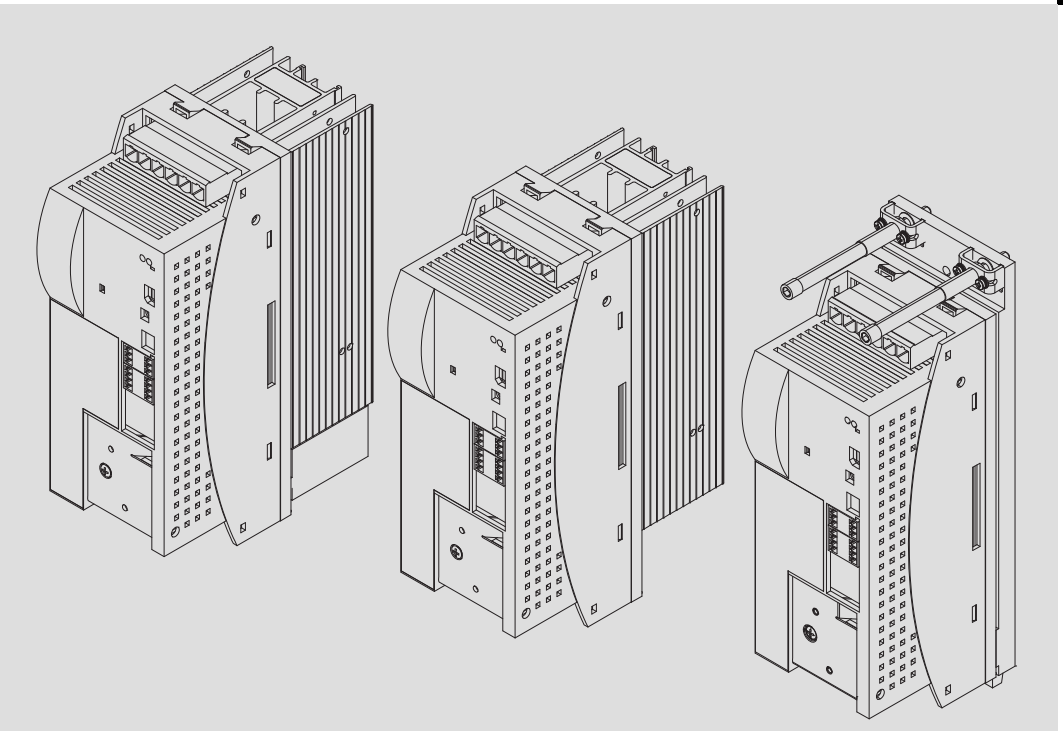
EDBCSXE040
13495352

Operating Instructions

ECS



ECSEExxx / ECSDExxx / ECSCExxx

Power supply module

Lenze

Please read these instructions before you start working!
Follow the enclosed safety instructions.

This documentation is valid for the ECSxE power supply modules as of version:

	①										
	ECS	x	E	xxx	x	4	x	xxx	XX	xx	xx

Device type

Design

E = standard panel-mounted unit, IP20
D = push-through technique (thermally separated)
C = cold-plate technique

Rated current

012 = 12 A
020 = 20 A
040 = 38.5 A

Fieldbus interface

C = system bus CAN

Voltage class

4 = 400 V/480 V

Technical version

B = standard
V = coated

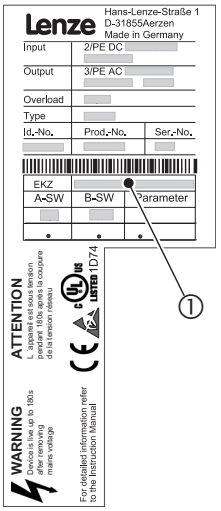
Variant

Hardware version

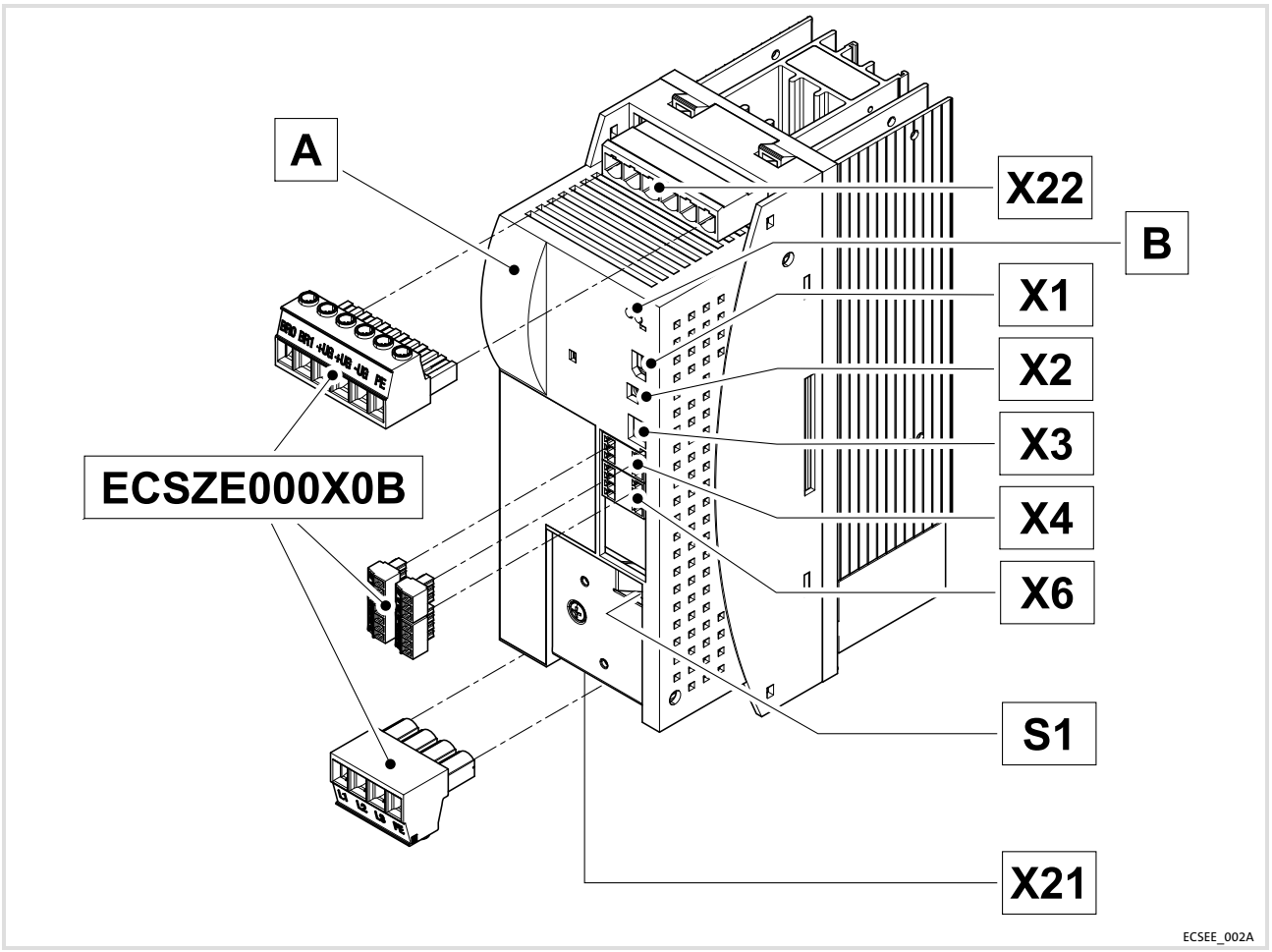
VA or higher

Operating software version (B-SW)

1.2 or higher



© 2015 Lenze Drive Systems GmbH, Hans-Lenze-Straße 1, 31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Drive Systems GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not take any responsibility or liability for any damage that may occur. Necessary corrections will be included in subsequent editions.


A
X22
B
X1
X2
X3
X4
X6
ECSZE000X0B
S1
X21
ECSEE_002A

Scope of supply

Position	Description	Quantity
A	ECS☐E... power supply module	1
	Accessory kit with fixings according to the design (☐): ● ”E” - panel-mounted device ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1

Note!

The **ECSZE000X0B** connector set must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X22	Connections ● External brake resistor ● DC-bus voltage ● PE	📖 44
B	LEDs: Status and fault display	
X1	Automation interface (AIF) for ● Communication module ● Operating module (XT keypad)	 📖 53 📖 73
X2	PE connection AIF	
X3	Not assigned	
X4	CAN connection ● System bus (CAN) ● Interface for – master control and other modules – PC/HMI for parameterisation and diagnostics	📖 54
X6	Connections ● Low-voltage supply ● Digital inputs and outputs ● Thermostat contacts	📖 52
S1	DIP switch ● CAN node address (device address in the CAN network) ● CAN baud rate	📖 78
X21	Mains connection	📖 42

Status displays

LED		Description
Red	Green	
Off	On	Power supply module is enabled, no fault
Off	Blinking	Power supply module is inhibited (CINH), switch-on inhibit
Blinking, 1 Hz	Off	Fault / error (TRIP) / short-circuit braking error (KSB-TRIP) is active
Blinking, 3 Hz	Off	Message active
Blinking, 1 Hz	Blinking	Warning active with inhibited module
Blinking, 1 Hz	On	Warning active with enabled module

1 Preface and general information 9

1.1 About these Operating Instructions 9

1.2 Terminology used 10

1.3 Properties of the ECSxE power supply module 11

1.4 Scope of supply 12

1.5 Legal regulations 13

2 Safety instructions 14

2.1 General safety and application notes for Lenze power supply modules 14

2.2 Residual hazards 17

2.3 Safety instructions for the installation according to UL/CSA 18

2.4 Notes used 20

3 Technical data 21

3.1 General data and operating conditions 21

3.2 Rated data 23

3.3 External brake resistors 24

4 Mechanical installation 26

4.1 Important notes 26

4.2 Mounting with fixing rails (standard installation) 27

4.2.1 Dimensions 27

4.2.2 Mounting steps 27

4.3 Mounting with thermal separation (push-through technique) 28

4.3.1 Dimensions 29

4.3.2 Mounting steps 31

4.4 Mounting in cold-plate design 32

4.4.1 Dimensions 33

4.4.2 Mounting steps 34

5 Electrical installation 35

5.1 Installation according to EMC (installation of a CE-typical drive system) 35

5.2 Drive system on the mains 38

5.2.1 Electrical isolation 38

5.2.2 Supply forms / electrical supply conditions 39

5.2.3 Operation on public supply systems (compliance with EN 61000-3-2) 39

5.3 Power terminals 40
5.3.1 Mains connection 42
5.3.2 Connection to the DC bus (+UG, -UG) 44
5.3.3 Connection plan for mimimum wiring with internal brake resistor 45
5.3.4 Connection plan for mimimum wiring with external brake resistor . . . 46
5.3.5 Connection of an ECSxK... capacitor module (optional) 48
5.4 Control terminals 49
5.4.1 Digital inputs and outputs 52
5.5 Automation interface (AIF) 53
5.6 Wiring of system bus (CAN) 54

6 Commissioning 57
6.1 Commissioning steps (overview) 58
6.1.1 Basic settings with GDC 59
6.1.2 Operation via system bus (CAN) with master control 61
6.1.3 Control via digital inputs 62
6.1.4 Operation via EtherCAT with master control 63
6.2 Setting the mains voltage 64
6.3 Setting chopper operation and short-circuit braking 65
6.4 Configuring power supply enable input 66
6.5 Operation with external brake resistor 68
6.6 After mains switch-on 69

7 Parameter setting 70
7.1 General information 70
7.2 Parameter setting with ”Global Drive Control” (GDC) 71
7.3 Parameter setting with the XT EMZ9371BC keypad 73
7.3.1 Connecting the keypad 73
7.3.2 Description of the display elements 74
7.3.3 Description of the function keys 75
7.3.4 Changing and saving parameters 76

8 Configuring system bus (CAN) 77
8.1 Setting the CAN node address and baud rate 78
8.1.1 Settings via DIP switch 78
8.1.2 Settings via codes 80
8.2 Individual addressing 82
8.3 Determining the boot-up master for the drive system 84
8.4 Setting the mode for process data transfer 85
8.5 Setting the boot-up time/cycle time 86
8.6 Node guarding 88

8.7 Executing a reset node 90
8.8 Assignment of the control word 91
8.9 Assignment of status words 92
8.10 Diagnostics codes 93
8.10.1 CAN bus status (C0359) 93
8.10.2 Diagnostics PDO (C0390/1 ... 8) 94

9 Monitoring functions 95
9.1 Fault responses 96
9.2 Overview of monitoring functions 97
9.3 Configuring monitoring functions 99
9.3.1 Mains monitoring (LP0, LP1) 99
9.3.2 Voltage supply monitoring - control electronics (U15) 101
9.3.3 DC bus monitoring (OU, OC1, OC2, OC3) 101
9.3.4 Temperature monitoring of device heatsink (OH) / inside the device (OH1) 101
9.3.5 Fan monitoring (FAN1) 101
9.3.6 Brake resistor monitoring (OC6, OH3) 102
9.3.7 Brake chopper IGBT monitoring (OC4) 103
9.3.8 Device utilisation / I x t monitoring (OC5) 103
9.3.9 Communication monitoring (CE1 ... CE4, node guarding) 104

10 Diagnostics 106
10.1 Diagnostics with Global Drive Control (GDC) 106
10.2 Advanced diagnostics via diagnostics PDO (CAN2_OUT) 109
10.3 Diagnostics with the XT EMZ9371BC keypad 111
10.4 Diagnostics with PCAN-View 112
10.4.1 Monitoring of telegram traffic on the CAN bus 112
10.4.2 Setting all CAN nodes to the ”Operational” status 114

11 Troubleshooting and fault elimination 115
11.1 Fault analysis 115
11.1.1 Fault analysis via the LED display 115
11.1.2 Fault analysis with keypad XT EMZ9371BC 115
11.1.3 Fault analysis with the history buffer 116
11.2 Fault messages 117
11.2.1 Causes and remedies 117
11.2.2 Reset fault messages (TRIP-RESET) 119

12 Appendix 120
12.1 Codes 120
12.2 Table of attributes 138
12.3 General information about the system bus (CAN) 141
12.3.1 Structure of the CAN data telegram 141
12.3.2 Communication phases of the CAN network (NMT) 143
12.3.3 Process data transfer 146
12.3.4 Parameter data transfer 152
12.3.5 Addressing of the parameter and process data objects 158
12.4 Overview of accessories 160
12.4.1 Connector sets 160
12.4.2 Shield mounting kit 160
12.4.3 Components for operation and communication 160
12.4.4 Brake resistor 161
12.4.5 Mains fuses 163
12.4.6 Mains chokes 163
12.4.7 RFI filters 164

13 Index 165

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions help you with the connection and commissioning of the ECSxE series power supply modules.

They contain safety instructions which must be observed!

All persons working on and with ECSxE series power supply modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.2 Terminology used

Term	In the following text used for
Power supply module Standard device	ECSxE... power supply module
ECSxE...	
Capacitor module	ECSxK series capacitor module
ECSxK...	
Axis module Controller	Axis module of the ECS series: ● ECSxS... - ”Speed and Torque” ● ECSxP... - ”Posi and Shaft” ● ECSxM... - ”Motion” ● ECSxA... - ”Application”
ECSxS... ECSxP... ECSxM... ECSxA ...	
Drive system	ECS drive system consisting of: ● ECSxE... power supply module ● Axis modules ECSxS... / ECSxP... / ECSxM... / ECSxA... ● ECSxK series capacitor module (optional) ● further Lenze drive components (accessories)
24 V supply Low-voltage supply	Voltage supply of the control card, voltage range 20 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
System bus (CAN)	A Lenze standard bus system based on *CANopen* for ● communication with a higher-level host system (PLC) or further controllers. ● parameter setting and diagnostics.
MotionBus (CAN)	The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 for the axis modules **ECSxS/P/M....** In case of these devices, communication takes place with a higher-level master system (PLC) or further controllers exclusively via the interface X4. Parameter setting and diagnostics are exclusively carried out via interface X14 (CAN-AUX).
GDC	Global Drive Control (Lenze software for parameter setting and diagnostics)
Cxxxx	Code Cxxxx (e.g. C0351) Parameter for parameterising or monitoring the controller.
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on plug connector Xk (e. g. X6/B+ = terminal B+ on plug connector X6)

1.3 Properties of the ECSxE power supply module

- Generation of the DC-bus voltage for an ECS drive system or single drive
- Controlled charging of the DC bus
- Check of the DC bus for earth fault and short circuit during mains connection
- Automatic detection of mains voltage
- Mains failure monitoring
- Single-phase mains current measurement for diagnostics
- Internal brake chopper IGBT
- Mains-voltage dependent adaptation of brake chopper switch-on voltage
- Internal brake resistor with monitoring (not for ECS**C**E series in cold plate design)
- Connection of external brake resistor with temperature switch possible
- Integrated system bus interface (CAN) for transmitting process data, parameter setting and diagnostics
- EtherCAT connection to the EMF2192IB communication module via the automation interface (AIF)
- Commissioning, parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC) or the XT EMZ9371BC keypad

1.4 Scope of supply

The scope of supply of the ECSxE... power supply module includes:

- Standard device
- Accessory kit with fixings according to the design:
  – ”E” - panel-mounted device
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting instructions
- Drilling jig

Accessories

The appendix includes information on the following accessories: (📖 160).

- Connector sets for
  – Power supply modules: ECSZE000X0B
  – Capacitor modules: ECSZK000X0B
  – Axis modules: ECSZA000X0B
- Shield mounting ECSZS000X0B001 (EMC accessories)
- Components for operation and communication
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters



Tip!

Information and tools concerning the Lenze products can be found in the download area at

www.lenze.com

1.5 Legal regulations

Identification	Nameplate	CE designation	Manufacturer
	Lenze power supply modules are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Automation GmbH Grünstraße 36 D-40667 Meerbusch
Application as directed	**ECSxE series power supply modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for the supply of servo inverters with DC bus voltage. – for installation in a machine. – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective 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 for industrial purposes only. **Drive systems with ECSxE series power supply modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC Directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to power supply modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these Instructions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damage and operating interference caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the power supply module – Operating errors – Improper working on and with the power supply module		
Warranty	● Terms of warranty: See terms of sales and delivery of the 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

2.1 General safety and application notes for Lenze power supply modules

(acc. to Low-Voltage Directive 2006/95/EC)

For your personal safety

Disregarding the following basic safety measures may lead to severe personal injury 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.
  - IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC-Report 664 or DIN VDE 0110 and national regulations for the prevention of accidents must be observed.
  - According to the 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 troublefree 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 Drives GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- Depending on their degree of protection, Lenze power supply modules and their accessory components can be live 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 power supply module. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

Application as directed

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

When installing the power supply modules in machines, commissioning (i.e. starting of 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 operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

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

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

Warning: The power supply modules are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interference 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 power supply modules must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed the 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.

Power supply modules contain electrostatically sensitive components 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 power supply modules, applicable national regulations (e.g. VBG 4) must be observed.

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.

The documentation contains information about installation in compliance with EMC (shielding, earthing, filters, and cables). These notes must also be observed for CE-marked power supply modules. The manufacturer of the system is responsible for compliance with the required limit values demanded by EMC legislation. The power supply modules 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 should have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Operation

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

After the power supply module 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 power supply module.

All protection covers and doors must be shut during operation.

Note for UL approved systems with integrated controllers: UL warnings are notes which only apply to UL systems. The documentation contains special information UL notes.

Maintenance and servicing

The power supply modules do not require any maintenance if the prescribed operating conditions are observed.

Waste 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 Residual hazards

Protection of persons

- Before working on the power supply module, check that no voltage is applied to the power terminals, because
  - the power terminals +UG, -UG, BR0 and BR1 remain live for at least 3 minutes after mains disconnection.
  - because the power terminals +UG, -UG, BR0 and BR1 remain live when the motor is stopped.
- The operating temperature of the heatsink is > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The leakage current to PE is > 3.5 mA AC or > 10 mA DC.
  - According to EN 61800-5-1, a fixed installation is required.
  - The PE connection has to conform to EN 61800-5-1.
  - Comply with further requirements of EN 61800-5-1 for high leakage currents!
- Operation of the power supply module with an earth-leakage circuit breaker:
  - The power supply modules are provided with an internal mains rectifier. In the event of a short-circuit to frame, a non-pulsating DC fault current can prevent the tripping of AC-sensitive or pulse-current-sensitive earth-leakage circuit breakers and thus block the protective function for all electrical equipment operated on these earth-leakage circuit breakers.
  - If a residual current device (RCD) is used as a protective means in the case of direct or indirect contact, only a residual current device (RCD) of type B may be used. Otherwise, another protective measure, such as separation from the environment through double or reinforced insulation or disconnection from the mains by means of a transformer must be used.

Device protection

- The power supply module may only be driven from balanced mains supplies. Mains supplies with earthed phase are not permitted.
- The power supply module contains electrostatic sensitive devices. The personnel must be free of electrostatic charge prior to assembly and service operations.
- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Observe the max. permissible mains voltage. Higher voltages will damage the power supply module.
- Operation is not permitted
  - without the use of a brake resistor.
  - if an internal brake resistor and an external brake resistor are used simultaneously.
  - if several power supply modules are connected in parallel.

2.3 Safety instructions for the installation according to UL/CSA

Original - English

Warnings!

General markings:

- ► Use 60/75 °C or 75 °C copper wire only.
- ► Maximum ambient temperature 55 °C, with reduced output current.

Markings provided for the supply units:

- ► Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V max, when protected by K5 or H Fuses (400/480 V devices).
- ► Alternate - Circuit breakers (either inverse-time, instantaneous trip types or combination motor controller type E) may be used in lieu of above fuses when it is shown that the let-through energy (i^2t) and peak let-through current (I_p) of the inverse-time current-limiting circuit breaker will be less than that of the non-semiconductor type K5 fuses with which the drive has been tested.
- ► Alternate - An inverse-time circuit breaker may be used, sized upon the input rating of the drive, multiplied by 300 %.

Markings provided for the inverter units:

- ► The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 3rd ed., Table 8.1.
- ► The devices are provided with integral overload and integral thermal protection for the motor.
- ► The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X21, X22, X23, X24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X21, X22, X23, X24	12 ... 8
X4, X6, X14	28 ... 16
X25	24 ... 12

Original - French

Warnings!

Marquages d'ordre général :

- ► Utiliser exclusivement des conducteurs en cuivre 60/75 °C ou 75 °C.
- ► Température ambiante maximale de 55 °C, avec courant de sortie réduit.

Marquage des unités d'alimentation :

- ► Convient aux circuits non susceptibles de délivrer plus de 5000 ampères symétriques eff., maximum 480 V, avec protection par fusibles de calibre H ou K5 (appareils 400/480 V).
- ► Variante - Des disjoncteurs (déclenchement instantané à temps inverse ou combinaison avec contrôleur moteur de type E) peuvent être utilisés à la place des fusibles si l'énergie passante (i^2 x t) et le courant de pointe à l'état passant (I_p) du disjoncteur limiteur est inférieur à celui des fusibles de calibre K5 sans semiconducteur avec lequel l'entraînement a été testé.
- ► Variante - Un disjonteur à temps inverse peut être utilisé et déterminé en fonction de la tension d'entrée de l'entraînement, multipliée par 300 %.

Marquage des variateurs :

- ► Les variateurs sont conçus pour fonctionner avec des unités d'alimentation dotées de dispositifs ou de systèmes de protection contre les surtensions, conformément à la norme UL840, 3e éd., tableau 8.1.
- ► Les appareils intègrent une protection thermique et une protection contre les surcharges du moteur.
- ► Les équipements ne sont pas dotés d'une protection contre les survitesses.

Couple de serrage de la borne en lb-in (Nm)

Borne	lb-in	Nm
X21, X22, X23, X24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X25	4.4 ... 7.1	0.5 ... 0.8

Schéma de câblage AWG

Borne	AWG
X21, X22, X23, X24	12 ... 8
X4, X6, X14	28 ... 16
X25	24 ... 12

2.4 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

Pictograph and signal word	Meaning
 **Warnings!**	**Safety note or application note for the operation according to UL or CSA requirements.** The measures are required to meet the requirements according to UL or CSA.
 **Warnings!**	

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (2006/95/EC)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
		CSA 22.2 No. 14	
Packaging (DIN 4180)		Shipping package	
Installation		Installation in control cabinet	
Mounting position		vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm with ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	can be mounted directly side by side without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) ● Atmospheric pressure: 86 ... 106 kPa ● Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl ● Reduce rated output current by 5 %/1000 m above 1000 m amsl. ● Over 2000 m amsl: Use is only permitted in environments with overvoltage category II
Pollution		EN 61800-5-1, UL840: Degree of pollution 2	
Vibration resistance		Acceleration resistant up to 0.7 g (Germanischer Lloyd, general conditions)	

General electrical data			
EMC	Compliance with the requirements acc. to EN 61800-3		
Noise emission	Compliance with the limit class C2 according to EN 61800-3(achieved with a collective filter typical for the application)		
Noise immunity	Requirements acc. to EN 61800-3		
	Requirement	**Standard**	**Severity**
	ESD [1)]	EN 61000-4-2	3, i. e. ● 8 kV for air discharge ● 6 kV for contact discharge
	Conducted high frequency	EN 61000-4-6	10 V; 0.15 ... 80 MHz
	RF interference (housing)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (surge voltage on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase/phase ● 2 kV phase/PE
Insulation resistance	EN 61800-5-1, UL 840: Overvoltage category III		
Discharge current to PE (Acc. to EN 61800-5-1)	> 3.5 mA AC		
Enclosure	IP20 for ● Standard installation (built-in unit) ● Cold-plate technique ● Mounting with thermal separation (push-through technique), IP54 on heatsink side		
Protective measures against	● Short circuit in power terminals (short-circuit-proof at mains connection) ● Short circuit in auxiliary circuits – Digital outputs: Short-circuit-proof – Bus and encoder systems: Limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:) ● Earth fault (earth-fault protected at mains connection) ● Overvoltage		
Protective insulation of control circuits	**Protective separation from the mains** Double/reinforced insulation acc. to EN 61800-5-1		

1) The noise immunity with the severities given must be ensured by the control cabinet. The user must check the compliance of the severities given.

3.2 Rated data

Rated data	Type	ECSxE012	ECSxE020	ECSxE040
Mains voltage	V_{mains} [V]	3 x 200 -10 % ... 3 x 480 +10 %		
Rated mains voltage	$V_{mains\ rated}$ [V]	3 x 400 V		
Mains frequency	f_{mains} [Hz]	45 ... 66		
Rated mains current	$I_{mains\ rated}$ [A]	9.6	15.9	31.3
Max. mains current	$I_{mains\ max}$ [A]	5 x $I_{mains\ rated}$ for 50 ms / 0 x $I_{mains\ rated}$ for 1.2 s		
		2 x $I_{mains\ rated}$ for 1 s / 0 x $I_{mains\ rated}$ for 3 s		
		1.5 x $I_{mains\ rated}$ for 10 s / 0 x $I_{mains\ rated}$ for 12.75 s		
Rated direct current (effective value)	$I_{DC\ rated,RMS}$ [A]	12.0	20.0	38.5
Max. connectable DC bus capacitance	C [uF]	6600		
Low-voltage supply of control electronics	U [V]	20 ... 30		
	$I_{typ.}$ [A]	0.35		
	I_{max} [A]	0.5 A at 24 V [1]		
Power loss, total	P_V [W]	50	68	111
Inside the device		20	23	30
Heatsink		30	45	81
Velocity of cooling air (only for ECSDE...)	V_C [m/s]	3		
Mass	m [kg]	approx. 2.5		approx. 3.2
Internal brake resistor (not available for ECSCE...)	R_B [Ω]	39		20
Continuous power	P_d [kW]	0.12		0.15
Max. braking power	P_{Bmax} [kW]	13.8		27.0
Max. braking energy	W_B [kWs]	2.5		3.0
Max. on-time	t_e [s]	0.15		0.10
Required recovery time	t_a [s]	20		

[1] For the dimensioning of a 24 V supply it may be necessary to add the current demand of the digital output (0.7 A).

3.3 External brake resistors

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

4 Mechanical installation

4.1 Important notes

- ECS power supply modules are provided with IP20 enclosure and can therefore only be used for installation in control cabinets.
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions
  - Vertical at the mounting plate
  - DC bus connections (X22) at the top
  - Mains connection (X21) at the bottom
- Maintain the specified clearances (above and below) to other installations!
  - If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  - must be electrically conductive.
  - must not be varnished.
- In case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

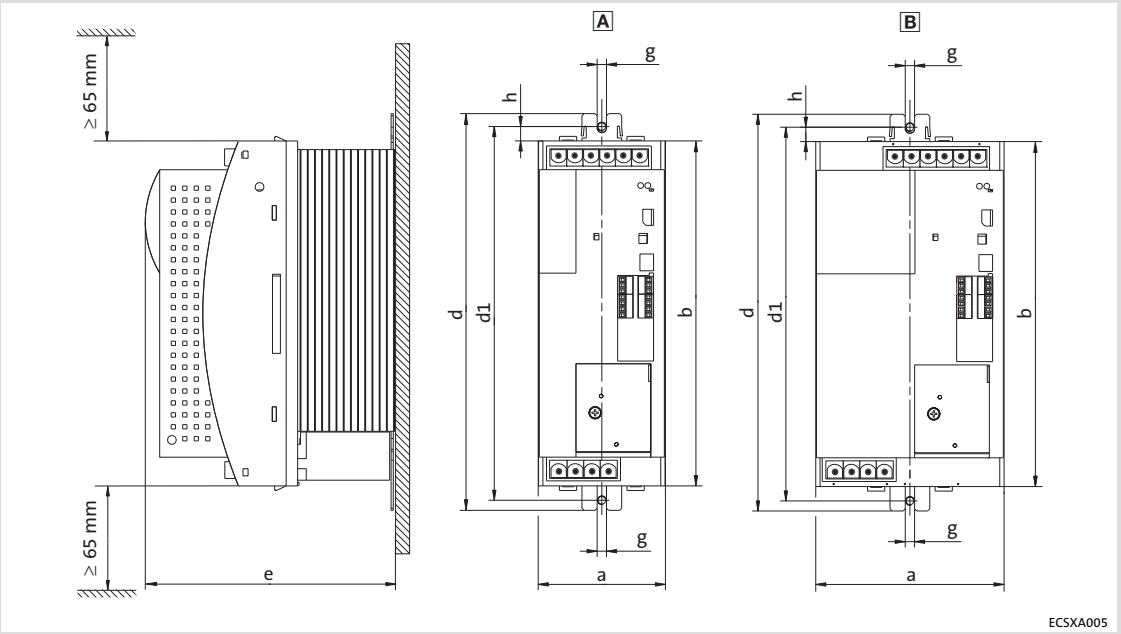


Fig. 4-1 Dimensions for "panel-mounted" design

Power supply module		Dimensions [mm]						
Type	Size	a	b	d	d1	e	h	g
ECSEE012	A	88.5	240	276	260	176 212 1)	10	6.5 (M6)
ECSEE020								
ECSEE040	B	131						

1) max. 212 mm, depending on the communication module attached

4.2.2 Mounting steps

Proceed as follows to mount the power supply module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: push in the long side.
   – From below: push in the short side.
4. Attach the power supply module to the mounting surface.

4.3 Mounting with thermal separation (push-through technique)

For the push-through technique the rear panel of the control cabinet must be a steel plate with a thickness of at least 2 mm.

The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the ECS module).

Cooling

The separated heatsink serves to reduce the heat generation in the control cabinet.

- Distribution of the power loss:
  - approx. 65 % via separated cooler
  - approx. 35 % in the inside of the ECS module
- Protection class of the separated cooler: IP54
  - The sealing surface at the heatsink of the ECS module must rest completely against the mounting plate.
  - Use a liquid thread sealant to bond the screws of the clamps.
- Cooling of the drive system:
  - Air flow behind the rear panel of the control cabinet must be $\geq$ 3 m/s (e.g. by means of a collective fan).
- With sufficient cooling, the rated data remains valid.

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

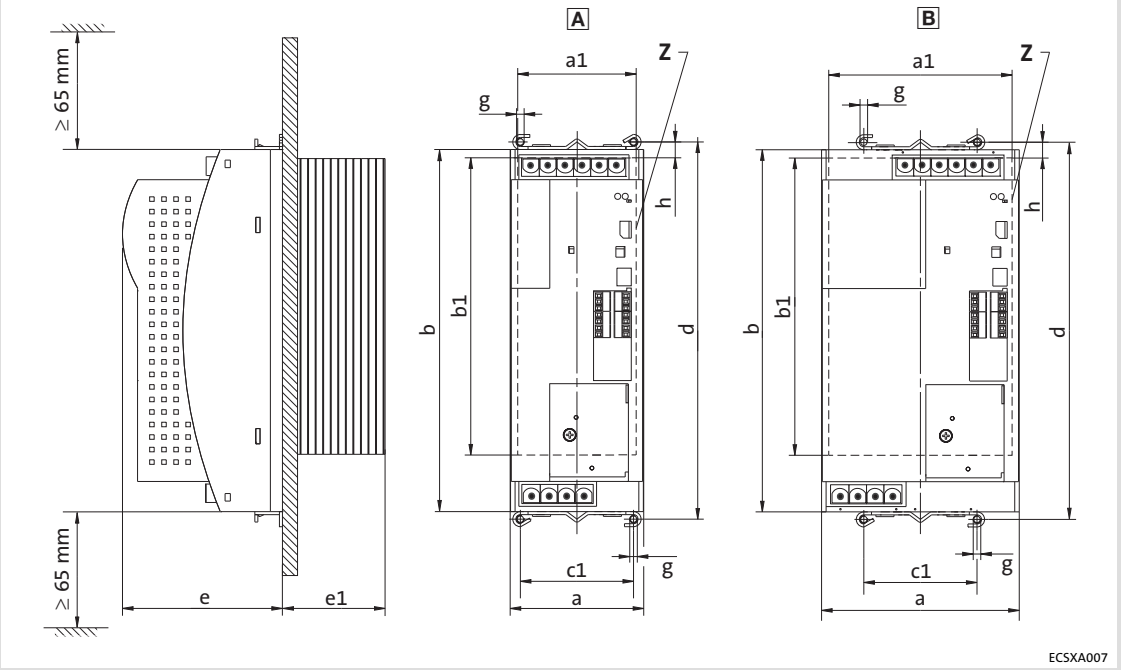


Fig. 4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 📖 30

Power supply module		Dimensions [mm]									
Type	Size	a	a1	b	b1	c1	d	e	e1	g	h
ECSDE012	A	88.5	78.5	240	197	75	250	109 145 [1]	67	M5	10.5
ECSDE020											
ECSDE040	B	131	121.5								

[1] max. 145 mm, depending on the communication module attached

Dimensions of mounting cutout

Note!

Installation with shield mounting ECSZS000X0B:

► Clearance below the mounting cutout > 220 mm

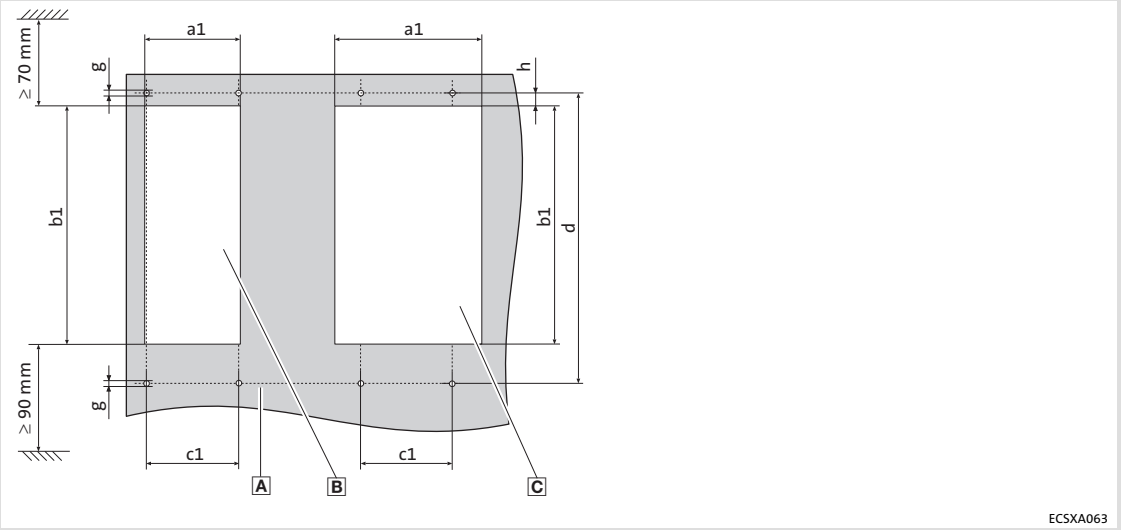


Fig. 4-3 Dimensions of mounting cutout

- A Mounting surface
- B Mounting cutout for size A
- C Mounting cutout for size B

Power supply module		Dimensions [mm]					
Type	Size	a1	b1	c1	d	g	h
ECSDE012	A	78.5	197	75	250	M5	10.5
ECSDE020							
ECSDE040	B	121.5					

4.3.2 Mounting steps

Proceed as follows to mount the power supply module:

1. Prepare the fixing holes for the clamps on the mounting surface.
   – Use the drilling jig for this purpose.
2. Prepare the mounting cutout.
   – The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the power supply module).
3. Apply liquid thread sealant to the threads of the screws for the wire clamps.
4. Fix the clamps.
5. Push the power supply module into the mounting cutout.
6. Let the power supply module snap into the clamps at the top and at the bottom.

4.4 Mounting in cold-plate design

The ECS**C**E... modules are intended for mounting in cold plate technique (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure safe and reliable operation of the power supply modules:

- Good thermal contact with the cooler:
  - The contact surface between collective cooler and power supply module must be at least as large as the cooling plate of the power supply module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Use all prescribed screwed connections to connect the collective cooler to the power supply module.
- Comply with the thermal resistance R_{th} according to the table.
  - The values are valid for operation of the power supply modules under rated conditions.

Power supply module	Power to be dissipated	Heatsink - environment
Type	Ploss [W]	R_{th} [k/W]
ECSCE012	30.0	0.45
ECSCE020	45.0	0.34
ECSCE040	81.0	0.17

- Ambient conditions:
  - The rated data regarding the ambient temperature remain valid for the power supply modules (📖 21 ff.).
  - Temperature of the cooling plate (”cold plate”): max. +85 °C

4.4.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

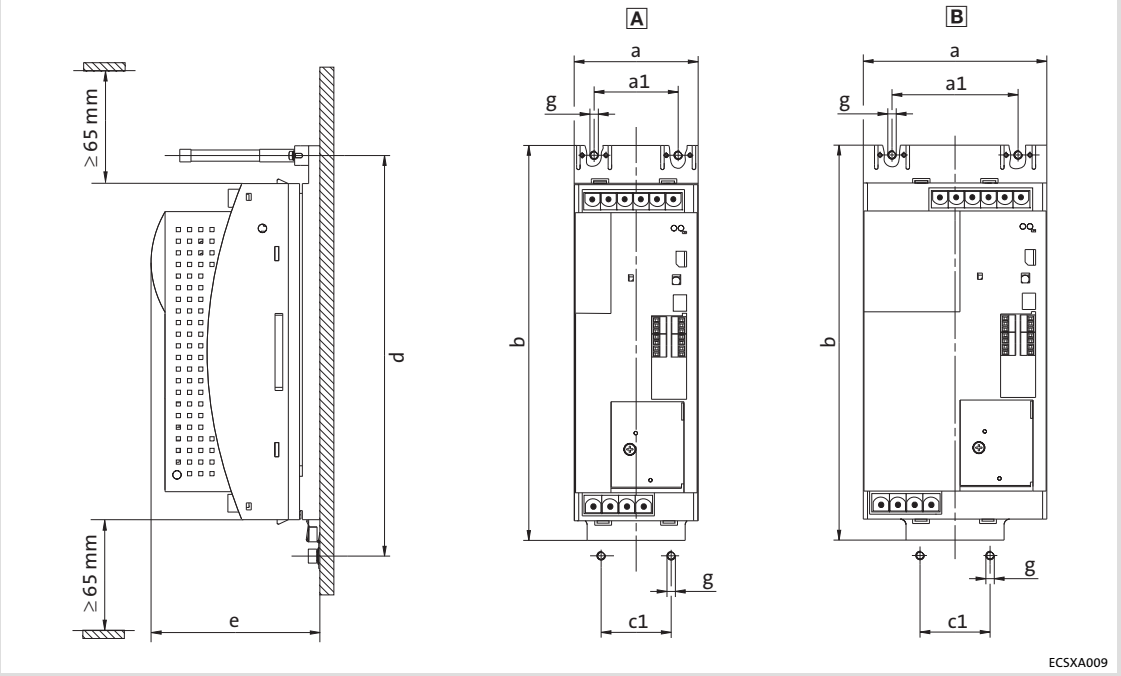


Fig. 4-4 Dimensions for "cold-plate design"

Power supply module		Dimensions [mm]						
Type	Size	a	a1	b	c1	d	e	g
ECSCE012	A	88.5	60	282	50	287	121 157 1)	M6
ECSCE020								
ECSCE040	B	131	90					

1) Max. 157 mm, depending on the plugged-on communication module

4.4.2 Mounting steps

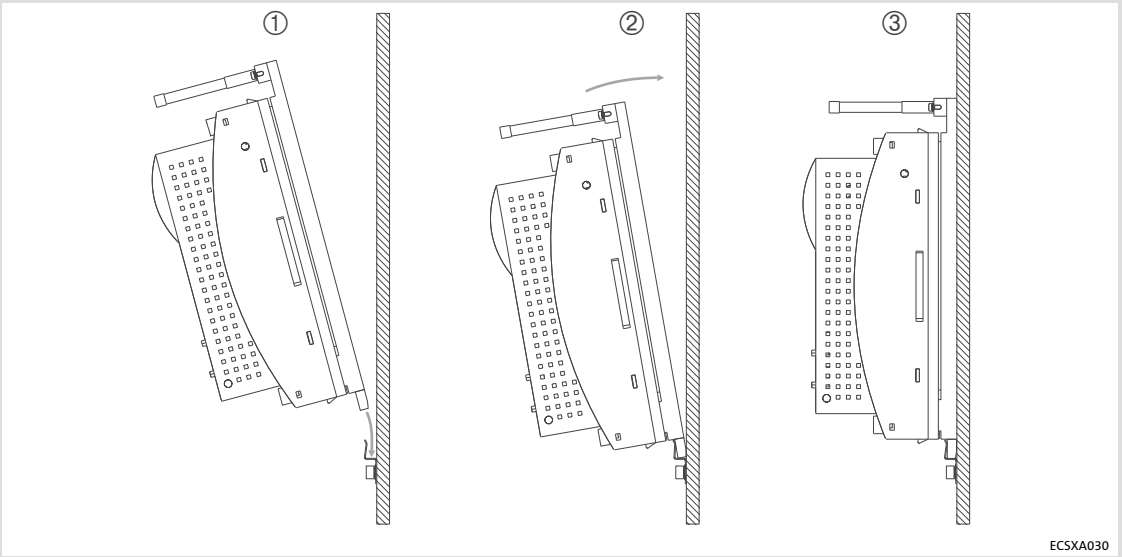


Fig. 4-5 Mounting for "cold-plate design"

Proceed as follows to mount the power supply module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Clean and degrease the contact areas of the collective cooler and the power supply module's cooling plate (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Push the power supply module from above ① into the support ② and tighten both studs with 3.5 ... 4.5 Nm ③.

Note!

Penetration depth of the screws into the collective cooler: approx. 15 mm!

Tip!

The heat transfer resistance is reduced if - following step 2. -

► a thin layer of heat conducting paste is applied to the contact surface or

► heat conducting foil is used.

5 Electrical installation

5.1 Installation according to EMC (installation of a CE-typical drive system)

General information

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Assembly
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the evaluation of the conformity to the EMC Directive requires a check of the machine or system regarding the EMC limit values. This for instance applies to:
  - Use of unshielded cables
  - Use of collective interference filters instead of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the ECS modules, these devices may be electromagnetically affected by the ECS modules.

Assembly

- Connect the ECS modules, RFI filters, and mains choke to the earthed mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow for permanent contact.
  - Painted plates are not suitable for an EMC-compliant installation.
- If you use the ECSxK... capacitor module:
  - Install the capacitor module between the power supply module and the axis module(s).
  - If the total cable length in the DC-bus connection is > 5 m, install the capacitor module as close as possible to the axis module with the greatest power.
- If you use several mounting plates:
  - Connect as much surface of the mounting plates as possible (e.g. with copper bands).
- Ensure the separation of the motor cable and the signal or mains cables.
- Avoid a common terminal/power strip for the mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filters

Only use RFI filters and mains chokes which are assigned to the power supply modules:

- RFI filters reduce impermissible high-frequency interferences to a permissible value.
- Mains chokes reduce low-frequency interferences which in particular depend on the motor cables and their lengths.

Shielding

- Connect the motor cable shield to the axis module
  - with the ECSZS000X0B shield mounting kit.
  - extensively to the mounting plate below the axis module.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor protection switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to each other and connect them to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing extensively to PE:
  - Metal glands at the motor terminal box ensure an extensive connection of the shield and the motor housing.
- Shield UG cables and control cables from a length of 0.3 m:
  - Connect both shields of the digital control cables.
  - Connect one shield end of the analog control cables.
  - Always connect the shields to the shield connection at the axis module over the shortest possible distance.
- Use of the ECS modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥10 dB . This can be achieved by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (e.g. ECS modules, RFI filters, motor filters, mains chokes) using suitable cables connected to a central earthing point (PE rail).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Drive system on the mains

This information applies to the ECS drive system, consisting of:

- ECSxE... power supply module
- ECSxK series capacitor module (optional)
- ECSxS/P/M/A series axis module
- Motor
- Accessories
- Wiring

5.2.1 Electrical isolation

The integrated electrical isolation between the power section and the control section is a protective separation (reinforced insulation) acc. to EN 61800-5-1.

To maintain this protective separation, it must be ensured that the external 24 V supply and all components connected to this supply also have a protective separation (SELV/PELV) acc. to EN 61800-5-1.

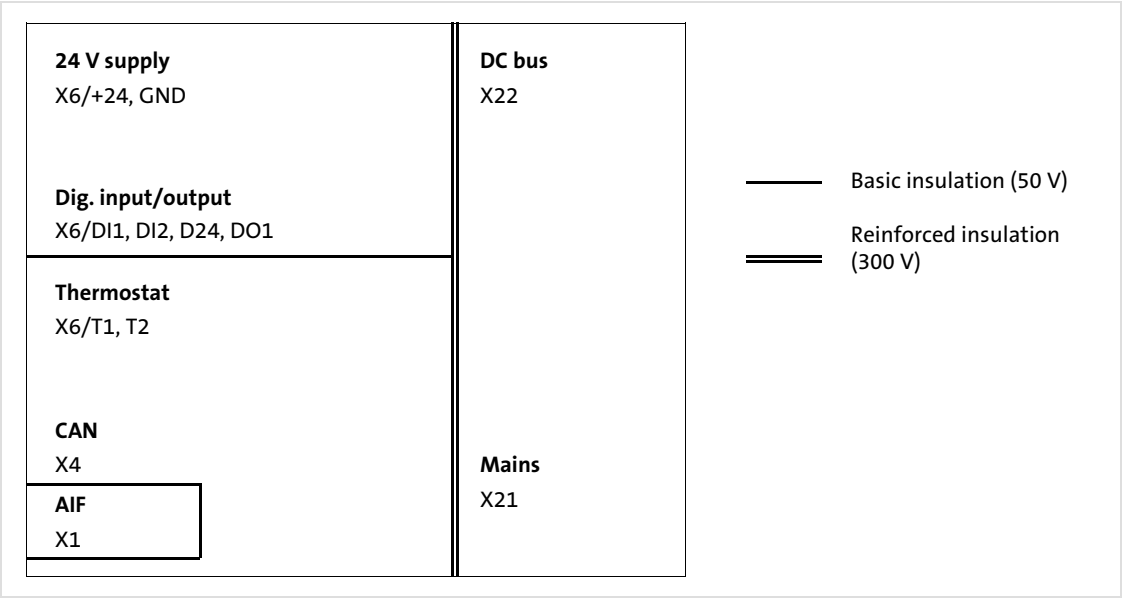


Fig. 5-1 Electrical isolation

5.2.2 Supply forms / electrical supply conditions

Stop!

The power supply module may only be operated on balanced mains supplies. Operation on mains supplies with earthed phase is not permitted.

The ECSxE series power supply modules are provided with an automatic detection of the mains voltage and adapt the brake chopper switch-on voltage.

Please observe the restrictions for the respective supply forms:

Mains	Operation of the power supply modules	Notes
With earthed neutral (TT/TN systems)	No restrictions	Observe the rated data of the power supply modules.
With isolated neutral (IT systems)	The ECSxExxxx**4**I IT variant can be used if the power supply module is protected in the event of an earth fault in the mains supply: ● by suitable equipment detecting the earth fault. ● by disconnecting the power supply module immediately from the mains.	In the event of an earth fault at the output of the power supply module, safe operation cannot be guaranteed.

Note!

► Mains voltage dips can be reduced by decreasing the max. charging current limit (C0022).

► Deactivate the charging current limitation (charge relay) of the connected ECS axis modules with C0175 = 3.

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

The European Standard EN 61000-3-2 determines limit values for limiting harmonic currents in the supply system. Non-linear loads (e.g. frequency inverters) produce harmonic currents which may ”pollute” the supply system and thus have an impact on other consumers.The standard wants to ensure the quality of the public supply system and reduce the mains load.

Note!

The standard only applies to public supply systems. Supply systems which have their own transformer substation as common in industry are not public. The standard does not apply to them.

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

5.3 Power terminals



Danger!

Hazardous electrical voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when touching the device in the event of an error.

Protective measures:

Implement the measures required in EN 61800-5-1. Especially:

► Fixed installation
  – Implement PE connection in compliance with standards.
  – Connect PE conductor twice or PE conductor cross-section ≥ 10 mm^2.
► Connection with a connector for industrial applications according to IEC 60309 (CEE):
  – PE conductor cross-section ≥ 2.5 mm^2 as part of a multi-core supply cable.
  – Provide for suitable strain relief.



Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.
► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

► All power connections are plug connections and are coded. The connector set for the ECSZ**E**000X0B power supply modules must be ordered separately.

► Installation of cables acc. to EN 60204-1.

► The cables used must comply with the approvals required for the respective application (e.g. VDE, UL, etc.).

Assignment of the plug connectors

Terminal	Function	Electrical data
X21	**Mains connection**	
X21/L1	Mains phase L1	Dependent on application and type 0 ... 480 V up to 31.3 A (📖 23)
X21/L2	Mains phase L2	
X21/L3	Mains phase L3	
X21/PE	Connection of PE conductor	
X22	**DC-bus voltage connection**	
X22/BR0	Internal brake resistor, connection 1	Dependent on application and type 0 ... 770 V up to 38.5 A (📖 23)
X22/BR1	External brake resistor, connection 1	
X22/+UG	Internal/external brake resistor, connection 2	
X22/+UG	DC-bus voltage supply, plus	
X22/-UG	DC-bus voltage supply, minus	
X22/PE	Connection of PE conductor	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Terminal strips X21 and X22				
Rigid	–	0.2 ... 10 mm² (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
Flexible	Without wire end ferrule	0.2 ... 10 mm² (AWG 24 ... 8)		
	With insulated wire end ferrule	0.25 ... 6 mm² (AWG 22 ... 10)		
	With insulated TWIN wire end ferrule	0.25 ... 4 mm² (AWG 22 ... 12)		

Shielded cables

The following factors decisively determine the effect of the shielded cables:

- Good shield connection
  - Ensure a contact surface as large as possible
- Low shield resistance
  - Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- High overlap rate of the braid
  - At least 70 ... 80 % with 90° overlap angle

The ECSZS000X0B shield mounting kit includes a wire clamp and shield sheet.

5.3.1 Mains connection

Important notes

- Keep the cables between the RFI filter and the power supply module as short as possible.
  – Make sure that no short-circuit can occur!
- Mains cables and $\pm U_G$ cables must not contact each other.
- When mains cables and $\pm U_G$ cables are laid in parallel:
  – Cable distance: > 150 mm
- Cable length > 30 cm:
  – Shield the cables between the RFI filter and the power supply module to comply with the general EMC Directive.
- With some 24 V switched-mode power supplies, the EMC limit values for the system will only be met if the power supplies are connected to **ECSZZ series** RFI filters. Please contact the manufacturer of the power supply unit on the compliance with EMC limit values for conducted interference.

Documentation of the RFI filter ECSZZ...
Observe the enclosed notes.

Wiring variants for the ECSxE power supply module

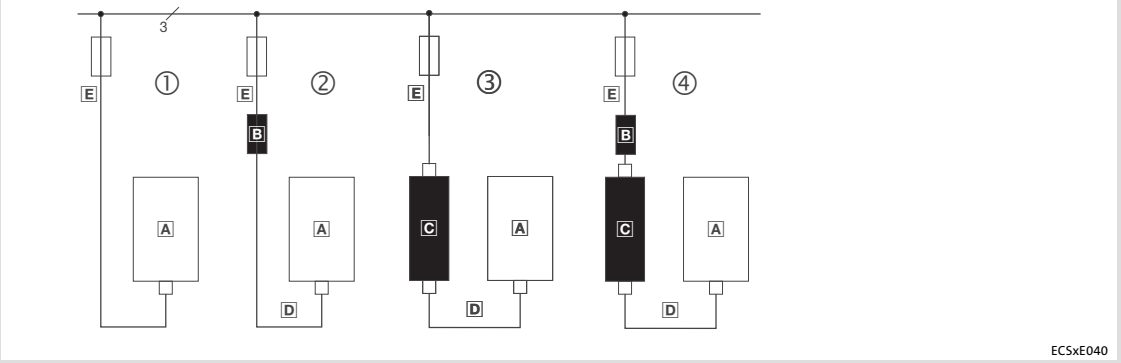


Fig. 5-2 Wiring variants for the ECSxE power supply module

① **Simple wiring**
②/④ **Wiring with mains chokes**
③ **Wiring with RFI filters**
A Power supply module ECSxE
B Mains choke
C RFI filter
D Wiring of components
E Mains cable

Fuses

Use the following circuit-breakers or UL-approved fuses to protect the mains cable (see Fig. 5-2 (📖 42)):

Power supply module	Dimensioning according to IEC/EN		Dimensioning to UL	
	Circuit-breaker	Cable cross-section [mm²]	UL fuse	AWG
ECSxE012	C16 A	2.5	25A	12
ECSxE020	C16 A	2.5	25A	12
ECSxE040				
①:E	C 40 A	10 1)	35 A	8 1)
②/④: D, E	C 32 A	6	35 A	10
③: D	C 40 A	6 2)	35 A	10 2)
③: E	C 40 A	10	35 A	8

1) Cable without wire end ferrule or with pin-end connector
2) Cable length max. 30 cm

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

Replacing defective fuses

Danger!

Hazardous electrical voltage

Components can carry hazardous voltages up to 3 minutes after power-off.

Possible consequences:

- ► Death or severe injuries when touching the device.

Protective measures:

- ► Replace fuses in the deenergised state only.
  - – Set controller inhibit (CINH) for all axis modules in DC-bus operation and disconnect all power supply modules from the mains.

5.3.2 Connection to the DC bus (+U_G, -U_G)

Stop!

- ► The supply of Lenze controllers of the **82xx** and **93xx** series is not permitted.
- ► If synchronous motors with a high centrifugal mass are used, a considerable amount of energy can be fed back into the DC bus. Please take this into account when dimensioning the brake resistor.

- ► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.
- ► Design the ±U_G cables twisted and as short as possible. Ensure short-circuit-proof routing!
- ► Cable length (module ↔ module) > 30 cm: install shielded ±U_G cables.

Documentation of the ECSxS/P/M/A axis modules

Observe the enclosed notes.

Documentation of the ECSxK capacitor module

Observe the enclosed notes.

Fuses

Fusing the DC-bus interconnection is not required if power supply modules of the ECS series are used which are fused on the mains side.

Cable cross-section

Cable length (module/ module)	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm² (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
	With insulated wire end ferrule			
> 20 m	Without wire end ferrule	10 mm² (AWG 8)		
	With insulated wire end ferrule **Use pin-end connectors for wiring!**			

5.3.3 Connection plan for mimimum wiring with internal brake resistor

Stop!

Always operate the ECS power supply modules with a brake resistor (internal/external).

The ECS power supply modules in the standard built-in unit and push-through design (ECSEE / ECSDE) are provided with a device-internal brake resistor.

In order to use the internal brake resistor (Rb), carry out the following wiring:

- Bridge between the terminals X22/+UG and X22/BR0 (CR)
  Current flow from +UG via the internal brake resistor (Rb) and the brake transistor to -UG.
- Bridge between the terminals X6/T1 and X6/T2 (CR)
  Deactivate the temperature monitoring of the non-existing external brake resistor.

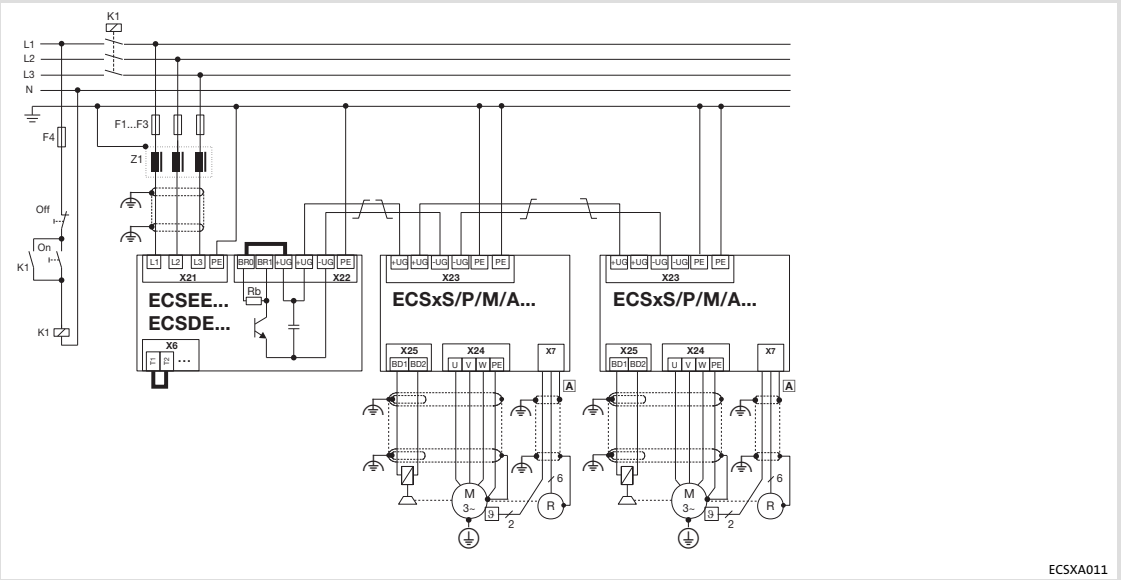


Fig. 5-3 Interconnected power system with internal brake resistor

⏚	HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
∫	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb	Internal brake resistor
ϑ	KTY thermal sensor of the motor
A	System cable for feedback

5.3.4 Connection plan for mimimum wiring with external brake resistor

Stop!

- ► Always operate the ECS power supply modules with a brake resistor.
- ► A parallel wiring of internal and external brake resistor is not permissible!
- ► Implement the thermal contact of the brake resistor into the system monitoring so that the mains supply of the power supply module will be switched off in case the brake resistor will be overheated.
- ► Read the documentation for the external brake resistor. Observe the safety instructions contained therein.

If the power supply module needs a high amount of braking power when it comes as standard built-in unit or in push-through technique design (**ECSEE / ECSDE**), an external and more powerful brake resistor can be connected instead of the internal brake resistor.

A power supply module in cold plate technique design (**ECSCE**) is not provided with an internal brake resistor so that this version always requires an external brake resistor (Rbext).

- ► Connect the brake resistor to X22/BR1 and X22/+UG.
- ► Connect the thermal contact (NC contact) of the external brake resistor to X6/T1 and X6/T2.

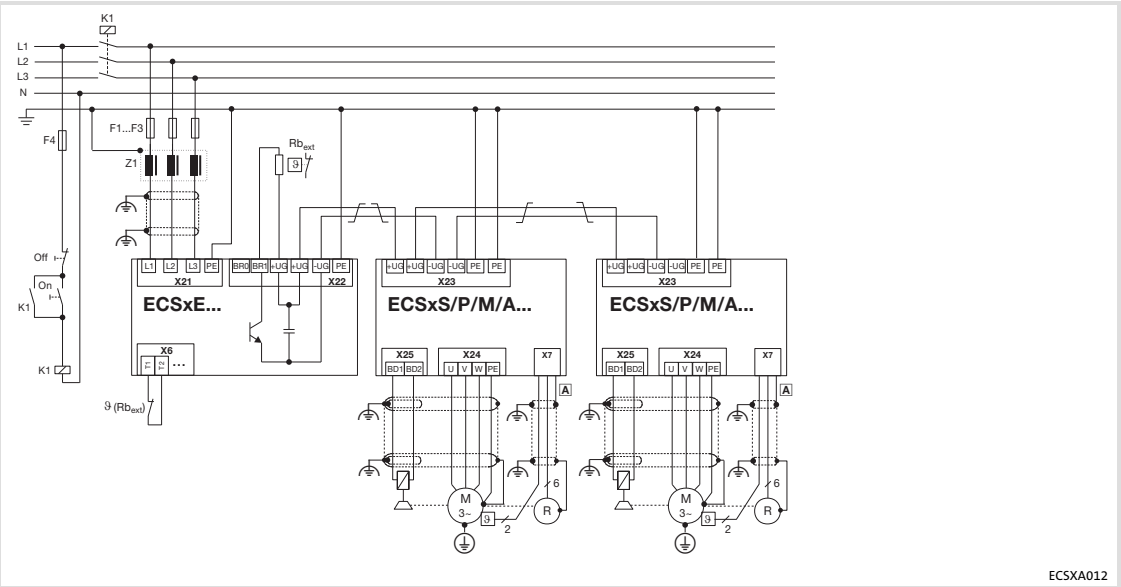


Fig. 5-4 Interconnected power system with external brake resistor

⏚	HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
∫	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb_{ext}	External brake resistor
ϑ	KTY thermal sensor of the motor
A	System cable for feedback

Wiring of external brake resistor ERBM...

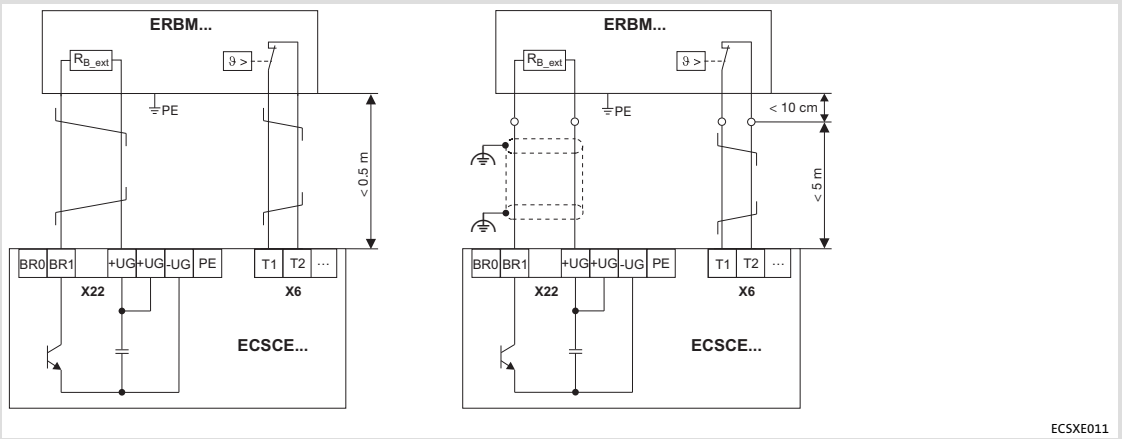


Fig. 5-5 Connection of external brake resistors, ERBM series

HF-shield termination by large surface PE connection

Twisted cables

Wiring of external brake resistor of ERBS.../ERBD... series

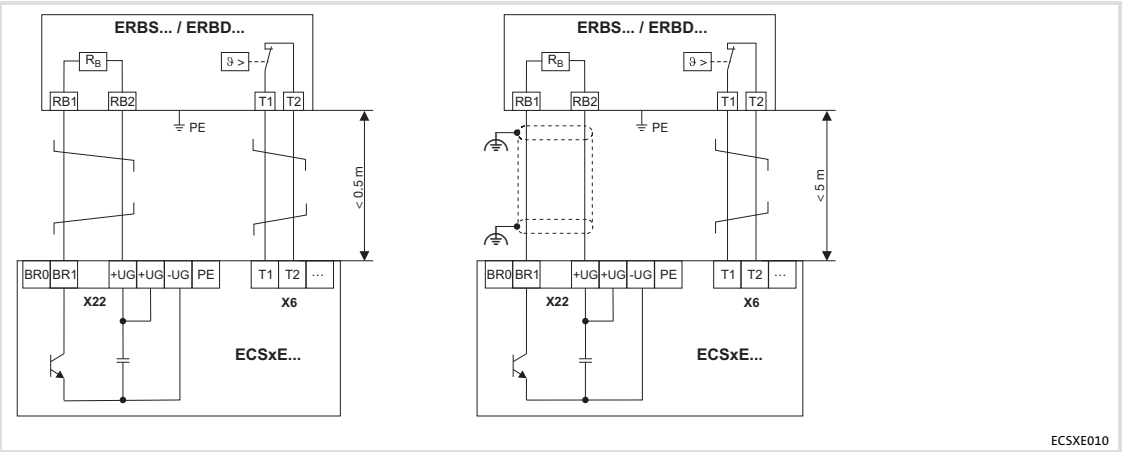


Fig. 5-6 Wiring of external brake resistor, ERBS.../ERBD... series

HF-shield termination by large surface PE connection

Twisted cables

5.3.5 Connection of an ECSxK... capacitor module (optional)

The ECS capacitor modules support the DC-bus voltage for the drive system. These capacitor module types are available:

- ECSxK001 (705 µF, ±20 %)
- ECSxK002 (1410 µF, ±20 %)

x Design/mounting technique: E = standard installation
C = Cold-plate technique
D = push-through technique

Documentation of the ECSxK capacitor module
Observe the enclosed notes.

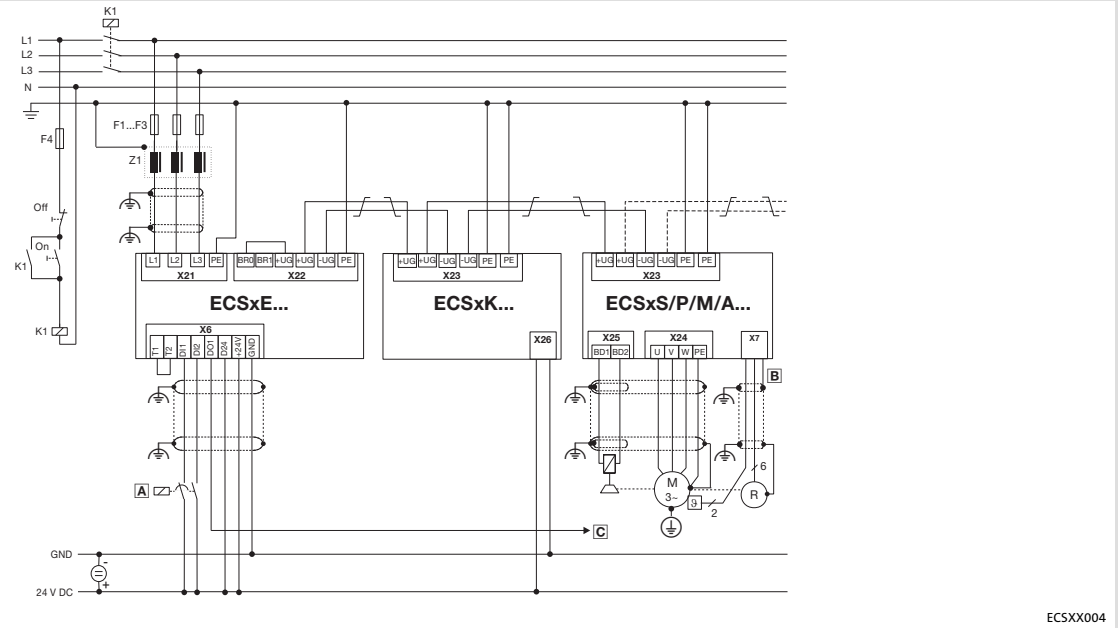


Fig. 5-7 Wiring of capacitor module ECSxK...

- HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- A Contactor relay
- B System cable - feedback
- C Terminal X6/SI1 of the connected axis modules (controller enable/inhibit)

5.4 Control terminals

- ► The supply of the control electronics requires an external 24 V DC voltage at terminals X6/+24 and X6/GND.
- ► Connect the thermal detector of an external brake resistor to the terminals X6/T1 and X6/T2. If no external brake resistor is required, jumper terminals X6/T1 and X6/T2.

Stop!

- ► The control cables must always be shielded to prevent interference injections.
- ► The voltage difference between X6/AG, X6/GND and PE of the axis module may maximally amount to 50 V.
- ► The voltage difference can be limited by:
  – overvoltage-limiting components or
  – direct connection of X6/AG and X6/GND to PE.
- ► The wiring has to ensure that for X6/DO1 = 0 (LOW level) the connected axis modules do not draw energy from the DC bus. Otherwise, the power supply module may be damaged.

Shield connection of control cables and signal cables

The plate on the front of the device serves as the mounting place (two threaded holes M4) for the shield connection of the signal cables. The screws used may extend into the inside of the device by up to 10 mm. For optimum contact of the shield connection, use the wire clamps from the ECSZS000X0B shield mounting kit.

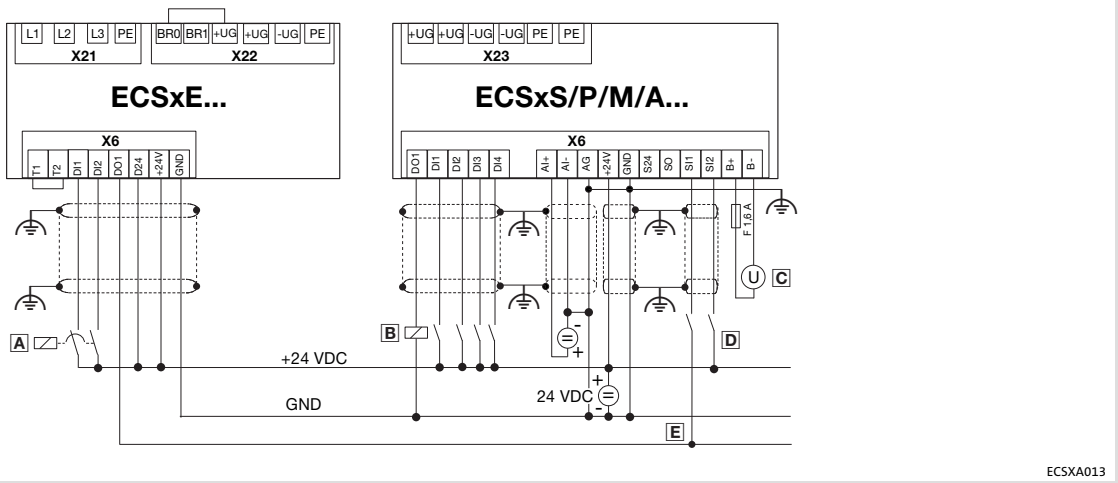


Fig. 5-8 Interconnection: Control signals with internal brake resistor

- ⏚ HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- A/B Contactor relay
- C Voltage supply of motor holding brake 23 ... 30 V DC, max. 1.5 A
- D Safe torque off (formerly: "Safe standstill")
- E Controller enable/inhibit

Switch-on sequence for the auxiliary relay

Stop!

Overload of the charging connection in the power supply module

The controller enable for the axes may only take place when the charging process of the DC bus is completed and the power supply module is ready for operation.

Possible consequences:

► Destruction of the power supply module

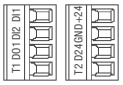
Protective measures:

► Use of switching the central controller enable for the axes via the inputs and outputs DI2 and DO1 of the power supply module (see the following descriptions).

The switch-on sequence of the auxiliary relay [A] (see Fig. 5-8) is as follows:

1. The digital input X6/DI1 (power supply enable) of the power supply module is switched to HIGH by the higher-level control or by the operator.
   – The DC bus is charged.
2. The ready for operation output of the axis module (DO1) now switches the X6/DI2 digital input (central controller enable) of the power supply module via the relay [A].
   – In the default Lenze setting of the ECS axis modules, DO1 is set to "ready". "Ready" is only present if a specified DC-bus voltage has been reached.
3. The central controller enable for the axis module takes place via the X6/DO1 output of the power supply module. The central controller enable DO1 only switches if the charging process of the DC bus is completed AND the X6/DI2 input is set.

Assignment of the plug connectors

Terminal strip X6			
View	**Terminal**	**Function**	**Electrical data**
	X6/+24	Low-voltage supply of control electronics	20 ... 30 V DC, 0.5 A (max. 1 A) for 24 V starting current: max. 2 A for 50 ms
	X6/GND	Reference potential low-voltage supply	
	X6/T1	Thermostat contact 1	
	X6/T2	Thermostat contact 2	
	X6/D24	Low-voltage supply X6/DO1 (digital output 1)	18 ... 30 V DC
	X6/DO1	Digital output 1 (for central controller enable signal to connected axis modules)	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
	X6/DI1	Digital input 1 (for power supply enable/charge of the DC bus)	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
	X6/DI2	Digital input 2 (for central controller enable signal to connected modules; available at output X6/DO1)	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	Without wire end ferrule	0.08 ... 1.5 mm^2 (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connection
	With insulated wire end ferrule	0.25 ... 0.5 mm^2 (AWG 22 ... 20)		9 mm for spring connection

We recommend to use control cables with a cable cross-section of 0.25 mm^2.

5.4.1 Digital inputs and outputs

Stop!

If an inductive load is connected to X6/DO1, a spark suppressor with a limiting function to max. 50 V ± 0 % must be provided.

Power supply enable of the power supply module

- The X6/DI1 input serves to start the controlled charge of the DC bus by the charging thyristor.
- Only when the charging process is completed, which is displayed through the ready for operation message at the X6/DO1 output of the power supply module, the connected axis modules may be enabled. Otherwise, the charging thyristor would be overloaded.

X6/DI2 - central controller enable for the connected axis modules via DO1

- The X6/DI2 input can be used together with the X6/DO1 output as centrally controlled controller enable for all connected axes. The DO1 output only switched if the DC bus has been charged completely without any trouble. This automatically ensures that the axis modules cannot be enabled too early and consume energy from the DC bus too early.
- For this purpose, wire the X6/DO1 output with the X6/SI1 inputs of the axis modules for controller enable.

  If required, one further contact can be connected in series for each axis module to be able to inhibit and enable the individual axis modules during operation.
- In order that the output of the power supply module X6/DO1 is set to ”HIGH”, the following conditions must be met:
  - The power supply module is ready for operation.
  - The DC bus is charged.
  - X6/DI1 = HIGH (the controller enable input of the power supply module is triggered)
  - The X6/DO1 output of the power supply module requires the 24 V supply voltage via terminal X6/D24.

5.5 Automation interface (AIF)

The keypad XT or a communication module can be attached to or removed from the automation interface (X1). This is also possible during operation.

- The keypad XT serves to enter and visualise parameters and codes.
- The communication modules serve to network the modules of the ECS servo system with the host system (PLC or PC).

The following combinations are possible:

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	-	✓
INTERBUS	EMF2113IB	-	✓
PROFIBUS-DP	EMF2133IB	-	✓
CANopen	EMF2178IB	-	✓
DeviceNet	EMF2179IB	-	✓
EtherCAT	EMF2192IB	✓	✓

Communication manuals for the communication modules

Here you will find detailed information on how to wire and use the communication modules.

5.6 Wiring of system bus (CAN)

The modules of the ECS series communicate

- via the system bus interface (X4).
- set parameters and display code contents.

System bus (CAN) wiring

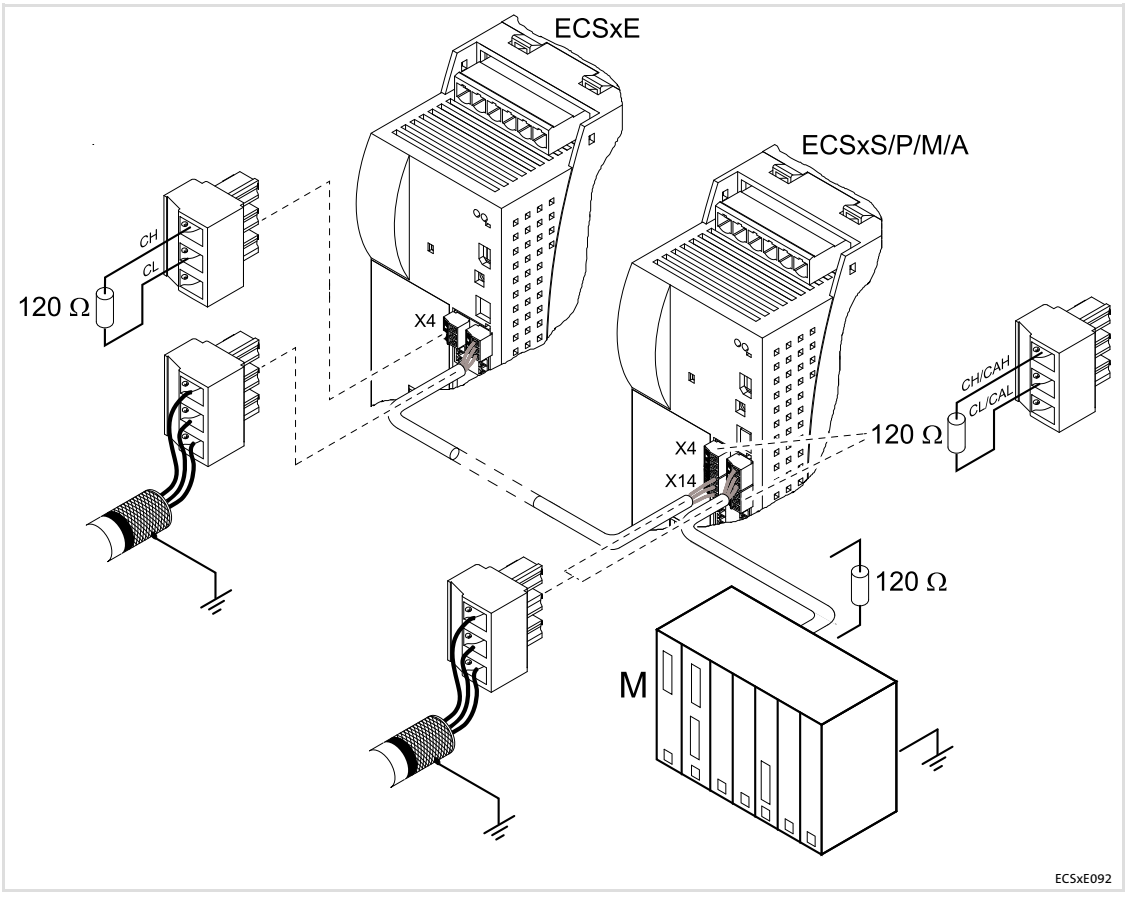


Fig. 5-9 Example of wiring the system bus (CAN)

ECSxE	Power supply module
ECSxS/P/M/A	Axis module
M	Master control, e.g. ETC

Note!

Connect one bus terminating resistor (120 Ω) each to the first and last node of the system bus (CAN).

Assignment of the plug connectors

X4 (CAN)	X14 (CAN-AUX)	Description
CH	CAH	CAN-HIGH
CL	CAL	CAN-LOW
CG	CAG	Reference potential

Specification of the transmission cable

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

Bus cable length

Note!

The permissible cable lengths must be observed.

1. Check the compliance with the total cable length in Tab. 5-1.

The baud rate determines the total cable length.

CAN baud rate [kbit/s]	**Max. bus length** [m]
50	1500
125	630
250	290
500	120
1000	25

Tab. 5-1 Total cable length

2. Check the compliance with the segment cable length in Tab. 5-2.

The segment cable length is determined by the cable cross-section used and the number of nodes. Without a repeater, the segment cable length corresponds to the total cable length.

Number of nodes	**Cable cross-section**			
	0.25 mm²	**0.5 mm²**	**0.75 mm²**	**1.0 mm²**
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 5-2 Segment cable length

3. Compare the two values detected.

If the value detected from Tab. 5-2 is smaller than the total cable length to be provided from Tab. 5-1 , repeaters must be used. Repeaters divide the total cable length into segments.

Example: Selection help

Specifications	
● Cable cross-section:	0.5 mm² (according to cable specifications 📖 55)
● Number of nodes:	63
● Repeater:	Lenze-repeater, type EMF2176IB (cable reduction: 30 m)

For the max. number of nodes (63), the following cable lengths / number of repeaters from the specifications must be observed:

Baud rate [kbit/s]	**50**	**120**	**250**	**500**	**1000**
Max. cable length [m]	1500	630	290	120	25
Segment cable length [m]	310	310	290	120	25
Number of repeaters	5	2	-	-	-

Check repeater application

Given:	
● Baud rate:	125 kbps
● Cable cross-section:	0.5 mm²
● Number of nodes:	28
● Cable length:	450 m

Procedure	Cable length	See
1. Total cable length at 125 kbps:	630 m	Tab. 5-1
2. Segment cable length for 28 bus nodes and a cable cross-section of 0.5 mm²:	360 m	Tab. 5-2
3. Comparison: The value under point 2 is smaller than the required cable length of 450 m.		

Conclusion
● It is not possible to use a cable length of 450 m without using a repeater.
● After 360 m (point 2) a repeater must be installed.

Result
● The Lenze repeater type EMF2176IB is used (cable reduction: 30 m)
● Calculation of the maximum cable length: First segment: 360 m Second segment: 360 m (according to Tab. 5-1) *minus* 30 m (cable reduction when a repeater is used)
→ Maximum possible cable length with repeater: 690 m.
→ Now it is possible to use the required cable length.

Note!

Repeaters are recommended as a

► Service interface
Advantage: Trouble-free connecting during bus operation is possible.

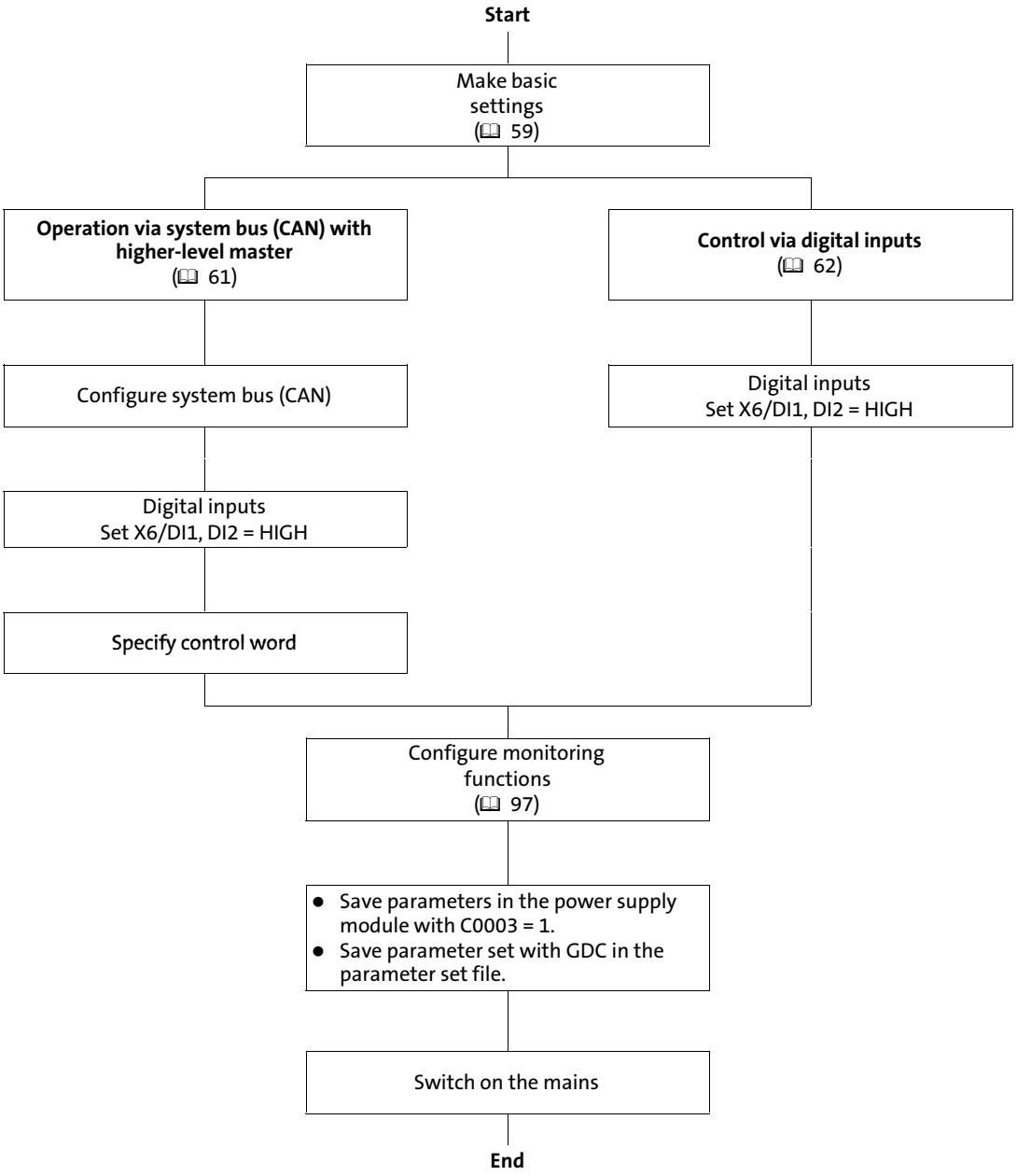
► Calibration interface
Advantage: Calibration/programming unit remains electrically isolated.

6 Commissioning

Check before switching on the power supply module for the first time:

- The wiring for completeness, short-circuit, and earth fault
- The power connection:
  - Mains connection via terminals L1, L2, L3 (X21)
  - Connection of the RFI filter / mains choke
  - Connection of the brake resistor (internal/external) via terminals BR0, BR1 (X22)
  - Polarity of the DC bus voltage supply via terminals +UG, -UG (X22)
- The control connection (X6):
  - Connection of the 24 V supply, GND
  - Connection of temperature sensor contact of the external brake resistor or connection of jumper when using the internal brake resistor to terminals T1, T2.
  - Adjustment of wiring to the signal assignment of the control terminals.
- The communication via the system bus (CAN)

6.1 Commissioning steps (overview)



6.1.1 Basic settings with GDC



Note!

Follow the commissioning steps in the given order!

	Setting	Brief description		Detailed information
	Conditions	● Mains is switched off. (Green LED is dark, red LED is blinking) ● Power supply module is inhibited. – Control bit 1 (STE_RESET) = 0 – Power supply enable input X6/DI1 = LOW ● For operation in an EtherCAT network: – Plug EtherCAT communication module (EMF2192IB) onto AIF interface (X1).		
1.	Switch on low-voltage supply.			
2.	XT keypad or Connect PC/laptop (with installed GDC parameter setting program) to the power supply module.	Parameter setting with XT keypad ● Plug the XT keypad into the AIF interface (X1). ● Not possible for operation in an EtherCAT network, since the AIF interface (X1) is already assigned by the EtherCAT module (see ”Preconditions” above).		📖 73
		Parameter setting with GDC ● Connect PC/laptop to system bus interface (X4) with PC system bus adapter EMF2173IB/EMF2177IB. ● Start GDC and select the device to be set.		📖 71
3.	Set mains voltage.	Setting via C0173 ● Setting of the connected ECS axis modules: – C0173: Set DC bus thresholds according to the mains voltage used. – Set C0175 = 3 (charging current limitation is not active)		📖 64
4.	Set function of the brake resistor.	Setting via C0127 (Brake chopper and/or fast discharge function (short-circuit braking))		📖 65
5.	**Only for operation with external brake resistor:** Deactivate monitoring of the internal brake resistor.	C0579 = 3 (internal brake resistor deactivated)		📖 68
6.	Configure power supply enable input.	● DC bus is charged if X6/DI1 = HIGH ● Set the response of the power supply module for X6/DI1 = LOW via C0468.		📖 66
7.	Connect mains voltage.	The detection of the mains voltage takes about 1 second. If the mains voltage is within the operating range (📖 99) ● the green LED at the power supply module will be blinking. ● XT keypad displays ”ok”.		
8.	Select operating mode.	C0001 = 0	Operation via system bus (CAN) with master control	📖 61
		C0001 = 1	Control via digital inputs	📖 62
		C0001 = 2	Operation via EtherCAT with master control ● For this purpose, use the EtherCAT module EMF2192IB.	📖 63

The basic settings are now complete: Please continue with the settings for the operating mode selected:

► Operation via system bus (CAN) with master control: 📖 61

► Control via digital inputs: 📖 62

► Operation via EtherCAT with master control: 📖 63

6.1.2 Operation via system bus (CAN) with master control

Note!
Follow the commissioning steps in the given order!

	Setting	Brief description	Detailed information
	Conditions	● Basic settings completed. ● C0001 = 0	📖 59
1.	Set baud rate.	● Setting via DIP switch (S1) or C0351 ● Lenze setting: 500 kbits/s ● Changes are accepted after – a "reset node" (e.g. C0358 = 1, 📖 90). – switching off and on again the low-voltage supply.	📖 78
2.	Set CAN node address at the power supply module and at each axis module.	**Each address can be used only once in the network!** ● Setting via DIP switch (S1) or C0350 ● Lenze setting power supply module: 32 ● Changes are accepted after – a "reset node" (e.g. C0358 = 1, 📖 90). – switching off and on again the low-voltage supply.	📖 78
3.	Set identifier for process data communication.	Setting via ● C0353 ● C0354	📖 82
	The master sets the system bus (CAN) to the "Operational" status.		
4.	If necessary, adapt further codes to your application.	● Master/slave operation: C0352 ● Mode for the process data transfer: – C0360 = 1: cyclic (sync-controlled), 📖 151) – C0360 = 0: event-controlled/cyclic without sync (📖 149) ● Boot up time/cycle time for process data transfer: C0356 ● "Node Guarding": C0352, C0382, C0383, C0384	📖 84 📖 85 📖 86 📖 88
5.	Set input X6/DI2 to HIGH.	If the power supply module is ready for operation, output X6/DO1 is set to HIGH.	
6.	Set input X6/DI1 to HIGH.	Charging is enabled.	
7.	Specify control word.	● Reset bit must be set to "0" in the first telegram. ● Transmit control word via CAN word 0. ● Initialise toggle bit or deactivate monitoring.	📖 91 📖 104
8.	Transmit sync telegram (optional).	Sync telegram will be only received by the power supply module if C0360 = 1 (📖 85).	
9.	Specify control word.	● Reset bit (LOW active) must be set to "1" to switch on the power supply module. ● Set controller enable bit to "1" if output X6/DO1 is to be set to HIGH when ready for operation.	📖 91
10.	Transmit sync telegram (optional).	See 8.	

After some seconds the earth-fault test is complete and the DC bus is charged.

The power supply module is now ready for operation (status word 1 / bit 0 = 1 (📖 92)).

6.1.3 Control via digital inputs

Note!
Follow the commissioning steps in the given order!

	Setting	Brief description	Detailed information
	Initial state: ● Basic settings completed. ● C0001 = 1		📖 59
1.	Set input X6/DI2 to HIGH.	Output X6/DO1 is set to HIGH when the module is ready for operation.	
2.	Set input X6/DI1 to HIGH.	Charging process is started.	

After some seconds the earth-fault test is complete and the DC bus is charged.

The power supply module is now ready for operation (status word 1 / bit 0 = 1 (📖 92)).

6.1.4 Operation via EtherCAT with master control

Note!
Follow the commissioning steps in the given order!

	Setting	Brief description	Detailed information
	Conditions	● EMF2192IB EtherCAT module is plugged onto the AIF interface (X1). ● Basic settings completed. ● C0001 = 2	📖 59
1.	Parameterise EtherCAT module.	Detailed information can be found in the **EMF2192IB (EtherCAT) communication manual**.	
2.	Switch on monitoring of the AIF communication (CE0). (optional)	Set C0126 = 0 (TRIP). ● CE0: Communication error on the automation interface (AIF)	
3.	Set EtherCAT module to ”Operational”.		
4.	Set input X6/DI2 to HIGH.	If the power supply module is ready for operation, output X6/DO1 is set to HIGH.	
5.	Set input X6/DI1 to HIGH.	Charging is enabled.	
6.	Specify control word.	A Reset bit must be set to ”0” in the first telegram.	
		B Specify control word via AIF.	
		Note: If AIF control is used it is not required to operate a toggle bit (not implemented).	
		C Reset bit (LOW active) must be set to ”1” to switch on the power supply module.	
		D Set controller enable bit to ”1” if output X6/DO1 is to be set to HIGH when ready for operation.	

After some seconds the earth-fault test is complete and the DC bus is charged.

The power supply module is now ready for operation (status word 1 / bit 0 = 1 (📖 92)).

6.2 Setting the mains voltage

The correct mains voltage must be set in the power supply module to ensure correct operation. The Lenze setting is the automatic adaptation of the switching thresholds for the brake chopper operation using the mains voltage measured (C0173 = 4). Optionally, also fixed values can be set.

► C0173 can be found in the GDC parameter menu (📖 72) under **Short setup**.



Stop!

Inhibit the power supply module before setting the mains voltage:

► Control bit 1 (STE_RESET) = 0

► Digital input X6/DI1 = LOW

Parameterisation of the connected axis modules:

► Set the DC bus voltage thresholds of the connected axis modules via axis module code C0173 according to the mains voltage used.

► Parameterise the charge relay function of the connected axis modules with C0175 = 3.

► Please observe the notes given in the detailed documentation on the axis modules!

Parameter	Designation	Data type: INTEGER_32
C0173	**Mains voltage selection**	Index: $24402_{dec} = 5F52_{hex}$

Mains voltage selection
📖 64

Selection list (Lenze setting printed in bold)		Information
	No response	
0	Operation on 230 V mains	
1	Operation on 400 V mains	
2	Operation on 460 V mains	
3	Operation on 480 V mains	
4	**Automatic determination**	

Switching thresholds for DC bus voltage and brake resistor

Depending on the mains voltage set in C0173, there are the following switching thresholds for the DC-bus voltage:

Value in C0173	Mains voltage [V]	DC-bus voltage [V]		
		Brake resistor		OU error (overvoltage threshold)
		On	Off	
0	230	380	370	880
1	400 ... 460	735	720	
2				
3	480	765	750	
4	180 ... 260	380	370	
	261 ... 528	765	750	

6.3 Setting chopper operation and short-circuit braking

The ”short-circuit braking” function serves to rapidly discharge the DC bus via the brake resistor. For this, the brake chopper IGBT is switched on permanently. The low-voltage supply of the power supply module must be ensured for this purpose.



Stop!

Pay attention to the kinetic energy of permanent-magnet synchronous motors during short-circuit braking!

Observe when short-circuit braking is deactivated:

- ► Rapid discharge of the DC bus via the brake resistor is not possible.
- ► For rapid discharge of the DC bus parameterise the charge relay function of the connected ECS axis modules with C0175 = 3.
- ► For the earth-fault test the DC bus is discharged via the brake resistor after switching on the low-voltage supply, independently of the settings.
- ► The discharging time depends on the entire DC bus circuit.

Observe when brake chopper IGBT is switched off:

During operation in generator mode

- ► overvoltage can occur in the DC bus.
- ► energy cannot be discharged from the DC bus.

- ► This function is carried out automatically with most error messages (📖 95) but it can also be requested via the master control system or manually.
- ► As the DC bus must be safely disconnected from the mains for short-circuit braking, the brake chopper IGBT is switched on with a delay of approx. 150 ms after the short-circuit braking request.
- ► The power supply enable input X6/DI1 can be configured in such a way that short-circuit braking is triggered with a LOW level (📖 66).
- ► The control bit 2 (STE_KSB) can be set by the control system when bus control is used (📖 91).
- ► In the case of manual operation (C0001 = 1), the STOP key of the keypad XT can also be configured to short-circuit braking via C0469.

The short-circuit braking function can be activated in the GDC parameter menu (📖 72) under **Short setup** via C0127.

Parameter	Designation	Data type: INTEGER_32
C0127	**Function of integrated brake transistor**	Index: $24448_{dec} = 5F80_{hex}$

Activation of brake chopper IGBT/fast discharge function (short-circuit braking)
📖 65

Selection list (Lenze setting printed in bold)		**Information**
0	**Brake chopper and short-circuit braking**	
1	Only brake chopper	
2	Only fast discharge function (short-circuit braking)	
4	Without function	

6.4 Configuring power supply enable input

A HIGH level at the power supply enable input X6/DI1 enables the charging of the DC bus.

Even if the control is carried out via the system bus (CAN), the input must be set to HIGH level to charge the DC bus.

The reaction of the power supply module to a low level or falling edge at X6/DI1 can be set under C0468.

► C0468 can be found in the GDC parameter menu (📖 72) under **Digital I/O**.

Parameter	Designation	Data type: INTEGER_32
C0468	**Function of power supply enable (X6/DI1)**	Index: $24107_{dec} = 5E2B_{hex}$

Setting of power supply enable via terminal X6/DI1
Note: The parameters can only be changed if the controller is inhibited.
📖 66

Selection list (Lenze setting printed in bold)		**Information**
0	Mains disconnection (slow discharge)	
1	**Mains disconnection and TRIP-RESET**	
2	Mains disconnection and quick discharge (short-circuit braking)	
4	Mains disconnection, quick discharge (short-circuit braking), and TRIP-RESET	

Note!

Mains voltage dips can be reduced by decreasing the max. charging current limit (C0022).

► C0022 can be found in the GDC parameter menu (📖 72) under **Short setup**.

Parameter	Designation	Data type: INTEGER_32
C0022	**Max. charging current after power supply enable**	Index: $24553_{dec} = 5FE9_{hex}$

Setting of the maximum charging current after power supply enable

Setting range (min. value | unit | max. value)			**Lenze setting**
2.0	A	25.0 ECSxE040: 32.0 (from firmware V4.0)	**16.0 A**

STOP key of the keypad XT

The STOP key only functions if controlled via digital inputs (C0001 = 1).

► The function of the STOP key can be set in the GDC parameter menu (📖 72) under **Keypad configuration** via C0469.



Stop!

Do not change the function of the STOP key if the STOP function has previously been activated by pressing the STOP key. The device cannot be restarted in this case.

Parameter	Designation	Data type: INTEGER_32
C0469	**Function of "STOP" keypad key for ECSxE**	Index: $24106_{dec} = 5E2A_{hex}$

Setting of the "STOP" keypad key function of the ECSxE power supply module
Note: The parameters can only be changed if the controller is inhibited.

Selection list (Lenze setting printed in bold)		**Information**
0	No function	
1	**Mains disconnection (slow discharge)**	
2	Quick discharge (short-circuit braking)	

6.5 Operation with external brake resistor

When an external brake resistor is used, monitoring of the internal brake resistor (OC6) must be deactivated with C0579 = 3.

► C0579 can be found in the GDC parameter menu (📖 72) under **Short setup** and **Monitoring**.



Stop!

The device can be destroyed if the monitoring is deactivated while the internal brake resistor is used.

Parameter	Designation	Data type: INTEGER_32
C0579	**Response - monitoring of internal brake resistor (OC6)**	Index: $23996_{dec} = 5DBC_{hex}$

Monitoring response of the internal brake resistor (fault message OC6)
📖 102

Selection list (Lenze setting printed in bold)		**Information**
0	**TRIP**	
3	No response	

6.6 After mains switch-on

The mains voltage detection will be enabled when the low-voltage supply is switched on.

The following data are continuously recorded:

- Mains voltage amplitude
- Mains phase sequence
- Mains frequency
- Balance of the mains

7 Parameter setting

7.1 General information

- Controllers and power supply modules can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter ”Commissioning” (📖 57).
- The parameters for the functions are stored in numbered codes:
  – The codes are marked in the text with a ”C”.
  – The code table in the appendix (📖 120) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a ”reference book”.

Parameter setting with XT keypad or PC/laptop

Detailed information on parameter setting with the XT keypad can be found in the following chapters.

Detailed information ...

on the parameterisation by means of a PC/laptop can be found in the documentation for the ”Global Drive Control” (GDC) parameterisation and operating program.

In addition to parameter setting, the XT keypad or PC/laptop serves to:

- Control the controller (e. g. inhibiting or enabling)
- Select the setpoints
- Display operating data
- Transfer parameter sets to other controllers (only with PC/laptop).

Parameter setting with a bus system

Detailed information ...

on the parameterisation with a bus system can be found in the documentation of the communication module to be applied (📖 160).

7.2 Parameter setting with ”Global Drive Control” (GDC)

With the ”Global Drive Control” (GDC) parameterisation and operating program, Lenze provides a plain, concise and compatible tool for the configuration of your application-specific drive task with the PC or laptop:

- The GDC input assistant offers a comfortable motor selection.
- The menu structure supports the commissioning process by its clear structuring.

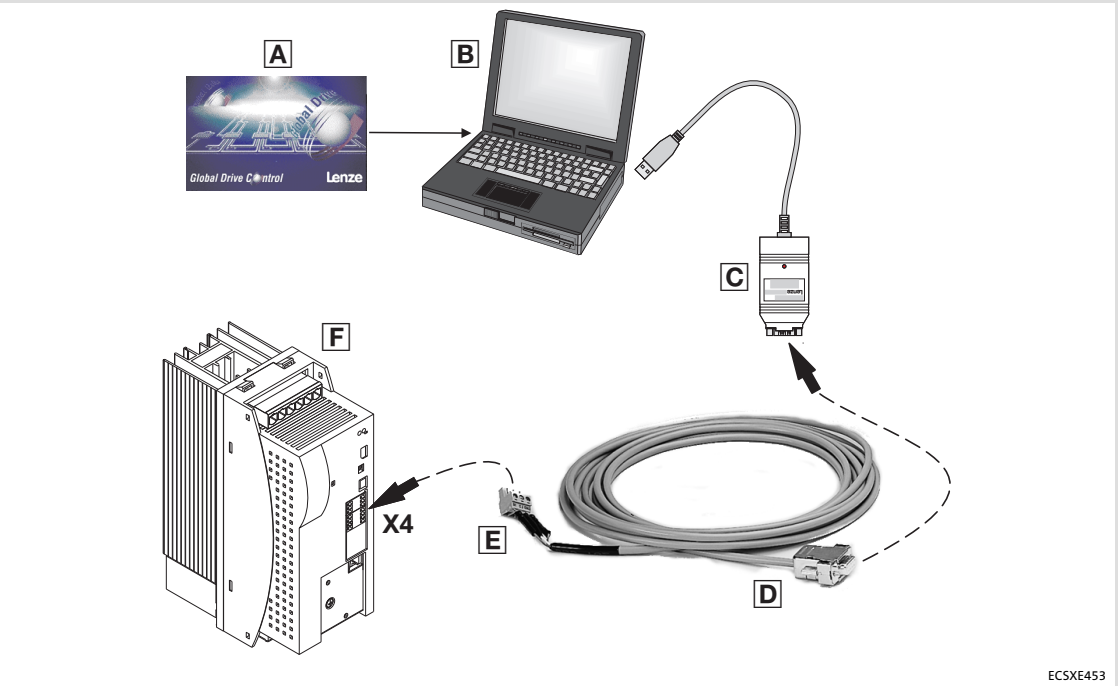


Fig. 7-1 Using the GDC

- A Lenze parameter setting program ”Global Drive Control” (GDC)
- B PC or laptop
- C PC system bus adapter (EMF2173IB/EMF2177IB) with connection cable
- D Sub-D plug with 3-pole cable
- E 3-pole plug (CAG – CAL – CAH) from connector set ECSZE000X0B
- F Power supply module ECSxE

More detailed information ...

is given in the documentation on the parameter setting and operating program **Global Drive Control (GDC)**.

GDC parameter menu

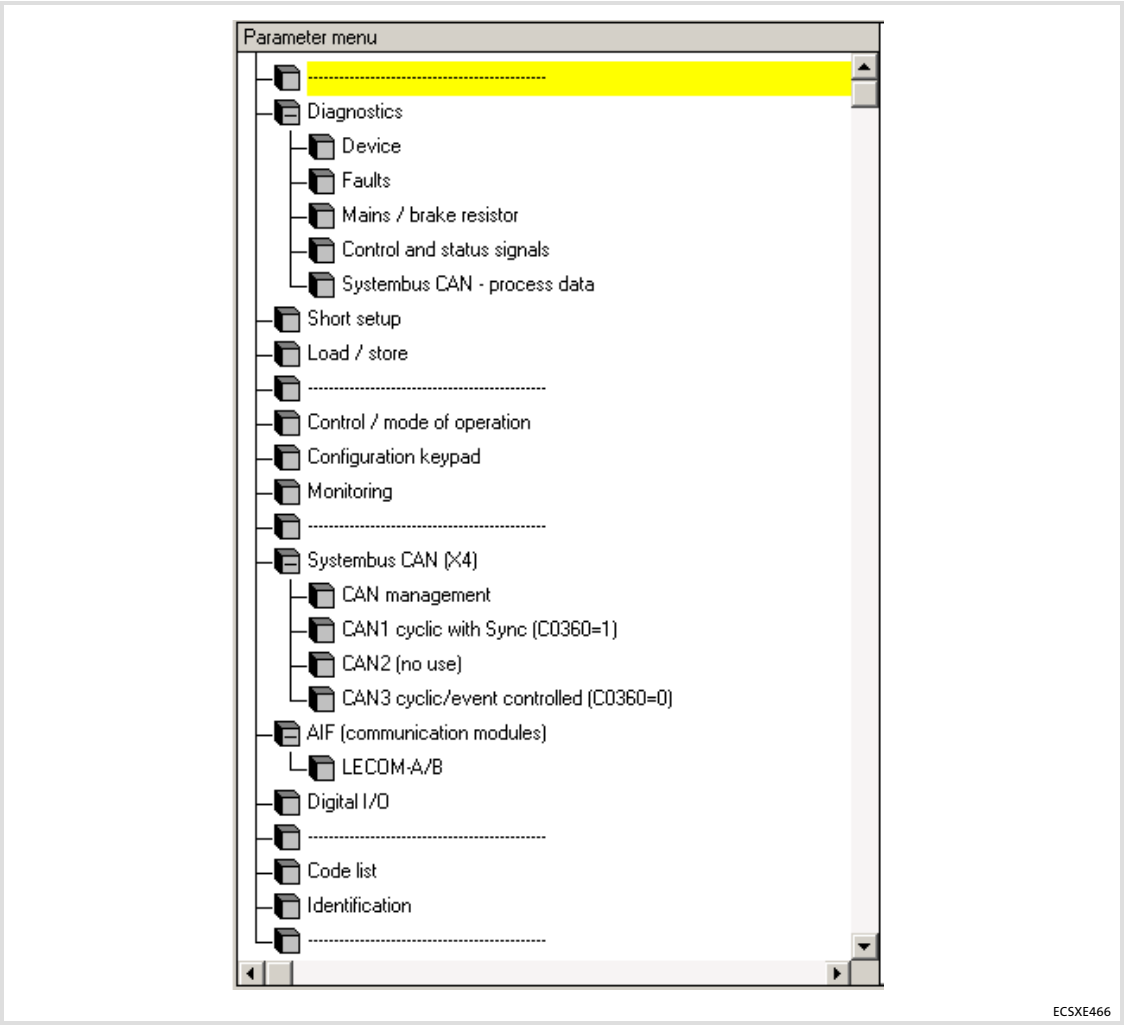


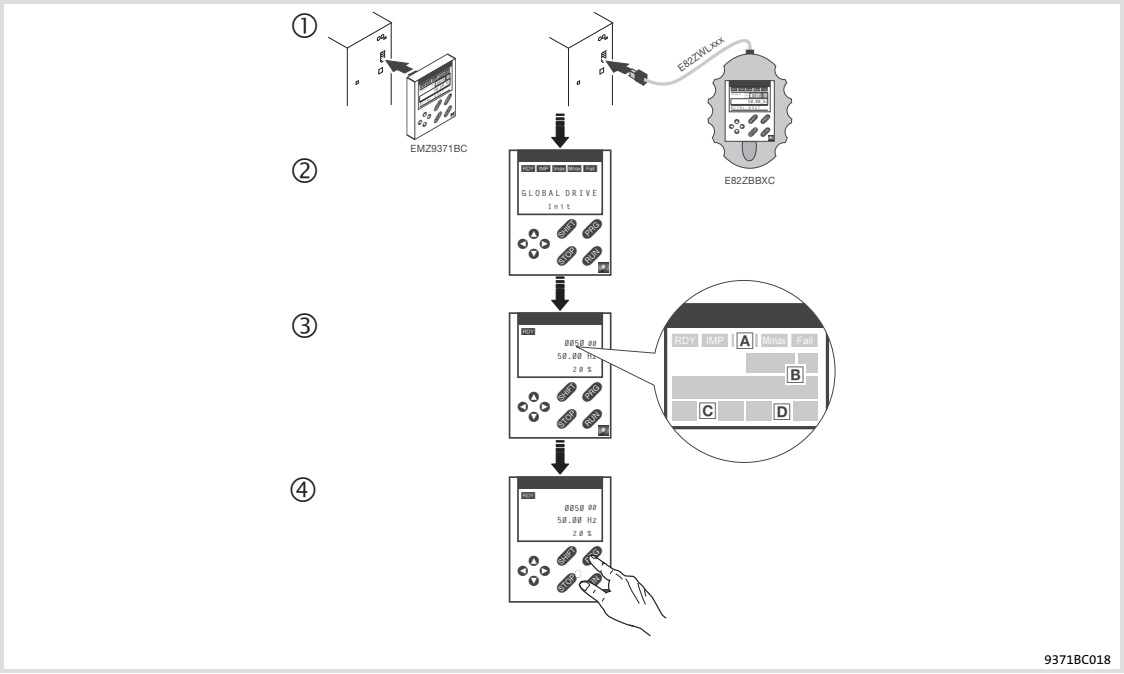
Fig. 7-2 GDC parameter menu in case of ECSxE power supply module

By double-clicking the single menu items of the GDC parameter menu the corresponding codes for setting and display of parameters are indicated.

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as accessories.
A complete description is given in the documentation on the keypad.

7.3.1 Connecting the keypad



① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad 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 status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined under C0004
④ PRG must be pressed to leave the operation level.

7.3.2 Description of the display elements

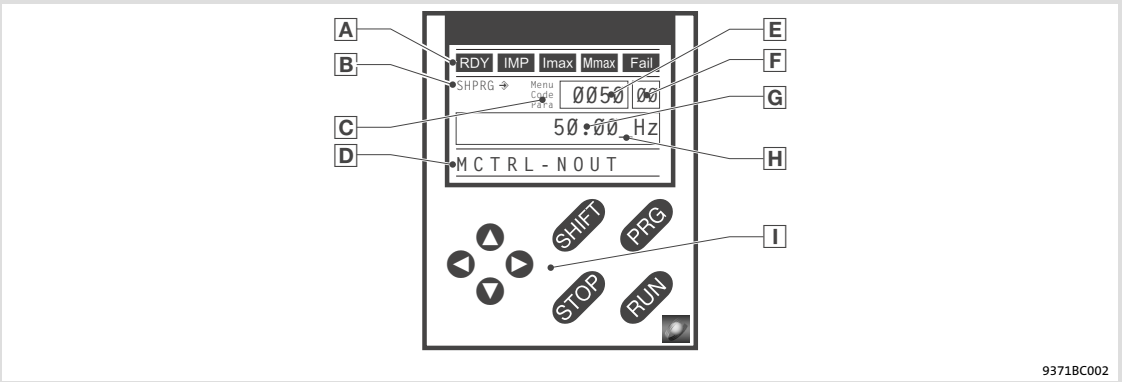


Fig. 7-3 Keypad front view

A	**Status displays**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit active	Power outputs inhibited
	Imax	Adjusted current limitation is exceeded in motor mode or generator mode	
	Mmax	Speed controller 1 within its limitation	• Drive is torque-controlled • Only active for operation with Lenze devices of the 9300 series!
	Fail	Active fault	
B	**Parameter acceptance**		
	Display	**Meaning**	**Explanation**
	→	Parameter is accepted immediately	The device immediately operates with the new parameter value.
	SHPRG →	The parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after being confirmed.
	SHPRG	When the controller is inhibited, the parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after the controller has been released again.
	None	Display parameters	Cannot be changed.
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Active menu level	• Selection of main menu and submenus • No menu for ECSxE power supply module
	Code	Active code level	Selection of codes and subcodes
	Para	Active parameter level	Change of parameters in the codes or subcodes
	None	Active operating level	Display of operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	Alphanumerical	Contents of the menus, meaning of the codes and parameters	
		Display of C0004 in % and the active fault in the operating level	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Two-digit subcode number	
G	**Parameter value**		
	Parameter value with unit		
H	**Cursor**		
	The figure over the cursor can be changed directly in the parameter level.		
I	**Function keys**		
	For description see the following table.		

7.3.3 Description of the function keys

Note!

Key combinations with SHIFT:
Press SHIFT and keep it pressed, then press second key in addition.

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

1) No menu for ECSxE power supply module
2) Only active when operating Lenze devices of the 8200 vector or 8200 motec series.

7.3.4 Changing and saving parameters

All parameters for the axis module/power supply module parameterisation or monitoring are stored in codes. The codes are numbered and marked with a ”C” in the documentation. Some codes store the parameters in numbered ”subcodes” to provide a clear structure for parameter setting (e.g. C0517 user menu).

Stop!

Your settings have an effect on the current parameters in the main memory. You must store your settings as a parameter set to prevent that they will get lost when switching the mains!

Step			Keys	Action
1.	Select menu		▲▼▶◀	Select the desired menu with arrow keys.
2.	Change to code level		▶	Display of first code in the menu
3.	Select code or subcode		▼▲	Display of the current parameter value
4.	Change to parameter level		PRG	
5.	If SHPRG is displayed, inhibit controller		STOP	The drive is coasting.
6.	Change parameter			
		A	▶◀	Move cursor under the digit to be changed
		B	▼▲	Change digit
			SHIFT ▼ SHIFT ▲	Change digit quickly
7.	Accept changed parameter			
	Display SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept parameter Display ”OK”
	Display →		-	The parameter was accepted immediately.
8.	If necessary, enable controller		RUN	The drive should be running again.
9.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display of the code with changed parameters
10.	Change further parameters			Restart the ”loop” at step 1. or step 3.
11.	Save changed parameters			
		A	▲▼▶◀	Select Code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to parameter level Display ”0” and ”Ready”
	Select parameter set in which the parameters are to be saved permanently	C	▶	Save as parameter set 1: ⇨ set ”1” ”Save PS1”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved.
12.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display C0003 ”PAR SAVE”

8 Configuring system bus (CAN)

The drive system can be adapted to your application by configuring the power supply module. These interfaces can be used to configure the power supply module:

- X1 – AIF (automation interface)
  - For the connection of the keypad XT or communication modules (📖 160) which serves to access the codes.
- X4 – System bus interface (CAN)
  - PC interface/HMI for parameter setting and diagnostics (e.g. with the Lenze parameter setting and operating program ”Global Drive Control”)
    or
  - Interface to a decentralised I/O system

The codes for configuring the system bus (CAN) can be found in the GDC parameter menu (📖 72) under **system bus (CAN)**.

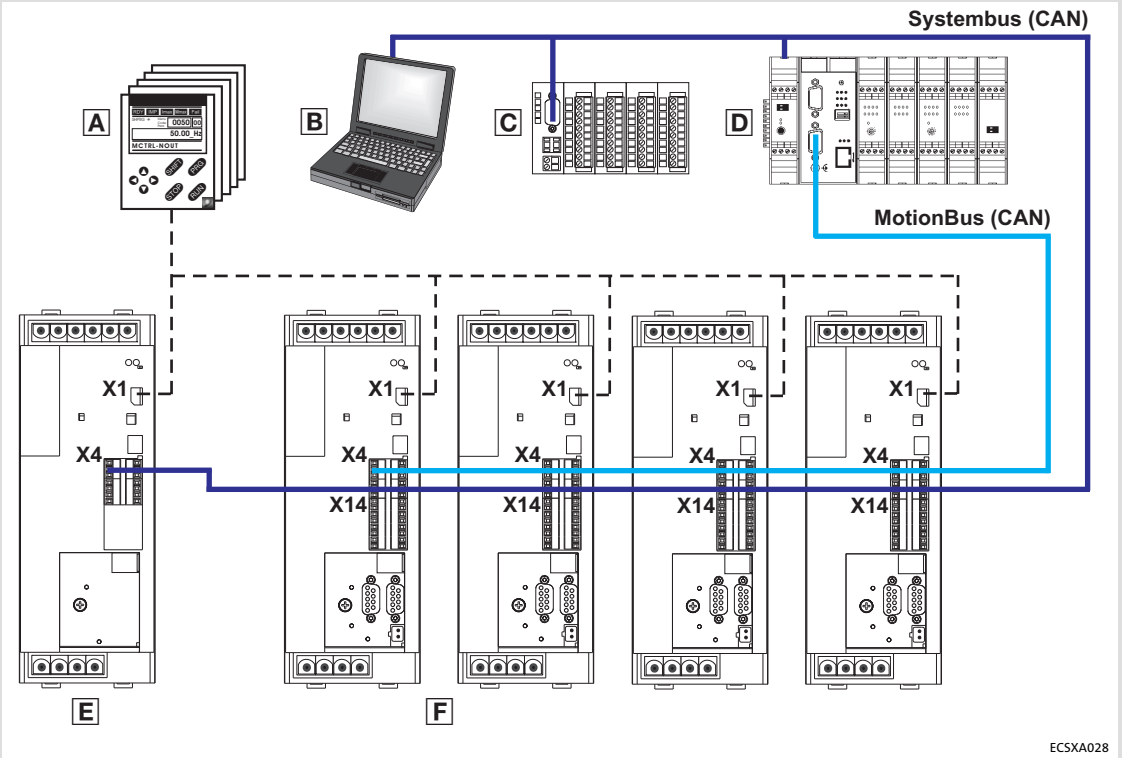


Fig. 8-1 Example: Wiring of the MotionBus (CAN) and system bus (CAN)

- A Keypad XT or another communication module
- B PC/laptop or HMI
- C Decentralised I/O system
- D Higher-level host system / MotionBus control
- E ECSxE... power supply module
- F ECSxS/P/M/A... axis module

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 141).

8.1 Setting the CAN node address and baud rate

The CAN node address and baud rate can be set via the DIP switch (S1) or via C0350/C0351.

- If one of the (address) switches 2 ... 7 of the DIP switch is switched on (ON) and the low-voltage supply is connected, the setting of the DIP switch is evaluated and entered into C0350 (CAN node address) and C0351 (baud rate).
- If the (address) switches 2 ... 7 are switched off (OFF), the switch position is not evaluated. The node address and the baud rate are then taken from C0350 and C0351.
- The switch 1 of the DIP switch has no function.

8.1.1 Settings via DIP switch

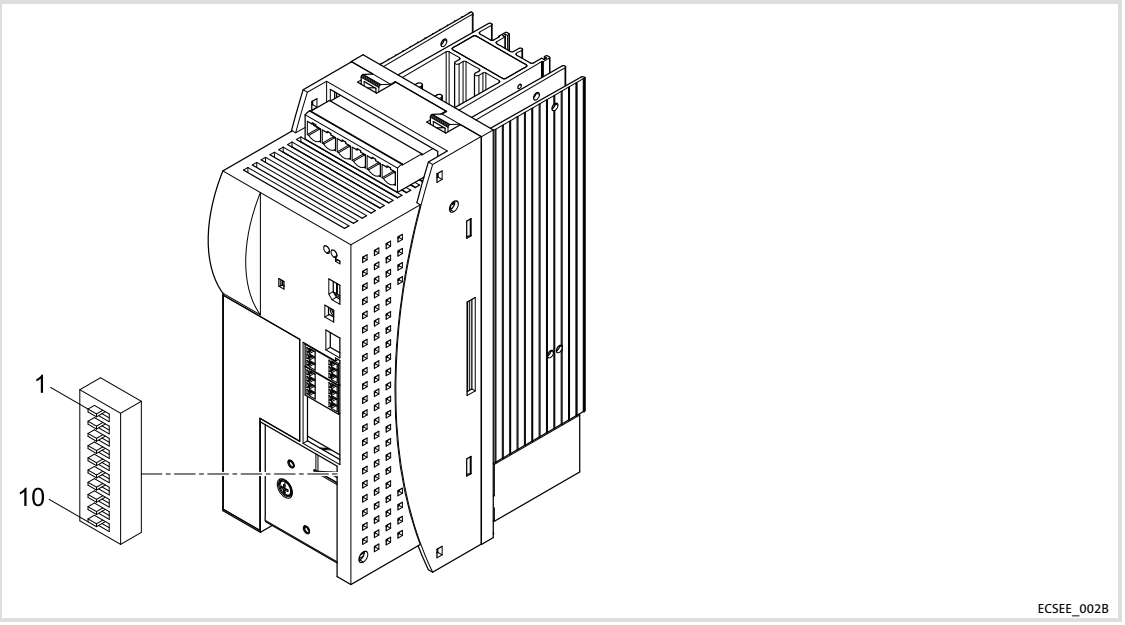
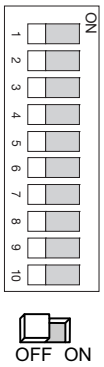


Fig. 8-2 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

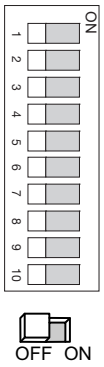
The node address is set with the switches 2 ... 7 of the DIP switch. The switches are assigned to certain valencies. The sum of the valencies make the node address to be set (see example).

Switch		Valency	Example	
			Switching status	Node address
	S1	**No function**	-	-
	S2	32	**ON**	32 + 16 + 8 = **56**
	S3	16	**ON**	
	S4	8	**ON**	
	S5	4	OFF	
	S6	2	OFF	
	S7	1	OFF	

Baud rate setting

Note!

The baud rate must be set identically for all CAN nodes.

Switch		Baud rate [kbit/s]				
		1000	500	250	125	50
	8	**ON**	OFF	OFF	OFF	OFF
	9	OFF	OFF	OFF	**ON**	**ON**
	10	OFF	OFF	**ON**	OFF	**ON**

8.1.2 Settings via codes

Note!

- The settings in C0350 (CAN node address) and C0351 (baud rate) are only used if the (address) switches **2 ... 7** of the DIP switch **S1** are switched off (OFF).
- If only one (address) switch **2 ... 7** is switched on (ON), the settings of the DIP switch **S1** usually apply.
- The baud rate (C0351) must be set identically for all CAN bus nodes.
- If the Lenze setting has been loaded via C0002,
  – C0351 is set to 0 (500 kbit/s);
  – you have to reset the baud rate (C0351) and the CAN node address (C0350).

Parameter	Designation	Data type: INTEGER_32
C0350	**CAN node address**	Index: $24225_{dec} = 5EA1_{hex}$

Setting of the CAN node address

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 78)
- After the setting, a reset node is required.
- Each CAN node must be assigned a definite node address.

Setting range (min. value | unit | max. value)			**Lenze setting**
1		63	**32**

Parameter	Designation	Data type: INTEGER_32
C0351	**CAN baud rate**	Index: $24224_{dec} = 5EA0_{hex}$

Entry of the CAN baud rate

Note:

- The baud rate must be set identically for all CAN nodes.
- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 78)
- After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**500 kbps**	
1	250 kbps	
2	125 kbps	
3	50 kbps	
4	1000 kbps	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.2 Individual addressing

C0353 can be used to determine whether the identifier (COB-ID) is created from a basic identifier (📖 158) plus the node address in C0350 or individually with an "ID offset" as follows:

Identifier (COB-ID) = 384 + ID offset (C0354)

The "ID offset" can be defined via C0354.



Note!

The identifier for the process data input (CANx-IN) must be set the same as the identifier of the transmitting process data output (CANx-OUT) to receive the respective PDO telegram.

Parameter	Designation	Data type: INTEGER_32
C0353	**Mode CAN_IN/OUT ID creation (COB-IDs)**	Index: $24222_{dec} = 5E9E_{hex}$

C0353 can be used to determine whether the identifier (COB-ID) is created from the basic identifier plus the node address in C0350 or individually with an ID offset in C0354.

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON".
- After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**COB-ID = basic identifier + C0350**	📖 158
1	COB-ID = 384 + C0354	📖 82

Subcodes	**Information**
C0353/1	ID creation CAN1_IN/OUT (cyclic operation (sync-controlled))
C0353/2	ID creation CAN2_IN/OUT (reserved)
C0353/3	ID creation CAN3_IN/OUT (event-controlled/cyclic operation without sync)

Parameter	Designation	Data type: INTEGER_32
C0354	**CAN_IN/OUT ID offset**	Index: $24221_{dec} = 5E9D_{hex}$

ID offset for calculating individual COB-IDs: COB-ID = 384 + ID offset
📖 82

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON".
- After the setting, a reset node is required.

Setting range (min. value | unit | max. value)		
0		513

Subcodes	**Lenze setting**	**Information**
C0354/1	32	ID offset for COB-ID CAN1_IN
C0354/2	160	ID offset for COB-ID CAN1_OUT
C0354/3	288	ID offset for COB-ID CAN2_IN
C0354/4	289	ID offset for COB-ID CAN2_OUT
C0354/5	416	ID offset for COB-ID CAN3_IN
C0354/6	417	ID offset for COB-ID CAN3_OUT

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

Display of the resulting identifiers

C0355 is the display code for the resulting identifiers:

- General addressing (📖 158):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 82):
  Identifier (COB-ID) = 384 + ID offset (C0354)

Parameter	Designation	Data type: INTEGER_32
C0355	**CAN_IN/OUT identifier (COB-IDs)**	Index: $24220_{dec} = 5E9C_{hex}$

Display of the CAN_IN/OUT identifiers (COB-IDs)
📖 83

Display range (min. value | unit | max. value)		
0		2047

Subcodes	Information
C0355/1	COB-ID CAN1_IN
C0355/2	COB-ID CAN1_OUT
C0355/3	COB-ID CAN2_IN
C0355/4	COB-ID CAN2_OUT
C0355/5	COB-ID CAN3_IN
C0355/6	COB-ID CAN3_OUT

8.3 Determining the boot-up master for the drive system

If the bus initialisation and the related state change from ”Pre-Operational” to ”Operational” is not carried out by a higher-level host system (PLC), another node can be determined as boot-up master to carry out this task.

The master functionality is only required for the initialisation phase of the drive system. C0356 serves to set a boot up time for the master for the initialisation phase (📖 86).

By means of the NMT telegram *start_remote_node* (broadcast telegram) **all** nodes are shifted to the NMT-state ”Operational” by the master. A data exchange via the process data objects can only be effected in this state.

The configuration is carried out via C0352.

Parameter	Designation	Data type: INTEGER_32
C0352	**CAN master/slave boot-up configuration**	Index: $24223_{dec} = 5E9F_{hex}$

Master/slave configuration for CAN bus interface X4
📖 84
Note: After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		Information
0	**Slave**	
1	Master (CAN network PDO enable)	
2	Slave node guarding	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.4 Setting the mode for process data transfer

The process data can be transmitted cyclically (sync-controlled, 📖 150) via CAN1_IN/OUT or event-controlled/cyclically without sync (📖 151) via CAN3_IN/OUT.

The configuration is carried out via C0360.

Parameter	Designation	Data type: INTEGER_32
C0360	**CAN PDOs/mode selection**	Index: $24215_{dec} = 5E97_{hex}$

Selection of CAN PDOs/mode for the process data transfer via the system bus (CAN)
📖 85

Selection list (Lenze setting printed in bold)		**Information**
0	No response	event-controlled/cyclic without sync
1	**CAN1_IN/OUT**	cyclic (sync-controlled)

8.5 Setting the boot-up time/cycle time

Boot-up time (C0356/1) setting

In a CAN network without higher-level control (PLC), a bus node (boot-up master) has to initialise the CAN network. If the 24 V low-voltage supply is switched on, the boot-up time elapses. After the boot-up time has elapsed, the NMT telegram for initialising the CAN network is sent by the boot-up master and the process data transfer is started.

- Only valid if C0352 = 1 (master).
- Normally the Lenze setting (3000 ms) is sufficient.
- State change from ”Pre-operational” to ”Operational”

Cycle time for process output data CAN2_OUT (C0356/2)

Transmission cycle time (in ms) for the process data object CAN2_OUT (diagnostics PDO C0390, (📖 94))

Cycle time for process output data CAN3_OUT (C0356/3)

Transmission cycle time (in ms) for the process data object CAN3_OUT in cyclic operation (without sync)

- Setting ”0” = event-controlled data transmission
  The output data will only be sent if a value in the output object changes.

Activation delay for process output data (C0356/4)

Delay time (in ms) for initial transmission of the process data object CAN3_OUT after the CAN bus changed from Pre-Operational” to ”Operational” NMT state.

After the delay time has elapsed, the process data object CAN3_OUT is sent for the first time.

Parameter	Name	Data type: INTEGER_32
C0356	**CAN time settings**	Index: $24219_{dec} = 5E9B_{hex}$

Setting of the ...
- Boot-up time
- Cycle time
- Activation delay

📖 86

Setting range (min. value | unit | max. value)		
0	ms	65000

Subcodes	Lenze setting	Information
C0356/1	3000 ms	CAN boot-up time ● Delay time after mains connection for the initialisation by the master. ● Only valid if C0352 = 1 (master).
C0356/2	0 ms	Cycle time for CAN2_OUT ● Diagnostics PDO C0390 (📖 94)
C0356/3	0 ms	Cycle time for CAN3_OUT ● Factor to task time for process data telegram transmission. ● 0 ms = event-controlled data transmission (the output data will only be transmitted if a value changes in the output object)
C0356/4	20 ms	Delay time for initial transmission of the process data object CAN3_OUT after the CAN bus changes to ”Operational”

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

► Renewed switch-on of the 24 V low-voltage supply

► Reset node via the bus system (by the network management (NMT))

► Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.6 Node guarding

The ”Node Guarding” function is implemented as of operating system V3.0.

In case of cyclic node monitoring (Node Guarding) the CAN master regularly enquires the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is enabled (fault message ”NodeGuard Trp/Msg/Wrn”).

Settings

In order that the power supply module takes over the function of the ”Node Guarding Slave”, make the following settings:

1. Set C0352 = 2.
   (The power supply module is configured as ”Node Guarding Slave”.)
2. Set the time interval of the status enquiry by the master (Node Guard Time) via C0382.
3. Set the factor for the monitoring time (Node Life Time Factor) via C0383.

   Node Life Time = Node Guard Time (C0382) · Node Life Time Factor (C0383)
4. Set the response to a ”Life Guarding Event” via C0384.

Parameter	Designation	Data type: INTEGER_32
C0352	**CAN master/slave boot-up configuration**	Index: $24223_{dec} = 5E9F_{hex}$

Master/slave configuration for CAN bus interface X4
📖 84
Note: After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**Slave**	
1	Master (CAN network PDO enable)	
2	Slave node guarding	

Parameter	Designation	Data type: INTEGER_32
C0382	**CAN Node Guarding: ”Node Guard Time”**	Index: $24193_{dec} = 5E81_{hex}$

Setting of the time interval for the status enquiry from the master
- Only relevant if C0352 = 2.

📖 88

Setting range (min. value | unit | max. value)			**Lenze setting**
0	ms	65535	**0 ms**

Parameter	Designation	Data type: INTEGER_32
C0383	**CAN Node Guarding: "Node Life Time Factor"**	Index: $24192_{dec} = 5E80_{hex}$

Factor for monitoring time "Node Life Time"
- Node Life Time = C0383 x C0382
- Only relevant if C0352 = 2.

📖 88

Setting range (min. value | unit | max. value)			Lenze setting
0		255	**0**

Parameter	Designation	Data type: INTEGER_32
C0384	**Response - CAN node guarding**	Index: $24191_{dec} = 5E7F_{hex}$

Response to a "Life Guarding Event"if no node guarding telegram has been received during "Node Life Time" (C0382 x C0383).
- When C0382 = 0 or C0383 = 0, the monitoring function is not active (no node guarding fault message is enabled).
- Only relevant if C0352 = 2.

📖 88

Selection list (Lenze setting printed in bold)		Information
0	TRIP	
1	Message	
2	Warning	
3	**Off**	

8.7 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 78)
- Changes of the addresses of process data objects (COB-IDs)
  - General addressing (📖 158)
  - Individual addressing (📖 82)
- Change of the master/slave boot up configuration (📖 84)

A reset node can be made by:

- Switching on again the low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1 by means of keypad XT
  - If the reset node is executed via GDC, the communication will be interrupted as a matter of principle. Thus, it is required to log in again manually or to research the devices connected to the bus.

Parameter	Designation	Data type: INTEGER_32
C0358	**CAN reset node**	Index: $24217_{dec} = 5E99_{hex}$

Make a reset node for the CAN bus node.
📖 90

Selection list (Lenze setting printed in bold)		**Information**
0	**No function**	
1	CAN reset	

8.8 Assignment of the control word

Control word to the power supply module (display in C0130)

Byte	Bit	Name	Meaning
LOW	0	STE_TOGGLE	Toggle bit: Bit state change as a ”sign of life” of the control
	1	STE_RESET	0: Reset fault message 1: Active fault message
	2	STE_KSB	0: No short-circuit braking (KSB) 1: Carry out short-circuit braking (KSB)
	3	STE_REGLERFREIGABE	0: X6/DO1 always LOW 1: X6/DO1 is HIGH if the power supply module is ready for operation and the input X6/DI2 is HIGH.
	4 ... 7	Free	
HIGH	8 ... 10	Reserved	
	11 ... 15	Free	

8.9 Assignment of status words

Status word 1 (display in C0131)

Byte	Bit	Name	Meaning
LOW	0	STA1_BTB	0: Power supply module not ready for operation 1: Status message: ready for operation
	1	STA1_WARNUNG	0: No warning active 1: At least one warning active
	2	STA1_MELDUNG	0: No message active 1: At least one message active
	3	STA1_TRIP	0: No TRIP active 1: At least one TRIP active
	4	STA1_KSB_FAIL	0: OK 1: No short-circuit braking possible because DC bus charged externally.
	5	STA1_KSB_AKTIV	0: Normal operation 1: Short-circuit braking active
	6	STA1_K1_EIN	0: -UG relay open 1: -UG relay closed (switched-on)
	7	STA1_K2_EIN	0: +UG relay open 1: +UG relay closed (switched-on)
HIGH	8 ... 10	Reserved	
	11	STA1_DI1	0: Terminal mains enable (x6/DI1) LOW 1: Terminal mains enable (x6/DI1) HIGH
	12	STA1_DI2	0: Terminal controller enable (X6/DI2) LOW 1: Terminal controller enable (X6/DI2) HIGH
	13	STA1_TOGGLE	Feedback of received toggle bit (as of operating software V2.3)
	14 15	Free	

Status word 2 (display under C0132)

The current fault number is transferred in status word 2 (📖 117).

8.10 Diagnostics codes

8.10.1 CAN bus status (C0359)

C0359 serves to query the current CAN bus status.

If the status of the system bus (CAN) is ”Operational”, you can use C0866 and C0868 to check the contents of the data words sent and received via CAN1_IN/OUT.

Value in C0359	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-operational	Only parameters (codes) can be transmitted via the bus system. A data exchange between nodes is not possible. A special signal on the system bus (CAN) serves to change to the ”Operational” status. The status can be changed from “pre-operational” to “operational” by one of the following actions: ● Master functionality of a higher-level host ● If a node is determined as master via C0352, the operating status is automatically changed for the entire drive system after the set boot-up time has elapsed (C0356/1), when power is switched on. ● Reset node (📖 90)
2	Warning	Faulty telegrams have been received. The node remains passive and does not send any data. Possible causes: ● Missing bus termination ● Insufficient shielding. ● Potential differences in the grounding of the control electronics ● Bus load is too high. ● Node is not connected to the system bus (CAN).
3	Bus off	Too many faulty telegrams: The node has disconnected from the system bus (CAN). It can be reconnected by: ● Mains reconnection ● Reset node (📖 90) ● Reset of the fault message CE4 (TRIP-RESET)

Parameter	Designation	Data type: UNSIGNED_16
C0866	**Process data input words CAN1_IN**	Index: $23709_{dec} = 5C9D_{hex}$

If the system bus (CAN) is in the ”Operational” state, you can check the contents of the data words received via CAN1_IN via C0866 (subcodes 1 and 2).
- The value is bit coded.

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Subcodes	Information
C0866/1	CAN1_IN.W0 (word 1, control word ”Ctrl1”)
C0866/2	CAN1_IN.W1 (word 2)

Parameter	Designation	Data type: UNSIGNED_16
C0868	**Process data output words CAN1_OUT**	Index: $23707_{dec} = 5C9B_{hex}$

If the system bus (CAN) is in the ”Operational” state, you can check the contents of the data words sent via CAN1_OUT via C0868 (subcodes 1 and 2).
- The value is bit coded.

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Subcodes	Information
C0868/1	CAN1_OUT.W0 (word 1, status word 1 ”Stat1”)
C0868/2	CAN1_OUT.W1 (word 2, status word 2 ”Stat2”)

8.10.2 Diagnostics PDO (C0390/1 ... 8)

Parameter	Name	Data type: INTEGER_32
C0390	**Configuration diagnostics PDO via CAN**	Index: $24185_{dec} = 5E79_{hex}$

Via C0390/1 ... 8 a diagnostics PDO (8 bytes) can be parameterised, which can be sent via CAN2_OUT.

- The 8 bytes can be assigned with variables for advanced diagnostics of the mains conditions and the internal state machine (mapping).
- In C0391 the assignment in percent (0 ... 100 %) of the 8 bytes of the PDO is shown.

Conditions for sending the diagnostics PDO:
The CAN bus is "Operational" and the cycle time for CAN2_OUT is > 0 ms (C0356/2).

Possible settings	
C390/x = 0	Not assigned [0 bytes]
C390/x = 1	Voltage V_{L1L2} [2 bytes]
C390/x = 2	Voltage V_{L2L3} [2 bytes]
C390/x = 3	Counter of the zero crossings per second (frequency measurement of V_{L1L2}) [2 bytes]
C390/x = 4	Mains synchronisation n-times outside the limits (evaluation of V_{sd} and V_{sq}) [1 byte]
C390/x = 5	Internal status bits [1 byte]
C390/x = 6	Transformed voltage component V_{sd} [2 bytes]
C390/x = 7	Transformed voltage component V_{sq} [2 bytes]
C390/x = 8	Internal error bits [2 bytes]

Subcodes	**Information**
C0390/1	Depending on the byte size of the variables selected, it may happen that the variables in the last subcodes do not become effective anymore.
...	
C0390/8	📖 109

9 Monitoring functions

Different monitoring functions (📖 97) 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) (📖 116).

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:

  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/no. ”x061”) between the AIF module and the ECS axis module.

- 2xxx:

  The fault response is a warning.

9.1 Fault responses

Reaction	⇨ Consequence	Display Keypad XT		
		RDY	IMP	Fail
TRIP / Short-circuit braking TRIP		☐	■	■
TRIP active:	⇨ The charging of the DC bus is stopped. With short-circuit braking TRIP the DC bus is quickly discharged via the brake resistor. ⇨ The drive is coasting (no control). ⇨ The system bus (CAN) indicates to the master that the power supply module is not ready for operation.			
TRIP is reset:	⇨ The power supply module is ready for operation again. ⇨ The charging of the DC bus is continued.			
Message	**Danger!** The drive restarts automatically if the message is removed.	☐	■	■
Message active:	⇨ The charging of the DC bus is stopped. ⇨ The drive is coasting (no control). ⇨ The system bus (CAN) indicates to the master that the power supply module is not ready for operation.			
Message is reset:	⇨ The power supply module is ready for operation again. ⇨ The charging of the DC bus is continued.			
Warning	⇨ The failure is only displayed, the drive continues to run normally.	■	☐	■
Off	**STOP!** The drive can be destroyed due to deactivated monitoring functions.	–	–	–
	⇨ There is no response to the failure.			
		☐ = off		■ = on

Responses (📖 96) of monitoring functions can be parameterised partly via codes – in the GDC parameter menu under **Monitoring**.

9.2 Overview of monitoring functions

Monitoring			Possible responses ● Lenze setting ✓ Setting possible					
Fault message		Description	Code	TRIP	Short-circuit brake TRIP	Message	Warning	Off
0011	OC1	Short circuit in the DC bus		✓	●	–	–	–
0012	OC2	Earth fault in the DC bus		✓	●	–	–	–
0013	OC3	Load of the DC bus during load process (from operating system V2.3)		✓	●	–	–	–
0014	OC4	Short circuit/overload of brake resistor or IGBT		●	–	–	–	–
0015	OC5	Device utilisation I x t (fix 100%)		✓	●	–	–	–
0016	OC6	Overload of internal brake resistor	C0579	●	–	–		✓
0020	OU	Overvoltage in the DC bus (C0173)		✓	●	–	–	–
1031 2031	LP0	Mains voltage outside the operating range		–	–	●	✓	–
0032 1032 2032	LP1	Mains phase failure (from operating system V2.0) ● C0599 < 65535: LP1-TRIP ● C0599 = 65535: LP1 warning/LP1 message	C0599	✓	●	✓	✓	–
0050	OH	Device heatsink temperature > 90 °C		✓	●	–	–	–
0051	OH1	Internal device temperature > 90 °C		✓	●	–	–	–
0053	OH3	Overload of external brake resistor		●	–	–	–	–
0061	CE0	Communication error on the automation interface (AIF)	C0126	✓	–	–	–	●
0062	CE1	Communication error at the process data input object CAN1_IN in cyclic operation (sync-controlled) ● The monitoring time can be set via C0357/1.		✓	✓	–	–	●
0063	CE2	Communication error at the process data input object CAN2_IN in event-controlled/cyclic operation without sync ● The monitoring time can be set via C0357/1.		✓	✓	–	–	●
0064	CE3	Communication error at the process data input object CAN3_IN in event-controlled/cyclic operation without sync ● The monitoring time can be set via C0357/1.		✓	✓	–	–	●
0065	CE4	Bus-off status of the system bus (CAN) (too many faulty telegrams or toggle bit errors)	C0595	✓	●	–	–	✓
0070	U15	Undervoltage of external low-voltage supply		●	–	–	–	–
0071	CCr	System failure		✓	●	–	–	–
0072	PR1	Checksum error in parameter set 1		✓	●	–	–	–
0079	PR5	Internal fault (EEPROM)		✓	●	–	–	–
0095	FAN1	Fan monitoring (only for built-in units ECSEE)		✓	●	–	–	–

Monitoring			Possible responses ● Lenze setting ✓ Setting possible					
Fault message		Description	Code	TRIP	Short-circuit brake TRIP	Message	Warning	Off
0105	H05	Internal fault (memory)		✓	●	–	–	–
0106	H06	Internal fault (power section)		✓	●	–	–	–
0260 1260 2260	NodeGuard Trp NodeGuard Msg NodeGuard Wrn	”Life Guarding Event”: The power supply module as CAN slave does not receive a node guarding telegram from the CAN master within the ”Node Life Time”.	C0384	●	–	✓	✓	✓

9.3 Configuring monitoring functions

9.3.1 Mains monitoring (LP0, LP1)

Mains voltage and mains frequency (LP0)

Mains voltage and mains frequency are permanently measured. The permissible ranges depend on the mains voltage set under C0173. The mains frequency must be within the range from 45 to 66 Hz. If the measured values are not within these limits, an LP0 message is activated and the DC bus cannot be charged or is disconnected from the mains.

If the power supply module is ready for operation, the limits are expanded to tolerate short mains fluctuations. In this case, an LP0 warning is displayed.

When C0173 = 4 (automatic detection of the mains voltage), the range is defined with the rising edge of the mains enable input.

Code C0173	Measured values U_{L1_L2} and U_{L2_L3} [V]				
	"Not ready for operation"		"Ready for operation"		
	OK	LP0 message	OK	LP0 warning	LP0 message
0	207 ... 253	< 207 > 253	207 ... 253	127 ... 206 254 ... 265	< 127 > 265
1	360 ... 440	< 360 > 440	360 ... 440	280 ... 359 441 ... 460	< 280 > 460
2	414 ... 506	< 414 > 506	414 ... 506	334 ... 413 507 ... 515	< 334 > 515
3	432 ... 528	< 432 > 528	432 ... 528	352 ... 431 529 ... 540	< 352 > 540
4	Lower range		Lower range		
	180 ... 260	< 180 > 260	180 ... 260	100 ... 179 261 ... 265	< 100 > 265
	Upper range		Upper range		
	261 ... 528	< 261 > 528	261 ... 528	181 ... 260 529 ... 540	< 181 > 540

Permissible ranges from ECSxE operating system V5.0:

Code C0173	Measured values U_{L1_L2} and U_{L2_L3} [V]				
	"Not ready for operation"		"Ready for operation"		
	OK	LP0 message	OK	LP0 warning	LP0 message
0	195.5 ... 264.5 (+/- 15 %)	< 195.5 > 264.5	195.5 ... 264.5 (+/- 15 %)	172.5 ... 195.5 (- 25 %) 264.5 ... 276 (+ 20 %)	< 172.5 > 276
1	340 ... 460 (+/- 15 %)	< 340 > 460	340 ... 460 (+/- 15 %)	300 ... 340 (- 25 %) 460 ... 480 (+ 20 %)	< 300 > 480
2	391 ... 506 (+/- 15 %)	< 391 > 506	391 ... 506 (+/- 15 %)	345 ... 391 (- 25 %) 506 ... 517.5 (+ 12.5 %)	< 345 > 517.5
3	408 ... 528 (+/- 15 %)	< 408 > 528	408 ... 528 (+/- 15 %)	360 ... 408 (- 25 %) 528 ... 540 (+ 12.5 %)	< 360 > 540
4	Lower range		Lower range		
	180 ... 260	< 180 > 260	180 ... 260	100 ... 179 261 ... 265	< 100 > 265
	Upper range		Upper range		
	261 ... 528	< 261 > 528	261 ... 528	181 ... 260 529 ... 540	< 181 > 540

Mains phase failure (LP1)

From the operating system V2.1 onwards, the power supply module monitors the mains for phase failure. A phase failure will be detected after half a mains period because the mains synchronisation is faulty. If the DC bus is charged and the power supply module is ready for operation, an LP1 warning is triggered. For all other states an LP1 message is triggered to prevent a charging process with faulty synchronisation. The LP1 warning/message will be deactivated when the mains synchronisation has been free of faults for 2 mains periods.

Under C0599 a time interval for triggering an LP1 TRIP can be set in addition. If an LP1 warning or an LP1 message is active for the time interval set under C0599, an LP1-TRIP is triggered. C0599 = 65535 ms deactivates the LP-TRIP. In this case, only an LP1 warning or an LP1 message is triggered.

Parameter	Designation	Data type: INTEGER_32
C0599	**Delay time - system disturbance (LP1)**	Index: $23976_{dec} = 5DA8_{hex}$

If an LP1 warning or LP1 message is active for the set time, an LP1-TRIP is enabled.
- Value < 65535 ms: LP1-TRIP
- Value = 65535 ms: LP1 warning/LP1 message

📖 99

Setting range (min. value | unit | max. value)			Lenze setting
0	ms	65535	**65535 ms**

9.3.2 Voltage supply monitoring - control electronics (U15)

If the voltage at X6/DI1 or X6/DI3 falls below 17 V, TRIP ”U15” is triggered. The fault can only be reset if U > 19 V.

9.3.3 DC bus monitoring (OU, OC1, OC2, OC3)

Overvoltage in DC bus (OU)

If the DC bus voltage exceeds 880 V, the power supply module sets TRIP ”OU” to protect the devices.

Short circuit in the DC bus (OC1)

The power supply module monitors the DC bus for short circuit during charging. If a short circuit is detected, the TRIP ”OC1” is triggered. This TRIP can only be reset after 3 s.

Earth fault in the DC bus (OC2)

The power supply module checks the DC bus for an earth fault before charging. If current is already flowing or a voltage is detected on the DC bus, the power supply module sets TRIP OC2. This TRIP can only be reset after 3 s.

Load on DC bus when charging (OC3)

The power supply module monitors the voltage rise in the DC bus during charging. If the DC bus voltage does not rise for 500 ms, this indicates that power is drawn from the DC bus or that the charging current is set too low (C0022). In this case the TRIP ”OC3” is triggered. This TRIP can only be reset after 3 s (from software version 2.3 onwards).

9.3.4 Temperature monitoring of device heatsink (OH) / inside the device (OH1)

The temperature inside the device and the heatsink temperature are monitored to protect the ECS module from impermissible heat. If the temperature exceeds the corresponding limit value, a TRIP is triggered. The higher-level control system can request the temperature values via the system bus (CAN).

- Heatsink temperature > 90 °C → TRIP ”OH”
- Temperature inside the device > 90 °C → TRIP ”OH1”

9.3.5 Fan monitoring (FAN1)

For built-in units of the ECSEE series, the integrated heatsink fan is monitored. If the fan is switched on and the feedback signal fails for more than 2 s, TRIP ”FAN1” is set.

9.3.6 Brake resistor monitoring (OC6, OH3)

Internal brake resistor (OC6)

Stop!

The power supply module can be destroyed if monitoring is deactivated while the internal brake resistor is used.

- The internal brake resistor is continuously monitored during operation (does not apply to ECS**C**E power supply module).
- The monitoring detects the duration of current flow in the brake resistor and calculates the power loss (display under C0066).
- If the power loss exceeds the limit value set permanently in the device – 120 W for ECSxE012/020 or 240 W for ECSxE040 – TRIP "OC6" is output.

  The TRIP "OC6" can be reset if the power loss falls below 114 W or 228 W again.
- The current flow is derived from the operating time and the voltage drop across the brake resistor. Thus, the fault message also occurs if the bridge between the terminals X22/BR1 and X22/+UG is missing or an external brake resistor is connected between X22/BR0 and X22/+UG.

Parameter	Designation	Data type: INTEGER_32
C0579	**Response - monitoring of internal brake resistor (OC6)**	Index: $23996_{dec} = 5DBC_{hex}$

Monitoring response of the internal brake resistor (fault message OC6)
📖 102

Selection list (Lenze setting printed in bold)		Information
0	**TRIP**	
3	No response	

External brake resistor (OH3)

Stop!

If an external brake resistor is used, the monitoring of the internal brake resistor must be deactivated (C0579 = 3).

The external brake resistor can be monitored via a temperature contact. It can be connected to X6/T1, X6/T2. If monitoring is not required, a jumper must be connected between X6/T1 and X6/T2. If the contact is opened, TRIP "OH3" is triggered.

9.3.7 Brake chopper IGBT monitoring (OC4)

The brake chopper IGBT is monitored independently of the brake resistor (internal or external). There are two types of monitoring causing a TRIP "OC4":

- The voltage U_{CE} is monitored by hardware. Monitoring is triggered by a low-resistance brake resistor. This error can be reset by a TRIP reset.
- It is also monitored whether the IGBT itself has a low resistance. For this purpose the voltage across the brake resistor is used. This error cannot be reset by a TRIP reset. Possible causes are:
  – Low-resistance IGBT,
  – wrong wiring of the brake resistor or
  – defective brake resistor / IGBT.

Note!
A TRIP "OC4" can occur even if no brake resistor is connected.

9.3.8 Device utilisation / I x t monitoring (OC5)

Use the mains fuses (📖 42) to ensure device protection.

A single-phase I x t monitoring measures the load of the power supply module. The monitoring enables operation with:

- a permanent device output current = I_r
- a device output current of up to 1.5 x I_N for ≤ 30 s

The power supply module calculates the device load in percent via the mains current. If this value exceeds 100 %, TRIP "OC5" is triggered. The TRIP can only be reset if the load has fallen below 95 %. The current value is indicated under C0064.

Parameter	Designation	Data type: INTEGER_32
C0064	**Device utilisation (I x t)**	Index: $24511_{dec} = 5FBF_{hex}$

Display of the device utilisation (I x t) over the last 180 s
- C0064 > 100 % activates OC5-TRIP.
- TRIP-RESET is only possible if C0064 < 95 %.

Display range (min. value | unit | max. value)		
0	%	65535

9.3.9 Communication monitoring (CE1 ... CE4, node guarding)

Monitoring times (C0357)

Each process data input object is able to monitor if a telegram has been received within the set time. As soon as a telegram has been received, the corresponding monitoring time (C0357) is restarted.

If no telegram is received within the set time,

- ► TRIP "CE1" (CAN1_IN, cyclic (sync-controlled)),
- ► TRIP "CE2" (CAN2_IN, reserved) or
- ► TRIP "CE3" (CAN3_IN, event-controlled/cyclic without sync) enabled.

When C0357 = 0 ms (Lenze setting) this monitoring function is switched off.

Parameter	Designation	Data type: INTEGER_32
C0357	**CAN_IN monitoring times (CE1 ... CE3)**	Index: $24218_{dec} = 5E9A_{hex}$

Monitoring times for process data input objects
- If no telegram arrives within the time set, CE1 ... CE3-TRIP is enabled.
- Setting "0 ms" = monitoring is switched off

📖 104

Setting range (min. value | unit | max. value)			
0	ms	65000	

Subcodes	Lenze setting	Information
C0356/1	0 ms	CAN1_IN monitoring time CE1 (cyclic operation (sync-controlled))
C0356/2	0 ms	CAN2_IN monitoring time CE2 (reserved)
C0356/3	0 ms	CAN3_IN monitoring time CE3 (event-controlled/cyclic operation without sync)

Bus-off (C0595)

If the power supply module is disconnected from the system bus (CAN) due to faulty telegrams, the "BusOffState" signal is set and TRIP "CE4" is enabled.

The monitoring can be deactivated with C0595 = 3.

Parameter	Designation	Data type: INTEGER_32
C0595	**Response - bus-off/toggle bit monitoring (CE4)**	Index: $23980_{dec} = 5DAC_{hex}$

Bus-off/toggle bit monitoring response of the CAN bus (fault message CE4)

📖 104

Selection list (Lenze setting printed in bold)		Information
0	**TRIP**	
3	No response	

Toggle bit monitoring

The functioning of the system bus connection is monitored via a cyclically toggling bit in the control word. The control system must change the bit status in every telegram sent. If the bit status does not change, an error counter in the power supply module is incremented. This counter is reset as soon as the toggle bit is transmitted error-free again. If the error counter reaches ”10”, TRIP ”CE4” is triggered.

The monitoring can be deactivated with C0595 = 3.

Node Guarding

The ”Node Guarding” function is implemented as of operating system V3.0.

In case of cyclic node monitoring (Node Guarding) the CAN master regularly enquires the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is enabled (fault message ”NodeGuard Trp/Msg/Wrn”).

Note!

Observe the information on the configuration of the ”Node Guarding” (📖 88).

Parameter	Designation	Data type: INTEGER_32
C0384	**Response - CAN node guarding**	Index: $24191_{dec} = 5E7F_{hex}$

Response to a ”Life Guarding Event”if no node guarding telegram has been received during ”Node Life Time” (C0382 x C0383).

- When C0382 = 0 or C0383 = 0, the monitoring function is not active (no node guarding fault message is enabled).
- Only relevant if C0352 = 2.

📖 88

Selection list (Lenze setting printed in bold)		Information
0	TRIP	
1	Message	
2	Warning	
3	**Off**	

10 Diagnostics

10.1 Diagnostics with Global Drive Control (GDC)

Different system values and fault messages can be read in the GDC parameter menu under **Diagnostics** via the following codes:

Parameter	Designation	Data type: INTEGER_32
C0050	**Mains voltage (V_{rms}) between phases L1-L2**	Index: $24525_{dec} = 5FCD_{hex}$

Display of the mains voltage (V_{rms}) between phases L1 and L2

Display range (min. value | unit | max. value)		
-16383	V	16383

Parameter	Designation	Data type: INTEGER_32
C0051	**Mains voltage (V_{rms}) between phases L2-L3**	Index: $24524_{dec} = 5FCC_{hex}$

Display of the mains voltage (V_{rms}) between phases L2 and L3

Display range (min. value | unit | max. value)		
-16383	V	16383

Parameter	Designation	Data type: INTEGER_32
C0053	**DC-bus voltage (U_G)**	Index: $24522_{dec} = 5FCA_{hex}$

Display of the DC-bus voltage (U_G)

Display range (min. value | unit | max. value)		
-32767	V	32767

Parameter	Designation	Data type: INTEGER_32
C0054	**Mains current (r.m.s. value)**	Index: $24521_{dec} = 5FC9_{hex}$

Display of the mains current (r.m.s. value)

Display range (min. value | unit | max. value)		
-1638.3	A	1638.3

Parameter	Designation	Data type: INTEGER_32
C0055	**Voltage across the brake resistor**	Index: $24520_{dec} = 5FC8_{hex}$

Display of the voltage across the brake resistor

Display range (min. value | unit | max. value)		
-32767	V	32767

Parameter	Designation	Data type: INTEGER_32
C0057	**Mains frequency**	Index: $24518_{dec} = 5FC6_{hex}$

Display of the mains frequency

Display range (min. value | unit | max. value)		
-3276.7	Hz	3276.7

Parameter	Designation	Data type: INTEGER_32
C0061	**Heatsink temperature**	Index: 24514_{dec} = $5FC2_{hex}$

Display of the heatsink temperature

Display range (min. value | unit | max. value)		
-3276.7	°C	3276.7

Parameter	Designation	Data type: INTEGER_32
C0062	**Interior device temperature**	Index: 24513_{dec} = $5FC1_{hex}$

Display of the interior temperature

Display range (min. value | unit | max. value)		
-3276.7	°C	3276.7

Parameter	Designation	Data type: INTEGER_32
C0064	**Device utilisation (I x t)**	Index: 24511_{dec} = $5FBF_{hex}$

Display of the device utilisation (I x t) over the last 180 s

- C0064 > 100 % activates OC5-TRIP.
- TRIP-RESET is only possible if C0064 < 95 %.

Display range (min. value | unit | max. value)		
0	%	65535

Parameter	Designation	Data type: INTEGER_32
C0065	**External low-voltage supply (U_{24})**	Index: 24510_{dec} = $5FBE_{hex}$

Display of the external low-voltage supply (U_{24})

Display range (min. value | unit | max. value)		
-1638.3	V	1638.3

Parameter	Designation	Data type: INTEGER_32
C0066	**Load of internal brake resistor**	Index: 24509_{dec} = $5FBD_{hex}$

Display of the load of the internal brake resistor

Display range (min. value | unit | max. value)		
0	W	65535

Parameter	Designation	Data type: INTEGER_32
C0093	**Device identification (type)**	Index: 24482_{dec} = $5FA2_{hex}$

Display of the device identification (type)

Display list		**Information**
0	No/unknown power section	
12	ECSxE012	
20	ECSxE020	
40	ECSxE040	

Parameter	Designation	Data type: INTEGER_32
C0099	**Firmware version**	Index: 24476_{dec} = $5F9C_{hex}$

Display of the firmware version

Display range (min. value | unit | max. value)		
0.0		25.5

Parameter	Designation	Data type: INTEGER_32
C0161	**Current TRIP fault**	Index: $24414_{dec} = 5F5E_{hex}$

Display of the current TRIP fault (TRIP, short-circuit brake TRIP)
📖 117

Parameter	Designation	Data type: INTEGER_32
C0168	**Fault history buffer**	Index: $24407_{dec} = 5F57_{hex}$

List of the fault messages occurred (TRIP, short circuit braking TRIP, message, warning)
📖 116
📖 117

Subcodes	Information
C0168/1	Currently active fault message
C0168/2	Last fault message
C0168/3	Second to last fault message
C0168/4	Third to last fault message
C0168/5	Fourth to last fault message
C0168/6	Fifth to last fault message
C0168/7	Sixth to last fault message
C0168/8	Seventh to last fault message

Parameter	Designation	Data type: INTEGER_32
C0178	**Elapsed-hour meter**	Index: $24397_{dec} = 5F4D_{hex}$

Display of the time during which the power supply module was enabled.

Display range (min. value | unit | max. value)		
-214748	h	214748

Parameter	Designation	Data type: INTEGER_32
C0179	**Power-on time meter**	Index: $24396_{dec} = 5F4C_{hex}$

Display of the time during which the DC bus was charged.

Display range (min. value | unit | max. value)		
-214748	h	214748

Parameter	Designation	Data type: VISIBLE_STRING
C0200	**Firmware identification (ID)**	Index: $24375_{dec} = 5F37_{hex}$

Display of the firmware identification (ID)

Parameter	Designation	Data type: VISIBLE_STRING
C0201	**Firmware creation date**	Index: $24374_{dec} = 5F36_{hex}$

Display of the firmware creation date

10.2 Advanced diagnostics via diagnostics PDO (CAN2_OUT)

Via CAN2_OUT a diagnostics process data telegram (PDO) with display values concerning the mains conditions and the internal state machine can be sent from the power supply module. The diagnostics PDO consists of 8 bytes which can be assigned with variables.

- ► The 8 bytes of the PDO are assigned with variables via code C0390/1 ... 8.
- ► Depending on the byte size of the variables selected, it may happen that the variables in the last subcodes do not become effective anymore.
- ► In C0391 the assignment in percent (0 ... 100 %) of the 8 bytes of the PDO is shown.
- ► For sending the diagnostics PDO the CAN bus has to be in the ”Operational” state and the cycle time for CAN2_OUT > 0 ms (C0356/2) has to be set.

Value C0390/1 ... 8	Description	Size
0	Not assigned	0 bytes
1	Actual value of the input voltage $V_{L1L2 \text{ on the supply side}}$	2 bytes
2	Actual value of the input voltage $V_{L2L3 \text{ on the supply side}}$	2 bytes
3	Counter of the zero crossings per second (frequency measurement of V_{L1L2}) ● The zero crossings of the mains input voltage V_{L1L2} are counted over the interval of one second. ● For a 50 Hz mains therefore 100 zero crossings result, for a 60 Hz mains 120 zero crossings. ● If the characteristic of the variables is shown graphically, a saw-tooth profile develops.	2 bytes
4	Mains synchronisation n-times outside the limits (evaluation of V_{sd} and V_{sq}) ● For the evaluation of the mains input voltage the voltages L1, L2 and L3 are transformed from alpha/beta to d/q and are scaled to the r.m.s. value of the mains input voltage. ● If the mains conditions are stable, the value of V_{sd} will set to approx. 350, and the value of V_{sq} to approx. 0. ● If the limit values of V_{sd} or V_{sq} are exceeded or too low, a counter is incremented. If the limit values have been exceeded for the fourth time, mains synchronism is no longer ensured and an LP1 error message is output. ● Range for V_{sd}: 300 ... 400 ● Range for V_{sq}: -50 ... 50	1 byte 1
5	Internal status bits: ● Bit 0 = 1: Mains voltage since switch-on (24 V) not OK. ● Bit 1 = 1: An LP1 error was detected. ● Bit 2: Switching status of the IGBT (0 = ”chopping”) ● Bit 3 = 1: Saving of parameter set permitted. ● Bit 4 = 1: A warning is active. ● Bit 5 = 1: A message is active. ● Bit 6 = 1: Calculation for mains synchronisation started. ● Bit 7 = 1: Mains synchronisation is active.	1 byte 1
6	Value of the transformed voltage component V_{sd} scaled to the r.m.s. value of the mains input voltage. The value should be approx. 350.	2 bytes
7	Value of the transformed voltage component V_{sq} scaled to the r.m.s. value of the mains input voltage. The value should be approx. 0.	2 bytes

Value C0390/1 ... 8	Description	Size
8	Internal error bits: ● Bit 0 = 1: An Ixt overload has occurred. ● Bit 1 = 1: The internal brake resistor is overloaded. ● Bit 2 = 1: The external temperature contact is open. ● Bit 3 = 1: A short circuit of the brake IGBT has occurred. ● Bit 4 = 1: An LP0 error has occurred. ● Bit 5 = 1: An LP1 error has occurred. ● Bit 6 = 1: No short-circuit braking possible. ● Bit 7 = 1: A U15 error has occurred (2 monitoring cycles below 17 V). ● Bit 8 = 1: The 24V supply was lower than the 17V monitoring threshold. ● Bit 9 ... 15: Not assigned.	2 bytes

10.3 Diagnostics with the XT EMZ9371BC keypad

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	

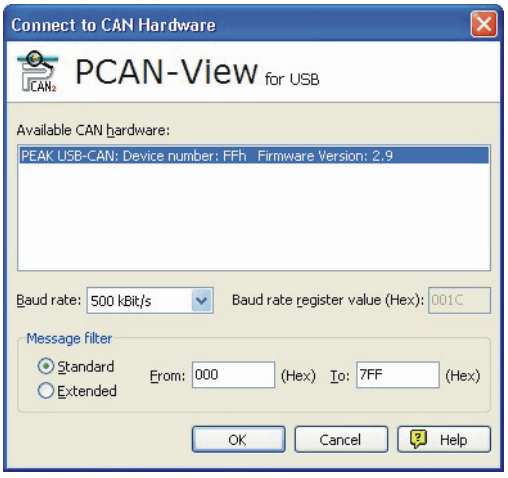
10.4 Diagnostics with PCAN-View

”PCAN-View” is the basic version of the ”PCAN-Explorer” program for Windows® of PEAK System Technik GmbH. The program permits a simultaneous transmission and reception of CAN messages which can be transmitted manually and periodically. Errors on the bus system and memory overflows of the triggered CAN hardware are displayed.

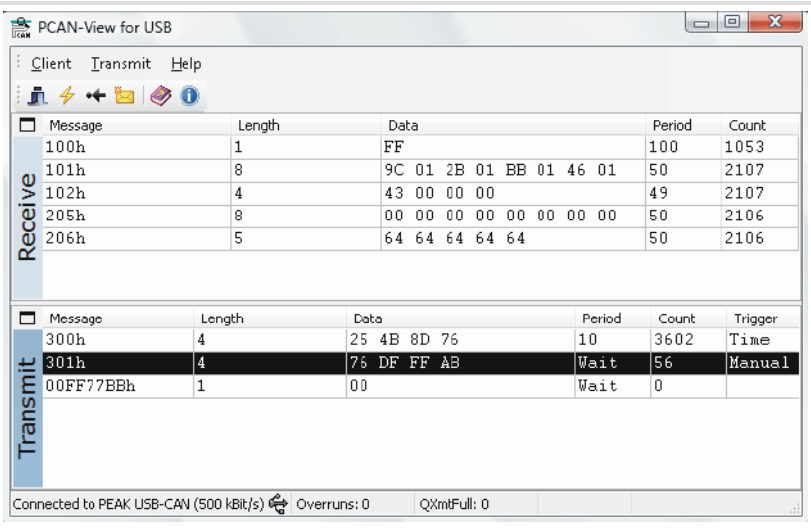
10.4.1 Monitoring of telegram traffic on the CAN bus

How to monitor the telegram traffic:

1. Connect the Engineering PC directly to the CANopen bus via the EMF2177IB USB system bus adapter.
2. Start the ”PCAN-View” program.
3. Connect ”PCAN-View” to ”Connect to CAN Hardware” using the USB system bus adapter and the desired baud rate.



The ”Receive” and ”Transmit” windows now continuously display the CAN telegrams.



On the basis of the IDs displayed, you can assign the telegrams to the devices.

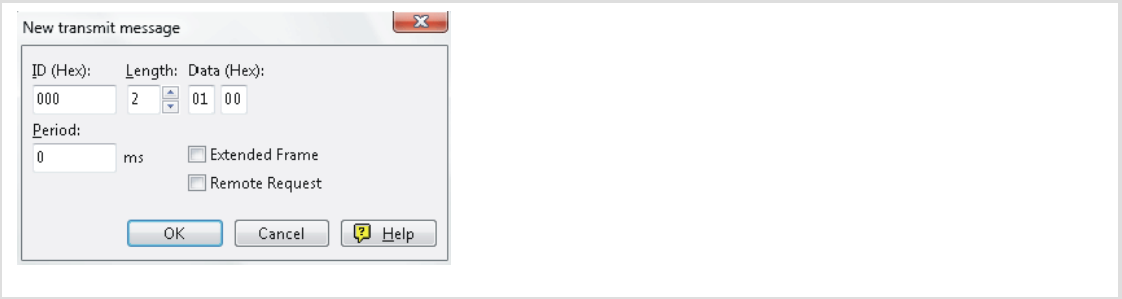
If no telegrams are displayed, this may be caused by various factors:

- Is your Engineering PC connected to the correct CAN bus?
- Is the correct system bus adapter activated under ”System control, CAN Hardware”?
- What does the status line of the »PCAN-View« contain?
  In case of ”Bus Heavy” mostly a node with a wrong baud rate disturbs the bus traffic.
- Do the devices are in the ”Operational” status?

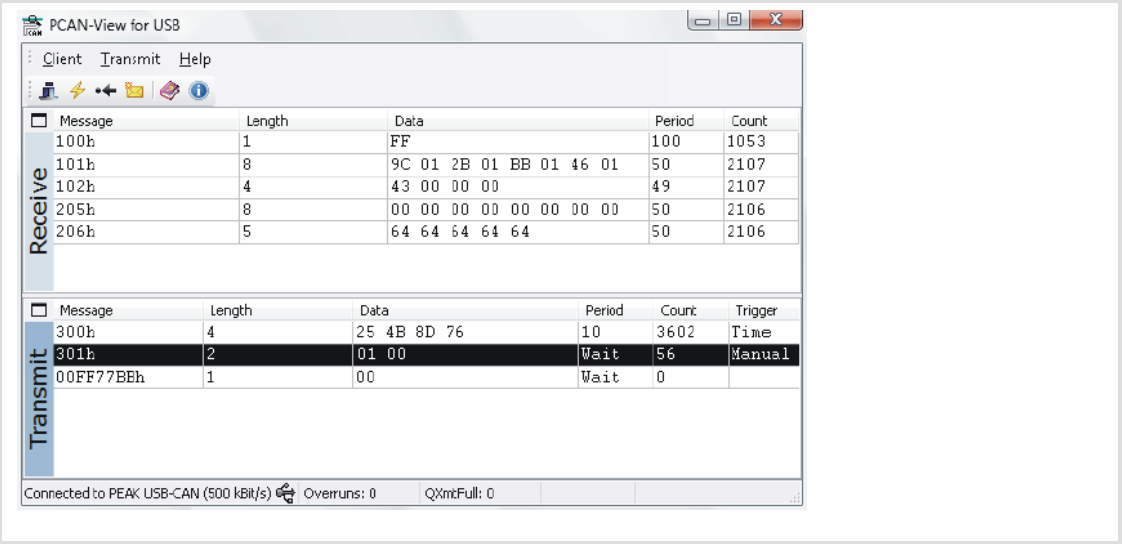
10.4.2 Setting all CAN nodes to the ”Operational” status

How to set all CAN nodes to the ”Operational” status:

1. Create the following CAN message under ”New transmit message”:



2. Select the CAN message in the ”Transmit” window and press the <space bar> once to transmit the CAN message.



11 Troubleshooting and fault elimination

Failures can be quickly detected and classified by means of display elements or status messages via the MotionBus (CAN).

Display elements and status messages provide a rough classification of the trouble.

The chapter ”11.2 Fault messages” (📖 117)contains notes on causes and deletion of faults.

11.1 Fault analysis

11.1.1 Fault analysis via the LED display

LED		Operating status	Check
Red	Green		
Off	On	Module enabled, no fault	
Off	Blinking	Module inhibited (CINH), switch-on inhibit	C0183
Blinking, 1 Hz	Off	Error (TRIP) / error short-circuit braking (short-circuit braking TRIP)	C0168/1
Blinking, 3 Hz	Off	Message	C0183, C0168/1
Blinking, 1 Hz	Blinking	Warning with inhibited module	C0183, C0168/1
Blinking, 1 Hz	On	Warning with enabled module	

11.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display give information on the device state.

Display	Device state	Check
RDY	Ready for operation, inhibit can be set	C0183, C0168/1
IMP	Power stage inhibited	C0183, C0168/1
Imax	Maximum current reached	
Fail	Fault caused by TRIP, short-circuit braking TRIP, message or warning	C0183, C0168/1

11.1.3 Fault analysis with the history buffer

The history buffer (C0168) enables you to trace faults. The corresponding fault messages are stored in eight memory locations in the sequence of their occurrence.

Structure of the history buffer

- The fields under ”fault history” show the memory locations 2 ... 7.
- The fields under ”current faults” indicate memory location 1. It gives information on the active fault.
- If the fault is no longer active or has been reset,
  - all information in the fault memory will be automatically shifted upwards by one subcode.
  - memory location 1 will be deleted (no active fault). The information on the formerly active fault is now in subcode 2.
  - the contents of subcode 8 will be eliminated from the history buffer and cannot be read any longer.
- The history buffer contains three information units for every fault occurred:
  - Fault number and response
  - Time of the last occurrence
  - Frequency of successive occurrence

Note!

- If several faults with different responses occur at the same time, only the fault the response of which has the highest priority is entered in the history buffer.
  - Power supply module ECSxE:
    TRIP/KSB-TRIP (highest) → message → warning (lowest)
  - Axis module ECSxS/P/M/A:
    TRIP (highest) → message → FAIL-QSP → warning (lowest)
- If several faults with the same response occur at the same time, (e.g. two messages) only the fault that occurred first is entered in the history buffer.
- If a fault occurs several times in quick succession, only the time of the last occurrence is entered in the history buffer.

Assignment of information to the codes

Code and retrievable information				contains information on ...
C0168	C0169	C0170	Subcode	
Number and **response** of the fault message	**Time** of the last occurrence of the fault message	**Frequency** of the occurrence of the fault message	1	active fault
			2	last fault
			3	second-to-last fault
			4	third-to-last fault
			5	fourth-to-last fault
			6	fifth-to-last fault
			7	six-to-last fault
			8	seventh-to-last fault

11.2 Fault messages

11.2.1 Causes and remedies



Tip!

When the fault messages are retrieved via the system bus (CAN) they are displayed as a number (see column “fault number –number” in the following table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	–	–
0011	OC1	Short circuit in the DC bus	Short circuit	• Find cause of short-circuit • Check DC bus wiring
			Charging current limitation of the axis module is active.	Do not use charging current limitation
0012	OC2	Earth fault in the DC bus	One of the DC bus cables has earth contact	Check DC bus wiring
			DC-bus capacity is too low	Increase capacity
0013	OC3	Load of the DC bus during charging (from software version 2.3)	• Power consumption of the DC bus while charging • Max. charging current too low (C0022)	• Check system control/wiring • Increase max. charging current (C0022)
0014	OC4	Short circuit/overload of brake resistor or IGBT	• Brake IGBT defective • Brake resistor has low resistance • No brake resistor connected	• Check brake resistor • Replace device
0015	OC5	I x t overload	• Frequent and too long acceleration with overcurrent • Continuous overload with $I_{mains} > 1.05 \times I_r$	Check dimensioning
0016	OC6	Overload of internal brake resistor	• Brake resistor thermally overloaded, caused e.g. by frequent or too long braking processes • OC6 monitoring activated while an external brake resistor is used	• Use external brake resistor • Deactivate OC6 monitoring when an external brake resistor is used (C0579 = 3)
0020	OU	Overvoltage in the DC bus	Excessive braking energy (DC-bus voltage higher than 880 V)	• Use braking unit or regenerative module • Check brake resistor dimensioning
1031 2031	LP0	Mains voltage beyond the operating range	Mains voltage beyond range defined under C0173	• Check mains voltage • Adapt C0173

Fault message		Description	Cause	Remedy
No.	Display			
0032 1032 2032	LP1	Mains phase failure (as of operating system V2.0)	• No mains phase • Mains not sinusoidal • Voltage dips (”unstable mains supply”)	• Check mains voltage In the case of voltage dips: • Reduce charging current (C0022) • For ECS axis modules, set charge relay function C0175 = 3.
0050	OH	Heatsink temperature > 90°C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow power supply module to cool and ensure better ventilation • Check ambient temperature in the control cabinet
			Heatsink very dirty	Clean heatsink
			Incorrect mounting position	Change mounting position
0051	OH1	Internal device temperature > 90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow power supply module to cool and ensure better ventilation • Check ambient temperature in the control cabinet
			Incorrect mounting position	Change mounting position
0053	OH3	Overload of external brake resistor	External brake resistor too hot by impermissibly high currents or frequent and too long braking processes	Check dimensioning
			• No PTC/temperature contact connected • No jumper	Correct wiring
0061	CE0	Communication error on the automation interface (AIF)	Faulty transfer of control commands via the automation interface (AIF).	• Plug the communication module/XT keypad firmly (screw down, if necessary) • Switch off monitoring (C0126 = 3)
0062	CE1	Communication error at the process data input object CAN1_IN in cyclic operation (sync-controlled)	• CAN1_IN object receives faulty data • Communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time under C0357/1, if necessary
0063	CE2	Communication error at the process data input object CAN2_IN in event-controlled/cyclic operation without sync	• CAN2_IN object receives faulty data • Communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time in C0357/2, if necessary
0064	CE3	Communication error at the process data input object CAN3_IN in event-controlled/cyclic operation without sync	• CAN3_IN object receives faulty data • Communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time in C0357/3, if necessary
0065	CE4	Bus-off status of the system bus (CAN)	Power supply module has received too many faulty telegrams	• Check wiring: bus termination available? • Check shield connection of the cables • Check PE connection • Check bus load, reduce baud rate if necessary (observe cable length)
		Toggle bit error	Transmitter does not change toggle bit	Check transmitter

Fault message		Description	Cause	Remedy
No.	Display			
0070	U15	Undervoltage of external low-voltage supply	Voltage < 17 V	Check low-voltage supply
0071	CCr	System failure	Strong interference on control cables	Control cables must be shielded
			Ground or earth loops in wiring	PE wiring
0072	PR1	Checksum error in parameter set 1		Contact Lenze
0079	PR5	Internal fault (EEPROM)		Contact Lenze
0095	FAN1	Fan monitoring (only for built-in units ECSEE)	Heatsink fan ● blocked ● dirty ● defective	Eliminate cause
0105	H05	Internal fault (memory)		Contact Lenze
0106	H06	Internal fault (power section)	During initialisation of the power supply module a wrong power stage has been detected	Contact Lenze
0260 1260 2260	NodeGuard Trp NodeGuard Msg NodeGuard Wrn	”Life Guarding Event”	The power supply module as 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 ● Make sure that ”Node Guarding” has been activated in the CAN master. ● Adapt ”Node Life Time” (C0382, C0383) to the setting in the CAN master.

11.2.2 Reset fault messages (TRIP-RESET)

Reaction	Measures to reset the fault message
TRIP	**Note!** If a TRIP source is still active, the pending TRIP cannot be reset. The TRIP can be reset by: ● Press keypad XT EMZ9371 BC ⇨ STOP. Then, press RUN to re-enable the power supply module. ● Set C0043 = 0. ● System bus (CAN) control word: C0130/Bit 1 = 0 (LOW active) ● Control word AIF After the reset: ⇨ The power supply module is ready for operation again. ⇨ The charging of the DC bus is continued.
Short-circuit braking TRIP	● Short-circuit braking function activated via C0127: – The short-circuit braking TRIP is set for a TRIP not related to the brake resistor or IGBT. ● Reset like TRIP After the reset: ⇨ The power supply module is ready for operation again. ⇨ The charging of the DC bus is continued.
Message	**Danger!** After eliminating the cause of malfunction, the fault message is reset automatically. ⇨ The power supply module is ready for operation again. ⇨ The charging of the DC bus is continued. ⇨ The drive restarts automatically.
Warning	After eliminating the cause of malfunction, the fault message is reset automatically.

12 Appendix

12.1 Codes

Parameter	Designation	Data type: INTEGER_32
C0001	**Operating mode**	Index: $24574_{dec} = 5FFE_{hex}$

Selection of the operating mode (control)

Selection list (Lenze setting printed in bold)		**Information**
0	**System bus (CAN) control word**	🕮 61
1	Control via dig. inputs	🕮 62
2	Control word via automation interface (AIF)	🕮 63

Parameter	Designation	Data type: INTEGER_32
C0002	**Load Lenze setting**	Index: $24573_{dec} = 5FFD_{hex}$

Note: The Lenze setting can only be loaded if the controller is inhibited.

Selection list (Lenze setting printed in bold)		**Information**
0	**Load Lenze setting**	
1	Loading executed	

Parameter	Designation	Data type: UNSIGNED_32
C0003	**Save parameter set**	Index: $24572_{dec} = 5FFC_{hex}$

Setting for saving the parameter set

Selection list (Lenze setting printed in bold)		**Information**
0	**No response**	
1	Save parameter set	

Parameter	Designation	Data type: INTEGER_32
C0004	**Selection of XT keypad status display**	Index: $24571_{dec} = 5FFB_{hex}$

The XT keypad displays the selected code in the operating level if no other status messages from C0183 are active.

- Example: 53 = C0053 (DC-bus voltage)

Setting range (min. value | unit | max. value)			**Lenze setting**
0		989	**53**

Parameter	Designation	Data type: INTEGER_32
C0009	**LECOM device address**	Index: $24566_{dec} = 5FF6_{hex}$

Entry of the device address for operation via AIF interface
Communication modules on AIF interface:

- LECOM-A/B/LI 2102
- PROFIBUS-DP 2133

Setting range (min. value | unit | max. value)			**Lenze setting**
0		99	**1**

Parameter	Designation	Data type: INTEGER_32
C0022	**Max. charging current after power supply enable**	Index: 24553_{dec} = $5FE9_{hex}$

Setting of the maximum charging current after power supply enable

Setting range (min. value | unit | max. value)			**Lenze setting**
2.0	A	25.0 ECSxE040: 32.0 (from firmware V4.0)	**16.0 A**

Parameter	Designation	Data type: INTEGER_32
C0023	**Peak current (peak)**	Index: 24552_{dec} = $5FE8_{hex}$

Display of the peak current (peak)
Note: Can be reset by writing to C0022 (max. charging current after power supply enable).

Display range (min. value | unit | max. value)			**Information**
0.0	A	500.0	

Parameter	Designation	Data type: INTEGER_32
C0024	**Service code**	Index: 24551_{dec} = $5FE7_{hex}$

Note: Only the Lenze service is allowed to make changes!

Setting range (min. value | unit | max. value)			**Lenze setting**
23	ms	10000	**50ms**

Parameter	Designation	Data type: INTEGER_32
C0028	**Service code**	Index: 24547_{dec} = $5FE3_{hex}$

Note: Only the Lenze service is allowed to make changes!

Setting range (min. value | unit | max. value)			**Lenze setting**
16		1216	**112**

Parameter	Designation	Data type: INTEGER_32
C0029	**Service code**	Index: 24546_{dec} = $5FE2_{hex}$

Note: Only the Lenze service is allowed to make changes!

Setting range (min. value | unit | max. value)			**Lenze setting**
1		70	**28**

Parameter	Designation	Data type: INTEGER_32
C0031	**Service code**	Index: 24544_{dec} = $5FE0_{hex}$

Note: Only the Lenze service is allowed to make changes!

Setting range (min. value | unit | max. value)			**Lenze setting**
40		100	**50**

Parameter	Designation	Data type: INTEGER_32
C0040	**Power supply enable - power supply module**	Index: 24535_{dec} = $5FD7_{hex}$

Setting for inhibit or enable of the power supply module

Selection list (Lenze setting printed in bold)		**Information**
0	Inhibit power supply module	
1	**Enable power supply module**	

Parameter	Designation	Data type: INTEGER_32
C0043	**Reset fault message**	Index: $24532_{dec} = 5FD4_{hex}$

Reset active fault message (TRIP-RESET)
📖 119

Selection list (Lenze setting printed in bold)		Information
0	**TRIP-RESET / no fault**	
1	Fault active	

Parameter	Designation	Data type: INTEGER_32
C0050	**Mains voltage (V_{rms}) between phases L1-L2**	Index: $24525_{dec} = 5FCD_{hex}$

Display of the mains voltage (V_{rms}) between phases L1 and L2

Display range (min. value | unit | max. value)			
-16383	V	16383	

Parameter	Designation	Data type: INTEGER_32
C0051	**Mains voltage (V_{rms}) between phases L2-L3**	Index: $24524_{dec} = 5FCC_{hex}$

Display of the mains voltage (V_{rms}) between phases L2 and L3

Display range (min. value | unit | max. value)			
-16383	V	16383	

Parameter	Designation	Data type: INTEGER_32
C0053	**DC-bus voltage (U_G)**	Index: $24522_{dec} = 5FCA_{hex}$

Display of the DC-bus voltage (U_G)

Display range (min. value | unit | max. value)			
-32767	V	32767	

Parameter	Designation	Data type: INTEGER_32
C0054	**Mains current (r.m.s. value)**	Index: $24521_{dec} = 5FC9_{hex}$

Display of the mains current (r.m.s. value)

Display range (min. value | unit | max. value)			
-1638.3	A	1638.3	

Parameter	Designation	Data type: INTEGER_32
C0055	**Voltage across the brake resistor**	Index: $24520_{dec} = 5FC8_{hex}$

Display of the voltage across the brake resistor

Display range (min. value | unit | max. value)			
-32767	V	32767	

Parameter	Designation	Data type: INTEGER_32
C0057	**Mains frequency**	Index: $24518_{dec} = 5FC6_{hex}$

Display of the mains frequency

Display range (min. value | unit | max. value)			
-3276.7	Hz	3276.7	

Parameter	Designation	Data type: INTEGER_32
C0061	**Heatsink temperature**	Index: $24514_{dec} = 5FC2_{hex}$

Display of the heatsink temperature

Display range (min. value | unit | max. value)		
-3276.7	°C	3276.7

Parameter	Designation	Data type: INTEGER_32
C0062	**Interior device temperature**	Index: $24513_{dec} = 5FC1_{hex}$

Display of the interior temperature

Display range (min. value | unit | max. value)		
-3276.7	°C	3276.7

Parameter	Designation	Data type: INTEGER_32
C0064	**Device utilisation (I x t)**	Index: $24511_{dec} = 5FBF_{hex}$

Display of the device utilisation (I x t) over the last 180 s

- C0064 > 100 % activates OC5-TRIP.
- TRIP-RESET is only possible if C0064 < 95 %.

Display range (min. value | unit | max. value)		
0	%	65535

Parameter	Designation	Data type: INTEGER_32
C0065	**External low-voltage supply (U_{24})**	Index: $24510_{dec} = 5FBE_{hex}$

Display of the external low-voltage supply (U_{24})

Display range (min. value | unit | max. value)		
-1638.3	V	1638.3

Parameter	Designation	Data type: INTEGER_32
C0066	**Load of internal brake resistor**	Index: $24509_{dec} = 5FBD_{hex}$

Display of the load of the internal brake resistor

Display range (min. value | unit | max. value)		
0	W	65535

Parameter	Designation	Data type: INTEGER_32
C0093	**Device identification (type)**	Index: $24482_{dec} = 5FA2_{hex}$

Display of the device identification (type)

Display list		**Information**
0	No/unknown power section	
12	ECSxE012	
20	ECSxE020	
40	ECSxE040	

Parameter	Designation	Data type: INTEGER_32
C0099	**Firmware version**	Index: $24476_{dec} = 5F9C_{hex}$

Display of the firmware version

Display range (min. value | unit | max. value)		
0.0		25.5

Parameter	Designation	Data type: INTEGER_32
C0125	**LECOM baud rate (AIF)**	Index: $24450_{dec} = 5F82_{hex}$

Baud rate for operation via AIF interface

Selection list (Lenze setting printed in bold)		**Information**
0	**9600 bits/s**	
1	4800 bits/s	
2	2400 bits/s	
3	1200 bits/s	
4	19200 bits/s	

Parameter	Designation	Data type: UNSIGNED_32
C0126	**Response of AIF communication monitoring (CE0)**	Index: $24449_{dec} = 5F81_{hex}$

Response in the case of a communication error on the AIF interface (CE0 fault message)

Selection list (Lenze setting printed in bold)		**Information**
0	TRIP	
3	**No response**	

Parameter	Designation	Data type: INTEGER_32
C0127	**Function of integrated brake transistor**	Index: $24448_{dec} = 5F80_{hex}$

Activation of brake chopper IGBT/fast discharge function (short-circuit braking)
📖 65

Selection list (Lenze setting printed in bold)		**Information**
0	**Brake chopper and short-circuit braking**	
1	Only brake chopper	
2	Only fast discharge function (short-circuit braking)	
4	Without function	

Parameter	Designation	Data type: UNSIGNED_16
C0130	**Control word "CTRL1" to power supply module**	Index: $24445_{dec} = 5F7D_{hex}$

Bit coded display of control word "CTRL1" to the power supply module
📖 91

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	Toggle bit	
Bit 1	TRIP-RESET (low active)	
Bit 2	Fast discharge (short-circuit braking)	
Bit 3	Central controller enable (for the axis modules via output X6/DO1)	
Bit 4	Not assigned	
...		
Bit 7		
Bit 8	Reserved	
...		
Bit 10		
Bit 11	Not assigned	
...		
Bit 15		

Parameter	Designation	Data type: UNSIGNED_16
C0131	**Status word 1 "Stat1" from power supply module**	Index: $24444_{dec} = 5F7C_{hex}$

Bit coded display of the status word 1 "Stat1" from the power supply module
📖 92

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	Ready for operation (RDY)	
Bit 1	Warning is active	
Bit 2	Message is active	
Bit 3	TRIP is active	
Bit 4	Quick discharge (short-circuit braking)not possible	
Bit 5	Quick discharge (short-circuit braking)I active	
Bit 6	-UG relay closed	
Bit 7	+UG relay closed	
Bit 8	Reserved	
...		
Bit 10		
Bit 11	Power supply enable status X6/DI1	
Bit 12	Controller enable status X6/DI2	
Bit 13	Feedback of received toggle bit	
Bit 14	Not assigned	
Bit 15	Not assigned	

Parameter	Designation	Data type: INTEGER_32
C0132	**Status word 2 "Stat2" from power supply module**	Index: $24443_{dec} = 5F7B_{hex}$

The current fault number is transferred in status word 2.
📖 117

Display range (min. value | unit | max. value)		
-2147483647		2147483647

Parameter	Designation	Data type: UNSIGNED_16
C0150	**DCTRL status word 1**	Index: $24425_{dec} = 5F69_{hex}$

Bit coded display of the internal status word 1

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	Discharge DC bus (U_G < 60 V)	
Bit 1	Pulse inhibit (IMP)	
Bit 2	I_{max} limit current reached	
Bit 3	Charging of the DC bus completed	
Bit 4	Heatsink fan on/off	• 1 = the heatsink fan is switched on if the temperature of the heatsink or the device interior exceeds 50°C. • 0 = the heatsink fan is switched off if the temperature of the heatsink or the device interior falls below 45°C.
Bit 5	I x t-warning active	
Bit 6	I x t-limit reached	
Bit 7	Controller inhibit (CINH)	
Bit 8	Status code (binary, LSB)	
Bit 9	Status code (binary)	
Bit 10	Status code (binary)	
Bit 11	Status code (binary, MSB)	
Bit 12	Not assigned	
...		
Bit 15		

Parameter	Designation	Data type: UNSIGNED_16
C0151	**DCTRL status word 2 (high word)**	Index: $24424_{dec} = 5F68_{hex}$

Bit coded display of the internal status word 2

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	Not assigned	
...		
Bit 3		
Bit 4	Fault/TRIP active	
Bit 5	Short-circ. brake TRIP active	
Bit 6	Not assigned	
Bit 7	LP1 warning active	
Bit 8	Power system ready (DC bus can be charged)	
Bit 9	No earth fault	
Bit 10	Heatsink fan fault (FAN)	
Bit 11	DC bus is charged externally	
Bit 12	Not assigned	
...		
Bit 15		

Parameter	Designation	Data type: INTEGER_32
C0161	**Current TRIP fault**	Index: $24414_{dec} = 5F5E_{hex}$

Display of the current TRIP fault (TRIP, short-circuit brake TRIP)
📖 117

Parameter	Designation	Data type: INTEGER_32
C0168	**Fault history buffer**	Index: $24407_{dec} = 5F57_{hex}$

List of the fault messages occurred (TRIP, short circuit braking TRIP, message, warning)
📖 116
📖 117

Subcodes	Information
C0168/1	Currently active fault message
C0168/2	Last fault message
C0168/3	Second to last fault message
C0168/4	Third to last fault message
C0168/5	Fourth to last fault message
C0168/6	Fifth to last fault message
C0168/7	Sixth to last fault message
C0168/8	Seventh to last fault message

Parameter	Designation	Data type: INTEGER_32
C0169	**Fault memory time**	Index: $24406_{dec} = 5F56_{hex}$

Time at which the fault messages entered in the history buffer (C0168) occurred.
- Respective status of the operating hour counter C0179

Display range (min. value | unit | max. value)		
-214748		214748

Subcodes	Information
C0169/1	Currently active fault message
C0169/2	Last fault message
C0169/3	Second to last fault message
C0169/4	Third to last fault message
C0169/5	Fourth to last fault message
C0169/6	Fifth to last fault message
C0169/7	Sixth to last fault message
C0169/8	Seventh to last fault message

Parameter	Designation	Data type: INTEGER_32
C0170	**Fault counter**	Index: $24405_{dec} = 5F55_{hex}$

Frequency at which the fault messages entered in the history buffer (C0168)) occurred.

Display range (min. value | unit | max. value)		
0		65535

Subcodes	Information
C0169/1	Currently active fault message
C0169/2	Last fault message
C0169/3	Second to last fault message
C0169/4	Third to last fault message
C0169/5	Fourth to last fault message
C0169/6	Fifth to last fault message
C0169/7	Sixth to last fault message
C0169/8	Seventh to last fault message

Parameter	Designation	Data type: INTEGER_32
C0173	**Mains voltage selection**	Index: $24402_{dec} = 5F52_{hex}$

Mains voltage selection
📖 64

Selection list (Lenze setting printed in bold)		**Information**
	No response	
0	Operation on 230 V mains	
1	Operation on 400 V mains	
2	Operation on 460 V mains	
3	Operation on 480 V mains	
4	**Automatic determination**	

Parameter	Designation	Data type: INTEGER_32
C0178	**Elapsed-hour meter**	Index: $24397_{dec} = 5F4D_{hex}$

Display of the time during which the power supply module was enabled.

Display range (min. value | unit | max. value)		
-214748	h	214748

Parameter	Designation	Data type: INTEGER_32
C0179	**Power-on time meter**	Index: $24396_{dec} = 5F4C_{hex}$

Display of the time during which the DC bus was charged.

Display range (min. value | unit | max. value)		
-214748	h	214748

Parameter	Designation	Data type: INTEGER_32
C0183	**Module diagnostics**	Index: $24392_{dec} = 5F48_{hex}$

- Display of fault or status information.
- If several pieces of fault or status information are available at the same time, the information with the lowest number is displayed.

Display list		**Information**
0	No fault	
101	Initialisation phase	
102	TRIP is active	
104	Message is active	
142	Pulse inhibit (IMP) is active	
250	Warning is active	

Parameter	Designation	Data type: VISIBLE_STRING
C0200	**Firmware identification (ID)**	Index: $24375_{dec} = 5F37_{hex}$

Display of the firmware identification (ID)

Parameter	Designation	Data type: VISIBLE_STRING
C0201	**Firmware creation date**	Index: $24374_{dec} = 5F36_{hex}$

Display of the firmware creation date

Parameter	Designation	Data type: INTEGER_32
C0204	**Device serial number**	Index: $24371_{dec} = 5F33_{hex}$

Display of the device serial number

Parameter	Designation	Data type: INTEGER_32
C0231	**Hardware version**	Index: $24344_{dec} = 5F18_{hex}$

Display of the hardware version

Display range (min. value | unit | max. value)		
0		65535

Parameter	Designation	Data type: INTEGER_32
C0235	**Device - month of manufacture**	Index: $24340_{dec} = 5F14_{hex}$

Display of the month of manufacture of the device

Display range (min. value | unit | max. value)		
0		65535

Parameter	Designation	Data type: INTEGER_32
C0236	**Device - year of manufacture**	Index: $24339_{dec} = 5F13_{hex}$

Display of the year of manufacture of the device

Display range (min. value | unit | max. value)		
0		65535

Parameter	Designation	Data type: INTEGER_32
C0238	**Version code**	Index: $24337_{dec} = 5F11_{hex}$

Display of the version code

Display range (min. value | unit | max. value)		
0		65535

Parameter	Designation	Data type: UNSIGNED_32
C0240	**Overflow of elapsed-hour meter**	Index: $24335_{dec} = 5F0F_{hex}$

Display for the overflow of the elapsed-hour meter

Display range (min. value | unit | max. value)		
0	h	4294967295

Parameter	Designation	Data type: UNSIGNED_32
C0241	**Overflow of op. hour meter**	Index: $24334_{dec} = 5F0E_{hex}$

Display for the overflow of the op. hour meter

Display range (min. value | unit | max. value)		
0	h	4294967295

Parameter	Designation	Data type: INTEGER_32
C0349	**DIP switch - system bus (CAN)**	Index: $24226_{dec} = 5EA2_{hex}$

Display of the DIP switch settings for the system bus (CAN)
📖 78

Subcodes	**Information**
C0349/1	CAN node address
C0349/2	CAN baud rate

Parameter	Designation	Data type: INTEGER_32
C0350	**CAN node address**	Index: 24225_{dec} = $5EA1_{hex}$

Setting of the CAN node address

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 78)
- After the setting, a reset node is required.
- Each CAN node must be assigned a definite node address.

Setting range (min. value | unit | max. value)			**Lenze setting**
1		63	**32**

Parameter	Designation	Data type: INTEGER_32
C0351	**CAN baud rate**	Index: 24224_{dec} = $5EA0_{hex}$

Entry of the CAN baud rate

Note:

- The baud rate must be set identically for all CAN nodes.
- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 78)
- After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**500 kbps**	
1	250 kbps	
2	125 kbps	
3	50 kbps	
4	1000 kbps	

Parameter	Designation	Data type: INTEGER_32
C0352	**CAN master/slave boot-up configuration**	Index: 24223_{dec} = $5E9F_{hex}$

Master/slave configuration for CAN bus interface X4

📖 84

Note: After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**Slave**	
1	Master (CAN network PDO enable)	
2	Slave node guarding	

Parameter	Designation	Data type: INTEGER_32
C0353	**Mode CAN_IN/OUT ID creation (COB-IDs)**	Index: 24222_{dec} = $5E9E_{hex}$

C0353 can be used to determine whether the identifier (COB-ID) is created from the basic identifier plus the node address in C0350 or individually with an ID offset in C0354.

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON".
- After the setting, a reset node is required.

Selection list (Lenze setting printed in bold)		**Information**
0	**COB-ID = basic identifier + C0350**	📖 158
1	COB-ID = 384 + C0354	📖 82

Subcodes	**Information**
C0353/1	ID creation CAN1_IN/OUT (cyclic operation (sync-controlled))
C0353/2	ID creation CAN2_IN/OUT (reserved)
C0353/3	ID creation CAN3_IN/OUT (event-controlled/cyclic operation without sync)

Parameter	Designation	Data type: INTEGER_32
C0354	**CAN_IN/OUT ID offset**	Index: $24221_{dec} = 5E9D_{hex}$

ID offset for calculating individual COB-IDs: COB-ID = 384 + ID offset
📖 82

Note:

- This code is not active if one of the switches 2 ... 7 of the DIP switch is set to ”ON”.
- After the setting, a reset node is required.

Setting range (min. value | unit | max. value)		
0		513

Subcodes	Lenze setting	Information
C0354/1	32	ID offset for COB-ID CAN1_IN
C0354/2	160	ID offset for COB-ID CAN1_OUT
C0354/3	288	ID offset for COB-ID CAN2_IN
C0354/4	289	ID offset for COB-ID CAN2_OUT
C0354/5	416	ID offset for COB-ID CAN3_IN
C0354/6	417	ID offset for COB-ID CAN3_OUT

Parameter	Designation	Data type: INTEGER_32
C0355	**CAN_IN/OUT identifier (COB-IDs)**	Index: $24220_{dec} = 5E9C_{hex}$

Display of the CAN_IN/OUT identifiers (COB-IDs)
📖 83

Display range (min. value | unit | max. value)		
0		2047

Subcodes	Information
C0355/1	COB-ID CAN1_IN
C0355/2	COB-ID CAN1_OUT
C0355/3	COB-ID CAN2_IN
C0355/4	COB-ID CAN2_OUT
C0355/5	COB-ID CAN3_IN
C0355/6	COB-ID CAN3_OUT

Parameter	Name	Data type: INTEGER_32
C0356	**CAN time settings**	Index: $24219_{dec} = 5E9B_{hex}$

Setting of the ...
- Boot-up time
- Cycle time
- Activation delay

📖 86

Setting range (min. value | unit | max. value)		
0	ms	65000

Subcodes	Lenze setting	Information
C0356/1	3000 ms	CAN boot-up time ● Delay time after mains connection for the initialisation by the master. ● Only valid if C0352 = 1 (master).
C0356/2	0 ms	Cycle time for CAN2_OUT ● Diagnostics PDO C0390 (📖 94)
C0356/3	0 ms	Cycle time for CAN3_OUT ● Factor to task time for process data telegram transmission. ● 0 ms = event-controlled data transmission (the output data will only be transmitted if a value changes in the output object)
C0356/4	20 ms	Delay time for initial transmission of the process data object CAN3_OUT after the CAN bus changes to ”Operational”

Parameter	Designation	Data type: INTEGER_32
C0357	**CAN_IN monitoring times (CE1 ... CE3)**	Index: $24218_{dec} = 5E9A_{hex}$

Monitoring times for process data input objects
- If no telegram arrives within the time set, CE1 ... CE3-TRIP is enabled.
- Setting ”0 ms” = monitoring is switched off

📖 104

Setting range (min. value | unit | max. value)		
0	ms	65000

Subcodes	Lenze setting	Information
C0356/1	0 ms	CAN1_IN monitoring time CE1 (cyclic operation (sync-controlled))
C0356/2	0 ms	CAN2_IN monitoring time CE2 (reserved)
C0356/3	0 ms	CAN3_IN monitoring time CE3 (event-controlled/cyclic operation without sync)

Parameter	Designation	Data type: INTEGER_32
C0358	**CAN reset node**	Index: $24217_{dec} = 5E99_{hex}$

Make a reset node for the CAN bus node.

📖 90

Selection list (Lenze setting printed in bold)		Information
0	**No function**	
1	CAN reset	

Parameter	Designation	Data type: INTEGER_32
C0359	**CAN status**	Index: $24216_{dec} = 5E98_{hex}$

Display of the system bus (CAN) operating status
📖 93

Display list		Information
0	Operational	
1	Pre-operational	
2	Warning	
3	Bus off	
4	Stopped	

Parameter	Designation	Data type: INTEGER_32
C0360	**CAN PDOs/mode selection**	Index: $24215_{dec} = 5E97_{hex}$

Selection of CAN PDOs/mode for the process data transfer via the system bus (CAN)
📖 85

Selection list (Lenze setting printed in bold)		Information
0	No response	event-controlled/cyclic without sync
1	**CAN1_IN/OUT**	cyclic (sync-controlled)

Parameter	Designation	Data type: INTEGER_32
C0370	**SDO gateway**	Index: $24205_{dec} = 5E8D_{hex}$

Activate address gateway/remote parameterisation
- C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here.
- The corresponding code is accessed via parameter data channel 1 of the target device.
- C0370 = 0: remote parameterisation is deactivated

Setting range (min. value | unit | max. value)			Lenze setting
0		63	**0**

Parameter	Designation	Data type: INTEGER_32
C0382	**CAN Node Guarding: "Node Guard Time"**	Index: $24193_{dec} = 5E81_{hex}$

Setting of the time interval for the status enquiry from the master
- Only relevant if C0352 = 2.

📖 88

Setting range (min. value | unit | max. value)			Lenze setting
0	ms	65535	**0 ms**

Parameter	Designation	Data type: INTEGER_32
C0383	**CAN Node Guarding: "Node Life Time Factor"**	Index: $24192_{dec} = 5E80_{hex}$

Factor for monitoring time "Node Life Time"
- Node Life Time = C0383 x C0382
- Only relevant if C0352 = 2.

📖 88

Setting range (min. value | unit | max. value)			Lenze setting
0		255	**0**

Parameter	Designation	Data type: INTEGER_32
C0384	**Response - CAN node guarding**	Index: $24191_{dec} = 5E7F_{hex}$

Response to a ”Life Guarding Event”if no node guarding telegram has been received during ”Node Life Time” (C0382 x C0383).

- When C0382 = 0 or C0383 = 0, the monitoring function is not active (no node guarding fault message is enabled).
- Only relevant if C0352 = 2.

📖 88

Selection list (Lenze setting printed in bold)		**Information**
0	TRIP	
1	Message	
2	Warning	
3	**Off**	

Parameter	Name	Data type: INTEGER_32
C0390	**Configuration diagnostics PDO via CAN**	Index: $24185_{dec} = 5E79_{hex}$

Via C0390/1 ... 8 a diagnostics PDO (8 bytes) can be parameterised, which can be sent via CAN2_OUT.

- The 8 bytes can be assigned with variables for advanced diagnostics of the mains conditions and the internal state machine (mapping).
- In C0391 the assignment in percent (0 ... 100 %) of the 8 bytes of the PDO is shown.

Conditions for sending the diagnostics PDO:

The CAN bus is ”Operational” and the cycle time for CAN2_OUT is > 0 ms (C0356/2).

Possible settings	
C390/x = 0	Not assigned [0 bytes]
C390/x = 1	Voltage V_{L1L2} [2 bytes]
C390/x = 2	Voltage V_{L2L3} [2 bytes]
C390/x = 3	Counter of the zero crossings per second (frequency measurement of V_{L1L2}) [2 bytes]
C390/x = 4	Mains synchronisation n-times outside the limits (evaluation of V_{sd} and V_{sq}) [1 byte]
C390/x = 5	Internal status bits [1 byte]
C390/x = 6	Transformed voltage component V_{sd} [2 bytes]
C390/x = 7	Transformed voltage component V_{sq} [2 bytes]
C390/x = 8	Internal error bits [2 bytes]

Subcodes	**Information**
C0390/1	Depending on the byte size of the variables selected, it may happen that the variables in the last subcodes do not become effective anymore. 📖 109
...	
C0390/8	

Parameter	Designation	Data type: INTEGER_32
C0391	**Assignment of diagnostics PDO in percent**	Index: $24184_{dec} = 5E78_{hex}$

Display of the assignment of the 8 bytes of the diagnostics PDO (CAN2_OUT) in percent

📖 109

Display range (min. value | unit | max. value)		
0	%	100

Parameter	Designation	Data type: INTEGER_32
C0400	**A/D values**	Index: $24175_{dec} = 5E6F_{hex}$

Display of the A/D values

Display range (min. value | unit | max. value)		
-214748		214748

Subcodes	**Information**
C0400/1	Interior device temperature
C0400/2	Design ID of the power section
C0400/3	External low-voltage supply
C0400/4	Mains current
C0400/5	Mains voltage L2_L3
C0400/6	Mains voltage L1_L2
C0400/7	Voltage across the brake resistor
C0400/8	DC-bus voltage

Parameter	Designation	Data type: UNSIGNED_16
C0443	**Status of digital inputs**	Index: $24132_{dec} = 5E44_{hex}$

Bit coded display of the digital input status

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	X6/T1, T2	Temperature of ext. brake resistor
Bit 1	X6/DI2	Controller enable (axis modules)
Bit 2	X6/DI1	Power supply enable
Bit 3	Heatsink fan	
Bit 4	Thyristor driver (LOW-active)	
Bit 5	Not assigned	
...		
Bit 15		

Parameter	Designation	Data type: UNSIGNED_16
C0444	**Status of digital outputs**	Index: $2413_{dec} = 5E43_{hex}$

Bit coded display of the digital output status

Display range (min. value | unit | max. value)		
0x0000		0xFFFF

Bits (read only)		**Information**
Bit 0	Trigger signal - +UG-relay	
Bit 1	Trigger signal - -UG-relay	
Bit 2	Trigger signal - IGBT	
Bit 3	Trigger signal - thyristor (LOW-active)	
Bit 4	Internal signal ready for operation (RDY)	Bit 4 = 1 (TRUE): DC bus charged AND controller enable active (X6/DI2 = HIGH or control word Ctrl1.Bit03 = 1)
Bit 5	Status of green LED (LOW-active)	
Bit 6	Status of red LED (LOW-active)	
Bit 7	Trigger signal - heatsink fan (LOW-active)	
Bit 8	IGBT gate driver reset (LOW-active)	
Bit 9	Not assigned	
...		
Bit 15		

Parameter	Designation	Data type: INTEGER_32
C0468	**Function of power supply enable (X6/DI1)**	Index: $24107_{dec} = 5E2B_{hex}$

Setting of power supply enable via terminal X6/DI1
Note: The parameters can only be changed if the controller is inhibited.
📖 66

Selection list (Lenze setting printed in bold)		**Information**
0	Mains disconnection (slow discharge)	
1	**Mains disconnection and TRIP-RESET**	
2	Mains disconnection and quick discharge (short-circuit braking)	
4	Mains disconnection, quick discharge (short-circuit braking), and TRIP-RESET	

Parameter	Designation	Data type: INTEGER_32
C0469	**Function of "STOP" keypad key for ECSxE**	Index: $24106_{dec} = 5E2A_{hex}$

Setting of the "STOP" keypad key function of the ECSxE power supply module
Note: The parameters can only be changed if the controller is inhibited.

Selection list (Lenze setting printed in bold)		**Information**
0	No function	
1	**Mains disconnection (slow discharge)**	
2	Quick discharge (short-circuit braking)	

Parameter	Designation	Data type: INTEGER_32
C0579	**Response - monitoring of internal brake resistor (OC6)**	Index: $23996_{dec} = 5DBC_{hex}$

Monitoring response of the internal brake resistor (fault message OC6)
📖 102

Selection list (Lenze setting printed in bold)		**Information**
0	**TRIP**	
3	No response	

Parameter	Designation	Data type: INTEGER_32
C0595	**Response - bus-off/toggle bit monitoring (CE4)**	Index: $23980_{dec} = 5DAC_{hex}$

Bus-off/toggle bit monitoring response of the CAN bus (fault message CE4)
📖 104

Selection list (Lenze setting printed in bold)		**Information**
0	**TRIP**	
3	No response	

Parameter	Designation	Data type: INTEGER_32
C0599	**Delay time - system disturbance (LP1)**	Index: $23976_{dec} = 5DA8_{hex}$

If an LP1 warning or LP1 message is active for the set time, an LP1-TRIP is enabled.
- Value < 65535 ms: LP1-TRIP
- Value = 65535 ms: LP1 warning/LP1 message

📖 99

Setting range (min. value | unit | max. value)			**Lenze setting**
0	ms	65535	**65535 ms**

Parameter	Designation	Data type: UNSIGNED_16
C0866	**Process data input words CAN1_IN**	Index: $23709_{dec} = 5C9D_{hex}$

If the system bus (CAN) is in the ”Operational” state, you can check the contents of the data words received via CAN1_IN via C0866 (subcodes 1 and 2).
- The value is bit coded.

Display range (min. value | unit | max. value)			
0x0000		0xFFFF	
Subcodes			**Information**
C0866/1			CAN1_IN.W0 (word 1, control word ”Ctrl1”)
C0866/2			CAN1_IN.W1 (word 2)

Parameter	Designation	Data type: UNSIGNED_16
C0868	**Process data output words CAN1_OUT**	Index: $23707_{dec} = 5C9B_{hex}$

If the system bus (CAN) is in the ”Operational” state, you can check the contents of the data words sent via CAN1_OUT via C0868 (subcodes 1 and 2).
- The value is bit coded.

Display range (min. value | unit | max. value)			
0x0000		0xFFFF	
Subcodes			**Information**
C0868/1			CAN1_OUT.W0 (word 1, status word 1 ”Stat1”)
C0868/2			CAN1_OUT.W1 (word 2, status word 2 ”Stat2”)

12.2 Table of attributes

The table of attributes contains information required for communicating with the ECSxE power supply module via parameters.

How to read the table of attributes:

Column		Meaning	Entry	
Code		Name of the Lenze code	Cxxxx	
Name		Parameter short text	Text	
Index	dec	Index under which the parameter is addressed. The subindex for array variables corresponds to the Lenze subcode number.	24575 - Lenze code number	Only required for control via bus system.
	hex		5FFFh - Lenze code number	
Data	DS	Data structure	E	Single variable (only one parameter element)
			A	Array variable (several parameter elements)
	DA	Number of array elements (subcodes)	Quantity	
	Data type	Indication of the data type	BITFIELD_8	1 byte bit coded
			BITFIELD_16	2 byte bit coded
			BITFIELD_32	4 byte bit coded
			INTEGER_8	1 byte with sign
			INTEGER_16	2 bytes with sign
			INTEGER_32	4 bytes with sign
			UNSIGNED_8	1 byte without sign
			UNSIGNED_16	2 bytes without sign
			UNSIGNED_32	4 bytes without sign
			VISIBLE_STRING	ASCII string
	Factor	Factor for data transmission via bus system, depending on the number of decimal positions	1, 10, 100, or 1000	1 ≡ no decimal position 10 ≡ 1 decimal position 100 ≡ 2 decimal positions 1000 ≡ 3 decimal positions
Access	R	Read access	✓ Reading allowed	
	W	Write access	✓ Writing allowed	
	CINH	Controller inhibit required	✓ Writing only possible when controller is inhibited	

Table of attributes

Code	Designation	Index		Data				Access		
		dec	hex	DS	DA	Data type	Factor	R	W	CINH
C0001	Operating mode	24574	5FFE	E	1	INTEGER_32	10000	✓	✓	
C0002	Load Lenze setting	24573	5FFD	E	1	INTEGER_32	10000	✓	✓	✓
C0003	Save parameter set	24572	5FFC	E	1	INTEGER_32	10000	✓	✓	
C0004	Selection of XT keypad status display	24571	5FFB	E	1	INTEGER_32	10000	✓	✓	
C0009	LECOM device address	24566	5FF6	E	1	INTEGER_32	10000	✓	✓	
C0022	Max. charging current after power supply enable	24553	5FE9	E	1	INTEGER_32	10000	✓	✓	
C0023	Peak current (peak)	24552	5FE8	E	1	INTEGER_32	10000	✓		
C0024	Service code	24551	5FE7	E	1	INTEGER_32	10000	✓	✓	
C0028	Service code	24547	5FE3	E	1	INTEGER_32	10000	✓	✓	
C0029	Service code	24546	5FE2	E	1	INTEGER_32	10000	✓	✓	
C0031	Service code	24544	5FE0	E	1	INTEGER_32	10000	✓	✓	
C0040	Power supply enable - power supply module	24535	5FD7	E	1	INTEGER_32	10000	✓	✓	
C0043	Reset fault message	24532	5FD4	E	1	INTEGER_32	10000	✓	✓	
C0050	Mains voltage (V_{rms}) between phases L1-L2	24525	5FCD	E	1	INTEGER_32	10000	✓		
C0051	Mains voltage (V_{rms}) between phases L2-L3	24524	5FCC	E	1	INTEGER_32	10000	✓		
C0053	DC-bus voltage (U_G)	24522	5FCA	E	1	INTEGER_32	10000	✓		

Code	Designation	Index		Data				Access		
		dec	hex	DS	DA	Data type	Factor	R	W	CINH
C0054	Mains current (r.m.s. value)	24521	5FC9	E	1	INTEGER_32	10000	✓		
C0055	Voltage across the brake resistor	24520	5FC8	E	1	INTEGER_32	10000	✓		
C0057	Mains frequency	24518	5FC6	E	1	INTEGER_32	10000	✓		
C0061	Heatsink temperature	24514	5FC2	E	1	INTEGER_32	10000	✓		
C0062	Interior device temp.	24513	5FC1	E	1	INTEGER_32	10000	✓		
C0064	Device utilisation (I x t)	24511	5FBF	E	1	INTEGER_32	10000	✓		
C0065	External low-voltage supply (U_{24})	24510	5FBE	E	1	INTEGER_32	10000	✓		
C0066	Load of internal brake resistor	24509	5FBD	E	1	INTEGER_32	10000	✓		
C0093	Device identification (type)	24482	5FA2	E	1	INTEGER_32	10000	✓		
C0099	Firmware version	24476	5F9C	E	1	INTEGER_32	10000	✓		
C0125	LECOM baud rate (AIF)	24450	5F82	E	1	INTEGER_32	10000	✓	✓	
C0126	Response of AIF communication monitoring (CE0)	24449	5F81	E	1	INTEGER_32	10000	✓	✓	
C0127	Function of integrated brake transistor	24448	5F80	E	1	INTEGER_32	10000	✓	✓	
C0130	Control word "CTRL1" to power supply module	24445	5F7D	E	1	UNSIGNED_16	1	✓		
C0131	Status word 1 "Stat1" from power supply module	24444	5F7C	E	1	UNSIGNED_16	1	✓		
C0132	Status word 2 "Stat2" from power supply module	24443	5F7B	E	1	INTEGER_32	1	✓		
C0150	DCTRL status word 1	24425	5F69	E	1	UNSIGNED_16	1	✓		
C0151	DCTRL status word 2 (Highword)	24424	5F68	E	1	UNSIGNED_16	1	✓		
C0161	Current TRIP fault	24414	5F5E	E	1	INTEGER_32	10000	✓		
C0168	Fault history buffer	24407	5F57	A	8	INTEGER_32	10000	✓		
C0169	Fault memory time	24406	5F56	A	8	INTEGER_32	10000	✓		
C0170	Fault counter	24405	5F55	A	8	INTEGER_32	10000	✓		
C0173	Mains voltage selection	24402	5F52	E	1	INTEGER_32	10000	✓	✓	
C0178	Elapsed-hour meter	24397	5F4D	E	1	INTEGER_32	10000	✓		
C0179	Power-on time meter	24396	5F4C	E	1	INTEGER_32	10000	✓		
C0183	Module diagnostics	24392	5F48	E	1	INTEGER_32	10000	✓		
C0200	Firmware identification (ID)	24375	5F37	E	1	VISIBLE_STRING		✓		
C0201	Firmware creation date	24374	5F36	E	1	VISIBLE_STRING		✓		
C0204	Device serial number	24371	5F33	E	1	INTEGER_32	10000	✓		
C0231	Hardware version	24344	5F18	E	1	INTEGER_32	10000	✓		
C0235	Device - month of manufacture	24340	5F14	E	1	INTEGER_32	10000	✓		
C0236	Device - year of manufacture	24339	5F13	E	1	INTEGER_32	10000	✓		
C0238	Version code	24337	5F11	E	1	INTEGER_32	10000	✓		
C0240	Overflow of elapsed-hour meter	24335	5F0F	E	1	UNSIGNED_32	1	✓		
C0241	Overflow of op. hour meter	24334	5F0E	E	1	UNSIGNED_32	1	✓		
C0349	DIP switch - system bus (CAN)	24226	5EA2	A	2	INTEGER_32	10000	✓		
C0350	CAN node address	24225	5EA1	E	1	INTEGER_32	10000	✓	✓	
C0351	CAN baud rate	24224	5EA0	E	1	INTEGER_32	10000	✓	✓	
C0352	CAN master/slave boot-up configuration	24223	5E9F	E	1	INTEGER_32	10000	✓	✓	
C0353	Mode CAN_IN/OUT ID creation (COB-IDs)	24222	5E9E	A	3	INTEGER_32	10000	✓	✓	
C0354	CAN_IN/OUT ID offset	24221	5E9D	A	6	INTEGER_32	10000	✓	✓	
C0355	CAN_IN/OUT identifier (COB-IDs)	24220	5E9C	A	6	INTEGER_32	10000	✓		
C0356	CAN time settings	24219	5E9B	A	4	INTEGER_32	10000	✓	✓	
C0357	CAN_IN monitoring times (CE1 ... CE3)	24218	5E9A	A	3	INTEGER_32	10000	✓	✓	

Code	Designation	Index		Data				Access		
		dec	hex	DS	DA	Data type	Factor	R	W	CINH
C0358	CAN reset node	24217	5E99	E	1	INTEGER_32	10000	✓	✓	
C0359	CAN status	24216	5E98	E	1	INTEGER_32	10000	✓		
C0360	CAN PDOs/mode selection	24215	5E97	E	1	INTEGER_32	10000	✓	✓	
C0370	SDO gateway	24205	5E8D	E	1	INTEGER_32	10000	✓	✓	
C0382	CAN Node Guarding: "Node Guard Time"	24193	5E81	E	1	INTEGER_32	10000	✓	✓	
C0383	CAN Node Guarding: "Node Life Time Factor"	24192	5E80	E	1	INTEGER_32	10000	✓	✓	
C0384	Response - CAN node guarding	24191	5E7F	E	1	INTEGER_32	10000	✓	✓	
C0390	Configuration diagnostics PDO via CAN	24185	5E79	A	8	INTEGER_32	10000	✓	✓	
C0391	Assignment of diagnostics PDO in percent	24184	5E78	E	1	INTEGER_32	10000	✓		
C0400	A/D values	24175	5E6F	A	8	INTEGER_32	10000	✓		
C0443	Status of digital inputs	24132	5E44	E	1	UNSIGNED_16	1	✓		
C0444	Status of digital outputs	24131	5E43	E	1	UNSIGNED_16	1	✓		
C0468	Function of power supply enable (X6/DI1)	24107	5E2B	E	1	INTEGER_32	10000	✓	✓	✓
C0469	Function of "STOP" keypad key for ECSxE	24106	5E2A	E	1	INTEGER_32	10000	✓	✓	✓
C0579	Response - monitoring of internal brake resistor (OC6)	23996	5DBC	E	1	INTEGER_32	10000	✓	✓	
C0595	Response - bus-off/toggle bit monitoring (CE4)	23980	5DAC	E	1	INTEGER_32	10000	✓	✓	
C0599	Delay time - system disturbance (LP1)	23976	5DA8	E	1	INTEGER_32	10000	✓	✓	
C0866	Process data input words CAN1_IN	23709	5C9D	A	2	UNSIGNED_16	1	✓	✓	
C0868	Process data output words CAN1_OUT	23707	5C9B	A	2	UNSIGNED_16	1	✓	✓	

12.3 General information about the system bus (CAN)

All Lenze drive and automation systems are provided with an integrated system bus interface for networking control components on the field level.

The system bus interface serves to exchange, for instance, process data and parameter values between the nodes. Moreover, the interface allows for the connection of further devices as e.g. decentralised terminals, operator and input devices and external control and host systems.

The system bus interface transfers CAN objects to the CANopen communication profile (CiA DS301, version 4.01) which has been created under the umbrella association of the der **CiA** (**C**AN **i**n **A**utomation) to conform with the **CAL** (**C**AN **A**pplication **L**ayer).

Tip!

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

12.3.1 Structure of the CAN data telegram

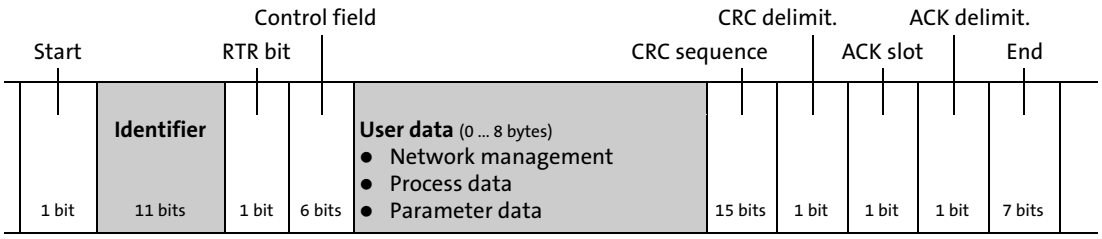


Fig. 12-1 Basic structure of the CAN telegram

Identifier

The identifier determines the priority of the message. Moreover, the following is coded:

- The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter "Addressing of the parameter and process data objects" (📖 158).
- The type of user data to be transferred

User data

The user data area of the CAN telegram either contains network management data, process data or parameter data:

User data	Description
Network management data (NMT data)	The information serves to establish communication via the CAN network
Process data (PDO, Process Data Objects)	• Process data are transmitted via the process data channel. • The process data serve to control the controller. • Process data can be accessed directly by the higher-level host system. The data are, for instance, stored directly in the I/O area of the PLC. It is necessary that the data can be exchanged between the host system and the controller within the shortest time possible. In this connection, small amounts of data can be transferred cyclically. • Process data are transmitted between the higher-level host system and the controllers to ensure a permanent exchange of current input and output data. • Process data are not stored in the controller. • Process data are, for instance, setpoints and actual values.
Parameter data (SDO, Service Data Objects)	• Parameter data are transferred via the parameter data channel and acknowledged by the receiver, i.e. the receiver gets a feedback whether the transmission was successful. • Parameter data of Lenze devices are called codes. • The parameter data channel enables access to all Lenze codes and all CANopen indexes. • Parameters are set, for instance, for the initial commissioning of a plant or when material of a production machine is exchanged. • Usually the transfer of parameters is not time-critical. • Parameter changes are stored in the controller. • Parameter data are, for instance, operating parameters, diagnostic information and motor data.



Tip!

The other signals refer to the transfer features of the CAN telegram that are not described in these instructions.

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

12.3.2 Communication phases of the CAN network (NMT)

Regarding communication, the controller knows the following statuses:

Status	Description
”Initialisation”	After the controller is switched on, the initialisation phase is run through. During this phase, the controller is not involved in the data exchange on the bus. A part of the initialisation or the complete initialisation can be run through again in every NMT status by transmitting different telegrams (see ”state transition”). Here, all parameters are written with their set values. After completing the initialisation, the controller automatically adopts the ”Pre-Operational” status.
”Pre-Operational”	The controller can receive parameter data. The process data are ignored.
”Operational”	The controller can receive parameter data and process data.
”Stopped”	Only network management telegrams can be received.

State transitions

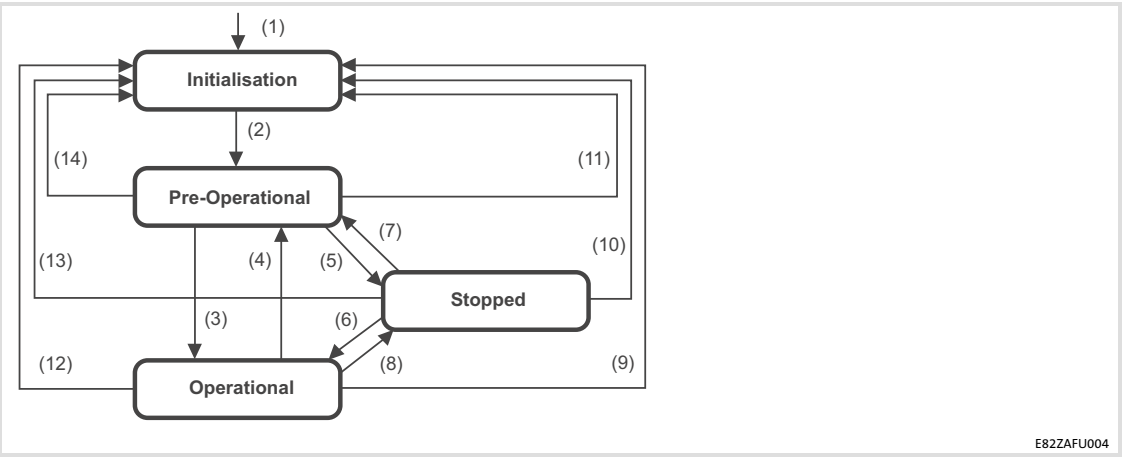


Fig. 12-2 State transitions in the CAN network (NMT)

State transition	Command (hex)	Network status after change	Effect on process or parameter data after state change
(1)	-	Initialisation	When the mains is switched on, the initialisation is started automatically. During the initialisation the controller is not involved in the data exchange. After the initialisation is completed, the node changes automatically to the ”Pre-Operational” status.
(2)	-	Pre-operational	In this phase the master decides how the controllers take part in the communication.
From here, the states are changed over by the master for the entire network. A target address included in the command specifies the receiver/s.			
(3), (6)	01xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active (corresponds to ”Start Remote Node”) Optional: In case of change, event-controlled and time-controlled process data (PDO) are sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency, and parameter data (SDO) are active (corresponds to ”Enter Pre-Operational State”)
(5), (8)	02 xx	Stopped	Only network management telegrams can be received.
(9)	81 xx	Initialisation	Initialisation of all parameters in the CAN fieldbus module with the values stored (corresponds to ”Reset Node”)
(10)			
(11)			
(12)	82 xx		Initialisation of communication-relevant parameters (CiA DS 301) in the CAN fieldbus module with the values stored (corresponds to ”Reset Communication”)
(13)			
(14)			

yy = 00	In case of this assignment, the telegram addresses all devices connected. The state of all devices can be changed at the same time.
yy = node ID	If a node address is given, only the state of the device with the corresponding address will be changed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

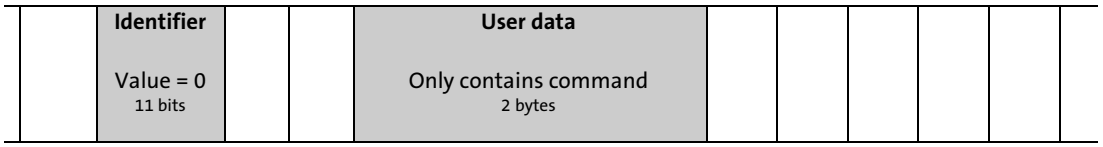


Fig. 12-3 Telegram for switching over the communication phases

The communication phases are changed over by a node, the network master, for the entire network. The change-over can also be done by a controller.

With a certain delay after mains connection, a telegram is sent once which changes the status of the entire drive system to ”Operational”. The delay time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356/4
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356/4
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456/4

Note!

Only a change to ”Operational” status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the ”Pre-Operational” communication status to the ”Operational” communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

12.3.3 Process data transfer

Agreements

- Process data telegrams between host (master) and controller (slave) are distinguished as follows with regard to their direction:
  - Process data telegrams **to** the controller
  - Process data telegrams **from** the controller
- In CANopen, the process data objects are named from the node's view:
  - RPDOx: A process data object received by a node
  - TPDOx: A process data object transmitted by a node

12.3.3.1 Available process data objects

The following process data objects (PDOs) are available for the ECS modules via the interfaces X1, X4 and X14:

Interface	PDOs RPDO: to ECS module TPDO: from ECS module		Availability in ECS modules				
			ECSxE	ECSxS	ECSxP	ECSxM	ECSxA
X1 Automation interface (AIF)	RPDO	AIF1_IN	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_IN	–	✓	–	–	✓
		AIF3_IN	–	✓	–	–	✓
	TPDO	AIF1_OUT	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_OUT	–	✓	–	–	✓
		AIF3_OUT	–	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	RPDO	CAN1_IN	✓	✓	✓	✓	✓
		CAN2_IN	–	✓	✓	–	✓
		CAN3_IN	✓	✓	✓	–	✓
	TPDO	CAN1_OUT	✓	✓	✓	✓	✓
		CAN2_OUT	✓ 1)	✓	✓	–	✓
		CAN3_OUT	✓	✓	✓	–	✓
X14 System bus (CAN) Interface is not available for ECSxE.	RPDO	CANaux1_IN	–	–	✓	–	✓
		CANaux2_IN	–	–	✓	–	✓
		CANaux3_IN	–	–	–	–	✓
	TPDO	CANaux1_OUT	–	–	✓	–	✓
		CANaux2_OUT	–	–	✓	–	✓
		CANaux3_OUT	–	–	–	–	✓

1) ECSxE from V5.0: CAN2_OUT (Diagnostic PDO)

Note!

Power supply module ECSxE

In case of the ECSxE power supply module, the PDOs CAN1_IN/OUT and CAN3_IN/OUT cannot be used simultaneously. The PDOs to be used are selected via C0360.

12.3.3.2 Structure of the process data

The process data telegrams have a maximum user data length of eight bytes each.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the controller.
- The control word is transmitted in byte 1 and 2 of the user data.

	Identifier			User data (8 bytes)							
				Control word		00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte						

Fig. 12-4 Structure of process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram reports status information from the controller. Status information can be as follows:
  - Current status of the controller
  - Status of the digital inputs
  - States about internal analog values
  - Fault/error messages

  This information enables the higher-level host system (PLC) to respond accordingly.
- The status word 1 is transmitted in byte 1 and 2 of the user data.
- In byte 3 and 4 of the user data, the extended status word 2 can be optionally transferred.

	Identifier			User data (8 bytes)							
				Status word 1		Status word 2 (optional)		00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte	LOW byte	HIGH byte				

Fig. 12-5 Structure of process data output telegram (TPDO)

12.3.3.3 Transfer of the process data objects

Process data objects		Data transmission	
		ECSxE	ECSxS/P/M/A
RPDOs (to ECS module)	AIF1_IN	–	cyclic (sync-controlled)
	CAN1_IN	cyclic (sync-controlled)	
	CANaux1_IN	–	
	AIF2_IN	–	event-controlled/cyclic without sync
	CAN2_IN	–	
	CANaux2_IN	–	
	AIF3_IN	–	event-controlled/cyclic without sync
	CAN3_IN	event-controlled/cyclic without sync	
	CANaux3_IN	–	
TPDOs (from ECS module)	AIF1_OUT	–	cyclic (sync-controlled)
	CAN1_OUT	cyclic (sync-controlled)	
	CANaux1_OUT	–	
	AIF2_OUT	–	event-controlled/cyclic without sync
	CAN2_OUT	–	
	CANaux2_OUT	–	
	AIF3_OUT	–	event-controlled/cyclic without sync
	CAN3_OUT	event-controlled/cyclic without sync	
	CANaux3_OUT	–	

► Cyclic data transmission with sync telegram (📖 150)
(via AIF1, CAN1, CANaux1)
The sync telegram enables the controller to accept the process data from the master (RPDOs) or send them to the master (TPDOs).

► Event-controlled data transmission
(via AIF2/3, CAN2/3, CANaux2/3)
The data will be transmitted if a value changes in the corresponding output object.

► Cyclic data transmission without sync telegram
(via AIF2/3, CAN2/3, CANaux2/3)
The data is transmitted in fixed times. The cycle time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456

– Setting of cycle time > 0: data transmission with fixed cycle time
– Setting of cycle time = 0: event-controlled data transmission

12.3.3.4 Cyclic process data objects

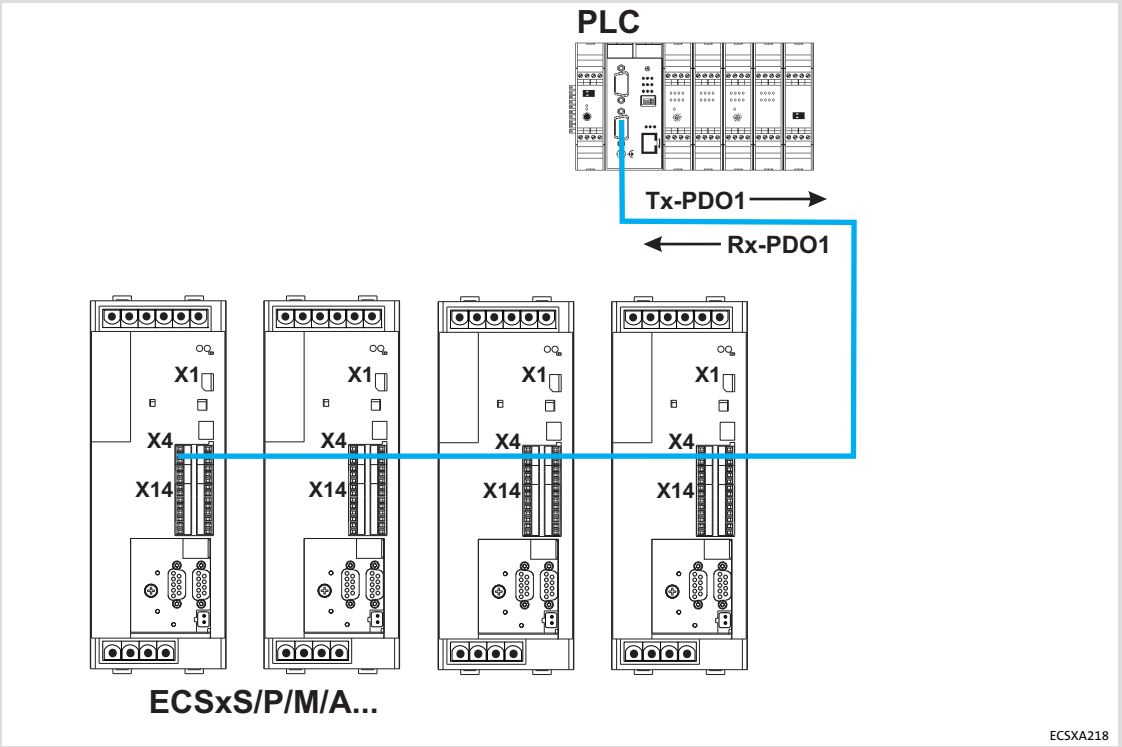


Fig. 12-6 Example: Cyclic process data transfer from/to master (PLC)

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO18), each with 8 bytes of user data, is provided.

Synchronisation of PDOs with sync-controlled transmission

In order that the cyclic process data can be read by the controller or the controller accepts the process data, a special telegram, the CAN sync telegram, is used in addition.

The CAN sync telegram is the trigger point for sending process data of the controller to the master and transferring process data from the master to the controller.

A sync-controlled process data processing requires a corresponding generation of the CAN sync telegram.

