1480	93.0				
229	75kW-ASM-50	–	75.00	1480	132.0				
250	DXRAXX071-12-87	DXRAXX071-12	0.43	2525	1.5	87	400	Asynchronous inverter motor (delta connection)	Thermal contact
251	DXRAXX071-22-87	DXRAXX071-22	0.64	2515	2.0				
252	DXRAXX080-12-87	DXRAXX080-12	0.95	2515	2.9				
253	DXRAXX080-22-87	DXRAXX080-22	1.3	2525	4.0				
254	DXRAXX090-12-87	DXRAXX090-12	2.0	2535	4.7				
255	DXRAXX090-32-87	DXRAXX090-32	2.7	2530	6.2				
256	DXRAXX100-22-87	DXRAXX100-22	3.9	2535	8.3				
257	DXRAXX100-32-87	DXRAXX100-32	5.35	2530	11.4				
258	DXRAXX112-12-87	DXRAXX112-12	7.10	2545	14.3				
259	DXRAXX132-12-87	DXRAXX132-12	9.7	2555	19.1				
260	DXRAXX132-22-87	DXRAXX132-22	13.2	2555	25.4				
261	DXRAXX160-12-87	DXRAXX160-12	19.3	2565	36.5				
262	DXRAXX160-22-87	DXRAXX160-22	26.4	2565	48.4				
263	DXRAXX180-12-87	DXRAXX180-12	32.4	2575	57.8				
264	DXRAXX180-22-87	DXRAXX180-22	38.7	2560	67.4				
265	30kW-ASM-87	–	52.00	2546	90.0	87	400	Asynchronous inverter motor (delta connection)	–
266	37kW-ASM-87	–	64.00	2546	114.0				
267	45kW-ASM-87	–	78.00	2563	142.0				
268	55kW-ASM-87	–	95.00	2563	161.0				
269	75kW-ASM-87	–	130.00	2563	228.0				

Asynchronous motor reference list

The motors listed in the “Motor nameplate data” table column are not included in Global Drive Control (GDC) and in the controller software.

1. Enter the corresponding value of column ”C86” in C0086.
2. Compare the motor data codes with the table values.
   – If necessary, adapt the values in the controller to the table values.
3. Optimise the dynamic performance of your machine via codes C0070 and C0071 if necessary.

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
410	MDXMAXM-071-12	210	1.23	0.25	35.80	116.80	1400	0.82	50	400	0.70	6	300	1.5	10
411	MDXMAXM-071-32	211	1.80	0.37	27.00	112.70	1400	1.20	50	400	0.71	6	300	1.5	10
412	MDXMAXM-080-12	212	2.40	0.55	16.30	78.60	1400	1.60	50	400	0.72	6	300	1.5	10
413	MDXMAXM-080-32	213	3.00	0.75	11.20	59.30	1380	2.00	50	400	0.76	6	300	1.5	10
414	MDXMAXM-090-12	214	3.90	1.10	9.14	41.80	1410	2.60	50	400	0.80	6	300	1.5	10
415	MDXMAXM-090-32	215	5.25	1.50	5.10	27.70	1420	3.50	50	400	0.80	6	300	1.5	10
416	MDXMAXM-100-12	216	8.40	2.20	2.96	18.20	1400	5.60	50	400	0.78	6	300	1.5	10
417	MDXMAXM-100-32	217	10.95	3.00	2.20	13.40	1400	7.30	50	400	0.81	6	300	1.5	10
418	MDXMAXM-112-22	218	12.75	4.00	1.50	10.80	1430	8.50	50	400	0.85	6	300	1.5	10
440	MDXMAXM-071-12	250	2.10	0.43	35.8	116.80	2510	1.40	87	400	0.70	6	300	1.5	10
441	MDXMAXM-071-32	251	3.15	0.64	27.0	112.70	2510	2.10	87	400	0.71	6	300	1.5	10
442	MDXMAXM-080-12	252	4.20	0.95	16.3	78.60	2510	2.80	87	400	0.72	6	300	1.5	10
443	MDXMAXM-080-32	253	5.25	1.30	11.2	59.30	2490	3.50	87	400	0.76	6	300	1.5	10
444	MDXMAXM-090-12	254	6.75	2.00	9.14	41.80	2520	4.50	87	400	0.80	6	300	1.5	10
445	MDXMAXM-090-32	255	9.15	2.70	5.1	27.70	2530	6.10	87	400	0.78	6	300	1.5	10

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
446	MDXMAXM-100-12	256	14.55	3.90	2.96	18.20	2510	9.70	87	400	0.81	6	300	1.5	10
447	MDXMAXM-100-32	257	19.05	5.40	2.2	13.40	2510	12.70	87	400	0.85	6	300	1.5	10
448	MDXMAXM-112-22	258	22.20	7.10	1.5	10.80	2540	14.80	87	400	0.78	6	300	1.5	10
449	MDXMAXM-112-32	259	18.75	5.50	2.45	21.40	1440	12.50	50	400	0.78	6	300	1.5	10
450	MDXMAXM-132-22	259	25.20	7.50	1.42	15.00	1460	16.80	50	400	0.77	6	300	1.5	10
451	MDXMAXM-132-32	259	29.25	9.20	1.34	14.00	1450	19.50	50	400	0.85	6	300	1.5	10
1006	MDXMAxx-071-12	210	1.28	0.25	39.90	157.20	1355	0.85	50	400	0.70	6	300	3.6	2
1007	MDXMAxx-071-12	250	2.25	0.47	39.90	157.20	2475	1.50	87	400	0.66	6	300	2	2
1008	MDXMAxx-071-32	211	1.73	0.37	25.03	122.60	1345	1.15	50	400	0.74	6	300	3.4	2
1009	MDXMAxx-071-32	251	3.00	0.67	25.03	122.60	2470	2.00	87	400	0.70	6	300	2.5	2
1010	MDXMAxx-080-12	212	2.40	0.55	20.69	89.00	1370	1.60	50	400	0.78	6	300	3.2	2
1011	MDXMAxx-080-12	252	3.90	1.00	20.69	89.00	2480	2.60	87	400	0.73	6	300	1.6	2
1012	MDXMAxx-080-32	213	2.85	0.75	11.69	65.20	1390	1.90	50	400	0.80	6	300	3.5	2
1013	MDXMAxx-080-32	253	4.95	1.35	11.69	65.20	2510	3.30	87	400	0.77	6	300	1.9	3
1014	MDXMAxx-090-12	214	3.90	1.10	10.01	40.20	1405	2.60	50	400	0.80	6	300	2.5	2
1015	MDXMAxx-090-12	254	6.75	2.00	10.01	40.20	2520	4.50	87	400	0.77	6	300	2	2
1016	MDXMAxx-090-32	215	5.25	1.50	5.85	28.80	1410	3.50	50	400	0.78	6	300	2	2
1017	MDXMAxx-090-32	255	9.15	2.70	5.85	28.80	2525	6.10	87	400	0.76	6	300	1	2
1018	MDXMAxx-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1019	MDXMAxx-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.76	6	300	0.8	1.5
1020	MDXMAxx-100-32	217	9.75	3.00	2.10	17.00	1415	6.50	50	400	0.81	6	300	2.5	1.5
1021	MDXMAxx-100-32	257	17.10	5.40	2.10	17.00	2530	11.40	87	400	0.78	6	300	1.4	1.8
1022	MDXMAxx-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1023	MDXMAxx-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.83	6	300	1	2
1024	MDXMAxx-132-12	219	16.50	5.50	0.86	13.00	1450	11.00	50	400	0.84	6	300	1.5	2
1025	MDXMAxx-132-12	259	28.65	9.70	0.86	13.00	2555	19.10	87	400	0.83	6	300	1.3	2
1026	MDXMAxx-132-22	220	21.90	7.50	0.80	11.00	1450	14.60	50	400	0.85	6	300	1.5	2
1027	MDXMAxx-132-22	260	38.10	13.20	0.80	11.00	2555	25.40	87	400	0.84	6	300	0.95	1.8
1028	MDXMAxx-160-22	221	31.50	11.00	0.50	7.00	1460	21.00	50	400	0.85	6	300	1.9	2.2
1029	MDXMAxx-160-22	261	54.75	19.30	0.50	7.00	2565	36.50	87	400	0.85	6	300	1	2
1030	MDXMAxx-160-32	222	41.70	15.00	0.40	5.50	1460	27.80	50	400	0.87	6	300	1.7	2.5
1031	MDXMAxx-160-32	262	72.60	26.40	0.40	5.50	2565	48.40	87	400	0.86	6	300	1	1.8
1032	MDXMAxx-180-12	223	49.20	18.50	0.40	4.00	1470	32.80	50	400	0.90	6	300	1.4	1.7
1033	MDXMAxx-180-12	263	86.70	32.40	0.40	4.00	2575	57.80	87	400	0.89	6	300	1	1.7
1034	MDXMAxx-180-22	224	58.20	22.00	0.20	3.80	1456	38.80	50	400	0.90	6	300	1	1.5
1035	MDXMAxx-180-22	264	101.1	38.70	0.20	3.80	2560	67.40	87	400	0.89	6	300	1	1.5
1036	MDXMAXM-63-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1037	MDXMAXM-63-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1038	MDXMAXM-63-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1039	MDXMAXM-63-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1040	MDXMAXM-112-32	219	18.75	5.50	0.86	7.20	1440	12.50	50	400	0.78	6	300	1.5	10
1041	MDXMAXM-112-32	259	32.55	9.60	0.86	7.20	2550	21.70	87	400	0.78	6	300	1.5	10
1042	MDXMAXM-132-22	220	25.20	7.50	0.54	4.80	1460	16.80	50	400	0.77	6	300	1.5	10
1043	MDXMAXM-132-22	260	43.80	13.10	0.54	4.80	2570	29.20	87	400	0.77	6	300	1.5	10
1044	MDXMAXM-132-32	221	29.25	9.20	0.46	4.70	1450	19.50	50	400	0.85	6	300	1.5	10
1045	MDXMAXM-132-32	261	50.70	16.00	0.46	4.70	2560	33.80	87	400	0.85	6	300	1.5	10
1046	MDXMAXM-160-22	260	31.50	11.00	1.27	18.97	1466	21.00	50	400	0.86	6	300	1.5	10
1047	MDXMAXM-160-32	260	42.30	15.00	0.87	14.28	1466	28.20	50	400	0.87	6	300	1.5	10
1048	MDXMAXM-180-22	260	54.60	18.50	0.40	4.00	1440	36.40	50	400	0.87	6	300	1.5	10
1049	MDXMAXM-180-32	260	66.15	22.00	0.20	3.80	1465	44.10	50	400	0.85	6	300	1.5	10
1050	MDXMAXM-200-32	260	90.00	30.00	0.17	3.50	1455	60.00	50	400	0.85	6	300	1.5	10
1051	MDXMAXM-225-12	260	108.0	37.00	0.15	2.00	1460	72.00	50	400	0.86	6	300	1.5	10
1052	MDXMAXM-225-22	260	128.25	45.00	0.15	2.00	1475	85.50	50	400	0.84	6	300	1.5	10

Motor nameplate data		Motor data													
Field		C0086	C0022	C0081	C0084	C0085	C0087	C0088	C0089	C0090	C0091	C0070	C0071	C0075	C0076
C86	Type		Imax [A]	P_r [kW]	R_s [Ω]	Lσ [mH]	n_r [rpm]	I_r [A]	f_r [Hz]	U_r [V]	cos φ	V_{pn}	T_{nn}	V_{pi}	T_{ni}
1053	MDXMAXM-063-11	210	1.43	0.18	51.00	273.7	2760	0.95	50	400	0.80	6	300	1.5	10
1054	MDXMAXM-063-31	210	1.65	0.25	33.00	93.4	2760	1.10	50	400	0.83	6	300	1.5	10
1055	MDXMAXM-071-11	211	1.50	0.37	22.50	90.2	2840	1.00	50	400	0.78	6	300	1.5	10
1056	MDXMAXM-071-31	212	2.25	0.55	16.90	62.9	2840	1.50	50	400	0.82	6	300	1.5	10
1057	MDXMAXM-080-11	213	2.85	0.75	11.36	47.4	2850	1.90	50	400	0.80	6	300	1.5	10
1058	MDXMAXM-080-31	214	4.20	1.10	6.86	33.4	2810	2.80	50	400	0.82	6	300	1.5	10
1059	MDXMAXM-090-11	215	4.80	1.50	5.10	22.2	2840	3.20	50	400	0.85	6	300	1.5	10
1060	MDXMAXM-090-31	216	7.20	2.20	3.20	14.5	2840	4.80	50	400	0.86	6	300	1.5	10
1061	MDXMAXM-100-31	217	9.30	3.00	1.81	10.7	2850	6.20	50	400	0.88	6	300	1.5	10
1062	MDXMAXM-100-41	218	12.75	4.00	1.45	8.6	2830	8.50	50	400	0.85	6	300	1.5	10
1063	MDXMAXM-112-31	250	18.30	5.50	3.10	17	2890	12.20	50	400	0.83	6	300	1.5	10
1064	MDXMAXM-112-41	250	23.25	7.50	1.96	12	2900	15.50	50	400	0.87	6	300	1.5	10
1065	MDXMAXM-132-21	250	28.05	9.00	1.41	11.292	2925	18.70	50	400	0.89	6	300	1.5	10
1066	MDXMAXM-071-13	210	1.13	0.18	58.93	342	870	0.75	50	400	0.71	6	300	1.5	10
1067	MDXMAXM-071-13	250	1.95	0.31	58.93	342	1610	1.30	87	400	0.71	6	300	1.5	10
1068	MDXMAXM-071-33	210	1.50	0.25	37.90	116.8	920	1.00	50	400	0.63	6	300	1.5	10
1069	MDXMAXM-071-33	250	2.55	0.43	37.90	116.8	1660	1.70	87	400	0.63	6	300	1.5	10
1070	MDXMAXM-080-13	211	2.10	0.37	28.00	112.7	900	1.40	50	400	0.67	6	300	1.5	10
1071	MDXMAXM-080-13	251	3.60	0.64	28.00	112.7	1640	2.40	87	400	0.67	6	300	1.5	10
1072	MDXMAXM-080-33	212	2.85	0.55	16.60	78.6	900	1.90	50	400	0.68	6	300	1.5	10
1073	MDXMAXM-080-33	252	4.95	0.95	16.60	78.6	1640	3.30	87	400	0.68	6	300	1.5	10
1078	MDFMAxx-250-22	224	147.75	55.00	0.04	1.92	1475	98.50	50	400	0.86	6	300	1	2
1079	MDFMAxx-250-22	264	255.90	95.00	0.04	1.92	2585	170.60	87	400	0.86	6	300	1	2
1080	MDEBAXM-063-12	210	0.68	0.12	87.58	610.53	1390	0.45	50	400	0.65	6	300	1.5	10
1081	MDEBAXM-063-12	250	1.17	0.21	87.58	610.53	2500	0.78	87	400	0.65	6	300	1.5	10
1082	MDEBAXM-063-32	210	0.98	0.18	56.90	342.11	1400	0.65	50	400	0.65	6	300	1.5	10
1083	MDEBAXM-063-32	250	1.70	0.31	56.90	342.11	2510	1.13	87	400	0.65	6	300	1.5	10
1084	MDEBAXM-071-12	210	1.35	0.25	39.90	157.20	1390	0.90	50	400	0.64	6	300	3.6	2
1085	MDEBAXM-071-12	250	2.34	0.43	39.90	157.20	2500	1.56	87	400	0.64	6	300	2	2
1086	MDEBAXM-071-32	211	1.95	0.37	25.03	122.60	1380	1.30	50	400	0.64	6	300	3.4	2
1087	MDEBAXM-071-32	251	3.38	0.64	25.03	122.60	2490	2.25	87	400	0.64	6	300	2.5	2
1088	MDEBAXM-080-12	212	2.40	0.55	20.69	89.00	1400	1.60	50	400	0.68	6	300	3.2	2
1089	MDEBAXM-080-12	252	4.16	0.95	20.69	89.00	2510	2.77	87	400	0.68	6	300	1.6	2
1090	MDEBAXM-080-32	213	3.00	0.75	11.69	65.20	1400	2.00	50	400	0.72	6	300	3.5	2
1091	MDEBAXM-080-32	253	5.20	1.30	11.69	65.20	2510	3.46	87	400	0.72	6	300	1.9	3
1092	MDEBAXM-090-12	214	4.05	1.10	6.40	37.00	1420	2.70	50	400	0.77	6	300	2.5	2
1093	MDEBAXM-090-12	254	7.05	2.00	6.40	37.00	2535	4.70	87	400	0.77	6	300	2	2
1094	MDEBAXM-090-32	215	5.40	1.50	4.80	26.00	1415	3.60	50	400	0.77	6	300	2	2
1095	MDEBAXM-090-32	255	9.30	2.70	4.80	26.00	2530	6.20	87	400	0.77	6	300	1	2
1096	MDEBAXM-100-12	216	7.20	2.20	2.90	20.00	1425	4.80	50	400	0.80	6	300	1	1.5
1097	MDEBAXM-100-12	256	12.45	3.90	2.90	20.00	2535	8.30	87	400	0.80	6	300	0.8	1.5
1098	MDEBAXM-100-32	217	9.90	3.00	2.10	17.00	1415	6.60	50	400	0.81	6	300	2.5	1.5
1099	MDEBAXM-100-32	257	17.10	5.35	2.10	17.00	2530	11.40	87	400	0.81	6	300	1.4	1.8
1100	MDEBAXM-112-22	218	12.45	4.00	1.50	11.00	1435	8.30	50	400	0.82	6	300	2	2
1101	MDEBAXM-112-22	258	21.45	7.10	1.50	11.00	2545	14.30	87	400	0.82	6	300	1	2
1102	MDEBAXM-112-32	219	17.85	5.50	2.71	21.40	1425	11.90	50	400	0.84	6	300	1.5	10
1114	MDFMAxx-200-32	224	83.25	30.00			1465	55.50	50	400	0.85	6	300	1	2
1115	MDFMAxx-200-32	264	145.50	52.00			2575	97.00	87	400	0.85	6	300	1	2

6.5.6 Motor temperature monitoring with PTC or thermal contact

Description

PTC resistors according to DIN 44081 and DIN 44082 can be connected via the terminal inputs T1 and T2. The motor temperature is measured and integrated into the drive monitoring.

A thermal contact (NC contact) can also be connected to T1 and T2. Lenze three-phase AC motors provide thermal contacts as default.

When using motors equipped with PTC resistors or thermostats, we recommend to always activate the PTC input. This prevents the motor from being destroyed by overheating.

Stop!

- ► The motor temperature monitoring may only be connected to T1, T2 if the cable is terminated with a PTC or thermal contact (NC contact) on the motor side.
  - – An "open" cable acts like an antenna and can cause faults on the drive controller.
  - – Input signals at T1, T2 are processed with a delay of 2 s.
- ► The drive controller can only evaluate one PTC resistor! Do not connect several PTC resistors in series or in parallel:
  - – The motor temperature would be measured incorrectly.
  - – The motors could be destroyed by overheating.
- ► If you operate several motors on a drive controller, use thermal contacts (NC contacts) for motor temperature monitoring and connect these in series.
- ► To achieve full motor protection, an additional temperature monitoring with separate evaluation must be installed.

Activation

Note!

- ► In the Lenze setting the motor temperature monitoring is switched off!
- ► If you work with several parameter sets, the monitoring must be activated separately in each parameter set!

1. Connect the monitoring circuit of the motor to T1 and T2.
   – With 1.6 kΩ < R < 4 kΩ, the monitoring responds.
2. Set the controller reaction:
   – C0585 = 3: Temperature monitoring of the motor is switched off.
   – C0585 = 0: TRIP error message (display of keypad: OH8 Trip)
   – C0585 = 2: Warning signal (display of keypad: OH8 Warn)

Function test

Connect the PTC input with a fixed resistor:

- ► R > 4 kΩ: The fault message OH8 must be activated.
- ► R < 1 kΩ: Fault message must not be activated.

6.5.7 Motor temperature monitoring with KTY

Description

- There are two possibilities to connect a KTY resistor:
  - At the incremental encoder connection X8 (pins X8/5 and X8/8)
  - At the resolver connection X7 (pins X7/8 and X7/9)
- The motor temperature is measured and integrated into the drive monitoring.
- The KTY resistor is monitored for open and short circuit.
- When using motors equipped with KTY resistors, we recommend always to activate the KTY input. This prevents the motor from being destroyed by overheating.

Stop!

- The controller can only evaluate one KTY resistor! Do not use several KTY resistors connected in series or in parallel:
  - This would result in an incorrect measurement of the motor temperature.
  - The motors could be destroyed by overheating.
- If several motors are operated on a controller, use thermal contacts (NC contacts) for monitoring the motor temperature and connect theses contacts in series.
- To ensure full motor protection, an additional temperature monitoring with separate evaluation has to be installed.

Activation

Stop!

Overheating of the motor!

In the Lenze setting, temperature monitoring of the motor is deactivated (C0583 = 3). The motor temperature in C0063 shows 0 °C even if C0584 = 2 is set.

Possible consequences:

► The motor can be damaged by a too high motor temperature.

Protective measures:

► Activate the monitoring of the motor temperature via X7 or X8 with C0583 = 2 or C0584 = 2.

► Set C0594 = 2 or 3. Then the connection is additionally monitored with regard to short circuit and interruption.

► If you work with several parameter sets, you have to activate the monitoring separately in each parameter set.

1. Connect monitoring circuit of the motor to X7/8, X7/9 or X8/5, X8/8.
2. Set response of the controller for short circuit or interruption on the connection (monitoring of the motor temperature has to be activated):
   – C0594 = 3: monitoring is switched off.
   – C0594 = 0: TRIP error message (keypad display: Sd6 Trip)
   – C0594 = 2: warning signal (keypad display: Sd6 Warn)

Adjustment

Monitoring with a fixed operating temperature (150 °C)

1. Set response of the controller:
   – C0583 = 3: temperature monitoring of the motor switched off.
   – C0583 = 0: TRIP error message (keypad display: OH3 Trip)
   – C0583 = 2: warning signal (keypad display: OH3 Warn)

Monitoring with a variable operating temperature (45...150 °C)

1. Set the operating temperature in C0121.
2. Set response of the controller:
   – C0584 = 3: temperature monitoring of the motor switched off.
   – C0584 = 2: warning signal (keypad display: OH7 Warn)

Adjustment of KTY operating range

The temperature and resistance range can be adapted to the KTY used.

- ► C1190 = 0: Fixed operating range for KTY in Lenze motors (Lenze setting)
- ► C1190 = 1: Adjustable operating range

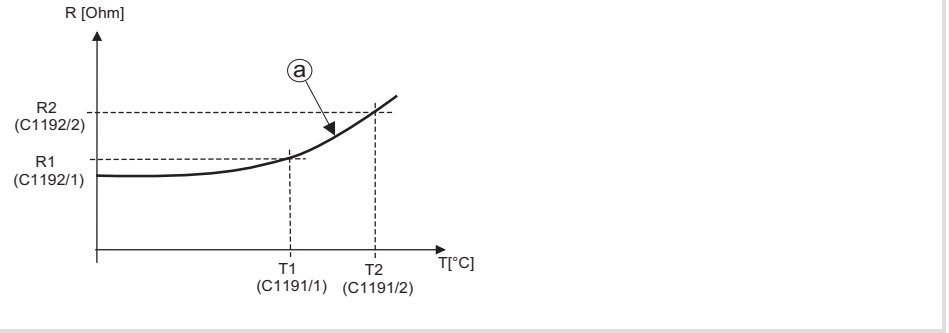


Fig. 6.5-9 Setting of the operating range for the KTY (C1190 = 1)

The operating range is specified by means of limit values and is in the almost linear section of the graph (a). The operating values are determined by interpolation.

C1191/1 C1191/2	Setting of the lower and upper temperature value (T1, T2) corresponding to the KTY used.
C1192/1 C1192/2	Setting of the lower and upper resistance value corresponding to the KTY used.

6.6 Setting the speed feedback

Description

The feedback signal can either be supplied via input X7 or via input X8.

- ► At X7 a resolver can be connected.
- ► At X8 an encoder can be connected.
  - – Incremental encoder TTL
  - – SinCos encoder
  - – SinCos encoder with serial communication (single-turn or multi-turn)

The resolver or encoder signal for slave drives can be output at the digital frequency output X10.

Note!

- ► Use a SinCos encoder with serial communication (multi-turn) if homing of the drive is not possible. Please specify the motor/encoder combination in your order.
- ► You can only use 2 of the 3 interfaces X8, X9, X10 simultaneously. Due to this it may be possible that the incremental encoder input cannot be activated or the digital frequency input / digital frequency output does not work.
  - – This dependency does not apply if the digital frequency output X10 is set to reproduction of the input signals at X8 or X9 (C0540 = 4 or 5).
  - – To deactivate the digital frequency input, it may be necessary to delete the internal signal link from function block DFIN to the following function block. Remove the function block DFIN from the processing table.

6.6.1 Resolver at X7

Resolvers can be operated at X7. For the wiring diagram and the pin assignment of X7, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

- ► C0025 = 10 (Lenze setting)
- ► Monitoring (SD2) of the resolver and the resolver cable for open circuit:
  C0586 = 0 (TRIP, Lenze setting)
  C0586 = 2 (warning)
  C0586 = 3 (off)

6.6.2 Incremental encoder with TTL level at X8

Incremental encoders with TTL level can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter ”Wiring of the standard device” → ”Wiring of the feedback system”.

Activation

► C0025 = 110, 111, 112 or 113. The number of increments (512, 1024, 2048 or 4096) is set automatically.

Adjustment

The incremental encoder is supplied with voltage by the drive controller.

Stop!

If the supply voltage is too high, it may destroy the incremental encoder.

Under C0421 you can adjust the supply voltage V_{CC} (5 V) of the incremental encoder in order to compensate for the voltage drop along the incremental encoder cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{Inc}\,[A]$$

l	Length of the incremental encoder cable
R	Resistance of the incremental encoder cable
I_{Inc}	Current consumption of the incremental encoder

6.6.3 SinCos encoder at X8

SinCos encoders can be operated at X8. For the wiring diagram and the pin assignment of X8, please refer to chapter "Wiring of the standard device" → "Wiring of the feedback system".

Activation

Stop!

Uncontrolled acceleration of the motor!

► If the SinCos encoder fails, the motor may accelerate in an uncontrolled manner.

Protective measures:

► Activate the monitoring for the SinCos encoder with C0580 = 0.

► SinCos encoder with 5 V supply voltage:
C0025 = 210, 211, 212, or 213. The number of increments (512, 1024, 2048 or 4096) is set automatically.

► Single-turn SinCos encoder with 8 V supply voltage:
C0025 = 309, 310, or 311. The number of increments (128, 512 or 1024) is set automatically.

► Multi-turn SinCos encoder with 8 V supply voltage:
C0025 = 409, 410, or 411. The number of increments (128, 512 or 1024) is set automatically.

► Monitoring (SD8) of the SinCos encoder:
C0580 = 0 (TRIP, Lenze setting)
C0580 = 3 (off)

Adjustment

The SinCos encoder is supplied with voltage by the controller.

Stop!

If the supply voltage is too high, the SinCos encoder may be damaged.

Under C0421 you can adjust the supply voltage V_{CC} (5 ... 8 V) of the SinCos encoder in order to compensate for the voltage drop along the cable (if required).

Calculation of the voltage drop

$$\Delta U \approx l\,[m] \cdot \frac{R\,[\Omega]}{[m]} \cdot I_{SINCOS}\,[A]$$

l	Length of the SinCos encoder cable
R	Resistance of the SinCos encoder cable
I_{SINCOS}	Current consumption of the SinCos encoder

6.7 Current controller adjustment

When is a current controller adjustment required?

- The motor data of the motor used is not contained in GDC (e.g. motors from other manufacturers).
- The application makes high demands on the dynamic performance of the drive controller (e.g. dynamic positioning, cross cutter).
- The motor/drive controller combination does conform to the standard power-based assignment. The basic current controller settings only match for a power-based assignment of the drive controller.

Preparations

Measure	Setting	Explanation
Reduce maximum current	Reduce the value in C0022	With the motor at standstill, the motor current of the motor phase U is measured (field frequency 0). This increases the motor current in the motor phase to 141% and the motor temperature rises significantly.
Generate maximum torque setpoint	Connect MCTRL-M-ADD with FIXED100%	For speed control or position control (MCTRL-N/M-SWT = 0)
	• Connect MCTRL-M-ADD with FIXED100% • Connect MCTRL-N-SET with FIXED100%	For torque control (MCTRL-N/M-SWT = 1)
Deactivate integral action component of current controller	Set C0076 = 2000 ms	The integral action component of the current controller is deactivated by setting the reset time T_n (C0076) to the longest time. The gain (C0075) remains unchanged (Lenze setting still valid).
Deactivate quick stop	Set X5/E1 = HIGH or X5/E2 = HIGH	By preselecting a direction of rotation the quick stop is deactivated.
Change the operation of the motor control	Set C0006 = 3	Even if an asynchronous motor is connected, set the motor control to 'synchronous motor'.
Set the rotor position setpoint	Set C0058 = -90°	Set the rotor displacement angle to -90°.
Set the actual value display of the rotor position to 0° under C0060	1. Select a TTL encoder under C0025 2. Save settings with C0003 = 1 3. If required, disconnect the encoder cable at X8 4. Switch off the mains supply and the external 24V supply (if required) and then on again.	After mains connection C0060 = 0° is displayed.
Connect the storage oscilloscope	Put the clamp-on ammeter around the motor phase U and connect it to the oscilloscope	Oscilloscope settings: • Time base: 400 µs/DIV • Auto-triggering

Adjustment

Stop!

Thermal destruction of the motor!

► If the controller is enabled for too long and the motor current is too high, the motor may be destroyed by overtemperature.

Protective measures:

► Reduce motor current under C0022 and enable the controller only for some seconds.

1. Inhibit the controller (X5/28 = LOW)
2. Deactivate quick stop (X5/E1 =HIGH or X5/E2 =HIGH)
3. Enable the controller for some seconds and then inhibit it again.
4. Record the current flowing in motor phase U with the controller being enabled.
5. Set the gain V_p (C0075) in such a way that the current rises rapidly.
6. Reduce the reset time T_n (C0076) so much that the transient response shows almost no overshoot and an optimum rise is achieved.
7. After each change of C0075 and C0076, the time course of the motor current must be recorded and checked again.

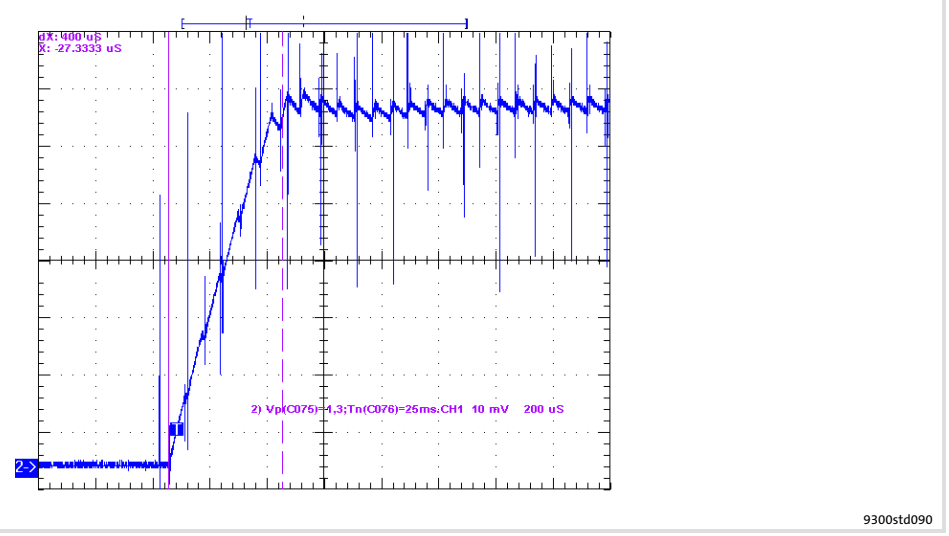


Fig. 6.7-1 Current characteristic for optimum controller adjustment
Time base 200 µs/DIV

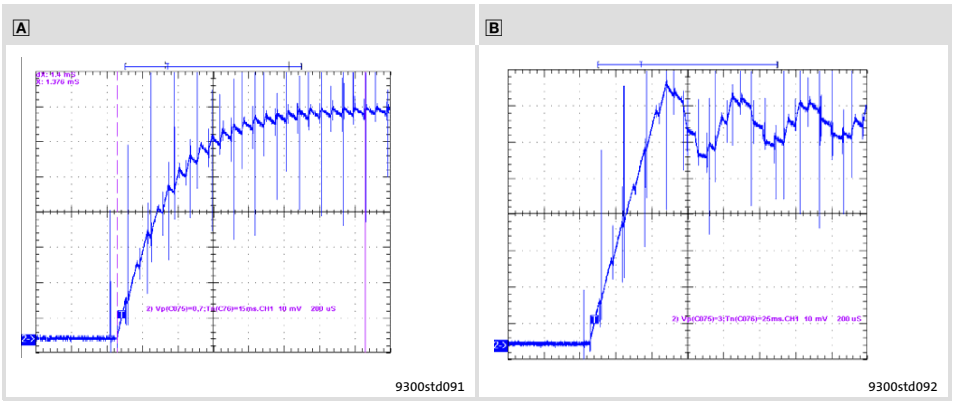


Fig. 6.7-2 Current characteristic for non-optimum controller adjustment

A Current rise of motor current too slow
Reset time T_n (C0076) too long and/or gain V_p (C0075) too small
Measured at time base 200 µs/DIV

B High-frequency oscillations of motor current, motor noises may occur
Reset time T_n (C0076) too short and/or gain V_p (C0075) too large
Measured at time base 200 µs/DIV

8. Check the transient response over a longer period of time (e.g. with time base 4000 µs/DIV). The motor current must reach the final steady-state value within the shortest possible time.

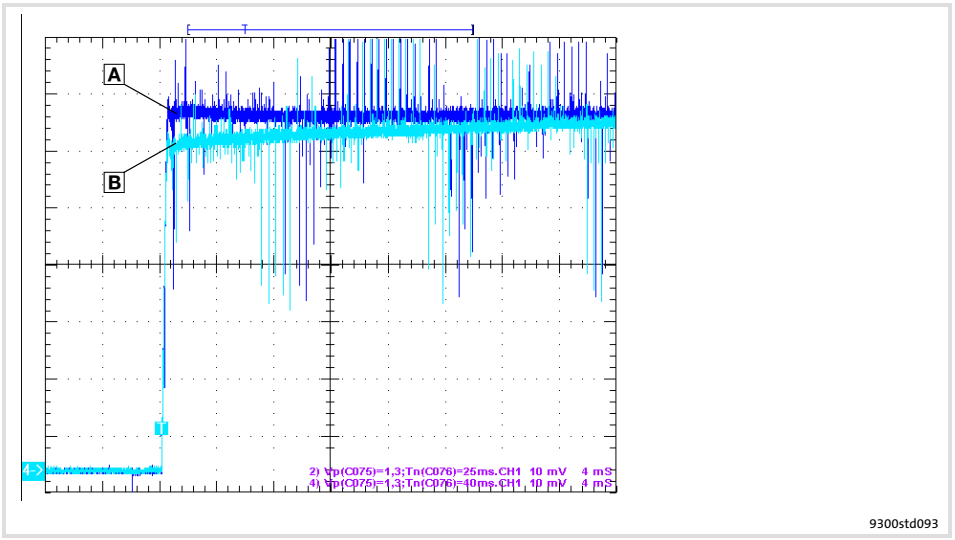


Fig. 6.7-3 Transient response of motor current over longer period of time

A Optimum transient response
B Final steady-state value is reached too slowly
Measured at time base 4000 µs/DIV

9. When the current controller adjustment is completed, reset the temporary settings:
   – Set the initial values again in C0006, C0022 and C0025. If necessary, reconnect the encoder cable to X8.
   – Connect the inputs MCTRL-M-ADD and MCTRL-N-SET with the initial signals.

6.8 Adjusting the rotor position

When is a rotor position adjustment required?

- A synchronous non-Lenze motor is used. The motor used is not included in GDC.
- Another encoder was mounted to the motor later on.
- A defective encoder was replaced.

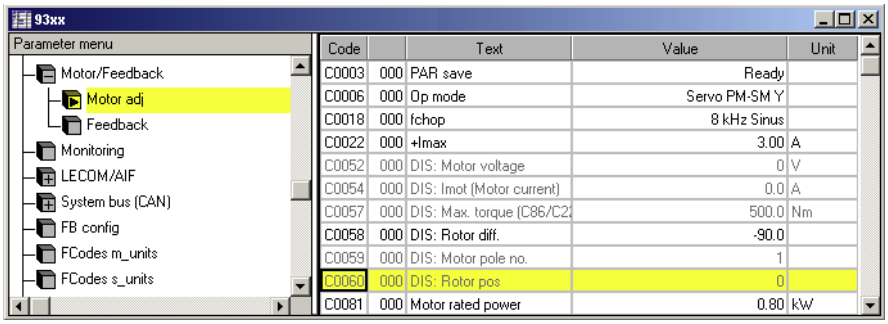
Note!

Only use single-pole resolvers or SinCos encoders (single-turn or multi-turn).

Preparatory work

- Inhibit the controller.
- Unload the motor mechanically.
  - Disconnect the motor from the gearbox/machine.
  - If necessary, remove toothed lock washers, gears, etc. from the motor shaft.
  - If necessary, support the holding torques provided by mounted motor brakes by means of locking devices.
- Deactivate the ”safe torque off” function so that the motor can be energised for the motor pole angle adjustment.
- Release the holding brake (if available).
- Adjust the current controller (see chapter ”Current controller adjustment”).
- Check resolver polarity.
- Set C0006 = 3.
  - For carrying out a rotor position adjustment, a synchronous motor must be selected.

Resolver polarity check



9300std200

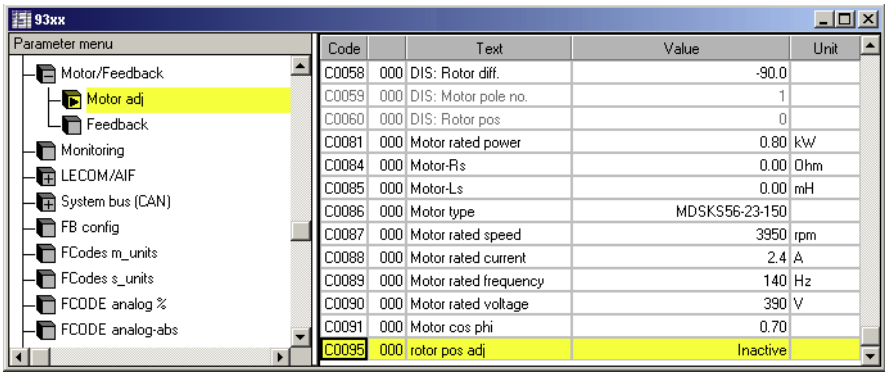
Fig. 6.8-1 ”Motor adj” menu of the parameter menu

Procedure

1. Inhibit the controller (X5/28 = LOW).
2. Disconnect the motor from the gearbox/machine.
3. Open the ”Parameter menu → Motor/Feedback → Motor adj” menu.
4. Turn the rotor to the right (when looking at the front end of the motor shaft). The value in C0060 must increase.
   - In C0060 the angle of rotation is displayed as a numerical value between 0 and 2047.

   Note!
   The actual value is only displayed if the selection cursor is placed on the code and [F6] is pressed.
5. If the value decreases, swap the signals at X7/6 and X7/7 (+SIN and -SIN).

Rotor position adjustment



9300std203

Fig. 6.8-2 ”Motor adj” menu of the parameter menu

Procedure

1. Inhibit controller (X5/28 = LOW).
2. Open the ”Parameter menu → Motor/feedback system → Motor setting” menu.
3. Select C0006 = 3.
   - A synchronous motor with feedback must be selected for pole position adjustment.
4. Click C0095 and activate the adjustment process by selecting C0095 = 1.
5. Enable controller (X5/28 = HIGH).
6. The position adjustment program of the controller is started.
   - The rotor rotates a full revolution in several steps.
   - Then C0095 is automatically set to 0.
7. C0058 displays the current rotor displacement angle.

   Note!
   - The current value will not be displayed until the bar cursor is on the code and [F6] is pressed.
   - For sin/cos encoders, C0058 always displays a value of 0 because the value is saved to the encoder.

Procedure	
8.	Inhibit controller (X5/28 = LOW).
9.	Reset C0006 to default setting if necessary.
10.	Click C0003 and save the setting by selecting C0003 = 1.
11.	Disconnect the mains and reconnect the motor to the machine.

Danger!

Uncontrolled movements of the drive after an ”Sd7” error in conjunction with absolute value encoders or in the case of a ”PL-TRIP” error.

If the rotor position adjustment was completed with an ”Sd7” or ”PL-TRIP” error (📖 9.3-1) it was not possible to assign the rotor position to the feedback system. In this case the drive may carry out uncontrolled movements after the controller has been enabled.

Possible consequences:

- ► Death or severe injuries.
- ► Destruction or damage to the machine.

Protective measures:

- ► Repeat rotor position adjustment (start with step 1).
- ► Check the wiring and the interference immunity of the encoder at X8.

6.9 Changing the assignment of the control terminals X5 and X6

Danger!

If you select a configuration in C0005, the signal assignment of the inputs and outputs will be overwritten with the corresponding basic assignment!

► Adapt the signal assignment to your wiring!

6.9.1 Free configuration of digital input signals

Description

► Internal digital signals can be freely linked with external digital signal sources. This serves to establish a freely configurable control of the drive controller.

– Digital inputs X5/E1 ... X5/E5

► A signal source can be linked with several targets. Ensure reasonable linkages for not activating functions that are mutually exclusive (e. g. linking a digital input with quick stop and DC injection braking at the same time).

Linking signals

The internal digital signal can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal digital signal.

Example

► C0787/2 =53 ⇨ signal source for JOG2 is terminal X5/E3

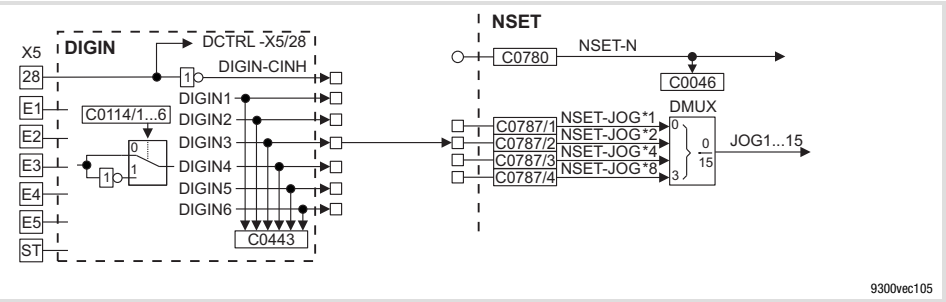


Fig. 6.9-1 Connecting digital signal JOG2 with terminal X5/E3

Tip!

► A list with all selection figures is included in the chapter ”Configuration” → ”Selection lists”.

► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Signal level

► Terminals (X5/E1 ... X5/E5):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0114 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/E1 ... X5/E5.

Example

► C0114/3 =1 ⇨ LOW level at X5/E3 activates JOG2

6.9.2 Free configuration of digital outputs

Description

► The digital outputs X5/A1 ... X5/A4 can be freely linked with internal digital signals.

► One signal source can be linked with several targets.

Linking signals

The digital outputs can be linked with internal digital signals by entering the selection figure of the internal signal into corresponding subcode of C0117.

Example

► C0117/2 = 505 ⇨ signal source for X5/A2 is the status message ”direction of rotation” (DCTRL-CW/CCW)

Signal level

► Terminals (X5/A1 ... X5/A4):
– HIGH = +12 V ... +30 V
– LOW = 0 V ... +3 V

► Response times: 1 ms

Inverting the signal level

In C0118 you can define the active signal level (HIGH level active or LOW level active) for the terminals X5/A1 ... X5/A4.

Example

► C0118/2 =1 ⇨ With LOW level at X5/A2 the motor rotates in CW direction (with in-phase motor connection)

6.9.3 Free configuration of analog input signals

Description

- Internal analog signals can be freely linked with external analog signal sources:
  – Analog inputs X3/1, X3/2 and X3/3, X3/4
- One signal source can be linked with several targets.

Linking signals

The internal analog signals can be linked with an external signal source by entering the selection figure of the external signal into the configuration code of the internal analog signal.

Example

- C0780 = 50 ⇨ signal source for the main setpoint (NSET-N) is terminal X6/1, X6/2

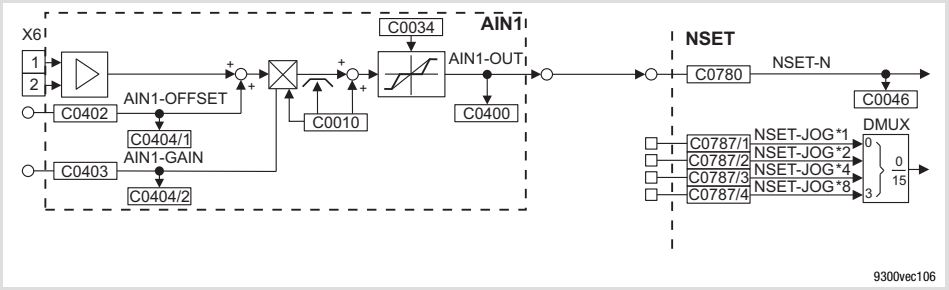


Fig. 6.9-2 Linking analog signal NSET-N with terminal X6/1, X6/2

Tip!

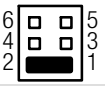
- A list with all selection figures is included in the chapter "Configuration" → "Selection lists".
- For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Gain and offset

Set gain (C0027) and offset (C0026) to adapt the input signal to the application.

Input range of X6/1, X6/2

Input range	C0034	Position of jumper at X3
-10 V ... +10 V	C0034 = 0	
+4 mA ... +20 mA	C0034 = 1	
-20 mA ... +20 mA	C0034 = 2	

Note!

Different settings in C0034 and of X3 result in a wrong input signal.

6.9.4 Free configuration of analog outputs

Description

- ► The analog outputs (X6/62, X6/63) can be freely linked with internal analog process or monitoring signals. The controller outputs a voltage proportional to the internal signal at the analog outputs.
- ► One signal source can be linked with several targets.

Linking signals

Analog outputs can be linked with internal analog signals by entering the selection figure of the internal signal into the code of C0431 (AOUT1, X6/62) or C0436 (AOUT2, X6/63).

Example

- ► C0436 = 5006 ⇨ signal source for X6/63 is the actual motor voltage

Tip!

- ► A list with all selection figures is included in the chapter "Configuration" → "Selection lists".
- ► For signal linkage we recommend the function block editor in GDC (ESP-GDC2).

Adjustment

Set gain (C0108) and offset (C0109) to adapt the output signal to the application.

With an internal signal of 100 % and a gain of 1, a voltage of 10 V is output at the terminal.

6.10 Manual control

6.10.1 Setting of manual control parameters

Stop!

Uncontrolled motor movement possible.

Incorrect settings in the configuration may cause uncontrolled movements.

Possible consequences:

► The machine is damaged or destroyed.

Protective measures:

► Select low values for the acceleration and speed in order to be able to reliably check the configuration.

► Select the Lenze setting. For most application cases it is sufficient.

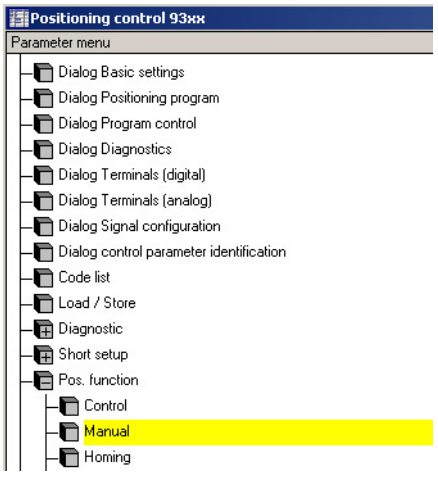


Fig. 6.10-1 ”Manual control” menu in the parameter menu

Procedure	
1.	Change to the parameter menu.
2.	Open the ”POS functions” menu.
3.	Open the ”Manual control” submenu.
4.	Click on code C1243 and enter a value for the manual control speed. ● Lenze setting: 5 % of v_{max}
5.	Click on code C1252 and enter a value for the manual control acceleration. ● Lenze setting: 10 % of a_{max}
6.	Click on code C0003 and save the settings (C0003 = 1).

6.10.2 Checking the configuration

Check a new or changed configuration in manual operation with regard to a faultless function.

Danger!

Uncontrolled motor movement possible.

Incorrect settings in the configuration may cause uncontrolled movements.

Possible consequences:

► Severe injuries to persons in or near the machine.

► The machine is damaged or destroyed.

Protective measures:

► Provide suitable emergency off equipment so that you are able to shut down the drive immediately.

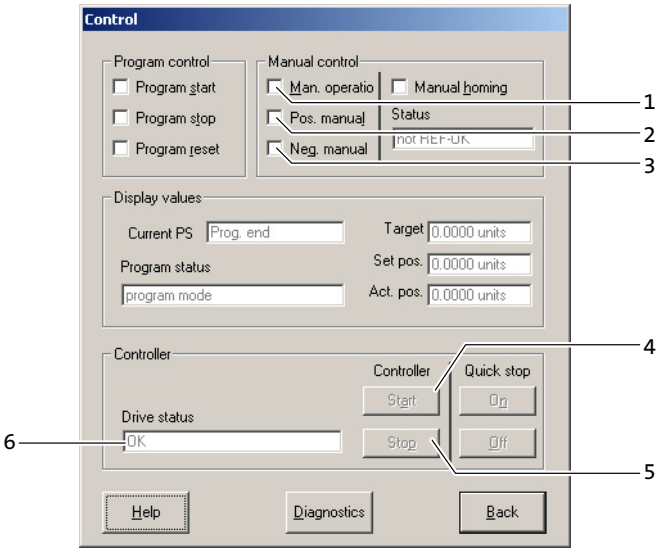


Fig. 6.10-2 ”Control” dialog box

Procedure	
1.	Activate ”Manual operation” (3).
2.	Click ”Start” (4) to enable the controller. ● If ”Ok” is displayed in the ”Drive diagnostics” field (5), controller enable can be executed. ● Controller inhibit must be deactivated (X5/28 = HIGH).
3.	Move the drive against the travel range limit switches, in order to check its function. ● ”Pos. manual” (2) or ”Neg. manual” (1) is activated: The drive traverses. ● ”Pos. manual” (2) or ”Neg. manual” (1) is deactivated: The drive stops.
A	Activate ”Pos. manual” (2). ● The drive traverses in the direction of the positive travel range limit switch.
B	Activate ”Neg. manual” (1). ● The drive traverses in the direction of the negative travel range limit switch.

Note!

- If the functions ”Pos. manual” and ”Neg. manual” are activated, the drive brakes with the max. acceleration (a-max) to standstill.
- The direction of rotation for the functions ”Pos. manual” and ”Neg. manual” can be changed by setting the ”Position polarity” field in the ”Basic settings” dialog box to ”Inverted”.
- You can only quit overtravelled limit switches by changing the traversing direction (”Pos. manual” or ”Neg. manual”).

6.11 Travel profile parameters

6.11.1 Description of the positioning program

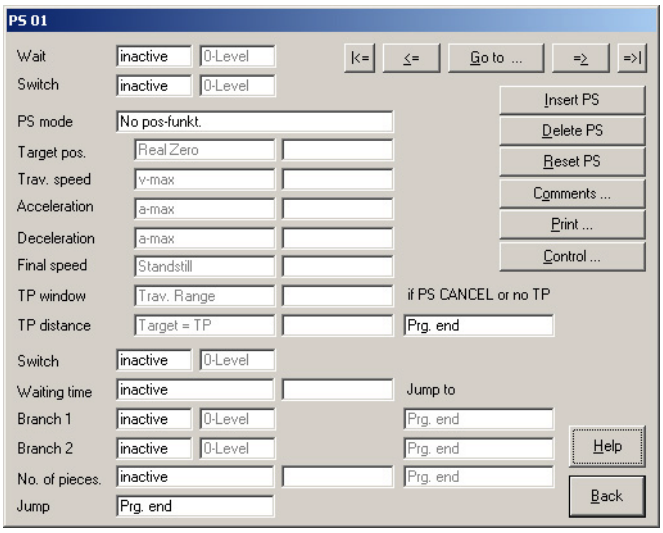


Fig. 6.11-1 ”Positioning program” dialog box

- The positioning program consists of max. 32 program sets (PS).
- The PS can be linked to a positioning program in an optional sequence.
- The PS determine the sequence of the positioning. The functions are processed within a PS according to a fixed sequence. (📖 6.11-6)

  These functions include:
  - Type of positioning (relative or absolute positioning with or without touch probe)
  - Speed profile of the positioning
  - Access to data in the variable tables (VT).
  - Response on external events via digital inputs (PFI)
  - Processing of waiting times
  - Repetition of number of pieces
  - Output of control signals via digital outputs (PFO)
- Positioning is effected with the travel profile parameters. These parameters are included in the variable table (VT). The following VTs are available:
  - VTPOS for the target position
  - VTVEL for the traversing speed and final speed
  - VTACC for the acceleration and deceleration
  - VTPCS for the number of pieces or repeat function
  - VTTIME for the waiting time

6.11.2 Structure of the travel profile

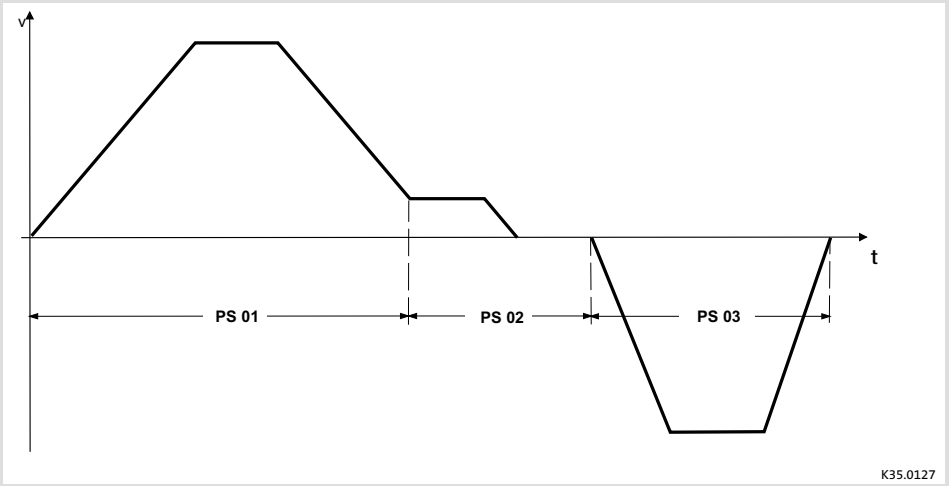


Fig. 6.11-2 Travel profile: Example of a point-to-point positioning

PS01, PS02, PS03 For the travel profile in Fig. 6.11-2 three program sets (PS) are required for entering all parameters.

- Create a travel profile of your drive task, e.g. as shown in Fig. 6.11-2 or Fig. 6.11-3.
- The parameter data for the travel profile are saved in program sets (PS).
- For more complex travel profiles, generate a positioning program with several PS (e.g. for different travelling speeds).
- The PS are parameterised in the "Positioning program" dialog box.
  - The sequence of the input is determined. (📖 6.11-4)
  - Complex positioning processes are divided into individual sections (program sets).
- Every program set can be called up as often as required without further programming effort.
- A total of 32 program sets is available.

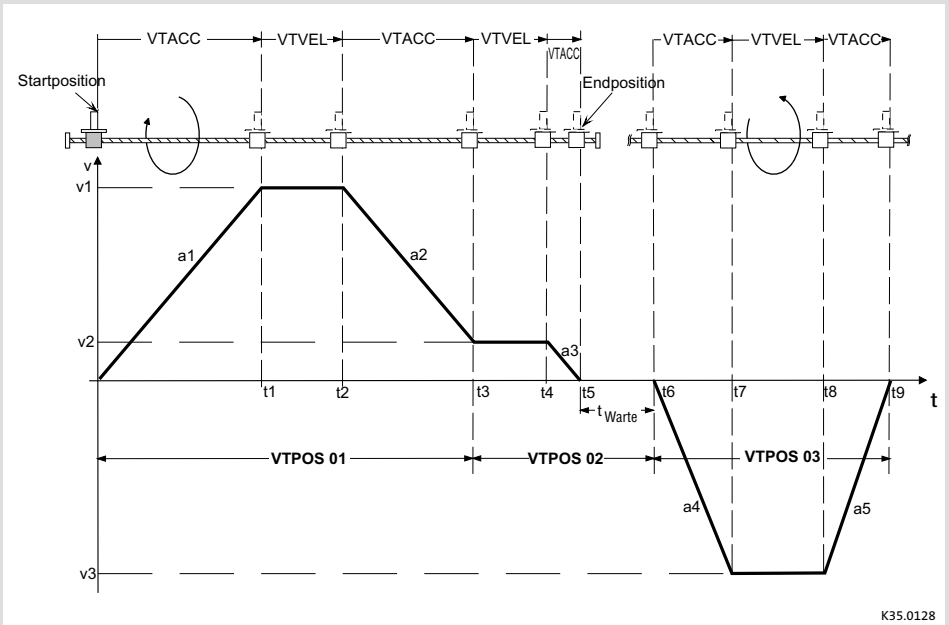


Fig. 6.11-3 Travel profile: Example of a point-to-point positioning with the PS required

Designation	Program set	Function
a1	PS01	Acceleration - forwards
t1	PS01	Time until v1 is reached
v1	PS01	Traversing speed - forwards
t2	PS01	Calculated time of braking to reach v2 in t3
a2	PS01	Deceleration 1 - forwards
t3	PS01	Start creeping with v2
v2	PS01, PS02	Final speed (PS01), traversing speed (PS02)
t4	PS02	Drive approaches position
a3	PS02	Deceleration 2 - forwards
t5	PS02	Position reached, then waiting time (e.g. processing of a workpiece)
t6	PS03	Start backward motion
a4	PS03	Acceleration - backwards
t7	PS03	Time until v3 is reached
v3	PS03	Traversing speed - backwards
t8	PS03	Time until a5 starts (calculated)
a5	PS03	Deceleration - backwards
t9	PS03	Time until the starting point is reached

6.11.3 Entering parameters

"Positioning program" dialog box

Click on the "Programming" button in the "Basic settings" dialog box.

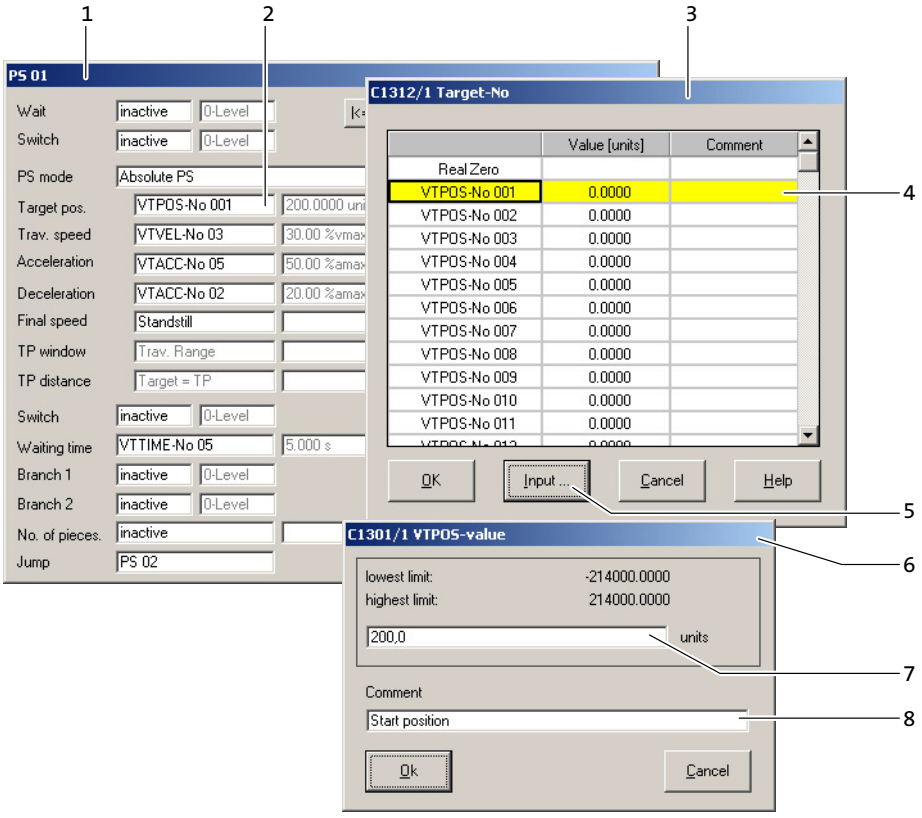


Fig. 6.11-4 "Positioning program" dialog box

Function		Description
1	"Positioning program" dialog box	Dialog box for entering the travel profile parameters for a PS and possible branches to further PS.
2, 3	Parameter field	Click on the field. Dialog box (3) for selecting a parameter is opened.
4, 5	Selection field	Selection of the parameter. Click on the desired field. For variable tables (VT) you can describe the table positions. For this, click on "Input" (5). Dialog box (6) opens for entering a parameter.
6	Dialog box for entering a parameter	Dialog box for entering a parameter in the variable table (see function 4, 5).
7	Input field	Entry of the desired parameter (see function 4, 5).
8		Description of the parameter, e.g. of the function for which it is required (see function 4, 5).

Editing tools

For entering the parameter data easily and quickly, the positioning program is provided with editing tools.

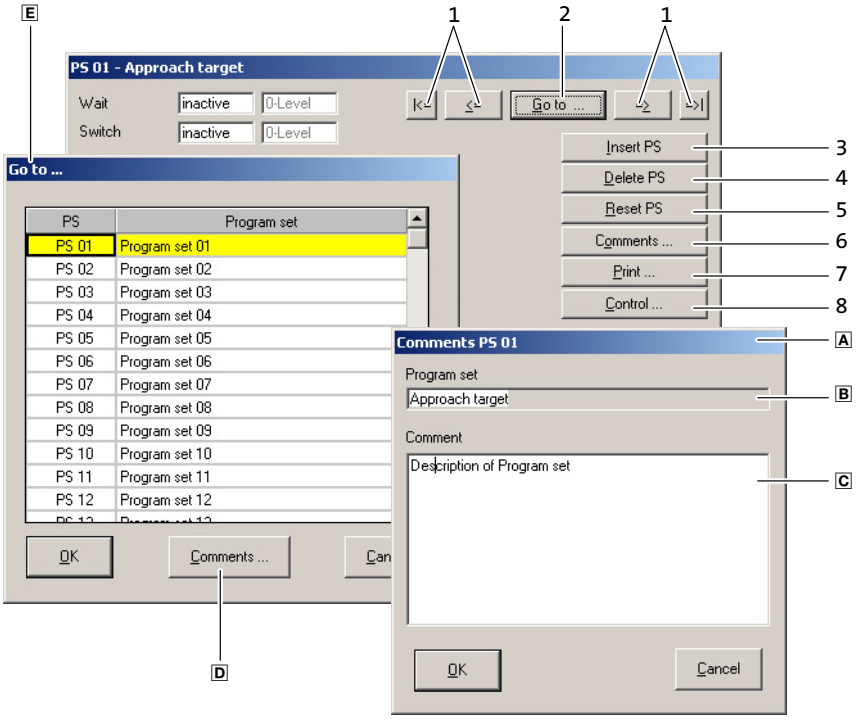


Fig. 6.11-5 ”Positioning program” dialog box

Function		Description
1	Browse PS	Select the previous or next program set or skip to the first or last program set.
2, E	Select PS	Click the ”Go to ...” button to open dialog box E. Select the PS for processing in the dialog box. Open the ”Documentation” dialog box for the PS selected, if required via the ”Documentation...” D button (see function 6).
3	Insert PS	Inserts a new PS at this position and shifts all following PS one position to the back. The last PS is deleted.
4	Delete PS	Deletes the current PS and shifts all following PS forwards by one position.
5	Reset PS	Resets all parameters of the current PS or of all PS to the default setting.
6, A, D	Write comments on the PS	Documentation of the current PS. In dialog box A, a name B can be assigned to the PS, and an explanatory text can be added as a comment C.
7	Print PS	Provide current or all PS to a printer.
8	Select ”Control” dialog box	Direct change to the ”Control” dialog box, e.g. to test modifications in manual operation. 🕮 6.10-2)

Processing a program set

The following chart shows the processing of a program set (PS).

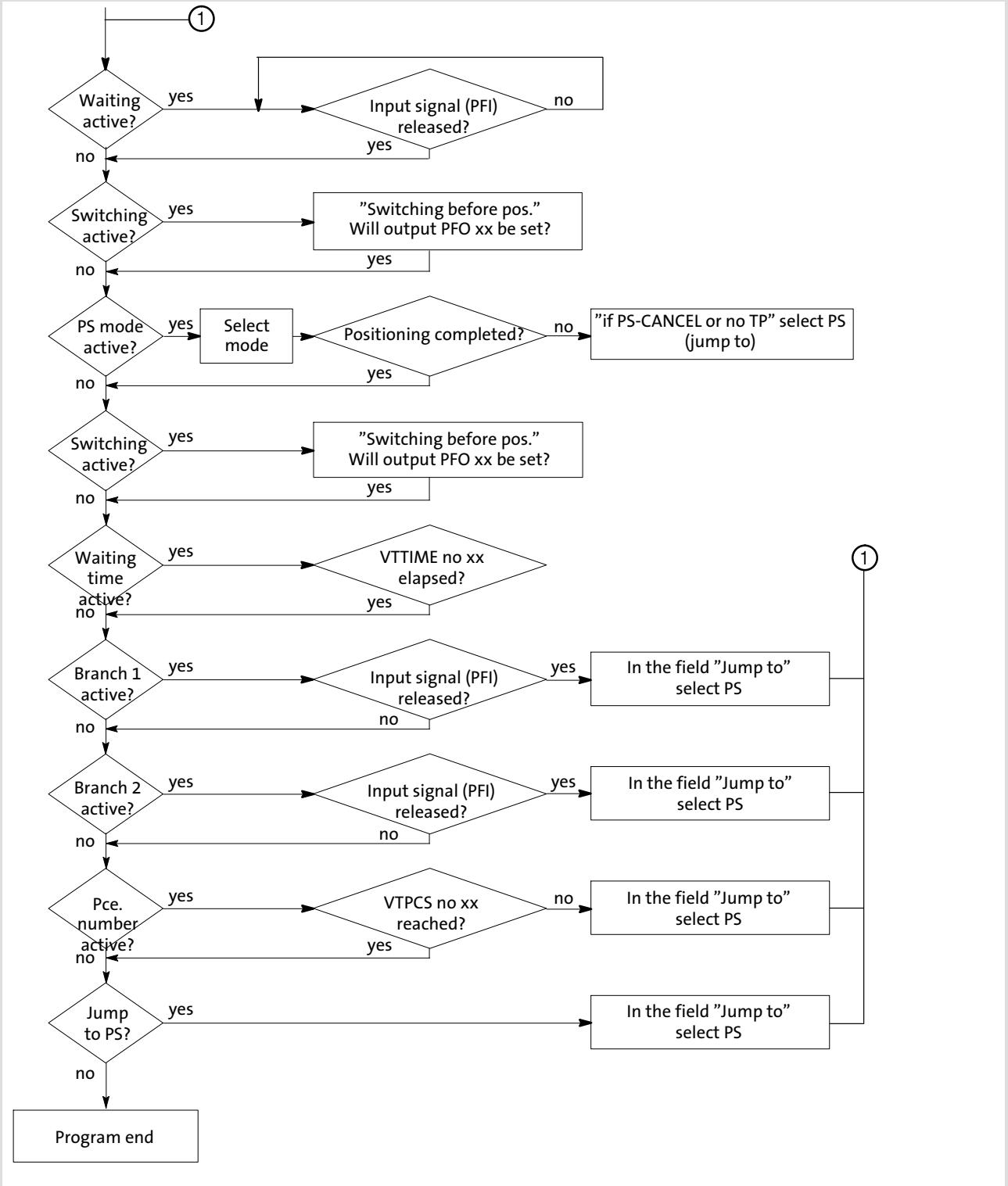


Fig. 6.11-6 Processing of a program set

Entering parameters

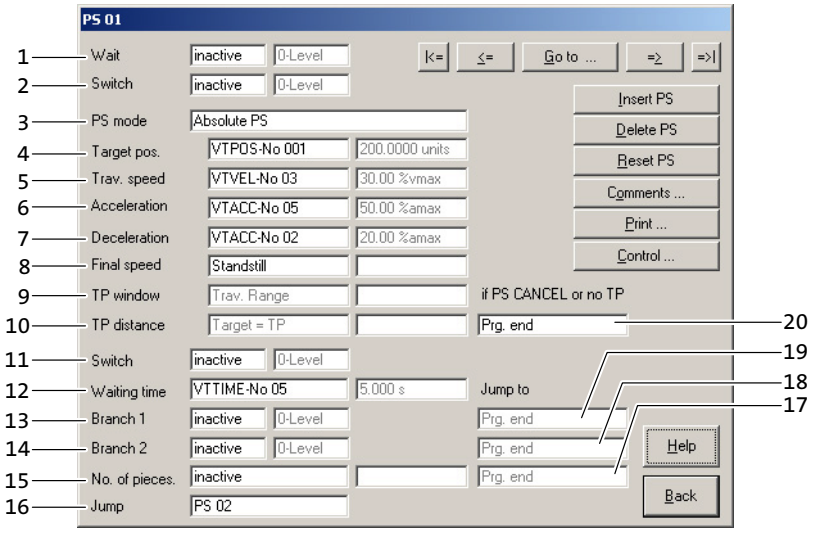


Fig. 6.11-7 ”Positioning program” dialog box

Function		Description
1	Inactive or no. of a PFI	Program function input (PFI). A digital input signal via an FB or terminal starts the PS processing. Possible signal levels: 0 or 1
2	Inactive or no. of a PFO	Program function output (PFO). A digital output signal indicates the state. Possible signal levels: 0 or 1
3	Type of positioning	e.g. absolute positioning, relative positioning, or special function (set reference).
4	Target position of VTPOS	Input of a target position from the variable table VTPOS.
5	Traversing speed from VTVEL	Input of a speed from the variable table VTVEL.
6	Acceleration from VTACC	Input of an acceleration from the variable table VTACC.
7	Deceleration from VTACC	Input of a deceleration from the variable table VTACC.
8	Final speed from VTVEL	Input of a speed from the variable table VIVEL or standstill.
9	TP window from VTPOS	Input of a position value from the variable table VTPOS.
10	TP residual path from VTPOS	Input of a position value from the variable table VTPOS. If there is no touch probe during a touch probe positioning, a branch/skip (”if PS CANCEL or no TP”) to a PS or program end is effected (see function 20).
11	Inactive or no. of a PFO	Program function output (PFO). A digital output signal indicates the state. Possible signal levels: 0 or 1
12	Inactive or time from VTTIME	Input of a waiting time from the variable table VTTIME until the next program function is processed.
13	Inactive or no. of a PFI	Program function input (PFI). If a digital input signal is applied during a request (via a FB or a terminal), a branch (”Jump to”) to a PS or to the program end is effected (see function 19). Possible signal levels: 0 or 1
14	Inactive or no. of a PFI	Program function input (PFI). If a digital input signal is applied during a request (via a FB or a terminal), a branch (”Jump to”) to a PS or to the program end is effected (see function 18). Possible signal levels: 0 or 1

Function		Description
15	Inactive or number from VTPCS	Input of a set quantity from the variable table VTPCS. If this quantity has not been reached, the program branches (”jump to”) to a PS or to the program end (see function 17).
16	Jump to the next PS or program end	Input of a PS or program end to which the program branches after the current PS has been processed.

6.12 Parameter set management

GDC provides different possibilities of loading or saving a parameter set.

6.12.1 Saving of parameter set

Save parameter set to a file

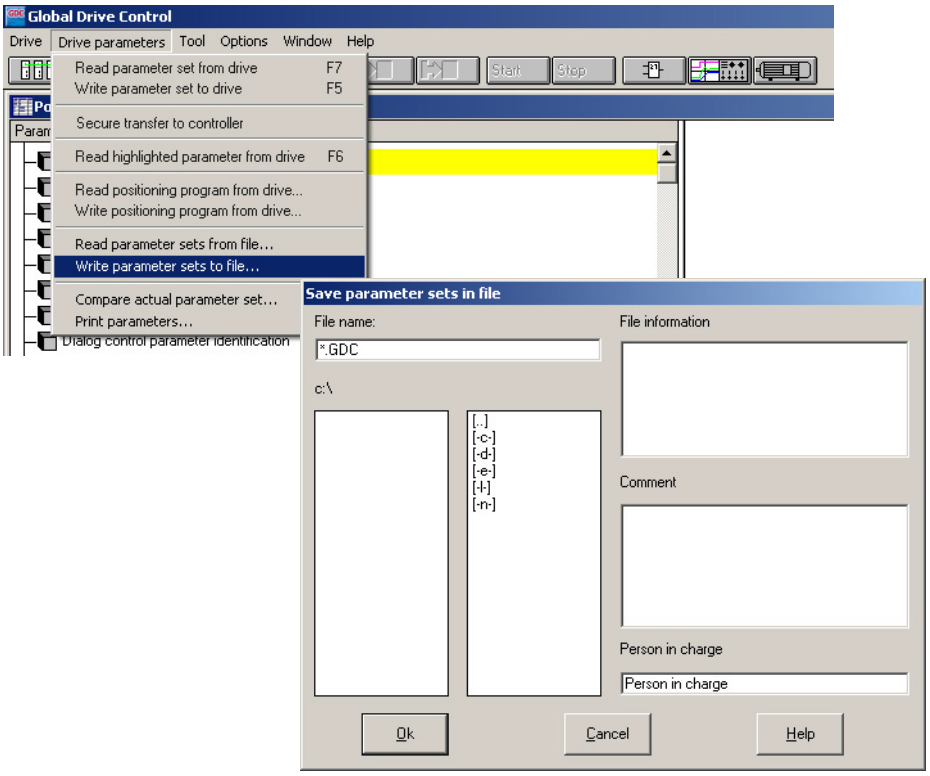


Fig. 6.12-1 Saving a parameter set to a file

How to save a parameter set in a file:

1. Execute **Drive parameters ➔ Save parameter sets in file...**.
2. Assign file name, select the drive and directory in which the parameter set is to be saved.
3. If required, document the parameter set in the ”Comment” field.
4. Confirm the entries with ”Ok”.
   – The parameter set is saved in a GDC file.

Save parameter set to the controller

A parameter set transfer can only be executed if controller inhibit is activated.

Danger!

Uncontrolled motor movement possible.

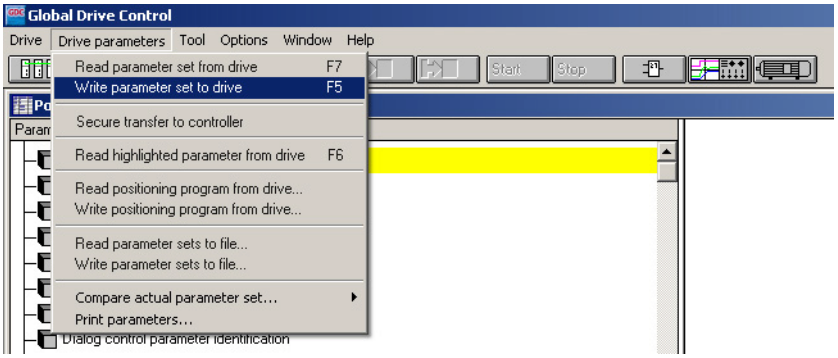
The controller is reinitialised by the parameter set transfer from the PC to the controller. System configurations and terminal assignments may be different.

Possible consequences:

- ► Severe injuries to persons in or near the machine.
- ► The machine is damaged or destroyed.

Protective measures:

- ► Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- ► Use terminal X5/28 or the STOP function in GDC as the source for controller inhibit.



How to transfer a parameter set to the controller:

1. Execute **Drive parameters ➔ Write parameter set to drive**.
   – Alternatively the command can be executed via key ”F5”.
2. Open the ”Load / Save” menu in the parameter menu and save the parameter set safe against mains failure with C0003 = 1.

6.12.2 Loading a parameter set

Read parameter set from file

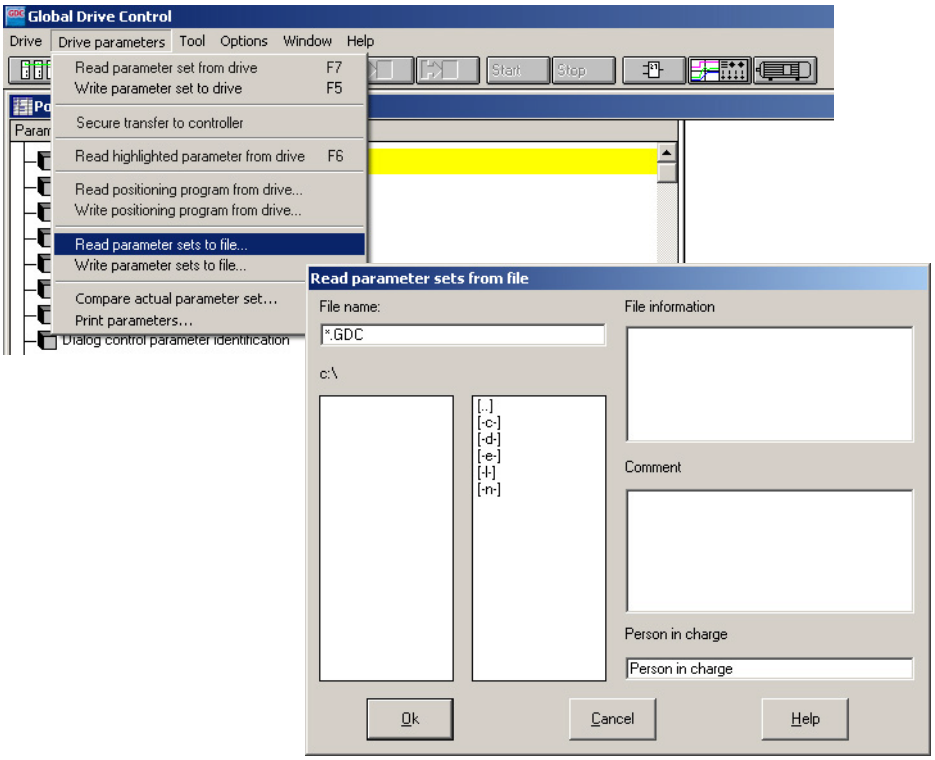


Fig. 6.12-2 Read parameter set from a file

How to open a parameter set from a file:

1. Execute **Drive parameters ➔ Read parameter sets from file...**.
2. Select the drive and directory in which the parameter set is stored.
3. Confirm the selection with ”Ok”.
   – The parameter set is opened in GDC.

Read parameter set from drive

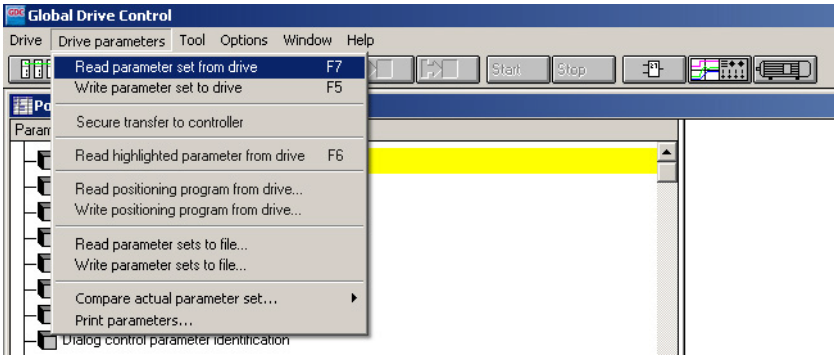


Fig. 6.12-3 Read parameter set from controller

How to read a parameter set from the controller:

1. Execute **Drive parameters ➔ Read parameter set from drive**.
   – Alternatively the command can be executed via key ”F7”.
2. Select the settings of the parameter set which are to be read in the parameter set management in C0002.
   – Load Lenze setting (C0002 = 0)
   – Load customised parameter set (C0002 = 1)
3. The parameter set is read from the controller and is loaded in GDC.
   – During the parameter set is loaded, the controller cannot be operated. The RDY message on the controller is inactive.

6.13 Homing

The reference of the motor revolution to the mechanics position gets lost when the controller is switched off. In order to reestablish this reference, a homing has to be carried out after switch-on.

6.13.1 Setting the homing parameters

Stop!

Uncontrolled, quick movements of the drive.

Incorrect settings in the configuration may cause impermissible movements of the drive.

Possible consequences:

► The machine is damaged or destroyed.

Protective measures:

► Select low values for the acceleration and speed in manual control in order to be able to reliably check the configuration.

► For instance use the Lenze setting. For most application cases it is sufficient.

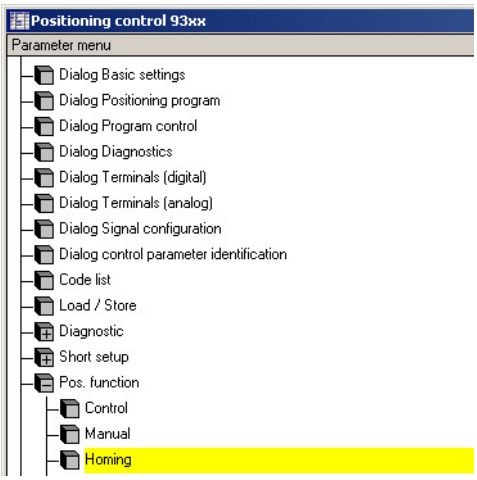


Fig. 6.13-1 ”Homing” menu in the parameter menu

Procedure	
1.	Change to the parameter menu.
2.	Open the ”POS functions” menu.
3.	Open the ”Homing” submenu.
4.	Click on code C1242 and enter a value for the homing speed. ● Lenze setting: 10 % of a_{max}
5.	Click on code C1251 and enter a value for the homing acceleration. ● Lenze setting: 10 % of a_{max}
6.	Click on code C1213 and select the homing mode. ● Mode ”Pos. via REF-MARK to home pos” (Lenze setting) – The drive moves in the positive direction towards the limit switch. ● Mode ”Neg. via REF-MARK to home pos” – The drive moves in the negative direction towards the limit switch.
7.	Click on code C0003 and save the settings (C0003 = 1).

6.13.2 Manual homing

The controller can only perform all positioning tasks exactly with a defined home position (zero point).

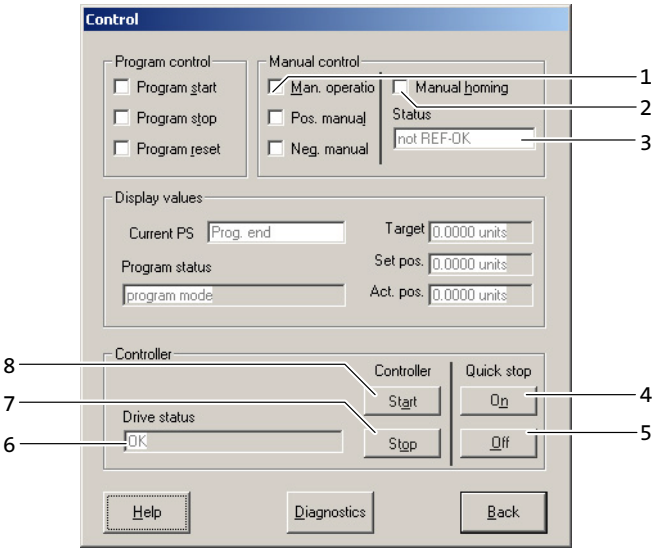


Fig. 6.13-2 ”Control” dialog box

Procedure

1. Click on the ”Control” button in the ”Basic settings” dialog box to open the ”Control” dialog box.
2. Activate ”Manual operation” (1).
3. Enable/inhibit the controller.
   - A Click ”Start” (8) to enable the controller.
     - If ”Ok” is displayed in the ”Drive diagnostics” field (5), enable can be executed.
     - Controller inhibit must be deactivated (X5/28 = HIGH).
   - B Click ”Stop” (7) to inhibit the controller.
4. Overtravel homing switch.
   - The drive traverses to the next zero position of the rotor and brakes to a standstill. This position is now considered to be the reference point for all positioning data.
   - After the homing has been completed successfully, ”Reference ok” (3) is displayed, and X5/A4 is set to HIGH.
   - A Activate ”Manual homing” (2).
     - The drive traverses with the homing parameters set. (📖 6.13-1)
   - B Deactivate ”Manual homing” (2).
     - The drive stops.
5. If required, stop the drive via quick stop (QSP).
   - A Click ”On” (4).
     - The drive is moved until standstill at the QSP deceleration ramp and is held with a standstill torque.
   - B Click ”Off” (5).
     - The drive is moved to setpoint speed at the QSP acceleration ramp.

6.14 Controlling the drive

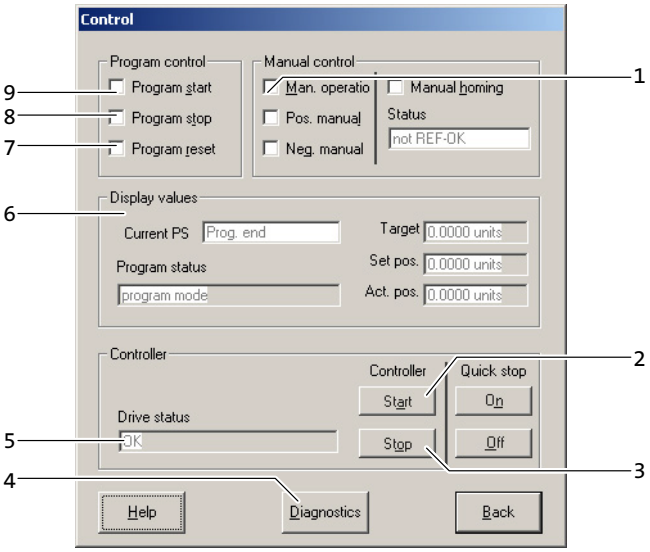


Fig. 6.14-1 ”Control” dialog box

Procedure

1. Click on the ”Control” button in the ”Basic settings” dialog box to open the ”Control” dialog box.
2. Activate the program operation.
   - Lenze setting: Set X5/E5 = HIGH.
   - ”Manual operation” (1) must be deselected.
3. Click ”Start” (4) to enable the controller.
   - If ”Ok” is displayed in the ”Drive diagnostics” field (5), enable can be executed.
   - Controller inhibit must be deactivated (X5/28 = HIGH).
4. Control the drive.
   - The ”Controller” field (6) shows the current positioning and the program status.

   A Select ”Program start” (9).
   - The drive moves according to the loaded positioning profile.

   B Deselect ”Program start” (9) and select it again.
   - The program restarts or is continued after an interruption (”Program stop”).

   C Select ”Program stop” (8).
   - The program execution is interrupted. The drive stops.

   D Deselect ”Program stop” (8).
   - The program execution can be continued with ”Program start”.

   E Select ”Program reset” (7).
   - The program execution is aborted. The drive stops. The piece counter and all PFOs are reset. (📖 6.11-1)

   F Deselect ”Program reset” (7).
   - The first PS with which the program is to start is loaded.
   - The program can be restarted with ”Program start”.

Via the ”Control” dialog box you can start, stop, and reset the positioning program and read the current program status.

6.15 Automatic control parameter identification

6.15.1 Important notes

Stop!

- ► A control parameter identification can only be carried out if the drive is not exposed to external torques. In the event of overhauling loads, for instance, a motion must not be activated through the function.
- ► Release the brake (if mounted) before executing the control parameter identification.
- ► In order to comply with the number of revolutions, a brake resistor or a regenerative power supply unit and a constant moment of inertia are required.
  - – A major change to the Lenze setting in the ”Limitation” field (C1182 ... C1185) may cause deviations during the identification of the distance parameters and thus can cause deviations with regard to the controller setting.
- ► The motion to be carried out by the control parameter identification must be set in a way that even the slowest rotating element of the drive train is still moving significantly.

Requirements for the activation

- ► The controller has to be inhibited (X5/28 = LOW).
- ► The drive has to be at standstill.

Note!

If the requirements are not met, the control parameter identification is not executed and an error code is set.
(📖 6.15-4)

- ► In the case of a reactivation, the error is reset and the function is initialised.

6.15.2 Description

How to open the dialog box (device description, from version 8.0):

1. Open the ”short setup” menu.
2. Double-click the ”DIALOG control parameter identification”.

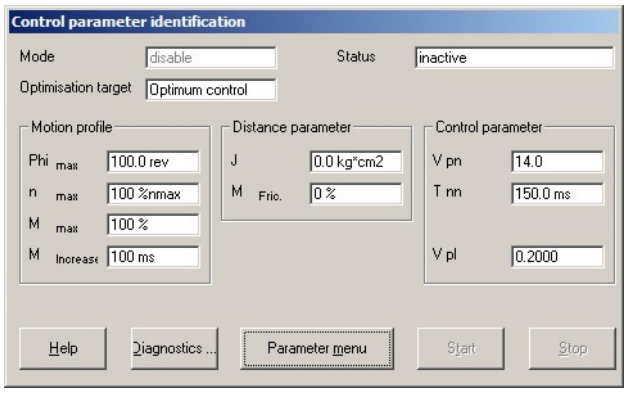


Fig. 6.15-1 “Control parameter identification” dialog box

Field	Description
Mode	Mode 0 (C1180 = 0): Not active ● The control parameter identification is reset to the initial state and is deactivated. Error messages are reset.
	Mode 1 (C1180 = 1): Calculate control parameters ● The control parameters for the speed and position controller are calculated according to the specifications in the ”Control parameters” field.
	Mode 2 (C1180 = 2): Identify J ● The plant parameters are identified automatically. ● A motion sequence of the drive is started. For this the controller has to be enabled (X5/28 = HIGH) after the activation, so that the drive can move. When the motion sequence has been completed, the controller has to be inhibited (X5/28 = LOW) to exit the function.
	Mode 3 (C1180 = 3): Identify & calculate ● The plant parameters are identified automatically. ● The control parameters for the speed and position controller are calculated according to the specifications in the ”Control parameters” field. ● A motion sequence of the drive is started. For this the controller has to be enabled (X5/28 = HIGH) after the activation, so that the drive can move. When the motion sequence has been completed, the controller has to be inhibited (X5/28 = LOW) to exit the function.
Optimisation target	Response to setpoint changes Response to failure
Status	Status display (C1181) ● The error messages serve to identify error causes during the control parameter identification. (📖 6.15-4)
Limitation	Selection of the limit values (C1182 ... C1185) for the motion sequence of the drive (modes 2 and 3). ● Major changes to the Lenze settings can cause deviations during the identification of the plant parameters and thus deviations of the controller setting.
Plant parameters	Selection of the plant parameters for mode 1. ● In the case of modes 2 and 3, the plant parameters are determined automatically.
Control parameters	Selection of the control parameters for modes 1 and 3. ● In the case of mode 2, no control parameters are determined.

6.15.3 Sequence diagram

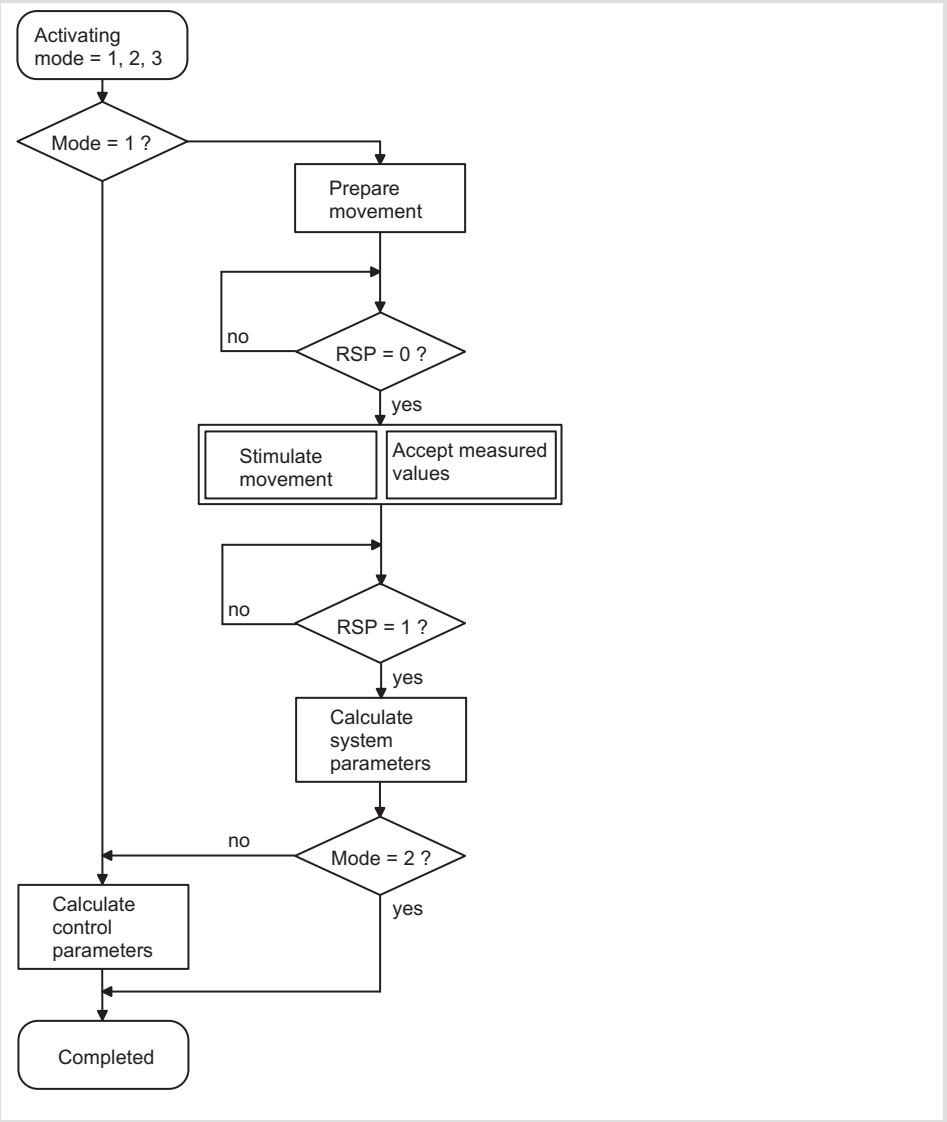


Fig. 6.15-2 Sequence of the control parameter identification

6.15.4 Troubleshooting

If an error occurs during the control parameter identification, you can determine the error cause via the ”Status” field or via C1181.

Error	C1181	Remedy
Control parameter calculation not possible.	2	Check whether plant parameters are set reasonably (C1187/C1188).
Too few scanning points registered.	3	Change basic motion conditions (C1182 ... C1185), i.e. increase torque, increase number of revolutions, increase speed, reduce torque rise time.
Reference torque too low	4	● Increase I_{max} (C0022) ● Check max. torque (C0057)
Speed at start ≠ 0	5	Stop drive and reactivate function
Controller inhibit set during motion sequence	6	Repeat control parameter identification.
Minimum braking torque not reached Torque ramp too flat, or max. torque too low.	7	Change basic motion conditions (C1182 ... C1185), i.e. increase torque, increase number of revolutions, increase speed, reduce torque rise time.
Time overflow	8	Select higher torque or shorter torque rise time.
Blocking of the drive	9	Release brake, check motor cable, eliminate mechanical blocking of the drive.

6.16 Commissioning examples

Example

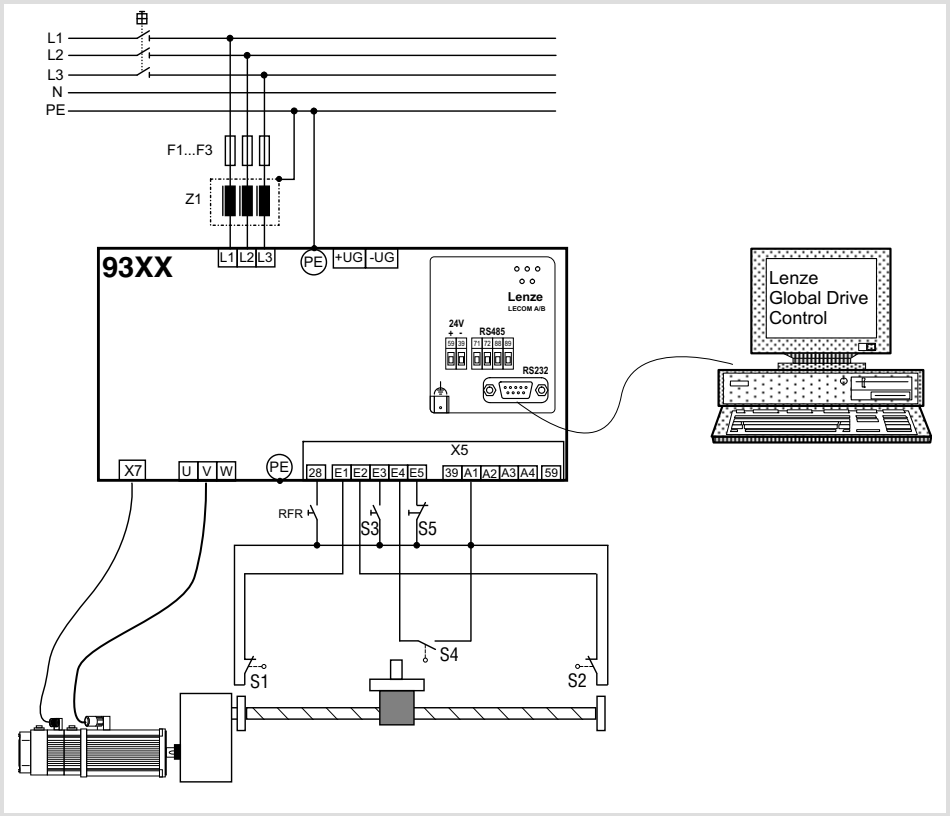


Fig. 6.16-1 Example of drive control with Lenze setting

S1	Limit switch for negative traversing direction (system protection)
S2	Limit switch for positive traversing direction (system protection)
S3	Start positioning program
S4	Home mark for reference run Tip: Set X5/E4 = HIGH if no home mark is available.
S5	Changeover from positioning operation to manual operation

Travel profile

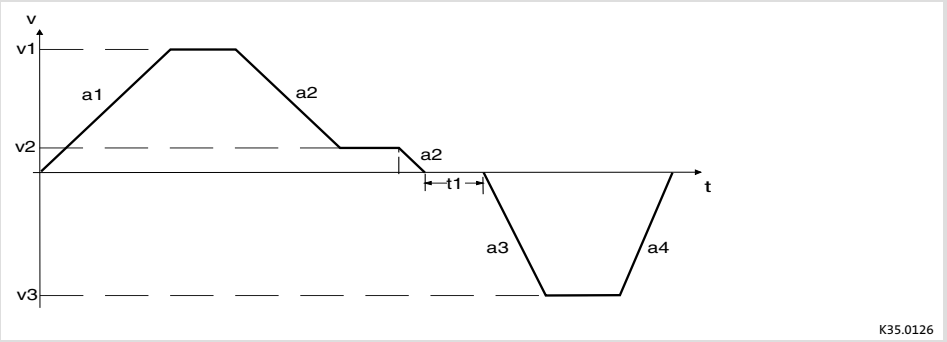


Fig. 6.16-2 Example of a travel profile

a1	Acceleration - forwards
v1	Traversing speed - forwards
a2	Deceleration - forwards
v2	Creeping for target approach
t1	Waiting time (e.g. processing of a workpiece)
a3	Acceleration - backwards
v3	Traversing speed - backwards
a4	Deceleration - backwards

Commissioning steps

The table shows the commissioning procedure of a positioning in short form, using the example in Fig. 6.16-1.

Section	Step	See also
Switch on controller	1. Inhibit controller (X5/28 = LOW). 2. Set X5/E1, X5/E2 to HIGH level. 3. Set X5/E3, X5/E4, X5/E5 to LOW level. 4. Switch on mains: – The controller is ready for operation after approx. 1 s (2 s for drives with SinCos encoder with serial interface).	📖 6.3-1
Switch on PC	Start GDC on the PC – Set the communication parameters for the online mode in the "Current drive" dialog box. – Select the controller in the "Assign device description" dialog box.	
Carry out basic settings	1. Adapt the controller to the mains.	📖 6.5-1
	2. Adapt the controller to the motor.	📖 6.5-3
	3. Enter machine parameters.	📖 6.5-2
Manual control	1. Enter parameters for manual control or use Lenze setting.	📖 6.10-1
	2. Carry out functional test with manual control.	📖 6.10-2
Enter parameters for travel profile	1. Enter positioning data in the "Programming" dialog box. 2. Connect the X5 terminals in the "Terminal monitor 93XX (digital)" menu. – For internal voltage supply, assign "FIXED1" to X5/A1. Approx. 24 V are then output at X5/A1. **TIP!** For this application case, use a predefined configuration in C0005. C0005 = XXX1X automatically assigns FIXED1 to output X5/A1 (e.g. 20010 = absolute positioning with control via terminals).	📖 6.11-1
Control drive	1. Check whether the controller is ready for operation: – When the green LED is blinking: Controller is ready for operation, proceed with step 2. – When the green LED is off and the red LED is blinking: A fault has occurred. Remove the fault before proceeding with the commissioning. 2. Enable controller (X5/28 = HIGH). – Green LED is lit when X5/28 is set to HIGH level and no other source of the controller inhibit is active. 3. For operation with a fieldbus module, additional settings are necessary (see Operating Instructions of the fieldbus module). The motor will now rotate according to the setpoint speed specified and the selected direction of rotation.	📖 6.14-1 📖 9-1

7 Parameter setting

Contents

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7.1 Important notes

Adapting the controller functions to the application

The controller functions can be adapted to your applications by means of parameterisation. You can either parameterise via keypad, PC or via the parameter channel of a bus system.

The function library contains a detailed description of the functions, the signal flow diagrams contain all configurable signals.

Parameters and codes

The parameters for the functions are stored in numbered codes:

- Codes are marked in the text with a ”C” (e.g. C0002).
- The code table provides a quick overview of all codes. The codes are sorted according to their numbers and can be used as reference. (📖 8.5-1)

Parameter setting via keypad

A quick parameter setting is provided by the keypad XT. Moreover, it serves as status display, error diagnosis and transfer of parameters to other drive controllers.

	Keypad XT EMZ9371BC
Can be used with	8200 vector, 8200 motec, starttec, Drive PLC, 9300 vector, 9300 servo
Operator buttons	8
Plain text display	yes
Menu structure	yes
Configurable menu (“user menu”)	yes
Predefined basic configurations	yes
Non-volatile memory for parameter transfer	yes
Password protection	yes
Diagnosis terminal	Keypad XT in handheld design, IP 20 (E82ZBBXC)
Installation in control cabinet	no
Type of protection	IP 20
Detailed description	📖 7.2-1

Parameter setting via PC

You need the parameter setting / operating software »Global Drive Control« (GDC) or »Global Drive Control easy« (GDC easy) and an interface for communication:

- ► Interface for system bus (CAN) (preset in GDC):
  - – PC system bus adapter
- ► Serial interface for LECOM:
  - – Communication module LECOM-A/B (RS232/RS485) EMF2102IB-V001

The parameter setting /operating software of the Global Drive Control family are easy-to-understand and tools for the operation, parameter setting and diagnostics or Lenze drive controllers.

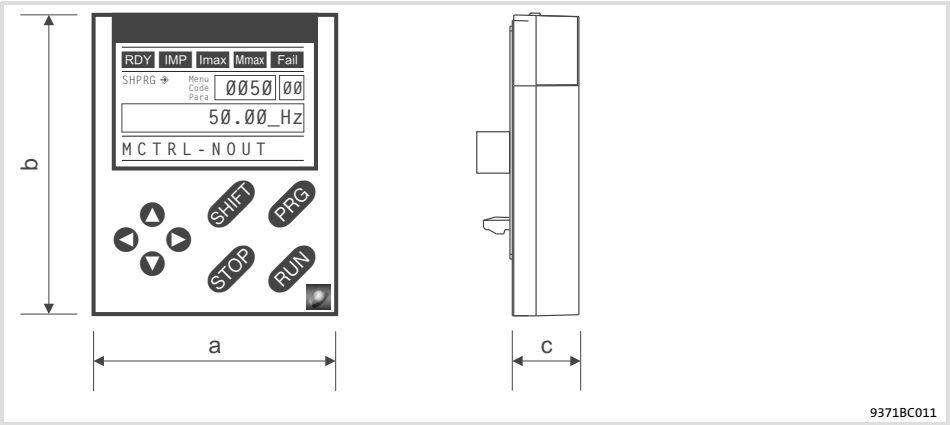
	GDC easy ESP-GDC2-E	**GDC ESP-GDC2**
Supply	Free download from the internet at www.lenze.com	Program package must be charged for
Operation in interactive mode	yes	yes
Comprehensive help functions	yes	yes
Menu ”Short setup”	yes	yes
Monitor windows for displaying operating parameters and for diagnostic purposes	yes	yes
Saving and printing of parameter settings as code list	yes	yes
Loading of parameter files from the controller to the PC	yes	yes
Storing of parameter files from the PC in the controller	yes	yes
Function block editor	no	yes
Technology functions for 9300 Servo	no	yes
Oscilloscope function for 9300 Servo and 9300 vector	no	yes
Detailed description	Online help of the program	Online help of the program

Parameter setting via bus system

Detailed information can be found in the documentation of the corresponding bus system.

7.2 Parameter setting with the XT EMZ9371BC keypad

7.2.1 General data and operating conditions



Feature		Values
Dimensions		
Width	a	60 mm
Height	b	73.5 mm
Depth	c	15 mm
Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +60 °C)
Enclosure		IP 20

7.2.2 Installation and commissioning

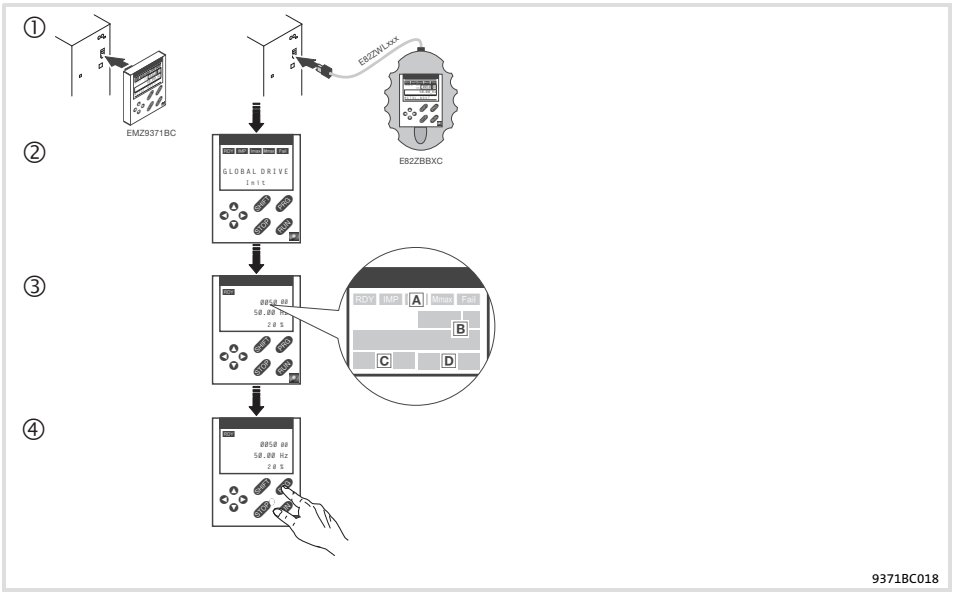


Fig. 7.2-1 Installation and commissioning of XT EMZ9371BC keypad or E82ZBBXC diagnosis terminal

① Connect keypad to the AIF interface on the front of the standard device.
The keypad can be connected/disconnected during operation.

② As soon as the keypad is supplied with voltage, it carries out a short self-test.

③ The operation level indicates when the keypad is ready for operation:

- A Current state of the standard device
- B Memory location 1 of the user menu (C0517):
  Code number, subcode number, and current value
- C Active fault message or additional status message
- D Actual value in % of the status display defined in C0004

④ PRG must be pressed to leave the operation level

7.2.3 Display elements and function keys

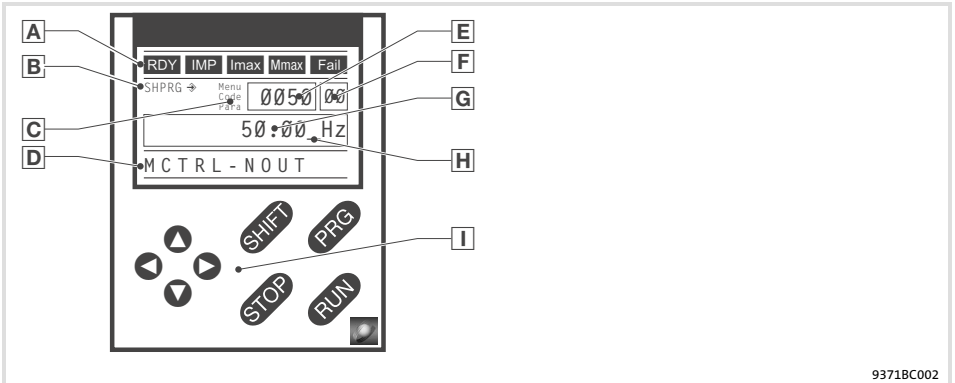


Fig. 7.2-2 Display elements and function keys of the XT EMZ9371BC keypad

Displays

A	Status displays of standard device		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit is active	Power outputs are inhibited
	Imax	The set current limit is exceeded in motor or generator mode	

	Mmax	Speed controller 1 in the limitation	Drive is torque-controlled (Only active for operation with standard devices of the 9300 series)
	Fail	Active fault	
B	**Acceptance of the parameters**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	Standard device operates immediately with the new parameter value
	SHPRG →	Parameter must be acknowledged with SHIFT PRG	Standard device operates with the new parameter value after being acknowledged
	SHPRG	Parameter must be acknowledged in case of controller inhibit SHIFT PRG	Standard device operates with the new parameter value after the controller is enabled again
	None	Display parameter	Change is not possible
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Menu level is active	Select main menu and submenus
	Code	Code level is active	Select codes and subcodes
	Para	Parameter level is active	Change parameters in the codes or subcodes
	None	Operating level is active	Display operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	alphanumerical	Contents of the menus, meaning of the codes and parameters	
		In the operating level display of C0004 in % and the active fault	
E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	Display is only active for operation with standard devices of the 8200 vector or 8200 motec series
	Code level	Two-digit subcode number	
G	**Parameter value**		
		Parameter value with unit	
H	**Cursor**		
		In the parameter level, the digit above the cursor can be directly changed	
I	**Function keys**		
		For description see the following table	

Function keys

Note!

Shortcuts with SHIFT:

Press and hold SHIFT, then press the second key in addition.

Key	Function			
	Menu level	Code level	Parameter level	Operating level
PRG		Change to the parameter level	Change to the operating level	Change to the code level
SHIFT PRG	Go to the "Short setup" menu and load predefined configurations [1]		Accept parameters when SHPRG ⇾ or SHPRG is displayed	
▲ ▼	Change between menu items	Change of code number	Change of digit via cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of digit via cursor	
▶	Change between main menu, submenu and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Deactivate the function of the key STOP, the LED in the key goes off			
STOP	Inhibit the controller, the LED in the key is lit.			
	Reset fault (TRIP-Reset):	1. Remove the cause of malfunction 2. Press STOP 3. Press RUN		

[1] Only active for operation with standard devices of the 8200 vector or 8200 motec series

7.2.4 Changing and saving parameters

Note!

Your settings have an effect on the current parameters in the main memory. You must save your settings in a parameter set so that they are not lost when the mains are connected.

If you only need one parameter set, save your settings as parameter set 1, since parameter set 1 is loaded automatically after mains connection.

Step			Key sequence	Action
1.	Select the menu		▲ ▼ ▶ ◀	Use the arrow keys to select the desired menu
2.	Change to the code level		▶	Display of the first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to the parameter level		PRG	
5.	When SHPRG is displayed, inhibit the controller		STOP [1]	The drive coasts
6.	Change parameter			
		A	▶ ◀	Move cursor below the digit to be changed
		B	▼ ▲	Change of digit

Step			Key sequence	Action
			SHIFT ▼ SHIFT ▲	Quick change of digit
7.	Accept the changed parameter			
	Display of SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept the parameter Display ”OK”
	Display →		-	The parameter has been accepted immediately
8.	Enable the controller, if required		RUN [1]	The drive runs again
9.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of the code with changed parameter
10.	Change further parameters			Restart the ”loop” with step 1. or 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select the code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to the parameter level Display ”0” and ”READY”
	Select the parameter set in which the parameters are to be saved permanently	C	▲	Save as parameter set 1: ⇨ Set ”1” ”Save PS1”
				Save as parameter set 2: ⇨ Set ”2” ”Save PS2”
				Save as parameter set 3: ⇨ Set ”3” ”Save PS3”
				Save as parameter set 4: ⇨ Set ”4” ”Save PS4”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved in the selected parameter set.
12.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0003 ”PAR SAVE”
13.	Set parameters for another parameter set			Restart the ”loop” with step 1. or 3.

[1] The function of the STOP key can be programmed:
C0469 = 1: Controller inhibit
C0469 = 2: Quick stop (Lenze setting)

7.2.5 Loading a parameter set

The keypad serves to load a saved parameter set into the main memory when the controller is inhibited. After the controller is enabled, it operates with the new parameters.

Danger!

- When a new parameter set is loaded, the controller is reinitialised and acts as if it had been connected to the mains:
  - System configurations and terminal assignments can be changed. Make sure that your wiring and drive configuration comply with the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise the drive may start in an uncontrolled way when switching over to another parameter set.

Note!

- After switching on the supply voltage, the controller always loads parameter set 1 into the main memory.
- It is also possible to load other parameter sets into the main memory via the digital inputs or bus commands.

Step			Key sequence	Action
1.	Inhibit controller			Terminal X5/28 = LOW
2.	Load the saved parameter set into the main memory			
		A	▲ ▼ ▶ ◀	Select the code C0002 ”PAR LOAD” in the menu ”Load/Store”
		B	PRG	Change to the parameter level The active parameter set is displayed, e. g. display ”0” and ”Load Default” If you want to restore the delivery status, proceed with D
	Select the parameter set to be loaded	C	▲	Load parameter set 1: ⇨ Set ”1” ”Load PS1”
				Load parameter set 2: ⇨ Set ”2” ”Load PS2”
				Load parameter set 3: ⇨ Set ”3” ”Load PS3”
				Load parameter set 4: ⇨ Set ”4” ”Load PS4”
		D	SHIFT PRG	”RDY” goes off. The parameter set is loaded completely into the main memory if ”RDY” is displayed again.
3.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0002 ”PAR LOAD”
4.	Enable controller			Terminal X5/28 = HIGH The drive is running with the settings of the loaded parameter set

7.2.6 Transferring parameters to other standard devices

Parameter settings can be easily copied from one standard device to another by using the keypad.

For this purpose use the ”Load/Store” menu

Danger!

During the parameter transfer from the keypad to the standard device the control terminals can adopt undefined states!

Therefore the plugs X5 and X6 must be disconnected from the standard device before the transfer takes place. This ensures that the controller is inhibited and all control terminals have the defined state ”LOW”.

Copying parameter sets from the standard device into the keypad

Note!

After copying the parameter sets into the XT keypad (C0003 = 11), always the parameter set that was loaded last via C0002 is activated.

Like this the current parameters also remain active after copying:

► Save the current parameters in the parameter set before copying and load this parameter set in the controller via C0002.

Step			Key sequence	Action
1.	Connect the keypad to standard device 1			
2.	Inhibit controller			Terminal X5/28 = LOW The drive coasts.
3.	Select C0003 in the ”Load/Store” menu		▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys.
4.	Change to the parameter level		PRG	Display ”0” and ”READY”
5.	Copy all parameter set into the keypad			The settings saved in the keypad are overwritten.
			▲	Set ”11” ”Save extern”
6.	Start copying		SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off after approx. one minute, all parameter sets were copied into the keypad. The ”RDY” status display is lit.
7.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display C0003 and ”PAR SAVE”
8.	Enable controller			Terminal X5/28 = HIGH
9.	Remove keypad from standard device 1			

Copying parameter sets fom keypad into the standard device

Step		Key sequence	Action
1.	Connect the keypad to standard device 2		
2.	Inhibit controller		Terminal X5/28 = LOW The ”IMP” status display is it. The drive coasts
3.	Pull the plugs X5 and X6		All control terminals have the defined ”LOW” status.
4.	Select C0002 in the ”Load/Store” menu	▲ ▼ ▶ ◀	Select code C0002 ”PAR LOAD” in the ”Load/Store” menu using the arrow keys.
5.	Change to the parameter level	PRG	The active parameter set is shown, e. g. display ”0” and ”Load Default”
6.	Select the correct copy function		The settings saved in the standard device are overwritten.
	● Copy all parameter sets available into the EEPROM of the standard device and save them permanently.		● The parameter set that was active before copying is overwritten. ● The parameters are not yet active after copying. Select parameter set and load it in the main memory. 📖 7.2-6
		▲	Set ”20” ”ext -> EEPROM”
	● Copy individual parameter sets into the main memory of the standard device.		
		▲	Copy parameter set 1 into the main memory: Set ⇨ ”11” ”Load ext PS1”
			Copy parameter set 2 into the main memory: Set ⇨ ”12” ”Load ext PS2”
			Copy parameter set 3 into the main memory: Set ⇨ ”13” ”Load ext PS3”
			Copy parameter set 4 into the main memory: Set ⇨ ”14” ”Load ext PS4”
7.	Start copying	SHIFT PRG	The ”RDY” status display goes off. As parameter value ”BUSY” is displayed. If ”BUSY” goes off, the parameter sets selected were copied into the standard device. The ”RDY” status display is lit.
8.	Change to the code level		
	A	PRG	Display of the operating level
	B	PRG	Display C0002 and ”PAR LOAD”
9.	● If the function ”Copy all parameter sets into the EEPROM” (C0002 = 20) is selected, they might have to be loaded in the main memory manually. ● If the function ”Copy individual parameter sets into the main memory” (C0002 = 1x) is selected, they might have to be saved permanently in the EEPROM manually.	▲ ▼ ▶ ◀	Select code C0003 ”PAR SAVE” in the ”Load/Store” menu using the arrow keys and store the contents of the main memory permanently.
10.	Plug in plugs X5 and X6		
11.	Enable controller		Terminal X5/28 = HIGH The drive is running with the new settings.

7.2.7 Activating password protection

Note!

- If the password protection is activated (C0094 = 1 ... 9999), you only have free access to the user menu.
- To access the other menus, you must enter the password. By this, the password protection is annulled until you enter a new password.
- Please observe that the password-protected parameters can be overwritten as well when transferring the parameter sets to other standard devices. The password is not transferred.
- Do not forget your password! If you have forgotten your password, it can only be reset via a PC or a bus system!

Activate password protection

Step			Key sequence	Action
1.	Select the "USER menu"		▲ ▼ ▶ ◀	Change to the user menu using the arrow keys
2.	Change to the code level		▶	Display of code C0051 "MCTRL-NACT"
3.	Select C0094		▲	Display of code C0094 "Password"
4.	Change to the parameter level		PRG	Display "0" = no password protection
5.	Set password			
		A	▲	Select password (1 ... 9999)
		B	SHIFT PRG	Confirm password
6.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"
7.	Change to the "USER menu"		◀ ◀ ▼	

The password protection is active now.
You can only quit the user menu if you re-enter the password and confirm it with SHIFT PRG.

Remove password protection

Step			Key sequence	Action
1.	Change to the code level in the user menu		▶	
2.	Select C0094		▲	Display of code C0094 "Password"
3.	Change to the parameter level		PRG	Display "9999" = password protection is active
4.	Enter password			
		A	▼	Set valid password
		B	SHIFT PRG	Confirm The password protection is deactivated by entering the password once again.
5.	Change to the code level			
		A	PRG	Display of the operating level
		B	PRG	Display of C0094 and "Password"

The password protection is deactivated now. All menus can be freely accessed again.

7.2.8 Diagnostics

In the ”Diagnostic” menu the two submenus ”Actual info” and ”History” contain all codes for

► monitoring the drive

► fault/error diagnosis

In the operating level, more status messages are displayed. If several status messages are active, the message with the highest priority is displayed.

Priority	Display	Meaning	
1	GLOBAL DRIVE INIT	Initialisation or communication error between keypad and controller	
2	XXX - TRIP	Active TRIP (contents of C0168/1)	
3	XXX - MESSAGE	Active message (contents of C0168/1)	
4	Special device states:		
		Switch-on inhibit	
5	Source for controller inhibit (the value of C0004 is displayed simultaneously):		
	STP1	9300 servo:	Terminal X5/28
		ECSxS/P/M/A:	Terminal X6/SI1
	STP3	Operating module or LECOM A/B/LI	
	STP4	INTERBUS or PROFIBUS-DP	
	STP5	9300 servo, ECSxA/E:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
	STP6	C0040	
6	Source for quick stop (QSP):		
	QSP-term-Ext	The MCTRL-QSP input of the MCTRL function block is on HIGH signal.	
	QSP-C0135	Operating module or LECOM A/B/LI	
	QSP-AIF	INTERBUS or PROFIBUS-DP	
	QSP-CAN	9300 servo, ECSxA:	System bus (CAN)
		ECSxS/P/M:	MotionBus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)	
8	xxxx	Value below C0004	

7.2.9 Menu structure

For simple, user-friendly operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	**Display**	
User-Menu		**Codes defined in C0517**
Code list		**All available codes**
	ALL	All available codes listed in ascending order (C0001 ... C7999)
	PS 1	Codes in parameter set 1 (C0001 ... C1999)
	PS 2	Codes in parameter set 2 (C2001 ... C3999)
	PS 3	Codes in parameter set 3 (C4001 ... C5999)
	PS 4	Codes in parameter set 4 (C6001 ... C7999)
Load/Store		**Parameter set management** Parameter set transfer, restore delivery status
Diagnostic		**Diagnostic**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
Short setup		**Quick configuration of predefined applications** **Configuration of the user menu** The predefined applications depend on the type of the standard device (frequency inverter, servo inverter, position controller, ...)
Main FB		**Configuration of the main function blocks**
	NSET	Setpoint processing
	NSET-JOG	Fixed setpoints
	NSET-RAMP1	Ramp function generator
	MCTRL	Motor control
	DFSET	Digital frequency processing
	DCTRL	Internal control
Terminal I/O		**Connection of inputs and outputs with internal signals**
	AIN1 X6.1/2	Analog input 1
	AIN2 X6.3/4	Analog input 2
	AOUT1 X6.62	Analog output 1
	AOUT2 X6.63	Analog output 2
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
	State bus	State bus (not with 9300 frequency inverter)
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller (not with 9300 frequency inverter)
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**

Main menu	Submenus	Description
Display	**Display**	
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words
System bus		**Configuration of system bus (CAN)**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	FDO	Free digital outputs
	Diagnostic	CAN diagnostic
FB config		**Configuration of function blocks**
Func blocks		**Parameterisation of function blocks** The submenus contain all available function blocks
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of standard device
	Op Keypad	Software version of keypad

8 Configuration

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8.1 Important notes

The chapter ”Configuration” consists of two parts.

System Manual

Contents of the chapter ”Configuration” in the System Manual:

- ► Monitoring
- ► Monitoring functions
- ► Code table
- ► Selection lists
- ► Table of attributes

System Manual (Extension)

Contents of the chapter ”Configuration” in the System Manual (Extension):

- ► Configuring with Global Drive Control (GDC)
- ► Basic configurations
- ► Operating modes

8.2 Monitoring

Different monitoring functions (📖 8.31) protect the drive system from impermissible operating conditions.

If a monitoring function responds,

► the set fault response is triggered to protect the drive and

► the fault message is entered position 1 in the fault history buffer (C0168/x, in case of ECSxP: C4168/x) (📖 9.2-1).

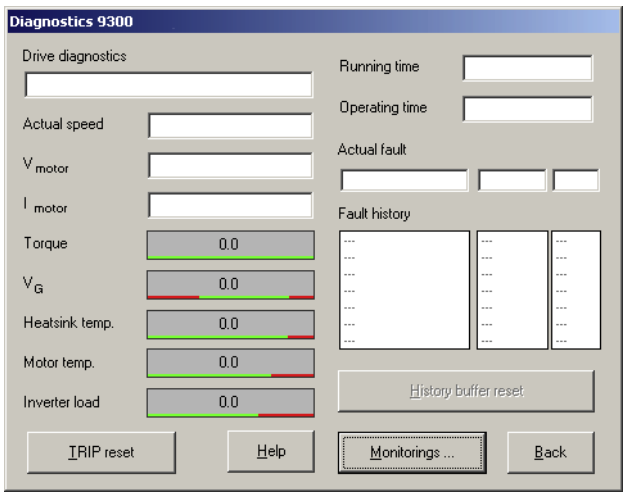
8.2.1 Fault responses

Depending on the failure, one or more of the following responses are possible:

Response	Effects on the drive and the controller		Danger warnings
TRIP (highest priority)	• Switches the power outputs U, V, W to a high resistance until TRIP is reset. • The drive coasts (no control!). • After TRIP reset, the drive accelerates to its setpoint on the ramps set.		
Message	Switches the power outputs U, V, W to a high resistance as long as the message is active.		**Danger!** The drive restarts automatically when the message is not pending anymore.
	• Short-term message ≤ 0.5 s	The drive coasts (no control!) as long as the message is active. When the message is not pending anymore, the drive accelerates to its setpoint with maximum torque.	
	• Longer message > 0.5 s	The drive coasts (due to internal controller inhibit) as long as the message is active. If required, restart the drive.	
FAIL-QSP	If a fault occurs, the drive brakes to standstill within the quick stop deceleration time (C0105).		
Warning	• Only display of the failure. • The drive continues to operate in a controlled manner.		**Stop!** As these responses have no effect on the drive behaviour, the drive can be destroyed.
Off	• No response on failures! Monitoring is deactivated.		

8.2.2 Setting of responses

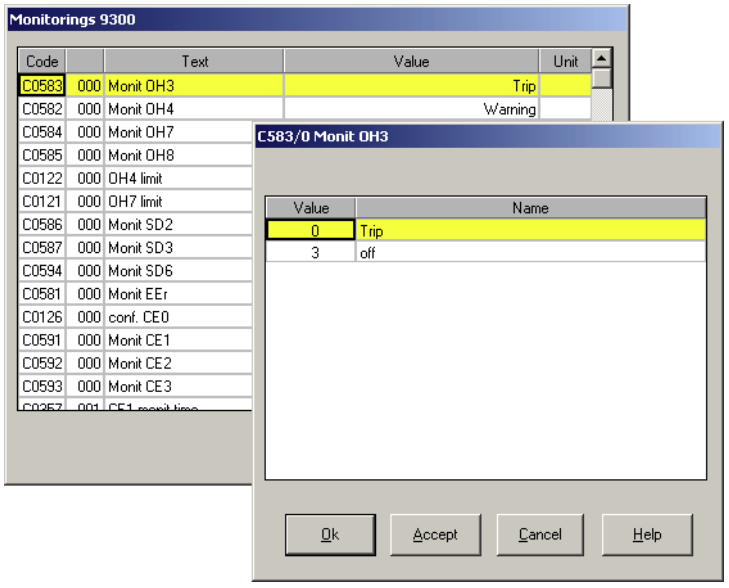
► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 8.2-1 ”Diagnostics” dialog box

► Click on the ”Monitorings” button.



9300std233

Fig. 8.2-2 ”Monitorings” dialog box

1. Click on a monitoring option. The configuration dialog box opens.
2. Select the desired response and confirm with ”OK”.

8.2.3 Monitoring times for process data input objects

Each process data input object can monitor whether a telegram has been received within a time set. As soon as a telegram arrives, the corresponding monitoring time (C0357) is restarted (”retriggerable monoflop” function).

The following assignments are valid:

Setting the response to the monitoring:

► C0591 for CAN1_IN (”CE1”)

► C0592 for CAN2_IN (”CE2”)

► C0593 for CAN3_IN (”CE3”)

The following can be set:

► 0 = error (TRIP) - controller sets controller inhibit (CINH)

► 2 = warning

► 3 = monitoring is switched off

You can also use the signals as binary output signals, e. g. for the assignment of the output terminal.

Bus off

If the controller disconnects from the CAN bus due to faulty telegrams, the ”BusOffState” (CE4) signal is set.

”BusOffState” can trigger an error (TRIP) or warning (like CE1, CE2, CE3). You can also switch the signal off. The response is set via C0595. You can also assign the terminal output.

Reset node

Changes with regard to the baud rates, the CAN node addresses, or the addresses of process data objects are only valid after a reset node.

The reset node can be effected by:

► A reconnection of the low-voltage supply

► Reset node via the bus system

► Reset node via C0358

8.2.4 Maximum speed

Stop!

Destruction of the drive!

- ► If the fault is triggered, the drive is without torque.
- ► In the event of an actual speed value encoder failure it is not guaranteed that the monitoring responds.

Protective measures:

- ► Use a mechanical brake if necessary.
- ► Special, system-specific measures are to be taken.

The NMAX fault is triggered if the system speed (MCTRL-NACT)

- ► exceeds the value set under C0596 or
- ► exceeds the maximum speed n_{max} (C0011) by twice the max. speed value.

A fault initiates TRIP NMAX. Other responses cannot be set.

8.2.5 Motor

Overcurrent in the motor cable (OC1)

Fault OC1 is triggered if the motor current exceeds the 2.25-fold rated controller current.

If a fault occurs, TRIP OC1 is triggered. Other responses cannot be set.

Earth fault in the motor cable (OC2)

The OC2 fault is triggered if

- ► the motor has a short circuit to the frame,
- ► one of the phases has a short circuit to the shield,
- ► one of the phases has a short circuit to PE,
- ► the capacitive charging current of the motor cable is too high.

A fault initiates TRIP OC2. Other responses cannot be set.

Failure of a motor phase (LP1)

If a current-carrying motor phase fails, a motor winding is broken or the current limit value set in C0599 is too high, the LP1 fault is triggered.

The monitoring is not appropriate for field frequencies > 480 Hz and when synchronous servo motors are used. Deactivate the monitoring at these conditions.

The response to exceeding the thresholds can be set under C0597.

Note!

The monitoring can only be activated if the function block MLP1 is entered in the processing table (C0465).

8.2.6 Controller current load (I x t monitoring)

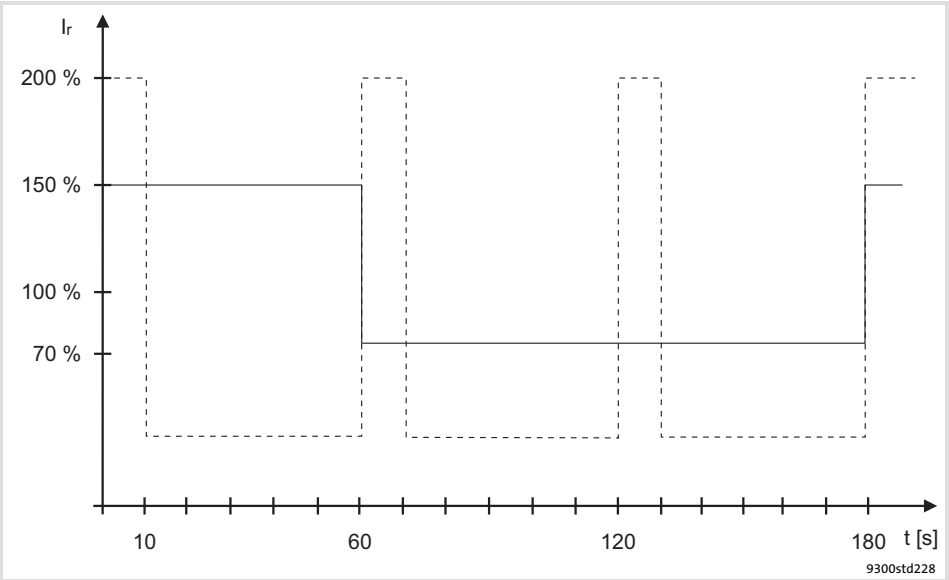


Fig. 8.2-3 I × t diagram

I_r	Device output current
———	100 % continuous thermal current at C0022 ≤ 1.5 I_r
- - - - - -	70 % continuous thermal current at C0022 > 1.5 I_r

The I × t monitoring monitors the current load of the controller. The current load is calculated from the mean value of the motor current over the acquisition period of 180 s.

The monitoring is set in such a way that the following operation modes are possible:

► Continuously with device output current = I_r.

► ≤ 60 s with device output current ≤ 1.5 x I_r.

A fault initiates TRIP OC5. Other responses cannot be set.

8.2.7 Motor temperature

KTY at X7 or X8

The motor temperature is monitored by means of a KTY. Connect the thermal sensor to the resolver cable at X7 or the encoder cable at X8.

► Warning threshold (OH7) can be set via C0121
  – The switch-on point is 5 °C below the threshold set.

► Fixed warning threshold (OH3) = 150 °C
  – The switch-on point is 135 °C.

The response for the case when the thresholds are exceeded can be defined in:

► C0584 (adjustable threshold)

► C0583 (fixed threshold)

Stop!

With the setting C0583 = 3, monitoring is deactivated. The motor temperature in C0063 shows 0 °C, even if C0584 = 2 (warning) is set.

Monitoring of the KTY at X7 or X8

The SD6 fault is triggered if there is a short or open circuit between X7/8 and X7/9 or X8/5 and X8/8.

The response can be set under C0594.

PTC thermistor or thermal contact (NC contact) at T1, T2

The motor temperature is monitored with a PTC thermistor or thermal contact. Wire the temperature sensor to T1, T2.

► Fixed warning threshold (OH8)
  – The switch-off threshold and the hysteresis depend on the temperature sensor (DIN 44081).

The response to exceeding the threshold can be set under C0585.

Stop!

Motor could be destroyed!

► If the responses ”Warning” or ”Off” are set, the motor could be destroyed by overload.

Protective measure:

► Set the response ”TRIP”.

8.2.8 Current load of motor (I^2 x t monitoring: OC6, OC8)

From software version 8.0 onwards, the 9300 controllers are provided with an I^2xt function for sensorless thermal monitoring of the connected motor.

Note!

- I^2 x t monitoring is based on a mathematical model which calculates a thermal motor load from the detected motor currents.
- The calculated motor load is saved when the mains is switched.
- The function is UL-certified, i.e. no additional protective measures are required for the motor in UL-approved systems.
- However, I^2 x t monitoring is **no** full motor protection as other influences on the motor load could not be detected as for instance changed cooling conditions (e.g. interrupted or too warm cooling air flow).

Die I^2 x t load of the motor is displayed in C0066.

The thermal loading capacity of the motor is expressed by the thermal motor time constant (τ, C0128). Find the value in the rated motor data or contact the manufacturer of the motor.

The I^2 x t monitoring has been designed such that it will be activated after 179 s in the event of a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128), a motor current of 1.5 x I_N and a trigger threshold of 100 %.

Two adjustable trigger thresholds provide for different responses.

- Adjustable response OC8 (TRIP, warning, off).
  - The trigger threshold is set in C0127.
  - The response is set in C0606.
  - The response OC8, for instance, can be used for an advance warning.
- Fixed response OC6-TRIP.
  - The trigger threshold is set in C0120.

Behaviour of the I^2 x t monitoring	Condition
The I^2 x t monitoring is deactivated. C0066 is set = 0 % and MCTRL-LOAD-I2XT is set = 0.00 %.	When C0120 = 0 % and C0127 = 0 %, set controller inhibit.
I^2 x t monitoring is stopped. The current value in C0066 and at the MCTRL-LOAD-I2XT output is frozen.	When C0120 = 0 % and C0127 = 0 %, set controller enable.
I^2 x t monitoring is deactivated. The motor load is displayed in C0066.	Set C0606 = 3 (off) and C0127 > 0 %.

Note!

An error message OC6 or OC8 can only be reset if the I^2 x t load falls below the set trigger threshold by 5 %.

8.2.8.1 Forced ventilated or naturally ventilated motors

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning

Calculate release time and I^2xt load

Formula for release time	Information	
$t = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{I_N}\right)^2 \times 100}\right]$	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

Read release time in the diagram

Diagram for detecting the release times for a motor with a thermal motor time constant of 5 minutes (Lenze setting C0128):

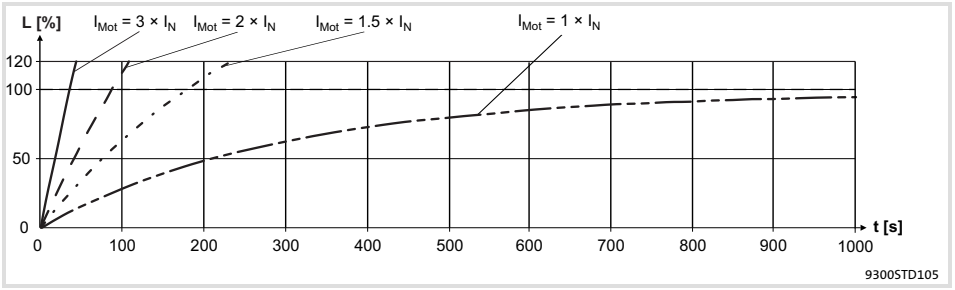


Fig. 8.2-4 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

I_{Mot} Actual motor current (C0054)
I_r Rated motor current (C0088)
L I^2 x t load of the motor (display: C0066)
T Time

8.2.8.2 Self-ventilated motors

Due to the construction, self-ventilated standard motors are exposed to an increased heat generation in the lower speed range compared to forced ventilated motors.

Warnings!

For complying with the UL 508C standard, you have to set the speed-dependent evaluation of the permissible torque via code **C0129/x**.

Parameter setting

The following codes can be set for I^2 x t monitoring:

Code	Meaning	Value range	Lenze setting
C0066	Display of the I^2 x t load of the motor	0 ... 250 %	-
C0120	Threshold: Triggering of error "OC6"	0 ... 120 %	0 %
C0127	Threshold: Triggering of error "OC8"	0 ... 120 %	0 %
C0128	Thermal motor time constant	0.1 ... 50.0 min	5.0 min
C0606	Response to error "OC8"	TRIP, warning, off	Warning
C0129/1	S1 torque characteristic I_1/I_{rated}	10 ... 200 %	100 %
C0129/2	S1 torque characteristics n_2/n_{rated}	10 ... 200 %	40 %

Effect of code C0129/x

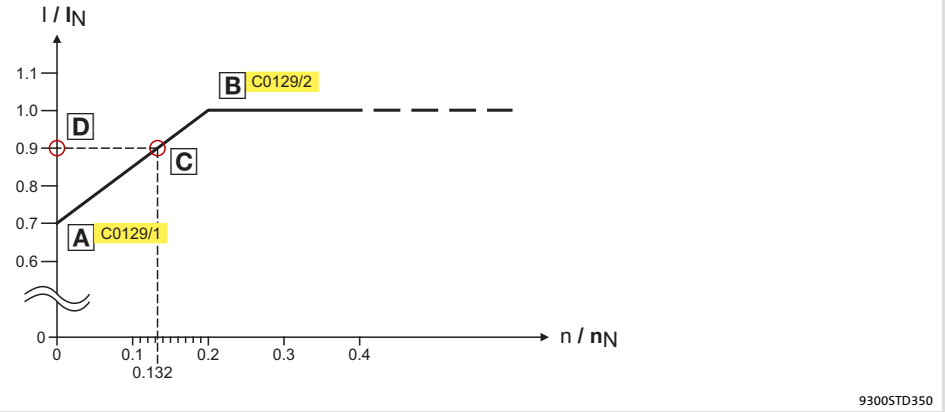


Fig. 8.2-5 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 8.2-5) reduces the permissible thermal load of self-ventilated standard motors. The characteristic is a line the definition of which requires two points:

► Point A: Definition with **C0129/1**

This value also enables an increase of the maximally permissible load.

► Point B: Definition with **C0129/2**

With increasing speeds, the maximally permissible load remains unchanged ($I_{Mot} = I_{rated}$).

In Fig. 8.2-5, the motor speed and the corresponding permissible motor torque (D) can be read for each working point (Con the characteristic (A) ... B). D can also be calculated using the values in **C0129/1**and **C0129/2** (evaluation coefficient "y", 📖 8.2-10).

Calculate release time and I^2xt load

Calculate the release time and the I^2 x t load of the motor considering the values in **C0129/1** and **C0129/2**(evaluation coefficient ”y”).

Formulae for release time	Information	
$T = -(\tau) \times \ln\left[1 - \frac{z+1}{\left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100}\right]$	T	Release time of the I^2 x t monitoring
	τ	Thermal motor time constant (C0128)
	In	Function: Natural logarithm
	I_{Mot}	Actual motor current (C0054)
	I_r	Rated motor current (C0088)
	z	Threshold value in C0120 (OC6) or C0127 (OC8)
$y = \frac{100\% - C0129/1}{C0129/2} \times \frac{n}{n_N} + C0129/1$	y	Evaluation coefficient
	n_{rated}	Rated speed (C0087)

Formulae for I^2 x t load	Information	
$L(t) = \left(\frac{I_{Mot}}{y \times I_N}\right)^2 \times 100\% \times \left(1 - e^{\frac{-t}{\tau}}\right)$	L(t)	Chronological sequence of the I^2 x t load of the motor (Display: C0066)
	y	Evaluation coefficient
	I_{Mot}	Actual motor current (C0054)
	Ir	Rated motor current (C0088)
	τ	Thermal motor time constant (C0128)
If the controller is inhibited, the I^2 x t load is reduced:		
$L(t) = L_{Start} \times \sqrt{e^{-\frac{t}{\tau}}}$	L_{Start}	I^2 x t load before controller inhibit If an error is triggered, the value corresponds to the threshold value set in C0120 (OC6) or C0127 (OC8).

8.2.9 Heatsink temperature

Via a temperature threshold, the heatsink temperature of the controller can be monitored:

- ► Adjustable threshold (OH4) under C0122
  - – The reset point is 5° C below the adjusted threshold.
- ► Fixed threshold (OH) = 85° C
  - – The reset point is at 80° C.

The response for exceeding the adjustable threshold can be set under C0582.

8.2.10 DC-bus voltage

In C0173 the mains voltage and the DC-bus voltage are set. The switching thresholds for overvoltage and undervoltage are based on these settings.

Selection C0173	Mains voltage [V AC]	Braking unit	Message LU (undervoltage) Set [V DC]	Message LU (undervoltage) Reset [V DC]	Message OU (overvoltage) Set [V DC]	Message OU (overvoltage) Reset [V DC]
0	< 400	Yes / no	285	430	770	755
1	400	Yes / no	285	430	770	755
2	400 ... 460	Yes / no	328	473	770	755
3	480	No	342	487	770	755
4	480	Yes	342	487	800	785

C0173 = 1: Lenze setting

Overvoltage

If the DC-bus voltage exceeds the upper switch-off threshold set in C0173, the OU message is triggered.

Undervoltage

If the DC-bus voltage falls below the lower switch-off threshold set in C0173, the LU message is triggered.

- ► An undervoltage message > 3 seconds is interpreted as an operating state (e.g. mains switched off) and entered in the history buffer. The entry is, however, deleted as soon as the cause has been eliminated (e.g. mains switched on again).