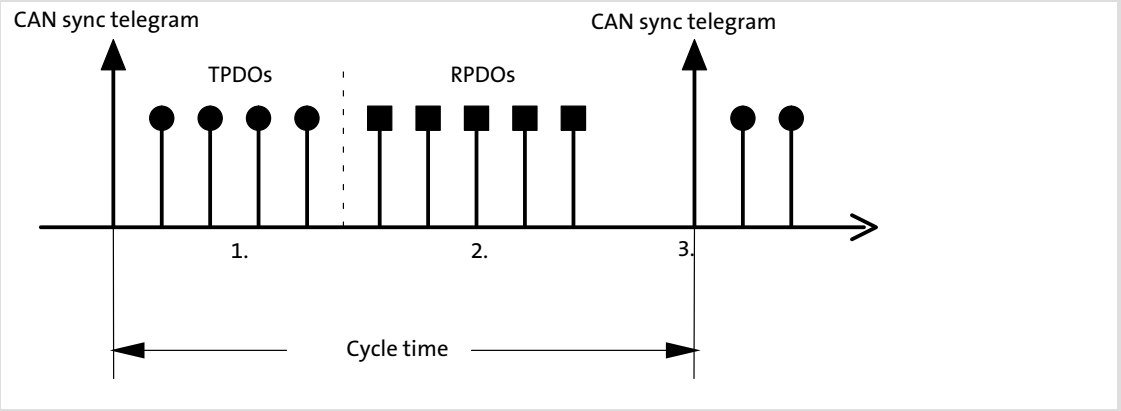


Fig. 12-7 Sync telegram

1. After the CAN sync telegram has been received, the synchronous process data from the controllers are sent to the master (TPDOs). They are read as process input data in the master.
2. When the transmission process is completed, the process output data (of the master) are received by the controllers (RPDOs).

   All other telegrams (e.g. parameters or event-controlled process data) are accepted acyclically by the controllers after transmission is completed. The acyclic data are not displayed in the above illustration. They must be considered when the cycle time is dimensioned.
3. The data in the controller is accepted with the next CAN sync telegram.

Tip!

The response to a CAN sync telegram is determined by the transmission type selected.

12.3.3.5 Event-controlled process data objects

The event-controlled process data objects are particularly suitable for the data exchange between controllers and for distributed terminal extensions. They can, however, also be used by a host system.

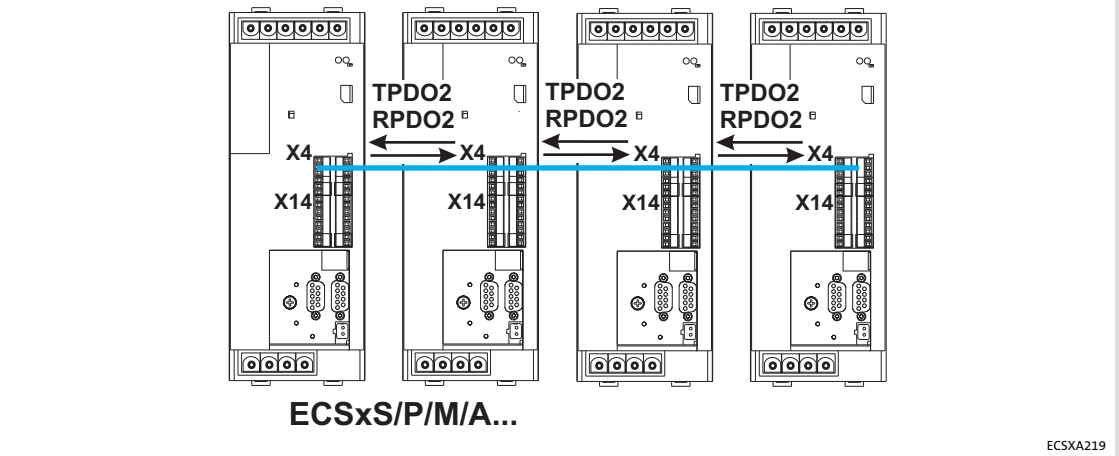


Fig. 12-8 Example: event-controlled process data objects PDO2

The process data objects serve to transmit simple binary signals (e.g. states of digital input terminals) or complete values in 16 and 32 bits (e.g. analog signals).

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

12.3.4 Parameter data transfer

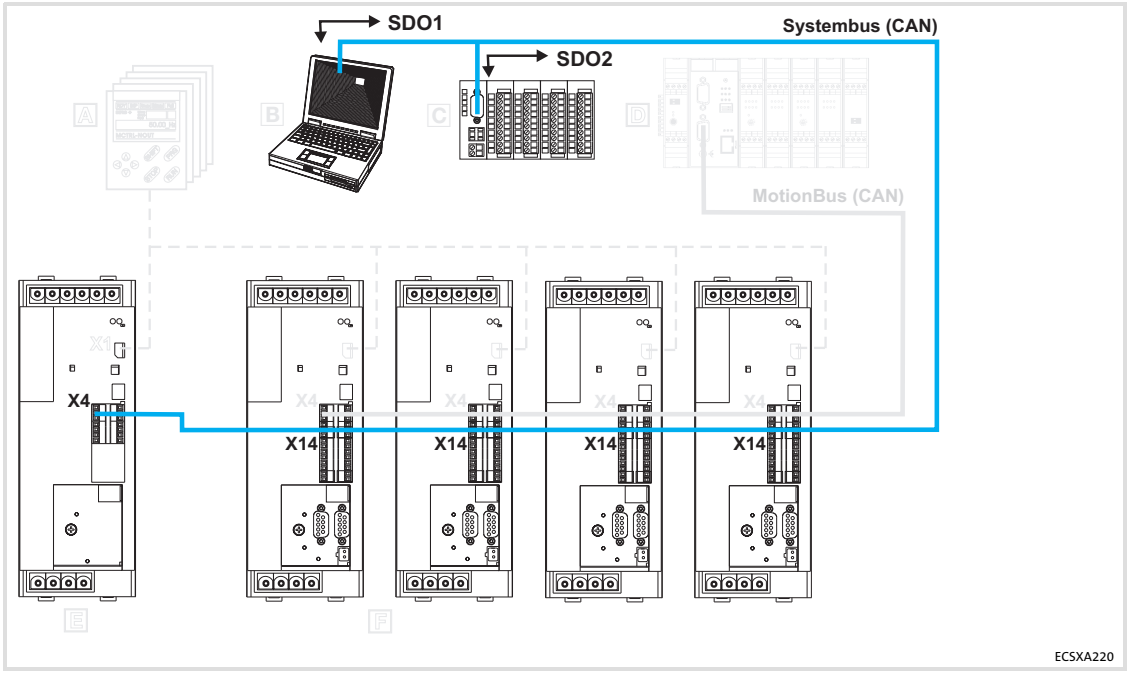


Fig. 12-9 Parameter data channels for parameterising ECS

Parameters ...

- ► are values which are stored under codes in the Lenze controllers.
- ► are set e.g. during initial commissioning or while changing materials in a machine.
- ► are transmitted with low priority.

Parameter data are transmitted as SDOs (Service Data Objects) via the system bus (CAN) and acknowledged by the receiver. The SDOs enable the writing and reading access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 as well as the CAN bus interfaces X4 and X14 are divided into separate ranges:

Interface		Code range
X1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C03xx
X14	System bus (CAN) ● Interface is not available for ECSxE.	C24xx

12.3.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1. byte	2. byte	3. byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data is shown in motorola format.

Examples for parameter data transfer can be found from 📖 155.

Command

The command contains the services for writing and reading the parameters and information on the length of the user data:

	Bit 7 MSB	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit 2**	**Bit 1**	**Bit 0** LSB
Command	Command specifier (cs)			toggle (t)	Length		e	E
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specification DS301, V4.02 (e.g. segmented transfer).

The command must contain the following information:

Command	4-byte data (5. ... 8. byte)		2-byte data (5. and 6. byte)		1-byte data (5. byte)		Block	
	hex	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameter to the controller)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller reports a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

”Error response” command: In case of a communication error an ”Error response” is generated by the addressed node. This telegram always contains the value ”6” in Data 4 and an error code in Data 3.

The error codes are standardised acc. to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

Parameter value length depending on the data format			
Parameter value **(Length: 1 byte)**	00	00	00
Parameter value **(length: 2 bytes)**		00	00
Low byte	High byte		
Parameter value **(length: 4 bytes)**			
Low word		High word	
Low byte	High byte	Low byte	High byte

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

12.3.4.2 Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	Index Low byte	Index High byte	Subindex	**Error code**			

► Byte 1:

In the **command** byte, the code **128** (**0x80**) indicates that an error has occurred.

► Bytes 2 ... 4:

In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.

► Bytes 5 ... 8:

In the bytes 5 ... to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example: Representation of the error codes 0x06040041 in the bytes 5 ... 8

Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	7th byte	8th byte	Meaning
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

12.3.4.3 Examples of the parameter data telegram

Reading parameters

The heatsink temperature C0061 (43 °C) is to be read from the controller with node address 5 via the parameter data channel 1.

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 5 = 1541

► Command ”Read Request” (request to read a parameter from the controller)

Command	Value [hex]
Read request	**0x40**

► Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = 0x5FC2

► Subindex: 0

► Telegram to controller

Identifier	User data							
	Command	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1541	0x40	0xC2	0x5F	0x00	0x00	0x00	0x00	0x00

► Telegram from controller

Identifier	User data							
	Command	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1413	0x43	0xC2	0x5F	0x00	0xB0	0x8F	0x06	0x00

– Command:
”Read Response” (response to the read request) = 0x43

– Identifier:
SDO1 from controller (1408) + node address (5) = 1413

– Index of the read request:
0x5FC2

– Subindex:
0

– Data 1 ... 4:
0x00068FB0 = 430000 ➞ 430000 : 10000 = 43 °C

Writing parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed to 20 seconds via the SDO1 (parameter data channel 1).

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 1 = 1537

► Command ”Write Request” (transmit parameter to drive)

Command	Value [hex]
Write request	**0x23**

► Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = 0x5FF3

► Subindex: 0

► Calculation of the acceleration time

Data 1 ... 4	Calculation
Value for acceleration time	20 s ú 10000 = 200000 = 0x00030D40

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	0x23	0xF3	0x5F	0x00	0x40	0x0D	0x03	0x00

► Telegram from controller if executed faultlessly

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	0x60	0xF3	0x5F	0x00	0x00	0x00	0x00	0x00

– Command:
”Write Response” (response of the controller (acknowledgement)) = 0x60

– Identifier:
SDO1 from controller (= 1408) + node address (= 1) = 1409

12.3.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier for the ECSxE power supply module is preset ex works with the following values:

Object	Basic identifier	
	dec	hex
Network management (NMT)	0	0
Sync telegram	128	80
Process data channel to ECSxE in cyclic operation (sync-controlled) (RPDO: CAN1_IN)	512	200
Process data channel from ECSxE in cyclic operation (sync-controlled) (TPDO: CAN1_OUT)	384	180
Process data channel to ECSxE in event-controlled/cyclic operation without sync (RPDO: CAN3_IN)	768	300
Process data channel from ECSxE in event-controlled/cyclic operation without sync (TPDO: CAN3_OUT)	769	301
Parameter data channel 1 to ECSxE (SDO1)	1536	600
Parameter data channel 2 to ECSxE (SDO2)	1600	640
Parameter data channel 1 from ECSxE (SDO1)	1408	580
Parameter data channel 2 from ECSxE (SDO2)	1472	5C0
Node Guarding	1792	700

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- Interface X1 (AIF) C2355.
- Interface X4 (CAN) C0355.
- Interface X14 (CAN-AUX) C2455.

Here, no values can be entered.

- General addressing (📖 158):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 82):
  Identifier (COB-ID) = 384 + ID offset (C0354 or C2454)

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (CAN2_IO/CAN3_IO) are factory-set so that the devices are able to communicate with each other.

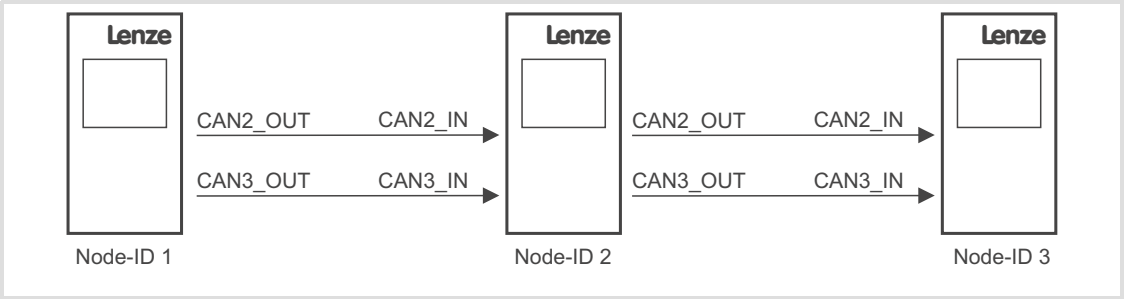


Fig. 12-10 Data exchange between Lenze devices

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

► A node address may not be assigned more than once within a network.

Note!

The ”8.1.1 Setting of CAN node address and baud rate” chapter contains information on

► Setting of the node address (📖 78).

► Individual addressing (📖 82).

12.4 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

12.4.1 Connector sets

To make purchasing easy, the connector sets are available as separate delivery units for the ECS power supply, capacitor and axis modules:

- ECSZ**E**000X0B (connector set for ECS power supply modules)
- ECSZ**K**000X0B (connector set for ECS capacitor modules)
- ECSZ**A**000X0B (connector set for ECS axis modules)

12.4.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

12.4.3 Components for operation and communication

Operating and communication modules

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	-	✓
INTERBUS	EMF2113IB	-	✓
PROFIBUS-DP	EMF2133IB	-	✓
CANopen	EMF2178IB	-	✓
DeviceNet	EMF2179IB	-	✓
EtherCAT	EMF2192IB	✓	✓

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrical isolation to CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1]

[1] "xxxx" = Cable length in decimetre (example: "xxxx" = "0015" → length = 15 dm)

12.4.4 Brake resistor

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Amount of heat } Q_B}{\text{On-time}}$	

12.4.5 Mains fuses

- Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- Use UL-approved cables, fuses and fuse holders only.
- UL fuse:
  – Voltage 500 ... 600 V
  – Tripping characteristic ”H”, ”K5” or ”CC”

12.4.6 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  – The waveform of the mains current is approximated to the sinusoidal shape.
  – Reduction of the effective mains current by up to 25%.
  – Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  – A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

12.4.7 RFI filters

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

13 Index

A

Accessories, 160
- brake resistors, 161
- communication modules, 160
- connector set, 160
- digital frequency cables, 161
- digital frequency distributor, 161
- mains chokes, 163
- operating modules, 160
- RFI filters, 164
- shield mounting kit, 160
- system bus components, 161

Address setting, 79
- via DIP switch, 79

Addressing
- display of the resulting identifiers, 83
- individual, 82
- parameter data objects, 158
- process data objects, 158

Application, as directed, 13

Application as directed, 13

Approvals, 21

Assignment, external brake resistor, 24, 161

Assignment of the plug connectors, system bus (CAN), 54

Atmospheric pressure, 21

Automation interface (AIF), 53

Auxiliary relay, switch-on sequence, 50

Axis module, 10

B

Basic identifier, 158

Basic settings with GDC, 59

Baud rate
- setting, 79
  via DIP switch, 79
- system bus (CAN). *Siehe* baud rate

Brake chopper IGBT, monitoring, 103

Brake resistor
- monitoring, 102
- switching thresholds, 64

Brake resistor, external, 24, 161
- assignment, 24, 161
- connection, 46
- type ERBD...
  connection, 47
  rated data, 24, 162
- type ERBM...
  connection, 47
  rated data, 24, 161
- type ERBS...
  connection, 47
  rated data, 25, 162

Brake resistor, internal
- Connection, 45
- rated data, 23

Bus cable length, 55

Bus status (C0359), 93

Bus-off, 104

C

Cable cross-section, 55

Cable cross-sections, 41
- Control connections, 44, 51

Cable specification, 55

Cables, shielded, 41

CAN bus
- assignment of the plug connectors, 54
- boot-up time setting, 86
- control word, assignment, 91
- cyclic process data objects, synchronisation, 150
- data telegram, 142
- determining the master in the drive system, 84
- display of telegram data, 93
- display of the resulting identifiers, 83
- event-controlled process data objects, 151
- identifier, 142, 158
  display code, 158
- Individual addressing, 82
- making a reset node, 90
- network management data, 142
- Node Guarding, 88, 105
- parameter data, 142, 152
- parameter data channels, 152
- parameter data objects, addressing, 158
- process data, 142
- process data objects, 146
  addressing, 158
  data transmission, 148
- process data telegrams, 147
- Setting the baud rate, 78
- setting the cycle time, 86
- setting the delay time, 86
- setting the mode for process data transfer, 85
- Setting the node address, 78
- status words, assignment, 92
- user data, 142, 153

CAN bus status (C0359), 93

CAN cable specification, 55

CAN data telegram, 141

CAN interface, 54

CAN network
- communication phases, 143
- state transitions, 144
- statuses, 143

CAN network management (NMT), 145

CAN user organisation CiA, Homepage, 142

Capacitor module, 10

Capacitor module ECSxK..., Connection, 48

Capacitor modules, 48

CE-typical drive system, 35
- assembly, 36
- earthing, 37
- filters, 36
- installation , 35
- shielding, 37
  cables, 41

COB-ID, 158
- display code, 158

Codes, 120

Collective cooler, ECSCE series power supply modules, 32

Commissioning, 57
- after power-on, 69
- basic settings
  Chopper operation and short-circuit braking, 65
  configuring the power supply enable input, 66
  operation with external brake resistor, 68
  setting the mains voltage, 64
  STOP key of keypad XT, 67
- Basic settings with GDC, 59
- commissioning steps, overview, 58
- Setting the operating mode, control via digital inputs, 62
- setting the operating mode
  operation via EtherCAT, 63
  operation via system bus (CAN), 61

Communication
- Bus-off, 104
- cyclic node monitoring (Node Guarding), 88, 105
- monitoring, 104
- monitoring times, 104
- system bus (CAN) interface, 54
- toggle bit monitoring, 105

Communication modules, 160

Communication phases, 143

Configuration
- monitoring, 95
  brake chopper IGBT, 103
  brake resistor, 102
  communication, 104
  current, 103
  DC bus, 101
  fan, 101
  heatsink temperature, 101
  mains, 99
  temperature inside the device, 101
  voltage supply of control electronics, 101
- monitoring functions, overview, 96
- System bus (CAN), Individual addressing, 82
- system bus (CAN)
  boot-up time setting, 86
  CAN bus status, 93
  control word, assignment, 91
  determining the master in the drive system, 84
  display of telegram data, 93
  display of the resulting identifiers, 83
  Making a reset node, 90
  Node Guarding, 88, 105
  Setting the baud rate, 78
  setting the cycle time, 86
  setting the delay time, 86
  setting the mode for process data transfer, 85
  Setting the node address, 78
  status words, assignment, 92
- Table of attributes, 138
- via automation interface (AIF), 77
- via system bus interface (CAN), 77

Configuration of CAN interface, node address (node ID), 159

Configuring CAN bus interfaces, 77

Configuring power supply enable input, 66

Conformity, 21

Connection
- Capacitor module ECSxK..., 48
- DC bus, 41, 44
- external brake resistor, 46
  type ERBD..., 47
  type ERBM..., 47
  type ERBS..., 47
- Internal brake resistor, 45
- mains, 41, 42

Control connections
- Cable cross-sections, 44, 51
- Tightening torques, 44, 51

Control signals, 49

Control terminals, 49

Control word, assignment, 91

Control/signal cables, shield connection, 49

Controller, 10

Controller enable, 52

Cooling, 28

Current, monitoring, 103

Cyclic process data objects, 149

D

Data telegram, 141

Data, general electrical, 22

DC bus
- connection, 41, 44
- fuses, 163
- monitoring, 101
- reducing voltage dips, 66

DC-bus voltage, switching thresholds, 64

Definition of notes used, 20

Definitions, 10

Determining the boot-up master, 84

Determining the master for the drive system, 84

Device protection, 17

Diagnostics, 106
- via diagnostics PDO (CAN2_OUT), 109
- with Global Drive Control (GDC), 106
- with PCAN-View, 112
- with XT EMZ9371BC keypad, 111

Diagnostics codes, 93

Diagnostics PDO (CAN), 94

Diagnostics PDO (CAN2_OUT), 109

Digital frequency cables, 161

Digital frequency distributor, 161

Digital inputs, 52
- controller enable, 52
- power supply enable, 52

Digital outputs, 52
- controller enable, 52
- power supply enable, 52

Dimensions, 27, 29, 33
- ECSCE...power supply module , 33
- ECSEE series power supply module, 27
- power supply module ECSDE..., 29
- power supply module ECSEE..., 27

DIP switch, 78

Discharge current to PE, 22

Drive system, 10

Drive system on the mains, 38
- operation on public supply systems, EN 61000-3-2, 39
- supply forms / electrical supply conditions, 39

E

Earthing, EMC, 37

ECSCE series power supply modules, collective cooler, 32

ECSEE series power supply module, dimensions, 27

Electrical installation, 35
- connection for communication, system bus (CAN) interface, 54
- Connection of capacitor module ECSxK..., 48
- control terminals, 49
- Drive system on the mains, supply forms / electrical supply conditions, 39
- drive system on the mains, 38
  operation on public supply systems, 39
- electrical isolation, 38
- installation of a CE-typical drive system, 35
  assembly, 36
  earthing, 37
  filters, 36
  shielding, 37
- Power connections
  Cable cross-sections, 41
  Screw-tightening torques, 41
- power connections, 40
  connection of external brake resistor, 46, 47
  internal brake resistor connection, 45
  mains connection, 41, 42
  terminal assignment, 41
- power terminals, DC bus connection, 41, 44

Electrical isolation, 38

Electromagnetic compatibility, 22

EMC, 22
- earthing, 37
- filters, 36
- shielding, 37
  cables, 41

EN 61000-3-2, operation on public supply systems, 39

Enclosure, 22

Environmental conditions, 21
- atmospheric pressure, 21
- pollution, 21
- site altitude, 21
- temperature, 21
- vibration resistance, 21

Error analysis, 115
- Via history buffer, 116

Error messages, 155
- Causes and remedies, 117
- causes and remedies, 117
- configuration, 97
- reset (TRIP-RESET), 119

Error response, 154

Event-controlled process data objects, 151

Examples
- reading parameters, 155
- Selection help for cable length / number of repeaters, 56
- writing parameters, 157

Executing a reset node, 90

External brake resistor, 24, 161
- assignment, 24, 161
- connection, 46
- operation, 68
- type ERBD...
  connection, 47
  rated data, 24, 162
- type ERBM...
  connection, 47
  rated data, 24, 161
- type ERBS...
  connection, 47
  rated data, 25, 162

F

Fan, monitoring, 101

Fault analysis, 115
- Via history buffer, 116
- via LEDs, 115
- with keypad XT EMZ9371BC, 115

Fault elimination, fault analysis with history buffer, 116

Fault messages, 117
- causes and remedies, 117
- configuration, 97
- reset (TRIP-RESET), 119

Fault responses, 96

Filters, EMC, 36

Free space, 21

Fuses, 43, 163
- DC bus, 163
- mains connection, 43
- replacing, 43

G

Global Drive Control (GDC)
- Diagnostics, 106
- parameter menu, 72
- Parameter setting, 71

H

Heatsink temperature, monitoring, 101

History buffer, 116
- codes, 116
- for fault elimination, 116

I

Identification, power supply modules, 13

Identifier, 142, 158

identifier, display code, 158

Individual addressing, 82

Installation, 21
- system bus (CAN), 54

Installation of a CE-typical drive system, 35
- assembly, 36
- earthing, 37
- filters, 36
- shielding, 37
  cables, 41

Installation, electrical, 35
- connection for communication, system bus (CAN) interface, 54
- Connection of capacitor module ECSxK..., 48
- control terminals, 49
- drive system on the mains, 38
  operation on public supply systems, 39
  supply forms / electrical supply conditions, 39
- electrical isolation, 38
- installation of a CE-typical drive system, 35
  assembly, 36
  earthing, 37
  filters, 36
  shielding, 37
- Power connections
  Cable cross-sections, 41
  Screw-tightening torques, 41
- power connections, 40
  connection of external brake resistor, 46, 47
  internal brake resistor connection, 45
  mains connection, 41, 42
  terminal assignment, 41
- power terminals, DC bus connection, 41, 44

Installation, mechanical, 26

Installation, mechanical , Important notes, 26

Insulation resistance, 22

Internal brake resistor
- Connection, 45
- rated data, 23

K

Keypad XT, STOP key, 67

Keypad XT EMZ9371BC
- changing and saving parameters, 76
- connecting the keypad, 73
- display elements, 74
- fault analysis, 115
- function keys, 75

L

LEDs, 115

Legal regulations, 13

Liability, 13

Low-voltage supply, 10

M

Mains
- after power-on, 69
- monitoring, 99
- Reducing voltage dips, 66

Mains connection, 41, 42
- fuses, 43

Mains fuses, 163

Mains parameter, detection, 69

Manufacturer, 13

Mechanical installation, 26
- Important notes, 26

Message, 96

Monitoring
- brake chopper IGBT, 103
- brake resistor, 102
- communication, 104
  Bus-off, 104
  cyclic node monitoring (Node Guarding), 88, 105
  monitoring times, 104
  toggle bit monitoring, 105
- configuring, 97
- current, 103
- DC bus, 101
- fan, 101
- heatsink temperature, 101
- mains, 99
- possible responses, 97
- temperature inside the device, 101
- voltage supply of control electronics, 101

Monitoring functions, 95
- configuring, 99
- Overview, 97

Monitoring times, 104

MotionBus (CAN)
- CAN data telegram, 142
- cyclic process data objects, synchronisation, 150
- event-controlled process data objects, 151
- identifier, 142, 158
- network management data, 142
- parameter data, 142, 152
- parameter data channels, 152
- parameter data objects, addressing, 158
- process data, 142
- process data objects, 146
  addressing, 158
  data transmission, 148
- process data telegrams, 147
- user data, 142, 153

Mounting
- cold-plate design, 32
- standard installation (with fixing rails), 27
- thermally separated (push-through technique), 28

Mounting position, 21

N

Network management (NMT), 145

Network management data, 142

Node address (node ID), CAN interface, 159

Node address setting, 79

Node Guarding, 105

Node guarding, 88

Node ID, 158

Node-ID, display code, 158

Noise emission, 22

Noise immunity, 22

Notes, definition, 20

O

Operating conditions, 21

Operating modules, 160

Operation on public supply systems, EN 61000-3-2, 39

Operation with external brake resistor, 68

P

Packaging, 21

Parameter data, 142, 152

Parameter data objects, addressing, 158

Parameter data telegram, 153
- examples, 155

Parameter data transfer, 152

Parameter menu, Global Drive Control (GDC), 72

Parameter setting, 70
- With Global Drive Control (GDC), 71
- with keypad XT EMZ9371BC
  changing and saving parameters, 76
  connecting the keypad, 73
  keypad display elements, 74
  keypad function keys, 75
- With XT EMZ9371BC keypad, 73

Parameters, changing and saving, with keypad XT EMZ9371BC, 76

PC system bus adapter, 161

PCAN-View, diagnostics, 112

Pollution, 21

Power connections, 40
- connection of external brake resistor, 46
  type ERBD..., 47
  type ERBM..., 47
  type ERBS..., 47
- Internal brake resistor connection, 45
- mains connection, 41, 42

Power reduction, 21

Power supply enable, 52

Power supply module, 10
- ECSCE..., dimensions, 33
- ECSDE..., dimensions, 29
- ECSEE..., dimensions, 27

Power supply modules
- application as directed, 13
- identification, 13

Power terminals, 40
- DC bus connection, 41, 44

Process data, 142
- Setting the mode for transfer, 85
- structure, 147

Process data objects
- addressing, 158
- available, 146
- cyclic, 149
- event-controlled, 151
- transfer, 148

Process data telegram, 147

Process data transfer, 146

Protection of persons, 17

Protective insulation, 22

Protective measures, 22

Protective separation, 22

R

Rated data, 23
- electrical data, 23
- external brake resistor
  type ERBD..., 24, 162
  type ERBM..., 24, 161
  type ERBS..., 25, 162
- internal brake resistor, 23

Reducing voltage dips, 66

Residual hazards, 17

Responses, 96
- message, 96
- short-circuit braking TRIP, 96
- TRIP, 96
- warning, 96

S

Safety instructions, 14
- definition, 20
- For Lenze power supply modules, 14
- layout, 20

Scope of supply, 12

Screw-tightening torques, 41

Selection help for cable length / number of repeaters, Example, 56

Setting chopper operation, 65

Setting short-circuit braking, 65

Setting the baud rate, 78

Setting the boot-up time, 86

Setting the cycle time, 86

Setting the mains voltage, 64

Setting the mode for process data transfer, 85

Setting the node address, 78
- via DIP switch, 79

Setting the operating mode
- control via digital inputs, 62
- operation via EtherCAT, 63
- operation via system bus (CAN), 61

Shield connection, control/signal cables, 49

Shielded cables, 41

Shielding
- cables, 41
- EMC, 37

Short-circuit braking TRIP, 96

Site altitude, 21

Specification of the transmission cable, 55

Standards, 21

Status words, assignment, 92

Statuses, CAN network, 143

STOP key of keypad XT, 67

Structure of the process data, 147

Supply forms / electrical supply conditions, 39

Switching thresholds, DC-bus voltage/brake resistor, 64

Sync telegram, 150

Synchronisation, cyclic process data objects, 150

System bus (CAN), 141
- assignment of the plug connectors, 54
- baud rate, 55, 56
- boot-up time setting, 86
- CAN bus status (C0359), 93
- configuring CAN bus interfaces, 77
- control word, assignment, 91
- cyclic process data objects, synchronisation, 150
- determining the master in the drive system, 84
- display of telegram data, 93
- display of the resulting identifiers, 83
- event-controlled process data objects, 151
- identifier, 142, 158
- Individual addressing, 82
- making a reset node, 90
- network management data, 142
- Node Guarding, 88, 105
- parameter data, 142, 152
- parameter data channels, 152
- process data, 142
- process data objects, 146
  addressing, 158
  data transmission, 148
- process data telegrams, 147
- setting the baud rate, 78
- setting the delay time, 86
- setting the mode for process data transfer, 85
- setting the node address, 78
- status words, assignment, 92
- structure of a bus system, 54
- user data, 142, 153
- wiring, 54

system bus (CAN)
- CAN data telegram, 142
- parameter data objects, addressing, 158

System bus (CAN) interface, 54

System bus (CAN) wiring, 54

System bus components, 161

System error messages, Causes and remedies, 117

T

Table of attributes, 138

Technical data, 21
- electrical data, 23
- external brake resistor
  type ERBD..., 24, 162
  type ERBM..., 24, 161
  type ERBS..., 25, 162
- general electrical data, 22
- internal brake resistor, 23
- standards and operating conditions, 21

Telegram data, display, 93

Temperature, 21

Temperature inside the device, monitoring, 101

Terminal assignment, power connections, 41

Thermal separation, 28

Tightening torques, Control connections, 44, 51

Toggle bit, monitoring, 105

Transmission cable, specification, 55

TRIP, 96

TRIP-RESET, 119

Troubleshooting
- fault analysis with history buffer, 116
- fault messages, 117

Troubleshooting and fault elimination, 115
- monitoring
  brake chopper IGBT, 103
  brake resistor, 102
  communication, 104
  current, 103
  DC bus, 101
  fan, 101
  heatsink temperature, 101
  mains, 99
  temperature inside the device, 101
  voltage supply of control electronics, 101

U

User data, 142, 153, 155

V

Vibration resistance, 21

Voltage supply of control electronics, monitoring, 101

W

Warning, 96

Warranty, 13

Waste disposal, 16

X

XT EMZ9371BC keypad, Diagnostics, 111

© 07/2015

Lenze Automation GmbH
Postfach 10 13 52, 31763 Hameln
Hans-Lenze-Str. 1, 31855 Aerzen
GERMANY
HR Hannover B 205381

+49 5154 82-0

+49 5154 82-2800

lenze@lenze.com

www.lenze.com

Service Lenze Service GmbH
Breslauer Straße 3, D-32699 Extertal

Germany

008000 2446877 (24 h helpline)

+49 5154 82-1112

service@lenze.com

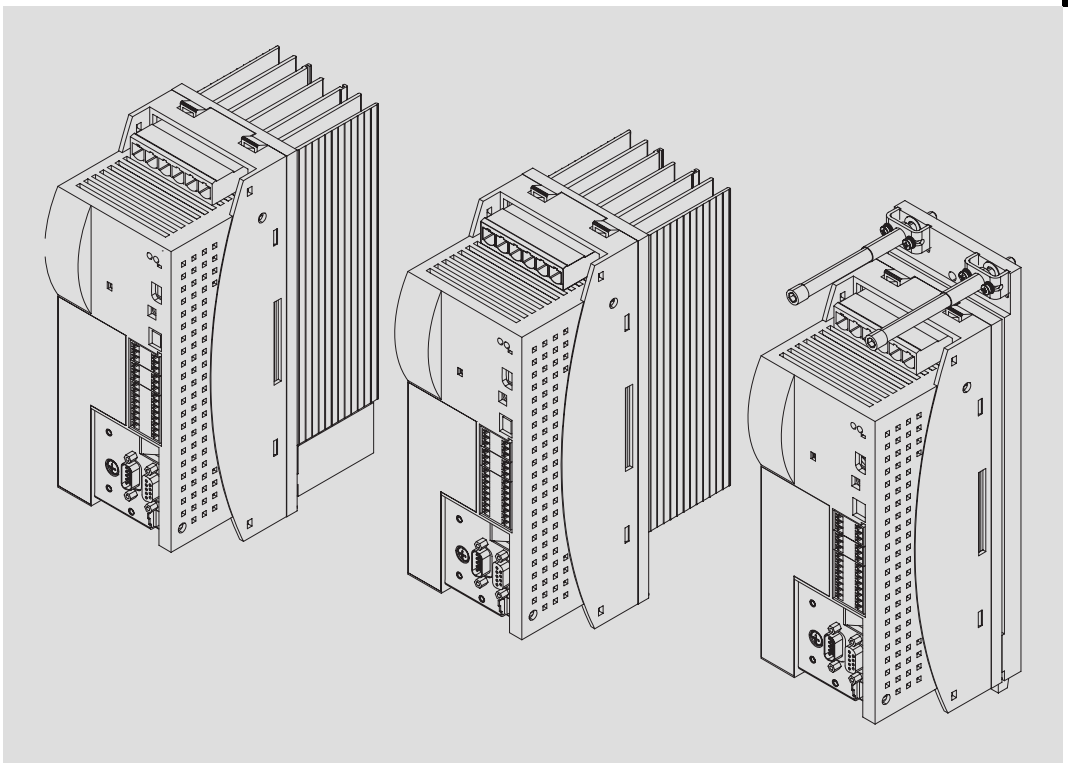
EDBCSXE040 ■ 13495352 ■ EN ■ 8.0 ■ TD29

10 9 8 7 6 5 4 3 2 1

EDBCSXA064
13446719

Operating Instructions

ECS



ECSEAxxx / ECSDAxxx / ECSCAxxx

Axis module – "Application"

Lenze

Please read these instructions before you start working!
Follow the enclosed safety instructions.

This documentation is valid for ECSxA axis modules, application software (A-SW) ”Application”, as of version:

	①										
	ECS	x	A	xxx	x	4	x	xxx	XX	xx	xx

Device type

Design

E = Standard panel-mounted unit, IP20
D = Push-through technique (thermally separated)
C = Cold-plate technique

Application

A = ”Application”

Peak current

004 = 4 A
008 = 8 A
016 = 16 A
032 = 32 A
048 = 48 A
064 = 64 A

Fieldbus interface

C = system bus (CAN)

Voltage class

4 = 400 V/500 V

Technical version

B = Standard
V = coated
I = for IT systems, uncoated
K= for IT systems, coated

Variant

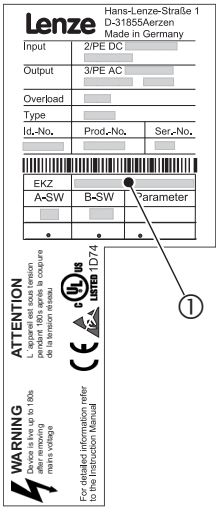
042 = Motion CiA402

Hardware version

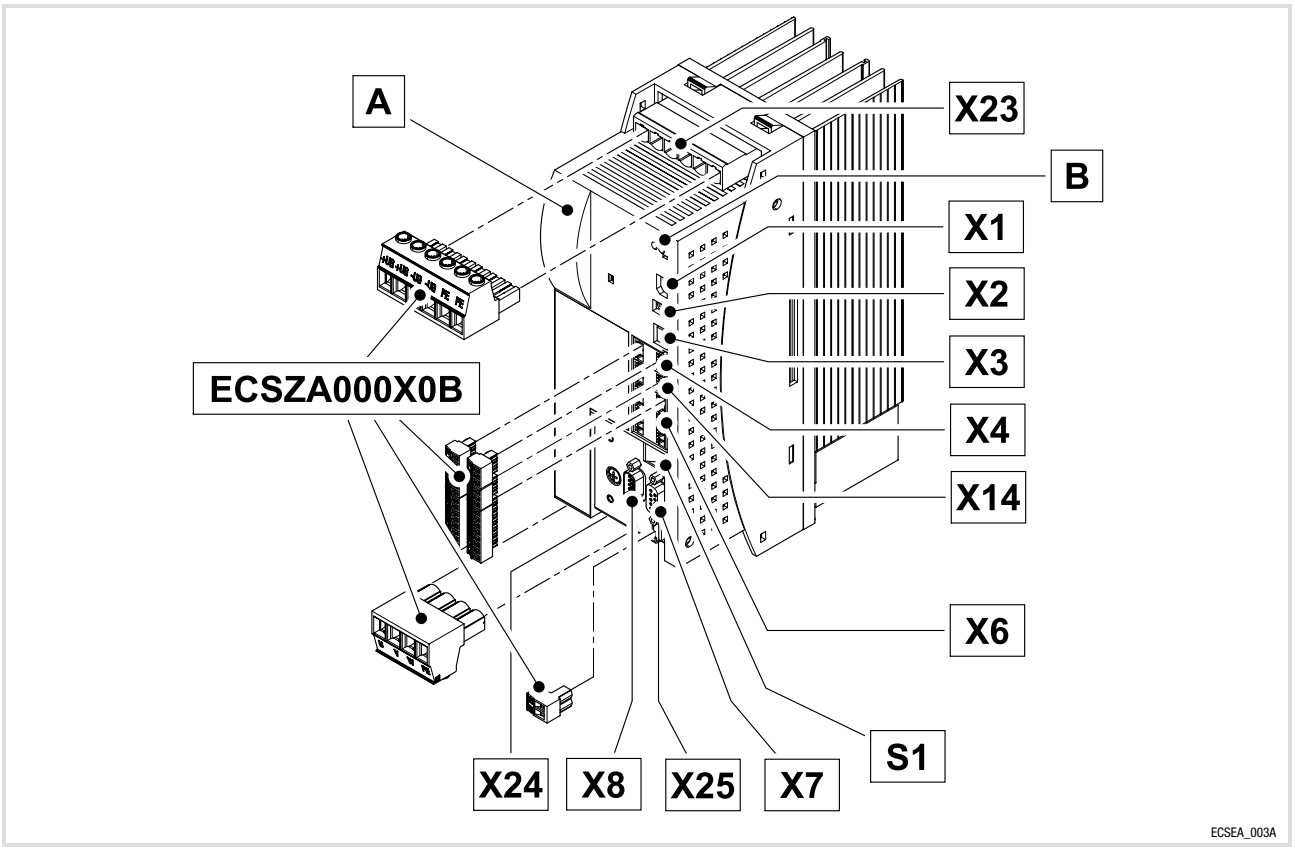
1A or higher

Operating software version (B-SW)

8.0 or higher



© 2013 Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Automation GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not take any responsibility or liability for any damage that may occur. Necessary corrections will be included in subsequent editions.


A
X23
B
X1
X2
X3
X4
X14
ECSZA000X0B
X6
S1
X24
X8
X25
X7
ECSEA_003A

Scope of supply

Position	Description	Quantity
A	ECS☐A... axis module	1
	Accessory kit with fixing material corresponding to the design (☐): ● ”E” - standard panel-mounted unit ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1
	Functional earth conductor (only ECS**D**A...)	1

Note!

The **ECSZA000X0B** connector set must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X23	Connections ● DC-bus voltage ● PE	📖 64
B	LEDs: Status and fault display	
X1	Automation interface (AIF) for ● Communication module ● Operating module (keypad XT)	 📖 89 📖 150
x2	PE connection of AIF	
X3	Analog input configuration	📖 79
X4	CAN connection ● MotionBus (CAN) / for ECSxA: System bus (CAN) ● Interface to the master control	📖 90
X14	CAN-AUXconnection ● System bus (CAN) ● PC interface/HMI for parameter setting and diagnostics	
X6	Connections ● Low-voltage supply ● Digital inputs and outputs ● Analog input ● ”Safe torque off” (formerly ”safe standstill”)	📖 74 📖 78 📖 79 📖 80
S1	DIP switch ● CAN node address ● CAN baud rate	📖 156
X7	Resolver connection	📖 96
X8	Encoder connection ● Incremental encoder (TTL encoder) ● Sin/cos encoder	📖 97
X25	Brake control connection	📖 71
X24	Motor connection	📖 70

Status displays

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibited (CINH), switch-on inhibit	Code C0183
Blinking	Off	Fault/error (TRIP) active	Code C0168/1
Blinking	On	Warning/FAIL-QSP active	Code C0168/1

1 Preface and general information 14
1.1 About these Operating Instructions 14
1.1.1 Conventions used in this Manual 14
1.1.2 Terminology used 15
1.1.3 Code descriptions 16
1.1.4 Structure of the system block descriptions 17
1.2 Features of the ECSxA axis module 18
1.3 Scope of supply 19
1.4 Legal regulations 20
1.5 System block introduction 21
1.5.1 System blocks – principle 21
1.5.2 Node numbers 22
1.5.3 Access via system variables 23
1.5.4 Access via absolute addresses 24
1.5.5 Definition of the inputs/outputs 24
1.5.6 Integrate system blocks into DDS 26
1.5.7 Signal types and scaling 27
2 Safety instructions 28
2.1 General safety and application notes for Lenze controllers 28
2.2 Thermal motor monitoring 32
2.2.1 Forced ventilated or naturally ventilated motors 33
2.2.2 Self-ventilated motors 34
2.3 Residual hazards 36
2.4 Safety instructions for the installation according to UL 38
2.5 Notes used 39
3 Technical data 40
3.1 General data and operating conditions 40
3.2 Rated data 42
3.3 Current characteristics 44
3.3.1 Increased continuous current depending on the control factor 44
3.3.2 Device protection by current derating 47

4 Mechanical installation 48
4.1 Important notes 48
4.2 Mounting with fixing rails (standard installation) 49
4.2.1 Dimensions 49
4.2.2 Mounting steps 50
4.3 Mounting with thermal separation (push-through technique) 51
4.3.1 Dimensions 52
4.3.2 Mounting steps 54
4.4 Mounting in cold-plate design 55
4.4.1 Dimensions 56
4.4.2 Mounting steps 57

5 Electrical installation 58
5.1 Installation according to EMC (installation of a CE-typical drive system) 58
5.2 Power terminals 61
5.2.1 Connection to the DC bus (+UG, -UG) 64
5.2.2 Connection plan for mimimum wiring with internal brake resistor 66
5.2.3 Connection plan for mimimum wiring with external brake resistor 68
5.2.4 Motor connection 70
5.2.5 Motor holding brake connection 71
5.2.6 Connection of an ECSxK... capacitor module (optional) 73
5.3 Control terminals 74
5.3.1 Digital inputs and outputs 78
5.3.2 Analog input 79
5.3.3 Safe torque off 80
5.4 Automation interface (AIF) 89
5.5 Wiring of system bus (CAN) 90
5.6 Wiring of the feedback system 95
5.6.1 Resolver connection 96
5.6.2 Encoder connection 97
5.6.3 Digital frequency input/output (encoder simulation) 100

6 Commissioning 102
6.1 Before you start 102
6.2 Commissioning steps (overview) 103
6.3 Carrying out basic settings with GDC 104
6.4 Loading the Lenze setting 106
6.5 Setting of mains data 107
6.5.1 Selecting the function of the charging current limitation 107
6.5.2 Setting the voltage thresholds 108
6.6 Entry of motor data for Lenze motors 109
6.7 Holding brake configuration 111
6.8 Setting of the feedback system for position and speed control 112
6.8.1 Resolver as position and speed encoder 113
6.8.2 TTL/SinCos encoder as position and speed encoder 115
6.8.3 TTL/SinCos encoder as position encoder and resolver as speed encoder 118
6.8.4 Absolute value encoder as position and speed encoder 122
6.8.5 Absolute value encoder as position encoder and resolver as speed encoder 125
6.9 Setting the polarity of digital inputs and outputs 129
6.10 Entry of machine parameters 130
6.11 Controller enable (CINH = 0) 131
6.12 Operation with motors from other manufacturers 132
6.12.1 Entering motor data manually 132
6.12.2 Checking the direction of rotation of the motor feedback system 135
6.12.3 Adjusting current controller 136
6.12.4 Effecting rotor position adjustment 138
6.13 Optimising the drive behaviour after start 141
6.13.1 Speed controller adjustment 141
6.13.2 Adjustment of field controller and field weakening controller 144
6.13.3 Resolver adjustment 147

7 Parameter setting 148
7.1 General information 148
7.2 Parameter setting with ”Global Drive Control” (GDC) 149
7.3 Parameter setting with the XT EMZ9371BC keypad 150
7.3.1 Connecting the keypad 150
7.3.2 Description of the display elements 151
7.3.3 Description of the function keys 153
7.3.4 Changing and saving parameters 154

8 System bus (CAN / CAN-AUX) configuration 155
8.1 Setting the CAN node address and baud rate 155
8.1.1 Settings via DIP switch 156
8.1.2 Settings via codes 158
8.2 Individual addressing 160
8.3 Determining the boot-up master for the drive system 162
8.4 Setting the boot-up time/cycle time 163
8.5 Reset node 165
8.6 Axis synchronisation (CAN synchronisation) 166
8.6.1 Monitoring of the synchronisation (sync time slot) 169
8.6.2 Axis synchronisation via CAN 170
8.6.3 Axis synchronisation via terminal X6/DI1 171
8.7 Node guarding 172
8.8 CAN management 174
8.9 Mapping indices to codes 175
8.10 Diagnostics codes 177
8.10.1 CAN bus status (C0359/C2459) 177
8.10.2 CAN telegram counter (C0360/2460) 178
8.10.3 CAN bus load (C0361/2461) 179
8.11 Remote parameterisation (gateway function) 180

9 Configuring the AIF interface (X1) 182
9.1 CAN baud rate 182
9.2 CAN boot up (AIF) 183
9.3 Node address (Node ID) 184
9.4 Identifiers of the process data objects 185
9.4.1 Individual identifier assignment 186
9.4.2 Display of the identifier set 187
9.5 Cycle time (XCAN1_OUT ... XCAN3_OUT) 188
9.6 Synchronisation 190
9.6.1 XCAN sync response 190
9.6.2 XCAN sync identifier 190
9.6.3 XCAN Sync Tx transmission cycle 191
9.7 Reset node 191
9.8 Monitoring 192
9.8.1 Time monitoring for XCAN1_IN ... XCAN3_IN 192
9.8.2 Bus off 193
9.9 Operating status of AIF interface 195

10 Monitoring functions 196
10.1 Fault responses 197
10.2 Overview of monitoring functions 198
10.3 Configuring monitoring functions 202
10.3.1 Monitoring times for process data input objects 202
10.3.2 Time-out monitoring for activated remote parameterisation 204
10.3.3 Short circuit monitoring (OC1) 205
10.3.4 Earth fault monitoring (OC2) 205
10.3.5 Motor temperature monitoring (OH3, OH7) 206
10.3.6 Heatsink temperature monitoring (OH, OH4) 208
10.3.7 Monitoring of internal device temperature (OH1, OH5) 209
10.3.8 Function monitoring of thermal sensors (H10, H11) 210
10.3.9 Current load of controller (I x t monitoring: OC5, OC7) 211
10.3.10 Current load of motor (I2 x t monitoring: OC6, OC8) 214
10.3.11 DC-bus voltage monitoring (OU, LU) 218
10.3.12 Voltage supply monitoring - control electronics (U15) 221
10.3.13 Motor phase failure monitoring (LP1) 221
10.3.14 Monitoring of the resolver cable (Sd2) 222
10.3.15 Motor temperature sensor monitoring (Sd6) 223
10.3.16 Monitoring of the absolute value encoder initialisation (Sd7) 224
10.3.17 Sin/cos signal monitoring (Sd8) 225
10.3.18 Monitoring of the speed system deviation (nErr) 226
10.3.19 Monitoring of max. system speed (NMAX) 227
10.3.20 Monitoring of the rotor position adjustment (PL) 228

11 Diagnostics 229
11.1 Diagnostics with Global Drive Control (GDC) 229
11.2 Diagnostics with Global Drive Oscilloscope (GDO) 230
11.2.1 GDO buttons 231
11.3 Diagnostics with the XT EMZ9371BC keypad 232
11.4 Diagnostics with PCAN-View 233
11.4.1 Monitoring of telegram traffic on the CAN bus 233
11.4.2 Setting all CAN nodes to the ”Operational” status 235

12 Troubleshooting and fault elimination 236
12.1 Fault analysis 236
12.1.1 Fault analysis via the LED display 236
12.1.2 Fault analysis with keypad XT EMZ9371BC 236
12.1.3 Fault analysis with the history buffer 237
12.1.4 Fault analysis via LECOM status words (C0150/C0155) 239
12.2 Malfunction of the drive 241
12.3 Fault messages 242
12.3.1 Overview of fault messages, error sources and responses 242
12.3.2 Causes and remedies 246
12.3.3 Reset fault messages (TRIP-RESET) 254

13 System blocks 255
13.1 AIF_IO_Management (node number 161) 255
13.1.1 Inputs_AIF_Management 255
13.1.2 Outputs_AIF_Management 258
13.2 AIF1_IO_AutomationInterface (node number 41) 259
13.2.1 Inputs_AIF1 259
13.2.2 Outputs_AIF1 264
13.3 AIF2_IO_AutomationInterface (node number 42) 267
13.3.1 Inputs_AIF2 267
13.3.2 Outputs_AIF2 269
13.4 AIF3_IO_AutomationInterface (node number 43) 271
13.4.1 Inputs_AIF3 271
13.4.2 Outputs_AIF3 273
13.5 ANALOG1_IO (node number 11) 275
13.5.1 Inputs_ANALOG1 (analog input) 275
13.6 CAN_Management (node number 101) 277
13.6.1 Inputs_CAN_Management 278
13.6.2 Outputs_CAN_Management 278
13.6.3 Executing a reset node 279
13.6.4 Define instant of transmission for CAN2_OUT/CAN3_OUT 279
13.6.5 Status messages 280
13.7 CAN_Synchronization (node number 102) 281
13.8 CAN1_IO (node number 31) 283
13.8.1 Inputs_CAN1 287
13.8.2 Outputs_CAN1 288
13.9 CAN2_IO (node number 32) 289
13.9.1 Inputs_CAN2 292
13.9.2 Outputs_CAN2 293

13.10 CAN3_IO (node number 33) 294
13.10.1 Inputs_CAN3 297
13.10.2 Outputs_CAN3 298
13.11 CANaux_Management (node number 111) 299
13.11.1 Inputs_CANaux_Management 300
13.11.2 Outputs_CANaux_Management 300
13.11.3 Executing a reset node 301
13.11.4 Define instant of transmission for CANaux2_OUT/CANaux3_OUT . . . 301
13.11.5 Status messages 302
13.12 CANaux1_IO (node number 34) 303
13.12.1 Inputs_CANaux1 306
13.12.2 Outputs_CANaux1 307
13.13 CANaux2_IO (node number 35) 309
13.13.1 Inputs_CANaux2 312
13.13.2 Outputs_CANaux2 313
13.14 CANaux3_IO (node number 36) 314
13.14.1 Inputs_CANaux3 317
13.14.2 Outputs_CANaux3 318
13.15 DCTRL_DriveControl (node number 121) 319
13.15.1 Inputs_DCTRL 321
13.15.2 Outputs_DCTRL 323
13.15.3 Quick stop (QSP) 324
13.15.4 Operation inhibit (DISABLE) 325
13.15.5 Controller inhibit (CINH) 325
13.15.6 Setting TRIP (TRIP-SET) 326
13.15.7 Resetting TRIP (TRIP-RESET) 326
13.15.8 Display of digital status signals 327
13.15.9 Device status 328
13.15.10 TRIP status (DCTRL_bExternalFault_b) 329
13.15.11 Transfer of the status/control word via AIF 329
13.16 DFIN_IO_DigitalFrequency (node number 21) 331
13.16.1 Inputs_DFIN 331
13.17 DFOUT_IO_DigitalFrequency (node number 22) 338
13.17.1 Inputs_DFOUT / Outputs_DFOUT 338
13.18 DIGITAL_IO (node number 1) 343
13.18.1 Inputs_DIGITAL (digital inputs) 343
13.18.2 Outputs_DIGITAL (digital outputs) 345
13.19 FCODE_FreeCode (node number 141) 347

13.20 MCTRL_MotorControl (node number 131) 351
13.20.1 Inputs_MCTRL 352
13.20.2 Outputs_MCTRL 354
13.20.3 Torque setpoint / additional torque setpoint 355
13.20.4 Torque limitation 356
13.20.5 Setting maximum speed 357
13.20.6 Speed setpoint limitation 358
13.20.7 Torque control with speed limitation 359
13.20.8 Parameterising phase controllers 360
13.20.9 Quick stop (QSP) 361
13.20.10 Manual field weakening 362
13.20.11 Switching frequency changeover 363
13.20.12 Touch probe (TP) 364
13.20.13 Adjusting the motor data 366
13.20.14 Monitoring 369
13.21 OSC_Oscilloscope (node number 60) 371
13.22 SYSTEM_FLAGS (system flags, node number 151) 372
13.22.1 Inputs SYSTEM_FLAGS 372
13.22.2 Outputs SYSTEM_FLAGS 373

14 Appendix 374
14.1 PLC functionality 374
14.2 Extendability / networking 375
14.3 Memories 376
14.3.1 Retain memory 376
14.3.2 Persistent memory 377
14.3.3 Download of various data items 379
14.3.4 Temporary codes 380
14.3.5 RAM memory access via codes 381
14.4 System program organisation units 383
14.5 Code table 384
14.6 Table of attributes 431
14.7 General information about the system bus (CAN) 440
14.7.1 Structure of the CAN data telegram 440
14.7.2 Communication phases of the CAN network (NMT) 442
14.7.3 Process data transfer 445
14.7.4 Parameter data transfer 452
14.7.5 Addressing of the parameter and process data objects 458
14.8 Overview of accessories 460
14.8.1 Connector sets 460
14.8.2 Shield mounting kit 460
14.8.3 Components for operation and communication 461
14.8.4 Brake resistor 462
14.8.5 Mains fuses 464
14.8.6 Mains chokes 465
14.8.7 RFI filters 466

15 Index 467

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions will assist you in connecting and commissioning the ECSxA... axis modules.

They contain safety instructions which must be observed!

All persons working on and with the ECSxA... axis modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.1.1 Conventions used in this Manual

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

Information type	Print (in the descriptive text)	Example
System block name	**bold**	The SB **DIGITAL_IO**...
System block variable identifier	*italics*	The input *DIGIN_bIn1_b*...



Further information ...

about the conventions used for the Lenze variable identifiers, system blocks, function blocks, and functions can be found in the appendix of the DDS online documentation ”Introduction to IEC 61131-3 programming”.

The compliance with these conventions ensures uniform and universal labelling and makes reading PLC programs easier.

1.1.2 Terminology used

Term	In the following text used for
Power supply module ECSxE...	ECSxE... power supply module
Capacitor module ECSxK...	ECSxK... capacitor module
Axis module Controller Standard device ECSxS... ECSxP... ECSxM... ECSxA ...	Axis module of the ECS series ● ECSxS... - ”Speed and Torque” ● ECSxP... - ”Posi and Shaft” ● ECSxM... - ”Motion” ● ECSxA... - ”Application”
Drive system	ECS drive system consisting of: ● ECSxE... power supply module ● Axis module ECSxS... / ECSxP... / ECSxM... / ECSxA... ● ECSxK series capacitor module (optional) ● further Lenze drive components (accessories)
24 V supply Low-voltage supply	Voltage supply ● of the control card, voltage range 20 ... 30 V DC (±0 V) ● of the ”safe torque off” function (formerly ”safe standstill”), voltage range 18 ... 30 V DC (±0 V) ● of the motor holding brake, voltage range 23 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
System bus (CAN)	Lenze standard bus system based on *CANopen* for ● communication with a higher-level host system (PLC) or further controllers. ● parameter setting and diagnostics.
MotionBus (CAN)	The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.
DDS	Drive PLC Developer Studio (Lenze software for PLC programming acc. to IEC 61131)
GDC	Global Drive Control (Lenze software for parameter setting and diagnostics)
GDO	Global Drive Oscilloscope (additional diagnostic tool of the GDC)
Cxxxx	Code Cxxxx (e.g. C0351) Parameters which serve to parameterise or monitor the controller.
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on terminal strip Xk (e.g. X6/B+ = terminal B+ on terminal strip X6)

1.1.3 Code descriptions

Lenze codes are described in the form of tables with the following structure:

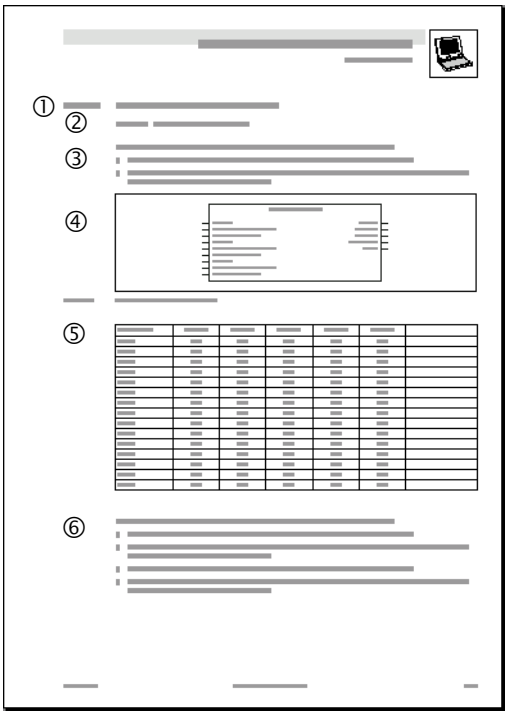
Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	Cxxxx 1	Subcode 1 of Cxxxx
	Cxxxx 2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Example

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0003	Par save	0				Non-volatile saving of parameter set
			0	No response		
			1	Save parameter set		
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2

1.1.4 Structure of the system block descriptions

All system block descriptions contained in this Manual have the same structure:



①	Headline with SB identifier
②	SB function and node number
③	Brief description of the SB and its most important features
④	Graph including all corresponding system variables ● Input variables ● Output variables
⑤	Table giving information about input and output variables: ● Identifier ● Data type ● Signal type ● Address ● Display code ● Display format ● Information
⑥	● Detailed functional description of the SB ● Code description

1.2 Features of the ECSxA axis module

- Safety function ”safe torque off” (formerly ”safe standstill”)
- PLC programming according to IEC 61131-3 with the Lenze software ”Drive PLC Developer Studio” (DDS)
- Functions that can be used in your projects are available as **system blocks**(SB).
  - Chapter ”1.5 Introduction of system blocks” (📖 21)
  - Chapter ”13 System blocks” (📖 255)
- Double CAN ON BORD
  - Interface X4 ”CAN” (PDO1, sync-based)
  - Interface X14 ”CAN-AUX”
- Automation interface (AIF)
  - Connection to other fieldbus systems with Lenze communication modules (e.g. EMF2133IB PROFIBUS-DP)
  - Connection of the XT EMZ9371BC keypad for parameter setting and diagnostics
- Supported feedback systems:
  - Resolver with and without position storage
  - Encoder (incremental encoder (TTL encoder), sin/cos encoder)
- Commissioning, parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC) or the XT EMZ9371BC keypad

1.3 Scope of supply

The scope of supply of the ECSxA... axis module includes:

- Standard device
- Accessory kit with fixings according to the design:
  – ”E” - panel-mounted device
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting Instructions
- Drilling jig
- Functional earth conductor (only ECS**D**A...)

Accessories

The appendix includes information on the following accessories: (📖 460).

- Connector sets for
  – power supply modules: ECSZE000X0B
  – capacitor modules: ECSZK000X0B
  – axis modules: ECSZA000X0B
- ECSZS000X0B001 shield mounting kit (EMC accessories)
- Components for operation and communication
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters



Tip!

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

http://www.Lenze.com

1.4 Legal regulations

Identification	**Nameplate**	**CE designation**	**Manufacturer**
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Automation GmbH Grünstraße 36 D-40667 Meerbusch
Application as directed	**ECSxA... axis modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for open and closed loop control of variable speed drives with PM synchronous motors and asynchronous motors. – for installation into a machine – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective 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 for industrial purposes only. **Drive systems with ECSxA... axis modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at public and non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to axis modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these Instructions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damages and failures caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the axis module – Operating errors – Improper working on and with the axis module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems 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.		

1.5 System block introduction

Lenze pursues the principle to describe functions of the controller by means of function blocks (FB). This principle is also described in the standard IEC 61131-3.

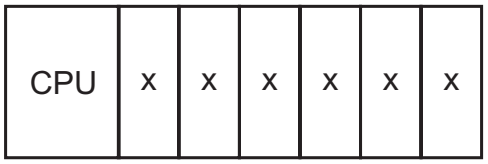
- Functions that you can use in your project as software functionalities, are contained in the function libraries as **function blocks** or **functions**.
- Moreover, quasi hardware functions are available as **system blocks**(SB).

1.5.1 System blocks – principle

- System blocks partly respond to real hardware.
- The system blocks are assigned/identified via node numbers. (📖 22)
- The inputs/outputs of the system blocks are assigned via:
  – System variables (📖 23)
  – Absolute memory addresses (📖 24)
- Inputs/outputs are always classified from the program's point of view.(📖 24)
- Required system blocks must be explicitly integrated into the project of the DDS via the control configuration. (📖 26)

The system block principle can be perfectly explained by means of a PLC system in a rack:

- Besides the CPU, the rack includes digital I/Os, analog I/Os, counter cards, positioning cards etc. as extension cards:



x = extension cards

- The CPU can directly access the extension cards and process the resulting information.
- The single extension cards have a permanent address for being addressed.

Tip!

In case of the ECSxA... axis modules, the system blocks correspond to these attachment cards!

System blocks therefore are specific (hardware) function blocks which are firmly integrated into the runtime system of the ECSxA... axis module.

1.5.2 Node numbers

The system blocks feature the following node numbers:

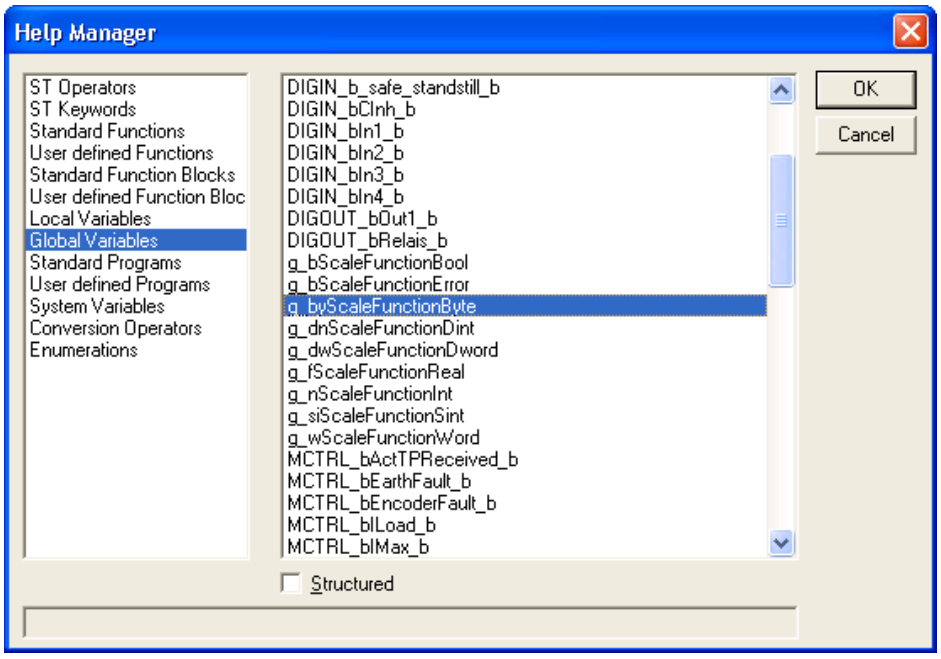
Node number	System block	Notes
1	DIGITAL_IO	Digital inputs/outputs
11	ANALOG1_IO	Analog input 1
21	DFIN_IO_DigitalFrequency	Digital frequency input
22	DFOUT_IO_DigitalFrequency	Digital frequency output
31	CAN1_IO	System bus (CAN)
32	CAN2_IO	
33	CAN3_IO	
34	CANaux1_IO	System bus (CAN-AUX)
35	CANaux2_IO	
36	CANaux3_IO	
41	AIF1_IO_AutomationInterface	Automation interface (AIF)
42	AIF2_IO_AutomationInterface	
43	AIF3_IO_AutomationInterface	
60	OSC_Oscilloscope	Oscilloscope function
101	CAN_Management	System bus (CAN) management
102	CAN_Synchronization	System bus (CAN) synchronisation
111	CANaux_Management	System bus (CAN-AUX) management
121	DCTRL_DriveControl	Device control
131	MCTRL_MotorControl	Motor control
141	FCODE_FreeCodes	Free codes
151	SYSTEM_FLAGS	System flags
161	AIF_IO_Management	Automation interface management
171	VAR_PERSISTENT	Persistent variables

The node number is part of the absolute system bus address (📖 24).

1.5.3 Access via system variables

If you have integrated a system block into the system configuration of the DDS, you can use its system variables within your project.

You can call up the input assistance in the editors of the DDS via **<F2>**, among other things listing all the system variables that are provided:



In this Manual, the system variables can be retrieved in the system variable table of the corresponding system block.

Example: Table with the inputs of the SB **Inputs_Digital** of the ECSxA... axis module

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DIGIN_bCInh_b	BOOL	binary	%IX1.0.0	–	–	Controller inhibit – takes direct effect on the device control DCTRL.
DIGIN_bIn1_b			%IX1.0.1	C0443	bin	
DIGIN_bIn2_b			%IX1.0.2			
DIGIN_bIn3_b			%IX1.0.3			
DIGIN_bIn4_b			%IX1.0.4			
DIGIN_b_safe_standstill_b			%IX1.0.5			"Safe torque off" (former "safe standstill")

1.5.4 Access via absolute addresses

You can also access the inputs and outputs of the system blocks via absolute addresses according to standard IEC 61131-3:

For inputs:	For outputs:	
%IXa.b.c	%QXa.b.c	a = node number b = word address c = bit address

In this Manual, the absolute addresses can be retrieved in the system variable table of the corresponding system block.

Example: Table with the inputs of the SB **Inputs_Digital** of the ECSxA... axis module

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DIGIN_bCInh_b	BOOL	binary	**%IX1.0.0**	–	–	Controller inhibit – takes direct effect on the device control DCTRL.
DIGIN_bIn1_b			**%IX1.0.1**	C0443	bin	
DIGIN_bIn2_b			**%IX1.0.2**			
DIGIN_bIn3_b			**%IX1.0.3**			
DIGIN_bIn4_b			**%IX1.0.4**			
DIGIN_b_safe_standstill_b			**%IX1.0.5**			"Safe torque off" (former "safe standstill")

1.5.5 Definition of the inputs/outputs

For connecting the application program with the hardware, system blocks are connected with program organisation units (POU):

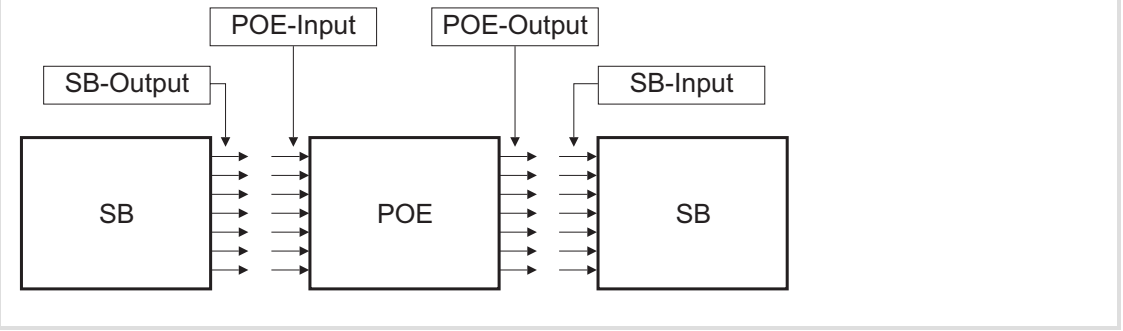


Fig. 1-1 Plan: Connecting system blocks to a program organisation unit (POU)

Note!

Inputs and outputs are always classified from the program's point of view.

- ► Logical SB inputs are always hardware-side outputs of the ECSxA axis... module
- ► Logical SB outputs are always hardware-side inputs of the ECSxA axis... module

Example:

Use of the system blocks **Inputs_Digital** and **Outputs_Digital**

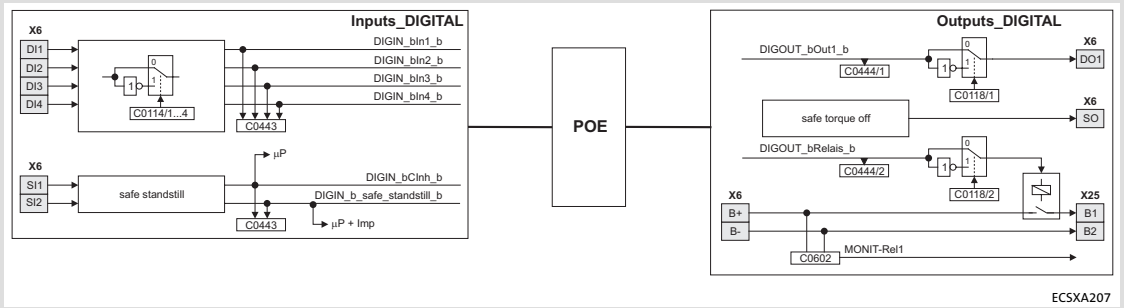


Fig. 1-2 Plan: connecting the system blocks ”Inputs_Digital” and ”Outputs_Digital”

If you want to use digital input 1 and digital output 1, carry out the following steps:

1. Explicitly integrate the system blocks **Inputs_DIGITAL** and **Outputs_DIGITAL** into the control configuration of the DDS. (📖 26)
2. For access to digital input 1:
   – Assign the system variable *DIGIN_bIn1_b* to a POU variable.
3. For access to digital output 1:
   – Assign the system variable *DIGOUT_bOut1_b* to a POU variable.

Note!

According to the IEC 61131-3 standard the system variables *DIGIN_bIn1_b* and *DIGOUT_bOut1_b* may generally only be used once.

The use of one system variable in several POUs must be carried out via a copy (as global variable).

1.5.6 Integrate system blocks into DDS

The required system blocks must be explicitly integrated into the project of the DDS via the control configuration.

- The control configuration is an object in the **Resources** tab in the *Object Organizer*.
- For each system block, the control configuration contains the inputs and outputs with the identifier of the corresponding system variable, the absolute address and the data type of the system variable:

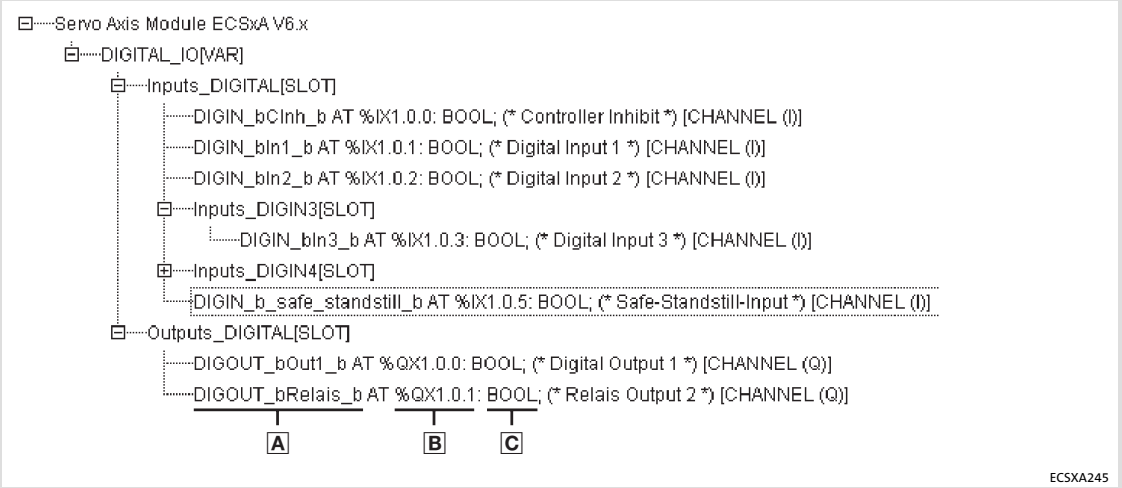


Fig. 1-3 Example: Control configuration with system blocks ”Inputs_DIGITAL” and ”Outputs_DIGITAL”

- A Identifier of the system variable
- B Absolute address
- C Data type of the system variable



Tip!

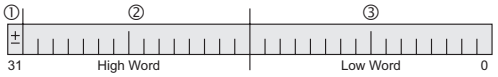
The control configuration provides a context menu via the right mouse button which serves to add or remove system blocks.

1.5.7 Signal types and scaling

A signal type can be assigned to most inputs and outputs of the Lenze function blocks/system blocks. The following signal types are distinguished:

- ► digital and analog signals
- ► position and speed signals

The identifier of the corresponding input/output variable has an ending (starting with an underscore). It indicates the signal type.

Signal		Ending	Memory	Scaling (external size ≡ internal size)
Type	Symbol			
Analog	H/L	_a (analog)	16 Bit1	100 % ≡ 16384
Digital	Disp	_b (binary)	1 bit	0 ≡ FALSE; 1 ≡ TRUE
Angular difference or speed (rot.)	Δ	_v (velocity)	16 Bit1	15000 rpm ≡ 16384
		● Angular difference/speed ref. to 1 ms ● Normalisation example: $Speed\ (on\ motor\ side) = 15000\ [rpm] = \frac{15000}{60\ [s]}$ $1\ motor\ revolution = 65536\ [inc]$ $Variable\ value\ (..._v) = \frac{15000}{60000\ [ms]} \cdot 65536\ [inc] = 16384\ \left[\frac{inc}{ms}\right]$		
Angle or position	▲	_p (position)	32 Bit	1 motor revolution ≡ 65536
		 ① Direction (0 ≡ clockwise rotation; 1 ≡ counter-clockwise rotation) ② No. of motor revolutions (0 ... 32767) ③ Angle or position (0 ... 65535)		

Due to their scaling, analog signals have an asymmetrical resolution range (-200 % ... +199.99 %):

External:	-200 %	-100 %	0 %	+100 %	+199.99 %
Internal:	-32768	-16384	0	+16384	+32767

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

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):

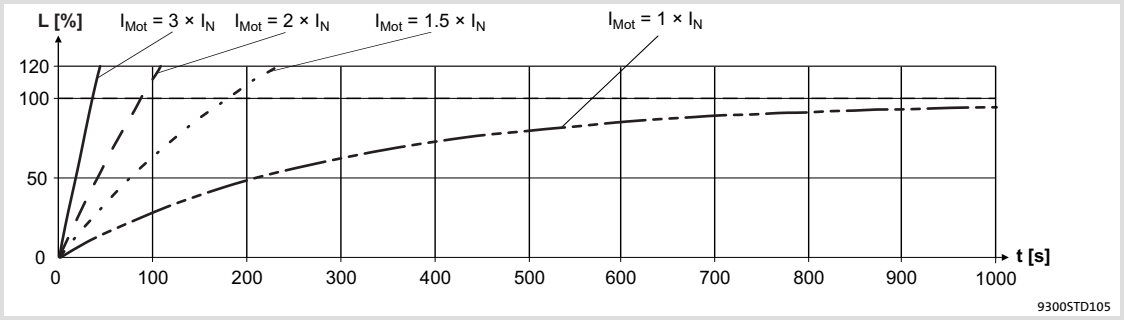


Fig. 2-1 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

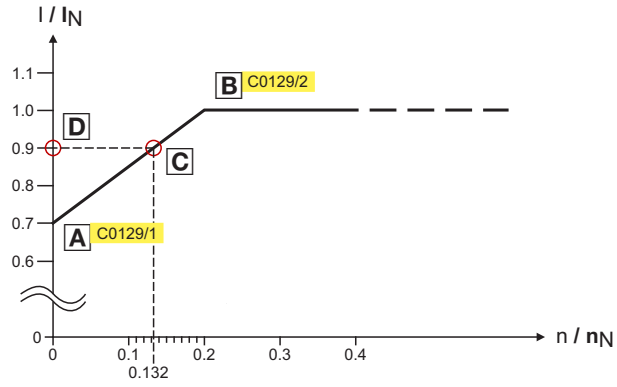


Fig. 2-2 Working point in the range of characteristic lowering

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", 📖 35)

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 axis module, check that no voltage is applied to the power terminals, because
  - the power terminals +UG, -UG, U, V and W remain live for at least 3 minutes after mains switch-off.
  - the power terminals +UG, -UG, U, V and W remain live when the motor is stopped.
- The heatsink has an operating temperature of > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The discharge current to PE is > 3.5 mA AC or. > 10 mA DC.
  - EN 61800-5-1 requires a fixed installation.
  - The PE connection must comply with EN 61800-5-1.
  - Comply with the further requirements of EN 61800-5-1 for high discharge currents!

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG, U, V, W and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Power must not be converted until all devices of the power system are ready for operation. Otherwise, the input current limitation may be destroyed.

Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the axis module, if

- the axis module is supplied via the ECSxE supply module and the input current limitation is activated depending on the DC-bus voltage (C0175 = 1 or 2).
- the axis module is not supplied via a supply module delivered by Lenze.
- the low-voltage supply (24 V) is switched off.

For this reason allow a break of at least three minutes between two starting operations!

Use the safety function ”Safe torque off” (STO) for frequent disconnections for safety reasons.

Motor protection

- Only use motors with a minimum insulation resistance of û = 1.5 kV, min. du/dt = 5 kV/µs.
  – Lenze motors meet these requirements.
- When using motors with an unknown insulation resistance, please contact your motor supplier.
- Some settings of the axis module lead to an overheating of the connected motor, e.g. longer operation of self-ventilated motors with low speeds.
- Use PTC thermistors or thermostats with PTC characteristic for motor temperature monitoring.

2.4 Safety instructions for the installation according to UL

Warnings!

General markings:

- ► Use 60/75 °C or 75 °C copper wire only.
- ► Maximum ambient temperature 55 °C, with reduced output current.

Markings provided for the supply units:

- ► Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V max, when protected by K5 or H Fuses (400/480 V devices).
- ► Alternate - Circuit breakers (either inverse-time, instantaneous trip types or combination motor controller type E) may be used in lieu of above fuses when it is shown that the let-through energy (i^2t) and peak let-through current (I_p) of the inverse-time current-limiting circuit breaker will be less than that of the non-semiconductor type K5 fuses with which the drive has been tested.
- ► Alternate - An inverse-time circuit breaker may be used, sized upon the input rating of the drive, multiplied by 300 %.

Markings provided for the inverter units:

- ► The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 2nd ed., Table 5.1.
- ► The devices are provided with integral overload and integral thermal protection for the motor.
- ► The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X 21, X 22, X 23, X 24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X 25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X 21, X 22, X 23, X 24	12 ... 8
X4, X6, X14	28 ... 16
X 25	24 ... 12

2.5 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.

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (2006/95/EG)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
		CSA 22.2 No. 14	
Max. permissible Motor cable length	shielded	50 m	For rated mains voltage and switching frequency of 8 kHz
Packaging (EN ISO 4180)		Shipping package	
Installation		• Installation into IP20 control cabinet • For the ”safe torque off” function (formerly ”safe standstill”): mounting in IP54 control cabinet	
Mounting position		vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm With ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	can be mounted directly side by side without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) • Atmospheric pressure: 86 ... 106 kPa • Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl • Reduce rated output current by 5 %/1000 m above 1000 m amsl. • Over 2000 m amsl: Use is only permitted in environments with overvoltage category II
Pollution		EN 61800-5-1, UL840: Degree of pollution 2	
Vibration resistance		Acceleration resistant up to 0.7 g (Germanischer Lloyd, general conditions)	

General electrical data			
EMC	Compliance with the requirements acc. to EN 61800-3		
Noise emission	Compliance with the limit class C2 acc. to EN 61800-3 (achieved by using collective filters typical for the application)		
Noise immunity	Requirements acc. to EN 61800-3		
	Requirement	**Standard**	**Severity**
	ESD [1]	EN 61000-4-2	3, i. e. ● 8 kV for air discharge ● 6 kV for contact discharge
	Conducted high frequency	EN 61000-4-6	10 V; 0.15 ... 80 MHz
	RF interference (housing)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (surge voltage on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase/phase ● 2 kV phase/PE
Insulation resistance	EN61800-5-1, UL840: Overvoltage category III		
Discharge current to PE (Acc. to EN 61800-5-1)	> 3.5 mA AC		
Enclosure	IP20 for ● Standard installation (built-in unit) ● Cold-plate technique ● Mounting with thermal separation (push-through technique), IP54 on heatsink side		
Protective measures against	● Short circuit in power terminals – Motor terminal has a limited protection against short circuit (after short circuit detection, the error message must be reset.) ● Short circuit in auxiliary circuits – Digital outputs: Short-circuit-proof – Bus and encoder systems: Limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:) ● Earth fault (earth-fault protected during operation, limited earth-fault protection on mains power-up) ● Overvoltage ● Motor stalling ● Motor overtemperature (input for KTY, I^2 x t monitoring)		
Protective insulation of control circuits	**Protective separation from the mains** Double/reinforced insulation acc. to EN 61800-5-1		

[1] Noise immunity in the above-mentioned severities must be guaranteed by the control cabinet! The user must check the compliance with the severities!

3.2 Rated data

Rated data		Type	Axis module					
			ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains		S_{rated} [kVA]	1.3		2.6		5.3	
Data for operation with upstream power supply module on mains voltage		V_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	2.5	2.0	4.9	3.9	9.8	7.8
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	2.0	1.6	4.0	3.2	8.0	6.4
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	1.4	1.1	2.7	2.2	5.3	4.2
Max. output current (acceleration current)		I_{max} [A]	4.0		8.0		16.0	
Continuous current at standstill (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	2.0	1.6	4.0	3.2	8.0	6.4
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	2.3		4.6		9.1	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	3.0		6.0		12.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	1.5		3.0		6.0	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	27.3		46.3		84.7	
	Inside the device		13.3		17.3		20.7	
	Heatsink		14.0		29.0		64.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4					

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque, M = Motion, P = Posi & Shaft, A = Application

Rated data		Type	Axis module					
			ECSx□032		ECSx□048		ECSx□064	
Output power 400 V mains		S_{rated} [kVA]	8.3		11.2		13.2	
Data for operation with upstream power supply module on mains voltage		U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	15.6	12.5	20.9	16.8	24.5	19.6
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	12.7	10.2	17.0	13.6	20.0	16.0
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	8.5	6.8	11.3	9.0	13.3	10.6
Max. output current (acceleration current)		I_{max} [A]	32.0		48.0		64.0	
Continuous current at standstill [2] (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	16.0	12.8	23.0	18.4	27.0	21.6
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	18.1		27.2		36.3	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	24.0		36.0		48.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	12.1		18.1		24.2	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	144.5		166.5		199.0	
	Inside the device		27.5		34.5		41.0	
	Heatsink		117.0		132.0		158.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4		approx. 3.3			

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

3.3 Current characteristics

3.3.1 Increased continuous current depending on the control factor

In the lower speed range – the motor does not need the full motor voltage – particularly the more powerful ECS axis modules can be permanently operated with increased output current (cp. continuous current $I_{0,eff}$ 📖 42).

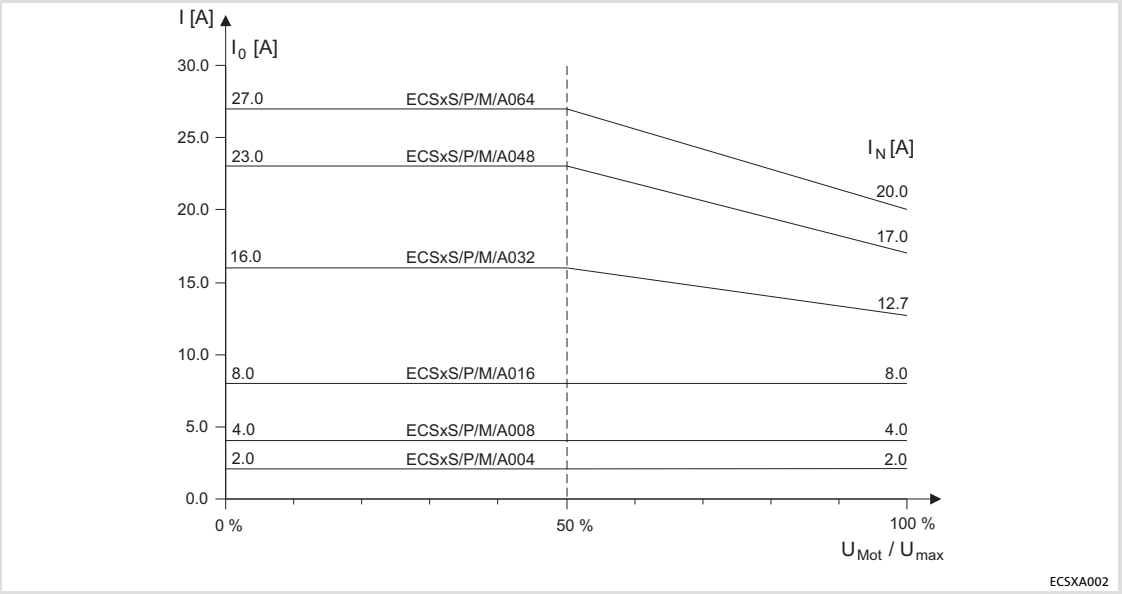


Fig. 3-1 Continuous device current, depending on the output voltage for $U_{mains} \leq 400$ V at 4 kHz

I_r	Rated output current of the axis module
U_{Mot_n}	Actual controller output voltage
U_{Mot_max}	0.9 x current mains voltage

The permissible continuous current depends on the control factor of the power output stages, approximately on the ratio of the motor voltage output in the operating point (U_{Mot_n}) to the maximum possible output voltage (U_{Mot_max}). Due to voltage drops across the components involved at rated load and a control margin, U_{Mot_max} can be estimated with 90 % of the mains voltage.

Tip!

The operating threshold of the device utilisation monitoring (I x t) function is automatically adapted to the continuous device current which changes depending on the output voltage (see fig.).

The following table shows the connections between mains voltage, DC-bus voltage and motor voltage:

Mains voltage [U_{mains}]	DC-bus voltage [$U_{DC} = U_{mains} \times 1.35$]	Output voltage (motor voltage) nominally achievable for 100 % modulation [$U_{mot} = 0.66 \times U_{DC}$]
3 x 230 V AC	310 V DC	3 x 205 V AC
3 x 380 V AC	510 V DC	3 x 340 V AC
3 x 400 V AC	540 V DC	3 x 360 V AC
3 x 415 V AC	560 V DC	3 x 370 V AC
3 x 460 V AC	620 V DC	3 x 415 V AC
3 x 480 V AC	650 V DC	3 x 435 V AC
3 x 528 V AC	712 V DC	3 x 475 V AC

For steady-state operation in generator mode with increased DC-bus voltage or supply from a closed-loop DC-voltage source, interpolate accordingly between the values given in the table.

The increased rated currents are valid for the entire voltage range specified at switching frequencies of 4 kHz and 8 kHz.

Note!

If in this connection a heatsink temperature of > 70 °C is reached, the drive switches to a switching frequency of 4 kHz, independently of the selected switching frequency.

Example:

The ECS axis module suitable for operation in conjunction with a Lenze motor of type MCS 14L32 is to be determined.

- Rated motor data
  - Rated motor torque (M_{mot}) = 17.2 Nm
  - Rated motor speed (n_{mot}) = 3225 rpm
  - Motor voltage at 3250 rpm (U_{mot_n3250}) = 275 V
  - Rated motor current (I_{mot}) = 15 A
  - Max. motor current (I_{mot_max}) = 92 A
- Application data:
  - Max. torque (M_{max}) = 35 Nm
  - Max. operating speed (n_{max}) = 2500 rpm
  - An effective process power (P_{eff}) of 4.5 kW arises on the basis of the Mn diagram.
  - The drive rating results in an effective motor current (I_{Mot_eff}) of 14.8 A.

A first estimation based on the rated current of the ECS axis module would probably lead to selecting the ECSxA048 module with a rated current of 17.0 A.

However, if we take into account the increased continuous current for smaller control factors, the more cost-effective ECSxA032 axis module with a rated current of 12.7 A can be used here.

- When the MCS 14L32 is operated with 2500 rpm, the real motor voltage is (U_{Mot_n2500}):

$$U_{Mot\_n2500} = U_{Mot\_n3250} \cdot \frac{n_{max}}{n_{Mot}} \quad \Rightarrow \quad 275\ V \cdot \frac{2500\ rpm}{3250\ rpm} = 212\ V$$

- This leads to the following max. control factor (α_{max}) of the axis module:

$$\alpha_{max} = \frac{U_{Mot\_n2500}}{U_{max}} \quad \Rightarrow \quad \frac{212\ V}{360\ V} = 0.59 = 59\ \%$$

  Using the current characteristic of Fig. 3-1 (📖 44), a continuous current of 15.5 A can be determined for the ECSxA032 axis module when the control factor (α_{max}) is 59 %.

- **Result:**

  Under the conditions mentioned above the MCS 14L32 Lenze motor can be operated continuously on the ECSxA032 axis module.

3.3.2 Device protection by current derating

The maximum output current is limited. With output frequencies < 5 Hz the limitation depends on the heatsink temperature.

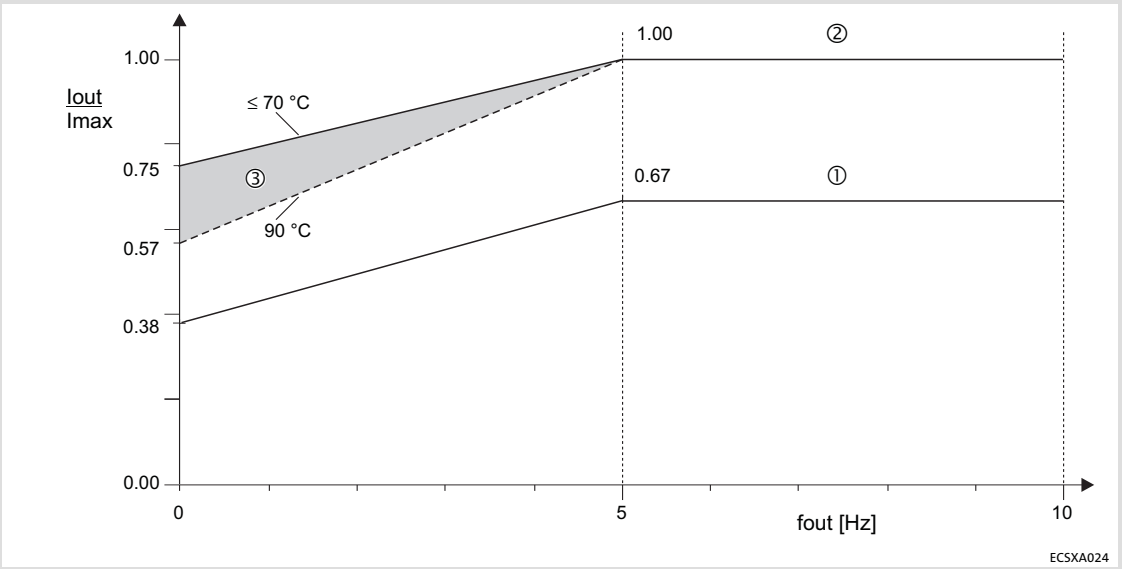


Fig. 3-2 Current derating characteristics

① Operation with switching frequency = 8 kHz (C0018 = 1).
- If the current exceeds the characteristic ①, the switching frequency is automatically changed to 4 kHz (e.g. for higher torque in acceleration processes).

② Operation with switching frequency = 4 kHz (C0018 = 0).
- The current limitation follows the characteristic ②.
- With output frequencies < 5 Hz and heatsink temperatures between 70 and 90 °C the current limit is steplessly adjusted in the range ③.

Type	I_{max} [A]				
	Switching frequency 8 kHz ①		Switching frequency 4 kHz ②		
	f_{out} > 5 Hz	f_{out} → 0 Hz	f_{out} > 5 Hz	f_{out} → 0 Hz ≤ 70 °C	f_{out} → 0 Hz 90 °C
ECSxA004	2.7	1.5	4.0	3.0	2.3
ECSxA008	5.3	3.0	8.0	6.0	4.6
ECSxA016	10.7	6.0	16.0	12.0	9.1
ECSxA032	21.3	12.1	32.0	24.0	18.1
ECSxA048	32.0	18.1	48.0	36.3	27.2
ECSxA064	42.7	24.2	64.0	48.0	36.3

4 Mechanical installation

4.1 Important notes

- Axis modules of the ECS series provide IP20 enclosure and can therefore only be used for installation in control cabinets.
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions:
  - Vertical at the mounting plate
  - DC bus connections (X23) at the top
  - Motor connection (X24) at the bottom
- Maintain the specified clearances (above and below) to other installations!
  - If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  - must be electrically conductive.
  - must not be varnished.
- In case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

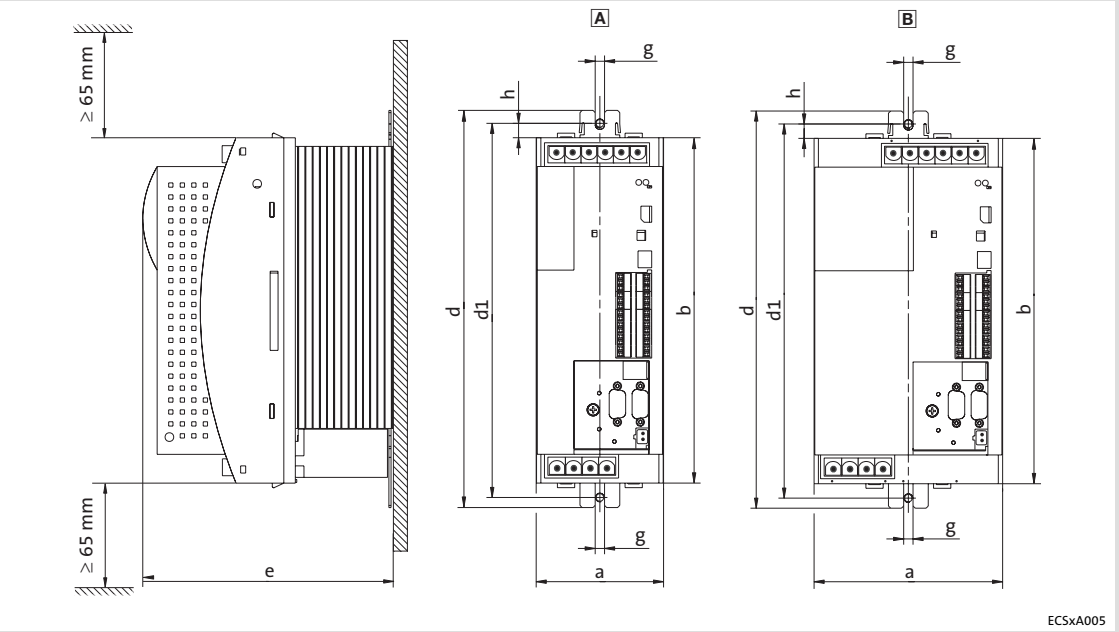


Fig. 4-1 Dimensions for "panel-mounted" design

Axis module		Dimensions [mm]						
Type	Size	a	b	d	d1	e	h	g
ECSE☐004	A	88,5	240	276	260	176 212 1)	10	6,5 (M6)
ECSE☐008								
ECSE☐016								
ECSE☐032								
ECSE☐048	B	131						
ECSE☐064								

1) Max. 212 mm, depending on the plugged-on communication module

☐ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.2.2 Mounting steps

How to install the axis module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: Push in the long side.
   – From below: Push in the short side.
4. Attach the axis module to the mounting surface.

4.3 Mounting with thermal separation (push-through technique)

For the push-through technique the rear panel of the control cabinet must be a steel plate with a thickness of at least 2 mm.

The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the axis module).

Cooling

With the separated heatsink the heat generation in the control cabinet can be reduced.

- Distribution of the power loss:
  - approx. 65 % via separated cooler
  - approx. 35 % in the inside of the axis module
- Protection class of the separated cooler: IP54
  - The sealing surface at the heatsink of the axis module must rest completely against the mounting plate.
  - Use a liquid thread sealant to bond the screws of the clamps.
- For sufficient cooling of the drive system:
  - Air flow behind the rear panel of the control cabinet must be $\geq$ 3 m/s (e.g. by means of a collective fan).
- With sufficient cooling, the rated data of the axis modules remain valid.

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

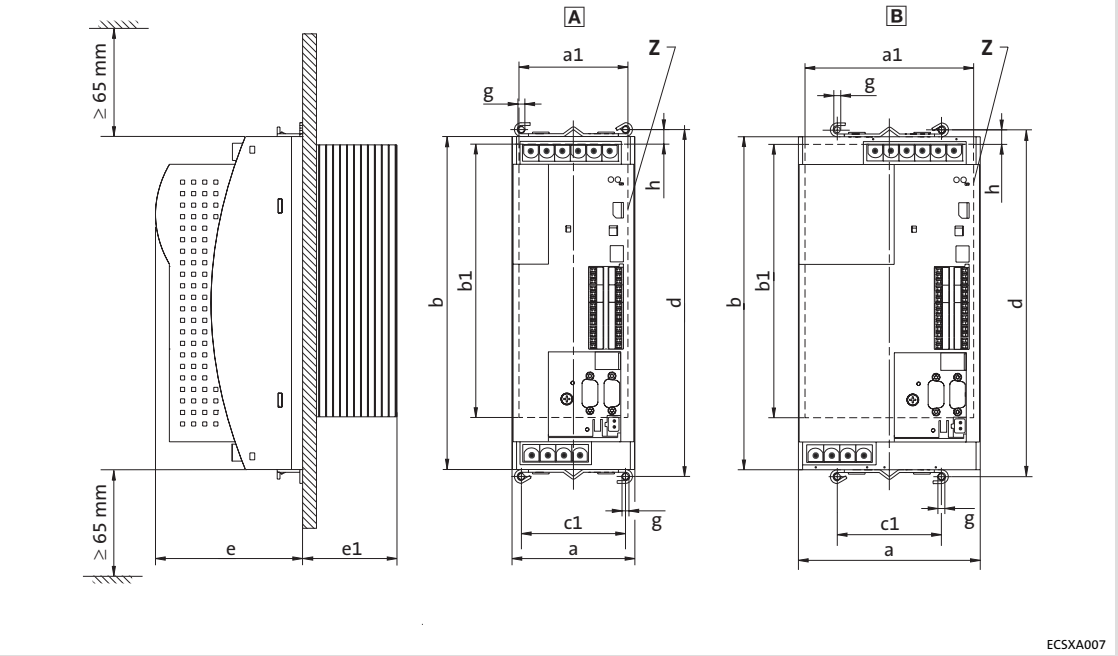


Fig. 4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 📖 53

Axis module		Dimensions [mm]									
Type	Size	a	a1	b	b1	c1	d	e	e1	g	h
ECSD□004	A	88,5	78,5	240	197	75	250	109 145 [1]	67	M5	10,5
ECSD□008											
ECSD□016											
ECSD□032											
ECSD□048	B	131	121,5								
ECSD□064											

1) Max. 145 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Dimensions of mounting cutout

Note!

Installation with shield mounting ECSZS000X0B:

► Clearance below the mounting cutout > 220 mm

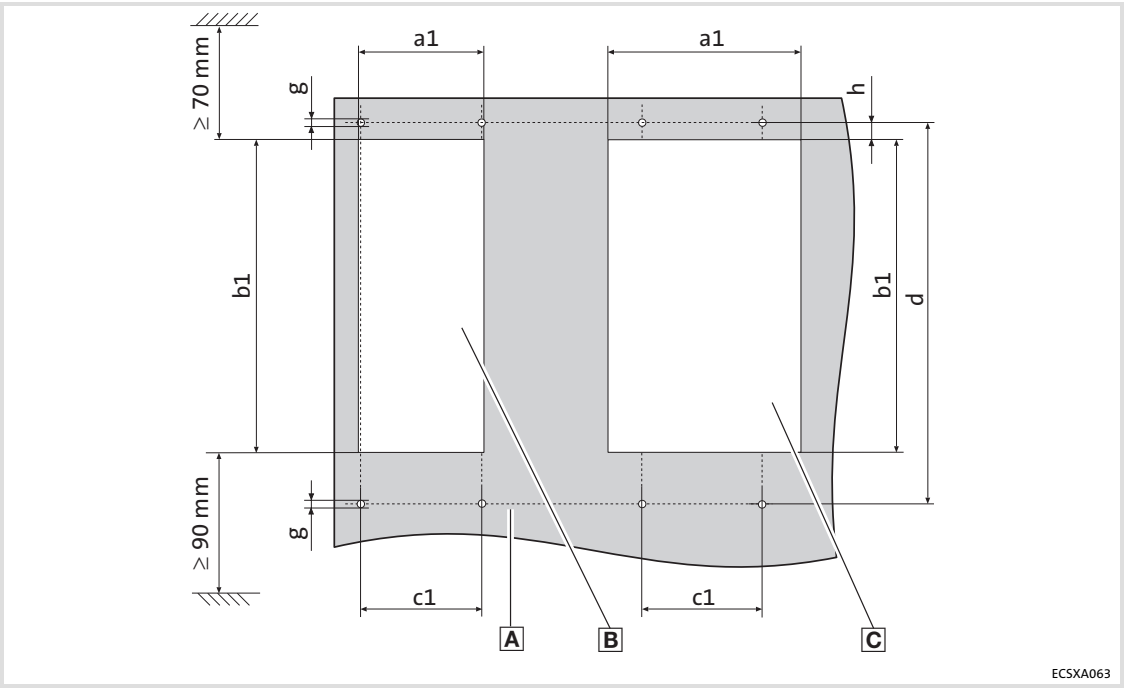


Fig. 4-3 Dimensions of mounting cutout

A Mounting surface
B Mounting cutout for size A
C Mounting cutout for size B

Axis module		Dimensions [mm]					
Type	Size	a1	b1	c1	d	g	h
ECSD□004	A	78,5	197	75	250	M5	10,5
ECSD□008							
ECSD□016							
ECSD□032							
ECSD□048	B	121,5					
ECSD□064							

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.3.2 Mounting steps

How to mount the axis module:

1. Prepare the fixing holes for the wire clamps on the mounting area.
   For this purpose, apply a drilling jig.
2. Prepare the mounting cutout.
   The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the axis module).
3. Apply liquid thread sealant to the threads of the screws for the wire clamps.
4. Fix the wire clamps together with the functional earth conductor supplied (Fig. 4-4).
   The functional earth conductor is part of the scope of supply of the ECS**D**x... axis module
5. Push the axis module into the mounting cutout.
6. Engage axis module in the wire clamp at the top and the bottom.
7. Connect the functional earth conductor to the axis module (Fig. 4-4).

Note!

Fixing the functional earth conductor to the ECS**D**x... axis module is required for a better electromagnetic compatibility (EMC).

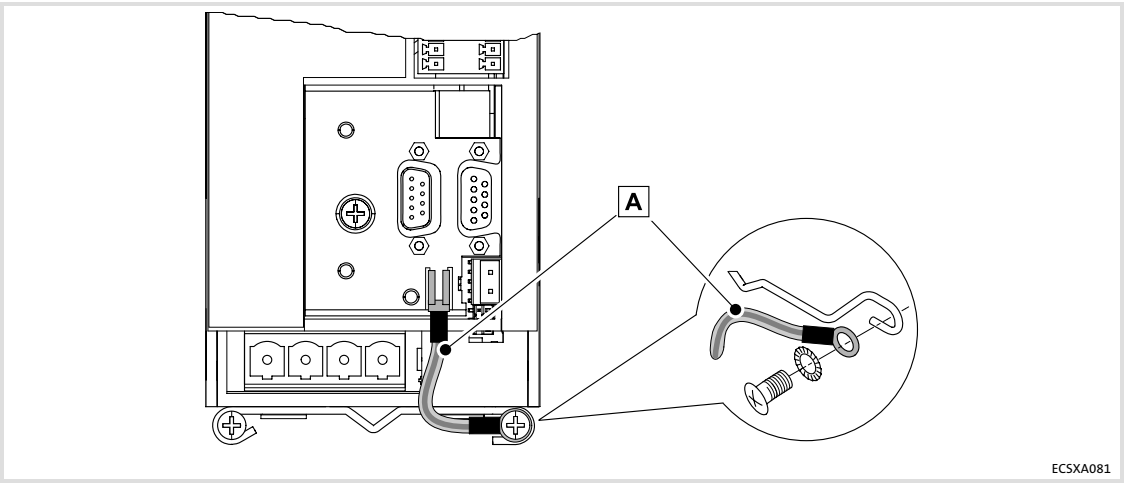


Fig. 4-4 Functional earth conductor at the ECSDx... axis module

A Functional earth conductor

4.4 Mounting in cold-plate design

The axis modules ECSC... are intended for mounting in cold-plate design (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure a safe operation of the axis modules:

- Good thermal contact with the cooler
  - The contact surface between collective cooler and axis module must be at least as large as the cooling plate of the axis module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Connect the collective cooler with all specified screwed connections to the axis module.
- Maintain the thermal resistance R_{th} according to the table.
  - The values apply for operating the axis modules under rated conditions.

Axis module Type	Power to be dissipated Ploss [W]	Heat sink - environment R_{th} [k/W]
ECSC□004	14.0	0,31
ECSC□008	29.0	
ECSC□016	64.0	
ECSC□032	117.0	0,13
ECSC□048	132.0	
ECSC□064	158.0	0,11

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

- Ambient conditions:
  - Furthermore the rated data regarding the ambient temperature and the derating factors at increased temperature apply to the axis modules (📖 40 et seqq.).
  - Temperature of the cooling plate (”Cold Plate”): max. +85 °C

4.4.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

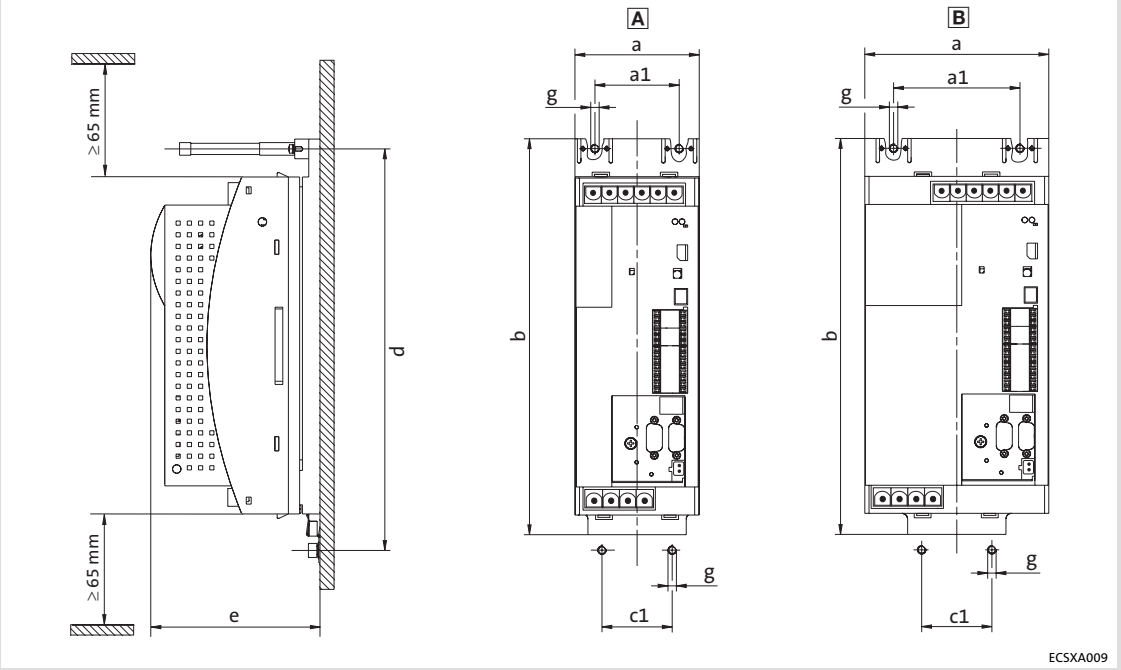


Fig. 4-5 Dimensions for "cold-plate design"

Axis module		Dimensions [mm]						
Type	Size	a	a1	b	c1	d	e	g
ECSC□004	A	88,5	60	282	50	287	121 157 1)	M6
ECSC□008								
ECSC□016								
ECSC□032								
ECSC□048	B	131	90					
ECSC□064								

1) Max. 157 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.4.2 Mounting steps

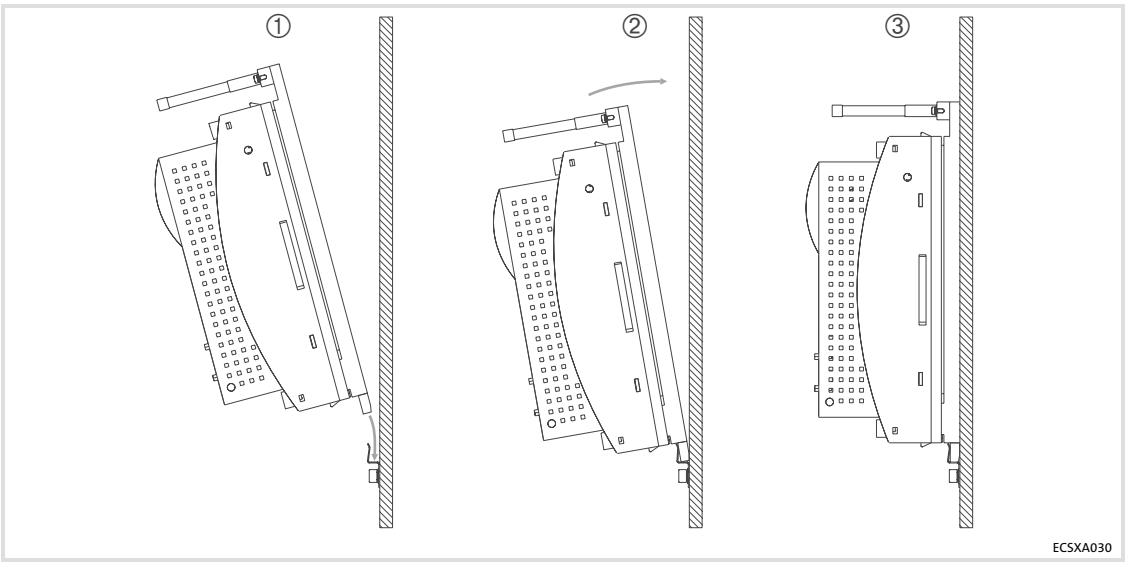


Fig. 4-6 Mounting for "cold-plate design"

Proceed as follows to mount the axis module:

1. Prepare the fixing holes on the mounting plate.
   – Use a drilling jig for this purpose.
2. Clean and degrease the contact area of collective cooler and heatsink of the axis module (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Insert the axis module from above ① into the support ② and fasten the two stud bolts with 3.5 ... 4.5 Nm ③.

Note!

Penetration depth of the screws into the collective cooler: approx. 15 mm!

Tip!

The heat transfer resistance is reduced if - following step 2. -
► a thin layer of heat conducting paste is applied to the contact surface or
► heat conducting foil is used.

5 Electrical installation

5.1 Installation according to EMC (installation of a CE-typical drive system)

General information

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Assembly
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the evaluation of the conformity to the EMC Directive requires a check of the machine or system regarding the EMC limit values. This for instance applies to:
  - Use of unshielded cables
  - Use of collective interference filters instead of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the ECS modules, these devices may be electromagnetically affected by the ECS modules.

Assembly

- Connect the ECS modules, RFI filters, and mains choke to the earthed mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow for permanent contact.
  - Painted plates are not suitable for an EMC-compliant installation.
- If you use the ECSxK... capacitor module:
  - Install the capacitor module between the power supply module and the axis module(s).
  - If the total cable length in the DC-bus connection is > 5 m, install the capacitor module as close as possible to the axis module with the greatest power.
- If you use several mounting plates:
  - Connect as much surface of the mounting plates as possible (e.g. with copper bands).
- Ensure the separation of the motor cable and the signal or mains cables.
- Avoid a common terminal/power strip for the mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filters

Only use RFI filters and mains chokes which are assigned to the power supply modules:

- RFI filters reduce impermissible high-frequency interferences to a permissible value.
- Mains chokes reduce low-frequency interferences which in particular depend on the motor cables and their lengths.

Shielding

- Connect the motor cable shield to the axis module
  - with the ECSZS000X0B shield mounting kit.
  - extensively to the mounting plate below the axis module.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor protection switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to each other and connect them to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing extensively to PE:
  - Metal glands at the motor terminal box ensure an extensive connection of the shield and the motor housing.
- Shield UG cables and control cables from a length of 0.3 m:
  - Connect both shields of the digital control cables.
  - Connect one shield end of the analog control cables.
  - Always connect the shields to the shield connection at the axis module over the shortest possible distance.
- Use of the ECS modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥10 dB. This can be achieved by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (e.g. ECS modules, RFI filters, motor filters, mains chokes) using suitable cables connected to a central earthing point (PE rail).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Power terminals

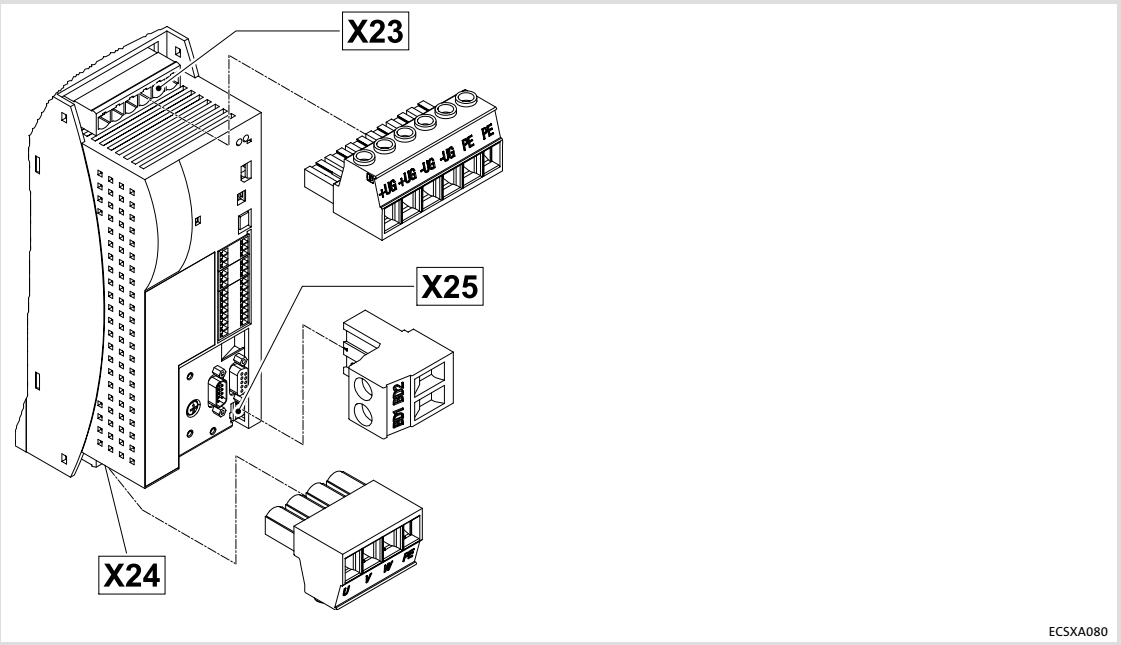


Fig. 5-1 Plug connectors for power terminals

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

- ► All power connections are plug connections and coded. The ECSZA000X0B plug connector set must be ordered separately.
- ► Installation of the cables to EN 60204-1.
- ► The cables used must comply with the approvals required at the site of use (e.g. VDE, UL, etc.).

Note!

ECSDA... axis modules:

For a better electromagnetic compatibility (EMC), connect the functional earth conductor to the ECS**D**A... axis module (📖 54).

This is not required for the ECS**E**A... (standard installation) and ECS**C**A... (cold plate) axis modules!

Assignment of the plug connectors

Plug connector/terminal	Function	Electrical data
X23	**DC-bus voltage connection**	
X23/+UG	Positive DC-bus voltage	Dependent on application and type 0 ... 770 V 2 ... 24.5 A (📖 42)
X23/+UG		
X23/-UG	Negative DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		
X24	**Motor connection**	
X24/U	Motor phase U	Dependent on application and type 0 ... 480 V 1.6 ... 20 A (📖 42)
X24/V	Motor phase V	
X24/W	Motor phase W	
X24/PE	Earth connection	
X25	**Motor holding brake connection**	
X25/BD1	Brake connection +	23 ... 30 V DC, max. 1.5 A
X25/BD2	Brake connection -	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Plug connectors X23 and X24				
Rigid	–	0.2 ... 10 mm² (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connections 10 mm for spring connections
Flexible	Without wire end ferrule	0.2 ... 10 mm² (AWG 24 ... 8)		
	Insulated with wire end ferrule	0.25 ... 6 mm² (AWG 22 ... 10)		
	Insulated with wire end ferrule	0.25 ... 4 mm² (AWG 22 ... 12)		
Plug connector X25				
Flexible	Insulated with wire end ferrule	0.25 ... 2.5 mm² (AWG 22 ... 12)	0.5 ... 0.8 Nm (4.4 ... 7.1 lb-in)	5 mm for screw connections 10 mm for spring connections
	Without wire end ferrule	0.2 ... 2.5 mm² (AWG 24 ... 12)		

Shielded cables

The following factors decisively determine the effect of the shielded cables:

- Good shield connection
  - Ensure a contact surface as large as possible
- Low shield resistance
  - Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- High overlap rate of the braid
  - At least 70 ... 80 % with 90° overlap angle

The ECSZS000X0B shield mounting kit includes a wire clamp and shield sheet.

5.2.1 Connection to the DC bus (+U_G, -U_G)

Stop!

No device protection for DC bus voltage surges

In passive axis modules (without 24 V-supply), the charging circuit can be overloaded through DC bus voltage surges.

Possible consequences:

► Destruction of the device

Protective measures:

► All axis modules in the DC-bus connection should be basically supplied with a control voltage of 24 V.

► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.

► Design the ±U_G cables twisted and as short as possible. Ensure short-circuit-proof routing!

► Cable length (module ↔ module) > 30 cm: install shielded ±U_G cables.

Cable cross-section

Cable length (module/ module)	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm² (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
	With insulated wire end ferrule			
> 20 m	Without wire end ferrule	10 mm² (AWG 8)		
	With insulated wire end ferrule **Use pin-end connectors for wiring!**			

Fuses

- ► Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- ► When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- ► When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- ► Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

Replacing defective fuses

Danger!

Hazardous electrical voltage

Components can carry hazardous voltages up to 3 minutes after power-off.

Possible consequences:

- ► Death or severe injuries when touching the device.

Protective measures:

- ► Replace fuses in the deenergised state only.
  - – Set controller inhibit (CINH) for all axis modules in DC-bus operation and disconnect all power supply modules from the mains.

5.2.2 Connection plan for mimimum wiring with internal brake resistor

Documentation of the ECSxE power supply module

Observe the enclosed notes.

Stop!

Always operate the ECS power supply modules with a brake resistor (internal/external).

The ECS power supply modules in the standard built-in unit and push-through design (ECSEE / ECSDE) are provided with a device-internal brake resistor.

In order to use the internal brake resistor (Rb), carry out the following wiring:

- Bridge between the terminals X22/+UG and X22/BR0 (CR)
  Current flow from +UG via the internal brake resistor (Rb) and the brake transistor to -UG.
- Bridge between the terminals X6/T1 and X6/T2 (CR)
  Deactivate the temperature monitoring of the non-existing external brake resistor.

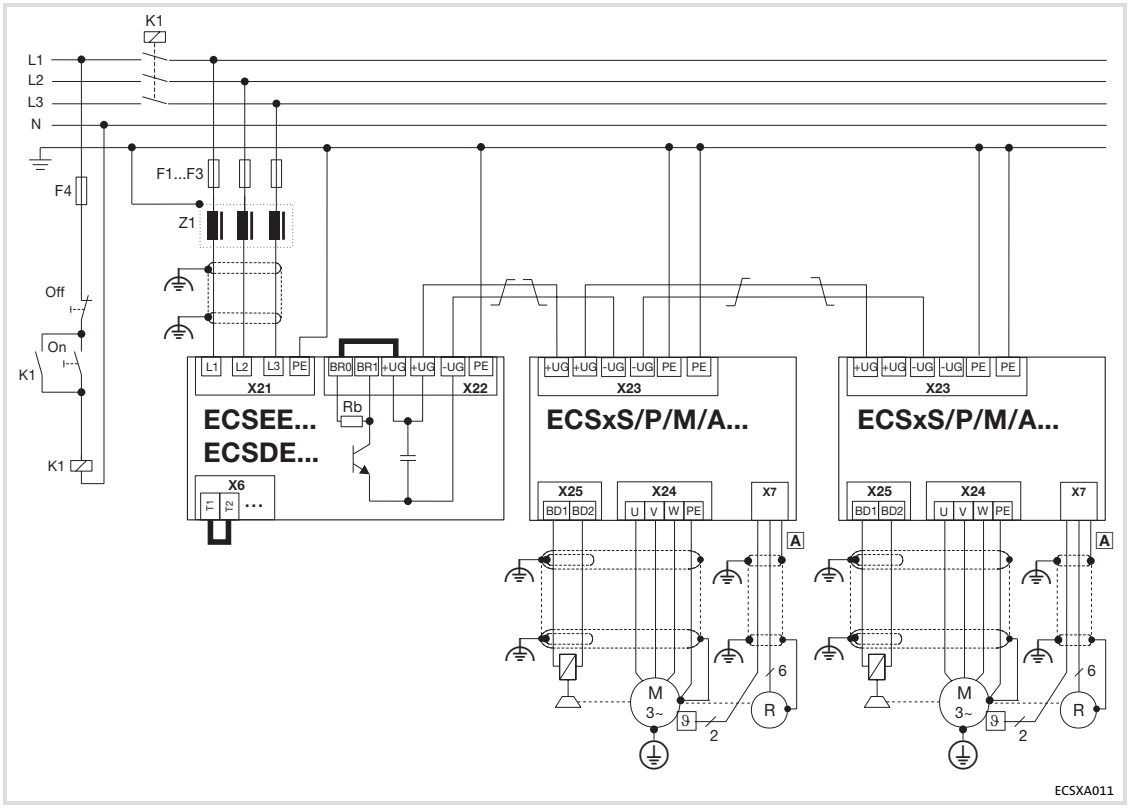


Fig. 5-2 Interconnected power system with internal brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb Internal brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.3 Connection plan for mimimum wiring with external brake resistor

Documentation of the ECSxE power supply module
Observe the enclosed notes.

Stop!

- ► Always operate the ECS power supply modules with a brake resistor.
- ► A parallel wiring of internal and external brake resistor is not permissible!
- ► Implement the thermal contact of the brake resistor into the system monitoring so that the mains supply of the power supply module will be switched off in case the brake resistor will be overheated.
- ► Read the documentation for the external brake resistor. Observe the safety instructions contained therein.

If the power supply module needs a high amount of braking power when it comes as standard built-in unit or in push-through technique design (**ECSEE / ECSDE**), an external and more powerful brake resistor can be connected instead of the internal brake resistor.

A power supply module in cold plate technique design (**ECSCE**) is not provided with an internal brake resistor so that this version always requires an external brake resistor (Rbext).

- ► Connect the brake resistor to X22/BR1 and X22/+UG.
- ► Connect the thermal contact (NC contact) of the external brake resistor to X6/T1 and X6/T2.

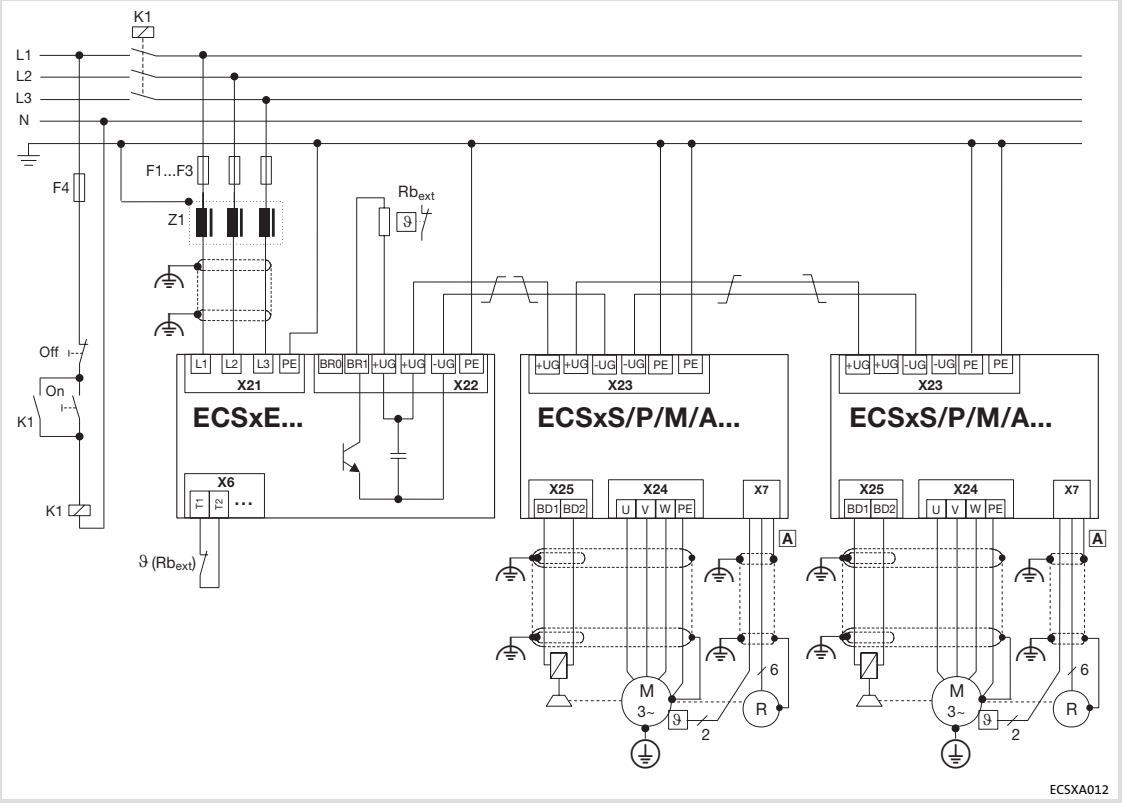


Fig. 5-3 Interconnected power system with external brake resistor

⏚	HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
∫	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb$_{ext}$	External brake resistor
ϑ	KTY thermal sensor of the motor
A	System cable for feedback

5.2.4 Motor connection

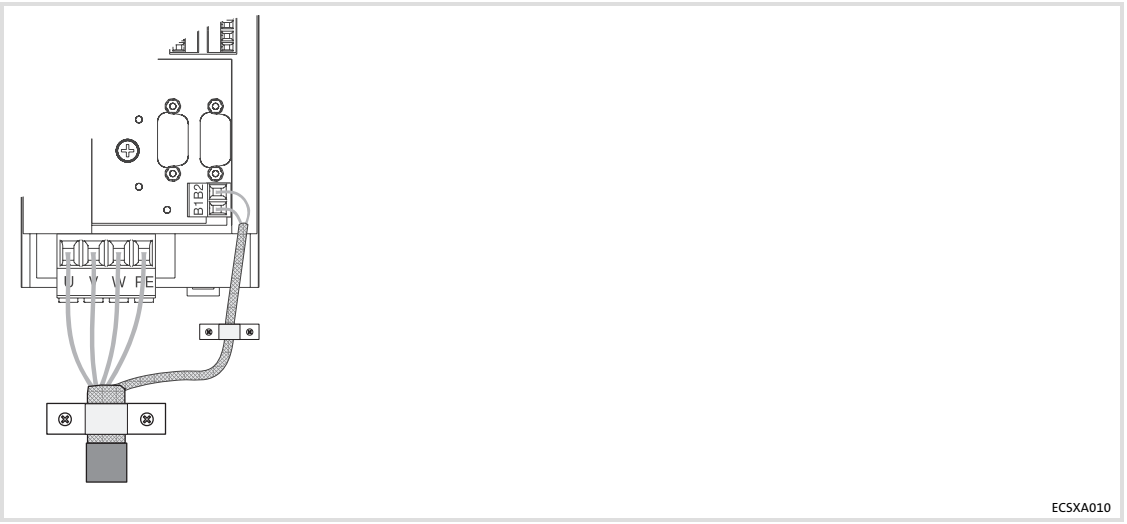


Fig. 5-4 Motor and motor holding brake connection

Motor cables

- Use low-capacitance motor cables. Capacitance per unit length:
  - Core/core: max. 75 pF/m
  - Core/shield: max. 150 pF/m
- Length: max. 50 m, shielded
- The cross-section of the motor cables are selected according to the motor standstill current (I_0) when using synchronous motors or according to the rated motor current (I_N) for asynchronous motors.
- Length of the unshielded ends: 40 ... 100 mm (depending on the cable cross-section)
- Lenze system cables meet these requirements.
- Use the ECSZS000X0B shield mounting kit for EMC-compliant wiring.

Mounting instructions for ECSZS000X0B shield mounting
Here you can find more information on wiring according to EMC.

5.2.5 Motor holding brake connection

The motor holding brake

- is connected to X25/BD1 and X25/BD2.
- is supplied with low voltage via the terminals X6/B+ and X6/B-:
  +23 ... +30 V DC, max.1.5 A

Stop!

- Protect X6/B+ with an F 1.6 A fuse.
- If no suitable voltage (incorrect amount, incorrect polarity) is connected to the brake, it is applied and can overheat or be destroyed by the continuously running motor.

5.2.5.1 Spark suppressor

The axis module comes with an integrated spark suppressor for protecting the contacts of the integrated brake relay when the motor holding brake (inductive load) is switched.

5.2.5.2 Monitoring the brake connection

The connection of the motor holding brake can be monitored for voltage failure and cable breakage if monitoring is activated under C0602.

The monitoring system of the brake connection trips under the following conditions:

Case 1, motor holding brake released (brake relay contact is closed):

- Current via holding brake (I_B) < 140 mA +/-10 % **or**
- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

Case 2, motor holding brake closed (brake relay contact is open):

- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

5.2.5.3 Requirements on the brake cables

- ► Use a Lenze system cable with integrated brake cable.
  – The shielding of the brake cable must be separated.
- ► Length: max. 50 m
- ► If a separately installed brake cable is required, lay it in a shielded manner.

Note!

Due to the monitoring circuit of the brake connection, an additional constant voltage drop of 1.5 V is produced. The voltage drop can be compensated by a higher voltage at the cable entry.

The voltage required at X6/B+ and X6/B- for the Lenze system cables is calculated as follows:

$$U_K\,[V] = U_B\,[V] + 0.08\left[\frac{V}{m \cdot A}\right] \cdot L_L\,[m] \cdot I_B\,[A] + 1.5\,[V]$$

V_{comp}	Voltage required at 6X/B+ and X6/B- [V]
V_B	Rated operating voltage of the brake [V]
L_L	Length of the brake cable [m]
I_B	Brake current [A]

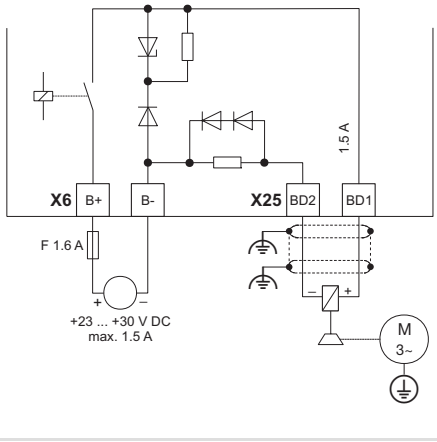


Fig. 5-5 Connection of the motor holding brake to X25

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

5.2.6 Connection of an ECSxK... capacitor module (optional)

The ECS capacitor modules support the DC-bus voltage for the drive system. These capacitor module types are available:

- ECSxK001 (705 µF, ±20 %)
- ECSxK002 (1410 µF, ±20 %)

x Design/mounting technique: E = standard installation
C = Cold-plate technique
D = push-through technique

Documentation of the ECSxK capacitor module
Observe the enclosed notes.

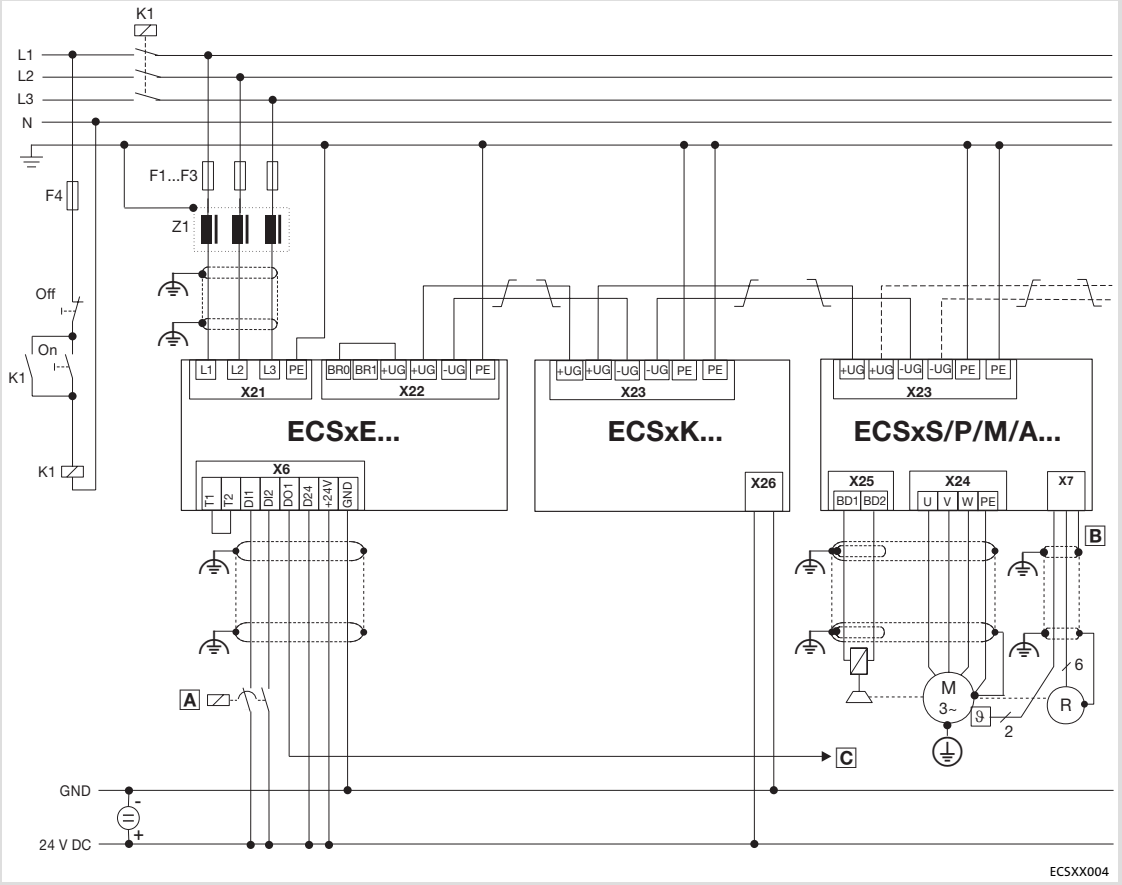


Fig. 5-6 Wiring of capacitor module ECSxK...

- HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- A Contactor relay
- B System cable – feedback
- C Terminal X6/SI1 of the connected axis modules (controller enable/inhibit)

5.3 Control terminals

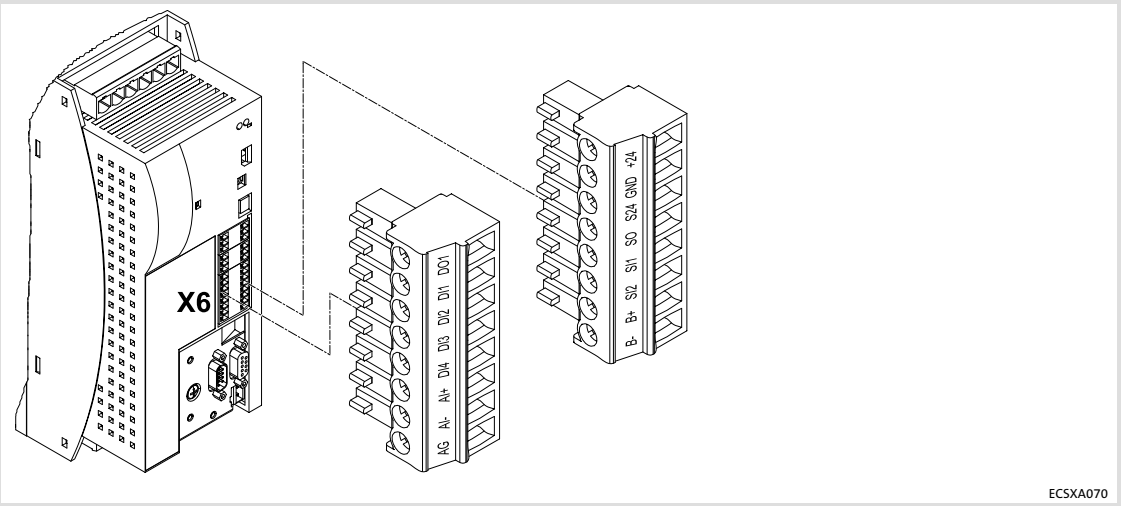


Fig. 5-7 Plug connectors for control terminals (X6)

For the supply of the control electronics an external 24 V DC voltage at terminals X6/+24 and X6/GND is required.

Stop!

- The control cables must always be shielded to prevent interference injections.
- The voltage difference between X6/AG, X6/GND and PE of the axis module may maximally amount to 50 V.
- The voltage difference can be limited by:
  – overvoltage-limiting components or
  – direct connection of X6/AG and X6/GND to PE.
- The wiring has to ensure that for X6/DO1 = 0 (LOW level) the connected axis modules do not draw energy from the DC bus. Otherwise, the power supply module may be damaged.

Shield connection of control cables and signal cables

The plate on the front of the device serves as the mounting place (two threaded holes M4) for the shield connection of the signal cables. The screws used may extend into the inside of the device by up to 10 mm. For optimum contact of the shield connection, use the wire clamps from the ECSZS000X0B shield mounting kit.

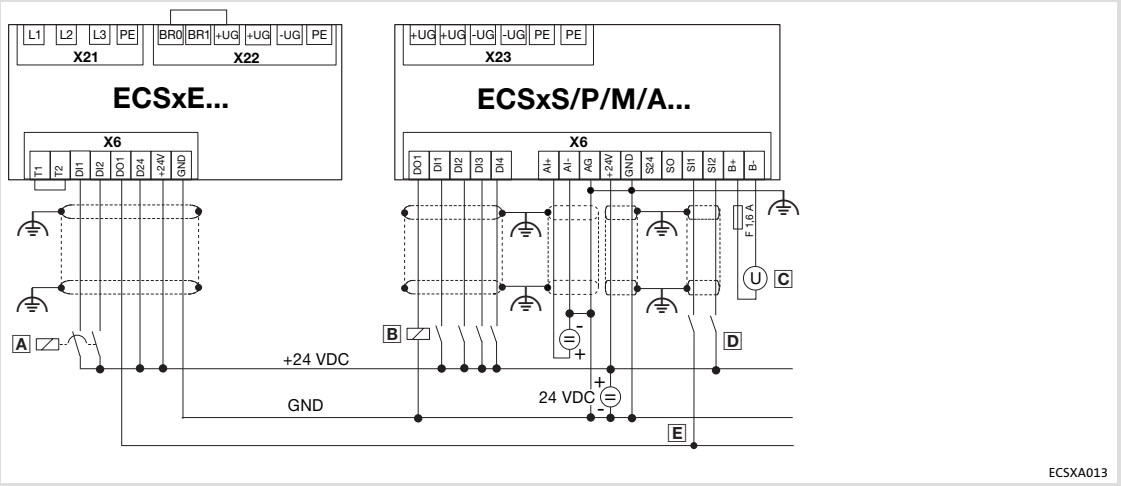


Fig. 5-8 Interconnection: Control signals with internal brake resistor

- ⏚ HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- A / B Contactor relay
- C Voltage supply of motor holding brake 23 ... 30 V DC, max. 1.5 A
- D Safe torque off (formerly: ”Safe standstill”)
- E Controller enable/inhibit

Switch-on sequence for the auxiliary relay

Stop!

Overload of the charging connection in the power supply module

The controller enable for the axes may only take place when the charging process of the DC bus is completed and the power supply module is ready for operation.

Possible consequences:

► Destruction of the power supply module

Protective measures:

► Use of switching the central controller enable for the axes via the inputs and outputs DI2 and DO1 of the power supply module (see the following descriptions).

The switch-on sequence of the auxiliary relay [A] (see Fig. 5-8) is as follows:

1. The digital input X6/DI1 (power supply enable) of the power supply module is switched to HIGH by the higher-level control or by the operator.
   – The DC bus is charged.
2. The ready for operation output of the axis module (DO1) now switches the X6/DI2 digital input (central controller enable) of the power supply module via the relay [A].
   – In the default Lenze setting of the ECS axis modules, DO1 is set to ”ready”. ”Ready” is only present if a specified DC-bus voltage has been reached.
3. The central controller enable for the axis module takes place via the X6/DO1 output of the power supply module. The central controller enable DO1 only switches if the charging process of the DC bus is completed AND the X6/DI2 input is set.

Assignment of the plug connectors

Plug connector X6		
Terminal	**Function**	**Electrical data**
X6/+24	Low-voltage supply of the control electronics	20 ... 30 V DC, 0. A (max. 1 A) for starting current of 24 V: max. 2 A for 50 ms
X6/GND	Reference potential of low-voltage supply	
X6/DO1	Digital output 1	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
X6/DI1	Digital input 1	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
X6/DI2	Digital input 2	
X6/DI3	Digital input 3	
X6/DI4	Digital input 4	
X6/AI+	Analog input +	Adjustable with jumper strip X3: -10 ... +10 V, max. 2 mA -20 ... +20 mA Resolution: 11 bits + sign
X6/AI-	Analog input -	
X6/AG	Reference potential of analog input (internal ground)	
X6/B+	Brake supply +	23 ... 30 V DC max. 1.5 A **Set brake voltage so that the permissible voltage at the brake is not under-run or exceeded – otherwise malfunction or destruction!**
X6/B-	Brake supply -	
X6/S24	Connection of "safe torque off" (formerly "safe standstill")	📖 80
X6/SO		
X6/SI1		
X6/SI2		

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	Without wire end ferrule	0.08 ... 1.5 mm² (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connection 9 mm for spring connection
	With insulated wire end ferrule	0.25 ... 0.5 mm² (AWG 22 ... 20)		

We recommend to use control cables with a cable cross-section of 0.25 mm².

5.3.1 Digital inputs and outputs

Stop!

If an inductive load is connected to X6/DO1, a spark suppressor with a limiting function to max. 50 V ± 0 % must be provided.

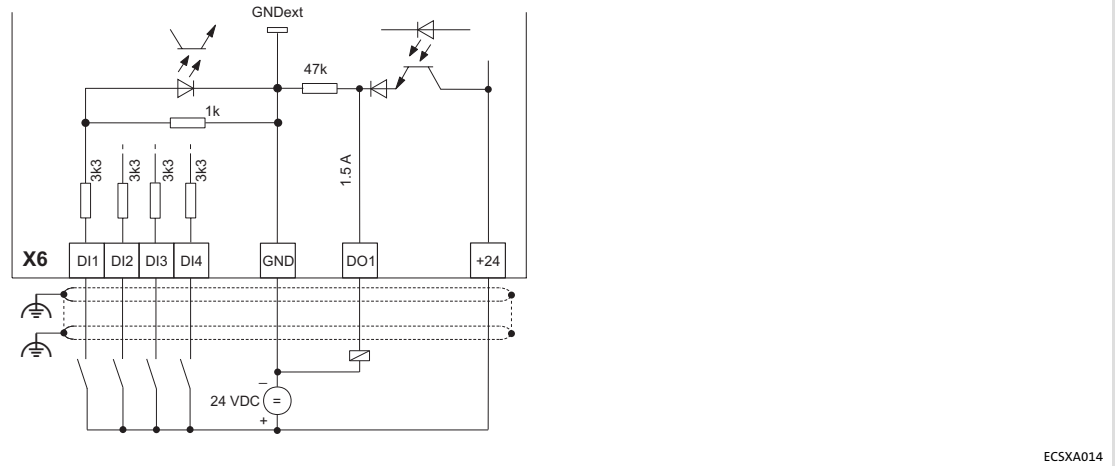


Fig. 5-9 Digital inputs and outputs at X6

HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

- The digital inputs X6/DI1 ... DI4 are freely assignable.
- The polarity of the digital inputs X6/DI1 ... DI4 is set under C0114/x.
- The polarity of the digital output (X6/DO1) is set under C0118/1.

5.3.2 Analog input

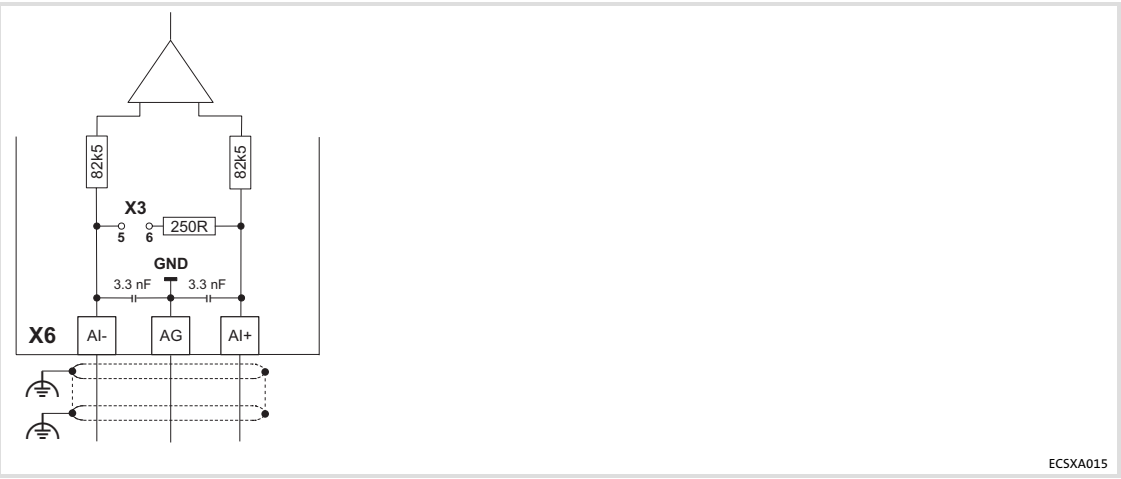


Fig. 5-10 Analog input at X6

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Analog input configuration

► Use C0034 to set whether the input is to be used for a master voltage (±10 V) or a master current (+4 ... 20 mA or ±20 mA).

► Set jumper bar X3 according to the setting in C0034:

Stop!

Do not plug the jumper on the pins 3-4! The axis module cannot be initialised like this.

Jumper bar X3	Setting	Measuring range
5 6 3 4 1 2	5-6 open Jumper on 1-2: Parking position	**C0034 = 0 (master voltage)** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡ ±16384 ≡ ±100 %
5 6 3 4 1 2	5-6 closed	**C0034 = 1 (master current)** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: +4 mA ≡ 0 ≡ 0 % +20 mA ≡ 16384 ≡ 100 %
		C0034 = 2 (master current) ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡ ±16384 ≡ ±100 %

5.3.3 Safe torque off

The axis modules support the ”safe torque off” safety function (formerly ”safe standstill”), ”protection against unexpected start-up”, in accordance with the requirements of EN ISO 13849-1, Performance Level Pld. For this purpose, the axis modules are equipped with two independent safety paths. The Performance Level Pld is obtained if the output signal is additionally checked with regard to correctness at X6/SO.

5.3.3.1 Implementation

In the axis module, the ”safe torque off” connection is implemented with optocouplers. The optocouplers isolate the following areas electrically from each other:

- The digital inputs and outputs:
  - input X6/SI1 (controller enable/inhibit)
  - input X6/SI2 (pulse enable/inhibit)
  - brake output X6/B+, B-
  - output X6/SO (”safe torque off” active/inactive)
- The circuit for the internal control
- The final power stage

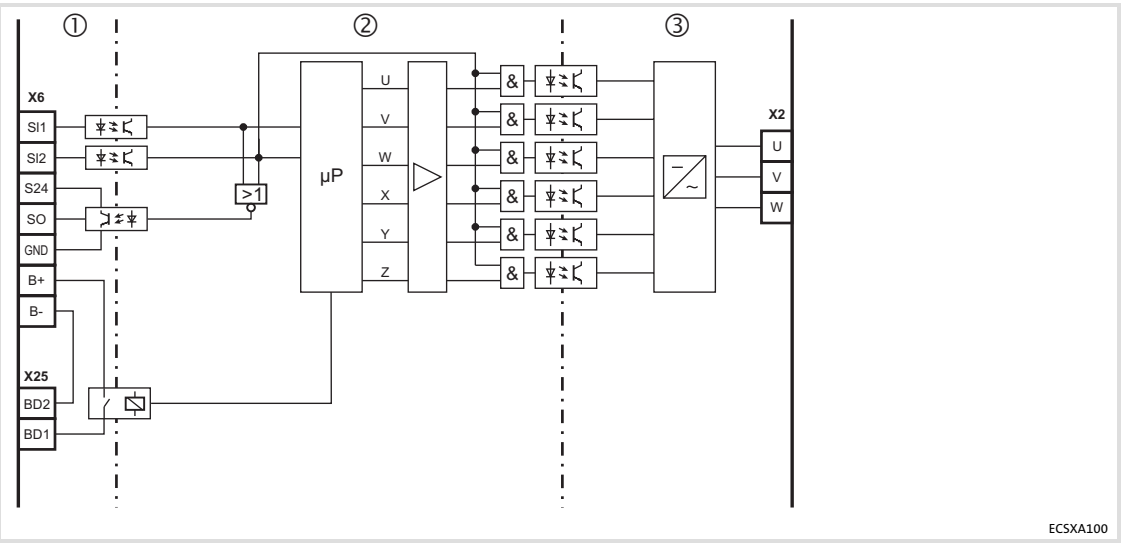


Fig. 5-11 Implementation of the ”safe torque off” function

Area 1:	Inputs and outputs
Area 2:	Circuit for the internal control
Area 3:	Power output stage

Stop!

Use insulated wire end ferrules when wiring the ”safe torque off” circuits to X6.

5.3.3.2 Functional description

The ”safe torque off” state can be initiated any time via the input terminals X6/SI1 (controller enable/inhibit) and X6/SI2 (pulse enable/inhibit). For this purpose a LOW level has to be applied at both terminals:

- X6/SI1 = LOW (controller inhibited):

  The inverter is inhibited via the microcontroller system.

- X6/SI2 = LOW (pulses inhibited):

  The supply voltage for the optocouplers of the power section driver is switched off, i. e. the inverter can no longer be enabled and controlled via the microcontroller system.

  The input signal at X6/SI2 to the hardware is additionally directed to the microcontroller system and is evaluated for the state control there. For the external further processing a HIGH level is output for the state ”safe torque off active” at the digital output X6/SO.

The control of the inverter thus is prevented by two different methods that are independent of each other. Therefore an unexpected start-up by the motor is avoided.

5.3.3.3 Important notes

Danger!

When using the ”safe torque off” function, additional measures are required for ”emergency stops”!

There is neither an electrical isolation between motor and axis module nor a ”service” or ”repair switch”.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

An ”emergency stop” requires the electrical isolation of the motor cable, e.g. by means of a central mains contactor with emergency stop wiring.

Installation/commissioning

► The ”safe torque off” function must only be installed and commissioned by qualified personnel.

► All control components (switches, relays, PLC, ...) and the control cabinet must meet the requirements of EN ISO 13849. These include for instance:
  – Switches, relays in enclosure IP54.
  – Control cabinet in enclosure IP54.
  – All other requirements can be found in EN ISO 13849.

► Wiring with insulated wire end ferrules is essential.

► All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. in the cable duct. It must be ensured that short circuits between the individual cables cannot occur. For further measures, see EN ISO 13849.

► If force effects from outside (e.g. sagging of hanging loads) are to be expected when the ”safe torque off” function is active, additional measures have to be taken (e.g. mechanical brakes).

During operation

► After installation, the operator must check the ”safe torque off” function.

► The function check must be repeated at regular intervals, but no later than after one year.

5.3.3.4 Technical data

Terminal assignment

Plug connector X6				
Terminal	**Function**	**Level**		**Electrical data**
X6/S24	Low-voltage supply			18 ... 30 V DC 0.7 A
X6/SO	"Safe torque off" feedback output	LOW	During operation	24 V DC 0.7 A (max. 1.4 A) Short-circuit-proof
		HIGH	"Safe torque off" active	
X6/SI1	Input 1 (controller enable/inhibit)	LOW	Controller inhibited	LOW level: -3 ... +5 V -3 ... +1.5 mA HIGH level: +15 ... +30 V +2 ... +15 mA Input current at 24 V DC: 8 mA per input
		HIGH	Controller enabled	
X6/SI2	Input 2 (pulse enable/inhibit)	LOW	Pulses for power section are inhibited	
		HIGH	Pulses for power section are enabled	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Starting torque	Stripping length
Flexible	With insulated wire end ferrule	0.25 ... 1.5 mm^2 (AWG 22 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connections 9 mm for spring connections
	Without wire end ferrule	Not permitted when the "Safe torque off" function is used		

5.3.3.5 Function check

- ► After installation the operator must check the ”safe torque off” function.
- ► The function check must be repeated at regular intervals, after one year at the latest.

Stop!

If the function check leads to impermissible states at the terminals, commissioning cannot take place!

Test specifications

- ► Check the circuitry with regard to correct function.
- ► Check directly at the terminals whether the ”safe torque off” function operates faultlessly in the axis module:

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	X6/SI2	X6/SO	X6/SO
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

5.3.3.6 Example: Wiring with electronic safety switching device ”Pilz PNOZ e1vp” for Performance Level Pl_d

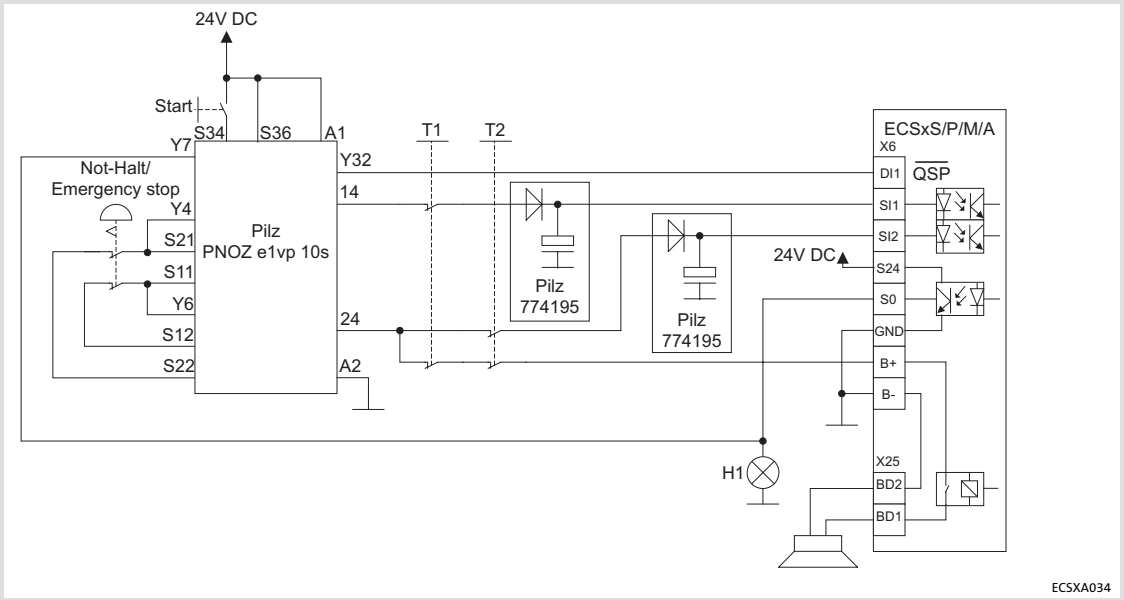


Fig. 5-12 Example: Wiring with ”Pilz PNOZ e1vp 10s” safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.
- The diode-capacitor combination prevents the test pulses of the safety switching device from disturbing the smooth running of the motor, as otherwise a short-time inhibit of the controller cannot be ruled out. The diode-capacitor combination can be procured from the company Pilz (Pilz order number: 774195) as a complete terminal block.

Description of the function

- The "PNOZ" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 14 and 24) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- The safety switching device is provided with test pulses at the output side, so that short circuits within the wiring are detected.
- Diagnostics is effected via the wiring of diagnostic output SO to input Y7 of the safety switching device. Y7 is the input of the feedback loop which has to be on HIGH level (+24 V) before the outputs 14 and 24 are activated. There is only HIGH level if both disconnecting paths have switched off.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!

Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.3.3.7 Example: Wiring with electromechanical safety switching device "Siemens 3TK2827" for Performance Level Pl_d

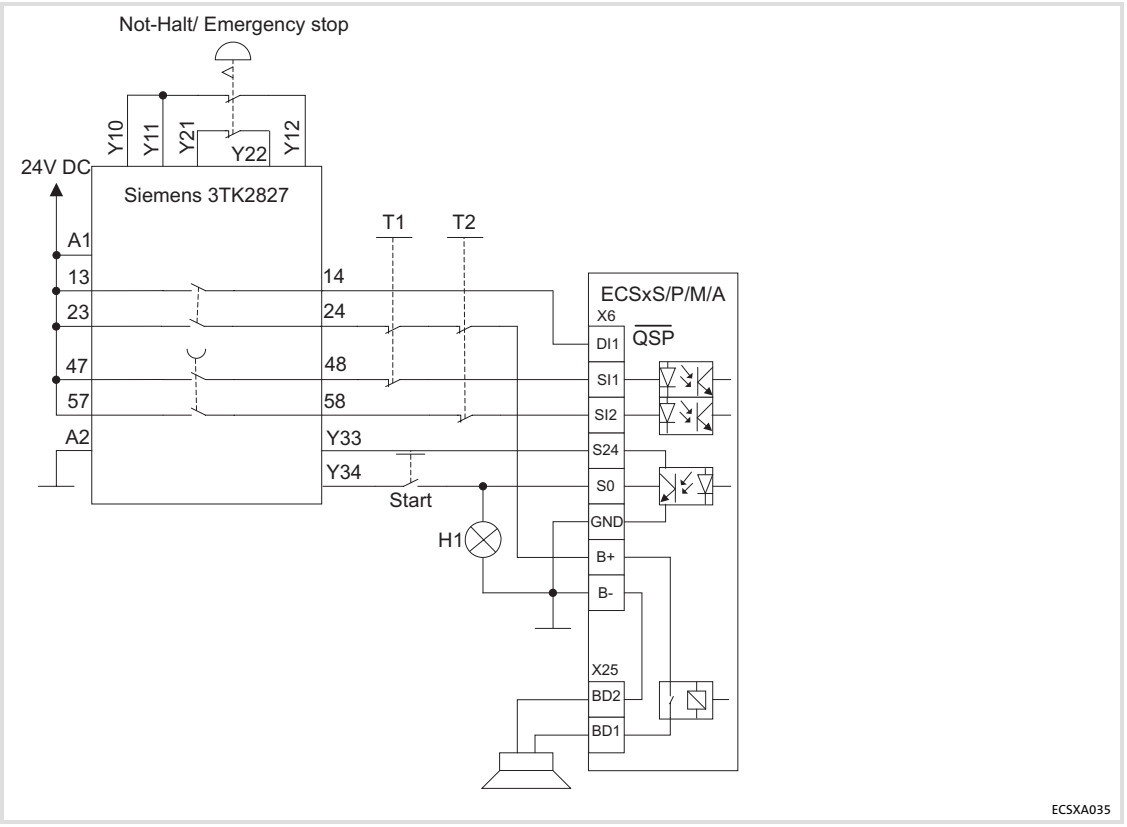


Fig. 5-13 Example: Wiring with "Siemens 3TK2827" safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.

Description of the function

- The "Siemens 3TK2827" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 48 and 58) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- If the "safe torque off" safety function is activated, output X6/SO is at HIGH level. This state is shown to the operator by means of the indicator light H1. Afterwards switch-on is possible again using the Start pushbutton.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.4 Automation interface (AIF)

The keypad XT or a communication module can be attached to or removed from the automation interface (X1). This is also possible during operation.

- The keypad XT serves to enter and visualise parameters and codes.
- The communication modules serve to network the modules of the ECS servo system with the host system (PLC or PC).

The following combinations are possible:

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

Further information ....

on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

5.5 Wiring of system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...**axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Basic wiring of the CAN bus networks

The two following schematic diagrams show drive systems with different master value concepts:

- In Fig. 5-14 a higher-level control assumes the function of the master, e.g. ETC.
- In Fig. 5-15 the function of the master is enabled by a controller intended as master.

In both representations, the master value transmission is effected via the MotionBus (CAN), interface X4.

The system bus (CAN), interface X14, serves to diagnose and/or parameterise the drives.

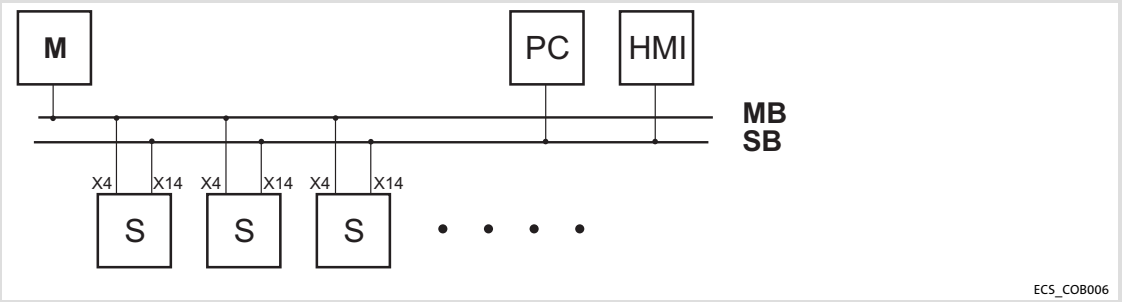


Fig. 5-14 MotionBus (CAN) with master control

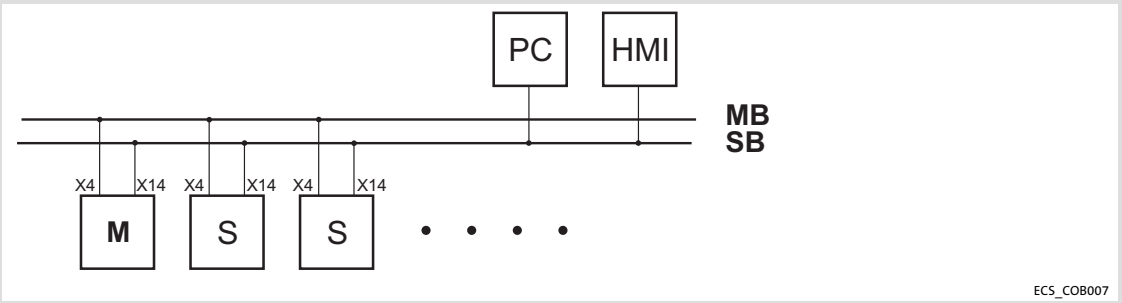


Fig. 5-15 MotionBus (CAN) with controller as master

MB	MotionBus (CAN), interface X4
SB	System bus (CAN), interface X14
M	Master
S	Slave
PC	PC with the Lenze parameter setting and operating software (GDC, GDL, GDO)
HMI	HMI / operating unit

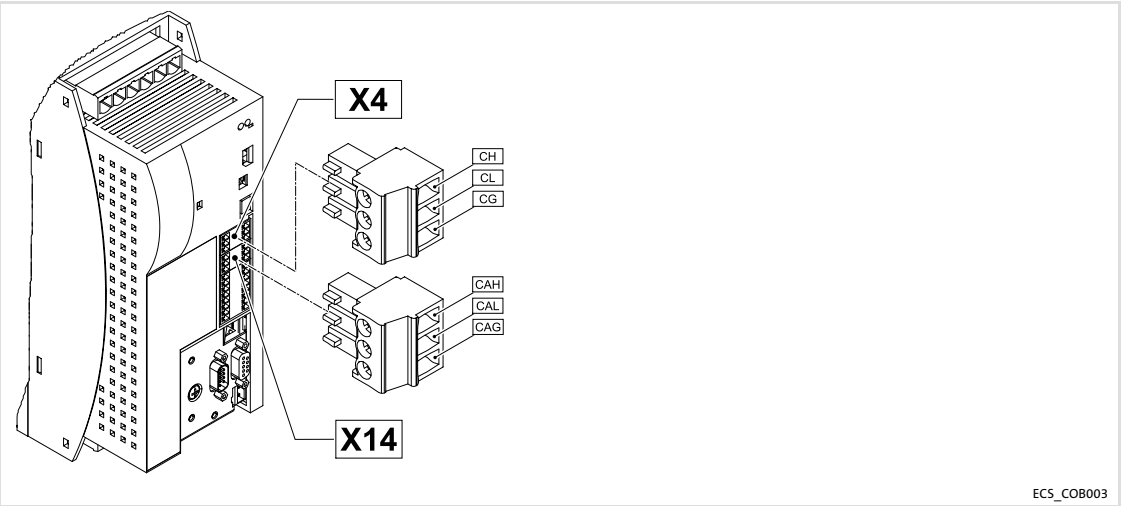


Fig. 5-16 Bus connections on the controller

Assignment of the plug connectors

X4 (CAN)	X14 (CAN-AUX)	Description
CH	CAH	CAN-HIGH
CL	CAL	CAN-LOW
CG	CAG	Reference potential

Specification of the transmission cable

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

System bus (CAN) wiring

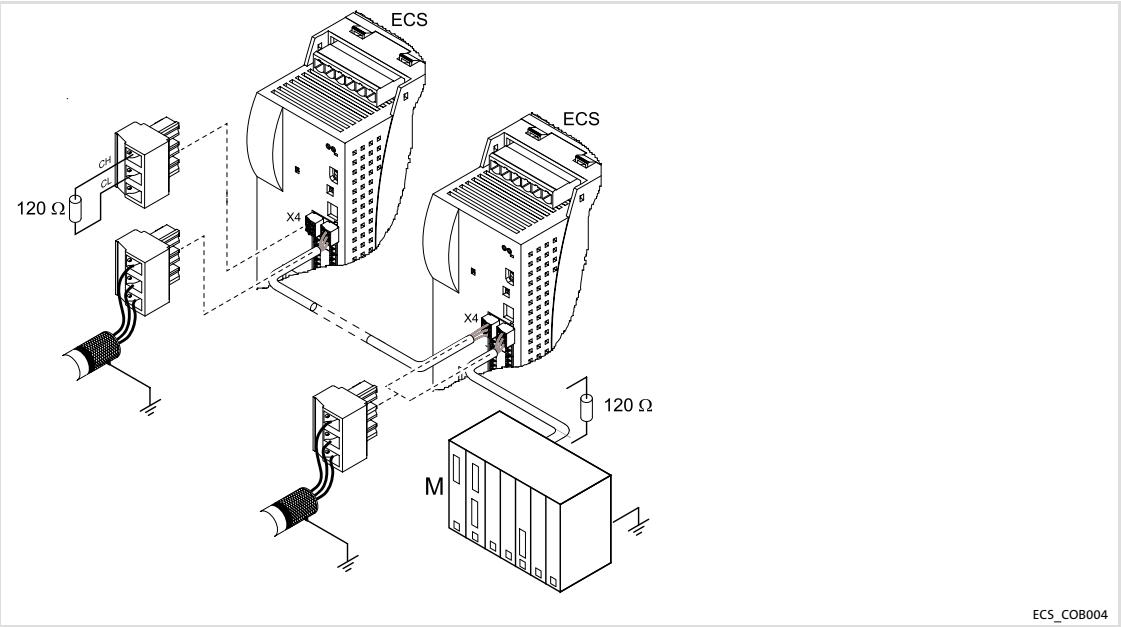


Fig. 5-17 Example: System bus (CAN) wiring via interface X4

ECS ECS axis module
M Master control, e.g. ETC

Note!

Connect one bus terminating resistor (120 Ω) each to the first and last node of the system bus (CAN).

Bus cable length

Note!
The permissible cable lengths must be observed.

1. Check the compliance with the total cable length in Tab. 5-1.

The baud rate determines the total cable length.

CAN baud rate [kbit/s]	**Max. bus length** [m]
50	1500
125	630
250	290
500	120
1000	25

Tab. 5-1 Total cable length

2. Check the compliance with the segment cable length in Tab. 5-2.

The segment cable length is determined by the cable cross-section used and the number of nodes. Without a repeater, the segment cable length corresponds to the total cable length.

Number of nodes	**Cable cross-section**			
	0.25 mm²	**0.5 mm²**	**0.75 mm²**	**1.0 mm²**
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 5-2 Segment cable length

3. Compare the two values detected.

If the value detected from Tab. 5-2 is smaller than the total cable length to be provided from Tab. 5-1 , repeaters must be used. Repeaters divide the total cable length into segments.

Example: Selection help

Specifications	
● Cable cross-section:	0.5 mm² (according to cable specifications 📖 91)
● Number of nodes:	63
● Repeater:	Lenze-repeater, type 2176 (cable reduction: 30 m)

For the max. number of nodes (63), the following cable lengths / number of repeaters from the specifications must be observed:

Baud rate [kbit/s]	**50**	**120**	**250**	**500**	**1000**
Max. cable length [m]	1500	630	290	120	25
Segment cable length [m]	310	310	290	120	25
Number of repeaters	5	2	-	-	-

Check repeater application

Given:	
● Baud rate:	125 kbps
● Cable cross-section:	0.5 mm²
● Number of nodes:	28
● Cable length:	450 m

Procedure	Cable length	See
1. Total cable length at 125 kbps:	630 m	Tab. 5-1
2. Segment cable length for 28 bus nodes and a cable cross-section of 0.5 mm²:	360 m	Tab. 5-2
3. Comparison: The value under point 2 is smaller than the required cable length of 450 m.		

Conclusion
● It is not possible to use a cable length of 450 m without using a repeater.
● After 360 m (point 2) a repeater must be installed.

Result
● The Lenze repeater type 2176 is used (cable reduction: 30 m)
● Calculation of the maximum cable length: First segment: 360 m Second segment: 360 m (according to Tab. 5-1) *minus* 30 m (cable reduction when a repeater is used)
→ Maximum possible cable length with repeater: 690 m.
→ Now it is possible to use the required cable length.

Note!

Repeaters are recommended as a

► Service interface
Advantage: Trouble-free connecting during bus operation is possible.

► Calibration interface
Advantage: Calibration/programming unit remains electrically isolated.

5.6 Wiring of the feedback system

You can connect various feedback systems to the axis module:

- Resolver on X7 (📖 96)
- Encoder on X8 (📖 97)
  - Incremental encoder with 5V-TTL level, RS-422
  - SinCos encoder with zero track without Hiperface, signal level 1 Vss
  - SinCos absolute value encoder (single-turn/multi-turn) with serial communication (Hiperface® interface), supply voltage 5 ... 8 V

Note!

If a ”safe isolation” acc. to EN 61140 between the encoder cable and motor cable (e.g. by using separating webs or separated trailing cables) is **not ensured** on the entire cable length cable due to an installation on the system side, the encoder cable must be provided with an insulation resistance of 300 V. Lenze encoder cables meet this requirement.

- We recommend to use Lenze encoder cables for wiring.
- In case of self-prepared cables
  - only use cables with shielded cores twisted in pairs.
  - Observe the notes on wiring/preparation on the following pages.

5.6.1 Resolver connection

Note!

- ► Use the prefabricated Lenze system cables for the connection of a resolver.
- ► Cable length: max. 50 m
- ► Depending on the cable length and resolver used parameterise the code C0416 (resolver excitation amplitude).
  Check the resolver control with code C0414 (recommended values: 0.5 ... 1.2; ideal value: 1.0).
- ► Before using a resolver from another manufacturer, please consult Lenze.

Connect a resolver via the 9-pole Sub-D socket X7.

Features

- ► Resolver: U = 10 V, f = 4 kHz
- ► Resolver and resolver supply cable are monitored for open circuit (fault message ”Sd2”).

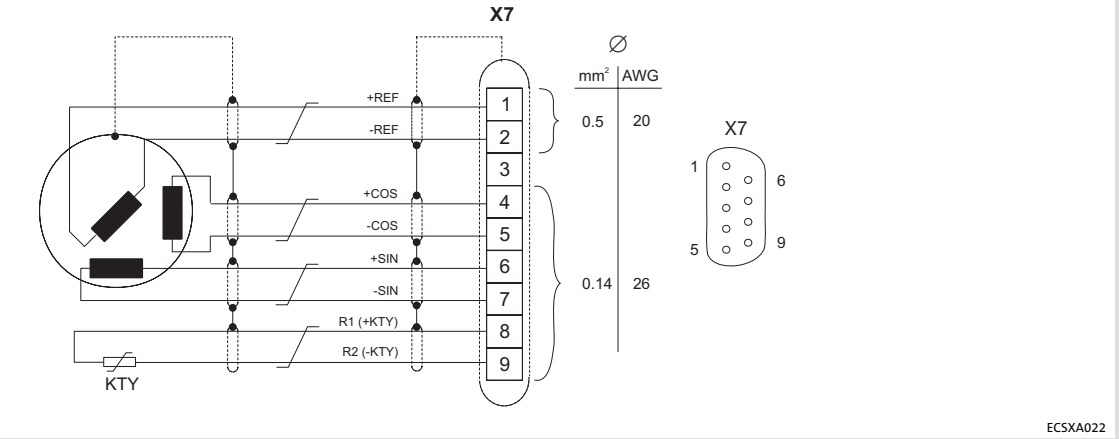


Fig. 5-18 Resolver connection

Assignment of socket connector X7: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	R1 (+KTY)	R2 (-KTY)
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.6.2 Encoder connection

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

Via the 9-pole Sub-D-plug X8, you can connect the following encoders:

► Incremental encoder (TTL encoder)
  – with two 5 V complementary signals (RS-422) that are electrically shifted by 90°.
  – with zero track that can be connected optionally.

► Sin/cos encoder (singleturn or multiturn rotary transducer)
  – with supply voltage (5 ... 8 V).
  – with serial communication.
    The initialisation time of the axis module is extended to approx. 2 s.

The controller supplies the encoder with voltage.

Use C0421 to set the supply voltage V_{CC} (5 ... 8 V) to compensate, if required, the voltage drop [ΔV] on the encoder cable:

$$\Delta U \cong 2 \cdot L_L\,[m] \cdot R/m\,[\Omega/m] \cdot I_G\,[A]$$

ΔV	Voltage drop on the encoder cable [V]
L_L	Cable length [m]
R/m	Ohmic resistance per meter of cable length [Ω/m]
I_G	Encoder current [A]

Stop!

Observe the permissible supply voltage of the encoder used. If the values in C0421 are set too high, the encoder can be destroyed!

Incremental encoder (TTL encoder)

Features	
Input/output frequency:	0 ... 200 kHz
Current consumption:	6 mA per channel
Current on output V_{CC} (X8/pin 4):	Max. 200 mA

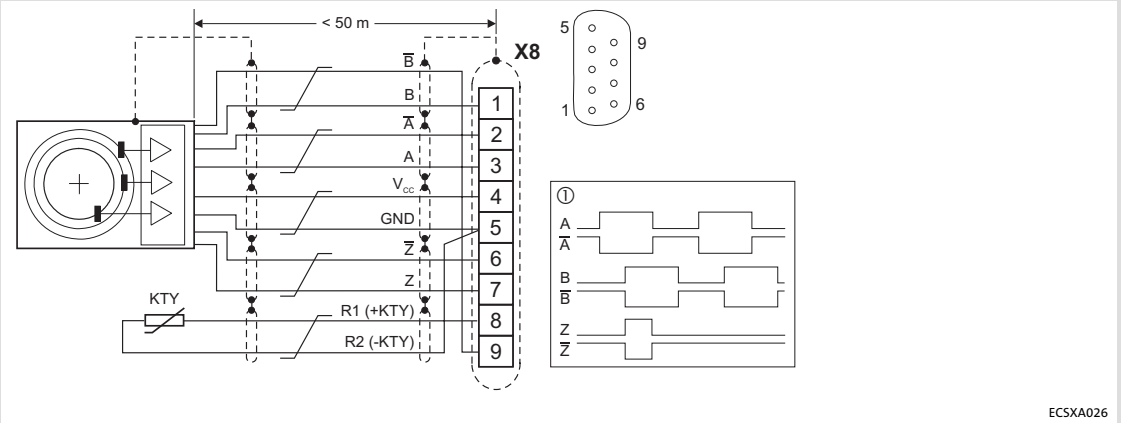


Fig. 5-19 Connection of incremental encoder with TTL level (RS-422)

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (R1/+KTY)	$\overline{Z}$	Z	R2 (-KTY)	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

SinCos encoders and SinCos absolute value encoders with Hiperface

Features	
Input/output frequency:	0 ... 200 kHz
Internal resistance (R_i):	221 Ω
Offset voltage for signals SIN, COS, Z:	2.5 V

- ► The differential voltage between signal track and reference track must not exceed 1 V ± 10 %.
- ► The connection is open-circuit monitored (fault message "Sd8")
- ► For encoders with tracks sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
  – Assign RefSIN with $\overline{\text{sine}}$.
  – Assign RefCOS with $\overline{\text{cosine}}$.
- ► For SinCos absolute value encoders with Hiperface, the serial interface (RS 485) is available instead of the zero track (Z track).

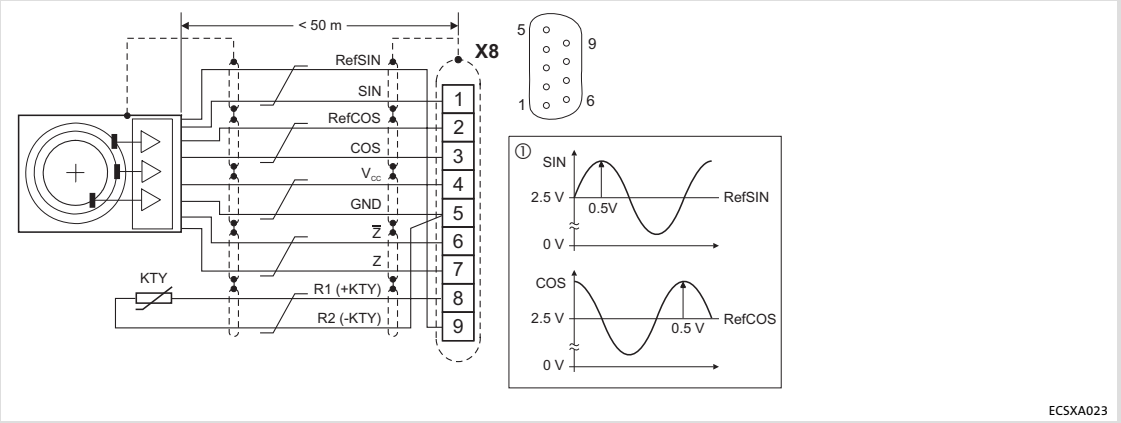


Fig. 5-20 Connection of SinCos encoder

① Signals in case of clockwise rotation
⌒ Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS ($\overline{\text{cos}}$)	COS	V_{CC}	GND (R2/-KTY)	$\overline{Z}$ or -RS458	Z or +RS485	R1 (+KTY)	RefSIN ($\overline{\text{sin}}$)
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.6.3 Digital frequency input/output (encoder simulation)

The digital frequency coupling of ECSxS/P/A axis modules basically is effected as a master-slave connection via the interface X8. This interface can either be used as a digital frequency input or as a digital frequency output (e. g. for encoder simulation) (configuration via C0491).

Features

X8 as digital frequency input	X8 as digital frequency output
● Input frequency: 0 ... 200 kHz ● Current consumption: max. 6 mA per channel ● Two-track with inverse 5 V signals and zero track ● Possible input signals: – incremental encoder with two 5 V complementary signals (TTL encoders) offset by 90° ● The function of the inputs signals can be set via C0427.	● Output frequency: 0 ... 200 kHz ● Permissible current loading: max. 20 mA per channel ● Two-track with inverse 5 V signals (RS422) ● The function of the output signals can be set via C0540.

Wiring

► 1 slave on the master:

Wire master and slave to each other directly via interface X8.

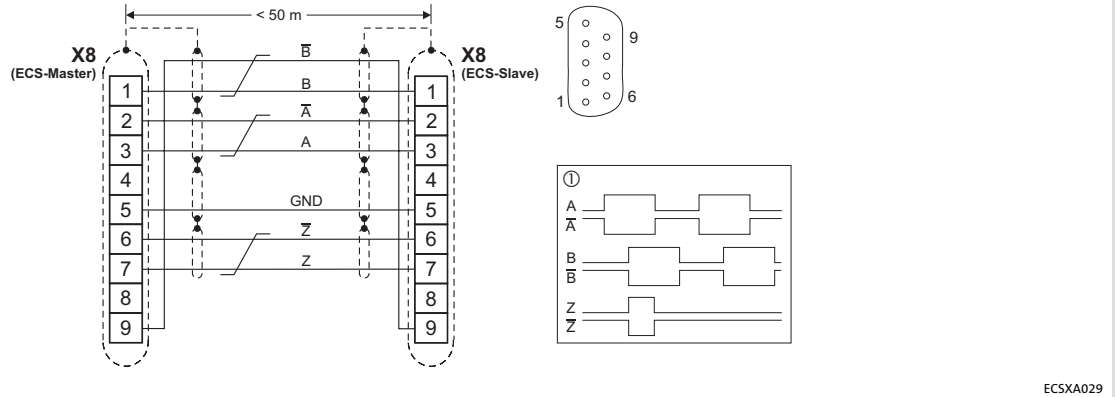


Fig. 5-21 Connection of the master frequency input/output X8 (master ↔ slave)

① Signals for clockwise rotation

⌒ Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Input signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
Output signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

► 2 to 3 slaves connected to the master:

Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

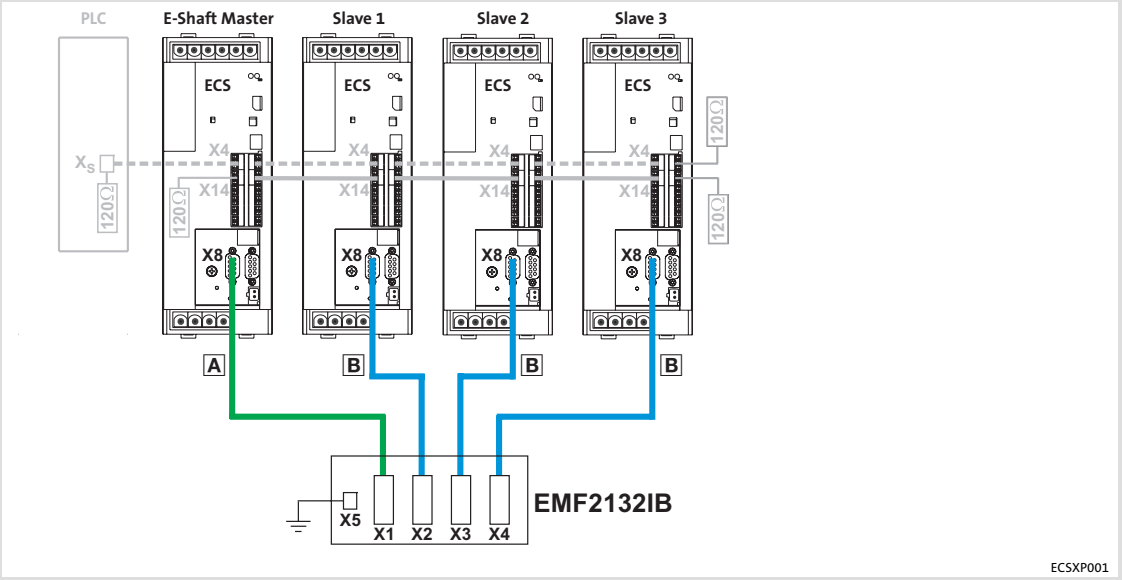


Fig. 5-22 ECS axis modules in the digital frequency network with digital frequency distributor EMF2132IB

PLC	Master control (PLC) or a PLC device to control the drive system
E-Shaft master	Master value master (axis module ECSxP)
Slave 1...3	Slave 1, slave 2, slave 3 (axis module ECSxP)
A	Master digital frequency cable EYD0017AxxxxW01W01 (socket/socket)
B	Slave digital frequency cable EYD0017AxxxxW01S01 (plug/socket)

Tip!

”xxxx” in the type designation of the digital frequency cables serves as a wildcard for the specification of the cable length in decimetres.

Example: EYD0017A**0015**W01W01 → cable length = 15 dm

6 Commissioning

6.1 Before you start

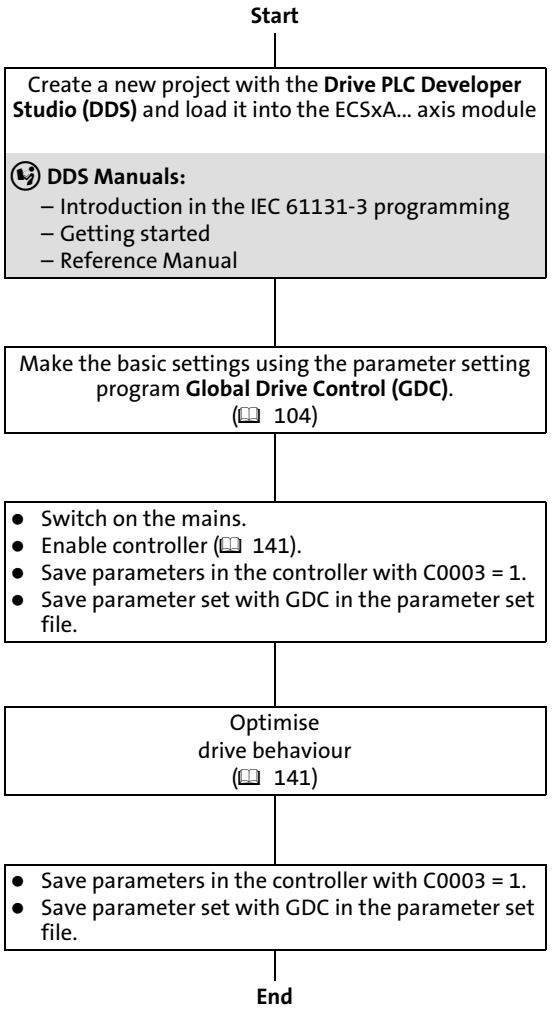
Note!

- The use of a Lenze motor is assumed in this description of the commissioning steps. For details on the operation with other motors see 📖 132.
- The description is based on operation with the Lenze programs ”Drive PLC Developer Studio” (DDS) and ”Global Drive Control” (GDC). The parameters are displayed in online mode, i.e. GDC can directly access the codes of the axis module.

Prior to initial switch-on of the drive system, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Polarity of the DC-bus voltage supply via terminals +UG, -UG
- Motor connection:
  – In-phase connection to the motor (direction of rotation)
- Wiring of “safe torque off” (formerly ”safe standstill”)
- Feedback system
- Control terminals:
  – Wiring adjusted to the signal assignment of the control terminals.

6.2 Commissioning steps (overview)



6.3 Carrying out basic settings with GDC

Note!
Follow the commissioning steps in the given order!

Settings		Brief description	Detailed information
Preconditions		• Mains is switched off. (Green LED is dark, red LED is blinking) • Controller inhibit is active. – Press the <F9> key in GDC. – X6/SI1 **or**X6/SI2 must be open (LOW). • DDS project has been created and loaded into the ECSxA axis module. See DDS Manuals: – Introduction in the IEC 61131-3 programming – Getting started – Reference Manual	
1.	Switch on low-voltage supply (24 V DC).		
2.	Connect PC/laptop (with installed GDC parameter setting program) to controller.	Connection to X14 (system bus (CAN)) with PC system bus adapter EMF2177IB.	📖 149
3.	Start GDC and select the device to be set.	Select device: Change to the online mode via the GDC toolbar with the <F4> key and select "Searching for drives" using the <F2> key. ⇨ Drive is identified and the parameter menu is opened.	GDC online help
4.	Load Lenze setting.	• Not required for initial commissioning of the axis module. • Only recommended if the Lenze setting is unclear.	📖 106
5.	Set communication parameters according the interface used.	Comm. parameters - AIF interface X1 **Please also read the documentation for the Lenze communication module used!**	📖 182
		Comm. parameters - CAN interface X4	📖 155
		Comm. parameters CAN-AUX interface X14	
6.	Set mains data.	Set the following codes in the GDC parameter menu under **Short setup → Mains**: • C0173 (voltage thresholds) • C0175 (function of the charge relay) – For operation with the power supply module ECSxE set C0175 = 3.	📖 107
7.	Enter motor data.	Lenze motors: Use the GDC motor assistant.	📖 109
		Motors from other manufacturers: Set the codes in the GDC parameter menu under **Motor/feedback systems → Motor setting**.	📖 132
8.	Configure holding brake.	• Not required if a holding brake is not available; *otherwise* • set C0472/10 (speed threshold) > 0 (e. g. 1 %) for closing the holding brake.	📖 111
9.	Set feedback system.	• Set Lenze motors with resolvers (standard) in the GDC parameter menu under **Short setup → Feedback system**. • Set other resolvers and encoders in the GDC parameter menu under **Motor/feedback systems → Feedback system**.	📖 112

Settings		Brief description	Detailed information
10.	Set the polarity of the digital inputs and outputs.	Select **Terminal I/O → Digital inputs/outputs** in the GDC parameter menu: ● C0114/x (polarity of dig. inputs X6/DI1 ... DI4) ● C0118/1 (polarity of dig. output X6/DO1)	🕮 129
11.	Enter machine parameters.	Set machine parameters as for instance maximum speed and ramp times in the parameter menu under **Short setup → Motor setting** .	🕮 130
12.	Switch on the mains.	● Green LED is blinking and red LED is off: – Controller is ready for operation. ● Green LED is off and red LED is blinking: – An error has occurred. Eliminate the error before you continue commissioning.	

The basic settings are completed now.

Proceed as follows:

► Enable controller (🕮 131).

► Save parameters in the controller with C0003 = 1.

► Save parameter set with GDC in the parameter set file.

► Optimise drive behaviour (🕮 141).

6.4 Loading the Lenze setting

Note!

When loading the Lenze setting, all parameters are reset to the basic setting defined by Lenze. Settings that have been adjusted before get lost during this process!

In GDC, you can find the parameters and codes to be set in the parameter menu under **Load / Save / PLC / Multitasking**.

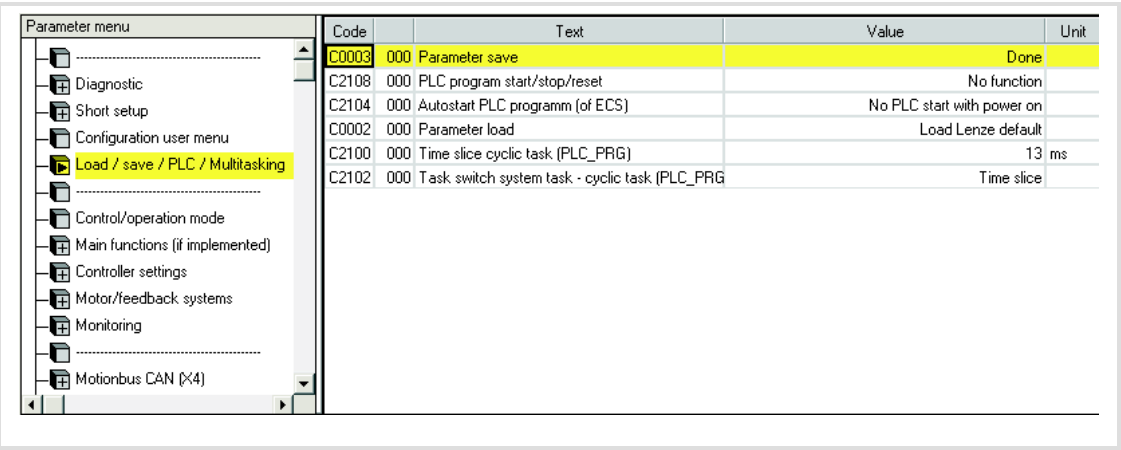


Fig. 6-1 GDC view: Load / Save / PLC / Multitasking

Setting sequence

1. Stop the PLC program: C2108 = 2
2. Load the Lenze setting: C0002 = 0
3. Continue with 3.1 **or** 3.2.

   3.1 The 24-V supply voltage can be switched.

   A Switch off and on again the 24 V-supply voltage.

   B Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   3.2 The 24-V supply voltage cannot be switched.

   A Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   B Reset the PLC: C2108 = 3

4. Continue with basic settings from point 5 of the table on 📖 104.
5. Automatic start of the PLC program after power-up: C2104 = 1
6. Start the PLC program: C2108 = 1
7. Save parameter set: C0003 = 1

6.5 Setting of mains data

In GDC, you can find the parameters and codes to be set in the parameter menu under **Code list**:

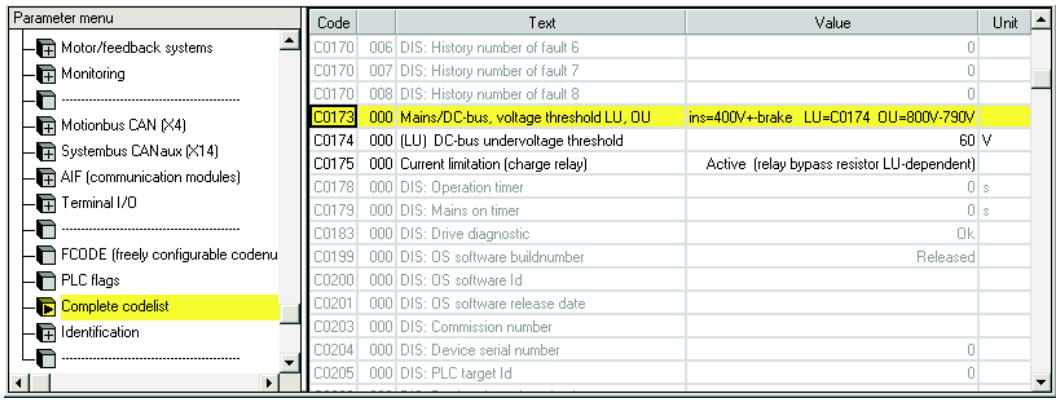


Fig. 6-2 GDC view: Network data in the code list

6.5.1 Selecting the function of the charging current limitation

The ECS axis modules are provided with a charging current limitation by means of charge resistors and charge relays. In the Lenze setting the charging current limitation is activated (C0175 = 1).

At mains connection the charge relay remains open for a while so that the charging current of the DC bus is limited by the charging resistors. When a certain voltage level has been reached, the charging resistors are short circuited by switching on (closing) the charge relay contacts.

Stop!

- In case of a mains supply via a power supply module **ECSxE** the entire DC bus is charged in a controlled way by a semiconductor circuit (thyristor) in the power supply module. Therefore, set **C0175 = 3** for the axis modules (charging current limitation inactive, charging resistor short-circuited).

  If the Lenze setting has been loaded via C0002, C0175 = 3 must be reset.
- Cyclic switching of the mains voltage at the power supply module can overload and destroy the charging current limitations of the axis modules if activated (C0175 = 1 or C0175 = 2).

  For this reason, allow a break of at least three minutes between two starting operations in case of cyclic mains switching over a longer period of time!

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 107
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

6.5.2 Setting the voltage thresholds

Note!

All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 107
			15	{1 V} 342		

6.6 Entry of motor data for Lenze motors

Note!

- The following only describes the parameter setting for Lenze motors! (If you use a motor from another manufacturer, see 📖 132.)
- If the Lenze setting has been loaded via C0002, the motor data must be re-entered.
- The freely available "GDC-Easy" does not provide the "Input assistant for motor data" which is described in the following so that you must enter the motor data manually (📖 132).

Parameter setting with the "Input assistant for motor data" of the GDC

1. Go to the GDC menu bar and select the **Tool → Motor data** menu item or click the button with the motor symbol in the tool bar:

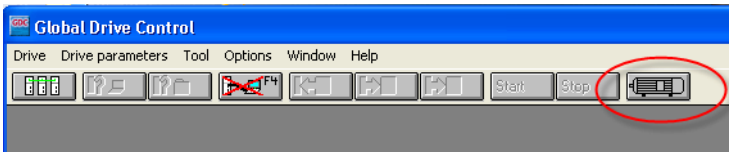


Fig. 6-3 GDC view: menu bar and tool bar

– The "Input assistant for motor data" opens:

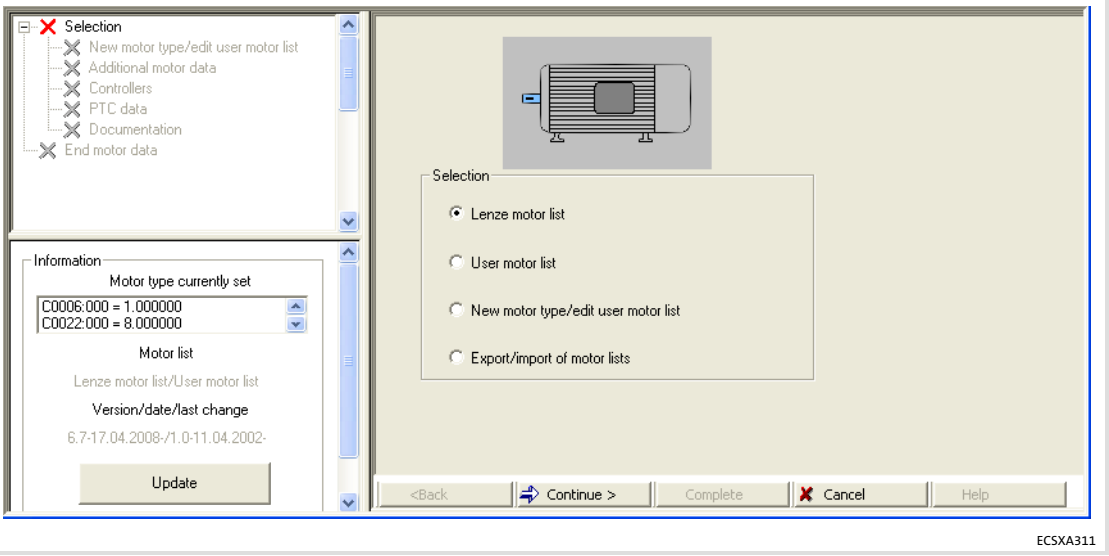


Fig. 6-4 GDC view: Selection of motor list

2. Select the "Lenze motor list" and click the [Continue] button.

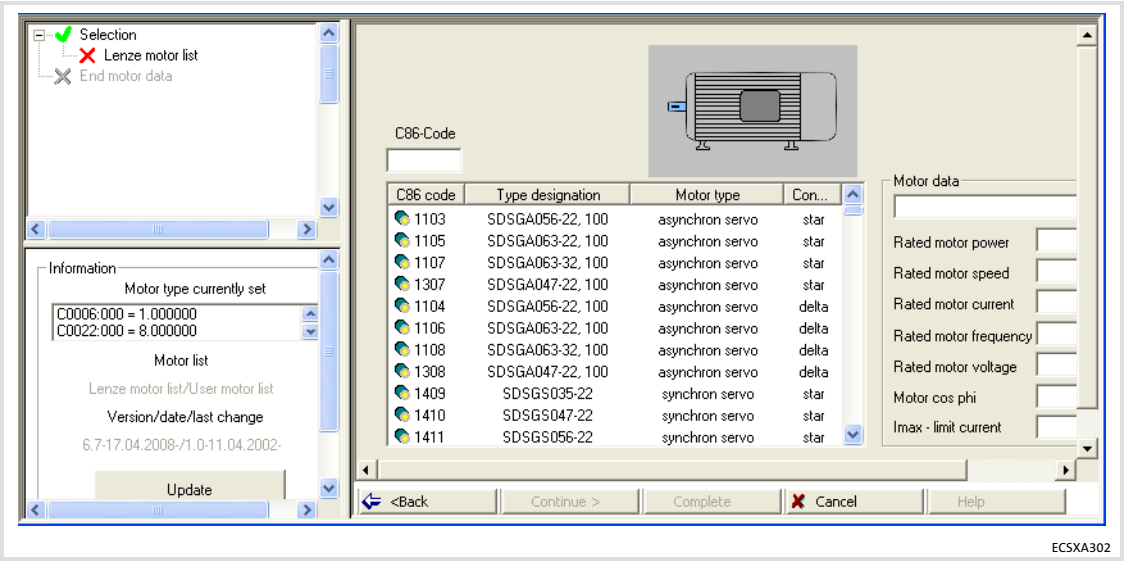


Fig. 6-5 GDC view: Motor selection

3. Select the connected motor from the list (see motor nameplate).
   – The corresponding motor data is displayed in the ”Motor data” fields on the right.
4. Click the [Complete] button.
   – The data is transferred to the controller. This process can take a few seconds and is confirmed by a message after being completed.

6.7 Holding brake configuration



Tip!

If you use a motor without a holding brake, you can skip this chapter.

In GDC, you can find the parameters and codes to be set in the parameter menu under **Complete code list**.

Code	Name	Description
C0472/10	FCODE analog [%]	Speed threshold from which the drive is allowed to output the signal ”Close brake”. ● This code refers to the maximum speed set in C0011. **Note:** Enter a value > 0 so that the brake can be opened.
C0472/11	FCODE analog [%]	Value/direction of the torque against the holding brake.

6.8 Setting of the feedback system for position and speed control

The following feedback systems can be selected for position and speed control:

- Resolver (📖 113)
- TTL incremental encoder/SinCos encoder without serial communication (📖 115)
  - as position and speed encoder (📖 115)
  - as position encoder and resolver as speed encoder (📖 118)
- Absolute value encoder (Hiperface®, single-turn/multi-turn)
  - as position and speed encoder (📖 122)
  - as position encoder and resolver as speed encoder (📖 125)

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/Feedb. → Feedback**:

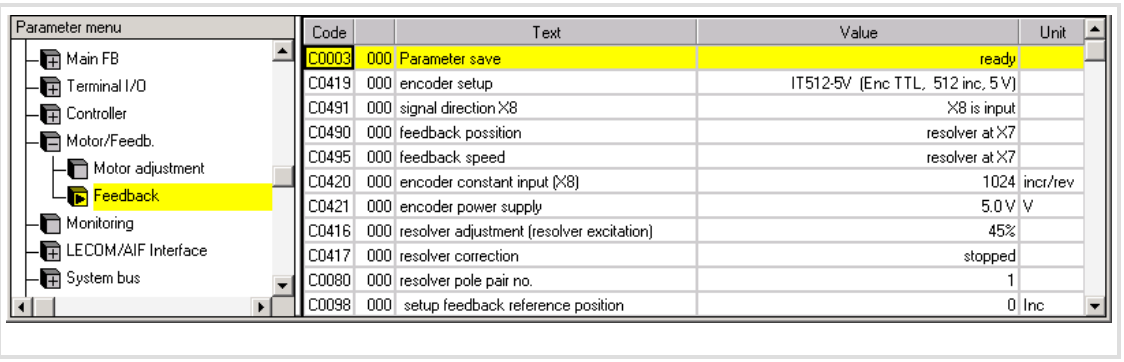


Fig. 6-6 GDC view: Commissioning of the feedback system

Note!

If the Lenze setting has been loaded via C0002, the feedback system must be reset.

6.8.1 Resolver as position and speed encoder

If a resolver is connected to X7 and used as a position and speed encoder, no settings are necessary.

Lenze setting:

- ► Resolver as position encoder: C0490 = 0
- ► Resolver as speed encoder: C0495 = 0

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 112
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 112
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 138
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 135
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0095]	Rotor pos adj	0		Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	138
			0 Inactive		
			1 Active		
C0414	DIS: ResQual.			Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	113
			0.00 {0.01} 1,60		
[C0416]	Resolver adj.	5		Resolver excitation amplitude	113
			0 100 %		
			1 80 %		
			2 68 %		
			3 58 %		
			4 50 %		
			5 45 %		
			6 40 %		
			7 37 %		
[C0417]	Resolver cor.	0		Resolver adjustment	147
			0 Ready		
			1 Start adjustment		
			2 Loading default values		

6.8.2 TTL/SinCos encoder as position and speed encoder

If a TTL incremental encoder or a sin/cos encoder without serial communication is connected to X8 and used for position and speed control, the following setting sequence must be observed:

1. Select encoder for position and speed control.
   – Incremental encoder (TTL encoder): C0490 and C0495 = 1
   – Sin/cos encoder without serial communication: C0490 and C0495 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

When encoders are used for position and speed control, the same feedback system will automatically be set for both control modes under C0490 and C0495. Separate feedback systems can only be selected in connection with a resolver.

2. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – Sin/cos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
3. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.

The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn)	
			408	AM128-8V		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
			409	AM256-8V		(multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			410	AM512-8V			
			411	AM1024-8V			
[C0420]	Encoder const.	512				Number of increments of the encoder	331 115 122
			1	{1 inc/rev}	8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0				Encoder voltage	331 115 122
			0	5.0 V		Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V			
			2	6.3 V			
			3	6.9 V			
			4	7.5 V			
			5	8.1 V			
[C0427]	Enc. signal	0				Function of the master frequency input signals on X8 (DFIN)	331 115 122
			0	2-phase			
			1	A: speed B: direction			
			2	A or B: speed or direction			
[C0491]	X8 in/out	0				Function of X8	331 115 122
			0	X8 is input			
			1	X8 is output			

6.8.3 TTL/SinCos encoder as position encoder and resolver as speed encoder

A TTL incremental encoder connected to X8 or a SinCos encoder without serial communication can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select TTL/SinCos encoder as position encoder.
   – Incremental encoder (TTL encoder): C0490 = 1
   – SinCos encoder without serial communication: C0490 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
4. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.
The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 138
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 135
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1			Number of pole pairs of resolver	
			1	{1} 10		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0414	DIS: ResQual.				Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 113
			0.00	{0.01} 1,60		
[C0416]	Resolver adj.	5			Resolver excitation amplitude	📖 113
			0	100 %		
			1	80 %		
			2	68 %		
			3	58 %		
			4	50 %		
			5	45 %		
			6	40 %		
			7	37 %		
[C0417]	Resolver cor.	0			Resolver adjustment	📖 147
			0	Ready		
			1	Start adjustment		
			2	Loading default values		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 331 📖 115 📖 122
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 331 📖 115 📖 122
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 331 📖 115 📖 122
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 331 📖 115 📖 122
			0	X8 is input		
			1	X8 is output		

6.8.4 Absolute value encoder as position and speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

If an absolute value encoder with Hiperface® interface is connected to X8 and used as position and speed encoder, the following setting sequence must be observed:

1. Select absolute value encoder as position and speed encoder.
   – Single-turn encoder: C0490 and C0495 = 3
   – Multi-turn encoder: C0490 and C0495 = 4
   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

When encoders are used for position and speed control, the same feedback system will automatically be set for both control modes. Separate feedback systems can only be selected in connection with a resolver (see code table, C0490 and C0495).

2. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411
   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

3. Save settings with C0003 = 1.

Note!

When configuring the absolute value encoder, an ”SD7” system error is activated. The error can only be reset by means of mains switching.

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 112
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 112
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 331 📖 115 📖 122
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 331
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	📖 115 📖 122
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 331 📖 115
			0	2-phase		📖 122
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 331
			0	X8 is input		📖 115 📖 122
			1	X8 is output		

6.8.5 Absolute value encoder as position encoder and resolver as speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

An absolute value encoder Hiperface® interface connected to X8 can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select absolute value encoder as position encoder.
   – Single-turn encoder: C0490 = 3
   – Multi-turn encoder: C0490 = 4
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411

   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 112
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 138
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 135
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 113
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 113
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 147
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 331 📖 115 📖 122
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 331 📖 115 📖 122
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 331 📖 115 📖 122
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 331 📖 115 📖 122
			0	X8 is input		
			1	X8 is output		

6.9 Setting the polarity of digital inputs and outputs

The polarity can be set for each digital input and output. This determines whether the input or output is HIGH active or LOW active.

The following are available:

- 4 digital inputs (X6/DI1 ... DI4)
- 1 digital output (X6/DO1)
- 1 relay output (X25/BD1, BD2)

The GDC contains codes for setting the polarity of digital inputs and outputs in the parameter menu under **Terminal I/O**:

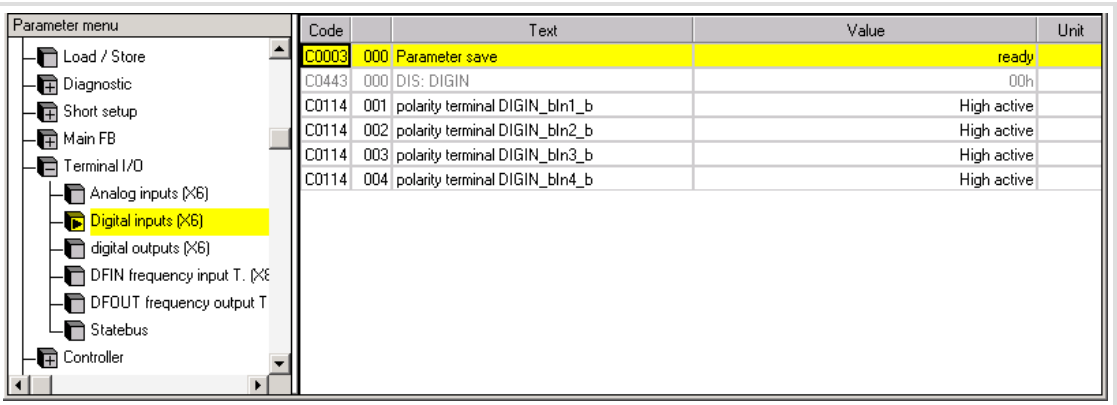


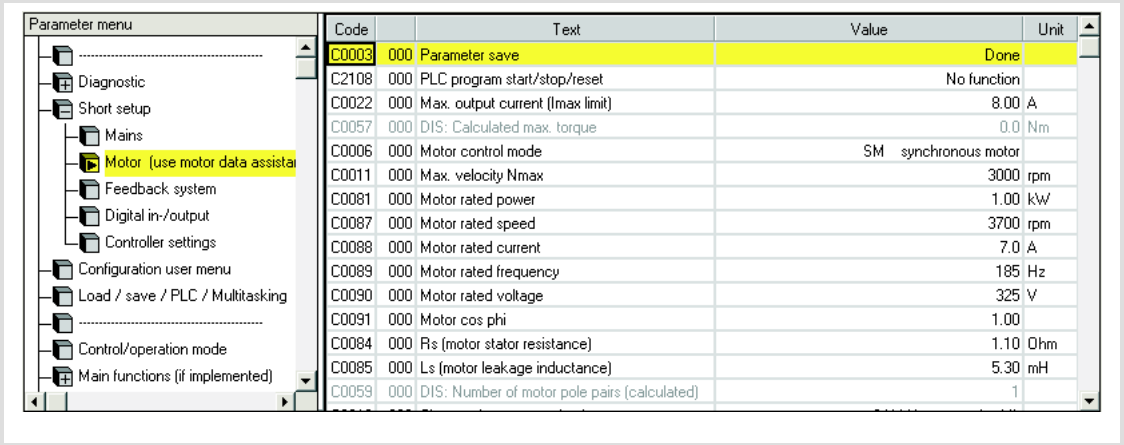
Fig. 6-7 GDC view: Setting of the polarity of digital inputs and outputs

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0114				Polarity of the digital inputs	📖 129
1	DIGIN pol	0	HIGH level active	X6/DI1 (DIGIN_bIn1_b)	
2	DIGIN pol	0	HIGH level active	X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0	HIGH level active	X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0	HIGH level active	X6/DI4 (DIGIN_bIn4_b)	
			0 HIGH level active		
			1 LOW level active		
C0118				Polarity of the digital outputs	📖 345
1	DIGOUT pol	0	HIGH level active	X6/DO1 (DIGOUT_bOut1_b)	📖 129
2	DIGOUT pol	0	HIGH level active	X25 (DIGOUT_bRelais_b, brake connection)	
			0 HIGH level active		
			1 LOW level active		

6.10 Entry of machine parameters

In GDC the codes for machine parameters such as maximum speed and ramp times can be found in the parameter menu under:

► **Short setup**



Code		Text	Value	Unit
C0003	000	Parameter save	Done	
C2108	000	PLC program start/stop/reset	No function	
C0022	000	Max. output current (Imax limit)	8.00	A
C0057	000	DIS: Calculated max. torque	0.0	Nm
C0006	000	Motor control mode	SM synchronous motor	
C0011	000	Max. velocity Nmax	3000	rpm
C0081	000	Motor rated power	1.00	kW
C0087	000	Motor rated speed	3700	rpm
C0088	000	Motor rated current	7.0	A
C0089	000	Motor rated frequency	185	Hz
C0090	000	Motor rated voltage	325	V
C0091	000	Motor cos phi	1.00	
C0084	000	Rs (motor stator resistance)	1.10	Ohm
C0085	000	Ls (motor leakage inductance)	5.30	mH
C0059	000	DIS: Number of motor pole pairs (calculated)	1	

Fig. 6-8 GDC view: Machine parameters

6.11 Controller enable (CINH = 0)

The controller will only be enabled internally if no signal sources relevant for the controller inhibit (CINH) are activated (i.e. CINH-signal sources = 0).

The following table shows the signal sources for controller enable:

Source for controller inhibit	Controller inhibit	Controller enable	Note
Terminal X6/SI1	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	For controller enable, X6/SI1 has to be = HIGH **and** X6/SI2 = HIGH.
Terminal X6/SI2	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	
C0040	C0040 = 0	C0040 = 1	
Operating module/keypad	STOP key	RUN key	Inhibiting with STOP key is only possible if the STOP key is assigned with "CINH" via C0469.
Fault	• In case of TRIP • In case of message	• No TRIP/message active • TRIP reset	For check see 📖 236.
Control word - system bus (CAN), C0135	C0135/bit 9 = 1	C0135/bit 9 = 0	GDC function keys: • <F8> key (controller enable/start) • <F9> key (controller inhibit/stop)
Fieldbus module	See Operating Instructions of the corresponding fieldbus module.		

Note!

All signal sources act like a series connection of switches which are independent of each other.

6.12 Operation with motors from other manufacturers

6.12.1 Entering motor data manually

If you use motors of other manufacturers together with the ECS axis module, you have to enter the motor data manually. The GDC includes the required codes in the parameter menu under **Motor/feedback systems→ → Motor adjustment**.

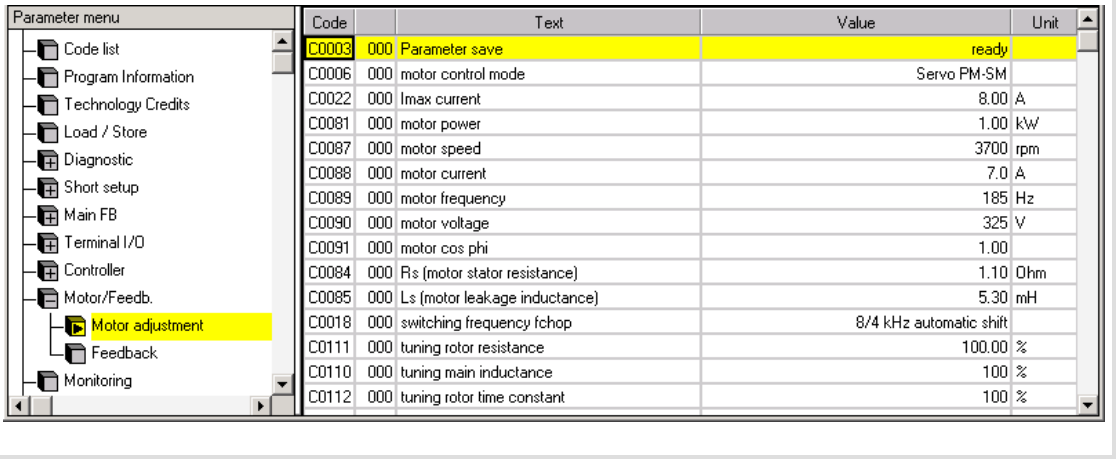


Fig. 6-9 GDC view: Manual setting of the motor data

Code		Possible settings		IMPORTANT
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**	
[C0006]	Op mode	1		Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1 Servo PM-SM	Servo control of synchronous motors
			2 Servo ASM	Servo control of asynchronous motors
C0018	fchop	2		Switching frequency
			1 4 kHz sin	4 kHz permanent PWM frequency
			2 8/4 kHz sin	8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0022	Imax current	→		I_{max} limit
			0 {0.01 A}	→ Device-dependent list Max. current can be gathered from the technical data.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 138
			-180.0	{0.1 °}	179.9		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 138
			0	Inactive			
			1	Active			
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0128	Tau motor	5.0				Thermal time constant of the motor	📖 214
			0.5	{0.1 min}	25.0	For calculating the $I^2 \times t$ disconnection	
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	📖 136
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

6.12.2 Checking the direction of rotation of the motor feedback system

In GDC, you can find the parameters and codes to be set in the parameter menu under **Motor/Feedback systems → Feedback system**.

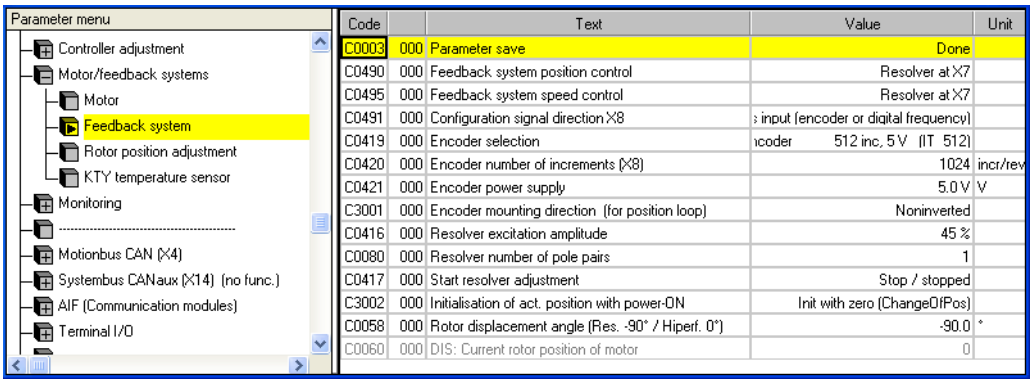


Fig. 6-10 GDC view: Feedback system

C0060 indicates the rotor position within one revolution as a numerical value between 0 and 2047. The indicated rotor position is derived from the selected position encoder (C0490) with reduced resolution.

Evaluation:

If the motor encoder (resolver) is set as position encoder (C0490) and the rotor rotates in CW direction (view on the front of the motor shaft), the numerical value must rise. If the values are falling, reverse the Sin+ and Sin- connections.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 135
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

6.12.3 Adjusting current controller

For an optimum machine operation, the current controller settings must be adapted to the electrical motor data.

The parameters of the current controller depend on the electrical motor data. They do not depend on mechanical data as with the speed and position control circuit. This is why the default current controller settings of the "GDC motor data input assistant" can usually be used. A current controller adjustment is only required for third-party motors and for Lenze motors only in special cases.

Leakage inductance and stator resistance of the motor are known:

The gain of the current controller V_p and the integral-action time of the current controller T_n can be calculated by approximation:

Current controller gain (V_p)	Integral-action time of the current controller (T_n)
$V_p = \frac{L1_S}{250\ \mu s}$	$T_n = \frac{L1_S}{R1_S}$

$L1_S$ Motor leakage inductance

$R1_S$ Motor stator resistance

Note!

Depending on the leakage inductance of the motor, the calculated values can be outside the adjustable range. In this case

- ► set a lower gain and a higher integral-action time;
- ► adjust the current controller metrologically (📖 137).

For applications with high current controller dynamics the pilot control of the current controller outputs can be activated with C0074 (C0074 = 1). For this, it is vital to enter the correct values for the stator resistance (C0084) and leakage inductance (C0085).These can be obtained from the data sheet of the motor used!

Leakage inductance and stator resistance of the motor are not known:

The current controller can be optimised metrologically with a current probe and an oscilloscope. For this, a test mode is available in which the current C0022 x √2 flows in phase U after controller enable.



Stop!

Avoid damage to the motor and machine

- ► During the current controller adjustment, the motor must be freely rotatable.
- ► The test current must not exceed the maximum permissible motor current.
- ► Always adjust the current controller at a switching frequency of 8 kHz.

Observe the current step in phase U to adjust the current controller.

Setting sequence

1. Select 8 kHz as switching frequency (C0018 = 2).
2. Select the test current under C0022:
   – Start with a low current value, e.g. half the rated motor current.
3. Activate the test mode with C0418 = 1.
4. Enable the controller. (📖 131)
   – Adjust the synchronous motor.
   – The asynchronous motor remains at standstill.
5. Enable and inhibit the controller several times in a row changing the current controller gain (C0075) and the current controller adjustment time (C0076) such that the current characteristic is free of harmonics.
6. After the adjustment has been completed, deactivate the test mode with C0418 = 0.
7. If required, change the switching frequency under C0018.

6.12.4 Effecting rotor position adjustment

Note!

Resolver / absolute value encoder with Hiperface® interface

- If the rotor zero phase is not known, the rotor position only has to be adjusted once during commissioning.
- For multi-turn absolute value encoders, the traversing range must be within the display range of the encoder (0 ... 4095 revolutions) if the traversing range is limited.

TTL incremental encoder / sin/cos encoder with zero track

- If these encoder types are used for the operation of synchronous motors, the rotor position must be adjusted every time the low-voltage supply is switched on.

The rotor position must be adjusted if:

- A motor from another manufacturer is connected to the controller.
- Another encoder has been mounted subsequently.
- A defective encoder has been replaced.

The rotor position can only be adjusted if:

- The resolver is polarised correctly.
- The current controller has been adjusted.

The GDC contains the parameters or codes to be set on the parameter menu under **Motor/Feedb. → Rotor position adjustment**:

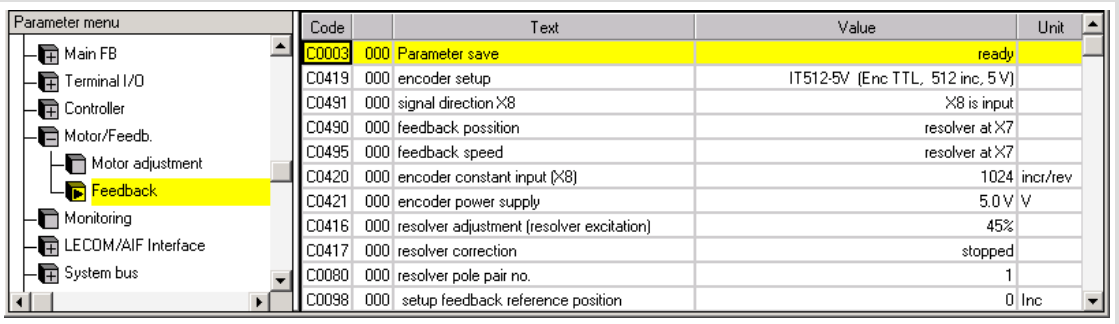


Fig. 6-11 GDC view: Commissioning of the feedback system

Setting sequence

1. Inhibit controller. (📖 131)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
2. Unload motor mechanically.
   – Separate the motor from the gearbox or machine so that it can rotate freely.
3. Open holding brake (if available).
4. Activate rotor position adjustment with C0095 = 1.
5. Enable controller. (📖 131)
   – X6/SI1 = HIGH and X6/SI2 = HIGH and press the <F8> key in GDC.
   The rotor position adjustment program of the controller is started:
   – The rotor rotates half a revolution in 16 steps (for resolver with 1 pole pair: 180° electrically ≙ 180° mechanically).
   – After one revolution, C0095 is automatically reset to ”0”.
   – The rotor zero phase is stored under C0058. (For absolute value encoders (Hiperface®, single-turn/multi-turn) at X8, C0058 is always ”0”.)



Danger!

Uncontrolled drive movements after an Sd7 fault with absolute value encoders

If absolute value encoders are used and the rotor position adjustment is completed with the fault message ”Sd7” (📖 246), the rotor position could not be assigned to the feedback system. In this case, the drive may carry out uncontrolled movements after controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Repeat rotor position adjustment (starting with step 1).

► Check wiring and interference immunity of the encoder at X8.

6. Inhibit controller. (📖 131)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
7. Save the data determined by the controller with C0003 = 1.



Tip!

The values for C0058 and C0095 are only displayed in GDC if you place the bar cursor on them and read back the code using function key <F6>.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	138
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	138
			0	Inactive			
			1	Active			

6.13 Optimising the drive behaviour after start

For applications with high current controller dynamics, the pilot control for the current controller can be adjusted under C0074:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0074	Dynamics	0		Pilot control of the current controller for higher dynamics	📖 136
			0 Normal		
			1 Enhanced		

6.13.1 Speed controller adjustment

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not ”noisy”.
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

In GDC, you can find the codes for adjusting the speed controller in the parameter menu under **Controller settings → Speed/position**.

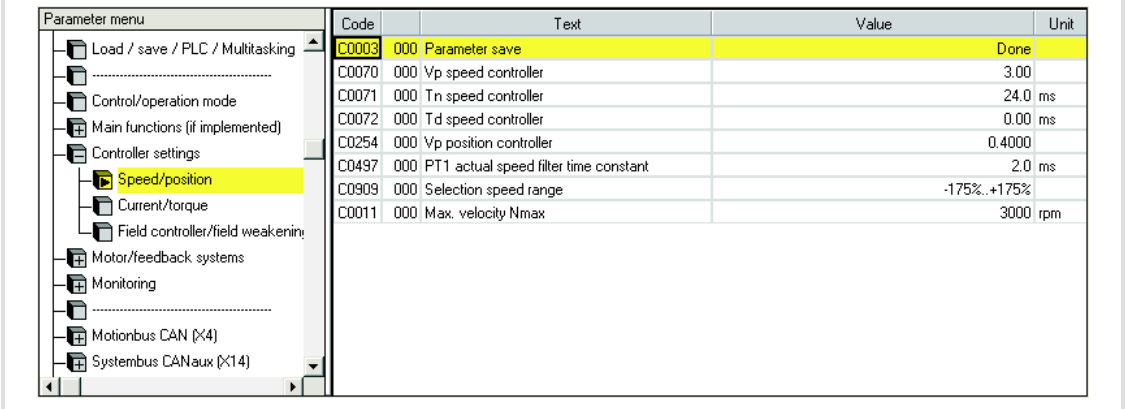


Fig. 6-12 GDC view: Adjustment of the speed controller

Parameter setting

- Set the proportional gain (V_{pn}) via C0070:
  - Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
  - Increase C0070 until the drive becomes instable (pay attention to engine noises).
  - Reduce C0070 until the drive runs stable again.
  - Reduce C0070 to approx. half the value.
- In the PLC program, the *MCTRL_nNAdapt_a* variable can be used to change the proportional gain (V_{pn}):
  - V_{pn} = *MCTRL_nNAdapt_a* [%] × C0070
  - Default: *MCTRL_nNAdapt_a* = 100 % ⇨ V_{pn} = 100 % × C0070 = C0070

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 141
			0.00	{ 0.01}	127.99		

- The reset time (T_{nn}) is set via C0071:
  - Reduce C0071 until the drive becomes instable (pay attention to engine noises).
  - Increase C0071 until the drive runs stable again.
  - Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 141
			1.0	{0.5 ms}	6000.0		

- The derivative gain (T_{dn}) is set via C0072:
  - Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 141
			0.0	{0.1 ms}	32.0		

Signal limitation

- If the drive operates with the maximum torque, the speed controller operates within the limitation.
- The drive cannot follow the speed setpoint.
- *MCTRL_bMMax_b* is set to TRUE.

Setting the I component

For selecting torque starting values the integral component of the speed controller can be set externally (e.g. when using the brake control).

- *MCTRL_bILoad_b* = TRUE
  - The speed controller accepts the value applied at *MCTRL_nISet_a* into its integral component.
  - The value at *MCTRL_nISet_a* acts as a torque setpoint for the motor control.
- *MCTRL_bILoad_b* = FALSE
  - The function is switched off.

6.13.2 Adjustment of field controller and field weakening controller

Stop!

- ► Field weakening operation is only possible with asynchronous motors.
- ► The available torque is reduced by the field weakening.

In order to optimise the machine operation in the field weakening range, you can set the field controller and the field weakening controller accordingly.

Field weakening occurs if the maximum output voltage of the controller is reached with rising speed and cannot be increased further.

The maximum possible output voltage depends on

- ► the respective DC-bus voltage (mains voltage).
- ► the voltage reduction through the controller load.
- ► the voltage drop at the mains choke.

Experience values for the voltage drop under the influence of the mains choke and inverter are between 6 ... 10 %.

$$\text{Max. output voltage [V]} = \text{mains voltage [V]} - \text{voltage drop [\%]}$$

The GDC contains the codes for adjusting the field controller/field weakening controller in the parameter menu under **Controller adjustment → Field control/Field weakening**:

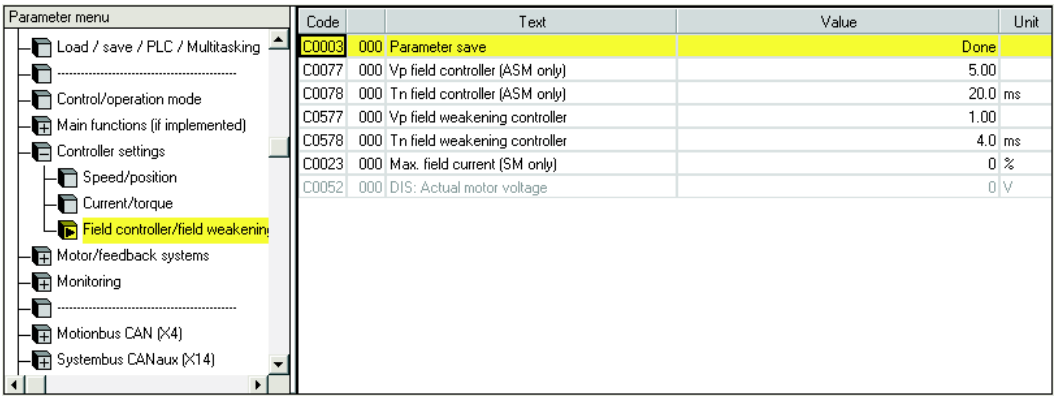


Fig. 6-13 GDC view: Field controller / field weakening controller adjustment

6.13.2.1 Adjusting the field controller

The field controller settings depend on the motor data.

Setting sequence

1. Stop the PLC program: C2108 = 2
   – As of operating system version 7.0 (see nameplate), this is no longer necessary, because C0006 (see 2.) can also be written when the PLC program is running!
2. Set motor control for asynchronous motors: C0006 = 2
   – The motor nameplate data must be entered correctly!
3. Read rotor time constant T_r (C0083).
4. Read magnetising current I_d (C0092).
5. Calculate field controller gain V_{pF} and enter in C0077.

$$V_{pF} = \frac{T_r\,(C0083) \cdot I_d\,(C0092)}{875\ \mu s \cdot I_{max}}$$

I_{max} Maximum current of axis module

6. Enter rotor time constant T_r as field controller integral-action time T_{nF} in C0078.

6.13.2.2 Field weakening controller adjustment

- The field weakening controller determines the speed performance of the asynchronous motor in the field weakening range.
- The field weakening controller can only be set correctly when the system constellation has been completed and is under load.

Note!

An excessive value of I_{max} (C0022) can cause a malfunction of the drive in the field weakening range of the asynchronous motor. For this reason, the current is limited in terms of speed in the field weakening range. The limitation has a 1/n characteristic and is derived from the motor parameters.

The limitation can be adjusted with the stator leakage inductance (C0085):

- Low values cause a limitation at higher speeds.
- Higher values cause a limitation at lower speeds.

Setting sequence

1. Set gain V_p: C0577 = 0.01 ... 0.99
   – V_p must not be ”0” (deactivates the field weakening controller)!
2. Set integral-action time T_n: C0578 = 1 ... 40 ms
3. Select a speed setpoint so that the motor is operated in the field weakening range.
4. Observe the speed curve
   – If the speed takes an irregular course, the field weakening controller must be readjusted.
   – The field weakening controller must be provided with a distinct integral action.

Tip!

Parameter setting with a distinct I component can improve the drive behaviour when changing to the field weakening range.

For this purpose, set the gain (V_p) in C0577 to at least 0.01.

The following applies:

- P component = V_p = C0577
- I component = V_I = C0577/C0578

If the P component (V_p) is reduced via C0577, adapt the reset time C0578 accordingly to keep the I component (V_I).

6.13.3 Resolver adjustment

When adjusting the resolver, mainly component tolerances of the resolver evaluation are compensated in the device. No resolver error characteristic is accepted. The resolver adjustment is only required if the speed behaviour is irregular despite optimised settings of the speed and position control loop.

The resolver adjustment is started via code C0417 = 1. Then the resolver is adjusted automatically during the next 16 motor revolutions.

If it is not possible to adjust the resolver (due to a fault or a defective cable), the original adjustment values can be restored with C0417 = 2.

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/Feedb. → Feedback**:

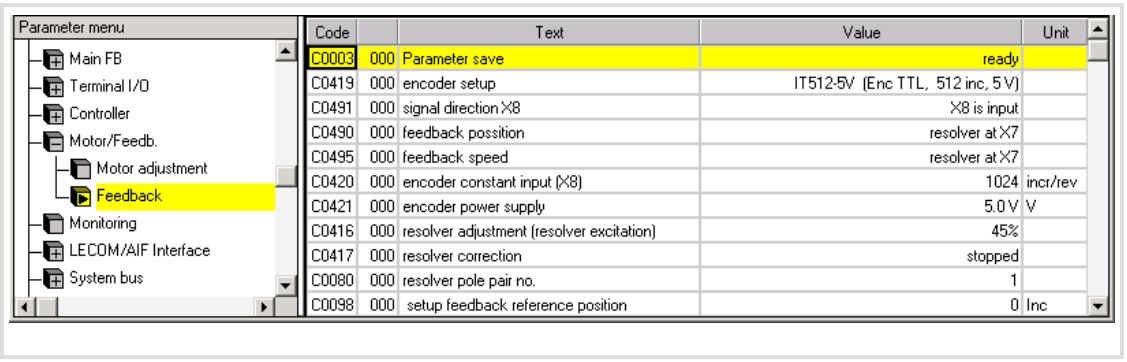


Fig. 6-14 GDC view: Commissioning of the feedback system

7 Parameter setting

7.1 General information

- Controllers and power supply modules can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter "Commissioning" (📖 102).
- The parameters for the functions are stored in numbered codes:
  - The codes are marked in the text with a "C".
  - The code table in the appendix (📖 384) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a "reference book".

Parameter setting with XT keypad or PC/laptop

Detailed information on parameter setting with the XT keypad can be found in the following chapters.

Detailed information ...

on the parameterisation by means of a PC/laptop can be found in the documentation for the "Global Drive Control" (GDC) parameterisation and operating program.

In addition to parameter setting, the XT keypad or PC/laptop serves to:

- Control the controller (e. g. inhibiting or enabling)
- Select the setpoints
- Display operating data
- Transfer parameter sets to other controllers (only with PC/laptop).

Parameter setting with a bus system

Detailed information ...

on the parameterisation with a bus system can be found in the documentation of the communication module to be applied (📖 461).

7.2 Parameter setting with ”Global Drive Control” (GDC)

With the ”Global Drive Control” (GDC) parameterisation and operating program, Lenze provides a plain, concise and compatible tool for the configuration of your application-specific drive task with the PC or laptop:

- The GDC input assistant offers a comfortable motor selection.
- The menu structure supports the commissioning process by its clear structuring.