  This operating state can occur if the control module is already supplied externally via terminals X5/39 and X5/59, but the mains voltage is not yet switched on.
- ► An undervoltage message < 3 seconds is interpreted as a fault (e.g. mains fault), entered in the history buffer and saved.

8.2.11 External error (EEr)

A HIGH signal at DCTRL-TRIP-SET triggers the EEr fault.

You can, for example, connect the digital input DCTRL-TRIP-SET with an input terminal (X5/Ex). In this way an external encoder can trigger the EEr fault.

The response can be set under C0581.

8.3 Overview of monitoring functions

The responses of monitoring functions can be partly parameterised via codes – in GDC in the parameter menu under **Monitoring** –.

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x071	CCR	System fault	Internal		●				
x091	EEr	External monitoring (triggered via DCTRL)	FWM	C0581	●	✓	✓		✓
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus (C0173)	MCTRL			●			
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x061	CE0	Communication error on the automation interface (AIF)	AIF	C0126	✓		✓		●
x062	CE1	Communication error on the CAN1_IN process data input object (monitoring time adjustable via C0357/1)	CAN1_IN	C0591	✓		✓		●
x063	CE2	Communication error on the CAN2_IN process data input object (monitoring time adjustable via C0357/2)	CAN2_IN	C0592	✓		✓		●
x064	CE3	Communication error on the CAN3_IN process data input object (monitoring time adjustable via C0357/3)	CAN3_IN	C0593	✓		✓		●
x065	CE4	BUS-OFF state of the system bus (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x166	P16	Faulty transmission of the sync telegram (system bus CAN)	Internal	C1290/1	✓		✓	●	✓
Temperatures / sensors									
x050	OH	Heatsink temperature > 85° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582			●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584			●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high. **Caution: At "warning" (C0585 = 2) or "off" (C0585 = 3), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0585	✓		✓		●
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x110	H10	Thermal sensor error at the heatsink	FWM	C0588	●		1)		1)
x111	H11	Thermal sensor error in the device interior	FWM	C0588	●		1)		1)
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
0015	OC5	Device utilisation I x t (fix 100%)	MCTRL		●				
0016	OC6	I^2 x t overload	MCTRL		●				
0018	OC8	I^2 x t overload advance warning	MCTRL	C0606	✓		●		✓
x032	LP1	Failure of a motor phase (current limit adjustable under C0599) **Caution: Can only be used with asynchronous motors. The function block MLP1 must be entered in C0465.**	MCTRL	C0597	✓		✓		●
x082	Sd2	Resolver error at X7 **Note:** If monitoring is switched off or in the case of "Warning", the machine can reach very high speeds in the case of fault, which may result in the damage of the motor and the machine that is driven!	MCTRL	C0586	●		✓		✓
x083	Sd3	Interruption of the digital frequency coupling. The input signal "Lamp Control" at X9/8 is LOW **Please note: In the case of "Warning" (C0587 = 2), the drive can be destroyed if the fault is not eliminated in time!**	MCTRL	C0587	●		✓		✓
x085	Sd5	At analog input X6/1, X6/2, the input current is < 2 mA Monitoring only possible if C0034 = 1	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder error at X8	MCTRL		✓				●
x088	Sd8	SinCos encoder error at X8 (filter setting under C0575)	MCTRL	C0580	✓				●
Speed									
x190	nErr	Speed control error (speed window can be set in C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	NMAX	Maximum speed (C0596) has been exceeded.	MCTRL		●				
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x153	P03	Following error (digital frequency > C0255)	Internal	C0589	✓		●		✓
x163	P13	Angle controller overflow	Internal	C0590	●		✓		✓
x169	P19	Input signal at X9 is limited	Internal	C1292	✓		●		✓
Parameter setting									
0072	PR1	Check sum error in parameter set 1	Internal		●				
0074	PEr	Program error	Internal		●				
0075	PR0	Error in the parameter sets	Internal		●				
0079	PI	Error during parameter initialisation	Internal		●				
x089	PL	Error during rotor position adjustment	Internal		●				
Positioning									

x151	P01	Limit switch negative = LOW	Internal	C1285/1	✓			●	
x152	P02	Limit switch positive = LOW	Internal	C1285/2	✓			●	
x154	P04	Position limit exceeded in negative direction	Internal	C1285/3	✓			●	
x155	P05	Position limit exceeded in positive direction	Internal	C1285/4	✓			●	
x156	P06	No reference	Internal	C1287/1	✓			●	
x157	P07	Parameter set mode absolute	Internal	C1291/1	✓			●	
x158	P08	Actual reference dimension offset outside position limits	Internal	C1291/2	✓			●	
x159	P09	Impermissible programming	Internal	C1291/3	✓			●	
x162	P12	Encoder range exceeded	Internal	C1288/1	✓			●	
x164	P14	1. following error tolerance > C1218/1	Internal	C1286/1	✓		✓	●	✓
x165	P15	2. following error tolerance > C1218/2	Internal	C1286/2	✓		✓	✓	●
x167	P17	Control error of touch probe	Internal	C1289/1	✓		✓	●	✓
x168	P18	Internal limitation (display area, position limits, speeds)	Internal	C1289/2	✓		✓	●	✓

Representation of the error number:
x 0 = TRIP, 1 = message, 2 = warning
E. g. ”2091”: An external monitoring has triggered EEr warning
1) Setting only permitted by Lenze service

8.4 Code table

How to read the code table

Column	Abbreviation	Meaning
Code	Cxxxx	Code Cxxxx • Parameter value of the code can be defined differently for each parameter set • Parameter value is accepted immediately (ONLINE)
	Cxxxx 1	Subcode 1 of Cxxxx
	Cxxxx 2	Subcode 2 of Cxxxx
	ENTER	Changed parameter of code or subcode is accepted after pressing SHIFT PRG
	STOP	Changed parameter of code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited
Designation		Designation of the code
Lenze		Lenze setting (value at delivery or after restoring the delivery status with C0002)
	→	The column "IMPORTANT" contains additional information
	Disp	The code only displays a value. It cannot be configured.
Selection	1 {%} 99	Min. value {unit} max. value
IMPORTANT	-	Short, important explanation

8.5 Basic configurations

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C0002 STOP	PAR LOAD	0			**Load parameter set**
			0	Default setting	Recover Lenze setting
			1	Load PS	Load and activate parameter set saved in the controller • Parameter set is loaded automatically after every mains connection
			11	Load PS 1 externally	Load parameter set from the keypad to the controller and activate it
			20	Load PS externally	Load all parameter sets from the keypad to the EEPROM of the controller • The current parameter set in the RAM of the controller is overwritten. Save the parameter set
C0003	PAR SAVE	0			**Save parameter set**
			0	Executed	Saving completed
			1	Save PS 1	Save the parameters loaded in the controller in the parameter set selected
			11	Save externally	Transfer parameter set to the keypad
C0004	OP DISPLAY	56	0 {1} 1999		**Status display** Keypad shows selected code in the operating level if no other status messages from C0183 are active

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0005 STOP	SIGNAL CFG	20000				**Signal configuration** Predefined basic configurations	📖 8.5-1
			0	COMMON		Changed basic configuration	
			100	Empty		All internal links are deleted	
			1000	Speed control			
			20000	Standard absolute positioning		Meaning of the digits: ● **2**xxxx: Positioning control ● 2**x**xxx: Positioning mode – 0: Positioning via home position – 2: Positioning via position switch points and with teach function – 6: External path control ● 2x**x**xx: Positioning type – 0: Absolute positioning – 2: Relative positioning ● 2xx**x**x: Voltage source for the control terminals – 0: External supply voltage – 1: Internal supply voltage ● 2xxx**x**: Device control – 0: Via control terminals – 1: Via LECOM A/B/LI – 3: Via AIF (INTERBUS, Profibus) – 5: Via system bus (CAN)	
			20003	Absolute/AIF			
			20010	Absolute/supply			
			20013	Absolute/supply/AIF			
			20200	Relative positioning			
			20203	Relative/AIF			
			20210	Relative/supply			
			20213	Relative/supply/AIF			
			22000	Absolute/switching pt.			
			22003	Absolute/switching pt./AIF			
			22010	Absolute/switching pt./supply			
			22013	Absolute/switching pt./supply/AIF			
			22200	Relative/switching pt.			
			22203	Relative/switching pt./AIF			
			22210	Relative/switching pt./supply			
			22213	Relative/switching pt./supply/AIF			
			26000	Interpolated set pos. selection			
			26010	Interpolated set pos. sel./supply			
C0006 STOP	OP MODE	→				**Motor control mode** → Depends on C0086 ● Change of C0086 resets value to the assigned default setting ● Change of C0006 sets C0086 = 0!	
			2	Servo async. Y asynchronous motor, star			
			3	Servo PM-SM Y PM synchronous motor, star			
			22	Servo asyn asychronous motor, delta			
C0009	LECOM ADDRESS	1	1	{1}	99	**LECOM unit address** Number of the node for operation via interface ● 10, 20, ..., 90 reserved for broadcast communication to device groups for RS232, RS485, optical fibre	
C0011	NMAX	3000	500	{1 rpm}	16000	**Max. speed N_{max}** Reference value for the absolute and relative setpoint selection for the acceleration and deceleration times ● For parameter setting via interface: – Greater changes in one step should only be made when the controller is inhibited	
C0012	TIR (ACC)	0.000	0.000	{0.001 s}	999.900	Acceleration time T_{ir} for the main setpoint of NSET (relating to speed variation 0 ... n_{max})	
C0013	TIF (DEC)	0.000	0.000	{0.001 s}	999.900	Deceleration time T_{if} for the main setpoint of NSET (relating to speed variation n_{max} ... 0)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0017	FCODE (QMIN)	50	-16000	{1 rpm}	16000	**FCODE (Q_{min})** Switching threshold $n_{is} < n_x$ $n_{act} <$ C0017 activates the comparator output CMP1-OUT
C0018	FCHOP	1				**Chopper frequency f_{chop}**
			0	16/8 kHz		Noise-optimised operation with automatic changeover to 8 kHz
			1	8 kHz sine		Noise optimised operation
			2	16 kHz sine		
C0019	THRESH NACT=0	0	0	{1 rpm}	16000	**Speed threshold for standstill message** Status word bit DCTRL-NACT=0
C0021	SLIPCOMP	0.00	0.00	{0.01 %}	20.00	**Slip compensation** ● Only active with sensorless control below the value of C0291
C0022	IMAX CURRENT	→	0	{0.01 A}	1.50 I_N	**Limit current I_{max}** → Depends on C0086 ● Change of C0086 resets value to the assigned factory setting (1.5×Imotor)
C0025 STOP	FEEDBACK TYPE	10				**Feedback** Input of the encoder specified on the nameplate of the Lenze motor: C0025 automatically changes C0420, C0490, C0495
			0	COMMON		C0420, C0490 or C0495 has been changed subsequently
			1	Without feedback		Control without feedback system (sensorless control, SSC)
			10	RSx (resolver)		The resolver is designated with RSxxxxxxxx. If a resolver is selected, the rotor displacement angle in C0058 is set to -90°.
			110	IT-512-5V		Incremental encoder with TTL level
			111	IT-1024-5V		
			112	IT-2048-5V		
			113	IT-4096-5V		
			210	IS-512-5V		SinCos encoder
			211	IS-1024-5V		
			212	IS-2048-5V		
			213	IS-4096-5V		
			309	AS-128-8V (SKS)		Single-turn SinCos encoder with RS485 interface Co. Stegmann (absolute value encoder) ● Enter the supply voltage in C0421.
			310	AS-512-8V (SCS)		
			311	AS-1024-8V SRS		
			409	AM-128-8V (SKM)		Stegmann multi-turn SinCos encoder with RS485 interface (absolute value encoder) ● Enter the supply voltage in C0421.
			410	AM-512-8V (SCM)		
			411	AM-1024-8V (SRM)		
						If an absolute value encoder is selected, an SD7 trip is triggered.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0026			-199.99	{0.01 %}	199.99	**FCODE (AIN offset)** Freely configurable code for relative analog signals	See system manual (extension)
1	FCODE (OFFSET)	0.00				Offset for terminal X6/1, X6/2	
2	FCODE (OFFSET)	0.00				Offset for terminal X6/3, X6/4	
C0027			-199.99	{0.01 %}	199.99	**FCODE (AIN gain)** Freely configurable code for relative analog signals	
1	FCODE (GAIN)	100.00				Gain X6/1, X6/2	
2	FCODE (GAIN)	100.00				Gain X6/3, X6/4	
C0030	DFOUT CONST	3	0 1 2 3 4 5 6	256 inc/rev 512 inc/rev 1024 inc/rev 2048 inc/rev 4096 inc/rev 8192 inc/rev 16384 inc./rev.		**DFOUT constant** Constant for the master frequency output in increments per revolution	
C0032	FCODE GEARBOX	1	-32767	{1}	32767	**FCODE (gearbox factor numerator)** Freely configurable code	
C0033	GEARBOX DENOM	1	1	{1}	32767	**Gearbox factor denominator**	
C0034	MST CURRENT	0	0 1 2	-10 V ... + 10 V +4 mA ... +20 mA -20 mA ... +20 mA		**AIN input signal** Selection of the input signal for X6/1, X6/2	
C0037	SET-VALUE RPM	0	-16000	{1 rpm}	16000	**Setpoint selection (rpm)**	
C0039			-199.99	{0.01 %}	199.99	**NSET JOG setpoints** Fixed speeds (JOG setpoints) can be selected for NSET using digital inputs.	See system manual (extension)
1	JOG SET-VALUE	100.00					
2	JOG SET-VALUE	75.00					
3	JOG SET-VALUE	50.00					
4	JOG SET-VALUE	25.00					
5	JOG SET-VALUE	0.00					
...	...	...					
14	JOG SET-VALUE	0.00					
15	JOG SET-VALUE	0.00					
C0040	CTRL ENABLE	1	0 1	Controller inhibited Controller enabled		**Controller enable CINH**	
C0042	QSP	Disp	1 2	QSP not active QSP active		**Quick stop (QSP)**	
C0043	TRIP RESET	0	0 1	TRIP reset Error active		**Reset error** Reset of an active trip: ● Set C0043 = 0	
C0045	ACT JOG	Disp	0 1 2 ... 15	Nset active JOG 1 JOG 2 ... JOG 15		**NSET** JOG selection	See system manual (extension)
C0046	NSET-N	Disp	-199.99	{0.01 %}	199.99	**NSET** Main setpoint	See system manual (extension)
C0049	NSET-NADD	Disp	-199.99	{0.01 %}	199.99	**NSET** Additional setpoint	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0050	MCTRL-NSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL** n_{soll} at speed controller input	See system manual (extension)
C0051	MCTRL-NACT	Disp	-30000	{1 rpm}	30000	**Actual speed value**	
C0052	MCTRL-UMOT	Disp	0	{1 V}	800	**Motor voltage**	
C0053	UG-VOLTAGE	Disp	0	{1 V}	900	**DC-bus voltage**	
C0054	IMOT	Disp	0.0	{0.1 A}	300.0	**Current motor current I_{mot} MCTRL function block** ● MCTRL-IACT = 100 % = C002 2	See system manual (extension)
C0056	MCTRL-MSET2	Disp	-100.00	{0.01 %}	100.00	**MCTRL-MSET2 (Mset)** Torque setpoint (n-controller output)	See system manual (extension)
C0057	MAX TORQUE	Disp	0	{1 Nm}	400	**Max. torque** Max. possible torque of the drive configuration ● Depending on C0022, C0086	
C0058	ROTOR DIFF	-90.0	-180.0	{0.1°}	179.9	**Rotor displacement angle of motor (offset angle)** Zero phase of the rotor for synchronous motors (C0095). If a resolver is selected in C0025 or C0490, C0058 is set to -90°. ● Lenze motor with resolver: C0058 = (-)90° ● Lenze motor with Hiperface absolute value encoder: C0058 = 0°	
C0059	MOT POLE NO.	Disp	1	{1}	50	**Number of motor pole pairs**	
C0060	ROTOR POS	Disp	0	{1}	2047	**Motor rotor position** 1 revolution = 2048 inc	
C0061	HEATSINK TEMP	Disp	0	{1 °C}	100	**Heatsink temperature**	See system manual (extension)
C0063	MOT TEMP	Disp	0	{1 °C}	200	**Motor temperature**	
C0064	UTILISATION	Disp	0	{1 %}	150	**Device utilisation Ixt** Utilisation of the last 180 s C0064 >100 % releases trip OC5 Trip reset is only possible if C0064 < 95 %	
C0066	MOTOR LOAD	Disp	0	{1 %}	150	**$I^2 \times t$ utilisation of the motor**	
C0067	ACT TRIP	Disp	All fault messages		→ selection list 10	**TRIP error message** Current fault message	
C0070	VP SPEED CTRL	→	0.0	{0.5}	255.0	**V_{pn} speed controller** → Depends on C0086 ● Change of C0086 resets value to the assigned default setting	
C0071	TN SPEED CTRL	→	1.0	{0.5 ms}	600.0	**T_{nn} speed controller** >512 ms: Switched off → Depends on C0086 ● Change of C0086 resets value to the assigned default setting	
C0072	TD SPEED-CTRL	0.0	0.0	{0.1 ms}	32.0	**T_{dn} speed controller**	
C0075	VP CURR-CTRL	0.35	0.00	{0.01}	15.99	**V_{pi} current controller** ● Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0076	TN CURR CTRL	1.8	0.5	{0.1 ms}	2000,0	**T_{ni} current controller** At 2000 ms the function is deactivated ● Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0077	VP FIELD CTRL	0.25	0.00	{0.01}	15.99	**V_{pF} field controller**
C0078	TN FIELD CTRL	15.0	1.0	{0.5 ms}	7999,0	**T_{nF} field controller** At 8000 ms the function is deactivated
C0081 STOP	MOT POWER	→	0.01	{0.01 kW}	150.00	**Rated motor power** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting ● Change of C0081 sets C0086 = 0
C0084 STOP	MOT RS	→	0.00	{0.01 Ω}	150.00	**Motor stator resistance** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0085 STOP	MOT LS	→	0.00	{0.01}	655.35	**Motor leakage inductance** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting
C0086 STOP	MOT TYPE	→			See motor selection list	**Selection of motor type** → Depending on the controller used ● Change of C0086 resets C0006, C0022, C0070, C0071, C0075, C0076, C0081, C0084, C0085, C0087, C0088, C0089, C0090, C0091 to the assigned Lenze setting
			Controller	Lenze setting	Motor type assigned	Lenze motor type
			EVS9321	110	MDSKS56-23-150	MDSKSXX056-23, f_N: 150Hz
			EVS9322	111	MDSKS56-33-150	MDSKSXX056-33, f_N: 150Hz
			EVS9323	112	MDSKS71-13-150	MDSKSXX071-13, f_N: 150Hz
			EVS9324	116	MDSKS71-33-150	MDSKSXX071-33, f_N: 150Hz
			EVS9325	15	MDFKA80-120	MDFKAXX080-22, f_N: 120Hz
			EVS9326	19	MDFKA90-120	MDFKAXX090-22, f_N: 120Hz
			EVS9327	23	MDFKA100-120	MDFKAXX100-22, f_N: 120Hz
			EVS9328	27	MDFKA112-120	MDFKAXX112-22, f_N: 120Hz
			EVS9329	225	30kW-ASM-50	–
			EVS9330	227	45kW-ASM-50	–
			EVS9331	228	55kW-ASM-50	–
			EVS9332	229	75kW-ASM-50	–
C0087 STOP	MOT SPEED	→	300	{1 rpm}	16000	**Rated motor speed** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0088 STOP	MOT CURRENT	→	0.2	{0.1 A}	500.0	**Rated motor current** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting	
C0089 STOP	MOT FREQUENCY	→	10	{1 Hz}	1000	**Rated motor frequency**	
C0090 STOP	MOT VOLTAGE	→	50	{1 V}	500	**Rated motor voltage** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting	
C0091 STOP	MOT COS PHI	→	0.50	{0.01}	1.00	**Motor cos φ** → Depends on C0086 ● Change of C0086 resets value to the assigned Lenze setting	
C0093	DRIVE IDENT	Disp	0 1 93xx	Defective power section No power section 93xx		**Controller identification** 93xx: Lenze position controller	
C0094	PASSWORD	0	0	{1}	9999	**Password** ● Parameter access protection for the keypad. When the password is activated, only codes of the user menu can be accessed. For further possible selections see C0096	
C0095 STOP	ROTOR POS ADJ	0	0 1	Not active Active		**Rotor position adjustment** For synchronous motors ● C0058 displays the zero angle of the rotor ● C0095 = 1 starts position adjustment	
C0096 STOP			0 1 2 3	No access protection Read protection Write protection Read/Write protection		Extended password protection for bus systems with activated password (C0094) ● All codes in the user menu can be accessed	
1	AIF PROTECT.	0				AIF access protection	
2	CAN PROTECT.	0				CAN access protection	
C0099	S/W VERSION	Disp	x.xx			**Software version**	
C0101			0.000	{0.001 s}	999.900	**NSET** Additional acceleration times for the main setpoint (relating to speed variation 0 ... n_{max})	See system manual (extension)
1	NSET-TIR	0.000					
2	NSET-TIR	0.000					
...	...	...					
15	NSET-TIR	0.000					
C0103			0.000	{0.001 s}	999.900	**NSET** Additional deceleration times for the main setpoint (relating to speed variation 0 ... n_{max})	
1	NSET-TIF	0.000					
2	NSET-TIF	0.000					
...	...	...					
15	NSET-TIF	0.000					
C0105	QSP TIF	0.000	0.000	{0.001 s}	999.900	**Quick stop deceleration time (QSP)** (relating to speed variation 0 ... n_{max})	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0108		100.00	-199.99	{0.01 %}	199.99	**FCODE (AOUT gain)** Freely configurable code for relative analog signals	See system manual (extension)
1	FCODE (GAIN)					AOUT1-GAIN	
2	FCODE (GAIN)					AOUT2-GAIN	
C0109			-199.99	{0.01 %}	199.99	**FCODE (offset AOUT)** Freely configurable code for relative analog signals	See system manual (extension)
1	FCODE (OFFSET)	0.00				AOUT1-OFFSET	
2	FCODE (OFFSET)	0.00				AOUT2-OFFSET	
C0114			0 HIGH active 1 LOW active			**DIGIN polarity** Polarity of the terminals X5/Ex	See system manual (extension)
1	DIGIN1 POL	1				X5/E1	
2	DIGIN2 POL	1				X5/E2	
3	DIGIN3 POL	0				X5/E3	
4	DIGIN4 POL	0				X5/E4	
5	DIGIN5 POL	0				X5/E5	
C0116 STOP			→ selection list 2			**Signal configuration of the free digital outputs (FDO)** Free digital outputs can only be evaluated when they are linked to automation interfaces	See system manual (extension)
1	FDO-00	1000	FIXED0				
2	FDO-01	15000	DCTRL-TRIP				
3	FDO-02	30002	ENDED				
4	FDO-03	30014	VTRAV-REA				
5	FDO-04	30104	PF04				
...	...	...	...				
10	FDO-09	30109	PF09				
11	FDO-10	30110	PF10				
12	FDO-11	30111	PF11				
...	...	...	...				
21	FDO-20	30120	PF20				
22	FDO-21	30121	PF21				
...	...	...	...				
31	FDO-30	30130	PF30				
32	FDO -31	30131	PF31				
33	FDO-32	30132	PF32				
C0117 STOP		→	→ selection list 2			**Signal configuration DIGOUT** → depending on C0005	See system manual (extension)
1	DIGOUT1	30012	pos-ref-ok			X5/A1	
2	DIGOUT2	30013	POS-IN-TARGET			X5/A2	
3	DIGOUT3	500	DCTRL-RDY			X5/A3	
4	DIGOUT4	30101	pos-pfo1			X5/A4	
C0118			0 HIGH active 1 LOW active			**DIGOUT polarity** Polarity of the terminals X5/Ax	See system manual (extension)
1	DIGOUT1 POL	0				X5/A1	
2	DIGOUT2 POL	0				X5/A2	
3	DIGOUT3 POL	0				X5/A3	
4	DIGOUT4 POL	0				X5/A4	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0120	OC6 LIMIT	0	00	{1 %}	120	**Threshold for the $I^2 \times t$ monitoring of the motor** ● C0120 = 0: $I^2 \times t$ monitoring switched off ● $I^2 \times t$ > C0120 ⇨ TRIP OC6	
C0121	OH7 LIMIT	150	45	{1 °C}	150	**Temperature for OH7** Threshold for motor temperature warning	
C0122	OH4 LIMIT	85	45	{1 °C}	85	**Temperature for OH4** Threshold for heatsink temperature warning	
C0125	BAUD RATE	0	0 1 2 3 4	9600 baud 4800 baud 2400 baud 1200 baud 19200 baud		**LECOM baud rate** LECOM baud rate for 2102 communication module	
C0126	MONIT CE0	3	0 2 3	TRIP Warning Off		**CE0monitoring** Configuration of communication error monitoring with CE0 automation interface	
C0127	OC8 LIMIT	0	0	{1 %}	120	**Threshold for the $I^2 \times t$ advance warning of the motor** ● C0127 = 0: $I^2 \times t$ warning switched off ● $I^2 \times t$ > C0127 ⇨ fault message OC8 (response set in C0606)	
C0128	TAU MOTOR	5.0	0.1	{0.1 min}	50.0	**Thermal time constant of the motor** The time constant is required for calculating the $I^2 \times t$ disconnection.	
C0130	ACT TI	Disp				**NSET** Active T_i times of NSET	See system manual (extension)
C0134	RFG CHARAC	0	0 1	Linear S-shaped		**NSET** Ramp function generator characteristic for main setpoint	
C0135	CONTROL WORD	0	0	{1}	65535	**LECOM control word** Device control word for LECOM-A/B/LI or keypad	See system manual (extension)
C0136		Disp				**LECOM control word**	See system manual (extension)
1	CTRLWORD C135					Control word in DCTRL	
2	CTRLWORD CAN					Control word in CAN-IN	
3	CTRLWORD AIF					Control word in AIF-IN	
C0141	FCODE (SETVAL)	0.0	-199.9	{0.1 %}	199.9	**Main setpoint** Freely configurable code for relative analog signals ● Used as main setpoint in configurations C0005 = xxx1	
C0142	START OPTIONS	1	0 1	Start lock Auto start		**Start option** Start conditions are executed: ● After mains connection ● After message (t > 0.5s) ● After TRIP	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C0150	STATUS WORD	Disp	0 {1} 65535	**Status word** Display when linked with automation interfaces ● Binary interpretation indicates the bit states	See system manual (extension)
C0151	FDO (DW)	Disp		Hexadecimal display of the free digital output signals configured in C0116 ● Binary interpretation indicates the bit states	See system manual (extension)
C0155	STATUS WORD 2	Disp	Bit00 Fail Bit08 R/L Bit01 Mmax Bit09 – Bit02 Imax Bit10 – Bit03 IMP Bit11 – Bit04 RDY Bit12 – Bit05 CINH Bit13 – Bit06 TRIP Bit14 – Bit07 Init Bit15 –	**Status word 2** Extended status word (decimal) ● Binary interpretation indicates the bit states	
C0156 STOP			→ selection list 2	Configuration of user-definable bits of the status word	See system manual (extension)
1	STAT.B0	1000	FIXED0		
2	STAT.B2	30012	pos-ref-ok		
3	STAT.B3	1000	FIXED0		
4	STAT.B4	10600	NOT1-OUT		
5	STAT.B5	30013	POS-IN-TARGET		
6	STAT.B14	15004	DCTRL-FAIL-QSP		
7	STAT.B15	500	DCTRL-RDY		
C0157		Disp		Display of the freely definable bits of the status word	See system manual (extension)
1	(C0156/1)				
...	...				
7	(C0156/7)				
C0161	ACT TRIP	Disp	Fault messages	**TRIP error message** Display of the current TRIP fault message (see also C0168/1)	
C0167	RESET FAILMEM	0	0 No reset 1 Reset	**History buffer reset** Clears the history buffer	
C0168		Disp	Fault messages	**Fault memory - number** List of faults occurred	
1	FAIL NO. ACT			Currently active fault	
2	FAIL NO. OLD1			Last fault	
...	...			...	
8	FAIL NO. OLD7			Seventh to last fault	
C0169		Disp	Power-on time	**Fault memory - time** List of the times when the faults occurred in C0168 (relating to C0179)	
1	FAILTIME ACT			Currently active fault	
2	FAILTIME OLD1			Last fault	
...	...			...	
8	FAILTIME OLD7			Seventh to last fault	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0170		Disp	Power-on time			**Fault memory - frequency** List of how often the faults have occurred consecutively in C0168	
1	COUNTER ACT					Currently active fault	
2	COUNTER OLD1					Last fault	
...	...					...	
8	COUNTER OLD7					Seventh to last fault	
C0172 STOP	OV REDUCE	0	0	{10 V}	100	**OV reduce** Threshold for activating the brake torque reduction before OU message	
C0173 STOP	UG LIMIT	1				**Adjustment of the DC-bus voltage** ● **Important!** Check and, if required, adapt during commissioning! ● All drive components in the interconnection must have the same values!	See system manual (extension)
			0	Mains<400V +-brake LU=285V, OU=770V-755V		Operation on mains <400 V with or without braking unit	
			1	Mains=400V +-brake LU=285V, OU=770V-755V		Operation on 400 V mains with or without braking unit	
			2	Mains=460V +-brake LU=328V, OU=770V-755V		Operation on 460 V mains with or without braking unit	
			3	Mains=480V -brake LU=342V, OU=770V-755V		Operation on 480 V mains without braking unit	
			4	Mains=480V +-brake LU=342V, OU=800V-785V		Operation on 480 V mains with braking unit	
C0178	OP TIMER	Disp	0	{1 s}	4294967295	**Operating time** Display of the time during which the controller was enabled	
C0179	MAINS TIMER	Disp	0	{1 s}	4294967295	**Mains operating time** Display of the time during which the mains was switched on	
C0182	TI S-SHAPED	20.00	0.01	{0.01 s}	50.00	**NSET** T_i time of the S shape ramp function generator (determines the form of the S-curve) ● Low values ⇒small S rounding ● High values ⇒large S rounding	See system manual (extension)

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C0183	DIAGNOSTICS	Disp			**Drive diagnostics** ● Indicates fault or status information ● Shows the smallest numerical value if several pieces of fault or status information are pending at the same time	
			0	OK	No fault	
			101	Initialisation	Initialisation phase	
			102	TRIP/fault	TRIP active	
			103	Emergency stop	Emergency stop was carried out	
			104	IMP message	Message active	
			105	Power OFF	Function is not supported	
			111	BSP C135 operation inhibit	Operation inhibit	
			112	BSP AIF operation inhibit		
			113	BSP CAN operation inhibit		
			121	RSP terminal 28 controller inhibit	Controller inhibited through X5/28	
			122	Controller inhibit, internal 1	DCTRL-CINH1	
			123	Controller inhibit, internal 2	DCTRL-CINH2	
			124	RSP C135/STOP controller inhibit	STOP key on the keypad	
			125	RSP AIF controller inhibit	Controller inhibited via AIF	
			126	RSP CAN controller inhibit	Controller inhibited through CAN	
			141	Switch-on inhibit	Restart protection active	
			142	IMP inhibit pulse inhibit	High resistance power outputs	
			151	QSP terminal ext. quick stop	Quick stop via MCTRL-QSP	
			152	QSP-C135 quick stop	Quick stop via STOP key on the keypad	
			153	QSP-AIF quick stop	Quick stop via AIF	
			154	QSP-CAN quick stop	Quick stop via system bus	
			250	Warning C168	Warning active	
C0190	NSET ARIT	0	0 1 2 3 4 5	OUT = C46 C46 + C49 C46 - C49 C46 * C49 C46 / C49 C46/(100 - C49)	**NSET** Arithmetic block in the NSET function block ● Connects main setpoint C0046 and additional setpoint C0040	See system manual (extension)
C0195	BRK1 T ACT	99.9	0.0	{0.1 s} 99.9	**BRK1** Brake closing time. Engagement time of the mechanical holding brake ● After the time under C0195 has elapsed, the "mechanical brake closed" status is reached	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0196	BRK T RELEASE	0.0	0.0	{0.1 s}	60.0	**BRK1** Brake opening time (disengagement time of the mechanical holding brake) ● After the time under C0196 has elapsed, the "mechanical brake open" status is reached. ● Observe technical data of the holding brake	See system manual (extension)
C0200	S/W ID	Disp				**Software identification** Software ID number	
C0201	S/W DATE	Disp				**Software date** Software creation date	
C0202	INTERNAL IO	Disp	0.000	{0.001}	100.000	Internal identification	
C0203	COMM. NO.	Disp	x / xxxx / xxxxx			**Commission number**	
C0204	SERIAL NO.	Disp	0	{1}	65535	**Serial number**	
C0206	PRODUCT DATE	Disp				**Production date**	
C0207	DL INFO 1	Disp				**Download info 1**	
C0208	DL INFO 2	Disp				**Download info 2**	
C0209	DL INFO 3	Disp				**Download info 3**	
C0220	NSET TIR ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Acceleration time T_{ir} of the additional setpoint for NSET (relating to speed variation 0 ... n_{max})	See system manual (extension)
C0221	NSET TIF ADD	0.000	0.000	{0.001 s}	999.900	**NSET** Deceleration time T_{if} of the additional setpoint for NSET (relating to speed variation 0 ... n_{max})	See system manual (extension)
C0222	PCTRL VP	1.0	0.1	{0.1}	500.0	**PCTRL** Gain V_p	See system manual (extension)
C0223	PCTRL TN	400	20	{1 ms}	99999	**PCTRL** Integral action component T_n ● 99999 ms: Switched off	
C0224	PCTRL KD	0.0	0.0	{0.1}	5.0	**PCTRL** Differential component K_d	
C0241	NSET RFG-I = O	1.00	0.00	{0.01 %}	100.00	**NSET** Threshold for the comparison of the main setpoint at the input of the RFG and at the output of the RFG after the PT1 filter ● If the input value reaches the threshold, NSET-RFG-I=0 is set to HIGH ● 100 % = n_{max}	See system manual (extension)
C0244	BRK M SET	0.00	-100.00	{0.01 %}	100.00	**BRK1** Holding torque of the DC injection brake ● 100 % = C0057	
C0250	FCODE 1BIT	0	0 Lower limit 1 Upper limit			**FCODE (1 bit digital)** Freely configurable code	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0252	ANGLE OFFSET	0	-245760000	{1 inc}	245760000	**DFSET** Anglular offset, fixed angular offset for digital frequency configurations ● 1 rev = 65536 inc	See system manual (extension)
C0253	ANGLE N-TRIM	→	-32767	{1 inc}	32767	**DFSET** Speed-dependent phase trimming → Depending on C0005, C0025, C0490 ● Change of C0005, C0025, or C0490 resets C0253 to the Lenze settingassigned ● 1 rev. = 65536 inc ● C0253 is reached at 15000 rpm	See system manual (extension)
C0254	VP ANGLE CTRL	0.4000	0.0000	{0.0001}	3.9999	**MCTRL** Gain V_p of the angle controller	See system manual (extension)
C0255	THRESHOLD P03	327680	10	{1 inc}	1800000000	**Following error limit P03** ● 1 rev. = 65536 inc ● Following error > C0255 triggers fault "P03"	
C0260	MPOT1 HIGH	100.00	-199.99	{0.01 %}	199.99	**MPOT1** Upper limit ● Condition: C0260 > C0261	See system manual (extension)
C0261	MPOT1 LOW	-100.00	-199.99	{0.01 %}	199.99	**MPOT1** Lower limit ● Condition: C0261 < C0260	See system manual (extension)
C0262	MPOT1 TIR	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Acceleration time (rel. to change 0 ... 100 %)	See system manual (extension)
C0263	MPOT1 TIF	10.0	0.1	{0.1 s}	6000.0	**MPOT1** Deceleration time (rel. to change 0 ... 100 %)	See system manual (extension)
C0264	MPOT1 ON/OFF	0	0 No change 1 Deceleration with T_{if} to 0 % 2 Deceleration with T_{if} to C0261 3 Skip with T_{if} = 0 to 0 % 4 Skip with T_{if} = 0 to C0261 5 Acceleration with T_{ir} to C0260			**MPOT1** Executable functions if motor potentiometer is deactivated via input MPOT1-INACTIVE	See system manual (extension)
C0265	MPOT1 INIT	0	0 Value during mains failure 1 Lower limit value from C0261 2 0 %			**MPOT1** Initialisation Value which is accepted at mains switching and activated motor potentiometer	See system manual (extension)
C0267 STOP					→ selection list 2	**MPOT1** Configuration of digital input signals	See system manual (extension)
1	MPOT1-UP	1000	FIXED0				
2	MPOT1-DOWN	1000	FIXED0				
C0268 STOP	MPOT1-INACT	1000	FIXED0		→ selection list 2	**MPOT1** Configuraton of digital input signal	See system manual (extension)
C0269		Disp				**MPOT1**	See system manual (extension)
1	MPOT1-UP						
2	MPOT1-DOWN						
3	MPOT1-INACT						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0325	VP2 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL** Process controller adaption gain V_{p2}	See system manual (extension)
C0326	VP3 ADAPT	1.0	0.1	{0.1}	500.0	**PCTRL** Process controller adaption gain V_{p3}	See system manual (extension)
C0327	SET2 ADAPT	100.00	0.00	{0.01 %}	100.00	**PCTRL** Set speed threshold nset2 of the process controller adaptation (condition: C0327 > C0328)	See system manual (extension)
C0328	SET1 ADAPT	0.00	0.00	{0.01 %}	100.00	**PCTRL** Setpoint speed threshold of the process controller adaptation ● Condition: C0328 < C0327	See system manual (extension)
C0329	ADAPT ON/OFF	0	0 1 2 3	No process controller adaptation Externally via input Adaptation via setpoint Adaptation via control difference		**PCTRL** Activate process controller adaption	See system manual (extension)
C0332	PCTRL TIR	0.000	0.000	{0.001 s}	999.900	**PCTRL** Acceleration time T_{ir} (relating to setpoint change 0...100 %)	See system manual (extension)
C0333	PCTRL TIF	0.000	0.000	{0.001 s}	999.900	**PCTRL** Deceleration time T_{if} (relating to setpoint change 0...100 %)	See system manual (extension)
C0336	ACT VP	Disp	0.0	{0.1}	500.0	**PCTRL** Current gain V_p	See system manual (extension)
C0337	BI/UNIPOLAR	0	0 1	Bipolar Unipolar		**PCTRL** Bipolar/unipolar process controller range	See system manual (extension)
C0338	ARIT1 FUNCT	1	0 1 2 3 4 5	OUT = IN1 OUT = IN1 + IN2 OUT = IN1 - IN2 OUT = IN1 × IN2 OUT = IN1 / IN2 OUT = IN1/(100% - IN2)		**ARIT1** Function selection	See system manual (extension)
C0339 STOP			→ Selection list 1			**ARIT1** Configuration of analog input signals	See system manual (extension)
1	ARIT1-IN1	1000	FIXED0%				
2	ARIT1-IN2	1000	FIXED0%				
C0340		Disp				**ARIT1** Display of analog input signals	See system manual (extension)
1	(C0339/1)						
2	(C0339/2)						
C0350	CAN ADDRESS	1	1	{1}	63	**CAN** System bus node address ● Change becomes effective after "reset node" command	See system manual (extension)
C0351	CAN BAUD RATE	0	0 1 2 3 4	500 kbps 250 kbps 125 kbps 50 kbps 1000 kbit/s		**CAN** System bus baud rate ● Change becomes effective after "reset node" command	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0352	CAN MST	0	0 1	Slave Master		**CAN** Configuration of system bus nodes ● Change becomes effective after ”reset node” command	See system manual (extension)
C0353			0 1	C0350 C0354		**CAN** CAN-IN / CAN-OUT selection of the system bus address	See system manual (extension)
1	IN/OUT1 ADR	0				CAN-IN1, CAN-OUT1	
2	IN/OUT2 ADR	0				CAN-IN2, CAN-OUT2	
3	IN/OUT3 ADR	0				CAN-IN3, CAN-OUT3	
C0354			1	{1}	513	**CAN** CAN-IN / CAN-OUT node address 2 ● Individual addressing of system bus process data objects	See system manual (extension)
1	IN1 ADR2	1				CAN-IN1	
2	OUT2 ADR2	129				CAN-OUT1	
3	IN2 ADR2	257				CAN-IN2	
4	OUT2 ADR2	258				CAN-OUT2	
5	IN3 ADR2	385				CAN-IN3	
6	OUT3 ADR2	386				CAN-OUT3	
C0355		Disp	0	{1}	2047	**CAN** System bus identifiers	See system manual (extension)
1	IN1 ID						
2	OUT1 ID						
3	IN2 ID						
4	OUT2 ID						
5	IN3 ID						
6	OUT3 ID						
C0356			0	{1 ms}	65000	**CAN** System bus time settings	See system manual (extension)
1	CAN BOOT UP	3000				Required for CAN interconnection without master	
2	OUT2 CYCLE	0				C0356 = 0: Event-controlled process data transfer	
3	OUT3 CYCLE	0				C0356 > 0: Cyclic process data transfer	
4	CAN DELAY	20				When the ”Operational” NMT status is reached (after ”Pre-operational” or ”Stopped”), the ”CANdelay” delay time is started. After the delay time has elapsed, the PDOs CAN-OUT2 and CAN-OUT3 are transmitted for the first time	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0357			0	{1 ms}	65000	**CAN** System bus monitoring times ● After a fault message, the CAN objects remain in receive position	See system manual (extension)
1	CE1 MONIT TIME	3000				CAN-IN1	
2	CE2 MONIT TIME	3000				CAN-IN2	
3	CE3 MONIT TIME	3000				CAN-IN3	
C0358	RESET NODE	0	0 1	No function CAN reset		**CAN** Establish nodal reset point for system bus	See system manual (extension)
C0359	CAN STATE	Disp	0 1 2 3	Operational Pre-operational Warning Bus off		**CAN** System bus status	See system manual (extension)
C0360		Disp	0		65535	**CAN** Telegram counter (number of telegrams) Count values > 65535: Restart with 0	See system manual (extension)
1	MESSAGE OUT					All telegrams sent	
2	MESSAGE IN					All telegrams received	
3	MESSAGE OUT1					Telegrams sent on CAN-OUT1	
4	MESSAGE OUT2					Telegrams sent on CAN-OUT2	
5	MESSAGE OUT3					Telegrams sent on CAN-OUT3	
6	MESSAGE POUT1					Telegrams sent on parameter channel 1	
7	MESSAGE POUT2					Telegrams sent on parameter channel 2	
8	MESSAGE IN1					Telegrams received from CAN-IN1	
9	MESSAGE IN2					Telegrams received from CAN-IN2	
10	MESSAGE IN3					Telegrams received from CAN-IN3	
11	MESSAGE PIN1					Telegrams received from parameter channel 1	
12	MESSAGE PIN2					Telegrams received from parameter channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0361		Disp	0.00	{1.00 %}	100.00	**CAN** Bus load of system bus For perfect operation the entire bus load (all nodes connected) should be less than 80 %	See system manual (extension)
1	LOAD OUT					All telegrams sent	
2	LOAD IN					All telegrams received	
3	LOAD OUT1					Telegrams sent on CAN-OUT1	
4	LOAD OUT2					Telegrams sent on CAN-OUT2	
5	LOAD OUT3					Telegrams sent on CAN-OUT3	
6	LOAD POUT1					Telegrams sent on parameter channel 1	
7	LOAD POUT2					Telegrams sent on parameter channel 2	
8	LOAD IN1					Telegrams received from CAN-IN1	
9	LOAD IN2					Telegrams received from CAN-IN2	
10	LOAD IN3					Telegrams received from CAN-IN3	
11	LOAD PIN1					Telegrams received from parameter channel 1	
12	LOAD PIN2					Telegrams received from parameter channel 2	
C0362	SYNC CYCLE	1.0	-32.0	{0.1 ms}	32.0	**CAN** Time between two sync telegrams on the system bus	See system manual (extension)
C0363	SYNC CORR	1	1 0.8 µs 2 1.6 µs 3 2.4 µs 4 3.2 µs 5 4.0 µs			**CAN** Correction value for C0362	See system manual (extension)
C0364 STOP	CAN ACTIVE	1000	FIXED0		→ selection list 2	**CAN** Configuraton of digital input signal ● Switches system bus from ”Pre-operational” to ”Operational” via external signal	See system manual (extension)
C0365	CAN ACTIVE	Disp				**CAN** System bus status	
C0366	SYNC RESPONSE	1	0 No sync response 1 Sync response			**CAN** Response to sync telegram by master	See system manual (extension)
C0367	SYNC RX ID	128	1	{1}	256	**CAN** Receive identifier (Rx) ● Sync identifier for grouping for accepting the data in CAN-IN1	See system manual (extension)
C0368	SYNC TX ID	128	1	{1}	256	**CAN** Transmit identifier (Tx) ● Identifier for the generation of a sync telegram	
C0369	SYNC TX TIME	0	0	{1}	65000	**CAN** Sync transmission interval (Tx) ● Transmission interval of the object set under C0368	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0400	AIN1-OUT	Disp	-199.99	{0.01 %}	199.99	**AIN1** Display of the output signal	See system manual (extension)
C0402 STOP	AIN1-OFFSET	19502	FCODE-26/1		→ Selection list 1	**AIN1** Offset configuration	
C0403 STOP	AIN1-GAIN	19504	FCODE-27/1		→ Selection list 1	**AIN1** Configuration of the gain	
C0404		Disp	-199.99		199.99	**AIN1** Display of analog input signals	
1	AIN1-OFFSET						
2	AIN1-GAIN						
C0405	AIN1-OUT	Disp	-199.99		199.99	**AIN2** Display of the output signal	See system manual (extension)
C0407 STOP	AIN2-OFFSET	19503	FCODE-26/2		→ Selection list 1	**AIN2** Offset configuration	
C0408 STOP	AIN2-GAIN	19505	FCODE-27/2		→ Selection list 1	**AIN2** Configuration of the gain	
C0409		Disp	-199.99	{0.01 %}	199.99	**AIN2** Display of analog input signals	
1	AIN2-OFFSET						
2	AIN2-GAIN						
C0416 STOP	RESOLVER ADJ	0	0	{1}	99999999	**Correction of resolver fault** For Lenze motors read out resolver errors from nameplate	
C0420 STOP	ENCODER CONST	512	1	{1 inc./rev.}	8192	**Encoder input X8** Selection of the encoder constant ● If an absolute value encoder is selected in C0025, an SD7 trip is triggered when the encoder constant is changed.	
C0421 STOP	ENC VOLTAGE	5.00	5.00	{0.1 V}	8.00	**Encoder voltage** Set voltage for encoder ● CAUTION! A wrong entry can destroy the encoder	
C0425	DFIN CONST	3	0 256 inc/rev 1 512 inc/rev 2 1024 inc/rev 3 2048 inc/rev 4 4096 inc/rev 5 8192 inc/rev 6 16384 inc./rev.			**DFIN** increment of the digital frequency input	See system manual (extension)
C0426	DFIN-OUT	Disp	-32767	{1 rpm}	32767	**DFIN** Output signal	See system manual (extension)
C0427	DFIN FUNCTION	0	0 2-phase 1 A pulse / B direction of rotation (right) 2 Pulse A or B			**DFIN** Selection of the digital frequency signal	
C0429	TP5 DELAY	0	-32767	{1 inc}	32767	**DFSET, DFRFG** Dead time compensation for the touch probe function	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0431 STOP	AOUT1-IN	5001	MCTRL-NACT		→ Selection list 1	**AOUT1** Configuration - analog input signal	See system manual (extension)
C0432 STOP	AOUT1-OFFSET	19512	FCODE-109/1		→ Selection list 1	**AOUT1** Offset configuration	
C0433 STOP	AOUT1-GAIN	19510	FCODE-108/1		→ Selection list 1	**AOUT1** Configuration of the gain	
C0434		Disp	-199.99	{0.01 %}	199.99	**AOUT1** Display of analog input signals	
1	AOUT1-IN						
2	AOUT1-OFFSET						
3	AOUT1-GAIN						
C0436 STOP	AOUT2-IN	5002	MCTRL-MSET2		→ Selection list 1	**AOUT2** Configuration - analog input signal	See system manual (extension)
C0437 STOP	AOUT2-OFFSET	19513	FCODE-109/2		→ Selection list 1	**AOUT2** Offset configuration	
C0438 STOP	AOUT2-GAIN	19511	FCODE-108/2		→ Selection list 1	**AOUT2** Configuration of the gain	
C0439		Disp	-199.99	{0.01 %}	199.99	**AOUT2** Display of analog input signals	
1	AOUT2-IN						
2	AOUT2-OFFSET						
3	AOUT2-GAIN						
C0440 STOP	STATE-BUS	1000			→ selection list 2	**State bus X5/ST** Configuration of input signal	
C0441	STATE-BUS	Disp				**State bus X5/ST** Display of input signal	
C0443	DIGIN-OUT	Disp	0	{1}	255	**DIGIN** Display of the signals at X5/E1 ... X5/E5 as decimal value • Binary interpretation indicates terminal signals	See system manual (extension)
C0444	DIGOUT A1...A4	Disp	0		1	**DIGOUT** Display of the set polarity at DIGOUT1 ... 4	See system manual (extension)
1	DIGOUT1						
2	DIGOUT2						
3	DIGOUT3						
4	DIGOUT4						
C0450 STOP	BRK1-NX	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration - analog input signal	See system manual (extension)
C0451 STOP	BRK1-SET	1000	FIXED0		→ selection list 2	**BRK1** Configuraton of digital input signal	
C0452 STOP	BRK1-SIGN	1000	FIXED0%		→ Selection list 1	**BRK1** Configuration - analog input signal	
C0458		Disp	-199.99	{0.01 %}	199.99	**BRK1** Display of analog input signals	
1	BRK1-NX						
2	BRK1-SIGN						
C0459	BRK1-SET	Disp				**BRK1** Display of digital input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0464	CUSTOMER I/F	Disp	0 1	Original Changed		**Customer interface** Status of selected basic configuration ● Reassignment of terminals in a basic configuration in C0005 does not change C0005 and sets C0464 = 1 ● Adding or removing function blocks or changing the signal flow among the function blocks in a basic configuration of C0005 sets C0005 = 0 and C0464= 1	
C0465 STOP	FB LIST	→			→ selection list 5	**FB processing table** Contained in the program of signal processing (sequence in which the function blocks are processed) → Depending on C0005. Changing C0005 loads assigned processing list – Lenze setting: C0005 = 20000 ● After changing the signal flow, the processing table must be adapted. Otherwise the controller uses the wrong signals! ● The function blocks DIGIN, DIGOUT, AIF-IN, CAN-IN, and MCTRL are always processed and do not have to be entered in the list	See system manual (extension)
1		0					
2		0					
...		...					
20		30000					
...		0					
25		5700					
26		10600					
...		0					
30		70					
...		...					
33		75					
...		...					
36		250					
...		...					
39		20000					
...		...					
50		0					
C0466	CPU T REMAIN	Disp				**Remaining process time** For processing function blocks	
C0469 STOP	KEY STOP FUNCTION	2	0 1 2	Deactivated Set CINH, controller inhibit Set QSP, quick stop		**Keypad** Set function of the STOP key on the keypad	
C0470			0	{1}	255	**FCODE** Freely configurable code for digital signals ● The data words C0470 and C0471 are in parallel and are identical	See system manual (extension)
0	FCODE 8BIT DIGITAL	0					
1	FCODE BIT 0-7	0					
2	FCODE BIT8-15	0					
3	FCODE BIT16-23	0					
4	FCODE BIT24-31	0					
C0471	FCODE 32 BIT	0	0	{1}	4294967296	**FCODE 32 bits digital** Freely configurable code for digital signals ● The data words C0470 and C0471 are in parallel and are identical	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0472	FCODE ANALOG		-199.99	{0.01 %}	199.99	**FCODE** Freely configurable code for relative analog signals	See system manual (extension)
1		0.00					
2		0.00					
3		100.00					
...		...					
6		100.00					
...		...					
20		0.00					
C0473	FCODE ABS		-32767	{1}	32767	**FCODE** Freely configurable code for absolute analog signals	See system manual (extension)
1		1					
2		1					
3		0					
...		...					
10		0					
C0474	FCODE PH		-2147483648	{1}	2147483647	**FCODE** Freely configurable code for angle singals ● 1 rev. = 65536 inc	See system manual (extension)
1		0					
...		...					
5		0					
C0475	FCODE DF		-16000	{1 rpm}	16000	**FCODE** Freely configurable code for angular difference singals ● 1 rev. = 65536 inc	See system manual (extension)
1		0					
2		0					
C0490 STOP	FEEDBACK POS	0				**Position feedback system** Feedback system for the position controller	
			0	Resolver at X7		The feedback system can be combined with the settings C0495 = 0, 1, 2, 3, 4	
			1	Encoder TTL at X8		The selection also sets C0495 to the same value	
			2	Encoder sin an X8			
			3	Absolute value encoder ST at X8			
			4	Absolute value encoder MT at X8			
C0495 STOP	FEEDBACK N	0				**Speed feedback system** Feedback system for the speed controller	
			0	Resolver at X7		The feedback system can be combined with the settings C0490 = 0, 1, 2, 3, 4 ● C0490 = 0 sets the rotor displacement angle in C0058 to -90°	
			1	Encoder TTL at X8		The selection also sets C0490 to the same value	
			2	Encoder sin an X8			
			3	Absolute value encoder ST at X8			
			4	Absolute value encoder MT at X8			
C0497	NACT-FILTER	2.0	0.0	{0.1 ms}	50.0	$n_{act\ filter\ time\ constant}$ Time constant for actual speed value C0497 = 0 ms: Switched off	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C0517			0.00 {0.01} 1999.00		**User menu** Up to 32 entries ● Under the subcodes the numbers of the desired code are entered ● The input is effected in the format xxx.yy – xxx: Code number – yy: Subcode number ● It is not checked whether the code entered exists	
1	USER MENU	51.00	C0051/0 MCTRL-NACT			
2	USER MENU	54.00	C0054/0 Imot			
3	USER MENU	56.00	C0056/0 MCTRL-MSET2			
4	USER MENU	46.00	C0046/0 N			
5	USER MENU	49.00	C0049/0 NADD			
6	USER MENU	183.00	C0183/0 Diagnostics			
7	USER MENU	168.01	C0168/1 Fail no. act			
8	USER MENU	86.00	C0086/0 Mot type			
9	USER MENU	22.00	C0022/0 Imax current			
10	USER MENU	5.00	C005/0 signal cfg			
11	USER MENU	11,00	C0011/0 Nmax			
12	USER MENU	12.00	C0012/0 T_{ir}			
13	USER MENU	13.00	C0013/0 T_{if}			
14	USER MENU	105.00	C0105/0 QSP T_{if}			
15	USER MENU	39.01	C0039/1 JOG setpoint			
16	USER MENU	70.00	C0070/0 Vp speed CTRL			
17	USER MENU	71.00	C0071/0 Tn speed CTRL			
18	USER MENU	0	Not assigned			
...	...	0	Not assigned			
31	USER MENU	94.00	C0094/0 Password			
32	USER MENU	3.00	C0003/0 Par save			
C0520 STOP	DFSET-IN	1000	FIXEDPHI-0	→ Selection list 4	**DFSET** Configuration of input signal	See system manual (extension)
C0521 STOP	DFSET-VP-DIV	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of gain factor numerator	See system manual (extension)
C0522 STOP	DFSET-RAT-DIV	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of gearbox factor numerator	
C0523 STOP	DFSET-A-TRIM	1000	FIXED0%	→ Selection list 1	**DFSET** Configuration of phase trimming	
C0524 STOP	DFSET-N-TRIM	1000	FIXED0%	→ Selection list 1	**DFSET** Speed trimming of DFSET	
C0525 STOP	DFSET-0-PULSE	1000	FIXED0	→ selection list 2	**DFSET** Configuration of one-time zero pulse activation	See system manual (extension)
C0526 STOP	DFSET-RESET	1000	FIXED0	→ selection list 2	**DFSET** Integrator resetting	
C0527 STOP	DFSET-SET	1000	FIXED0	→ selection list 2	**DFSET** Configuration of integrator setting	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0528		Disp	$-2 \cdot 10^9$	{1}	$2 \cdot 10^9$	**DFSET**	See system manual (extension)
1	0-PULSE A					Angular difference between 2 index pulses	
2	OFFSET					Offset from C0523 × C0529 + C0252	
C0529	MULTIP OFFSET	1	-20000	{1}	20000	**DFSET** Offset multiplier	
C0530	DF EVALUATION	0	0 1	With gearbox factor Without gearbox factor		**DFSET** Evaluation of the digital frequency	
C0531	ACT 0 DIV	1	1	{1}	16384	**DFSET** Divisor for actual zero pulse	
C0532	0-PULSE/TP	1	1 2	0-pulse Touch probe		**DFSET** Selection of zero pulse or touch probe	
C0533	VP DENOM	1	1	{1}	32767	**DFSET Vp denominator** Gain factor denominator	
C0534	SYNC MODE	0	0 1 2 10 11 12 13	Inactive Continuous Continuously switchable Once, fast way Once, + direction Once, - direction Once, 2 × zero pulse		**DFSET** Mode for synchronising the zero pulse and/or touch probe	
C0535	SET 0 DIV	1	1	{1}	16384	**DFSET** Set zero pulse scaler	
C0536		Disp	-32767	{1}	32767	**DFSET** Display of analog input signals	See system manual (extension)
1	DFSET-VP-DIV						
2	DFSET-RAT-DIV						
3	DFSET-A-TRIM						
C0537	DFSET-N-TRIM	Disp	-199.99	{0.01 %}	199.99	**DFSET** Display of analog input signal	
C0538		Disp				**DFSET** Display of digital input signals	
1	DFSET-0-PULSE						
2	DFSET-RESET						
3	DFSET-SET						
C0539	DFSET-IN	Disp	-32767	{1 rpm}	32767	**DFSET** Display of input signal	
C0540	DFOUT-FUNCTION	2	0 1 2 3 4 5	Analog input Phase difference input Resolver simulation + index pulse Resolver simulation without index pulse X10 = X9 X10 = X8		**DFOUT** Encoder output function • X9 is inhibited if 0, 1, 2 or 3 has been selected • The input signals are buffered	See system manual (extension)
C0541 STOP	DFOUT-AN-IN	1000	FIXED0%		→ Selection list 1	**DFOUT** Configuration - analog input signal	See system manual (extension)
C0542 STOP	DFOUT-DF-IN	5000	MCTRL-PHI-ACT		→ Selection list 4	**DFOUT** Digital frequency signal configuration	
C0544 STOP	DFOUT-SYN-RDY	1000	FIXED0		→ selection list 2	**DFOUT** Configuration of synchronisation signal for the zero pulse	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0545	DFOUT-PH OFFSET	0	0	{1 inc}	65535	**DFOUT** Angular offset	See system manual (extension)
C0546	DFOUT-MIN INC/REV	1000	-245760000	{1inc}	245760000	**DFOUT** Masking (suppressing) interference pulses at X5/E5 (set pulse of touch probe signal) ● The size of the masking window between two set pulses is set	
C0547	DFOUT-AN-IN	Disp	-199.99	{0.01 %}	199.99	**DFOUT** Display of analog input signal	See system manual (extension)
C0548	DFOUT-SYN-RDY	Disp	0		1	**DFOUT** Display of digital input signal	
C0549	DFOUT-DF-IN	Disp	-32767	{1 rpm}	32767	**DFOUT** Display of input signal	
C0560			-199.99	{0.01 %}	199.99	**FIXSET1** Fixed setpoints	See system manual (extension)
1	FIXSET1-VALUE	100					
2	FIXSET1-VALUE	75					
3	FIXSET1-VALUE	50					
4	FIXSET1-VALUE	25					
5	FIXSET1-VALUE	0					
...	...	...					
15	FIXSET1-VALUE	0					
C0561 STOP	FIXSET1-AIN	1000	FIXED0%		→ Selection list 1	**FIXSET1** Configuration - analog input signal	
C0562 STOP					→ selection list 2	**FIXSET1** Configuration of digital input signals	
1	FIXSET1-IN1	1000	FIXED0				
2	FIXSET1-IN2	1000	FIXED0				
3	FIXSET1-IN3	1000	FIXED0				
4	FIXSET1-IN4	1000	FIXED0				
C0563	FIXSET1-AIN	Disp	-199.99	{0.01 %}	199.99	**FIXSET1** Display of analog input signal	
C0564		Disp				**FIXSET1** Display of digital input signals	
1	FIXSET1-IN1						
2	FIXSET1-IN2						
3	FIXSET1-IN3						
4	FIXSET1-IN4						
C0570 STOP	S&H1-IN	1000	FIXED0%		→ Selection list 1	**S&H1** Configuration - analog input signal	See system manual (extension)
C0571 STOP	S&H1-LOAD	1000	FIXED0		→ selection list 2	**S&H1** Configuraton of digital input signal	
C0572	S&H1-IN	Disp	-199.99	{0.01 %}	199.99	**S&H1** Display of analog input signal	
C0573	S&H1-LOAD	Disp				**S&H1** Display of digital input signal	
C0575	SD8 FILTER	1	1	{1 ms}	200	**SD8 monitoring** Tripping delay of error message SD8	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze	Selection			
C0576		100.00	0.00	{0.01 %}	100.00	**nErr monitoring speed window** Setting of the system deviation between actual speed value and speed setpoint
C0577	VP FLD WEAK	3.00	0.00	{0.01 ms]	15.99	**Field weakening controller** $V_{p\ gain}$
C0578	TN FLD WEAK	50.0	2.0	{0.5 ms}	8192,0	**Field weakening controller** Reset time Tn C0578 = 8000 ms: Switched off
C0579	MONIT NERR	3	0 TRIP 1 Message 2 Warning 3 Off			**nEEr monitoring** Configuration of ”system deviation between actual speed value and speed setpoint” monitoring
C0580	MONIT SD8	3	0 TRIP 3 Off			**SD8 monitoring** Configuration of ”Encoder error at X8” monitoring
C0581	MONIT EER	0	0 TRIP 1 Message 2 Warning 3 Off			**EEr monitoring** Configuration of ”external fault” monitoring
C0582	MONIT OH4	2	2 Warning 3 Off			**OH4 monitoring** Configuration of heatsink temperature monitoring
C0583	MONIT OH3	→	0 TRIP 2 Warning 3 Off			**OH3 monitoring** Configuration of ”fixed motor temperature” monitoring → Depends on C0086
C0584	MONIT OH7	→	2 Warning 3 Off			**OH7 monitoring** Configuration of ”adjustable motor temperature” monitoring → Depends on C0086 Temperature monitoring via resolver input
C0585	MONIT OH8	3	0 TRIP 2 Warning 3 Off			**OH8 monitoring** Configuration of ”adjustable motor temperature” monitoring Temperature monitoring via PTC input
C0586	MONIT SD2	0	0 TRIP 2 Warning 3 Off			**SD2 monitoring** Configuration of resolver monitoring
C0587	MONIT SD3	3	0 TRIP 2 Warning 3 Off			**SD3 monitoring** Configuration of ”encoder at X9” monitoring
C0588	MONIT H10/H11	0	0 TRIP 2 Warning 3 Off			**H10/H11 monitoring** Setting C0588 = 2 or C0588 = 3 only allowed for Lenze service
C0589	MONIT P03	2	0 TRIP 2 Warning 3 Off			**P03 monitoring** Configuration of following error monitoring ● The following error is monitored by the DFSET function block. The monitoring is only active if DFSET is used.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0590	MONIT P13	0	0 2 3	TRIP Warning Off		**P13 monitoring** Configuration of angle error monitoring ● The following error is monitored by the DFSET function block. The monitoring is only active if DFSET is used.	
C0591	MONIT CE1	3	0 2 3	TRIP Warning Off		**CE1 monitoring** Configuration of ”CAN-IN1 fault” monitoring	
C0592	MONIT CE2	3	0 2 3	TRIP Warning Off		**CE2 monitoring** Configuration of ”CAN-IN2 error” monitoring	
C0593	MONIT CE3	3	0 2 3	TRIP Warning Off		**CE3 monitoring** Configuration of ”CAN-IN3 error” monitoring	
C0594	MONIT SD6	→	0 2 3	TRIP Warning Off		**SD6 monitoring** Configuration of ”motor temperature sensor” monitoring → Depends on C0086	
C0595	MONIT CE4	3	0 2 3	TRIP Warning Off		**CE4 monitoring** Configuration of ”CAN bus off” monitoring	
C0596	NMAX LIMIT	5500	0	{1 rpm}	16000	**System speed monitoring**	
C0597	MONIT LP1	3	0 2 3	TRIP Warning Off		**LP1 monitoring** Configuration of motor phase failure monitoring	
C0598	MONIT SD5	3	0 2 3	TRIP Warning Off		**SD5 monitoring** Configuration monitoring master current at X5/1.2 < 2mA	
C0599	LIMIT LP 1	5.0	1.0	{0.1 %}	10.0	**LP1 monitoring** Current limit value for motor phase monitoring	
C0600	FUNCTION	1	0 1 2 3 4 5	OUT = IN1 IN1 + IN2 IN1 - IN2 IN1 * IN2 IN1 / IN2 IN1/(100% - IN2)		**ARIT2** Function selection	See system manual (extension)
C0601 STOP					→ Selection list 1	**ARIT2** Configuration of analog input signals	
1	ARIT2-IN1	1000	FIXED0%				
2	ARIT2-IN2	1000	FIXED0%				
C0602		Disp	-199.99	{0.01 %}	199.99	**ARIT2** Display of analog input signals	
1	ARIT2-IN1						
2	ARIT2-IN2						
C0606	MONIT OC8	2	0 2 3	TRIP Warning Off		**OC8 monitoring** Configuration of the $I^2 \times t$ advance warning ● The threshold is set in C0127	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0610 STOP					→ × Selection list 1	**ADD1** Configuration of analog input signals	See system manual (extension)
1	ADD1-IN1	1000	FIXED0%				
2	ADD1-IN2	1000	FIXED0%				
3	ADD1-IN3	1000	FIXED0%				
C0611		Disp	-199.99	{0.01 %}	199.99	**ADD1** Display of analog input signals	
1	ADD1-IN1						
2	ADD1-IN2						
3	ADD1-IN3						
C0620	DB1 GAIN	1.00	-10.00	{0.01}	10.00	**DB1** Gain	See system manual (extension)
C0621	DB1 VALUE	1.00	0.00	{0.01 %}	100.00	**DB1** Dead band	
C0622 STOP	DB1-IN	1000	FIXED0%		→ Selection list 1	**DB1** Configuration - analog input signal	
C0623	DB1-IN	Disp	-199.99	{0.01 %}	199.99	**DB1** Display of analog input signal	
C0630	MAX LIMIT	100.00	-199.99	{0.01 %}	199.99	**LIM1** Upper limit of the limiter	See system manual (extension)
C0631	MIN LIMIT	-100.0	-199.99	{0.01 %}	199.99	**LIM1** Lower limit of the limiter	
C0632 STOP	LIM1-IN	1000	FIXED0%		→ Selection list 1	**LIM1** Configuration - analog input signal	
C0633	LIM1-IN	Disp	-199.99	{0.01 %}	199.99	**LIM1** Display of analog input signal	
C0640	PT1-1-DELAY T	20.00	0.01	{0.01 s}	50.00	**PT1-1** Setting of the time constant	See system manual (extension)
C0641 STOP	PT1-1-IN	1000	FIXED0%		→ selection list 1	**PT1-1** Configuration - analog input signal	
C0642	PT1-1-IN	Disp	-199.99	{0.01 %}	199.99	**PT1-1** Display of analog input signal	
C0650	DT1-1-GAIN	1.000	-320.00	{0.01}	320.00	**DT1-1** Gain	See system manual (extension)
C0651	DT1-1-DELAY T	1.000	0.005	{0.001 s}	5.000	**DT1-1** Time constant	
C0652 STOP	DT1-1-IN	1000	FIXED0%		→ Selection list 1	**DT1-1** Configuration - analog input signal	
C0653	DT1-1-SENSIBILITY	1	1 15 bits 2 14 bits 3 13 bits 4 12 bits 5 11 bits 6 10 bits 7 9 bits			**DT1-1** Sensitivity	
C0654	DT1-1-IN	Disp	-199.99	{0.01 %}	199.99	**DT1-1** Display of analog input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0655	CONV5-NUMERATOR	1	-32767	{1}	32767	**CONV5** Numerator	See system manual (extension)
C0656	CONV5-DENOMINATOR	1	1	{1}	32767	**CONV5** Denominator	
C0657 STOP	CONV5-IN	1000	FIXED0%		→ Selection list 1	**CONV5** Configuration - analog input signal	
C0658	CONV5-IN	Disp	-199.99	{0.01 %}	199.99	**CONV5** Display of analog input signal	
C0661 STOP	ABS1-IN	1000	FIXED0%		→ Selection list 1	**ABS1** Configuration - analog input signal ● Input for absolute value generators	See system manual (extension)
C0662	ABS1-IN	Disp	-199.99	{0.01 %}	199.99	**ABS1** Display of analog input signal	
C0671	RFG1-TIR	0.000	0.000	{0.01 s}	999.900	**RFG1** Acceleration time T_{ir}	See system manual (extension)
C0672	RFG1-TIF	0.000	0.000	{0.01 s}	999.900	**RFG1** Deceleration time T_{if}	
C0673 STOP	RFG1-IN	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration - analog input signal	
C0674 STOP	RFG1-SET	1000	FIXED0%		→ Selection list 1	**RFG1** Configuration - analog input signal	
C0675 STOP	RFG1-LOAD	1000	FIXED0		→ selection list 2	**RFG1** Configuraton of digital input signal	
C0676		Disp	-199.99	{0.01 %}	199.99	**RFG1** Display of analog input signals	
1	RFG1-IN						
2	RFG1-SET						
C0677	RFG1-LOAD	Disp				**RFG1** Display of digital input signal	
C0680	CMP1-FUNCTION	6	1 IN1 = IN 2 2 IN 1 > IN2 3 IN 1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMP1** Function selection ● Comparison of inputs IN1 and IN2	See system manual (extension)
C0681	CMP1-HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP1** Hysteresis	
C0682	CMP1-WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP1** Window	
C0683 STOP					→ Selection list 1	**CMP1** Configuration of analog input signals	
1	CMP1-IN1	5001	MCTRL-NACT				
2	CMP1-IN2	19500	FCODE-17				
C0684		Disp	-199.99	{0.01 %}	199.99	**CMP1** Display of analog input signals	
1	(C0683/1)						
2	(C0683/1)						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0685	CMP2-FUNCTION	1	1 2 3 4 5 6	IN1 = IN2 IN 1 > IN2 IN 1 < IN2 |IN1| = |IN2| |IN1| > |IN2| |IN1| < |IN2|		**CMP2** Function selection ● Comparison of inputs IN1 and IN2	See system manual (extension)
C0686	CMP2-HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP2** Hysteresis	
C0687	CMP2-WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP2** Window	
C0688 STOP					→ Selection list 1	**CMP2** Configuration of analog input signals	
1	CMP2-IN1	1000	FIXED0%				
2	CMP2-IN2	1000	FIXED0%				
C0689		Disp	-199.99	{0.01 %}	199.99	**CMP2** Display of analog input signals	
1	CMP2-IN1						
2	CMP2-IN2						
C0690	CMP3-FUNCTION	1	1 2 3 4 5 6	IN1 = IN 2 IN 1 > IN2 IN 1 < IN2 |IN1| = |IN2| |IN1| > |IN2| |IN1| < |IN2|		**CMP3** Function selection ● Comparison of inputs IN1 and IN2	See system manual (extension)
C0691	CMP3-HYSTERESIS	1.00	0.00	{0.01 %}	100.00	**CMP3** Hysteresis	
C0692	CMP3-WINDOW	1.00	0.00	{0.01 %}	100.00	**CMP3** Window	
C0693 STOP					→ Selection list 1	**CMP3** Configuration of analog input signals	
1	CMP3-IN1	1000	FIXED0%				
2	CMP3-IN2	1000	FIXED0%				
C0694		Disp	-199.99	{0.01 %}	199.99	**CMP3** Display of analog input signals	
1	CMP3-IN1						
2	CMP3-IN2						
C0700 STOP	ANEG1-IN	19523	FCODE-472/3		→ Selection list 1	**ANEG1** Configuration - analog input signal	See system manual (extension)
C0701	ANEG1-IN	Disp	-199.99	{0.01 %}	199.99	**ANEG1** Display of analog input signal	
C0703 STOP	ANEG2-IN	1000	FIXED0%		→ Selection list 1	**ANEG2** Configuration - analog input signal	See system manual (extension)
C0704	ANEG2-IN	Disp	-199.99	{0.01 %}	199.99	**ANEG2** Display of analog input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0710	TRANS1-FUNCTION	0	0 1 2	Rising edge Falling edge Both edges		**TRANS1** Edge evaluation ● In the case of a corresponding signal edge at IN, OUT switches to HIGH	See system manual (extension)
C0711	TRANS1-PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS1** Pulse duration	
C0713 STOP	TRANS1-IN	1000	FIXED0		→ selection list 2	**TRANS1** Configuraton of digital input signal	
C0714	TRANS1-IN	Disp				**TRANS1** Display of digital input signal	
C0715	TRANS2-FUNCTION	0	0 1 2	Rising edge Falling edge Both edges		**TRANS2** Edge evaluation ● In the case of a corresponding signal edge at IN, OUT switches to HIGH	See system manual (extension)
C0716	TRANS2-PULSE T	0.001	0.001	{0.001 s}	60.000	**TRANS2** Pulse duration	
C0718 STOP	TRANS2-IN	1000	FIXED0		→ selection list 2	**TRANS2** Configuraton of digital input signal	
C0719	TRANS2-IN	Disp				**TRANS2** Display of digital input signal	
C0720	DIGDEL1-FUNCTION	2	0 1 2	On delay Off delay On/off delay		**DIGDEL1** Function selection	See system manual (extension)
C0721	DIGDEL1-DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL1** Setting of the delay time	
C0723 STOP	DIGDEL1-IN	1000	FIXED0		→ selection list 2	**DIGDEL1** Configuraton of digital input signal	
C0724	DIGDEL1-IN	Disp				**DIGDEL1** Display of digital input signal	
C0725	DIGDEL2-INFUNCTION	2	0 1 2	On delay Off delay On/off delay		**DIGDEL2** Function selection	See system manual (extension)
C0726	DIGDEL2-DELAY T	1.000	0.001	{0.001 s}	60.000	**DIGDEL2** Setting of the delay time	
C0728 STOP	DIGDEL2-IN	1000	FIXED0		→ selection list 2	**DIGDEL2** Configuraton of digital input signal	
C0729	DIGDEL2-IN	Disp				**DIGDEL2** Display of digital input signal	
C0730	OSZ MODUS	0	0 1	Start measurement Stop measurement		**OSC** Start / stop of the measured value recording	See system manual (extension)
C0731	OSC STATUS	0	0 1 2 3 4 5	Measurement completed Measurement active Trigger detected Abort Abort after trigger Read memory		**OSC** Current operating status	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0732 STOP					→ Selection list 1	**OSC** Configuration of analog input signals	See system manual (extension)
1	OSC CHANNEL1	1000	FIXED0%				
2	OSC CHANNEL2	1000	FIXED0%				
3	OSC CHANNEL3	1000	FIXED0%				
4	OSC CHANNEL4	1000	FIXED0%				
C0733					→ selection list 2	**OSC** Trigger input	
1	OSC-TRIG INP	1000	FIXED0				
C0734	TRIG-SOURCE	1	0 1 2 3 4	Digital trigger input Measuring channel 1 Measuring channel 2 Measuring channel 3 Measuring channel 4		**OSC** Selection of trigger source	See system manual (extension)
C0735	TRIGGER-LEVEL	0	-32767	{1}	32767	**OSC** Setting of trigger level for channels 1 ... 4	
C0736	TRIGGER-SLOPE	0	0 1	LOW/HIGH edge HIGH/LOW edge		**OSC** Selection of the trigger edge	
C0737	TRIGGER-DELAY	0.0	-100.0	{0.1 %}	999.9	**OSC** Setting of pre- and post-triggering	
C0738	PROBE PERIOD	3	3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	1 ms 2 ms 5 ms 10 ms 20 ms 50 ms 100 ms 200 ms 500 ms 1 s 2 s 5 s 10 s 20 s 50 s 1 min 2 min 5 min 10 min		**OSC** Selection of the sampling period	See system manual (extension)
C0739	NUMBER OF CHANNELS	4	1	{1}	4	**OSC** Number of channels to be measured	See system manual (extension)
C0740	DATA READ					**OSC**	
1		0	0	{1}	65535	Define the starting point for reading the data memory. This enables a selective access to a memory block	
2		0	0 1	Inhibit "Read data" Enable "Read data"		Inhibit "Read memory"	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C0741				**OSC**	See system manual (extension)
1	VERSION OSC	Disp		Version	
2	LENGTH MEMORY			Memory size	
3	DATA WIDTH			Data width	
4	NO. CHANNELS			Number of channels	
C0742	LENGTH OF DB	Disp		**OSC** Show data block length	
C0743	READ DB	Disp		**OSC** Reading of an 8-byte data block	
C0744	MEM: DEPTH	2048	0 512 measured values 1 1024 measured values 2 1536 measured values 3 2048 measured values 4 3072 measured values 5 4096 measured values 6 8192 measured values	**OSC** Adapt memory depth to the measuring task	
C0749		Disp		**OSC** Information on the storage of the measured values	See system manual (extension)
1	BRK:OFF INDEX				
2	TRIGGER INDEX				
3	END INDEX				
C0750	DFRFG1-VP DENOM	16	1 V_p = 1 2 V_p = 1/2 4 V_p = 1/4 8 V_p = 1/8 16 V_p = 1/16 34 V_p = 1/32 64 V_p = 1/64 128 V_p = 1/128 256 V_p = 1/256 512 V_p = 1/512 1024 V_p = 1/1024 2048 V_p = 1/2048 4096 V_p = 1/4096 8192 V_p = 1/8192 16384 V_p = 1/16384	**DFRFG1** Denominator of the position controller gain V_p	See system manual (extension)
C0751	DFRFG1-DFRFG1 TIR	1.000	0.001 {0.001 s} 999.900	**DFRFG1** Acceleration time T_{ir}	See system manual (extension)
C0752	DFRFG1-MAX SPEED	3000	1 {1 rpm} 16000	**DFRFG1** Maximum speed (here: maximum compensation speed)	
C0753	DFRFG1-DFRFG1 QSP	0.000	0.000 {0.001 s} 999.900	**DFRFG1** Deceleration time T_{if} if the deceleration ramp is activated	
C0754	DFRFG1-PH ERROR	$2 \cdot 10^9$	10 {1} $2 \cdot 10^9$	**DFRFG1** Following error	
C0755	SYN WINDOW	100	0 {1 inc} 65535	**DFRFG1** Synchronisation window	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0756	DFRFG1-OFFSET	0	$-1 \cdot 10^9$	{1 inc}	$1 \cdot 10^9$	**DFRFG1** Offset	See system manual (extension)
C0757	DFRFG1-FUNCTION	0	0 No TP start 1 With TP start			**DFRFG1** Function selection	
C0758 STOP	DFRFG1-IN	1000	FIXEDPHI-0		→ Selection list 4	**DFRFG1** Configuration of input signal	
C0759 STOP	DFRFG1-QSP	1000	FIXED0		→ selection list 2	**DFRFG1** Configuraton of digital input signal	
C0760 STOP	DFRFG1-STOP	1000	FIXED0		→ selection list 2	**DFRFG1-STOP** Configuraton of digital input signal "Ramp function generator stop"	
C0761 STOP	DFRFG1-RESET	1000	FIXED0		→ selection list 2	**DFRFG1** Configuraton of digital input signal Reset integrators	
C0764		Disp				**DFRFG1** Display of digital input signals	
1	DFRFG1-QSP						
2	DFRFG1-STOP						
3	DFRFG1-RESET						
C0765	DFRFG1-IN	Disp	-32767	{1 rpm}	32767	**DFRFG1** Display of input signal	
C0766	DFRFG1-SPEED DIR	1	1 Direction of rotation cw/ccw 2 CW rotation (to the right) 3 CCW rotation (to the left)			**DFRFG1** Selection of the direction of rotation	
C0770 STOP	FLIP1-D	1000	FIXED0		→ selection list 2	**FLIP1** Data input Configuraton of digital input signal	See system manual (extension)
C0771 STOP	FLIP1-CLK	1000	FIXED0		→ selection list 2	**FLIP1** Configuration of clock input signal	
C0772 STOP	FLIP1-CLR	1000	FIXED0		→ selection list 2	**FLIP1** Configuration of reset input signal	
C0773		Disp				**FLIP1** Display of digital input signals	
1	FLIP1-D						
2	FLIP1-CLK						
3	FLIP1-CLR						
C0775 STOP	FLIP2-D	1000	FIXED0		→ selection list 2	**FLIP2** Data input Configuraton of digital input signal	See system manual (extension)
C0776 STOP	FLIP2-CLK	1000	FIXED0		→ selection list 2	**FLIP2** Configuration of clock input signal	
C0777 STOP	FLIP2-CLR	1000	FIXED0		→ selection list 2	**FLIP2** Configuration of reset input signal	
C0778		Disp				**FLIP2** Display of digital input signals	
1	FLIP2-D						
2	FLIP2-CLK						
3	FLIP2-CLR						

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C0780 STOP	NSET-N	1000	FIXED0%	→ Selection list 1	**NSET** Configuration main setpoint input	See system manual (extension)
C0781 STOP	NSET-N-INV	1000	FIXED0	→ selection list 2	**NSET** Configuration main setpoint inversion	
C0782 STOP	NSET-NADD	1000	FIXED0%	→ Selection list 1	**NSET** Configuration additional setpoint input	
C0783 STOP	NSET-NADD-INV	1000	FIXED0	→ selection list 2	**NSET** Configuration of additional setpoint inversion	
C0784 STOP	NSET-CINH-VAL	1000	FIXED0%	→ Selection list 1	**NSET** Configuration of output signal with inhibited controller	
C0785 STOP	NSET-SET	1000	FIXED0%	→ Selection list 1	**NSET** Configuration ramp function generator	See system manual (extension)
C0786 STOP	NSET-LOAD	1000	FIXED0	→ selection list 2	**NSET** Configuration of digital input (load ramp function generator)	
C0787 STOP				→ selection list 2	**NSET** Configuration of JOG selection and JOG activation • Binary interpretation	
1	NSET-JOG*1	1000	FIXED0			
2	NSET-JOG*2	1000	FIXED0			
3	NSET-JOG*4	1000	FIXED0			
4	NSET-JOG*8	1000	FIXED0			
C0788 STOP				→ selection list 2	**NSET** Configuration of Ti selection and Ti activation • Binary interpretation • T_{ir} and T_{if} are equal	See system manual (extension)
1	NSET-TI*1	1000	FIXED0			
2	NSET-TI*2	1000	FIXED0			
3	NSET-TI*4	1000	FIXED0			
4	NSET-TI*8	1000	FIXED0			
C0789 STOP	NSET-RFG-0	1000	FIXED0	→ selection list 2	**NSET** Digital input (ramp function generator 0)	
C0790 STOP	NSET-RFG-STOP	1000	FIXED0	→ selection list 2	**NSET** Digital input (ramp function generator stop)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0798		Disp	-199.99	{0.01 %}	199.99	**NSET** Display of analog input signals	See system manual (extension)
1	NSET-CINH-VAL						
2	NSET-SET						
C0799		Disp				**NSET** Display of digital input signals	
1	NSET-N-INV						
2	NSET-NADD-INV						
3	NSET-LOAD						
4	NSET-JOG*1						
5	NSET-JOG*2						
6	NSET-JOG*4						
7	NSET-JOG*8						
8	NSET-TI*1						
9	NSET-TI*2						
10	NSET-TI*4						
11	NSET-TI*8						
12	NSET-RFG-0						
13	NSET-RFG-STOP						
C0800 STOP	PCTRL1-SET	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of setpoint input signal	See system manual (extension)
C0801 STOP	PCTRL1-ACT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of actual value input signal	
C0802 STOP	PCTRL1-INFLU	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of evaluation input signal	
C0803 STOP	PCTRL1-ADAPT	1000	FIXED0%		→ Selection list 1	**PCTRL1** Configuration of adaptation input signal	
C0804 STOP	PCTRL1-INACT	1000	FIXED0		→ selection list 2	**PCTRL1** Configuration of inactivation input signal	
C0805 STOP	PCTRL1-I-OFF	1000	FIXED0		→ selection list 2	**PCTRL1** Configuration of digital input signal (switch-off I component)	See system manual (extension)
C0808		Disp	-199.99	{0.01 %}	199.99	**PCTRL1** Display of analog input signals	
1	PCTRL1-SET						
2	PCTRL1-ACT						
3	PCTRL1-INFLU						
4	PCTRL1-ADAPT						
C0809		Disp				**PCTRL1** Display of digital input signals	
1	PCTRL1-INACT						
2	PCTRL1-I-OFF						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0810 STOP					→ Selection list 1	**ASW1** Configuration of analog input signals	See system manual (extension)
1	ASW1-IN1	1000	FIXED0%				
2	ASW1-IN2	1000	FIXED0%				
C0811 STOP	ASW1-SET	1000	FIXED0		→ selection list 2	**ASW1** Configuraton of digital input signal	
C0812		Disp	-199.99	{0.01 %}	199.99	**ASW1** Display of analog input signals	
1	ASW1-IN1						
2	ASW1-IN2						
C0813	ASW1-SET	Disp				**ASW1** Display of digital input signal	
C0815 STOP					→ Selection list 1	**ASW2** Configuration of analog input signals	
1	ASW2-IN1	1000	FIXED0%				
2	ASW2-IN2	1000	FIXED0%				
C0816 STOP	ASW2-SET	1000	FIXED0		→ selection list 2	**ASW2** Configuraton of digital input signal	
C0817		Disp	-199.99	{0.01%}	199.99	**ASW2** Display of analog input signals	
1	ASW2-IN1						
2	ASW2-IN2						
C0818	ASW2-SET	Disp				**ASW2** Display of digital input signal	
C0820 STOP					→ selection list 2	**AND1** Configuration of digital input signals	See system manual (extension)
1	AND1-IN	1000	FIXED0				
2	AND1-IN	1000	FIXED0				
3	AND1-IN	1000	FIXED0				
C0821		Disp				**AND1** Display of digital input signals	
1	AND1-IN1						
2	AND1-IN2						
3	AND1-IN3						
C0822 STOP		1000			→ selection list 2	**AND2** Configuration of digital inputs	See system manual (extension)
1	AND2-IN	1000	FIXED0				
2	AND2-IN	1000	FIXED0				
3	AND2-IN	1000	FIXED0				
C0823		Disp				**AND2** Display of digital input signals	
1	AND2-IN1						
2	AND2-IN2						
3	AND2-IN3						

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C0824 STOP			→ selection list 2	**AND3** Configuration of digital input signals	See system manual (extension)
1	AND3-IN1	1000	FIXED0		
2	AND3-IN2	1000	FIXED0		
3	AND3-IN3	1000	FIXED0		
C0825		Disp		**AND3** Display of digital input signals	
1	AND3-IN1				
2	AND3-IN2				
3	AND3-IN3				
C0826 STOP			→ selection list 2	**AND4** Configuration of digital input signals	See system manual (extension)
1	AND4-IN1	1000	FIXED0		
2	AND4-IN2	1000	FIXED0		
3	AND4-IN3	1000	FIXED0		
C0827		Disp		**AND4** Display of digital input signals	
1	AND4-IN1				
2	AND4-IN2				
3	AND4-IN3				
C0828 STOP			→ selection list 2	**AND5** Configuration of digital inputs	See system manual (extension)
1	AND5-IN1	1000	FIXED0		
2	AND5-IN2	1000	FIXED0		
3	AND5-IN3	1000	FIXED0		
C0829		Disp		**AND5** Display of digital input signals	
1	AND5-IN1				
2	AND5-IN2				
3	AND5-IN3				
C0830 STOP			→ selection list 2	**OR1** Configuration of digital input signals	See system manual (extension)
1	OR1-IN1	1000	FIXED0		
2	OR1-IN2	1000	FIXED0		
3	OR1-IN3	1000	FIXED0		
C0831		Disp		**OR1** Display of digital input signals	
1	OR1-IN1				
2	OR1-IN2				
3	OR1-IN3				
C0832 STOP			→ selection list 2	**OR2** Configuration of digital input signals	See system manual (extension)
1	OR2-IN1	1000	FIXED0		
2	OR2-IN2	1000	FIXED0		
3	OR2-IN3	1000	FIXED0		
C0833		Disp		**OR2** Display of digital input signals	
1	OR2-IN1				
2	OR2-IN2				
3	OR2-IN3				

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C0834 STOP			→ selection list 2	**OR3** Configuration of digital input signals	See system manual (extension)
1	OR3-IN1	1000	FIXED0		
2	OR3-IN2	1000	FIXED0		
3	OR3-IN3	1000	FIXED0		
C0835		Disp		**OR3** Display of digital input signals	
1	OR3-IN1				
2	OR3-IN2				
3	OR3-IN3				
C0836 STOP			→ selection list 2	**OR4** Configuration of digital input signals	See system manual (extension)
1	OR4-IN1	1000	FIXED0		
2	OR4-IN2	1000	FIXED0		
3	OR4-IN3	1000	FIXED0		
C0837		Disp		**OR4** Display of digital input signals	
1	OR4-IN1				
2	OR4-IN2				
3	OR4-IN3				
C0838 STOP			→ selection list 2	**OR5** Configuration of digital input signals	See system manual (extension)
1	OR5-IN1	1000	FIXED0		
2	OR5-IN2	1000	FIXED0		
3	OR5-IN3	1000	FIXED0		
C0839		Disp		**OR5** Display of digital input signals	
1	OR5-IN1				
2	OR5-IN2				
3	OR5-IN3				
C0840 STOP	NOT1-IN	1000	FIXED0 → selection list 2	**NOT1** Configuraton of digital input signal	See system manual (extension)
C0841	NOT1-IN	Disp		**NOT1** Display of digital input signal	
C0842 STOP	NOT2-IN	1000	FIXED0 → selection list 2	**NOT2** Configuraton of digital input signal	See system manual (extension)
C0843	NOT2-IN	Disp		**NOT2** Display of digital input signal	
C0844 STOP	NOT3-IN	1000	FIXED0 → selection list 2	**NOT3** Configuraton of digital input signal	See system manual (extension)
C0845	NOT3-IN	Disp		**NOT3** Display of digital input signal	
C0846 STOP	NOT4-IN	1000	FIXED0 → selection list 2	**NOT4** Configuraton of digital input signal	See system manual (extension)
C0847	NOT4-IN	Disp		**NOT4** Display of digital input signal	
C0848 STOP	NOT5-IN	1000	FIXED0 → selection list 2	**NOT5** Configuraton of digital input signal	See system manual (extension)
C0849	NOT5-IN	Disp		**NOT5** Display of digital input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0850 STOP					→ Selection list 1	**AIF-OUT** Configuration process output words for automation interface AIF (X1)	See system manual (extension)
1	AIF1OUT.W1	1000	FIXED0%				
2	AIF-OUT.W2	1000	FIXED0%				
3	AIF-OUT.W3	1000	FIXED0%				
C0851 STOP	AIF-OUT.D1	1000	FIXED0INC		→ Selection list 3	**AIF-OUT** Configuration of 32-bit angle information	
C0852	AIF-TYPE OUT.W2	0	0 1 2 3	Analog signal Digital 0-15 D1: LOW angle D2: HIGH angle		**AIF-OUT** Configuration process output word 2 for automation interface AIF (X1)	
C0853	AIF-TYPE OUT.W3	0	0 1 2	Analog signal Digital 16-31 HIGH angle		**AIF-OUT** Configuration - process output word 3 for automation interface AIF (X1)	
C0854	AIF-TYPE OUT.W1	0	0 3	Analog signal D2: LOW phase		**AIF-OUT** Configuration process output word 1 for automation interface AIF (X1)	
C0855		Disp				**AIF-IN** Process input words hexadecimal for automation interface X1	See system manual (extension)
1	AIF-IN (0-15)		Bit 00	{1}	Bit 15		
2	AIF-IN (16-31)		16 bit	{1}	Bit 31		
C0856		Disp	-199	{1 %}	199	**AIF-IN** Decimal process input words Display: 100.00 % = 16384	
1	AIF-IN.W1						
2	AIF-IN.W2						
3	AIF-IN.W3						
C0857	AIF-IN.D1	Disp	-2147483648	{1}	2147483647	**AIF-IN** 32-bit phase information	
C0858		Disp	-199.99	{0.01 %}	199.99	**AIF-OUT** Process output words Display: 100 % = 16384	See system manual (extension)
1	AIF-OUT.W1						
2	AIF-OUT.W2						
3	AIF-OUT.W3						
C0859	AIF-OUT.D1	Disp	-2147483648	{1}	2147483647	**AIF-OUT** 32-bit phase information	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C0860 STOP			→ Selection list 1	**CAN-OUT** Configuration of process output words	See system manual (extension)
1	CAN-OUT1.W1	5001			
2	CAN-OUT1.W2	1000	FIXED0%		
3	CAN-OUT1.W3	1000	FIXED0%		
4	CAN-OUT2.W1	1000	FIXED0%		
5	CAN-OUT2.W2	1000	FIXED0%		
6	CAN-OUT2.W3	1000	FIXED0%		
7	CAN-OUT2.W4	1000	FIXED0%		
8	CAN-OUT3.W1	1000	FIXED0%		
9	CAN-OUT3.W2	1000	FIXED0%		
10	CAN-OUT3.W3	1000	FIXED0%		
11	CAN-OUT3.W4	1000	FIXED0%		
C0861 STOP			→ Selection list 3	**CAN-OUT** Configuration of 32-bit angle information	
1	CAN-OUT1.D1	1000	FIXED0INC		
2	CAN-OUT2.D1	1000	FIXED0INC		
3	CAN-OUT3.D1	1000	FIXED0INC		
C0863		Disp	0 1	**CAN-IN** Display of process input words, hexadecimal	See system manual (extension)
1	CAN-IN1 (0-15)				
2	CAN-IN1 (16-31)				
3	CAN-IN2 (0-15)				
4	CAN-IN2 (16-31)				
5	CAN-IN3 (0-15)				
6	CAN-IN3 (16-31)				
C0864			0 Analog signal 1 Digital 0-15 2 LOW angle	**CAN-OUT** Configuration of process output words	See system manual (extension)
1	CAN-OUT1.W2	0			
2	CAN-OUT2.W1	0			
3	CAN-OUT3.W1	0			
C0865			0 Analog signal 1 Digital 16-31 2 HIGH angle	**CAN-OUT** Configuration of process output words	
1	CAN-OUT1.W3	0			
2	CAN-OUT2.W2	0			
3	CAN-OUT3.W2	0			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0866		Disp	-32768,00	{0.01%}	32767,00	**CAN-IN** Process input words Display: 100 % = 16384	See system manual (extension)
1	CAN-IN1.W1						
2	CAN-IN1.W2						
3	CAN-IN1.W3						
4	CAN-IN2.W1						
5	CAN-IN2.W2						
6	CAN-IN2.W3						
7	CAN-IN2.W4						
8	CAN-IN3.W1						
9	CAN-IN3.W2						
10	CAN-IN3.W3						
11	CAN-IN3.W4						
C0867		Disp				**CAN-IN** 32-bit phase information	
1	CAN-IN1.D1						
2	CAN-IN2.D1						
3	CAN-IN3.D1						
C0868		Disp	-199.99	{0.01%}	199.99	**CAN-OUT** Process output words Display: 100 % = 16384	See system manual (extension)
1	CAN-OUT1.W1						
2	CAN-OUT1.W2						
3	CAN-OUT1.W3						
4	CAN-OUT2.W1						
5	CAN-OUT2.W2						
6	CAN-OUT2.W3						
7	CAN-OUT2.W4						
8	CAN-OUT3.W1						
9	CAN-OUT3.W2						
10	CAN-OUT3.W3						
11	CAN-OUT3.W4						
C0869		Disp	-2147483648	{1}	2147483647	**CAN-OUT** 32-bit phase information	
1	CAN-OUT1.D1						
2	CAN-OUT2.D1						
3	CAN-OUT3.D1						
C0870 STOP					→ selection list 2	**DCTRL** Configuration of digital input signals (inhibit controller)	See system manual (extension)
1	DCTRL-CINH1	1000	FIXED0				
2	DCTRL-CINH2	1000	FIXED0				
C0871 STOP	DCTRL-TRIP-SET	1000	FIXED0		→ selection list 2	**DCTRL** Configuraton of digital input signal	
C0876 STOP	DCTRL-TRIP-RES	55	DIGIN5		→ selection list 2	**DCTRL** Configuraton of digital input signal	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C0878		Disp			**DCTRL** Display of digital input signals	See system manual (extension)
1	DCTRL-CINH1					
2	DCTRL-CINH2					
3	DCTRL-TRIP-SET					
4	DCTRL-TRIP-RES					
C0879			0 No reset 1 Reset		**DCTRL** Reset control words	
1	RESET C135	0				
2	RESET AIF	0				
3	RESET CAN	0				
C0885 STOP	R/L/Q-R	1000	FIXED0	→ selection list 2	**R/L/Q** Configuration of digital input signal (CW rotation)	See system manual (extension)
C0886 STOP	R/L/Q-L	1000	FIXED0	→ selection list 2	**R/L/Q** Configuration of digital input signal (CCW rotation)	
C0889		Disp			**R/L/Q** Display of digital input signals	
1	R/L/Q-L					
2	R/L/Q-R					
C0890 STOP	N-SET	30020	pos-nout	→ Selection list 1	**MCTRL** Configuration of input signal for speed setpoint	See system manual (extension)
C0891 STOP	MCTRL-M-ADD	30021	pos-Mout	→ Selection list 1	**MCTRL** Configuration of input signal for torque setpoint	
C0892 STOP	MCTRL-LO-M-LIM	5700	ANEG1-OUT	→ Selection list 1	**MCTRL** Configuration of input signal for lower torque limit	
C0893 STOP	MCTRL-HI-M-LIM	19523	FCODE-472/3	→ Selection list 1	**MCTRL** Configuration of input signal for upper torque limit	
C0894 STOP	MCTRL-PHI-SET	30020	POS-POUT	→ Selection list 3	**MCTRL** Configuration of input signal for rotor position setpoint	
C0895 STOP	MCTRL-PHI-LIM	19526	FCODE-472/6	→ Selection list 1	**MCTRL** Configuration of input signal for angle controller limit	
C0896 STOP	MCTRL-N2-LIM	1000	FIXED0%	→ Selection list 1	**MCTRL** Configuration of input signal for 2. speed limitation value	See system manual (extension)
C0897 STOP	MCTRL-PHI-ON	1001	FIXED1	→ selection list 2	**MCTRL** Configuration of switch-on signal for angle controller	
C0898 STOP	MCTRL-FLD-WEAK	1006	FIXED100%	→ Selection list 1	**MCTRL** Configuration of input signal for field weakening	
C0899 STOP	MCTRL-N/M-SWT	1000	FIXED0	→ selection list 2	**MCTRL** Configuration of input signal for the change over between speed and torque control	
C0900 STOP	MCTRL-QSP	1000	FIXED0	→ selection list 2	**MCTRL** Configuration of control signal for activation	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0901 STOP	MCTRL-I-SET	1000	FIXED0%		→ Selection list 1	**MCTRL** Configuration of input signal for loading the I component for the speed controller	See system manual (extension)
C0902 STOP	MCTRL-I-LOAD	1000	FIXED0		→ selection list 2	**MCTRL** Configuration of tripping signal for loading the I component for the speed controller	
C0903 STOP	MCTRL-P-ADAPT	1006	FIXED100%		→ Selection list 1	**MCTRL** Configuration of input signal for adaption of the angle controller	
C0906		Disp	-199.99	{0.01 %}	199.99	**MCTRL** Display of analog input signals	See system manual (extension)
1	MCTRL-N-SET						
2	MCTRL-M-ADD						
3	MCTRL-LO-M-LIM						
4	MCTRL-HI-M-LIM						
5	MCTRL-PHI-LIM						
6	MCTRL-N2-LIM						
7	MCTRL-FLD-WEAK						
8	MCTRL-I-SET						
9	MCTRL-P-ADAPT						
C0907		Disp				**MCTRL** Digital input signals	See system manual (extension)
1	MCTRL-PHI-ON						
2	MCTRL-N/M-SWT						
3	MCTRL-QSP						
4	MCTRL-I-LOAD						
C0908	MCTRL-PHI-SET	Disp	-2147483647	{1 inc}	2147483647	**MCTRL** Display of setpoint angle signal • 1 rev. = 65536 inc	
C0909	SPEED LIMIT	1	1 +/- 175 % 2 0 ... +175 % 3 -175 ... 0 %			**MCTRL** Rotating direction limitation for speed setpoint	
C0940	CONV1-NUMERATOR	1	-32767	{1}	32767	**CONV1** Numerator	See system manual (extension)
C0941	CONV1-DENOMINATOR	1	1	{1}	32767	**CONV1** Denominator	
C0942 STOP	CONV1-IN	1000	FIXED0%		→ Selection list 1	**CONV1** Configuration of analog input	
C0943	CONV1-IN	Disp	-199.99	{0.01 %}	199.99	**CONV1** Display of analog input signal	
C0945	CONV2-NUMERATOR	1	-32767	{1}	32767	**CONV2** Numerator	See system manual (extension)
C0946	CONV2-DENOMINATOR	1	1	{1}	32767	**CONV2** Denominator	
C0947 STOP	CONV2-IN	1000	FIXED0%		→ Selection list 1	**CONV2** Configuration of analog input	
C0948	CONV2-IN	Disp	-199.99	{0.01 %}	199.99	**CONV2** Display of analog input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C0950	CONV3-NUMERATOR	1	-32767	{1}	32767	**CONV3** Numerator	See system manual (extension)
C0951	CONV3-DENOMINATOR	1	1	{1}	32767	**CONV3** Denominator	
C0952 STOP	CONV3-IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV3** Configuration of analog input	
C0953	CONV3-IN	Disp	-32767	{1 rpm}	32767	**CONV3** Display of analog input signal	
C0955	CONV4-NUMERATOR	1	-32767	{1}	32767	**CONV4** Numerator	See system manual (extension)
C0956	CONV4-DENOMINATOR	1	1	{1}	32767	**CONV4** Denominator	
C0957 STOP	CONV4-IN	1000	FIXEDPHI-0		→ Selection list 4	**CONV4** Configuration of analog input	
C0958	CONV4-IN	Disp	-32767	{1 rpm}	32767	**CONV4** Display of analog input signal	
C0960	CURVE-FUNCTION	1	1 Characteristic 1 2 Characteristic 2 3 Characteristic 3			**CURVE** Selection of the characteristic function	See system manual (extension)
C0961	CURVE-Y0	0.00	0.00	{0.01 %}	199.99	**CURVE** Configuration - grid point	
C0962	CURVE-Y1	50.00	0.00	{0.01 %}	199.99	**CURVE** Configuration - grid point	
C0963	CURVE-Y2	75.00	0.00	{0.01 %}	199.99	**CURVE** Configuration - grid point	
C0964	CURVE-Y100	100.00	0.00	{0.01 %}	199.99	**CURVE** Configuration - grid point	
C0965	CURVE-X1	50.00	0.01	{0.01 %}	99.00	**CURVE** Configuration - grid point	
C0966	CURVE-X2	75.00	0.01	{0.01 %}	99.00	**CURVE** Configuration - grid point	
C0967 STOP	CURVE-IN	1000	FIXED0%		→ Selection list 1	**CURVE** Configuration of analog input	
C0968	CURVE-IN	Disp	-199.99	{0.01 %}	199.99	**CURVE** Display of analog input signal	
C0990 STOP	PHINT1-IN	1000	FIXEDPHI-0		→ Selection list 4	**PHINT1** Configuration of input signal	See system manual (extension)
C0991 STOP	PHINT1-RESET	1000	FIXED0		→ selection list 2	**PHINT1** Configuration of reset signal	
C0992	PHINT1-IN	Disp	-32767	{1}	32767	**PHINT1** Display of input signal	
C0993	PHINT1-RESET	Disp				**PHINT1** Display of digital input signal	
C0995	PHDIV-DIVISION	0	-31	{1}	31	**PHDIV** Divisor in the power-of-two format (2^{C0995})	See system manual (extension)
C0996 STOP	PHDIV-IN	1000	FIXED0INC		→ Selection list 3	**PHDIV** Configuration of input signal	
C0997	PHDIV-IN	Disp	-2147483647	{1}	2147483647	**PHDIV** Display of input signal	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C1000	CONVPPHA1-DIVISION	1	0 {1} 31	**CONVPHA1** Divisor in the power-of-two format (2^{C0995})	See system manual (extension)
C1001 STOP	CONVPPHA1-IN	1000	FIXED0INC → Selection list 3	**CONVPHA1** Configuration of input signal	
C1002	CONVPPHA1-IN	Disp	-2147483647 {1} 2147483647	**CONVPHA1** Display of input signal	
C1010	ARITPH1-FUNCTION	1	0 OUT = IN1 1 IN1 + IN2 2 IN1 - IN2 3 IN1 * IN2 / 2^{30} 13 IN1 * IN2 14 IN1 / IN2 15 IN1 % IN2 21 IN1 + IN2 (no limit) 22 IN1 - IN2 (no limit)	**ARITPH1** Arithmetic function selection	See system manual (extension)
C1011 STOP			→ Selection list 3	**ARITPH1** Configuration of input signals	
1	ARITPH1-IN1	1000	FIXED0INC		
2	ARITPH1-IN2	1000	FIXED0INC		
C1012		Disp	-2147483647 {1} 2147483647	**ARITPH1** Display of input signals	
1	ARITPH1-IN1				
2	ARITPH1-IN2				
C1020	ARITPH2-FUNCTION	1	0 OUT = IN1 1 IN1 + IN2 2 IN1 - IN2 3 IN1 * IN2 / 2^{30} 13 IN1 * IN2 14 IN1 / IN2 15 IN1 % IN2 21 IN1 + IN2 (no limit) 22 IN1 - IN2 (no limit)	**ARITPH2** Arithmetic function selection	See system manual (extension)
C1021 STOP			→ Selection list 3	**ARITPH2** Configuration of input signals	
1	ARITPH2-IN1	1000	FIXED0INC		
2	ARITPH2-IN2	1000	FIXED0INC		
C1022		Disp	-2147483647 {1} 2147483647	**ARITPH2** Display of input signals	
1	ARITPH2-IN1				
2	ARITPH2-IN2				
C1025	ARITPH3-FUNCTION	1	0 OUT = IN1 1 IN1 + IN2 2 IN1 - IN2 3 IN1 * IN2 / 2^{30} 13 IN1 * IN2 14 IN1 / IN2 15 IN1 % IN2 21 IN1 + IN2 (no limit) 22 IN1 - IN2 (no limit)	**ARITPH3** Arithmetic function selection	See system manual (extension)
C1026 STOP			→ Selection list 3	**ARITPH3** Configuration of input signals	
1	ARITPH3-IN1	1000	FIXED0INC		
2	ARITPH3-IN2	1000	FIXED0INC		
C1027		Disp	-2147483647 {1} 2147483647	**ARITPH3** Display of input signals	
1	ARITPH3-IN1				
2	ARITPH3-IN2				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1090	FEVAN1-OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN1** Display of output signal	See system manual (extension)
C1091	FEVAN1-CODE	141	2	{1}	2000	**FEVAN1** Selection target code	
C1092	FEVAN1-SUBCODE	0	0	{1}	255	**FEVAN1** Selection of the target subcode	
C1093	FEVAN1-NUMERATOR	1.0000	0.0001	{0.0001}	100000,0000	**FEVAN1** Numerator	
C1094	FEVAN1-DENOMIATOR	0.0001	0.0001	{0.0001}	100000,0000	**FEVAN1** Denominator	
C1095	FEVAN1-OFFSET	0	0	{1}	1000000000	**FEVAN1** Offset setting	
C1096 STOP	FEVAN1-IN	1000	FIXED0%		→ Selection list 1	**FEVAN1** Configuration - analog input signal	See system manual (extension)
C1097 STOP					→ selection list 2	**FEVAN1** Configuration of digital input signals	
1	FEVAN1-LOAD	1000	FIXED0				
2	FEVAN1-BUSY-IN	1000	FIXED0				
3	FEVAN1-FAIL-IN	1000	FIXED0				
C1098	FEVAN1-IN	Disp	-32768	{1}	32767	**FEVAN1** Display of analog input signal	See system manual (extension)
C1099		Disp				**FEVAN1** Display of digital input signals	
1	FEVAN1-LOAD						
2	FEVAN1-BUSY-IN						
3	FEVAN1-FAIL-IN						
C1100	FCNT1-FUNCTION	1				**FCNT1** Function selection	See system manual (extension)
			1	Return		If |counter content| ≥ |FCNT1-CMP-Val|, FCNT1-EQUAL is set to HIGH for 1 ms	
			2	Hold if >=		If |counter content| ≥ |FCNT1-CMP-Val|, the counter stops	
			3	Hold if =		If |counter content| = |FCNT1-CMP-Val|, the counter stops	
C1101 STOP					→ Selection list 1	**FCNT1** Configuration of analog input signals	See system manual (extension)
1	FCNT1-LD-VAL	1000	FIXED0%				
2	FCNT1-CMP-VAL	1000	FIXED0%				
C1102 STOP					→ selection list 2	**FCNT1** Configuration of digital input signals	
1	FCNT1-CLKUP	1000	FIXED0				
2	FCNT1-CLKDWN	1000	FIXED0				
3	FCNT1-LOAD	1000	FIXED0				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1103		Disp	-32768	{1}	32768	**FCNT1** Display of analog input signals	See system manual (extension)
1	FCNT1-LD-VAL						
2	FCNT1-CMP-VAL						
C1104		Disp				**FCNT1** Display of digital input signals	
1	FCNT1-CLKUP						
2	FCNT1-CLKDWN						
3	FCNT1-LOAD						
C1105	FCNT2-FUNCTION	1				**FCNT2** Function selection	See system manual (extension)
			1	Return		If |counter content| ≥ |FCNT2-CMP-Val|, FCNT2-EQUAL is set to HIGH for 1 ms	
			2	Hold if >=		If |counter content| ≥ |FCNT2-CMP-Val|, the counter stops	
			3	Hold if =		If |counter content| = |FCNT2-CMP-Val|, the counter stops	
C1106 STOP					→ Selection list 1	**FCNT2** Configuration of analog input signals	See system manual (extension)
1	FCNT2-LD-VAL	1000	FIXED0%				
2	FCNT2-CMP-VAL	1000	FIXED0%				
C1107 STOP					→ selection list 2	**FCNT2** Configuration of digital input signals	
1	FCNT2-CLKUP	1000	FIXED0				
2	FCNT2-CLKDWN	1000	FIXED0				
3	FCNT2-LOAD	1000	FIXED0				
C1108		Disp	-32768	{1}	32768	**FCNT2** Display of analog input signals	See system manual (extension)
1	FCNT2-LD-VAL						
2	FCNT2-CMP-VAL						
C1109		Disp				**FCNT2** Display of digital input signals	
1	FCNT2-CLKUP						
2	FCNT2-CLKDWN						
3	FCNT2-LOAD						
C1110	FCNT3-FUNCTION	1				**FCNT3** Function selection	See system manual (extension)
			1	Return		If |counter content| ≥ |FCNT3-CMP-Val|, FCNT3-EQUAL is set to HIGH for 1 ms	
			2	Hold if >=		If |counter content| ≥ |FCNT3-CMP-Val|, the counter stops	
			3	Hold if =		If |counter content| = |FCNT3-CMP-Val|, the counter stops	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1111 STOP					→ Selection list 1	**FCNT3** Configuration of analog input signals	See system manual (extension)
1	FCNT3-LD-VAL	1000	FIXED0%				
2	FCNT3-CMP-VAL	1000	FIXED0%				
C1112 STOP					→ selection list 2	**FCNT3** Configuration of digital input signals	
1	FCNT3-CLKUP	1000	FIXED0				
2	FCNT3-CLKDWN	1000	FIXED0				
3	FCNT3-LOAD	1000	FIXED0				
C1113		Disp	-32768	{1}	32768	**FCNT3** Display of analog input signals	See system manual (extension)
1	FCNT3-LD-VAL						
2	FCNT3-CMP-VAL						
C1114		Disp				**FCNT3** Display of digital input signals	
1	FCNT3-CLKUP						
2	FCNT3-CLKDWN						
3	FCNT3-LOAD						
C1120	SYNC MODE	2	0 1 2	Sync switched off CAN Sync activated Terminal Sync activated		**SYNC1** Function	See system manual (extension)
C1121 STOP			0	{1 ms}	13	**SYNC1** The interpolation is restarted with every sync signal.	
1	SYNC CYCLE	2				Definition of the cycle time of the sync signals (in the slave); only for system bus	
2	INTERPOL. CYCL	2				Definition of the interpolation time between the sync signals (in the slave), only for terminal	
C1122	SYNC TIME	0.460	0.000	{0.001 ms}	10.000	**SYNC1** Phase shift between CAN Sync and internal control program cycle ● Only for system bus ● Depending on the baud rate and bus load	See system manual (extension)
C1123			-0.450	{0.001 ms}	0.450	**SYNC1**	See system manual (extension)
1	PHASESHIFT	0.000				Phase shift between Terminal Sync and internal control program cycle ● Only for terminal sync	
2	SYNC WINDOW	0.200				Synchronisation window for synchronisation edge of the Terminal Sync (LOW-HIGH edge) ● Only for terminal sync ● When the Sync signal is in the window, SYNCx-STAT switches to HIGH	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1124 STOP	SYNC1-IN1	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration - analog input signal	See system manual (extension)
C1125 STOP	SYNC1-IN2	1000	FIXED0INC		→ Selection list 3	**SYNC1** Configuration of input signal	
C1126 STOP	SYNC1-IN3	1000	FIXED0%		→ Selection list 1	**SYNC1** Configuration - analog input signal	
C1127	SYNC1-IN1	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal	
C1128	SYNC1-IN2	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of input signal	
C1129	SYNC1-IN3	Disp	-2147483647	{1}	2147483647	**SYNC1** Display of analog input signal	
C1130 STOP					→ Selection list 1	**CONVPHPH2** Configuration of analog input signals	See system manual (extension)
1	CONVPHPH2-NUM	1000	FIXED0%				
2	CONVPHPH2-DEN	1000	FIXED0%				
C1131 STOP	CONVPHPH2-ACT	1000	FIXED0		→ selection list 2	**CONVPHPH2** Configuraton of digital input signal	
C1132 STOP	CONVPHPH2-IN2	1000	FIXED0INC		→ Selection list 3	**CONVPHPH2** Configuration of input signal	
C1135		Disp				**CONVPHPH2** Display of analog input signals	
1	CONVPHPH2-NUM						
2	CONVPHPH2-DEN						
C1136	CONVPHPH2-ACT	Disp				**CONVPHPH2** Display of digital input signal	
C1137	CONVPHPH2-IN2	Disp	-2147483647	{1}	2147483647	**CONVPHPH2** Display of input signal	
C1160 STOP					→ Selection list 1	**ASW3** Configuration of analog input signals	See system manual (extension)
1	ASW3-IN1	1000	FIXED0%				
2	ASW3-IN2	1000	FIXED0%				
C1161 STOP	ASW3-SET	1000	FIXED0		→ selection list 2	**ASW3** Configuraton of digital input signal	
C1162		Disp	-199.99	{0.01 %}	199.99	**ASW3** Display of analog input signals	
1	ASW3-IN1						
2	ASW3-IN2						
C1163	ASW3-SET	Disp				**ASW3** Display of digital input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1165 STOP					→ Selection list 1	**ASW4** Configuration of analog input signals	See system manual (extension)
1	ASW4-IN1	1000	FIXED0%				
2	ASW4-IN2	1000	FIXED0%				
C1166 STOP	ASW4-SET	1000	FIXED0		→ selection list 2	**ASW4** Configuraton of digital input signal	
C1167		Disp	-199.99	{0.01 %}	199.99	**ASW4** Display of analog input signals	
1	ASW4-IN1						
2	ASW4-IN2						
C1168	ASW4-SET	Disp				**ASW4** Display of digital input signal	
C1180	IDENT MODE	0	0	Inactive		**Control parameter identification**	
			1	Calculate control parameters		Calculate control parameters from data set	
			2	Identify		Identify plant parameters	
			3	Identify & calculate		Identify plant parameters and calculate control parameters	

Code		Possible settings			IMPORTANT
No.	Designation	Lenze	Selection		
C1181	ID STATE	Disp			**Status of the control parameter identification**
			0	Not activated / completed	
			1	Busy	Control parameters are identified
			2	Error: Calculation not possible (C1187/C1188)	Control parameter calculation not possible ● Check whether the plant parameters are set reasonably (C1187/C1188)
			3	Error: Identification not possible (C1182-C1185)	Too few scanning points registered ● Change basic conditions of the movement (C1182-C1185) – Increase torque, increase number of revolutions, increase speed, reduce torque rise time
			4	Error: Reference torque C0057 too low	Reference torque too low ● Increase I_{max} (C0022) ● Check max. torque (C0057)
			5	Error: Speed at start not zero	Speed at start ≠ 0 ● Stop drive and reactivate function
			6	Error: Controller inhibit during motion	Controller inhibit during motion ● Repeat identification
			7	Error: Torque ramp in C1185 too long	Minimum braking torque not reached, torque ramp too flat, or max. torque too low ● Change basic conditions of the movement (C1182-C1185) – Increase torque, increase number of revolutions, increase speed, reduce torque rise time
			8	Error: Identification too long (C1184-C1185)	Time overflow ● Increase torque, reduce torque rise time
			9	Error: Unfavourable entries (C1182-C1185)	Blocking ● Release brake, check motor cable, eliminate blocking
			10	Waiting for enable to start the movement	
			11	Waiting for end of movement	
			12	Waiting for controller inhibit for completion	
			99	Internal error	
C1182	PHI-ID PHASE	100.0	0.5	{0.1 rev} 3000.0	**Control parameter identification** ● Selection of the number of revolutions
C1183	N-ID MAX	100	10	{1 %} 100	**Control parameter identification** ● Selection of the speed ● 100 % = n_{max}

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1184	M-ID MAX	100	10	{1 %}	100	**Control parameter identification** ● Selection of the torque ● 100 % = M_{max}	
C1185	M RISETIME	100	10	{1 ms}	10000	**Control parameter identification** ● Selection of the torque rise time	
C1186	OPTIMISE ID	0	0 1	Optimum control Fault		**Control parameter identification** ● Optimisation of the control parameter identification	
C1187	INERTIA	0.0	0.0	{0.1 kg*cm²}	214000.0	**Control parameter identification** Plant parameters ● Inertia	
C1188	FRICTION	0	0	{1 %}	100	**Control parameter identification** Plant parameters ● Part of friction load (proportional to speed)	
C1190	MOTOR PTC SELECTION	0				**Temperature characteristic for PTC thermistors** Selection of the characteristic for PTC thermistors at X7 or X8 for detecting the motor temperature	
			0	Standard		Characteristic for PTC thermistors in Lenze motors	
			1	Characteristic		Characteristic for application-specific PTC thermistors	
C1191	CHAR.: TEMPERATURE 1		0	{1 °C}	255	**Temperature range for PTC thermistors** Define temperature points on the characteristic for PTC thermistors	
1	CHAR.: TEMP 1	100				Temperature point 1	
2	CHAR.: TEMP 2	150				Temperature point 2	
C1192	CHAR.: RESISTANCE 1		0	{1 Ω}	3000	**Resistance range for PTC thermistors** Define resistance points on the characteristic for PTC thermistors	
1	CHAR.: OHM 1	1670				Resistance point 1	
2	CHAR.: OHM 2	2225				Resistance point 2	
C1195 STOP	AIF-OUT.D2	1000	FIXED0INC		→ Selection list 3	**AIF-OUT** Configuration of phase input signal	See system manual (extension)
C1196	AIF-OUT.D2	Disp	-2147483647	{1}	2147483647	**AIF-OUT** Display of input signal	
C1197	AIF-IN.D2	Disp				**AIF-IN** Display of input signal	See system manual (extension)
C1202	RATIO NUM.	1	1	{1}	65535	**Gearbox factor numerator** $i = \frac{C1202}{C1203} = \frac{n_{motor}}{n_{gearbox\_output}}$	See system manual (extension)
C1203	RATIO DENUM.	1	1	{1}	65535	**Gearbox factor denominator**	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1204	FEED CONSTANT	1.0000	0.0001	{0.0001}	214000,0000	**Feed constant** ● Feed of the machine in units per revolution of the load side of the gearbox.	See system manual (extension)
C1205	POS. RESOLUT.	Disp	0	{0.0001 inc/unit}	214000.0000	**Position resolution** ● The position resolution indicates the number of increments which resolve a unit determined by the user.	See system manual (extension)
C1206 STOP	SET POLARITY	0	0 1	Not inverted Inverted		**Polarity of position setpoint** ● Reversal of the position direction	See system manual (extension)
C1207			1	{1}	65335	**Position encoder - gearbox factor** ● Gearbox factor between motor and position encoder ● Numerator/denominator corresponds to motor speed/encoder speed ● Encoder to motor shaft: 1/1	See system manual (extension)
1	FDBK RAT NUM	1					
2	FDBK RAT DEN	1					
C1208	ACT POLARITY	0	0 1	Not inverted Inverted		**Polarity - actual position** ● >Inversion of the actual position, e.g. when using a separate position encoder behind the gearbox.	See system manual (extension)
C1209	REF END-POINT	0	0 1 61 71 101	Ref-point Real-0 VTPOS-No 060 VTPOS-No 070 VTPOS-No 100		**Homing end point** ● Point where the drive is to be positioned after homing	See system manual (extension)
C1210	POS. MODE	0	0 1 2	Absolute positioning Relative positioning Absolute positioning with saving		**Positioning mode** ● If C1210 = 0, relative and absolute positioning processes can be carried out ● If C11210 = 1, only relative positioning processes can be carried out	See system manual (extension)
C1211	START PS NO.	1	1	{1}	32	**Program set number** ● Program set with which processing of the positioning program is to be started ● The program start is effected after an edge at the input "PRG-START"	See system manual (extension)
C1212	ACT. PS NO.	Disp	0 1 2 ... 31 32	Prog. end PS 01 PS 02 ... PS 31 PS 32		**Program set number** ● Display of the actual program set number	See system manual (extension)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1213	REF. MODE	0			Travel direction	**Homing mode** ● Mode for homing (valid for manual mode and program homing).	📖 6.13-1 See system manual (extension)
			0	+home	positive	Move to reference point via homing switch	
			1	-home	negative		
			2	+LIM,-home	positive	Approach end of travel range limit switch, reverse and move to reference point via homing switch	
			3	-LIM,+home	negative		
			4	+MARK,-home	positive	Move to homing switch, reverse and move to reference point	
			5	-MARK,+home	negative		
			6	+MARK,+TP	positive	Move to TP signal via reference switch	
			7	-MARK,-TP	negative		
			8	+TP	positive	Directly travel to TP signal	
			9	-TP	negative		
			10	+LIM,-TP	positive	Move to the travel range limit switch, reverse there, and reference to TP	
			11	-LIM,+TP	negative		
C1214	REF TP-INPUT	4	1 2 3 4	TP-IN = X5/E1 TP-IN = X5/E2 TP-IN = X5/E3 TP-IN = X5/E4		**Homing touch probe** ● Selection of the touch probe input (TP-IN) for homing acc. to modes 6...9. When using an incremental encoder, the TP input X5/E4 is particularly suitable.	See system manual (extension)
C1215			0 1	LOW/HIGH edge HIGH/LOW edge		**TP input edge** ● Selection of the edge for the touch probe input terminals. (Applies to homing acc. to modes 6...9, TP positioning, TP storage)	See system manual (extension)
1	TP-TRANS	0					
2	TP-TRANS	0					
3	TP-TRANS	0					
4	TP-TRANS	0					
C1216	V-REF2 ACTIVE.	0	0 1	inactive active		**Homing speed** Activation of 2nd speed	See system manual (extension)
C1218			0	{0.0001 units}	214000.0000	**POS** Following error tolerance	See system manual (extension)
1	FOL.TOLERANCE	4,0000					
2	FOL.TOLERANCE	1.0000					

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1220		Disp	-214000.0000	{0.0001 units}	214000.0000	**POS** Display in units	See system manual (extension)
1	POS-TARGET					Actual target position	
2	POS-SETPOS					Actual position setpoint	
3	POS-ACTPOS					Actual position	
4	ACT.FOLLOW ERR					Actual following error	
5	ACTPOS ABS.					Actual position (absolute value)	
6	REFMARK 0-IMP					Distance between REF-MARK and index pulse	
7	ACT.HOME OFFS					Actual reference dimension offset	
8	ACT.HOME POS.					Actual home position	
9	ACT. WAY					Actual path (path still to be positioned)	
10	ACT. C1223					Real internal values of codes C1223, C1224, C1240, C1250 (internal limitation possible: see error message P18 in the chapter ”Troubleshooting and fault messages	
11	ACT. C1224						
12	ACT. C1240						
13	ACT. C1250						
14	ACT. VNORM					Actual value Vnorm Internal value for fault analysis	
15	ACT. ANORM					Actual value Anorm Internal value for fault analysis	
16	POS-ABS-VAL					Actual position (without offset)	
C1221		Disp	-2147483647	{1 inc}	2147483647	**POS** Display in increments	See system manual (extension)
1	POS-TARGET					Actual target position	
2	POS-SETPOS					Actual position setpoint	
3	POS-ACTPOS					Actual position	
4	ACT.FOLLOW ERR					Actual following error	
5	ACTPOS ABS.					Read in absolute value	
6	REFMARK 0-IMP					Distance of REF-MARK to index pulse	
7	ACT.HOME OFFS					Actual reference dimension offset	
8	ACT.HOME POS.					Actual home position	
9	ACT. WAY					Path still to be positioned	
10	ACT. C1223					Real internal values of codes C1223, C1224, C1240, C1250 (internal limitation possible: see error message P18 in the chapter ”Troubleshooting and fault messages	
11	ACT. C1224						
12	ACT. C1240						
13	ACT. C1250						
14	ACT. VNORM					Actual value Vnorm Internal value for fault analysis	
15	ACT. ANORM					Actual value Anorm Internal value for fault analysis	
16	POS-ABS-VAL					Actual position (without offset)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1223 STOP	POS. LIMIT+	16000.0000	0	{0.0001 units}	214000.0000	**POS** Position limit positive	See system manual (extension)
C1224 STOP	POS. LIMIT-	-16000.0000	-214000.0000	{0.0001 units}	0	**POS** Position limit negative	
C1225	HOME OFFSET	0	-214000.0000	{0.0001 units}	214000.0000	**POS** Homing measure offset	
C1227	HOME POSITION	0	-214000.0000	{0.0001 units}	214000.0000	**POS** Home position	See system manual (extension)
C1240	V-MAX	50.0000	0.0001	{0.0001units/s}	214000.0000	**POS** Max. speed v_{max}	See system manual (extension)
C1241	V-HOMING 2	2.00	0.01	{0.01 %vmax}	100.00	**POS** Second homing speed	
C1242	V-HOMING	5.00	0.01	{0.01 %vmax}	100.00	**POS** Homing speed	
C1243	V-MANUAL	5.00	0.01	{0.01 %vmax}	100.00	**POS** Manual speed	
C1245		Disp	-199.99	{0.01 %vmax}	199.99	**POS** Display of speeds	See system manual (extension)
1	POS-VSET					Actual speed setpoint	
2	POS-VTRAV					Traversing speed of current program set	
3	POS-VFINAL					Final speed of current program set	
C1250	A-MAX	100.0000	0.0001	{0.0001 units/s²}	214000.0000	**POS** Max. acceleration/deceleration a_{max}	
C1251	A-HOMING	10.00	0.01	{0.01 %amax}	100.00	**Acceleration/deceleration of homing**	📖 6.13-1 See system manual (extension)
C1252	A-MANUAL	10.00	0.01	{0.01 %amax}	100.00	**Acceleration/deceleration of manual jog**	See system manual (extension)
C1253	A-CANCEL	100.00	0.01	{0.01 %amax}	100.00	**Deceleration PS-CANCEL** Deceleration of the drive until standstill when the PS is aborted	See system manual (extension)
C1255		Disp	-199.99	{0.01 %amax}	199.99	**POS**	See system manual (extension)
1	POS-ASET					Actual acceleration/deceleration	
2	POS-ACC					Acceleration of current PS	
3	POS-DCC					Deceleration of current PS	
C1256	S-RMP: JERK	1	0.064	{0.001 s}	10	**POS** S-ramp, max. jerk	See system manual (extension)
C1257	S-RMP: FILTER	10	0	{1 rpm}	1000	**S-ramp** PARAM-RD filter	
C1259			0 Linear ramp 1 S-ramp			**POS** Mode of the deceleration ramp	See system manual (extension)
1	MODE MAN RAMP	0				Deceleration of manual jog	
2	MODE STP RAMP	0				Deceleration program stop	
3	MODE CANCEL	0				Deceleration of PS-CANCEL	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C1260	MANUAL MODE	0	0 1	Without intermediate stop With intermediate stop	**POS** Manual jog mode	See system manual (extension)
C1261			0 1 2 3 ... 104	Inactive VTPOS-No 001 VTPOS-No 002 VTPOS-No 003 ... VTPOS-No 104	**POS** Intermediate stop target, number in VTPOS	
1	MANU-STP-NO	0				
2	MANU-STP-NO	1				
...	...	...				
15	MANU-STP-NO	14				
16	MANU-STP-NO	15				
C1280	POS. CONTROL	0	0	{1} 65535	**POS** Control word positioning	See system manual (extension)
			Bit 0 Bit 1 Bit 2 Bit 3 Bit 4 Bit 5 Bit 6 Bit 7 Bits 8-15	Program start Program stop Program reset Program abort Manual operation Negative manual jog Positive manual jog Manual homing reserved		
C1283	POS. STATUS	Disp	0 5 10 11 12 15 20 25 26 30 35 36 50 51 55 56 57 58 59 62 63 80 85	Program operation Ready to start Started Started-dig Started-rem Started-break Program end Stopped-dig Stopped-rem Stand-by-operation Program reset-dig Program reset-rem Manual operation-dig Manual operation-rem Manual-negative-dig Manual-negative-rem Manual-positive-dig Manual-positive-rem Manual negative and positive active Manual referencing-dig Manual referencing-rem POS-LOOP-INH active POS-PSET-SWT active	**POS** Position status display The state is only updated under the following conditions: ● Power section supplied: DCTRL-RDY = 1 ● No fault: DCTRL-TRIP = 0 DCTRL-FAIL-QSP = 0 ● Drive enabled: DCTRL-CINH = 0 ● No quick stop (QSP) active: MCTRL-QSP-OUT = 0 ● No manual operation active: POS-MANUAL = 0 C1280.B4 = 0	See system manual (extension)
C1284	HOMING-STATUS	Disp	0 1 5 10 11 20 25	No reference Reference known Prg-fct. homing active Manual referencing-dig Manual referencing - C1280 Absolute value encoder External absolute value	**POS** Homing status	See system manual (extension)
C1285			0 4	TRIP Fail-QSP	**Monitoring P01, P02, P04, P05**	📖 8.31
1	MONIT P01	4			Negative limit switch	
2	MONIT P02	4			Positive limit switch	
3	MONIT P04	4			Limit position negative	
4	MONIT P05	4			Limit position positive	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C1286			0 TRIP 2 Warning 3 Off 4 Fail-QSP		**Monitoring P14, P15**	📖 8.31
1	MONIT P14	4			1. following error tolerance > C1218/1	
2	MONIT P15	3			2. following error tolerance > C1218/2	
C1287		4	0 TRIP 4 Fail-QSP		**P06 monitoring** No reference	📖 8.31
1	MONIT P06					
C1288		4	0 TRIP 2 Warning 3 Off 4 Fail-QSP		**P12 monitoring** Exceeding the encoder range	
1	MONIT P12					
C1289			0 TRIP 2 Warning 3 Off 4 Fail-QSP		**Monitoring P17, P18**	📖 8.31
1	MONIT P17	4			Control error of touch probe	
2	MONIT P18	2			Internal limitation (display area, position limits, speeds)	
C1290			0 TRIP 2 Warning 3 Off 4 Fail-QSP		**P16 monitoring** Configuration of monitoring in the case of a sync error	📖 8.31
1	MONIT P16	4				
C1291			0 TRIP 4 Fail-QSP		**Monitoring P07, P08, P09**	📖 8.31
1	MONIT P07	4			PS mode absolute instead of relative	
2	MONIT P08	4			Actual reference dimension offset outside position limits	
3	MONIT P09	4			Impermissible programming	
C1292	MONIT P19	2	0 TRIP 2 Warning 3 Off		**P19 monitoring** Configuration of monitoring a limitation of the input value at DFIN	
C1298	P18 DIAGNOSTIC	Disp	0 No P18 source 1 C1223 2 C1224 3 C1240 4 C1250 5 V_norm 6 A_norm		**P18 diagnostics** Display of the code which has led to an internal limitation	📖 8.31
C1299		Disp	0	{1 pcs} 65535	**POS** Display of actual state of piece counter	See system manual (extension)
1	ACT. CNT					
2	ACT. CNT					
...	...					
32	ACT. CNT					
C1301			-214000,0000	{0.0001 units} 214000,0000	**POS** Entry of VTPOS position values	See system manual (extension)
1	VTPOS-VALUE	0				
2	VTPOS-VALUE	0				
...	...	...				
60	VTPOS-VALUE	0				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1302			0.01	{0.01 %vmax}	100.00	**POS** Input VTVEL speeds	See system manual (extension)
1	VTVEL-VALUE	10.00					
2	VTVEL-VALUE	20.00					
...	...	...					
10	VTVEL-VALUE	100.00					
...	...	...					
30	VTVEL-VALUE	100.00					
C1303			0.01	{0.01 %amax}	100.00	**POS** Input of VTACC accelerations/decelerations	See system manual (extension)
1	VTACC-VALUE	10.00					
2	VTACC-VALUE	20.00					
...	...	...					
10	VTACC-VALUE	100.00					
...	...	...					
30	VTACC-VALUE	100.00					
C1304			1	{1 pcs}	65535	**POS** Input VTPCS piece numbers	See system manual (extension)
1	VTPCS-VALUE	1					
...	...	...					
30	VTPCS-VALUE	30					
C1305			0	{0.001 s}	65535.000	**POS** Input VTTIME waiting times	See system manual (extension)
1	VTTIME-VALUE	1.000					
...	...	...					
30	VTTIME-VALUE	30.000					
C1311			0	No positioning/special function		**POS** Program set mode	See system manual (extension)
1	PS MODE	0	1	Absolute PS			
2	PS MODE	0	2	Relative PS			
3	PS MODE	0	3	Homing			
4	PS MODE	0	4	Set home position			
5	PS MODE	0	5	Set position value to target position (C1312)			
6	PS MODE	0	6	Absolute PS, TP positioning with E01			
7	PS MODE	0	7	Absolute PS, TP positioning with E02			
...	...	...	8	Absolute PS, TP positioning with E03			
25	PS MODE	0	9	Absolute PS, TP positioning with E04			
25	PS MODE	0	11	Relative PS, TP positioning with E01			
26	PS MODE	0	12	Relative PS, TP positioning with E02			
27	PS MODE	0	13	Relative PS, TP positioning with E03			
28	PS MODE	0	14	Relative PS, TP positioning with E04			
29	PS MODE	0	16	Acceptance of home position (C1227)			
28	PS MODE	0	30	Stand-by operation, cancel with STDBY-STP			
29	PS MODE	0	31	Stand-by operation, abort with TP E01 (+residual path)			
30	PS MODE	0	32	Stand-by operation, abort with TP E02 (+residual path)			
31	PS MODE	0	33	Stand-by operation, abort with TP E03 (+residual path)			
32	PS MODE	0	34	Stand-by operation, abort with TP E04 (+residual path)			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C1312			0	Real zero	**POS** Program set target position, number in VTPOS	See system manual (extension)
1	TARGET-NO	0	1	VTPOS-No 001		
2	TARGET-NO	0	2	VTPOS-No 002		
...	...	...	3	VTPOS-No 003		
32	TARGET-NO	0	...	...		
			104	VTPOS-No 104		
C1313			0	v-max	**POS** Program set traversing speed, number in VTVEL	See system manual (extension)
1	V-TRAVEL-NO	0	1	VTVEL-No 01		
2	V-TRAVEL-NO	0	2	VTVEL-No 02		
...	...	...	3	VTVEL-No 03		
32	V-TRAVEL-NO	0	...	...		
			34	VTVEL-No 34		
C1314			0	a-max	**POS** Program set acceleration, number in VTACC	See system manual (extension)
1	ACC-NO	0	1	VTACC-No 01		
2	ACC-NO	0	2	VTACC-No 02		
...	...	...	3	VTACC-No 03		
32	ACC-NO	0	...	...		
			34	VTACC-No 34		
C1315			0	a-max	**POS** Program set deceleration, number in VTACC	See system manual (extension)
1	DCC-NO	0	1	VTACC-No 01		
2	DCC-NO	0	2	VTACC-No 02		
...	...	...	3	VTACC-No 03		
32	DCC-NO	0	...	...		
			34	VTACC-No 34		
C1316			0	Standstill	**POS** Program set final speed, number in VTVEL	See system manual (extension)
1	V-FINAL-NO	0	1	VTVEL-No 01		
2	V-FINAL-NO	0	2	VTVEL-No 02		
...	...	...	3	VTVEL-No 03		
32	V-FINAL-NO	0	...	...		
			34	VTVEL-No 34		
C1318			0	Inactive	**POS** Wait for PFI, number of the PFI)	See system manual (extension)
1	WAIT-PFI-NO	0	1	PFI 01		
2	WAIT-PFI-NO	0	2	PFI 02		
...	...	...	...	...		
32	WAIT-PFI-NO	0	32	PFI 32		
C1319			0	LOW level	**POS** Level for Wait-PFI	See system manual (extension)
			1	HIGH level		
1	WAIT-LEVEL	0				
2	WAIT-LEVEL	0				
...	...	...				
32	WAIT-LEVEL	0				
C1320			0	Inactive	**POS** First switching PFO, number of the PFO • PFO1: Setting an output BEFORE the positioning	See system manual (extension)
1	PFO1-NO	0	1	PFO 01		
			2	PFO 02		
2	PFO1-NO	0	3	PFO 03		
			...	...		
...	...	...	31	PFO 31		
			32	PFO 32		
32	PFO1-NO	0	100	All PFO's		
			101	PFO 01 ... 08		
			102	PFO 09 ... 16		
			103	PFO 17 ... 24		
			104	PFO 25 ... 32		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C1321			0	LOW level	**POS** First switching PFO level	See system manual (extension)
			1	HIGH level		
1	PFO1-LEVEL	0				
2	PFO1-LEVEL	0				
...	...	...				
32	PFO1-LEVEL	0				
C1322			0	Inactive	**POS** Second switching PFO, number of the PFO ● PFO2: Setting an output AFTER the positioning	See system manual (extension)
			1	PFO 01		
1	PFO2-NO	0	2	PFO 02		
			3	PFO 03		
2	PFO2-NO	0	...	...		
			31	PFO 31		
...	...	...	32	PFO 32		
			100	All PFOs		
32	PFO2-NO	0	101	PFO 01 ... 08		
			102	PFO 09 ... 16		
			103	PFO 17 ... 24		
			104	PFO 25 ... 32		
C1323			0	LOW level	**POS** Second switching PFO level	See system manual (extension)
			1	HIGH level		
1	PFO2-LEVEL	0				
2	PFO2-LEVEL	0				
...	...	...				
32	PFO2-LEVEL	0				
C1324			0	Inactive	**POS,** Waiting time, number in VTTIME	See system manual (extension)
1	WAITTIME-NO	0	1	VTTIME-No 01		
2	WAITTIME-NO	0	2	VTTIME-No 02		
			3	VTTIME-No 03		
...	...	...	...	...		
32	WAITTIME-NO	0	34	VTTIME-No 34		
C1325			0	Inactive	**POS** Number of a PFI for branch 1	See system manual (extension)
1	JMP1-PFI-NO	0	1	PFI 01		
2	JMP1-PFI-NO	0	2	PFI 02		
			...	...		
...	...	...	32	PFI 32		
32	JMP1-PFI-NO	0				
C1326			0	LOW level	**POS** Level of a PFI for branch 1	See system manual (extension)
			1	HIGH level		
1	JMP1-LEVEL	0				
2	JMP1-LEVEL	0				
...	...	...				
32	JMP1-LEVEL	0				
C1327			0	Prg.-end	**POS** Branch 1 to a program set	See system manual (extension)
1	JMP1-PS	0	1	Ps 01		
2	JMP1-PS	0	2	Ps 02		
			3	Ps 03		
...	...	...	...	...		
32	JMP1-PS	0	32	Ps 32		
C1328			0	Inactive	**POS** Selection of a set piece number from VTPCS for the piece number repeat function	See system manual (extension)
1	JMP-PCS-NO	0	1	VTPCS-No 01		
2	JMP-PCS-NO	0	2	VTPCS-No 02		
			3	VTPCS-No 03		
...	...	...	...	...		
32	JMP-PCS-NO	0	34	VTPCS-No 34		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze	Selection			
C1329			0	Prg.-end	**POS** Branch to a program set if the piece number selected in VTPCS (C1328) has not been reached yet	See system manual (extension)
1	JMP-PCS-PS	0	1	PS 01		
2	JMP-PCS-PS	0	2	PS 02		
...	...	...	3	PS 03		
32	JMP-PCS-PS	0	...	...		
			32	PS 32		
C1330			0	Travel range	**Touch probe window** Selection of a window for touch probe. In this area the touch probe is ”sharp”.	
1	TP WINDOW	0	1	VTPOS-No 001		
2	TP WINDOW	0	2	VTPOS-No 002		
...	...	...	3	VTPOS-No 003		
32	TP WINDOW	0	...	...		
			104	VTPOS-No 104		
C1331			0	Target = TP position	**Residual touch probe path** Selection of a residual path from VTPOS for touch probe	
1	TP DISTANCE	0	1	VTPOS-No 001		
2	TP DISTANCE	0	2	VTPOS-No 002		
...	...	...	3	VTPOS-No 003		
32	TP DISTANCE	0	...	...		
			104	VTPOS-No 104		
C1333			0	Prg.-end	**POS** Branch to a program set if no touch probe has occurred until the target position (C1312) is reached	See system manual (extension)
1	JMP-TP-PS	0	1	PS 01		
2	JMP-TP-PS	0	2	PS 02		
...	...	...	3	PS 03		
32	JMP-TP-PS	0	...	...		
			32	PS 32		
C1334			0	Inactive	**POS** Number of a PFI for branch 2	See system manual (extension)
1	JMP2-PFI-NO		1	PFI 01		
2	JMP2-PFI-NO		2	PFI 02		
...	...		...	...		
32	JMP2-PFI-NO		32	PFI 32		
C1335			0	LOW level	**POS** Level of a PFI for branch 1	See system manual (extension)
1	JMP2-LEVEL	0	1	HIGH level		
2	JMP2-LEVEL	0				
...	...	...				
32	JMP2-LEVEL	0				
C1336			0	Prg.-end	**POS** Branch 2 to a program set	See system manual (extension)
1	JMP2-PS	0	1	PS 01		
2	JMP2-PS	0	2	PS 02		
...	...	...	3	PS 03		
32	JMP2-PS	0	...	...		
			32	PS 32		
C1349			0	Prg.-end	**POS** Unconditional branch to a program set	See system manual (extension)
1	JMP-PS	0	1	PS 01		
2	JMP-PS	0	2	PS 02		
...	...	...	3	PS 03		
32	JMP-PS	0	...	...		
			32	PS 32		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1350 STOP					→ Selection list 3	**VTPOS** Configuration of input signals	See system manual (extension)
1	VTPOS-IN1	1000	FIXED0INC				
...	...	...	...				
10	VTPOS-IN10	1000	FIXED0INC				
C1351		Disp	-2147483647	{1 inc}	2147483647	**VTPOS** Display of input signals	
1	VTPOS-IN1						
...	...						
10	VTPOS-IN10						
C1352 STOP					→ Selection list 3	**VTVEL** Configuration of input signals	See system manual (extension)
1	VTVEL-IN1	1000	FIXED0INC				
...	...	...	...				
4	VTVEL-IN4	1000	FIXED0INC				
C1353		Disp	-2147483647	{1}	2147483647	**VTVEL** Display of input signals	
1	VTVEL-IN1						
...	...						
4	VTVEL-IN4						
C1354 STOP					→ Selection list 3	**VTACC** Configuration of input signals	See system manual (extension)
1	VTACC-IN1	1000	FIXED0INC				
...	...	...	...				
4	VTACC-IN4	1000	FIXED0INC				
C1355		Disp	-2147483647	{1}	2147483647	**VTACC** Display of input signals	
1	VTACC-IN1						
...	...						
4	VTACC-IN4						
C1356 STOP					→ Selection list 1	**VTPCS** Configuration of analog input signals	See system manual (extension)
1	VTPCS-IN1	1000	FIXED0%				
...	...	...	...				
4	VTPCS-IN4	1000	FIXED0%				
C1357		Disp	-32768	{1}	32767	**VTPCS** Display of analog input signals	
1	VTPCS-IN1						
...	...						
4	VTPCS-IN4						
C1358					→ Selection list 1	**VTTIME** Configuration of analog input signals	See system manual (extension)
1	VTTIME-IN1	1000	FIXED0%				
...	...	...	...				
4	VTTIME-IN4	1000	FIXED0%				
C1359		Disp	-32768	{1}	32767	**VTTIME** Display of analog input signals	
1	VTTIME-IN1						
...	...						
4	VTTIME-IN4						