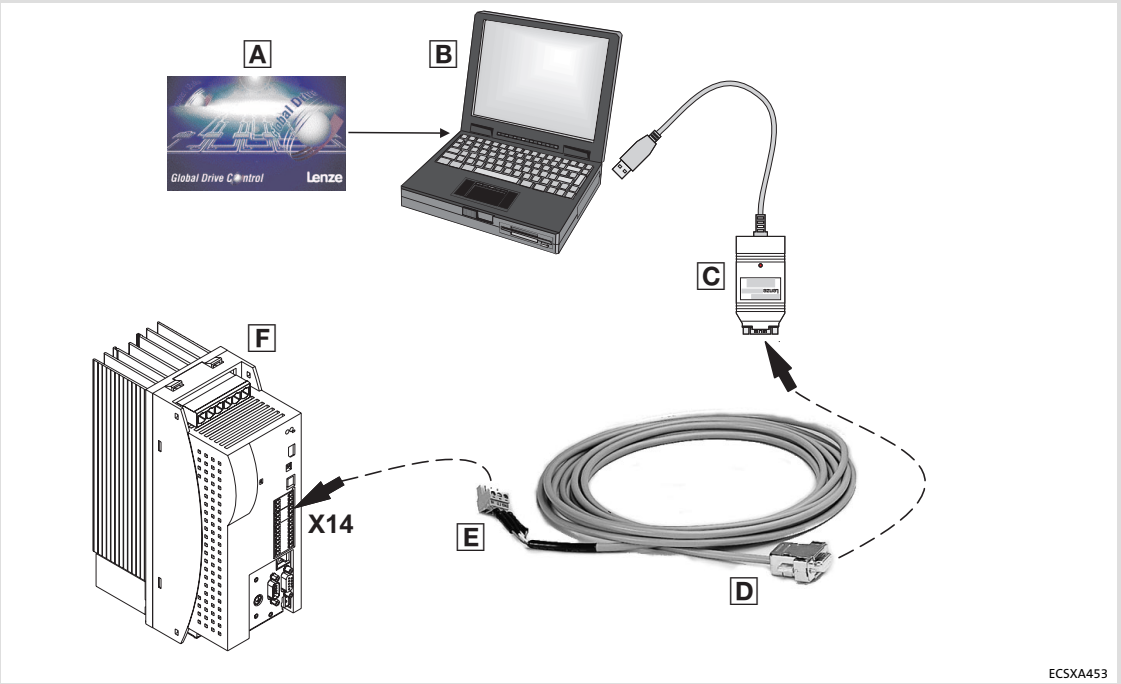


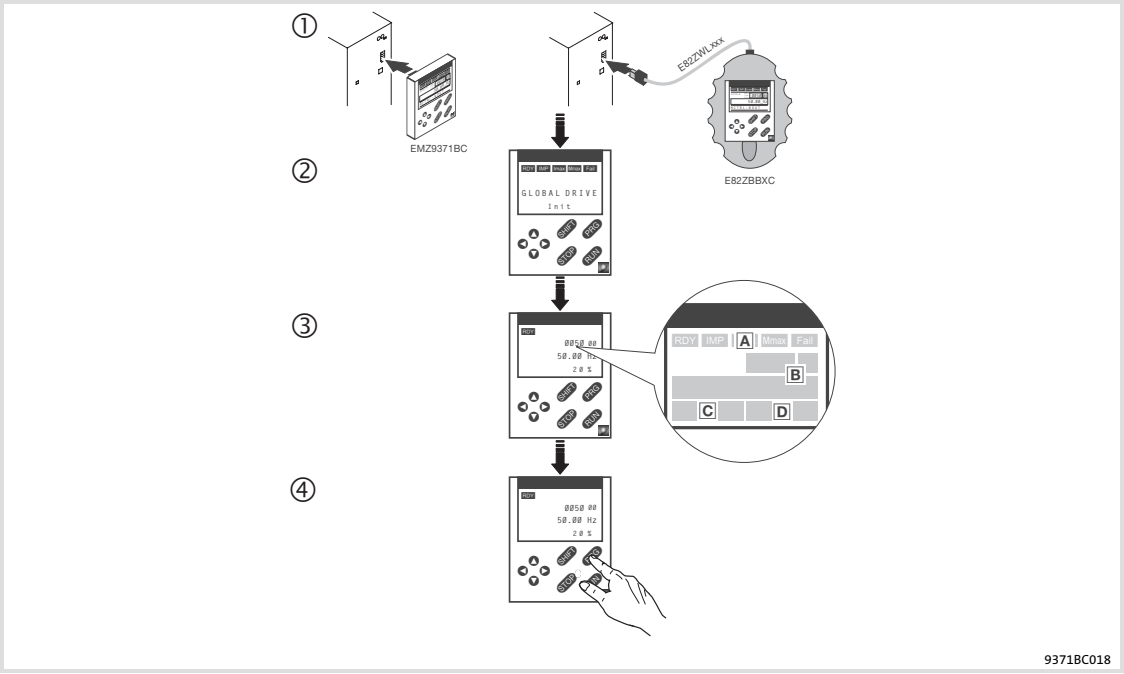
Fig. 7-1 Using the GDC

- A Lenze parameter program ”Global Drive Control” (GDC)
- B PC or laptop
- C PC system bus adapter (EMF2173IB/EMF2177IB) with connecting cable
- D Sub-D plug with 3-pole cable
- E 3-pole plug (CAG – CAL – CAH) from ECSZA000X0B connector set
- F ECSxS/P/M/A axis module

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as accessories.
A complete description is given in the documentation on the keypad.

7.3.1 Connecting the keypad



① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad 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 status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined under C0004
④ PRG must be pressed to leave the operation level.

7.3.2 Description of the display elements

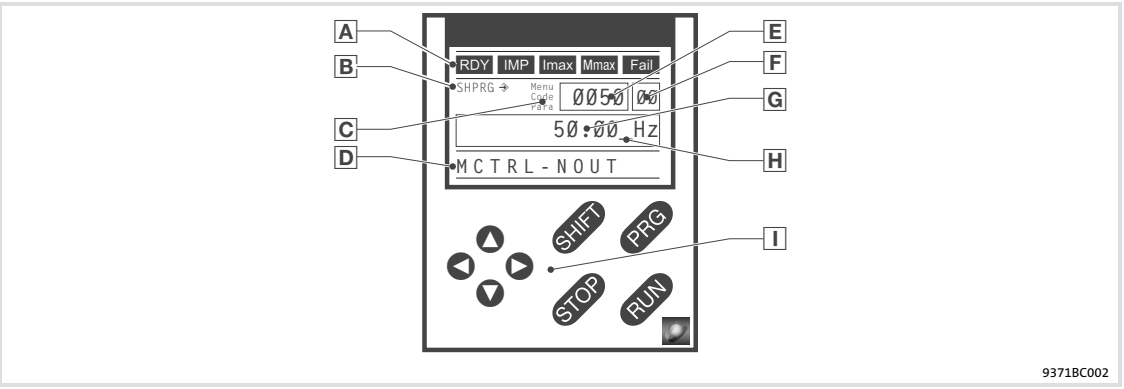


Fig. 7-2 Keypad front view

A	**Status displays**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit active	Power outputs inhibited
	Imax	Adjusted current limitation is exceeded in motor mode or generator mode	
	Mmax	Speed controller 1 within its limitation	• Drive is torque-controlled • Only active for operation with Lenze devices of the 9300 series!
	Fail	Active fault	
B	**Parameter acceptance**		
	Display	**Meaning**	**Explanation**
	↵	Parameter is accepted immediately	The device immediately operates with the new parameter value.
	SHPRG ↵	The parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after being confirmed.
	SHPRG	When the controller is inhibited, the parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after the controller has been released again.
	None	Display parameters	Cannot be changed.
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Active menu level	• Selection of main menu and submenus • No menu for ECSxE power supply module
	Code	Active code level	Selection of codes and subcodes
	Para	Active parameter level	Change of parameters in the codes or subcodes
	None	Active operating level	Display of operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	Alphanumerical	Contents of the menus, meaning of the codes and parameters	
		Display of C0004 in % and the active fault in the operating level	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Two-digit subcode number	
G	**Parameter value**		
	Parameter value with unit		
H	**Cursor**		
	The figure over the cursor can be changed directly in the parameter level.		
I	**Function keys**		
	For description see the following table.		

7.3.3 Description of the function keys

Note!

Key combinations with SHIFT:

Press SHIFT and keep it pressed, then press second key in addition.

Key	Function			
	Menu level [1]	Code level	Parameter level	Operating level
PRG		Change to parameter level	Change to operating level	Change to code level
SHIFT PRG	Load predefined configurations in the menu "Short setup" [2]		Accept parameters when SHPRG ↵ or SHPRG is displayed	
▲ ▼	Change between menu items	Change code number	Change figure over cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of figure over cursor	
▶ ◀	Change between main menu, submenus and code level		Cursor to the right Cursor to the left	
RUN	Cancel function of STOP key, the LED in the key goes out.			
STOP	Inhibit the controller, LED in the key lights up.			
	Reset fault (TRIP reset): 1. Remove cause of malfunction 2. Press STOP 3. Press RUN			

1) No menu for ECSxE power supply module

2) Only active when operating Lenze devices of the 8200 vector or 8200 motec series.

7.3.4 Changing and saving parameters

All parameters for the axis module/power supply module parameterisation or monitoring are stored in codes. The codes are numbered and marked with a ”C” in the documentation. Some codes store the parameters in numbered ”subcodes” to provide a clear structure for parameter setting (e.g. C0517 user menu).

Stop!

Your settings have an effect on the current parameters in the main memory. You must store your settings as a parameter set to prevent that they will get lost when switching the mains!

Step			Keys	Action
1.	Select menu		▲ ▼ ▶ ◀	Select the desired menu with arrow keys.
2.	Change to code level		▶	Display of first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to parameter level		PRG	
5.	If SHPRG is displayed, inhibit controller		STOP	The drive is coasting.
6.	Change parameter			
		A	▶ ◀	Move cursor under the digit to be changed
		B	▼ ▲	Change digit
			SHIFT ▼ SHIFT ▲	Change digit quickly
7.	Accept changed parameter			
	Display SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept parameter Display ”OK”
	Display →		-	The parameter was accepted immediately.
8.	If necessary, enable controller		RUN	The drive should be running again.
9.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display of the code with changed parameters
10.	Change further parameters			Restart the ”loop” at step 1. or step 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select Code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to parameter level Display ”0” and ”Ready”
	Select parameter set in which the parameters are to be saved permanently	C	▶	Save as parameter set 1: ⇨ set ”1” ”Save PS1”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved.
12.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display C0003 ”PAR SAVE”

8 System bus (CAN / CAN-AUX) configuration

The codes for the system bus (CAN / CAN-AUX) configuration can be found in the GDC parameter menu under **System bus**. They are divided into separate code ranges:

Interface		Code range
X4	System bus (CAN)	C03xx
X14	System bus (CAN-AUX)	C24xx



Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 440).

8.1 Setting the CAN node address and baud rate

For the CAN interfaces **X4** (CAN) and **X14**(CAN-AUX), the CAN node address and the transfer rate can be set via the DIP switch **S1** or via codes.

- The (address) switch **1** serves to define whether the set CAN node address shall only apply to the interface **X4**(CAN) or for both interfaces **X4** (CAN) and **X14** (CAN-AUX).
- If one of the (address) switches **2 ... 7** of the DIP switch is switched on (ON), and the low-voltage supply is connected, the setting of the DIP switch is evaluated and written into C0350/C2450 (CAN node address) and C0351/C2451 (baud rate).
- If the (address) switches **2 ... 7** are switched off (OFF), the switch position is not evaluated. The settings from C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are accepted.
- The settings for the baud rate with the switches **8 ... 10**are only written into C0351 (CAN) when the low-voltage supply is switched on. The baud rate for CAN-AUX can only be set via C2451.

8.1.1 Settings via DIP switch

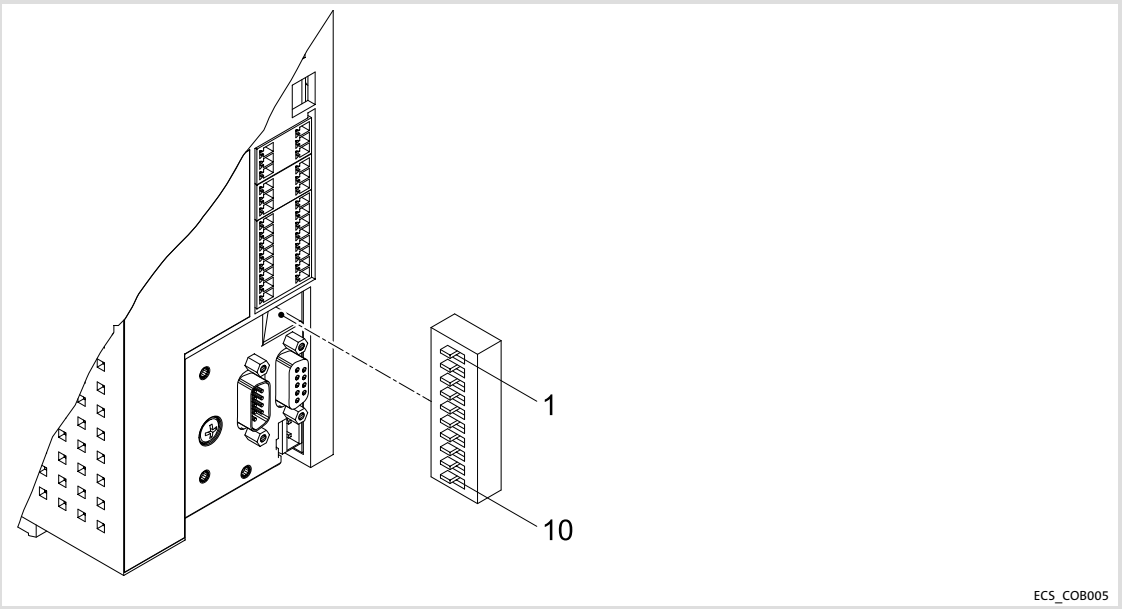
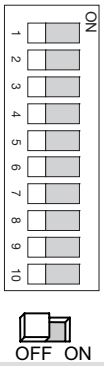


Fig. 8-1 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

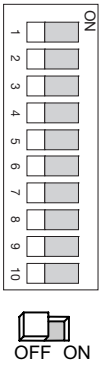
The node address is set by means of switches 2 ... 7 of the DIP switch. Specific values are assigned to the switches. The sum of the values specifies the node address to be set (see example).

Switch		Value	Example	
			Switching status	Node address
	S1	**OFF:** Node address setting is only valid for CAN (C0350 is overwritten if one of switches S2 ... S7 is in ON position.) **ON:** Node address setting is valid for CAN and CANaux (C0350 and C2450 are overwritten if one of switches S2 ... S7 is in ON position.)		-
	S2	32	**ON**	32 + 16 + 8 = **56**
	S3	16	**ON**	
	S4	8	**ON**	
	S5	4	OFF	
	S6	2	OFF	
	S7	1	OFF	

Baud rate setting

Note!

The baud rate must be set identically for all CAN nodes.

Switch		Baud rate [kbit/s]				
		1000	500	250	125	50
	8	**ON**	OFF	OFF	OFF	OFF
	9	OFF	OFF	OFF	**ON**	**ON**
	10	OFF	OFF	**ON**	OFF	**ON**

8.1.2 Settings via codes

Note!

- The settings in C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are only used if the (address) switches **2 ... 7** of the DIP switch **S1** are switched off (OFF).
- If only one (address) switch **2 ... 7** is switched on (ON), the settings of the DIP switch **S1** usually apply.
- The baud rate (C0351/C2451) must be set identically for all CAN bus nodes.
- If the Lenze setting has been loaded via C0002,
  – C0351/C2451 is set = 0 (500 kbits;
  – you have to reset the baud rate (C0351/C2451) and the CAN node address (C0350/C2450).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0350	CAN address	32				Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 156) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 156 📖 458
			1	{1}	63		
C0351	CAN baud rate	0				Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 156
			0	500 kbps			
			1	250 kbits/sec			
			2	125 kbit/s			
			3	50 kbps			
			4	1000 kbit/s			
C2450	CANa address	1				Node address for CAN bus interface X14 (CAN-AUX)	📖 156 📖 458
			1	{1}	63	This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to "ON".	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2451	CANa baud rate	0		Baud rate for CAN bus interface X14 (CAN-AUX)	📖 156
			0 500 kBit/s		
			1 250 kBit/s		
			2 125 kBit/s		
			3 50 kBit/s		
			4 1000 kBit/s		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.2 Individual addressing

In C0353/C2453 you can determine whether the identifier (COB-ID) consists of the basic identifier (📖 458) and the node address in C0350/C2453 or individually with an ”ID offset”.

The ”ID offset” can be specified via C0354. Thus, the identifier for all process data input and output objects is as follows:

Identifier (COB-ID) = 384 + ID offset (C0354)

Note!

The identifier of the telegram to be sent must correspond to the identifier of the process data input object to be addressed.

To make the alternative node address valid, set the corresponding subcode of C0353/C2453 = 1.

CAN interface	Code	Value	The addresses are defined by
X4 (CAN)	C0353/1	0	C0350 (Lenze setting)
		1	C0354/1 for CAN1_IN C0354/2 for CAN1_OUT
	C0353/2	0	C0350 (Lenze setting)
		1	C0354/3 for CAN2_IN C0354/4 for CAN2_OUT
	C0353/3	0	C0350 (Lenze setting)
		1	C0354/5 for CAN3_IN C0354/6 for CAN3_OUT
X14 (CAN-AUX)	C2453/1	0	C2450 (Lenze setting)
		1	C2454/1 for CANaux1_IN C2454/2 for CANaux1_OUT
	C2453/2	0	C2450 (Lenze setting)
		1	C2454/3 for CANaux2_IN C2454/4 for CANaux2_OUT
	C2453/3	0	C2450 (Lenze setting)
		1	C2454/5 for CANaux3_IN C2454/6 for CANaux3_OUT

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0353				Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 160
1	CAN addr sel	0	CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0	CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0	CAN node address (C0350)	Address CAN3_IN/OUT	
			0 C0350 (auto)	Automatically determined by C0350.	
			1 C0354 (man.)	Determined by C0354.	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0354				Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 160
1	CAN addr.	129	1 {1} 512	Address 2 CAN1_IN	
2	CAN addr.	1		Address 2 CAN1_OUT	
3	CAN addr.	257		Address 2 CAN2_IN	
4	CAN addr.	258		Address 2 CAN2_OUT	
5	CAN addr.	385		Address 2 CAN3_IN	
6	CAN addr.	386		Address 2 CAN3_OUT	
C2453				Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 160
1	CANa addr sel	0	CAN node address (C2450)	Address CANaux1_IN/OUT	
2	CANa addr sel	0	CAN node address (C2450)	Address CANaux2_IN/OUT	
3	CANa addr sel	0	CAN node address (C2450)	Address CANaux3_IN/OUT	
			0 C2450 (auto)	Automatically determined by C2450	
			1 C2454 (man.)	Determined by C2454	
C2454				Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 160
1	CANa addr.	129	1 {1} 512	CANaux1_INaddress 2	
2	CANa addr.	1		CANaux1_OUTaddress 2	
3	CANa addr.	257		CANaux2_INaddress 2	
4	CANa addr.	258		CANaux2_OUTaddress 2	
5	CANa addr.	385		CANaux3_IN address 2	
6	CANa addr.	386		CANaux3_OUT address 2	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.3 Determining the boot-up master for the drive system

If the bus initialisation and the related state change from ”Pre-Operational” to ”Operational” is not carried out by a higher-level host system (PLC), another node can be determined as boot-up master to carry out this task.

The master functionality only is required for the initialisation phase of the drive system. A boot-up time for the master in the initialisation phase can be set via C0356/C2456 (📖 163).

By means of the NMT telegram *start_remote_node* (broadcast telegram) **all** nodes are shifted to the NMT-state ”Operational” by the master. A data exchange via the process data objects can only be effected in this state.

Use C0352/C2452 for configuration.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0352	CAN mst	0		Boot-up master/slave configuration for CAN bus interface X4	📖 162
			0 Slave		
			1 Master boot-up	Device is active as CAN boot-up master.	
			2 Master node guarding		
			3 Slave heartbeat producer		
			4 Slave node guarding		
C2452	CANa mst	0		Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 162
			0 Slave		
			1 Master		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.4 Setting the boot-up time/cycle time

Boot-up time (C0356/1, C2456/1) setting

In a CAN network without higher-level control (PLC), a bus node (boot-up master) has to initialise the CAN network. If the 24 V low-voltage supply is switched on, the boot-up time elapses. After the boot-up time has elapsed, the NMT telegram for initialising the CAN network is sent by the boot-up master and the process data transfer is started.

- Only valid if C0352/C2452 = 1 (master).
- Normally the Lenze setting (3000 ms) is sufficient.
- State change from ”Pre-operational” to ”Operational”

Cycle time for process output data (C0356/2...3, C2456/2...3)

Transmission cycle time for the process data objects CAN2...3_OUT (C0356/2...3) or CANaux2...3_OUT (C2456/2...3) in cyclic operation (without sync)

- Setting ”0” = event-controlled data transmission
  The output data will only be sent if a value in the output object changes.

Activation delay for process output data (C0356/4, C2456/4)

Delay time for initial transmission of the process data objects CAN2...3_OUT (C0356/4) or CANaux2...3_OUT (C2456/4) after the CAN bus changes from NMT ”Pre-Operational” NMT state to ”Operational””.

After the delay time has elapsed, the process data objects CAN2...3_OUT or CANaux2...3_OUT will be sent for the first time.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 163
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 163
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.5 Reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 156)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 458)
  – Individual addressing (📖 160)
- Change of the master/slave boot-up configuration (📖 162)

A reset node can be made by:

- Renewed switch-on of the 24 V low-voltage supply
- the bus system (via the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- C0358/C2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0358	Reset node	0			Make a reset node for the CAN bus node.	📖 279
			0	No function		
			1	CAN reset		
C2458	Reset node	0			Resetting a node (CAN bus interface X14)	📖 279
			0	No function		
			1	CAN-AUX reset		

8.6 Axis synchronisation (CAN synchronisation)

By means of the axis synchronisation, the internal time base can be synchronised with the instant of reception of the sync signal. By this, the start of cyclic internal processes of all drives involved in the synchronisation is synchronous.

Sync signal source

The sync signal source is set via C1120:

Note!

If synchronisation takes place via **X6/DI1** terminal, the control configuration of the "Drive PLC Developer Studio" (DDS) must not only comprise the SB **CAN_Synchronization** (📖 281) but also the SB **DIGITAL_IO**. (📖 343)

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C1120	Sync mode	0		Sync signal source	📖 166
			0 Off	Off	
			1 CAN sync	Sync connection via interface X4 (CAN)	📖 170
			2 Terminal sync	Sync connection via terminal X6/DI1	📖 171

Synchronisation cycle

For the purpose of synchronisation the master sends a cyclic CAN sync telegram.

The controllers receive the CAN sync telegram and control the starting time of their own program cycle in relation to the instant of reception of the CAN sync signal. The start is to be offset by the synchronisation phase (C1122).

The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the CAN sync telegrams.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C1121	Sync cycle	2		Synchronisation cycle	📖 166
			1 {1 ms} 13		

Phase shift

The synchronisation phase (C1122) defines the period of time of the offset by which the start of the controller-internal cycle lags behind the sync signal received.

Note!

Always set the synchronisation phase higher than the maximum possible ”jitter” of the received CAN sync telegrams!

phase shifting and thus periodic changes of signal frequencies are called ”Jitter”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1122	Sync phase	0.460				Synchronisation phase	📖 167
			0.000	{0.001 ms}	6.500		

Start of axis synchronisation

After mains connection and the initialisation phase, the synchronisation is started. After the first sync telegrams have been received, it takes a few seconds until the system is compensated. The duration of this process is basically determined by the interval of the sync signals and the sync correction increment.

The CAN sync correction increment (C0363) indicates the increment used to extend or shorten the control cycle (e.g. to shift the start time).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1				CAN sync correction increment	📖 167
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 167
			0	{1 ms}	65000	0 = switched off	
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 166 📖 163
			0	{1 ms}	65000	0 = switched off	

CAN sync identifiers

The transmit and receive identifiers of the sync telegram can be configured via the following codes:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 168
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 442 📖 166
			1	{1}	256		
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 168
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 442 📖 169
			1	{1}	256		

8.6.1 Monitoring of the synchronisation (sync time slot)

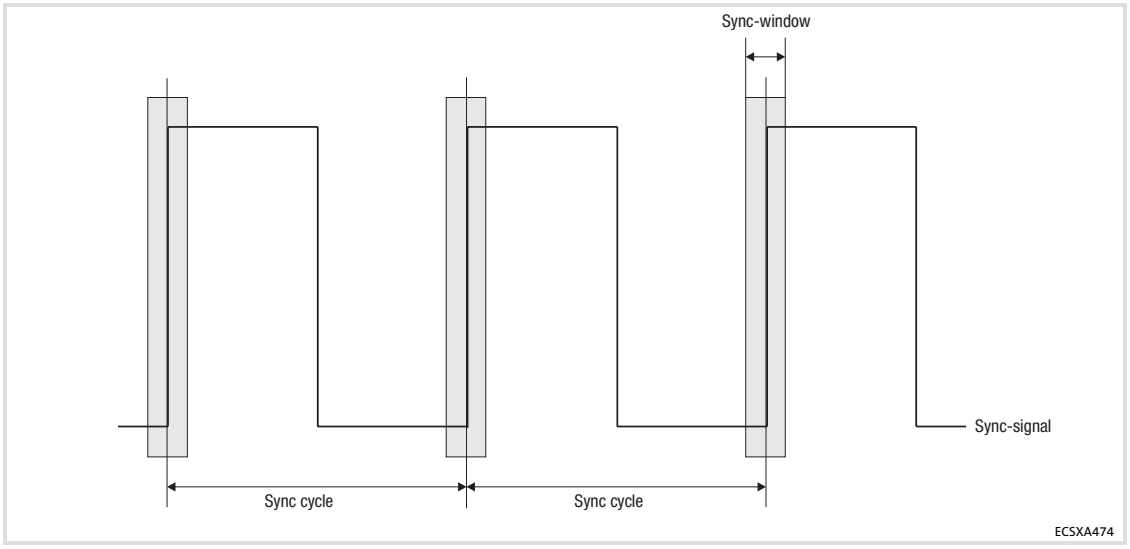


Fig. 8-2 "Time slot" for the LOW-HIGH edges of the sync signal

Note!

A jitter (📖 167) up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The amount of the jitter has an impact on the parameterisation of the "time slot".

The variable *CAN_bSyncInsideWindow_b* can be used to monitor the synchronisation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1123	Sync window	0.010				Synchronisation window	📖 169
			0.000	{0.001 ms}	6.500		

CAN sync response

The response to the reception of a sync telegram can be configured under C0366/C02466:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0366	Sync Response	1			CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 169
			0	No response		
			1	Response		
C2466	Sync Response	1			CAN sync response for interface X14 (CAN-AUX) **The value "1" should always be set!**	
			0	No response		
			1	Response		

8.6.2 Axis synchronisation via CAN

The CAN interface X4 serves to transfer the CAN sync telegram as synchronisation signal and the process data.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 131
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	C1120 = 1	Active synchronisation by sync telegram via CAN bus.
	5.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	6.	Define the telegram (identifier) sequence: A . Send new setpoint to all slaves. B Send sync telegram. C Receive response of all slaves.	
	7.	Start communication/send sync telegrams.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync telegram from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (🕮 167), increase ”time slot”.
Slaves	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.6.3 Axis synchronisation via terminal X6/DI1

The transmission paths for the sync signal and the process data are separated.

- ► The process data are transmitted via the CAN interface X4.
- ► The sync signal is injected via the digital input X6/DI1.

Note!

If synchronisation takes place via **X6/DI1** terminal, the control configuration of the ”Drive PLC Developer Studio” (DDS) must not only comprise the SB **CAN_Synchronization** (📖 281) but also the SB **DIGITAL_IO**. (📖 343)

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	📖 131
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	Connect the sync signal of the master to terminal X6/DI1.	
Slaves	5.	C1120 = 2	Synchronisation through sync signal via terminal X6/DI1 (DigIn_bIn1_b) is active.
Slaves	6.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	7.	Start communication/send sync signals.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync signal from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync signal to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (📖 167), increase ”time slot”.
	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.7 Node guarding

In case of cyclic node monitoring (Node Guarding), the CAN master regularly enquired the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is activated (fault message ”Err NodeGuard”).

Settings

In order that the device takes over the function of the ”Node Guarding Slave”, make the following settings:

1. Set C0352 = 2.
   (The device is configured as ”Node Guarding Slave”.)
2. Set the monitoring time (Node Guard Time) for the reception of the status enquiry by the master in C0383.
3. Set the factor (Node Life Time Factor) for the monitoring time in C0383.

   Node Life Time = Node Guard Time (C0382) · Node Life Time Factor (C0383)
4. Set the response to a ”Life Guarding Event” via C0384.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 162
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0382	GuardTime	0			Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 172
			0	{1 ms} 65535		
C0383	LifeTimeFact	0			Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 172
			0	{1} 255		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0384	Err NodeGuard	3		Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	📖 172
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

8.8 CAN management

The system block **CAN_Management/CANaux_Management**

- serves to activate a **reset node** to e.g. accept changes in the transfer rate and addressing.
- serves to process statuses as **Communication Error**, **Bus Off State**, etc. in the PLC program.
- serves to influence the transmission time of CAN2_OUT/CANaux2_OUT and CAN3_OUT/CANaux3_OUT.
- serves to monitor the CAN communication.



Tip!

Detailed information on the SB **CAN_Management** can be found in chapter 13.6 (📖 277).

Detailed information on the SB **CANaux_Management** can be found in chapter 13.11 (📖 299).

8.9 Mapping indices to codes

The operating system from V6.0 of the ECSxA axis module contains a special CanDSx driver which can be activated by means of the functions of the function library **LenzeCanDSxDrv.lib**.

By means of this driver, indices of the ECSxA... axis modules and other Lenze PLCs can be assigned to another code than the one that is assigned automatically.

Note!

- Each Lenze code is firmly assigned to an index via the following formula:
  - Index = $5FFF_{hex}$ - code
  - Index = 24575_{dec} - code
- The function of the CanDSx driver is restricted to the system bus (CAN).

Functional principle using the following example

Problem

Users have equipped the ECSxA... axis module with a function which can be parameterised via the user code C3200/5. The code C3200 is automatically assigned to the index 21375_{dec}.

$$Index = 24575_{dec} - code = 24575_{dec} - 3200 = 21375_{dec}$$

Due to the communication profile used, however, this function should be parameterised via the index 4101_{dec}/subindex 2.

Solution

By means of the functions of the function library **LenzeCanDSxDrv.lib** the index 4101_{dec}/subindex 2 in the ECSxA... axis module is simply redirected to code C3200/5 so that the communication profile can be used as usual.

Functional principle

The operating system (from V6.0) of the ECSxA... axis module contains a ”mapping table”. According to this table up to 256 indices within the ECSxA... can be ”mapped” to other codes than the ones that are automatically assigned.

If a CAN telegram arrives and the index is within the valid range, it is checked if this index is listed in the mapping table.

- If the index is listed in the mapping table, the codes which are reassigned to this index in the mapping table are accessed. ①
- If the index is **not** listed in the mapping table, the automatically assigned code which results from the formula mentioned above is accessed. ②

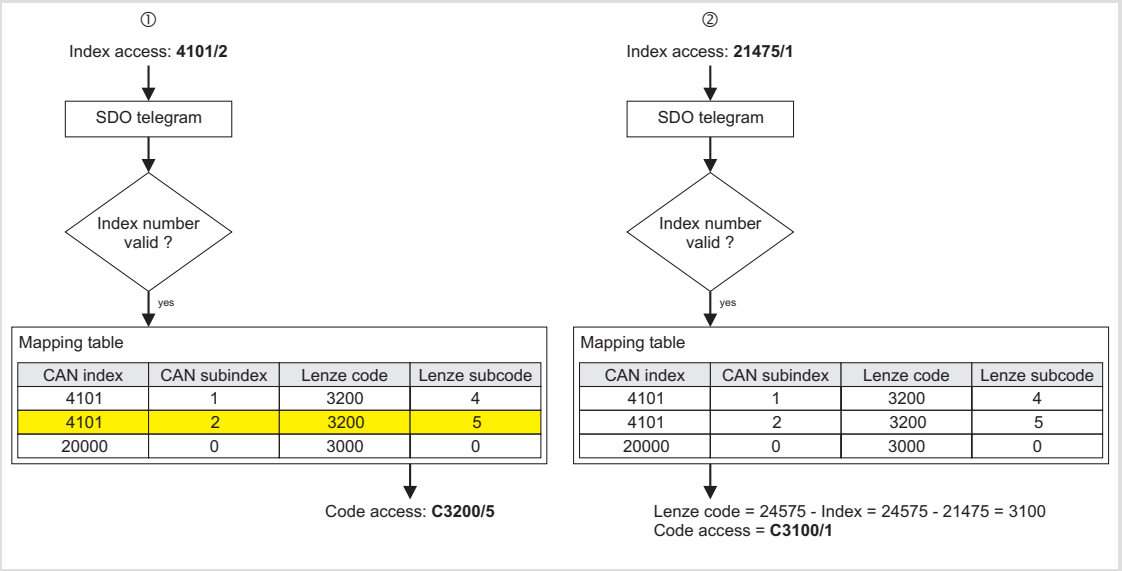


Fig. 8-3 Redirection process of indices to codes

8.10 Diagnostics codes

The following diagnostic codes serves to follow the process of the CAN communication via the interfaces X4 (CAN, C03xx) and X14 (CAN-AUX, C24xx):

- C0359/C2459: Bus state
- C0360/C2460: Telegram counter
- C0361/C2461: Bus load

8.10.1 CAN bus status (C0359/C2459)

C0359/C2459 shows the current CAN operating state.

Value of C0359/C2459	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-operational	Only parameters (codes) can be transferred via the bus system. Data exchange between controllers is not possible. A change into the state ”operational” can be made via a special signal on the CAN bus. A status change from ”Pre-operational” to ”Operational” is possible through: ● Master function of a higher-level host system ● If a master has been selected under C0352/C2452, the operating status will be changed automatically for the entire drive system after the set boot-up time (C0356/C2456) when power is switched on. ● Reset node via C0358/C2458 (📖 279) ● With a binary input signal ”Reset node”, which can be set accordingly. ● Reset node via the connected hostsystem
2	Warning	Faulty telegrams have been received. The controller is passive (does not send any data). Possible causes: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Bus load is too high ● Controller is not connected to the CAN bus
3	Bus off	Too many faulty telegrams. The controller is disconnected from the CAN bus. It can be reconnected by: ● TRIP-RESET ● Reset node (📖 279) ● Mains reconnection

8.10.2 CAN telegram counter (C0360/2460)

C0360/2460 counts for all parameter data channel the telegrams which are valid for the controller. The counters have a width of 16 bits. If the value ”65535” is exceeded, counting restarts with ”0”.

Counted messages:

C0360/C2460	Meaning
Subcode 1	All sent telegrams
Subcode 2	All received telegrams
Subcode 3	Telegrams sent of CAN1_OUT/CANaux1_OUT
Subcode 4	Telegrams sent of CAN2_OUT/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent of CAN3_OUT/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent of parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received of CAN1_IN/CANaux1_IN
Subcode 9	Telegrams received of CAN2_IN/CANaux2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received of CAN3_IN/CANaux3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received of parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

8.10.3 CAN bus load (C0361/2461)

Use C0361/C2461 to determine the bus load through the controller or the individual data channels in percent. Faulty telegrams are not considered.

Bus load of the individual subcodes:

C0361/C2461	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Telegrams sent of CAN1_OUT/CANaux1_OUT
Subcode 4	Telegrams sent of CAN2_OUT/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent of CAN3_OUT/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received of CAN1_IN/CANaux1_OUT
Subcode 9	Telegrams received of CAN2_IN/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 10	Telegrams received of CAN3_IN/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

The data transfer is limited. The limits are determined by the number of telegrams transmitted per time unit and the baud rate.

The limits can be determined during data exchange in a drive network by adding all drives involved under C0361/1 or C2461/1.

Example:

Drives/host system (PLC)	Bus load
C0361/1 - controller 1	23.5 %
C0361/1 - controller 2	12.6 %
Host system (PLC)	16,0 %
	52.1 % (total)

Two drives and the host system (PLC) are interconnected via the CAN bus.

Note!

- ► Max. bus load of all devices involved: 80 %
- ► If other devices are connected, as for instance decentralised inputs and outputs, their telegrams must be taken into consideration.
- ► If the time between the individual sync telegrams is too short the bus can be overloaded.
  - – **Remedy:** Change the synchronisation cycle of the host system (PLC) and the controller (C1121).

8.11 Remote parameterisation (gateway function)

From operating system V6.x onwards, the axis module supports the remote parameterisation of other fieldbus nodes. Then, all write/read accesses to parameters are not executed anymore in the axis module but redirected to the bus node selected for remote maintenance.

- The redirection takes place via the parameter data channel SDO1 of the selected node.
- The node to which the write/read accesses is to be redirected, is determined with the corresponding node address via C0370.
  (C0370 = 0: remote parameterisation deactivated)
- The gateway channel of the axis module is selected via C0371 (interface X4 (CAN) or interface X14 (CAN-AUX)).
- C2118 (CAN) or C2470 (CAN-AUX) serves to select the transmission channel for reading and writing the parameter data.
- A timeout during remote parameterisation activates the system error message ”CE5” (CAN) or ”CE15” (CAN-AUX). The corresponding response can be configured under C0603/C2485 (📖 204).

Note!

The SDO gateway cannot be used to read out codes >C2000 or codes of the Inverter Drives 8400 and Servo Drives 9400.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0370]	SDO gateway	0		Activate address gateway/remote parameterisation **The SDO gateway cannot be used to read out codes >C2000 or codes of the Inverter Drives 8400 and Servo Drives 9400.** ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 180
			0 {1} 63		
C0371	Gateway Ch.	1		Selection of the gateway channel	📖 180
			0 CAN	Use CAN bus interface X4	
			1 CAN-AUX	Use CAN bus interface X14	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0603	MONIT CE5	3			Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	202 180
			0	TRIP		
			2	Warning		
			3	Off		
C2118	ParWriteChan.	0			CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	180
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)		
			1	Parameter data channel 2		
C2470	ParWrite	0			CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	180
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)		
			1	Parameter data channel 2		
C2485	MONIT CE15	3			Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	202 180
			0	TRIP		
			2	Warning		
			3	Off		

9 Configuring the AIF interface (X1)

The ”EMF2178IB CANopen” fieldbus module serves to use the AIF interface X1 of the ECSxA... axis module as additional system bus interface.

Note!

- If the ”EMF2178IB CANopen” fieldbus module plugged on the AIF interface X1 and the integrated CAN interface (X4, X14) are connected to the **same** CAN network, you have to set **different** CAN addresses and **different** identifiers for the interfaces.
- Changes of the CAN baud rate, the node address and the identifiers for PDOs are only accepted after a **reset node** (📖 191).

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 440).

9.1 CAN baud rate

In order that communication can be established via the system bus, all nodes must use the same baud rate for the data transmission.

The baud rate is configured via code C2351:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/appl.	Selection		
C2351	XCAN baud rate	0		Baud rate XCAN (AIF interface X1)	📖 182
			0 500 kbps		
			1 250 kbit/sec		
			2 125 kbits/s		
			3 50 kbps		
			4 1000 kbit/s		

9.2 CAN boot up (AIF)

If the system bus initialisation and the related state change from *Pre-Operational* to *Operational*is not executed by a higher-level host system (PLC), a controller can be intended for a ”quasi” master to execute this task.

The configuration is done via code C2352:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/appl.	Selection			
C2352	XCAN mst	0			Establish XCAN master operation. (AIF interface X1)	📖 183
			0	Slave		
			1	Master		

Delay time for system bus initialisation (boot up)

Some nodes (e.g. HMIs) need a certain starting time after mains power-up until they can be put into the *Operational* state by the master via NMT commands.

In order to ensure that the node with the largest starting time is ready to receive NMT commands, you can set a delay time. After this time has expired, the NMT commands can only be sent after mains power-up.

This delay time is configured via code C2356/1:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2356						Time settings for XCAN (AIF interface X1)	📖 188
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time for initialisation through the master after mains connection.	
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission	
3	XCAN times	0					
4	XCAN times	0					
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to ”Operational”	

9.3 Node address (Node ID)

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

The node address may not be assigned more than once within the network.

The node address for the AIF interface X1 of the ECSxA axis module is configured via code C2350:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/appl.	Selection		
C2350	XCAN address	1		Node address XCAN (AIF interface X1)	📖 184
			1 {1} 63		

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (XCAN2_IO/XCAN3_IO) are factory-set so that the devices are able to communicate with each other:

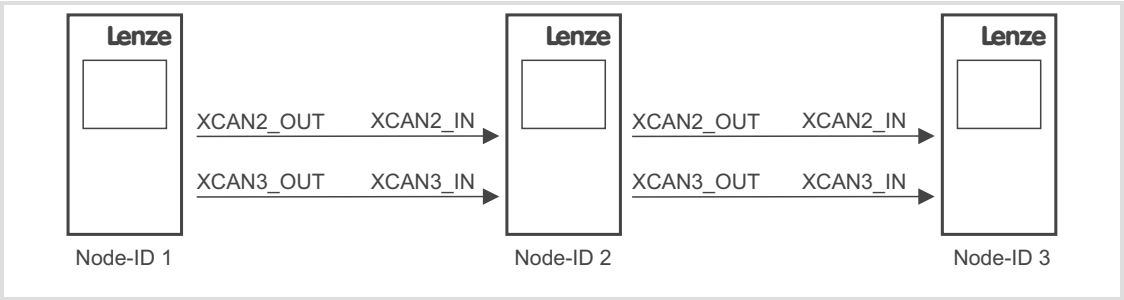


Fig. 9-1 Data exchange between Lenze devices

9.4 Identifiers of the process data objects

The identifiers for the process data objects XCAN1_IO ... XCAN3_IO consist of the basic identifiers and the node address set in C2350:

Identifier = basic identifier + node address

Object			Basic identifier	
			dec	hex
PDO1 (Process data channel 1)	XCAN1_IO (cyclic process data)			
		XCAN1_IN	512	200
		XCAN1_OUT	384	180
PDO2 (Process data channel 2)	XCAN2_IO (event/time-controlled process data)			
		XCAN2_IN	640	280
		XCAN2_OUT	641	281
PDO3 (Process data channel 3)	XCAN3_IO (event/time-controlled process data)			
		XCAN3_IN	768	300
		XCAN3_OUT	769	301

9.4.1 Individual identifier assignment

In case of larger system bus networks with many nodes it may be sensible to set individual identifiers for the process data objects XCAN1_IO ... XCAN3_IO via C2353/C2354 which are independent of the node address set in C2350:

1. Set C2353/x to ”1”.
   – (x = Subcode of the corresponding process data object):

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/appl.	Selection			
C2353					Source for system bus node addresses of XCAN_IN/XCAN_OUT (AIF interface X1)	📖 185
1	XCAN addr sel	0		CAN node address (C2350)	XCAN1_IN/OUTaddress	
2	XCAN addr sel	0		CAN node address (C2350)	XCAN2_IN/OUTaddress	
3	XCAN addr sel	0		CAN node address (C2350)	XCAN3_IN/OUTaddress	
			0	C2350 (auto)	Automatically determined by C2350	
			1	C2354 (man.)	Determined by C2354	

2. Set in C2354/x the value which results in the desired identifier when added to ”384”.
   – (x = Subcode of the corresponding process data object):

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT (AIF interface X1)	📖 185
1	XCAN addr.	129	1	{1}	512	XCAN1_INaddress 2	
2	XCAN addr.	1				XCAN1_OUTaddress 2	
3	XCAN addr.	257				XCAN2_INaddress 2	
4	XCAN addr.	258				XCAN2_OUTaddress 2	
5	XCAN addr.	385				XCAN3_INaddress 2	
6	XCAN addr.	386				XCAN3_OUTaddress 2	

- ► Ensure that the identifier of the telegram to be sent must correspond to the identifier of the process data object to be addressed.
- ► In case the addresses are assigned individually, the identifier for the process data objects is made up as follows:

  Identifier = 384 + value of C0354/x

- ► Thus, identifiers can be assigned for the process data objects within the range 385 ... 896.

9.4.2 Display of the identifier set

The identifier which is set for the process data objects can be displayed via C2355.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2355						Identifier for XCAN_IN/XCAN_OUT (AIF interface X1) Read only	📖 187
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN	
2	XCAN Id					Identifier XCAN1_OUT	
3	XCAN Id					Identifier XCAN2_IN	
4	XCAN Id					Identifier XCAN2_OUT	
5	XCAN Id					Identifier XCAN3_IN	
6	XCAN Id					Identifier XCAN3_OUT	

9.5 Cycle time (XCAN1_OUT ... XCAN3_OUT)

The transfer of the output data of XCAN1_OUT ... XCAN3_OUT can be event or time-controlled.

The transmission mode can be configured via code C2356/x:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2356						Time settings for XCAN (AIF interface X1)	📖 188
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time for initialisation through the master after mains connection.	
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission	
3	XCAN times	0					
4	XCAN times	0					
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to "Operational"	

Event-controlled transmission

C2356/x = 0

► The output data is always transferred when one value in the eight bytes of user data has changed (Lenze default setting).

Time-controlled transmission

C2356/x = 1 ... 65000

► The output data is transferred with the cycle time set in C2356/x (referred to the task cycle time).

Example:

► The CAN object is used in a 10 ms task.

► Factor set via C0356/2 = 5

⇨The CAN object is sent in every fifth task cycle, hence every 50 ms (10 ms x 5).

Code for activating the transmission of event-controlled PDOs

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/appl.	Selection		
C2364		0			Event-controlled PDO transmission (AIF interface X1)
			0	Send PDOs when changing to ”Operational” state	
			1	Do not send PDOs	

Code for enabling the second parameter data channel and the PDO channels

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/appl.	Selection		
C2365					Enabling the second parameter data channel and the PDO channels (AIF interface X1)
1		0	0 {1} 3		Enabling the second parameter data channel
2		1			Enabling the first process data channel
3		1			Enabling the second process data channel
4		1			Enabling the third process data channel
			0	Deactivated	
			1	Activated	
			2	Reception activated	
			3	Transmission activated	

9.6 Synchronisation

9.6.1 XCAN sync response

The response to the receipt of a sync telegram can be configured via C2375:

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/appl.	Selection		
C2375					TX mode for XCANx_OUT (AIF interface X1)
1	XCAN Tx mode	0		Response to sync	XCAN1_OUT
2	XCAN Tx mode	0		Response to sync	XCAN2_OUT
3	XCAN Tx mode	0		Response to sync	XCAN3_OUT
			0	Response to sync	
			1	No response to sync	
			2	Event	
			3	Event, cycle C2356 superimposed	

9.6.2 XCAN sync identifier

The transmit and receive identifiers of the sync telegram can be configured via C2367/C2368:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/appl.	Selection			
C2367	Sync Rx Id	128				XCAN receive identifier of the sync telegram (AIF interface X1)
			1	{1}	2047	
C2368	Sync Tx Id	128				XCAN send identifier of the sync telegram (AIF interface X1)
			1	{1}	2047	
C2369		0				XCAN Consumer Heartbeat COB-ID (AIF interface X1)
			0	{1}	255	

9.6.3 XCAN Sync Tx transmission cycle

The cycle time required for transmitting a sync telegram with the identifier set in C2368 can be configured via C2356/5:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2356						Time settings for XCAN (AIF interface X1)	📖 188
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time for initialisation through the master after mains connection.	
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission	
3	XCAN times	0					
4	XCAN times	0					
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to "Operational"	

9.7 Reset node

Changes of the CAN baud rate, the node addresses and the identifiers are only accepted after a node has been reset.

A reset node can be made by:

- New mains connection
- Reset node command by NMT command
- Reset-node command via the SB **AIF_IO_Management** (📖 255)

9.8 Monitoring

9.8.1 Time monitoring for XCAN1_IN ... XCAN3_IN

For the inputs of the process data objects XCAN1_IN ... XCAN3_IN a time monitoring can be configured via C2357:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/appl.	Selection				
C2357						Monitoring time for XCAN process data input objects (AIF interface X1) **Only ECSxA:** When the subcodes 1 ... 4 are set, consider the task runtime: C2357/1...4 = Desired monitoring time / task runtime	📖 192
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time	
2	CE monit time	3000				XCAN2_IN monitoring time	
3	CE monit time	3000				XCAN3_IN monitoring time	
4	CE monit time	3000				Bus-off	
5	CE monit time	3000				AIF monitoring time (can only be set if C2357/6 = 0)	
6	CE monit time	0				Sync monitoring time (can only be set if C2357/5 = 0)	

The response, if no telegram has been received within the defined monitoring time, can be configured via the code C2382/x:

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/appl.	Selection		
C2382					The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)
1	XCAN Conf. CE	0		Off	XCAN1_IN
2	XCAN Conf. CE	0		Off	XCAN2_IN
3	XCAN Conf. CE	0		Off	XCAN3_IN
4	XCAN Conf. CE	0		Off	Bus-off
5	XCAN Conf. CE	0		Off	Life Guarding / Heartbeat Event
6	XCAN Conf. CE	0		Off	Response to sync reception
			0	Off	
			1	Controller inhibit (CINH)	
			2	Quick stop (QSP)	

9.8.2 Bus off

If the ECSxA... axis module has been decoupled from the system bus due to too many faulty received telegrams, the signal "BusOffState" (CE14) is set.

The response to this can be configured via C2382/4

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/appl.	Selection		
C2382					The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)
1	XCAN Conf. CE	0		Off	XCAN1_IN
2	XCAN Conf. CE	0		Off	XCAN2_IN
3	XCAN Conf. CE	0		Off	XCAN3_IN
4	XCAN Conf. CE	0		Off	Bus-off
5	XCAN Conf. CE	0		Off	Life Guarding / Heartbeat Event
6	XCAN Conf. CE	0		Off	Response to sync reception
			0	Off	
			1	Controller inhibit (CINH)	
			2	Quick stop (QSP)	

Tip!

Possible causes of faulty received telegrams may be:

- ► Missing bus termination
- ► Insufficient shielding
- ► Potential differences in the grounding of the control electronics
- ► Excessive bus load(📖 179).

Codes for heartbeat

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/appl.	Selection			
C2369		0				XCAN Consumer Heartbeat COB-ID (AIF interface X1)
			0	{1}	255	
C2370						XCAN Heartbeat time setting (AIF interface X1)
1		0	0	{1 ms}	65535	Consumer heartbeat time
2		0	0	{1 ms}	65535	Producer heartbeat time

Codes for emergency

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/appl.	Selection			
C2371		128				XCAN COB-ID Emergency Object (AIF interface X1)
			0	{1}	2047	
C2372		0				XCAN COB-ID Emergency Object (AIF interface X1)
			0	{1}	65535	Inhibit time emergency

9.9 Operating status of AIF interface

C2121 serves to display the operating status of the AIF interface X1:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/appl.	Selection			
C2121	AIF:State				AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only	📖 195
			1 {1} 255		Binary interpretation reflects bit states.	
			Bit 0	XCAN1_IN monitoring time		
			Bit 1	XCAN2_IN monitoring time		
			Bit2	XCAN3_IN monitoring time		
			Bit3	XCAN bus off		
			Bit4	XCAN operational		
			Bit5	XCAN pre-operational		
			Bit 6	XCAN warning		
			Bit 7	Assigned internally		

C2121 Bits 3 ... 6	Operating state	Description
Bit 3 = 1	Bus off	The ECSxA... axis module has been decoupled from the system bus due to too many faulty telegrams received. ● The response to this status can be configured via C2382/4. 📖 193
Bit 4 = 1	Operational	The system bus is fully operational. The ECSxA... axis module can transmit and receive parameter and process data.
Bit 5 = 1	Pre-operational	The ECSxA... axis module can transmit and receive parameter data. Process data, however, are ignored. The *Pre-Operational* status can be changed to *Operational* status by: ● CAN master ● a reset node (📖 191) ● the ”Pre-Operational to Operational” NMT command
Bit 6 = 1	Warning	The ECSxA... axis module has received faulty telegrams and participates only passively in the system bus, i.e. the axis module no longer transmits any data. Possible causes: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Excessive bus load ● The ECSxA... axis module is not connected to the system bus.

10 Monitoring functions

Different monitoring functions (📖 198) 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) (📖 237).

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:

  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/no. ”x061”) between the AIF module and the ECS axis module.

- 2xxx:

  The fault response is a warning.

10.1 Fault responses

Response	⇨ Consequence	Display Keypad XT		
		RDY	IMP	Fail
TRIP		☐	■	■
TRIP active:	⇨ The power outputs U, V, W are switched to high resistance. ⇨ The drive is coasting (no control).			
TRIP reset:	⇨ The drive decelerates to its setpoint within the set deceleration times.			
Message	 **Danger!** The drive restarts automatically if the message is removed.	☐	■	■
Message active:	⇨ The power outputs U, V, W are switched to high resistance.			
≤ 0.5 s	⇨ The drive is coasting (no control).			
> 0.5 s	⇨ The drive is coasting (due to internal controller inhibit). If necessary, restart program.			
Message reset:	⇨ The drive runs to its setpoint with the maximum torque.			
FAIL-QSP	⇨ The drive is decelerated to standstill within the quick stop deceleration time (C0105).	–	–	■
Warning	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	■	☐	■
	⇨ The failure merely is displayed, the drive runs on in a controlled manner.			
Off	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	–	–	–
	⇨ There is no response to the failure.			

☐ = off ■ = on

Responses (📖 197) of monitoring functions can be parameterised partly via codes – in the GDC parameter menu under **Monitoring**.

10.2 Overview of monitoring functions

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 (activated via DCTRL)	FWM	C0581	●	✓	✓	✓	✓
x191	HSF	Internal error	Internal		●				
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus(C0174)	MCTRL			●			
0070	U15	Undervoltage of internal 15 V voltage supply	Internal		●				
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x041	AP1	Internal fault (signal processor)	Internal		●				
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 CAN bus at interface X4 (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x066	CE5	Communication error of the gateway function (C0370, C0371) via CAN bus at interface X4 (CAN)	CAN	C0603	✓		✓		●
x122	CE11	Communication error on the CANaux1_IN process data input object (time monitoring adjustable via C2457/1)	CANaux1_IN	C2481	✓		✓		●
x123	CE12	Communication error on the CANaux2_IN process data input object (time monitoring adjustable via C2457/2)	CANaux2_IN	C2482	✓		✓		●
x124	CE13	Communication error on the CANaux3_IN process data input object (time monitoring adjustable via C2457/3)	CANaux3_IN	C2483	✓		✓		●
x125	CE14	BUS-OFF state CAN bus at interface X14 (CAN-AUX) (too many faulty telegrams)	CANaux	C2484	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		Description	Source	Code	TRIP	Message	Warning	Fail-QSP	Off
x126	CE15	Communication error of the gateway function via CAN bus at interface X14 (CAN-AUX) ● C0371 = 1: Gateway channel X14 (CAN-AUX) ● C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	CANaux	C2485	✓		✓		●
x260	Err Node Guard	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.	Node Guarding	C0384	●	✓	✓	✓2)	✓
Temperatures / sensors									
0050	OH	Device heatsink temperature > 90° C	MCTRL		●				
0051	OH1	Temperature inside the device > 90° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582	✓		●		✓
x055	OH5	Temperature inside the device > C0124	MCTRL	C0605	✓		●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584	✓		●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	MCTRL	C0585	✓		●		✓
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x095	FAN1	Devicefan monitoring (only for built-in units)			✓	●			
x110	H10	Device thermal sensor error on heatsink	FWM	C0588	●				✓
x111	H11	Device thermal sensor error in the interior of the device	FWM	C0588	●				✓
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				
0015	OC5	Device utilisation I x t (fix 100%)	MCTRL		●				
0016	OC6	Motor utilisation I^2 x t (threshold C0120)	MCTRL		●				
x017	OC7	Device utilisation I x t (clip C0123)	MCTRL	C0604	✓		●		✓
x018	OC8	Motor utilisation I^2 x t (threshold C0127)	MCTRL	C0606	✓		●		✓
x032	LP1	Motor phase failure **Note:** Can only be used for asynchronous motors. Activation of the motor phase failure detection minimises the computing time available to the user!	MCTRL	C0597	✓		✓		●
x081	Rel1	Open circuit monitoring of the brake relay output (X25)	FWM	C0602	✓	✓		✓	●
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	●		✓		✓

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder initialisation error at X8	MCTRL		●				
x088	Sd8	Sin&cos signal fault at X8	MCTRL	C0580	✓				●
x089	PL	Fault during rotor position adjustment	MCTRL		●				
Speed									
x190	nErr	Speed control error (monitoring window C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	NMAX	Max. system speed (C0596) has been exceeded.	MCTRL	C0607	●		✓		✓
Float error									
0209	float Sys-T	Float error in system task (ID 0)	Internal		●		✓	✓	2)
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)	Internal		●		✓	✓	2)
0211	float Task1	Float error in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0218	float Task8	Float error in task 8 (ID 9)							
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x108	H08	Extension board not connected properly or not supported by program.	Internal		●				
0201	overrun Task1	Time-out in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0208	overrun Task8	Time-out in task 8 (ID 9)							
0219	overrun Cycl.-T	Time-out in cyclic task (PLC_PRG, ID 1)	Internal		●		✓	✓	2)
0220	noT-Fkt Credit	Not enough technology units available in the PLC.	Internal		●				
0230	No program	No PLC program loaded in the PLC.	Internal		●				
0231	Unallowed Lib	You have called the library function in the PLC program. This function is not supported.	Internal		●				
x232	NoCamData	Motion profiles (cam data) are not available.	Internal		●				
x240	ovrTrans Queue	Overflow of transmit request memory	Free CAN objects	C0608	●	✓	✓	✓	✓
x241	ovr Receive	Too many receive telegrams	Free CAN objects	C0609	●			✓	
Parameter setting									

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		Description	Source	Code	TRIP	Message	Warning	Fail-QSP	Off
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		●				
0080	PR6	● **For ECSxS/P/M:**Internal fault ● **For ECSxA:** Too many user codes	Internal		●				

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

10.3 Configuring monitoring functions

10.3.1 Monitoring times for process data input objects

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
x062	CE1	Communication error at the process data input object CAN1_IN	CAN_bCe1CommErrCanIn1_b	✓		✓	•
x063	CE2	Communication error at the process data input object CAN2_IN	CAN_bCe2CommErrCanIn2_b	✓		✓	•
x064	CE3	Communication error at the process data input object CAN3_IN	CAN_bCe3CommErrCanIn3_b	✓		✓	•
x065	CE4	BUS-OFF state of the CAN bus at interface X4 (CAN)	CAN_bCe4BusOffState_b	✓		✓	•
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux_bCe1CommErrCanIn1_b	✓		✓	•
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux_bCe2CommErrCanIn2_b	✓		✓	•
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux_bCe3CommErrCanIn3_b	✓		✓	•
x125	CE14	BUS-OFF state of the CAN bus at interface X14 (CAN-AUX)	CANaux_bCe4BusOffState_b	✓		✓	•

• Default setting
✓Setting possible

Each process data input object can monitor whether a telegram has been received within a specified time. As soon as a telegram arrives, the corresponding monitoring time (C0357/C02457) is restarted (”retriggerable monoflop” function).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	202
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

The following responses can be set for communication errors:

- 0 = Error (TRIP) - controller sets controller inhibit (CINH)
- 2 = Warning
- 3 = Monitoring is switched off

Codes for setting the response to the monitoring functions:

CAN bus interface	Code	Monitoring
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: System bus (CAN)	C0591	CAN1_IN (”CE1”)
	C0592	CAN2_IN (”CE2”)
	C0593	CAN3_IN (”CE3”)
	C0595	Bus off (”CE4”)
	C0603	Gateway function (”CE5”)
X14 System bus (CAN)	C2481	CANaux1_IN (”CE11”)
	C2482	CANaux2_IN (”CE12”)
	C2483	CANaux3_IN (”CE13”)
	C2484	Bus off (”CE14”)
	C2485	Gateway function (”CE15”)

The input signals (CAN1...3_IN/CANaux1...3_IN) can also be used 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 signal ”BusOffState” (CE4/CE14) is set.

”BusOffState” can activate an error (TRIP) or warning. The signal can also be switched off. The response is set under C0595/C2484. You can also assign the terminal output for this.

10.3.2 Time-out monitoring for activated remote parameterisation

If remote parameterisation is activated (gateway function (📖 180)) and a timeout occurs, the system error message CE5/CE15 is output.

The response to this can be configured via C0603/C2485.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 202 📖 180
			0 TRIP		
			2 Warning		
			3 Off		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 202 📖 180
			0 TRIP		
			2 Warning		
			3 Off		

10.3.3 Short circuit monitoring (OC1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
011	OC1	Short circuit	MCTRL_bShortCircuit_b	•			

• Default setting
✓Setting possible

The monitoring process is activated if a short circuit occurs in the motor phases. This can also be caused by an interturn fault in the machine.

► Monitoring can also be actuated at mains connection, if an **earth fault** occurs.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the short circuit has to be eliminated.

10.3.4 Earth fault monitoring (OC2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
012	OC2	Earth fault	MCTRL_bEarthFault_b	•			

• Default setting
✓Setting possible

The ECSxA... axis module is equipped with a standard earth fault detection.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the earth fault has to be eliminated.

Possible causes of an earth fault are:

► Short circuit to frame of the machine

► Short circuit of a phase to the shield

► Short circuit of a phase to PE

10.3.5 Motor temperature monitoring (OH3, OH7)

Stop!

The temperature sensor must only be connected to either X7 **or** X8, the other input of the temperature sensor must be left open!

Note!

This monitoring function only applies to temperature sensors specified by Lenze like the ones used on standard Lenze servo motors.

With regard to default setting, this monitoring is switched actively and is actuated when no Lenze servo motor is used!

The motor temperature is monitored by means of a continuous KTY temperature sensor.

The motor temperature monitoring functions (OH3/OH7) respond when the set temperature thresholds are exceeded.

Wire the KTY temperature sensor to the resolver cable at X7 (📖 96) or the encoder cable at X8 (📖 97).

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
053	OH3	Motor temperature (fixed, 150 °C)	MCTRL_bMotorTempGreaterSetValue_b	•		✓	✓
057	OH7	Motor temperature (adjustable, C0121)	MCTRL_bMotorTempGreaterC0121_b	✓		•	✓

• Default setting
✓Setting possible

► Adjustable warning threshold (OH7)
  – The warning threshold can be set under C0121
  – The reaction to exceeding the threshold can be set under C0584

► Fixed warning threshold (OH3)
  – Threshold = 150 °C
  – The reaction to exceeding the threshold can be set under C0583

The hysteresis is 15 K, i.e. the switching value for the fixed warning threshold is 135 °C.

Monitoring with the adjustable threshold (OH7) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH3). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0121	OH7 limit	120			Threshold for motor temperature monitoring	📖 206
			45 {1 °C} 150		Motor temperature > C0121 ⇨ fault message OH7 (C0584)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0583	MONIT OH3	0		Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	📖 206
			0 TRIP		
			2 Warning		
			3 Off		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 206
			0 TRIP		
			2 Warning		
			3 Off		

10.3.6 Heatsink temperature monitoring (OH, OH4)

The heatsink temperature of the controller can be monitored with two temperature thresholds:

- Adjustable temperature threshold (OH4)
  - Threshold can be set under C0122
  - The reaction to exceeding the threshold can be set under C0582
- Fixed temperature threshold (OH)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
050	OH	Heatsink temperature (fixed, 90 °C)	MCTRL_bKuehlGreaterSetValue_b	•			
054	OH4	Heatsink temperature (adjustable, C0122)	MCTRL_bKuehlGreaterC0122_b	✓		•	✓

• Default setting
✓Setting possible

The hysteresis is 5 K, i.e. the switching value for the fixed threshold is 85 °C.

Monitoring with the adjustable threshold (OH4) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0122	OH4 limit	80			Threshold for heatsink temperature monitoring	📖 208
			45 {1 °C} 90		Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0582	MONIT OH4	2			Setting of the fault response - monitoring of heatsink temperature in C0122	📖 208
			0	TRIP		
			2	Warning		
			3	Off		

The following causes can bring about an actuation of the monitoring process:

Cause	Remedy
The ambient temperature is too high.	Mount a fan in the control cabinet.
The drive controller is overloaded in the arithmetic mean, i. e. overload and recovery phase are above 100%.	• Mount a fan in the control cabinet. • Reduce overload phase. • Use more powerful drive controller.

10.3.7 Monitoring of internal device temperature (OH1, OH5)

The temperature inside the controller can be monitored with two temperature thresholds:

- Adjustable threshold (OH5)
  - The warning threshold can be set under C0124
  - The reaction to exceeding the threshold can be set under C0605
- Fixed threshold (OH1)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

The hysteresis is 5 K, i.e. the reset value for the fixed warning threshold is 85 °C.

The monitoring with the adjustable threshold (OH4) is designed as an early warning stage before final disconnection of the controller by means of TRIP (OH). Therefore, the process can be influenced accordingly, so that the final disconnection of the controller at unfavourable moments is avoided. Furthermore, for instance, additional fans can be activated, generating a noise load when switched to continuous operation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 209
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 209
			0	TRIP			
			2	Warning			
			3	Off			

10.3.8 Function monitoring of thermal sensors (H10, H11)

The function of the thermal sensors of the heatsink and the interior of the device is monitored. If the thermal sensors report values outside the measuring range, fault H10 (heatsink) or H11 (interior) is reported. The response to these faults can be defined under C0588.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 210
			0 TRIP		
			2 Warning		
			3 Off		

10.3.9 Current load of controller (I x t monitoring: OC5, OC7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
015	OC5	I x t overload	MCTRL_bIxtOverload_b	•			

• Default setting
✓Setting possible

The I x t monitoring function monitors the current load of the axis module. The monitoring function is set so that operation

- is permanently possible with a device output current = I_r.
- is possible for ≤≤ 30 s with a device output current ≤≤ 1.5 x I_r.

The overload protection of the axis module can be set with thresholds:

- adjustable threshold (OC7) via C0123
- fixed threshold (OC5) = 100 %

After an overcurrent phase, you can calculate with a recovery phase of 120 s. For a more precise consideration, see the overcurrent characteristic and the value 3 x $\tau_{axis\ module}$ (📖 212).

The response to exceeding the adjustable threshold can be defined under C0604.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	📖 205
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 205
			0	TRIP			
			2	Warning			
			3	Off			

Overcurrent characteristic

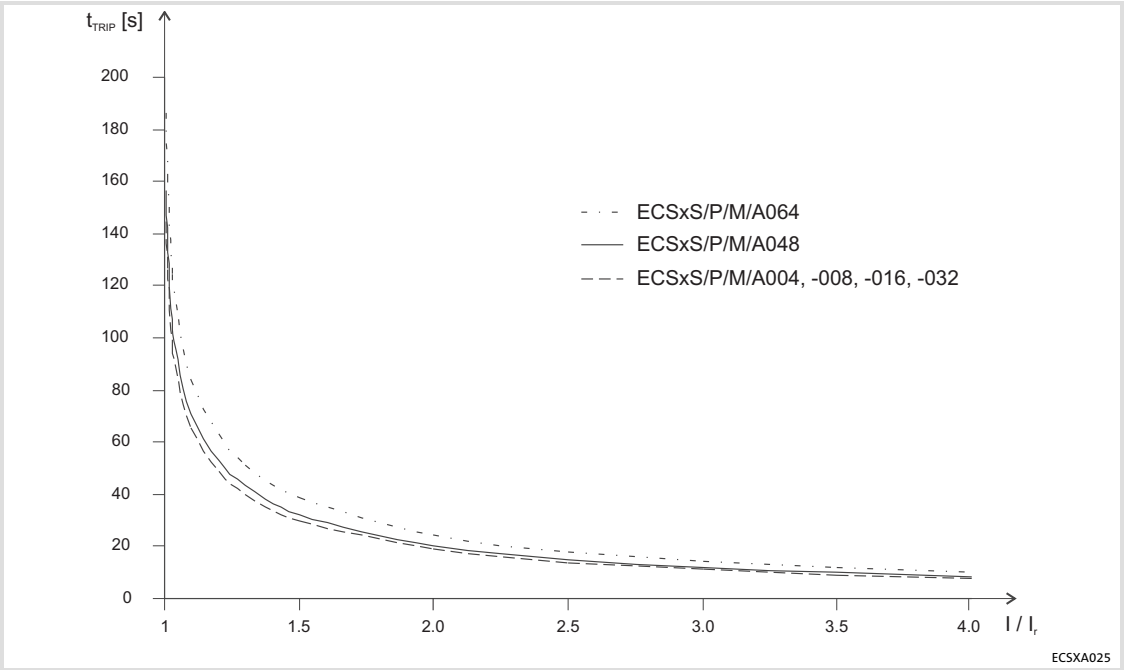


Fig. 10-1 Overcurrent characteristic ECSxA..., see also "Rated data" 📖 42

The overcurrent characteristic shows the maximum time t_{TRIP} till the axis module generates an I x t error. In order to reach this time t_{TRIP} again, the time 3 x $\tau_{axis\ module}$ with the load I/I_r = 0 A must be observed.

Device	$\tau_{axis\ module}$ [s]	Overcurrent characteristic
ECSxA004	54.6	$I \cdot t = \frac{I_{subprofile\_x}}{I_{rated}} - \left(\frac{I_{subprofile\_x}}{I_{rated}} - I \cdot t_{subprofile\_x-1} \right) \cdot e^{-\frac{t_{subprofile\_x}}{\tau_{axis\_module}}}$
ECSxA008	27.3	
ECSxA016	27.3	
ECSxA032	27.3	
ECSxA048	29.5	
ECSxA064	35.1	

Overcurrent diagram for OC5 fault message

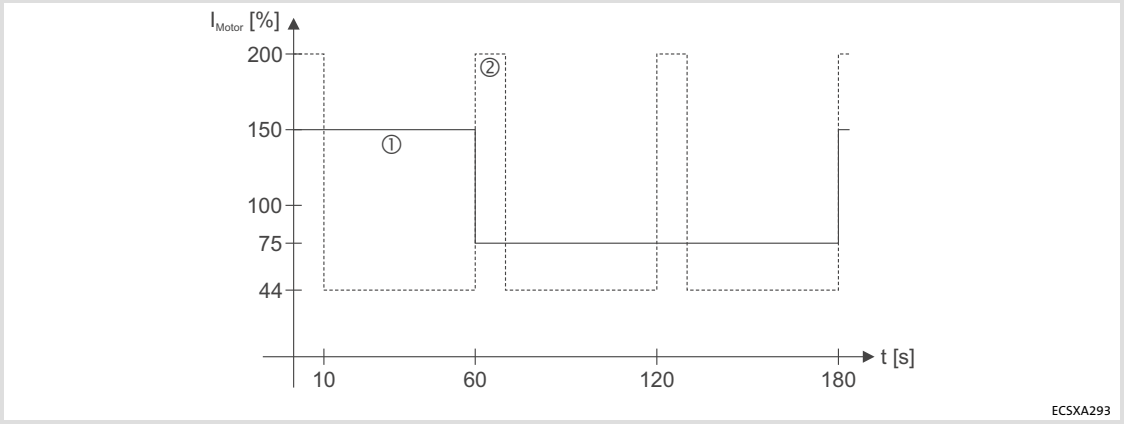


Fig. 10-2 Maximum overcurrent as a function of time

The maximum admissible overcurrent is dependent on the I_{max}limit set in C0022.

① I_{max} limit set in C0022 ≤ 150 % I_r:

► For **180 s**, the arithmetic mean value of the motor current must not exceed **100 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ①:

$$\frac{60\ \text{s} \cdot 150\ \% + 120\ \text{s} \cdot 75\ \%}{180\ \text{s}} = 100\ \%$$

② I_{max} limit set in C0022 > 150 % I_r:

► For **60 s**, the arithmetic mean value of the motor current must not exceed **70 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ②:

$$\frac{10\ \text{s} \cdot 200\ \% + 50\ \text{s} \cdot 44\ \%}{60\ \text{s}} = 70\ \%$$

The current device utilisation is displayed in C0064:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.

10.3.10 Current load of motor (I^2 x t monitoring: OC6, OC8)

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 %.

10.3.10.1 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):

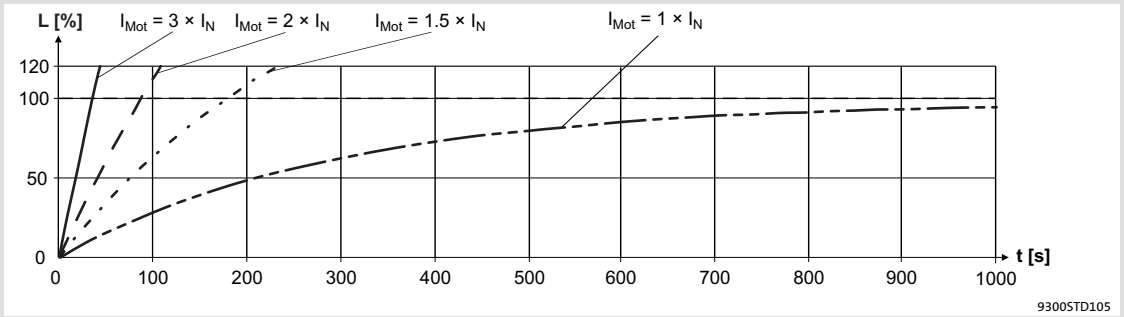


Fig. 10-3 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

10.3.10.2 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

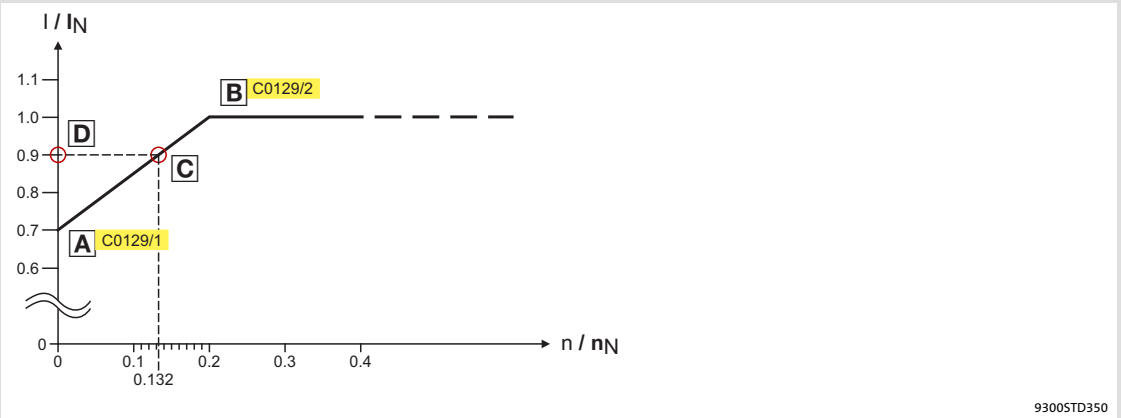


Fig. 10-4 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 10-4) 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. 10-4, 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", 📖 217)

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).

10.3.11 DC-bus voltage monitoring (OU, LU)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
020	OU	Overvoltage	MCTRL_bOvervoltage_b		•		
030	LU	Undervoltage	MCTRL_bUndervoltage_b		•		

• Default setting
✓Setting possible

These monitoring functions monitor the DC bus and protect the controller.

- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ exceeds the upper switch-off threshold set in C0173, an OU message is sent.
- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ falls below the lower switch-off threshold set in C0174, an LU message is sent.

The monitoring response remains active until the corresponding threshold is fallen below/exceeded again.

Note!
All drive components in DC-bus connections must have the same thresholds!

Switch-off and switch-on thresholds

- The switch-off threshold defines the voltage level of the DC-bus voltage, at which the pulse inhibit is activated.
- The switch-off and switch-on thresholds dependent on C0173 can be gathered from the following table:

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785



Tip!

If undervoltage is existent for more that 3 s, or if mains connection is carried out, an entry into the fault memory is effected.

- ► This operational mode can occur if the control module is fed via the terminals X6/+24 and X6/GND by means of an external supply and the mains are disconnected.
- ► If there is no undervoltage anymore (mains are reconnected again), the entry in the fault memory is not continued, but deleted. This case does not describe an error, but a state of the drive controller.

Undervoltages of less than 3 s are interpreted as a fault (e. g. mains fault) and are entered into the fault memory. In this case, the fault memory is updated.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0173	UG limit	11			Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 107
			0	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3	Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4	Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13	Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14	Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 107
			15	{1 V} 342		

10.3.12 Voltage supply monitoring - control electronics (U15)

If the voltage at X6/DI1 or X6/DI3 falls below 17 V, TRIP ”U15” is triggered. The fault can only be reset if U > 19 V.

10.3.13 Motor phase failure monitoring (LP1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
032	LP1	Motor phase failure	MCTRL_bMotorphaseFail_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether a motor phase has failed.

Note!

- ► This monitoring function can only be used for asynchronous motors.
- ► When this monitoring function is activated, the calculating time available to the user is reduced.

- ► The response is set via C0597.
- ► The monitoring limit is set via C0599.

Reset fault message

1. Check motor cables.
2. Carry out TRIP-RESET.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0597	MONIT LP1	3			Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 221
			0	TRIP		
			2	Warning		
			3	Off		
C0599	Limit LP1	5.0			Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 221
			0.01	{0.01 %} 10.00		

10.3.14 Monitoring of the resolver cable (Sd2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
082	Sd2	Resolver error	MCTRL_bResolverFault_b	•		✓	✓

• Default setting
✓Setting possible

This monitoring function monitors the resolver cable and the resolver with regard to open circuit and protects the motor.

Stop!

If monitoring is disconnected, the machine can achieve very high speeds in case of faults (e. g. system cable is disconnected or not correctly screwed), which can result in the damage of the motor and of the driven machine! The same applies if ”warning” is set as a response.

- ► For commissioning C0586, always use the Lenze setting (TRIP).
- ► Only use the possibility of disconnection via C0586 if the monitoring is activated without apparent reason (e. g. by very long cables or intense interference injection of other drives).
- ► Configure C0586 = 2 (warning) only on the above-mentioned condition, because the pulses are enabled despite faulty feedback.

If a fault with regard to the actual value acquisition is available, it is not definitely ensured that monitoring is triggered by overspeed (NMAX, 📖 227).

This monitoring ...

- ► is automatically activated if a resolver is selected as an actual speed value encoder via C0419.
- ► is automatically activated if another actual speed value encoder is selected.

The response is set via C0586.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 222
			0 TRIP		
			2 Warning		
			3 Off		

10.3.15 Motor temperature sensor monitoring (Sd6)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
086	Sd6	Motor temperature sensor fault	MCTRL_bSensorFault_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether the motor temperature sensor supplies values within the measuring range of -50 ... +250 °C. If the values are outside this measuring range, monitoring is activated.

The response is set via C0594.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. "SensorFault" (Sd6)	📖 223
			0 TRIP		
			2 Warning		
			3 Off		

10.3.16 Monitoring of the absolute value encoder initialisation (Sd7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
087	Sd7	Absolute value encoder initialisation error	MCTRL_bEncoderFault_b	•			

• Default setting
✓Setting possible

When the ECSxA... axis module is switched on, this monitoring function repeatedly downloads the absolute value of the hiperface absolute value encoder to identify whether the same value is transferred to the drive.

The absolute value encoders (single-turn, multi-turn) are supported by a hiperface interface with various numbers of increments, e.g.: SRM50 with 1024 Sin/Cos periods/rev. or SKM38 with 128 periods/rev.(see also C0419).

If a deviation > 5° on the motor shaft is detected, the monitoring (TRIP) is actuated.

The fault message ”Sd7” can only be reset by mains switching!

10.3.17 Sin/cos signal monitoring (Sd8)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
088	Sd8	Sin/cos signal fault	MCTRL_bEncoderFault_b	✓			•

• Default setting
✓Setting possible

This monitoring function carries out a plausibility test to check that the encoder is available and that the sin/cos track supply plausible values with regard to each other.

- If required, the encoder has to move by several angular degrees for actuating a fault.
- The response is set via C0580.
- The filter time constant (C0559) serves to filter short-time trouble on the sin/cos track of the encoder without an SD8 trip being released immediately.
- The ”Sd8” fault message can only be reset by mains switching.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 225
			0	TRIP			
			3	Off			
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	

Note!

For the desired encoder monitoring, and in particular when using synchronous machines, set fault handling to ”TRIP”.

In order to achieve further encoder safety, monitoring of following errors can be activated for positioning systems. Set its fault response to ”TRIP”, too.

Visible faults	Non-visible faults
• Unplugged plug, all encoder signals open. • Singe wire breakage, one of the following signals is missing: – COS A – RefCOS A – SIN B – RefSIN B – GND – VCC • Double wire breakage with the following signal pairs: – COS A and RefCOS A – SIN B and RefSIN B – COS A and SIN B – RefCOS A and RefSIN B – and all four signals (COS A, RefCOS A, SIN B, RefSIN B) open.	• Short circuits, in particular between sine and cosine signals. • Cable/encoder faults with intermediate values • ”Semi”-short circuits (> 0 Ohm) • ”Semi”-interruptions (< infinite)

10.3.18 Monitoring of the speed system deviation (nErr)

Fault message		Monitoring function	System variable	Possible response				
				TRIP	Message	Warning	FAIL-QSP	Off
190	nErr	Speed outside of the tolerance window (C0576)	MCTRL_bSpeedLoopFault_b	✓	✓	✓	✓	•

• Default setting
✓Setting possible

This monitoring function compares the actual speed value provided by the speed sensor with the speed setpoint of the speed controller. If the difference between the two speed values exceeds the tolerance window set in C0576, the nErr monitoring function responds.

► If the system deviation exceeds a certain value, this may indicate a drive problem. The drive cannot follow the selected speed setpoint as fast as required. If the controller generally is in working condition, mechanical blockages on the load side or insufficient motor torque may be the cause.

Furthermore, this monitoring function can be used to additionally protect a speed sensor operating in the speed-controlled mode. The monitoring function thus supplements the individual encoder monitoring.

► Faults on the encoder system bring about an incorrect actual speed value. This normally results in a system deviation on the speed controller that is greater than that in the normal operating status.

► The tolerance margin is set via C0576.

► The response is set via C0579.

Note!

► Set the tolerance window (C0576) to at least twice the value of the system deviation occurring during operation. The value can be identified by respective tests when commissioning is effected.

► Please observe that the system deviation reaches higher values under normal operating conditions with short ramp times.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 226
			0	{1 %}	100		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 226
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

10.3.19 Monitoring of max. system speed (NMAX)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
200	NMAX	Max. system speed exceeded	MCTRL_bNmaxFault_b	•			

• Default setting
✓Setting possible

The monitoring function responds if the current speed exceeds the max. system speed or twice the value of C0011 (n_{max}).

Stop!

- ► With regard to active loads (e. g. hoists), pay attention to the fact that the drive in this case operates without torque. Specific on-site measures are required!
- ► If the actual speed value encoder fails, it is not provided that this monitoring will be activated.

The max. system speed can be set via C0596.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0596	NMAX limit	5500				Maximum system speed	📖 227
			0	{1 rpm}	16000		

10.3.20 Monitoring of the rotor position adjustment (PL)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
089	PL	Fault during rotor position adjustment	MCTRL_bRotorPositionFault_b	•			

• Default setting
✓Setting possible

This monitoring function observes the correct execution of the rotor position adjustment.

This monitoring function can occur during rotor position adjustment in connection with feedback systems:

- Resolver
- TTL encoder
- Sin/cos encoder
- Absolute value encoder (single/multi-turn)

Cause for this is a cancellation of the adjustment routine as a result of

- a supply voltage loss
- an encoder cable interruption
- a routine stop through the deactivation of C0095

Reset fault message

1. Remove the cause for the cancellation.
2. Inhibit controller
3. Deactivate rotor position adjustment with C0095 = 0.
4. Carry out TRIP-RESET.
5. Activate rotor position adjustment with C0095 = 1.

11 Diagnostics

11.1 Diagnostics with Global Drive Control (GDC)

In GDC, the codes for drive system diagnostics can be found in the parameter menu under **Diagnostic** and the corresponding submenus. Fault history values can be found in the **Fault history** menu.

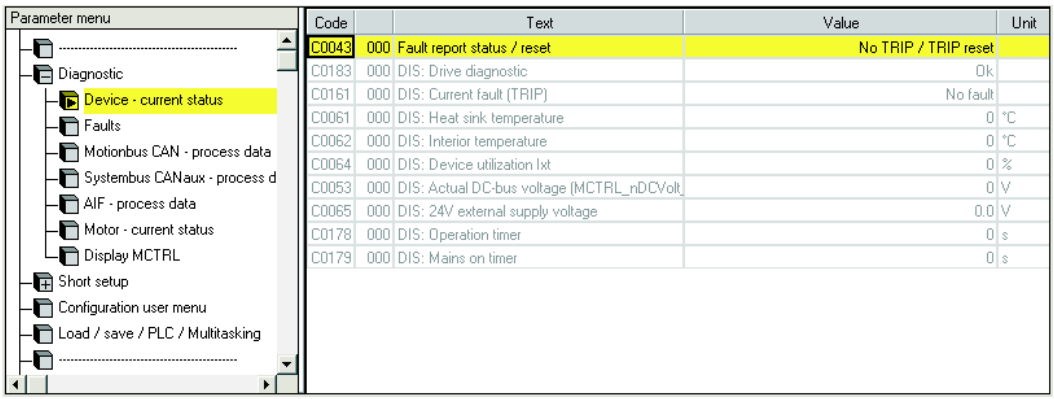


Fig. 11-1 GDC view: Diagnostics - Device - current status

11.2 Diagnostics with Global Drive Oscilloscope (GDO)

The ”Global Drive Oscilloscope” (GDO) is included in the scope of supply of the Lenze parameter setting and operating program ”Global Drive Control” (GDC) and the ”Drive PLC Developer Studio” (DDS) and can be used as an additional diagnostic program.

The GDO serves to record e.g. input and output data and device-internal states during controller operation.

Note!

Detailed information about the functionality and handling of GDO can be found in the Manual ”Global Drive Oscilloscope (GDO), Getting started”.

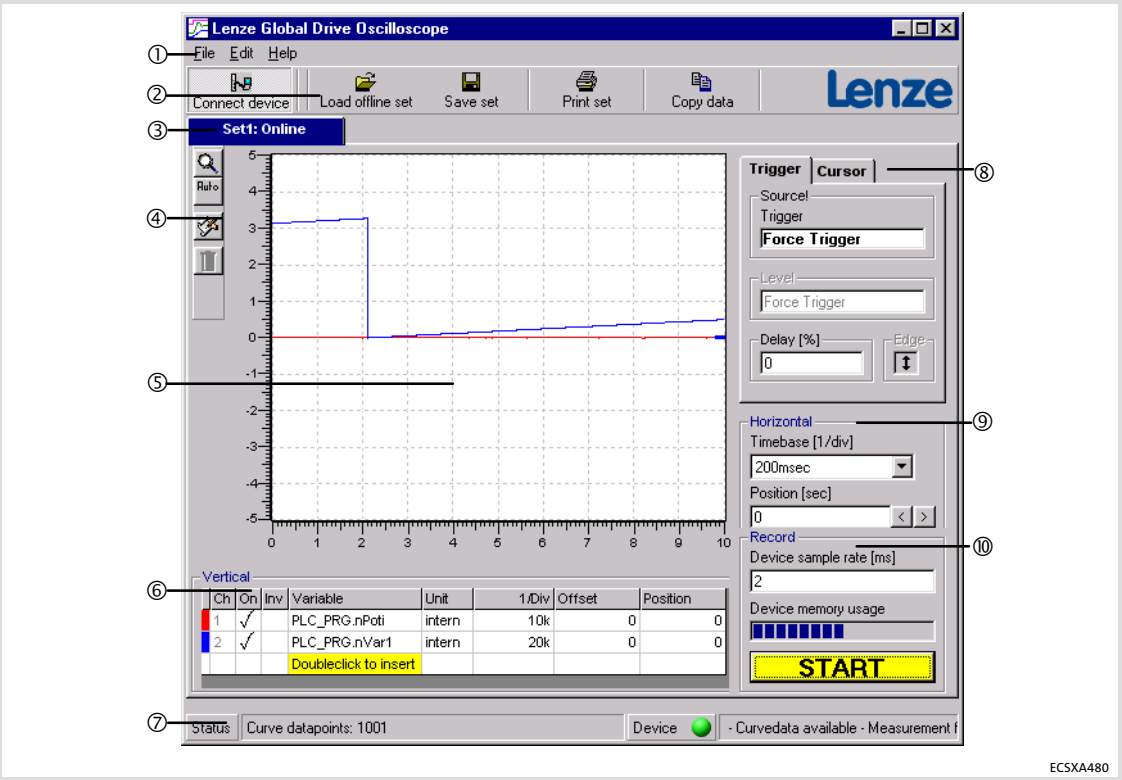


Fig. 11-2 Global Drive Oscilloscope (GDO)

① Menu bar
② Symbol bar at the top
③ Data sets
④ Symbol bar on the left
⑤ Graph display field
⑥ Vertical operating elements
⑦ Status display
⑧ Trigger/cursor operating elements
⑨ Horizontal operating elements
⑩ Operating elements for recording

11.2.1 GDO buttons

Clicking on the corresponding button executes the respective function.

Press the **<F1>** key to call the HTML online help.

Symbol bar at the top (②, Fig. 11-2)

Symbol (button)	Function
	**Connect device** Here a connection can be established to an attached module. This button has the same function as the menu command **File → Connect**.
	**Load offline set** Here saved data sets can be loaded.
	**Save set** Here recorded curves can be saved. This button has the same function as the menu command **File → Save**.
	**Print set** Here the recorded curve can be printed in different variants.
	**Copy data** Here data sets can be copied. This button has the same function as the menu command **Edit → Copy**.

Symbol bar on the left (④, Fig. 11-2)

Symbol (button)	Function
	**Zoom** Here different zoom functions can be executed.
	**Automatic scaling** Here all selected curves can be automatically scaled and repositioned and the offset value can be set to ”0”. The following data types are supported in automatic scaling: BYTE; WORD; DWORD; USINT; UINT; UDINT; SINT; INT; SDINT; Array; Struct
	**Comment** Here information concerning the current data set can be entered. This information is saved together with the current data set and after loading it is displayed as a short info.
	**Delete** Here the selected offline data set can be deleted.

11.3 Diagnostics with the XT EMZ9371BC keypad

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	

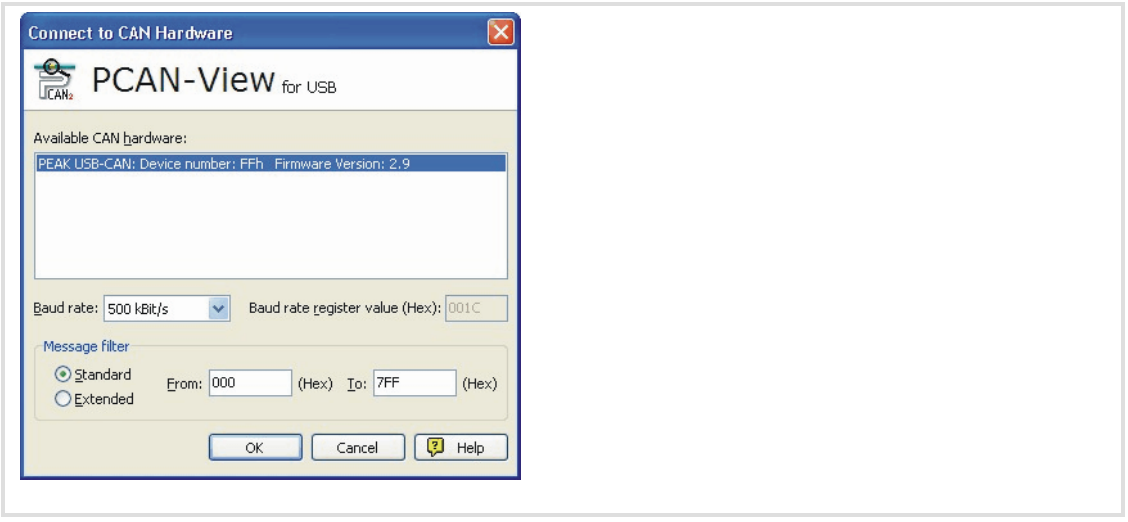
11.4 Diagnostics with PCAN-View

”PCAN-View” is the basic version of the ”PCAN-Explorer” program for Windows® of PEAK System Technik GmbH. The program permits a simultaneous transmission and reception of CAN messages which can be transmitted manually and periodically. Errors on the bus system and memory overflows of the triggered CAN hardware are displayed.

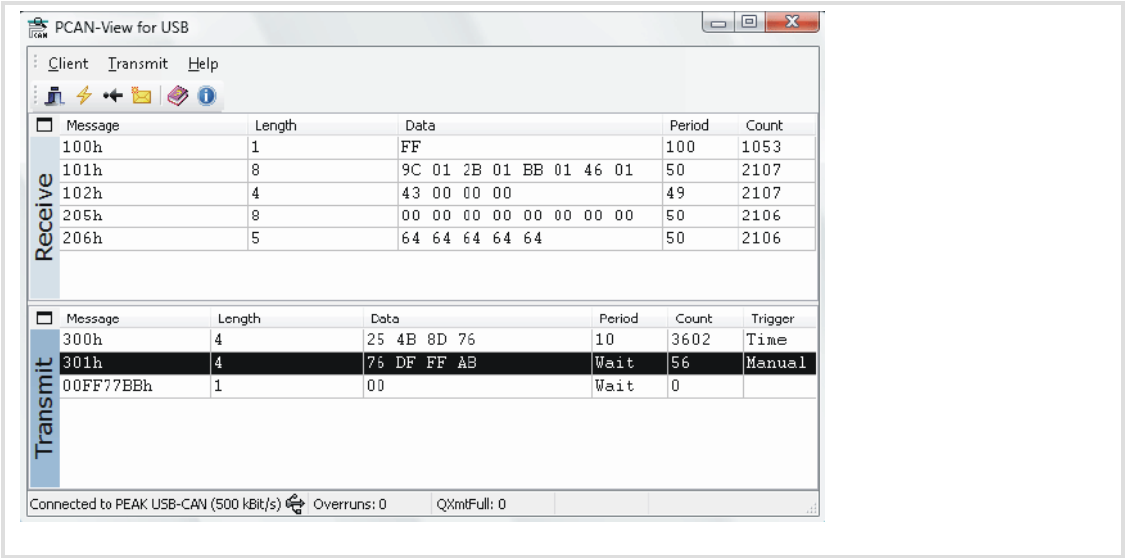
11.4.1 Monitoring of telegram traffic on the CAN bus

How to monitor the telegram traffic:

1. Connect the Engineering PC directly to the CANopen bus via the EMF2177IB USB system bus adapter.
2. Start the ”PCAN-View” program.
3. Connect ”PCAN-View” to ”Connect to CAN Hardware” using the USB system bus adapter and the desired baud rate.



The ”Receive” and ”Transmit” windows now continuously display the CAN telegrams.



On the basis of the IDs displayed, you can assign the telegrams to the devices.

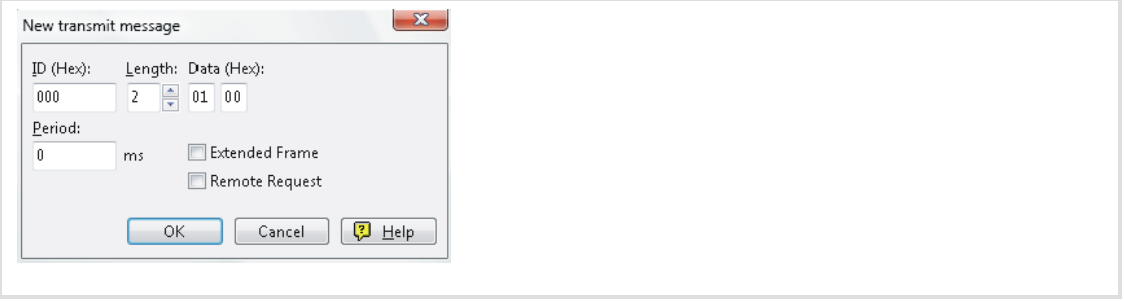
If no telegrams are displayed, this may be caused by various factors:

- Is your Engineering PC connected to the correct CAN bus?
- Is the correct system bus adapter activated under ”System control, CAN Hardware”?
- What does the status line of the »PCAN-View« contain?
  In case of ”Bus Heavy” mostly a node with a wrong baud rate disturbs the bus traffic.
- Do the devices are in the ”Operational” status?

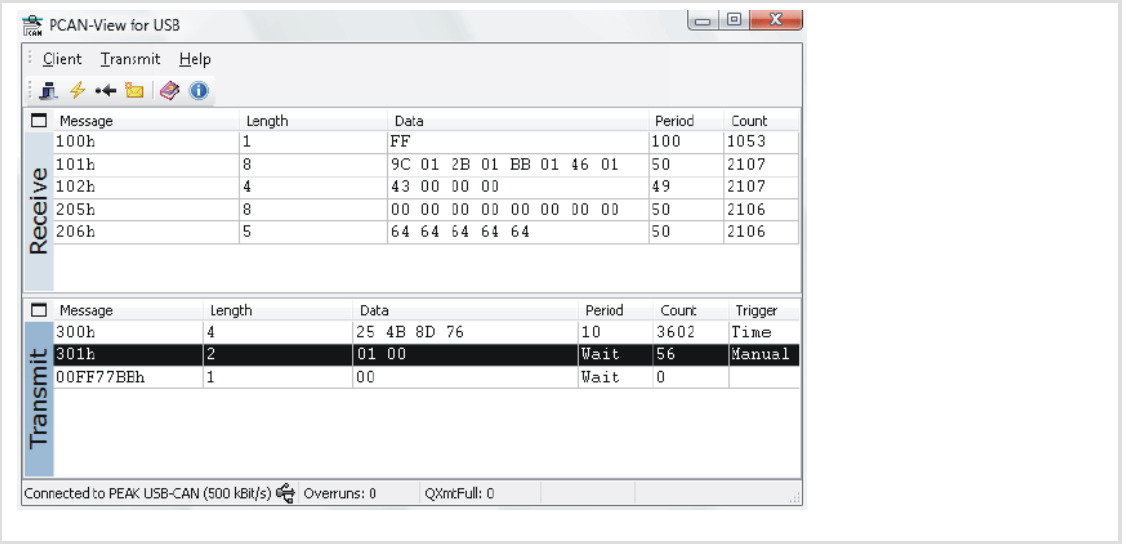
11.4.2 Setting all CAN nodes to the ”Operational” status

How to set all CAN nodes to the ”Operational” status:

1. Create the following CAN message under ”New transmit message”:



2. Select the CAN message in the ”Transmit” window and press the <space bar> once to transmit the CAN message.



12 Troubleshooting and fault elimination

Failures can be quickly detected by means of display elements or status messages via the system bus (CAN/CAN-AUX).

Display elements and status messages provide a rough classification of the trouble.

In the chapter ”12.3.2 Causes and remedies” (📖 246) , you can find information on fault elimination.

12.1 Fault analysis

12.1.1 Fault analysis via the LED display

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibit (CINH) active, switch-on inhibit	C0183
Blinking	Off	Trouble/fault (TRIP) is active	C0168/1
Blinking	On	Warning/FAIL-QSP is active	C0168/1

12.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display indicate the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited.	C0183, C0168/1
IMP	Pulses at the power stage inhibited.	C0183, C0168/1
Imax	Maximum current reached.	
Mmax	Maximum torque reached.	
FAIL	Fault through TRIP, message, fail QSP or warning.	C0183, C0168/1

12.1.3 Fault analysis with the history buffer

The history buffer (C0168) enables you to trace faults. The corresponding fault messages are stored in eight memory locations in the sequence of their occurrence.

Structure of the history buffer

- The fields under ”fault history” show the memory locations 2 ... 7.
- The fields under ”current faults” indicate memory location 1. It gives information on the active fault.
- If the fault is no longer active or has been reset,
  - all information in the fault memory will be automatically shifted upwards by one subcode.
  - memory location 1 will be deleted (no active fault). The information on the formerly active fault is now in subcode 2.
  - the contents of subcode 8 will be eliminated from the history buffer and cannot be read any longer.
- The history buffer contains three information units for every fault occurred:
  - Fault number and response
  - Time of the last occurrence
  - Frequency of successive occurrence

Note!

- If several faults with different responses occur at the same time, only the fault the response of which has the highest priority is entered in the history buffer.
  - Power supply module ECSxE:
    TRIP/KSB-TRIP (highest) → message → warning (lowest)
  - Axis module ECSxS/P/M/A:
    TRIP (highest) → message → FAIL-QSP → warning (lowest)
- If several faults with the same response occur at the same time, (e.g. two messages) only the fault that occurred first is entered in the history buffer.
- If a fault occurs several times in quick succession, only the time of the last occurrence is entered in the history buffer.

Assignment of information to the codes

Code and retrievable information				contains information on ...
C0168	C0169	C0170	Subcode	
Number and **response** of the fault message	**Time** of the last occurrence of the fault message	**Frequency** of the occurrence of the fault message	1	active fault
			2	last fault
			3	second-to-last fault
			4	third-to-last fault
			5	fourth-to-last fault
			6	fifth-to-last fault
			7	six-to-last fault
			8	seventh-to-last fault

Reset fault message

The current fault message can be reset via a TRIP-RESET (e.g. via C0043):

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0043	Trip reset	0		Reset active fault message (TRIP-RESET)	📖 254
			0 Reset fault message (TRIP-RESET) / no fault		
			1 Active fault message		

Delete entries in the history buffer

The entries in the history buffer can be deleted via C0167.

► This function only works when no trouble is active.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0167	Reset failmem	0		Delete history buffer (C0168)	📖 237
			0 No reaction		
			1 Delete history buffer		

12.1.4 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 1 (DCTRL) Read only	📖 328 📖 239
			0 {1} 65535		Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned	DCTRL_bStateB0_b	
			Bit 1	Pulse inhibit (IMP)	DCTRL_bImp_b	
			Bit2	Not assigned	DCTRL_bStateB2_b	
			Bit3	Not assigned	DCTRL_bStateB3_b	
			Bit4	Not assigned	DCTRL_bStateB4_b	
			Bit5	Not assigned	DCTRL_bStateB5_b	
			Bit 6	n = 0	DCTRL_bNActEq0_b	
			Bit 7	Controller inhibit (CINH)	DCTRL_bCInh_b	
			Bit 8	Device status bit 1	DCTRL_bStat1_b	
			Bit 9	Device status bit 2	DCTRL_bStat2_b	
			Bit10	Device status bit 3	DCTRL_bStat4_b	
			Bit11	Device status bit 4	DCTRL_bStat8_b	
			Bit12	Warning	DCTRL_bWarn_b	
			Bit13	Message	DCTRL_bMess_b	
			Bit14	Not assigned	DCTRL_bStateB14_b	
			Bit15	Not assigned	DCTRL_bStateB15_b	

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
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	

12.2 Malfunction of the drive

Maloperation/fault	Cause	Remedy
Feedback system		
● Motor rotates CCW when viewed to the motor shaft. ● C0060 counts down after controller enable.	Feedback system is not connected in correct phase relation.	Connect feedback system in correct phase relation. The rotor position indicated under C0060 is derived from the position encoder (MCTRL_dnPos_p). Therefore observe the mounting position when using separate feedback systems for position (C0490) and speed (C0495).
Asynchronous motor		
● Motor rotates with I_{max} and half slip frequency. ● Motor does not react to setpoint change.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
Synchronous motor		
● Motor does not follow the setpoint change. ● I_{max} follows the setpoint selection in idle state.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
● Motor rotates CCW when viewed to the motor shaft. ● Synchronous motor accelerates with a speed setpoint = 0 to rated speed. ● Torque of synchronous motor is too low.	Rotor angle (offset of electrical and mechanical rotor angle) is not correct.	Carry out rotor position adjustment (C0095 = 1) or set rotor displacement angle manually. **Operate motor without load for this purpose!**
● Motor blocks in certain positions.	The number of pole pairs of the resolver or motor is not set correctly.	Number of pole pairs (C0080) must be set correctly.

12.3 Fault messages

12.3.1 Overview of fault messages, error sources and responses

System error message				Possible settings/response • Lenze setting ✓ Setting possible						Available in		
No.	Display	Source	Meaning	Code	TRIP	Message	Warning	FAIL-QSP	Off	Drive PLC	Servo PLC	ECSxA
x011	OC1	MCTRL	Short circuit in motor cable		•						✓	✓
x012	OC2	MCTRL	Earth fault in motor cable		•						✓	✓
x015	OC5	MCTRL	I x t overload		•						✓	✓
x016	OC6	MCTRL	I^2 x t overload (C0120)		•							✓
x017	OC7	MCTRL	I x t warning (C0123)	C0604	✓		•		✓			✓
x018	OC8	MCTRL	I^2 x t warning (C0127)	C0605	✓		•		✓			✓
x020	OU	MCTRL	Overvoltage in the DC bus			•					✓	✓
x030	LU	MCTRL	Undervoltage in DC bus			•					✓	✓
x032	LP1	MCTRL	Motor phase failure	C0597	✓		✓		•		✓	✓
x050	OH	MCTRL	Heatsink temperature higher than fixed limit temperature		•						✓	✓
x051	OH1	MCTRL	Interior temperature > 90° C		•							✓
x053	OH3	MCTRL	Motor temperature higher than fixed limit temperature	C0583	•				✓		✓	✓
x054	OH4	MCTRL	Heatsink temperature higher than variable limit temperature (C0122)	C0582			•		✓		✓	✓
x055	OH5	MCTRL	Interior temperature > C0124	C0605	✓		•		✓			✓
x057	OH7	MCTRL	Motor temperature higher than variable limit temperature (C0121)	C0584			•		✓		✓	✓
x058	OH8	MCTRL	Motor temperature via inputs T1/T2 is too high	C0585	✓		✓		•		✓	✓
x061	CE0	AIF	Communication error - AIF module⇔PLC	C0126	✓		✓		•	✓	✓	✓
x062	CE1	CAN1	CAN1_IN (monitoring time can be set with C0357/1)	C0591	✓		✓		•	✓	✓	✓
x063	CE2	CAN2	CAN2_IN (monitoring time can be set with C0357/2)	C0592								
x064	CE3	CAN3	CAN3_IN (monitoring time can be set with C0357/3)	C0593								
x065	CE4	CAN	CAN BUS-OFF status (too many faulty telegrams received)	C0595	✓		✓		•	✓	✓	✓
x066	CE5	CAN	CAN time-out (gateway function C0370)	C0603	✓		✓		•	✓	✓	✓

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

System error message				Possible settings/response • Lenze setting ✓ Setting possible						Available in		
No.	Display	Source	Meaning	Code	TRIP	Message	Warning	FAIL-QSP	Off	Drive PLC	Servo PLC	ECSxA
x070	U15	Internal	Undervoltage of internal 15 V voltage supply		•					✓	✓	✓
x071	CCr	Internal	Internal fault 1)		•					✓	✓	✓
x072	PR1	Internal	Checksum error in parameter set 1		•					✓	✓	✓
x074	PEr	Internal	Program error 1)		•					✓	✓	✓
x075	PR0	Internal	General parameter set fault 1)		•					✓	✓	✓
x076	PR5	Internal	Error saving parameters		•					✓		✓
x079	PI	Internal	Fault during parameter initialisation 1)		•					✓	✓	✓
x080	PR6	Internal	Too many user codes		•					✓	✓	✓
x082	Sd2	MCTRL	Resolver error	C0586	•		✓		✓		✓	✓
x083	Sd3	MCTRL	Encoder error at X9 pin 8	C0587	✓		✓		•		✓	
x085	Sd5	MCTRL	Encoder error at analog input (X6) (C0034 = 1)	C0598	✓		✓		•		✓	✓
x086	Sd6	MCTRL	Motor temperature sensor error (X7 or X8)	C0594	•		✓		✓		✓	✓
x087	Sd7	MCTRL	Absolute value encoder error at X8 1)	C0025	•						✓	✓
x088	Sd8	MCTRL	Absolute value encoder error at X8 1)	C0580	✓				•		✓	✓
x089	PL	MCTRL	Error during rotor position adjustment		•						✓	✓
x091	EEr	FWM	External monitoring actuated via DCTRL	C0581	•	✓	✓	✓	✓		✓	✓
x105	H05	Internal	Internal fault (memory)		•					✓	✓	✓
x107	H07	Internal	Internal fault (power section)		•						✓	✓
x108	H08	Internal	Extension board not connected correctly or not supported by program		•					✓		✓
x110	H10	FWM	Heatsink temperature sensor error	C0588	•				✓		✓	✓
x111	H11	FWM	Thermal sensor error in the interior of the device		•				✓		✓	✓

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

1) Completely deenergise device after error correction!

System error message				Possible settings/response • Lenze setting ✓ Setting possible						Available in		
No.	**Display**	**Source**	**Meaning**	Code	TRIP	Message	Warning	FAIL-QSP	Off	Drive PLC	Servo PLC	ECSxA
x122	CE11	FIF-CAN 1	FIF-CAN1_IN (monitoring time can be set with C2457/1)	C0591	✓		✓		•	✓		
		CAN-aux1	CANaux1_IN (monitoring time can be set with C2457/1)	C2481	✓		✓		•			✓
x123	CE12	FIF-CAN 2	FIF-CAN2_IN (monitoring time can be set with C2457/2)	C0592	✓		✓		•	✓		
		CAN-aux2	CANaux2_IN (monitoring time can be set with C2457/2)	C2482	✓		✓		•			✓
x124	CE13	FIF-CAN 3	FIF-CAN3_IN (monitoring time can be set with C2457/3)	C0593	✓		✓		•	✓		
		CAN-aux3	CANaux3_IN (monitoring time can be set with C2457/3)	C2483	✓		✓		•			✓
x125	CE14	FIF-CAN	BUS-OFF status of FIF-CAN (too many faulty telegrams received)	C0595	✓		✓		•	✓		
		CAN-aux	BUS-OFF state CAN AUX (too many faulty telegrams received)	C2484	✓		✓		•			✓
x126	CE15	CAN-aux	Communication error of gateway function (C0370, C0371) via CAN-AUX	C2485	✓		✓		•			✓
x190	nErr	MCTRL	Speed beyond tolerance margin (C0576)	C0579	✓	✓	✓	✓	•		✓	✓
x200	NMAX	MCTRL	Maximum speed exceeded (C0596)		•						✓	✓
x201	overrun Task1	Internal	Task with ID 2	[2]	•		✓	✓		✓	✓	✓
x202	overrun Task2		Task with ID 3									
x203	overrun Task3		Task with ID 4									
x204	overrun Task4		Task with ID 5									
x205	overrun Task5		Task with ID 6									
x206	overrun Task6		Task with ID 7									
x207	overrun Task7		Task with ID 8									
x208	overrun Task8		Task with ID 9									
x219	overrun Cycl.-T	Internal	Time-out in cyclic task (PLC_PRG, ID 1)	[2]	•		✓	✓		✓	✓	✓

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

[2] Can be set in DDS under **Project → Exception handling**

System error message				Possible settings/response • Lenze setting ✓ Setting possible						Available in		
No.	**Display**	**Source**	**Meaning**	Code	TRIP	Message	Warning	FAIL-QSP	Off	Drive PLC	Servo PLC	ECSxA
x209	float Sys-T	Internal	System task	[2]	•		✓	✓		✓	✓	✓
x210	float Cycl.-T		Cyclic task (PLC_PRG, ID 1)									
x211	float T Id2		Task with ID 2									
x212	float T Id3		Task with ID 3									
x213	float T Id4		Task with ID 4									
x214	float T Id5		Task with ID 5									
x215	float T Id6		Task with ID 6									
x216	float T Id7		Task with ID 7									
x217	float T Id8		Task with ID 8									
x218	float T Id9		Task with ID 9									
x220	NoT-FktCredit	Internal	Not enough technology units available in the PLC		•					✓	✓	✓
x230	No Program	Internal	No PLC program loaded		•					✓	✓	✓
x231	Unallowed Lib	Internal	In the PLC program a library function was called which is not supported		•					✓	✓	✓
x232	NoCamData	Internal	Motion profiles (cam data) are not available		•					✓	✓	✓
x240	ovrTransQueue	free CAN obj.	Overflow of transmit request memory	C0608	•	✓	✓	✓ [3]	✓	✓	✓	✓
x241	ovr Receive		Too many receive telegrams	C0609	•			✓			✓	✓
x250	2.Flash Err	Internal	Access not possible [1] (FLASH memory damaged or not available)		•						✓	
x251	AddData CsErr	Internal	Checksum error when loading data into the FLASH memory									
x252	AddData DlErr	Internal	Error when downloading data into the FLASH memory (e.g. time-out)									
x260	Err NodeGuard	Node Guarding	”Life guarding event”: The PLC as a CAN slave has not received any ”node guarding” telegram within the node lifetime of the CAN master.	C0384	•	✓	✓	✓ [3]	✓	✓	✓	✓

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

[1] Completely deenergise device after error correction!

[2] Can be set in DDS under **Project → Exception handling**

[3] Only for 9300 Servo PLC!

12.3.2 Causes and remedies



Tip!

When the fault messages are retrieved via the system bus (CAN) they are displayed as a number (see column “fault number –number” in the following 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 TRIP (axis module, fix 100 %)	Current overload of the axis module, e.g. by: ● frequent and too long acceleration processes ● continuous overload with $I_{motor} > 1.05 \times I_{Nx}$	Check drive dimensioning.
0016	OC6	I^2 x t overload TRIP (motor, C0120)	Current overload of the motor, e.g. due to: ● frequent or too long acceleration processes ● impermissible continuous current	● Check drive dimensioning. ● Check setting of C0120.
x017	OC7	I x t overload warning (axis module, C0123)	Current overload of the axis module > C0123 (e.g. due to frequent or too long acceleration phases)	● Check drive dimensioning. ● Check setting of C0123.
x018	OC8	I^2 x t overload warning (motor, C0127)	Current overload of the motor > C0127 (e.g. due to frequent or too long acceleration phases)	● Check drive dimensioning. ● Check setting of C0127.
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 DC bus	DC-bus voltage is lower than specified under C0174.	● Check mains voltage. ● Check power supply module.
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.
x041	AP1	Internal fault		Contact Lenze.
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
0051	OH1	Interior 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.
			Wrong mounting position	Change mounting position.
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.
x055	OH5	Interior temperature > C0124		• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0605 = 3).
			The value under C0124 is set too low.	Enter a higher value under C0124.
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x065	CE4	BUS-OFF state of system bus (CAN), interface X4	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X4: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C0595 = 3).
x066	CE5	System bus (CAN) time-out (communication error of gateway function), interface X4	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X4. • Check CAN bus configuration. • Switch off monitoring (C0603 = 3).
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
0074	PEr	Program error	Error in the program flow	• Check use of pointers. • Send module with PLC program and parameter set to Lenze (on floppy disk/CD-ROM).
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)!
0076	PR5	Memory error	Error saving parameters in the fail-safe memory area.	Contact Lenze
0079	PI	Fault during parameter initialisation	• An error has been detected during parameter set transfer between two controllers. • Parameter set does not match the controller, e.g. when data were transmitted from a controller with more performance to a controller with less performance.	• Correct parameter set. • Check code initialisation values. **After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!**
0080	PR6	**With ECSxS/P/M:** internal error		Contact Lenze.
		With ECSxA: too many user codes		Reduce number of user codes.
x082	Sd2	Resolver error at X7	Resolver cable is interrupted.	• Check cable for wire breakage. • Check resolver. • Switch off monitoring (C0586 = 3).
			Excitation amplitude is too low.	Increase excitation amplitude of resolver (C0416). Check control factor of resolver under C0414 (as of operating system V8.0).
x085	Sd5	Master current value encoder error at analog input X6/AI+, AI- (C0034 = 1)	Master current value at X6/AI+, AI- < 2mA	• Check cable for wire breakage. • Check master current value encoder. • Switch off monitoring (C0598 = 3). • Check control factor of resolver under C0414 (as of operating system V8.0).
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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. 🕮 138 **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	• Sd7 fault during rotor position adjustment with absolute value encoder after mains switching • Cancellation of rotor position adjustment (e.g. by C0095 = 0 or switching off)	1. Activate rotor position adjustment with C0095 = 1. 2. Carry out TRIP reset. 3. Repeat rotor position adjustment.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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).
x095	FAN1	Fan monitoring (for built-in units)	Heatsink fan is locked, dirty or defect.	Clean or exchange heatsink fan.
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.
x108	H08	”Extension board” error	”Extension board” not connected correctly.	• Connect ”extension board” correctly. • Check connector.
			”Extension board” is not supported by PLC program.	• Adapt PLC program to ”extension board”. • Use ”extension board” which is supported by PLC program.
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).
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux1_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/1, if necessary. • Switch off monitoring (C2481 = 3).
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux2_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/2, if necessary. • Switch off monitoring (C2482 = 3).
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux3_IN object receives faulty data or communication is interrupted.	• Check wiring on X14. • Check transmitter. • Increase monitoring time under C2457/3, if necessary. • Switch off monitoring (C2483 = 3).
x125	CE14	BUS-OFF state of system bus (CAN), interface X14	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X14: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C2484 = 3).
x126	CE15	Communication error of the gateway function via interface X14 (CAN-AUX) • C0371 = 1: Gateway channel X14 (CAN-AUX) • C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	• Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X14. • Check CAN bus configuration. • Switch off monitoring (C2485 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
1131	PRM	Parameters of the motor model are faulty	The parameters calculated from the entered rated motor data are outside the permissible value range.	Check and correct the set rated motor data (especially C0084, C0085, C0088, C0090).
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.
x191	HSF	Internal error		Contact Lenze.
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)		
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.
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.)

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x260	Err Node Guard	”Life guarding event”	The controller configured as CAN slave does not receive a ”Node Guarding” telegram within the ”Node Life Time” from the CAN master.	• Check wiring at X4. • Check CAN configuration. • Make sure that ”Node Guarding” has been activated in the CAN master. • Adapt ”Node Life Time” (C0382) to the setting in the CAN master.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

12.3.3 Reset fault messages (TRIP-RESET)

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.

13 System blocks

13.1 AIF_IO_Management (node number 161)

13.1.1 Inputs_AIF_Management

This SB serves to monitor the communication of a fieldbus module connected to the automation interface (AIF).

- In the event of an error, *AIF_bCe0CommErr_b* is set to TRUE and the communication error "CE0" (LECOM no. 61) is set. The response to this can be configured via C0126 (default setting: off).
- New AIF fielbus modules (e. g. 2133 and 2175) also use *AIF_bFieldBusStateBit0_b ... AIF_bFieldBusStateBit15_b* to transfer an error number from the fieldbus module.
- C2121 serves to display the status.

Please read the documentation for the connected fieldbus module.

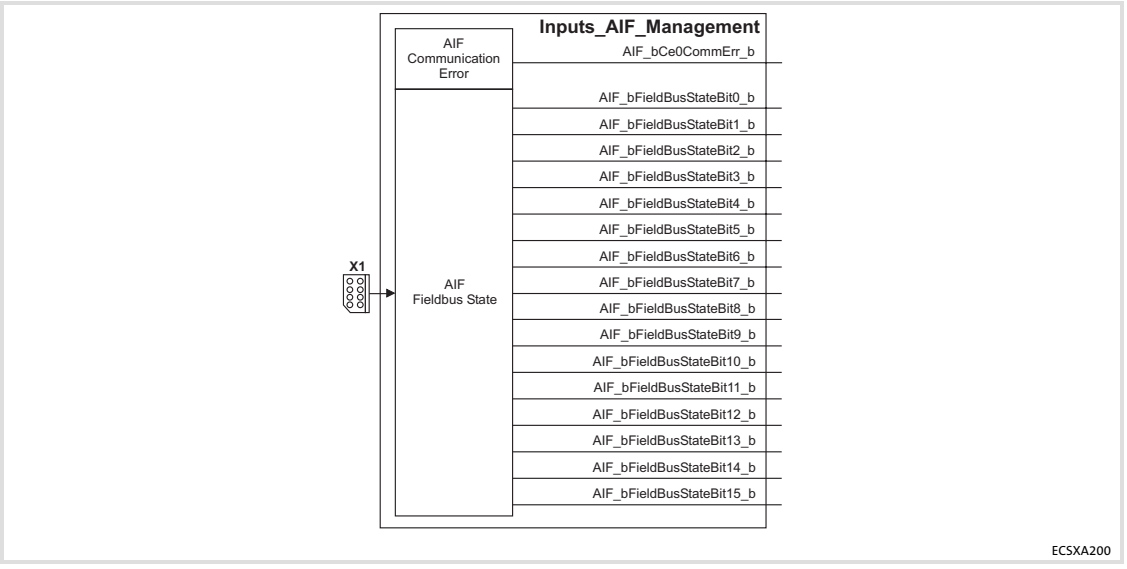


Fig. 13-1 System block "Inputs_AIF_Management"

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
AIF_bCe0CommErr_b	Bool	binary	%IX161.0.0	–	–	Communication error ”CE0”
AIF_bFieldBusStateBit0_b			%IX161.1.0	–	–	Error number – bit 0
AIF_bFieldBusStateBit1_b			%IX161.1.1	–	–	Error number – bit 1
AIF_bFieldBusStateBit2_b			%IX161.1.2	–	–	Error number – bit 2
AIF_bFieldBusStateBit3_b			%IX161.1.3	–	–	Error number – bit 3
AIF_bFieldBusStateBit4_b			%IX161.1.4	–	–	Error number – bit 4
AIF_bFieldBusStateBit5_b			%IX161.1.5	–	–	Error number – bit 5
AIF_bFieldBusStateBit6_b			%IX161.1.6	–	–	Error number – bit 6
AIF_bFieldBusStateBit7_b			%IX161.1.7	–	–	Error number – bit 7
AIF_bFieldBusStateBit8_b			%IX161.1.8	–	–	Error number – bit 8
AIF_bFieldBusStateBit9_b			%IX161.1.9	–	–	Error number – bit 9
AIF_bFieldBusStateBit10_b			%IX161.1.10	–	–	Error number – bit 10
AIF_bFieldBusStateBit11_b			%IX161.1.11	–	–	Error number – bit 11
AIF_bFieldBusStateBit12_b			%IX161.1.12	–	–	Error number – bit 12
AIF_bFieldBusStateBit13_b			%IX161.1.13	–	–	Error number – bit 13
AIF_bFieldBusStateBit14_b			%IX161.1.14	–	–	Error number – bit 14
AIF_bFieldBusStateBit15_b			%IX161.1.15	–	–	Error number – bit 15

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0126	MONIT CE0	3		Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	📖 255
			0 TRIP	A communication error activates the CE0 response set.	
			2 Warning		
			3 Off	Monitoring switched off.	
C2121	AIF:State			AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only	📖 195
			1 {1} 255	Binary interpretation reflects bit states.	
			Bit 0 XCAN1_IN monitoring time		
			Bit 1 XCAN2_IN monitoring time		
			Bit2 XCAN3_IN monitoring time		
			Bit3 XCAN bus off		
			Bit4 XCAN operational		
			Bit5 XCAN pre-operational		
			Bit 6 XCAN warning		
			Bit 7 Assigned internally		

13.1.2 Outputs_AIF_Management

This SB serves to transfer command and messages to a fieldbus module connected to an automation interface (AIF).

For this purpose, a control word is available via C2120. The commands are given as numbers. Some command numbers generally apply to all fieldbus modules, others only apply to single fieldbus modules. A total of 16 commands can be made available.

Please read the documentation for the connected fieldbus module.

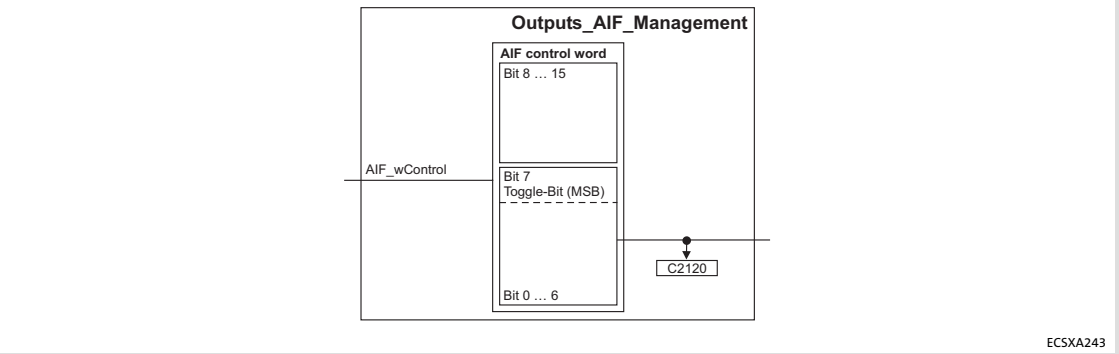


Fig. 13-2 System block "Outputs_AIF_Management"

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF_wControl	Word	–	%QX161.0	C2120	–	

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2120	AIF: Control	0		AIF-CAN: control word	📖 258
			0 {1} 255	Binary interpretation reflects bit states	
			0 No command	**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!	
			1 Read XCAN codes + reinitialisation		
			2 Read XCAN code		
			10 Read XCAN C2356/1 ... 4		
			11 Read XCAN C2357		
			12 Read XCAN C2375		
			13 Read XCAN C2376 ... C2378		
			14 Read XCAN C2382		
			255 Not assigned		

13.2 AIF1_IO_AutomationInterface (node number 41)

13.2.1 Inputs_AIF1

This SB is used as an interface for input signals (e.g. setpoints/actual values) to the attached fieldbus module (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.



Please read the documentation for the connected fieldbus module.

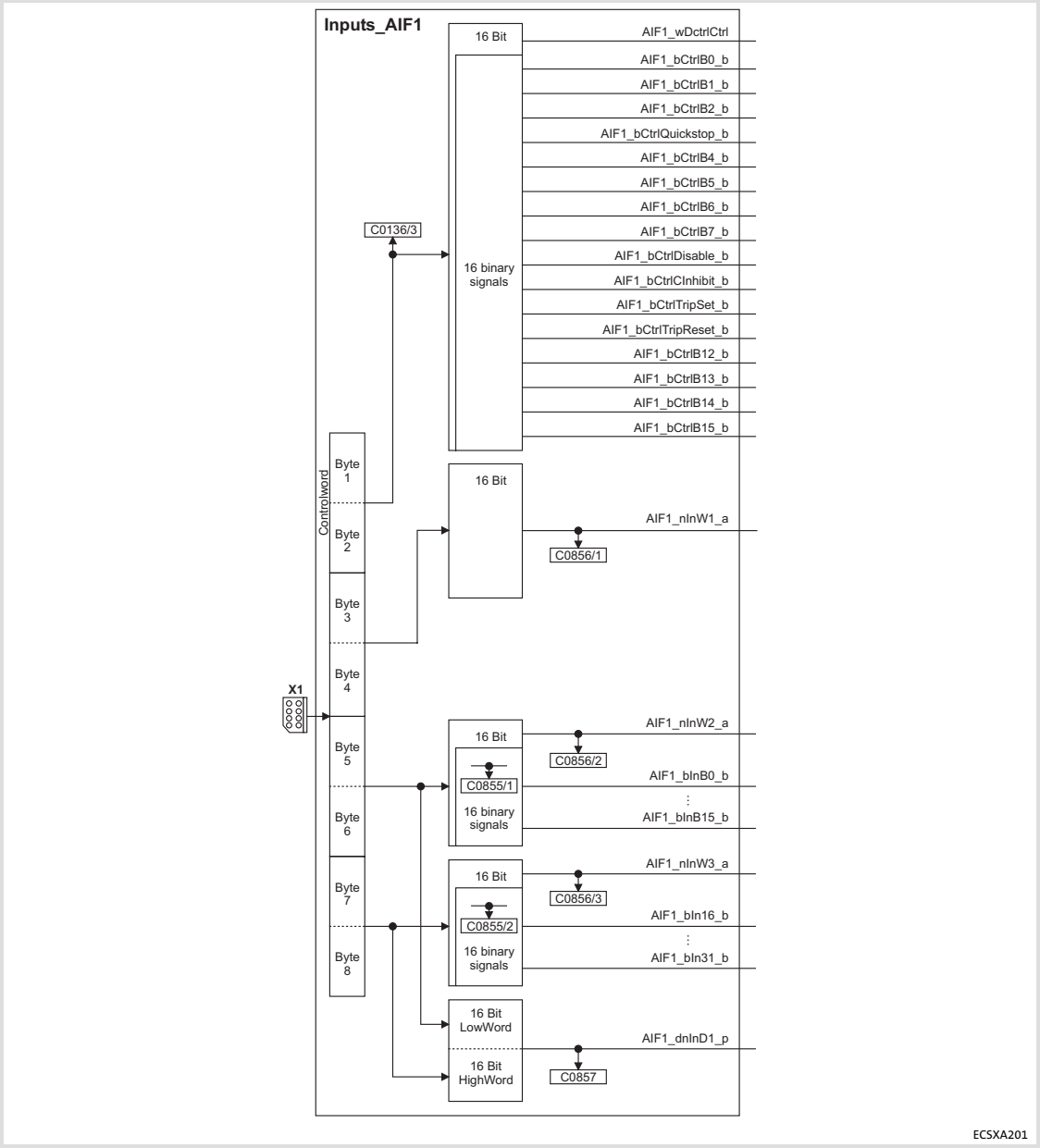


Fig. 13-3 System block ”Inputs_AIF1”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
AIF1_wDctrlCtrl	Word	–	%IW41.0	C0136/3	hex	
AIF1_bCtrlB0_b	BOOL	binary	%IX41.0.0	C0136/3	bin	
AIF1_bCtrlB1_b			%IX41.0.1			
AIF1_bCtrlB2_b			%IX41.0.2			
AIF1_bCtrlQuickstop_b			%IX41.0.3			
AIF1_bCtrlB4_b			%IX41.0.4			
AIF1_bCtrlB5_b			%IX41.0.5			
AIF1_bCtrlB6_b			%IX41.0.6			
AIF1_bCtrlB7_b			%IX41.0.7			
AIF1_bCtrlDisable_b			%IX41.0.8			
AIF1_bCtrlCInhibit_b			%IX41.0.9			
AIF1_bCtrlTripSet_b			%IX41.0.10			
AIF1_bCtrlTripReset_b			%IX41.0.11			
AIF1_bCtrlB12_b			%IX41.0.12			
AIF1_bCtrlB13_b			%IX41.0.13			
AIF1_bCtrlB14_b			%IX41.0.14			
AIF1_bCtrlB15_b			%IX41.0.15			
AIF1_nInW1_a	integer	analog	%IW41.1	C0856/1	dec [%]	
AIF1_nInW2_a			%IW41.2	C0856/2		
AIF1_nInW3_a			%IW41.3	C0856/3		
AIF1_bInB0_b ... AIF1_bInB15_b	BOOL	binary	%IX41.2.0 ... %IX41.2.15	C0855/1	hex	
AIF1_bInB16_b ... AIF1_bInB31_b			%IX41.3.0 ... %IX41.3.15	C0855/2		
AIF1_dnInD1_p	double integer	position	%ID41.1	C0857	dec [inc]	

User data

The 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they can thus be evaluated by the PLC program as:

- binary information (1 bit)
- control word/quasi-analog value (16 bit)
- angle information (32 bit)

<table>
<tr><th>Byte</th><th>Variable (1 bit)</th><th>Variable (16 bit)</th><th>Variable (32 bit)</th></tr>
<tr><td>1, 2</td><td>AIF1_bCtrlB0_b
AIF1_bCtrlB1_b
AIF1_bCtrlB2_b
AIF1_bCtrlQuickstop_b
AIF1_bCtrlB4_b
...
AIF1_bCtrlB7_b
AIF1_bCtrlDisable_b
AIF1_bCtrlCInhibit_b
AIF1_bCtrlTripSet_b
AIF1_bCtrlTripReset_b
AIF1_bCtrlB12_b
...
AIF1_bCtrlB15_b</td><td>AIF1_wDctrlCtrl</td><td></td></tr>
<tr><td></td><td colspan="3">The quick stop (QSP), DISABLE, CINH, TRIP-SET and TRIP-RESET functions can be controlled via the following variables (control signals):
● AIF1_bCtrlQuickstop_b
● AIF1_bCtrlDisable_b
● AIF1_bCtrlCInhibit_b
● AIF1_bCtrlTripSet_b
● AIF1_bCtrlTripReset_b
The remaining 11 bits (AIF1_bCtrlB..._b) can be used to control other functions/function blocks.</td></tr>
<tr><td>3, 4</td><td></td><td>AIF1_nInW1_a</td><td></td></tr>
<tr><td>5, 6</td><td>AIF1_bInB0_b
...
AIF1_bInB15_b</td><td>AIF1_nInW2_a</td><td rowspan="2">AIF1_dnInD1_p</td></tr>
<tr><td>7, 8</td><td>AIF1_bInB16_b
...
AIF1_bInB31_b</td><td>AIF1_nInW3_a</td></tr>
</table>

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	259
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	259
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	259
			-2147483648	{1}	2147483647		

13.2.2 Outputs_AIF1

This SB is used as an interface for output signals (e.g. setpoints/actual values) to attached fieldbus modules (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.

Please read the documentation for the connected fieldbus module.

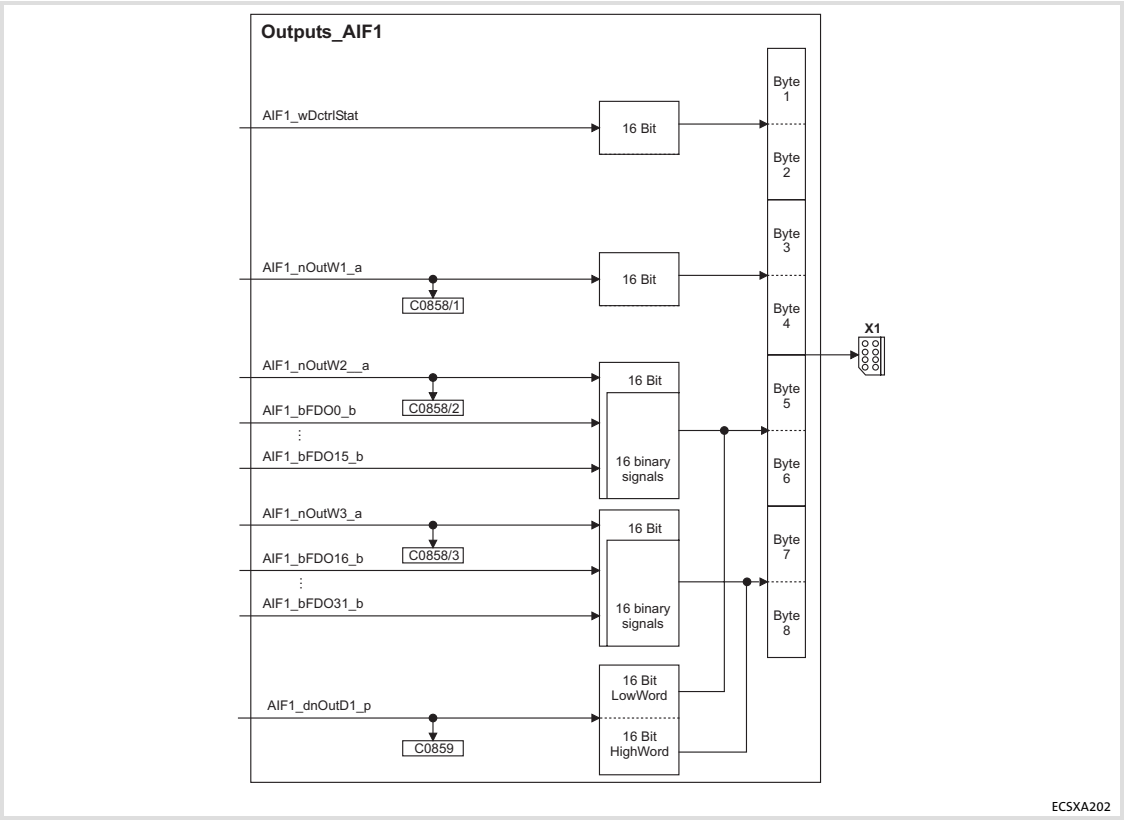


Fig. 13-4 System block "Outputs_AIF1"

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF1_wDctrlStat	Word	–	%QW41.0	–	–	
AIF1_nOutW1_a	Integer	analog	%QW41.1	C0858/1	dec [%]	
AIF1_nOutW2_a			%QW41.2	C0858/2		
AIF1_nOutW3_a			%QW41.3	C0858/3		
AIF1_bFDO0_b ... AIF1_bFDO15_b	BOOL	binary	%QX41.2.0 ... %QX41.2.15	–	hex	
AIF1_bFDO16_b ... AIF1_bFDO31_b			%QX41.3.0 ... %QX41.3.15			
AIF1_dnOutD1_p	Double integer	position	%QD41.1	C0859	dec [inc]	

User data

The 8 bytes of user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

Thus, bytes 5 and 6 should only be overwritten by

- variable *AIF1_dnOutD1_p*,
- variable *AIF1_nOutW2_a* or
- variables *AIF1_bFDO0_b ... AIF1_bFDO15_b*.

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2		AIF1_wDctrlStat	
	Byte 1/2 can be used for transferring the status word from the SB **DCTRL_DriveControl** to the field bus module. ● For this purpose, connect variable *DCTRL_wStat* of the SB **DCTRL_DriveControl** to variable *AIF1_wDctrlStat*. ● In addition to signals such as IMP and CINH the SB status word **DCTRL_DriveControl** contains some freely assignable signals which can be overwritten via the variables *DCTRL_bStateB..._b* of the SB **DCTRL_DriveControl**.		
3, 4		AIF1_nOutW1_a	
5, 6	AIF1_bFDO0_b ... AIF1_bFDO15_b	AIF1_nOutW2_a	AIF1_dnOutD1_p
7, 8	AIF1_bFDO16_b ... AIF1_bFDO31_b	AIF1_nOutW3_a	

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	📖 264
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	📖 264
			-2147483648	{1}	2147483647		

13.3 AIF2_IO_AutomationInterface (node number 42)

13.3.1 Inputs_AIF2

This SB is used as an interface for input signals (e.g. setpoints/actual values) to the attached fieldbus module (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.

Please read the documentation for the connected fieldbus module.

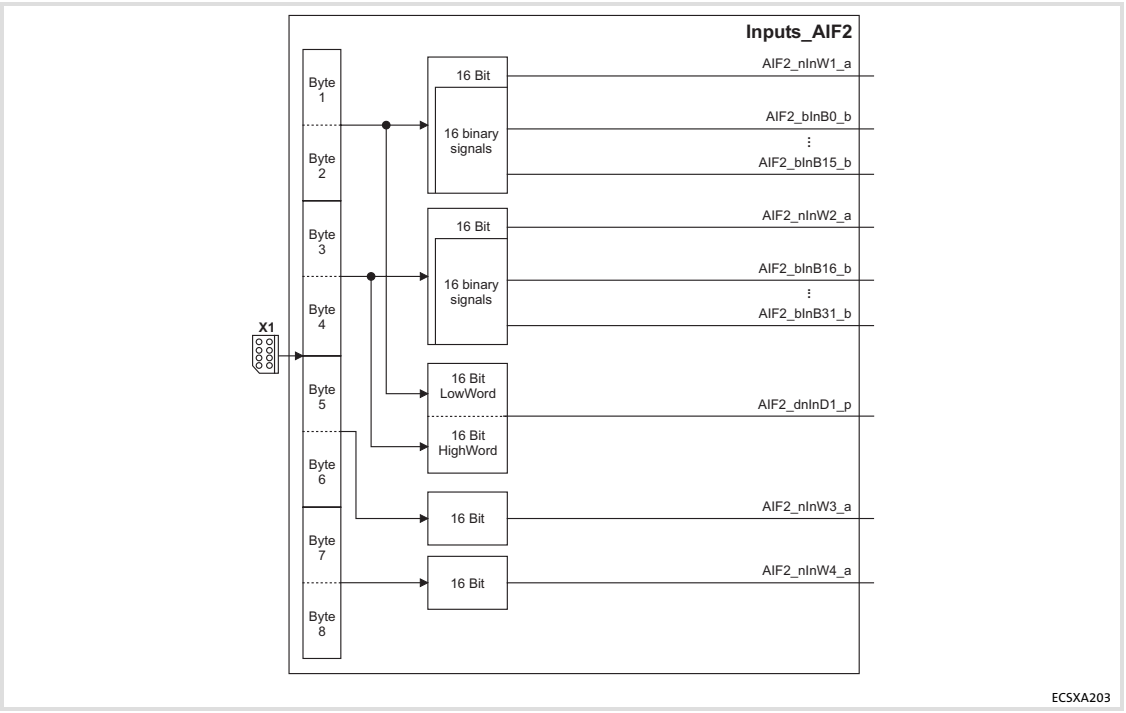


Fig. 13-5 System block ”Inputs_AIF2”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF2_nInW1_a	Integer	analog	%IW42.0	–	–	
AIF2_nInW2_a			%IW42.1			
AIF2_nInW3_a			%IW42.2			
AIF2_nInW4_a			%IW42.3			
AIF2_bInB0_b ... AIF2_bInB15_b	Bool	binary	%IX42.0.0 ... %IX42.0.15	–	–	
AIF2_bInB16_b ... AIF2_bInB31_b			%IX42.1.0 ... %IX42.1.15			
AIF2_dnInD1_p	Double Integer	position	%ID42.0	–	–	

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	AIF2_bInB0_b ... AIF2_bInB15_b	AIF2_nInW1_a	AIF2_dnInD1_p
3, 4	AIF2_bInB16_b ... AIF2_bInB31_b	AIF2_nInW2_a	
5, 6		AIF2_nInW3_a	
7, 8		AIF2_nInW4_a	

13.3.2 Outputs_AIF2

This SB is used as an interface for output signals (e.g. setpoints/actual values) to attached fieldbus modules (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.

Please read the documentation for the connected fieldbus module.

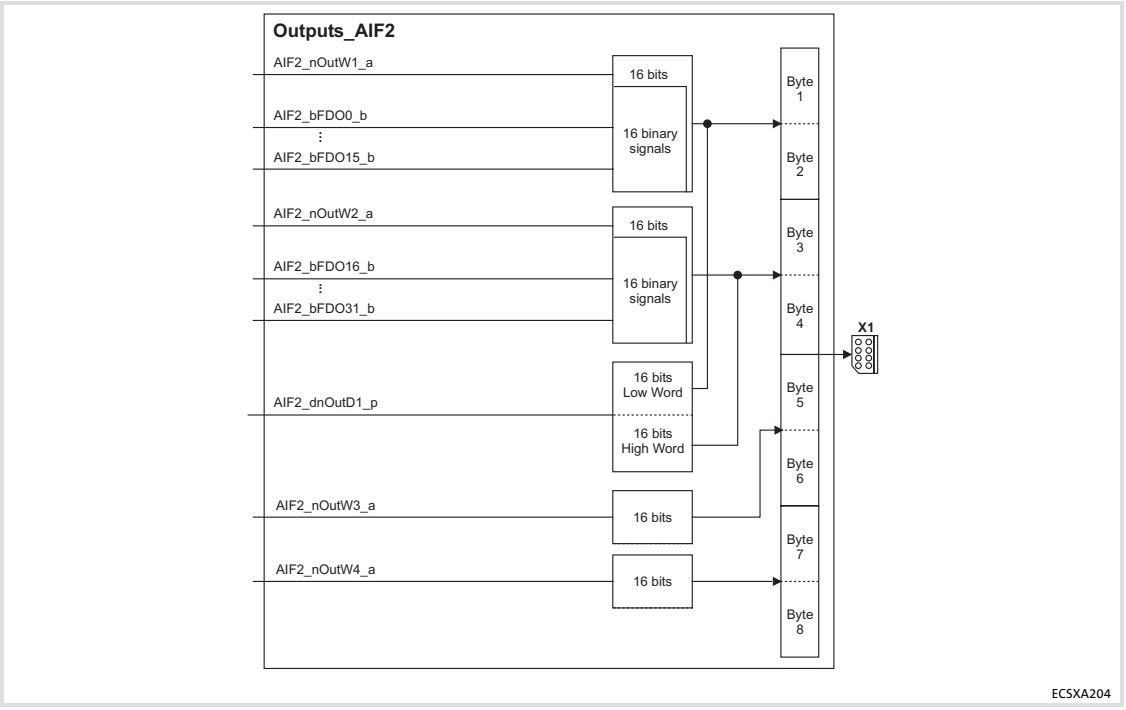


Fig. 13-6 System block "Outputs_AIF2"

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF2_nOutW1_a	Integer	analog	%QW42.0	–	–	
AIF2_nOutW2_a			%QW42.1			
AIF2_nOutW3_a			%QW42.2			
AIF2_nOutW4_a			%QW42.3			
AIF2_bFDO0_b ... AIF2_bFDO15_b	Bool	binary	%QX42.0.0 ... %QX42.0.15	–	–	
AIF2_bFDO16_b ... AIF2_bFDO31_b			%QX42.1.0 ... %QX42.1.15			
AIF2_dnOutD1_p	Double Integer	position	%QD42.0	–	–	

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

Thus, bytes 1 and 2 should only be overwritten by

- variable *AIF2_dnOutD1_p*,
- variable *AIF2_nOutW1_a* or
- variables *AIF2_bFDO0_b ... AIF2_bFDO15_b*.

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	AIF2_bFDO0_b ... AIF2_bFDO15_b	AIF2_nOutW1_a	AIF2_dnOutD1_p
3, 4	AIF2_bFDO16_b ... AIF2_bFDO31_b	AIF2_nOutW2_a	
5, 6		AIF2_nOutW3_a	
7, 8		AIF2_nOutW4_a	

13.4 AIF3_IO_AutomationInterface (node number 43)

13.4.1 Inputs_AIF3

This SB is used as an interface for input signals (e.g. setpoints/actual values) to the attached fieldbus module (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.

Please read the documentation for the connected fieldbus module.

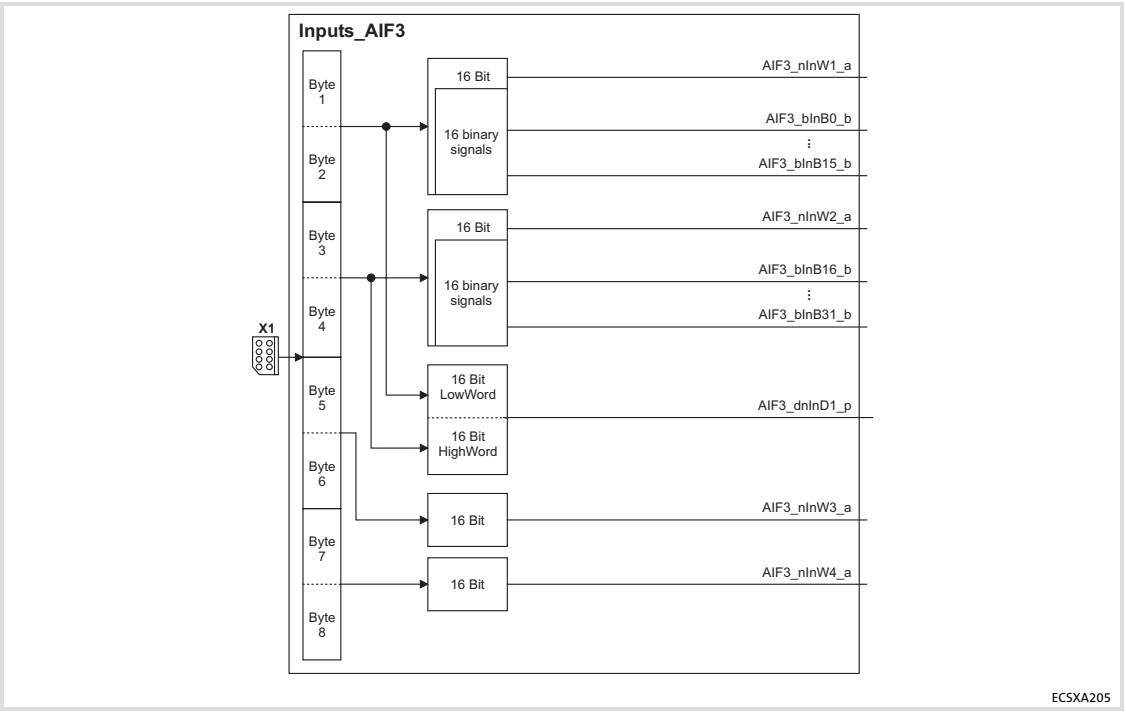


Fig. 13-7 System block ”Inputs_AIF3”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF3_nInW1_a	Integer	analog	%IW43.0	–	–	
AIF3_nInW2_a			%IW43.1			
AIF3_nInW3_a			%IW43.2			
AIF3_nInW4_a			%IW43.3			
AIF3_bInB0_b ... AIF3_bInB15_b	Bool	binary	%IX43.0.0 ... %IX43.0.15	–	–	
AIF3_bInB16_b ... AIF3_bInB31_b			%IX43.1.0 ... %IX43.1.15			
AIF3_dnInD1_p	Double Integer	position	%ID43.0	–	–	

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	AIF3_bInB0_b ... AIF3_bInB15_b	AIF3_nInW1_a	AIF3_dnInD1_p
3, 4	AIF3_bInB16_b ... AIF3_bInB31_b	AIF3_nInW2_a	
5, 6		AIF3_nInW3_a	
7, 8		AIF3_nInW4_a	

13.4.2 Outputs_AIF3

This SB is used as an interface for output signals (e.g. setpoints/actual values) to attached fieldbus modules (e.g. INTERBUS, PROFIBUS-DP).

The process image is

- created in the cyclic task by means of a fixed set time interval of 10 ms.
- created in an interval task within the time set for this task.
- read at the beginning of the task and written at its end.

Please read the documentation for the connected fieldbus module.

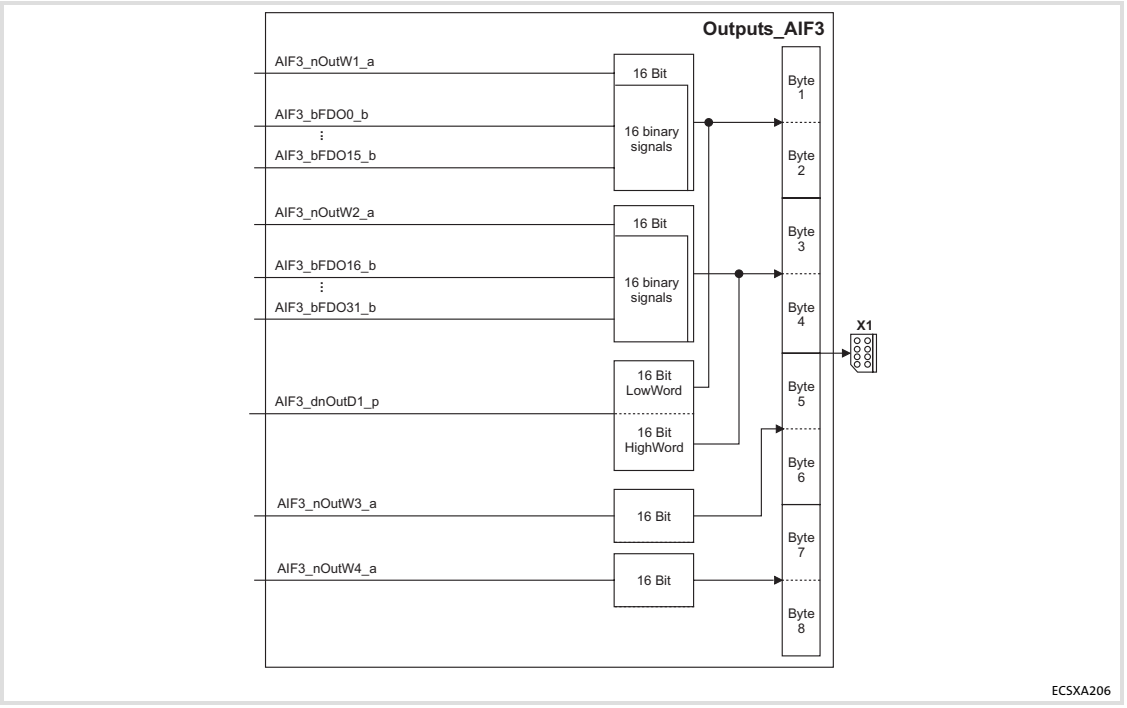


Fig. 13-8 System block "Outputs_AIF3"

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
AIF3_nOutW1_a	Integer	analog	%QW43.0	–	–	
AIF3_nOutW2_a			%QW43.1			
AIF3_nOutW3_a			%QW43.2			
AIF3_nOutW4_a			%QW43.3			
AIF3_bFDO0_b ... AIF3_bFDO15_b	BOOL	binary	%QX43.0.0 ... %QX43.0.15	–	–	
AIF3_bFDO16_b ... AIF3_bFDO31_b			%QX43.1.0 ... %QX43.1.15			
AIF3_dnOutD1_p	Double integer	position	%QD43.0	–	–	

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

Thus, bytes 1 and 2 should only be overwritten by

- variable *AIF3_dnOutD1_p*,
- variable *AIF3_nOutW1_a* or
- variables *AIF3_bFDO0_b ... AIF3_bFDO15_b*.

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	AIF3_bFDO0_b ... AIF3_bFDO15_b	AIF3_nOutW1_a	AIF3_dnOutD1_p
3, 4	AIF3_bFDO16_b ... AIF3_bFDO31_b	AIF3_nOutW2_a	
5, 6		AIF3_nOutW3_a	
7, 8		AIF3_nOutW4_a	

13.5 ANALOG1_IO (node number 11)

13.5.1 Inputs_ANALOG1 (analog input)

This SB represents the interface for analog differential signals via terminal X6/AI+, AI- as a setpoint input or an actual value input.

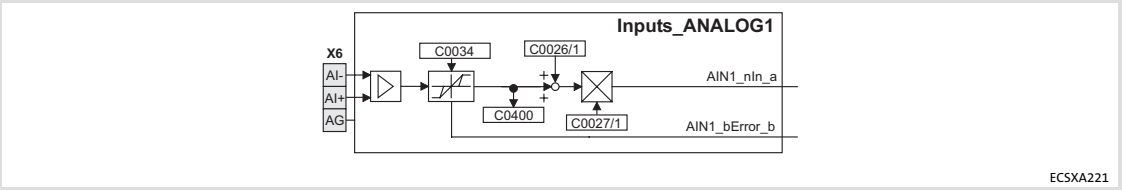


Fig. 13-9 System block "Inputs_ANALOG1"

Analog input configuration

► Use C0034 to set whether the input is to be used for a master voltage (±10 V) or a master current (+4 ... 20 mA or ±20 mA).

► Set jumper bar X3 according to the setting in C0034:

Stop!

Do not plug the jumper on the pins 3-4! The axis module cannot be initialised like this.

Jumper bar X3	Setting	Measuring range
5 6 3 4 1 2	5-6 open Jumper on 1-2: Parking position	**C0034 = 0 (master voltage)** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡ ±16384 ≡ ±100 %
5 6 3 4 1 2	5-6 closed	**C0034 = 1 (master current)** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: +4 mA ≡ 0 ≡ 0 % +20 mA ≡ 16384 ≡ 100 %
		C0034 = 2 (master current) ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡ ±16384 ≡ ±100 %

Use as master current input

► Master current < 2 mA:
– Variable *AIN1_bError_b* = TRUE
– An error handling can be set via C0598.

► Master current >= 2 mA:
– Variable *AIN1_bError_b* = FALSE

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
AIN1_nIn_a	integer	analog	%IW11.0	C0400	dec [%]	Analog input 1
AIN1_bError_b	BOOL	binary	%IX11.1.0	–	–	Only when C0034 = 1: TRUE, if |I| < 2 mA

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0026						Offset for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a	
2	FCODE(offset)	0,0				FCODE_nC26_2_a	
C0027						Gain for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	📖 275
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0400	DIS: AnalogIn					Signal at the analog input Read only	
			-199.99	{0.01 %}	199.99		
C0598	MONIT SD5	3				Fault response - master current monitoring at X6 < 2 mA "MastISourceDef"	📖 275
			0	TRIP			
			2	Warning			
			3	Off			

13.6 CAN_Management (node number 101)

This SB

- serves to activate a **reset node** to e.g. accept changes in the transfer rate and addressing.
- serves to process statuses as **Communication Error**, **Bus Off State**, etc. in the PLC program.
- the instant of transmission of CAN2_Out and CAN3_Out can be influenced.
- serves to monitor the system bus communication.

Note!

- The process image for this SB is created in the course of a fixed system task (interval: 1 ms).
- Even if this SB has not been assigned to the control configuration, a reset node can be carried out via C0358.

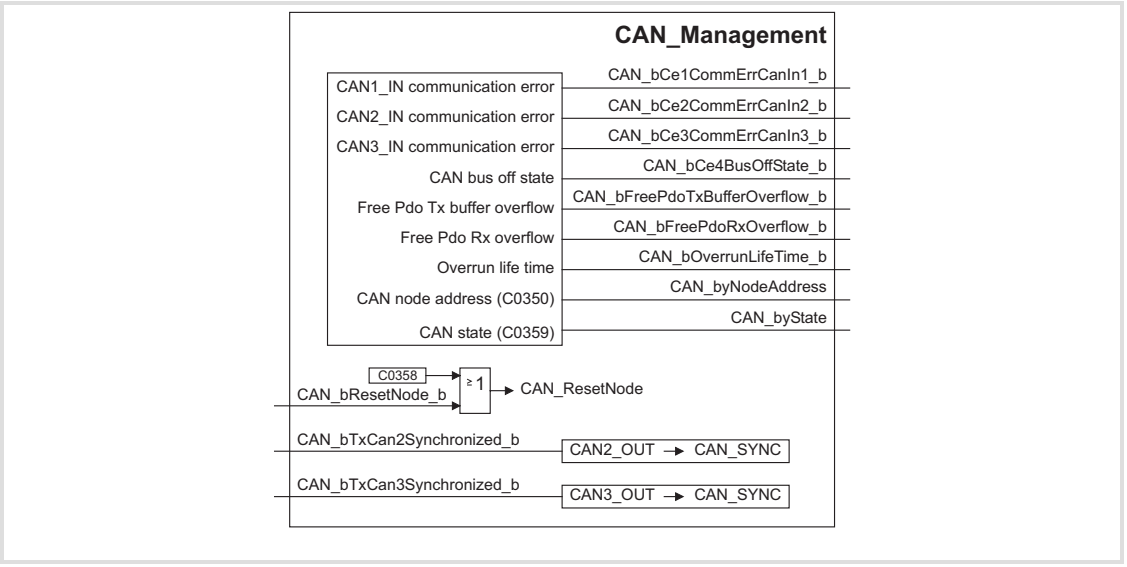


Fig. 13-10 System block "CAN_Management"

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 440).

13.6.1 Inputs_CAN_Management

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN_bCe1CommErrCanIn1_b	BOOL	binary	%IX101.0.0	–	–	CAN1_IN communication error
CAN_bCe2CommErrCanIn1_b			%IX101.0.1			CAN2_IN communication error
CAN_bCe3CommErrCanIn1_b			%IX101.0.2			CAN3_IN communication error
CAN_bCe4BusOffState_b			%IX101.0.3			CAN bus "Off State" detected (CAN bus interface X4)
CAN_bFreePdoTxBufferOverflow_b			%IX101.0.4			Overflow of transmit request memory
CAN_bFreePdoRxOverflow_b			%IX101.0.5			Overflow of receipt memory
CAN_bOverrunLifeTime_b			%IX101.0.6			"Node Life Time" exceeded
CAN_byNodeAddress	Byte	–	%IB101.2	C0350	–	Node address (CAN bus interface X4)
CAN_byState			%IB101.3	C0359	–	CAN bus status (CAN bus interface X4)

13.6.2 Outputs_CAN_Management

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN_bResetNode_b	BOOL	binary	%QX101.0.0	–	–	Carry out reset node (CAN bus interface X4)
CAN_bTxCan2Synchronized_b			%QX101.0.1			Transmit CAN2_OUT with Sync telegram.
CAN_bTxCan3Synchronized_b			%QX101.0.2			Transmit CAN3_OUT with sync telegram.

13.6.3 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 156)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 458)
  – Individual addressing (📖 160)
- Change of the master/slave boot up configuration (📖 162)

Reset node can be activated by:

- switching on the low-voltage supply
- the bus system (via the network management (NMT))
- C0358 = 1 using the XTkeypad
- *CAN_bResetNode_b* = TRUE

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again.

13.6.4 Define instant of transmission for CAN2_OUT/CAN3_OUT

CAN_bTxCan2Synchonized_b and *CAN_bTxCan3Synchonized_b* serve to define the instant of transmission for the CAN objects CAN2_OUT and CAN3_OUT:

- **FALSE**: data from CAN2_OUT/CAN3_OUT is sent at the end of the process image.
- **TRUE**: Data from CAN2_OUT/CAN3_OUT is sent after the CAN synchronisation.
  – The identifiers for sync transmission and reception telegrams can be set via C0367/C0368.
  – The *sync Tx time* can be set via C0369.

Tip!

Detailed information on CAN synchronisation and configuration via codes can be found in the chapter 8.6 ”Axis synchronisation (CAN synchronisation)” (📖 166).

13.6.5 Status messages

The SB **CAN_Management** provides different status messages which can be processed in the PLC program:

Identifiers	Information	
CAN_bCe1CommErrCanIn1_b	TRUE	CAN1_IN communication error
CAN_bCe2CommErrCanIn1_b	TRUE	CAN2_IN communication error
CAN_bCe3CommErrCanIn1_b	TRUE	CAN3_IN communication error
CAN_bCe4BusOffState_b	TRUE	CAN bus ”Off State” detected (CAN bus interface X4)
CAN_bFreePdoTxBufferOverflow_b	Free CAN objects	
	TRUE	Overflow of the transmit request memory
CAN_bFreePdoRxOverflow_b	Free CAN objects	
	TRUE	Overflow of the receipt memory
CAN_bOverrunLifeTime_b	CAN monitoring mechanism ”Node Guarding”	
	TRUE	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.
CAN_byNodeAddress	1 ... 63	Node address (CAN bus interface X4)
CAN_byState	CAN bus operating status (CAN bus interface X4)	
	1	Operational
	2	Pre-Operational
	3	Warning
	4	Bus off

13.7 CAN_Synchronization (node number 102)

Tip!

Detailed information on CAN synchronisation and configuration via codes can be found in the chapter 8.6 ”Axis synchronisation (CAN synchronisation)” ((📖 166)).

This SB serves to synchronise the internal time base of the controller with the instant of reception of the sync telegram or a terminal signal. Thereby the start of cyclic and time-controlled internal processes of all controllers involved in the synchronisation (e.g. data transfer from tasks to the DCTRL function block) is effected synchronously.

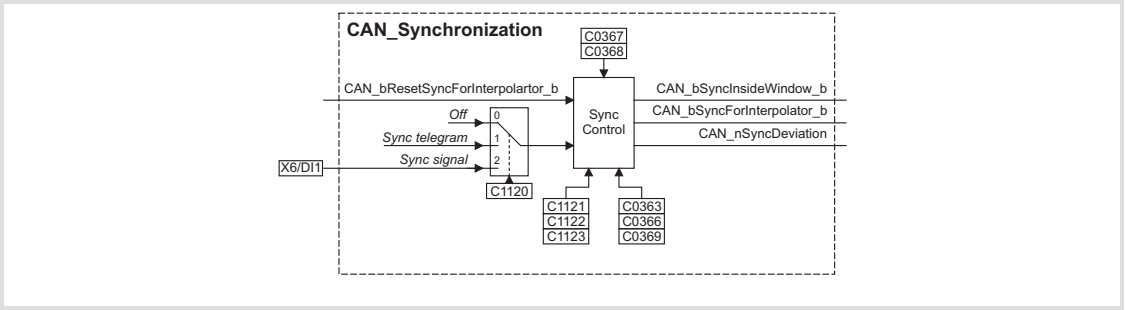


Fig. 13-11 System block ”CAN_Synchronization”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN_bSyncInsideWindow_b	BOOL	binary	%IX102.0.0	–	–	TRUE: Sync telegram/signal within the time slot (C1123) FALSE: ● Quit synchronicity ● no sync telegram/signal ● Time slot (C1123) too small
CAN_bSyncForInterpolator_b	BOOL	binary	%IX102.0.1	–	–	TRUE: Sync telegram/signal detected
CAN_nSyncDeviation	integer		%IX102.1	–	–	current sync deviation
CAN_bResetSyncForInterpolator_b	BOOL	binary	%QX102.0.0	–	–	TRUE: Reset CAN_bSyncForInterpolator_b

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1				CAN sync correction increment	📖 167
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0366	Sync Response	1				CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 169
			0	No response			
			1	Response			
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 168
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 442 📖 166
			1	{1}	256		
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 167
			0	{1 ms}	65000	0 = switched off	
C1120	Sync mode	0				Sync signal source	📖 166
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	📖 170
			2	Terminal sync		Sync connection via terminal X6/DI1	📖 171
C1121	Sync cycle	2				Synchronisation cycle	📖 166
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	📖 167
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window	📖 169
			0.000	{0.001 ms}	6.500		

13.8 CAN1_IO (node number 31)

This SB serves to transmit cyclic process data via the CAN bus interface X4.

A sync telegram which must be generated from **another** node is required for transmission.

- ► The transmission mode (event or time-controlled) is set via C0356.
- ► The monitoring time is set via C0357 (Lenze setting: 3000 ms).

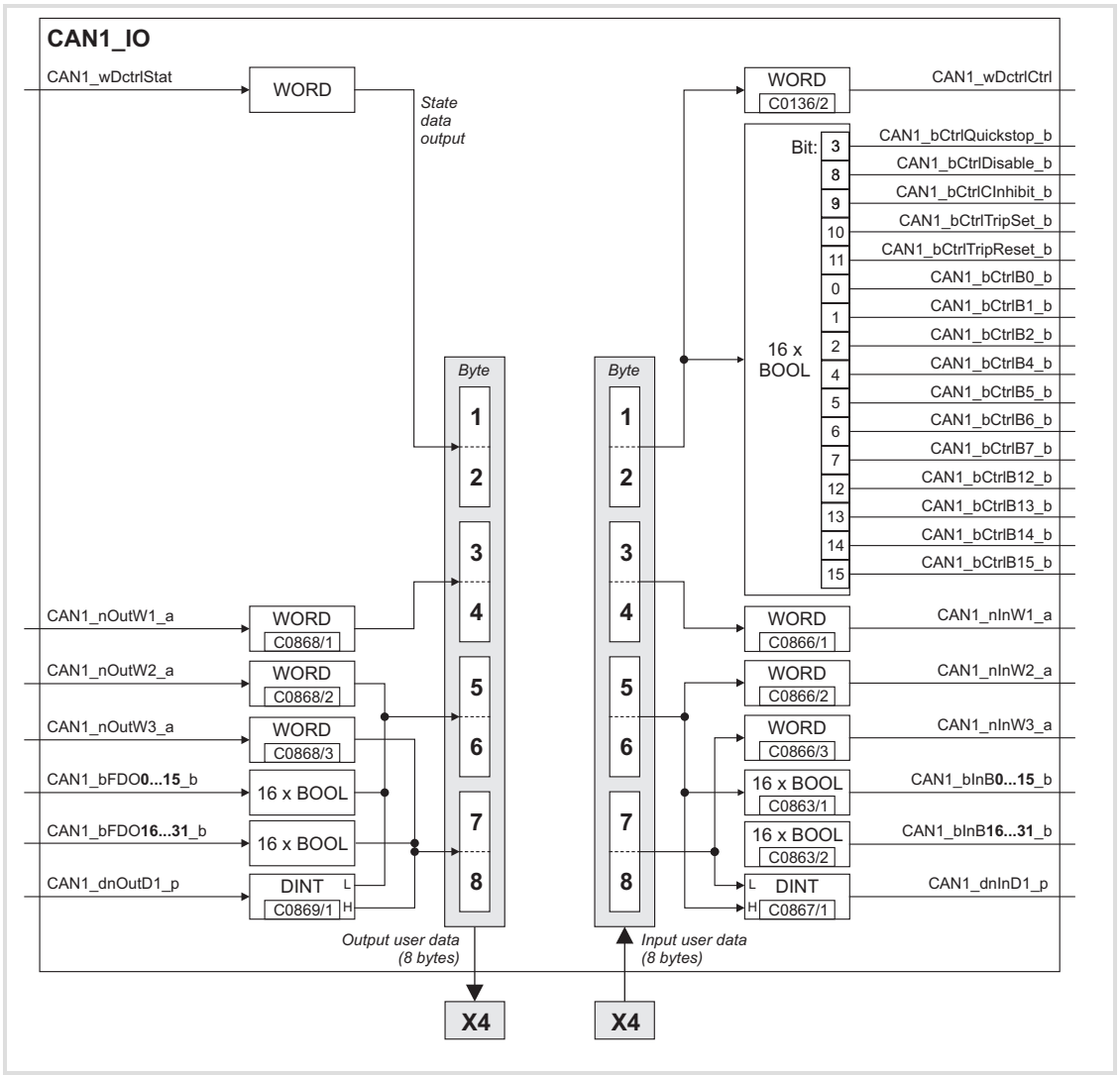


Fig. 13-12 System block "CAN1_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0356						CAN time settings for CAN bus interface X4	📖 163
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0863						Digital process data input words for CAN bus interface X4	📖 446
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 446
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1	
2	CAN OUT words					CAN1_OUT word 2	
3	CAN OUT words					CAN1_OUT word 3	
4	CAN OUT words					CAN2_OUT word 1	
5	CAN OUT words					CAN2_OUT word 2	
6	CAN OUT words					CAN2_OUT word 3	
7	CAN OUT words					CAN2_OUT word 4	
8	CAN OUT words					CAN3_OUT word 1	
9	CAN OUT words					CAN3_OUT word 2	
10	CAN OUT words					CAN3_OUT word 3	
11	CAN OUT words					CAN3_OUT word 4	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0869						32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647	CAN1_OUT
2	CAN OUT phi					CAN2_OUT
3	CAN OUT phi					CAN3_OUT

13.8.1 Inputs_CAN1

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN1_wDctrlCtrl	Integer	analog	%IW31.0	C0136/2	dec [%]	
CAN1_bInB0_b ... CAN1_bInB15_b	Bool	binary	%IX31.2.0 ... %IX31.2.15	C0863/1	hex	Display code for binary signals of CAN1_nInW1_a
CAN1_nInW1_a	Integer	analog	%IW31.1	C0866/1	dec [%]	
CAN1_bInB16_b ... CAN1_bInB31_b	Bool	binary	%IX31.3.0 ... %IX31.3.15	C0863/2	hex	Display code for binary signals of CAN1_nInW2_a
CAN1_nInW2_a	Integer	analog	%IW31.2	C0866/2	dec [%]	
CAN1_nInW3_a	Integer	analog	%IW31.3	C0866/3	dec [%]	
CAN1_dnInD1_p	Double integer	position	%ID31.1	C0867/1	dec [inc]	

User data

The 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they can thus be evaluated by the PLC program as:

- binary information (1 bit)
- control word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CAN1_bCtrlB0_b CAN1_bCtrlB1_b CAN1_bCtrlB2_b CAN1_bCtrlQuickstop_b CAN1_bCtrlB4_b CAN1_bCtrlB5_b CAN1_bCtrlB6_b CAN1_bCtrlB7_b CAN1_bCtrlDisable_b CAN1_bCtrlCInhibit_b CAN1_bCtrlTripSet_b CAN1_bCtrlTripReset_b CAN1_bCtrlB12_b CAN1_bCtrlB13_b CAN1_bCtrlB14_b CAN1_bCtrlB15_b	CAN1_wDctrlCtrl	
3, 4		CAN1_nInW1_a	
5, 6	CAN1_bInB0_b ... CAN1_bInB15_b	CAN1_nInW2_a	CAN1_dnInD1_p
7, 8	CAN1_bInB16_b ... CAN1_bInB31_b	CAN1_nInW3_a	

13.8.2 Outputs_CAN1

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN1_wDctrlStat	Integer	analog	%QW31.0	–	–	
CAN1_bFDO0_b ... CAN1_bFDO15_b	Bool	binary	%QX31.2.0 ... %QX31.2.15	–	hex	
CAN1_nOutW1_a	Integer	analog	%QW31.1	C0868/1	dec [%]	
CAN1_bFDO16_b ... CAN1_bFDO31_b	Bool	binary	%QX31.3.0 ... %QX31.3.15	–	hex	
CAN1_nOutW2_a	Integer	analog	%QW31.2	C0868/2	dec [%]	
CAN1_nOutW3_a	Integer	analog	%QW31.3	C0868/3	dec [%]	
CAN1_dnOutD1_p	Double integer	position	%QD31.1	C0869/1	dec [inc]	

User data

The 8 bytes of user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2		CAN1_wDctrlStat	
3, 4		CAN1_nOutW1_a	
5, 6	CAN1_bFDO0_b ... CAN1_bFDO15_b	CAN1_nOutW2_a	CAN1_dnOutD1_p
7, 8	CAN1_bFDO16_b ... CAN1_bFDO31_b	CAN1_nOutW3_a	

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

E.g., for overwriting bytes 5 and 6, either only use the variable *CAN1_dnOutD1_p*, only the variable *CAN1_nOutW2_a* or only the variables *CAN1_bFDO0_b* ... *CAN1_bFDO15_b*!

13.9 CAN2_IO (node number 32)

This SB serves to transmit event or time-controlled process data via the CAN bus interface X14.

A sync telegram is not required.

- ► The transmission mode (event or time-controlled) is set via C0356.
- ► The monitoring time is set via C0357 (Lenze setting: 3000 ms).

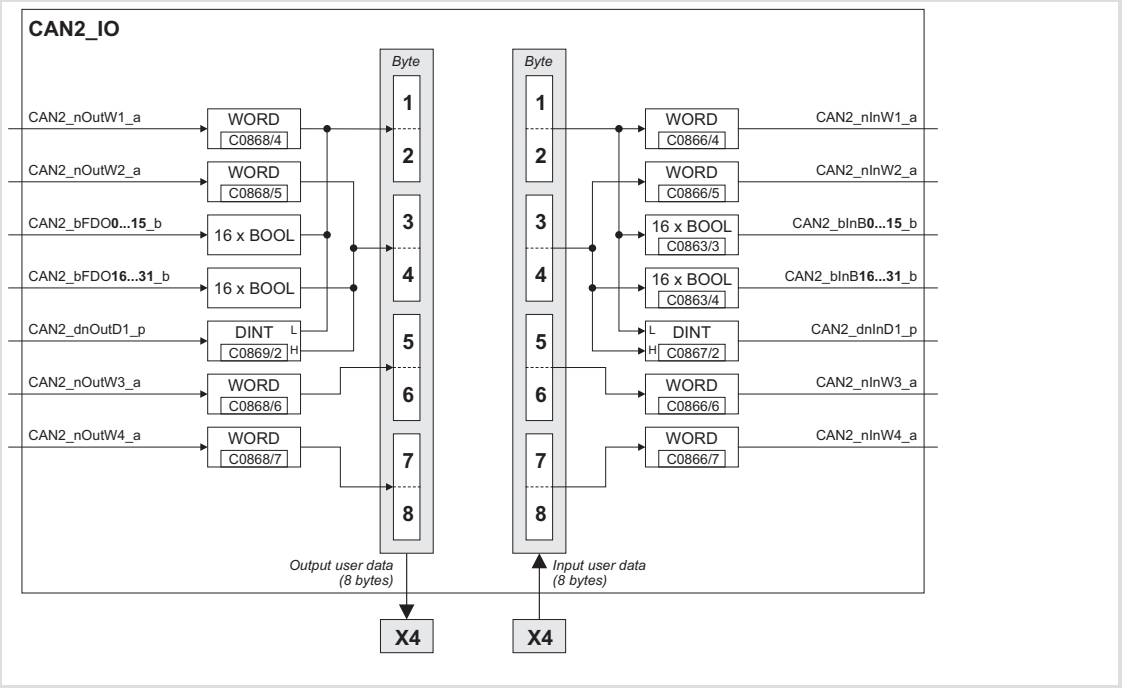


Fig. 13-13 System block "CAN2_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 163
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0863						Digital process data input words for CAN bus interface X4	📖 446
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 446
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0867						32-bit phase information for CAN bus interface X4 Read only
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN
2	CAN IN phi					CAN2_IN
3	CAN IN phi					CAN3_IN
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1
2	CAN OUT words					CAN1_OUT word 2
3	CAN OUT words					CAN1_OUT word 3
4	CAN OUT words					CAN2_OUT word 1
5	CAN OUT words					CAN2_OUT word 2
6	CAN OUT words					CAN2_OUT word 3
7	CAN OUT words					CAN2_OUT word 4
8	CAN OUT words					CAN3_OUT word 1
9	CAN OUT words					CAN3_OUT word 2
10	CAN OUT words					CAN3_OUT word 3
11	CAN OUT words					CAN3_OUT word 4
C0869						32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647	CAN1_OUT
2	CAN OUT phi					CAN2_OUT
3	CAN OUT phi					CAN3_OUT

13.9.1 Inputs_CAN2

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN2_nInW1_a	integer	analog	%IW32.0	C0866/4	dec [%]	
CAN2_nInW2_a			%IW32.1	C0866/5		
CAN2_bInB0_b ... CAN2_bInB15_b	BOOL	binary	%IX32.0.0 ... %IX32.0.0	C0863/3	hex	
CAN2_bInB16_b ... CAN2_bInB31_b			%IX32.1.0 ... %IX32.1.15	C0863/4		
CAN2_dnInD1_p	double integer	position	%ID32.0	C0867/2	dec [inc]	
CAN2_nInW3_a	integer	analog	%IW32.2	C0866/6	dec [%]	
CAN2_nInW4_a			%IW32.3	C0866/7		

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CAN2_bInB0_b ... CAN2_bInB15_b	CAN2_nInW1_a	CAN2_dnInD1_p
3, 4	CAN2_bInB16_b ... CAN2_bInB31_b	CAN2_nInW2_a	
5, 6		CAN2_nInW3_a	
7, 8		CAN2_nInW4_a	

13.9.2 Outputs_CAN2

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN2_nOutW1_a	integer	analog	%QW32.0	C0868/4	dec [%]	
CAN2_nOutW2_a			%QW32.1	C0868/5		
CAN2_bFDO0_b ... CAN2_bFDO15_b	BOOL	binary	%QX32.0.0 ... %QX32.0.15	C0151/2	hex	Display code in hex as double word
CAN2_bFDO16_b ... CAN2_bFDO31_b			%QX32.1.0 ... %QX32.1.15			
CAN2_dnOutD1_p	double integer	position	%QD32.0	C0869/2	dec [inc]	
CAN2_nOutW3_a	integer	analog	%QW32.2	C0868/6	dec [%]	
CAN2_nOutW4_a			%QW32.3	C0868/7		

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CAN2_bFDO0_b ... CAN2_bFDO15_b	CAN2_nOutW1_a	CAN2_dnOutD1_p
3, 4	CAN2_bFDO16_b ... CAN2_bFDO31_b	CAN2_nOutW2_a	
5, 6		CAN2_nOutW3_a	
7, 8		CAN2_nOutW4_a	

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

If you want to describe e.g. the bytes 1 and 2, either use only the variable *CAN2_dnOutD1_p*, only the variable *CAN2_nOutW1_a* or only the variables *CAN2_bFDO0_b ... CAN2_bFDO15_b*!

13.10 CAN3_IO (node number 33)

This SB serves to transmit event or time-controlled process data via the CAN bus interface X14.

A sync telegram is not required.

- ► The transmission mode (event or time-controlled) is set via C0356.
- ► The monitoring time is set via C0357 (Lenze setting: 3000 ms).

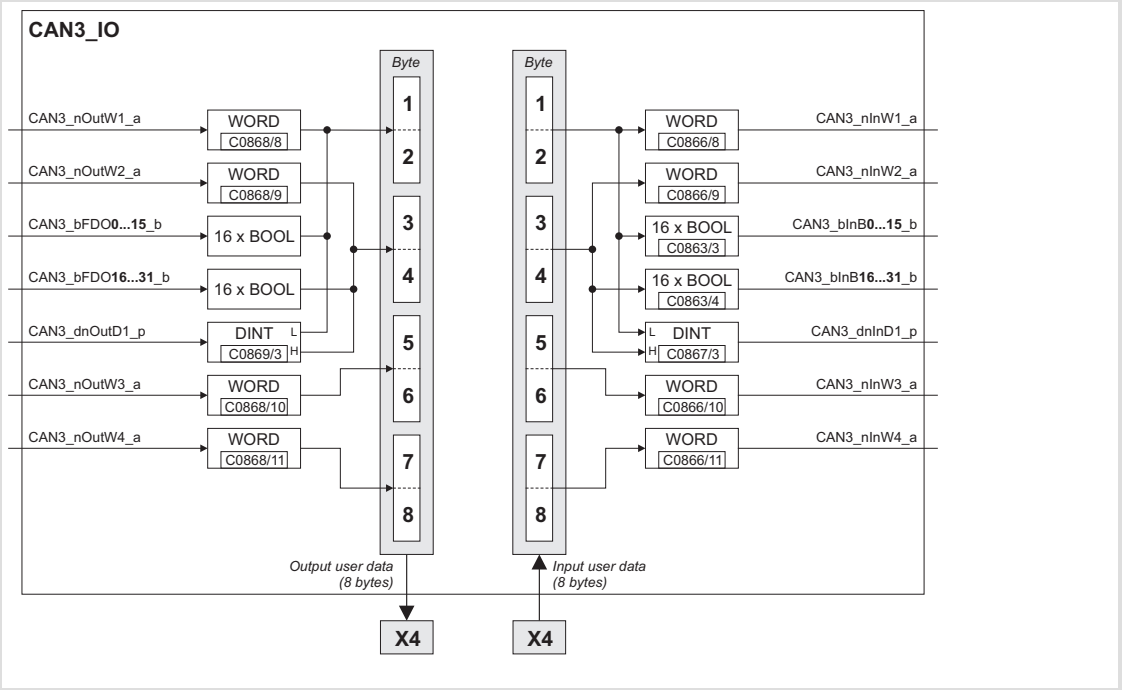


Fig. 13-14 System block "CAN3_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 163
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0863						Digital process data input words for CAN bus interface X4	📖 446
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 446
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0867						32-bit phase information for CAN bus interface X4 Read only
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN
2	CAN IN phi					CAN2_IN
3	CAN IN phi					CAN3_IN
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1
2	CAN OUT words					CAN1_OUT word 2
3	CAN OUT words					CAN1_OUT word 3
4	CAN OUT words					CAN2_OUT word 1
5	CAN OUT words					CAN2_OUT word 2
6	CAN OUT words					CAN2_OUT word 3
7	CAN OUT words					CAN2_OUT word 4
8	CAN OUT words					CAN3_OUT word 1
9	CAN OUT words					CAN3_OUT word 2
10	CAN OUT words					CAN3_OUT word 3
11	CAN OUT words					CAN3_OUT word 4
C0869						32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647	CAN1_OUT
2	CAN OUT phi					CAN2_OUT
3	CAN OUT phi					CAN3_OUT

13.10.1 Inputs_CAN3

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN3_nInW1_a	integer	analog	%IW33.0	C0866/8	dec [%]	
CAN3_nInW2_a			%IW33.1	C0866/9		
CAN3_bInB0_b ... CAN3_bInB15_b	BOOL	binary	%IX33.0.0 ... %IX33.0.15	C0863/5	hex	
CAN3_bInB16_b ... CAN3_bInB31_b			%IX33.1.0 ... %IX33.1.15	C0863/6		
CAN3_dnInD1_p	double integer	position	%ID33.0	C0867/3	dec [inc]	
CAN3_nInW3_a	integer	analog	%IW33.2	C0866/10	dec [%]	
CAN3_nInW4_a			%IW33.3	C0866/11		

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CAN3_bInB0_b ... CAN3_bInB15_b	CAN3_nInW1_a	CAN3_dnInD1_p
3, 4	CAN3_bInB16_b ... CAN3_bInB31_b	CAN3_nInW2_a	
5, 6		CAN3_nInW3_a	
7, 8		CAN3_nInW4_a	

13.10.2 Outputs_CAN3

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CAN3_nOutW1_a	integer	analog	%QW33.0	C0868/8	dec [%]	
CAN3_nOutW2_a			%QW33.1	C0868/9		
CAN3_bFDO0_b ... CAN3_bFDO15_b	BOOL	binary	%QX33.0.0 ... %QX33.0.15	C0151/3	hex	Display code in hex as double word
CAN3_bFDO16_b ... CAN3_bFDO31_b			%QX33.1.0 ... %QX33.1.15			
CAN3_dnOutD1_p	double integer	position	%QD33.0	C0869/3	dec [inc]	
CAN3_nOutW3_a	integer	analog	%QW33.2	C0868/10	dec [%]	
CAN3_nOutW4_a			%QW33.3	C0868/11		

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CAN3_bFDO0_b ... CAN3_bFDO15_b	CAN3_nOutW1_a	CAN3_dnOutD1_p
3, 4	CAN3_bFDO16_b ... CAN3_bFDO31_b	CAN3_nOutW2_a	
5, 6		CAN3_nOutW3_a	
7, 8		CAN3_nOutW4_a	

Note!

Avoid simultaneous overwriting via different varianle types to ensure data consistency.

If you want to describe e.g. the bytes 1 and 2, either use only the variable *CAN3_dnOutD1_p*, only the variable *CAN3_nOutW1_a* or only the variables *CAN3_bFDO0_b ... CAN3_bFDO15_b*!

13.11 CANaux_Management (node number 111)

This SB

- serves to activate a **reset node** to e.g. accept changes in the transfer rate and addressing.
- serves to process statuses as **Communication Error**, **Bus Off State**, etc. in the PLC program.
- the instant of transmission of CANaux2_OUT and CANaux3_OUT can be influenced.
- serves to monitor the system bus communication.

Note!

- The process image for this SB is created in the course of a fixed system task (interval: 1 ms).
- Even if this SB has not been assigned to the control configuration, a reset node can be carried out via C2458.

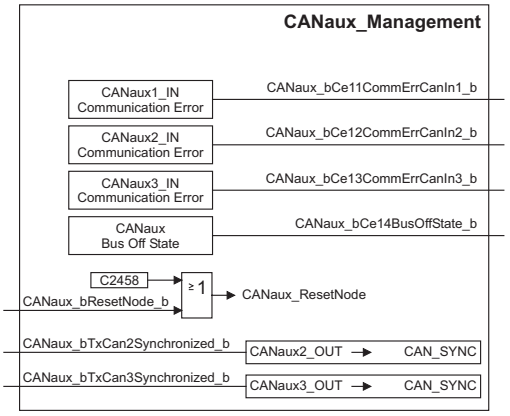


Fig. 13-15 System block "CANaux_Management"

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 440).

13.11.1 Inputs_CANaux_Management

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux_bCe11Comm-ErrCanIn1_b	BOOL	binary	%IX111.0.0	–	–	CANaux1_IN communication error
CANaux_bCe12Comm-ErrCanIn2_b			%IX111.0.1			CANaux2_IN communication error
CANaux_bCe13Comm-ErrCanIn3_b			%IX111.0.2			CANaux3_IN communication error
CANaux_bCe14BusOffState_b			%IX111.0.3			CAN bus "Off State" detected (CAN bus interface X14)
CANaux_byNode-Address	Byte	–	%IB111.2	C2450	–	Node address (CAN bus interface X14)
CANaux_byState			%IB111.3	C2459	–	CAN bus status (CAN bus interface X14)

13.11.2 Outputs_CANaux_Management

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux_bResetNode_b	BOOL	binary	%QX111.0.0	–	–	Carry out reset node (CAN bus interface X14)
CANaux_bTxCan2Synchronized_b			%QX111.0.1			Transmit CANaux2_OUT with sync telegram.
CANaux_bTxCan3Synchronized_b			%QX111.0.2			Transmit CANaux3_OUT with sync telegram.

13.11.3 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 156)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 458)
  – Individual addressing (📖 160)
- Change of the master/slave boot up configuration (📖 162)

Reset node can be activated by:

- switching on the low-voltage supply
- the bus system (via the network management (NMT))
- C2458 = 1 using the XTkeypad
- *CANaux_bResetNode_b* = TRUE

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again.

13.11.4 Define instant of transmission for CANaux2_OUT/CANaux3_OUT

CANaux_bTxCan2Synchonized_b and *CANaux_bTxCan3Synchonized_b* serve to define the instant of transmission for the CAN objects CANaux2_OUT and CANaux3_OUT:

- **FALSE**: Data of CANaux2_OUT/CANaux3_OUT is sent at the end of the process image.
- **TRUE**: Data of CANaux2_OUT/CANaux3_OUT is sent after the CAN synchronisation.
  – The identifiers for sync transmission and reception telegrams can be set via C2467/C2468.
  – The *sync Tx time* can be set via C2469.

Tip!

Detailed information on CAN synchronisation and configuration via codes can be found in the chapter 8.6 ”Axis synchronisation (CAN synchronisation)” ((📖 166).

13.11.5 Status messages

The SB **CANaux_Management** provides different status messages which can be processed in the PLC program:

Identifiers	Information	
CANaux_bCe11CommErrCanIn1_b	TRUE	CANaux1_IN communication error
CANaux_bCe12CommErrCanIn1_b	TRUE	CANaux2_IN communication error
CANaux_bCe13CommErrCanIn1_b	TRUE	CANaux3_IN communication error
CANaux_bCe14BusOffState_b	TRUE	CAN bus "Off State" detected (CAN bus interface X14)
CANaux_byNodeAddress	1 ... 63	Node address (CAN bus interface X14)
CANaux_byState	CAN bus operating status (CAN bus interface X14)	
	1	Operational
	2	Pre-Operational
	3	Warning
	4	Bus off

13.12 CANaux1_IO (node number 34)

This SB serves to transmit cyclic process data via the CAN bus interface X14.

A sync telegram which must be generated from **another** node is required for transmission.

- The transmission mode (event or time-controlled) is set via C2456.
- The monitoring time is set via C2457 (Lenze setting: 3000 ms).

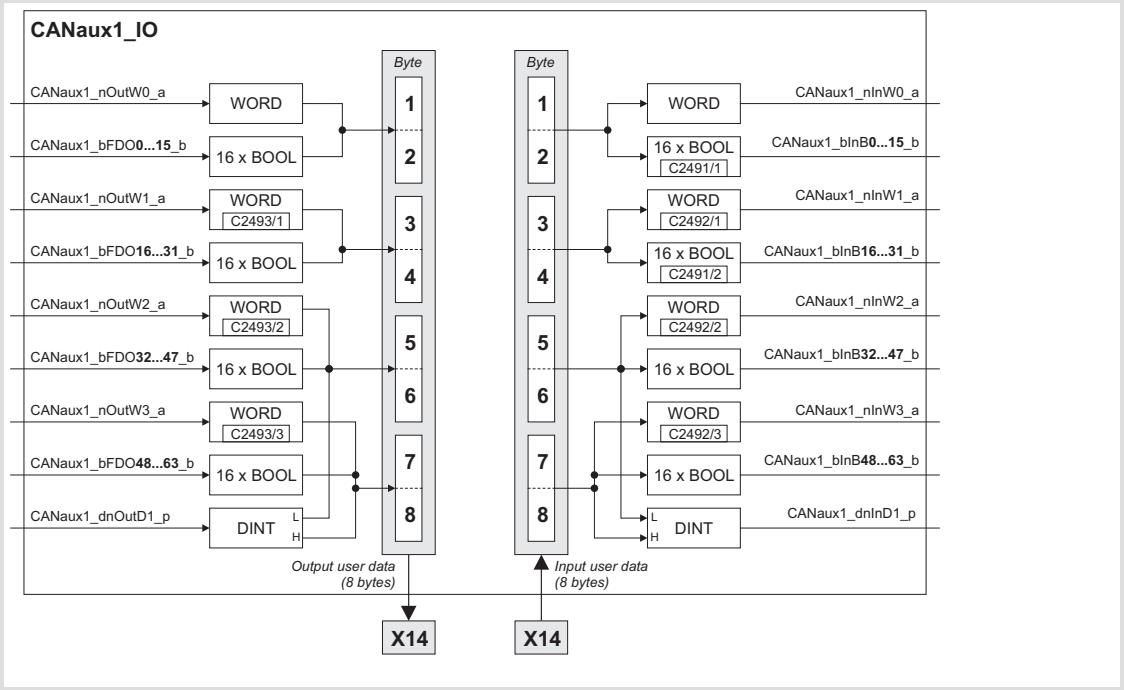


Fig. 13-16 System block "CANaux1_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 163
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1
2	CANa IN words					CANaux1_IN word 2
3	CANa IN words					CANaux1_IN word 3
4	CANa IN words					CANaux2_IN word 1
5	CANa IN words					CANaux2_IN word 2
6	CANa IN words					CANaux2_IN word 3
7	CANa IN words					CANaux2_IN word 4
8	CANa IN words					CANaux3_IN word 1
9	CANa IN words					CANaux3_IN word 2
10	CANa IN words					CANaux3_IN word 3
11	CANa IN words					CANaux3_IN word 4
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1
2	CANa OUT words					CANaux1_OUT word 2
3	CANa OUT words					CANaux1_OUT word 3
4	CANa OUT words					CANaux2_OUT word 1
5	CANa OUT words					CANaux2_OUT word 2
6	CANa OUT words					CANaux2_OUT word 3
7	CANa OUT words					CANaux2_OUT word 4
8	CANa OUT words					CANaux3_OUT word 1
9	CANa OUT words					CANaux3_OUT word 2
10	CANa OUT words					CANaux3_OUT word 3
11	CANa OUT words					CANaux3_OUT word 4

13.12.1 Inputs_CANaux1

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux1_nInW0_a	integer	analog	%IW34.0	–	–	
CANaux1_bInB0_b ... CANaux1_bInB15_b	BOOL	binary	%IX34.0.0 ... %IX34.0.15	C2491/1	hex	
CANaux1_nInW1_a	integer	analog	%IW34.1	C2492/1	dec [%]	
CANaux1_bInB16_b ... CANaux1_bInB31_b	BOOL	binary	%IX34.1.0 ... %IX34.1.15	C2491/2	hex	
CANaux1_nInW2_a	integer	analog	%IW34.2	C2492/2	dec [%]	
CANaux1_bInB32_b ... CANaux1_bInB47_b	BOOL	binary	%IX34.2.0 ... %IX34.2.15	–	–	
CANaux1_nInW3_a	integer	analog	%IW34.3	C2492/3	dec [%]	
CANaux1_bInB48_b ... CANaux1_bInB63_b	BOOL	binary	%IX34.3.0 ... %IX34.3.15	–	–	
CANaux1_dnInD1_p	double integer	position	%ID34.1	–	–	

User data

The 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they can thus be evaluated by the PLC program as:

- binary information (1 bit)
- control word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux1_bInB0_b ... CANaux1_bInB15_b	CANaux1_nInW0_a	
3, 4	CANaux1_bInB16_b ... CANaux1_bInB31_b	CANaux1_nInW1_a	
5, 6	CANaux1_bInB32_b ... CANaux1_bInB47_b	CANaux1_nInW2_a	CANaux1_dnInD1_p
7, 8	CANaux1_bInB48_b ... CANaux1_bInB63_b	CANaux1_nInW3_a	

13.12.2 Outputs_CANaux1

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux1_nOutW0_a	integer	analog	%QW34.0	–	–	
CANaux1_bFDO0_b ... CANaux1_bFDO15_b	BOOL	binary	%QX34.0.0 ... %QX34.0.15	–	–	
CANaux1_nOutW1_a	integer	analog	%QW34.1	C2493/1	dec [%]	
CANaux1_bFDO16_b ... CANaux1_bFDO31_b	BOOL	binary	%QX34.1.0 ... %QX34.1.15	–	–	
CANaux1_nOutW2_a	integer	analog	%QW34.2	C2493/2	dec [%]	
CANaux1_bFDO32_b ... CANaux1_bFDO47_b	BOOL	binary	%QX34.2.0 ... %QX34.2.15	–	–	
CANaux1_nOutW3_a	integer	analog	%QW34.3	C2493/3	dec [%]	
CANaux1_bFDO48_b ... CANaux1_bFDO63_b	BOOL	binary	%QX34.3.0 ... %QX34.3.15	–	–	
CANaux1_dnOutD1_p	double integer	position	%QD34.1	–	–	

User data

The 8 bytes of user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux1_bFDO0_b ... CANaux1_bFDO15_b	CANaux1_nOutW0_a	
3, 4	CANaux1_bFDO16_b ... CANaux1_bFDO31_b	CANaux1_nOutW1_a	
5, 6	CANaux1_bFDO32_b ... CANaux1_bFDO47_b	CANaux1_nOutW2_a	CANaux1_dnOutD1_p
7, 8	CANaux1_bFDO48_b ... CANaux1_bFDO63_b	CANaux1_nOutW3_a	

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

If you want to describe e.g. the bytes 5 and 6, either use only the variable *CANaux1_dnOutD1_p*, only the variable *CANaux1_nOutW2_a* or only the variables *CANaux1_bFDO32_b* ... *CANaux1_bFDO47_b*!

13.13 CANaux2_IO (node number 35)

This SB serves to transmit event or time-controlled process data via the CAN bus interface X14.

A sync telegram is not required.

- ► The transmission mode (event or time-controlled) is set via C2456.
- ► The monitoring time is set via C2457 (Lenze setting: 3000 ms).

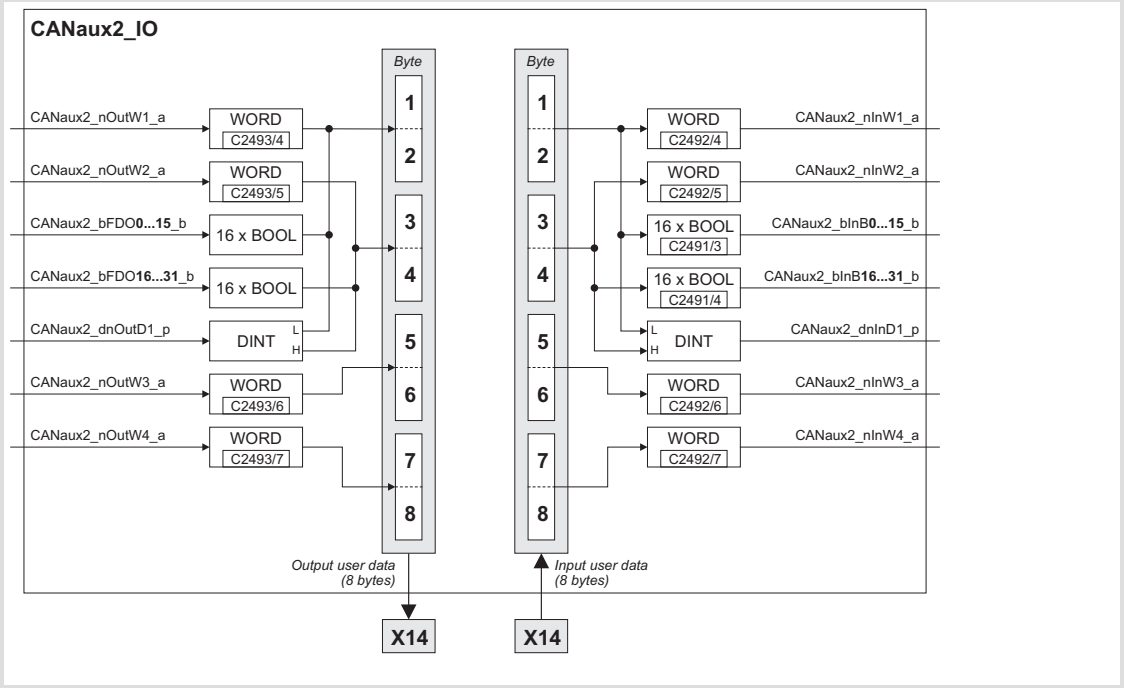


Fig. 13-17 System block "CANaux2_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 163
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1
2	CANa IN words					CANaux1_IN word 2
3	CANa IN words					CANaux1_IN word 3
4	CANa IN words					CANaux2_IN word 1
5	CANa IN words					CANaux2_IN word 2
6	CANa IN words					CANaux2_IN word 3
7	CANa IN words					CANaux2_IN word 4
8	CANa IN words					CANaux3_IN word 1
9	CANa IN words					CANaux3_IN word 2
10	CANa IN words					CANaux3_IN word 3
11	CANa IN words					CANaux3_IN word 4
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1
2	CANa OUT words					CANaux1_OUT word 2
3	CANa OUT words					CANaux1_OUT word 3
4	CANa OUT words					CANaux2_OUT word 1
5	CANa OUT words					CANaux2_OUT word 2
6	CANa OUT words					CANaux2_OUT word 3
7	CANa OUT words					CANaux2_OUT word 4
8	CANa OUT words					CANaux3_OUT word 1
9	CANa OUT words					CANaux3_OUT word 2
10	CANa OUT words					CANaux3_OUT word 3
11	CANa OUT words					CANaux3_OUT word 4

13.13.1 Inputs_CANaux2

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux2_nInW1_a	integer	analog	%IW35.0	C2492/4	dec [%]	
CANaux2_nInW2_a			%IW35.1	C2492/5		
CANaux2_bInB0_b ... CANaux2_bInB15_b	BOOL	binary	%IX35.0.0 ... %IX35.0.15	C2491/3	hex	
CANaux2_bInB16_b ... CANaux2_bInB31_b			%IX35.1.0 ... %IX35.1.15	C2491/4		
CANaux2_dnInD1_p	double integer	position	%ID35.0	–	–	
CANaux2_nInW3_a	integer	analog	%IW35.2	C2492/6	dec [%]	
CANaux2_nInW4_a			%IW35.3	C2492/7		

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux2_bInB0_b ... CANaux2_bInB15_b	CANaux2_nInW1_a	CANaux2_dnInD1_p
3, 4	CANaux2_bInB16_b ... CANaux2_bInB31_b	CANaux2_nInW2_a	
5, 6		CANaux2_nInW3_a	
7, 8		CANaux2_nInW4_a	

13.13.2 Outputs_CANaux2

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux2_nOutW1_a	integer	analog	%QW35.0	C2493/4	dec [%]	
CANaux2_nOutW2_a			%QW35.1	C2493/5		
CANaux2_bFDO0_b ... CANaux2_bFDO15_b	BOOL	Binary	%QX35.0.0 ... %QX35.0.15	–	–	
CANaux2_bFDO16_b ... CANaux2_bFDO31_b			%QX35.1.0 ... %QX35.1.15			
CANaux2_dnOutD1_p	Double integer	Position	%QD35.0	–	–	
CANaux2_nOutW3_a	integer	analog	%QW35.2	C2493/6	dec [%]	
CANaux2_nOutW4_a			%QW35.3	C2493/7		

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux2_bFDO0_b ... CANaux2_bFDO15_b	CANaux2_nOutW1_a	CANaux2_dnOutD1_p
3, 4	CANaux2_bFDO16_b ... CANaux2_bFDO31_b	CANaux2_nOutW2_a	
5, 6		CANaux2_nOutW3_a	
7, 8		CANaux2_nOutW4_a	

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

If you want to describe e.g. the bytes 1 and 2, either use only the variable *CANaux2_dnOutD1_p*, or the variable *CANaux2_nOutW1_a* or only the variables *CANaux2_bFDO0_b ... CANaux2_bFDO15_b*!

13.14 CANaux3_IO (node number 36)

This SB serves to transmit event or time-controlled process data via the CAN bus interface X14.

A sync telegram is not required.

- ► The transmission mode (event or time-controlled) is set via C2456.
- ► The monitoring time is set via C2457 (Lenze setting: 3000 ms).

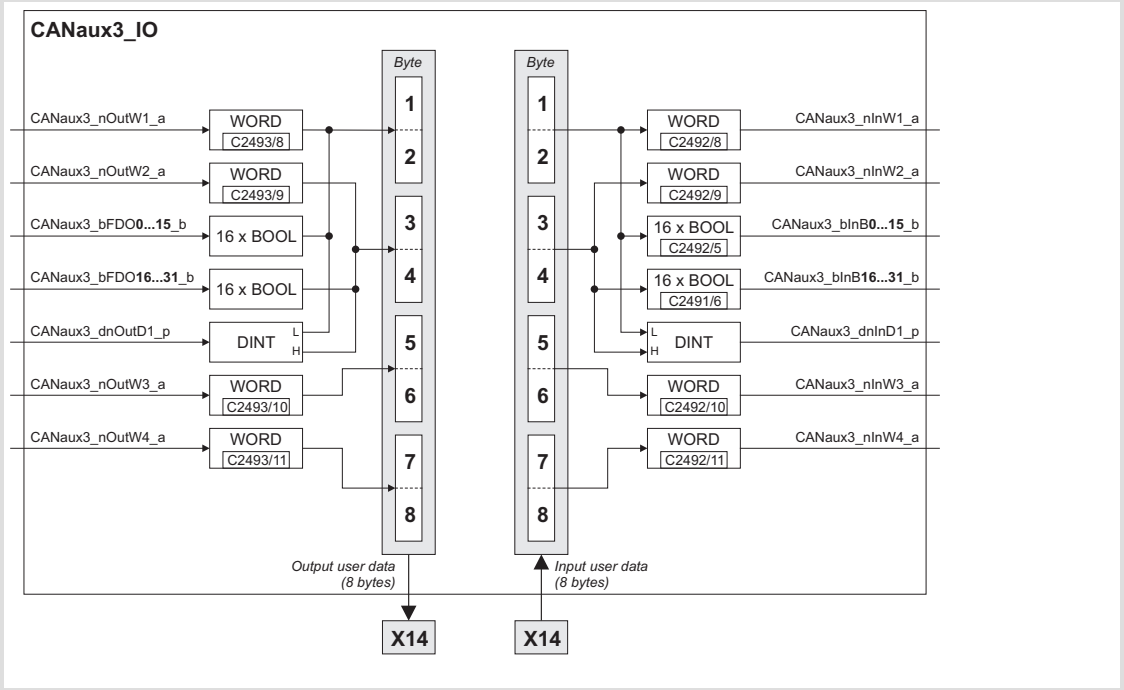


Fig. 13-18 System block "CANaux3_IO"

Process data telegram

The process data telegram consists of an *identifier* and eight bytes of user data.

Identifier	8 bytes of user data							
11 bits	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 163
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1
2	CANa IN words					CANaux1_IN word 2
3	CANa IN words					CANaux1_IN word 3
4	CANa IN words					CANaux2_IN word 1
5	CANa IN words					CANaux2_IN word 2
6	CANa IN words					CANaux2_IN word 3
7	CANa IN words					CANaux2_IN word 4
8	CANa IN words					CANaux3_IN word 1
9	CANa IN words					CANaux3_IN word 2
10	CANa IN words					CANaux3_IN word 3
11	CANa IN words					CANaux3_IN word 4
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1
2	CANa OUT words					CANaux1_OUT word 2
3	CANa OUT words					CANaux1_OUT word 3
4	CANa OUT words					CANaux2_OUT word 1
5	CANa OUT words					CANaux2_OUT word 2
6	CANa OUT words					CANaux2_OUT word 3
7	CANa OUT words					CANaux2_OUT word 4
8	CANa OUT words					CANaux3_OUT word 1
9	CANa OUT words					CANaux3_OUT word 2
10	CANa OUT words					CANaux3_OUT word 3
11	CANa OUT words					CANaux3_OUT word 4

13.14.1 Inputs_CANaux3

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux3_nInW1_a	integer	analog	%IW36.0	C2492/8	dec [%]	
CANaux3_nInW2_a			%IW36.1	C2492/9		
CANaux3_bInB0_b ... CANaux3_bInB15_b	BOOL	Binary	%IX36.0.0 ... %IX36.0.15	C2491/5	hex	
CANaux3_bInB16_b ... CANaux3_bInB31_b			%IX36.1.0 ... %IX36.1.15	C2491/6		
CANaux3_dnInD1_p	Double integer	Position	%ID36.0	–	–	
CANaux3_nInW3_a	integer	analog	%IW36.2	C2492/10	dec [%]	
CANaux3_nInW4_a			%IW36.3	C2492/11		

User data

The first 4 bytes from the 8 bytes of received user data are assigned to several variables of different data types. According to requirements, they thus can be evaluated by the PLC program as:

- binary information (1 bit)
- quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux3_bInB0_b ... CANaux3_bInB15_b	CANaux3_nInW1_a	CANaux3_dnInD1_p
3, 4	CANaux3_bInB16_b ... CANaux3_bInB31_b	CANaux3_nInW2_a	
5, 6		CANaux3_nInW3_a	
7, 8		CANaux3_nInW4_a	

13.14.2 Outputs_CANaux3

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
CANaux3_nOutW1_a	integer	analog	%QW36.0	C2493/8	dec [%]	
CANaux3_nOutW2_a			%QW36.1	C2493/9		
CANaux3_bFDO0_b ... CANaux3_bFDO15_b	BOOL	binary	%QX36.0.0 ... %QX36.0.15	–	–	
CANaux3_bFDO16_b ... CANaux3_bFDO31_b			%QX36.1.0 ... %QX36.1.15			
CANaux3_dnOutD1_p	double integer	position	%QD36.0	–	–	
CANaux3_nOutW3_a	integer	analog	%QW36.2	C2493/10	dec [%]	
CANaux3_nOutW4_a			%QW36.3	C2493/11		

User data

The first 4 bytes of the 8 bytes user data to be sent can be written via several variables of different data types. According to requirements, data can therefore be transferred from the PLC program as

- binary information (1 bit)
- status word/quasi-analog value (16 bit)
- angle information (32 bit)

Byte	Variable (1 bit)	Variable (16 bit)	Variable (32 bit)
1, 2	CANaux3_bFDO0_b ... CANaux3_bFDO15_b	CANaux3_nOutW1_a	CANaux3_dnOutD1_p
3, 4	CANaux3_bFDO16_b ... CANaux3_bFDO31_b	CANaux3_nOutW2_a	
5, 6		CANaux3_nOutW3_a	
7, 8		CANaux3_nOutW4_a	

Note!

Avoid simultaneous overwriting via different variable types to ensure data consistency.

If you want to describe e.g. the bytes 1 and 2, either use only the variable *CANaux3_dnOutD1_p*, or only the variable *CANaux3_nOutW1_a* or only the variables *CANaux3_bFDO0_b ... CANaux3_bFDO15_b*!

13.15 DCTRL_DriveControl (node number 121)

This FB controls the axis module into certain states:

- Quick stop (QSP, 📖 324)
- Operation inhibit (DISABLE, 📖 325)
- Controller inhibit (CINH, 📖 325)
- Setting a TRIP (TRIP-SET, 📖 326)
- Resetting a TRIP (TRIP-RESET, 📖 326)

C0150 displays the status of the axis module (📖 239).

The process image is created in a permanent system task (interval: 2 ms).

Note!

The SB **DCTRL_DriveControl** only affects the motor control or the drive control. Motor control/drive control and application program of the PLC are decoupled from one another, provided that no query of the signals is effected in the application program.

- If, for instance, a TRIP is activated by the motor control, the application program thereby is not stopped!
- If, in contrast, a TRIP is activated as a result of a task overflow, the application program of the PLC is stopped as well!

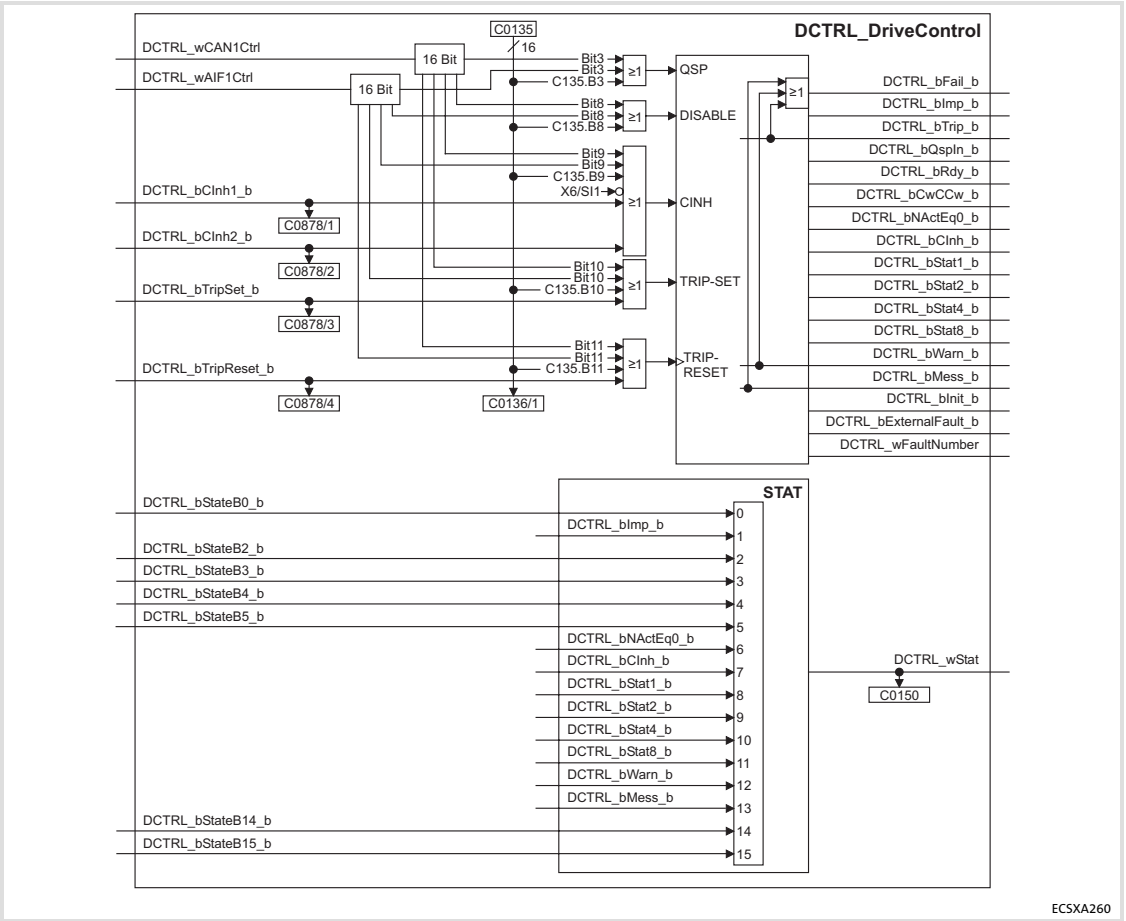


Fig. 13-19 System block ”DCTRL_DriveControl”

13.15.1 Inputs_DCTRL

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DCTRL_bFail_b	Bool	Binary	%IX121.0.0	–	–	TRUE = active error
DCTRL_bImp_b			%IX121.0.1			TRUE = high-resistance power output stages
DCTRL_bTrip_b			%IX121.0.2			TRUE = active error
DCTRL_bQspIn_b			%IX121.0.3			TRUE = quick stop (QSP) (📖 324)
DCTRL_bRdy_b			%IX121.0.4			TRUE = ready for operation
DCTRL_bCwCcw_b			%IX121.0.5			FALSE = CW rotation TRUE = CCW rotation
DCTRL_bNActEq0_b			%IX121.0.6			TRUE = motor speed < C0019
DCTRL_bCInh_b			%IX121.0.7			TRUE = controller inhibit (📖 325)
DCTRL_bStat1_b	Bool	Binary	%IX121.0.8	–	–	Status signals (📖 327)
DCTRL_bStat2_b			%IX121.0.9			
DCTRL_bStat4_b			%IX121.0.10			
DCTRL_bStat8_b			%IX121.0.11			
DCTRL_bWarn_b	Bool	Binary	%IX121.0.12	–	–	TRUE = active warning
DCTRL_bMess_b			%IX121.0.13			TRUE = active message
DCTRL_bInit_b			%IX121.0.14			TRUE = initialisation phase
DCTRL_bExternalFault_b			%IX121.0.15			TRUE = external error (📖 329)
DCTRL_wStat	Word	–	%IW121.1	C0150	hex	Status word (📖 327)
DCTRL_wFaultNumber			%IW121.2	C0168		Current error number (📖 369)

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0150	Status word	0				Device status word 1 (DCTRL) Read only	📖 328 📖 327
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned		DCTRL_bStateB0_b	
			Bit 1	Pulse inhibit (IMP)		DCTRL_bImp_b	
			Bit2	Not assigned		DCTRL_bStateB2_b	
			Bit3	Not assigned		DCTRL_bStateB3_b	
			Bit4	Not assigned		DCTRL_bStateB4_b	
			Bit5	Not assigned		DCTRL_bStateB5_b	
			Bit 6	n = 0		DCTRL_bNActEq0_b	
			Bit 7	Controller inhibit (CINH)		DCTRL_bCInh_b	
			Bit 8	Device status bit 1		DCTRL_bStat1_b	
			Bit 9	Device status bit 2		DCTRL_bStat2_b	
			Bit10	Device status bit 3		DCTRL_bStat4_b	
			Bit11	Device status bit 4		DCTRL_bStat8_b	
			Bit12	Warning		DCTRL_bWarn_b	
			Bit13	Message		DCTRL_bMess_b	
			Bit14	Not assigned		DCTRL_bStateB14_b	
			Bit15	Not assigned		DCTRL_bStateB15_b	
C0878						Digital input signals to DCTRL Only display	📖 321
1	DigInOfDCTRL		0		1	Controller inhibit (CINH) 1	
2	DigInOfDCTRL					Controller inhibit (CINH) 2	
3	DigInOfDCTRL					TRIP-set	
4	DigInOfDCTRL					TRIP-RESET	

13.15.2 Outputs_DCTRL

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DCTRL_wCAN1Ctrl	Word	–	%QW121.3	–	–	CAN control word
DCTRL_wAIF1Ctrl			%QW121.2			Control word AIF
DCTRL_bCInh1_b	BOOL	binary	%QX121.0.1	C0878/1	bin	Controller inhibit (📖 325)
DCTRL_bCInh2_b			%QX121.0.2	C0878/2		
DCTRL_bTripSet_b			%QX121.0.3	C0878/3		TRIP SET (📖 326)
DCTRL_bTripReset_b			%QX121.0.4	C0878/4		TRIP RESET (📖 326)
DCTRL_bStatB0_b	BOOL	binary	%QX121.1.0	–	–	Status signals (📖 327)
DCTRL_bStatB2_b			%QX121.1.2			
DCTRL_bStatB3_b			%QX121.1.3			
DCTRL_bStatB4_b			%QX121.1.4			
DCTRL_bStatB5_b			%QX121.1.5			
DCTRL_bStatB14_b			%QX121.1.14			
DCTRL_bStatB15_b			%QX121.1.15			

Codes

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0135	Control word	0				System control word DCTRL
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Not assigned		
			Bit 2	Not assigned		
			Bit 3	Quick stop (QSP)		
			Bit 4	Not assigned		
			Bit 5	Not assigned		
			Bit 6	Not assigned		
			Bit 7	Not assigned		
			Bit 8	Operation inhibit (DISABLE)		
			Bit 9	Controller inhibit (CINH)		
			Bit 10	TRIP-SET		
			Bit 11	TRIP-RESET		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		

13.15.3 Quick stop (QSP)

The QSP function serves to stop the drive – irrespective of the setpoint selection – within the time adjusted in C0105.

- The function can be controlled via the following inputs (OR'd):
  - Control word *DCTRL_wAIF1Ctrl* (📖 259)
  - Control word *DCTRL_wCAN1Ctrl* (📖 283)
  - Control word C0135, bit 3
- C0136/1 indicates the control word C0135.

Note!

Quick stop (QSP) only is set if *DCTRL_bQspIn_b* is connected to *MCTRL_bQspOut_b* of the SB **MCTRL_MotorControl** (📖 351)!

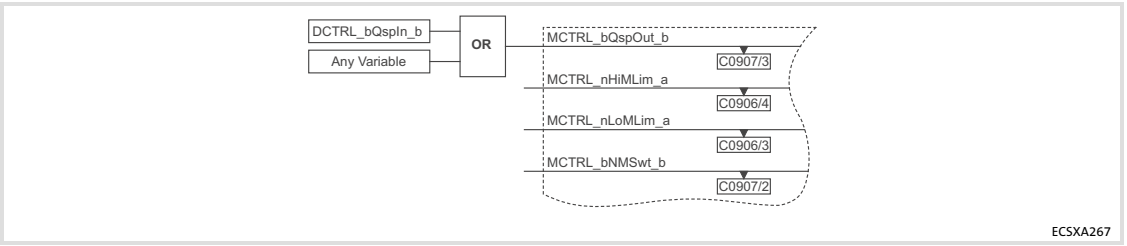


Fig. 13-20 Programming: actuation of a quick stop (QSP) via SB "Inputs_DCTRL"

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 324 📖 361
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

13.15.4 Operation inhibit (DISABLE)

This function actuates an ”operation inhibit” (DISABLE) in the drive. The power output stages are inhibited, and all speed controllers/current controllers/position controllers are reset. In the ”operation inhibit” state, the drive cannot be started by the command ”controller enable”.

- The function can be controlled via the following inputs (OR’d):
  - Control word *DCTRL_wAIF1Ctrl* (📖 259)
  - Control word *DCTRL_wCAN1Ctrl* (📖 283)
  - Control word C0135, bit 8
- C0136/1 indicates the control word C0135.

13.15.5 Controller inhibit (CINH)

This function activates ”controller inhibit (CINH)” in the drive. The power output stages are inhibited, and all speed controllers/current controllers/position controllers are reset.

- The function can be controlled via the following inputs (OR’d):
  - Terminal X6/SI1 (FALSE = controller inhibit)
  - Control word *DCTRL_wAIF1Ctrl* (📖 259)
  - Control word *DCTRL_wCAN1Ctrl* (📖 283)
  - Control word C0135, bit 9
  - Variable *DCTRL_bCInh1_b* (TRUE = inhibit controller)
  - Variable *DCTRL_bCInh2_b* (TRUE = inhibit controller)
- C0136/1 indicates the control word C0135.

13.15.6 Setting TRIP (TRIP-SET)

This function sets ”TRIP” in the drive and reports ”external error” (error message ”EEr”).

- The function can be controlled via the following inputs (OR'd):
  – Control word *DCTRL_wAIF1Ctrl* (📖 259)
  – Control word *DCTRL_wCAN1Ctrl* (📖 283)
  – Control word C0135, bit 10
  – Variable *DCTRL_bTripSet_b* (TRUE = set TRIP)
- C0136/1 indicates the control word C0135.
- The reaction to TRIP can be set via C0581:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0581	MONIT EEr	0		Fault response - external fault monitoring ”ExternalFault” (EEr)	📖 326
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

13.15.7 Resetting TRIP (TRIP-RESET)

This function resets an upcoming TRIP if the cause of malfunction is eliminated. If the cause of malfunction is still active, no response will be effected.

- The function can be controlled via the following inputs (OR'd):
  – Control word *DCTRL_wAIF1Ctrl* (📖 259)
  – Control word *DCTRL_wCAN1Ctrl* (📖 283)
  – Control word C0135, bit 11
  – Variable *DCTRL_bTripReset_b*
  – Code C0043
- C0136/1 indicates the control word C0135.



Note!

The function is only carried out by a FALSE-TRUE edge of the signal resulting from the OR operation.

If one input is assigned to TRUE, a FALSE-TRUE edge cannot occur.

13.15.8 Display of digital status signals

Via *DCTRL_wStat*, a status word is output, consisting of signals generated by the SB **DCTRL_DriveControl** as well as of signals of freely configurable SB inputs.

The status word can be displayed via C0150.

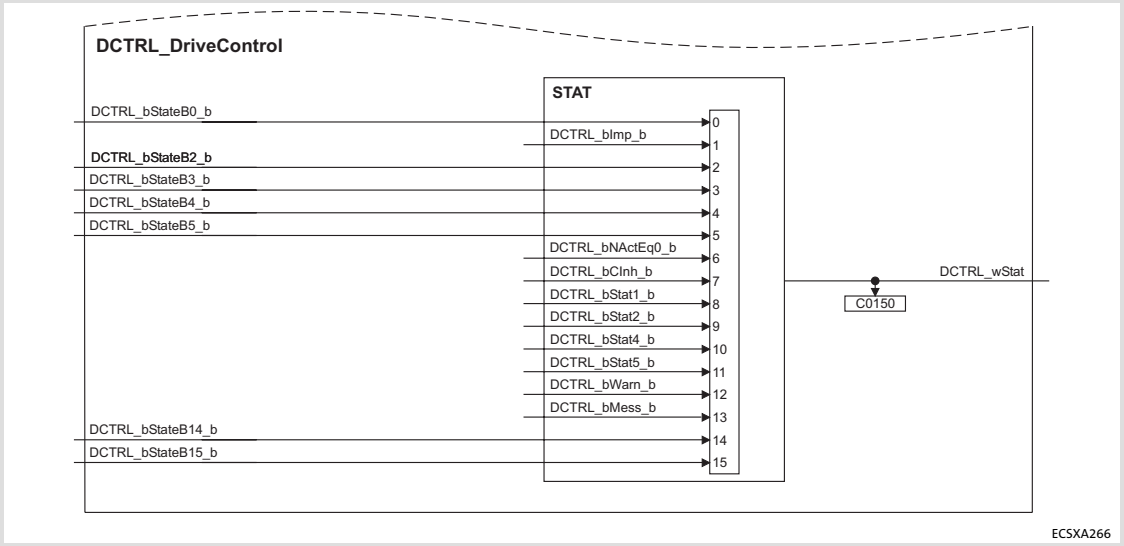


Fig. 13-21 Output of the status word "DCTRL_wStat"

13.15.9 Device status

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0			Device status word 1 (DCTRL) Read only	📖 328 📖 327
			0 {1} 65535		Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned	DCTRL_bStateB0_b	
			Bit 1	Pulse inhibit (IMP)	DCTRL_bImp_b	
			Bit2	Not assigned	DCTRL_bStateB2_b	
			Bit3	Not assigned	DCTRL_bStateB3_b	
			Bit4	Not assigned	DCTRL_bStateB4_b	
			Bit5	Not assigned	DCTRL_bStateB5_b	
			Bit 6	n = 0	DCTRL_bNActEq0_b	
			Bit 7	Controller inhibit (CINH)	DCTRL_bCInh_b	
			Bit 8	Device status bit 1	DCTRL_bStat1_b	
			Bit 9	Device status bit 2	DCTRL_bStat2_b	
			Bit10	Device status bit 3	DCTRL_bStat4_b	
			Bit11	Device status bit 4	DCTRL_bStat8_b	
			Bit12	Warning	DCTRL_bWarn_b	
			Bit13	Message	DCTRL_bMess_b	
			Bit14	Not assigned	DCTRL_bStateB14_b	
			Bit15	Not assigned	DCTRL_bStateB15_b	

13.15.10 TRIP status (DCTRL_bExternalFault_b)

If "TRIP" is activated in the drive (e.g. via the variable *DCTRL_bTripSet_b*, C0135/bit 10 or keypad), the variable *DCTRL_bExternalFault_b* is set to TRUE.

DCTRL_bExternalFault_b is reset to FALSE, as soon as the error source is reset.

13.15.11 Transfer of the status/control word via AIF

If the control and/or status word of the SB **DCTRL_DriveControl** is to be assigned to the SB **Inputs_AIF1**/**Outputs_AIF1**, this can be realised in the IEC 1131-3 programming language AWL, e. g. as follows:

```
LD DCTRL_wStat
ST AIF1_wDctrlStat    /* Writing the status word*/

LD AIF1_wDctrlCtrl
ST DCTRL_wAIF1Ctrl    /* Writing the control word*/
```

Note!

The assignment of the bits of the control/status word marked as "not assigned" depends on the fieldbus module used and the transmission profile set (z. B. DRIVECOM).

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0135	Control word	0			System control word DCTRL
			0	{1} 65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned	
			Bit 1	Not assigned	
			Bit 2	Not assigned	
			Bit 3	Quick stop (QSP)	
			Bit 4	Not assigned	
			Bit 5	Not assigned	
			Bit 6	Not assigned	
			Bit 7	Not assigned	
			Bit 8	Operation inhibit (DISABLE)	
			Bit 9	Controller inhibit (CINH)	
			Bit 10	TRIP-SET	
			Bit 11	TRIP-RESET	
			Bit 12	Not assigned	
			Bit 13	Not assigned	
			Bit 14	Not assigned	
			Bit 15	Not assigned	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0150	Status word	0				Device status word 1 (DCTRL) Read only	📖 328 📖 327
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned		DCTRL_bStateB0_b	
			Bit 1	Pulse inhibit (IMP)		DCTRL_bImp_b	
			Bit2	Not assigned		DCTRL_bStateB2_b	
			Bit3	Not assigned		DCTRL_bStateB3_b	
			Bit4	Not assigned		DCTRL_bStateB4_b	
			Bit5	Not assigned		DCTRL_bStateB5_b	
			Bit 6	n = 0		DCTRL_bNActEq0_b	
			Bit 7	Controller inhibit (CINH)		DCTRL_bCInh_b	
			Bit 8	Device status bit 1		DCTRL_bStat1_b	
			Bit 9	Device status bit 2		DCTRL_bStat2_b	
			Bit10	Device status bit 3		DCTRL_bStat4_b	
			Bit11	Device status bit 4		DCTRL_bStat8_b	
			Bit12	Warning		DCTRL_bWarn_b	
			Bit13	Message		DCTRL_bMess_b	
			Bit14	Not assigned		DCTRL_bStateB14_b	
			Bit15	Not assigned		DCTRL_bStateB15_b	

13.16 DFIN_IO_DigitalFrequency (node number 21)

13.16.1 Inputs_DFIN

This SB can convert a power pulse current at the master frequency input X8 into a speed value and scale it. A master frequency can be transferred with high precision without any offset and gain errors.

- The master frequency input X8 is designed for signals with TTL level.
- The input of a zero track is optional.
- A configuration of the master frequency input X8 as output (📖 338) is possible via C0491.
- An encoder can be selected and configured via the codes:
  - C0419 (encoder selection)
  - C0420 (encoder increments)
  - C0421 (encoder bias)
  - C0427 (type of master frequency input signal)

Stop!

The connection X8 cannot be used as a master frequency input if incremental encoders/SinCos encoders are used **and** X8 is configured as a master frequency output.

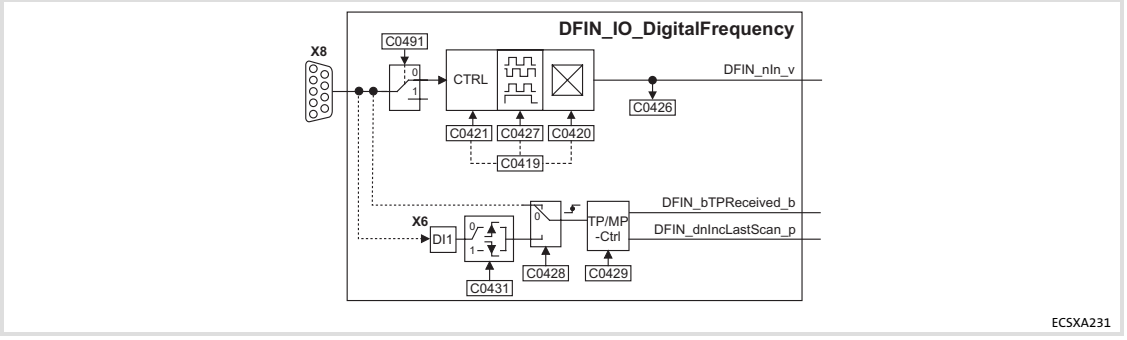


Fig. 13-22 System block "DFIN_IO_DigitalFrequency"

Note!

The process image is newly created for every task the SB is used in.

- If therefore *DFIN_nIn_v* is used in several tasks, an individual process image of the SB is created for each of these tasks.
- This process is different from the previous process image principle!

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DFIN_nIn_v	Integer	Velocity	%IW21.0	C0426	dec [rpm]	Value in inc/ms
DFIN_bTPReceived_b	BOOL	Binary	%IX21.1.2	–	–	Touch probe (TP) received
DFIN_dnIncLastScan_p	Double integer	Position	%ID21.1	–	–	Δinc during TP and task start

Codes

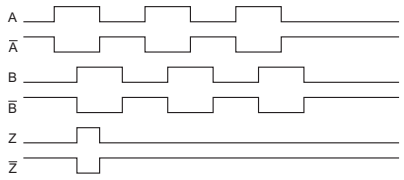
Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 331 📖 115 📖 122
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0421]	Encoder volt	0				Encoder voltage	📖 331
			0	5.0 V		Sets C0419 = 0 (”common”) if the value is altered.	📖 115 📖 122
			1	5.6 V			
			2	6.3 V			
			3	6.9 V			
			4	7.5 V			
			5	8.1 V			
C0426	DIS: In					Signal at DFIN input Only display	📖 331
			-32767	{1 rpm}	32767		
[C0427]	Enc. signal	0				Function of the master frequency input signals on X8 (DFIN)	📖 331 📖 115 📖 122
			0	2-phase			
			1	A: speed B: direction			
			2	A or B: speed or direction			
C0428	DFIN TP sel.	0				DFIN touch probe signal source	📖 336 📖 331
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP1		X6/DI1	
			2	Zero pulse of digital frequency input		X8	
C0429	TP1 delay	0				DFIN dead time compensation TP1 (DI1)	📖 336 📖 331
			-32767	{1 inc}	32767		
C0431	DFIN TP Edge	0				DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	📖 336
			0	Rising edge TP1			
			1	Falling edge TP1			
			2	Rising and falling edge TP1			
			3	Switched off			
[C0491]	X8 in/out	0				Function of X8	📖 331 📖 115 📖 122
			0	X8 is input			
			1	X8 is output			

13.16.1.1 Configuration master frequency input signal

You configure the type of the master frequency input signal via C0427:

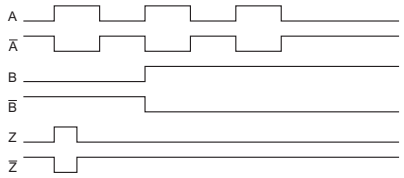
C0427 = 0 (2 phases)



Signal sequence with phase shift (CW rotation)

Track	CW rotation	CCW rotation
A	Track A leads by 90° (*DFIN_nIn_v* = positive value)	Track A lags by 90° (*DFIN_nIn_v* = negative value)
B	–	–

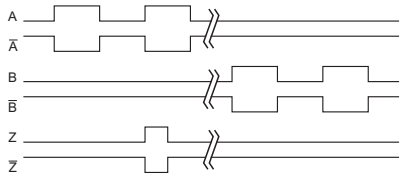
C0427 = 1 (A = speed / B = direction)



Control of the direction of rotation via track B

Track	CW rotation	CCW rotation
A	Transmits the speed.	Transmits the speed
B	= FALSE (*DFIN_nIn_v* = positive value)	= TRUE (*DFIN_nIn_v* = negative value)

C0427 = 2 (A or B = speed or direction)



Control of speed and direction of rotation via track A or track B

Track	CW rotation	CCW rotation
A	Transmits speed and direction of rotation (*DFIN_nIn_v* = positive value)	= FALSE
B	= FALSE	Transmits speed and direction of rotation (*DFIN_nIn_v* = negative value)

Transfer function

$$DFIN\_nIn\_v = f\,[Hz] \cdot \frac{60}{Number\ of\ incr.\ from\ C0420} \cdot \frac{2^{14}}{15000}$$

Example:

- Input frequency = 200 kHz
- C0420 = 2048

$$DFIN\_nIn\_v\,[rpm] = 200000\ Hz \cdot \frac{60}{2048} = 5859\ rpm$$

Signal setting

Finer resolutions can be realised by a downstream function block (e.g. **L_CONV** from the **LenzeDrive.lib**) function library:

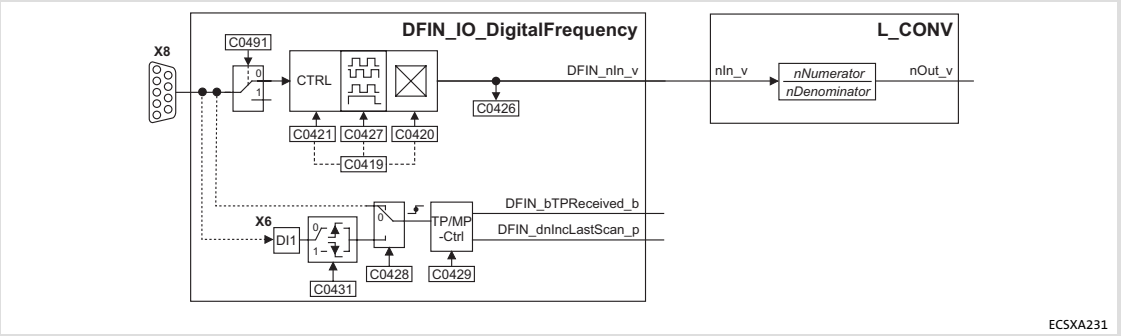


Fig. 13-23 SB "DFIN_IO_DigitalFrequency" with downstream FB "L_CONV" for the scaling

$$nOut\_v = f\,[Hz] \cdot \frac{60}{Number\_of\_incr.\_from\ C0420} \cdot \frac{nNumerator}{nDenominator} \cdot \frac{2^{17}}{15000}$$

13.16.1.2 Configurating touch probe

Process

If an edge change on the input actuating a TP (e. g. X6/DI1) occurs, the instantaneous phase value (master frequency input value) is stored in the operating system by means of a very fast interrupt.

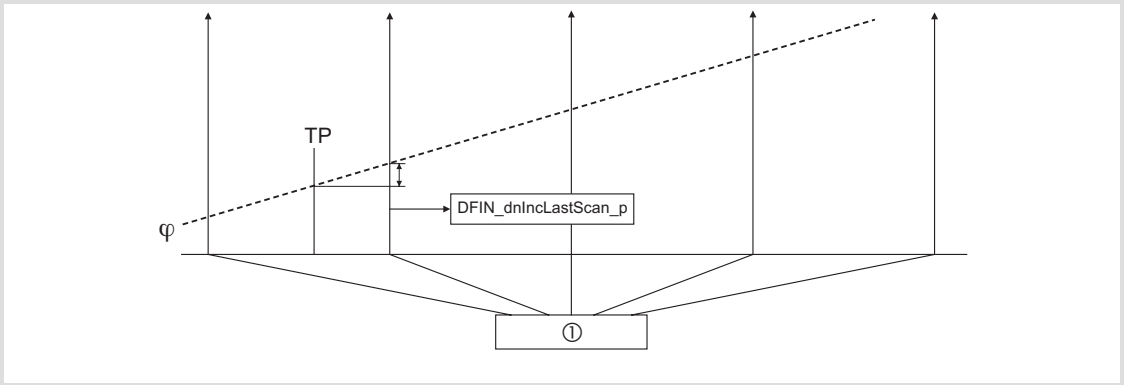


Fig. 13-24 Function diagram of a Touch Probe (TP)

① Time-equidistant start of an interval task

ϑ Phase-angle signal

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0428	DFIN TP sel.	0			DFIN touch probe signal source	📖 336 📖 331
			0	Zero pulse of position encoder (C0490)	X7/X8	
			1	Touch probe input TP1	X6/DI1	
			2	Zero pulse of digital frequency input	X8	
C0429	TP1 delay	0			DFIN dead time compensation TP1 (DI1)	📖 336 📖 331
			-32767	{1 inc} 32767		
C0431	DFIN TP Edge	0			DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	📖 336
			0	Rising edge TP1		
			1	Falling edge TP1		
			2	Rising and falling edge TP1		
			3	Switched off		

Function sequence

1. The TP is activated in an edge-controlled manner via the digital input X6/DI1 or via a zero pulse (only if encoder is connected).
2. If a TP has occurred, *DFIN_bTPReceived_b* is set = TRUE.
3. After the start of the task, *DFIN_dnIncLastScan_p* indicates the number of increments [inc] counted since the TP.
4. Following, *DFIN_bTPReceived_b* = FALSE is set.

Note!

- ► It is necessary that all three outputs (*DFIN_nIn_v*, *DFIN_bTPReceived_b* and *DFIN_dnIncLastScan_p*) are processed in the task even if just one signal is required.
- ► The polarity of the digital input X6/DI1 configured via C0114/1 does not have an influence on the edge evaluation.

DFIN_nIn_v

- ► The value *DFIN_nIn_v* is scaled to increments per millisecond [inc/ms].
  - – (INT) 16384 corresponds to 15000 rpm. See chapter ”Signal types and scaling” (📖 27).
- ► For every task in which *DFIN_nIn_v* is used, the operating system creates an individual integrator that is reset after every start of the task (task-internal process image).
- ► For reliable TP generation, *DFIN_nIn_v* must not be used in the PLC_PRG.

Example: *DFIN_nIn_v* in a 10 ms task:

- ► When the 10 ms task starts, the value of the integrator is stored in a local area of the task and the integrator is reset. The value in the local area gives an average value in increments per 1 ms.
- ► If a position value is to be calculated from the average value, the average value has to be multiplied by (*SYSTEM_nTaskInterval* / 4) in order to obtain increments per 10 ms.
  - – At a task of 10 ms, the value of *SYSTEM_nTaskInterval* is ’40’ (40 × 0.25 ms = 10 ms).
  - – See also chapter ”SYSTEM_FLAGS (system flags)” (📖 373).
- ► The Lenze function blocks already implement this procedure.

13.17 DFOUT_IO_DigitalFrequency (node number 22)

13.17.1 Inputs_DFOUT / Outputs_DFOUT

This SB converts internal speed signals into frequency signals and outputs them to X8 (configuration via C0491).

- Transmission is effected with high precision (without offset and amplification faults) including remainder considered.
- The type of output signals can be set via C0540.
- A configuration of the master frequency output X8 as input (📖 331) is possible via C0491.

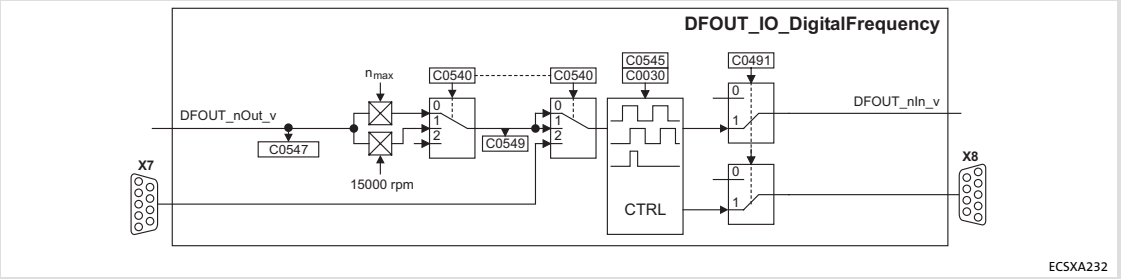


Fig. 13-25 System block "DFOUT_IO_DigitalFrequency"

Note!

The process image is recreated for every task the SB is used in.

- If therefore *DFOUT_nIn_v* and *DFOUT_nOut_v* are used in several tasks, an individual process image of the SB is created for each of these tasks.
- This process is different from the previous process image principle!

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DFOUT_nOut_v	Integer	Velocity	%QW22.0	C0547	dec [%]	
				C0549	dec [rpm]	
DFOUT_nIn_v	Integer	Velocity	%IW22.0	–	–	

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0030	DFOUT const	3				Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 340 📖 115 📖 122
			0	256 incr./rev			
			1	512 incr./rev			
			2	1024 incr./rev			
			3	2048 incr./rev			
			4	4096 incr./rev			
			5	8192 incr./rev			
			6	16384 incr./rev			
[C0491]	X8 in/out	0				Function of X8	📖 331 📖 115 📖 122
			0	X8 is input			
			1	X8 is output			
[C0540]	X8 Signal out	2				Function of the digital frequency output signals on X8 (DFOUT)	📖 112
			0	DFOUT in [%]			
			1	DFOUT in [rpm]			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	📖 340
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	📖 340
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	📖 340
			-32767	{1 rpm}	32767		

13.17.1.1 Configure encoder constant

Via C0030 you configure the encoder constant:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0030	DFOUT const	3		Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 340 📖 115 📖 122
			0 256 incr./rev		
			1 512 incr./rev		
			2 1024 incr./rev		
			3 2048 incr./rev		
			4 4096 incr./rev		
			5 8192 incr./rev		
			6 16384 incr./rev		

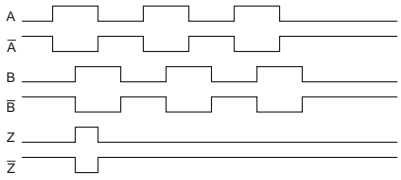
13.17.1.2 Configuration master frequency output signal

You configure the type of the master frequency output signal via C0540:

C0540 = 0	Output of an analog signal
Function	The input signal *DFOUT_nOut_v*is interpreted as an analog signal [%] and is output as a frequency signal on the master frequency output X8.
Scaling	100 % ≡ (INT)16384 ≡ C0011 (n_{max})
Transmission function	$f\,[Hz] = DFOUT\_nOut\_v\,[\%] \cdot \frac{C0030}{100} \cdot \frac{C0011\,(n_{max})}{60}$ $DFOUT\_nIn\_v = f\,[Hz] \cdot \frac{60}{C0030} \cdot \frac{2^{14}}{15000}$
Example	• *DFOUT_nOut_v* = 50 % • C0030 = 3, this corresponds to a number of increments of 2048 increments/revolution • C0011 = 3000 rpm $f\,[Hz] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ Hz$
C0540 = 1	**Output of a speed signal**
Function	The input signal *DFOUT_nOut_v*is interpreted as a speed signal [rpm] and is output as a frequency signal on the master frequency output X8.
Scaling	15000 rpm ≡ (INT)16384
Transmission function	$f\,[Hz] = DFOUT\_nOut\_v\,[rpm] \cdot \frac{C0030}{60}$
Example	• *DFOUT_nOut_v* = 3000 rpm • C0030 = 3, this corresponds to a number of increments of 2048 increments/revolution $f\,[Hz] = 3000\ rpm \cdot \frac{2048}{60} = 102400\ Hz$
C0540 = 2	**Encoder simulation of the resolver with zero track in resolver position**
Function	• The function is used if a resolver is connected to X7. • The encoder constant for output X8 is set in C0030. • The output of the zero pulse with reference 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 °).

Note!

The zero pulse can only be output with C0540 = 2 (encoder simulation of resolver).

Phase-displaced signal sequence	Track	CW rotation	CCW rotation
 CW rotation	**A**	If the input values are positive, track A leads by 90º.	If the input values are negative, track A lags by 90º.
	B	–	–

- The output signal corresponds to the message of an incremental encoder:
  - Track A, B and, if selected, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  - The levels are TTL compatible.
- The zero track is output in accordance with the function set in C0540.

Note!

The digital frequency output X8 has a system-dependent delay time:

- T_d = task cycle time (process image cycle) - 1 ms

Example:

If *DFOUT_nOut_v* is described in a ”10 ms task”, the signal on X8 has a delay time T_d of 9 ms (10 ms - 1 ms)

13.18 DIGITAL_IO (node number 1)

13.18.1 Inputs_DIGITAL (digital inputs)

This SB reads and conditions the signals on X6/DI1 ... DI4.

- The configuration of the terminal polarity for the inputs X6/DI1 ... DI4 is effected via C0114.
- The safety function ”safe torque off” (former ”safe standstill”) is activated via X6/SI1 and X6/SI2.

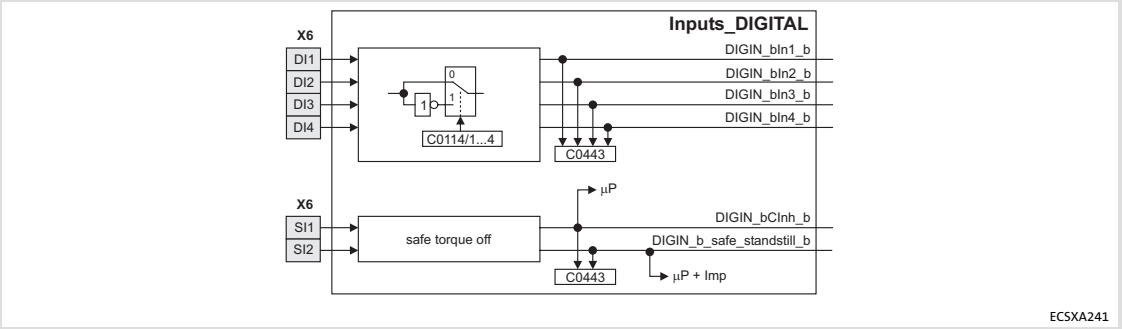


Fig. 13-26 System block ”Inputs_DIGITAL”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DIGIN_bCInh_b	BOOL	binary	%IX1.0.0	–	–	Controller inhibit – takes direct effect on the device control DCTRL.
DIGIN_bIn1_b			%IX1.0.1	C0443	bin	
DIGIN_bIn2_b			%IX1.0.2			
DIGIN_bIn3_b			%IX1.0.3			
DIGIN_bIn4_b			%IX1.0.4			
DIGIN_b_safe_standstill_b			%IX1.0.5			”Safe torque off” (former ”safe standstill”)

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0114				Polarity of the digital inputs	📖 129
1	DIGIN pol	0	HIGH level active	X6/DI1 (DIGIN_bIn1_b)	
2	DIGIN pol	0	HIGH level active	X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0	HIGH level active	X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0	HIGH level active	X6/DI4 (DIGIN_bIn4_b)	
			0 HIGH level active		
			1 LOW level active		
C0443	DIS: DIGIN			Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	📖 343
			0 {1} 255		
			Bit 0 DIGIN1	X6/DI1	
			Bit 1 DIGIN2	X6/DI2	
			Bit 2 DIGIN3	X6/DI3	
			Bit 3 DIGIN4	X6/DI4	
			Bit 4 DIGIN_safe_standstill	X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	📖 80
			Bit 5 Free		
			Bit 6 DIGIN_CInh	X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	📖 80
			Bit 7 Free		

Terminal assignment

Terminal	Function		
X6	**Digital inputs**		
X6/DI1	Digital input 1 (DigIn_bIn1_b)		freely assignable
X6/DI2	Digital input 2 (DigIn_bIn2_b)		
X6/DI3	Digital input 3 (DigIn_bIn3_b)		
X6/DI4	Digital input 4 (DigIn_bIn4_b)		
X6	**Connection of "Safe torque off"(📖 80)**		
X6/SI1	Input 1	LOW	DIGIN_bCInh_b = TRUE
		HIGH	DIGIN_bCInh_b = FALSE
X6/SI2	Input 2	LOW	DIGIN_b_safe_standstill_b = FALSE
		HIGH	DIGIN_b_safe_standstill_b = TRUE
X6/S24	Low-voltage supply		

13.18.2 Outputs_DIGITAL (digital outputs)

This SB conditions the digital signal *DIGOUT_bOut1_b* and outputs it via X6/DO1.

- A motor holding brake supplied with low voltage via X6/B+ and X6/B- can be connected to X25/B1 and X25/B2:
  - The motor holding brake can be switched by the signal *DIGOUT_bRelais_b*.
  - The terminal polarity for the outputs X6/DO1, X25/B1 and X25/B2 can be configured via C0118.
- X6/SO serves to the feedback of the safety function ”safe torque off” (former ”safe standstill”).

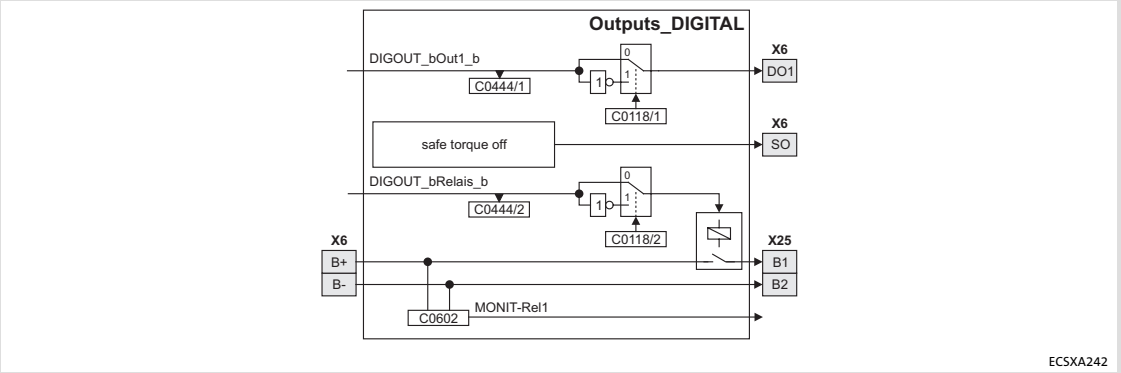


Fig. 13-27 System block ”Outputs_DIGITAL”

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
DIGOUT_bOut1_b	BOOL	Binary	%QX1.0.0	C0444/1	bin	
DIGOUT_bRelais_b			%QX1.0.1	C0444/2		Feedback ”safe torque off” (former ”safe standstill”)

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0118				Polarity of the digital outputs	📖 345
1	DIGOUT pol	0	HIGH level active	X6/DO1 (DIGOUT_bOut1_b)	📖 129
2	DIGOUT pol	0	HIGH level active	X25 (DIGOUT_bRelais_b, brake connection)	
			0 HIGH level active		
			1 LOW level active		
C0444				Status of the digital outputs Only display	📖 345
1	DIS: DIGOUT		0 1	Status of the digital output X6/DO1	
2	DIS: DIGOUT			Relay control status	
C0602	MONIT REL1	3		Fault response - open circuit monitoring of relay output X25	
			0 TRIP		
			2 Message		
			3 Off		
			4 FAIL-QSP		

Terminal assignment

Digital inputs	Function			Electrical data
X6	**Digital output**			24 V DC 0.7 A (max. 1.4 A) short-circuit-proof
X6/DO1	Digital output 1			
X6	**Output "safe torque off" (former "safe standstill")**			
X6/SO	Output feedback	LOW	During operation	
		HIGH	"Safe torque off" (former "safe standstill") active	
X25	**Connection motor holding brake**			23 ... 30 V DC; max. 1.5 A **Set the brake voltage so that the permissible voltage at the brake will not be exceeded or the values do not fall below the threshold!**
X25/B1	Brake connection +			
X25/B2	Brake connection -			
X6	**Low-voltage supply motor holding brake**			
X6/B+	Brake supply +			
X6/B-	Brake supply -			

13.19 FCODE_FreeCode (node number 141)

At Lenze, drive parameters are called codes. By changing the code values, the controller can be adapted to the corresponding application without any additional programming effort.

This SB provides different variables. The variables can be directly read out by means of the assigned ”free” codes of the ECSxA... axis module and can be processed in the PLC program.

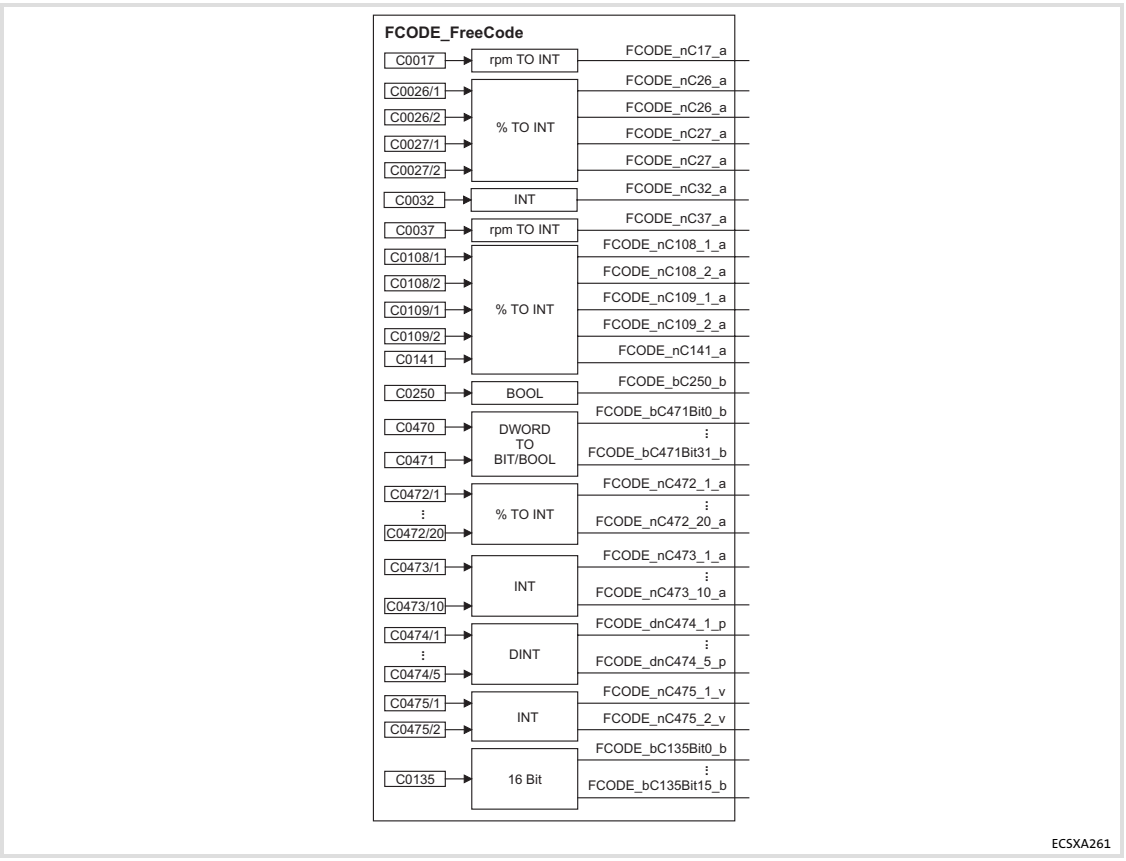


Fig. 13-28 System block ”FCODE_FreeCode”

Note!

- The code C0032 only is available as of software version 7.0.
- The free code C0470 is placed on the same memory address as the code C0471. C0470 can be read out via the variables assigned to the C0471 *FCODE_bC0471Bit0_b* ... *FCODE_bC0471Bit31_b*.

  In contrast to code C0471, which can accept a 32-bit value, code C0470 is divided into four subcodes with 8 bits each.

- The values in the codes ( ) of the SB are assigned to the respective variables.
- The code value is converted into a variable value via a fixed scaling routine.

  Example:

  It is possible to enter a percentage [%] (e. g. by means of the keypad) to code C0472/1 of the ECSxA... axis module. The value is directly assigned to the variable *FCODE_nC0472_1_a* (data type ”integer”) and can be further processed in the PLC program.

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Notes
FCODE_nC17_a	Integer	analog	%IW141.0	–	–	default = 50 rpm
FCODE_nC26_1_a			%IW141.2			default = 0.00 %
FCODE_nC26_2_a			%IW141.3			default = 0.00 %
FCODE_nC27_1_a			%IW141.4			default = 100.00 %
FCODE_nC27_2_a			%IW141.5			default = 100.00 %
FCODE_nC32_a			%IW141.6			default = 1
FCODE_nC37_a			%IW141.7			default = 0 rpm
FCODE_nC108_1_a			%IW141.8			default = 100.00 %
FCODE_nC108_2_a			%IW141.9			default = 100.00 %
FCODE_nC109_1_a			%IW141.10			default = 0.00 %
FCODE_nC109_2_a			%IW141.11			default = 0.00 %
FCODE_nC141_a			%IW141.12			default = 0.00 %
FCODE_bC250_b	BOOL	binary	%IX141.13.0	–	–	default = 0
FCODE_bC471Bit**0**_b ... FCODE_bC471Bit**15**_b	BOOL	binary	%IX141.14.**0** ... %IX141.14.**15**	–	–	default = 0
FCODE_bC471Bit**16**_b ... FCODE_bC471Bit**31**_b			%IX141.15.**0** ... %IX141.15.**15**			
FCODE_nC472_**1**_a ... FCODE_nC472_**20**_a	Integer	analog	%IW141.**16** ... %IW141.**35**	–	–	default = 0.00 % C0472/3 = 100.00 %
FCODE_nC473_**1**_a ... FCODE_nC473_**10**_a	Integer	analog	%IW141.**36** ... %IW141.**45**	–	–	default = 0 C0473/1,2 = 1
FCODE_dnC474_**1**_p ... FCODE_dnC474_**5**_p	Double integer	Position	%ID141.**23** ... %ID141.**27**	–	–	default = 0
FCODE_nC475_1_v	Integer	velocity	%IW141.56	–	–	default = 0
FCODE_nC475_2_v			%IW141.57			
FCODE_bC135Bit**0**_b ... FCODE_bC135Bit**15**_b	BOOL	binary	%IX141.58.**0** ... %IX141.58.**15**	–	–	default = 0

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)	📖 347
			-16000	{1 rpm}	16000		
C0026						Offset for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a	
2	FCODE(offset)	0,0				FCODE_nC26_2_a	
C0027						Gain for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0032	FCODE Gearbox	1				Freely configurable code for gearbox factor ? (FCODE_nC32_a)	📖 347
			-32767	{1}	32767		
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	📖 347
			-16000	{1 rpm}	16000		
C0108						Gain for relative analog signals (AOUT)	📖 347
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	📖 347
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0135	Control word	0				System control word DCTRL	
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned			
			Bit 1	Not assigned			
			Bit 2	Not assigned			
			Bit 3	Quick stop (QSP)			
			Bit 4	Not assigned			
			Bit 5	Not assigned			
			Bit 6	Not assigned			
			Bit 7	Not assigned			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit 10	TRIP-SET			
			Bit 11	TRIP-RESET			
			Bit 12	Not assigned			
			Bit 13	Not assigned			
			Bit 14	Not assigned			
			Bit 15	Not assigned			
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)	📖 347
			-199.99	{0.01 %}	199.99		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	📖 347
			0		1		
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	📖 347
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	📖 347
			0	{1}	4294967295		
C0472	FCODE analog					Freely configurable code for relative analog signals	📖 347
1		0.0	-199.99	{0.01 %}	199.99	FCODE_bC472_1_a	
2		0.0				FCODE_bC472_2_a	
3		100.0				FCODE_bC472_3_a	
4		0.0				FCODE_bC472_4_a	
...		...				...	
20		0.0				FCODE_bC472_20_a	
C0473						Freely configurable code for absolute analog signals	📖 347
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	📖 347
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	📖 347
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					

13.20 MCTRL_MotorControl (node number 131)

This SB contains the control of the driving machine. It consists of the phase controller, speed controller, and the motor control.

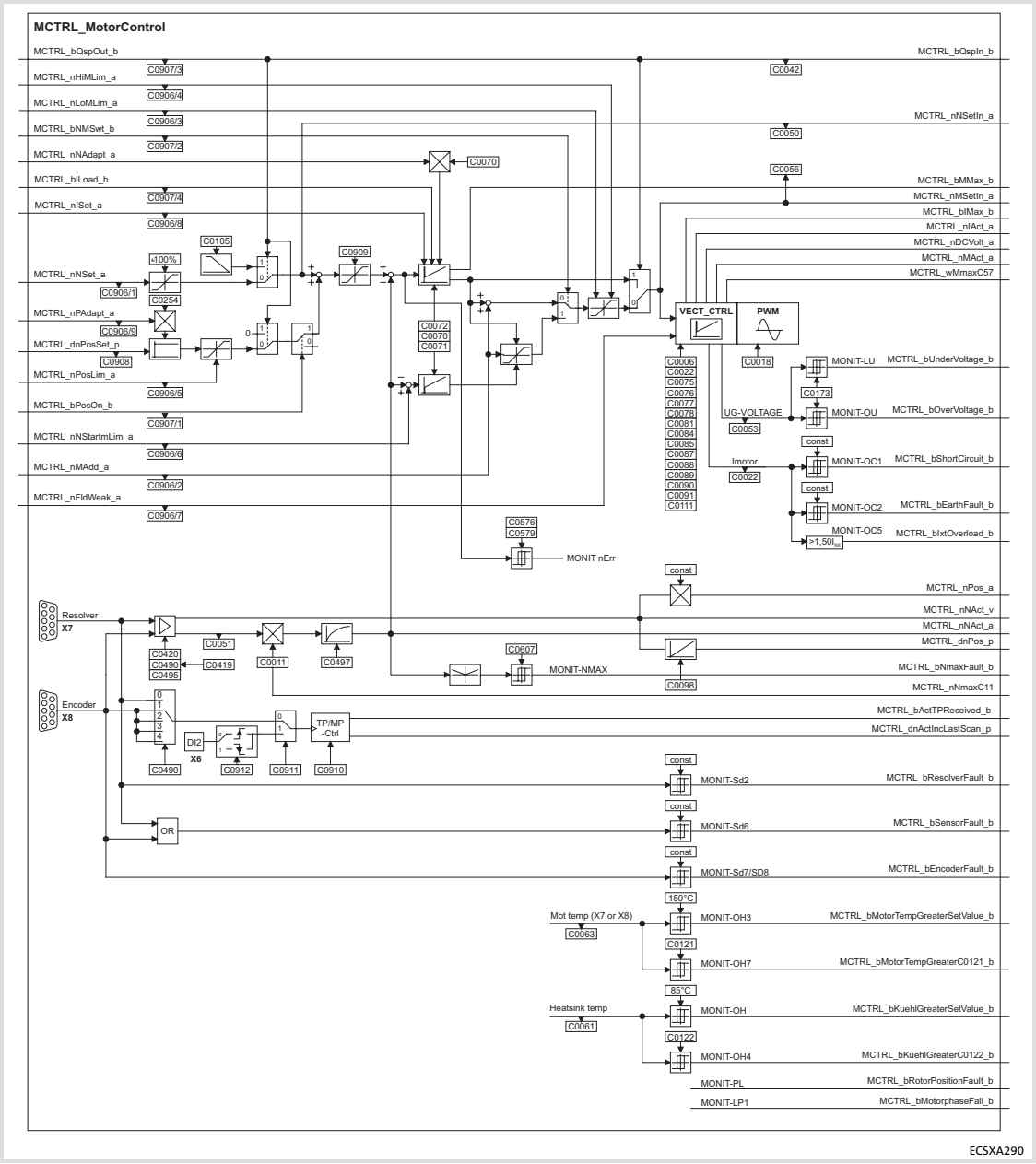


Fig. 13-29 System block "MCTRL_MotorControl"

Note!

The process image is established in the course of a fixed system task (interval: 1 ms).

Exception: *MCTRL_bActTPReceived_b*, *MCTRL_dnActIncLastScan_p* and *MCTRL_nNAct_v* respectively are read in the process input image of the task in which they are used.

13.20.1 Inputs_MCTRL

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
MCTRL_bQspIn_b	BOOL	binary	%IX131.0.0.0	C0042	bin	TRUE = drive carries out quick stop (QSP)
MCTRL_nNSetIn_a	integer	analog	%IW131.1	C0050	dec [%]	Speed setpoint ● 16384 ≡ 100 % n_{max} (C0011)
MCTRL_bMMax_b	BOOL	binary	%IX131.0.2	–	–	TRUE = speed controller operates in limitation
MCTRL_nMSetIn_a	integer	analog	%IW131.3	C0056	dec [%]	Torque setpoint ● 16384 ≡ 100 % M_{max} (C0057)
MCTRL_bIMax_b	BOOL	binary	%IX131.0.1	–	–	TRUE = drive operates at limit C0022
MCTRL_nIAct_a	integer	analog	%IW131.5	–	–	Actual motor current ● 16384 ≡ 100 % I_{max} (C0022)
MCTRL_nDCVolt_a			%IW131.6			DC voltage ● 16384 ≡ 1000 V
MCTRL_nMAct_a			%IW131.4			Current torque ● 16384 ≡ 100 % M_{max} (C0057)
MCTRL_wMmaxC57	Word	–	%IW131.16	–	–	Display of maximum torque (C0057) x 10
MCTRL_bUnderVoltage_b	BOOL	binary	%IX131.0.3	–	–	Monit: undervoltage
MCTRL_bOverVoltage_b			%IX131.0.4			Monit: overvoltage
MCTRL_bShortCircuit_b			%IX131.0.5			Monit: short circuit
MCTRL_bEarthFault_b			%IX131.0.6			Monit: earth fault
MCTRL_bIxtOverload_b			%IX131.9.2			Monit: I x t - overload
MCTRL_nPos_a	integer	analog	%IW131.7	–	–	Actual phase value as analog signal ● 90° ≡ 100%
MCTRL_nNAct_v	integer	Velocity	%IW131.8	–	–	Actual speed value [inc/ms]
MCTRL_nNAct_a	integer	analog	%IW131.2	–	–	Actual speed value ● 16384 ≡ 100 % n_{max} (C0011)
MCTRL_dnPos_p	double integer	position	%ID131.5	–	–	Rotor position of the motor
MCTRL_bNmaxFault_b	BOOL	binary	%IX131.0.7	–	–	Monit: max. system speed exceeded
MCTRL_nNmaxC11	integer	–	%IW131.15	–	–	Display of max. speed (C0011)
MCTRL_bActTPReceived_b	BOOL	binary	%IX131.0.10	–	–	Receive touch probe (TP)
MCTRL_dnActIncLastScan_p	double integer	position	%ID131.6	–	–	Δinc during TP and task start

Variable	Data type	Signal type	Address	Display code	Display format	Comments
MCTRL_bResolverFault_b	BOOL	binary	%IX131.0.8	–	–	Monit: resolver error
MCTRL_bEncoderFault_b			%IX131.9.1			Monit: Encoder error
MCTRL_bSensorFault_b			%IX131.9.0			Monit: Thermal sensor error
MCTRL_bMotorTempGreaterSetValue_b			%IX131.0.11			Monit: Motor temperature > 150 °C
MCTRL_bMotorTempGreaterC0121_b			%IX131.0.12			Monit: Motor temperature > C0121
MCTRL_bKuehlGreaterSetValue_b			%IX131.0.14			Monit: Heatsink temperature > 85 °C
MCTRL_bKuehlGreaterC0122_b			%IX131.0.15			Monit: Heatsink temperature > C0122
MCTRL_bRotorPositionFault_b			%IX131.9.3			Monit: Error during rotor position adjustment
MCTRL_bMotorphaseFail_b			%IX131.9.4			Monit: Failure of a motor phase

13.20.2 Outputs_MCTRL

System variables

Variable	Data type	Signal type	Address	Display code	Display format	Comments
MCTRL_bQspOut_b	BOOL	binary	%QX131.0.0	C0907/3	bin	TRUE = drive carries out quick stop (QSP)
MCTRL_nHiMLim_a	integer	analog	%QW131.4	C0906/4	dec [%]	Upper torque limitation ● in % of C0057
MCTRL_nLoMLim_a			%QW131.3	C0906/3		Lower torque limitation ● in % of C0057
MCTRL_bNMSwt_b	BOOL	binary	%QX131.0.1	C0907/2	bin	FALSE = speed control TRUE = torque control
MCTRL_nNAdapt_a	integer	analog	%QW131.12	–	–	Adaptive proportional gain of the speed controller
MCTRL_bILoad_b	BOOL	binary	%QX131.0.3	C0907/4	bin	TRUE = integral action component of the speed controller is accepted by *MCTRL_nISet_a*
MCTRL_nISet_a	integer	analog	%QW131.7	C0906/8	dec [%]	Integral action component of the speed controller
MCTRL_nNSet_a			%QW131.1	C0906/1		Speed setpoint
MCTRL_nPAdapt_a			%QW131.8	C0906/9		Impact of C0254 on the proportional gain (in %), ● The sum (without sign) is processed.
MCTRL_dnPosSet_p	double integer	position	%QD131.5	C0908	dec [inc]	Setpoint phase differs from actual phase for phase controller
MCTRL_nPosLim_a	integer	analog	%QW131.9	C0906/5	dec [%]	Influence of the phase controller ● In % of n_{max} (C0011)
MCTRL_bPosOn_b	BOOL	binary	%QX131.0.2	C0907/1	–	TRUE = activate phase controller
MCTRL_nNStartMLim_a	integer	analog	%QW131.5	C0906/6	dec [%]	Lower speed limit at speed limitation
MCTRL_nMAdd_a			%QW131.2	C0906/2		Additional torque setpoint or torque setpoint
MCTRL_nFldWeak_a			%QW131.6	C0906/7		Motor control

13.20.3 Torque setpoint / additional torque setpoint

According to setting of *MCTRL_bNMSwt_b*, *MCTRL_nMAdd_a* serves as a torque setpoint or as an additional torque setpoint.

Torque setpoint

At *MCTRL_bNMSwt_b* = TRUE, the speed control is active.

- *MCTRL_nMAdd_a* acts as a torque setpoint.
- The speed controllers carry out a monitoring function.
- The torque setpoint is defined in [%] of the maximum possible torque.
  – Negative values cause a torque in CCW rotation of the motor.
  – Positive values cause a torque in CW rotation of the motor.
- Set the maximum possible torque via C0057:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0057	Max Torque					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	📖 355
			0,0	{0.1 Nm}	500,0		

Additional torque setpoint

At *MCTRL_bNMSwt_b* = FALSE, the speed control is active.

- *MCTRL_nMAdd_a* additionally acts on the output of the n controller.
- The limits specified by the torque limitation *MCTRL_nLoMLim_a* and *MCTRL_nHiMLim_a* thereby cannot be exceeded.
- The additional torque setpoint can, for instance, be used for friction compensation or acceleration feed forward (dv/dt).

13.20.4 Torque limitation

MCTRL_nLoMLim_a and *MCTRL_nHiMLim_a* serve to set an external torque limitation. This serves to define various torque values for the quadrants ”drive” and ”brake”.

- *MCTRL_nHiMLim_a* is the upper torque limit in [%] of the maximally possible torque.
- *MCTRL_nLoMLim_a* is the lower torque limit in [%] of the maximally possible torque.
- The maximally possible torque is set via C0057.

Stop!

Set only positive values in *MCTRL_nHiMLim_a* and only negative values in *MCTRL_nLoMLim_a* as otherwise the speed controller may get out of control. This may cause the drive to speed up in an uncontrolled way.

Note!

- If *MCTRL_nHiMLim_a* is unassigned (free), the upper torque limit automatically amounts to 100 % of the max. possible torque.
- If *MCTRL_nLoMLim_a* is unassigned (free), the lower torque limit automatically amounts to -100 % of the max. possible torque.
- In case of quick stop (QSP), the torque limitation is switched to an inactive state, i.e. the operation runs with ±100 %.

13.20.5 Setting maximum speed

The maximum speed (n_{max}) which is used as a reference variable for the absolute and relative setpoint selection with regard to the acceleration and deceleration times as well as to the upper and lower speed limit, is set via C0011.

► n_{max} = 100 % ≡ (INT) 16384

Note!

MCTRL_nNmaxC11 displays the maximum speed set via C0011.

► By means of this system variable, you are able to program your own speed scalings.

► Example: C0011 = 3000 rpm ⇨ *MCTRL_nNmaxC11* = 3000

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0011	Nmax	3000				Maximum speed	📖 357
			500	{1 rpm}	16000	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 (CINH)!**	

13.20.6 Speed setpoint limitation

A speed setpoint limitation can be set via C0909.

- You define the speed setpoint via *MCTRL_nNSet_a* in [%] of n_{max}.
- N_{max} is selected via C0011. (📖 357)

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0909	speed limit	1		Limitation of direction of rotation for speed setpoint	📖 358
			1 -175 ... +175 %		
			2 0 ... +175 %		
			3 -175 ... 0 %		

13.20.7 Torque control with speed limitation

Set *MCTRL_bNMSwt_b* = TRUE, in order to activate this function.

- For the speed limitation a second speed controller (auxiliary speed controller) is connected.
- *MCTRL_nMAdd_a* acts as a bipolar torque setpoint.
- The speed controller 1 is used to make up the upper speed limit.
  - The upper speed limit is specified by *MCTRL_nNSet_a* in [%] of n_{max} (positive sign for clockwise sense of rotation).
- The speed controller 2 (auxiliary speed controller) is used to make up the lower speed limit.
  - The lower speed limit is specified by *MCTRL_nNStartLim_a* in [%] of n_{max} (negative sign for anticlockwise sense of rotation).
- N_{max} is selected via C0011. (📖 357)



Stop!

Use ...

- the upper speed limit for the clockwise sense of rotation (positive values) only.
- the lower speed limit for the anticlockwise sense of rotation (negative values) only.

Otherwise, the drive can run out of control!

13.20.8 Parameterising phase controllers

The angle controller is required, for instance, to achieve an angle-synchronous operation and a drift-free standstill.

Parameter setting

1. Assign *MCTRL_nPosSet_a* with a signal source which provides the angular difference between set angle and actual angle.
2. Enter a value > 0 at *MCTRL_nPosLim_a*.
3. Set *MCTRL_bPosOn_b* = TRUE.
4. Set a highest possible proportional gain ($V_{pn)}$ of the speed controller in C0070.
   In the PLC program, the *MCTRL_nNAdapt_a* variable can be used to change the proportional gain (V_{pn}):
   – V_{pn} = *MCTRL_nNAdapt_a* [%] × C0070
   – Default: *MCTRL_nNAdapt_a* = 100 % ⇨ V_{pn} = 100 % × C0070 = C0070
5. Set the gain of the phase controller > 0 via C0254.
   Increase C0254 during operation until the drive has the required control mode.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 141
			0.00	{ 0.01}	127.99		
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	📖 360
			0.0000	{ 0.0001}	3.9999		

Angle controller influence

The output of the phase controller is added to the speed setpoint.

- When the actual angle is lagging, the drive is accelerated.
- When the actual angle is leading, the drive is decelerated until the required angular synchronism has been reached.

The influence of the phase controller consists of:

- Angular difference multiplied by the gain V_p (C0254).
- Influence via an analog signal at *MCTRL_nPAdapt_a*.
  V_p = C0254 × *MCTRL_nPAdapt_a* / 16384
- Limitation of the phase controller output
  – The output of the angle controller is limited to the ±*MCTRL_nPosLim_a* value.
  – ±*MCTRL_nPosLim_a*limits the maximum speed-up of the drive at great angular differences.

13.20.9 Quick stop (QSP)

The QSP function serves to stop the drive – irrespective of the setpoint selection – within the time set in C0105.

- The QSP function is active if *MCTRL_bQsp_b* is set = TRUE.
- If the SB **DCTRL_DriveControl** is to actuate QSP (see also 📖 361), program the QSP function as follows:

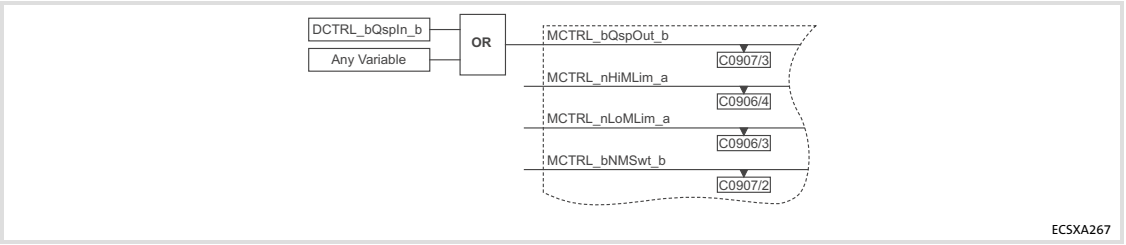


Fig. 13-30 Programming: actuation of a quick stop (QSP) via SB "Inputs_DCTRL"

Function:

- The torque limitation *MCTRL_nLoMLim_a* and *MCTRL_nHiMLim_a* is switched inactively, i. e. the process is run at ±100 % capacity (📖 356). The drive is operated by the speed controller.
- The phase controller is switched actively. If the rotor position is moved actively, the drive creates a torque to counter the swing if
  – C0254 is set unequal to '0'.
  – *MCTRL_nPosLim_a*is controlled by means of a value > 0 %.
- The speed is reduced to '0' within the deceleration time set via C0105:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 361
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

13.20.10 Manual field weakening

A manual field weakening can be achieved via *MCTRL_nFldWeak_a*.

- For a maximum excitation *MCTRL_nFldWeak_a* has to be activated by +100 % (= 16384).
- If *MCTRL_nFldWeak_a* is not connected (free), the field weakening automatically is +100 %.



Stop!

If the field is weakened manually (*MCTRL_nFldWeak_a* < 100 %), the drive cannot produce the maximum torque.

13.20.11 Switching frequency changeover

For the inverter the following switching frequencies can be set via C0018:

- 4 kHz for power-optimised operation ⇨ maximum power output of the drive controller, however, with audible pulse operation.
- Automatic switch-over between power-optimised and noise optimised operation (8 kHz).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0018	fchop	2		Switching frequency	📖 363
			1 4 kHz sinus	Power-optimised operation permanent 4 kHz frequency	
			2 4 8 kHz sinus	Noise optimised operation automatic change-over to 8 kHz at higher load	

Automatic switching frequency changeover

You can use the automatic switching frequency changeover if you intend to operate the drive in the noise optimised range, and if the available torque for acceleration processes is not sufficient for this purpose.

Condition M = f(I)	Function
$M < M_N (I_N)$	Drive controller operates at 8 kHz (noise optimised)
$M_N (I_{N(8)}) < M < M_N (I_{N(4)})$	Drive controller switches to 4 kHz (power-optimised)
$M > M_{max} (I_{max})$	Drive controller operates at 4 kHz in current limitation

13.20.12 Touch probe (TP)

Procedure: In case of an edge change on the input activating a TP (e. g. X6/DI2), the current angle value (master frequency input value) is saved in the operating system by a very quick interrupt.

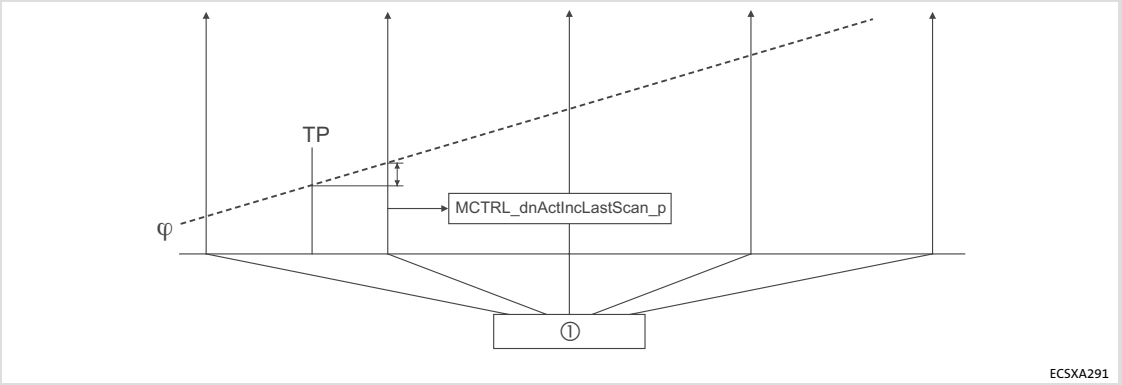


Fig. 13-31 Function diagram of a touch probe (TP)

① Time-equidistant start of an interval task

ϑ Phase-angle signal

Configuring touch probe (TP)

The digital inputs X6/DI1 ... DI4 can be assigned with the following TP signals:

Dig. input	System variable	Signal assignment
X6/DI1	DigIn_bIn1_b	DfIn_bActTpReceived_b (C0431, 📖 331)
X6/DI2	DigIn_bIn2_b	MCTRL_bActTpReceived_b (C0912)
X6/DI3	DigIn_bIn3_b	Freely configurable TP (LenzeTpDrvXXX.lib function library)
X6/DI4	DigIn_bIn4_b	

The following codes are available for touch probe configuration:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0910	MCTRL TP2 delay	0			MCTRL dead time compensation TP2 (X6/DI2)	📖 364
			-32767 {1 inc} 32767		1 inc ≡ approx. 60 µs	
C0911	MCTRL TP2 sel.	0			MCTRL touch probe signal source	📖 364
			0	Zero pulse of position encoder (C0490)	X7/X8	
			1	Touch probe input TP2	X6/DI2	
C0912	MCTRL TP2 Edge	0			MCTRL touch probe TP2 edge (for touch probe via digital input X6/DI2 (C0911 = 1))	📖 364
			0	Rising edge TP2		
			1	Falling edge TP2		
			2	Rising and falling edge TP2		
			3	Switched off		

Function sequence

1. The TP is activated in an edge-controlled manner via the digital input X6/DI2 or via a zero pulse from the master frequency input X8 or the resolver input X7.
2. If a TP has been effected, *MCTRL_bActTPReceived_b* is set = TRUE.
3. After the start of the task, *MCTRL_dnActIncLastScan_p* indicates the number of increments [inc/ms] counted since the TP.
4. Following, *MCTRL_bActTPReceived_b* is set = FALSE.

Note!

It is necessary that all three outputs (*MCTRL_nNAct_v*, *MCTRL_bActTPReceived_b* and *MCTRL_dnActIncLastScan_p*) are processed in the task, even if just one signal is required.

MCTRL_nNAct_v (actual speed value)

- The polarity of the digital input X6/DI2 configured under C0114/2 has no influence on the edge evaluation.
- The value *MCTRL_nNAct_v* is scaled to increments per millisecond [inc/ms].
  - (INT) 16384 corresponds to 15000 rpm. See chapter "Signal types and scaling" (📖 27).
- For every task in which *MCTRL_nNAct_v* is used, the operating system creates an individual integrator that is reset after every start of the task (task-internal process image).
- For reliable TP generation, *MCTRL_nNAct_v* must not be used in the PLC_PRG.

Example: *MCTRL_nNAct_v* in a 10 ms task:

- When the 10 ms task starts, the value of the integrator is stored in a local area of the task and the integrator is reset. The value in the local area gives an average value in increments per 1 ms.
- If a position value is to be calculated from the average value, the average value has to be multiplied by (*SYSTEM_nTaskInterval* / 4) in order to obtain increments per 10 ms.
  - At a 10 ms task, the value of *SYSTEM_nTaskInterval* is '40' (40 × 0.25 ms = 10 ms).
  - See also chapter "SYSTEM_FLAGS (system flags)" (📖 373).
- The Lenze function blocks already implement this procedure.

13.20.13 Adjusting the motor data



Tip!

The GDC ”input assistant for motor data” makes motor parameterisation easy.

For more information, please see the ”Global Drive Control (GDC) - Getting started” Manual.

In ”GDC Easy”, the ”Input assistant for motor data” is not available. In this case, please contact your Lenze representative for the stator resistance and leakage inductance data.

For the manual adjustment of the motor data, the following codes are provided to you:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0006]	Op mode	1				Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.	
			1	Servo PM-SM		Servo control of synchronous motors	
			2	Servo ASM		Servo control of asynchronous motors	
C0022	Imax current	→				I_{max} limit	
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	📖 144
			0.00	{0.01}	63.99		
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	📖 144
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Read only	
			0.00	{0.01 A}	327,67		
C0093	Drive ident					Device identification of the ECS axis module Read only	
			0	Defective power section			
			1	No power section recognised			
			4	ECSxS/P/M/A004C4			
			8	ECSxS/P/M/A008C4			
			16	ECSxS/P/M/A016C4			
			32	ECSxS/P/M/A032C4			
			48	ECSxS/P/M/A048C4			
			64	ECSxS/P/M/A064C4			
			65	ECSxS/P/M/A064C2			
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 138
			0	Inactive			
			1	Active			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0097	DIS:Lt-Ident	0				Power stage identification	
			0	{1}	255		
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		

13.20.14 Monitoring

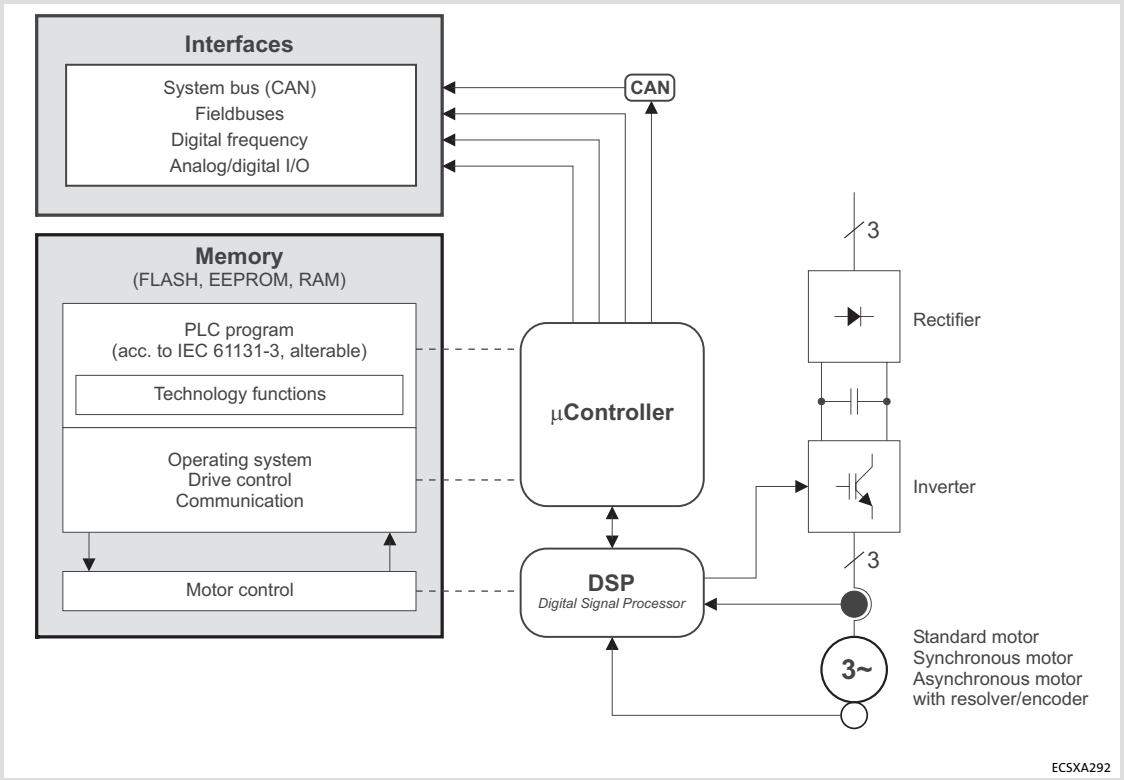


Fig. 13-32 Signal flow: motor control – PLC

The motor control is provided with different monitoring functions, protecting the drive against impermissible operating conditions.

If a monitoring function is activated,

- the corresponding response for device protection is initiated.
- the fault indication is entered on the first position in the history buffer (📖 237).
- a corresponding variable is set to TRUE as long as the trigger condition is fulfilled.
  The variables of the monitoring function can be processed in the application program of the PLC.

The current error number is also displayed in the variable *DCTRL_wFaultNumber* after the PLC has been started.

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:
  The current fault (subcode 1 of C0168) is a communication error (fault message "CE0"/no. "x061") between the AIF module and the ECS axis module.
- 2xxx:
  The fault response is a warning.

Note!

An overview of the monitoring function is provided in chapter "10.2 Monitoring functions" (📖 198).
The monitoring responses are described in the same chapter (📖 202).

Tip!

Occurring faults generally do not affect the operating ability of the PLC!

13.21 OSC_Oscilloscope (node number 60)

Note!

When the oscilloscope is integrated into the IEC 61131 program (DDS), it requires a permanent calculating time of 100 µs. Check in the task monitor, if enough calculating capacity is available.

The following steps must be carried out to activate the oscilloscope in the DDS:

1. Enter the system block **OSC_Oscilloscope** into the control configuration.
2. Read the system block input *OSC_bUsed* into the program organisation unit of the program type.

Thus the oscilloscope is called in the input process of the tasks which also contains the program wit the entry mentioned. The minimum sampling rate is determined by the task which includes the oscilloscope.

Examples

- AWL:
  LD OSC_bUsed
  ST A
- ST:
  A := OSC_bUsed

Further information ....

concerning the handling and functional range of GDO can be obtained from the Manual ”Global Drive Oscilloscope (GDO), Getting started”.

13.22 SYSTEM_FLAGS (system flags, node number 151)

System flags are global variables that are integrated in the run-time system as an inherent part. They feature functionalities for making programming easier.

13.22.1 Inputs SYSTEM_FLAGS

The following system flags are part of the ECSxA... axis module:

Variable	Data type	Address	Comments
SYSTEM_bClock01Hz	BOOL	%IX151.0.0	0.1 Hz system clock
SYSTEM_bClock1Hz		%IX151.0.8	1.0 Hz system clock
SYSTEM_bClock10Hz		%IX151.1.0	10 Hz system clock
SYSTEM_bClock0100Hz		%IX151.1.8	100 Hz system clock
SYSTEM_bTogCycleTask		%IX151.2.0	Toggle marker - cyclic task
SYSTEM_b1LoopCyclicTask		%IX151.2.8	First loop - cyclic task
SYSTEM_b1LoopTask2		%IX151.3.0	First loop - task ID2
SYSTEM_b1LoopTask3		%IX151.3.8	First loop - task ID3
SYSTEM_b1LoopTask4		%IX151.4.0	First loop - task ID4
SYSTEM_b1LoopTask5		%IX151.4.8	First loop - task ID5
SYSTEM_b1LoopTask6		%IX151.5.0	First loop - task ID6
SYSTEM_b1LoopTask7		%IX151.5.8	First loop - task ID7
SYSTEM_b1LoopTask8		%IX151.6.0	First loop - task ID8
SYSTEM_b1LoopTask9		%IX151.6.8	First loop - task ID9
SYSTEM_nTaskInterval	integer	%IW151.7	Interval of current task
SYSTEM_nTaskID		%IW151.8	Identification of current task

Tip!

The system flags are not generated in simulation mode.

SYSTEM_bClockxHz

These system flags output a fixed clock pulse with an equal pulse/pause ratio.

- State alterations of the flag are effected in real time.
- When you use this system flag, observe the sampling frequency used for polling the flag (aliasing effect). It should at least be twice the change frequency.

  Example: You want to use the system flag *SYSTEM_bClock100Hz* as a clock for a counter.
- The pulse/pause ratio is 5 ms/5 ms.
- To avoid an aliasing effect, the counter must always be polled with an INTERVAL TASK < 5 ms.

Note!

The *SYSTEM_bClockxHz* system variables must not be used to trigger event-controlled tasks. Use time-controlled tasks for this.

SYSTEM_bTogCycleTask

This system flag alters the state with the cyclic task:

1. cycle: FALSE
2. cycle: TRUE
3. cycle: FALSE
4. cycle: TRUE
   etc.

SYSTEM_nTaskInterval

This system flag indicates the interval of the running task with a resolution of 0.25 ms.

- If, for instance, a tasks of 10 ms is processed, the system flag indicates '40' (40 × 0.25 ms = 10 ms).
- If a task different from an interval task is processed, the system flag indicates 0".

SYSTEM_nTaskID

This system flag indicates the task ID of the running task.

SYSTEM_b1LoopCyclicTask/SYSTEM_b1Loop Task X

These system flags are TRUE only once during the first cycle of a task.

- After the first cycle, the flags will be set to FALSE.
- The only way to reset the status to TRUE is to reset the program in the drive controller.

13.22.2 Outputs SYSTEM_FLAGS

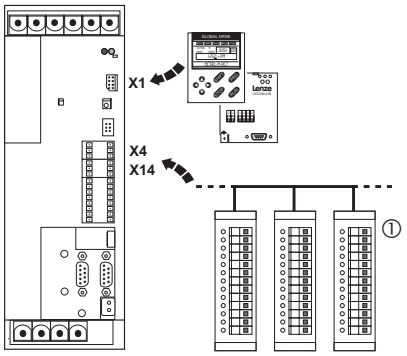
Variable	Data type	Address	Comments
SYSTEM_bPLCResetAndRun	Bool	%QX151.0.0	This system flag executes a reset with immediate restart of the axis module. After the reset, the flag will be deleted and a restart is executed.

14 Appendix

14.1 PLC functionality

Field		Quantity	Description	
Inputs	Digital	1	Input for controller enable	24 V DC 8 mA per input [1] response time 0.25 ms
		4	Free inputs (2 interrupt-capable[1])	
	Analog	1	Free input (11 bits + sign)	-10 ... +10 V -20 ... +20 mA/+4 ... +20 mA
	"Safe torque off" (former "safe standstill")	2	X6/SI1 for controller inhibit X6/SI2 for pulse inhibit	24 V DC / 8 mA per input
	Digital frequency	1	Input	0 ... 500 kHz
Outputs	Digital	1	Free output	24 V DC / 0.7 A max. 1.4 A (short-circuit-proof)
	Digital frequency	1	Output	0 ... 500 kHz
	"Safe torque off" (former "safe standstill")	1	S6/SO for feedback	24 V DC / 0.7 A max. 1.4 A (short-circuit-proof)
Feedback system			Resolver, incremental or sin/cos encoder	
Operation set			According to IEC61131-3	
Counter/times			According to IEC61131-3, depending on the data memory available	
Fast counter		1	0 ... 500 kHz	
Flags		512	Flag words	
Memory			See chapter 14.3 (📖 376)	
Processing time (1-bit operation)			0.7 µs	
Task types		8	Time or event-controlled tasks (1 ms ... 16 s)	
		1	Cyclic task	
Functions			• PID control functions • Electrical shaft • Positioning function • Mains failure control • Brake control • Yield point arithmetic	
Programming software			Drive PLC Developer Studio • Programming languages according to IEC61131-3 (IL, LD, FBD, ST, SFC) as well as CFC editor • Monitoring, visualisation, simulation and debugging	
Technology functions			Software packages (cam, positioner, winder)	

14.2 Extendability / networking



ECSXA294

X1 **Automation interface (AIF)**
for XT EMZ9371BC keypad or the following AIF modules:
- EMF2102IB LECOM-A/B/LI
- EMF2141IB LON
- EMF2113IB INTERBUS
- EMF2133IB PROFIBUS-DP
- EMF2178IB CANopen
- EMF2179IB DeviceNet
- EMF2192IB EtherCAT

X4 **System bus interface CAN**

X14 **System bus interface CAN-AUX**

① **Terminal extension IO system IP20**

System bus (CAN)

Interface	CAN objects available	
Integrated system bus interface ● X4 (CAN) ● X14 (CAN-AUX)	PDO	CAN1_IN/CAN1_OUT CAN2_IN/CAN2_OUT CAN3_IN/CAN3_OUT CANaux1_IN/CANaux1_OUT CANaux2_IN/CANaux2_OUT CANaux3_IN/CANaux3_OUT
	SDO	SDO1 (parameter data channel 1) SDO2 (parameter data channel 2)
		L_ParRead/L_ParWrite functionality only via CAN interface X4
	Sync telegram	
	CanDSx driver for mapping indices to codes and for the bus monitoring functions ”Heartbeat” and ”Node Guarding” (see manual for function library **LenzeCanDSxDrv.lib**). **Note:** In case of CAN-AUX, there are no bus monitoring functions ”Heartbeat” and ”Node Guarding”.	
Automation interface (AIF) ● X1 with fieldbus module EMF2178IB CANopen	PDO	XCAN1_IN/XCAN1_OUT XCAN2_IN/XCAN2_OUT XCAN3_IN/XCAN3_OUT XCANaux1_IN/XCANaux1_OUT XCANaux2_IN/XCANaux2_OUT XCANaux3_IN/XCANaux3_OUT
	SDO	XSDO1 (parameter data channel 1) XSDO2 (parameter data channel 2)
	Sync telegram	
	AifParMap driver for mapping code accesses via AIF to other codes (see manual for function library **LenzeAifParMapDrv.lib**).	

14.3 Memories

The table below gives you an overview of the memories available:

Memory		Size	Information
ROM			
	Program memory	512 kbytes	Re-written whenever the program is downloaded
RAM			
	PLC data memory	10 kbytes	Can be symbolically used for FB instances and PLC variables.
	Application memory	2 blocks à 64 kbytes	Data get lost after mains disconnection.
E2PROM-buffered memory			
	Retain memory	160 bytes	See chapter 14.3.1
	Persistent memory	32 bytes	See chapter 14.3.2

Tip!

Function library **LenzeMemDrv.lib** includes functions for read/write access to the additional backup memory (application data memory) of the ECSxA... axis module.

Further information ...

can be found in the Manual for the function library **LenzeMemDrv.lib**.

14.3.1 Retain memory

The values of the retain variables are stored fail-safe in the retain memory, and therefore are still available to the program after mains switching. Saving with C0003 = 1 is not necessary.

- Retain variables are declared by using the variable class **`VAR RETAIN`**.
- Retain variables are created as a symbolically addressable memory.
- At every program download, the retain variables are reset to their initialisation value; if no initialisation value is specified, the respective retain variable is initialised with the value ’0’.
- The retain variables in the ECSxA... axis module can be reset to their initialisation value in the online mode of the DDS by using the commands **Online→Reset (cold)** or **Online→Reset (original)**.

14.3.2 Persistent memory

32 bytes of data can be stored fail-safe in the persistent memory, so that they are also still available to the program after mains switching. In contrast to the retain memory, the data even remains in the persistent memory after a new program download. Saving with C0003 = 1 is not necessary.

► The persistent memory can only be deleted in the online mode of the DDS by using the command **Online→Reset (original)**.

Access to the persistent memory

Access to the persistent memory is effected via the system variables of the control configuration, assigning the available 32 bytes to several variables of different data types at the same time, which enables them to be used in the PLC program according to specific applications:

Byte	Variable (8 bit)		Variable (16 bit)		Variable (32 bit)	
	Identifier	Address	Identifier	Address	Identifier	Address
0	VAR_Persistent_byByte0	%QB171.0	VAR_Persistent_wWord0	%QW171.0	VAR_Persistent_dwDWord0	%QD171.0
1	VAR_Persistent_byByte1	%QB171.1				
2	VAR_Persistent_byByte2	%QB171.2	VAR_Persistent_wWord1	%QW171.1		
3	VAR_Persistent_byByte3	%QB171.3				
4	VAR_Persistent_byByte4	%QB171.4	VAR_Persistent_wWord2	%QW171.2	VAR_Persistent_dwDWord1	%QD171.1
5	VAR_Persistent_byByte5	%QB171.5				
6	VAR_Persistent_byByte6	%QB171.6	VAR_Persistent_wWord3	%QW171.3		
7	VAR_Persistent_byByte7	%QB171.7				
8	VAR_Persistent_byByte8	%QB171.8	VAR_Persistent_wWord4	%QW171.4	VAR_Persistent_dwDWord2	%QD171.2
9	VAR_Persistent_byByte9	%QB171.9				
10	VAR_Persistent_byByte10	%QB171.10	VAR_Persistent_wWord5	%QW171.5		
11	VAR_Persistent_byByte11	%QB171.11				
12	VAR_Persistent_byByte12	%QB171.12	VAR_Persistent_wWord6	%QW171.6	VAR_Persistent_dwDWord3	%QD171.3
13	VAR_Persistent_byByte13	%QB171.13				
14	VAR_Persistent_byByte14	%QB171.14	VAR_Persistent_wWord7	%QW171.7		
15	VAR_Persistent_byByte15	%QB171.15				

Byte	Variable (8 bit)		Variable (16 bit)		Variable (32 bit)	
	Identifier	Address	Identifier	Address	Identifier	Address
16	VAR_Persistent_byByte16	%QB171.16	VAR_Persistent_wWord8	%QW171.8	VAR_Persistent_dwDWord4	%QD171.4
17	VAR_Persistent_byByte17	%QB171.17				
18	VAR_Persistent_byByte18	%QB171.18	VAR_Persistent_wWord9	%QW171.9		
19	VAR_Persistent_byByte19	%QB171.19				
20	VAR_Persistent_byByte20	%QB171.20	VAR_Persistent_wWord10	%QW171.10	VAR_Persistent_dwDWord5	%QD171.5
21	VAR_Persistent_byByte21	%QB171.21				
22	VAR_Persistent_byByte22	%QB171.22	VAR_Persistent_wWord11	%QW171.11		
23	VAR_Persistent_byByte23	%QB171.23				
24	VAR_Persistent_byByte24	%QB171.24	VAR_Persistent_wWord12	%QW171.12	VAR_Persistent_dwDWord6	%QD171.6
25	VAR_Persistent_byByte25	%QB171.25				
26	VAR_Persistent_byByte26	%QB171.26	VAR_Persistent_wWord13	%QW171.13		
27	VAR_Persistent_byByte27	%QB171.27				
28	VAR_Persistent_byByte28	%QB171.28	VAR_Persistent_wWord14	%QW171.14	VAR_Persistent_dwDWord7	%QD171.7
29	VAR_Persistent_byByte29	%QB171.29				
30	VAR_Persistent_byByte30	%QB171.30	VAR_Persistent_wWord15	%QW171.15		
31	VAR_Persistent_byByte31	%QB171.31				



Note!

Some projects, program examples, as well as Lenze templates use areas of the persistent memory. They also are labelled by ”LenzeInternalUse” and must not be altered by the user.

Example: Saving current position fail-safe

By means of an AT declaration, for instance, the variable can be directly connected to the address of a persistent variable in its current position, and like this can save the position fail-safe:

```
g_dnActualPosition_p AT%QD171.6:DINT;
```

14.3.3 Download of various data items

In DDS (as of version 2.0) it is possible to attach a file to your project whose data are automatically transferred in the drive controller when the program is downloaded.

► This mechanism is, for instance, used in the **software package "Cam"** to download motion profiles.

Note!

With regard to the ECSxA... axis module, the additional data is immediately attached to the PLC program, because the module is not provided with an application memory (FLASH).

Data will be downloaded if the following conditions are met:

1. The PLC program in the ECSxA... axis module has to be stopped.
2. The header of the file attached to the project must have the following structure:

Name	Data type	Data length in bytes	Content
wSizeHeader	WORD	2	Header length in bytes
wDataType	WORD	2	Data specification identifier ● This information can be found under C2131 after data has been downloaded.
			0 ... 10000 Lenze-specific data
			> 10000 User data
dwVersion	DWORD	4	Data version ● This information can be found under C2132 after data has been downloaded.
dwRealSize	DWORD	4	User data length in bytes (without header)
dwTimeStamp	DWORD	4	Time stamp of the last data change ● This information can be found under C2133 after data has been downloaded.
wLicenseInfo	WORD	2	*Reserved for future extensions*
wSizeSymbolicName	WORD	2	Length of the symbolic file name
achSymbolicName	ACH	wSizeSymbolicName	Character array including the symbolic file name ● This information can be found under C2130 after data has been downloaded.
wCopyToRam	WORD	2	Specifying whether the data is automatically copied into the application RAM of the ECSxA... axis module after download. ● Maximum data length = 128 kbytes (RAM block 1 & 2)
			0 Data is not copied into the application RAM.
			1 Data is copied into the application RAM.
			2 ... 65535 Reserved
dwReserved	DWORD	4	*Reserved for future extensions*
awSizeAddInfo	DWORD	190	

Interpretation of the header information: least significant byte first.

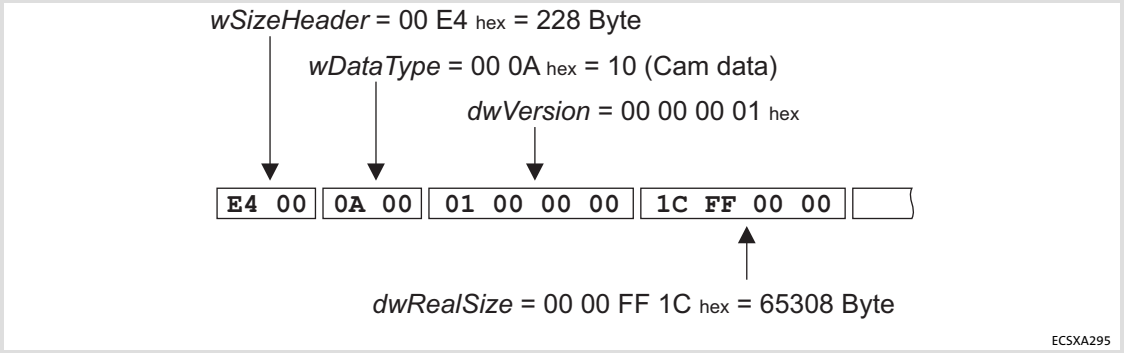


Fig. 14-1 Header interpretation

14.3.4 Temporary codes

The codes C2500 and C2501 are temporary codes, i. e. the data of these codes

- ► does not assign storage space in the EPROM of the drive.
- ► cannot be stored with C0003 = 1 in the parameter set of the drive.
- ► is lost after switch-off of the drive or after mains failure.
- ► is fixedly interlinked with the flag area of the PLC.

Tip!

- ► Temporary codes are suited for the reception of parameters which are to be accessed during a switch-on cycle of the ECSxA... axis module only.
- ► Furthermore, the codes present the possibility to directly (e. g. via HMI) access the flag area of the ECSxA... axis module without having to apply a variable.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2500						PLC flag 1 ... 255	📖 380
			0	{1}	65535		
C2501						PLC flag 256 ... 512	📖 380
			0	{1}	65535		

14.3.5 RAM memory access via codes

Note!

- In the system task, the memory access is processed at the same time as the PLC program. This is why the processing time depends on the workload of the system.
- If you want to access the RAM memory from the IEC 61131 program, you can use the functions of the **LenzeMemDrv.lib** function library for this purpose.

If you want to access the RAM memory of the ECSxA... axis module by external controls or PC tools, e. g. in order to manipulate the data of motion profiles online, you can implement a RAM memory access by means of the following codes:

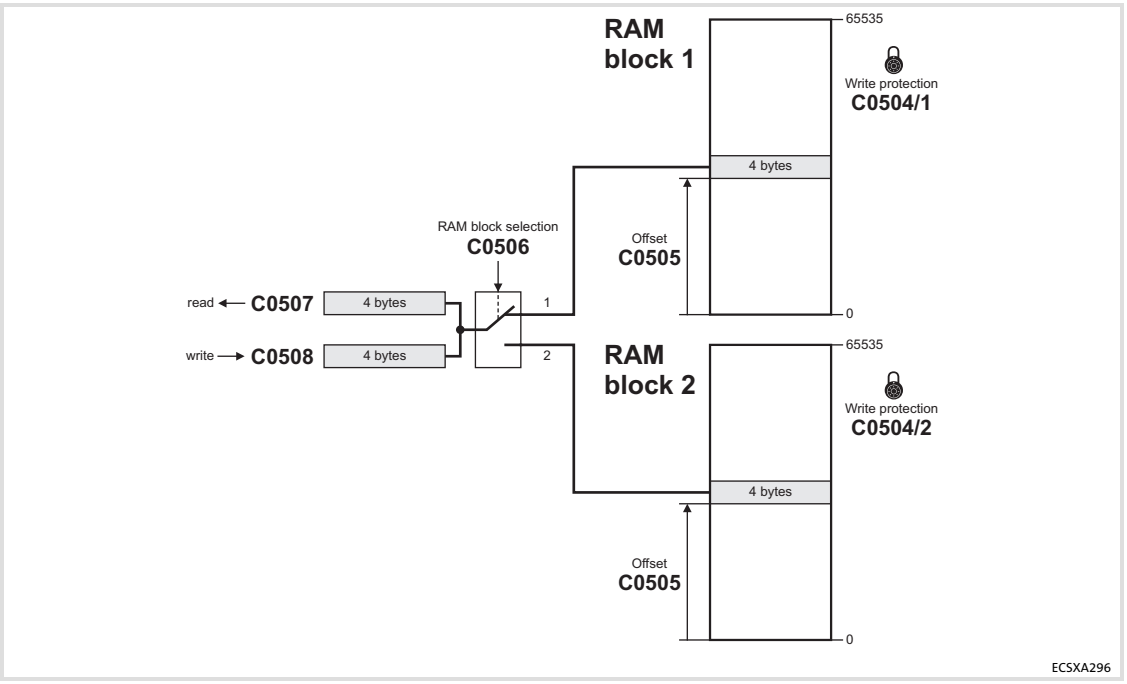


Fig. 14-2 Codes for RAM memory access

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0504					Activate/deactivate write protection for RAM memory ● In case of activated write protection, writing on the RAM memory via codes or functions from the function library **LenzeMemDrv.lib** not possible.	📖 381
1		0	0	Write protection RAM block 1 inactive		
			1	Write protection RAM block 1 active		
2		0	0	Write protection RAM block 2 inactive		
			1	Write protection RAM block 2 active		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0505		0				Offset address within the RAM block selected via C0506	📖 381
			0	{1}	65532		
C0506		1				Selection of the RAM block for access via C0509	📖 381
			1	RAM block 1			
			2	RAM block 2			
C0507		0				Value read from the RAM block ● After reading, the pointer to the memory address is automatically incremented by 4 bytes.	📖 381
			0	{1}	65532		
C0508		0				Value to be written into the RAM block ● After writing, the pointer to the memory address is automatically incremented by 4 bytes.	📖 381
			0	{1}	65532		
C0509	CmpChecksRam	0				Check sum verification	📖 381
			0	Inactive		Stop the PLC during the check sum verification to avoid a time-out when reading back the code.	
			1	Active			

Auto increment access

Reading/writing of the corresponding 4 data bytes is effected by means of the ”auto increment access”, i. e. the pointer to the corresponding address in the selected RAM block is automatically incremented by 4 bytes after every reading of the code C0507, or after writing of the code C0508.

Example: reading of successive ”double integer” values from the RAM block by means of auto increment access

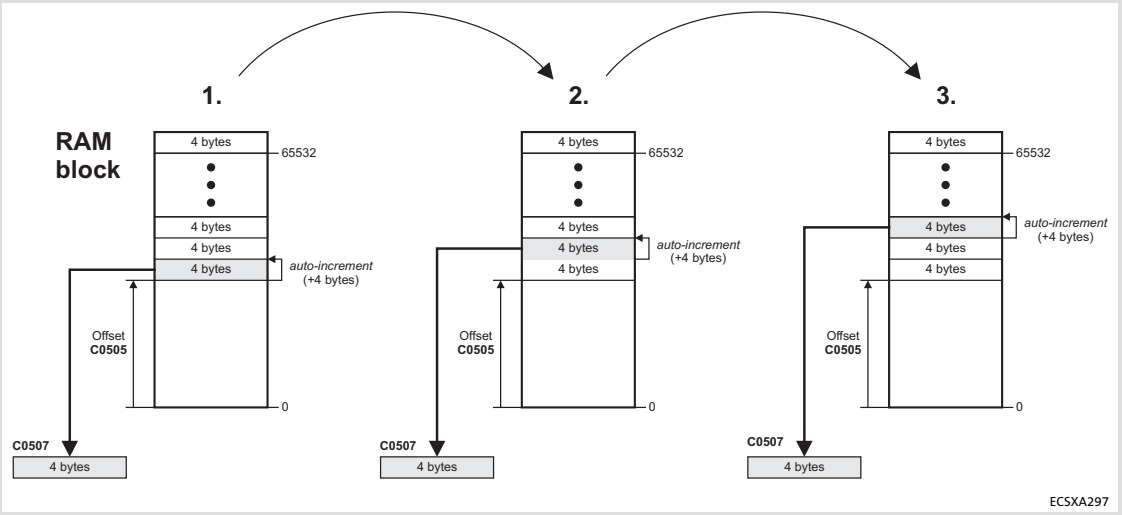


Fig. 14-3 Example: auto increment access

14.4 System program organisation units

System POUs are program organisation units of the ”program” type, which by means of a specific designation adopt the feature of being started subject to an event occurring in the ECSxA... axis module.

- The program includes max. 1000 instructions for system POUs.
- Unlike tasks or PLC_PRG, system POUs are not run-time monitored by a ”watchdog”.
- See the following table for special POU names and the related events for starting the POU:

POU name	Event for starting POU	The POU starts if
PLC_TaskOverrun	Task overflow	... the task monitoring time is exceeded. [1]
PLC_RealError	Floating-point error	...a floating-point error occurs.
PLC_FailTripping	TRIP	...a trip is set.
PLC_WarningTripping	Warning	...a warning is activated.
PLC_MessageTripping	Message	...a message is indicated.
PLC_FailQspTripping	FAIL-QSP	...a FAIL-QSP is activated. [2]
PLC_CANError	CAN bus error	... a CAN bus error occurs (e.g. BUS-OFF). [3]
PLC_AIFError	AIF bus error	... an AIF bus error occurs. [3]
PLC_Restart	Start	... the START command is activated after a STOP.
PLC_ColdStart	Cold start	... a RESET, RESET (cold), RESET (original) or a program download has been activated. [4] **Note:** System variables must not be used in PLC_ColdStart since this can lead to an unexpected maloperation of the control system (e.g. restart of the motor).
PLC_Stop	PLC stop	... the STOP command is activated. [5]
PLC_Undervoltage	LU threshold	... the set LU threshold is fallen below.

1) The system variable ”SYSTEM_bPLCResetAndRun” does not execute a TRIP reset. Thus, an automatic restart is not possible in this POU.
Procedure without mains switching:
PLC reset (C2108) => TRIP reset (C0043) => PLC start (C2108)

2) Is only called if pulse inhibit is not active.

3) Only called if all monitoring functions of the corresponding communication are deactivated.

4) The CAN/AIF bus is ready after this POU has been executed.

5) This POU is not activated by Reset (cold, original).



Tip!

If you need a system POU for an event-controlled start, create a ”program” POU and use the name of this POU as POU name related to the corresponding event listed in the table.

14.5 Code table

How to read the code table

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	1	Subcode 1 of Cxxxx
	2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0002	Par load	0			Load parameter set **The Lenze setting can only be loaded if the controller is inhibited (CINH).**
			0	Load Lenze setting	Load Lenze setting into the RAM and activate it. **Only possible if C2108 = 2 (PLC stopped).**
			1	Load parameter set 1	Load parameter set 1 into the RAM and activate it. **Parameter set 1 is loaded automatically after every mains connection.**
C0003	Par save	0			Non-volatile saving of parameter set
			0	No response	
			1	Save parameter set	
C0004	Op display	56			Selection of XT keypad status display
			1	{Code no.} 9999	The keypad displays the selected code in the operating level, if no status messages from C0183 are active (e. g.: 56 = torque setpoint (C0056))

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0006]	Op mode	1				Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.	
			1	Servo PM-SM		Servo control of synchronous motors	
			2	Servo ASM		Servo control of asynchronous motors	
C0009	LECOM address	1				Entry of the device address for operation via AIF interface X1	
			1	{1}	99	Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
C0011	Nmax	3000				Maximum speed	📖 357
			500	{1 rpm}	16000	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 (CINH)!**	
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)	📖 347
			-16000	{1 rpm}	16000		
C0018	fchop	2				Switching frequency	
			1	4 kHz sin		4 kHz permanent PWM frequency	
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load	
C0019	Thresh nact = 0	0				Threshold when actual speed value (n_{act}) = 0 is detected. (DCTRL_bNActEq0_b)	
			0	{1 rpm}	16000		
C0022	Imax current	→				I_{max} limit	
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
C0023	Imax fld.weak	0				Maximum field weakening current for synchronous machines	
			0	{1 %}	100		
C0026						Offset for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a	
2	FCODE(offset)	0,0				FCODE_nC26_2_a	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0027						Gain for relative analog signals (AIN)	📖 275 📖 347
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0030	DFOUT const	3				Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 340 📖 115 📖 122
			0	256 incr./rev			
			1	512 incr./rev			
			2	1024 incr./rev			
			3	2048 incr./rev			
			4	4096 incr./rev			
			5	8192 incr./rev			
			6	16384 incr./rev			
C0032	FCODE Gearbox	1				Freely configurable code for gearbox factor ? (FCODE_nC32_a)	📖 347
			-32767	{1}	32767		
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	📖 275
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	📖 347
			-16000	{1 rpm}	16000		
C0040	Ctrl enable	1				Controller enable / controller inhibit (CINH) ● Writing: Controls the controller inhibit ● Reading: Reads the status of the controller inhibit	
			0	Controller inhibited			
			1	Controller enabled			
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 324
			0	QSP not active			
			1	QSP active			
C0043	Trip reset	0				Reset active fault message (TRIP-RESET)	📖 254
			0	Reset fault message (TRIP-RESET) / no fault			
			1	Active fault message			
C0050	MCTRL-NSET2					Speed setpoint on speed controller input (MCTRL_nNSetIn_a) Read only	
			-100,00	{0.01 %}	100.00		
C0051	MCTRL-NACT					Actual speed (MCTRL_nNAct_a) Read only	
			-30000	{1 rpm}	30000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0052	MCTRL Umot					Actual motor voltage Read only	
			0	{1 V}	800		
C0053	UG-VOLTAGE					DC-bus voltage Read only	
			0	{1 V}	900		
C0054	Imot					Actual motor current Read only	
			0,0	{0.1 A}	500,0		
C0055	Phase current					Motor phase current Read only	
1	iu		0,0	{0.1 A}	500,0	Actual current in U phase	
2	iv					Actual current in V phase	
3	iw					Actual current in W phase	
4	Io					Actual theoretical star-point current	
C0056	MCTRL-MSET2					Torque setpoint on speed controller output (MCTRL_nMSetIn_a) Read only	
			-100	{1 %}	100		
C0057	Max Torque					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	📖 355
			0,0	{0.1 Nm}	500,0		
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 138
			-180.0	{0.1 °}	179.9		
C0059	Mot pole no.					Calculated number of motor pole pairs Read only	
			1	{1}	200		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 135
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0061	Heatsink temp					Heatsink temperature Read only	📖 208
			-200	{1 °C}	200		
C0062	Interior temp					Interior device temperature Read only	📖 209
			-200	{1 °C}	200		
C0063	Mot temp					Motor temperature Read only	📖 206
			0	{1 °C}	200		
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display	
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.	
C0065	U24 ext					External low-voltage supply (U_{24}) Read only	
			0,0	{0.1V}	100,0		
C0066	Motor load					Thermal motor load $I^{2x}t$ Only display	📖 214
			0	{1 %}	250		
C0067	Act trip					Current fault (TRIP) (in case of FAIL-QSP, warning and message, "0" is displayed.) Only display	📖 242
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 141
			0.00	{ 0.01}	127.99		
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 141
			1.0	{0.5 ms}	6000.0		
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 141
			0.0	{0.1 ms}	32.0		
C0074	Dynamics	0				Pilot control of the current controller for higher dynamics	📖 136
			0	Normal			
			1	Enhanced			
C0075	Vp currCTRL	20.0				Proportional gain of current controller (V_{pi}) The upper limit is device-dependent.	📖 136
			0.00	{0.01 Ω}	381.80	ECSxS/P/M/A004	
					190.90	ECSxS/P/M/A008	
					95.46	ECSxS/P/M/A016	
					47.72	ECSxS/P/M/A032	
					31.82	ECSxS/P/M/A048	
					23.86	ECSxS/P/M/A064	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0076	Tn currCTRL	5.0				Reset time of current controller (T_{ni})	📖 136
			0.01	{0.01 ms}	200.00		
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	📖 144
			0.00	{0.01}	63.99		
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	📖 144
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Read only	
			0.00	{0.01 A}	327,67		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0093	Drive ident					Device identification of the ECS axis module Read only	
			0	Defective power section			
			1	No power section recognised			
			4	ECSxS/P/M/A004C4			
			8	ECSxS/P/M/A008C4			
			16	ECSxS/P/M/A016C4			
			32	ECSxS/P/M/A032C4			
			48	ECSxS/P/M/A048C4			
			64	ECSxS/P/M/A064C4			
			65	ECSxS/P/M/A064C2			
C0094	Password	0				Keypad password Parameter access protection for the keypad	
			0	{1}	9999	When the password is activated, only the codes of the user menu (C0517) can be accessed. Further possible selections: see C0096 0 = no password	
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 138
			0	Inactive			
			1	Active			
C0096						Extended password protection for bus systems with activated password (C0094) All codes in the user menu can be accessed.	
1	AIF/CAN prot.	0		No access protection		AIF access protection	
2	AIF/CAN prot.	0		No access protection		CAN access protection	
			0	No access protection		Full access	
			1	Read protection		Reading not possible	
			2	Write protection		Writing not possible	
			3	Read/write protection		Reading and writing not possible	
C0097	DIS:Lt-Ident	0				Power stage identification	
			0	{1}	255		
C0098	Set position	0				Home position of encoder	
			-2147483647	{1 inc}	2147483647		
C0099	S/W version					Firmware version Read only	
			0,0	{0,1}	25,5		
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 324 📖 361
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0108						Gain for relative analog signals (AOUT)	📖 347
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	📖 347
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0114						Polarity of the digital inputs	📖 129
1	DIGIN pol	0		HIGH level active		X6/DI1 (DIGIN_bIn1_b)	
2	DIGIN pol	0		HIGH level active		X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0		HIGH level active		X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0		HIGH level active		X6/DI4 (DIGIN_bIn4_b)	
			0	HIGH level active			
			1	LOW level active			
C0118						Polarity of the digital outputs	📖 345
1	DIGOUT pol	0		HIGH level active		X6/DO1 (DIGOUT_bOut1_b)	📖 129
2	DIGOUT pol	0		HIGH level active		X25 (DIGOUT_bRelais_b, brake connection)	
			0	HIGH level active			
			1	LOW level active			
C0120	OC6 limit	105				Threshold for $I^2 x t$ monitoring (motor)	📖 214
			0	{1 %}	120	0 = $I^2 x t$ monitoring is switched off $I^2 x t$ > C0120 ⇨ OC6-TRIP	
C0121	OH7 limit	120				Threshold for motor temperature monitoring	📖 206
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault message OH7 (C0584)	
C0122	OH4 limit	80				Threshold for heatsink temperature monitoring	📖 208
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	📖 205
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 209
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0125	Baud rate	0				Baud rate for operation via AIF interface X1	
			0	9600 bit/s		Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
			1	4800 bits/s			
			2	2400 bit/s			
			3	1200 bit/s			
			4	19200 bit/s			
C0126	MONIT CE0	3				Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	📖 255
			0	TRIP		A communication error activates the CE0 response set.	
			2	Warning			
			3	Off		Monitoring switched off.	
C0127	OC8 limit	100				Threshold for $I^2 x t$ warning (motor)	📖 214
			0	{1 %}	120	$I^2 x t$ > C0127 ⇨ fault message OC8 (C0606)	
C0128	Tau motor	5.0				Thermal time constant of the motor	📖 214
			0.5	{0.1 min}	25.0	For calculating the $I^2 x t$ disconnection	
C0129	Charc.: Ix/Nx					Reduction of the speed/torque characteristic for UL-compliant thermal motor monitoring ($I^2 x t$) The reduced speed/torque characteristic reduces the permissible thermal load of self-ventilated standard motors.	📖 34
1		100	10	{1 %}	200	S1 torque characteristic I_1/I_{rated} This value also enables an increase of the maximally permissible utilisation.	
2		40				S1 torque characteristics n_2/n_{rated} With increasing speeds, the maximally permissible utilisation remains unchanged ($I_{Mot} = I_{rated}$).	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0135	Control word	0				System control word DCTRL	
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned			
			Bit 1	Not assigned			
			Bit 2	Not assigned			
			Bit 3	Quick stop (QSP)			
			Bit 4	Not assigned			
			Bit 5	Not assigned			
			Bit 6	Not assigned			
			Bit 7	Not assigned			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit 10	TRIP-SET			
			Bit 11	TRIP-RESET			
			Bit 12	Not assigned			
			Bit 13	Not assigned			
			Bit 14	Not assigned			
			Bit 15	Not assigned			
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)	📖 347
			-199.99	{0.01 %}	199.99		
C0142	Start options	1				Starting condition for start after ● mains connection ● message (t > 0.5 s) ● TRIP	
			0	Protection against unexpected start-up			
			1	Automatic start			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0150	Status word	0				Device status word 1 (DCTRL) Read only	📖 328 📖 239
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned		DCTRL_bStateB0_b	
			Bit 1	Pulse inhibit (IMP)		DCTRL_bImp_b	
			Bit2	Not assigned		DCTRL_bStateB2_b	
			Bit3	Not assigned		DCTRL_bStateB3_b	
			Bit4	Not assigned		DCTRL_bStateB4_b	
			Bit5	Not assigned		DCTRL_bStateB5_b	
			Bit 6	n = 0		DCTRL_bNActEq0_b	
			Bit 7	Controller inhibit (CINH)		DCTRL_bCInh_b	
			Bit 8	Device status bit 1		DCTRL_bStat1_b	
			Bit 9	Device status bit 2		DCTRL_bStat2_b	
			Bit10	Device status bit 3		DCTRL_bStat4_b	
			Bit11	Device status bit 4		DCTRL_bStat8_b	
			Bit12	Warning		DCTRL_bWarn_b	
			Bit13	Message		DCTRL_bMess_b	
			Bit14	Not assigned		DCTRL_bStateB14_b	
			Bit15	Not assigned		DCTRL_bStateB15_b	
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			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0157						Status of free bits of DCTRL status word 1 (C0150) Only display	
1	Stat. FreeBit		0	{1 bit}	1	Bit 0 (DCTRL_bStat_B0_b)	
2	Stat. FreeBit					Bit 2 (DCTRL_bStat_B2_b)	
3	Stat. FreeBit					Bit 3 (DCTRL_bStat_B3_b)	
4	Stat. FreeBit					Bit 4 (DCTRL_bStat_B4_b)	
5	Stat. FreeBit					Bit 5 (DCTRL_bStat_B5_b)	
6	Stat. FreeBit					Bit 14 (DCTRL_bStat_B14_b)	
7	Stat. FreeBit					Bit 15 (DCTRL_bStat_B15_b)	
C0161	Act trip					Current TRIP ● as in C0168/1 ● In case of FAIL-QSP, warning, and message, ”0” is displayed. Only display	📖 242
C0167	Reset failmem	0				Delete history buffer (C0168)	📖 237
			0	No reaction			
			1	Delete history buffer			
C0168						Fault history buffer (list of faults occurred) Read only	📖 237 📖 242
1	Fail number					Currently active fault	
2	Fail number					Last fault	
3	Fail number					Last fault but one	
4	Fail number					Last fault but two	
5	Fail number					Last fault but three	
6	Fail number					Last fault but four	
7	Fail number					Last fault but five	
8	Fail number					Last fault but six	
			All fault indications (TRIP, FAIL-QSP, warning, message)				
C0169						Time at which the fault messages entered in the history buffer (C0168) occurred. Read only	📖 237
1	FailTime		Respective status of the operating hour counter (C0179)			Occurrence of the currently active fault message	
2	FailTime					Occurrence of the last fault message	
3	FailTime					Occurrence of the second-last fault message	
4	FailTime					Occurrence of the third-last fault message	
5	FailTime					Occurrence of the fourth-last fault message	
6	FailTime					Occurrence of the fifth-last fault message	
7	FailTime					Occurrence of the sixth-last fault message	
8	FailTime					Occurrence of the seventh-last fault message	
			0	{1 h}	65535		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0170				Frequency of successive occurrence of the fault messages entered in the history buffer (C0168) Read only	📖 237
			0 {1} 65535		
1	Counter			Frequency of the fault message currently active	
2	Counter			Frequency of the last fault message	
3	Counter			Frequency of the second-last fault message	
4	Counter			Frequency of the third-last fault message	
5	Counter			Frequency of the fourth-last fault message	
6	Counter			Frequency of the fifth-last fault message	
7	Counter			Frequency of the sixth-last fault message	
8	Counter			Frequency of the seventh-last fault message	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0173	UG limit	11		Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 107
			0 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3 Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4 Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13 Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14 Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60		Undervoltage threshold of DC bus (LU)	📖 107
			15 {1 V} 342		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 107
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0178	Op timer					Running time meter Read only
			0	{1 sec}	4294967295	Time when the controller was enabled
C0179	Mains timer					Power-on time meter Only display
			0	{1 sec}	4294967295	Time when the mains was switched on
C0183	Diagnostics					Drive diagnostics Read only ● Indicates fault or status information ● If several fault or status information are to be shown at the same time, the information with the smallest number is displayed
			0	OK		No fault
			101	Initialisation phase		
			102	TRIP/trouble		
			103	Emergency stop activated		
			104	IMP message		
			105	Power off		
			111	Operation inhibit C0135		
			112	Operation inhibit AIF		
			113	Operation inhibit CAN		
			121	Controller inhibit via X6/SI1		
			122	Internal controller inhibit 1		
			123	Internal controller inhibit 2		
			124	Controller inhibit via STOP key of the keypad		
			125	Controller inhibit via AIF		
			126	Controller inhibit via CAN		
			131	Fail QSP		
			141	Restart protection		
			142	Pulse inhibit		High resistance power outputs
			151	Quick stop (QSP) via terminal		
			152	Quick stop (QSP) via STOP key of the keypad		
			153	Quick stop (QSP) via AIF		
			154	Quick stop (QSP) via CAN		
			160	PLC Stop		PLC must be started.
			250	Warning		
C0199	BuildNumber					Software identification Only display
C0200	S/W Id					Software identification Only display
C0201	S/W date					Software release date Read only

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0202				Service code Only display	
1				Product code 1	
...				...	
4				Product code 4	
C0203	Komm.-No.		x / xxxx / xxxxx	Commission number Only display	
C0204	Serial-No.			Serial number Read only	
C0205	PLC Target ID			Identification key Only display	
C0206	Product. date			Production date Only display	
C0207	DL info 1			Download info 1 Only display	
C0208	DL info 2			Download info 2 Only display	
C0209	DL info 3			Download info 3 Only display	
C0250	FCODE 1 Bit	0		Freely selectable digital signal (1 bit)	📖 347
			0 1		
C0254	Vp angle CTRL	0.4000		Phase controller gain (V_p)	📖 360
			0.0000 { 0.0001} 3.9999		
C0300 ... C0302	Service Codes			**Only the Lenze service is allowed to make changes!**	
C0304 ... C0310	Service Codes			**Only the Lenze service is allowed to make changes!**	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0349					Status of the DIP switch for CAN bus interface X4 Read only	
1	CAN DIP-SW		0	{1} 63	Node address set on the DIP switch	
2	CAN DIP-SW		0	4	For setting the DIP switches > 4, the display is set to 0.	
C0350	CAN address	32			Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 156) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 156 📖 458
			1	{1} 63		
C0351	CAN baud rate	0			Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 156
			0	500 kbps		
			1	250 kbits/sec		
			2	125 kbit/s		
			3	50 kbps		
			4	1000 kbit/s		
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 162
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 160
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 160
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C0355						Identifier for CAN_IN/CAN_OUT (CAN bus interface X4) Read only	📖 458
1	CAN Id		1	{1}	2047	Identifier CAN1_IN	
2	CAN Id					Identifier CAN1_OUT	
3	CAN Id					Identifier CAN2_IN	
4	CAN Id					Identifier CAN2_OUT	
5	CAN Id					Identifier CAN3_IN	
6	CAN Id					Identifier CAN3_OUT	
C0356						CAN time settings for CAN bus interface X4	📖 163
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0358	Reset node	0				Make a reset node for the CAN bus node.	📖 279
			0	No function			
			1	CAN reset			
C0359	CAN state					CAN bus status (interface X4) Read only	📖 177
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
			4	Stopped			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0360				Telegram counter CAN_IN/CAN_OUT (CAN bus interface X4), number of telegrams Read only	📖 178
1	CAN Messages		0 {1} 65535	All sent telegrams	
2	CAN Messages		With a count value > 65535 the counter restarts with 0	All received telegrams	
3	CAN Messages			Sent to CAN1_OUT	
4	CAN Messages			Sent to CAN2_OUT	
5	CAN Messages			Sent to CAN3_OUT	
6	CAN Messages			Sent on parameter data channel 1	
7	CAN Messages			Sent on parameter data channel 2	
8	CAN Messages			Received from CAN1_IN	
9	CAN Messages			Received from CAN2_IN	
10	CAN Messages			Received from CAN3_IN	
11	CAN Messages			Received from parameter data channel 1	
12	CAN Messages			Received from parameter data channel 2	
C0361				Detected load CAN_IN/CAN_OUT (CAN bus interface X4) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 179
1	Load IN/OUT		0 {1 %} 100	All sent telegrams	
2	Load IN/OUT			All received telegrams	
3	Load IN/OUT			Sent to CAN1_OUT	
4	Load IN/OUT			Sent to CAN2_OUT	
5	Load IN/OUT			Sent to CAN3_OUT	
6	Load IN/OUT			Sent on parameter data channel 1	
7	Load IN/OUT			Sent on parameter data channel 2	
8	Load IN/OUT			Received from CAN1_IN	
9	Load IN/OUT			Received from CAN2_IN	
10	Load IN/OUT			Received from CAN3_IN	
11	Load IN/OUT			Received from parameter data channel 1	
12	Load IN/OUT			Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0362	Sync cycle					Time interval between 2 sync telegrams via the X4 CAN bus interface or EMF2192IB EtherCAT communication module at X1 AIF interface Read only	📖 166
			1	{1 ms}	30		
C0363	Sync correct.	1				CAN sync correction increment	📖 167
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0365	DIS:CAN active					Input signal CAN active Only display	
			0	CAN not active			
			1	CAN active			
C0366	Sync Response	1				CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 169
			0	No response			
			1	Response			
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 168
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 442 📖 166
			1	{1}	256		
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 167
			0	{1 ms}	65000	0 = switched off	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0370]	SDO gateway	0				Activate address gateway/remote parameterisation **The SDO gateway cannot be used to read out codes >C2000 or codes of the Inverter Drives 8400 and Servo Drives 9400.** ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 180
			0	{1}	63		
C0371	Gateway Ch.	1				Selection of the gateway channel	📖 180
			0	CAN		Use CAN bus interface X4	
			1	CAN-AUX		Use CAN bus interface X14	
C0381	HeartProdTime	0				Heartbeat (slave): HeartbeatProducerTime ● Time interval for sending the heartbeat message ● Only relevant for setting C0352 = 3.	
			0	{1 ms}	65535		
C0382	GuardTime	0				Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 172
			0	{1 ms}	65535		
C0383	LifeTimeFact	0				Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 172
			0	{1}	255		
C0384	Err NodeGuard	3				Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	📖 172
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0400	DIS: AnalogIn					Signal at the analog input Read only	
			-199.99	{0.01 %}	199.99		
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 113
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 113
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 147
			0	Ready			
			1	Start adjustment			
			2	Loading default values			
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	📖 136
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 331 📖 115 📖 122
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 331 📖 115 📖 122
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 331 📖 115 📖 122
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
C0426	DIS: In				Signal at DFIN input Only display	📖 331
			-32767	{1 rpm} 32767		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 331 📖 115 📖 122
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0428	DFIN TP sel.	0				DFIN touch probe signal source	📖 336 📖 331
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP1		X6/DI1	
			2	Zero pulse of digital frequency input		X8	
C0429	TP1 delay	0				DFIN dead time compensation TP1 (DI1)	📖 336 📖 331
			-32767	{1 inc}	32767		
C0431	DFIN TP Edge	0				DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	📖 336
			0	Rising edge TP1			
			1	Falling edge TP1			
			2	Rising and falling edge TP1			
			3	Switched off			
C0443	DIS: DIGIN					Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	📖 343
			0	{1}	255		
			Bit 0	DIGIN1		X6/DI1	
			Bit 1	DIGIN2		X6/DI2	
			Bit 2	DIGIN3		X6/DI3	
			Bit 3	DIGIN4		X6/DI4	
			Bit 4	DIGIN_safe_standstill		X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	📖 80
			Bit 5	Free			
			Bit 6	DIGIN_CInh		X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	📖 80
			Bit 7	Free			
C0444						Status of the digital outputs Only display	📖 345
1	DIS: DIGOUT		0		1	Status of the digital output X6/DO1	
2	DIS: DIGOUT					Relay control status	
[C0469]	Fct STP key	2				Function of the STOP key of the keypad **Must not be changed if the "STOP" key is pressed!**	
			0	Inactive		Without function	
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	📖 347
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	📖 347
			0	{1}	4294967295		
C0472	FCODE analog					Freely configurable code for relative analog signals	📖 347
1		0.0	-199.99	{0.01 %}	199.99	FCODE_bC472_1_a	
2		0.0				FCODE_bC472_2_a	
3		100.0				FCODE_bC472_3_a	
4		0.0				FCODE_bC472_4_a	
...		...				...	
20		0.0				FCODE_bC472_20_a	
C0473						Freely configurable code for absolute analog signals	📖 347
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	📖 347
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	📖 347
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 112
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
[C0491]	X8 in/out	0				Function of X8	📖 331 📖 115 📖 122
			0	X8 is input			
			1	X8 is output			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 112
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
C0497	Nact filter	2.0				Time constant of actual speed value	
			0.0	{0.1 ms}	50.0	0.0 ms = switched off	
C0504						Activate/deactivate write protection for RAM memory ● In case of activated write protection, writing on the RAM memory via codes or functions from the function library **LenzeMemDrv.lib** not possible.	📖 381
1		0	0	Write protection RAM block 1 inactive			
			1	Write protection RAM block 1 active			
2		0	0	Write protection RAM block 2 inactive			
			1	Write protection RAM block 2 active			
C0505		0				Offset address within the RAM block selected via C0506	📖 381
			0	{1}	65532		
C0506		1				Selection of the RAM block for access via C0509	📖 381
			1	RAM block 1			
			2	RAM block 2			
C0507		0				Value read from the RAM block ● After reading, the pointer to the memory address is automatically incremented by 4 bytes.	📖 381
			0	{1}	65532		
C0508		0				Value to be written into the RAM block ● After writing, the pointer to the memory address is automatically incremented by 4 bytes.	📖 381
			0	{1}	65532		
C0509	CmpChecksRam	0				Check sum verification	📖 381
			0	Inactive		Stop the PLC during the check sum verification to avoid a time-out when reading back the code.	
			1	Active			
C0510	ProtAppFlash	0				Write-protection application FLASH	
			0	No write protection			
			1	Write protection is active			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0517						User menu with up to 32 entries
			0.00	{0.01}	7999.00	• Enter the numbers of the required codes into the subcodes. Format: xxxx.yy – xxxx = code number – yy = subcode of the code • It is not checked whether the entered code exists.
1	User menu	51.00	C0051	MCTRL-NACT		Display of actual speed
2	User menu	54.00	C0054	Imot		Display of motor current
3	User menu	56.00	C0056	MCTRL-MSET2		Display of torque setpoint
4	User menu	0.00		Not assigned		
5	User menu	0.00		Not assigned		
6	User menu	183.00	C0183	Diagnostics		Display for diagnostics
7	User menu	168.01	C0183	Fail number		Display of current fault message
8	User menu	0.00		Not assigned		
9	User menu	22.00	C0022	Imax current		Input of maximum output current
10	User menu	0.00		Not assigned		
11	User menu	11.00	C0011	Nmax		Input of the maximum speed
12	User menu	0.00		Not assigned		
13	User menu	0.00		Not assigned		
14	User menu	105.00	C0105	QSP Tif		Input of quick stop deceleration time
15	User menu	0.00		Not assigned		
16	User menu	70.00	C0070	Vp speed CTRL		Input of speed controller gain (Vp)
17	User menu	71.00	C0071	Tn speed CTRL		Input of speed controller reset time (Tn)
18	User menu	0.00		Not assigned		
19	User menu	2100.00	C2100	Time slice		Input of time dial for cycl. task
20	User menu	2102.00	C2102	Task switch		Selection of the switching function for cycl. task
21	User menu	2104.00	C2104	PLC autorun		Autom. start of the PLC program after mains power-up
22	User menu	2106.00	C2106	Download protect		Write protection of the PLC program
23	User menu	2108.00	C2108	PLC run/stop		Control of the PLC program
24	User menu	2111.00	C2111	GDC ID		Creation date of the PLC program
25	User menu	2113.00	C2113	PLC prog name		Name of the PLC program
26	User menu	2115.00	C2115	T-fct Credit		Number of technology units
27	User menu	0.00		Not assigned		
28	User menu	0.00		Not assigned		
29	User menu	0.00		Not assigned		
30	User menu	0.00		Not assigned		
31	User menu	94.00	C0094	Password		Parameter access protection for the keypad
32	User menu	3.00	C0003	Par save		Save parameter set

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0540]	X8 Signal out	2				Function of the digital frequency output signals on X8 (DFOUT)	📖 112
			0	DFOUT in [%]			
			1	DFOUT in [rpm]			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	📖 340
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	📖 340
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	📖 340
			-32767	{1 rpm}	32767		
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 226
			0	{1 %}	100		
C0577	Vp fld weak	0.100				Gain of the field weakening controller (V_p)	📖 144
			0.000	{0.001}	63.999		
C0578	Tn fld weak	3.0				Integral-action time of the field weakening controller (V_n)	
			0.1	{0.1 ms}	6000.0		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 226
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 225
			0	TRIP			
			3	Off			
C0581	MONIT EEr	0				Fault response - external fault monitoring ”ExternalFault” (EEr)	📖 326
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0582	MONIT OH4	2		Setting of the fault response - monitoring of heatsink temperature in C0122	📖 208
			0 TRIP		
			2 Warning		
			3 Off		
C0583	MONIT OH3	0		Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	📖 206
			0 TRIP		
			2 Warning		
			3 Off		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 206
			0 TRIP		
			2 Warning		
			3 Off		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 222
			0 TRIP		
			2 Warning		
			3 Off		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 210
			0 TRIP		
			2 Warning		
			3 Off		
C0591	MONIT CE1	3		Fault response - monitoring CAN1_IN (no telegrams) ”CommErrCANIN1” (CE1)	📖 202
			0 TRIP		
			2 Warning		
			3 Off		
C0592	MONIT CE2	3		Fault response - monitoring CAN2_IN (no telegrams) ”CommErrCANIN2” (CE2)	📖 202
			0 TRIP		
			2 Warning		
			3 Off		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0593	MONIT CE3	3				Fault response - monitoring CAN3_IN (no telegrams) ”CommErrCANIN3” (CE3)	📖 202
			0	TRIP			
			2	Warning			
			3	Off			
C0594	MONIT SD6	3				Fault response - monitoring KTY sensor for the motor temperature. ”SensorFault” (Sd6)	📖 223
			0	TRIP			
			2	Warning			
			3	Off			
C0595	MONIT CE4	3				Fault response - system bus (CAN) monitoring ”Bus-off” at X4 ”BusOffState” (CE4)	📖 202
			0	TRIP			
			2	Warning			
			3	Off			
C0596	NMAX limit	5500				Maximum system speed	📖 227
			0	{1 rpm}	16000		
C0597	MONIT LP1	3				Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 221
			0	TRIP			
			2	Warning			
			3	Off			
C0598	MONIT SD5	3				Fault response - master current monitoring at X6 < 2 mA ”MastISourceDef”	📖 275
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 221
			0.01	{0.01 %}	10.00		
C0602	MONIT REL1	3				Fault response - open circuit monitoring of relay output X25	
			0	TRIP			
			2	Message			
			3	Off			
			4	FAIL-QSP			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 202 📖 180
			0 TRIP		
			2 Warning		
			3 Off		
C0604	MONIT OC7	2		Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 205
			0 TRIP		
			2 Warning		
			3 Off		
C0605	MONIT OH5	2		Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 209
			0 TRIP		
			2 Warning		
			3 Off		
C0606	MONIT OC8	2		Fault response - monitoring of I^2 x t motor utilisation. Threshold can be set under C0120.	📖 214
			0 TRIP		
			2 Warning		
			3 Off		
C0607	MONIT NMAX	0		Fault response - maximum speed monitoring of the machine	
			0 TRIP		
			2 Warning		
			3 Off		
C0608	ovr. Tx-Queue	2		Fault response - transmission memory overflow of free CAN objects	
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		
C0609	ovr. Rx-Isr	0		Fault response Receive memory overflow of free CAN objects	
			0 TRIP		
			4 FAIL-QSP		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	259
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	259
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	259
			-2147483648	{1}	2147483647		
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	264
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	264
			-2147483648	{1}	2147483647		
C0863						Digital process data input words for CAN bus interface X4	446
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 446
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1	
2	CAN OUT words					CAN1_OUT word 2	
3	CAN OUT words					CAN1_OUT word 3	
4	CAN OUT words					CAN2_OUT word 1	
5	CAN OUT words					CAN2_OUT word 2	
6	CAN OUT words					CAN2_OUT word 3	
7	CAN OUT words					CAN2_OUT word 4	
8	CAN OUT words					CAN3_OUT word 1	
9	CAN OUT words					CAN3_OUT word 2	
10	CAN OUT words					CAN3_OUT word 3	
11	CAN OUT words					CAN3_OUT word 4	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0869						32-bit phase information for CAN bus interface X4 Read only	
1	CAN OUT phi		-2147483648	{1}	2147483647	CAN1_OUT	
2	CAN OUT phi					CAN2_OUT	
3	CAN OUT phi					CAN3_OUT	
C0878						Digital input signals to DCTRL Only display	📖 321
1	DigInOfDCTRL		0		1	Controller inhibit (CINH) 1	
2	DigInOfDCTRL					Controller inhibit (CINH) 2	
3	DigInOfDCTRL					TRIP-set	
4	DigInOfDCTRL					TRIP-RESET	
C0879							
1	Reset C0135 Controlword	0	No reset			Reset DCTRL control word of C0135	
2	Reset AIF Controlword	0	No reset			Reset DCTRL control word of AIF	
3	Reset CAN Controlword	0	No reset			Reset DCTRL control word of CAN	
			0	No reset			
			1	Reset		Performs one ”reset”	
C0906						Analog input signals to MCTRL Read only	
1	MCTRL analog		-199.99	{0.01 %}	199.99	Speed controller input	
2	MCTRL analog					Torque setpoint	
3	MCTRL analog					Lower torque limit	
4	MCTRL analog					Upper torque limit	
5	MCTRL analog					Limit of the position controller	
6	MCTRL analog					Speed for activating the torque limitation	
7	MCTRL analog					Field weakening	
8	MCTRL analog					Integrator of the speed controller	
9	MCTRL analog					P adaptation of the position controller	
C0907						Digital input signals to MCTRL Only display	
1	MCTRL digital		0		1	Activating position controller	
2	MCTRL digital					Speed control or torque control	
3	MCTRL digital					Set quick stop (QSP)	
4	MCTRL digital					Loading integral-action component of the speed controller	
C0908	MCTRL PosSet					Set phase signal 1 revolution = 65536 increments Only display	
			-2147483648	{1 inc}	2147483647		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0909	speed limit	1				Limitation of direction of rotation for speed setpoint	📖 358
			1	-175 ... +175 %			
			2	0 ... +175 %			
			3	-175 ... 0 %			
C0910	MCTRL TP2 delay	0				MCTRL dead time compensation TP2 (X6/DI2)	📖 364
			-32767	{1 inc}	32767	1 inc ≡ approx. 60 µs	
C0911	MCTRL TP2 sel.	0				MCTRL touch probe signal source	📖 364
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP2		X6/DI2	
C0912	MCTRL TP2 Edge	0				MCTRL touch probe TP2 edge (for touch probe via digital input X6/DI2 (C0911 = 1))	📖 364
			0	Rising edge TP2			
			1	Falling edge TP2			
			2	Rising and falling edge TP2			
			3	Switched off			
C1120	Sync mode	0				Sync signal source	📖 166
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	📖 170
			2	Terminal sync		Sync connection via terminal X6/DI1	📖 171
C1121	Sync cycle	2				Synchronisation cycle	📖 166
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	📖 167
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window	📖 169
			0.000	{0.001 ms}	6.500		
C1190	MPTC mode	0				Selection of PTC motor temperature sensor characteristic	
			0	Characteristic for PTC 83-110 (Lenze standard)			
			1	Can be specifically set by the user under C1191 and C1192			
			2	Characteristic for PTC 83-110 and 2 x PTC150 (e.g. in MCS motors)		This selection is only available as of operating system V 8.0. For the corresponding motors, the parameter is not automatically transferred into GDC by the motor data assistant. The parameter has to be set later!	
C1191						Selection of temperature characteristic for PTC	
1	Char.: temp	25	0	{1 °C}	255	PTC characteristic: lower temperature T1	
2	Char.: temp	150				PTC characteristic: upper temperature T2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1192						Selection of resistance characteristic for PTC	
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1	
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2	
C1810	SW ID LECOM					Software identification LECOM Only display	
C1811	SW date LECOM					Software creation date LECOM Only display	
C2100	Time slice	13				Time slice for cyclic task	
			6	{1 ms}	26		
C2102	Task switch	0				Change-over: System task →cycl. task (PLC)	
			0	Time slice		No change-over	
			1	Time slice + end of PLC_PRG			
			2	Time slice + end of PLC_PRG + end of system task			
C2104	PLC Autorun	0				Automatic start of the PLC program after mains connection	
			0	Off			
			1	On			
C2106	Downl.protect	0				Write protection of PLC program	
			0	Inactive			
			1	Active			
			2	Reserved			
C2108	PLC run/stop	0				Control PLC program	
			0	No function			
			1	Run			
			2	Stop			
			3	Reset			
C2111	GDC Id		27012006132510 = • Date (day.month.year): 27.01.2006 • Time (h:min:sec): 13:25:10			Creation date of PLC program Read only	
C2113	PLC Prog Name					Name of PLC program Read only	
C2115	T-Fkt Credit	0				Number of technology units	
C2116	CreditPinCode	0				Code for technology units if service is required (please consult Lenze)	
			0	{1}	4294967295		
C2117	Full Credit	0				Service code	
C2118	ParWriteChan.	0				CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	📖 180
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)			
			1	Parameter data channel 2			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2120	AIF: Control	0		AIF-CAN: control word	📖 258
			0 {1} 255	Binary interpretation reflects bit states	
			0 No command	**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!	
			1 Read XCAN codes + reinitialisation		
			2 Read XCAN code		
			10 Read XCAN C2356/1 ... 4		
			11 Read XCAN C2357		
			12 Read XCAN C2375		
			13 Read XCAN C2376 ... C2378		
			14 Read XCAN C2382		
			255 Not assigned		
C2121	AIF:State			AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only	📖 195
			1 {1} 255	Binary interpretation reflects bit states.	
			Bit 0 XCAN1_IN monitoring time		
			Bit 1 XCAN2_IN monitoring time		
			Bit2 XCAN3_IN monitoring time		
			Bit3 XCAN bus off		
			Bit4 XCAN operational		
			Bit5 XCAN pre-operational		
			Bit 6 XCAN warning		
			Bit 7 Assigned internally		
C2130	FileNameAddDa		Symbolic data name	Information on the additional data that have been transmitted together with the application program. Only display	
C2131	Type AddData		Specification identification of the data		
C2132	VersionAddData		Data version		
C2133	TimeStamp		Time stamp of the data		
C2350	XCAN address	1		Node address XCAN (AIF interface X1)	📖 184
			1 {1} 63		
C2351	XCAN baud rate	0		Baud rate XCAN (AIF interface X1)	📖 182
			0 500 kbps		
			1 250 kbit/sec		
			2 125 kbits/s		
			3 50 kbps		
			4 1000 kbit/s		
C2352	XCAN mst	0		Establish XCAN master operation. (AIF interface X1)	📖 183
			0 Slave		
			1 Master		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2353						Source for system bus node addresses of XCAN_IN/XCAN_OUT (AIF interface X1)	📖 185
1	XCAN addr sel	0		CAN node address (C2350)		XCAN1_IN/OUTaddress	
2	XCAN addr sel	0		CAN node address (C2350)		XCAN2_IN/OUTaddress	
3	XCAN addr sel	0		CAN node address (C2350)		XCAN3_IN/OUTaddress	
			0	C2350 (auto)		Automatically determined by C2350	
			1	C2354 (man.)		Determined by C2354	
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT (AIF interface X1)	📖 185
1	XCAN addr.	129	1	{1}	512	XCAN1_INaddress 2	
2	XCAN addr.	1				XCAN1_OUTaddress 2	
3	XCAN addr.	257				XCAN2_INaddress 2	
4	XCAN addr.	258				XCAN2_OUTaddress 2	
5	XCAN addr.	385				XCAN3_INaddress 2	
6	XCAN addr.	386				XCAN3_OUTaddress 2	
C2355						Identifier for XCAN_IN/XCAN_OUT (AIF interface X1) Read only	📖 187
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN	
2	XCAN Id					Identifier XCAN1_OUT	
3	XCAN Id					Identifier XCAN2_IN	
4	XCAN Id					Identifier XCAN2_OUT	
5	XCAN Id					Identifier XCAN3_IN	
6	XCAN Id					Identifier XCAN3_OUT	
C2356						Time settings for XCAN (AIF interface X1)	📖 188
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission	
3	XCAN times	0					
4	XCAN times	0					
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to "Operational"	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2357						Monitoring time for XCAN process data input objects (AIF interface X1) **Only ECSxA:** When the subcodes 1 ... 4 are set, consider the task runtime: C2357/1...4 = Desired monitoring time / task runtime	📖 192
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time	
2	CE monit time	3000				XCAN2_IN monitoring time	
3	CE monit time	3000				XCAN3_IN monitoring time	
4	CE monit time	3000				Bus-off	
5	CE monit time	3000				AIF monitoring time (can only be set if C2357/6 = 0)	
6	CE monit time	0				Sync monitoring time (can only be set if C2357/5 = 0)	
C2359	AIF HW Set.	0					
			0	{1}	65535		
C2364		0				Event-controlled PDO transmission (AIF interface X1)	
			0	Send PDOs when changing to ”Operational” state			
			1	Do not send PDOs			
C2365						Enabling the second parameter data channel and the PDO channels (aIF interface X1)	
1		0	0	{1}	3	Enabling the second parameter data channel	
2		1				Enabling the first process data channel	
3		1				Enabling the second process data channel	
4		1				Enabling the third process data channel	
			0	Deactivated			
			1	Activated			
			2	Reception activated			
			3	Transmission activated			
C2367	Sync Rx Id	128				XCAN receive identifier of the sync telegram(AIF interface X1)	
			1	{1}	2047		
C2368	Sync Tx Id	128				XCAN send identifier of the sync telegram (AIF interface X1)	
			1	{1}	2047		
C2369		0				XCAN Consumer Heartbeat COB-ID (AIF interface X1)	
			0	{1}	255		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2370						XCAN Heartbeat time setting (AIF interface X1)
1		0	0	{1 ms}	65535	Consumer heartbeat time
2		0	0	{1 ms}	65535	Producer heartbeat time
C2371		128				XCAN COB-ID Emergency Object (AIF interface X1)
			0	{1}	2047	
C2372		0				XCAN COB-ID Emergency Object (AIF interface X1)
			0	{1}	65535	Inhibit time emergency
C2373						XCAN Sync counter (AIF interface X1)
1	Sync Rate IN	1	1	{1}	240	XCAN1_IN
2	Sync Rate IN	1				XCAN2_IN
3	Sync Rate IN	1				XCAN3_IN
C2374						XCAN Sync counter (AIF interface X1)
1	Sync Rate OUT	1	1	{1}	240	XCAN1_OUT
2	Sync Rate OUT	1				XCAN2_OUT
3	Sync Rate OUT	1				XCAN3_OUT
C2375						TX mode for XCANx_OUT (AIF interface X1)
1	XCAN Tx mode	0	Response to sync			XCAN1_OUT
2	XCAN Tx mode	0	Response to sync			XCAN2_OUT
3	XCAN Tx mode	0	Response to sync			XCAN3_OUT
			0	Response to sync		
			1	No response to sync		
			2	Event		
			3	Event, cycle C2356 superimposed		
C2376						XCAN1_OUT mask (AIF interface X1)
1	XCAN1 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN1 Mask	FFFF				Mask for process data output word 2
3	XCAN1 Mask	FFFF				Mask for process data output word 3
4	XCAN1 Mask	FFFF				Mask for process data output word 4

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2377						XCAN2_OUT mask (AIF interface X1)	
1	XCAN2 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN2 Mask	FFFF				Mask for process data output word 2	
3	XCAN2 Mask	FFFF				Mask for process data output word 3	
4	XCAN2 Mask	FFFF				Mask for process data output word 4	
C2378						XCAN3_OUT mask (AIF interface X1)	
1	XCAN3 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN3 Mask	FFFF				Mask for process data output word 2	
3	XCAN3 Mask	FFFF				Mask for process data output word 3	
4	XCAN3 Mask	FFFF				Mask for process data output word 4	
C2382						The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)	
1	XCAN Conf. CE	0	Off			XCAN1_IN	
2	XCAN Conf. CE	0	Off			XCAN2_IN	
3	XCAN Conf. CE	0	Off			XCAN3_IN	
4	XCAN Conf. CE	0	Off			Bus-off	
5	XCAN Conf. CE	0	Off			Life Guarding / Heartbeat Event	
6	XCAN Conf. CE	0	Off			Response to sync reception	
			0	Off			
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C2450	CANa address	1				Node address for CAN bus interface X14 (CAN-AUX)	📖 156 📖 458
			1	{1}	63	This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to ”ON”.	
C2451	CANa baud rate	0				Baud rate for CAN bus interface X14 (CAN-AUX)	📖 156
			0	500 kBit/s			
			1	250 kBit/s			
			2	125 kBit/s			
			3	50 kBit/s			
			4	1000 kBit/s			
C2452	CANa mst	0				Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 162
			0	Slave			
			1	Master			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 160
1	CANa addr sel	0		CAN node address (C2450)		Address CANaux1_IN/OUT	
2	CANa addr sel	0		CAN node address (C2450)		Address CANaux2_IN/OUT	
3	CANa addr sel	0		CAN node address (C2450)		Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 160
1	CANa addr.	129	1	{1}	512	CANaux1_INaddress 2	
2	CANa addr.	1				CANaux1_OUTaddress 2	
3	CANa addr.	257				CANaux2_INaddress 2	
4	CANa addr.	258				CANaux2_OUTaddress 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	
C2455						Identifier for CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only	📖 458
1	CANa Id		1	{1}	2047	Identifier CANaux1_IN	
2	CANa Id					Identifier CANaux1_OUT	
3	CANa Id					Identifier CANaux2_IN	
4	CANa Id					Identifier CANaux2_OUT	
5	CANa Id					Identifier CANaux3_IN	
6	CANa Id					Identifier CANaux3_OUT	
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 163
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 202
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2458	Reset node	0			Resetting a node (CAN bus interface X14)	279
			0	No function		
			1	CAN-AUX reset		
C2459	CANa state				CAN bus status (CAN bus interface X14) Read only	177
			0	Operational		
			1	Pre-operational		
			2	Warning		
			3	Bus off		
C2460					Telegram counter CANaux_IN/CANaux_OUT (CAN bus interface X14), number of telegrams Read only	178
1	CANa Messages		0 {1} 65535		All sent telegrams	
2	CANa Messages		With a count value > 65535 the counter restarts with 0		All received telegrams	
3	CANa Messages				Sent to CANaux1_OUT	
4	CANa Messages				Sent to CANaux2_OUT	
5	CANa Messages				Sent to CANaux3_OUT	
6	CANa Messages				Sent to parameter data channel 1	
7	CANa Messages				Sent to parameter data channel 2	
8	CANa Messages				Received from CANaux1_IN	
9	CANa Messages				Received from CANaux2_IN	
10	CANa Messages				Received from CANaux3_IN	
11	CANa Messages				Received from parameter data channel 1	
12	CANa Messages				Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2461						Detected load CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 179
1	Load IN/OUT		0	{1 %}	100	All sent telegrams	
2	Load IN/OUT					All received telegrams	
3	Load IN/OUT					Sent to CANaux1_OUT	
4	Load IN/OUT					Sent to CANaux2_OUT	
5	Load IN/OUT					Sent to CANaux3_OUT	
6	Load IN/OUT					Sent to parameter data channel 1	
7	Load IN/OUT					Sent to parameter data channel 2	
8	Load IN/OUT					Received from CANaux1_IN	
9	Load IN/OUT					Received from CANaux2_IN	
10	Load IN/OUT					Received from CANaux3_IN	
11	Load IN/OUT					Received from parameter data channel 1	
12	Load IN/OUT					Received from parameter data channel 2	
C2466	Sync Response	1				CAN sync response for interface X14 (CAN-AUX) **The value ”1” should always be set!**	
			0	No response			
			1	Response			
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 168
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 442 📖 169
			1	{1}	256		
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 166 📖 163
			0	{1 ms}	65000	0 = switched off	
C2470	ParWrite	0				CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 180
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)			
			1	Parameter data channel 2			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2481	MONIT CE11	3			Fault response - monitoring CANaux1_IN error ”CommErrCANauxIN1” (CE11)	📖 202
			0	TRIP		
			2	Warning		
			3	Off		
C2482	MONIT CE12	3			Fault response - monitoring CANaux2_IN error ”CommErrCANauxIN2” (CE12)	📖 202
			0	TRIP		
			2	Warning		
			3	Off		
C2483	MONIT CE13	3			Fault response - monitoring CANaux3_IN error ”CommErrCANauxIN3” (CE13)	📖 202
			0	TRIP		
			2	Warning		
			3	Off		
C2484	MONIT CE14	3			Fault response - ”system bus (CAN-AUX) off” monitoring at CAN bus interface X14 ”BusOffState” (CE14)	📖 202
			0	TRIP		
			2	Warning		
			3	Off		
C2485	MONIT CE15	3			Fault response - gate function monitoring (CE15) ”Timeout” when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 202 📖 180
			0	TRIP		
			2	Warning		
			3	Off		
C2491					Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex} FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits				CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits				CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits				CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits				CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits				CANaux3_IN (bit 16 ... 31)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1
2	CANa IN words					CANaux1_IN word 2
3	CANa IN words					CANaux1_IN word 3
4	CANa IN words					CANaux2_IN word 1
5	CANa IN words					CANaux2_IN word 2
6	CANa IN words					CANaux2_IN word 3
7	CANa IN words					CANaux2_IN word 4
8	CANa IN words					CANaux3_IN word 1
9	CANa IN words					CANaux3_IN word 2
10	CANa IN words					CANaux3_IN word 3
11	CANa IN words					CANaux3_IN word 4
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1
2	CANa OUT words					CANaux1_OUT word 2
3	CANa OUT words					CANaux1_OUT word 3
4	CANa OUT words					CANaux2_OUT word 1
5	CANa OUT words					CANaux2_OUT word 2
6	CANa OUT words					CANaux2_OUT word 3
7	CANa OUT words					CANaux2_OUT word 4
8	CANa OUT words					CANaux3_OUT word 1
9	CANa OUT words					CANaux3_OUT word 2
10	CANa OUT words					CANaux3_OUT word 3
11	CANa OUT words					CANaux3_OUT word 4

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2500						PLC flag 1 ... 255	📖 380
			0	{1}	65535		
C2501						PLC flag 256 ... 512	📖 380
			0	{1}	65535		

14.6 Table of attributes

If you want to establish separate programs, you need the information from the table of attributes. It contains all information for the communication to the ECSxA... axis module via parameters.

How to read the table of attributes:

Column		Meaning	Entry	
CoDe		Name of the Lenze code	Cxxxx	
Index	dec	Index used to address a parameter A subindex of an array variable is the same as a Lenze subcode number	24575 - Lenze codes	Only needed for control via INTERBUS-S, PROFIBUS-DP, or system bus (CAN).
	hex		5FFFh - Lenze code	
Data	DS	Data structure	E	Single variable (one parameter element only)
			O	Array variable (several parameter elements)
	DA	Number of the array elements (subcodes)		
	DT	Data type	B8	1 byte bit coded
			B16	2 bytes bit coded
			B32	4 bytes bit coded
			FIX32	32 bit value with sign; decimal with four decimal positions
			I32	4 byte with sign
			U16	2 byte without sign
			U32	4 byte without sign
			VS	ASCII string
	Format	LECOM format (see also the Operating Instructions for the 2102 fieldbus module)	VD	ASCII decimal format
			VH	ASCII hexadecimal format
			VS	String format
			VO	Octett string format for data blocks
	DL	Data length in bytes		
	Decimal position	Number of decimal positions		
Access	LCM-R/W	Access authorisation for LECOM	Ra	Reading is always permitted
			Wa	Writing is always permitted
			W	Writing is bound to a condition
	Condition	Writing condition	CINH	Writing is only permitted when the controller is inhibited (CINH)
			PLC run	Writing is only permitted when the program is running.

Table of attributes

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0002	24573	5FFDh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0003	24572	5FFCh	E	1	FIX32	VD	4	0	Ra/Wa	
C0004	24571	5FFBh	E	1	FIX32	VD	4	0	Ra/Wa	
C0005	24570	5FFAh	E	1	FIX32	VD	4	0	Ra/Wa	
C0006	24569	5FF9h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0009	24566	5FF6h	E	1	FIX32	VD	4	0	Ra/Wa	
C0011	24564	5FF4h	E	1	FIX32	VD	4	0	Ra/Wa	
C0017	24558	5FEEh	E	1	FIX32	VD	4	0	Ra/Wa	
C0018	24557	5FEDh	E	1	FIX32	VD	4	0	Ra/Wa	
C0019	24556	5FECh	E	1	FIX32	VD	4	0	Ra/Wa	
C0022	24553	5FE9h	E	1	FIX32	VD	4	2	Ra/Wa	
C0023	24552	5FE8h	E	1	FIX32	VD	4	0	Ra/Wa	
C0026	24549	5FE5h	A	2	FIX32	VD	4	2	Ra/Wa	
C0027	24548	5FE4h	A	2	FIX32	VD	4	2	Ra/Wa	
C0030	24545	5FE1h	E	1	FIX32	VD	4	0	Ra/Wa	
C0032	24543	5FDFh	E	1	FIX32	VD	4	0	Ra/Wa	
C0034	24541	5FDDh	E	1	FIX32	VD	4	0	Ra/Wa	
C0037	24538	5FDAh	E	1	FIX32	VD	4	0	Ra/Wa	
C0040	24535	5FD7h	E	1	FIX32	VD	4	0	Ra/Wa	
C0042	24533	5FD5h	E	1	FIX32	VD	4	0	Ra	
C0043	24532	5FD4h	E	1	FIX32	VD	4	0	Ra/Wa	
C0050	24525	5FCDh	E	1	FIX32	VD	4	2	Ra	
C0051	24524	5FCCh	E	1	FIX32	VD	4	0	Ra	
C0052	24523	5FCBh	E	1	FIX32	VD	4	0	Ra	
C0053	24522	5FCAh	E	1	FIX32	VD	4	0	Ra	
C0054	24521	5FC9h	E	1	FIX32	VD	4	1	Ra	
C0055	24520	5FC8h	A	4	FIX32	VD	4	2	Ra	
C0056	24519	5FC7h	E	1	FIX32	VD	4	0	Ra	
C0057	24518	5FC6h	E	1	FIX32	VD	4	1	Ra	
C0058	24517	5FC5h	E	1	FIX32	VD	4	1	Ra/Wa	
C0059	24516	5FC4h	E	1	FIX32	VD	4	0	Ra	
C0060	24515	5FC3h	E	1	FIX32	VD	4	0	Ra	
C0061	24514	5FC2h	E	1	FIX32	VD	4	0	Ra	
C0062	24513	5FC1h	E	1	FIX32	VD	4	0	Ra	
C0063	24512	5FC0h	E	1	FIX32	VD	4	0	Ra	
C0064	24511	5FBFh	E	1	FIX32	VD	4	0	Ra	
C0065	24510	5FBEh	E	1	FIX32	VD	4	1	Ra	
C0066	24509	5FBDh	E	1	FIX32	VD	4	0	Ra	
C0067	24508	5FBCh	E	1	FIX32	VD	4	0	Ra	
C0070	24505	5FB9h	E	1	FIX32	VD	4	2	Ra/Wa	
C0071	24504	5FB8h	E	1	FIX32	VD	4	1	Ra/Wa	
C0072	24503	5FB7h	E	1	FIX32	VD	4	2	Ra/Wa	
C0074	24501	5FB5h	E	1	FIX32	VD	4	0	Ra/Wa	
C0075	24500	5FB4h	E	1	FIX32	VD	4	2	Ra/Wa	
C0076	24499	5FB3h	E	1	FIX32	VD	4	2	Ra/Wa	
C0077	24498	5FB2h	E	1	FIX32	VD	4	2	Ra/Wa	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0078	24497	5FB1h	E	1	FIX32	VD	4	1	Ra/Wa	
C0079	24496	5FB0h	E	1	FIX32	VD	4	1	Ra	
C0080	24495	5FAFh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0081	24494	5FAEh	E	1	FIX32	VD	4	2	Ra/W	CINH
C0082	24493	5FADh	E	1	FIX32	VD	4	3	Ra	
C0083	24492	5FACh	E	1	FIX32	VD	4	2	Ra	
C0084	24491	5FABh	E	1	FIX32	VD	4	2	Ra/W	CINH
C0085	24490	5FAAh	E	1	FIX32	VD	4	2	Ra/W	CINH
C0087	24488	5FA8h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0088	24487	5FA7h	E	1	FIX32	VD	4	1	Ra/W	CINH
C0089	24486	5FA6h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0090	24485	5FA5h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0091	24484	5FA4h	E	1	FIX32	VD	4	2	Ra/W	CINH
C0092	24483	5FA3h	E	1	FIX32	VD	4	2	Ra	
C0093	24482	5FA2h	E	1	FIX32	VD	4	0	Ra	
C0094	24481	5FA1h	E	1	FIX32	VD	4	0	Ra/Wa	
C0095	24480	5FA0h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0096	24479	5F9Fh	A	2	FIX32	VD	4	0	Ra/Wa	
C0097	24478	5F9Eh	E	1	FIX32	VD	4	0	Ra	
C0098	24477	5F9Dh	E	1	I32	VH	4	0	Ra/W	CINH
C0099	24476	5F9Ch	E	1	FIX32	VD	4	1	Ra	
C0105	24470	5F96h	E	1	FIX32	VD	4	3	Ra/Wa	
C0108	24467	5F93h	A	2	FIX32	VD	4	2	Ra/Wa	
C0109	24466	5F92h	A	2	FIX32	VD	4	2	Ra/Wa	
C0110	24465	5F91h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0111	24464	5F90h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0112	24463	5F8Fh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0113	24462	5F8Eh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0114	24461	5F8Dh	A	4	FIX32	VD	4	0	Ra/Wa	
C0118	24457	5F89h	A	2	FIX32	VD	4	0	Ra/Wa	
C0120	24455	5F87h	E	1	FIX32	VD	4	0	Ra/Wa	
C0121	24454	5F86h	E	1	FIX32	VD	4	0	Ra/Wa	
C0122	24453	5F85h	E	1	FIX32	VD	4	0	Ra/Wa	
C0123	24452	5F84h	E	1	FIX32	VD	4	0	Ra/Wa	
C0124	24451	5F83h	E	1	FIX32	VD	4	0	Ra/Wa	
C0125	24450	5F82h	E	1	FIX32	VD	4	0	Ra/Wa	
C0126	24449	5F81h	E	1	FIX32	VD	4	0	Ra/Wa	
C0127	24448	5F80h	E	1	FIX32	VD	4	0	Ra/Wa	
C0128	24447	5F7Fh	E	1	FIX32	VD	4	1	Ra/Wa	
C0129	24446	5F7Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C0135	24440	5F78h	E	1	B16	VH	2	0	Ra/Wa	
C0136	24439	5F77h	A	3	B16	VH	2	0	Ra	
C0141	24434	5F72h	E	1	FIX32	VD	4	2	Ra/Wa	
C0142	24433	5F71h	E	1	FIX32	VD	4	0	Ra/Wa	
C0150	24425	5F69h	E	1	B16	VH	2	0	Ra	
C0155	24420	5F64h	E	1	B16	VH	2	0	Ra	
C0157	24418	5F62h	A	7	FIX32	VD	4	0	Ra	
C0161	24414	5F5Eh	E	1	FIX32	VD	4	0	Ra	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0167	24408	5F58h	E	1	FIX32	VD	4	0	Ra/Wa	
C0168	24407	5F57h	A	8	FIX32	VD	4	0	Ra	
C0169	24406	5F56h	A	8	U32	VH	4	0	Ra	
C0170	24405	5F55h	A	8	FIX32	VD	4	0	Ra	
C0173	24402	5F52h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0174	24401	5F51h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0175	24400	5F50h	E	1	FIX32	VD	4	0	Ra/Wa	
C0178	24397	5F4Dh	E	1	U32	VH	4	0	Ra	
C0179	24396	5F4Ch	E	1	U32	VH	4	0	Ra	
C0183	24392	5F48h	E	1	FIX32	VD	4	0	Ra	
C0199	24376	5F38h	E	1	FIX32	VD	4	0	Ra	
C0200	24375	5F37h	E	1	VS	VS	14	0	Ra	
C0201	24374	5F36h	E	1	VS	VS	20	0	Ra	
C0202	24373	5F35h	A	4	U32	VH	4	0	Ra	
C0203	24372	5F34h	E	1	VS	VS	12	0	Ra	
C0204	24371	5F33h	E	1	FIX32	VD	4	0	Ra	
C0205	24370	5F32h	E	1	FIX32	VD	4	0	Ra	
C0206	24369	5F31h	E	1	VS	VS	13	0	Ra	
C0207	24368	5F30h	E	1	VS	VS	14	0	Ra	
C0208	24367	5F2Fh	E	1	VS	VS	14	0	Ra	
C0209	24366	5F2Eh	E	1	VS	VS	14	0	Ra	
C0250	24325	5F05h	E	1	FIX32	VD	4	0	Ra/Wa	
C0254	24321	5F01h	E	1	FIX32	VD	4	4	Ra/Wa	
C0300	24275	5ED3h	E	1	FIX32	VD	4	0	Ra	
C0301	24274	5ED2h	E	1	FIX32	VD	4	0	Ra	
C0302	24273	5ED1h	E	1	B32	VH	4	0	Ra	
C0304	24271	5ECFh	E	1	FIX32	VD	4	0	Ra/Wa	
C0305	24270	5ECEh	E	1	FIX32	VD	4	0	Ra/Wa	
C0306	24269	5ECDh	E	1	B32	VH	4	0	Ra/Wa	
C0307	24268	5ECCh	E	1	B16	VH	2	0	Ra/Wa	
C0308	24267	5ECBh	E	1	FIX32	VD	4	0	Ra/Wa	
C0309	24266	5ECAh	E	1	FIX32	VD	4	0	Ra/Wa	
C0310	24265	5EC9h	E	1	FIX32	VD	4	0	Ra/Wa	
C0349	24226	5EA2h	A	2	FIX32	VD	4	0	Ra	
C0350	24225	5EA1h	E	1	FIX32	VD	4	0	Ra/Wa	
C0351	24224	5EA0h	E	1	FIX32	VD	4	0	Ra/Wa	
C0352	24223	5E9Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C0353	24222	5E9Eh	A	3	FIX32	VD	4	0	Ra/Wa	
C0354	24221	5E9Dh	A	6	FIX32	VD	4	0	Ra/Wa	
C0355	24220	5E9Ch	A	6	FIX32	VD	4	0	Ra	
C0356	24219	5E9Bh	A	4	FIX32	VD	4	0	Ra/Wa	
C0357	24218	5E9Ah	A	3	FIX32	VD	4	0	Ra/Wa	
C0358	24217	5E99h	E	1	FIX32	VD	4	0	Ra/Wa	
C0359	24216	5E98h	E	1	FIX32	VD	4	0	Ra	
C0360	24215	5E97h	A	12	FIX32	VD	4	0	Ra	
C0361	24214	5E96h	A	12	FIX32	VD	4	0	Ra	
C0362	24213	5E95h	E	1	FIX32	VD	4	0	Ra	
C0363	24212	5E94h	E	1	FIX32	VD	4	0	Ra/Wa	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0365	24210	5E92h	E	1	FIX32	VD	4	0	Ra	
C0366	24209	5E91h	E	1	FIX32	VD	4	0	Ra/Wa	
C0367	24208	5E90h	E	1	FIX32	VD	4	0	Ra/Wa	
C0368	24207	5E8Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C0369	24206	5E8Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C0370	24205	5E8Dh	E	1	FIX32	VD	4	0	Ra/Wa	
C0371	24204	5E8Ch	E	1	FIX32	VD	4	0	Ra/Wa	
C0381	24194	5E82h	E	1	FIX32	VD	4	0	Ra/Wa	
C0382	24193	5E81h	E	1	FIX32	VD	4	0	Ra/Wa	
C0383	24192	5E80h	E	1	FIX32	VD	4	0	Ra/Wa	
C0384	24191	5E7Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C0400	24175	5E6Fh	E	1	FIX32	VD	4	2	Ra	
C0416	24159	5E5Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C0417	24158	5E5Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C0418	24157	5E5Dh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0419	24156	5E5Ch	E	1	FIX32	VD	4	0	Ra/W	CINH
C0420	24155	5E5Bh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0421	24154	5E5Ah	E	1	FIX32	VD	4	0	Ra/W	CINH
C0426	24149	5E55h	E	1	FIX32	VD	4	0	Ra	
C0427	24148	5E54h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0428	24147	5E53h	E	1	FIX32	VD	4	0	Ra/Wa	
C0429	24146	5E52h	E	1	FIX32	VD	4	0	Ra/Wa	
C0431	24144	5E50h	E	1	FIX32	VD	4	0	Ra/Wa	
C0443	24132	5E44h	E	1	B8	VH	1	0	Ra	
C0444	24131	5E43h	A	2	FIX32	VD	4	0	Ra	
C0469	24106	5E2Ah	E	1	FIX32	VD	4	0	Ra/W	CINH
C0470	24105	5E29h	A	4	B8	VH	1	0	Ra/Wa	
C0471	24104	5E28h	E	1	B32	VH	4	0	Ra/Wa	
C0472	24103	5E27h	A	20	FIX32	VD	4	2	Ra/Wa	
C0473	24102	5E26h	A	10	FIX32	VD	4	0	Ra/Wa	
C0474	24101	5E25h	A	5	I32	VH	4	0	Ra/Wa	
C0475	24100	5E24h	A	2	FIX32	VD	4	0	Ra/Wa	
C0490	24085	5E15h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0491	24084	5E14h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0495	24080	5E10h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0497	24078	5E0Eh	E	1	FIX32	VD	4	1	Ra/Wa	
C0504	24071	5E07h	A	2	FIX32	VD	4	0	Ra/Wa	
C0505	24070	5E06h	E	1	FIX32	VD	4	0	Ra/Wa	
C0506	24069	5E05h	E	1	FIX32	VD	4	0	Ra/Wa	
C0507	24068	5E04h	E	1	FIX32	VD	4	0	Ra	
C0508	24067	5E03h	E	1	FIX32	VD	4	0	Ra/Wa	
C0509	24066	5E02h	E	1	FIX32	VD	4	0	Ra/Wa	
C0510	24065	5E01h	E	1	FIX32	VD	4	0	Ra/Wa	
C0514	24061	5DFDh	A	40	U32	VH	4	0	Ra/Wa	
C0515	24060	5DFCh	A	40	U32	VH	4	0	Ra	
C0516	24059	5DFBh	E	1	FIX32	VD	4	0	Ra/W	CINH
C0517	24058	5DFAh	A	32	FIX32	VD	4	2	Ra/Wa	
C0518	24057	5DF9h	A	250	B32	VH	4	0	Ra/Wa	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0519	24056	5DF8h	A	250	B32	VH	4	0	Ra	
C0540	24035	5DE3h	E	1	FIX32	VD	4	0	Ra/W	CINH
C0545	24030	5DDEh	E	1	FIX32	VD	4	0	Ra/Wa	
C0547	24028	5DDCh	E	1	FIX32	VD	4	2	Ra	
C0549	24026	5DDAh	E	1	FIX32	VD	4	0	Ra	
C0559	24016	5DD0h	E	1	FIX32	VD	4	0	Ra/Wa	
C0576	23999	5DBFh	E	1	FIX32	VD	4	0	Ra/Wa	
C0577	23998	5DBEh	E	1	FIX32	VD	4	3	Ra/Wa	
C0578	23997	5DBDh	E	1	FIX32	VD	4	1	Ra/Wa	
C0579	23996	5DBCh	E	1	FIX32	VD	4	0	Ra/Wa	
C0580	23995	5DBBh	E	1	FIX32	VD	4	0	Ra/Wa	
C0581	23994	5DBAh	E	1	FIX32	VD	4	0	Ra/Wa	
C0582	23993	5DB9h	E	1	FIX32	VD	4	0	Ra/Wa	
C0583	23992	5DB8h	E	1	FIX32	VD	4	0	Ra/Wa	
C0584	23991	5DB7h	E	1	FIX32	VD	4	0	Ra/Wa	
C0586	23989	5DB5h	E	1	FIX32	VD	4	0	Ra/Wa	
C0588	23987	5DB3h	E	1	FIX32	VD	4	0	Ra/Wa	
C0591	23984	5DB0h	E	1	FIX32	VD	4	0	Ra/Wa	
C0592	23983	5DAFh	E	1	FIX32	VD	4	0	Ra/Wa	
C0593	23982	5DAEh	E	1	FIX32	VD	4	0	Ra/Wa	
C0594	23981	5DADh	E	1	FIX32	VD	4	0	Ra/Wa	
C0595	23980	5DACh	E	1	FIX32	VD	4	0	Ra/Wa	
C0596	23979	5DABh	E	1	FIX32	VD	4	0	Ra/Wa	
C0597	23978	5DAAh	E	1	FIX32	VD	4	0	Ra/Wa	
C0598	23977	5DA9h	E	1	FIX32	VD	4	0	Ra/Wa	
C0599	23976	5DA8h	E	1	FIX32	VD	4	1	Ra/Wa	
C0602	23973	5DA5h	E	1	FIX32	VD	4	0	Ra/Wa	
C0603	23972	5DA4h	E	1	FIX32	VD	4	0	Ra/Wa	
C0604	23971	5DA3h	E	1	FIX32	VD	4	0	Ra/Wa	
C0605	23970	5DA2h	E	1	FIX32	VD	4	0	Ra/Wa	
C0606	23969	5DA1h	E	1	FIX32	VD	4	0	Ra/Wa	
C0607	23968	5DA0h	E	1	FIX32	VD	4	0	Ra/Wa	
C0608	23967	5D9Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C0609	23966	5D9Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C0745	23830	5D16h	E	1	U32	VH	4	0	Ra/Wa	
C0746	23829	5D15h	A	200	U32	VH	4	0	Ra	
C0747	23828	5D14h	A	8	I16	VH	2	0	Ra	
C0855	23720	5CA8h	A	2	B16	VH	2	0	Ra	
C0856	23719	5CA7h	A	3	FIX32	VD	4	2	Ra	
C0857	23718	5CA6h	E	1	I32	VH	4	0	Ra	
C0858	23717	5CA5h	A	3	FIX32	VD	4	2	Ra	
C0859	23716	5CA4h	E	1	I32	VH	4	0	Ra	
C0863	23712	5CA0h	A	6	B16	VH	2	0	Ra	
C0866	23709	5C9Dh	A	11	FIX32	VD	4	2	Ra	
C0867	23708	5C9Ch	A	3	I32	VH	4	0	Ra	
C0868	23707	5C9Bh	A	11	FIX32	VD	4	2	Ra	
C0869	23706	5C9Ah	A	3	I32	VH	4	0	Ra	
C0878	23697	5C91h	A	4	FIX32	VD	4	0	Ra	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C0879	23696	5C90h	A	3	FIX32	VD	4	0	Ra/Wa	
C0906	23669	5C75h	A	9	FIX32	VD	4	2	Ra	
C0907	23668	5C74h	A	4	FIX32	VD	4	0	Ra	
C0908	23667	5C73h	E	1	I32	VH	4	0	Ra	
C0909	23666	5C72h	E	1	FIX32	VD	4	0	Ra/Wa	
C0910	23665	5C71h	E	1	FIX32	VD	4	0	Ra/Wa	
C0911	23664	5C70h	E	1	FIX32	VD	4	0	Ra/Wa	
C0912	23663	5C6Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C1120	23455	5B9Fh	E	1	FIX32	VD	4	0	Ra/Wa	
C1121	23454	5B9Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C1122	23453	5B9Dh	E	1	FIX32	VD	4	3	Ra/Wa	
C1123	23452	5B9Ch	E	1	FIX32	VD	4	3	Ra/Wa	
C1190	23385	5B59h	E	1	FIX32	VD	4	0	Ra/Wa	
C1191	23384	5B58h	A	2	FIX32	VD	4	0	Ra/Wa	
C1192	23383	5B57h	A	2	FIX32	VD	4	0	Ra/Wa	
C1771	22804	5914h	E	1	FIX32	VD	4	0	Ra/Wa	
C1772	22803	5913h	E	1	FIX32	VD	4	0	Ra/Wa	
C1773	22802	5912h	E	1	FIX32	VD	4	0	Ra/Wa	
C1792	22783	58FFh	E	1	FIX32	VD	4	0	Ra/Wa	
C1793	22782	58FEh	E	1	FIX32	VD	4	1	Ra/Wa	
C1794	22781	58FDh	E	1	FIX32	VD	4	0	Ra/W	CINH
C1798	22777	58F9h	E	1	VS	VS	13	0	Ra	
C1810	22765	58EDh	E	1	VS	VS	14	0	Ra	
C1811	22764	58ECh	E	1	VS	VS	20	0	Ra	
C1921	22654	587Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C1922	22653	587Dh	E	1	FIX32	VD	4	0	Ra/Wa	
C1923	22652	587Ch	E	1	FIX32	VD	4	0	Ra/Wa	
C2100	22475	57CBh	E	1	FIX32	VD	4	0	Ra/Wa	
C2102	22473	57C9h	E	1	FIX32	VD	4	0	Ra/Wa	
C2103	22472	57C8h	A	8	I16	VH	2	0	Ra	
C2104	22471	57C7h	E	1	FIX32	VD	4	0	Ra/Wa	
C2106	22469	57C5h	E	1	FIX32	VD	4	0	Ra/Wa	
C2108	22467	57C3h	E	1	FIX32	VD	4	0	Ra/Wa	
C2110	22465	57C1h	A	3	FIX32	VD	4	0	Ra	
C2111	22464	57C0h	E	1	VS	VS	14	0	Ra	
C2112	22463	57BFh	A	4	U32	VH	4	0	Ra	
C2113	22462	57BEh	E	1	VS	VS	12	0	Ra	
C2114	22461	57BDh	A	13	U32	VH	4	0	Ra	
C2115	22460	57BCh	E	1	U16	VH	2	0	Ra/Wa	
C2116	22459	57BBh	E	1	U32	VH	4	0	Ra/Wa	
C2117	22458	57BAh	E	1	FIX32	VD	4	0	Ra	
C2118	22457	57B9h	E	1	FIX32	VD	4	0	Ra/Wa	
C2120	22455	57B7h	E	1	FIX32	VD	4	0	Ra/Wa	
C2121	22454	57B6h	E	1	B8	VH	1	0	Ra	
C2130	22445	57ADh	E	1	VS	VS	12	0	Ra	
C2131	22444	57ACh	E	1	FIX32	VD	4	0	Ra	
C2132	22443	57ABh	E	1	U32	VH	4	0	Ra	
C2133	22442	57AAh	E	1	U32	VH	4	0	Ra	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C2140	22435	57A3h	E	1	B16	VH	2	0	Ra	
C2141	22434	57A2h	E	1	B16	VH	2	0	Ra	
C2142	22433	57A1h	E	1	B16	VH	2	0	Ra	
C2143	22432	57A0h	E	1	B16	VH	2	0	Ra/Wa	
C2144	22431	579Fh	E	1	VS	VS	4	0	Ra	
C2145	22430	579Eh	E	1	VS	VS	2	0	Ra	
C2146	22429	579Dh	E	1	VS	VS	12	0	Ra	
C2147	22428	579Ch	E	1	VS	VS	13	0	Ra	
C2148	22427	579Bh	A	8	B8	VH	1	0	Ra	
C2149	22426	579Ah	A	35	B8	VH	1	0	Ra	
C2150	22425	5799h	E	1	B16	VH	2	0	Ra/Wa	
C2350	22225	56D1h	E	1	FIX32	VD	4	0	Ra/Wa	
C2351	22224	56D0h	E	1	FIX32	VD	4	0	Ra/Wa	
C2352	22223	56CFh	E	1	FIX32	VD	4	0	Ra/Wa	
C2353	22222	56CEh	A	3	FIX32	VD	4	0	Ra/Wa	
C2354	22221	56CDh	A	6	FIX32	VD	4	0	Ra/Wa	
C2355	22220	56CCh	A	6	FIX32	VD	4	0	Ra/Wa	
C2356	22219	56CBh	A	5	FIX32	VD	4	0	Ra/Wa	
C2357	22218	56CAh	A	4	FIX32	VD	4	0	Ra/Wa	
C2359	22216	56C8h	E	1	FIX32	VD	4	0	Ra/Wa	
C2367	22208	56C0h	E	1	FIX32	VD	4	0	Ra/Wa	
C2368	22207	56BFh	E	1	FIX32	VD	4	0	Ra/Wa	
C2373	22202	56BAh	A	3	FIX32	VD	4	0	Ra/Wa	
C2374	22201	56B9h	A	3	FIX32	VD	4	0	Ra/Wa	
C2375	22200	56B8h	A	3	FIX32	VD	4	0	Ra/Wa	
C2376	22199	56B7h	A	4	FIX32	VD	4	0	Ra/Wa	
C2377	22198	56B6h	A	4	FIX32	VD	4	0	Ra/Wa	
C2378	22197	56B5h	A	4	FIX32	VD	4	0	Ra/Wa	
C2382	22193	56B1h	A	5	FIX32	VD	4	0	Ra/Wa	
C2450	22125	566Dh	E	1	FIX32	VD	4	0	Ra/Wa	
C2451	22124	566Ch	E	1	FIX32	VD	4	0	Ra/Wa	
C2452	22123	566Bh	E	1	FIX32	VD	4	0	Ra/Wa	
C2453	22122	566Ah	A	3	FIX32	VD	4	0	Ra/Wa	
C2454	22121	5669h	A	6	FIX32	VD	4	0	Ra/Wa	
C2455	22120	5668h	A	6	FIX32	VD	4	0	Ra	
C2456	22119	5667h	A	4	FIX32	VD	4	0	Ra/Wa	
C2457	22118	5666h	A	3	FIX32	VD	4	0	Ra/Wa	
C2458	22117	5665h	E	1	FIX32	VD	4	0	Ra/Wa	
C2459	22116	5664h	E	1	FIX32	VD	4	0	Ra	
C2460	22115	5663h	A	12	FIX32	VD	4	0	Ra	
C2461	22114	5662h	A	12	FIX32	VD	4	0	Ra	
C2466	22109	565Dh	E	1	FIX32	VD	4	0	Ra/Wa	
C2467	22108	565Ch	E	1	FIX32	VD	4	0	Ra/Wa	
C2468	22107	565Bh	E	1	FIX32	VD	4	0	Ra/Wa	
C2469	22106	565Ah	E	1	FIX32	VD	4	0	Ra/Wa	
C2470	22105	5659h	E	1	FIX32	VD	4	0	Ra/Wa	
C2481	22094	564Eh	E	1	FIX32	VD	4	0	Ra/Wa	
C2482	22093	564Dh	E	1	FIX32	VD	4	0	Ra/Wa	

Code	Index		Data						Access	
	dec	hex	DS	DA	DT	Format	DL	Decimal position	LCM-R/W	Condition
C2483	22092	564Ch	E	1	FIX32	VD	4	0	Ra/Wa	
C2484	22091	564Bh	E	1	FIX32	VD	4	0	Ra/Wa	
C2485	22090	564Ah	E	1	FIX32	VD	4	0	Ra/Wa	
C2491	22084	5644h	A	6	B16	VH	2	0	Ra	
C2492	22083	5643h	A	11	FIX32	VD	4	2	Ra	
C2493	22082	5642h	A	11	FIX32	VD	4	2	Ra	
C2500	22075	563Bh	A	255	FIX32	VD	4	0	Ra/Wa	
C2501	22074	563Ah	A	255	FIX32	VD	4	0	Ra/Wa	

14.7 General information about the system bus (CAN)

All Lenze drive and automation systems are provided with an integrated system bus interface for networking control components on the field level.

The system bus interface serves to exchange, for instance, process data and parameter values between the nodes. Moreover, the interface allows for the connection of further devices as e.g. decentralised terminals, operator and input devices and external control and host systems.

The system bus interface transfers CAN objects to the CANopen communication profile (CiA DS301, version 4.01) which has been created under the umbrella association of the der **CiA** (**C**AN **i**n **A**utomation) to conform with the **CAL** (**C**AN **A**pplication **L**ayer).

Tip!

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

14.7.1 Structure of the CAN data telegram

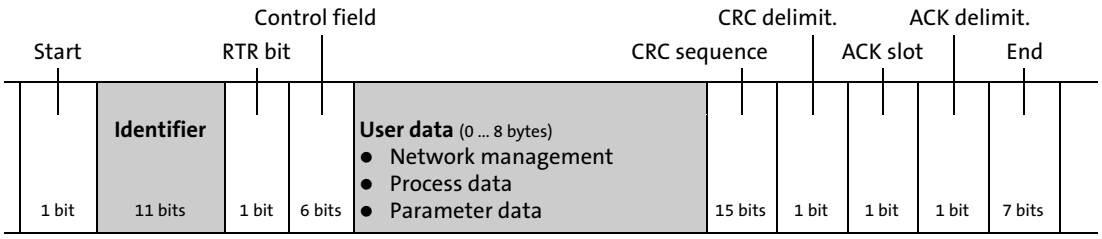


Fig. 14-4 Basic structure of the CAN telegram

Identifier

The identifier determines the priority of the message. Moreover, the following is coded:

- The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter "Addressing of the parameter and process data objects" (📖 458).
- The type of user data to be transferred

User data

The user data area of the CAN telegram either contains network management data, process data or parameter data:

User data	Description
Network management data (NMT data)	The information serves to establish communication via the CAN network
Process data (PDO, Process Data Objects)	• Process data are transmitted via the process data channel. • The process data serve to control the controller. • Process data can be accessed directly by the higher-level host system. The data are, for instance, stored directly in the I/O area of the PLC. It is necessary that the data can be exchanged between the host system and the controller within the shortest time possible. In this connection, small amounts of data can be transferred cyclically. • Process data are transmitted between the higher-level host system and the controllers to ensure a permanent exchange of current input and output data. • Process data are not stored in the controller. • Process data are, for instance, setpoints and actual values.
Parameter data (SDO, Service Data Objects)	• Parameter data are transferred via the parameter data channel and acknowledged by the receiver, i.e. the receiver gets a feedback whether the transmission was successful. • Parameter data of Lenze devices are called codes. • The parameter data channel enables access to all Lenze codes and all CANopen indexes. • Parameters are set, for instance, for the initial commissioning of a plant or when material of a production machine is exchanged. • Usually the transfer of parameters is not time-critical. • Parameter changes are stored in the controller. • Parameter data are, for instance, operating parameters, diagnostic information and motor data.



Tip!

The other signals refer to the transfer features of the CAN telegram that are not described in these instructions.

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

14.7.2 Communication phases of the CAN network (NMT)

Regarding communication, the controller knows the following statuses:

Status	Description
”Initialisation”	After the controller is switched on, the initialisation phase is run through. During this phase, the controller is not involved in the data exchange on the bus. A part of the initialisation or the complete initialisation can be run through again in every NMT status by transmitting different telegrams (see ”state transition”). Here, all parameters are written with their set values. After completing the initialisation, the controller automatically adopts the ”Pre-Operational” status.
”Pre-Operational”	The controller can receive parameter data. The process data are ignored.
”Operational”	The controller can receive parameter data and process data.
”Stopped”	Only network management telegrams can be received.

State transitions

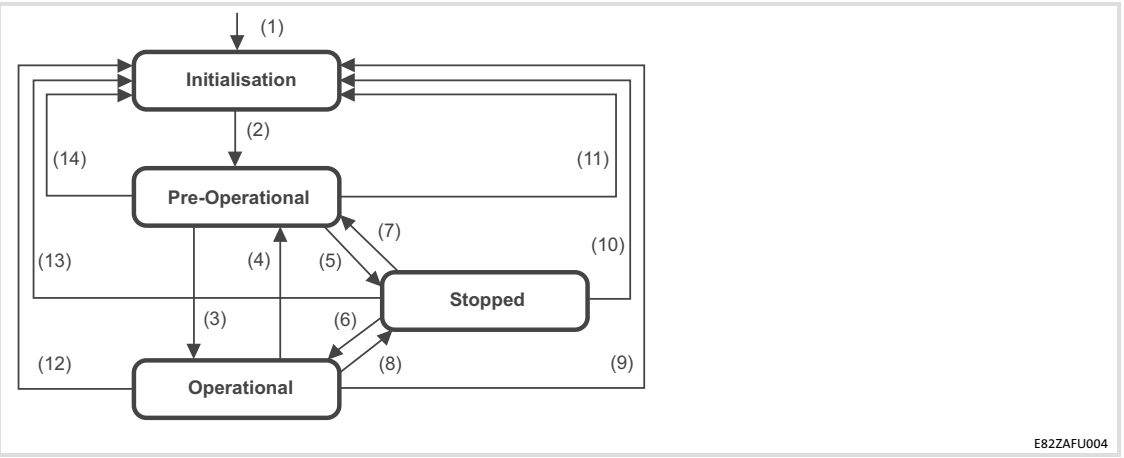


Fig. 14-5 State transitions in the CAN network (NMT)

State transition	Command (hex)	Network status after change	Effect on process or parameter data after state change
(1)	-	Initialisation	When the mains is switched on, the initialisation is started automatically. During the initialisation the controller is not involved in the data exchange. After the initialisation is completed, the node changes automatically to the ”Pre-Operational” status.
(2)	-	Pre-operational	In this phase the master decides how the controllers take part in the communication.
From here, the states are changed over by the master for the entire network. A target address included in the command specifies the receiver/s.			
(3), (6)	01xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active (corresponds to ”Start Remote Node”) Optional: In case of change, event-controlled and time-controlled process data (PDO) are sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency, and parameter data (SDO) are active (corresponds to ”Enter Pre-Operational State”)
(5), (8)	02 xx	Stopped	Only network management telegrams can be received.
(9)	81 xx	Initialisation	Initialisation of all parameters in the CAN fieldbus module with the values stored (corresponds to ”Reset Node”)
(10)			
(11)			
(12)	82 xx		Initialisation of communication-relevant parameters (CiA DS 301) in the CAN fieldbus module with the values stored (corresponds to ”Reset Communication”)
(13)			
(14)			

yy = 00	In case of this assignment, the telegram addresses all devices connected. The state of all devices can be changed at the same time.
yy = node ID	If a node address is given, only the state of the device with the corresponding address will be changed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

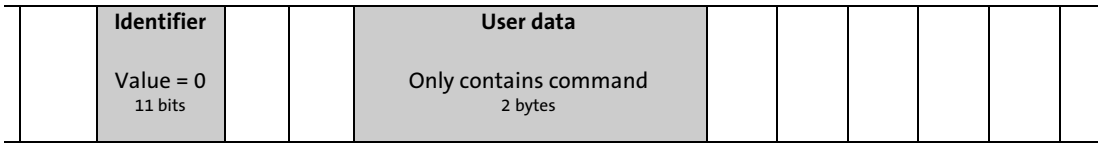


Fig. 14-6 Telegram for switching over the communication phases

The communication phases are changed over by a node, the network master, for the entire network. The change-over can also be done by a controller.

With a certain delay after mains connection, a telegram is sent once which changes the status of the entire drive system to ”Operational”. The delay time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356/4
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356/4
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456/4

Note!

Only a change to ”Operational” status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the ”Pre-Operational” communication status to the ”Operational” communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

14.7.3 Process data transfer

Agreements

- Process data telegrams between host (master) and controller (slave) are distinguished as follows with regard to their direction:
  - Process data telegrams **to** the controller
  - Process data telegrams **from** the controller
- In CANopen, the process data objects are named from the node's view:
  - RPDOx: A process data object received by a node
  - TPDOx: A process data object transmitted by a node

14.7.3.1 Available process data objects

The following process data objects (PDOs) are available for the ECS modules via the interfaces X1, X4 and X14:

Interface	PDOs RPDO: to ECS module TPDO: from ECS module		Availability in ECS modules				
			ECSxE	ECSxS	ECSxP	ECSxM	ECSxA
X1 Automation interface (AIF)	RPDO	AIF1_IN	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_IN	–	✓	–	–	✓
		AIF3_IN	–	✓	–	–	✓
	TPDO	AIF1_OUT	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_OUT	–	✓	–	–	✓
		AIF3_OUT	–	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	RPDO	CAN1_IN	✓	✓	✓	✓	✓
		CAN2_IN	–	✓	✓	–	✓
		CAN3_IN	✓	✓	✓	–	✓
	TPDO	CAN1_OUT	✓	✓	✓	✓	✓
		CAN2_OUT	✓ 1)	✓	✓	–	✓
		CAN3_OUT	✓	✓	✓	–	✓
X14 System bus (CAN) Interface is not available for ECSxE.	RPDO	CANaux1_IN	–	–	✓	–	✓
		CANaux2_IN	–	–	✓	–	✓
		CANaux3_IN	–	–	–	–	✓
	TPDO	CANaux1_OUT	–	–	✓	–	✓
		CANaux2_OUT	–	–	✓	–	✓
		CANaux3_OUT	–	–	–	–	✓

1) ECSxE from V5.0: CAN2_OUT (Diagnostic PDO)

Note!

Power supply module ECSxE

In case of the ECSxE power supply module, the PDOs CAN1_IN/OUT and CAN3_IN/OUT cannot be used simultaneously. The PDOs to be used are selected via C0360.

- The process data objects are integrated into the ECSxA... axis modules in the form of system blocks (📖 255).
- In the system blocks the user data is converted to corresponding signal types for further use.

14.7.3.2 Structure of the process data

The process data telegrams have a maximum user data length of eight bytes each.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the controller.
- The control word is transmitted in byte 1 and 2 of the user data.

	Identifier			User data (8 bytes)							
				Control word		00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte						

Fig. 14-7 Structure of process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram reports status information from the controller. Status information can be as follows:
  - Current status of the controller
  - Status of the digital inputs
  - States about internal analog values
  - Fault/error messages

  This information enables the higher-level host system (PLC) to respond accordingly.
- The status word 1 is transmitted in byte 1 and 2 of the user data.
- In byte 3 and 4 of the user data, the extended status word 2 can be optionally transferred.

	Identifier			User data (8 bytes)							
				Status word 1		Status word 2 (optional)		00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte	LOW byte	HIGH byte				

Fig. 14-8 Structure of process data output telegram (TPDO)

14.7.3.3 Transfer of the process data objects

Process data objects		Data transmission	
		ECSxE	ECSxS/P/M/A
RPDOs (to ECS module)	AIF1_IN	–	cyclic (sync-controlled)
	CAN1_IN	cyclic (sync-controlled)	
	CANaux1_IN	–	
	AIF2_IN	–	event-controlled/cyclic without sync
	CAN2_IN	–	
	CANaux2_IN	–	
	AIF3_IN	–	event-controlled/cyclic without sync
	CAN3_IN	event-controlled/cyclic without sync	
	CANaux3_IN	–	
TPDOs (from ECS module)	AIF1_OUT	–	cyclic (sync-controlled)
	CAN1_OUT	cyclic (sync-controlled)	
	CANaux1_OUT	–	
	AIF2_OUT	–	event-controlled/cyclic without sync
	CAN2_OUT	–	
	CANaux2_OUT	–	
	AIF3_OUT	–	event-controlled/cyclic without sync
	CAN3_OUT	event-controlled/cyclic without sync	
	CANaux3_OUT	–	

► Cyclic data transmission with sync telegram (📖 450)
(via AIF1, CAN1, CANaux1)
The sync telegram enables the controller to accept the process data from the master (RPDOs) or send them to the master (TPDOs).

► Event-controlled data transmission
(via AIF2/3, CAN2/3, CANaux2/3)
The data will be transmitted if a value changes in the corresponding output object.

► Cyclic data transmission without sync telegram
(via AIF2/3, CAN2/3, CANaux2/3)
The data is transmitted in fixed times. The cycle time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456

– Setting of cycle time > 0: data transmission with fixed cycle time
– Setting of cycle time = 0: event-controlled data transmission

14.7.3.4 Cyclic process data objects

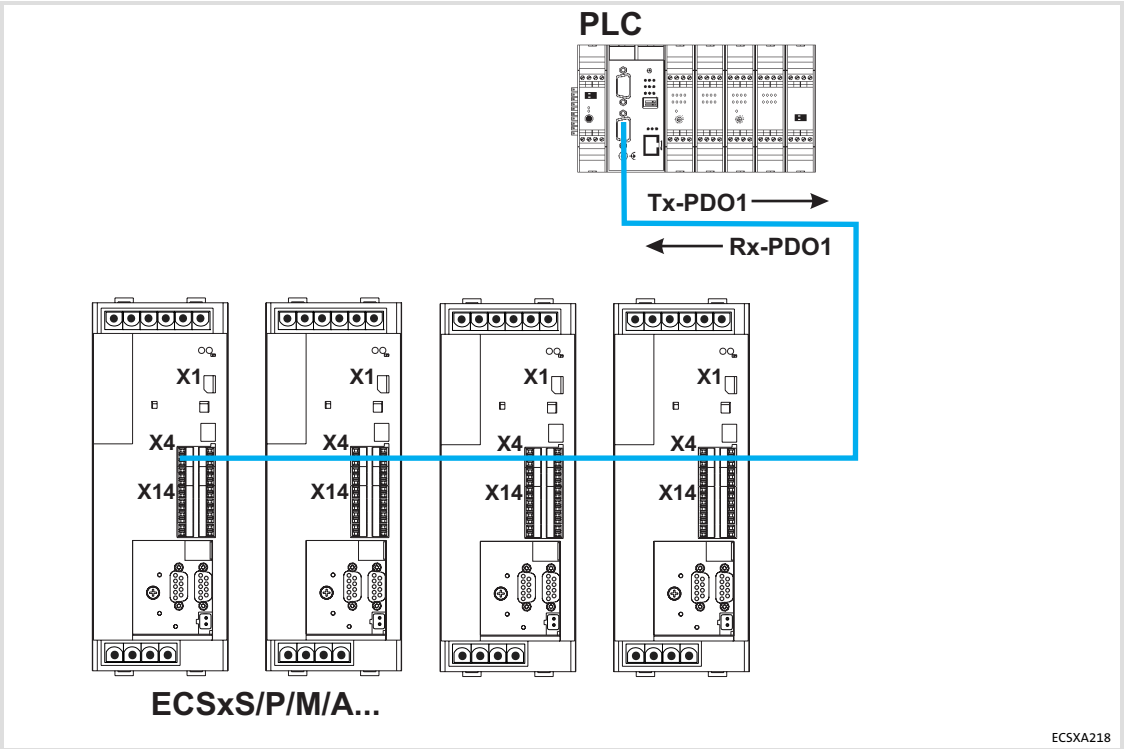


Fig. 14-9 Example: Cyclic process data transfer from/to master (PLC)

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO18), each with 8 bytes of user data, is provided.

Synchronisation of PDOs with sync-controlled transmission

In order that the cyclic process data can be read by the controller or the controller accepts the process data, a special telegram, the CAN sync telegram, is used in addition.

The CAN sync telegram is the trigger point for sending process data of the controller to the master and transferring process data from the master to the controller.

A sync-controlled process data processing requires a corresponding generation of the CAN sync telegram.

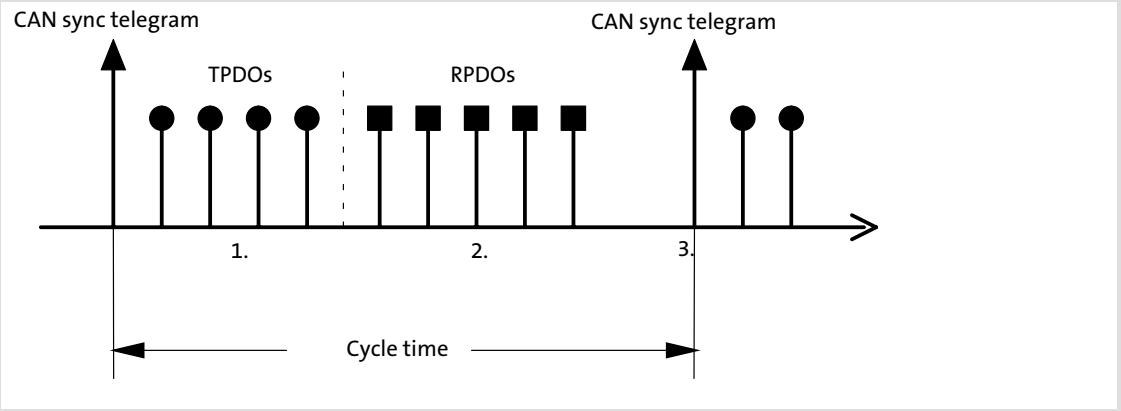


Fig. 14-10 Sync telegram

1. After the CAN sync telegram has been received, the synchronous process data from the controllers are sent to the master (TPDOs). They are read as process input data in the master.
2. When the transmission process is completed, the process output data (of the master) are received by the controllers (RPDOs).

   All other telegrams (e.g. parameters or event-controlled process data) are accepted acyclically by the controllers after transmission is completed. The acyclic data are not displayed in the above illustration. They must be considered when the cycle time is dimensioned.
3. The data in the controller is accepted with the next CAN sync telegram.

Tip!

The response to a CAN sync telegram is determined by the transmission type selected.

Note!

Information on how to set the synchronisation can be found from 📖 166.

14.7.3.5 Event-controlled process data objects

The event-controlled process data objects are particularly suitable for the data exchange between controllers and for distributed terminal extensions. They can, however, also be used by a host system.

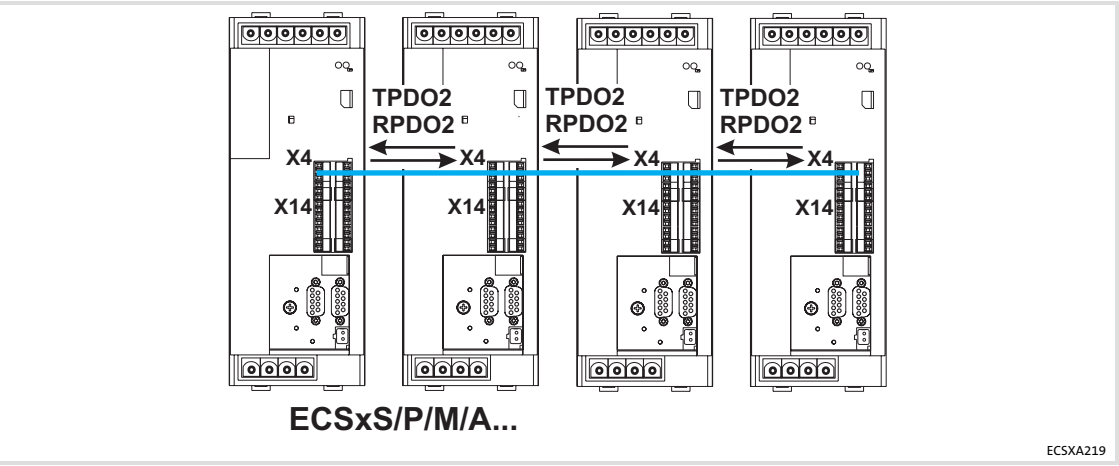


Fig. 14-11 Example: event-controlled process data objects PDO2

The process data objects serve to transmit simple binary signals (e.g. states of digital input terminals) or complete values in 16 and 32 bits (e.g. analog signals).

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

14.7.4 Parameter data transfer

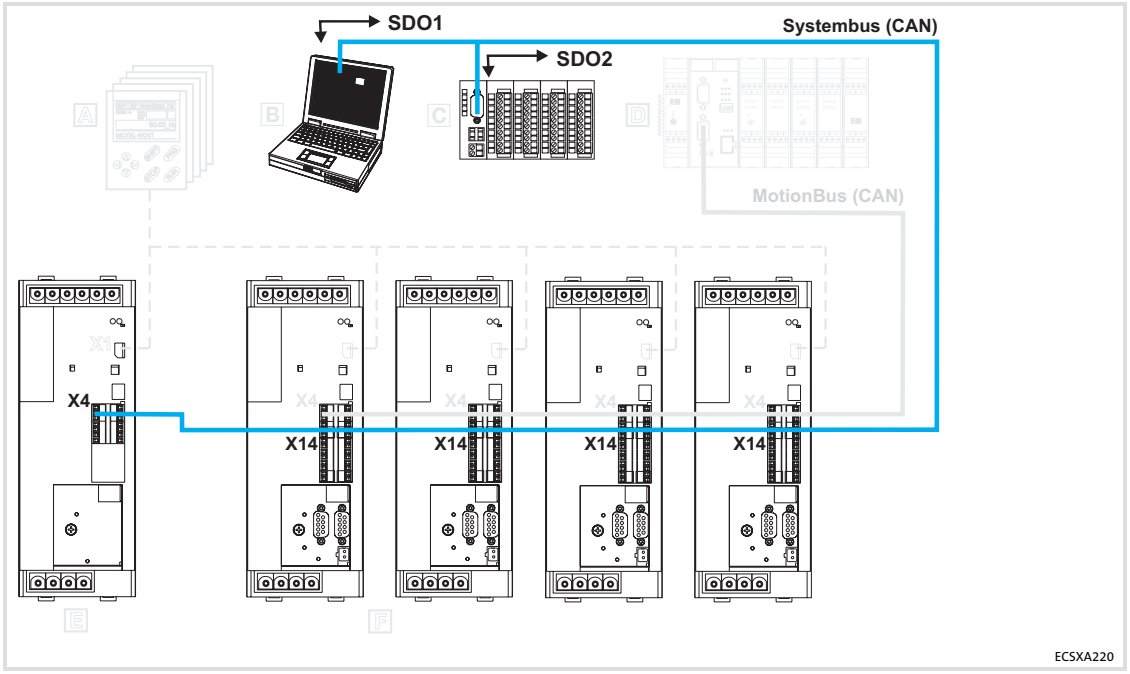


Fig. 14-12 Parameter data channels for parameterising ECS

Parameters ...

- ► are values which are stored under codes in the Lenze controllers.
- ► are set e.g. during initial commissioning or while changing materials in a machine.
- ► are transmitted with low priority.

Parameter data are transmitted as SDOs (Service Data Objects) via the system bus (CAN) and acknowledged by the receiver. The SDOs enable the writing and reading access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 as well as the CAN bus interfaces X4 and X14 are divided into separate ranges:

Interface		Code range
X1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C03xx
X14	System bus (CAN) ● Interface is not available for ECSxE.	C24xx

14.7.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1. byte	2. byte	3. byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data is shown in motorola format.

Examples for parameter data transfer can be found from 📖 456.

Command

The command contains the services for writing and reading the parameters and information on the length of the user data:

	Bit 7 MSB	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit 2**	**Bit 1**	**Bit 0** LSB
Command	Command specifier (cs)			toggle (t)	Length		e	E
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specification DS301, V4.02 (e.g. segmented transfer).

The command must contain the following information:

Command	4-byte data (5. ... 8. byte)		2-byte data (5. and 6. byte)		1-byte data (5. byte)		Block	
	hex	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameter to the controller)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller reports a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

”Error response” command: In case of a communication error an ”Error response” is generated by the addressed node. This telegram always contains the value ”6” in Data 4 and an error code in Data 3.

The error codes are standardised acc. to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

Parameter value length depending on the data format			
Parameter value **(Length: 1 byte)**	00	00	00
Parameter value **(length: 2 bytes)**		00	00
Low byte	High byte		
Parameter value **(length: 4 bytes)**			
Low word		High word	
Low byte	High byte	Low byte	High byte

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

14.7.4.2 Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	Index Low byte	Index High byte	Subindex	**Error code**			

- Byte 1:
  In the **command** byte, the code **128** (**0x80**) indicates that an error has occurred.
- Bytes 2 ... 4:
  In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.
- Bytes 5 ... 8:
  In the bytes 5 ... to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example: Representation of the error codes 0x06040041 in the bytes 5 ... 8

Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	7th byte	8th byte	Meaning
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

14.7.4.3 Examples of the parameter data telegram

Reading parameters

The heatsink temperature C0061 (43 °C) is to be read from the controller with node address 5 via the parameter data channel 1.

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 5 = 1541

► Command ”Read Request” (request to read a parameter from the controller)

Command	Value [hex]
Read request	**0x40**

► Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = 0x5FC2

► Subindex: 0

► Telegram to controller

	User data							
Identifier	Command	Index LOW byte	Index HIGH byte	Subindex	Data 1	Data 2	Data 3	Data 4
1541	0x40	0xC2	0x5F	0x00	0x00	0x00	0x00	0x00

► Telegram from controller

	User data							
Identifier	Command	Index LOW byte	Index HIGH byte	Subindex	Data 1	Data 2	Data 3	Data 4
1413	0x43	0xC2	0x5F	0x00	0xB0	0x8F	0x06	0x00

– Command:
”Read Response” (response to the read request) = 0x43

– Identifier:
SDO1 from controller (1408) + node address (5) = 1413

– Index of the read request:
0x5FC2

– Subindex:
0

– Data 1 ... 4:
0x00068FB0 = 430000 ➞ 430000 : 10000 = 43 °C

Writing parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed to 20 seconds via the SDO1 (parameter data channel 1).

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 1 = 1537

► Command ”Write Request” (transmit parameter to drive)

Command	Value [hex]
Write request	**0x23**

► Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = 0x5FF3

► Subindex: 0

► Calculation of the acceleration time

Data 1 ... 4	Calculation
Value for acceleration time	20 s · 10000 = 200000 = 0x00030D40

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	0x23	0xF3	0x5F	0x00	0x40	0x0D	0x03	0x00

► Telegram from controller if executed faultlessly

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	0x60	0xF3	0x5F	0x00	0x00	0x00	0x00	0x00

– Command:
”Write Response” (response of the controller (acknowledgement)) = 0x60

– Identifier:
SDO1 from controller (= 1408) + node address (= 1) = 1409

14.7.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier is preset with the following values:

Object			Direction		Basic identifier	
			to the ECS module	from the ECS module	dec	hex
NMT					0	0
Sync					128	80
PDO1 (Process data channel 1)	RPDO1	XCAN1_IN CAN1_IN CANaux1_IN	X		512	200
	TPDO1	XCAN1_OUT CAN1_OUT CANaux1_OUT		X	384	180
PDO2 (Process data channel 2)	RPDO2	XCAN2_IN CAN2_IN CANaux2_IN	X		640	280
	TPDO2	XCAN2_OUT CAN2_OUT CANaux2_OUT		X	641	281
PDO3 (Process data channel 3)	RPDO3	XCAN3_IN CAN3_IN CANaux3_IN	X		768	300
	TPDO3	XCAN3_OUT CAN3_OUT CANaux3_OUT		X	769	301
SDO1 (Parameter data channel 1)			X		1536	600
				X	1408	580
SDO2 (Parameter data channel 2)			X		1600	640
				X	1472	5C0
Node guarding			X		1792	700

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- Interface X1 (AIF) C2355.
- Interface X4 (CAN) C0355.
- Interface X14 (CAN-AUX) C2455.

Here, no values can be entered.

- General addressing (📖 458):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 160):
  Identifier (COB-ID) = 384 + ID offset (C0354 or C2454)

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (CAN2_IO/CAN3_IO) are factory-set so that the devices are able to communicate with each other.

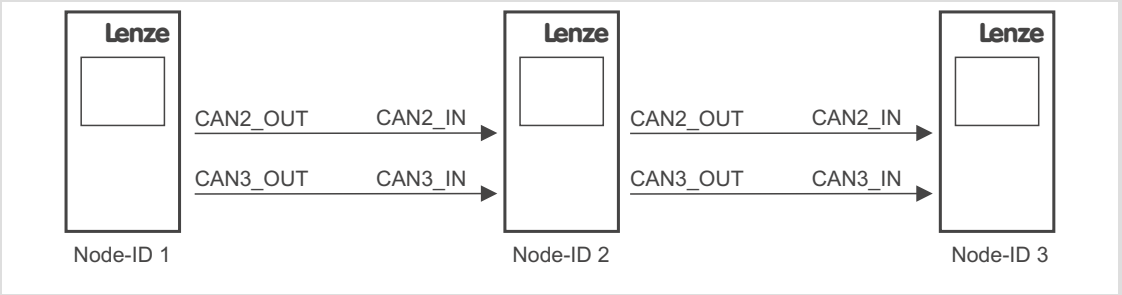


Fig. 14-13 Data exchange between Lenze devices

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

► A node address may not be assigned more than once within a network.

Note!

The ”8.1.1 Setting of CAN node address and baud rate” chapter contains information on

► Setting of the node address (📖 156).

► Individual addressing (📖 160).

14.8 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

14.8.1 Connector sets

To make purchasing easy, the connector sets are available as separate delivery units for the ECS power supply, capacitor and axis modules:

- ECSZ**E**000X0B (connector set for ECS power supply modules)
- ECSZ**K**000X0B (connector set for ECS capacitor modules)
- ECSZ**A**000X0B (connector set for ECS axis modules)

14.8.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

14.8.3 Components for operation and communication

Operating and communication modules

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrical isolation to CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1)]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1)]

1) ”xxxx” = Cable length in decimetre (example: ”xxxx” = ”0015” → length = 15 dm)

14.8.4 Brake resistor

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

14.8.5 Mains fuses

- Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- Use UL-approved cables, fuses and fuse holders only.
- UL fuse:
  – Voltage 500 ... 600 V
  – Tripping characteristic ”H”, ”K5” or ”CC”

14.8.6 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  - The waveform of the mains current is approximated to the sinusoidal shape.
  - Reduction of the effective mains current by up to 25%.
  - Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  - A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

14.8.7 RFI filters

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

15 Index

A

Absolute value encoder (Hiperface, single-turn/multi-turn), 112
- as position and speed encoder, 122

Access
- absolute addresses, 24
- via system variables, 23

Accessories, 460
- brake resistors, 462
- communication modules, 461
- connector set, 460
- digital frequency cables, 461
- digital frequency distributor, 461
- mains chokes, 465
- operating modules, 461
- RFI filters, 466
- shield mounting kit, 460
- system bus components, 461

Actual speed value, 365

Additional torque setpoint, 355

Address setting, 156

Addresses, absolute , 24

Addressing
- individual, 160
- parameter data objects, 458
- process data objects, 458

Adjusting current controller, 136

Adjusting speed controllers, setting the I component, 143

Adjusting the current controller, calculating the electrical motor values, 136

Adjusting the speed controller, signal limitation, 143

Adjustment of field controller / field weakening controller, Adjustment, 144

AIF_IO_Management, 255
- Inputs_AIF_Management, 255
- Outputs_AIF_Management, 258

AIF1_IO_AutomationInterface, 259
- Inputs_AIF1, 259
- Outputs_AIF1, 264

AIF2_IO_AutomationInterface, 267
- Inputs_AIF2, 267
- Outputs_AIF2, 269
- Outputs_AIF3, 273

AIF3_IO_AutomationInterface, 271
- Inputs_AIF3, 271

Analog input, 79 , 275

Analog inputs, Configuration, 79 , 275

ANALOG1_IO, Inputs_ANALOG1, 275

Analog1_IO, 275

Application, as directed, 20

Application as directed, 20

Approvals, 40

Assignment, external brake resistor, 462

Assignment of the plug connectors
- control connections, 77
- system bus (CAN), 91

Atmospheric pressure, 40

Auto increment access (RAM memory), 382

Automation interface
- AIF_IO_Management, 255
  Inputs_AIF_Management, 255
  Outputs_AIF_Management, 258
- AIF1_IO_AutomationInterface, 259
  Inputs_AIF1, 259
  Outputs_AIF1, 264
- AIF2_IO_AutomationInterface, 267
  Inputs_AIF2, 267
  Outputs_AIF2, 269
- AIF3_IO_AutomationInterface, 271
  Inputs_AIF3, 271
  Outputs_AIF3, 273
- communication error CE0, 255
- control word, 258
- status, 255
- transfer of the status/control word, 329

Automation interface (AIF), 89

Auxiliary relay, switch-on sequence, 76

Axis module, 15
- ECSCx...
  dimensions, 56
  mounting, 55
- ECSDx...
  dimensions, 52
  mounting, 51
- ECSEx...
  dimensions, 49
  mounting, 50

Axis synchronisation, 166

Axis synchronisation via CAN, 170

Axis synchronisation via terminal X6/DI1, 171

B

Basic identifier, 458

Baud rate
- AIF interface, 182
- setting, 157
  via DIP switch, 157
- system bus (CAN). *Siehe* baud rate

Boot up, AIF interface, 183

Brake, connection, 71

Brake configuration, 111

Brake resistor, external, 462
- assignment, 462
- connection, 69
- type ERBD..., rated data, 462
- type ERBM..., rated data, 462
- type ERBS..., rated data, 463

Brake resistor, internal, Connection, 67

Bus cable length, 93

Bus load CAN, 179

Bus off, 203
- AIF interface, 193

C

Cable cross-section, 93

Cable cross-sections
- Control connections, 64 , 77
- control connections, 62
- control terminals, connection "Safe torque off", 83

Cable specification, 91

Cables, shielded, 63

Cables, specification, motor cables, 70

CAN bus
- assignment of the plug connectors, 91
- boot-up time setting, 163
- cyclic process data objects, synchronisation, 450
- data telegram, 441
- determining the master in the drive system, 162
- event-controlled process data objects, 451
- identifier, 441 , 458
  display code, 458
- Individual addressing, 160
- making a reset node, 165 , 279 , 301
- network management data, 441
- parameter data, 441 , 452
- parameter data channels, 452
- parameter data objects, addressing, 458
- process data, 441
- process data objects, 445
  addressing, 458
  data transmission, 448
- process data telegrams, 446
- setting delay time, 163
- Setting the baud rate, 155
- setting the cycle time, 163
- Setting the node address, 155
- user data, 441 , 453

CAN bus load, 179

CAN bus status, 177

CAN data telegram, 440

CAN diagnostic codes, 177

CAN management, 174 , 277

CAN network
- communication phases, 442
- state transitions, 443
- statuses, 442

CAN network management (NMT), 444

CAN Sync correction increment, 167

CAN sync identifiers, 168

CAN sync response, 169

CAN synchronisation, 166

CAN synchronisation cycle, 166

CAN telegram counter , 178

CAN user organisation CiA, Homepage, 441

CAN-AUX management, 299

CAN-AUX-Management, 174

CAN_bTxCan2Syncronized_b, 279

CAN_Management, 277
- Inputs_CAN_Management, 278
- Outputs_CAN_Management, 278

CAN_Synchronization (system block), 281

CAN1_IO, 283
- Inputs_CAN1, 287
- Outputs_CAN1, 288

CAN2_IO, 289
- Inputs_CAN2, 292
- Outputs_CAN2, 293

CAN3_IO, 294
- Inputs_CAN3, 297
- Outputs_CAN3, 298

CANaux_bTxCan2Syncronized_b, 301

CANaux_Management, 299
- Inputs_CANaux_Management, 300
- Outputs_CANaux_Management, 300

CANaux1_IO, 303
- Inputs_CANaux1, 306
- Outputs_CANaux1, 307

CANaux2_IO, 309
- Inputs_CANaux2, 312
- Outputs_CANaux2, 313

CANaux3_IO, 314
- Inputs_CANaux3, 317
- Outputs_CANaux3, 318

Capacitor module, 15

Capacitor module ECSxK..., Connection, 73

Capacitor modules, 73

Carrying out basic settings with GDC, 104

CE-typical drive system, 58
- assembly, 59
- earthing, 60
- filters, 59
- installation , 58
- shielding, 60
  cables, 63

Charging current limitation, function selection, 107

COB-ID, 458
- display code, 458

Code descriptions, 16

Code table, 384

Codes, temporary, 380

Commissioning, 102
- adjusting the current controller, calculating the electrical motor values, 136
- Adjustment of field controller / field weakening controller, 144
- before you start, 102
- carrying out basic settings with GDC, 104
- commissioning steps, overview, 103
- configuration of digital inputs/outputs, setting the polarity, 129
- controller enable, 131
- current controller adjustment, metrological determination of electrical motor values, 137
- entry of machine parameters, 130
- Entry of motor data, 109
- holding brake configuration, 111
- loading the Lenze settings, 106
- operation with motors of other manufacturers, 132
- Operation with servo motors from other manufacturers, Motor feedback system - checking the direction of rotation, 135
- operation with servo motors of other manufacturers
  adjusting current controller, 136
  effecting rotor position adjustment, 138
  entering motor data, 132
- Optimising the drive behaviour, 141
- Resolver adjustment, 147
- Selecting the function of the charging current limitation, 107
- setting of mains data, 107
- setting of the feedback system, 112
- setting the feedback system
  absolute value encoder (Hiperface, single-turn/multi-turn), 122
  absolute value encoder (position encoder), resolver (speed encoder), 125
  resolver as position and speed encoder, 113
  sin/cos encoder without serial communication, 115
  TTL incremental encoder, 115
  TTL/SinCos encoder (position encoder), resolver (speed sensor), 118
- setting the polarity of digital inputs/outputs, 129
- setting the voltage threshold, 108
- Speed controller adjustment, 141

Communication error CE0, 255

Communication modules, 461

Communication phases, 442

Configuration
- axis synchronisation, 166
- Axis synchronisation (start), 167
- axis synchronisation via CAN, 170
- axis synchronisation via terminal X6/DI1, 171
- CAN bus load, 179
- CAN bus status, 177
- CAN diagnostic codes, 177
- CAN management, 174
- CAN sync correction increment, 167
- CAN sync identifiers, 168
- CAN synchronisation, 166
- CAN synchronisation (start), 167
- CAN synchronisation cycle, 166
- CAN telegram counter , 178
- Code table, 384
- cyclic node monitoring (Node Guarding), 172
- mapping indices to codes, 175
- monitoring, 196
  current load of the motor (I2 x t monitoring), 32 , 214
  voltage supply of control electronics, 221
- Monitoring functions, Motor temperature, 32
- monitoring functions
  bus off, 203
  current load of controller (I x t monitoring), 211
  DC-bus voltage, 218
  earth fault, 205
  heatsink temperature, 208
  max. system speed, 227
  monitoring times for process data input objects, 202
  motor phase failure, 221
  motor temperature, 206
  motor temperature sensor, 223
  overview, 197
  Resolver cable, 222
  rotor position adjustment, 228
  short circuit, 205
  sin/cos signal, 225
  speed system deviation, 226
  temperature inside the controller, 209
  thermal sensors, 210
- monitoring of the synchronisation, 169
- MotionBus (CAN), boot-up time setting, 163
- Sync phase displacement, 167
- sync phase displacement, correction value, 167
- System bus (CAN), Individual addressing, 160
- system bus (CAN)
  determining the master in the drive system, 162
  Making a reset node, 165 , 279 , 301
  setting delay time, 163
  setting the baud rate, 155
  setting the cycle time, 163
  setting the node address, 155
- Table of attributes, 431
- Thermal motor monitoring, 32

Configuration of AIF interface, node address (node ID), 184

Configuration of CAN bus interfaces, 155

Configuration of CAN interface, node address (node ID), 459

Configuring AIF interface
- operating status, 195
- synchronisation, XCAN sync identifiers, 190

Configuring CAN interface, monitoring, timeout with activated remote parameterisation, 204

Configuring the AIF interface, 182
- baud rate, 182
- boot up, 183
- cycle time, 188
- identifiers of the process data objects, 185
- monitoring, 192
  bus off, 193
  time monitoring, 192
- reset node, 191
- synchronisation
  XCAN sync response, 190
  XCAN Sync Tx transmission cycle, 191

Configuring the CAN interface, synchronisation, sync response, 169

Configuring touch probe (TP), 364

Conformity, 40

Connection
- Capacitor module ECSxK..., 73
- DC bus, 62 , 64
- external brake resistor, 69
- Internal brake resistor, 67
- motor, 62
- motor holding brake, 62 , 71

Connection "Safe torque off", terminals, 83

Connection "safe torque off", 80
- functional description, 81
- Important notes, 82

connection "safe torque off", Important notes, 82

Connection of "safe torque off"
- function check, 84
- implementation, 80
- technical data, 83

Control connections
- Analog inputs, configuration, 79 , 275
- assignment of the plug connectors, 77
- Cable cross-sections, 64 , 77
- cable cross-sections, 62
- Digital inputs, 78
- Digital outputs, 78
- Tightening torques, 64 , 77
- tightening torques, 62

Control drive controller, 320

Control factor, 44

Control signals, 75

Control terminals, 74
- cable cross-sections, connection "Safe torque off", 83
- starting torques, connection "Safe torque off", 83

Control word, transfer, 329

Control/signal cables, shield connection, 75

Controller, 15
- application as directed, 20
- identification, 20

Controller enable, 131

Controller inhibit (CINH), 325
- DCTRL_DriveControl (device control), 325

Conventions, 14

Current characteristics
- application example, 46
- device protection by current derating, 47
- rated output current, 44

Current controller adjustment, metrological determination of electrical motor values, 137

Current derating, 47

Current load of controller, I x t monitoring, 211

Current load of the motor, I2 x t monitoring, 32 , 214

Cycle time, AIF interface, 188

Cyclic node monitoring (Node Guarding), 172

Cyclic process data objects, 449

D

Data telegram, 440

Data, download, 379

Data, general electrical, 41

DC bus
- connection, 62 , 64
- fuses, 65 , 464

DC-bus voltage
- monitoring functions, 218
- overvoltage, 218
- undervoltage, 218

DC-bus voltage monitoring (OU, LU), 218

DCTRL (device control), transfer of status/control word, 329

DCTRL_DriveControl (device control), 319
- controller inhibit (CINH), 325
- Inputs_DCTRL, 321
- operation inhibit (DISABLE), 325
- Outputs_DCTRL, 323
- quick stop, 324
- resetting TRIP (TRIP RESET), 326
- setting TRIP (TRIP-SET), 326
- status word, 327
- TRIP status, 329

Define instant of transmission for CAN2/CAN3_OUT, 279

Define instant of transmission for CANaux2/CANaux3_OUT, 301

Definition
- inputs, 24
- outputs, 24

Definition of notes used, 39

Definitions of terms, 15

Determining the boot-up master, 162

Determining the master for the drive system, 162

Device control, 320

Device protection, 36

Device protection by current derating, 47

Device status, 328

device status, 239 , 328

DFIN_IO_DigitalFrequency, 331
- Inputs_DFIN, 331
- inputs_DFIN
  configuring master frequenccy input signal, 334
  configuring touch probe, 336

DFOUT_IO_DigitalFrequency, 338
- Inputs_DFOUT, 338
- Outputs_DFOUT, 338
- outputs_DFOUT
  configuring encoder constant, 340
  configuring master frequency output signal, 341

Diagnostics, 229
- AIF interface, operating status, 195
- with Global Drive Control (GDC), 229
- with Global Drive Oscilloscope (GDO), 230
  GDO buttons, 231
- with PCAN-View, 233
- with XT EMZ9371BC keypad, 232

Diagnostics codes, 177

Digital frequency cables, 461

Digital frequency distributor, 461

Digital frequency input, 100
- configuring the input signal, signal setting, 335
- features, 100

Digital frequency output, 100
- features, 100

Digital inputs, 78 , 343
- setting the polarity, 129

Digital outputs, 78 , 345
- setting the polarity, 129

DIGITAL_IO, 343
- Inputs_DIGITAL, 343
- Outputs_DIGITAL, 345

Dimensions, 49 , 52 , 56
- axis module ECSCx..., 56
- axis module ECSDx..., 52
- axis module ECSEx..., 49

DIP switch, 156

Discharge current to PE, 41

Disposal, 31

Download of various data items, 379

Drive control, 320

Drive system, 15

DRIVECOM, 329

E

E2PROM-buffered memory, 376

Earth fault monitoring (OC2), 205

Earth-fault monitoring, 205

Earthing, EMC, 60

Effecting rotor position adjustment, 138

Electrical installation, 58
- connection "Safe torque off", terminals, 83
- connection "safe torque off", 80
  functional description, 81
  Important notes, 82
- connection of "safe torque off"
  function check, 84
  implementation, 80
  technical data, 83
- Connection of capacitor module ECSxK..., 73
- control connections, 74
  assignment of the plug connectors, 77
  Digital inputs, 78
  Digital outputs, 78
- control terminals, 75
- feedback system, 95
  encoder, 97
  resolver, 96
- installation of a CE-typical drive system, 58
  assembly, 59
  earthing, 60
  filters, 59
  shielding, 60
- power connections, 62
  connection of external brake resistor, 69
  DC bus connection, 62
  internal brake resistor connection, 67
  motor connection, 62 , 70
  motor holding brake connection, 62
  plug connector assignment, 62
- power terminals
  connection of motor holding brake, 71
  DC bus connection, 64
- specification of the cables, motor cables, 70

Electromagnetic compatibility, 41

EMC, 41
- earthing, 60
- filters, 59
- shielding, 60
  cables, 63

EMF2131IB digital frequency distributor, wire, 101

EMF2131IB digital frequency distributor , wire, 101

Enclosure, 41

Encoder, 97
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 122
- absolute value encoder (Hiperface, single-turn/multi-turn), 112
- incremental encoder (TTL encoder), 98
- SinCos absolute value encoder, 99
- SinCos encoder, 99
  absolute value encoder (Hiperface, single-turn/multi-turn), 112
- supply voltage, 97

Encoder constant master frequency output, 340

Encoder simulation, 100

Entering motor data, 132

Entry of machine parameters, 130

Entry of motor data, 109

Environmental conditions, 40
- atmospheric pressure, 40
- pollution, 40
- site altitude, 40
- temperature, 40
- vibration resistance, 40

Error analysis, 236
- Via history buffer, 237
- via LECOM status word, 239

Error messages, 455
- Causes and remedies, 246
- causes and remedies, 246
- configuration, 198
- overview, 242
- reset (TRIP-RESET), 254

Error response, 454

Error sources, overview, 242

Event-controlled process data objects, 451

Examples
- reading parameters, 456
- Selection help for cable length / number of repeaters, 94
- writing parameters, 457

Executing a reset node, 279 , 301

Explanations, Code table, 384

Extendability, 375

External brake resistor, 462
- assignment, 462
- connection, 69
- type ERBD..., rated data, 462
- type ERBM..., rated data, 462
- type ERBS..., rated data, 463

F

FAIL-QSP, 197

Fault analysis, 236
- Via history buffer, 237
- via LECOM status word, 239
- via LEDs, 236
- with keypad XT EMZ9371BC, 236

Fault elimination, fault analysis with history buffer, 237

Fault messages, 242
- causes and remedies, 246
- configuration, 198
- overview, 242
- reset (TRIP-RESET), 238 , 254

Fault responses, 197

FCODE_FreeCode, 347

Feedback system, wiring, 95
- encoder, 97
- incremental encoder (TTL encoder), 98
- resolver, 96
- SinCos absolute value encoder, 99
- SinCos encoder, 99

Field controller / field weakening controller, 144

Field weakening (manual), 362

Filters, EMC, 59

Free codes, 347

Free space, 40

Function monitoring of thermal sensors (H10, H11), 210

Function sequence, touch probe, 337

Functional earth conductor, 54

Fuses, 65 , 464
- DC bus, 65 , 464
- replacing, 65

G

Gateway function, 180

Global Drive Control (GDC)
- Diagnostics, 229
- Parameter setting, 149

Global Drive Oscilloscope (GDO), 230
- GDO buttons, 231

Global variables (flags), 372

Guiding angle default and synchronisation, CAN sync response, 169

H

Heatsink temperature, monitoring functions, 208

Heatsink temperature monitoring (OH, OH4), 208

History buffer, 237
- codes, 237
- delete entries, 238
- for fault elimination, 237

Holding brake configuration, 111

I

Identification, controller, 20

Identifier, 441 , 458
- AIF interface, 185

identifier, display code, 458

Increment access (RAM memory), 382

Incremental encoder, as position and speed encoder, 115

Incremental encoder (TTL encoder), 98

Individual addressing, 160

Inputs, definition, 24

Inputs SYSTEM_FLAGS, 372

Inputs_AIF_Management, 255

Inputs_AIF1, 259

Inputs_AIF2, 267

Inputs_AIF3, 271

Inputs_ANALOG1, 275

Inputs_CAN_Management, 278

Inputs_CAN1, 287

Inputs_CAN2, 292

Inputs_CAN3, 297

Inputs_CANaux_Management, 300

Inputs_CANaux1, 306

Inputs_CANaux2, 312

Inputs_CANaux3, 317

Inputs_DCTRL, 321

Inputs_DFIN, 331
- configuring master frequency input signal, 334
  transfer function, 334
- configuring the digital frequency input signal, signal setting, 335
- configuring touch probe, 336
  function sequence, 337

Inputs_DFOUT, 338

Inputs_DIGITAL, 343

Inputs_MCTRL, 352

Installation, 40
- system bus (CAN), 90

Installation of a CE-typical drive system, 58
- assembly, 59
- earthing, 60
- filters, 59
- shielding, 60
  cables, 63

Installation, electrical, 58
- connection "Safe torque off", terminals, 83
- connection "safe torque off", 80
  functional description, 81
  Important notes, 82
- connection of "safe torque off"
  function check, 84
  implementation, 80
  technical data, 83
- Connection of capacitor module ECSxK..., 73
- control connections, 74
  assignment of the plug connectors, 77
  Digital inputs, 78
  Digital outputs, 78
- control terminals, 75
- feedback system, 95
  encoder, 97
  resolver, 96
- installation of a CE-typical drive system, 58
  assembly, 59
  earthing, 60
  filters, 59
  shielding, 60
- power connections, 62
  connection of external brake resistor, 69
  DC bus connection, 62
  internal brake resistor connection, 67
  motor connection, 62 , 70
  motor holding brake connection, 62
  plug connector assignment, 62
- power terminals
  connection of motor holding brake, 71
  DC bus connection, 64
- specification of the cables, motor cables, 70

Installation, mechanical, 48
- push-through technique (ECSDx...), 51

Installation, mechanical
- cold-plate technique (ECSCx...), 55
- important notes, 48
- with fixing rails (ECSEx...), 50

Insulation resistance, 41

Integrate system blocks into DDS, 26

Internal brake resistor, Connection, 67

J

Jitter, 167

K

Keypad XT EMZ9371BC
- changing and saving parameters, 154
- connecting the keypad, 150
- display elements, 151
- fault analysis, 236
- function keys, 153

L

LECOM, status word (C0150/C0155), 239

LEDs, 236

Legal regulations, 20

Liability, 20

Loading the Lenze setting, 106

Low-voltage supply, 15

M

Mains fuses, 464

Malfunction of drive, 241

Manual field weakening, 362

Manufacturer, 20

Mapping indices to codes, 175

Master frequency input, 331
- configuring input signal, 334
- configuring touch probe, 336
  function sequence, 337
- transfer function, 334

Master frequency output, 338
- configuring encoder constant, 340
- configuring output signal, 341

Max. system speed, monitoring functions, 227

MCTRL_MotorControl (motor control), 351
- additional torque setpoint, 355
- adjusting motor data, 366
- adjusting the speed controller, 142
- Inputs_MCTRL, 352
- manual field weakening, 362
- monitoring, 369
  absolute value encoder initialisation, 224
- Outputs_MCTRL, 354
- parameterising the angle controller, 360
- quick stop, 361
- setting maximum speed, 357
- speed setpoint limitation , 358
- switching frequency changeover, 363
- torque control with speed limitation, 359
- torque limitation, 356
- torque setpoint, 355
- touch probe (TP)
  configuration, 364
  function, 364
  sequence, 365

MCTRL_nNmaxC11, 357

Mechanical installation, 48
- cold-plate technique (ECSCx...), 55
- important notes, 48
- push-through technique (ECSDx...), 51
- with fixing rails (ECSEx...), 50

Memory
- persistent memory, 377
- retain memory, 376

Memory types, 376

Message, 197

Monitoring, 369
- absolute value encoder initialisation, 224
- AIF interface, 192
  bus off, 193
  time monitoring, 192
- CAN interface, timeout with activated remote parameterisation, 204
- current load of the motor, I2 x t monitoring, 32 , 214
- FAIL-QSP, 197
- message, 197
- Monitoring times for process data input objects, 202
- voltage supply of control electronics, 221
- warning, 197

Monitoring functions, 196
- bus off, 203
- configuring, 202
- current load of controller, I x t monitoring, 211
- DC-bus voltage, 218
- earth fault, 205
- heatsink temperature, 208
- max. system speed, 227
- motor phase failure, 221
- Motor temperature, 32
- motor temperature, 206
- motor temperature sensor, 223
- Overview, 198
- Resolver cable, 222
- rotor position adjustment, 228
- short circuit, 205
- sin/cos signal, 225
- speed system deviation, 226
- temperature inside the controller, 209
- thermal sensors, 210

Monitoring of internal device temperature (OH1, OH5), 209

Monitoring of the synchronisation, 169

Monitoring times for process data input objects, 202

Monitorings
- configuration, 198
- possible fault responses, 198

MotionBus (CAN)
- boot-up time setting, 163
- CAN data telegram, 441
- CAN1_IO, 283
- CAN2_IO, 289
- CAN3_IO, 294
- cyclic process data objects, synchronisation, 450
- event-controlled process data objects, 451
- identifier, 441 , 458
- network management data, 441
- parameter data, 441 , 452
- parameter data channels, 452
- parameter data objects, addressing, 458
- process data, 441
- process data objects, 445
  addressing, 458
  data transmission, 448
- process data telegrams, 446
- user data, 441 , 453

Motor, connection, 62 , 70

motor, Thermal monitoring, Sensorless, 32

Motor cable length, 40

Motor cables, specification, 70

Motor data, adjusting, 366

Motor feedback system, Checking the direction of rotation, 135

Motor holding brake
- connection, 62
- terminals, 346

Motor monitoring, 32

Motor phase failure, monitoring functions, 221

Motor protection, 37

Motor temperature, monitoring functions, 206

Motor temperature monitoring (OH3, OH7), 206

Motor temperature sensor, monitoring, 223

Motor temperature sensor monitoring (Sd6), 223

Motor, connection, , 70

Motors of other manufacturers, 132

Mounting
- axis module ECSCx..., 55
- axis module ECSDx..., 51
- axis module ECSEx..., 50
- cold-plate design, 55
- standard installation (with fixing rails), 49
- thermally separated (push-through technique), 51

Mounting position, 40

N

Network management (NMT), 444

Network management data, 441

Networking, 375

Node address (node ID)
- AIF interface, 184
- CAN interface, 459

Node address setting, 156

Node guarding, 172

Node ID, 458

Node numbers, 22

Node-ID, display code, 458

Noise emission, 41

Noise immunity, 41

Notes, definition, 39

O

Operating conditions, 40

Operating modules, 461

Operation inhibit (DISABLE), 325
- DCTRL_DriveControl (device control), 325

Operation with motors of other manufacturers, 132

Operation with servo motors from other manufacturers
- Checking the direction of rotation of the motor feedback system, 135
- current controller adjustment, metrological determination of electrical motor values, 137

Operation with servo motors of other manufacturers
- adjusting current controller, 136
- adjusting the current controller, calculating the electrical motor values, 136
- effecting rotor position adjustment, 138
- entering motor data, 132

Optimising the drive behaviour, 141

OSC_Oscilloscope, 371

Outputs, definition, 24

Outputs SYSTEM_FLAGS, 373

Outputs_AIF_Management, 258

Outputs_AIF1, 264

Outputs_AIF2, 269

Outputs_AIF3, 273

Outputs_CAN_Management, 278

Outputs_CAN1, 288

Outputs_CAN2, 293

Outputs_CAN3, 298

Outputs_CANaux_Management, 300

Outputs_CANaux1, 307

Outputs_CANaux2, 313

Outputs_CANaux3, 318

Outputs_DCTRL, 323

Outputs_DFOUT, 338
- configuring encoder constant, 340
- configuring master frequency output signal, 341

Outputs_DIGITAL, 345

Outputs_MCTRL, 354

Overcurrent characteristic, 212

Overcurrent diagram, 212

Overvoltage threshold, DC-bus voltage, 218

P

Packaging, 40

Parameter data, 441 , 452

Parameter data objects, addressing, 458

Parameter data telegram, 453
- examples, 456

Parameter data transfer, 452

Parameter setting, 148
- With Global Drive Control (GDC), 149
- with keypad XT EMZ9371BC
  changing and saving parameters, 154
  connecting the keypad, 150
  keypad display elements, 151
  keypad function keys, 153
- With XT EMZ9371BC keypad, 150

Parameterising phase controllers, 360

Parameters
- changing and saving, with keypad XT EMZ9371BC, 154
- machine parameters, 130

PC system bus adapter, 461

PCAN-View, diagnostics, 233

Persistent memory, 377

Phase displacement, correction value, 167

Phase shift, 167

PLC functionality, 374

Plug connector assignment, power connections, 62

Plug connectors
- control connections, 77
- power connections, 62

Polarity of digital inputs/outputs, 129

Pollution, 40

Position control, feedback system, 112
- absolute value encoder (Hiperface, single-turn/multi-turn), 122
- Absolute value encoder (position encoder), resolver (speed encoder), 125
- resolver, 113
- sin/cos encoder, without serial communication, 115
- TTL incremental encoder, 115
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 118

POUs, 383

Power connections, 62
- connection of external brake resistor, 69
- DC bus connection, 62
- Internal brake resistor connection, 67
- motor connection, 62 , 70
- motor holding brake connection, 62
- plug connector assignment, 62

Power reduction, 40

Power supply module, 15

Power terminals, 61
- connection of motor holding brake, 71
- DC bus connection, 64

Process data, 441
- of the axis module, device status, 328
- structure, 446

Process data objects
- addressing, 458
- available, 445
- cyclic, 449
- event-controlled, 451
- transfer, 448

Process data telegram, 283 , 289 , 294 , 303 , 309 , 314 , 446

Process data transfer, 445

Program organisation unit (POU), 24

Protection of persons, 36

Protective insulation, 41

Protective measures, 41

Protective separation, 41

Q

Quick stop, 324 , 361
- DCTRL_DriveControl (device control), 324
- MCTRL_MotorControl (motor control), 361

Quick stop (QSP), 324 , 361
- DCTRL_DriveControl (device control), 324
- MCTRL_MotorControl (motor control), 361

R

RAM, 376

RAM memory access, 381
- auto increment access, 382

Rated data, 42 , 43
- external brake resistor
  type ERBD..., 462
  type ERBM..., 462
  type ERBS..., 463

Rated output current, 44

Remote parameterisation (gateway function), 180

Reset node, 165
- AIF interface, 191

Reset TRIP (TRIP RESET), DCTRL_DriveControl (device control), 326

Resetting TRIP (TRIP-RESET), 326

Residual hazards, 36

Resolver, 96 , 147
- Adjustment, 147
- as position and speed encoder, 113

Resolver cable, monitoring, 222

Responses, 197
- CAN sync response, 169
- overview, 242

Retain memory, 376

ROM, 376

Rotor position adjustment, monitoring, 228

S

Safe standstill, 80

Safe torque off, 80
- inputs, 344
- outputs, 346

Safety instructions, 28
- definition, 39
- layout, 39

Scaling, 27

Sd7 - absolute value encoder initialisation, 224

Selection help for cable length / number of repeaters, Example, 94

Setting maximum speed, 357

Setting of mains data, 107

Setting of the feedback system, 112

Setting the address, via DIP switch, 156

Setting the baud rate, 155

Setting the boot-up time, 163

Setting the cycle time, 163

Setting the feedback system
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 122
- absolute value encoder (position encoder), resolver (speed encoder), 125
- Resolver as position and speed encoder, 113
- sin/cos encoder, without serial communication, 115
- TTL incremental encoder, 115
- TTL-/SinCos encoder (position encoder), resolver (speed sensor), 118

Setting the node address, 155
- via DIP switch, 156

Setting the polarity, digital inputs/outputs, 129

Setting the voltage thresholds, 108

Setting TRIP (TRIP-SET), 326
- DCTRL_DriveControl (drive control), 326

Shield connection, control/signal cables, 75

Shielded cables, 63

Shielding
- cables, 63
- EMC, 60

Short circuit monitoring (OC1), 205

Short-circuit monitoring, 205

Signal setting - digital frequency input, 335

Signal types, 27

Sin/cos signal, monitoring functions, 225

Sin/cos signal monitoring (Sd8), 225

SinCos absolute value encoder, 99

SinCos encoder, 99
- without serial communication, as position and speed encoder, 115

Site altitude, 40

Specification of the cables, motor cables, 70

Specification of the transmission cable, 91

Speed control, feedback system, 112
- absolute value encoder (Hiperface, single-turn/multi-turn), 122
- Absolute value encoder (position encoder), resolver (speed encoder), 125
- resolver, 113
- sin/cos encoder, without serial communication, 115
- TTL incremental encoder, 115
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 118

Speed controller, 141
- Adjustment, 141

Speed setpoint limitation, 358

Speed system deviation, monitoring functions, 226

Standards, 40

Starting torques, control terminals, connection "Safe torque off", 83

Status CAN, 177

Status messages, 280 , 302

status of the axis module, 239 , 328

Status signals, display, 327

Status word
- DCTRL_DriveControl (device control), 327
- LECOM (C0150/C0155), 239
- transfer, 329

Statuses, CAN network, 442

Structure of the process data, 446

Structure of the system block descriptions, 17

Supply voltage, encoder, 97

Switch-off thresholds, 218

Switch-on thresholds, 218

Switching frequency changeover, 363

Sync correction increment, 167

Sync identifiers, 168

Sync phase displacement, 167
- correction value, 167

Sync signal source, 166

Sync telegram, 450

Synchronisation
- CAN sync response, 169
- cyclic process data objects, 450
- sync response, 169
- XCAN sync identifiers, 190
- XCAN sync response, 190
- XCAN Sync Tx transmission cycle, 191

Synchronisation cycle, 166

Synchronisation via CAN, 170

Synchronisation via terminal X6/DI1, 171

System block, MCTRL_MotorControl (motor control), adjusting the speed controller, 142

System blocks, 255
- absolute adresses, 24
- AIF_IO_Management, 255
  Inputs_AIF_Management, 255
  Outputs_AIF_Management, 258
- AIF1_IO_AutomationInterface, 259
  Inputs_AIF1, 259
  Outputs_AIF1, 264
- AIF2_IO_AutomationInterface, 267
  Inputs_AIF2, 267
  Outputs_AIF2, 269
  Outputs_AIF3, 273
- AIF3_IO_AutomationInterface, 271
  Inputs_AIF3, 271
- ANALOG1_IO, Inputs_ANALOG1, 275
- Analog1_IO, 275
- CAN_Management, 277
  Inputs_CAN_Management, 278
  Outputs_CAN_Management, 278
- CAN_Synchronization, 281
- CAN1_IO, 283
  Inputs_CAN1, 287
  Outputs_CAN1, 288
- CAN2_IO, 289
  Inputs_CAN2, 292
  Outputs_CAN2, 293
- CAN3_IO, 294
  Inputs_CAN3, 297
  Outputs_CAN3, 298
- CANaux_Management, 299
  Inputs_CANaux_Management, 300
  Outputs_CANaux_Management, 300
- CANaux1_IO, 303
  Inputs_CANaux1, 306
  Outputs_CANaux1, 307
- CANaux2_IO, 309
  Inputs_CANaux2, 312
  Outputs_CANaux2, 313
- CANaux3_IO, 314
  Inputs_CANaux3, 317
  Outputs_CANaux3, 318
- connecting, 25
- DCTRL_DriveControl (device control), 319
  Inputs_DCTRL, 321
  Outputs_DCTRL, 323
  quick stop, 324
- DFIN_IO_DigitalFrequency, 331
  Inputs_DFIN, 331
- DFOUT_IO_DigitalFrequency, 338
  Inputs_DFOUT, 338
  Outputs_DFOUT, 338
- DIGITAL_IO, 343
  Inputs_DIGITAL, 343
  Outputs_DIGITAL, 345
- FCODE_FreeCode, 347
- inputs, 24
- Integration into DDS, 26
- introduction, 21
- MCTRL_MotorControl, Inputs_MCTRL, 352
- MCTRL_MotorControl (motor control), 351
  additional torque setpoint, 355
  manual field weakening, 362
  monitoring, 369
  Outputs_MCTRL, 354
  parameterising the angle controller, 360
  quick stop, 361
  setting maximum speed, 357
  speed setpoint limitation , 358
  switching frequency changeover, 363
  torque control with speed limitation, 359
  torque limitation, 356
  torque setpoint, 355
  touch probe (TP), 364
- node numbers, 22
- OSC_Oscilloscope, 371
- outputs, 24
- principle, 21
- scaling, 27
- signal types, 27
- structure of the descriptions, 17
- system block variable, 23
- SYSTEM_FLAGS, 372
  Inputs SYSTEM_FLAGS, 372
  Outputs SYSTEM_FLAGS, 373
- SYSTEM_FLAGS (system flags), 372

System bus (CAN), 375 , 440
- assignment of the plug connectors, 91
- baud rate, 93 , 94
- CAN_Synchronization, 281
- CANaux1_IO, 303
- CANaux2_IO, 309
- CANaux3_IO, 314
- cycle time, AIF interface, 188
- cyclic process data objects, synchronisation, 450
- defining the instant of transmission for CAN2/CAN3_OUT, 279
- determining the master in the drive system, 162
- event-controlled process data objects, 451
- identifier, 441 , 458
  AIF interface, 185
- Individual addressing, 160
- Interfaces for system bus connection, Configuration of CAN bus interfaces, 155
- interfaces for system bus connection, configuring the AIF interface, 182
- making a reset node, 165 , 279 , 301
- monitoring, AIF interface, 192
- network management data, 441
- parameter data, 441 , 452
- parameter data channels, 452
- process data, 441
- process data objects, 445
  addressing, 458
  data transmission, 448
- process data telegrams, 446
- reset node, AIF interface, 191
- setting delay time, 163
- setting the baud rate, 155
- setting the cycle time, 163
- setting the node address, 155
- status messages, 280 , 302
- user data, 441 , 453
- wiring, 90 , 92

system bus (CAN)
- CAN data telegram, 441
- parameter data objects, addressing, 458

System bus components, 461

System error messages, Causes and remedies, 246

System program organisation units, 383

System variables, 23

SYSTEM_FLAGS, 372
- Inputs SYSTEM_FLAGS, 372
- Outputs SYSTEM_FLAGS, 373

Systembus (CAN). *Siehe* manual "System bus (CAN) for Lenze PLC devices"

T

Table of attributes, 431

Technical data, 40
- current characteristics
  application example, 46
  device protection by current derating, 47
  rated output current, 44
- external brake resistor
  type ERBD..., 462
  type ERBM..., 462
  type ERBS..., 463
- general electrical data, 41
- rated data, 42 , 43
- standards and operating conditions, 40

Telegram counter CAN, 178

Temperature, 40

Temperature inside the controller, monitoring functions, 209

Temporary codes, 380

Terminal extension 9374IB, 375

Terminology used, 15

Thermal monitoring, motor, Sensorless, 32

Thermal sensors, monitoring functions, 210

Thermal separation, 51

Tightening torques
- Control connections, 64 , 77
- control connections, 62

Time monitoring, AIF interface, 192

Time-out monitoring for activated remote parameterisation, 204

Timeout with activated remote parameterisation, CAN interface, 204

Torque, safe torque off, 80

Torque control, with speed limitation, 359

Torque limitation, 356

Torque setpoint , 355

Touch probe, 336
- configuring, 336

Touch probe (TP), 364
- function, 364
- sequence, 365

Transfer function master frequency input, 334

Transfer of status/control word, DCTRL (device control), 329

Transmission cable, specification, 91

TRIP, 197

TRIP status, 329
- DCTRL_DriveControl (device control), 329

TRIP-RESET, 238 , 254

Troubleshooting
- fault analysis with history buffer, 237
- fault messages, 242
- malfunction of drive, 241

Troubleshooting and fault elimination, 236
- monitoring
  current load of the motor (I2 x t monitoring), 32 , 214
  voltage supply of control electronics, 221
- monitoring functions
  bus off, 203
  current load of controller (I x t monitoring), 211
  DC-bus voltage, 218
  earth fault, 205
  heatsink temperature, 208
  max. system speed, 227
  monitoring times for process data input objects, 202
  motor phase failure, 221
  motor temperature, 206
  motor temperature sensor, 223
  Resolver cable, 222
  rotor position adjustment, 228
  short circuit, 205
  sin/cos signal, 225
  speed system deviation, 226
  temperature inside the controller, 209
  thermal sensors, 210

TTL encoder, 98

TTL incremental encoder, as position and speed encoder, 115

U

Undervoltage threshold, DC-bus voltage, 218

User data, 441 , 453 , 455

V

Vibration resistance, 40

Voltage supply of control electronics, monitoring, 221

W

Warning, 197

Warranty, 20

Wiring, system bus (CAN), 92

X

XCAN sync identifier, 190

XCAN sync response, 190

XCAN Sync Tx transmission cycle, 191

XT EMZ9371BC keypad, Diagnostics, 232

© 09/2013

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

+49 (0)51 54 / 82-0

+49 (0)51 54 / 82 - 28 00

Lenze@Lenze.de

www.Lenze.com

Service

Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany

00 80 00 / 24 4 68 77 (24 h helpline)

+49 (0)51 54 / 82-11 12

Service@Lenze.de

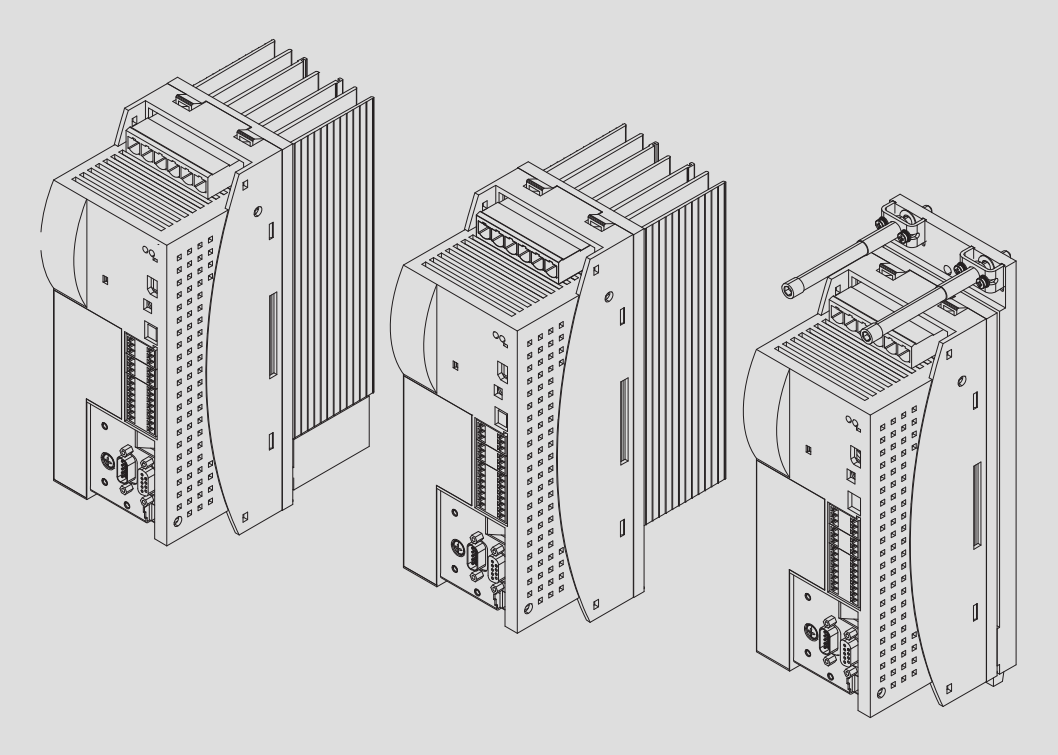
EDBCSXA064 ■ 13446719 ■ EN ■ 3.2 ■ TD17

10 9 8 7 6 5 4 3 2 1

EDBCSXM064
13434279

Operating Instructions

ECS



ECSEMxxx / ECSDMxxx / ECSCMxxx

Axis module – "Motion"

Lenze

Please read these instructions before you start working!
Follow the enclosed safety instructions.

This documentation is valid for ECSxM axis modules, ”Motion” application software from V 1.2, as of version:

	①										
	ECS	x	M	xxx	x	4	x	xxx	XX	xx	xx

Device type

Design

E = standard panel-mounted unit, IP20
D = push-through technique (thermally separated)
C = cold-plate technique

Application

M = ”Motion”

Peak current

004 = 4 A
008 = 8 A
016 = 16 A
032 = 32 A
048 = 48 A
064 = 64 A

Fieldbus interface

C = MotionBus/system bus (CAN)

Voltage class

4 = 400 V/500 V

Technical version

B = standard
V = coated
I = for IT systems, uncoated
K= for IT systems, coated

Variant

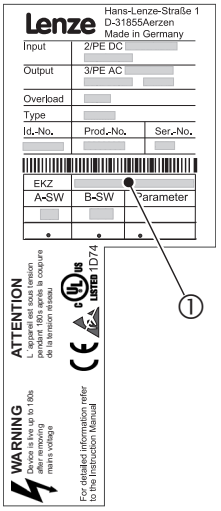
042 = Motion CiA402

Hardware version

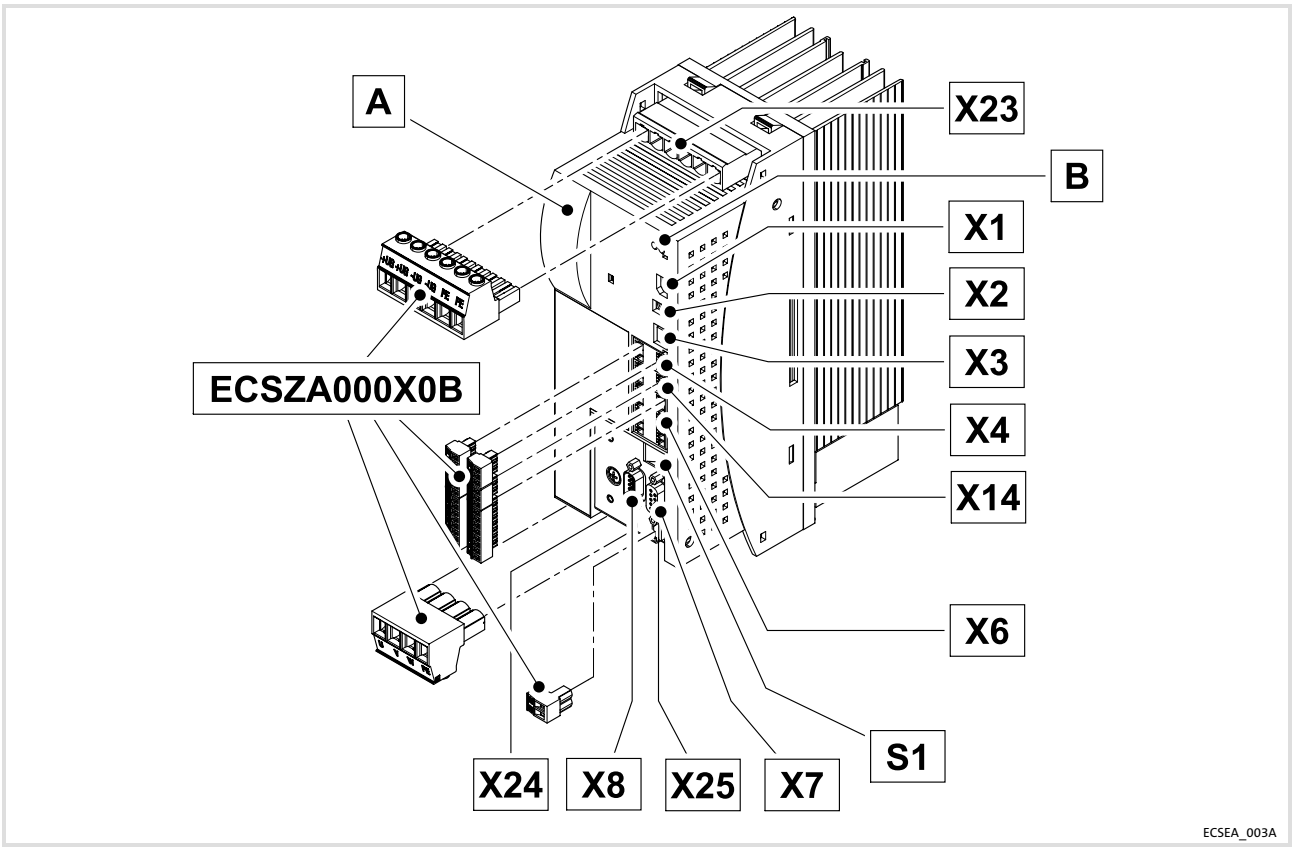
1A or higher

Operating software version (B-SW)

6.0 or higher



© 2013 Lenze Drive Systems GmbH, Hans-Lenze-Straße 1, 31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Drive Systems GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not take any responsibility or liability for any damage that may occur. Necessary corrections will be included in subsequent editions.


A
X23
B
X1
X2
X3
X4
X14
ECSZA000X0B
X6
S1
X24
X8
X25
X7
ECSEA_003A

Scope of supply

Position	Description	Quantity
A	ECS☐M... axis module	1
	Accessory kit with fixing material corresponding to the design (☐): ● ”E” - standard panel-mounted unit ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1
	Functional earth conductor (only ECS**D**M...)	1

Note!