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C1360 STOP			→ selection list 2	**POS** Configuration of digital input signals	See system manual (extension)
1	POS-PRG-START	53	DIGIN3		
2	POS-PRG-STOP	20201	CAN-IN2.B0		
3	POS-PRG-RESET	55	DIGIN5		
4	POS-LIM-NEG	51	DIGIN1		
5	POS-LIM-POS	52	DIGIN2		
6	POS-MANUAL	55	DIGIN5		
7	POS-MANU-NEG	20202	CAN-IN2.B1		
8	POS-MANU-POS	20203	CAN-IN2.B2		
9	POS-MANU-REF	20204	CAN-IN2.B3		
10	POS-REF-MARK	54	DIGIN4		
11	POS-TP1-ENABL-TP1	1000	FIXED0		
12	POS-TP2-ENABL-TP2	1000	FIXED0		
13	POS-TP3-ENABL-TP3	1000	FIXED0		
14	POS-TP4-ENABL-TP4	1000	FIXED0		
15	POS-PS-CANCEL	20208	CAN-IN2.B7		
16	POS-STDBY-STP	20205	CAN-IN2.B4		
17	POS-S-RAMPS	19522	FCODE-471.B1		
18	POS-PARAM-RD	20206	CAN-IN2.B5		
19	POS-LOOP-INH	20207	CAN-IN2.B6		
20	POS-PSET-SWT	1000	FIXED0		
21	POS-ABS-SET	1000	FIXED0		
22	POS-WAITSTATE	1000	FIXED0		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C1361		Disp		**POS** Display of digital input signals	See system manual (extension)
1	POS-PRG-START				
2	POS-PRG-STOP				
3	POS-PRG-RESET				
4	POS-LIM-NEG				
5	POS-LIM-POS				
6	POS-MANUAL				
7	POS-MANU-NEG				
8	POS-MANU-POS				
9	POS-MANU-REF				
10	POS-REF-MARK				
11	POS-TP1-ENABL-TP1				
12	POS-TP2-ENABL-TP2				
13	POS-TP3-ENABL-TP3				
14	POS-TP4-ENABL-TP4				
15	POS-PS-CANCEL				
16	POS-STDBY-STP				
17	POS-S-RAMPS				
18	POS-PARAM-RD				
19	POS-LOOP-INH				
20	POS-PSET-SWT				
21	POS-ABS-SET				
22	POS-WAITSTATE				
C1362 STOP			→ Selection list 1	**POS** Configuration of analog input signals	See system manual (extension)
1	POS-START-PS	19517	FCODE-1211		
2	POS-V-OVERRID	1006	FIXED100%		
3	POS-A-OVERRID	1006	FIXED100%		
4	POS-N-IN	1000	FIXED0%		
5	POS-NOUT-GAIN	1006	FIXED100%		
6	POS-M-IN	1000	FIXED0%		
7	POS-MOUT-GAIN	1000	FIXED0%		
8	POS-JERK-RED	1006	FIXED100%		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1363		Disp	-32768	{1}	32767	**POS** Display of analog input signals	See system manual (extension)
1	POS-START-PS						
2	POS-V-OVERRID						
3	POS-A-OVERRID						
4	POS-N-IN						
5	POS-NOUT-GAIN						
6	POS-M-IN						
7	POS-MOUT-GAIN						
8	POS-JERK-RED						
C1364 STOP			→ Selection list 3			**POS** Configuration of input signals	See system manual (extension)
1	POS-PSET-EXT	1000	FIXED0INC				
2	POS-ABS-IN	5000	MCTRL-PHI-ANG				
3	POS-P-IN	1000	FIXED0INC				
C1365		Disp	-2147483647	{1 inc}	2147483647	**POS** Display of input signals	See system manual (extension)
1	POS-PSET-EXT						
2	POS-ABS-IN						
3	POS-P-IN						
C1370 STOP			→ selection list 2			**POS** Configuration of digital input signals	See system manual (extension)
1	POS-PFI	20201	CAN-IN2.B0				
2	POS-PFI	20202	CAN-IN2.B1				
...	...	...	...				
30	POS-PFI	20230	CAN-IN2.B29				
31	POS-PFI	53	DIGIN3				
32	POS-PFI	54	DIGIN4				
C1371		Disp				**POS** Display of digital input signals	
1	POS-PFI-LOW					LOW-WORD	
2	POS-PFI-HIGH					HIGH-WORD	
C1372		Disp				**POS** Display of digital input signals	
1	POS-PFO-LOW					LOW-WORD	
2	POS-PFO-HIGH					HIGH-WORD	
C1380		Disp	-214000.0000	{0.0001 units}	214000.0000	**VTPOS** Display of the table position with the position values	See system manual (extension)
1	VTPOS1						
...	...						
104	VTPOS104						
C1381		Disp	-2147483647	{1 inc}	2147483647	**VTPOS** Display of the table positions with the position values	
1	VTPOS1						
...	...						
104	VTPOS104						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1382		Disp	0.01	{0.01 %vmax}	100.00	**VTVEL** Display of the table positions with the values for the speed in [%] of v_{max}	See system manual (extension)
1	VTVEL1						
...	...						
34	VTVEL34						
C1383		Disp	-2147483647	2^{-14} inc/ms	2147483647	**VTVEL** Display of the table positions with the values for the speed in [inc]	
1	VTVEL1						
...	...						
34	VTVEL34						
C1384		Disp	0.01	{0.01 %amax}	100.00	**VTACC** Display of the table positions with the values for acceleration and deceleration in [%] of a_{max}	See system manual (extension)
1	VTACC1						
...	...						
34	VTACC34						
C1385		Disp	-2147483647	2^{-14} inc/ms^2	2147483647	**VTACC** Display of the table positions with the values for the acceleration and deceleration in [inc]	
1	VTACC1						
...	...						
34	VTACC34						
C1386		Disp	0	{1 pcs}	65535	**VTPCS** Display of the table positions with the piece numbers	See system manual (extension)
1	VTPCS1						
...	...						
34	VTPCS34						
C1387		Disp	0.000	{0.001 s}	65535.000	**VTTIME** Display of the table positions with the waiting times	See system manual (extension)
1	VTTIME1						
...	...						
34	VTTIME34						
C1400 STOP					→ selection list 2	**TEACH1** Configuration of digital input signals	See system manual (extension)
1	TEACH1-SET	1000	FIXED0				
2	TEACH1-NEXT	1000	FIXED0				
3	TEACH1-CLR	1000	FIXED0				
4	TEACH1-LOAD	1000	FIXED0				
C1401 STOP					→ Selection list 3	**TEACH1** Configuration of input signals	
1	TEACH1-L-IN	1000	FIXED0INC				
C1402		Disp	0	{1}	1	**TEACH1** Display of digital input signals	
1	TEACH1-SET						
2	TEACH1-NEXT						
3	TEACH1-CLR						
4	TEACH1-LOAD						
C1403	TEACH1-CNT	Disp	0	{1}	65535	**TEACH1** Display of analog output signal	See system manual (extension)
C1404		Disp	-2147483647	{1 inc}	2147483647	**TEACH1** Display of input signals	
1	TEACH1-L-IN						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1405 STOP					→ Selection list 1	**TEACH1** Configuration - analog input signal	See system manual (extension)
1	TEACH1-LDVAL	1000	FIXED0%				
C1406		Disp	-32768	{1}	32768	**TEACH1** Display of analog input signal	
1	TEACH1-LDVAL						
C1500	OUTPUT SIGNAL	Disp	-2147483648	{1}	2147483647	**FEVAN2** Signal output	See system manual (extension)
C1501	FEVAN2 CODE	141	2	{1}	2000	**FEVAN2** Target code of FEVAN2	
C1502	FEVAN2 SUBCODE	0	0	{1}	255	**FEVAN2** Target subcode FEVAN2	
C1503	FEVAN2 NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN2** Numerator	
C1504	FEVAN2 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN2** Denominator	
C1505	FEVAN2 OFFSET	0	0		1000000000	**FEVAN2** Offset	
C1506 STOP	FEVAN2-IN	1000	FIXED0%		→ Selection list 1	**FEVAN2** Configuration - analog input signal	See system manual (extension)
C1507 STOP					→ selection list 2	**FEVAN2** Configuration of digital input signals	
1	FEVAN2-LOAD	1000	FIXED0				
2	FEVAN2-BUSY-IN	1000	FIXED0				
3	FEVAN2-FAIL-IN	1000	FIXED0				
C1508	FEVAN2-IN	Disp	-32768	{1}	32767	**FEVAN2** Display of analog input signal	
C1509		Disp				**FEVAN2** Display of digital input signals	
1	FEVAN2-LOAD						
2	FEVAN2-BUSY-IN						
3	FEVAN2-FAIL-IN						
C1510	OUTPUT SIGNAL		-2147483648	{1}	2147483647	**FEVAN3** Signal output	See system manual (extension)
C1511	FEVAN3 CODE	141	2	{1}	2000	**FEVAN3** Target code of FEVAN3	
C1512	FEVAN3 SUBCODE	0	0	{1}	255	**FEVAN3** Target subcode FEVAN3	
C1513	FEVAN3 NUMERATOR	1,0000	0.0001	{0.0001}	100000,0000	**FEVAN3** Numerator	
C1514	FEVAN3 DENOMINATOR	0,0001	0,0001	{0,0001}	100000,0000	**FEVAN3** Denominator	
C1515	FEVAN3 OFFSET	0	0		1000000000	**FEVAN3** Offset	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1516 STOP	FEVAN3-IN	1000	FIXED0%		→ Selection list 1	**FEVAN3** Configuration - analog input signal	See system manual (extension)
C1517 STOP					→ selection list 2	**FEVAN3** Configuration of digital input signals	
1	FEVAN3-LOAD	1000	FIXED0				
2	FEVAN3-BUSY-IN	1000	FIXED0				
3	FEVAN3-FAIL-IN	1000	FIXED0				
C1518	FEVAN3-IN	Disp	-32768	{1}	32767	**FEVAN3** Display of analog input signal	
C1519		Disp				**FEVAN3** Display of digital input signals	
1	FEVAN3-LOAD						
2	FEVAN3-BUSY-IN						
3	FEVAN3-FAIL-IN						
C1520	OUTPUT SIGNAL		-2147483648	{1}	2147483647	**FEVAN4** Signal output	See system manual (extension)
C1521	FEVAN4 CODE	141	2	{1}	2000	**FEVAN4** Target code of FEVAN4	
C1522	SUBCODE	0	0	{1}	255	**FEVAN4** Target subcode FEVAN4	
C1523	FEVAN4 NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN4** Numerator	
C1524	FEVAN4 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN4** Denominator	
C1525	FEVAN4 OFFSET	0	0		1000000000	**FEVAN4** Offset	
C1526 STOP	FEVAN4-IN	1000	FIXED0%		→ Selection list 1	**FEVAN4** Configuration - analog input signal	See system manual (extension)
C1527 STOP					→ selection list 2	**FEVAN4** Configuration of digital input signals	
1	FEVAN4-LOAD	1000	FIXED0				
2	FEVAN4-BUSY-IN	1000	FIXED0				
3	FEVAN4-FAIL-IN	1000	FIXED0				
C1528	FEVAN4-IN	Disp	-32768	{1}	32767	**FEVAN4** Display of analog input signal	
C1529		Disp				**FEVAN4** Display of digital input signals	
1	FEVAN4-LOAD						
2	FEVAN4-BUSY-IN						
3	FEVAN4-FAIL-IN						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1530	OUTPUT SIGNAL		-2147483648	{1}	2147483647	**FEVAN5** Signal output	See system manual (extension)
C1531	FEVAN5 CODE	141	2	{1}	2000	**FEVAN5** Target code of FEVAN5	
C1532	FEVAN5 SUBCODE	0	0	{1}	255	**FEVAN5** Target subcode FEVAN5	
C1533	FEVAN5 NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN5** Numerator	
C1534	FEVAN5 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**FEVAN5** Denominator	
C1535	FEVAN5 OFFSET	0	0		1000000000	**FEVAN5** Offset	
C1536 STOP	FEVAN5-IN	1000	FIXED0%		→ Selection list 1	**FEVAN5** Configuration - analog input signal	See system manual (extension)
C1537 STOP					→ selection list 2	**FEVAN5** Configuration of digital input signals	
1	FEVAN5-LOAD	1000	FIXED0				
2	FEVAN5-BUSY-IN	1000	FIXED0				
3	FEVAN5-FAIL-IN	1000	FIXED0				
C1538	FEVAN5-IN	Disp	-32768	{1}	32767	**FEVAN5** Display of analog input signal	
C1539		Disp				**FEVAN5** Display of digital input signals	
1	FEVAN5-LOAD						
2	FEVAN5-BUSY-IN						
3	FEVAN5-FAIL-IN						
C1540	OUTPUT SIGNAL		-2147483648	{1}	2147483647	**FEVAN6** Signal output	See system manual (extension)
C1541	FEVAN6 CODE	141	2	{1}	2000	**FEVAN6** Target code of FEVAN6	
C1542	FEVAN6 SUBCODE	0	0	{1}	255	**FEVAN6** Target subcode FEVAN6	
C1543	FEVAN6 NUMERATOR	1.0000	0.0001	{0.0001}	100000.0000	**FEVAN6** Numerator	
C1544	FEVAN6 DENOMINATOR	0.0001	0,0001	{0.0001}	100000.0000	**FEVAN6** Denominator	
C1545	FEVAN6 OFFSET	0	0		1000000000	**FEVAN6** Offset	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C1546 STOP	FEVAN6-IN	1000	FIXED0% → Selection list 1	**FEVAN6** Configuration - analog input signal	See system manual (extension)
C1547 STOP			→ selection list 2	**FEVAN6** Configuration of digital input signals	
1	FEVAN6-LOAD	1000	FIXED0		
2	FEVAN6-BUSY-IN	1000	FIXED0		
3	FEVAN6-FAIL-IN	1000	FIXED0		
C1548	FEVAN6-IN	Disp	-32768 {1} 32767	**FEVAN6** Display of analog input signal	
C1549		Disp		**FEVAN6** Configuration of digital input signals	
1	FEVAN6-LOAD				
2	FEVAN6-BUSY-IN				
3	FEVAN6-FAIL-IN				
C1550	ARITPH4 FUNCTION	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH4** Arithmetic function selection	See system manual (extension)
C1551 STOP			→ Selection list 3	**ARITPH4** Configuration of input signals	
1	ARITPH4-IN1	1000	FIXED0INC		
2	ARITPH4-IN2	1000	FIXED0INC		
C1552		Disp	-2147483647 {1} 2147483647	**ARITPH4** Display of input signals	
1	ARITPH4-IN1				
2	ARITPH4-IN2				
C1555	ARITPH5 FUNCTION	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)	**ARITPH5** Arithmetic function selection	See system manual (extension)
C1556 STOP			→ Selection list 3	**ARITPH5** Configuration of input signals	
1	ARITPH5-IN1	1000	FIXED0INC		
2	ARITPH5-IN2	1000	FIXED0INC		
C1557		Disp	-2147483647 {1} 2147483647	**ARITPH5** Display of input signals	
1	ARITPH5-IN1				
2	ARITPH5-IN2				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1560	ARITPH6 FUNCTION	1	0 OUT = IN1 1 OUT = IN1 + IN2 2 OUT = IN1 - IN2 3 OUT = IN1 × IN2 / 2^{30} 13 OUT = IN1 × IN2 14 OUT = IN1 / IN2 15 OUT = IN1 % IN2 21 OUT = IN1 + IN2 (no limit) 22 OUT = IN1 - IN2 (no limit)			**ARITPH6** Arithmetic function selection	See system manual (extension)
C1561 STOP		1000			→ Selection list 3	**ARITPH6** Configuration of input signals	
1	ARITPH6-IN1	1000	FIXED0INC				
2	ARITPH6-IN2	1000	FIXED0INC				
C1562		Disp	-2147483647	{1}	2147483647	**ARITPH6** Display of input signals	
1	ARITPH6-IN1						
2	ARITPH6-IN2						
C1570 STOP					→ selection list 2	**CONVDA1** Configuration of digital input signals	See system manual (extension)
1	CONVDA1-B0	1000	FIXED0				
2	CONVDA1-B1	1000	FIXED0				
3	CONVDA1-B2	1000	FIXED0				
4	CONVDA1-B3	1000	FIXED0				
5	CONVDA1-B4	1000	FIXED0				
6	CONVDA1-B5	1000	FIXED0				
7	CONVDA1-B6	1000	FIXED0				
8	CONVDA1-B7	1000	FIXED0				
9	CONVDA1-B8	1000	FIXED0				
10	CONVDA1-B9	1000	FIXED0				
11	CONVDA1-B10	1000	FIXED0				
12	CONVDA1-B11	1000	FIXED0				
13	CONVDA1-B12	1000	FIXED0				
14	CONVDA1-B13	1000	FIXED0				
15	CONVDA1-B14	1000	FIXED0				
16	CONVDA1-SIGN	1000	FIXED0				
C1571	RESULT	Disp	0	{1 hex}	65536	**CONVDA1** Display of the result	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1573 STOP					→ selection list 2	**CONVDA2** Configuration of digital input signals	See system manual (extension)
1	CONVDA2-B0	1000	FIXED0				
2	CONVDA2-B1	1000	FIXED0				
3	CONVDA2-B2	1000	FIXED0				
4	CONVDA2-B3	1000	FIXED0				
5	CONVDA2-B4	1000	FIXED0				
6	CONVDA2-B5	1000	FIXED0				
7	CONVDA2-B6	1000	FIXED0				
8	CONVDA2-B7	1000	FIXED0				
9	CONVDA2-B8	1000	FIXED0				
10	CONVDA2-B9	1000	FIXED0				
11	CONVDA2-B10	1000	FIXED0				
12	CONVDA2-B11	1000	FIXED0				
13	CONVDA2-B12	1000	FIXED0				
14	CONVDA2-B13	1000	FIXED0				
15	CONVDA2-B14	1000	FIXED0				
16	CONVDA2-SIGN	1000	FIXED0				
C1574	RESULT	Disp	0	{1 hex}	65536	**CONVDA2** Display of the result	
C1576 STOP					→ selection list 2	**CONVDA3** Configuration of digital input signals	See system manual (extension)
1	CONVDA3-B0	1000	FIXED0				
2	CONVDA3-B1	1000	FIXED0				
3	CONVDA3-B2	1000	FIXED0				
4	CONVDA3-B3	1000	FIXED0				
5	CONVDA3-B4	1000	FIXED0				
6	CONVDA3-B5	1000	FIXED0				
7	CONVDA3-B6	1000	FIXED0				
8	CONVDA3-B7	1000	FIXED0				
9	CONVDA3-B8	1000	FIXED0				
10	CONVDA3-B9	1000	FIXED0				
11	CONVDA3-B10	1000	FIXED0				
12	CONVDA3-B11	1000	FIXED0				
13	CONVDA3-B12	1000	FIXED0				
14	CONVDA3-B13	1000	FIXED0				
15	CONVDA3-B14	1000	FIXED0				
16	CONVDA3-SIGN	1000	FIXED0				
C1577	RESULT	Disp	0	{1 hex}	65536	**CONVDA3** Display of the result	
C1580 STOP	CONVAD1-IN	1000	FIXED0%		→ Selection list 1	**CONVAD1** Configuration - analog input signal	See system manual (extension)
C1581	CONVAD1-IN	Disp	-32768	{1}	32767	**CONVAD1** Display of analog input signal	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1582 STOP	CONVAD2-IN	1000	FIXED0%		→ Selection list 1	**CONVAD2** Configuration - analog input signal	See system manual (extension)
C1583	CONVAD2-IN	Disp	-32768	{1}	32767	**CONVAD2** Display of analog input signal	
C1590	CONVAPH1 NUMERATOR	1	-32767	{1}	32767	**CONVAPH1** Numerator	See system manual (extension)
C1591	CONVAPH1 DENUMERATOR	1	1	{1}	32767	**CONVAPH1** Denominator	
C1593 STOP	CONVAPH1-IN	1000	FIXED0%		→ Selection list 1	**CONVAPH1** Configuration - analog input signal	
C1594	CONVAPH1-IN	Disp	-32768	{1}	32767	**CONVAPH1** Display of analog input signal	
C1595	CONVAPH2 NUMERATOR	1	-32767	{1}	32767	**CONVAPH2** Numerator	See system manual (extension)
C1596	CONVAPH2 DENUMERATOR	1	1	{1}	32767	**CONVAPH2** Denominator	
C1598 STOP	CONVAPH2-IN	1000	FIXED0%		→ Selection list 1	**CONVAPH2** Configuration - analog input signal	
C1599	CONVAPH2-IN	Disp	-32768	{1}	32767	**CONVAPH2** Display of analog input signal	
C1600	CONVAPH3 NUMERATOR	1	-32767	{1}	32767	**CONVAPH3** Numerator	See system manual (extension)
C1601	CONVAPH3 DENUMERATOR	1	1	{1}	32767	**CONVAPH3** Denominator	
C1603 STOP	CONVAPH3-IN	1000	FIXED0%		→ Selection list 1	**CONVAPH3** Configuration - analog input signal	
C1604	CONVAPH3-IN	Disp	-32768	{1}	32767	**CONVAPH3** Display of analog input signal	
C1610		1	0	{1}	31	**CONVPHA2** Division factor	See system manual (extension)
C1611 STOP	CONVPHA2-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHA2** Configuration of input signal	
C1612	CONVPHA2-IN	Disp				**CONVPHA2** Display of input signal	
C1615		1	0	{1}	31	**CONVPHA3** Division factor	See system manual (extension)
C1616 STOP	CONVPHA3-IN	1000	FIXED0INC		→ Selection list 3	**CONVPHA3** Configuration of input signal	
C1617	CONVPHA3-IN	Disp				**CONVPHA3** Display of input signal	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze	Selection		
C1640 STOP	SP1-RESET	1000	FIXED0 → selection list 2	**SP1** Configuraton of digital input signal	See system manual (extension)
C1641			0 Real zero 1 VTPOS-No 001 ... ... 104 VTPOS-No 104	**SP1**	
1	SP1-VALUE 1-1	1		Switching point output SP1-STAT1	
2	SP1-VALUE 1-2	1			
3	SP1-VALUE 2-1	1		Switching point output SP1-STAT2	
4	SP1-VALUE 2-2	1			
5	SP1-VALUE 3-1	1		Switching point output SP1-STAT3	
6	SP1-VALUE 3-2	1			
7	SP1-VALUE 4-1	1		Switching point output SP1-STAT4	
8	SP1-VALUE 4-2	1			
9	SP1-VALUE 5-1	1		Switching point output SP1-STAT5	
10	SP1-VALUE 5-2	1			
11	SP1-VALUE 6-1	1		Switching point output SP1-STAT6	
12	SP1-VALUE 6-2	1			
13	SP1-VALUE 7-1	1		Switching point output SP1-STAT8	
14	SP1-VALUE 7-2	1			
15	SP1-VALUE 8-1	1		Switching point output SP1-STAT8	
16	SP1-VALUE 8-2	1			
C1642 STOP	SP1-L-IN	1000	FIXED0INC → Selection list 3	**SP1** Configuration of input signal	
C1643	SP1-RESET	Disp	0 1	**SP1** Display of digital input signal	
C1644	SP1-L-IN	Disp	-1073741824 {1 inc} 1073741823	**SP1** Display of input signal	
C1645	SP1-MODE	0	0 Starting point and final point 1 Centre with switch range	**SP1** Setting of the switching points	

Code		Possible settings		IMPORTANT
No.	Designation	Lenze	Selection	
C1650 STOP	SP2-RESET	1000	FIXED0 → selection list 2	**SP2** Configuraton of digital input signal
C1651			0 Real zero 1 VTPOS-No 001 ... ... 104 VTPOS-No 104	**SP2**
1	SP2-VALUE 1-1	1		Switching point output SP2-STAT1
2	SP2-VALUE 1-2	1		
3	SP2-VALUE 2-1	1		Switching point output SP2-STAT2
4	SP2-VALUE 2-2	1		
5	SP2-VALUE 3-1	1		Switching point output SP2-STAT3
6	SP2-VALUE 3-2	1		
7	SP2-VALUE 4-1	1		Switching point output SP2-STAT4
8	SP2-VALUE 4-2	1		
9	SP2-VALUE 5-1	1		Switching point output SP2-STAT5
10	SP2-VALUE 5-2	1		
11	SP2-VALUE 6-1	1		Switching point output SP2-STAT6
12	SP2-VALUE 6-2	1		
13	SP2-VALUE 7-1	1		Switching point output SP2-STAT8
14	SP2-VALUE 7-2	1		
15	SP2-VALUE 8-1	1		Switching point output SP2-STAT8
16	SP2-VALUE 8-2	1		
C1652 STOP	SP2-L-IN	1000	FIXED0INC → Selection list 3	**SP2** Configuration of input signal
C1653	SP2-RESET	Disp	0 1	**SP2** Display of digital input signal
C1654	SP2-L-IN	Disp	-1073741824 {1 inc} 1073741823	**SP2** Display of input signal
C1655	SP2-MODE	0	0 Starting point and final point 1 Centre with switch range	**SP2** Setting of the switching points
C1657			-30000 {1 ms} 30000	**SP2** Dead time
1	DEAD TIME	0		
...	...	0		
4	DEAD TIME	0		
C1658	HYSTERESIS	0	-32767 {1 inc} 32767	**SP2** Hysteresis
C1659	FILTER	1	0 Filter off 1 Filter 1 ms 2 Filter 2 ms 4 Filter 4 ms 8 Filter 8 ms 16 Filter 16 ms	**SP2** Filters

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1660	ACT. SELECTION	Disp	0	{1}	8	**SELPH1** Shows which input is currently switched to SELPH1-OUT	
C1661 STOP	SELPH1-SELECT	1000	FIXED0%		→ Selection list 1	**SELPH1** Configuration - analog input signal	
C1662 STOP					→ Selection list 3	**SELPH1** Configuration of input signals	
1	SELPH1-IN1	1000	FIXED0INC				
...	...	1000	FIXED0INC				
8	SELPH1-IN8	1000	FIXED0INC				
C1663	SELPH1-SELECT	Disp	-32768	{1}	32767	**SELPH1** Display of analog input signal	
C1664		Disp	-2147483648	{1 inc}	147483647	**SELPH1** Display of input signals	
1	SELPH1-IN1						
...	...						
8	SELPH1-IN8						
C1665	ACT. SELECTION	Disp	0	{1}	8	**SELPH2** Shows which input is currently switched to SELPH2-OUT	See system manual (extension)
C1666 STOP	SELPH2-SELECT	1000	FIXED0%		→ Selection list 1	**SELPH2** Configuration - analog input signal	
C1667 STOP					→ Selection list 3	**SELPH2** Configuration of input signals	
1	SELPH2-IN1	1000	FIXED0INC				
...	...	1000	FIXED0INC				
8	SELPH2-IN8	1000	FIXED0INC				
C1668	SELPH2-SELECT	Disp	-32768	{1}	32767	**SELPH2** Display of analog input signal	
C1669		Disp	-2147483648	{1 inc}	147483647	**SELPH2** Display of input signals	
1	SELPH2-IN1						
...	...						
8	SELPH2-IN8						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1670	CMPPH1-FUNCTION	1	1 IN1 = IN2 2 IN1 > IN2 3 IN1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMPPH1** Selection of the function for comparing two phase signals	See system manual (extension)
C1671	CMPPH1-HYSTERESIS	50	0	{1 inc}	1073741824	**CMPPH1** Hysteresis to compensate an oscillating output signal due to unstable input signals	
C1672	CMPPH1-WINDOW	0	0	{1 inc}	1073741824	**CMPPH1** Window within which the phase signals comply with each other	
C1673 STOP					→ Selection list 3	**CMPPH1** Configuration of input signals	
1	CMPPH1-IN1	1000	FIXED0INC				
2	CMPPH1-IN2	1000	FIXED0INC				
C1674		Disp	-2147483647	{1 inc}	2147483647	**CMPPH1** Display of input signals	
1	CMPPH1-IN1						
2	CMPPH1-IN2						
C1675	CMPPH2-FUNCTION	1	1 IN1 = IN2 2 IN1 > IN2 3 IN1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMPPH2** Selection of the function for comparing two phase signals	See system manual (extension)
C1676	CMPPH2-HYSTERESIS	50	0	{1 inc}	1073741824	**CMPPH2** Hysteresis to compensate an oscillating output signal due to unstable input signals	
C1677	CMPPH2-WINDOW	0	0	{1 inc}	1073741824	**CMPPH2** Window within which the phase signals comply with each other	
C1678 STOP					→ Selection list 3	**CMPPH2** Configuration of input signals	
1	CMPPH2-IN1	1000	FIXED0INC				
2	CMPPH2-IN2	1000	FIXED0INC				
C1679		Disp	-2147483647	{1 inc}	2147483647	**CMPPH2** Display of input signals	
1	CMPPH2-IN1						
2	CMPPH2-IN2						
C1680	CMPPH3-FUNCTION	1	1 IN1 = IN2 2 IN1 > IN2 3 IN1 < IN2 4 |IN1| = |IN2| 5 |IN1| > |IN2| 6 |IN1| < |IN2|			**CMPPH3** Selection of the function for comparing two phase signals	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1681	CMPPH3-HYSTERESIS	50	0	{1 inc}	1073741824	**CMPPH3** Hysteresis to compensate an oscillating output signal due to unstable input signals	See system manual (extension)
C1682	CMPPH3-WINDOW	0	0	{1 inc}	1073741824	**CMPPH3** Window within which the phase signals comply with each other	
C1683 STOP					→ Selection list 3	**CMPPH3** Configuration of input signals	
1	CMPPH3-IN1	1000	FIXED0INC				
2	CMPPH3-IN2	1000	FIXED0INC				
C1684		Disp	-2147483647	{1 inc}	2147483647	**CMPPH3** Display of input signals	
1	CMPPH3-IN1						
2	CMPPH3-IN2						
C1690 STOP					→ Selection list 1	**DISA** Configuration of analog input signals	See system manual (extension)
1	DISA-IN1	1000	FIXED0%				
...	...	...	...				
10	DISA-IN10	1000	FIXED0%				
C1691		Disp	-199.99	{0.01 %}	199.99	**DISA** Display of the input signals in the analog format	
1	DISA-IN (%)1						
...	...						
10	DISA-IN (%)10						
C1692		Disp	-32768	{1}	32768	**DISA** Display of the input signals in the decimal format	
1	DISA-IN (VALUE)1						
...	...						
10	DISA-IN (VALUE)10						
C1693		Disp	0	{1 hex}	65536	**DISA** Display of the input signals in the hexadecimal format	
1	DISA-IN (HEX)1						
...	...						
10	DISA-IN (HEX)10						
C1695 STOP					→ Selection list 3	**DISPH** Configuration of input signals	See system manual (extension)
1	DISPH-IN1	1000	FIXED0INC				
...	...	...	FIXED0INC				
10	DISPH-IN10	1000	FIXED0INC				
C1696		Disp	-2147483647	{1 inc}	2147483647	**DISPH** Display of input signals	
1	DISPH-IN1						
...	...						
10	DISPH-IN10						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1700		Disp	-2147483647	{1}	2147483647	**BCD1**	See system manual (extension)
1	OUTPUT SIGNAL					Display of output signal	
2	BCD RESULT					Display of the output signal after the evaluation with C1703/C1704 and C1705	
C1701	BCD1 CODE	141	11	{1}	2000	**BCD1** Code	
C1702	BCD1 SUBCODE	0	0	{1}	255	**BCD1** Subcode	
C1703	BCD1 NUMERATOR	1	0	{1}	100000	**BCD1** Numerator	
C1704	BCD1 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**BCD1** Denominator	
C1705	BCD1 OFFSET	0	0	{1}	1000000000	**BCD1** Offset	
C1706	BCD MODE	0	0 Without acceptance signal 1 With acceptance signal			**BCD1** Mode	
C1707	BCD DELAY	10	0	{1 ms}	255	**BCD1** Deceleration	
C1708 STOP					→ selection list 2	**BCD1** Configuration of digital input signals	See system manual (extension)
1	BCD1-READ	1000	FIXED0				
2	BCD1-DATA1	1000	FIXED0				
3	BCD1-DATA2	1000	FIXED0				
4	BCD1-DATA3	1000	FIXED0				
5	BCD1-DATA4	1000	FIXED0				
6	BCD1-LOAD	1000	FIXED0				
7	BCD1-BUSY-IN	1000	FIXED0				
8	BCD1-FAIL-IN	1000	FIXED0				
C1709		Disp	0		1	**BCD1** Display of digital input signals	
1	BCD1-READ						
2	BCD1-DATA1						
3	BCD1-DATA2						
4	BCD1-DATA3						
5	BCD1-DATA4						
6	BCD1-LOAD						
7	BCD1-BUSY-IN						
8	BCD1-FAIL-IN						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1710		Disp	-2147483647	{1}	2147483647	**BCD2**	See system manual (extension)
1	OUTPUT SIGNAL					Display of output signal	
2	BCD RESULT					Display of the output signal after the evaluation with C1703/C1704 and C1705	
C1711	BCD2 CODE	141	11	{1}	2000	**BCD2** Code	
C1712	BCD2 SUBCODE	0	0	{1}	255	**BCD2** Subcode	
C1713	BCD2 NUMERATOR	1	0	{1}	100000	**BCD2** Numerator	
C1714	BCD2 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**BCD2** Denominator	
C1715	BCD2 OFFSET	0	0	{1}	1000000000	**BCD2** Offset	
C1716	BCD MODE	0	0 Without acceptance signal 1 With acceptance signal			**BCD2** Mode	
C1717	BCD DELAY	10	0	{1 ms}	255	**BCD2** Deceleration	
C1718 STOP					→ selection list 2	**BCD2** Configuration of digital input signals	See system manual (extension)
1	BCD2-READ	1000	FIXED0				
2	BCD2-DATA1	1000	FIXED0				
3	BCD2-DATA2	1000	FIXED0				
4	BCD2-DATA3	1000	FIXED0				
5	BCD2-DATA4	1000	FIXED0				
6	BCD2-LOAD	1000	FIXED0				
7	BCD2-BUSY-IN	1000	FIXED0				
8	BCD2-FAIL-IN	1000	FIXED0				
C1719		Disp	0		1	**BCD2** Display of digital input signals	
1	BCD2-READ						
2	BCD2-DATA1						
3	BCD2-DATA2						
4	BCD2-DATA3						
5	BCD2-DATA4						
6	BCD2-LOAD						
7	BCD2-BUSY-IN						
8	BCD2-FAIL-IN						

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze	Selection				
C1720		Disp	-2147483647	{1}	2147483647	**BCD3**	See system manual (extension)
1	OUTPUT SIGNAL					Display of output signal	
2	BCD RESULT					Display of the output signal after the evaluation with C1703/C1704 and C1705	
C1721	BCD3 CODE	141	11	{1}	2000	**BCD3** Code	
C1722	BCD3 SUBCODE	0	0	{1}	255	**BCD3** Subcode	
C1723	BCD3 NUMERATOR	1	0	{1}	100000	**BCD3** Numerator	
C1724	BCD3 DENOMINATOR	0.0001	0.0001	{0.0001}	100000.0000	**BCD3** Denominator	
C1725	BCD3 OFFSET	0	0	{1}	1000000000	**BCD3** Offset	
C1726	BCD MODE	0	0 1	Without acceptance signal With acceptance signal		**BCD3** Mode	
C1727	BCD DELAY	10	0	{1 ms}	255	**BCD3** Deceleration	
C1728 STOP					→ selection list 2	**BCD3** Configuration of digital input signals	See system manual (extension)
1	BCD3-READ	1000	FIXED0				
2	BCD3-DATA1	1000	FIXED0				
3	BCD3-DATA2	1000	FIXED0				
4	BCD3-DATA3	1000	FIXED0				
5	BCD3-DATA4	1000	FIXED0				
6	BCD3-LOAD	1000	FIXED0				
7	BCD3-BUSY-IN	1000	FIXED0				
8	BCD3-FAIL-IN	1000	FIXED0				
C1729		Disp	0		1	**BCD3** Display of digital input signals	
1	BCD3-READ						
2	BCD3-DATA1						
3	BCD3-DATA2						
4	BCD3-DATA3						
5	BCD3-DATA4						
6	BCD3-LOAD						
7	BCD3-BUSY-IN						
8	BCD3-FAIL-IN						
C1799	DFOUT F_{MAX} [KHZ]	1250	20	{1}	1250	**DFOUT f_{max} (kHz)** 1250 corresponds to 500 kHz	

8.6 Selection lists

8.6.1 Selection list 1: Analog output signals

Parameter	Analog output signal (O)
000050	AIN1-OUT
000055	AIN2-OUT
000100	DFSET-NOUT
001000	FIXED0%
001006	FIXED100%
001007	FIXED-100%
005000	MCTRL-NSET2
005001	MCTRL-NACT
005002	MCTRL-MSET2
005003	MCTRL-MACT
005004	MCTRL-IACT
005005	MCTRL-DCVOLT
005009	MCTRL-PHI-ANA
005050	NSET-NOUT
005051	NSET-RFG-I
005100	MPOT1-OUT
005550	ADD1-OUT
005600	RFG1-OUT
005650	ASW1-OUT
005655	ASW2-OUT
005700	ANEG1-OUT
005705	ANEG2-OUT
006200	CONV1-OUT
006205	CONV2-OUT
006210	CONV3-OUT
006215	CONV4-OUT
006230	CONVPHA1-OUT
006232	CONVPHA2-OUT
006234	CONVPHA3-OUT
006300	S&H1-OUT
006350	CURVE1-OUT
006400	FCNT1-OUT
006405	FCNT2-OUT
006410	FCNT3-OUT
006550	TEACH1-CNT
006600	SYNC1-OUT3
007200	CONVDA1-OUT
007205	CONVDA2-OUT
007210	CONVDA3-OUT
010000	BRK1-M-SET
015028	MCTRL-Utilization
015030	MCTRL-LOAD-I2Xt

Parameter	Analog output signal (O)
019500	FCODE-17
019502	FCODE-26/1
019503	FCODE-26/2
019504	FCODE-27/1
019505	FCODE-27/2
019506	FCODE-32
019507	FCODE-37
019510	FCODE-108/1
019511	FCODE-108/2
019512	FCODE-109/1
019513	FCODE-109/2
019515	FCODE-141
019517	FCODE-1211
019521	FCODE-472/1
019522	FCODE-472/2
019523	FCODE-472/3
019524	FCODE-472/4
019525	FCODE-472/5
019526	FCODE-472/6
019527	FCODE-472/7
019528	FCODE-472/8
019529	FCODE-472/9
019530	FCODE-472/10
019531	FCODE-472/11
019532	FCODE-472/12
019533	FCODE-472/13
019534	FCODE-472/14
019535	FCODE-472/15
019536	FCODE-472/16
019537	FCODE-472/17
019538	FCODE-472/18
019539	FCODE-472/19
019540	FCODE-472/20
019551	FCODE-473/1
019552	FCODE-473/2
019553	FCODE-473/3
019554	FCODE-473/4
019555	FCODE-473/5
019556	FCODE-473/6
019557	FCODE-473/7
019558	FCODE-473/8
019559	FCODE-473/9

Parameter	Analog output signal (O)
019560	FCODE-473/10
020101	CAN-IN1.W1
020102	CAN-IN1.W2
020103	CAN-IN1.W3
020201	CAN-IN2.W1
020202	CAN-IN2.W2
020203	CAN-IN2.W3
020204	CAN-IN2.W4
020301	CAN-IN3.W1
020302	CAN-IN3.W2
020303	CAN-IN3.W3
020304	CAN-IN3.W4
025101	AIF-IN.W1
025102	AIF-IN.W2
025103	AIF-IN.W3
030000	POS-ACT-PS-NO
030010	POS-NSET
030020	pos-nout
030021	pos-Mout
030030	POS-POUT-NORM
031301	VTTIME-OUT1
031302	VTTIME-OUT2
031303	VTTIME-OUT3
031304	VTTIME-OUT4
031351	VTPCS-OUT1
031352	VTPCS-OUT2
031353	VTPCS-OUT3
031354	VTPCS-OUT4

8.6.2 Selection list 2: Digital output signals

Parameter	Digital output signal (□)
000051	DIGIN1
000052	DIGIN2
000053	DIGIN3
000054	DIGIN4
000055	DIGIN5
000060	STATE-BUS-O
000065	DIGIN-CINH
000100	DFSET-ACK
000500	DCTRL-RDY
000501	DCTRL-CINH
000502	DCTRL-INIT
000503	DCTRL-IMP
000504	DCTRL-NACT=0
000505	DCTRL-CW/CCW
001000	FIXED0
001001	FIXED1
005001	MCTRL-QSP-OUT
005002	MCTRL-IMAX
005003	MCTRL-MMAX
005050	NSET-RFG-I=0
006000	DFRFG1-FAIL
006001	DFRFG1-SYNC
006400	FCNT1-EQUAL
006405	FCNT2-EQUAL
006410	FCNT3-EQUAL
006450	SP1-STATUS-01
006451	SP1-STATUS-02
006452	SP1-STATUS-03
006453	SP1-STATUS-04
006454	SP1-STATUS-05
006455	SP1-STATUS-06
006456	SP1-STATUS-07
006457	SP1-STATUS-08
006460	SP2-STATUS-01
006461	SP2-STATUS-02
006462	SP2-STATUS-03
006463	SP2-STATUS-04
006464	SP2-STATUS-05
006465	SP2-STATUS-06
006466	SP2-STATUS-07
006467	SP2-STATUS-08
006600	SYNC1-STAT
007150	CONVAD1-0
007151	CONVAD1-1
007152	CONVAD1-2

Parameter	Digital output signal (□)
007153	CONVAD1-3
007154	CONVAD1-4
007155	CONVAD1-5
007156	CONVAD1-6
007157	CONVAD1-7
007158	CONVAD1-8
007159	CONVAD1-9
007160	CONVAD1-10
007161	CONVAD1-11
007162	CONVAD1-12
007163	CONVAD1-13
007164	CONVAD1-14
007165	CONVAD1-SIGN
007170	CONVAD2-0
007171	CONVAD2-1
007172	CONVAD2-2
007173	CONVAD2-3
007174	CONVAD2-4
007175	CONVAD2-5
007176	CONVAD2-6
007177	CONVAD2-7
007178	CONVAD2-8
007179	CONVAD2-9
007180	CONVAD2-10
007181	CONVAD2-11
007182	CONVAD2-12
007183	CONVAD2-13
007184	CONVAD2-14
007185	CONVAD2-SIGN
010000	BRK1-OUT
010001	BRK1-CINH
010002	BRK1-QSP
010003	BRK1-M-STORE
010250	R/L/Q-QSP
010251	R/L/Q-R/L
010500	AND1-OUT
010505	AND2-OUT
010510	AND3-OUT
010515	AND4-OUT
010520	AND5-OUT
010550	OR1-OUT
010555	OR2-OUT
010560	OR3-OUT
010565	OR4-OUT
010570	OR5-OUT

Parameter	Digital output signal (□)
010600	NOT1-OUT
010605	NOT2-OUT
010610	NOT3-OUT
010615	NOT4-OUT
010620	NOT5-OUT
010650	CMP1-OUT
010655	CMP2-OUT
010700	DIGDEL1-OUT
010705	DIGDEL2-OUT
010750	TRANS1-OUT
010755	TRANS2-OUT
010900	FLIP1-OUT
010905	FLIP2-OUT
011000	CMPPH1-OUT
011005	CMPPH2-OUT
011010	CMPPH3-OUT
012000	PHINT1-FAIL
013000	FEVAN1-BUSY
013001	FEVAN1-FAIL
013005	FEVAN2-BUSY
013006	FEVAN2-FAIL
013010	FEVAN3-BUSY
013011	FEVAN3-FAIL
013015	FEVAN4-BUSY
013016	FEVAN4-FAIL
013020	FEVAN5-BUSY
013021	FEVAN5-FAIL
013025	FEVAN6-BUSY
013026	FEVAN6-FAIL
013050	BCD1-SEL1
013051	BCD1-SEL2
013052	BCD1-SEL3
013053	BCD1-SEL4
013054	BCD1-SEL5
013055	BCD1-SEL6
013056	BCD1-SEL7
013057	BCD1-SEL8
013058	BCD1-SIGN
013059	BCD1-NEW-DATA
013060	BCD1-EOT
013061	BCD1-DATA-FLT
013062	BCD1-BUSY
013063	BCD1-FAIL
013065	BCD2-SEL1
013066	BCD2-SEL2
013067	BCD2-SEL3

Parameter	Digital output signal (□)
013068	BCD2-SEL4
013069	BCD2-SEL5
013070	BCD2-SEL6
013071	BCD2-SEL7
013072	BCD2-SEL8
013073	BCD2-SIGN
013074	BCD2-NEW-DATA
013075	BCD2-EOT
013076	BCD2-DATA-FLT
013077	BCD2-BUSY
013078	BCD2-FAIL
013080	BCD3-SEL1
013081	BCD3-SEL2
013082	BCD3-SEL3
013083	BCD3-SEL4
013084	BCD3-SEL5
013085	BCD3-SEL6
013086	BCD3-SEL7
013087	BCD3-SEL8
013088	BCD3-SIGN
013089	BCD3-NEW-DATA
013090	BCD3-EOT
013091	BCD3-DATA-FLT
013092	BCD3-BUSY
013093	BCD3-FAIL
015000	DCTRL-TRIP
015001	DCTRL-MESS
015002	DCTRL-WARN
015003	DCTRL-FAIL
015004	DCTRL-FAILQSP
015010	MONIT-LU
015011	MONIT-OU
015012	MONIT-EEr
015013	MONIT-OC1
015014	MONIT-OC2
015015	MONIT-LP1
015016	MONIT-OH
015017	MONIT-OH3
015018	MONIT-OH4
015019	MONIT-OH7
015020	MONIT-OH8
015021	MONIT-Sd2
015022	MONIT-Sd3
015023	MONIT-P03
015024	MONIT-P13
015026	MONIT-CE0

Parameter	Digital output signal (☐)
015027	MONIT-NMAX
015028	MONIT-OC5
015029	MONIT-SD5
015030	MONIT-SD6
015031	MONIT-SD7
015032	MONIT-H07
015033	MONIT-H10
015034	MONIT-H11
015040	MONIT-CE1
015041	MONIT-CE2
015042	MONIT-CE3
015043	MONIT-CE4
015044	MONIT-PL
015047	MONIT-OC6
015301	MONIT-P01
015302	MONIT-P02
015304	MONIT-P04
015305	MONIT-P05
015306	MONIT-P06
015307	MONIT-P07
015308	MONIT-P08
015309	MONIT-P09
015312	MONIT-P12
015314	MONIT-P14
015315	MONIT-P15
015316	MONIT-P16
015317	MONIT-P17
015318	MONIT-P18
019500	FCODE-250
019521	FCODE-471.B0
019522	FCODE-471.B1
019523	FCODE-471.B2
019524	FCODE-471.B3
019525	FCODE-471.B4
019526	FCODE-471.B5
019527	FCODE-471.B6
019528	FCODE-471.B7
019529	FCODE-471.B8
019530	FCODE-471.B9
019531	FCODE-471.B10
019532	FCODE-471.B11
019533	FCODE-471.B12
019534	FCODE-471.B13
019535	FCODE-471.B14
019536	FCODE-471.B15
019537	FCODE-471.B16

Parameter	Digital output signal (☐)
019538	FCODE-471.B17
019539	FCODE-471.B18
019540	FCODE-471.B19
019541	FCODE-471.B20
019542	FCODE-471.B21
019543	FCODE-471.B22
019544	FCODE-471.B23
019545	FCODE-471.B24
019546	FCODE-471.B25
019547	FCODE-471.B26
019548	FCODE-471.B27
019549	FCODE-471.B28
019550	FCODE-471.B29
019551	FCODE-471.B30
019552	FCODE-471.B31
019751	FCODE-135.B0
019752	FCODE-135.B1
019753	FCODE-135.B2
019755	FCODE-135.B4
019756	FCODE-135.B5
019757	FCODE-135.B6
019758	FCODE-135.B7
019763	FCODE-135.B12
019764	FCODE-135.B13
019765	FCODE-135.B14
019766	FCODE-135.B15
020001	CAN-CTRL.B0
020002	CAN-CTRL.B1
020003	CAN-CTRL.B2
020005	CAN-CTRL.B4
020006	CAN-CTRL.B5
020007	CAN-CTRL.B6
020008	CAN-CTRL.B7
020013	CAN-CTRL.B12
020014	CAN-CTRL.B13
020015	CAN-CTRL.B14
020016	CAN-CTRL.B15
020101	CAN-IN1.B0
020102	CAN-IN1.B1
020103	CAN-IN1.B2
020104	CAN-IN1.B3
020105	CAN-IN1.B4
020106	CAN-IN1.B5

Parameter	Digital output signal (☐)
020107	CAN-IN1.B6
020108	CAN-IN1.B7
020109	CAN-IN1.B8
020110	CAN-IN1.B9
020111	CAN-IN1.B10
020112	CAN-IN1.B11
020113	CAN-IN1.B12
020114	CAN-IN1.B13
020115	CAN-IN1.B14
020116	CAN-IN1.B15
020117	CAN-IN1.B16
020118	CAN-IN1.B17
020119	CAN-IN1.B18
020120	CAN-IN1.B19
020121	CAN-IN1.B20
020122	CAN-IN1.B21
020123	CAN-IN1.B22
020124	CAN-IN1.B23
020125	CAN-IN1.B24
020126	CAN-IN1.B25
020127	CAN-IN1.B26
020128	CAN-IN1.B27
020129	CAN-IN1.B28
020130	CAN-IN1.B29
020131	CAN-IN1.B30
020132	CAN-IN1.B31
020201	CAN-IN2.B0
020202	CAN-IN2.B1
020203	CAN-IN2.B2
020204	CAN-IN2.B3
020205	CAN-IN2.B4
020206	CAN-IN2.B5
020207	CAN-IN2.B6
020208	CAN-IN2.B7
020209	CAN-IN2.B8
020210	CAN-IN2.B9
020211	CAN-IN2.B10
020212	CAN-IN2.B11
020213	CAN-IN2.B12
020214	CAN-IN2.B13
020215	CAN-IN2.B14
020216	CAN-IN2.B15
020217	CAN-IN2.B16
020218	CAN-IN2.B17
020219	CAN-IN2.B18
020220	CAN-IN2.B19

Parameter	Digital output signal (☐)
020221	CAN-IN2.B20
020222	CAN-IN2.B21
020223	CAN-IN2.B22
020224	CAN-IN2.B23
020225	CAN-IN2.B24
020226	CAN-IN2.B25
020227	CAN-IN2.B26
020228	CAN-IN2.B27
020229	CAN-IN2.B28
020230	CAN-IN2.B29
020231	CAN-IN2.B30
020232	CAN-IN2.B31
020301	CAN-IN3.B0
020302	CAN-IN3.B1
020303	CAN-IN3.B2
020304	CAN-IN3.B3
020305	CAN-IN3.B4
020306	CAN-IN3.B5
020307	CAN-IN3.B6
020308	CAN-IN3.B7
020309	CAN-IN3.B8
020310	CAN-IN3.B9
020311	CAN-IN3.B10
020312	CAN-IN3.B11
020313	CAN-IN3.B12
020314	CAN-IN3.B13
020315	CAN-IN3.B14
020316	CAN-IN3.B15
020317	CAN-IN3.B16
020318	CAN-IN3.B17
020319	CAN-IN3.B18
020320	CAN-IN3.B19
020321	CAN-IN3.B20
020322	CAN-IN3.B21
020323	CAN-IN3.B22
020324	CAN-IN3.B23
020325	CAN-IN3.B24
020326	CAN-IN3.B25
020327	CAN-IN3.B26
020328	CAN-IN3.B27
020329	CAN-IN3.B28
020330	CAN-IN3.B29
020331	CAN-IN3.B30
020332	CAN-IN3.B31
025001	AIF-CTRL.B0
025002	AIF-CTRL.B1

Parameter	Digital output signal (☐)
025003	AIF-CTRL.B2
025005	AIF-CTRL.B4
025006	AIF-CTRL.B5
025007	AIF-CTRL.B6
025008	AIF-CTRL.B7
025013	AIF-CTRL.B12
025014	AIF-CTRL.B13
025015	AIF-CTRL.B14
025016	AIF-CTRL.B15
025101	AIF-IN.B0
025102	AIF-IN.B1
025103	AIF-IN.B2
025104	AIF-IN.B3
025105	AIF-IN.B4
025106	AIF-IN.B5
025107	AIF-IN.B6
025108	AIF-IN.B7
025109	AIF-IN.B8
025110	AIF-IN.B9
025111	AIF-IN.B10
025112	AIF-IN.B11
025113	AIF-IN.B12
025114	AIF-IN.B13
025115	AIF-IN.B14
025116	AIF-IN.B15
025117	AIF-IN.B16
025118	AIF-IN.B17
025119	AIF-IN.B18
025120	AIF-IN.B19
025121	AIF-IN.B20
025122	AIF-IN.B21
025123	AIF-IN.B22
025124	AIF-IN.B23
025125	AIF-IN.B24
025126	AIF-IN.B25
025127	AIF-IN.B26
025128	AIF-IN.B27
025129	AIF-IN.B28
025130	AIF-IN.B29
025131	AIF-IN.B30
025132	AIF-IN.B31
030000	POS-STARTED
030001	POS-STOPED
030002	POS-ENDED
030003	POS-RESETED
030010	POS-STDBY-ACT
030011	POS-MANU-ACT

Parameter	Digital output signal (☐)
030012	pos-ref-ok
030013	POS-IN-TARGET
030014	POS-VTRAV-REA
030015	POS-VFIN-REAC
030016	POS-ACC-RAMP
030017	POS-DCC-RAMP
030101	pos-pfo1
030102	POS-PFO2
030103	POS-PFO3
030104	POS-PFO4
030105	POS-PFO5
030106	POS-PFO6
030107	POS-PFO7
030108	POS-PFO8
030109	POS-PFO9
030110	POS-PFO10
030111	POS-PFO11
030112	POS-PFO12
030113	POS-PFO13
030114	POS-PFO14
030115	POS-PFO15
030116	POS-PFO16
030117	POS-PFO17
030118	POS-PFO18
030119	POS-PFO19
030120	POS-PFO20
030121	POS-PFO21
030122	POS-PFO22
030123	POS-PFO23
030124	POS-PFO24
030125	POS-PFO25
030126	POS-PFO26
030127	POS-PFO27
030128	POS-PFO28
030129	POS-PFO29
030130	POS-PFO30
030131	POS-PFO31
030132	POS-PFO32
030200	POS-TP1-EN
030201	POS-TP1-RECOG
030202	POS-TP2-EN
030203	POS-TP2-RECOG
030204	POS-TP3-EN
030205	POS-TP3-RECOG
030206	POS-TP4-EN
030207	POS-TP4-RECOG

8.6.3 Selection list 3: Angle signals

Parameter	Angle signal (▲)
000100	DFSET-PSET
000101	DFSET-PSET2
001000	FIXED0INC
005000	MCTRL-PHI-ANG
005520	ARITPH1-OUT
005525	ARITPH2-OUT
005530	ARITPH3-OUT
005535	ARITPH4-OUT
005540	ARITPH5-OUT
005545	ARITPH6-OUT
005775	SELPH1-OUT
005780	SELPH2-OUT
006237	CONVPHPH2-OUT
006600	SYNC1-OUT2
007050	CONVAPH1-OUT
007055	CONVAPH2-OUT
007060	CONVAPH3-OUT
012000	PHINT1-OUT
012050	PHDIV1-OUT
019521	FCODE-474/1
019522	FCODE-474/2
019523	FCODE-474/3
019524	FCODE-474/4
019525	FCODE-474/5
019526	FCODE-474/6
019527	FCODE-474/7
019528	FCODE-474/8
019529	FCODE-474/9
019530	FCODE-474/10
020103	CAN-IN1.D1
020201	CAN-IN2.D1
020301	CAN-IN3.D1
025103	AIF-IN.D1
025104	AIF-IN.D2
030010	POS-TARGET
030011	POS-VTRAV
030012	POS-VFINAL
030013	POS-ACC
030014	POS-DCC
030015	POS-ASET
030016	POS-VSET
030017	POS-SETPOS
030020	POS-POUT
030021	POS-ACTPOS
030022	POS-ABS-VAL
031001	VTPOS-OUT1

Parameter	Angle signal (▲)
031002	VTPOS-OUT2
031003	VTPOS-OUT3
031004	VTPOS-OUT4
031005	VTPOS-OUT5
031006	VTPOS-OUT6
031007	VTPOS-OUT7
031008	VTPOS-OUT8
031009	VTPOS-OUT9
031010	VTPOS-OUT10
031011	VTPOS-OUT11
031012	VTPOS-OUT12
031013	VTPOS-OUT13
031014	VTPOS-OUT14
031015	VTPOS-OUT15
031016	VTPOS-OUT16
031017	VTPOS-OUT17
031018	VTPOS-OUT18
031019	VTPOS-OUT19
031020	VTPOS-OUT20
031021	VTPOS-OUT21
031022	VTPOS-OUT22
031023	VTPOS-OUT23
031024	VTPOS-OUT24
031025	VTPOS-OUT25
031026	VTPOS-OUT26
031027	VTPOS-OUT27
031028	VTPOS-OUT28
031029	VTPOS-OUT29
031030	VTPOS-OUT30
031031	VTPOS-OUT31
031032	VTPOS-OUT32
031033	VTPOS-OUT33
031034	VTPOS-OUT34
031035	VTPOS-OUT35
031036	VTPOS-OUT36
031037	VTPOS-OUT37
031038	VTPOS-OUT38
031039	VTPOS-OUT39
031040	VTPOS-OUT40
031041	VTPOS-OUT41
031042	VTPOS-OUT42
031043	VTPOS-OUT43
031044	VTPOS-OUT44
031045	VTPOS-OUT45
031046	VTPOS-OUT46
031047	VTPOS-OUT47

Parameter	Angle signal (▲)
031048	VTPOS-OUT48
031049	VTPOS-OUT49
031050	VTPOS-OUT50
031051	VTPOS-OUT51
031052	VTPOS-OUT52
031053	VTPOS-OUT53
031054	VTPOS-OUT54
031055	VTPOS-OUT55
031056	VTPOS-OUT56
031057	VTPOS-OUT57
031058	VTPOS-OUT58
031059	VTPOS-OUT59
031060	VTPOS-OUT60
031061	VTPOS-OUT61
031062	VTPOS-OUT62
031063	VTPOS-OUT63
031064	VTPOS-OUT64
031065	VTPOS-OUT65
031066	VTPOS-OUT66
031067	VTPOS-OUT67
031068	VTPOS-OUT68
031069	VTPOS-OUT69
031070	VTPOS-OUT70
031071	VTPOS-OUT71
031072	VTPOS-OUT72
031073	VTPOS-OUT73
031074	VTPOS-OUT74
031075	VTPOS-OUT75
031076	VTPOS-OUT76
031077	VTPOS-OUT77
031078	VTPOS-OUT78
031079	VTPOS-OUT79

Parameter	Angle signal (▲)
031080	VTPOS-OUT80
031081	VTPOS-OUT81
031082	VTPOS-OUT82
031083	VTPOS-OUT83
031084	VTPOS-OUT84
031085	VTPOS-OUT85
031086	VTPOS-OUT86
031087	VTPOS-OUT87
031088	VTPOS-OUT88
031089	VTPOS-OUT89
031090	VTPOS-OUT90
031091	VTPOS-OUT91
031092	VTPOS-OUT92
031093	VTPOS-OUT93
031094	VTPOS-OUT94
031095	VTPOS-OUT95
031096	VTPOS-OUT96
031097	VTPOS-OUT97
031098	VTPOS-OUT98
031099	VTPOS-OUT99
031100	VTPOS-OUT100
031101	VTPOS-OUT101
031102	VTPOS-OUT102
031103	VTPOS-OUT103
031104	VTPOS-OUT104
031201	VTVEL-OUT1
031202	VTVEL-OUT2
031203	VTVEL-OUT3
031204	VTVEL-OUT4
031251	VTACC-OUT1
031252	VTACC-OUT2
031253	VTACC-OUT3
031254	VTACC-OUT4

8.6.4 Selection list 4: Speed signals

Parameter	Speed signal (△)
000050	DFIN-OUT
000100	DFSET-POUT
000250	DFOUT-OUT
001000	FIXEDPHI-0
005000	MCTRL-PHI-ACT
006000	DFRFG1-OUT
006220	CONV5-OUT
006600	SYNC1-OUT1
019521	FCODE-475/1
019522	FCODE-475/2
030000	POS-PHI-SET

8.6.5 Selection list 5: Function blocks

Parameter	Function block
000000	Empty
000050	AIN1
000055	AIN2
000070	AOUT1
000075	AOUT2
000100	DFSET
000200	DFIN
000250	DFOUT
005050	NSET
005100	MPOT1
005520	ARITPH1
005525	ARITPH2
005530	ARITPH3
005535	ARITPH4
005540	ARITPH5
005545	ARITPH6
005550	ADD1
005600	RFG1
005650	ASW1
005655	ASW2
005660	ASW3
005665	ASW4
005700	ANEG1
005705	ANEG2
005750	FIXSET1
005775	SELPH1
005780	SELPH2
005800	LIM1
005850	ABS1
005900	PT1-1
005950	DT1-1
006000	DFRFG1
006150	DB1
006200	CONV1
006205	CONV2
006210	CONV3
006215	CONV4
006220	CONV5
006230	CONVPHA1
006232	CONVPHA2
006234	CONVPHA3
006237	CONVPHPH2
006300	S&H1
006350	CURVE1
006400	FCNT1
006405	FCNT2
006410	FCNT3
006450	SP1
006460	SP2
006550	TEACH1
006600	SYNC1
007050	CONVAPH1
007055	CONVAPH2
007060	CONVAPH3
007150	CONVAD1
007170	CONVAD2
007200	CONVDA1
007205	CONVDA2
007210	CONVDA3
008000	DISA
008050	DISPH
010000	BRK1
010250	R/L/Q
010500	AND1
010505	AND2
010510	AND3
010515	AND4
010520	AND5
010550	OR1
010555	OR2
010560	OR3
010565	OR4
010570	OR5
010600	NOT1
010605	NOT2
010610	NOT3
010615	NOT4
010620	NOT5
010650	CMP1
010655	CMP2
010660	CMP3
010700	DIGDEL1
010705	DIGDEL2
010750	TRANS1
010755	TRANS2
010900	FLIP1
010905	FLIP2
011000	CMPPH1
011005	CMPPH2
011010	CMPPH3
012000	PHINT1
012050	PHDIV1

Parameter	Function block
013000	FEVAN1
013005	FEVAN2
013010	FEVAN3
013015	FEVAN4
013020	FEVAN5
013025	FEVAN6
013050	BCD1
013065	BCD2
013080	BCD3
015100	MLP1
020000	CAN-OUT
025000	AIF-OUT
030000	POS
030050	POS-SRAMPS
031000	VTPOS
031200	VTVEL
031250	VTACC
031300	VTTIME
031350	VTPCS

8.6.6 Selection list 10: Error messages

Parameter	Error message
000000	No error
000011	OC1-TRIP
000012	OC2-TRIP
000015	OC5-TRIP
000016	OC6-TRIP
000018	OC8-TRIP
000022	LUQ-TRIP
000032	LP1-TRIP
000050	OH-TRIP
000053	OH3-TRIP
000057	OH7-TRIP
000058	OH8-TRIP
000061	CE0-TRIP
000062	CE1-TRIP
000063	CE2-TRIP
000064	CE3-TRIP
000065	CE4-TRIP
000070	U15-TRIP
000071	CCr-TRIP
000072	Pr1-TRIP
000073	Pr2-TRIP
000074	PEr-TRIP
000075	Pr0-TRIP
000077	Pr3-TRIP
000078	Pr4-TRIP
000079	PI-TRIP
000082	Sd2-TRIP
000083	Sd3-TRIP
000085	Sd5-TRIP
000086	Sd6-TRIP
000087	Sd7-TRIP
000088	Sd8-TRIP
000089	PL-TRIP
000091	EEr-TRIP
000105	H05-TRIP
000107	H07-TRIP
000110	H10-TRIP
000111	H11-TRIP
000151	P01-TRIP
000152	P02-TRIP
000153	P03-TRIP
000154	P04-TRIP
000155	P05-TRIP
000156	P06-TRIP
000157	P07-TRIP
000158	P08-TRIP

Parameter	Error message
000159	P09-TRIP
000162	P12-TRIP
000163	P13-TRIP
000164	P14-TRIP
000165	P15-TRIP
000166	P16-TRIP
000167	P17-TRIP
000168	P18-TRIP
000169	P19-TRIP
000190	nErr-TRIP
000200	NMAX-TRIP
001020	OU message
001030	LU message
001091	EEr message
002018	OC8 warning
002032	LP1 warning
002053	OH3 warning
002054	OH4 warning
002057	OH7 warning
002058	OH8 warning
002061	CE0 warning
002062	CE1 warning
002063	CE2 warning
002064	CE3 warning
002065	CE4 warning
002082	Sd2 warning
002083	Sd3 warning
002085	Sd5 warning
002086	Sd6 warning
002091	EER warning
002153	P03 warning
002163	P13 warning
002164	P14 warning
002165	P15 warning
002166	P16 warning
002167	P17 warning
002168	P18 warning
002169	P19 warning
002191	nErr warning
003091	EEr-QSP
003151	P01-QSP
003152	P02-QSP
003154	P04-QSP
003155	P05-QSP
003156	P06-QSP
003157	P07-QSP

Parameter	Error message
003158	P08-QSP
003159	P09-QSP
003162	P12-QSP
003163	P13-QSP
003164	P14-QSP
003165	P15-QSP
003166	P16-QSP
003167	P17-QSP
003168	P18-QSP
003190	nErr-QSP

8.7 Table of attributes

The attribute table describes the properties of the codes used. It enables you to create your own communication programs for the controller.

How to read the table of attributes

Column		Abbreviation	Meaning	
Code		Cxxxx	Name of the Lenze code	
Index	dec	24575 - Lenze code number	Index under which the parameter is addressed The subindex of array variables corresponds to the Lenze subcode number	Is only required for control via INTERBUS, PROFIBUS DP or system bus (CAN)
	hex	5FFFh - Lenze code number		
Data	DS	E	Data structure	Single variable (only one parameter element)
		A		Array variable (several parameter elements)
	DA	xx	Number of array elements (subcodes)	
	DT	B8	Data type	1 byte bit-coded
		B16		2 bytes bit-coded
		B32		4 bytes bit-coded
		FIX32		32-bit value with sign; decimal with four decimal places
		I32		4 bytes with sign
		U32		4 bytes without sign
		VS		ASCII string
	Format	VD	LECOM format (see also Operating Instructions of the bus module)	ASCII decimal format
		VH		ASCII hexadecimal format
		VS		String format
		VO		Octet string format for data blocks
	DL		Data length in byte	The column "Important" contains further information
Access	LCM-R/W	Ra	Access authorisation for LECOM	Reading is always permitted
		Wa		Writing is always permitted
		W		Writing is restricted
	Condition	CINH	Condition for writing	Writing permitted only when controller is inhibited

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0002	24573	5FFDh	E	1	FIX32	VD	4	Ra/W	CINH
C0003	24572	5FFCh	E	1	FIX32	VD	4	Ra/Wa	
C0004	24571	5FFBh	E	1	FIX32	VD	4	Ra/Wa	
C0005	24570	5FFAh	E	1	FIX32	VD	4	Ra/W	CINH
C0006	24569	5FF9h	E	1	FIX32	VD	4	Ra/W	CINH
C0009	24566	5FF6h	E	1	FIX32	VD	4	Ra/Wa	
C0011	24564	5FF4h	E	1	FIX32	VD	4	Ra/W	CINH
C0012	24563	5FF3h	E	1	FIX32	VD	4	Ra/Wa	
C0013	24562	5FF2h	E	1	FIX32	VD	4	Ra/Wa	
C0017	24558	5FEEh	E	1	FIX32	VD	4	Ra/Wa	
C0018	24557	5FEDh	E	1	FIX32	VD	4	Ra/Wa	
C0019	24556	5FECh	E	1	FIX32	VD	4	Ra/Wa	
C0022	24553	5FE9h	E	1	FIX32	VD	4	Ra/Wa	
C0025	24550	5FE6h	E	1	FIX32	VD	4	Ra/W	CINH
C0026	24549	5FE5h	A	2	FIX32	VD	4	Ra/Wa	
C0027	24548	5FE4h	A	2	FIX32	VD	4	Ra/Wa	
C0030	24545	5FE1h	E	1	FIX32	VD	4	Ra/Wa	
C0032	24543	5FDFh	E	1	FIX32	VD	4	Ra/Wa	
C0033	24542	5FDEh	E	1	FIX32	VD	4	Ra/Wa	
C0034	24541	5FDDh	E	1	FIX32	VD	4	Ra/Wa	
C0037	24538	5FDAh	E	1	FIX32	VD	4	Ra/Wa	
C0039	24536	5FD8h	A	15	FIX32	VD	4	Ra/Wa	
C0040	24535	5FD7h	E	1	FIX32	VD	4	Ra/Wa	
C0042	24533	5FD5h	E	1	FIX32	VD	4	Ra	
C0043	24532	5FD4h	E	1	FIX32	VD	4	Ra/Wa	
C0045	24530	5FD2h	E	1	FIX32	VD	4	Ra	
C0046	24529	5FD1h	E	1	FIX32	VD	4	Ra	
C0049	24526	5FCEh	E	1	FIX32	VD	4	Ra	
C0050	24525	5FCDh	E	1	FIX32	VD	4	Ra	
C0051	24524	5FCCh	E	1	FIX32	VD	4	Ra	
C0052	24523	5FCBh	E	1	FIX32	VD	4	Ra	
C0053	24522	5FCAh	E	1	FIX32	VD	4	Ra	
C0054	24521	5FC9h	E	1	FIX32	VD	4	Ra	
C0056	24519	5FC7h	E	1	FIX32	VD	4	Ra	
C0057	24518	5FC6h	E	1	FIX32	VD	4	Ra	
C0058	24517	5FC5h	E	1	FIX32	VD	4	Ra/Wa	
C0059	24516	5FC4h	E	1	FIX32	VD	4	Ra	
C0060	24515	5FC3h	E	1	FIX32	VD	4	Ra	
C0061	24514	5FC2h	E	1	FIX32	VD	4	Ra	
C0063	24512	5FC0h	E	1	FIX32	VD	4	Ra	
C0064	24511	5FBFh	E	1	FIX32	VD	4	Ra	
C0066	24509	5FBDh	E	1	FIX32	VD	4	Ra	
C0067	24508	5FBCh	E	1	FIX32	VD	4	Ra	
C0070	24505	5FB9h	E	1	FIX32	VD	4	Ra/Wa	
C0071	24504	5FB8h	E	1	FIX32	VD	4	Ra/Wa	
C0072	24503	5FB7h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0075	24500	5FB4h	E	1	FIX32	VD	4	Ra/Wa	
C0076	24499	5FB3h	E	1	FIX32	VD	4	Ra/Wa	
C0077	24498	5FB2h	E	1	FIX32	VD	4	Ra/Wa	
C0078	24497	5FB1h	E	1	FIX32	VD	4	Ra/Wa	
C0081	24494	5FAEh	E	1	FIX32	VD	4	Ra/W	CINH
C0084	24491	5FABh	E	1	FIX32	VD	4	Ra/W	CINH
C0085	24490	5FAAh	E	1	FIX32	VD	4	Ra/W	CINH
C0086	24489	5FA9h	E	1	FIX32	VD	4	Ra/W	CINH
C0087	24488	5FA8h	E	1	FIX32	VD	4	Ra/W	CINH
C0088	24487	5FA7h	E	1	FIX32	VD	4	Ra/W	CINH
C0089	24486	5FA6h	E	1	FIX32	VD	4	Ra/W	CINH
C0090	24485	5FA5h	E	1	FIX32	VD	4	Ra/W	CINH
C0091	24484	5FA4h	E	1	FIX32	VD	4	Ra/W	CINH
C0093	24482	5FA2h	E	1	FIX32	VD	4	Ra	
C0094	24481	5FA1h	E	1	FIX32	VD	4	Ra/Wa	
C0095	24480	5FA0h	E	1	FIX32	VD	4	Ra/W	CINH
C0096	24479	5F9Fh	A	2	FIX32	VD	4	Ra/Wa	
C0099	24476	5F9Ch	E	1	FIX32	VD	4	Ra	
C0101	24474	5F9Ah	A	15	FIX32	VD	4	Ra/Wa	
C0103	24472	5F98h	A	15	FIX32	VD	4	Ra/Wa	
C0105	24470	5F96h	E	1	FIX32	VD	4	Ra/Wa	
C0108	24467	5F93h	A	2	FIX32	VD	4	Ra/Wa	
C0109	24466	5F92h	A	2	FIX32	VD	4	Ra/Wa	
C0114	24461	5F8Dh	A	5	FIX32	VD	4	Ra/Wa	
C0116	24459	5F8Bh	A	32	FIX32	VD	4	Ra/W	CINH
C0117	24458	5F8Ah	A	4	FIX32	VD	4	Ra/W	CINH
C0118	24457	5F89h	A	4	FIX32	VD	4	Ra/Wa	
C0120	24455	5F87h	E	1	FIX32	VD	4	Ra/Wa	
C0121	24454	5F86h	E	1	FIX32	VD	4	Ra/Wa	
C0122	24453	5F85h	E	1	FIX32	VD	4	Ra/Wa	
C0125	24450	5F82h	E	1	FIX32	VD	4	Ra/Wa	
C0126	24449	5F81h	E	1	FIX32	VD	4	Ra/Wa	
C0127	24448	5F80h	E	1	FIX32	VD	4	Ra/Wa	
C0128	24447	5F79h	E	1	FIX32	VD	4	Ra/Wa	
C0130	24445	5F7Dh	E	1	FIX32	VD	4	Ra	
C0134	24441	5F79h	E	1	FIX32	VD	4	Ra/Wa	
C0135	24440	5F78h	E	1	B16	VH	2		
C0136	24439	5F77h	A	3	B16	VH	2	Ra	
C0141	24434	5F72h	E	1	FIX32	VD	4	Ra/Wa	
C0142	24433	5F71h	E	1	FIX32	VD	4	Ra/Wa	
C0150	24425	5F69h	E	1	B16	VH	2	Ra	
C0151	24424	5F68h	E	1	B32	VH	4	Ra	
C0155	24420	5F64h	E	1	B16	VH	2	Ra	
C0156	24419	5F63h	A	7	FIX32	VD	4	Ra/W	CINH
C0157	24418	5F62h	A	7	FIX32	VD	4	Ra	
C0161	24414	5F5Eh	E	1	FIX32	VD	4	Ra	
C0167	24408	5F58h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0168	24407	5F57h	A	8	FIX32	VD	4	Ra	
C0169	24406	5F56h	A	8	U32	VH	4	Ra	
C0170	24405	5F55h	A	8	FIX32	VD	4	Ra	
C0173	24402	5F52h	E	1	FIX32	VD	4	Ra/Wa	
C0178	24397	5F4Dh	E	1	U32	VH	4	Ra	
C0179	24396	5F4Ch	E	1	U32	VH	4	Ra	
C0182	24393	5F49h	E	1	FIX32	VD	4	Ra/Wa	
C0183	24392	5F48h	E	1	FIX32	VD	4	Ra	
C0190	24385	5F41h	E	1	FIX32	VD	4	Ra/Wa	
C0195	24380	5F3Ch	E	1	FIX32	VD	4	Ra/Wa	
C0196	24379	5F3Bh	E	1	FIX32	VD	4	Ra/Wa	
C0200	24375	5F37h	E	1	VS	VS	?	Ra	
C0201	24374	5F36h	E	1	VS	VS	?	Ra	
C0202	24373	5F35h	E	1	FIX32	VD	4	Ra	
C0203	24372	5F34h	E	1	VS	VS	?	Ra	
C0204	24371	5F33h	E	1	FIX32	VD	4	Ra	
C0206	24369	5F31h	E	1	VS	VS	?	Ra	
C0207	24368	5F30h	E	1	VS	VS	?	Ra	
C0208	24367	5F2Fh	E	1	VS	VS	?	Ra	
C0209	24366	5F2Eh	E	1	VS	VS	?	Ra	
C0220	24355	5F23h	E	1	FIX32	VD	4	Ra/Wa	
C0221	24354	5F22h	E	1	FIX32	VD	4	Ra/Wa	
C0222	24353	5F21h	E	1	FIX32	VD	4	Ra/Wa	
C0223	24352	5F20h	E	1	FIX32	VD	4	Ra/Wa	
C0224	24351	5F1Fh	E	1	FIX32	VD	4	Ra/Wa	
C0241	24334	5F0Eh	E	1	FIX32	VD	4	Ra/Wa	
C0244	24331	5F0Bh	E	1	FIX32	VD	4	Ra/Wa	
C0250	24325	5F05h	E	1	FIX32	VD	4	Ra/Wa	
C0252	24323	5F03h	E	1	I32	VH	4	Ra/Wa	
C0253	24322	5F02h	E	1	FIX32	VD	4	Ra/Wa	
C0254	24321	5F01h	E	1	FIX32	VD	4	Ra/Wa	
C0255	24320	5F00h	E	1	U32	VH	4	Ra/Wa	
C0260	24315	5EFBh	E	1	FIX32	VD	4	Ra/Wa	
C0261	24314	5EFAh	E	1	FIX32	VD	4	Ra/Wa	
C0262	24313	5EF9h	E	1	FIX32	VD	4	Ra/Wa	
C0263	24312	5EF8h	E	1	FIX32	VD	4	Ra/Wa	
C0264	24311	5EF7h	E	1	FIX32	VD	4	Ra/Wa	
C0265	24310	5EF6h	E	1	FIX32	VD	4	Ra/Wa	
C0267	24308	5EF4h	A	2	FIX32	VD	4	Ra/W	CINH
C0268	24307	5EF3h	E	1	FIX32	VD	4	Ra/W	CINH
C0269	24306	5EF2h	A	3	FIX32	VD	4	Ra	
C0325	24250	5EBAh	E	1	FIX32	VD	4	Ra/Wa	
C0326	24249	5EB9h	E	1	FIX32	VD	4	Ra/Wa	
C0327	24248	5EB8h	E	1	FIX32	VD	4	Ra/Wa	
C0328	24247	5EB7h	E	1	FIX32	VD	4	Ra/Wa	
C0329	24246	5EB6h	E	1	FIX32	VD	4	Ra/Wa	
C0332	24243	5EB3h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0333	24242	5EB2h	E	1	FIX32	VD	4	Ra/Wa	
C0336	24239	5EAFh	E	1	FIX32	VD	4	Ra	
C0337	24238	5EAEh	E	1	FIX32	VD	4	Ra/Wa	
C0338	24237	5EADh	E	1	FIX32	VD	4	Ra/Wa	
C0339	24236	5EACh	A	2	FIX32	VD	4	Ra/W	CINH
C0340	24235	5EABh	A	2	FIX32	VD	4	Ra	
C0350	24225	5EA1h	E	1	FIX32	VD	4	Ra/Wa	
C0351	24224	5EA0h	E	1	FIX32	VD	4	Ra/Wa	
C0352	24223	5E9Fh	E	1	FIX32	VD	4	Ra/Wa	
C0353	24222	5E9Eh	A	3	FIX32	VD	4	Ra/Wa	
C0354	24221	5E9Dh	A	6	FIX32	VD	4	Ra/Wa	
C0355	24220	5E9Ch	A	6	FIX32	VD	4	Ra	
C0356	24219	5E9Bh	A	4	FIX32	VD	4	Ra/Wa	
C0357	24218	5E9Ah	A	3	FIX32	VD	4	Ra/Wa	
C0358	24217	5E99h	E	1	FIX32	VD	4	Ra/Wa	
C0359	24216	5E98h	E	1	FIX32	VD	4	Ra	
C0360	24215	5E97h	A	12	FIX32	VD	4	Ra	
C0361	24214	5E96h	A	12	FIX32	VD	4	Ra	
C0362	24213	5E95h	E	1	FIX32	VD	4	Ra	
C0363	24212	5E94h	E	1	FIX32	VD	4	Ra/Wa	
C0364	24211	5E93h	E	1	FIX32	VD	4	Ra/W	CINH
C0365	24210	5E92h	E	1	FIX32	VD	4	Ra	
C0366	24209	5E91h	E	1	FIX32	VD	4	Ra/Wa	
C0367	24208	5E90h	E	1	FIX32	VD	4	Ra/Wa	
C0368	24207	5E8Fh	E	1	FIX32	VD	4	Ra/Wa	
C0369	24206	5E8Eh	E	1	FIX32	VD	4	Ra/Wa	
C0400	24175	5E6Fh	E	1	FIX32	VD	4	Ra	
C0402	24173	5E6Dh	E	1	FIX32	VD	4	Ra/W	CINH
C0403	24172	5E6Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0404	24171	5E6Bh	A	2	FIX32	VD	4	Ra	
C0405	24170	5E6Ah	E	1	FIX32	VD	4	Ra	
C0407	24168	5E68h	E	1	FIX32	VD	4	Ra/W	CINH
C0408	24167	5E67h	E	1	FIX32	VD	4	Ra/W	CINH
C0409	24166	5E66h	A	2	FIX32	VD	4	Ra	
C0416	24159	5E5Fh	E	1	U32	VH	4	Ra/W	CINH
C0420	24155	5E5Bh	E	1	FIX32	VD	4	Ra/W	CINH
C0421	24154	5E5Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0425	24150	5E56h	E	1	FIX32	VD	4	Ra/Wa	
C0426	24149	5E55h	E	1	FIX32	VD	4	Ra	
C0427	24148	5E54h	E	1	FIX32	VD	4	Ra/Wa	
C0429	24146	5E52h	E	1	FIX32	VD	4	Ra/Wa	
C0430	24145	5E51h	A	4	FIX32	VD	4	Ra/Wa	
C0431	24144	5E50h	E	1	FIX32	VD	4	Ra/W	CINH
C0432	24143	5E4Fh	E	1	FIX32	VD	4	Ra/W	CINH
C0433	24142	5E4Eh	E	1	FIX32	VD	4	Ra/W	CINH
C0434	24141	5E4Dh	A	3	FIX32	VD	4	Ra	
C0436	24139	5E4Bh	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0437	24138	5E4Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0438	24137	5E49h	E	1	FIX32	VD	4	Ra/W	CINH
C0439	24136	5E48h	A	3	FIX32	VD	4	Ra	
C0440	24135	5E47h	E	1	FIX32	VD	4	Ra/W	CINH
C0441	24134	5E46h	E	1	FIX32	VD	4	Ra	
C0443	24132	5E44h	E	1	B8	VH	1	Ra	
C0444	24131	5E43h	A	4	FIX32	VD	4	Ra	
C0450	24125	5E3Dh	E	1	FIX32	VD	4	Ra/W	CINH
C0451	24124	5E3Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0452	24123	5E3Bh	E	1	FIX32	VD	4	Ra/W	CINH
C0458	24117	5E35h	A	2	FIX32	VD	4	Ra	
C0459	24116	5E34h	E	1	FIX32	VD	4	Ra	
C0464	24111	5E2Fh	E	1	FIX32	VD	4	Ra	
C0465	24110	5E2Eh	A	50	FIX32	VD	4	Ra/W	CINH
C0466	24109	5E2Dh	E	1	FIX32	VD	4	Ra	
C0469	24106	5E2Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0470	24105	5E29h	A	4	B8	VH	1	Ra/Wa	
C0471	24104	5E28h	E	1	B32	VH	4	Ra/Wa	
C0472	24103	5E27h	A	20	FIX32	VD	4	Ra/Wa	
C0473	24102	5E26h	A	10	FIX32	VD	4	Ra/Wa	
C0474	24101	5E25h	A	10	I32	VH	4	Ra/Wa	
C0475	24100	5E24h	A	2	FIX32	VD	4	Ra/Wa	
C0490	24085	5E15h	E	1	FIX32	VD	4	Ra/W	CINH
C0495	24080	5E10h	E	1	FIX32	VD	4	Ra/W	CINH
C0497	24078	5E0Eh	E	1	FIX32	VD	4	Ra/Wa	
C0517	24058	5DFAh	A	32	FIX32	VD	4	Ra/Wa	
C0520	24055	5DF7h	E	1	FIX32	VD	4	Ra/W	CINH
C0521	24054	5DF6h	E	1	FIX32	VD	4	Ra/W	CINH
C0522	24053	5DF5h	E	1	FIX32	VD	4	Ra/W	CINH
C0523	24052	5DF4h	E	1	FIX32	VD	4	Ra/W	CINH
C0524	24051	5DF3h	E	1	FIX32	VD	4	Ra/W	CINH
C0525	24050	5DF2h	E	1	FIX32	VD	4	Ra/W	CINH
C0526	24049	5DF1h	E	1	FIX32	VD	4	Ra/W	CINH
C0527	24048	5DF0h	E	1	FIX32	VD	4	Ra/W	CINH
C0528	24047	5DEFh	A	2	I32	VH	4	Ra	
C0529	24046	5DEEh	E	1	FIX32	VD	4	Ra/Wa	
C0530	24045	5DEDh	E	1	FIX32	VD	4	Ra/Wa	
C0531	24044	5DECh	E	1	FIX32	VD	4	Ra/Wa	
C0532	24043	5DEBh	E	1	FIX32	VD	4	Ra/Wa	
C0533	24042	5DEAh	E	1	FIX32	VD	4	Ra/Wa	
C0534	24041	5DE9h	E	1	FIX32	VD	4	Ra/Wa	
C0535	24040	5DE8h	E	1	FIX32	VD	4	Ra/Wa	
C0536	24039	5DE7h	A	3	FIX32	VD	4	Ra	
C0537	24038	5DE6h	E	1	FIX32	VD	4	Ra	
C0538	24037	5DE5h	A	3	FIX32	VD	4	Ra	
C0539	24036	5DE4h	E	1	FIX32	VD	4	Ra	
C0540	24035	5DE3h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0541	24034	5DE2h	E	1	FIX32	VD	4	Ra/W	CINH
C0542	24033	5DE1h	E	1	FIX32	VD	4	Ra/W	CINH
C0544	24031	5DDFh	E	1	FIX32	VD	4	Ra/W	CINH
C0545	24030	5DDEh	E	1	FIX32	VD	4	Ra/Wa	
C0546	24029	5DDDh	E	1	U32	VH	4	Ra/Wa	
C0547	24028	5DDCh	E	1	FIX32	VD	4	Ra	
C0548	24027	5DDBh	E	1	FIX32	VD	4	Ra	
C0549	24026	5DDAh	E	1	FIX32	VD	4	Ra	
C0560	24015	5DCFh	A	15	FIX32	VD	4	Ra/Wa	
C0561	24014	5DCEh	E	1	FIX32	VD	4	Ra/W	CINH
C0562	24013	5DCDh	A	4	FIX32	VD	4	Ra/W	CINH
C0563	24012	5DCCh	E	1	FIX32	VD	4	Ra	
C0564	24011	5DCBh	A	4	FIX32	VD	4	Ra	
C0570	24005	5DC5h	E	1	FIX32	VD	4	Ra/W	CINH
C0571	24004	5DC4h	E	1	FIX32	VD	4	Ra/W	CINH
C0572	24003	5DC3h	E	1	FIX32	VD	4	Ra	
C0573	24002	5DC2h	E	1	FIX32	VD	4	Ra	
C0577	23998	5DBEh	E	1	FIX32	VD	4	Ra/Wa	
C0578	23997	5DBDh	E	1	FIX32	VD	4	Ra/Wa	
C0581	23994	5DBAh	E	1	FIX32	VD	4	Ra/Wa	
C0582	23993	5DB9h	E	1	FIX32	VD	4	Ra/Wa	
C0583	23992	5DB8h	E	1	FIX32	VD	4	Ra/Wa	
C0584	23991	5DB7h	E	1	FIX32	VD	4	Ra/Wa	
C0585	23990	5DB6h	E	1	FIX32	VD	4	Ra/Wa	
C0586	23989	5DB5h	E	1	FIX32	VD	4	Ra/Wa	
C0587	23988	5DB4h	E	1	FIX32	VD	4	Ra/Wa	
C0588	23987	5DB3h	E	1	FIX32	VD	4	Ra/Wa	
C0589	23986	5DB2h	E	1	FIX32	VD	4	Ra/Wa	
C0590	23985	5DB1h	E	1	FIX32	VD	4	Ra/Wa	
C0591	23984	5DB0h	E	1	FIX32	VD	4	Ra/Wa	
C0592	23983	5DAFh	E	1	FIX32	VD	4	Ra/Wa	
C0593	23982	5DAEh	E	1	FIX32	VD	4	Ra/Wa	
C0594	23981	5DADh	E	1	FIX32	VD	4	Ra/Wa	
C0595	23980	5DACh	E	1	FIX32	VD	4	Ra/Wa	
C0596	23979	5DABh	E	1	FIX32	VD	4	Ra/Wa	
C0597	23978	5DAAh	E	1	FIX32	VD	4	Ra/Wa	
C0598	23977	5DA9h	E	1	FIX32	VD	4	Ra/Wa	
C0599	23976	5DA8h	E	1	FIX32	VD	4	Ra/Wa	
C0600	23975	5DA7h	E	1	FIX32	VD	4	Ra/Wa	
C0601	23974	5DA6h	A	2	FIX32	VD	4	Ra/W	CINH
C0602	23973	5DA5h	A	2	FIX32	VD	4	Ra	
C0606	23966	5D9Eh	E	1	FIX32	VD	4	Ra/Wa	
C0610	23965	5D9Dh	A	3	FIX32	VD	4	Ra/W	CINH
C0611	23964	5D9Ch	A	3	FIX32	VD	4	Ra	
C0620	23955	5D93h	E	1	FIX32	VD	4	Ra/Wa	
C0621	23954	5D92h	E	1	FIX32	VD	4	Ra/Wa	
C0622	23953	5D91h	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0623	23952	5D90h	E	1	FIX32	VD	4	Ra	
C0630	23945	5D89h	E	1	FIX32	VD	4	Ra/Wa	
C0631	23944	5D88h	E	1	FIX32	VD	4	Ra/Wa	
C0632	23943	5D87h	E	1	FIX32	VD	4	Ra/W	CINH
C0633	23942	5D86h	E	1	FIX32	VD	4	Ra	
C0640	23935	5D7Fh	E	1	FIX32	VD	4	Ra/Wa	
C0641	23934	5D7Eh	E	1	FIX32	VD	4	Ra/W	CINH
C0642	23933	5D7Dh	E	1	FIX32	VD	4	Ra	
C0650	23925	5D75h	E	1	FIX32	VD	4	Ra/Wa	
C0651	23924	5D74h	E	1	FIX32	VD	4	Ra/Wa	
C0652	23923	5D73h	E	1	FIX32	VD	4	Ra/W	CINH
C0653	23922	5D72h	E	1	FIX32	VD	4	Ra/Wa	
C0654	23921	5D71h	E	1	FIX32	VD	4	Ra	
C0655	23920	5D70h	E	1	FIX32	VD	4	Ra/Wa	
C0656	23919	5D6Fh	E	1	FIX32	VD	4	Ra/Wa	
C0657	23918	5D6Eh	E	1	FIX32	VD	4	Ra/W	CINH
C0658	23917	5D6Dh	E	1	FIX32	VD	4	Ra	
C0661	23914	5D6Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0662	23913	5D69h	E	1	FIX32	VD	4	Ra	
C0671	23904	5D60h	E	1	FIX32	VD	4	Ra/Wa	
C0672	23903	5D5Fh	E	1	FIX32	VD	4	Ra/Wa	
C0673	23902	5D5Eh	E	1	FIX32	VD	4	Ra/W	CINH
C0674	23901	5D5Dh	E	1	FIX32	VD	4	Ra/W	CINH
C0675	23900	5D5Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0676	23899	5D5Bh	A	2	FIX32	VD	4	Ra	
C0677	23898	5D5Ah	E	1	FIX32	VD	4	Ra	
C0680	23895	5D57h	E	1	FIX32	VD	4	Ra/Wa	
C0681	23894	5D56h	E	1	FIX32	VD	4	Ra/Wa	
C0682	23893	5D55h	E	1	FIX32	VD	4	Ra/Wa	
C0683	23892	5D54h	A	2	FIX32	VD	4	Ra/W	CINH
C0684	23891	5D53h	A	2	FIX32	VD	4	Ra	
C0685	23890	5D52h	E	1	FIX32	VD	4	Ra/Wa	
C0686	23889	5D51h	E	1	FIX32	VD	4	Ra/Wa	
C0687	23888	5D50h	E	1	FIX32	VD	4	Ra/Wa	
C0688	23887	5D4Fh	A	2	FIX32	VD	4	Ra/W	CINH
C0689	23886	5D4Eh	A	2	FIX32	VD	4	Ra	
C0690	23885	5D4Dh	E	1	FIX32	VD	4	Ra/Wa	
C0691	23884	5D4Ch	E	1	FIX32	VD	4	Ra/Wa	
C0692	23883	5D4Bh	E	1	FIX32	VD	4	Ra/Wa	
C0693	23882	5D4Ah	A	2	FIX32	VD	4	Ra/W	CINH
C0694	23881	5D49h	A	2	FIX32	VD	4	Ra	
C0700	23875	5D43h	E	1	FIX32	VD	4	Ra/W	CINH
C0701	23874	5D42h	E	1	FIX32	VD	4	Ra	
C0703	23872	5D40h	E	1	FIX32	VD	4	Ra/W	CINH
C0704	23871	5D3Fh	E	1	FIX32	VD	4	Ra	
C0710	23865	5D39h	E	1	FIX32	VD	4	Ra/Wa	
C0711	23864	5D38h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0713	23862	5D36h	E	1	FIX32	VD	4	Ra/W	CINH
C0714	23861	5D35h	E	1	FIX32	VD	4	Ra	
C0715	23860	5D34h	E	1	FIX32	VD	4	Ra/Wa	
C0716	23859	5D33h	E	1	FIX32	VD	4	Ra/Wa	
C0718	23857	5D31h	E	1	FIX32	VD	4	Ra/W	CINH
C0719	23856	5D30h	E	1	FIX32	VD	4	Ra	
C0720	23855	5D2Fh	E	1	FIX32	VD	4	Ra/Wa	
C0721	23854	5D2Eh	E	1	FIX32	VD	4	Ra/Wa	
C0723	23852	5D2Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0724	23851	5D2Bh	E	1	FIX32	VD	4	Ra	
C0725	23850	5D2Ah	E	1	FIX32	VD	4	Ra/Wa	
C0726	23849	5D29h	E	1	FIX32	VD	4	Ra/Wa	
C0728	23847	5D27h	E	1	FIX32	VD	4	Ra/W	CINH
C0729	23846	5D26h	E	1	FIX32	VD	4	Ra	
C0744	23831	5D17h	E						
C0750	23825	5D11h	E	1	FIX32	VD	4	Ra/Wa	
C0751	23824	5D10h	E	1	FIX32	VD	4	Ra/Wa	
C0752	23823	5D0Fh	E	1	FIX32	VD	4	Ra/Wa	
C0753	23822	5D0Eh	E	1	FIX32	VD	4	Ra/Wa	
C0754	23821	5D0Dh	E	1	U32	VH	4	Ra/Wa	
C0755	23820	5D0Ch	E	1	FIX32	VD	4	Ra/Wa	
C0756	23819	5D0Bh	E	1	I32	VH	4	Ra/Wa	
C0757	23818	5D0Ah	E	1	FIX32	VD	4	Ra/Wa	
C0758	23817	5D09h	E	1	FIX32	VD	4	Ra/W	CINH
C0759	23816	5D08h	E	1	FIX32	VD	4	Ra/W	CINH
C0760	23815	5D07h	E	1	FIX32	VD	4	Ra/W	CINH
C0761	23814	5D06h	E	1	FIX32	VD	4	Ra/W	CINH
C0764	23811	5D03h	A	3	FIX32	VD	4	Ra	
C0765	23810	5D02h	E	1	FIX32	VD	4	Ra	
C0766	23809	5D01h	E	1	FIX32	VD	4	Ra/Wa	
C0770	23805	5CFDh	E	1	FIX32	VD	4	Ra/W	CINH
C0771	23804	5CFCh	E	1	FIX32	VD	4	Ra/W	CINH
C0772	23803	5CFBh	E	1	FIX32	VD	4	Ra/W	CINH
C0773	23802	5CFAh	A	3	FIX32	VD	4	Ra	
C0775	23800	5CF8h	E	1	FIX32	VD	4	Ra/W	CINH
C0776	23799	5CF7h	E	1	FIX32	VD	4	Ra/W	CINH
C0777	23798	5CF6h	E	1	FIX32	VD	4	Ra/W	CINH
C0778	23797	5CF5h	A	3	FIX32	VD	4	Ra	
C0780	23795	5CF3h	E	1	FIX32	VD	4	Ra/W	CINH
C0781	23794	5CF2h	E	1	FIX32	VD	4	Ra/W	CINH
C0782	23793	5CF1h	E	1	FIX32	VD	4	Ra/W	CINH
C0783	23792	5CF0h	E	1	FIX32	VD	4	Ra/W	CINH
C0784	23791	5CEFh	E	1	FIX32	VD	4	Ra/W	CINH
C0785	23790	5CEEh	E	1	FIX32	VD	4	Ra/W	CINH
C0786	23789	5CEDh	E	1	FIX32	VD	4	Ra/W	CINH
C0787	23788	5CECh	A	4	FIX32	VD	4	Ra/W	CINH
C0788	23787	5CEBh	A	4	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0789	23786	5CEAh	E	1	FIX32	VD	4	Ra/W	CINH
C0790	23785	5CE9h	E	1	FIX32	VD	4	Ra/W	CINH
C0798	23777	5CE1h	A	2	FIX32	VD	4	Ra	
C0799	23776	5CE0h	A	13	FIX32	VD	4	Ra	
C0800	23775	5CDFh	E	1	FIX32	VD	4	Ra/W	CINH
C0801	23774	5CDEh	E	1	FIX32	VD	4	Ra/W	CINH
C0802	23773	5CDDh	E	1	FIX32	VD	4	Ra/W	CINH
C0803	23772	5CDCh	E	1	FIX32	VD	4	Ra/W	CINH
C0804	23771	5CDBh	E	1	FIX32	VD	4	Ra/W	CINH
C0805	23770	5CDAh	E	1	FIX32	VD	4	Ra/W	CINH
C0808	23767	5CD7h	A	4	FIX32	VD	4	Ra	
C0809	23766	5CD6h	A	2	FIX32	VD	4	Ra	
C0810	23765	5CD5h	A	2	FIX32	VD	4	Ra/W	CINH
C0811	23764	5CD4h	E	1	FIX32	VD	4	Ra/W	CINH
C0812	23763	5CD3h	A	2	FIX32	VD	4	Ra	
C0813	23762	5CD2h	E	1	FIX32	VD	4	Ra	
C0815	23760	5CD0h	A	2	FIX32	VD	4	Ra/W	CINH
C0816	23759	5CCFh	E	1	FIX32	VD	4	Ra/W	CINH
C0817	23758	5CCEh	A	2	FIX32	VD	4	Ra	
C0818	23757	5CCDh	E	1	FIX32	VD	4	Ra	
C0820	23755	5CCBh	A	3	FIX32	VD	4	Ra/W	CINH
C0821	23754	5CCAh	A	3	FIX32	VD	4	Ra	
C0822	23753	5CC9h	A	3	FIX32	VD	4	Ra/W	CINH
C0823	23752	5CC8h	A	3	FIX32	VD	4	Ra	
C0824	23751	5CC7h	A	3	FIX32	VD	4	Ra/W	CINH
C0825	23750	5CC6h	A	3	FIX32	VD	4	Ra	
C0826	23749	5CC5h	A	3	FIX32	VD	4	Ra/W	CINH
C0827	23748	5CC4h	A	3	FIX32	VD	4	Ra	
C0828	23747	5CC3h	A	3	FIX32	VD	4	Ra/W	CINH
C0829	23746	5CC2h	A	3	FIX32	VD	4	Ra	
C0830	23745	5CC1h	A	3	FIX32	VD	4	Ra/W	CINH
C0831	23744	5CC0h	A	3	FIX32	VD	4	Ra	
C0832	23743	5CBFh	A	3	FIX32	VD	4	Ra/W	CINH
C0833	23742	5CBEh	A	3	FIX32	VD	4	Ra	
C0834	23741	5CBDh	A	3	FIX32	VD	4	Ra/W	CINH
C0835	23740	5CBCh	A	3	FIX32	VD	4	Ra	
C0836	23739	5CBBh	A	3	FIX32	VD	4	Ra/W	CINH
C0837	23738	5CBAh	A	3	FIX32	VD	4	Ra	
C0838	23737	5CB9h	A	3	FIX32	VD	4	Ra/W	CINH
C0839	23736	5CB8h	A	3	FIX32	VD	4	Ra	
C0840	23735	5CB7h	E	1	FIX32	VD	4	Ra/W	CINH
C0841	23734	5CB6h	E	1	FIX32	VD	4	Ra	
C0842	23733	5CB5h	E	1	FIX32	VD	4	Ra/W	CINH
C0843	23732	5CB4h	E	1	FIX32	VD	4	Ra	
C0844	23731	5CB3h	E	1	FIX32	VD	4	Ra/W	CINH
C0845	23730	5CB2h	E	1	FIX32	VD	4	Ra	
C0846	23729	5CB1h	E	1	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0847	23728	5CB0h	E	1	FIX32	VD	4	Ra	
C0848	23727	5CAFh	E	1	FIX32	VD	4	Ra/W	CINH
C0849	23726	5CAEh	E	1	FIX32	VD	4	Ra	
C0850	23725	5CADh	A	3	FIX32	VD	4	Ra/W	CINH
C0851	23724	5CACh	E	1	FIX32	VD	4	Ra/W	CINH
C0852	23723	5CABh	E	1	FIX32	VD	4	Ra/Wa	
C0853	23722	5CAAh	E	1	FIX32	VD	4	Ra/Wa	
C0854	23721	5CA9h	E	1	FIX32	VD	4	Ra/Wa	
C0855	23720	5CA8h	A	2	B16	VH	2	Ra	
C0856	23719	5CA7h	A	3	I32	VH	4	Ra	
C0857	23718	5CA6h	E	1	I32	VH	4	Ra	
C0858	23717	5CA5h	A	3	FIX32	VD	4	Ra	
C0859	23716	5CA4h	E	1	I32	VH	4	Ra	
C0860	23715	5CA3h	A	11	FIX32	VD	4	Ra/W	CINH
C0861	23714	5CA2h	A	3	FIX32	VD	4	Ra/W	CINH
C0863	23712	5CA0h	A	6	B16	VH	2	Ra	
C0864	23711	5C9Fh	A	3	FIX32	VD	4	Ra/Wa	
C0865	23710	5C9Eh	A	3	FIX32	VD	4	Ra/Wa	
C0866	23709	5C9Dh	A	11	FIX32	VD	4	Ra	
C0867	23708	5C9Ch	A	5	I32	VH	4	Ra	
C0868	23707	5C9Bh	A	11	FIX32	VD	4	Ra	
C0869	23706	5C9Ah	A	3	I32	VH	4	Ra	
C0870	23705	5C99h	A	2	FIX32	VD	4	Ra/W	CINH
C0871	23704	5C98h	E	1	FIX32	VD	4	Ra/W	CINH
C0876	23699	5C93h	E	1	FIX32	VD	4	Ra/W	CINH
C0878	23697	5C91h	A	4	FIX32	VD	4	Ra	
C0879	23696	5C90h	A	3	FIX32	VD	4	Ra/Wa	
C0885	23690	5C8Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0886	23689	5C89h	E	1	FIX32	VD	4	Ra/W	CINH
C0889	23686	5C86h	A	2	FIX32	VD	4	Ra	
C0890	23685	5C85h	E	1	FIX32	VD	4	Ra/W	CINH
C0891	23684	5C84h	E	1	FIX32	VD	4	Ra/W	CINH
C0892	23683	5C83h	E	1	FIX32	VD	4	Ra/W	CINH
C0893	23682	5C82h	E	1	FIX32	VD	4	Ra/W	CINH
C0894	23681	5C81h	E	1	FIX32	VD	4	Ra/W	CINH
C0895	23680	5C80h	E	1	FIX32	VD	4	Ra/W	CINH
C0896	23679	5C7Fh	E	1	FIX32	VD	4	Ra/W	CINH
C0897	23678	5C7Eh	E	1	FIX32	VD	4	Ra/W	CINH
C0898	23677	5C7Dh	E	1	FIX32	VD	4	Ra/W	CINH
C0899	23676	5C7Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0900	23675	5C7Bh	E	1	FIX32	VD	4	Ra/W	CINH
C0901	23674	5C7Ah	E	1	FIX32	VD	4	Ra/W	CINH
C0902	23673	5C79h	E	1	FIX32	VD	4	Ra/W	CINH
C0903	23672	5C78h	E	1	FIX32	VD	4	Ra/W	CINH
C0906	23669	5C75h	A	9	FIX32	VD	4	Ra	
C0907	23668	5C74h	A	4	FIX32	VD	4	Ra	
C0908	23667	5C73h	E	1	I32	VH	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C0909	23666	5C72h	E	1	FIX32	VD	4	Ra/Wa	
C0940	23635	5C53h	E	1	FIX32	VD	4	Ra/Wa	
C0941	23634	5C52h	E	1	FIX32	VD	4	Ra/Wa	
C0942	23633	5C51h	E	1	FIX32	VD	4	Ra/W	CINH
C0943	23632	5C50h	E	1	FIX32	VD	4	Ra	
C0945	23630	5C4Eh	E	1	FIX32	VD	4	Ra/Wa	
C0946	23629	5C4Dh	E	1	FIX32	VD	4	Ra/Wa	
C0947	23628	5C4Ch	E	1	FIX32	VD	4	Ra/W	CINH
C0948	23627	5C4Bh	E	1	FIX32	VD	4	Ra	
C0950	23625	5C49h	E	1	FIX32	VD	4	Ra/Wa	
C0951	23624	5C48h	E	1	FIX32	VD	4	Ra/Wa	
C0952	23623	5C47h	E	1	FIX32	VD	4	Ra/W	CINH
C0953	23622	5C46h	E	1	FIX32	VD	4	Ra	
C0955	23620	5C44h	E	1	FIX32	VD	4	Ra/Wa	
C0956	23619	5C43h	E	1	FIX32	VD	4	Ra/Wa	
C0957	23618	5C42h	E	1	FIX32	VD	4	Ra/W	CINH
C0958	23617	5C41h	E	1	FIX32	VD	4	Ra	
C0960	23615	5C3Fh	E	1	FIX32	VD	4	Ra/Wa	
C0961	23614	5C3Eh	E	1	FIX32	VD	4	Ra/Wa	
C0962	23613	5C3Dh	E	1	FIX32	VD	4	Ra/Wa	
C0963	23612	5C3Ch	E	1	FIX32	VD	4	Ra/Wa	
C0964	23611	5C3Bh	E	1	FIX32	VD	4	Ra/Wa	
C0965	23610	5C3Ah	E	1	FIX32	VD	4	Ra/Wa	
C0966	23609	5C39h	E	1	FIX32	VD	4	Ra/Wa	
C0967	23608	5C38h	E	1	FIX32	VD	4	Ra/W	CINH
C0968	23607	5C37h	E	1	FIX32	VD	4	Ra	
C0990	23585	5C21h	E	1	FIX32	VD	4	Ra/W	CINH
C0991	23584	5C20h	E	1	FIX32	VD	4	Ra/W	CINH
C0992	23583	5C1Fh	E	1	FIX32	VD	4	Ra	
C0993	23582	5C1Eh	E	1	FIX32	VD	4	Ra	
C0995	23580	5C1Ch	E	1	FIX32	VD	4	Ra/Wa	
C0996	23579	5C1Bh	E	1	FIX32	VD	4	Ra/W	CINH
C0997	23578	5C1Ah	E	1	I32	VH	4	Ra	
C1000	23575	5C17h	E	1	FIX32	VD	4	Ra/Wa	
C1001	23574	5C16h	E	1	FIX32	VD	4	Ra/W	CINH
C1002	23573	5C15h	E	1	I32	VH	4	Ra	
C1010	23565	5C0Dh	E	1	FIX32	VD	4	Ra/Wa	
C1011	23564	5C0Ch	A	2	FIX32	VD	4	Ra/W	CINH
C1012	23563	5C0Bh	A	2	I32	VH	4	Ra	
C1020	23555	5C03h	E	1	FIX32	VD	4	Ra/Wa	
C1021	23554	5C02h	A	2	FIX32	VD	4	Ra/W	CINH
C1022	23553	5C01h	A	2	I32	VH	4	Ra	
C1025	23550	5BFEh	E	1	FIX32	VD	4	Ra/Wa	
C1026	23549	5BFDh	A	2	FIX32	VD	4	Ra/W	CINH
C1027	23548	5BFCh	A	2	I32	VH	4	Ra	
C1090	23485	5BBDh	E	1	I32	VH	4	Ra	
C1091	23484	5BBCh	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1092	23483	5BBBh	E	1	FIX32	VD	4	Ra/Wa	
C1093	23482	5BBAh	E	1	FIX32	VD	4	Ra/Wa	
C1094	23481	5BB9h	E	1	FIX32	VD	4	Ra/Wa	
C1095	23480	5BB8h	E	1	I32	VH	4	Ra/Wa	
C1096	23479	5BB7h	E	1	FIX32	VD	4	Ra/W	CINH
C1097	23478	5BB6h	A	3	FIX32	VD	4	Ra/W	CINH
C1098	23477	5BB5h	E	1	FIX32	VD	4	Ra	
C1099	23476	5BB4h	A	3	FIX32	VD	4	Ra	
C1100	23475	5BB3h	E	1	FIX32	VD	4	Ra/Wa	
C1101	23474	5BB2h	A	2	FIX32	VD	4	Ra/W	CINH
C1102	23473	5BB1h	A	3	FIX32	VD	4	Ra/W	CINH
C1103	23472	5BB0h	A	2	FIX32	VD	4	Ra	
C1104	23471	5BAFh	A	3	FIX32	VD	4	Ra	
C1105	23470	5BAEh	E	1	FIX32	VD	4	Ra/Wa	
C1106	23469	5BADh	A	2	FIX32	VD	4	Ra/W	CINH
C1107	23468	5BACh	A	3	FIX32	VD	4	Ra/W	CINH
C1108	23467	5BABh	A	2	FIX32	VD	4	Ra	
C1109	23466	5BAAh	A	3	FIX32	VD	4	Ra	
C1110	23465	5BA9h	E	1	FIX32	VD	4	Ra/Wa	
C1111	23464	5BA8h	A	2	FIX32	VD	4	Ra/W	CINH
C1112	23463	5BA7h	A	3	FIX32	VD	4	Ra/W	CINH
C1113	23462	5BA6h	A	2	FIX32	VD	4	Ra	
C1114	23461	5BA5h	A	3	FIX32	VD	4	Ra	
C1120	23455	5B9Fh	E	1	FIX32	VD	4	Ra/Wa	
C1121	23454	5B9Eh	A	2	FIX32	VD	4	Ra/Wa	
C1122	23453	5B9Dh	E	1	FIX32	VD	4	Ra/Wa	
C1123	23452	5B9Ch	A	2	FIX32	VD	4	Ra/Wa	
C1124	23451	5B9Bh	E	1	FIX32	VD	4	Ra/W	CINH
C1125	23450	5B9Ah	E	1	FIX32	VD	4	Ra/W	CINH
C1126	23449	5B99h	E	1	FIX32	VD	4	Ra/W	CINH
C1127	23448	5B98h	E	1	I32	VH	4	Ra	
C1128	23447	5B97h	E	1	I32	VH	4	Ra	
C1129	23446	5B96h	E	1	I32	VH	4	Ra	
C1130	23445	5B95h	A	2	FIX32	VD	4	Ra/W	CINH
C1131	23444	5B94h	E	1	FIX32	VD	4	Ra/W	CINH
C1132	23443	5B93h	E	1	FIX32	VD	4	Ra/W	CINH
C1135	23440	5B90h	A	2	FIX32	VD	4	Ra	
C1136	23439	5B8Fh	E	1	FIX32	VD	4	Ra	
C1137	23438	5B8Eh	E	1	I32	VH	4	Ra	
C1160	23415	5B77h	A	2	FIX32	VD	4	Ra/W	CINH
C1161	23414	5B76h	E	1	FIX32	VD	4	Ra/W	CINH
C1162	23413	5B75h	A	2	FIX32	VD	4	Ra	
C1163	23412	5B74h	E	1	FIX32	VD	4	Ra	
C1165	23410	5B72h	A	2	FIX32	VD	4	Ra/W	CINH
C1166	23409	5B71h	E	1	FIX32	VD	4	Ra/W	CINH
C1167	23408	5B70h	A	2	FIX32	VD	4	Ra	
C1168	23407	5B6Fh	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1180	23395	5B63h	E	1	FIX32	VD	4	Ra/W	CINH
C1181	23394	5B62h	E	1	FIX32	VD	4	Ra	
C1182	23393	5B61h	E	1	FIX32	VD	4	Ra/Wa	
C1183	23392	5B60h	E	1	FIX32	VD	4	Ra/Wa	
C1184	23391	5B5Fh	E	1	FIX32	VD	4	Ra/Wa	
C1185	23390	5B5Eh	E	1	FIX32	VD	4	Ra/Wa	
C1186	23389	5B5Dh	E	1	FIX32	VD	4	Ra/Wa	
C1187	23388	5B5Ch	E	1	FIX32	VD	4	Ra/Wa	
C1188	23387	5B5Bh	E	1	FIX32	VD	4	Ra/Wa	
C1190	23385	5B59h	E	1	FIX32	VD	4	Ra/Wa	
C1191	23384	5B58h	A	2	FIX32	VD	4	Ra/Wa	
C1192	23383	5B57h	A	2	FIX32	VD	4	Ra/Wa	
C1195	23380	5B54h	E	1	FIX32	VD	4	Ra/W	CINH
C1196	23379	5B53h	E	1	I32	VH	4	Ra	
C1197	23378	5B52h	E	1	I32	VH	4	Ra	
C1202	23373	5B4Dh	E	1	FIX32	VD	4	Ra/W	CINH
C1203	23372	5B4Ch	E	1	FIX32	VD	4	Ra/W	CINH
C1204	23371	5B4Bh	E	1	FIX32	VD	4	Ra/W	CINH
C1205	23370	5B4Ah	E	1	FIX32	VD	4	Ra	
C1206	23369	5B49h	E	1	FIX32	VD	4	Ra/W	CINH
C1207	23368	5B48h	A	2	FIX32	VD	4	Ra/W	CINH
C1208	23367	5B47h	E	1	FIX32	VD	4	Ra/W	CINH
C1209	23366	5B46h	E	1	FIX32	VD	4	Ra/Wa	
C1210	23365	5B45h	E	1	FIX32	VD	4	Ra/Wa	
C1211	23364	5B44h	E	1	FIX32	VD	4	Ra/Wa	
C1212	23363	5B43h	E	1	FIX32	VD	4	Ra	
C1213	23362	5B42h	E	1	FIX32	VD	4	Ra/Wa	
C1214	23361	5B41h	E	1	FIX32	VD	4	Ra/Wa	
C1215	23360	5B40h	A	4	FIX32	VD	4	Ra/Wa	
C1216	23359	5B3Fh	E	1	FIX32	VD	4	Ra/Wa	
C1218	23357	5B3Dh	A	2	FIX32	VD	4	Ra/Wa	
C1220	23355	5B3Bh	A	15	FIX32	VD	4	Ra	
C1221	23354	5B3Ah	A	15	I32	VH	4	Ra	
C1223	23352	5B38h	E	1	FIX32	VD	4	Ra/W	CINH
C1224	23351	5B37h	E	1	FIX32	VD	4	Ra/W	CINH
C1225	23350	5B36h	E	1	FIX32	VD	4	Ra/Wa	
C1227	23348	5B34h	E	1	FIX32	VD	4	Ra/Wa	
C1240	23335	5B27h	E	1	FIX32	VD	4	Ra/Wa	
C1241	23334	5B26h	E	1	FIX32	VD	4	Ra/Wa	
C1242	23333	5B25h	E	1	FIX32	VD	4	Ra/Wa	
C1243	23332	5B24h	E	1	FIX32	VD	4	Ra/Wa	
C1245	23330	5B22h	A	3	FIX32	VD	4	Ra	
C1250	23325	5B1Dh	E	1	FIX32	VD	4	Ra/Wa	
C1251	23324	5B1Ch	E	1	FIX32	VD	4	Ra/Wa	
C1252	23323	5B1Bh	E	1	FIX32	VD	4	Ra/Wa	
C1253	23322	5B1Ah	E	1	FIX32	VD	4	Ra/Wa	
C1255	23320	5B18h	A	3	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1256	23319	5B17h	E	1	FIX32	VD	4	Ra/Wa	
C1257	23318	5B16h	E	1	FIX32	VD	4	Ra/Wa	
C1260	23315	5B13h	E	1	FIX32	VD	4	Ra/Wa	
C1261	23314	5B12h	A	16	FIX32	VD	4	Ra/Wa	
C1280	23295	5AFFh	E	1	B16	VH	2	Ra/Wa	
C1283	23292	5AFCh	E	1	FIX32	VD	4	Ra	
C1284	23291	5AFBh	E	1	FIX32	VD	4	Ra	
C1285	23290	5AFAh	A	4	FIX32	VD	4	Ra/Wa	
C1286	23289	5AF9h	A	2	FIX32	VD	4	Ra/Wa	
C1287	23288	5AF8h	E	1	FIX32	VD	4	Ra/Wa	
C1288	23287	5AF7h	E	1	FIX32	VD	4	Ra/Wa	
C1289	23286	5AF6h	A	2	FIX32	VD	4	Ra/Wa	
C1290	23285	5AF5h	E	1	FIX32	VD	4	Ra/Wa	
C1291	23284	5AF4h	A	3	FIX32	VD	4	Ra/Wa	
C1298	23277	5AEDh	E	1	FIX32	VD	4	Ra	
C1299	23276	5AECh	A	32	FIX32	VD	4	Ra	
C1301	23274	5AEAh	A	60	FIX32	VD	4	Ra/Wa	
C1302	23273	5AE9h	A	30	FIX32	VD	4	Ra/Wa	
C1303	23272	5AE8h	A	30	FIX32	VD	4	Ra/Wa	
C1304	23271	5AE7h	A	30	FIX32	VD	4	Ra/Wa	
C1305	23270	5AE6h	A	30	FIX32	VD	4	Ra/Wa	
C1311	23264	5AE0h	A	32	FIX32	VD	4	Ra/Wa	
C1312	23263	5ADFh	A	32	FIX32	VD	4	Ra/Wa	
C1313	23262	5ADEh	A	32	FIX32	VD	4	Ra/Wa	
C1314	23261	5ADDh	A	32	FIX32	VD	4	Ra/Wa	
C1315	23260	5ADCh	A	32	FIX32	VD	4	Ra/Wa	
C1316	23259	5ADBh	A	32	FIX32	VD	4	Ra/Wa	
C1318	23257	5AD9h	A	32	FIX32	VD	4	Ra/Wa	
C1319	23256	5AD8h	A	32	FIX32	VD	4	Ra/Wa	
C1320	23255	5AD7h	A	32	FIX32	VD	4	Ra/Wa	
C1321	23254	5AD6h	A	32	FIX32	VD	4	Ra/Wa	
C1322	23253	5AD5h	A	32	FIX32	VD	4	Ra/Wa	
C1323	23252	5AD4h	A	32	FIX32	VD	4	Ra/Wa	
C1324	23251	5AD3h	A	32	FIX32	VD	4	Ra/Wa	
C1325	23250	5AD2h	A	32	FIX32	VD	4	Ra/Wa	
C1326	23249	5AD1h	A	32	FIX32	VD	4	Ra/Wa	
C1327	23248	5AD0h	A	32	FIX32	VD	4	Ra/Wa	
C1328	23247	5ACFh	A	32	FIX32	VD	4	Ra/Wa	
C1329	23246	5ACEh	A	32	FIX32	VD	4	Ra/Wa	
C1330	23245	5ACDh	A	32	FIX32	VD	4	Ra/Wa	
C1331	23244	5ACCh	A	32	FIX32	VD	4	Ra/Wa	
C1333	23242	5ACAh	A	32	FIX32	VD	4	Ra/Wa	
C1334	23241	5AC9h	A	32	FIX32	VD	4	Ra/Wa	
C1335	23240	5AC8h	A	32	FIX32	VD	4	Ra/Wa	
C1336	23239	5AC7h	A	32	FIX32	VD	4	Ra/Wa	
C1349	23226	5ABAh	A	32	FIX32	VD	4	Ra/Wa	
C1350	23225	5AB9h	A	10	FIX32	VD	4	Ra/W	CINH

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1351	23224	5AB8h	A	10	I32	VH	4	Ra	
C1352	23223	5AB7h	A	4	FIX32	VD	4	Ra/W	CINH
C1353	23222	5AB6h	A	4	I32	VH	4	Ra	
C1354	23221	5AB5h	A	4	FIX32	VD	4	Ra/W	CINH
C1355	23220	5AB4h	A	4	I32	VH	4	Ra	
C1356	23219	5AB3h	A	4	FIX32	VD	4	Ra/W	CINH
C1357	23218	5AB2h	A	4	FIX32	VD	4	Ra	
C1358	23217	5AB1h	A	4	FIX32	VD	4	Ra/Wa	
C1359	23216	5AB0h	A	4	FIX32	VD	4	Ra	
C1360	23215	5AAFh	A	22	FIX32	VD	4	Ra/W	CINH
C1361	23214	5AAEh	A	22	FIX32	VD	4	Ra	
C1362	23213	5AADh	A	8	FIX32	VD	4	Ra/W	CINH
C1363	23212	5AACh	A	8	FIX32	VD	4	Ra	
C1364	23211	5AABh	A	3	FIX32	VD	4	Ra/W	CINH
C1365	23210	5AAAh	A	3	I32	VH	4	Ra	
C1370	23205	5AA5h	A	32	FIX32	VD	4	Ra/W	CINH
C1371	23204	5AA4h	A	2	B16	VH	2	Ra	
C1372	23203	5AA3h	A	2	B16	VH	2	Ra	
C1380	23195	5A9Bh	A	104	FIX32	VD	4	Ra	
C1381	23194	5A9Ah	A	104	I32	VH	4	Ra	
C1382	23193	5A99h	A	34	FIX32	VD	4	Ra	
C1383	23192	5A98h	A	34	I32	VH	4	Ra	
C1384	23191	5A97h	A	34	FIX32	VD	4	Ra	
C1385	23190	5A96h	A	34	I32	VH	4	Ra	
C1386	23189	5A95h	A	34	FIX32	VD	4	Ra	
C1387	23188	5A94h	A	34	FIX32	VD	4	Ra	
C1400	23175	5A87h	A	4	FIX32	VD	4	Ra/W	CINH
C1401	23174	5A86h	E	1	FIX32	VD	4	Ra/W	CINH
C1402	23173	5A85h	A	4	FIX32	VD	4	Ra	
C1403	23172	5A84h	E	1	FIX32	VD	4	Ra	
C1404	23171	5A83h	E	1	I32	VH	4	Ra	
C1405	23170	5A82h	E	1	FIX32	VD	4	Ra/W	CINH
C1406	23169	5A81h	E	1	FIX32	VD	4	Ra	
C1500	23075	5A23h	E	1	I32	VH	4	Ra	
C1501	23074	5A22h	E	1	FIX32	VD	4	Ra/Wa	
C1502	23073	5A21h	E	1	FIX32	VD	4	Ra/Wa	
C1503	23072	5A20h	E	1	FIX32	VD	4	Ra/Wa	
C1504	23071	5A1Fh	E	1	FIX32	VD	4	Ra/Wa	
C1505	23070	5A1Eh	E	1	I32	VH	4	Ra/Wa	
C1506	23069	5A1Dh	E	1	FIX32	VD	4	Ra/W	CINH
C1507	23068	5A1Ch	A	3	FIX32	VD	4	Ra/W	CINH
C1508	23067	5A1Bh	E	1	FIX32	VD	4	Ra	
C1509	23066	5A1Ah	A	3	FIX32	VD	4	Ra	
C1510	23065	5A19h	E	1	I32	VH	4	Ra	
C1511	23064	5A18h	E	1	FIX32	VD	4	Ra/Wa	
C1512	23063	5A17h	E	1	FIX32	VD	4	Ra/Wa	
C1513	23062	5A16h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1514	23061	5A15h	E	1	FIX32	VD	4	Ra/Wa	
C1515	23060	5A14h	E	1	I32	VH	4	Ra/Wa	
C1516	23059	5A13h	E	1	FIX32	VD	4	Ra/W	CINH
C1517	23058	5A12h	A	3	FIX32	VD	4	Ra/W	CINH
C1518	23057	5A11h	E	1	FIX32	VD	4	Ra	
C1519	23056	5A10h	A	3	FIX32	VD	4	Ra	
C1520	23055	5A0Fh	E	1	I32	VH	4	Ra	
C1521	23054	5A0Eh	E	1	FIX32	VD	4	Ra/Wa	
C1522	23053	5A0Dh	E	1	FIX32	VD	4	Ra/Wa	
C1523	23052	5A0Ch	E	1	FIX32	VD	4	Ra/Wa	
C1524	23051	5A0Bh	E	1	FIX32	VD	4	Ra/Wa	
C1525	23050	5A0Ah	E	1	I32	VH	4	Ra/Wa	
C1526	23049	5A09h	E	1	FIX32	VD	4	Ra/W	CINH
C1527	23048	5A08h	A	3	FIX32	VD	4	Ra/W	CINH
C1528	23047	5A07h	E	1	FIX32	VD	4	Ra	
C1529	23046	5A06h	A	3	FIX32	VD	4	Ra	
C1530	23045	5A05h	E	1	I32	VH	4	Ra	
C1531	23044	5A04h	E	1	FIX32	VD	4	Ra/Wa	
C1532	23043	5A03h	E	1	FIX32	VD	4	Ra/Wa	
C1533	23042	5A02h	E	1	FIX32	VD	4	Ra/Wa	
C1534	23041	5A01h	E	1	FIX32	VD	4	Ra/Wa	
C1535	23040	5A00h	E	1	I32	VH	4	Ra/Wa	
C1536	23039	59FFh	E	1	FIX32	VD	4	Ra/W	CINH
C1537	23038	59FEh	A	3	FIX32	VD	4	Ra/W	CINH
C1538	23037	59FDh	E	1	FIX32	VD	4	Ra	
C1539	23036	59FCh	A	3	FIX32	VD	4	Ra	
C1540	23035	59FBh	E	1	I32	VH	4	Ra	
C1541	23034	59FAh	E	1	FIX32	VD	4	Ra/Wa	
C1542	23033	59F9h	E	1	FIX32	VD	4	Ra/Wa	
C1543	23032	59F8h	E	1	FIX32	VD	4	Ra/Wa	
C1544	23031	59F7h	E	1	FIX32	VD	4	Ra/Wa	
C1545	23030	59F6h	E	1	I32	VH	4	Ra/Wa	
C1546	23029	59F5h	E	1	FIX32	VD	4	Ra/W	CINH
C1547	23028	59F4h	A	3	FIX32	VD	4	Ra/W	CINH
C1548	23027	59F3h	E	1	FIX32	VD	4	Ra	
C1549	23026	59F2h	A	3	FIX32	VD	4	Ra	
C1550	23025	59F1h	E	1	FIX32	VD	4	Ra/Wa	
C1551	23024	59F0h	A	2	FIX32	VD	4	Ra/W	CINH
C1552	23023	59EFh	A	2	I32	VH	4	Ra	
C1555	23020	59ECh	E	1	FIX32	VD	4	Ra/Wa	
C1556	23019	59EBh	A	2	FIX32	VD	4	Ra/W	CINH
C1557	23018	59EAh	A	2	I32	VH	4	Ra	
C1560	23015	59E7h	E	1	FIX32	VD	4	Ra/Wa	
C1561	23014	59E6h	A	2	FIX32	VD	4	Ra/W	CINH
C1562	23013	59E5h	A	2	I32	VH	4	Ra	
C1570	23005	59DDh	A	16	FIX32	VD	4	Ra/W	CINH
C1571	23004	59DCh	E	1	B16	VH	2	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1573	23002	59DAh	A	16	FIX32	VD	4	Ra/W	CINH
C1574	23001	59D9h	E	1	B16	VH	2	Ra	
C1576	22999	59D7h	A	16	FIX32	VD	4	Ra/W	CINH
C1577	22998	59D6h	E	1	B16	VH	2	Ra	
C1580	22995	59D3h	E	1	FIX32	VD	4	Ra/W	CINH
C1581	22994	59D2h	E	1	FIX32	VD	4	Ra	
C1582	22993	59D1h	E	1	FIX32	VD	4	Ra/W	CINH
C1583	22992	59D0h	E	1	FIX32	VD	4	Ra	
C1590	22985	59C9h	E	1	FIX32	VD	4	Ra/Wa	
C1591	22984	59C8h	E	1	FIX32	VD	4	Ra/Wa	
C1593	22982	59C6h	E	1	FIX32	VD	4	Ra/W	CINH
C1594	22981	59C5h	E	1	FIX32	VD	4	Ra	
C1595	22980	59C4h	E	1	FIX32	VD	4	Ra/Wa	
C1596	22979	59C3h	E	1	FIX32	VD	4	Ra/Wa	
C1598	22977	59C1h	E	1	FIX32	VD	4	Ra/W	CINH
C1599	22976	59C0h	E	1	FIX32	VD	4	Ra	
C1600	22975	59BFh	E	1	FIX32	VD	4	Ra/Wa	
C1601	22974	59BEh	E	1	FIX32	VD	4	Ra/Wa	
C1603	22972	59BCh	E	1	FIX32	VD	4	Ra/W	CINH
C1604	22971	59BBh	E	1	FIX32	VD	4	Ra	
C1610	22965	59B5h	E	1	FIX32	VD	4	Ra/Wa	
C1611	22964	59B4h	E	1	FIX32	VD	4	Ra/W	CINH
C1612	22963	59B3h	E	1	I32	VH	4	Ra	
C1615	22960	59B0h	E	1	FIX32	VD	4	Ra/Wa	
C1616	22959	59AFh	E	1	FIX32	VD	4	Ra/W	CINH
C1617	22958	59AEh	E	1	I32	VH	4	Ra	
C1640	22935	5997h	E	1	FIX32	VD	4	Ra/W	CINH
C1641	22934	5996h	A	16	FIX32	VD	4	Ra/Wa	
C1642	22933	5995h	E	1	FIX32	VD	4	Ra/W	CINH
C1643	22932	5994h	E	1	FIX32	VD	4	Ra	
C1644	22931	5993h	E	1	I32	VH	4	Ra	
C1645	22930	5992h	E	1	FIX32	VD	4	Ra/Wa	
C1650	22925	598Dh	E	1	FIX32	VD	4	Ra/W	CINH
C1651	22924	598Ch	A	16	FIX32	VD	4	Ra/Wa	
C1652	22923	598Bh	E	1	FIX32	VD	4	Ra/W	CINH
C1653	22922	598Ah	E	1	FIX32	VD	4	Ra	
C1654	22921	5989h	E	1	I32	VH	4	Ra	
C1655	22920	5988h	E	1	FIX32	VD	4	Ra/Wa	
C1657	22918	5986h	A	4	FIX32	VD	4	Ra/Wa	
C1658	22917	5985h	E	1	FIX32	VD	4	Ra/Wa	
C1659	22916	5984h	E	1	FIX32	VD	4	Ra/Wa	
C1660	22915	5983h	E	1	FIX32	VD	4	Ra	
C1661	22914	5982h	E	1	FIX32	VD	4	Ra/W	CINH
C1662	22913	5981h	A	8	FIX32	VD	4	Ra/W	CINH
C1663	22912	5980h	E	1	FIX32	VD	4	Ra	
C1664	22911	597Fh	A	8	I32	VH	4	Ra	
C1665	22910	597Eh	E	1	FIX32	VD	4	Ra	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1666	22909	597Dh	E	1	FIX32	VD	4	Ra/W	CINH
C1667	22908	597Ch	A	8	FIX32	VD	4	Ra/W	CINH
C1668	22907	597Bh	E	1	FIX32	VD	4	Ra	
C1669	22906	597Ah	A	8	I32	VH	4	Ra	
C1670	22905	5979h	E	1	FIX32	VD	4	Ra/Wa	
C1671	22904	5978h	E	1	I32	VH	4	Ra/Wa	
C1672	22903	5977h	E	1	I32	VH	4	Ra/Wa	
C1673	22902	5976h	A	2	FIX32	VD	4	Ra/W	CINH
C1674	22901	5975h	A	2	I32	VH	4	Ra	
C1675	22900	5974h	E	1	FIX32	VD	4	Ra/Wa	
C1676	22899	5973h	E	1	I32	VH	4	Ra/Wa	
C1677	22898	5972h	E	1	I32	VH	4	Ra/Wa	
C1678	22897	5971h	A	2	FIX32	VD	4	Ra/W	CINH
C1679	22896	5970h	A	2	I32	VH	4	Ra	
C1680	22895	596Fh	E	1	FIX32	VD	4	Ra/Wa	
C1681	22894	596Eh	E	1	I32	VH	4	Ra/Wa	
C1682	22893	596Dh	E	1	I32	VH	4	Ra/Wa	
C1683	22892	596Ch	A	2	FIX32	VD	4	Ra/W	CINH
C1684	22891	596Bh	A	2	I32	VH	4	Ra	
C1690	22885	5965h	A	10	FIX32	VD	4	Ra/W	CINH
C1691	22884	5964h	A	10	FIX32	VD	4	Ra	
C1692	22883	5963h	A	10	FIX32	VD	4	Ra	
C1693	22882	5962h	A	10	B16	VH	2	Ra	
C1695	22880	5960h	A	10	FIX32	VD	4	Ra/W	CINH
C1696	22879	595Fh	A	10	I32	VH	4	Ra	
C1700	22875	595Bh	A	2	I32	VH	4	Ra	
C1701	22874	595Ah	E	1	FIX32	VD	4	Ra/Wa	
C1702	22873	5959h	E	1	FIX32	VD	4	Ra/Wa	
C1703	22872	5958h	E	1	FIX32	VD	4	Ra/Wa	
C1704	22871	5957h	E	1	FIX32	VD	4	Ra/Wa	
C1705	22870	5956h	E	1	I32	VH	4	Ra/Wa	
C1706	22869	5955h	E	1	FIX32	VD	4	Ra/Wa	
C1707	22868	5954h	E	1	FIX32	VD	4	Ra/Wa	
C1708	22867	5953h	A	8	FIX32	VD	4	Ra/W	CINH
C1709	22866	5952h	A	8	FIX32	VD	4	Ra	
C1710	22865	5951h	A	2	I32	VH	4	Ra	
C1711	22864	5950h	E	1	FIX32	VD	4	Ra/Wa	
C1712	22863	594Fh	E	1	FIX32	VD	4	Ra/Wa	
C1713	22862	594Eh	E	1	FIX32	VD	4	Ra/Wa	
C1714	22861	594Dh	E	1	FIX32	VD	4	Ra/Wa	
C1715	22860	594Ch	E	1	I32	VH	4	Ra/Wa	
C1716	22859	594Bh	E	1	FIX32	VD	4	Ra/Wa	
C1717	22858	594Ah	E	1	FIX32	VD	4	Ra/Wa	
C1718	22857	5949h	A	8	FIX32	VD	4	Ra/W	CINH
C1719	22856	5948h	A	8	FIX32	VD	4	Ra	
C1720	22855	5947h	A	2	I32	VH	4	Ra	
C1721	22854	5946h	E	1	FIX32	VD	4	Ra/Wa	

Code	Index		Data					Access	
	dec	hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1722	22853	5945h	E	1	FIX32	VD	4	Ra/Wa	
C1723	22852	5944h	E	1	FIX32	VD	4	Ra/Wa	
C1724	22851	5943h	E	1	FIX32	VD	4	Ra/Wa	
C1725	22850	5942h	E	1	I32	VH	4	Ra/Wa	
C1726	22849	5941h	E	1	FIX32	VD	4	Ra/Wa	
C1727	22848	5940h	E	1	FIX32	VD	4	Ra/Wa	
C1728	22847	593Fh	A	8	FIX32	VD	4	Ra/W	CINH
C1729	22846	593Eh	A	8	FIX32	VD	4	Ra	

9 Troubleshooting and fault elimination

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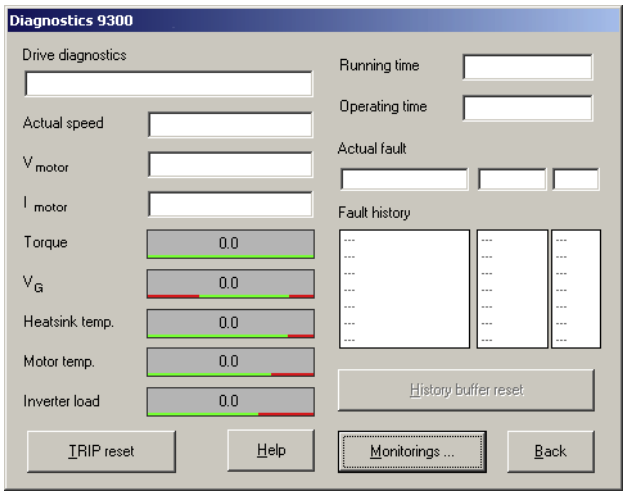
9.1 Display of operating data, diagnostics

The dialog box displays important operating parameters and supports you in diagnosing the drive controller.

► Open the **Diagnostics** dialog box in the parameter menu.



9300std230

Fig. 9.1-1 "Diagnostics" dialog box

► You can recognise immediately that a fault has occurred from the display elements or status information.

► An error can be analysed with
- the history buffer in Global Drive Control (GDC) (📖 9.2-1) or
- the XT keypad
- and with the "General error messages" table in the "System error messages" chapter.

► The "General error messages" table provides tips on how to eliminate an error.

9.2 Troubleshooting

Detecting breakdowns

A breakdown can be detected quickly via the LEDs at the controller or via the status information at the keypad.

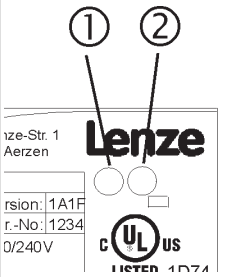
Analysing errors

Analyse the error using the history buffer. The list of fault messages gives you advice how to remove the fault. (📖 9.3-1)

9.2.1 Status display via controller LEDs

During operation the operating status of the controller is shown by 2 LEDs.

LED		Operating status
Red ①	**Green** ②	
Off	On	Controller enabled
On	On	Mains switched on and automatic start inhibited
Off	Blinking slowly	Controller inhibited
Blinking quickly	Off	Undervoltage or overvoltage
Blinking slowly	Off	Fault active



9.2.2 Fault analysis with the history buffer

The history buffer can be used to trace faults. The fault messages are stored in the 8 memory locations in the order of their occurrence.

► Open the **Diagnostics** dialog box in the parameter menu.

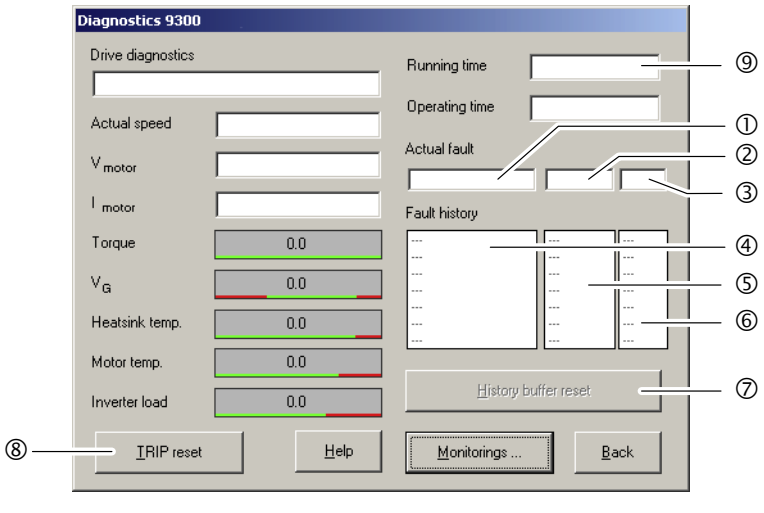


Fig. 9.2-1 "Diagnostics" dialog box

Field			History buffer location	Entry	Note
①	②	③	1	Active fault	If the fault is no longer pending or has been acknowledged:
			2	Last fault	

Field			History buffer location	Entry	Note
④	⑤	⑥	3	Next to last fault	● The content of memory units 1 ... 7 is shifted "upwards" by one memory unit. ● The content of memory unit 8 is removed from the history buffer and can no longer be retrieved. ● Memory unit 1 is deleted (= no active fault).
			4	Third to last fault	
			5	Fourth to last fault	
			6	Fifth to last fault	
			7	Sixth to last fault	
			8	Seventh to last fault	

Explanations	
①, ④	**Fault indication and fault response (C0168)** ● The entry is effected as LECOM error number. ● If several faults with a different response occur at the same time: – Only the fault the response of which has the highest priority is entered (1. TRIP, 2. message, 3. warning). ● If faults with the same response occur (e. g. 2 messages) at the same time: – Only the fault that was triggered first is entered. – The OH7 and OH3 warnings are exceptions. If an OH7 warning is pending and the OH3 motor temperature threshold is reached, the OH7 warning is overwritten by the OH3 warning. If the motor temperature decreases again, the OH7 warning reappears.
②, ⑤	**Time of the fault (C0169)** ● Reference time is the content of the power-on time meter ⑨. ● If a fault is immediately followed by another fault for several times, only the time of the last occurrence is stored.
③, ⑥	**Frequency of occurrence of the fault (C0170)** ● The time of the last occurrence is stored.
⑦	Click on **Fault memory reset** to clear the history buffer. The history buffer can only be cleared if no fault is active.
⑧	Click on **TRIP reset** to reset the fault.