The **ECSZA000X0B** connector set must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X23	Connections ● DC-bus voltage ● PE	📖 54
B	LEDs: Status and fault display	
X1	Automation interface (AIF) for ● Communication module ● Operating module (keypad XT)	 📖 79 📖 191
x2	PE connection of AIF	
X3	Analog input configuration	📖 69
X4	CAN connection ● MotionBus (CAN) / for ECSxA: System bus (CAN) ● Interface to the master control	📖 80
X14	CAN-AUXconnection ● System bus (CAN) ● PC interface/HMI for parameter setting and diagnostics	
X6	Connections ● Low-voltage supply ● Digital inputs and outputs ● Analog input ● ”Safe torque off” (formerly ”safe standstill”)	📖 64 📖 68 📖 69 📖 70
S1	DIP switch ● CAN node address ● CAN baud rate	📖 197
X7	Resolver connection	📖 86
X8	Encoder connection ● Incremental encoder (TTL encoder) ● Sin/cos encoder	📖 87
X25	Brake control connection	📖 61
X24	Motor connection	📖 60

Status displays

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibited (CINH), switch-on inhibit	Code C0183
Blinking	Off	Fault/error (TRIP) active	Code C0168/1
Blinking	On	Warning/FAIL-QSP active	Code C0168/1

1 Preface and general information 11

1.1 About these Operating Instructions 11
1.1.1 Terminology used 12
1.1.2 Code descriptions 13
1.2 Features of the axis module ECSxM (Motion) 14
1.3 Structure 15
1.4 Scope of supply 16
1.5 Legal regulations 17

2 Safety instructions 18

2.1 General safety and application notes for Lenze controllers 18
2.2 Thermal motor monitoring 22
2.2.1 Forced ventilated or naturally ventilated motors 23
2.2.2 Self-ventilated motors 24
2.3 Residual hazards 26
2.4 Safety instructions for the installation according to UL 28
2.5 Notes used 29

3 Technical data 30

3.1 General data and operating conditions 30
3.2 Rated data 32
3.3 Current characteristics 34
3.3.1 Increased continuous current depending on the control factor 34
3.3.2 Device protection by current derating 37

4 Mechanical installation 38

4.1 Important notes 38
4.2 Mounting with fixing rails (standard installation) 39
4.2.1 Dimensions 39
4.2.2 Mounting steps 40
4.3 Mounting with thermal separation (push-through technique) 41
4.3.1 Dimensions 42
4.3.2 Mounting steps 44
4.4 Mounting in cold-plate design 45
4.4.1 Dimensions 46
4.4.2 Mounting steps 47

5 Electrical installation 48
5.1 Installation according to EMC (installation of a CE-typical drive system) 48
5.2 Power terminals 51
5.2.1 Connection to the DC bus (+UG, -UG) 54
5.2.2 Connection plan for mimimum wiring with internal brake resistor 56
5.2.3 Connection plan for mimimum wiring with external brake resistor 58
5.2.4 Motor connection 60
5.2.5 Motor holding brake connection 61
5.2.6 Connection of an ECSxK... capacitor module (optional) 63
5.3 Control terminals 64
5.3.1 Digital inputs and outputs 68
5.3.2 Analog input 69
5.3.3 Safe torque off 70
5.4 Automation interface (AIF) 79
5.5 Wiring of system bus (CAN) 80
5.6 Wiring of the feedback system 85
5.6.1 Resolver connection 86
5.6.2 Encoder connection 87
5.6.3 Digital frequency input/output (encoder simulation) 90

6 Commissioning 92
6.1 Before you start 92
6.2 Commissioning steps (overview) 93
6.2.1 Basic settings with GDC 94
6.2.2 Setting of homing 96
6.3 Loading the Lenze setting 100
6.4 Setting of mains data 101
6.4.1 Selecting the function of the charging current limitation 101
6.4.2 Setting the voltage thresholds 102
6.5 Entry of motor data for Lenze motors 103
6.6 Holding brake configuration 105
6.6.1 Closing the brake 107
6.6.2 Opening the brake 108

6.7 Setting of the feedback system for position and speed control 109
6.7.1 Resolver as position and speed encoder 110
6.7.2 Resolver as absolute value encoder 112
6.7.3 TTL/SinCos encoder as position and speed encoder 113
6.7.4 TTL/SinCos encoder as position encoder and resolver as speed encoder 117
6.7.5 Absolute value encoder as position and speed encoder 121
6.7.6 Absolute value encoder as position encoder and resolver as speed encoder 126
6.8 Selecting the control interface (C4010) 130
6.9 Process data to the axis module (control word Ctrl1 and setpoints) 131
6.10 Process data from the axis module (status words and actual values) 134
6.10.1 Toggle-bit monitoring 136
6.11 Entry of machine parameters 138
6.12 Configuring the digital inputs and outputs 140
6.12.1 Digital inputs for communication via the MotionBus (CAN) X4 141
6.12.2 Digital inputs for communication via the automation interface (AIF) X1 141
6.12.3 Setting the polarity of digital inputs and outputs 142
6.13 Setting of homing parameters 143
6.13.1 Homing parameters 143
6.13.2 Homing modes 145
6.13.3 Shifting the zero position with regard to the home position (offsets C3011, C3012) 155
6.13.4 Example: Reference search with linear positioning axis 156
6.13.5 Example: Reference search with continuous positioning axis 158
6.14 Selection of the operating mode 160
6.14.1 Operating mode ”Interpolated Position Mode” (IP-Mode) 161
6.14.2 ”Homing” operating mode 164
6.14.3 ”Manual jog” operating mode 165
6.14.4 ”Velocity” operating mode 167
6.15 Controller enable (CINH = 0) 169
6.16 Following error monitoring (C3030, C3031) 170
6.17 Evaluating and retracting from hardware limit switch 172
6.17.1 Evaluating hardware limit switches 172
6.17.2 Retracting from hardware limit switches 172
6.18 Quick stop (QSP) 173

6.19 Operation with motors from other manufacturers 174
6.19.1 Entering motor data manually 174
6.19.2 Checking the direction of rotation of the motor feedback system 177
6.19.3 Adjusting current controller 178
6.19.4 Effecting rotor position adjustment 180
6.20 Optimising the drive behaviour after start 183
6.20.1 Speed controller adjustment 183
6.20.2 Adjustment of field controller and field weakening controller 185
6.20.3 Resolver adjustment 188

7 Parameter setting 189

7.1 General information 189
7.2 Parameter setting with ”Global Drive Control” (GDC) 190
7.3 Parameter setting with the XT EMZ9371BC keypad 191
7.3.1 Connecting the keypad 191
7.3.2 Description of the display elements 192
7.3.3 Description of the function keys 194
7.3.4 Changing and saving parameters 195

8 Configuration 196

8.1 Configuring MotionBus/system bus (CAN) 197
8.1.1 Setting CAN node address and baud rate 197
8.1.2 Individual addressing 201
8.1.3 Defining boot-up master in the drive system 203
8.1.4 Setting of boot-up time/cycle time 204
8.1.5 Executing a reset node 206
8.1.6 Axis synchronisation (CAN synchronisation) 207
8.1.7 Monitoring of the synchronisation (sync time slot) 209
8.1.8 Axis synchronisation via CAN 210
8.1.9 Axis synchronisation via terminal X6/DI1 211
8.2 Node guarding 212
8.3 Diagnostics codes 214
8.3.1 CAN bus status (C0359) 214
8.3.2 CAN telegram counter (C0360) 215
8.3.3 CAN bus load (C0361) 216
8.4 Remote parameterisation (gateway function) 217

9 Monitoring functions 219
9.1 Fault responses 220
9.2 Overview of monitoring functions 221
9.3 Configuring monitoring functions 225
9.3.1 Monitoring times for process data input objects 225
9.3.2 Time-out monitoring for activated remote parameterisation 227
9.3.3 Short circuit monitoring (OC1) 228
9.3.4 Earth fault monitoring (OC2) 228
9.3.5 Motor temperature monitoring (OH3, OH7) 229
9.3.6 Heatsink temperature monitoring (OH, OH4) 231
9.3.7 Monitoring of internal device temperature (OH1, OH5) 232
9.3.8 Function monitoring of thermal sensors (H10, H11) 233
9.3.9 Current load of controller (I x t monitoring: OC5, OC7) 234
9.3.10 Current load of motor (I2 x t monitoring: OC6, OC8) 237
9.3.11 DC-bus voltage monitoring (OU, LU) 241
9.3.12 Voltage supply monitoring - control electronics (U15) 244
9.3.13 Motor phase failure monitoring (LP1) 244
9.3.14 Monitoring of the resolver cable (Sd2) 245
9.3.15 Motor temperature sensor monitoring (Sd6) 246
9.3.16 Monitoring of the absolute value encoder initialisation (Sd7) 247
9.3.17 Sin/cos signal monitoring (Sd8) 248
9.3.18 Monitoring of the speed system deviation (nErr) 249
9.3.19 Monitoring of max. system speed (NMAX) 250
9.3.20 Monitoring of the rotor position adjustment (PL) 251

10 Diagnostics 252
10.1 Diagnostics with Global Drive Control (GDC) 252
10.2 Diagnostics with Global Drive Oscilloscope (GDO) 253
10.2.1 GDO buttons 254
10.2.2 Diagnostics with GDO 255
10.3 Diagnostics with the XT EMZ9371BC keypad 259
10.4 Diagnostics with PCAN-View 260
10.4.1 Monitoring of telegram traffic on the CAN bus 260
10.4.2 Setting all CAN nodes to the ”Operational” status 262

11 Troubleshooting and fault elimination 263
11.1 Fault analysis 263
11.1.1 Fault analysis via the LED display 263
11.1.2 Fault analysis with keypad XT EMZ9371BC 263
11.1.3 Fault analysis with the history buffer 264
11.1.4 Fault analysis via application status word (C3150/C3151) 266
11.1.5 Fault analysis via LECOM status words (C0150/C0155) 267
11.2 Malfunction of the drive 269
11.3 Fault messages 270
11.3.1 Causes and remedies 270
11.3.2 Reset fault messages (TRIP-RESET) 278

12 Appendix 279
12.1 Code table 279
12.2 General information about the system bus (CAN) 333
12.3 Communication with MotionBus/system bus (CAN) 334
12.3.1 Structure of the CAN data telegram 334
12.3.2 Communication phases of the CAN network (NMT) 336
12.3.3 Process data transfer 339
12.3.4 Parameter data transfer 345
12.3.5 Addressing of the parameter and process data objects 351
12.4 Overview of accessories 353
12.4.1 Connector sets 353
12.4.2 Shield mounting kit 353
12.4.3 Components for operation and communication 354
12.4.4 Brake resistor 355
12.4.5 Mains fuses 357
12.4.6 Mains chokes 358
12.4.7 RFI filters 359

13 Index 360

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions will assist you in connecting and commissioning the ECSxM... axis modules.

They contain safety instructions which must be observed!

All persons working on and with the ECSxM... axis modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.1.1 Terminology used

Term	In the following text used for
Power supply module ECSxE...	ECSxE... power supply module
Capacitor module ECSxK...	ECSxK... capacitor module
Axis module Controller Standard device ECSxS... ECSxP... ECSxM... ECSxA ...	Axis module of the ECS series ● ECSxS... - ”Speed and Torque” ● ECSxP... - ”Posi and Shaft” ● ECSxM... - ”Motion” ● ECSxA... - ”Application”
Drive system	ECS drive system consisting of: ● ECSxE... power supply module ● Axis module ECSxS... / ECSxP... / ECSxM... / ECSxA... ● ECSxK series capacitor module (optional) ● further Lenze drive components (accessories)
24 V supply Low-voltage supply	Voltage supply ● of the control card, voltage range 20 ... 30 V DC (±0 V) ● of the ”safe torque off” function (formerly ”safe standstill”), voltage range 18 ... 30 V DC (±0 V) ● of the motor holding brake, voltage range 23 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
System bus (CAN)	Lenze standard bus system based on *CANopen* for ● communication with a higher-level host system (PLC) or further controllers. ● parameter setting and diagnostics.
MotionBus (CAN)	The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.
DDS	Drive PLC Developer Studio (Lenze software for PLC programming acc. to IEC 61131)
GDC	Global Drive Control (Lenze software for parameter setting and diagnostics)
GDO	Global Drive Oscilloscope (additional diagnostic tool of the GDC)
Cxxxx	Code Cxxxx (e.g. C0351) Parameters which serve to parameterise or monitor the controller.
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on terminal strip Xk (e.g. X6/B+ = terminal B+ on terminal strip X6)

1.1.2 Code descriptions

Lenze codes are described in the form of tables with the following structure:

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	Cxxxx 1	Subcode 1 of Cxxxx
	Cxxxx 2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Example

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0003	Par save	0				Non-volatile saving of parameter set
			0	No response		
			1	Save parameter set		
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2

1.2 Features of the axis module ECSxM (Motion)

- Safety function ”safe torque off” (formerly ”safe standstill”)
- Homing can be selected from 19 modes
- Brake logic activatable
- Switching of operating modes
  – ”Interpolated Position Mode” (for travel according to setpoint selection)
  – ”Homing Mode”
  – ”Manual Jog”
  – ”Velocity Mode”
- Torque feedforward control
- Fine interpolation
- Interpolation cycle can be selected between 1 - 10 ms
- Process coordination by higher-level host system (PLC)
- Toggle bit monitoring
- Monitor data selectable via control word
- Double CAN ON BORD
  – **MotionBus (CAN):**
  Interface X4 ”CAN” (PDO1, Sync-based) for communicating with a higher-level host system (PLC) or further controllers.
  – **System bus (CAN):**
  Interface X14 ”CAN-AUX” for parameter setting and diagnostics
- Selectable control interfaces (via code C4010):
  – MotionBus (CAN)
  – MotionBus (EtherCAT) via the automation interface (AIF)
  – Via codes through parameter channel
- Supported feedback systems:
  – Resolver with and without position storage
  – Encoder (incremental encoder (TTL encoder), sin/cos encoder)
- Commissioning, parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC) or the XT EMZ9371BC keypad

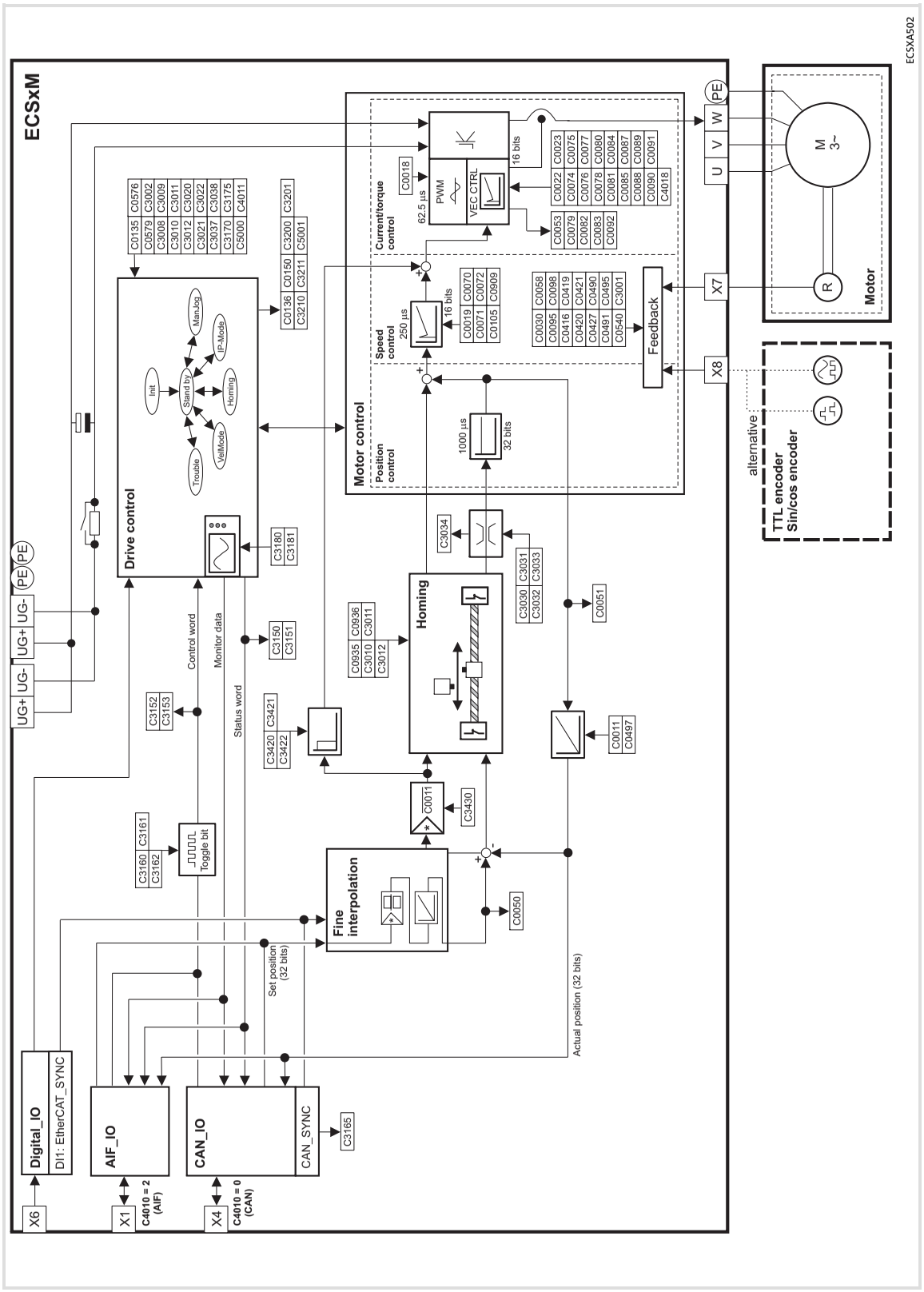


Fig. 1-1 Structure of the ECS application "Motion"

1.4 Scope of supply

The scope of supply of the ECSxM... axis module includes:

- Standard device
- Accessory kit with fixings according to the design:
  – ”E” - panel-mounted device
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting Instructions
- Drilling jig
- Functional earth conductor (only ECS**D**M...)

Accessories

The appendix includes information on the following accessories: (📖 353).

- Connector sets for
  – power supply modules: ECSZE000X0B
  – capacitor modules: ECSZK000X0B
  – axis modules: ECSZA000X0B
- ECSZS000X0B001 shield mounting kit (EMC accessories)
- Components for operation and communication
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters



Tip!

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

http://www.Lenze.com

1.5 Legal regulations

Identification	Nameplate	CE designation	Manufacturer
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Automation GmbH Grünstraße 36 D-40667 Meerbusch
Application as directed	**ECSxM... axis modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for open and closed loop control of variable speed drives with PM synchronous motors and asynchronous motors. – for installation into a machine – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective 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 for industrial purposes only. **Drive systems with ECSxM... axis modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at public and non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to axis modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these Instructions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damages and failures caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the axis module – Operating errors – Improper working on and with the axis module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems 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

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

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):

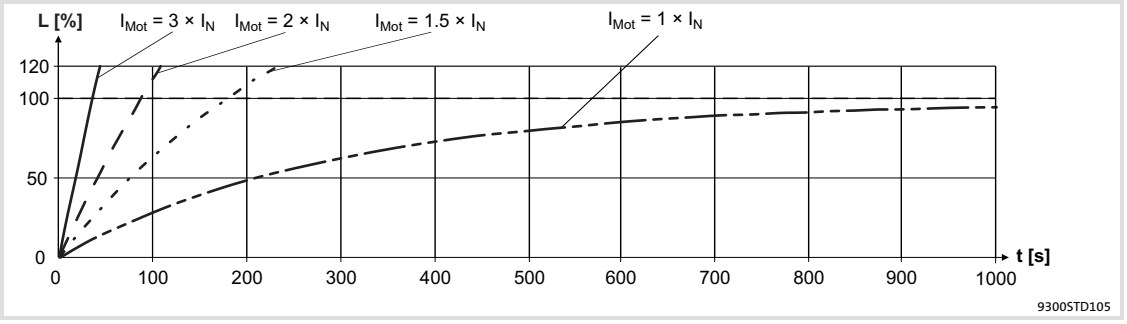


Fig. 2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

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

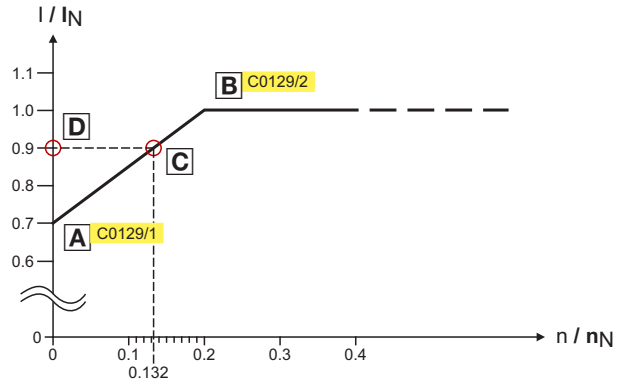


Fig. 2-2 Working point in the range of characteristic lowering

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", 📖 25)

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 axis module, check that no voltage is applied to the power terminals, because
  - the power terminals +UG, -UG, U, V and W remain live for at least 3 minutes after mains switch-off.
  - the power terminals +UG, -UG, U, V and W remain live when the motor is stopped.
- The heatsink has an operating temperature of > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The discharge current to PE is > 3.5 mA AC or. > 10 mA DC.
  - EN 61800-5-1 requires a fixed installation.
  - The PE connection must comply with EN 61800-5-1.
  - Comply with the further requirements of EN 61800-5-1 for high discharge currents!

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG, U, V, W and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Power must not be converted until all devices of the power system are ready for operation. Otherwise, the input current limitation may be destroyed.

Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the axis module, if

- the axis module is supplied via the ECSxE supply module and the input current limitation is activated depending on the DC-bus voltage (C0175 = 1 or 2).
- the axis module is not supplied via a supply module delivered by Lenze.
- the low-voltage supply (24 V) is switched off.

For this reason allow a break of at least three minutes between two starting operations!

Use the safety function ”Safe torque off” (STO) for frequent disconnections for safety reasons.

Motor protection

- Only use motors with a minimum insulation resistance of û = 1.5 kV, min. du/dt = 5 kV/µs.
  – Lenze motors meet these requirements.
- When using motors with an unknown insulation resistance, please contact your motor supplier.
- Some settings of the axis module lead to an overheating of the connected motor, e.g. longer operation of self-ventilated motors with low speeds.
- Use PTC thermistors or thermostats with PTC characteristic for motor temperature monitoring.

2.4 Safety instructions for the installation according to UL

Warnings!

General markings:

- ► Use 60/75 °C or 75 °C copper wire only.
- ► Maximum ambient temperature 55 °C, with reduced output current.

Markings provided for the supply units:

- ► Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V max, when protected by K5 or H Fuses (400/480 V devices).
- ► Alternate - Circuit breakers (either inverse-time, instantaneous trip types or combination motor controller type E) may be used in lieu of above fuses when it is shown that the let-through energy (i^2t) and peak let-through current (I_p) of the inverse-time current-limiting circuit breaker will be less than that of the non-semiconductor type K5 fuses with which the drive has been tested.
- ► Alternate - An inverse-time circuit breaker may be used, sized upon the input rating of the drive, multiplied by 300 %.

Markings provided for the inverter units:

- ► The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 2nd ed., Table 5.1.
- ► The devices are provided with integral overload and integral thermal protection for the motor.
- ► The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X 21, X 22, X 23, X 24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X 25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X 21, X 22, X 23, X 24	12 ... 8
X4, X6, X14	28 ... 16
X 25	24 ... 12

2.5 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.

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (2006/95/EG)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
		CSA 22.2 No. 14	
Max. permissible Motor cable length	shielded	50 m	For rated mains voltage and switching frequency of 8 kHz
Packaging (EN ISO 4180)		Shipping package	
Installation		• Installation into IP20 control cabinet • For the ”safe torque off” function (formerly ”safe standstill”): mounting in IP54 control cabinet	
Mounting position		vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm With ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	can be mounted directly side by side without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) • Atmospheric pressure: 86 ... 106 kPa • Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl • Reduce rated output current by 5 %/1000 m above 1000 m amsl. • Over 2000 m amsl: Use is only permitted in environments with overvoltage category II
Pollution		EN 61800-5-1, UL840: Degree of pollution 2	
Vibration resistance		Acceleration resistant up to 0.7 g (Germanischer Lloyd, general conditions)	

General electrical data			
EMC	Compliance with the requirements acc. to EN 61800-3		
Noise emission	Compliance with the limit class C2 acc. to EN 61800-3 (achieved by using collective filters typical for the application)		
Noise immunity	Requirements acc. to EN 61800-3		
	Requirement	**Standard**	**Severity**
	ESD [1]	EN 61000-4-2	3, i. e. ● 8 kV for air discharge ● 6 kV for contact discharge
	Conducted high frequency	EN 61000-4-6	10 V; 0.15 ... 80 MHz
	RF interference (housing)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (surge voltage on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase/phase ● 2 kV phase/PE
Insulation resistance	EN61800-5-1, UL840: Overvoltage category III		
Discharge current to PE (Acc. to EN 61800-5-1)	> 3.5 mA AC		
Enclosure	IP20 for ● Standard installation (built-in unit) ● Cold-plate technique ● Mounting with thermal separation (push-through technique), IP54 on heatsink side		
Protective measures against	● Short circuit in power terminals – Motor terminal has a limited protection against short circuit (after short circuit detection, the error message must be reset.) ● Short circuit in auxiliary circuits – Digital outputs: Short-circuit-proof – Bus and encoder systems: Limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:) ● Earth fault (earth-fault protected during operation, limited earth-fault protection on mains power-up) ● Overvoltage ● Motor stalling ● Motor overtemperature (input for KTY, I^2 x t monitoring)		
Protective insulation of control circuits	**Protective separation from the mains** Double/reinforced insulation acc. to EN 61800-5-1		

[1] Noise immunity in the above-mentioned severities must be guaranteed by the control cabinet! The user must check the compliance with the severities!

3.2 Rated data

Rated data		Type	Axis module					
			ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains		S_{rated} [kVA]	1.3		2.6		5.3	
Data for operation with upstream power supply module on mains voltage		V_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	2.5	2.0	4.9	3.9	9.8	7.8
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	2.0	1.6	4.0	3.2	8.0	6.4
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	1.4	1.1	2.7	2.2	5.3	4.2
Max. output current (acceleration current)		I_{max} [A]	4.0		8.0		16.0	
Continuous current at standstill (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	2.0	1.6	4.0	3.2	8.0	6.4
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	2.3		4.6		9.1	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	3.0		6.0		12.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	1.5		3.0		6.0	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	27.3		46.3		84.7	
	Inside the device		13.3		17.3		20.7	
	Heatsink		14.0		29.0		64.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4					

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Rated data		Type	Axis module					
			ECSx□032		ECSx□048		ECSx□064	
Output power 400 V mains		S_{rated} [kVA]	8.3		11.2		13.2	
Data for operation with upstream power supply module on mains voltage		U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	15.6	12.5	20.9	16.8	24.5	19.6
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	12.7	10.2	17.0	13.6	20.0	16.0
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	8.5	6.8	11.3	9.0	13.3	10.6
Max. output current (acceleration current)		I_{max} [A]	32.0		48.0		64.0	
Continuous current at standstill [2] (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	16.0	12.8	23.0	18.4	27.0	21.6
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	18.1		27.2		36.3	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	24.0		36.0		48.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	12.1		18.1		24.2	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	144.5		166.5		199.0	
	Inside the device		27.5		34.5		41.0	
	Heatsink		117.0		132.0		158.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4		approx. 3.3			

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

3.3 Current characteristics

3.3.1 Increased continuous current depending on the control factor

In the lower speed range – the motor does not need the full motor voltage – particularly the more powerful ECS axis modules can be permanently operated with increased output current (cp. continuous current $I_{0,eff}$ 📖 32).

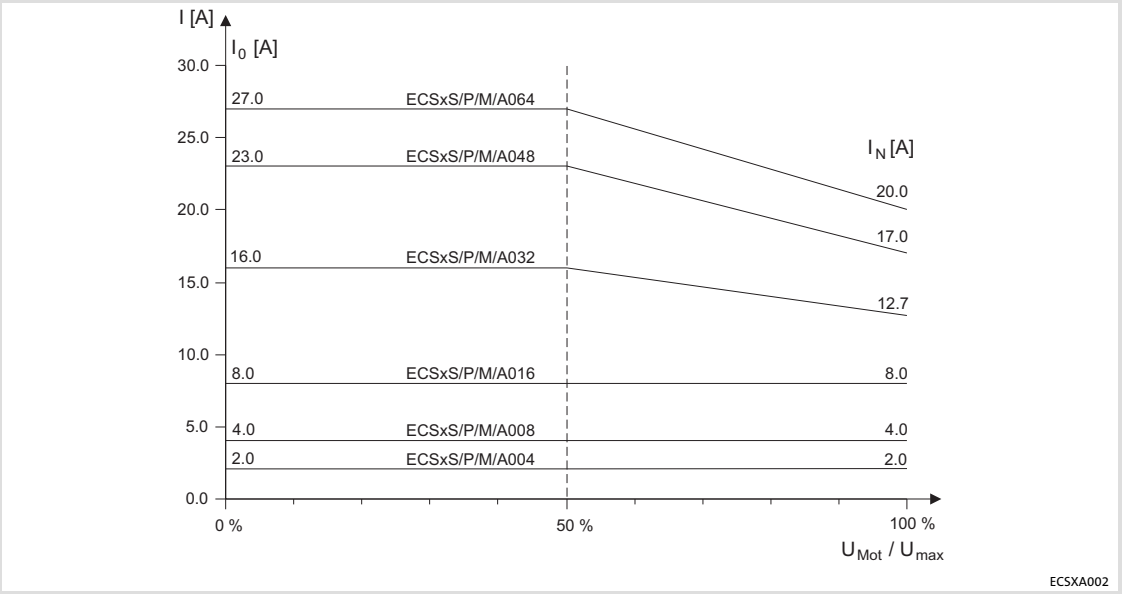


Fig. 3-1 Continuous device current, depending on the output voltage for $U_{mains} \leq 400$ V at 4 kHz

I_r	Rated output current of the axis module
U_{Mot_n}	Actual controller output voltage
U_{Mot_max}	0.9 x current mains voltage

The permissible continuous current depends on the control factor of the power output stages, approximately on the ratio of the motor voltage output in the operating point (U_{Mot_n}) to the maximum possible output voltage (U_{Mot_max}). Due to voltage drops across the components involved at rated load and a control margin, U_{Mot_max} can be estimated with 90 % of the mains voltage.

Tip!

The operating threshold of the device utilisation monitoring (I x t) function is automatically adapted to the continuous device current which changes depending on the output voltage (see fig.).

The following table shows the connections between mains voltage, DC-bus voltage and motor voltage:

Mains voltage [U_{mains}]	DC-bus voltage [$U_{DC} = U_{mains} \times 1.35$]	Output voltage (motor voltage) nominally achievable for 100 % modulation [$U_{mot} = 0.66 \times U_{DC}$]
3 x 230 V AC	310 V DC	3 x 205 V AC
3 x 380 V AC	510 V DC	3 x 340 V AC
3 x 400 V AC	540 V DC	3 x 360 V AC
3 x 415 V AC	560 V DC	3 x 370 V AC
3 x 460 V AC	620 V DC	3 x 415 V AC
3 x 480 V AC	650 V DC	3 x 435 V AC
3 x 528 V AC	712 V DC	3 x 475 V AC

For steady-state operation in generator mode with increased DC-bus voltage or supply from a closed-loop DC-voltage source, interpolate accordingly between the values given in the table.

The increased rated currents are valid for the entire voltage range specified at switching frequencies of 4 kHz and 8 kHz.

Note!

If in this connection a heatsink temperature of > 70 °C is reached, the drive switches to a switching frequency of 4 kHz, independently of the selected switching frequency.

Example:

The ECS axis module suitable for operation in conjunction with a Lenze motor of type MCS 14L32 is to be determined.

- Rated motor data
  - Rated motor torque (M_{mot}) = 17.2 Nm
  - Rated motor speed (n_{mot}) = 3225 rpm
  - Motor voltage at 3250 rpm (U_{mot_n3250}) = 275 V
  - Rated motor current (I_{mot}) = 15 A
  - Max. motor current (I_{mot_max}) = 92 A
- Application data:
  - Max. torque (M_{max}) = 35 Nm
  - Max. operating speed (n_{max}) = 2500 rpm
  - An effective process power (P_{eff}) of 4.5 kW arises on the basis of the Mn diagram.
  - The drive rating results in an effective motor current (I_{Mot_eff}) of 14.8 A.

A first estimation based on the rated current of the ECS axis module would probably lead to selecting the ECSxM048 module with a rated current of 17.0 A.

However, if we take into account the increased continuous current for smaller control factors, the more cost-effective ECSxM032 axis module with a rated current of 12.7 A can be used here.

- When the MCS 14L32 is operated with 2500 rpm, the real motor voltage is (U_{Mot_n2500}):

$$U_{Mot\_n2500} = U_{Mot\_n3250} \cdot \frac{n_{max}}{n_{Mot}} \quad \Rightarrow \quad 275\ V \cdot \frac{2500\ rpm}{3250\ rpm} = 212\ V$$

- This leads to the following max. control factor (α_{max}) of the axis module:

$$\alpha_{max} = \frac{U_{Mot\_n2500}}{U_{max}} \quad \Rightarrow \quad \frac{212\ V}{360\ V} = 0.59 = 59\ \%$$

  Using the current characteristic of Fig. 3-1 (📖 34), a continuous current of 15.5 A can be determined for the ECSxM032 axis module when the control factor (α_{max}) is 59 %.

- **Result:**

  Under the conditions mentioned above the MCS 14L32 Lenze motor can be operated continuously on the ECSxM032 axis module.

3.3.2 Device protection by current derating

The maximum output current is limited. With output frequencies < 5 Hz the limitation depends on the heatsink temperature.

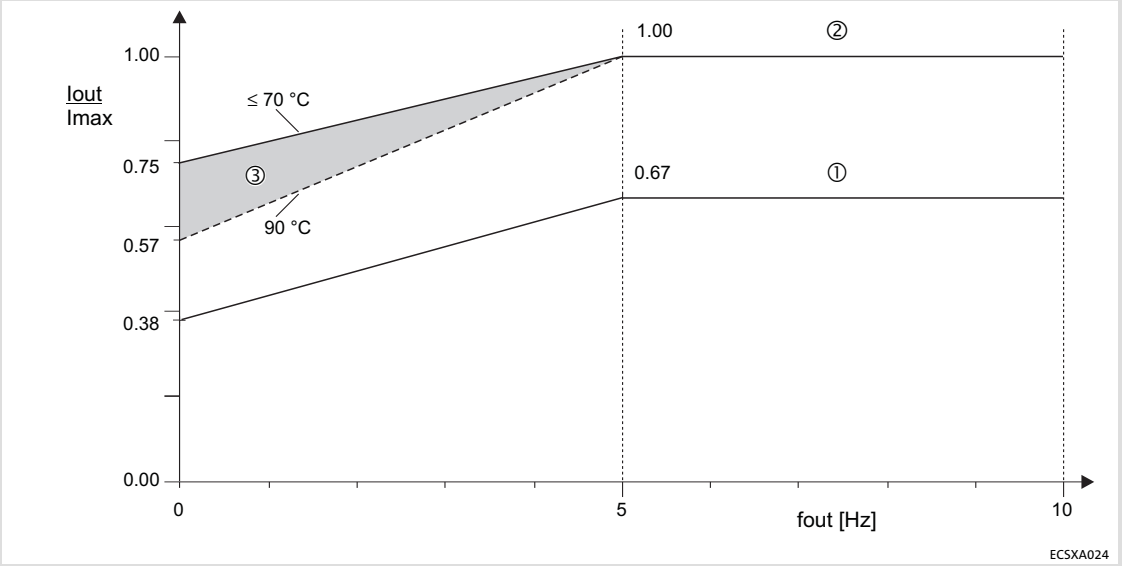


Fig. 3-2 Current derating characteristics

① Operation with switching frequency = 8 kHz (C0018 = 1).
- If the current exceeds the characteristic ①, the switching frequency is automatically changed to 4 kHz (e.g. for higher torque in acceleration processes).

② Operation with switching frequency = 4 kHz (C0018 = 0).
- The current limitation follows the characteristic ②.
- With output frequencies < 5 Hz and heatsink temperatures between 70 and 90 °C the current limit is steplessly adjusted in the range ③.

Type	I_{max} [A]				
	Switching frequency 8 kHz ①		Switching frequency 4 kHz ②		
	f_{out} > 5 Hz	f_{out} → 0 Hz	f_{out} > 5 Hz	f_{out} → 0 Hz ≤ 70 °C	f_{out} → 0 Hz 90 °C
ECSxM004	2.7	1.5	4.0	3.0	2.3
ECSxM008	5.3	3.0	8.0	6.0	4.6
ECSxM016	10.7	6.0	16.0	12.0	9.1
ECSxM032	21.3	12.1	32.0	24.0	18.1
ECSxM048	32.0	18.1	48.0	36.3	27.2
ECSxM064	42.7	24.2	64.0	48.0	36.3

4 Mechanical installation

4.1 Important notes

- Axis modules of the ECS series provide IP20 enclosure and can therefore only be used for installation in control cabinets.
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions:
  - Vertical at the mounting plate
  - DC bus connections (X23) at the top
  - Motor connection (X24) at the bottom
- Maintain the specified clearances (above and below) to other installations!
  - If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  - must be electrically conductive.
  - must not be varnished.
- In case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

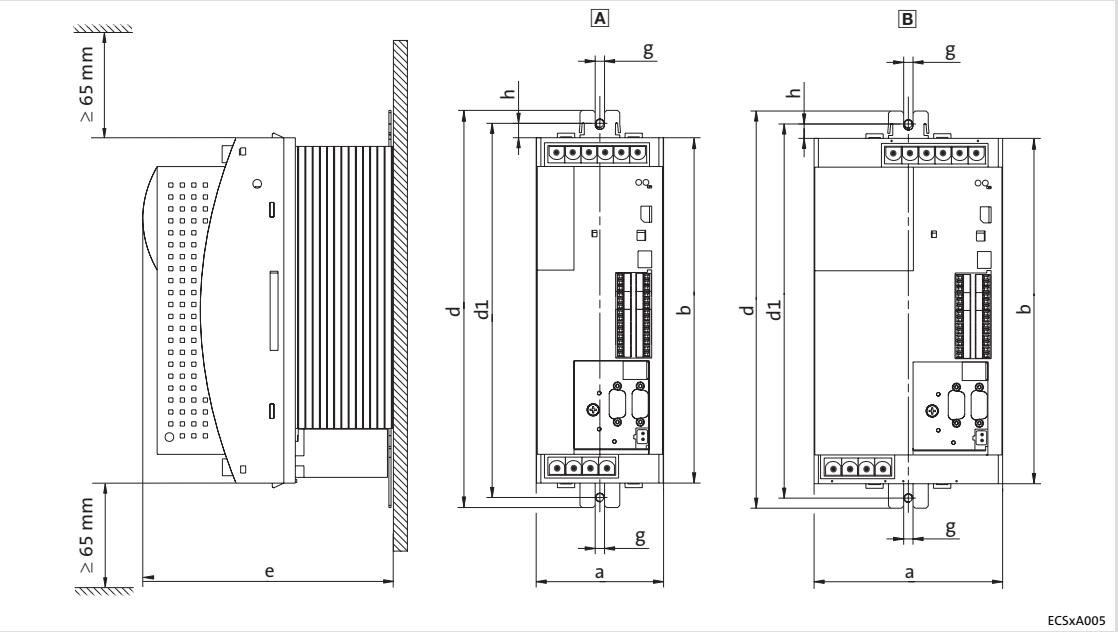


Fig. 4-1 Dimensions for ”panel-mounted” design

Axis module		Dimensions [mm]						
Type	**Size**	**a**	**b**	**d**	**d1**	**e**	**h**	**g**
ECSE☐004	A	88,5	240	276	260	176 212 1)	10	6,5 (M6)
ECSE☐008								
ECSE☐016								
ECSE☐032								
ECSE☐048	B	131						
ECSE☐064								

1) Max. 212 mm, depending on the plugged-on communication module

☐ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.2.2 Mounting steps

How to install the axis module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: Push in the long side.
   – From below: Push in the short side.
4. Attach the axis module to the mounting surface.

4.3 Mounting with thermal separation (push-through technique)

For the push-through technique the rear panel of the control cabinet must be a steel plate with a thickness of at least 2 mm.

The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the axis module).

Cooling

With the separated heatsink the heat generation in the control cabinet can be reduced.

- Distribution of the power loss:
  - approx. 65 % via separated cooler
  - approx. 35 % in the inside of the axis module
- Protection class of the separated cooler: IP54
  - The sealing surface at the heatsink of the axis module must rest completely against the mounting plate.
  - Use a liquid thread sealant to bond the screws of the clamps.
- For sufficient cooling of the drive system:
  - Air flow behind the rear panel of the control cabinet must be $\geq$ 3 m/s (e.g. by means of a collective fan).
- With sufficient cooling, the rated data of the axis modules remain valid.

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

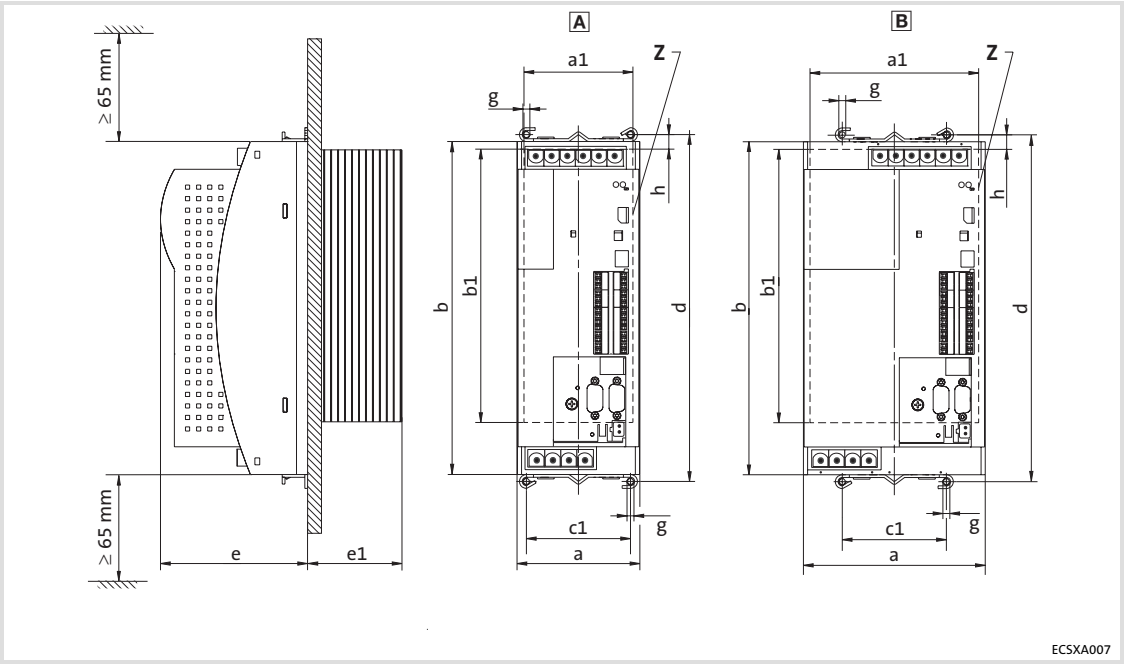


Fig. 4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 📖 43

Axis module		Dimensions [mm]									
Type	Size	a	a1	b	b1	c1	d	e	e1	g	h
ECSD□004	A	88,5	78,5	240	197	75	250	109 145 [1]	67	M5	10,5
ECSD□008											
ECSD□016											
ECSD□032											
ECSD□048	B	131	121,5								
ECSD□064											

1) Max. 145 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Dimensions of mounting cutout

Note!

Installation with shield mounting ECSZS000X0B:

► Clearance below the mounting cutout > 220 mm

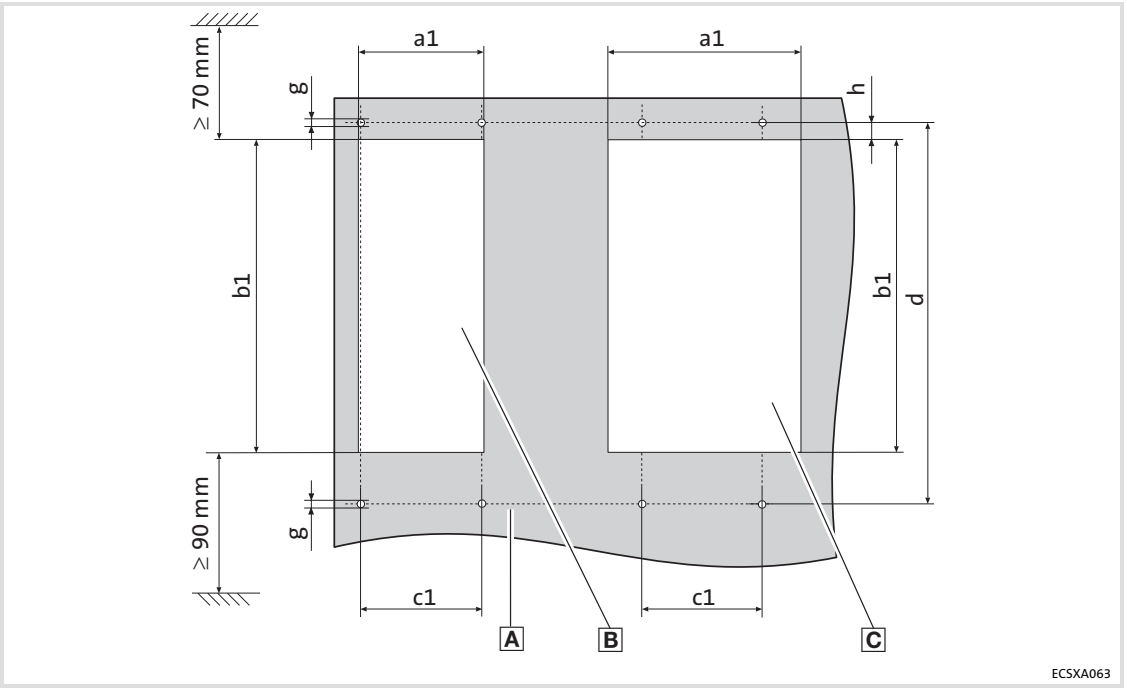


Fig. 4-3 Dimensions of mounting cutout

A Mounting surface
B Mounting cutout for size A
C Mounting cutout for size B

Axis module		Dimensions [mm]					
Type	Size	a1	b1	c1	d	g	h
ECSD□004	A	78,5	197	75	250	M5	10,5
ECSD□008							
ECSD□016							
ECSD□032							
ECSD□048	B	121,5					
ECSD□064							

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.3.2 Mounting steps

How to mount the axis module:

1. Prepare the fixing holes for the wire clamps on the mounting area.
   For this purpose, apply a drilling jig.
2. Prepare the mounting cutout.
   The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the axis module).
3. Apply liquid thread sealant to the threads of the screws for the wire clamps.
4. Fix the wire clamps together with the functional earth conductor supplied (Fig. 4-4).
   The functional earth conductor is part of the scope of supply of the ECS**D**x... axis module
5. Push the axis module into the mounting cutout.
6. Engage axis module in the wire clamp at the top and the bottom.
7. Connect the functional earth conductor to the axis module (Fig. 4-4).

Note!

Fixing the functional earth conductor to the ECS**D**x... axis module is required for a better electromagnetic compatibility (EMC).

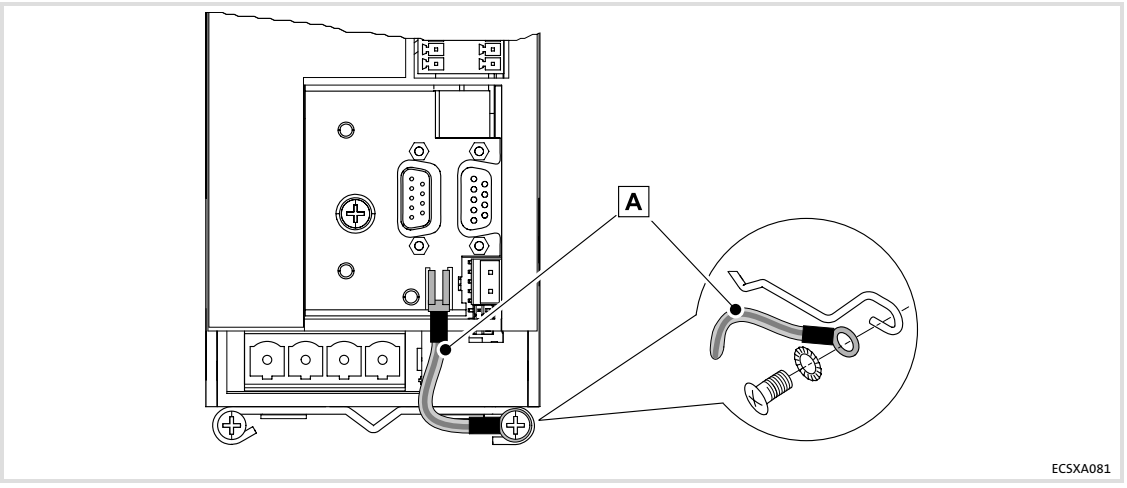


Fig. 4-4 Functional earth conductor at the ECSDx... axis module

A Functional earth conductor

4.4 Mounting in cold-plate design

The axis modules ECSC... are intended for mounting in cold-plate design (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure a safe operation of the axis modules:

- Good thermal contact with the cooler
  - The contact surface between collective cooler and axis module must be at least as large as the cooling plate of the axis module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Connect the collective cooler with all specified screwed connections to the axis module.
- Maintain the thermal resistance R_{th} according to the table.
  - The values apply for operating the axis modules under rated conditions.

Axis module Type	Power to be dissipated Ploss [W]	Heat sink - environment R_{th} [k/W]
ECSC□004	14.0	0,31
ECSC□008	29.0	
ECSC□016	64.0	
ECSC□032	117.0	0,13
ECSC□048	132.0	
ECSC□064	158.0	0,11

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

- Ambient conditions:
  - Furthermore the rated data regarding the ambient temperature and the derating factors at increased temperature apply to the axis modules (📖 30 et seqq.).
  - Temperature of the cooling plate (”Cold Plate”): max. +85 °C

4.4.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

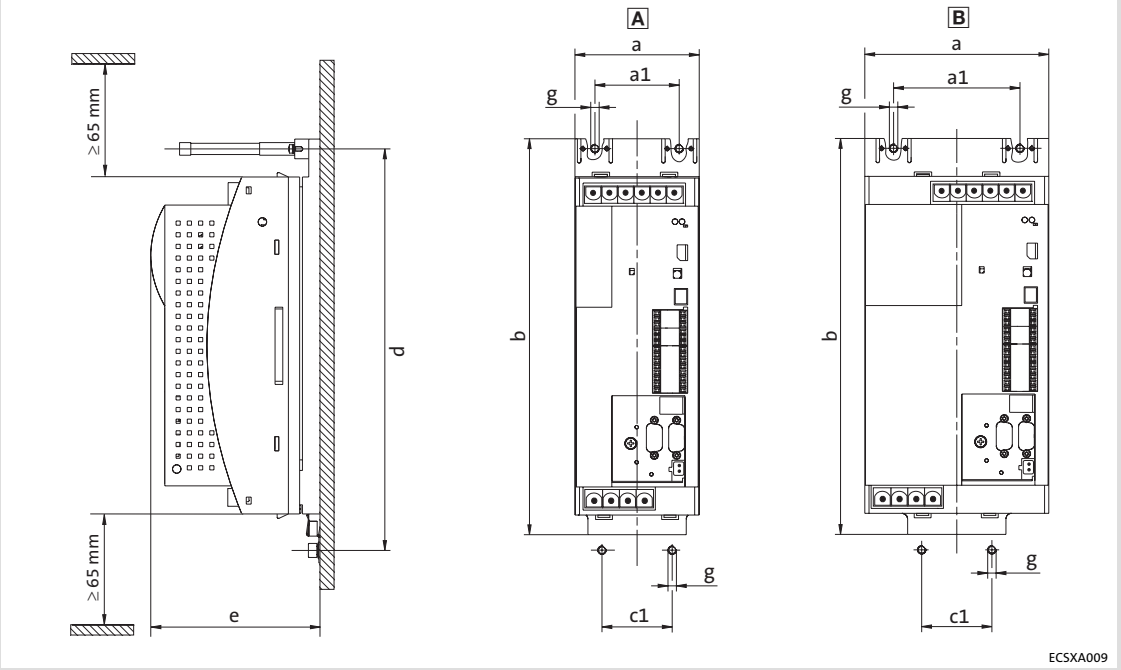


Fig. 4-5 Dimensions for "cold-plate design"

Axis module		Dimensions [mm]						
Type	Size	a	a1	b	c1	d	e	g
ECSC□004	A	88,5	60	282	50	287	121 157 1)	M6
ECSC□008								
ECSC□016								
ECSC□032								
ECSC□048	B	131	90					
ECSC□064								

1) Max. 157 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.4.2 Mounting steps

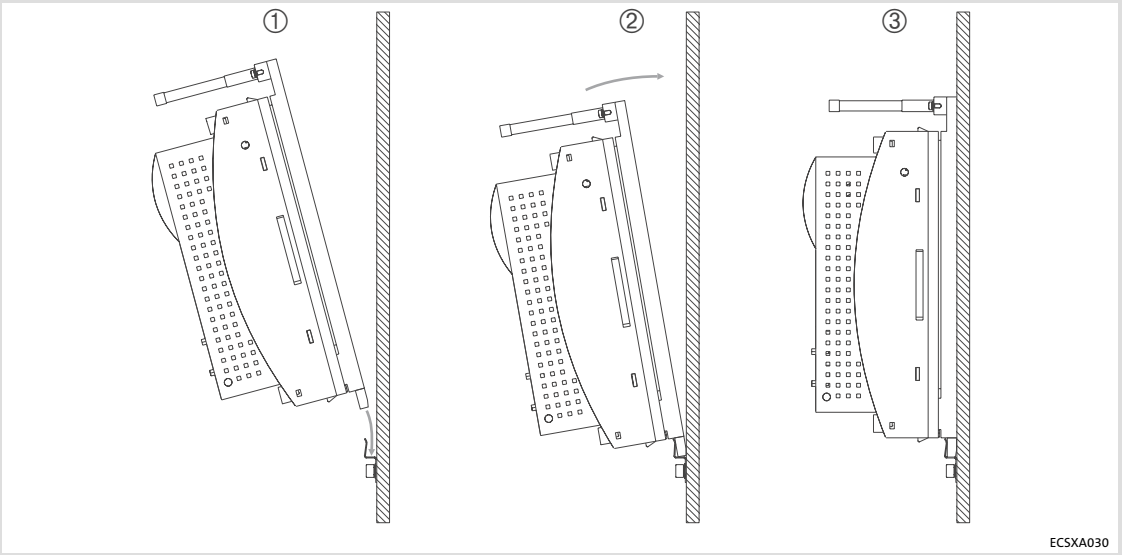


Fig. 4-6 Mounting for "cold-plate design"

Proceed as follows to mount the axis module:

1. Prepare the fixing holes on the mounting plate.
   – Use a drilling jig for this purpose.
2. Clean and degrease the contact area of collective cooler and heatsink of the axis module (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Insert the axis module from above ① into the support ② and fasten the two stud bolts with 3.5 ... 4.5 Nm ③.

Note!

Penetration depth of the screws into the collective cooler: approx. 15 mm!

Tip!

The heat transfer resistance is reduced if - following step 2. -
► a thin layer of heat conducting paste is applied to the contact surface or
► heat conducting foil is used.

5 Electrical installation

5.1 Installation according to EMC (installation of a CE-typical drive system)

General information

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Assembly
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the evaluation of the conformity to the EMC Directive requires a check of the machine or system regarding the EMC limit values. This for instance applies to:
  - Use of unshielded cables
  - Use of collective interference filters instead of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the ECS modules, these devices may be electromagnetically affected by the ECS modules.

Assembly

- Connect the ECS modules, RFI filters, and mains choke to the earthed mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow for permanent contact.
  - Painted plates are not suitable for an EMC-compliant installation.
- If you use the ECSxK... capacitor module:
  - Install the capacitor module between the power supply module and the axis module(s).
  - If the total cable length in the DC-bus connection is > 5 m, install the capacitor module as close as possible to the axis module with the greatest power.
- If you use several mounting plates:
  - Connect as much surface of the mounting plates as possible (e.g. with copper bands).
- Ensure the separation of the motor cable and the signal or mains cables.
- Avoid a common terminal/power strip for the mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filters

Only use RFI filters and mains chokes which are assigned to the power supply modules:

- RFI filters reduce impermissible high-frequency interferences to a permissible value.
- Mains chokes reduce low-frequency interferences which in particular depend on the motor cables and their lengths.

Shielding

- Connect the motor cable shield to the axis module
  - with the ECSZS000X0B shield mounting kit.
  - extensively to the mounting plate below the axis module.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor protection switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to each other and connect them to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing extensively to PE:
  - Metal glands at the motor terminal box ensure an extensive connection of the shield and the motor housing.
- Shield UG cables and control cables from a length of 0.3 m:
  - Connect both shields of the digital control cables.
  - Connect one shield end of the analog control cables.
  - Always connect the shields to the shield connection at the axis module over the shortest possible distance.
- Use of the ECS modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥10 dB . This can be achieved by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (e.g. ECS modules, RFI filters, motor filters, mains chokes) using suitable cables connected to a central earthing point (PE rail).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Power terminals

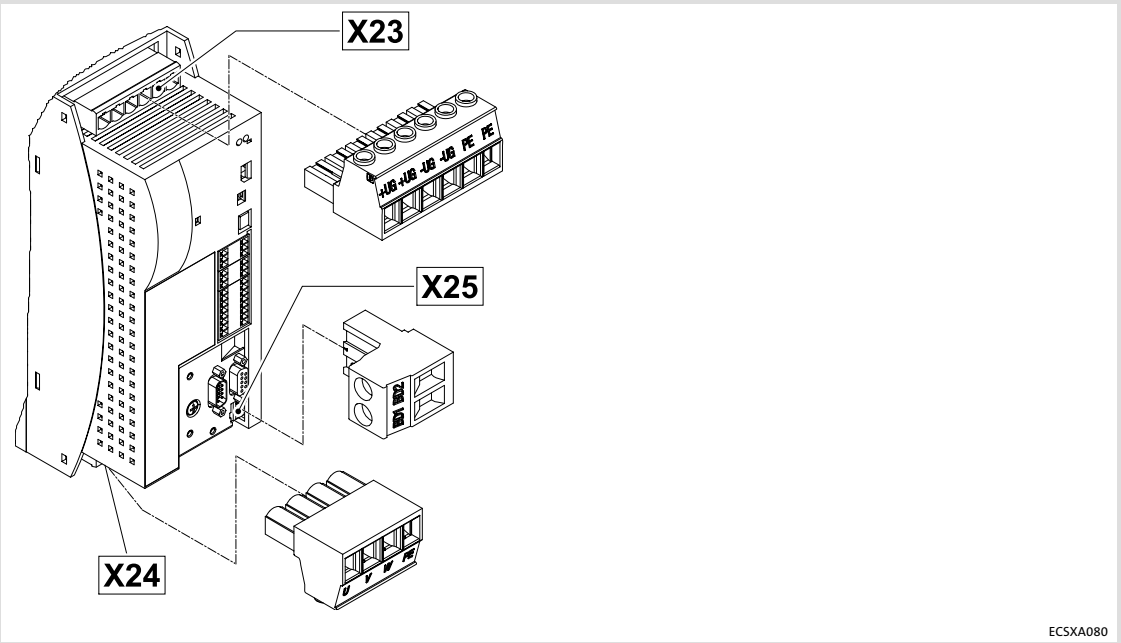


Fig. 5-1 Plug connectors for power terminals

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

- ► All power connections are plug connections and coded. The ECSZA000X0B plug connector set must be ordered separately.
- ► Installation of the cables to EN 60204-1.
- ► The cables used must comply with the approvals required at the site of use (e.g. VDE, UL, etc.).

Note!

ECSDM... axis modules:

For a better electromagnetic compatibility (EMC), connect the functional earth conductor to the ECS**D**M... axis module (📖 44).

This is not required for the ECS**E**M... (standard installation) and ECS**C**M... (cold plate) axis modules!

Assignment of the plug connectors

Plug connector/terminal	Function	Electrical data
X23	**DC-bus voltage connection**	
X23/+UG	Positive DC-bus voltage	Dependent on application and type 0 ... 770 V 2 ... 24.5 A (📖 32)
X23/+UG		
X23/-UG	Negative DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		
X24	**Motor connection**	
X24/U	Motor phase U	Dependent on application and type 0 ... 480 V 1.6 ... 20 A (📖 32)
X24/V	Motor phase V	
X24/W	Motor phase W	
X24/PE	Earth connection	
X25	**Motor holding brake connection**	
X25/BD1	Brake connection +	23 ... 30 V DC, max. 1.5 A
X25/BD2	Brake connection -	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Plug connectors X23 and X24				
Rigid	–	0.2 ... 10 mm² (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connections 10 mm for spring connections
Flexible	Without wire end ferrule	0.2 ... 10 mm² (AWG 24 ... 8)		
	Insulated with wire end ferrule	0.25 ... 6 mm² (AWG 22 ... 10)		
	Insulated with wire end ferrule	0.25 ... 4 mm² (AWG 22 ... 12)		
Plug connector X25				
Flexible	Insulated with wire end ferrule	0.25 ... 2.5 mm² (AWG 22 ... 12)	0.5 ... 0.8 Nm (4.4 ... 7.1 lb-in)	5 mm for screw connections 10 mm for spring connections
	Without wire end ferrule	0.2 ... 2.5 mm² (AWG 24 ... 12)		

Shielded cables

The following factors decisively determine the effect of the shielded cables:

- Good shield connection
  - Ensure a contact surface as large as possible
- Low shield resistance
  - Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- High overlap rate of the braid
  - At least 70 ... 80 % with 90° overlap angle

The ECSZS000X0B shield mounting kit includes a wire clamp and shield sheet.

5.2.1 Connection to the DC bus (+U_G, -U_G)

Stop!

No device protection for DC bus voltage surges

In passive axis modules (without 24 V-supply), the charging circuit can be overloaded through DC bus voltage surges.

Possible consequences:

► Destruction of the device

Protective measures:

► All axis modules in the DC-bus connection should be basically supplied with a control voltage of 24 V.

► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.

► Design the ±U_G cables twisted and as short as possible. Ensure short-circuit-proof routing!

► Cable length (module ↔ module) > 30 cm: install shielded ±U_G cables.

Cable cross-section

Cable length (module/ module)	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm² (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
	With insulated wire end ferrule			
> 20 m	Without wire end ferrule	10 mm² (AWG 8)		
	With insulated wire end ferrule **Use pin-end connectors for wiring!**			

Fuses

- ► Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- ► When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- ► When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- ► Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

Replacing defective fuses

Danger!

Hazardous electrical voltage

Components can carry hazardous voltages up to 3 minutes after power-off.

Possible consequences:

- ► Death or severe injuries when touching the device.

Protective measures:

- ► Replace fuses in the deenergised state only.
  - – Set controller inhibit (CINH) for all axis modules in DC-bus operation and disconnect all power supply modules from the mains.

5.2.2 Connection plan for mimimum wiring with internal brake resistor



Documentation of the ECSxE power supply module

Observe the enclosed notes.



Stop!

Always operate the ECS power supply modules with a brake resistor (internal/external).

The ECS power supply modules in the standard built-in unit and push-through design (ECSEE / ECSDE) are provided with a device-internal brake resistor.

In order to use the internal brake resistor (Rb), carry out the following wiring:

- Bridge between the terminals X22/+UG and X22/BR0 (CR)
  Current flow from +UG via the internal brake resistor (Rb) and the brake transistor to -UG.
- Bridge between the terminals X6/T1 and X6/T2 (CR)
  Deactivate the temperature monitoring of the non-existing external brake resistor.

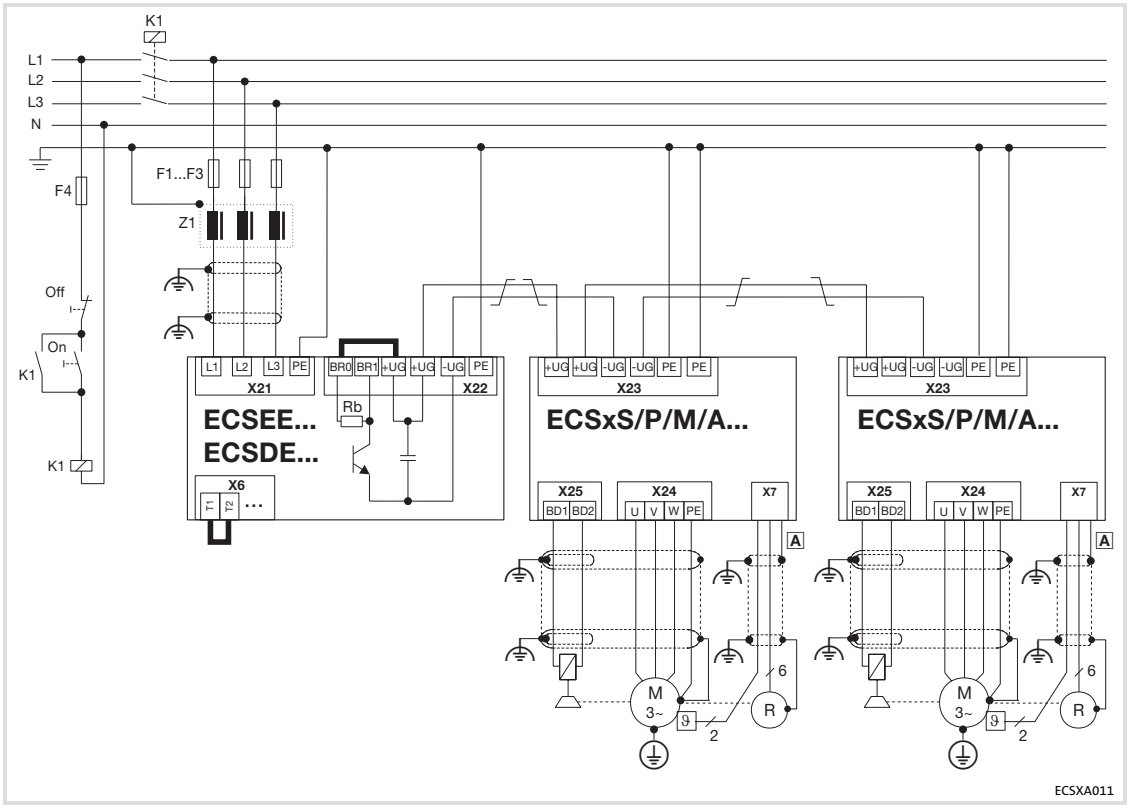


Fig. 5-2 Interconnected power system with internal brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb Internal brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.3 Connection plan for mimimum wiring with external brake resistor

Documentation of the ECSxE power supply module
Observe the enclosed notes.

Stop!

- ► Always operate the ECS power supply modules with a brake resistor.
- ► A parallel wiring of internal and external brake resistor is not permissible!
- ► Implement the thermal contact of the brake resistor into the system monitoring so that the mains supply of the power supply module will be switched off in case the brake resistor will be overheated.
- ► Read the documentation for the external brake resistor. Observe the safety instructions contained therein.

If the power supply module needs a high amount of braking power when it comes as standard built-in unit or in push-through technique design (**ECSEE / ECSDE**), an external and more powerful brake resistor can be connected instead of the internal brake resistor.

A power supply module in cold plate technique design (**ECSCE**) is not provided with an internal brake resistor so that this version always requires an external brake resistor (Rbext).

- ► Connect the brake resistor to X22/BR1 and X22/+UG.
- ► Connect the thermal contact (NC contact) of the external brake resistor to X6/T1 and X6/T2.

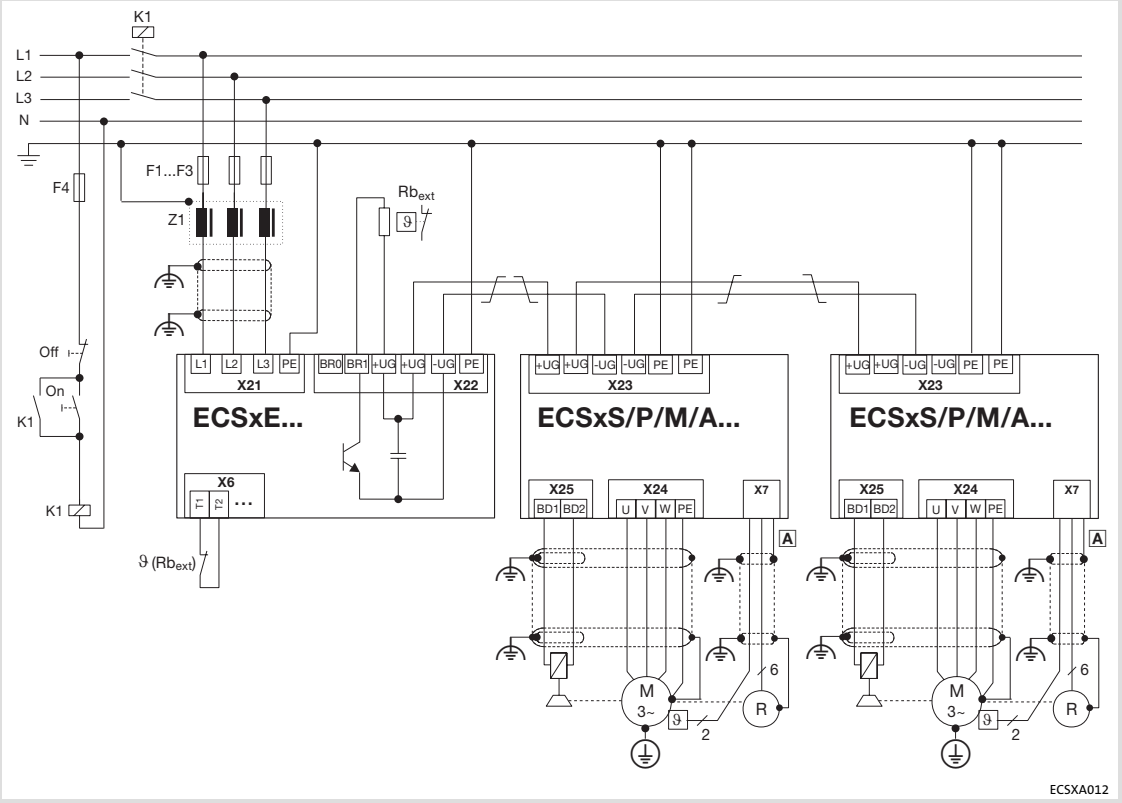


Fig. 5-3 Interconnected power system with external brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb_{ext} External brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.4 Motor connection



Fig. 5-4 Motor and motor holding brake connection

Motor cables

- Use low-capacitance motor cables. Capacitance per unit length:
  – Core/core: max. 75 pF/m
  – Core/shield: max. 150 pF/m
- Length: max. 50 m, shielded
- The cross-section of the motor cables are selected according to the motor standstill current (I_0) when using synchronous motors or according to the rated motor current (I_N) for asynchronous motors.
- Length of the unshielded ends: 40 ... 100 mm (depending on the cable cross-section)
- Lenze system cables meet these requirements.
- Use the ECSZS000X0B shield mounting kit for EMC-compliant wiring.

Mounting instructions for ECSZS000X0B shield mounting
Here you can find more information on wiring according to EMC.

5.2.5 Motor holding brake connection

The motor holding brake

- is connected to X25/BD1 and X25/BD2.
- is supplied with low voltage via the terminals X6/B+ and X6/B-:
  +23 ... +30 V DC, max.1.5 A

Stop!

- Protect X6/B+ with an F 1.6 A fuse.
- If no suitable voltage (incorrect amount, incorrect polarity) is connected to the brake, it is applied and can overheat or be destroyed by the continuously running motor.

5.2.5.1 Spark suppressor

The axis module comes with an integrated spark suppressor for protecting the contacts of the integrated brake relay when the motor holding brake (inductive load) is switched.

5.2.5.2 Monitoring the brake connection

The connection of the motor holding brake can be monitored for voltage failure and cable breakage if monitoring is activated under C0602.

The monitoring system of the brake connection trips under the following conditions:

Case 1, motor holding brake released (brake relay contact is closed):

- Current via holding brake (I_B) < 140 mA +/-10 % **or**
- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

Case 2, motor holding brake closed (brake relay contact is open):

- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

5.2.5.3 Requirements on the brake cables

- Use a Lenze system cable with integrated brake cable.
  – The shielding of the brake cable must be separated.
- Length: max. 50 m
- If a separately installed brake cable is required, lay it in a shielded manner.

Note!

Due to the monitoring circuit of the brake connection, an additional constant voltage drop of 1.5 V is produced. The voltage drop can be compensated by a higher voltage at the cable entry.

The voltage required at X6/B+ and X6/B- for the Lenze system cables is calculated as follows:

$$U_K\,[V] = U_B\,[V] + 0.08\left[\frac{V}{m \cdot A}\right] \cdot L_L\,[m] \cdot I_B\,[A] + 1.5\,[V]$$

V_{comp}	Voltage required at 6X/B+ and X6/B- [V]
V_B	Rated operating voltage of the brake [V]
L_L	Length of the brake cable [m]
I_B	Brake current [A]

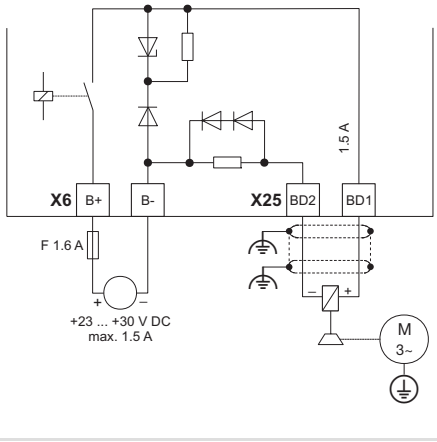


Fig. 5-5 Connection of the motor holding brake to X25

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

5.2.6 Connection of an ECSxK... capacitor module (optional)

The ECS capacitor modules support the DC-bus voltage for the drive system. These capacitor module types are available:

- ECSxK001 (705 µF, ±20 %)
- ECSxK002 (1410 µF, ±20 %)

x Design/mounting technique: E = standard installation
C = Cold-plate technique
D = push-through technique

Documentation of the ECSxK capacitor module
Observe the enclosed notes.

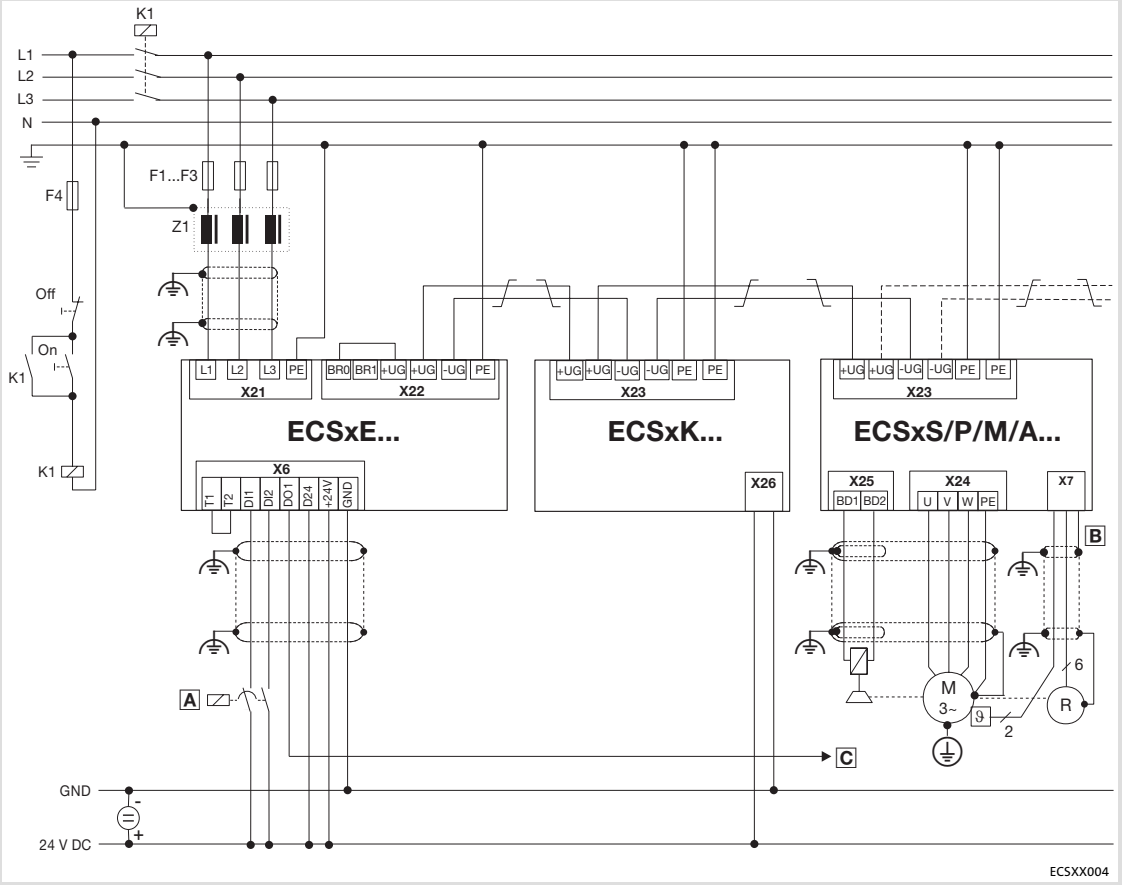


Fig. 5-6 Wiring of capacitor module ECSxK...

- HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- A Contactor relay
- B System cable – feedback
- C Terminal X6/SI1 of the connected axis modules (controller enable/inhibit)

5.3 Control terminals

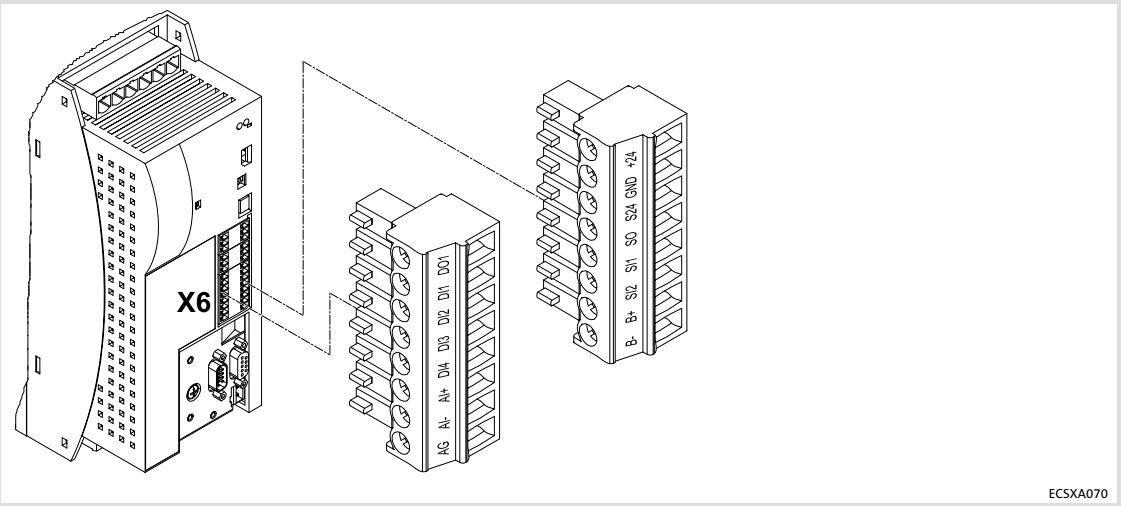


Fig. 5-7 Plug connectors for control terminals (X6)

For the supply of the control electronics an external 24 V DC voltage at terminals X6/+24 and X6/GND is required.

Stop!

- The control cables must always be shielded to prevent interference injections.
- The voltage difference between X6/AG, X6/GND and PE of the axis module may maximally amount to 50 V.
- The voltage difference can be limited by:
  – overvoltage-limiting components or
  – direct connection of X6/AG and X6/GND to PE.
- The wiring has to ensure that for X6/DO1 = 0 (LOW level) the connected axis modules do not draw energy from the DC bus. Otherwise, the power supply module may be damaged.

Shield connection of control cables and signal cables

The plate on the front of the device serves as the mounting place (two threaded holes M4) for the shield connection of the signal cables. The screws used may extend into the inside of the device by up to 10 mm. For optimum contact of the shield connection, use the wire clamps from the ECSZS000X0B shield mounting kit.

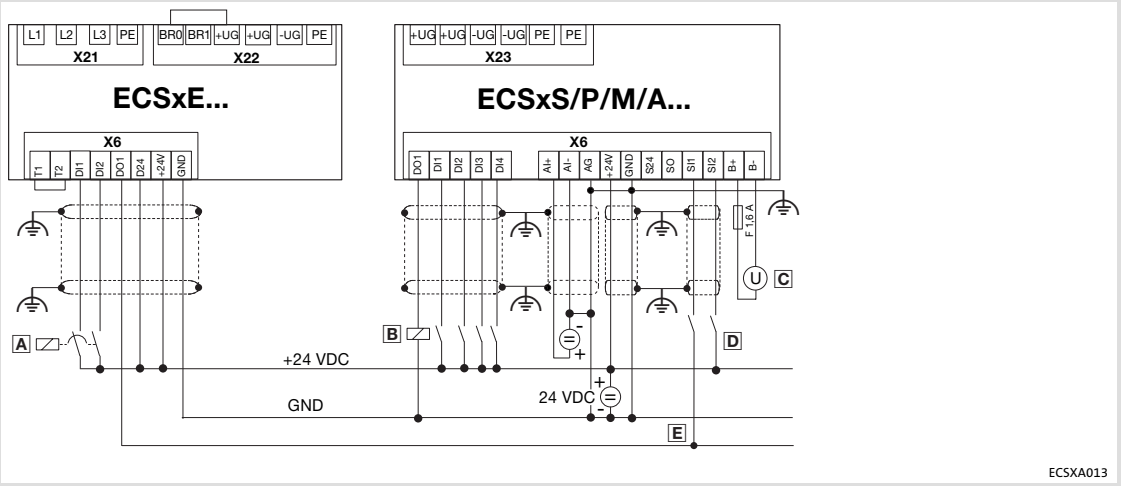


Fig. 5-8 Interconnection: Control signals with internal brake resistor

- ⏚ HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- A / B Contactor relay
- C Voltage supply of motor holding brake 23 ... 30 V DC, max. 1.5 A
- D Safe torque off (formerly: ”Safe standstill”)
- E Controller enable/inhibit

Switch-on sequence for the auxiliary relay



Stop!

Overload of the charging connection in the power supply module

The controller enable for the axes may only take place when the charging process of the DC bus is completed and the power supply module is ready for operation.

Possible consequences:

► Destruction of the power supply module

Protective measures:

► Use of switching the central controller enable for the axes via the inputs and outputs DI2 and DO1 of the power supply module (see the following descriptions).

The switch-on sequence of the auxiliary relay A (see Fig. 5-8) is as follows:

1. The digital input X6/DI1 (power supply enable) of the power supply module is switched to HIGH by the higher-level control or by the operator.
   – The DC bus is charged.
2. The ready for operation output of the axis module (DO1) now switches the X6/DI2 digital input (central controller enable) of the power supply module via the relay A.
   – In the default Lenze setting of the ECS axis modules, DO1 is set to ”ready”. ”Ready” is only present if a specified DC-bus voltage has been reached.
3. The central controller enable for the axis module takes place via the X6/DO1 output of the power supply module. The central controller enable DO1 only switches if the charging process of the DC bus is completed AND the X6/DI2 input is set.

Assignment of the plug connectors

Plug connector X6		
Terminal	**Function**	**Electrical data**
X6/+24	Low-voltage supply of the control electronics	20 ... 30 V DC, 0. A (max. 1 A) for starting current of 24 V: max. 2 A for 50 ms
X6/GND	Reference potential of low-voltage supply	
X6/DO1	Digital output 1	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
X6/DI1	Digital input 1	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
X6/DI2	Digital input 2	
X6/DI3	Digital input 3	
X6/DI4	Digital input 4	
X6/AI+	Analog input +	Adjustable with jumper strip X3: -10 ... +10 V, max. 2 mA -20 ... +20 mA Resolution: 11 bits + sign
X6/AI-	Analog input -	
X6/AG	Reference potential of analog input (internal ground)	
X6/B+	Brake supply +	23 ... 30 V DC max. 1.5 A **Set brake voltage so that the permissible voltage at the brake is not under-run or exceeded – otherwise malfunction or destruction!**
X6/B-	Brake supply -	
X6/S24	Connection of "safe torque off" (formerly "safe standstill")	📖 70
X6/SO		
X6/SI1		
X6/SI2		

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	Without wire end ferrule	0.08 ... 1.5 mm² (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connection 9 mm for spring connection
	With insulated wire end ferrule	0.25 ... 0.5 mm² (AWG 22 ... 20)		

We recommend to use control cables with a cable cross-section of 0.25 mm².

5.3.1 Digital inputs and outputs

Stop!

If an inductive load is connected to X6/DO1, a spark suppressor with a limiting function to max. 50 V ± 0 % must be provided.

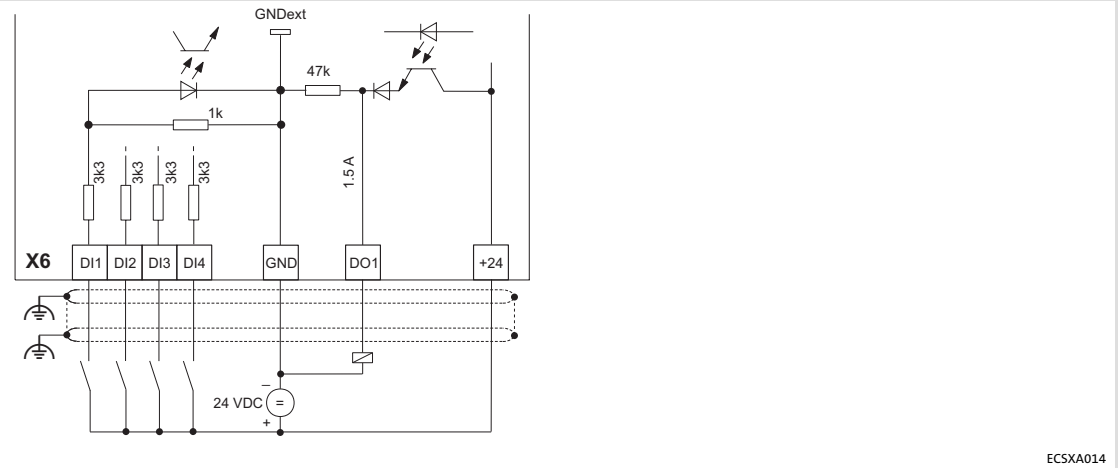


Fig. 5-9 Digital inputs and outputs at X6

HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

- The digital inputs X6/DI1 ... DI4 are freely assignable.
- The polarity of the digital inputs X6/DI1 ... DI4 is set under C0114/x.
- The polarity of the digital output (X6/DO1) is set under C0118/1.

5.3.2 Analog input

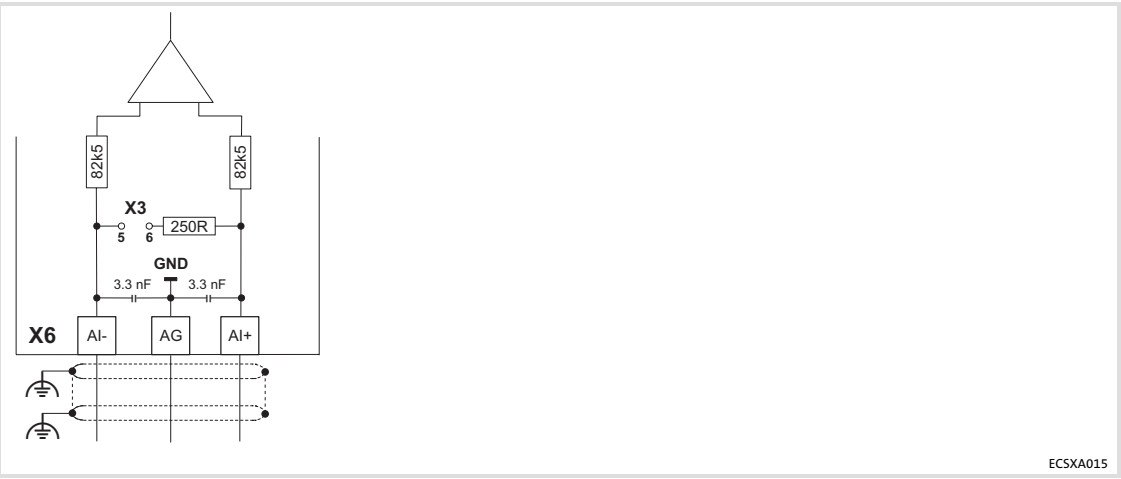


Fig. 5-10 Analog input at X6

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Analog input configuration

► Use C0034 to set whether the input is to be used for a master voltage (±10 V) or a master current (+4 ... 20 mA or ±20 mA).

► Set jumper bar X3 according to the setting in C0034:

Stop!

Do not plug the jumper on the pins 3-4! The axis module cannot be initialised like this.

Jumper bar X3	Setting	Measuring range
5 6 3 4 1 2	5-6 open Jumper on 1-2: Parking position	**C0034 = 0 (master voltage)** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡ ±16384 ≡ ±100 %
5 6 3 4 1 2	5-6 closed	**C0034 = 1 (master current)** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: +4 mA ≡ 0 ≡ 0 % +20 mA ≡ 16384 ≡ 100 %
		C0034 = 2 (master current) ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡ ±16384 ≡ ±100 %

5.3.3 Safe torque off

The axis modules support the ”safe torque off” safety function (formerly ”safe standstill”), ”protection against unexpected start-up”, in accordance with the requirements of EN ISO 13849-1, Performance Level Pld. For this purpose, the axis modules are equipped with two independent safety paths. The Performance Level Pld is obtained if the output signal is additionally checked with regard to correctness at X6/SO.

5.3.3.1 Implementation

In the axis module, the ”safe torque off” connection is implemented with optocouplers. The optocouplers isolate the following areas electrically from each other:

- The digital inputs and outputs:
  - input X6/SI1 (controller enable/inhibit)
  - input X6/SI2 (pulse enable/inhibit)
  - brake output X6/B+, B-
  - output X6/SO (”safe torque off” active/inactive)
- The circuit for the internal control
- The final power stage

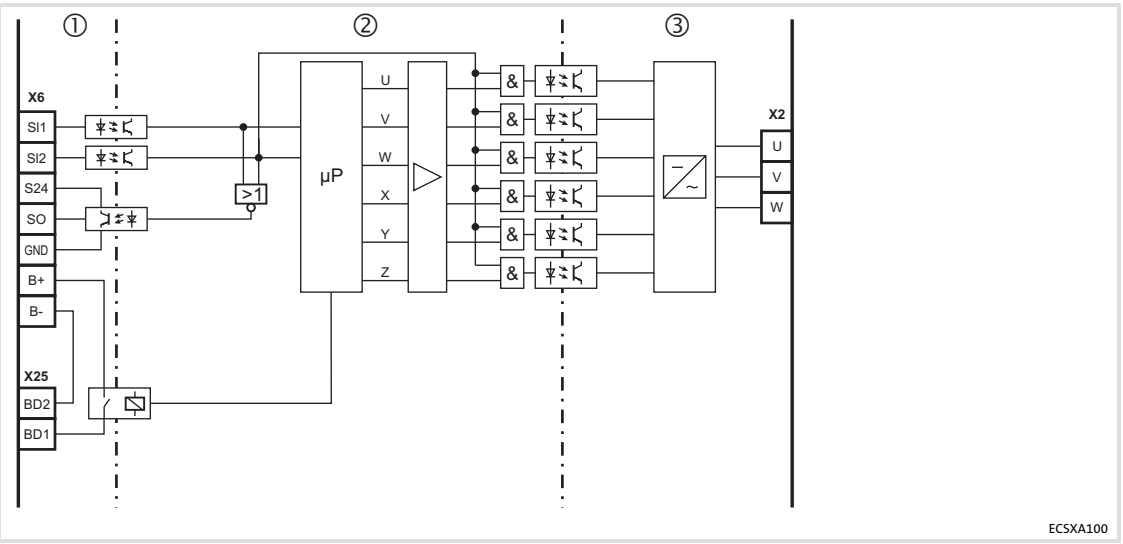


Fig. 5-11 Implementation of the ”safe torque off” function

Area 1:	Inputs and outputs
Area 2:	Circuit for the internal control
Area 3:	Power output stage

Stop!

Use insulated wire end ferrules when wiring the ”safe torque off” circuits to X6.

5.3.3.2 Functional description

The ”safe torque off” state can be initiated any time via the input terminals X6/SI1 (controller enable/inhibit) and X6/SI2 (pulse enable/inhibit). For this purpose a LOW level has to be applied at both terminals:

- X6/SI1 = LOW (controller inhibited):

  The inverter is inhibited via the microcontroller system.

- X6/SI2 = LOW (pulses inhibited):

  The supply voltage for the optocouplers of the power section driver is switched off, i. e. the inverter can no longer be enabled and controlled via the microcontroller system.

  The input signal at X6/SI2 to the hardware is additionally directed to the microcontroller system and is evaluated for the state control there. For the external further processing a HIGH level is output for the state ”safe torque off active” at the digital output X6/SO.

The control of the inverter thus is prevented by two different methods that are independent of each other. Therefore an unexpected start-up by the motor is avoided.

5.3.3.3 Important notes

Danger!

When using the ”safe torque off” function, additional measures are required for ”emergency stops”!

There is neither an electrical isolation between motor and axis module nor a ”service” or ”repair switch”.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

An ”emergency stop” requires the electrical isolation of the motor cable, e.g. by means of a central mains contactor with emergency stop wiring.

Installation/commissioning

► The ”safe torque off” function must only be installed and commissioned by qualified personnel.

► All control components (switches, relays, PLC, ...) and the control cabinet must meet the requirements of EN ISO 13849. These include for instance:
  – Switches, relays in enclosure IP54.
  – Control cabinet in enclosure IP54.
  – All other requirements can be found in EN ISO 13849.

► Wiring with insulated wire end ferrules is essential.

► All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. in the cable duct. It must be ensured that short circuits between the individual cables cannot occur. For further measures, see EN ISO 13849.

► If force effects from outside (e.g. sagging of hanging loads) are to be expected when the ”safe torque off” function is active, additional measures have to be taken (e.g. mechanical brakes).

During operation

► After installation, the operator must check the ”safe torque off” function.

► The function check must be repeated at regular intervals, but no later than after one year.

5.3.3.4 Technical data

Terminal assignment

Plug connector X6				
Terminal	**Function**	**Level**		**Electrical data**
X6/S24	Low-voltage supply			18 ... 30 V DC 0.7 A
X6/SO	"Safe torque off" feedback output	LOW	During operation	24 V DC 0.7 A (max. 1.4 A) Short-circuit-proof
		HIGH	"Safe torque off" active	
X6/SI1	Input 1 (controller enable/inhibit)	LOW	Controller inhibited	LOW level: -3 ... +5 V -3 ... +1.5 mA HIGH level: +15 ... +30 V +2 ... +15 mA Input current at 24 V DC: 8 mA per input
		HIGH	Controller enabled	
X6/SI2	Input 2 (pulse enable/inhibit)	LOW	Pulses for power section are inhibited	
		HIGH	Pulses for power section are enabled	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Starting torque	Stripping length
Flexible	With insulated wire end ferrule	0.25 ... 1.5 mm^2 (AWG 22 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connections 9 mm for spring connections
	Without wire end ferrule	Not permitted when the "Safe torque off" function is used		

5.3.3.5 Function check

- ► After installation the operator must check the ”safe torque off” function.
- ► The function check must be repeated at regular intervals, after one year at the latest.

Stop!

If the function check leads to impermissible states at the terminals, commissioning cannot take place!

Test specifications

- ► Check the circuitry with regard to correct function.
- ► Check directly at the terminals whether the ”safe torque off” function operates faultlessly in the axis module:

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	X6/SI2	X6/SO	X6/SO
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

5.3.3.6 Example: Wiring with electronic safety switching device ”Pilz PNOZ e1vp” for Performance Level Pl_d

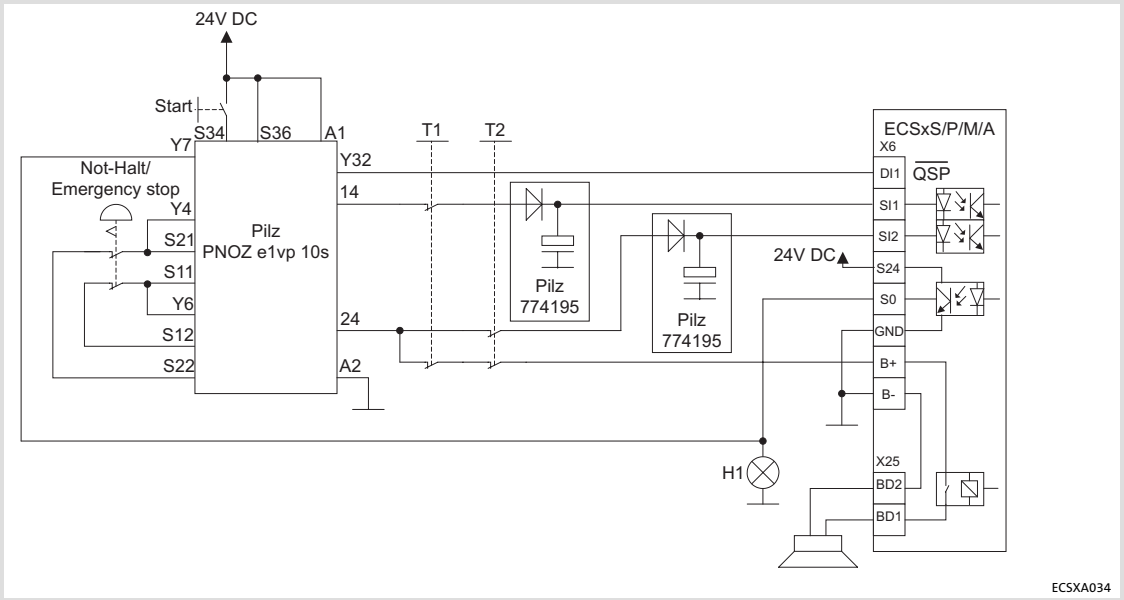


Fig. 5-12 Example: Wiring with ”Pilz PNOZ e1vp 10s” safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.
- The diode-capacitor combination prevents the test pulses of the safety switching device from disturbing the smooth running of the motor, as otherwise a short-time inhibit of the controller cannot be ruled out. The diode-capacitor combination can be procured from the company Pilz (Pilz order number: 774195) as a complete terminal block.

Description of the function

- The "PNOZ" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 14 and 24) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- The safety switching device is provided with test pulses at the output side, so that short circuits within the wiring are detected.
- Diagnostics is effected via the wiring of diagnostic output SO to input Y7 of the safety switching device. Y7 is the input of the feedback loop which has to be on HIGH level (+24 V) before the outputs 14 and 24 are activated. There is only HIGH level if both disconnecting paths have switched off.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.3.3.7 Example: Wiring with electromechanical safety switching device ”Siemens 3TK2827” for Performance Level Pl_d

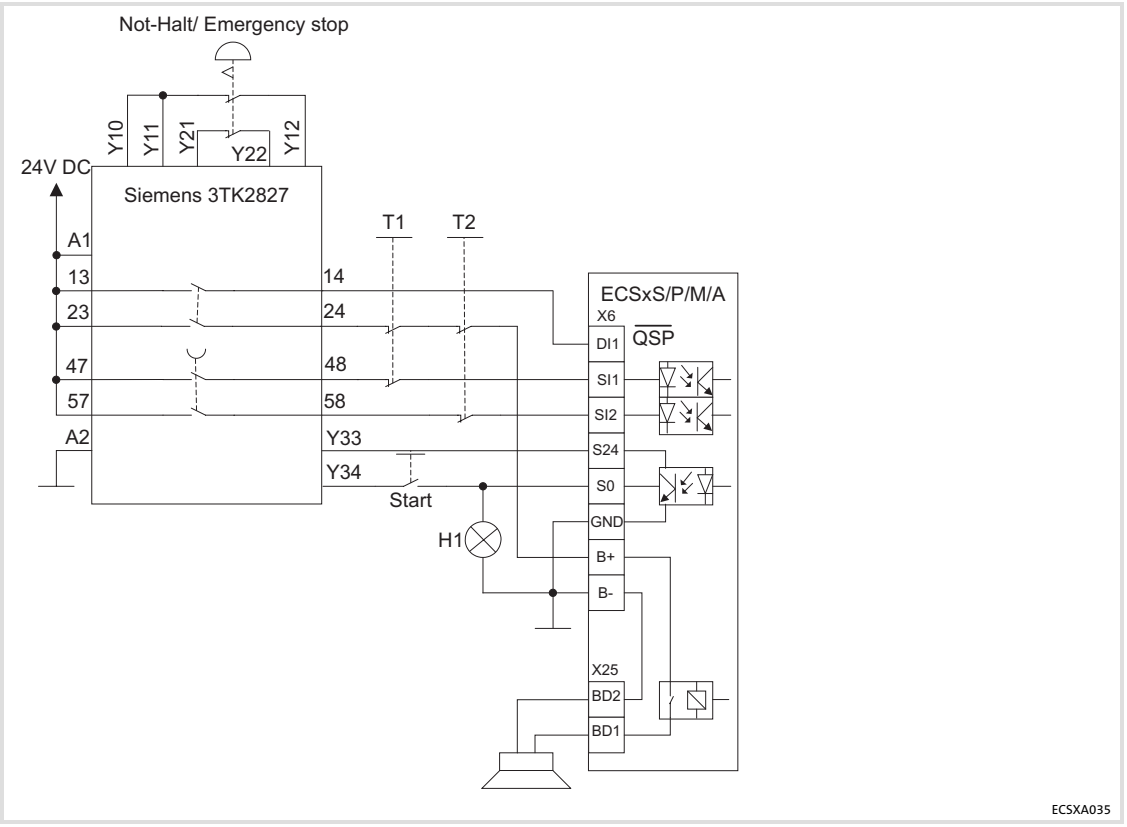


Fig. 5-13 Example: Wiring with ”Siemens 3TK2827” safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.

Description of the function

- The ”Siemens 3TK2827” safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 48 and 58) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- If the ”safe torque off” safety function is activated, output X6/SO is at HIGH level. This state is shown to the operator by means of the indicator light H1. Afterwards switch-on is possible again using the Start pushbutton.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.4 Automation interface (AIF)

The keypad XT or a communication module can be attached to or removed from the automation interface (X1). This is also possible during operation.

- The keypad XT serves to enter and visualise parameters and codes.
- The communication modules serve to network the modules of the ECS servo system with the host system (PLC or PC).

The following combinations are possible:

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

Further information ....

on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

5.5 Wiring of system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...**axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Basic wiring of the CAN bus networks

The two following schematic diagrams show drive systems with different master value concepts:

- In Fig. 5-14 a higher-level control assumes the function of the master, e.g. ETC.
- In Fig. 5-15 the function of the master is enabled by a controller intended as master.

In both representations, the master value transmission is effected via the MotionBus (CAN), interface X4.

The system bus (CAN), interface X14, serves to diagnose and/or parameterise the drives.

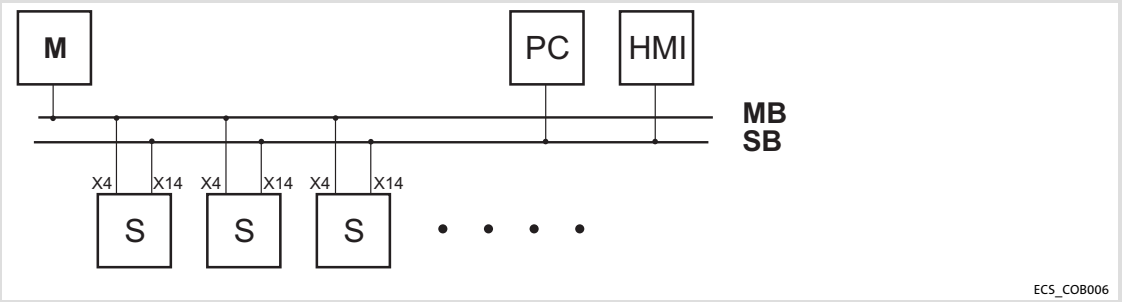


Fig. 5-14 MotionBus (CAN) with master control

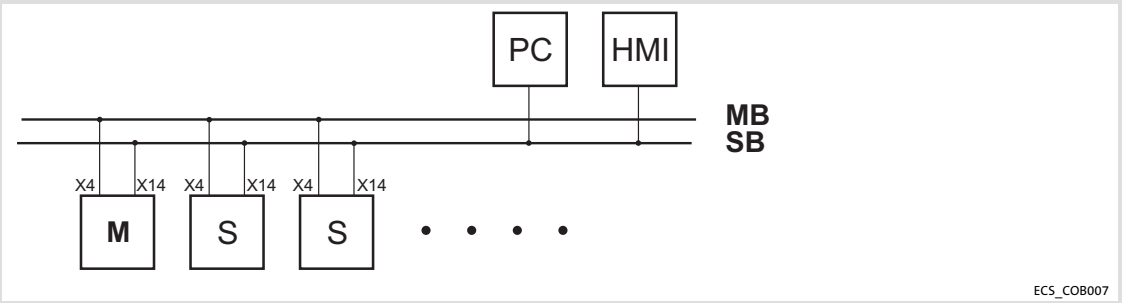


Fig. 5-15 MotionBus (CAN) with controller as master

MB	MotionBus (CAN), interface X4
SB	System bus (CAN), interface X14
M	Master
S	Slave
PC	PC with the Lenze parameter setting and operating software (GDC, GDL, GDO)
HMI	HMI / operating unit

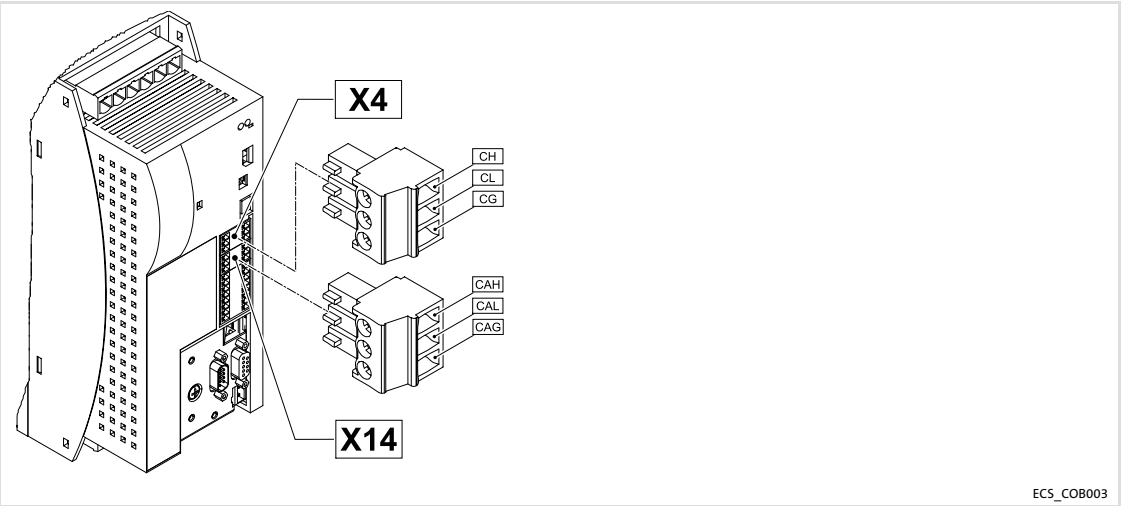


Fig. 5-16 Bus connections on the controller

Assignment of the plug connectors

X4 (CAN)	X14 (CAN-AUX)	Description
CH	CAH	CAN-HIGH
CL	CAL	CAN-LOW
CG	CAG	Reference potential

Specification of the transmission cable

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

System bus (CAN) wiring

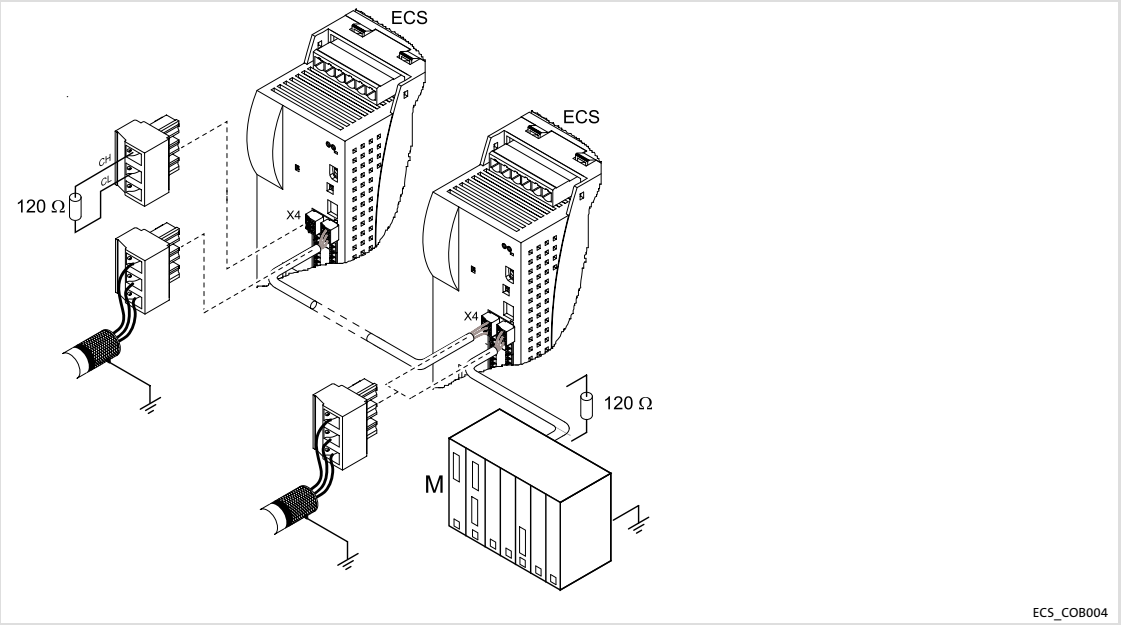


Fig. 5-17 Example: System bus (CAN) wiring via interface X4

ECS ECS axis module
M Master control, e.g. ETC

Note!

Connect one bus terminating resistor (120 Ω) each to the first and last node of the system bus (CAN).

Bus cable length

Note!

The permissible cable lengths must be observed.

1. Check the compliance with the total cable length in Tab. 5-1.

The baud rate determines the total cable length.

CAN baud rate [kbit/s]	**Max. bus length** [m]
50	1500
125	630
250	290
500	120
1000	25

Tab. 5-1 Total cable length

2. Check the compliance with the segment cable length in Tab. 5-2.

The segment cable length is determined by the cable cross-section used and the number of nodes. Without a repeater, the segment cable length corresponds to the total cable length.

Number of nodes	**Cable cross-section**			
	0.25 mm²	**0.5 mm²**	**0.75 mm²**	**1.0 mm²**
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 5-2 Segment cable length

3. Compare the two values detected.

If the value detected from Tab. 5-2 is smaller than the total cable length to be provided from Tab. 5-1 , repeaters must be used. Repeaters divide the total cable length into segments.

Example: Selection help

Specifications	
● Cable cross-section:	0.5 mm² (according to cable specifications 📖 81)
● Number of nodes:	63
● Repeater:	Lenze-repeater, type 2176 (cable reduction: 30 m)

For the max. number of nodes (63), the following cable lengths / number of repeaters from the specifications must be observed:

Baud rate [kbit/s]	**50**	**120**	**250**	**500**	**1000**
Max. cable length [m]	1500	630	290	120	25
Segment cable length [m]	310	310	290	120	25
Number of repeaters	5	2	-	-	-

Check repeater application

Given:	
● Baud rate:	125 kbps
● Cable cross-section:	0.5 mm²
● Number of nodes:	28
● Cable length:	450 m

Procedure	Cable length	See
1. Total cable length at 125 kbps:	630 m	Tab. 5-1
2. Segment cable length for 28 bus nodes and a cable cross-section of 0.5 mm²:	360 m	Tab. 5-2
3. Comparison: The value under point 2 is smaller than the required cable length of 450 m.		

Conclusion
● It is not possible to use a cable length of 450 m without using a repeater.
● After 360 m (point 2) a repeater must be installed.

Result
● The Lenze repeater type 2176 is used (cable reduction: 30 m)
● Calculation of the maximum cable length: First segment: 360 m Second segment: 360 m (according to Tab. 5-1) *minus* 30 m (cable reduction when a repeater is used)
→ Maximum possible cable length with repeater: 690 m.
→ Now it is possible to use the required cable length.

Note!

Repeaters are recommended as a

► Service interface
Advantage: Trouble-free connecting during bus operation is possible.

► Calibration interface
Advantage: Calibration/programming unit remains electrically isolated.

5.6 Wiring of the feedback system

You can connect various feedback systems to the axis module:

- Resolver on X7 (📖 86)
- Encoder on X8 (📖 87)
  - Incremental encoder with 5V-TTL level, RS-422
  - SinCos encoder with zero track without Hiperface, signal level 1 Vss
  - SinCos absolute value encoder (single-turn/multi-turn) with serial communication (Hiperface® interface), supply voltage 5 ... 8 V

Note!

If a ”safe isolation” acc. to EN 61140 between the encoder cable and motor cable (e.g. by using separating webs or separated trailing cables) is **not ensured** on the entire cable length cable due to an installation on the system side, the encoder cable must be provided with an insulation resistance of 300 V. Lenze encoder cables meet this requirement.

- We recommend to use Lenze encoder cables for wiring.
- In case of self-prepared cables
  - only use cables with shielded cores twisted in pairs.
  - Observe the notes on wiring/preparation on the following pages.

5.6.1 Resolver connection

Note!

- ► Use the prefabricated Lenze system cables for the connection of a resolver.
- ► Cable length: max. 50 m
- ► Depending on the cable length and resolver used parameterise the code C0416 (resolver excitation amplitude).
  Check the resolver control with code C0414 (recommended values: 0.5 ... 1.2; ideal value: 1.0).
- ► Before using a resolver from another manufacturer, please consult Lenze.

Connect a resolver via the 9-pole Sub-D socket X7.

Features

- ► Resolver: U = 10 V, f = 4 kHz
- ► Resolver and resolver supply cable are monitored for open circuit (fault message ”Sd2”).

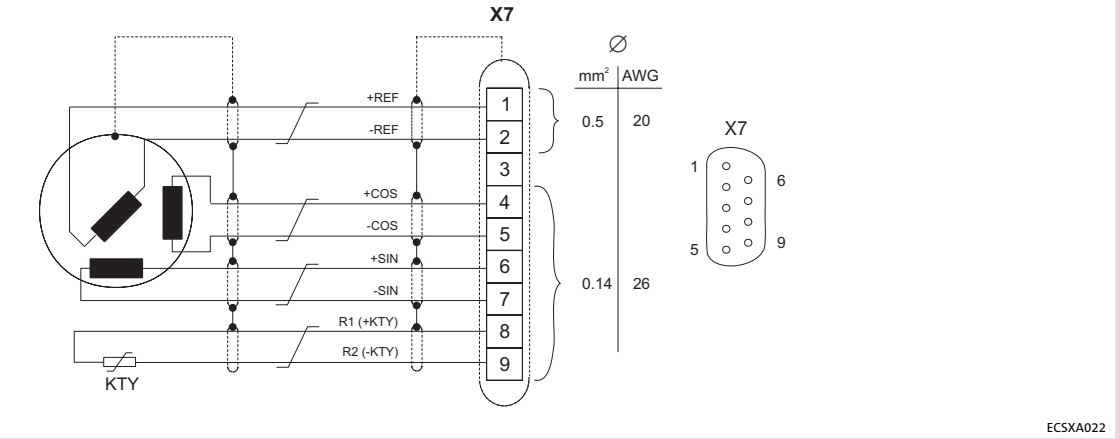


Fig. 5-18 Resolver connection

Assignment of socket connector X7: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	R1 (+KTY)	R2 (-KTY)
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.6.2 Encoder connection

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

- ► Death or severe injuries
- ► Destruction or damage of the machine/drive

Protective measures:

- ► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

Via the 9-pole Sub-D-plug X8, you can connect the following encoders:

- ► Incremental encoder (TTL encoder)
  - – with two 5 V complementary signals (RS-422) that are electrically shifted by 90°.
  - – with zero track that can be connected optionally.
- ► Sin/cos encoder (singleturn or multiturn rotary transducer)
  - – with supply voltage (5 ... 8 V).
  - – with serial communication.
    The initialisation time of the axis module is extended to approx. 2 s.

The controller supplies the encoder with voltage.

Use C0421 to set the supply voltage V_{CC} (5 ... 8 V) to compensate, if required, the voltage drop [ΔV] on the encoder cable:

$$\Delta U \cong 2 \cdot L_L\,[m] \cdot R/m\,[\Omega/m] \cdot I_G\,[A]$$

ΔV	Voltage drop on the encoder cable [V]
L_L	Cable length [m]
R/m	Ohmic resistance per meter of cable length [Ω/m]
I_G	Encoder current [A]

Stop!

Observe the permissible supply voltage of the encoder used. If the values in C0421 are set too high, the encoder can be destroyed!

Incremental encoder (TTL encoder)

Features	
Input/output frequency:	0 ... 200 kHz
Current consumption:	6 mA per channel
Current on output V_{CC} (X8/pin 4):	Max. 200 mA

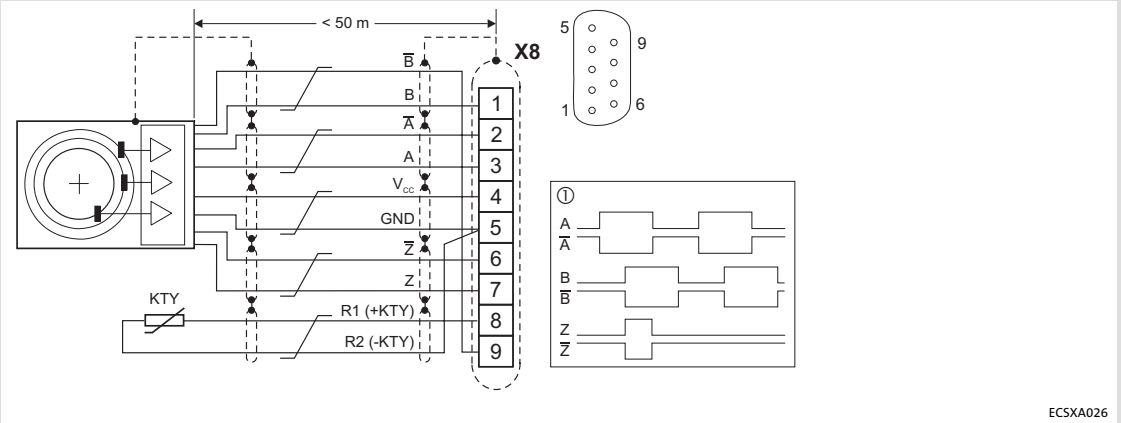


Fig. 5-19 Connection of incremental encoder with TTL level (RS-422)

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (R1/+KTY)	$\overline{Z}$	Z	R2 (-KTY)	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

SinCos encoders and SinCos absolute value encoders with Hiperface

Features	
Input/output frequency:	0 ... 200 kHz
Internal resistance (R_i):	221 Ω
Offset voltage for signals SIN, COS, Z:	2.5 V

- ► The differential voltage between signal track and reference track must not exceed 1 V ± 10 %.
- ► The connection is open-circuit monitored (fault message "Sd8")
- ► For encoders with tracks sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
  – Assign RefSIN with $\overline{\text{sine}}$.
  – Assign RefCOS with $\overline{\text{cosine}}$.
- ► For SinCos absolute value encoders with Hiperface, the serial interface (RS 485) is available instead of the zero track (Z track).

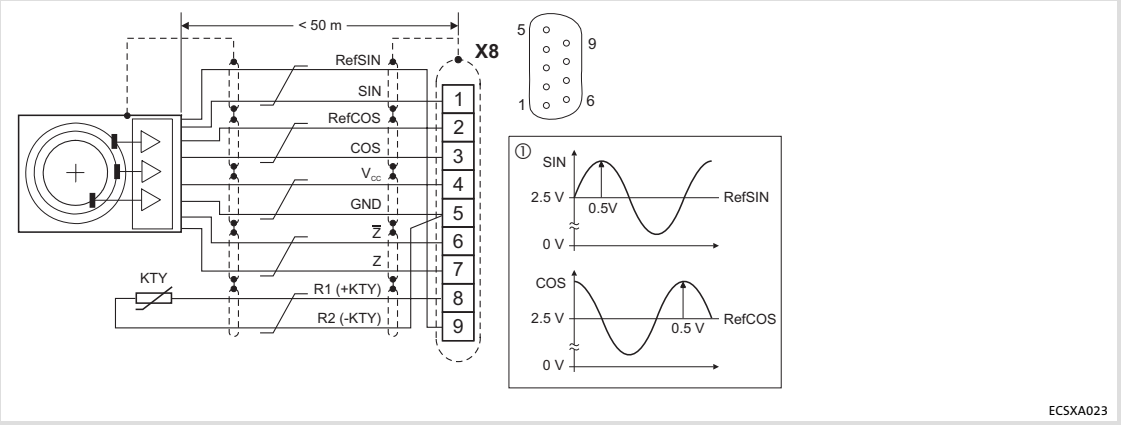


Fig. 5-20 Connection of SinCos encoder

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS ($\overline{\text{cos}}$)	COS	V_{CC}	GND (R2/-KTY)	$\overline{Z}$ or -RS458	Z or +RS485	R1 (+KTY)	RefSIN ($\overline{\text{sin}}$)
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.6.3 Digital frequency input/output (encoder simulation)

The digital frequency coupling of ECSxS/P/A axis modules basically is effected as a master-slave connection via the interface X8. This interface can either be used as a digital frequency input or as a digital frequency output (e. g. for encoder simulation) (configuration via C0491).

Features

X8 as digital frequency input	X8 as digital frequency output
● Input frequency: 0 ... 200 kHz ● Current consumption: max. 6 mA per channel ● Two-track with inverse 5 V signals and zero track ● Possible input signals: – incremental encoder with two 5 V complementary signals (TTL encoders) offset by 90° ● The function of the inputs signals can be set via C0427.	● Output frequency: 0 ... 200 kHz ● Permissible current loading: max. 20 mA per channel ● Two-track with inverse 5 V signals (RS422) ● The function of the output signals can be set via C0540.

Wiring

► 1 slave on the master:

Wire master and slave to each other directly via interface X8.

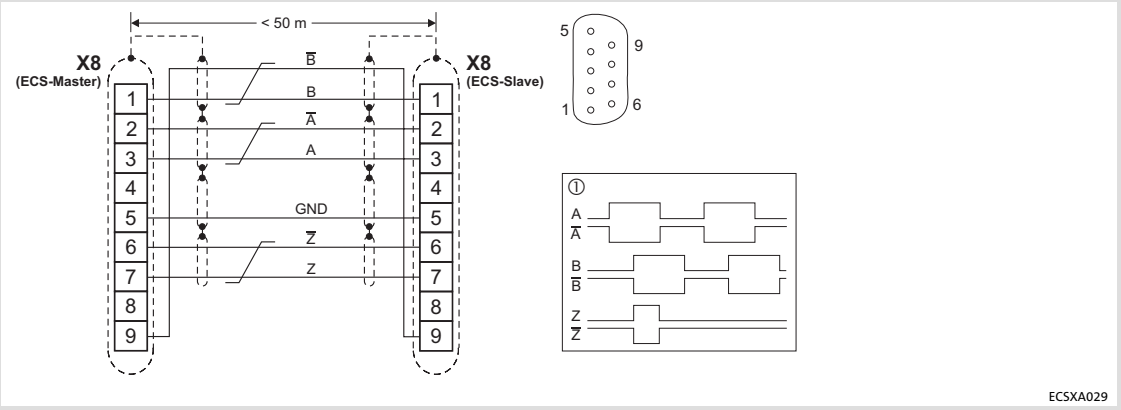


Fig. 5-21 Connection of the master frequency input/output X8 (master ↔ slave)

① Signals for clockwise rotation

Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Input signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
Output signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

► 2 to 3 slaves connected to the master:

Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

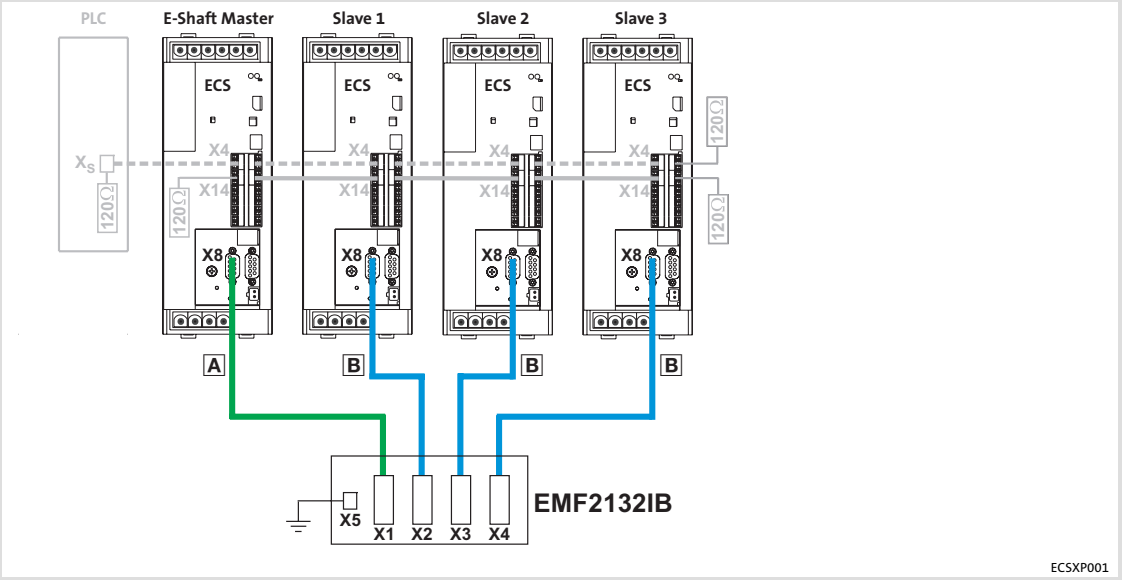


Fig. 5-22 ECS axis modules in the digital frequency network with digital frequency distributor EMF2132IB

PLC	Master control (PLC) or a PLC device to control the drive system
E-Shaft master	Master value master (axis module ECSxP)
Slave 1...3	Slave 1, slave 2, slave 3 (axis module ECSxP)
A	Master digital frequency cable EYD0017AxxxxW01W01 (socket/socket)
B	Slave digital frequency cable EYD0017AxxxxW01S01 (plug/socket)

Tip!

”xxxx” in the type designation of the digital frequency cables serves as a wildcard for the specification of the cable length in decimetres.

Example: EYD0017A**0015**W01W01 → cable length = 15 dm

6 Commissioning

6.1 Before you start

Note!

- The use of a Lenze motor is assumed in this description of the commissioning steps. For details on the operation with other motors see 📖 174.
- The operation with the Lenze parameter setting and operating program "Global Drive Control (GDC)" is taken as a basis. The parameters are displayed in the online mode, i.e. GDC can directly access the codes of the axis module.

Prior to initial switch-on of the drive system, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Polarity of the DC-bus voltage supply via terminals +UG, -UG
- Motor connection:
  – In-phase connection to the motor (direction of rotation)
- Wiring of "safe torque off" (formerly "safe standstill")
- Feedback system
- Control terminals:
  – Wiring adjusted to the signal assignment of the control terminals.

6.2 Commissioning steps (overview)



6.2.1 Basic settings with GDC

Note!
Follow the commissioning steps in the given order!

Settings		Brief description	Detailed information
Preconditions		● Mains is switched off. (Green LED is dark, red LED is blinking) ● Controller inhibit is active. – Press the <F9> key in GDC. – X6/SI1 **or**X6/SI2 must be open (LOW). – Control bit 9 = 1	
1.	Switch on low-voltage supply (24 V DC).		
2.	Connect PC/laptop (with installed GDC parameter setting program) to controller.	Connection to X14 (system bus (CAN)) with PC system bus adapter EMF2177IB.	📖 190
3.	Start GDC and select the device to be set.	Select device: Change to the online mode via the GDC toolbar with the <F4> key and select "Searching for drives" using the <F2> key. ⇨ The drive is identified and the parameter menu is opened.	GDC online help
4.	Load Lenze setting.	● Not required for initial commissioning of the axis module. ● Only recommended if the Lenze setting is unclear.	📖 100
5.	Set communication parameters according the interface used.	Comm. parameters - AIF interface: **Please also read the documentation for the Lenze communication module used!**	
		AIF: EtherCAT settings (EMF2192IB) ● C1120 = 2 (synchronisation via terminal X6/DI1) ● C1121 (synchronisation cycle [in ms]) ● The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the sync telegrams.	📖 207
		Comm. parameters - CAN interface: ● CAN node address (via DIP switch or C0350/C2450) ● Baud rate (via DIP switch or C0351/C2451) ● C0356 (CAN boot up/cycle time) ● C1120 = 1 (sync connection via MotionBus (CAN)) ● C1121 (synchronisation cycle [in ms])	📖 197 📖 204 📖 207
6.	Set mains data.	Set the following codes in the GDC parameter menu under **Short setup → Mains**: ● C0173 (voltage thresholds) ● C0175 (function of the charge relay) – For operation with the power supply module ECSxE set C0175 = 3.	📖 101
7.	Enter motor data.	Lenze motors: Use the GDC motor assistant.	📖 103
		Motors from other manufacturers: Set the codes in the GDC parameter menu under **Motor/feedback systems → Motor setting**.	📖 174
8.	Configure holding brake.	● Not required if a holding brake is not available; *otherwise* ● set C0472/10 (speed threshold) > 0 (e. g. 1 %) for closing the holding brake.	📖 105

	Settings	Brief description	Detailed information
9.	Set feedback system.	● Set Lenze motors with resolvers (standard) in the GDC parameter menu under **Short setup → Feedback system**. ● Set other resolvers and encoders in the GDC parameter menu under **Motor/feedback systems → Feedback system**.	📖 109
10.	Select the control interface.	● Set C4010 in the GDC parameter menu under **Short setup → Control/operating mode**.	📖 130
11.	Set toggle bit monitoring.	Set the following codes in the GDC parameter menu under **Motion → Toggle bit monitoring**: ● C3160 (toggle bit error handling) ● C3161 (toggle bit error counter limit)	📖 136
12.	A Set signal assignment of the digital inputs.	Set C4011 in the GDC parameter menu under **Short setup → Digital inputs/outputs**: ● 0: Control via the CAN interface X4 (MotionBus) ● 1: Control via the AIF interface X1 (for EtherCAT only)	📖 140
	B Set the polarity of the digital inputs and outputs.	● Set IC0114/x (polarity X6/DI1 ... DI4) in the GDC parameter menu under **Terminals I/O → Digital inputs**. ● Set C0118/1 (polarity X6/DO1) in the GDC parameter menu under **Terminals I/O → Digital outputs**.	📖 142
13.	Enter machine parameters.	Set the following codes in the GDC parameter menu under **Motion → Machine parameters**: ● C0011 (max. speed) ● C0105 (deceleration time for quick stop (QSP)) ● C0596 (max. system speed) ● C3030 (following error warning limit) ● C3031 (following error limit FAIL-QSP) ● C3032 (1st response when following error limit has been reached) ● C3033 (2nd response when following error limit has been reached)	📖 138
14.	Switch on the mains.	● Green LED is blinking and red LED is off: – Controller is ready for operation. ● Green LED is off and red LED is blinking: – An error has occurred. Eliminate the error before you continue commissioning.	

The basic settings are completed now.

Proceed as follows:

► Enable controller (📖 183).

► Save parameters in the controller with C0003 = 1.

► Save parameter set with GDC in the parameter set file.

► Set homing (📖 96).

6.2.2 Setting of homing

Homing

By means of homing, the zero position is defined within the physically possible traversing range of the machine. Thus, the reference of the measuring systems to the machine is established.

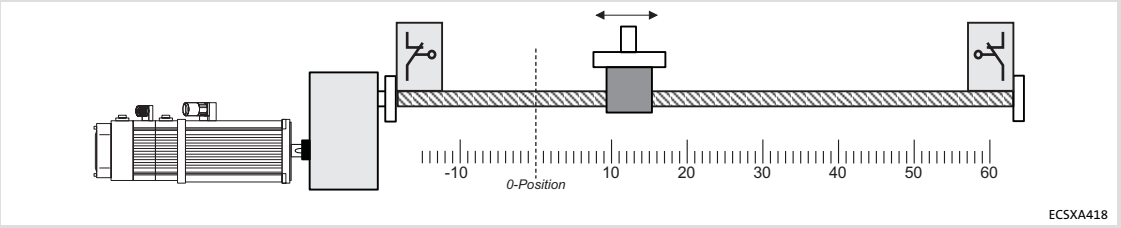


Fig. 6-1 Homing (defining the zero position)

The zero position (home position) can be defined by homing or by setting a reference:

- When homing, the drive travels in a mode defined before (Homing Mode) to detect the zero position independently and in a reproducible way. The homing mode can preferably be executed with the homing function implemented in the ECS Motion. Homing modes for various application tasks are selectable.
- Optionally, homing can also be executed via the functionality of the higher-level motion control if required. The ECS Motion is then operated in the ”Interpolated Position Mode” and controlled via higher-level control until the home position has been reached. At the end, the ”Reference setting” function is executed. When the reference is set, the current position is defined as zero position (reference).

The homing setting described in this chapter requires the following system structure:

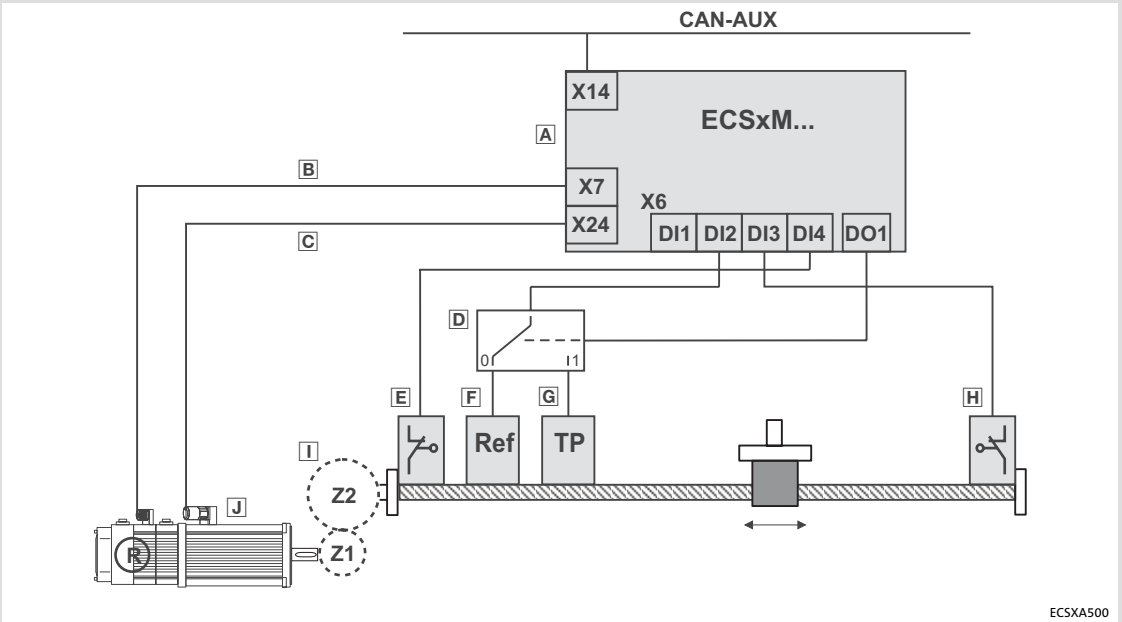


Fig. 6-2 Basic system structure

- A ECSxM... axis module with "Motion" application software
- B Speed / position feedback
- C Motor power connection
- D Change-over between reference switch and touch probe sensor (only required in the homing modes 6 and 7! 📖 145)
- E Negative hardware limit switch
- F Reference switch
- G Touch probe sensor
- H Positive hardware limit switch
- I Gearbox with ratio i = Z2/Z1 (ratio of the number of teeth or circumferences) or i = n1/n2 (ratio of speeds)
- J Servo motor

Setting sequence:

Comply with ...

the safety and application instructions for multi-axis applications in the corresponding manuals and on the systems.

Note!

Follow the commissioning steps in the given order!

	Settings	Brief description	Detailed information
1.	Activate controller inhibit.	● Press the <F9> key in GDC. ● X6/SI1 **or**X6/SI2 must be open (LOW). ● Control bit 9 = 1	
2.	Set homing parameters.	Set the following codes in the GDC parameter menu under **Motion → Homing**: ● C3010 (homing mode) ● C3011 (zero position offset with drive traversing) ● C3012 (zero position offset without drive traversing) ● C0935 (traversing speed of homing) ● C0936 (deceleration time (T_i) of homing)	📖 143
3.	Save parameters in the controller.	Set C0003 = 1.	
4.	C Select ”Homing Mode”.	The ”homing” mode is automatically selected by the higher-level control (PLC): C5000 = 6 The operating mode can also be set manually in the GDC parameter menu under **Motion → Operating mode**.	📖 164
	D Confirm setting of ”Homing Mode”.	In order that the drive performs homing, the ECSxM axis module must write the value from C5000 into C5001 (here C5001 = 6). If this is not the case, set the operating mode manually in the GDC parameter menu under **Motion → Operating mode**.	
5.	Enable controllers.	The controller can only be enabled by a higher-level control (PLC). ● Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the PLC. ● Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. No enable via PLC.	📖 169
6.	Start homing.	The master control (PLC) set the control word bit Ctrl1.Bit12 = 1 (TRUE). **Notes:** ● In order to interrupt homing, reset the Ctrl1.Bit12 to ”0” using the master control. ● Homing can also be started via the parameter setting and operating program GDC or the keypad XT if the control interface is switched over to codes (C4010).	📖 131
	⇨ The drive approaches the home position according to the setting in C3010.		

Settings		Brief description	Detailed information
7.	A Select ”Interpolated Position Mode”.	The ”Interpolated Position Mode” is automatically selected by the higher-level control (PLC): C5000 = 7 The operating mode can also be set manually in the GDC parameter menu under **Motion → Operating mode**.	📖 161
	B Confirm setting of ”Interpolated Position Mode”.	In order that the drive performs a travel according to the setpoint selection, the ECSxM axis module must write the value from C5000 into C5001 (here C5001 = 7). If this is not the case, set the operating mode manually in the GDC parameter menu under **Motion → Operating mode**.	
8.	Start travel according to the setpoint selection.	The master control (PLC) set the control word bit Ctrl1.Bit12 = 1 (TRUE). **Note:** In order to interrupt homing, reset the Ctrl1.Bit12 to ”0” using the master control.	📖 131

The settings for homing are now completed.

Proceed as follows:

► Save parameter set with GDC in the parameter set file.

► Optimise drive behaviour (📖 183).

6.3 Loading the Lenze setting

Note!

When loading the Lenze setting, all parameters are reset to the basic setting defined by Lenze. Settings that have been adjusted before get lost during this process!

In GDC, you can find the parameters and codes to be set in the parameter menu under **Load / Save / PLC**.

Setting sequence

1. Stop the PLC program: C2108 = 2
2. Load the Lenze setting: C0002 = 0
3. Continue with 3.1 **or** 3.2.

   3.1 The 24-V supply voltage can be switched.

   A Switch off and on again the 24 V-supply voltage.

   B Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   3.2 The 24-V supply voltage cannot be switched.

   A Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   B Reset the PLC: C2108 = 3
4. Continue with basic settings from point 5 of the table on 📖 94.
5. Automatic start of the PLC program after power-up: C2104 = 1
6. Start the PLC program: C2108 = 1
7. Save parameter set: C0003 = 1

6.4 Setting of mains data

The GDC includes the parameters and codes to be set in the parameter menu under **Short setup → Mains**:

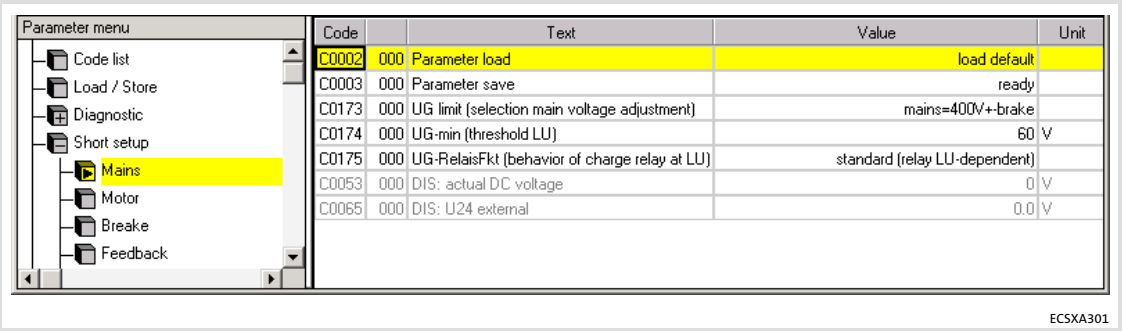


Fig. 6-3 GDC view: Short setup of the mains data

6.4.1 Selecting the function of the charging current limitation

The ECS axis modules are provided with a charging current limitation by means of charge resistors and charge relays. In the Lenze setting the charging current limitation is activated (C0175 = 1).

At mains connection the charge relay remains open for a while so that the charging current of the DC bus is limited by the charging resistors. When a certain voltage level has been reached, the charging resistors are short circuited by switching on (closing) the charge relay contacts.

Stop!

- In case of a mains supply via a power supply module **ECSxE** the entire DC bus is charged in a controlled way by a semiconductor circuit (thyristor) in the power supply module. Therefore, set **C0175 = 3** for the axis modules (charging current limitation inactive, charging resistor short-circuited).

  If the Lenze setting has been loaded via C0002, C0175 = 3 must be reset.
- Cyclic switching of the mains voltage at the power supply module can overload and destroy the charging current limitations of the axis modules if activated (C0175 = 1 or C0175 = 2).

  For this reason, allow a break of at least three minutes between two starting operations in case of cyclic mains switching over a longer period of time!

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0175	UG-Relais Fkt	1			Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 101
			1	Standard	Relay switches as a function of LU.	
			2	One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3	Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

6.4.2 Setting the voltage thresholds

Note!

All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 101
			15	{1 V} 342		

6.5 Entry of motor data for Lenze motors

Note!

- The following only describes the parameter setting for Lenze motors! (If you use a motor from another manufacturer, see 174.)
- If the Lenze setting has been loaded via C0002, the motor data must be re-entered.
- The freely available "GDC-Easy" does not provide the "Input assistant for motor data" which is described in the following so that you must enter the motor data manually (174).

Parameter setting with the "Input assistant for motor data" of the GDC

1. Go to the GDC menu bar and select the **Tool → Motor data** menu item or click the button with the motor symbol in the tool bar:

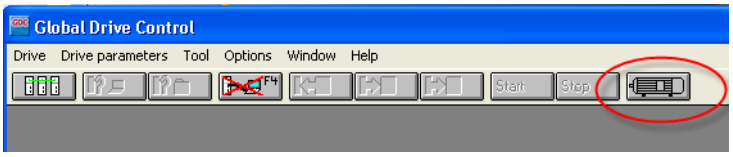


Fig. 6-4 GDC view: menu bar and tool bar

– The "Input assistant for motor data" opens:

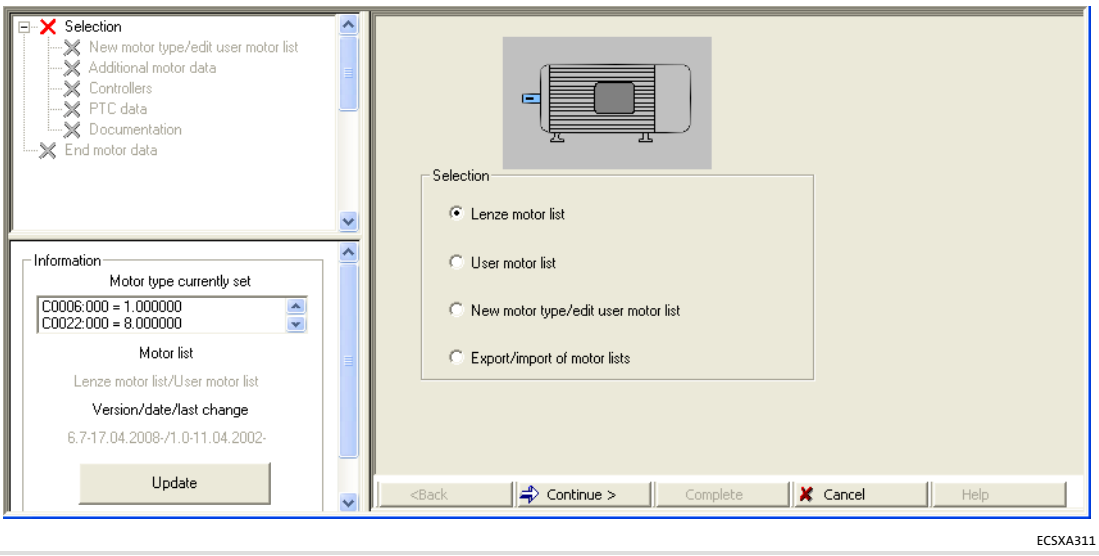


Fig. 6-5 GDC view: Selection of motor list

2. Select the "Lenze motor list" and click the [Continue] button.

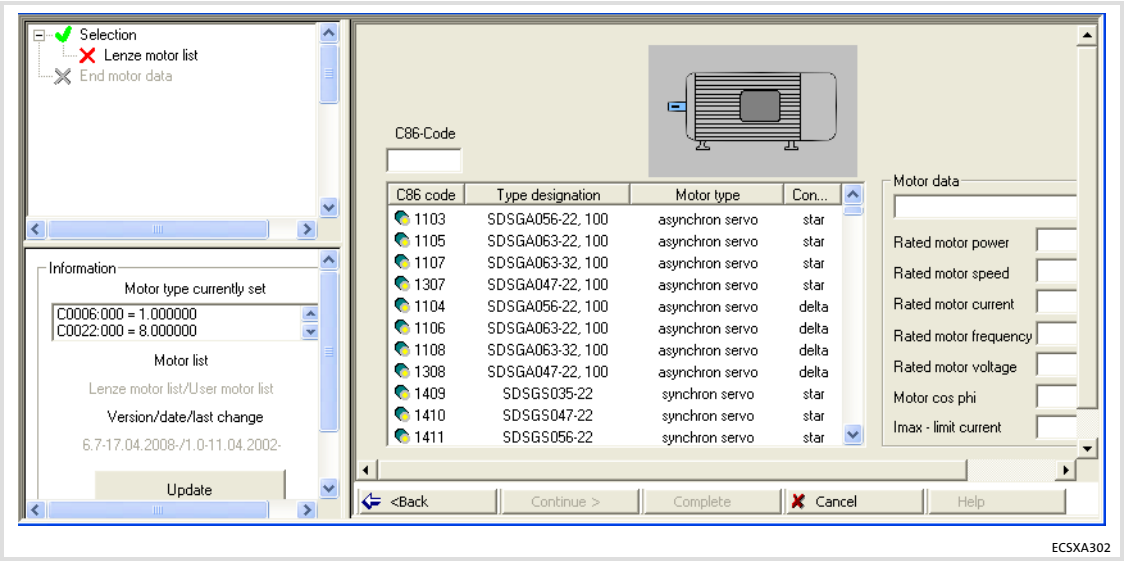


Fig. 6-6 GDC view: Motor selection

3. Select the connected motor from the list (see motor nameplate).
   – The corresponding motor data is displayed in the ”Motor data” fields on the right.
4. Click the [Complete] button.
   – The data is transferred to the controller. This process can take a few seconds and is confirmed by a message after being completed.

6.6 Holding brake configuration

Tip!

If you use a motor without a holding brake, you can skip this chapter.

In the GDC, the parameters or codes to be set can be found in the parameter menu under **Short setup → Brake**.

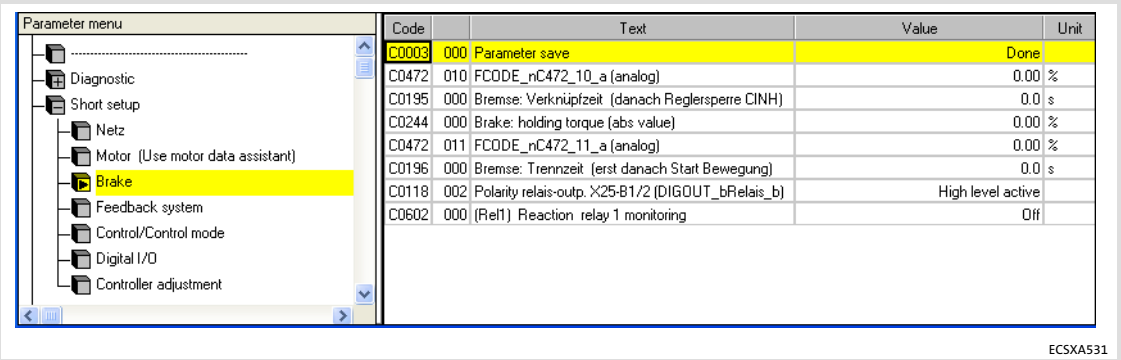


Fig. 6-7 GDC view: Short setup of the holding brake

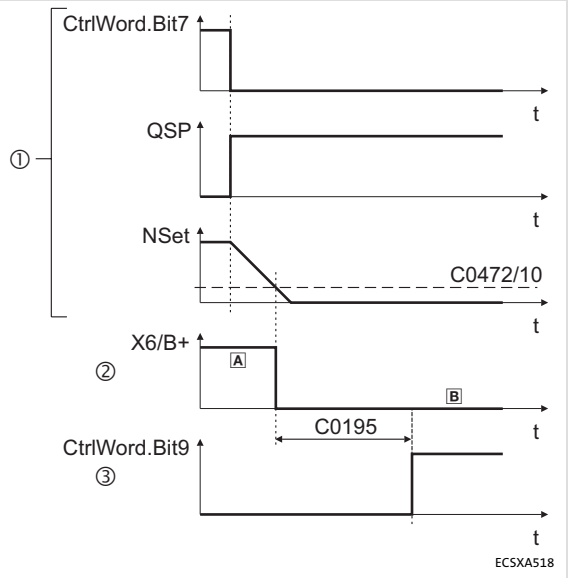
Note!

The codes C0195, C0196, C0244, C0472/10 and C0472/11 are only effective if the brake logic is active (C4020 = 1).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4020	Brake logic	1		Activate brake logic	105
			0 Brake Off		
			1 Brake On		
			2 Brake control via application control word bit 2	Brake control via control bit 2 in the application control word: • 0: brake closed (relay output is not triggered) • 1: brake open (relay output is triggered)	

Code	Name	Description
C0195	Brake closing time/engagement time	The time required for closing the holding brake. ● When Ctrl1.Bit7 = 0 (FALSE), the brake is closed. ● Only after this time has elapsed, the controller inhibit is activated.
C0196	Brake opening time/disengagement time	The time required for opening the holding brake. ● During the time set the drive generates the torque set under C0244 against the holding brake. ● If an actual speed higher than the value in C0472/10 is detected before the brake opening time (C0196) has expired, the drive can immediately change to speed-controlled operation.
C0244	Holding torque	Holding torque of the drive against the holding brake ● 100 % ≙ value of C0057
C0472/10	FCODE analog [%]	Speed threshold for closing the brake: ● Only if the actual speed value has fallen below the speed threshold, the ”close brake” signal is output. ● This code refers to the maximum speed set in C0011. **Note:** Enter a value > 0 so that the brake can be opened.
C0472/11	FCODE analog [%]	Value/direction of the torque against the holding brake.
C0118	Polarity of the digital outputs	In the Lenze setting, the outputs are ”HIGH level active” (📖 142). ● C0118/1: Output X6/DO1 (DIGOUT_bOut1_b) ● C0118/2: Output X25 (DIGOUT_bRelais_b, brake connection)
C0602	Fault response - open circuit monitoring at X25	Fault response to open circuit monitoring of relay output X25 ● 0: TRIP ● 2: Message ● 3: Off (Lenze setting) ● 4: FAIL-QSP

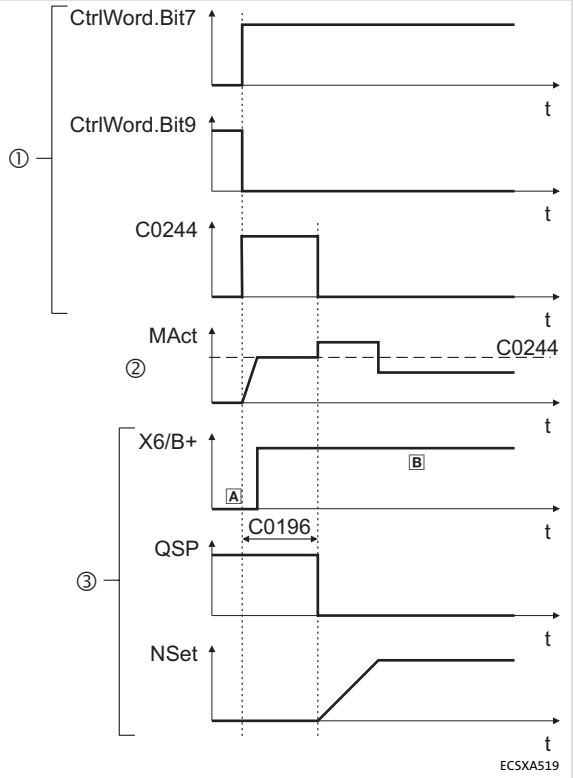
6.6.1 Closing the brake



①	Use control bit 7 = 0 (FALSE) to close the brake. At the same time the internal quick stop (QSP) is activated and the drive is braked to standstill within the deceleration time set in C0105 (NSet = 0).
②	If the speed falls below the speed threshold in C0472/10, the brake is activated via the digital output X6/B+.
③	After the brake closing time in C0195 has elapsed, the controller inhibit (CINH) is activated.

CtrlWord.Bit7	Controller enable (control bit 7)
QSP	Quick stop
Nset	Setpoint speed
X6/B+	Digital output X6/B+
CtrlWord.Bit9	Controller inhibit (control bit 9)
A	Brake is open
B	Brake is closed

6.6.2 Opening the brake



① Use control bit 7 = 1 (TRUE) to enable the controller. The control bit 9 is set to 0 (FALSE) at the same time (controller inhibit (CINH) is deactivated) and the torque defined in C0244 is created. This happens within the brake opening time set in C0196.

② As soon as the torque (Mact) has reached the value in C0244, the brake is opened.

③ If the brake is opened via the digital output X6/B+, the following happens after the brake opening time has elapsed (C0196)
- Quick stop (QSP) is cancelled.
- Setpoint integrator is enabled.

CtrlWord.Bit7	Controller enable (control bit 7)
CtrlWord.Bit9	Controller inhibit (control bit 9)
Mact	Actual torque
X6/B+	Digital output X6/B+
QSP	Quick stop (QSP)
Nset	Setpoint speed
A	Brake is closed
B	Brake is open

6.7 Setting of the feedback system for position and speed control

The following feedback systems can be selected for position and speed control:

- Resolver (📖 110)
- TTL incremental encoder/SinCos encoder without serial communication (📖 113)
  - as position and speed encoder (📖 113)
  - as position encoder and resolver as speed encoder (📖 117)
- Absolute value encoder (Hiperface®, single-turn/multi-turn)
  - as position and speed encoder (📖 121)
  - as position encoder and resolver as speed encoder (📖 126)

The GDC includes the parameters or codes to be set in the parameter menu under **Short setup → Feedback system**:

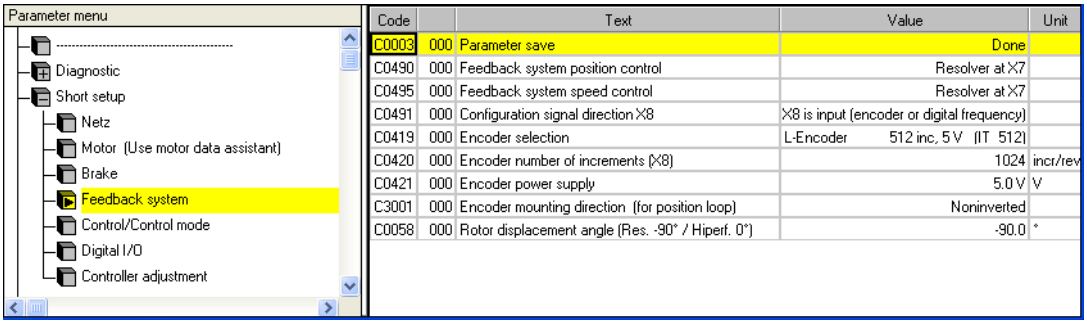


Fig. 6-8 GDC view: Commissioning of the feedback system

Note!

If the Lenze setting has been loaded via C0002, the feedback system must be reset.

6.7.1 Resolver as position and speed encoder

If a resolver is connected to X7 and used as a position and speed encoder, no settings are necessary.

Lenze setting:

- ► Resolver as position encoder: C0490 = 0
- ► Resolver as speed encoder: C0495 = 0

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive			
			1	Active			
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 110
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 110
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 188
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

6.7.2 Resolver as absolute value encoder

If the following requirements are met, a resolver (or single-turn absolute value encoder) can take over the function of a multi-turn absolute value encoder:

- When the axis module is switched off, the reference is known.
- Until the axis module is connected for the next time, it is ensured that the position of the machine part does not change (e.g. by using a brake). When switched off, the motor encoder may maximally move +/- half a revolution.
- C3002 = 1 (initialisation with saved actual position after power on)

At switch off, the actual position is saved fail-safe. After switch on, the actual position is re-initialised with this value. Turning the drive by maximally ± ½ revolution of the position encoder when the axis module is switched off will be detected and considered when the actual position is initialised (loaded).

General formula for the calculation of the maximum resolver rotation when the axis module is switched off, in particular for multi-pole resolvers (number of pole pairs > 1):

$$\text{Max. rotation} = \pm \left(\frac{180°}{\text{number\_of\_pole\_pairs}} \right)$$

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C3002	NoChangeOf Pos	0		Resolver as absolute value encoder	📖 112
			0 ChangeOfPos	After ”mains off/on”, homing has to be carried out. The actual position is initialised with the value ”0”.	
			1 NoChangeOfPos	The actual position value is initialised with the position value at ”Mains off” and is used further at ”Mains on”. Homing is not required. **Note:** With ”Mains off” the feedback system must rotate less than ± 0.5 revolutions.	

6.7.3 TTL/SinCos encoder as position and speed encoder

If an incremental encoder or a SinCos encoder without serial communication is connected to X8 and used for position and speed control, comply with the following setting sequence:

1. Select encoder for position and speed control.
   – Incremental encoder (TTL encoder): C0490 and C0495 = 1
   – SinCos encoder without serial communication: C0490 and C0495 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
3. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.

The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
4. Set the encoder mounting position.
   – C3001 = 0: normal (direction of rotation CW with regard to direction of rotation of the motor)
   – C3001 = 1: inverse (direction of rotation CCW with regard to direction of rotation of the motor)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with • resolver: -90° • hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0095]	Rotor pos adj	0			Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive		
			1	Active		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 113 📖 121
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 113 📖 121
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 113 📖 121
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0427]	Enc. signal	0		Function of the master frequency input signals on X8 (DFIN)	📖 113 📖 121
			0 2-phase		
			1 A: speed B: direction		
			2 A or B: speed or direction		
[C0491]	X8 in/out	0		Function of X8	📖 113 📖 121
			0 X8 is input		
			1 X8 is output		

6.7.4 TTL/SinCos encoder as position encoder and resolver as speed encoder

A TTL incremental encoder connected to X8 or a SinCos encoder without serial communication can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select TTL/SinCos encoder as position encoder.
   – Incremental encoder (TTL encoder): C0490 = 1
   – SinCos encoder without serial communication: C0490 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
4. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.
The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1			Number of pole pairs of resolver	
			1	{1} 10		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0095]	Rotor pos adj	0		Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0 Inactive		
			1 Active		
C0414	DIS: ResQual.			Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 110
			0.00 {0.01} 1,60		
[C0416]	Resolver adj.	5		Resolver excitation amplitude	📖 110
			0 100 %		
			1 80 %		
			2 68 %		
			3 58 %		
			4 50 %		
			5 45 %		
			6 40 %		
			7 37 %		
[C0417]	Resolver cor.	0		Resolver adjustment	📖 188
			0 Ready		
			1 Start adjustment		
			2 Loading default values		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 113 📖 121
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 113 📖 121
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 113 📖 121
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 113 📖 121
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 113 📖 121
			0	X8 is input		
			1	X8 is output		

6.7.5 Absolute value encoder as position and speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

An absolute value encoder mounted on the motor shaft can be used without an additional resolver as position and speed encoder.

1. Select absolute value encoder for position and speed control.
   – Single-turn encoder: C0490 and C0495 = 3
   – Multi-turn encoder: C0490 and C0495 = 4
   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

If an encoder (TTL, SinCos, absolute value encoder) is used, for C0490 and C0495 only identical settings are permissible.

2. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411
   The encoder data (C0420, C0421, C0427) are set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with high speed and high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► Do not parameterise the codes C0420, C0421 and C0427!

3. Set the encoder mounting position.
   – C3001 = 0: normal (same direction of rotation as direction of rotation of motor)
   – C3001 = 1: inverse (opposite direction of rotation to direction of rotation of motor)
4. Save settings with C0003 = 1.

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/feedback systems → Feedback system**.

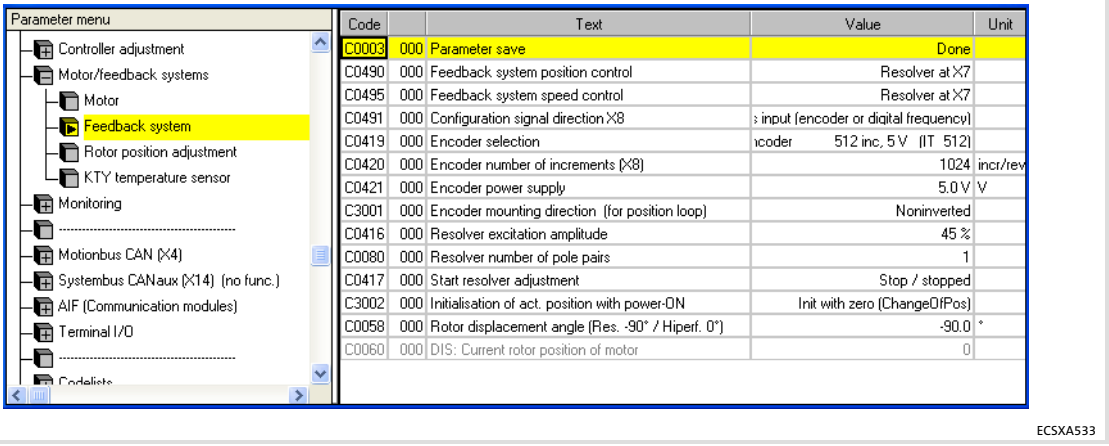


Fig. 6-9 GDC view: Commissioning of further feedback systems

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 109
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 109
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0095]	Rotor pos adj	0			Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive		
			1	Active		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 113 📖 121
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 113 📖 121
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 113 📖 121
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0427]	Enc. signal	0		Function of the master frequency input signals on X8 (DFIN)	📖 113 📖 121
			0 2-phase		
			1 A: speed B: direction		
			2 A or B: speed or direction		
[C0491]	X8 in/out	0		Function of X8	📖 113 📖 121
			0 X8 is input		
			1 X8 is output		
C3000	MotDirInv	0		Motor mounting position	📖 121
			0 Motor mounting position not inverted		
			1 Motor mounting position inverted		
C3001	EncDirInv	0		Encoder mounting position	📖 113 📖 121
			0 Normal (direction of rotation CW)	Direction of rotation with regard to motor direction of rotation	
			1 Inverse (direction of rotation CCW)		

6.7.6 Absolute value encoder as position encoder and resolver as speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

An absolute value encoder Hiperface® interface connected to X8 can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select absolute value encoder as position encoder.
   – Single-turn encoder: C0490 = 3
   – Multi-turn encoder: C0490 = 4
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411

   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 109
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive			
			1	Active			
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 110
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 110
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 188
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 113 📖 121
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 113 📖 121
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 113 📖 121
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 113 📖 121
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 113 📖 121
			0	X8 is input		
			1	X8 is output		

6.8 Selecting the control interface (C4010)

The control interface between the higher-level control and the drive system serves to ...

- control the axis module;
- transfer setpoints and actual values.

The control interface is used to transmit process data cyclically between the higher-level control and the axis module. The following fieldbus interfaces can be selected under C4010:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4010	Ctrl_Interf	0		Control interface selection	📖 130
			0 CAN1 (PDO1 with sync)	The control word is expected via the PDO CAN1_IN. Control is carried out via the CAN interface X4 (MotionBus). Control and status information is sent and received via CAN1_IN (PDO1).	📖 167 📖 165
			1 Without function		
			2 AIF X1 (PDO1 with sync)	Control via the automation interface (AIF) X1 is only possible in conjunction with the EMF2192IB EtherCAT communication module. (From Motion V3.0)	
			3 C4040 (control via codes)	Control is carried out via codes. The control word "Ctrl1" is set via code C4040. The Global Drive Control (GDC) diagnostics and parameterisation software can for instance be used to change individual control bits in order to simulate the higher-level control for testing purposes.	
			4 Without function		

The GDC parameter menu includes the code C4010 under **Short setup → Control/operating mode**.

6.9 Process data to the axis module (control word Ctrl1 and setpoints)

The control interface set under C4010 (📖 130) is used to cyclically transmit process data to the axis module.

Note!

- For communication between master control (path control) and drive system, only the process data channels **CAN1_IN** and **CAN1_OUT** of MotionBus interface X4 are used.

  The MotionBus (CAN) serves ...
  - to synchronise the control cycle of the slaves to the one of the control master,
  - to transmit the master value,
  - to control the drive and
  - if required, to transmit the monitor data for diagnostic purposes.
- The system bus interface X14 can only be used for parameter setting and diagnostics with the Lenze parameter setting and operating program "Global Drive Control" (GDC).
- Further information on communication can be found in chapter "8 Configuration" (📖 196).

Structure of the process data transmitted to the axis module

User data							
Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
Word 1		Word 2		DWord (word 3 + word 4)			
Control word Ctrl1 (C3152, C3153)		Only in "Velocity Mode": Speed setpoint		Set position (The set position is included in the double word1 and is thus displayed in code C0867/1)			

The GDC parameter menu includes codes for displaying the control word (C3152 and C3153) under **Diagnostics → Control/status bits**.

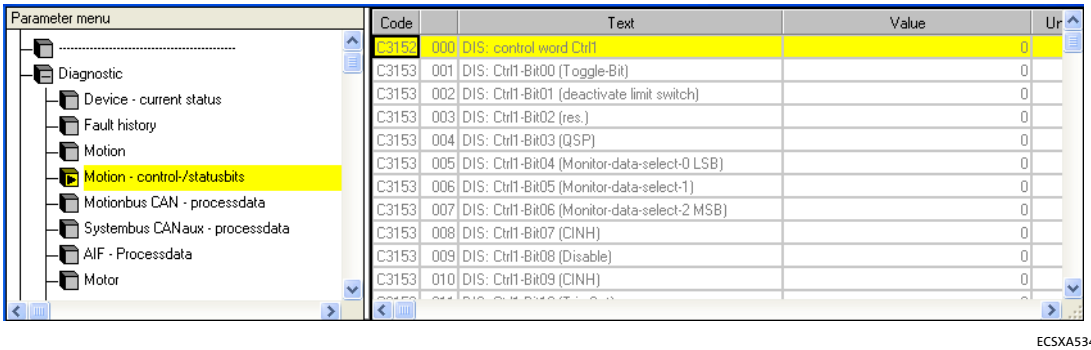


Fig. 6-10 GDC view: Display of the control and status bits

Control word Ctrl1

The control word Ctrl1 consists of 16 bits which are displayed bit by bit under C3151/x:

Bit	Designation	Level	Meaning
0	Toggle	HIGH active	Toggle bit: The master control changes the status of this bit with each telegram. The cyclic "toggling" is monitored in the controller. If the error counter exceeds the value in C3161, the drive reacts according to the function set in C3160.
1	Reserved		Only ECS Motion ≤V1.x: Deactivating hardware limit switch monitoring (Release Limit Switch): 0 = limit switch monitoring is active 1 = limit switch monitoring is not active: After a TRIP-RESET, the activated hardware limit switch can be retracted.
2	Brake-direct		Directly trigger the brake relay output without brake logic ● Only active if mode of the brake logic C4010 = 2. ● Consider the brake closing time/brake opening time in the higher-level control. 0: brake closed (relay output is not triggered) 1: brake open (relay output is triggered)
3	Quick stop (QSP)		Quick stop (QSP): 0 = QSP not active 1 = QSP active: The drive is decelerated to standstill within the deceleration time set in C0105.
4 5 6	Monitor data selection		Selection of the monitor data returned to the master control in addition to the actual position. (📖 133) (Bit 4 = LSB, Bit 6 = MSB)
7	Controller enable		Controller enable: 0 = controller not enabled 1 = controller enabled **Note:** This bit must be set to "1" (TRUE) so that the controller operates. Depending on the setting of the brake logic (C4020) the controller enable (bit 7) additionally affects the brake control.
8	Operation inhibit		Operation inhibit 0 = operation inhibit not active 1 = operation inhibit active:
9	Controller inhibit (CINH)		Controller inhibit (CINH): 0 = controller inhibit not active 1 = controller inhibit active: All internal controllers are reset.
10	TRIP set		Set trip (TRIP-SET): 0 = no not set trip 1 = set trip: The drive is triggered into the status selected under C0581 and signals "EEr" (external monitoring).
11	TRIP reset	Positive edge	Reset fault message (TRIP RESET): 0 = do not reset fault message 1 = reset fault message: This function resets an active TRIP provided that the cause of malfunction has been eliminated. If the cause of malfunction is still active, there will be no reaction.
12	Operation mode specific (1)	HIGH active	See operating modes (bit 12 = LSB, bit 14 = MSB):
13	Operation mode specific (2)		"Velocity Mode" (📖 167) / "Homing Mode" (📖 164) / "IP Mode" (📖 161) / "Manual Jog" (📖 165)
14	Operation mode specific (3)		
15	Reserved	HIGH active	

Monitor data selection (C3181)

Depending on the values of the control bits 4 ... 6, the following monitor data can be transmitted from the drive:

Ctrl1.			Value of the control bits 4 ... 6	Monitor data	Meaning
Bit6	Bit5	Bit4			
0	0	0	0	Free	
0	0	1	1	MCTRL_nPos_a	Axis position 16 bits
0	1	0	2	DINT_TO_INT (MCTRL_dnPosSet_p)	Following error ($\pm 2^{15}$ increments)
0	1	1	3	MCTRL_nNAct_a	Current speed ($n_{max} = 2^{14}$ increments)
1	0	0	4	MCTRL_nMAct_a	Current torque ($M_{max} = 2^{14}$ increments)
1	0	1	5	MCTRL_nIAct_a	Current motor current ($I_{max} = 2^{14}$ increments)
1	1	0	6	MCTRL_nDCVolt_a	Current DC-bus voltage (2^{14} [units] = 1000 V)
1	1	1	7	nPosLatchDiff	Difference between actual position and actual position at touch probe (C6000)

6.10 Process data from the axis module (status words and actual values)

The control interface set under C4010 (📖 130) is used to cyclically transmit process data from the axis module to the higher-level control.

Structure of the transmitted process data

User data							
Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
Word 1		Word 2		DWord (word 3 + word 4)			
Application status word Stat1 (C3150, 3151)		Monitor data (C3181)		Actual position (32 bit value) (Scaling: 2^{16} per revolution of position encoder)			

The GDC parameter menu includes the codes for displaying the status word Stat1 (3150 and C3151) under **Diagnostics → Motion - control/status bits**.

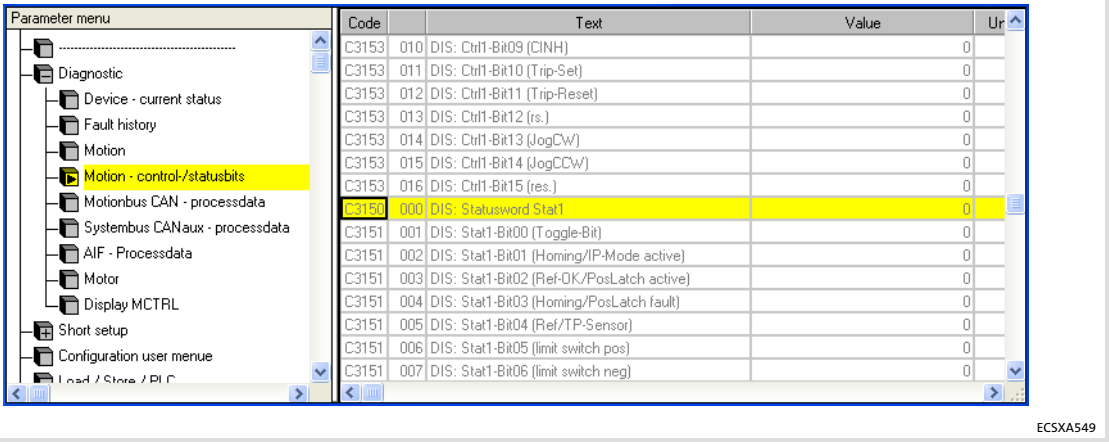


Fig. 6-11 GDC view: Display of the status word

Status word Stat1

The status word Stat1 (C3150, C3151) consists of 16 bits, each of them giving the following information:

Bit	Name	Level	Meaning	
			Operating mode "Homing mode" (C5000=6) (📖 164)	**Operating mode "IP mode" (C5000=7)** (📖 161)
0	Toggle	HIGH active	Toggle bit: The control changes the status of this bit with each telegram. The cyclic "toggling" is monitored in the controller. If the error counter exceeds the value in C3161, the drive reacts according to the function set in C3160.	
1	Homing/IP mode is active		0: Stop homing 1: Homing is active	0: IP mode is not enabled 1: IP mode is enabled
2	Ref-ok/PosLatch is active		0: "Homing" required 1: Home position is known	0: Position detection (Pos_Latch) stopped or not yet active 1: Position detection (Pos_Latch) is evaluated
3	Res.		Reserved	Reserved
4	Reference switch/TP sensor		1: Reference switch is assigned	1: Touch probe sensor is assigned
5	Axis limit switch (positive)	LOW active	1: Hardware limit switch of the positive traversing range is activated.	
6	Axis limit switch (negative)		1: Hardware limit switch of the negative traversing range is activated.	
7	**ECS Motion ≥ V3.0:** Brake-open	HIGH active	Brake relay output: 0: brake closed (relay output is not triggered) 1: brake open (relay output is triggered)	
8	Status 0 (LSB)		The following possible values apply to all four status bits (binary coded): ● 0000: Initialisation after connecting the 24 V supply voltage ● 0001: Switch-on inhibit (LOCK-MODE), restart protection active (C0142 = 0) ● 0011: Controller inhibited ● 0110: Controller enabled ● 0111: A monitoring function returned a "message". ● 1000: A monitoring function returned a "TRIP". ● 1010: A monitoring function or an external quick stop (QSP) via a digital input X6/DI1 results in a "FAIL-QSP".	
9	Status 1			
10	Status 2			
11	Status 3 (MSB)			
12	Warning		1 = Warning (Only display, the drive continues to run normally.)	
13	ActPositionOK		0 = the actual position is faulty or the reference to the home position is missing: Homing must be executed again.	
14	FailToAckn		1 = a fault message is pending: Fault reset is required.	
15	RDY		1 = ready for operation	

6.10.1 Toggle-bit monitoring

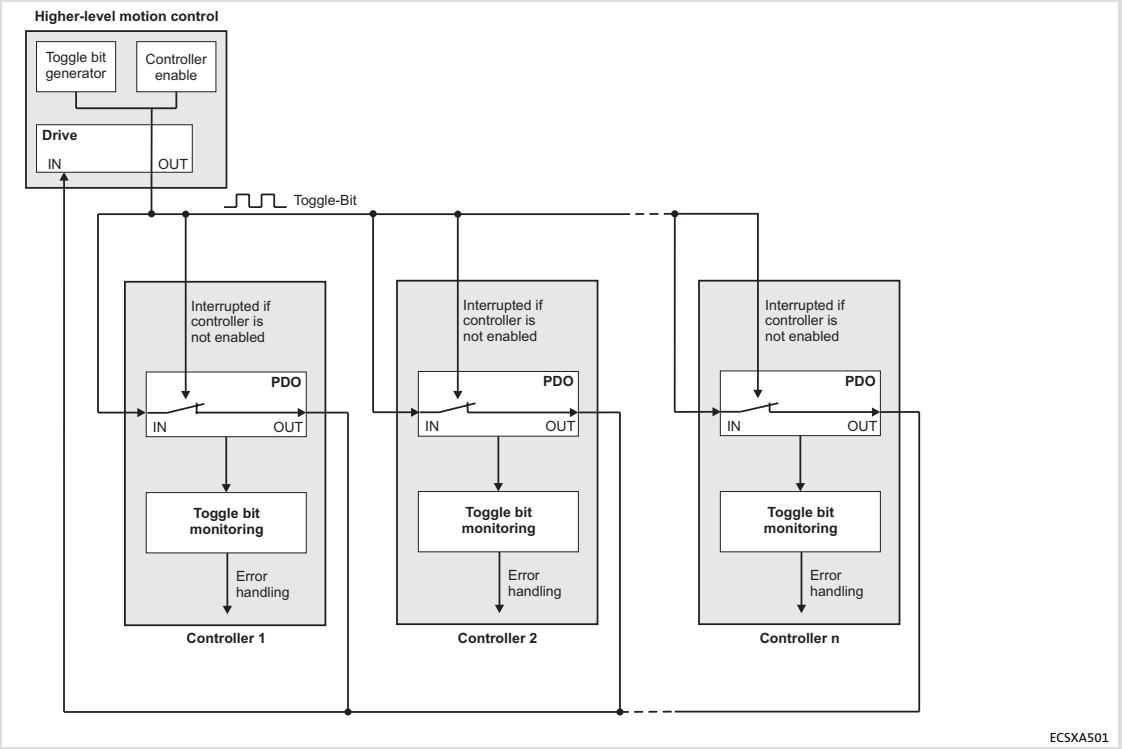


Fig. 6-12 Basic principle of toggle bit monitoring

Toggle bit monitoring serves to monitor the sync-controlled transfer of telegrams on the fieldbus.

The higher-level motion control generates a signal which alternates between low and high (toggle bit). This bit pattern is transmitted cyclically to all controllers of the drive system via a process data channel of the MotionBus (CAN, EtherCAT).

Each controller monitors the state change of the toggle bit and simultaneously returns the bit pattern 1 : 1 to the control. If errors occur in the drive system, every controller involved carries out an independent error evaluation.

In the event of an error (e.g. if a telegram is not transmitted) the toggle bit error counter is increased by 1. Depending on the error counter limit (C3161) and the fault response (C3160) all controllers involved can react irrespective of the communication (error handling).

The toggle bit monitoring function is only active if enabled via the control bit *Ctrl1.Bit07* by the higher-level motion control. Furthermore, the toggle bit signal is only returned to the control system if this mode is selected.

In the GDC, the error limit (C3161) and error response (C3160) can be set in the parameter menu under **Motion → Toggle bit monitoring**.

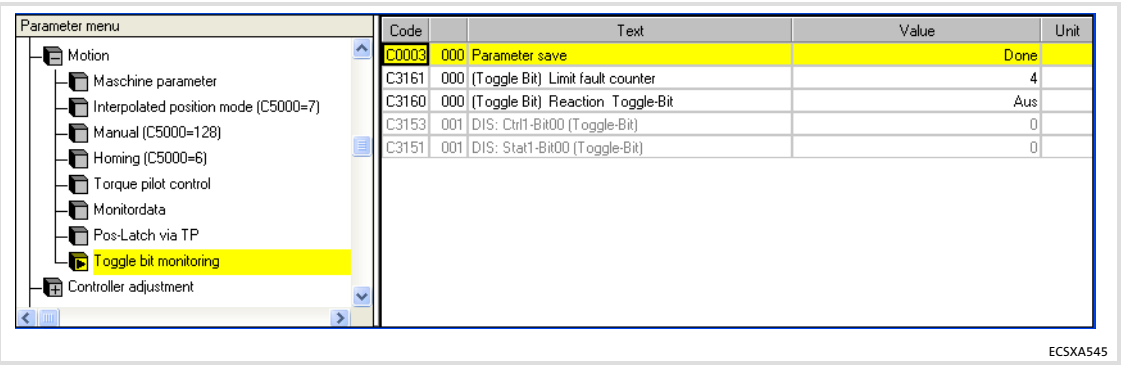


Fig. 6-13 GDC view: Monitoring

Code		Possible settings			IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**			
C3160	ToggleErrReac	3			Toggle bit error handling	📖 136
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		
C3161	ToggleErLimit	4			Toggle bit error counter limit	📖 136
			0	{1 units} 65535		

6.11 Entry of machine parameters

The GDC parameter menu includes the codes for machine parameters (e.g. deceleration time for quick stop or maximum speeds) under **Motion → Machine parameter**.

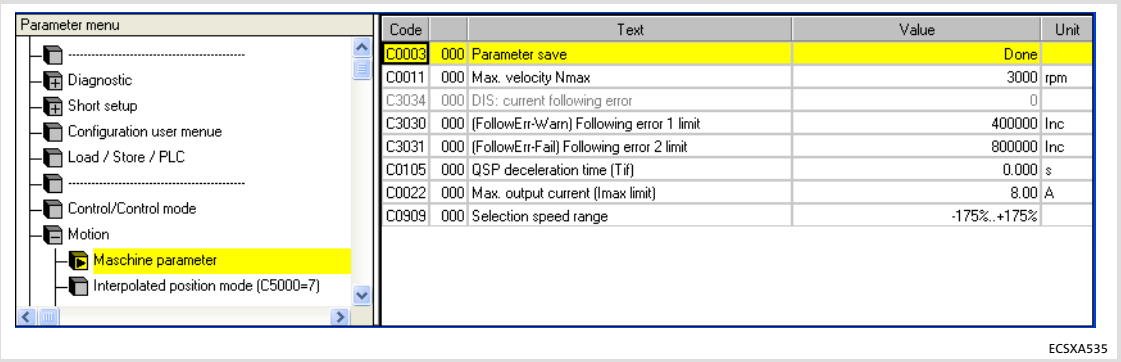


Fig. 6-14 GDC view: Short setup, entry of machine parameters

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0011	Nmax	3000			Maximum speed	
		500	{1 rpm}	16000	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 (CINH)!**	
C0022	Imax current	→			I_{max} limit	
		0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
C0105	QSP Tif	0.0			Deceleration time for quick stop (QSP)	📖 173
		0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	
C0596	NMAX limit	5500			Maximum system speed	📖 250
		0	{1 rpm}	16000		
C0909	speed limit	1			Limitation of direction of rotation for speed setpoint	
		1	-175 ... +175 %			
		2	0 ... +175 %			
		3	-175 ... 0 %			
C3030	FolloErrWarn	400000			Following error limit for enabling a warning	📖 170
		0	{1 inc}	2140000000		
C3031	FolloErrFail	800000			Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	📖 170
		0	{1 inc}	2140000000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3032	FollErr1reac	2				First reaction when following error limit has been reached	📖 170
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3033	FollErr2reac	4				Second reaction when following error limit has been reached	📖 170
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3034	FollowErrDisp	0				Following error Read only	📖 170
			-2147483647	{1 units}	2147483647		

6.12 Configuring the digital inputs and outputs

The signal assignment for the digital inputs can be set via code C4011. This code is included in the GDC parameter menu under **Short setup → Digital inputs/outputs**.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4011		0		Assignment (mapping) of the digital inputs (from Motion V3.0) ● QSP: Quick stop ● SYNC: Synchronisation signal ● Ref: Reference switch ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction	📖 140
			0 DI1: QSP DI2: Ref DI3: Lp DI4: Ln	Setting for control via the MotionBus (CAN interface X4). ● Setting C4010 = 0	📖 141
			1 DI1: SYNC DI2: Ref DI3: Lp DI4: Ln	Setting for control via EtherCAT (AIF interface X1) ● X6/DI1 serves as an input for the synchronisation signal for EtherCAT. ● Setting C4010 = 2	📖 141

6.12.1 Digital inputs for communication via the MotionBus (CAN) X4

Setting C4011 = 0:

Terminal	Function	Level	Response
X6/DI1	Quick stop (QSP)	LOW	The drive is decelerated to standstill within the deceleration time set in C0105.
		HIGH	The motor follows the setpoint selection.
X6/DI2	Reference switch/ Touch probe sensor	LOW	No response
		HIGH	Activation of reference switch/touch probe sensor (both edge active)
X6/DI3	Positive hardware limit switch	LOW	The controller reports the activation of the positive hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No response
X6/DI4	Negative hardware limit switch	LOW	The controller reports the activation of the negative hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No response

6.12.2 Digital inputs for communication via the automation interface (AIF) X1

Setting C4011 = 1:

Terminal	Function	Level	Response
X6/DI1	Sync source	LOW	No sync
		HIGH	Sync is active
X6/DI2	Reference switch/ Touch probe sensor	LOW	No response
		HIGH	Activation of reference switch/touch probe sensor (both edge active)
X6/DI3	Positive hardware limit switch	LOW	The controller reports the activation of the positive hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No response
X6/DI4	Negative hardware limit switch	LOW	The controller reports the activation of the negative hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No response

6.12.3 Setting the polarity of digital inputs and outputs

The polarity can be set for each digital input and output. This determines whether the input or output is HIGH active or LOW active.

The following are available:

- 4 digital inputs (X6/DI1 ... DI4)
- 1 digital output (X6/DO1)
- 1 relay output (X25/BD1, BD2)

Note!

If the touch probe function or synchronisation via digital input X6/DI1 are used, the set polarities are not taken into account.

The GDC contains codes for setting the polarity of digital inputs and outputs in the parameter menu under **Terminal I/O**:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0114				Polarity of the digital inputs (DIGIN)	142
1	DIGIN pol	0 {1}	HIGH level active) {LOW level active}	X6/DI1	
2	DIGIN pol	0 {0}	HIGH level active) {HIGH level active}	X6/DI2	
3	DIGIN pol	0 {1}	HIGH level active) {LOW level active}	X6/DI3	
4	DIGIN pol	0 {1}	HIGH level active) {LOW level active}	X6/DI4	
			0 HIGH level active)		
			1 LOW level active		
C0118				Polarity of the digital outputs	142
1	DIGOUT pol	0	HIGH level active	X6/DO1 (DIGOUT_bOut1_b)	
2	DIGOUT pol	0	HIGH level active	X25 (DIGOUT_bRelais_b, brake connection)	
			0 HIGH level active		
			1 LOW level active		

6.13 Setting of homing parameters

During homing the drive traverses in a preselected mode (C3010). While doing so, the zero position (reference) is detected by means of a reference mark and transmitted to the drive control. All position data refer to this reference.

The GDC parameter menu includes the codes for setting the homing parameters (e.g. homing mode, speed, offsets) under **Motion → Homing**.

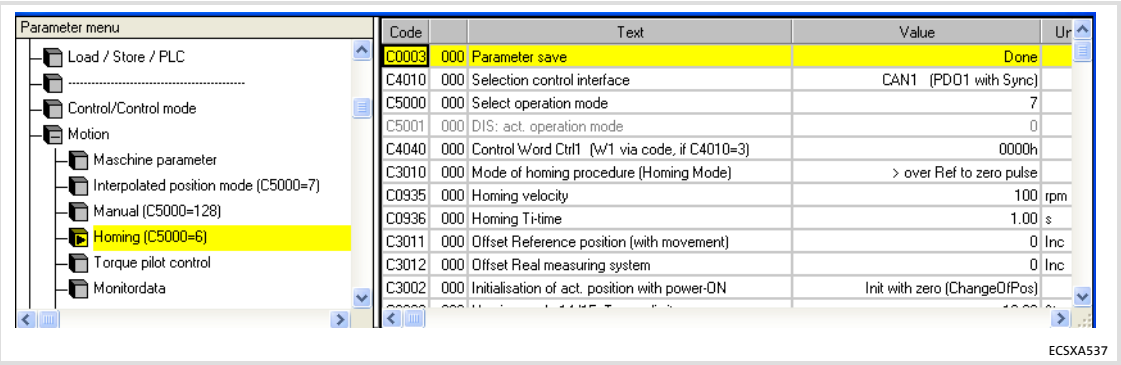


Fig. 6-15 GDC view: Short setup, entry of homing parameters

6.13.1 Homing parameters

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0935	L_REF1 speed	100				Traversing speed of homing	143
			1	{1 rpm}	16000		
C0936	L_REF1 Ti	1.0				Deceleration time (T_i) of homing	143
			0.01	{0.01 s}	650.00		
C3008	HomeMlim	10.0				Torque limit value for homing mode C3010 = 16 or 17 (100.00 % = maximum torque from C0057)	153
			0.00	{0.01 %}	100.00		
C3009	TimeHome Mlim	100				Duration for detecting the mechanical limit stop for homing mode C3010 = 16 or 17	153
			0	{1 ms}	65535		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3010	HomingMode	8				Homing mode	📖 143
			0	>_Rn_MP		**Selection symbolism:** ● >: Movement in pos. direction ● <: Movement in neg. direction ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction ● Rp: Pos. edge of the reference switch ● Rn: Neg. edge of the reference switch ● MP: Zero pulse/position of the position encoder, once per motor revolution ● TP: Touch probe signal ● Mlim: mechanical limit stop (torque limit value) **Notes:** ● When using the homing modes 0 ... 5, set C0540 = 2. ● The mechanical limit stop is defined as exceedance of the torque limit C3008 for the duration C3009. ● When the last action listed is executed, the home position is set (e.g. zero pulse with "MP"), even if the drive continues traversing. ● In all modes without limit switch ("Lp" / "Ln") retracting from the limit switch with error handling set in C3175 is not possible.	📖 145
			1	<_Rn_MP			
			2	>_Lp_<_Rn_MP			
			3	<_Ln_>_Rn_MP			
			4	>_Rp_<_Rn_MP			
			5	<_Rp_>_Rn_MP			
			6	>_Rn_>_TP			
			7	<_Rn_<_TP			
			8	>_TP			
			9	<_TP			
			10	>_Lp_<_TP			
			11	<_Ln_>_TP			
			12	>_Lp_<_MP			
			13	<_Ln_>_MP			
			14	>_MP			
			15	<_MP			
			16	>_MLim			
			17	<_MLim			
			99	Set reference			
C3011	Home offset	0				Offset between home position and standstill position	📖 155
			-2140000000	{1 inc}	2140000000		
C3012	Measure offs.	0				Offset for shifting the zero position with regard to the standstill position	📖 155
			-2147483647	{1 inc}	2147483647		

6.13.2 Homing modes

Modes 0 and 1

Travelling to zero pulse (zero position of the position encoder) via the reference switch.

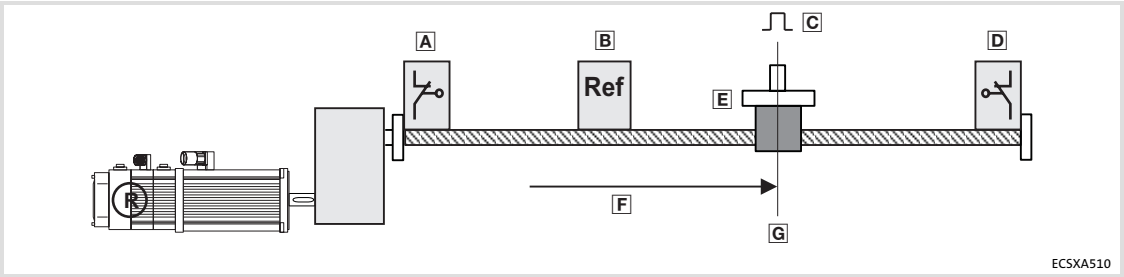


Fig. 6-16 Homing in mode 0

- A Negative hardware limit switch
- B Reference switch
- C Zero pulse (zero position of the position encoder)
- D Positive hardware limit switch
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e. g. slide) travels from its starting position beyond the reference switch to the first zero pulse after leaving the reference switch. This zero pulse bears the home position. Before homing, the load may be positioned on the reference switch.

Settings

Mode 0 (Homing towards the positive hardware limit switch)	**Mode 1** (Homing towards the negative hardware limit switch)
● Set C3010 = 0.	● Set C3010 = 1.

Note!

- ► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).
- ► If the digital frequency output (X8) is to be used as encoder simulation with zero pulse, set C0540=2.

Modes 2 and 3

Approaching the hardware limit switch, reversing the direction of travel and travelling to the zero position (zero position of the position encoder) via the reference switch.

Note!

- ► While reversing, the approached hardware limit switch must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, the negative/positive hardware limit switches are queried.

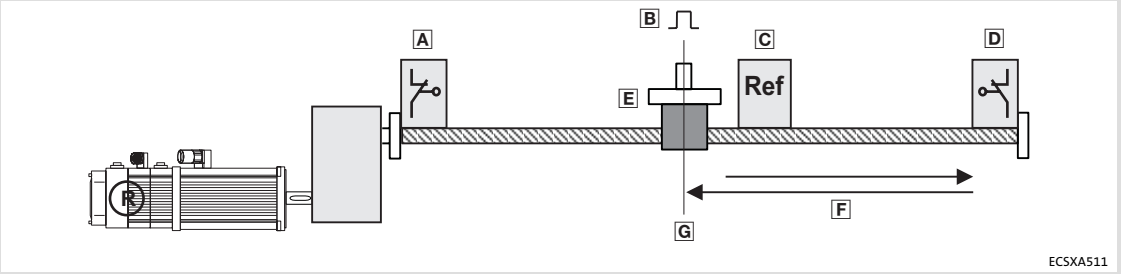


Fig. 6-17 Homing in mode 2

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Positive hardware limit switch
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load, after leaving the reference switch, is traversed to the first zero pulse beyond the reference switch. This zero pulse bears the home position. If the drive has already approached a hardware limit switch before homing, the direction of travel is reversed immediately.

In the homing modes 2 and 3, the reference switch is safely found since if the worst comes to the worst, the entire travel range will be executed.

Settings

Mode 2 (Homing towards the positive hardware limit switch)	**Mode 3** (Homing towards the negative hardware limit switch)
● Set C3010 = 2.	● Set C3010 = 3.

Note!

- ► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).
- ► If the digital frequency output (X8) is to be used as encoder simulation with zero pulse, set C0540=2.

Modes 4 and 5

Approaching the reference switch, reversing, and travelling to the zero pulse (zero position of the position encoder).

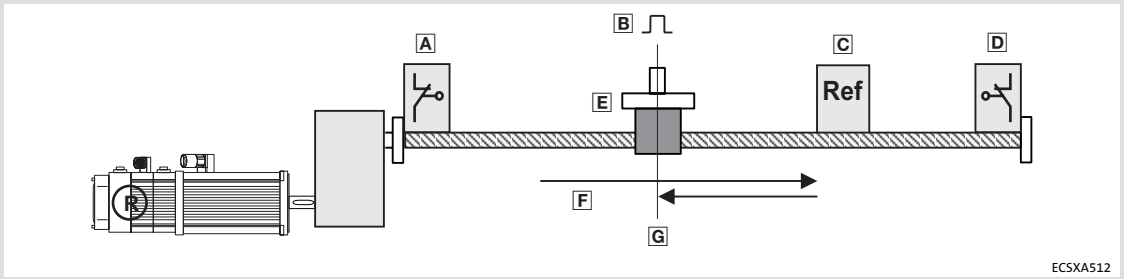


Fig. 6-18 Homing in mode 4

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Positive hardware limit switch
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) travels from its original position to the reference switch. At the approached reference switch the direction of travel is reversed and the load travels to the first zero pulse after leaving the reference switch. The zero pulse bears the home position. If the drive is already situated at the reference switch, the direction of travel is reversed immediately.

Settings

Mode 4 (Homing towards the positive hardware limit switch)	**Mode 5** (Homing towards the negative hardware limit switch)
● Set C3010 = 4.	● Set C3010 = 5.

Note!

- ► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).
- ► If the digital frequency output (X8) is to be used as encoder simulation with zero pulse, set C0540=2.

Mode 6 and 7

Travelling to touch probe signal via reference switch.

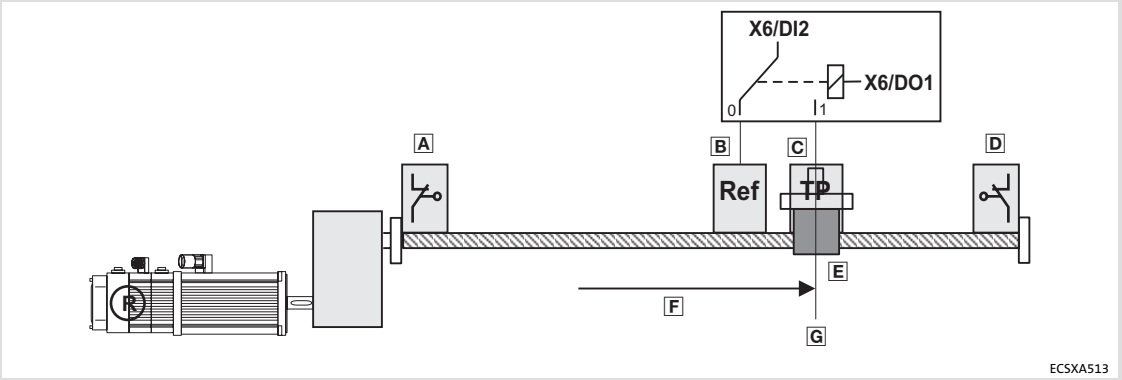


Fig. 6-19 Homing in mode 6

- A Negative hardware limit switch
- B Reference switch
- C Touch probe signal (touch probe sensor)
- D Positive hardware limit switch
- E Load (e.g. slide)
- F Direction of travel
- G Home position

The touch probe is used if the zero pulse (zero position of the position encoder) does not occur reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor replacement.

The load (e.g. slide) travels from its original position beyond the reference switch to the first touch probe signal after leaving the reference switch. This touch probe signal bears the home position. A HIGH level is pending at the digital input X6/DI2. Before homing, the load may already be situated on the reference switch.

Use X6/DO1 to switch a relay which changes over between reference switch and touch probe sensor at X6/DI2. (📖 68)

Settings

Mode 6 (Homing towards the positive hardware limit switch)	**Mode 7** (Homing towards the negative hardware limit switch)
● Set C3010 = 6.	● Set C3010 = 7.

Modes 8 and 9

Travelling to touch probe signal.

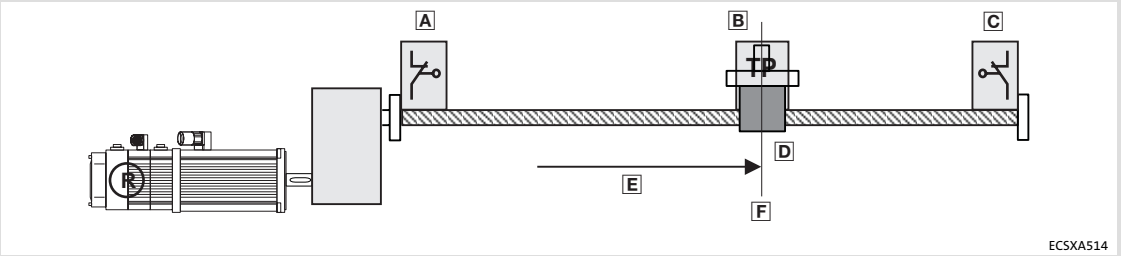


Fig. 6-20 Homing in mode 8

- A Negative hardware limit switch
- B Touch probe signal (touch probe sensor)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Direction of travel
- F Home position

The touch probe is used if the zero pulse (zero position of the position encoder) does not occur reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor replacement.

The load (e.g. slide) travels from its original position to the first touch probe signal which lies in the direction of travel. This touch probe signal bears the home position.

Settings

Mode 8 (Homing towards the positive hardware limit switch)	**Mode 9** (Homing towards the negative hardware limit switch)
• Set C3010 = 2. • If the touch probe signal is already applied to X6/DI2, first of all retracting towards the positive hardware limit switch is performed.	• Set C3010 = 3. • If the touch probe signal is already applied to X6/DI2, first of all retracting towards the negative hardware limit switch is performed.

Modes 10 and 11

Approaching the hardware limit switch, reversing and travelling towards touch probe signal.

Note!

- ► While reversing, the hardware limit switch approached must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, the negative/positive hardware limit switches are queried.

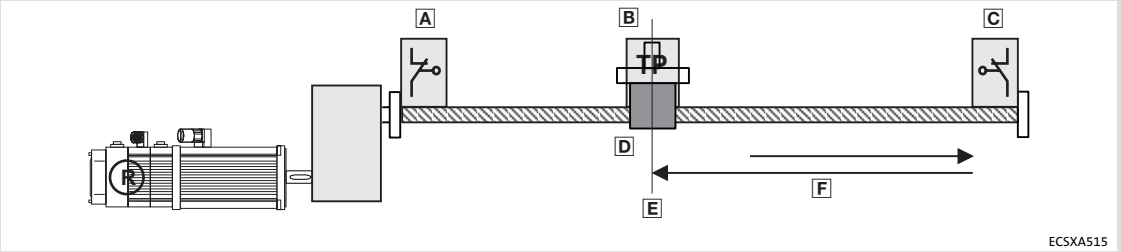


Fig. 6-21 Homing in mode 10

- A Negative hardware limit switch
- B Touch probe signal (touch probe sensor)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Home position
- F Direction of travel

The touch probe is used if the zero pulse (zero position) of the position encoder occurs non-reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor exchange.

The load (e. g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load is traversed to the touch probe signal. This touch probe signal bears the home position. If the drive already is at the hardware limit switch before homing, the direction of travel is reversed immediately.

Settings

Mode 10 (Homing towards the positive hardware limit switch)	**Mode 11** (Homing towards the negative hardware limit switch)
● Set C3010 = 10.	● Set C3010 = 11.

Modes 12 and 13

Approaching the hardware limit switch, reversing and travelling to the zero pulse (zero position of the position encoder).

Note!

- ► While reversing, the approached hardware limit switch must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, the negative/positive hardware limit switches are queried.

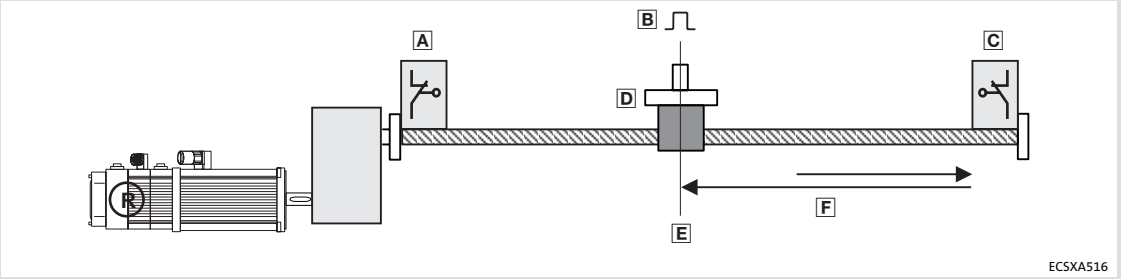


Fig. 6-22 Homing in mode 12

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Positive hardware limit switch
- D Load (e. g. slide)
- E Home position
- F Direction of travel

Zero pulse and hardware limit switch are used if a reference switch and touch probe sensor are not available (e.g. in case of rotary tables).

The load (e.g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load travels to the first zero pulse (zero position of the position encoder) after leaving the limit switch. This zero pulse bears the home position. If the drive has already approached the hardware limit switch before homing, the direction of travel is reversed immediately.

Settings

Mode 12 (Homing towards the positive hardware limit switch)	**Mode 13** (Homing towards the negative hardware limit switch)
● Set C0540 = 12.	● Set C3010 = 13.

Note!

- ► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).
- ► If the digital frequency output (X8) is to be used as encoder simulation with zero pulse, set C0540=2.

Modes 14 and 15

Travelling to zero pulse (zero position of the position encoder).

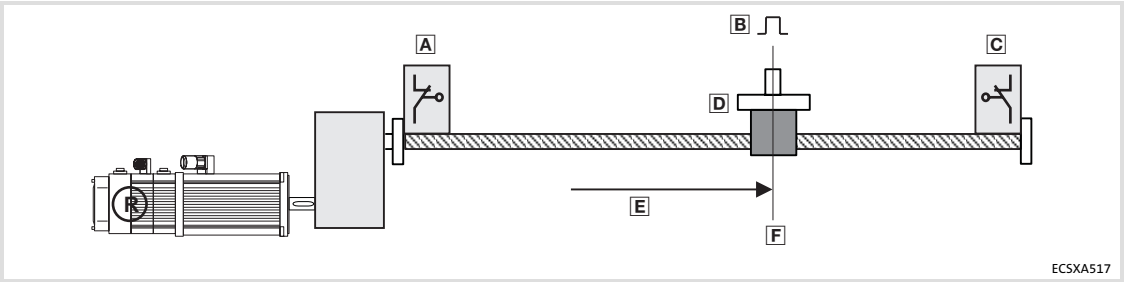


Fig. 6-23 Homing in mode 14

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Direction of travel
- F Home position

The zero pulse is only used if a reference switch and touch probe sensor are not available (e.g. in case of rotary tables).

The load (e.g. slide) travels from its original position to the first zero pulse which lies in the direction of travel (zero position of the position encoder). This zero pulse bears the home position.

Settings

Mode 14 (Homing towards the positive hardware limit switch)	**Mode 15** (Homing towards the negative hardware limit switch)
● Set C3010 = 14.	● Set C3010 = 15.

Note!

- ► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).
- ► If the digital frequency output (X8) is to be used as encoder simulation with zero pulse, set C0540=2.

Modes 16 and 17

Approach mechanical limit stop and set home position.

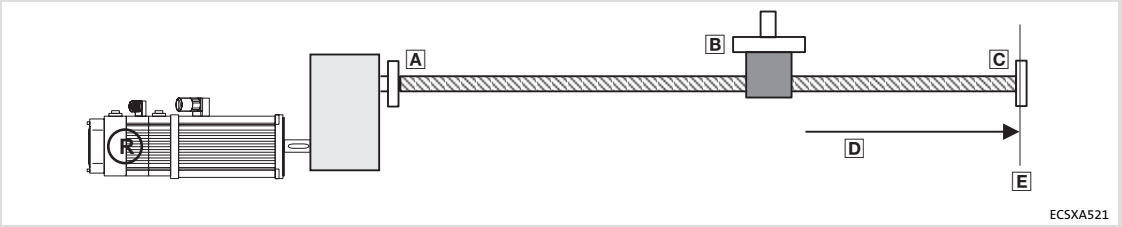


Fig. 6-24 Homing in mode 16

- A Mechanical limit stop (negative)
- B Load (e. g. slide)
- C Mechanical limit stop (positive)
- D Direction of travel
- E Home position

The load (e.g. slide) is travelled from its original position in positive or negative direction towards the mechanical limit stop. The motor torque is limited during homing to the torque limit value (C3008). If the motor torque reaches the torque limit value for a longer time than specified in C3009, the internal speed setpoint is travelled to ”0” within the deceleration time set (C0936). After that it is traversed by the offset set in C3011 (📖 155). If the internal speed setpoint = 0, a home position is set at this position.

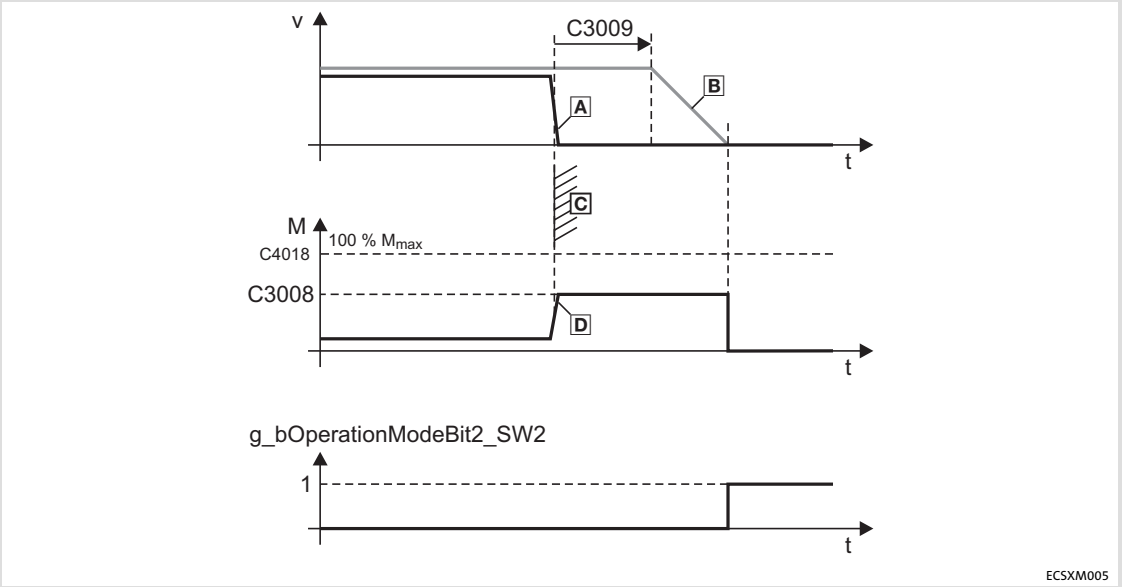


Fig. 6-25 Sequence of homing in mode 16/17

- A Actual speed value
- B Speed setpoint
- C Mechanical limit stop
- D Actual torque

Settings

Mode 16 (Homing towards the positive mechanical limit stop)	**Mode 17** (Homing towards the negative mechanical limit stop)
● Set C3010 = 16.	● Set C3010 = 17.

Mode 99

Set reference

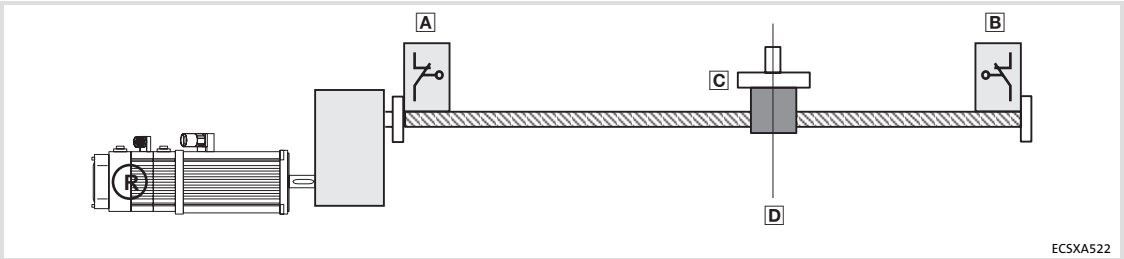


Fig. 6-26 Set reference in the mode 99

- A Negative hardware limit switch
- B Positive hardware limit switch
- C Load (e.g. slide)
- D Home position

Use ”Set reference” if

- ► you want to determine the zero position yourself.
- ► no touch probe sensor is available (e.g. in case of rotary tables).
- ► a home position cannot be determined depending on sensors, switches, or zero pulses (e.g. in case of transformed axes).

The load (e.g. slide) is situated on a position. Here, it is switched to the homing mode and the reference is set to C3011 + C3012 (📖 155) . The axis does not move. After an internal calculation ”Reference OK” is displayed.

Note!

In case of absolute value encoders (single-turn, multi-turn), ”Set reference” is only possible via C0098 (position offset) in combination with the controller inhibit (CINH).

6.13.3 Shifting the zero position with regard to the home position (offsets C3011, C3012)

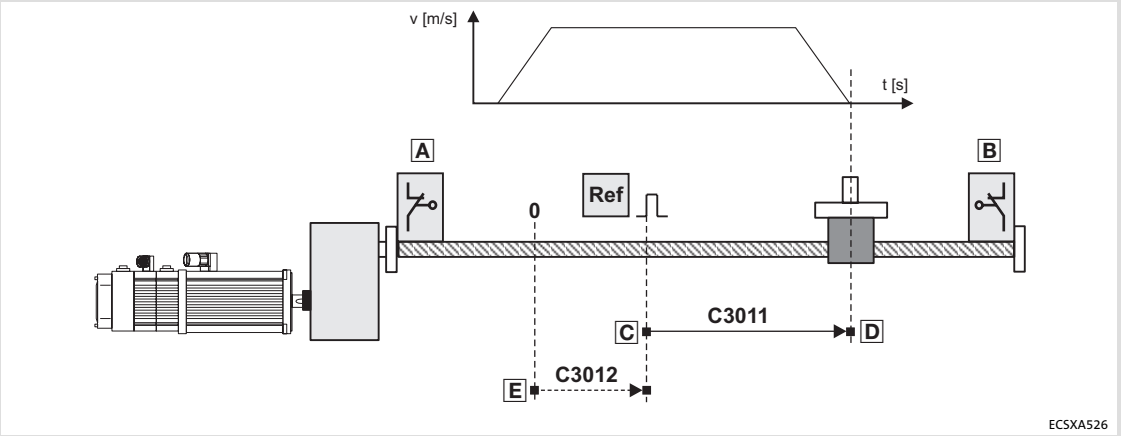


Fig. 6-27 Offset of the zero position (note: Different behaviour of ECS Motion and ECS Posi&Shaft)

A, B Negative and positive hardware limit switch
C Home position (zero pulse/zero position of the position encoder)
D Standstill position after completion of homing
E Zero position of the measuring system after offset by C3011 and C3012
REF Reference switch

Code	Description
C3011	Offset between home position and standstill position ● Distance still to be traversed [inc] after reaching the home position (e.g. zero pulse (zero position of the position encoder)). ● Positive values: Drive motion towards the positive hardware limit switch. ● Negative values: Drive motion towards the negative hardware limit switch. ● Value range: -2140000000 ... 2140000000 [inc]
C3012	Offset for shifting the zero position: ● Positive values: Offset of the zero position towards the negative hardware limit switch. ● Negative values: Offset of the zero position towards the positive hardware limit switch. ● The zero position is offset without any further drive motion. ● **Actual position via MotionBus = C3011 + C3012** (The outcome of this is the offset of the zero position.) ● Value range: -2147483647... 2147483647 [inc]

Example

1. C3011 = 100000 [inc]:

   After reaching the home position (e.g. zero pulse (zero position of the position encoder)) the drive travels in **positive direction** by 100000 [inc].

   The zero position is situated at the home position.

2. a) C3012 = 50000 [inc] (compare Fig. 6-27):

   The zero position is offset by 50000 [inc] in **negative direction**.

   Actual position = 100000 [inc] + 50000 [inc] = 150000 [inc]

   b) C3012 = -50000 [inc]:

   The zero position is offset by 50000 [inc] in **positive direction**.

   Actual position = 100000 [inc] + (-50000 [inc]) = 50000 [inc]

6.13.4 Example: Reference search with linear positioning axis

Settings for homing mode 13

- Set homing mode 13 with C3010 = 13.
- The negative hardware limit switch is to be used as reference switch at the same time:
  - Connect hardware limit switch in parallel with X6/DI3 and X6/DI4. (For terminal assignment see 📖 68)
  - Set C0114/3 and C0114/4 = 1 (LOW level is active).
- Set travelling speed with C0935.
- Set acceleration/deceleration with C0936.
- Define target position as offset to the home position via C3011.

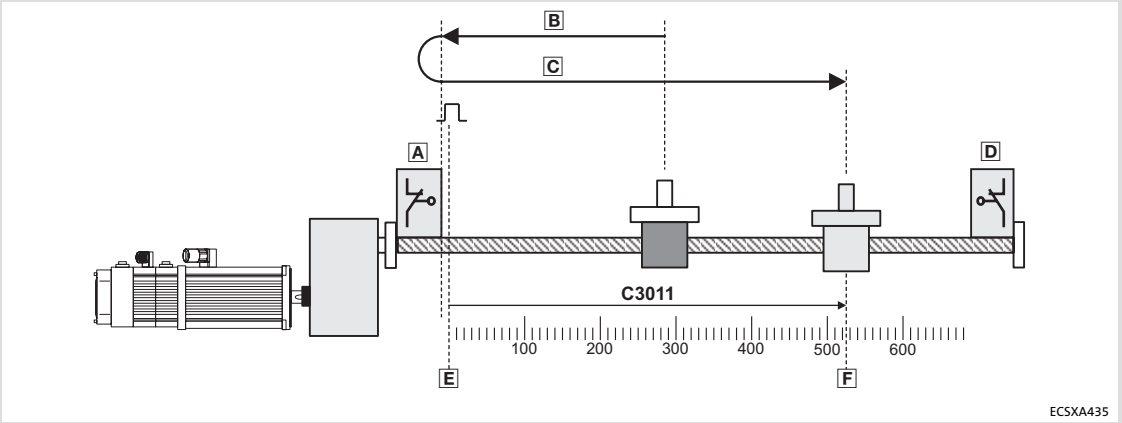


Fig. 6-28 Homing in mode 3, negative hardware limit switch as reference switch

A Negative hardware limit switch
B Travel towards reference switch
C Travel via the defined offset (C3011) towards target position
D Positive hardware limit switch
E Zero pulse (zero position of the position encoder)
F Target position

Sequence

1. The ”Homing Mode” is selected via parameter channel (SDO) (📖 345) with C5000 and confirmed with C5001.
2. Homing is started by activating the Ctrl1.Bit12.
   – Ctrl1.Bit12 = 1 (TRUE)
3. During the homing mode, Ctrl1.Bit1 (homing/IP mode) is set.
   – Ctrl1.Bit1 = 1 (TRUE)
4. The drive travels to the negative hardware limit switch (A)and reverses (B).
   – Since the limit switch is also used as reference switch, the preliminary stop will be set when the drive leaves the limit switch, i.e. when the next zero pulse (E) of the position encoder is reached, the drive control will know the home position.
5. The drive continues traversing without interruption to the target position (F) which has been defined as offset to the home position under C3011 (C).
6. When the target position is reached, homing is completed.
   – Ctrl1.Bit12 = 0 (FALSE)
   – Ctrl1.Bit2 = 1 (TRUE)
7. The zero position (C3012 plus the distance covered in C3011) is transmitted as actual position to the master control.

6.13.5 Example: Reference search with continuous positioning axis

For applications with an unlimited traversing range (e. g. conveying belts and rotary tables) the reference is always searched via a mark. In that case, the reference switch serves as a mark sensor.

Settings for homing mode 8

- ► Set homing mode 8 with C3010 = 8.
- ► Set target position as the offset to the home position (TP) via C3011 and C3012.
- ► Set travelling speed via C0935.
- ► Set acceleration/deceleration via C0936.

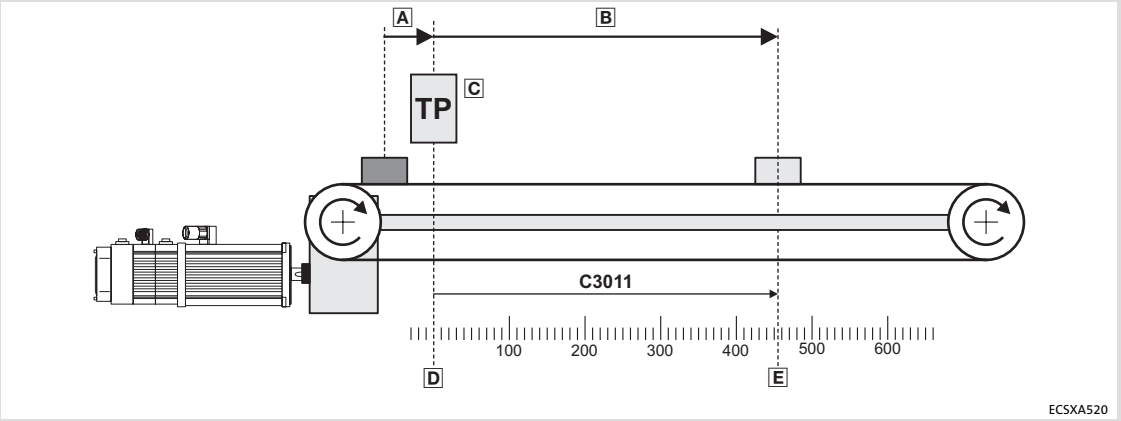


Fig. 6-29 Homing in mode 8

A Travel towards home position
B Travel via the defined offset towards target position
C Touch probe sensor (home position)
D Zero position
E Target position

Functional sequence

1. The "Homing Mode" is selected via parameter channel (SDO) (📖 345) with C5000 and confirmed with C5001.
2. Homing is started by activating the Ctrl1.Bit12.
   – Ctrl1.Bit12 = 1 (TRUE)
3. During the homing mode, Ctrl1.Bit1 (homing/IP mode) is set.
   – Ctrl1.Bit1 = 1 (TRUE)
4. The drive travels in positive direction. [A]
   When the positive edge of the touch probe sensor ([C]) has been reached, the drive control knows the reference.
5. The drive continues traversing without interruption to the target position ([E]) which has been defined as offset to the home position (TP) under C3011. [B]
6. When the target position is reached, homing is completed.
   – Ctrl1.Bit12 = 0 (FALSE)
   – Ctrl1.Bit2 = 1 (TRUE)
7. The zero position (C3012 plus the distance covered in C3011) is transmitted as actual position to the master control.

6.14 Selection of the operating mode

The ”Motion” application software (A-SW) supports the operating modes

- ”Interpolated Position Mode” (for travel with cyclic setpoint selection of a path control with travel profile generation)
- ”Homing Mode”
- ”Manual Jog” e.g. via GDC
- ”Velocity Mode”

Use C5000 to select the operating mode manually. The display code C5001 serves to confirm the currently set operating mode.

The GDC includes the codes for selecting the operating mode in the parameter menu under **Motion**.

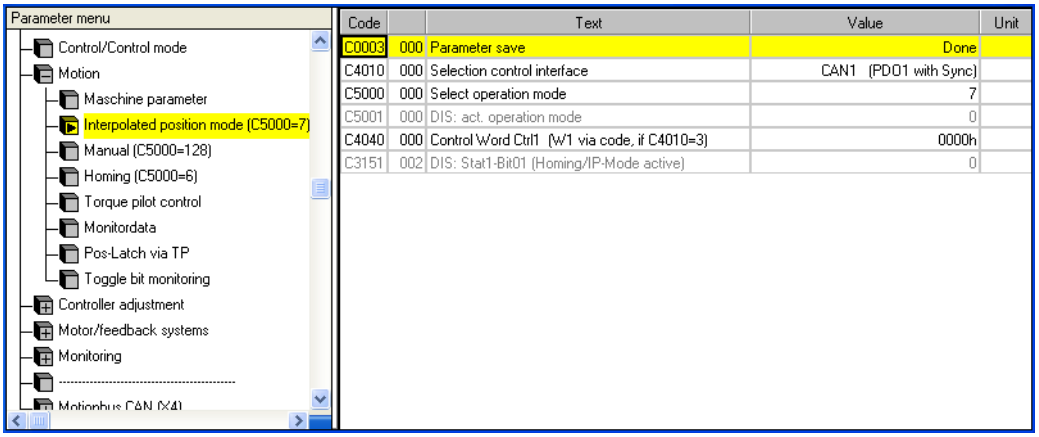


Fig. 6-30 GDC view: Selection of the operating mode

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C5000	OpMode	7		Selection of the operating mode (Operation Mode)	160
			2 Velocity Mode		167
			6 Homing Mode		164
			7 Interpolated Position Mode		161
			128 Manual jog		165
C5001	Mode_Op_Dis			Operating mode (Operation Mode) Read only	160
			2 Velocity Mode		167
			6 Homing Mode		164
			7 Interpolated Position Mode		161
			128 Manual jog		165

6.14.1 Operating mode ”Interpolated Position Mode” (IP-Mode)

The ”IP mode”enables a travel according to setpoint selection.

Settings

► Select ”IP mode”: C5000 = 7
  – The code C5000 (4C77h) is written via parameter data channel (SDO, 📖 345).

► Selection confirmation: C5001 = 7
  – Code C5001 (4C76h) can be read out via parameter data channel (SDO) in order to query whether the operating mode in the drive has been changed already.
  – Write/read access via SDO may take typically 30 ... 50 ms.

► Enable ”IP mode”: Ctrl1.Bit12 = 1 (TRUE)
  – The travel according to setpoint selection has not been started yet due to changeover to ”IP mode”. The ”IP mode” must be enabled by control bit (Ctrl1.Bit12 = 1).

Operating mode-dependent bits in the control word Ctrl1

Bit	Name	Value	Response
1	Release limit switch		Only with user software ≤1.x (A-SW see nameplate):
		0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Enable IP mode	0	Without function
		1	Enable IP mode so that the drive follows the cyclically defined setpoints.
13	Activate Pos_Latch	0	Without function
		1	Touch probe storage is activated. The TP position is detected with the next selected touch probe edge (📖 162).

Note!

The external setpoint can only be read if the ”IP mode” has been enabled (Ctrl1.Bit12 = 1). Otherwise, the drive must control the motor with the internal setpoint.

Operating mode-dependent bits in the status word

Bit	Name	Value	Response
1	Enable IP mode	0	IP mode is not enabled
		1	Enable IP mode
2	Evaluate Pos_Latch	0	No touch probe signal occurred
		1	The active touch probe edge has completed the position detection.
3	Pos_Latch error	0	No error during position detection
		1	Error during position detection → Function abort
4	Touch probe sensor	0	No touch probe
		1	Touch probe sensor is active

Touch probe storage of the actual position (Pos_Latch)

For position detection the drive traverses the sensor mark to a defined target. If ”Touch Probe” is detected by the controller, the current position is saved.

Note!

The digital input X6/DI2 is double-assigned with touch probe and homing switch. Ensure that both signals do not interact.

Setting sequence

	Setting	Brief description
1.	Parameter setting.	Set the following codes in the GDC parameter menu under **Motion → PosLatch**: ● Set C3181 = 7 (nPosLatchDiff) *or* Set Ctrl1.Bit4, Ctrl1.Bit5 and Ctrl1.Bit6 = 7 [dec]. ● C0911 (MCTRL selection zero pulse/touch probe)
2.	Save parameter set.	Set C0003 = 1.
3.	Activate position detection.	Set Ctrl1.Bit13 = 1 (TRUE). *or* Set C6001 = 1, 2 or 3: 1 = wait for rising edge 2 = wait for falling edge 3 = wait for rising or falling edge
4.	Start positioning.	Start positioning via the sensor in the IP mode by selecting a setpoint.
5.	Storage of the touch probe position	With touch probe (X6/DI2 = HIGH) ● the position where the touch probe has occurred is saved in C6000. ● the difference to the actual position in ”Word 2” of the process data telegram is transmitted. ● bit 4 in the status word is set to 1 (TRUE).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0911	MCTRL TP2 sel.	0		MCTRL touch probe signal source	
			0 Zero pulse of position encoder (C0490)	X7/X8	
			1 Touch probe input TP2	X6/DI2	
C3181	MonitorData	0		Monitor data selection	📖 133
			0 Free		
			1 MCTRL_nPos_a	Actual position (16 bits) referred to one revolution (rotor position)	
			2 DINT_TO_INT (MCTRL_dnPosSet_p)	Following error $\pm 2^{15}$	
			3 MCTRL_nNAct_a	Actual speed ($n_{max} = 2^{14}$)	
			4 MCTRL_nMAct_a	Actual torque ($M_{max} = 2^{14}$)	
			5 MCTRL_nIAct_a	Actual motor current ($I_{max} = 2^{14}$)	
			6 MCTRL_nDCVolt_a	Actual DC-bus voltage ($2^{14} \triangleq$ 1000 V)	
			7 PosLatchDiff	Difference between actual position and position at touch probe (C6000)	
C6000	LatchPosition	0		Position at touch probe	📖 133
			-2147483647 {1 inc} 2147483647		
C6001	PosLatchAct	0		Activation: At touch probe (X6/DI2 = HIGH), the actual position is saved in C6000.	📖 133
			0 Not active		
			1 Wait for rising edge		
			2 Wait for falling edge		
			3 Wait for rising or falling edge		
C6002	TPReceived	0		Touch Probe (TP) recognised Read only	
			0 No TP recognised		
			1 TP with rising edge recognised		
			2 TP with falling edge recognised		
			3 TP with rising or falling edge recognised		

6.14.2 ”Homing” operating mode

Note!

- ► No homing with absolute value encoders.
- ► Use C0098 to set another position than the one transmitted by the absolute value encoder.

Settings

► Select ”Homing Mode”: C5000 = 6
– The code C5000 (4C77h) is written via parameter channel (SDO) (📖 345).

► Selection confirmation: C5001 = 6
– The selection of ”homing mode” is confirmed.
– The code C5001 (4C76h) must be read out via parameter channel (SDO).

► Start homing: Ctrl1.Bit12 = 1 (TRUE)

Operating mode-dependent bits in the control word Ctrl1

Bit	Name	Value	Response
1	Release limit switch		Only with user software ≤1.x (A-SW see nameplate):
		0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Activate ”Homing Mode”	0	Homing is not executed.
		0 → 1	Start of homing
		1	Homing is being executed.
		1 → 0	Homing is interrupted or completed.

Operating mode-dependent bits in the status word

Bit	Name	Value	Response
1	Homing is active	0	”Homing mode” is not active
		1	Homing is started by setting the control bit 12 = 1.
2	Reference known	0	Homing is being executed or has been aborted.
		1	Homing is completed. → Reference is known.
3	Reference error	0	No error during homing
		1	Error during homing →Function abort
4	Reference switch	0	Reference switch is not active
		1	Reference switch is active

6.14.3 ”Manual jog” operating mode

When commissioning for the first time, it may be required to travel the axis module without active master control for optimisation reasons (e.g. using GDC). This is enabled by manual control through settings in C4010 and C4040.

Settings

► Select control interface ”C4040”: C4010 = 3

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4010	Ctrl_Interf	0		Control interface selection	📖 130
			0 CAN1 (PDO1 with sync)	The control word is expected via the PDO CAN1_IN. Control is carried out via the CAN interface X4 (MotionBus). Control and status information is sent and received via CAN1_IN (PDO1).	📖 167 📖 165
			1 Without function		
			2 AIF X1 (PDO1 with sync)	Control via the automation interface (AIF) X1 is only possible in conjunction with the EMF2192IB EtherCAT communication module. (From Motion V3.0)	
			3 C4040 (control via codes)	Control is carried out via codes. The control word ”Ctrl1” is set via code C4040. The Global Drive Control (GDC) diagnostics and parameterisation software can for instance be used to change individual control bits in order to simulate the higher-level control for testing purposes.	
			4 Without function		

► Set manual jog parameters:
– C3020 (speed: 0.00 ... 100.00 % of C0011 (maximum speed))
– C3021 (acceleration time: 0.000 ... 999.000 s)
– C3022 (deceleration time: 0.000 ... 999.000 s)

► Select ”Manual Jog” mode: C5000 = 128
– The code C5000 (4C77h) is written via parameter channel (SDO) (📖 345).

► Selection confirmation: C5001 = 128
– The selection of the ”Manual Jog” mode is confirmed.
– The code C5001 (4C76h) must be read out via parameter channel (SDO).

► The drive does not respond to the control word Ctrl1 in code C4040. (No response to the CAN control word.)

Operating mode-dependent bits in the control word Ctrl1

► Hardware limit switch monitoring:

Bit	Name	Value	Response
1	Release limit switch		Only with user software ≤1.x (A-SW see nameplate):
		0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.

► Manual jog:
– Ctrl1.Bit13 (JogCW): 1 signal: Manual jog in positive direction.
– Ctrl1.Bit14 (JogCCW): 1 signal: Manual jog in negative direction.
– Both control bits = 1 signal: Stop.

The manual jog parameters set for speed, acceleration, and deceleration apply to manual jog.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4040	Control word Ctrl1	0			Control word Ctrl1 for C4010 = 3	📖 167 📖 165
			0 {1 bit} 1		Here, a drive can also be traversed without having a master control (e.g. using GDC).	
			Bit 0	Toggle		
			Bit 1	Res. ECS Motion ≤V1.x: deactivate hardware limit switch monitoring (release limit switch)		
			Bit 2	Brake-direct		
			Bit 3	Quick stop (QSP)		
			Bit 4	Monitor data selection LSB		
			Bit 5	Monitor data selection		
			Bit 6	Monitor data selection MSB		
			Bit 7	Controller enable		
			Bit 8	Res.		
			Bit 9	Controller inhibit (CINH)		
			Bit 10	TRIP-SET		
			Bit 11	TRIP-RESET		
			Bit 12	Operation mode specific (1)	See operating modes (bit 12 = LSB, bit 14 = MSB): ”IP Mode” (📖 161) ”Homing Mode” (📖 164) ”Manual Jog” (📖 165) ”Velocity Mode” (📖 167)	
			Bit 13	Operation mode specific (2)		
			Bit 14	Operation mode specific (3)		
			Bit 15	Res.		

6.14.4 ”Velocity” operating mode

The ”Velocity Mode” enables the higher-level control to transfer a speed profile to the ECSxM axis module via the MotionBus (CAN).

Settings

1. Select the control interface:
   – CAN interface: C4010 = 0
   – Automation interface (AIF): C4010 = 2

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4010	Ctrl_Interf	0			Control interface selection	📖 130
			0	CAN1 (PDO1 with sync)	The control word is expected via the PDO CAN1_IN. Control is carried out via the CAN interface X4 (MotionBus). Control and status information is sent and received via CAN1_IN (PDO1).	📖 167 📖 165
			1	Without function		
			2	AIF X1 (PDO1 with sync)	Control via the automation interface (AIF) X1 is only possible in conjunction with the EMF2192IB EtherCAT communication module. (From Motion V3.0)	
			3	C4040 (control via codes)	Control is carried out via codes. The control word ”Ctrl1” is set via code C4040. The Global Drive Control (GDC) diagnostics and parameterisation software can for instance be used to change individual control bits in order to simulate the higher-level control for testing purposes.	
			4	Without function		

2. Select ”Velocity Mode”: C5000 = 2
   – The code C5000 (4C77h) is written via parameter channel (SDO) (📖 345).
3. Selection confirmation: C5001 = 2
   – The selection of ”Velocity Mode” is confirmed.
   – The code C5001 (4C76h) must be read out via parameter channel (SDO).
4. Activate ”Velocity mode”: Ctrl1.Bit12 = 1 (TRUE)
5. Definitions from the master control to the axis module:
   – Velocity signal (*CAN1_nInW1_a* or *AIF1_nInW1_a*)
   – Ramp times (acceleration, deceleration and stop times)

Operating mode-dependent bits in the control word Ctrl1

Bit	Name	Value	Response
1	Release limit switch		Only with user software ≤1.x (A-SW see nameplate):
		0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Activate ”Velocity Mode”	0	Speed profile of the master control is not executed.
		0 → 1	Start of the speed profile
		1	Speed profile is executed.
		1 → 0	Speed profile is interrupted or executed.

6.15 Controller enable (CINH = 0)

The controller will only be enabled internally if no signal sources relevant for the controller inhibit (CINH) are activated (i.e. CINH-signal sources = 0).

The following table shows the conditions for controller enable:

Source of the Controller inhibit	Controller inhibit	Controller enable	Note
Terminal X6/SI1	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	For controller enable, X6/SI1 must be = HIGH **and** X6/SI2 must be = HIGH.
Terminal X6/SI2	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	
C0040	C0040 = 0	C0040 = 1	
Operating module/keypad	STOP key	RUN key	Inhibiting with STOP key is only possible if the STOP key is assigned with "CINH" via C0469.
Fault	• In case of TRIP • In case of message	No fault active	For check see 📖 263.
Control word • MotionBus (📖 131) • C4040	C3153/Bit 9 = 1 C4040/Bit 9 = 1	C3153/Bit 9 = 0 C4040/Bit 9 = 0	GDC function key: • <F9> key (inhibit/stop controller) **Note:** With ECS-M, the controller is enabled via the master control!
Fieldbus module	See operating instructions for the respective fieldbus module.		

LED status displays

LED		Operating state
Red	Green	
Off	On	Enable through master control • X6/SI1 = HIGH • X6/SI2 = HIGH
Off	Blinking	No enable through master control • X6/SI1 = HIGH • X6/SI2 = HIGH

Note!

All signal sources act like a series connection of switches which are independent of each other.

6.16 Following error monitoring (C3030, C3031)

Following errors are monitored in all motion states of the drive.

To configure the monitoring of following errors use C3030/C3031 (following error limits) and C3032/C3033 (reactions to following errors) in the GDC parameter menu under **Motion → Machine parameter**.

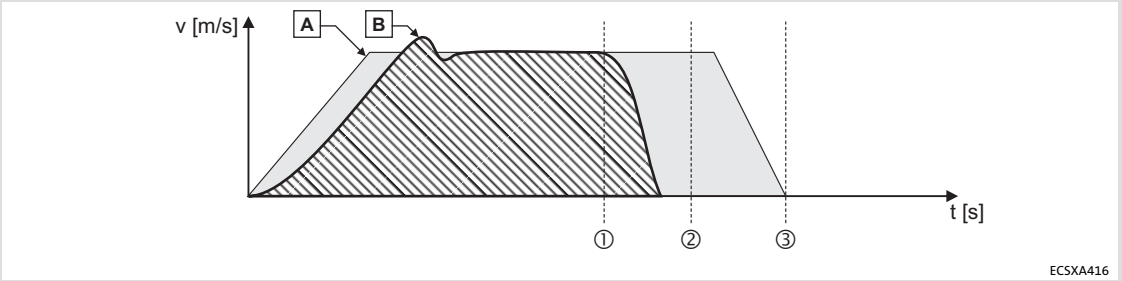


Fig. 6-31 Following error

- A Setpoint speed profile (the area below the curve corresponds to the path)
- B Profile travelled
- ① The drive decelerates, a difference between set position and actual position arises.
- ② Following error tolerance is exceeded.
- ③ End of the set profile

If the difference between set position and actual position is higher than the following error limit, the higher-level control must activate a reaction according to the set error class.

- ► When the first following error limit in C3030 is reached, the first error reaction set in C3032 is activated.
- ► When the first following error limit in C3030 is reached, the second error reaction set in C3033 is activated.

Note!

For correct monitoring of following errors set:

- ► Limit value in C3031 > limit value in C3030 **and**
- ► error reaction in C3033 stronger than error reaction in C3032

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3030	FolloErrWarn	400000				Following error limit for enabling a warning	📖 170
			0	{1 inc}	2140000000		
C3031	FolloErrFail	800000				Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	📖 170
			0	{1 inc}	2140000000		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C3032	FollErr1reac	2		First reaction when following error limit has been reached	📖 170
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		
C3033	FollErr2reac	4		Second reaction when following error limit has been reached	📖 170
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

6.17 Evaluating and retracting from hardware limit switch

6.17.1 Evaluating hardware limit switches

- ► Ensure a fail-safe design of the hardware limit switches (NC contact, LOW active).
- ► The active level is set with C0114/x.
- ► A response to active hardware limit switches can be set via C3175.
- ► If a hardware limit switch is activated, the drive reacts as set and a fault message is displayed.

  Positive hardware limit switch is activated:

  – Fault no. x400 (”Pos HW End”)

  – Status bit 5 = 1

  Negative hardware limit switch is activated:

  – Fault no. x401 (”Neg HW End”)

  – Status bit 6 = 1

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C3175	HW EndReac	4		Reaction, when a hardware limit switch is activated.	📖 172
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

6.17.2 Retracting from hardware limit switches

1. Only with user software ≤1.x(A-SW see nameplate):
   Deactivate limit switch monitoring: Ctrl1.Bit1 = 1 (TRUE)
   Retracting from an activated hardware limit switch is enabled.
2. Reset fault message: Set Ctrl1.Bit11 = 1.
3. Activate operating mode: Ctrl1.Bit12 = 1 (TRUE)

Note!

For retracting, return the drive to the travel range. The active hardware limit switch must not be overtravelled while retracting.

- ► Positive hardware limit switch is active → Retracting in negative direction
- ► Negative hardware limit switch is active → Retracting in positive direction

4. Only with user software ≤1.x (A-SW see nameplate):
   Activate limit switch monitoring: Set Ctrl1.Bit1 = 0 (FALSE).

6.18 Quick stop (QSP)

The quick stop function serves to brake the drive to standstill within an adjustable deceleration time. The function is triggered by:

- Control word bit 3 (*QSP*) = 1 (TRUE)
- LOW level at X6/DI1

The deceleration time for the braking process can be set with C0105 in the GDC parameter menu under **Motion → Machine parameter**.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 173
			0	QSP not active			
			1	QSP active			
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 173
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Behaviour when reaching the current limit

The actual quick stop deceleration time prolongs if C0105 is set so shortly that the controller must operated at its current limits (I_{max}, M_{max}). The following error occurring in this case in the position control loop is automatically modified internally so that the drive does not reverse when reaching standstill to process the following error but rests at standstill. Thus, the position control loop provides for a drift-free standstill at quick stop (QSP).

Tip!

The quick stop function may require a setting of the position controller gain under C0254.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	
			0.0000	{ 0.0001}	3.9999		

6.19 Operation with motors from other manufacturers

6.19.1 Entering motor data manually

If you use motors of other manufacturers together with the ECS axis module, you have to enter the motor data manually. The GDC includes the required codes in the parameter menu under **Motor/feedback systems→ → Motor adjustment**.

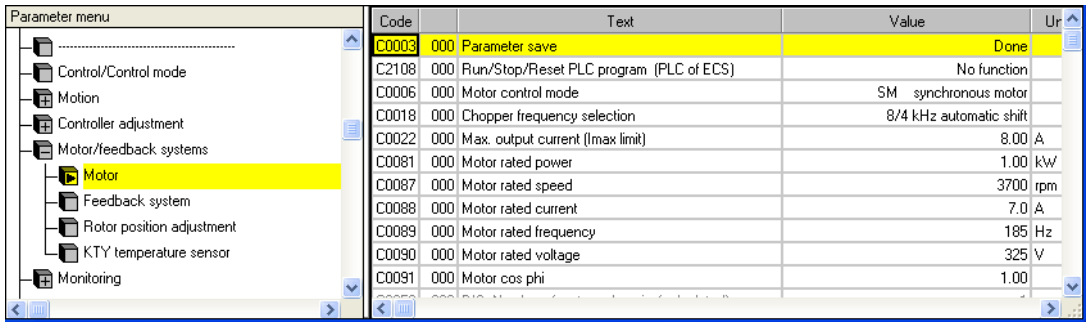


Fig. 6-32 GDC view: Manual setting of the motor data

Code		Possible settings		IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection	
[C0006]	Op mode	1		Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1 Servo PM-SM	Servo control of synchronous motors
			2 Servo ASM	Servo control of asynchronous motors
C0018	fchop	2		Switching frequency
			1 4 kHz sin	4 kHz permanent PWM frequency
			2 8/4 kHz sin	8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0022	Imax current	→		I_{max} limit
			0 {0.01 A}	→ Device-dependent list Max. current can be gathered from the technical data.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive			
			1	Active			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0128	Tau motor	5.0				Thermal time constant of the motor	237
			0.5	{0.1 min}	25.0	For calculating the $I^2 \times t$ disconnection	
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	178
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

6.19.2 Checking the direction of rotation of the motor feedback system

In GDC, you can find the parameters and codes to be set in the parameter menu under **Motor/Feedback systems → Feedback system**.