9.2.3 Fault analysis via LECOM status words (C0150/C0155)

The LECOM status words (C0150/C0155) are coded as follows:

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only
			0 {1} 65535		Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned	
			Bit 1	Pulse inhibit (IMP)	
			Bit2	Not assigned	
			Bit3	Not assigned	
			Bit4	Not assigned	
			Bit5	Not assigned	
			Bit 6	n = 0	
			Bit 7	Controller inhibit (CINH)	
			Bit 8	Device status bit 1	
			Bit 9	Device status bit 2	
			Bit10	Device status bit 3	
			Bit11	Device status bit 4	
			Bit12	Warning	
			Bit13	Message	
			Bit14	Not assigned	
			Bit15	Not assigned	
C0155	Status word 2	0			Status word 2 (advanced status word) Display only
			0 {1} 65535		Controller interprets information as 16 bit (binary coded)
			Bit 0	Active fault	
			Bit 1	M_{max} reached	
			Bit 2	I_{max} reached	
			Bit 3	Pulse inhibit(IMP)	
			Bit 4	Ready for operation (RDY)	
			Bit 5	Controller inhibit (CINH)	
			Bit 6	TRIP active	
			Bit 7	Initialisation	
			Bit 8	Motor direction of rotation (Cw/CCw)	
			Bit 9	Not assigned	
			Bit 10	Not assigned	
			Bit 11	Not assigned	
			Bit 12	Not assigned	
			Bit 13	Not assigned	
			Bit 14	Not assigned	
			Bit 15	Not assigned	

9.3 System error messages

9.3.1 General error messages

Note!

In the case of a query via system bus (CAN), the fault messages are represented as numbers (see first column of the table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{motor} > 1.05 \times I_{rx.}$	Check drive dimensioning.
0016	OC6	I^2xt overload	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
x018	OC8	I^2xt overload advance warning	• Frequent and too long acceleration processes with motor overcurrent. • Permanent motor overload with $I_{motor} > I_{rmotor}$	Check drive dimensioning.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in the DC bus	DC bus voltage is lower than specified in C0173.	• Check mains voltage • Check supply cable
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.

Fault message		Description	Cause	Remedy
No.	Display			
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	● Allow module to cool and ensure better ventilation. ● Check ambient temperature in the control cabinet. ● Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: ● Impermissible continuous current ● Frequent or too long acceleration processes	● Check drive dimensioning. ● Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	● Plug in the communication module/keypad XT firmly, screw down, if necessary. ● Switch off monitoring (C0126 = 3).
x062	CE1	Communication error on the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/1, if necessary. ● Switch off monitoring (C0591 = 3).
x063	CE2	Communication error on the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/2, if necessary. ● Switch off monitoring (C0592 = 3).
x064	CE3	Communication error on the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	● Check wiring at X4. ● Check sender. ● Increase monitoring time under C0357/3, if necessary. ● Switch off monitoring (C0593 = 3).

Fault message		Description	Cause	Remedy
No.	Display			
x065	CE4	BUS-OFF state of system bus (CAN)	The controller has received too many faulty telegrams via the system bus (CAN) and has disconnected from the bus.	• Check wiring at X4: Is the bus correctly terminated? • Check shield connection of the cables. • Check PE connection. • Check bus load, reduce the baud rate if necessary. (Observe the cable length!) • Switch off the monitoring (C0595 = 3).
0071	CCr	System failure	Strong interference injection on the control cables	Screen control cables
			Ground or earth loops in the wiring	• Check wiring • Check PE connection
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0072	PR1	Checksum error in parameter set 1 **CAUTION: The Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption while transmitting the parameter set via keypad.	• Set the required parameters and store them under C0003 = 1. • As to PLC devices, check the use of pointers.
			The stored parameters are incompatible with the loaded software version.	Store the parameter set under C0003 = 1 first to allow for a faults reset.
0073	PR2	Checksum error in parameter set 2 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 2.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 2.
0074	PEr	Program error	Error in the program flow	Send the parameter set (on floppy disk/CD-ROM) with a detailed description of the problem to Lenze. **After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!**
0075	PR0	Error in parameter set.	The operating system software has been updated.	Storage of the Lenze setting C0003 = 1.
				After troubleshooting: Deenergise the device completely (disconnect 24 V supply, discharge DC bus)!
0077	PR3	Checksum error in parameter set 3 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 3.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 3.
0078	PR4	Checksum error in parameter set 4 **PLEASE NOTE: The Lenze setting is loaded automatically!**	• Fault while loading a parameter set. • Interruption during the transfer of the parameter set via keypad.	• Set the required parameters and save them with C0003 = 4.
			The parameters saved do not comply with the software version loaded.	In order to be able to acknowledge the error, first save the parameter set with C0003 = 4.

Fault message		Description	Cause	Remedy
No.	Display			
0079	PI	Fault during parameter initialisation	• An error has been detected during the parameter set transfer between two devices. • The parameter set does not match the controller, e.g. if data has been transferred from a higher-power controller to a lower-power controller.	• Correct parameter set. • Send parameter set (on floppy disk/CD-ROM) and a detailed description of the problem to Lenze.
x082	Sd2	Resolver error at X7	Resolver cable interrupted.	• Check cable for open circuit. • Check resolver. • Switch off the monitoring (C0586 = 3).
x083	Sd3	Encoder error at X9	Cable interrupted.	Check cable for open circuit.
			Pin X9/8 not connected.	Apply 5 V to pin X9/8 or switch off monitoring (C0587 = 3).
x085	Sd5	Encoder error at X6/1 and X6/2 (C0034 = 1)	Current signal at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check current signal encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).
x087	Sd7	Selection of the feedback in C0025 as absolute value encoder or alteration of the encoder constant in C0420 for setting C0025 ≥ 309	The absolute value encoder must be initialised.	Save parameter set, then completely deenergise the device, and afterwards switch it on again.
		Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send data. **Tip:** The encoder must not rotate during mains switching.	• Make sure that the cable at X8 is tightened properly, and check it with regard to open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply via C0421 to 8.0 V. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. 📖 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
				After fault elimination: Completely deenergise device (switch off 24 V supply, discharge DC bus)!

Fault message		Description	Cause	Remedy
No.	Display			
x088	Sd8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable for wire breakage.
			Incorrect encoder connected.	Connect SinCos encoder of the Stegmann company.
			SinCos encoder is defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x089	PL	Error during rotor position adjustment (the error is saved with mains failure protection)	• The rotor position adjustment was cancelled. • During rotor position adjustment with an absolute value encoder the error Sd7 or SD8 occurred.	Repeat rotor position adjustment. 📖 6.8-1 **Note:** After an Sd7 fault it is absolutely required to carry out another rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive must not be commissioned without a successfully executed rotor position adjustment!
x091	EEr	External monitoring has been triggered via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	• Check external encoder. • Switch off the monitoring (C0581 = 3).
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.
x110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x151	P01	Error ”negative limit switch”.	Negative limit switch was reached.	• Control drive in positive direction • Check wiring at X5/E2.
x152	P02	Error ”positive limit switch”.	Positive limit switch was reached.	• Control drive in negative direction • Check wiring at X5/E1.
x153	P03	Following error	The angle difference between set and actual position is larger than the following error limit set under C0255.	• Increase following error limit under C0255. • Switch off the monitoring (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.

Fault message		Description	Cause	Remedy
No.	Display			
x154	P04	Error ”negative position limit”.	Negative position limit (C1224) was not reached.	Find out why the value was not reached (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1224 if necessary.
x155	P05	Error ”positive position limit”.	Positive position limit (C1223) was exceeded.	Find out why the value was exceeded (e.g. ”incorrect” position targets, set function position value) and adjust the position limit in C1223 if necessary.
x156	P06	No reference.	The reference point is not known. In the case of absolute positioning, no homing was performed before the first positioning.	Perform one of the following functions and restart: ● Manual homing. ● Start homing in the program. ● Set reference.
x157	P07	Parameter set mode is absolute instead of relative.	An absolute parameter set (C1311) was performed during relative positioning (position mode C1210).	Perform one of the following functions and restart: ● Change the parameter set from absolute to relative. ● Change position mode.
x158	P08	Error ”actual reference dimension offset”.	Actual reference dimension offset (C1226) outside the position limits. Error of the program function ”set position value”.	If necessary, adapt the position limit values or check whether the program function ”set position value” is to be applied.
x159	P09	Error in positioning program.	Impermissible programming	Check position program: ● A parameter set with final speed must be followed by a parameter set with positioning; it is not permissible to wait for input.
x162	P12	Error in the range of the encoder.	The range of the absolute encoder was exceeded.	● Return drive by manual positioning. ● Check position limits and adjustment of the encoder. ● Design and mount the absolute encoder in a way that does not exceed the traversing range.
x163	P13	Angle overrun.	● Phase controller limit reached ● Drive cannot follow the digital frequency (I_{max} limit).	● Enable drive ● Check drive dimensioning.
x164	P14	1. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/1.	● Increase current limit under C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/1
x165	P15	2. Following error.	The drive cannot follow the setpoint. The following error is greater than the limit value in C1218/2.	● Increase current limit C0022 (observe max. motor current). ● Reduce acceleration. ● Check drive dimensioning. ● Increase limit value under C1218/2

Fault message		Description	Cause	Remedy
No.	Display			
x166	P16	Faulty transfer of system bus (CAN) sync telegram.	The sync telegram from the master (PLC) is out of sync cycle.	● Set the ”sync cycle” to the transmission cycle of the master (PLC) under C1121. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The sync telegram of the master (PLC) is not received.	● Check communication channel. ● Check baud rate, controller address. ● Note: – C0362 displays the time interval between 2 sync telegrams. – C0362 = 0: communication interrupted.
			The controller is enabled too fast.	Delay the controller enable. The time delay required depends on the time interval between the sync telegrams.
x167	P17	Error ”touch probe control”.	Various function blocks use the touch probe input at the same time (e.g. FB DFSET and POS). A conflict arises.	● Configure another touch probe input for FB POS (not possible for FB DFSET). ● Switch off monitoring (C1289/1).
x168	P18	Internal limitation.	Arithmetic operation generated data cannot be varied arbitrarily. Wrongly specified values were automatically limited internally.	
			C1298 = 1: The negative position limit in C1223 is outside the possible display range of $1 \le (C1223 \times C1205) \le 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/10 and enter it in C1223 if necessary.
			C1298 = 2: The positive position limit in C1224 is outside the possible display range of $1 \le (C1224 \times C1205) \le 1.07E9$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/11 and enter it in C1224 if necessary.
			C1298 = 3: The maximum speed v_{max} in C1240 is outside the possible display range of $1 \le (C1240 \times C1205 \times 16.384) \le 2.14E9$ inc or v_{max} not $C1240 / C1204 \times 60 \le 1.5 \times n_{max}$	Check the values in C0011, C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/12 and enter it in C1240 or adjust the value in C1240 to C0011 if necessary.
			C1298 = 4: The maximum acceleration a_{max} in C1250 is outside the possible display range of $1 \le (C1250 \times C1205 \times 16.384 / 1000) \le 2.8634E7$ inc	Check the values in C1202/4, C1207/1, C1207/2. Read out the limited value in C1220/13 and enter it in C1250 if necessary.
			C1298 = 5: An internal value range has been exceeded for a speed standardisation. Valid range: $1 \le (C0011 \times C1207/1 / C1207/2 \; 65536 / 60000) \le 32767$	Check the values in C0011, C1207/1, C1207/2 and correct them.

Fault message		Description	Cause	Remedy
No.	Display			
x169	P19	The input values at X9 are limited.	The function block DFIN limits the input values. This causes the loss of increments.	• Reduce the frequency on the digital frequency connection. • Check the settings for the slave (C0425) and for the master (C0030). These settings must be identical.
x190	nErr	Speed control error (Speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x200	NMAX	Maximum system speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high. • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Increase torque limit, if necessary. • Switch off monitoring (C0607 = 3).

Representation of the error number:
x 0 = TRIP, 1 = message, 2 = warning
E. g. ”2091”: An external monitoring function has triggered EEr warning

9.3.2 Resetting system error messages

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** If a TRIP/FAIL QSP source is still active, the pending TRIP/FAIL QSP cannot be reset.
	The TRIP/FAIL QSP can be reset by: • pressing ⇨ STOP on keypad XT EMZ9371 BC. Then, press RUN to re-enable the controller. • Set code C0043 = 0. • Control word C0135, bit 11 • Control word AIF • Control word system bus (CAN) / MotionBus (CAN) at ECSxS/P/M After the reset of the TRIP/FAIL QSP, the drive remains at standstill.
Message	**Danger!** The fault message is reset automatically after the fault has been eliminated, and the drive restarts automatically.
Warning	After the fault has been eliminated, the fault message is reset automatically.

10 DC-bus operation

Contents

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10.3 Fuses and cable cross-sections 10.3-1
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10.1 Function

- DC-bus connections of drive systems enable the exchange of energy between connected controllers.
- If one or more controllers operate in generator mode (braking operation), the energy will be fed into the shared DC-voltage bus. The energy will then be available to the controllers which operate in motor mode.
- The use of braking units and supply units can be reduced.
- The energy consumption from the three-phase AC mains can be reduced.
- The number of mains supplies and the related expenses (e.g. wiring) can be perfectly adapted to your application.

10.2 Conditions for trouble-free DC-bus operation

- Distributed supply (parallel mains supply):
  - Always use the prescribed mains choke when connecting a controller to the mains.
  - Controllers of the EVx9321 ... EVx9333, 8200 and 8200 vector series must not be connected to the mains if they are operated in a DC-bus connection with EVx9335 ... EVx9338 and EVx9381 ... EVx9383 controllers.
- Only controllers with identical mains voltage/DC bus voltage ranges can be operated in a DC-bus connection:
  - Set the mains voltage/DC-bus voltage under C0173.
- 9340 regenerative power supply modules and 9360 DC input modules cannot be used together in the DC-bus connection.
- Read the documentation for the other controllers connected to the DC bus with regard to ”DC-bus operation”.

10.3 Fuses and cable cross-sections

Note!

- ► **All fuses specified here only have the purpose of disconnection after a short circuit.** For cable protection specific fuses must be used.
- ► In the following tables the rated currents of the Lenze fuses are listed. If other fuses are used, other fuse currents and cable cross-sections may result.
- ► We recommend using fuse holders with a signalling contact. Like this, the entire drive system can be switched off (inhibited) when a fuse fails.
- ► Always fuse DC cables using 2 poles ($+U_G$, $-U_G$).

Installation in accordance with EN 60204-1

Supply conditions	
Range	Description
Mains	DC 460 ... 740 V
Fuses	• Only semiconductor fuses. • If you are using fuses other than those indicated, other fuse currents and cable cross-sections may result.
Cables	• DC cables ($+U_G$, $-U_G$) must always have two-pole insulation. • Laying systems B2 and C: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 40 °C, no bundling of cables or cores, three loaded cores. The information is a recommendation. Other designs/laying systems are possible (e.g. according to VDE 0298-4).
Observe all national and regional regulations!	

Inverter		DC fuse 14 × 51 (EFSGR0xx0AYHx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9321	3/PE 400 V	12	12	1.5	1.5
EVS9322		12	12	1.5	1.5
EVS9323		12	12	1.5	1.5
EVS9324		20	20	1.5	1.5
EVS9325		40	40	4.0	4.0
EVS9326		50	50	6.0 [1]	4.0

[1] Pin-end connector required, since a maximum cable cross-section of 4 mm² can be connected to the inverter.

Inverter		DC fuse NH1 (EFSGRxxx0ANVx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9327	3/PE 400 V	100	100	-	25
EVS9328		100	100	-	25
EVS9329		200	-	-	25
EVS9330		200	-	-	50
EVS9331		200	-	-	50

Inverter		DC fuse NH2 (EFSGRxxx0ANWx)	DC fuse 22 × 58 (EFSGR0xx0AYIx)	Installation in accordance with EN 60204-1	
Type	Mains	Rated current of fuse	Rated current of fuse	$+U_G$, $-U_G$ Laying system	
				B2	C
		[A]	[A]	[mm²]	[mm²]
EVS9332	3/PE 400 V	250	-	-	95

10.4 Distributed supply (several supply points)

Basic circuit diagram

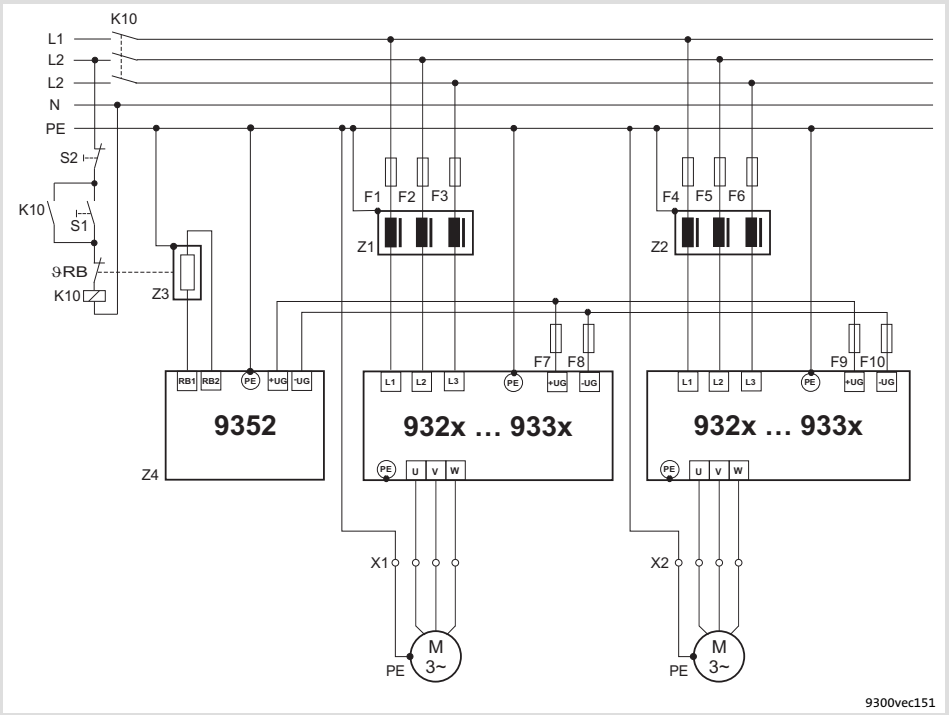

Fig. 10.4-1 Basic circuit diagram of a distributed supply with brake chopper

F1 ... F10	Fusing
K10	Mains contactor
Z1, Z2	Mains choke / mains filter
Z3	Brake resistor
Z4	Brake chopper
S1	Mains supply on
S2	Mains supply off

► Dimension the components according to the requirements of the DC-bus operation.

Stop!

Set the DC-bus voltage thresholds of the controller (C0173) and the brake chopper (see documentation of the brake chopper) to the same values.

10.5 Central supply (one supply point)

Basic circuit diagram

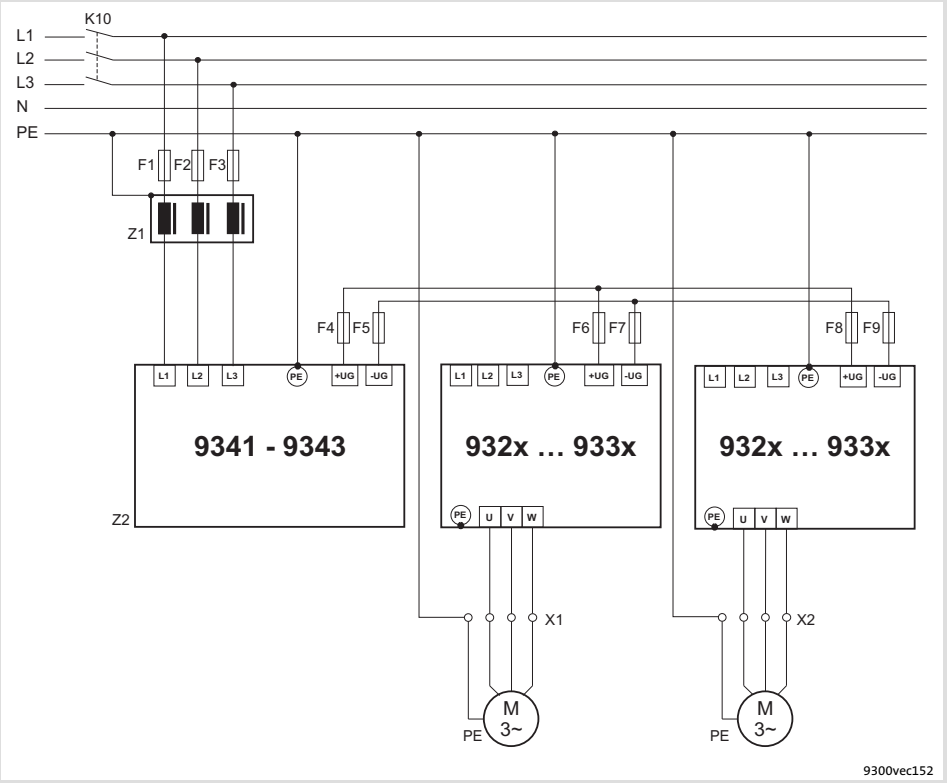

Fig. 10.5-1 Basic circuit diagram of a central supply with regenerative power supply module

F1 ... F9	Fusing
K10	Mains contactor
Z1	Mains choke / mains filter
Z2	Regenerative power supply module

► Dimension the components according to the requirements of the DC-bus operation.

Note!

► If the supply power of the regenerative power supply module is not sufficient, the system can be additionally supplied via the mains connection of further controllers.

► Before connecting the supply module and the controllers read the Operating Instructions of the regenerative power supply module.

11 Safety engineering

Contents

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11.1 Important notes

The controllers support the safety functions ”Safe torque off” (former designation ”Safe standstill”), ”Protection against unexpected start-up”, in accordance with the requirements of control category 3 of ISO 13849-1 (former EN 954-1). Depending on the external interconnection, a standard up to ”category 3” in accordance with ISO 13849-1 is achieved.

Note!

In order to comply with control category 3 in accordance with ISO 13849-1 (former EN 954-1), the two methods ”Pulse inhibit via safety relay K_{SR}” **and** ”Controller inhibit”, which are independent of each other, have to be used.

- Only qualified personnel may install and commission the “Safe torque off” function.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN ISO 13849-1 and EN ISO 13849-2. This includes among other things:
  - Control cabinet, switches, relays in enclosure IP54!
  - All other requirements can be found in EN ISO 13849-1 and EN ISO 13849-2!
- Wiring with insulated wire end ferrules or rigid cables is absolutely required.
- All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. by a cable duct. It must be ensured that short circuits between the individual cables cannot occur!
- With the “Safe torque off” function no emergency stop can be effected without additional measures:
  - There is neither an electrical isolation between motor and controller nor a service or repair switch!
  - An ”Emergency stop” requires the electrical isolation of the conductor to the motor, e.g. by means of a central mains contactor with emergency stop wiring.
- If in the case of the ”Safe torque off” a force effect is to be expected from outside, (e.g. sagging of hanging loads), additional measures are required (e.g. mechanical brakes).
- After the installation the operator has to check the function of the ”Safe torque off” circuit.
  - The functional test must be repeated at regular intervals.
  - Basically, the inspection intervals depend on the application, the related risk analysis, and the overall system. The inspection intervals must not be longer than 1 year.

11.2 Operating mode

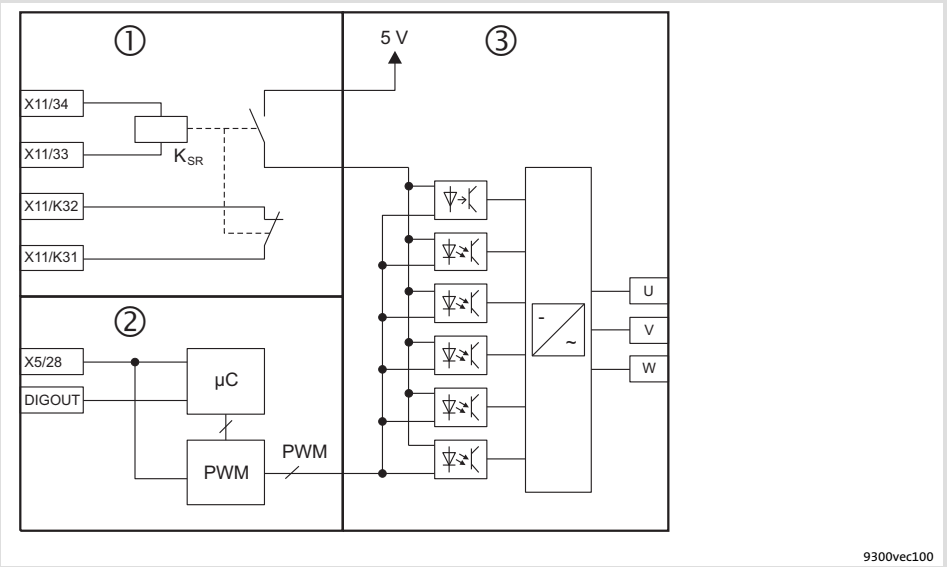

Fig. 11.2-1 Internal connection of the "Safe torque off" function with 3 electrically isolated circuits

Area ①: Pulse inhibit via safety relay K_{SR}; forcibly guided feedback for monitoring the safety relay

Area ②: Controller inhibit (X5/28), optional feedback via a digital output (DIGOUT)

Area ③: Power output stage

Activating "Safe torque off"

The "Safe torque off" status is activated via two different disconnecting paths which are independent of each other:

1. disconnecting path: Pulse inhibit via safety relay K_{SR} (terminal X11/33, X11/34)

- In the case of LOW level at terminals X11/33, X11/34, the safety relay K_{SR} is deactivated.The driver supply of the power section drivers is interrupted. The inverter no longer receives pulses.
- The disconnection of the safety relay K_{SR} has to be monitored externally, so that a failure of this disconnecting path can be detected. X11/K31, X11/K32 is a forcibly guided break contact, i. e. if the safety relay K_{SR} has been deactivated ("Safe torque off" activated), the contact is closed.

2. disconnecting path: Controller inhibit by input signal at terminal X5/28

- The input signal at X5/28 is fed to the microcontroller system and the PWM unit. In the case of LOW level at terminal X5/28, the output of pulses to the inverter is inhibited in the microcontroller system.
- The disconnecting path "Controller inhibit" can be evaluated optionally via a digital output. Further information can be gathered from the chapter "Functional test" (📖 11.5-1).

"Safe torque off" is activated if **both disconnecting paths are on LOW level**.

Deactivating "Safe torque off"

An AND operation of the disconnecting paths prevents the drive from restarting if only one disconnecting path is enabled.

"Safe torque off" is deactivated if **both disconnecting paths are on HIGH level**.

11.3 Safety relay K_{SR}

Technical data

Terminal	Description	Field	Values
X11/K32 X11/K31 X11/33 X11/34	Safety relay K_{SR} 1st disconnecting path	Coil voltage at +20 °C	DC 24 V (20 ... 30 V)
		Coil resistance at +20 °C	823 Ω ±10 %
		Rated coil power	Approx. 700 mW
		Max. switching voltage	AC 250 V, DC 250 V (0.45 A)
		Max. AC switching capacity	1500 VA
		Max. switching current (ohmic load)	AC 6 A (250 V), DC 6 A (50 V)
		Recommended minimum load	> 50 mW
		Max. switching rate	6 switchings per minute
		Mechanical service life	10^7 switching cycles
		Electrical service life	
		at 250 V AC (ohmic load)	10^5 switching cycles at 6 A 10^6 switching cycles at 1 A 10^7 switching cycles at 0.25 A
		at 24 V DC (ohmic load)	6×10^3 switching cycles at 6 A 10^6 switching cycles at 3 A 1.5×10^6 switching cycles at 1 A 10^7 switching cycles at 0.1 A

11.4 Wiring

Wiring

Danger!

Faulty operation in case of earth faults possible

The correct functioning of the safety function is not ensured if an earth fault occurs.

Possible consequences:

► A failure of the safety function can lead to death, severe injuries or damage to material.

Protective measures:

The electrical reference point for the coil of the safety relay K_{SR} must be connected to the PE conductor system (EN 60204-1, paragraph 9.4.3)!

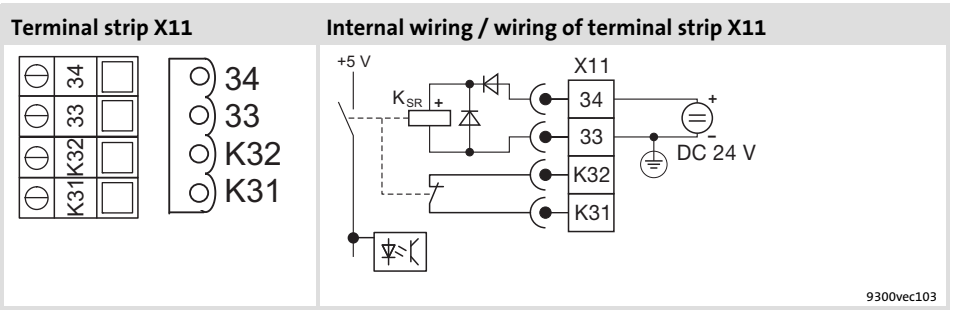

Fig. 11.4-1 Safety relay K_{SR}

Terminal		Function Bold print = **Lenze setting**	Level / state	Electrical data
X11/K32 X11/K31	Safety relay K_{SR} 1st disconnecting path	Feedback - pulse inhibit	Open contact: Pulse inhibit is inactive (operation) Closed contact: Pulse inhibit is active	See technical data of the safety relay K_{SR}
X11/33		– coil of safety relay K_{SR}	Coil is not carrying any current: pulse inhibit is active	
X11/34		+ coil of safety relay K_{SR}	Coil is carrying current: pulse inhibit is inactive (operation)	
X5/28	Controller inhibit (DCTRL-CINH) 2nd disconnecting path	Controller enable/inhibit	LOW: Controller inhibited HIGH: Controller enabled	LOW: 0 ... +3 V HIGH: +12 ... +30 V
				Input current at +24 V: 8 mA
				Reading and processing the input signals - 1/ms (mean value)

Terminal data

Wiring of the terminals X11/34, X11/33, X11/K32, X11/K31, X5/28:

Leitungstyp	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Rigid	–	2,5 mm² (AWG 14)	0,5 ... 0,6 Nm (4.4 ... 5.3 lb-in)	5 mm
Flexible	With plastic sleeve	2,5 mm² (AWG 14)		

11.5 Functional test

11.5.1 Important notes

Danger!

Unexpected start-up of the machine possible

The ”Safe torque off” safety function provides protection against an unexpected start-up of the drive and therefore is an important item within the safety concept for a machine. It has to be ensured that this function works correctly.

Possible consequences:

► Death, severe injury, or damage to material assets, when the safety function fails.

Protective measures:

After the installation and at regular intervals, the operator has to check the function of the ”Safe torque off” circuit.

► When doing this, check both disconnecting paths separately with regard to their disconnection capability.

► The functional test can be carried out manually or automatically via the PLC.

► Basically the inspection interval depends on the application and the corresponding risk analysis, as well as on the system as a whole. It should not exceed 1 year.

► If the functional test shows impermissible states,
  – the drive or the machine has to be shut down immediately.
  – commissioning is not permitted until the safety function operates correctly.

11.5.2 Manual safety function check

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

How to proceed during the test:

1. Alternately apply LOW and HIGH level to input X11/34 and check the states given in the table below.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

The individual tests are passed if the correct states given in the table result.

2. disconnecting path: Controller inihibit

Requirement for the test:

- ► "Quickstop" (QSP) function deactivated
- ► "Automatic DC injection brake" deactivated (C0019 = 0)
- ► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

How to proceed during the test:

1. Set controller inhibit (X5/28 = LOW).
2. Define a setpoint $n_{set} > 0$.
3. Check that the motor is not rotating.

The individual test is passed if the motor does not rotate.

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

- ► The drive or machine has to be shut down immediately.
- ► Commissioning is not permitted until the safety function operates correctly.

11.5.3 Monitoring the safety function with a PLC

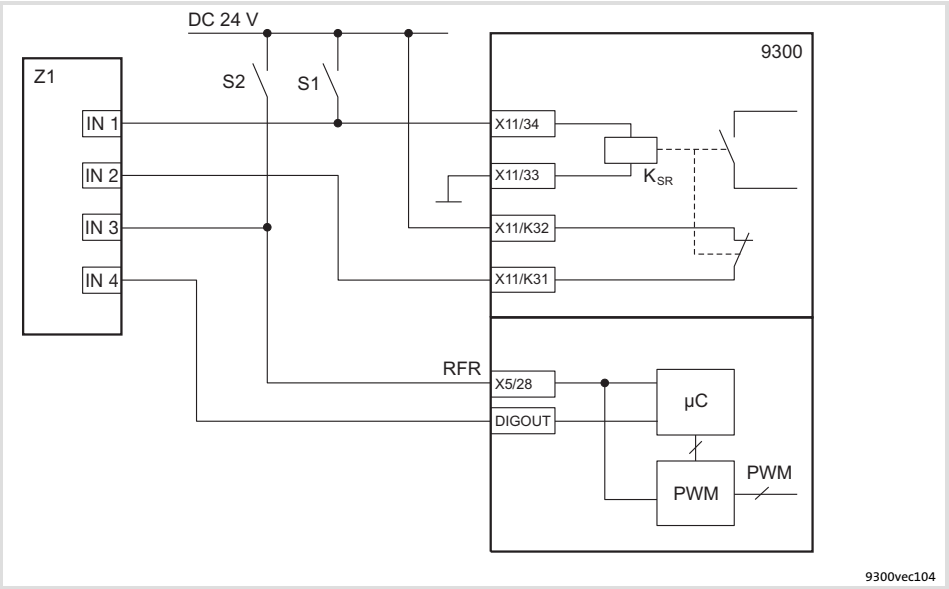

Fig. 11.5-1 Circuit diagram for monitoring the safety function with a PLC

S1, S2	Separate disconnection options of the two disconnecting paths
K_{SR}	Safety relay
X11/34	Safety relay control
X11/33	Safety relay control (GND)
X11/K32	Forcibly guided feedback contact (24 V)
X11/K31	Forcibly guided feedback contact
DIGOUT	Digital output for evaluating the motor current
X5/28	Controller inhibit
Z1	Programmable logic controller (PLC)
IN 1 - 4	Digital inputs

Requirements

The following conditions must be met:

- ► The PLC must be programmed such that the complete system is set to a safe state immediately when the function check leads to an impermissible state.
- ► The parameter setting of a digital output must be such that you can conclude to the output current I_{motor} of the drive (see parameterisation example).

Example: Parameterising a digital output

In the following we will show you a possibility of parameterising a digital output, so that a conclusion with regard to the motor current is provided.

Sequence		Parameter	Note
1.	Configure function block CMP3 (comparator)		
	• Connect CMP3-IN1 to MCTRL-IACT	C0693/1 = 5004	
	• Connect CMP3-IN2 to FCODE-472/1	C0693/2 = 19521	
	• Configure the function IN1 < IN2	C0690 = 3	
2.	Configure output signal of CMP3 • Connect DIGOUT4 to CMP3-OUT	C0117/4 = 10660	
3.	Enter function block CMP3 in the processing table		
	• Select a free space in the processing table In the Lenze setting, for instance space 2 of the processing table is free	C0465/2 = 10660	
4.	Set the current threshold • Set the current threshold for $I_{rated\ FI}$ to 2 %	C0472/1 = 2.00	$I_{Motor} = 0 \rightarrow$ DIGOUT4 = HIGH $I_{Motor} \neq 0 \rightarrow$ DIGOUT4 = LOW

Functional test within the inspection interval

For the functional test, check both disconnecting paths **separately**.

1. disconnecting path: Pulse inhibit via safety relay K_{SR}

The individual tests are passed if the correct states given in the table result.

	Specification	Correct status
Individual test	**Input relay activation (X11/34)**	**Output feedback (X11/K31)**
Pulse inhibit	LOW	HIGH
Pulse enable	HIGH	LOW

2. disconnecting path: Controller inihibit

Requirement for the test:

- ► "Quickstop" (QSP) function deactivated
- ► "Automatic DC injection brake" deactivated (C0019 = 0)
- ► Pulses enabled by the safety relay K_{SR} (X11/34 = HIGH)

The individual tests are passed if the correct states given in the table result.

	Specification		Correct status
Individual test	**X5/28**	**Setpoint**	**Output DIGOUT**
Controller inhibit	LOW	$n_{set} > 0$	HIGH
Controller enable	HIGH		LOW

Functional test not passed

If an individual test results in an impermissible status, the functional test is not passed.

- ► The drive or machine has to be shut down immediately.
- ► Commissioning is not permitted until the safety function operates correctly.

12 Accessories (overview)

Contents

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12.1 General accessories

Accessories	Designation		Order number
Communication modules	LECOM-LI (optical fibre)		EMF2102IBCV003
	LECOM-B (RS485)		EMF2102IBCV002
	LECOM-A/B (RS232/485)		EMF2102IBCV001
	LON		EMF2141IB
	INTERBUS		EMF2113IB
	INTERBUS-Loop		EMF2112IB
	PROFIBUS-DP		EMF2133IB
	DeviceNet/CANopen		EMF2175IB
	Operating module keypad XT		EMZ9371BC
	Diagnosis terminal (keypad XT in handheld design, IP20) [1)]		E82ZBBXC
Other	Connecting cable	2.5 m	E82ZWL025
		5 m	E82ZWL050
		10 m	E82ZWL100
	Parameterisation/operating software »Global Drive Control« (GDC)		ESP-GDC2
	PC system bus adapter (Voltage supply via DIN connection)		EMF2173IB
	PC system bus adapter (Voltage supply via PS2 connection)		EMF2173IB-V002
	PC system bus adapter (Voltage supply via PS2 connection, electrical isolation)		EMF2173IB-V003
	PC system bus adapter USB		EMF2177IB
	CAN repeater		EMF2176IB
	PC system cable RS232	5 m	EWL0020
		10 m	EWL0021
	Optical fibre adapter (standard output power)		EMF2125IB
	Optical fibre adapter (increased output power)		EMF2126IB
	Power supply unit for optical fibre adapter		EJ0013
	Optical fibre, single-core, black PE sheath (basic protection), sold by the meter		EWZ0007
	Optical fibre, single-core, red PUR sheath (reinforced protection), sold by the meter		EWZ0006
	Setpoint potentiometer		ERPD0010k0001W
	Rotary knob for setpoint potentiometer		ERZ0001
	Scale for setpoint potentiometer		ERZ0002
	Digital display		EPD203
	Encoder cable	2.5 m	EWLE002GX-T
		5.0 m	EWLE005GX-T
		10.0 m	EWLE010GX-T
		15.0 m	EWLE015GX-T
		20.0 m	EWLE020GX-T
		25.0 m	EWLE025GX-T
		30.0 m	EWLE030GX-T
		35.0 m	EWLE035GX-T
		40.0 m	EWLE040GX-T
		45.0 m	EWLE045GX-T
		50.0 m	EWLE050GX-T

Accessories	Designation		Order number
	Connecting cable for digital frequency coupling	2.5 m	EWLD002GGBS93

1) Additional connecting cable required

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

12.2 Type-specific accessories

9300	EVS9321	EVS9322	EVS9323	EVS9324
Accessories	Order No.			
Mains choke	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Mains filter				
Category C2 EN 61800-3	EZN3A2400H002	EZN3A1500H003	EZN3A0900H004	EZN3A0500H007
Category C1 EN 61800-3	EZN3B2400H002	EZN3B1500H003	EZN3B0900H004	EZN3B0500H007
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD180R300W	ERBD180R300W	ERBD082R600W	ERBD068R800W
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0016	EZZ0016
Mounting kit for push-through technique	EJ0036	EJ0036	EJ0037	EJ0037

9300	EVS9325	EVS9326	EVS9327	EVS9328
Accessories	Order No.			
Mains choke	EZN3A0300H013	ELN3-0150H024-001	ELN3-0088H035-001	ELN3-0075H045
Mains filter				
Category C2 EN 61800-3	EZN3A0300H013	EZN3A0150H024	EZN3A0110H030 E82ZN22334B230 E82ZZ15334B230 [1]	EZN3A0080H042 E82ZN22334B230
Category C1 EN 61800-3	EZN3B0300H013	EZN3B0150H024	E82ZN22334B230 E82ZZ15334B230 [1] EZN3B0110H030U [2]	E82ZN22334B230 EZN3B0080H042
Brake chopper	EMB9352-E	EMB9352-E	EMB9352-E	EMB9352-E
Brake resistor	ERBD047R01k2	ERBD047R01k2	ERBD033R02k0	ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0016	EZZ0016	EZZ0017	EZZ0017
Mounting kit for push-through technique	EJ0038	EJ0038	EJ0011	EJ0011

9300	EVS9329	EVS9330	EVS9331	EVS9332
Accessories	Order No.			
Mains choke	ELN3-0055H055	ELN3-0038H085	ELN3-0027H105	ELN3-0022H130
Mains filter				
Category C2 EN 61800-3	E82ZN30334B230 EZN3A0055H060	E82ZN55334B230 EZN3A0030H110 EZN3A0030H110N001 3)	E82ZN75334B230 EZN3A0022H150	E82ZN75334B230 EZN3A0022H150
Category C1 EN 61800-3	E82ZN30334B230 EZN3B0055H060	EZN3B0030H110	E82ZN75334B230 EZN3B0022H150	E82ZN75334B230 EZN3B0022H150
Brake chopper	EMB9352-E	2 × EMB9352-E	2 × EMB9352-E	3 × EMB9352-E
Brake resistor	ERBD018R03k0	2 × ERBD022R03k0	2 × ERBD022R03k0	3 × ERBD022R03k0
Shield mounting kit				
Control cable	EZZ0015	EZZ0015	EZZ0015	EZZ0015
Motor cable	EZZ0017	–	–	–
Mounting kit for push-through technique	EJ0011	EJ0010	EJ0010	EJ0009

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13.1 Glossary

13.1.1 Terminology and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter

P_r [kW]	Rated motor power
R [Ω]	Resistance
S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)

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EDSVS9332P-EXT
13375728

Global Drive

System Manual

(Extension)

9300 *0.37 ... 75 kW*

EVS9321xP ... EVS9332xP

Servo position controllers

Lenze

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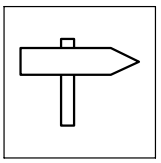

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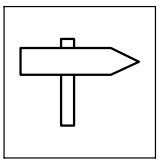

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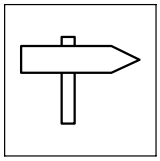

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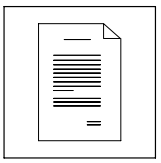

1 Preface

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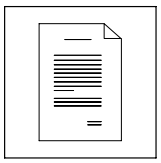
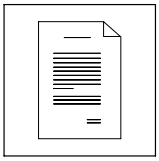


Preface and general information



1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual addresses to all persons who dimension, install, commission, and set 9300 servo position controllers.

Together with the System Manual, document no. EDSVS9332P, and the catalog, it forms the basis for project planning for the manufacturer of plants and machinery.

Contents

The System Manual (supplement) completes the System Manual, document no. EDSVS9332P:

- The features and functions are described in detail.
- It describes additional possible applications in detail.
- The parameterisation for typical applications is pointed up by the use of examples.
- In case of doubt the Mounting Instructions supplied with the 9300 servo position controller are always valid.

Contents of System Manual	Contents of System Manual (supplement)
1 Preface	1 Preface
2 Safety	-
3 Technical data	-
4 Mounting the standard device	-
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6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
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8.3 Code table	2.3 Modes of operation
8.4 Selection lists	2.4 Change of the terminal assignment
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-	3 Function library
-	4 Application examples
9 Troubleshooting and fault elimination	-
10 DC-bus operation	-
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13 Appendix	5 Appendix

How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Note!

Documents and software updates for other Lenze products are available on the Internet in the ”Services & Downloads” area under

http://www.Lenze.com

1.1.2 Document history

What is new / what has changed?

Material number	Version			Description
13375728	2.0	03/2012	TD23	Error corrections
13337389	1.0	03/2010	TD23	Extended by functions for software version 8.0 Error correction Division of the System Manual into 2 parts (EDSVS9332P and EDSVS9332P-EXT)

1.1.3 Products to which the System Manual applies

This documentation is valid for 9300 servo position controllers from nameplate data:

	①					②	③
	EVS	93xx	-	x	P	Vxx	1x	8x

Product series

EVS = servo controller

Type no. / rated power

	400V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = panel-mounted unit

C = panel-mounted unit in "cold plate" technology

Version

P = servo position controller

Variant

- = standard

V003 = in "cold plate" technology

V004 = with "safe standstill" function

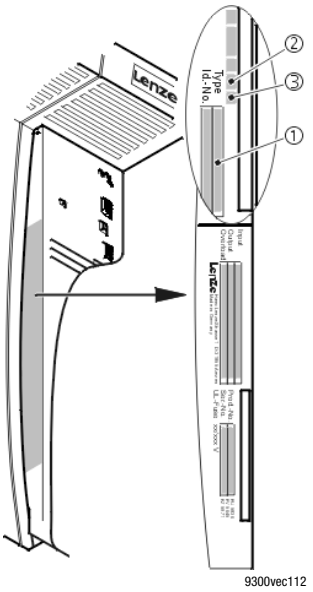
V100 = for IT systems

V104 = with "safe standstill" function and for IT systems

Hardware version

Software version

Nameplate



1.2 Definition of notes used

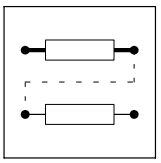
All safety information given in these instructions has the same layout:

Pictograph (indicates the type of danger)

Signal word! (indicates the severity of danger)

Note (describes the danger and explains how to avoid it)

Pictograph	Signal word		Consequences if disregarded
	Signal word	Meaning	
Dangerous electrical voltage General danger	**Danger!**	**Impending danger for persons**	Death or severe injuries
	Warning!	**Possible, very dangerous situation for persons**	Death or severe injuries
	Caution!	**Possible, dangerous situation for persons**	Injuries
	Stop!	**Possible damage to material**	Damage of the drive system or its environment
	Note!	**Useful tip** If you observe it, handling of the drive system will be easier.	



2 Configuration

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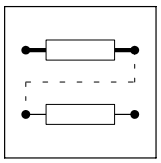
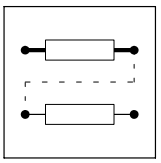


Configuration



2.1 Configuration with Global Drive Control

With Global Drive Control (GDC), a program for the PC, Lenze offers an easy-to-understand, clearly-laid-out and convenient tool for configuring your application-specific drive task.

Function block library

GDC provides a clear overview of the function blocks (FB) available in a library. GDC also lists the complete assignment of a function block.

Signal configuration

Signals can be configured in a single dialog box. This is a convenient way

- to display every FB as a block diagram.
- to see the assignment of all signal inputs at a glance.
- to enter the FB in the processing table.
- to print your signal configuration.

Terminal assignment

Freely assignable terminals can be configured using two dialog boxes:

- Dialog box - to link digital inputs and outputs.
- Dialog box - to link analog inputs and outputs.

2.2 Basic configurations

Stop!

It is possible to load predefined basic configurations via code C0005. If you load a configuration via C0005, the assignment of all inputs and outputs will be overwritten with the corresponding basic configuration.

Adapt the function assignment to the wiring.

The internal signal processing is adapted to the drive task by selection of a predefined basic configuration in C0005. Lenze setting: C0005 = 20000 (standard absolute positioning).

- Application examples of basic configurations can be found in the chapter ”Application examples”.
- Before you can load a basic configuration via C0005, the controller must be inhibited.

The selection numbers in C0005 have the following meaning:

C0005 =		**1**	**0**	**0**	**0**	= Speed control

C0005 = 2 X X X X

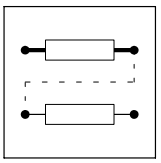
Device control
0 = Control via control terminals
1 - Control via LECOM A/B/LI
3 - Control via AIF (INTERBUS,PROFIBUS)
5 - Control via system bus (CAN)

Voltage source for the control terminals
0 = External supply voltage
1 = Internal supply voltage

0 = Absolute positioning
2 = Relative positioning

0 = Positioning via home position
2 = Positioning via position switch points and with teach function
6 = External path control

2 = Positioning control



2.2.1 Changing the basic configuration

If the basic configuration must be changed for a special application, proceed as follows:

1. Select a basic configuration via C0005 which largely meets the requirements.
2. Add functions by:
   – Reconfiguring inputs and/or outputs.
   – Setting parameters for function blocks. (📖 3-6)
   – Inserting or removing function blocks. (📖 3-12)

Note!

If you change the signal flow of the basic configuration, e. g. by adding function blocks, C0005 is set to 0. The display indicates ”COMMON”.

2.2.2 Speed control C0005 = 1XXX (1000)

For standard applications, with the default settings you can commission the drive immediately. In order to adapt it to specific requirements, observe the notes in the following sections.

2.2.2.1 Setpoint selection

Main setpoint

Via the setpoint n_{set} (display in C0046) the speed is defined, relating to the value n_{max} (C0011) which can be set. The setpoint is specified in a bipolar analog manner via input X6/1,2. By the settings carried out, the drive runs with the speed set in C0011 if a master voltage of 10 V is selected. If you want to actuate the drive at master voltages with low voltages you can adapt the system via codes C0026/1 (offset) and C0027/1 (gain).
Alternatively you can also specify the setpoints via

- Keyboard,
- Integrated system bus (CAN),
- Automation interface (LECOM, InterBus, Profibus DP, RS 232, RS 485, optical fibre).

Which input is active as setpoint source depends on the configuration selected in C0005, or the setpoint source can be set via configuration code C0780 in the NSET function block.

Current master value

If the analog main setpoint is to be specified as current master value via X6/1,2, you can select the current setting range with code C0034:

- For -20 mA … +20 mA: C0034 = 2
- For 4 … 20 mA: C0034 = 1 (can only be used in unipolar mode)

If the range 4…20 mA has been selected, the error message Sd5 appears when the value is lower than 2 mA.

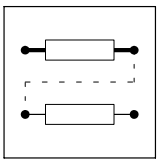
The signal conditioning for this is effected in function block AIN1.

The change-over from the voltage master value to the current master value (current load 242R) has to be effected via the jumper position at X3:

- Voltage master value/potentiometer:
  – Jumper X3 in the lower position (default setting)
- Current master value:
  – Jumper X3 in the upper position

JOG setpoints

If you require specific fixed settings as main setpoint, you can call parameterisable setpoints from the memory via the JOG inputs. JOG setpoints replace the main setpoint. The JOG setpoints are entered in a relative manner in % of n_{max}. If you set input E3 to HIGH signal, the main setpoint is switched off and at the same time the first JOG setpoint is activated. A total of 15 JOG setpoints can be selected.



Inverting the main setpoint

Via terminals E1 and E2 the main setpoint can be inverted (i.e. the sign of the input value is changed). The following applies:

E1	E2	Main setpoint
0	0	Drive executes QSP (quick stop)
1	0	Main setpoint not inverted
0	1	Main setpoint inverted
1	1	Drive maintains its previous state

Acceleration and deceleration times for the main setpoint path

The main setpoint is controlled via a ramp function generator. Like this, input steps can be converted to a ramp.

The acceleration time and deceleration time refer to a change in speed from 0 to n_{max} (0% to 100%). The calculation of the times T_{ir} (C0012) and T_{if} (C0013) to be set is described in the NSET function block description.

Additional acceleration and deceleration times

For the ramp function generator of the main setpoint (NSET-N/JOG setpoint) you can call additional acceleration and deceleration times from the memory via the NSET-TI*x inputs, e.g. to change over the acceleration speed of the drive from a specific speed. For this, these inputs have to be assigned to a signal source. A maximum of 15 additional acceleration and deceleration times can be programmed.

S-shaped ramp function generator characteristic

For the ramp function generator of the main setpoint you can select two different characteristics via C0134:

- Linear characteristic for all acceleration processes requiring a constant acceleration
- S-shaped characteristic for all acceleration processes requiring a jerk-free acceleration

Code	Parameter	Meaning
C0134	0 1	Linear characteristic S-shaped characteristic
C0182	0.01 … 50.0 s	T_i-time for the S-shaped ramp function generator
C0012	0.00 … 999.9 s	T_{ir}-time for the acceleration
C0013	0.00 … 999.9 s	T_{if}-time for the deceleration

Additional setpoint

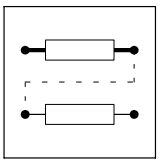
Via input X6/3,4 (or also another signal source) an analog additional setpoint (bipolar) can be connected. The additional setpoint (display in C0049) internally first goes to the NSET function block via an analog switch. Here the additional setpoint first is lead across a facility for inversion. This facility for inversion is deactivated. Furthermore there is a ramp function generator (acceleration and deceleration times via C0220/C0221) before the additional setpoint is linked with the main setpoint in the arithmetic block. The additional setpoint for instance can be used as a correcting signal for grinding machines (for controlling a constant circumferential speed when the grinding wheel diameter is decreased).

If you want to use the additional setpoint, set code C0190 to the desired arithmetic link. According to the default setting, code C0190 is parameterised to 0. Thus the additional setpoint is switched off.

Selection of direction of rotation

The selection of direction of rotation results from the sign of the speed setpoint at the input MCTRL-N-SET of the MCTRL function block.
In turn, the sign of this speed setpoint results from

- the sign of the main and additional setpoint,
- the level position at terminals E1 and E2,
- the selected link of the main and additional setpoint via the arithmetic block in the NSET function block



Limitation of the speed setpoint

The speed setpoint is always limited to 100% n_{max} (C0011) in the MCTRL function block. This means that the maximum speed is always specified to the greatest speed possible in C0011.

Example:

With this configuration a speed of 4500 rpm is to be travelled. The speed is to be corrected in the range from 0 to +10% using the additional setpoint. At inputs X6/1,2 and X6/3,4 a master voltage of 0 to +10 V is provided.

The following parameter setting results from this:

- C0011 = 5000 rpm, C0190 = 1 (addition)
- C0027/1 = 90%
- C0027/2 = 10%

Code C0909 presents another possibility of influencing the speed limit. Here the direction of rotation can be specified:

- C0909 = 0 → clockwise and counter-clockwise rotating direction permitted
- C0909 = 1 → only clockwise rotating direction permitted
- C0909 = 2 → only counter-clockwise rotating direction permitted

For systems that only permit one rotating direction this serves to prevent the drive from rotating backwards which would be caused by the setpoint.

Additional torque setpoint

For some applications it may be required to apply an additional torque setpoint.

Example: An acceleration connection for winding and positioning applications:

For this purpose, the input MCTRL-M-ADD is provided. This input is not active by default (is on FIXED0%). To use this input, an analog signal source has to be assigned to it.

Torque limitation

The torque can be limited in the range from 0 to +100% via code C0472/3.

Every other signal source can be assigned as well.

Actual speed value feedback

In this configuration all specified actual value encoders can be used. The corresponding actual value encoder can be selected via code C0025. An adjustment is not required.

Quick stop (QSP)

When the quick stop function is activated, the drive runs to speed 0 via the ramp set in C0105 and executes a holding torque with a drift-free standstill. The torque limitation and the additional torque setpoint have no effect. This means that the drive outputs the maximum possible torque (observe settings of motor data). When the QSP request is cancelled, the drive synchronises to the current speed.

Controller inhibit (CINH)

By setting controller inhibit the drive becomes torqueless, the machine coasts. When the controller inhibit request is cancelled, the drive synchronises to the current speed.

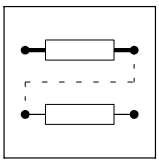
Shutting down the controller via TRIP (TRIP-SET)

With LOW signal at terminal X5/E4, the controller can be shut down via the monitoring function. This input mainly serves to evaluate external binary encoders.

The response to this input signal can be programmed.

Resetting a fault (TRIP-RESET)

With a LOW-HIGH edge at terminal X5/E5 a pending TRIP can be reset if the cause of the fault has been eliminated.



2.3 Operating modes

By selecting the operating mode you can also select the interface you want to use for parameter setting or control of the controller.

C0005 contains predefined configurations which allow a very easy change of the operating mode.

2.3.1 Parameter setting

Parameters can be set with one of the following modules:

- Communication module
  - 2102 (LECOM A/B/LI)
  - 2111, 2113 (INTERBUS)
  - 2131, 2133 (PROFIBUS)
  - 2175 (CANopen/DeviceNet)
- PC system bus module (CAN)
  - 2173

2.3.2 Control

The drive controller can be controlled via terminals (X5 and X6), via the fieldbus module at X1 or via the system bus (X4). Mixed forms are also possible.

Example: C0005 = 1005

This configuration corresponds to a speed control with control via system bus (CAN).

If more inputs of the function blocks are to be controlled via an interface, proceed as follows:

- Assign the function block inputs to be controlled to ”control objects” depending on the interface used (see System Manual):
  - Free control codes
    in case of control via LECOM A/B/LI (RS232, RS485 or optical fibre interface) or operating module.
  - AIF objects
    in case of control using InterBus S or Profibus DP.
  - CAN objects
    in case of control using system bus.
- Then the inputs can be controlled using these codes or input objects by accessing them via the interface.

Example for a distribution of the control on terminals and RS232:

The main speed setpoint in the configuration C0005=1000 is to be controlled via LECOM A/B/LI. All other inputs remain on terminal control.

1. Select C0780 via LECOM:
   - C0780 is the configuration code for the main setpoint NSET-N in the function block ”Speed setpoint conditioning” (NSET).
2. Assign a free control code via a selection number.
   - e.g. 19515 (control code C0141)

The main speed setpoint is now controlled by C0141.

2.4 Change of the terminal assignment

(see also chapter 3.1 ”Working with function blocks”)

If the configuration is changed via C0005, the assignment of all inputs and outputs is overwritten with the corresponding basic assignment. If necessary, the function assignment must be adapted to the wiring.

Tip!

Use the menu ”Terminal I/O” for the keypad 9371BB or the menu ”Terminal I/O” for Global Drive Control or LEMOC2.

Stop!

If you reassign an input, the signal source that has been assigned up to know will **not** be overwritten! Those active connections that are not required must be removed (see chapter 3.1.3).

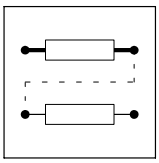
2.4.1 Freely assignable digital inputs

Five freely assignable digital inputs are available (X5/E1 … X5/E5). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

Change assignment:

Tip!

Use the submenu ”DIGIN” for the keypad 9371BB or the submenu ”Digital inputs” for Global Drive Control or LEMOC2.



Example:
Menu "Terminal I/O; DIGIN" (terminal I/O; digital inputs)

Here are the most important aims for digital inputs

Valid for the basic configuration C0005 = 1000.

Code			controlled by			Note
CFG	Subcode	Signal name	Signal (interface)		Selection list 2	
C0885	000	R/L/Q-R	DIGIN1	(Term. X5/E1)	0051	HIGH = do not invert main setpoint (CW rotation)
C0886	000	R/L/Q-L	DIGIN2	(Term. X5/E2)	0052	HIGH = Invert main setpoint (CCW rotation)
C0787	001	NSET-JOG*1	DIGIN3	(Term. X5/E3)	0053	HIGH = Main setpoint is substituted by the fixed speed from C0039/x The signals are binary coded.
	002	NSET-JOG*2	FIXED0	-	1000	
	003	NSET-JOG*4	FIXED0	-	1000	
	004	NSET-JOG*8	FIXED0	-	1000	
C0788	001	NSET-TI*1	FIXED0	-	1000	Additional acceleration and deceleration times from C0101/x and C0103/x The signals are binary coded.
	002	NSET-TI*2	FIXED0	-	1000	
	003	NSET-TI*4	FIXED0	-	1000	
	004	NSET-TI*8	FIXED0	-	1000	
C0880	001	DCTRL-PAR*1	FIXED0	-	1000	Parameter set selection: The signals are binary coded.
	002	DCTRL-PAR*2	FIXED0	-	1000	
C0881	000	DCTRL-PAR-LOAD	FIXED0	-	1000	Signal LOW-HIGH loads selected parameter set with DCTRL-PAR*x
C0871	000	DCTRL-TRIP-SET	DIGIN4	(Term. X5/E4)	0054	LOW = Controller sets TRIP (EEr)
C0876	-	DCTRL-TRIP-RES	DIGIN5	(Term. X5/E5)	0055	Signal LOW-HIGH = Resets active trip
C0920	000	REF-ON	FIXED0	-	1000	HIGH = Start homing
C0921	000	REF-MARK	FIXED0	-	1000	LOW-HIGH edge = Stop homing

1. Select the input of the function blocks which is to be assigned to a new source under the configuration code CFG in the code level.
   – Example:
   C0787/2 (CFG/subcode) determines the source for the input "NSET-JOG*2" (signal name) in the function block "Speed setpoint conditioning" (NSET).
2. Change to the parameter level with PRG. Select the source (signal) from the indicated list. Ask yourself: Where does the signal for controlling this input is to come from?
   – Example:
   "NSET-JOG*2" is to be controlled by terminal X5/E5 (interface).
   – For this, select DIGIN5 (signal) and confirm with SHIFT + PRG.
3. Change to the code level with 2 * .
4. Determine the polarity of the input terminals X5/E1 to X5/E5 (HIGH active or LOW active) under code C0114 and subcode.
   – In the code level the terminal is selected via subcode.
   – Change to the parameter level using PRG and select the polarity.
   – Change to the code level by 2 * PRG.
5. Repeat steps 1. to 4. until all inputs required are assigned.
6. Remove undesired connections (see chapter 3.1.3). The connection so far of the terminal X5/E5 is not cancelled automatically. If the connection is to be cancelled:
   – Select C0876 in the code level (previous target of terminal X5/E5)
   – Change to the parameter level using PRG.
   – Select FIXED0 (signal) and acknowledge with SHIFT+PRG.

2.4.2 Freely assignable digital outputs

Four freely assignable digital outputs are available (X5/A1 … X5/A4). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

The most important codes can be found in the submenu: DIGOUT (digital outputs).

Change assignment:

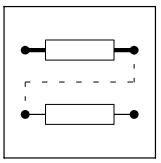
1. Select the output which is to be assigned to another function via the subcode under C0117.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be output via the selected output terminal. Change to the code level with PRG.
3. Determine the polarity (HIGH active or LOW active) via the subcode of the output under C0118.
4. Repeat step 1. to 3., until all outputs desired are assigned.

2.4.3 Freely assignable analog inputs

The most important codes can be found in the submenu: AIN1 X6.1/2 or AIN2 X6.3/4 (analog input 1 (X6.1/2) or analog input 2 (X6.3/4))

Change assignment:

1. Select the input of the function block to be assigned to a new source in the code level.
   – Example
   Determine the source for the input ”Main setpoint” (NSET-N) in the function block ”Speed setpoint conditioning” (NSET) under C0780.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be used for the selected input.
3. Repeat steps 1. and 2. until all inputs required are assigned.
4. Remove unwanted links (see Chapter 3.1.3).



2.4.4 Freely assignable monitor outputs

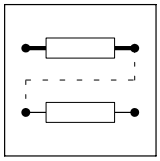
Use the monitor outputs X6/62 and X6/63 to output internal signals as voltage signals.

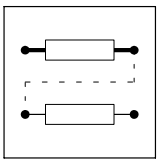
Under C0108 and C0109 the outputs can be adapted to e.g. a measuring device or a slave drive.

The most important codes can be found in the submenu: AOUT1 X6.62 or AIN2 X6.63 (analog output 1 (X6.62) or analog output 1 (X6.63))

Change assignment:

1. Select the output to be assigned to another signal (source) (e.g. C0431 for output X6/62) in the code level.
2. Change to the parameter level with PRG. Select the signal from the indicated list which is to be output via the monitor output.
3. If necessary, adjust an offset in the hardware under C0109
4. If necessary, the signal gain can be adapted to the hardware under C0108.
5. Repeat steps 1. to 4. to assign the second output.





3 Function library

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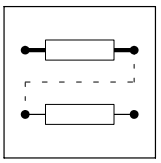

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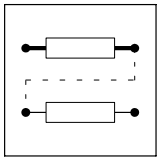
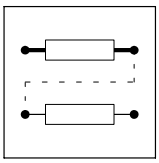


Function library



3.1 Working with function blocks

The signal flow of the controller can be configured by connecting function blocks. The controller can thus be easily adapted to diverse applications.

3.1.1 Signal types

Each function block has a certain number of inputs and outputs, which can be interlinked. Corresponding to their respective functions, only particular signal types occur at the inputs and outputs:

- Quasi analog signals
  - Symbol: O
  - Unit: %
  - Designation: a
  - Value range: ±16384 = ±100 %
  - Resolution: 16 bits, scaling: ±16384 ≙ ±100 %
- Digital signals
  - Symbol: □
  - Unit: binary, with HIGH or LOW level
  - Designation: d
  - Resolution: 1 bit
- Speed signals
  - Symbol: Δ
  - Unit: rpm (for display, internal representation in [inc/ms])
  - Designation: phd
  - Value range: $\pm 2^{15} - 1$
  - Resolution: 16 bit
- Angle signals
  - Symbol: ▲
  - Unit: inc
  - Designation: ph
  - Value range: $\pm 2^{31} - 1$
  - Resolution: 32 bits, scaling: 1 revolution ≙ 65536 inc

Only the same signal types can be connected with each other. Thus, an analog output signal of one function block can only be connected to the analog output of the other function block. If two different signal types are connected, the connection will be rejected.

3.1.2 Elements of a function block

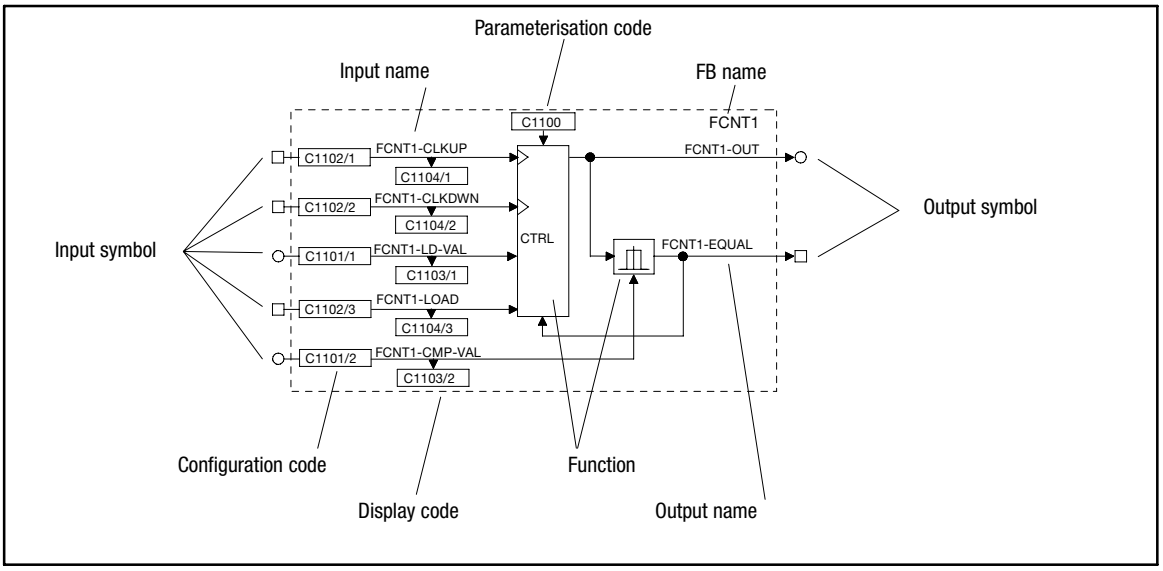


Fig. 3-1 Structure of a function block (FB) using the example of FCNT1

FB name

Clearly identifies the FB. The FB name is followed by a number distinguishing the function of the FB.

Each FB is defined via its selection number. For calculating the FB the input of the selection number into the processing table is always required. (📖 3-12)

The selection numbers are listed in selection list 5.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1 ≙ selection number 6400 (selection list 5).

Input symbol

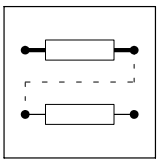
Indicates the signal type which can be used as a signal source for this input. (📖 3-5)

Note!

Only inputs led through the FB can be configured.

Input name

Consists of the FB name and a designation. Inputs with the same function are distinguished by the number that is added to the designation.



Configuration code

Configures the input with a signal source (e. g. terminal signal, control code, output of an FB, ...). Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are configured via the subcode.

It is not possible to connect an input with several signal sources.

Display code

Displays the current input value. Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are displayed via the subcode.

Display codes cannot be processed.

Function

Represents the mathematical function as a block diagram (see Fig. 3-1).

Parameterisation code

Adaptation of the function or behaviour to the drive task. Possible settings are described in the text editor and / or the line diagrams. (📖 3-95)

Output symbol

Designates the signal type. Connections with inputs of the same signal type are possible. (📖 3-5)

Each output is defined by a selection number. The selection numbers are divided into selection lists (1 ... 4) according to the different signal types.

An output is linked to an input by the selection numbers.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1-OUT ≙ selection number 6400 (analog signal, selection list 1).
- FCNT1-EQUAL ≙ selection number 6400 (digital signal, selection list 2).

Note!

Only outputs brought out of the FB can be configured.

Output name

Consists of the FB name and a designation. Outputs with the same function are distinguished by the number that is added to the designation.

3.1.3 Connecting function blocks

General rules

- Assign a signal source to an input.
- One input can have only one signal source.
- Inputs of different function blocks can have the same signal source.
- Only signals of the same type can be connected.

Stop!

Existing connections which are not required must be removed by reconfiguration. Otherwise the drive cannot perform the desired function.

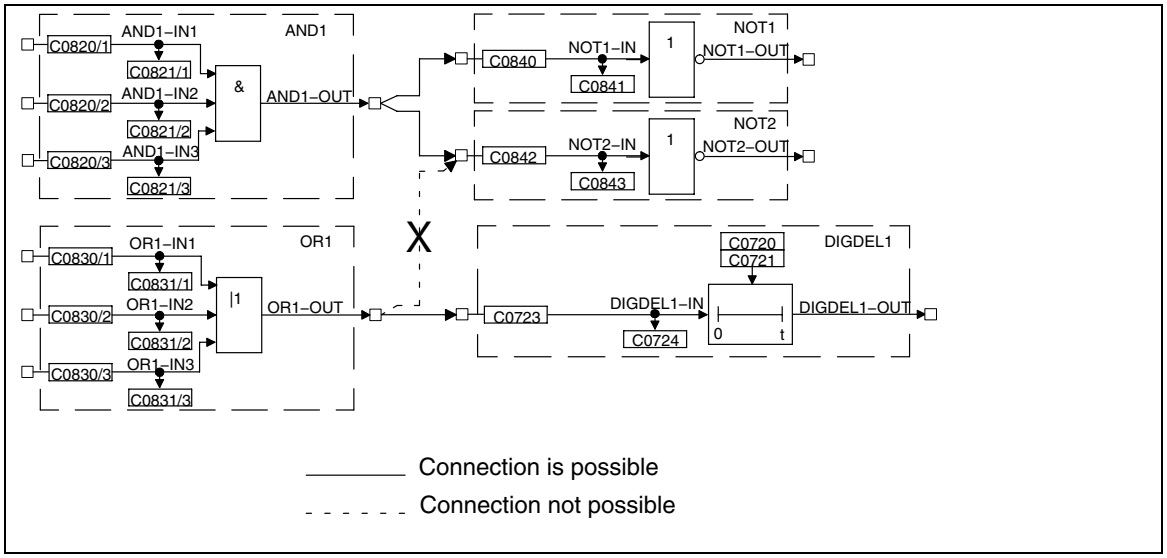


Fig. 3-2 Correct connection of function blocks

Basic procedure

1. Select the configuration code of the function block input which is to be changed.
2. Determine the source of the input signal for the selected input (e.g. from the output of another function block).
3. The function block input is assigned via a menu which contains only those signal sources which are of the same type as the function block input to be assigned.
4. Select and confirm the signal source.
5. Remove undesired connections, if any.
   – For this, select the corresponding signal assignment of the input via the configuration code (e.g. FIXED0, FIXED1, FIXED0%, ...).
6. Repeat 1. to 5. until the desired configuration is set.
7. Save modified configuration in the desired parameter set.

Example

- Condition:
  – Default setting
- Task:
  – Square the analog signal of X6/3, X6/4 and output to X6/62.
- Solution:
  – You need the function blocks AIN2, ARIT2 and AOUT2.

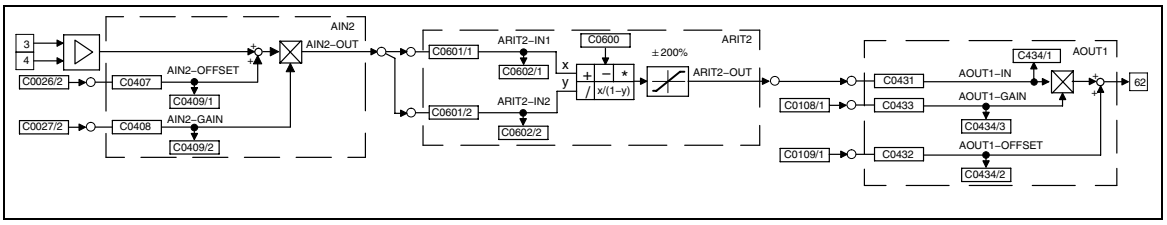


Fig. 3-3 Example of a simple configuration

Create connections

1. Determine the signal source for ARIT2-IN1:
   – Change to the code level using the arrow keys
   – Select C0601/1 using ▲ or ▼.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
2. Determine signal source for ARIT2-IN2:
   – Select C0601/2 using ▲.
   – Change to the parameter level using PRG.
   – Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
3. Parameterise ARIT2:
   – Select C0600 using ▼.
   – Change to the parameter level using PRG.
   – Select multiplication (selection number 3).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
4. Determine signal source for AOUT1:
   – Select C0431 using ▼.
   – Change to the parameter level using PRG.
   – Select output ARIT2-OUT (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
5. Enter function block ARIT2 in the processing table:
   – Select C0465 and subcode 8 using ▲.
   – Change to the parameter level using PRG.
   – Enter function block ARIT2 (selection number 5505).
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
   – The sequence of the FB processing is thus determined.

Remove connections

- Since a source can have several targets, there may be additional, unwanted signal connections.
- Example:
  - In the basic configuration C0005 = 1000, ASW1-IN1 and AIN2-OUT are connected.
  - This connection is not automatically removed by the settings described above! If you do not want this connection, remove it.

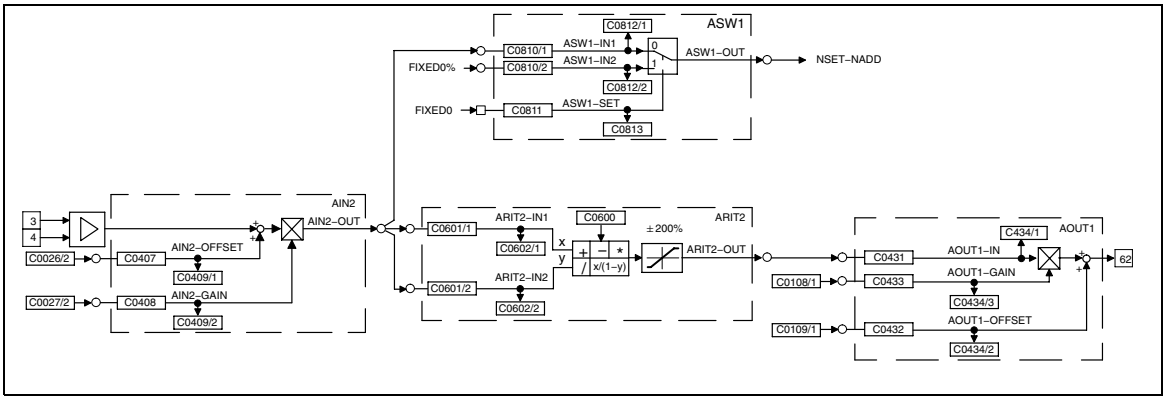


Fig. 3-4 Removing connections in a configuration

1. Remove connection between ASW1-IN1 and AIN2-OUT:
   - Select C0810/1 using ▲ or ▼.
   - Change to the parameter level using PRG.
   - Select the constant FIXED0% (selection number 1000) using ▲ or ▼.
   - Confirm using SH + PRG
   - Change to the code level again using PRG.

Now, the connection is removed.

2. Save new configuration, if desired:
   - If you do not want to lose the modifications after mains disconnection, save the new signal configuration under C0003 in one of the parameter sets.

3.1.4 Entries into the processing table

The 93XX drive controller provides a certain computing time for processing function blocks. Since the type and number of the function blocks used can vary considerably, not all function blocks available are permanently calculated. Therefore the code C0465 provides a processing table, in which only the FBs used are entered. This means that the drive system is perfectly adapted to the task to be solved. If further FBs are used in an extant configuration, they must be entered into the processing table.

The following aspects must be observed:

The number of FBs to be processed is limited

A maximum of 50 FBs can be integrated into a configuration. Each FB needs a certain processing time (operating time). The code C0466 shows the time still remaining for processing the FBs. If this time has elapsed, no further FBs can be integrated.

Sequence for entering FBs

Normally, the sequence of the entries into C0465 is discretionary, but it may be important for applications with a highly dynamic response. In general the most favourable sequence is adapted to the signal flow.

Example:

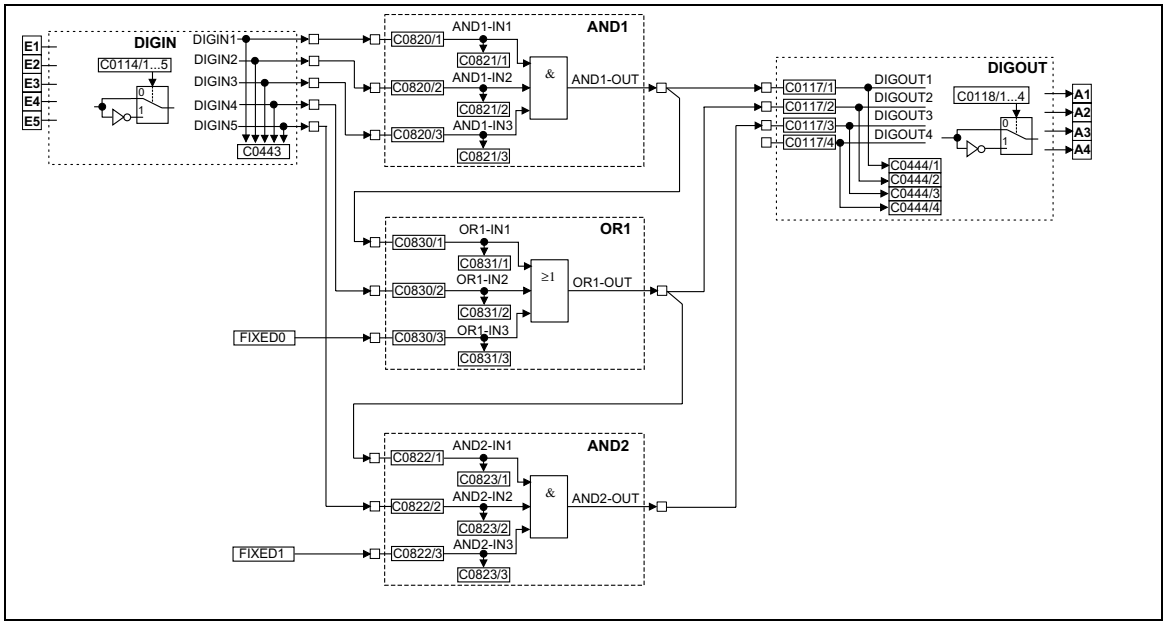
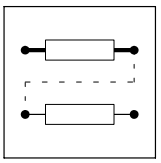


Fig. 3-5 Example of a configuration



Structure of the processing table for the configuration example Fig. 3-5:

1. DIGIN does not have to be entered into the processing table.
2. The first FB is AND1, since it receives its input signals from DIGIN and only has successors.
3. The second FB is OR1, since its signal source is the output of AND1 (predecessor). Hence, the output signal in AND1 must be generated first, before being processed in OR1. At the same time, OR1 has a successor. Hence, OR1 must be entered into the processing table before the successor.
4. The third FB is AND2, since it has a predecessor (see 3.)
5. The entries under C0465 are as follows:
   – Position 10: AND1 10500
   – Position 11: OR1 10550
   – Position 12: AND2 10505

This example was started with position 10, since these positions are not assigned in the default setting.

FBs do not have to be entered into the processing table directly one after the other. Empty positions in the processing table are permissible.

Note!

It is also possible that other FBs are entered between the FBs listed in the example.

FBs, which do not have to be entered into the processing table

The following signal sources are always executed and therefore do not need to be entered into the processing table:

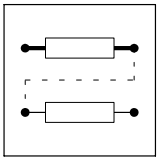
- AIF-IN
- CANx-IN
- DIGIN
- DIGOUT
- FCODE (all free codes)
- MCTRL
- fixed signal sources (FIXED0, FIXED0%, etc.)

Frequent errors

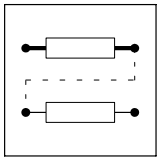
Malfunction	Cause	Remedy
FB does not supply an output signal	FB was not entered into the processing table C0465	Enter FB
FB only supplies constant signals	FB was deleted from or overwritten in the processing table C0465	Enter FB again, possibly under a different subcode (list position)
The output signal does not arrive at the following FB	The connection between the FBs has not been established	Establish the connection (from the view of the following FB) via the configuration code (CFG)
FB cannot be entered into the table C0465	Residual processing time is too short (see C0466)	Delete unused FBs (e. g. inputs and outputs not used) In networked drives, functions may be assigned to other controllers
The drive controller transmits internally calculated signals with a delay to the outputs.	The FBs are processed in an incorrect sequence	Adapt the processing table under C0465 to the signal flow

3.2 Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
ABS1	Absolute value generator	🕮 3-95	4				
ADD1	Addition block	🕮 3-96	8				
AIF-IN	Fieldbus	🕮 3-97	60				
AIF-OUT	Fieldbus	🕮 3-100	56	•			
AIN1	Analog input X6/1, X6/2	🕮 3-102	10	•			
AIN2	Analog input X6/3, X6/4		28	•			
AND1	Logic AND, block1	🕮 3-104	6				
AND2	Logic AND, block2						
AND3	Logic AND, block3						
AND4	Logic AND, block4						
AND5	Logic AND, block5						
ANEG1	Analog inverter 1	🕮 3-107	3	•	•	•	•
ANEG2	Analog inverter 2						
AOUT1	Analog output X6/62	🕮 3-108	12	•	•	•	•
AOUT2	Analog output X6/63			•	•	•	•
ARIT1	Arithmetic block 1	🕮 3-110	11				
ARIT2	Arithmetic block 2						
ARITPH1	32-bit arithmetic block	🕮 3-111	15				
ARITPH2	32-bit arithmetic block 2						
ARITPH3	32-bit arithmetic block3						
ARITPH4	32-bit arithmetic block 4						
ARITPH5	32-bit arithmetic block 5						
ARITPH6	32-bit arithmetic block 6						
ASW1	Analog change-over switch 1	🕮 3-114	4	•			
ASW2	Analog change-over switch 2						
ASW3	Analog change-over switch 3						
ASW4	Analog change-over switch 4						
BCD1	BCD decade switch 1	🕮 3-116	30				
BCD2	BCD decade switch 2						
BCD3	BCD decade switch 3						
BRK	Holding brake control	🕮 3-127	15				
CAN-IN1	System bus	🕮 3-132	-				
CAN-IN2	System bus						
CAN-IN3	System bus						
CAN-OUT1	System bus	🕮 3-133	56	•	•	•	
CAN-OUT2	System bus			•	•	•	
CAN-OUT3	System bus			•	•	•	
CMP1	Comparator 1	🕮 3-134	15	•			
CMP2	Comparator 2						
CMP3	Comparator 3		15				
CMPPH1	Comparator 1	🕮 3-139	20				
CMPPH2	Comparator 2						
CMPPH3	Comparator 3						
CONV1	Conversion of analog signals	🕮 3-144	8				
CONV2	Conversion of analog signals						
CONV3	Conversion of speed signals to analog signals						
CONV4	Conversion of speed signals to analog signals						
CONV5	Conversion of analog signals to speed signals						
CONVAD1	Analog-digital converter 1	🕮 3-146	4				
CONVAD2	Analog-digital converter 2						
CONVAPH1	Analog phase converter 1	🕮 3-148	31				
CONVAPH2	Analog phase converter 2						
CONVAPH3	Analog phase converter 3						



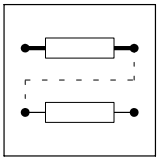
Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
CONVDA1	Digital-analog converter 1	3-150	38				
CONVDA2	Digital-analog converter 2						
CONVDA3	Digital-analog converter 3						
CONVPHA1	Phase analog converter 1	3-153	6				
CONVPHA2	Phase analog converter 2						
CONVPHA3	Phase analog converter 3						
CONVPHPH2	Phase converter 2	3-155	80				•
CURVE1	Characteristic function	3-156	15			•	
DB1	Dead band	3-159	7				
DCTRL	Device control	3-160	-				
DFIN	Digital frequency input	3-164	5	•			
DFOUT	Digital frequency output	3-167	35	•	•	•	•
DFRFG1	Digital frequency ramp function generator	3-171	40				
DFSET	Digital frequency processing	3-177	85				
DIGDEL1	Binary delay element 1	3-182	9				
DIGDEL2	Binary delay element 2						
DIGIN	Input terminals X5/E1…X5/E5	3-185	-				
DIGOUT	Output terminals X5/A1…X5/A4	3-186	-				
DISA	Free analog display code	3-187	1				
DISPH	Free phase display code	3-189	1				
DT1	Differential element	3-190	12				
FCNT1	Free piece counter, block 1	3-191	11				
FCNT2	Free piece counter, block 2						
FCNT3	Free piece counter, block 3						
FDO	Free digital outputs	3-193	-				
FEVAN1	Free analog input variable	3-195	4				
FEVAN2	Free analog input variable						
FEVAN3	Free analog input variable						
FEVAN4	Free analog input variable						
FEVAN5	Free analog input variable						
FEVAN6	Free analog input variable						
FIXSET1	Fixed setpoints	3-202	9				
FLIP1	D-flipflop 1	3-204	6				
FLIP2	D-flipflop 2						
LIM1	Limiter	3-207	5				
MCTRL	Servo control	3-208	-				
MPOT1	Motor potentiometer	3-220	20				
NOT1	Logic NOT, block1	3-223	4		•	•	•
NOT2	Logic NOT, block2						•
NOT3	Logic NOT, block3						•
NOT4	Logic NOT, block4						
NOT5	Logic NOT, block5						
NSET	Speed setpoint conditioning	3-225	70	•			
OR1	Logic OR, block1	3-230	6				•
OR2	Logic OR, block2						•
OR3	Logic OR, block3						
OR4	Logic OR, block4						
OR5	Logic OR, block5						
OSC	Oscilloscope function	3-233	70				
PCTRL1	Process controller	3-237	58				
PHDIV1	Conversion	3-240	8				
PHINT1	Phase integrator	3-241	7				
POS	Positioning control	3-19	330		•	•	•
PT1-1	1st order delay element	3-244	8				
R/L/Q	QSP / setpoint inversion	3-245	8	•			
RFG1	Ramp function generator	3-246	16				
S&H1	Sample and Hold	3-248	4				



Function library

Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
SELPH1	Phase value selection, block 1	📖 3-249	6				
SELPH2	Phase value selection, block 2						
SP1	Position switch points, block 1	📖 3-251	80			•	
SP2	Position switch points, block 2		130				
STAT	Output of digital status signals	📖 3-258	-				
STATE-BUS	Control of a drive network	📖 3-259	-				
SYNC1	Multi-axis positioning	📖 3-260	37				•
TEACH1	Teach in programming	📖 3-268	10			•	
TRANS1	Binary edge evaluation	📖 3-270	7				•
TRANS2	Binary edge evaluation						
VTACC	"Acceleration" variable table	📖 3-273	20				
VTPCS	"Piece number" variable table	📖 3-275	12				
VTPOS	"Target position" variable table	📖 3-277	45				
VTTIME	"Waiting time" variable table	📖 3-279	12				
VTVEL	"Speed" variable table	📖 3-281	18				



3.3 Table of free control codes

Free control codes can be used for the selection of setpoints or as variables. The codes can be connected with inputs of function blocks.

Designation	Signal type	Code	Connection to the function block in the Lenze setting	Note
FCODE-17	a	C0017	-	
FCODE-26/1	a	C0026/1	AIN1-OFFSET	
FCODE-26/2	a	C0026/2	AIN2-OFFSET	
FCODE-27/1	a	C0027/1	AIN1-GAIN	
FCODE-27/2	a	C0027/2	AIN2-GAIN	
FCODE-32	a	C0032	-	
FCODE-37	a	C0037	-	
FCODE-108/1	a	C0108/1	AOUT1-GAIN	
FCODE-108/2	a	C0108/2	AOUT2-GAIN	
FCODE-109/1	a	C0109/1	AOUT1-OFFSET	
FCODE-109/2	a	C0109/2	AOUT2-OFFSET	
FCODE-141	a	C0141	-	
FCODE-1211	a	C1211	POS-START-PS	
FCODE-472/1	a	C0472/1	-	
FCODE-472/2	a	C0472/2	-	
FCODE-472/3	a	C0472/3	ANEG1-IN MCTRL-HI-M-LIM	
FCODE-472/4	a	C0472/4	-	
FCODE-472/5	a	C0472/5	-	
FCODE-472/6	a	C0472/6	MCTRL-PHI-LIM	
FCODE-472/7	a	C0472/7	-	
FCODE-472/8	a	C0472/8	-	
FCODE-472/9	a	C0472/9	-	
FCODE-472/10	a	C0472/10	-	
FCODE-472/11	a	C0472/11	-	
FCODE-472/12	a	C0472/12	-	
FCODE-472/13	a	C0472/13	-	
FCODE-472/14	a	C0472/14	-	
FCODE-472/15	a	C0472/15	-	
FCODE-472/16	a	C0472/16	-	
FCODE-472/17	a	C0472/17	-	
FCODE-472/18	a	C0472/18	-	
FCODE-472/19	a	C0472/19	-	
FCODE-472/20	a	C0472/20	-	
FCODE-473/1	a	C0473/1	-	
FCODE-473/2	a	C0473/2	-	
FCODE-473/3	a	C0473/3	-	
FCODE-473/4	a	C0473/4	-	
FCODE-473/5	a	C0473/5	-	
FCODE-473/6	a	C0473/6	-	
FCODE-473/7	a	C0473/7	-	
FCODE-473/8	a	C0473/8	-	
FCODE-473/9	a	C0473/9	-	
FCODE-473/10	a	C0473/10	-	
FCODE-250	d	C0250	-	
FCODE-471.B0	d	C0471	-	
FCODE-471.B1	d	C0471	POS-S-RAMPS	
FCODE-471.B2	d	C0471	-	
FCODE-471.B3	d	C0471	-	

Designation	Signal type	Code	Connection to the function block in the Lenze setting	Note
FCODE-471.B4	d	C0471	-	
FCODE-471.B5	d	C0471	-	
FCODE-471.B6	d	C0471	-	
FCODE-471.B7	d	C0471	-	
FCODE-471.B8	d	C0471	-	
FCODE-471.B9	d	C0471	-	
FCODE-471.B10	d	C0471	-	
FCODE-471.B11	d	C0471	-	
FCODE-471.B12	d	C0471	-	
FCODE-471.B13	d	C0471	-	
FCODE-471.B14	d	C0471	-	
FCODE-471.B15	d	C0471	-	
FCODE-471.B16	d	C0471	-	
FCODE-471.B17	d	C0471	-	
FCODE-471.B18	d	C0471	-	
FCODE-471.B19	d	C0471	-	
FCODE-471.B20	d	C0471	-	
FCODE-471.B21	d	C0471	-	
FCODE-471.B22	d	C0471	-	
FCODE-471.B23	d	C0471	-	
FCODE-471.B24	d	C0471	-	
FCODE-471.B25	d	C0471	-	
FCODE-471.B26	d	C0471	-	
FCODE-471.B27	d	C0471	-	
FCODE-471.B28	d	C0471	-	
FCODE-471.B29	d	C0471	-	
FCODE-471.B30	d	C0471	-	
FCODE-471.B31	d	C0471	-	
FCODE-135.B0	d	C0135	-	LECOM control word
FCODE-135.B1	d	C0135	-	LECOM control word
FCODE-135.B2	d	C0135	-	LECOM control word
FCODE-135.B3	d	C0135	-	LECOM control word, signal: QSP (see DCTRL)
FCODE-135.B4	d	C0135	-	LECOM control word
FCODE-135.B5	d	C0135	-	LECOM control word
FCODE-135.B6	d	C0135	-	LECOM control word
FCODE-135.B7	d	C0135	-	LECOM control word
FCODE-135.B12	d	C0135	-	LECOM control word
FCODE-135.B13	d	C0135	-	LECOM control word
FCODE-135.B14	d	C0135	-	LECOM control word
FCODE-135.B15	d	C0135	-	LECOM control word
FCODE-474/1	ph	C0474/1	-	
FCODE-474/2	ph	C0474/2	-	
FCODE-474/3	ph	C0474/3	-	
FCODE-474/4	ph	C0474/4	-	
FCODE-474/5	ph	C0474/5	-	
FCODE-474/6	ph	C0474/6	-	
FCODE-474/7	ph	C0474/7	-	
FCODE-474/8	ph	C0474/8	-	
FCODE-474/9	ph	C0474/9	-	
FCODE-474/10	ph	C0474/10	-	
FCODE-475/1	phd	C0475/1	-	
FCODE-475/2	phd	C0475/2	-	

3.4 Positioning control (POS)

Purpose

The function block ”positioning control (POS)” is the core of the 9300 servo position controller. It controls positioning in the controller.

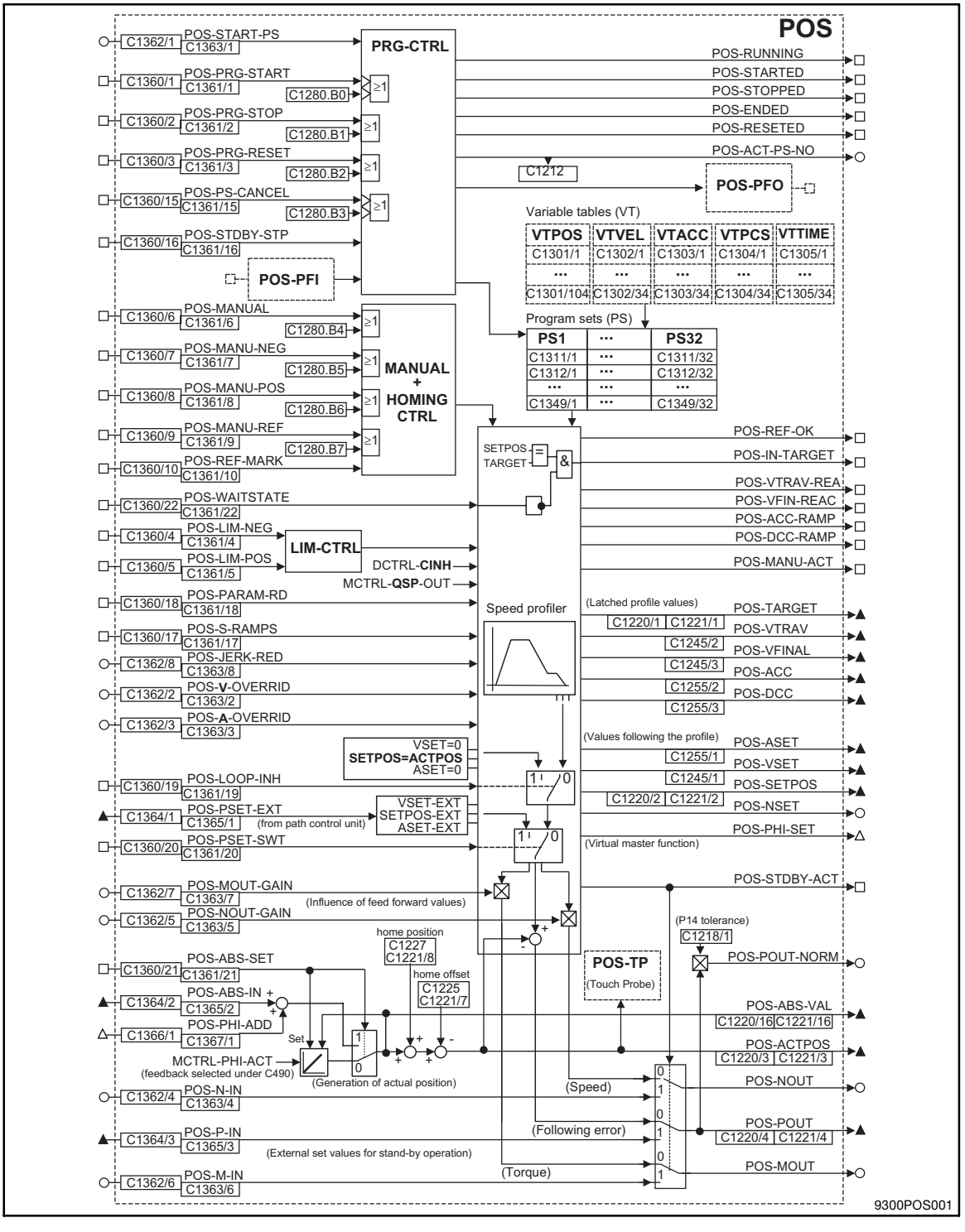
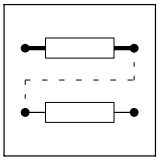


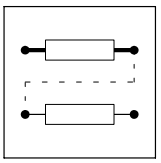
Fig. 3-6 Function block POS

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
POS-A-OVERRID	a	C1363/3	dec [%]	C1362/3	1	Reduces the acceleration and deceleration as well as the manual traversing acceleration and homing acceleration. Note: Only positive override values are effective, negative values will be evaluated as zero. (See "Override" 🕮 3-62)
POS-ABS-IN	ph	C1365/2	dec [inc]	C1364/2	3	Input for external actual position value, e. g. when using an absolute value encoder with a CAN interface. (see "Absolute encoder via system bus" 🕮 3-40)
POS-ABS-SET	d	C1361/21	bin	C1360/21	2	HIGH = Phase value at POS-ABS-IN is read for generating the actual position value (POS-ACTPOS). The following values are considered for the POS-ACTPOS: position setpoint polarity (C1206), actual position polarity (C1208), actual home position (display C1220/8), actual dimension offset (display C1220/7).
POS-ABS-VAL	ph	C1220/16 C1221/16	dec [units] dec [inc]			Display as actual position POS-ACTPOS, but without considering setpoint position polarity (C1206), actual position (C1206), actual home position (display C1220/8) and actual reference dimension offset (display C1220/7).
POS-ACC	ph	C1255/2	dec [inc]	-	-	Deceleration, absolute value for current PS; for scaling see formula 3.
POS-ACC-RAMP	d	-	-	-	-	HIGH = Drive accelerates
POS-ACT-PS-NO	a	C1212	dec [inc]	-	-	Current program block
POS-ACTPOS	ph	C1220/3 C1221/3	dec [units] dec [inc]	-	-	Actual position; for scaling see formula 1
POS-ASET	ph	C1255/1	dec [inc]	-	-	Current acceleration/deceleration setpoint, for scaling see formula 3.
POS-DCC	ph	C1255/3	dec [inc]	-	-	Deceleration in current program block (positive display); for scaling see formula 3
POS-DCC-RAMP	d	-	-	-	-	HIGH = drive brakes
POS-ENDED	d	-	-	-	-	Position status display HIGH = program end reached. Current program block no.=0 (POS-ACT-PS-NO). (see "program control" 🕮 3-70)
POS-IN-TARGET	d	-	bin	-	-	HIGH = Position setpoint has reached target position, positioning is completed, the following function of the PS will be processed. LOW = Positioning is running or was cancelled by POS-PS-CANCEL. POS-IN-TARGET remains LOW, as long as POS-WAITESTATE = HIGH. 🕮 3-64
POS-JERK-RED	a	1363/8	dec [%]	C1362/8	1	Reduces the jerk of an S profile, or prolongs the jerk time (Tr) (see "S ramps" 🕮 3-60). Note: will be evaluated as value.
POS-LIM-NEG	d	C1361/4	bin	C1360/4	2	HIGH = negative end of travel range limit switch approached. (see "Travel limits" 🕮 3-44)
POS-LIM-POS	d	C1361/5	bin	C1360/5	2	HIGH = positive travel range limit switch approached. (see "Travel range limits" 🕮 3-44)
POS-LOOP-INH	d	C1361/19	bin	C1360/19	2	HIGH = position control loop is switched off. (POS-SETPOS = POS-ACTPOS, POS-VSET = 0, POS-ASET = 0).
POS-M-IN	a	C1363/6	dec [%]	C1362/6	1	External torque precontrol, effective in stand-by operation (🕮 3-81)
POS-MANU-ACT	d	-	-	-	-	HIGH = manual operation active, no program operation Note: Signal will not be updated when the controller is inhibited (DCTRL-CINH = HIGH) or quick stop (MCTRL-QSP-OUT = HIGH) is set
POS-MANU-NEG	d	C1361/7	bin	C1360/7	2	HIGH = drive travels with v_manual (C1243) in negative direction. Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. LOW = drive is stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. Note: POS-MANU-REF has priority. When -NEG and -POS are controlled simultaneously the drive stops. (see "Manual operation" 🕮 3-67)
POS-MANU-POS	d	C1361/8	bin	C1360/8	2	like POS-MANU-NEG, but in positive direction. (see "Manual operation" 🕮 3-67)
POS-MANU-REF	d	C1361/9	bin	C1360/9	2	LOW-HIGH signal = Start manual homing HIGH level required for the time of homing (see "manual homing" 🕮 3-69)
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual/program operation HIGH = manual operation; if necessary, running program is interrupted. If necessary, drive is decelerated to standstill with a-manual (C1252) and the influence of POS-A-OVERRID. LOW = Program mode (see "manual mode" 🕮 3-67)
POS-MOUT	a	-	-	-	-	Current torque precontrol value after influence of POS-MOUT-GAIN. Scaling: 100% acc. to a-max (C1250).



Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
POS-MOUT-GAIN	a	C1363/7	dec [%]	C1362/7	1	Reduces torque precontrol. The polarity of the input signal is considered.
POS-N-IN	a	C1363/4	dec [%]	C1362/4	1	External speed setpoint, effective in stand-by operation (📖 3-81)
POS-NOUT	a	-	-	-	-	Current speed setpoint for n controller after influence of POS-NOUT-GAIN. Scaling: 100% acc. to. nmax (C0011).
POS-NOUT-GAIN	a	C1363/5	dec [%]	C1362/5	1	Reduces speed precontrol. The polarity of the input signal is considered.
POS-NSET	a	-	-	-	-	Current speed setpoint (profile generator output), scaling: 100% acc. to nmax (C0011).
POS-P-IN	ph	C1365/3	dec [inc]	C1364/3	3	Externally calculated following error, effective in stand-by operation (📖 3-81)
POS-PARAM-RD	d	C1361/18	bin	C1360/18	2	LOW-HIGH signal = new profile parameters will be accepted immediately, even during positioning HIGH level accepts new parameters every 10 ms Profile parameters: target position, traversing speed, acceleration, deceleration, final speed, V-0VERRID, A-0VERRID, POS-S-RAMPS. Note: Not effective in stand-by operation ("Stand-By operation" see 📖 3-81)
POS-PHI-ADD	phd	C1367/1		C1366/1		Phase difference signal is added to POS-ABS-IN. Function: With POS-ABS-SET= HIGH the actual position is set to the value POS-ABS-IN. Encoder increments that have arrived in the setting cycle are not considered in the default. If required, the encoder change can be connected in the setting cycle; the signal MCTRL-PHI-ACT must be linked with the input POS-PHI-ADD.
POS-PHI-SET	phd	-	-	-	-	"Virtual Master" application: 📖 3-65)
POS-POUT	ph	-	-	-	-	Following error for phase controller
POS-POUT-NORM	d	-	dec [%]			Scaled analog following error output. The current following error POS-POUT is additionally output as follows: 100% equals first following error tolerance (C1218/1). Tip: for monitoring the dynamic drive response.
POS-PRG-RESET	d	C1361/3	bin	C1360/3	2	HIGH= interrupts the program processing and sets "program end". Parts counters and PFOs are reset. The Touch Probe inputs used by the program are disabled and, if required, the stand-by operation is interrupted. The drive is stopped with a-max (C1250) (no influence of POS-A-OVERRID). (see "program control" 📖 3-70)
POS-PRG-START	d	C1361/1	bin	C1360/1	2	Start of the program. LOW-HIGH edge = Start, from the beginning (POS-START-PS) or continued at the same position after program interruption. The program is executed to the "program end", even if POS-PRG-START is reset again. If POS-PRG-START = HIGH at the program end, the program will be processed again from its beginning. (see "program control" 📖 3-70)
POS-PRG-STOP	d	C1361/2	bin	C1360/2	2	HIGH = program processing and the running positioning are interrupted. The drive is stopped with the current delay of the program block (no influence of POS-A-0VERRID). LOW = Program processing is continued. Positioning is continued with the current profile parameters of the program block, if required. (see "program control" 📖 3-70)
POS-PS-CANCEL	d	C1361/15	bin	C1360/15	2	Cancel PS and continue program from another point. LOW-HIGH edge = aborts current program block. Drive is braked to standstill with the separately adjustable delay "a-cancel" (C1253). Afterwards the program is continued in the selected program block (C1333; JMP-TP-PS). (see "program control" 📖 3-70)
POS-PSET-EXT	ph	C1365/1	dec [inc]	C1364/1	3	External position setpoint.
POS-PSET-SWT	d	C1361/20	bin	C1360/20	2	HIGH = Phase value at POS-PSET-EXT will be accepted as position setpoint (POS-SETPOS) LOW = Position setpoint will be generated by the profile generator.
POS-REF-MARK	d	C1361/10	bin	C1360/10	2	Home position switch
POS-REF-OK	d	C1284/1	-	-	-	HIGH = Homing completed/reference known
POS-RESETED	d	-	-	-	-	Position status display HIGH = Position program in status "Prg-Reset" (see "program control" 📖 3-70)

Signal				Source		Note
Designation	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
POS-RUNNING	d	-	-	-	-	Position status display POS-RUNNING = HIGH: Program run is started and is not interrupted by controller inhibit, faults or manual control. POS-RUNNING = LOW and POS-STARTED = HIGH: Program run interrupted; for continuing the program run a new edge to POS-PRG-START is required.
POS-S-RAMPS	d	C1361/17	bin	C1361/17	2	HIGH level = S profile is active (see S-shaped ramps" 🕮 3-60)
POS-SETPOS	ph	C1220/2 C1221/2	dec [units] dec [inc]	-	-	Current position setpoint; for scaling see formula 1
POS-START-PS	a	C1363/1	dec [inc]	C1362/1	1	Start program set Number of the program set with which the program run is to be started. In the standard configurations (see C0005) it is connected with C1211,
POS-STARTED	d	-	-	-	-	Position status display HIGH = Program started If the program has been interrupted by controller inhibit, fault or manual homing, POS-STARTED remains HIGH. The program can only continue if a new signal is applied to POS-PRG-START. (see "program control" 🕮 3-70)
POS-STDBY-ACT	d	-	-	-	-	HIGH = stand-by operation is active (see "Stand-by operation" 🕮 3-81)
POS-STDBY-STP	d	C1361/16	bin	C1360/16	2	HIGH = terminates the stand-by operation, if "STDBY" is selected in the POS mode (C1311 = 30). No other function. (see "Stand-by operation" 🕮 3-81)
POS-STOPPED	d	-	-	-	-	Position status display HIGH = Program and drive have been stopped or drive is being stopped (see "program control" 🕮 3-70)
POS-TARGET	ph	C1220/1 C1221/1	dec [units] dec [inc]	-	-	current target position in real measuring system; for scaling see formula 1
POS-V-OVERRID	a	C1363/2	dec [%]	C1362/2	1	Reduces the traversing and final speed as well as the manual traversing speed and the homing speed. Note: Only positive override values are effective, negative values will be evaluated as zero. (See "Override" 🕮 3-62)
POS-VFIN-REAC	d	-	-	-	-	HIGH = current final speed reached
POS-VFINAL	ph	C1245/3	dec [inc]	-	-	Acceleration, absolute value for current PS, for scaling see formula 3.
POS-VSET	ph	C1245/1	dec [inc]	-	-	Current speed setpoint; for scaling see formula 2
POS-VTRAV	ph	C1245/2	dec [inc]	-	-	Final speed, absolute value for current PS, for scaling see formula 2.
POS-VTRAV-REA	d	-		-	-	HIGH = current traversing speed reached
POS-WAITSTATE	d	C1360/22	bin	C1361/22	2002	Completion of positioning in the actual program block is delayed to wait until the possibly occurring following error has been eliminated when reaching the target. HIGH = POS-IN-TARGET is not set, the actual positioning is not completed. (see chapter "Target window" 🕮 3-64)



Formulae for scaling the signals (see preceding table, column ”Note”):

Formula 1: Position

$$\text{Position [inc]} = \text{Position [units]} \cdot \frac{65536\ [\text{inc/rev.}] \cdot \text{gear nominator}}{\text{Feed const. [units/rev.]} \cdot \text{gear denominator}} = \text{Position} \cdot \frac{65536 \cdot C1202}{C1204 \cdot C1203}$$

Formula 2: Speed (VEL)

$$\text{VEL } [\text{inc}_v/\text{ ms}] = \text{VEL [units/s]} \cdot \frac{65536\ [\text{inc/rev.}] \cdot \text{gear nominator} \cdot 16384\ [\text{inc}_v/\text{inc}]}{\text{Feed const. [units/rev.]} \cdot \text{gear denominator} \cdot 1000\ [1/\text{s}]} = \text{VEL} \cdot \frac{65536 \cdot C1202 \cdot 16384}{C1204 \cdot C1203 \cdot 1000}$$

Formula 3: Acceleration/deceleration (ACC/DCC)

$$\text{ACC}[\text{inc}_v/\text{ms}^2] = \text{ACC}[\text{units/s}^2] \cdot \frac{65536[\text{inc/rev.}] \cdot \text{gear nominator} \cdot 16384\ [\text{inc}_v/\text{inc}]}{\text{Feed const.[units/rev.]} \cdot \text{gear denominator} \cdot 1000000[1/\text{s}^2]} = \text{ACC} \cdot \frac{65536 \cdot C1202 \cdot 16384}{C1204 \cdot C1203 \cdot 1000000}$$

$$1\ \text{inc}_v = \frac{1\ \text{inc}}{2^{14}}$$

Function

- Dimensions (📖 3-25)
- Machine parameters (📖 3-26)
- Positioning mode “Relative Positioning” (📖 3-30)
- Positioning mode “Absolute Positioning” (📖 3-32)
- Measuring systems (📖 3-34)
- Absolute positioning with saving (📖 3-33)
- Absolute positioning through encoder connection X8 (📖 3-38)
- Absolute positioning through system bus (CAN) (📖 3-40)
- Travel range limits (📖 3-44)
- Traversing profile generator and setpoints (📖 3-58)
- Manual operation (📖 3-67)
- Program operation (📖 3-70)
- Variable tables (📖 3-75)
- Program sets (PS) (📖 3-76)
- POS-TP (touch probe saving of the actual position value) (📖 3-91)
- POS-PFI (Program Function Inputs) (📖 3-93)
- POS-PFO (Program Function Outputs) (📖 3-94)

3.4.1 Dimensions

Absolute dimensions

An absolute target position is a defined position on the traversing path with reference to a zero point. The target position is approached irrespective of the current position.

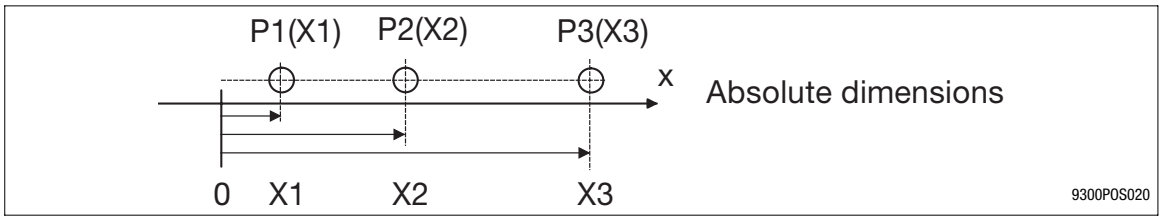


Fig. 3-7 Absolute dimensions

Relative dimensions

Relative dimensioning corresponds to incremental dimensioning. Each new target refers to the preceding target.

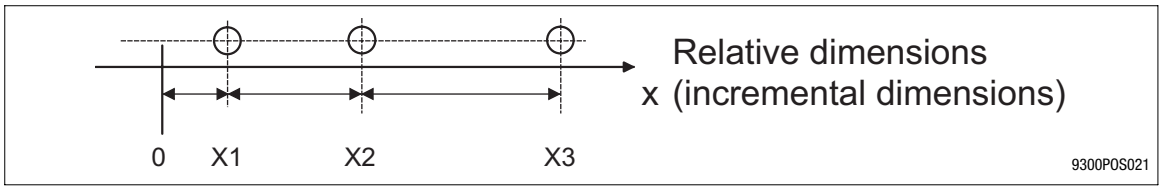


Fig. 3-8 Relative dimensions

Mixed dimensions

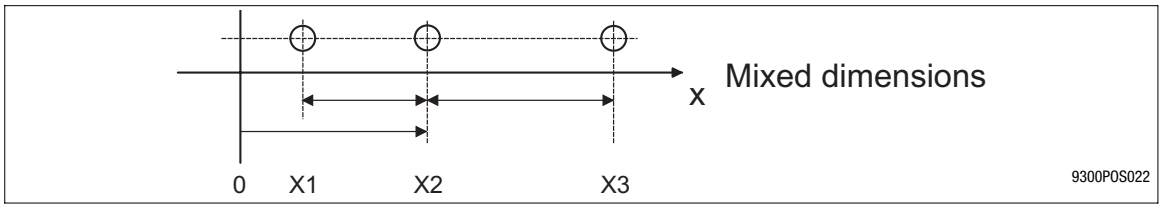


Fig. 3-9 Mixed dimensions

3.4.2 Machine parameters

Example

Purpose

- The physical unit (e.g.: mm, m, degrees) for a “unit” is defined via the entry of the machine parameters.

Function

- Entry of the gearbox ratio under C1202 and C1203, according to the nameplate data of the gearbox.

$$\frac{C1202}{C1203} \equiv \frac{Motor\_speed}{Getriebeabtriebsdrehzahl}$$

- Entry of the feed constant under C1204. Enter the number of units (e.g.: mm) to be fed during one revolution at the gearbox output side.
- Entry of the maximum motor speed (n_{max}) under C0011. The limitation mainly applies to the motor.
- Entry of the maximum speed (v_{max}) under C1240. Limitation mainly applies to the entire machine. It should be set lower than the speed that can be attained at maximum motor speed. The maximum speed v_{max} is considered as the reference for all speed data in the VTVEL variable table.

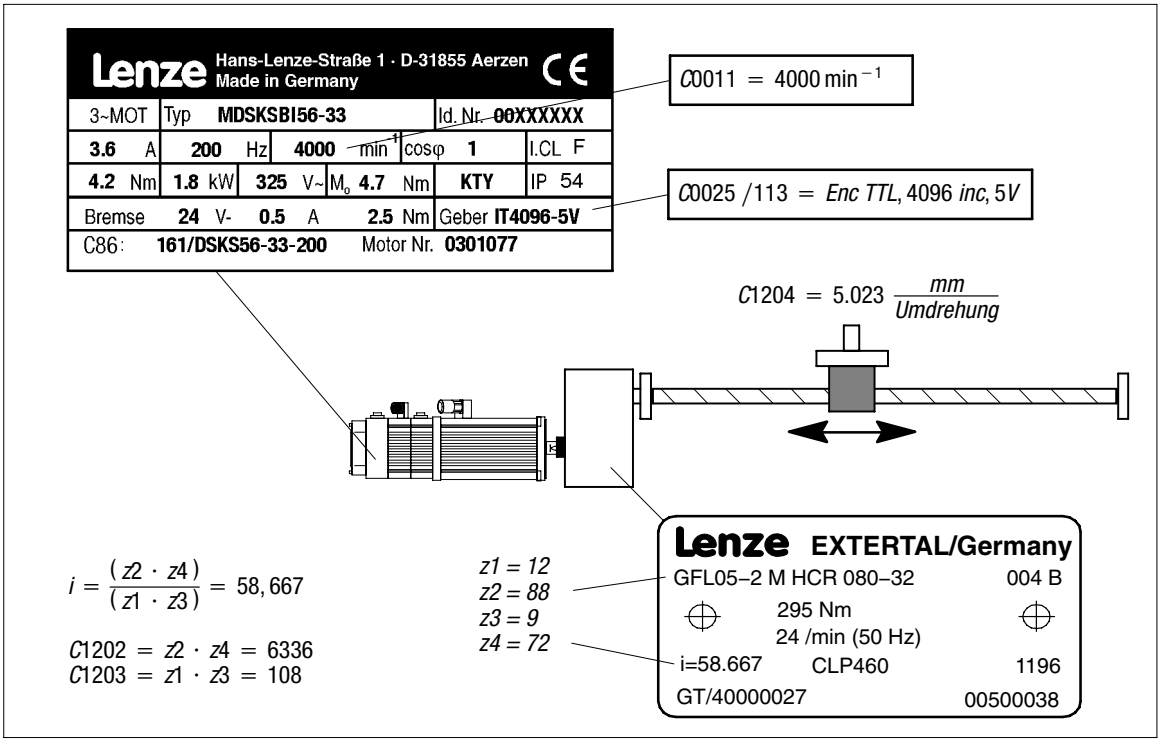
$$v_{max} \leq n_{max} \cdot \frac{v_k}{60 \cdot i}$$

$$C1240 \leq C0011 \cdot \frac{C1204 \cdot C1203}{60 \cdot C1202}$$

- Entry of the maximum acceleration (a_{max}) under C1250.
  The maximum acceleration is considered as the reference for all acceleration data given in per cent in the VTACC variable table.

Application example

For positioning a spindle feeding unit is driven via a gearbox. Instead of the standard resolver an incremental encoder is used as feedback system. The incremental encoder is mounted to the motor and has a number of increments of 4096 pulses / rev.. The gearbox has a ratio of i = 32 ($n_{motor}/n_{spindle}$). The spindle has a lead of h = 10 mm. The entries are to be made in mm (1 mm = 1 unit).



Settings:

Code	Designation	Entry	Notes
C0025	Encoder system selection	-113-	Incremental encoder, IT-4096-5V
C0420	Encoder constant X8	4096 incr	(automatically through C0025)
C0490	Position feedback system	-1-	(TTL encoder) (automatically through C0025)
C0495	Speed feedback system	-1-	(TTL encoder) (automatically through C0025)
C1202	Gearbox numerator	6336	Numerator corresponds to motor speed
C1203	Gearbox denominator	108	Denominator corresponds to gearbox output speed
C1204	Feed constant	5.023 units/rev	mm per rev. at gearbox output
C1207/1	Position encoder gearbox factor, numerator	1	(1/1 = no gearbox between encoder and motor) Numerator corresponds to motor speed
C1207/2	Position encoder gearbox factor, denominator	1	(1/1 = no gearbox between encoder and motor) Denominator corresponds to encoder speed

3.4.2.1 Position encoder at material path

Purpose

The gearbox backlash and, if applicable, the slip between the drive, machine, and material path should be eliminated to increase the accuracy of the calculation of an act. position value.

Function

- The position feedback is ensured by a separate position encoder (C0490) at the material path.
- The speed is fed back through an encoder mounted to the motor shaft (C0495).

Tip!

For defining the dimension of a unit (e.g. mm, cm), machine parameters are entered as if the position encoder was mounted to the motor shaft.

- There is a ratio between the position encoder and the motor. This ratio is adjusted via the ”encoder/gearbox factor” (C1207/1, C1207/2). Nominator and denominator are entered according to the speed ratio between the motor and position encoder.

$$\frac{C1207/1}{C1207/2} = \frac{n_{motor}}{n_{encoder}}$$

- The counting direction of the actual position value (GDC monitor, C1220/3) must increase with clockwise rotation of the motor.
  Condition: C1206 = 0 (position setpoint not inverted).

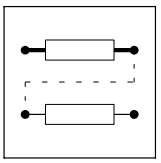
If this is not the case, the counting direction of the position encoder can be inverted as follows:

1. Exchanging the encoder tracks
2. Exchanging the polarity of the actual position (C1208)

Stop!

An opposing setting of the counting directions of the position setpoint and the actual position leads to a positive feedback in the control loop with the consequence that the drive may overspeed.

- For software version ≤ V2.1:
  - Inverting the counting direction via the actual value polarity (C1208) is not considered while executing the QSP function.This could lead to a positive feedback in the position control loop when the QSP or FAIL-QSP function is activated. The drive could accelerate to its speed limit n_{max} in an uncontrolled way (overspeed)!
  - Therefore the position controller must be switched off during the update of the QSP function (MCTRL-QSP-OUT = HIGH). In the case of QSP it is not enough to only switch the input MCTRL-PHI-ON = LOW. The analog input MCTRL-P-ADAPT = 0% must be switched e.g. by means of the function block ASW via MCTRL-QSP-OUT.
- For software version > V2.1:
  With QSP only the motor encoder is evaluated automatically to stop the motor.



Stop!

Increasing the ratio between the position encoder and the motor shaft reduces the position resolution information. This can have a negative effect on the stability of the control loop!

Example (refers to the previous safety information):
In the case of a quadruple evaluation of a position encoder with 1024 increments 4096 increments are available. Angle of rotation of the motor shaft per encoder increment:

$$\frac{360°}{4096\ incr} = 0.0879° = 0°\ 5.3'$$ (5.3 *phase minutes*)

Ratio of the position encoder e.g. i = 128:

$$0.0879° \times 128 = 11.25° = 11°\ 15'$$ (11 ° and 15 *phase minutes*)

The motor should rotate by 11° to compensate an offset of one increment. A further increase of the ratio would raise the ”compensating path” of the motor.

Permanent slipping of a friction wheel running on the material web (= drive of the position encoder) results in a faulty actual position value. A web break could accelerate the drive to high speeds due to the missing actual position value.

Example:
The spindle drive mentioned in the previous example is driven with a separate position encoder connected to the spindle (gearbox output side).

Settings as described under machine parameters but:

C1206	Polarity of position setpoint	-0-: Not inverse -1-: Inverse	Reversal of traversing direction
C1207/1	Position encoder gearbox factor, numerator	32	Numerator corresponds to motor speed
C1207/2	Position encoder gearbox factor, denominator	1	Denominator corresponds to encoder speed
C1208	Polarity - actual position	-0-: Not inverse -1-: Inverse	If “inverse” is selected, observe the QSP function notes.

3.4.3 Positioning modes (C1210)

You can select the following positioning modes under C1210:

- Relative positioning (📖 3-30)
- Absolute positioning (📖 3-32)
- Absolute positioning with saving (📖 3-33)

3.4.3.1 Relative positioning

Purpose

- Use with infinite applications, e.g. a cutter.

Function

- Set positioning mode (C1210) = 1.
- Absolute target positions cannot be approached. A fault is indicated (P07).
- The setpoint positions and actual positions are reset prior to a new positioning.
  - The current following error is maintained (POS-SETPOS = 0, POS-ACTPOS = current following error).
- The position limit values (C1223, C1224) determine the maximum feed length in the corresponding direction.

Tip!

If you do not need the travel range limit switch remove the connection to the digital input terminals (DIGIN) or switch to +24 V.

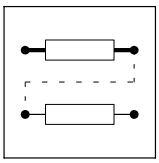
- Homing is not necessary, but can be used to set the machine to a defined position.

Rounding error

Without special measures for the mechanical design the path covered of a defined target position may amount to a fractional number of increments (e. g. 1554.4 inc.). The internal calculation merely considers the integer part of this value (= 1554 inc.).

For a relative positioning, the momentary target position of which always refers to the previous target position, rounding errors are propagated with each distance traversed.

This effect can lead to a drifting of the holding position of a conveyor. Therefore it must be observed that all required target positions can be displayed without decimal position of an increment (see position resolution).



Position resolution

- Display via code C1205.
  Display of the number of increments with which the units defined by the user are resolved (incr/unit).
- The position resolution can be used to check for rounding errors.

Calculation example:

C1301/1 = 100.2550 units (position value in VTPOS)

C1205 = 80.0000 inc/unit (position resolution)

Formula:

$$\text{Feed} = \text{C1301[units]} \cdot \text{C1205[inc/unit]}$$

$$8020,4\ \text{inc} = 100,2550\ \text{units} * 80,0000\ \text{inc/unit}$$

A difference of 0.4 inc results from every feed.

Tip!

If it is not possible to have increments without decimal positions, drifting of the holding position can be avoided by touch-probe positioning.

3.4.3.2 Absolute positioning

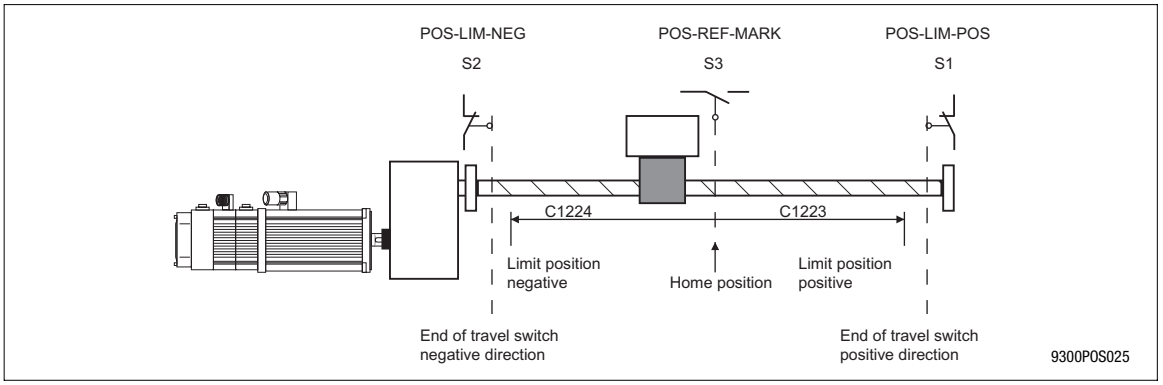


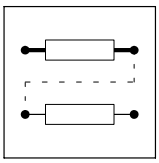
Fig. 3-10 Example of a machine with finite traversing range

Purpose

- Use in applications with finite traversing range, e. g. in warehousing or handling machines.

Function

- Set positioning mode (C1210) = 0 (default setting)
- Before starting a positioning drive homing must be carried out (output POS-REF-OK = 1, homing status C1284 = “REF-OK”). By homing the reference point of the measuring system to the machine is determined (📖 3-46)
- In the absolute positioning mode absolute and relative target positions can be approached. There are two measuring systems (📖 3-34):
  – the machine measuring system and
  – the real measuring system
- The travel range limit switches are located in front of the mechanical stops. They prevent the drive from touching the stops.
- Adjustable position limiting values (C1223, C1224) prevent the travel range limit switches from being approached under normal operating conditions. A target position located outside the position limiting value is not approached. In this case a fault is indicated (P04, P05).



3.4.3.3 Absolute positioning with saving

Purpose

Homing is not necessary after mains switching.

Function

- Resolver or absolute value encoder (single-turn) to X8 is required as position feedback system.
- Set positioning mode (C1210) = 2 (absolute positioning with saving).
- The actual position value (POS-ACTPOS) is automatically stored when the mains is switched off and reinitialised when the mains is switched on. In the OFF state the motor may rotate with a deviation of max. ±0,5 revolutions so that the actual position value is correctly initialised after switching on the mains.

All other function are identical with absolute positioning in chapter 3.4.3.2.

Homing status ”Homing known”

For absolute positioning the correct machine reference is required (”Homing known”)! Output POS-REF-OK = 1 and homing status C1284 = “REF-OK” .

During commissioning or after homing loss (📖 3-46) the drive must be referenced once. According to the requirements of the application homing can be carried out by “homing function”, “home setting” or the function “POS-ABS-SET”.

- With firmware version ≥V2.5:
  - The current homing status is stored at mains switch-off and is initialised correspondingly when the mains is switched on again.
    At the first commissioning the homing status is not set.
- With firmware version < V2.5:
  - Homing status “Homing known” is automatically set when the mains is switched on.

Tip!

Although POS-REF-OK = 1 is displayed the drive must be set once during commissioning or after a homing loss. This serves to re-establish the correct reference to the machine.

3.4.4 Measuring systems

Purpose

- Limitation of the traversing and determination of reference points for positioning.

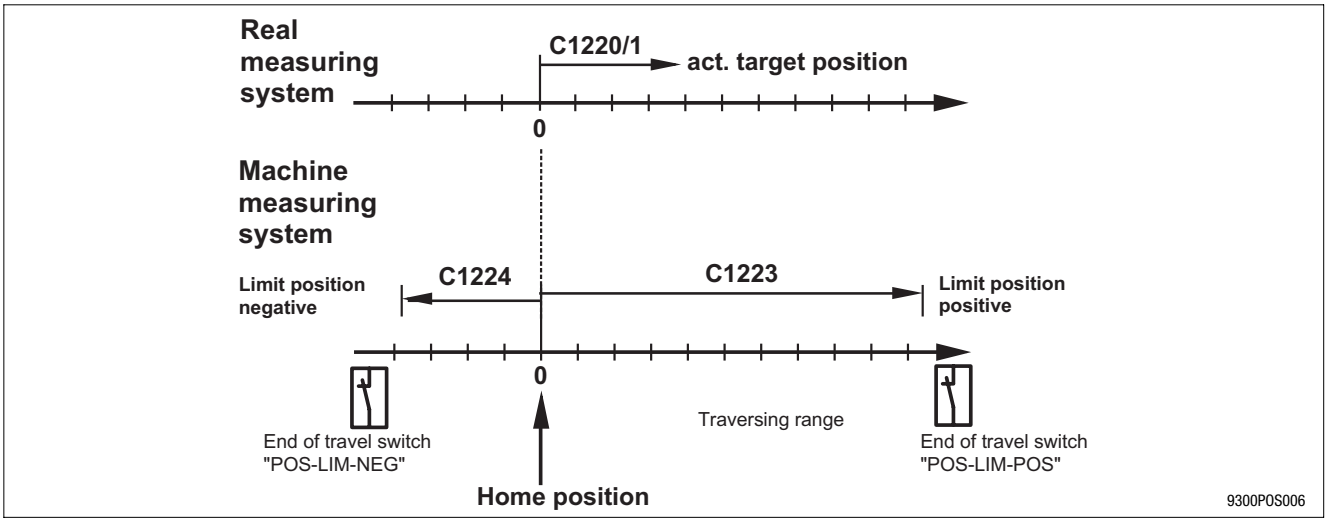


Fig. 3-11 Measuring systems for absolute positioning in default setting (C1225=0, C1227=0)

In default setting the reference point = machine zero = real zero (📖 3-34).

Reference point

- The reference point is the reference for the “connection” of the measuring systems with the machine.
- Is detected through “referencing”.

Machine measuring system

- The permissible travelling range for the machine measuring system is determined through the position limit values (C1223 and C1224).
- The machine measuring system has a fixed reference to the machine because of the reference point.
- The reference point is detected by a “reference run” or “setting reference” and, usually, not shifted later. (📖 3-46).

Real measuring system

- All indications (e.g.: target positions, position setpoint, and actual position) refer to the real zero of the real measuring system.
- The real measuring system can be shifted by entering a reference measuring offset.

3.4.4.1 Measuring systems and zero shifts

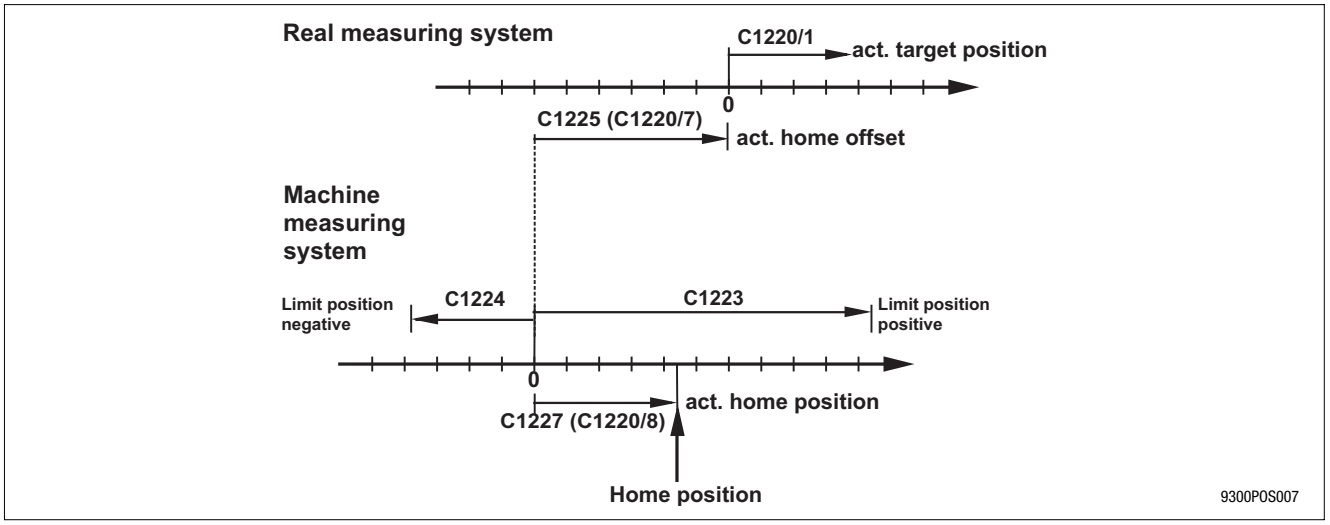


Fig. 3-12 Measuring systems for absolute positioning and zero point shifting

Shifting of machine zero

Purpose

- The reference run is to be carried out on one side of the traversing range when it is too time consuming to approach the machine zero.

Function

- Via the home position (C1227) the machine zero point is shifted with regard to the reference point. The home position is set at the reference point so that with a positive home position the machine zero point is situated in negative direction.
- The home position (C1227) will only be accepted as “actual home position” when being in “reference run” or “set reference point” mode.
- The effective “actual home position” is indicated under C1220/8 and C1221/8.

Shifting of real zero

Purpose

- The target positions must always refer e.g. to the front edge of the workpiece. This means the real measuring system must be shifted accordingly.

Function

- By means of the reference offset (C1225) the real zero point can be shifted with regard to the machine zero point. The input of a positive value results in a shift of the real zero point in positive direction.
- The reference measure offset takes directly effect with the input. The position setpoint (POS-SETPOS) and the actual position value (POS-ACTPOS) change in accordance with the change of the reference offset because of the change of its reference point (real zero point).
- The effective “actual reference offset” is indicated under C1220/7 and C1221/7.

Tip!

The input value C1225 and the actual reference offset can only be different when using the program function ”set position value”.

3.4.4.2 Measuring systems for absolute value encoders

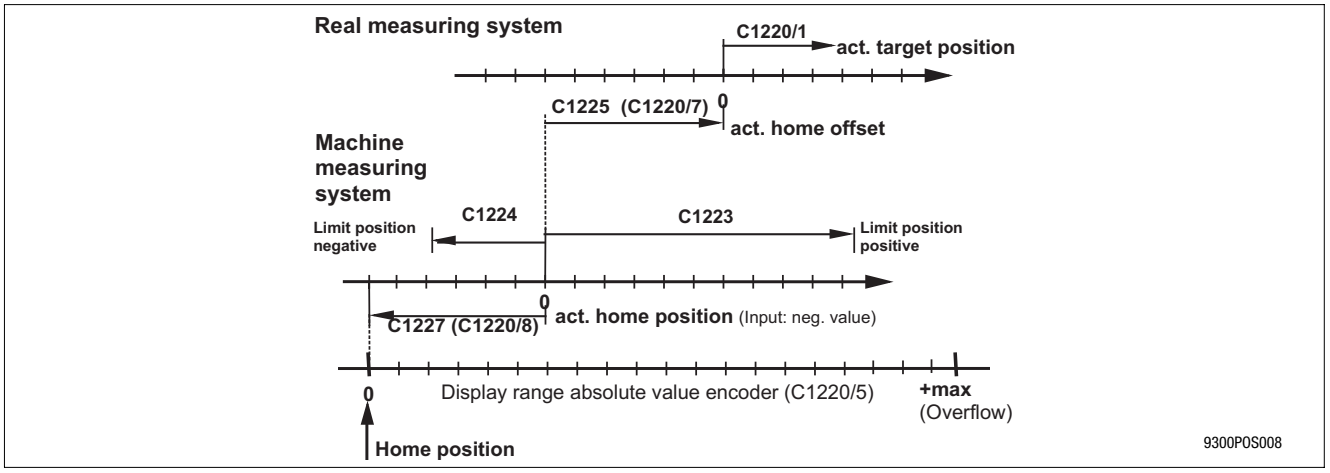


Fig. 3-13 Measuring systems with absolute value encoders

For absolute value encoders the same conditions than for positioning apply (see above) concerning the measuring systems and their references.The only difference is the definition of the reference point.

Encoder zero is defined as reference point.

- Actual home position
  - Use “actual home position” to move the machine zero further into the traversing range (negative value moves the machine zero in positive direction).
  - The “actual home position” is indicated under C1220/8 in “units” and C1221/8 in “incr”.
- Initialisation
  - After switch-on the ”actual home position” is initialised with the ”home position”.
  - “Actual home offset” (C1220/7, C1221/7) is set equal to the input value “home offset” (C1225).
- During operation
  - After changing, C1227 is not directly transferred to the ”actual home position”. During program operation, the transfer can be initialised via the function ”Acceptance home position (C1227)” (setting under PS mode (C1311) = 16).
- Set homing value
  - The program function ”set reference” enables the machine zero point to be set at the current position. Therefore the ”actual home position” is set to the negative value of the actual position value (POS-ACTPOS).
  - Transfer the value manually under C1220/8 to C1227 and save it under C0003 to ensure that the setting is available after mains switching.
  - The “actual reference offset” (C1220/7) is set equal to the input value “reference offset” (C1225) when setting the home position.

3.4.5 Absolute value encoder

Purpose

The absolute actual position value should be known immediately after mains switching so that homing is not necessary (for instance if homing is not possible because of machining or processing circumstances).

- The following functions **cannot** be executed for positioning with absolute value encoder:
  - Homing in program operation,
  - manual homing
  - Program function “set position value” (PS mode C1311 = 5).

Tip!

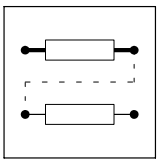
Homing (to determine the machine zero) can be simulated when using touch probe positioning and the home position setting function.

3.4.5.1 Absolute value encoder via encoder connection X8

Function

- Connection of sine/cosine absolute value encoders with hyperface communication interfaces to encoder input X8. Absolute value encoders with a number of increments of 512 periods/rev and the corresponding data format of the initialisation value of 2^{14} inc/rev can be used (e. g. Stegmann SCS70, SCS60).
- The following absolute value encoders can be used as of the device version 33.93xx.EP.2x.**62**:

Number of increments [Periods/rev]	**Data format** [inc/rev]	**Tenderer**	**Type designation**
2048	2^{16}	–	–
1024	2^{15}	Stegmann	SRM50, SRS50
512	2^{14}	Stegmann	SCM70, SCM60
256	2^{13}	–	–
128	2^{12}	Stegmann	SKS36
64	2^{11}	–	–



Installation

The absolute value encoder must be mechanically mounted so that the encoder zero point is outside the travel range. Otherwise a value overflow would occur in the encoder within the travel range. This would result in a wrong actual position value after mains switching.

Commissioning

Observe the commissioning sequence to avoid a reset of C0420 to default setting.

1. Select the connected absolute value encoder under C0025 or C0495.
   – After the selection the fault SD7 is indicated since the encoder has not yet been initialised. The initialisation only takes place by mains switching. (see step 5.).
2. Enter the number of increments of the absolute value encoder under C0420.
   – By entering the number of increments the data format is automatically considered during initialisation. The data format determines the resolution to be reached of the initialised absolute value.
3. Carry out a fine adjustment under C1227 (home position).
   – By entering a negative value (see Fig. 3-13) the machine zero point is shifted into the traversing range by means of the home position to enable the input of reasonable position limit values and monitoring of the traversing range. (📖 3-37)
4. Save the settings under C0003.
5. Switch of the mains voltage off and on again.
   – The absolute value encoder is initialised. The fault indication SD7 is reset.

Tip!

- Absolute value encoders have a finite area, e. g. 4096 revolutions. Within this area they can also be moved in a switch-off state; nevertheless they are able to deliver the correct absolute actual position value after switching on the mains.
- The overflow point of the encoder amounts to 65536 inc/rev × 4096 rev = 268.435.456 inc. (display: C1221/5)
  – When the area to be described is exceeded the fault P12 is indicated.

3.4.5.2 Absolute value encoder via system bus (CAN)

Purpose

- Using absolute value encoders with CAN interface (e. g. laser measuring system).