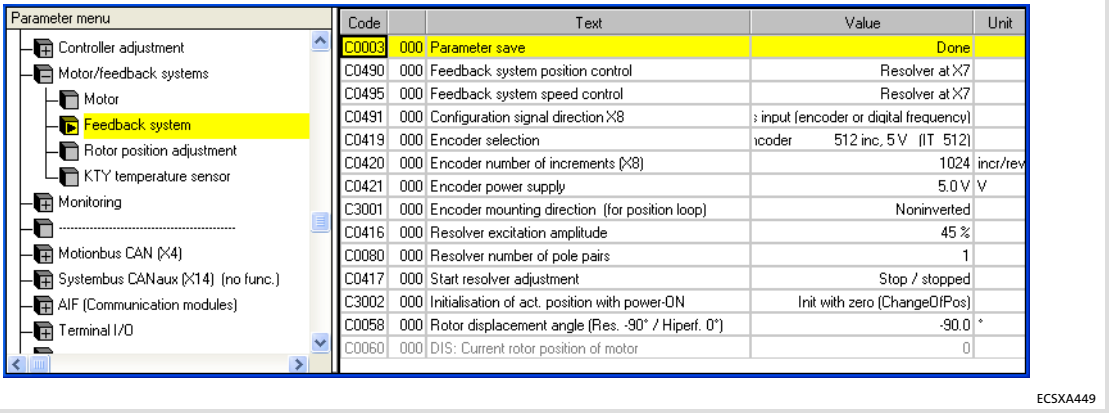


Fig. 6-33 GDC view: Feedback system

C0060 indicates the rotor position within one revolution as a numerical value between 0 and 2047. The indicated rotor position is derived from the selected position encoder (C0490) with reduced resolution.

Evaluation:

If the motor encoder (resolver) is set as position encoder (C0490) and the rotor rotates in CW direction (view on the front of the motor shaft), the numerical value must rise. If the values are falling, reverse the Sin+ and Sin- connections.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

6.19.3 Adjusting current controller

For an optimum machine operation, the current controller settings must be adapted to the electrical motor data.

The parameters of the current controller depend on the electrical motor data. They do not depend on mechanical data as with the speed and position control circuit. This is why the default current controller settings of the "GDC motor data input assistant" can usually be used. A current controller adjustment is only required for third-party motors and for Lenze motors only in special cases.

Leakage inductance and stator resistance of the motor are known:

The gain of the current controller V_p and the integral-action time of the current controller T_n can be calculated by approximation:

Current controller gain (V_p)	Integral-action time of the current controller (T_n)
$V_p = \frac{L1_S}{250\ \mu s}$	$T_n = \frac{L1_S}{R1_S}$

$L1_S$ Motor leakage inductance

$R1_S$ Motor stator resistance

Note!

Depending on the leakage inductance of the motor, the calculated values can be outside the adjustable range. In this case

► set a lower gain and a higher integral-action time;

► adjust the current controller metrologically (📖 179).

For applications with high current controller dynamics the pilot control of the current controller outputs can be activated with C0074 (C0074 = 1). For this, it is vital to enter the correct values for the stator resistance (C0084) and leakage inductance (C0085).These can be obtained from the data sheet of the motor used!

Leakage inductance and stator resistance of the motor are not known:

The current controller can be optimised metrologically with a current probe and an oscilloscope. For this, a test mode is available in which the current C0022 x √2 flows in phase U after controller enable.

Stop!

Avoid damage to the motor and machine

- ► During the current controller adjustment, the motor must be freely rotatable.
- ► The test current must not exceed the maximum permissible motor current.
- ► Always adjust the current controller at a switching frequency of 8 kHz.

Observe the current step in phase U to adjust the current controller.

Setting sequence

1. Select 8 kHz as switching frequency (C0018 = 2).
2. Select the test current under C0022:
   – Start with a low current value, e.g. half the rated motor current.
3. Activate the test mode with C0418 = 1.
4. Enable the controller. (📖 169)
   – Adjust the synchronous motor.
   – The asynchronous motor remains at standstill.
5. Enable and inhibit the controller several times in a row changing the current controller gain (C0075) and the current controller adjustment time (C0076) such that the current characteristic is free of harmonics.
6. After the adjustment has been completed, deactivate the test mode with C0418 = 0.
7. If required, change the switching frequency under C0018.

6.19.4 Effecting rotor position adjustment

Note!

Resolver / absolute value encoder with Hiperface® interface

- If the rotor zero phase is not known, the rotor position only has to be adjusted once during commissioning.
- For multi-turn absolute value encoders, the traversing range must be within the display range of the encoder (0 ... 4095 revolutions) if the traversing range is limited.

TTL incremental encoder / sin/cos encoder with zero track

- If these encoder types are used for the operation of synchronous motors, the rotor position must be adjusted every time the low-voltage supply is switched on.

The rotor position must be adjusted if:

- A motor from another manufacturer is connected to the controller.
- Another encoder has been mounted subsequently.
- A defective encoder has been replaced.

The rotor position can only be adjusted if:

- The resolver is polarised correctly.
- The current controller has been adjusted.

The GDC contains the parameters or codes to be set on the parameter menu under **Motor/Feedb. → Rotor position adjustment**:

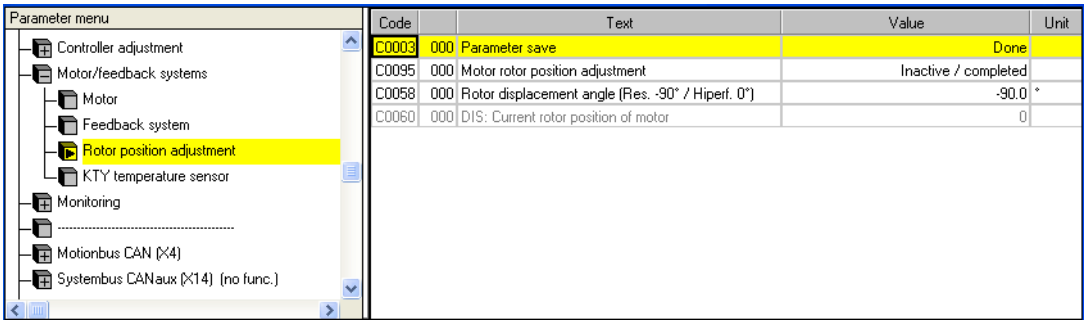


Fig. 6-34 Rotor position adjustment in GDC

Setting sequence

1. Inhibit controller. (📖 169)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
2. Unload motor mechanically.
   – Separate the motor from the gearbox or machine so that it can rotate freely.
3. Open holding brake (if available).
4. Activate rotor position adjustment with C0095 = 1.
5. Enable controller. (📖 169)
   – X6/SI1 = HIGH and X6/SI2 = HIGH and press the <F8> key in GDC.
   The rotor position adjustment program of the controller is started:
   – The rotor rotates half a revolution in 16 steps (for resolver with 1 pole pair: 180° electrically ≙ 180° mechanically).
   – After one revolution, C0095 is automatically reset to ”0”.
   – The rotor zero phase is stored under C0058. (For absolute value encoders (Hiperface®, single-turn/multi-turn) at X8, C0058 is always ”0”.)



Danger!

Uncontrolled drive movements after an Sd7 fault with absolute value encoders

If absolute value encoders are used and the rotor position adjustment is completed with the fault message ”Sd7” (📖 270), the rotor position could not be assigned to the feedback system. In this case, the drive may carry out uncontrolled movements after controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Repeat rotor position adjustment (starting with step 1).

► Check wiring and interference immunity of the encoder at X8.

6. Inhibit controller. (📖 169)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
7. Save the data determined by the controller with C0003 = 1.



Tip!

The values for C0058 and C0095 are only displayed in GDC if you place the bar cursor on them and read back the code using function key <F6>.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive			
			1	Active			

6.20 Optimising the drive behaviour after start

For applications with high current controller dynamics, the pilot control for the current controller can be adjusted under C0074:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0074	Dynamics	0 {1}		Feedforward control of the current controllers for a higher dynamic performance	178
			0 Normal		
			1 Enhanced		

6.20.1 Speed controller adjustment

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not "noisy".
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

In GDC, you can find the codes for adjusting the speed controller in the parameter menu under **Controller settings → Speed/position**.

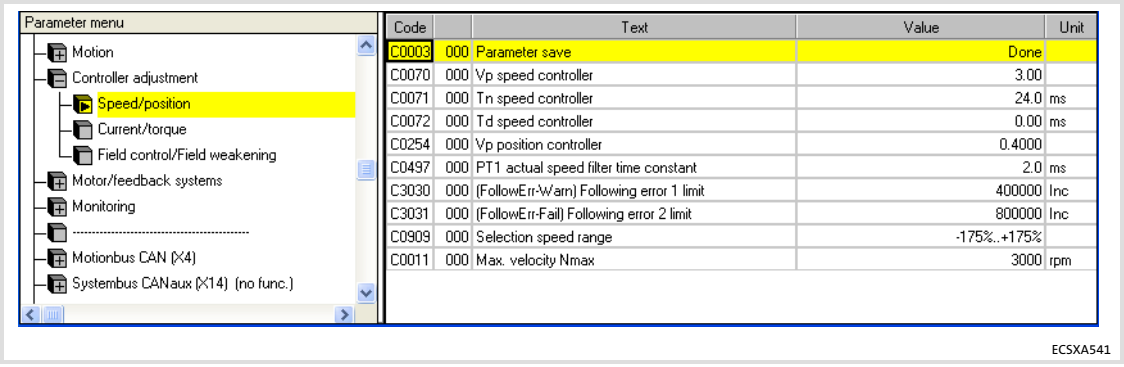


Fig. 6-35 GDC view: Adjustment of the speed controller

Parameter setting

► Set the proportional gain (V_{pn}) via C0070:
– Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
– Increase C0070 until the drive becomes instable (pay attention to engine noises).
– Reduce C0070 until the drive runs stable again.
– Reduce C0070 to approx. half the value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 183
			0.00	{ 0.01}	127.99		

► The reset time (T_{nn}) is set via C0071:
– Reduce C0071 until the drive becomes instable (pay attention to engine noises).
– Increase C0071 until the drive runs stable again.
– Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 183
			1.0	{0.5 ms}	6000.0		

► The derivative gain (T_{dn}) is set via C0072:
– Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 183
			0.0	{0.1 ms}	32.0		

6.20.2 Adjustment of field controller and field weakening controller

Stop!

- ► Field weakening operation is only possible with asynchronous motors.
- ► The available torque is reduced by the field weakening.

In order to optimise the machine operation in the field weakening range, you can set the field controller and the field weakening controller accordingly.

Field weakening occurs if the maximum output voltage of the controller is reached with rising speed and cannot be increased further.

The maximum possible output voltage depends on

- ► the respective DC-bus voltage (mains voltage).
- ► the voltage reduction through the controller load.
- ► the voltage drop at the mains choke.

Experience values for the voltage drop under the influence of the mains choke and inverter are between 6 ... 10 %.

$$\text{Max. output voltage [V]} = \text{mains voltage [V]} - \text{voltage drop [\%]}$$

The GDC contains the codes for adjusting the field controller/field weakening controller in the parameter menu under **Controller adjustment → Field control/Field weakening**:

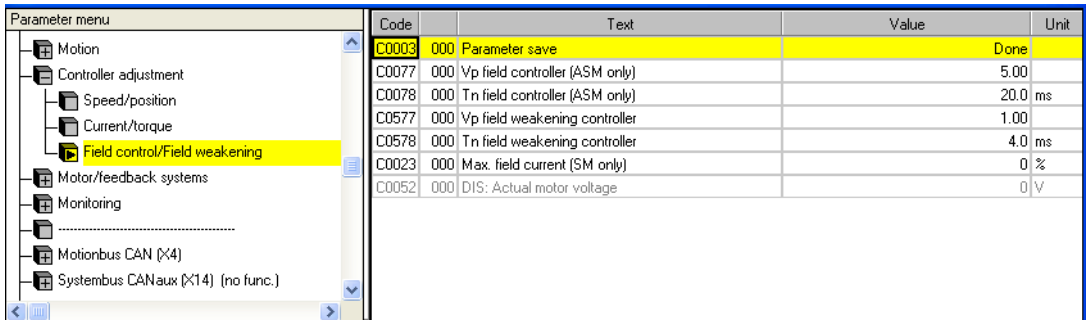


Fig. 6-36 GDC view: Field controller / field weakening controller adjustment

6.20.2.1 Adjusting the field controller

The field controller settings depend on the motor data.

Setting sequence

1. Stop the PLC program: C2108 = 2
   – As of operating system version 7.0 (see nameplate), this is no longer necessary, because C0006 (see 2.) can also be written when the PLC program is running!
2. Set motor control for asynchronous motors: C0006 = 2
   – The motor nameplate data must be entered correctly!
3. Read rotor time constant T_r (C0083).
4. Read magnetising current I_d (C0092).
5. Calculate field controller gain V_{pF} and enter in C0077.

$$V_{pF} = \frac{T_r\,(C0083) \cdot I_d\,(C0092)}{875\ \mu s \cdot I_{max}}$$

I_{max} Maximum current of axis module

6. Enter rotor time constant T_r as field controller integral-action time T_{nF} in C0078.

6.20.2.2 Field weakening controller adjustment

- The field weakening controller determines the speed performance of the asynchronous motor in the field weakening range.
- The field weakening controller can only be set correctly when the system constellation has been completed and is under load.

Note!

An excessive value of I_{max} (C0022) can cause a malfunction of the drive in the field weakening range of the asynchronous motor. For this reason, the current is limited in terms of speed in the field weakening range. The limitation has a 1/n characteristic and is derived from the motor parameters.

The limitation can be adjusted with the stator leakage inductance (C0085):

- Low values cause a limitation at higher speeds.
- Higher values cause a limitation at lower speeds.

Setting sequence

1. Set gain V_p: C0577 = 0.01 ... 0.99
   – V_p must not be ”0” (deactivates the field weakening controller)!
2. Set integral-action time T_n: C0578 = 1 ... 40 ms
3. Select a speed setpoint so that the motor is operated in the field weakening range.
4. Observe the speed curve
   – If the speed takes an irregular course, the field weakening controller must be readjusted.
   – The field weakening controller must be provided with a distinct integral action.

Tip!

Parameter setting with a distinct I component can improve the drive behaviour when changing to the field weakening range.

For this purpose, set the gain (V_p) in C0577 to at least 0.01.

The following applies:

- P component = V_p = C0577
- I component = V_I = C0577/C0578

If the P component (V_p) is reduced via C0577, adapt the reset time C0578 accordingly to keep the I component (V_I).

6.20.3 Resolver adjustment

When adjusting the resolver, mainly component tolerances of the resolver evaluation are compensated in the device. No resolver error characteristic is accepted. The resolver adjustment is only required if the speed behaviour is irregular despite optimised settings of the speed and position control loop.

The resolver adjustment is started via code C0417 = 1. Then the resolver is adjusted automatically during the next 16 motor revolutions.

If it is not possible to adjust the resolver (due to a fault or a defective cable), the original adjustment values can be restored with C0417 = 2.

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/feedback systems → Feedback system**.

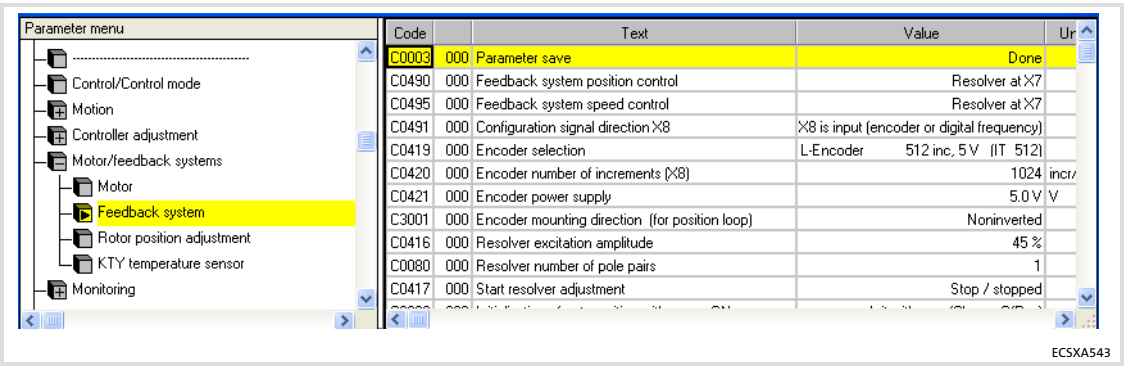


Fig. 6-37 GDC view: Resolver adjustment

7 Parameter setting

7.1 General information

- Controllers and power supply modules can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter "Commissioning" (📖 92).
- The parameters for the functions are stored in numbered codes:
  - The codes are marked in the text with a "C".
  - The code table in the appendix (📖 279) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a "reference book".

Parameter setting with XT keypad or PC/laptop

Detailed information on parameter setting with the XT keypad can be found in the following chapters.

Detailed information ...

on the parameterisation by means of a PC/laptop can be found in the documentation for the "Global Drive Control" (GDC) parameterisation and operating program.

In addition to parameter setting, the XT keypad or PC/laptop serves to:

- Control the controller (e. g. inhibiting or enabling)
- Select the setpoints
- Display operating data
- Transfer parameter sets to other controllers (only with PC/laptop).

Parameter setting with a bus system

Detailed information ...

on the parameterisation with a bus system can be found in the documentation of the communication module to be applied (📖 354).

7.2 Parameter setting with ”Global Drive Control” (GDC)

With the ”Global Drive Control” (GDC) parameterisation and operating program, Lenze provides a plain, concise and compatible tool for the configuration of your application-specific drive task with the PC or laptop:

- The GDC input assistant offers a comfortable motor selection.
- The menu structure supports the commissioning process by its clear structuring.

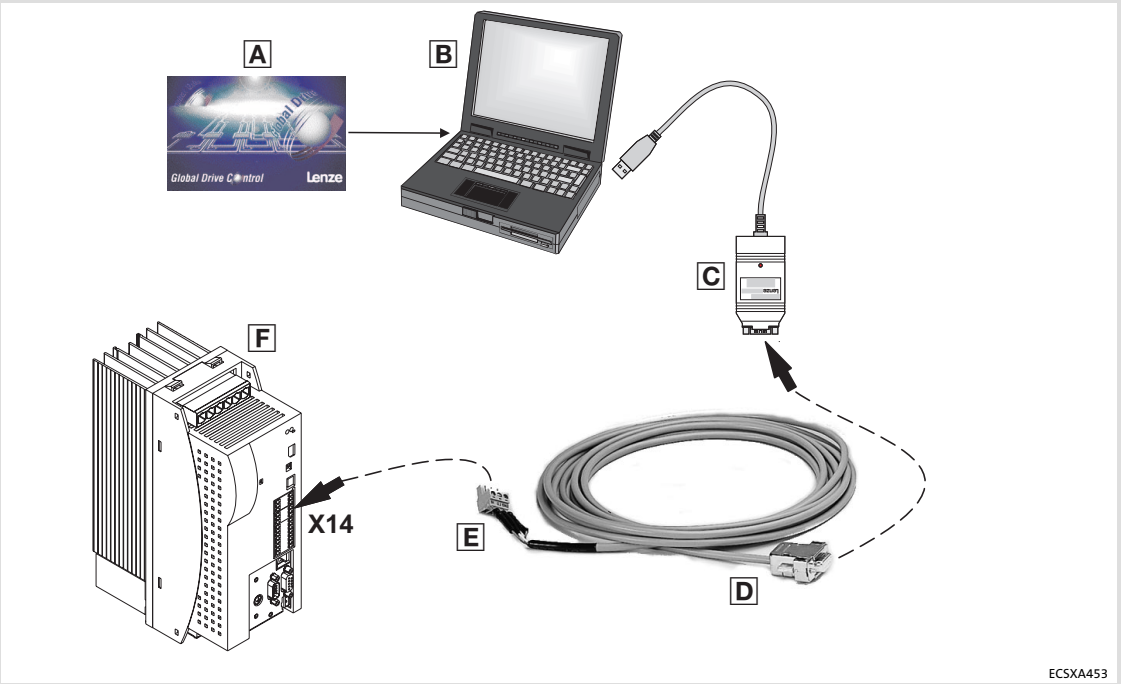


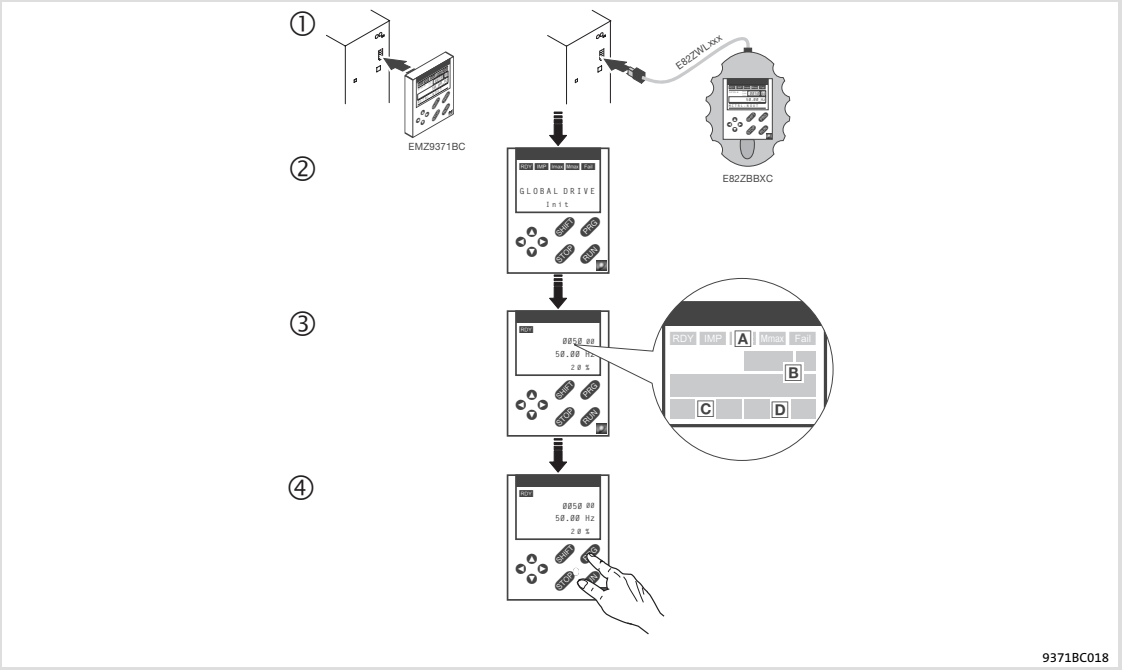
Fig. 7-1 Using the GDC

- A Lenze parameter program ”Global Drive Control” (GDC)
- B PC or laptop
- C PC system bus adapter (EMF2173IB/EMF2177IB) with connecting cable
- D Sub-D plug with 3-pole cable
- E 3-pole plug (CAG – CAL – CAH) from ECSZA000X0B connector set
- F ECSxS/P/M/A axis module

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as accessories.
A complete description is given in the documentation on the keypad.

7.3.1 Connecting the keypad



① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad 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 status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined under C0004
④ PRG must be pressed to leave the operation level.

7.3.2 Description of the display elements

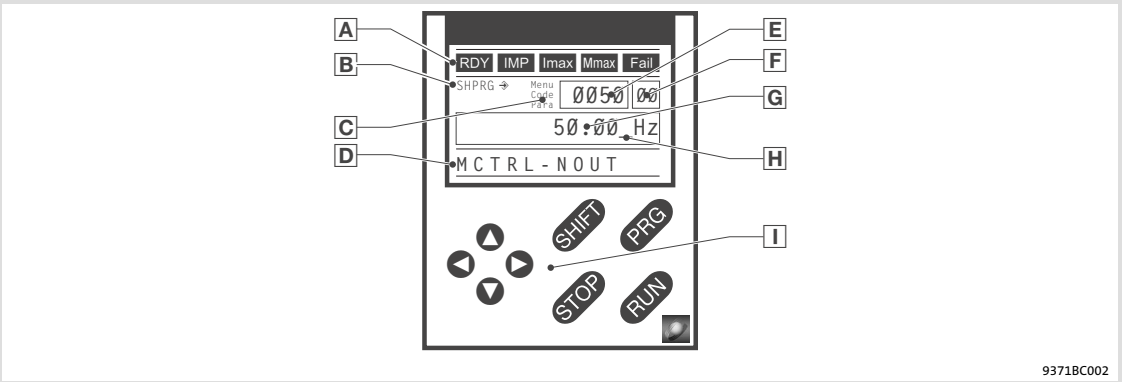


Fig. 7-2 Keypad front view

A	**Status displays**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit active	Power outputs inhibited
	Imax	Adjusted current limitation is exceeded in motor mode or generator mode	
	Mmax	Speed controller 1 within its limitation	• Drive is torque-controlled • Only active for operation with Lenze devices of the 9300 series!
	Fail	Active fault	
B	**Parameter acceptance**		
	Display	**Meaning**	**Explanation**
	↵	Parameter is accepted immediately	The device immediately operates with the new parameter value.
	SHPRG ↵	The parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after being confirmed.
	SHPRG	When the controller is inhibited, the parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after the controller has been released again.
	None	Display parameters	Cannot be changed.
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Active menu level	• Selection of main menu and submenus • No menu for ECSxE power supply module
	Code	Active code level	Selection of codes and subcodes
	Para	Active parameter level	Change of parameters in the codes or subcodes
	None	Active operating level	Display of operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	Alphanumerical	Contents of the menus, meaning of the codes and parameters	
		Display of C0004 in % and the active fault in the operating level	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Two-digit subcode number	
G	**Parameter value**		
	Parameter value with unit		
H	**Cursor**		
	The figure over the cursor can be changed directly in the parameter level.		
I	**Function keys**		
	For description see the following table.		

7.3.3 Description of the function keys

Note!

Key combinations with SHIFT:

Press SHIFT and keep it pressed, then press second key in addition.

Key	Function			
	Menu level [1]	Code level	Parameter level	Operating level
PRG		Change to parameter level	Change to operating level	Change to code level
SHIFT PRG	Load predefined configurations in the menu "Short setup" [2]		Accept parameters when SHPRG ↵ or SHPRG is displayed	
▲ ▼	Change between menu items	Change code number	Change figure over cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of figure over cursor	
▶ ◀	Change between main menu, submenus and code level		Cursor to the right Cursor to the left	
RUN	Cancel function of STOP key, the LED in the key goes out.			
STOP	Inhibit the controller, LED in the key lights up.			
	Reset fault (TRIP reset): 1. Remove cause of malfunction 2. Press STOP 3. Press RUN			

1) No menu for ECSxE power supply module

2) Only active when operating Lenze devices of the 8200 vector or 8200 motec series.

7.3.4 Changing and saving parameters

All parameters for the axis module/power supply module parameterisation or monitoring are stored in codes. The codes are numbered and marked with a ”C” in the documentation. Some codes store the parameters in numbered ”subcodes” to provide a clear structure for parameter setting (e.g. C0517 user menu).

Stop!

Your settings have an effect on the current parameters in the main memory. You must store your settings as a parameter set to prevent that they will get lost when switching the mains!

Step			Keys	Action
1.	Select menu		▲ ▼ ▶ ◀	Select the desired menu with arrow keys.
2.	Change to code level		▶	Display of first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to parameter level		PRG	
5.	If SHPRG is displayed, inhibit controller		STOP	The drive is coasting.
6.	Change parameter			
		A	▶ ◀	Move cursor under the digit to be changed
		B	▼ ▲	Change digit
			SHIFT ▼ SHIFT ▲	Change digit quickly
7.	Accept changed parameter			
	Display SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept parameter Display ”OK”
	Display →		-	The parameter was accepted immediately.
8.	If necessary, enable controller		RUN	The drive should be running again.
9.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display of the code with changed parameters
10.	Change further parameters			Restart the ”loop” at step 1. or step 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select Code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to parameter level Display ”0” and ”Ready”
	Select parameter set in which the parameters are to be saved permanently	C	▶	Save as parameter set 1: ⇨ set ”1” ”Save PS1”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved.
12.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display C0003 ”PAR SAVE”

8 Configuration

By configuring the axis module you can adapt the drive system to your application. The axis module can be configured via the following interfaces:

- X1 – AIF (automation interface)
  - For connection of the keypad XT or communication modules (📖 354) which serve to access the codes.
- X14 – system bus interface (CAN-AUX)
  - PC interface/HMI for parameter setting and diagnostics (e.g. with the Lenze parameter setting and operating program "Global Drive Control")
    or
  - Interface to a decentralised I/O system

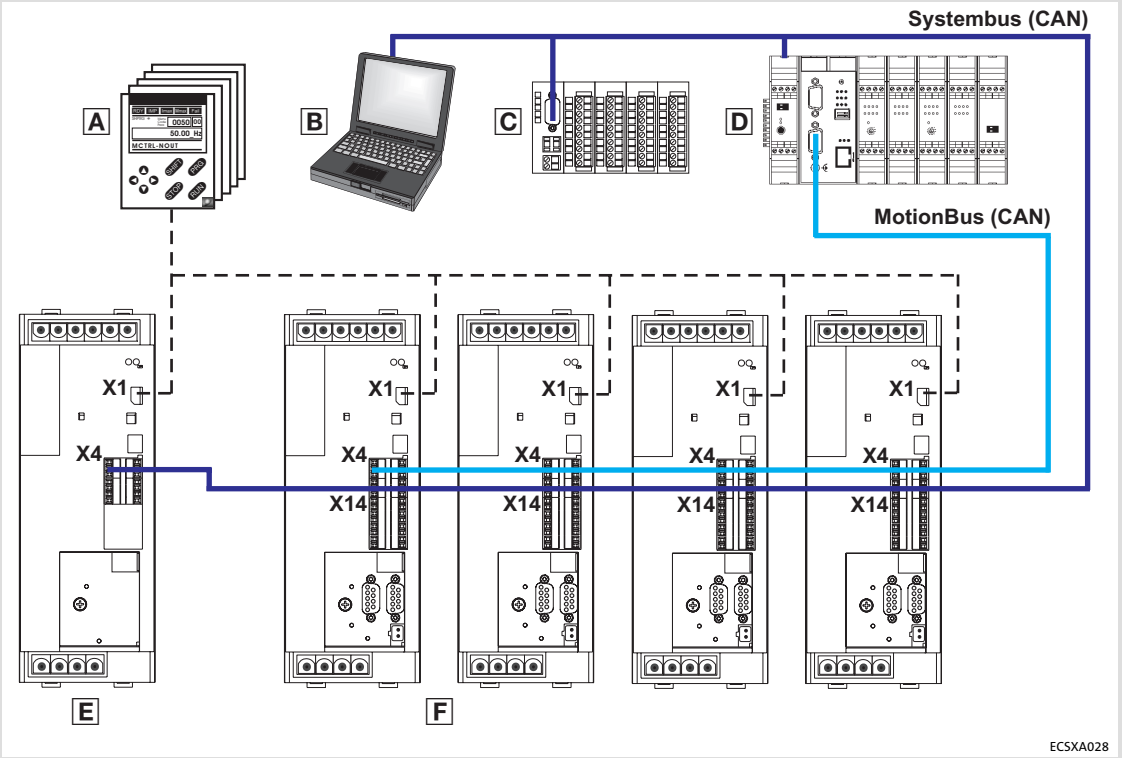


Fig. 8-1 Example: Wiring of the MotionBus (CAN) and system bus (CAN)

- A Keypad XT or another communication module
- B PC/laptop or HMI
- C Decentralised I/O system
- D Higher-level host system / MotionBus control
- E ECSxE... power supply module
- F ECSxS/P/M/A... axis module

8.1 Configuring MotionBus/system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Note!

ECSxM... axis modules

- ► only use the channels **CAN1_IN**and **CAN1_OUT** for communication via the MotionBus (CAN) interface X4.
- ► only the parameter data channels (SDO) are supported for the system bus (CAN) – interface X14 (CAN-AUX) –.

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 333).

8.1.1 Setting CAN node address and baud rate

For the CAN interfaces **X4** (MotionBus) and **X14** (system bus), the CAN node address and the baud rate can be set via the DIP switch **S1** or via codes.

- ► The (address) switch **1** serves to define whether the set CAN node address shall only apply to the interface **X4**(MotionBus) or for both interfaces **X4** (MotionBus) and **X14** (system bus).
- ► If one of the (address) switches **2 ... 7** of the DIP switch is switched on (ON), and the low-voltage supply is connected, the setting of the DIP switch is evaluated and written into C0350/C2450 (CAN node address) and C0351/C2451 (baud rate).
- ► If the (address) switches **2 ... 7** are switched off (OFF), the switch position is not evaluated. The settings from C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are accepted.
- ► The settings for the baud rate with the switches **8 ... 10**are only written into C0351 (X4 CAN) when the low-voltage supply is switched on.
- ► The baud rate for X14 CAN-AUX can only be set via C2451.

8.1.1.1 Settings via DIP switch

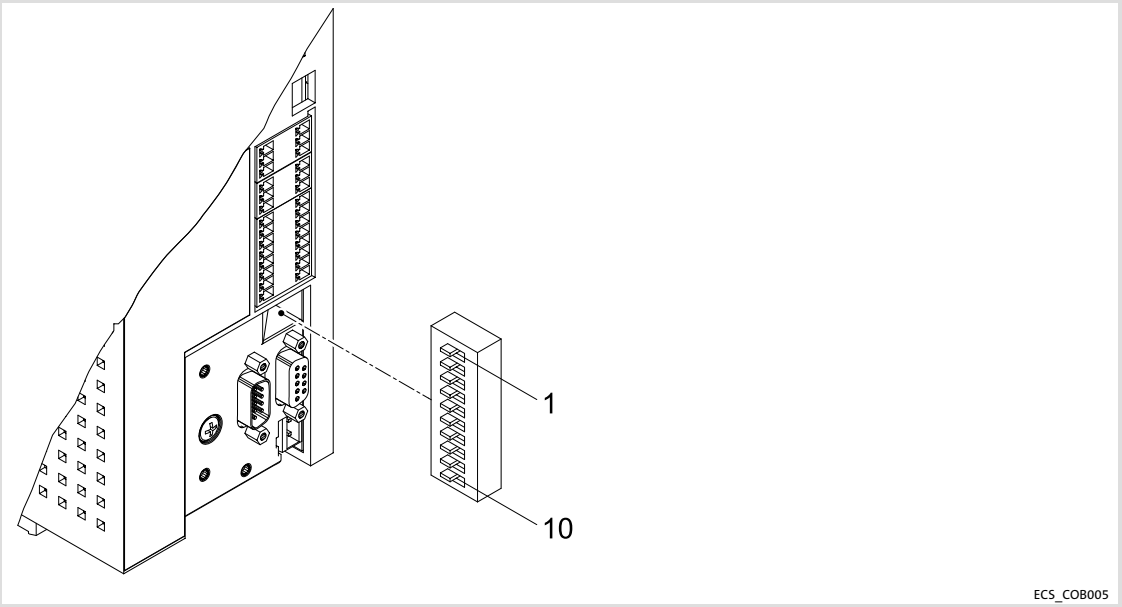
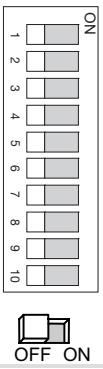


Fig. 8-2 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

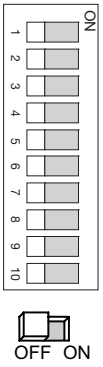
The node address is set by means of switches 2 ... 7 of the DIP switch. Specific values are assigned to the switches. The sum of the values specifies the node address to be set (see example).

Switch		Value	Example	
			Switching status	Node address
	S1	**OFF:** Node address setting is only valid for CAN (C0350 is overwritten if one of switches S2 ... S7 is in ON position.) **ON:** Node address setting is valid for CAN and CANaux (C0350 and C2450 are overwritten if one of switches S2 ... S7 is in ON position.)		-
	S2	32	**ON**	32 + 16 + 8 = **56**
	S3	16	**ON**	
	S4	8	**ON**	
	S5	4	OFF	
	S6	2	OFF	
	S7	1	OFF	

Baud rate setting

Note!

The baud rate must be set identically for all CAN nodes.

Switch		Baud rate [kbit/s]				
		1000	500	250	125	50
	8	**ON**	OFF	OFF	OFF	OFF
	9	OFF	OFF	OFF	**ON**	**ON**
	10	OFF	OFF	**ON**	OFF	**ON**

8.1.1.2 Settings via codes

Note!

- ► The settings in C0350 (CAN node address) and C0351 (baud rate) are only used if the (address) switches **2 ... 7** of the DIP switch **S1** are switched off (OFF).
- ► If only one (address) switch **2 ... 7** is switched on (ON), the settings of the DIP switch **S1** usually apply.
- ► The baud rate (C0351) must be set identically for all CAN bus nodes.
- ► If the Lenze setting has been loaded via C0002,
  - – C0351 is set to 0 (500 kbit/s);
  - – you have to reset the baud rate (C0351) and the CAN node address (C0350).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0350	CAN address	32		Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 197) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 197 📖 351
			1 {1} 63		
C0351	CAN baud rate	0 {4}		Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required. ● When the Lenze setting is loaded via C0002, C0351 is set to 0 (500 kbit/s).	📖 197
			0 500 kbps		
			1 250 kbits/sec		
			2 125 kbit/s		
			3 50 kbps		
			4 1000 kbit/s		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- ► Renewed switch-on of the 24 V low-voltage supply
- ► Reset node via the bus system (by the network management (NMT))
- ► Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.2 Individual addressing

C0353 can be used to determine whether the identifier (COB-ID) is generated from a basic identifier (📖 351) and the node address in C0350 or individually with an ”ID offset”.

The ”ID offset” can be specified via C0354. Thus, the identifier for all process data input and output objects is as follows:

Identifier (COB-ID) = 384 + ID offset (C0354)

Note!

The identifier of the telegram to be sent must correspond to the identifier of the process data input object to be addressed.

To make the alternative node address valid, set the corresponding subcode of C0353 = 1.

Bus	code	Value	The addresses are defined by
MotionBus (CAN)	C0353/1	0	C0350 (Lenze setting)
		1	C0354/1 for CAN1_IN C0354/2 for CAN1_OUT
	C0353/2	0	C0350 (Lenze setting)
		1	C0354/3 for CAN2_IN C0354/4 for CAN2_OUT
	C0353/3	0	C0350 (Lenze setting)
		1	C0354/5 for CAN3_IN C0354/6 for CAN3_OUT

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 201
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 201
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.3 Defining boot-up master in the drive system

If the bus initialisation and the related state change from ”Pre-Operational” to ”Operational” is not carried out by a higher-level host system (PLC), another node can be determined as boot-up master to carry out this task.

The master functionality is only required for the initialisation phase of the drive system. C0356 serves to set a boot up time for the master for the initialisation phase (📖 204).

By means of the NMT telegram *start_remote_node* (broadcast telegram) **all** nodes are shifted to the NMT-state ”Operational” by the master. A data exchange via the process data objects can only be effected in this state.

The configuration is carried out via C0352.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0352	CAN mst	0		Boot-up master/slave configuration for CAN bus interface X4	📖 203
			0 Slave		
			1 Master boot-up	Device is active as CAN boot-up master.	
			2 Master node guarding		
			3 Slave heartbeat producer		
			4 Slave node guarding		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.4 Setting of boot-up time/cycle time

Boot-up time (C0356/1) setting

In a CAN network without higher-level control (PLC), a bus node (boot-up master) has to initialise the CAN network. If the 24 V low-voltage supply is switched on, the boot-up time elapses. After the boot-up time has elapsed, the NMT telegram for initialising the CAN network is sent by the boot-up master and the process data transfer is started.

- Only valid if C0352 = 1 (master).
- Normally the Lenze setting (3000 ms) is sufficient.
- State change from ”Pre-operational” to ”Operational”

Cycle time for process output data (C0356/2...3)

Transmission cycle time for the process data objects CAN2...3_OUT (C0356/2...3) in cyclic operation (without sync)

- Setting ”0” = event-controlled data transmission
  The output data will only be sent if a value in the output object changes.

Activation delay for process output data (C0356/4)

Delay time for initial transmission of the process data objects CAN2...3_OUT after the CAN bus changed from ”Pre-Operational” to ”Operational” NMT state.

After the delay time has elapsed, the process data objects CAN2...3_OUT or CANaux2...3_OUT will be sent for the first time.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 204
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1



Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.5 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 197)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 351)
  – Individual addressing (📖 201)
- Change of the master/slave boot-up configuration (📖 203)

A reset node can be made by:

- Renewed switch-on of the 24 V low-voltage supply
- the bus system (via the network management (NMT))
- C0358/C2458 = 1



Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0358	Reset node	0		Make a reset node for the CAN bus node.	📖 206
			0 No function		
			1 CAN reset		

8.1.6 Axis synchronisation (CAN synchronisation)

By means of the axis synchronisation, the internal time base can be synchronised with the instant of reception of the sync signal. By this, the start of cyclic internal processes of all drives involved in the synchronisation is synchronous.

Sync signal source

The sync signal source is set via C1120:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C1120	Sync mode	0 {1}			Sync signal source	📖 207
			0	Off	Off	
			1	CAN sync	Sync connection via interface X4 (CAN)	📖 210
			2	Terminal sync	Sync connection via terminal X6/DI1	📖 211

Synchronisation cycle

For the purpose of synchronisation the master sends a cyclic CAN sync telegram.

The controllers receive the CAN sync telegram and control the starting time of their own program cycle in relation to the instant of reception of the CAN sync signal. The start is to be offset by the synchronisation phase (C1122).

The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the CAN sync telegrams.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1121	Sync cycle	2				Synchronisation cycle	📖 207
			1	{1 ms}	13		

Phase shift

The synchronisation phase (C1122) defines the period of time of the offset by which the start of the controller-internal cycle lags behind the sync signal received.

Note!

Always set the synchronisation phase higher than the maximum possible ”jitter” of the received CAN sync telegrams!

phase shifting and thus periodic changes of signal frequencies are called ”Jitter”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1122	Sync phase	0.460				Synchronisation phase	📖 207
			0.000	{0.001 ms}	6.500		

Start of axis synchronisation

After mains connection and the initialisation phase, the synchronisation is started. After the first sync telegrams have been received, it takes a few seconds until the system is compensated. The duration of this process is basically determined by the interval of the sync signals and the sync correction increment.

The CAN sync correction increment (C0363) indicates the increment used to extend or shorten the control cycle (e.g. to shift the start time).

The lowest value preset by default can be left as it is. Only in unfavourable conditions (e.g. if the sync master does not exactly comply with its cycle time) it may be necessary to prolong the CAN sync correction increment so that the value in C4264 is reduced to a minimum. Apart from that, a prolongation has a more negative effect on the drive characteristics.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1				Sync correction increment (for CAN and EtherCAT) ● Change correction value until C4264 reaches the minimum.	📖 208
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0369	SyNc Tx Time	0 {0}				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier set in C0368 is sent with the set cycle time.	📖 208
			0	{1 ms}	65000	0 = switched off	
C4264	CanSync_Dev	0				Deviation of the control program synchronisation This also applies to synchronisation via the digital input X6/DI1. Read only	📖 208
			-32767	{1}	32767		

CAN sync identifiers

The transmit and receive identifiers of the sync telegram can be configured via the following codes:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 208
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 336 📖 207
			1	{1}	256		

8.1.7 Monitoring of the synchronisation (sync time slot)

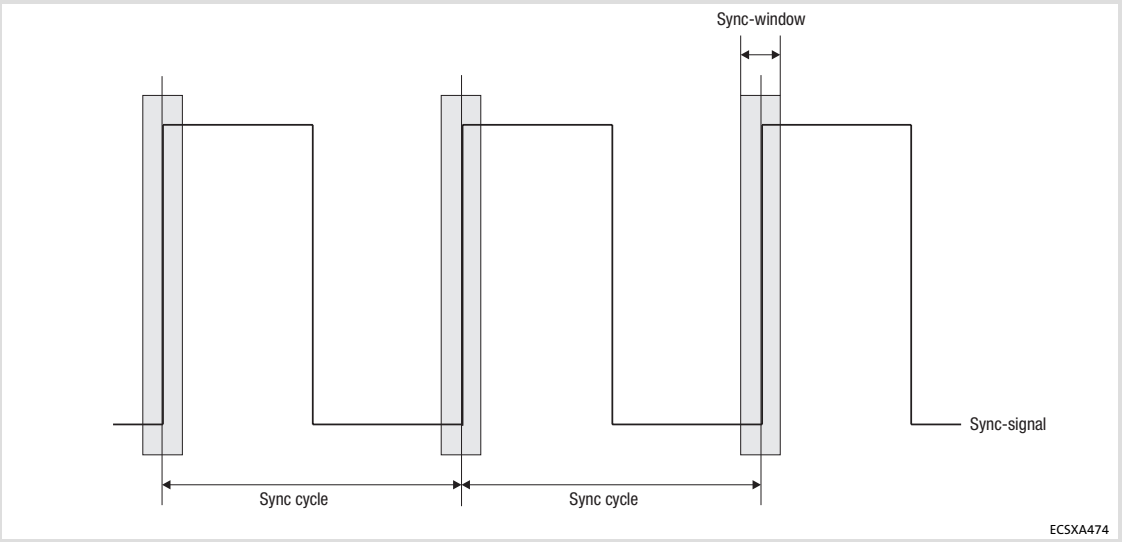


Fig. 8-3 ”Time slot” for the LOW-HIGH edges of the sync signal

Note!

A jitter (📖 207) up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The amount of the jitter has an impact on the parameterisation of the ”time slot”.

C3165 can be used for monitoring the synchronisation.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C1123	Sync window	0.010			Synchronisation window ● If the sync telegram/signal sent by the master is inside this ”time slot”, C3165 is set to 1.	📖 209
			0.000 {0.001 ms}	6.500		
C3165	SyncInside Win	0			CAN synchronisation inside the window Read only	📖 209
			0 {1 bit}	1		

CAN sync response

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0366	Sync Response	1		CAN sync response for interface X4 (CAN) **The value ”1” should always be set!**	📖 209
			0 No response		
			1 Response		

8.1.8 Axis synchronisation via CAN

The CAN interface X4 serves to transfer the CAN sync telegram as synchronisation signal and the process data.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 169
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	C1120 = 1	Active synchronisation by sync telegram via CAN bus.
	5.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	6.	Define the telegram (identifier) sequence: A . Send new setpoint to all slaves. B Send sync telegram. C Receive response of all slaves.	
	7.	Start communication/send sync telegrams.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync telegram from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (🕮 207), increase ”time slot”.
Slaves	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.1.9 Axis synchronisation via terminal X6/DI1

The transmission paths for the sync signal and the process data are separated.

- ► The process data are transmitted via the CAN interface X4.
- ► The sync signal is injected via the digital input X6/DI1.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 169
Slaves	3.	Connect "CANSync-InsideWindow" with digital output.	
	4.	Connect the sync signal of the master to terminal X6/DI1.	
Slaves	5.	C1120 = 2	Synchronisation through sync signal via terminal X6/DI1 (DigIn_bIn1_b) is active.
Slaves	6.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	7.	Start communication/send sync signals.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync signal from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync signal to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the "time slot". ● If the sync signal "jitters" heavily (🕮 207), increase "time slot".
	11.	Enable the controller via the signal "CANSync-InsideWindow" applied to the digital output.	Synchronisation monitoring: ● If "CANSync-InsideWindow" = TRUE, enable the controller.

8.2 Node guarding

In case of cyclic node monitoring (Node Guarding), the CAN master regularly enquired the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is activated (fault message ”Err NodeGuard”).

Settings

In order that the device takes over the function of the ”Node Guarding Slave”, make the following settings:

1. Set C0352 = 2.
   (The device is configured as ”Node Guarding Slave”.)
2. Set the monitoring time (Node Guard Time) for the reception of the status enquiry by the master in C0383.
3. Set the factor (Node Life Time Factor) for the monitoring time in C0383.

   Node Life Time = Node Guard Time (C0382) · Node Life Time Factor (C0383)
4. Set the response to a ”Life Guarding Event” via C0384.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 203
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0382	GuardTime	0			Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 212
			0	{1 ms} 65535		
C0383	LifeTimeFact	0			Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 212
			0	{1} 255		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0384	Err NodeGuard	3		Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	212
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

8.3 Diagnostics codes

The following diagnostic codes are available for the MotionBus (CAN) (in the GDC parameter menu under **MotionBus CAN → Bus load CAN**):

- C0359: Bus state
- C0360/x: Telegram counter
- C0361/x: Bus load

8.3.1 CAN bus status (C0359)

C0359 shows the current operating state of the MotionBus (CAN).

Value of C0359	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-operational	Only parameters (codes) can be transferred via the bus system. Data exchange between controllers is not possible. A change into the state operational" can be made via a special signal on the MotionBus (CAN). A status change from "Pre-operational" to "Operational" is possible through: ● Master function of a higher-level host system ● If a drive is defined to be the master via C0352, the operating state is automatically changed for the entire drive system after mains connection when the boot-up time set in C0356/1 has elapsed. ● Reset node via C0358 (📖 206) ● With a binary input signal "Reset node", which can be set accordingly. ● Reset node via the connected hostsystem
2	Warning	Faulty telegrams have been received. The controller is passive (does not send any data). Possible causes: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Bus load is too high ● Controller is not connected to MotionBus (CAN)
3	Bus off	Too many faulty telegrams. The controller is disconnected from the MotionBus (CAN). It can be reconnected by: ● TRIP reset ● Reset node (📖 206) ● Mains reconnection

8.3.2 CAN telegram counter (C0360)

C0360 counts for all parameter channels those telegrams that are valid for the controller. The counters have a width of 16 bits. If a counter exceeds the value ’65535’, the counting process restarts with ’0’.

Counted messages:

C0360	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received from CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

8.3.3 CAN bus load (C0361)

It can be detected via C0361 which bus load in percent is needed by the controller or by the single data channels. Faulty telegrams are not considered.

Bus load of the individual subcodes:

C0361	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received from CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

The data transfer is limited. The limits are determined by the number of telegrams transmitted per time unit and the baud rate.

The limits can be determined during data exchange in a drive network by adding all drives involved under code C0361/1.

Example:

Drive/host	Bus load
C0361/1 - controller 1	23.5 %
C0361/1 - controller 2	12.6 %
Host	16,0 %
	52.1 % (total)

Two drives and the host (PLC) are interconnected via the MotionBus (CAN).

Note!

- ► Max. bus load of all devices involved: 80 %
- ► If other devices are connected, as for instance decentralised inputs and outputs, their telegrams must be taken into consideration.
- ► If the time between the individual sync telegrams is too short the bus can be overloaded.
  - – **Remedy:** Change synchronisation cycle of the master control and the controller (C1121).

8.4 Remote parameterisation (gateway function)

From operating system V6.x onwards, the axis module supports the remote parameterisation of other fieldbus nodes. Then, all write/read accesses to parameters are not executed anymore in the axis module but redirected to the bus node selected for remote maintenance.

- ► The redirection takes place via the parameter data channel SDO1 of the selected node.
- ► The node to which the write/read accesses is to be redirected, is determined with the corresponding node address via C0370.
  (C0370 = 0: remote parameterisation deactivated)
- ► With C0371 = 1, determine the interface X14 (CAN-AUX) of the axis module as gateway channel.
- ► Use C2470 (CAN-AUX) to select the transmission channel for reading and writing parameter data.
- ► A time-out during remote parameterisation activates the system error message ”CE15”. The corresponding response can be configured under C2485 (📖 227).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0370]	SDO gateway	0		Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 217
			0 {1} 63		
C0371	Gateway Ch.	1		Selection of the gateway channel	📖 217
			0 CAN	Use CAN bus interface X4	
			1 CAN-AUX	Use CAN bus interface X14	
C2470	ParWrite	0		CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 217
			0 Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)		
			1 Parameter data channel 2		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) ”Timeout” when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 225 📖 217
			0 TRIP		
			2 Warning		
			3 Off		

9 Monitoring functions

Different monitoring functions (📖 221) 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) (📖 264).

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:

  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/no. ”x061”) between the AIF module and the ECS axis module.

- 2xxx:

  The fault response is a warning.

9.1 Fault responses

Response	⇨ Consequence	Display Keypad XT		
		RDY	IMP	Fail
TRIP		☐	■	■
TRIP active:	⇨ The power outputs U, V, W are switched to high resistance. ⇨ The drive is coasting (no control).			
TRIP reset:	⇨ The drive decelerates to its setpoint within the set deceleration times.			
Message	 **Danger!** The drive restarts automatically if the message is removed.	☐	■	■
Message active:	⇨ The power outputs U, V, W are switched to high resistance.			
≤ 0.5 s	⇨ The drive is coasting (no control).			
> 0.5 s	⇨ The drive is coasting (due to internal controller inhibit). If necessary, restart program.			
Message reset:	⇨ The drive runs to its setpoint with the maximum torque.			
FAIL-QSP	⇨ The drive is decelerated to standstill within the quick stop deceleration time (C0105).	–	–	■
Warning	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	■	☐	■
	⇨ The failure merely is displayed, the drive runs on in a controlled manner.			
Off	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	–	–	–
	⇨ There is no response to the failure.			

☐ = off ■ = on

Responses (📖 220) of monitoring functions can be parameterised partly via codes – in the GDC parameter menu under **Monitoring**.

9.2 Overview of monitoring functions

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 (activated via DCTRL)	FWM	C0581	●	✓	✓	✓	✓
x191	HSF	Internal error	Internal		●				
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus(C0174)	MCTRL			●			
0070	U15	Undervoltage of internal 15 V voltage supply	Internal		●				
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x041	AP1	Internal fault (signal processor)	Internal		●				
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 CAN bus at interface X4 (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x066	CE5	Communication error of the gateway function (C0370, C0371) via CAN bus at interface X4 (CAN)	CAN	C0603	✓		✓		●
x122	CE11	Communication error on the CANaux1_IN process data input object (time monitoring adjustable via C2457/1)	CANaux1_IN	C2481	✓		✓		●
x123	CE12	Communication error on the CANaux2_IN process data input object (time monitoring adjustable via C2457/2)	CANaux2_IN	C2482	✓		✓		●
x124	CE13	Communication error on the CANaux3_IN process data input object (time monitoring adjustable via C2457/3)	CANaux3_IN	C2483	✓		✓		●
x125	CE14	BUS-OFF state CAN bus at interface X14 (CAN-AUX) (too many faulty telegrams)	CANaux	C2484	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x126	CE15	Communication error of the gateway function via CAN bus at interface X14 (CAN-AUX) ● C0371 = 1: Gateway channel X14 (CAN-AUX) ● C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	CANaux	C2485	✓		✓		●
x260	Err Node Guard	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.	Node Guarding	C0384	●	✓	✓	✓2)	✓
Temperatures / sensors									
0050	OH	Device heatsink temperature > 90° C	MCTRL		●				
0051	OH1	Temperature inside the device > 90° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582	✓		●		✓
x055	OH5	Temperature inside the device > C0124	MCTRL	C0605	✓		●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584	✓		●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	MCTRL	C0585	✓		●		✓
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x095	FAN1	Devicefan monitoring (only for built-in units)			✓	●			
x110	H10	Device thermal sensor error on heatsink	FWM	C0588	●				✓
x111	H11	Device thermal sensor error in the interior of the device	FWM	C0588	●				✓
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				
0015	OC5	I x t overload TRIP (axis module, fix 100 %)	MCTRL		●				
0016	OC6	Motor utilisation I^2 x t (threshold C0120)	MCTRL		●				
x017	OC7	Device utilisation I x t (clip C0123)	MCTRL	C0604	✓		●		✓
x018	OC8	Motor utilisation I^2 x t (threshold C0127)	MCTRL	C0606	✓		●		✓
x032	LP1	Motor phase failure **Note:** Can only be used for asynchronous motors. Activation of the motor phase failure detection minimises the computing time available to the user!	MCTRL	C0597	✓		✓		●
x081	Rel1	Open circuit monitoring of the brake relay output (X25)	FWM	C0602	✓	✓		✓	●
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	●		✓		✓

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
1) Adjustable in the DDS under **Project → Exceptional handling**
2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder initialisation error at X8	MCTRL		●				
x088	Sd8	Sin&cos signal fault at X8	MCTRL	C0580	✓				●
x089	PL	Fault during rotor position adjustment	MCTRL		●				
Speed									
x190	nErr	Speed control error (monitoring window C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	NMAX	Max. system speed (C0596) has been exceeded.	MCTRL	C0607	●		✓		✓
Float error									
0209	float Sys-T	Float error in system task (ID 0)	Internal		●		✓	✓	2)
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)	Internal		●		✓	✓	2)
0211	float Task1	Float error in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0218	float Task8	Float error in task 8 (ID 9)							
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x108	H08	Extension board not connected properly or not supported by program.	Internal		●				
0201	overrun Task1	Time-out in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0208	overrun Task8	Time-out in task 8 (ID 9)							
0219	overrun Cycl.-T	Time-out in cyclic task (PLC_PRG, ID 1)	Internal		●		✓	✓	2)
0220	noT-Fkt Credit	Not enough technology units available in the PLC.	Internal		●				
0230	No program	No PLC program loaded in the PLC.	Internal		●				
0231	Unallowed Lib	You have called the library function in the PLC program. This function is not supported.	Internal		●				
x232	NoCamData	Motion profiles (cam data) are not available.	Internal		●				
x240	ovrTrans Queue	Overflow of transmit request memory	Free CAN objects	C0608	●	✓	✓	✓	✓
x241	ovr Receive	Too many receive telegrams	Free CAN objects	C0609	●			✓	
Parameter setting									

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
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		●				
0080	PR6	● **For ECSxS/P/M:**Internal fault ● **For ECSxA:** Too many user codes	Internal		●				
Application-specific fault messages									
x400	Pos HW End	Positive hardware limit switch has bee approached.		C3175	✓		✓	✓	●
x401	Neg HW End	Negative hardware limit switch has been approached.		C3175	✓		✓	✓	●
x404	Follow Err 1	Warning against exceeding the following error limit (C3030).		C3032	✓	✓	●	✓	✓
x405	Follow Err 2	Following error limit (C3031) has been exceeded.		C3033	✓	✓	✓	●	✓
x406	Home Pos Err	Home position is unknown.		C3170	✓	✓	✓	✓	●
x407	Toggle Bit Err	Toggle bit error		C3160	✓	✓	✓	●	✓
3408	External QSP	Externally enabled quick stop (QSP) via X6/DI1 (A reset of the fault message is required.)						●	
x410	VelModeErr	Speed error in ”Velocity Mode” (C5000 = 2)		C3038	✓	✓	✓	✓	●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

9.3 Configuring monitoring functions

9.3.1 Monitoring times for process data input objects

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
x062	CE1	Communication error at the process data input object CAN1_IN	CAN_bCe1CommErrCanIn1_b	✓		✓	•
x063	CE2	Communication error at the process data input object CAN2_IN	CAN_bCe2CommErrCanIn2_b	✓		✓	•
x064	CE3	Communication error at the process data input object CAN3_IN	CAN_bCe3CommErrCanIn3_b	✓		✓	•
x065	CE4	BUS-OFF state of the CAN bus at interface X4 (CAN)	CAN_bCe4BusOffState_b	✓		✓	•
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux_bCe1CommErrCanIn1_b	✓		✓	•
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux_bCe2CommErrCanIn2_b	✓		✓	•
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux_bCe3CommErrCanIn3_b	✓		✓	•
x125	CE14	BUS-OFF state of the CAN bus at interface X14 (CAN-AUX)	CANaux_bCe4BusOffState_b	✓		✓	•

• Default setting
✓Setting possible

Each process data input object can monitor whether a telegram has been received within a specified time. As soon as a telegram arrives, the corresponding monitoring time (C0357/C02457) is restarted (”retriggerable monoflop” function).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 225
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 225
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

The following responses can be set for communication errors:

- 0 = Error (TRIP) - controller sets controller inhibit (CINH)
- 2 = Warning
- 3 = Monitoring is switched off

Codes for setting the response to the monitoring functions:

CAN bus interface	Code	Monitoring
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: System bus (CAN)	C0591	CAN1_IN (”CE1”)
	C0592	CAN2_IN (”CE2”)
	C0593	CAN3_IN (”CE3”)
	C0595	Bus off (”CE4”)
	C0603	Gateway function (”CE5”)
X14 System bus (CAN)	C2481	CANaux1_IN (”CE11”)
	C2482	CANaux2_IN (”CE12”)
	C2483	CANaux3_IN (”CE13”)
	C2484	Bus off (”CE14”)
	C2485	Gateway function (”CE15”)

The input signals (CAN1...3_IN/CANaux1...3_IN) can also be used 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 signal ”BusOffState” (CE4/CE14) is set.

”BusOffState” can activate an error (TRIP) or warning. The signal can also be switched off. The response is set under C0595/C2484. You can also assign the terminal output for this.

9.3.2 Time-out monitoring for activated remote parameterisation

If remote parameterisation is activated (gateway function (📖 217)) and a timeout occurs, the system error message CE5/CE15 is output.

The response to this can be configured via C0603/C2485.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 225 📖 217
			0 TRIP		
			2 Warning		
			3 Off		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 225 📖 217
			0 TRIP		
			2 Warning		
			3 Off		

9.3.3 Short circuit monitoring (OC1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
011	OC1	Short circuit	MCTRL_bShortCircuit_b	•			

• Default setting
✓Setting possible

The monitoring process is activated if a short circuit occurs in the motor phases. This can also be caused by an interturn fault in the machine.

► Monitoring can also be actuated at mains connection, if an **earth fault** occurs.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the short circuit has to be eliminated.

9.3.4 Earth fault monitoring (OC2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
012	OC2	Earth fault	MCTRL_bEarthFault_b	•			

• Default setting
✓Setting possible

The ECSxM... axis module is equipped with a standard earth fault detection.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the earth fault has to be eliminated.

Possible causes of an earth fault are:

► Short circuit to frame of the machine

► Short circuit of a phase to the shield

► Short circuit of a phase to PE

9.3.5 Motor temperature monitoring (OH3, OH7)

Stop!

The temperature sensor must only be connected to either X7 **or** X8, the other input of the temperature sensor must be left open!

Note!

This monitoring function only applies to temperature sensors specified by Lenze like the ones used on standard Lenze servo motors.

With regard to default setting, this monitoring is switched actively and is actuated when no Lenze servo motor is used!

The motor temperature is monitored by means of a continuous KTY temperature sensor.

The motor temperature monitoring functions (OH3/OH7) respond when the set temperature thresholds are exceeded.

Wire the KTY temperature sensor to the resolver cable at X7 (📖 86) or the encoder cable at X8 (📖 87).

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
053	OH3	Motor temperature (fixed, 150 °C)	MCTRL_bMotorTempGreaterSetValue_b	•		✓	✓
057	OH7	Motor temperature (adjustable, C0121)	MCTRL_bMotorTempGreaterC0121_b	✓		•	✓

• Default setting
✓Setting possible

► Adjustable warning threshold (OH7)
  – The warning threshold can be set under C0121
  – The reaction to exceeding the threshold can be set under C0584

► Fixed warning threshold (OH3)
  – Threshold = 150 °C
  – The reaction to exceeding the threshold can be set under C0583

The hysteresis is 15 K, i.e. the switching value for the fixed warning threshold is 135 °C.

Monitoring with the adjustable threshold (OH7) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH3). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/{Appl.}	Selection			
C0121	OH7 limit	120			Threshold for motor temperature monitoring	📖 229
			45 {1 °C} 150		Motor temperature > C0121 ⇨ fault message OH7 (C0584)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0583	MONIT OH3	0		Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	229
			0 TRIP		
			2 Warning		
			3 Off		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	229
			0 TRIP		
			2 Warning		
			3 Off		

9.3.6 Heatsink temperature monitoring (OH, OH4)

The heatsink temperature of the controller can be monitored with two temperature thresholds:

- Adjustable temperature threshold (OH4)
  - Threshold can be set under C0122
  - The reaction to exceeding the threshold can be set under C0582
- Fixed temperature threshold (OH)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
050	OH	Heatsink temperature (fixed, 90 °C)	MCTRL_bKuehlGreaterSetValue_b	•			
054	OH4	Heatsink temperature (adjustable, C0122)	MCTRL_bKuehlGreaterC0122_b	✓		•	✓

• Default setting
✓Setting possible

The hysteresis is 5 K, i.e. the switching value for the fixed threshold is 85 °C.

Monitoring with the adjustable threshold (OH4) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0122	OH4 limit	80			Threshold for heatsink temperature monitoring	📖 231
			45 {1 °C} 90		Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0582	MONIT OH4	2			Setting of the fault response - monitoring of heatsink temperature in C0122	📖 231
			0	TRIP		
			2	Warning		
			3	Off		

The following causes can bring about an actuation of the monitoring process:

Cause	Remedy
The ambient temperature is too high.	Mount a fan in the control cabinet.
The drive controller is overloaded in the arithmetic mean, i. e. overload and recovery phase are above 100%.	• Mount a fan in the control cabinet. • Reduce overload phase. • Use more powerful drive controller.

9.3.7 Monitoring of internal device temperature (OH1, OH5)

The temperature inside the controller can be monitored with two temperature thresholds:

- Adjustable threshold (OH5)
  - The warning threshold can be set under C0124
  - The reaction to exceeding the threshold can be set under C0605
- Fixed threshold (OH1)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

The hysteresis is 5 K, i.e. the reset value for the fixed warning threshold is 85 °C.

The monitoring with the adjustable threshold (OH4) is designed as an early warning stage before final disconnection of the controller by means of TRIP (OH). Therefore, the process can be influenced accordingly, so that the final disconnection of the controller at unfavourable moments is avoided. Furthermore, for instance, additional fans can be activated, generating a noise load when switched to continuous operation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 232
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 232
			0	TRIP			
			2	Warning			
			3	Off			

9.3.8 Function monitoring of thermal sensors (H10, H11)

The function of the thermal sensors of the heatsink and the interior of the device is monitored. If the thermal sensors report values outside the measuring range, fault H10 (heatsink) or H11 (interior) is reported. The response to these faults can be defined under C0588.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 233
			0 TRIP		
			2 Warning		
			3 Off		

9.3.9 Current load of controller (I x t monitoring: OC5, OC7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
015	OC5	I x t overload	MCTRL_bIxtOverload_b	•			

• Default setting
✓Setting possible

The I x t monitoring function monitors the current load of the axis module. The monitoring function is set so that operation

- is permanently possible with a device output current = I_r.
- is possible for ≤≤ 30 s with a device output current ≤≤ 1.5 x I_r.

The overload protection of the axis module can be set with thresholds:

- adjustable threshold (OC7) via C0123
- fixed threshold (OC5) = 100 %

After an overcurrent phase, you can calculate with a recovery phase of 120 s. For a more precise consideration, see the overcurrent characteristic and the value 3 x $\tau_{\text{axis module}}$ (📖 235).

The response to exceeding the adjustable threshold can be defined under C0604.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	📖 228
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 228
			0	TRIP			
			2	Warning			
			3	Off			

Overcurrent characteristic

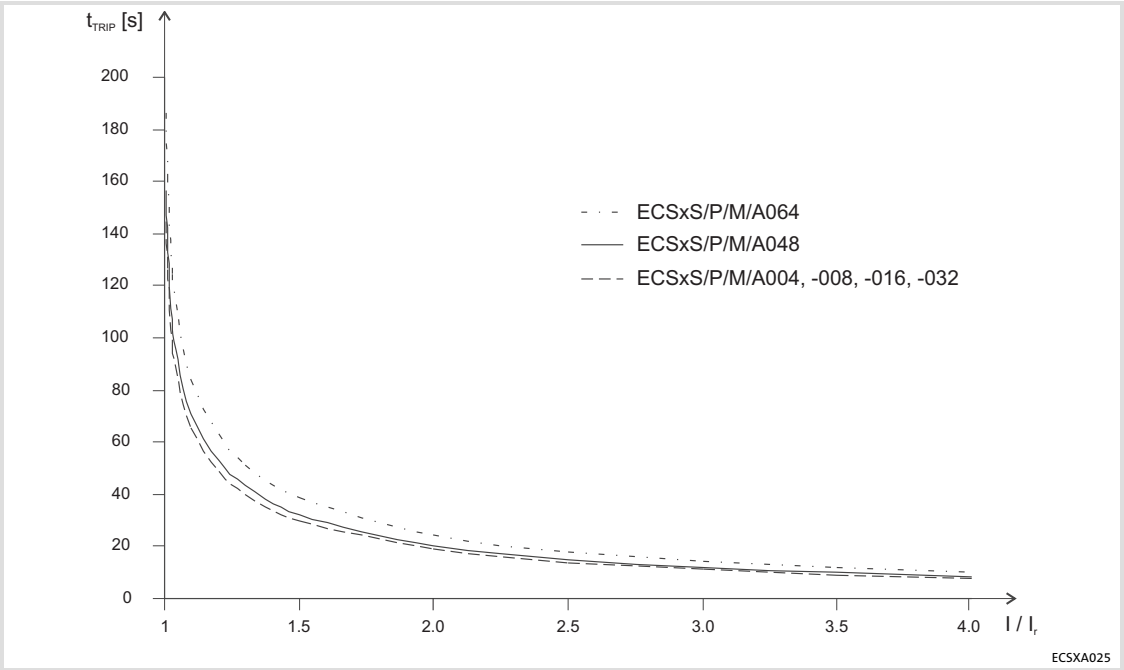


Fig. 9-1 Overcurrent characteristic ECSxM..., see also “Rated data“ 🕮 32

The overcurrent characteristic shows the maximum time t_{TRIP} till the axis module generates an I x t error. In order to reach this time t_{TRIP} again, the time 3 x $\tau_{axis\ module}$ with the load I/I_r = 0 A must be observed.

Device	$\tau_{axis\ module}$ [s]	Overcurrent characteristic
ECSxM004	54.6	$I \cdot t = \frac{I_{subprofile\_x}}{I_{rated}} - \left(\frac{I_{subprofile\_x}}{I_{rated}} - I \cdot t_{subprofile\_x-1} \right) \cdot e^{-\frac{t_{subprofile\_x}}{\tau_{axis\_module}}}$
ECSxM008	27.3	
ECSxM016	27.3	
ECSxM032	27.3	
ECSxM048	29.5	
ECSxM064	35.1	

Overcurrent diagram for OC5 fault message

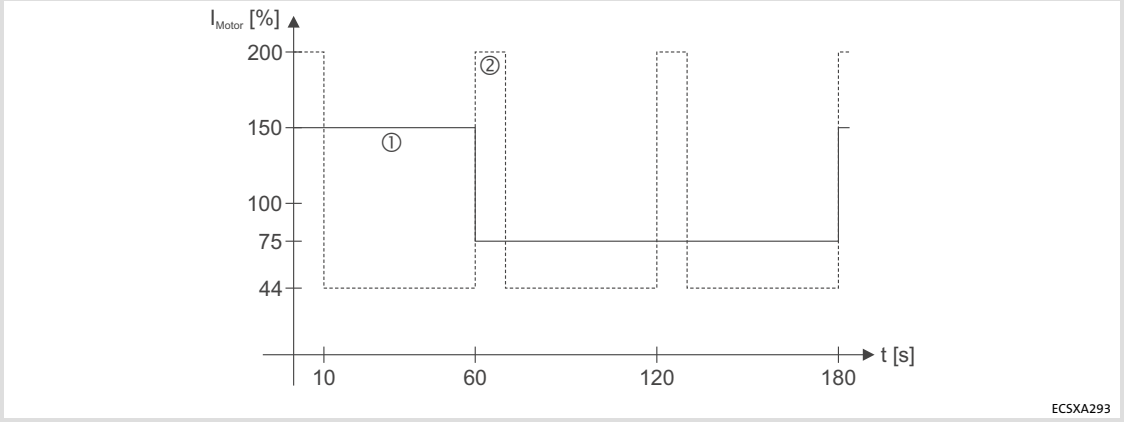


Fig. 9-2 Maximum overcurrent as a function of time

The maximum admissible overcurrent is dependent on the I_{max}limit set in C0022.

① I_{max} limit set in C0022 ≤ 150 % I_r:

► For **180 s**, the arithmetic mean value of the motor current must not exceed **100 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ①:

$$\frac{60\ \text{s} \cdot 150\ \% + 120\ \text{s} \cdot 75\ \%}{180\ \text{s}} = 100\ \%$$

② I_{max} limit set in C0022 > 150 % I_r:

► For **60 s**, the arithmetic mean value of the motor current must not exceed **70 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ②:

$$\frac{10\ \text{s} \cdot 200\ \% + 50\ \text{s} \cdot 44\ \%}{60\ \text{s}} = 70\ \%$$

The current device utilisation is displayed in C0064:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.

9.3.10 Current load of motor (I^2 x t monitoring: OC6, OC8)

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 %.

9.3.10.1 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):

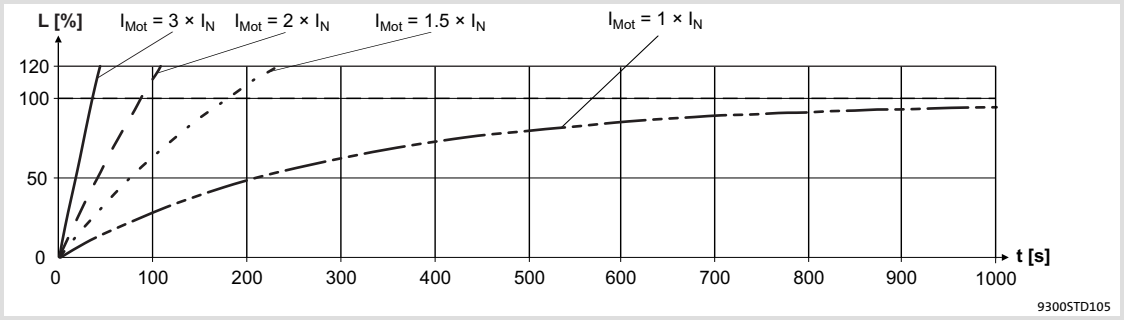


Fig. 9-3 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

9.3.10.2 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

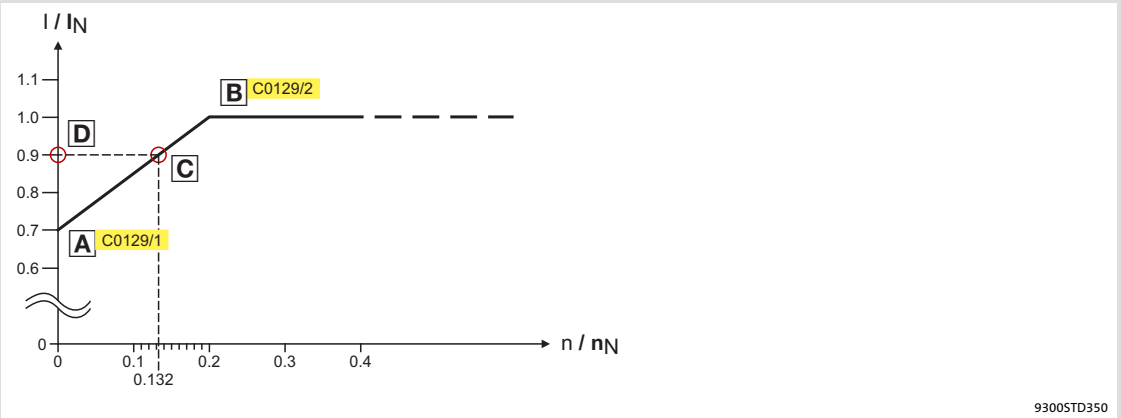


Fig. 9-4 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 9-4) 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. 9-4, 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", 📖 240).

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).

9.3.11 DC-bus voltage monitoring (OU, LU)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
020	OU	Overvoltage	MCTRL_bOvervoltage_b		•		
030	LU	Undervoltage	MCTRL_bUndervoltage_b		•		

• Default setting
✓Setting possible

These monitoring functions monitor the DC bus and protect the controller.

- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ exceeds the upper switch-off threshold set in C0173, an OU message is sent.
- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ falls below the lower switch-off threshold set in C0174, an LU message is sent.

The monitoring response remains active until the corresponding threshold is fallen below/exceeded again.

Note!
All drive components in DC-bus connections must have the same thresholds!

Switch-off and switch-on thresholds

- The switch-off threshold defines the voltage level of the DC-bus voltage, at which the pulse inhibit is activated.
- The switch-off and switch-on thresholds dependent on C0173 can be gathered from the following table:

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785



Tip!

If undervoltage is existent for more that 3 s, or if mains connection is carried out, an entry into the fault memory is effected.

- ► This operational mode can occur if the control module is fed via the terminals X6/+24 and X6/GND by means of an external supply and the mains are disconnected.
- ► If there is no undervoltage anymore (mains are reconnected again), the entry in the fault memory is not continued, but deleted. This case does not describe an error, but a state of the drive controller.

Undervoltages of less than 3 s are interpreted as a fault (e. g. mains fault) and are entered into the fault memory. In this case, the fault memory is updated.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0173	UG limit	11			Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 101
			0	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3	Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4	Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13	Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14	Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 101
			15	{1 V} 342		

9.3.12 Voltage supply monitoring - control electronics (U15)

If the voltage at X6/DI1 or X6/DI3 falls below 17 V, TRIP ”U15” is triggered. The fault can only be reset if U > 19 V.

9.3.13 Motor phase failure monitoring (LP1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
032	LP1	Motor phase failure	MCTRL_bMotorphaseFail_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether a motor phase has failed.

Note!

- ► This monitoring function can only be used for asynchronous motors.
- ► When this monitoring function is activated, the calculating time available to the user is reduced.

- ► The response is set via C0597.
- ► The monitoring limit is set via C0599.

Reset fault message

1. Check motor cables.
2. Carry out TRIP-RESET.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0597	MONIT LP1	3			Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 244
			0	TRIP		
			2	Warning		
			3	Off		
C0599	Limit LP1	5.0			Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 244
			0.01	{0.01 %} 10.00		

9.3.14 Monitoring of the resolver cable (Sd2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
082	Sd2	Resolver error	MCTRL_bResolverFault_b	•		✓	✓

• Default setting
✓Setting possible

This monitoring function monitors the resolver cable and the resolver with regard to open circuit and protects the motor.

Stop!

If monitoring is disconnected, the machine can achieve very high speeds in case of faults (e. g. system cable is disconnected or not correctly screwed), which can result in the damage of the motor and of the driven machine! The same applies if ”warning” is set as a response.

- ► For commissioning C0586, always use the Lenze setting (TRIP).
- ► Only use the possibility of disconnection via C0586 if the monitoring is activated without apparent reason (e. g. by very long cables or intense interference injection of other drives).
- ► Configure C0586 = 2 (warning) only on the above-mentioned condition, because the pulses are enabled despite faulty feedback.

If a fault with regard to the actual value acquisition is available, it is not definitely ensured that monitoring is triggered by overspeed (NMAX, 📖 250).

This monitoring ...

- ► is automatically activated if a resolver is selected as an actual speed value encoder via C0419.
- ► is automatically activated if another actual speed value encoder is selected.

The response is set via C0586.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 245
			0 TRIP		
			2 Warning		
			3 Off		

9.3.15 Motor temperature sensor monitoring (Sd6)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
086	Sd6	Motor temperature sensor fault	MCTRL_bSensorFault_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether the motor temperature sensor supplies values within the measuring range of -50 ... +250 °C. If the values are outside this measuring range, monitoring is activated.

The response is set via C0594.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. "SensorFault" (Sd6)	📖 246
			0 TRIP		
			2 Warning		
			3 Off		

9.3.16 Monitoring of the absolute value encoder initialisation (Sd7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
087	Sd7	Absolute value encoder initialisation error	MCTRL_bEncoderFault_b	•			

• Default setting
✓Setting possible

When the ECSxM... axis module is switched on, this monitoring function repeatedly downloads the absolute value of the hiperface absolute value encoder to identify whether the same value is transferred to the drive.

The absolute value encoders (single-turn, multi-turn) are supported by a hiperface interface with various numbers of increments, e.g.: SRM50 with 1024 Sin/Cos periods/rev. or SKM38 with 128 periods/rev.(see also C0419).

If a deviation > 5° on the motor shaft is detected, the monitoring (TRIP) is actuated.

The fault message ”Sd7” can only be reset by mains switching!

9.3.17 Sin/cos signal monitoring (Sd8)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
088	Sd8	Sin/cos signal fault	MCTRL_bEncoderFault_b	✓			•

• Default setting
✓Setting possible

This monitoring function carries out a plausibility test to check that the encoder is available and that the sin/cos track supply plausible values with regard to each other.

- ► If required, the encoder has to move by several angular degrees for actuating a fault.
- ► The response is set via C0580.
- ► The filter time constant (C0559) serves to filter short-time trouble on the sin/cos track of the encoder without an SD8 trip being released immediately.
- ► The ”Sd8” fault message can only be reset by mains switching.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0580	Monit SD8	3			Fault response - monitoring of SinCos signals at X8	📖 248
			0	TRIP		
			3	Off		
C0559	SD8 filter t	1			Filter time constant (SD8)	
			1 {1 ms} 200		Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	

Note!

For the desired encoder monitoring, and in particular when using synchronous machines, set fault handling to ”TRIP”.

In order to achieve further encoder safety, monitoring of following errors can be activated for positioning systems. Set its fault response to ”TRIP”, too.

Visible faults	Non-visible faults
• Unplugged plug, all encoder signals open. • Singe wire breakage, one of the following signals is missing: – COS A – RefCOS A – SIN B – RefSIN B – GND – VCC • Double wire breakage with the following signal pairs: – COS A and RefCOS A – SIN B and RefSIN B – COS A and SIN B – RefCOS A and RefSIN B – and all four signals (COS A, RefCOS A, SIN B, RefSIN B) open.	• Short circuits, in particular between sine and cosine signals. • Cable/encoder faults with intermediate values • ”Semi”-short circuits (> 0 Ohm) • ”Semi”-interruptions (< infinite)

9.3.18 Monitoring of the speed system deviation (nErr)

Fault message		Monitoring function	System variable	Possible response				
				TRIP	Message	Warning	FAIL-QSP	Off
190	nErr	Speed outside of the tolerance window (C0576)	MCTRL_bSpeedLoopFault_b	✓	✓	✓	✓	•

• Default setting
✓Setting possible

This monitoring function compares the actual speed value provided by the speed sensor with the speed setpoint of the speed controller. If the difference between the two speed values exceeds the tolerance window set in C0576, the nErr monitoring function responds.

► If the system deviation exceeds a certain value, this may indicate a drive problem. The drive cannot follow the selected speed setpoint as fast as required. If the controller generally is in working condition, mechanical blockages on the load side or insufficient motor torque may be the cause.

Furthermore, this monitoring function can be used to additionally protect a speed sensor operating in the speed-controlled mode. The monitoring function thus supplements the individual encoder monitoring.

► Faults on the encoder system bring about an incorrect actual speed value. This normally results in a system deviation on the speed controller that is greater than that in the normal operating status.

► The tolerance margin is set via C0576.

► The response is set via C0579.

Note!

► Set the tolerance window (C0576) to at least twice the value of the system deviation occurring during operation. The value can be identified by respective tests when commissioning is effected.

► Please observe that the system deviation reaches higher values under normal operating conditions with short ramp times.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 249
			0	{1 %}	100		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 249
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

9.3.19 Monitoring of max. system speed (NMAX)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
200	NMAX	Max. system speed exceeded	MCTRL_bNmaxFault_b	•			

• Default setting
✓Setting possible

The monitoring function responds if the current speed exceeds the max. system speed or twice the value of C0011 (n_{max}).

Stop!

- ► With regard to active loads (e. g. hoists), pay attention to the fact that the drive in this case operates without torque. Specific on-site measures are required!
- ► If the actual speed value encoder fails, it is not provided that this monitoring will be activated.

The max. system speed can be set via C0596.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0596	NMAX limit	5500			Maximum system speed	📖 250
			0 {1 rpm}	16000		

9.3.20 Monitoring of the rotor position adjustment (PL)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
089	PL	Fault during rotor position adjustment	MCTRL_bRotorPositionFault_b	•			

• Default setting
✓Setting possible

This monitoring function observes the correct execution of the rotor position adjustment.

This monitoring function can occur during rotor position adjustment in connection with feedback systems:

- Resolver
- TTL encoder
- Sin/cos encoder
- Absolute value encoder (single/multi-turn)

Cause for this is a cancellation of the adjustment routine as a result of

- a supply voltage loss
- an encoder cable interruption
- a routine stop through the deactivation of C0095

Reset fault message

1. Remove the cause for the cancellation.
2. Inhibit controller
3. Deactivate rotor position adjustment with C0095 = 0.
4. Carry out TRIP-RESET.
5. Activate rotor position adjustment with C0095 = 1.

10 Diagnostics

10.1 Diagnostics with Global Drive Control (GDC)

The GDC **diagnostics** parameter menu contains the codes for diagnosing the drive system.

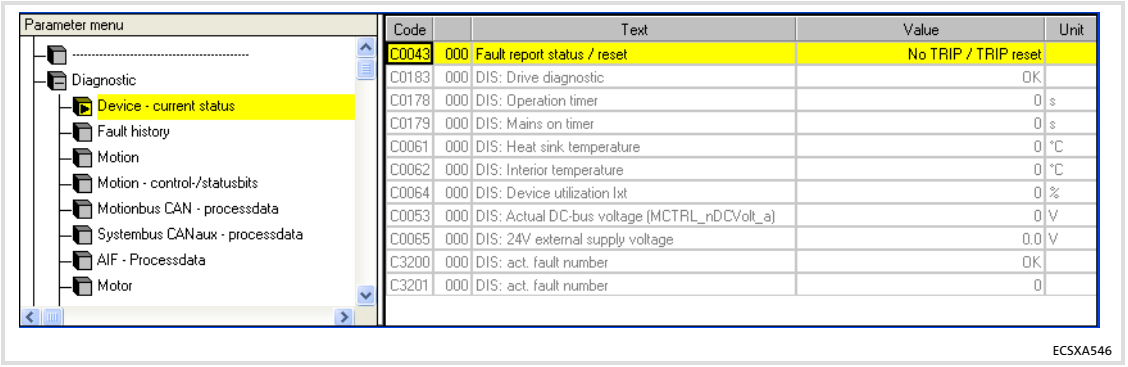


Fig. 10-1 GDC view: Diagnostics - Device - current status

The most important operating values are displayed under**Diagnostics → Motion**:

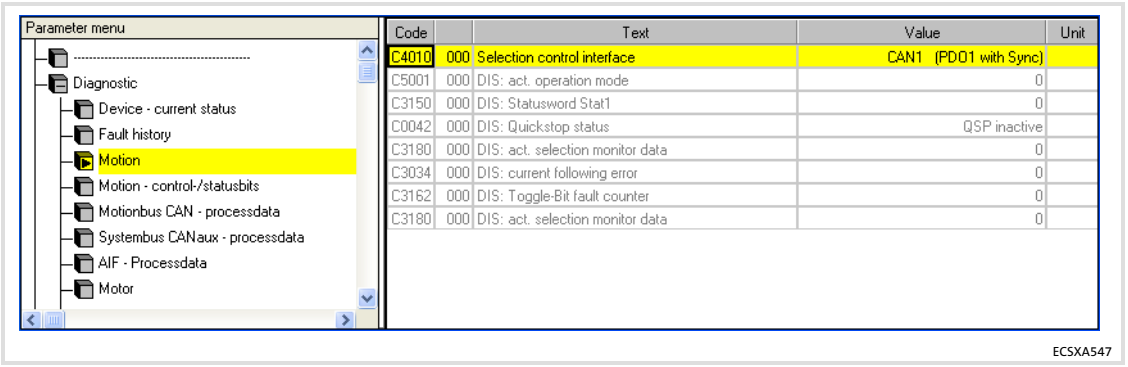


Fig. 10-2 GDC view: Diagnostic of Display-Motion

Information on the fault history are displayed under **Diagnostics → Faults**:

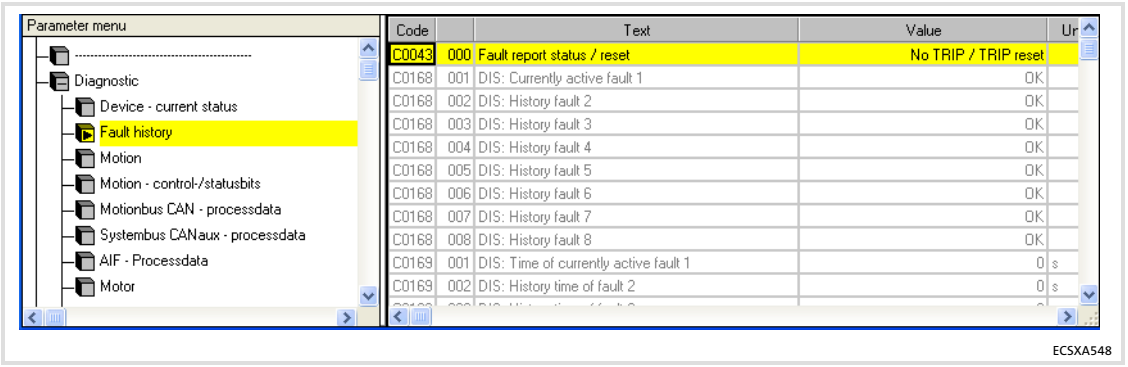


Fig. 10-3 GDC view: Fault diagnostics

10.2 Diagnostics with Global Drive Oscilloscope (GDO)

The ”Global Drive Oscilloscope” (GDO) is included in the scope of supply of the Lenze parameter setting and operating program ”Global Drive Control” (GDC) and the ”Drive PLC Developer Studio” (DDS) and can be used as an additional diagnostic program.

The GDO serves to record e.g. input and output data and device-internal states during controller operation.

Note!

Detailed information about the functionality and handling of GDO can be found in the Manual ”Global Drive Oscilloscope (GDO), Getting started”.

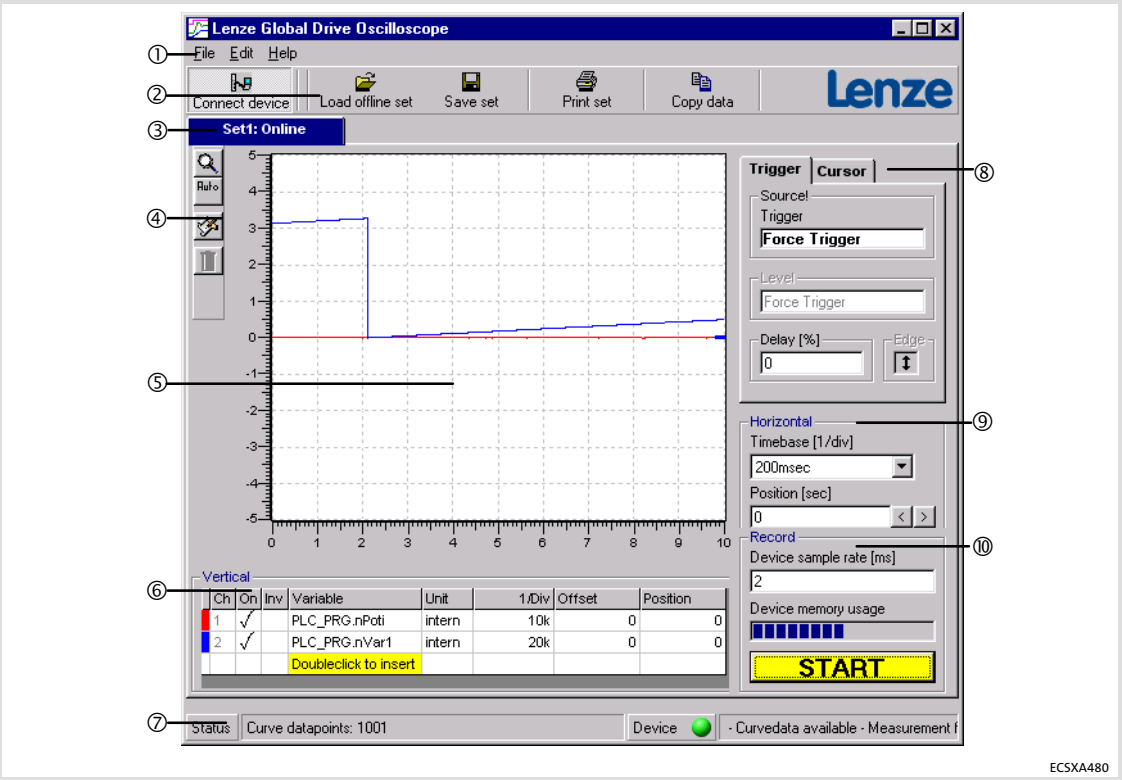


Fig. 10-4 Global Drive Oscilloscope (GDO)

① Menu bar
② Symbol bar at the top
③ Data sets
④ Symbol bar on the left
⑤ Graph display field
⑥ Vertical operating elements
⑦ Status display
⑧ Trigger/cursor operating elements
⑨ Horizontal operating elements
⑩ Operating elements for recording

10.2.1 GDO buttons

Clicking on the corresponding button executes the respective function.

Press the **<F1>** key to call the HTML online help.

Symbol bar at the top (②, Fig. 10-4)

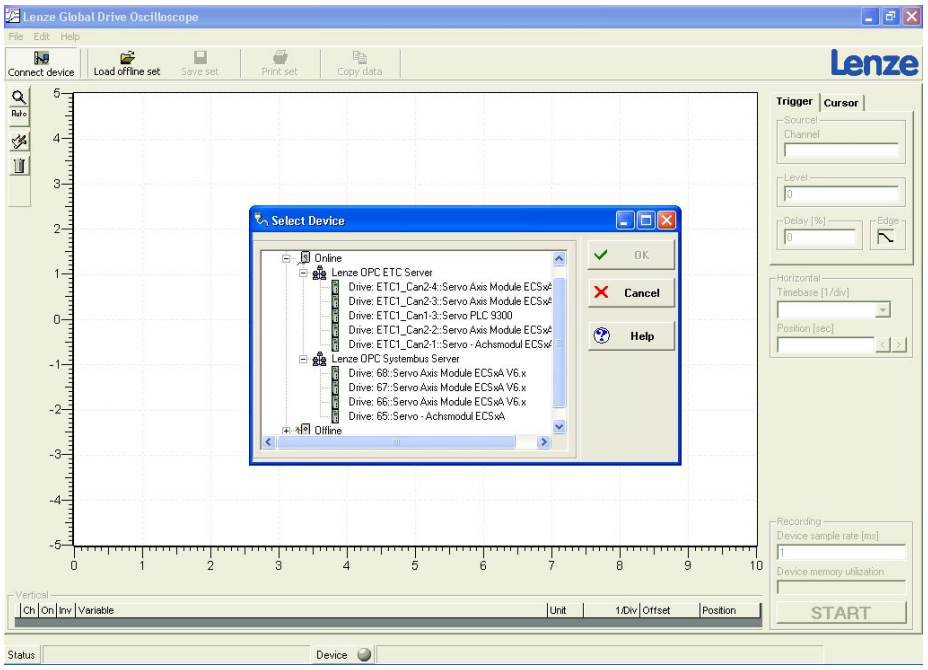
Symbol (button)	Function
	**Connect device** Here a connection can be established to an attached module. This button has the same function as the menu command **File → Connect**.
	**Load offline set** Here saved data sets can be loaded.
	**Save set** Here recorded curves can be saved. This button has the same function as the menu command **File → Save**.
	**Print set** Here the recorded curve can be printed in different variants.
	**Copy data** Here data sets can be copied. This button has the same function as the menu command **Edit → Copy**.

Symbol bar on the left (④, Fig. 10-4)

Symbol (button)	Function
	**Zoom** Here different zoom functions can be executed.
	**Automatic scaling** Here all selected curves can be automatically scaled and repositioned and the offset value can be set to ”0”. The following data types are supported in automatic scaling: BYTE; WORD; DWORD; USINT; UINT; UDINT; SINT; INT; SDINT; Array; Struct
	**Comment** Here information concerning the current data set can be entered. This information is saved together with the current data set and after loading it is displayed as a short info.
	**Delete** Here the selected offline data set can be deleted.

10.2.2 Diagnostics with GDO

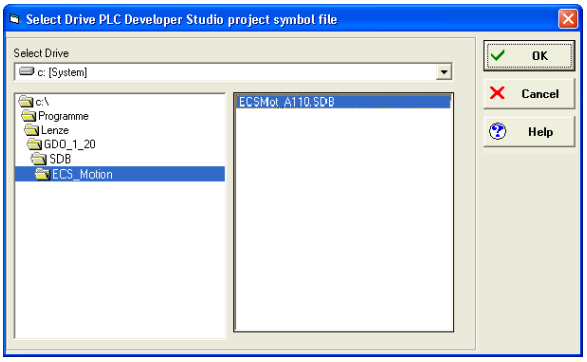
1. Connect axis module to the PC/laptop.
   – Connection to terminal X14 (system bus (CAN)) with a PC system bus adapter.
2. Supply the axis module with a control voltage of 24 V (📖 64).
3. Start the GDO on the PC/Laptop.
4. Click on the [Connect device] button.
   – The dialog ”Select Device” opens (Fig. 10-5).
   – The devices connected to the bus are listed under ”Online”.



ECSXA561

Fig. 10-5 GDO view: Dialog ”Select Device”

5. Select the corresponding device under ”Online” and click on the [OK] button.
   – The dialog ”Select Drive PLC Developer Studio project symbol file” opens:



ECSXA562

Fig. 10-6 GDO view: Dialog ”Select Drive PLC Developer Studio project symbol file”

6. Select symbol file **ECSMot_Axxx.SDB** (xxx = version number) and click on the [OK] button.

7. Select the variables the values of which are to be recorded during positioning .
   – Double-click on the yellow text box ”Variable” in the group box ”Vertical”.
   – Select the variables in the dialog box appearing now.
   – The values of up to 8 variables can be displayed in the graph box.

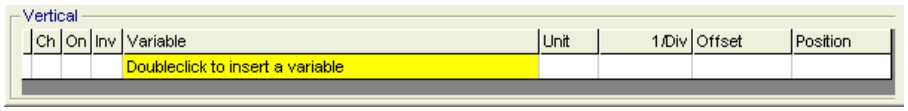


Fig. 10-7 GDO view: Variable selection

8. Click on the [START] button to perform a positioning process.

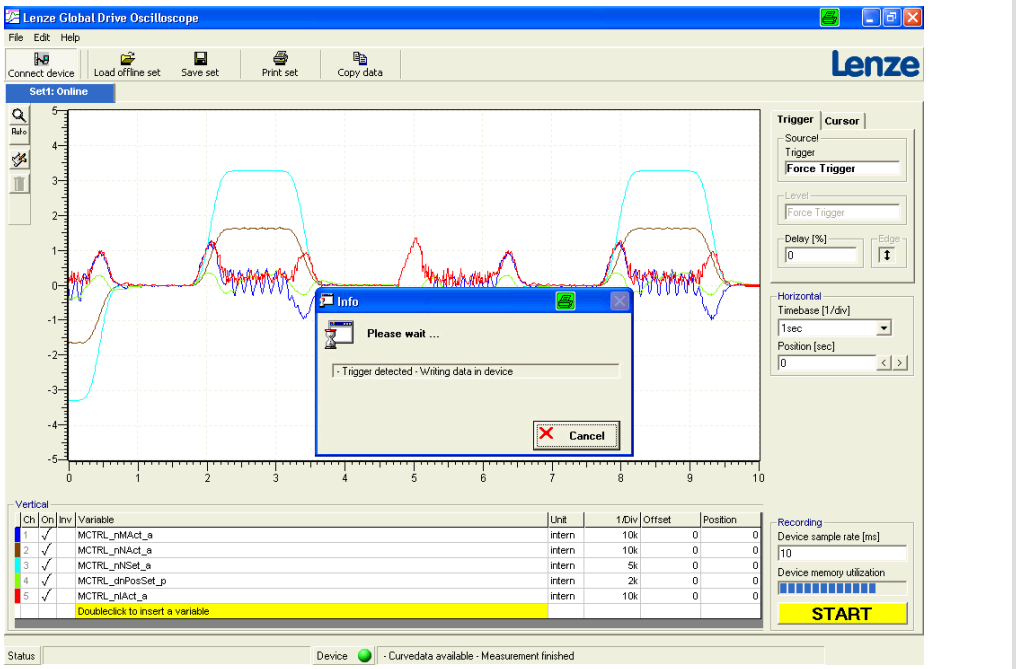


Fig. 10-8 GDO view: Performing a positioning process

System variables

The meaning of the most important variables is shown in the following table:

Variable	Data type	Signal type	Code	Display format	Description
AIF1_wDctrlCtrl	Word	–	–	–	Control word (📖 131)
AIF1_wDctrlStat					Status word (📖 134)
AIF1_dnInD1_p	double Integer	Position	–	–	Set position [inc] 65536 inc = 1 revolution
AIF1_dnOutD1_p	double Integer	Position	–	–	Actual position [inc] 65536 inc = 1 revolution
Brake.L_BRK1.bSet_b	BOOL	binary	–	–	Demands on brake logic
Brake.L_BRK1.bOut_b	BOOL	binary	–	–	Set brake
CAN1_wDctrlCtrl	Word	–	–	–	Control word (📖 131)
CAN1_wDctrlStat					Status word (📖 134)
CAN1_dnInD1_p	double Integer	Position	–	–	Set position [inc] 65536 inc = 1 revolution

Variable	Data type	Signal type	Code	Display format	Description
CAN1_dnOutD1_p	double Integer	Position	–	–	Actual position [inc] 65536 inc = 1 revolution
CAN1_bSyncInsideWindow_b	BOOL	binary	C3165	bin	Synchronisation telegram within the set window (📖 209)
CAN1_nSyncDeviation	Integer	analog	C4264	–	Deviation of the control program synchronisation This also applies to synchronisation via the digital input X6/DI1.
DCTRL_bCInh1_b	BOOL	binary	C0878/1	bin	Controller inhibit
DCTRL_bCInh2_b			C0878/2		
DCTRL_bTripSet_b			C0878/3		TRIP-SET
DCTRL_bTripReset_b			C0878/4		TRIP-RESET
DCTRL_bFail_b	BOOL	binary	–	–	TRUE = active error
DCTRL_bImp_b					TRUE = high-resistance power output stages
DCTRL_bTrip_b					TRUE = active fault
DCTRL_bQspIn_b					TRUE = QSP
DCTRL_bRdy_b					TRUE = ready for operation
DCTRL_bCwCcw_b					TRUE = CCW rotation FALSE = CW rotation
DCTRL_bNActEq0_b					TRUE = motor speed < C0019
DCTRL_bCInh_b					TRUE = controller inhibit
DCTRL_bExternalFault_b					TRUE = external error
MCTRL_bQspOut_b	BOOL	binary	C0907/3	bin	TRUE = drive executes QSP
MCTRL_nHiMLim_a	Integer	analog	C0906/4	dec [%]	Upper torque limitation (in % of C0057)
MCTRL_nLoMLim_a			C0906/3		Lower torque limitation (in % of C0057)
MCTRL_bNMSwt_b	BOOL	binary	C0907/2	bin	TRUE = torque control FALSE = speed control
MCTRL_bnNAdapt_a	Integer	analog	–	–	Adaptive Vp of the speed controller
MCTRL_bILoad_b	BOOL	binary	C0907/4	bin	TRUE = integral action component of the speed controller is accepted by *MCTRL_nISet_a*.
MCTRL_nISet_a	Integer	analog	C0906/8	dec [%]	Integral action component of the speed controller
MCTRL_nNSet_a			C0906/1		Speed setpoint
MCTRL_nPAdapt_a			C0906/9		Influence of C0254 on Vp (in %) ● The amount is processed (without sign).
MCTRL_dnPosSet_p	double Integer	Position	C0908	dec [inc]	Deviation between setpoint angle and actual angle for angle controller
MCTRL_nPosLim_a	Integer	analog	C0906/5	dec [%]	Influence of angle controller ● In % of n_{max} (C0011)
MCTRL_bPosOn_b	BOOL	binary	C0907/1	–	TRUE = activation of angle controller
MCTRL_nNStartMLim_a	Integer	analog	C0906/6	dec [%]	Lower speed limit for speed limitation
MCTRL_nMAdd_a			C0906/2		Additional torque setpoint or torque setpoint
MCTRL_nFldWeak_a			C0906/7		Motor control
MCTRL_bQspIn_b	BOOL	binary	C0042	bin	TRUE = drive executes QSP
MCTRL_nNSetIn_a	Integer	analog	C0050	dec [%]	Speed setpoint ● In % of n_{max} (C0011)

Variable	Data type	Signal type	Code	Display format	Description
MCTRL_bMMax_b	BOOL	binary	–	–	TRUE = speed controller operates at the limit.
MCTRL_nMSetIn_a	Integer	analog	C0056	dec [%]	Torque setpoint ● In % of M_{max} (C0057)
MCTRL_bIMax_b	BOOL	binary	–	–	TRUE = drive operates at the current limit C0022.
MCTRL_nIAct_a	Integer	analog	–	–	Current motor current - 16384 = 100 % I_{max} (C0022)
MCTRL_nDCVolt_a					100% = 1000V
MCTRL_nMAct_a					In % of M_{max} (C0057)
MCTRL_bUnderVoltage_b	BOOL	binary	–	–	Monit: undervoltage
MCTRL_bOverVoltage_b					Monit: overvoltage
MCTRL_bShortCircuit_b					Monit: short circuit
MCTRL_bEarthFault_b					Monit: earth fault
MCTRL_bIxtOverload_b					Monit: I x t overload
MCTRL_nPos_a	Integer	analog	–	–	Actual phase value as analog signal ● 90° = 100 %
MCTRL_nNAct_v	Integer	Velocity	–	–	Actual speed value [rpm]
MCTRL_nNAct_a	Integer	analog	–	–	Actual speed value ● In % of n_{max} (C0011)
MCTRL_dnPos_p	double Integer	Position	–	–	Rotor position of the motor
MCTRL_bNmaxFault_b	BOOL	binary	–	–	Monit: Max. system speed exceeded.
MCTRL_nNmaxC11	Integer	–	–	–	Display of max. speed (C0011)
MCTRL_bActTPReceived_b	BOOL	binary	–	–	Touch probe (TP) received.
MCTRL_bActIncLastScan_b	double Integer	Position	–	–	∆inc between TP and task start
MCTRL_bResolverFault_b	BOOL	binary	–	–	Monit: resolver error
MCTRL_bEncoderFault_b					Monit: encoder error
MCTRL_bSensorFault_b					Monit: absolute value encoder error
MCTRL_bMotorTempGreaterSetValue_b					Monit: Motor temperature > 150 °C
MCTRL_bMotorTempGreaterC0121_b					Monit: Motor temperature > C0121
MCTRL_bPtcOverTemp_b					Monit: Motor overtemperature (PTC)
MCTRL_bKuehlGreaterSetValue_b					Monit: heatsink temperature > 90 °C
MCTRL_bKuehlGreaterC0122_b					Monit: heatsink temperature > C0122

10.3 Diagnostics with the XT EMZ9371BC keypad

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	

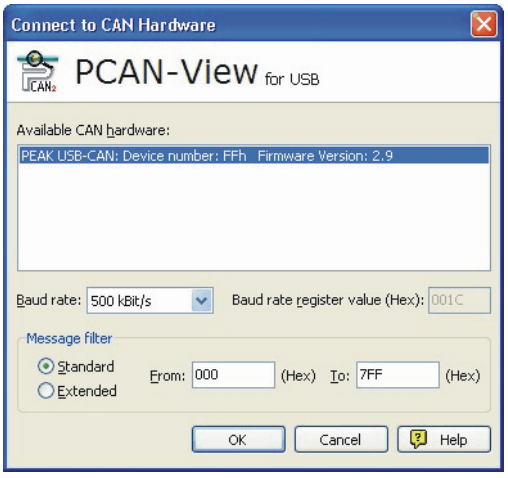
10.4 Diagnostics with PCAN-View

”PCAN-View” is the basic version of the ”PCAN-Explorer” program for Windows® of PEAK System Technik GmbH. The program permits a simultaneous transmission and reception of CAN messages which can be transmitted manually and periodically. Errors on the bus system and memory overflows of the triggered CAN hardware are displayed.

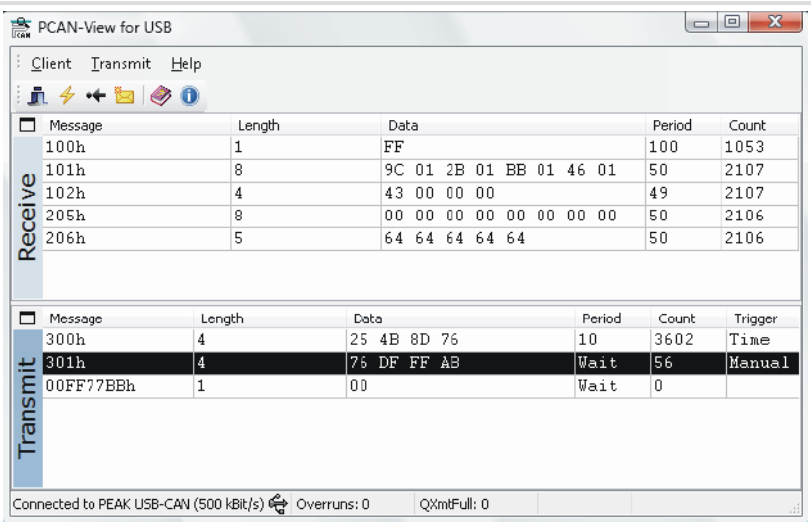
10.4.1 Monitoring of telegram traffic on the CAN bus

How to monitor the telegram traffic:

1. Connect the Engineering PC directly to the CANopen bus via the EMF2177IB USB system bus adapter.
2. Start the ”PCAN-View” program.
3. Connect ”PCAN-View” to ”Connect to CAN Hardware” using the USB system bus adapter and the desired baud rate.



The ”Receive” and ”Transmit” windows now continuously display the CAN telegrams.



On the basis of the IDs displayed, you can assign the telegrams to the devices.

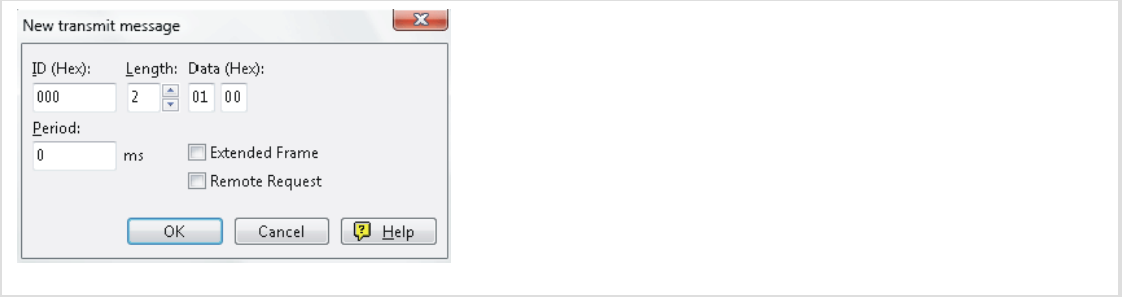
If no telegrams are displayed, this may be caused by various factors:

- Is your Engineering PC connected to the correct CAN bus?
- Is the correct system bus adapter activated under ”System control, CAN Hardware”?
- What does the status line of the »PCAN-View« contain?
  In case of ”Bus Heavy” mostly a node with a wrong baud rate disturbs the bus traffic.
- Do the devices are in the ”Operational” status?

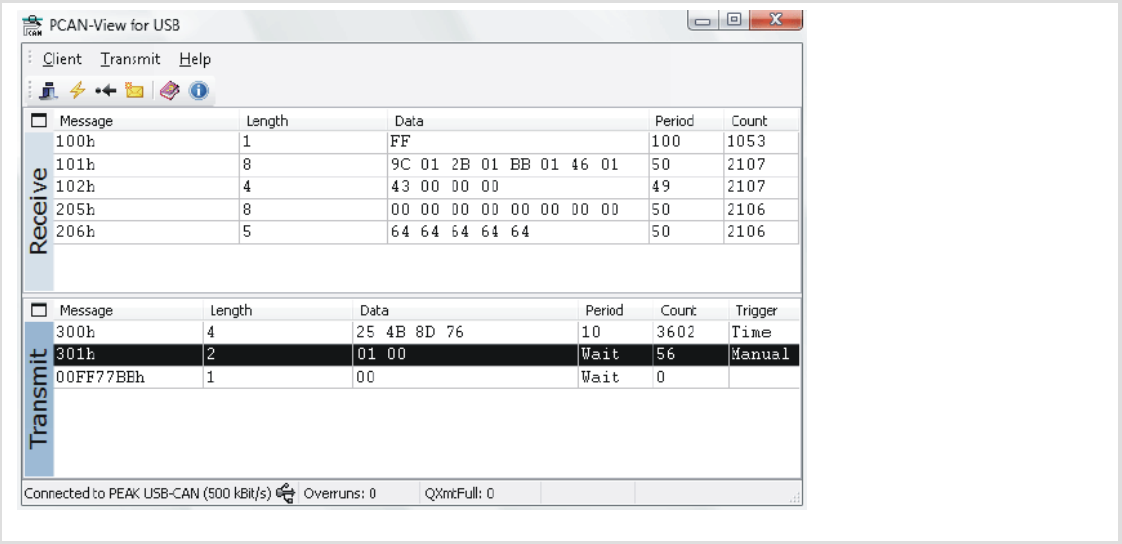
10.4.2 Setting all CAN nodes to the ”Operational” status

How to set all CAN nodes to the ”Operational” status:

1. Create the following CAN message under ”New transmit message”:



2. Select the CAN message in the ”Transmit” window and press the <space bar> once to transmit the CAN message.



11 Troubleshooting and fault elimination

Failures can be quickly detected and classified by means of display elements or status messages via the MotionBus (CAN).

Display elements and status messages provide a rough classification of the trouble.

The chapter ”11.3 Fault messages” (📖 270)contains notes on causes and deletion of faults.

11.1 Fault analysis

11.1.1 Fault analysis via the LED display

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibit (CINH) active, switch-on inhibit	C0183
Blinking	Off	Trouble/fault (TRIP) is active	C0168/1
Blinking	On	Warning/FAIL-QSP is active	C0168/1

11.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display indicate the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited.	C0183, C0168/1
IMP	Pulses at the power stage inhibited.	C0183, C0168/1
Imax	Maximum current reached.	
Mmax	Maximum torque reached.	
FAIL	Fault through TRIP, message, fail QSP or warning.	C0183, C0168/1

11.1.3 Fault analysis with the history buffer

The history buffer (C0168) enables you to trace faults. The corresponding fault messages are stored in eight memory locations in the sequence of their occurrence.

Structure of the history buffer

- The fields under ”fault history” show the memory locations 2 ... 7.
- The fields under ”current faults” indicate memory location 1. It gives information on the active fault.
- If the fault is no longer active or has been reset,
  - all information in the fault memory will be automatically shifted upwards by one subcode.
  - memory location 1 will be deleted (no active fault). The information on the formerly active fault is now in subcode 2.
  - the contents of subcode 8 will be eliminated from the history buffer and cannot be read any longer.
- The history buffer contains three information units for every fault occurred:
  - Fault number and response
  - Time of the last occurrence
  - Frequency of successive occurrence

Note!

- If several faults with different responses occur at the same time, only the fault the response of which has the highest priority is entered in the history buffer.
  - Power supply module ECSxE:
    TRIP/KSB-TRIP (highest) → message → warning (lowest)
  - Axis module ECSxS/P/M/A:
    TRIP (highest) → message → FAIL-QSP → warning (lowest)
- If several faults with the same response occur at the same time, (e.g. two messages) only the fault that occurred first is entered in the history buffer.
- If a fault occurs several times in quick succession, only the time of the last occurrence is entered in the history buffer.

Assignment of information to the codes

Code and retrievable information				contains information on ...
C0168	C0169	C0170	Subcode	
Number and **response** of the fault message	**Time** of the last occurrence of the fault message	**Frequency** of the occurrence of the fault message	1	active fault
			2	last fault
			3	second-to-last fault
			4	third-to-last fault
			5	fourth-to-last fault
			6	fifth-to-last fault
			7	six-to-last fault
			8	seventh-to-last fault

Reset fault message

The current fault message can be reset via a TRIP-RESET (e.g. via C0043):

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0043	Trip reset	0		Reset active fault message (TRIP-RESET)	📖 278
			0 Reset fault message (TRIP-RESET) / no fault		
			1 Active fault message		

Delete entries in the history buffer

The entries in the history buffer can be deleted via C0167.

► This function only works when no trouble is active.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0167	Reset failmem	0		Delete history buffer (C0168)	📖 264
			0 No reaction		
			1 Delete history buffer		

11.1.4 Fault analysis via application status word (C3150/C3151)

Status word Stat1

The status word Stat1 (C3150, C3151) consists of 16 bits, each of them giving the following information:

Bit	Name	Level	Meaning	
			Operating mode "Homing mode" (C5000=6) (📖 164)	**Operating mode "IP mode" (C5000=7)** (📖 161)
0	Toggle	HIGH active	Toggle bit: The control changes the status of this bit with each telegram. The cyclic "toggling" is monitored in the controller. If the error counter exceeds the value in C3161, the drive reacts according to the function set in C3160.	
1	Homing/IP mode is active		0: Stop homing 1: Homing is active	0: IP mode is not enabled 1: IP mode is enabled
2	Ref-ok/PosLatch is active		0: "Homing" required 1: Home position is known	0: Position detection (Pos_Latch) stopped or not yet active 1: Position detection (Pos_Latch) is evaluated
3	Res.		Reserved	Reserved
4	Reference switch/TP sensor		1: Reference switch is assigned	1: Touch probe sensor is assigned
5	Axis limit switch (positive)	LOW active	1: Hardware limit switch of the positive traversing range is activated.	
6	Axis limit switch (negative)		1: Hardware limit switch of the negative traversing range is activated.	
7	**ECS Motion ≥ V3.0:** Brake-open	HIGH active	Brake relay output: 0: brake closed (relay output is not triggered) 1: brake open (relay output is triggered)	
8	Status 0 (LSB)		The following possible values apply to all four status bits (binary coded): ● 0000: Initialisation after connecting the 24 V supply voltage ● 0001: Switch-on inhibit (LOCK-MODE), restart protection active (C0142 = 0) ● 0011: Controller inhibited ● 0110: Controller enabled ● 0111: A monitoring function returned a "message". ● 1000: A monitoring function returned a "TRIP". ● 1010: A monitoring function or an external quick stop (QSP) via a digital input X6/DI1 results in a "FAIL-QSP".	
9	Status 1			
10	Status 2			
11	Status 3 (MSB)			
12	Warning		1 = Warning (Only display, the drive continues to run normally.)	
13	ActPositionOK		0 = the actual position is faulty or the reference to the home position is missing: Homing must be executed again.	
14	FailToAckn		1 = a fault message is pending: Fault reset is required.	
15	RDY		1 = ready for operation	

11.1.5 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	📖 267
			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		

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
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	

11.2 Malfunction of the drive

Maloperation/fault	Cause	Remedy
Feedback system		
● Motor rotates CCW when viewed to the motor shaft. ● C0060 counts down after controller enable.	Feedback system is not connected in correct phase relation.	Connect feedback system in correct phase relation. The rotor position indicated under C0060 is derived from the position encoder (MCTRL_dnPos_p). Therefore observe the mounting position when using separate feedback systems for position (C0490) and speed (C0495).
Asynchronous motor		
● Motor rotates with I_{max} and half slip frequency. ● Motor does not react to setpoint change.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
Synchronous motor		
● Motor does not follow the setpoint change. ● I_{max} follows the setpoint selection in idle state.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
● Motor rotates CCW when viewed to the motor shaft. ● Synchronous motor accelerates with a speed setpoint = 0 to rated speed. ● Torque of synchronous motor is too low.	Rotor angle (offset of electrical and mechanical rotor angle) is not correct.	Carry out rotor position adjustment (C0095 = 1) or set rotor displacement angle manually. **Operate motor without load for this purpose!**
● Motor blocks in certain positions.	The number of pole pairs of the resolver or motor is not set correctly.	Number of pole pairs (C0080) must be set correctly.

11.3 Fault messages

11.3.1 Causes and remedies



Tip!

When the fault messages are retrieved via the MotionBus/system bus (CAN), the fault messages are displayed as numbers (see column "Fault message – No." in the following 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 TRIP (axis module, fix 100 %)	Current overload of the axis module, e.g. by: • frequent and too long acceleration processes • continuous overload with $I_{motor} > 1.05 \times I_{Nx}$	Check drive dimensioning.
0016	OC6	I^2 x t overload TRIP (motor, C0120)	Current overload of the motor, e.g. due to: • frequent or too long acceleration processes • impermissible continuous current	• Check drive dimensioning. • Check setting of C0120.
x017	OC7	I x t overload warning (axis module, C0123)	Current overload of the axis module > C0123 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0123.
x018	OC8	I^2 x t overload warning (motor, C0127)	Current overload of the motor > C0127 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0127.
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 DC bus	DC-bus voltage is lower than specified under C0174.	• Check mains voltage. • Check power supply module.
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.
x041	AP1	Internal fault		Contact Lenze.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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.
0051	OH1	Interior 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.
			Wrong mounting position	Change mounting position.
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.
x055	OH5	Interior temperature > C0124		• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0605 = 3).
			The value under C0124 is set too low.	Enter a higher value under C0124.
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x065	CE4	BUS-OFF state of system bus (CAN), interface X4	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X4: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C0595 = 3).
x066	CE5	System bus (CAN) time-out (communication error of gateway function), interface X4	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X4. • Check CAN bus configuration. • Switch off monitoring (C0603 = 3).
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
0074	PEr	Program error	Error in the program flow	• Check use of pointers. • Send module with PLC program and parameter set to Lenze (on floppy disk/CD-ROM).
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 parameter set transfer between two controllers. • Parameter set does not match the controller, e.g. when data were transmitted from a controller with more performance to a controller with less performance.	• Correct parameter set. • Check code initialisation values. **After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!**
0080	PR6	**With ECSxS/P/M:** internal error		Contact Lenze.
		With ECSxA: too many user codes		Reduce number of user codes.
0081	Rel1	Error on brake relay output (X25)	• Cable breakage • Short circuit • No supply voltage	• Check fuse. • Check supply. • Check cables. • Check motor holding brake
x082	Sd2	Resolver error at X7	Resolver cable is interrupted.	• Check cable for wire breakage. • Check resolver. • Switch off monitoring (C0586 = 3).
			Excitation amplitude is too low.	Increase excitation amplitude of resolver (C0416). Check control factor of resolver under C0414 (as of operating system V8.0).
x085	Sd5	Master current value encoder error at analog input X6/AI+, AI- (C0034 = 1)	Master current value at X6/AI+, AI- < 2mA	• Check cable for wire breakage. • Check master current value encoder. • Switch off monitoring (C0598 = 3). • Check control factor of resolver under C0414 (as of operating system V8.0).
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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. 📖 180 **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	• Sd7 fault during rotor position adjustment with absolute value encoder after mains switching • Cancellation of rotor position adjustment (e.g. by C0095 = 0 or switching off)	1. Activate rotor position adjustment with C0095 = 1. 2. Carry out TRIP reset. 3. Repeat rotor position adjustment.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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).
x095	FAN1	Fan monitoring (for built-in units)	Heatsink fan is locked, dirty or defect.	Clean or exchange heatsink fan.
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.
x108	H08	”Extension board” error	”Extension board” not connected correctly.	• Connect ”extension board” correctly. • Check connector.
			”Extension board” is not supported by PLC program.	• Adapt PLC program to ”extension board”. • Use ”extension board” which is supported by PLC program.
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).
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux1_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/1, if necessary. • Switch off monitoring (C2481 = 3).
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux2_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/2, if necessary. • Switch off monitoring (C2482 = 3).
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux3_IN object receives faulty data or communication is interrupted.	• Check wiring on X14. • Check transmitter. • Increase monitoring time under C2457/3, if necessary. • Switch off monitoring (C2483 = 3).
x125	CE14	BUS-OFF state of system bus (CAN), interface X14	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X14: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C2484 = 3).
x126	CE15	Communication error of the gateway function via interface X14 (CAN-AUX) • C0371 = 1: Gateway channel X14 (CAN-AUX) • C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	• Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X14. • Check CAN bus configuration. • Switch off monitoring (C2485 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
1131	PRM	Parameters of the motor model are faulty	The parameters calculated from the entered rated motor data are outside the permissible value range.	Check and correct the set rated motor data (especially C0084, C0085, C0088, C0090).
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.
x191	HSF	Internal error		Contact Lenze.
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)		
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.
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.
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
x260	Err Node Guard	”Life guarding event”	The controller configured as CAN slave does not receive a ”Node Guarding” telegram within the ”Node Life Time” from the CAN master.	• Check wiring at X4. • Check CAN configuration. • Make sure that ”Node Guarding” has been activated in the CAN master. • Adapt ”Node Life Time” (C0382) to the setting in the CAN master.
x400	Pos HW End	Positive hardware limit switch has been approached.	• Hardware limit switch has been overtravelled or has not been set. • Cable is interrupted. • **ECSxS/P/A**: Terminal polarity X6/DI3, DI4 (C0114/3, C0114/4) is set incorrectly.	• Check traversing range. • Check position/function of the limit switches. • Check cable for wire breakage. • **ECSxS/P/A**: Correct setting C0114/3 and C0114/4.
x401	Neg HW End	Negative hardware limit switch has been approached.	• Hardware limit switch has been overtravelled or has not been set. • Cable is interrupted. • **ECSxS/P/A**: Terminal polarity X6/DI3, DI4 (C0114/3, C0114/4) is set incorrectly.	• Check traversing range. • Check position/function of the limit switches. • Check cable for wire breakage. • **ECSxS/P/A**: Correct setting C0114/3 and C0114/4.
x404	Follow Err 1	Warning against exceeding the following error limit (C3030).	• Following error input of the motor control (MCTRL) exceeds the limit value set (C3030/C3031). • Difference between setpoint and actual value is too big.	• Reduce acceleration. • Increase limit value (C3030/C3031). • Increase current limit (C0022). (Observe max. motor current!) • Avoid setpoint step-change of the higher-level control. • Check drive dimensioning.
x405	Follow Err 2	Following error limit (C3031) has been exceeded.		
x406	Home Pos Err	Home position is unknown.	• No homing executed. • Error in the feedback system	• Start homing. • Check feedback. • Switch off monitoring in C3170.
x407	Toggle Bit Err	Toggle bit error	• Telegrams with the same toggle bit value have arrived. • Communication is interrupted. • Bus load is too high.	• Check bus cable. • Does the master control change the bit? • Reduce bus load. • Set toggle bit error limit (C3161) an error response (C3160).
3408	External QSP	Externally enabled quick stop (FAIL-QSP)	Digital input X6/DI1 has been set.	• Check cable for wire breakage. • Check setting C0114/1. • Check emergency stop circuit.
x410	VelModeErr	Speed error in ”Velocity Mode” (C5000 = 2)	The actual speed value cannot follow the speed setpoint: Difference > 25.00 % (Lenze setting C3037).	Set error threshold (C3037) and error response (C3038).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

11.3.2 Reset fault messages (TRIP-RESET)

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** As long as a TRIP/FAIL-QSP source is active, the TRIP/FAIL-QSP cannot be reset. The TRIP/FAIL-QSP can be reset by: ● Press keypad XT EMZ9371 BC ⇨ STOP. Then, press RUN to re-enable the axis module. ● Set C0043 = 1. ● MotionBus (CAN) control word: set C3153/12 (Bit 11) = 1. ● Set control word C4040/Bit 11 = 1. (Dependent on the control interface selected in C4010.) After the TRIP/FAIL-QSP has been reset, the drive remains at standstill.
Message	**Danger!** After the fault has been removed, the fault message is removed automatically and the drive restarts automatically.
Warning	After eliminating the fault, the fault message is reset automatically.

12 Appendix

12.1 Code table

How to read the code table

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	1	Subcode 1 of Cxxxx
	2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0002	Par load	0			Load parameter set **The Lenze setting can only be loaded if the controller is inhibited (CINH).**
			0	Load Lenze setting	Load Lenze setting into the RAM and activate it. **Only possible if C2108 = 2 (PLC stopped).**
			1	Load parameter set 1	Load parameter set 1 into the RAM and activate it. **Parameter set 1 is loaded automatically after every mains connection.**
C0003	Par save	0			Non-volatile saving of parameter set
			0	No response	
			1	Save parameter set	
C0004	Op display	56			Selection of XT keypad status display
			1 {Code no.} 9999		The keypad displays the selected code in the operating level, if no status messages from C0183 are active (e. g.: 56 = torque setpoint (C0056))

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
[C0006]	Op mode	1				Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1	Servo PM-SM		Servo control of synchronous motors
			2	Servo ASM		Servo control of asynchronous motors
C0009	LECOM address	1				Entry of the device address for operation via AIF interface X1
			1	{1}	99	Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133
C0011	Nmax	3000				Maximum speed
			500	{1 rpm}	16000	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 (CINH)!**
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)
			-16000	{1 rpm}	16000	
C0018	fchop	2				Switching frequency
			1	4 kHz sin		4 kHz permanent PWM frequency
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0019	Thresh nact = 0	0				Threshold when actual speed value (n_{act}) = 0 is detected. (DCTRL_bNActEq0_b)
			0	{1 rpm}	16000	
C0022	Imax current	→				I_{max} limit
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.
C0023	Imax fld.weak	0				Maximum field weakening current for synchronous machines
			0	{1 %}	100	
C0026						Offset for relative analog signals (AIN)
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a
2	FCODE(offset)	0,0				FCODE_nC26_2_a

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0027						Gain for relative analog signals (AIN)	
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0030	DFOUT const	3				Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 113 📖 121
			0	256 incr./rev			
			1	512 incr./rev			
			2	1024 incr./rev			
			3	2048 incr./rev			
			4	4096 incr./rev			
			5	8192 incr./rev			
			6	16384 incr./rev			
C0032	FCODE Gearbox	1				Freely configurable code for gearbox factor ? (FCODE_nC32_a)	
			-32767	{1}	32767		
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	
			-16000	{1 rpm}	16000		
C0040	Ctrl enable	1				Controller enable / controller inhibit (CINH) ● Writing: Controls the controller inhibit ● Reading: Reads the status of the controller inhibit	
			0	Controller inhibited			
			1	Controller enabled			
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 173
			0	QSP not active			
			1	QSP active			
C0043	Trip reset	0				Reset active fault message (TRIP-RESET)	📖 278
			0	Reset fault message (TRIP-RESET) / no fault			
			1	Active fault message			
C0050	MCTRL-NSET2					Speed setpoint on speed controller input (MCTRL_nNSetIn_a) Read only	
			-100,00	{0.01 %}	100.00		
C0051	MCTRL-NACT					Actual speed (MCTRL_nNAct_a) Read only	
			-30000	{1 rpm}	30000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0052	MCTRL Umot					Actual motor voltage Read only	
			0	{1 V}	800		
C0053	UG-VOLTAGE					DC-bus voltage Read only	
			0	{1 V}	900		
C0054	Imot					Actual motor current Read only	
			0,0	{0.1 A}	500,0		
C0055	Phase current					Motor phase current Read only	
1	iu		0,0	{0.1 A}	500,0	Actual current in U phase	
2	iv					Actual current in V phase	
3	iw					Actual current in W phase	
4	Io					Actual theoretical star-point current	
C0056	MCTRL-MSET2					Torque setpoint on speed controller output (MCTRL_nMSetIn_a) Read only	
			-100	{1 %}	100		
C0057	Max Torque					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	
			0,0	{0.1 Nm}	500,0		
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 180
			-180.0	{0.1 °}	179.9		
C0059	Mot pole no.					Calculated number of motor pole pairs Read only	
			1	{1}	200		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 177
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0061	Heatsink temp					Heatsink temperature Read only	231
			-200	{1 °C}	200		
C0062	Interior temp					Interior device temperature Read only	232
			-200	{1 °C}	200		
C0063	Mot temp					Motor temperature Read only	229
			0	{1 °C}	200		
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display	
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.	
C0065	U24 ext					External low-voltage supply (U_{24}) Read only	
			0,0	{0.1V}	100,0		
C0066	Motor load					Thermal motor load $I^{2x}t$ Only display	237
			0	{1 %}	250		
C0067	Act trip					Current fault (TRIP) (in case of FAIL-QSP, warning and message, "0" is displayed.) Only display	270
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	183
			0.00	{ 0.01}	127.99		
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	183
			1.0	{0.5 ms}	6000.0		
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	183
			0.0	{0.1 ms}	32.0		
C0074	Dynamics	0 {1}				Feedforward control of the current controllers for a higher dynamic performance	178
			0	Normal			
			1	Enhanced			
C0075	Vp currCTRL	20.0				Proportional gain of current controller (V_{pi}) The upper limit is device-dependent.	178
			0.00	{0.01 Ω}	381.80	ECSxS/P/M/A004	
					190.90	ECSxS/P/M/A008	
					95.46	ECSxS/P/M/A016	
					47.72	ECSxS/P/M/A032	
					31.82	ECSxS/P/M/A048	
					23.86	ECSxS/P/M/A064	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0076	Tn currCTRL	5.0				Reset time of current controller (T_{ni})	📖 178
			0.01	{0.01 ms}	200.00		
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	📖 185
			0.00	{0.01}	63.99		
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	📖 185
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Read only	
			0.00	{0.01 A}	327,67		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0093	Drive ident					Device identification of the ECS axis module Read only	
			0	Defective power section			
			1	No power section recognised			
			4	ECSxS/P/M/A004C4			
			8	ECSxS/P/M/A008C4			
			16	ECSxS/P/M/A016C4			
			32	ECSxS/P/M/A032C4			
			48	ECSxS/P/M/A048C4			
			64	ECSxS/P/M/A064C4			
			65	ECSxS/P/M/A064C2			
C0094	Password	0				Keypad password Parameter access protection for the keypad	
			0	{1}	9999	When the password is activated, only the codes of the user menu (C0517) can be accessed. Further possible selections: see C0096 0 = no password	
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 180
			0	Inactive			
			1	Active			
C0096						Extended password protection for bus systems with activated password (C0094) All codes in the user menu can be accessed.	
1	AIF/CAN prot.	0		No access protection		AIF access protection	
2	AIF/CAN prot.	0		No access protection		CAN access protection	
			0	No access protection		Full access	
			1	Read protection		Reading not possible	
			2	Write protection		Writing not possible	
			3	Read/write protection		Reading and writing not possible	
C0097	DIS:Lt-Ident	0				Power stage identification	
			0	{1}	255		
C0098	Set position	0				Home position of encoder	
			-2147483647	{1 inc}	2147483647		
C0099	S/W version					Firmware version Read only	
			0,0	{0,1}	25,5		
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 173
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0108						Gain for relative analog signals (AOUT)	
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0114						Polarity of the digital inputs (DIGIN)	142
1	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI1	
2	DIGIN pol	0 {0}		HIGH level active) {HIGH level active}		X6/DI2	
3	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI3	
4	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI4	
			0	HIGH level active)			
			1	LOW level active			
C0118						Polarity of the digital outputs	142
1	DIGOUT pol	0		HIGH level active		X6/DO1 (DIGOUT_bOut1_b)	
2	DIGOUT pol	0		HIGH level active		X25 (DIGOUT_bRelais_b, brake connection)	
			0	HIGH level active			
			1	LOW level active			
C0120	OC6 limit	105				Threshold for I^2 x t monitoring (motor)	237
			0	{1 %}	120	0 = I^2 x t monitoring is switched off I^2 x t > C0120 ⇨ OC6-TRIP	
C0121	OH7 limit	120				Threshold for motor temperature monitoring	229
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault message OH7 (C0584)	
C0122	OH4 limit	80				Threshold for heatsink temperature monitoring	231
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	

Code		Possible settings					IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection					
C0123	OC7 limit	90					Threshold for I x t warning (axis module)	📖 228
			0		{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0124	OH5 limit	75					Threshold for temperature monitoring inside the device	📖 232
			10		{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0125	Baud rate	0					Baud rate for operation via AIF interface X1	
			0	9600 bit/s			Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
			1	4800 bits/s				
			2	2400 bit/s				
			3	1200 bit/s				
			4	19200 bit/s				
C0126	MONIT CE0	3					Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	
			0	TRIP			A communication error activates the CE0 response set.	
			2	Warning				
			3	Off			Monitoring switched off.	
C0127	OC8 limit	100					Threshold for I^2 x t warning (motor)	📖 237
			0		{1 %}	120	I^2 x t > C0127 ⇨ fault message OC8 (C0606)	
C0128	Tau motor	5.0					Thermal time constant of the motor	📖 237
			0.5		{0.1 min}	25.0	For calculating the I^2 x t disconnection	
C0129	Charc.: Ix/Nx						Reduction of the speed/torque characteristic for UL-compliant thermal motor monitoring (I^2 x t) The reduced speed/torque characteristic reduces the permissible thermal load of self-ventilated standard motors.	📖 24
1		100	10		{1 %}	200	S1 torque characteristic I_1/I_{rated} This value also enables an increase of the maximally permissible utilisation.	
2		40					S1 torque characteristics n_2/n_{rated} With increasing speeds, the maximally permissible utilisation remains unchanged ($I_{Mot} = I_{rated}$).	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0135	Control word	0				System control word DCTRL
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Not assigned		
			Bit 2	Not assigned		
			Bit 3	Quick stop (QSP)		
			Bit 4	Not assigned		
			Bit 5	Not assigned		
			Bit 6	Not assigned		
			Bit 7	Not assigned		
			Bit 8	Operation inhibit (DISABLE)		
			Bit 9	Controller inhibit (CINH)		
			Bit 10	TRIP-SET		
			Bit 11	TRIP-RESET		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		
C0136						Control words Hexadecimal value is bit-coded. Read only
1	CTRLWORD		0	{hex}	FFFF	Control word C0135
2	CTRLWORD					CAN control word
3	CTRLWORD					AIF control word
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)
			-199.99	{0.01 %}	199.99	
C0142	Start options	1				Starting condition for start after ● mains connection ● message (t > 0.5 s) ● TRIP
			0	Protection against unexpected start-up		
			1	Automatic start		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only	📖 267
			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			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0157						Status of free bits of DCTRL status word 1 (C0150) Only display	
1	Stat. FreeBit		0	{1 bit}	1	Bit 0 (DCTRL_bStat_B0_b)	
2	Stat. FreeBit					Bit 2 (DCTRL_bStat_B2_b)	
3	Stat. FreeBit					Bit 3 (DCTRL_bStat_B3_b)	
4	Stat. FreeBit					Bit 4 (DCTRL_bStat_B4_b)	
5	Stat. FreeBit					Bit 5 (DCTRL_bStat_B5_b)	
6	Stat. FreeBit					Bit 14 (DCTRL_bStat_B14_b)	
7	Stat. FreeBit					Bit 15 (DCTRL_bStat_B15_b)	
C0161	Act trip					Current TRIP ● as in C0168/1 ● In case of FAIL-QSP, warning, and message, ”0” is displayed. Only display	📖 270
C0167	Reset failmem	0				Delete history buffer (C0168)	📖 264
			0	No reaction			
			1	Delete history buffer			
C0168						Fault history buffer (list of faults occurred) Read only	📖 264 📖 270
1	Fail number					Currently active fault	
2	Fail number					Last fault	
3	Fail number					Last fault but one	
4	Fail number					Last fault but two	
5	Fail number					Last fault but three	
6	Fail number					Last fault but four	
7	Fail number					Last fault but five	
8	Fail number					Last fault but six	
			All fault indications (TRIP, FAIL-QSP, warning, message)				
C0169						Time at which the fault messages entered in the history buffer (C0168) occurred. Read only	📖 264
1	FailTime		Respective status of the operating hour counter (C0179)			Occurrence of the currently active fault message	
2	FailTime					Occurrence of the last fault message	
3	FailTime					Occurrence of the second-last fault message	
4	FailTime					Occurrence of the third-last fault message	
5	FailTime					Occurrence of the fourth-last fault message	
6	FailTime					Occurrence of the fifth-last fault message	
7	FailTime					Occurrence of the sixth-last fault message	
8	FailTime					Occurrence of the seventh-last fault message	
			0	{1 h}	65535		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0170				Frequency of successive occurrence of the fault messages entered in the history buffer (C0168) Read only	📖 264
			0 {1} 65535		
1	Counter			Frequency of the fault message currently active	
2	Counter			Frequency of the last fault message	
3	Counter			Frequency of the second-last fault message	
4	Counter			Frequency of the third-last fault message	
5	Counter			Frequency of the fourth-last fault message	
6	Counter			Frequency of the fifth-last fault message	
7	Counter			Frequency of the sixth-last fault message	
8	Counter			Frequency of the seventh-last fault message	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0173	UG limit	11		Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 101
			0 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3 Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4 Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13 Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14 Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60		Undervoltage threshold of DC bus (LU)	📖 101
			15 {1 V} 342		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 101
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0178	Op timer					Running time meter Read only	
			0	{1 sec}	4294967295	Time when the controller was enabled	
C0179	Mains timer					Power-on time meter Only display	
			0	{1 sec}	4294967295	Time when the mains was switched on	
C0183	Diagnostics					Drive diagnostics Read only ● Indicates fault or status information ● If several fault or status information are to be shown at the same time, the information with the smallest number is displayed	
			0	OK		No fault	
			101	Initialisation phase			
			102	TRIP/trouble			
			103	Emergency stop activated			
			104	IMP message			
			105	Power off			
			111	Operation inhibit C0135			
			112	Operation inhibit AIF			
			113	Operation inhibit CAN			
			121	Controller inhibit via X6/SI1			
			122	Internal controller inhibit 1			
			123	Internal controller inhibit 2			
			124	Controller inhibit via STOP key of the keypad			
			125	Controller inhibit via AIF			
			126	Controller inhibit via CAN			
			131	Fail QSP			
			141	Restart protection			
			142	Pulse inhibit		High resistance power outputs	
			151	Quick stop (QSP) via terminal			
			152	Quick stop (QSP) via STOP key of the keypad			
			153	Quick stop (QSP) via AIF			
			154	Quick stop (QSP) via CAN			
			160	PLC Stop		PLC must be started.	
			250	Warning			
C0195	BRK T act	99.9 {0.0}				Closing time of the motor holding brake	📖 105
			0.0	{0.1 s}	99.9	During the time set the drive continues to generate a torque. After the set time has elapsed, the status "mechanical brake closed" is reached.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0196	BRK T rel	0.0				Opening time of the motor holding brake	📖 105
			0.0	{0.1 s}	60.0	During the time set the drive can generate the torque set under C0244 against the holding brake. After the set time has elapsed, the status "mechanical brake opened" is reached.	
C0199	BuildNumber					Software identification Only display	
C0200	S/W Id					Software identification Only display	
C0201	S/W date					Software release date Read only	
C0202						Service code Only display	
1						Product code 1	
...						...	
4						Product code 4	
C0203	Komm.-No.		x / xxxx / xxxxx			Commission number Only display	
C0204	Serial-No.					Serial number Read only	
C0205	PLC Target ID					Identification key Only display	
C0206	Product. date					Production date Only display	
C0207	DL info 1					Download info 1 Only display	
C0208	DL info 2					Download info 2 Only display	
C0209	DL info 3					Download info 3 Only display	
C0244	BRK M set	0.0				Holding torque of the drive against the motor holding brake, with reference to M_{max} (C0057).	📖 105
			0.00	{0.01 %}	199.99	During the time set in C0196 the drive generates the set torque against the holding brake.	
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	
			0		1		
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	
			0.0000	{ 0.0001}	3.9999		
C0300 ... C0302	Service Codes					**Only the Lenze service is allowed to make changes!**	
C0304 ... C0310	Service Codes					**Only the Lenze service is allowed to make changes!**	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0349					Status of the DIP switch for CAN bus interface X4 Read only	
1	CAN DIP-SW		0 {1} 63		Node address set on the DIP switch	
2	CAN DIP-SW		0 4		For setting the DIP switches > 4, the display is set to 0.	
C0350	CAN address	32			Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 197) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 197 📖 351
			1 {1} 63			
C0351	CAN baud rate	0 {4}			Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required. ● When the Lenze setting is loaded via C0002, C0351 is set to 0 (500 kbit/s).	📖 197
			0	500 kbps		
			1	250 kbits/sec		
			2	125 kbit/s		
			3	50 kbps		
			4	1000 kbit/s		
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 203
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 201
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 201
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C0355						Identifier for CAN_IN/CAN_OUT (CAN bus interface X4) Read only	📖 351
1	CAN Id		1	{1}	2047	Identifier CAN1_IN	
2	CAN Id					Identifier CAN1_OUT	
3	CAN Id					Identifier CAN2_IN	
4	CAN Id					Identifier CAN2_OUT	
5	CAN Id					Identifier CAN3_IN	
6	CAN Id					Identifier CAN3_OUT	
C0356						CAN time settings for CAN bus interface X4	📖 204
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 225
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0358	Reset node	0				Make a reset node for the CAN bus node.	📖 206
			0	No function			
			1	CAN reset			
C0359	CAN state					CAN bus status (interface X4) Read only	📖 214
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
			4	Stopped			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0360					Telegram counter CAN_IN/CAN_OUT (CAN bus interface X4), number of telegrams Read only	📖 215
1	CAN Messages		0	{1} 65535	All sent telegrams	
2	CAN Messages		With a count value > 65535 the counter restarts with 0		All received telegrams	
3	CAN Messages				Sent to CAN1_OUT	
4	CAN Messages				Sent to CAN2_OUT	
5	CAN Messages				Sent to CAN3_OUT	
6	CAN Messages				Sent on parameter data channel 1	
7	CAN Messages				Sent on parameter data channel 2	
8	CAN Messages				Received from CAN1_IN	
9	CAN Messages				Received from CAN2_IN	
10	CAN Messages				Received from CAN3_IN	
11	CAN Messages				Received from parameter data channel 1	
12	CAN Messages				Received from parameter data channel 2	
C0361					Detected load CAN_IN/CAN_OUT (CAN bus interface X4) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 216
1	Load IN/OUT		0	{1 %} 100	All sent telegrams	
2	Load IN/OUT				All received telegrams	
3	Load IN/OUT				Sent to CAN1_OUT	
4	Load IN/OUT				Sent to CAN2_OUT	
5	Load IN/OUT				Sent to CAN3_OUT	
6	Load IN/OUT				Sent on parameter data channel 1	
7	Load IN/OUT				Sent on parameter data channel 2	
8	Load IN/OUT				Received from CAN1_IN	
9	Load IN/OUT				Received from CAN2_IN	
10	Load IN/OUT				Received from CAN3_IN	
11	Load IN/OUT				Received from parameter data channel 1	
12	Load IN/OUT				Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0362	Sync cycle					Time interval between 2 sync telegrams via the X4 CAN bus interface or EMF2192IB EtherCAT communication module at X1 AIF interface Read only	📖 207
			1	{1 ms}	30		
C0363	Sync correct.	1				Sync correction increment (for CAN and EtherCAT) ● Change correction value until C4264 reaches the minimum.	📖 208
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0365	DIS:CAN active					Input signal CAN active Only display	
			0	CAN not active			
			1	CAN active			
C0366	Sync Response	1				CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 209
			0	No response			
			1	Response			
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 208
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 336 📖 207
			1	{1}	256		
C0369	SyNc Tx Time	0 {0}				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier set in C0368 is sent with the set cycle time.	📖 208
			0	{1 ms}	65000	0 = switched off	
[C0370]	SDO gateway	0				Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 217
			0	{1}	63		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0371	Gateway Ch.	1				Selection of the gateway channel	217
			0	CAN		Use CAN bus interface X4	
			1	CAN-AUX		Use CAN bus interface X14	
C0381	HeartProdTime	0				Heartbeat (slave): HeartbeatProducerTime • Time interval for sending the heartbeat message • Only relevant for setting C0352 = 3.	
			0	{1 ms}	65535		
C0382	GuardTime	0				Node Guarding (slave): NodeGuardTime • Time interval of the status inquiry of the master • Only relevant for setting C0352 = 4.	212
			0	{1 ms}	65535		
C0383	LifeTimeFact	0				Node Guarding (slave): NodeLifeTime factor • Factor for the monitoring time of NodeLifeTime • NodeLifeTime = C0383 x C0382 (NodeGuardTime) • Only relevant for setting C0352 = 4.	212
			0	{1}	255		
C0384	Err NodeGuard	3				Node Guarding (slave) • Response for the occurrence of a NodeGuard-Event • Only relevant for setting C0352 = 4.	212
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0400	DIS: AnalogIn					Signal at the analog input Read only	
			-199.99	{0.01 %}	199.99		
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	110
			0.00	{0.01}	1,60		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0416]	Resolver adj.	5			Resolver excitation amplitude	📖 110
			0	100 %		
			1	80 %		
			2	68 %		
			3	58 %		
			4	50 %		
			5	45 %		
			6	40 %		
			7	37 %		
[C0417]	Resolver cor.	0			Resolver adjustment	📖 188
			0	Ready		
			1	Start adjustment		
			2	Loading default values		
[C0418]	Test Cur.Ctrl	0			Controller adjustment:	📖 178
			0	Deactivated	Deactivate test mode	
			1	Activated	Activate test mode	
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 113 📖 121
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 113 📖 121
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0421]	Encoder volt	0			Encoder voltage	📖 113
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	📖 121
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
C0426	DIS: In				Signal at DFIN input Only display	
			-32767	{1 rpm} 32767		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 113 📖 121
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
C0428	DFIN TP sel.	0			DFIN touch probe signal source	
			0	Zero pulse of position encoder (C0490)	X7/X8	
			1	Touch probe input TP1	X6/DI1	
			2	Zero pulse of digital frequency input	X8	
C0429	TP1 delay	0			DFIN dead time compensation TP1 (DI1)	
			-32767	{1 inc} 32767		
C0431	DFIN TP Edge	0			DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	
			0	Rising edge TP1		
			1	Falling edge TP1		
			2	Rising and falling edge TP1		
			3	Switched off		
C0443	DIS: DIGIN				Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	
			0	{1} 255		
			Bit 0	DIGIN1	X6/DI1	📖 140
			Bit 1	DIGIN2	X6/DI2	
			Bit 2	DIGIN3	X6/DI3	
			Bit 3	DIGIN4	X6/DI4	
			Bit 4	DIGIN_safe_standstill	X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	📖 70
			Bit 5	Free		
			Bit 6	DIGIN_CInh	X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	📖 70
			Bit 7	Free		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0444						Status of the digital outputs Only display
1	DIS: DIGOUT		0		1	Status of the digital output X6/DO1
2	DIS: DIGOUT					Relay control status
[C0469]	Fct STP key	2				Function of the STOP key of the keypad **Must not be changed if the "STOP" key is pressed!**
			0	Inactive		Without function
			1	Controller inhibit (CINH)		
			2	Quick stop (QSP)		
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470
			0	{1}	4294967295	
C0472						Freely configurable code for relative analog signals
1	FCODE analog	0.00	-199.99	{0.01 %}	199.99	
2	FCODE analog	0.00				
3	FCODE analog	100.00				
4	FCODE analog	0.00				
...	...	...				
10	FCODE analog	0.00 {10.00}				Speed threshold for closing the holding brake with reference to the value in C0011 (maximum speed n_{max}).
11	FCODE analog	0.00				Value/direction of the torque against the holding brake
...	...	...				
20	FCODE analog	0.00				
C0473						Freely configurable code for absolute analog signals
1	FCODE abs	1	-32767	{1}	32767	
2	FCODE abs	1				
3	FCODE abs	0				
...	...	...				
10	FCODE abs	0				
C0474						Freely configurable code for phase signals
1	FCODE PH	0	-2147483647	{1}	2147483647	
...	...	...				
5	FCODE PH	0				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0475						Freely configurable code for phase difference signals	
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 109
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
[C0491]	X8 in/out	0				Function of X8	📖 113 📖 121
			0	X8 is input			
			1	X8 is output			
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 109
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
C0497	Nact filter	2.0				Time constant of actual speed value	
			0.0	{0.1 ms}	50.0	0.0 ms = switched off	
C0504 ... C0509	Service codes					**Only the Lenze service is allowed to make changes!**	
C0510	ProtAppFlash	0				Write-protection application FLASH	
			0	No write protection			
			1	Write protection is active			
C0517						User menu with up to 32 entries	
			0.00	{0.01}	7999.00	• Enter the numbers of the required codes into the subcodes. Format: xxxx.yy – xxxx = code number – yy = subcode of the code • It is not checked whether the entered code exists.	
1	User menu	51.00	C0051	MCTRL-NACT		Display of actual speed	
2	User menu	54.00	C0054	Imot		Display of motor current	
3	User menu	56.00	C0056	MCTRL-MSET2		Display of torque setpoint	
4	User menu	0.00		Not assigned			
5	User menu	0.00		Not assigned			
6	User menu	183.00	C0183	Diagnostics		Display for diagnostics	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
7	User menu	168.01	C0183	Fail number		Display of current fault message	
8	User menu	0.00		Not assigned			
9	User menu	22.00	C0022	Imax current		Input of maximum output current	
10	User menu	0.00		Not assigned			
11	User menu	11.00	C0011	Nmax		Input of the maximum speed	
12	User menu	0.00		Not assigned			
13	User menu	0.00		Not assigned			
14	User menu	105.00	C0105	QSP Tif		Input of quick stop deceleration time	
15	User menu	0.00		Not assigned			
16	User menu	70.00	C0070	Vp speed CTRL		Input of speed controller gain (Vp)	
17	User menu	71.00	C0071	Tn speed CTRL		Input of speed controller reset time (Tn)	
18	User menu	0.00		Not assigned			
19	User menu	2100.00	C2100	Time slice		Input of time dial for cycl. task	
20	User menu	2102.00	C2102	Task switch		Selection of the switching function for cycl. task	
21	User menu	2104.00	C2104	PLC autorun		Autom. start of the PLC program after mains power-up	
22	User menu	2106.00	C2106	Download protect		Write protection of the PLC program	
23	User menu	2108.00	C2108	PLC run/stop		Control of the PLC program	
24	User menu	2111.00	C2111	GDC ID		Creation date of the PLC program	
25	User menu	2113.00	C2113	PLC prog name		Name of the PLC program	
26	User menu	2115.00	C2115	T-fct Credit		Number of technology units	
27	User menu	0.00		Not assigned			
28	User menu	0.00		Not assigned			
29	User menu	0.00		Not assigned			
30	User menu	0.00		Not assigned			
31	User menu	94.00	C0094	Password		Parameter access protection for the keypad	
32	User menu	3.00	C0003	Par save		Save parameter set	
[C0540]	X8 Signal out	2				Function of the digital frequency output signals at X8 (DFOUT)	📖 109
			0	No function			
			1	No function			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	
			-32767	{1 rpm}	32767		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 249
			0	{1 %}	100		
C0577	Vp fld weak	0.100				Gain of the field weakening controller (V_p)	📖 185
			0.000	{0.001}	63.999		
C0578	Tn fld weak	3.0				Integral-action time of the field weakening controller (V_n)	
			0.1	{0.1 ms}	6000.0		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 249
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 248
			0	TRIP			
			3	Off			
C0581	MONIT EEr	0				Fault response - external fault monitoring ”ExternalFault” (EEr)	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0582	MONIT OH4	2				Setting of the fault response - monitoring of heatsink temperature in C0122	📖 231
			0	TRIP			
			2	Warning			
			3	Off			
C0583	MONIT OH3	0				Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	📖 229
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 229
			0 TRIP		
			2 Warning		
			3 Off		
C0586	MONIT SD2	0		Fault response - monitoring Resolver "ResolverFault" (Sd2)	📖 245
			0 TRIP		
			2 Warning		
			3 Off		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 233
			0 TRIP		
			2 Warning		
			3 Off		
C0591	MONIT CE1	3		Fault response - monitoring CAN1_IN (no telegrams) "CommErrCANIN1" (CE1)	📖 225
			0 TRIP		
			2 Warning		
			3 Off		
C0592	MONIT CE2	3		Fault response - monitoring CAN2_IN (no telegrams) "CommErrCANIN2" (CE2)	📖 225
			0 TRIP		
			2 Warning		
			3 Off		
C0593	MONIT CE3	3		Fault response - monitoring CAN3_IN (no telegrams) "CommErrCANIN3" (CE3)	📖 225
			0 TRIP		
			2 Warning		
			3 Off		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. "SensorFault" (Sd6)	📖 246
			0 TRIP		
			2 Warning		
			3 Off		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0595	MONIT CE4	3				Fault response - system bus (CAN) monitoring "Bus-off" at X4 "BusOffState" (CE4)	📖 225
			0	TRIP			
			2	Warning			
			3	Off			
C0596	NMAX limit	5500				Maximum system speed	📖 250
			0	{1 rpm}	16000		
C0597	MONIT LP1	3				Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 244
			0	TRIP			
			2	Warning			
			3	Off			
C0598	MONIT SD5	3				Fault response - master current monitoring at X6 < 2 mA "MastISourceDef"	
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 244
			0.01	{0.01 %}	10.00		
C0602	MONIT REL1	3				Fault response - open circuit monitoring of relay output X25	
			0	TRIP			
			2	Message			
			3	Off			
			4	FAIL-QSP			
C0603	MONIT CE5	3				Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 225 📖 217
			0	TRIP			
			2	Warning			
			3	Off			
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 228
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 232
			0	TRIP			
			2	Warning			
			3	Off			
C0606	MONIT OC8	2				Fault response - monitoring of I^2 x t motor utilisation. Threshold can be set under C0120.	📖 237
			0	TRIP			
			2	Warning			
			3	Off			
C0607	MONIT NMAX	0				Fault response - maximum speed monitoring of the machine	
			0	TRIP			
			2	Warning			
			3	Off			
C0608	ovr. Tx-Queue	2				Fault response - transmission memory overflow of free CAN objects	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0609	ovr. Rx-Isr	0				Fault response Receive memory overflow of free CAN objects	
			0	TRIP			
			4	FAIL-QSP			
C0651	Delay T	0.006 {1.000}				DT1-1 time constant	
			-0.005	{0.001 s}	199.999		
C0653	Sensibility	1				DT1-1 sensitivity	
			1	15 bits			
			2	14 Bit			
			3	13 bits			
			4	12 bits			
			5	11 bits			
			6	10 bits			
			7	9 bits			
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	
			-2147483648	{1}	2147483647		
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	
			-2147483648	{1}	2147483647		
C0863						Digital process data input words for CAN bus interface X4 Hexadecimal value is bit-coded. Read only	📖 340
			0000	{hex}	FFFF		
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 340
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1	
2	CAN OUT words					CAN1_OUT word 2	
3	CAN OUT words					CAN1_OUT word 3	
4	CAN OUT words					CAN2_OUT word 1	
5	CAN OUT words					CAN2_OUT word 2	
6	CAN OUT words					CAN2_OUT word 3	
7	CAN OUT words					CAN2_OUT word 4	
8	CAN OUT words					CAN3_OUT word 1	
9	CAN OUT words					CAN3_OUT word 2	
10	CAN OUT words					CAN3_OUT word 3	
11	CAN OUT words					CAN3_OUT word 4	

Code		Possible settings					IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection				
C0869							32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647		CAN1_OUT
2	CAN OUT phi						CAN2_OUT
3	CAN OUT phi						CAN3_OUT
C0878							Digital input signals to DCTRL Only display
1	DigInOfDCTRL		0			1	Controller inhibit (CINH) 1
2	DigInOfDCTRL						Controller inhibit (CINH) 2
3	DigInOfDCTRL						TRIP-set
4	DigInOfDCTRL						TRIP-RESET
C0879							
1	Reset C0135 Controlword	0		No reset			Reset DCTRL control word of C0135
2	Reset AIF Controlword	0		No reset			Reset DCTRL control word of AIF
3	Reset CAN Controlword	0		No reset			Reset DCTRL control word of CAN
			0	No reset			
			1	Reset			Performs one ”reset”
C0906							Analog input signals to MCTRL Read only
1	MCTRL analog		-199.99	{0.01 %}	199.99		Speed controller input
2	MCTRL analog						Torque setpoint
3	MCTRL analog						Lower torque limit
4	MCTRL analog						Upper torque limit
5	MCTRL analog						Limit of the position controller
6	MCTRL analog						Speed for activating the torque limitation
7	MCTRL analog						Field weakening
8	MCTRL analog						Integrator of the speed controller
9	MCTRL analog						P adaptation of the position controller
C0907							Digital input signals to MCTRL Only display
1	MCTRL digital		0			1	Activating position controller
2	MCTRL digital						Speed control or torque control
3	MCTRL digital						Set quick stop (QSP)
4	MCTRL digital						Loading integral-action component of the speed controller
C0908	MCTRL PosSet						Set phase signal 1 revolution = 65536 increments Only display
			-2147483648	{1 inc}	2147483647		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0909	speed limit	1				Limitation of direction of rotation for speed setpoint	
			1	-175 ... +175 %			
			2	0 ... +175 %			
			3	-175 ... 0 %			
C0910	MCTRL TP2 delay	0				MCTRL dead time compensation TP2 (X6/DI2)	
			-32767	{1 inc}	32767	1 inc ≡ approx. 60 µs	
C0911	MCTRL TP2 sel.	0				MCTRL touch probe signal source	
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP2		X6/DI2	
C0912	MCTRL TP2 Edge	0				MCTRL touch probe TP2 edge (for touch probe via digital input X6/DI2 (C0911 = 1))	
			0	Rising edge TP2			
			1	Falling edge TP2			
			2	Rising and falling edge TP2			
			3	Switched off			
C0935	L_REF1 speed	100				Traversing speed of homing	143
			1	{1 rpm}	16000		
C0936	L_REF1 Ti	1.0				Deceleration time (T_i) of homing	143
			0.01	{0.01 s}	650.00		
C1120	Sync mode	0 {1}				Sync signal source	207
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	210
			2	Terminal sync		Sync connection via terminal X6/DI1	211
C1121	Sync cycle	2				Synchronisation cycle	207
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	207
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window • If the sync telegram/signal sent by the master is inside this "time slot", C3165 is set to 1.	209
			0.000	{0.001 ms}	6.500		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C1190	MPTC mode	0				Selection of PTC motor temperature sensor characteristic
			0	Characteristic for PTC 83-110 (Lenze standard)		
			1	Can be specifically set by the user under C1191 and C1192		
			2	Characteristic for PTC 83-110 and 2 x PTC150 (e.g. in MCS motors)		This selection is only available as of operating system V 8.0. For the corresponding motors, the parameter is not automatically transferred into GDC by the motor data assistant. The parameter has to be set later!
C1191						Selection of temperature characteristic for PTC
1	Char.: temp	25	0	{1 °C}	255	PTC characteristic: lower temperature T1
2	Char.: temp	150				PTC characteristic: upper temperature T2
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2
C1810	SW ID LECOM					Software identification LECOM Only display
C1811	SW date LECOM					Software creation date LECOM Only display
C2100	Time slice	13				Time slice for cyclic task
			6	{1 ms}	26	
C2102	Task switch	0				Change-over: System task →cycl. task (PLC)
			0	Time slice		No change-over
			1	Time slice + end of PLC_PRG		
			2	Time slice + end of PLC_PRG + end of system task		
C2104	PLC Autorun	0 {1}				Automatic start of PLC program after power-up
			0	Off		
			1	On		
C2106	Downl.protect	0				Write protection of PLC program
			0	Inactive		
			1	Active		
			2	Reserved		
C2108	PLC run/stop	0				Control PLC program
			0	No function		
			1	Run		
			2	Stop		
			3	Reset		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2111	GDC Id		27012006132510 = ● Date (day.month.year): 27.01.2006 ● Time (h:min:sec): 13:25:10		Creation date of PLC program Read only	
C2113	PLC Prog Name				Name of PLC program Read only	
C2115	T-Fkt Credit	0			Number of technology units	
C2116	CreditPinCode	0			Code for technology units if service is required (please consult Lenze)	
			0	{1} 4294967295		
C2117	Full Credit	0			Service code	
C2118	ParWriteChan.	0			CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	📖 217
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)		
			1	Parameter data channel 2		
C2120	AIF: Control	0			AIF-CAN: control word	
			0	{1} 255	Binary interpretation reflects bit states	
			0	No command	**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!	
			1	Read XCAN codes + reinitialisation		
			2	Read XCAN code		
			10	Read XCAN C2356/1 ... 4		
			11	Read XCAN C2357		
			12	Read XCAN C2375		
			13	Read XCAN C2376 ... C2378		
			14	Read XCAN C2382		
			255	Not assigned		
C2121	AIF:State				AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only	
			1	{1} 255	Binary interpretation reflects bit states.	
			Bit 0	XCAN1_IN monitoring time		
			Bit 1	XCAN2_IN monitoring time		
			Bit2	XCAN3_IN monitoring time		
			Bit3	XCAN bus off		
			Bit4	XCAN operational		
			Bit5	XCAN pre-operational		
			Bit 6	XCAN warning		
			Bit 7	Assigned internally		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2130	FileNameAdd Da		Symbolic data name			Information on the additional data that have been transmitted together with the application program. Only display
C2131	Type AddData		Specification identification of the data			
C2132	VersionAddDa ta		Data version			
C2133	TimeStamp		Time stamp of the data			
C2350	XCAN address	1				Node address XCAN (AIF interface X1)
			1	{1}	63	
C2351	XCAN baud rate	0				Baud rate XCAN (AIF interface X1)
			0	500 kbps		
			1	250 kbit/sec		
			2	125 kbits/s		
			3	50 kbps		
			4	1000 kbit/s		
C2352	XCAN mst	0				Establish XCAN master operation. (AIF interface X1)
			0	Slave		
			1	Master		
C2353						Source for system bus node addresses of XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr sel	0		CAN node address (C2350)		XCAN1_IN/OUTaddress
2	XCAN addr sel	0		CAN node address (C2350)		XCAN2_IN/OUTaddress
3	XCAN addr sel	0		CAN node address (C2350)		XCAN3_IN/OUTaddress
			0	C2350 (auto)		Automatically determined by C2350
			1	C2354 (man.)		Determined by C2354
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr.	129	1	{1}	512	XCAN1_INaddress 2
2	XCAN addr.	1				XCAN1_OUTaddress 2
3	XCAN addr.	257				XCAN2_INaddress 2
4	XCAN addr.	258				XCAN2_OUTaddress 2
5	XCAN addr.	385				XCAN3_INaddress 2
6	XCAN addr.	386				XCAN3_OUTaddress 2
C2355						Identifier for XCAN_IN/XCAN_OUT (AIF interface X1) Read only
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN
2	XCAN Id					Identifier XCAN1_OUT
3	XCAN Id					Identifier XCAN2_IN
4	XCAN Id					Identifier XCAN2_OUT
5	XCAN Id					Identifier XCAN3_IN
6	XCAN Id					Identifier XCAN3_OUT

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2356						Time settings for XCAN (AIF interface X1)
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time after mains connection for initialisation through the master.
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission
3	XCAN times	0				
4	XCAN times	0				
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to "Operational"
C2357						Monitoring time for XCAN process data input objects (AIF interface X1) **Only ECSxA:** When the subcodes 1 ... 4 are set, consider the task runtime: C2357/1...4 = Desired monitoring time / task runtime
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time
2	CE monit time	3000				XCAN2_IN monitoring time
3	CE monit time	3000				XCAN3_IN monitoring time
4	CE monit time	3000				Bus-off
5	CE monit time	3000				AIF monitoring time (can only be set if C2357/6 = 0)
6	CE monit time	0				Sync monitoring time (can only be set if C2357/5 = 0)
C2359	AIF HW Set.	0				
			0	{1}	65535	
C2367	Sync Rx Id	128				XCAN receive identifier of the sync telegram(AIF interface X1)
			1	{1}	2047	
C2368	Sync Tx Id	128				XCAN send identifier of the sync telegram (AIF interface X1)
			1	{1}	2047	
C2373						XCAN Sync counter (AIF interface X1)
1	Sync Rate IN	1	1	{1}	240	XCAN1_IN
2	Sync Rate IN	1				XCAN2_IN
3	Sync Rate IN	1				XCAN3_IN
C2374						XCAN Sync counter (AIF interface X1)
1	Sync Rate OUT	1	1	{1}	240	XCAN1_OUT
2	Sync Rate OUT	1				XCAN2_OUT
3	Sync Rate OUT	1				XCAN3_OUT

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2375						TX mode for XCANx_OUT (AIF interface X1)
1	XCAN Tx mode	0		Response to sync		XCAN1_OUT
2	XCAN Tx mode	0		Response to sync		XCAN2_OUT
3	XCAN Tx mode	0		Response to sync		XCAN3_OUT
			0	Response to sync		
			1	No response to sync		
			2	Event		
			3	Event, cycle C2356 superimposed		
C2376						XCAN1_OUT mask (AIF interface X1)
1	XCAN1 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN1 Mask	FFFF				Mask for process data output word 2
3	XCAN1 Mask	FFFF				Mask for process data output word 3
4	XCAN1 Mask	FFFF				Mask for process data output word 4
C2377						XCAN2_OUT mask (AIF interface X1)
1	XCAN2 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN2 Mask	FFFF				Mask for process data output word 2
3	XCAN2 Mask	FFFF				Mask for process data output word 3
4	XCAN2 Mask	FFFF				Mask for process data output word 4
C2378						XCAN3_OUT mask (AIF interface X1)
1	XCAN3 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN3 Mask	FFFF				Mask for process data output word 2
3	XCAN3 Mask	FFFF				Mask for process data output word 3
4	XCAN3 Mask	FFFF				Mask for process data output word 4

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2382						The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)	
1	XCAN Conf. CE	0		Off		XCAN1_IN	
2	XCAN Conf. CE	0		Off		XCAN2_IN	
3	XCAN Conf. CE	0		Off		XCAN3_IN	
4	XCAN Conf. CE	0		Off		Bus-off	
5	XCAN Conf. CE	0		Off		Life Guarding / Heartbeat Event	
6	XCAN Conf. CE	0		Off		Response to sync reception	
			0	Off			
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C2450	CANa address	1				Node address for CAN bus interface X14 (CAN-AUX)	📖 197 📖 351
			1	{1}	63	This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to ”ON”.	
C2451	CANa baud rate	0				Baud rate for CAN bus interface X14 (CAN-AUX)	📖 197
			0	500 kBit/s			
			1	250 kBit/s			
			2	125 kBit/s			
			3	50 kBit/s			
			4	1000 kBit/s			
C2452	CANa mst	0				Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 203
			0	Slave			
			1	Master			
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 201
1	CANa addr sel	0		CAN node address (C2450)		Address CANaux1_IN/OUT	
2	CANa addr sel	0		CAN node address (C2450)		Address CANaux2_IN/OUT	
3	CANa addr sel	0		CAN node address (C2450)		Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 201
1	CANa addr.	129	1	{1}	512	CANaux1_INaddress 2	
2	CANa addr.	1				CANaux1_OUTaddress 2	
3	CANa addr.	257				CANaux2_INaddress 2	
4	CANa addr.	258				CANaux2_OUTaddress 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2455						Identifier for CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only	📖 351
1	CANa Id		1	{1}	2047	Identifier CANaux1_IN	
2	CANa Id					Identifier CANaux1_OUT	
3	CANa Id					Identifier CANaux2_IN	
4	CANa Id					Identifier CANaux2_OUT	
5	CANa Id					Identifier CANaux3_IN	
6	CANa Id					Identifier CANaux3_OUT	
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 204
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 225
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2458	Reset node	0				Resetting a node (CAN bus interface X14)	📖 206
			0	No function			
			1	CAN-AUX reset			
C2459	CANa state					CAN bus status (CAN bus interface X14) Read only	📖 214
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2460						Telegram counter CANaux_IN/CANaux_OUT (CAN bus interface X14), number of telegrams Read only	📖 215
1	CANa Messages		0	{1}	65535	All sent telegrams	
2	CANa Messages		With a count value > 65535 the counter restarts with 0			All received telegrams	
3	CANa Messages					Sent to CANaux1_OUT	
4	CANa Messages					Sent to CANaux2_OUT	
5	CANa Messages					Sent to CANaux3_OUT	
6	CANa Messages					Sent to parameter data channel 1	
7	CANa Messages					Sent to parameter data channel 2	
8	CANa Messages					Received from CANaux1_IN	
9	CANa Messages					Received from CANaux2_IN	
10	CANa Messages					Received from CANaux3_IN	
11	CANa Messages					Received from parameter data channel 1	
12	CANa Messages					Received from parameter data channel 2	
C2461						Detected load CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 216
1	Load IN/OUT		0	{1 %}	100	All sent telegrams	
2	Load IN/OUT					All received telegrams	
3	Load IN/OUT					Sent to CANaux1_OUT	
4	Load IN/OUT					Sent to CANaux2_OUT	
5	Load IN/OUT					Sent to CANaux3_OUT	
6	Load IN/OUT					Sent to parameter data channel 1	
7	Load IN/OUT					Sent to parameter data channel 2	
8	Load IN/OUT					Received from CANaux1_IN	
9	Load IN/OUT					Received from CANaux2_IN	
10	Load IN/OUT					Received from CANaux3_IN	
11	Load IN/OUT					Received from parameter data channel 1	
12	Load IN/OUT					Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2466	Sync Response	1				CAN sync response for interface X14 (CAN-AUX) **The value ”1” should always be set!**	
			0	No response			
			1	Response			
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 208
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 336 📖 209
			1	{1}	256		
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 207 📖 204
			0	{1 ms}	65000	0 = switched off	
C2470	ParWrite	0				CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 217
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)			
			1	Parameter data channel 2			
C2481	MONIT CE11	3				Fault response - monitoring CANaux1_IN error ”CommErrCANauxIN1” (CE11)	📖 225
			0	TRIP			
			2	Warning			
			3	Off			
C2482	MONIT CE12	3				Fault response - monitoring CANaux2_IN error ”CommErrCANauxIN2” (CE12)	📖 225
			0	TRIP			
			2	Warning			
			3	Off			
C2483	MONIT CE13	3				Fault response - monitoring CANaux3_IN error ”CommErrCANauxIN3” (CE13)	📖 225
			0	TRIP			
			2	Warning			
			3	Off			
C2484	MONIT CE14	3				Fault response - ”system bus (CAN-AUX) off” monitoring at CAN bus interface X14 ”BusOffState” (CE14)	📖 225
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2485	MONIT CE15	3				Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 225 📖 217
			0	TRIP			
			2	Warning			
			3	Off			
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1	
2	CANa IN words					CANaux1_IN word 2	
3	CANa IN words					CANaux1_IN word 3	
4	CANa IN words					CANaux2_IN word 1	
5	CANa IN words					CANaux2_IN word 2	
6	CANa IN words					CANaux2_IN word 3	
7	CANa IN words					CANaux2_IN word 4	
8	CANa IN words					CANaux3_IN word 1	
9	CANa IN words					CANaux3_IN word 2	
10	CANa IN words					CANaux3_IN word 3	
11	CANa IN words					CANaux3_IN word 4	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1	
2	CANa OUT words					CANaux1_OUT word 2	
3	CANa OUT words					CANaux1_OUT word 3	
4	CANa OUT words					CANaux2_OUT word 1	
5	CANa OUT words					CANaux2_OUT word 2	
6	CANa OUT words					CANaux2_OUT word 3	
7	CANa OUT words					CANaux2_OUT word 4	
8	CANa OUT words					CANaux3_OUT word 1	
9	CANa OUT words					CANaux3_OUT word 2	
10	CANa OUT words					CANaux3_OUT word 3	
11	CANa OUT words					CANaux3_OUT word 4	
C2500						PLC flag 1 ... 255	
			0	{1}	65535		
C2501						PLC flag 256 ... 512	
			0	{1}	65535		
C3000	MotDirInv	0				Motor mounting position	📖 121
			0	Motor mounting position not inverted			
			1	Motor mounting position inverted			
C3001	EncDirInv	0				Encoder mounting position	📖 113
			0	Normal (direction of rotation CW)		Direction of rotation with regard to motor direction of rotation	📖 121
			1	Inverse (direction of rotation CCW)			
C3002	NoChangeOfPos	0				Resolver as absolute value encoder	📖 112
			0	ChangeOfPos		After ”mains off/on”, homing has to be carried out. The actual position is initialised with the value ”0”.	
			1	NoChangeOfPos		The actual position value is initialised with the position value at ”Mains off” and is used further at ”Mains on”. Homing is not required. **Note:** With ”Mains off” the feedback system must rotate less than ± 0.5 revolutions.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3008	HomeMlim	10.0				Torque limit value for homing mode C3010 = 16 or 17 (100.00 % = maximum torque from C0057)	153 153
			0.00	{0.01 %}	100.00		
C3009	TimeHome Mlim	100				Duration for detecting the mechanical limit stop for homing mode C3010 = 16 or 17	153 153
			0	{1 ms}	65535		
C3010	HomingMode	8				Homing mode	143 145
			0	>_Rn_MP		**Selection symbolism:** ● >: Movement in pos. direction ● <: Movement in neg. direction ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction ● Rp: Pos. edge of the reference switch ● Rn: Neg. edge of the reference switch ● MP: Zero pulse/position of the position encoder, once per motor revolution ● TP: Touch probe signal ● Mlim: mechanical limit stop (torque limit value) **Notes:** ● When using the homing modes 0 ... 5, set C0540 = 2. ● The mechanical limit stop is defined as exceedance of the torque limit C3008 for the duration C3009. ● When the last action listed is executed, the home position is set (e.g. zero pulse with "MP"), even if the drive continues traversing. ● In all modes without limit switch ("Lp" / "Ln") retracting from the limit switch with error handling set in C3175 is not possible.	
			1	<_Rn_MP			
			2	>_Lp_<_Rn_MP			
			3	<_Ln_>_Rn_MP			
			4	>_Rp_<_Rn_MP			
			5	<_Rp_>_Rn_MP			
			6	>_Rn_>_TP			
			7	<_Rn_<_TP			
			8	>_TP			
			9	<_TP			
			10	>_Lp_<_TP			
			11	<_Ln_>_TP			
			12	>_Lp_<_MP			
			13	<_Ln_>_MP			
			14	>_MP			
			15	<_MP			
			16	>_MLim			
			17	<_MLim			
			99	Set reference			
C3011	Home offset	0				Offset between home position and standstill position	155
			-2140000000	{1 inc}	2140000000		
C3012	Measure offs.	0				Offset for shifting the zero position with regard to the standstill position	155
			-2147483647	{1 inc}	2147483647		
C3020	ManJog	25.0				Manual jog speed in % of C0011 (maximum speed)	165
			-0.00	{0.01 %}	100.00		
C3021	ACC-CTRL enable	1.0				Acceleration time: Within this time, the manual jog speed (C3020) is reached.	165
			0.000	{1 s}	999.000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3022	DCC-CTRL enable	1.0				Deceleration time: Within this time, the manual jog speed (C3020) is reduced to zero.	🕮 165
			0.000	{1 s}	999.000		
C3030	FolloErrWarn	400000				Following error limit for enabling a warning	🕮 170
			0	{1 inc}	2140000000		
C3031	FolloErrFail	800000				Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	🕮 170
			0	{1 inc}	2140000000		
C3032	FollErr1reac	2				First reaction when following error limit has been reached	🕮 170
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3033	FollErr2reac	4				Second reaction when following error limit has been reached	🕮 170
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3034	FollowErrDisp	0				Following error Read only	🕮 170
			-2147483647	{1 units}	2147483647		
C3037	VelModeErr	25.0				Speed deviation for enabling the response to speed errors (C3038)	
			0.00	{0.01 %}	100.00		
C3038	VelModeErr Reac	3				Response to speed errors in ”Velocity Mode” (C5000 = 2)	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3150	Stateword	0				Status word Read only	🕮 134
			0	{1 units}	65535		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3151					Status word (in bits) Read only	📖 134
			0	{1 bit} 1		
1	StateBit	0	Bit 0	Toggle bit		
2	StateBit	0	Bit1	Operating mode-oriented function		
3	StateBit	0	Bit2	Operating mode-oriented function		
4	StateBit	0	Bit3	Operating mode-oriented function		
5	StateBit	0	Bit4	Operating mode-oriented function		
6	StateBit	0	Bit5	Positive hardware limit switch		
7	StateBit	0	Bit6	Negative hardware limit switch		
8	StateBit	0	Bit 7	Reserved		
9	StateBit	0	Bit 8	Status information 0		
10	StateBit	0	Bit 9	Status information 1		
11	StateBit	0	Bit10	Status information 2		
12	StateBit	0	Bit11	Status information 3		
13	StateBit	0	Bit12	Warning		
14	StateBit	0	Bit13	Actual position OK		
15	StateBit	0	Bit14	FailToAckn (Reset fault message)		
16	StateBit	0	Bit15	Controller is ready for operation		
C3152	Controlword	0			Control word Read only	📖 131
			0	{1 units} 65535		
C3153					Control word (in bits) Read only	📖 131
			0	{1 bit} 1		
1	ControlBit	0	Bit 0	Toggle bit		
2	ControlBit	0	Bit 1	Not assigned		
3	ControlBit	0	Bit 2	Brake relay		
4	ControlBit	0	Bit 3	Quick stop (QSP)		
5	ControlBit	0	Bit 4	Monitor data selection		
6	ControlBit	0	Bit 5	Monitor data selection		
7	ControlBit	0	Bit 6	Monitor data selection		
8	ControlBit	0	Bit 7	Controller enable		
9	ControlBit	0	Bit 8	Operation inhibit		
10	ControlBit	0	Bit 9	Controller inhibit (CINH)		
11	ControlBit	0	Bit 10	Set fault message (TRIP-SET)		
12	ControlBit	0	Bit 11	Reset fault message (TRIP RESET)		
13	ControlBit	0	Bit 12	Operating mode-oriented function		
14	ControlBit	0	Bit 13	Operating mode-oriented function		
15	ControlBit	0	Bit 14	Not assigned		
16	ControlBit	0	Bit 15	Reserved		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3160	ToggleErrReac	3				Toggle bit error handling	📖 136
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3161	ToggleErLimit	4				Toggle bit error counter limit	📖 136
			0	{1 units}	65535		
C3162	ToggleBitFail	0				Toggle bit error counter Read only	
			0	{1 units}	65535		
C3165	SyncInside Win	0				CAN synchronisation inside the window Read only	📖 209
			0	{1 bit}	1		
C3170	NoHoming Reac	3				Reaction, when the reference is not known.	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3175	HW EndReac	4				Reaction, when a hardware limit switch is activated.	📖 172
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3180	MonitorData	0				Monitor data selection Read only	📖 133
			0	{1 units}	7		
C3181	MonitorData	0				Monitor data selection	📖 133
			0	Free			
			1	MCTRL_nPos_a		Actual position (16 bits) referred to one revolution (rotor position)	
			2	DINT_TO_INT (MCTRL_dnPosSet_p)		Following error $\pm 2^{15}$	
			3	MCTRL_nNAct_a		Actual speed ($n_{max} = 2^{14}$)	
			4	MCTRL_nMAct_a		Actual torque ($M_{max} = 2^{14}$)	
			5	MCTRL_nIAct_a		Actual motor current ($I_{max} = 2^{14}$)	
			6	MCTRL_nDCVolt_a		Actual DC-bus voltage ($2^{14} \triangleq$ 1000 V)	
			7	PosLatchDiff		Difference between actual position and position at touch probe (C6000)	
C3200	Act.Fault	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Current fault Read only	📖 270

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3201	FailReaction	0				Fault handling Read only	
			0	TRIP			
			1	Message			
			2	Warning			
			3	FAIL-QSP			
			4	Not assigned			
C3210	Failnumber	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Current fault number Read only	📖 270
C3211	FailNumber Old	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Previous fault number Read only	📖 270
C3420	M_Pilot_ Contr	1				Torque feedforward control	
			0	Off			
			1	On			
C3421	M_Operate_ TH	10				Torque operating threshold	
			0	{1 units}	16384		
C3422	PilotCon MGain	1.0				Gain of torque feedforward control	
			1.00	{0.01 units}	100.00		
C3430	NPilotControl	1				Speed feedforward control	
			0	Off			
			1	On			
C4000	GlobalReset	0				Global reset of the PRG	
			0	Off			
			1	On			
C4010	Ctrl_Interf	0				Control interface selection	📖 130
			0	CAN1 (PDO1 with sync)		The control word is expected via the PDO CAN1_IN. Control is carried out via the CAN interface X4 (MotionBus). Control and status information is sent and received via CAN1_IN (PDO1).	📖 167 📖 165
			1	Without function			
			2	AIF X1 (PDO1 with sync)		Control via the automation interface (AIF) X1 is only possible in conjunction with the EMF2192IB EtherCAT communication module. (From Motion V3.0)	
			3	C4040 (control via codes)		Control is carried out via codes. The control word "Ctrl1" is set via code C4040. The Global Drive Control (GDC) diagnostics and parameterisation software can for instance be used to change individual control bits in order to simulate the higher-level control for testing purposes.	
			4	Without function			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4011		0			Assignment (mapping) of the digital inputs (from Motion V3.0) ● QSP: Quick stop ● SYNC: Synchronisation signal ● Ref: Reference switch ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction	📖 140
			0	DI1: QSP DI2: Ref DI3: Lp DI4: Ln	Setting for control via the MotionBus (CAN interface X4). ● Setting C4010 = 0	📖 141
			1	DI1: SYNC DI2: Ref DI3: Lp DI4: Ln	Setting for control via EtherCAT (AIF interface X1) ● X6/DI1 serves as an input for the synchronisation signal for EtherCAT. ● Setting C4010 = 2	📖 141
C4011		0			Assignment (mapping) of the digital inputs (from Motion V3.0) ● QSP: Quick stop ● SYNC: Synchronisation signal ● Ref: Reference switch ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction	📖 140
			0	DI1: QSP DI2: Ref DI3: Lp DI4: Ln	Setting for control via the MotionBus (CAN interface X4). ● Setting C4010 = 0	📖 141
			1	DI1: SYNC DI2: Ref DI3: Lp DI4: Ln	Setting for control via EtherCAT (AIF interface X1) ● X6/DI1 serves as an input for the synchronisation signal for EtherCAT. ● Setting C4010 = 2	📖 141
C4016	MmaxPosVal	100.0			Limit value for torque limitation only for movements in the positive direction of rotation (pos. speed setpoint). ● 100 % = maximum torque from C0057 ● The torque limitations (C4018, C4016, C4017) take effect independently of one another. ● The torque limitations do not take effect during ”Homing”.	
			0.01	{0.01 %} 100.00		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4017	MmaxNegVal	100.0				Limit value for torque limitation only for movements in the negative direction of rotation (neg. speed setpoint). ● 100 % = maximum torque from C0057 ● The torque limitations (C4018, C4016, C4017) take effect independently of one another. ● The torque limitations do not take effect during ”Homing”.	
			0.01	{0.01 %}	100.00		
C4018	MmaxVal	100.0				Limit value for torque limitation, effective for both directions of rotation (pos. or neg. speed setpoint). ● 100 % = maximum torque from C0057 ● The torque limitations (C4018, C4016, C4017) take effect independently of one another. ● The torque limitations do not take effect during ”Homing”.	
			0.01	{0.01 %}	100.00		
C4020	Brake logic	1				Activate brake logic	📖 105
			0	Brake Off			
			1	Brake On			
			2	Brake control via application control word bit 2		Brake control via control bit 2 in the application control word: ● 0: brake closed (relay output is not triggered) ● 1: brake open (relay output is triggered)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4040	Control word Ctrl1	0		Control word Ctrl1 for C4010 = 3	📖 167
			0 {1 bit} 1	Here, a drive can also be traversed without having a master control (e.g. using GDC).	📖 165
			Bit 0 Toggle		
			Bit 1 Res. ECS Motion ≤V1.x: deactivate hardware limit switch monitoring (release limit switch)		
			Bit 2 Brake-direct		
			Bit 3 Quick stop (QSP)		
			Bit 4 Monitor data selection LSB		
			Bit 5 Monitor data selection		
			Bit 6 Monitor data selection MSB		
			Bit 7 Controller enable		
			Bit 8 Res.		
			Bit 9 Controller inhibit (CINH)		
			Bit 10 TRIP-SET		
			Bit 11 TRIP-RESET		
			Bit 12 Operation mode specific (1)	See operating modes (bit 12 = LSB, bit 14 = MSB): ”IP Mode” (📖 161) ”Homing Mode” (📖 164) ”Manual Jog” (📖 165) ”Velocity Mode” (📖 167)	
			Bit 13 Operation mode specific (2)		
			Bit 14 Operation mode specific (3)		
			Bit 15 Res.		
C4264	CanSync_Dev	0		Deviation of the control program synchronisation This also applies to synchronisation via the digital input X6/DI1. Read only	📖 208
			-32767 {1} 32767		
C5000	OpMode	7		Selection of the operating mode (Operation Mode)	📖 160
			2 Velocity Mode		📖 167
			6 Homing Mode		📖 164
			7 Interpolated Position Mode		📖 161
			128 Manual jog		📖 165
C5001	Mode_Op_Dis			Operating mode (Operation Mode) Read only	📖 160
			2 Velocity Mode		📖 167
			6 Homing Mode		📖 164
			7 Interpolated Position Mode		📖 161
			128 Manual jog		📖 165
C6000	LatchPosition	0		Position at touch probe	📖 133
			-2147483647 {1 inc} 2147483647		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6001	PosLatchAct	0		Activation: At touch probe (X6/DI2 = HIGH), the actual position is saved in C6000.	📖 133
			0 Not active		
			1 Wait for rising edge		
			2 Wait for falling edge		
			3 Wait for rising or falling edge		
C6002	TPReceived	0		Touch Probe (TP) recognised Read only	
			0 No TP recognised		
			1 TP with rising edge recognised		
			2 TP with falling edge recognised		
			3 TP with rising or falling edge recognised		
C7901	Customer_ Vers	0		Customer's version identification ● Can be set by the customer.	
			0 {1} 99999		

12.2 General information about the system bus (CAN)

All Lenze drive and automation systems are provided with an integrated system bus interface for networking control components on the field level.

The system bus interface serves to exchange, for instance, process data and parameter values between the nodes. Moreover, the interface allows for the connection of further devices as e.g. decentralised terminals, operator and input devices and external control and host systems.

The system bus interface transfers CAN objects to the CANopen communication profile (CiA DS301, version 4.01) which has been created under the umbrella association of the der **CiA** (**C**AN **i**n **A**utomation) to conform with the **CAL** (**C**AN **A**pplication **L**ayer).



Tip!

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.



Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

12.3 Communication with MotionBus/system bus (CAN)

Note!

ECSxM... axis modules

- ► only use the channels **CAN1_IN**and **CAN1_OUT** for communication via the MotionBus (CAN) interface X4.
- ► only the parameter data channels (SDO) are supported for the system bus (CAN) – interface X14 (CAN-AUX) –.

For communication between the components of the drive system the axis modules ECSxM... have two CAN interfaces:

- ► Interface X4 (”CAN”)
  - – MotionBus (CAN)
  - – For communication with a higher-level host system (PLC) or further controllers
  - – The data is exchanged via process data channels and parameter data channels.
  - – Parameter setting/diagnostics via code range **C03xx**
- ► Interface X14 (”CAN-AUX”)
  - – System bus (CAN)
  - – PC interface/HMI for parameter setting and diagnostics
  - – Interface to a decentralised I/O system
  - – The data is exchanged via parameter data channels only.
  - – Parameter setting/diagnostics via code range **C24xx**

The communication is effected via data telegrams.

12.3.1 Structure of the CAN data telegram

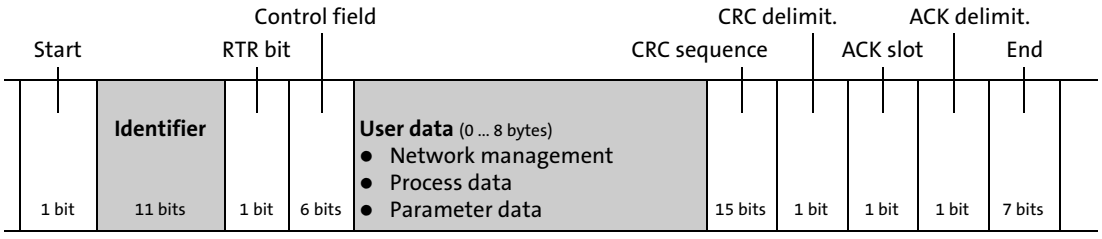


Fig. 12-1 Basic structure of the CAN telegram

Identifier

The identifier determines the priority of the message. Moreover, the following is coded:

- ► The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter ”Addressing of the parameter and process data objects” (📖 351).
- ► The type of user data to be transferred

User data

The user data area of the CAN telegram either contains network management data, process data or parameter data:

User data	Description
Network management data (NMT data)	The information serves to establish communication via the CAN network
Process data (PDO, Process Data Objects)	● Process data are transmitted via the process data channel. ● The process data serve to control the controller. ● Process data can be accessed directly by the higher-level host system. The data are, for instance, stored directly in the I/O area of the PLC. It is necessary that the data can be exchanged between the host system and the controller within the shortest time possible. In this connection, small amounts of data can be transferred cyclically. ● Process data are transmitted between the higher-level host system and the controllers to ensure a permanent exchange of current input and output data. ● Process data are not stored in the controller. ● Process data are, for instance, setpoints and actual values.
Parameter data (SDO, Service Data Objects)	● Parameter data are transferred via the parameter data channel and acknowledged by the receiver, i.e. the receiver gets a feedback whether the transmission was successful. ● Parameter data of Lenze devices are called codes. ● The parameter data channel enables access to all Lenze codes and all CANopen indexes. ● Parameters are set, for instance, for the initial commissioning of a plant or when material of a production machine is exchanged. ● Usually the transfer of parameters is not time-critical. ● Parameter changes are stored in the controller. ● Parameter data are, for instance, operating parameters, diagnostic information and motor data.



Tip!

The other signals refer to the transfer features of the CAN telegram that are not described in these instructions.

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

12.3.2 Communication phases of the CAN network (NMT)

Regarding communication, the controller knows the following statuses:

Status	Description
"Initialisation"	After the controller is switched on, the initialisation phase is run through. During this phase, the controller is not involved in the data exchange on the bus. A part of the initialisation or the complete initialisation can be run through again in every NMT status by transmitting different telegrams (see "state transition"). Here, all parameters are written with their set values. After completing the initialisation, the controller automatically adopts the "Pre-Operational" status.
"Pre-Operational"	The controller can receive parameter data. The process data are ignored.
"Operational"	The controller can receive parameter data and process data.
"Stopped"	Only network management telegrams can be received.

State transitions

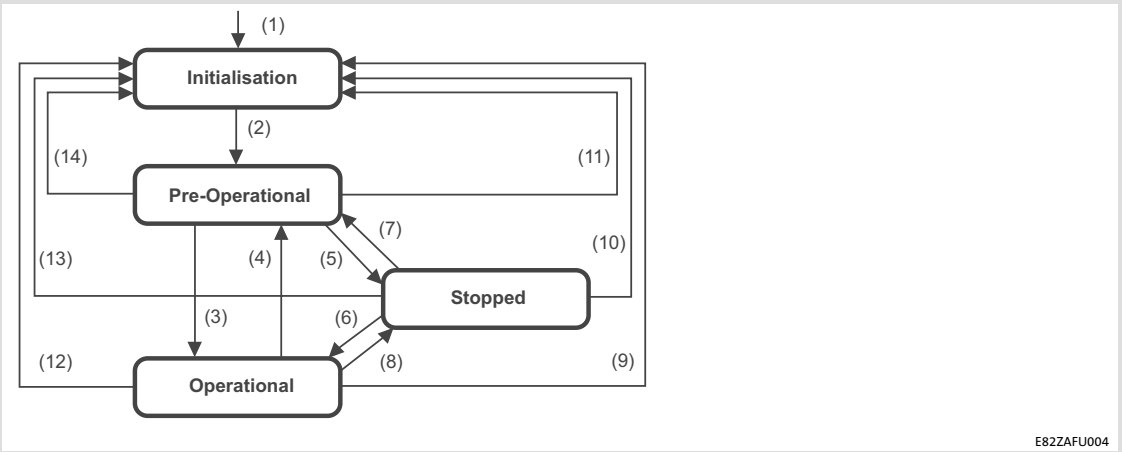


Fig. 12-2 State transitions in the CAN network (NMT)

State transition	Command (hex)	Network status after change	Effect on process or parameter data after state change
(1)	-	Initialisation	When the mains is switched on, the initialisation is started automatically. During the initialisation the controller is not involved in the data exchange. After the initialisation is completed, the node changes automatically to the ”Pre-Operational” status.
(2)	-	Pre-operational	In this phase the master decides how the controllers take part in the communication.
From here, the states are changed over by the master for the entire network. A target address included in the command specifies the receiver/s.			
(3), (6)	01xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active (corresponds to ”Start Remote Node”) Optional: In case of change, event-controlled and time-controlled process data (PDO) are sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency, and parameter data (SDO) are active (corresponds to ”Enter Pre-Operational State”)
(5), (8)	02 xx	Stopped	Only network management telegrams can be received.
(9)	81 xx	Initialisation	Initialisation of all parameters in the CAN fieldbus module with the values stored (corresponds to ”Reset Node”)
(10)			
(11)			
(12)	82 xx		Initialisation of communication-relevant parameters (CiA DS 301) in the CAN fieldbus module with the values stored (corresponds to ”Reset Communication”)
(13)			
(14)			

yy = 00	In case of this assignment, the telegram addresses all devices connected. The state of all devices can be changed at the same time.
yy = node ID	If a node address is given, only the state of the device with the corresponding address will be changed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

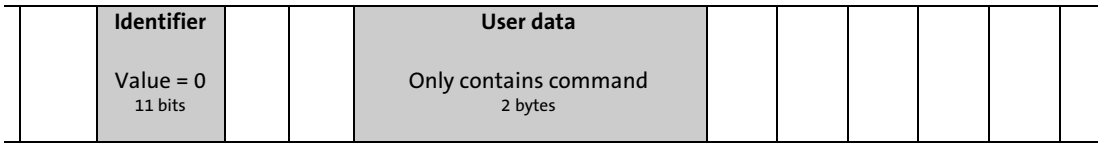


Fig. 12-3 Telegram for switching over the communication phases

The communication phases are changed over by a node, the network master, for the entire network. The change-over can also be done by a controller.

With a certain delay after mains connection, a telegram is sent once which changes the status of the entire drive system to ”Operational”. The delay time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356/4
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356/4
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456/4

Note!

Only a change to ”Operational” status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the ”Pre-Operational” communication status to the ”Operational” communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

12.3.3 Process data transfer

Agreements

- Process data telegrams between host (master) and controller (slave) are distinguished as follows with regard to their direction:
  - Process data telegrams **to** the controller
  - Process data telegrams **from** the controller
- In CANopen, the process data objects are named from the node's view:
  - RPDOx: A process data object received by a node
  - TPDOx: A process data object transmitted by a node

12.3.3.1 Available process data objects

The following process data objects (PDOs) are available for the ECS modules via the interfaces X1, X4 and X14:

Interface	PDOs RPDO: to ECS module TPDO: from ECS module		Availability in ECS modules				
			ECSxE	ECSxS	ECSxP	ECSxM	ECSxA
X1 Automation interface (AIF)	RPDO	AIF1_IN	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_IN	–	✓	–	–	✓
		AIF3_IN	–	✓	–	–	✓
	TPDO	AIF1_OUT	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_OUT	–	✓	–	–	✓
		AIF3_OUT	–	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	RPDO	CAN1_IN	✓	✓	✓	✓	✓
		CAN2_IN	–	✓	✓	–	✓
		CAN3_IN	✓	✓	✓	–	✓
	TPDO	CAN1_OUT	✓	✓	✓	✓	✓
		CAN2_OUT	✓ 1)	✓	✓	–	✓
		CAN3_OUT	✓	✓	✓	–	✓
X14 System bus (CAN) Interface is not available for ECSxE.	RPDO	CANaux1_IN	–	–	✓	–	✓
		CANaux2_IN	–	–	✓	–	✓
		CANaux3_IN	–	–	–	–	✓
	TPDO	CANaux1_OUT	–	–	✓	–	✓
		CANaux2_OUT	–	–	✓	–	✓
		CANaux3_OUT	–	–	–	–	✓

1) ECSxE from V5.0: CAN2_OUT (Diagnostic PDO)

Note!

Power supply module ECSxE

In case of the ECSxE power supply module, the PDOs CAN1_IN/OUT and CAN3_IN/OUT cannot be used simultaneously. The PDOs to be used are selected via C0360.

12.3.3.2 Structure of the process data

The process data telegrams have a maximum user data length of eight bytes each.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the controller.
- The control word is transmitted in byte 1 and 2 of the user data.

	Identifier			User data (8 bytes)							
				Control word		00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte						

Fig. 12-4 Structure of process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram reports status information from the controller. Status information can be as follows:
  - Current status of the controller
  - Status of the digital inputs
  - States about internal analog values
  - Fault/error messages

  This information enables the higher-level host system (PLC) to respond accordingly.
- The status word 1 is transmitted in byte 1 and 2 of the user data.
- In byte 3 and 4 of the user data, the extended status word 2 can be optionally transferred.

	Identifier			User data (8 bytes)							
				Status word 1		Status word 2 (optional)		00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte	LOW byte	HIGH byte				

Fig. 12-5 Structure of process data output telegram (TPDO)

12.3.3.3 Transfer of the process data objects

Process data objects		Data transmission	
		ECSxE	ECSxS/P/M/A
RPDOs (to ECS module)	AIF1_IN	–	cyclic (sync-controlled)
	CAN1_IN	cyclic (sync-controlled)	
	CANaux1_IN	–	
	AIF2_IN	–	event-controlled/cyclic without sync
	CAN2_IN	–	
	CANaux2_IN	–	
	AIF3_IN	–	event-controlled/cyclic without sync
	CAN3_IN	event-controlled/cyclic without sync	
	CANaux3_IN	–	
TPDOs (from ECS module)	AIF1_OUT	–	cyclic (sync-controlled)
	CAN1_OUT	cyclic (sync-controlled)	
	CANaux1_OUT	–	
	AIF2_OUT	–	event-controlled/cyclic without sync
	CAN2_OUT	–	
	CANaux2_OUT	–	
	AIF3_OUT	–	event-controlled/cyclic without sync
	CAN3_OUT	event-controlled/cyclic without sync	
	CANaux3_OUT	–	

- Cyclic data transmission with sync telegram (📖 343)
  (via AIF1, CAN1, CANaux1)
  The sync telegram enables the controller to accept the process data from the master (RPDOs) or send them to the master (TPDOs).
- Event-controlled data transmission
  (via AIF2/3, CAN2/3, CANaux2/3)
  The data will be transmitted if a value changes in the corresponding output object.
- Cyclic data transmission without sync telegram
  (via AIF2/3, CAN2/3, CANaux2/3)
  The data is transmitted in fixed times. The cycle time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456

  – Setting of cycle time > 0: data transmission with fixed cycle time
  – Setting of cycle time = 0: event-controlled data transmission

12.3.3.4 Cyclic process data objects

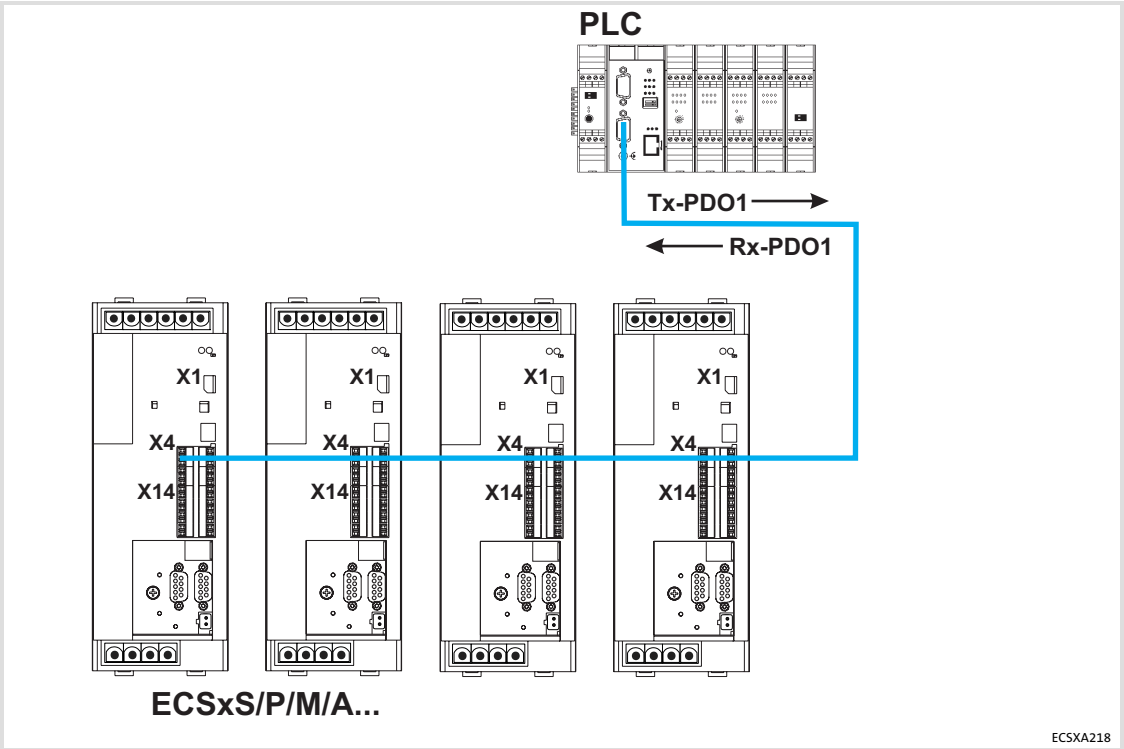


Fig. 12-6 Example: Cyclic process data transfer from/to master (PLC)

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO18), each with 8 bytes of user data, is provided.

Synchronisation of PDOs with sync-controlled transmission

In order that the cyclic process data can be read by the controller or the controller accepts the process data, a special telegram, the CAN sync telegram, is used in addition.

The CAN sync telegram is the trigger point for sending process data of the controller to the master and transferring process data from the master to the controller.

A sync-controlled process data processing requires a corresponding generation of the CAN sync telegram.

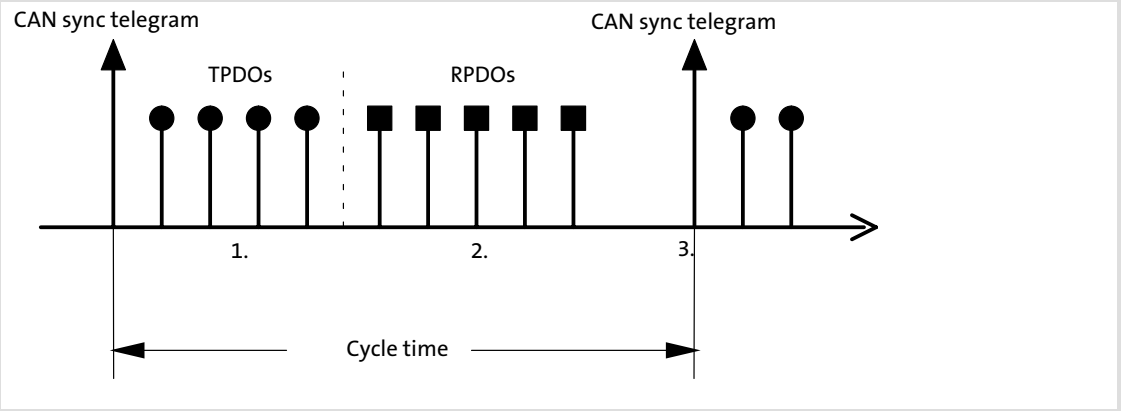


Fig. 12-7 Sync telegram

1. After the CAN sync telegram has been received, the synchronous process data from the controllers are sent to the master (TPDOs). They are read as process input data in the master.
2. When the transmission process is completed, the process output data (of the master) are received by the controllers (RPDOs).

   All other telegrams (e.g. parameters or event-controlled process data) are accepted acyclically by the controllers after transmission is completed. The acyclic data are not displayed in the above illustration. They must be considered when the cycle time is dimensioned.
3. The data in the controller is accepted with the next CAN sync telegram.

Tip!

The response to a CAN sync telegram is determined by the transmission type selected.

Note!

Information on how to set the synchronisation can be found from 📖 207.

12.3.3.5 Event-controlled process data objects

The event-controlled process data objects are particularly suitable for the data exchange between controllers and for distributed terminal extensions. They can, however, also be used by a host system.

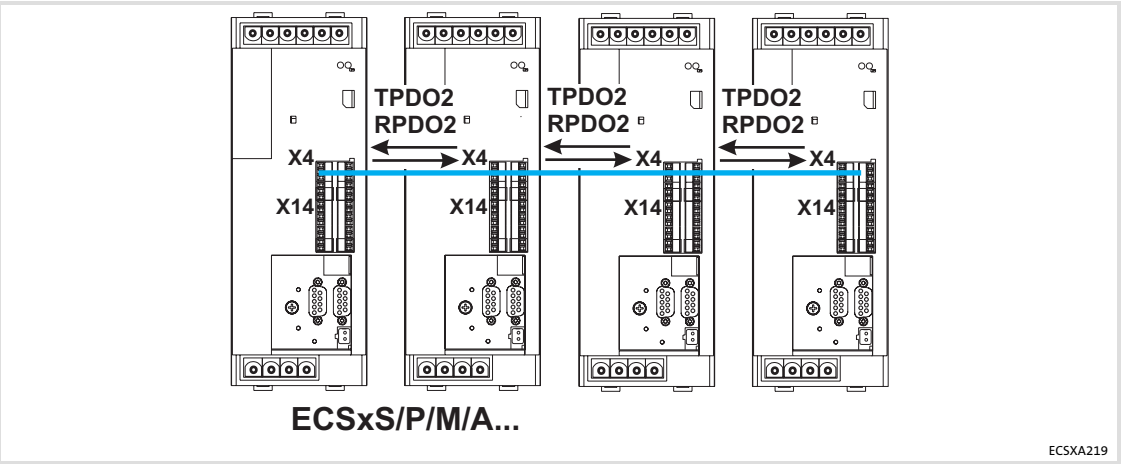


Fig. 12-8 Example: event-controlled process data objects PDO2

The process data objects serve to transmit simple binary signals (e.g. states of digital input terminals) or complete values in 16 and 32 bits (e.g. analog signals).

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

12.3.4 Parameter data transfer

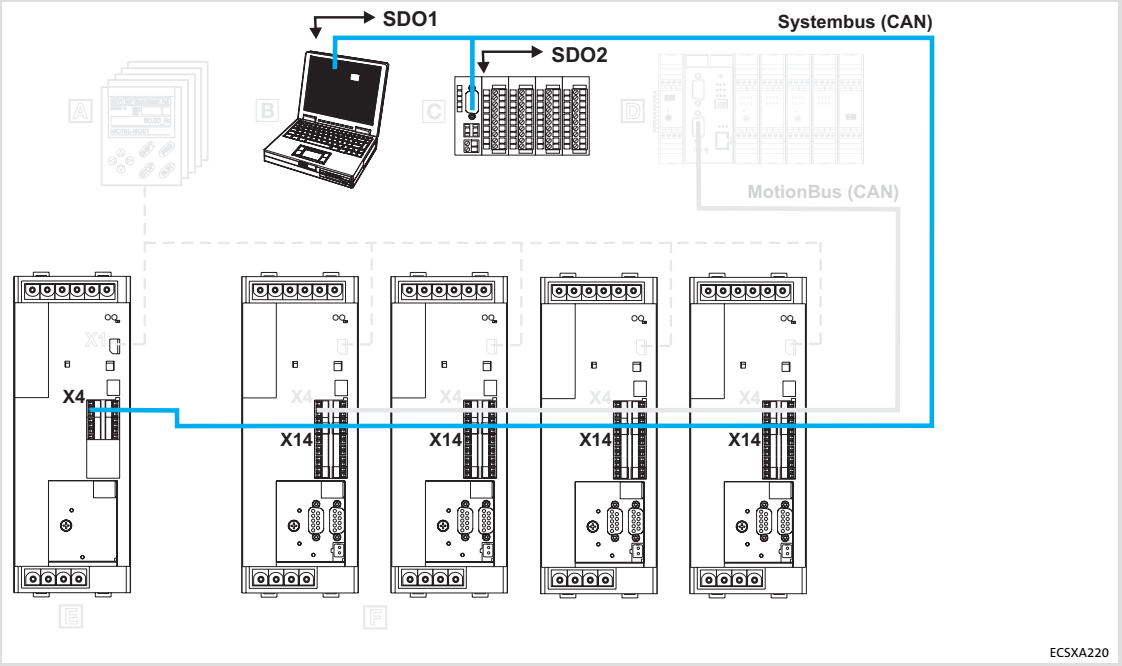


Fig. 12-9 Parameter data channels for parameterising ECS

Parameters ...

- ► are values which are stored under codes in the Lenze controllers.
- ► are set e.g. during initial commissioning or while changing materials in a machine.
- ► are transmitted with low priority.

Parameter data are transmitted as SDOs (Service Data Objects) via the system bus (CAN) and acknowledged by the receiver. The SDOs enable the writing and reading access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 as well as the CAN bus interfaces X4 and X14 are divided into separate ranges:

Interface		Code range
X1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C03xx
X14	System bus (CAN) ● Interface is not available for ECSxE.	C24xx

12.3.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1. byte	2. byte	3. byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data is shown in motorola format.

Examples for parameter data transfer can be found from 📖 349.

Command

The command contains the services for writing and reading the parameters and information on the length of the user data:

	Bit 7 MSB	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit 2**	**Bit 1**	**Bit 0** LSB
Command	Command specifier (cs)			toggle (t)	Length		e	E
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specification DS301, V4.02 (e.g. segmented transfer).

The command must contain the following information:

	4-byte data (5. ... 8. byte)		2-byte data (5. and 6. byte)		1-byte data (5. byte)		Block	
Command	**hex**	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameter to the controller)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller reports a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

”Error response” command: In case of a communication error an ”Error response” is generated by the addressed node. This telegram always contains the value ”6” in Data 4 and an error code in Data 3.

The error codes are standardised acc. to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

Parameter value length depending on the data format			
Parameter value **(Length: 1 byte)**	00	00	00
Parameter value **(length: 2 bytes)**		00	00
Low byte	High byte		
Parameter value **(length: 4 bytes)**			
Low word		High word	
Low byte	High byte	Low byte	High byte

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

12.3.4.2 Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	Index Low byte	Index High byte	Subindex	**Error code**			

- Byte 1:
  In the **command** byte, the code **128** (**0x80**) indicates that an error has occurred.
- Bytes 2 ... 4:
  In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.
- Bytes 5 ... 8:
  In the bytes 5 ... to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example: Representation of the error codes 0x06040041 in the bytes 5 ... 8

Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	**7th byte**	**8th byte**	**Meaning**
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

12.3.4.3 Examples of the parameter data telegram

Reading parameters

The heatsink temperature C0061 (43 °C) is to be read from the controller with node address 5 via the parameter data channel 1.

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 5 = 1541

► Command ”Read Request” (request to read a parameter from the controller)

Command	Value [hex]
Read request	**0x40**

► Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = 0x5FC2

► Subindex: 0

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1541	0x40	0xC2	0x5F	0x00	0x00	0x00	0x00	0x00

► Telegram from controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1413	0x43	0xC2	0x5F	0x00	0xB0	0x8F	0x06	0x00

– Command:
”Read Response” (response to the read request) = 0x43

– Identifier:
SDO1 from controller (1408) + node address (5) = 1413

– Index of the read request:
0x5FC2

– Subindex:
0

– Data 1 ... 4:
0x00068FB0 = 430000 ➞ 430000 : 10000 = 43 °C

Writing parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed to 20 seconds via the SDO1 (parameter data channel 1).

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 1 = 1537

► Command ”Write Request” (transmit parameter to drive)

Command	Value [hex]
Write request	**0x23**

► Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = 0x5FF3

► Subindex: 0

► Calculation of the acceleration time

Data 1 ... 4	Calculation
Value for acceleration time	20 s · 10000 = 200000 = 0x00030D40

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	0x23	0xF3	0x5F	0x00	0x40	0x0D	0x03	0x00

► Telegram from controller if executed faultlessly

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	0x60	0xF3	0x5F	0x00	0x00	0x00	0x00	0x00

– Command:
”Write Response” (response of the controller (acknowledgement)) = 0x60

– Identifier:
SDO1 from controller (= 1408) + node address (= 1) = 1409

12.3.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier is preset with the following values:

Object			Direction		Basic identifier	
			to the ECS module	from the ECS module	dec	hex
NMT					0	0
Sync					128	80
PDO1 (Process data channel 1)	RPDO1	XCAN1_IN CAN1_IN CANaux1_IN	X		512	200
	TPDO1	XCAN1_OUT CAN1_OUT CANaux1_OUT		X	384	180
PDO2 (Process data channel 2)	RPDO2	XCAN2_IN CAN2_IN CANaux2_IN	X		640	280
	TPDO2	XCAN2_OUT CAN2_OUT CANaux2_OUT		X	641	281
PDO3 (Process data channel 3)	RPDO3	XCAN3_IN CAN3_IN CANaux3_IN	X		768	300
	TPDO3	XCAN3_OUT CAN3_OUT CANaux3_OUT		X	769	301
SDO1 (Parameter data channel 1)			X		1536	600
				X	1408	580
SDO2 (Parameter data channel 2)			X		1600	640
				X	1472	5C0
Node guarding			X		1792	700

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- Interface X1 (AIF) C2355.
- Interface X4 (CAN) C0355.
- Interface X14 (CAN-AUX) C2455.

Here, no values can be entered.

- General addressing (📖 351):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 201):
  Identifier (COB-ID) = 384 + ID offset (C0354 or C2454)

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (CAN2_IO/CAN3_IO) are factory-set so that the devices are able to communicate with each other.

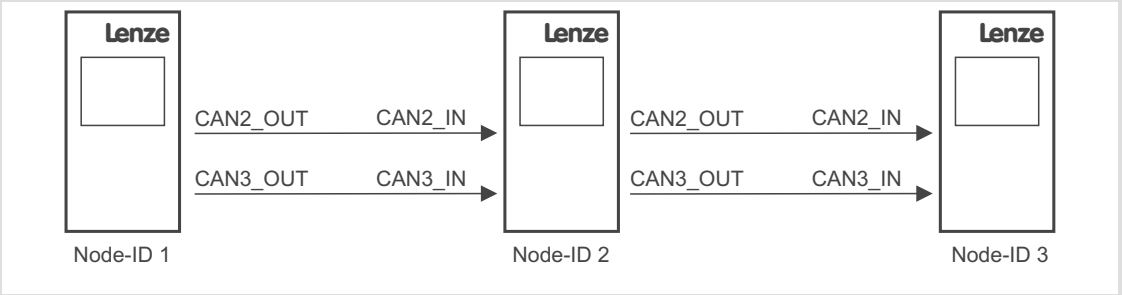


Fig. 12-10 Data exchange between Lenze devices

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

► A node address may not be assigned more than once within a network.

Note!

The ”8.1.1 Setting of CAN node address and baud rate” chapter contains information on

► Setting of the node address (📖 197).

► Individual addressing (📖 201).

12.4 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

12.4.1 Connector sets

To make purchasing easy, the connector sets are available as separate delivery units for the ECS power supply, capacitor and axis modules:

- ECSZ**E**000X0B (connector set for ECS power supply modules)
- ECSZ**K**000X0B (connector set for ECS capacitor modules)
- ECSZ**A**000X0B (connector set for ECS axis modules)

12.4.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

12.4.3 Components for operation and communication

Operating and communication modules

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrical isolation to CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1)]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1)]

1) ”xxxx” = Cable length in decimetre (example: ”xxxx” = ”0015” → length = 15 dm)

12.4.4 Brake resistor

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

12.4.5 Mains fuses

- Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- Use UL-approved cables, fuses and fuse holders only.
- UL fuse:
  – Voltage 500 ... 600 V
  – Tripping characteristic ”H”, ”K5” or ”CC”

12.4.6 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  - The waveform of the mains current is approximated to the sinusoidal shape.
  - Reduction of the effective mains current by up to 25%.
  - Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  - A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

12.4.7 RFI filters

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

13 Index

A

Absolute value encoder (Hiperface, single-turn/multi-turn), 109
- as position and speed encoder, 121

Accessories, 353
- brake resistors, 355
- communication modules, 354
- connector set, 353
- digital frequency cables, 354
- digital frequency distributor, 354
- mains chokes, 358
- operating modules, 354
- RFI filters, 359
- shield mounting kit, 353
- system bus components, 354

Address setting, 198

Addressing
- individual, 201
- parameter data objects, 351
- process data objects, 351

Adjusting current controller, 178

Adjusting the current controller, calculating the electrical motor values, 178

Adjustment of field controller / field weakening controller, Adjustment, 185

Analog input, 69

Analog inputs, Configuration, 69

Application, as directed, 17

Application as directed, 17

Application status word (C3150/C3151), 266

Approvals, 30

Assignment, external brake resistor, 355

Assignment of the plug connectors
- control connections, 67
- system bus (CAN), 81

Atmospheric pressure, 30

Automation interface (AIF), 79

Auxiliary relay, switch-on sequence, 66

Axis module, 12
- ECSCx...
  dimensions, 46
  mounting, 45
- ECSDx...
  dimensions, 42
  mounting, 41
- ECSEx...
  dimensions, 39
  mounting, 40

Axis synchronisation, 207

Axis synchronisation via CAN, 210

Axis synchronisation via terminal X6/DI1, 211

B

Basic identifier, 351

Basic settings with GDC, 94

Baud rate
- setting, 199
  via DIP switch, 199
- system bus (CAN). *Siehe* baud rate

Brake
- closing, 107
- connection, 61
- opening, 108

Brake configuration, 105

Brake resistor, external, 355
- assignment, 355
- connection, 59
- type ERBD..., rated data, 355
- type ERBM..., rated data, 355
- type ERBS..., rated data, 356

Brake resistor, internal, Connection, 57

Bus cable length, 83

Bus load CAN, 216

Bus off, 226

C

Cable cross-section, 83

Cable cross-sections
- Control connections, 54 , 67
- control connections, 52
- control terminals, connection "Safe torque off", 73

Cable specification, 81

Cables, shielded, 53

Cables, specification, motor cables, 60

CAN bus
- assignment of the plug connectors, 81
- boot-up time setting, 204
- communication, 334
- configuring, 197
- cycle time setting, 204
- cyclic process data objects, synchronisation, 343
- data telegram, 334
- delay time setting, 204
- determining the master in the drive system, 203
- event-controlled process data objects, 344
- identifier, 334 , 351
  display code, 351
- Individual addressing, 201
- making a reset node, 206
- network management data, 335
- parameter data, 335 , 345
- parameter data channels, 345
- parameter data objects, addressing, 351
- process data, 335
  from the axis module, 134
  to the axis module, 131
- process data objects, 339
  addressing, 351
  data transmission, 341
- process data telegrams, 340
- setting baud rate, 197
- setting node address, 197
- user data, 335 , 346

CAN bus load, 216

CAN bus status, 214

CAN data telegram, 334

CAN diagnostic codes, 214

CAN network
- communication phases, 336
- state transitions, 337
- statuses, 336

CAN network management (NMT), 338

CAN Sync correction increment, 208

CAN sync identifiers, 208

CAN sync response, 209

CAN synchronisation, 207

CAN synchronisation cycle, 207

CAN telegram counter , 215

CAN user organisation CiA, Homepage, 335

Capacitor module, 12

Capacitor module ECSxK..., Connection, 63

Capacitor modules, 63

CE-typical drive system, 48
- assembly, 49
- earthing, 50
- filters, 49
- installation , 48
- shielding, 50
  cables, 53

Charging current limitation, function selection, 101

COB-ID, 351
- display code, 351

Code descriptions, 13

Code table, 279

Commissioning, 92
- adjusting the current controller, calculating the electrical motor values, 178
- Adjustment of field controller / field weakening controller, 185
- Basic settings with GDC, 94
- before you start, 92
- commissioning steps, overview, 93
- configuration of control interface
  monitor data, 133
  status word "Stat1", 135 , 266
- configuration of digital inputs/outputs, setting the polarity, 142
- configuring the control interface, control word Ctrl1, 132
- configuring the digital inputs/outputs, 140
- controller enable, 169
- current controller adjustment, metrological determination of electrical motor values, 179
- entry of machine parameters, 138
- Entry of motor data, 103
- following error monitoring, 170
- holding brake configuration, 105
  closing the brake, 107
  opening the brake, 108
- limit positions and limit switches
  evaluating hardware limit switches, 172
  retracting from hardware limit switches, 172
- loading the Lenze settings, 100
- operation with motors of other manufacturers, 174
- Operation with servo motors from other manufacturers, Motor feedback system - checking the direction of rotation, 177
- operation with servo motors of other manufacturers
  adjusting current controller, 178
  effecting rotor position adjustment, 180
  entering motor data, 174

- Optimising the drive behaviour, 183
- quick stop (QSP), 173
- Resolver adjustment, 188
- select operating mode, homing mode, 164
- selecting operating mode
  manual jog, 165
  velocity mode, 167
- selecting the control interface, 130
- Selecting the function of the charging current limitation, 101
- selection of the operating mode, 160
  Interpolated Position Mode (IP-Mode), 161
- set homing, offset of the zero position (offset selection), 155
- setting homing
  reference search with continuous positioning axis, 158
  reference search with linear positioning axis, 156
- setting of feedback system
  absolute value encoder, 121
  SinCos encoder (single-turn, multi-turn), 121
- Setting of homing, 96
  homing modes, 145
- setting of homing, parameters, 143
- setting of mains data, 101
- setting of manual jog (inching mode)
  evaluating hardware limit switches, 172
  retracting from hardware limit switches, 172
- setting of the feedback system, 109
  resolver as multi-turn absolute value encoder, 112
- setting the feedback system
  absolute value encoder (position encoder), resolver (speed encoder), 126
  incremental encoder (TTL encoder), 113
  resolver as position and speed encoder, 110
  SinCos encoder, 113
  TTL/SinCos encoder (position encoder), resolver (speed sensor), 117
- setting the polarity of digital inputs/outputs, 142
- setting the voltage threshold, 102
- Speed controller adjustment, 183

Communication modules, 354

Communication phases, 336

Configuration, 196
- axis synchronisation, 207
- Axis synchronisation (start), 208
- axis synchronisation via CAN, 210
- axis synchronisation via terminal X6/DI1, 211
- CAN bus load, 216
- CAN bus status, 214
- CAN diagnostic codes, 214
- CAN sync correction increment, 208
- CAN sync identifiers, 208
- CAN synchronisation, 207
- CAN synchronisation (start), 208
- CAN synchronisation cycle, 207
- CAN telegram counter , 215
- Code table, 279
- cyclic node monitoring (Node Guarding), 212
- monitoring, 219
  current load of the motor (I2 x t monitoring), 22 , 237
  voltage supply of control electronics, 244
- Monitoring functions, Motor temperature, 22
- monitoring functions
  bus off, 226
  current load of controller (I x t monitoring), 234
  DC-bus voltage, 241
  earth fault, 228
  heatsink temperature, 231
  max. system speed, 250
  monitoring times for process data input objects, 225
  motor phase failure, 244
  motor temperature, 229
  motor temperature sensor, 246
  overview, 220
  Resolver cable, 245
  rotor position adjustment, 251
  short circuit, 228
  sin/cos signal, 248
  speed system deviation, 249
  temperature inside the controller, 232
  thermal sensors, 233
- monitoring of the synchronisation, 209
- MotionBus (CAN)
  boot-up time setting, 204
  cycle time setting, 204
  delay time setting, 204
  determining the master in the drive system, 203
  making a reset node, 206
  setting the baud rate, 197
  setting the node address, 197
- Sync phase displacement, 207
- sync phase displacement, correction value, 208
- system bus (CAN)
  Individual addressing, 201
  setting the baud rate, 197
  setting the node address, 197
- Thermal motor monitoring, 22
- via automation interface (AIF), 196
- via system bus interface, 196

Configuration of CAN interface, node address (node ID), 352

Configuration of control interface
- process data from drive, status word Stat1, 135 , 266
- process data to the drive, monitor data, 133

Configuring CAN interface, monitoring, timeout with activated remote parameterisation, 227

Configuring the control interface, process data to the drive, control word Ctrl1, 132

Conformity, 30

Connection
- Capacitor module ECSxK..., 63
- DC bus, 52 , 54
- external brake resistor, 59
- Internal brake resistor, 57
- motor, 52
- motor holding brake, 52 , 61

Connection "Safe torque off", terminals, 73

Connection "safe torque off", 70
- functional description, 71
- Important notes, 72

connection "safe torque off", Important notes, 72

Connection of "safe torque off"
- function check, 74
- implementation, 70
- technical data, 73

Control connections
- Analog inputs, configuration, 69
- assignment of the plug connectors, 67
- Cable cross-sections, 54 , 67
- cable cross-sections, 52
- Digital inputs, 68
- Digital outputs, 68
- Tightening torques, 54 , 67
- tightening torques, 52

Control factor, 34

Control signals, 65

Control terminals, 64
- cable cross-sections, connection "Safe torque off", 73
- starting torques, connection "Safe torque off", 73

Control word Ctrl1, 132

Control/signal cables, shield connection, 65

Controller, 12
- application as directed, 17
- identification, 17

Controller enable, 169

Controller inhibit (CINH), 169

Current characteristics
- application example, 36
- device protection by current derating, 37
- rated output current, 34

Current controller adjustment, metrological determination of electrical motor values, 179

Current derating, 37

Current load of controller, I x t monitoring, 234

Current load of the motor, I2 x t monitoring, 22 , 237

Cyclic node monitoring (Node Guarding), 212

Cyclic process data objects, 342

D

Data telegram, 334

Data, general electrical, 31

DC bus
- connection, 52 , 54
- fuses, 55 , 357

DC-bus voltage
- monitoring functions, 241
- overvoltage, 241
- undervoltage, 241

DC-bus voltage monitoring (OU, LU), 241

Defining boot-up master, 203

Defining master in the drive system, 203

Definition of notes used, 29

Definitions of terms, 12

Device protection, 26

Device protection by current derating, 37

device status, 267

Device status (status word Stat1), 135 , 266

Diagnostics, 252
- with Global Drive Control (GDC), 252
- with Global Drive Oscilloscope (GDO), 253
  Diagnostics with GDO, 255
  GDO buttons, 254
- with PCAN-View, 260
- with XT EMZ9371BC keypad, 259

Diagnostics codes, 214

Digital frequency cables, 354

Digital frequency distributor, 354

Digital frequency input, 90
- features, 90

Digital frequency output, 90
- features, 90

Digital inputs, 68
- configuring, 140
- setting the polarity, 142

Digital outputs, 68
- configuring, 140
- setting the polarity, 142

Dimensions, 39 , 42 , 46
- axis module ECSCx..., 46
- axis module ECSDx..., 42
- axis module ECSEx..., 39

DIP switch, 198

Discharge current to PE, 31

Disposal, 21

Drive system, 12

E

Earth fault monitoring (OC2), 228

Earth-fault monitoring, 228

Earthing, EMC, 50

Effecting rotor position adjustment, 180

Electrical installation, 48
- connection "Safe torque off", terminals, 73
- connection "safe torque off", 70
  functional description, 71
  Important notes, 72
- connection of "safe torque off"
  function check, 74
  implementation, 70
  technical data, 73
- Connection of capacitor module ECSxK..., 63
- control connections, 64
  assignment of the plug connectors, 67
  Digital inputs, 68
  Digital outputs, 68
- control terminals, 65
- feedback system, 85
  encoder, 87
  resolver, 86
- installation of a CE-typical drive system, 48
  assembly, 49
  earthing, 50
  filters, 49
  shielding, 50
- power connections, 52
  connection of external brake resistor, 59
  DC bus connection, 52
  internal brake resistor connection, 57
  motor connection, 52 , 60
  motor holding brake connection, 52
  plug connector assignment, 52
- power terminals
  connection of motor holding brake, 61
  DC bus connection, 54
- specification of the cables, motor cables, 60

Electromagnetic compatibility, 31

EMC, 31
- earthing, 50
- filters, 49
- shielding, 50
  cables, 53

EMF2131IB digital frequency distributor, wire, 91

EMF2131IB digital frequency distributor , wire, 91

Enclosure, 31

Encoder, 87
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 121
- absolute value encoder (Hiperface, single-turn/multi-turn), 109
- incremental encoder (TTL encoder), 88
- SinCos absolute value encoder, 89
- SinCos encoder, 89
  absolute value encoder (Hiperface, single-turn/multi-turn), 109
- supply voltage, 87

Encoder simulation, 90

Entering motor data, 174

Entry of machine parameters, 138

Entry of motor data, 103

Environmental conditions, 30
- atmospheric pressure, 30
- pollution, 30
- site altitude, 30
- temperature, 30
- vibration resistance, 30

Error analysis, 263
- via application status word, 266
- Via history buffer, 264
- via LECOM status word, 267

Error messages, 348
- Causes and remedies, 270
- causes and remedies, 270
- configuration, 221
- reset (TRIP-RESET), 278

Error response, 347

Event-controlled process data objects, 344

Examples
- reading parameters, 349
- Selection help for cable length / number of repeaters, 84
- writing parameters, 350

Executing a reset node, 206

Explanations, Code table, 279

External brake resistor, 355
- assignment, 355
- connection, 59
- type ERBD..., rated data, 355
- type ERBM..., rated data, 355
- type ERBS..., rated data, 356

F

FAIL-QSP, 220

Fault analysis, 263
- via application status word, 266
- Via history buffer, 264
- via LECOM status word, 267
- via LEDs, 263
- with keypad XT EMZ9371BC, 263

Fault elimination, fault analysis with history buffer, 264

Fault messages, 270
- causes and remedies, 270
- configuration, 221
- reset (TRIP-RESET), 265 , 278

Fault responses, 220

Features, ECSxM, 14

Feedback system, wiring, 85
- encoder, 87
- incremental encoder (TTL encoder), 88
- resolver, 86
- SinCos absolute value encoder, 89
- SinCos encoder, 89

Field controller / field weakening controller, 185

Filters, EMC, 49

Following errors, monitoring, 170

Free space, 30

Function monitoring of thermal sensors (H10, H11), 233

Functional earth conductor, 44

Fuses, 55 , 357
- DC bus, 55 , 357
- replacing, 55

G

Gateway function, 217

Global Drive Control (GDC)
- Diagnostics, 252
- Parameter setting, 190

Global Drive Oscilloscope (GDO), 253
- Diagnostics with GDO, 255
- GDO buttons, 254

Guiding angle default and synchronisation, CAN sync response, 209

H

Hardware limit switches, retracting, 172

hardware limit switches, evaluate, 172

Heatsink temperature, monitoring functions, 231

Heatsink temperature monitoring (OH, OH4), 231

History buffer, 264
- codes, 264
- delete entries, 265
- for fault elimination, 264

Holding brake configuration, 105
- closing the brake, 107
- opening the brake, 108

Homing, 96

Homing mode, 164

Homing modes, 145
- Mode 99, 154
- modes 0 and 1, 145
- modes 10 and 11, 150
- modes 12 and 13, 151
- modes 14 and 15, 152
- modes 16 and 17, 153
- modes 2 and 3, 146
- modes 4 and 5, 147
- modes 8 and 9, 149

Homing modes (homing modes), modes 6 and 7, 148

I

Identification, controller, 17

Identifier, 334 , 351

identifier, display code, 351

Incremental encoder, as position and speed encoder, 113

Incremental encoder (TTL encoder), 88

Individual addressing, 201

Installation, 30
- system bus (CAN), 80

Installation of a CE-typical drive system, 48
- assembly, 49
- earthing, 50
- filters, 49
- shielding, 50
  cables, 53

Installation, electrical, 48
- connection "Safe torque off", terminals, 73
- connection "safe torque off", 70
  functional description, 71
  Important notes, 72
- connection of "safe torque off"
  function check, 74
  implementation, 70
  technical data, 73
- Connection of capacitor module ECSxK..., 63
- control connections, 64
  assignment of the plug connectors, 67
  Digital inputs, 68
  Digital outputs, 68
- control terminals, 65
- feedback system, 85
  encoder, 87
  resolver, 86
- installation of a CE-typical drive system, 48
  assembly, 49
  earthing, 50
  filters, 49
  shielding, 50
- power connections, 52
  connection of external brake resistor, 59
  DC bus connection, 52
  internal brake resistor connection, 57
  motor connection, 52 , 60
  motor holding brake connection, 52
  plug connector assignment, 52
- power terminals
  connection of motor holding brake, 61
  DC bus connection, 54
- specification of the cables, motor cables, 60

Installation, mechanical, 38
- push-through technique (ECSDx...), 41

Installation, mechanical
- cold-plate technique (ECSCx...), 45
- important notes, 38
- with fixing rails (ECSEx...), 40

Insulation resistance, 31

Internal brake resistor, Connection, 57

Interpolated Position Mode (IP mode), 161

J

Jitter, 207 , 208

K

Keypad XT EMZ9371BC
- changing and saving parameters, 195
- connecting the keypad, 191
- display elements, 192
- fault analysis, 263
- function keys, 194

L

LECOM, status word (C0150/C0155), 267

LEDs, 263

Legal regulations, 17

Liability, 17

Limit positions and limit switches, hardware limit switches
- evaluate, 172
- retracting, 172

Loading the Lenze setting, 100

Low-voltage supply, 12

M

Mains fuses, 357

Malfunction of drive, 269

Manual jog, 165

Manual jog parameters, 165

Manufacturer, 17

Max. system speed, monitoring functions, 250

MCTRL_MotorControl (motor control), monitoring, absolute value encoder initialisation, 247

Mechanical installation, 38
- cold-plate technique (ECSCx...), 45
- important notes, 38
- push-through technique (ECSDx...), 41
- with fixing rails (ECSEx...), 40

Message, 220

Modes for homing, 145
- Mode 99, 154
- modes 0 and 1, 145
- modes 14 and 15, 152
- modes 16 and 17, 153
- modes 4 and 5, 147
- modes 6 and 7, 148
- modes 8 and 9, 149

Monitor data, 133

Monitoring
- absolute value encoder initialisation, 247
- CAN interface, timeout with activated remote parameterisation, 227
- current load of the motor, I2 x t monitoring, 22 , 237
- FAIL-QSP, 220
- message, 220
- Monitoring times for process data input objects, 225
- of following errors, 170
- Toggle-bit monitoring, 136
- voltage supply of control electronics, 244
- warning, 220

Monitoring functions, 219
- bus off, 226
- configuring, 225
- current load of controller, I x t monitoring, 234
- DC-bus voltage, 241
- earth fault, 228
- heatsink temperature, 231
- max. system speed, 250
- motor phase failure, 244
- Motor temperature, 22
- motor temperature, 229
- motor temperature sensor, 246
- Overview, 221
- Resolver cable, 245
- rotor position adjustment, 251
- short circuit, 228
- sin/cos signal, 248
- speed system deviation, 249
- temperature inside the controller, 232
- thermal sensors, 233

Monitoring of internal device temperature (OH1, OH5), 232

Monitoring of the synchronisation, 209

Monitoring times for process data input objects, 225

Monitorings
- configuration, 221
- possible fault responses, 221

MotionBus (CAN), 334
- boot-up time setting, 204
- CAN data telegram, 334
- communication, 334
- configuring, 197
- cycle time setting, 204
- cyclic process data objects, synchronisation, 343
- delay time setting, 204
- determining the master in the drive system, 203
- event-controlled process data objects, 344
- identifier, 334 , 351
- making a reset node, 206
- network management data, 335
- parameter data, 335 , 345
- parameter data channels, 345
- parameter data objects, addressing, 351
- process data, 335
- process data objects, 339
  addressing, 351
  data transmission, 341
- process data telegrams, 340
- setting the baud rate, 197
- setting the node address, 197
- user data, 335 , 346

Motor, connection, 52 , 60

motor, Thermal monitoring, Sensorless, 22

Motor cable length, 30

Motor cables, specification, 60

Motor feedback system, Checking the direction of rotation, 177

Motor holding brake, connection, 52

Motor monitoring, 22

Motor phase failure, monitoring functions, 244

Motor protection, 27

Motor temperature, monitoring functions, 229

Motor temperature monitoring (OH3, OH7), 229

Motor temperature sensor, monitoring, 246

Motor temperature sensor monitoring (Sd6), 246

Motor, connection, , 60

Motors of other manufacturers, 174

Mounting
- axis module ECSCx..., 45
- axis module ECSDx..., 41
- axis module ECSEx..., 40
- cold-plate design, 45
- standard installation (with fixing rails), 39
- thermally separated (push-through technique), 41

Mounting position, 30

N

Network management (NMT), 338

Network management data, 335

Node address (node ID), CAN interface, 352

Node address setting, 198

Node guarding, 212

Node ID, 351

Node-ID, display code, 351

Noise emission, 31

Noise immunity, 31

Notes, definition, 29

O

Offset selection, 155

Operating conditions, 30

Operating modules, 354

Operation with motors of other manufacturers, 174

Operation with servo motors from other manufacturers
- Checking the direction of rotation of the motor feedback system, 177
- current controller adjustment, metrological determination of electrical motor values, 179

Operation with servo motors of other manufacturers
- adjusting current controller, 178
- adjusting the current controller, calculating the electrical motor values, 178
- effecting rotor position adjustment, 180
- entering motor data, 174

Optimising the drive behaviour, 183

Overcurrent characteristic, 235

Overcurrent diagram, 235

Overvoltage threshold, DC-bus voltage, 241

P

Packaging, 30

Parameter, for manual jog, 165

Parameter data, 335 , 345

Parameter data objects, addressing, 351

Parameter data telegram, 346
- examples, 349

Parameter data transfer, 345

Parameter setting, 189
- With Global Drive Control (GDC), 190
- with keypad XT EMZ9371BC
  changing and saving parameters, 195
  connecting the keypad, 191
  keypad display elements, 192
  keypad function keys, 194
- With XT EMZ9371BC keypad, 191

Parameters
- changing and saving, with keypad XT EMZ9371BC, 195
- for homing, 143
- machine parameters, 138

PC system bus adapter, 354

PCAN-View, diagnostics, 260

Phase displacement, correction value, 208

Phase shift, 207

Plug connector assignment, power connections, 52

Plug connectors
- control connections, 67
- power connections, 52

Polarity of digital inputs/outputs, 142

Pollution, 30

Pos_Latch (position detection), 162

Position control, feedback system, 109
- absolute value encoder, 121
- Absolute value encoder (position encoder), resolver (speed encoder), 126
- incremental encoder (TTL encoder), 113
- resolver, 110
- resolver as multi-turn absolute value encoder, 112
- SinCos encoder, 113
- SinCos encoder (single-turn, multi-turn), 121
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 117

Position detection (Pos_Latch), 162

Power connections, 52
- connection of external brake resistor, 59
- DC bus connection, 52
- Internal brake resistor connection, 57
- motor connection, 52 , 60
- motor holding brake connection, 52
- plug connector assignment, 52

Power reduction, 30

Power supply module, 12

Power terminals, 51
- connection of motor holding brake, 61
- DC bus connection, 54

Process data, 335
- from the axis module, 134
- structure, 340
- to the axis module, 131

process data from drive, status word Stat1, 135 , 266

Process data objects
- addressing, 351
- available, 339
- cyclic, 342
- event-controlled, 344
- transfer, 341

Process data telegram, 340

Process data to the drive
- control word Ctrl1, 132
- monitor data, 133

Process data transfer, 339

Protection of persons, 26

Protective insulation, 31

Protective measures, 31

Protective separation, 31

Q

Quick stop (QSP), 173

R

Rated data, 32 , 33
- external brake resistor
  type ERBD..., 355
  type ERBM..., 355
  type ERBS..., 356

Rated output current, 34

Reference search with continuous positioning axis, 158

Reference search with linear positioning axis, 156

Reference setting, 96

Remote parameterisation (gateway function), 217

Residual hazards, 26

Resolver, 86 , 188
- Adjustment, 188
- as position and speed encoder, 110
- setting as absolute value encoder, 112

Resolver cable, monitoring, 245

Responses, 220
- CAN sync response, 209

Rotor position adjustment, monitoring, 251

S

Safe standstill, 70

Safe torque off, 70

Safety instructions, 18
- definition, 29
- layout, 29

Sd7 - absolute value encoder initialisation, 247

Select operating mode, homing mode, 164

Selecting operating mode
- manual jog, 165
- velocity mode, 167

Selecting the control interface, 130

Selection help for cable length / number of repeaters, Example, 84

Selection of the operating mode, 160
- Interpolated Position Mode (IP mode), 161

Set homing
- homing modes
  Mode 99, 154
  modes 0 and 1, 145
  modes 14 and 15, 152
  modes 16 and 17, 153
  modes 6 and 7, 148
  modes 8 and 9, 149
- offset of the zero position (offset selection), 155

Set reference, 154

Setting homing
- homing modes, modes 4 and 5, 147
- parameters, 143
- reference search with continuous positioning axis, 158
- reference search with linear positioning axis, 156

Setting node address, 197

Setting of boot up time , 204

Setting of cycle time, 204

Setting of feedback system
- absolute value encoder, 121
- SinCos encoder (single-turn, multi-turn), 121

Setting of homing, 96
- homing modes, 145
- parameters, 143

Setting of mains data, 101

Setting of manual jog (inching mode)
- evaluating hardware limit switches, 172
- retracting from hardware limit switches, 172

Setting of the feedback system, 109
- resolver as multi-turn absolute value encoder, 112

Setting the address, via DIP switch, 198

Setting the baud rate, 197

Setting the feedback system
- absolute value encoder (position encoder), resolver (speed encoder), 126
- incremental encoder (TTL encoder), 113
- Resolver as position and speed encoder, 110
- SinCos encoder, 113
- TTL-/SinCos encoder (position encoder), resolver (speed sensor), 117

Setting the homing, homing modes
- modes 10 and 11, 150
- modes 12 and 13, 151
- modes 2 and 3, 146

Setting the node address, via DIP switch, 198

Setting the polarity, digital inputs/outputs, 142

Setting the voltage thresholds, 102

Shield connection, control/signal cables, 65

Shielded cables, 53

Shielding
- cables, 53
- EMC, 50

Shifting the zero position (offset selection), 155

Short circuit monitoring (OC1), 228

Short-circuit monitoring, 228

Sin/cos signal, monitoring functions, 248

Sin/cos signal monitoring (Sd8), 248

SinCos absolute value encoder, 89

SinCos encoder, 89
- without serial communication, as position and speed encoder, 113

Site altitude, 30

Specification of the cables, motor cables, 60

Specification of the transmission cable, 81

Speed control, feedback system, 109
- absolute value encoder, 121
- Absolute value encoder (position encoder), resolver (speed encoder), 126
- incremental encoder (TTL encoder), 113
- resolver, 110
- resolver as multi-turn absolute value encoder, 112
- SinCos encoder, 113
- SinCos encoder (single-turn, multi-turn), 121
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 117

Speed controller, 183
- Adjustment, 183

Speed system deviation, monitoring functions, 249

Standards, 30

Starting torques, control terminals, connection "Safe torque off", 73

Status CAN, 214

status of the axis module, 267

Status word
- application (C3150/C3151), 266
- LECOM (C0150/C0155), 267

Status word Stat1, 135 , 266

Statuses, CAN network, 336

Structure of the ECS positioner, 15

Structure of the process data, 340

Supply voltage, encoder, 87

Switch-off thresholds, 241

Switch-on thresholds, 241

Sync correction increment, 208

Sync identifiers, 208

Sync phase displacement, 207
- correction value, 208

Sync signal source, 207

Sync telegram, 343

Synchronisation
- CAN sync response, 209
- cyclic process data objects, 343

Synchronisation cycle, 207

Synchronisation via CAN, 210

Synchronisation via terminal X6/DI1, 211

System bus (CAN), 333 , 334
- assignment of the plug connectors, 81
- baud rate, 83 , 84
- communication, 334
- configuring, 197
- cyclic process data objects, synchronisation, 343
- event-controlled process data objects, 344
- identifier, 334 , 351
- Individual addressing, 201
- network management data, 335
- parameter data, 335 , 345
- parameter data channels, 345
- process data, 335
- process data objects, 339
  addressing, 351
  data transmission, 341
- process data telegrams, 340
- setting the baud rate, 197
- setting the node address, 197
- user data, 335 , 346
- wiring, 80 , 82

system bus (CAN)
- CAN data telegram, 334
- parameter data objects, addressing, 351

System bus components, 354

System error messages, Causes and remedies, 270

System variables, 256

T

Technical data, 30
- current characteristics
  application example, 36
  device protection by current derating, 37
  rated output current, 34
- external brake resistor
  type ERBD..., 355
  type ERBM..., 355
  type ERBS..., 356
- general electrical data, 31
- rated data, 32 , 33
- standards and operating conditions, 30

Telegram counter CAN, 215

Temperature, 30

Temperature inside the controller, monitoring functions, 232

Terminology used, 12

Thermal monitoring, motor, Sensorless, 22

Thermal sensors, monitoring functions, 233

Thermal separation, 41

Tightening torques
- Control connections, 54 , 67
- control connections, 52

Time-out monitoring for activated remote parameterisation, 227

Timeout with activated remote parameterisation, CAN interface, 227

Toggle-bit monitoring, 136

Torque, safe torque off, 70

Transmission cable, specification, 81

TRIP, 220

TRIP-RESET, 265 , 278

Troubleshooting
- fault analysis with history buffer, 264
- fault messages, 270
- malfunction of drive, 269

Troubleshooting and fault elimination, 263
- monitoring
  current load of the motor (I2 x t monitoring), 22 , 237
  voltage supply of control electronics, 244
- monitoring functions
  bus off, 226
  current load of controller (I x t monitoring), 234
  DC-bus voltage, 241
  earth fault, 228
  heatsink temperature, 231
  max. system speed, 250
  monitoring times for process data input objects, 225
  motor phase failure, 244
  motor temperature, 229
  motor temperature sensor, 246
  Resolver cable, 245
  rotor position adjustment, 251
  short circuit, 228
  sin/cos signal, 248
  speed system deviation, 249
  temperature inside the controller, 232
  thermal sensors, 233

TTL encoder, 88

TTL incremental encoder, as position and speed encoder, 113

U

Undervoltage threshold, DC-bus voltage, 241

User data, 335 , 346 , 348

V

Variables, 256

Velocity mode, 167

Vibration resistance, 30

Voltage supply of control electronics, monitoring, 244

W

Warning, 220

Warranty, 17

Wiring, system bus (CAN), 82

X

XT EMZ9371BC keypad, Diagnostics, 259

Z

Zero position
- defining (homing), 96
- shifting (offset selection), 155

© 06/2013

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

+49 (0)51 54 / 82-0

+49 (0)51 54 / 82 - 28 00

Lenze@Lenze.de

www.Lenze.com

Service

Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany

00 80 00 / 24 4 68 77 (24 h helpline)

+49 (0)51 54 / 82-11 12

Service@Lenze.de

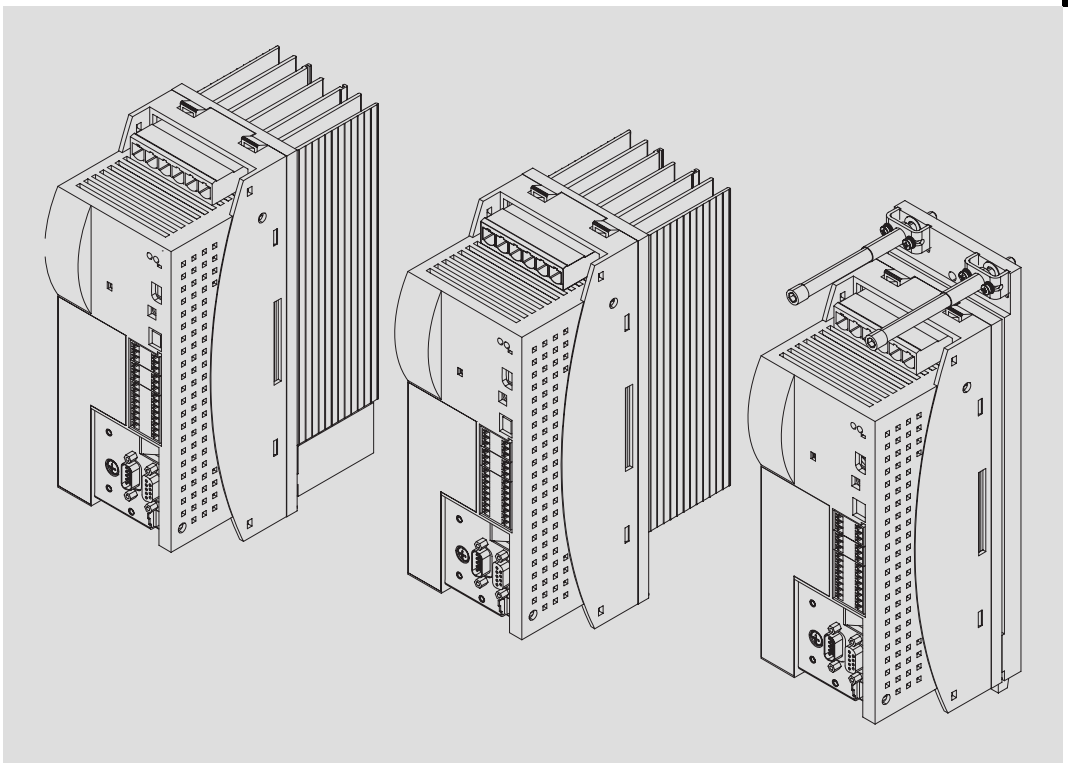
EDBCSXM064 ■ 13434279 ■ EN ■ 11.0 ■ TD17

10 9 8 7 6 5 4 3 2 1

EDBCSXP064
13434281

Operating Instructions

ECS



ECSEPxxx / ECSDPxxx / ECSCPxxx

Axis module – "Posi & Shaft"

Lenze

Please read these instructions before you start working!
Follow the enclosed safety instructions.