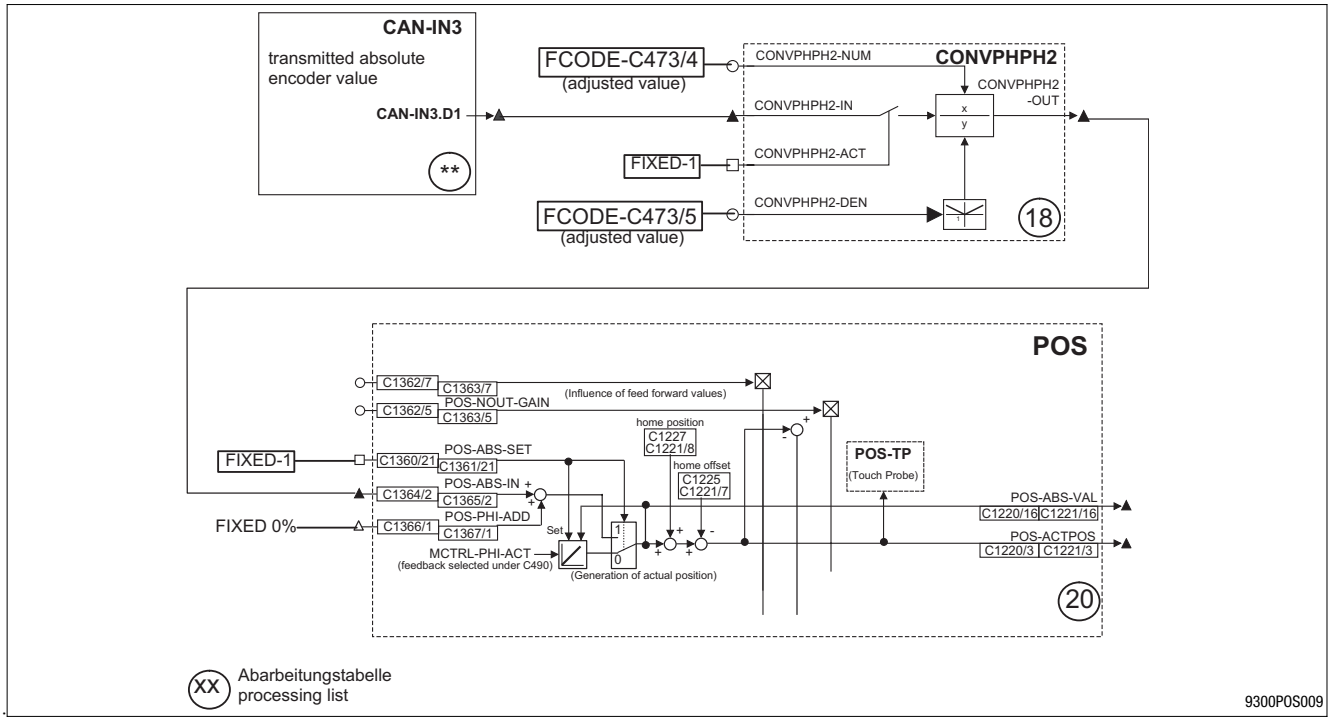


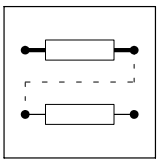
Fig. 3-14 Absolute value encoder via system bus (CAN)

Function

- All absolute value encoders with a CAN interface to specification “CAL DS-301” (CAN open) can be used.
- The CAN parameters, especially CAN baud rate, CAN identifier, and cycle time are to be set accordingly. The set CAN parameters must be storable in the encoder!
- The absolute value read via, for instance, CAN-IN3.D1 is sent to the input “POS-ABS-IN”.
- Input “POS-ABS-SET” is assigned to 1 signal (e.g.: FIXED1) and thus the acceptance of the absolute value at input POS-ABS-IN is activated.
- POS-ABS-SET = HIGH sets the homing status “REF-OK” automatically, homing is therefore not necessary.
- The encoder resolution is adapted to the internal position resolution of 65536 inc/rev via the function block CONVPHPH2. The adaptation factor is entered via the free codes C473/4 and C473/5.

Tip!

The input POS-PHI-ADD and the output POS-ABS-VAL are available as of firmware version ≥ 2.5



Example for the adaptation of the encoder resolution:

Gearbox between encoder and drive	i = 30
Effective wheel diameter	d = 50 mm
Position resolution of the measuring system	A_{meas} = 8 inc/mm
Internal position resolution (fix)	$A_{internal}$ = 65536 inc/rev

Position resolution of the measuring system (with regard to motor side):

$$Ax_{mess} = \frac{(A_{mess} \cdot d \cdot \pi)}{i} = \frac{(8\ inc/mm \cdot 50\ mm \cdot 3,14)}{30}$$

$$Ax_{mess} = 41,87\ inc/rev$$

Adaptation factor for CONVPHPH2:

$$\frac{C0473/4}{C0473/5} = \frac{A_{intern}}{Ax_{mess}} = \frac{65536 inc/rev}{41,87 inc/rev}$$

$$\frac{C0473/4}{C0473/5} = \frac{1565}{1}$$

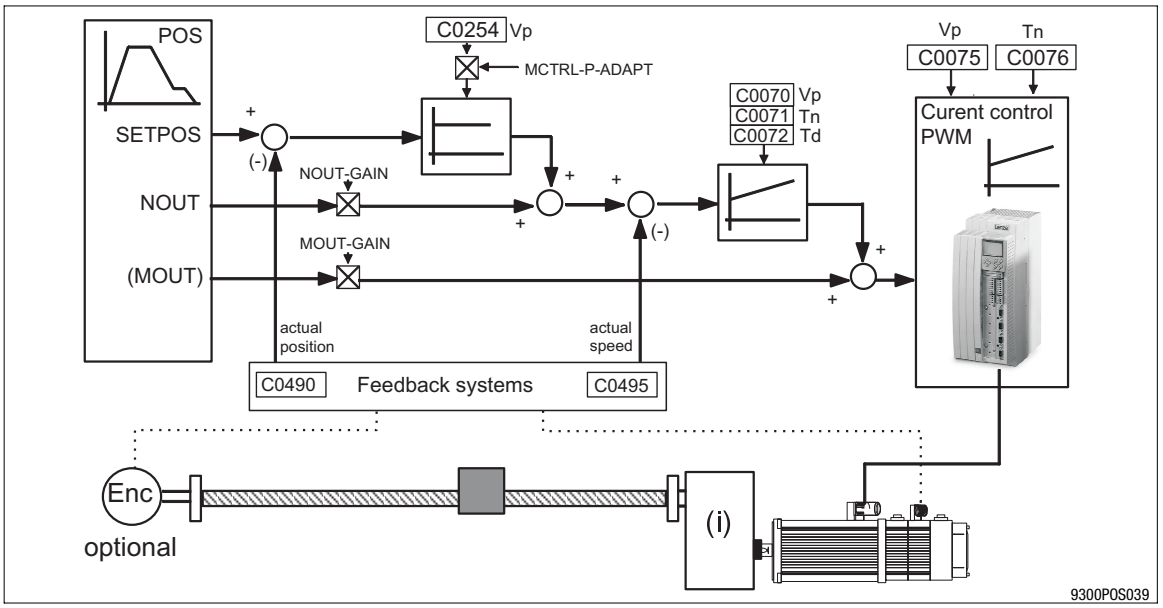
- Read the absolute value at POS-ABS-IN under consideration of the setpoint polarity (C1206) and the actual value polarity (C1208).
- The “actual home position” (C1220/8) is then added and the “actual home offset” (C1220/7) is subtracted.
- The “actual home position” is set equal to C1227 if POS-ABS-SET = HIGH during initialisation (switch on).

Tip!

The display values under C1220/5 and C1221/5 only correspond to the absolute value of the encoder read when using the absolute value encoder through X8!

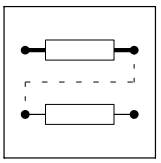
3.4.6 Control structure

The following graphic representation provides an overview of the control structure realised in the 9300 servo position controller. It shows the parameters and codes that are decisive for the adjustment of the control loops.



Adjustment points of the control loops

- Speed controller (PID controller)
  - C0070: Gain Vp_n
  - C0071: Integral-action time Tn_n
  - C0072: Rate time Td_n (default setting Td_n = 0 is usually not changed)
  - POS-NOUT-GAIN: Speed feedforward control (default setting: 100%)
- Position controller (P controller)
  - C0254: Gain Vp position controller
  - MCTRL-P-ADAPT for adapting the gain depending on e.g. the speed
- Current controller (PI controller)
  - C0075: Vp (default setting is usually not changed)
  - C0076: Tn (default setting is usually not changed)



Important signals for adjusting the control loops

The following signals are especially suitable for evaluating the positioning behaviour and control features:

- POS-NOUT: Speed setpoint, 100 % ≡ n_{max} (C0011)
- MCTRL-NACT: Actual speed value, 100 % ≡ n_{max} (C0011)
- MCTRL-MSET2: Actual torque, 100 % ≡ M_{max} (C0057)
- POS-POUT-NORM: Actual following error, 100 % ≡ Following error tolerance (C1218/1)

Tip!

The code table can be found in the system manual, document number EDSVS9332P.

3.4.7 Travel range limits

You can prevent the mechanical stops of the limited travel range from being touched by

- the travel range limit switches (hardware),
- the position limiting values (software).

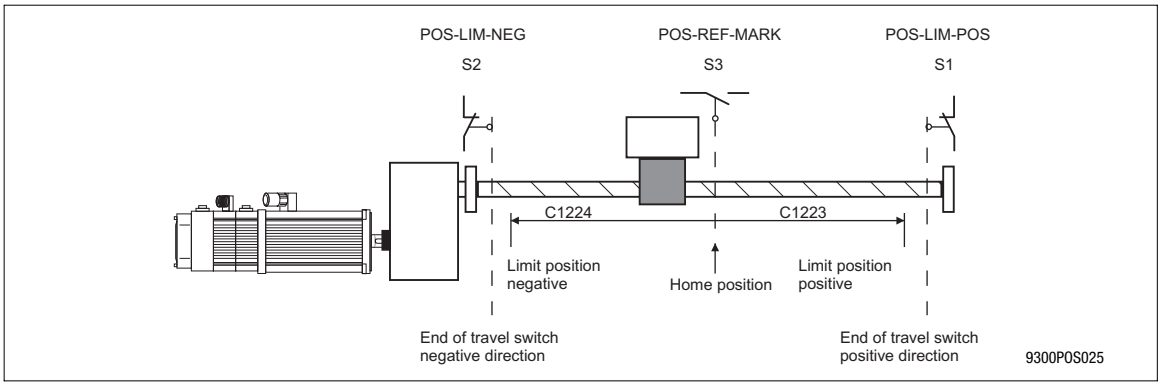


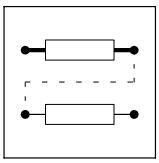
Fig. 3-15 Example of travel range limits

3.4.7.1 End of travel range limit switch

- The travel range limit switches are connected via the digital input terminals X5/E1 and X5/E2.
- In the default setting, X5/E1 and X5/E2 are configured for the function block inputs POS-LIM-POS and POS-LIM-NEG and are LOW active (protected against open circuit).
- A travel range limit switch indicates the fault P01 or P02 under the following circumstances:
  - In program operation if the speed setpoint (POS-NOUT) is unequal 0.
  - In manual operation if the drive moves outside the traversing range.
  - During homing, if the drive does not reverse when reaching the limit switch.
- In the event of a failure the drive brakes to standstill using the function “FAIL-QSP” (default setting); the ramp time “QSP-Tif” can be adjusted under C0105.

Tip!

The travel range limit switches should be mounted in positions that provide enough braking distance for the drive in the event of a failure.



3.4.7.2 Position limit values (C1223, C1224)

- Position limit values (C1223, C1224) define the permissible traversing range of the drive.
- The reference point for the position limiting values always is the machine zero point. Shifting the real zero point does not result in a shift of the position limiting value with the regard to the mechanical travel range limits. (📖 3-34).
- Exceeding the limit positions causes a fault (P04, P05).
- In the event of a failure the drive brakes to standstill using the function “FAIL-QSP” (default setting); the ramp time “QSP-Tif” can be adjusted under C0105.

Code	Name	Limits	Note
C1223	Pos.limit+	0.0000 ... 214000.0000 [units]	Positive position limiting value
C1224	Pos.limit-	-214000.0000 ... 0.0000 [units]	Negative positive limiting value

Tip!

- The settings should not allow that the end of travel limit switches are reached during operation.
- The max. traversing range amounts to ±16000 revolutions of position encoder.
- If the position limiting values exceed the internal area, the warning P18 (internal limitation) is triggered. The limiting values are internally automatically limited to the possible area. Positioning can only take place within these limits.
- The input values under C1223 and C1224 remain the same and need to be modified by the user (if necessary).
- Display of internally limited position limiting values under C1220/10 and C1220/11 [units] and under C1221/10 and C1221/11 [incr.].

3.4.8 Homing

Determination of the mechanical reference point for measuring systems.

After homing, the drive is in a defined position.

Functions

- Homing (📖 3-46)
- Homing end (📖 3-47)
- Homing status (📖 3-48)
- Homing modes (📖 3-49)ff.
- Second homing speed (📖 3-56)
- Set homing value(📖 3-57)

3.4.8.1 Homing

Purpose

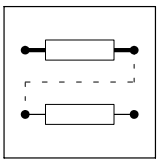
Definition of the reference point in the absolute or relative positioning mode.

Function

- Selection of a sequence suitable for homing (📖 3-49).
- Setting of the homing speed under C1242
  – Setting of a second homing speed under C1241 (if necessary) (📖 3-56)
- Setting of the homing acceleration under C1251
- Definition of the final homing point under C1209.
- Execution of homing in
  – Manual operation via ”manual referencing” (📖 3-67).
  – Program operation (GDC dialog ”Programming” under “PS mode” or selection under C1311/x = 3, program set mode)

Homing procedure

- The homing status POS-REF-OK is reset (see (📖 3-48)) and the current reference offset initialised using the value entered under C1225.
- Homing is started and carried out according to the mode selected under C1213.
- If the reference point is found, the home position (C1227) is set and the reference offset (C1225) is added. The position data now refer to the real zero point (see Fig. 3-12).
- The homing status POS-REF-OK is set.



3.4.8.2 Final homing point

Purpose

- Determination of the final point where the drive stops after homing.
- Avoid reversing while homing

Selection of the final homing point (C1209)

- C1209 = 0 (default setting):
  Drive stops at **reference point** (index pulse / zero position / touch probe) or returns to that point.
- C1209 = 1:
  Drive does not stop until it has reached the **real zero point**. The distance covered additionally is determined by the reference offset and the home position.
- C1209 = 61:
  Drive does not stop until it has reached the target position **VTPOS-NO-60** (parameter C1301/60). The distance covered additionally is determined by the reference offset, the home position, and the target position.
- C1209 = 71:
  Drive stops at target position **VTPOS-NO-70** (function block input). The distance covered additionally is determined by the reference offset, the home position and the target position.
- C1209 = 101:
  Drive stops at target position **VTPOS-NO-100** (teach-in value). The distance covered additionally is determined by the reference offset, the home position, and the target position.

Tip!

When the drive must not reverse during homing:

- Select real zero as final homing point (C1209) and
- Enter reference offset.

Like this, the braking distance after homing is always long enough.

3.4.8.3 Homing status (POS-REF-OK)

The homing status is indicated via the function block output “POS-REF-OK” and displayed under C1284.

The homing status is displayed as ”Reference known” when the measuring systems have a defined reference to the machine. Absolute positioning (📖 3-32) or (📖 3-33) is only possible after a defined reference has been created.

The output POS-REF-OK is set if

- homing is completed,
- the program function “Set reference” is set,
- the absolute value encoder is selected as position feedback (C0490 = 4).
- Set Fb input POS-ABS-SET = 1.
- C1210 = 2 (absolute positioning with saving)

The output POS-REF-OK is reset by

- Start of homing
- Writing to the following codes:
  - C0011 (Nmax)
  - C0490 (feedback system for the position controller)
    Note:
    Please take into consideration that codes C0490 and C0025 have an impact on each other.
    A subsequent change of one of the codes overwrites the other.
  - C1202 (Gearbox factor, numerator)
  - C1203 (Gearbox factor, denominator)
  - C1204 (Feed constant)
  - C1207/1(Position encoder gearbox factor, numerator)
  - C1207/2 (Position encoder gearbox factor, denominator)
  - C1210 (Positioning mode)
- The following errors occur:
  - NMAX (limit speed from C0596)
  - P12 (encoder limit exceeded)
  - SD2 (resolver error) if resolver has been selected as position feedback system (C0490=0), SD7 (absolute value encoder).
- In relative positioning mode (C1210=1) if Prg-reset is carried out during a running positioning process.

3.4.8.4 Homing modes 0 and 1

Purpose

- Simple homing in all positioning modes (C1210 = 0, 1, 2).
- The homing switch (POS-REF-MARK) must be in direction of the movement.

Move to reference point via homing switch

Mode 0: Traversing direction to positive end of travel range limit switch

Set C1213 = 0.

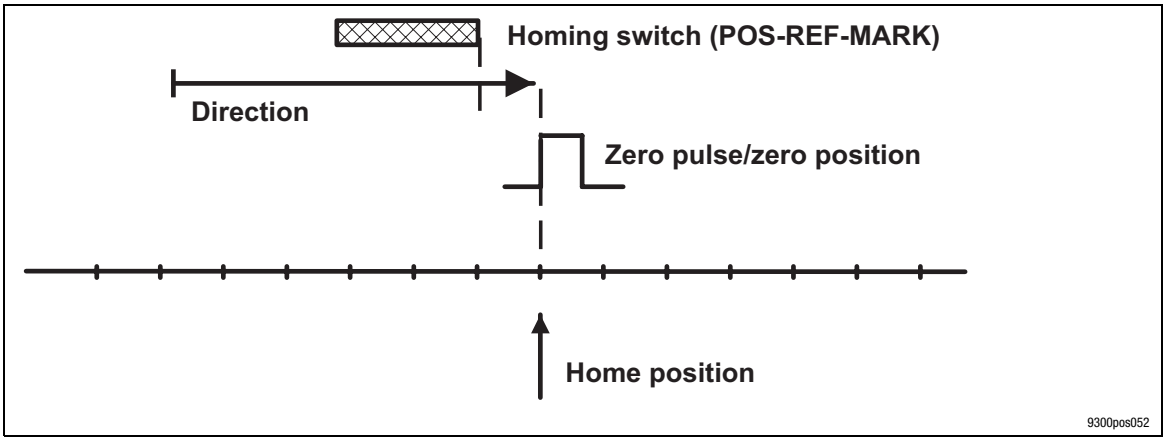


Fig. 3-16 Move to reference point via homing switch

Function sequence

- Move to the reference point with homing speed (C1242) towards positive end of travel range limit switch overtravelling the homing switch.
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.

The drive can be on the homing switch before homing.

Mode 1: Traversing direction to negative end of travel range limit switch

Set C1213 = 1.

Function sequence

- Like mode 0, but the drive traverses in negative direction to travel range limit switch.

3.4.8.5 Homing modes 2 and 3

Purpose

- Homing in absolute positioning mode (C1210 = 0, 2), with finite traversing range and existing travel range limit switches (POS-LIM-xxx).
- The homing switch (POS-REF-MARK) is always found. In the worst case the entire traversing range will be searched.

Approach end of travel range limit switch, reverse and move to reference point via homing switch

Mode 2: Traversing direction to positive end of travel range limit switch

Set C1213 = 2.

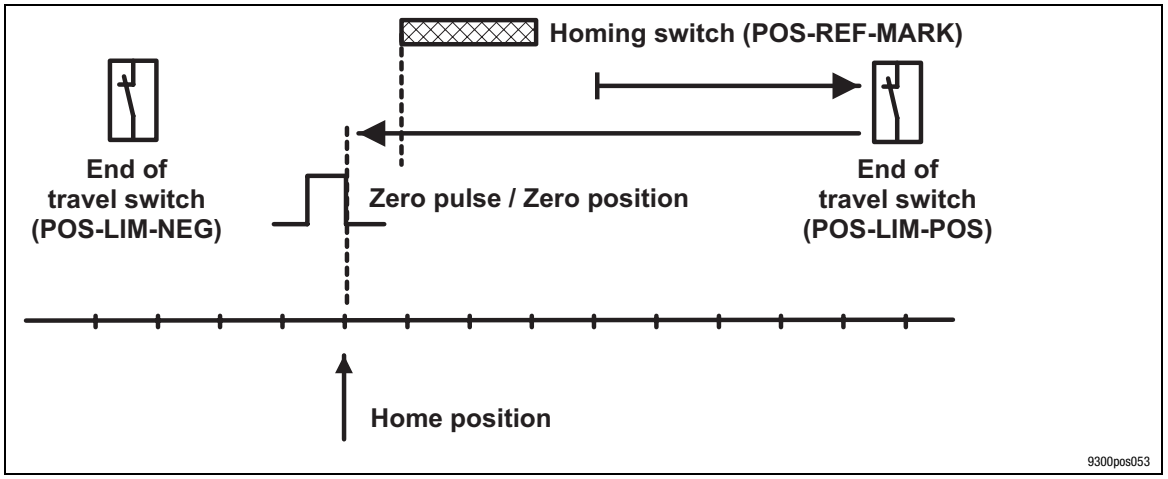
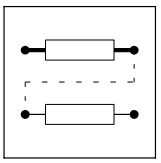


Fig. 3-17 Move to POS-LIM-POS, reverse, move to reference point via POS-REF-MARK

Function sequence

- Move to positive travel range limit switch with homing speed C1242.
- Reverse there and move beyond the reference switch to the reference point with homing speed C1242. In this case no fault (PO2) is indicated!
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.
- If the drive is already on the positive end of travel range limit switch before homing, it is reversed immediately.
- If the drive is positioned at the reference switch when homing is started, the switch will be overtravelled. The drive then goes on to the limit switch and reverses there.



Mode 3: Traversing direction to negative end of travel range limit switch

Set C1213 = 3.

Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.
- No fault indication (PO2)

Tip!

The limit switch (POS-LIM-xxx) can be used as homing switch (POS-REF-MARK) at the same time to save initiators.

3.4.8.6 Homing modes 4 and 5

Purpose

- Simple homing in all positioning modes (C1210 = 0, 1, 2).
- The homing switch (POS-REF-MARK) will not be overtravelled. Positions to the right of the homing switch cannot occur due to the mechanical design.
- The homing switch must be in direction of the movement.

Move to homing switch, reverse and move to reference point

Mode 4: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 4.

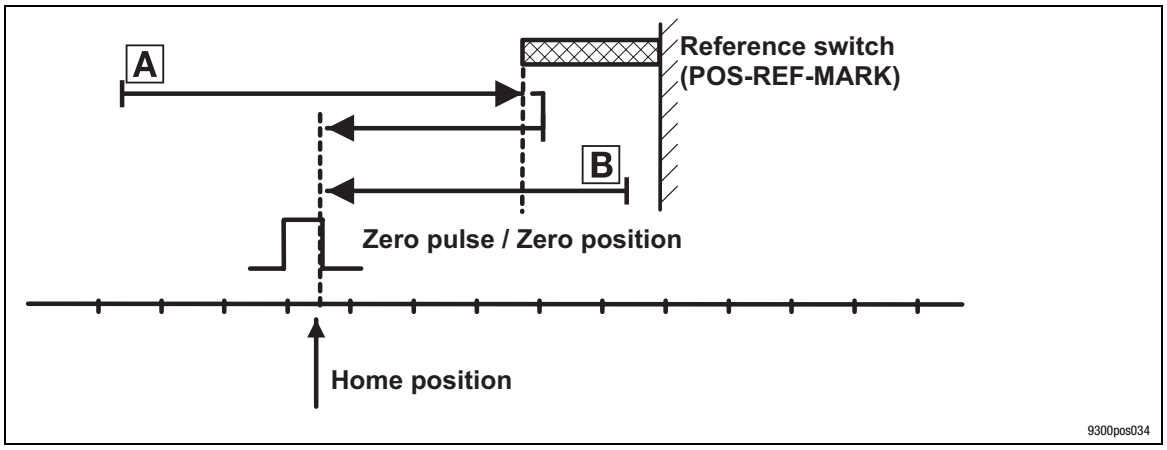


Fig. 3-18 Move to POS-REF-MARK, reverse and move to reference point

Function sequence

- Move towards travel range limit switch with homing speed C1242 up to homing switch (case A).
- Reverse there and move to the reference point. The homing switch must be assigned during the entire homing process!
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.
- If the drive is already positioned on the homing switch before homing it is reversed immediately (case B).

Mode 5: Traversing direction to negative end of travel range limit switch

Set C1213 = 5.

Function sequence

- Like mode 4, but the drive traverses in negative direction of travel range limit switch.

3.4.8.7 Homing modes 6 and 7

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor exchange.
- The homing switch (POS-REF-MARK) must be in direction of the movement.

Travelling to TP signal via homing switch

Mode 6: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 6.

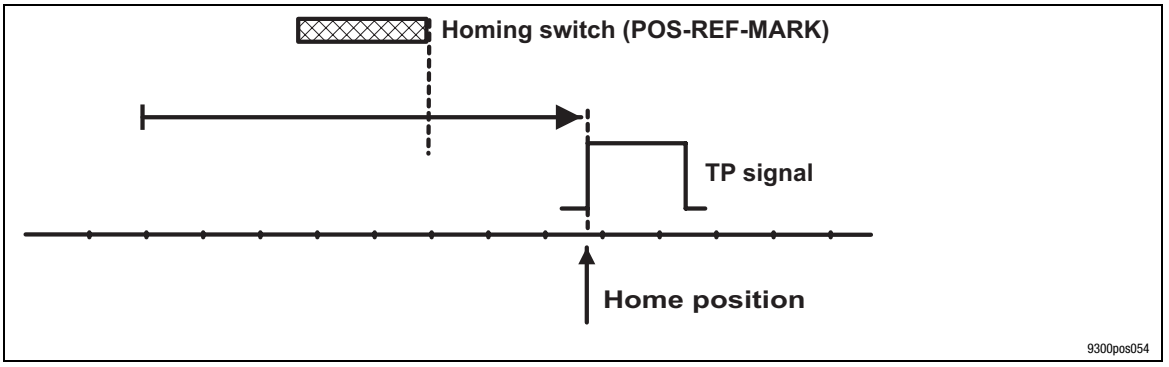


Fig. 3-19 Move to TP signal via POS-REF-MARK

The following settings are necessary:

- Select terminal for TP initiator via C1214.
  - C1214 = 1 ≙ terminal X5/E1.
  - C1214 = 2 ≙ terminal X5/E2.
  - C1214 = 3 ≙ terminal X5/E3.
  - C1214 = 4 ≙ terminal X5/E4 (This setting is recommended by LENZE).
- Select edge of the TP input via C1215.
  - C1215 = 0 ≙ LOW-HIGH edge.
  - C1215 = 1 ≙ HIGH-LOW edge.

Function sequence

- Move to the home position with homing speed (C1242) towards positive end of travel range limit switch overtravelling the homing switch.
- After leaving the homing switch the reference point is determined by the TP signal. TP signals that occurred before are ignored.
- The drive can be on the homing switch before homing.

Mode 7: Traversing direction to negative end of travel range limit switch

Set C1213 = 7.

Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.

3.4.8.8 Homing modes 8 and 9

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor replacement.
- The touch probe must be situated in direction of movement. The TP must not be assigned before starting homing.

Directly travel to TP signal

Mode 8: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 8.

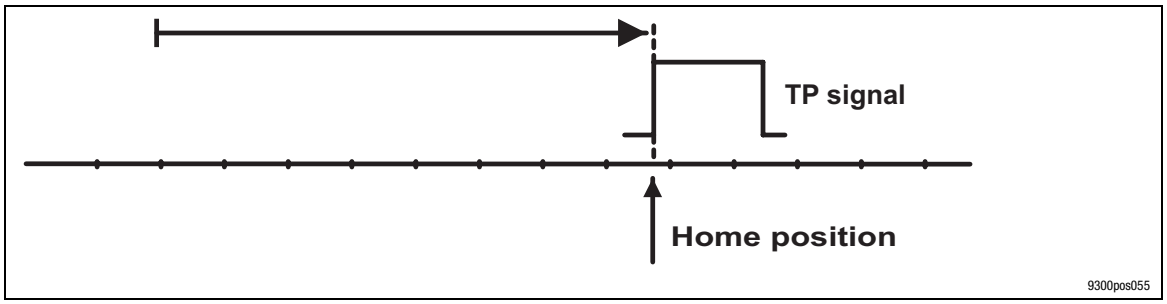


Fig. 3-20 Move to TP signal

The following settings are necessary:

- Select terminal for TP initiator via C1214.
  - C1214 = 1 ≙ terminal X5/E1.
  - C1214 = 2 ≙ terminal X5/E2.
  - C1214 = 3 ≙ terminal X5/E3.
  - C1214 = 4 ≙ terminal X5/E4 (This setting is recommended by LENZE).
- Select signal of the TP input via C1215/x.
  - C1215/x = 0 ≙ LOW-HIGH edge.
  - C1215/x = 1 ≙ HIGH-LOW edge.

Function sequence

- Move to the TP signal with homing speed (C1242) towards positive end of travel range limit switch.
- The first TP signal determines the reference point.

Mode 9: Traversing direction to negative end of travel range limit switch

Set C1213 = 9.

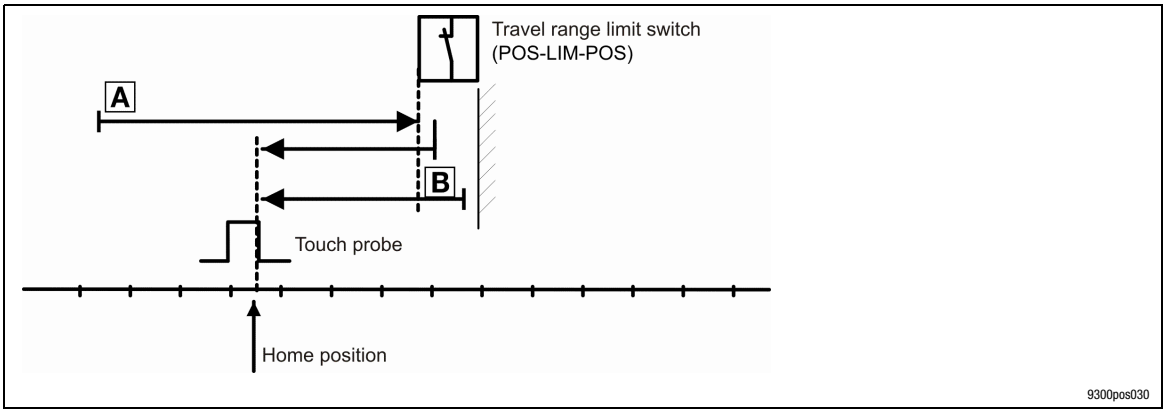
Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.

3.4.8.9 Homing modes 10 and 11

Purpose

- Homing in absolute positioning mode (C1210 = 0, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor replacement.



Mode 10: Traversing direction to positive POS-LIM-POS

Traverse in positive direction up to POS-LIM-POS, reverse there and reference to TP (case A). During reversing the limit switch must always be assigned!

- Move to positive end of travel range limit switch in positive direction with homing speed C1242.
- Reverse and move in negative direction to the reference point via touch probe with homing speed C1242 or C1241 (depending on the setting in C1216, see second homing speed).
- If the drive is positioned on the positive end of the travel range limit switch before homing, it directly travels in negative direction (case B).
- The reference point is at touch probe + home position C1227.

Monitoring P02 does not respond!

Mode 11: Traversing direction to negative POS-LIM-NEG

Travel in negative direction up to POS-LIM-NEG, reverse there and reference to TP. TP can also be the negative edge of POS-LIM-NEG.

Otherwise identical with mode 10

Tip!

In order to save initiators the limit switch (POS-LIM-xxx) can be simultaneously used as touch probe. The TP input is selected under C1214.

Since the limit switches are factory-set to LOW active, select the rising edge for TP (C1215/x = 0). After homing, the drive must not directly stop on the reference point, since this may result in a response of the travel range limit switches. The reference limit point must be set accordingly.

3.4.8.10 Second homing speed

Second homing speed

A second homing speed (C1241) can be activated by C1216.

Homing procedure with activated second homing speed:

Modes 0, 1:

To POS-REF-MARK at first speed, then at second speed.

Modes 2, 3:

At first speed to limit switch POS-LIM-POS (mode 2) or POS-LIM-NEG (mode 3), second speed after reversing.

Modes 4, 5:

To limit switch POS-REF-MARK at first speed, second speed after reversing.

Modes 6, 7:

To POS-REF-MARK at first speed, then at second speed.

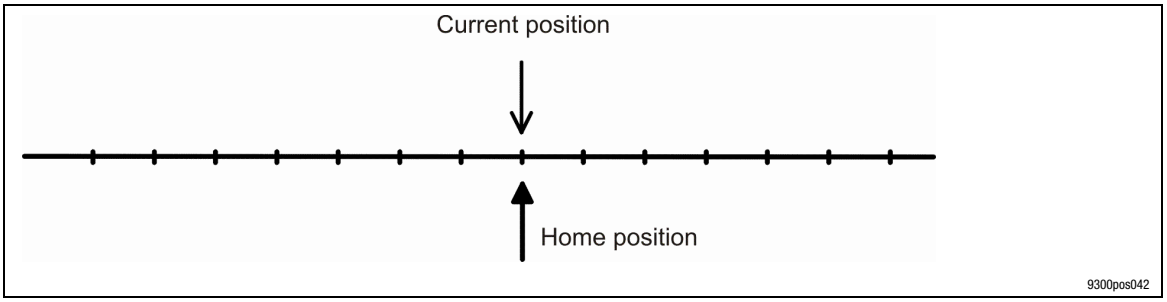
Modes 8, 9:

Only at first speed to reference point via TP.

Modes 10, 11:

To limit switch POS-LIM-POS or POS-LIM-NEG at first speed, second speed after reversing.

3.4.8.11 Set homing value



Purpose

If the home position is known (e.g. by a higher-level master system), homing is not necessary.

Function

- Select ”Set homing value” under ”PS mode” in the PS (C1311 = 4).
- In this case, the current position is the reference point.
- The zero points of the measuring systems are set accordingly (📖 3-34).

3.4.9 Travel profile generator and setpoints

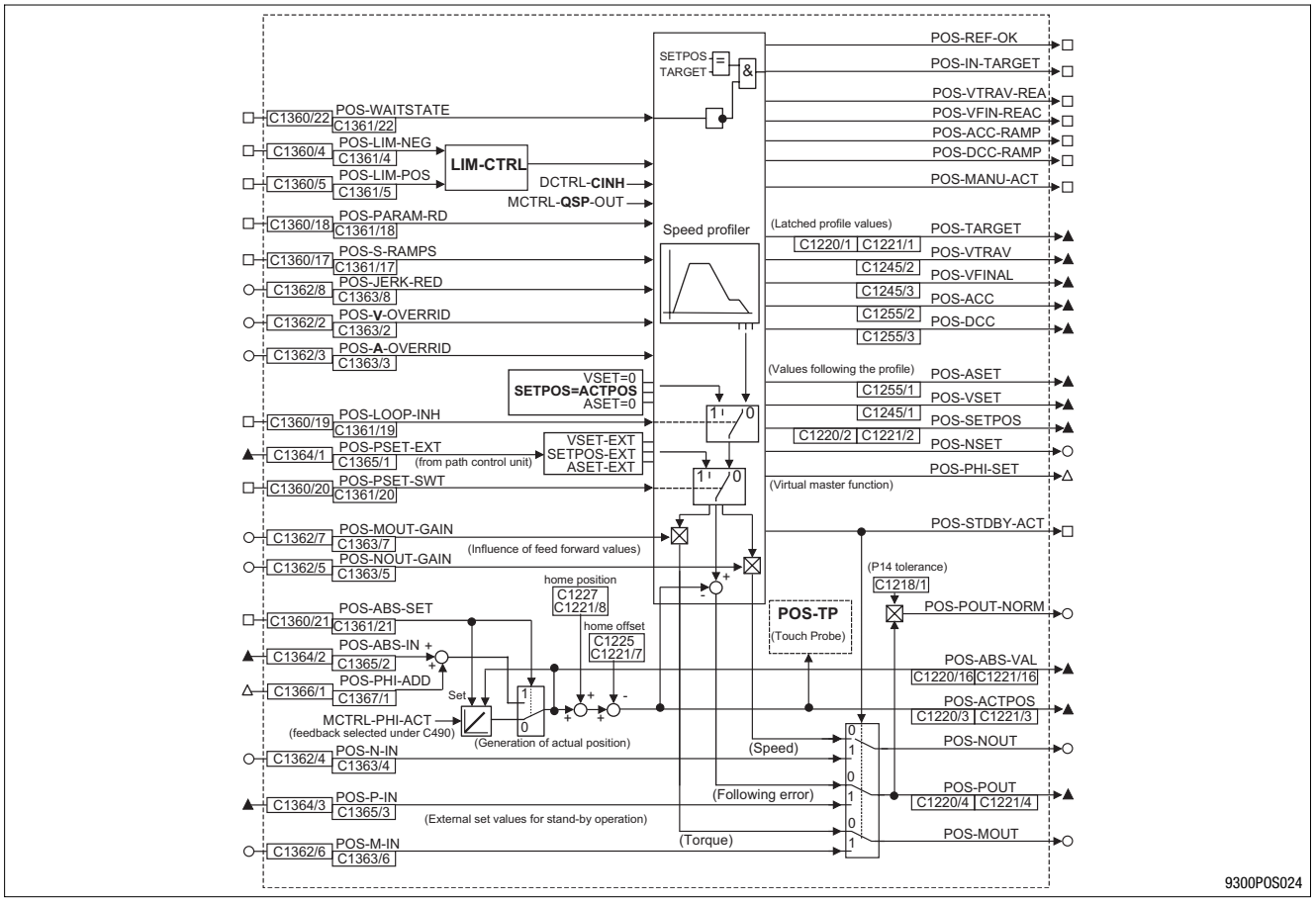


Fig. 3-21 Part of the POS function block

Purpose

- The travel profile generator of the POS function block generates a speed travel profile with the corresponding setpoints for:
  - position setpoint (POS-SETPOS),
  - speed feedforward control value and (POS-NOUT) and
  - torque precontrol value (POS-MOUT).
- The travel profile is generated with regard to the defined travel profile parameters:
  - target position (VTPOS),
  - traversing speed (VTVEL)
  - acceleration (VTACC)
  - deceleration (VTACC)
  - final speed (VTVEL).
- The travel profile parameters are always read by the profile generator at the beginning of a positioning process and remain unchanged for the entire positioning time. The override inputs (POS-V-OVERRID, POS-A-OVERRID) are taken into consideration during this process.
  The values given in the variable tables VTxxx can already be changed for the next positioning while the current positioning is still running.

- Traversing profile parameters can be changed via input POS-PARAM-RD even during a positioning process.

Stop!

For the ”Manual jog function with intermediate stop”, POS-PARAM-RD has to be set = LOW.

Function

- Linear ramps (L profile) (📖 3-59)
- S ramps (S profile) (📖 3-60)
- Override (POS-V-OVERRID, POS-A-OVERRID) (📖 3-62)
- New traversing profile parameters during positioning (POS-PARAM-RD) (📖 3-58)
- Influence of precontrol values (POS-NOUT-GAIN, POS-MOUT-GAIN) (📖 3-62)
- Target window (POS-WAITSTATE) (📖 3-64)
- Virtual master (POS-PHI-SET) (📖 3-65)

3.4.9.1 Linear ramps (L profile)

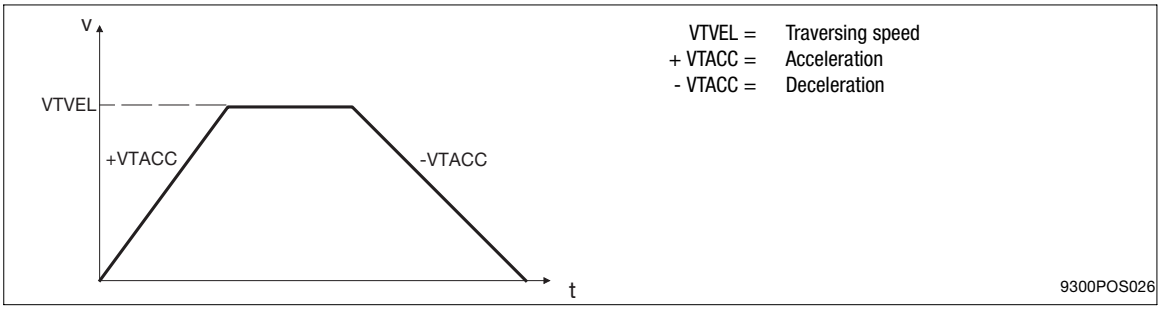


Fig. 3-22 Linear ramps (L profile)

- The profile generator works on an optimum time base using the L profile, i.e. the target position can be reached as quickly as possible with the acceleration and speed selected.
- The acceleration selected is effective immediately when the velocity is changed.
- Default setting: L profile.

3.4.9.2 S-shaped ramps (S profile)

Purpose

Protection from damage of the drive components by reducing the jerk during acceleration and deceleration.

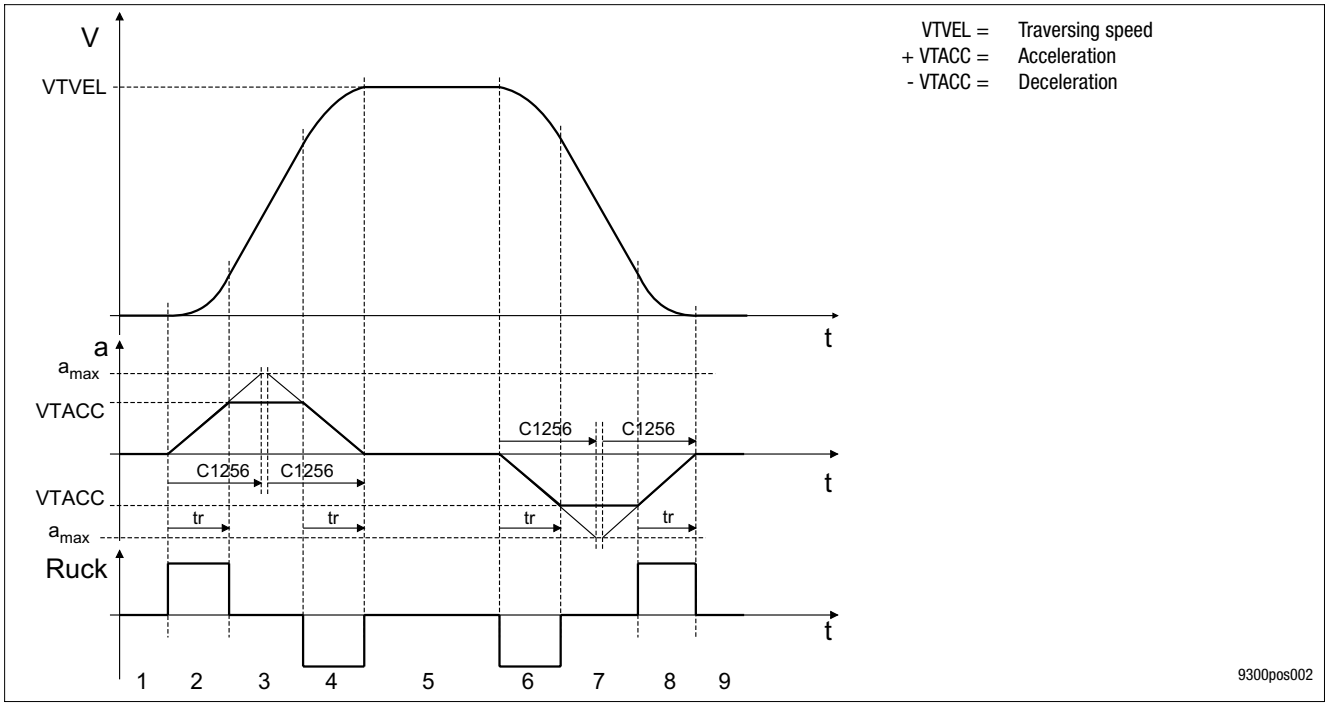


Fig. 3-23 S-shaped ramps (S profile)

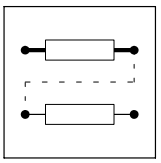
1. Standstill
2. Deceleration with set jerk
3. Acceleration with VTACC
4. Reduce acceleration with set jerk
5. Traversing with VTVEL
6. Deceleration with set jerk
7. Deceleration with VTACC
8. Reduce deceleration with set jerk
9. Drive in targetposition

- With the S profile acceleration and deceleration processes are started smoothly. The defined acceleration is only reached at the end of the jerk time.
  - A slower acceleration always leads to a longer positioning time - compared to the time-optimised L profile.
  - Set jerk time (T_r) via C1256.
    T_r corresponds to the time when the max. acceleration a-max (C1250) is reached. The actual jerk time tr decreases according to the actual acceleration a:

$$t_r = T_r \times \frac{a}{a_{max}} \rightarrow t_r = C1256 \times \frac{VTACC\ [\%]}{100\ \%}$$

  - Reducing the jerk or increasing the jerk time ($t_{r(RED)}$) can be set via the input “POS-JERK-RED” (default setting 100%).

$$t_{r(RED)} = t_r \times \frac{100\%}{POS\text{-}JERK\text{-}RED}$$



- The S profile must be activated before starting the positioning process.
- S profile is activated as follows:
  Connect input “POS-S-RAMPS” with 1-signal, e. g. assign FIXED1 directly or set FCODE-471.B1 = 1 (default setting).
- With “POS-PARAM-RD” you can switch between both profiles even during the positioning process.
  When changing from the L profile to the S profile during acceleration/deceleration, the S profile starts with acceleration 0 all the same. The process is prolonged accordingly.

Tip!

- The jerk remains unchanged when the acceleration is changed.
  - If a target position cannot be reached with these parameters (e. g. with TP positioning or velocity changeover) the target position is overtravelled. Afterwards the drives changes its direction of rotation and travels to the target position.
  - If a positioning process with or without final speed (changeover of velocity) is followed by a positioning process in opposite direction, the acceleration will be reduced to 0 before it is built up in opposite direction.
- For the S-profile, the deceleration is automatically equated with the acceleration in the PS. Inputs for the deceleration are not considered.
- Special feature when stopping in manual operation, homing, PS-CANCEL, program stop:
  → Stops are always realised with linear ramps!

  Firmware version ≥ 2.5:
  Under C1259/1.../3 it is possible to change to S ramps for stopping.

Stopping with S ramp

The corresponding setting parameters for the S ramp can be found in the GDC under the following menu: “POS functions / S-ramps”. This function can be set with code C1258.

When the S-ramp function is activated, the default settings of the controller cause the drive to be stopped in the case of the following functions with linear ramp:

- Manual jog,
- Prg-stop,
- PS-CANCEL and
- Homing

With firmware version ≥V2.5 the controller can be switched to stopping with S-ramp for the following functions when the S-ramp function is activated:

- Manual jog (C1258/1),
- Prg-Stop (C1258/2),
- PS-CANCEL (C1258/3)

3.4.9.3 Override

Purpose

- Dynamic change of the profile parameters (speed and acceleration).
  Example: Setting the traversing speed depending on the master speed.

Function

- Dynamic adaptation of traversing and final speed (POS-**V**-OVERRID).
- Dynamic adaptation of acceleration and deceleration (POS-**A**-OVERRID).
- The override inputs are considered before each positioning process. With the input POS-PARAM-RD this is also possible during the process (see chapter 3.4.9.4)
  – The parameter values are reduced according to the % values at the override inputs.
- In manual operation the override inputs are always effective.
  – Note: Only positive override values are effective, negative values will be evaluated as zero.

3.4.9.4 New traversing profile parameters during positioning (POS-PARAM-RD)

Purpose

- Change of the target position, speed or acceleration during positioning.

Function

- LOW-HIGH edge at POS-PARAM-RD immediately accepts - also while positioning is running - new profile parameters from the VT variable tables.
  Profile : Target position, traversing speed, acceleration, deceleration, final speed, V override, A override, POS-S-RAMPS (limited).
  – With a constant HIGH level: new profile parameters are accepted every 10 ms.

Tip!

Firmware version < 2.5: Not effective in stand-by operation.

Firmware version ≥ 2.5: Also effective in stand-by operation.

3.4.9.5 Influence of precontrol values (POS-NOUT-GAIN, POS-MOUT-GAIN)

Purpose

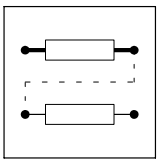
- Reduction of the influence of precontrol on speed and torque controller.

Function

- Adaptation of the speed precontrol (POS-NOUT) to the speed controller (MCTRL-N-SET) (POS-**N**OUT-GAIN, default setting: 100 %)
- Adaptation of the torque precontrol (POS-MOUT) to the torque controller (POS-**M**OUT-GAIN, default setting: switched off)
- The precontrol values are reduced according to the % values at the inputs.

Tip!

With dynamic positioning processes, a reduction of the speed precontrol (e.g. to 95%) can be advantageous for the travelling performance towards the target position.



3.4.9.6 "Target-reached" message (POS-IN-TARGET)

Purpose

Messaging the termination of positioning.

Function

- A positioning process is terminated when the position setpoint POS-SETPOS of the profile generator has reached the target position POS-TARGET ("setpoint-based").
- POS-IN-TARGET = HIGH messages that the position setpoint POS-SETPOS has reached the target position POS-TARGET.
- The other program functions are only processed further when → POS-IN-TARGET = HIGH.

Tip!

Because of mains failure, the drive may not be in the indicated position, although the message POS-IN-TARGET was indicated.

3.4.9.7 Target window (POS-WAITSTATE)

Purpose

Particularly high demands on the accuracy for reaching the target position (message: Target reached).

Function

Via the input POS-WAITSTATE the ”Target reached” message can be (📖 3-63) delayed until the pending following error has been compensated and the drive has reached the target with sufficient accuracy (target window).

The program will not be processed until

- the position setpoint POS-SETPOS has reached the target and
- the input POS-WAITSTATE = LOW.

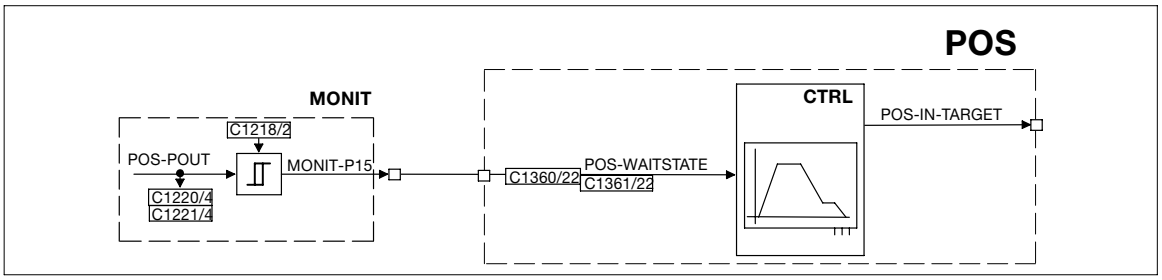


Fig. 3-24 Connect output MONIT-P15 with input POS-WAITSTATE

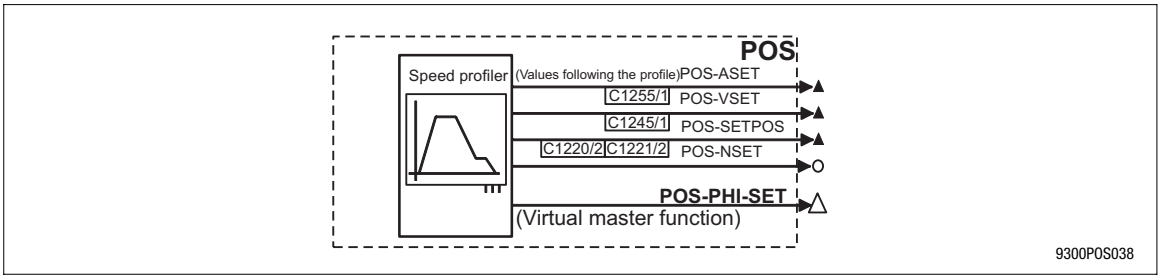
By the interconnection of the function blocks shown in Fig. 3-24 the continuation of the program is delayed within a narrow target window (POS-WAITSTATE = HIGH) until the actual position value is actually in the target window. For this the target window is preselected in a very narrow manner in C1218/2 (second following error tolerance). In order to be able to continue the program processing later on, the system deviation between the setpoint and the actual value, which is referred to as the following error, must be smaller than the target window defined before. The output MONIT-P15 also switches if monitoring P15 is switched off.

Output	Level	Description
POS-WAITSTATE	HIGH	POS-IN-TARGET is not yet set since the current positioning is still running. The functions of the next PS are not carried out yet. During homing, the function is not effective.
	LOW	Continuation of the program: The program is only continued if the difference between actual value and setpoint is compensated such that the difference is within the permissible following error tolerance. Under code C1218/2 you can enter a following error with less tolerance.
MONIT-P15	HIGH	Display when the current following error is greater than the target window.
		The output MONIT-P15 will be switched even if the second following error monitoring is switched off.

Tip!

- In practice, the ”Target window” function only has to be used for particularly high demands with regard to the accuracy of the target achievement. According to experience, in most applications the standard ”Target reached” message, which is derived from the setpoint of the profile generator, is sufficient.
- During homing the POS-WAITSTATE function is not effective. The end of a reference run is always indicated by the homing status (POS-REF-OK).

3.4.9.8 Virtual master (output POS-PHI-SET)



Purpose

- Phase- and speed-synchronous traversing of two or several drives.

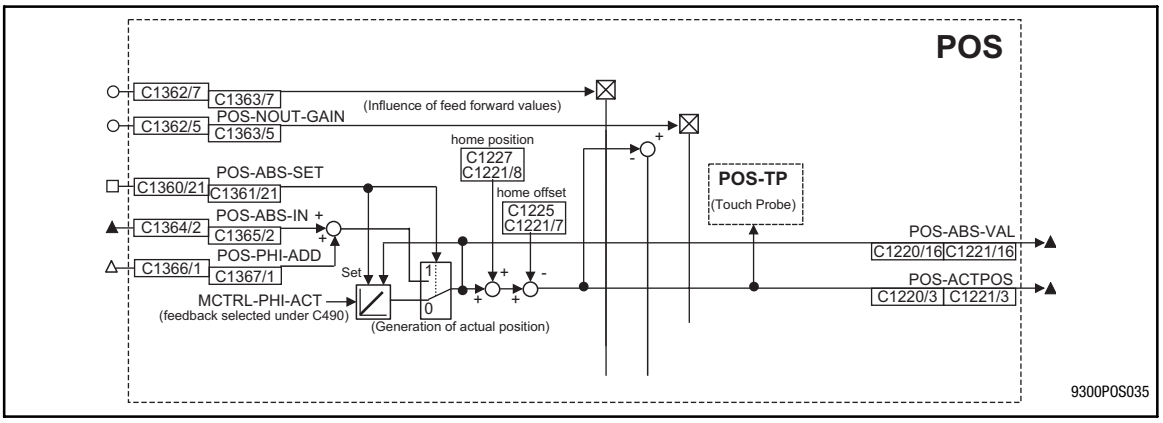
Function

- Definition of “virtual master”:
  Via the required phase difference output (POS-PHI-SET) of the master drive the master drive itself and the ”slave” drives are positioned in parallel.
  This does not lead to any reactions between the drives and no offset in positioning occurs in contrast to connecting the slave drives via the actual phase difference output (MCTRL-PHI-ACT).
- POS-PHI-SET is transmitted to the slave drives through digital frequency connection (DFOUT, DFIN, DFSET).
- A connection via system bus (CAN) is possible.
  – Advantage of clocked drives:
    For improving the dynamic features a speed precontrol can be transmitted in addition.

Tip!

With system bus coupling (CAN) the controllers must be synchronised, otherwise position information may get lost. The synchronisation is realised in the slave drives via the SYNC function block. In the master drive the ”CAN sync telegram” must be generated.

3.4.9.9 Setting the actual position value (POS-ABS-SET)



POS-ABS-IN	C1365/2	C1364/2	Input for external actual position value, e. g. when using an absolute value encoder with a CAN interface. (see "Absolute encoders via system bus" 📖 3-40)
POS-ABS-SET			Changeover (position encoder C490) / (ABS-IN)
POS-ABS-VAL	C1220/16 C1221/16		Display as actual position POS-ACTPOS, but without considering setpoint position polarity (C1206), actual position (C1206), actual home position (display C1220/8) and actual reference dimension offset (display C1220/7).
POS-ACTPOS	C1220/3 C1221/3	-	Actual position; position relating to real zero For rating see formula 1
POS-PHI-ADD	C1367/1	C1366/1	Phase difference signal is added to POS-ABS-IN. Function: With POS-ABS-SET= HIGH the actual position is set to the value POS-ABS-IN. Encoder increments that have arrived in the setting cycle are not considered in the default. If required, the encoder change can be connected in the setting cycle; the signal MCTRL-PHI-ACT must be linked with the input POS-PHI-ADD.

Home position

HIGH = Phase value at POS-ABS-IN is read in for actual position value generation (POS-ACTPOS).

The following values are considered when POS-ACTPOS is generated:

- Position setpoint polarity (C1206)
- Actual position value polarity (C1208)
- Actual home position (display C1220/8)
- Actual reference dimension offset (display C1220/7).

3.4.10 Manual operation

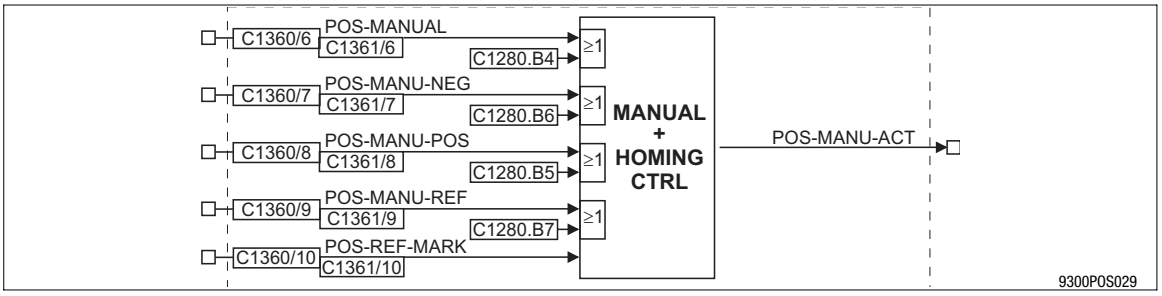


Fig. 3-25 Manual jog (part of the POS function block)

Signal				Source		Note
Designation	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual jog / program operation HIGH = manual operation; if necessary, running program is interrupted. If necessary, drive is decelerated to standstill with a-manual (C1252) and the influence of POS-A-OVERRID. LOW = Program operation
POS-MANU-NEG	d	C1361/7	bin	C1360/7	2	HIGH = drive travels with v_manual (C1243) in negative direction. Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. LOW = drive is stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. Note: POS-MANU-REF has priority. When -NEG and -POS are triggered simultaneously the drive stops.
POS-MANU-POS	d	C1361/8	bin	C1360/8	2	Like POS-MANU-NEG, but in positive direction
POS-MANU-REF	d	C1361/9	bin	C1360/9	2	LOW-HIGH signal = Start manual homing HIGH level required for the time of homing (see 3.4.10.3 "Manual referencing")
POS-REF-MARK	d	C1361/10	bin	C1360/10	2	Homing switch
POS-MANU-ACT	d	-	-	-	-	HIGH = manual operation active, no program operation Note: Signal will not be updated when the controller is inhibited (DCTRL-CINH = HIGH) or quick stop (MCTRL-QSP-OUT = HIGH) is set

Function

- Manual jog without intermediate stop (📖 3-68)
- Manual jog with intermediate stop (📖 3-69)
- Manual homing (📖 3-69)

3.4.10.1 Manual positioning

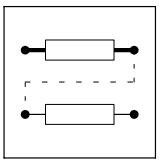
- Set manual jog mode to “Manual jog without intermediate stop” (C1260 = 0)
- Activating manual operation: Activating manual operation:
  POS-MANUAL = HIGH and/or
  C1280/B4 = 1 (“manual jog” in the ”Control” GDC dialog)
- Manual control in positive direction:
  POS-MANU-POS = HIGH and/or
  C1280/B5 = 1 (“manual positive” in the “Control” GDC dialog).
- Manual control in negative direction:
  POS-MANU-NEG = HIGH and/or
  C1280/B6 = 1 (“manual negative” in the ”Control” GDC dialog).
- The drive brakes to standstill if none of the manual functions is activated or both of them.
- Manual positioning speed adjustable under C1243.
- Manual acceleration/deceleration adjustable under C1252.
- The override inputs POS-V-OVERRIDE and POS-A-OVERRIDE are always effective
- The drive stops when a travel range limit switch is reached. Fault messages P01 or P02 are activated.

Tip!

- Assigned travel range limit switches can be left again in manual operation in direction of the travel range. The fault must be reset before.
- In manual operation the drive stops with linear ramps (L-profile). From software version 2.5 the ramps can be set with C1256. (📖 3-60)

The following conditions must be met to ensure that the drive can be traversed manually:

1. The drive must be enabled (DCTRL-CINH =0),
2. The QSP function must not be activated (MCTRL-QSP-OUT=0),
3. Manual homing must be inactive:
   POS-MANU-REF = LOW and
   C1280/B7 = 0 (“Manual homing” in the “Control” GDC dialog),
4. Only one direction is to be selected.
   If the positive and negative direction are activated at the same time, the drive is braked to standstill.



3.4.10.2 Manual jog with intermediate stop

Purpose

- During manual positioning, the drive is to stop at defined target positions (intermediate stops).

Activating this function

- Set manual jog mode to “Manual jog with intermediate stop” (C1260 = 1).
- Set input POS-PARAM-RD = LOW.
- Carry out the next steps like in chapter ”Manual jog”. (📖 3-68)
- The intermediate stop positions are defined by selecting the target positions from the VTPOS variable table. Up to 16 target positions can be selected via C2161/1 to C1261/16.
  (GDC menu: “Positioning functions/manual jog”)
- The drive travels to the next target position and stops there. In order to continue, the control signal for ”manual positive” or ”manual negative” must be reset and then set again.
  The drive immediately brakes to standstill if the control signal is reset before reaching the next target position.

3.4.10.3 Manual homing

Purpose

Example: Homing during commissioning.

Activating the function

The homing parameters set apply to manual homing (📖 3-46)

Procedure:

1. Activate manual operation
   – Set POS-MANUAL = HIGH and/or
   C1280/B4 = 1 (Activate the “Manual jog” option field in the ”Control” GDC dialog).
2. Start manual homing
   – Rising edge at POS-MANU-REF or
   rising edge at C1280/B7 (Activate the “Manual homing” option field in the ”Control” GDC dialog).
   The signal for manual referencing has to be pending until the end of the homing process, otherwise the process is interrupted.
   – A restart is effected with a rising edge again.
   – For ”Manual jog with intermediate stop”, set the input POS-PARAM-RD = LOW.

Tip!

- Manual homing has priority over manual jog, that means the signals for manual jog have no effect when manual homing is activated by a control signal.
- For manual homing the following conditions have to be met:
  – The drive must be enabled (DCTRL-CINH = 0).
  – The QSP function must not be activated (MCTRL-QSP-OUT = 0).
  – The interval between ”Activate manual operation” and a rising edge for ”Start manual homing” at least has to be 1 ms (1 x cycle time).

3.4.11 Program operation

Purpose

Positioning programs for automatic operation of the application can run during program operation.

Function

- Program control (📖 3-70)
- Variable tables (VT) (📖 3-75)
- Program blocks (PS) (📖 3-76)

3.4.11.1 Program control

Purpose

The program control offers the possibility to influence program processing by a higher-level control (e.g. PLC) or directly from the operator's panel.

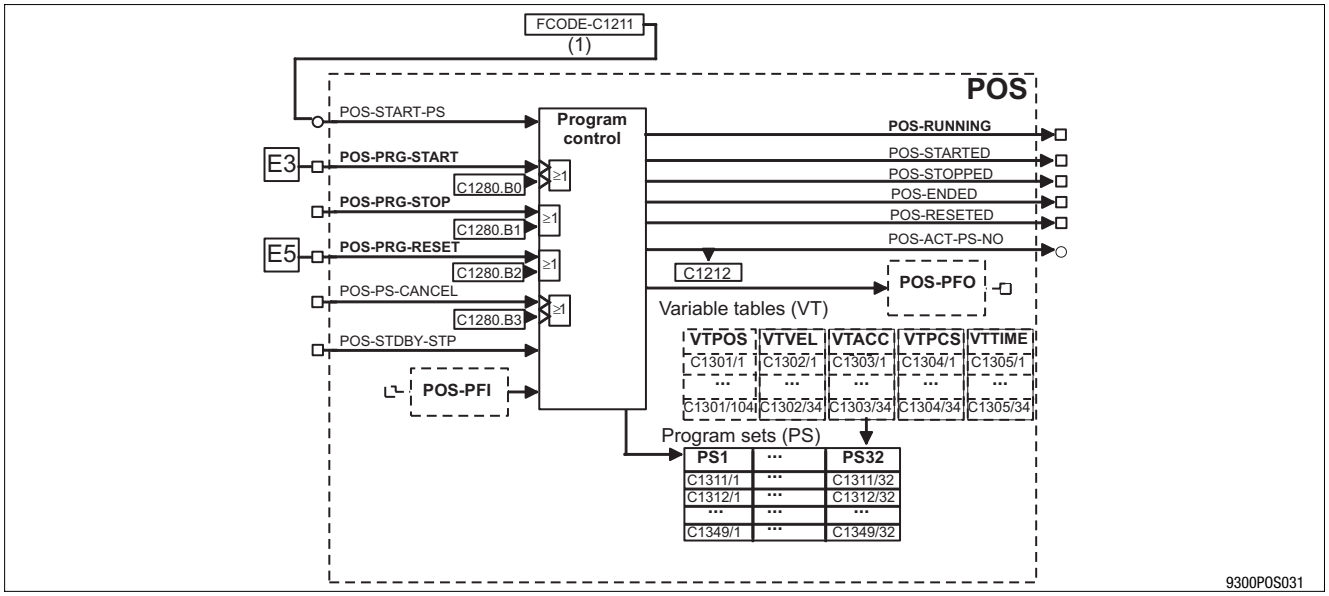
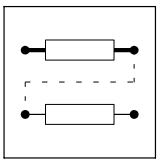


Fig. 3-26 Functionality of PS, VT, PFI and PFO (excerpt from the POS function block)

Starting the program (PRG-START)

- The beginning of the program to be started is determined by the FB input "POS-START-PS". In the standard configurations this input is connected with FCODE C1211. In the default setting the program starts with PS01.
- Starting the positioning program with
  - LOW-HIGH edge at POS-PRG-START or
  - C1280.B0 = 0 / 1 edge ("Program start" in the GDC dialog "Control").



Tip!

- The program processing is continued to the ”Program end” even if the start signal is reset immediately.
- If the start signal is still applied at ”program end” the program will be restarted automatically every time.
- A new edge at POS-PRG-START is required after interrupting the program processing (e.g. by controller inhibit) or by a fault message.
  Afterwards the program is continued from the same position (status display: C1283=15).

The start signal will only be accepted in program operation and when the controller is enabled.

The controller is enabled if

1. the power stage is supplied (DCTRL-RDY=1),
2. no fault applies (DCTRL-TRIP=0, DCTRL-FAIL-QSP=0),
3. the control enable signal is applied (DCTRL-CINH=0)
4. quick stop (QSP) is not activated (MCTRL-QSP-OUT=0)
5. manual operation is not activated (POS-MANUAL=0, C1280.B4=0)
6. program reset is not activated (POS-PRG-RESET=0, C1280.B2=0)

Stopping the program (PRG_STOP)

- POS-PRG-STOP = HIGH or C1280.B1 = 1 (“Program stop” in the GDC dialog ”Control”).
  – The signal ”program stop” interrupts the program processing and the running positioning process. The drive is stopped with the current delay of the program set (no influence of POS-A-OVERRID).
- POS-PRG-STOP = LOW **and** C1280.B1 = 0 (“Program stop” in the GDC dialog ”Control”).
  – The program is continued from the same position when “Program stop” = LOW. The positioning process is finished with the current profile parameters of the PS.

Resetting the program (PRG-RESET)

- POS-PRG-RESET = HIGH or C1280.B2 = 0 (“Program reset” in the GDC dialog ”Control”).
- When a program is reset,
  - the drive will be stopped with a-max (C1250) (no influence of POS-A-OVERRID)
  - the program will be interrupted
  - “Program end” will be set
  - the piece counter will be set to zero
  - the program function outputs (PFO) will be reset
  - the touch probe inputs used by the program will be “disabled”
  - and if necessary, stand-by operation will be cancelled.

Tip!

The signal for resetting the program is also accepted and saved in the inhibited state. The program reset will only be executed in the released state (see notes under ”starting the program”).

Cancelling the current PS (PS-CANCEL)

- LOW-HIGH signal at POS-PS-CANCEL or C1280.B3 = 0 / 1 signal.
  - The drive will be decelerated to standstill with the separately adjustable delay “a-cancel” (C1253).
  - The program will be continued in the PS selected (C1333; JMP-TP-PS).

3.4.11.2 Status of the program control

The actual state of the program control is displayed via the status outputs of the POS function block and the positioning status (C1283).

Status outputs

Update conditions of the status outputs ”RUNNING”, “POS-STARTED”, “POS-STOPPED”, “POS-ENDED”, “POS-RESETED” and the positioning status in code C1283:

- The power stage is supplied (DCTRL-RDY=1)
- The drive is enabled (DCTRL-CINH=0)
- No fault applies (DCTRL-TRIP=0, DCTRL-FAIL-QSP=0)
- Quick stop (QSP) is not activated (MCTRL-QSP-OUT=0)
- Manual operation is not activated (POS-MANUAL=0, C1280.B4=0)

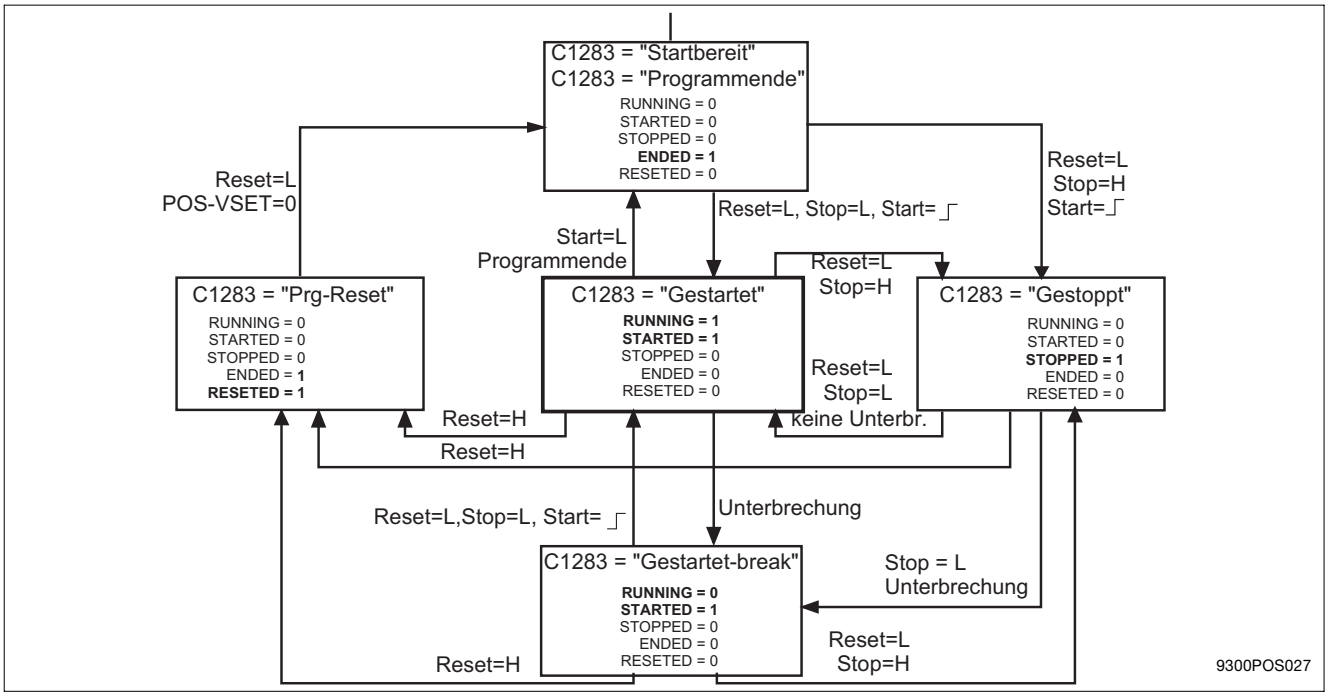


Fig. 3-27 Status machine of program control

Status ”Ready to start”

- Program control is ready to start but not started yet.
- Status output POS-ENDED = HIGH,
- Positioning status (C1283) = “Ready to start”,
- Current PS No. (POS-ACT-PS-NO) = 0 (program end)

Status “Started”

- Program has been started, the positioning program is running.
- Status output POS-STARTED = HIGH and
- Status output POS-RUNNING = HIGH (for firmware version ≥ 2.5)
- Positioning status (C1283) = “Started”,
  or “Started-rem”, if C1280.B0 = 1 (GDC control),
  or “Started-dig”, if input POS-PRG-START = HIGH.

Status “Started-break”

- Program processing is started but is interrupted by controller inhibit, QSP, TRIP, mains failure, Fail-QSP or manual control (interruption). In order to continue the program processing a new start edge is required.
- Status output POS-STARTED = HIGH and
- POS-RUNNING = LOW (for firmware version ≥ 2.5)
- Positioning status (C1283) = “Started break”.

Tip!

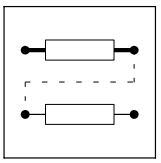
- Firmware version ≥2.5:
  The states ”Started” and ”Started-break” can be distinguished by the new status output “POS-RUNNING”.
- Firmware version < 2.5:
  When the stand-by operation is activated, ”Started-break” cannot be identified!
  The states “Started” and “Started-break” can only be distinguished via the positioning status (C1283).

“Stopped” status

- Program and drive stopped, or drive will be stopped.
- Status output POS-STOPPED = HIGH,
- Positioning status (C1283) = “Stopped”,
  or “Stopped-rem”, if C1280.B1 = 1 (GDC control),
  or “Stopped-dig”, if input POS-PRG-STOP = HIGH,

“Prg reset” status

- Program processing is aborted and the drive is stopped. Actual PS No. (POS-ACT-PS-NO) is set to ”program end”.
- Output POS-RESETED = HIGH,
- Output POS-ENDED = HIGH,
- Positioning status (C1283) = “Prg-Reset-rem”, if C1280.B2 = 1 (GDC control),
  or “Prg-Reset-dig”, if input POS-PRG-RESET = HIGH,
- Current PS No. (POS-ACT-PS-NO) = 0 (program end)



3.4.12 Variable tables (VT)

Five variable tables comprise the profile parameters determining the positioning.

- Function block: VTPOS (📖 3-277)
  – 104 variables for position values
- Function block: VTVEL (📖 3-281)
  – 34 variables for speeds
- Function block: VTACC (📖 3-273)
  – 34 variables for acceleration / deceleration
- Function block: VTTIME (📖 3-279)
  – 34 variables for waiting time
- Function block: VTPCS (📖 3-275)
  – 34 variables for piece numbers

3.4.13 Program sets (PS)

Function

- PS mode
- Point-to-point positioning
- Point-to-point positioning with velocity changeover
- Touch probe positioning
- Stand-by operation
- Set position value
- Prg. fct. “Wait for input”
- Prg. fct. “Switch output **before** positioning”
- Prg. fct. “Positioning or special function”
- Prg. fct. “Switch output **after** positioning”
- Prg. fct. “Waiting time”
- Prg. fct. “Branch 1”
- Prg. fct. “Branch 2”
- Prg. fct. “Repeat function - piece number”
- Prg fct. “Jump to next PS”

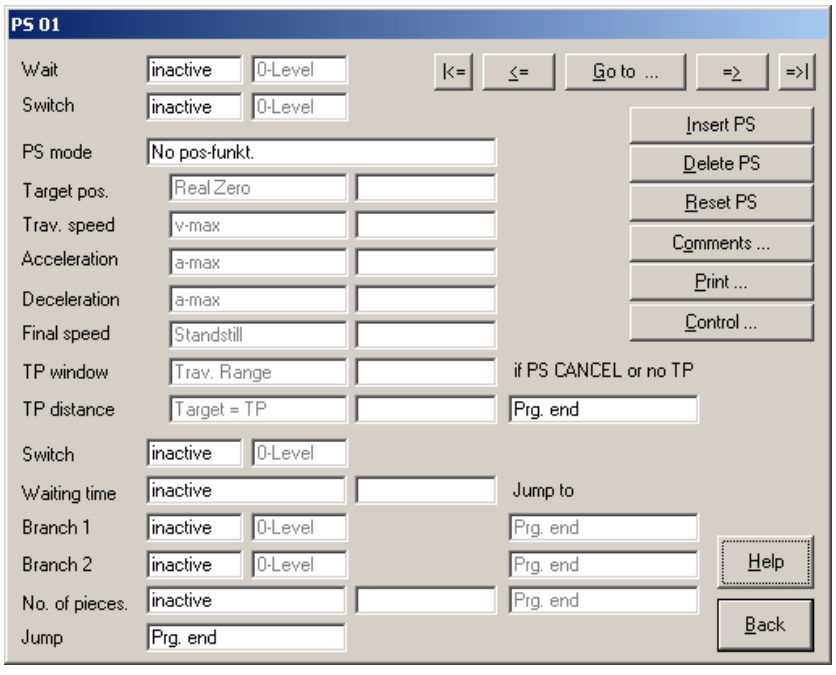
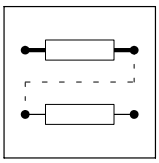


Fig. 3-28 Screenshot: GDC input: “Programming” dialog)



3.4.13.1 PS mode

Purpose

- Selection of which positioning or special function is to be carried out in the PS.

Function

- GDC input: “Programming” dialog
- Factory setting: No positioning or special function
- Input under PS mode (C1311):

Value	Program functions
0	No positioning or special function
1	Absolute PS
2	Relative PS
3	Homing
4	Set homing value
5	Set position value to target position (C1312)
6	Absolute PS; TP positioning with E01
7	Absolute PS, TP positioning with E02
8	Absolute PS, TP positioning with E03
9	Absolute PS, TP positioning with E04
11	Relative PS, TP positioning with E01
12	Absolute PS, TP positioning with E02
13	Relative PS, TP positioning with E03
14	Relative PS, TP positioning with E04
16	Acceptance of home position (C1227)
30	Stand-by operation, cancel with STDBY-STP
31	Stand-by operation, cancel with TP E01 and traversing of the residual distance
32	Stand-by operation, cancel with TP E02 and traversing of the residual distance
33	Stand-by operation, cancel with TP E03 and traversing of the residual distance
34	Stand-by operation, cancel with TP E04 and traversing of the residual distance

3.4.13.2 Point-to-point positioning

Purpose

Point-to-point positioning of a defined target position A.

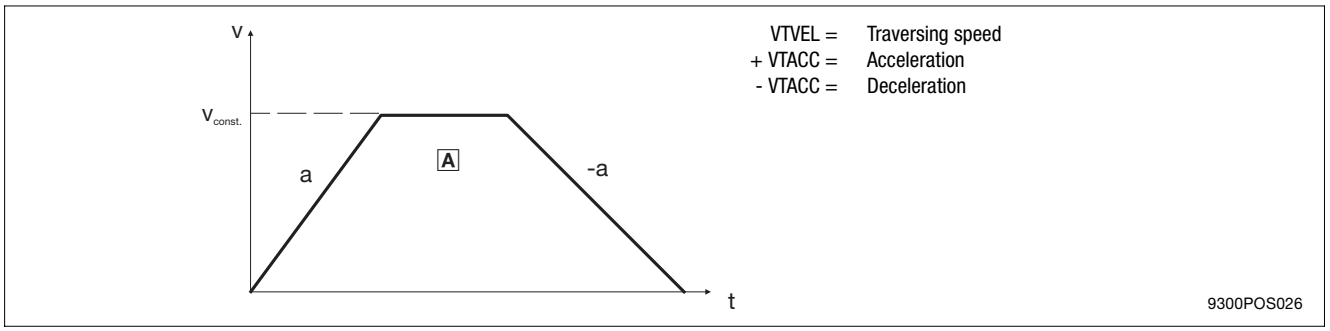


Fig. 3-29 Point-to-point positioning

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The travel profile is generated according to the parameters selected (see also travel profile generator).
- The travel profile parameters can be adjusted individually for any PS. They are selected from the variable tables VTxxx:
  Select **target position** from “VTPOS” (selection under C1312/x)
  Select **traversing speed** from “VTVEL” (selection under C1313/x)
  Select **acceleration** from “VTACC” (selection under C1314/x)
  Select **deceleration** from “VTACC” (selection under C1315/x)
  Final speed = 0 (standstill) (selection under C1316/x)
- Point-to-point positioning is possible with the positioning modes (C1210) “absolute” and “relative positioning”.
- The travel profile parameters can be changed during positioning (see chapter 3.4.9.4)
- The travel profile parameters can be adjusted during operation with the override inputs (see chapter 3.4.9.3).
- The status output POS-IN-TARGET displays the end of a positioning process (see also 3.4.9.7)

3.4.13.3 Point-to-point positioning with changeover of velocity

Purpose

- Velocity changeover between two positioning processes without stopping.

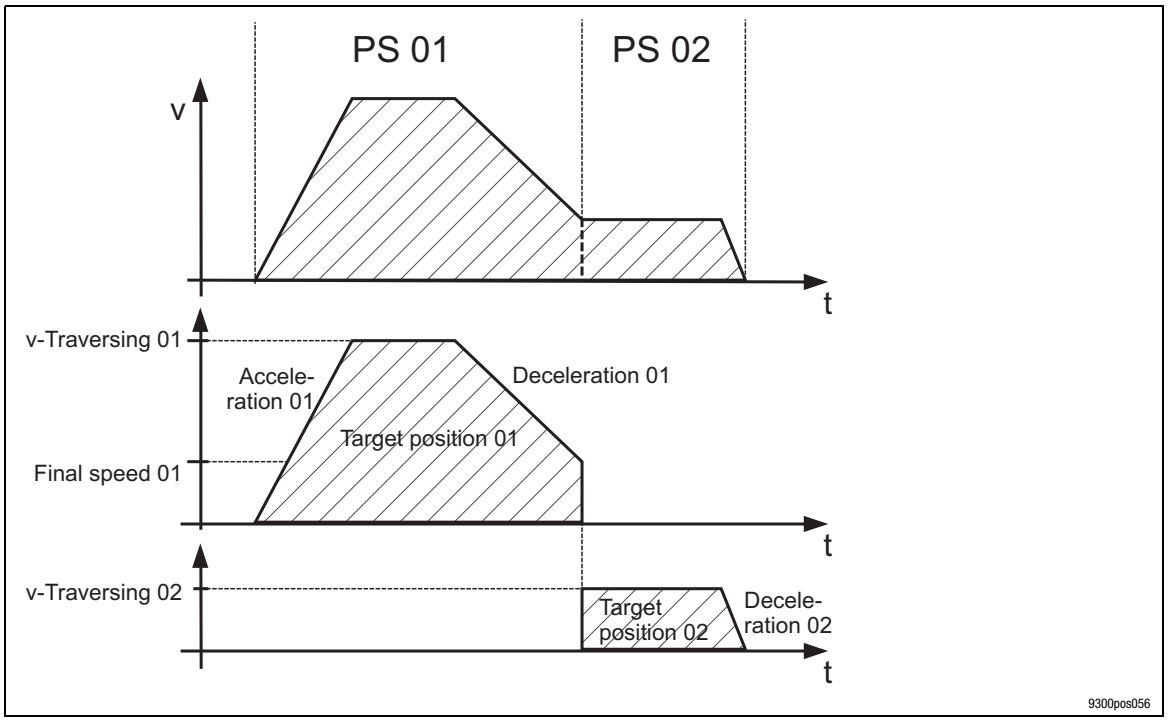


Fig. 3-30 Point-to-point positioning with velocity changeover

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The travel profiles of two subsequent positioning processes are set as in point-to-point positioning except that one final speed is unequal 0. The final speed is reached when the target position is reached. Positioning will start at this speed. Positioning will start at this speed.
  Select **target position** from “VTPOS” (selection under C1312/x)
  Select **traversing speed** from “VTVEL” (selection under C1313/x)
  Select **acceleration** from “VTACC” (selection under C1314/x)
  Select **deceleration** from “VTACC” (selection under C1315/x)
  Select **final speed from “VTVEL”** (selection under C1316/x)
- Point-to-point positioning is possible with the positioning modes (C1210) “absolute” and “relative positioning”.

Tip!

If a PS with final speed unequal 0 is not followed by a positioning, for instance because of a jump to “Program end” or the function “Wait for input”, the fault message P09 (impermissible programming) will be activated. The drive brakes to standstill.

3.4.13.4 Touch probe positioning

Purpose

- Positioning depending on an external digital terminal signal (TP positioning).
- E. g.: The front edge of workpieces of different lengths is always to be positioned in the same position.

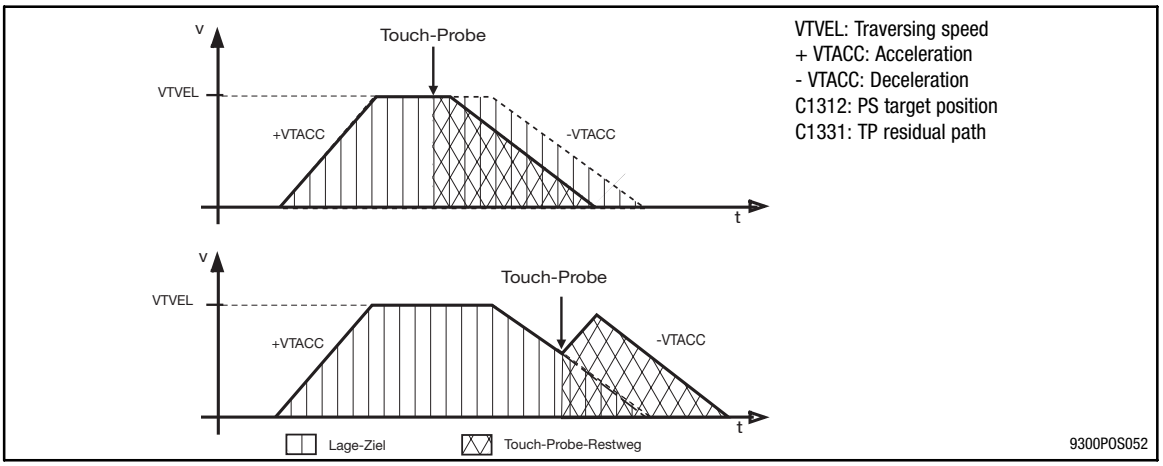


Fig. 3-31 Speed travel profile of a TP positioning

Function

- PS mode (C1311): Select 6...14 (“Absolute PS”, “Relative PS”, TP).
- TP positioning corresponds to a point-to-point positioning with / without velocity changeover. One of the four possible touch probe inputs (terminals X5/E1 ... X5/E4) is enabled during positioning.
- If TP occurs, the actual position value is saved as TP position and the target position of the current positioning is changed.

  Calculation of the new target position when TP occurs

  TP position + | TP residual path |

  – The value of the TP residual path is always added to the value of the TP position.
  – The direction of the TP residual path always corresponds to the traversing direction when TP occurs.
- The actual position value saving via TP is interrupt-controlled and has a very short response time:
  – rising edge at terminal: <0.010 ms
  – falling edge at terminal: <0.100 ms
- The TP input can be enabled for the entire TP positioning process or for parts of it. Target position, TP residual path and TP window determine the restricted area (fig. 7-37).

Tip!

- The TP position values saved are available in VTPOS-OUT-101 to -104 for further function block interconnections.
- The function “Touch-probe saving of the actual position value” via the function block inputs “POS-TPx-ENABL” is a separate function (see POS-TP). TP positioning has priority over “Touch-probe saving”.

3.4.13.5 Stand-by operation

Purpose

- Implementation of a “Flying saw”, with additional function block interconnection (on request).
- Enables the changeover between positioning and another setpoint source, e.g. master frequency of a main drive.

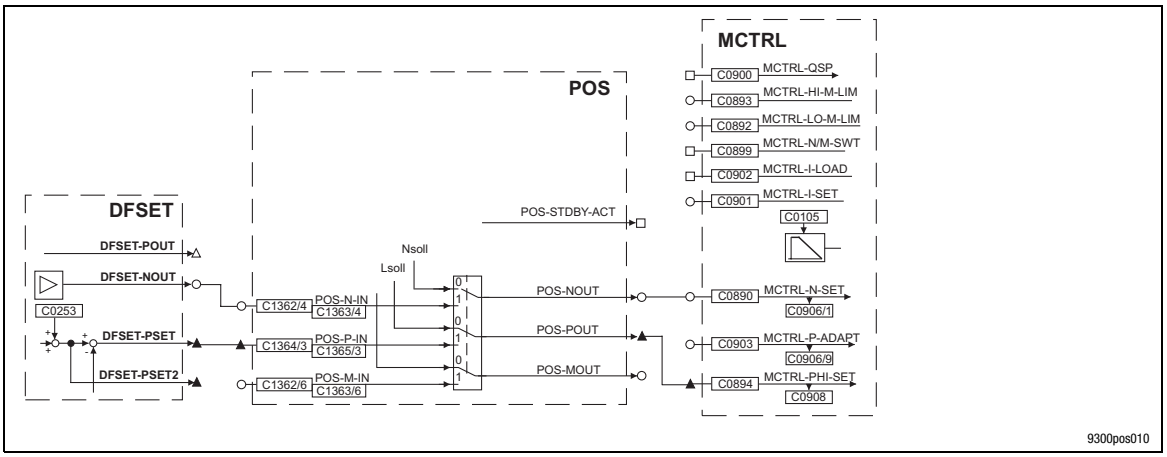


Fig. 3-32 Stand-by operation with selection via digital frequency

Function

- Stand-by operation is only possible during program operation.
- PS mode (C1311): Select 30...34 (stand-by operation and signal source for abort).
- In PS, stand-by operation is executed instead of positioning. As long as stand-by operation is active, ”positioning or special function” in the PS is not completed. The following PS functions are only processed when stand-by operation is terminated (see diagrams).
- After having started stand-by operation, the drive is accelerated or decelerated to the external speed setpoint at POS-N-N due to positioning. The profile parameters of the PS apply.
  When reaching the speed, the external setpoint inputs (POS-N-IN, POS-P-IN) are used. From now on, the position setpoint (POS-SETPOS) equals the actual position value (POS-ACTPOS):
  → POS-STDBY-ACT = HIGH

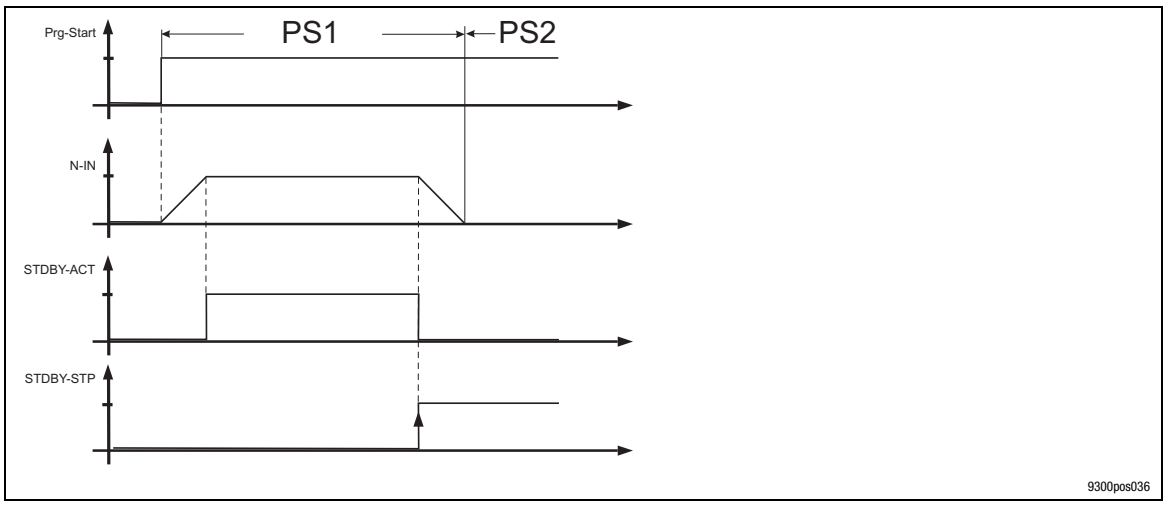
Cancelling stand-by operation

Stand-by operation can be cancelled via two ways:

1. Abortion via FB input “POS-STDBY-STP”
2. Abortion via touch-probe signal at terminal X5/E1 ... X5/E4

Abortion via FB input “POS-STDBY-STP”

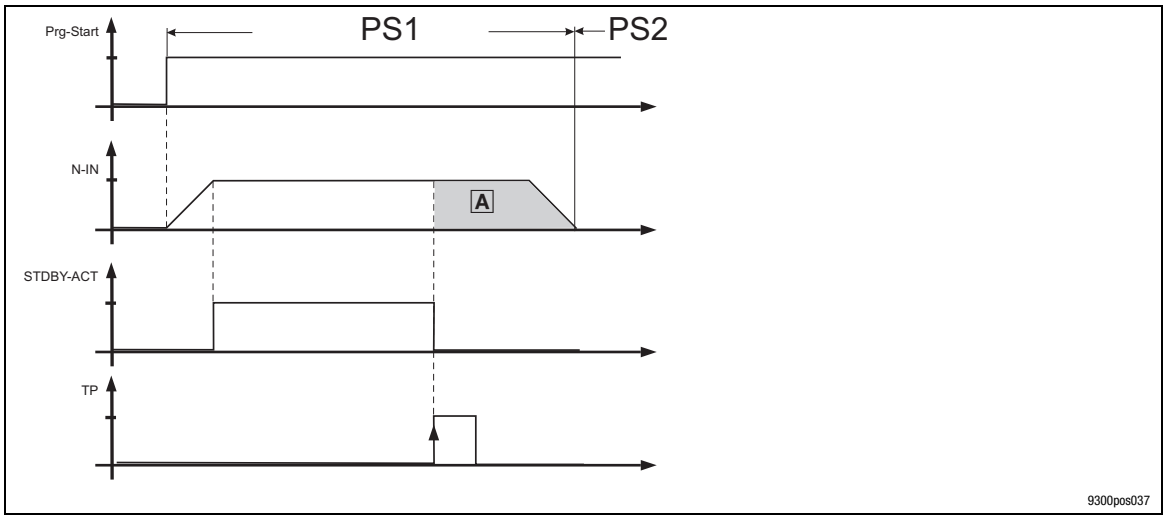
E.g.: Linkage with a digital control signal via a fieldbus or a function block interconnection.



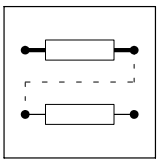
Stand-by operation is aborted and the drive will be reset to positioning when POS-STDBY-STP = HIGH. Positioning accelerates /decelerates the drive with the profile parameters of the PS to the preset final speed of the PS. Further PS functions will only be processed when the final speed has been reached.

Abortion via touch-probe signal at terminal X5/E1 ... X5/E4

E. g.: For accurate positioning over a mark signal after operation with a digital frequency.



A TP input has been enabled during stand-by operation. When the TP signal occurs, stand-by operation is aborted and the drive is reset to positioning. A positioning action follows comprising the TP residual path and starting from the TP position. The positioning traverses the drive using the profile parameters of the PS. Only after positioning has been completed, the following PS functions will be processed.



Monitoring in stand-by operation

- Monitoring of the travel range limit switch is active (fault P01, P02).
- Monitoring of the position limit value is active (fault P04, P05).
- Continuous operation is possible with relative positioning (1210 = 1). The position values (POS-SETPOS and POS-ACTPOS) are reset to 0 when reaching half the position limiting value; the current following error remains the same (no jerk in the drive).
- The following error monitoring of the positioning (P14, P15) is not active in stand-by operation.

Tip!

Stand-by operation is terminated when the program is reset (see program control) or manual operation is activated (see manual operation).

- Firmware version ≥ 2.5:
  - If the program is interrupted by CINH or QSP stand-by operation is interrupted. After a renewed program start, stand-by operation will be continued.
  - New profile parameters can be accepted in stand-by operation using PARAM-RD.
- Firmware version < 2.5:
  - If the program is interrupted by CINH (controller inhibit) or QSP (see program control) stand-by operation will be continued. Stand-by operation cannot be aborted. The program must be restarted.
  - The profile parameters and override inputs are **not** read in again.

3.4.13.6 Set position value

Purpose

- Shifting of the real measuring system during program processing

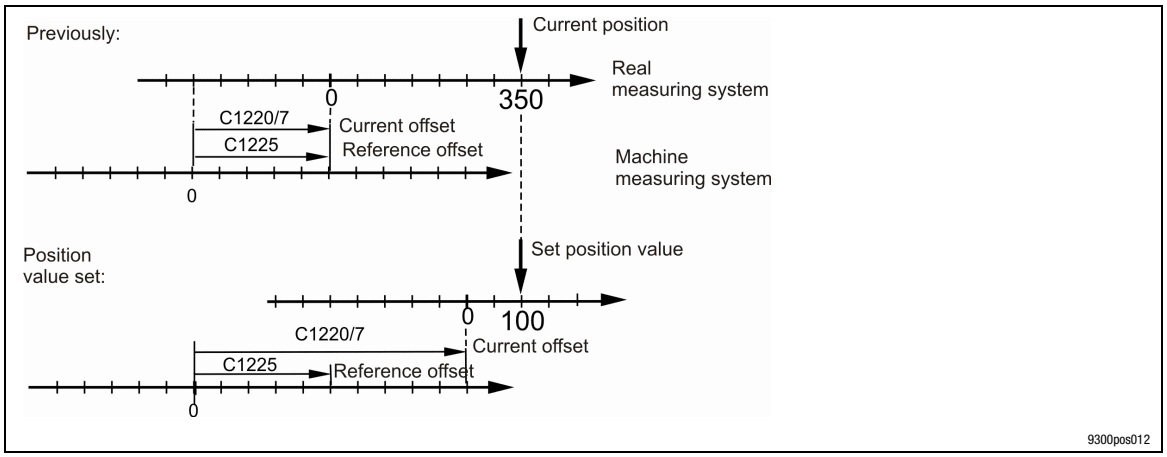


Fig. 3-33 Set position value

Function

- Selection of the function “Set position value” in PS under PS mode (C1311=5).
- The position setpoint (POS-SETPOS) is set to the target position selected in the PS.
- The actual position value (POS-ACTPOS) is set in order to keep the actual following error (no jerk).
- Setting the position value shifts the real zero; the actual reference offset (C1220/7) is changed. The actual reference offset does no longer correspond to the input value under C1225.
- The real zero can be shifted within the position limiting values (C1223, C1224). When exceeding these limits the error message “P08” (actual offset out of range) is set.

3.4.13.7 Prg. fct. “Wait for input”

Purpose

PS processing will not be continued before the selected digital input (POS-PFI) shows the level required.

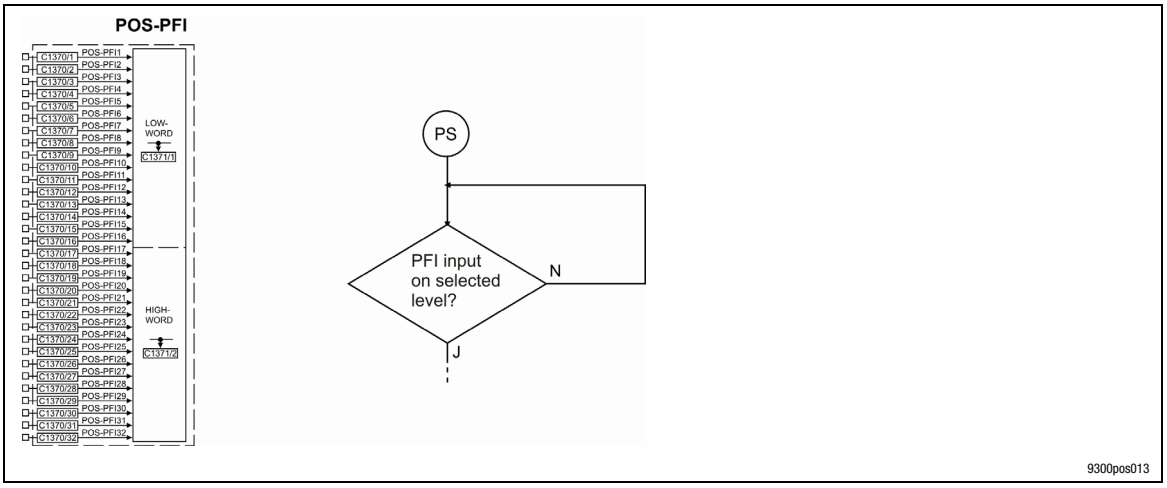


Fig. 3-34 Diagram - Wait for input

Function

- Selection of any PFI under C1318/x
- Selection of the required level under C1319/x.
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.8 Prg. fct. “Switch output before positioning”

Purpose

Setting or resetting a digital output signal (POS-PFO), for instance, to control a machine function before positioning starts.

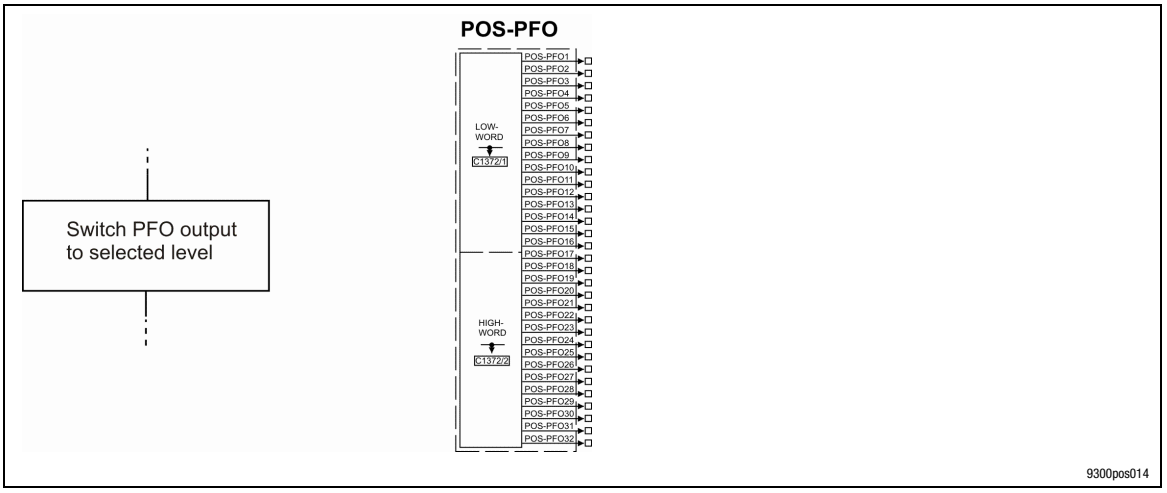


Fig. 3-35 Diagram - Switch output

Function

- Selection of any PFO under C1320/x. It is also possible to switch all PFO at the same time or in groups of 8.
- Selection of the signal level (setting or resetting) under C1321/x.
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.9 Prg. fct. “Switch output after positioning”

Purpose

Like “Switch output before positioning”.

Function

- Selection of any PFO under C1322/x. It is also possible to switch all PFO at the same time or in groups of 8.
- Selection of the signal level (setting or resetting) under C1323/x.
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

Tip!

If an output is to be set and reset before a positioning process, the output will not be switched if no positioning has taken place or the target position has been reached in the same cycle. As a remedy the output can be reset in one of the following PS. The output will then be switched for at least one cycle.

3.4.13.10 Prg. fct. “Waiting time”

Purpose

Continue program only after waiting time is over.

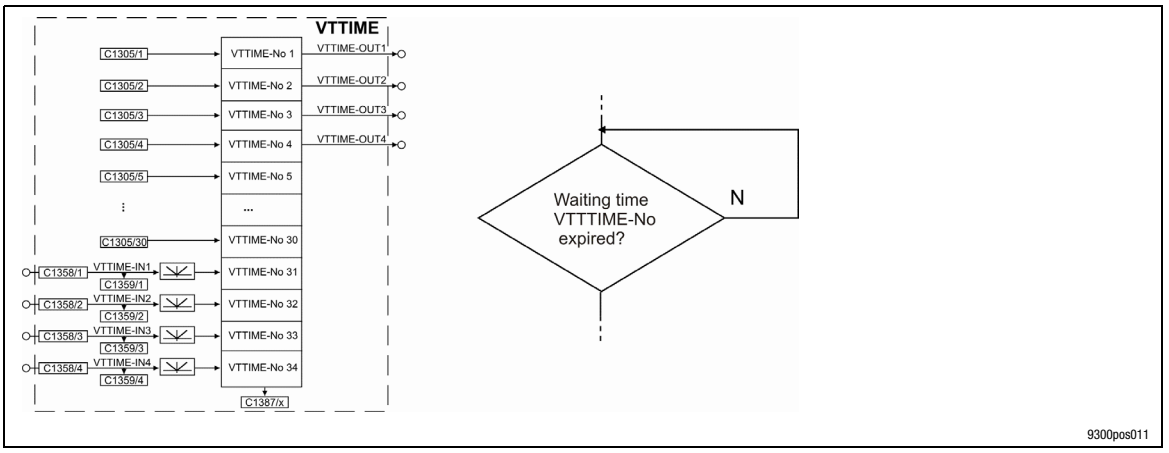


Fig. 3-36 Diagram - Waiting time

Function

- Waiting time selection from VTTIME under C1324/x.
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.11 Prg. fct. ”Branch 1”

Purpose

Branching during program processing depending on the digital input signals (PFI).

Branching because of conditional query of two variables (<, >, = <=, >=):

1. Comparison of two variables with function block “CMPPH” (7-109)
2. Connect the CMPPH output to the desired POS-PFI.

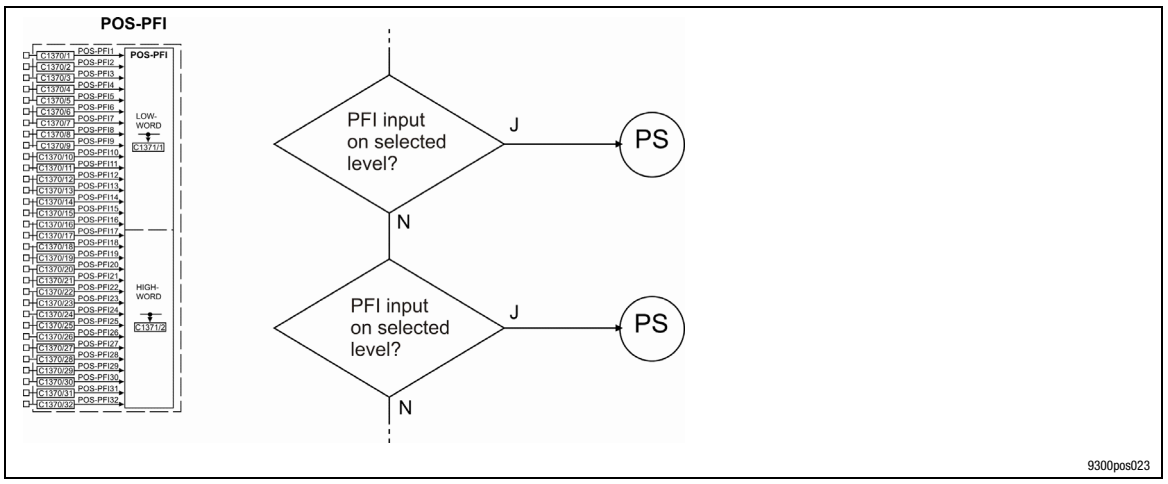


Fig. 3-37 Diagram - Branches 1 and 2

Function

- Selection of any PFI under C1325/x.
- Selection of the signal level under C1326/x.
- Selection of the PS to be branched to PS under C1327/x (if the PFI has the level selected).
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.12 Prg. fct. “Branch 2”

Purpose

See branch 1

Function

- Selection of any PFI under C1334/x.
- Selection of the signal level under C1335/x.
- Selection of the PS to be branched to PS under C1336/x (if the PFI has the level selected).
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.13 Prg. fct. “Repeat function - piece number”

Purpose

- Multiple repetition of the same PS or PS sequence.

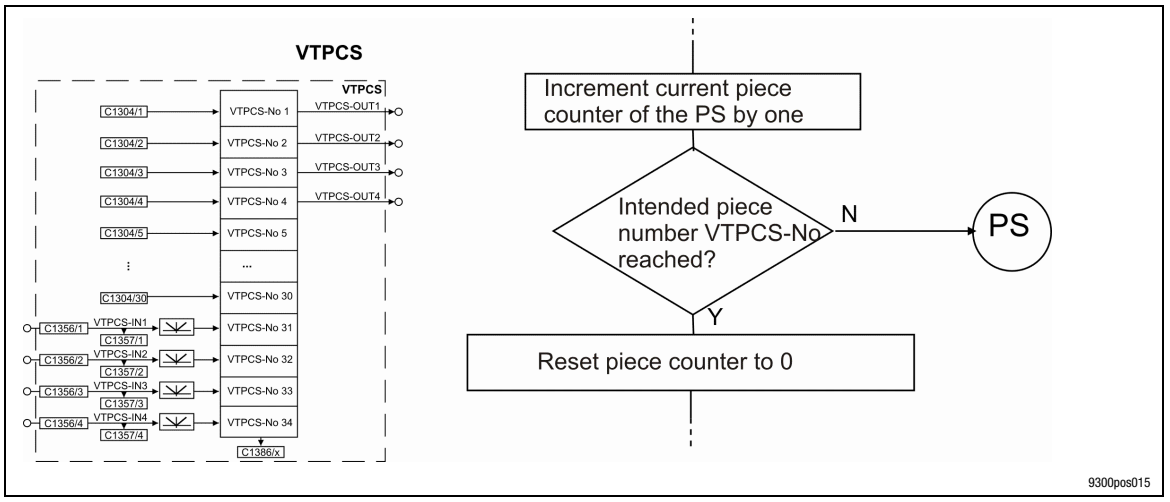


Fig. 3-38 Diagram - Piece number - repeat function

Function

- Selection of a no. of pieces from VTPCS under C1328/x.
- Selection of the PS to be branched to as long as the no. of pieces is not reached under C1229/x.
- Each PS has its own piece counter. C1299/x indicates the current count.
- With every PS cycle the corresponding piece counter is increased by 1, starting from 0. Afterwards the setpoint and actual values are compared and branched accordingly if the required no. of pieces has still not been reached. When the no. of pieces is reached, the piece counter is reset for the cycle and the piece number repeat function is terminated.
- “Program reset” resets all piece counters.
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.14 Prg fct. “Jump to next PS”

Purpose

- Link several PS in one program.

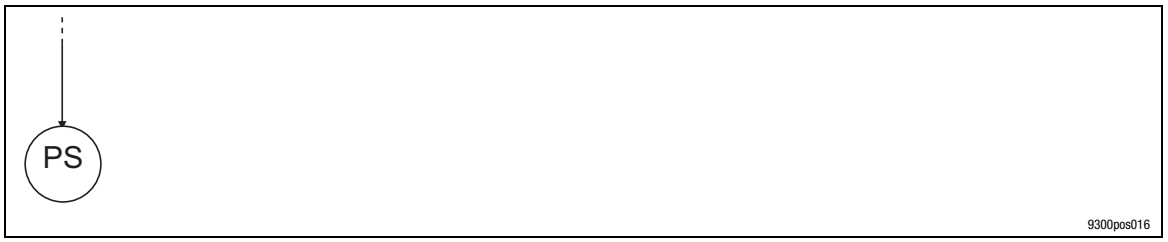


Fig. 3-39 Diagram - Jump to next PS

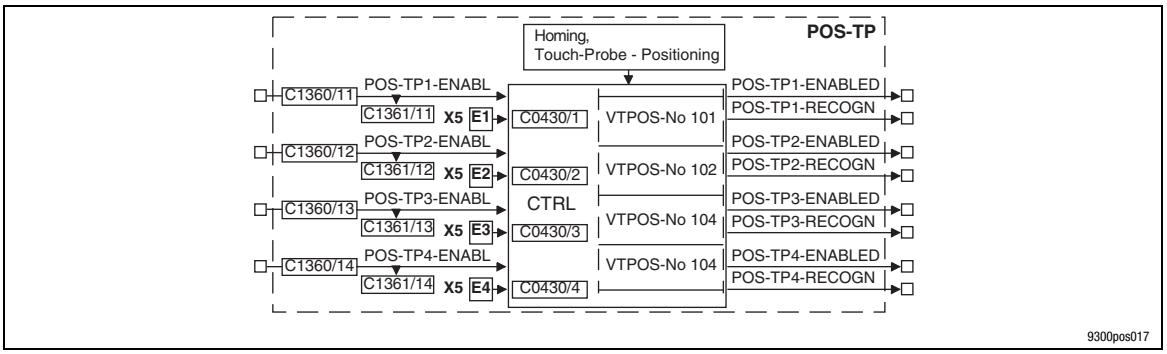
Function

- Selection of the next PS under C1349/x.
- GDC input: “Programming” dialog
- Default setting: Program end

3.4.14 POS-TP (Touch-probe saving of the actual position value)

Purpose

- Saving of the actual position value (POS-ACTPOS) is interrupt-controlled, the reaction times are very short.



- The values saved are available as position-targets for positioning or, for instance, for length calculation with arithmetic function blocks.

Fig. 3-40 Table inputs, outputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-TP1-ENABL	d	C1361/11	bin	C1360/11	2	HIGH = activate TP saving
POS-TP2-ENABL	d	C1361/12	bin	C1360/12	2	HIGH = activate TP saving
POS-TP3-ENABL	d	C1361/13	bin	C1360/13	2	HIGH = activate TP saving
POS-TP4-ENABL	d	C1361/14	bin	C1360/14	2	HIGH = activate TP saving
POS-TP1-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP1-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E1
POS-TP2-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP2-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E2
POS-TP3-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP3-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E3
POS-TP4-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP4-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E4

Function

The following table positions are assigned to the TP inputs:

- TP1 ≙ X5/E1 and saves in table position VTPOS-No 101.
- TP2 ≙ X5/E2 and saves in table position VTPOS-No 102.
- TP3 ≙ X5/E3 and saves in table position VTPOS-No 103.
- TP4 ≙ X5/E4 and saves in table position VTPOS-No 104.

The following settings are required:

Code	Subcode	Function
C1215	1 ... 4	Determine signal edge for the initiator at the TP input. • 0 = LOW-HIGH edge • 1 = HIGH-LOW edge • Subcode 1 ... 4 for terminal X5/E1 ... X5/E4
C1360	11 ... 14	Configuration of a signal source to activate the TP input.

Procedure:

1. A LOW-HIGH edge at POS-ENABLE-TPx
   – switches POS-TPx-RECOGN = LOW.
   – switches POS-TPx-ENABLED = HIGH.
2. A signal edge at TP input terminal X5/Ex
   – switches POS-TPx-RECOGN = HIGH,
   – switches POS-TPx-ENABLED = LOW.
3. The actual position at POS-ACTPOS valid at this time is saved in VTPOS at the corresponding table position.
4. Another LOW-HIGH edge at POS-ENABLE-TPx
   – switches POS-TPx-RECOGN = LOW.
   – switches POS-TPx-ENABLED = HIGH.

Tip!

The function block POS-TP is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

TP positioning has priority over the POS-TP function. When the same TP input is used simultaneously, TP positioning takes precedence with regard to the TP enable (also see chapter 3.4.13.4).

3.4.15 POS-PFI (Program Function Inputs)

Purpose

- Input for digital signals for controlling user programs, e. g. initiators at the machine or switches in the keyboard.

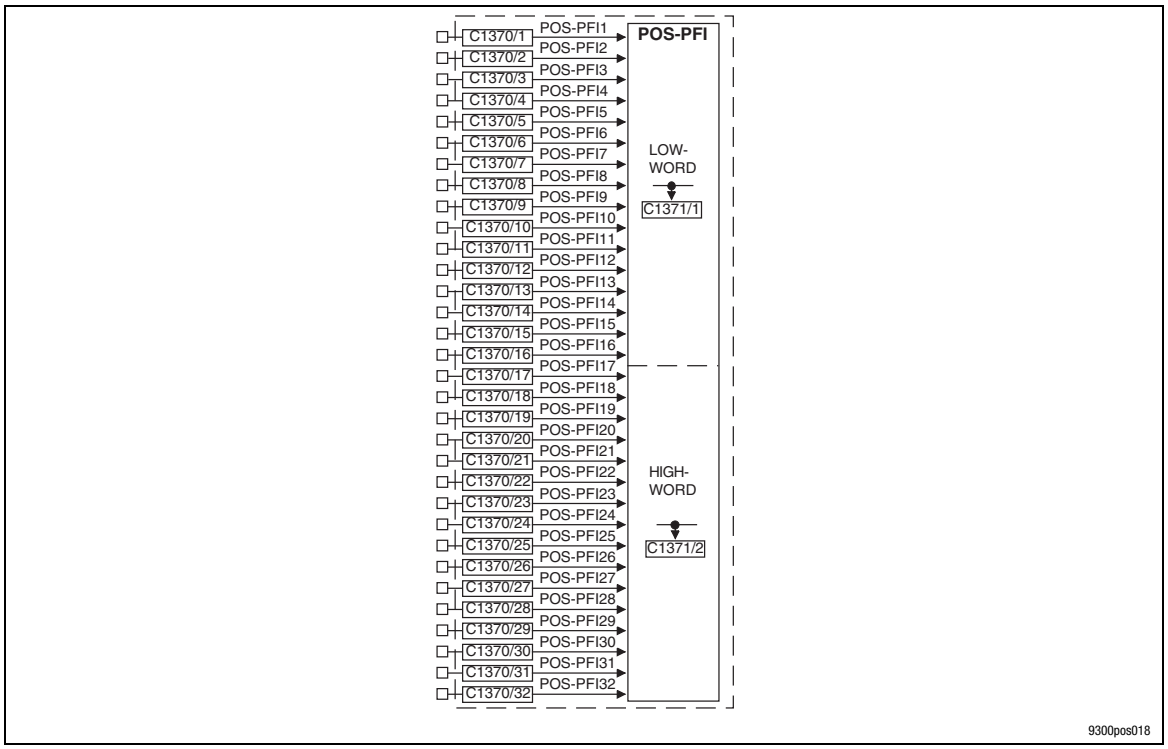


Fig. 3-41 POS-PFI, Program Function Inputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-PFI1	d	-	-	C1370/1	2	-
...	d	-	-	...	2	-
POS-PFI32	d	-	-	C1370/32	2	-
LOW-WORD	-	C1371/1	hex	-	-	-
HIGH-WORD	-	C1371/2	hex	-	-	-

Function

- The PFI are evaluated during PS processing through the following program functions:
  “Wait for input”,
  “Branch 1” and
  “Branch 2”.
- 32 PFI available.
- The PFI can be linked to any number of digital signal sources (e.g. the digital input terminals (DIGIN), fieldbus control signals (AIF-IN) or system bus control signals (CAN-IN) (function block interconnection).

Tip!

The function block POS-PFI is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

3.4.16 POS-PFO (Program Function Outputs)

Purpose

- Output of digital signals for controlling machine functions and operating status displays, e. g. start slave drive or activate spray jet.

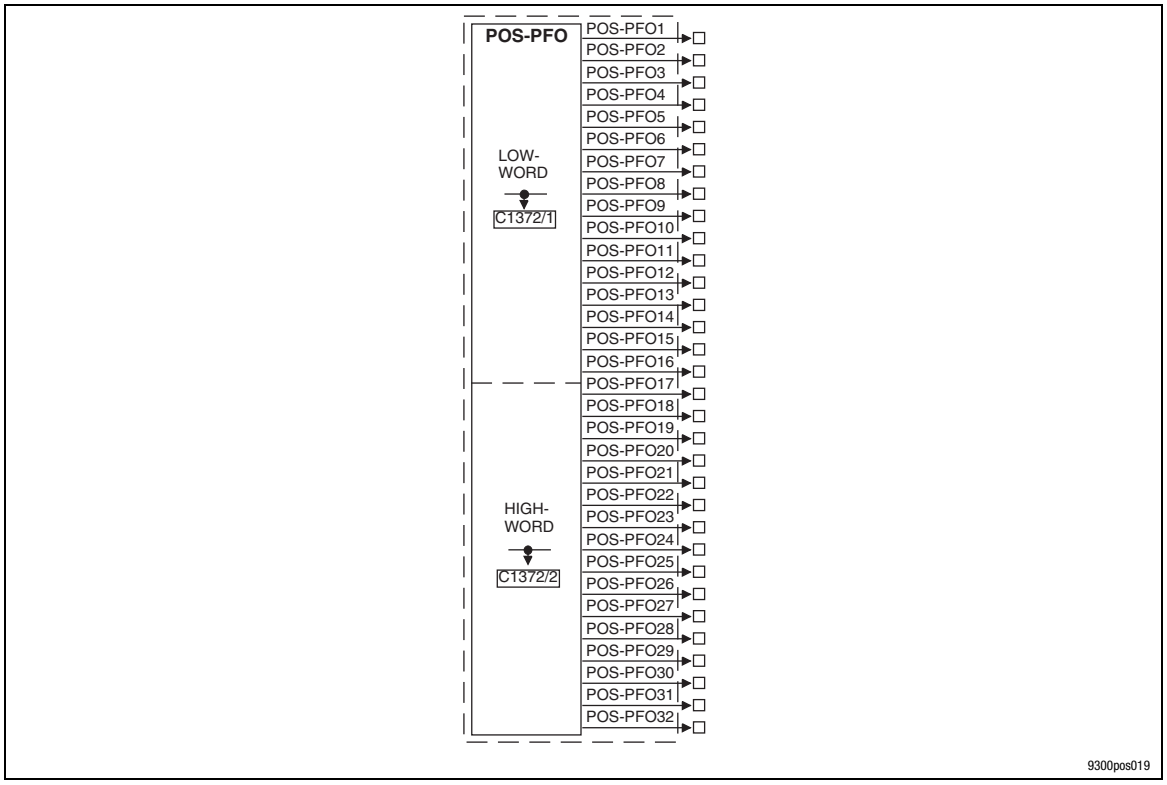


Fig. 3-42 POS-PFO, Program Function Outputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-PFO1	d	-	-	-	-	-
...	d	-	-	-	-	-
POS-PFO32	d	-	-	-	-	-
LOW-WORD	-	C1372/1	hex	-	-	-
HIGH-WORD	-	C1372/2	hex	-	-	-

Function

- The PFO are switched during PS processing through the following program functions:
  “Switch output **before** positioning”,
  “Switch output **after** positioning”.
- PFO can be used as single PFOs, altogether or in groups of 8 PFOs.
- PFOs are available as digital signal sources. They can be output via digital output terminals (DIGOUT) (function block interconnection).

Tip!

The function block POS-PFO is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

3.5 Function blocks

3.5.1 Absolute value generation (ABS)

Description

This function block converts bipolar signals to unipolar signals.

The absolute value is generated by the input signal and is provided at the output.

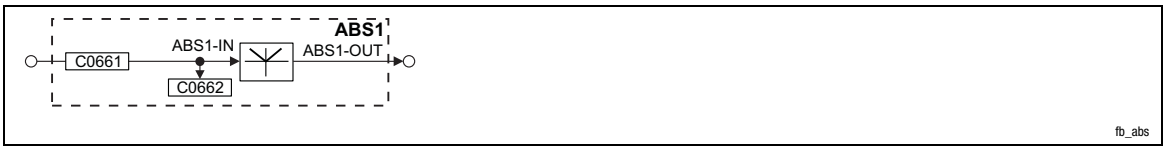


Fig. 3-43 Absolute value generator (ABS1)

3.5.2 Addition block (ADD)

Purpose

Adds or subtracts ”analog” signal depending on the input used.

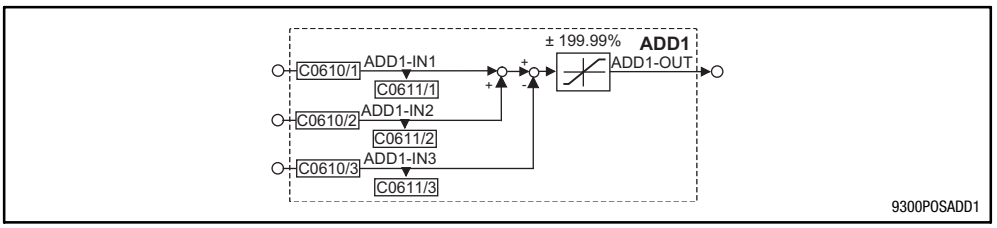


Fig. 3-44 Addition block (ADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADD1-IN1	a	C0611/1	dec [%]	C0610/1	1	1000	Addition input
ADD1-IN2	a	C0611/2	dec [%]	C0610/2	1	1000	Addition input
ADD1-IN3	a	C0611/3	dec [%]	C0610/3	1	1000	Subtraction input
ADD1-OUT	a	-	-	-	-	-	Limited to ±199.99%

Function

- Input ADD1-IN1 is added to input ADD1-IN2.
- The input ADD-IN3 is subtracted from the calculated result.
- Then, the result of the subtraction is limited to ±199.99 %.

3.5.3 Automation interface (AIF-IN)

Purpose

Interface for input signals of the plug-on fieldbus module (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog, or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

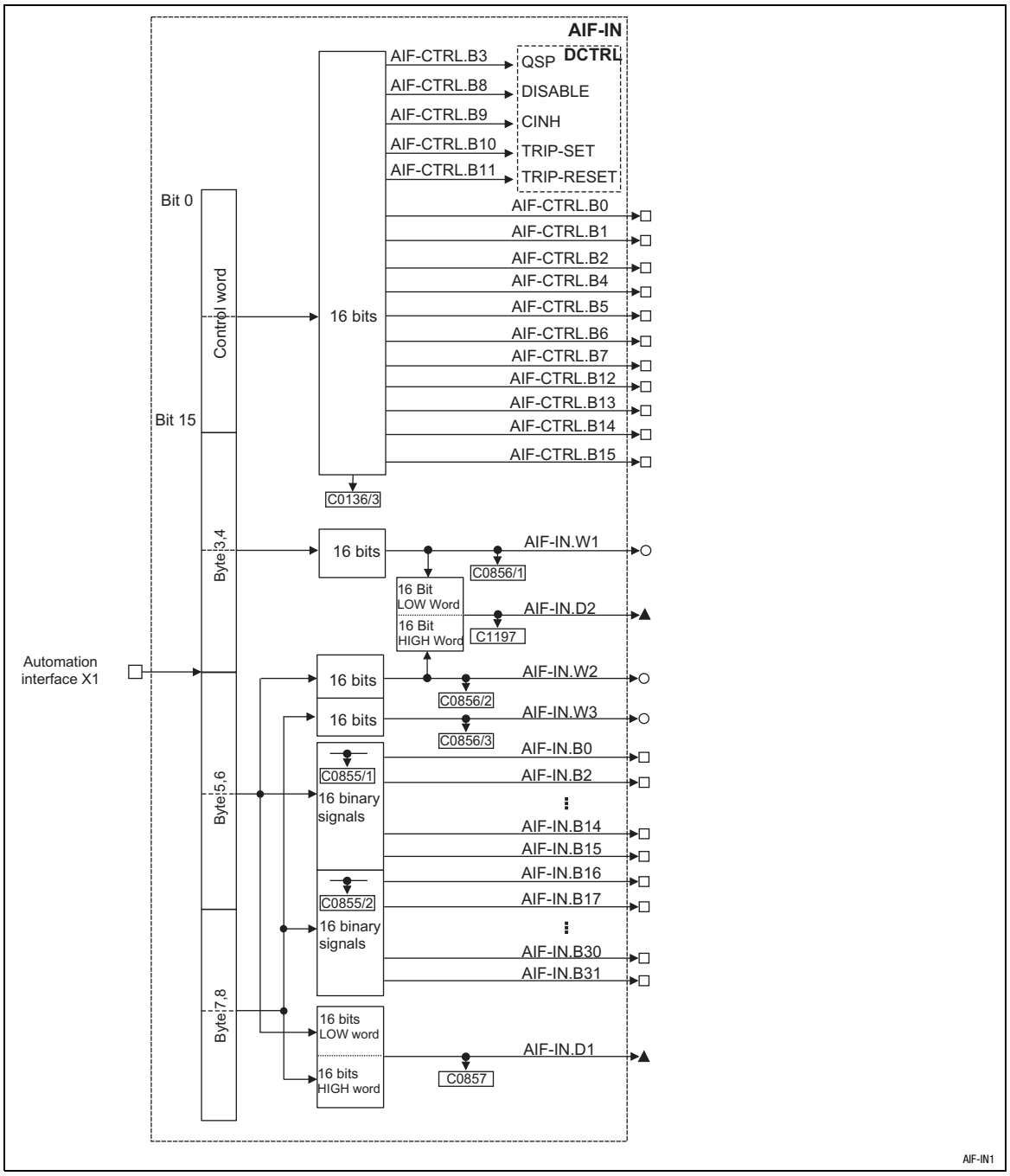
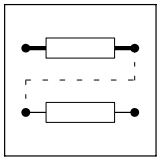
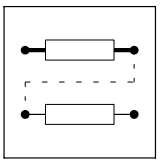


Fig. 3-45 Automation interface (AIF-IN)



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-CTRL.B0	d	C0136/3	bin	-	-	-	
AIF-CTRL.B1	d	C0136/3	bin	-	-	-	
AIF-CTRL.B2	d	C0136/3	bin	-	-	-	
AIF-CTRL.B4	d	C0136/3	bin	-	-	-	
AIF-CTRL.B5	d	C0136/3	bin	-	-	-	
AIF-CTRL.B6	d	C0136/3	bin	-	-	-	
AIF-CTRL.B7	d	C0136/3	bin	-	-	-	
AIF-CTRL.B12	d	C0136/3	bin	-	-	-	
AIF-CTRL.B13	d	C0136/3	bin	-	-	-	
AIF-CTRL.B14	d	C0136/3	bin	-	-	-	
AIF-CTRL.B15	d	C0136/3	bin	-	-	-	
AIF-IN.W1	a	C0856/1	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W2	a	C0856/2	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W3	a	C0856/3	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.D1	ph	C0857	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.D2	ph	C1197	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.B0	d	C0855/1	hex	-	-	-	
AIF-IN.B1	d	C0855/1	hex	-	-	-	
AIF-IN.B2	d	C0855/1	hex	-	-	-	
AIF-IN.B3	d	C0855/1	hex	-	-	-	
AIF-IN.B4	d	C0855/1	hex	-	-	-	
AIF-IN.B5	d	C0855/1	hex	-	-	-	
AIF-IN.B6	d	C0855/1	hex	-	-	-	
AIF-IN.B7	d	C0855/1	hex	-	-	-	
AIF-IN.B8	d	C0855/1	hex	-	-	-	
AIF-IN.B9	d	C0855/1	hex	-	-	-	
AIF-IN.B10	d	C0855/1	hex	-	-	-	
AIF-IN.B11	d	C0855/1	hex	-	-	-	
AIF-IN.B12	d	C0855/1	hex	-	-	-	
AIF-IN.B13	d	C0855/1	hex	-	-	-	
AIF-IN.B14	d	C0855/1	hex	-	-	-	
AIF-IN.B15	d	C0855/1	hex	-	-	-	
AIF-IN.B16	d	C0855/2	hex	-	-	-	
AIF-IN.B17	d	C0855/2	hex	-	-	-	
AIF-IN.B18	d	C0855/2	hex	-	-	-	
AIF-IN.B19	d	C0855/2	hex	-	-	-	
AIF-IN.B20	d	C0855/2	hex	-	-	-	
AIF-IN.B21	d	C0855/2	hex	-	-	-	
AIF-IN.B22	d	C0855/2	hex	-	-	-	
AIF-IN.B23	d	C0855/2	hex	-	-	-	
AIF-IN.B24	d	C0855/2	hex	-	-	-	
AIF-IN.B25	d	C0855/2	hex	-	-	-	
AIF-IN.B26	d	C0855/2	hex	-	-	-	
AIF-IN.B27	d	C0855/2	hex	-	-	-	
AIF-IN.B28	d	C0855/2	hex	-	-	-	
AIF-IN.B29	d	C0855/2	hex	-	-	-	
AIF-IN.B30	d	C0855/2	hex	-	-	-	
AIF-IN.B31	d	C0855/2	hex	-	-	-	



Function

The input signals of the 8-byte user data of the AIF object are converted into corresponding signal types. The signals can be used via further function blocks.

Byte 1 and 2

Byte 1 and 2 form the control word for the controller. The bits 3, 8, 9, 10, and 11 of these bytes are directly transferred into the function block DCTRL where they are linked with further signals. The other 11 bits can be used to control further function blocks.

Byte 3 and 4

form the signal to AIF-IN.W1.

Byte 5, 6, 7, and 8

This user data can be interpreted as different signal types. According to the requirement this data can be evaluated as up to two analog signals, 32 digital signals or one angle signal. Mixed forms are also possible.

3.5.4 Automation interface (AIF-OUT)

Purpose

Interface for output signals of the plug-on fieldbus modules (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

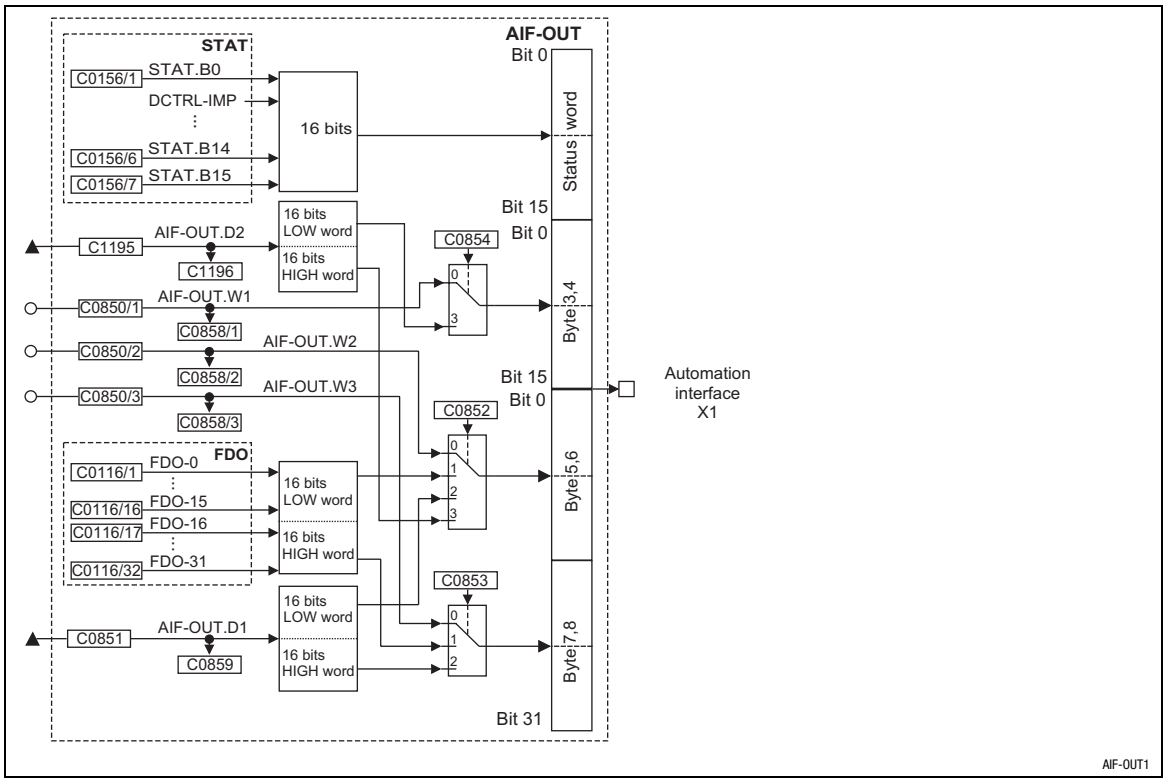
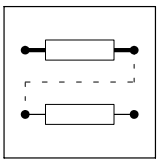


Fig. 3-46 Automation interface (AIF-OUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-OUT.W1	a	C0858/1	dec [%]	C0850/1	1	1000	+100 % = +16384
AIF-OUT.W2	a	C0858/2	dec [%]	C0850/2	1	1000	+100 % = +16384
AIF-OUT.W3	a	C0858/3	dec [%]	C0850/3	1	1000	+100 % = +16384
AIF-OUT.D1	ph	C0859	abs [inc]	C0851	4	1000	1 rev. = 65536
AIF-OUT.D2	ph	C1196	abs [inc]	C1195	4	1000	1 rev. = 65536



Function

The input signals of this function block are copied into the 8-byte user data of the AIF object and assigned to the plug-on fieldbus module. The meaning of the user data can be determined very easily with C0852 and C0853 and the corresponding configuration code (CFG).

Byte 1 and 2

Here, the status word from the function block STAT is mapped. Some of the bits are freely assignable (see description of the function block STAT in chapter 3.5.60)

Byte 3 and 4

- C0854 = 0
  – The analog signal at AIF-OUT.W1 is output.
- C0854 = 3
  – The LOW-WORD of AIF-OUT.D2 is output.

Byte 5 and 6

- C0852 = 0
  – The analog signal at AIF-OUT.W2 is output at bytes 5 and 6.
- C0852 = 1
  – The bits 0 ... 15 of FDO are output.
- C0852 = 2
  – The LOW-WORD of AIF-OUT.D1 is output.
- C0852 = 3
  – The HIGH-WORD of AIF-OUT.D2 is output.

Byte 7 and 8

- C0853 = 0
  – The analog signal at AIF-OUT.W3 is output.
- C0853 = 1
  – The bits 16 ... 31 of FDO are output.
- C0853 = 2
  – The HIGH-WORD of AIF-OUT.D1 is output.

Example

You want to output 16 digital signals of FDO and the LOW-WORD of AIF-OUT.D1:

- The LOW-WORD of AIF-OUT.D1 can only be output at bytes 5 and 6.
  – For this purpose, C0852 is set to 2. The angle signal at C0851 is output at bytes 5 and 6.
- For the digital signals, only the bits 16 ... 31 (bytes 7 and 8) are available (bytes 5 and 6 are assigned):
  – For this purpose, C0853 is set to 1. Bits 16 ... 31 (FDO) are output at bytes 7 and 8.

3.5.5 Analog inputs via terminal X6/1, X6/2 and X6/3, X6/4 (AIN)

Purpose

These function blocks are the interface for analog signals as the

- setpoint input,
- actual value input and
- parameter control.

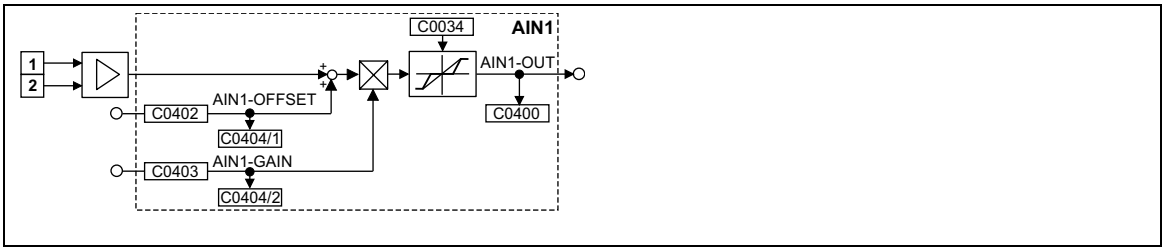


Fig. 3-47 Analog input via terminal X6/1, X6/2 (AIN1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN1-OFFSET	a	C0404/1	dec [%]	C0402	1	19502	-
AIN1-GAIN	a	C0404/2	dec [%]	C0403	1	19504	-
AIN1-OUT	a	C0400	-	-	-	-	-

Special features of AIN1

- A dead band element can be integrated into the output signal at AIN1 via code C0034. Together with the jumper position X2 (controller front) the function 4 ... 20 mA can be implemented as a master current value.
- The signal is read cyclically (1 ms).

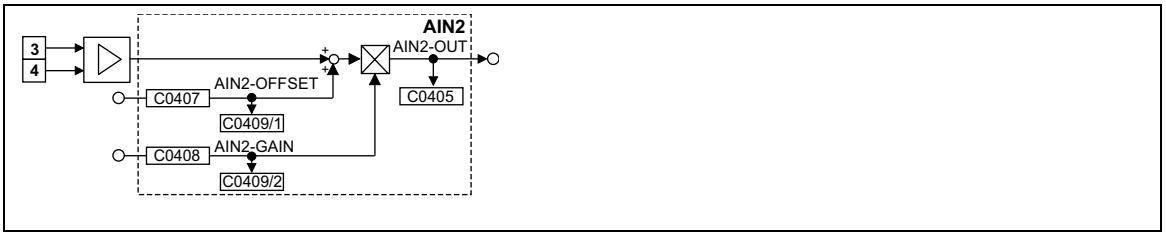


Fig. 3-48 Analog input via terminal X6/3, X6/4 (AIN2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN2-OFFSET	a	C0409/1	dec [%]	C0407	1	19503	-
AIN2-GAIN	a	C0409/2	dec [%]	C0408	1	19505	-
AIN2-OUT	a	C0405	-	-	-	-	-

Special feature of AIN2

- The signal is read cyclically every 250 µs.

Function

- The analog input value is added to the value at input AINx-OFFSET.
- The result of the addition is limited to ±200 %.
- The limited value is multiplied by the value which is applied to input AINx-GAIN.
- Then the signal is limited to ±200%.
- The signal is output at AINx-OUT.

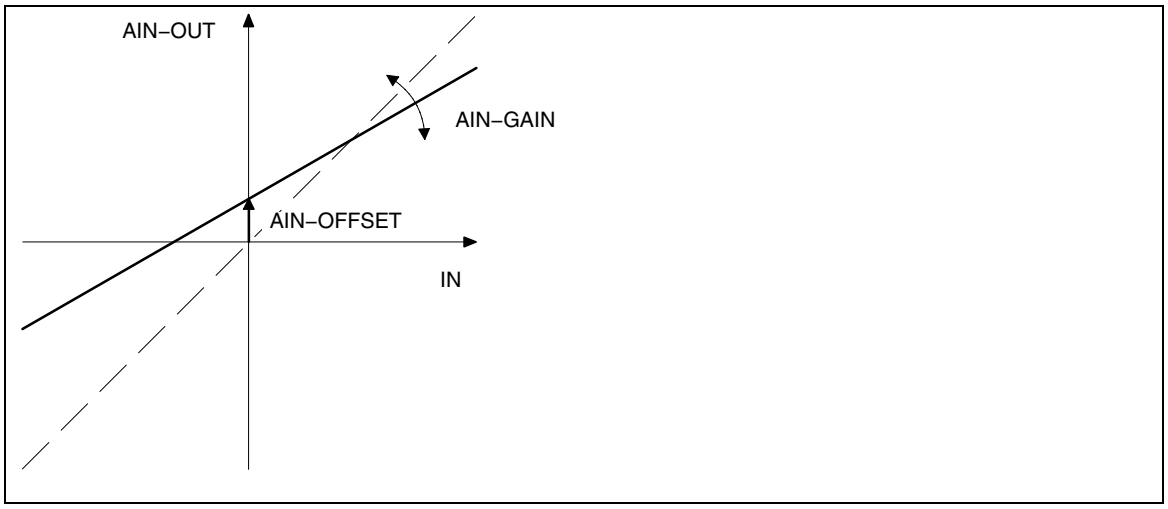


Fig. 3-49 Offset and gain of the analog input

3.5.6 AND operation (AND)

Purpose

With this function digital signals can be logically ANDed. These links can be used to control functions or to create status information.

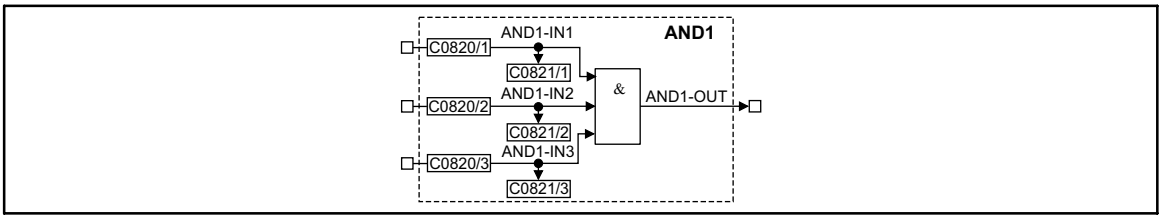


Fig. 3-50 AND operation (AND1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND1-IN1	d	C0821/1	bin	C0820/1	2	1000	-
AND1-IN2	d	C0821/2	bin	C0820/2	2	1000	-
AND1-IN3	d	C0821/3	bin	C0820/3	2	1000	-
AND1-OUT	d	-	-	-	-	-	-

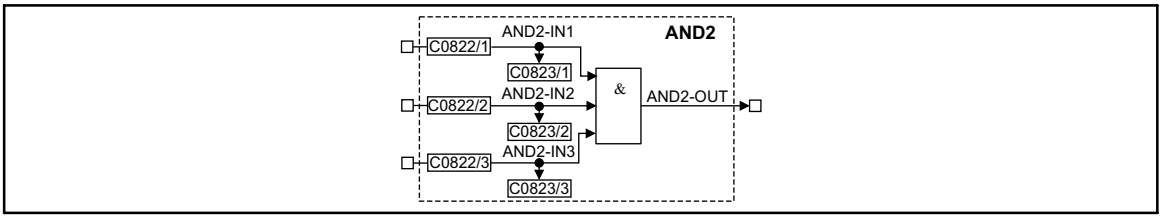


Fig. 3-51 AND operation (AND2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND2-IN1	d	C0823/1	bin	C0822/1	2	1000	-
AND2-IN2	d	C0823/2	bin	C0822/2	2	1000	-
AND2-IN3	d	C0823/3	bin	C0822/3	2	1000	-
AND2-OUT	d	-	-	-	-	-	-

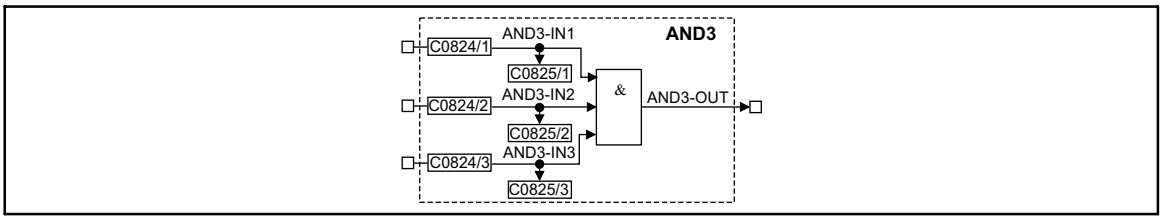


Fig. 3-52 AND operation (AND3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND3-IN1	d	C0825/1	bin	C0824/1	2	1000	-
AND3-IN2	d	C0825/2	bin	C0824/2	2	1000	-
AND3-IN3	d	C0825/3	bin	C0824/3	2	1000	-
AND3-OUT	d	-	-	-	-	-	-

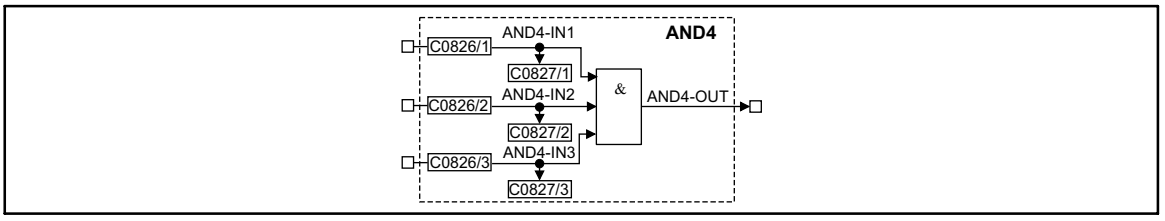


Fig. 3-53 AND operation (AND4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND4-IN1	d	C0827/1	bin	C0826/1	2	1000	-
AND4-IN2	d	C0827/2	bin	C0826/2	2	1000	-
AND4-IN3	d	C0827/3	bin	C0826/3	2	1000	-
AND4-OUT	d	-	-	-	-	-	-

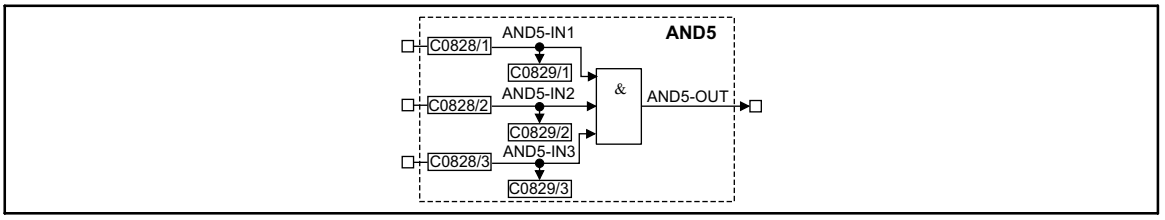


Fig. 3-54 AND operation (AND5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND5-IN1	d	C0829/1	bin	C0828/1	2	1000	-
AND5-IN2	d	C0829/2	bin	C0828/2	2	1000	-
AND5-IN3	d	C0829/3	bin	C0828/3	2	1000	-
AND5-OUT	d	-	-	-	-	-	-

Function

ANDx-IN1	ANDx-IN2	ANDx-IN3	ANDx-OUT
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	1

The function corresponds to a series connection of normally-open contacts in a contactor control.

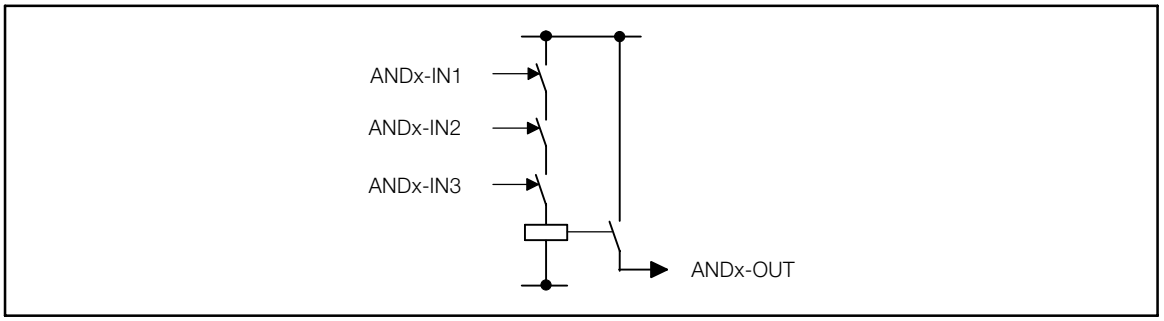


Fig. 3-55 AND function as a series connection of normally-open contacts

Tip!

If only two inputs are required, use the inputs ANDx-IN1 and ANDx-IN2. Assign the input ANDx-IN3 to the signal source FIXED1 via the configuration code.

3.5.7 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

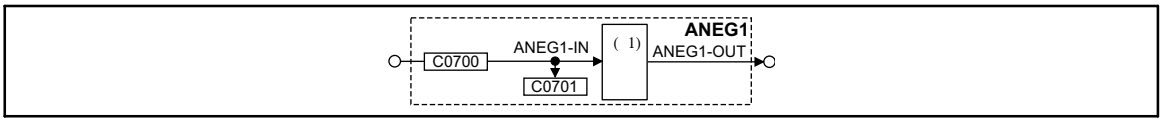


Fig. 3-56 Inverter (ANEG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG1-IN	a	C0701	dec [%]	C0700	1	19523	-
ANEG1-OUT	a	-	-	-	-	-	-

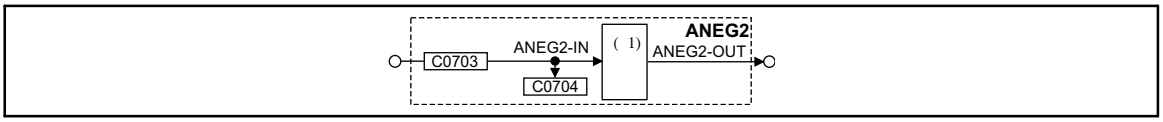


Fig. 3-57 Inverter (ANEG2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG2-IN	a	C0704	dec [%]	C0703	1	1000	-
ANEG2-OUT	a	-	-	-	-	-	-

Function

The input value is multiplied by -1 and then output again.

3.5.8 Analog output via terminal 62/63 (AOUT)

Purpose

AOUT1 and AOUT2 can be used as monitor outputs.

Internal analog signals can be output as voltage signals and be used e.g. as display values or setpoints for slaves.

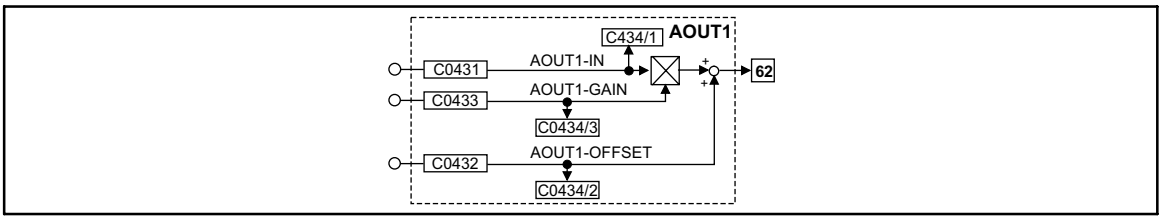


Fig. 3-58 Analog output via terminal X6/62 (AOUT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT1-IN	a	C0434/1	dec [%]	C0431	1	5001	-
AOUT1-GAIN	a	C0434/3	dec [%]	C0433	1	19510	-
AOUT1-OFFSET	a	C0434/2	dec [%]	C0432	1	19512	-

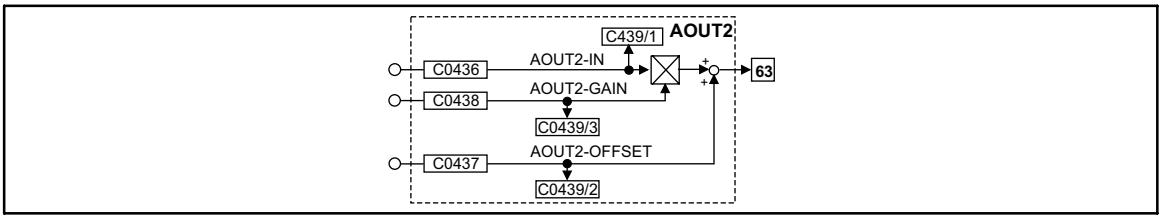


Fig. 3-59 Analog output via terminal X6/63 (AOUT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT2-IN	a	C0439/1	dec [%]	C0436	1	5002	-
AOUT2-GAIN	a	C0439/3	dec [%]	C0438	1	19511	-
AOUT2-OFFSET	a	C0439/2	dec [%]	C0437	1	19513	-

Function

- The value at input AOUTx-IN is multiplied by the value at input AOUTx-GAIN.
  – The formula for the multiplication is: 100% * 100% = 100%.
- The result of the multiplication is limited to ±200%.
- The limited value is added to the value which is applied at input AOUTx-OFFSET.
  – The formula for the addition is 50% + 10% = 60%. The result of the calculation is mapped in such a way that 100% = 10 V.
- The result of the addition is again limited to ±200%.
- The result of the calculation is mapped in such a way that 100% = 10 V and is output as a signal at terminal 62 or 63.

Example for an output value

AOUT1-IN = 50%, AOUT1-GAIN = 100%, AOUT1-OFFSET = 10%

Output terminal 62 = ((50% * 100% = 50%) + 10% = 60%) = 6 V

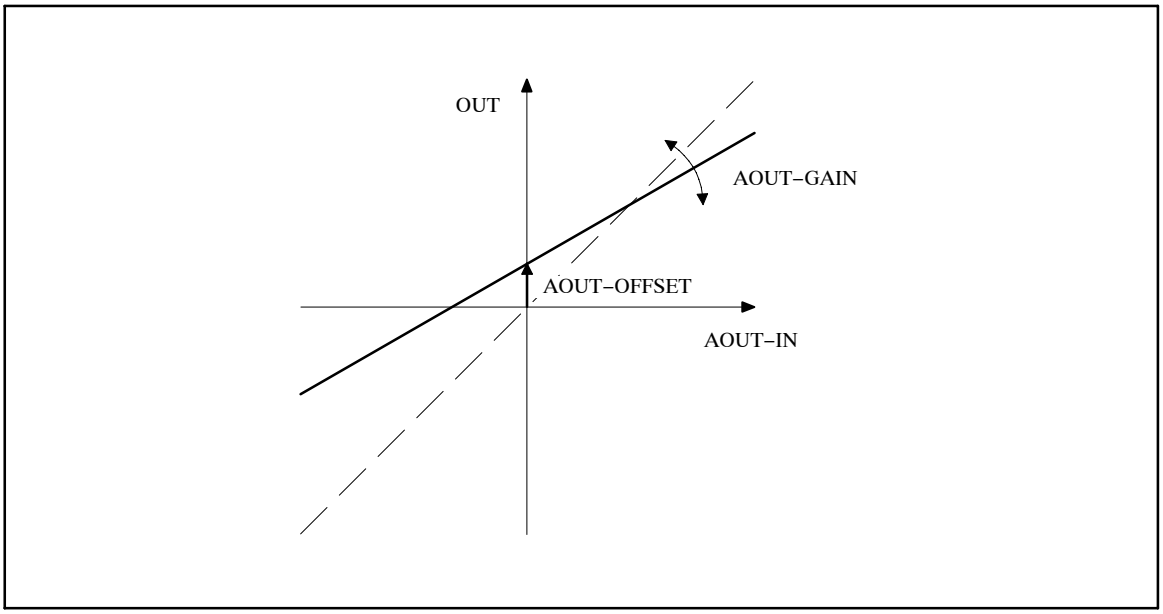


Fig. 3-60 Offset and gain of the analog output

3.5.9 Arithmetic block (ARIT)

Purpose

Arithmetic operation of two ”analog” signals.

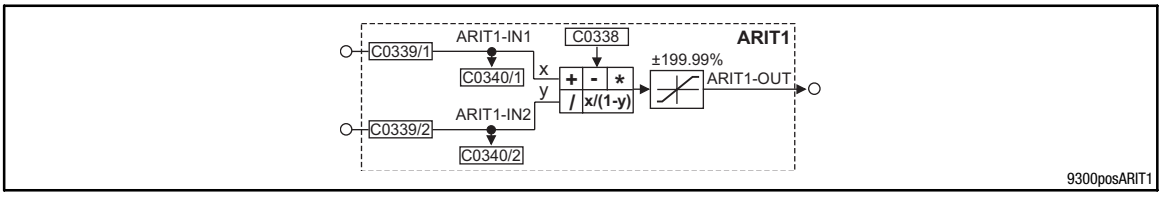


Fig. 3-61 Arithmetic block (ARIT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT1-IN1	a	C0340/1	dec [%]	C0339/1	1	1000	-
ARIT1-IN2	a	C0340/2	dec [%]	C0339/2	1	1000	-
ARIT1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

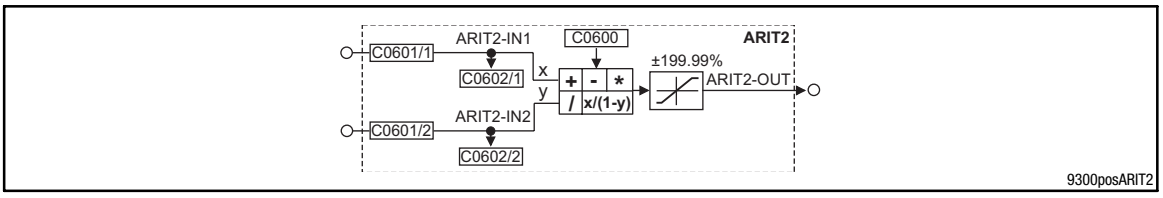


Fig. 3-62 Arithmetic block (ARIT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT2-IN1	a	C0602/1	dec [%]	C0601/1	1	1000	-
ARIT2-IN2	a	C0602/2	dec [%]	C0601/2	1	1000	-
ARIT2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

For both arithmetic blocks the following functions can be preselected:

Code	Subcode	Arithmetic function	Example
ARIT1: C0338	0	OUT = IN1 Note: IN2 will not be processed	
	1	OUT = IN1 + IN2	100% = 50% + 50%
	2	OUT = IN1 - IN2	50% = 100% - 50%
	3	OUT [inc] = IN1 [inc] ×IN2 [inc] ÷16384 OUT [%] = IN1 [%] × IN2 [%] ÷100	100% = 100% ×100% ÷(100)
	4	OUT [inc] = IN1 [inc] ×16384÷100 ÷ |IN2| [inc] OUT [%] = IN1 [%] ÷ | IN2 | [%]	1% = 100% ÷100%
	5	OUT [inc] = IN1 [inc] ×16384 ÷ (16384 - IN2 [inc]) OUT [%] = IN1 [%] × 100 ÷ (100 - IN2 [%])	200% = 100% × (100) ÷ (100 - 50%)

Conversion: [inc] = [%] ÷100 × 16384

3.5.10 Arithmetic block (ARITPH)

Purpose

The FB ARITPH calculates a angle output signal from two angle input signals.

ARITPH1

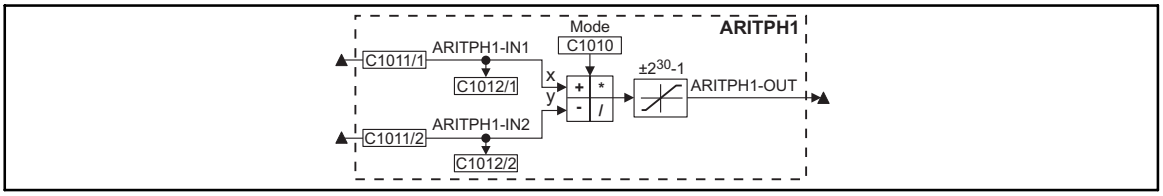


Fig. 3-63 Function block ARITPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH1-IN1	ph	C1012/1	dec [inc]	C1011/1	3	-
ARITPH1-IN2	ph	C1012/2	dec [inc]	C1011/2	3	-
ARITPH1-OUT	ph	-	-	-	-	

ARITPH2

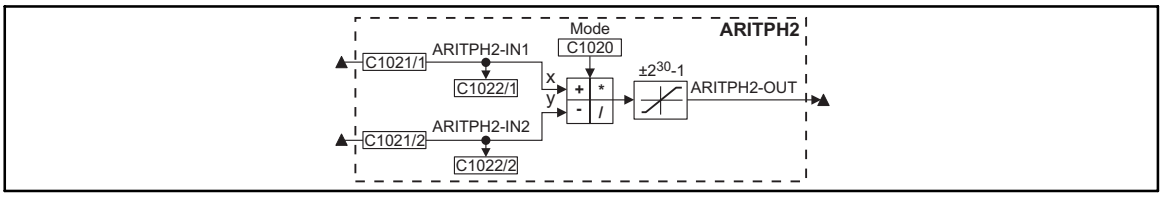


Fig. 3-64 Function block ARITPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH2-IN1	ph	C1022/1	dec [inc]	C1021/1	3	-
ARITPH2-IN2	ph	C1022/2	dec [inc]	C1021/2	3	-
ARITPH2-OUT	ph	-	-	-	-	

ARITPH3

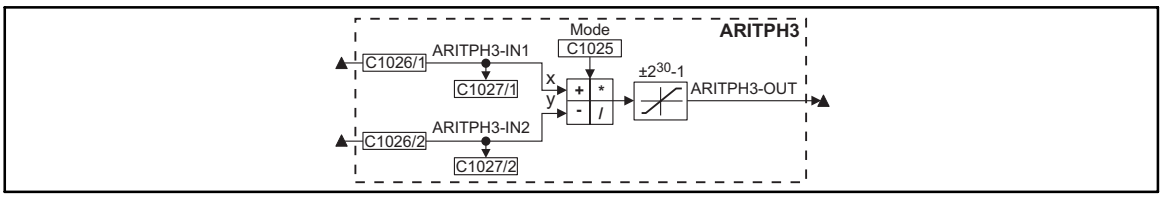


Fig. 3-65 Function block ARITPH3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH3-IN1	ph	C1027/1	dec [inc]	C1026/1	3	-
ARITPH3-IN2	ph	C1027/2	dec [inc]	C1026/2	3	-
ARITPH3-OUT	ph	-	-	-	-	

ARITPH4

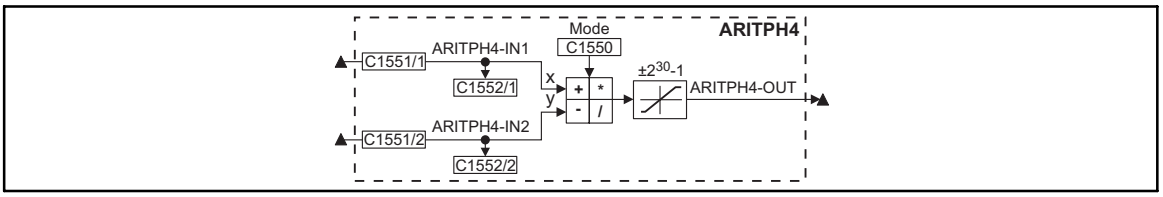


Fig. 3-66 Function block ARITPH4

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH4-IN1	ph	C1552/1	dec [inc]	C1551/1	3	-
ARITPH4-IN2	ph	C1552/2	dec [inc]	C1551/2	3	-
ARITPH4-OUT	ph	-	-	-	-	

ARITPH5

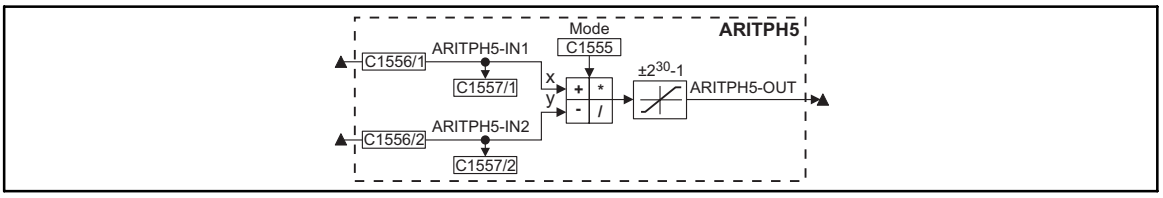


Fig. 3-67 Function block ARITPH5

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH5-IN1	ph	C1557/1	dec [inc]	C1556/1	3	-
ARITPH5-IN2	ph	C1557/2	dec [inc]	C1556/2	3	-
ARITPH5-OUT	ph	-	-	-	-	

ARITPH6

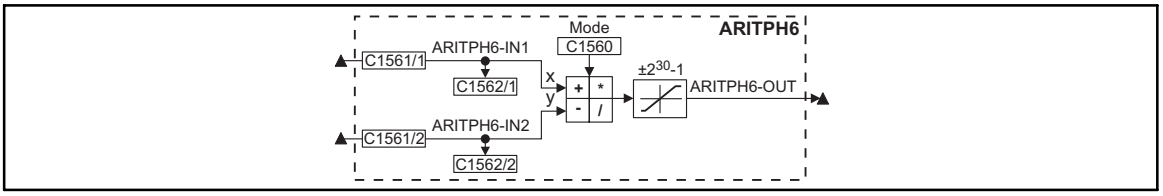
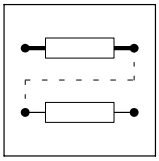


Fig. 3-68 Function block ARITPH6

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH6-IN1	ph	C1562/1	dec [inc]	C1561/1	3	-
ARITPH6-IN2	ph	C1562/2	dec [inc]	C1561/2	3	-
ARITPH6-OUT	ph	-	-	-	-	



Function

- Selection of the arithmetic function with code ARITPH mode.
- The calculation is performed cyclically in the control program.
- The function block limits the results (see table)

Code	Selection number	Arithmetic function	Limitation	Note
ARITPH1: C1010 ARITPH2: C1020 ARITPH3: C1025 ARITPH4: C1550 ARITPH5: C1555 ARITPH6: C1560	0	OUT = IN1		Without limitation
	1	OUT = IN1 + IN2	2^{30} -1	
	2	OUT = IN1 - IN2	2^{30} -1	
	3	OUT = (IN1 × IN2) ÷ 2^{30}	2^{30} -1	Remainder not considered
	13	OUT = IN1 × IN2	2^{31}	
	14	OUT = IN1 ÷ IN2	2^{30} -1	Remainder not considered
	15	OUT = IN1 % IN2		Remainder output (Modulo)
	21	OUT = IN1 + IN2	No limit	Without limitation
	22	OUT = IN1 - IN2	No limit	Without limitation

3.5.11 Analog signal changeover switch (ASW)

Purpose

This FB changes between two analog signals.

This FB enables you to change e.g. during a winding process between an initial diameter and a calculated diameter.

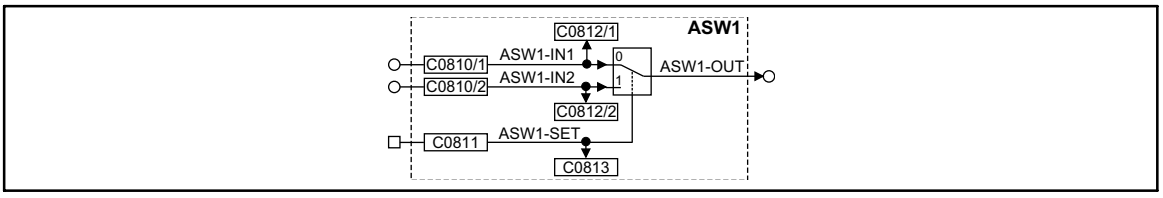


Fig. 3-69 Changeover switch for analog signals (ASW1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW1-IN1	a	C0812/1	dec [%]	C0810/1	1	55	-
ASW1-IN2	a	C0812/2	dec [%]	C0810/2	1	1000	-
ASW1-SET	d	C0813	bin	C0811	2	1000	-
ASW1-OUT	a	-	-	-	-	-	-

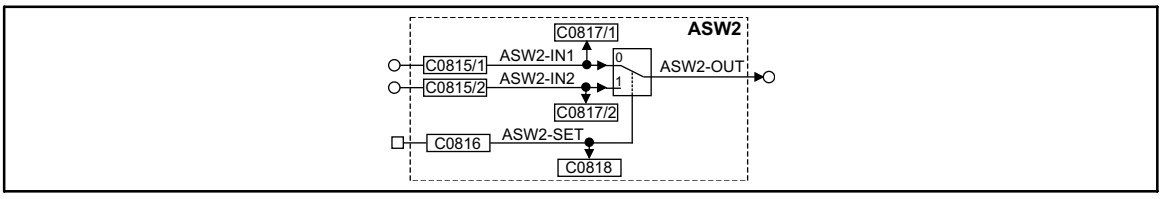


Fig. 3-70 Changeover switch for analog signals (ASW2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW2-IN2	a	C0817/1	dec [%]	C0815/1	1	1000	-
ASW2-IN1	a	C0817/2	dec [%]	C0815/2	1	1000	-
ASW2-SET	d	C0818	bin	C0816	2	1000	-
ASW2-OUT	a	-	-	-	-	-	-

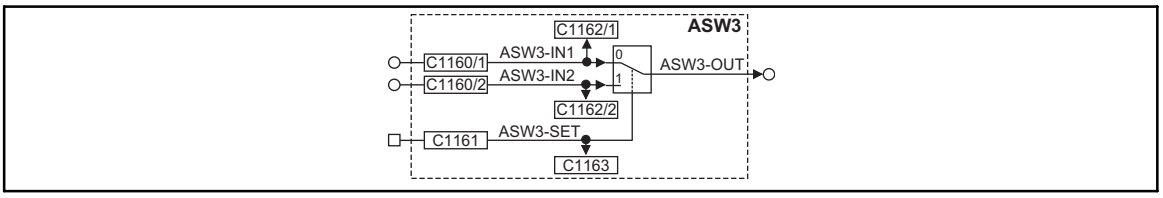


Fig. 3-71 Changeover switch for analog signals (ASW3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW3-IN2	a	C1162/1	dec [%]	C1160/1	1	1000	-
ASW3-IN1	a	C1162/2	dec [%]	C1160/2	1	1000	-
ASW3-SET	d	C1163	bin	C1161	2	1000	-
ASW3-OUT	a	-	-	-	-	-	-

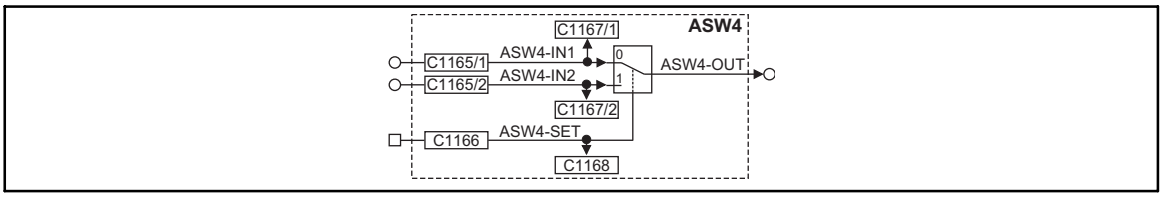


Fig. 3-72 Changeover switch for analog signals (ASW4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW4-IN2	a	C1167/1	dec [%]	C1165/1	1	1000	-
ASW4-IN1	a	C1167/2	dec [%]	C1165/2	1	1000	-
ASW4-SET	d	C1168	bin	C1166	2	1000	-
ASW4-OUT	a	-	-	-	-	-	-

Function

This FB is controlled via the binary input. Depending on the input signal, different signals are sent to the output:

- If a HIGH signal is applied at the binary input, the signal which is applied at the ASWx-IN2 input is sent to the output.
- If a LOW signal is applied, the signal which is applied at the ASW-IN2 input is sent to the output.

3.5.12 BCD decade switch (BCD)

Three FBs are available FB (BCD1 ... BCD3).

Purpose

Reads eight absolute value digits and a sign in binary coding and transmits it to a code.

BCD1

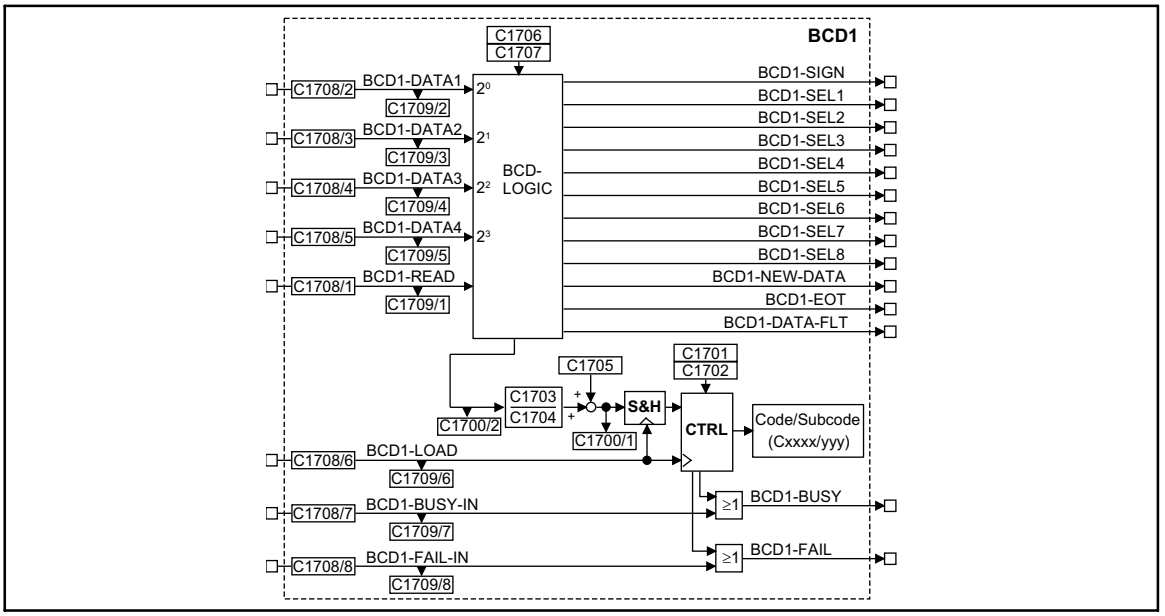


Fig. 3-73 Function block BCD1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD1-DATA1	d	C1709/2	bin	C1708/2	2	Data input (LSB)
BCD1-DATA2	d	C1709/3	bin	C1708/3	2	Data input
BCD1-DATA3	d	C1709/4	bin	C1708/4	2	Data input
BCD1-DATA4	d	C1709/5	bin	C1708/5	2	Data input (MSB).
BCD1-READ	d	C1709/1	bin	C1708/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD1-LOAD	d	C1709/6	bin	C1708/6	2	LOW-HIGH edge = Write data to the code.
BCD1-BUSY-IN	d	C1709/7	bin	C1708/7	2	Generating a collective busy signal
BCD1-FAIL-IN	d	C1709/8	bin	C1708/8	2	Generating a collective fail signal
BCD1-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD1-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD1-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD1-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD1-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD1-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD1-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD1-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD1-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD1-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD1-EOT	d	-	-	-	-	HIGH = all BCDs read or "CANCEL" recognised.
BCD1-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD1-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD1-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD2

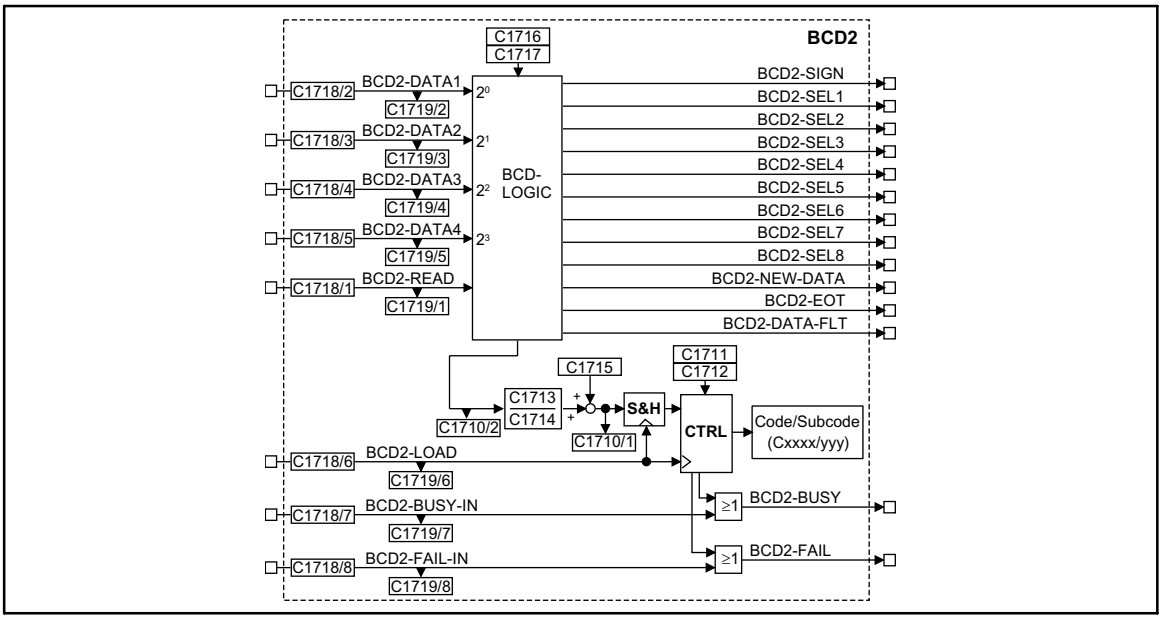


Fig. 3-74 Function block BCD2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD2-DATA1	d	C1719/2	bin	C1718/2	2	Data input (LSB)
BCD2-DATA2	d	C1719/3	bin	C1718/3	2	Data input
BCD2-DATA3	d	C1719/4	bin	C1718/4	2	Data input
BCD2-DATA4	d	C1719/5	bin	C1718/5	2	Data input (MSB)
BCD2-READ	d	C1719/1	bin	C1718/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD2-LOAD	d	C1719/6	bin	C1718/6	2	LOW-HIGH edge = Write data to the code.
BCD2-BUSY-IN	d	C1719/7	bin	C1718/7	2	Generating a collective busy signal
BCD2-FAIL-IN	d	C1719/8	bin	C1718/8	2	Generating a collective fail signal
BCD2-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD2-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD2-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD2-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD2-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD2-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD2-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD2-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD2-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD2-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD2-EOT	d	-	-	-	-	HIGH = all BCDs read or "CANCEL" recognised.
BCD2-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD2-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD2-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD3

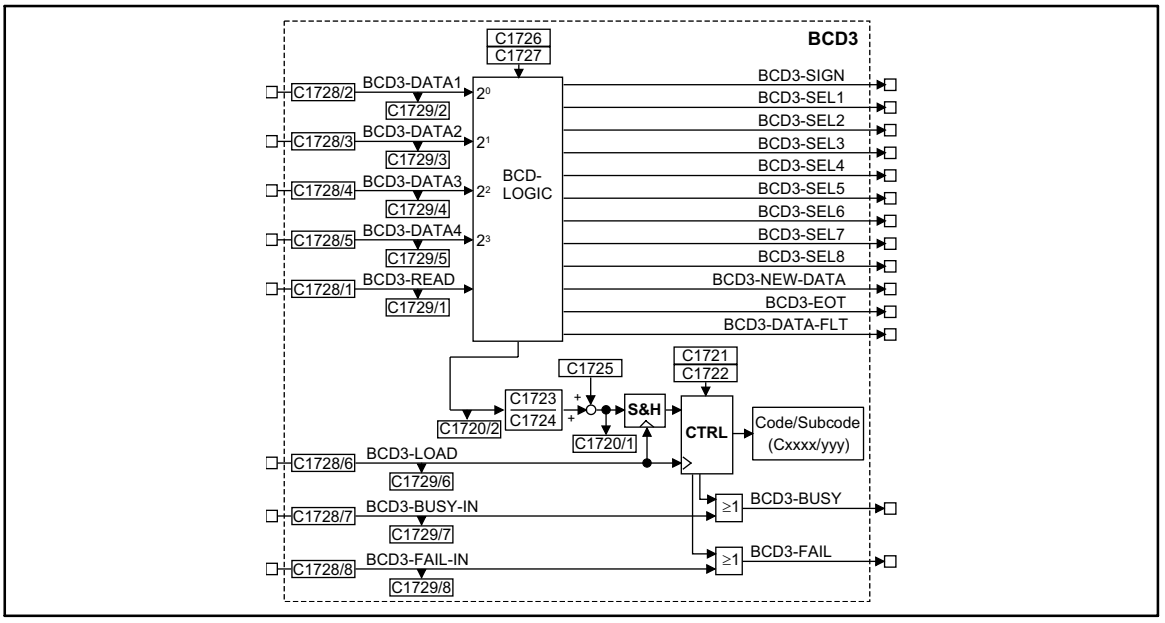


Fig. 3-75 Function block BCD3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD3-DATA1	d	C1729/2	bin	C1728/2	2	Data input (LSB)
BCD3-DATA2	d	C1729/3	bin	C1728/3	2	Data input
BCD3-DATA3	d	C1729/4	bin	C1728/4	2	Data input
BCD4-DATA4	d	C1729/5	bin	C1728/5	2	Data input (MSB)
BCD3-READ	d	C1729/1	bin	C1728/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD3-LOAD	d	C1729/6	bin	C1728/6	2	LOW-HIGH edge = Write data to the code.
BCD3-BUSY-IN	d	C1729/7	bin	C1728/7	2	Generating a collective busy signal
BCD3-FAIL-IN	d	C1729/8	bin	C1728/8	2	Generating a collective fail signal
BCD3-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD3-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD3-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD3-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD3-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD3-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD3-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD3-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD3-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD3-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD3-EOT	d	-	-	-	-	HIGH = all BCDs read or ”CANCEL” recognised.
BCD3-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD3-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD3-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

Overview of the codes for the evaluation of the read data and for the selection of the target code.

Function	BCD1	BCD2	BCD3
Output signal (DIS)	C1700/1	C1710/1	C1720/1
BCD result of the read data (DIS)	C1700/2	C1710/2	C1720/2
Target code	C1701	C1711	C1721
Subcode of the target code	C1702	C1712	C1722
Numerator (evaluation of the result)	C1703	C1713	C1723
Denominator (evaluation of the result)	C1704	C1714	C1724
Offset (evaluation of the result)	C1705	C1715	C1725

Function

- BCD decade switch
- Data inputs
- Signal processing
- ”CANCEL” function
- ”RESET” function
- BCD decade switch
- Complete BCD reading
- BCD mode

3.5.12.1 Data inputs

Evaluation of the read data:

BCDx-Datax MSB ... LSB	BCD ABSOLUTE VALUE	BCD-SIGN
0000	0	(+)
0001	1	
0010	2	
0011	3	
0100	4	
0101	5	
0110	6	
0111	7	
1000	8	(-)
1001	9	
1010	CANCEL	CANCEL
1011	RESET	RESET
1100	BCD error	BCD error
1101		
1110		
1111		

3.5.12.2 Signal processing

Reading the BCDs:

Output	Signal	Function
BCDx-EOT	LOW	Beginning of the BCD reading.
	HIGH	If • all 8 absolute value digits and the sign are transmitted or • "CANCEL" has been identified.
BCDx-NEW-DATA	LOW	After a LOW-HIGH edge at BCD-READ.
	HIGH	After the transmission of a BCD is completed.
BCDx-DATA-FLT	HIGH	If "BCD error" has been identified (see table in chapter 3.5.12.1).
BCDx-FAIL	HIGH	If • the permissible value range for the target code is exceeded or • BCDx-DATA-FLT = HIGH has occurred before.

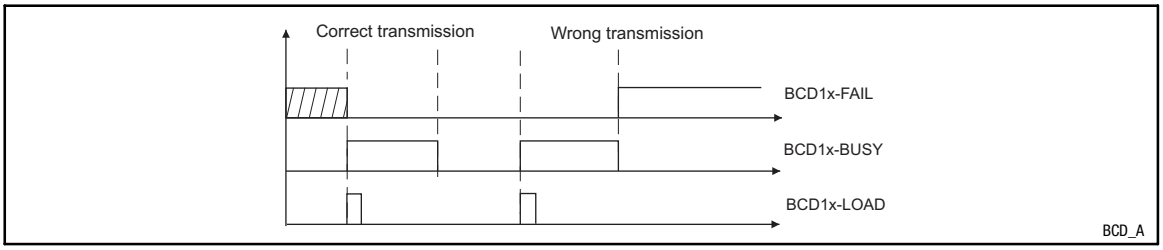


Fig. 3-76 Signal shape for FB BCD1 for the transmission to the target code

Transmission sequence of data to the target code:

Output	Signal	Function
BCDx-LOAD	LOW-HIGH edge	Transmits the signal to the target code.
BCDx-BUSY	HIGH	For the time of transmission
BCDx-FAIL	HIGH	If a transmission error occurs. Only another LOW-HIGH edge at BCDx-LOAD switches BCDx-FAIL = LOW. Transmission error: • No target code • No target subcode. • transmitted data are out of the target code limits. • "BCD error" has been identified (BCDx-DATA-FLT = HIGH). • The target code is inhibited. Code can only be written when the controller is inhibited.

For the data conditioning for the target code see FB FEVAN. (📖 3-195)

3.5.12.3 ”CANCEL” function

The identification for ”CANCEL” at the inputs BCDx-DATAx results in the following state:

Input/output	Signal	Function
BCDx-EOT	HIGH	Switches
BCDx-NEW-DATA	HIGH	Switches
-	-	Sets BCDs which are not yet read to zero and stops reading.
-	-	The inputs BCDx-DATAx expect the sign as the next BCD.

3.5.12.4 ”RESET” function

The identification for ”RESET” at the inputs BCDx-DATAx results in the following state:

Function	Input/output	Signal
Switches	BCDx-EOT	LOW
Switches	BCDx-DATA-FLT	LOW
Switches for a millisecond	BCDx-NEW-DATA	LOW
Switches if BCDx-FAIL-IN = LOW is switched at the same time (internal OR link).	BCDx-FAIL	LOW
Switches if BCDx-BUSY-IN = LOW is switched at the same time (internal OR link).	BCDx-BUSY	LOW
The inputs BCDx-DATAx expect the sign as the next BCD.	-	-
The BCD read last remains and can be transmitted to the target code.	-	-

3.5.12.5 BCD decade switch

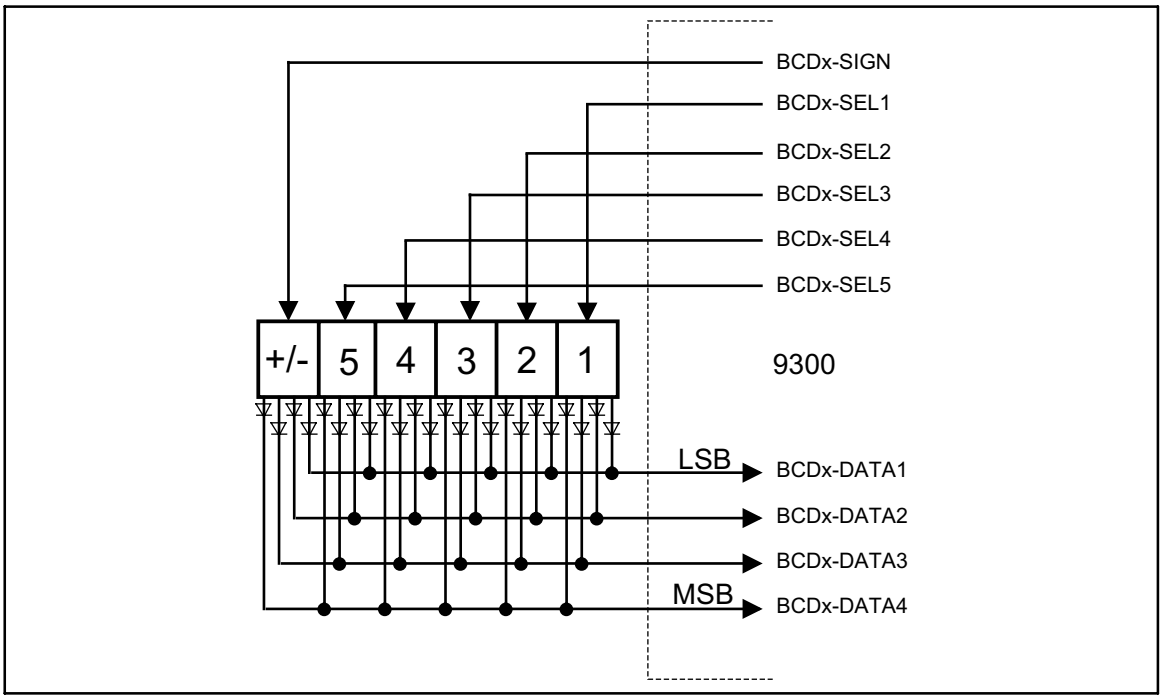


Fig. 3-77 Connection of a BCD decade switch

- The data outputs of the BCD decade switch must be decoupled via diodes. If necessary, use a terminal extension (via system bus CAN).
  – LENZE offers this terminal extension.

Function

A BCD is transmitted to the target code as follows:

Input/output	Signal	Function
BCDx-SELx or BCDx-SIGN	HIGH	Triggers the corresponding BCD decade switch. Reading and temporary storing of the BCD data to BCDx-DATA1 ... BCDx-DATA4.
BCDx-LOAD	LOW-HIGH edge	Writes BCD data to the target code.

3.5.12.6 Complete BCD reading

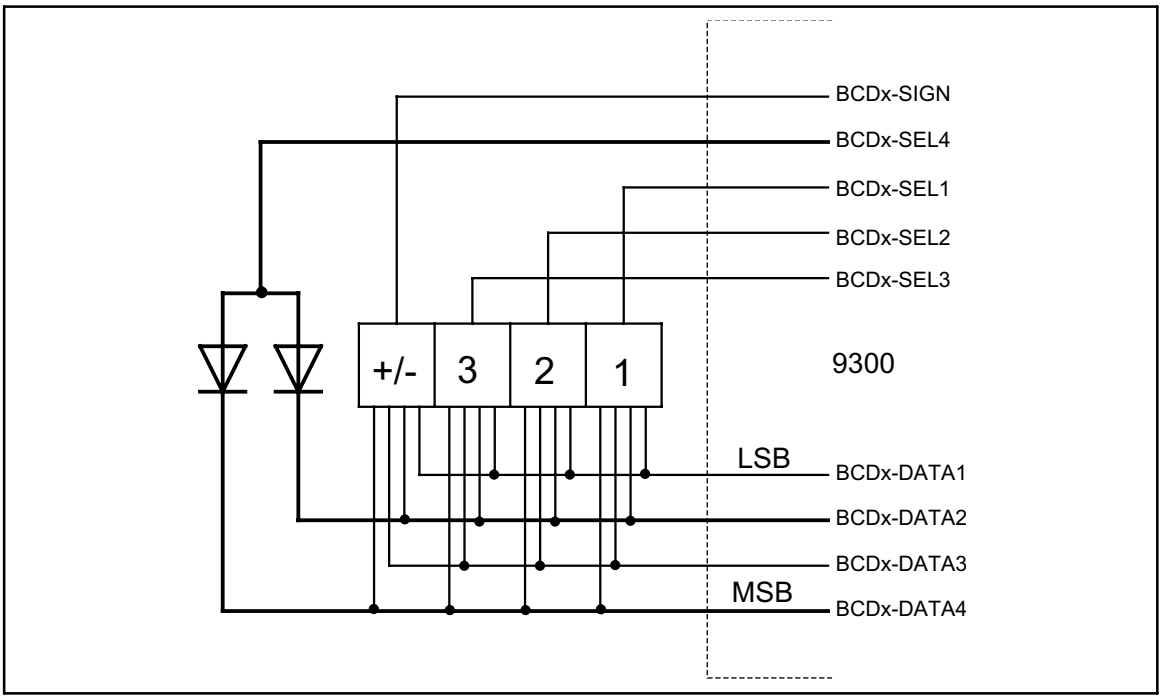
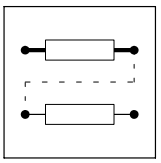


Fig. 3-78 Cancel after the 3rd absolute value digit (diode circuit)

Function

Reading can be shortened if BCDs are not required.

- The FB does not read the following BCDs if the value A_{hex} (1010_{bin}) for ”ABORT” is transmitted after a BCD has been read. The reading stops with the identification of ”ABORT”.
- In the case of the abort via a value digit, the least significant bit (LSB) is to be assigned with ”ABORT”, because the reading sequence stops at the least significant bit.
- In the handshake mode, ”CANCEL” should be identified at the beginning of the data transmission (see also the following chapter).



3.5.12.7 BCD mode

The BCD mode defines the type of BCD transmission (not the transmission to the target code).

Overview of the settings in the BCD mode:

Function	BCD1	BCD2	BCD3
BCD mode • 0 = no handshaking • 1 = handshaking	C1706	C1716	C1726
BCD delay in ms (only for data transmission without handshaking)	C1707	C1717	C1727

No handshaking, minimum wiring

Set BCD mode = 0.

Function

- Cyclic reading of BCDs
  - No acceptance signal (BCDx-READ), e.g. for reading a BCD decade switch required.
- Set BCD delay (see table)
  - Defines the period between reading the individual BCDs. The setting may be necessary if a bus system provides the data transfer between the BCD decade switch and the FB BCDx (e.g. terminal extension via system bus).
  - The bus system used, the baud rate, and the bus load determine the time to be set.

The BCDs are read in the following sequence:

1. Sign
2. BCD 1
3. BCD 2
4. etc.

With handshaking, minimum wiring

Set BCD mode = 1.

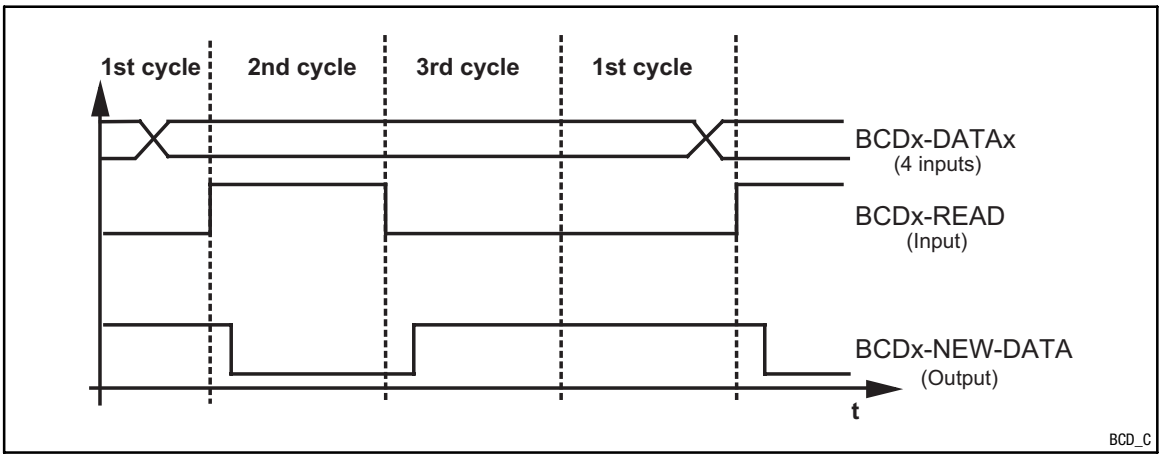


Fig. 3-79 Sequence of handshaking

Function

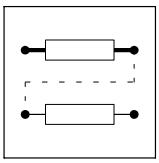
- The superimposed control (e.g. PLC) determines the time of data transmission.
- After the acceptance signal has been sent from the control to BCDx-READ the BCD is read.
  - The signal must be sent for every BCD.
  - The reading routine of the FB BCD remains in waiting position until the data transmission is started.

The BCDs are read in the following sequence:

1. Sign
2. BCD 1
3. BCD 2
4. etc.

Transmission sequence of a BCD:

Input/output	Signal	Function
BCDx-DATA1 ... BCDx-DATA4		Generating data for the first or next BCD via PLC.
BCDx-NEW-DATA	HIGH	Enables the transmission for the next BCD.
BCDx-READ	LOW-HIGH edge	Reading of the BCD data to the FB BCD.
BCDx-NEW-DATA	LOW	Inhibits the transmission for the next BCD.
BCDx-READ	LOW	Set via PLC.



3.5.13 Holding brake (BRK)

Danger!

Condition for applying the BRK function block

Exclusively triggering the holding brake via the function block BRK is not permissible!

The **safe** triggering of the holding brake additionally requires a second switch-off mode. Without the second switch-off mode there is a risk of severe personal injury and danger to material assets!

Applications with active loads

With an increase of the DC-bus voltage (e.g. by braking processes) the torque limitation may intervene due to code C0172. The torque limitation is activated if e.g.

- the brake resistor is damaged.
- the switching threshold set at the brake chopper or brake module is not adapted correctly.

Code C0172 is a pre-stage of the monitoring function “OU” (overvoltage of the DC-bus voltage). Code C0172 defines which differential mode voltage causes a reduction in torque before OU. With the default setting the torque is reduced to ”0” if the DC-bus voltage amounts to 760 V (770 V - 10 V):

- OU threshold = 770V (C0173 = 0...3)*
- C0172 = 10 V
- No message is generated.

Only after the DC-bus voltage is decreased below the OU reclosing threshold the torque is reconnected.

With unchanged basic conditions the continuously ”chopping” drive behaviour may lead to undefined motions.

Remedy:

5. Set C0172 = 0 V
6. MONIT-OU must generate EEr-TRIP (e.g. with C0871/0 = 15011).
   This serves to apply the standstill brake over the controller inhibit (CINH) if the braking energy cannot be dissipated.

*) Exception: OU threshold 800 V with C0173 = 4 (see description in code table)

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traversing drives
- Active loads

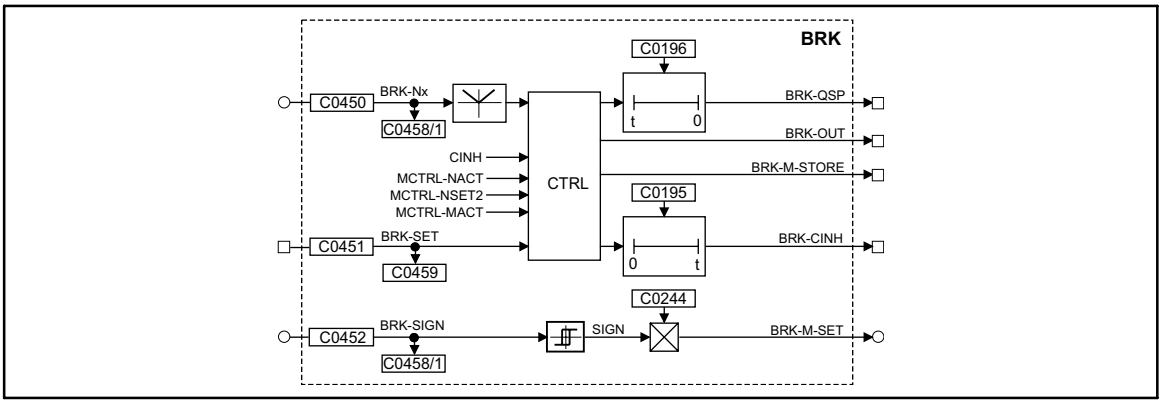


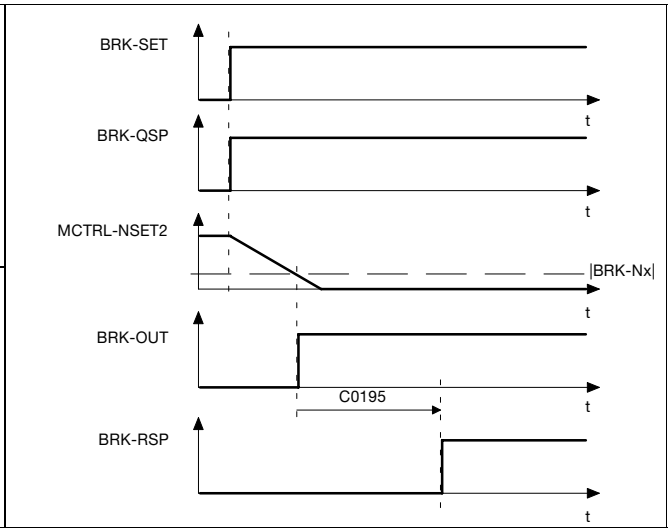
Fig. 3-80 Holding brake (BRK)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
BRK-SET	d	C0459	bin	C0451	2	1000	-
BRK-NX	a	C0458/1	dec [%]	C0450	1	1000	Speed threshold from which the drive may output the signal "Close brake". The signal source for this input can be a control code, a fixed value, or any other analog FB output.
BRK-SIGN	a	C0458/2	dec [%]	C0452	1	1000	Direction of the torque with which the drive is to set up a torque against the brake. The signal source for this input can be a control code, a fixed value, or any other FB output.
BRK-M-SET	a	-	dec [%]	C0244	-	0.00	Holding torque of the DC injection brake 100 % = value of C0057
BRK-T-ACT	a	-	dec	C0195	-	99.9	Brake application time
BRK-T-RELEASE	a	-	dec	C0196	-	0.0	Brake release time

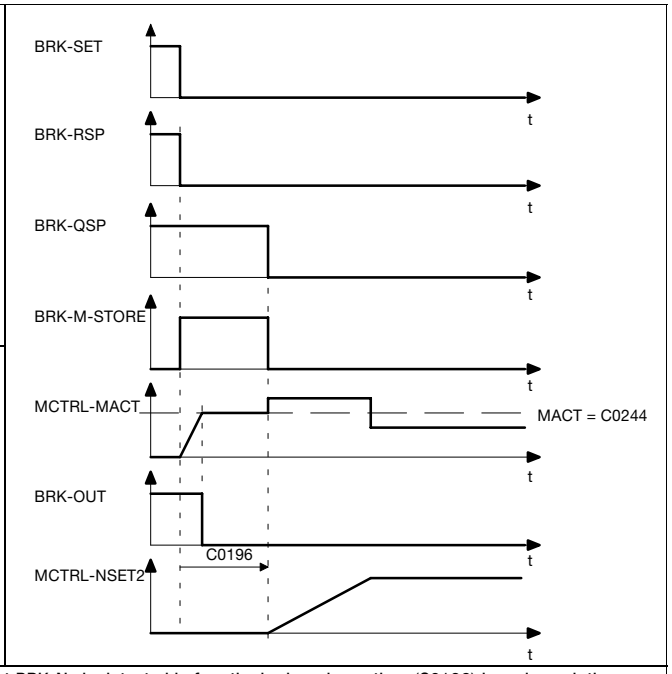
Function

The signals N-ACT, M-ACT, N-SET and BRK-Nx are processed as absolute values within the function block.

3.5.13.1 Applying the brake

Purpose	A HIGH-Signal at the BRK-SET input activates the function. The BRK-QSP output is simultaneously set to HIGH. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.	
Function	If the setpoint speed falls below the value set at the BRK-Nx input, the BRK-OUT output is set to HIGH. In order to ensure a fail-safe design this signal must be inverted at the output (e.g. via C0118).	

3.5.13.2 Opening the brake (release)

Purpose	A LOW signal at the BRK-SET input immediately sets the BRK-CINH output to LOW. At the same time the BRK-M-STORE output is set to HIGH. This signal can be used to generate a defined torque against the brake. The drive thus takes over the torque while the brake is released. The signal is only reset after the time set under C0196 is elapsed.	
Function	The BRK-OUT output signal is set to LOW as soon as the torque reaches the value set under C0244 (holding torque). When the input is reset, a time element is triggered. After the time set under C0196 has elapsed the BRK-QSP output is reset. This signal serves to e.g. release the setpoint integrator after the brake release time has elapsed.	
Note	If an actual value higher than the value at BRK-Nx is detected before the brake release time (C0196) has elapsed, the signals BRK-QSP and BRK-M-STORE are reset immediately. The drive can immediately operate speed or phase-controlled. If the BRK-QSP output acts on the QSP control word the drive is synchronised to the actual speed and follows its setpoint.	

3.5.13.3 Setting controller inhibit

Purpose

Controller inhibit can be set e.g. in case of a fault (LU, OU, …).

Function

When the controller is inhibited (CINH) the BRK-OUT signal is immediately set to HIGH. The drive is then braked via the mechanical brake.

If the fault is eliminated quickly, i.e. the controller inhibit (CINH) is reset before the actual falls below the threshold value BRK-Nx, the BRK-OUT signal is set immediately to LOW. The drive is synchronised to the actual speed and follows its setpoint.

If the value falls below the threshold, the drive starts as described under ”Opening the brake”.

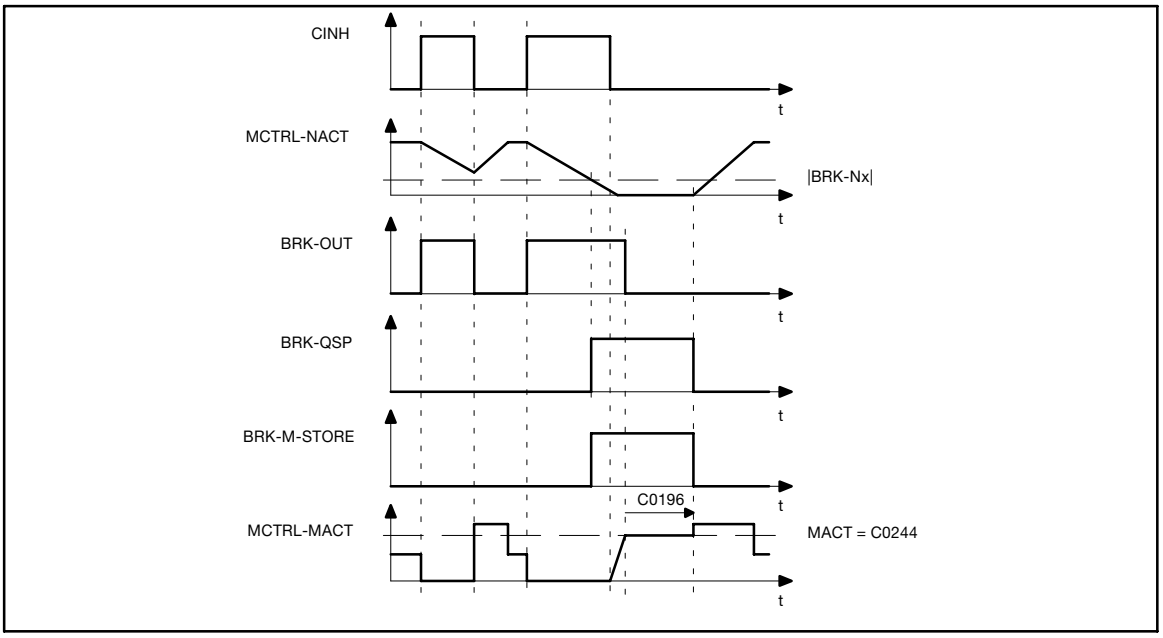


Fig. 3-81 Control brake by CINH

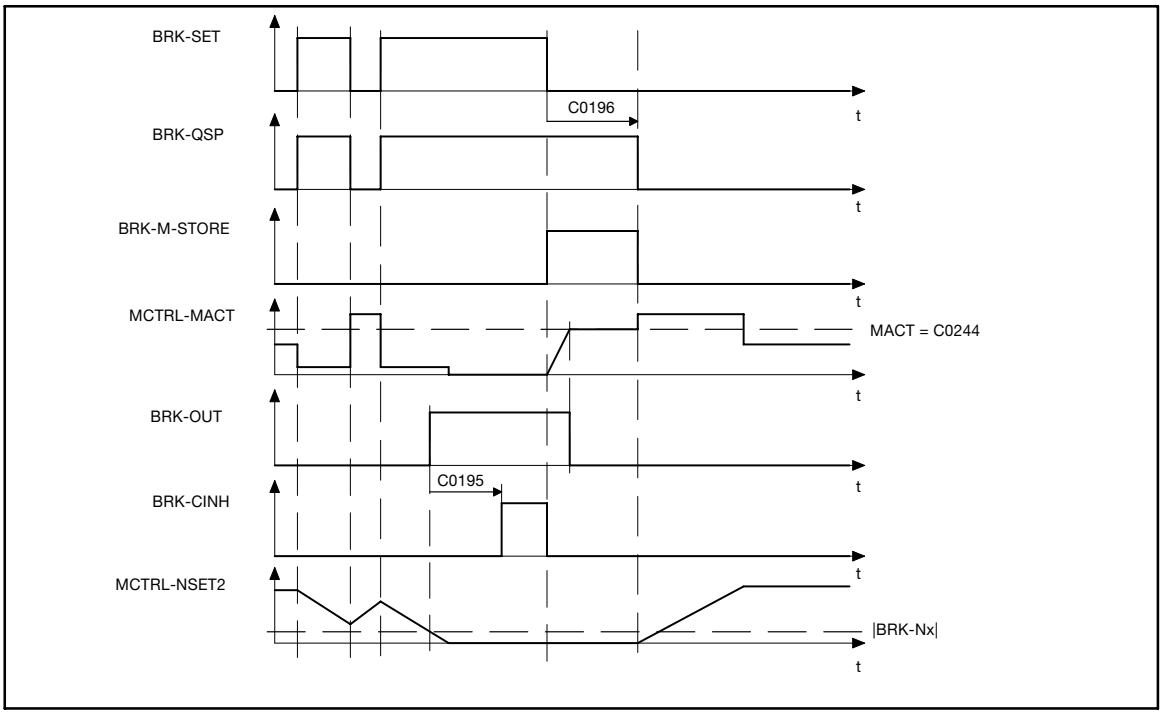
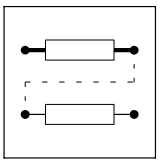


Fig. 3-82 Switching cycle when braking

3.5.14 System bus (CAN-IN)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.



3.5.15 System bus (CAN-OUT)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.5.16 Comparator (CMP)

Purpose

These FBs serve to compare two analog signals. Three comparators are available which serve to implement triggers.

CMP1

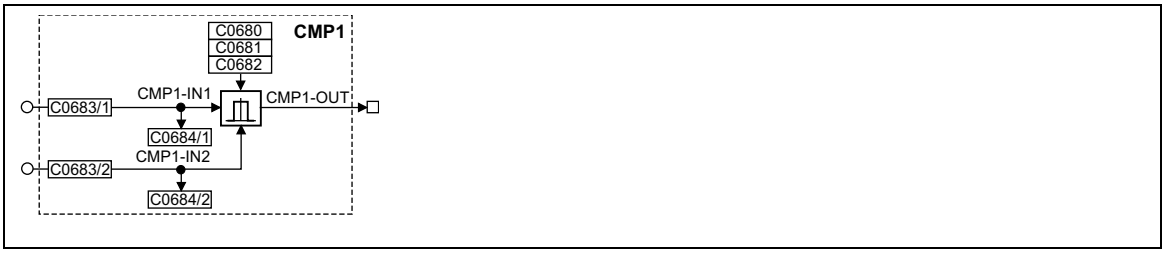


Fig. 3-83 Comparator (CMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP1-IN1	a	C0684/1	dec [%]	C0683/1	1	5001	-
CMP1-IN2	a	C0684/2	dec [%]	C0683/2	1	19500	-
CMP1-OUT	a	-	-	-	-	-	-

CMP2

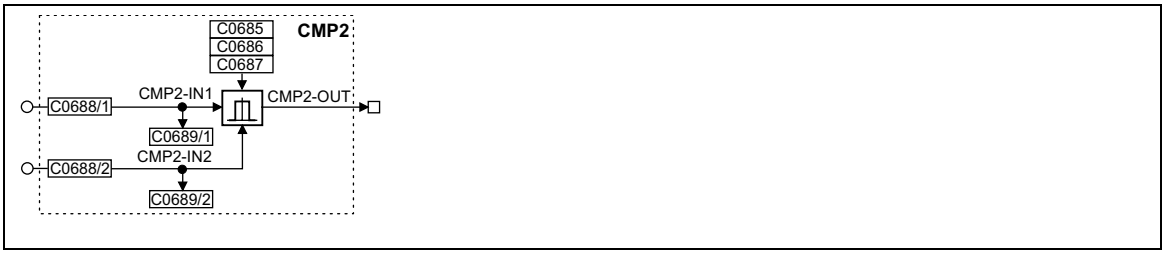


Fig. 3-84 Comparator (CMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP2-IN1	a	C0689/1	dec [%]	C0688/1	1	1000	-
CMP2-IN2	a	C0689/2	dec [%]	C0688/2	1	1000	-
CMP2-OUT	a	-	-	-	-	-	-

CMP3

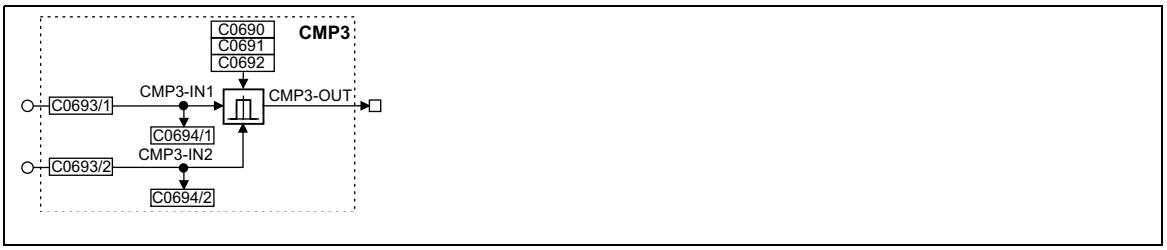


Fig. 3-85 Comparator (CMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP3-IN1	a	C0694/1	dec [%]	C0693/1	1	1000	-
CMP3-IN2	a	C0694/2	dec [%]	C0693/2	1	1000	-
CMP3-OUT	a	-		-	-	-	-

Function

The description uses the example of CMP1 and also applies to CMP2 and CMP3.

The function of these function blocks can be set via code C0680 (CMP1). The following comparison operations are available:

- CMP1-IN1 = CMP1-IN2
- CMP1-IN1 > CMP1-IN2
- CMP1-IN1 < CMP1-IN2
- |CMP1-IN1| = |CMP1-IN2|
- |CMP1-IN1| > |CMP1-IN2|
- |CMP1-IN1| < |CMP1-IN2|

3.5.16.1 Function 1: CMP1-IN1 = CMP1-IN2

This function serves to compare two signals with regard to equality. Hence, the comparison "actual speed equals setpoint speed ($n_{act} = n_{set}$)" can be carried out.

- Via code C0682 the window of equality can be set.
- Via code C0681 a hysteresis can be set if the input signals are not stable and cause the output to oscillate.

The exact function can be obtained from the line diagram.

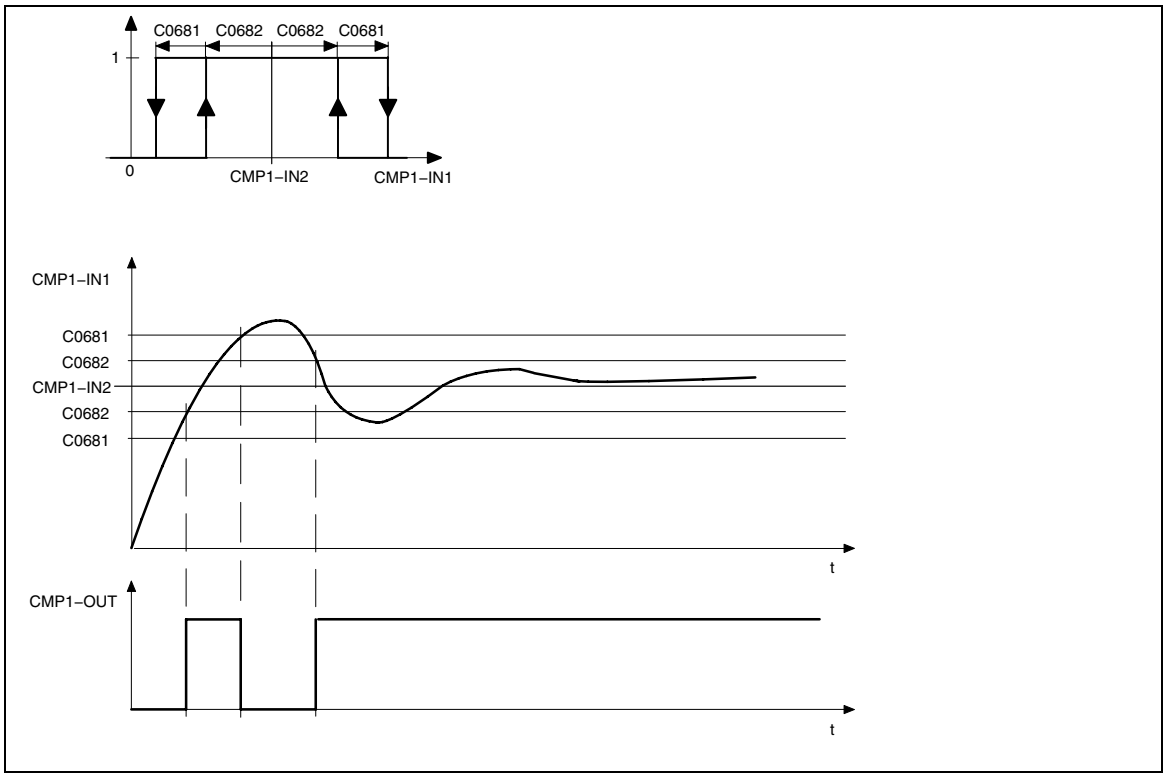


Fig. 3-86 Equality of signals (CMP1-IN1 = CMP1-IN2)

3.5.16.2 Function 2: CMP1-IN1 > CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is higher than a limit value ($n_{act} > n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 exceeds the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 falls below the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

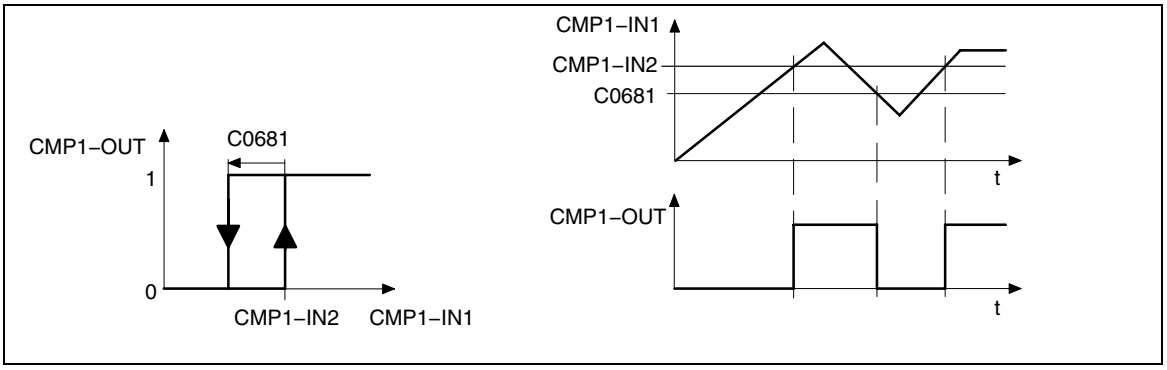


Fig. 3-87 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

3.5.16.3 Function 3: CMP1-IN1 < CMP1-IN2

This function is used, for example, to implement the comparison "Actual speed is lower than a limit value ($n_{act} < n_x$)" for a direction of rotation.

- If the value at input CMP1-IN1 falls below the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 exceeds the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

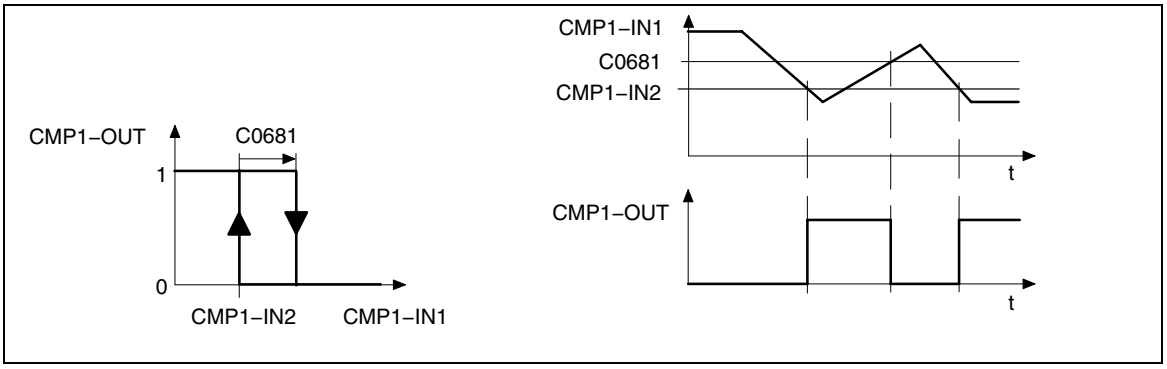


Fig. 3-88 Values falling below signal values (CMP1-IN1 CMP1-IN2)

3.5.16.4 Function 4: |CMP1-IN1| = |CMP1-IN2|

This function is the same as function 1. Before signal processing the absolute value of the input signals (without sign) is generated.

This can be used to implement the comparison "$n_{act} = 0$".

3.5.16.5 Function 5: |CMP1-IN1| > |CMP1-IN2|

This function is the same as function 3. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| > |n_x|$" irrespective of the direction of rotation.

3.5.16.6 Function 6: |CMP1-IN1| < |CMP1-IN2|

This function is the same as function 2. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison "$|n_{act}| < |n_x|$" irrespective of the direction of rotation.

3.5.17 Long comparator (CMPPH)

Three FBs are available (CMPPH1 ... CMPPH3).

Purpose

Comparison of two phase signals or their absolute values to achieve triggers.

CMPPH1

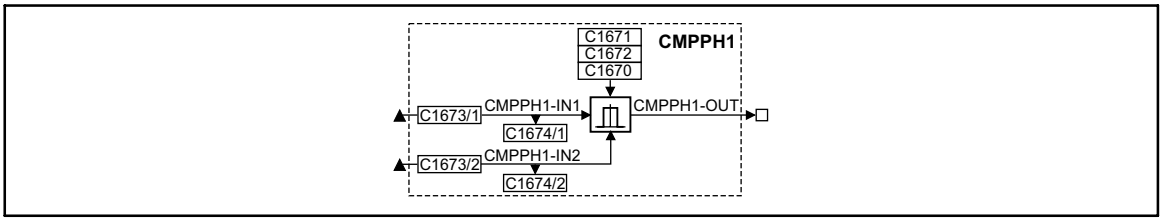


Fig. 3-89 Function block CMPPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH1-IN1	ph	C1674/1	dec [inc]	C1673/1	3	-
CMPPH1-IN2	ph	C1674/2	dec [inc]	C1673/2	3	-
CMPPH1-OUT	d	-	-	-	-	-

CMPPH2

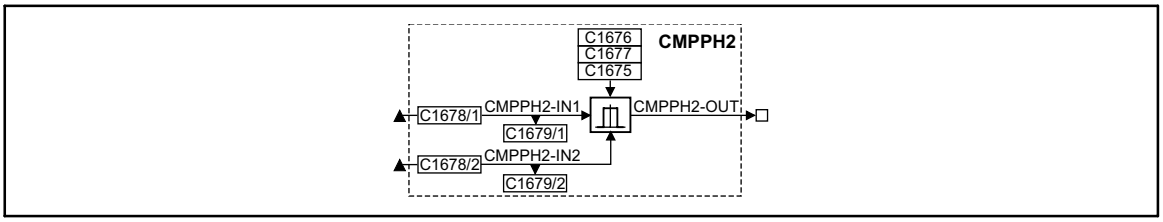


Fig. 3-90 Function block CMPPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH2-IN1	ph	C1679/1	dec [inc]	C1678/1	1	-
CMPPH2-IN2	ph	C1679/2	dec [inc]	C1678/2	1	-
CMPPH2-OUT	d	-	-	-	-	-

CMPPH3

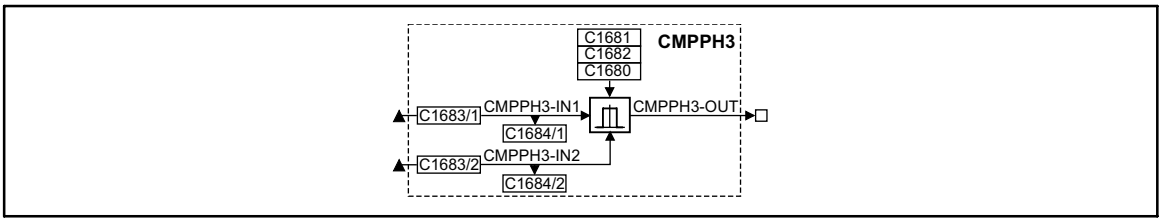


Fig. 3-91 Function block CMPPH3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH3-IN1	ph	C1684/1	dec [inc]	C1683/1	1	-
CMPPH3-IN2	ph	C1684/2	dec [inc]	C1683/2	1	-
CMPPH3-OUT	d	-	-	-	-	-

Function

FB CMPPH1 serves as example for the functions. They are also applicable for the FB CMPPH2 and CMPPH3.

The following functions can be selected via C1670 (CMPPH1):

- Function 1: CMPPH1-IN1 = CMPPH1-IN2
- Function 2: CMPPH1-IN1 > CMPPH1-IN2
- Function 3: CMPPH1-IN1 < CMPPH1-IN2
- Function 4: |CMPPH1-IN1| = |CMPPH1-IN2|
- Function 5: |CMPPH1-IN1| > |CMPPH1-IN2|
- Function 6: |CMPPH1-IN1| < |CMPPH1-IN2|

3.5.17.1 Function 1: CMPPH1-IN1 = CMPPH1-IN2

Comparison of two phase signals.

- Set the window under C1672, where the equality is to be effective.
- Set a hysteresis under C1671 if the input signals are not stable and the output oscillates.

The exact function can be obtained from the line diagram.

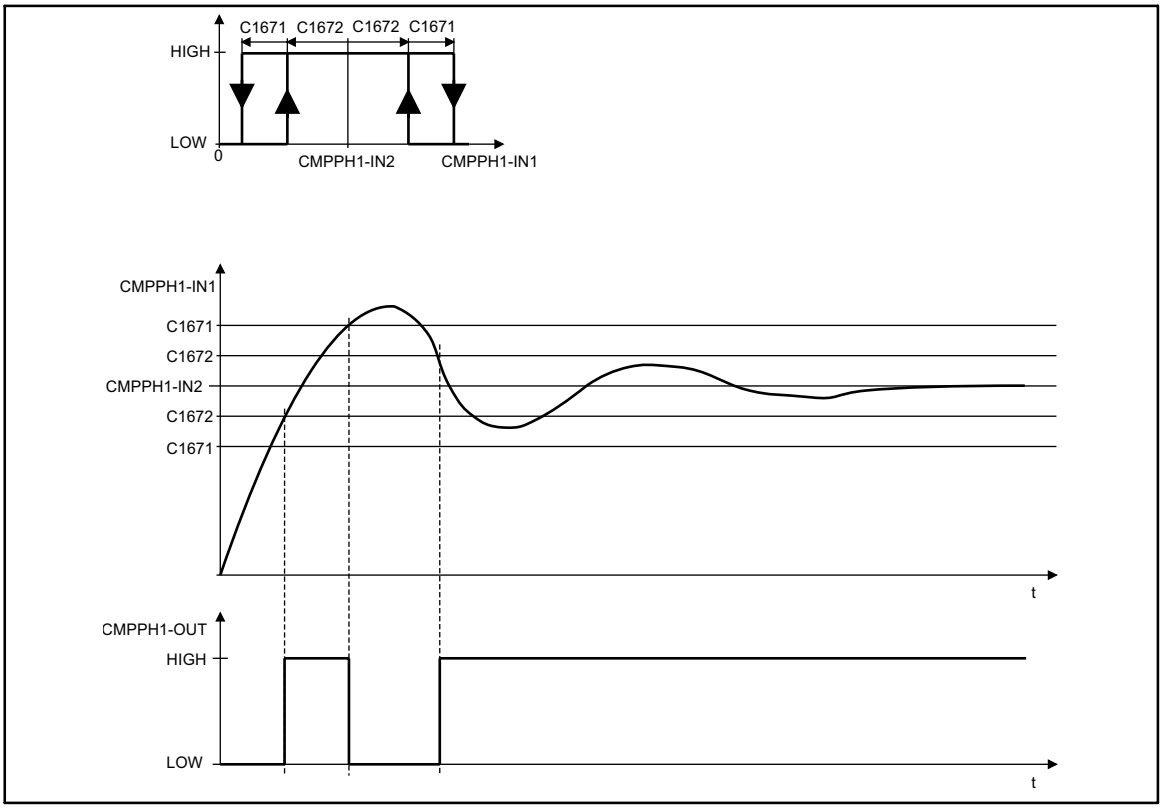


Fig. 3-92 Equality of signals (CMPPH1-IN1 = CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase equal to setpoint phase ($ph_{act.}$= ph_{set})”.

3.5.17.2 Function 2: CMPPH1-IN1 > CMPPH1-IN2

- CMPPH1-IN1 > CMPPH1-IN2
  – CMPPH1-OUT = HIGH
- CMPPH1-IN1 < CMPPH1-IN2
  – CMPPH1-OUT = LOW

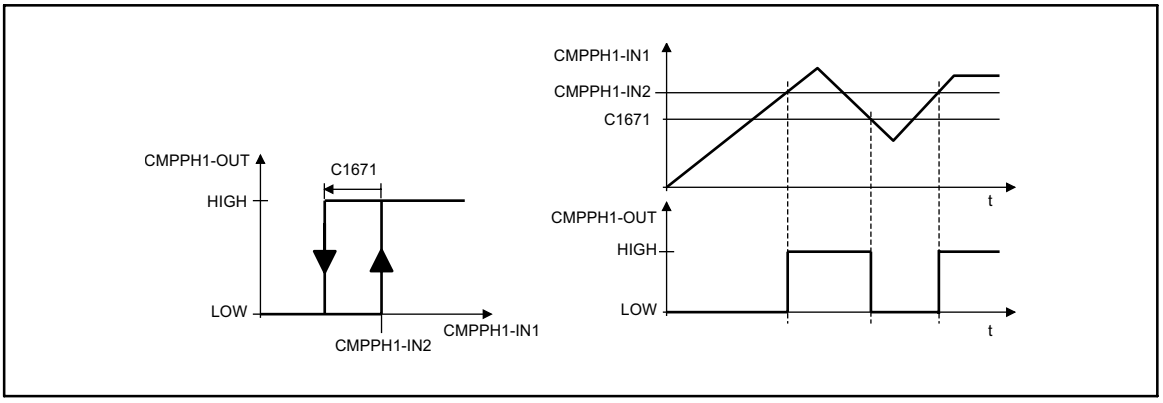


Fig. 3-93 Exceeding signal values (CMPPH1-IN1 > CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase equal to limit value ($ph_{act.} > ph_x$)”.

3.5.17.3 Function 3: CMPPH1-IN1 < CMPPH1-IN2

- CMPPH1-IN1 < CMPPH1-IN2
  – CMPPH1-OUT = HIGH
- CMPPH1-IN1 > CMPPH1-IN2
  – CMPPH1-OUT = LOW

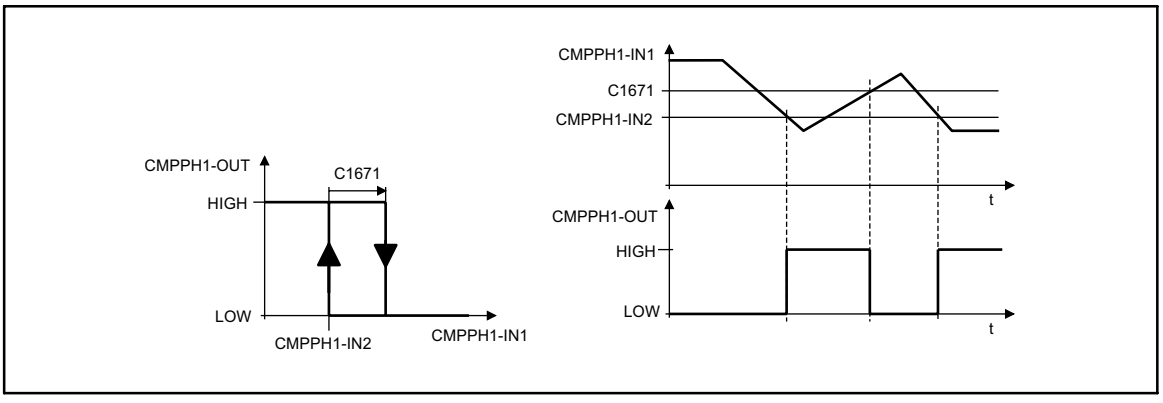
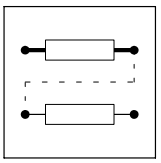


Fig. 3-94 Falling below signal values (CMPPH1-IN1 < CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase smaller than a limit value ($ph_{act.} < ph_x$)”.



3.5.17.4 Function 4: |CMPPH1-IN1| = |CMPPH1-IN2|

This function is the same as function 1.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison "$ph_{act.} = 0$".

3.5.17.5 Function 5: |CMPPH1-IN1| > |CMPPH1-IN2|

This function is the same as function 3.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison "$|ph_{act.}| > |ph_x|$".

3.5.17.6 Function 6: |CMPPH1-IN1| < |CMPPH1-IN2|

This function is the same as function 2.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison "$|ph_{act.}| < |ph_x|$".

3.5.18 Signal conversion (CONV)

Purpose

These function blocks can be used to standardize signals or signal types or to convert signal types into different signal types.The conversion is very precise by providing the conversion factor as numerator and denominator.

CONV1

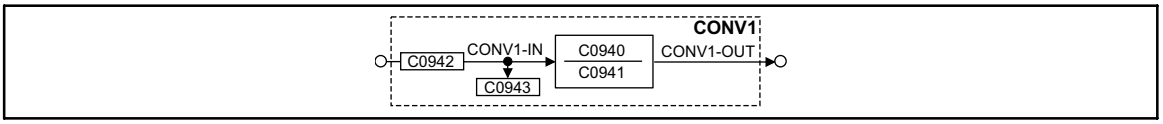


Fig. 3-95 Function block CONV1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV1-IN	a	C0943	dec [%]	C0942	1	1000	
CONV1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to multiply or divide analog signals.

The conversion is done according to the formula:

$$\text{CONV1–OUT} = \text{CONV1–IN} \cdot \frac{\text{C0940}}{\text{C0941}}$$

Example:

An analog signal is to be multiplied with 1.12.
For this, enter C0940 = 112 and C0941 = 100.

CONV2

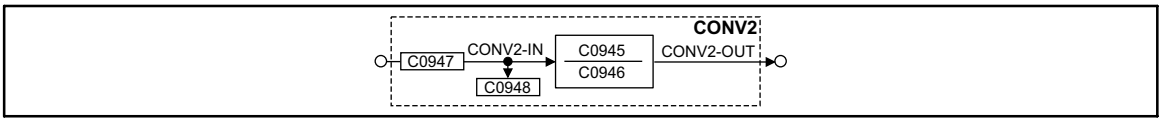


Fig. 3-96 Function block CONV2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV2-IN	a	C0948	dec [%]	C0947	1	1000	
CONV2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to multiply or divide analog signals.

The conversion is done according to the formula:

$$\text{CONV2–OUT} = \text{CONV2–IN} \cdot \frac{\text{C0945}}{\text{C0946}}$$

CONV3

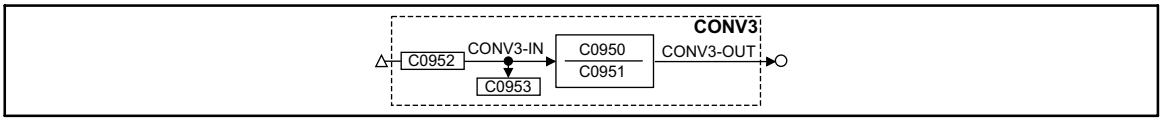


Fig. 3-97 Function block CONV3

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV3-IN	phd	C0953	dec [rpm]	C0952	4	1000	
CONV3-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to convert speed signals into analog signals.

The conversion is done according to the formula:

$$\text{CONV3-OUT} = \text{CONV3-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

CONV4

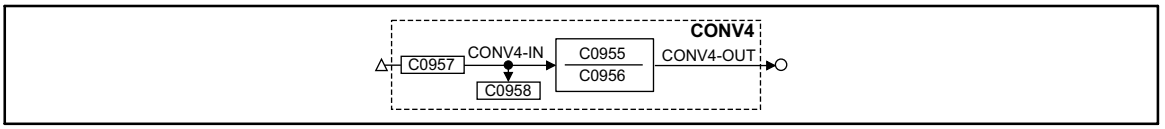


Fig. 3-98 Function block CONV4

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV4-IN	phd	C0958	dec [rpm]	C0957	4	1000	
CONV4-OUT	a	-	-	-	-	-	Limited to ±199.99 %

This function block is used to convert speed signals into analog signals.

The conversion is done according to the formula:

$$\text{CONV4-OUT} = \text{CONV4-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0955}}{\text{C0956}}$$

CONV5

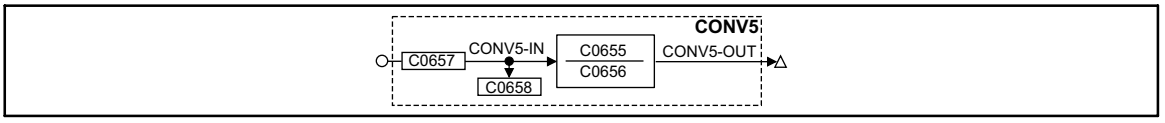


Fig. 3-99 Function block CONV5

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV5-IN	a	C0658	dec [%]	C0657	1	1000	
CONV5-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV5-OUT} = \text{CONV5-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C0655}}{\text{C0656}}$$

3.5.19 Analog-digital converter (CONVAD)

Conversion of an analog value into individual digital signals.

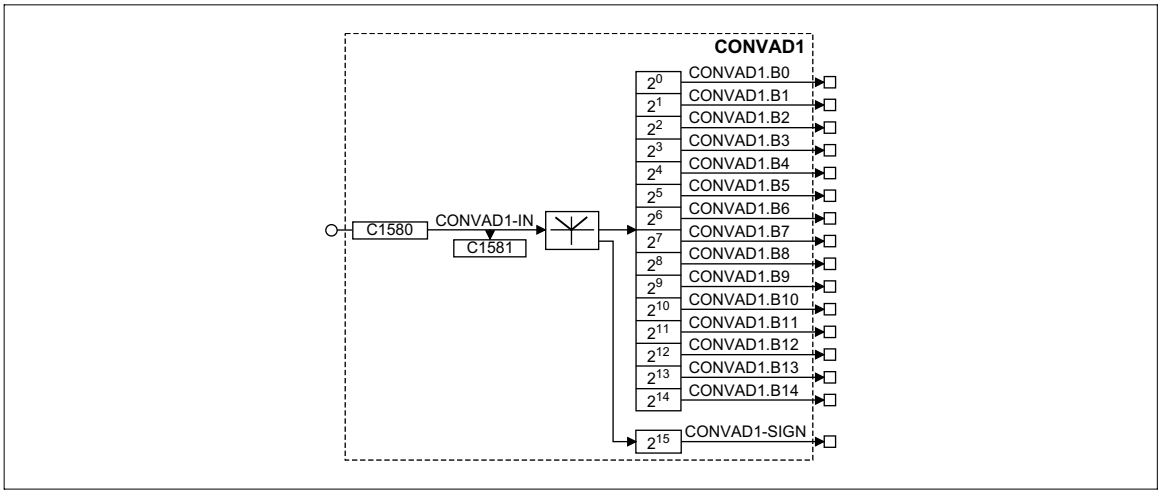


Fig. 3-100 Analog/digital converter (CONVAD1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD1-IN	a	C1581	dec	C1580	1	-
CONVAD1.B0 ... B14	d	-	-	-	-	-
CONVAD1-SIGN	d	-	-	-	-	Sign digit

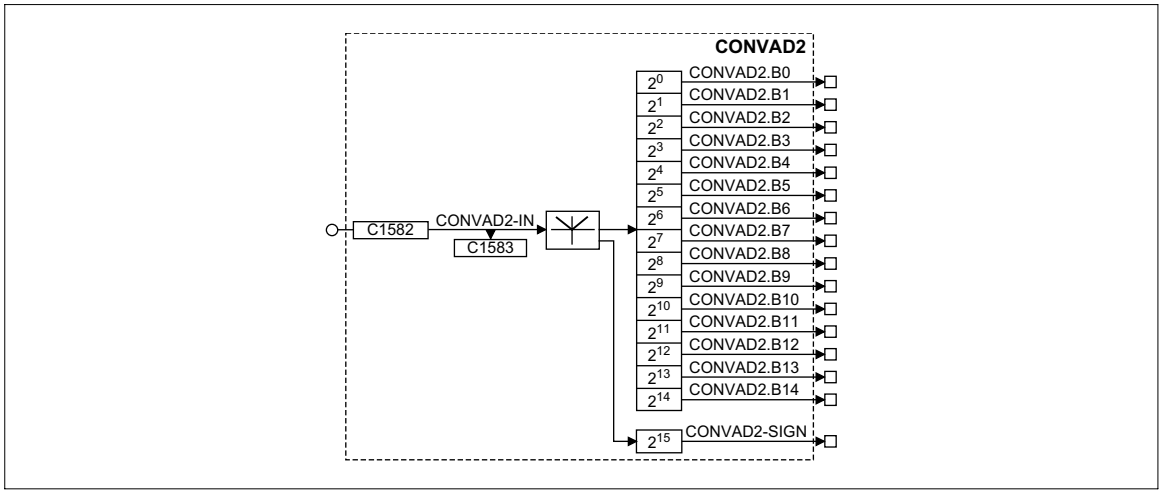


Fig. 3-101 Analog/digital converter (CONVAD2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD2IN	a	C1583	dec	C1582	1	-
CONVAD2.B0 ... B14	d	-	-	-	-	-
CONVAD2-SIGN	d	-	-	-	-	Sign digit

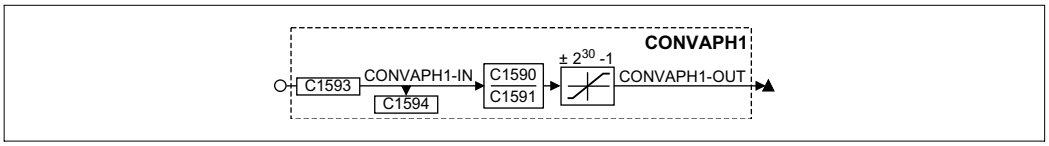
Function

- Represents the analog value as 16-bit binary word.
- Every binary digit is assigned to a digital output.
- The 16th bit (2^{15}) is the sign digit indicating whether it is a positive or negative analog value.

3.5.20 Analog-phase converter (CONVAPH)

Conversion of an analog value into a phase signal.

CONVAPH1



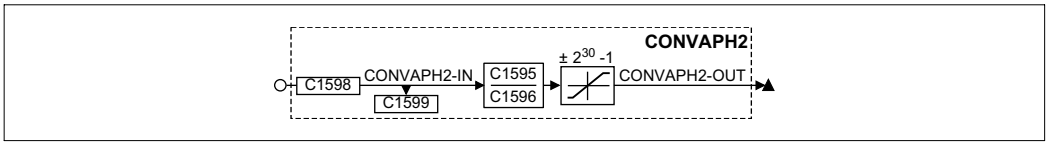
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH1-IN	a	C1594	dec	C1593	1	-
CONVAPH1-OUT	ph	-	-	-	-	Limited to $\pm 2^{30}$-1

Function

- Conversion with adaptation through multiplier and divisor.
- Conversion according to formula:

$$\text{CONVAPH1–OUT} = \text{CONVAPH1–IN} \cdot \frac{\text{C1590}}{\text{C1591}} \cdot \frac{16384}{100\%}$$

CONVAPH2



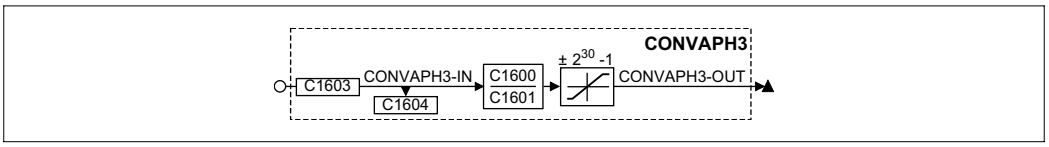
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH2-IN	a	C1599	dec	C1598	1	-
CONVAPH2-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}$-1

Function

- Conversion with adaptation using multiplier and divisor.
- The conversion is performed according to the formula:

$$\text{CONVAPH1} - \text{OUT} = \text{CONVAPH1} - \text{IN} \cdot \frac{\text{C1595}}{\text{C1596}} \cdot \frac{16384}{100\%}$$

CONVAPH3



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH3-IN	a	C1604	dec	C1603	1	-
CONVAPH3-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}$-1

Function

- Conversion with adaptation using multiplier and divisor.
- The conversion is performed according to the formula:

$$\text{CONVAPH1} - \text{OUT} = \text{CONVAPH1} - \text{IN} \cdot \frac{\text{C1600}}{\text{C1601}} \cdot \frac{16384}{100\%}$$

3.5.21 Digital-analog converter (CONVDA)

Three function blocks (CONVDA1 ... CONVDA3) are available.

Purpose

Conversion of individual digital signals to an analog value.

CONVDA1

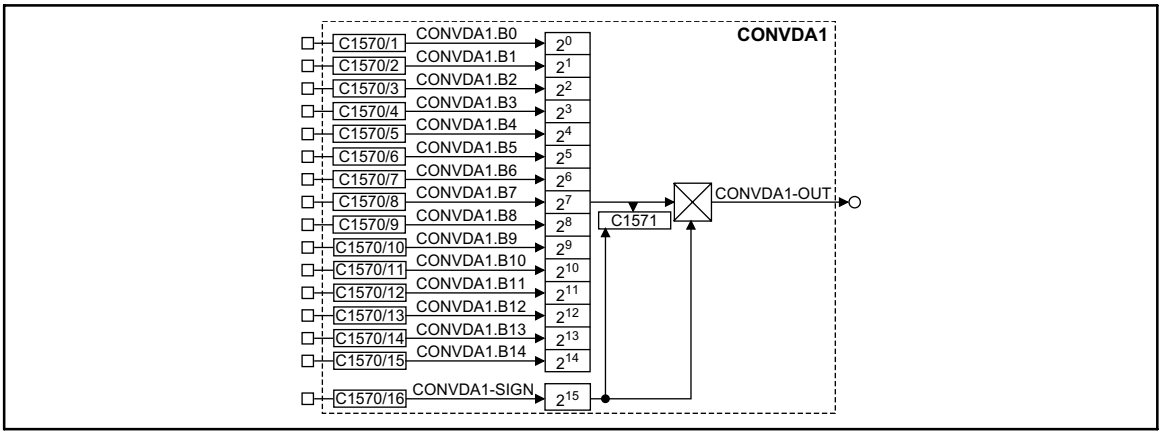


Fig. 3-102 Function block CONVDA1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVDA1.B0	d	-	-	C1570/1	2	-
CONVDA1.B1	d	-	-	C1570/2	2	-
CONVDA1.B2	d	-	-	C1570/3	2	-
CONVDA1.B3	d	-	-	C1570/4	2	-
CONVDA1.B4	d	-	-	C1570/5	2	-
CONVDA1.B5	d	-	-	C1570/6	2	-
CONVDA1.B6	d	-	-	C1570/7	2	-
CONVDA1.B7	d	-	-	C1570/8	2	-
CONVDA1.B8	d	-	-	C1570/9	2	-
CONVDA1.B9	d	-	-	C1570/10	2	-
CONVDA1.B10	d	-	-	C1570/11	2	-
CONVDA1.B11	d	-	-	C1570/12	2	-
CONVDA1.B12	d	-	-	C1570/13	2	-
CONVDA1.B13	d	-	-	C1570/14	2	-
CONVDA1.B14	d	-	-	C1570/15	2	-
CONVDA1-SIGN	d	-	-	C1570/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA1-OUT	a	-	-	-	-	-
-	-	C1571	hex	-	-	Indicates the result

CONVDA2

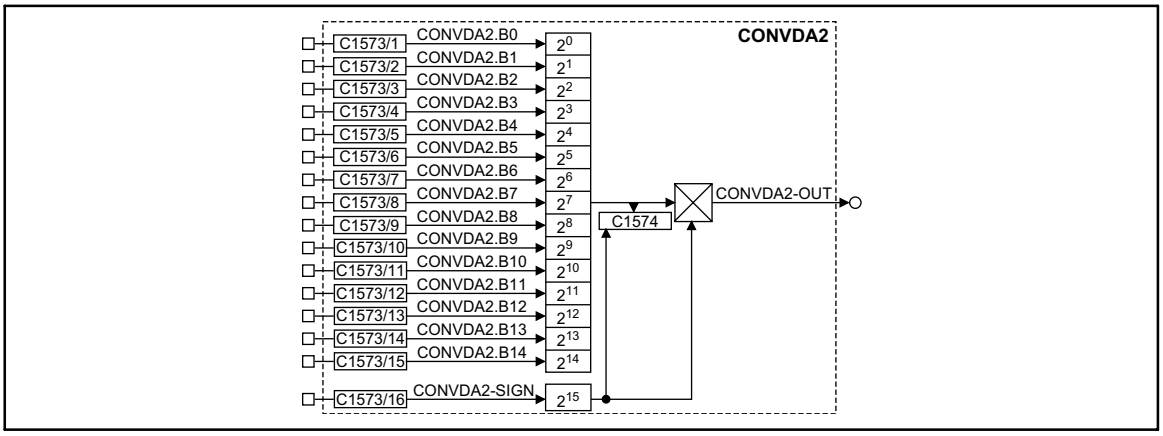


Fig. 3-103 Function block CONVDA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVDA2.B0	d	-	-	C1573/1	2	-
CONVDA2.B1	d	-	-	C1573/2	2	-
CONVDA2.B2	d	-	-	C1573/3	2	-
CONVDA2.B3	d	-	-	C1573/4	2	-
CONVDA2.B4	d	-	-	C1573/5	2	-
CONVDA2.B5	d	-	-	C1573/6	2	-
CONVDA2.B6	d	-	-	C1573/7	2	-
CONVDA2.B7	d	-	-	C1573/8	2	-
CONVDA2.B8	d	-	-	C1573/9	2	-
CONVDA2.B9	d	-	-	C1573/10	2	-
CONVDA2.B10	d	-	-	C1573/11	2	-
CONVDA2.B11	d	-	-	C1573/12	2	-
CONVDA2.B12	d	-	-	C1573/13	2	-
CONVDA2.B13	d	-	-	C1573/14	2	-
CONVDA2.B14	d	-	-	C1573/15	2	-
CONVDA2-SIGN	d	-	-	C1573/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA2-OUT	a	-	-	-	-	-
-	-	C1574	hex	-	-	Indicates the result

CONVDA3

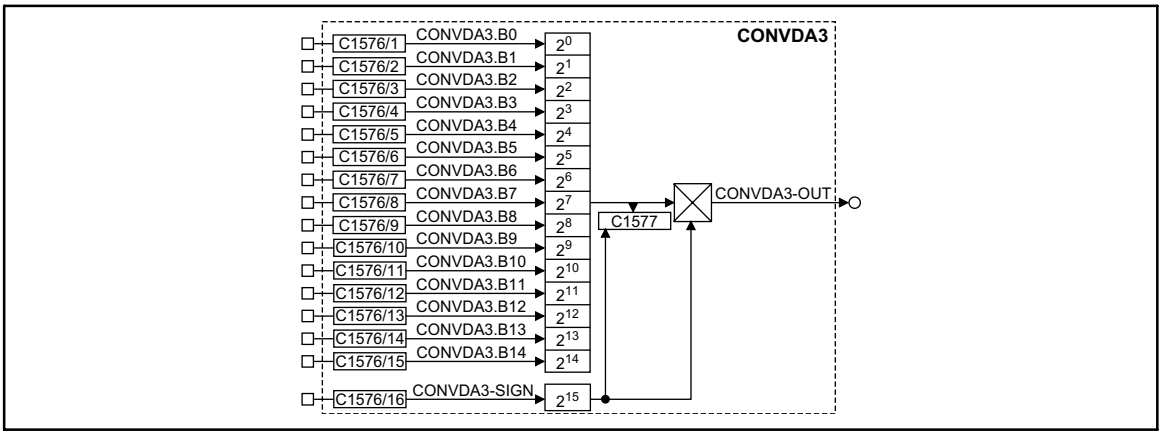


Fig. 3-104 Function block CONVDA3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVDA3.B0	d	-	-	C1576/1	2	-
CONVDA3.B1	d	-	-	C1576/2	2	-
CONVDA3.B2	d	-	-	C1576/3	2	-
CONVDA3.B3	d	-	-	C1576/4	2	-
CONVDA3.B4	d	-	-	C1576/5	2	-
CONVDA3.B5	d	-	-	C1576/6	2	-
CONVDA3.B6	d	-	-	C1576/7	2	-
CONVDA3.B7	d	-	-	C1576/8	2	-
CONVDA3.B8	d	-	-	C1576/9	2	-
CONVDA3.B9	d	-	-	C1576/10	2	-
CONVDA3.B10	d	-	-	C1576/11	2	-
CONVDA3.B11	d	-	-	C1576/12	2	-
CONVDA3.B12	d	-	-	C1576/13	2	-
CONVDA3.B13	d	-	-	C1576/14	2	-
CONVDA3.B14	d	-	-	C1576/15	2	-
CONVDA3-SIGN	d	-	-	C1576/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA3-OUT	a	-	-	-	-	-
-	-	C1577	hex	-	-	Indicates the result

Function

- Input of 15 absolute values (2^0 ... 2^{14})
- The 16th bit (2^{15}) is the sign to indicate whether the analog value is positive or negative.
- Display of the analog value via a code in the hex format
  - C1571 for CONVDA1
  - C1574 for CONVDA2
  - C1577 for CONVDA3

3.5.22 Phase-analog converter (CONVPHA)

Three function blocks (CONVPHA1 ... CONVPHA3) are available.

Purpose

Conversion of a phase signal into an analog value.

CONVPHA1

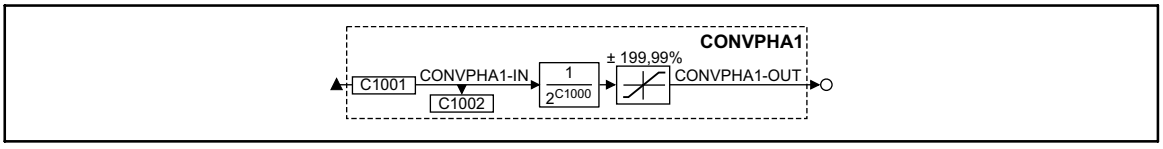


Fig. 3-105 Function block CONVPHA1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA1-IN	ph	C1002	dec [inc]	C1001	3	-
CONVPHA1-OUT	a	-	-	-	-	Limited to ±199.99 %

Function

- Conversion with adaptation using divisor.
- The conversion is performed according to the formula:

$$\text{CONVPHA1–OUT} = \text{CONVPHA1–IN} \cdot \frac{1}{2^{C1000}} \cdot \frac{100\%}{16384}$$

CONVPHA2

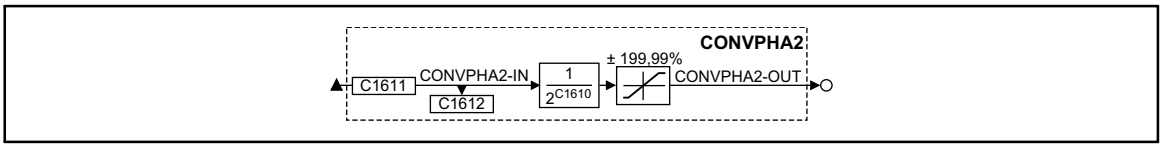


Fig. 3-106 Function block CONVPHA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA2-IN	ph	C1612	dec [inc]	C1611	3	-
CONVPHA2-OUT	a	-	-	-	-	Limited to ±199.99 %

Function

- Conversion with adaptation using divisor.
- The conversion is performed according to the formula:

$$\text{CONVPHA2–OUT} = \text{CONVPHA2–IN} \cdot \frac{1}{2^{C1610}} \cdot \frac{100\%}{16384}$$

CONVPHA3

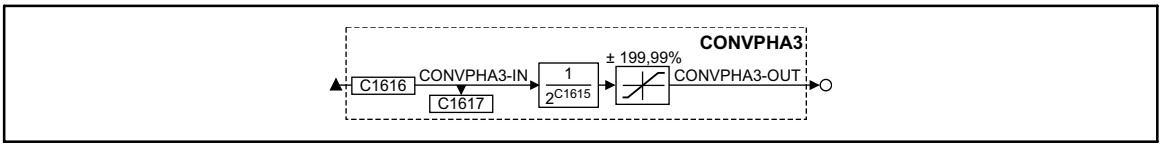


Fig. 3-107 Function block CONVPHA3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA3-IN	ph	C1617	dec [inc]	C1616	3	-
CONVPHA3-OUT	a	-	-	-	-	Limited to ±199.99 %

Function

- Conversion with adaptation using divisor and exact residual value treatment.
- The conversion is performed according to the formula:

$$\text{CONVPHA3–OUT} = \text{CONVPHA3–IN} \cdot \frac{1}{2^{C1615}} \cdot \frac{100\%}{16384}$$

3.5.23 Phase conversion (CONVPHPH2)

Purpose

Conversion of a phase signal with dynamic fracture.

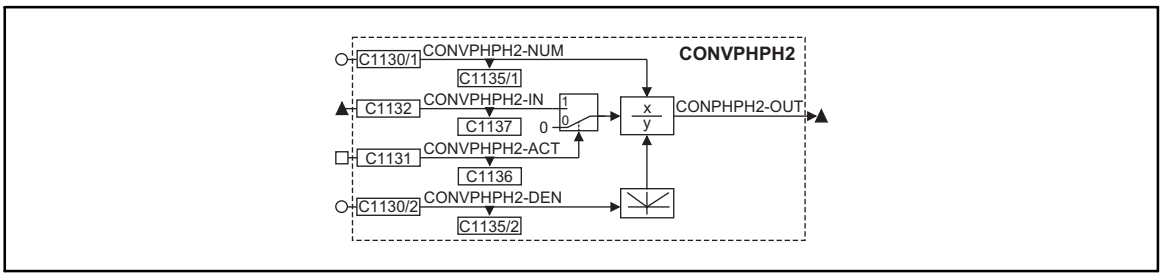


Fig. 3-108 Phase conversion (CONVPHPH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPH2-IN	ph	C1137	dec [inc]	C1132	3	-
CONVPHPH2-NUM	a	C1135/1	dec	C1130/1	1	Numerator
CONVPHPH2-DEN	a	C1135/2	dec	C1130/2	1	Denominator (with absolute-value generation)
CONVPHPH2-ACT	d	C1136	bin	C1131	2	-
CONVPHPH2-OUT	ph	-	-	-	-	Without limitation, residual value considered

Function

Caution!

The conversion result is not limited. The result must not exceed the range of ±2147483647.

- C1131 = HIGH
  – The phase signal at CONVPHPH2-IN is evaluated with the factor from C1135/1 / C1135/2.
- C1131 = LOW
  – The value 0 is evaluated with the factor from C1135/1 / C1135/2.

3.5.24 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

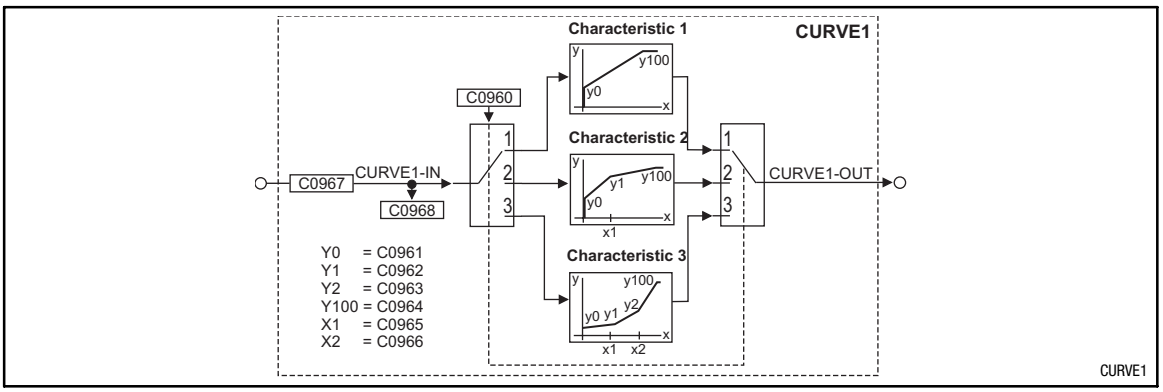


Fig. 3-109 Characteristic function (CURVE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CURVE1-IN	a	C0968	dec [%]	C0967	1	5001	-
CURVE1-OUT	a	-	-	-	-	-	-

Range of functions

Under C0960, you can select the function:

- Characteristic with two interpolation points
- Characteristic with three interpolation points
- Characteristic with four interpolation points

The codes for entering the interpolation points can be obtained from the line diagrams.

Linear interpolation between the points.

For negative input values at CURVEx-IN, the settings of the interpolation points are processed inversely (see line diagrams). If this is not desired:

- Connect an absolute value generator (ABS) before or behind the CURVE function block

or

- connect a limiter (LIM) before or behind the CURVE function block

3.5.24.1 Characteristic with two interpolation points

Set C0960 = 1.

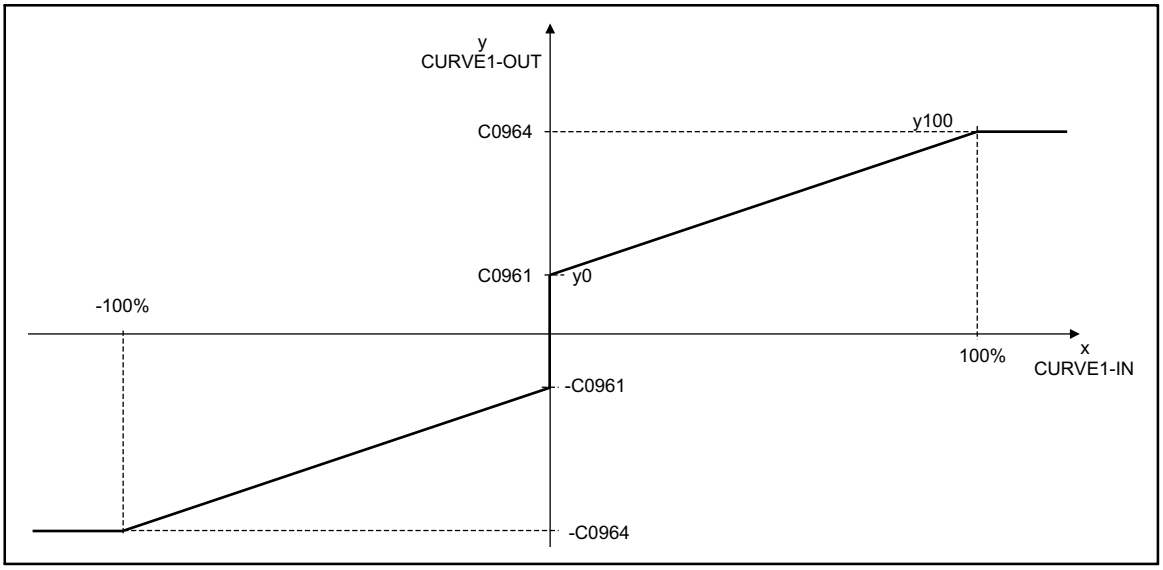


Fig. 3-110 Line diagram of characteristic with 2 interpolation points

3.5.24.2 Characteristic with three interpolation points

Set C0960 = 2.

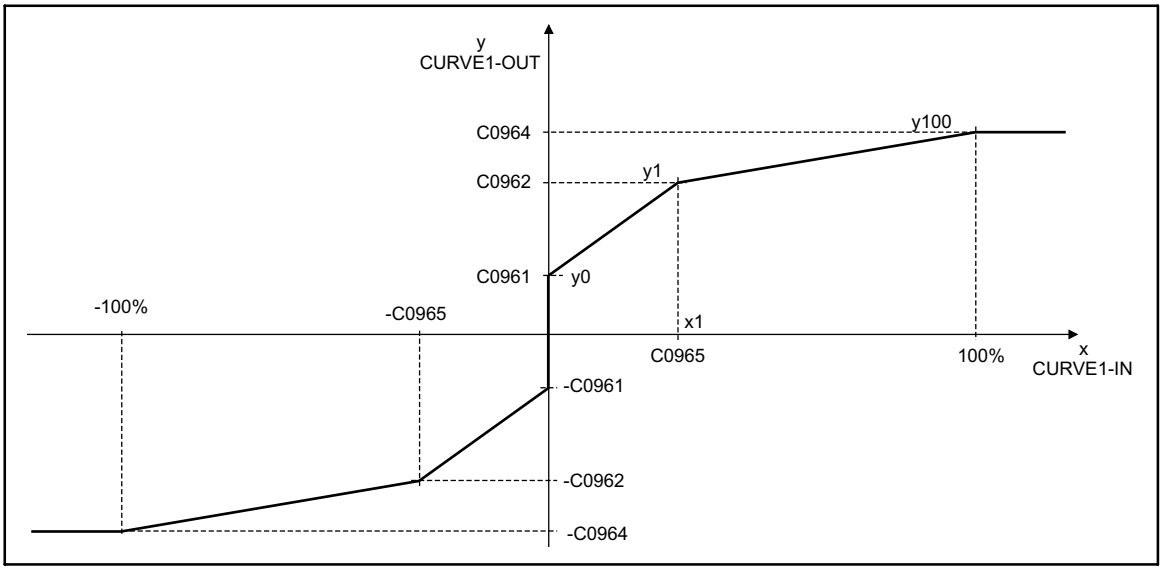


Fig. 3-111 Line diagram of characteristic with 3 interpolation points

3.5.24.3 Characteristic with four interpolation points

Set C0960 = 3.

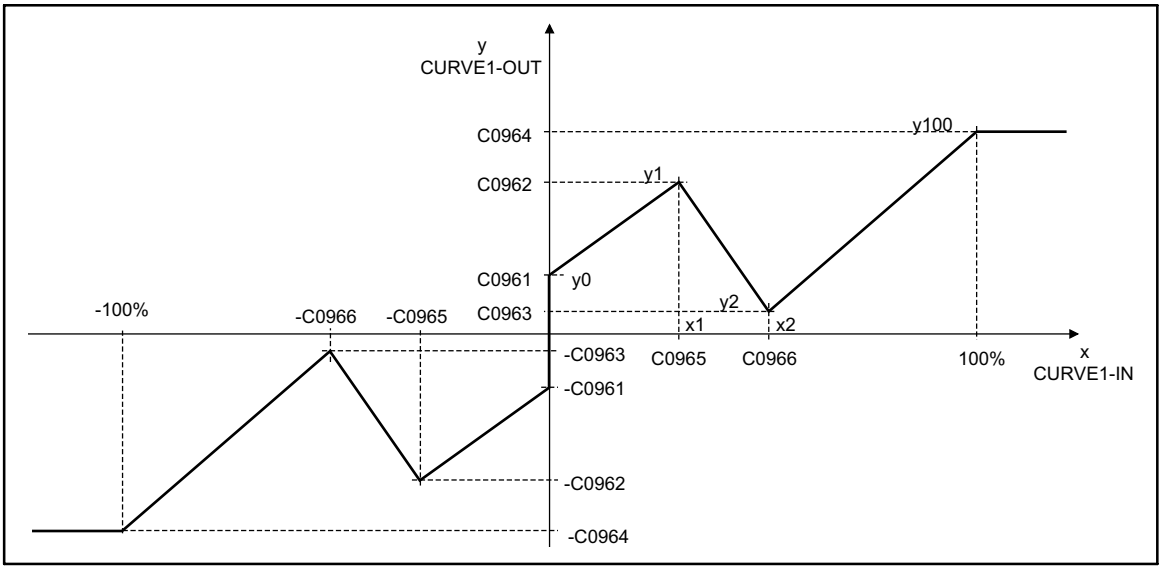


Fig. 3-112 Line diagram of characteristic with 4 interpolation points

3.5.25 Dead band (DB)

Purpose

The dead band element is used to set interfering influences around zero, e.g. interferences on analog input voltages, to digital zero.

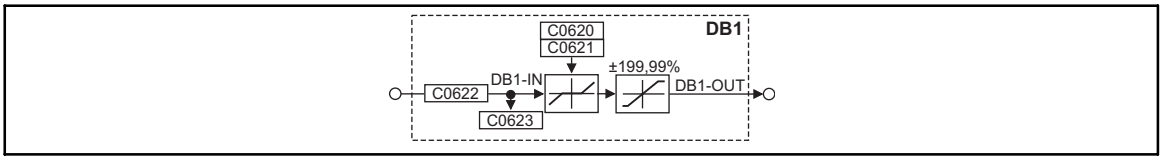


Fig. 3-113 Dead band element (DB1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DB1-IN	a	C0623	dec [%]	C0622	1	1000	-
DB1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The dead band is parameterised under C0621.
- The gain is set under C0620.

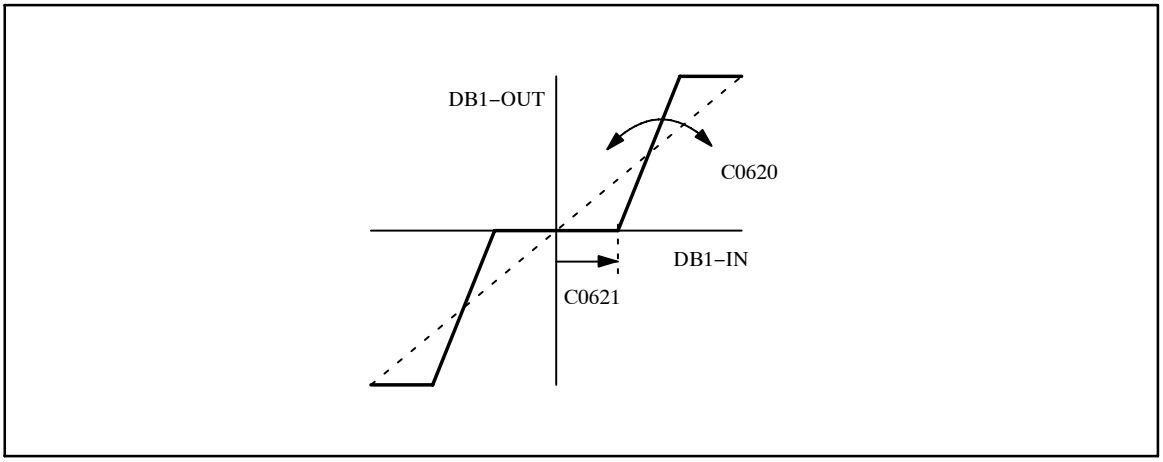


Fig. 3-114 Dead band and gain

3.5.26 Drive control (DCTRL)

Purpose

Sets certain controller states (e. g. trip, trip reset, quick stop or controller inhibit).

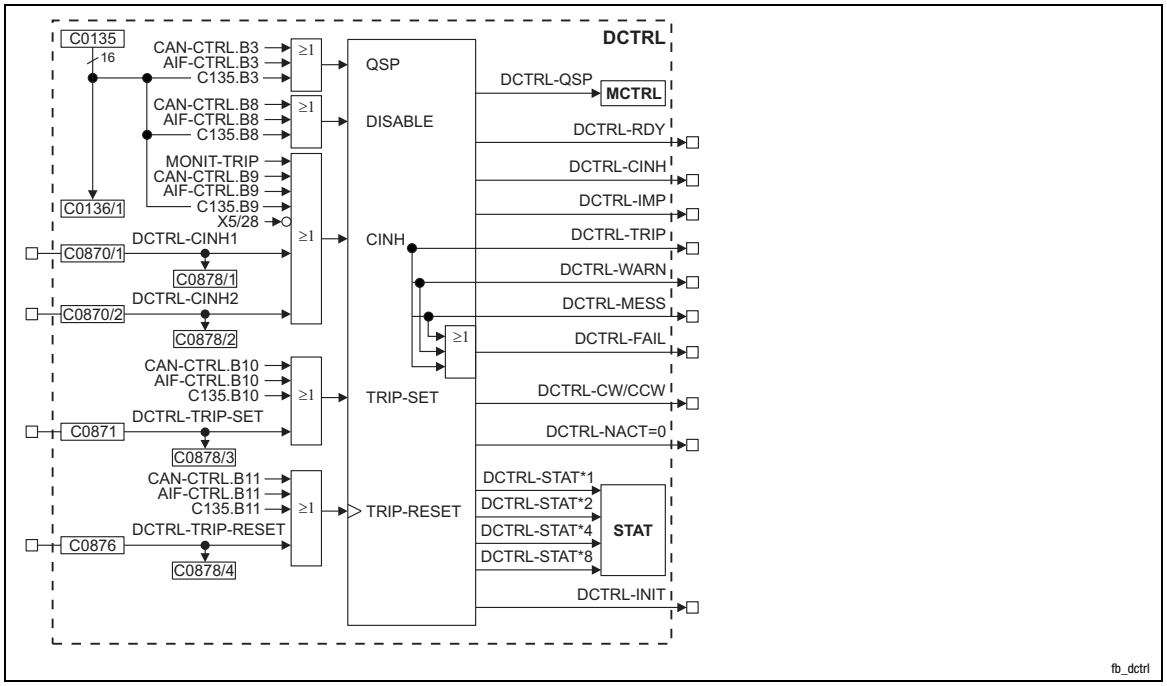
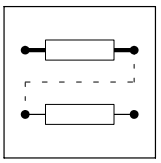


Fig. 3-115 Control of the controller (DCTRL)

Signal				Source			Note
Designation	Type	DIS	DIS format	CFG	List	Lenze	
DCTRL-CINH1	d	C0878/1	bin	C0870/1	2	1000	HIGH = inhibit controller
DCTRL-CINH2	d	C0878/2	bin	C0870/2	2	1000	HIGH = inhibit controller
DCTRL-TRIP-SET	d	C0878/3	bin	C0871	2	54	HIGH = error message EEr
DCTRL-TRIP-RESET	d	C0878/4	bin	C0876	2	55	LOW-HIGH signal = Trip reset
DCTRL-QSP	d	-	-	-	-	-	HIGH = drive performs quick stop
DCTRL-RDY	d	-	-	-	-	-	HIGH = Ready for operation
DCTRL-CINH	d	-	-	-	-	-	HIGH = Controller reset
DCTRL-IMP	d	-	-	-	-	-	HIGH = High-resistance power output stages
DCTRL-TRIP	d	-	-	-	-	-	HIGH = Fault active
DCTRL-WARN	d	-	-	-	-	-	HIGH = Active warning
DCTRL-MESS	d	-	-	-	-	-	HIGH = Active message
DCTRL-FAIL	d	-	-	-	-	-	-
DCTRL-CW/CCW	d	-	-	-	-	-	LOW = CW rotation, HIGH = CCW rotation
DCTRL-NACT=0	d	-	-	-	-	-	HIGH = Motor speed < C0019
DCTRL-STAT*1	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*2	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*4	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*8	d	-	-	-	-	-	General status (binary coded)
DCTRL-INIT	d	-	-	-	-	-	-



Function

- Quick stop (QSP)
- Operation inhibited (DISABLE)
- Controller inhibit (CINH)
- TRIP set
- TRIP reset
- Change of parameter set (PAR)
- Controller state

3.5.26.1 Quick stop (QSP)

The drive is braked to standstill via the deceleration ramp C105 and generates a holding torque.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 3 of CAN-IN1
  - Control word AIF-CTRL bit 3 of AIF-IN
  - Control word C0135 bit 3
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.5.26.2 Operation inhibit (DISABLE)

In this state the drive cannot be started by the command: Controller enable. The power output stages are inhibited. All controllers are reset.

- The function can be controlled by three inputs
  - Control word CAN-CTRL bit 8 of CAN-IN1
  - Control word AIF-CTRL bit 8 of AIF-IN
  - Control word C0135 bit 8
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.5.26.3 Controller inhibit (CINH)

Note!

When the controller changes to an LU message or an OU message, the signal DCTRL-CINH is not set.

The power output stages are inhibited. All controllers are reset.

- The function can be controlled via seven inputs:
  - Terminal X5/28 (LOW = controller inhibit)
  - Control word CAN-CTRL bit 9 of CAN-IN1
  - Control word AIF-CTRL bit 9 of AIF-IN
  - Control word C0135 bit 9
  - MONIT-TRIP (HIGH = A monitoring function that is configured to TRIP has been activated in the MONIT function block)
  - Free input DCTRL-CINH1
  - Free input DCTRL-CINH2
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.5.26.4 TRIP-Set

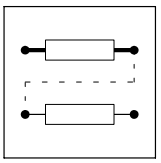
The drive is lead to the state selected under code C0581 and indicates EEr (external monitoring).

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 10 of CAN-IN1
  - Control word AIF-CTRL bit 10 of AIF-IN
  - Control word C0135 bit 10
  - Free input DCTRL-TRIP-SET
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.5.26.5 TRIP RESET

Resets a pending trip if the cause of malfunction has been eliminated. If the cause of malfunction is still active, no response is effected.

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 11 of CAN-IN1
  - Control word AIF-CTRL bit 11 of AIF-IN
  - Control word C0135 bit 11
  - Free input DCTRL-TRIP-RESET
- All inputs are linked by an OR-operation.
- This function is only carried out by a LOW-HIGH edge of the signal resulting from the OR operation.
- C0136/1 indicates the control word C0135



Note!

If one of the inputs is set to HIGH, it is not possible that a LOW-HIGH edge occurs at the resulting signal.

3.5.26.6 Controller state

The status is binary coded via the outputs DCTRL-STAT*x. These outputs are connected with the STAT function block inside the device.

The status can be evaluated via the status word C0150, CAN status word, and AIF status word.

STAT*8	STAT*4	STAT*2	STAT*1	Action of the controller
0	0	0	0	Initialisation after the supply voltage has been connected
0	0	0	1	Switch-on inhibit (LOCK MODE), restart protection is active C0142
0	0	1	1	Drive is inhibited
0	1	1	0	Controller enabled
0	1	1	1	The activation of a monitoring function resulted in a ”message”
1	0	0	0	The activation of a monitoring function resulted in a ”trip”
1	0	1	0	The activation of a monitoring function resulted in a ”FAIL-QSP”

3.5.26.7 Speed threshold n_{act}=0rpm

The standstill message (DCTRL-NACT=1) is set if the actual speed (MCTRL-NACT) is lower than the threshold set in C0019.

The standstill message (DCTRL-NACT=0) is cancelled if the actual speed (MCTRL-NACT) exceeds a threshold from C0019 plus hysteresis. The amount of hysteresis corresponds to 1 % of the max. speed n_{max} from C0011.

Note!

The hysteresis provides for a stable standstill signal, even in the case of a jittering actual speed value. The hysteresis only has an effect during start-up and is not active during a stop process.

3.5.27 Master frequency input (DFIN)

Purpose

Converting and scaling a power pulse current at the digital frequency input X9 into a speed and phase setpoint. The digital frequency is transferred in a high-precision mode (with offset and gain errors).

Fig. 3-116 Digital frequency input (DFIN)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFIN-OUT	phd	C0426	dec [rpm]	-	-	

Function

- The input X9 is designed for signals with TTL level.
- In the event of digital frequency cascade or digital frequency rail, adapt the drive to the connected encoder or controller via C0425.
- The input of a zero track is optional.
- Via C0427 the following input signals can be evaluated:

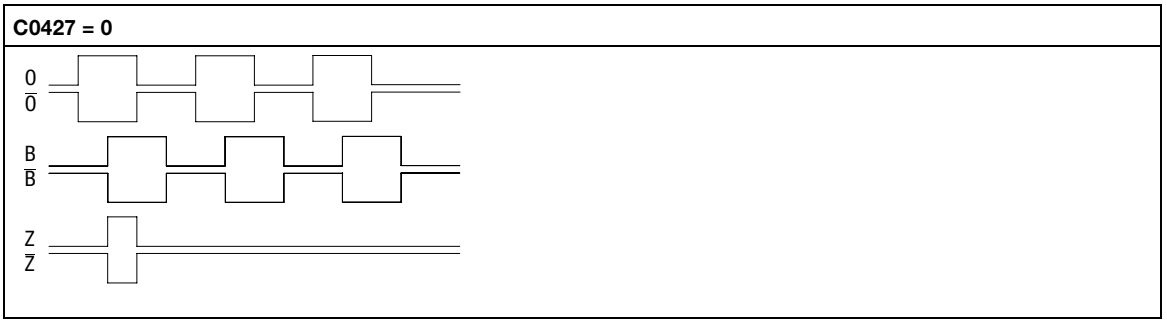
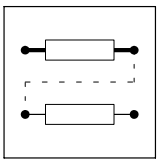


Fig. 3-117 Phase-delayed signal sequence (CW rotation)

CW rotation	Track A is leading track B by 90	(positive value at DFIN-OUT).
CCW rotation	Track A is lagging track B by 90	(negative value at DFIN-OUT).



C0427 = 1

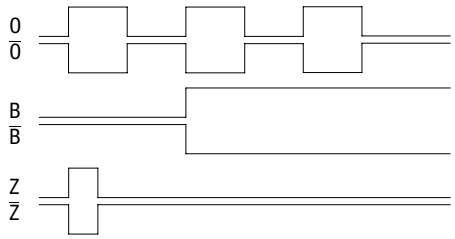


Fig. 3-118 Control of direction of rotation via track B

CW rotation	Track A transmits the speed
	Track B = LOW (positive value at DFIN-OUT)
CCW rotation	Track A transmits the speed
	Track B = HIGH (negative value at DFIN-OUT)

C0427 = 2

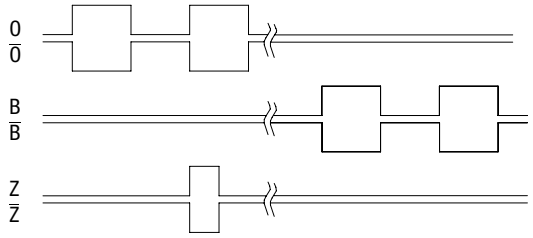


Fig. 3-119 Control of speed and direction of rotation via track A or track B

CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT)
	Track B = LOW
CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT)
	Track A = LOW

Transfer function

$$\text{DFIN-OUT [rpm]} = \text{f [Hz]} \cdot \frac{60}{\text{Number of increments from C0425}}$$

Example:

Input frequency = 200 kHz

C0425 = 3 ($\triangleq$ a number of increments of 2048 Inc/rev.)

$$\text{DFIN-OUT [rpm]} = 200000\ \text{Hz} \cdot \frac{60}{2048} = 5859\ \text{rpm}$$

Signal adaptation

Finer resolutions than the power-of-two format can be realised by connecting an FB (e.g. CONV3 or CONV4).

Example:

The FB CONV3 converts the speed signal into a quasi-analog signal. The conversion is done according to the formula:

$$\text{CONV3-OUT [\%]} = \text{f [Hz]} \cdot \frac{0,4}{\text{Number of increments from C0425}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

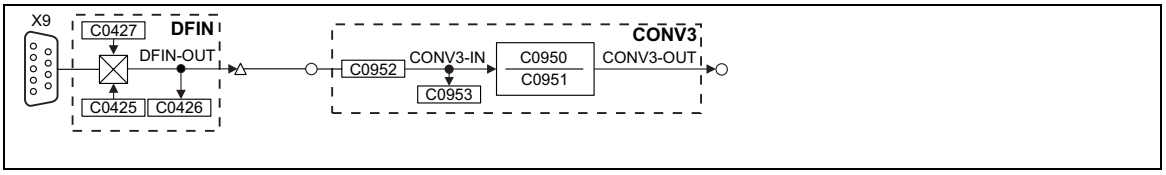


Fig. 3-120 Digital frequency input (DFIN) with connected converter

STOP!

If C0540 = 0, 1, 2, 3 and a feedback system C0025 > 10, you must not use the digital frequency input X9 anymore.

3.5.28 Digital frequency output (DFOUT)

Purpose

Converts internal speed signals into frequency signals and outputs them to subsequent drives. The transmission is highly precise (without offset and gain errors).