This documentation is valid for ECSxP axis modules, application software "Posi & Shaft" from V1.3, and operating software (B-SW) V7.0 or higher, as of version:

①										
ECS	x	P	xxx	x	4	x	xxx	XX	xx	xx

Device type

Design

E = standard panel-mounted unit, IP20
D = push-through technique (thermally separated)
C = cold-plate technique

Application

P = "Posi & Shaft"

Peak current

004 = 4 A
008 = 8 A
016 = 16 A
032 = 32 A
048 = 48 A
064 = 64 A

Fieldbus interface

C = MotionBus/system bus (CAN)

Voltage class

4 = 400 V/500 V

Technical version

B = standard
V = coated
I = for IT systems, uncoated
K= for IT systems, coated

Variant

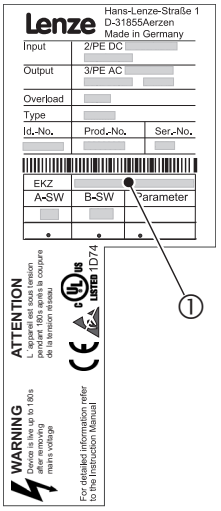
042 = Motion CiA402

Hardware version

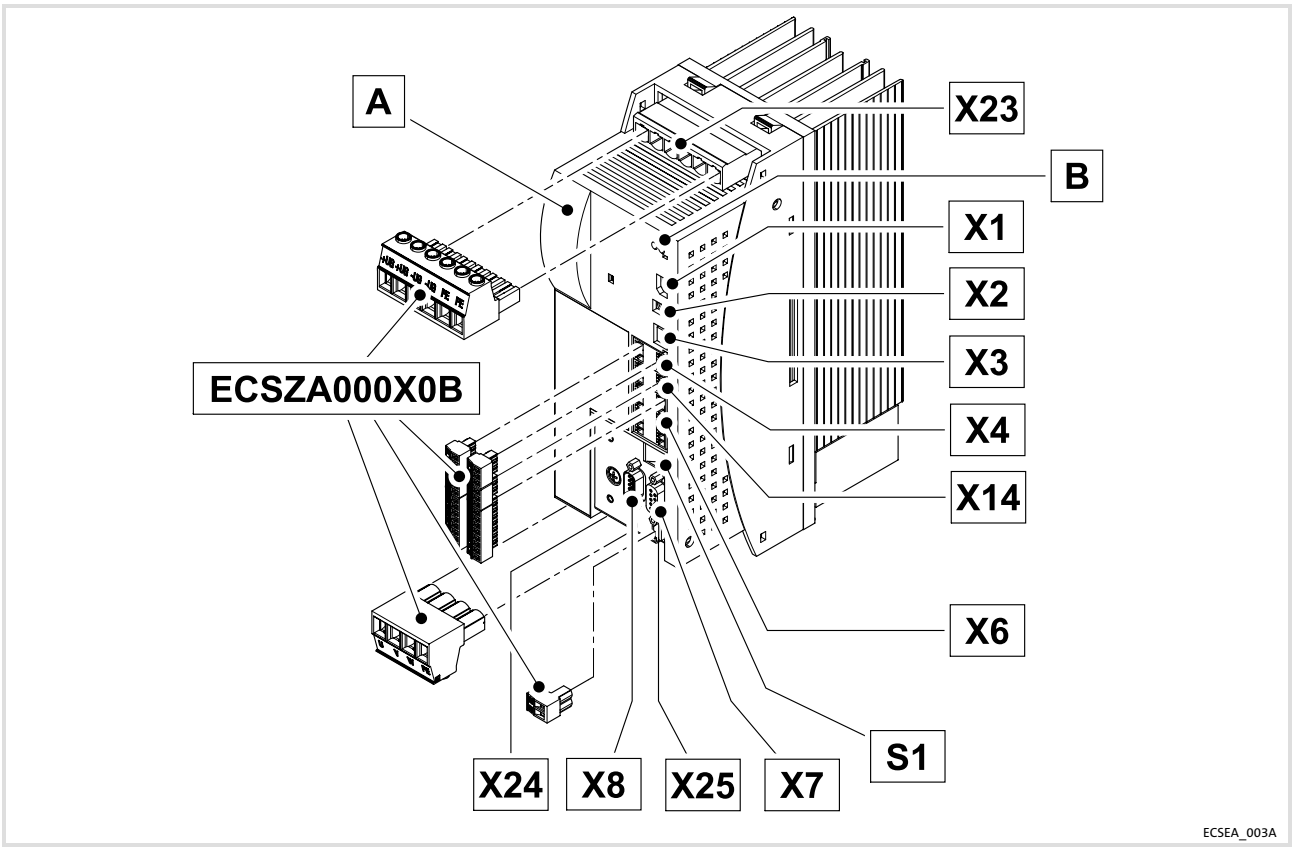
1A or higher

Operating software version (B-SW)

7.0 or higher



© 2013 Lenze Drive Systems GmbH, Hans-Lenze-Straße 1, 31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Drive Systems GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not take any responsibility or liability for any damage that may occur. Necessary corrections will be included in subsequent editions.


A
X23
B
X1
X2
X3
X4
X14
ECSZA000X0B
X6
S1
X24
X8
X25
X7
ECSEA_003A

Scope of supply

Position	Description	Quantity
A	ECS☐P... axis module	1
	Accessory kit with fixing material corresponding to the design (☐): ● ”E” - standard panel-mounted unit ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1
	Functional earth conductor (only ECS**D**P...)	1

Note!

The **ECSZA000X0B** connector set must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X23	Connections ● DC-bus voltage ● PE	📖 54
B	LEDs: Status and fault display	
X1	Automation interface (AIF) for ● Communication module ● Operating module (keypad XT)	 📖 79 📖 260
x2	PE connection of AIF	
X3	Analog input configuration	📖 69
X4	CAN connection ● MotionBus (CAN) / for ECSxA: System bus (CAN) ● Interface to the master control	📖 80
X14	CAN-AUXconnection ● System bus (CAN) ● PC interface/HMI for parameter setting and diagnostics	
X6	Connections ● Low-voltage supply ● Digital inputs and outputs ● Analog input ● ”Safe torque off” (formerly ”safe standstill”)	📖 64 📖 68 📖 69 📖 70
S1	DIP switch ● CAN node address ● CAN baud rate	📖 266
X7	Resolver connection	📖 86
X8	Encoder connection ● Incremental encoder (TTL encoder) ● Sin/cos encoder	📖 87
X25	Brake control connection	📖 61
X24	Motor connection	📖 60

Status displays

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibited (CINH), switch-on inhibit	Code C0183
Blinking	Off	Fault/error (TRIP) active	Code C0168/1
Blinking	On	Warning/FAIL-QSP active	Code C0168/1

1 Preface and general information 12
1.1 About these Operating Instructions 12
1.1.1 Terminology used 13
1.1.2 Code descriptions 14
1.2 Features of the ECSxP axis module 15
1.3 Scope of supply 16
1.4 Legal regulations 17

2 Safety instructions 18
2.1 General safety and application notes for Lenze controllers 18
2.2 Thermal motor monitoring 22
2.2.1 Forced ventilated or naturally ventilated motors 23
2.2.2 Self-ventilated motors 24
2.3 Residual hazards 26
2.4 Safety instructions for the installation according to UL 28
2.5 Notes used 29

3 Technical data 30
3.1 General data and operating conditions 30
3.2 Rated data 32
3.3 Current characteristics 34
3.3.1 Increased continuous current depending on the control factor 34
3.3.2 Device protection by current derating 37

4 Mechanical installation 38
4.1 Important notes 38
4.2 Mounting with fixing rails (standard installation) 39
4.2.1 Dimensions 39
4.2.2 Mounting steps 40
4.3 Mounting with thermal separation (push-through technique) 41
4.3.1 Dimensions 42
4.3.2 Mounting steps 44
4.4 Mounting in cold-plate design 45
4.4.1 Dimensions 46
4.4.2 Mounting steps 47

5 Electrical installation 48
5.1 Installation according to EMC (installation of a CE-typical drive system) 48
5.2 Power terminals 51
5.2.1 Connection to the DC bus (+UG, -UG) 54
5.2.2 Connection plan for mimimum wiring with internal brake resistor 56
5.2.3 Connection plan for mimimum wiring with external brake resistor 58
5.2.4 Motor connection 60
5.2.5 Motor holding brake connection 61
5.2.6 Connection of an ECSxK... capacitor module (optional) 63
5.3 Control terminals 64
5.3.1 Digital inputs and outputs 68
5.3.2 Analog input 69
5.3.3 Safe torque off 70
5.4 Automation interface (AIF) 79
5.5 Wiring of system bus (CAN) 80
5.6 Wiring of the feedback system 85
5.6.1 Resolver connection 86
5.6.2 Encoder connection 87
5.6.3 Digital frequency input/output (encoder simulation) 90

6 Commissioning 92
6.1 Basic terms of positioning 92
6.1.1 Positioning 92
6.1.2 Touch probe positioning 93
6.1.3 Positioning profile 94
6.1.4 Positioning profile mode 95
6.1.5 Additional functions of the positioning profile (C3096/x) 96
6.1.6 Positioning profile parameters 97
6.1.7 Setting of manual jog (inching mode) 101
6.1.8 Homing 101
6.1.9 Measuring system for positioning 102
6.1.10 Machine parameters 103
6.1.11 Electrical shaft (”EShaft”) 107
6.1.12 Device structure and interfaces to the higher-level control 108
6.2 State control of the positioning drive 110
6.2.1 Operating states 111
6.2.2 Conditions for state change (transitions) 113
6.3 Before you start 115

6.4 Commissioning steps (overview) . . . 116
6.4.1 Basic settings with GDC . . . 117
6.4.2 Set reference . . . 119
6.4.3 Setting of manual jog (inching mode) . . . 121
6.4.4 Setting of homing . . . 122
6.4.5 Setting absolute positioning/relative continuous positioning . . . 123
6.5 Loading the Lenze setting . . . 125
6.6 Setting of mains data . . . 126
6.6.1 Selecting the function of the charging current limitation . . . 126
6.6.2 Setting the voltage thresholds . . . 127
6.7 Entry of motor data for Lenze motors . . . 128
6.8 Holding brake configuration . . . 130
6.9 Setting of the feedback system for position and speed control . . . 132
6.9.1 Resolver as position and speed encoder . . . 133
6.9.2 Resolver as absolute value encoder . . . 135
6.9.3 TTL/SinCos encoder as position and speed encoder . . . 136
6.9.4 TTL/SinCos encoder as position encoder and resolver as speed encoder . . . 140
6.9.5 Absolute value encoder as position and speed encoder . . . 145
6.9.6 Absolute value encoder as position encoder and resolver as speed encoder . . . 150
6.10 Select control interface (operating mode) . . . 155
6.11 Process data to the axis module (control word Ctrl1 and setpoints) . . . 158
6.11.1 Control word Ctrl1 . . . 159
6.11.2 Setpoint data words to the controller (VelDirect, PosDirect, rx_par1..3) . . . 160
6.12 Process data from the axis module (status words and actual values) . . . 161
6.12.1 Status word 1 (Stat1), status word 2 (Stat2) . . . 161
6.12.2 Device status . . . 163
6.12.3 Monitor data words from the controller (tx_par1 und tx_par2) . . . 164
6.13 Entry of machine parameters . . . 165
6.14 Configuring the digital inputs and outputs . . . 168
6.14.1 Digital inputs for operation with continuous positioning axis . . . 170
6.14.2 Digital inputs for operation with linear positioning axis . . . 171
6.14.3 Setting the polarity of digital inputs and outputs . . . 172
6.15 Setting of manual control parameters . . . 173
6.15.1 Manual control to software limit position . . . 175
6.15.2 Manual control to hardware limit switch . . . 175
6.15.3 Retracting from hardware limit switches . . . 176

6.16 Setting of homing parameters 177
6.16.1 Setting homing modes 179
6.16.2 Shifting the zero position with regard to the home position (offsets C3011, C3012) 187
6.16.3 Example: Reference search with linear positioning axis 188
6.16.4 Example: Reference search with continuous positioning axis 189
6.17 Setting the positioning profile 191
6.17.1 Selecting a positioning profile mode 191
6.17.2 ”Point-to-point” positioning 193
6.17.3 Touch probe positioning 194
6.17.4 Continuous constant travel 195
6.17.5 Electrical shaft (”E-shaft”) per digital frequency, MotionBs (CAN) or EtherCAT 196
6.17.6 Homing 197
6.17.7 Direct positioning 198
6.17.8 Positioning sequence for controller optimisation 200
6.17.9 Setting of positioning profile parameters 201
6.17.10 Setting the profile parameter jerk time for S-shaped ramps 202
6.17.11 Additional functions of the positioning profile (C3096/x) 204
6.17.12 Activating the speed override 205
6.17.13 Activating the torque limitation after positioning 208
6.17.14 Activating the profile continuation function 209
6.17.15 Activate immediate profile change during positioning (Direct Change) 210
6.18 Configuring the electrical shaft (”E-Shaft”) 211
6.18.1 Setting the stretch factor (C3097 / C3098) 212
6.18.2 Electrical shaft via classical digital frequency coupling (digital frequency input X8) 215
6.18.3 Electrical shaft via MotionBus (CAN) with ECSxP as electrical shaft master 217
6.18.4 Electrical shaft via MotionBus (CAN) with PLC as electrical shaft master 220
6.18.5 Electrical shaft via EtherCAT with PLC as electrical shaft master 224
6.19 Starting positioning profiles (ProfEnable, profile number) 226
6.19.1 Start of positioning profile via the ”ProfEnable” control bit 227
6.19.2 Start of positioning profile by selecting a new profile number ”PNoSet_x” 228
6.20 Setting the target position window (InTarget) 229
6.21 Defining the window for standstill message 231
6.22 Defining the dwell time 232
6.23 Following error monitoring (C3030, C3031) 233
6.24 E-Shaft: Speed-dependent angular trimming 235
6.25 Software limit positions, limitation of the travel range 237

6.26 Evaluation of hardware limit switches 240
6.27 Controller enable (CINH = 0) 241
6.28 Quick stop (QSP) 243
6.29 Operation with motors from other manufacturers 244
6.29.1 Entering motor data manually 244
6.29.2 Checking the direction of rotation of the motor feedback system 246
6.29.3 Adjusting current controller 247
6.29.4 Effecting rotor position adjustment 249
6.30 Optimising the drive behaviour after start 252
6.30.1 Speed controller adjustment 252
6.30.2 Adjustment of field controller and field weakening controller 254
6.30.3 Resolver adjustment 257

7 Parameter setting 258
7.1 General information 258
7.2 Parameter setting with ”Global Drive Control” (GDC) 259
7.3 Parameter setting with the XT EMZ9371BC keypad 260
7.3.1 Connecting the keypad 260
7.3.2 Description of the display elements 261
7.3.3 Description of the function keys 263
7.3.4 Changing and saving parameters 264

8 Configuration 265
8.1 Configuring MotionBus/system bus (CAN) 266
8.1.1 Setting CAN node address and baud rate 266
8.1.2 Individual addressing 271
8.1.3 Defining boot-up master in the drive system 273
8.1.4 Setting of boot-up time/cycle time 274
8.1.5 Executing a reset node 276
8.1.6 Guiding angle selection and synchronisation via MotionBus (CAN) . . . 277
8.1.7 Axis synchronisation (CAN synchronisation) 278
8.1.8 Monitoring of the synchronisation (sync time slot) 281
8.1.9 Axis synchronisation via CAN 282
8.1.10 Axis synchronisation via terminal X6/DI1 283
8.2 Node guarding 284
8.3 Diagnostics codes 286
8.3.1 CAN bus status (C0359/C2459) 286
8.3.2 CAN telegram counter (C0360/2460) 287
8.3.3 CAN bus load (C0361/2461) 288
8.4 Remote parameterisation (gateway function) 289

9 Monitoring functions 291
9.1 Fault responses 292
9.2 Overview of monitoring functions 293
9.3 Configuring monitoring functions 297
9.3.1 Monitoring times for process data input objects 297
9.3.2 Time-out monitoring for activated remote parameterisation 299
9.3.3 Short circuit monitoring (OC1) 300
9.3.4 Earth fault monitoring (OC2) 300
9.3.5 Motor temperature monitoring (OH3, OH7) 301
9.3.6 Heatsink temperature monitoring (OH, OH4) 303
9.3.7 Monitoring of internal device temperature (OH1, OH5) 304
9.3.8 Function monitoring of thermal sensors (H10, H11) 305
9.3.9 Current load of controller (I x t monitoring: OC5, OC7) 306
9.3.10 Current load of motor (I2 x t monitoring: OC6, OC8) 309
9.3.11 DC-bus voltage monitoring (OU, LU) 313
9.3.12 Voltage supply monitoring - control electronics (U15) 316
9.3.13 Motor phase failure monitoring (LP1) 316
9.3.14 Monitoring of the resolver cable (Sd2) 317
9.3.15 Motor temperature sensor monitoring (Sd6) 318
9.3.16 Monitoring of the absolute value encoder initialisation (Sd7) 319
9.3.17 Sin/cos signal monitoring (Sd8) 320
9.3.18 Monitoring of the speed system deviation (nErr) 321
9.3.19 Monitoring of max. system speed (NMAX) 322
9.3.20 Monitoring of the rotor position adjustment (PL) 323

10 Diagnostics 324
10.1 Diagnostics with Global Drive Control (GDC) 324
10.2 Diagnostics with Global Drive Oscilloscope (GDO) 326
10.2.1 GDO buttons 327
10.2.2 Diagnostics with GDO 328
10.3 Diagnostics with the XT EMZ9371BC keypad 333
10.4 Diagnostics with PCAN-View 334
10.4.1 Monitoring of telegram traffic on the CAN bus 334
10.4.2 Setting all CAN nodes to the ”Operational” status 336

11 Troubleshooting and fault elimination 337
11.1 Fault analysis 337
11.1.1 Fault analysis via the LED display 337
11.1.2 Fault analysis with keypad XT EMZ9371BC 337
11.1.3 Fault analysis with the history buffer 338
11.1.4 Fault analysis via LECOM status words (C0150/C0155) 340
11.2 Malfunction of the drive 342
11.3 Fault messages 343
11.3.1 Causes and remedies 343
11.3.2 Reset fault messages (TRIP-RESET) 352

12 Appendix 353
12.1 Code table 353
12.2 General information about the system bus (CAN) 411
12.3 Communication with MotionBus/system bus (CAN) 412
12.3.1 Structure of the CAN data telegram 412
12.3.2 Communication phases of the CAN network (NMT) 414
12.3.3 Process data transfer 417
12.3.4 Parameter data transfer 423
12.3.5 Addressing of the parameter and process data objects 429
12.4 Overview of accessories 431
12.4.1 Connector sets 431
12.4.2 Shield mounting kit 431
12.4.3 Components for operation and communication 432
12.4.4 Brake resistor 433
12.4.5 Mains fuses 435
12.4.6 Mains chokes 436
12.4.7 RFI filters 437

13 Index 438

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions will assist you in connecting and commissioning the ECSxP... axis modules.

They contain safety instructions which must be observed!

All persons working on and with the ECSxP... axis modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.1.1 Terminology used

Term	In the following text used for
Power supply module ECSxE...	ECSxE... power supply module
Capacitor module ECSxK...	ECSxK... capacitor module
Axis module Controller Standard device ECSxS... ECSxP... ECSxM... ECSxA ...	Axis module of the ECS series ● ECSxS... - ”Speed and Torque” ● ECSxP... - ”Posi and Shaft” ● ECSxM... - ”Motion” ● ECSxA... - ”Application”
Drive system	ECS drive system consisting of: ● ECSxE... power supply module ● Axis module ECSxS... / ECSxP... / ECSxM... / ECSxA... ● ECSxK series capacitor module (optional) ● further Lenze drive components (accessories)
24 V supply Low-voltage supply	Voltage supply ● of the control card, voltage range 20 ... 30 V DC (±0 V) ● of the ”safe torque off” function (formerly ”safe standstill”), voltage range 18 ... 30 V DC (±0 V) ● of the motor holding brake, voltage range 23 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
System bus (CAN)	Lenze standard bus system based on *CANopen* for ● communication with a higher-level host system (PLC) or further controllers. ● parameter setting and diagnostics.
MotionBus (CAN)	The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.
DDS	Drive PLC Developer Studio (Lenze software for PLC programming acc. to IEC 61131)
GDC	Global Drive Control (Lenze software for parameter setting and diagnostics)
GDO	Global Drive Oscilloscope (additional diagnostic tool of the GDC)
Cxxxx	Code Cxxxx (e.g. C0351) Parameters which serve to parameterise or monitor the controller.
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on terminal strip Xk (e.g. X6/B+ = terminal B+ on terminal strip X6)

1.1.2 Code descriptions

Lenze codes are described in the form of tables with the following structure:

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	Cxxxx 1	Subcode 1 of Cxxxx
	Cxxxx 2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Example

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0003	Par save	0				Non-volatile saving of parameter set
			0	No response		
			1	Save parameter set		
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2

1.2 Features of the ECSxP axis module

- Safety function ”safe torque off” (formerly ”safe standstill”)
- 15 separate positioning profile can be stored:
  - Positioning in a finite travel range (absolute measuring system)
  - Continuous positioning in one direction (incremental dimensioning system), e.g. for cut-to-length cutters
  - Touch probe positioning (mark sensor)
  - ”Electrical shaft” with classic digital frequency coupling or via CAN
- Additional profile functions:
  - Speed override via analog input or per process data communication (PDO) via CAN or fieldbus module at the automation interface (AIF)
  - Stretch factor for the ”electrical shaft” function
  - Torque limitation after positioning
  - Profile continuation after profile stop
  - Immediate profile change during positioning(direct change)
- Homing, 14 different modes
- Manual jog
- Brake logic activatable
- Software based monitoring of the travel range and of the hardware limit switch
- Process coordination by higher-level host system (PLC)
- Double CAN ON BORD
  - **MotionBus (CAN):**
    Interface X4 ”CAN” (PDO1, Sync-based) for communicating with a higher-level host system (PLC) or further controllers.
  - **System bus (CAN):**
    Interface X14 ”CAN-AUX” for parameter setting and diagnostics
- Selectable control interfaces (via code C4010):
  - MotionBus (CAN)
  - System bus (CAN-AUX)
  - Fieldbus via the automation interface (AIF)
  - Via codes per parameter data channel
- Supported feedback systems:
  - Resolver with and without position storage
  - Encoder (incremental encoder (TTL encoder), sin/cos encoder)
- Commissioning, parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC) or the XT EMZ9371BC keypad

1.3 Scope of supply

The scope of supply of the ECSxP... axis module includes:

- Standard device
- Accessory kit with fixings according to the design:
  – ”E” - panel-mounted device
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting Instructions
- Drilling jig
- Functional earth conductor (only ECS**D**P...)

Accessories

The appendix includes information on the following accessories: (📖 431).

- Connector sets for
  – power supply modules: ECSZE000X0B
  – capacitor modules: ECSZK000X0B
  – axis modules: ECSZA000X0B
- ECSZS000X0B001 shield mounting kit (EMC accessories)
- Components for operation and communication
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters



Tip!

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

http://www.Lenze.com

1.4 Legal regulations

Identification	Nameplate	CE designation	Manufacturer
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Automation GmbH Grünstraße 36 D-40667 Meerbusch
Application as directed	**ECSxP... axis modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for open and closed loop control of variable speed drives with PM synchronous motors and asynchronous motors. – for installation into a machine – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective 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 for industrial purposes only. **Drive systems with ECSxP... axis modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at public and non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to axis modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these Instructions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damages and failures caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the axis module – Operating errors – Improper working on and with the axis module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems 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

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

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):

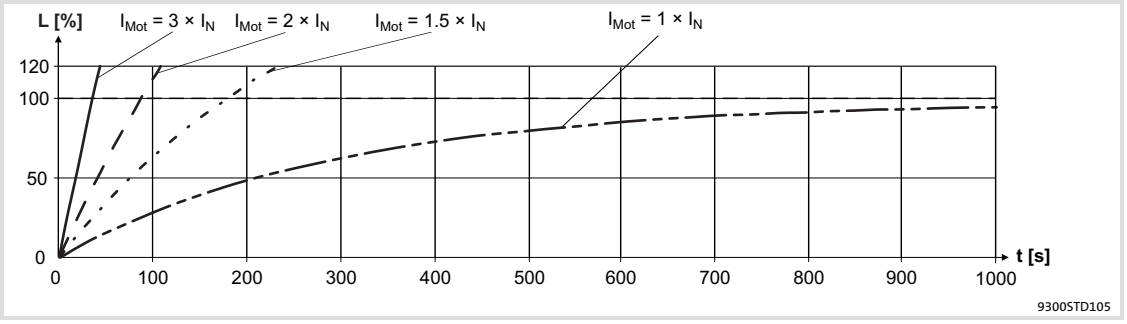


Fig. 2-1 $I^2 \times t$-monitoring: Release times for different motor currents and trigger thresholds

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

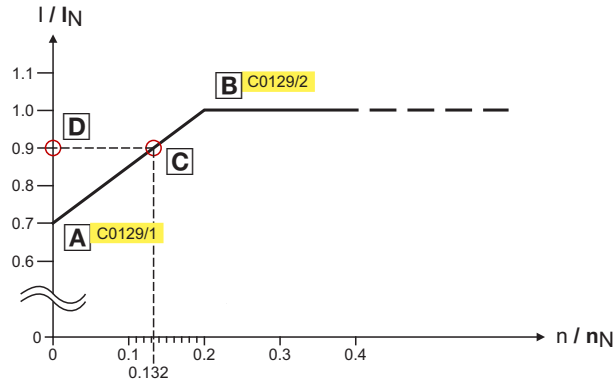


Fig. 2-2 Working point in the range of characteristic lowering

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", 📖 25).

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 axis module, check that no voltage is applied to the power terminals, because
  - the power terminals +UG, -UG, U, V and W remain live for at least 3 minutes after mains switch-off.
  - the power terminals +UG, -UG, U, V and W remain live when the motor is stopped.
- The heatsink has an operating temperature of > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The discharge current to PE is > 3.5 mA AC or. > 10 mA DC.
  - EN 61800-5-1 requires a fixed installation.
  - The PE connection must comply with EN 61800-5-1.
  - Comply with the further requirements of EN 61800-5-1 for high discharge currents!

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG, U, V, W and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Power must not be converted until all devices of the power system are ready for operation. Otherwise, the input current limitation may be destroyed.

Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the axis module, if

- the axis module is supplied via the ECSxE supply module and the input current limitation is activated depending on the DC-bus voltage (C0175 = 1 or 2).
- the axis module is not supplied via a supply module delivered by Lenze.
- the low-voltage supply (24 V) is switched off.

For this reason allow a break of at least three minutes between two starting operations!

Use the safety function ”Safe torque off” (STO) for frequent disconnections for safety reasons.

Motor protection

- Only use motors with a minimum insulation resistance of û = 1.5 kV, min. du/dt = 5 kV/µs.
  – Lenze motors meet these requirements.
- When using motors with an unknown insulation resistance, please contact your motor supplier.
- Some settings of the axis module lead to an overheating of the connected motor, e.g. longer operation of self-ventilated motors with low speeds.
- Use PTC thermistors or thermostats with PTC characteristic for motor temperature monitoring.

2.4 Safety instructions for the installation according to UL

Warnings!

General markings:

- ► Use 60/75 °C or 75 °C copper wire only.
- ► Maximum ambient temperature 55 °C, with reduced output current.

Markings provided for the supply units:

- ► Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V max, when protected by K5 or H Fuses (400/480 V devices).
- ► Alternate - Circuit breakers (either inverse-time, instantaneous trip types or combination motor controller type E) may be used in lieu of above fuses when it is shown that the let-through energy (i^2t) and peak let-through current (I_p) of the inverse-time current-limiting circuit breaker will be less than that of the non-semiconductor type K5 fuses with which the drive has been tested.
- ► Alternate - An inverse-time circuit breaker may be used, sized upon the input rating of the drive, multiplied by 300 %.

Markings provided for the inverter units:

- ► The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 2nd ed., Table 5.1.
- ► The devices are provided with integral overload and integral thermal protection for the motor.
- ► The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X 21, X 22, X 23, X 24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X 25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X 21, X 22, X 23, X 24	12 ... 8
X4, X6, X14	28 ... 16
X 25	24 ... 12

2.5 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.

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (2006/95/EG)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
		CSA 22.2 No. 14	
Max. permissible Motor cable length	shielded	50 m	For rated mains voltage and switching frequency of 8 kHz
Packaging (EN ISO 4180)		Shipping package	
Installation		• Installation into IP20 control cabinet • For the ”safe torque off” function (formerly ”safe standstill”): mounting in IP54 control cabinet	
Mounting position		vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm With ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	can be mounted directly side by side without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) • Atmospheric pressure: 86 ... 106 kPa • Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl • Reduce rated output current by 5 %/1000 m above 1000 m amsl. • Over 2000 m amsl: Use is only permitted in environments with overvoltage category II
Pollution		EN 61800-5-1, UL840: Degree of pollution 2	
Vibration resistance		Acceleration resistant up to 0.7 g (Germanischer Lloyd, general conditions)	

General electrical data			
EMC	Compliance with the requirements acc. to EN 61800-3		
Noise emission	Compliance with the limit class C2 acc. to EN 61800-3 (achieved by using collective filters typical for the application)		
Noise immunity	Requirements acc. to EN 61800-3		
	Requirement	**Standard**	**Severity**
	ESD [1]	EN 61000-4-2	3, i. e. ● 8 kV for air discharge ● 6 kV for contact discharge
	Conducted high frequency	EN 61000-4-6	10 V; 0.15 ... 80 MHz
	RF interference (housing)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (surge voltage on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase/phase ● 2 kV phase/PE
Insulation resistance	EN 61800-5-1, UL840: Overvoltage category III		
Discharge current to PE (Acc. to EN 61800-5-1)	> 3.5 mA AC		
Enclosure	IP20 for ● Standard installation (built-in unit) ● Cold-plate technique ● Mounting with thermal separation (push-through technique), IP54 on heatsink side		
Protective measures against	● Short circuit in power terminals – Motor terminal has a limited protection against short circuit (after short circuit detection, the error message must be reset.) ● Short circuit in auxiliary circuits – Digital outputs: Short-circuit-proof – Bus and encoder systems: Limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:) ● Earth fault (earth-fault protected during operation, limited earth-fault protection on mains power-up) ● Overvoltage ● Motor stalling ● Motor overtemperature (input for KTY, I^2 x t monitoring)		
Protective insulation of control circuits	**Protective separation from the mains** Double/reinforced insulation acc. to EN 61800-5-1		

[1] Noise immunity in the above-mentioned severities must be guaranteed by the control cabinet! The user must check the compliance with the severities!

3.2 Rated data

Rated data		Type	Axis module					
			ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains		S_{rated} [kVA]	1.3		2.6		5.3	
Data for operation with upstream power supply module on mains voltage		V_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	2.5	2.0	4.9	3.9	9.8	7.8
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	2.0	1.6	4.0	3.2	8.0	6.4
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	1.4	1.1	2.7	2.2	5.3	4.2
Max. output current (acceleration current)		I_{max} [A]	4.0		8.0		16.0	
Continuous current at standstill (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	2.0	1.6	4.0	3.2	8.0	6.4
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	2.3		4.6		9.1	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	3.0		6.0		12.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	1.5		3.0		6.0	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	27.3		46.3		84.7	
	Inside the device		13.3		17.3		20.7	
	Heatsink		14.0		29.0		64.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4					

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Rated data		Type	Axis module					
			ECSx□032		ECSx□048		ECSx□064	
Output power 400 V mains		S_{rated} [kVA]	8.3		11.2		13.2	
Data for operation with upstream power supply module on mains voltage		U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	15.6	12.5	20.9	16.8	24.5	19.6
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	12.7	10.2	17.0	13.6	20.0	16.0
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	8.5	6.8	11.3	9.0	13.3	10.6
Max. output current (acceleration current)		I_{max} [A]	32.0		48.0		64.0	
Continuous current at standstill [2] (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	16.0	12.8	23.0	18.4	27.0	21.6
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	18.1		27.2		36.3	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	24.0		36.0		48.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	12.1		18.1		24.2	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	144.5		166.5		199.0	
	Inside the device		27.5		34.5		41.0	
	Heatsink		117.0		132.0		158.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4		approx. 3.3			

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

3.3 Current characteristics

3.3.1 Increased continuous current depending on the control factor

In the lower speed range – the motor does not need the full motor voltage – particularly the more powerful ECS axis modules can be permanently operated with increased output current (cp. continuous current $I_{0,eff}$ 📖 32).

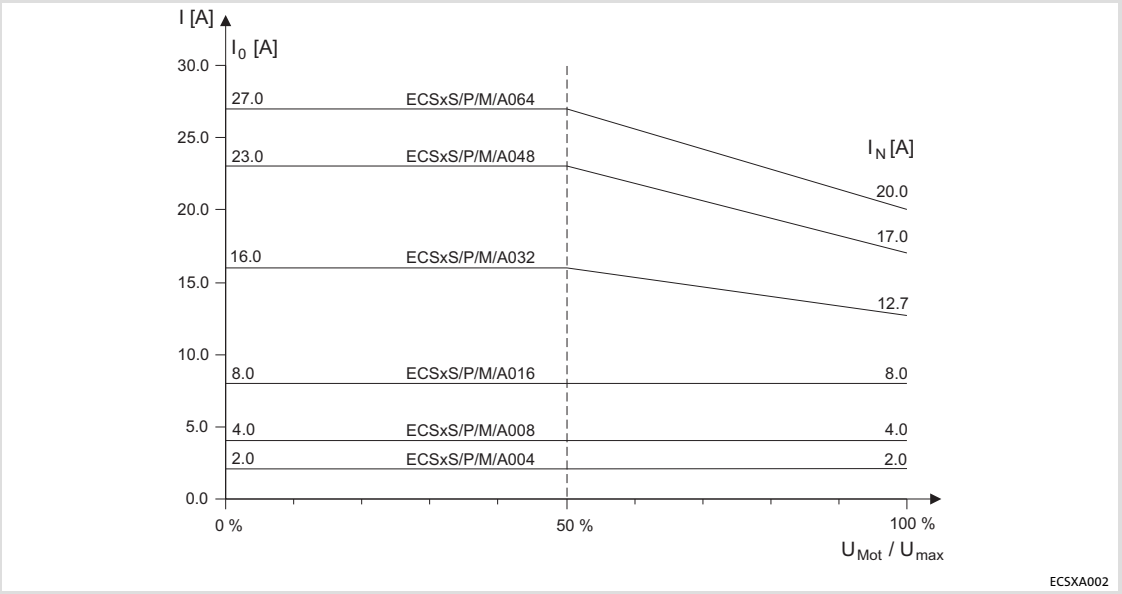


Fig. 3-1 Continuous device current, depending on the output voltage for $U_{mains} \leq 400$ V at 4 kHz

I_r	Rated output current of the axis module
U_{Mot_n}	Actual controller output voltage
U_{Mot_max}	0.9 x current mains voltage

The permissible continuous current depends on the control factor of the power output stages, approximately on the ratio of the motor voltage output in the operating point (U_{Mot_n}) to the maximum possible output voltage (U_{Mot_max}). Due to voltage drops across the components involved at rated load and a control margin, U_{Mot_max} can be estimated with 90 % of the mains voltage.

Tip!

The operating threshold of the device utilisation monitoring (I x t) function is automatically adapted to the continuous device current which changes depending on the output voltage (see fig.).

The following table shows the connections between mains voltage, DC-bus voltage and motor voltage:

Mains voltage [U_{mains}]	DC-bus voltage [$U_{DC} = U_{mains} \times 1.35$]	Output voltage (motor voltage) nominally achievable for 100 % modulation [$U_{mot} = 0.66 \times U_{DC}$]
3 x 230 V AC	310 V DC	3 x 205 V AC
3 x 380 V AC	510 V DC	3 x 340 V AC
3 x 400 V AC	540 V DC	3 x 360 V AC
3 x 415 V AC	560 V DC	3 x 370 V AC
3 x 460 V AC	620 V DC	3 x 415 V AC
3 x 480 V AC	650 V DC	3 x 435 V AC
3 x 528 V AC	712 V DC	3 x 475 V AC

For steady-state operation in generator mode with increased DC-bus voltage or supply from a closed-loop DC-voltage source, interpolate accordingly between the values given in the table.

The increased rated currents are valid for the entire voltage range specified at switching frequencies of 4 kHz and 8 kHz.

Note!

If in this connection a heatsink temperature of > 70 °C is reached, the drive switches to a switching frequency of 4 kHz, independently of the selected switching frequency.

Example:

The ECS axis module suitable for operation in conjunction with a Lenze motor of type MCS 14L32 is to be determined.

- Rated motor data
  - Rated motor torque (M_{mot}) = 17.2 Nm
  - Rated motor speed (n_{mot}) = 3225 rpm
  - Motor voltage at 3250 rpm (U_{mot_n3250}) = 275 V
  - Rated motor current (I_{mot}) = 15 A
  - Max. motor current (I_{mot_max}) = 92 A
- Application data:
  - Max. torque (M_{max}) = 35 Nm
  - Max. operating speed (n_{max}) = 2500 rpm
  - An effective process power (P_{eff}) of 4.5 kW arises on the basis of the Mn diagram.
  - The drive rating results in an effective motor current (I_{Mot_eff}) of 14.8 A.

A first estimation based on the rated current of the ECS axis module would probably lead to selecting the ECSxP048 module with a rated current of 17.0 A.

However, if we take into account the increased continuous current for smaller control factors, the more cost-effective ECSxP032 axis module with a rated current of 12.7 A can be used here.

- When the MCS 14L32 is operated with 2500 rpm, the real motor voltage is (U_{Mot_n2500}):

$$U_{Mot\_n2500} = U_{Mot\_n3250} \cdot \frac{n_{max}}{n_{Mot}} \quad \Rightarrow \quad 275\ V \cdot \frac{2500\ rpm}{3250\ rpm} = 212\ V$$

- This leads to the following max. control factor (α_{max}) of the axis module:

$$\alpha_{max} = \frac{U_{Mot\_n2500}}{U_{max}} \quad \Rightarrow \quad \frac{212\ V}{360\ V} = 0.59 = 59\ \%$$

  Using the current characteristic of Fig. 3-1 (📖 34), a continuous current of 15.5 A can be determined for the ECSxP032 axis module when the control factor (α_{max}) is 59 %.

- **Result:**

  Under the conditions mentioned above the MCS 14L32 Lenze motor can be operated continuously on the ECSxP032 axis module.

3.3.2 Device protection by current derating

The maximum output current is limited. With output frequencies < 5 Hz the limitation depends on the heatsink temperature.

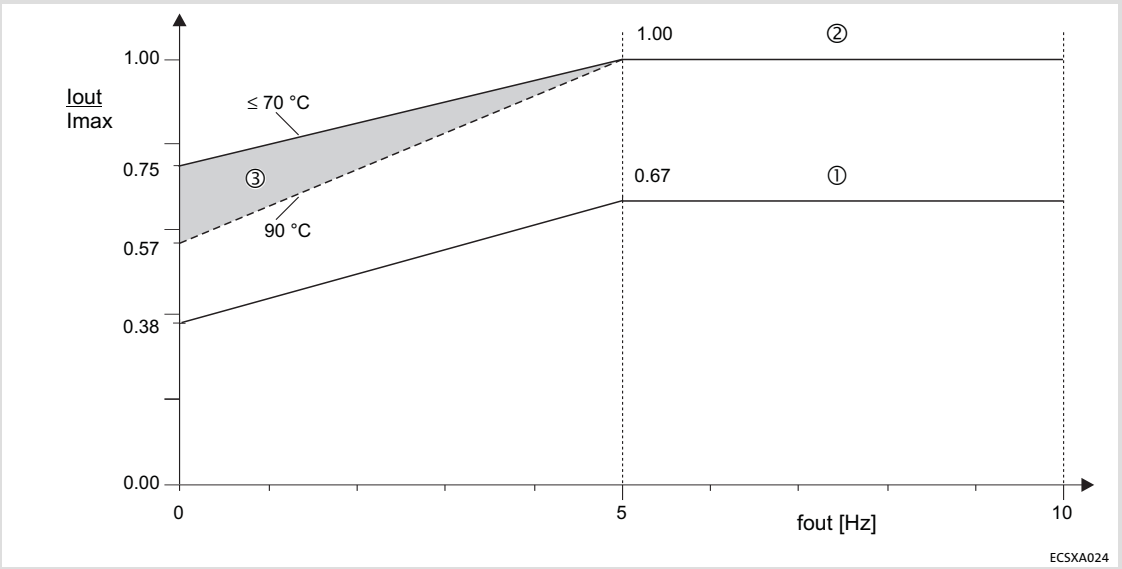


Fig. 3-2 Current derating characteristics

① Operation with switching frequency = 8 kHz (C0018 = 1).
- If the current exceeds the characteristic ①, the switching frequency is automatically changed to 4 kHz (e.g. for higher torque in acceleration processes).

② Operation with switching frequency = 4 kHz (C0018 = 0).
- The current limitation follows the characteristic ②.
- With output frequencies < 5 Hz and heatsink temperatures between 70 and 90 °C the current limit is steplessly adjusted in the range ③.

Type	I_{max} [A]				
	Switching frequency 8 kHz ①		Switching frequency 4 kHz ②		
	f_{out} > 5 Hz	f_{out} → 0 Hz	f_{out} > 5 Hz	f_{out} → 0 Hz ≤ 70 °C	f_{out} → 0 Hz 90 °C
ECSxP004	2.7	1.5	4.0	3.0	2.3
ECSxP008	5.3	3.0	8.0	6.0	4.6
ECSxP016	10.7	6.0	16.0	12.0	9.1
ECSxP032	21.3	12.1	32.0	24.0	18.1
ECSxP048	32.0	18.1	48.0	36.3	27.2
ECSxP064	42.7	24.2	64.0	48.0	36.3

4 Mechanical installation

4.1 Important notes

- Axis modules of the ECS series provide IP20 enclosure and can therefore only be used for installation in control cabinets.
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions:
  - Vertical at the mounting plate
  - DC bus connections (X23) at the top
  - Motor connection (X24) at the bottom
- Maintain the specified clearances (above and below) to other installations!
  - If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  - must be electrically conductive.
  - must not be varnished.
- In case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

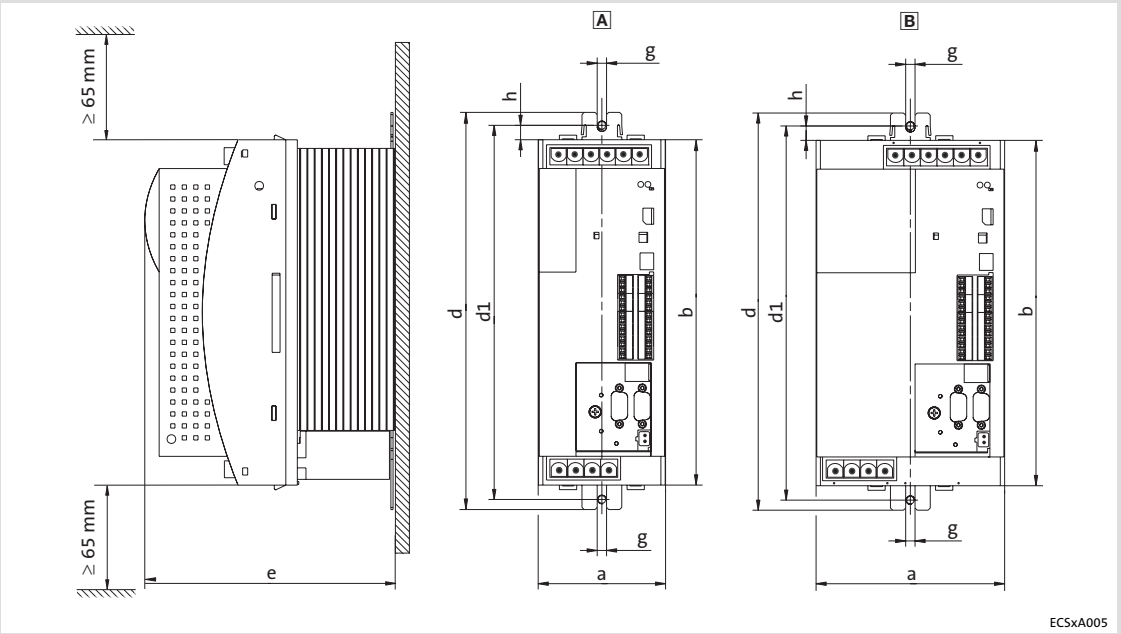


Fig. 4-1 Dimensions for ”panel-mounted” design

Axis module		Dimensions [mm]						
Type	**Size**	**a**	**b**	**d**	**d1**	**e**	**h**	**g**
ECSE☐004	A	88,5	240	276	260	176 212 1)	10	6,5 (M6)
ECSE☐008								
ECSE☐016								
ECSE☐032								
ECSE☐048	B	131						
ECSE☐064								

1) Max. 212 mm, depending on the plugged-on communication module

☐ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.2.2 Mounting steps

How to install the axis module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: Push in the long side.
   – From below: Push in the short side.
4. Attach the axis module to the mounting surface.

4.3 Mounting with thermal separation (push-through technique)

For the push-through technique the rear panel of the control cabinet must be a steel plate with a thickness of at least 2 mm.

The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the axis module).

Cooling

With the separated heatsink the heat generation in the control cabinet can be reduced.

- Distribution of the power loss:
  - approx. 65 % via separated cooler
  - approx. 35 % in the inside of the axis module
- Protection class of the separated cooler: IP54
  - The sealing surface at the heatsink of the axis module must rest completely against the mounting plate.
  - Use a liquid thread sealant to bond the screws of the clamps.
- For sufficient cooling of the drive system:
  - Air flow behind the rear panel of the control cabinet must be $\geq$ 3 m/s (e.g. by means of a collective fan).
- With sufficient cooling, the rated data of the axis modules remain valid.

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

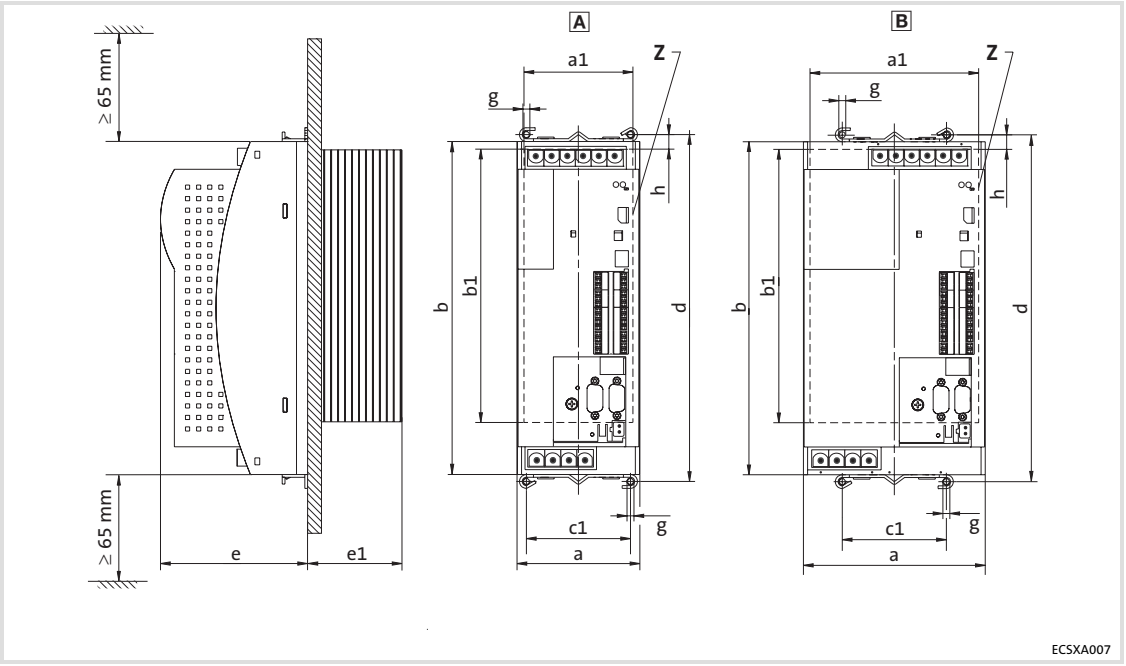


Fig. 4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 📖 43

Axis module		Dimensions [mm]									
Type	Size	a	a1	b	b1	c1	d	e	e1	g	h
ECSD□004	A	88,5	78,5	240	197	75	250	109 145 [1]	67	M5	10,5
ECSD□008											
ECSD□016											
ECSD□032											
ECSD□048	B	131	121,5								
ECSD□064											

1) Max. 145 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Dimensions of mounting cutout

Note!

Installation with shield mounting ECSZS000X0B:

► Clearance below the mounting cutout > 220 mm

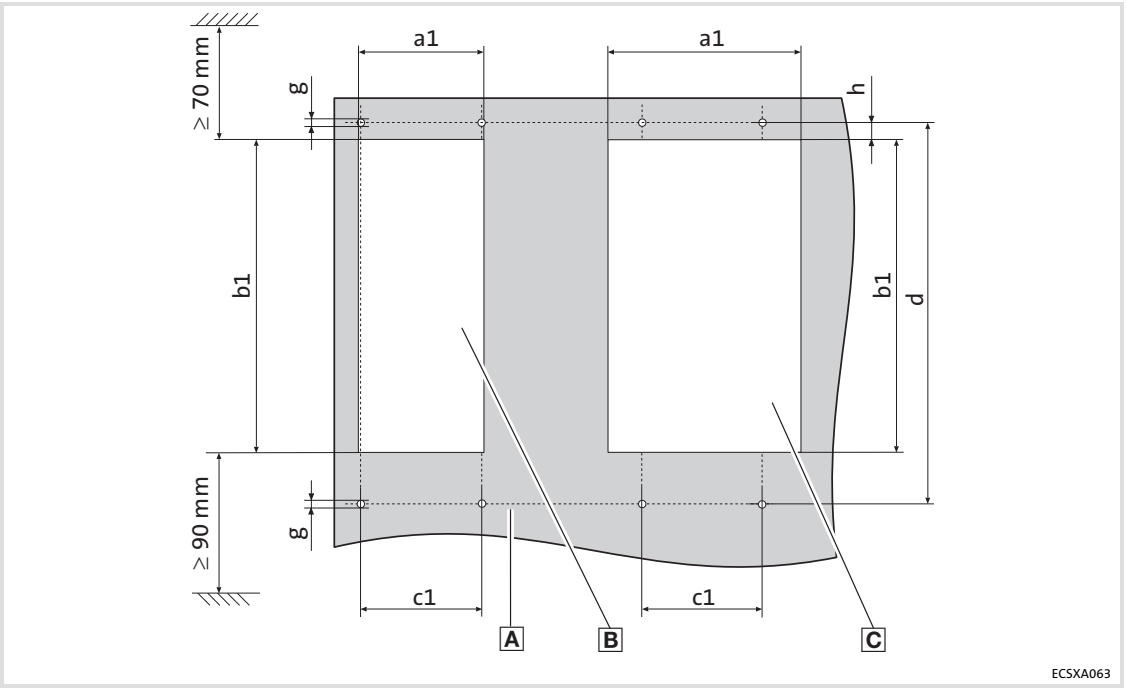


Fig. 4-3 Dimensions of mounting cutout

A Mounting surface
B Mounting cutout for size A
C Mounting cutout for size B

Axis module		Dimensions [mm]					
Type	Size	a1	b1	c1	d	g	h
ECSD□004	A	78,5	197	75	250	M5	10,5
ECSD□008							
ECSD□016							
ECSD□032							
ECSD□048	B	121,5					
ECSD□064							

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.3.2 Mounting steps

How to mount the axis module:

1. Prepare the fixing holes for the wire clamps on the mounting area.
   For this purpose, apply a drilling jig.
2. Prepare the mounting cutout.
   The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the axis module).
3. Apply liquid thread sealant to the threads of the screws for the wire clamps.
4. Fix the wire clamps together with the functional earth conductor supplied (Fig. 4-4).
   The functional earth conductor is part of the scope of supply of the ECS**D**x... axis module
5. Push the axis module into the mounting cutout.
6. Engage axis module in the wire clamp at the top and the bottom.
7. Connect the functional earth conductor to the axis module (Fig. 4-4).

Note!

Fixing the functional earth conductor to the ECS**D**x... axis module is required for a better electromagnetic compatibility (EMC).

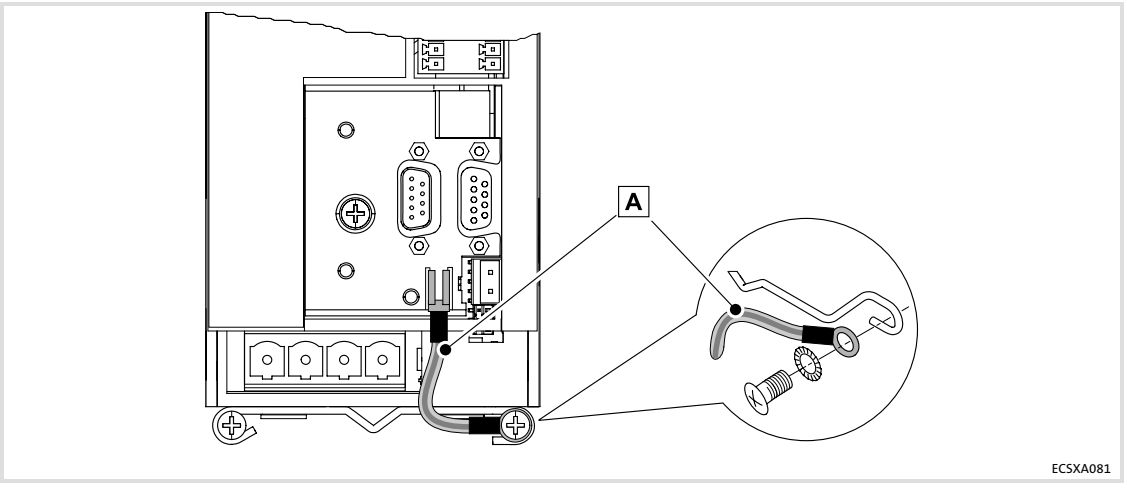


Fig. 4-4 Functional earth conductor at the ECSDx... axis module

A Functional earth conductor

4.4 Mounting in cold-plate design

The axis modules ECSC... are intended for mounting in cold-plate design (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure a safe operation of the axis modules:

- Good thermal contact with the cooler
  - The contact surface between collective cooler and axis module must be at least as large as the cooling plate of the axis module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Connect the collective cooler with all specified screwed connections to the axis module.
- Maintain the thermal resistance R_{th} according to the table.
  - The values apply for operating the axis modules under rated conditions.

Axis module Type	Power to be dissipated Ploss [W]	Heat sink - environment R_{th} [k/W]
ECSC□004	14.0	0,31
ECSC□008	29.0	
ECSC□016	64.0	
ECSC□032	117.0	0,13
ECSC□048	132.0	
ECSC□064	158.0	0,11

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

- Ambient conditions:
  - Furthermore the rated data regarding the ambient temperature and the derating factors at increased temperature apply to the axis modules (📖 30 et seqq.).
  - Temperature of the cooling plate (”Cold Plate”): max. +85 °C

4.4.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

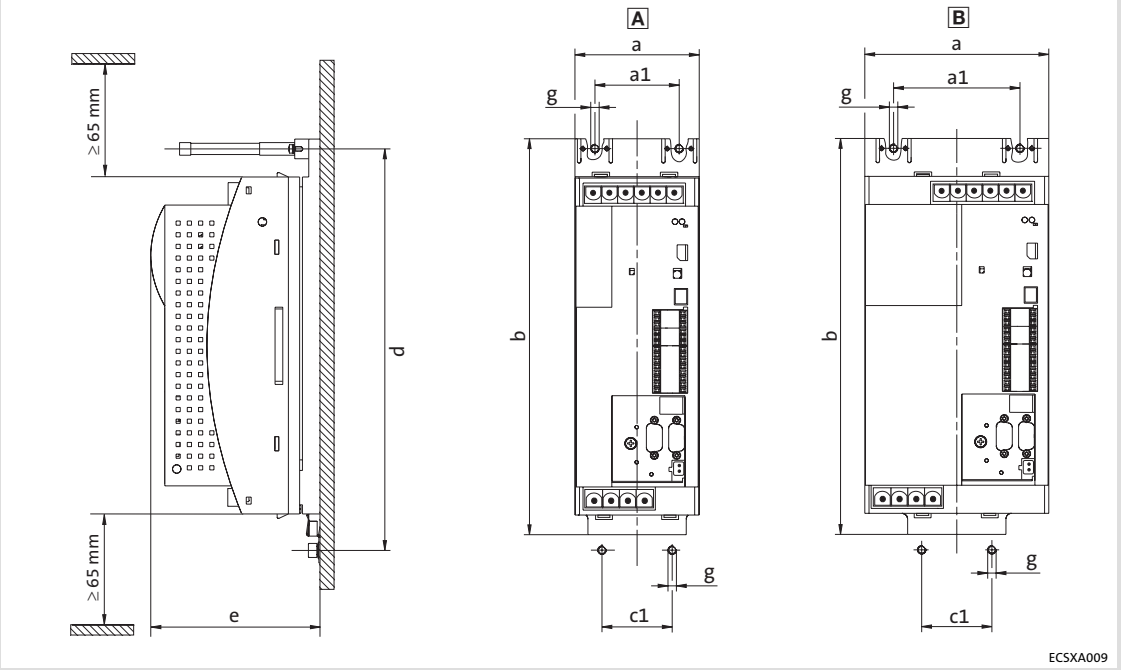


Fig. 4-5 Dimensions for "cold-plate design"

Axis module		Dimensions [mm]						
Type	Size	a	a1	b	c1	d	e	g
ECSC□004	A	88,5	60	282	50	287	121 157 1)	M6
ECSC□008								
ECSC□016								
ECSC□032								
ECSC□048	B	131	90					
ECSC□064								

1) Max. 157 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.4.2 Mounting steps

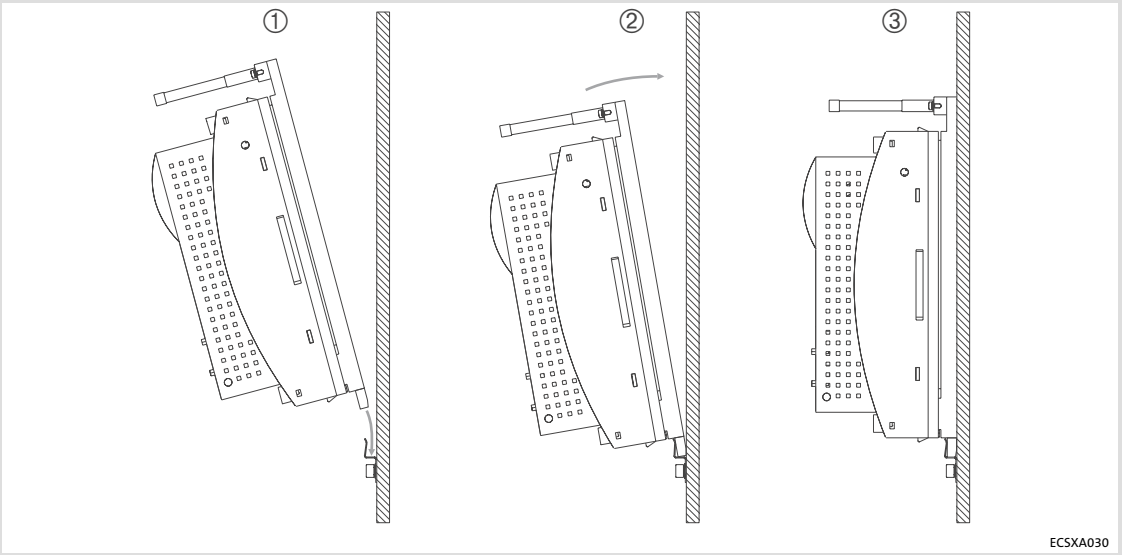


Fig. 4-6 Mounting for "cold-plate design"

Proceed as follows to mount the axis module:

1. Prepare the fixing holes on the mounting plate.
   – Use a drilling jig for this purpose.
2. Clean and degrease the contact area of collective cooler and heatsink of the axis module (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Insert the axis module from above ① into the support ② and fasten the two stud bolts with 3.5 ... 4.5 Nm ③.

Note!

Penetration depth of the screws into the collective cooler: approx. 15 mm!

Tip!

The heat transfer resistance is reduced if - following step 2. -
► a thin layer of heat conducting paste is applied to the contact surface or
► heat conducting foil is used.

5 Electrical installation

5.1 Installation according to EMC (installation of a CE-typical drive system)

General information

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Assembly
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the evaluation of the conformity to the EMC Directive requires a check of the machine or system regarding the EMC limit values. This for instance applies to:
  - Use of unshielded cables
  - Use of collective interference filters instead of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the ECS modules, these devices may be electromagnetically affected by the ECS modules.

Assembly

- Connect the ECS modules, RFI filters, and mains choke to the earthed mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow for permanent contact.
  - Painted plates are not suitable for an EMC-compliant installation.
- If you use the ECSxK... capacitor module:
  - Install the capacitor module between the power supply module and the axis module(s).
  - If the total cable length in the DC-bus connection is > 5 m, install the capacitor module as close as possible to the axis module with the greatest power.
- If you use several mounting plates:
  - Connect as much surface of the mounting plates as possible (e.g. with copper bands).
- Ensure the separation of the motor cable and the signal or mains cables.
- Avoid a common terminal/power strip for the mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filters

Only use RFI filters and mains chokes which are assigned to the power supply modules:

- RFI filters reduce impermissible high-frequency interferences to a permissible value.
- Mains chokes reduce low-frequency interferences which in particular depend on the motor cables and their lengths.

Shielding

- Connect the motor cable shield to the axis module
  - with the ECSZS000X0B shield mounting kit.
  - extensively to the mounting plate below the axis module.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor protection switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to each other and connect them to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing extensively to PE:
  - Metal glands at the motor terminal box ensure an extensive connection of the shield and the motor housing.
- Shield UG cables and control cables from a length of 0.3 m:
  - Connect both shields of the digital control cables.
  - Connect one shield end of the analog control cables.
  - Always connect the shields to the shield connection at the axis module over the shortest possible distance.
- Use of the ECS modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥10 dB . This can be achieved by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (e.g. ECS modules, RFI filters, motor filters, mains chokes) using suitable cables connected to a central earthing point (PE rail).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Power terminals

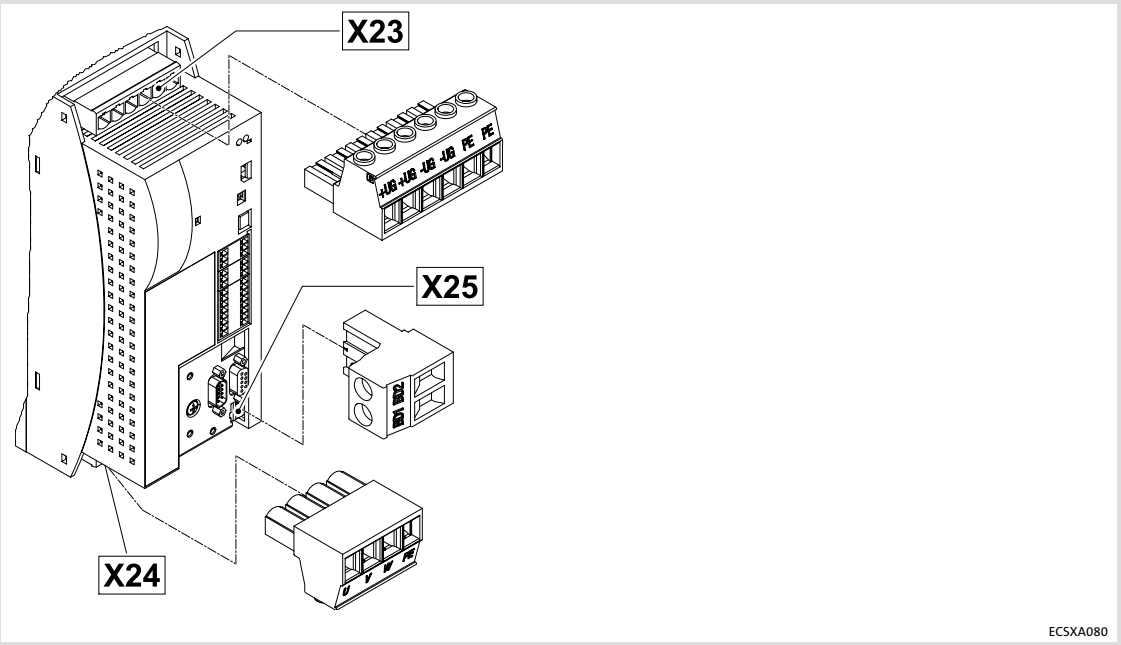


Fig. 5-1 Plug connectors for power terminals

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

- ► All power connections are plug connections and coded. The ECSZA000X0B plug connector set must be ordered separately.
- ► Installation of the cables to EN 60204-1.
- ► The cables used must comply with the approvals required at the site of use (e.g. VDE, UL, etc.).

Note!

ECSDP... axis modules:

For a better electromagnetic compatibility (EMC), connect the functional earth conductor to the ECS**D**P... axis module (📖 44).

This is not required for the ECS**E**P... (standard installation) and ECS**C**P... (cold plate) axis modules!

Assignment of the plug connectors

Plug connector/terminal	Function	Electrical data
X23	**DC-bus voltage connection**	
X23/+UG	Positive DC-bus voltage	Dependent on application and type 0 ... 770 V 2 ... 24.5 A (📖 32)
X23/+UG		
X23/-UG	Negative DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		
X24	**Motor connection**	
X24/U	Motor phase U	Dependent on application and type 0 ... 480 V 1.6 ... 20 A (📖 32)
X24/V	Motor phase V	
X24/W	Motor phase W	
X24/PE	Earth connection	
X25	**Motor holding brake connection**	
X25/BD1	Brake connection +	23 ... 30 V DC, max. 1.5 A
X25/BD2	Brake connection -	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Plug connectors X23 and X24				
Rigid	–	0.2 ... 10 mm² (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connections 10 mm for spring connections
Flexible	Without wire end ferrule	0.2 ... 10 mm² (AWG 24 ... 8)		
	Insulated with wire end ferrule	0.25 ... 6 mm² (AWG 22 ... 10)		
	Insulated with wire end ferrule	0.25 ... 4 mm² (AWG 22 ... 12)		
Plug connector X25				
Flexible	Insulated with wire end ferrule	0.25 ... 2.5 mm² (AWG 22 ... 12)	0.5 ... 0.8 Nm (4.4 ... 7.1 lb-in)	5 mm for screw connections 10 mm for spring connections
	Without wire end ferrule	0.2 ... 2.5 mm² (AWG 24 ... 12)		

Shielded cables

The following factors decisively determine the effect of the shielded cables:

- Good shield connection
  - Ensure a contact surface as large as possible
- Low shield resistance
  - Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- High overlap rate of the braid
  - At least 70 ... 80 % with 90° overlap angle

The ECSZS000X0B shield mounting kit includes a wire clamp and shield sheet.

5.2.1 Connection to the DC bus (+U_G, -U_G)

Stop!

No device protection for DC bus voltage surges

In passive axis modules (without 24 V-supply), the charging circuit can be overloaded through DC bus voltage surges.

Possible consequences:

► Destruction of the device

Protective measures:

► All axis modules in the DC-bus connection should be basically supplied with a control voltage of 24 V.

► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.

► Design the ±U_G cables twisted and as short as possible. Ensure short-circuit-proof routing!

► Cable length (module ↔ module) > 30 cm: install shielded ±U_G cables.

Cable cross-section

Cable length (module/ module)	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm² (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
	With insulated wire end ferrule			
> 20 m	Without wire end ferrule	10 mm² (AWG 8)		
	With insulated wire end ferrule **Use pin-end connectors for wiring!**			

Fuses

- ► Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- ► When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- ► When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- ► Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

Replacing defective fuses

Danger!

Hazardous electrical voltage

Components can carry hazardous voltages up to 3 minutes after power-off.

Possible consequences:

- ► Death or severe injuries when touching the device.

Protective measures:

- ► Replace fuses in the deenergised state only.
  - – Set controller inhibit (CINH) for all axis modules in DC-bus operation and disconnect all power supply modules from the mains.

5.2.2 Connection plan for mimimum wiring with internal brake resistor



Documentation of the ECSxE power supply module

Observe the enclosed notes.



Stop!

Always operate the ECS power supply modules with a brake resistor (internal/external).

The ECS power supply modules in the standard built-in unit and push-through design (ECSEE / ECSDE) are provided with a device-internal brake resistor.

In order to use the internal brake resistor (Rb), carry out the following wiring:

- Bridge between the terminals X22/+UG and X22/BR0 (CR)
  Current flow from +UG via the internal brake resistor (Rb) and the brake transistor to -UG.
- Bridge between the terminals X6/T1 and X6/T2 (CR)
  Deactivate the temperature monitoring of the non-existing external brake resistor.

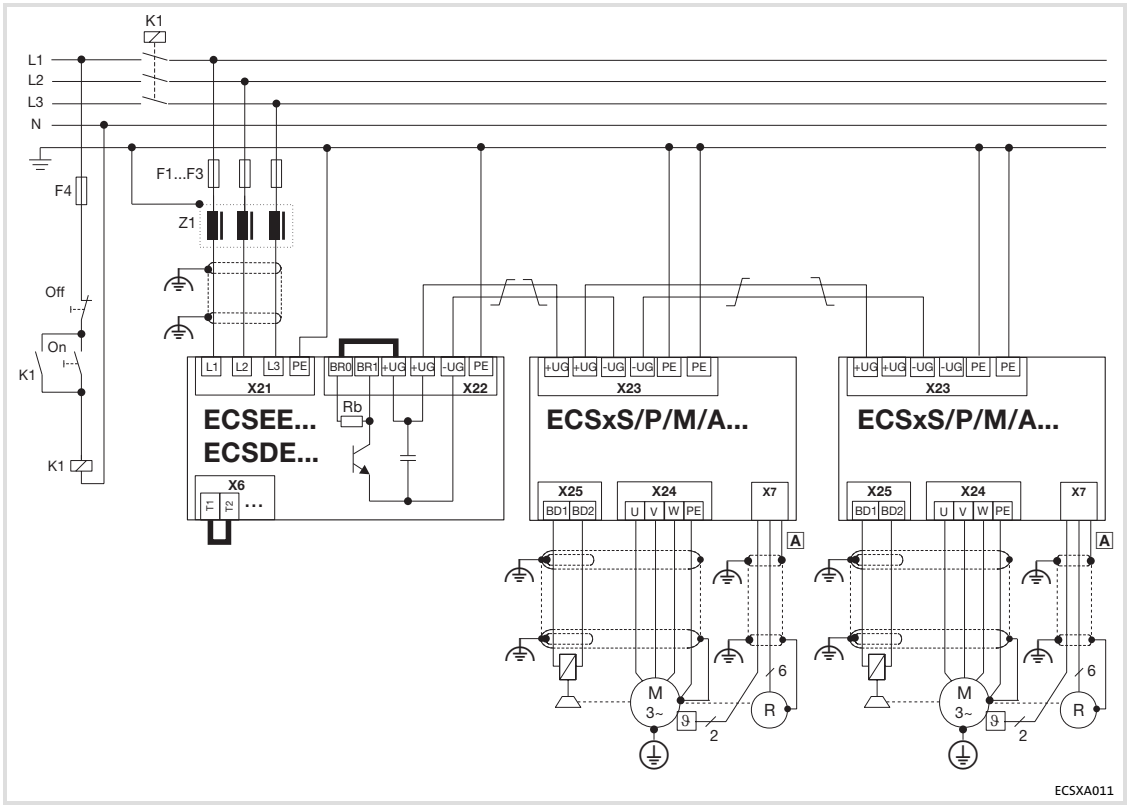


Fig. 5-2 Interconnected power system with internal brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb Internal brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.3 Connection plan for mimimum wiring with external brake resistor

Documentation of the ECSxE power supply module
Observe the enclosed notes.

Stop!

- ► Always operate the ECS power supply modules with a brake resistor.
- ► A parallel wiring of internal and external brake resistor is not permissible!
- ► Implement the thermal contact of the brake resistor into the system monitoring so that the mains supply of the power supply module will be switched off in case the brake resistor will be overheated.
- ► Read the documentation for the external brake resistor. Observe the safety instructions contained therein.

If the power supply module needs a high amount of braking power when it comes as standard built-in unit or in push-through technique design (**ECSEE / ECSDE**), an external and more powerful brake resistor can be connected instead of the internal brake resistor.

A power supply module in cold plate technique design (**ECSCE**) is not provided with an internal brake resistor so that this version always requires an external brake resistor (Rbext).

- ► Connect the brake resistor to X22/BR1 and X22/+UG.
- ► Connect the thermal contact (NC contact) of the external brake resistor to X6/T1 and X6/T2.

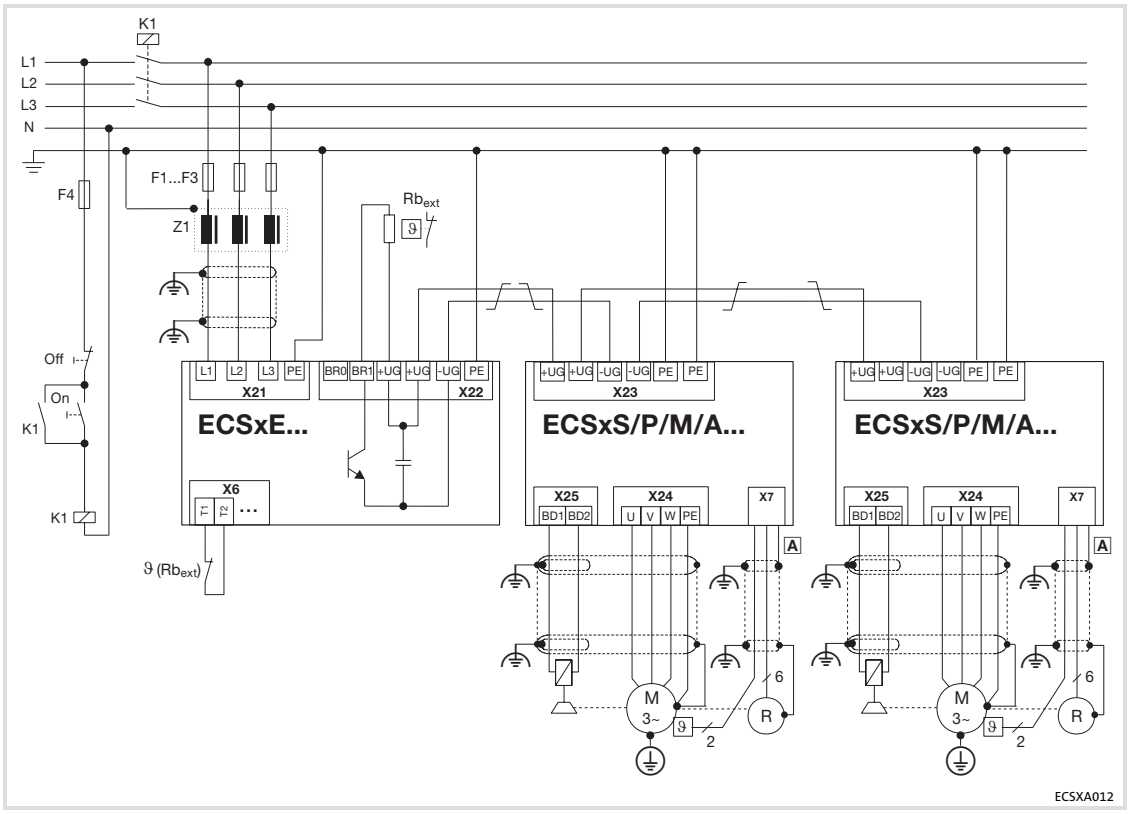


Fig. 5-3 Interconnected power system with external brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb_{ext} External brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.4 Motor connection



Fig. 5-4 Motor and motor holding brake connection

Motor cables

- Use low-capacitance motor cables. Capacitance per unit length:
  – Core/core: max. 75 pF/m
  – Core/shield: max. 150 pF/m
- Length: max. 50 m, shielded
- The cross-section of the motor cables are selected according to the motor standstill current (I_0) when using synchronous motors or according to the rated motor current (I_N) for asynchronous motors.
- Length of the unshielded ends: 40 ... 100 mm (depending on the cable cross-section)
- Lenze system cables meet these requirements.
- Use the ECSZS000X0B shield mounting kit for EMC-compliant wiring.

Mounting instructions for ECSZS000X0B shield mounting
Here you can find more information on wiring according to EMC.

5.2.5 Motor holding brake connection

The motor holding brake

- is connected to X25/BD1 and X25/BD2.
- is supplied with low voltage via the terminals X6/B+ and X6/B-:
  +23 ... +30 V DC, max.1.5 A

Stop!

- Protect X6/B+ with an F 1.6 A fuse.
- If no suitable voltage (incorrect amount, incorrect polarity) is connected to the brake, it is applied and can overheat or be destroyed by the continuously running motor.

5.2.5.1 Spark suppressor

The axis module comes with an integrated spark suppressor for protecting the contacts of the integrated brake relay when the motor holding brake (inductive load) is switched.

5.2.5.2 Monitoring the brake connection

The connection of the motor holding brake can be monitored for voltage failure and cable breakage if monitoring is activated under C0602.

The monitoring system of the brake connection trips under the following conditions:

Case 1, motor holding brake released (brake relay contact is closed):

- Current via holding brake (I_B) < 140 mA +/-10 % **or**
- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

Case 2, motor holding brake closed (brake relay contact is open):

- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

5.2.5.3 Requirements on the brake cables

- Use a Lenze system cable with integrated brake cable.
  – The shielding of the brake cable must be separated.
- Length: max. 50 m
- If a separately installed brake cable is required, lay it in a shielded manner.

Note!

Due to the monitoring circuit of the brake connection, an additional constant voltage drop of 1.5 V is produced. The voltage drop can be compensated by a higher voltage at the cable entry.

The voltage required at X6/B+ and X6/B- for the Lenze system cables is calculated as follows:

$$U_K\,[V] = U_B\,[V] + 0.08\left[\frac{V}{m \cdot A}\right] \cdot L_L\,[m] \cdot I_B\,[A] + 1.5\,[V]$$

V_{comp}	Voltage required at 6X/B+ and X6/B- [V]
V_B	Rated operating voltage of the brake [V]
L_L	Length of the brake cable [m]
I_B	Brake current [A]

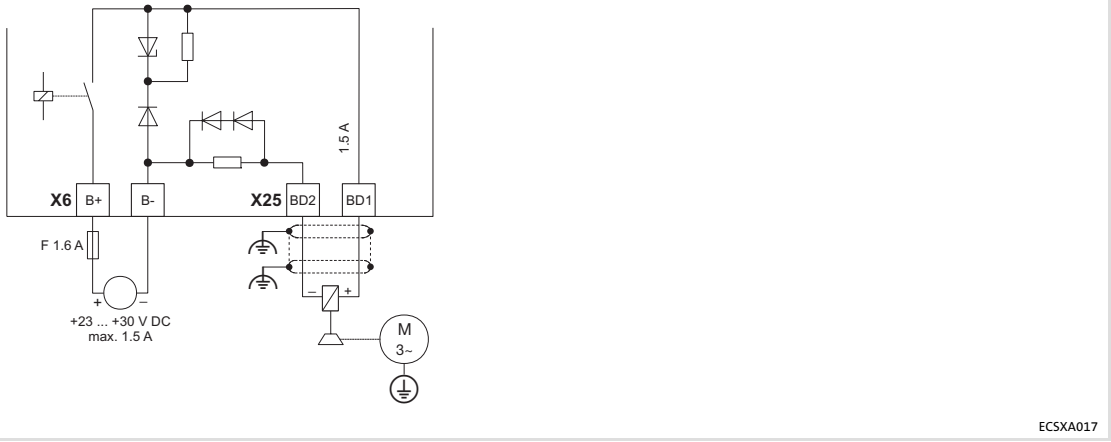


Fig. 5-5 Connection of the motor holding brake to X25

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

5.2.6 Connection of an ECSxK... capacitor module (optional)

The ECS capacitor modules support the DC-bus voltage for the drive system. These capacitor module types are available:

- ECSxK001 (705 µF, ±20 %)
- ECSxK002 (1410 µF, ±20 %)

x Design/mounting technique: E = standard installation
C = Cold-plate technique
D = push-through technique

Documentation of the ECSxK capacitor module
Observe the enclosed notes.

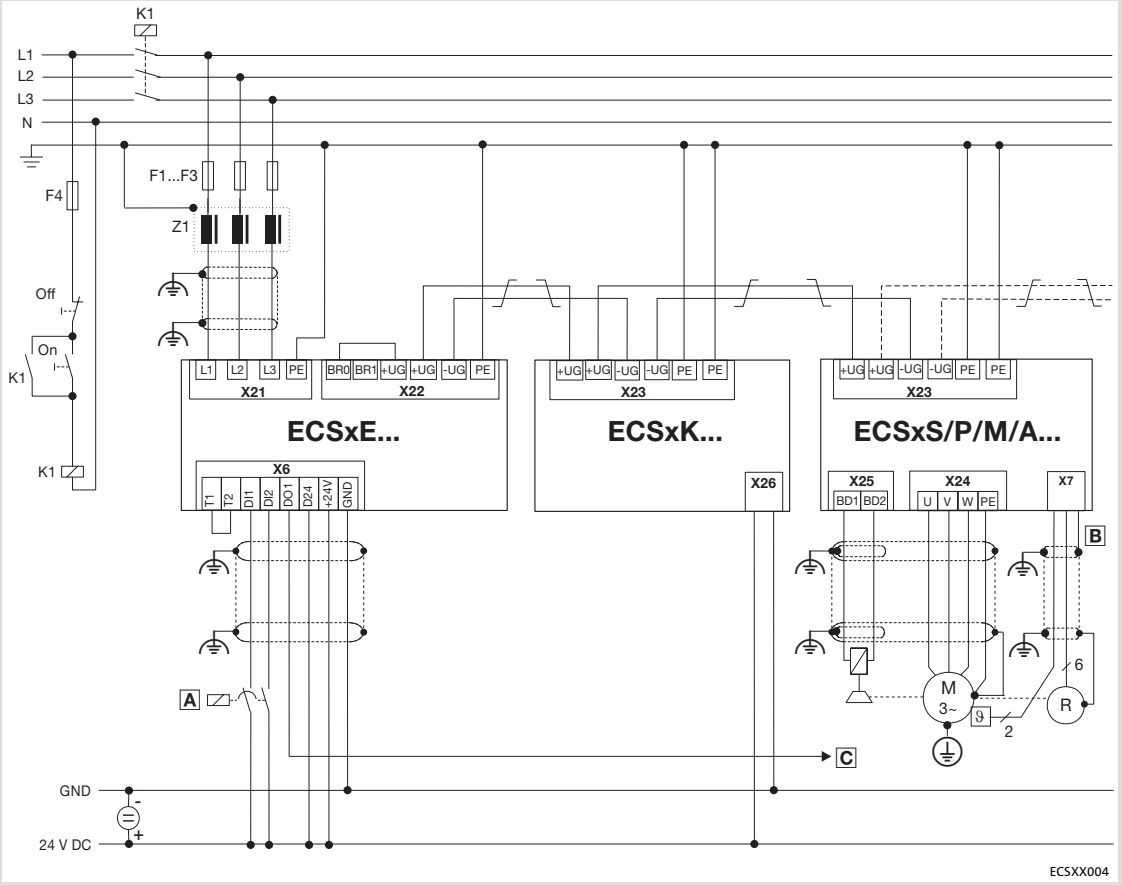


Fig. 5-6 Wiring of capacitor module ECSxK...

- HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- A Contactor relay
- B System cable – feedback
- C Terminal X6/SI1 of the connected axis modules (controller enable/inhibit)

5.3 Control terminals

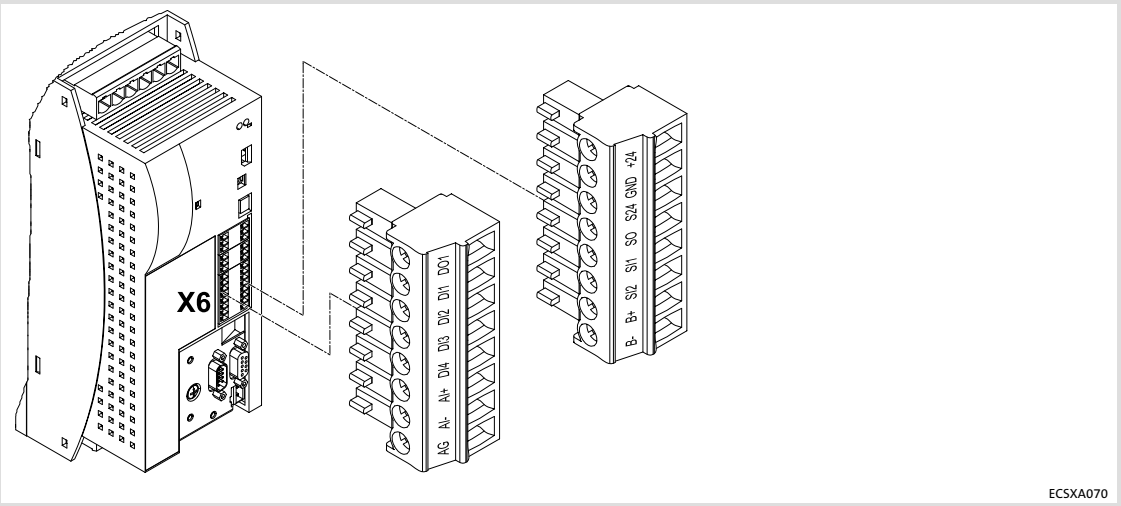


Fig. 5-7 Plug connectors for control terminals (X6)

For the supply of the control electronics an external 24 V DC voltage at terminals X6/+24 and X6/GND is required.

Stop!

- The control cables must always be shielded to prevent interference injections.
- The voltage difference between X6/AG, X6/GND and PE of the axis module may maximally amount to 50 V.
- The voltage difference can be limited by:
  – overvoltage-limiting components or
  – direct connection of X6/AG and X6/GND to PE.
- The wiring has to ensure that for X6/DO1 = 0 (LOW level) the connected axis modules do not draw energy from the DC bus. Otherwise, the power supply module may be damaged.

Shield connection of control cables and signal cables

The plate on the front of the device serves as the mounting place (two threaded holes M4) for the shield connection of the signal cables. The screws used may extend into the inside of the device by up to 10 mm. For optimum contact of the shield connection, use the wire clamps from the ECSZS000X0B shield mounting kit.

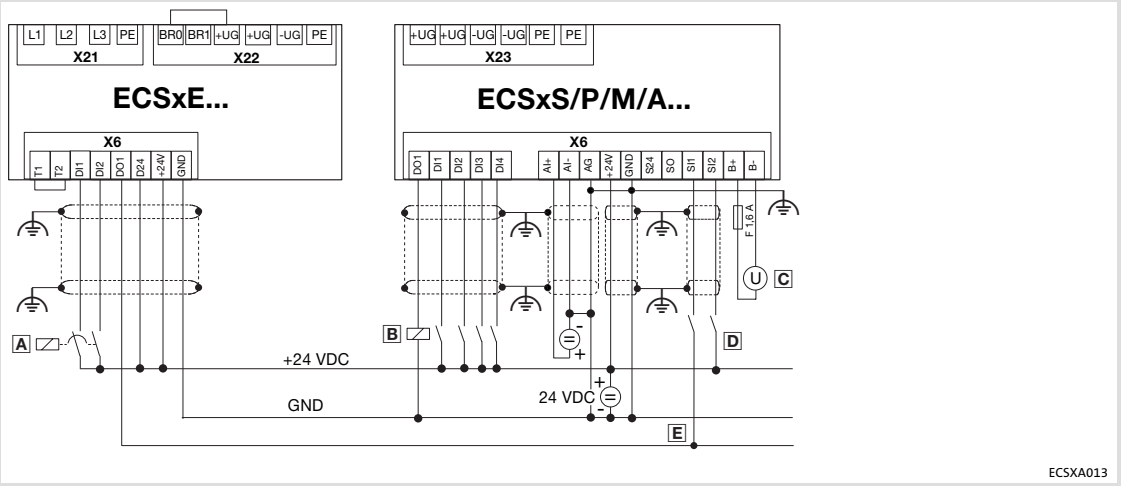


Fig. 5-8 Interconnection: Control signals with internal brake resistor

- ⏚ HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- A / B Contactor relay
- C Voltage supply of motor holding brake 23 ... 30 V DC, max. 1.5 A
- D Safe torque off (formerly: ”Safe standstill”)
- E Controller enable/inhibit

Switch-on sequence for the auxiliary relay

Stop!

Overload of the charging connection in the power supply module

The controller enable for the axes may only take place when the charging process of the DC bus is completed and the power supply module is ready for operation.

Possible consequences:

► Destruction of the power supply module

Protective measures:

► Use of switching the central controller enable for the axes via the inputs and outputs DI2 and DO1 of the power supply module (see the following descriptions).

The switch-on sequence of the auxiliary relay [A] (see Fig. 5-8) is as follows:

1. The digital input X6/DI1 (power supply enable) of the power supply module is switched to HIGH by the higher-level control or by the operator.
   – The DC bus is charged.
2. The ready for operation output of the axis module (DO1) now switches the X6/DI2 digital input (central controller enable) of the power supply module via the relay [A].
   – In the default Lenze setting of the ECS axis modules, DO1 is set to ”ready”. ”Ready” is only present if a specified DC-bus voltage has been reached.
3. The central controller enable for the axis module takes place via the X6/DO1 output of the power supply module. The central controller enable DO1 only switches if the charging process of the DC bus is completed AND the X6/DI2 input is set.

Assignment of the plug connectors

Plug connector X6		
Terminal	**Function**	**Electrical data**
X6/+24	Low-voltage supply of the control electronics	20 ... 30 V DC, 0. A (max. 1 A) for starting current of 24 V: max. 2 A for 50 ms
X6/GND	Reference potential of low-voltage supply	
X6/DO1	Digital output 1	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
X6/DI1	Digital input 1	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
X6/DI2	Digital input 2	
X6/DI3	Digital input 3	
X6/DI4	Digital input 4	
X6/AI+	Analog input +	Adjustable with jumper strip X3: -10 ... +10 V, max. 2 mA -20 ... +20 mA Resolution: 11 bits + sign
X6/AI-	Analog input -	
X6/AG	Reference potential of analog input (internal ground)	
X6/B+	Brake supply +	23 ... 30 V DC max. 1.5 A **Set brake voltage so that the permissible voltage at the brake is not under-run or exceeded – otherwise malfunction or destruction!**
X6/B-	Brake supply -	
X6/S24	Connection of "safe torque off" (formerly "safe standstill")	📖 70
X6/SO		
X6/SI1		
X6/SI2		

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	Without wire end ferrule	0.08 ... 1.5 mm² (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connection 9 mm for spring connection
	With insulated wire end ferrule	0.25 ... 0.5 mm² (AWG 22 ... 20)		

We recommend to use control cables with a cable cross-section of 0.25 mm².

5.3.1 Digital inputs and outputs

Stop!

If an inductive load is connected to X6/DO1, a spark suppressor with a limiting function to max. 50 V ± 0 % must be provided.

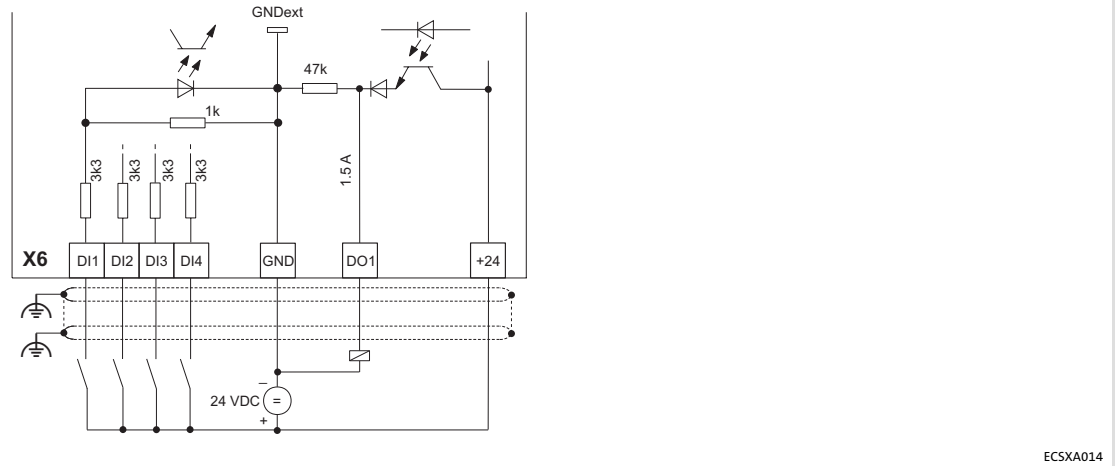


Fig. 5-9 Digital inputs and outputs at X6

HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

- The digital inputs X6/DI1 ... DI4 are freely assignable.
- The polarity of the digital inputs X6/DI1 ... DI4 is set under C0114/x.
- The polarity of the digital output (X6/DO1) is set under C0118/1.

5.3.2 Analog input

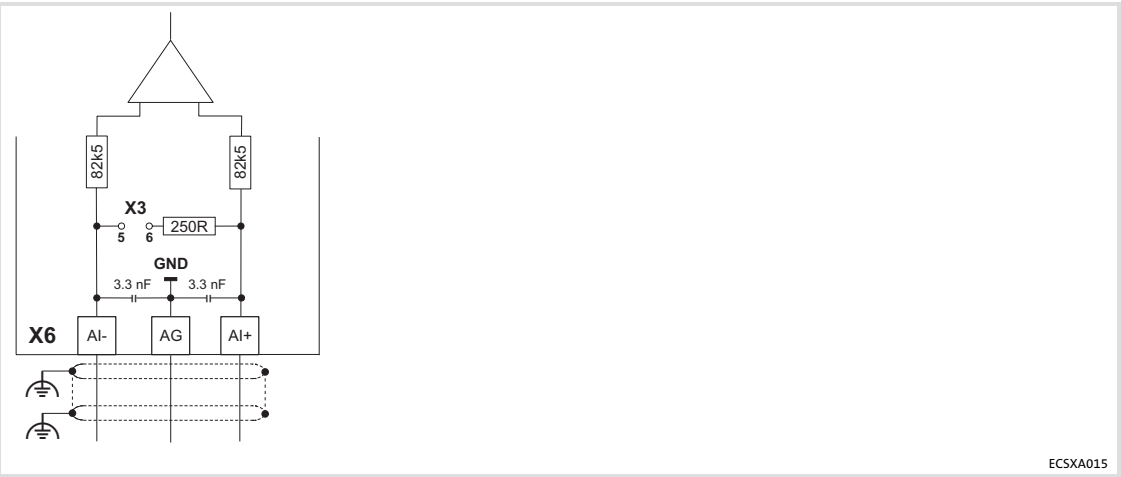


Fig. 5-10 Analog input at X6

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Analog input configuration

► Use C0034 to set whether the input is to be used for a master voltage (±10 V) or a master current (+4 ... 20 mA or ±20 mA).

► Set jumper bar X3 according to the setting in C0034:

Stop!

Do not plug the jumper on the pins 3-4! The axis module cannot be initialised like this.

Jumper bar X3	Setting	Measuring range
5 6 3 4 1 2	5-6 open Jumper on 1-2: Parking position	**C0034 = 0 (master voltage)** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡ ±16384 ≡ ±100 %
5 6 3 4 1 2	5-6 closed	**C0034 = 1 (master current)** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: +4 mA ≡ 0 ≡ 0 % +20 mA ≡ 16384 ≡ 100 %
		C0034 = 2 (master current) ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡ ±16384 ≡ ±100 %

5.3.3 Safe torque off

The axis modules support the ”safe torque off” safety function (formerly ”safe standstill”), ”protection against unexpected start-up”, in accordance with the requirements of EN ISO 13849-1, Performance Level Pld. For this purpose, the axis modules are equipped with two independent safety paths. The Performance Level Pld is obtained if the output signal is additionally checked with regard to correctness at X6/SO.

5.3.3.1 Implementation

In the axis module, the ”safe torque off” connection is implemented with optocouplers. The optocouplers isolate the following areas electrically from each other:

- The digital inputs and outputs:
  - input X6/SI1 (controller enable/inhibit)
  - input X6/SI2 (pulse enable/inhibit)
  - brake output X6/B+, B-
  - output X6/SO (”safe torque off” active/inactive)
- The circuit for the internal control
- The final power stage

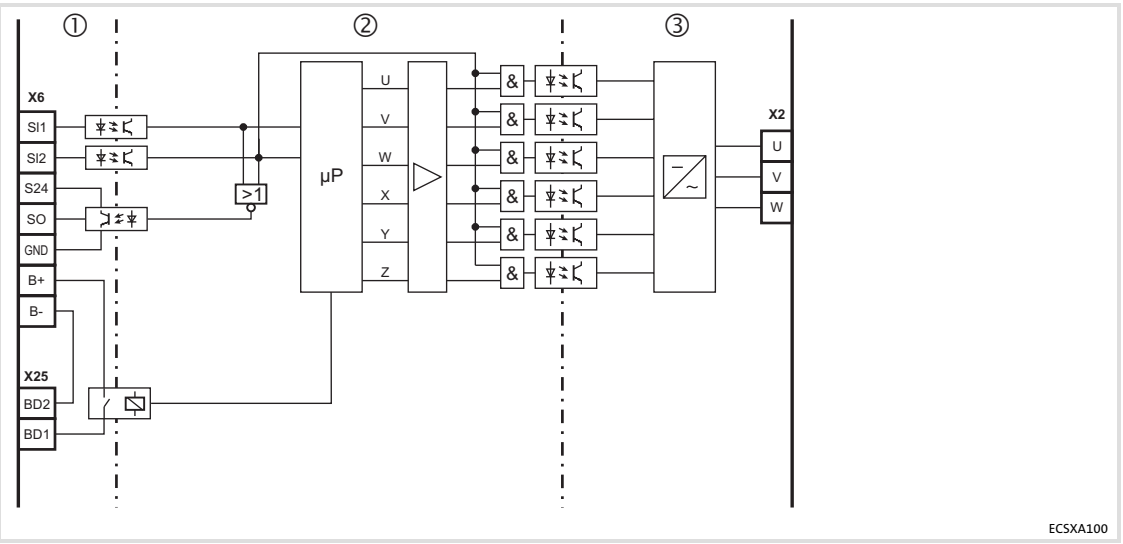


Fig. 5-11 Implementation of the ”safe torque off” function

Area 1:	Inputs and outputs
Area 2:	Circuit for the internal control
Area 3:	Power output stage

Stop!

Use insulated wire end ferrules when wiring the ”safe torque off” circuits to X6.

5.3.3.2 Functional description

The ”safe torque off” state can be initiated any time via the input terminals X6/SI1 (controller enable/inhibit) and X6/SI2 (pulse enable/inhibit). For this purpose a LOW level has to be applied at both terminals:

- X6/SI1 = LOW (controller inhibited):

  The inverter is inhibited via the microcontroller system.

- X6/SI2 = LOW (pulses inhibited):

  The supply voltage for the optocouplers of the power section driver is switched off, i. e. the inverter can no longer be enabled and controlled via the microcontroller system.

  The input signal at X6/SI2 to the hardware is additionally directed to the microcontroller system and is evaluated for the state control there. For the external further processing a HIGH level is output for the state ”safe torque off active” at the digital output X6/SO.

The control of the inverter thus is prevented by two different methods that are independent of each other. Therefore an unexpected start-up by the motor is avoided.

5.3.3.3 Important notes

Danger!

When using the ”safe torque off” function, additional measures are required for ”emergency stops”!

There is neither an electrical isolation between motor and axis module nor a ”service” or ”repair switch”.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

An ”emergency stop” requires the electrical isolation of the motor cable, e.g. by means of a central mains contactor with emergency stop wiring.

Installation/commissioning

► The ”safe torque off” function must only be installed and commissioned by qualified personnel.

► All control components (switches, relays, PLC, ...) and the control cabinet must meet the requirements of EN ISO 13849. These include for instance:
  – Switches, relays in enclosure IP54.
  – Control cabinet in enclosure IP54.
  – All other requirements can be found in EN ISO 13849.

► Wiring with insulated wire end ferrules is essential.

► All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. in the cable duct. It must be ensured that short circuits between the individual cables cannot occur. For further measures, see EN ISO 13849.

► If force effects from outside (e.g. sagging of hanging loads) are to be expected when the ”safe torque off” function is active, additional measures have to be taken (e.g. mechanical brakes).

During operation

► After installation, the operator must check the ”safe torque off” function.

► The function check must be repeated at regular intervals, but no later than after one year.

5.3.3.4 Technical data

Terminal assignment

Plug connector X6				
Terminal	**Function**	**Level**		**Electrical data**
X6/S24	Low-voltage supply			18 ... 30 V DC 0.7 A
X6/SO	"Safe torque off" feedback output	LOW	During operation	24 V DC 0.7 A (max. 1.4 A) Short-circuit-proof
		HIGH	"Safe torque off" active	
X6/SI1	Input 1 (controller enable/inhibit)	LOW	Controller inhibited	LOW level: -3 ... +5 V -3 ... +1.5 mA HIGH level: +15 ... +30 V +2 ... +15 mA Input current at 24 V DC: 8 mA per input
		HIGH	Controller enabled	
X6/SI2	Input 2 (pulse enable/inhibit)	LOW	Pulses for power section are inhibited	
		HIGH	Pulses for power section are enabled	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Starting torque	Stripping length
Flexible	With insulated wire end ferrule	0.25 ... 1.5 mm^2 (AWG 22 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connections 9 mm for spring connections
	Without wire end ferrule	Not permitted when the "Safe torque off" function is used		

5.3.3.5 Function check

- ► After installation the operator must check the ”safe torque off” function.
- ► The function check must be repeated at regular intervals, after one year at the latest.

Stop!

If the function check leads to impermissible states at the terminals, commissioning cannot take place!

Test specifications

- ► Check the circuitry with regard to correct function.
- ► Check directly at the terminals whether the ”safe torque off” function operates faultlessly in the axis module:

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	X6/SI2	X6/SO	X6/SO
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

5.3.3.6 Example: Wiring with electronic safety switching device ”Pilz PNOZ e1vp” for Performance Level Pl_d

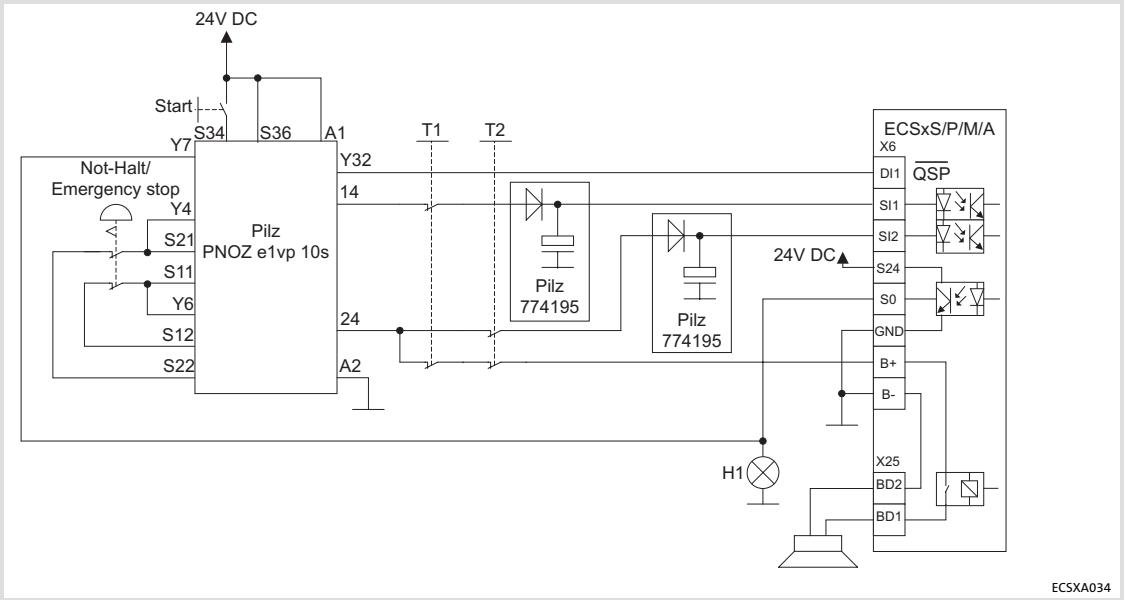


Fig. 5-12 Example: Wiring with ”Pilz PNOZ e1vp 10s” safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.
- The diode-capacitor combination prevents the test pulses of the safety switching device from disturbing the smooth running of the motor, as otherwise a short-time inhibit of the controller cannot be ruled out. The diode-capacitor combination can be procured from the company Pilz (Pilz order number: 774195) as a complete terminal block.

Description of the function

- The "PNOZ" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 14 and 24) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- The safety switching device is provided with test pulses at the output side, so that short circuits within the wiring are detected.
- Diagnostics is effected via the wiring of diagnostic output SO to input Y7 of the safety switching device. Y7 is the input of the feedback loop which has to be on HIGH level (+24 V) before the outputs 14 and 24 are activated. There is only HIGH level if both disconnecting paths have switched off.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.3.3.7 Example: Wiring with electromechanical safety switching device "Siemens 3TK2827" for Performance Level Pl_d

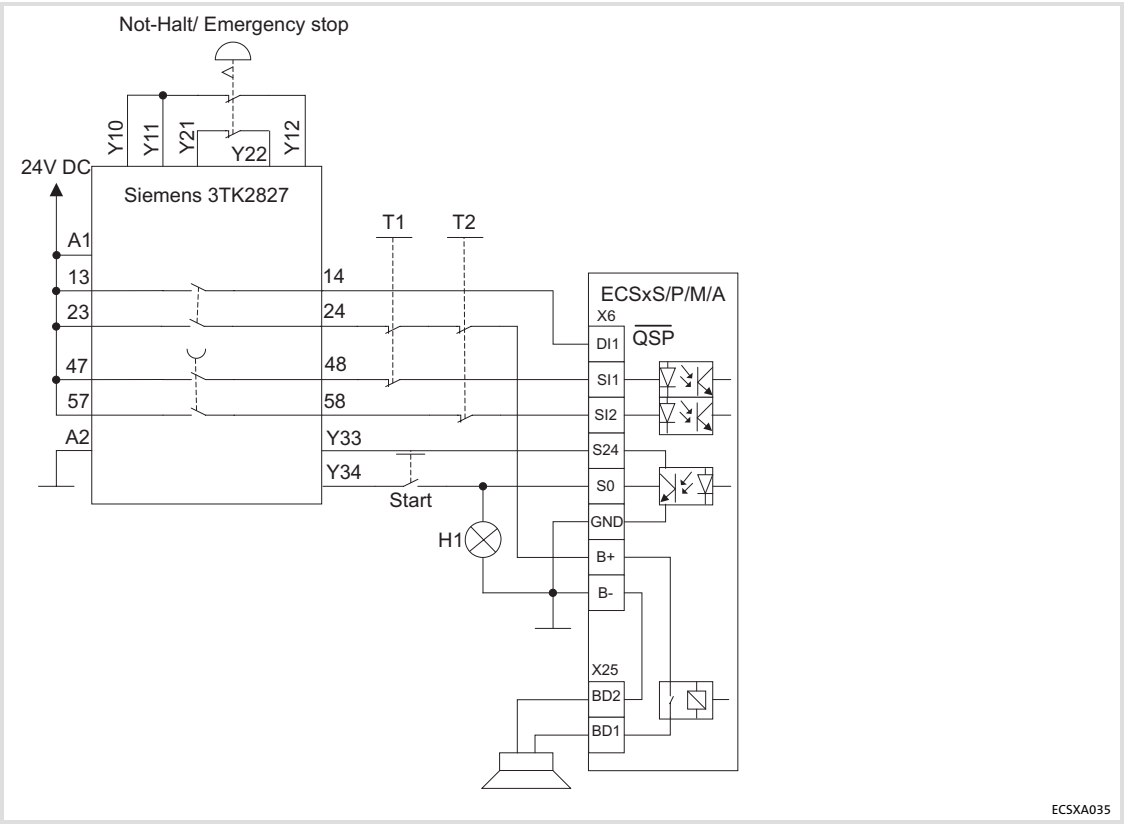


Fig. 5-13 Example: Wiring with "Siemens 3TK2827" safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.

Description of the function

- The "Siemens 3TK2827" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 48 and 58) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- If the "safe torque off" safety function is activated, output X6/SO is at HIGH level. This state is shown to the operator by means of the indicator light H1. Afterwards switch-on is possible again using the Start pushbutton.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.4 Automation interface (AIF)

The keypad XT or a communication module can be attached to or removed from the automation interface (X1). This is also possible during operation.

- The keypad XT serves to enter and visualise parameters and codes.
- The communication modules serve to network the modules of the ECS servo system with the host system (PLC or PC).

The following combinations are possible:

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

Further information ....

on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

5.5 Wiring of system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...**axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Basic wiring of the CAN bus networks

The two following schematic diagrams show drive systems with different master value concepts:

- In Fig. 5-14 a higher-level control assumes the function of the master, e.g. ETC.
- In Fig. 5-15 the function of the master is enabled by a controller intended as master.

In both representations, the master value transmission is effected via the MotionBus (CAN), interface X4.

The system bus (CAN), interface X14, serves to diagnose and/or parameterise the drives.

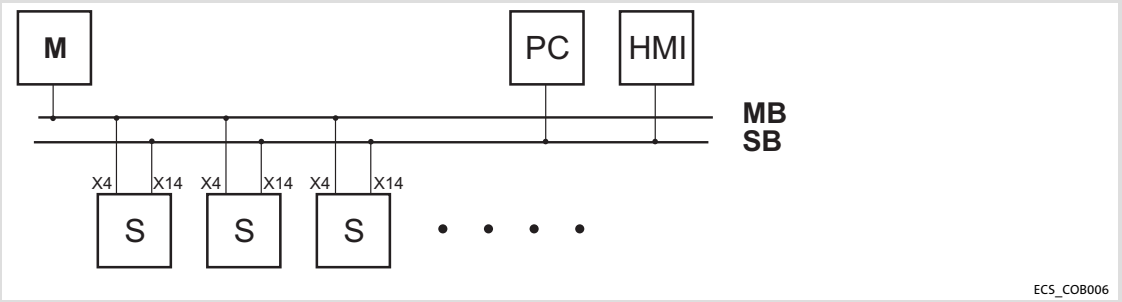


Fig. 5-14 MotionBus (CAN) with master control

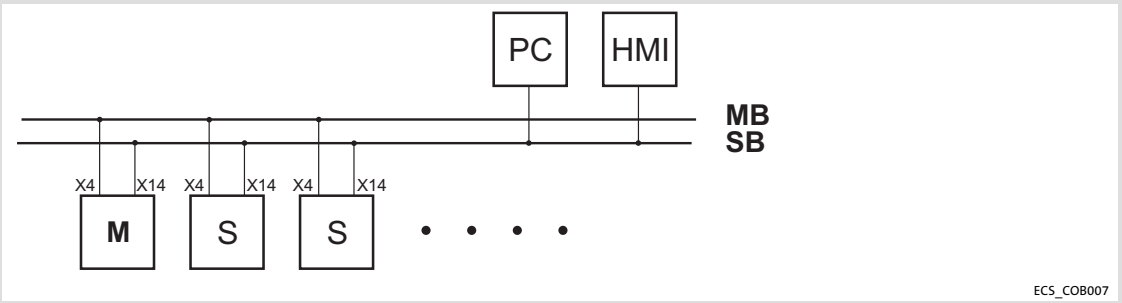


Fig. 5-15 MotionBus (CAN) with controller as master

MB	MotionBus (CAN), interface X4
SB	System bus (CAN), interface X14
M	Master
S	Slave
PC	PC with the Lenze parameter setting and operating software (GDC, GDL, GDO)
HMI	HMI / operating unit

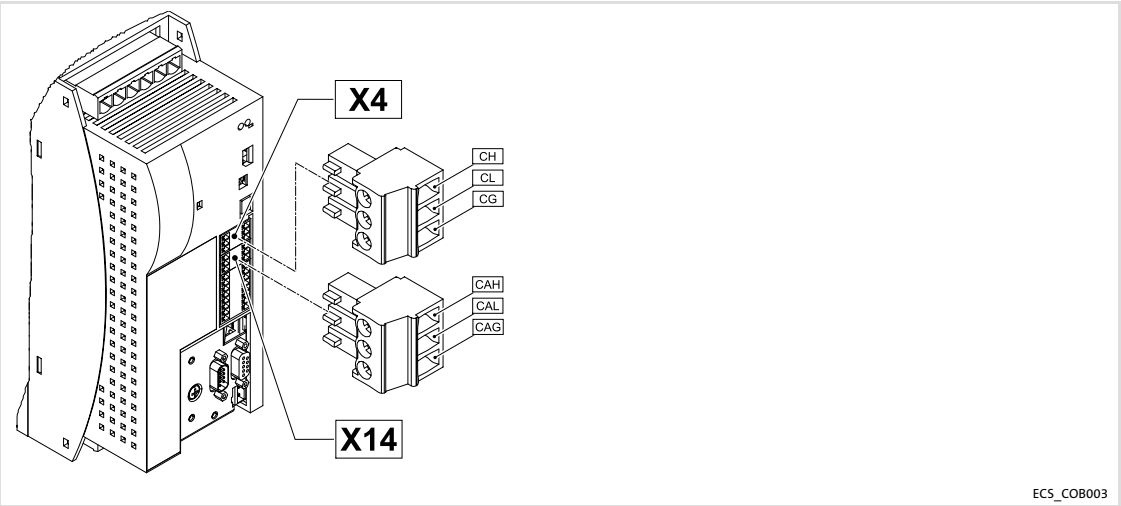


Fig. 5-16 Bus connections on the controller

Assignment of the plug connectors

X4 (CAN)	X14 (CAN-AUX)	Description
CH	CAH	CAN-HIGH
CL	CAL	CAN-LOW
CG	CAG	Reference potential

Specification of the transmission cable

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

System bus (CAN) wiring

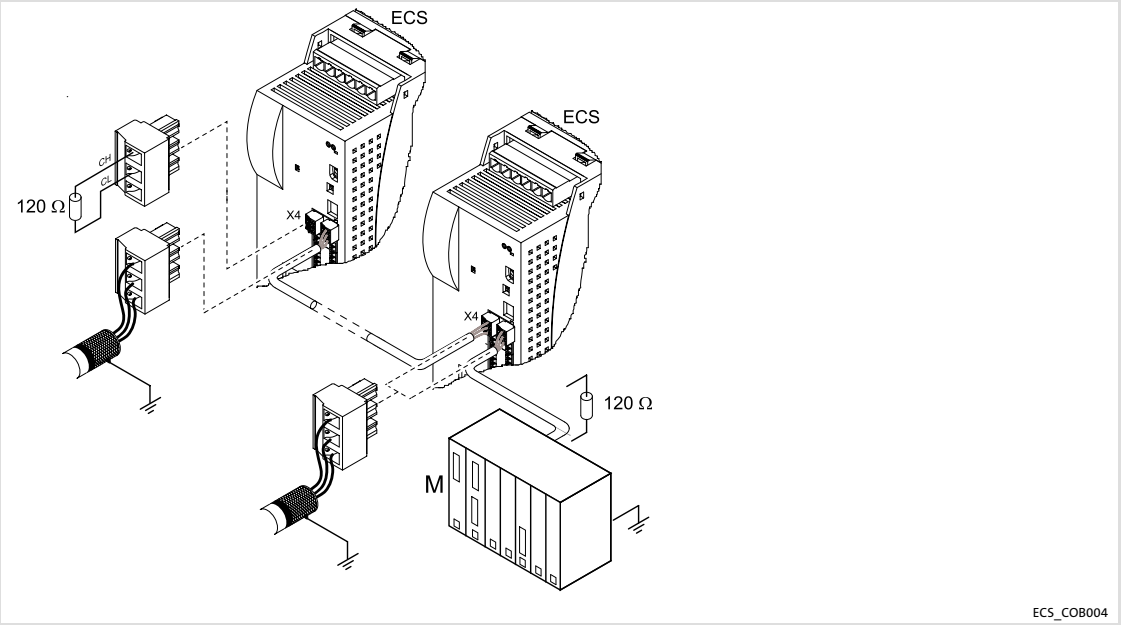


Fig. 5-17 Example: System bus (CAN) wiring via interface X4

ECS ECS axis module
M Master control, e.g. ETC

Note!

Connect one bus terminating resistor (120 Ω) each to the first and last node of the system bus (CAN).

Bus cable length

Note!

The permissible cable lengths must be observed.

1. Check the compliance with the total cable length in Tab. 5-1.

The baud rate determines the total cable length.

CAN baud rate [kbit/s]	**Max. bus length** [m]
50	1500
125	630
250	290
500	120
1000	25

Tab. 5-1 Total cable length

2. Check the compliance with the segment cable length in Tab. 5-2.

The segment cable length is determined by the cable cross-section used and the number of nodes. Without a repeater, the segment cable length corresponds to the total cable length.

Number of nodes	**Cable cross-section**			
	0.25 mm²	**0.5 mm²**	**0.75 mm²**	**1.0 mm²**
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 5-2 Segment cable length

3. Compare the two values detected.

If the value detected from Tab. 5-2 is smaller than the total cable length to be provided from Tab. 5-1 , repeaters must be used. Repeaters divide the total cable length into segments.

Example: Selection help

Specifications	
● Cable cross-section:	0.5 mm² (according to cable specifications 📖 81)
● Number of nodes:	63
● Repeater:	Lenze-repeater, type 2176 (cable reduction: 30 m)

For the max. number of nodes (63), the following cable lengths / number of repeaters from the specifications must be observed:

Baud rate [kbit/s]	**50**	**120**	**250**	**500**	**1000**
Max. cable length [m]	1500	630	290	120	25
Segment cable length [m]	310	310	290	120	25
Number of repeaters	5	2	-	-	-

Check repeater application

Given:	
● Baud rate:	125 kbps
● Cable cross-section:	0.5 mm²
● Number of nodes:	28
● Cable length:	450 m

Procedure	Cable length	See
1. Total cable length at 125 kbps:	630 m	Tab. 5-1
2. Segment cable length for 28 bus nodes and a cable cross-section of 0.5 mm²:	360 m	Tab. 5-2
3. Comparison: The value under point 2 is smaller than the required cable length of 450 m.		

Conclusion
● It is not possible to use a cable length of 450 m without using a repeater.
● After 360 m (point 2) a repeater must be installed.

Result
● The Lenze repeater type 2176 is used (cable reduction: 30 m)
● Calculation of the maximum cable length: First segment: 360 m Second segment: 360 m (according to Tab. 5-1) *minus* 30 m (cable reduction when a repeater is used)
→ Maximum possible cable length with repeater: 690 m.
→ Now it is possible to use the required cable length.

Note!

Repeaters are recommended as a

► Service interface
Advantage: Trouble-free connecting during bus operation is possible.

► Calibration interface
Advantage: Calibration/programming unit remains electrically isolated.

5.6 Wiring of the feedback system

You can connect various feedback systems to the axis module:

- Resolver on X7 (📖 86)
- Encoder on X8 (📖 87)
  - Incremental encoder with 5V-TTL level, RS-422
  - SinCos encoder with zero track without Hiperface, signal level 1 Vss
  - SinCos absolute value encoder (single-turn/multi-turn) with serial communication (Hiperface® interface), supply voltage 5 ... 8 V

Note!

If a ”safe isolation” acc. to EN 61140 between the encoder cable and motor cable (e.g. by using separating webs or separated trailing cables) is **not ensured** on the entire cable length cable due to an installation on the system side, the encoder cable must be provided with an insulation resistance of 300 V. Lenze encoder cables meet this requirement.

- We recommend to use Lenze encoder cables for wiring.
- In case of self-prepared cables
  - only use cables with shielded cores twisted in pairs.
  - Observe the notes on wiring/preparation on the following pages.

5.6.1 Resolver connection

Note!

- ► Use the prefabricated Lenze system cables for the connection of a resolver.
- ► Cable length: max. 50 m
- ► Depending on the cable length and resolver used parameterise the code C0416 (resolver excitation amplitude).
  Check the resolver control with code C0414 (recommended values: 0.5 ... 1.2; ideal value: 1.0).
- ► Before using a resolver from another manufacturer, please consult Lenze.

Connect a resolver via the 9-pole Sub-D socket X7.

Features

- ► Resolver: U = 10 V, f = 4 kHz
- ► Resolver and resolver supply cable are monitored for open circuit (fault message ”Sd2”).

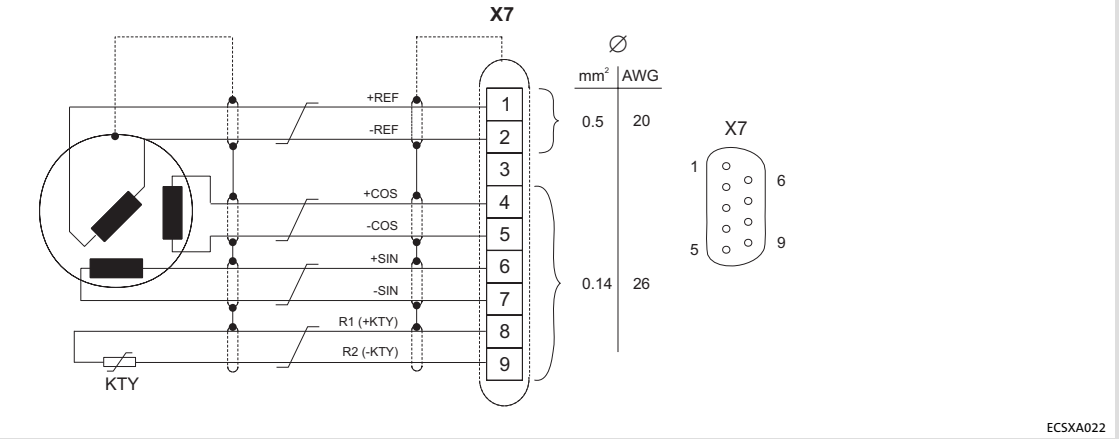


Fig. 5-18 Resolver connection

Assignment of socket connector X7: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	R1 (+KTY)	R2 (-KTY)
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.6.2 Encoder connection

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

Via the 9-pole Sub-D-plug X8, you can connect the following encoders:

► Incremental encoder (TTL encoder)
  – with two 5 V complementary signals (RS-422) that are electrically shifted by 90°.
  – with zero track that can be connected optionally.

► Sin/cos encoder (singleturn or multiturn rotary transducer)
  – with supply voltage (5 ... 8 V).
  – with serial communication.
    The initialisation time of the axis module is extended to approx. 2 s.

The controller supplies the encoder with voltage.

Use C0421 to set the supply voltage V_{CC} (5 ... 8 V) to compensate, if required, the voltage drop [ΔV] on the encoder cable:

$$\Delta U \cong 2 \cdot L_L\,[m] \cdot R/m\,[\Omega/m] \cdot I_G\,[A]$$

ΔV	Voltage drop on the encoder cable [V]
L_L	Cable length [m]
R/m	Ohmic resistance per meter of cable length [Ω/m]
I_G	Encoder current [A]

Stop!

Observe the permissible supply voltage of the encoder used. If the values in C0421 are set too high, the encoder can be destroyed!

Incremental encoder (TTL encoder)

Features	
Input/output frequency:	0 ... 200 kHz
Current consumption:	6 mA per channel
Current on output V_{CC} (X8/pin 4):	Max. 200 mA

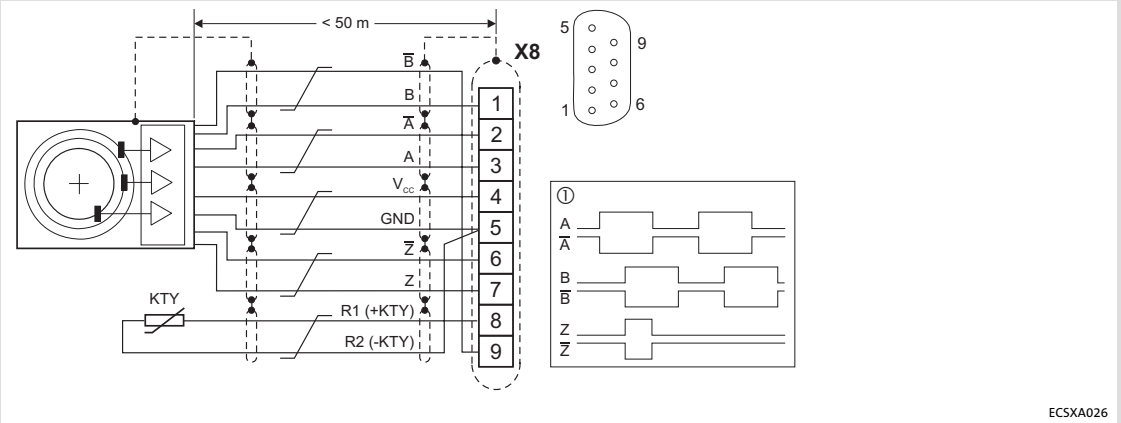


Fig. 5-19 Connection of incremental encoder with TTL level (RS-422)

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (R1/+KTY)	$\overline{Z}$	Z	R2 (-KTY)	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

SinCos encoders and SinCos absolute value encoders with Hiperface

Features	
Input/output frequency:	0 ... 200 kHz
Internal resistance (R_i):	221 Ω
Offset voltage for signals SIN, COS, Z:	2.5 V

- ► The differential voltage between signal track and reference track must not exceed 1 V ± 10 %.
- ► The connection is open-circuit monitored (fault message "Sd8")
- ► For encoders with tracks sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
  – Assign RefSIN with $\overline{\text{sine}}$.
  – Assign RefCOS with $\overline{\text{cosine}}$.
- ► For SinCos absolute value encoders with Hiperface, the serial interface (RS 485) is available instead of the zero track (Z track).

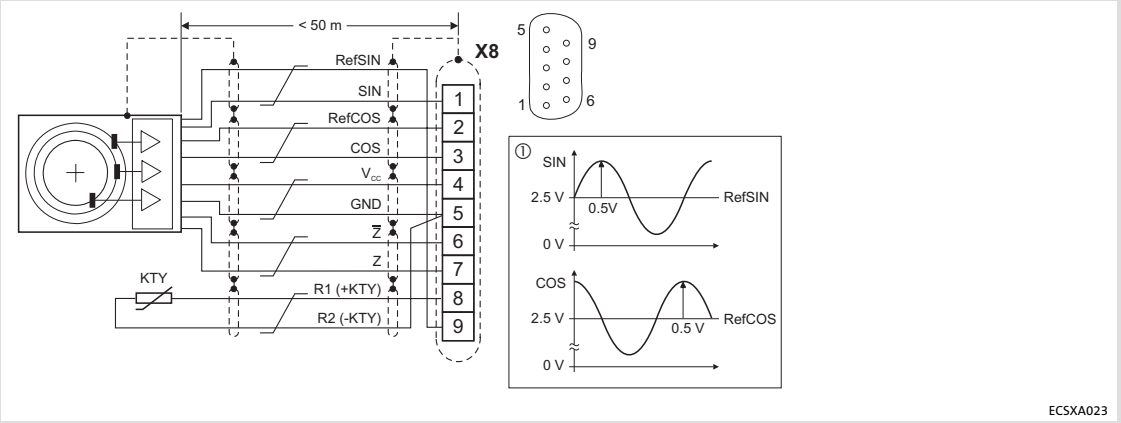


Fig. 5-20 Connection of SinCos encoder

① Signals in case of clockwise rotation
⌒ Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS ($\overline{\text{cos}}$)	COS	V_{CC}	GND (R2/-KTY)	$\overline{Z}$ or -RS458	Z or +RS485	R1 (+KTY)	RefSIN ($\overline{\text{sin}}$)
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.6.3 Digital frequency input/output (encoder simulation)

The digital frequency coupling of ECSxS/P/A axis modules basically is effected as a master-slave connection via the interface X8. This interface can either be used as a digital frequency input or as a digital frequency output (e. g. for encoder simulation) (configuration via C0491).

Features

X8 as digital frequency input	X8 as digital frequency output
● Input frequency: 0 ... 200 kHz ● Current consumption: max. 6 mA per channel ● Two-track with inverse 5 V signals and zero track ● Possible input signals: – incremental encoder with two 5 V complementary signals (TTL encoders) offset by 90° ● The function of the inputs signals can be set via C0427.	● Output frequency: 0 ... 200 kHz ● Permissible current loading: max. 20 mA per channel ● Two-track with inverse 5 V signals (RS422) ● The function of the output signals can be set via C0540.

Wiring

► 1 slave on the master:

Wire master and slave to each other directly via interface X8.

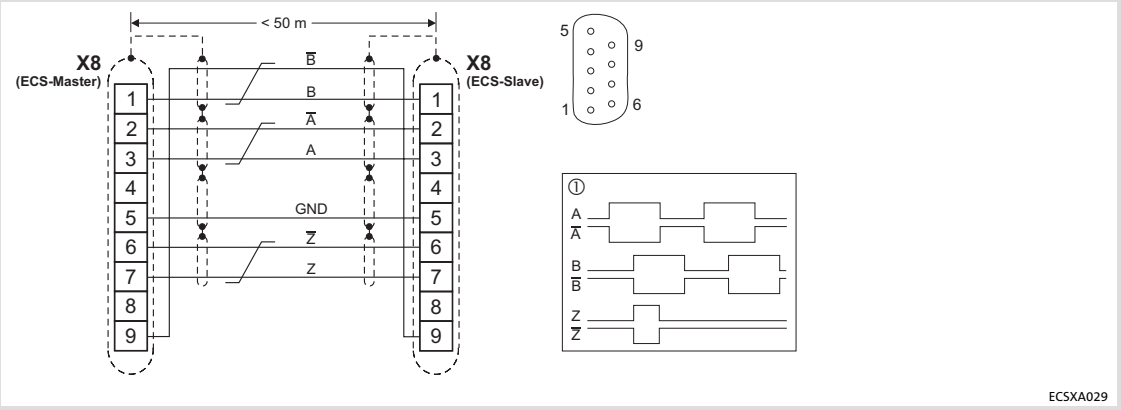


Fig. 5-21 Connection of the master frequency input/output X8 (master ↔ slave)

① Signals for clockwise rotation

Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Input signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
Output signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

► 2 to 3 slaves connected to the master:

Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

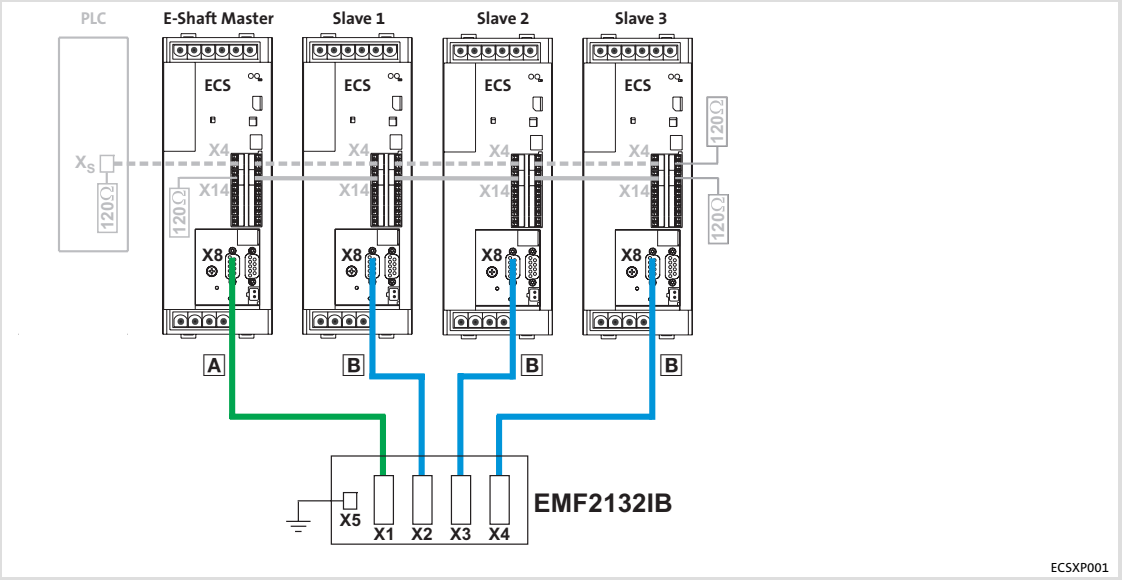


Fig. 5-22 ECS axis modules in the digital frequency network with digital frequency distributor EMF2132IB

PLC	Master control (PLC) or a PLC device to control the drive system
E-Shaft master	Master value master (axis module ECSxP)
Slave 1...3	Slave 1, slave 2, slave 3 (axis module ECSxP)
A	Master digital frequency cable EYD0017AxxxxW01W01 (socket/socket)
B	Slave digital frequency cable EYD0017AxxxxW01S01 (plug/socket)

Tip!

”xxxx” in the type designation of the digital frequency cables serves as a wildcard for the specification of the cable length in decimetres.

Example: EYD0017A**0015**W01W01 → cable length = 15 dm

6 Commissioning

6.1 Basic terms of positioning

6.1.1 Positioning

Positioning means to move one or several machine parts from a starting position to a defined target position.

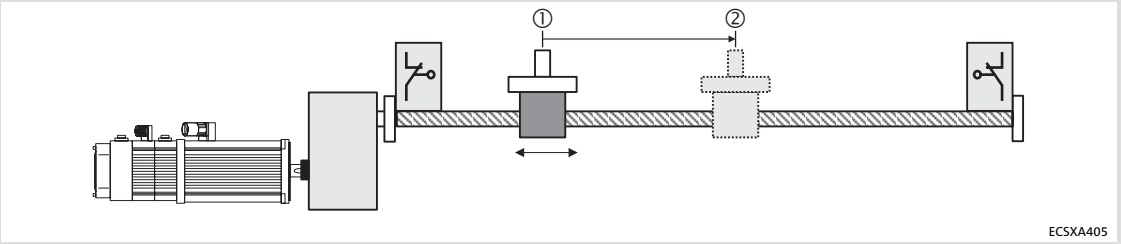


Fig. 6-1 Example: Positioning of a linear positioning axis with spindle

① Starting position
② Target position

6.1.2 Touch probe positioning

During the touch probe positioning process the drive at first travels towards the selected target position until a mark sensor (touch probe signal) at the digital input X6/DI3 of the axis module responds. When this has happened, the drive travels along a specified residual path.

The residual path is defined by entering the target position in the following positioning profile (profile number + 1). If several touch-probe signals occur during a touch probe positioning process, the residual path is measured from the last touch-probe signal.

Note!

The touch probe positioning profile before its start is not monitored with regard to software limit positions (📖 237). If one of the software limit positions is reached during touch probe positioning, a fault and a quick stop (QSP) are activated.

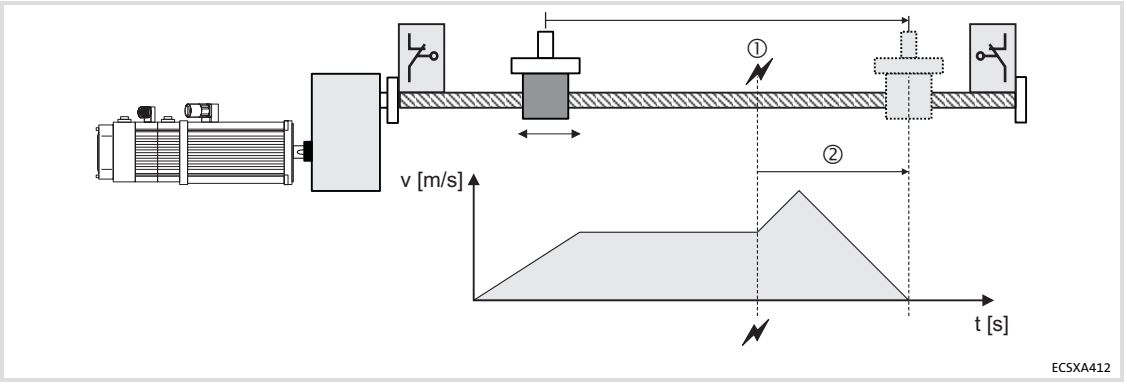


Fig. 6-2 Example: Touch probe positioning with a linear positioning axis

① Sensor mark transmits touch probe signal
② Residual path

To suppress further touch probe signals, you can set a debounce time for the touch probe input X6/DI3 under C3036. After touch probe identification, further touch probe signal will be ignored for the time selected under C3036.

6.1.3 Positioning profile

A positioning process is described by a ”positioning profile ”. It includes the following parameters:

- Positioning profile mode
  – ”Absolute positioning”, ”continuous positioning”, etc.
- Additional positioning profile function
  – ”Speed override”, ”torque limitation after positioning”, etc.
- Positioning profile parameters
  – Target position, traversing speed, acceleration, deceleration, etc.

Motion sequence graph of a positioning profile:

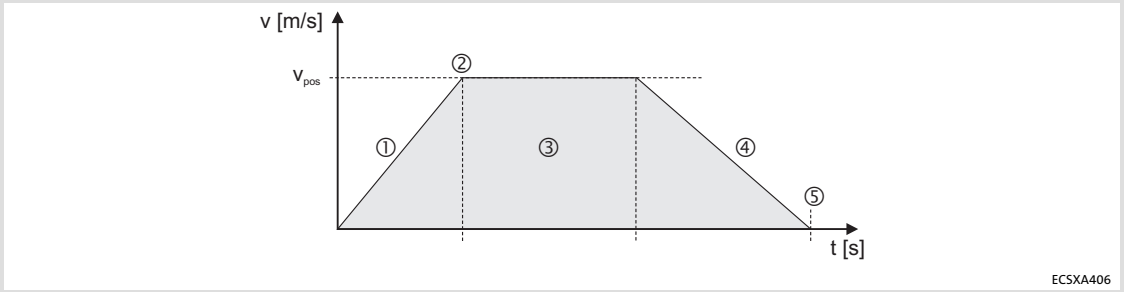


Fig. 6-3 Positioning profile

① Acceleration
② Traversing speed
③ Distance (= area of the trapezium)
④ Deceleration
⑤ Target position

The controller is able to store up to 15 positioning profiles which can be controlled via the device interfaces (🕮 108).

6.1.4 Positioning profile mode

You can select the following positioning profile modes via C3095/x:

Positioning profile mode		Setting C3095/x	Detailed description
Absolute positioning		0	🕮 193
Relative positioning in continuous measuring system		1	🕮 193
Continuous constant travel		2	🕮 195
Relative positioning with absolute reference		3	🕮 194
Absolute touch probe positioning	Rising edge at X6/DI3	10	🕮 194
	Falling edge at X6/DI3	20	
Relative touch probe positioning in the continuous measuring system	Rising edge at X6/DI3	11	🕮 195
	Falling edge at X6/DI3	21	
Relative touch probe positioning with absolute reference	Rising edge at X6/DI3	13	🕮 195
	Falling edge at X6/DI3	23	
Electrical shaft (”EShaft”)	Setpoint via encoder input X8	30	🕮 196
	Setpoint via MotionBus (CAN) X4	31	
	Setpoint via EtherCAT (EMF2192IB at AIF interface X1)	32	
Homing		100	🕮 197
Set reference		101	🕮 197
Reset home position		102	🕮 197
Direct positioning	Absolute positioning (direct)	110	🕮 198
	Relative positioning in continuous measuring system (direct)	111	🕮 198
	Continuous constant travel (direct)	112	🕮 199
	Relative positioning with absolute reference (direct)	113	🕮 199
Positioning sequence for controller optimisation		251	🕮 200

6.1.5 Additional functions of the positioning profile (C3096/x)

- Speed override
  - The term ”Override” refers to the variation of the speed set in the positioning profile via the analog input (10 V ≡ 100 %) and/or by means of the process data object (PDO) via CAN, AIF, C4040.
- Torque limitation after positioning
  - After completion of positioning the torque is limited to a defined value after a certain time has elapsed.
- Profile continuation after profile abort
  - If the profile continuation function is activated and traversing of the profile is stopped, this profile can be completed with a renewed profile start.
  - If the profile continuation function is deactivated, the stopped positioning process is considered to be completed when the profile is started anew (changing back to the ”Positioning” state).
- Immediate profile change during positioning(direct change)
  - If a new profile number is defined during a positioning process, the new positioning profile is started immediately without completing the previous positioning process.
  - Condition: Direct Change must be activated for the new profile (C3096).
- Stretch factor for ”electrical shaft”
  - The ”electrical shaft” drive function is used for line drives when several drives are to be traversed with synchronous phase angle and speed, for instance, because they act upon the same web. Via an adjustable stretch factor (profile parameters C3097/C3098), the web tension can be varied between the contact points of the drives at the web (electronic gearbox).
  - The machine parameters for the gearbox ratio (C1202/C1203, 📖 103) only have an effect on positioning and have no impact on the ”electrical shaft” drive function.

6.1.6 Positioning profile parameters

6.1.6.1 Target position (C3100/x)

The effect of this parameter depends on the type of the positioning carried out. Three basic types of positioning are differentiated:

- Absolute positioning
  - The value ”target position” indicates an unequivocal absolute position in the measuring system.
  - The zero position of the measuring system must be known as reference point (see homing, 📖 101).
  - Application: axes with a limited traversing range (e. g. palletizers)

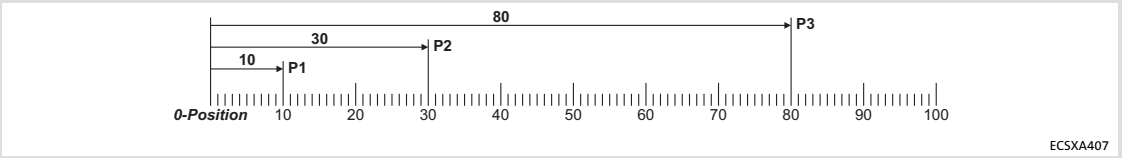


Fig. 6-4 Absolute positioning

- Relative positioning in the continuous measuring system
  - The ”target position” value indicates the distance to be traversed with regard to the current position (incremental dimension).
  - The zero position of the measuring system does not need to be known.
  - The state ”Home position available” (Stat1.HomePosAvailable is reset).
  - Application: roll feed

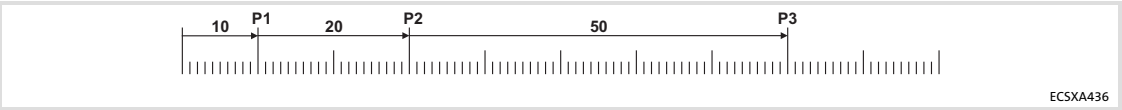


Fig. 6-5 Relative positioning in continuous measuring system

- Relative positioning with absolute reference
  - The ”target position” value indicates the distance to be traversed with regard to the current position.
  - The zero position of the measuring system has to be known.
  - Application: incremental positioning for axes with a limited traversing range

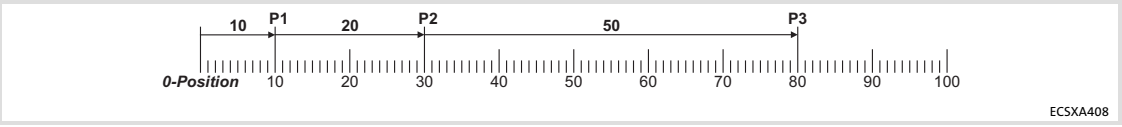


Fig. 6-6 Relative positioning with absolute reference

6.1.6.2 Traversing speed (C3200/x)

This parameter defines, with which max. speed the position is to be approached.

Depending on the three positioning profile parameters ”position”, ”acceleration” and ”deceleration” it may occur that the drive does not reach the max. speed at all:

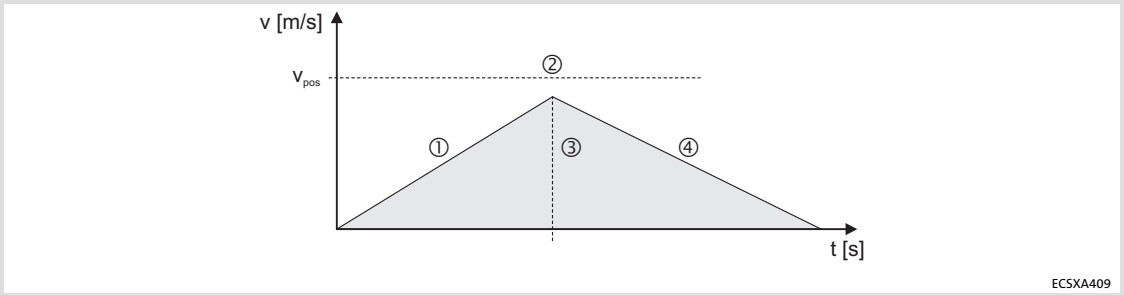


Fig. 6-7 Positioning profile

① Acceleration
② Traversing speed (is not reached here)
③ Distance (= area of the triangle)
④ Deceleration

6.1.6.3 Acceleration (C3300/x) / deceleration (C3400/x)

These two parameters serve to define the acceleration time required to reach the maximum speed and the deceleration time required to reach standstill again.

Note!

There are two acceleration modes:

- ► Constant acceleration: The speed increases linearly (L-profile).
- ► Linearly increasing acceleration: The speed increases in an S-curve (S-profile).

6.1.6.4 Final speed (C3500/x)

This parameter has no function.

6.1.6.5 Jerk time (C3600/x) L-profile, S-profile

The setting of the jerk time under C3600/x serves to change over between L profile and S profile for generating the travel profile.

- **Jerk time = 0, L profile is active** (Lenze setting):

  The positioning profile is generated with linear ramps. All positioning profile modes (C3095/x) can be used.

- **Jerk time ≠ 0, S profile is active**:

  The positioning profile is generated with S-shaped ramps. This ramp form cannot be used with the touch probe positioning profile modes C3095/x = 10 ... 23 and neither with positioning profiles with the activated additional function ”Immediate profile change” (C3096/x.Bit5 = 1).

The jerk time set under C3600/x is a measure for smoothening the speed curve with S-ramps. The jerk time corresponds to the ramp time (t_{jerk}), after which the acceleration set in the positioning profile is reached, starting from acceleration 0.

The smoothening of the speed curve with S-ramps serves to limit the jerk and thus for a protection of the machine mechanics.

Note!

If disproportionately high jerk times (t_{jerk}) are set for short acceleration phases (t_{acc}), the profile may be generated incorrectly.

Example:

v = 100 mm/s, a = 1000 mm/s^2

⇨ t_{acc} = v / a = 0.1 s

⇨ t_{jerk} = 0.05 s

For this reason, set only plausible jerk times for the S-ramps under C3600/x. These must not exceed half the value of t_{acc}.

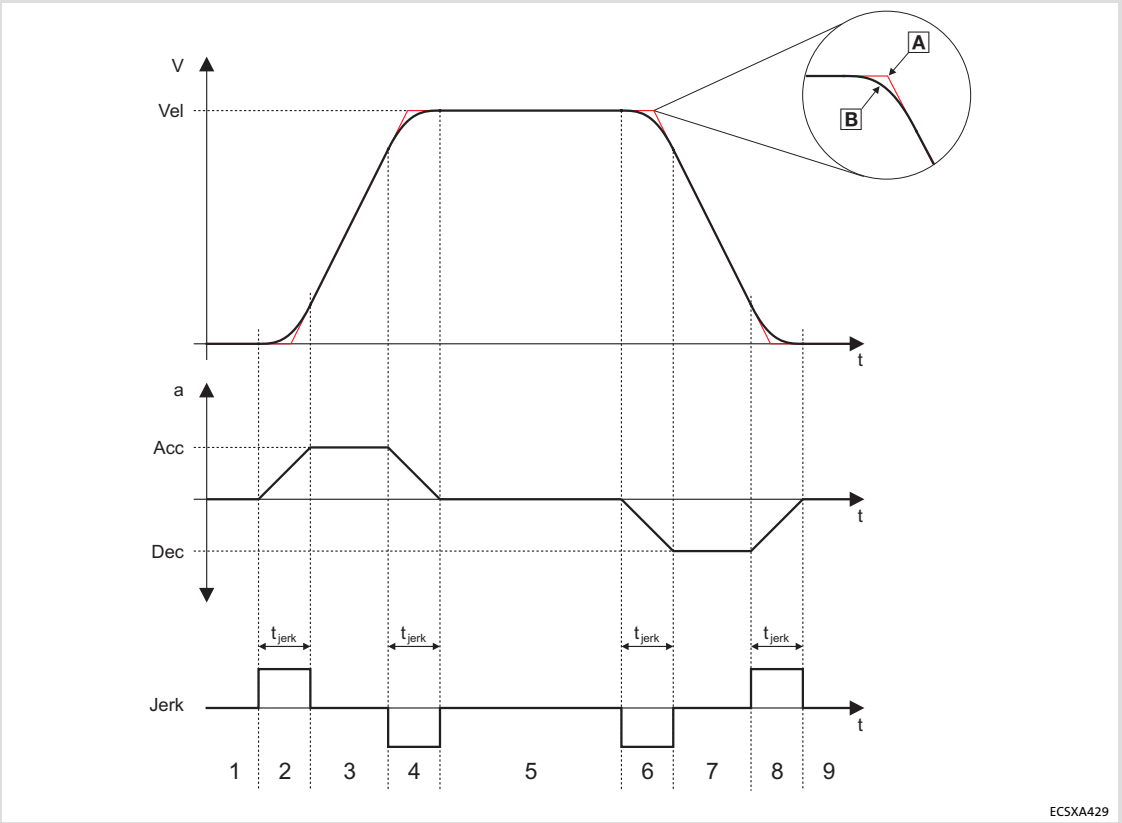


Fig. 6-8 Jerk time C3600/x

- A Process without jerk limitation
- B Process with jerk limitation
- 1 Standstill
- 2 Accelerating with increasing acceleration (limited jerk)
- 3 Accelerating with constant acceleration acc. to positioning profile (Acc, C3300/x)
- 4 Accelerating with decreasing acceleration (limited jerk)
- 5 Travelling with traversing speed acc. to positioning profile (Vel, C3200/x)
- 6 Decelerating with increasing deceleration (limited jerk)
- 7 Decelerating with constant deceleration acc. to positioning profile (Dec, C3400/x)
- 8 Decelerating with decreasing deceleration (limited jerk)
- 9 Standstill (target position reached)

6.1.7 Setting of manual jog (inching mode)

”Manual jog” means running the drive by manual operation.

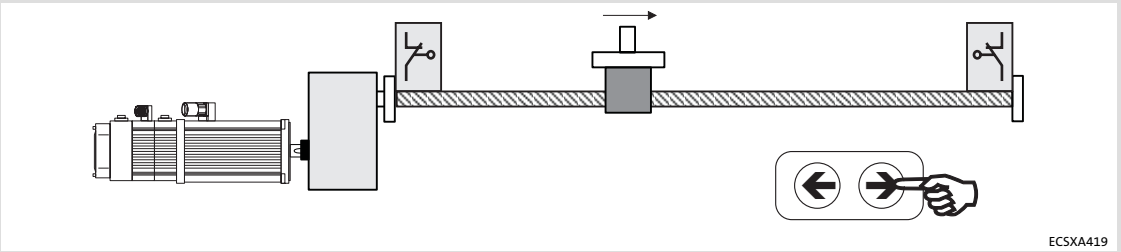


Fig. 6-9 Manual jog (inching mode)

► The parameters ”traversing speed”, ”acceleration” and ”deceleration” can also be set for manual jog. (📖 173)

6.1.8 Homing

By means of homing, the zero position is defined within the physically possible traversing range of the machine. Thus, the reference of the measuring systems to the machine is established.

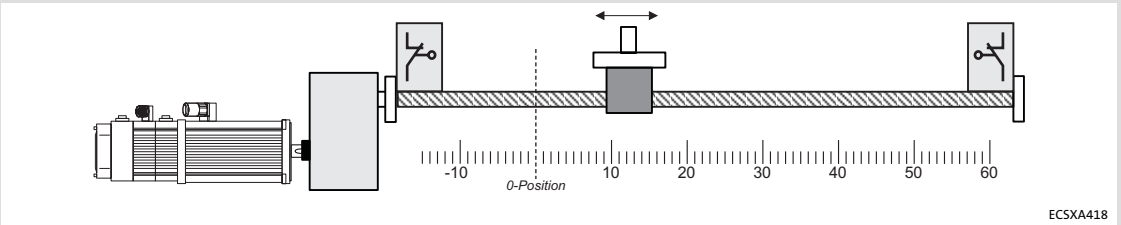


Fig. 6-10 Homing (defining the zero position)

The zero position (home position) can be defined by homing or by setting a reference:

► During homing the drive traverses in a defined mode (homing mode) to detect the zero position on its own and in a reproducible manner.

► When homing is carried out, the current position is defined as zero position (home position).

6.1.9 Measuring system for positioning

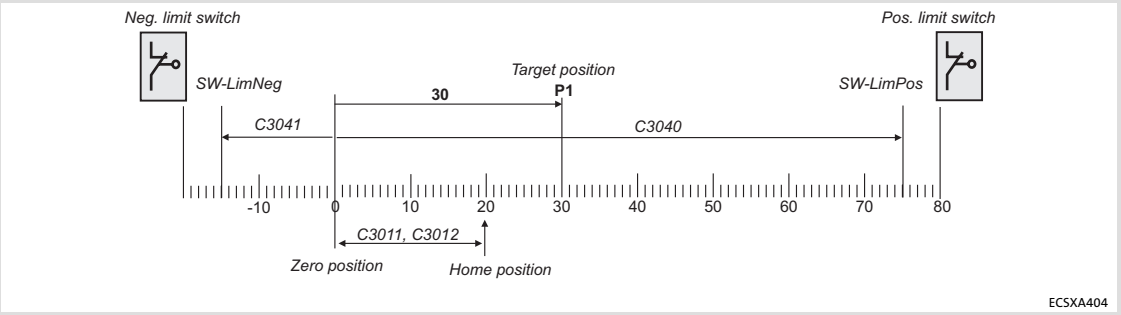


Fig. 6-11 Measuring system for the positioning

The measuring system for positioning has the following features:

- The zero position of the measuring system has a firm reference to the machine due to the home position.
- The home position is found out by homing.
- The software limit positions (SW-LimNeg, SW-LimPos) refer to the zero position.
- The zero position can be shifted via the offset values C3011 (home offset) and C3012 (measure offset)(📖 187).
- The data for C3051 (actual position in units) and C3056 (target position in increments) refer to the zero position of the measuring system.

6.1.10 Machine parameters

A positioning process requires the machine parameters to convert the entries in the application units into a device-internal incremental representation (inc). The GDC contains the codes for setting the machine parameters in the parameter menu under **Positioning → Machine parameters**. (📖 165)

The machine parameters are explained in detail considering as example the operation of a linear positioning axis with spindle which is provided with a movable slide:

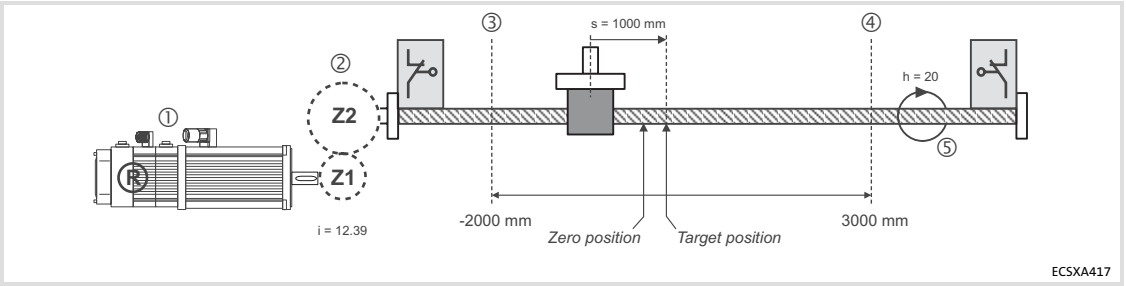


Fig. 6-12 Example: Linear positioning axis with spindle

① Motor/encoder
② Gearbox with transmission ratio i = Z2 / Z1 (ratio of the tooth numbers or circumferences) or i = n1/n2 (ratio of the speeds)
③ Negative software limit position
④ Positive software limit position
⑤ Feed constant (in mm/revolution), h = leadscrew pitch

The parameters for the positioning profile (target position, traversing speed, acceleration and deceleration) are specified in real units with regard to the slide (e. g. 1000 mm as relative target position or distance).

Target position in number of motor revolutions or converted into increments

In order to move the slide exactly 1000 mm to the right, the motor must rotate a certain number of times which results from the gearbox ratio (i) and the feed constant (h).

$$\textit{Motor revolutions} = \frac{\textit{Path}\ (s)}{\textit{Feed constant}\ (h)} \cdot \textit{Gearbox ratio}\ (i)$$

$$\textit{Motor revolutions} = \frac{1000\ mm}{20\ mm/rev.} \cdot 12.39 = 619.5\ \textit{revolutions}$$

When multiplying the number of revolutions by the fixed position resolution of 65536 incr/rev. you obtain the distance to be traversed with internal incremental representation.

Gearbox ratio (C1202/C1203)

The gearbox ratio specifies the number of revolutions of the motor axis at which the spindle revolves exactly once.

It is entered into the codes C1202 (gearbox factor numerator) and C1203 (gearbox factor denominator). For the example described above, it follows that:

$$\textit{Gearbox ratio}\ (i) = \frac{n_{Motor}\ [rev./min.]}{n_{Gearbox\_output}\ [rev./min.]} = \frac{Z2}{Z1} = \frac{C1202}{C1203}$$

$$\textit{Gearbox ratio}\ (i) = \frac{1239\ [rev./min.]}{100\ [rev./min.]} = 12.39$$

Note!

The gearbox ratio regarding the ratio of speeds ($n_{Motor}/n_{Gearbox}$) is entered inverse to the ratio of number of teeth (Z2/Z1) and the circumferences (U2/U1).

Feed constant (C1204)

The feed constant specifies the path (in units) the load (slide) covers in one revolution of the spindle.

It is entered into code C1204:

$$C1204\left[\frac{units}{rev.}\right] = Feed\left[\frac{[mm,\ cm,\ ...]}{[1\ rev.]}\right]$$

The physical size of a unit is defined in this way via C1204. For the example described above, it follows that:

$$C1204 = h = 20\left[\frac{units}{rev.}\right] \qquad 1\ unit = 1\ mm$$

Between real units (*Pos_real*) and variables relating to the position encoder/motor (*Pos_intern* in increments), there is the following interrelation:

$$Pos\_intern\ [incr.] = \frac{Pos\_real \cdot 65536 \cdot GFD \cdot SFN}{1000 \cdot Vconst. \cdot GFN \cdot SFD}$$

GFD	Gearbox factor denominator
GFN	Gearbox factor numerator
SFD	Sensor factor denominator
SFN	Sensor factor numerator
Vconst.	Feed constant

Thus, the following applies to the conversion of position values in positioning profiles into internal increments:

$$Pos\_intern\ [incr.] = \frac{C3100 \cdot 65536 \cdot C1202 \cdot C1201}{1000 \cdot C1204 \cdot C1203 \cdot C1200}$$

Irrespective of the feedback system used, one revolution of the position encoder/motor corresponds to 65536 increments.

Examples for the calculation of the feed constant

Feed constant for ball screw	Feed constant for toothed belt drive
• Leadscrew pitch h = 10 • A (path) unit corresponds to 1 mm. ⇨ *C1204 = 10 units/rev.*	• Tooth number of the belt pulley: 40 teeth/rev., toothed belt division: 5 mm • A (path) unit corresponds to 1 mm. ⇨ *C1204 = 40 x 5 units = 200 units/rev.*

Maximum target position selection (C4265)

The maximum target position selection results from the possible traversing range of 16384 position encoder revolutions converted into real units.

$$C4265 = 16384\,[rev.] \cdot 65536\,[incr./rev.] \cdot \frac{10000 \cdot C1204 \cdot C1203 \cdot C1200}{65536 \cdot C1202 \cdot C1201}$$

C4265 is limited to ±214000.0000 units.

Position resolution (C4266)

Number of increments per unit specified

- Due to the internal remainder considered, the lowest-order position can vary about 1.
- 1 revolution of position encoder ≙ 65536 increments.
- Value range: 0 ... 2140000000

Maximum traversing speed (C1240)

Via C1240 you can define the maximum traversing speed (v_{max}) for the machine. The speed specifications in the positioning profiles are limited internally to v_{max}. v_{max} should be set lower than the velocity possible at maximum motor speed (C0011). The value can be calculated according to the following formula:

$$v_{max} \leq n_{max} \cdot \frac{v_k}{60 \cdot i}$$

$$C1240 \leq C0011 \cdot \frac{C1204 \cdot C1203}{60 \cdot C1202}$$

Tip!

The maximum input value for v_{max} can be read out via C3060.

Maximum acceleration/deceleration (C1250)

The maximum permissible acceleration or deceleration for positioning processes among other things depends on the motor torque and the moment of inertia of the entire mechanics driven during the positioning process.

Software limit positions (C3040/C3041)

As well as defining the zero position it is important to define the limits of travel range to avoid damages of the system, e. g. at manual control. These limits (limit switches/limit positions) can be defined by hardware and software:

- Hardware limit switches are linked with the digital inputs of the controller; when being activated, a certain action is carried out (e. g. quick stop).
- Software limit positions additionally limit the possible travel range within the hardware limit switches and check on the drive level whether a position can be approached.

  Information on the operating mode and setting of the software limit positions can be found on 📖 237.

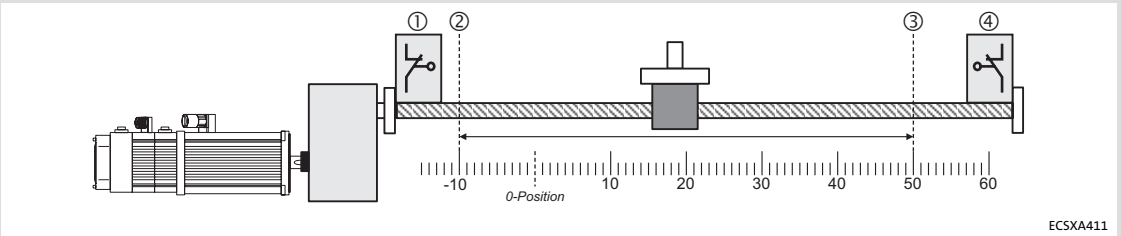


Fig. 6-13 Example: Limit positions of a linear positioning axis with spindle

① Negative hardware limit switch
② Negative software limit position, C3041 = -10 units
③ Positive software limit position, C3040 = +50 units
⑥ Positive hardware limit switch

6.1.11 Electrical shaft (”EShaft”)

The ”electrical shaft” drive function is used for line drives when several drives are to be traversed with synchronous phase angle and speed, for instance, because they act upon the same web. Via an adjustable stretch factor, the web tension can be varied between the contact points of the drives at the web.

Detailed information on the configuration of the ”Electrical shaft” drive function can be found from 📖 211.

6.1.12 Device structure and interfaces to the higher-level control

The ECSxP axis module with the ”Posi and Shaft” application program requires a higher-level control (e. g. Lenze Drive PLC) for the coordination of the positioning process.

The ”Posi and Shaft” application program enables input and storage of individual positioning profiles and the accompanying profile parameters (target position, traversing speed, acceleration, etc.). The selection, starting and timely sequencing of the positioning profiles must be carried out by a higher-level control.

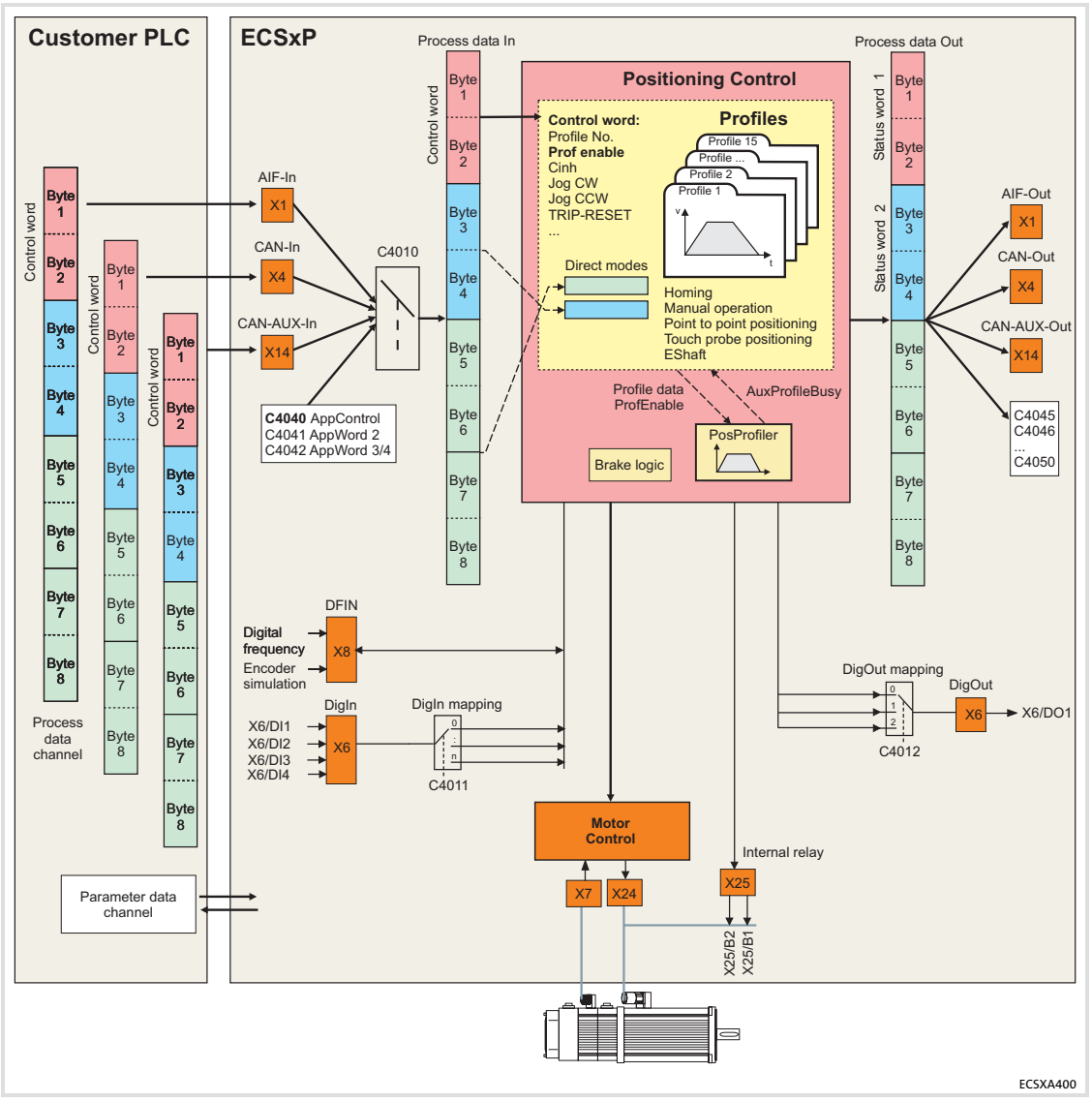


Fig. 6-14 Structure of ECS ”Posi and Shaft”

The following control interfaces are available for the controller under code C4010:

- Automation interface (AIF) X1
  - 4 process data words (in conjunction with the EMF2192IB EtherCAT communication module, sync-controlled via the terminal X6/DI1)
- MotionBus (CAN) connection X4
  - CAN1 (process data object 1, PDO1, sync-controlled)
  - CAN3 (process data object 3, PDO3, cyclic)
- System bus (CANaux) connection X14
  - CANaux1 (process data object 1, PDO1, sync-controlled)
  - CANaux2 (process data object 2, PDO2, cyclic)
- Control via codes C4040, C4041, C4042 through a parameter data channel, e.g. AIF, CAN, CAN-AUX, LECOM (for commissioning and test purposes)

The interface between the control and the ECSxP axis module is mainly determined by the control word (*Ctrl1*) and the two status words (*Stat1*) and (*Stat2*). They contain all control and status bits required for controlling the process.

The most important control bits from the control: (📖 158):

Bit	Designation	Function
3	Quick stop (QSP)	Quick stop
4	PNoSet_1	Selection of the positioning profile (binary coded)
5	PNoSet_2	
6	PNoSet_4	
7	PNoSet_8	
8	ProfEnable	Start of the selected positioning profile
9	CINH	Controller inhibit
11	TripReset	Reset fault message
12	JogCCW	Manual jog (inching mode)
13	JogCW	

The most important status bits (”*Stat1*”) to the control (📖 161):

Bit	Designation	Function
6	PNoAct_1	Feedback of the currently active positioning profile (binary coded)
7	PNoAct_2	
8	PNoAct_4	
9	PNoAct_8	
13	HomePosAvailable	Home position known
14	InTarget	Positioning target reached
15	DwellTime	The dwell time has expired after profile generator setpoint has reached the target position.

6.2 State control of the positioning drive

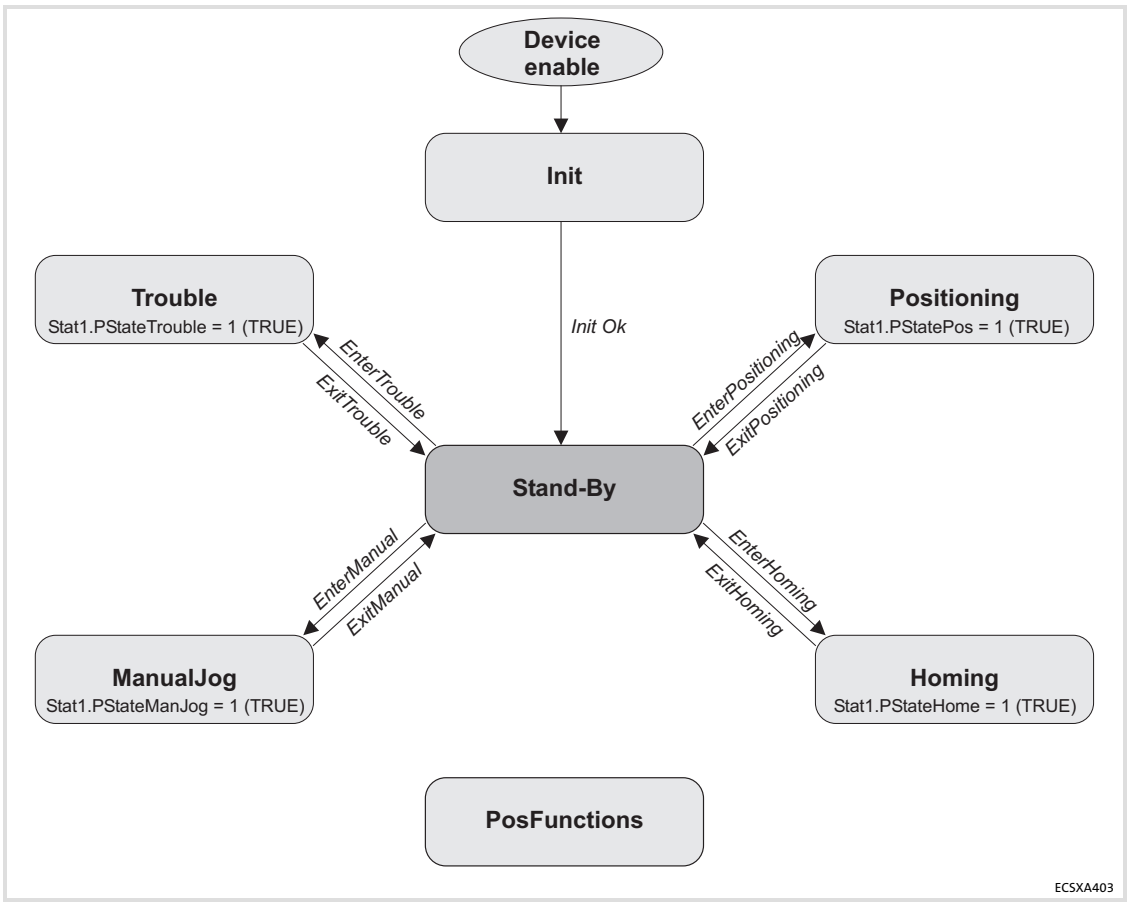


Fig. 6-15 State representation of positioning drive

The ECSxP position controller contains a state machine with a corresponding state control. In each state, a related function is processed.

State changes (transitions; e.g. ”EnterTrouble”) take place under certain conditions. During one program cycle, only one of the states is really active. This does not apply to the ”PosFunctions” state which is always processed in parallel.

The ”Stand-by” state is of central importance since it is always activated when a state changes to another. If you change e.g. from ”Trouble” to ”ManualJog”, ”Stand-By” will be active for one cycle.

Use the ”Enter...” transitions (see illustration) to change from ”Stand-By” to another state (”Homing”, ”Trouble”, ...) of the state machine.

Use the ”Exit...” transitions to change back to the central ”Stand-by” state.

6.2.1 Operating states

"PosFunctions" state

These functions are permanently active, irrespective of the transitions of the state control. In the states the following "PosFunctions" are carried out:

- General control functions
- Calculation of the monitoring functions (software limit positions, hardware limit positions, following errors, etc.).

The individual operating states and the conditions for state changes (transitions) are described in the following.

"Stand-by" state

The following actions are executed in "stand-by":

- Checking and calculation of the maximum speed indicated in C3060.
- Calculation/acceptance of the monitoring limit values, e.g.:
  - Following error warning tolerance
  - Following error limit
  - Calculation of the positioning window for the message "Target position reached" (*Stat1.InTarget*)
  - Calculation of the time setting for the message "Dwell time elapsed" (*Stat1.DwellTime*)
- Setting of the home position ⇨ C3095/x = 101 (set home pos.)
- Calculation of the internal values for homing.

"Init" state

This state is only activated once directly after the control voltage has been switched on.

The following actions are executed in "Init":

- Identification of the drive hardware and firmware.
- Identification and setting of the feedback systems for speed and position detection.
- Checking of the home position if multi-turn absolute value encoders/resolvers are used as absolute value encoders.
- Calculation of the internal values for the positioning control.

"Trouble" state

This state is activated when the operating system of the drive or the application program detects a fault.

The following actions are executed in "Trouble":

- Current fault display.
- Enabling the reset mechanism for fault states.

”ManualJog” state

This state enables manual traversing of the drive system (manual jog/inching mode)

The following actions are executed in ”ManualJog”:

- Creation of motion profiles for the function ”ManualJog” (manual control).
- Evaluation of the hardware limit switches during manual jog.
- Retracting from hardware limit switches.

”Homing” state

This state enables setting or automatic search of the home position.

The following actions are executed in ”Homing”:

- Creation of motion profiles for the function ”Homing” (home position search).
- Evaluation of the hardware limit switches during the home position search.

”Positioning” state

This state enables the core function ”Positioning of the drive system”.

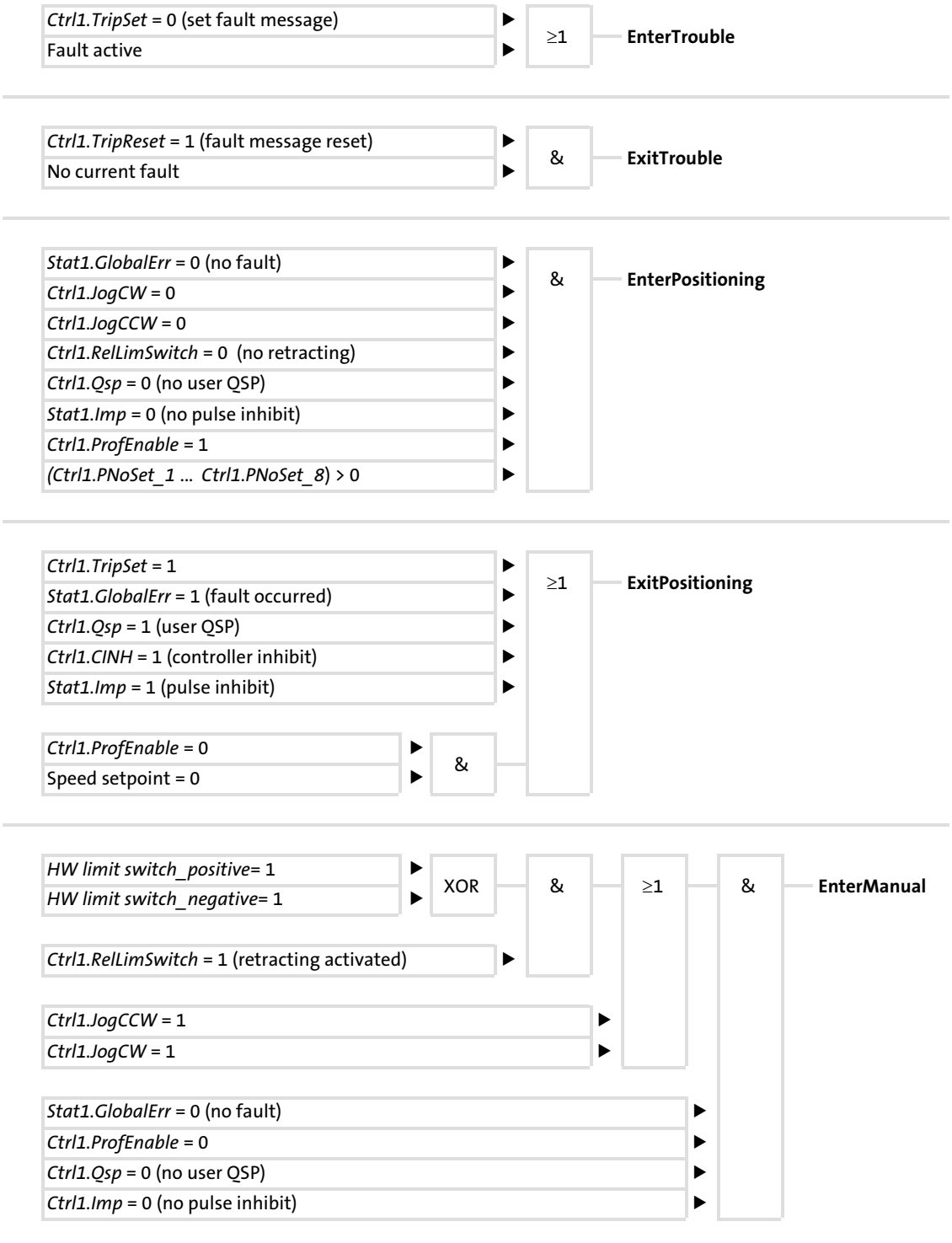
- Positioning profiles are only executed in ”Positioning”.
- A state change (e.g. as a result of a fault or initiated by the user) leads to an immediate quick stop (QSP) of the drive system.

In the ”positioning” state the following motion profiles for positioning are created:

- Point-to-point positioning
- Touch probe positioning
- Override positioning

6.2.2 Conditions for state change (transitions)

The figure below shows the conditions to be fulfilled for the individual state changes in the form of logic operations:



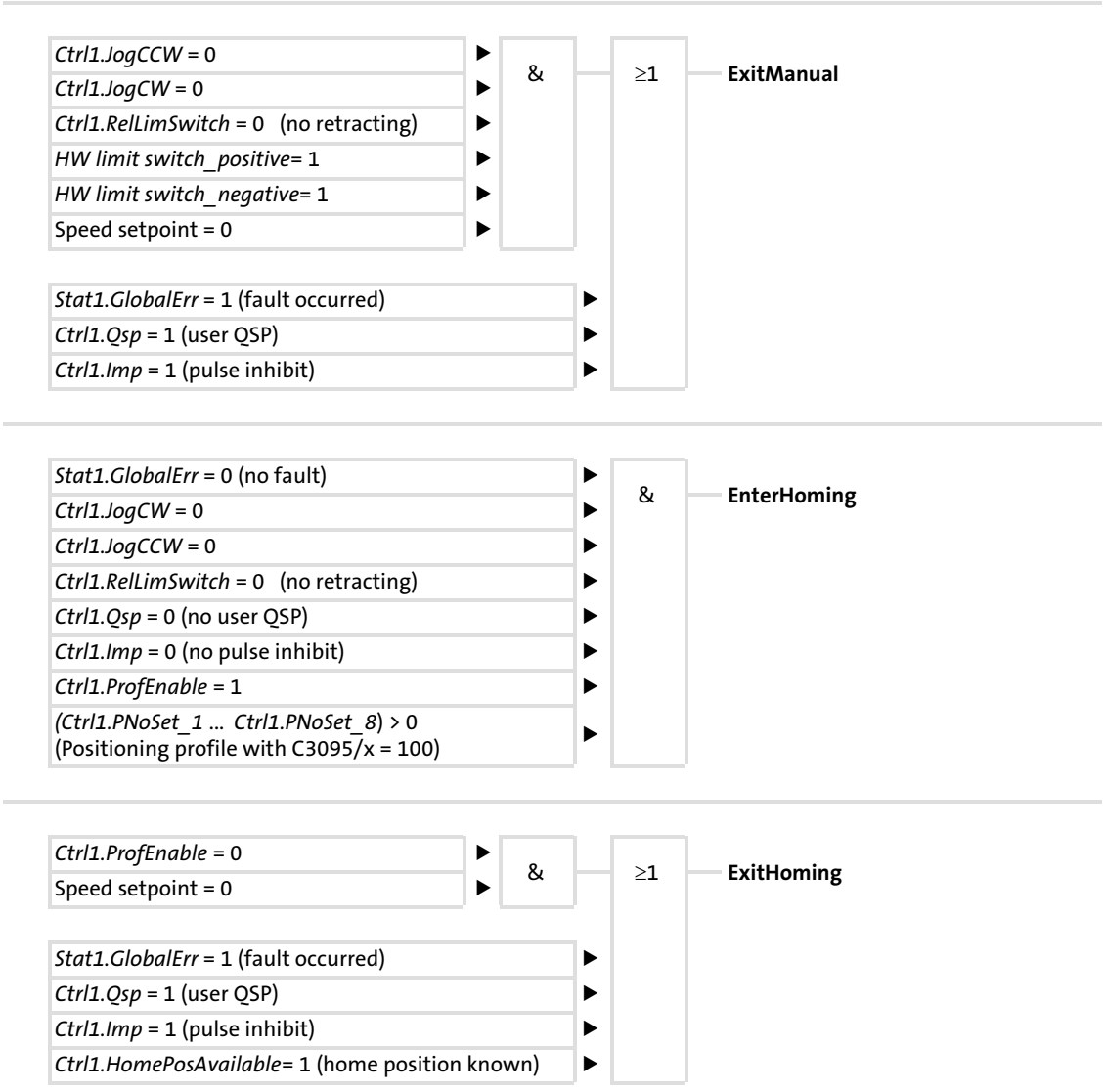


Fig. 6-16 Conditions for state change (transitions)

&	Logic AND operation
≥	Logic OR operation
XOR	Logic EXCLUSIVE OR operation
Ctrl1...	Control bits (📖 158)
Stat1...	Status bits (📖 161)

6.3 Before you start

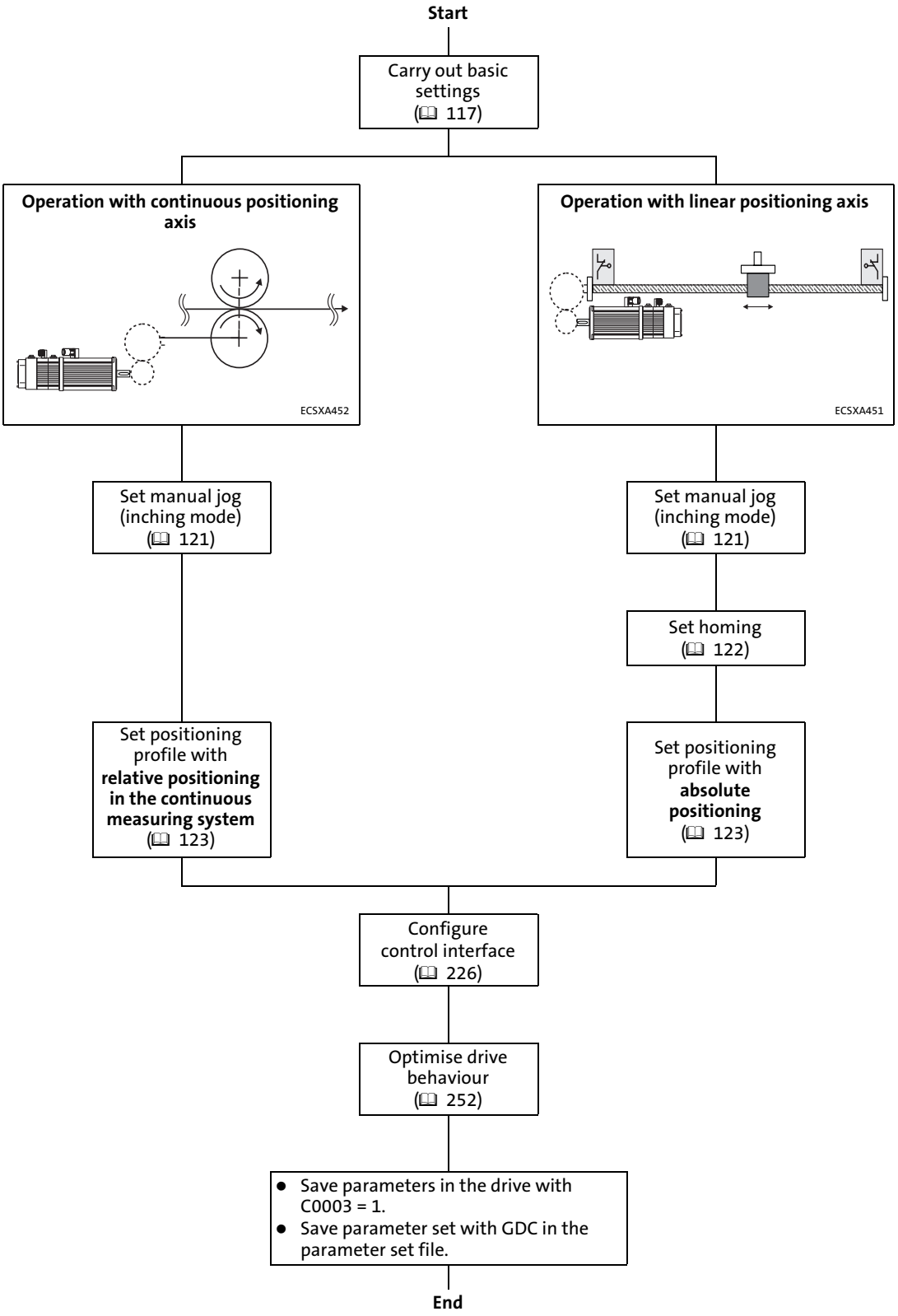
Note!

- The use of a Lenze motor is assumed in this description of the commissioning steps. For details on the operation with other motors see 📖 244.
- The operation with the Lenze parameter setting and operating program "Global Drive Control (GDC)" is taken as a basis. The parameters are displayed in the online mode, i.e. GDC can directly access the codes of the axis module.

Prior to initial switch-on of the drive system, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Polarity of the DC-bus voltage supply via terminals +UG, -UG
- Motor connection:
  – In-phase connection to the motor (direction of rotation)
- Wiring of "safe torque off" (formerly "safe standstill")
- Feedback system
- Control terminals:
  – Wiring adjusted to the signal assignment of the control terminals.

6.4 Commissioning steps (overview)



6.4.1 Basic settings with GDC

Note!

- ► The settings are required for operation with a linear or continuous positioning axis.
- ► Comply with the commissioning steps in the given order.

	Setting	Brief description	Detailed information
	Preconditions	● Mains is switched off. (Green LED is dark, red LED is blinking) ● Controller inhibit is active. – Press the <F9> key in GDC. – X6/SI1 **or**X6/SI2 must be open (LOW). – Control bit *Ctrl1.Rsp* = 1	
1.	Switch on low-voltage supply (24 V DC).		
2.	Connect PC/laptop (with installed GDC parameter setting program) to controller.	Connection to X14 (system bus (CAN)) with PC system bus adapter EMF2177IB.	📖 259
3.	Start GDC and select the device to be set.	Select device: Change to the online mode via the GDC toolbar with the <F4> key and select "Searching for drives" using the <F2> key. ⇨ The drive is identified and the parameter menu is opened.	GDC online help
4.	Load Lenze setting.	● Not required for initial commissioning of the axis module. ● Only recommended if the Lenze setting is unclear.	📖 125
5.	Set communication parameters according the interface used.	Comm. parameters - CAN interface: ● CAN node address (via DIP switch or C0350/C2450) ● Baud rate (via DIP switch or C0351/C2451) ● C0356 (CAN boot up/cycle time) ● C1120 = 1 (sync connection via MotionBus (CAN)) ● C1121 (synchronisation cycle [in ms])	📖 266 📖 274 📖 278
		Comm. parameters - AIF interface: **Please also read the documentation for the Lenze communication module used!**	
		AIF: Electrical shaft via EtherCAT with PLC as electrical shaft master (EMF2192IB) ● C1120 = 2 (synchronisation via terminal X6/DI1) ● C1121 (synchronisation cycle [in ms]) ● The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the sync telegrams.	📖 224
6.	Set mains data.	Set the following codes in the GDC parameter menu under **Short setup → Mains**: ● C0173 (voltage thresholds) ● C0175 (function of the charge relay) – For operation with the power supply module ECSxE set C0175 = 3.	📖 126
7.	Enter motor data.	Lenze motors: Use the GDC motor assistant.	📖 128
		Motors from other manufacturers: Set the codes in the GDC parameter menu under **Motor/feedback systems → Motor setting**.	📖 244
8.	Configure holding brake.	● Not required if a holding brake is not available; *otherwise* ● Set C4023 (speed threshold) > 0 (e.g. 1 %) to apply the holding brake.	📖 130

	Setting	Brief description	Detailed information
9.	Set feedback system.	● Set Lenze motors with resolvers (standard) in the GDC parameter menu under **Short setup → Feedback system**. ● Set other resolvers and encoders in the GDC parameter menu under **Motor/feedback systems → Feedback system**.	📖 132
10.	Select operating mode "Control via code C4040".	Set C4010 = 3 in the GDC parameter menu under **Short setup → Control/operating mode**.	📖 226
11.	A Set signal assignment of the digital inputs.	Set C4011 in the GDC parameter menu under **Short setup → Digital inputs/outputs**: ● Operation with continuous positioning axis: C4011 = 5 ● Operation with linear positioning axis: C4011 = 0	📖 168
	B Set the polarity of the digital inputs and outputs.	● Set IC0114/x (polarity X6/DI1 ... DI4) in the GDC parameter menu under **Terminals I/O → Digital inputs**. ● Set C0118/1 (polarity X6/DO1) in the GDC parameter menu under **Terminals I/O → Digital outputs**.	📖 172
12.	Enter machine parameters.	Set the following codes in the GDC parameter menu in **Positioning/E-Shaft → Machine parameters**: ● C1202 (gearbox ratio numerator: number of teeth on the machine side or speed on the motor side) ● C1203 (gearbox ratio denominator: number of teeth on the motor side or speed on the machine side) ● C1204 (feed constant) ● C1240 (max. speed of the machine) ● C1250 (max. acceleration of the machine) ● C3031 (following error limit) ● C3040 (positive software limit position) ● C3041 (negative software limit position) ● C0105 (quick stop deceleration time)	📖 165
13.	Switch on the mains.	● Green LED is blinking, red LED is off: – Controller is ready for operation. ● Green LED is off, red LED is blinking: – An error has occurred. Eliminate the error before you continue commissioning.	
14.	Carry out a positioning profile with the positioning profile mode "Set reference".	Only required.... ● in the case of initial commissioning of an absolute value encoder (multi-turn/single-turn); ● after the replacement of an encoder, controller, or motor; ● if modifications regarding the mechanics are carried out.	📖 119

The basic settings are completed now.

Proceed as follows:

► Set Manual jog (inching mode) (📖 121).

6.4.2 Set reference

Note!

Setting the reference (homing) is required ...

- ► in the case of initial commissioning of an absolute value encoder (multi-turn/single-turn);
- ► after the replacement of an encoder, controller, or motor;
- ► if modifications regarding the mechanics are carried out.

- ► When homing is carried out, the current position is defined as zero position (home position).
- ► Reference setting can be carried out in all connectable encoder systems.
- ► For setting the reference, the homing status ”Reference known” (*HomePosAvailable*) has to be reset (C4045/bit 13 = 0).

  If ”Reference know” has already been set (C4045/Bit 13 = 1), first the ”Reset HomePosAvailable” profile function has to be executed (C3095/x = 102) to reset the status.

Set reference for absolute value encoders (multi-turn)

Reference setting does not influence the internal value of the absolute value encoder. The ECSxP axis module ”remembers” the zero position (home position) via corresponding offset variables with regard to the overflow point of the absolute value encoder. The axis module is not limited to the 4096 displayable revolutions in the absolute value encoder. Thus the maximum display range (like for the resolver) is provided to the module. The condition for this is that the absolute value encoder in the switched-off state is not moved more than ± 2048 revolutions.

Setting sequence

	Setting	Brief description	Detailed information
	Preconditions	● The axis module is ready for operation (RDY). – Check with C0183, C0168/1 – Green LED is blinking, red LED is off ● Controller inhibit is active. – Press the <F9> key in GDC. – X6/SI1 **or**X6/SI2 must be open (LOW). – Control bit *Ctrl1.Rsp* = 1 – The homing status "Reference known" (*HomePosAvailable*) has to be reset (C4045/bit 13 = 0).	
1.	Define the positioning profile.	Set the following codes in the GDC parameter menu in **Positioning profiles →Profile 01**: ● C3095/1 = 101 (positioning profile mode "Set reference") ● C3011 (home position offset) ● C3012 (reference measuring system offset)	📖 191
2.	Start positioning profile (profile 01).	Set the following codes in the GDC parameter menu in **Short setup → Operating mode**: ● C4010 = 3 (control interface C4040) ● C4040/bit 4 = 1 (control bit *Ctrl1.PNoSet_1*, select positioning profile) ● C4040/bit 8 = 1 (control bit *Ctrl1.ProfEnable*, start positioning profile) ⇨ Changeover to the "Positioning" state – C4045/bit 4 = 1 (status bit *Stat1.PStatPos*) – C4045/Bit 10 = 1 (status bit *Stat1.ProfileBusy*) ⇨ Home position is known. – C4045/Bit 13 = 1 (status bit *Stat1.HomPosAvail*)	📖 158 📖 161
3.	Reset positioning profile selection.	Settings: ● C4040/bit 4 = 0 ● C4040/bit 8 = 0 ⇨ Changeover to the "Stand-by" state – C4045/Bit 0 = 1 (status bit *Stat1.PStatStdBy*) – C4045/Bit 4 = 0 (status bit *Stat1.PStatPos*)	

The settings for the reference setting are now completed.

Proceed as follows:

► Set Manual jog (inching mode) (📖 121).

6.4.3 Setting of manual jog (inching mode)

Stop!

Machine parts can be damaged or destroyed!

The drive can travel into a mechanical limit during manual jog if

► no reference is known (status bit *Stat1.HomePosAvailable* = 0, 📖 161).

► no software limit positions are set (📖 237).

A manual jog requires the following commissioning steps:

	Setting	Brief description	Detailed information
1.	Set parameters for the manual control.	Set the following codes in the GDC parameter menu in **Positioning → Manual jog**: ● C3020 (traversing speed) ● C3021 (acceleration) ● C3022 (deceleration)	📖 173
2.	Save parameter set.	Set C0003 = 1.	
3.	Enable controller.	● Press the <F8> key in the GDC. ● Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the master control (PLC). ● Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. (No enable via master control!)	📖 241
4.	Set the direction of rotation for manual control.	Set the following codes in the GDC parameter menu in **Short setup → Operating mode**: ● C4010 = 3 (control interface C4040) ● Control bits for CCW rotation (JogCCW): – C4040/bit 12 = 1 – C4040/bit 13 = 0 ⇨ Changeover to ”ManualJog”state – C4045/bit 2 = 1 (status bit *Stat1.PStatManJog*) ● Control bits for CW rotation (JogCW): – C4040/bit 12 = 0 – C4040/bit 13 = 1 ⇨ Changeover to ”ManualJog”state – C4045/bit 2 = 1 (status bit *Stat1.PStatManJog*) ● Control bits for manual jog stop: – C4040/bit 12 = 0 – C4040/bit 13 = 0 ⇨ Changeover to the ”Stand-by” state – C4045/Bit 0 = 1 (status bit *Stat1.PStatStdBy*) **Note:** In the case of C4040/bit 12 = 1 and bit 13 = 1, manual jog is interrupted until one of the two bits is set to ”0”. The state remains unchanged.	📖 158 📖 161
	The motor rotates in the direction selected.		

The settings for manual jog are now completed.

Proceed as follows:

► Set homing (📖 122) when operating with a linear positioning axis

or

► Set relative continuous positioning (📖 123) when operating with a continuous positioning axis

6.4.4 Setting of homing

Note!

► Homing only is necessary when operating with a linear positioning axis.
► Comply with the commissioning steps in the given order!

	Setting	Brief description	Detailed information
1.	Set homing parameters.	Set the following codes in the GDC parameter menu in **Positioning → Homing**: ● C3010 (homing mode) ● C3011 (home position offset) ● C3012 (reference measuring system offset) ● C3013 (traversing speed) ● C3014 (acceleration)	📖 177
2.	Set positioning profile to homing.	Set **Profile** 01 C3095/1 = 100 m (positioning profile mode ”Homing”) in the GDC parameter menu in **Positioning profiles →**.	
3.	Save parameter set.	Set C0003 = 1.	
4.	Enable controller.	● Press the <F8> key in the GDC. ● Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the master control (PLC). ● Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. (No enable via master control!)	📖 241
5.	Start homing.	Set the following codes in the GDC parameter menu in **Short setup → Operating mode**: ● C4010 = 3 (control interface C4040) ● C4040/bit 4 = 1 (control bit *Ctrl1.PNoSet_1*, select positioning profile) ● C4040/bit 8 = 1 (control bit *Ctrl1.ProfEnable*, start positioning profile) ⇨ Changeover to the ”Homing”state – C4045/bit 3 = 1 (status bit *Stat1.PStatHome*) – C4045/bit 12 = 1 (status bit *Stat1.HomeBusy*) – C4045/bit 13 = 1 (status bit *Stat1.HomPosAvail*, ”Reference known”) **Note:** To interrupt the homing, set C4040/Bit 8 = 0.	📖 158 📖 161
	The drive approaches the home position according to the mode set (C3010).		
6.	Reset homing.	Settings: ● C4040/bit 4 = 0 ● C4040/bit 8 = 0 ⇨ Changeover to the ”Stand-by” state – C4045/Bit 0 = 1 (status bit *Stat1.PStatStdBy*) – C4045/Bit 3 = 0 (status bit *Stat1.PStatHome*)	

The zero position of the measuring system is known. The settings for homing are now completed.

Proceed as follows:

► Set absolute positioning (📖 123).

6.4.5 Setting absolute positioning/relative continuous positioning

Note!

- ► Absolute positioning is required for operation with a linear positioning axis.
- ► Relative positioning in the continuous measuring system is required for operation with a continuous positioning axis.
- ► Comply with the commissioning steps in the given order!

	Operation with a continuous positioning axis	Operation with a linear positioning axis
1.	Definition of positioning profile with **relative positioning in the continuous measuring system**. (📖 191) Set the following codes in the GDC parameter menu in **Positioning profiles → Profile 02**: ● C3095/2 = 1 (positioning profile mode "modulo pos.")	Definition of positioning profile with **absolute positioning**. (📖 191) Set the following codes in the GDC parameter menu in **Positioning profiles → Profile 02**: ● C3095/2 = 0 (positioning profile mode "absolute pos.")
	● C3100/2 (position for positioning profile 2) ● C3200/2 (speed for positioning profile 2) ● C3300/2 (acceleration for positioning profile 2) ● C3400/2 (deceleration for positioning profile 2)	
2.	Enable controller. (📖 241) ● Press the <F8> key in the GDC. ● Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the master control (PLC). ● Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. (No enable via master control!)	
3.	Start positioning profile (profile 02). Set the following codes in the GDC parameter menu in **Short setup → Operating mode**: ● C4010 = 3 (control interface C4040) ● C4040/Bit 5 = 1 (control bit *Ctrl1.PNoSet_2*, select positioning profile) ● C4040/bit 8 = 1 (control bit *Ctrl1.ProfEnable*, start positioning profile) ⇨ Changeover to the "Positioning" state – C4045/bit 4 = 1 (status bit *Stat1.PStatPos*) – C4045/Bit 10 = 1 (status bit *Stat1.ProfileBusy*) (Control bits see 📖 158, status bits see 📖 161)	
	The drive travels the relative distance specified under C3100/2.	**The drive approaches the absolute target position defined by C3100/2.**
4.	Reset positioning profile (profile 02). Settings: ● C4040/bit 5 = 0 ● C4040/bit 8 = 0 ⇨ Changeover to the "Stand-by" state – C4045/Bit 0 = 1 (status bit *Stat1.PStatStdBy*) – C4045/Bit 4 = 0 (status bit *Stat1.PStatPos*) – C4045/Bit 14 = 1 (status bit *Stat1.InTarget*) – C4045/Bit 15 = 1 (status bit *Stat1.DwellTime*)	
	Note: To traverse a positioning profile with relative positioning in the continuous measuring system again, repeat steps 3. and 4.	**Note:** To retravel a positioning profile with absolute positioning, ● change the value in C3100/2 (see step 1.); ● then continue with steps 3. and 4.

	Operation with a continuous positioning axis	Operation with a linear positioning axis
5.	Inhibit controller. ● Press the <F9> key in GDC. ● X6/SI1 **or**X6/SI2 must be open (LOW). ● C4040/bit 9 = 1 (*Ctrl1.Rsp*)	
6.	Set the operating mode required for the application via C4010 in the GDC parameter menu under **Short setup → Operating mode**. (📖 226)	

The settings for travel with absolute positioning or relative positioning in the continuous measuring system are completed.

Proceed as follows:

► Save parameters in the controller with C0003 = 1.

► Save parameter set with GDC in the parameter set file.

► Enable controller (📖 252).

► Optimise drive behaviour (📖 252).

6.5 Loading the Lenze setting

Note!

When loading the Lenze setting, all parameters are reset to the basic setting defined by Lenze. Settings that have been adjusted before get lost during this process!

In GDC, you can find the parameters and codes to be set in the parameter menu in **Load / Save / PLC**.

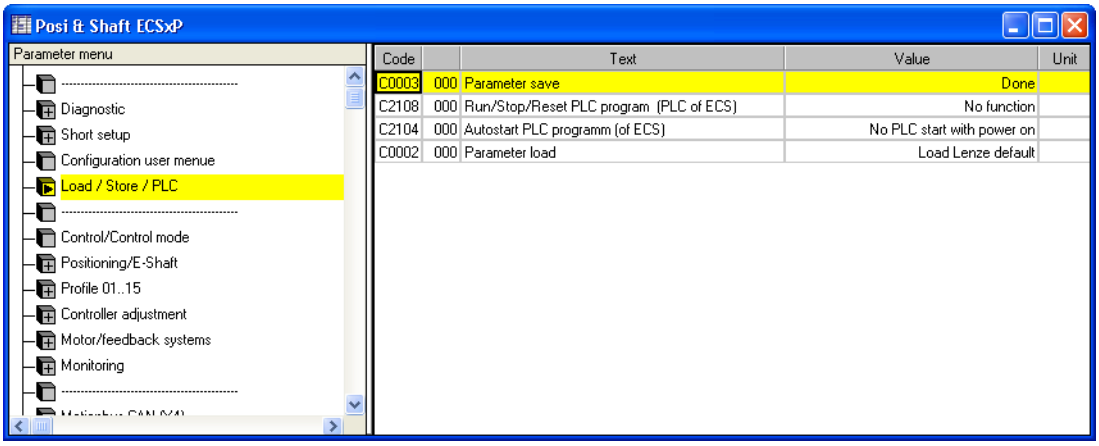


Fig. 6-17 GDC view: Parameter set management

Setting sequence

1. Stop the PLC program: C2108 = 2
2. Load the Lenze setting: C0002 = 0
3. Continue with 3.1 **or** 3.2.

   3.1 The 24-V supply voltage can be switched.

   A Switch off and on again the 24 V-supply voltage.

   B Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   3.2 The 24-V supply voltage cannot be switched.

   A Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   B Reset the PLC: C2108 = 3

4. Continue with basic settings from point 5 of the table on 📖 117.
5. Automatic start of the PLC program after power-up: C2104 = 1
6. Start the PLC program: C2108 = 1
7. Save parameter set: C0003 = 1

6.6 Setting of mains data

The GDC includes the parameters and codes to be set in the parameter menu under **Short setup → Mains**:

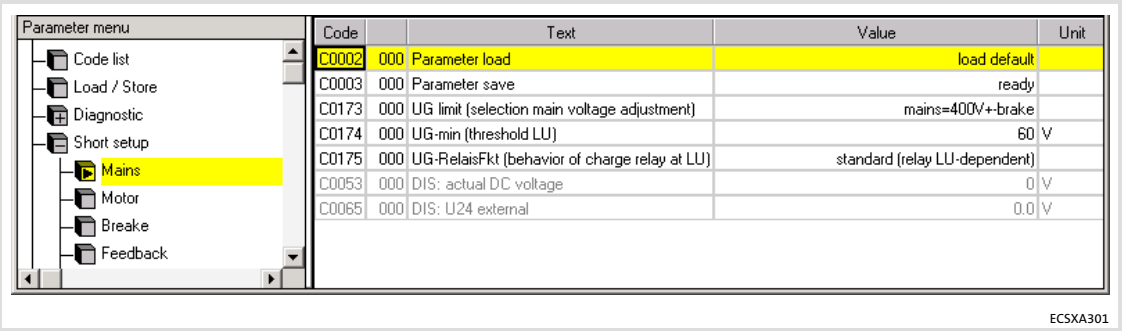


Fig. 6-18 GDC view: Short setup of the mains data

6.6.1 Selecting the function of the charging current limitation

The ECS axis modules are provided with a charging current limitation by means of charge resistors and charge relays. In the Lenze setting the charging current limitation is activated (C0175 = 1).

At mains connection the charge relay remains open for a while so that the charging current of the DC bus is limited by the charging resistors. When a certain voltage level has been reached, the charging resistors are short circuited by switching on (closing) the charge relay contacts.

Stop!

- In case of a mains supply via a power supply module **ECSxE** the entire DC bus is charged in a controlled way by a semiconductor circuit (thyristor) in the power supply module. Therefore, set **C0175 = 3** for the axis modules (charging current limitation inactive, charging resistor short-circuited).
  If the Lenze setting has been loaded via C0002, C0175 = 3 must be reset.
- Cyclic switching of the mains voltage at the power supply module can overload and destroy the charging current limitations of the axis modules if activated (C0175 = 1 or C0175 = 2).
  For this reason, allow a break of at least three minutes between two starting operations in case of cyclic mains switching over a longer period of time!

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 126
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

6.6.2 Setting the voltage thresholds

Note!

All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 126
			15	{1 V} 342		

6.7 Entry of motor data for Lenze motors

Note!

- The following only describes the parameter setting for Lenze motors! (If you use a motor from another manufacturer, see 📖 244.)
- If the Lenze setting has been loaded via C0002, the motor data must be re-entered.
- The freely available "GDC-Easy" does not provide the "Input assistant for motor data" which is described in the following so that you must enter the motor data manually (📖 244).

Parameter setting with the "Input assistant for motor data" of the GDC

1. Go to the GDC menu bar and select the **Tool → Motor data** menu item or click the button with the motor symbol in the tool bar:

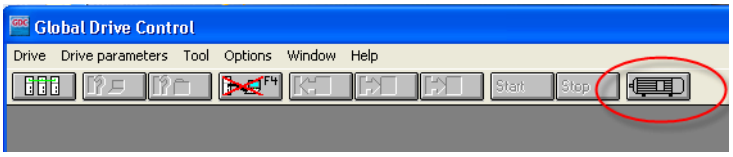


Fig. 6-19 GDC view: menu bar and tool bar

– The "Input assistant for motor data" opens:

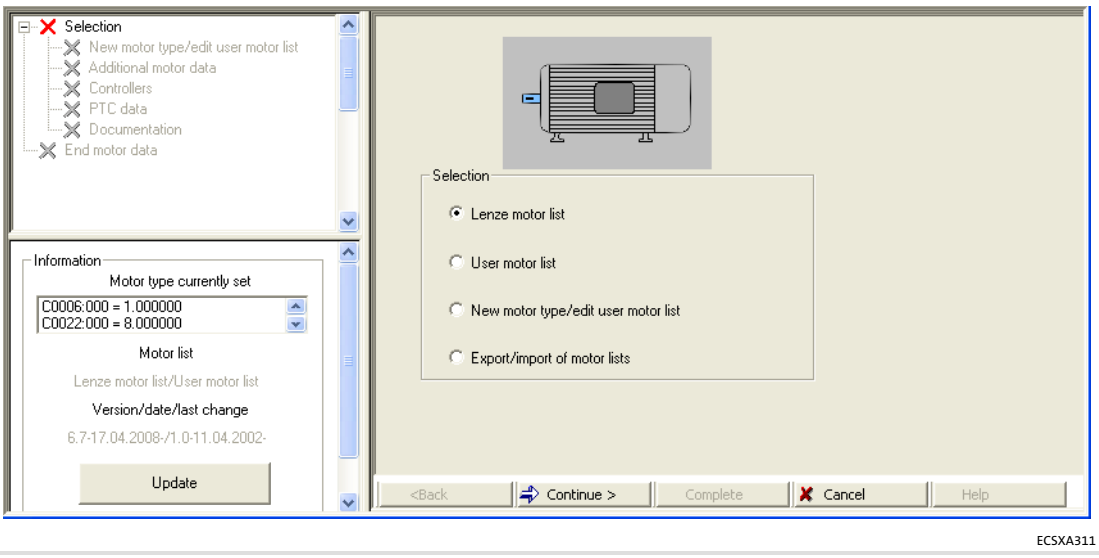


Fig. 6-20 GDC view: Selection of motor list

2. Select the "Lenze motor list" and click the [Continue] button.

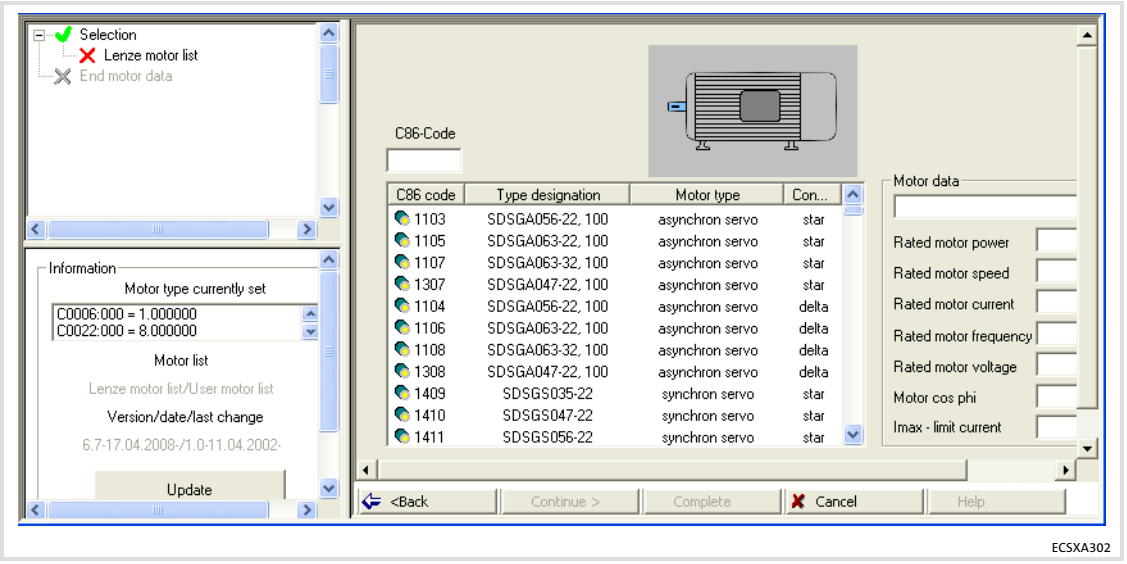


Fig. 6-21 GDC view: Motor selection

3. Select the connected motor from the list (see motor nameplate).
   – The corresponding motor data is displayed in the ”Motor data” fields on the right.
4. Click the [Complete] button.
   – The data is transferred to the controller. This process can take a few seconds and is confirmed by a message after being completed.

6.8 Holding brake configuration

Tip!

If you use a motor without a holding brake, you can skip this chapter.

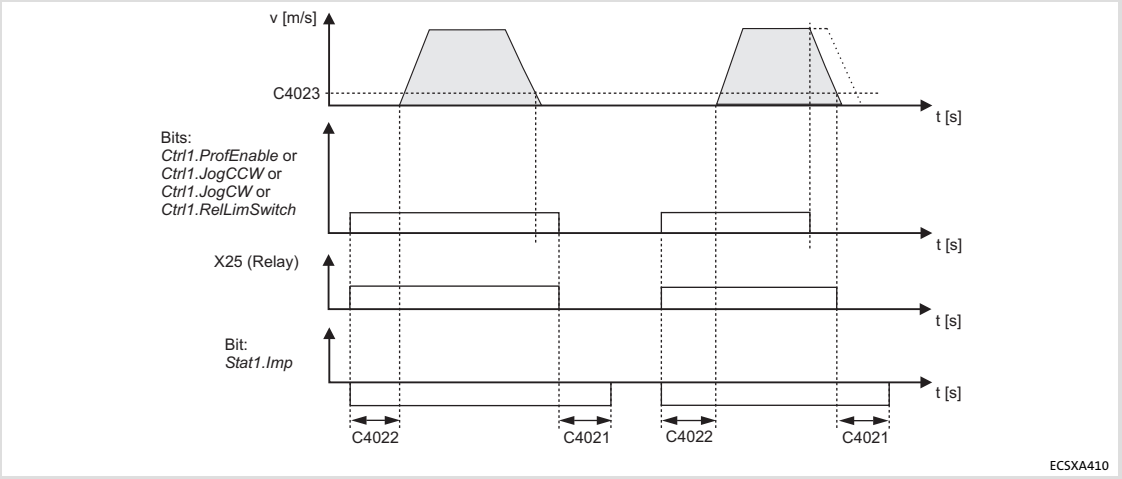


Fig. 6-22 Signal representation of the brake logic

Note!

If the brake logic is activated (C4020 = 1), the controller remains inhibited (control bit *Ctrl1.Rsp* = 1) until a start command is effected via the control bits *Ctrl1.ProfEnable*, *Ctrl1.JogCCW*, *Ctrl1.JogCW*or *Ctrl1.RelLimSwitch*, even if the controller is enabled via X6/SI1 and X6/SI2.

Even if the brake logic is switched off (C4020=0), the brake relay is triggered directly via the controller inhibit or internal pulse inhibit. When the controller is inhibited, the brake is to close.

In the GDC, the parameters or codes to be set can be found in the parameter menu under **Short setup → Brake**.

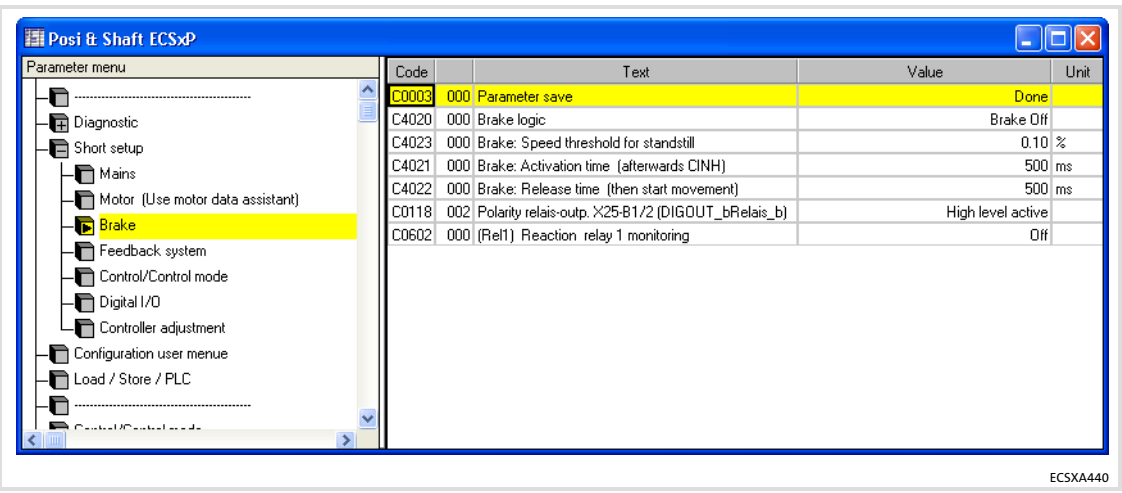


Fig. 6-23 GDC view: Short setup of the holding brake

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0420]	Encoder const.	512				Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev}	8192	Sets C0419 = 0 (”common”) if the value is altered.	
C4021	Brk: T_activ	500				Closing time of the motor holding brake (engagement time)	📖 130
			0	{1 ms}	5000		
C4022	Brk: T_releas	500				Release time of the motor holding brake (disengagement time)	📖 130
			0	{1 ms}	5000		
C4023	Brk: N_Thresh	0.1 %				Speed threshold for brake activation	📖 130
			0.00	{0.01 %}	10.00		
C0118						Polarity of the digital outputs (DIGOUT)	📖 172
1	DIGOUT pol	0		HIGH level active		X6/DO1	
2	DIGOUT pol	0		HIGH level active		X25/BD1, X25/BD2 (brake connection)	
			0	HIGH level active			
			1	LOW level active			
C0602	MONIT REL1	3				Fault response - open circuit monitoring of relay output X25	
			0	TRIP			
			2	Message			
			3	Off			
			4	FAIL-QSP			

6.9 Setting of the feedback system for position and speed control

The following feedback systems can be selected for position and speed control:

- Resolver (📖 133)
- TTL incremental encoder/SinCos encoder without serial communication (📖 136)
  - as position and speed encoder (📖 136)
  - as position encoder and resolver as speed encoder (📖 140)
- Absolute value encoder (Hiperface®, single-turn/multi-turn)
  - as position and speed encoder (📖 145)
  - as position encoder and resolver as speed encoder (📖 150)

The GDC includes the parameters or codes to be set in the parameter menu under **Short setup → Feedback system**:

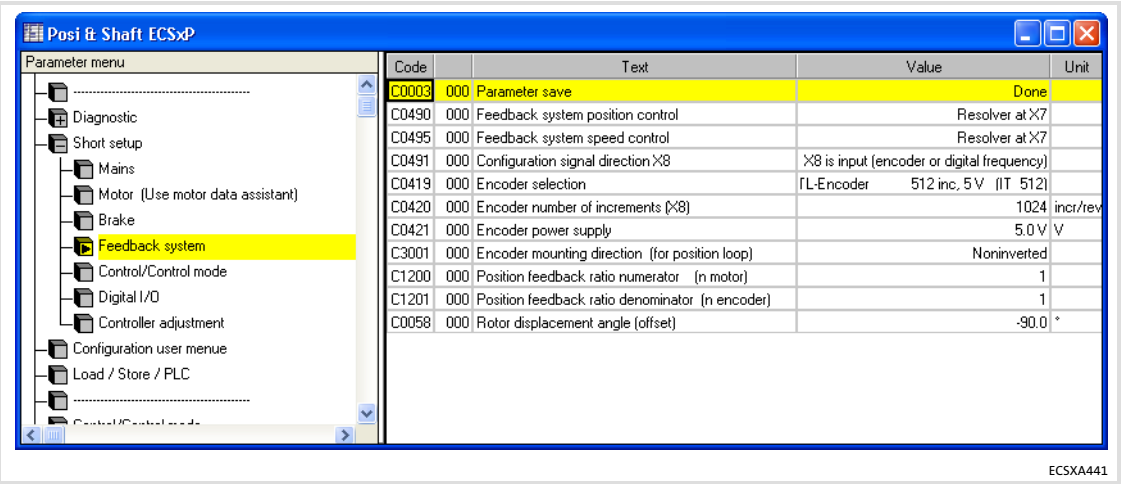


Fig. 6-24 GDC view: Commissioning of the feedback system

More parameters or codes for setting the feedback system can be found in the parameter menu under **Motor/feedback system → Feedback system**.

Note!

If the Lenze setting has been loaded via C0002, the feedback system must be reset.

6.9.1 Resolver as position and speed encoder

If a resolver is connected to X7 and used as a position and speed encoder, no settings are necessary.

Lenze setting:

- ► Resolver as position encoder: C0490 = 0
- ► Resolver as speed encoder: C0495 = 0

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive			
			1	Active			
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 133
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 133
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 257
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

6.9.2 Resolver as absolute value encoder

If the following requirements are met, a resolver (or single-turn absolute value encoder) can take over the function of a multi-turn absolute value encoder:

- When the axis module is switched off, the reference is known.
- Until the axis module is connected for the next time, it is ensured that the position of the machine part does not change (e.g. by using a brake). When switched off, the motor encoder may maximally move +/- half a revolution.
- C3002 = 1 (initialisation with saved actual position after power on)

At switch off, the actual position is saved fail-safe. After switch on, the actual position is re-initialised with this value. Turning the drive by maximally ± ½ revolution of the position encoder when the axis module is switched off will be detected and considered when the actual position is initialised (loaded).

General formula for the calculation of the maximum resolver rotation when the axis module is switched off, in particular for multi-pole resolvers (number of pole pairs > 1):

$$\text{Max. rotation} = \pm \left(\frac{180°}{\text{number\_of\_pole\_pairs}} \right)$$

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C3002	NoChangeOf Pos	0		Resolver as absolute value encoder	📖 135
			0 ChangeOfPos	After ”mains off/on”, homing has to be carried out. The actual position is initialised with the value ”0”.	
			1 NoChangeOfPos	The actual position value is initialised with the position value at ”Mains off” and is used further at ”Mains on”. Homing is not required. **Note:** With ”Mains off” the feedback system must rotate less than ± 0.5 revolutions.	