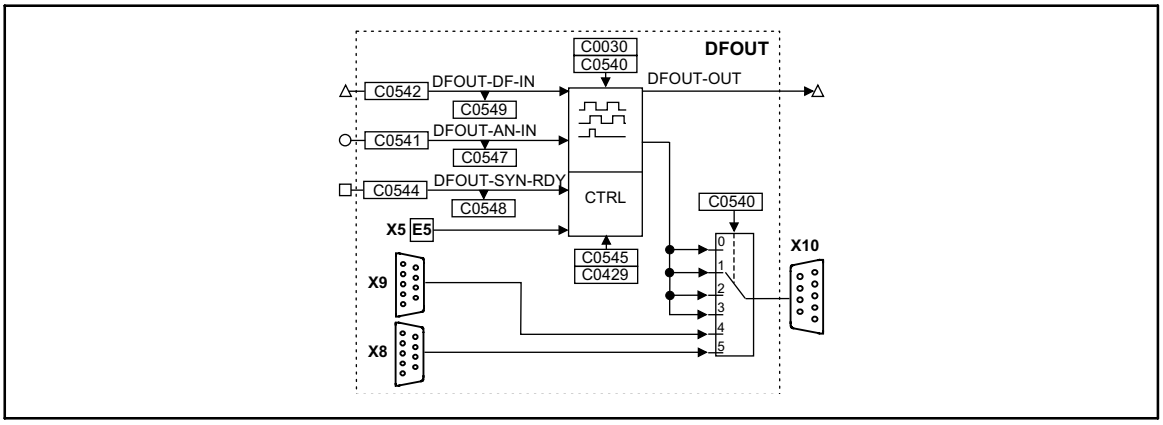


Fig. 3-121 Digital frequency output (DFOUT)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFOUT-DF-IN	phd	C0549	dec [rpm]	C0542	4	-
DFOUT-AN-IN	a	C0547	dec [%]	C0541	1	Input in [%] of nmax (C0011)
DFOUT-SYN-RDY	d	C0548	bin	C0544	2	-
DFOUT-OUT	phd	-	-	-	-	-

Function

- Output signals on X10
- Output of an analog signal
- Output of a speed signal
- Encoder simulation of the resolver with internal zero track
- Encoder simulation of the resolver with external zero track
- Direct output of X8
- Direct output of X9

3.5.28.1 Output signals on X10

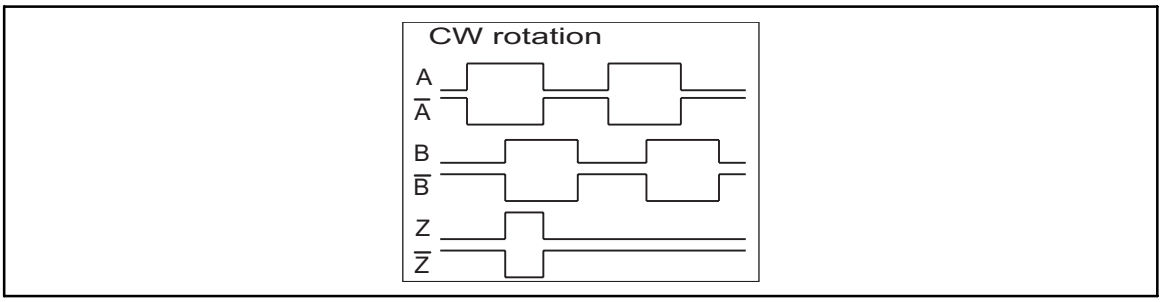


Fig. 3-122 Signal sequence for CW rotation (definition)

- The output signal corresponds to the simulation of an incremental encoder:
  - Track A, B and, if necessary, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  - The levels are TTL-compatible.
- Positive input values (CW rotation) result in the represented signal sequence.
- With negative input values (CCW rotation) track B is leading track A by 90° .
- The zero track is output according to the function set in C0540
- With C0030 the encoder constant of the encoder simulation is set.
- The function of the digital frequency output X10 is defined via C0540.

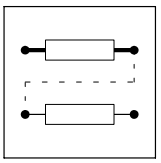
Stop!

C0540 = 0 to C0540 = 3 cannot be set if the connection to the digital frequency input DFIN X9 has been established and C0025 > 10 has been selected.

C0540	Signal at X10
0	DFOUT-AN-IN is output at X10; zero track can be input externally
1	DFOUT-DF-IN is output at X10; zero track can be input externally
2	Encoder simulation of the resolver with zero track in resolver zero position (mounted on the motor)
3	Encoder simulation of the resolver with external input of the zero track (terminal X5/E5)
4	The signal at input X9 is electrically amplified and directly output (C0030 is without function)
5	The signal at input X8 is electrically amplified and directly output (C0030 is without function)

Create zero track (Z track)

- Condition:
  - Set C0540 = 0, C0540 = 1 or C0540 = 3.
  - Encoder simulation must be active.
- Start creation:
  - The creation starts immediately with the first rising or falling edge on track A or track B.



3.5.28.2 Output of an analog signal

For this purpose, set code C0540 = 0. The value applied at input DFOUT-AN-IN is converted into a frequency.

Transfer function

$$f\,[Hz] = DFOUT - AN - IN\,[\%] \cdot \frac{\text{No. of increments from C0030}}{100} \cdot \frac{C0011}{60}$$

Example:

DFOUT-AN-IN = 50 %

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

C0011 = 3000 rpm

$$f\,[Hz] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ Hz$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Activate the function through a LOW → HIGH edge at the input DFOUT-SYN-RDY.
2. A LOW → HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse is automatically shifted by the value C0545.

Note!

This procedure must be done after every mains switching.

3.5.28.3 Output of a speed signal

- Set C0540 = 1.
  – This setting only converts the value at input DFOUT-DF-IN into a frequency.

Transfer function

$$f\,[Hz] = DFOUT\text{-}DF\text{-}IN\,[rpm] \cdot \frac{\text{No. of increments from C0030}}{60}$$

Example:

DFOUT-DF-IN = 3000 rpm

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

$$f\,[Hz] = 3000\,[rpm] \cdot \frac{2048}{60} = 102400\,[Hz]$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Set input DFOUT-SYN-RDY = edge from LOW → HIGH.
2. A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

3.5.28.4 Encoder simulation of the resolver

Set C0540 = 2 or C0540 = 3 (depending on the desired generation of the zero track)

- The function is used when a resolver is connected to X7.
- The encoder constant for output X10 is set in C0030.

Generating a zero pulse in resolver zero position (C0540 = 2)

The output of the zero pulse with regard to the rotor depends on how the resolver is mounted to the motor.

- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Generating an external zero pulse (C0540 = 3)

An artificial zero pulse can be generated for the output frequency.

- The function is activated through a LOW-HIGH edge at the input DFOUT-SYN-RDY.
- A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°.
  – After this, every 360° a zero pulse is generated according to the setting in C0030.
- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Note!

The procedure for generating an artificial zero pulse must be repeated after every mains switching and after every setting of C0540 = 3.

3.5.28.5 Direct output of X8 (C0540 = 5)

- The input signal at X8 is electrically amplified and directly output.
- The signals depend on the assignment of the input X8.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X8.

3.5.28.6 Direct output of X9 (C0540 = 4)

- The input signal at X9 is electrically amplified and directly output.
- The signals depend on the assignment of the input X9.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X9.

Note!

For directly outputting X8 or X9 to the digital frequency output X10 the function block DFOUT does not need to be entered into the processing table.

3.5.29 Digital frequency ramp function generator (DFRFG)

Purpose

The drive (motor shaft) is synchronised to a digital frequency (phase selection). The drive then performs a phase-synchronous operation with the digital frequency.

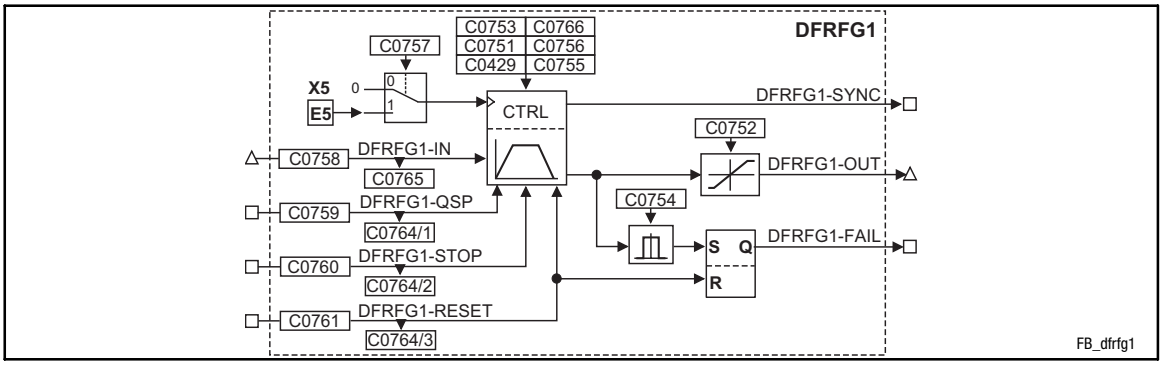


Fig. 3-123 Digital frequency ramp function generator (DFRFG1)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
DFRFG1-SET	phd	C0769	-	C0768	-	Initial speed
DFRFG1-IN	phd	C0765	dec [rpm]	C0758	4	Speed/Phase setpoint
DFRFG1-QSP	d	C0764/1	bin	C0759	2	HIGH = quick stop
DFRFG1-STOP	d	C0764/2	bin	C0760	2	HIGH = save setpoint
DFRFG1-RESET	d	C0764/3	bin	C0761	2	HIGH = reset
DFRFG1-OUT	phd	-	-	-	-	Speed/Phase setpoint
DFRFG1-SYNC	d	-	-	-	-	HIGH = drive runs synchronously
DFRFG1-FAIL	d	-	-	-	-	HIGH = phase difference exceeded

Function

- Profile generator
- Quick stop
- Ramp function generator stop
- RESET
- Detect phase difference
- Start via touch probe initiator (terminal X5/E5)
- Correction of the touch probe initiator (terminal X5/E5)

3.5.29.1 Profile generator

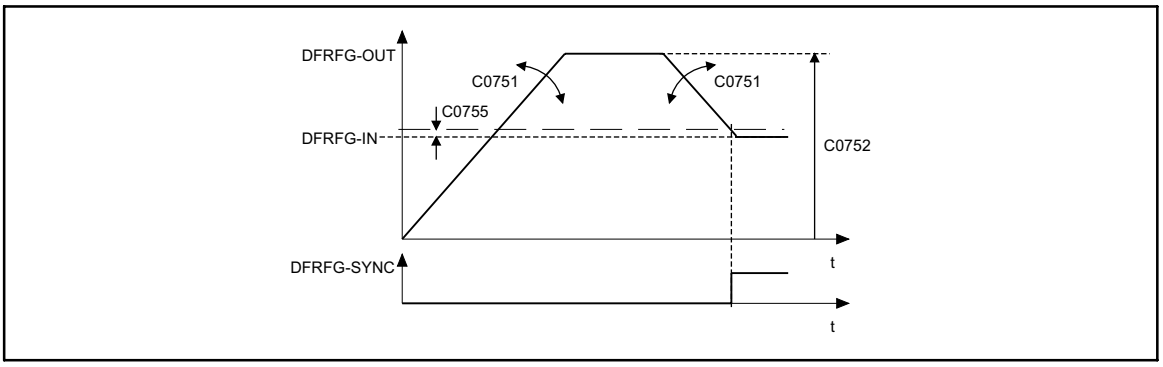


Fig. 3-124 Synchronisation on DFRFG

The profile generator generates ramps which lead the setpoint phase to its target position.

- Set acceleration and deceleration via C0751.
- Set max. speed via C0752.
- When the distance and speed reach their setpoints, the output switches DFRFG1-SYNC = HIGH. At the same time the FB switches the profile generator to ”inactive”.
- Set the switching point via C0755.

Stop!

Do not operate the drive with this function at the torque limitation M_{max}, I_{max}.

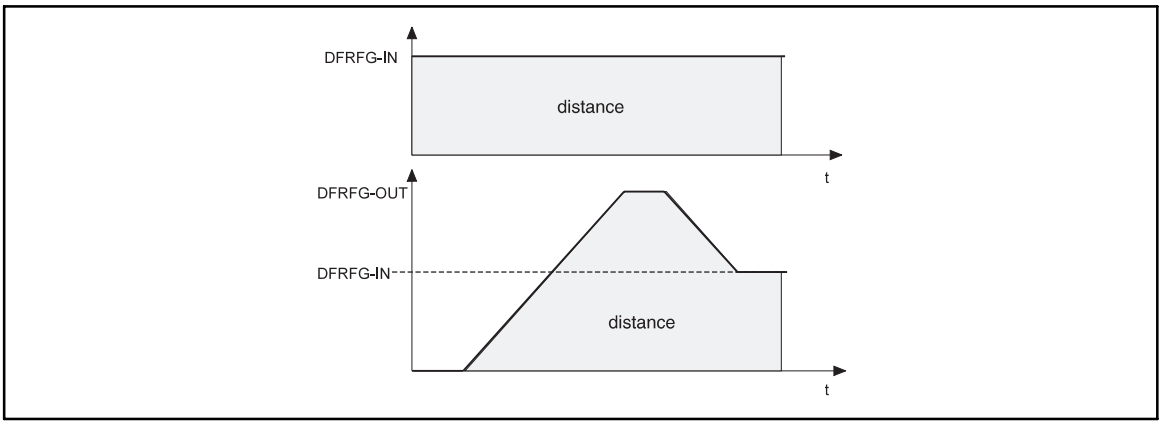


Fig. 3-125 Speed-time diagram DFRFG

The number of increments at DFRFG-IN (master drive) defines the target position. The target can be displayed as a path. The speed-time diagram shows the distance covered (angle) as the area below the speed profile. When synchronicity is reached, master and slave have covered the same distance (angle).

3.5.29.2 Quick stop

Removes the drive from the network and brakes it to standstill.

- Activate with DFRFG-QSP = HIGH.
- Set deceleration time via C0753.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the quick stop request.

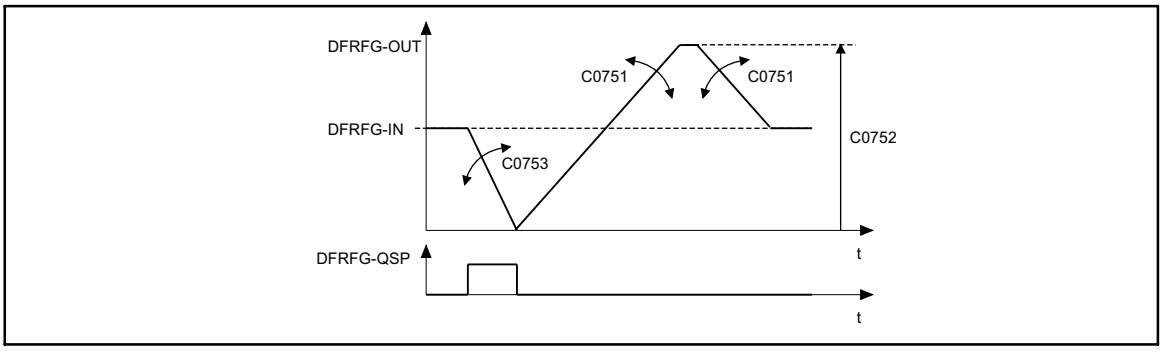


Fig. 3-126 Quick stop DFRFG

3.5.29.3 Ramp function generator stop

Maintains the state of the profile generator during operation.

- Activate with DFRFG-STOP = HIGH
- Output of the last state at DFRFG-OUT.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the stop request.

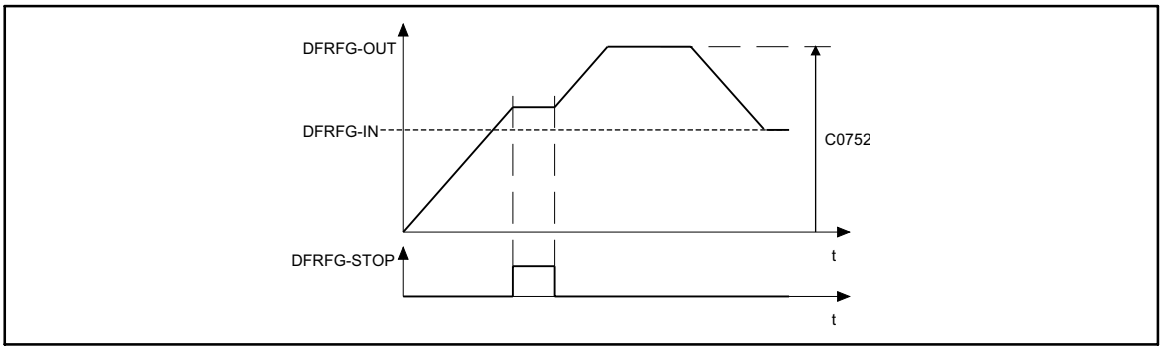


Fig. 3-127 Ramp function generator stop

3.5.29.4 RESET

DFRFG-RESET = HIGH:

- Resets setpoint phases which are internally added.
- Activates the profile generator.
- HIGH-LOW edge at DFRFG-RESET: Detecting the setpoint phase.

3.5.29.5 Detect phase difference

Monitoring the phase difference between input DFRFG-IN and output DFRFG-OUT.

- Set limit value of monitoring via C0754.
- Activates the monitoring: DFRFG-FAIL = HIGH
- Storing the signal until DFRFG-RESET = HIGH.
- The profile generator can accept a phase difference of up to ±2140000000 inc (= 32000 revolutions).

3.5.29.6 Start via touch probe initiator (terminal X5/E5)

Stop!

In the default setting the terminal X5/E5 is assigned to another function.

Function

- Set C0757 = 1.
- The function is activated by **simultaneously** setting the inputs:
  – DFRFG-QSP and DFRFG-RESET = HIGH.
- Starting procedure:
  – Signals at DFRFG-QSP and DFRFG-RESET = LOW.
  – Otherwise touch probe signals are ignored.
- A LOW-HIGH edge at terminal X5/E5 starts the process:

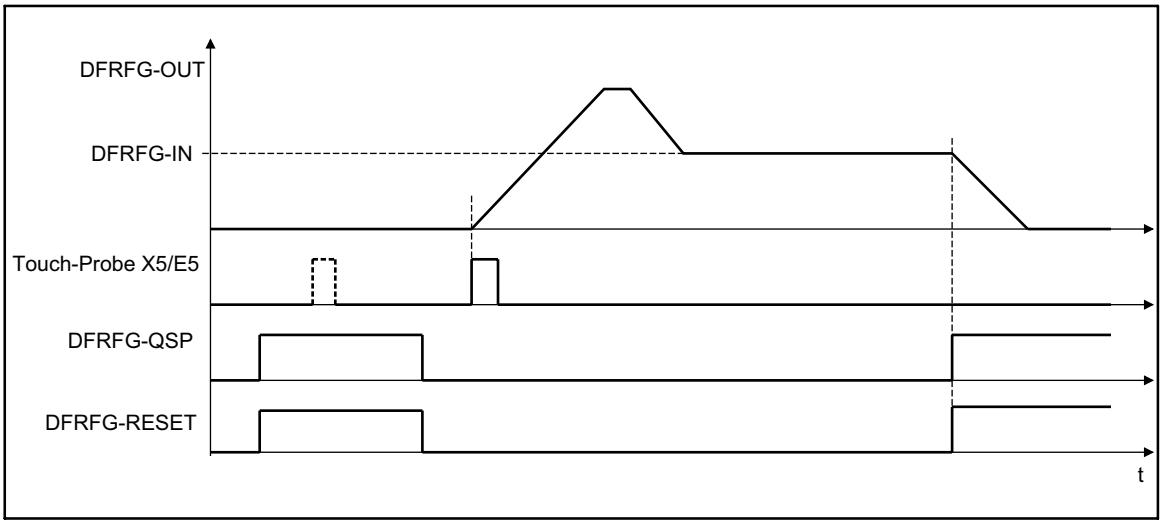


Fig. 3-128 Start via touch probe initiator (terminal X5/E5)

3.5.29.7 Correction of the touch probe initiator (terminal X5/E5)

Delay times during the activation of the initiator cause a speed-dependent phase offset (e.g. during positioning, synchronising).

In order to take this angular offset into account, the response time [ms] of the initiators as a function of the setpoint speed DFRFG-IN is converted to a phase angle correction and is then taken into consideration in the setpoint angle. For this, the response time [ms] has to be converted to a correction value [Inc.] first.

- Set correction value for the phase offset under C0429.
- Formula for input value in C0429:

$$\text{Input value C0429} = 16384 \times \text{response time [ms]}$$

- The response time [ms] can be gathered from the data sheet of the initiator or requested by the manufacturer.

3.5.29.8 Offset setting

The offset can be set with code C0756. The offset refers to the digital frequency input and is scaled to 1 revolution ($\triangleq$ 65536 increments).

The touch probe (TP) initiates the start of the ramp function generator. The leading of the master drive from the moment of starting or the resulting path/phase difference is taken up during the acceleration phase.

- Setting: positive offset values
  - Causes a time shift of the TP
  - This means that less time is necessary - compared to the setting with e.g. offset = 0 - to obtain synchronism with the master drive.

Tip!

With high offsets and low input speeds the drive may reverse. To avoid this, a direction of rotation can be selected for the output via C0766.

3.5.30 Digital frequency processing (DFSET)

Purpose

Conditions the digital frequency for the controller. Selection of the stretch factor, gearbox factor, and speed or phase trimming.

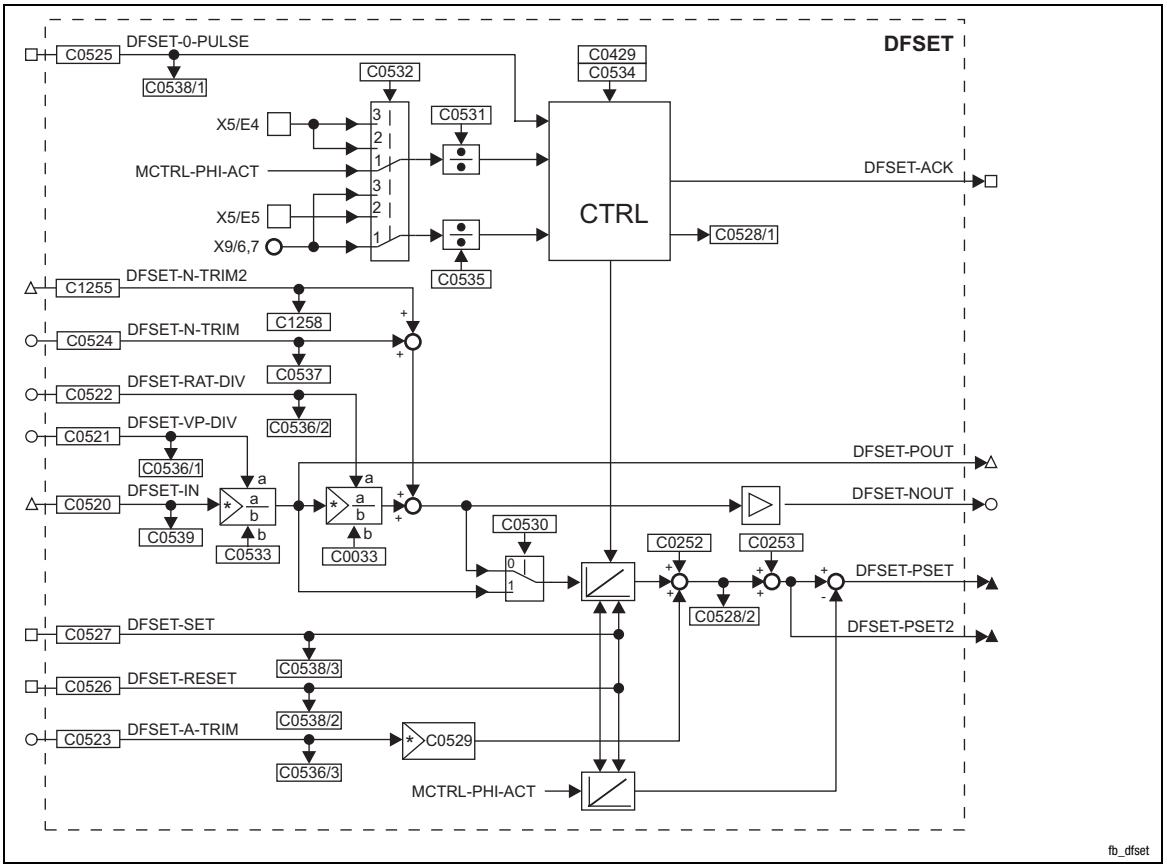


Fig. 3-129 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/angle setpoint
DFSET-N-TRIM	a	C0537	dec [%]	C0524	1	Speed trimming in [%] of C0011
DFSET-N-TRIM2	phd	C1258	dec [rpm]	C1255	4	Speed trimming in [rpm] of C0011
DFSET-A-TRIM	a	C0536/3	dec [inc]	C0523	1	Phase trimming 100% = 16384 inc
DFSET-VP-DIV	a	C0536/1	dec	C0521	1	Numerator of stretch factor 100 % = 16384 inc
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator of gearbox factor 100 % = 16384 inc
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = enable of zero pulse synchronisation
DFSET-SET	d	C0538/3	bin	C0527	2	• HIGH = Set phase integrators to equal values • LOW-HIGH edge sets DFSET-PSET = 0 • HIGH-LOW edge sets DFSET-PSET = current value of MCTRL-PHI-SET • DFSET-SET has a higher priority than DFSET-RESET
DFSET-RESET	d	C0538/2	bin	C0526	2	• HIGH = sets position difference = 0 • HIGH = sets DFSET-PSET and DFSET-PSET2 = 0
DFSET-NOUT	a	-	-	-	-	in [%] of nmax (C0011)
DFSET-POUT	phd	-	-	-	-	Speed/angle setpoint
DFSET-PSET	ph	-	-	-	-	Following error for phase controller
DFSET-PSET2	ph	-	-	-	-	Phase setpoint 65536 inc = 1 revolution
DFSET-ACK	d	-	-	-	-	HIGH = synchronising is performed

Function

- Setpoint conditioning with stretch and gearbox factor
- Processing of correction values
- Synchronising to zero track or touch probe (for resolver feedback touch probe only)

3.5.30.1 Setpoint conditioning with stretch and gearbox factor

Stretch factor

Defines the ratio between the drive and the setpoint.

- The stretch factor evaluates the setpoint at DFSET-IN. DFSET-POUT outputs the result.
- The stretch factor results from numerator and denominator.
  - Numerator is variable from analog signal source or fixed value by the code.
  - Input of the denominator under C0533.
- Relationship:

$$\text{DFSET–POUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}}$$

Gearbox factor

Defines the gearbox ratio of the drive. Enter the ratio of the drive.

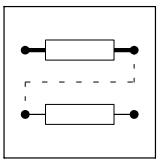
- The gearbox factor evaluates the setpoint at DFSET-IN multiplied by the stretch factor. DFSET-NOUT outputs the result.
- The gearbox factor results from the numerator and denominator.
  - Numerator is variable from analog signal source or fixed value by the code.
  - Input of the denominator under C0033.
- Relationship:

$$\text{DFSET–NOUT} = \text{Reckfaktor} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

$$\text{DFSET–NOUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

Tip!

With C0530 the gearbox factor and the DFSET-N-TRIM values can be deactivated as a basis for the setpoint angle. In the case of C0530 = 1, only the stretch factor is used for calculating the setpoint angle.



3.5.30.2 Processing of correction values

Speed trimming

This is used to add correction values, e.g. by a superimposed control loop. This enables the drive to accelerate or decelerate.

- Adds an analog value at DFSET-N-TRIM (see C0537) to the speed setpoint.
- Adds a speed value at DFSET-N-TRIM2 (see C1258) to the speed setpoint.
  – The speed trimming via this input is more precise.

Phase trimming

This adds a setpoint at DFSET-A-TRIM (see C0536/3) to the phase setpoint and changes the rotor position to the setpoint with the number of increments provided in either direction (drive is leading or lagging). The phase is trimmed within a range of ±32767 increments ($\triangleq$ ±1/2 revolution). Every analog signal can be used as a source.

- The entry is made in increments (one revolution $\triangleq$ 65536 increments).
- When analog values are entered, 100% correspond to 1/4 revolution = 16384 increments.
- Extension of the setting range with a multiplier under C0529.

Angular offset

Addition of a fixed phase offset under C0252 to the setpoint of the drive.

Speed-proportional phase setting

Leading or lagging of the phase with rising speed.

- Enter a suitable setting in increments under code C0253.
- The set phase offset is reached at 15000 rpm of the drive (linear relationship).

3.5.30.3 Synchronising to zero track or touch probe

Stop!

When the synchronisation via terminals X5/E4 and X5/E5 (C0532 = 2) is activated, these terminals must not contain any other signal connections. If a basic configuration is selected via C0005, the terminals receive a basic setting.

Synchronisation is selected in C0532.

- C0532 = 1, index pulse
  - Zero track of digital frequency input X9 and zero track by the feedback system set under C0490 (not for resolver evaluation).
- C0532 = 2, touch probe
  - Via terminals X5/E4 (actual pulse) and X5/E5 (set pulse).

Note!

For both modes you can define a dividing factor for the actual pulses in C0531 and for the set pulses in C0535.

- For C0531 = 10, for example, only every 10. actual pulse is evaluated. The other 9 pulses are ignored.
- Lenze setting: C0531 = 1, C0535 = 1

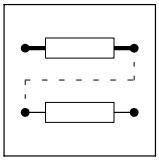
Correction of the touch probe initiator (terminal X5/E5)

Delay times when activating the initiator cause a speed-dependent angular offset (e.g. in the case of positioning, synchronising). In order to take this angular offset into account, the response time [ms] of the initiators as a function of the setpoint speed is converted to a phase angle correction and is then taken into consideration in the setpoint angle.

How to determine the phase angle correction value:

1. Convert the response time [ms] to a correction value [inc] using the formula:

   Phase angle correction value in C0429 = 16384 × response time [ms]
   - The response time [ms] can be gathered from the data sheet or requested from the manufacturer of the initiator.
2. Set the phase angle correction value for the angular offset in C0429.



Synchronisation mode

For the synchronisation, different modes are available which can be set under C0534.

C0534	Synchronisation mode	Note
0	Synchronisation not active	
1	Permanent synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	
2	Permanent synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	A LOW-HIGH edge at DFSET-0-pulse activates a continuous synchronisation.
10	One-time synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
11	One-time synchronisation with correction of the angular difference in clockwise rotation.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
12	One-time synchronisation with correction of the angular difference in counter-clockwise rotation.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
13	One-time synchronisation with correction of the angular difference. The difference is determined between the setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.

3.5.31 Delay elements (DIGDEL)

Purpose

This function is used to delay digital signals. This function can be used for the control of functions or the generation of status information.

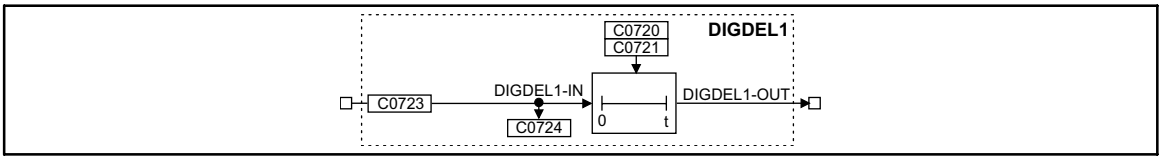


Fig. 3-130 Delay element (DIGDEL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL1-IN	d	C0724	bin	C0723	2	1000	-
DIGDEL1-OUT	d	-	-	-	-	-	-

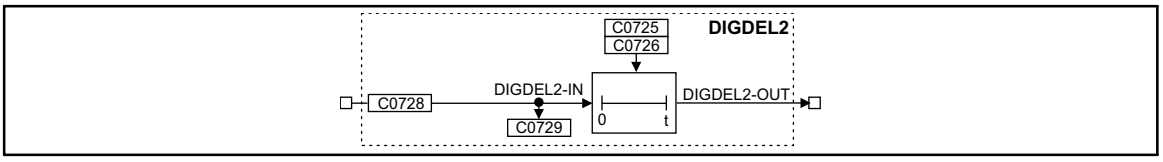


Fig. 3-131 Delay element (DIGDEL2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL2-IN	d	C0729	bin	C0728	2	1000	-
DIGDEL-OUT	d	-	-	-	-	-	-

Function

You can select the following functions under C0720 (DIGDEL1) and C0725 (DIGDEL2):

- On-delay
- Off-delay
- General delay

3.5.31.1 On-delay

If the on-delay is set, a signal change from LOW to HIGH at the input DIGDELx-IN is passed on to the DIGDELx-OUT output after the delay time set under C0721 or C0726 has elapsed.

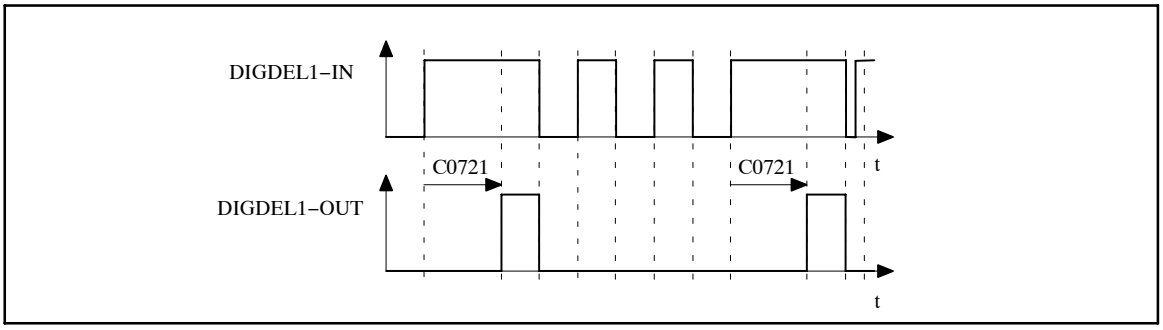


Fig. 3-132 On-delay (DIGDEL1)

In this function, the time element operates like a retriggerable monoflop:

- A LOW-HIGH edge at the input DIGDELx-IN starts the time element.
- If the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to HIGH.
- The time element is reset and the output DIGDELx-OUT is set to LOW with a HIGH-LOW edge at the input DIGDELx-IN.

3.5.31.2 Off-delay

An off-delay causes a signal change from HIGH to LOW at the input DIGDELx-IN to be passed on to the output DIGDELx-OUT after the delay time set under C0721 or C0726 has elapsed.

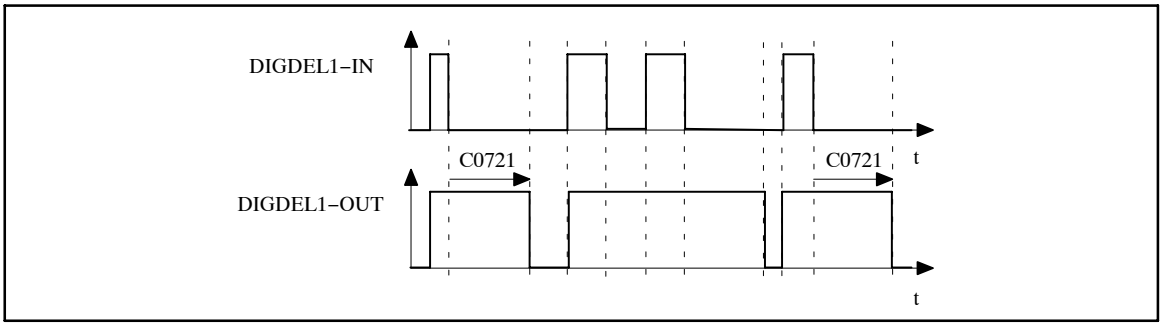


Fig. 3-133 Off-delay (DIGDEL1)

- A LOW-HIGH edge at the input DIGDELx-IN causes the output DIGDELx-OUT to be set to HIGH and the time element to be reset.
- The time element is started with a HIGH-LOW edge at the input DIGDELx-IN.
- After the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to LOW.

3.5.31.3 General delay

A general delay causes any signal change at the input DIGDELx-IN to be passed onto the output DIGDELx-OUT only after the time set under C0721 or C0726 has elapsed.

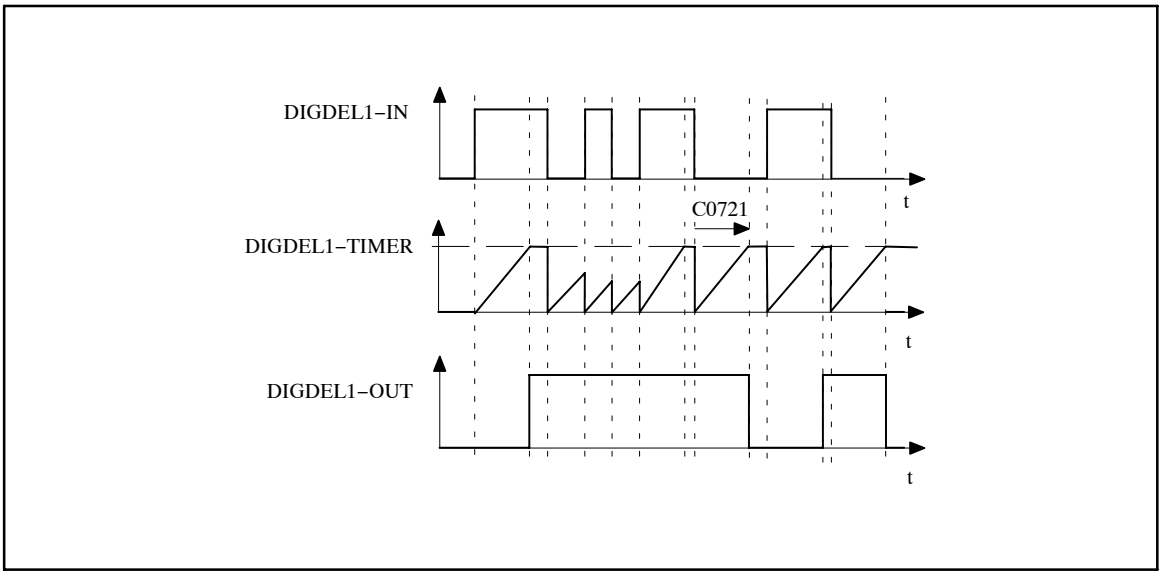


Fig. 3-134 General delay

- The time element is started with any edge at the input DIGDELx-IN.
- When the timer (can be set under C0721 or C0726) has reached the upper limit, the output DIGDELx-OUT is set to the same value as the input DIGDEL1-IN.

3.5.32 Freely assignable digital inputs (DIGIN)

Purpose

Reading and conditioning of the signals at the terminals X5/E1 to X5/E5.

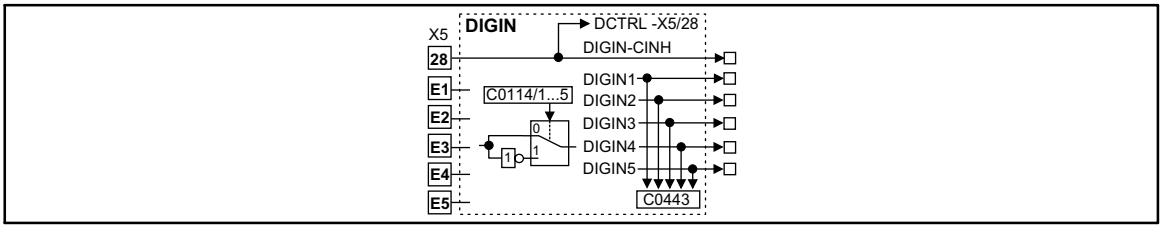


Fig. 3-135 Freely assignable digital inputs (DIGIN)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGIN-CINH	d	-	dec	-	-	-	Controller inhibit acts directly on the DCTRL control
DIGIN1	d	C0443	dec	-	-	-	-
DIGIN2	d	C0443	dec	-	-	-	-
DIGIN3	d	C0443	dec	-	-	-	-
DIGIN4	d	C0443	dec	-	-	-	-
DIGIN5	d	C0443	dec	-	-	-	-

Function

The terminals X5/E1 to X5/E5 are scanned every millisecond. The level for every input can be inverted. For this, proceed as follows:

- Select code C0114 with corresponding subcode (e.g. subcode 3 for input X5/E3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.5.33 Freely assignable digital outputs (DIGOUT)

Purpose

Conditioning of the digital signals and output at the terminals X5/A1 to X5/A4.

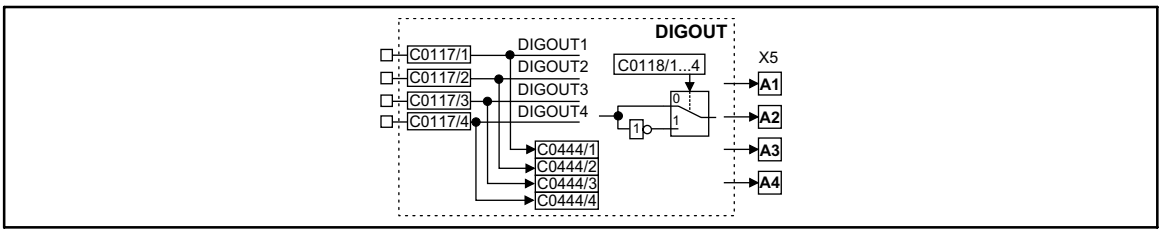


Fig. 3-136 Freely assignable digital outputs (DIGOUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGOUT1	d	C0444/1	bin	C0117/1	2	15000	-
DIGOUT2	d	C0444/2	bin	C0117/2	2	10650	-
DIGOUT3	d	C0444/3	bin	C0117/3	2	500	-
DIGOUT4	d	C0444/4	bin	C0117/4	2	5003	-

Function

The terminals X5/A1 to X5/A4 are updated every millisecond. The level for every output can be inverted. For this, proceed as follows:

- Select code C0118 with corresponding subcode (e.g. subcode 3 for output X5/A3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.5.34 Free analog display code (DISA)

One function block (DISA) is available.

Purpose

Display analog values in the following formats:

- Analog (%)
- Decimal (dec)
- Hexadecimal (hex)

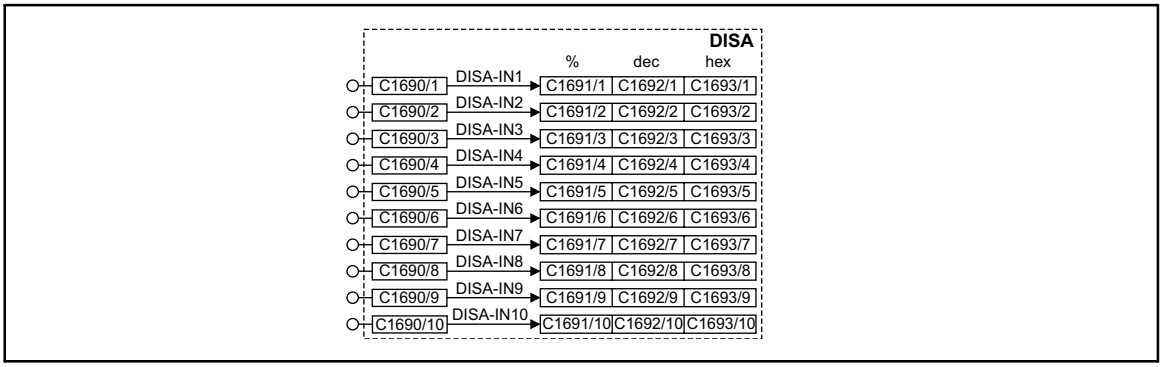


Fig. 3-137 Function block DISA

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DISA-IN1	a	C1691/1	dec [%]	C1690/1	1	-
		C1692/1	dec			
		C1693/1	hex			
DISA-IN2	a	C1691/2	dec [%]	C1690/2	1	-
		C1692/2	dec			
		C1693/2	hex			
DISA-IN3	a	C1691/3	dec [%]	C1690/3	1	-
		C1692/3	dec			
		C1693/3	hex			
DISA-IN4	a	C1691/4	dec [%]	C1690/4	1	-
		C1692/4	dec			
		C1693/4	hex			
DISA-IN5	a	C1691/5	dec [%]	C1690/5	1	-
		C1692/5	dec			
		C1693/5	hex			

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DISA-IN6	a	C1691/6	dec [%]	C1690/6	1	-
		C1692/6	dec			
		C1693/6	hex			
DISA-IN7	a	C1691/7	dec [%]	C1690/7	1	-
		C1692/7	dec			
		C1693/7	hex			
DISA-IN8	a	C1691/8	dec [%]	C1690/8	1	-
		C1692/8	dec			
		C1693/8	hex			
DISA-IN9	a	C1691/9	dec [%]	C1690/9	1	-
		C1692/9	dec			
		C1693/9	hex			
DISA-IN10	a	C1691/10	dec [%]	C1690/10	1	-
		C1692/10	dec			
		C1693/10	hex			

3.5.35 Free phase display code (DISPH)

One function block (DISPH) is available.

Purpose

Display phase values.

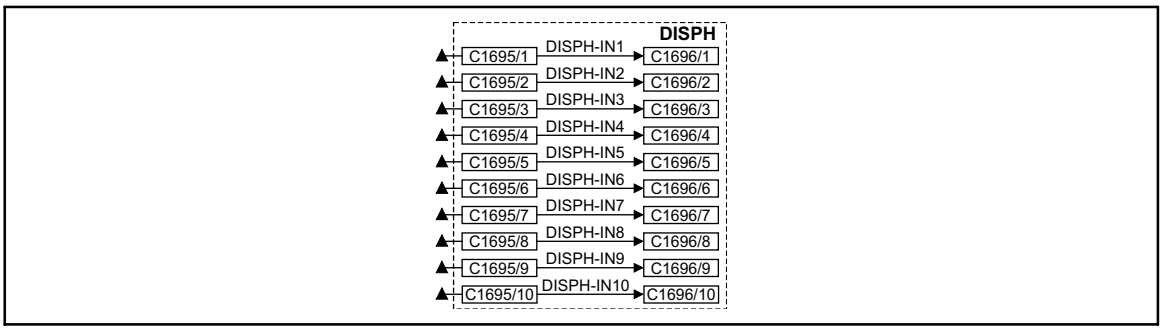


Fig. 3-138 Function block DISPH

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DISPH-IN1	ph	C1696/1	dec [inc]	C1695/1	3	-
DISPH-IN2	ph	C1696/2	dec [inc]	C1695/2	3	-
DISPH-IN3	ph	C1696/3	dec [inc]	C1695/3	3	-
DISPH-IN4	ph	C1696/4	dec [inc]	C1695/4	3	-
DISPH-IN5	ph	C1696/5	dec [inc]	C1695/5	3	-
DISPH-IN6	ph	C1696/6	dec [inc]	C1695/6	3	-
DISPH-IN7	ph	C1696/7	dec [inc]	C1695/7	3	-
DISPH-IN8	ph	C1696/8	dec [inc]	C1695/8	3	-
DISPH-IN9	ph	C1696/9	dec [inc]	C1695/9	3	-
DISPH-IN10	ph	C1696/10	dec [inc]	C1695/10	3	-

3.5.36 First order derivative-action element (DT1)

Purpose

Derivative action on signals.

For instance, used for the acceleration processes (dv/dt).

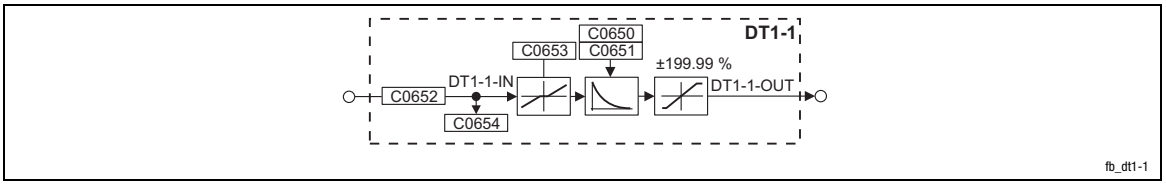


Fig. 3-139 First order derivative-action element (DT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DT1-1-IN	a	C0654	dec [%]	C0652	1	1000	-
DT1-1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The gain is set under C0650.
- The delay T_V is set under C0651.
- The input sensitivity of the DT1-1 element can be reduced under C0653.
- The FB only evaluates the specified most significant bits, according to the setting.

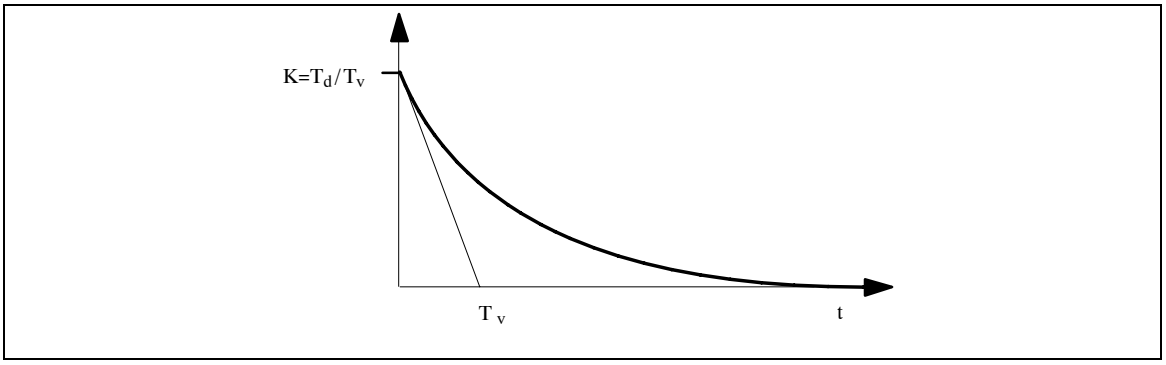


Fig. 3-140 Delay time T_V of the first order derivative-action element

3.5.37 Free piece counter (FCNT)

Purpose

Digital up/down counter

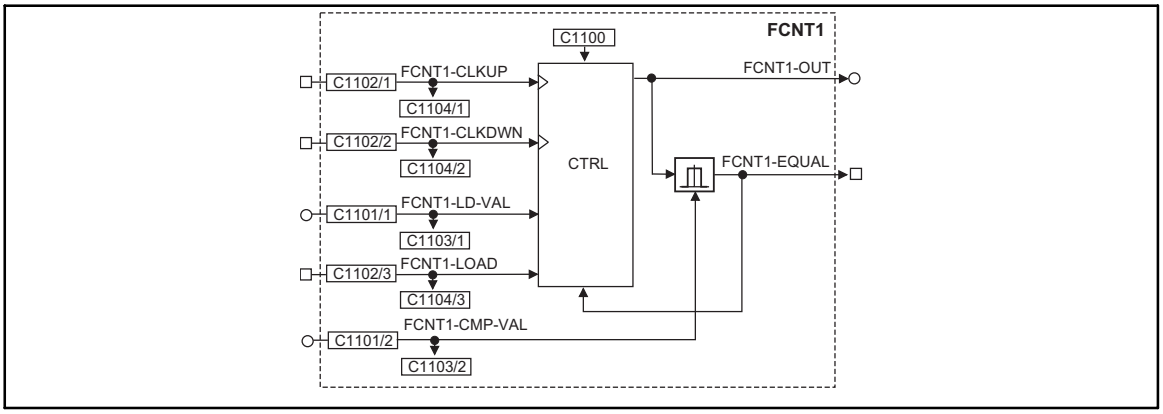


Fig. 3-141 Free piece counter (FCNT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT1-CLKUP	d	C1104/1	bin	C1102/1	2	LOW-HIGH edge = counts up by 1
FCNT1-CLKDWN	d	C1104/2	bin	C1102/2	2	LOW-HIGH edge = counts down by 1
FCNT1-LD-VAL	a	C1103/1	dec	C1101/1	1	Starting value
FCNT1-LOAD	d	C1104/3	bin	C1102/3	2	• HIGH = Accept starting value • The input has the highest priority
FCNT1-CMP-VAL	a	C1103/2	dec	C1101/2	1	Comparison value
FCNT1-OUT	a	-	-	-	-	Counter limited to ±199.99 % (≙ ±32767)
FCNT1-EQUAL	d	-	-	-	-	HIGH = comparison value reached

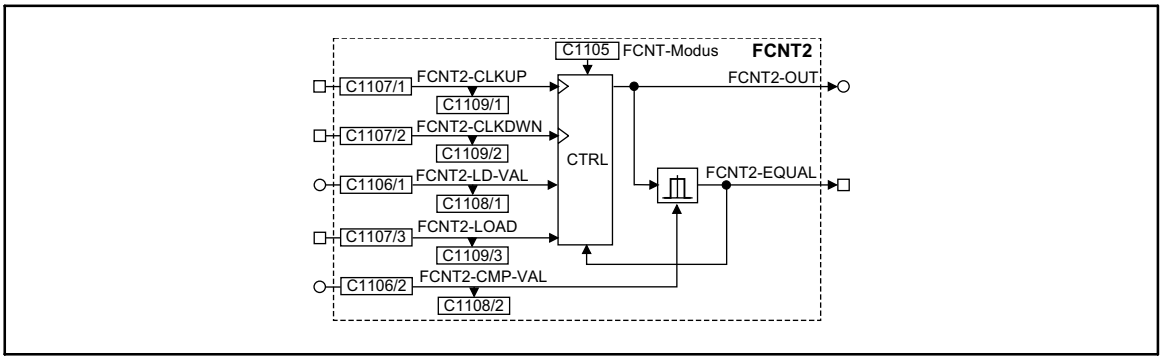


Fig. 3-142 Free piece counter (FCNT2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT2-CLKUP	d	C1109/1	bin	C1107/1	2	LOW-HIGH edge = Increment counter by 1
FCNT2-CLKDWN	d	C1109/2	bin	C1107/2	2	LOW-HIGH edge = Decrement counter by 1
FCNT2-LD-VAL	a	C1108/1	dec	C1106/1	1	Start value
FCNT2-LOAD	d	C1109/3	bin	C1107/3	2	HIGH = Accept start value
FCNT2-CMP-VAL	a	C1108/2	dec	C1106/2	1	Comparison value
FCNT2-OUT	a	-	-	-	-	Count limited to ±199.99% corresponds to ±32767
FCNT2-EQUAL	d	-	-	-	-	HIGH = comparison value reached

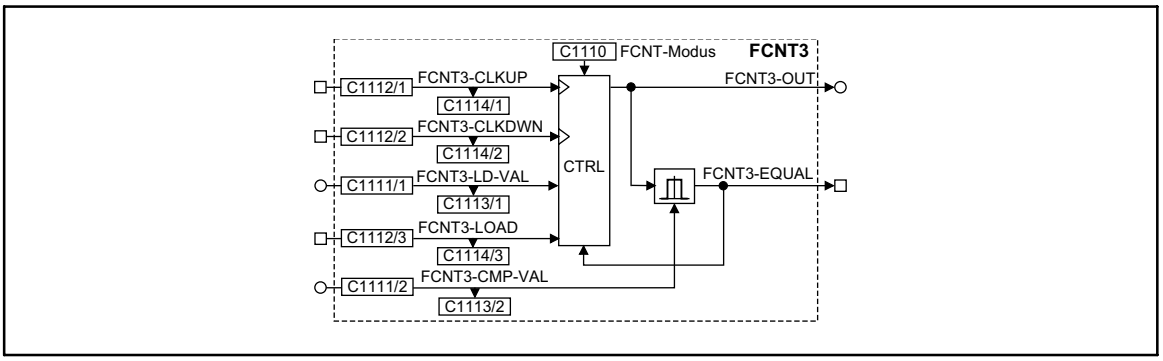


Fig. 3-143 Free piece counter (FCNT3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT3-CLKUP	d	C1114/1	bin	C1112/1	2	LOW-HIGH edge = Increment counter by 1
FCNT3-CLKDWN	d	C1114/2	bin	C1112/2	2	LOW-HIGH edge = Decrement counter by 1
FCNT3-LD-VAL	a	C1113/1	dec	C1111/1	1	Start value
FCNT3-LOAD	d	C1114/3	bin	C1112/3	2	HIGH = Accept start value
FCNT3-CMP-VAL	a	C1113/2	dec	C1111/2	1	Comparison value
FCNT3-OUT	a	-	-	-	-	Count limited to ±199.99% corresponds to ±32767
FCNT3-EQUAL	d	-	-	-	-	HIGH = comparison value reached

Function

- C1100 = 1
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), FCNT1-EQUAL is set = HIGH for 1 ms. Afterwards the counter is reset to the starting value (FCNT1-LD-VAL).

Note!

If the signal is to be available longer, e. g. for a query of the output via a PLC, you can prolong the signal via the TRANS function block.

- C1100 = 2
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
- C1100 = 3
  - If | counter content| = | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
  - FCNT1-OUT is limited to 32767 for counting upwards and to -32767 for counting downwards.

3.5.38 Free digital outputs (FDO)

Purpose

This function block can be used to connect digital signals via C0151, the function block AIF-OUT and function block CAN-OUT to the connected fieldbus systems.

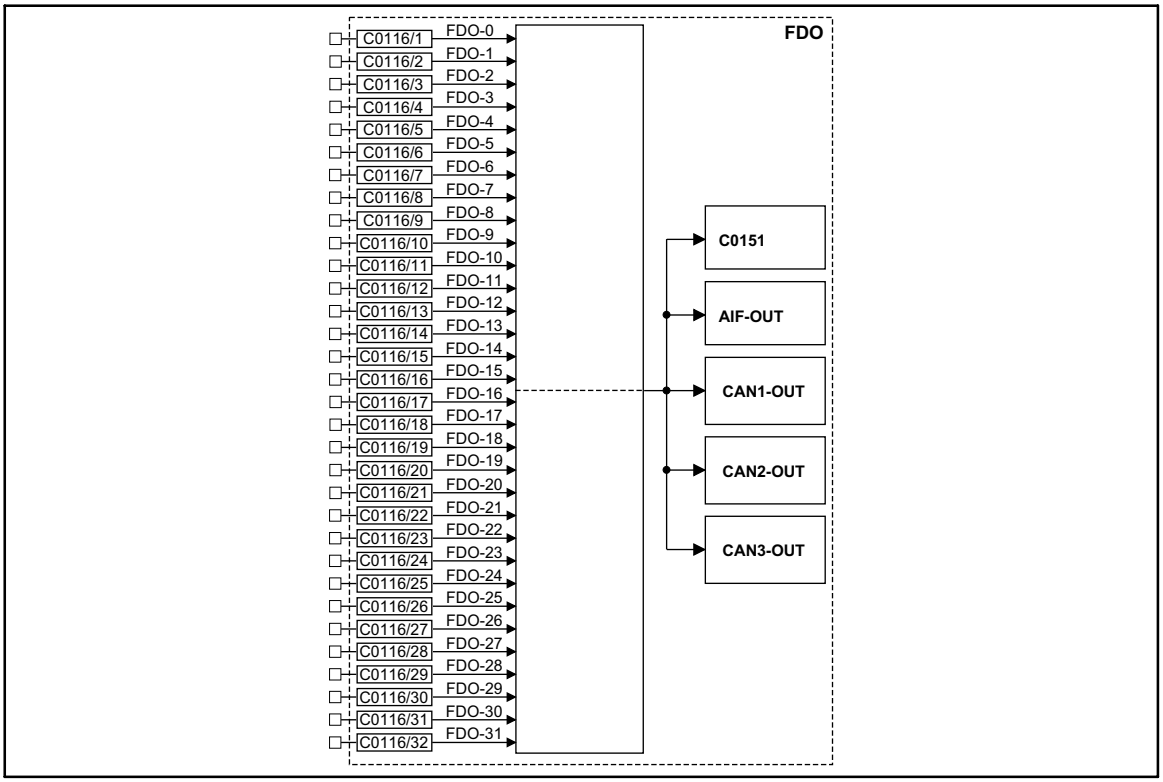


Fig. 3-144 Free digital outputs (FDO)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FDO-0	d	C0151	hex	C0116/1	2	1000	
FDO-1	d	C0151	hex	C0116/2	2	1000	
FDO-2	d	C0151	hex	C0116/3	2	1000	
FDO-3	d	C0151	hex	C0116/4	2	1000	
FDO-4	d	C0151	hex	C0116/5	2	1000	
FDO-5	d	C0151	hex	C0116/6	2	1000	
FDO-6	d	C0151	hex	C0116/7	2	1000	
FDO-7	d	C0151	hex	C0116/8	2	1000	
FDO-8	d	C0151	hex	C0116/9	2	1000	
FDO-9	d	C0151	hex	C0116/10	2	1000	
FDO-10	d	C0151	hex	C0116/11	2	1000	
FDO-11	d	C0151	hex	C0116/12	2	1000	
FDO-12	d	C0151	hex	C0116/13	2	1000	
FDO-13	d	C0151	hex	C0116/14	2	1000	
FDO-14	d	C0151	hex	C0116/15	2	1000	
FDO-15	d	C0151	hex	C0116/16	2	1000	
FDO-16	d	C0151	hex	C0116/17	2	1000	
FDO-17	d	C0151	hex	C0116/18	2	1000	
FDO-18	d	C0151	hex	C0116/19	2	1000	
FDO-19	d	C0151	hex	C0116/20	2	1000	
FDO-20	d	C0151	hex	C0116/21	2	1000	
FDO-21	d	C0151	hex	C0116/22	2	1000	
FDO-22	d	C0151	hex	C0116/23	2	1000	
FDO-23	d	C0151	hex	C0116/24	2	1000	
FDO-24	d	C0151	hex	C0116/25	2	1000	
FDO-25	d	C0151	hex	C0116/26	2	1000	
FDO-26	d	C0151	hex	C0116/27	2	1000	
FDO-27	d	C0151	hex	C0116/28	2	1000	
FDO-28	d	C0151	hex	C0116/29	2	1000	
FDO-29	d	C0151	hex	C0116/30	2	1000	
FDO-30	d	C0151	hex	C0116/31	2	1000	
FDO-31	d	C0151	hex	C0116/32	2	1000	

Function

You can freely select a digital signal source for every signal input.

- The corresponding bit in the data word (DWORD) is marked with FDO-x (e.g. FDO-0 for the LSB and FDO-31 for the MSB).
- The DWORD is transferred to code C0151 and to the function blocks AIF-OUT, CAN-OUT1, CAN-OUT2, and CAN-OUT3.

3.5.39 Freely assignable input variables (FEVAN)

Purpose

Transfer of analog signals to any code. At the same time, the FB converts the signal into the data format of the target code.

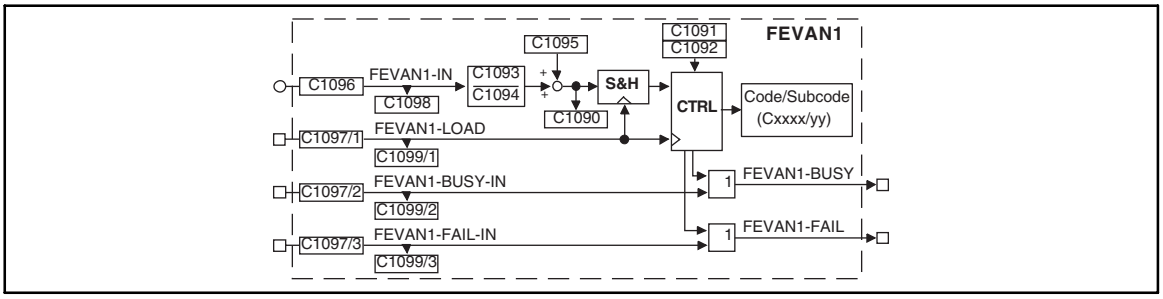


Fig. 3-145 Freely assignable input variables (FEVAN1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN1-IN	a	C1098	dec	C1096	1	Input value
FEVAN1-LOAD	d	C1099/1	bin	C1097/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN1-BUSY-IN	d	C1099/2	bin	C1097/2	2	HIGH = transmitting
FEVAN1-FAIL-IN	d	C1099/3	bin	C1097/3	2	High = transmission failed
FEVAN1-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN1-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN1-LOAD sets FEFAN1-FAIL = LOW.
-	-	C1090	-	-	-	Display of the converted signal

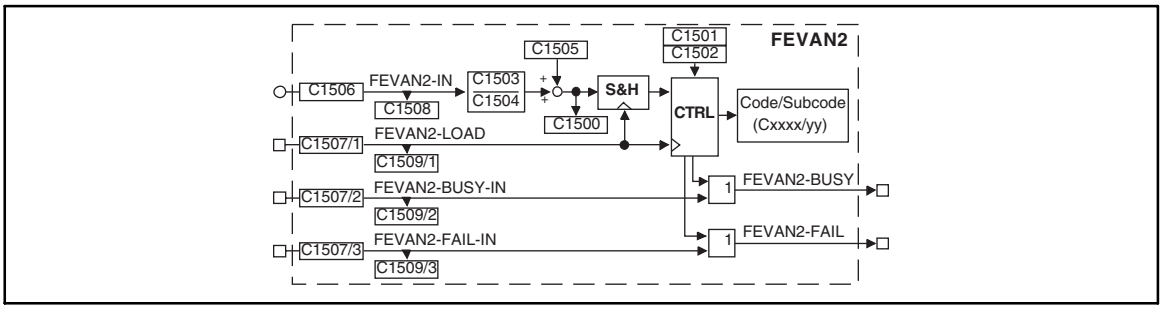


Fig. 3-146 Freely assignable input variables (FEVAN2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN2-IN	a	C1508	dec	C1506	1	Input value
FEVAN2-LOAD	d	C1509/1	bin	C1507/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN2-BUSY-IN	d	C1509/2	bin	C1507/2	2	HIGH = transmitting
FEVAN2-FAIL-IN	d	C1509/3	bin	C1507/3	2	HIGH = transmission failed
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN2-LOAD switches FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

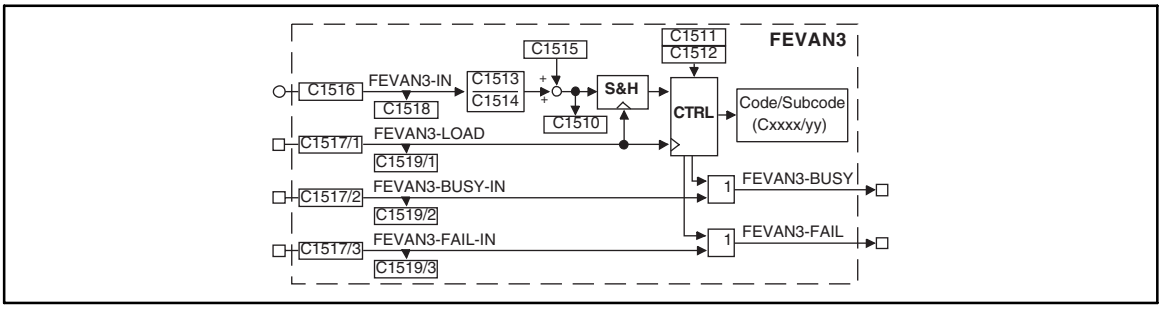


Fig. 3-147 Freely assignable input variables (FEVAN3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN3-IN	a	C1518	dec	C1516	1	Input value
FEVAN3-LOAD	d	C1519/1	bin	C1517/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN3-BUSY-IN	d	C1519/2	bin	C1517/2	2	HIGH = transmitting
FEVAN3-FAIL-IN	d	C1519/3	bin	C1517/3	2	High = transmission failed
FEVAN3-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN3-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN3-LOAD sets FEFAN3-FAIL = LOW.
-	-	C1510	-	-	-	Display of the converted signal

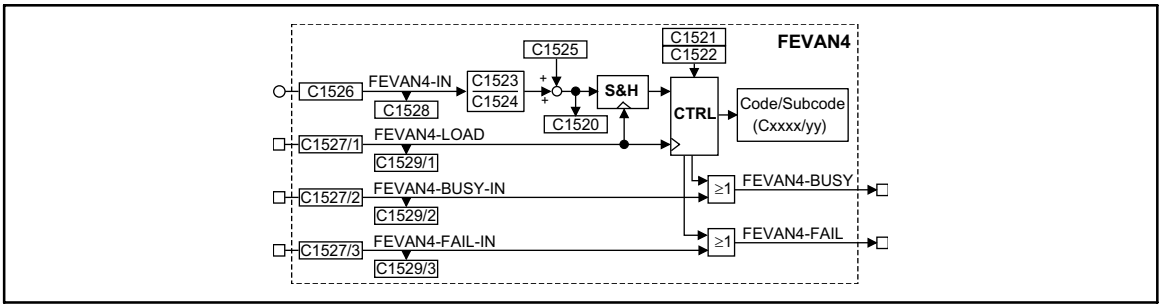


Fig. 3-148 Freely assignable input variables (FEVAN4)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN4-IN	a	C1528	dec	C1526	1	Input value
FEVAN4-LOAD	d	C1529/1	bin	C1527/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN4-BUSY-IN	d	C1529/2	bin	C1527/2	2	HIGH = transmitting
FEVAN4-FAIL-IN	d	C1529/3	bin	C1527/3	2	HIGH = transmission failed
FEVAN4-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN4-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN4-LOAD sets FEFAN4-FAIL = LOW.
-	-	C1520	-	-	-	Display of the converted signal

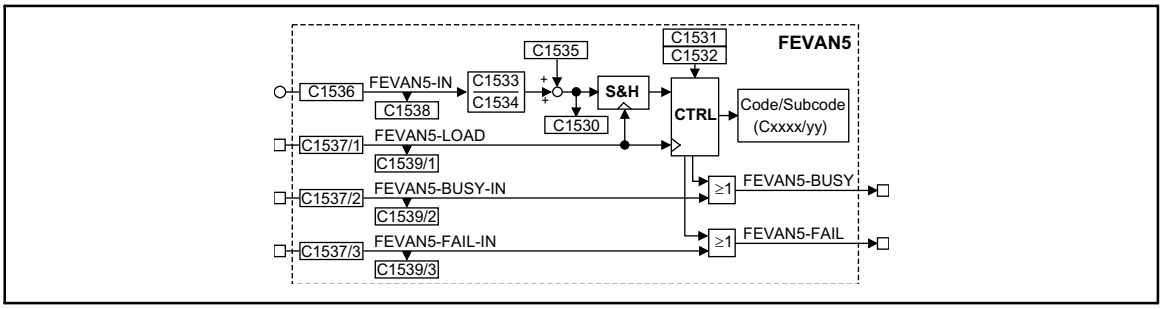


Fig. 3-149 Freely assignable input variables (FEVAN5)

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
FEVAN5-IN	a	C1538	dec	C1536	1	Input value
FEVAN5-LOAD	d	C1539/1	bin	C1537/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN5-BUSY-IN	d	C1539/2	bin	C1537/2	2	HIGH = transmitting
FEVAN5-FAIL-IN	d	C1539/3	bin	C1537/3	2	HIGH = transmission failed
FEVAN5-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN5-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN5-LOAD sets FEFAN5-FAIL = LOW.
-	-	C1530	-	-	-	Display of the converted signal

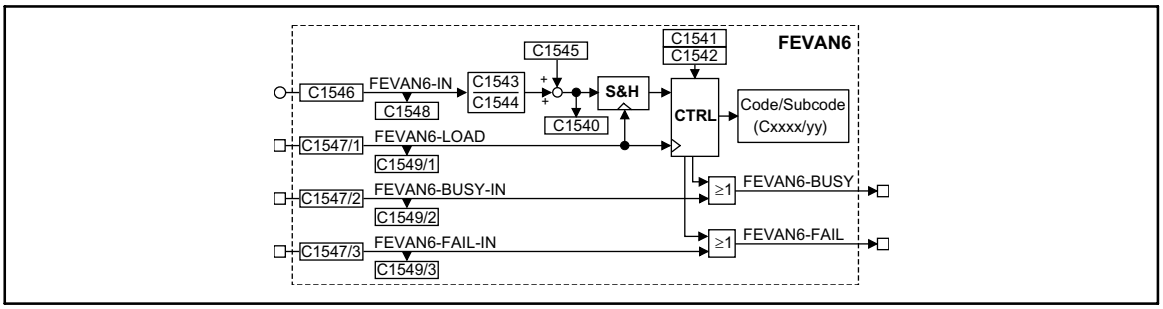


Fig. 3-150 Freely assignable input variables (FEVAN6)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN6-IN	a	C1548	dec	C1546	1	Input value
FEVAN6-LOAD	d	C1549/1	bin	C1547/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN6-BUSY-IN	d	C1549/2	bin	C1547/2	2	HIGH = transmitting
FEVAN6-FAIL-IN	d	C1549/3	bin	C1547/3	2	High = transmission failed
FEVAN6-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN6-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN6-LOAD sets FEFAN6-FAIL = LOW.
-	-	C1540	-	-	-	Display of the converted signal

Function

- Conversion of the read data via:
  - Numerator, denominator.
  - Offset.
- Selection of a target code for the read data.

Codes for the conversion of the data read and for the selection of the target code

				Selection of the target code		
Function block	Numerator	Denominator	Offset	Code	Subcode	Examples
FEVAN1	C1093	C1094	C1095	C1091	C1092	
FEVAN2	C1503	C1504	C1505	C1501	C1502	
FEVAN3	C1513	C1514	C1515	C1511	C1512	
FEVAN4	C1523	C1524	C1525	C1521	C1522	
FEVAN5	C1533	C1534	C1535	C1531	C1532	
FEVAN6	C1543	C1544	C1545	C1541	C1542	

Data transmission

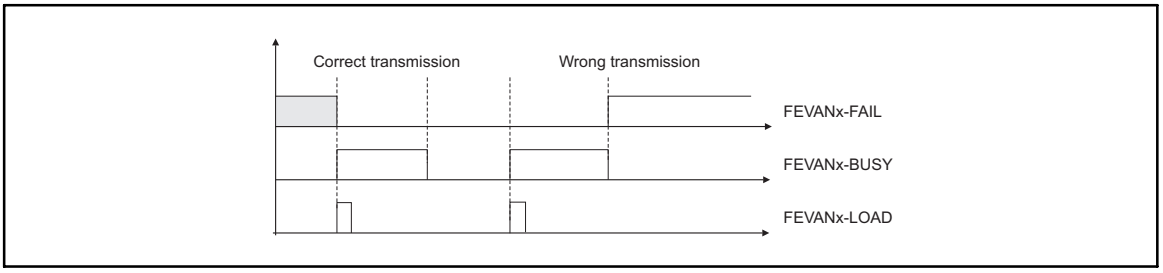


Fig. 3-151 Signal flow

Transmission errors may occur if

- no target code is available,
- no target subcode is available,
- the data transmitted are out of the target code limits,
- the target code is inhibited since it may only be written if the controller is inhibited. Inhibit the controller (see code table).

Cyclic data transmission

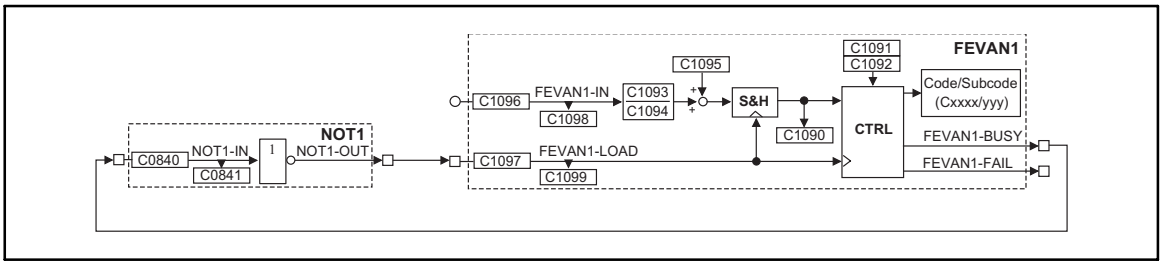


Fig. 3-152 Example for a cyclic data transmission to a target code

Conversion

In the example, the conversion is made at FB FEVAN1.

- The data format of the target code is important for the conversion (see attribute table).
- Adapt the input signal to the data format of the target code:
  - C1093 (numerator).
  - C1094 (denominator).
- C1094 also fixes the decimal positions of the target code:
  - Set C1094 according to the existing decimal positions of the target code. The number of decimal positions can be obtained from the code table.
  - 0.0001 ≙ no decimal positions.
  - 0.001 ≙ one decimal position.
  - 0.01 ≙ two decimal positions.
  - 0.1 ≙ three decimal positions.
  - 1 ≙ four decimal positions.
- For target codes with % scaling the formula for conversion must include a scaling factor (see example 1).

Example 1 (only for FIX32 format with % scaling):

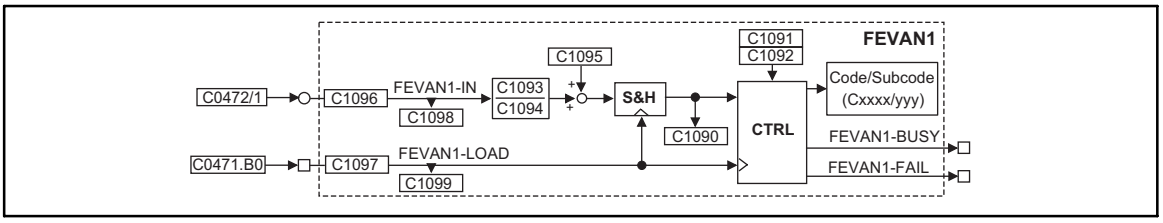


Fig. 3-153 Example of a circuit for FIX32 format with % scaling

Task:

- C0472/1 = 1.05 %. Write this value to C0141.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-472/1 (19521).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 141 (≙ C0141)
- Set C1092 = 0 (no subcode available)
- C1093 = calculate numerator
- Set C1094 = 0.01 (two decimal positions)
- Set C1095 = 0 (no offset).

Calculation:

$$\text{FEVAN1–IN [\%]} \cdot \underbrace{\frac{1}{10000}}_{\text{Scaling factor}} \cdot \underbrace{\frac{16384}{100}}_{\text{Scaling factor}} \cdot \frac{C1093}{C1094} + C1095 = C0141\ [\%]$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data are transmitted to the target code.

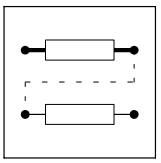
Example for converting to C1093:

$$1.05\ \% \cdot 10000 \cdot \frac{100}{16384} \cdot C1094 \cdot \underbrace{\frac{1}{1.05\ \%}}_{\text{FEVAN1-IN}} = C1093 = 0.6103$$

Setpoint in C0141

Display:

- C0141 = 1.00 %



Example 2 (only for FIX32 format without % scaling):

Task:

- C0473/1 = 1000. Write this value to C0011.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-473/1 (19551).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 11 (≙ C0011)
- Set C1092 = 0 (no subcode available)
- Set C1093 = 1.0
- Set C1094 = 0.0001 (no decimal position)
- Set C1095 = 0 (no offset).

The source code has no unit. The scaling factor is dropped.

Calculation:

$$\text{FEVAN1–IN} \cdot \frac{1}{10000} \cdot \frac{C1093}{C1094} + C1095 = C0011\ [\text{rpm}]$$

Scaling factor

$$1000 \cdot \frac{1}{10000} \cdot \frac{1,0}{0.0001} + 0 = 1000\ \text{rpm}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data are transmitted to the target code.

Display:

- C0011 displays the value 1000 rpm.

The other formats are calculated with the following formula:

$$\text{FEVAN1–IN} \cdot \frac{C1093}{C1094} + C1095 = x$$

3.5.40 Fixed setpoints (FIXSET)

Purpose

This FB serves to program up to 15 fixed setpoints which can be retrieved via digital terminals or control codes.

The fixed setpoints can e.g. be used for:

- different setpoint dancer positions for one dancer position control or
- different stretching ratios (gearbox factor) for a speed ratio control with digital frequency coupling

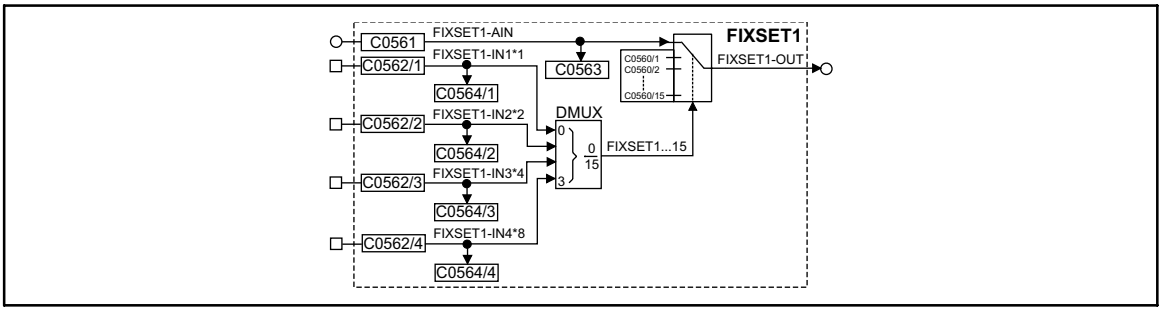


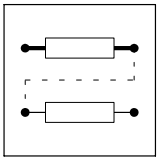
Fig. 3-154 Fixed setpoint (FIXSET1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FIXSET1-AIN	a	C0563	dec [%]	C0561	1	1000	The input is switched to the output if a LOW level is applied to all selection inputs FIXSET-INx.
FIXSET1-IN1*1	d	C0564/1	bin	C0562/1	2	1000	The number of the inputs to be assigned depends on the number of the FIXSET setpoints required.
FIXSET1-IN2*2	d	C0564/2	bin	C0562/2	2	1000	
FIXSET1-IN3*4	d	C0564/3	bin	C0562/3	2	1000	
FIXSET1-IN4*8	d	C0564/4	bin	C0562/4	2	1000	
FIXSET1-OUT	a	-	-	-	-	-	

Function

The FB output can be used as a setpoint source (signal source) for another FB (e.g. process controller, arithmetic block etc.). Parameter setting and handling are similar to JOG but independent of JOG (cp. FB NSET).

- Parameter setting of the fixed setpoints:
  - The single fixed setpoints are parameterised via the subcodes of C0560.
- Output of the fixed setpoint selected:
  - If the binary inputs are triggered with HIGH signal, a fixed setpoint from the table is switched to the output.
- Value range:
  - The values for the fixed setpoint can be set between -200% and +200%.



3.5.40.1 Release of the FIXSET1 setpoints

Number of the fixed setpoints required	Number of inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

System for decoding the binary input signals:

Output signal FIXSET1-OUT =	1st input FIXSET1-IN1	2nd input FIXSET1-IN2	3rd input FIXSET1-IN3	4th input FIXSET1-IN4
FIXSET1-Ain	0	0	0	0
C0560/1	1	0	0	0
C0560/2	0	1	0	0
C0560/3	1	1	0	0
C0560/4	0	0	1	0
C0560/5	1	0	1	0
C0560/6	0	1	1	0
C0560/7	1	1	1	0
C0560/8	0	0	0	1
C0560/9	1	0	0	1
C0560/10	0	1	0	1
C0560/11	1	1	0	1
C0560/12	0	0	1	1
C0560/13	1	0	1	1
C0560/14	0	1	1	1
C0560/15	1	1	1	1

3.5.41 Flipflop element (FLIP)

Purpose

This FB is a D flipflop. This function is used to evaluate and save digital signal edges.

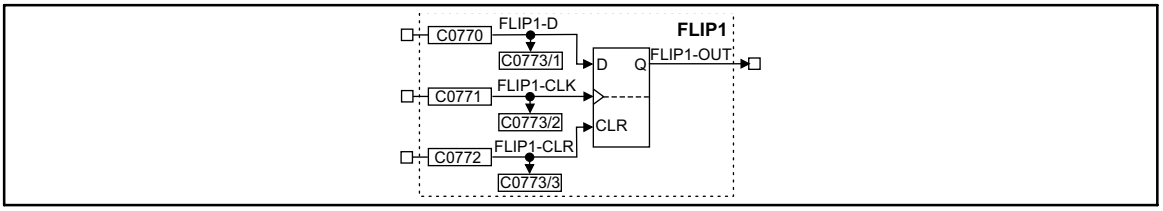


Fig. 3-155 Flipflop element (FLIP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP1-D	d	C0773/1	bin	C0770	2	1000	-
FLIP1-CLK	d	C0773/2	bin	C0771	2	1000	Evaluates LOW-HIGH edges only
FLIP1-CLR	d	C0773/3	bin	C0772	2	1000	Evaluates the input level only: input has highest priority
FLIP1-OUT	d	-	-	-	-	-	-

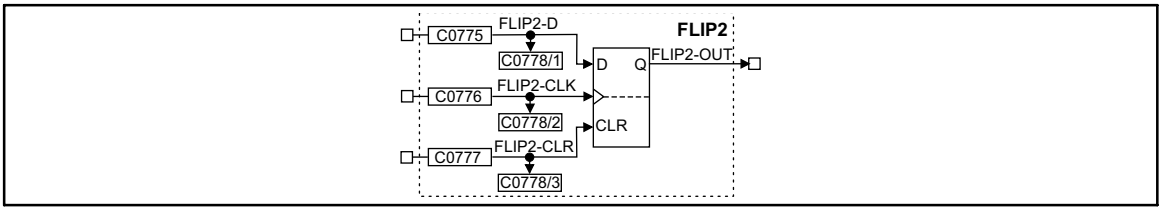


Fig. 3-156 Flipflop element (FLIP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP2-D	d	C0778/1	bin	C0775	2	1000	-
FLIP2-CLK	d	C0778/2	bin	C0776	2	1000	Evaluates LOW-HIGH edges only
FLIP2-CLR	d	C0778/3	bin	C0777	2	1000	Evaluates the input level only: input has highest priority
FLIP2-OUT	d	-	-	-	-	-	-

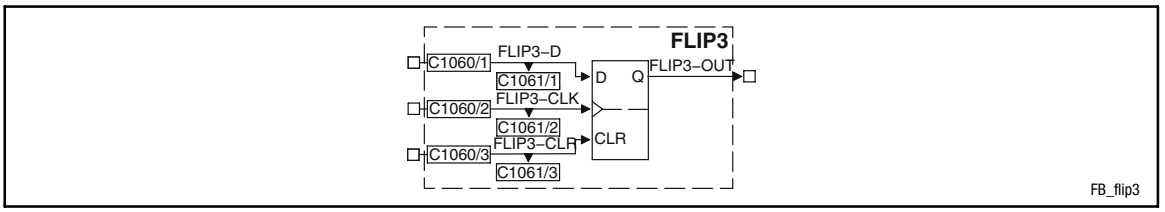


Fig. 3-157 Flipflop element (FLIP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP3-D	d	C1061/1	bin	C1060/1	2	1000	-
FLIP3-CLK	d	C1061/2	bin	C1060/2	2	1000	Evaluates LOW-HIGH edges only
FLIP3-CLR	d	C1061/3	bin	C1060/3	2	1000	Evaluates the input level only: input has highest priority
FLIP3-OUT	d	-	-	-	-	-	-

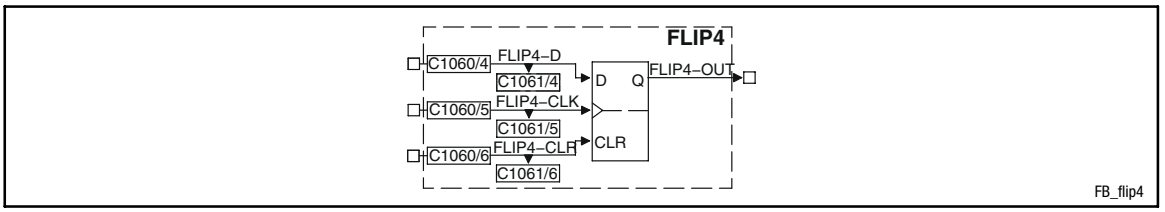


Fig. 3-158 Flipflop element (FLIP4)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP4-D	d	C1061/4	bin	C1060/4	2	1000	-
FLIP4-CLK	d	C1061/5	bin	C1060/5	2	1000	Evaluates LOW-HIGH edges only
FLIP4-CLR	d	C1061/6	bin	C1060/6	2	1000	Evaluates the input level only: input has highest priority
FLIP4-OUT	d	-	-	-	-	-	-

Function

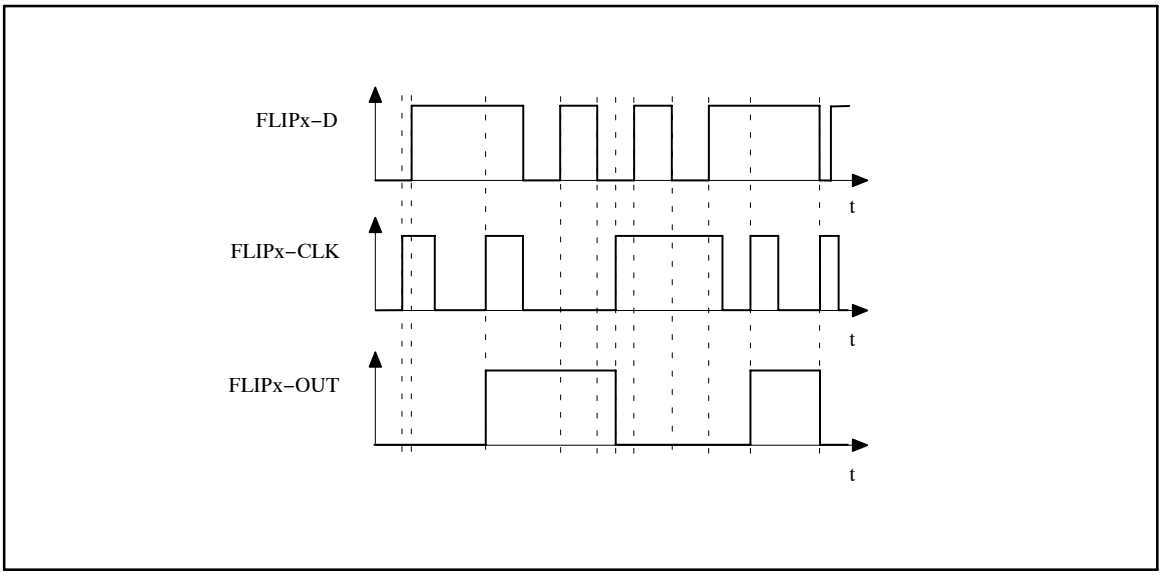


Fig. 3-159 Function sequence of a flipflop

- The input FLIPx-CLR always has priority.
- If a HIGH level is applied at the input FLIPx-CLR, the output FLIPx-OUT is set to and maintained at a LOW level al long as this input is at a HIGH level.
- With a LOW-HIGH edge at the input FLIPx-CLK, the level at the input FLIPx-D is switched to the output and saved until
  – another LOW-HIGH edge is applied at the input FLIPx-CLK or
  – the input FLIPx-CLR is set to a HIGH level.

3.5.42 Limiting element (LIM)

Purpose

This FB is used to limit signals to adjustable value ranges.

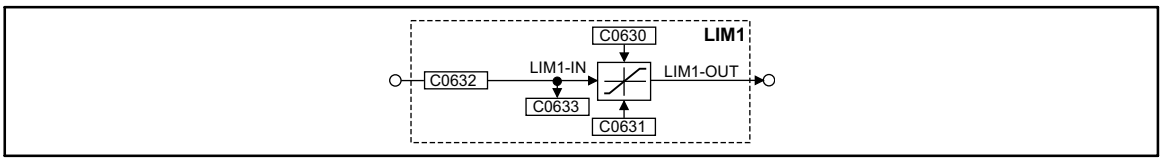


Fig. 3-160 Limiting element (LIM1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIM1-IN1	a	C0633	dec [%]	C0632	1	1000	-
LIM1-OUT	a	-	-	-	-	-	-

Function

- If the input signal exceeds the upper limit (C0630), the upper limit is effective.
- If the input signal falls below the lower limit (C0631), the lower limit is effective.

Tip!

The lower limit (C0631) must be smaller than the upper limit (C0630).

3.5.43 Internal motor control (MCTRL)

Purpose

This function block controls the drive machine consisting of angle controller, speed controller, and motor control.

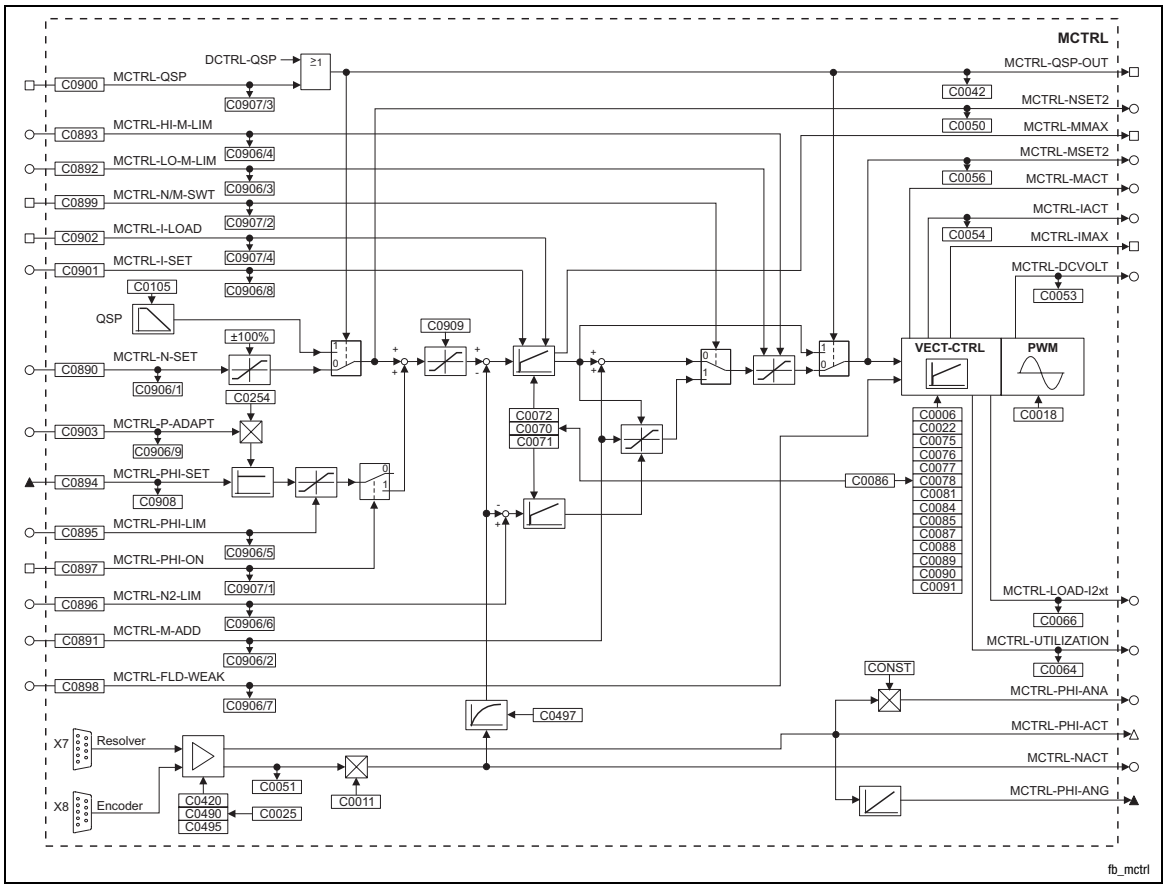
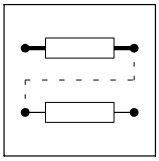


Fig. 3-161 Internal motor control (MCTRL)



Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
MCTRL-PHI-SET	ph	C0908	dec [inc]	C0894	3	1000	Angle controller input for difference of setpoint angle to actual angle
MCTRL-N-SET	a	C0906/1	dec [%]	C0890	1	5050	Speed setpoint input
MCTRL-M-ADD	a	C0906/2	dec [%]	C0891	1	1000	Additional torque setpoint or torque setpoint
MCTRL-LO-MLIM	a	C0906/3	dec [%]	C0892	1	5700	Lower torque limitation in % of C0057
MCTRL-HI-MLIM	a	C0906/4	dec [%]	C0893	1	19523	Upper torque limitation in % of C0057
MCTRL-PHI-LIM	a	C0906/5	dec [%]	C0895	1	1006	Influence of angle controller in % of nmax C0011
MCTRL-N2-LIM	a	C0906/6	dec [%]	C0896	1	1000	Lower speed limit at speed limitation
MCTRL-FLDWEAK	a	C0906/7	dec [%]	C0898	1	1006	Motor excitation
MCTRL-I-SET	a	C0906/8	dec [%]	C0901	1	1006	Input for setting the I component of the speed controller
MCTRL-P-ADAPT	a	C0906/9	dec [%]	C0903	1	1006	Influence in % on V_P of C0254, the absolute value is processed (without sign)
MCTRL-PHI-ON	d	C0907/1	bin	C0897	2	1000	HIGH = Activation of angle controller
MCTRL-N/M-SWT	d	C0907/2	bin	C0899	2	1000	LOW = active speed control HIGH = active torque control
MCTRL-QSP	d	C0907/3	bin	C0900	2	10250	HIGH = drive performs QSP
MCTRL-I-LOAD	d	C0907/4	bin	C0902	2	1000	HIGH = I component of the n-controller is accepted by MCTRL-I-SET
MCTRL-QSP-OUT	d	-	-	-	-	-	HIGH = drive performs QSP
MCTRL-NSET2	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-MMAX	d	-	-	-	-	-	HIGH = speed controller operates within the limits
MCTRL-MSET2	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-MACT	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-IACT	a	-	-	-	-	-	MCTRL-IACT = 100 % = C0022
MCTRL-IMAX	d	-	-	-	-	-	HIGH = drive operates at the current limit C0022
MCTRL-DCVOLT	a	-	-	-	-	-	100 % = 1000 V
MCTRL-LOAD-I2xt	a	-	-	-	-	-	$I^2 \times t$ utilisation of the motor in %
MCTRL-UTILIZATION	a	-	-	-	-	-	Device utilisation $I \times t$ in %
MCTRL-PHI-ANA	a	-	-	-	-	-	Actual angle value as analog signal 90° = 100 %
MCTRL-PHI-ACT	phd	-	-	-	-	-	
MCTRL-NACT	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-PHI-ANG	ph	-	-	-	-	-	65536 inc = one revolution

Function

- Current controller
- Torque limitation
- Additional torque setpoint
- Speed controller
- Torque control with speed limitation
- Speed setpoint limitation
- Angle controller
- Quick stop QSP
- Field weakening
- Switching frequency changeover

3.5.43.1 Current controller

Adapt current controller via C0075 (proportional gain) and C0076 (reset time) to the machine connected.

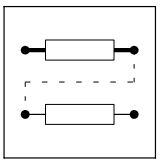
Note!

Use C0086 to select a suitable motor from the motor selection list. In this way, the parameters of the current controller are automatically set to the correct values.

3.5.43.2 Additional torque setpoint

The input MCTRL-M-ADD serves as torque setpoint or additional torque setpoint, depending on the control of the input MCTRL-N/M-SWT. The additional torque setpoint can be used e.g. for friction compensation or speed injection (dv/dt).

- When MCTRL-N/M-SWT = LOW the speed control is active.
  - MCTRL-M-ADD is added to the output of the n-controller.
  - The limits defined by the torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM cannot be exceeded.
- When MCTRL-N/M-SWT = HIGH, the torque control is active.
  - MCTRL-M-ADD acts as torque setpoint
  - The n-controllers have a monitoring function.
- The torque setpoint is specified in [%] of the max. possible torque (see C0057).
  - Negative values mean a torque with CCW rotation of the motor.
  - Positive values mean a torque with CW rotation of the motor.



3.5.43.3 Torque limitation

Via the inputs MCTRL-LO-M-LIM and MCTRL-HI-M-LIM an external torque limitation can be set. This serves to set different torques for the quadrants ”driving” and ”braking”.

- MCTRL-HI-M-LIM is the upper torque limit in [%] of the max. possible torque (C0057).
- MCTRL-LO-M-LIM is the lower torque limit in [%] of the max. possible torque (C0057).
- In case of quick stop (QSP) the torque limitation is deactivated.

Stop!

Only apply positive values to MCTRL-HI-M-LIM and negative values to MCTRL-LO-M-LIM. Otherwise the speed controller may lose control and the drive may rev up in an uncontrolled manner.

3.5.43.4 Speed controller

The speed controller is designed as an ideal PID controller.

Parameter setting

If you select a motor via C0086, the parameters are preset so that only a few (if any) adaptations to the application are necessary.

- Parameterisation of the proportional gain V_p in C0070:
  - Enter approx. 50 % of the speed setpoint
  - Increase C0070 until the drive becomes unstable (observe motor noises)
  - Reduce C0070 until the drive runs stable again
  - Reduce C0070 to approx. 50 %
- Parameterisation of the reset time T_n in C0071:
  - Reduce C0071 until the drive becomes unstable (observe motor noises)
  - Increase C0071 until the drive runs stable again
  - Set C0071 to the double value
- Parameterisation of the derivative gain T_d in C0072:
  - Increase C0072 during operation until an optimum behaviour is achieved.

Signal limitation

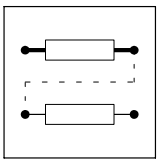
When the drive outputs the max. torque, the speed controller operates within the limits.

- The drive cannot follow the speed setpoint.
- This state is indicated with MCTRL-MMAX = HIGH.

Setting the integral component

To enter defined starting values for the torque the integral component of the n-controller can be set externally (e.g. when using the brake control).

- MCTRL-I-LOAD = HIGH
  - The n-controller accepts the value at input MCTRL-I-SET as its integral component.
  - The value at input MCTRL-I-SET acts as a torque setpoint for the motor control.
- MCTRL-I-LOAD = LOW
  - Function is switched off.



3.5.43.5 Torque control with speed limitation

This function is activated with MCTRL-N/M-SWT = HIGH. A second speed controller (auxiliary speed controller) is connected for the speed limitation.

- MCTRL-M-ADD acts as bipolar torque setpoint.
- The n-controller 1 is used to create the upper speed limit.
  - The upper speed limit is selected at the input MCTRL-N-SET in [%] of nmax (C0011) (pos. sign for CW rotation).
  - The upper speed limit is only to be used for CW rotation.
- The n-controller (auxiliary speed controller) is used to form the lower speed limit
  - The lower speed limit is selected at the input MCTRL-N2-LIM in [%] of nmax (C0011) (neg. sign for CCW rotation).
  - The lower speed limit is only to be used for CCW rotation.

3.5.43.6 Speed setpoint limitation

The speed setpoint is limited to ±100 % of nmax (C0011) at the MCTRL-N-SET input.

C0909 is used to set a limitation of the direction of rotation for the speed setpoint.

3.5.43.7 Angle controller

The angle controller is required to achieve angular synchronism and drift-free standstill.

Note!

Select a configuration with digital frequency coupling in C0005 since this serves to link all important signals automatically. On this basis the system can be optimised.

Activating the angle controller

1. Configure a signal source with C0894, which provides the angular difference between setpoint and actual angle (see ”Digital frequency configuration under C0005).
2. Select a value > 0 at the MCTRL-PHI-LIM input.
3. Trigger the input MCTRL-PHI-ON with HIGH (e.g. with FIXED1).
4. Set the gain of the angle controller > 0 in C0254 (see chapter 3.5.43.4)
   – Before setting C0254, select an as high as possible P-gain for the n-controller in C0070.
   – Increase C0254 during operation until the drive shows the required control response.

Influence of angle controller

The output of the angle controller is added to the speed setpoint.

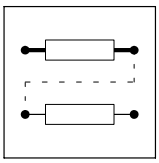
- If the actual angle is lagging, the drive is accelerated
- If the actual angle is leading the drive is decelerated until the required angular synchronism is achieved.

The influence of the angle controller consists of:

- Angular difference multiplied by the P-gain C0254
- Additional influence via analog signal at MCTRL-P-ADAPT
- Limitation of the angle controller output to ±MCTRL-PHI-LIM

Limitation of the angle controller output

This limits the max. speed-up of the drive at high angular differences.



3.5.43.8 Quick stop QSP

The QSP function is used to stop the drive within an adjustable time independently of the setpoint selection.

The QSP function is active

- if the input MCTRL-QSP is triggered with HIGH.
- if the controller is triggered via the control words (DCTRL).

Function:

- If torque control has been selected, it will be deactivated. The drive is controlled by the speed controller.
- The speed runs with the deceleration time set under C0105 to zero speed.
- The torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM are deactivated.
- The angle controller is activated. If the rotor position is shifted actively, the drive generates a torque against this displacement if:
  - C0254 is not zero
  - The input MCTRL-PHI-LIM is triggered with a value > 0 %.

Stop!

If the field is weakened manually (MCTRL-FLD-WEAK < 100%), the drive is unable to generate the max. torque.

3.5.43.9 Field weakening

The field weakening range does not need to be set if the motor type has been set in C0086. In this case all settings required are made automatically. The motor is operated in the field weakening mode if

- the output voltage of the controller exceeds the rated motor voltage set in C0090,
- the controller cannot increase the output voltage with rising speed any more because of the mains voltage / DC-bus voltage.

Manual field weakening

A manual field weakening is possible via the input MCTRL-FLD-WEAK. For reaching the maximum excitation this input must be triggered with +100 % (e.g. FIXED100%).

Stop!

The available torque is reduced by the field weakening.

3.5.43.10 Switching frequency changeover

The switching frequency of the inverter can be selected:

- 8 kHz fixed, for power-optimised operation (C0018 = 1)
  – maximum power output of the controller, but with audible pulse operation
- 16 kHz fixed, for noise-optimised operation (C0018 = 2)
  – inaudible pulse operation of the controller, but with reduced power output (torque)
- Automatic changeover between power-optimised and noise-optimised operation (C0018 = 0)

Automatic switching frequency changeover

The automatic switching frequency changeover can be used if the drive is to be operated in the noise-optimised range, but the available torque is not sufficient for acceleration processes.

Condition M = f(I)	Function
$M < M_{N16}$ (I_{N16})	Controller is operated with 16 kHz (noise-optimised)
M_{N16} (I_{N16}) $< M < M_{N8}$ (I_{N8})	Controller switches over to 8 kHz (power-optimised)
$M > M_{max8}$ (I_{max8})	Controller operates with 8 kHz in the current limitation

3.5.44 Motor phase failure detection (MLP)

Purpose

Motor phase monitoring.

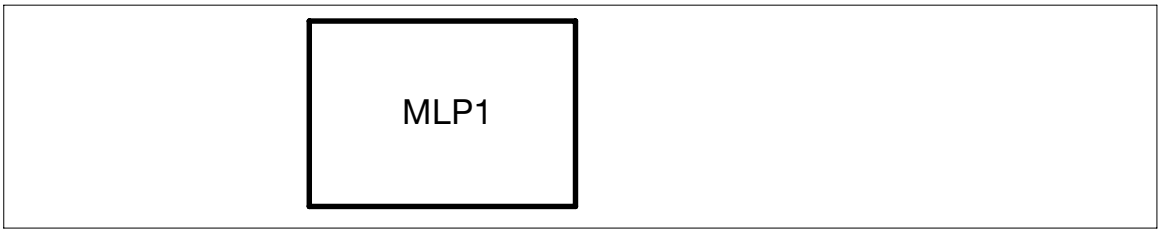


Fig. 3-162 Motor phase failure detection (MLP1)

Code	LCD	Possible settings					Important
		Lenze	Selection				
C0597	MONIT LP1	3	0 2 3	Trip Warning Off			**Conf. LP1** Configuration of motor phase failure monitoring
C0599	LIMIT LP 1	5.0	1.0		{0.1}	10.0	**Current limit LP1** Current limit for motor phase failure monitoring

Function

Detailed descriptions of monitoring systems and error messages can be found in the system manual, document number EDSVS9332P.

The function block MLP1 must be entered in the processing table if the motor phase failure detection is to be used.

3.5.45 Monitor outputs of monitoring system (MONIT)

Purpose

The monitoring functions output digital monitor signals.

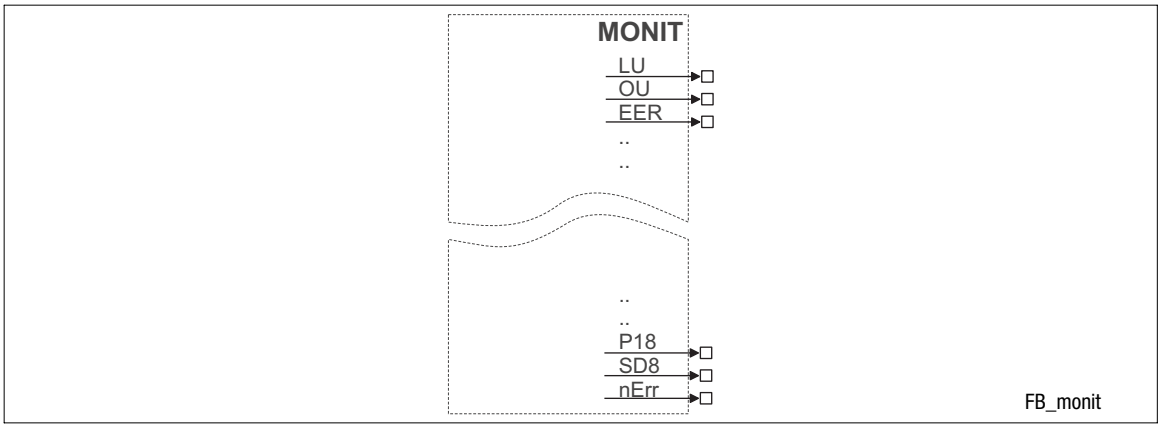


Fig. 3-163 Monitor outputs of the monitoring system (MONIT)

Function

The MONIT outputs switch to HIGH level if one of the monitoring functions responds.

The digital monitor signals respond dynamically, i.e.

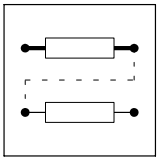
- depending on the state of the monitoring function, but
- independently of the selected fault reaction (e.g. TRIP).

Example

MONIT-LP1 (motor phase monitoring) responds if a cable disruption is detected in a motor connection phase, although the fault reaction of LP1 is set to ”Off” (C0597 = 3).

Note!

- With appropriate signal conditioning, the MONIT outputs can be used to locate the cause of malfunction (e.g. by storing the MONIT output signal via the FLIP function block).
- More detailed descriptions of the monitoring functions / error messages can be found in the chapter ”Troubleshooting and fault elimination”.



MONIT outputs

MONIT output	Description
CE0	Communication error - automation interface (AIF)
CE1	Communication error - process data input object CAN1_IN
CE2	Communication error - process data input object CAN2_IN
CE3	Communication error - process data input object CAN3_IN
CE4	BUS-OFF state of system bus (CAN)
EEr	External monitoring, triggered via DCTRL
H05	Internal fault (memory)
H07	Internal fault (power section)
H10	Thermal sensor error - heatsink
H11	Thermal sensor error - inside the device
LP1	Motor phase failure
LU	Undervoltage in the DC bus
nErr	Speed control error
NMAX	Maximum speed (C0596) exceeded
OC2	Earth fault - motor cable
OC5	I x t overload
OC6	I^2 x t overload
OC8	I^2 x t overload advance warning
OH	Heatsink temperature > +90 °C
OH3	Motor temperature > +150 °C threshold (temperature detected via resolver or incremental value encoder)
OH4	Heatsink temperature > C0122
OH7	Motor temperature > C0121 (temperature detected via resolver or incremental value encoder)
OH8	Motor temperature measured via inputs T1 and T2 too high
OU	DC-bus overvoltage
P03	Following error
P16	Faulty transmission of sync telegram on system bus (CAN)
P19	Limitation of input values at X9
PL	Error during rotor position adjustment
Sd2	Resolver error at X7
Sd3	Encoder error at X9
Sd5	Encoder error at X6 pins 1 and 2
Sd6	Thermal sensor error - motor (X7 or X8)
Sd7	Absolute value encoder at X8 Initialisation error or communication error during rotor position adjustment
Sd8	Sin/cos encoder at X8 transmits no or inconsistent data

3.5.46 Motor potentiometer (MPOT)

Purpose

The FB replaces a hardware motor potentiometer.

The motor potentiometer is used as an alternative setpoint source, which is controlled via two terminals.

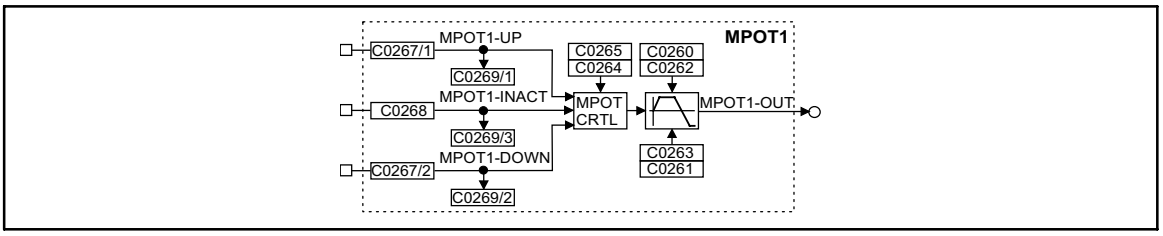


Fig. 3-164 Motor potentiometer (MPOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MPOT1-UP	d	C0269/1	bin	C0267/1	2	1000	-
MPOT1-INACT	d	C0269/3	bin	C0268	2	1000	-
MPOT1-DOWN	d	C0269/2	bin	C0267/2	2	1000	-
MPOT1-OUT	a	-	-	-	-		-

Function

Control of the motor potentiometer:

- MPOT1-UP = HIGH
  – The motor potentiometer approaches its upper limit value.
- MPOT1-DOWN = HIGH
  – The motor potentiometer approaches its lower limit value.
- MPOT1-UP = LOW and MPOT1-DOWN = LOW or
  MPOT1-UP = HIGH and MPOT1-DOWN = HIGH:
  – The motor potentiometer does not change the output signal.

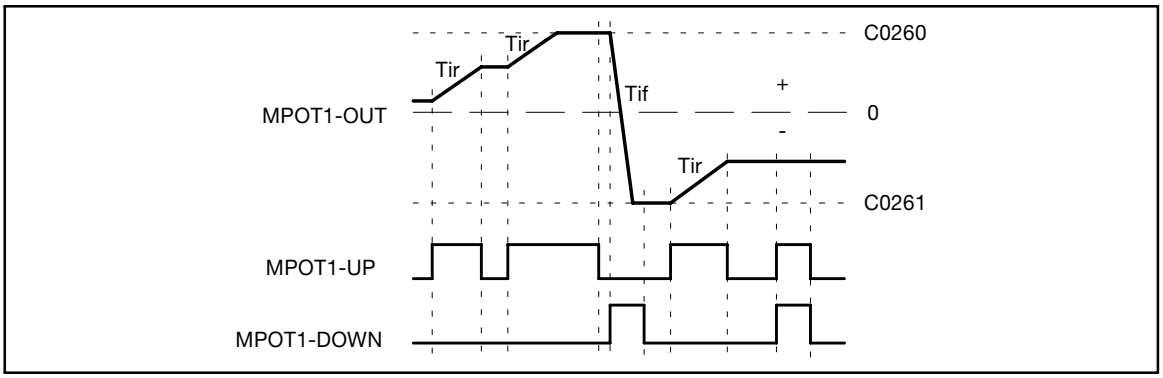


Fig. 3-165 Control signals of the motor potentiometer

In addition to the digital signals MPOT1-UP and MPOT1-DOWN another digital input exists (MPOT1-INACT). The input MPOT1-INACT is used to activate or deactivate the motor potentiometer function. Logic 1 at this input deactivates the motor potentiometer function. The input MPOT1-INACT has priority over the inputs MPOT1-UP and MPOT1-DOWN.

When the motor potentiometer is deactivated, the motor potentiometer output (MPOT1-OUT) follows the function set under C0264. The following functions can be set under C0264:

C0264 =	Meaning
0	No further action; the output MPOT1-OUT keeps its value
1	The motor potentiometer returns to 0 % with the corresponding deceleration time
2	The motor potentiometer approaches the lower limit value with the corresponding deceleration time (C0261)
3	The motor potentiometer immediately changes its output to 0%. **(Important for EMERGENCY–OFF function)**
4	The motor potentiometer immediately changes its output to the lower limit value (C0261)
5	The motor potentiometer approaches the upper limit value with the corresponding acceleration time (C0260)

If the motor potentiometer is activated (input MPOT1-INACT = 0), the subsequent function depends on

- the current output signal,
- the set limit values of the MPOT,
- the control signals UP and DOWN.

If the output value is out of the set limits, the MPOT approaches the next limit with the set T_i times. This function is independent of the control inputs MPOT1-UP and MPOT1-DOWN

If the output value is within the set limits, the output follows the selected control function UP, DOWN or no action.

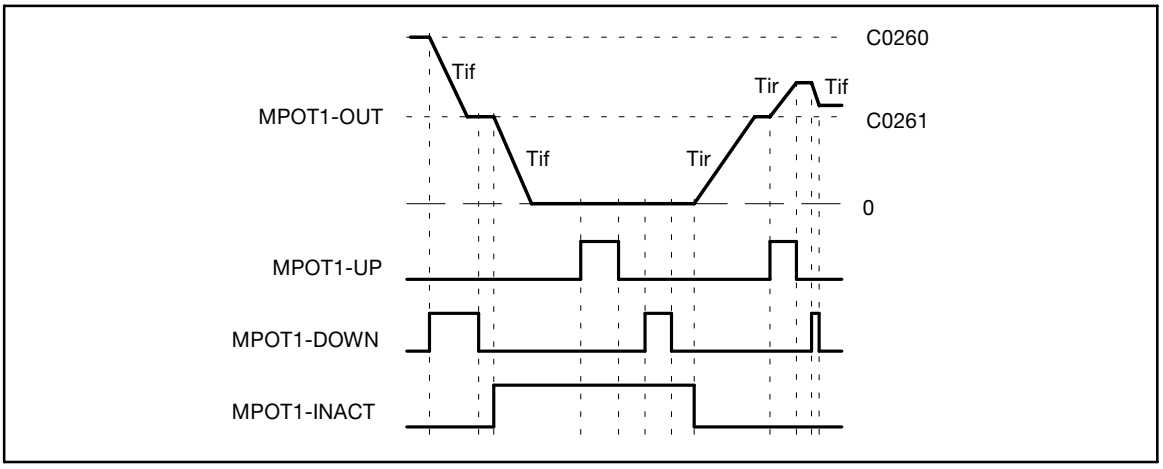


Fig. 3-166 Deactivation of the motor potentiometer via the input MPOT1-INACT

Initialisation

This function is used to store the output value of the MPOT non-volatilely in the internal memory of the device, when the mains is switched off. The value is saved automatically if this function was selected via the code. When the mains is switched on, the value is reloaded into the MPOT.

C0265 can be used to activate other initialisation functions (see code table).

When the initialisation is completed, the MPOT follows the applied control function.

3.5.47 Logic NOT

Purpose

Logic inversion of digital signals. The inversion can be used to control functions or generate status information.

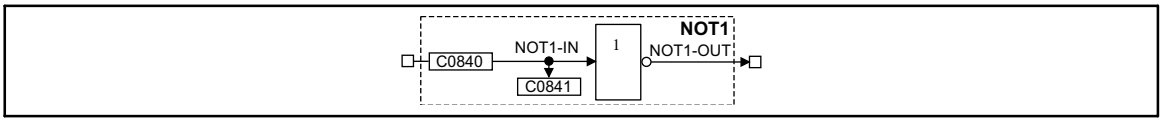


Fig. 3-167 Logic NOT (NOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT1-IN	d	C0841	bin	C0840	2	1000	-
NOT1-OUT	d	-	-	-	-	-	-

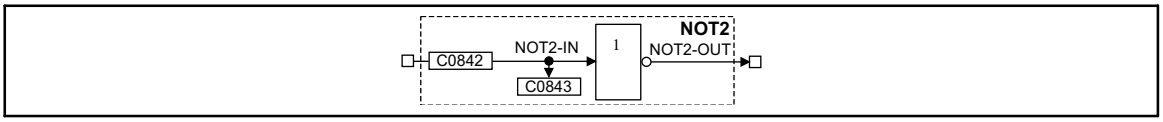


Fig. 3-168 Logic NOT (NOT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT2-IN	d	C0843	bin	C0842	2	1000	-
NOT2-OUT	d	-	-	-	-	-	-

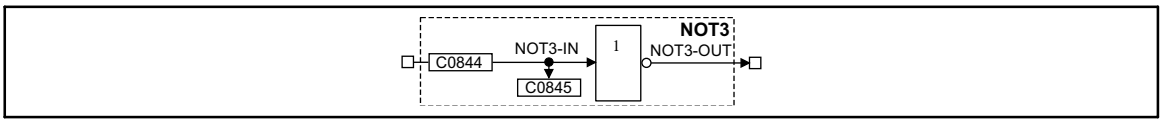


Fig. 3-169 Logic NOT (NOT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT3-IN	d	C0845	bin	C0844	2	1000	-
NOT3-OUT	d	-	-	-	-	-	-

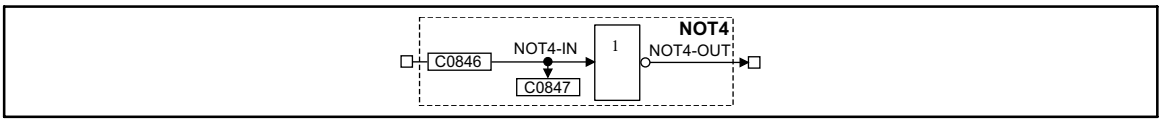


Fig. 3-170 Logic NOT (NOT4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT4-IN	d	C0847	bin	C0846	2	1000	-
NOT4-OUT	d	-	-	-	-	-	-

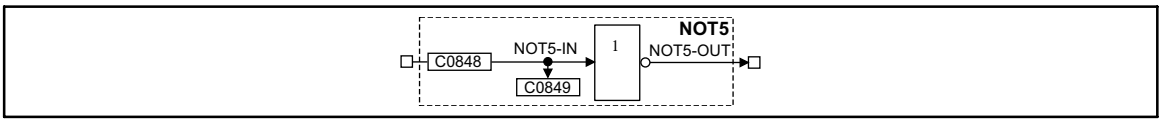


Fig. 3-171 Logic NOT (NOT5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT5-IN	d	C0849	bin	C0848	2	1000	-
NOT5-OUT	d	-	-	-	-	-	-

Function

NOTx-IN1	NOTx-OUT
0	1
1	0

The function corresponds to a change from an NO contact to an NC contact in a contactor control.

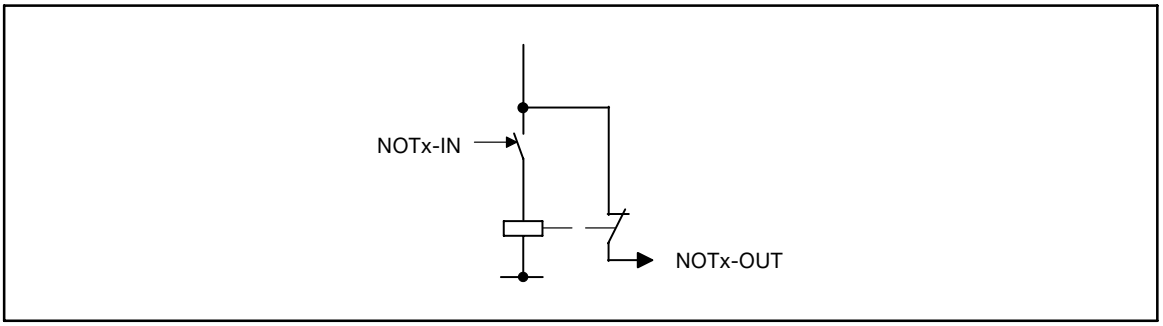


Fig. 3-172 Function of NOT when changing an NO contact to an NC contact.

3.5.48 Speed setpoint conditioning (NSET)

Purpose

This FB conditions

- the main speed setpoint and
- an additional setpoint (or other signals as well)

for the following control structure via ramp function generator or fixed speeds.

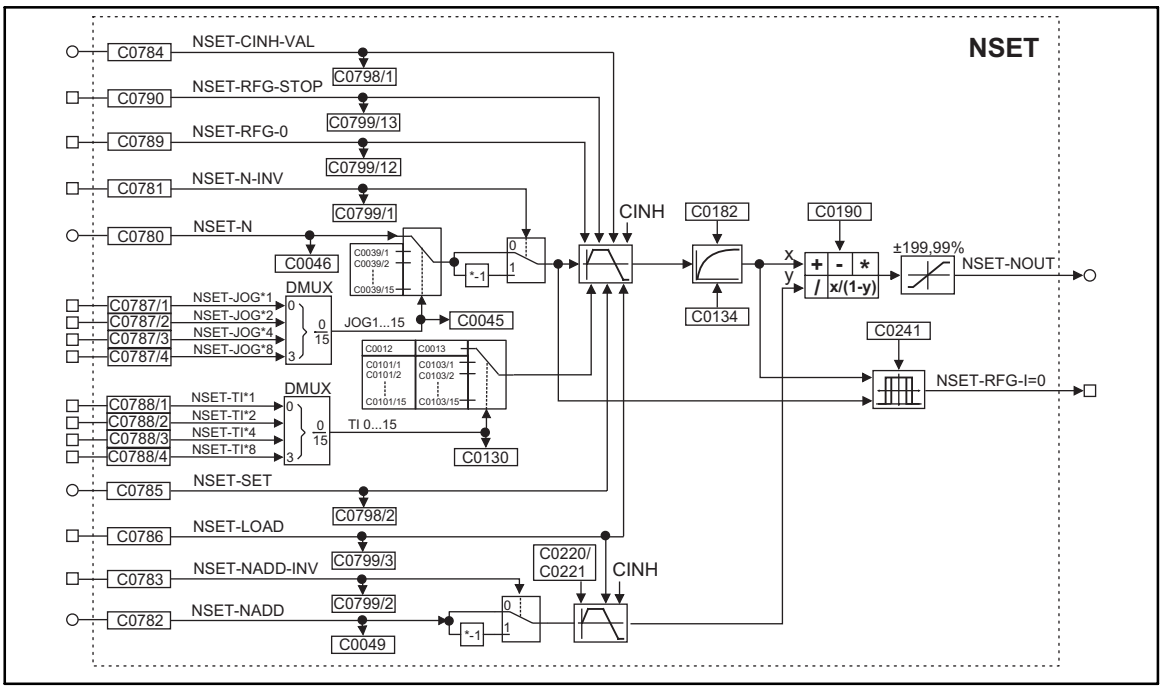


Fig. 3-173 Speed setpoint conditioning (NSET)

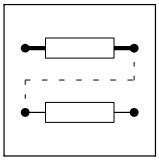
Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	0	C0046	dec [%]	C0780	1	50	Intended for main setpoint, other signals are permissible
NSET-NADD	0	C0047	dec [%]	C0782	1	5650	Intended for additional setpoint, other signals are permissible
NSET-JOG*1	d	C0799/4	bin	C0787/1	2	53	Selection and control of overriding "fixed setpoints" for the main setpoint
NSET-JOG*2	d	C0799/5	bin	C0787/2	2	1000	
NSET-JOG*4	d	C0799/6	bin	C0787/3	2	1000	
NSET-JOG*8	d	C0799/7	bin	C0787/4	2	1000	
NSET-TI*1	d	C0799/8	bin	C0788/1	2	1000	Selection and control of alternative acceleration and deceleration times for the main setpoint
NSET-TI*2	d	C0799/9	bin	C0788/2	2	1000	
NSET-TI*4	d	C0799/10	bin	C0788/3	2	1000	
NSET-TI*8	d	C0799/11	bin	C0788/4	2	1000	
NSET-N-INV	d	C0799/1	bin	C0781	2	10251	Control of the signal inversion for the main setpoint
NSET-NADD-INV	d	C0799/2	bin	C0783	2	1000	Control of the signal inversion for the additional setpoint
NSET-RFG-0	d	C0799/12	bin	C0789	2	1000	The main setpoint integrator is led to zero via the current T_i times.
NSET-RFG-STOP	d	C0799/13	bin	C0790	2	1000	Keeping (freezing) of the main setpoint integrator to its actual value.
NSET-CINH-VAL	0	C0798/1	dec [%]	C0784	1	5001	Here, the signal is applied which is to be accepted by the main setpoint integrator when the controller is inhibited
NSET-SET	0	C0798/2	dec [%]	C0785	1	5000	Here, the signal is applied which is to be accepted by the main setpoint integrator when the NSET-LOAD input is set
NSET-LOAD	d	C0799/3	bin	C0786	2	5001	Control of both ramp function generators in special situations, e.g. QSP
NSET-OUT	0	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

- Main setpoint path
- JOG setpoints
- Setpoint inversion
- S ramp

3.5.48.1 Main setpoint path

- The signals in the main setpoint path are limited to the value range ±199.99 %.
- The signal at input NSET-N is led via the function JOG selection.
- The JOG function has priority over the setpoint input NSET-N. This means a selected JOG value deactivates the input. The subsequent signal conditioning the JOG value instead.



3.5.48.2 JOG setpoints

- Are fixed values which are stored in the memory.
- JOG values can be called from the memory via the inputs NSET-JOG*x.
- The inputs NSET-JOG*x are binary coded so that 15 JOG values can be called.
- The decoding for enabling the JOG values (called from the memory) is carried out according to the following table:

Output signal	1st input NSET-JOG*1	2nd input NSET-JOG*2	3rd input NSET-JOG*4	4th input NSET-JOG*8
NSET-N	0	0	0	0
JOG 1	1	0	0	0
JOG 2	0	1	0	0
JOG 3	1	1	0	0
JOG 4	0	0	1	0
JOG 5	1	0	1	0
JOG 6	0	1	1	0
JOG 7	1	1	1	0
JOG 8	0	0	0	1
JOG 9	1	0	0	1
JOG 10	0	1	0	1
JOG 11	1	1	0	1
JOG 12	0	0	1	1
JOG 13	1	0	1	1
JOG 14	0	1	1	1
JOG 15	1	1	1	1

- When all inputs are assigned with 0, the input NSET-N is active.
- The number of inputs that must be assigned depends on the required number of JOG values. Four inputs and thus 15 possible selections are available. A digital signal source is assigned via C0787 and the corresponding subcode.

Number of required JOG setpoints	Number of inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

3.5.48.3 Setpoint inversion

The output signal of the JOG function is led via an inverter.

The sign of the setpoint is inverted, if the input NSET-N-INV is triggered with HIGH signal.

Ramp function generator for the main setpoint

The setpoint is then led via a ramp function generator with linear characteristic. Setpoint step-changes at the input are thus led into a ramp.

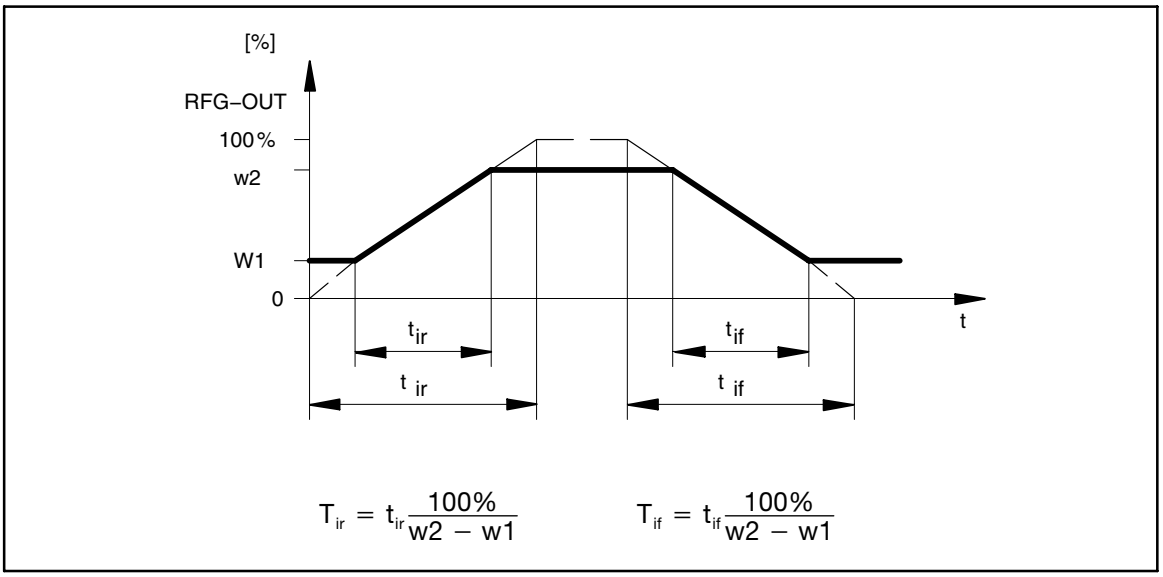
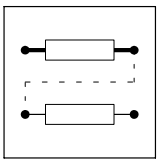


Fig. 3-174 Acceleration and deceleration times of the ramp function generator

- The ramps can be set separately for acceleration and deceleration.
  - Different acceleration and deceleration times can be activated via the inputs NSET-TI*x 16 (for table and function see JOG setpoints; the decoding must be done according to the signal graphic).
  - The T_i times can only be activated in pairs.
- When the controller is inhibited (CINH) the ramp function generator accepts the value that was applied to the input NSET-CINH-VAL and transmits it to the next function. This function has priority over all other functions.
- NSET-RFG-STOP = HIGH
  - The ramp function generator is stopped. Changes at the input of the ramp function generator have no effect on the output.
- NSET-RFG-0 = HIGH
  - The ramp function generator decelerates to zero along the deceleration ramp.
- It is also possible to load the ramp function generator online with a defined value. For this, the input NSET-LOAD must be set to HIGH. As long as this input is set, the value at input NSET-SET is accepted by the ramp function generator and provided the output.



Priorities:

CINH	NSET-LOAD	NSET-RFG-0	NSET-RFG-STOP	Function
0	0	0	0	RFG follows the input value via the set ramps
0	0	0	1	The value at the output of RFG is frozen
0	0	1	0	RFG decelerates to zero along the set deceleration time
0	0	1	1	
0	1	0	0	RFG accepts the value applied to input NSET-SET and provides it at its output
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	RFG accepts the value applied to input CINH-VAL and provides it at its output
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

3.5.48.4 S ramp

The linear ramp function generator is connected to a PT1 element. This arrangement implements an S ramp for an almost jerk-free acceleration and deceleration.

- The PT1 element is switched on and off via C0134.
- The time constant is set via C0182.

3.5.48.5 Arithmetic operation

The output value is led to an arithmetic module. This module links the main setpoint and the additional setpoint arithmetically. The arithmetic operation is selected via C0190 (see the following table).

C0190	Function	Example
0	Output = X (Y is not processed)	-
1	Output = X + Y	100 % = 50 % + 50 %
2	Output = X - Y	50 % = 100 % - 50%
3	Output = X * Y	100 % = 100 % * 100%
4	Output = X/|Y|	1 % = 100 % / 100%
5	Output = X/(100% - Y)	200 % = 100 % / (100 % - 50 %)

3.5.48.6 Additional setpoint

- An additional setpoint (e.g. a correction signal) can be linked with the main setpoint via the input NSET-NADD.
- The input signal can be inverted via the input NSET-NADD-INV before affecting the ramp function generator. The ramp function generator has a linear characteristic and an acceleration time and deceleration time each.
- With NSET-LOAD = HIGH the ramp function generator is set to zero and kept there without considering the T_i times.The same applies when the controller is inhibited.

3.5.49 OR operation (OR)

Purpose

Logic OR operation of digital signals. The operations are used for controlling functions or creating status information.

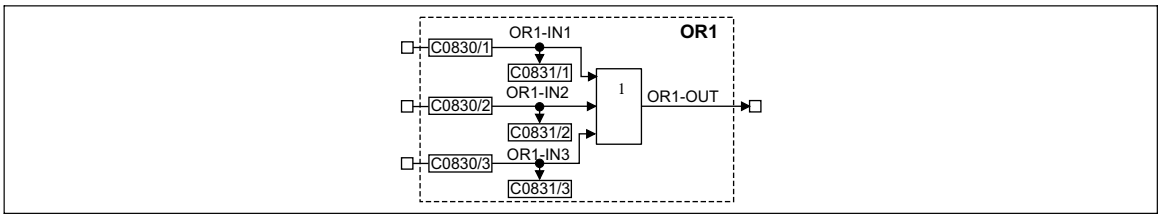


Fig. 3-175 OR operation (OR1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR1-IN1	d	C0831/1	bin	C0830/1	2	1000	-
OR1-IN2	d	C0831/2	bin	C0830/2	2	1000	-
OR1-IN3	d	C0831/3	bin	C0830/3	2	1000	-
OR1-OUT	d	-	-	-	-	-	-

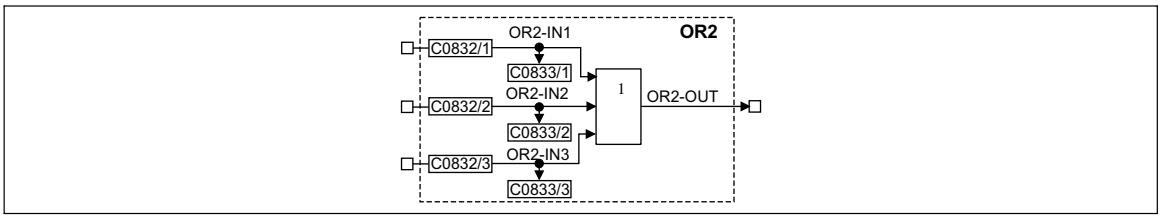


Fig. 3-176 OR operation (OR2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR2-IN1	d	C0833/1	bin	C0832/1	2	1000	-
OR2-IN2	d	C0833/2	bin	C0832/2	2	1000	-
OR2-IN	d	C0833/3	bin	C0832/3	2	1000	-
OR2-OUT	d	-	-	-	-	-	-

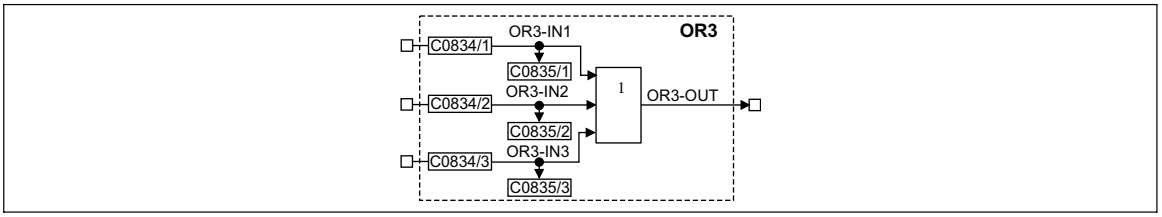


Fig. 3-177 OR operation (OR3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR3-IN1	d	C0835/1	bin	C0834/1	2	1000	-
OR3-IN2	d	C0835/2	bin	C0834/2	2	1000	-
OR3-IN3	d	C0835/3	bin	C0834/3	2	1000	-
OR3-OUT	d	-	-	-	-	-	-

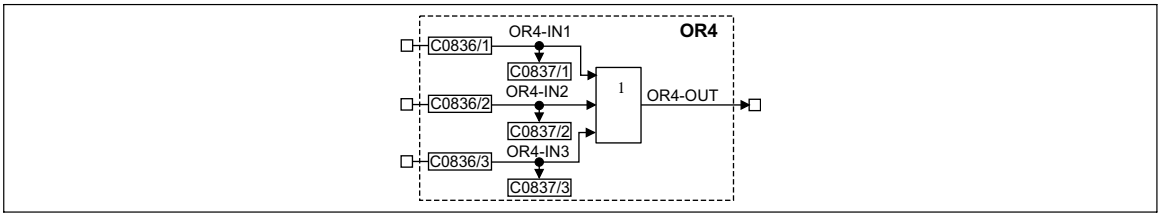


Fig. 3-178 OR operation (OR4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR4-IN1	d	C0837/1	bin	C0826/1	2	1000	-
OR4-IN2	d	C0837/2	bin	C0826/2	2	1000	-
OR4-IN3	d	C0837/3	bin	C0826/3	2	1000	-
OR4-OUT	d	-	-	-	-	-	-

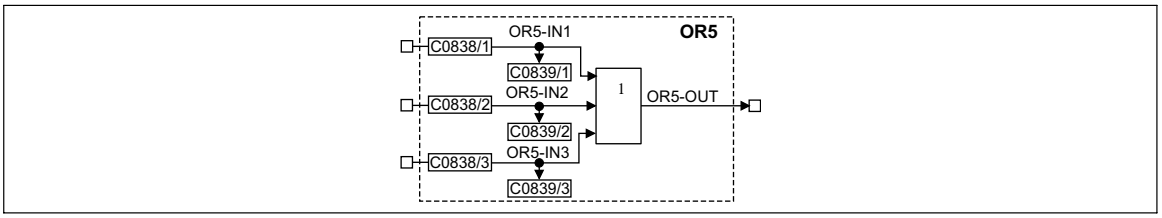


Fig. 3-179 OR operation (OR5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR5-IN1	d	C0839/1	bin	C0828/1	2	1000	-
OR5-IN2	d	C0839/2	bin	C0828/2	2	1000	-
OR5-IN3	d	C0839/3	bin	C0828/3	2	1000	-
OR5-OUT	d	-	-	-	-	-	-

Function

ORx-IN1	ORx-IN2	ORx-IN3	ORx-OUT
0	0	0	0
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	1

The function corresponds to a connection in parallel of NO contacts in a contactor control.

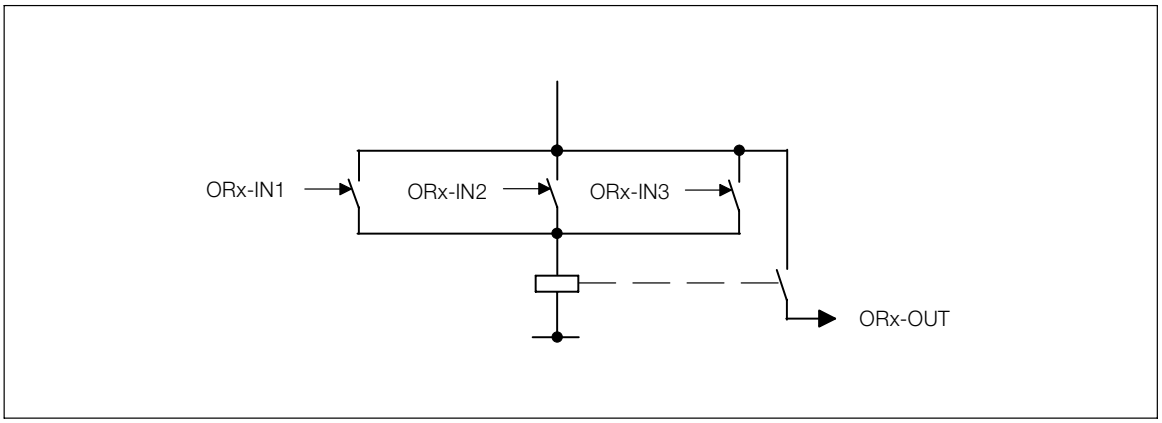


Fig. 3-180 Function of the OR operation as a parallel connection of NO contacts.

Tip!

If only two inputs are needed, use the inputs ORx-IN1 and ORx-IN2. Assign the input ORx-IN3 with the signal source FIXED0.

3.5.50 Oscilloscope function (OSZ)

Purpose

Detection of any measured variable (e. g. speed setpoint, actual speed, torque etc.). They are visualised in Global Drive Control.

Supports the commissioning of controllers and the troubleshooting.

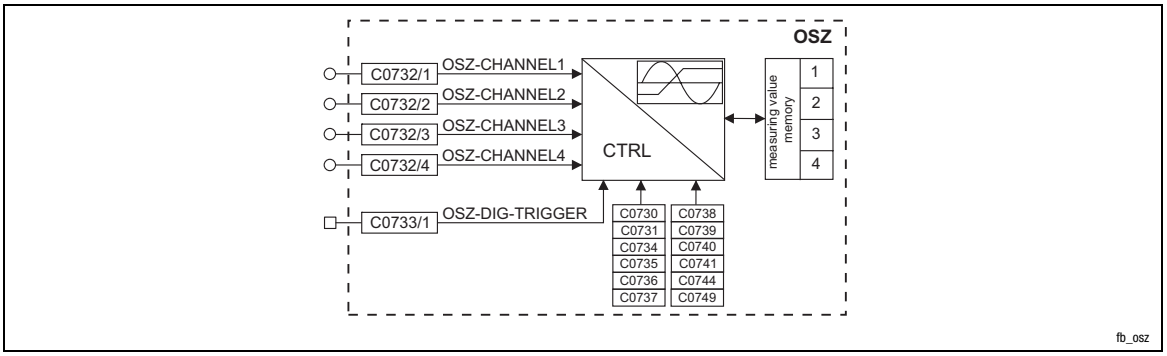


Fig. 3-181 Oscilloscope function (OSZ)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OSZ CHANNEL1	a	-	-	C0732/1	1	-	-
OSZ CHANNEL2	a	-	-	C0732/2	1	-	-
OSZ CHANNEL3	a	-	-	C0732/3	1	-	-
OSZ CHANNEL4	a	-	-	C0732/4	1	-	-
OSZ-DIG-TRIGGER	d	-	-	C0733/1	2	-	-

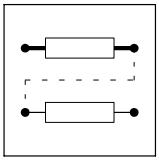
Function

The FB has three function units:

- Trigger check
  - Monitoring of the digital trigger source for a valid trigger event
- Processing of the measured signal
  - Linking the measurement inputs
  - Calculating the time base
  - Monitoring of the analog trigger source for a valid trigger event.
- Measuring value memory
  - Scaling the ring buffer
  - Filing the measured data in the ring buffer
  - Saving the measuring points for image generation

Functional description

Function	Code	Selection	Description
OSZ mode			Controls the measurement in the controller
	C0730	1	• Starts the recording of the measured values
		0	• Cancels a running measurement
OSZ status			Displays five different operating states
	C0731	1	• Measurement completed – The memory of the measured values is completely filled with measured data. The measured values can be accessed via the PC.
		2	• Measurement active – A measurement was started with C0730 = 1. The FB is waiting for a valid trigger event.
		3	• Trigger detected – The FB has detected a valid trigger event. Depending on the trigger delay the saving of the measured data is not yet completed. It is automatically completed with the entry into the last memory unit.
		4	• Measurement cancelled – Cancel of a running recording of the measured values (C0730 = 0). The memory of the measured values is filled with the data that has just been measured. The data can be accessed via the PC.
		5	• Read data memory – The measured data memory is being read at the moment. No settings are possible in this operating state.
Configuration OSZ channel 1 ... 4	C0732/1 to C0732/4		• Links the measuring channels of the FB with the signals of the process environment – The four measuring channels can be assigned with any analog signal. Enter the corresponding signal number into C0732/1 ... C0732/4. – Always start linking with channel 1, then channel 2 and so on. Unused channels are automatically assigned with signal FIXED 0%.
Configuration OSZ trigger	C0733/1		Links the digital trigger input with a digital signal in the process environment. – The trigger input can be assigned with any digital signal. Enter the corresponding signal number into C0733/1.
Trigger source			Defines the trigger source
	C0734	1	Source is one of the four measuring channels (C0734/1 ... C0734/4)
		0	Source is the digital trigger input (C0733/1)
Trigger level	C0735	-32767 ... 32767	• Defines the trigger level which activates the triggering when the level is exceeded. – The trigger level is only monitored when the triggering is done on one of the four channels. – The trigger level is not effective with digital triggering.
Trigger edge			Defines the trigger edge which activates the triggering. • Triggering on an analog input channel – With a LOW-HIGH trigger edge the analog trigger signal must exceed a defined trigger level to activate the triggering. – With a HIGH-LOW trigger edge the analog trigger signal must fall below a defined trigger level to activate the triggering. • Triggering on a digital trigger input – With a LOW-HIGH trigger edge the digital trigger signal must change from LOW to HIGH to activate the triggering. – With a HIGH-LOW trigger edge the digital trigger signal must change from HIGH to LOW to activate the triggering. Fig. 3-182 shows the triggering of an analog signal with a positive edge.
	C0736	1	– HIGH-LOW trigger edge
		0	LOW-HIGH trigger edge



Function	Code	Selection	Description
Trigger delay			The trigger delay defines when to begin with the saving of the measured values with regard to the trigger time.
	C0737	-100.0 % ... 0 %	• Negative trigger delay (pre-triggering) – Defines a percentage of the whole memory content. This part of the memory content is filled with measured values **before** the triggering (see Fig. 3-183).
		0 % ... 999.9 %	• Positive trigger delay (post-triggering) – Defines a percentage of the whole memory content. The saving of the measured values **after** triggering is delayed by this part of the memory content (Fig. 3-182).
Sampling period	C0738	1 ms ... 10 min	• Setting of the sampling period – The sampling period is the time between two measurements – The measurements are carried out simultaneously for all channels (e. g. value measured at channel 1 is measured at the same time as the measured value at channel 2, 3 or 4. – The sampling period can be set in steps of 1, 2 and 5.
Number of Channels	C0739		Number of channels used for measurements.
Read data memory			The code is required if the GDC is not used for the visualisation.
	C0740/1	0 ... 16383	• Defines the starting point for reading the data memory and thus enables the memory array to be selectively accessed. – In order to read the data memory bit by bit (e. g. reading only the measured values of one channel or reading with reduced memory depth), the starting point can be changed.
	C0740/2	1	• Enable “Read memory” – Enables the access to the memory to read the data
		0	• Inhibit “Read memory” – Inhibits the access to the memory. The access must be inhibited after every reading of the data
Information about the function block			Provides information on the function block
	C0741/1		Version of the function block (e. g. 120: Version 1.20)
	C0741/2		Data memory size (1024 ... 16384 bytes)
	C0741/3		Data width of the measured values (1 byte / 2 bytes)
	C0741/4		Number of the available measuring channels (1 ... 4)

Function	Code	Selection	Description
Memory size	C0744	0 ... 6	Set memory depth of the data memory – Max. size of the data memory: 8192 measured values ≙ 16384 bytes (C0744 = 6) – Min. size of the data memory: 512 measured values ≙ 1024 bytes (C0744 = 0) – Changing the memory depth from 512 to 8192 measured values/step – A memory depth which is optimally adapted to the corresponding measuring task reduces the data transmission time.
Information on saving			Information on saving the measured values in the data memory The FB saves the data in a ring format. For reconstructing the chronological signal sequence the following three "graphic points" are marked.
	C0749/1		Measured value no. of the instant of abortion
	C0749/2		Measured value no. of the instant of triggering
	C0749/3		Measured value no. of the instant of completion

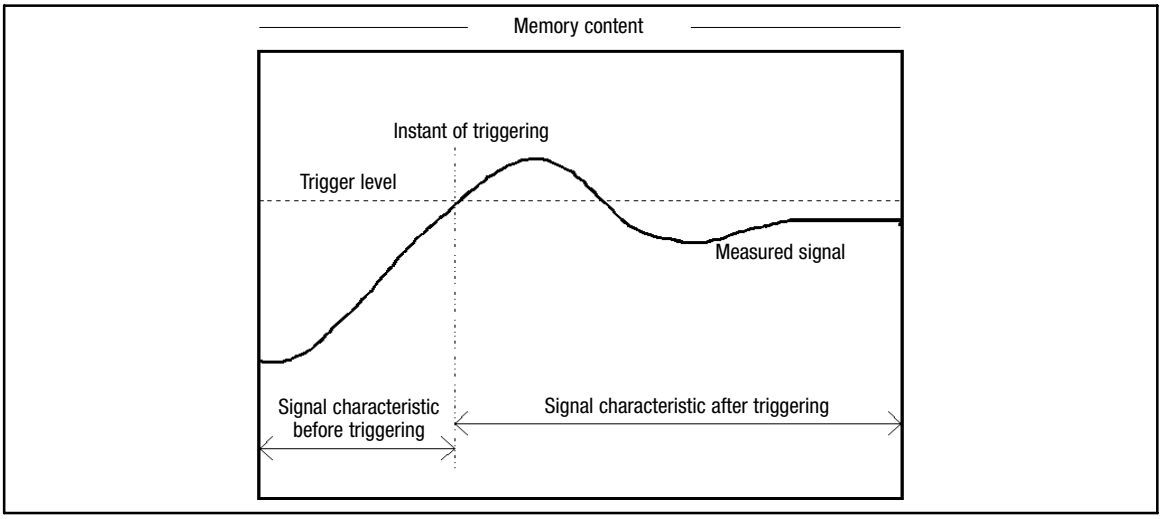


Fig. 3-182 Example: Trigger level and trigger delay with approx. -30 % of pre-triggering

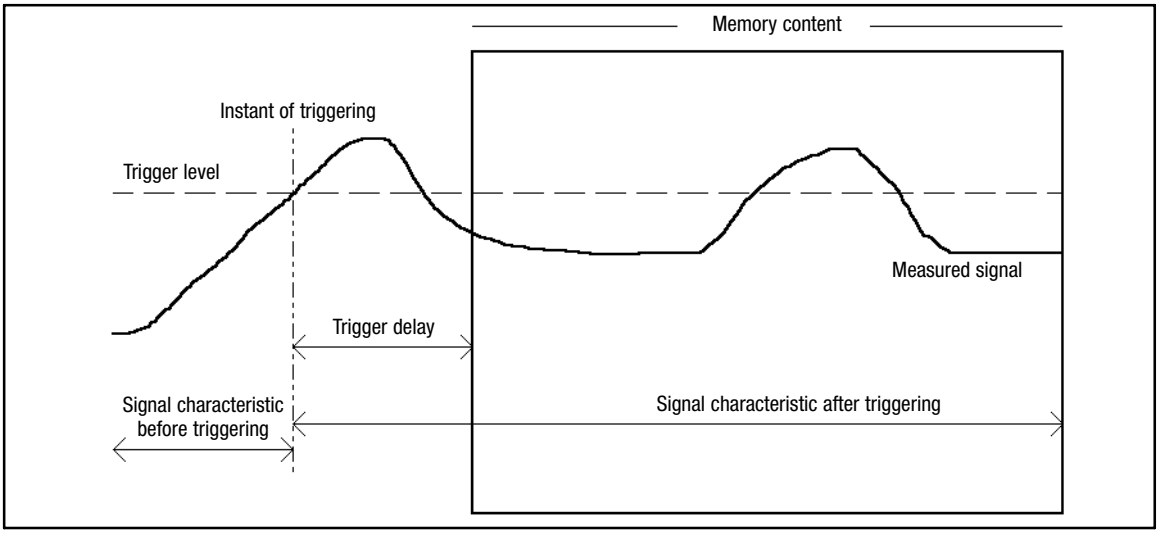


Fig. 3-183 Example: Trigger level and trigger delay with approx. -30 % of post-triggering

3.5.51 Process controller (PCTRL1)

Purpose

The FB is used, for instance, as a higher-level controller (dancer position controller, tension controller, pressure controller etc.).

The control characteristic follows the ideal PID algorithm, but it can also be changed over to a PI or P characteristic.

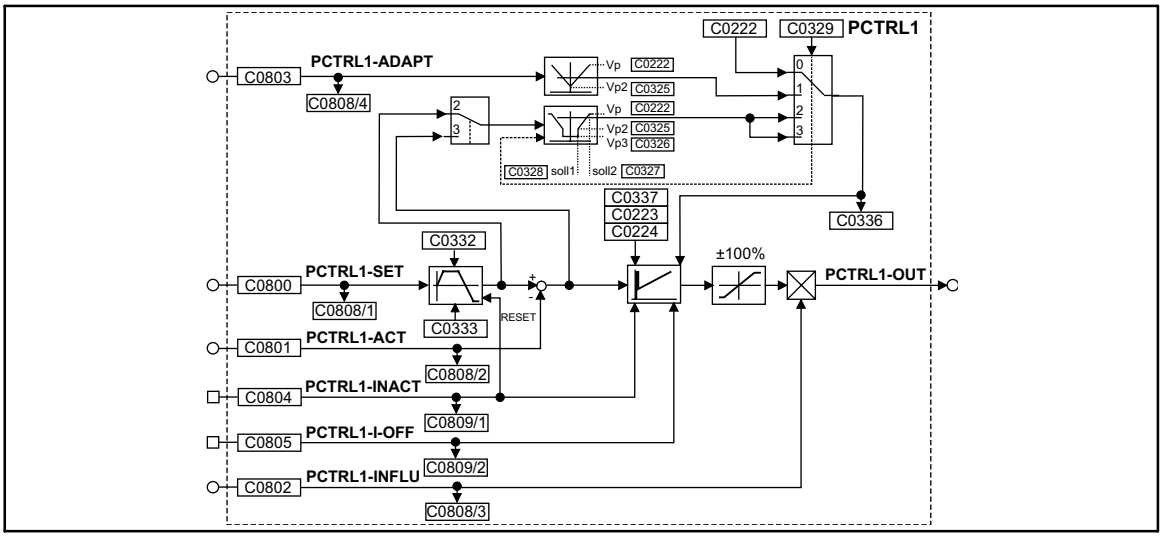


Fig. 3-184 Process controller (PCTRL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PCTRL1-SET	a	C0808/1	dec [%]	C0800	1	1000	Input of the process setpoint. Possible value range: ±200%. The time characteristic of step-change signals can be affected via the ramp function generator (C0332 for the acceleration time; C0333 for the deceleration time).
PCTRL1-ACT	a	C0808/2	dec [%]	C0801	1	1000	Actual value input; value range ±200%
PCTRL1-INFLU	a	C0808/3	dec [%]	C0802	1	1000	Evaluation or suppression of the output signal; value range ±200%
PCTRL1-ADAPT	a	C0808/4	dec [%]	C0803	1	1000	Online change of the P gain; value range ±200%
PCTRL1-INACT	d	C0809/1	bin	C0804	2	1000	Online deactivation of the process controller
PCTRL1-I-OFF	d	C0809/2	bin	C0805	2	1000	Online setting of the I component to zero
PCTRL1-OUT	a	-	-	-	-	-	-

Function

Setpoint and actual value are sent to the process controller via the corresponding inputs and processed according to the selected control algorithm (control chararacteristic).

3.5.51.1 Control characteristic

- In the default setting, the PID algorithm is active.
- The D-component can be deactivated by setting code C0224 to zero. Thus, the controller becomes a PI-controller (or P-controller if the I-component is also switched off).
- The I-component can be switched on or off online via the PCTRL-I-OFF input. For this, the input is assigned a digital signal source (e.g. one of the freely assignable digital input terminals). If the I-component is to be switched off permanently, the input is assigned the signal source ”FIXED1”.
  – PCTRL-I-OFF = HIGH switches off the I-component
  – PCTRL-I-OFF = LOW switches on the I-component
- The reset time is parameterised via C0223.
- The P-gain can be set in different ways. The function providing the P-gain is selected under C0329:
  – C0329 = 0
    The P-gain is entered under C0222.
  – C0329 = 1
    The P-gain is entered via the PCTRL-ADAPT input. The input value is led via a linear characteristic. The slope of the characteristic is set under C0222 (upper limit) and C0325 (lower limit). The value under C0222 is valid if the input value = +100 % or -100 %. The value under C0325 applies if the input value is 0 %.

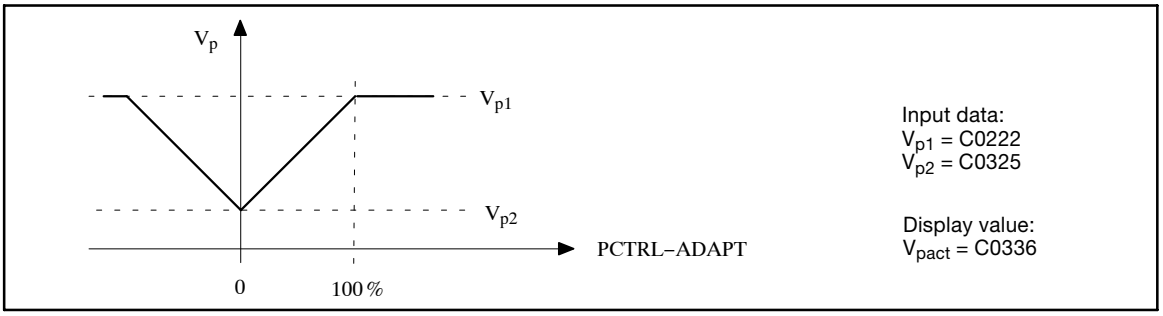


Fig. 3-185 Input of the P-gain via PCTRL-ADAPT input

  – C0329 = 2
    The P-gain is derived from the process setpoint PCTRL-SET. The setpoint is measured after the ramp function generator and calculated by means of a characteristic with three interpolation points.

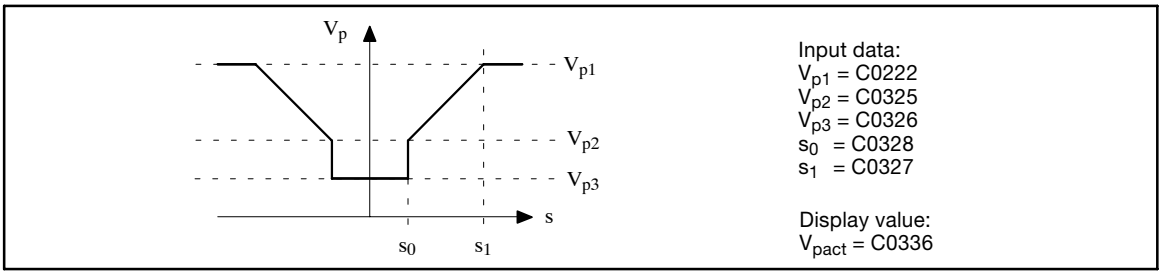


Fig. 3-186 P-gain derived from the PCTRL-SET process setpoint

  – C0329 = 3
    The P-gain is derived from the control difference and calculated by means of a characteristic as for C0329 = 2.

3.5.51.2 Ramp function generator

The setpoint PCTRL-SET is led via a ramp function generator with linear characteristic. Thus, setpoint step-changes at the input can be transformed into a ramp.

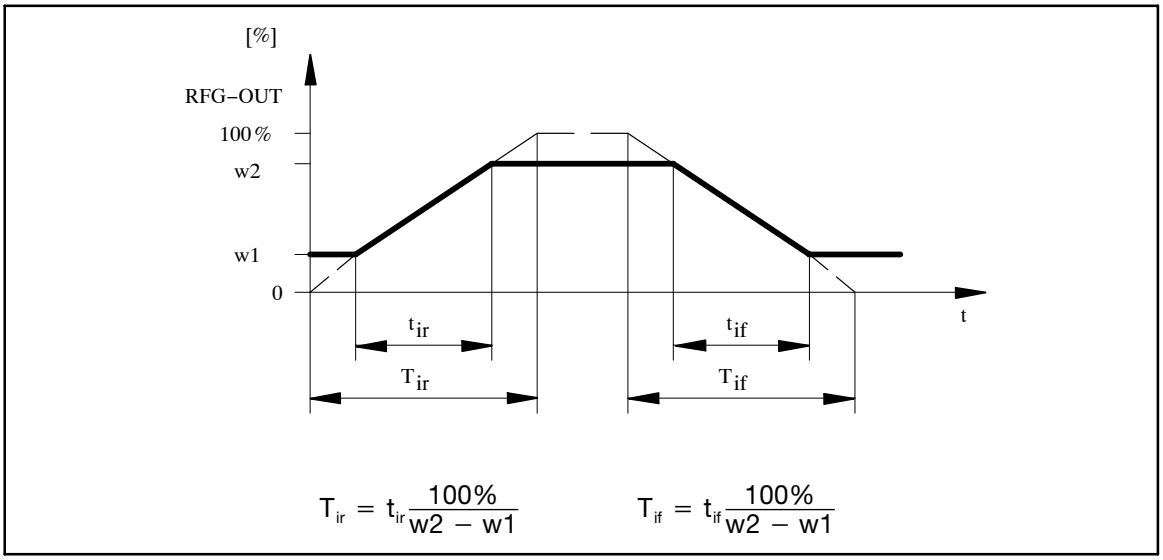


Fig. 3-187 Acceleration and deceleration times of the ramp function generator

- The ramps can be adjusted separately for acceleration and deceleration.
  - Acceleration time t_{ir} with C0332.
  - Deceleration time t_{if} with C0333.
- PCTRL-INACT = HIGH
  - The ramp function generator is immediately set to zero.

3.5.51.3 Value range of the output signal

- The process controller operates in bipolar mode in the default setting.
  - The output value is limited to ±100 %.
- The function can be set to unipolar mode under C0337.
  - The output value is limited to 0 ... +100 %.

3.5.51.4 Evaluation of the output signal

- The output signal can be evaluated after the limitation block via PCTRL-INFLU.
  - The process controller can be hidden or unhidden with this evaluation.
  - The calcuation is done according to the following formula:
    100 % (PCTRL-OUT) = 100 % * 100 % (PCTRL-INFLU).

3.5.51.5 Deactivation of the process controller

- PCTRL-INACT = HIGH deactivates the process controller
  - PCTRL-OUT is set to zero.
  - The I-component is set to zero.
  - The ramp function generator is set to zero.

3.5.52 Signal adaptation for angle signals (PHDIV)

Purpose

Power-of-two division or multiplication of angle signals.

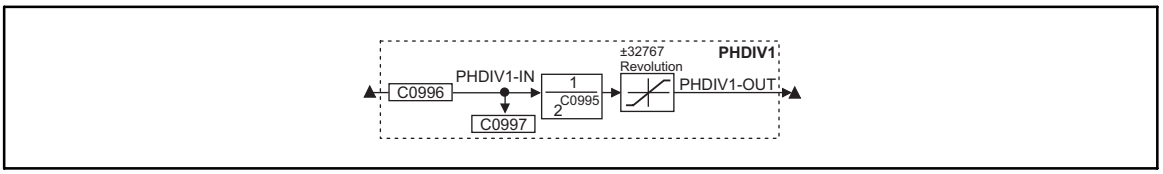


Fig. 3-188 Signal adaptation for angle signals (PHDIV1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHDIV1-IN	ph	C0997	dec [inc]	C0996	3	1000	
PHDIV1-OUT	ph	-	-	-	-	-	65536 inc = one encoder revolution

Function

- Arithmetic function:

$$\text{PHDIV1-OUT} = \frac{\text{PHDIV1-IN}}{2^{\text{C0995}}}$$

  – Positive values in C0995 result in a division.
  – Negative values in C0995 result in a multiplication.

- The output value is limited to $\pm(2^{31}-1)$ inc (corresponds to ±32767 encoder revolutions).
  – If the limit is exceeded, the output is kept at the limit value.

3.5.53 Phase integrator (PHINT)

Purpose

Integrates a speed or a velocity to a phase (distance). The integrator can maximally accept ±32000 encoder revolutions.

PHINT3 can recognise a relative distance.

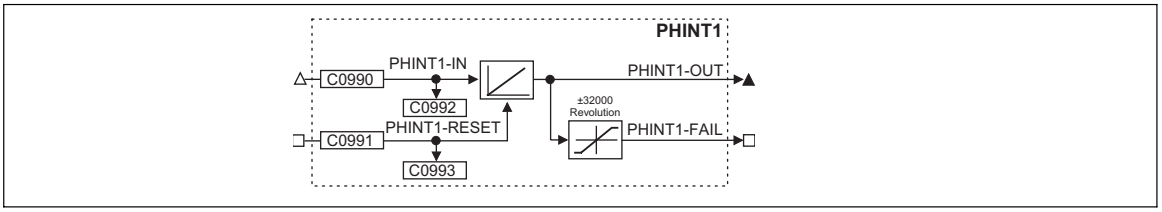


Fig. 3-189 Phase integrator (PHINT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT1-IN	phd	C0992	dec [rpm]	C0990	4	1 revolution = 65536 increments
PHINT1-RESET	d	C0993	bin	C0091	2	HIGH = sets the phase integrator to 0 and PHINT1-FAIL = LOW
PHINT1-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT1-FAIL	d	-	-	-	-	HIGH = overflow

Function

- constant input value
- Scaling of PHINTx-OUT

3.5.53.1 Constant input value

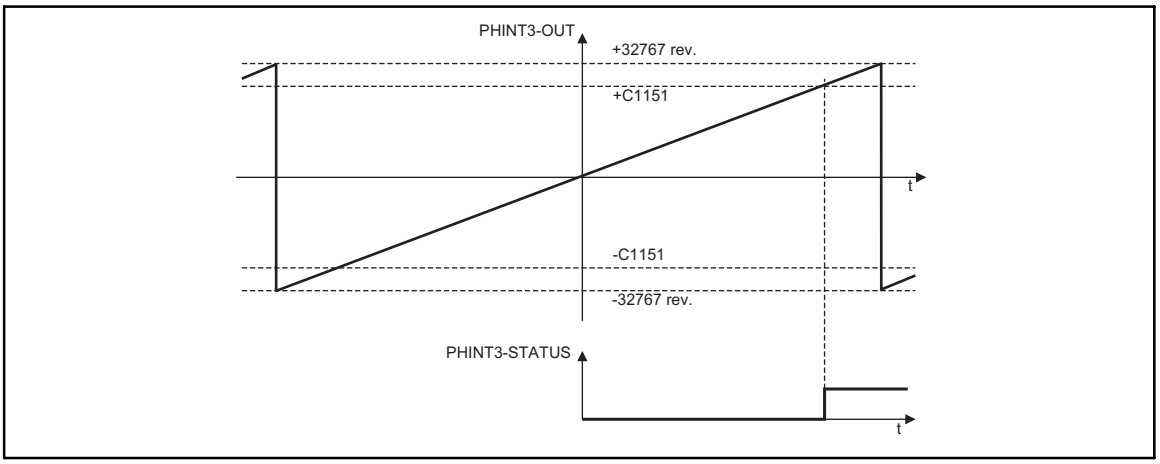
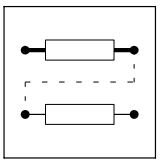


Fig. 3-190 Function of PHINTx with constant input value

- The FB integrates speed or velocity values at PHINTx-IN to a phase (distance).
- PHINTx-OUT outputs the count of the bipolar integrator.
  – A positive value at PHINTx-IN increments the integrator (count is increased).
  – A negative value at PHINTx-IN decrements the integrator (count is reduced).
- If the count exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  – an overflow occurs. The counting is continued with the value -32768.
  – PHINTx-FAIL switches to HIGH when the value ≥ +32000 is reached
- If the count falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  – an overflow occurs. The counting starts at the value +32767.
  – PHINTx-FAIL switches to HIGH when the value ≤ -32000 is reached.
- PHINTX-RESET = HIGH
  – sets the integrator to 0
  – Sets PHINTx-OUT = 0, as long as a HIGH level is applied to PHINTx-IN.
  – Sets PHINTx-FAIL = LOW.



3.5.53.2 Scaling of PHINTx-OUT

Mathematic description of PHINTx-OUT:

$$\text{PHINTx–OUT[inc]} = \text{PHINTx–IN[rpm]} \cdot t[s] \cdot 65536[\text{inc/Umdr.}]$$

t = integration time

Example:

You want to determine the count of the integrator with a certain speed at the input and a certain integration time.

- Given values:
  - PHINTx-IN = 1000 rpm
  - t = 10 s
  - Start value of the integrator = 0
- Solution:
  - Conversion of PHINTx-IN:

$$1000\ \text{rpm} = \frac{1000\ \text{rev.}}{60\ \text{s}}$$

  - Calculation of PHINTx-OUT:

$$\text{PHINTx} - \text{OUT} = \frac{1000\ \text{rev.}}{60\ \text{s}} \cdot 10\ \text{s} \cdot \frac{65536\ \text{inc}}{\text{rev.}} = 10922666\ \text{inc}$$

3.5.54 Delay element (PT1-1)

Purpose

Filtering and delaying of analog signals.

Fig. 3-191 Delay element (PT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PT1-1-IN	a	C0642	dec [%]	C0641	1	1000	-
PT1-1-OUT	a	-	-	-	-	-	-

Function

- The delay time T is set under C0640.
- The proportional coefficient is fixed at K = 1.

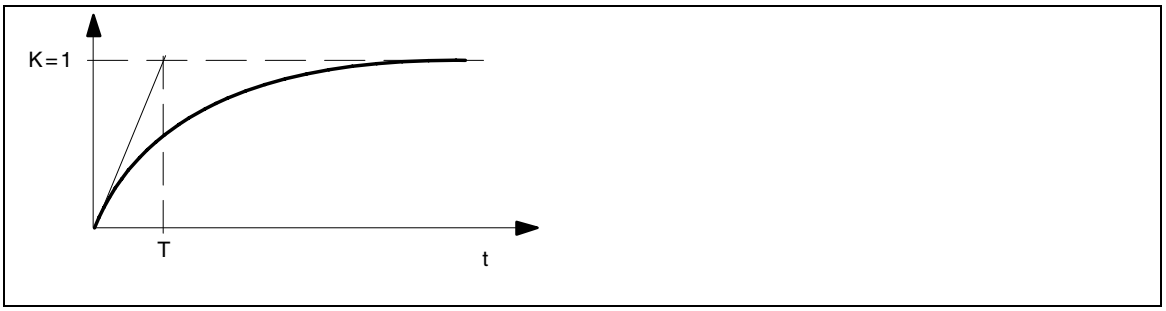


Fig. 3-192 Delay time T of the first order delay element

3.5.55 CW/CCW/QSP linking (R/L/Q)

Purpose

The FB provides a fail-safe connection for the selection of a rotation direction and the QSP function.

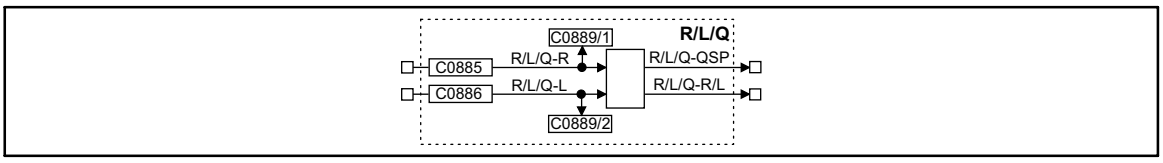


Fig. 3-193 CW/CCW/QSP linking (R/L/Q)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
R/L/Q-R	d	C0889/1	bin	C0885	2	51	-
R/L/Q-L	d	C0889/2	bin	C0886	2	52	-
R/L/Q-QSP	d	-	-	-	-	-	-
R/L/Q-R/L	d	-	-	-	-	-	-

Function

- After mains connection and simultaneous HIGH level at both inputs, the outputs are set as follows:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
1	1	0	1

- The following truth table results if one of the inputs is set to LOW once after mains connection:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
0	0	0	1
1	0	0	0
0	1	1	0
1	1	unchanged	unchanged

- If both inputs are set to HIGH during operation, the values at both outputs remain unchanged.

3.5.56 Ramp function generator (RFG)

Purpose

The ramp function generator limits the rise of signals.

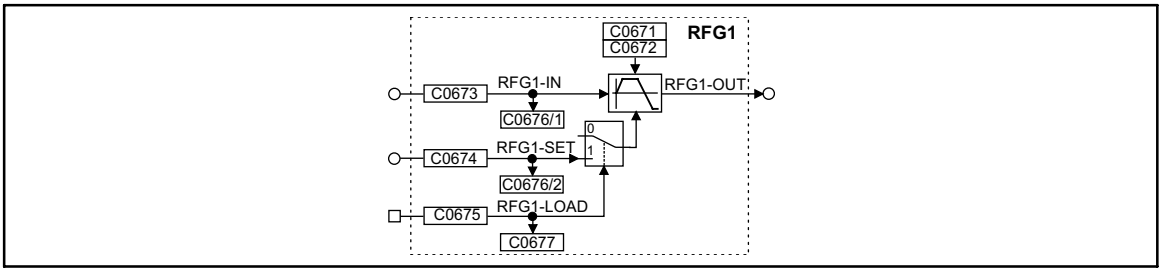


Fig. 3-194 Ramp function generator (RFG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

- Calculation and setting of the times T_{ir} and T_{if}
- Loading of the ramp function generator

3.5.56.1 Calculation and setting of the times T_{ir} and T_{if}

The acceleration time and deceleration time refer to a change of the output value from 0 to 100 %. The times T_{ir} and T_{if} to be set can be calculated as follows:

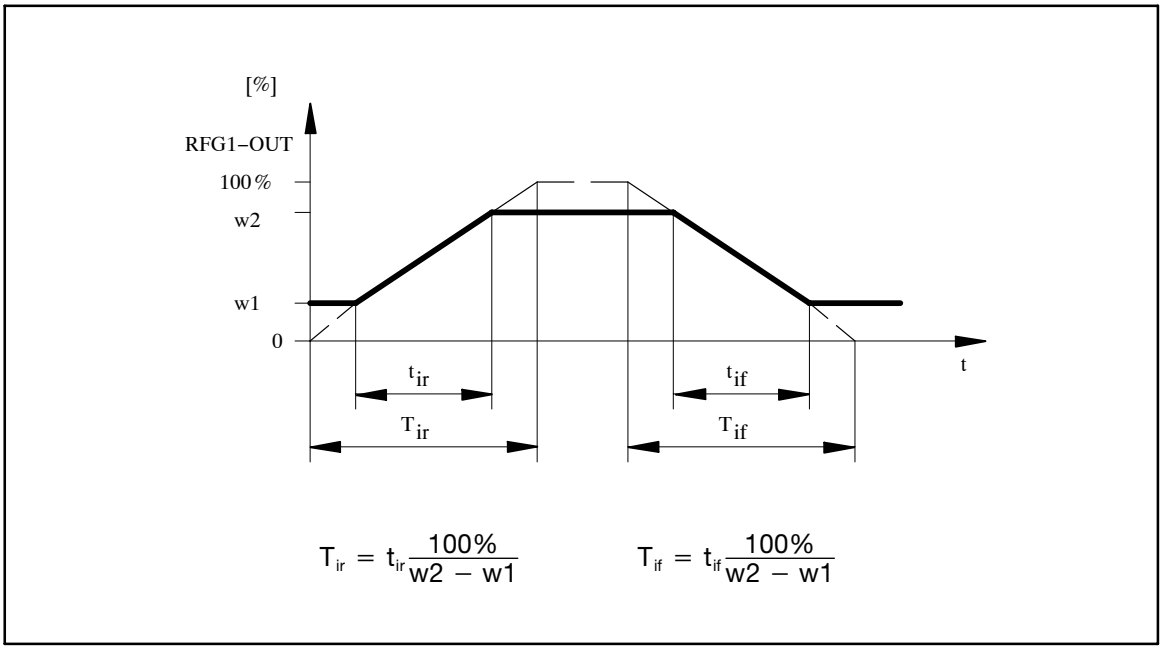


Fig. 3-195 Acceleration and deceleration times of the ramp function generator

t_{ir} and t_{if} are the times desired for the change between w_1 and w_2.The values for T_{ir} and T_{if} can be set under C0671 and C0672.

3.5.56.2 Loading of the ramp function generator

The ramp function generator can be initialised with defined values via the inputs RFG1-SET and RFG1-LOAD.

- As long as the input RFG1-LOAD = HIGH, the input RFG1-SET is switched to the output.
- If the input RFG1-LOAD = LOW, the ramp function generator accelerates/decelerates from this value to its input value within the set T_i times.

3.5.57 Sample and hold function (S&H)

Purpose

The FB can save analog signals. The saved value is also available after mains switching.

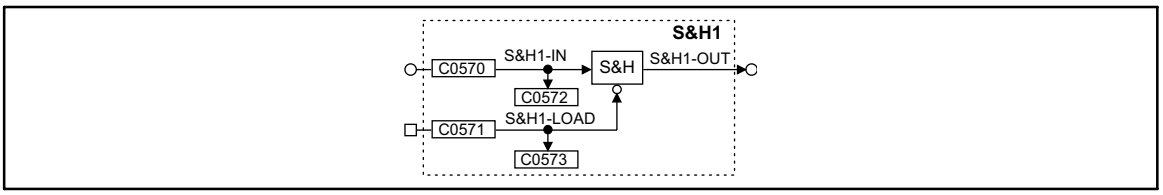


Fig. 3-196 Sample and hold function (S&H1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
S&H1-IN	a	C0572	dec [%]	C0570	1	1000	
S&H1-LOAD	d	C0573	bin	C0571	2	1000	LOW = save
S&H1-OUT	a	-	-	-	-	-	

Function

- With S&H1-LOAD = HIGH the signal at the input S&H1-IN is switched to the output S&H1-OUT.
- With S&H1-LOAD = LOW the output S&H1-OUT is disconnected from the input S&H1-IN and outputs the value which was last valid.

Saving in the case of mains disconnection:

- Keep S&H1-LOAD at LOW level when disconnecting the supply voltage (mains, DC bus or terminal 59).
- Keep S&H1-LOAD at LOW level when connecting the supply voltage (mains, DC bus or terminal 59).

3.5.58 Angle value selection (SELPH)

Two FBs (SELPH1, SELPH2) are available.

Purpose

Select one angle value from nine angle values and switch it to the output.

SELPH1

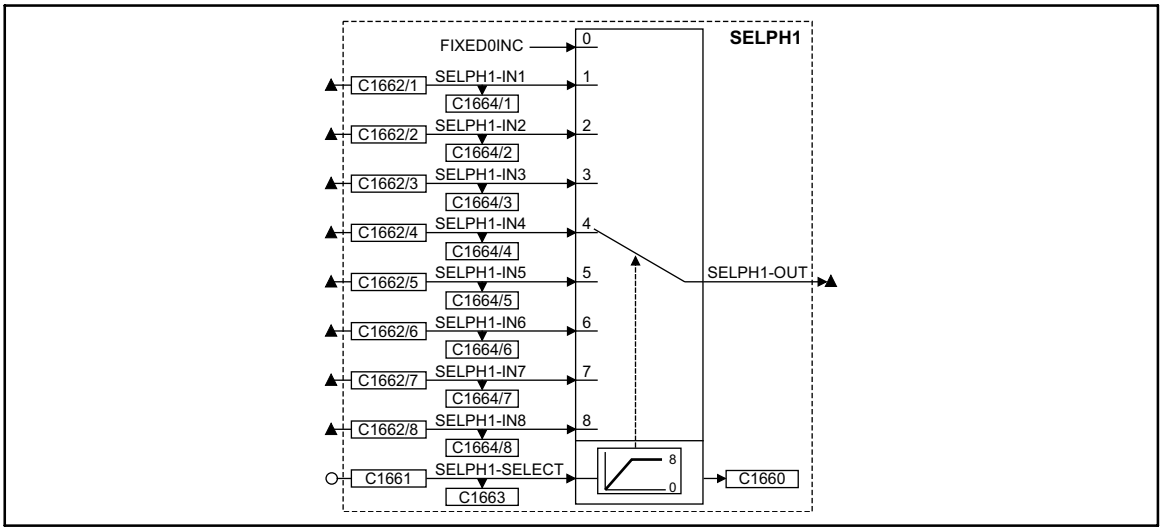


Fig. 3-197 Function block SELPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH1-SELECT	a	C1663	dec	C1661	1	-
SELPH1-IN1	ph	C1664/1	dec [inc]	C1662/1	3	-
SELPH1-IN2	ph	C1664/2	dec [inc]	C1662/2	3	-
SELPH1-IN3	ph	C1664/3	dec [inc]	C1662/3	3	-
SELPH1-IN4	ph	C1664/4	dec [inc]	C1662/4	3	-
SELPH1-IN5	ph	C1664/5	dec [inc]	C1662/5	3	-
SELPH1-IN6	ph	C1664/6	dec [inc]	C1662/6	3	-
SELPH1-IN7	ph	C1664/7	dec [inc]	C1662/7	3	-
SELPH1-IN8	ph	C1664/8	dec [inc]	C1662/8	3	-
SELPH1-OUT	ph	-	-	-	-	-
-	-	C1660	dec	-	-	Displays the current selection

SELPH2

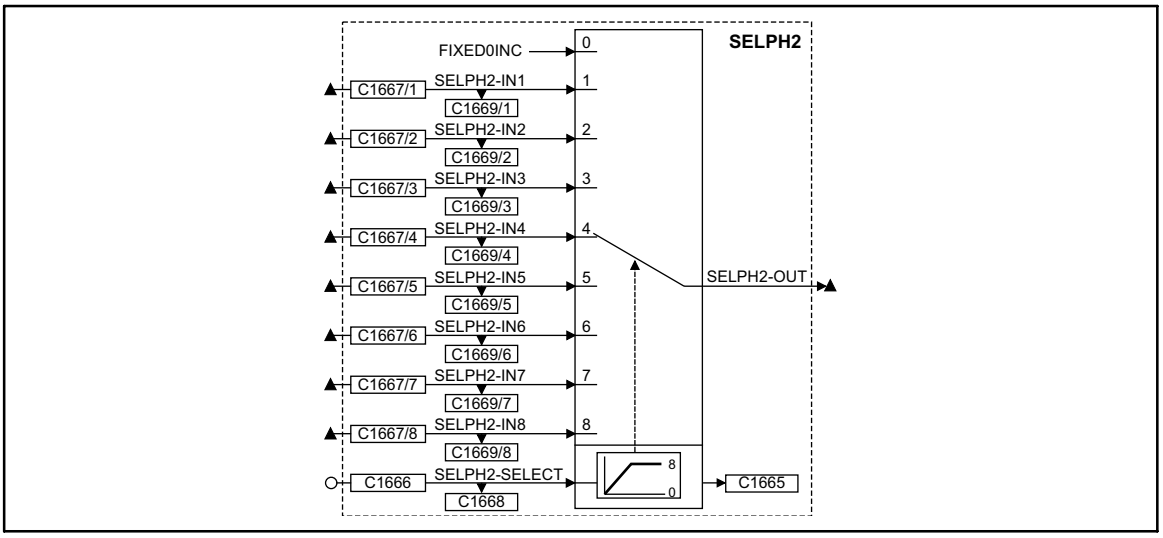


Fig. 3-198 Function block SELPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH2-SELECT	a	C1668	dec	C1666	1	-
SELPH2-IN1	ph	C1669/1	dec [inc]	C1667/1	3	-
SELPH2-IN2	ph	C1669/2	dec [inc]	C1667/2	3	-
SELPH2-IN3	ph	C1669/3	dec [inc]	C1667/3	3	-
SELPH2-IN4	ph	C1669/4	dec [inc]	C1667/4	3	-
SELPH2-IN5	ph	C1669/5	dec [inc]	C1667/5	3	-
SELPH2-IN6	ph	C1669/6	dec [inc]	C1667/6	3	-
SELPH2-IN7	ph	C1669/7	dec [inc]	C1667/7	3	-
SELPH2-IN8	ph	C1669/8	dec [inc]	C1667/8	3	-
SELPH2-OUT	ph	-	-	-	-	-
-	-	C1665	dec	-	-	Displays the current selection

Function

- An analog signal at SELPHx-SELECT directly selects an input and switches it to SELPHx-OUT.
  - If SELPHx-SELECT = 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT < 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT > 8, SELPHx-OUT switches to SELPHx-IN8.

Tip!

You can select an input via a digital signal by connecting the FB CONVDAx upstream of SELPHx-SELECT.

3.5.59 Switching points (SP)

Two FBs (SP1, SP2) are available.

Purpose

Switches an output signal if the drive moves within a certain range (achieving a camgroup, triggering spray jets).

SP1

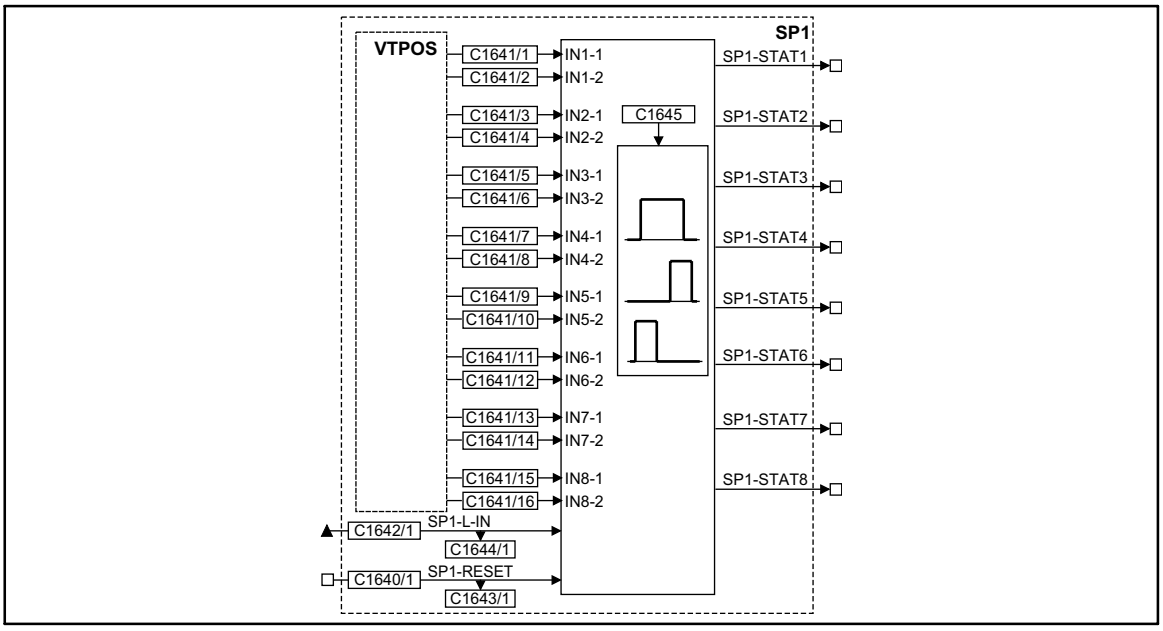


Fig. 3-199 Function block SP1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SP1-L-IN	ph	C1644/1	dec [inc]	C1642/1	3	65536 inc = 1 revolution
SP1-RESET	d	C1643/1	bin	C1640/1	2	-
SP1-STAT1	d	-	-	-	-	-
SP1-STAT2	d	-	-	-	-	-
SP1-STAT3	d	-	-	-	-	-
SP1-STAT4	d	-	-	-	-	-
SP1-STAT5	d	-	-	-	-	-
SP1-STAT6	d	-	-	-	-	-
SP1-STAT7	d	-	-	-	-	-
SP1-STAT8	d	-	-	-	-	-

SP2

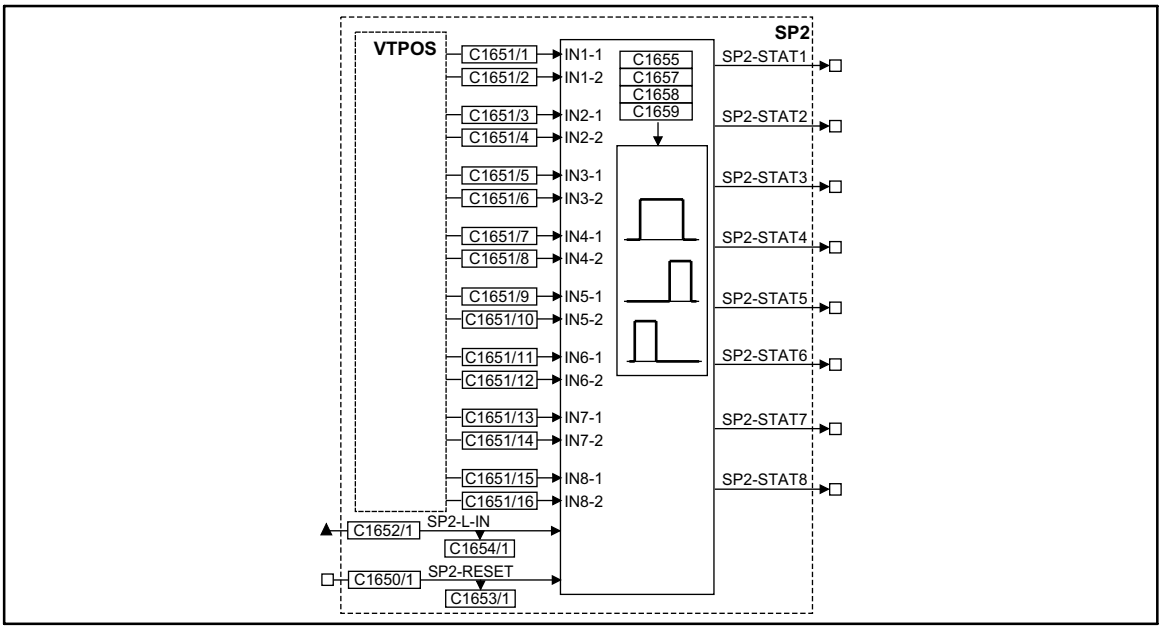


Fig. 3-200 Function block SP2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SP2-L-IN	ph	C1654/1	dec [inc]	C1652/1	3	65536 inc = 1 revolution
SP2-RESET	d	C1653/1	bin	C1650/1	2	-
SP2-STAT1	d	-	-	-	-	-
SP2-STAT2	d	-	-	-	-	-
SP2-STAT3	d	-	-	-	-	-
SP2-STAT4	d	-	-	-	-	-
SP2-STAT5	d	-	-	-	-	-
SP2-STAT6	d	-	-	-	-	-
SP2-STAT7	d	-	-	-	-	-
SP2-STAT8	d	-	-	-	-	-

Function

- Switching points (start/end, center/range)
- Switching hysteresis
- Switching dead time
- Switching filter time constant

3.5.59.1 Switching points

- The switching points can be set in two ways:
  - Mode 1: Start and end point
  - Mode 2: Centre point with switching range
- The switching points are entered via the variable table VTPOS.
  - Direct input of the switch-on and switch-off points or centre point and range in VTPOS.
- If the value at SPx-L-IN is within the range of the switching points set, SPx-STATx switches HIGH
- In factory setting, SPx-L-IN is connected to the actual position value (POS-ACTPOS) of the FB POS.
  - Therefore, the switching points refer to the distance traversed by the motor.

Assignment of the switch-on and switch-off points for SP1 (see also Fig. 3-199):

Code	Subcode	Switching point	Output FB
C1641	1	IN1-1	SP1-STAT1
	2	IN1-2	
...	...	...	...
C1641	15	IN8-1	SP1-STAT8
	16	IN8-2	

Assignment of the switch-on and switch-off points for SP2 (see also Fig. 3-200):

Code	Subcode	Switching point	Output FB
C1651	1	IN1-1	SP2-STAT1
	2	IN1-2	
...	...	...	...
C1651	15	IN8-1	SP2-STAT8
	16	IN8-2	

Mode 1: Start and end point

C1645 = set 0 (SP1)

C1655 = set 0 (SP2)

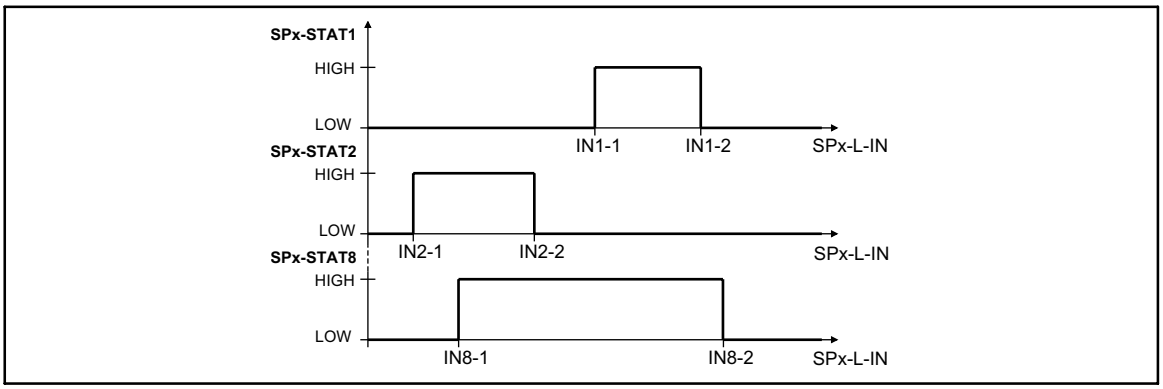


Fig. 3-201 Switch-on and switch-off points for SPx-STAT1, SPx-STAT2 and SPx-STAT8

Switch-on and switch-off positions depend on the travel direction:

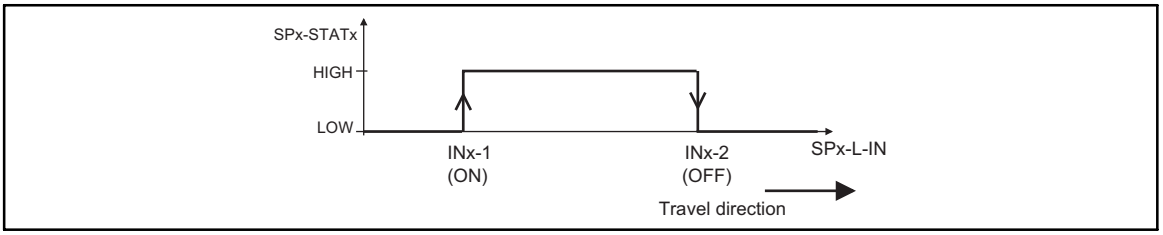


Fig. 3-202 Definition of a switch-on and switch-off position according to the travel direction

Mode 2: Centre point with switching range

C1645 = set 1 (SP1)

C1655 = set 1 (SP2)

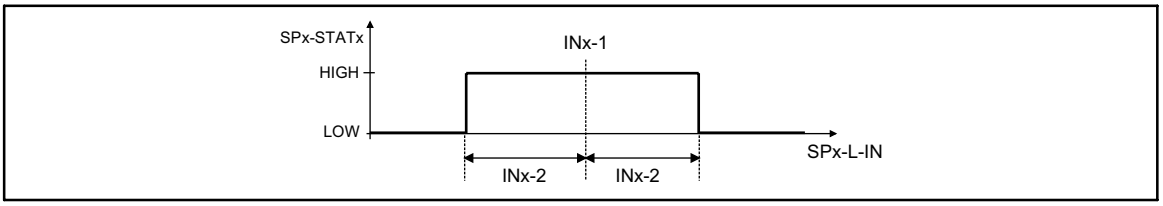


Fig. 3-203 Centre point with switching range

- INx-1 determines the centre point.
- INx-2 determines the switching range around the centre point.

3.5.59.2 Hysteresis

This function is available only for the FB SP2.

Purpose

Avoids indefined switching of the output signals (in standstill the drive is located exactly on a switching point).

Function

- The hysteresis is entered via C1658.
  – The setting is effective for SP2-STAT1 ... SP2-STAT8.

Function library

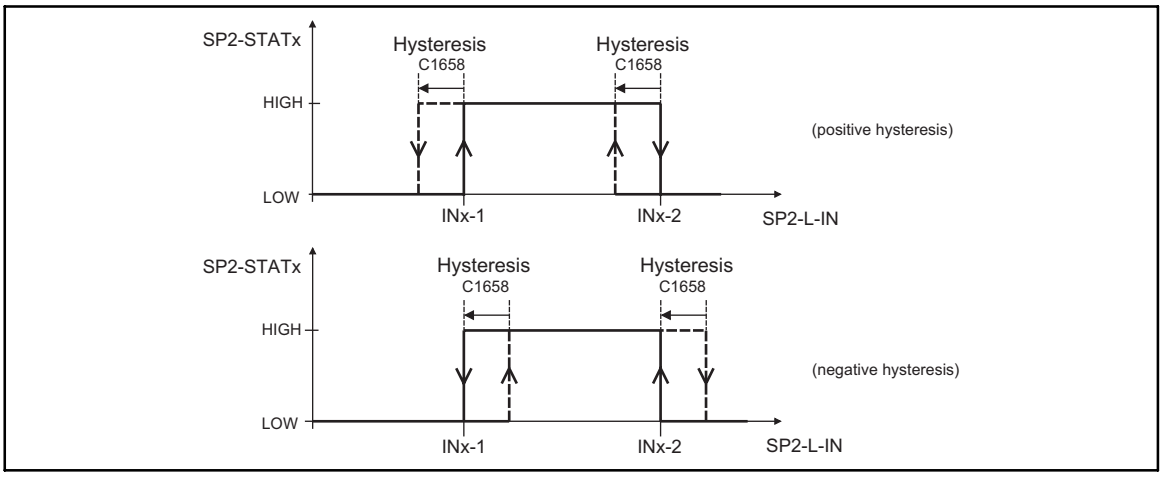


Fig. 3-204 Hysteresis for positive and negative values

3.5.59.3 Dead time

This function is available only for the FB SP2.

Purpose

Delayed triggering of subsequent machine parts (e.g. spray jets).

Function

- The dead time is entered via C1657.
  – The setting is possible for SP2-STAT1 ... SP2-STAT4 only.

Assignment of the code to the outputs:

Code	Subcode	Output FB SP2
C1657	1	SP2-STAT1
	2	SP2-STAT2
	3	SP2-STAT3
	4	SP2-STAT4

- The dead time acts on switching points and hysteresis.

Positive dead time

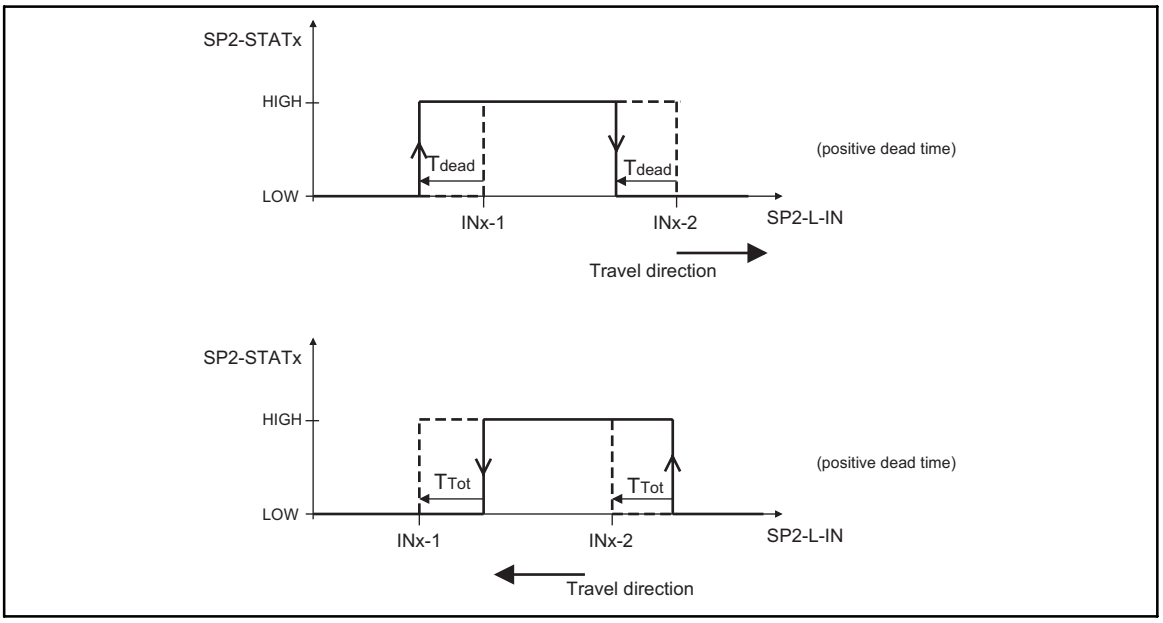


Fig. 3-205 Function of the positive dead time with different travel directions

- With a positive dead time, the drive reacts earlier by the time period set.

Negative dead time

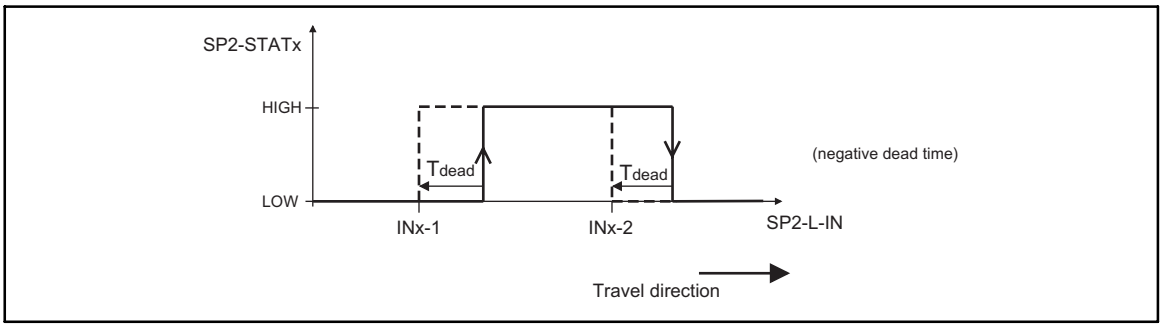


Fig. 3-206 Function of the negative dead time

- With a negative dead time, the drive reacts later by the time period set.

3.5.59.4 Filter time constant

This function is available only for the FB SP2.

Purpose

Avoids undefined switching of the output signals at SP2-STAT1 ... SP2-STAT4 when the motor is running at low speed.

Function

- The filter time constant is entered via C1659.
  – The setting is valid for SP2-STAT1 ... SP2-STAT4.

Assignment of the codes to the filter time constant:

Code	Value	Filter time constant
C1659	0	Off
	1	1 ms
	2	2 ms
	4	4 ms
	8	8 ms
	16	16 ms

Tip!

The correct setting can only be found by testing.

In general:

- The lower the resolution of the actual position encoder and the lower the travel speed, the higher the filter time constant.

3.5.60 Output of digital status signals (STAT)

Purpose

The FB evaluates digital signals of function blocks and the status of the controller and passes them on to C0150 and FB AIF-OUT and CAN-OUT1.

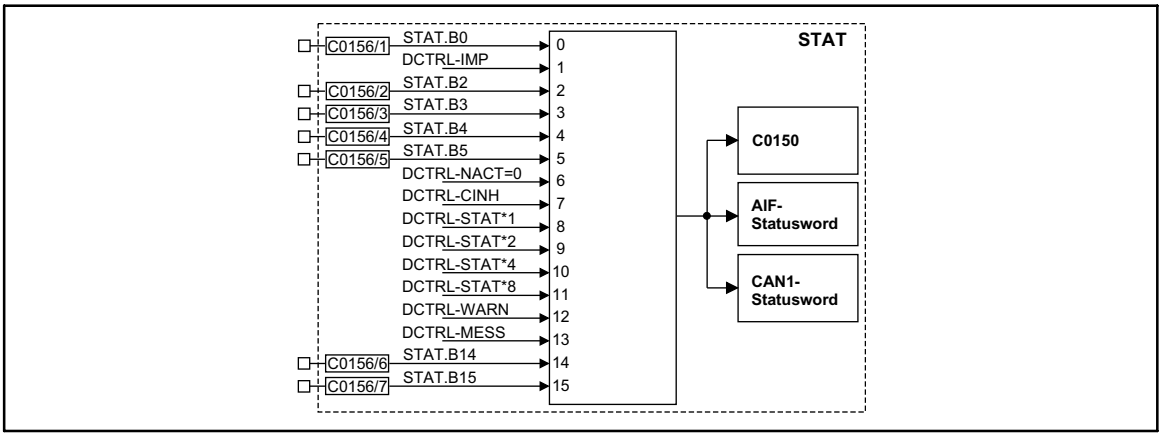


Fig. 3-207 Output of digital status signals (STAT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STAT.B0	d	-	bin	C0156/1	2	2000	
STAT.B2	d	-	bin	C0156/2	2	5002	
STAT.B3	d	-	bin	C0156/3	2	5003	
STAT.B4	d	-	bin	C0156/4	2	5050	
STAT.B5	d	-	bin	C0156/5	2	10650	
STAT.B14	d	-	bin	C0156/6	2	505	
STAT.B15	d	-	bin	C0156/7	2	500	

Function

The status word consists of some fixedly linked (DCTRL-xxxx-) and some freely linkable signal inputs (STAT.Bx).

- Digital signal sources can be freely assigned to the inputs STAT.Bx.
- The corresponding bit in the data word is marked with STAT.Bx (e.g. STAT.B0 for the LSB)
- The status word is transferred to code C0150 and to the function blocks AIF-OUT and CAN-OUT1.
- The inputs with the name DCTRL-xxxx are directly accepted from the function block DCTRL. (📖 3-160)

3.5.61 Control of a drive network (STATE-BUS)

Purpose

The FB controls the drive network to specified states (e.g. trip, quick stop or controller inhibit).

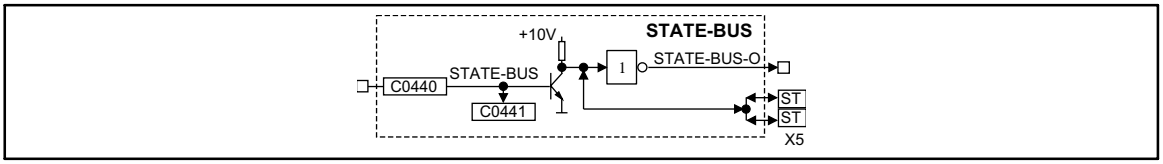


Fig. 3-208 Control of a function block STATE-BUS

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STATE-BUS	d	C0441	bin	C0440	2	1000	
STATE-BUS-0	d	-	-	-	-	-	
TERMINAL X5/ST	d	-	-	-	-	-	

Function

The STATE-BUS is a device-specific bus system which is designed for Lenze controllers only. The function block STATE-BUS acts on the terminals X5/ST or reacts on a LOW signal at these terminals (multi-master capable).

- Every connected controller can set these terminals to LOW.
- All connected controllers evaluate the signal level at these terminals and control the internally configured function blocks.
- Up to 20 controllers can be connected.

STOP

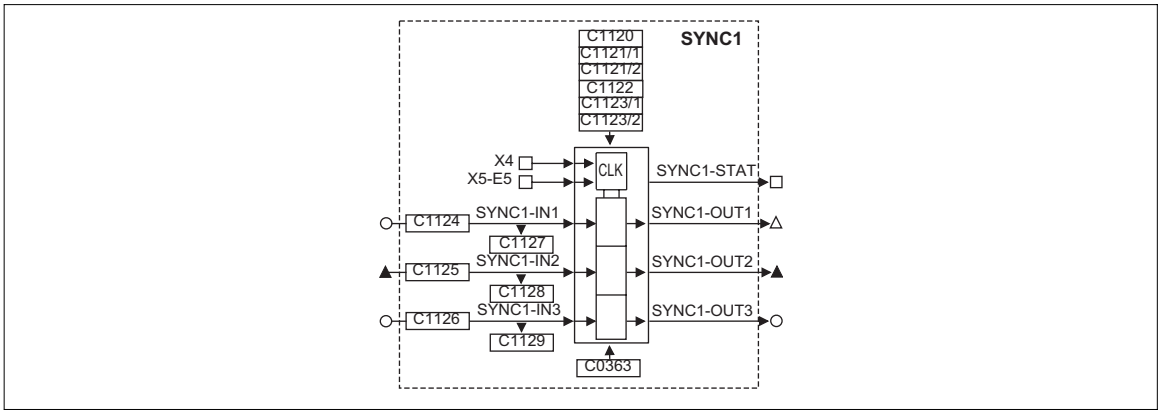
Stop!

Do not apply an external voltage at terminals X5/ST.

3.5.62 Multi-axis synchronisation (SYNC1)

Purpose

Synchronises the control program cycle of the drives to the cycle of a master control.



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC1-IN1	a	C1127	dec [inc]	C1124	1	1000	-
SYNC1-IN2	ph	C1128	dec [inc]	C1125	3	1000	-
SYNC1-IN3	a	1129	dec	C1126	1	1000	
SYNC1-STAT	d	-	-	-	-	-	After the synchronisation is completed, SYNC1-STAT switches to HIGH. If the synchronisation is quit, SYNC1-STAT switches to LOW.
SYNC1-OUT1	phd	-	-	-	-	-	Cannot be used for angle-accurate speed/angle difference transmission
SYNC1-OUT2	ph	-	-	-	-	-	With interpolation, for cyclically synchronised position information
SYNC1-OUT3	a	-	-	-	-	-	With interpolation, for analog values

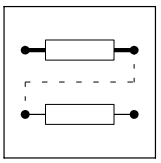
Function

- Possible axis synchronisations (chapter 3.5.62.1)
- Cycle times (chapter 3.5.62.2)
- Phase displacement (chapter 3.5.62.3)
- Synchronisation window for synchronisation via terminal (SYNC WINDOW) (chapter 3.5.62.4)
- Correction value of phase controller (SYNC CORRECT) (chapter 3.5.62.5)
- Fault indications (chapter 3.5.62.6)
- Configuration examples (chapter 3.5.62.7)
- Scaling (chapter 3.5.62.8)

3.5.62.1 Possible axis synchronisations

Operating mode

Code	Value	Function
C1120	0	FB without function. Assigns the data at the inputs directly to the outputs.
	1	CAN Sync active Synchronises the controllers to the sync telegram of the system bus.
	2	Terminal Sync active Synchronises the controllers to the sync signal of terminal X5/E5.



Synchronisation time

In addition to certain mains connection and initialisation time of the controller, the FB SYNC1 also requires a synchronisation time.

The synchronisation time depends on

- the baud rate of the system bus (CAN-SYNC),
- the starting time (reception of the first SYNC telegram / signal),
- the time between the SYNC telegrams,
- the SYNC correction factor (C0363),
- the operating mode of the FB SYNC1.

Axis synchronisation via system bus (CAN)

The system bus (CAN) transmits the sync telegram and the process signals.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via the system bus (CAN).

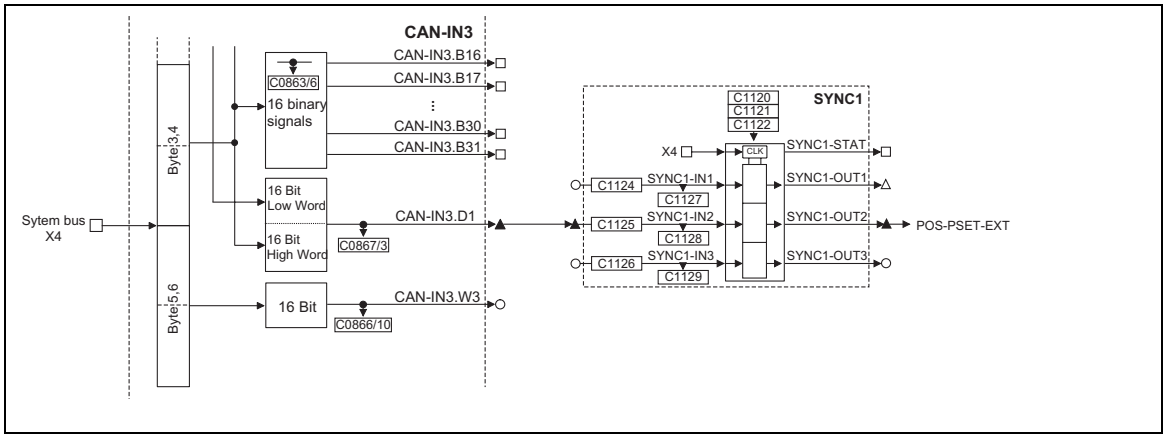


Fig. 3-209 Example for linking the FB SYNC1

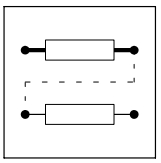
Axis synchronisation via terminal control (X5/E5)

The transmission paths for the sync signal and the process signals are separated.

- The process signals are connected via a freely selectable input channel (e. g. AIF interface, DF input).
- The sync signal is injected via terminal X5/E5.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via other bus systems (e. g. Interbus).
- Synchronisation of the internal processing cycles of the FB to higher-level process controls.



3.5.62.2 Cycle times

Sync cycle time (SYNC CYCLE)

The master (e. g. PLC) sends the periodic sync telegram[1)] (sync signal[2)]).

The controllers (slaves) receive the sync telegram and compare the time between two LOW-HIGH edges of the signal with the selected cycle time (1121/1).

The cycle time is entered in integers (1 ms, 2 ms, 3 ms, ...).

1) Designation for the synchronisation via system bus (CAN)

2) Designation for the synchronisation via terminal

Code	Value	Function
C1121/1	1 ... 13 ms	Definition of the cycle time of the sync telegram (sync signal). Parameters must only be set for the slave. • C1120 = 1 (CAN sync) – Time between two sync telegrams of the master. Adapt the time to the master SYNC. C0362 indicates the time (CAN sync cycle) for the slave. Set the value in C1121/1 higher than the value in C0362. • C1120 = 2 (terminal SYNC) – Time between two sync signals of the master at X5/E5. Adapt the time to the master SYNC. Set the value in C1121/1 ≥ the cycle time of the master.

Interpolation cycle time (INTPOL. CYCLE)

The FB interpolates the input signals (C1124, C1125, C1126) between the sync telegrams or sync signals and transmits them to the corresponding output. This ensures an optimum signal course with regard to the internal processing cycle (e. g. minimising signal jumps in the output variable when operating with high sync cycles).

The interpolation is restarted with every sync signal (LOW-HIGH edge).

Code	Value	Function
C1121/2	1 ... 13 ms	Definition of the interpolation cycles/steps • C1120 = 1 – C1121/2 has no effect. – The interpolation cycles are derived from the sync cycle (C1121/1). • C1120 = 2 – The interpolation cycle can be selected irrespective of the sync cycle. – The parameter setting of C1121/2 must be selected according to the cycle of the process value input.

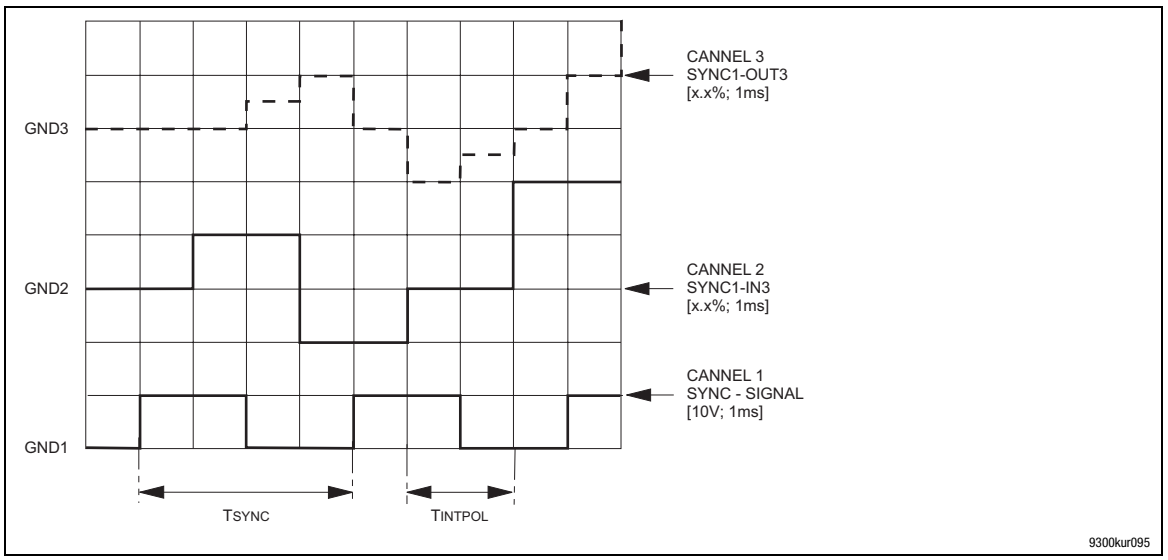


Fig. 3-210 Interpolation example

See Fig. 3-210:

An analog value at SYNC1-IN3 is output as an interpolated value at SYNC1-OUT3.

- Sync cycle (C1121/1) = 4 ms
- Interpol. cycle (C1121/2) = process cycle = 2 ms
- Phase displacement (C1123/1) = 0 ms

3.5.62.3 Phase displacement

Phase displacement for synchronisation via system bus (SYNC TIME)

Code	Value	Function
C1122	0 ...10.000 µs	• C1120 = 1 – Phase displacement between the sync telegram and the start of the internal control program. – The parameters are set automatically depending on the parameter setting of the system bus (CAN). • C1120 = 2 – C1122 has no effect.

Phase displacement for synchronisation via terminal (PHASESHIFT)

Code	Value	Function
C1123/1	-1.000 ms to +1.000 ms	• C1120 = 1 – C1123/1 has no effect. • C1120 = 2 – Phase displacement between the sync signal and the start of the internal control program (e. g. for compensating the effects of signal propagation delays/dead times for the sync signal of the single slave drives).

3.5.62.4 Time slot for synchronisation via terminal

Code	Value	Function
C1123/2	0 ... 1.000 ms	• C1120 = 1 – C1123/2 has no effect. • C1120 = 2 – Definition of a ”time slot” for the LOW-HIGH edges of the sync signal for the slave (defined via C1121/1). – If the sync signal sent by the master is within the ”time slot”, the SYNC1-STAT is switched to HIGH.

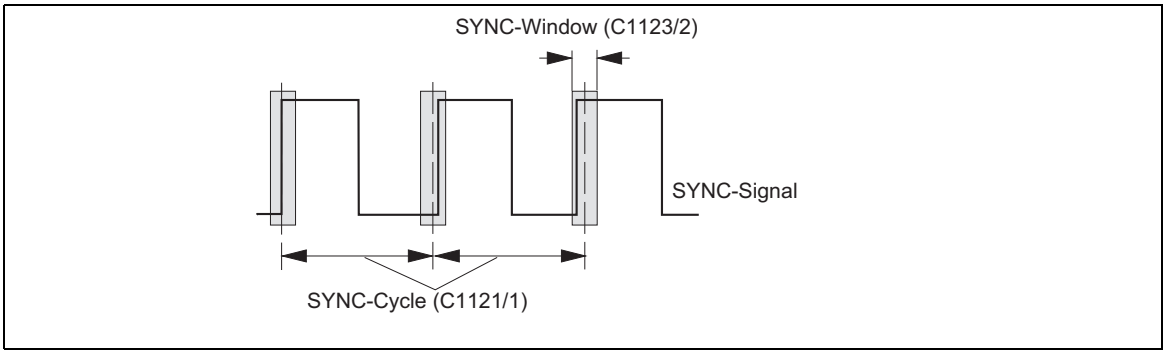


Fig. 3-211 “Time slot” for the LOW-HIGH edges of the sync signal

Tip!

A jitter of up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The size of the jitter affects the parameter setting of the ”time slot”.

3.5.62.5 Correction value of the phase controller

Code	Value	Function
C0363	1 ... 5	• Correction values for C0363 = 1 → 0.8 µs 2 → 1.6 µs 3 → 2.4 µs 4 → 3.2 µs 5 → 4.0 µs • C1120 = 1 – The value is automatically derived from the internal parameters of the system bus (CAN). • C1120 = 2 – Optimising the rise time of the phase controller depending on the frequency of the sync signal. – Increase the value if the frequency of the sync signal decreases. – A stable signal at SYNC1-STAT is an indicator for an optimal parameter setting.

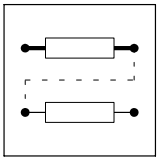
3.5.62.6 Fault indications

Fault indications for the synchronisation via system bus

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	The time between two sync telegrams is faulty	C0362 indicates the time between two sync telegrams • Set the time in C1121/1 to the time in C0362 • Adapt the time interval of the sync telegram from the master

Fault indications for the synchronisation via terminal

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	Sync signal is missing	Connect sync signal with terminal X5/E5
	The period of the sync signal is not a multiple of 1 ms	Adapt the period
	Sync window is too small	Adapt C1123/2 to the conditions



3.5.62.7 Configuration examples

Configuration example CAN-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller and system bus without FB SYNC1
2.	-	Inhibit controller
3.	CAN master	Define the sequence of the telegrams 1. Send new setpoint to all slaves 2. Send sync telegram 3. All slaves must respond
4.	CAN slave drives	Enter FB SYNC1 into the first position of the processing table
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 1 (sync mode for FB SYNC1)
7.	CAN master	Start communication, send sync telegrams
8.	CAN slave drives	FB SYNC1 (CAN SYNC-CYCLE) • Retrieve cycle time of the SYNC telegram from the master via C0362
9.		FB SYNC1 (SYNC CYCLE) • Set C1121 according to the time interval of the sync telegrams from the control • Set C1121 ≥ C0362
10.		Parameterise the monitoring function P16 via C1290
11.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
12.		Via FB DIGOUT • Detect signal of SYNC1-STAT
13.		Only enable the controller when SYNC1-STAT = HIGH

Configuration example TERMINAL-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller without FB SYNC1
2.	-	Inhibit controller
3.	Slave drives	Enter FB SYNC1 into the first position of the processing table
4.		Apply sync signal to terminal X5/E5
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 2 (sync mode for FB SYNC1)
7.	Sync master	Start communication, send sync signals
8.	Slave drives	FB SYNC1 (SYNC CYCLE) • Parameterise the sync cycle time of the sending source via C1121
9.		Parameterise the monitoring function P16 via C1290
10.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
11.		Via FB DIGOUT • Output signal of SYNC1-STAT
12.		FB SYNC1 (SYNC WINDOW) • Enter the optimal size of the ”time slot” via C1123/2 • If the sync signal jitters strongly, increase the ”time slot”
13.		Only enable the controller when SYNC1-STAT = HIGH

3.5.62.8 Scaling

The signal at input is transmitted in a scaled form to SYNC1-OUT1.

Scaling formula:

$$\text{SYNC1-OUT1 [rpm]} = \text{SYNC1-IN1 [inc]} \cdot \frac{1875\ \text{rpm}}{2048\ \text{inc}}$$

The inputs SYNC1-IN2 and SYNC1-IN3 are not scaled. The FB transmits the data to SYNC1-OUT2 or SYNC1-OUT3 without any evaluation.

3.5.63 Teach-in in programming (TEACH)

A function block (TEACH1) is available.

Purpose

Accepting actual position values and saving them in the VTPOS table. These values are then available as position setpoints.

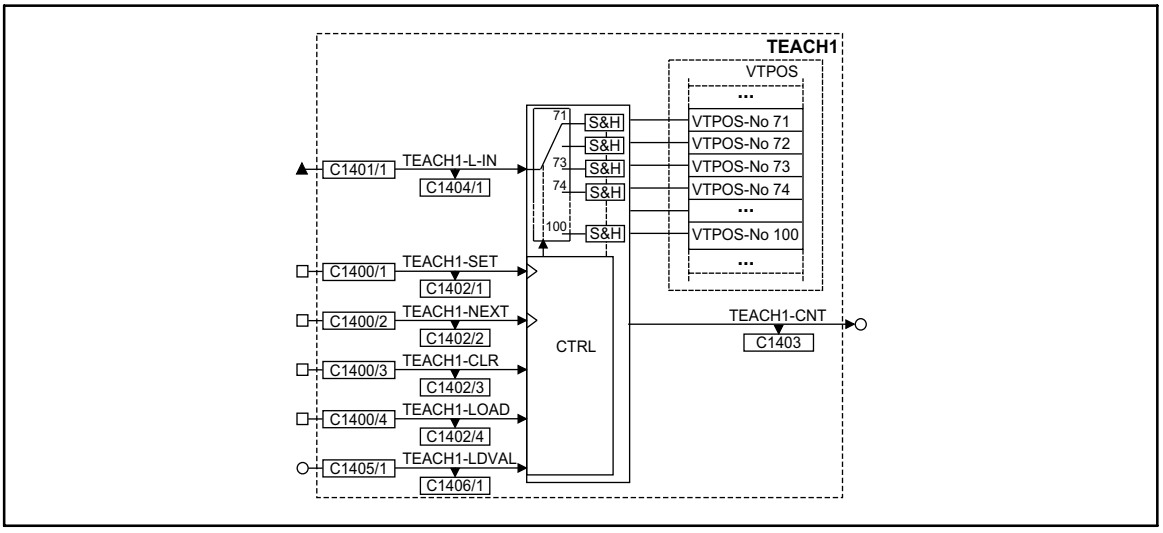
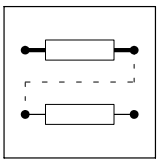


Fig. 3-212 Function block TEACH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
TEACH1-L-IN	ph	C1404/1	dec [inc]	C1401/1	3	Input for actual position
TEACH1-SET	d	C1402/1	bin	C1400/1	2	-
TEACH1-NEXT	d	C1402/2	bin	C1400/2	2	-
TEACH1-CLR	d	C1402/3	bin	C1400/3	2	-
TEACH1-LOAD	d	C1402/4	bin	C1400/4	2	-
TEACH1-LDVAL	a	C1406/1	dec [inc]	C1405/1	1	-
TEACH1-CNT	a	C1403	dec [inc]	-	-	Display of the table position which is selected as memory unit (table position = C1403 + 70)



Function

- The FB accepts a value (e.g. actual position) at TEACH1-L-IN.
- A LOW HIGH edge at TEACH1-SET transmits the value TEACH1-L-IN to the selected table position in VTPOS.
- A LOW-HIGH edge at TEACH-NEXT selects the next table position.
  - 30 table positions (VTPOS-No 71 ... VTPOS-No 100) are available.
  - The number of the selected table position can be displayed via C1403.
  - TEACH1-CNT transmits the number of the table position as analog signal.
- TEACH1-CLR = HIGH resets all values in the table positions to zero and selects simultaneously the table position VTPOS-No 71.
- An analog signal at TEACH1-LDVAL selects directly a table position (VTPOS-No).
  - Signal values < 71 = interpreted as VTPOS-No 71.
  - Signal values > 100 = interpreted as VTPOS-No 100.
  - TEACH1-LOAD = HIGH selects the position.
- If the levels are applied at the same time to the digital inputs, the following priority is valid:
  - TEACH1-CLR (1)
  - TEACH1-LOAD (2)
  - TEACH1-NEXT (3)
  - TEACH1-SET (4)

Tip!

Save the target positions permanently using C0003.

3.5.64 Edge evaluation (TRANS)

Purpose

This function is used to evaluate digital signal edges and convert them into pulses of a defined duration.

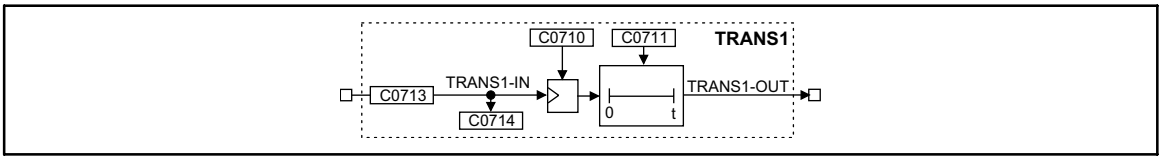


Fig. 3-213 Edge evaluation (TRANS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS1-IN	d	C0714	bin	C0713	2	1000	-
TRANS1-OUT	d	-	-	-	-	-	-

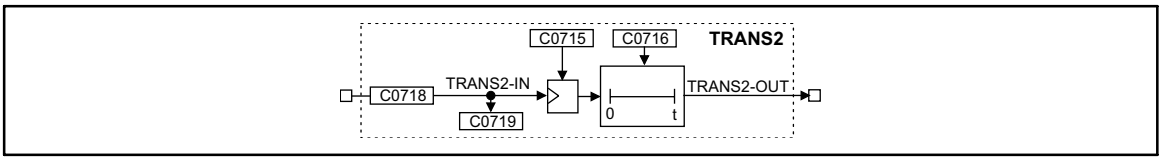


Fig. 3-214 Edge evaluation (TRANS2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS2-IN	d	C0719	bin	C0718	2	1000	-
TRANS2-OUT	d	-	-	-	-	-	-

Function

This FB is an edge evaluator which can be retriggered. This FB can react to different events. The following functions can be selected under code C0710 or C0716:

- Positive edge
- Negative edge
- Positive or negative edge

3.5.64.1 Evaluate positive edge

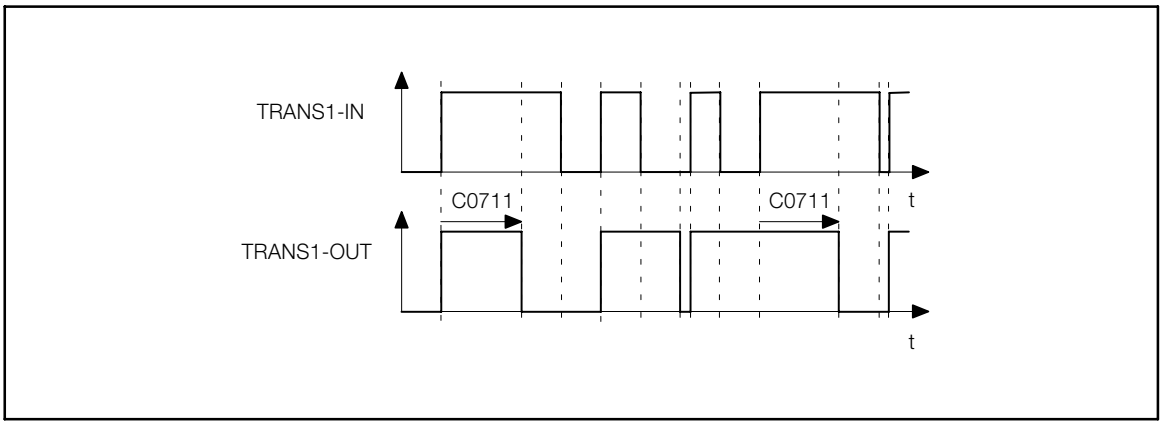


Fig. 3-215 Evaluation of positive edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another LOW-HIGH edge at the input.

3.5.64.2 Evaluate negative edge

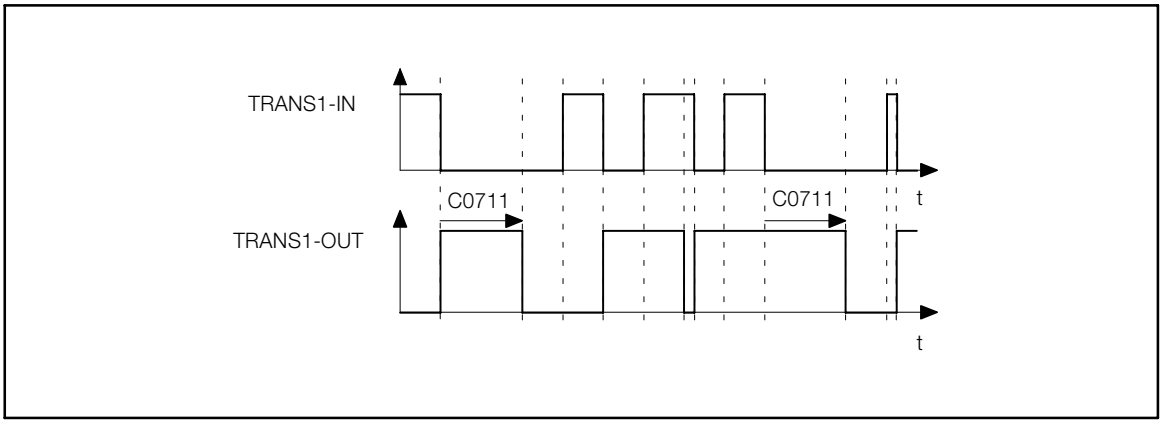


Fig. 3-216 Evaluation of negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW, unless there is another HIGH-LOW edge at the input.

3.5.64.3 Evaluate positive or negative edge

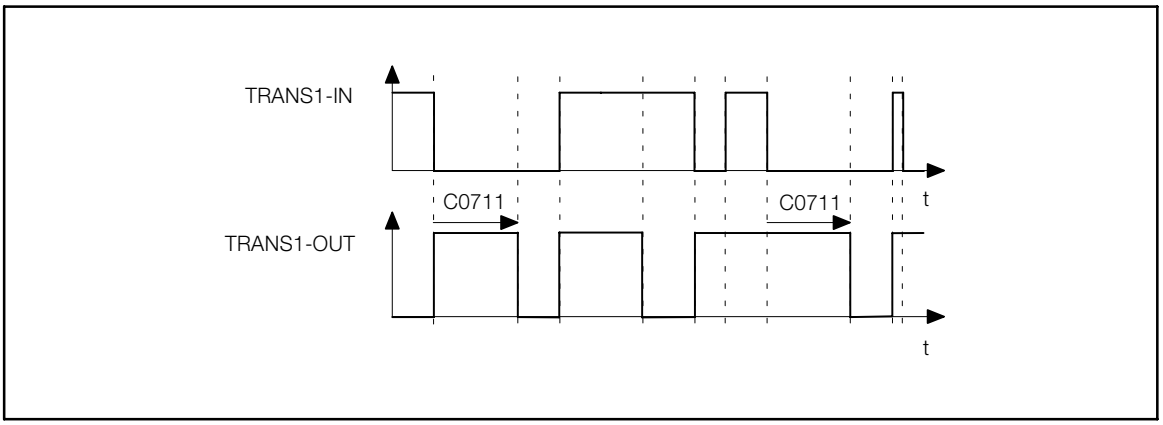


Fig. 3-217 Evaluation of positive and negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge or a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another HIGH-LOW edge or LOW-HIGH edge at the input.

3.5.65 Variable table - acceleration (VTACC)

One function block (VTACC) is available.

Purpose

Stores the values for acceleration and deceleration. They serve as acceleration and deceleration ramps in the positioning program.

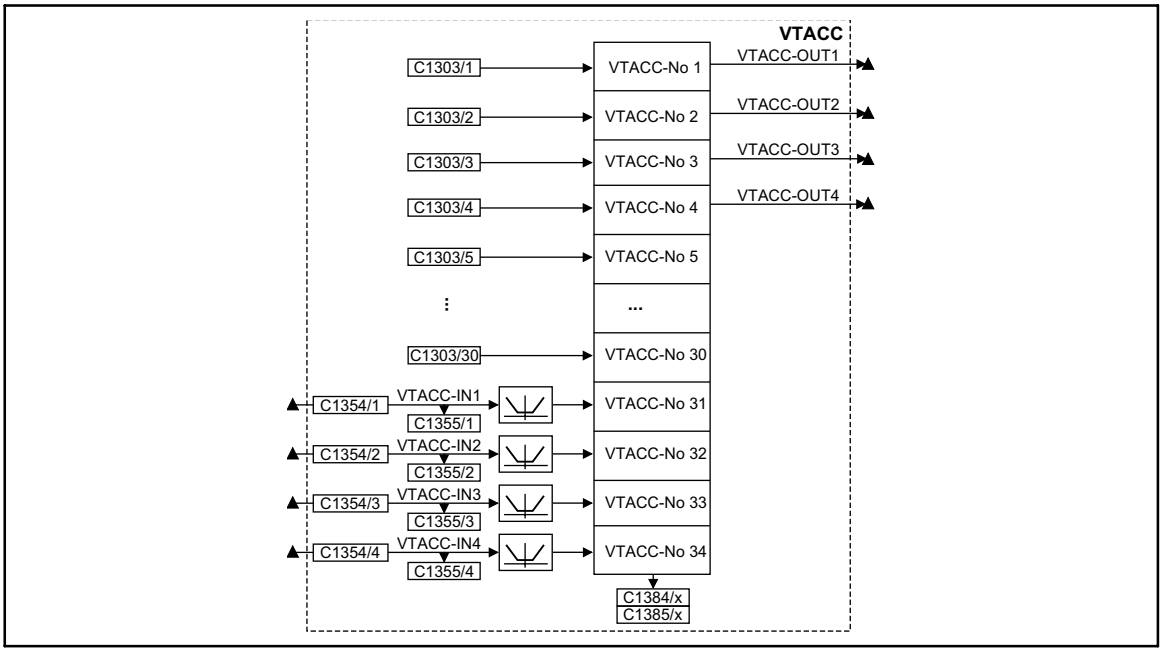


Fig. 3-218 Function block VTACC

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTACC-IN1	ph	C1355/1	dec [inc]	C1354/1	3	• Generates the absolute value for negative values. • When the values are > amax (C1250) the drive moves with amax.
VTACC-IN2	ph	C1355/2	dec [inc]	C1354/2	3	
VTACC-IN3	ph	C1355/3	dec [inc]	C1354/3	3	
VTACC-IN4	ph	C1355/4	dec [inc]	C1354/4	3	
VTACC-OUT1	ph	-	-	-	-	-
VTACC-OUT2	ph	-	-	-	-	-
VTACC-OUT3	ph	-	-	-	-	-
VTACC-OUT4	ph	-	-	-	-	-

Function

A total of 34 table positions is available.

- Enter fixed values under C1303.
  - 30 table positions (VTACC-No1 ... VTACC-No30) are available.
  - Subcodes (C1303/1 ... C1303/30) define the table position number.
- Enter variable values in VTACC-INx.
  - 4 table positions (VTACC-No31 ... VTACC-No34) are available.
  - Signal input via function blocks.
  - The values must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- C1384 indicates the values (in % of amax) on the table positions.
  - Select table position (C1384/1 ... C1384/34) with subcode.
- C1385 displays the values (in inc) on the table positions.
  - Select table position (C1385/1 ... C1385/34) with subcode.
- The conversion from a [units/s^2] to a [inc] is performed according to the formula:

$$a\,[\text{inc}] = a\,[\text{units}/s^2] \cdot \frac{65536\,[\text{inc}/r] \cdot \text{gear nominator} \cdot 16384}{\text{Feed const.}\,[\text{units}/r] \cdot \text{gear denominator} \cdot 1000000\,[1/s^2]}$$

Tip!

Entries into the processing table are only required if FB inputs and outputs are used.

3.5.66 Variable table Piece number (VTPCS)

One function block FB (VTPCS) is available.

Purpose

Stores setpoint piece numbers. They are used as comparison values for the piece number function in the program processing.

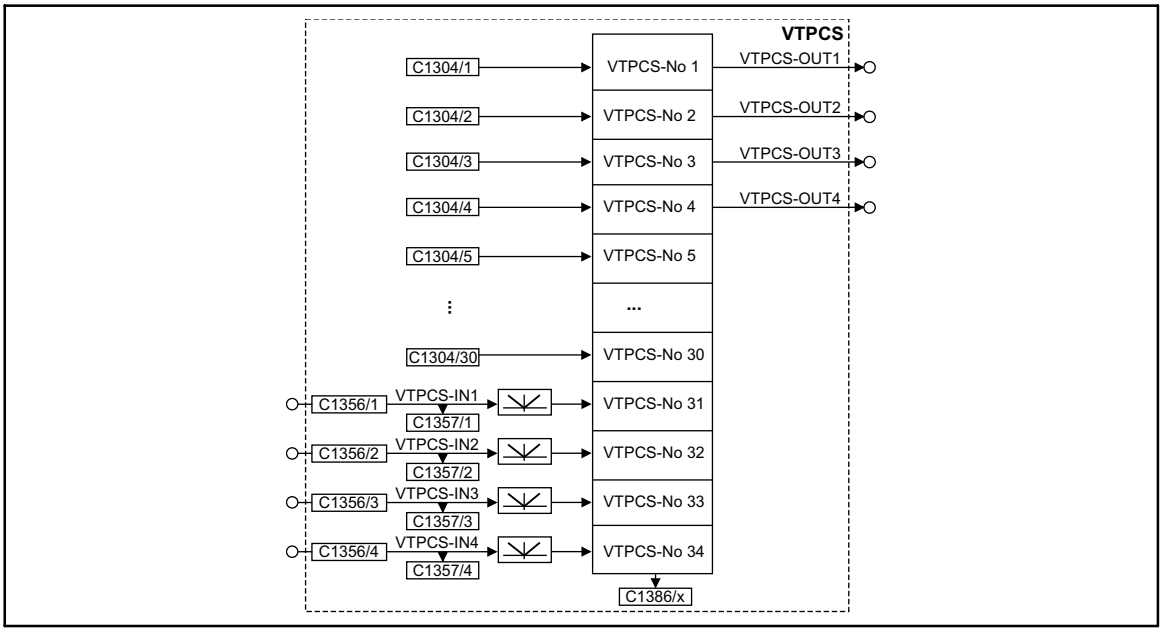


Fig. 3-219 Function block VTPCS

Stop!

If piece numbers >32767 are entered under C1304/1 to C1304/4, the outputs VTPCS-OUT1 ... VTPCS-OUT4 must no longer be used.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTPCS-IN1	a	C1357/1	dec [inc]	C1356/1	1	• Generates the absolute value for negative values. • Limits the value to 32767.
VTPCS-IN2	a	C1357/2	dec [inc]	C1356/2	1	
VTPCS-IN3	a	C1357/3	dec [inc]	C1356/3	1	
VTPCS-IN4	a	C1357/4	dec [inc]	C1356/4	1	
VTPCS-OUT1	a	-	-	-	-	-
VTPCS-OUT2	a	-	-	-	-	-
VTPCS-OUT3	a	-	-	-	-	-
VTPCS-OUT4	a	-	-	-	-	-

Function

A total of 34 table positions are available.

- Enter fixed values under C1304.
  - 30 table positions (VTPCS-No1 ... VTPCS-No30) are available.
  - Subcodes (C1304/1 ... C1304/30) define the table position number.
- Enter variable values in VTPCS-INx.
  - 4 table positions (VTPCS-No31 ... VTPCS-No34) are available.
  - Signal input via function blocks.
  - The values must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- C1386 displays the values on the table positions.
  - Select table position (C1386/1 ... C1386/34) with subcode.
- For signals with percentage standardization at VTPCS-INx the conversion is performed according the the formula:

$$\text{VTPCS–INx [inc]} = \text{VTPCS–INx [\%]} \cdot \frac{16384\ \text{[inc]}}{100\ \%}$$

Tip!

Entries into the processing table are necessary only if the FB inputs and outputs are used.

3.5.67 Variable table - target position/position values (VTPOS)

One function block (VTPOS) is available.

Purpose

Stores values for target positions (position values): They serve as target positions in the positioning program or comparison values for SP1 and SP2.

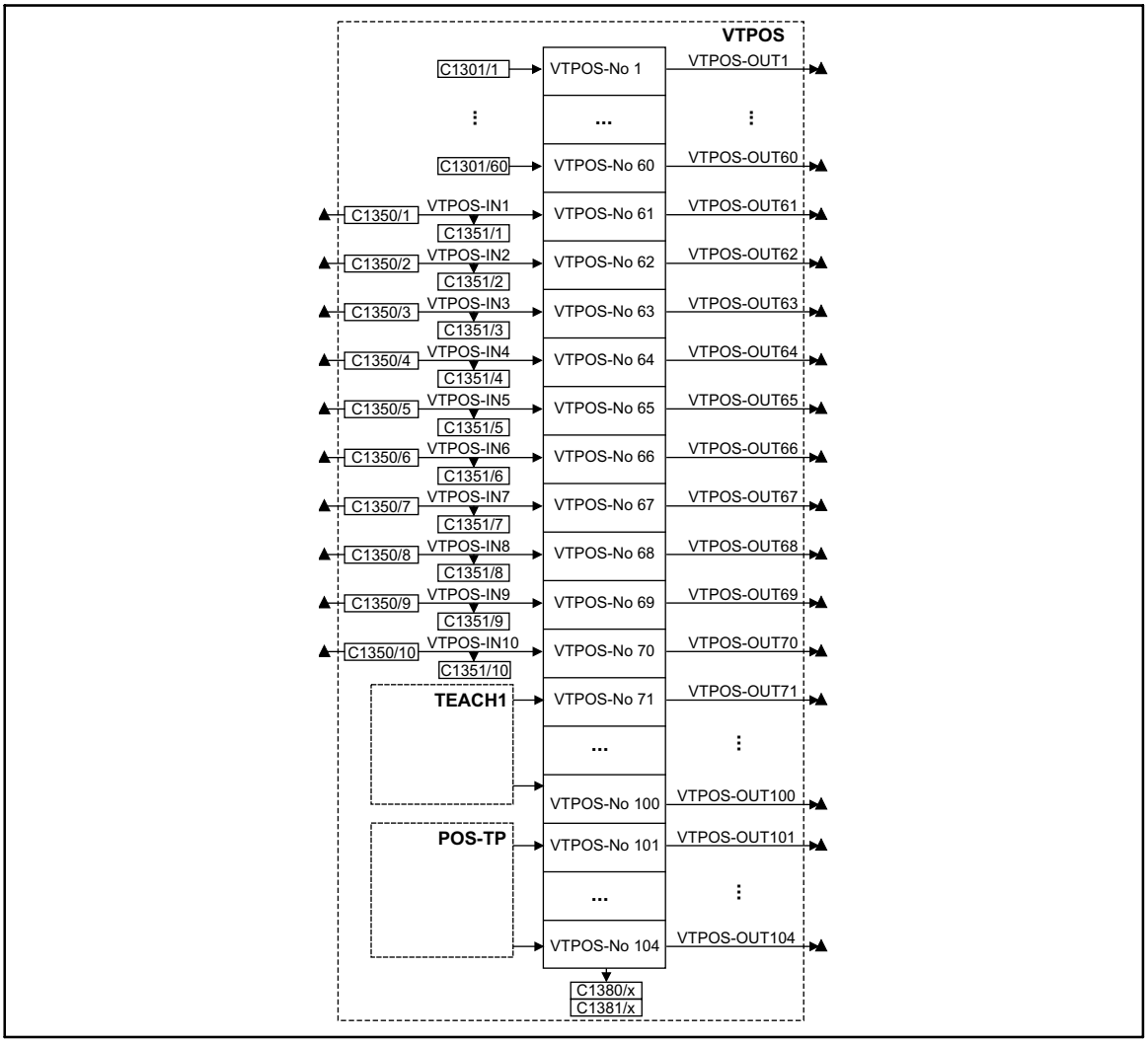


Fig. 3-220 Function block VTPOS

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTPOS-IN1	ph	C1351/1	dec [inc]	C1350/1	3	-
VTPOS-IN2	ph	C1351/2	dec [inc]	C1350/2	3	-
VTPOS-IN3	ph	C1351/3	dec [inc]	C1350/3	3	-
VTPOS-IN4	ph	C1351/4	dec [inc]	C1350/4	3	-
VTPOS-IN5	ph	C1351/5	dec [inc]	C1350/5	3	-
VTPOS-IN6	ph	C1351/6	dec [inc]	C1350/6	3	-
VTPOS-IN7	ph	C1351/7	dec [inc]	C1350/7	3	-
VTPOS-IN8	ph	C1351/8	dec [inc]	C1350/8	3	-
VTPOS-IN9	ph	C1351/8	dec [inc]	C1350/9	3	-
VTPOS-IN10	ph	C1351/10	dec [inc]	C1350/10	3	-
VTPOS-OUT1	ph	-	-	-	-	-
...	...					
VTPOS-OUT104	ph	-	-	-	-	-

Function

A total of 104 table positions are available.

- Enter fixed target position values via C1301/x.
  - 60 table positions (VTPOS-No1 ... VTPOS-No60) are available.
  - Subcodes (C1301/1 ... C1301/60) define the table position number.
- Enter variable target position values via VTPOS-INx.
  - 10 table positions (VTVEL-No61 ... VTVEL-No70) are available.
  - Signal input via function blocks.
  - The target position value must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- Enter target position values of FB TEACH1.
  - 30 table positions (VTPOS-No71 ... VTPOS-No100) are available.
- Enter target position values via touch probe.
  - 4 table positions (VTPOS-No101 ... VTPOS-No104) are available.
- C1380 displays the target position values (in units) on the table positions.
  - Select table position (C1380/1 ... C1380/104) with subcode.
- C1381 displays the target position values (in inc) on the table positions.
  - Select table position (C1381/1 ... C1381/104) with subcode.
- The conversion from target position [units] to target position [inc] is performed according to the formula:

$$\text{Target position [inc]} = \text{Target position [units]} \cdot \frac{65536\ [\text{inc/r}] \cdot \text{gear nominator}}{\text{Feed const. [units/r]} \cdot \text{gear denominator}}$$

Tip!

Entries into the processing table are only required if FB inputs are used.

3.5.68 Variable table Waiting time (VTTIME)

One function block (VTTIME) is available.

Purpose

Store values for waiting times. They are used as delays for the function ”Waiting time” in the positioning program.

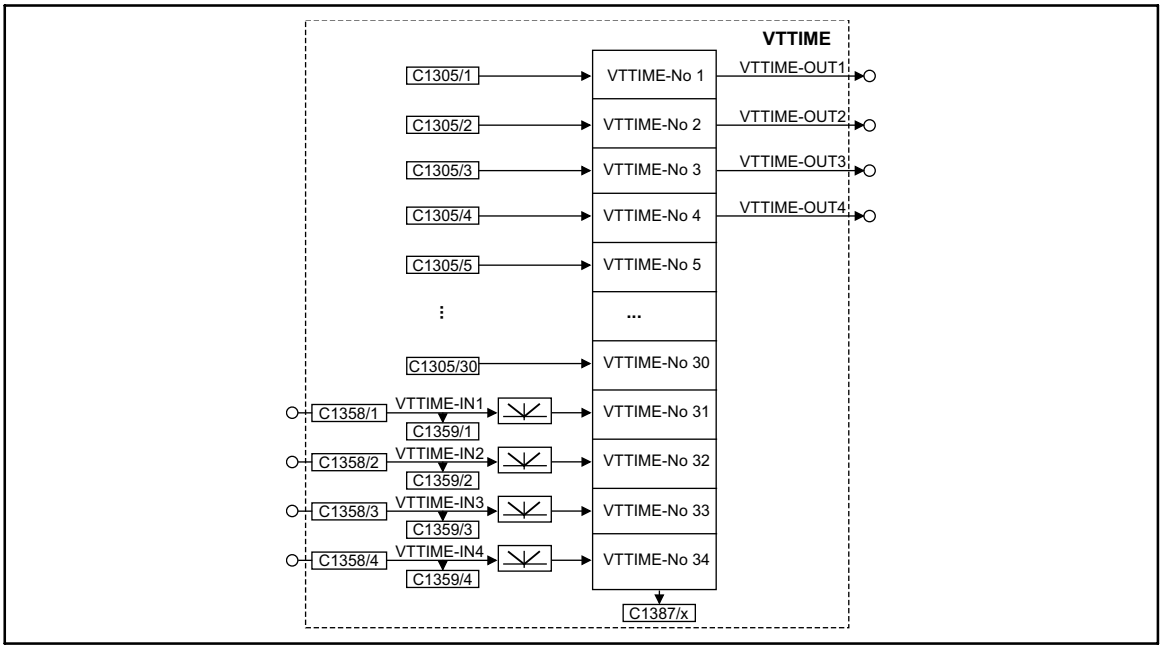


Fig. 3-221 Function block VTTIME

Stop!

If times >32767 ms are entered under C1305/1 to C1305/4 the outputs VTTIME-OUT1 ... VTTIME-OUT4 must no longer be used.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTTIME-IN1	a	C1359/1	dec [inc]	C1358/1	3	• Generates the absolute value for negative values. • Value = 100 % = 16384 ms • Limits the value to 32767 ms • Display: 1 inc = 1 ms
VTTIME-IN2	a	C1359/2	dec [inc]	C1358/2	3	
VTTIME-IN3	a	C1359/3	dec [inc]	C1358/3	3	
VTTIME-IN4	a	C1359/4	dec [inc]	C1358/4	3	
VTTIME-OUT1	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT2	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT3	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT4	a	-	-	-	-	1 inc = 1 ms

Function

A total of 34 table positions are available.

- Enter fixed time value under C1305.
  - 30 table positions (VTTIME-No1 ... VTTIME-No30) are available.
  - Subcodes (C1305/1 ... C1305/30) define the table position number.
- Enter variable time values under VTTIME-INx.
  - 4 table positions (VTTIME-No31 ... VTTIME-No34) are available.
  - Signal input via function blocks.
  - The time values must be transmitted to the table positions before the program set starts and has access to it.
- C1387 displays the time values on the table positions.
  - Select table position (C1387/1 ... C1387/34) with subcode.

Note!

Entries into the processing table are necessary only if the FB inputs and outputs are used.

3.5.69 Variable table - speed (VTVEL)

One function block (VTVEL) is available.

Purpose

Stores values for traversing and final speeds. They serve as setpoint speeds in the positioning program.

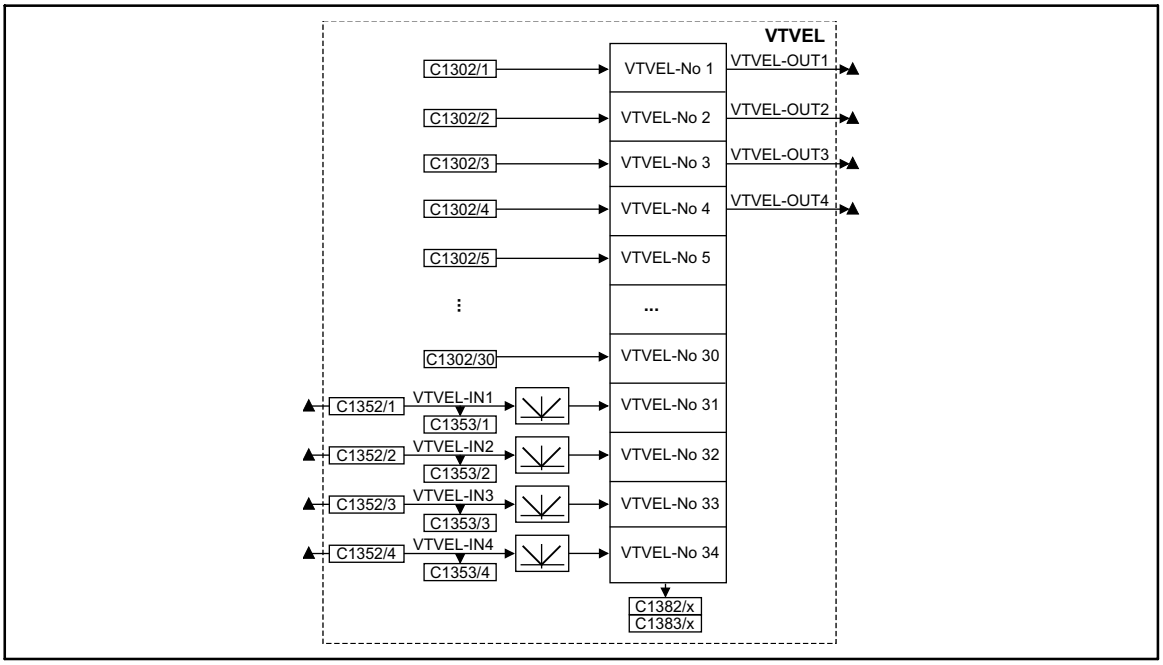


Fig. 3-222 Function block VTVEL

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTVEL-IN1	ph	C1353/1	dec [inc]	C1352/1	3	• Generates the absolute value for negative values. • When the values exceed vmax (C1240) the drive moves with vmax.
VTVEL-IN2	ph	C1353/2	dec [inc]	C1352/2	3	
VTVEL-IN3	ph	C1353/3	dec [inc]	C1352/3	3	
VTVEL-IN4	ph	C1353/4	dec [inc]	C1352/4	3	
VTVEL-OUT1	ph	-	-	-	-	-
VTVEL-OUT2	ph	-	-	-	-	-
VTVEL-OUT3	ph	-	-	-	-	-
VTVEL-OUT4	ph	-	-	-	-	-

Function

A total of 34 table positions is available.

- Enter fixed setpoints under C1302.
  - 30 table positions (VTVEL-No1 ... VTVEL-No30) are available.
  - Subcodes (C1302/1 ... C1302/30) define the table position number.
- Enter variable setpoints under VTVEL-INx.
  - Four table positions (VTVEL-No31 ... VTVEL-No34) are available.
  - Signal input via function blocks.
  - The setpoints must be transmitted to the table positions before the program set starts and has access to it.
- C1382 indicates the setpoints (in % of vmax) on the table positions.
  - Select table position (C1382/1 ... C1382/34) with subcode.
- C1383 displays the setpoints (in inc) on the table positions.
  - Select table position (C1383/1 ... C1383/34) with subcode.
- The conversion from v [units/s] to v [inc] is performed according to the formula:

$$v\,[\text{inc}] = v\,[\text{units/s}] \cdot \frac{65536\,[\text{inc/r}] \cdot \text{gear nominator} \cdot 16384}{\text{Feed const.}\,[\text{units/r}] \cdot \text{gear denominator} \cdot 1000\,[1/\text{s}]}$$

Tip!

Entries into the processing table are only required if FB inputs and outputs are used.

4 Application examples

Contents

4.1 Example 1: Dosing system 4-3
4.2 Example 2: Spray nozzle control 4-7
4.3 Example 3: Path control 4-10
4.3.1 Commissioning of the path control 4-13

Application examples

4.1 Example 1: Dosing system

The ”Dosing system” application example describes different filling stations of a packaging machine. The containers of these machine parts are to be filled using the least amount of space or the shortest possible time. It is also important that the exact amount is supplied via the feed screw. Two 9300 servo position controllers with power-optimised servo motors are used as drive components.

The 9300 servo position controller contains functions which could previously only be offered by a higher-level control (e.g. PLC). Positioning tasks which are similar to this example can easily be achieved at minimum expense using this controller.

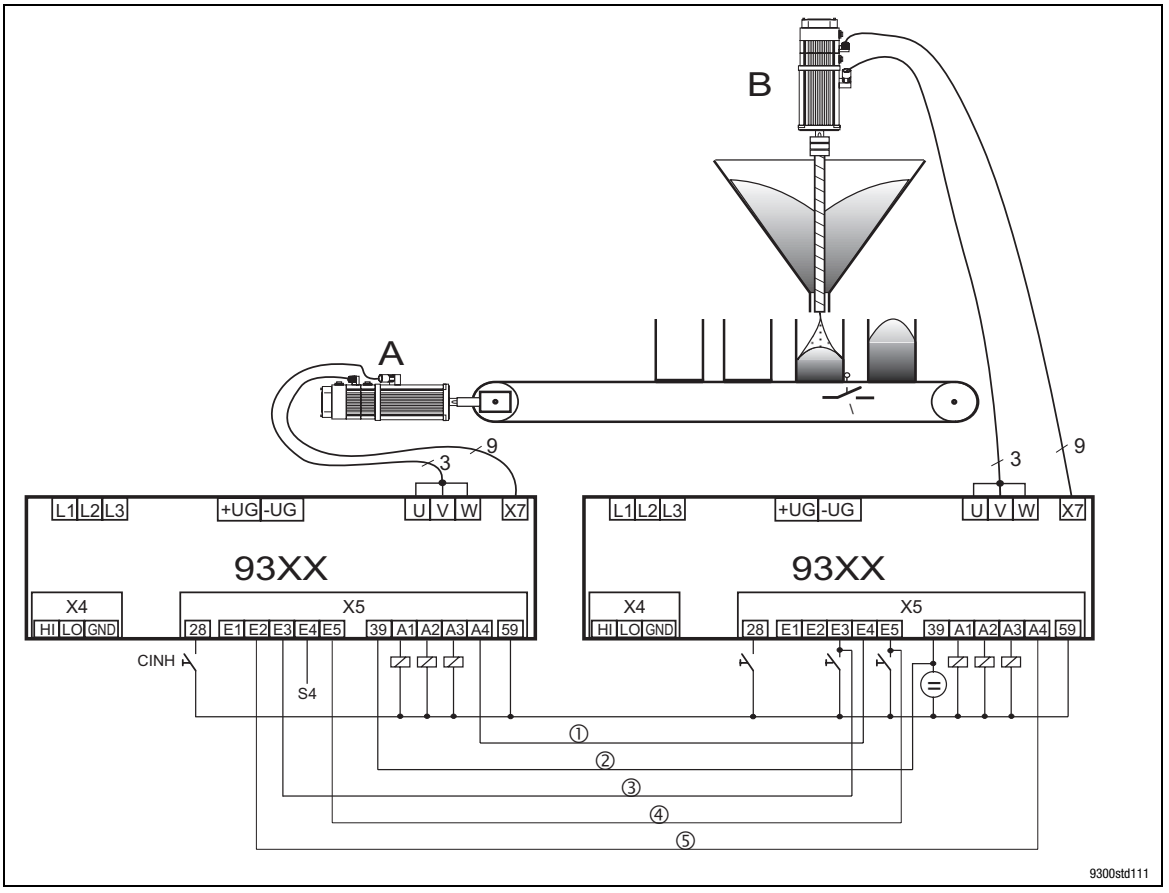


Fig. 4-1 Example of a relative positioning

Drive	Input	Function	Connection cable
A	E1	Not assigned	
	E2	Handshake: start feed	⑤
	E3	Start program	③
	E4	Touch probe initiator (S4) for the detection of the container position	
	E5	Changeover of manual / program mode	
B	E1	Not used	
	E2	Not used	
	E3	Start program	③
	E4	Handshake: start dosing	①
	E5	Changeover of manual / program mode	④
	39	Reference potential	②

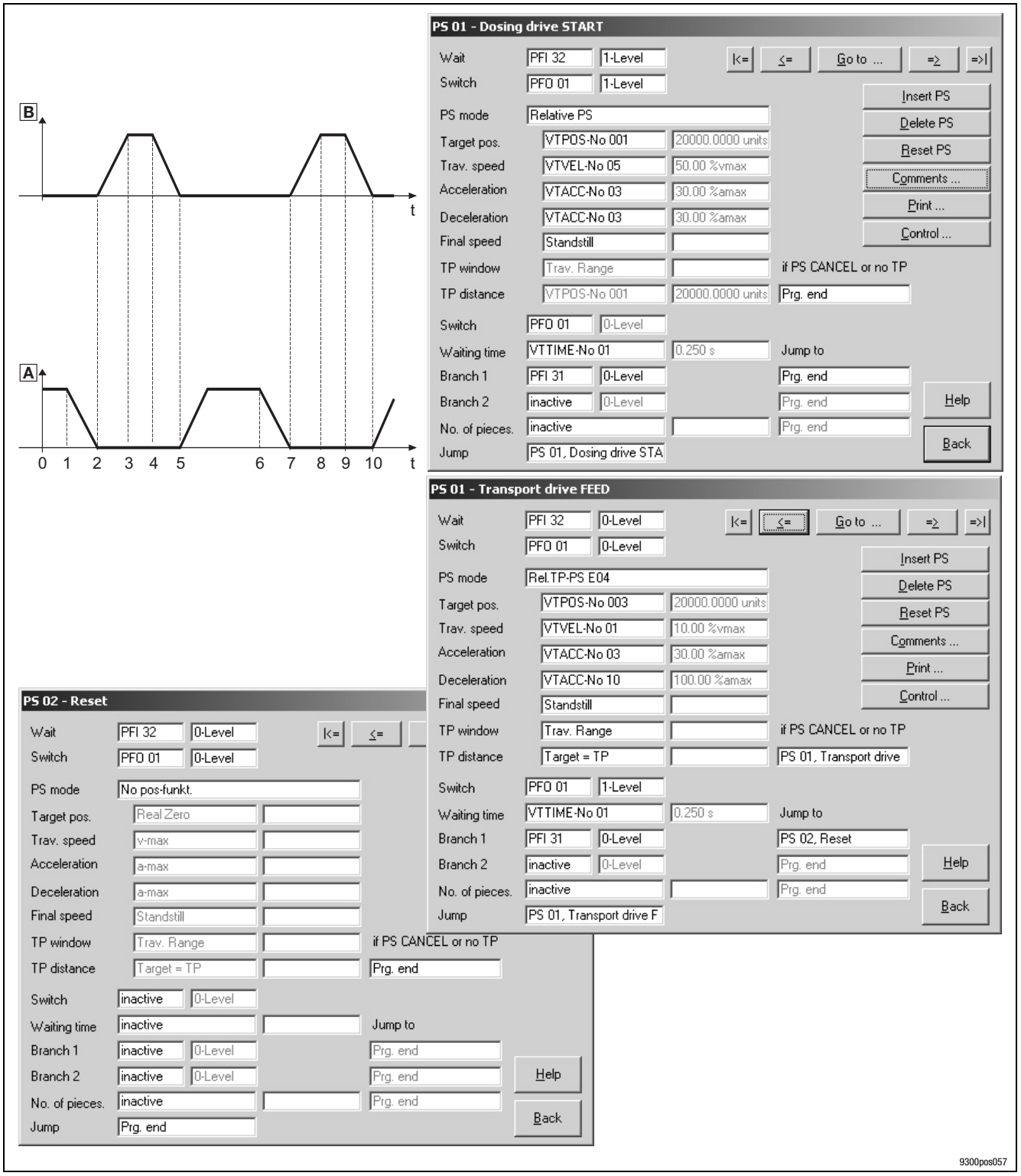


Fig. 4-2 Travel profiles and entry via the dialog boxes in GDC

Travel profiles	
Time	**Description**
1, 6	Container has almost reached the target position • Brake feed
2, 7	Container in target position • Start filling (observe dead time)
5, 10	Filling completed • Start feed, filled container leaves positioning sensor, empty container is positioned

Dosing drive B		
PS	**Time**	**Description**
01	0 - 2	Waiting for input POS-PFI 32, signal at X5/E4 (H level). The feed drive starts the dosing drive if the container is positioned.
	2 - 5	Filling according to program set parameters
	5	Start feed (drive A): switch POS-PFO1, X5/A4; L level • Jump to program set 1 (PS01)

Transport drive FEED A		
PS	**Time**	**Description**
01	2 - 5	Wait for input POS-PFI = 0 level
	5 - 6	Feed until TP(E4) responds
	6 - 7	Cover residual path and stop
	7	Start dosing drive PFO 01 = H: A4 = High, then jump to PS01
02	Is required to complete the program.	

Basis: Basic configuration 20200

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Manual jog in negative direction			X5/A1	Reference known
X5/E2	Manual jog in positive direction			X5/A2	Setpoint position reached
X5/E3	Program start	PS function (PFI 31)		X5/A3	Ready for operation
X5/E4	Homing switch	PS function (PFI 31)		X5/A4	PS function (POS-PFO1)
X5/E5	Trip reset	Program reset	Manual jog		

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_actual = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation			

Assignment of CAN2					
Inputs CAN-IN2.	Function 1	Function 2	Function 3	**Outputs CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached (acceleration completed)
B3	PS function	Start homing / manual		B3	PS function (POS-PFO4)
B4	PS function	End of stand-by		B4	PS function
B5	PS function	New travel profile parameters		B5	PS function
B6	PS function	No position control		B6	PS function
B7	PS function	Cancel PS		B7	PS function
B8 - B28	PS function			B8 - B28	PS function
B29	PS function (POS-PFI30)			B29	PS function
B30	PS function			B30	PS function
B31	PS function			B31	PS function (POS-PFO32)

Assignment of CAN3			
Input	Function	**Output**	Function
CAN-IN2.D1			

Special functions			
Input	Function	**Output**	Function
C0471.B1	Activate S-profiles		

4.2 Example 2: Spray nozzle control

The combination of the spray nozzle control and the positioning of the workpiece are required for printing machines and painting equipment. Previously a cam controller was used. However, mechanical inaccuracies and wear often led to bad results. The absolute positioning in the 9300 servo position controllers and open control structure enables the nozzle control to be provided with the corresponding messages. They can be read via a fieldbus or (as shown in the example) output via the terminals.

The spray nozzle control in Fig. 4-3 is an example of absolute positioning, which replaces former applications with mechanical cam groups.
These applications do not require mechanical limit switches or initiators that were used to be necessary to detect the position. Using the evaluation electronics of the 9300 servo position controller, the position information of the fed part is determined and positioned.

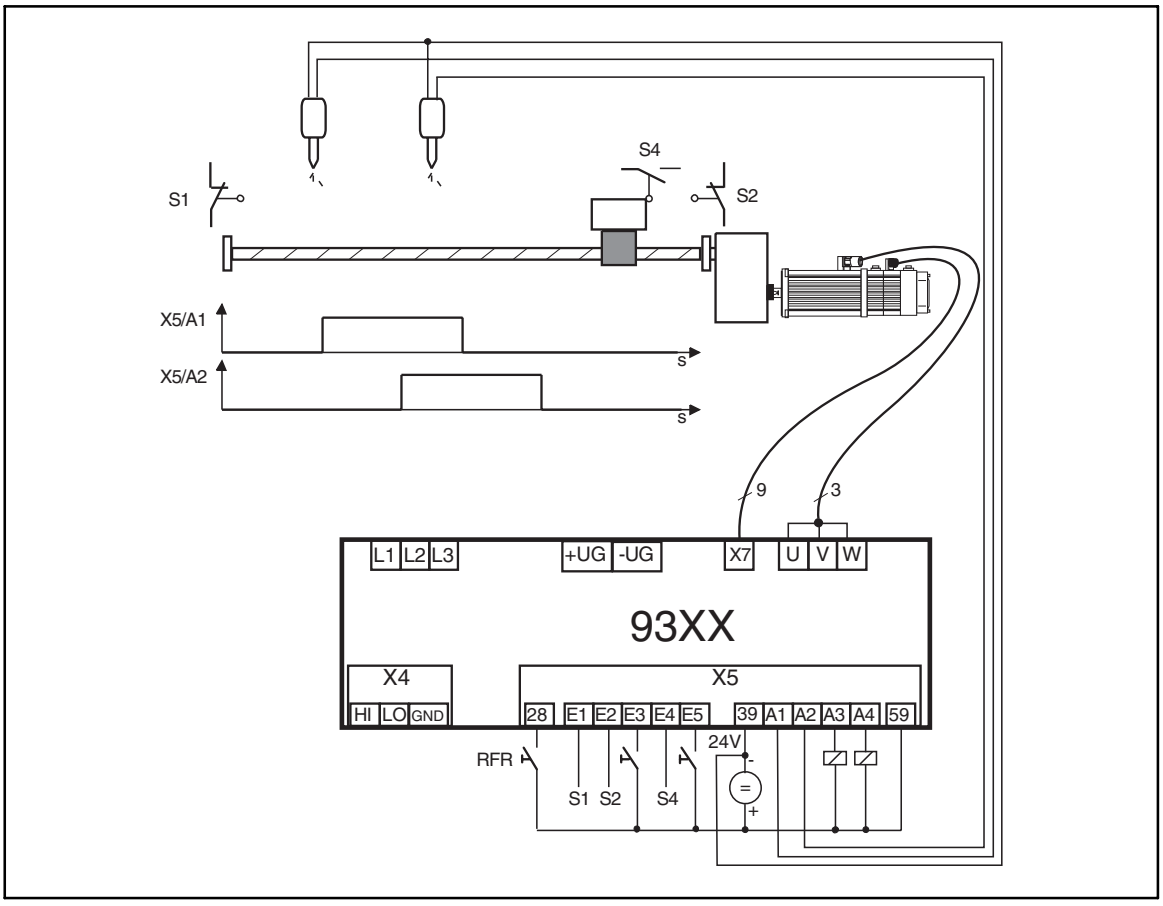


Fig. 4-3 Example of an absolute positioning with the 'SP1' function block (position switch points)

Input	Function
E1	Limit switch (S1) negative direction
E2	Limit switch (S2) positive direction
E3	Start program
E4	Homing switch (S4)
E5	Changeover manual jog / program mode

Basis: Basic configuration 22000

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Limit switch negative traversing direction	External setpoint off		X5/A1	Reference known
X5/E2	Limit switch positive traversing direction	External setpoint off		X5/A2	Setpoint position reached
X5/E3	Program start	PS function		X5/A3	Ready for operation
X5/E4	Homing switch	PS function		X5/A4	PS function (POS-PFO1)
X5/E5	Trip reset	Program reset	Manual jog		

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
		CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_act = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation	

Assignment of CAN2					
Inputs CAN-IN2.	Function 1	Function 2	Function 3	**Outputs CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached (acceleration completed)
B3	PS function			B3	PS function (POS-PFO4)
B4	PS function			B4	PS function
B5	PS function			B5	PS function
B6	PS function			B6	PS function (POS-PFO7)
B7	PS function	Cancel PS		B7	Position switch point 1
B8 - B14	PS function			B8 - B14	Position switch point 2 - 8
B15 - B17	PS function			B15 - B17	Touch probe recognised at X5/E1 - X5/E3
B18	PS function			B18	Touch probe enabled at X5/E4
B19	PS function			B19	PS function (POS-PFO20)
B20 - B28	PS function			B20 - B28	PS function
B29	PS function (POS-PFI30)			B29	PS function
B30				B30	PS function
B31				B31	PS function (POS-PFO32)

Adaptation to the example by extending the basic configuration

Please establish the following connections:

DIGOUT 1 (terminal X5/A1	<->	SP1-STAT1
DIGOUT 2 (terminal X5/A2	<->	SP1-STAT2

Please observe:

- Description of the function block SP1
- GDC mask (if the program is used)
- Operating Instructions/Manual: Chapter 'Commissioning'

4.3 Example 3: Path control

Path control is an interesting solution for warehousing and complex transport tasks. These motion sequences often require complicated and expensive control systems.Thanks to the different function blocks, such as AND, OR, NOR elements, the servo position controller is able to perform a variety of functions and features.

For a multi-axis application, the individual stations can be linked e.g. via the InterBus fieldbus. A higher-level control is required in these cases.

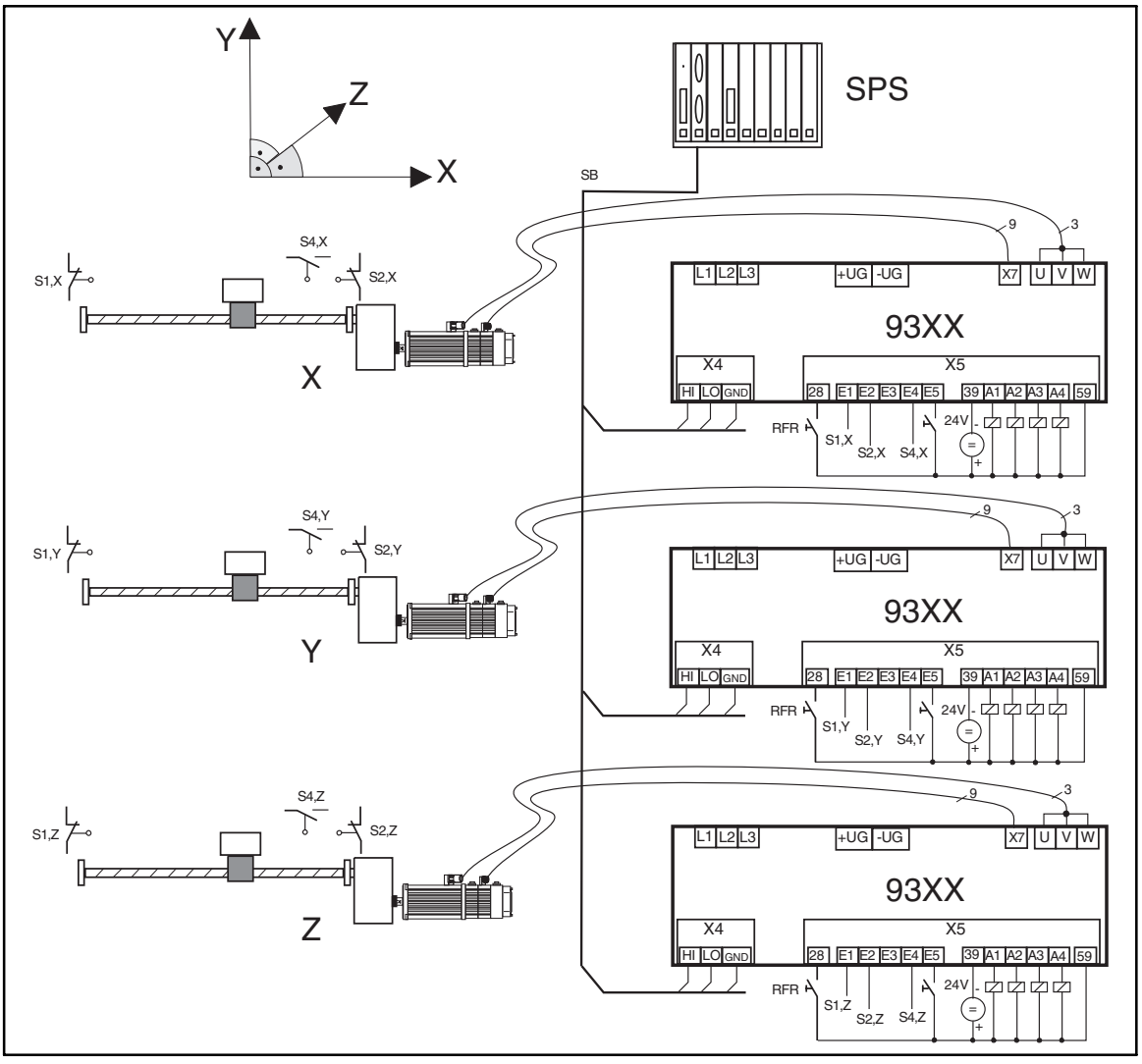


Fig. 4-4 Example of a multi-axis positioning

Input	Function
E1	Limit switch (S1X, S1Y, S1Z) negative traversing direction
E2	Limit switch (S2X, S2Y, S2Z) positive traversing direction
E3	Not assigned
E4	Reference switch (S4X, S4Y, S4Z)
E5	Changeover manual jog / program mode

Abbreviations	Meaning
PLC	Programmable logic controller
SB	System bus (CAN)

Basis: Basic configuration 26000

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Negative manual jog	External setpoint off		X5/A1	Synchronisation status
X5/E2	Positive manual jog	External setpoint off		X5/A2	Following error 1
X5/E3	Program start	Actual position = external setpoint	PS function	X5/A3	Ready for operation
X5/E4	Homing switch	PS function		X5/A4	Reference known
X5/E5	Trip reset				

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
		CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_act = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation	

Assignment of CAN2					
Inputs CAN-IN2.	Function 1	Function 2	Function 3	**Outputs CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached
B3	PS function			B3	PS function (POS-PF04)
B4	PS function			B4	PS function
B5	PS function			B5	PS function
B6	PS function			B6	PS function
B7	PS function	Cancel PS		B7	PS function
B8 - B29	PS function			B8 - B29	PS function
B30				B30	PS function
B31				B31	PS function (POS-PF032)

Assignment of CAN3			
Input CAN-IN2.	Function	**Outputs**	Function
D1			

Adaptation to the example by extending the basic configuration

Please establish the following connections:

POS-MANU-NEG	<->	CAN-IN2.B9
POS-MANU-POS	<->	CAN-IN2.B10B1
OR1-IN1	<->	FIXED0
OR1-IN2	<->	FIXED0
POS-LIM-NEG	<->	DIGIN1
POS-LIM-POS	<->	DIGIN2
POS-MANUAL	<->	CAN-IN2.B11
POS-LOOP-INH	<->	CAN-IN2.B4
POS-ABS-SET	<->	CAN-IN2.B4
POS-PSET-SWT	<->	NOT2-OUT
NOT2-IN	<->	CAN-IN2.B11

Function of the 'Path control' after changing the configuration

Input	Level	Function	
CAN-IN2.B4	HIGH	Switch off position control circuit	Accept position setpoint as actual position
CAN-IN2.B9	HIGH	Manual operation in negative traversing direction	
CAN-IN2.B10	HIGH	Manual operation in positive traversing direction	
CAN-IN2.B11	HIGH	Activate manual operation	

4.3.1 Commissioning of the path control

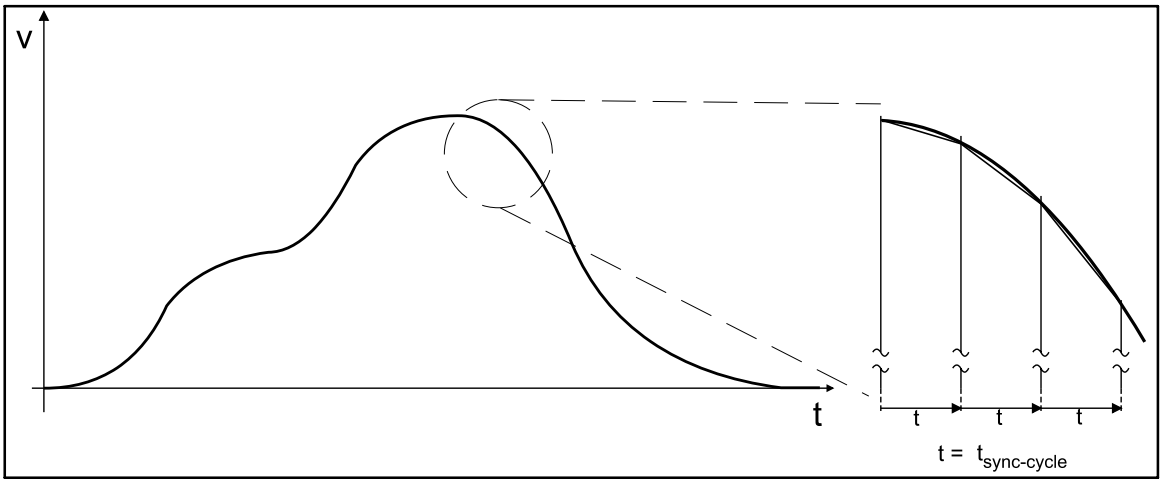


Fig. 4-5 Example of a travel profile

How to commission the system bus (CAN)

- Control: slave 1 (drive X)
  - Node addresses: C0350 = 1
  - Position setpoint on bytes 1 to 4 (see description CAN-IN3)
  - CAN-IN3 identifier = 385
  - Baud rate: C0351 → Adapt to control
    Reset mode: C0358 = 1
    Sync mode: C1120 = 1
    Sync cycle: C1121 → According to the time interval between the sync telegram and the control
  - Actual value = set setpoint (following error = 0)
    CAN-IN2.B4 = 1 (afterwards set CAN-IN2.B4 = 0)
- Control: slave 2 (drive Y)
  Node addresses 0350 = 2
  - CAN-IN3 identifier = 386
  - As slave 1
- Control: slave 3 (drive Z)
  Node addresses C0350 = 3
  - CAN-IN3 identifier = 387 (otherwise as slave 1)

- Telegram sequence
  - Send new position setpoint to slave 1, slave 2 and slave 3
  - Send sync telegram
  - All slaves reply with CAN-OUT1

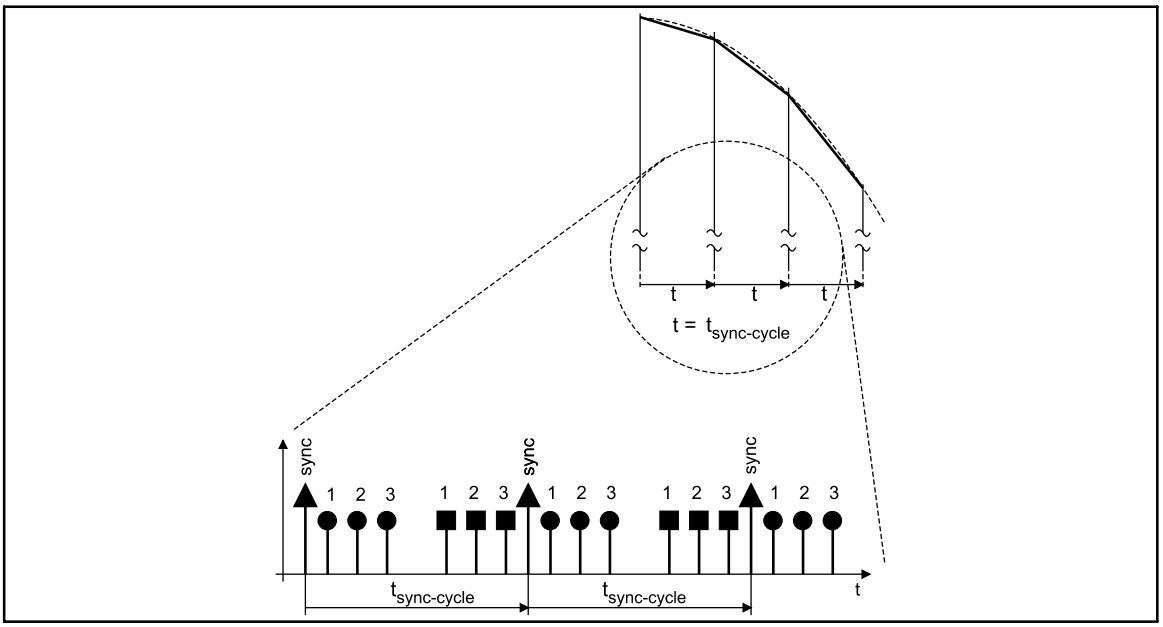
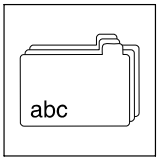


Fig. 1 Sequence of communication between master and slaves

Character	Explanation
●	Response of the controller (CAN-IN1)
■	Send setpoint position (from the master) to the controller
1	Slave 1
2	Slave2
3	Slave 3

Input of the target position by an external control (here: PLC)

- The setpoint position is determined by cyclic set phase increments ($t_{sync\text{-}cycle}$) in increments of milliseconds ($\pm 150\mu s$).
  The input must be crystal-precise in the long term.
- The POS function block calculates the speed and the acceleration.
- Inputs in v_{max} (C1240) and a_{max} (C1250) have no effect.
- This means that speed profiles are possible in any form (e.g. cams).
- Activation by POSD-PSET-SWT = HIGH (e.g. FIXED1)



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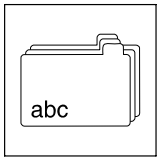

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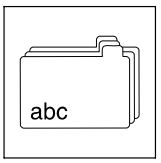
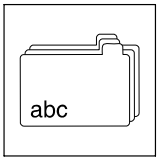


5.1 Glossary

5.1.1 Terminology and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter
P_r [kW]	Rated motor power
R [Ω]	Resistance

S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)



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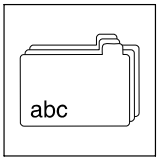

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