6.9.3 TTL/SinCos encoder as position and speed encoder

If an incremental encoder or a SinCos encoder without serial communication is connected to X8 and used for position and speed control, comply with the following setting sequence:

1. Select encoder for position and speed control.
   – Incremental encoder (TTL encoder): C0490 and C0495 = 1
   – SinCos encoder without serial communication: C0490 and C0495 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
3. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.
The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
4. Set the encoder mounting position.
   – C3001 = 0: normal (direction of rotation CW with regard to direction of rotation of the motor)
   – C3001 = 1: inverse (direction of rotation CCW with regard to direction of rotation of the motor)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with • resolver: -90° • hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0095]	Rotor pos adj	0			Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive		
			1	Active		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 136 📖 145
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 136 📖 145
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 136 📖 145
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 132
			0	X8 is input	Use as encoder feedback or master frequency input for positioning profile mode C3095/x = 30 (electrical shaft with setpoint via X8)	
			1	X8 is output	Use as encoder feedback or master frequency output during master operation (electrical shaft as setpoint via X8)	
C3001	EncDirInv	0			Position encoder mounting position	
			0	Normal (direction of rotation CW)	Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)		

6.9.4 TTL/SinCos encoder as position encoder and resolver as speed encoder

A TTL incremental encoder connected to X8 or a SinCos encoder without serial communication can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select TTL/SinCos encoder as position encoder.
   – Incremental encoder (TTL encoder): C0490 = 1
   – SinCos encoder without serial communication: C0490 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
4. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.
The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1			Number of pole pairs of resolver	
			1	{1} 10		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0095]	Rotor pos adj	0		Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0 Inactive		
			1 Active		
C0414	DIS: ResQual.			Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 133
			0.00 {0.01} 1,60		
[C0416]	Resolver adj.	5		Resolver excitation amplitude	📖 133
			0 100 %		
			1 80 %		
			2 68 %		
			3 58 %		
			4 50 %		
			5 45 %		
			6 40 %		
			7 37 %		
[C0417]	Resolver cor.	0		Resolver adjustment	📖 257
			0 Ready		
			1 Start adjustment		
			2 Loading default values		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 136 📖 145
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 136 📖 145
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 136 📖 145
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0491]	X8 in/out	0			Function of X8	📖 132
			0	X8 is input	Use as encoder feedback or master frequency input for positioning profile mode C3095/x = 30 (electrical shaft with setpoint via X8)	
			1	X8 is output	Use as encoder feedback or master frequency output during master operation (electrical shaft as setpoint via X8)	
C3001	EncDirInv	0			Position encoder mounting position	
			0	Normal (direction of rotation CW)	Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)		

6.9.5 Absolute value encoder as position and speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

Note!

For initial commissioning of an absolute value encoder, after an encoder, controller or motor replacement, or for modifications regarding the mechanics, carry out a positioning process with the positioning profile mode ”Set reference” (📖 119).

An absolute value encoder mounted on the motor shaft can be used without an additional resolver as position and speed encoder.

1. Select absolute value encoder for position and speed control.
   – Single-turn encoder: C0490 and C0495 = 3
   – Multi-turn encoder: C0490 and C0495 = 4
   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

If an encoder (TTL, SinCos, absolute value encoder) is used, for C0490 and C0495 only identical settings are permissible.

2. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411
   The encoder data (C0420, C0421, C0427) are set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with high speed and high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► Do not parameterise the codes C0420, C0421 and C0427!

3. Set the encoder mounting position.
   – C3001 = 0: normal (same direction of rotation as direction of rotation of motor)
   – C3001 = 1: inverse (opposite direction of rotation to direction of rotation of motor)
4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 132
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 132
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0095]	Rotor pos adj	0			Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive		
			1	Active		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 136 📖 145
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 136 📖 145
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 136 📖 145
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 132
			0	X8 is input	Use as encoder feedback or master frequency input for positioning profile mode C3095/x = 30 (electrical shaft with setpoint via X8)	
			1	X8 is output	Use as encoder feedback or master frequency output during master operation (electrical shaft as setpoint via X8)	
C3001	EncDirInv	0			Position encoder mounting position	
			0	Normal (direction of rotation CW)	Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)		

6.9.6 Absolute value encoder as position encoder and resolver as speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

An absolute value encoder Hiperface® interface connected to X8 can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select absolute value encoder as position encoder.
   – Single-turn encoder: C0490 = 3
   – Multi-turn encoder: C0490 = 4
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411

   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive			
			1	Active			
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 133
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 133
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 257
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 136 📖 145
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 136 📖 145
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 136 📖 145
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0491]	X8 in/out	0			Function of X8	📖 132
			0	X8 is input	Use as encoder feedback or master frequency input for positioning profile mode C3095/x = 30 (electrical shaft with setpoint via X8)	
			1	X8 is output	Use as encoder feedback or master frequency output during master operation (electrical shaft as setpoint via X8)	
C3001	EncDirInv	0			Position encoder mounting position	
			0	Normal (direction of rotation CW)	Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)		

6.10 Select control interface (operating mode)

The control interface between master control (PLC) and ECS drive system serves to...

- control the drive;
- control the positioning sequence;
- transfer setpoints and actual values.

Process data are cyclically transmitted from the higher-level control (PLC) to the drive via the control interface and the drive sends process data back to the control.

You can select from the following fieldbus interfaces under C4010:

- Automation interface (AIF) X1 for fieldbus communication modules
  - C4010 = 2: 4 process data words with parameter data channel
  - In conjunction with the EMF2192IB EtherCAT communication module, sync-controlled via the terminal X6/DI1.
- MotionBus (CAN) connection X4
  - C4010 = 0: CAN process data object 1 (PDO1, sync-controlled)
  - C4010 = 5: CAN process data object 3 (PDO3, cyclic)
- System bus (CAN) connectionX14
  - C4010 = 1: CAN-AUX process data object 1 (PDO1, sync-controlled)
  - C4010 = 4: CAN-AUX (PDO2, cyclic)

The GDC contains the code C4010 in the parameter menu under **Short setup → Control/Operating mode**.

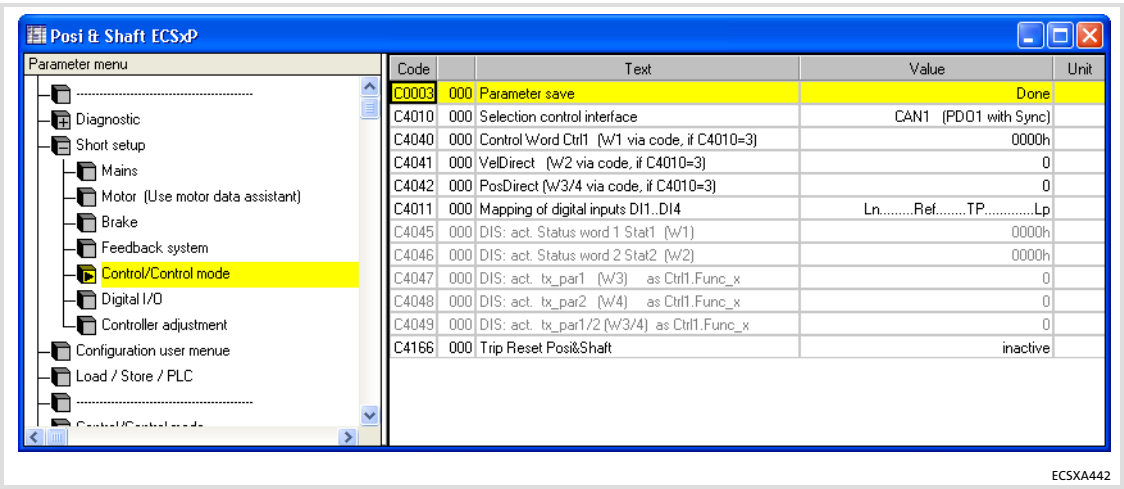


Fig. 6-25 GDC view: Select short setup - operating mode

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C4010]	Ctrl_Interf	0		Selection of the control interface	📖 155
			0 CAN1 (PDO1 with Synch)	MotionBus (CAN) X4 (CAN PDO1, sync-controlled)	
			1 CANaux1 (PDO1 with Synch)	System bus (CAN) X14 (CAN-AUX PDO1, sync-controlled)	
			2 AIF (EtherCAT)	Automation interface (AIF) X1 with EMF2192IB EtherCAT communication module	
			3 C4040 (control via codes)	Control via C4040	
			4 CANaux2 (PDO2 cyclic)	Lenze I/O modules of the EPM series or Lenze Drive PLC via CAN-AUX (PDO2, cyclically)	
			5 CAN3 (PDO3 cyclic)	MotionBus (CAN) X4 (CAN PDO3, cyclically)	

Control with codes via parameter communication

Note!

C4010 = 3 (control via C4040), to control the drive for test and commissioning purposes via codes in the GDC. The following codes serve to manually define the process data words for test purposes:

- ► C4040 control word Ctrl1 (Word 1)
- ► C4041 VelDirect (Word 2)
- ► C4042 PosDirect (Word 3/4)

Codes C4040, C4041 and C4042 can be found in the GDC parameter menu under **Short setup → Control/Operating mode**.

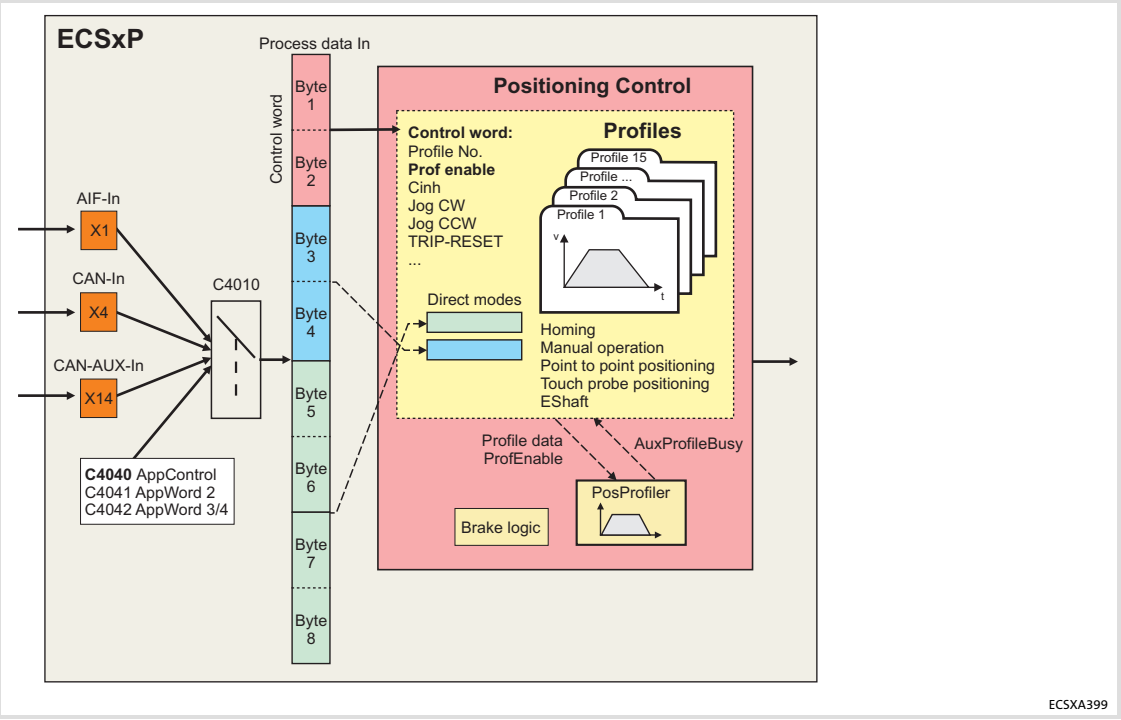


Fig. 6-26 Control interface

6.11 Process data to the axis module (control word Ctrl1 and setpoints)

Process data is transmitted cyclically to the drive via the control interface set under C4010 with a data width of 8 bytes or 4 words.

The telegram structure of the 8 byte process data to the drive is the same for all selectable control interfaces. In addition to the control word Ctrl1 (Word 1), Word 2, Word 3 and Word 4 are available for setpoints.

Control bit 15 of the control word Ctrl1 serves to set the assignment of the words 2 ... 4.

Assignment of the process data to the drive:

	Word 1		**Word 2**		**DWord (word 3 + word 4)**			
	LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
	Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
Ctrl1.Bit15 = 0	Control word Ctrl1		rx_par1		rx_par2		rx_par3	
Ctrl1.Bit15 = 1			VelDirect		PosDirect			

6.11.1 Control word Ctrl1

The control word Ctrl1 contains the following control bits:

Bit	Name	Level	Meaning
0	Func1	HIGH active	Signal selection tx_par1/2, binary coded 2^0
1	Func2	HIGH active	Signal selection tx_par1/2, binary coded 2^1
2	Func4	HIGH active	Signal selection tx_par1/2, binary coded 2^2
3	Quick stop (QSP)	HIGH active	Quick stop (QSP): ● 0 = No QSP active ● 1 = QSP active – The drive is braked to a standstill within the QSP deceleration time (C0150). – Change to ”Stand-by”.
4	PNoSet_1	HIGH active	Selection of the positioning profile (binary coded 2^0)
5	PNoSet_2	HIGH active	Selection of the positioning profile (binary coded 2^1)
6	PNoSet_4	HIGH active	Selection of the positioning profile (binary coded 22)
7	PNoSet_8	HIGH active	Selection of the positioning profile (binary coded 23)
8	ProfEnable	HIGH active	Start positioning profile: ● 0 = brakes to standstill with current QSP deceleration time (C0150) – Change to ”Stand-by”. – Completing the positioning profiles with profile mode ”constant travel”. – Activating the brake when brake logic is active. ● 1 = start positioning profile (*PNoSet_x* > 0) – If status bit *Stat1.ProfileBusy* = 0 **and** *Stat2.AuxProfileBusy* = 0, the positioning profile concerned can be started immediately by the selection of a new profile number (*PNoSet_x*).
9	CINH	HIGH active	Controller inhibit (CINH) - change to ”Stand-by”: ● 0 = deactivation of ctrl. inhibit ● 1 = activation of ctrl. inhibit – The power output stages are inhibited. – All internal controllers are reset.
10	TripSet	HIGH active	Change to ”Trouble”: ● The drive is decelerated to standstill within the QSP deceleration time (C0150). ● 0 = do not set fault message ● 1 = set fault message
11	TripReset	Rising edge	Fault message reset - change to ”Stand-by”: ● 0-1 edge = reset fault message – This function resets an active fault message provided that the cause of the fault has been removed. If the cause of the fault is still active, there will be no reaction.
12	JogCCW	HIGH active	Manual jog in negative direction of rotation (CCW) ● 0 = change to ”Stand-by” ● 1 = manual jog in negative direction of rotation (CCW), ”ManualJog” status
13	JogCW	HIGH active	Manual jog in positive direction of rotation (CW) ● 0 = change to ”Stand-by” ● 1 = manual jog in positive direction of rotation (CW), ”ManualJog” status
14	RelLimSwitch	HIGH active	Activation of ”retracting on/off switch” function.
15	PosDirect	HIGH active	Selection for setpoints in words 2 ... 4 of the process input data: ● 0 = rx_par1, rx_par2, rx_par3 ● 1 = VelDirect, PosDirect for direct positioning (C3095/x = 110 ... 113)

6.11.2 Setpoint data words to the controller (VelDirect, PosDirect, rx_par1..3)

- The data word ”rx_par1” is used for speed override with ECS ”Posi&Shaft”.
- The data words ”rx_par2” and ”rx_par3” are currently not used with ESC ”Posi and Shaft”.
- The data words ”VelDirect” and ”PosDirect” are used for the positioning modes with ”direct positioning” (C3095/x = 110 ... 113, 📖 198). The control bit 15 in the control word Ctrl1 must be set to use the data words as VelDirect and PosDirect.

6.12 Process data from the axis module (status words and actual values)

The ECSxP axis module can return process data cyclically to the master via the control interface set under C4010 with a data width of 8 bytes or 4 words. Two status words consisting of status bits and monitor data (actual values) are transmitted.

Structure of the process data from the drive

The telegram structure of the 8 byte process data from the drive is the same for all selectable control interfaces.

Assignment of the process data from the drive:

Word 1		Word 2		DWord (word 3 + word 4)			
LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
Status word Stat1		Status word Stat2		tx_par1		tx_par2	

6.12.1 Status word 1 (Stat1), status word 2 (Stat2)

The status words (Stat1) and (Stat2) each consist of 16 status bits and are transmitted in Word 1 and Word 2 of the process data from the drive to the master control. In addition, they can be read out via codes C4045 and C4546 and displayed in bits in the GDC.

The status word 1 (Stat1) consists of the following status bits:

Bit	Name	Level	Meaning
0	PStatStdBy	HIGH active	”Stand-by” status
1	PStatTrouble	HIGH active	”Trouble” status
2	PStatManJog	HIGH active	”ManualJog” status
3	PStatHome	HIGH active	”Homing” status
4	PStatPos	HIGH active	”Positioning” status
5	IMP	HIGH active	1 = pulse inhibit (DCTRL-IMP) is active, inverter is inhibited
6 7 8 9	PNoAct_1 PNoAct_2 PNoAct_4 PNoAct_8	HIGH active	4 bits (binary coded) for display of the profile number of the active positioning profile. **Note:** In addition, the profile number is displayed under C3052.
10	ProfileBusy	HIGH active	1 = positioning is active
11	GlobalErr		1 = fault is active ⇨ fault number is requested for diagnostics
12	HomeBusy	HIGH active	1 = homing is active
13	HomPosAvail	HIGH active	Message ”Reference known”
14	InTarget	HIGH active	1 = The actual position is in the target window (C3034) around the target position (message: target position reached)
15	DwellTime	HIGH active	1 = the dwell time (C3035) has elapsed. **Note:** Bit is reset to ”0” when positioning starts.

The status word 2 (Stat2) consists of the following status bits:

Bit	Name	Level	Meaning
0	Mmax	HIGH active	1 = "Maximum torque" reached (value: C0057 x C3910)
1	Imax	HIGH active	1 = maximum current reached (value: C0022)
2	Nmin	HIGH active	1 = value falls below speed threshold (C3017) **Note:** Hysteresis is set with C3018.
3	ProfMlimAct	HIGH active	1 = Profile function torque reduction is active
4	FollowErrWarn	HIGH active	1 = Following error tolerance C3030 for warning has exceeded
5	CANSyncInWin	HIGH active	Control program synchronisation: 1 = Drive is synchronised to CAN sync telegram
6	ProfCont	HIGH active	1 = profile continuation after profile stop possible
7	SwLimErr	HIGH active	1 = software limit position reached
8	QspIn	HIGH active	1 = quick stop active
9	AuxProfileBusy	HIGH active	1 = touch probe positioning active
10 ... 12			Not assigned
13 14 15	Func1 Func2 Func4	HIGH active	3 bits (binary coded) for display of the monitor data transmitted in tx_par1/2 (Word 3/4) in the same process data telegram.

6.12.2 Device status

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only	📖 163
			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		

6.12.3 Monitor data words from the controller (tx_par1 und tx_par2)

The monitor data words ”tx_par1” and ”tx_par2” can be assigned with various display values via control bits in the control word Ctrl1:

- Control bit 0 (”*Ctrl1-Func1*”)
- Control bit 1 (”*Ctrl1-Func2*”)
- Control bit 2 (”*Ctrl1-Func4*”)

The following assignment of the monitor data words can be set via the control bits:

Control bits 0..2 in the control word Ctrl1 [binary]	Monitor data word	
	tx_par1	tx_par2
...000	Actual position (2^{16} == 1 position encoder revolution)	
...001	FollowErr (2^{16} == 1 position encoder revolution)	
...010	Actual speed value n_{act} Scaling: 2^{14} == C0011 (maximum speed)	Actual torque M_{act} Scaling: 2^{14} == C0057 (calculated maximum torque)
...011	Not assigned	
...100	Not assigned	
...101	Fault number	DCTRL_wStat (C0150) Bit assignment: See code list
...110	Profile generator state (C3066) Bit assignment: See code list	Not assigned
...111	AIn1 Bit assignment ● Bits 0 ... 12: image of analog input ● Bits 13, 14, 15: 0 (no function)	DigIn Bit assignment ● Bit 0 (x6/DI1): image of digital input 1 ● Bit 1 (X6/DI2): image of digital input 2 ● Bit 2 (X6/DI3): image of digital input 3 ● Bit 3 (x6/DI4): image of digital input 4 ● Bits 4 ... 15: 0 (no function)

6.13 Entry of machine parameters

In GDC you will find the codes for machine parameters, like for example the deceleration time for quick stop (QSP) or maximum speeds in the parameter menu under **Positioning/E-Shaft→ Machine parameters**.

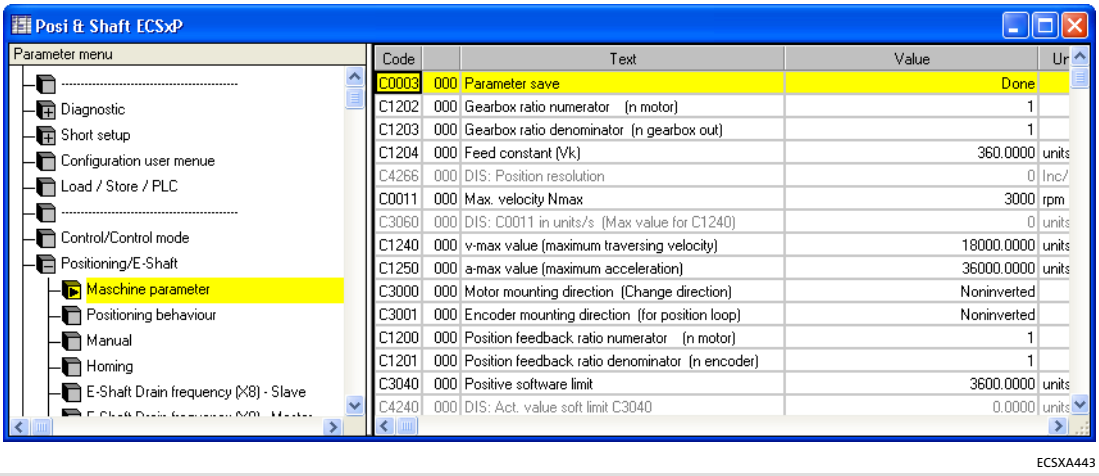


Fig. 6-27 GDC view: Short setup, entry of machine parameters

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0011	Nmax	3000			Maximum speed	
			500 {1 rpm}	16000	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 (CINH)!**	
C0105	QSP Tif	0.0			Deceleration time for quick stop (QSP)	243
			0.000 {0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	
C1202	Gear num	1			Gearbox factor numerator The gearbox ratio specifies the number of revolutions of the motor axis at which the load revolves exactly once. • i = Z2 / Z1 (ratio of the number of teeth or circumferences) • i = n1 / n2 (ratio of the speeds)	103
			1 {1}	65535		
C1203	Gear denom	1			Gearbox factor denominator	103
			1 {1}	65535		
C1204	Feed const	360.0			The feed constant specifies the path (in units) which the load (slide) covers in one revolution.	103
			0.0001 {0.0001 units/rev}	214000.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1240	Vel_max	18000.0				Max. permissible speed of the load (slide). **Note:** Enter the motor speed resulting from *Vel_max* plus 10% reserve in C0011!	📖 103
			0.0001	{0.0001 units/s}	214000.0000		
C1250	Acc_max	36000.0				Max. acceleration **Note:** This parameter among other things depends on the motor torque and the moment of inertia of the entire mechanics driven during the positioning process!	📖 103
			0.0001	{0.0001 units/s²}	214000.0000		
C3000	MotDirInv	0				Motor mounting position	
			0	Normal (direction of rotation CW)			
			1	Inverse (direction of rotation CCW)			
C3001	EncDirInv	0				Position encoder mounting position	
			0	Normal (direction of rotation CW)		Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)			
C3017	Lim.n=0-Flag	0.10				Limit value for speed, (n_{min} signal)	📖 231
			0.01	{0.01 %}	100.00	If the value falls below the limit value, the status bit *Stat2.Nmin* is set to 1.	
C3018	Hyst.n=0-Flag	0.10				Hysteresis for speed (n_{min} signal)	📖 231
			0.00	{0.01 %}	100.00		
C3030	FollErrWarn	360.0				Following error tolerance (warning)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the "FollowErr" warning will be triggered. The status bit *Stat2.FollowErrWarn* is set to "1" (TRUE). **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	
C3031	FollowErrQSP	720.0				Following error tolerance (Fail-QSP)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the Fail-QSP "FollowErr" fault is triggered and the drive is stopped through the QSP ramp. **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	
C3034	Target Window	360.0				Total width of the target position window Layout: Half of the window width before and after the target position	📖 229
			-0.0000	{0.0001 units}	65536.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3035	DwellTime	50				Dwell time after end of profile	232
			0	{1 ms}	65535	Time required from positioning profile end (setpoint generator has reached target position) to the setting of status bit *Stat1.DwellTime* = 1	
C3036	BounceTime	0				Debounce time for touch probe input	
			0	{0.001 ms}	65535		
C3040	SW-LimPos	3600.0				Positive software limit position	237
			0.0000	{0.0001 units}	214000.0000		
C3041	SW-LimNeg	-3600.0				Negative software limit position	237
			-214000.0000	{0.0001 units}	0.0000		
C4018	MmaxVal	100.0				Limit value for max. torque (M_{max})	
			0.01	{0.01 %}	100.00	● 100 % = maximum torque from C0057 ● The value in C4018 is overwritten by the following functions: – Torque limitation after positioning 208 – Homing modes 14 and 15 (C3010) 186	
C4060	ES_NOffs					Only for "electrical shaft" function: default value (in increments) for speed-proportional angular trimming relating to 15000 rev./min. **Note:** Only change value when the controller is at standstill!	235
			-655360	{1 inc}	655360		

6.14 Configuring the digital inputs and outputs

In the GDC parameter menu under **Short setup → Digital inputs/outputs** you'll find the codes for setting the signal assignment of the digital inputs X6/DI1 ... DI4 (C4011) and the digital output X6/DO1 (C4012).

- The digital inputs X6/DI1 ... DI4 and the control bits of the control word Ctrl1 have the same priority. Both signals are OR'd. If a digital input or the corresponding bit is set in the control word, the control signal is transmitted as set to the drive.
- The RDY signal (ready for operation) is fixedly assigned to the digital output X6/DO1.

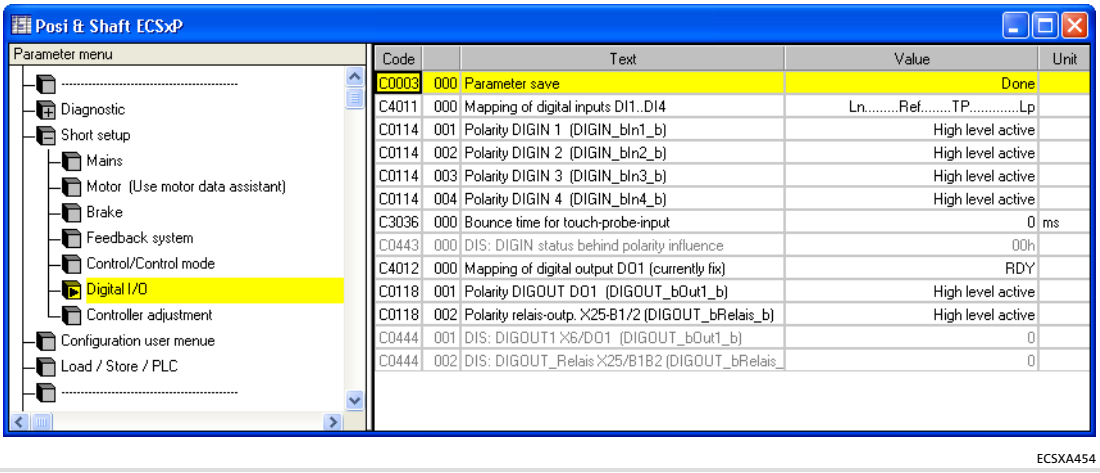


Fig. 6-28 GDC view: Codes for configuring the digital inputs and outputs

Note!

When using fail-safe limit switches (NC contacts), set the polarity of the digital inputs with C0114/x = 1 (LOW level active).

The OR operation of the digital inputs and control bits is implemented as of Posi & Shaft V2.0 (A-SW). Up to Posi & Shaft V1.x, the digital inputs had priority over the control bits.

Code		Possible settings						IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection						
[C4011]	DigIn_map	0						Assignment of the digital inputs X6/DI1 ... DI4 Acceptance only if the controller is inhibited (status word *Stat1.Imp* = 1).	168
				DI1	**DI2**	**DI3**	**DI4**	Ix: Input x is not assigned with a function. JogCW: Manual jog CW JogCCW: Manual jog CCW Ln: Limit switch in negative direction Lp: Limit switch in positive direction PNo1: Selection of positioning profile bit 2^0 PNo2: Selection of positioning profile bit 2^1 PNo4: Selection of positioning profile bit 2^2 PNo8: Selection of positioning profile bit 2^3 Penb: Positioning profile activated (enable) Qsp: Quick stop (QSP) R: TRIP-RESET Ref: Reference switch TP: Touch probe input	
			0	Ln	Ref	TP	Lp		
			1	PNo1	PNo2	PNo4	PNo8		
			2	PNo1	PNo2	PNo4	PEnb		
			3	PNo1	PNo2	R	PEnb		
			4	Qsp	JogCW	Tp	JogCCW		
			5	I1	I2	TP	I4		
			6	Ln	Qsp	Penb	Lp		
			7	PNo1	PNo2	TP	Penb		
			8	PNo1	PNo2	Ref	Penb		
			9	Ln	PNo1	PNo2	Lp		
			10	Ln	JogCW	JogCCW	Lp		
			11	Ln	Ref	Penb	Lp		
			12	Ln	Ref	Qsp	Lp		
			13	Ln	Qsp	TP	Lp		
[C4012]	DigOut_map	0						Assignment of digital output X6/DO1 Acceptance only if the controller is inhibited (status word *Stat1.Imp* = 1).	168
			0	RDY				Rdy: Drive is ready for operation.	

6.14.1 Digital inputs for operation with continuous positioning axis

Set C4011 = 5 in the parameter menu of the GDC under **Short setup → Digital I/Os**.

Assignment of the inputs X6/DI1 ... DI4 when C4011 = 5:

Digital input	Function	Description
DI1	-	Input is not assigned with a function.
DI2	-	Input is not assigned with a function.
DI3	Touch probe (TP)	HIGH level active
DI4	-	Input is not assigned with a function.

The following overview shows the assignment C4011 = 5.

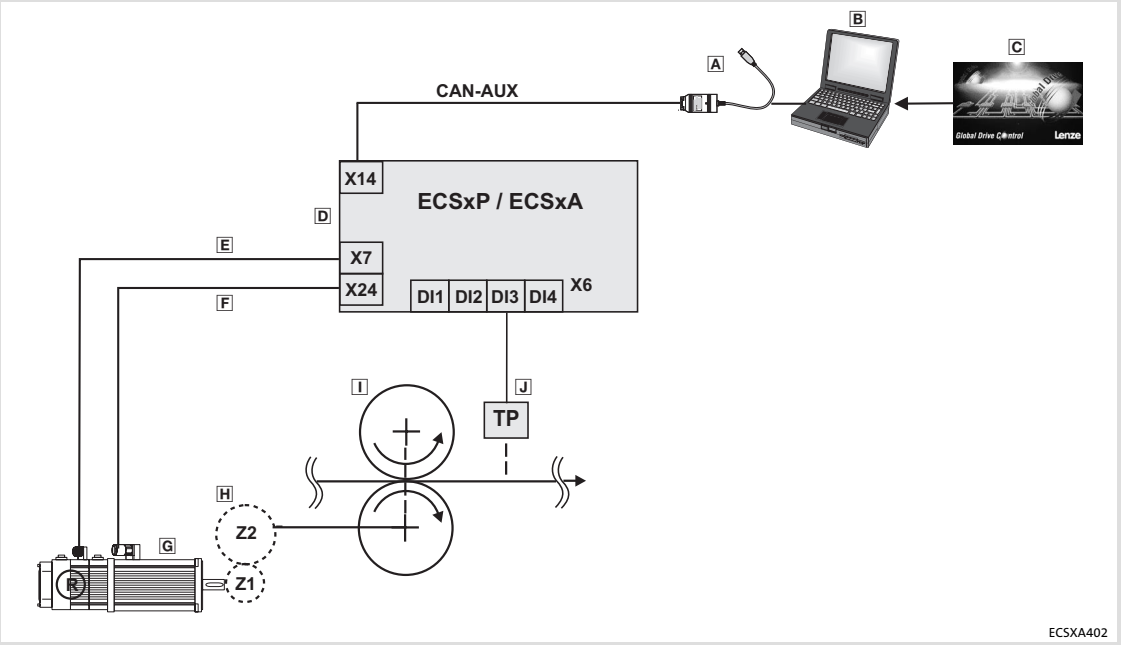


Fig. 6-29 Overview of continuous positioning axis

- A PC system bus adapter (EMF2173IB/2177IB) with connecting cable
- B PC/laptop
- C Lenze parameter program "Global Drive Control" (GDC)
- D ECSxP or ECSxA axis module with "Posi and Shaft" application program
- E Speed / position feedback
- F Motor power connection
- G Servo motor with resolver feedback
- H Gearbox with transmission ratio i = Z2 / Z1 (ratio of the tooth numbers or circumferences) or i = n1/n2 (ratio of the speeds)
- I Kinematics with unlimited travel range (roll feed, rotary table)
- J Touch probe sensor

Note!

The assignment of further control and power connection is described in chapter "Electrical installation" (📖 48).

6.14.2 Digital inputs for operation with linear positioning axis

Set C4011 = 0 in the parameter menu of the GDC under **Short setup → Digital I/Os**.

Assignment of the inputs X6/DI1 ... DI4 when C4011 = 0:

Digital input	Function	Description
DI1	Negative limit switch	LOW level active
DI2	Reference switch	HIGH level active
DI3	Touch probe (TP)	HIGH level active
DI4	Positive limit switch	LOW level active

The following overview shows the assignment of C4011 = 0.

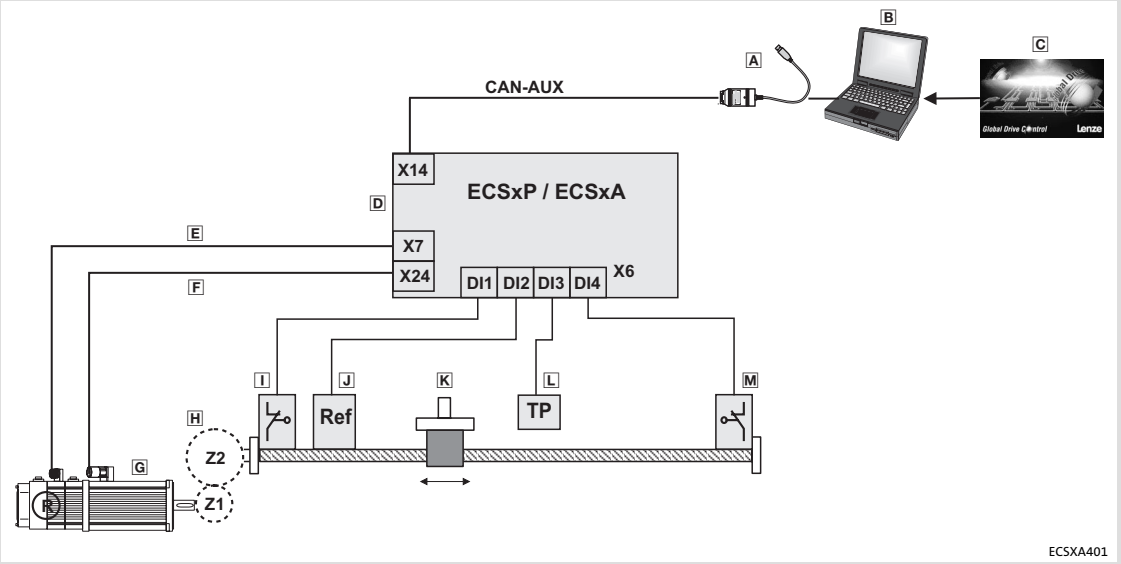


Fig. 6-30 Overview - linear positioning axis

- A PC system bus adapter (EMF2173IB/2177IB) with connecting cable
- B PC/laptop
- C Lenze parameterisation program "Global Drive Control" (GDC)
- D ECSxP or ECSxA axis module with "Posi and Shaft" application program
- E Speed / position feedback
- F Motor power connection
- G Servo motor with resolver feedback
- H Gearbox with transmission ratio i = Z2 / Z1 (ratio of the tooth numbers or circumferences) or i = n1/n2 (ratio of the speeds)
- I Negative hardware limit switch
- J Reference switch
- K Kinematics with limited travel range (spindle, linear unit)
- L Touch probe sensor
- M Positive hardware limit switch

Note!

The assignment of further control and power connection is described in chapter "Electrical installation" (📖 48).

6.14.3 Setting the polarity of digital inputs and outputs

The polarity can be set for each digital input and output. This determines whether the input or output is HIGH active or LOW active.

The following are available:

- 4 digital inputs (X6/DI1 ... DI4)
- 1 digital output (X6/DO1)
- 1 relay output (X25/BD1, BD2)

Note!

If the touch probe function or synchronisation via digital input X6/DI1 are used, the set polarities are not taken into account.

The GDC contains codes for setting the polarity of digital inputs and outputs in the parameter menu under **Terminal I/O**:

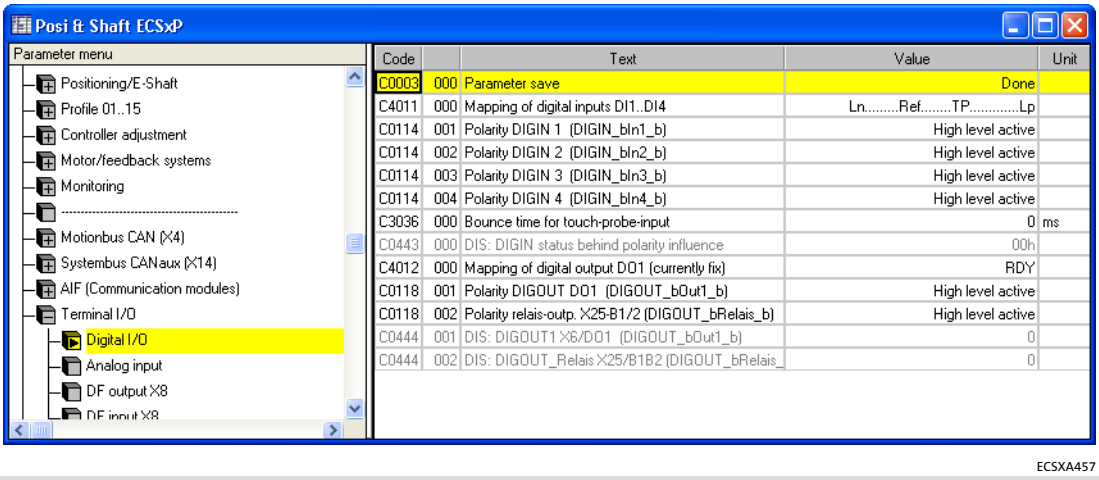


Fig. 6-31 GDC view: Setting of the polarity of digital inputs and outputs

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0114				Polarity of the digital inputs	172
1	DIGIN pol	0	HIGH level active	X6/DI1 (DIGIN_bIn1_b)	
2	DIGIN pol	0	HIGH level active	X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0	HIGH level active	X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0	HIGH level active	X6/DI4 (DIGIN_bIn4_b)	
			0 HIGH level active		
			1 LOW level active		
C0118				Polarity of the digital outputs (DIGOUT)	172
1	DIGOUT pol	0	HIGH level active	X6/DO1	
2	DIGOUT pol	0	HIGH level active	X25/BD1, X25/BD2 (brake connection)	
			0 HIGH level active		
			1 LOW level active		

6.15 Setting of manual control parameters

Stop!

Machine parts can be damaged or destroyed!

The drive can travel into a mechanical limit during manual jog if

► no reference is known (status bit *Stat1.HomePosAvailable* = 0, 📖 161).

► no software limit positions are set (📖 237).

The ”manual jog” function is used to run the drive in inching mode, e. g. for cleaning or changing the tool. The function is activated by setting the control bits *Ctrl1.JogCW* = 1 or *Ctrl1.JogCCW* = 1 (📖 158).

The control signals for ”manual jog” can be linked to the digital input terminals to activate the manual jog, for instance, via pushbuttons (📖 168).

The GDC includes the codes for setting the manual control parameters in the parameter menu under **Positioning/E-Shaft → Manual jog**.

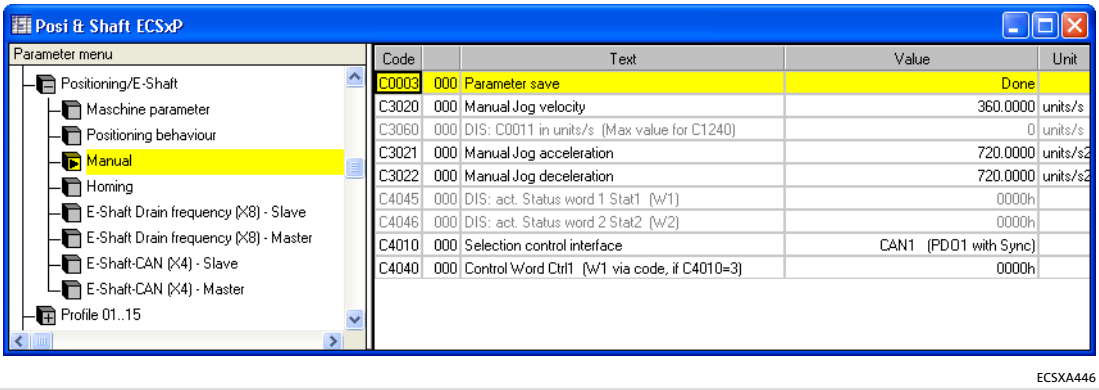


Fig. 6-32 GDC view: Short setup - entry of manual control parameters

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3020	ManualVel	360.0			Traversing speed for manual jog (inching mode)	📖 173
		0.0001	{0.0001 units/s}	214000.0000		
C3021	ManualAcc	720.0			Acceleration for manual jog (inching mode)	📖 173
		0.0001	{0.0001 units/s²}	214000.0000		
C3022	ManualDec	720.0			Deceleration for manual jog (inching mode)	📖 173
		0.0001	{0.0001 units/s²}	214000.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3060	Max for C1240					Nmax (C0011) converted from rpm to units/s based on the machine parameters C1202, C1203 and C1204. The speed indicated here is the max. possible machine speed due to the set machine parameters and the maximum speed nmax. Thus, the setting of the maximum machine speed (Vmax) under C1240 is only sensible up to this amount.	📖 173
			0	{1 units/s}	4294960000		

6.15.1 Manual control to software limit position

- When the home position is known (status bit *Stat1.HomePosAvailable* = 1) and the positive software limit position C3040 is set to ≠ 0 and the negative software limit position C3041 is set to ≠ 0, manual positioning is carried out on the corresponding software limit position:
  - The drive brakes to the position of the corresponding software limit position with the manual deceleration set (C3022), and the warning 2403 (”NegPosLimit”) or 2402 (”PosPosLimit”) is displayed.
  - In C4046, status bit *Stat2.SwLimErr* is set to 1.
  - This ensures that the software limit positions set cannot be passed in the ”ManualJog” state when the home position is known.
- By resetting control bits *Ctrl1.JogCW* or *Ctrl1.JogCCW* to ”0”, manual jog is stopped:
  - The drive decelerates to standstill with the corresponding manual setting (C3022).

6.15.2 Manual control to hardware limit switch

If a hardware limit switch is approached during manual jog, the drive brakes to standstill via the QSP deceleration time set (C0105).

- FAIL-QSP 3401 (”NegLimitSw”) or 3400 (”PosLimitSw”) is displayed.
- The drive changes to the ”Trouble” state.
- The display of the current actual position (C3051) is limited to ±214000.0000 units. If the maximum displayable position value is exceeded, the position display C3051 remains on the maximum value of ±214000.0000 units.

6.15.3 Retracting from hardware limit switches

Note!

Retracting from a hardware limit switch is only possible if the limit switch is still activated.

Ensure by the trigger mechanics that an approached hardware limit switch remains activated as long as the drive is outside the permissible travel range.

The two hardware limit switches must not be activated at the same time. Otherwise it is not possible to detect the traversing direction for retracting.

By setting the control bit *Ctrl1.RelLimSwitch* = 1, retracting from an active hardware limit switch is possible by travelling in the corresponding retracting direction until the limit switch is not active anymore.

- Positive hardware limit switch approached:
  - Retracting in negative direction until the positive limit switch is not active anymore.
- Negative hardware limit switch approached:
  - Retracting in positive direction until the negative limit switch is not active anymore.

6.16 Setting of homing parameters

During homing the drive travels in the selected mode (C3010) to detect the reference position on its own by means of a reference mark. All position data refer to this reference position.

The ”referencing” function is selected in the positioning profile with C3095/x (📖 191). The following selections are possible:

- Homing (C3095/x = 100)
  - Homing is mainly used for systems with feedback via incremental encoders, resolvers or single-turn absolute value encoders, where the home position gets lost when the supply voltage is switched off.
- Reference setting (C3095/x = 101)
  - A reference is generally set only once during the commissioning or in case of service (e. g. when drive components are replaced) and is mainly applied in systems with feedback via absolute value encoders.
- Reset the reference (C3095/x = 102)
  - The ”Reference known” state is reset.

The GDC contains the codes for setting the homing parameters (homing mode), speed, acceleration etc.) in the parameter menu under **Positioning/E-Shaft→ Homing**.

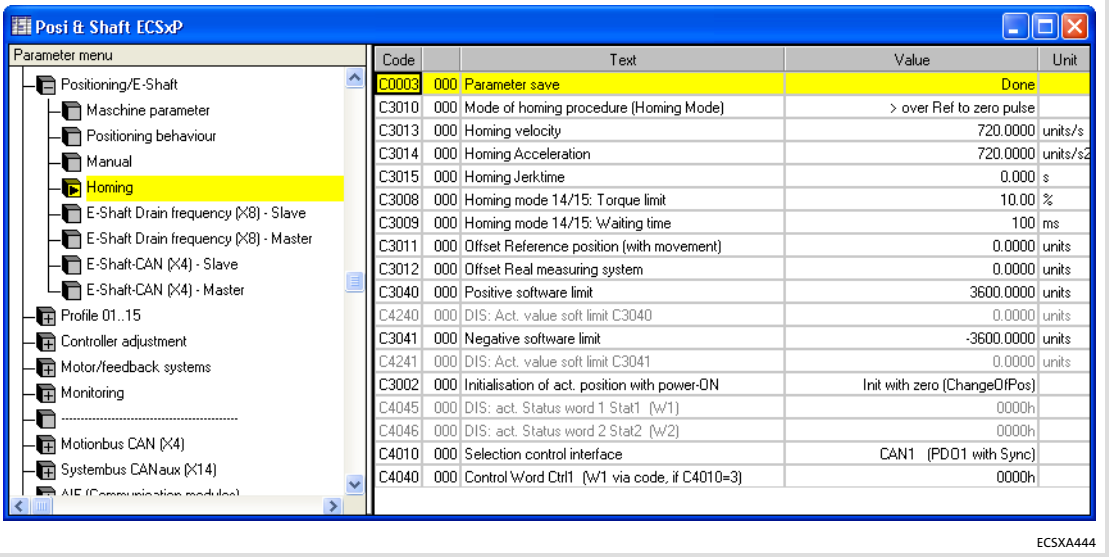


Fig. 6-33 GDC view: Short setup, entry of homing parameters

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C3008	HomeMlim	10.0			Torque limit value for homing mode C3010 = 14 or 15 (homing to mechanical limit stop) 100 % = maximum torque from C0057
			0.00	{0.01 %} 100.00	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3009	TimeHome Mlim	100				Time required for detecting the mechanical limit stop for homing mode C3010 = 14 or 15.	
			0	{1 ms}	65535		
C3010	HomingMode	0				Homing mode	📖 179
			0	>_Rn_MP		**Selection symbolism:** >: Movement in pos. direction <: Movement in neg. direction Lp: Limit switch in pos. direction Ln: Limit switch in neg. direction Lp+: Pos. edge of the limit switch in pos. direction Lp-: Neg. edge of the limit switch in pos. direction Ln+: Pos. edge of the limit switch in neg. direction Ln-: Neg. edge of the limit switch in neg. direction Rp: Pos. edge of the reference switch Rn: Neg. edge of the reference switch MP: Zero pulse / zero position of the position encoder (once per motor revolution) Mlim: Mechanical limit stop (torque limit value) **Notes:** ● When using homing modes 0 ... 5, set C0540 = 2. ● The mechanical limit stop is defined as an excess of the torque limit C3008 for a period of C3009. ● When the last action listed is executed, the home position is set (e.g. zero pulse with "MP"), even if the drive continues traversing. ● In all modes without "Lp" or "Ln" it is not possible to retract from the limit switch.	
			1	<_Rn_MP			
			2	>_Lp_<_Rn_MP			
			3	<_Ln_>_Rn_MP			
			4	>_Rp_<_Rn_MP			
			5	<_Rp_>_Rn_MP			
			6	Reserved			
			7	Reserved			
			8	>_Rp			
			9	<_Rp			
			10	>_Lp_<_Rp			
			11	<_Ln_>_Rp			
			12	>_Lp+_<_Lp-			
			13	<_Ln+_>_Ln-			
			14	>_Mlim			
			15	<_Mlim			
C3011	Home offset	0.0				Offset between home position and standstill position	📖 187
			-214000.0000s	{0.0001 units}	214000.0000		
C3012	Measure offs.	0.0				Offset to shift the zero position compared to the standstill position	📖 187
			-214000.0000	{0.0001 units}	214000.0000		
C3013	Homing Vel	720.0				Homing speed	
			1.0000	{0.0001 units/s}	214000.0000		
C3014	Homing Acc	720.0				Homing acceleration	
			1.0000	{0.0001 units/s²}	214000.0000		

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C3015	HomJerkTime	0.0			Homing - jerk time
			0.000	{0.001 ms} 10.000	

6.16.1 Setting homing modes

Modes 0 and 1

Travelling to zero pulse (zero position of the position encoder) via the reference switch.

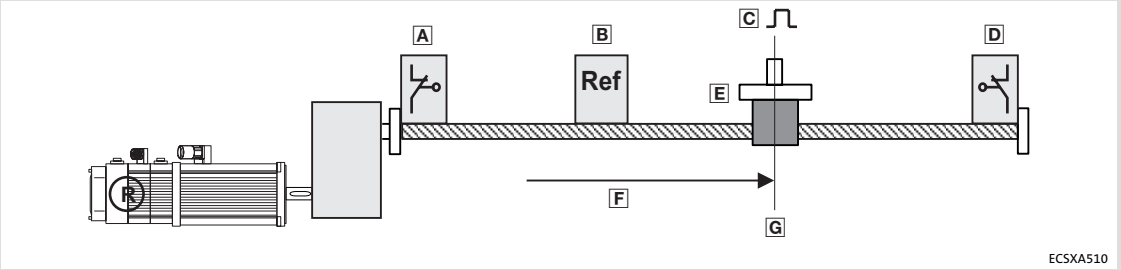


Fig. 6-34 Homing in mode 0

- A Negative hardware limit switch
- B Reference switch
- C Zero pulse (zero position of the position encoder)
- D Positive hardware limit switch
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e. g. slide) travels from its starting position beyond the reference switch to the first zero pulse after leaving the reference switch. This zero pulse bears the home position. Before homing, the load may be positioned on the reference switch.

Settings

Mode 0 (Homing in positive direction)	Mode 1 (Homing in negative direction)
• Set C0540 = 2. • Set C3010 = 0.	• Set C0540 = 2. • Set C3010 = 1.

Note!

► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.

► For multi-turn absolute value encoders only homing modes 8 ... 15 can be used (C3010 = 8 ... 15).

Modes 2 and 3

Approaching the hardware limit switch, reversing the direction of travel and travelling to the zero position (zero position of the position encoder) via the reference switch.

Note!

- ► While reversing, the approached hardware limit switch must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, the rising edges of the hardware limit switches are queried.

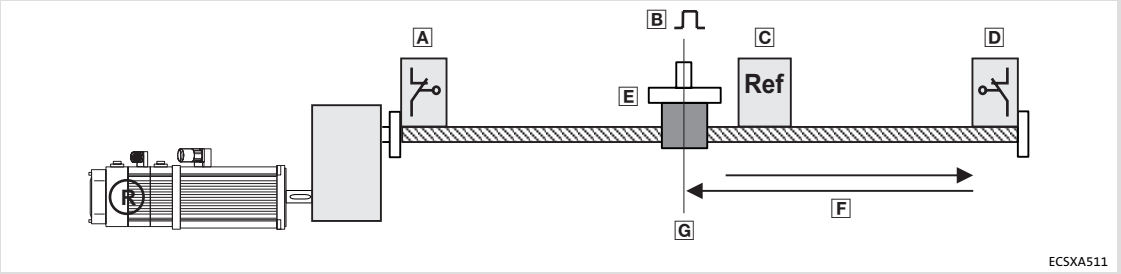


Fig. 6-35 Homing in mode 2

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Falling edge of the positive hardware limit switch (query in 6 ms cycle)
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and, after leaving the reference switch, it is traversed to the first zero pulse beyond the reference switch. This zero pulse bears the home position. If the drive has already approached a hardware limit switch before homing, the direction of travel is reversed immediately.

In homing modes 2 and 3 the reference switch is found in any case, independent of the initial position, as in the worst case the entire travel range is executed.

Settings

Mode 2 (Homing in positive direction)	Mode 3 (Homing in negative direction)
• Set C0540 = 2. • Set C3010 = 2.	• Set C0540 = 2. • Set C3010 = 3.
Variant (positive hardware limit switch = reference switch)	**Variant** (negative hardware limit switch = reference switch)
Additionally • connect the positive hardware limit switch parallel to X6/DI2 and X6/DI4. • Set C0114/2 = 1. (X6/DI2 is LOW-level active.)	Additionally • Connect the negative hardware limit switch parallel to X6/DI1 and X6/DI2. • Set C0114/2 = 1. (X6/DI2 is LOW-level active.)

Note!

► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.

► For multi-turn absolute value encoders only homing modes 8 ... 15 can be used (C3010 = 8 ... 15).

Modes 4 and 5

Approaching the reference switch, reversing, and travelling to the zero pulse (zero position of the position encoder).

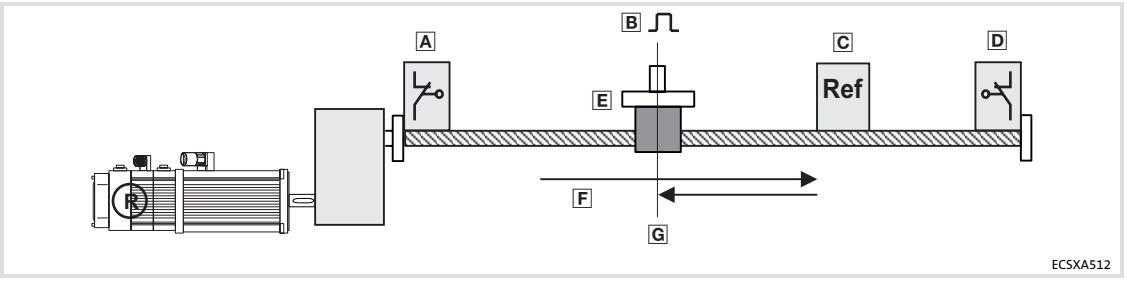


Fig. 6-36 Homing in mode 4

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Positive hardware limit switch
- E Load (e. g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) travels from its original position to the reference switch. At the approached reference switch the direction of travel is reversed and the load travels to the first zero pulse after leaving the reference switch. The zero pulse bears the home position. If the drive is already situated at the reference switch, the direction of travel is reversed immediately.

Settings

Mode 4 (Homing in positive direction)	**Mode 5** (Homing in negative direction)
• Set C0540 = 2. • Set C3010 = 4.	• Set C0540 = 2. • Set C3010 = 5.

Note!

► Single-turn absolute value encoder (SinCos encoder) and resolver do not have a zero pulse. Here the zero position corresponds to the zero pulse.

► For multi-turn absolute value encoders only homing modes 8 ... 15 can be used (C3010 = 8 ... 15).

Modes 6 and 7

Modes 6 and 7 (C3010 = 6 or 7) are functionally not assigned or reserved for possible future mode supplements.

Modes 8 and 9

Travel to the rising edge of the reference switch.

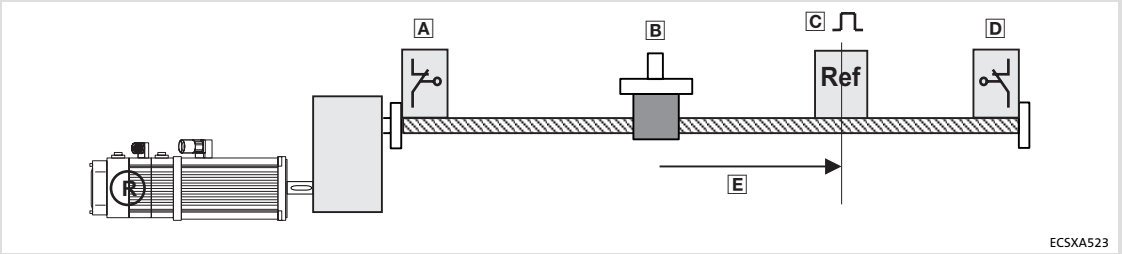


Fig. 6-37 Homing in mode 8

- A Negative hardware limit switch
- B Load (e. g. slide)
- C Home position at rising edge of the reference switch
- D Positive hardware limit switch
- E Direction of travel

The load (e.g. slide) is navigated from its initial position in positive direction up to the rising edge of the reference switch. The home position is placed at the rising edge of the reference switch. A zero pulse of the position encoder is not required.

Settings

Mode 8 (Homing in positive direction)	**Mode 9** (Homing in negative direction)
● Set C3010 = 8.	● Set C3010 = 9.

Modes 10 and 11

Approach hardware limit switch, reverse and navigate to the rising edge of the reference switch.

Note!

- ► While reversing, the approached hardware limit switch must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, it is queried whether the hardware limit switch is assigned.

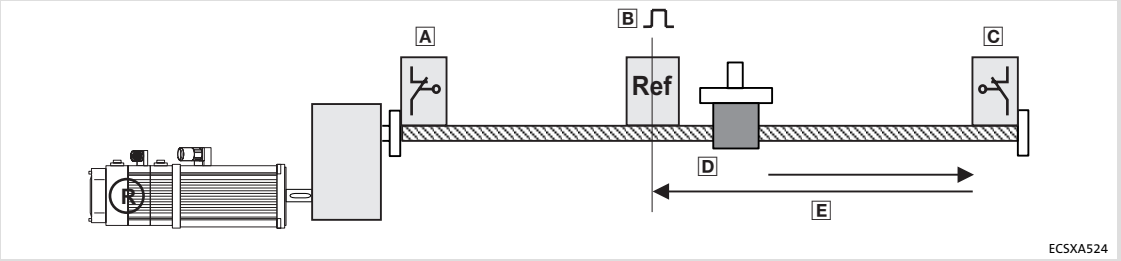


Fig. 6-38 Homing in mode 10

- A Negative hardware limit switch
- B Home position at rising edge of the reference switch
- C Falling edge of the positive hardware limit switch (query in 6 ms cycle)
- D Load (e. g. slide)
- E Direction of travel

The load (e.g. slide) is navigated from its initial position to a hardware limit switch. Thereby no fault message is triggered. According to the direction of travel, a reversal takes place at the hardware limit switch approached and then the reference switch is approached. The home position is placed a the rising edge of the reference switch. A zero pulse of the position encoder is not required.

Settings

Mode 10 (Homing in positive direction)	**Mode 11** (Homing in negative direction)
• Set C3010 = 10.	• Set C3010 = 11.

Modes 12 and 13

Approach hardware limit switch, reverse, and execute "Home offset" (C3011).

Note!

- ► While reversing, the approached hardware limit switch must continue to be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, it is queried whether the hardware limit switch is assigned.

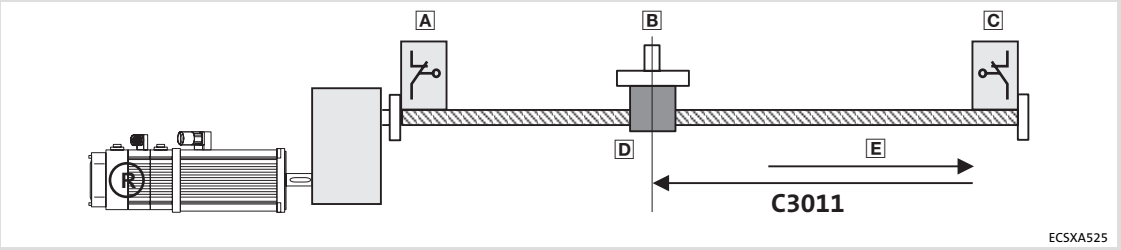


Fig. 6-39 Homing in mode 12

- A Negative hardware limit switch
- B Home position at standstill position
- C Falling edge of the positive hardware limit switch (query in 6 ms cycle)
- D Load (e. g. slide)
- E Direction of travel

The load (e. g. slide) is navigated from its initial position to a hardware limit switch. Thereby no fault message is actuated. According to the direction of travel, a reversal takes place at the positive or negative hardware limit switch and "Home offset" (C3011) is executed. The home position is placed at the standstill position. A zero pulse of the position encoder is not required.

Settings

Mode 12 (Homing in positive direction)	**Mode 13** (Homing in negative direction)
● Set C0540 = 12. ● C3011 ("Home offset")	● Set C3010 = 13. ● C3011 ("Home offset")

Modes 14 and 15

Approach mechanical limit stop and set home position.

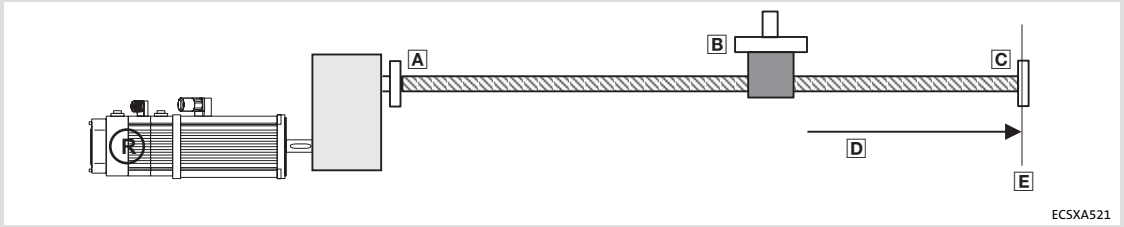


Fig. 6-40 Homing in mode 14

- A Mechanical limit stop (negative)
- B Load (e. g. slide)
- C Mechanical limit stop (positive)
- D Direction of travel
- E Home position

The load (e. g. slide) is navigated in positive or negative direction to the mechanical limit stop from its initial position. For the duration of the homing, the motor torque is limited to the torque limit value (C3008). If the motor torque reaches the torque limit value or a time that is longer than the time defined in C3009, the internal speed setpoint is traversed to ”0” with the homing acceleration (C3014). If the internal speed setpoint is 0, the home position is set in this position and homing is completed.

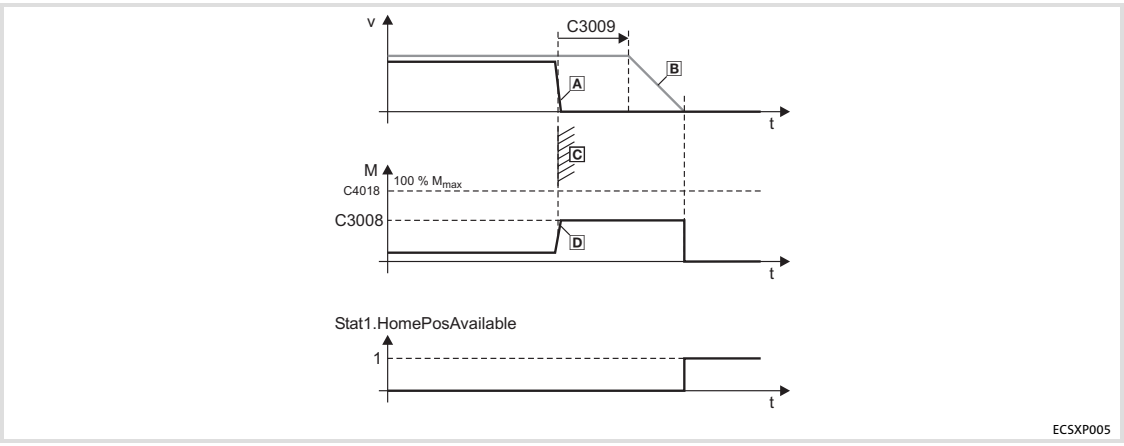


Fig. 6-41 Procedure of the homing in modes 14/15

- A Actual speed value
- B Speed setpoint
- C Mechanical limit stop
- D Actual torque

Settings

Mode 14 (Homing in positive direction)	**Mode 15** (Homing in negative direction)
● Set C3010 = 14.	● Set C3010 = 15.

6.16.2 Shifting the zero position with regard to the home position (offsets C3011, C3012)

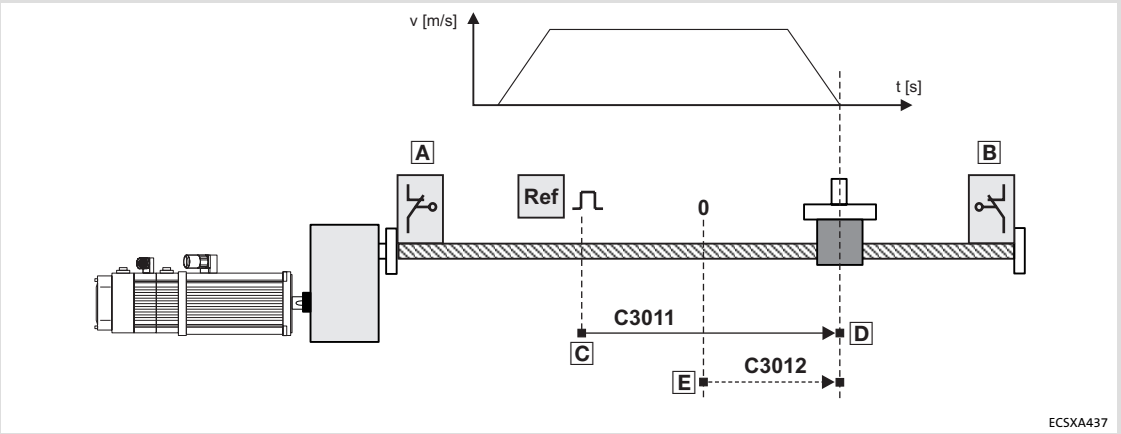


Fig. 6-42 Offset of the zero position (note: Different behaviour of ECS Motion and ECS Posi&Shaft)

- A, B Negative and positive hardware limit switch
- C Home position (zero pulse/zero position of the position encoder)
- D Standstill position after completion of homing
- E Zero position of the measuring system after offset by C3011 and C3012
- REF Reference switch

Offset between home position and standstill position (C3011)

- ► Distance to be traversed after the home position has been reached (zero pulse/zero position of the position encoder).
- ► Positive values cause a drive movement in the direction of the positive hardware limit switch, negative values cause the opposite direction.

Offset to shift the zero position compared to the standstill position (C3012):

- ► The zero position is only offset in terms of figures without moving the drive: Zero position = standstill position - C3012
- ► With positive values, the zero position is offset in negative direction.
- ► The actual position is set to the value C3012. This leads to the offset of the zero position.

Note!

When the zero position is shifted by C3011 and C3012, the software limit positions (C3040, C3041) are shifted as well towards the mechanical components. Therefore adapt the software limit positions (📖 237) accordingly.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3011	Home offset	0.0				Offset between home position and standstill position	📖 187
			-214000.0000s	{0.0001 units}	214000.0000		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3012	Measure offs.	0.0			Offset to shift the zero position compared to the standstill position	📖 187
			-214000.0000	{0.0001 units} 214000.0000		

6.16.3 Example: Reference search with linear positioning axis

Settings for homing mode 3

- ► Set homing mode 3 with C3010 = 3.
- ► The negative hardware limit switch at the same time is to be used as a homing switch.
  - – Connect hardware limit switch in parallel with X6/DI1 and X6/DI2.(For terminal assignment see 📖 172)
  - – Set C0114/1 and C0114/2 = 1 (LOW level is active).
- ► Define homing speed via C3013.
- ► Define acceleration/deceleration via C3014.
- ► Define target position as offset to the home position via C3011.

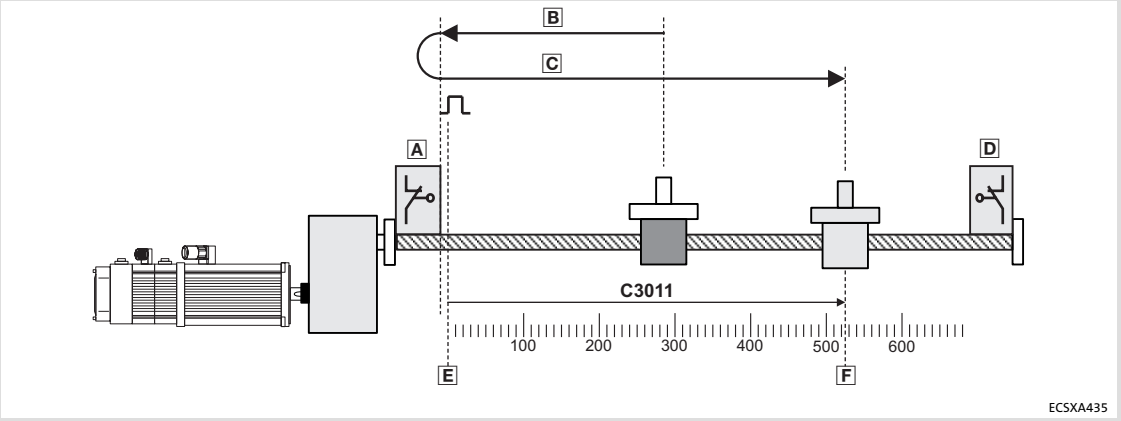


Fig. 6-43 Homing in mode 3, negative hardware limit switch as reference switch

- A Negative hardware limit switch
- B Travel to limit switch (= reference switch) and reverse there
- C From zero pulse travel via the defined offset (C3011) towards target position
- D Positive hardware limit switch
- E Zero pulse (zero position of the position encoder)
- F Target position

Process

1. Homing is started by activating the positioning profile.
2. During homing the status bit *Stat1.HomeBusy* is set to TRUE.
3. The drive travels to the negative hardware limit switch (A)and reverses (B).
   Since the limit switch is also used as reference switch, "Reference known" is set after the limit switch is left at the next zero pulse (E) of the position encoder (status bit *Stat1.HomePosAvailable*= TRUE).
4. The drive then continues traversing without interruption to the target position (F) which has been defined as offset to the home position under C3011 (C).
5. When the target position is reached, homing is completed.
   – Status bit *Stat1.HomeBusy* = FALSE
   – Status bit *Stat1.HomePosAvailable* = TRUE

6.16.4 Example: Reference search with continuous positioning axis

For applications with an unlimited traversing range (e. g. conveying belts and rotary tables) the reference is always searched via a mark. In that case, the reference switch serves as a mark sensor.

Settings for homing mode 8

- ► Set homing mode 8 with C3010 = 8.
- ► Define traversing speed via C3013.
- ► Define acceleration/deceleration via C3014.
- ► When homing is completed, select the target position as offset with regard to the home position via C3011.

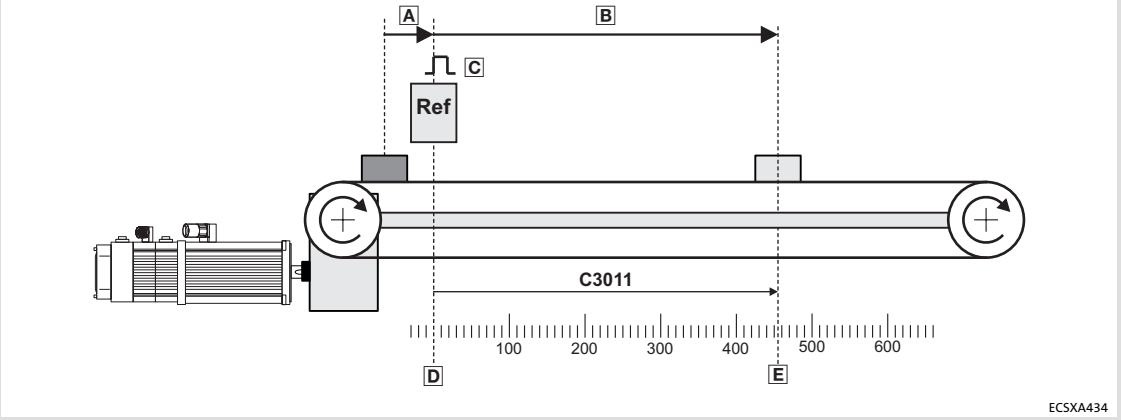


Fig. 6-44 Homing in mode 8

A Travel towards reference switch
B Travel via the defined offset towards target position
C Reference switch
D Zero position
E Target position

Process

1. Homing is started by activating the positioning profile.
2. During homing the status bit *Stat1.HomeBusy* is set to TRUE.
3. The drive travels in positive direction (A).
   Mit Erreichen der steigenden Flanke des Referenzschalters (C) ist der Antriebssteuerung die Referenz bekannt.
4. The drive continues traversing without interruption to the target position (E) which has been defined as offset to the home position under C3011 (B).
5. When the target position is reached, homing is completed.
   – Status bit *Stat1.HomeBusy* = FALSE
   – Status bit *Stat1.HomePosAvailable* = TRUE

6.17 Setting the positioning profile

Up to 15 positioning profiles can be set in the ECSxP axis module to execute the different positioning tasks required for a machine.

For setting a positioning profile, carry out the following steps:

- ► Select the positioning profile mode via C3095. (📖 191)
- ► Set positioning profile parameters. (📖 201)
- ► Configure the additional functions of the positioning profile. (📖 204)

The Global Drive Control (GDC) contains the corresponding codes in the parameter menu under **Profile 01..15**.

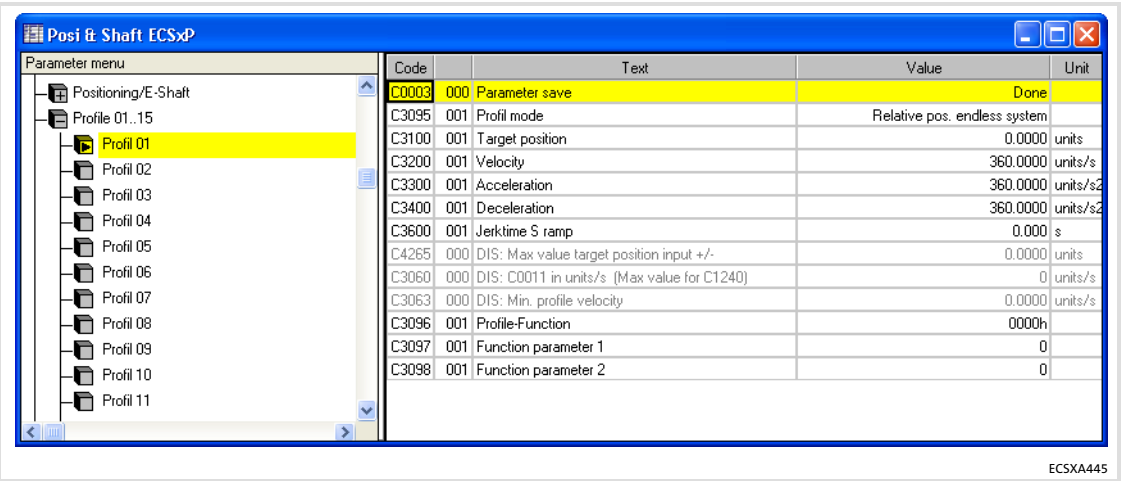


Fig. 6-45 GDC view: Setting of positioning profiles

6.17.1 Selecting a positioning profile mode

Note!

- ► The target position in C3100 must be between the positive and negative value from C4265 (max. target position selection).
  - – **Example:** C4265 = 10000 ⇨ C3100 = -10000 ... +10000
- ► The maximum traversing range amounts to 2147483649 increments for all positioning profile modes (2^{31} - 1).
- ► The position display C3051 is limited to ± 214000,0000 units.

You can select the following positioning profile modes via C3095/x:

Positioning profile mode		Setting C3095/x	Detailed description
Absolute positioning		0	📖 193
Relative positioning in continuous measuring system		1	📖 193
Continuous constant travel		2	📖 195
Relative positioning with absolute reference		3	📖 194
Absolute touch probe positioning	Rising edge at X6/DI3	10	📖 194
	Falling edge at X6/DI3	20	
Relative touch probe positioning in the continuous measuring system	Rising edge at X6/DI3	11	📖 195
	Falling edge at X6/DI3	21	
Relative touch probe positioning with absolute reference	Rising edge at X6/DI3	13	📖 195
	Falling edge at X6/DI3	23	
Electrical shaft (”EShaft”)	Setpoint via encoder input X8	30	📖 196
	Setpoint via MotionBus (CAN) X4	31	
	Setpoint via EtherCAT (EMF2192IB at AIF interface X1)	32	
Homing		100	📖 197
Set reference		101	📖 197
Reset home position		102	📖 197
Direct positioning	Absolute positioning (direct)	110	📖 198
	Relative positioning in continuous measuring system (direct)	111	📖 198
	Continuous constant travel (direct)	112	📖 199
	Relative positioning with absolute reference (direct)	113	📖 199
Positioning sequence for controller optimisation		251	📖 200

6.17.2 ”Point-to-point” positioning

6.17.2.1 Absolute positioning

Application: axes with a limited traversing range (e. g. palletizers)

C3095/x = 0

- The drive carries out a ”point-to-point” positioning in the absolute measuring system.
- The target position is defined as definite absolute position with regard to the zero position of the measuring system. The distance to be travelled results from the distance between the actual position and the absolute target position.

Preconditions

- The drive must be referenced (status bit *Stat1.HomePosAvailable* = 1).

6.17.2.2 Relative positioning in the continuous measuring system

C3095/x = 1

- The drive carries out a relative ”point-to-point” positioning in the continuous measuring system (incremental dimension).

  Application: roll feed
- The defined target position corresponds to the distance to be travelled. Thus, the drive continues to travel by exactly the defined distance from the current position on.

  Before positioning is started, the path integrators are reset in the continuous measuring system. The following error, however, remains stored in order that no jerk occurs in the drive.
- Status bit *Stat1.HomePosAvailable* is reset.

Preconditions

- No homing required.

6.17.2.3 Relative positioning with absolute reference

C3095/x = 3

- The drive carries out a relative "point-to-point" positioning in the absolute measuring system.

  Application: Feed by a given distance in case of axes with limited traversing range
- The target position defined via the profile parameters corresponds to the distance to be travelled (as in the continuous measuring system). Thus, the drive travels exactly by the defined distance (target position) from the current position on, but the path integrators are not reset before.

  The absolute target position to be approached results from the last absolute target position plus the distance defined as profile parameters (target position).

Preconditions

- The drive must be referenced (status bit *Stat1.HomePosAvailable* = 1).

6.17.3 Touch probe positioning

Touch probe positioning is used if the exact target position to be approached is not known yet but can only be determined by a mark signal of the machine or the product.

Process of TP positioning:

- TP positioning always consists of two successive positioning profiles.

  Only the profile numbers 1 ... 14 may be used as the first TP profile so that a sequence profile is still available!
- In the first TP positioning, it is first travelled to a provisional target position. During this motion, the TP input (X6/DI3) is active.

  Only after the touch probe sensor responds during operation, the final target position is calculated in the sequence profile (profile number +1) and approached without stop.
- The final target position is calculated from the TP position plus the target position of the sequence profile which is evaluated as relative distance (residual path). The sign of the residual path determines the traversing direction.

  Example: With a negative traversing direction in the first TP profile and a positive residual path, the drive would reverse. The positioning profile mode (C3095/x) of the sequence profile is ignored.
- Different TP positioning types can be set under the profile mode C3095/x. They differ in the first positioning type and the edge of the TP signal is set.

6.17.3.1 Absolute TP positioning

C3095/x = 10 or 20

- The first TP positioning to the provisional target position is executed the same way as is the case with absolute positioning. The same conditions apply (📖 193).
- Edge selection of TP input:
  – C3095/x = 10: positive edge at TP input X6/DI3
  – C3095/x = 20: negative edge at TP input X6/DI3

6.17.3.2 Relative TP positioning in the continuous measuring system

C3095/x = 11 or 21

- The first TP positioning to the provisional target position is executed the same way as is the case with relative positioning in the continuous measuring system. The same conditions apply (📖 193).
- Edge selection of TP input:
  – C3095/x = 11: positive edge at input X6/DI3
  – C3095/x = 21: negative edge at input X6/DI3

6.17.3.3 Relative TP positioning with absolute reference

C3095/x = 13 or 23

- The first TP positioning to the provisional target position is executed the same way as is the case with relative positioning with absolute reference. The same conditions apply (📖 194).
- Edge selection of TP input:
  – C3095/x = 11: positive edge at input X6/DI3
  – C3095/x = 21: negative edge at input X6/DI3

6.17.4 Continuous constant travel

C3095/x = 2

- The drive travels with constant speed according to the speed selection as long as the profile is active.
- The target position selection is ignored.
- The positioning parameters (📖 201) are defined in the positioning profile.
- Stop of the constant travel by aborting the profile by the control bit *Ctrl1.ProfEnable* = 0 or, if "Direct Change" is active, by selecting another profile number.
- The software limit positions are monitored when homing is executed and thus the reference is known (status bit *Stat1.HomePosAvailable* = 1).

Preconditions

- No homing required!
- The 32-bit display area of $\pm(2^{31} - 1)$ internal increments can be overtravelled without stopping the drive if ...
  – homing has not been executed before (status bit *Stat1.HomePosAvailable* = 0) or
  – the software limit positions are deactivated (setting 0 units).
- When the range limit is overtravelled, the actual value jumps by 2^{32} increments and the warning 2423 ("OverflIntPos", position setpoint overflow) is displayed.

6.17.5 Electrical shaft (”E-shaft”) per digital frequency, MotionBs (CAN) or EtherCAT

C3095/x = 30, 31 or 32

- The drive performs a ratio synchronisation.
- C3095/x = 30:

  ”Electrical shaft” with setpoint selection via digital frequency input X8 via TTL rectangular differential signal.

  Setting sequence see 📖 215.
- C3095/x = 31:

  ”Electrical shaft” with setpoint selection via the process data channel of the MotionBus (CAN) X4. The master value is defined as 32-bit angle setpoint at X4 (CAN, Rx-PDO2).

  – Definition as DWORD (word3/4)

  – Scaling: 2^{16} inc/rev (motor)

  Activate the control program synchronization via CAN sync telegram.

  Setting sequence see 📖 217 159.
- C3095/x = 32:

  ”Electrical shaft” with setpoint selection via the process data channel of the EMF2192IB EtherCAT communication module at the AIF interface (X1). The master value is defined as 32-bit angle setpoint at X1 (AIF, Rx-PDO1).

  – Definition as DWORD (word3/4)

  – Scaling: 2^{16} inc/rev (motor)

  Activate the control program synchronization via EtherCAT sync telegram.

  Setting sequence see 📖 224.
- The stretch factor for setting the ratio between master and slave drive is defined as numerator (C3097) / denominator (C3 098):

  – Permissible value range C3097: -32767 ... +32767

  – Negative values cause a reversal of the rotation direction.

  – Permissible value range C3098: 1 ... 32760
- The stretch factor can be changed during the running positioning profile.
- The machine parameters for the gearbox ratio (C1202/C1203, 📖 103) only have an effect on positioning and have no impact on the ”electrical shaft” drive function.
- No ramps are created. Therefore it is only reasonable to activate/deactivate the function when the master value encoder is at standstill.
- The following errors are switched off at the limit value (C3031).
- In case of an exceedance of the following error warning tolerance C3030, the warning ”FollowErrWarn” will be enabled. The status bit *Stat2.FollowErrWarn* will be set to ”1” (TRUE).
- In case of a known reference (status bit *Stat1.HomePosAvailable* = 1), the software limit switches will be monitored.
- The compensation of speed-proportional angular offsets is effected via C4060.

6.17.6 Homing

6.17.6.1 Homing

C3095/x = 100

- Homing is carried out according to the selected homing mode (📖 179).
- For homing parameters see 📖 177.
- The status bit *Stat1.HomePosAvailable* is set to ”1” after a successful execution (monitoring of the software limit positions is activated).

6.17.6.2 Setting the reference

C3095/x = 101

- The current position is stored as the home position and used as the measuring system reference.
- The drive does not move.
- The status bit *Stat1.HomePosAvailable* is set to ”1” (monitoring of the software limit position is activated).
- In case of feedback system of type AM:
  – When the reference is set, the controller must be inhibited (*Ctrl1.Cinh* = 1).
  – The home position is maintained after switching off and on again the control voltage of the drive.

Preconditions

- Status bit *Stat1.HomePosAvailable* = 0; if required, execute the ”Reset reference” function first (see below).

6.17.6.3 Reset reference (Reset HomePosAvailable)

C3095/x = 102

- The reference of the measuring system to the home position is cancelled.
- The status bit *Stat1.HomePosAvailable* is set to ”0” (monitoring of the software limit position is deactivated).

6.17.7 Direct positioning

6.17.7.1 Absolute positioning (direct)

C3095/x = 110

Positioning is executed the same way as it is the case with absolute positioning (📖 193), with the following differences:

- The position selection is carried out in the process data telegram via ”PosDirect” in increments (65536 incr. = 1 motor revolution).
- The speed selection is effected in the process data telegram via ”VelDirect” in percent [%] of the maximum speed (v_{max}) from C3060.
  (VelDirect = 16384 = 100 % v_{max}.)
- The other positioning parameters (📖 201) are defined in the positioning profile.

Preconditions

- Status bit *Stat1.HomePosAvailable* = 1
- Control bit *Ctrl1.PosDirect* = 1 (selection of direct positioning)
- From software version V2.0, the control bit *Ctrl1.PosDirect* is redundant. Thus, there is no need for it anymore to be set as precondition for the direct positioning.

6.17.7.2 Relative positioning in the continuous measuring system (direct)

C3095/x = 111

- Positioning is executed the same way as it is the case with relative positioning in the continuous measuring system (📖 193), with the following differences:
- The position selection is carried out in the process data telegram via ”PosDirect” in increments (65536 incr. = 1 motor revolution).
- The speed selection is effected in the process data telegram via ”VelDirect” in percent [%] of the maximum speed (v_{max}) from C3060.
  (VelDirect = 16384 = 100 % v_{max}.)
- The other positioning parameters (📖 201) are defined in the positioning profile.
- Status bit *Stat1.HomePosAvailable* is reset.

Preconditions

- No homing required!
- Control bit *Ctrl1.PosDirect* = 1 (selection of direct positioning)
- The path integrators are reset before the start.

6.17.7.3 Continuous constant travel (direct)

C3095/x = 112

- The drive performs a constant travel as long as the function is active.
- The target position selection is ignored.
- The speed selection is effected in the process data telegram via ”VelDirect” in percent [%] of the maximum speed (v_{max}) from C3060.
  (VelDirect = 16384 = 100 % v_{max}.)
- The other positioning parameters (📖 201) are defined in the positioning profile.
- Abortion with control bit *Ctrl1.ProfEnable* = 0.
- When status bit *Stat1.HomePosAvailable* = 1, the software limit positions are monitored.

Preconditions

- No homing required!
- Control bit *Ctrl1.PosDirect* = 1 (selection of direct positioning)

Special feature with the ”Continuous constant travel (direct)” mode and active override-PDO:

When the positioning profile with ”Continuous constant travel (direct)” starts, the sign of the PDO data word ”rx_par1” determines the direction of rotation of the constant travel. The override influence itself continues to be effected according to amount.

6.17.7.4 Relative positioning with absolute reference (direct)

C3095/x = 113

- Positioning is executed the same way as it is the case with relative positioning with absolute reference (📖 194), with the following differences:
- The target position is defined as a relative distance with regard to the current position.
- The position selection is carried out in the process data telegram via ”PosDirect” in increments (65536 incr. = 1 motor revolution).
- The speed selection is effected in the process data telegram via ”VelDirect” in percent [%] of the maximum speed (v_{max}) from C3060.
  (VelDirect = 16384 = 100 % v_{max}.)
- The other positioning parameters (📖 201) are defined in the positioning profile.

Preconditions

– Status bit *Stat1.HomePosAvailable* = 1
– Control bit *Ctrl1.PosDirect* = 1 (selection of direct positioning)

6.17.8 Positioning sequence for controller optimisation

C3095/x = 251

- The drive carries out a relative ”point-to-point” positioning in positive direction in the continuous measuring system (incremental dimension). (see also mode C3095/x = 1, 📖 193)
- With *Stat1.DwellTime* = 1, the target position is inverted internally and traversing is carried out in negative direction. This process is repeated in a cyclic manner.
- The positioning parameters (📖 201) are defined in the positioning profile.
- This positioning profile mode can be used for testing or for optimising the control loop settings.

6.17.9 Setting of positioning profile parameters

The target position, traversing speed, acceleration, deceleration, and jerk time for the positioning profile parameters can be set via the following codes:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3100						Parameter "Target position" for positioning profiles 1 ... 15 **Note:** Input value must be within the range of the ± value from C4265. ● Example: C4265 = 10000 ⇨ value range -10000 ... +10000	📖 97
1	Prof.Position	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Position	0					
C3200						Parameter "Traversing speed" for positioning profiles 1 ... 15 **Note:** C3063 < [input value] ≤ C3060	📖 98
1	Prof.Velocity	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Velocity	0					
C3300						Parameter "Acceleration" for positioning profiles 1 ... 15	📖 98
1	Prof.Acc	0	-0.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Acc	0					
C3400						Parameter "Deceleration" for positioning profiles 1 ... 15	📖 98
1	Prof.Dec	0	-0.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Dec	0					
C3500						Parameter reserved	📖 98
1	Prof.FinalVel	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.FinalVel	0					
C3600						Parameter "Jerk time" for positioning profiles 1 ... 15	📖 99
1	Prof.JerkTime	0	0.000	{0.001 s}	0.500		
...	...	...					
15	Prof.JerkTime	0					

6.17.10 Setting the profile parameter jerk time for S-shaped ramps

The setting of the jerk time under C3600/x serves to change over between L profile and S profile for generating the travel profile.

- **Jerk time = 0, L profile is active** (Lenze setting):
  The positioning profile is generated with linear ramps. All positioning profile modes (C3095/x) can be used.
- **Jerk time ≠ 0, S profile is active**:
  The positioning profile is generated with S-shaped ramps. This ramp form cannot be used with the touch probe positioning profile modes C3095/x = 10 ... 23 and neither with positioning profiles with the activated additional function "Immediate profile change" (C3096/x.Bit5 = 1).

The jerk time set under C3600/x is a measure for smoothening the speed curve with S-ramps. The jerk time corresponds to the ramp time (t_{jerk}), after which the acceleration set in the positioning profile is reached, starting from acceleration 0.

The smoothening of the speed curve with S-ramps serves to limit the jerk and thus for a protection of the machine mechanics.

Note!

If disproportionately high jerk times (t_{jerk}) are set for short acceleration phases (t_{acc}), the profile may be generated incorrectly.

Example:

v = 100 mm/s, a = 1000 mm/s^2

⇨ t_{acc} = v / a = 0.1 s

⇨ t_{jerk} = 0.05 s

For this reason, set only plausible jerk times for the S-ramps under C3600/x. These must not exceed half the value of t_{acc}.

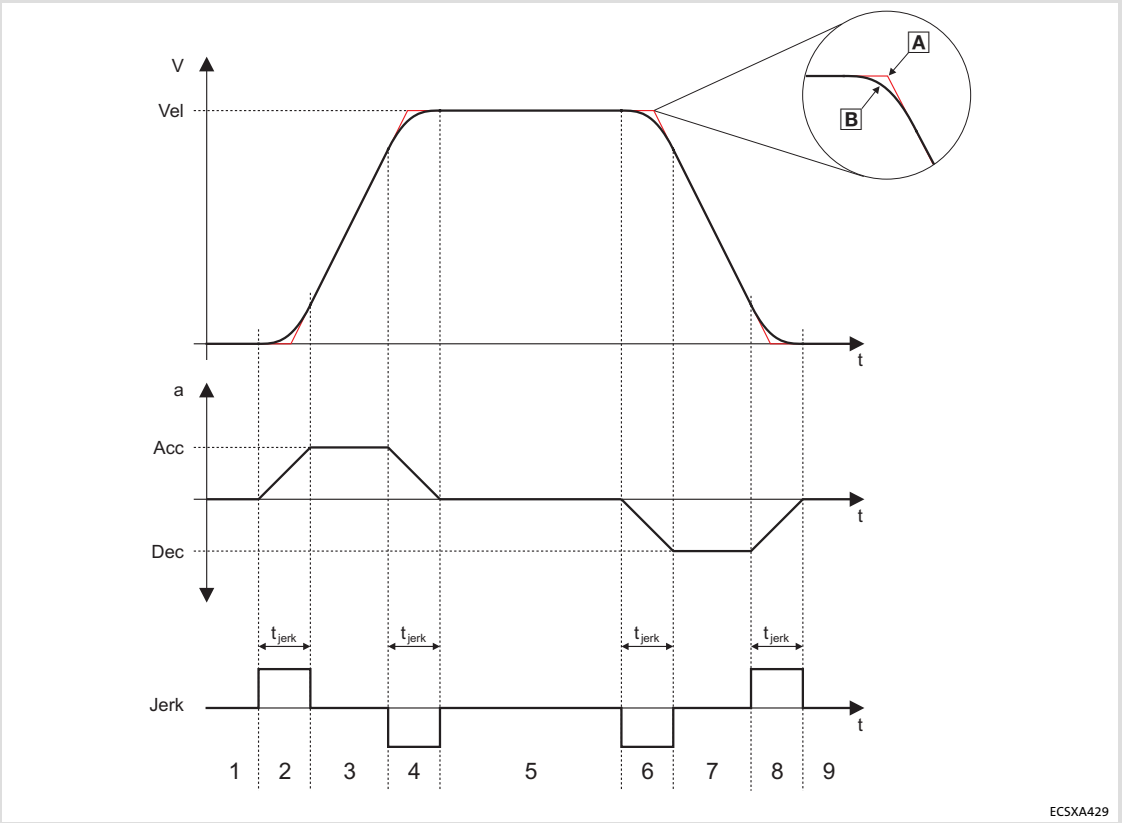


Fig. 6-46 Jerk time C3600/x

A Process without jerk limitation
B Process with jerk limitation
1 Standstill
2 Accelerating with increasing acceleration (limited jerk)
3 Accelerating with constant acceleration acc. to positioning profile (Acc, C3300/x)
4 Accelerating with decreasing acceleration (limited jerk)
5 Travelling with traversing speed acc. to positioning profile (Vel, C3200/x)
6 Decelerating with increasing deceleration (limited jerk)
7 Decelerating with constant deceleration acc. to positioning profile (Dec, C3400/x)
8 Decelerating with decreasing deceleration (limited jerk)
9 Standstill (target position reached)

6.17.11 Additional functions of the positioning profile (C3096/x)

The following additional positioning profile functions can be set under code C3096/x:

- Activate a speed override (📖 205)
  – via the analog input (10 V ≡ 100%) and/or
  – by means of the process data object (PDO) via CAN, AIF, C4040.
- Activate a torque limitation after positioning. (📖 208)
- Activate profile continuation after a profile stop. (📖 209)
- Activate immediate profile change during positioning. (📖 210)

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C3096				Additional function for positioning profile 1 ... 15	📖 204
1	Prof.Func1	0	No function	Additional function for positioning profile 1	
...	...	...	...	...	
15	Prof.Func1	0	No function	Additional function for positioning profile 15	
			0 65535	The controller interprets the information in bit codes (16 bits).	
			0000.0000.0000.0000: No function	No function	
			xxxx.xxxx.xxxx.xxx1: Vel_Ovr_Ain	Speed override is activated via analog input.	
			xxxx.xxxx.xxxx.xx1x: pos_>Mlim	Torque limitation after positioning	
			xxxx.xxxx.xxxx.x1xx: ProfEnable_>Continue	Profile continuation after profile stop	
			xxxx.xxxx.xxxx.1xxx: Vel_Ovr_PDO	Speed override is activated via PDO "Rx_par1" (CAN, AIF, C4041).	
			xxxx.xxxx.xxx1.xxxx: Direct change	Immediate profile change during positioning	

6.17.12 Activating the speed override

The term ”override” is used for the changing of the traversing speed set in the positioning profile. Changing override values are accepted even during positioning. The profile generator automatically adapts the travel profile, taking into account the adjusted acceleration/deceleration. The target position will always be reached safely and reliably. The positioning time, however, may change due to the underlying principle.

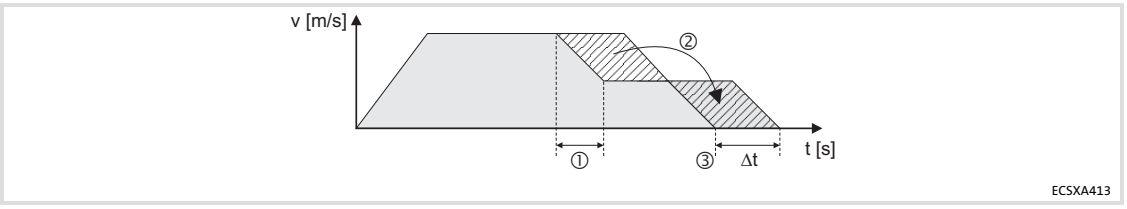


Fig. 6-47 Speed override

① The traversing speed is reduced during the positioning process.
② In order to reach the specified target position, the missing distance (area) is automatically added to the travel profile.
③ When reducing the traversing speed, the positioning process will last accordingly longer (Δt).

Activation

The speed override can be selected via the analog input (10 V ≡ 100 %) and/or by means of a process data object (PDO) via CAN, AIF, C4040.

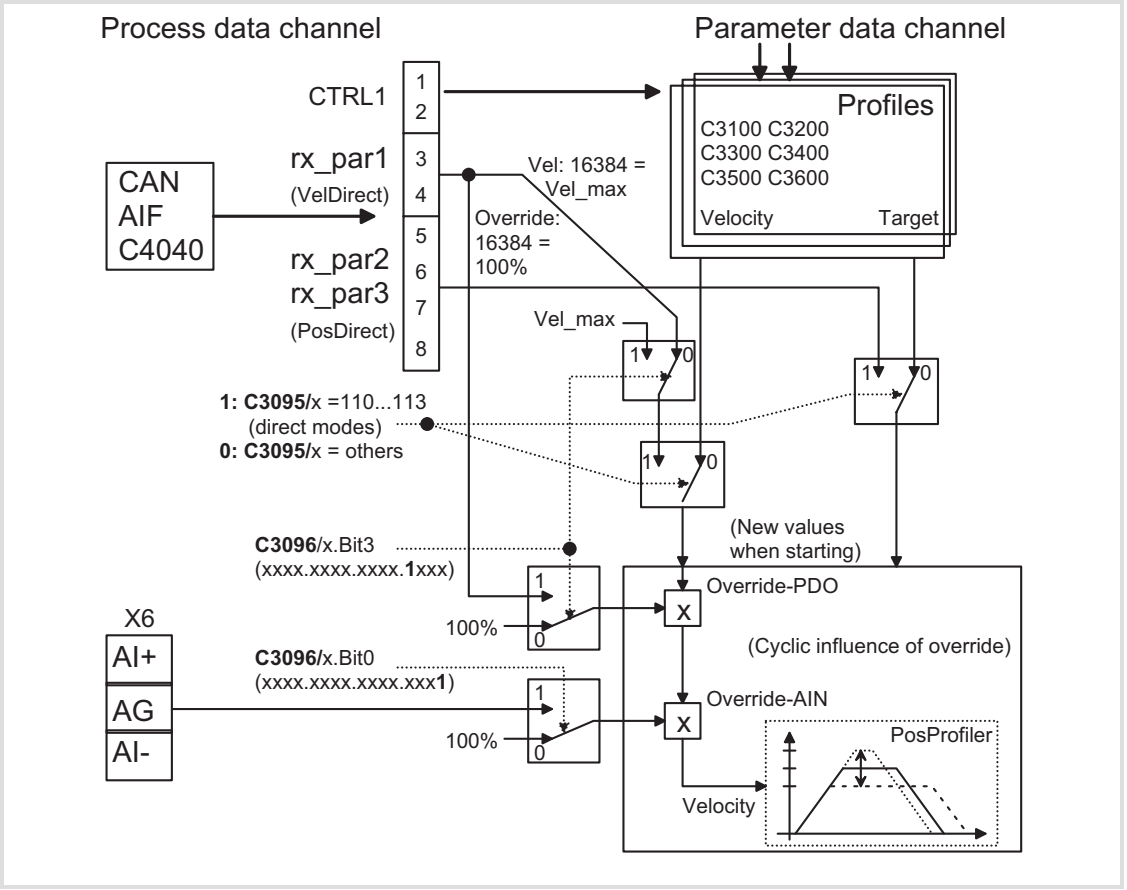


Fig. 6-48 Selection and activation of the speed override

6.17.12.1 Override via analog input (override-AIN)

- Activation of the override AIN: C3096/x.**Bit0** = 1 (xxxx.xxxx.xxxx.xxx1)
- Scaling: 10 V = 16384 = 100 %

Example: Calculation of the effective speed (v_{real})

- Profile traversing speed (v_{prof}) = 5000 mm/s
- Override-AIN = 80 %

$$v_{real} = v_{prof} \cdot \text{Override-AIN [\%]} \quad \Rightarrow \quad 5000\ \text{mm/s} \cdot 80\ \% = 4000\ \text{mm/s}$$

6.17.12.2 Override via process data object (override-PDO)

- Activation of the override PDO: C3096/x.**Bit3** = 1 (xxxx.xxxx.xxxx.1xxx)
- Scaling: 16384 = 100 %
- Transmission via data word ”rx_par1” (VelDirect)

Example: Calculation of the effective speed (v_{real})

- Profile traversing speed (v_{prof}) = 5000 mm/s
- Override-PDO = 50 %

$$v_{real} = v_{prof} \cdot \text{Override-PDO [\%]} \quad \Rightarrow \quad 5000\ \text{mm/s} \cdot 50\ \% = 2500\ \text{mm/s}$$

Direct positioning without override-PDO

- Transmission:
  Data word ”rx_par1” (VelDirect) = profile traversing speed
  (Is accepted once for the profile start.)

Direct positioning with override-PDO

- Transmission:
  Data word ”rx_par1” (VelDirect) = override PDO
  (Is accepted cyclically, also during positioning.)

$$v_{real} = \text{Vel\_max} \cdot \text{Override-PDO [\%]}$$

v_{real}	effective speed
Vel_max	maximum permissible speed (C1240)

Special feature with the ”Continuous constant travel (direct)” with override-PDO:

When the ”Continuous constant travel (direct)” starts, the sign of the PDO data word ”rx_par1” determines the direction of rotation. The override influence itself continues to be effected according to amount.

Override-AIN and override-PDO are activated simultaneously

If override-AIN and override-PDO are activated at the same time, both override inputs are effective (also for direct positioning).

► Setting: C3096/x.**Bit0** = 1 (xxxx.xxxx.xxxx.xxx1) und C3096/x.**Bit3** = 1 (xxxx.xxxx.xxxx.1xxx)

Example: Calculation of the effective speed (v_{real})

► Profile traversing speed (v_{prof}) = 5000 mm/s

► Override-AIN = 80 %

► Override-PDO = 50 %

$$v_{real} = v_{prof} \cdot \text{Override-AIN [\%]} \cdot \text{Override-PDO [\%]}$$

$$5000\ \text{mm/s} \cdot 80\ \% \cdot 50\ \% = 2000\ \text{mm/s}$$

The speed override is deactivated under the following conditions (is a byword for override = 100 %):

► C3096/x.**Bit0**= 0 (xxxx.xxxx.xxxx.xxx0) bzw. **Bit3** = 0 (xxxx.xxxx.xxxx.0xxx)

► Operating status ”Trouble” is active.

► Operating status ”Stand-by” is active.
(For information on operating states see 📖 110.)

6.17.13 Activating the torque limitation after positioning

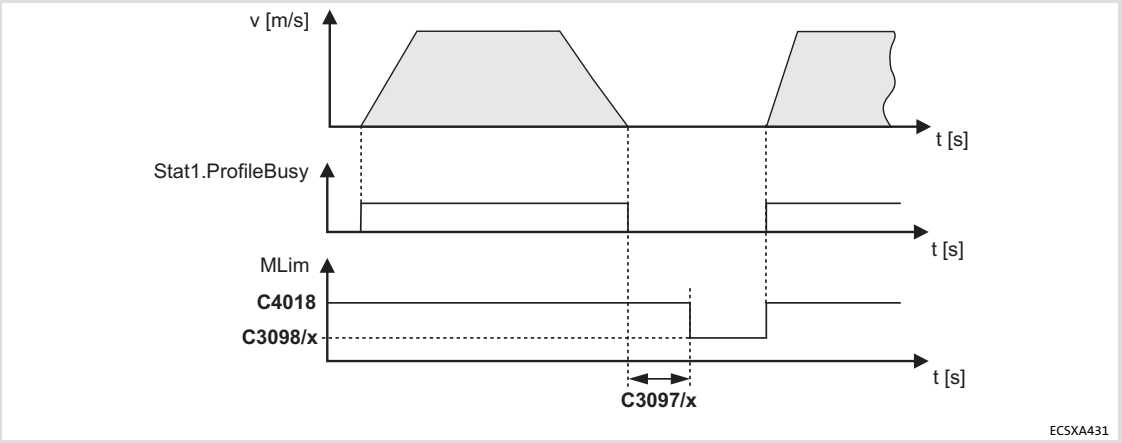


Fig. 6-49 Profile of torque limitation after positioning

Note!

The additional positioning profile function ”Activate torque limitation after positioning” cannot be used together with the ”Touch probe” positioning mode.

This function can be activated by setting C3096/x.**Bit1** = 1 (xxxx.xxxx.xxxx.xx1x).

After completing the positioning process (status bit *ProfileBusy* = 0), the maximum torque instead of the limit value in C4018 (MmaxVal) is limited to the value in C3098/x (function parameter 2). This happens after the time (in ms) set in C3097/x (function parameter 1).

The reduced torque limitation (C3098/x) is active until a new profile is started and the ”Positioning” state is still active.

Assignment of the function parameters		
Code	**Permissible value range**	**Description**
C3097	0 ... 65535 [ms]	Function parameter 1: Time after profile end until torque limitation is activated
C3098	0 ... 16384 [units]	Function parameter 2: Reduced torque, 16384 = 100 % of the max. torque

The ”Positioning” status is quit under the following conditions:

- A fault message occurs (change to ”trouble” status)
- Control bit 8 (*Prof-Enable*) = 0
- Control bit 12 (*JogCCW*) = 1
- Control bit 13 (*JogCW*) = 1
- Control bit 14 (*RelLimitSwitch*) = 1
  (For information on control word Ctrl1 see 📖 158 ff.)
  (For information on operating states see 📖 110.)

6.17.14 Activating the profile continuation function

This function can be activated by setting C3096/x.**Bit2** = 1 (xxxx.xxxx.xxxx.x1xx).

Profile continuation function is not active (default):

After a running positioning process is interrupted, e.g. by a fault, this positioning process is considered to be completed with regard to a restart of the same positioning profile. After a restart, the complete distance would be travelled anew in case of relative positioning.

Profile continuation function is active (C3096/x.bit2 = 1):

After a restart of the same profile, this is first travelled to the end automatically. If the aborted profile is to be continued when the profile is restarted (change to ”Positioning” status), the corresponding profile number in control bit *Ctrl1.PNoSet_x* must also be selected. Status word1 contains the number of the interrupted profile (*Stat1.PNoAct_x*).

If another profile number is selected in the control word (bit *Ctrl1.PNoSet_x*), this other profile is executed and the interrupted profile will not be completed.

Entering the profile number 0 (*Ctrl1.PNoSet_x* =0) deletes the information on the stopped profile. A new positioning process can be started by entering a valid profile number (*Ctrl1.PNoSet_x* > 0).

If a positioning profile with activated profile continuation function is stopped, the *Stat2.ProfCont* bit of status word2 is set to 1.

► For information on the control word ”Ctrl1” see 🕮 158 et seqq.

► For information on the status words ”Stat1” and ”Stat2” see 🕮 161 et seqq.

Note!

The profile continuation function for the profile set 15 is deactivated independent of the setting in C3096/x.**bit2** if the profile set 15 is used as a continuation profile of the Touch-Probe profile defined in profile set 14.

6.17.15 Activate immediate profile change during positioning (Direct Change)

By setting C3096/x.Bit4 = 1 (xxxx.xxxx.xxx1.xxxx), the direct change function is activated individually for each positioning profile.

If a new profile number is defined during a positioning process, the new positioning profile is started immediately without completing the previous positioning process.

The profile parameters get active immediately and the positioning mode is executed accordingly. The required speed changes due to various profile parameters are executed with the new parameters without stopping in the meantime.

6.18 Configuring the electrical shaft (”E-Shaft”)

The ”Electrical shaft” drive function is used with linear drives if several drives are to be traversed with angular and speed synchronism, e.g. because they affect the same web.

The coupling is executed via a digital frequency signal which contains information on the setpoint angle (setpoint position) and the setpoint speed.

Adjustable stretch factors serve to vary the material strength between the points of action of the drives at the web. When the stretch factor = 1/1 (at the same mechanical ratio), both drives move exactly in angular and speed synchronism. If the stretch factor is set higher than 1, the slave drive moves faster than the master drive and distortion is built up.

Ways to implement the electrical shaft function:

- Coupling via digital frequency input X8
- Coupling via MotionBus (CAN) X4
- Coupling via EtherCAT at AIF interface X1 (EMF2192IB EtherCAT communication module required)

The digital frequency for angle and speed of the ”electrical shaft” is determined by the so-called digital frequency master. This master can be:

- A master control with digital frequency output, CAN or EtherCAT interface.
- A TTL encoder located at the web path or elsewhere at the machine.
- A drive controller with digital frequency output, CAN or EtherCAT interface.

6.18.1 Setting the stretch factor (C3097 / C3098)

With the electrical shaft function, the setpoint speed can be adapted in the slave drive via the stretch factor under C3097/C3098.

The required stretch factor results from the following factors:

- Mechanical ratio of the master drive in proportion to the mechanical ratio of the slave drive (virtual gearbox).
- Required speed overshoot of the slave drive to increase the web tension.

The stretch factor is specified as numerator (C3097) / denominator (C3098). Permissible value range:

- C3097: -32767 ... +32767 (negative values cause a reversal of direction of rotation).
- C3098: 1 ... 32760

The master value input (at X8, X4 or X1) is multiplied by the numerator (C3097) and divided by the denominator (C3098):

$$\text{Drehzahlsollwert} = \text{Leitwert} \cdot \frac{C3097}{C3098}$$

Note!

- The machine parameters for the gearbox ratio (C1202/C1203, 📖 103) only have an effect on positioning and have no impact on the ”electrical shaft” drive function.
- The stretch factor (C3097/C3098) can be changed during operation of the ”electrical shaft”.

Formulas for setting the stretch factor

Requirements:

- The circumferential speeds of both rolls are to be the same.
- Both rolls have the same diameter so that they must have the same speed too.

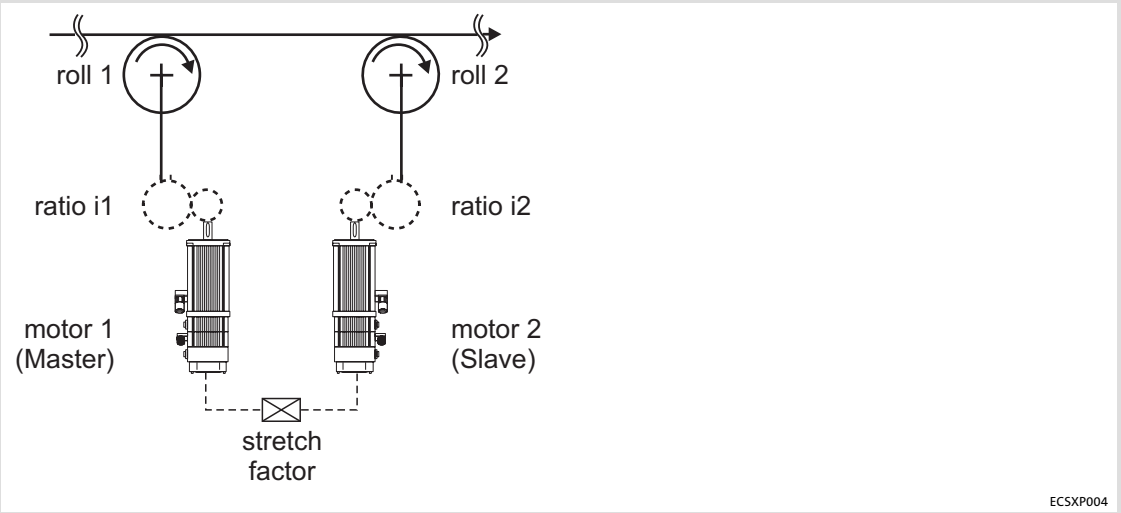


Fig. 6-50 Electrical shaft: Master and slave roller drives affect the same web.

roll 1	Roll 1
roll 2	Roll 2
ratio i1	Mechanical gearbox ratio - master
ratio i2	Mechanical gearbox ratio - slave
stretch factor	Stretch factor

Requirement: Synchronism of the rolls

$$n_{roll\,1} = n_{roll\,2}$$

$$\frac{n_{motor\,1}}{i1} = \frac{n_{motor\,2}}{i2}$$

$$\text{stretchfactor} = \frac{n_{motor\,2}}{n_{motor\,1}} = \frac{i2}{i1}$$

$$\text{stretch factor} = \frac{i2}{i1} = \frac{C3097}{C3098}$$

Different roll diameters (d1, d2) must be considered for the stretch factor as follows:

$$\text{stretch factor} = \frac{i2}{i1} \cdot \frac{d1}{d2} = \frac{C3097}{C3098}$$

Arithmetic example: The following is given ...

- Roll diameter - master (d1) = 175 mm
- Gearbox ration - master (i1) = 7,21
- Roll diameter - slave (d2) = 225 mm
- Gearbox ration - slave (i2) = 9,73

$$\text{stretch factor} = \frac{9,73}{7,21} * \frac{175}{225}$$

$$\text{stretch factor} = \frac{9,73 * 175}{7,21 * 225} = \frac{1702,75}{1622,25} = 1,049622$$

The stretch factor can only be entered as a rounded value:

- C3097 = 1703
- C3098 = 1622

Entered stretch factor:

$$\text{stretch factor} = \frac{1703}{1622} = 1,049938$$

This example results in a deviation of 0.03 % by rounding.



Tip!

By extending the numerator and denominator by the factor 4, input values can be found which correspond to the real stretch factor: C3097 = 6811; C3098 = 6489

Entered stretch factor: 6811 / 6489 = 1.049622

This example with the extended input values does not show any deviations by rounding.

6.18.2 Electrical shaft via classical digital frequency coupling (digital frequency input X8)

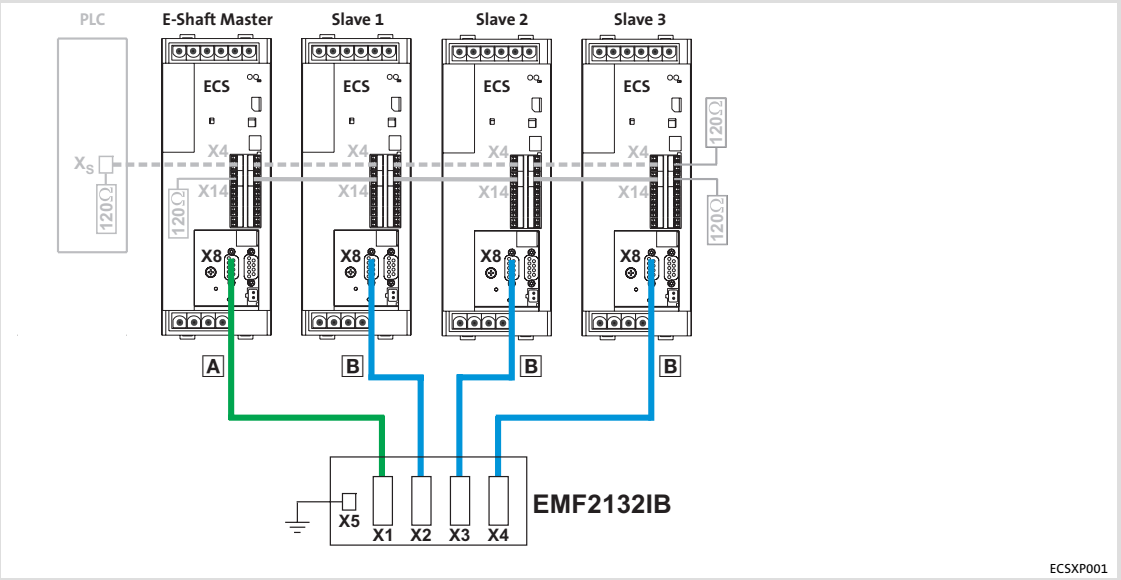


Fig. 6-51 ECS axis modules in the digital frequency network with digital frequency distributor EMF2132IB

PLC	Master control (PLC) or a PLC device to control the drive system
E-Shaft master	Master value master (axis module ECSxP)
Slave 1...3	Slave drives (ECSxPaxis modules)
A	Master digital frequency cable EYD0017AxxxxW01W01 (socket/socket)
B	Slave digital frequency cable EYD0017AxxxxW01S01 (plug/socket)

Commissioning steps for a mimimum configuration

The codes can be found in the GDC in the ”Positioning/E-shaft” menu item.

Setting		Brief description
Preconditions		• Wiring of the digital frequency connection between interface X8 of the drive controllers and the digital frequency distributor EMF2132IB • Wiring of the MotionBus (CAN) X4 for the control and coordination of the drive system by the master control (PLC) • Connection of a PC via the ”Global Drive Control” (GDC) operating program to the system bus (CAN) X14 for parameterisation • Information on selection and configuration of the control interface to control the drive system can be found on 📖 226.
Settings for the master drive		
1.	Configure digital frequency output.	• **C0491 = 1**; configuration of signal direction at X8 = digital frequency output • **C0540 = 1 or 2**; set output function of X8 – **1**: Digital frequency derived from setpoint (profile generator output) – **2**: Digital frequency derived from actual value (encoder simulation + zero pulse) • **C0030 = 2048**; set DFOUT constant for the digital frequency output X8 – Standard setting: 2048 inc/rev • **C0545 = 0 inc**; set DFOUT angular offset – Recommendation: 0 Inc
2.	Define positioning profile for the operation.	• Go to positioning profiles in the GDC parameter menu and create the positioning profiles required for your application; e.g. with absolute positioning or relative positioning in the continuous measuring system. (see brief description 📖 123.) • Do not start the profiles yet!
3.	Save settings with mains failure protection.	• **C0003 = 1**; save parameter set 1 safe against mains failure. The settings for the master drive are now completed.
4.	**GDC: change to online connection to the slave drive.**	

	Setting	Brief description
Settings for the slave drive		
5.	Configure digital frequency input X8.	The recommended setting value has been checked metrologically by Lenze. ● **C0491 = 0**; Configuration of signal direction at X8 = digital frequency input ● **C0421 = 5 V**; set voltage supply encoder at X8. – 5V for TTL level ● **C0420 = 2048**; set encoder increments X8 – Same number of increments as for the digital frequency output of the master (C0030) or the master encoder. ● **C4060 = xxx inc**; set speed-proportional angular offset for the electrical shaft. The settings depends on the set output function of X8 in the master C0540: – C0540 = 1 in the master: C4060 = 15500 inc – C0540 = 2 in the master: C4060 = 2200 inc
6.	Set the positioning profile for electrical shaft operation and stretch factor.	● **C3095 = 30**; et positioning profile mode to ”E-shaft via digital frequency (X8)”. ● **C3097 = 1000 / C3098 = 1000** ; set stretch factor numerator and denominator for the electrical shaft (e.g.: 1000 / 1000) **Notes:** ● Negative values in the numerator C3097 cause a reversal of direction of rotation. ● The machine parameters C1202 and C1203 for the gearbox ration are only effective for positioning and do not influence the drive function ”electrical shaft”.
7.	Save settings with mains failure protection.	● **C0003 = 1**; save parameter set 1 safe against mains failure. The settings for the slave drive are now completed. **Make the same settings for each slave drive in the drive system (from 5th).**

In order to put the drive system into operation, the following actions must be carried out:

► Enable the slave drives by the master control (PLC) (🕮 241)and start the positioning profile with the setting profile mode = electrical shaft (”E-shaft”) (🕮 226).

► Enable the master drive by the master control (PLC) and start the corresponding positioning profiles (🕮 226).



Tip!

For test purposes, the control interface can be set to ”control via codes” with C4010 = 3. Then the control bits of the ”Ctrl1” control word can be defined in GDC via C4040 to control the drives without a master control.

6.18.3 Electrical shaft via MotionBus (CAN) with ECSxP as electrical shaft master

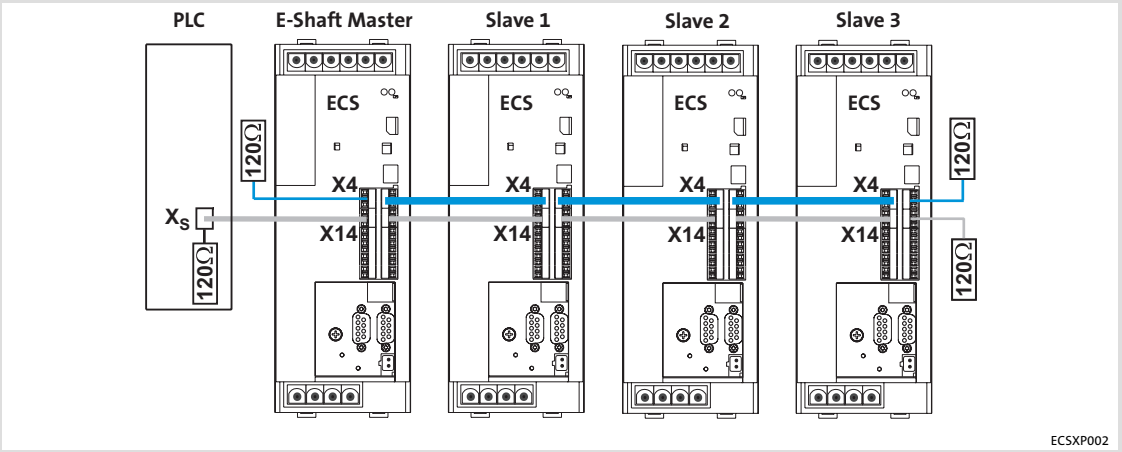


Fig. 6-52 Electrical shaft via MotionBus (CAN), control via system bus (CAN)

PLC	Master control (PLC) or a PLC device to control the drive system
E-shaft master	Master value master (axis module ECSxP)
Slave 1 ... 3	Slave drives (ECSxP axis modules)

The following special features apply to the master value transmission per MotionBus (CAN) X4 between master and slave/slaves:

- The master transmits the master values per process data channel 2 (PDO2-OUT) and the slaves receive these via the process data channel 1 (PDO1-IN).
- For acceptance of the data of PDO1 in the slaves, the reception of a CAN sync telegram is required. The CAN sync telegram is transmitted by the master.
- In this configuration with an ECSxP axis module as frequency master, the slave drives do not return any status telegrams back to the master via the MotionBus (CAN) at (X4).
- The control and coordination of the master control (PLC) is executed via the system bus (CAN) at X14. Here, the control and status information are exchanged accordingly.

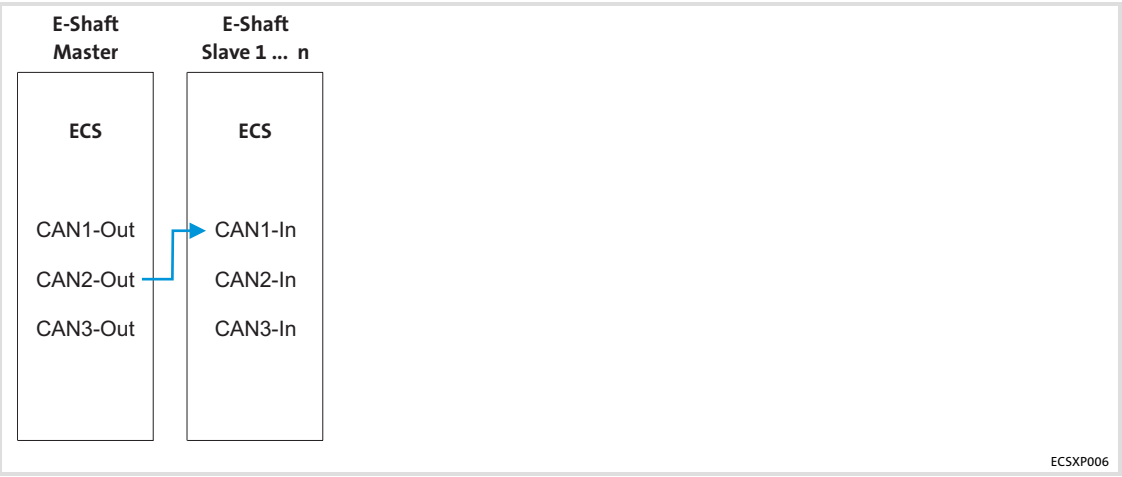


Fig. 6-53 MotionBus (CAN) telegram structure

Commissioning steps for a mimimum configuration

The codes can be found in the GDC in the ”Positioning/E-shaft” menu item.

Setting		Brief description
Preconditions		● Wiring of the MotionBus (CAN) X4 for the master value transmission ● Wiring of the system bus (CAN) X14 for the control and coordination of the drive system by the master control (PLC) ● A PC with the "Global Drive Control" (GDC) operating program can be connected to the system bus (CAN) X14 for parameterisation. ● Information on selection and configuration of the control interface to control the drive system can be found on 📖 226.
Settings for the master drive		
1.	Carry out CAN settings.	● **C0350 = x**; set the CAN node address of the CAN node. ● **C0351 = 500 kbps**; set the same CAN baud rate for all nodes. ● **C0353/2 = 0**; leave ID creation mode in default setting.
2.	Carry out boot-up settings.	● **C0352 = 1**; set master boot-up. ● **C0356/1 = 3000 ms**; leave default setting.
3.	Set transmission cycle for the setpoints.	● **C4062 = 2 ms**; Electrical shaft - setpoint cycle of master (recommendation) The cycle time setting under code C4062 is automatically accepted into the codes C0369 (CAN-sync transmission cycle) and C0356/2 (CAN2-OUT transmission cycle) ● **C0355/4**; display: Identifier CAN2_Out. Take a note of the displayed identifier for the CAN2-Out of the master to be able to set the suitable identifiers in the slaves.
4.	Define positioning profile for the operation.	● Go to positioning profiles in the GDC parameter menu and create the positioning profiles required for your application; e.g. with absolute positioning or relative positioning in the continuous measuring system. (see brief description 📖 123.) ● Do not start the profiles yet!
5.	Save settings with mains failure protection.	● **C0003 = 1**; save parameter set 1. The settings for the master drive are now completed.
6.	**GDC: change to online connection to the slave drive.**	
Settings for the slave drive		
7.	Carry out CAN settings.	● **C0350 = x**; set the CAN node address of the CAN node. ● **C0351 = 500 kbps**; set the same CAN baud rate for all nodes.
8.	Configure process data channel 1 (PDO1) as input channel.	● **C4010 = 0**; select control interface "CAN1 (PDO1, sync-controlled)". ● **C0353/1 = 1**; set ID creation mode for CAN1_IN/OUT to "Identifier = 384 + ID-Offset C0354". ● **C0354/1 = xx** ; set ID offset CAN1_IN as follows: – ID offset = (value written down from C0355/4 - 384) – Check: The identifier displayed in the slave under C0355/1 for CAN1_IN must be equal to the identifier written down from CAN2_OUT of the master.
9.	Set the synchronisation of the program cycles by means of a CAN sync telegram.	● **C1120 = 1**; set the source of the sync signal to "CAN Sync MotionBus X4" (the synchronisation function will be activated). ● **C1121 = 2 ms**; set the same time for the synchronisation cycle as for the master under C4062. ● **C1122 = 0.800 ms**; set the synchronisation phase. – Recommendation: 0.8 ms for baud rate = 500 kbps and synchronisation cycle = 2 ms ● **C1123 = 0.4 ms**; synchronisation window, set time. – Recommendation: 0.4 ms for baud rate = 500 kbps and synchronisation cycle = 2 ms ● **C0363 = 1**; set sync correction increment. – Standard setting = 1 (0.2 µs/ms) – Select the correction increment so that the synchronisation deviation in code C4264 is about 0. (Recommendation: 0.2 µs/ms)
10.	Set monitoring of the CAN communication.	Settings in the GDC under "Monitoring - CAN MotionBus" menu ● **C0357/1 = 3000 ms**; set CAN1_IN monitoring time (CE1). – Standard setting = 3000 ms – If the reception at CAN1_IN of the slave is disturbed longer than the monitoring time, the fault response set under code C0591 will be carried out. ● **C0591 = 0**; set CE1 fault response to TRIP or warning.

	Setting	Brief description
11.	Set electrical shaft speed-proportional angular offset.	● **C4060 = (-)16400 inc**; set the speed-proportional angular offset of the electrical shaft. – The recommended value applies to a synchronisation cycle of 2 ms, a synchronisation phase (C1122) of 0.8 ms and a CAN baud rate of 500 kbps. – Setting in case of a CAN baud rate of 1000 kbps: C4060 = (-)17380 **Notes:** ● The input of negative values for the speed-proportional angular offset under C4060 is correct since the setpoint position transferred to the slave within the electrical shaft master is processed with an offset of one cycle time (2 ms) but immediately in the slave. In total this results in a lead of the slave drives despite the telegram runtimes and the sync phase setting C1122 = 0.8 ms. ● The lead of the slaves compared to the master is approx. 1 ms = (2 ms - C1122 - sync telegram runtime). ● If the speed is 15000 rpm, the drive would lead approx. 16400 inc within this time of 1 ms. (📖 235)
12.	Set the positioning profile for electrical shaft operation and stretch factor.	● **C3095 = 31**; set the positioning profile mode to ”E-shaft via CAN (X4)”. ● **C3097 = 1000 / C3098 = 1000** ; set the stretch factor numerator and denominator for the electrical shaft (e.g.: 1000 / 1000). **Notes:** ● Negative values in the numerator C3097 cause a reversal of direction of rotation. ● The machine parameters C1202 and C1203 for the gearbox ration are only effective for positioning and do not influence the drive function ”electrical shaft”.
13.	Save settings with mains failure protection.	● **C0003 = 1**; save parameter set 1. The settings for the slave drive are now completed. **Make the same settings for each slave drive in the drive system (from 7th).**

In order to put the drive system into operation, the following actions must be carried out:

► Enable the slave drives by the master control (PLC) (📖 241) and start the positioning profile with the setting profile mode = electrical shaft (”E-shaft”) (📖 226).

► Enable the master drive by the master control (PLC) and start the corresponding positioning profiles (📖 226).



Tip!

For test purposes, the control interface can be set to ”control via codes” with C4010 = 3. Then the control bits of the ”Ctrl1” control word can be defined in GDC via C4040 to control the drives without a master control.

6.18.4 Electrical shaft via MotionBus (CAN) with PLC as electrical shaft master

In this operating mode, control information and master value are comprised in a telegram and individually transmitted to each slave.

The function of the master as a master value source can be taken over by a higher-level control (PLC). The speed and position-controlled slave drives follow the cyclic master value (angle) determined by the master as path followers.

In this configuration of the electrical shaft, the master control (PLC) takes over the function of the E-shaft master and the control of the slave drives (start / stop of the positioning profiles).

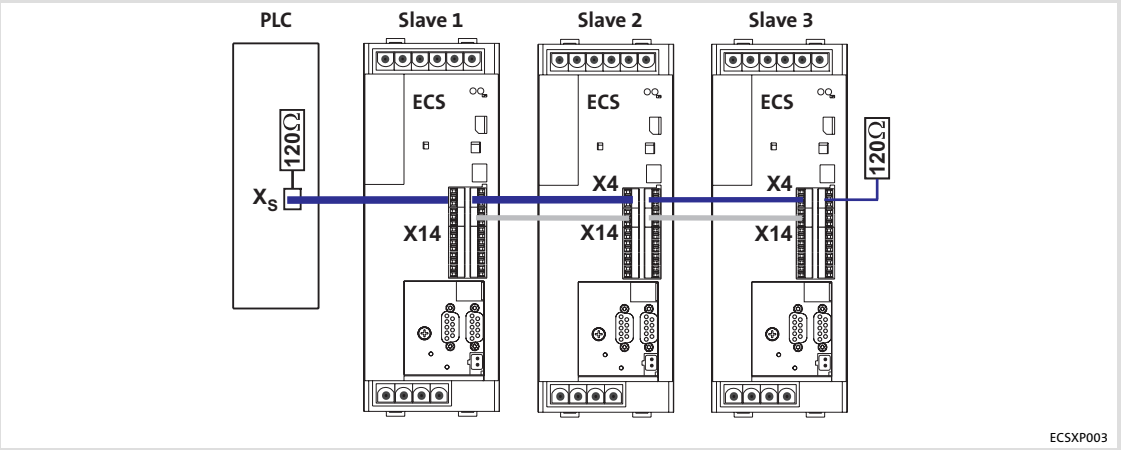


Fig. 6-54 Electrical shaft via MotionBus (CAN) with higher-level control as electrical shaft master

PLC	Higher-level control (PLC) as electrical shaft master and for control of the drive system
Slave 1 ... 3	Slave drives (ECSxP axis modules)

Only the MotionBus (CAN) at X4 is used for data exchange between the master control (PLC) and the slave drives.

Each slave drive receives an individual process data telegram from the master within a fixed cycle time. This contains the ”Ctrl1” control word with the control bits from the master to the slaves and the master value for the electrical shaft function.

The slaves send a status telegram each back to the master. For estimating the bus load, two telegrams must be set per slave. Moreover, one CAN sync telegram is transmitted cyclically by the master. More telegrams are transmitted for the parameter communication.

The total number of the CAN telegrams to be transmitted via the MotionBus (CAN) and the set CAN baud rate determine how many slave drives can be connected when a setpoint cycle is defined. Or vice versa, which minimum setpoint cycle can be set with a defined number of slave drives.

The following table can serve as indication for the maximum number of the slaves and the setpoint cycle:

Baud rate	500 kbps			1000 kbps		
Setpoint cycle	2 ms	4 ms	6 ms	2 ms	4 ms	6 ms
Number of slaves	2	5	8	4	10	16

Commissioning steps for a mimimum configuration

The codes can be found in the GDC in the ”Positioning/E-shaft” menu item.

Setting		Brief description
Preconditions		● Wiring of the MotionBus (CAN) X4 with the master control (PLC) which acts as electrical shaft master. ● Connection of a PC via the ”Global Drive Control” (GDC) operating program to the system bus (CAN) X14 for parameterisation. ● Information on selection and configuration of the control interface to control the drive system can be found on 🕮 226.
Settings for the master (PLC)		
1.	Configure master control as electrical shaft master.	● Set CAN node address of the CAN node. ● Set the same CAN baud rate for all nodes. ● Tx-COB-IDs; identifiers of the process data telegrams to the slaves – The master transmits the process data to the slave drives via the process data channel 1 (PDO1). – The identifiers to be set of the individual output telegrams to the slaves result from the CANopen convention: Identifier = basic value + node address of the slave – The slaves therefore only require few settings differing from the standard settings for process data communication. ● Rx-COB IDs, identifiers of the process data telegrams from the slaves – The telegrams sent back from the slaves via PDO1 are received by the master. – The identifiers of the individual telegrams in standard setting of the slaves also correspond to the CANopen convention and are calculated as follows: Identifier = basic value + node address of the slave ● Cyclically send a CAN sync telegram (🕮 420) with the identifier = 0x80. ● Master setpoint cycle; Interval in which the process data and the CAN sync telegram are transmitted by the master – The setpoint cycle is to amount to 2, 4 or 6 ms. **Note:** The set interval time for the setpoint cycle must be complied exactly with regard to a long-term medium. A jitter of single CAN sync telegrams of up to one telegram runtime is non-critical if the long-term medium is complied with. In case of CAN, delays may occur due to telegrams being in transmission since running telegrams cannot be interrupted. ● If required, provide for monitoring of the response telegrams from the slaves. ● Generation of the master value/master angle to be transmitted to the slaves – Telegram structure see 🕮 158 and 🕮 161. – The master angle is transmitted in bytes 5 ... 8 (PosDirect). – Information on selection and configuration of the control interface to control the drive system can be found on 🕮 226.
Settings for the slave drive		
2.	Carry out CAN settings.	● **C0350 = x**; set the CAN node address of the CAN node. ● **C0351 = 500 kbps**; set the same CAN baud rate for all nodes.
3.	Configure process data channel 1 (PDO1) as input channel.	● **C4010 = 0**; select control interface ”CAN1 (PDO1, sync-controlled)”. ● **C0353/1 = 0**; set the ID creation mode for CAN1_IN/OUT to ”Identifier = base value + node address C0350”. – C0355/1: Display of the identifier CAN1_IN of the slave – C0355/2: Display of the identifier CAN1_OUT of the slave

	Setting	Brief description
4.	Set the synchronisation of the program cycles by means of a CAN sync telegram.	● **C1120 = 1**; set the source of the sync signal to ”CAN Sync MotionBus X4” (the synchronisation function will be activated). ● **C1121 = 2 ms**; set the same time for the synchronisation cycle as for the master. ● **C1122 = 0.800 ms**; set the synchronisation phase. – Recommendation: 0.8 ms for baud rate = 500 kbps and synchronisation cycle = 2 ms ● **C1123 = 0,4 ms**; synchronisation window, set time ● Recommendation: 0.4 ms for baud rate = 500 kbps and synchronisation cycle = 2 ms ● **C0363 = 1**; set sync correction increment. – Standard setting = 1 (0.2 µs/ms) – Select the correction increment so that the synchronisation deviation in code C4264 is about 0. (Recommendation: 0.2 µs/ms) ● **C0366 = 1**; activate transmission of CAN1_OUT sync response message (response).
5.	Set monitoring of the CAN communication.	Settings in the GDC under ”Monitoring - CAN MotionBus” menu ● **C0357/1 = 3000 ms**; set CAN1_IN monitoring time (CE1). – Standard setting = 3000 ms – If the reception at CAN1_IN of the slave is disturbed longer than the monitoring time, the fault response set under code C0591 will be carried out. ● **C0591 = 0**; set CE1 fault response to TRIP or warning.
6.	Set electrical shaft speed-proportional angular offset.	● **C4060 = (-)16400 inc**; set the speed-proportional angular offset for the electrical shaft. – The recommended value applies for a synchronisation cycle (C1121) of 2 ms, a synchronisation phase (C1122) of 0.8 ms and a CAN baud rate (C0351) of 500 kbps. – Setting in case of a CAN baud rate of 1000 kbit/s: C4060 = (-)17380. **Notes:** ● The input of negative values for the speed-proportional angular offset under C4060 is correct since the setpoint position transferred to the slave within the electrical shaft master is processed with an offset of one cycle time (2 ms) but immediately in the slave. In total this results in a lead of the slave drives despite the telegram runtimes and the sync phase setting C1122 = 0.8 ms. ● The lead of the slaves compared to the master is approx. 1 ms = (2 ms - C1122 - sync telegram runtime). ● If the speed is 15000 rpm, the drive would lead approx. 16400 inc within this time of 1 ms. (📖 235)

	Setting	Brief description
7.	Set the positioning profile for electrical shaft operation and stretch factor.	● **C3095 = 31**; set the positioning profile mode to ”E-shaft via CAN (X4)”. ● **C3097 = 1000 / C3098 = 1000** ; set the stretch factor numerator and denominator for the electrical shaft (e.g.: 1000 / 1000). **Notes:** ● Negative values in the numerator C3097 cause a reversal of direction of rotation. ● The machine parameters C1202 and C1203 for the gearbox ration are only effective for positioning and do not influence the drive function ”electrical shaft”.
8.	Save settings with mains failure protection.	● **C0003 = 1**; save parameter set 1. The settings for the slave drive are now completed. **Make the same settings for each slave drive in the drive system (from 2nd).**

In order to put the drive system into operation, the following actions must be carried out:

► Cyclically transmit the process data and the sync telegram (setpoint cycle).

► Enable the slave drives by the master control (PLC) (📖 241)and start the positioning profile with the setting profile mode = electrical shaft (”E-shaft”) (📖 226).

► Start the setpoint default by the master control (PLC).



Tip!

For test purposes, the control interface can be set to ”control via codes” with C4010 = 3. Then the control bits of the ”Ctrl1” control word can be defined in GDC via C4040 to control the drives without a master control.

6.18.5 Electrical shaft via EtherCAT with PLC as electrical shaft master

The following special features apply for the master value transmission via EtherCAT between master and slave(s):

- The master control (PLC) undertakes the function of the E-shaft master as digital master value source as well as the control of the slave drives (start / stop of the positioning profile).
- Control information and master value are comprised in a telegram and individually transmitted to each E-shaft slave.
- The slave drives follow the master value (angle) cyclically specified by the E-shaft master as speed and position controlled path followers.

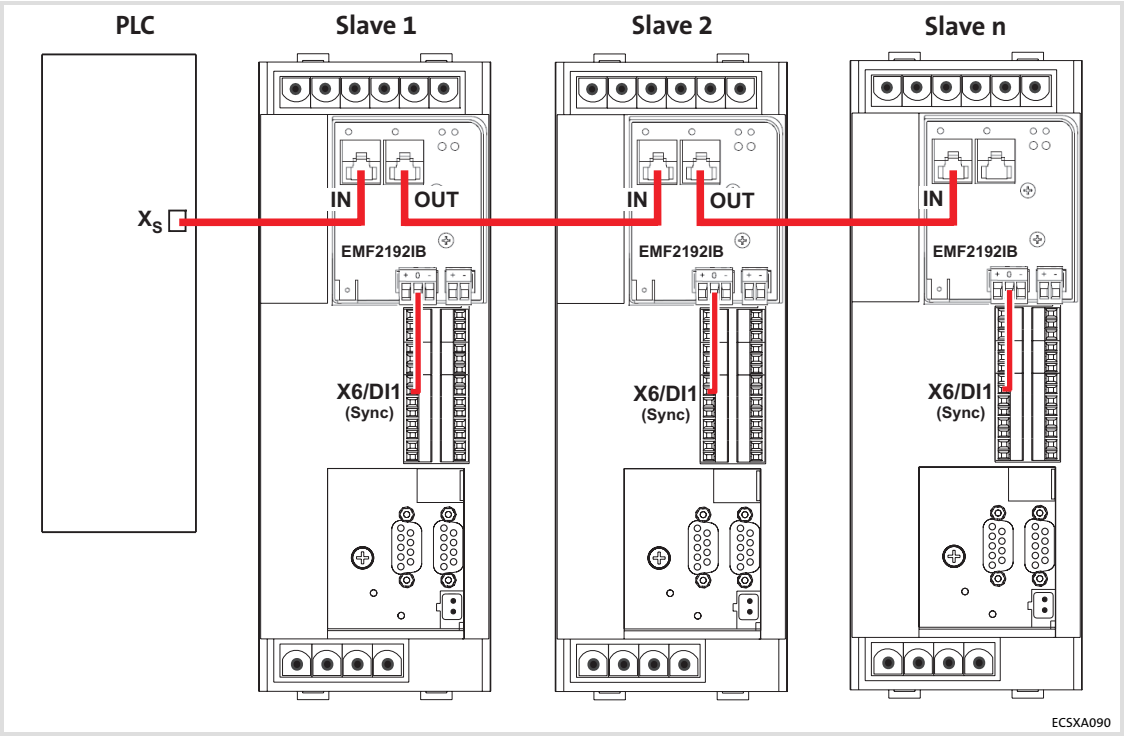


Fig. 6-55 Electrical shaft via EtherCAT with master control as E-Shaft-Master

PLC	Higher-level control (PLC) as electrical shaft master and for control of the drive system
Slave 1 ... 3	Slave drives (ECSxP axis modules)

The data exchange between the master control (PLC) and the slave drives is made via the EMF2191IB EtherCAT communication module at the AIF interface X1.

Each slave drive receives an individual process data telegram from the master within a fixed cycle time. This contains the ”Ctrl1” control word with the control bits from the master to the slaves and the master value for the electrical shaft function. The slave drives then transmit a status telegram back to the master.

A sync signal is cyclically transmitted via the digital input terminal X6/DI1 at the axis module and the sync terminal at the EMF2192IB communication module.

Commissioning steps for a mimimum configuration

The codes can be found in the GDC in the ”Positioning/E-shaft” menu item.

Setting		Brief description
Preconditions		● The EtherCAT communication module (EMF2192IB) is connected to the AIF interface (X1). ● Wiring of the EtherCAT fieldbus at the EtherCAT communication module (EMF2192IB) and to the master control (PLC) which acts as electrical shaft master. ● Connection of a PC via the ”Global Drive Control” (GDC) operating program to the system bus (CAN) X14 for parameterisation ● Information on selection and configuration of the control interface to control the drive system can be found on 📖 226.
Settings for the master (PLC)		
1.	Set master control as electrical shaft master.	● Setpoint cycle of master; interval in which the process data and the sync signal are transmitted by the master. – The setpoint cycle should be 2 or 4 ms. ● Generation of the master value/master angle to be transmitted to the slaves – Telegram structure see 📖 158 and 📖 161. – The master angle is transmitted in bytes 5 ... 8 (PosDirect). – Information on selection and configuration of the control interface to control the drive system can be found on 📖 226.
Settings for the slave drive		
2.	Select the control interface.	● **C4010 = 2**; select the control interface ”AIF (EtherCAT)”.
3.	Set the synchronisation of the program cycles by means of a sync signal via terminal X6/DI1.	● **C4011 = 5**; assignment of the digital inputs – Synchronisation is carried out via the digital input 1 (X6/ID1). ● **C1120 = 2**; set the source of the sync signal to ”synchronisation via terminal X6/DI1” (the synchronisation function will be activated). ● **C1121 = 2 ms**; set the same synchronisation cycle as for the master. ● Set **C1122** (synchronisation phase), **C1123** (synchronisation window) and **C0363** (sync correction increment).
4.	Set monitoring of the AIF communication.	● **C0126 = 0**; set the CE0 fault response to TRIP. (Monitoring of the communication on the automation interface (AIF))
5.	Set the positioning profile for electrical shaft operation and stretch factor.	● **C3095 = 32**; set positioning profile mode to ”E-shaft via EtherCAT (X1 + EMF2192IB)”. ● **C3097 = 1000 / C3098 = 1000** ; set the stretch factor numerator and denominator for the electrical shaft (e.g.: 1000 / 1000). **Notes:** ● Negative values in the numerator C3097 cause a reversal of direction of rotation. ● The machine parameters C1202 and C1203 for the gearbox ration are only effective for positioning and do not influence the drive function ”electrical shaft”.
6.	Save settings with mains failure protection.	● **C0003 = 1**; save parameter set 1. The settings for the slave drive are now completed. **Make the same settings for each slave drive in the drive system (from 2nd).**

In order to put the drive system into operation, the following actions must be carried out:

► Set the EtherCAT node to the state ”operational”.

► Enable the slave drives by the master control (PLC) (📖 241)and start the positioning profile with the setting profile mode = electrical shaft (”E-shaft”) (📖 226).

► Start the setpoint default by the master control (PLC).



Tip!

For test purposes, the control interface can be set to ”control via codes” with C4010 = 3. Then the control bits of the ”Ctrl1” control word can be defined in GDC via C4040 to control the drives without a master control.

6.19 Starting positioning profiles (ProfEnable, profile number)

There are two possibilities for starting positioning profiles via the higher-level control (PLC):

1. Start via the control bit *Ctrl1.ProfEnable*
   – Activation time until execution: up to 30 ms
   – From Posi&Shaft V2.0 onwards: activation time 18 ... 24 ms (up to 6 ms variation depending on the moment of transmission)
2. Start by selection of a new profile number (PNoSet_x) while the control bit *Ctrl1.ProfEnable* is set to 1.
   – Activation time until execution: 12 ... 18 ms (up to 6 ms variation depending on the moment of transmission); (fastest option)

Note!

Ctrl1.ProfEnable must remain set to ”1” until the target position has been reached. The drive stops immediately if the control bit *Ctrl1.ProfEnable* is reset to ”0” during a running positioning profile.

(See also chapter 6.11.1 ”Control word Ctrl1” (📖 159).)

6.19.1 Start of positioning profile via the ”ProfEnable” control bit

Preconditions

- The ECSxP axis module must be ready for starting. (Controller is enabled, ”Stand-by” state is active, no fault, etc.)
- The master control (PLC) including the communication channels are ready to control the axis module.

Control sequence

1. PLC:

   Note: In order that the rising edge at *Ctrl1.ProfEnable* can be recognised by the ECSxP axis module for starting the next profile, ensure that *Ctrl1.ProfEnable*= 0 in the axis module.

   – Select positioning profile number via the 4 control bits *PNoSet_x* in the control word *Ctrl1* (binary coded).

   – Start the positioning profile by setting the control bit *Ctrl1.ProfEnable* to 1 (rising edge).

2. ECSxP axis module:

   ⇨ Status bits *Stat1.InTarget* and *Stat1.DwellTime* are reset and the selected profile number is accepted (display in *Stat1.PNoAct_x*).

3. PLC:

   – Wait until the selected positioning profile has been started in the ECSxP axis module.
   Display: Status bits *Stat1.PNoAct_x*, *Stat1.InTarget* = 0, *Stat1.DwellTime* = 0).

4. PLC:

   – Wait until the profile function has been processed or positioning has been completed.
   Display: Status bits *Stat1.InTarget* = 1 and *Stat1.DwellTime* = 1.

5. PLC:

   – Reset control bit: *Ctrl1.ProfEnable* = 0

6. Proceed with step 1 for the next profile.

6.19.2 Start of positioning profile by selecting a new profile number ”PNoSet_x”

Precondition

The ECSxP axis module must be in the ”positioning” mode and thus ready to start. The axis module is in the ”positioning” mode when a positioning process has been completed, the controller is still enabled and the control bit *ProfileEnable* remains set.

Control sequence

1. PLC:
   – Select and thus start the positioning profile via the 4 control bits *PNoSet_x* (binary coded) in the control word *Ctrl1*.
   – The control bit *Ctrl1.ProfEnable* remains set.
2. ECSxP axis module:
   ⇨ Status bits *Stat1.InTarget* and *Stat1.DwellTime* are reset and the selected profile number is accepted (display in *Stat1.PNoAct_x*).
3. PLC:
   – Wait until the selected positioning profile has been started in the ECSxPaxis module.
   Display: Status bits *Stat1.PNoAct_x*, *Stat1.InTarget* = 0, *Stat1.DwellTime* = 0).
4. PLC:
   – Wait until the profile function has been processed or positioning has been completed.
   Display: Status bits *Stat1.InTarget* = 1 and *Stat1.DwellTime* = 1.
   ⇨ If the target position has been reached, status bits *Stat1.InTarget* and *Stat1.DwellTime* are both set to 1.
5. Proceed with step 1 for the next profile.



Tip!

Quickest possible profile sequence by specifying new profile numbers during the running positioning process in step 4 of the control sequence:

- ► In this case, the sequence profile is started immediately after the profile generator has reached the previous target position (setpoint-based).
- ► The dwell time is not awaited anymore and the *Stat1.DwellTime* status bit is not set in the meantime.
- ► Depending on the setting of the target window, it may occur that *Stat1.InTarget* status bit is not set either when changing to the new profile.

6.20 Setting the target position window (InTarget)

The C3034 target position window serves to set a window for the ”Target position reached” message. The entered target window is positioned around the target position which is in the middle of it. The settings can be made in the GDC parameter menu under **Positioning → Machine parameters**.

- The status message ”Target reached” is set (status bit *Stat1.InTarget* = 1) as soon as the actual position has reached the target window which is positioned around the positioning target.
- Only for constant travel modes (C3095 = 2 or 112):

  The target position is defined as the position where standstill has been reached for the first time when stopping. Then the target position window is set around this position and the *Stat1.InTarget* status bit is set to ”1” as long as the current position is within the window.

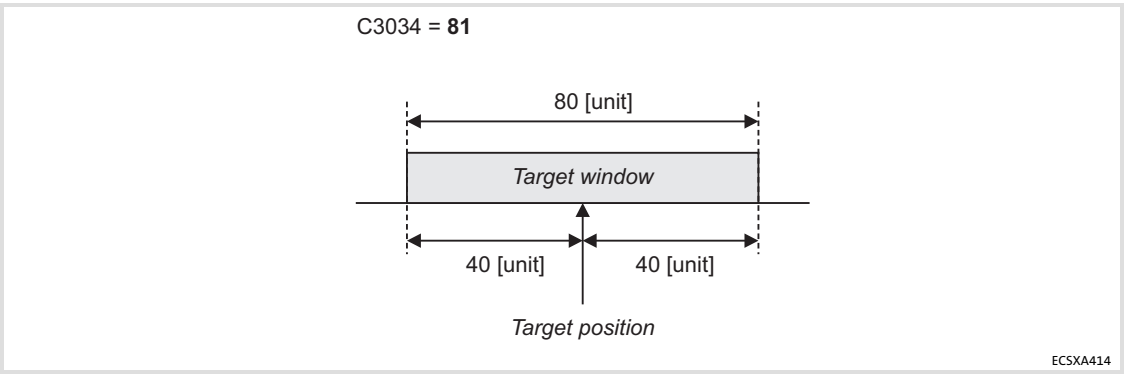


Fig. 6-56 Symmetrical structure of the target position window

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3034	Target Window	360.0			Total width of the target position window Layout: Half of the window width before and after the target position	229
			-0.0000	{0.0001 units} 65536.0000		



Tip!

The target window for the status bit *Stat1.InTarget* is evaluated independent of the position setpoint of the profile generator. This means, depending on the setting of the target window and the drive properties, it may happen that the status bit *Stat1.InTarget* is already set before the position setpoint of the profile generator has reached the target position.

If this is not required, it is possible to evaluate the following status bits AND'ed:

► *Stat1.InTarget*AND *Stat1.DwellTime* (📖 *161*)

This has the effect that the setpoint from the profile generator must at least have reached the target position (with dwell time = 0) or even a dwell time must be waited for (with dwell time > 0).

6.21 Defining the window for standstill message

The standstill message is activated if the actual speed falls below a certain speed limit value (independent of the direction of rotation). The limit value (C3017) and hysteresis (C3018) can be set in the GDC parameter menu under **Positioning → Machine parameters**.

Function sequence

- If the current speed falls below the speed threshold (C3017), status bit *Stat2.Nmin* is set to 1.
- Only when the current speed exceeds the value of C3017 + C3018 again, status bit *Stat2.Nmin* is reset to "0".

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3017	Lim.n=0-Flag	0.10				Limit value for speed, (n_{min} signal)	231
			0.01	{0.01 %}	100.00	If the value falls below the limit value, the status bit *Stat2.Nmin* is set to 1.	
C3018	Hyst.n=0-Flag	0.10				Hysteresis for speed (n_{min} signal)	231
			0.00	{0.01 %}	100.00		

6.22 Defining the dwell time

The dwell time entered under C3035 serves to give the drive time to remove a possibly available following error when the target position has been reached.

The setting can be made in the GDC parameter menu in **Positioning → Positioning behaviour**.

- The dwell time starts to elapse when the position setpoint from the profile generator has reached the target position (status bits *Stat1.ProfileBusy* = 0 and *Stat2.AuxProfileBusy* = 0).
- After the dwell time has elapsed, status bit *Stat1.DwellTime* is set to 1.
- If a new positioning is started, status bit *Stat1.DwellTime* is set to 0.

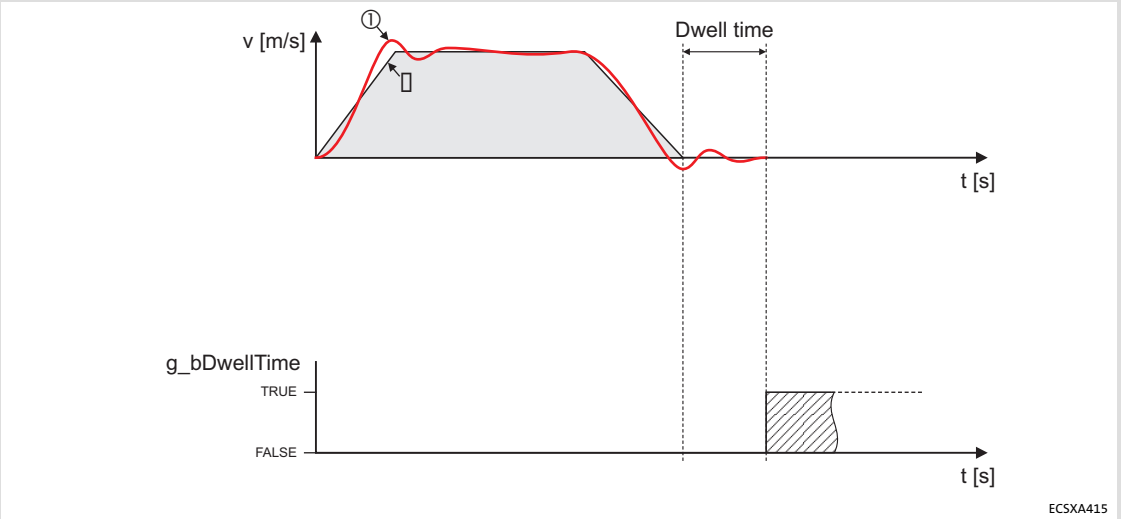


Fig. 6-57 Definition of the dwell time

① Actual value profile
② Setpoint profile

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3035	DwellTime	50				Dwell time after end of profile	📖 232
			0	{1 ms}	65535	Time required from positioning profile end (setpoint generator has reached target position) to the setting of status bit *Stat1.DwellTime* = 1	

6.23 Following error monitoring (C3030, C3031)

The following error monitoring function is triggered if the drive cannot follow the defined position setpoint within the tolerances to be set.

Mechanical stiffness may be the reason or the setpoint selection comprises an acceleration which is too high for the drive power.

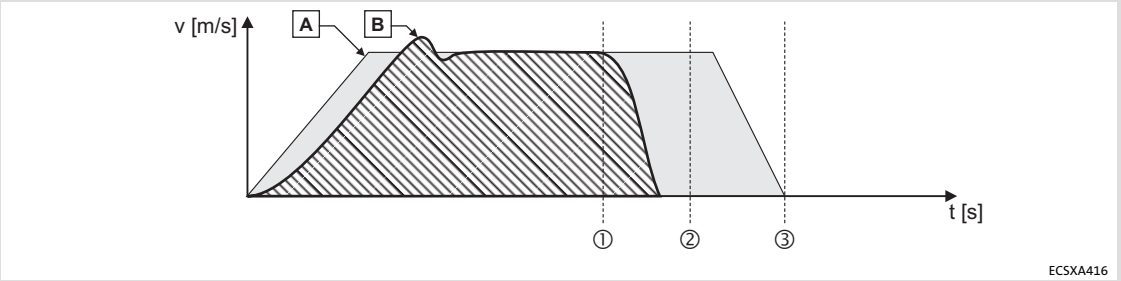


Fig. 6-58 Following error

- A Setpoint speed profile (the area below the curve corresponds to the path)
- B Profile travelled
- ① The drive decelerates, a difference between set position and actual position arises.
- ② Following error tolerance is exceeded.
- ③ End of the set profile

For the following error monitoring mode it is checked whether the current following error (difference between set position and actual position) is higher than the set following error tolerance. Two following error tolerances can be set which trip different responses:

► **Following error warning (C3030):**

If the current following error exceeds the tolerance set under C3030, a warning is output as fault response *only*, and the movement of the drive is not interrupted. The warning is to announce an upcoming stiffness so that the master control (PLC) can initiate a controlled response.

The status bit *Stat2.FollowErrWarn* is set to ”1” as long as the current following error is higher than the tolerance C3030.

If a profile is being processed (”Positioning” status), the start for the next positioning profile to be travelled (e.g. sequence profile with touch probe positioning) is not executed as long as the warning is active.

► **Following error-FAIL-QSP (C3031):**

The following error limit C3031 must be set higher than the tolerance under C3030.

If the current following error exceeds the limit set in C3031, the FAIL-QSP fault response is triggered. The drive brakes to standstill over the set quick stop deceleration time (C0105).

Fault response FAIL-QSP "FollowErr"

– The drive changes to the "Trouble" state.

– The quick stop deceleration time is set via C0105 in the GDC parameter menu under **Positioning → Machine parameters**.

– The following errors are monitored in all motion states of the drive. A reset of the fault message is required (e.g. control bit *Ctrl1.TripReset* = 1).

Note!

In case of the ECSxP axis module, the fault responses "Warning" and "FAIL-QSP" cannot be changed or switched off for following error monitoring.

However, it is possible to set the following error tolerances to the maximum value which practically switches off the following error monitoring.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3030	FollErrWarn	360.0				Following error tolerance (warning)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the "FollowErr" warning will be triggered. The status bit *Stat2.FollowErrWarn* is set to "1" (TRUE). **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	
C3031	FollowErrQSP	720.0				Following error tolerance (Fail-QSP)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the Fail-QSP "FollowErr" fault is triggered and the drive is stopped through the QSP ramp. **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	

6.24 E-Shaft: Speed-dependent angular trimming

Application

The transmission of the master angle from the digital frequency master to the slave drives causes an offset over time (dead time) between master and slave drives. With increasing speed, this dead time causes an increasing angular offset of the slaves compared to the master.

When the electrical shaft is used, the angular offset in the slave can be compensated via the ”Speed-proportional angular trimming” function. This function is only active in the positioning profile mode ”Electrical shaft” (C3095 = 30, 31, 32)!

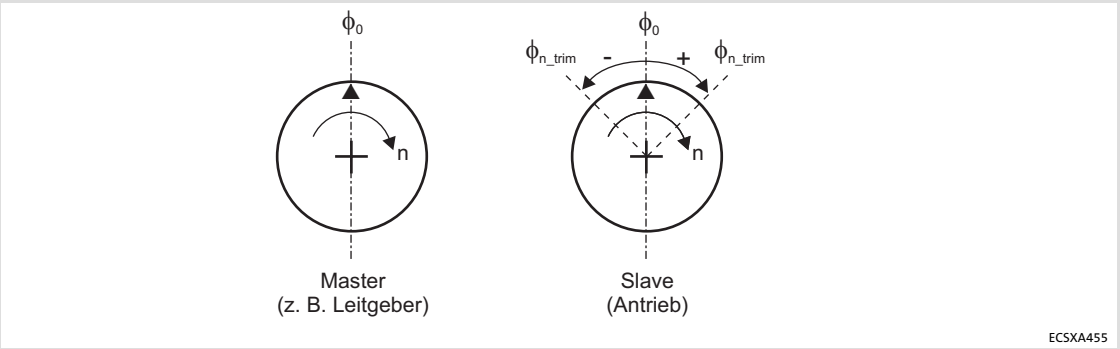


Fig. 6-59 Angular trimming in the slave drive

In the slave drives, the effective angular trimming is calculated based on the angular trimming characteristic as a function of the master speed (linear characteristic).

The user can adapt the slope of this linear characteristic by entering a point on the characteristic. Under code C4060, the required angular offset for the master speed of 15000 rpm is entered. The entry is done in increments, and 2^{16} increments correspond to one revolution of the motor shaft.

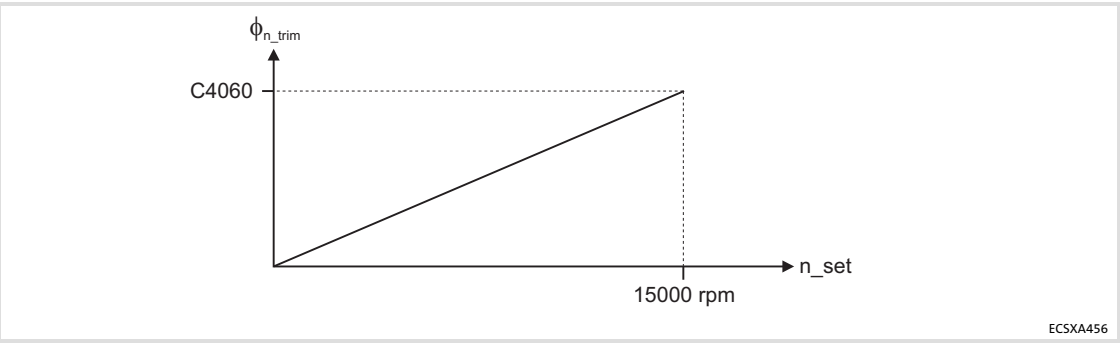


Fig. 6-60 Linear connection in the speed-proportional angular trimming

Note!

The value C4060 is only to be changed at standstill of the drive to prevent speed steps.

The value of angular trimming becoming effective at the current speed is displayed in C4061.

The codes C4060 and C4061 can be found in the GDC parameter menu under **Positioning/E-shaft → E-shaft - slave**.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4060	ES_NOffs					Only for "electrical shaft" function: default value (in increments) for speed-proportional angular trimming relating to 15000 rev./min. **Note:** Only change value when the controller is at standstill!	📖 235
			-655360	{1 inc}	655360		
C4061	ES_ActN Offset					Only for "electrical shaft" function: Currently active value of the angular trimming relating to 15000 rev./min at current speed. Read only	📖 235

6.25 Software limit positions, limitation of the travel range

Software limit positions are position marks which limit the traversing range of the tool to ensure that the hardware limit switches are not reached.

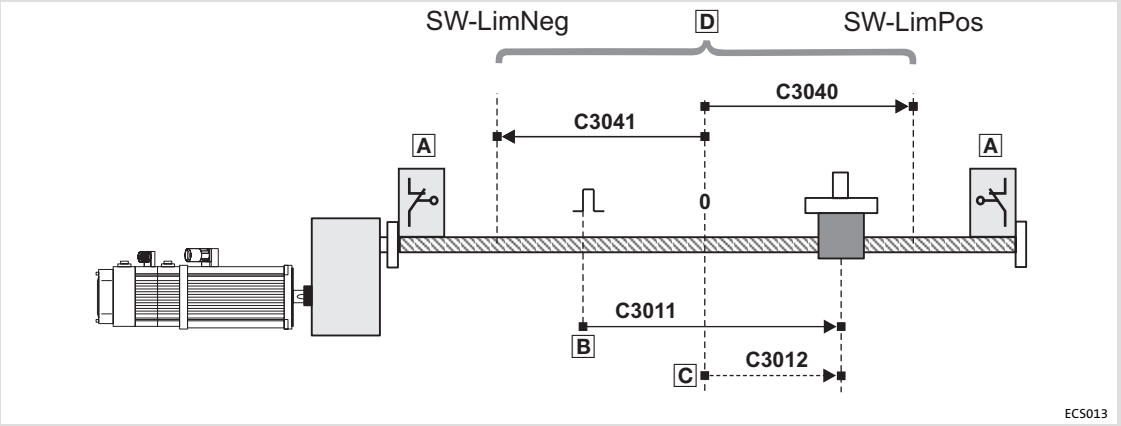


Fig. 6-61 GDC view: Monitoring of the travel range by software limit positions

A	Hardware limit switch
B	Home position (zero pulse/zero position of the position encoder))
C	Zero position of the measuring system after offset by C3011 and C3012
SW-LimNeg	Negative software limit position
SW-LimPos	Positive software limit position
D	Permissible travel range

STOP

Stop!

- If **no** software limit positions are set (C3040=0, C3041=0), the drive may reach its mechanical limits and parts of the machine can be damaged or destroyed.
- When the zero position is shifted by C3011 and C3012 (📖 187), the software limit positions (C3040, C3041) are shifted as well towards the mechanical components. Therefore adapt the software limit positions accordingly.

The software limit positions are set with C3040 (positive software limit position) and C3041 (negative software limit position) in the parameter menu under **Positioning → Homing**.

- The software limit positions refer to the zero position.
- Depending on the setting of the machine parameters, it may occur that the software limit positions entered in C3040/C3041 in units cannot be displayed in internal increments anymore. In this case, an internal limitation of the maximally displayable value is made automatically and the warning 2424 (”SWLimOutOfRange”) is output. The currently effective values of the positive and negative software limit positions are displayed in C4240/C4241.
- Consider an appropriate back-up distance when selecting the software limit positions which ensures that the software limit positions will not be reached even in case of slight variations of the actual position values in correct positioning processes.
- The acceptance of new settings in C3034/C3041 requires a status change to ”Stand-by”!
- The value for the positive software limit position must be greater than the value for the negative software limit position (C3040 > C3041). Otherwise FAIL-QSP (fault number 3417, ”InvSftwLimits”) is activated and the drive changes to ”Trouble”.
- If the home position is known in the ”Continuous constant travel” mode (C3095/x = 2) and if a software limit position is reached, FAIL-QSP is activated:
  – Fault no. 3402, ”PosPosLimit”
  – Fault no. 3403, ”NegPosLimit”
  (For manual jog (inching mode) instead of FAIL-QSP a corresponding warning (fault no. 2402, 2403) is actuated.)
- If the software limit positions are overtravelled, status bit *Stat2.SWLimErr* is set to 1 in C4046.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3040	SW-LimPos	3600.0				Positive software limit position	📖 237
			0.0000	{0.0001 units}	214000.0000		
C3041	SW-LimNeg	-3600.0				Negative software limit position	📖 237
			-214000.0000	{0.0001 units}	0.0000		
C3042	SWLimCtrl Mode	0				Mode of the software limit position monitoring	
			0			Current setpoint position + defined direction of movement	
			1			Current actual position	
C4265	MaxTargetInp					Max. target position input (in units) Read only	📖 103
			-214000.0000	{0.0001 units}	214000.0000		

Operating mode of the software limit position monitoring

Before positioning is started, the software limit position monitoring checks if the target position is within the valid traversing range defined by the software limit positions. If this is not the case, positioning is not started and a fault message is indicated.

If the current position is beyond the software limit positions, the defined direction of movement of the drive is checked in addition to the position in case of a setpoint-based monitoring of the software limit positions (C3042 = 0) . If the drive stands still or if the tool is to move towards the permissible traversing range, no fault is triggered. Only if the tool is to travel further away from the permissible traversing range, a fault message is output and a QSP is activated.

With the actual value-based monitoring of the software limit positions (C3042 = 1), the current actual position of the drive is checked. If the current actual position is beyond the permissible traversing range, a fault message is output and a QSP is activated. When the fault message is triggered, the status changes to ”Trouble”.

In ”ManualJog” the software limit positions cannot be exceeded because the drive traverses to the software limit positions.

When is the software limit position monitoring deactivated?

The monitoring of the software limit positions is deactivated if:

- Both software limit positions (C3040/C3041) are set to ”0”.
- Homing is executed.
- Status bit *Stat1.HomePosAvailable* = 0 (home position not known.)

6.26 Evaluation of hardware limit switches

- Ensure a fail-safe design of the hardware limit switches (NC contact, LOW active).
- The active level is set via C0114/x (polarity of the digital inputs).
- If a hardware limit switch is approached, the drive brakes to standstill via the quick stop deceleration time set and FAIL-QSP is actuated.
  – Fault No. 3400, ”PosLimitSw”
  – Fault No. 3401, ”NegLimitSw”
  The drive changes to the ”Trouble” state.
- The quick stop deceleration time is set with C0105 in the GDC parameter menu under **Positioning/E-Shaft → Machine parameters**.

6.27 Controller enable (CINH = 0)

The controller will only be enabled internally if no signal sources relevant for the controller inhibit (CINH) are activated (i.e. CINH-signal sources = 0).

The following table describes the signal sources for the controller inhibit (CINH) / controller enable:

Source of the Controller inhibit	Controller inhibit	Controller enable	Comment
Terminal X6/SI1 (Controller inhibit)	LOW level (0 ... +4 V)	HIGH level (+13 ... +30 V)	For controller enable, both input terminals (X6/SI1 AND X6/SI2) must be controlled with HIGH level.
Terminal X6/SI2 (Pulse inhibit)	LOW level (0 ... +4 V)	HIGH level (+13 ... +30 V)	
Control bit *Ctrl1.Cinh* in the control word "Ctrl1"	*Ctrl1.Cinh* = 1	*Ctrl1.Cinh* = 0	see 📖 158 The control word "Ctrl1" is described via the set control interface. The control interface is selected under C4010. The following are available: ● MotionBus (CAN) ● System bus (CAN-AUX) ● Fieldbus via AIF interface ● Code C4040 If required, see the documentation on the corresponding fieldbus module, if control via AIF interface.
C0040 (Controller inhibit)	C0040 = 0	C0040 = 1	
STOP/RUN key on the operating module/keypad XT	STOP key	RUN key	Inhibiting with STOP key is only possible if the STOP key is assigned with "CINH" via C0469. Set C0135.Bit09 = 1 via the STOP key. Set C0135.Bit09 = 0 via the RUN key.
Fault/message	● in case of TRIP ● in case of message	TRIP-RESET	For check see 📖 337.
Control bit09 (controller inhibit CINH) in the "DCTRL control word" under C0135	C0135.Bit09 = 1	C0135.Bit09 = 0	
Function button <F8> and <F9> in the Global Drive Control (GDC)	Button <F8>	Button <F9>	GDC writes to C0135.Bit09 via parameter data channel. <F8> (start drive) serves to set C0135.Bit09 = 1. <F9> (stop drive) serves to set C0135.Bit09 = 0.
Brake logic	CINH is controlled internally by brake logic	CINH is not controlled internally by brake logic	Display through C0183 = 122 (CINH-intern1 (brake logic))

The following table describes the status displays for the controller inhibit (Cinh) / controller enable:

Status display	Controller inhibited	Enable controller	Comment
Green LED	Blinking	Constantly ON	
C0183 drive diagnostics	Display of the signal source for controller inhibit (Cinh)	Display "OK"	See GDC menu "Diagnostics / Device current status" or GDC monitor window down right
C0150 DCTRL status word Bit 7 (CINH active)	C0150.Bit07 = 1	C0150.Bit07 = 0	See GDC menu "Diagnostics / display MCTRL"
Keypad text display "IMP"	"IMP"	"IMP" not displayed	

Note!

All signal sources for controller inhibit (Cinh) act like a series connection of switches which are independent of each other.

6.28 Quick stop (QSP)

During the process, a quick stop (QSP) can be actuated via the control word Ctrl1 with control bit *Ctrl1.QSP* = 1, i. e. the drive brakes to standstill along the QSP deceleration time set (C0105) and a change to the ”Stand-by” state is effected (status bit *Stat2.QspIn* = 1).

The quick stop deceleration time is set with C0105 in the GDC parameter menu under **Positioning/E-Shaft→ Positioning behaviour**.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 243
			0	QSP not active			
			1	QSP active			
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 243
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

6.29 Operation with motors from other manufacturers

6.29.1 Entering motor data manually

If you use motors of other manufacturers together with the ECS axis module, you have to enter the motor data manually. The GDC includes the required codes in the parameter menu under **Motor/feedback systems→ → Motor**.

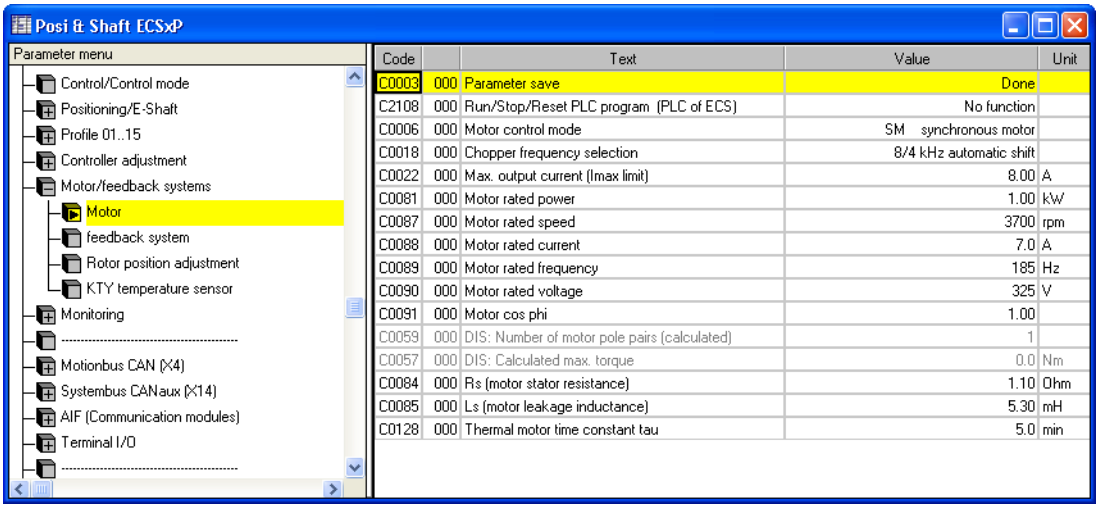


Fig. 6-62 GDC view: Manual setting of the motor data

Tip!

First, select a Lenze motor with similar motor data via the motor data input assistant in the GDC (button with motor symbol). Then enter the exact nameplate data via the corresponding codes.

Code		Possible settings		IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection	
[C0006]	Op mode	1		Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1 Servo PM-SM	Servo control of synchronous motors
			2 Servo ASM	Servo control of asynchronous motors

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0018	fchop	2				Switching frequency	
			1	4 kHz sin		4 kHz permanent PWM frequency	
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load	
C0022	Imax current	→				I_{max} limit	
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
C0128	Tau motor	5.0				Thermal time constant of the motor	📖 309
			0.5	{0.1 min}	25.0	For calculating the $I^2 x t$ disconnection	
C2108	PLC run/stop (Posi & Shaft)	2 {1}				PLC programcontrol	
			0	No function			
			1	Run			
			2	Stop			
			3	Reset			

6.29.2 Checking the direction of rotation of the motor feedback system

In GDC, you can find the parameters and codes to be set in the parameter menu under **Motor/Feedback systems → Feedback system**.

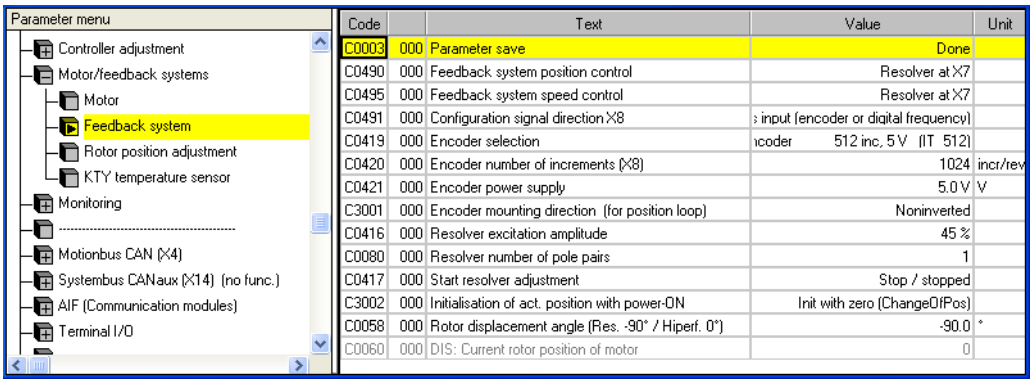


Fig. 6-63 GDC view: Feedback system

C0060 indicates the rotor position within one revolution as a numerical value between 0 and 2047. The indicated rotor position is derived from the selected position encoder (C0490) with reduced resolution.

Evaluation:

If the motor encoder (resolver) is set as position encoder (C0490) and the rotor rotates in CW direction (view on the front of the motor shaft), the numerical value must rise. If the values are falling, reverse the Sin+ and Sin- connections.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

6.29.3 Adjusting current controller

For an optimum machine operation, the current controller settings must be adapted to the electrical motor data.

The parameters of the current controller depend on the electrical motor data. They do not depend on mechanical data as with the speed and position control circuit. This is why the default current controller settings of the ”GDC motor data input assistant” can usually be used. A current controller adjustment is only required for third-party motors and for Lenze motors only in special cases.

Leakage inductance and stator resistance of the motor are known:

The gain of the current controller V_p and the integral-action time of the current controller T_n can be calculated by approximation:

Current controller gain (V_p)	Integral-action time of the current controller (T_n)
$V_p = \frac{L1_S}{250\ \mu s}$	$T_n = \frac{L1_S}{R1_S}$

$L1_S$ Motor leakage inductance

$R1_S$ Motor stator resistance

Note!

Depending on the leakage inductance of the motor, the calculated values can be outside the adjustable range. In this case

► set a lower gain and a higher integral-action time;

► adjust the current controller metrologically (📖 248).

For applications with high current controller dynamics the pilot control of the current controller outputs can be activated with C0074 (C0074 = 1). For this, it is vital to enter the correct values for the stator resistance (C0084) and leakage inductance (C0085).These can be obtained from the data sheet of the motor used!

Leakage inductance and stator resistance of the motor are not known:

The current controller can be optimised metrologically with a current probe and an oscilloscope. For this, a test mode is available in which the current C0022 x √2 flows in phase U after controller enable.

Stop!

Avoid damage to the motor and machine

- ► During the current controller adjustment, the motor must be freely rotatable.
- ► The test current must not exceed the maximum permissible motor current.
- ► Always adjust the current controller at a switching frequency of 8 kHz.

Observe the current step in phase U to adjust the current controller.

Setting sequence

1. Select 8 kHz as switching frequency (C0018 = 2).
2. Select the test current under C0022:
   – Start with a low current value, e.g. half the rated motor current.
3. Activate the test mode with C0418 = 1.
4. Enable the controller. (📖 241)
   – Adjust the synchronous motor.
   – The asynchronous motor remains at standstill.
5. Enable and inhibit the controller several times in a row changing the current controller gain (C0075) and the current controller adjustment time (C0076) such that the current characteristic is free of harmonics.
6. After the adjustment has been completed, deactivate the test mode with C0418 = 0.
7. If required, change the switching frequency under C0018.

6.29.4 Effecting rotor position adjustment

Note!

Resolver / absolute value encoder with Hiperface® interface

- If the rotor zero phase is not known, the rotor position only has to be adjusted once during commissioning.
- For multi-turn absolute value encoders, the traversing range must be within the display range of the encoder (0 ... 4095 revolutions) if the traversing range is limited.

TTL incremental encoder / sin/cos encoder with zero track

- If these encoder types are used for the operation of synchronous motors, the rotor position must be adjusted every time the low-voltage supply is switched on.

The rotor position must be adjusted if:

- A motor from another manufacturer is connected to the controller.
- Another encoder has been mounted subsequently.
- A defective encoder has been replaced.

The rotor position can only be adjusted if:

- The resolver is polarised correctly.
- The current controller has been adjusted.

The GDC contains the parameters or codes to be set on the parameter menu under **Motor/Feedb. → Rotor position adjustment**:

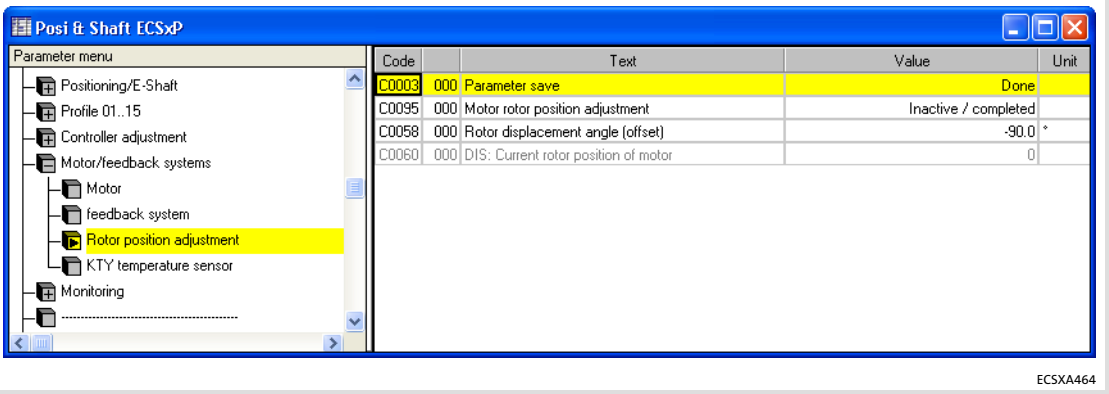


Fig. 6-64 GDC view: Commissioning of rotor position adjustment

Setting sequence

1. Inhibit controller. (📖 241)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
2. Unload motor mechanically.
   – Separate the motor from the gearbox or machine so that it can rotate freely.
3. Open holding brake (if available).
4. Activate rotor position adjustment with C0095 = 1.
5. Enable controller. (📖 241)
   – X6/SI1 = HIGH and X6/SI2 = HIGH and press the <F8> key in GDC.
   The rotor position adjustment program of the controller is started:
   – The rotor rotates half a revolution in 16 steps (for resolver with 1 pole pair: 180° electrically ≙ 180° mechanically).
   – After one revolution, C0095 is automatically reset to ”0”.
   – The rotor zero phase is stored under C0058. (For absolute value encoders (Hiperface®, single-turn/multi-turn) at X8, C0058 is always ”0”.)



Danger!

Uncontrolled drive movements after an Sd7 fault with absolute value encoders

If absolute value encoders are used and the rotor position adjustment is completed with the fault message ”Sd7” (📖 343), the rotor position could not be assigned to the feedback system. In this case, the drive may carry out uncontrolled movements after controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Repeat rotor position adjustment (starting with step 1).

► Check wiring and interference immunity of the encoder at X8.

6. Inhibit controller. (📖 241)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
7. Save the data determined by the controller with C0003 = 1.



Tip!

The values for C0058 and C0095 are only displayed in GDC if you place the bar cursor on them and read back the code using function key <F6>.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive			
			1	Active			

6.30 Optimising the drive behaviour after start

For applications with high current controller dynamics, the pilot control for the current controller can be adjusted under C0074:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0074	Dynamics	0		Pilot control of the current controller for higher dynamics	📖 247
			0 Normal		
			1 Enhanced		

6.30.1 Speed controller adjustment

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not ”noisy”.
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

In GDC, you can find the codes for adjusting the speed controller in the parameter menu under **Controller settings → Speed/position**.

Parameter setting

► Set the proportional gain (V_{pn}) via C0070:
– Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
– Increase C0070 until the drive becomes instable (pay attention to engine noises).
– Reduce C0070 until the drive runs stable again.
– Reduce C0070 to approx. half the value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 252
			0.00	{ 0.01}	127.99		

► The reset time (T_{nn}) is set via C0071:
– Reduce C0071 until the drive becomes instable (pay attention to engine noises).
– Increase C0071 until the drive runs stable again.
– Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 252
			1.0	{0.5 ms}	6000.0		

► The derivative gain (T_{dn}) is set via C0072:
– Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 252
			0.0	{0.1 ms}	32.0		

6.30.2 Adjustment of field controller and field weakening controller

Stop!

- ► Field weakening operation is only possible with asynchronous motors.
- ► The available torque is reduced by the field weakening.

In order to optimise the machine operation in the field weakening range, you can set the field controller and the field weakening controller accordingly.

Field weakening occurs if the maximum output voltage of the controller is reached with rising speed and cannot be increased further.

The maximum possible output voltage depends on

- ► the respective DC-bus voltage (mains voltage).
- ► the voltage reduction through the controller load.
- ► the voltage drop at the mains choke.

Experience values for the voltage drop under the influence of the mains choke and inverter are between 6 ... 10 %.

$$\text{Max. output voltage [V]} = \text{mains voltage [V]} - \text{voltage drop [\%]}$$

The GDC contains the codes for adjusting the field controller/field weakening controller in the parameter menu under **Controller adjustment → Field control/Field weakening**:

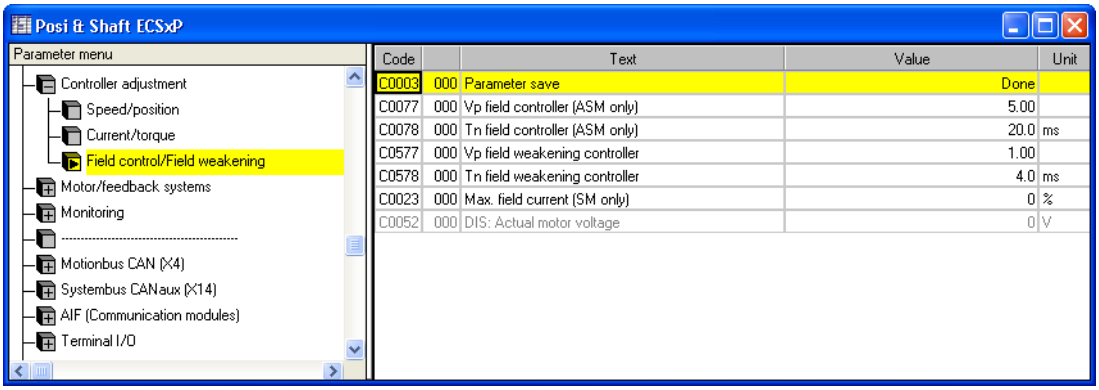


Fig. 6-65 GDC view: Field controller / field weakening controller adjustment

6.30.2.1 Adjusting the field controller

The field controller settings depend on the motor data.

Setting sequence

1. Stop the PLC program: C2108 = 2
   – As of operating system version 7.0 (see nameplate), this is no longer necessary, because C0006 (see 2.) can also be written when the PLC program is running!
2. Set motor control for asynchronous motors: C0006 = 2
   – The motor nameplate data must be entered correctly!
3. Read rotor time constant T_r (C0083).
4. Read magnetising current I_d (C0092).
5. Calculate field controller gain V_{pF} and enter in C0077.

$$V_{pF} = \frac{T_r\,(C0083) \cdot I_d\,(C0092)}{875\ \mu s \cdot I_{max}}$$

I_{max} Maximum current of axis module

6. Enter rotor time constant T_r as field controller integral-action time T_{nF} in C0078.

6.30.2.2 Field weakening controller adjustment

- The field weakening controller determines the speed performance of the asynchronous motor in the field weakening range.
- The field weakening controller can only be set correctly when the system constellation has been completed and is under load.

Note!

An excessive value of I_{max} (C0022) can cause a malfunction of the drive in the field weakening range of the asynchronous motor. For this reason, the current is limited in terms of speed in the field weakening range. The limitation has a 1/n characteristic and is derived from the motor parameters.

The limitation can be adjusted with the stator leakage inductance (C0085):

- Low values cause a limitation at higher speeds.
- Higher values cause a limitation at lower speeds.

Setting sequence

1. Set gain V_p: C0577 = 0.01 ... 0.99
   – V_p must not be ”0” (deactivates the field weakening controller)!
2. Set integral-action time T_n: C0578 = 1 ... 40 ms
3. Select a speed setpoint so that the motor is operated in the field weakening range.
4. Observe the speed curve
   – If the speed takes an irregular course, the field weakening controller must be readjusted.
   – The field weakening controller must be provided with a distinct integral action.

Tip!

Parameter setting with a distinct I component can improve the drive behaviour when changing to the field weakening range.

For this purpose, set the gain (V_p) in C0577 to at least 0.01.

The following applies:

- P component = V_p = C0577
- I component = V_I = C0577/C0578

If the P component (V_p) is reduced via C0577, adapt the reset time C0578 accordingly to keep the I component (V_I).

6.30.3 Resolver adjustment

When adjusting the resolver, mainly component tolerances of the resolver evaluation are compensated in the device. No resolver error characteristic is accepted. The resolver adjustment is only required if the speed behaviour is irregular despite optimised settings of the speed and position control loop.

The resolver adjustment is started via code C0417 = 1. Then the resolver is adjusted automatically during the next 16 motor revolutions.

If it is not possible to adjust the resolver (due to a fault or a defective cable), the original adjustment values can be restored with C0417 = 2.

C0417 can be found in the GDC in the parameter menu under **Motor/Feedback → Feedbacksystem**.

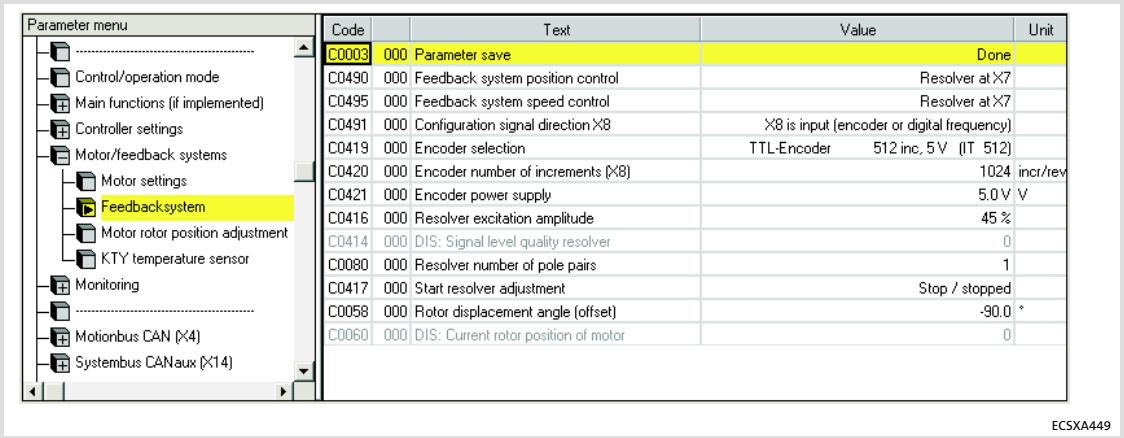


Fig. 6-66 GDC view: Commissioning of the feedback system

7 Parameter setting

7.1 General information

- Controllers and power supply modules can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter "Commissioning" (📖 92).
- The parameters for the functions are stored in numbered codes:
  - The codes are marked in the text with a "C".
  - The code table in the appendix (📖 353) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a "reference book".

Parameter setting with XT keypad or PC/laptop

Detailed information on parameter setting with the XT keypad can be found in the following chapters.

Detailed information ...

on the parameterisation by means of a PC/laptop can be found in the documentation for the "Global Drive Control" (GDC) parameterisation and operating program.

In addition to parameter setting, the XT keypad or PC/laptop serves to:

- Control the controller (e. g. inhibiting or enabling)
- Select the setpoints
- Display operating data
- Transfer parameter sets to other controllers (only with PC/laptop).

Parameter setting with a bus system

Detailed information ...

on the parameterisation with a bus system can be found in the documentation of the communication module to be applied (📖 432).

7.2 Parameter setting with ”Global Drive Control” (GDC)

With the ”Global Drive Control” (GDC) parameterisation and operating program, Lenze provides a plain, concise and compatible tool for the configuration of your application-specific drive task with the PC or laptop:

- The GDC input assistant offers a comfortable motor selection.
- The menu structure supports the commissioning process by its clear structuring.

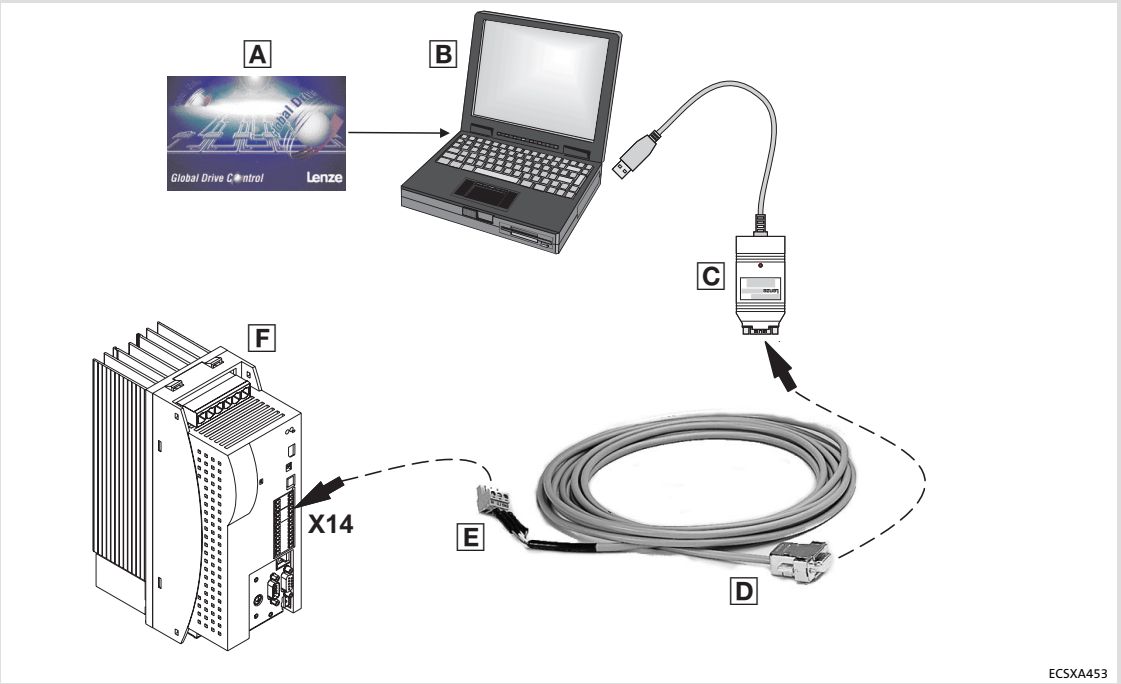


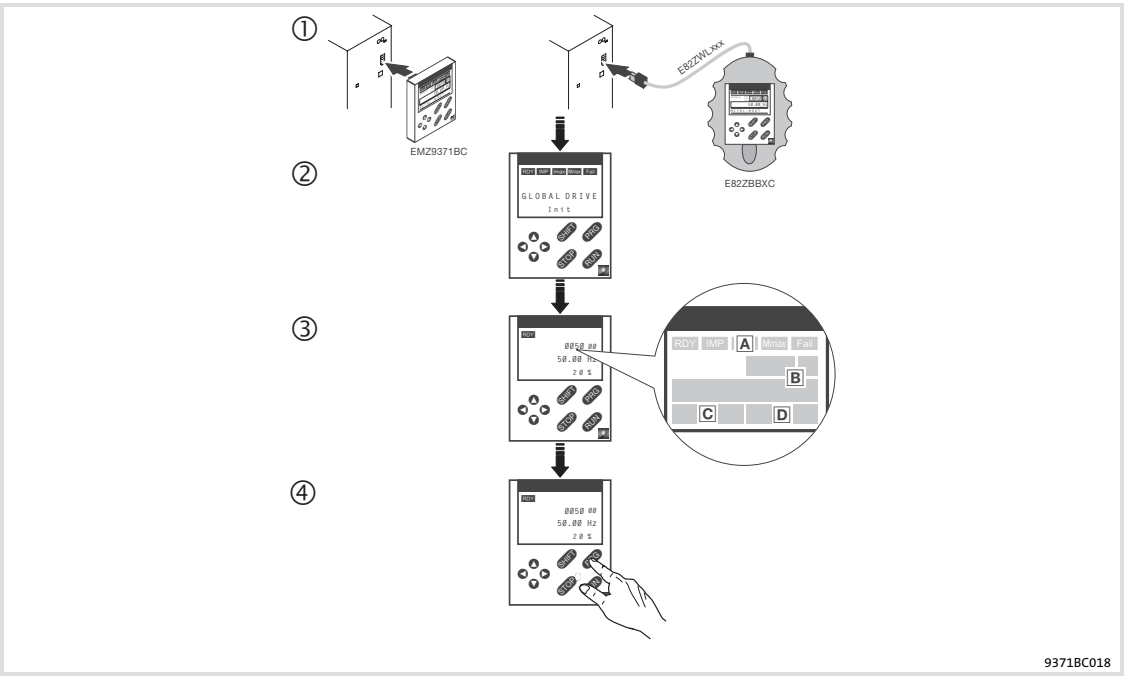
Fig. 7-1 Using the GDC

- A Lenze parameter program ”Global Drive Control” (GDC)
- B PC or laptop
- C PC system bus adapter (EMF2173IB/EMF2177IB) with connecting cable
- D Sub-D plug with 3-pole cable
- E 3-pole plug (CAG – CAL – CAH) from ECSZA000X0B connector set
- F ECSxS/P/M/A axis module

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as accessories.
A complete description is given in the documentation on the keypad.

7.3.1 Connecting the keypad



① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad 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 status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined under C0004
④ PRG must be pressed to leave the operation level.

7.3.2 Description of the display elements

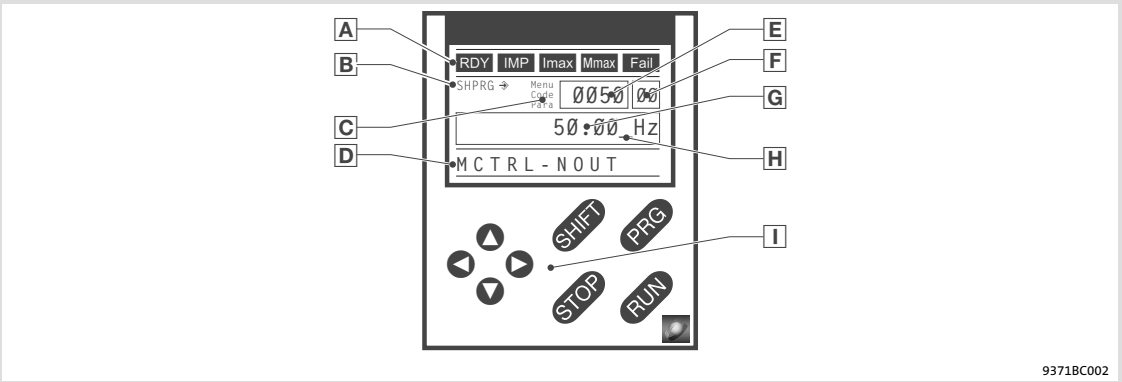


Fig. 7-2 Keypad front view

A	**Status displays**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit active	Power outputs inhibited
	Imax	Adjusted current limitation is exceeded in motor mode or generator mode	
	Mmax	Speed controller 1 within its limitation	• Drive is torque-controlled • Only active for operation with Lenze devices of the 9300 series!
	Fail	Active fault	
B	**Parameter acceptance**		
	Display	**Meaning**	**Explanation**
	⇢	Parameter is accepted immediately	The device immediately operates with the new parameter value.
	SHPRG ⇢	The parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after being confirmed.
	SHPRG	When the controller is inhibited, the parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after the controller has been released again.
	None	Display parameters	Cannot be changed.
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Active menu level	• Selection of main menu and submenus • No menu for ECSxE power supply module
	Code	Active code level	Selection of codes and subcodes
	Para	Active parameter level	Change of parameters in the codes or subcodes
	None	Active operating level	Display of operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	Alphanumerical	Contents of the menus, meaning of the codes and parameters	
		Display of C0004 in % and the active fault in the operating level	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Two-digit subcode number	
G	**Parameter value**		
	Parameter value with unit		
H	**Cursor**		
	The figure over the cursor can be changed directly in the parameter level.		
I	**Function keys**		
	For description see the following table.		

7.3.3 Description of the function keys

Note!

Key combinations with SHIFT:

Press SHIFT and keep it pressed, then press second key in addition.

Key	Function			
	Menu level [1]	Code level	Parameter level	Operating level
PRG		Change to parameter level	Change to operating level	Change to code level
SHIFT PRG	Load predefined configurations in the menu "Short setup" [2]		Accept parameters when SHPRG ↵ or SHPRG is displayed	
▲ ▼	Change between menu items	Change code number	Change figure over cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of figure over cursor	
▶ ◀	Change between main menu, submenus and code level		Cursor to the right Cursor to the left	
RUN	Cancel function of STOP key, the LED in the key goes out.			
STOP	Inhibit the controller, LED in the key lights up.			
	Reset fault (TRIP reset): 1. Remove cause of malfunction 2. Press STOP 3. Press RUN			

1) No menu for ECSxE power supply module

2) Only active when operating Lenze devices of the 8200 vector or 8200 motec series.

7.3.4 Changing and saving parameters

All parameters for the axis module/power supply module parameterisation or monitoring are stored in codes. The codes are numbered and marked with a ”C” in the documentation. Some codes store the parameters in numbered ”subcodes” to provide a clear structure for parameter setting (e.g. C0517 user menu).



Stop!

Your settings have an effect on the current parameters in the main memory. You must store your settings as a parameter set to prevent that they will get lost when switching the mains!

Step			Keys	Action
1.	Select menu		▲ ▼ ▶ ◀	Select the desired menu with arrow keys.
2.	Change to code level		▶	Display of first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to parameter level		PRG	
5.	If SHPRG is displayed, inhibit controller		STOP	The drive is coasting.
6.	Change parameter			
		A	▶ ◀	Move cursor under the digit to be changed
		B	▼ ▲	Change digit
			SHIFT ▼ SHIFT ▲	Change digit quickly
7.	Accept changed parameter			
	Display SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept parameter Display ”OK”
	Display →		-	The parameter was accepted immediately.
8.	If necessary, enable controller		RUN	The drive should be running again.
9.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display of the code with changed parameters
10.	Change further parameters			Restart the ”loop” at step 1. or step 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select Code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to parameter level Display ”0” and ”Ready”
	Select parameter set in which the parameters are to be saved permanently	C	▶	Save as parameter set 1: ⇨ set ”1” ”Save PS1”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved.
12.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display C0003 ”PAR SAVE”

8 Configuration

By configuring the axis module you can adapt the drive system to your application. The axis module can be configured via the following interfaces:

- X1 – AIF (automation interface)
  - For connection of the keypad XT or communication modules (📖 432) which serve to access the codes.
- X14 – system bus interface (CAN-AUX)
  - PC interface/HMI for parameter setting and diagnostics (e.g. with the Lenze parameter setting and operating program "Global Drive Control")
    or
  - Interface to a decentralised I/O system

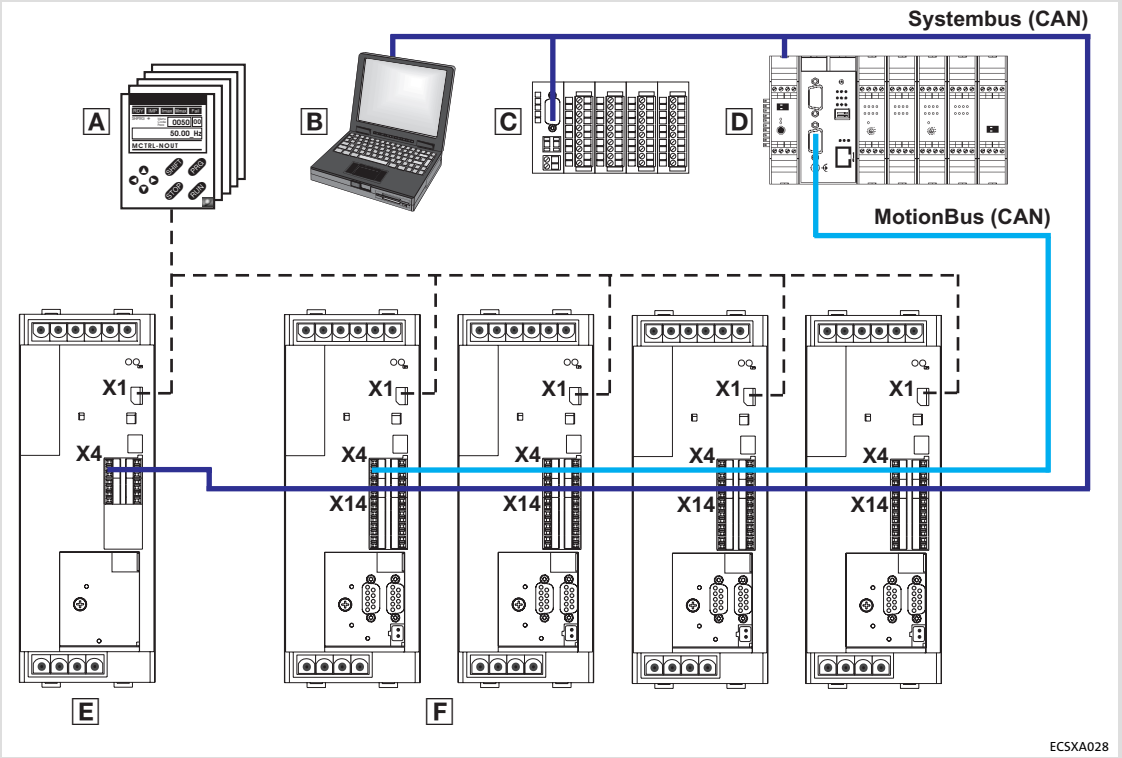


Fig. 8-1 Example: Wiring of the MotionBus (CAN) and system bus (CAN)

- A Keypad XT or another communication module
- B PC/laptop or HMI
- C Decentralised I/O system
- D Higher-level host system / MotionBus control
- E ECSxE... power supply module
- F ECSxS/P/M/A... axis module

8.1 Configuring MotionBus/system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Note!

In case of the ECSxP axis module, the PDOs **CANaux1_IN/OUT** and **CANaux2_IN/OUT** can be used via the CAN interface X14 (system bus (CAN)). Configuration takes place via codes **C24xx**.

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 411).

8.1.1 Setting CAN node address and baud rate

For the CAN interfaces **X4** (MotionBus) and **X14** (system bus), the CAN node address and the baud rate can be set via the DIP switch **S1** or via codes.

- The (address) switch **1** serves to define whether the set CAN node address shall only apply to the interface **X4**(MotionBus) or for both interfaces **X4** (MotionBus) and **X14** (system bus).
- If one of the (address) switches **2 ... 7** of the DIP switch is switched on (ON), and the low-voltage supply is connected, the setting of the DIP switch is evaluated and written into C0350/C2450 (CAN node address) and C0351/C2451 (baud rate).
- If the (address) switches **2 ... 7** are switched off (OFF), the switch position is not evaluated. The settings from C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are accepted.
- The settings for the baud rate with the switches **8 ... 10**are only written into C0351 (X4 CAN) when the low-voltage supply is switched on.
- The baud rate for X14 CAN-AUX can only be set via C2451.

8.1.1.1 Settings via DIP switch

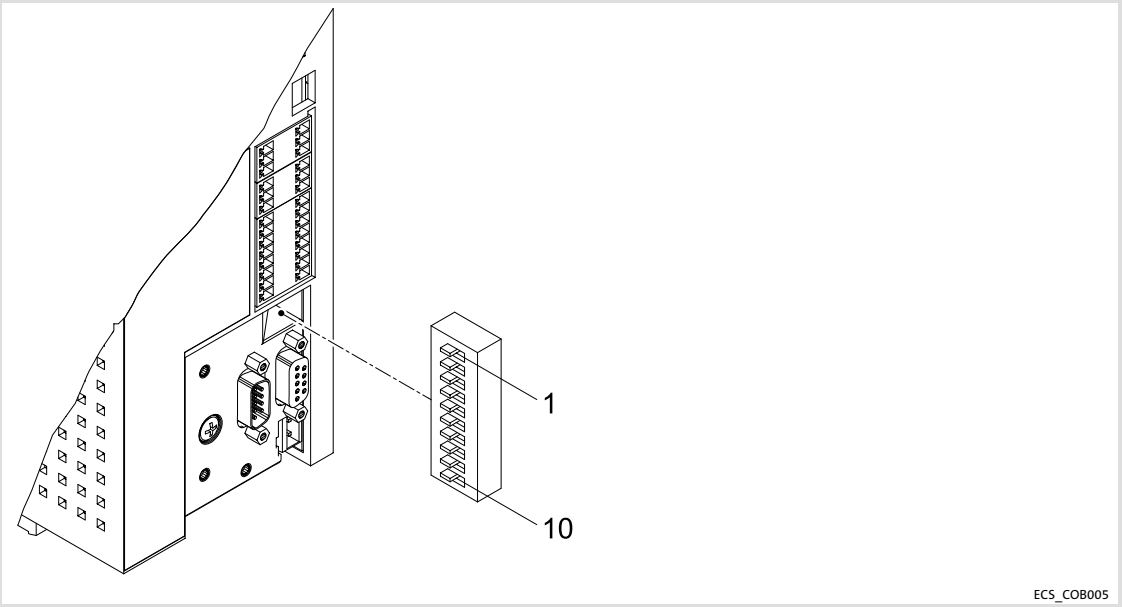
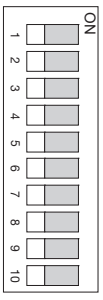


Fig. 8-2 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

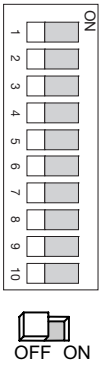
The node address is set by means of switches 2 ... 7 of the DIP switch. Specific values are assigned to the switches. The sum of the values specifies the node address to be set (see example).

Switch		Value	Example	
			Switching status	Node address
	S1	**OFF:** Node address setting is only valid for CAN (C0350 is overwritten if one of switches S2 ... S7 is in ON position.) **ON:** Node address setting is valid for CAN and CANaux (C0350 and C2450 are overwritten if one of switches S2 ... S7 is in ON position.)		-
	S2	32	**ON**	32 + 16 + 8 = **56**
	S3	16	**ON**	
	S4	8	**ON**	
	S5	4	OFF	
	S6	2	OFF	
	S7	1	OFF	

Baud rate setting

Note!

The baud rate must be set identically for all CAN nodes.

Switch		Baud rate [kbit/s]				
		1000	500	250	125	50
	8	**ON**	OFF	OFF	OFF	OFF
	9	OFF	OFF	OFF	**ON**	**ON**
	10	OFF	OFF	**ON**	OFF	**ON**

8.1.1.2 Settings via codes

Note!

- The settings in C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are only used if the (address) switches **2 ... 7** of the DIP switch **S1** are switched off (OFF).
- If only one (address) switch **2 ... 7** is switched on (ON), the settings of the DIP switch **S1** usually apply.
- The baud rate (C0351/C2451) must be set identically for all CAN bus nodes.
- If the Lenze setting has been loaded via C0002,
  - C0351/C2451 is set = 0 (500 kbits;
  - you have to reset the baud rate (C0351/C2451) and the CAN node address (C0350/C2450).

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0350	CAN address	32			Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 266) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 266 📖 429
			1 {1} 63			
C0351	CAN baud rate	0			Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 266
			0	500 kbps		
			1	250 kbits/sec		
			2	125 kbit/s		
			3	50 kbps		
			4	1000 kbit/s		
C2450	CANa address	1			Node address for CAN bus interface X14 (CAN-AUX)	📖 266 📖 429
			1 {1} 63		This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to "ON".	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2451	CANa baud rate	0		Baud rate for CAN bus interface X14 (CAN-AUX)	📖 266
			0 500 kBit/s		
			1 250 kBit/s		
			2 125 kBit/s		
			3 50 kBit/s		
			4 1000 kBit/s		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.2 Individual addressing

In C0353/C2453 you can determine whether the identifier (COB-ID) consists of the basic identifier (📖 429) and the node address in C0350/C2453 or individually with an "ID offset".

The "ID offset" can be specified via C0354. Thus, the identifier for all process data input and output objects is as follows:

Identifier (COB-ID) = 384 + ID offset (C0354)

Note!

The identifier of the telegram to be sent must correspond to the identifier of the process data input object to be addressed.

To make the alternative node address valid, set the corresponding subcode of C0353/C2453 = 1.

CAN interface	Code	Value	The addresses are defined by
X4 (CAN)	C0353/1	0	C0350 (Lenze setting)
		1	C0354/1 for CAN1_IN C0354/2 for CAN1_OUT
	C0353/2	0	C0350 (Lenze setting)
		1	C0354/3 for CAN2_IN C0354/4 for CAN2_OUT
	C0353/3	0	C0350 (Lenze setting)
		1	C0354/5 for CAN3_IN C0354/6 for CAN3_OUT
X14 (CAN-AUX)	C2453/1	0	C2450 (Lenze setting)
		1	C2454/1 for CANaux1_IN C2454/2 for CANaux1_OUT
	C2453/2	0	C2450 (Lenze setting)
		1	C2454/3 for CANaux2_IN C2454/4 for CANaux2_OUT

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 271
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 271
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 271
1	CANa addr sel	0	CAN node address (C2450)			Address CANaux1_IN/OUT	
2	CANa addr sel	0	CAN node address (C2450)			Address CANaux2_IN/OUT	
3	CANa addr sel	0	CAN node address (C2450)			Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 271
1	CANa addr.	129	1	{1}	512	CANaux1_INaddress 2	
2	CANa addr.	1				CANaux1_OUTaddress 2	
3	CANa addr.	257				CANaux2_INaddress 2	
4	CANa addr.	258				CANaux2_OUTaddress 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.3 Defining boot-up master in the drive system

If the bus initialisation and the related state change from ”Pre-Operational” to ”Operational” is not carried out by a higher-level host system (PLC), another node can be determined as boot-up master to carry out this task.

The master functionality only is required for the initialisation phase of the drive system. A boot-up time for the master in the initialisation phase can be set via C0356/C2456 (📖 274).

By means of the NMT telegram *start_remote_node* (broadcast telegram) **all** nodes are shifted to the NMT-state ”Operational” by the master. A data exchange via the process data objects can only be effected in this state.

Use C0352/C2452 for configuration.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 273
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C2452	CANa mst	0			Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 273
			0	Slave		
			1	Master		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.4 Setting of boot-up time/cycle time

Boot-up time (C0356/1, C2456/1) setting

In a CAN network without higher-level control (PLC), a bus node (boot-up master) has to initialise the CAN network. If the 24 V low-voltage supply is switched on, the boot-up time elapses. After the boot-up time has elapsed, the NMT telegram for initialising the CAN network is sent by the boot-up master and the process data transfer is started.

- Only valid if C0352/C2452 = 1 (master).
- Normally the Lenze setting (3000 ms) is sufficient.
- State change from ”Pre-operational” to ”Operational”

Cycle time for process output data (C0356/2...3, C2456/2)

Transmission cycle time for the process data objects CAN2...3_OUT (C0356/2...3) or CANaux2_OUT (C2456/2) in cyclic operation (without sync)

- Setting ”0” = event-controlled data transmission
  The output data will only be sent if a value in the output object changes.

Activation delay for process output data (C0356/4, C2456/4)

Delay time for initial transmission of the process data object CAN2...3_OUT (C0356/4) or CANaux2_OUT (C2456/4) after the CAN bus changes from NMT ”Pre-Operational” state to ”Operational””.

After the delay time has elapsed, the process data objects CAN2...3_OUT or CANaux2_OUT will be sent for the first time.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 274
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 274
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Variable *CAN_bResetNode_b* or *CANaux_bResetNode_b* = TRUE
- Reset node with C0358/2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.5 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 266)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 429)
  – Individual addressing (📖 271)
- Change of the master/slave boot-up configuration (📖 273)

A reset node can be made by:

- Renewed switch-on of the 24 V low-voltage supply
- the bus system (via the network management (NMT))
- C0358/C2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0358	Reset node	0			Make a reset node for the CAN bus node.	📖 276
			0	No function		
			1	CAN reset		
C2458	Reset node	0			Resetting a node (CAN bus interface X14)	📖 276
			0	No function		
			1	CAN-AUX reset		

8.1.6 Guiding angle selection and synchronisation via MotionBus (CAN)

Note!

- ► This function is activated by C3095/x = 31 (electrical shaft (”E-shaft”) via MotionBus (CAN)) in the positioning profile.
- ► An external control master is required for selecting the setpoint telegrams!

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and MotionBus (CAN).	
	2.	Inhibit controller. ● Press the <F9> key in GDC.	🕮 241
Slave drives	3.	C1120 = 1	Active synchronisation by sync telegram via system bus.
	4.	C0366 = 1	Sync response: Slaves respond to sync telegram.
Master (ext. control)	5.	Define the telegram sequence (identifier): A Send setpoint telegram to all slaves. B Transmit sync telegram. C Receive response of all slaves.	● For the structure of the setpoint telegram, see 🕮 158. ● The angle is selected with the bytes 5 - 8 (”PosDirect”) of the setpoint telegram in increments (2^{10} inc = 1 revolution of the motor shaft).
	6.	Start communication, send sync telegrams.	
Slave drives	7.	Read C0362 from the master.	Retrieve cycle time of the sync telegram from the master.
	8.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	9.	Set C1123.	Set optimum size of the ”sync window”. ● If the sync signal ”jitters” heavily (🕮 278), increase ”time slot”. ● Guide values subject to the CAN baud rate: – 1 Mbit → 0.2 ms – 500 kbit → 0.4 ms – 250 kbit → 0.8 ms
	10.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.1.7 Axis synchronisation (CAN synchronisation)

By means of the axis synchronisation, the internal time base can be synchronised with the instant of reception of the sync signal. By this, the start of cyclic internal processes of all drives involved in the synchronisation is synchronous.

Sync signal source

The sync signal source is set via C1120:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C1120	Sync mode	0			Sync signal source	📖 278
			0	Off	Off	
			1	CAN sync	Sync connection via interface X4 (CAN)	📖 282
			2	Terminal sync	Sync connection via terminal X6/DI1	📖 283

Synchronisation cycle

For the purpose of synchronisation the master sends a cyclic CAN sync telegram.

The controllers receive the CAN sync telegram and control the starting time of their own program cycle in relation to the instant of reception of the CAN sync signal. The start is to be offset by the synchronisation phase (C1122).

The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the CAN sync telegrams.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1121	Sync cycle	2				Synchronisation cycle	📖 278
			1	{1 ms}	13		

Phase shift

The synchronisation phase (C1122) defines the period of time of the offset by which the start of the controller-internal cycle lags behind the sync signal received.

Note!

Always set the synchronisation phase higher than the maximum possible ”jitter” of the received CAN sync telegrams!

phase shifting and thus periodic changes of signal frequencies are called ”Jitter”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1122	Sync phase	0.460				Synchronisation phase	📖 278
			0.000	{0.001 ms}	6.500		

Start of axis synchronisation

After mains connection and the initialisation phase, the synchronisation is started. After the first sync telegrams have been received, it takes a few seconds until the system is compensated. The duration of this process is basically determined by the interval of the sync signals and the sync correction increment.

The CAN sync correction increment (C0363) indicates the increment used to extend or shorten the control cycle (e.g. to shift the start time).

The lowest value preset by default can be left as it is. Only in unfavourable conditions (e.g. if the sync master does not exactly comply with its cycle time) it may be necessary to prolong the CAN sync correction increment so that the value in C4264 is reduced to a minimum. Apart from that, a prolongation has a more negative effect on the drive characteristics.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1				Sync correction increment (for CAN and EtherCAT) ● Change correction value until C4264 reaches the minimum.	279
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	279
			0	{1 ms}	65000	0 = switched off	
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	278 274
			0	{1 ms}	65000	0 = switched off	
[C4062]	ES_MCycle	0				Only for "electrical shaft" function: Setpoint cycle of master activates transmission of master angle in the selected time interval.	
			0	Off			
			1	2 ms		Value is written in C0369.	
			2	4 ms			
			3	6 ms			
			4	8 ms			
			5	10 ms			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4264	CanSync_Dev	0				Deviation of the control program synchronisation This also applies to synchronisation via the digital input X6/DI1. Read only	279
			-32767	{1}	32767		

CAN sync identifiers

The transmit and receive identifiers of the sync telegram can be configured via the following codes:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	280
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	414 278
			1	{1}	256		
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	280
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	414 281
			1	{1}	256		

8.1.8 Monitoring of the synchronisation (sync time slot)

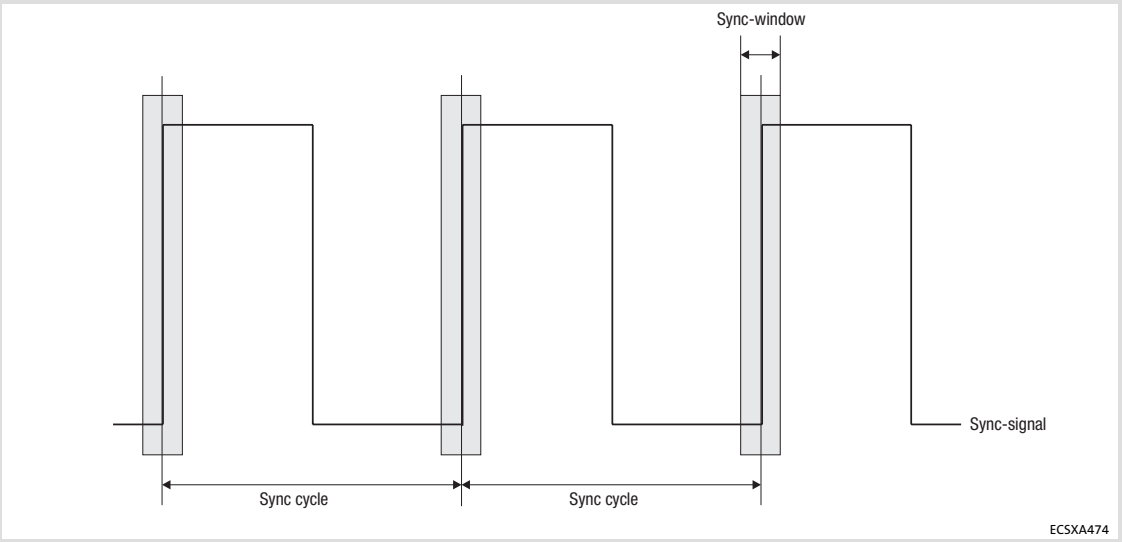


Fig. 8-3 ”Time slot” for the LOW-HIGH edges of the sync signal

Note!

A jitter (📖 278) up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The amount of the jitter has an impact on the parameterisation of the ”time slot”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1123	Sync window	0.010				Synchronisation window	📖 281
			0.000	{0.001 ms}	6.500		

CAN sync response

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0366	Sync Response	1			CAN sync response for interface X4 (CAN) **The value ”1” should always be set!**	📖 281
			0	No response		
			1	Response		
C2466	Sync Response	1			CAN sync response for interface X14 (CAN-AUX) **The value ”1” should always be set!**	
			0	No response		
			1	Response		

8.1.9 Axis synchronisation via CAN

The CAN interface X4 serves to transfer the CAN sync telegram as synchronisation signal and the process data.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 241
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	C1120 = 1	Active synchronisation by sync telegram via CAN bus.
	5.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	6.	Define the telegram (identifier) sequence: A . Send new setpoint to all slaves. B Send sync telegram. C Receive response of all slaves.	
	7.	Start communication/send sync telegrams.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync telegram from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (🕮 278), increase ”time slot”.
Slaves	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.1.10 Axis synchronisation via terminal X6/DI1

The transmission paths for the sync signal and the process data are separated.

- ► The process data are transmitted via the CAN interface X4.
- ► The sync signal is injected via the digital input X6/DI1.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 241
Slaves	3.	Connect "CANSync-InsideWindow" with digital output.	
	4.	Connect the sync signal of the master to terminal X6/DI1.	
Slaves	5.	C1120 = 2	Synchronisation through sync signal via terminal X6/DI1 (DigIn_bIn1_b) is active.
Slaves	6.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	7.	Start communication/send sync signals.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync signal from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync signal to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the "time slot". ● If the sync signal "jitters" heavily (🕮 278), increase "time slot".
	11.	Enable the controller via the signal "CANSync-InsideWindow" applied to the digital output.	Synchronisation monitoring: ● If "CANSync-InsideWindow" = TRUE, enable the controller.

8.2 Node guarding

In case of cyclic node monitoring (Node Guarding), the CAN master regularly enquired the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is activated (fault message ”Err NodeGuard”).

Settings

In order that the device takes over the function of the ”Node Guarding Slave”, make the following settings:

1. Set C0352 = 2.
   (The device is configured as ”Node Guarding Slave”.)
2. Set the monitoring time (Node Guard Time) for the reception of the status enquiry by the master in C0383.
3. Set the factor (Node Life Time Factor) for the monitoring time in C0383.

   Node Life Time = Node Guard Time (C0382) · Node Life Time Factor (C0383)
4. Set the response to a ”Life Guarding Event” via C0384.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 273
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0382	GuardTime	0			Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 284
			0	{1 ms} 65535		
C0383	LifeTimeFact	0			Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 284
			0	{1} 255		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0384	Err NodeGuard	3		Node Guarding (slave) • Response for the occurrence of a NodeGuard-Event • Only relevant for setting C0352 = 4.	📖 284
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

8.3 Diagnostics codes

The following diagnostic codes serves to follow the process of the CAN communication via the interfaces X4 (CAN, C03xx) and X14 (CAN-AUX, C24xx):

- C0359/C2459: Bus state
- C0360/C2460: Telegram counter
- C0361/C2461: Bus load

8.3.1 CAN bus status (C0359/C2459)

C0359/C2459 shows the current CAN operating state.

Value of C0359/C2459	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-operational	Only parameters (codes) can be transferred via the bus system. Data exchange between controllers is not possible. A change into the state ”operational” can be made via a special signal on the CAN bus. A status change from ”Pre-operational” to ”Operational” is possible through: ● Master function of a higher-level host system ● If a master has been selected under C0352/C2452, the operating status will be changed automatically for the entire drive system after the set boot-up time (C0356/C2456) when power is switched on. ● Reset node via C0358/C2458 (📖 276) ● With a binary input signal ”Reset node”, which can be set accordingly. ● Reset node via the connected hostsystem
2	Warning	Faulty telegrams have been received. The controller is passive (does not send any data). Possible causes: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Bus load is too high ● Controller is not connected to the CAN bus
3	Bus off	Too many faulty telegrams. The controller is disconnected from the CAN bus. It can be reconnected by: ● TRIP-RESET ● Reset node (📖 276) ● Mains reconnection

8.3.2 CAN telegram counter (C0360/2460)

C0360/2460 counts for all parameter data channel the telegrams which are valid for the controller. The counters have a width of 16 bits. If the value ”65535” is exceeded, counting restarts with ”0”.

Counted messages:

C0360/C2460	Meaning
Subcode 1	All sent telegrams
Subcode 2	All received telegrams
Subcode 3	Telegrams sent of CAN1_OUT/CANaux1_OUT
Subcode 4	Telegrams sent of CAN2_OUT/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent of CAN3_OUT/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent of parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received of CAN1_IN/CANaux1_IN
Subcode 9	Telegrams received of CAN2_IN/CANaux2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received of CAN3_IN/CANaux3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received of parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

8.3.3 CAN bus load (C0361/2461)

Use C0361/C2461 to determine the bus load through the controller or the individual data channels in percent. Faulty telegrams are not considered.

Bus load of the individual subcodes:

C0361/C2461	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Telegrams sent of CAN1_OUT/CANaux1_OUT
Subcode 4	Telegrams sent of CAN2_OUT/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent of CAN3_OUT/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received of CAN1_IN/CANaux1_OUT
Subcode 9	Telegrams received of CAN2_IN/CANaux2_OUT ● Always ”0”; channel is not used!
Subcode 10	Telegrams received of CAN3_IN/CANaux3_OUT ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

The data transfer is limited. The limits are determined by the number of telegrams transmitted per time unit and the baud rate.

The limits can be determined during data exchange in a drive network by adding all drives involved under C0361/1 or C2461/1.

Example:

Drives/host system (PLC)	Bus load
C0361/1 - controller 1	23.5 %
C0361/1 - controller 2	12.6 %
Host system (PLC)	16,0 %
	52.1 % (total)

Two drives and the host system (PLC) are interconnected via the CAN bus.



Note!

► Max. bus load of all devices involved: 80 %

► If other devices are connected, as for instance decentralised inputs and outputs, their telegrams must be taken into consideration.

► If the time between the individual sync telegrams is too short the bus can be overloaded.

– **Remedy:** Change the synchronisation cycle of the host system (PLC) and the controller (C1121).

8.4 Remote parameterisation (gateway function)

From operating system V6.x onwards, the axis module supports the remote parameterisation of other fieldbus nodes. Then, all write/read accesses to parameters are not executed anymore in the axis module but redirected to the bus node selected for remote maintenance.

- ► The redirection takes place via the parameter data channel SDO1 of the selected node.
- ► The node to which the write/read accesses is to be redirected, is determined with the corresponding node address via C0370.
  (C0370 = 0: remote parameterisation deactivated)
- ► The gateway channel of the axis module is selected via C0371 (interface X4 (CAN) or interface X14 (CAN-AUX)).
- ► C2118 (CAN) or C2470 (CAN-AUX) serves to select the transmission channel for reading and writing the parameter data.
- ► A timeout during remote parameterisation activates the system error message ”CE5” (CAN) or ”CE15” (CAN-AUX). The corresponding response can be configured under C0603/C2485 (📖 299).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0370]	SDO gateway	0		Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 289
			0 {1} 63		
C0371	Gateway Ch.	1		Selection of the gateway channel	📖 289
			0 CAN	Use CAN bus interface X4	
			1 CAN-AUX	Use CAN bus interface X14	
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) ”Timeout” when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 297 📖 289
			0 TRIP		
			2 Warning		
			3 Off		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2118	ParWriteChan.	0			CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	📖 289
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)		
			1	Parameter data channel 2		
C2470	ParWrite	0			CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 289
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)		
			1	Parameter data channel 2		
C2485	MONIT CE15	3			Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 297 📖 289
			0	TRIP		
			2	Warning		
			3	Off		

9 Monitoring functions

Different monitoring functions (📖 293) 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) (📖 338).

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:

  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/no. ”x061”) between the AIF module and the ECS axis module.

- 2xxx:

  The fault response is a warning.

9.1 Fault responses

Response	⇨ Consequence	Display Keypad XT		
		RDY	IMP	Fail
TRIP		☐	■	■
TRIP active:	⇨ The power outputs U, V, W are switched to high resistance. ⇨ The drive is coasting (no control).			
TRIP reset:	⇨ The drive decelerates to its setpoint within the set deceleration times.			
Message	 **Danger!** The drive restarts automatically if the message is removed.	☐	■	■
Message active:	⇨ The power outputs U, V, W are switched to high resistance.			
≤ 0.5 s	⇨ The drive is coasting (no control).			
> 0.5 s	⇨ The drive is coasting (due to internal controller inhibit). If necessary, restart program.			
Message reset:	⇨ The drive runs to its setpoint with the maximum torque.			
FAIL-QSP	⇨ The drive is decelerated to standstill within the quick stop deceleration time (C0105).	–	–	■
Warning	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	■	☐	■
	⇨ The failure merely is displayed, the drive runs on in a controlled manner.			
Off	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	–	–	–
	⇨ There is no response to the failure.			

☐ = off ■ = on

Responses (📖 292) of monitoring functions can be parameterised partly via codes – in the GDC parameter menu under **Monitoring**.

9.2 Overview of monitoring functions

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 (activated via DCTRL)	FWM	C0581	●	✓	✓	✓	✓
x191	HSF	Internal error	Internal		●				
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus(C0174)	MCTRL			●			
0070	U15	Undervoltage of internal 15 V voltage supply	Internal		●				
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x041	AP1	Internal fault (signal processor)	Internal		●				
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 CAN bus at interface X4 (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x066	CE5	Communication error of the gateway function (C0370, C0371) via CAN bus at interface X4 (CAN)	CAN	C0603	✓		✓		●
x122	CE11	Communication error on the CANaux1_IN process data input object (time monitoring adjustable via C2457/1)	CANaux1_IN	C2481	✓		✓		●
x123	CE12	Communication error on the CANaux2_IN process data input object (time monitoring adjustable via C2457/2)	CANaux2_IN	C2482	✓		✓		●
x124	CE13	Communication error on the CANaux3_IN process data input object (time monitoring adjustable via C2457/3)	CANaux3_IN	C2483	✓		✓		●
x125	CE14	BUS-OFF state CAN bus at interface X14 (CAN-AUX) (too many faulty telegrams)	CANaux	C2484	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x126	CE15	Communication error of the gateway function via CAN bus at interface X14 (CAN-AUX) ● C0371 = 1: Gateway channel X14 (CAN-AUX) ● C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	CANaux	C2485	✓		✓		●
x260	Err Node Guard	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.	Node Guarding	C0384	●	✓	✓	✓2)	✓
Temperatures / sensors									
0050	OH	Device heatsink temperature > 90° C	MCTRL		●				
0051	OH1	Temperature inside the device > 90° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582	✓		●		✓
x055	OH5	Temperature inside the device > C0124	MCTRL	C0605	✓		●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584	✓		●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	MCTRL	C0585	✓		●		✓
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x095	FAN1	Devicefan monitoring (only for built-in units)			✓	●			
x110	H10	Device thermal sensor error on heatsink	FWM	C0588	●				✓
x111	H11	Device thermal sensor error in the interior of the device	FWM	C0588	●				✓
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				
0015	OC5	I x t overload TRIP (axis module, fix 100 %)	MCTRL		●				
0016	OC6	Motor utilisation I^2 x t (threshold C0120)	MCTRL		●				
x017	OC7	Device utilisation I x t (clip C0123)	MCTRL	C0604	✓		●		✓
x018	OC8	Motor utilisation I^2 x t (threshold C0127)	MCTRL	C0606	✓		●		✓
x032	LP1	Motor phase failure **Note:** Can only be used for asynchronous motors. Activation of the motor phase failure detection minimises the computing time available to the user!	MCTRL	C0597	✓		✓		●
x081	Rel1	Open circuit monitoring of the brake relay output (X25)	FWM	C0602	✓	✓		✓	●
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	●		✓		✓

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder initialisation error at X8	MCTRL		●				
x088	Sd8	Sin&cos signal fault at X8	MCTRL	C0580	✓				●
x089	PL	Fault during rotor position adjustment	MCTRL		●				
Speed									
x190	nErr	Speed control error (monitoring window C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	NMAX	Max. system speed (C0596) has been exceeded.	MCTRL	C0607	●		✓		✓
Float error									
0209	float Sys-T	Float error in system task (ID 0)	Internal		●		✓	✓	2)
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)	Internal		●		✓	✓	2)
0211	float Task1	Float error in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0218	float Task8	Float error in task 8 (ID 9)							
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x108	H08	Extension board not connected properly or not supported by program.	Internal		●				
0201	overrun Task1	Time-out in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0208	overrun Task8	Time-out in task 8 (ID 9)							
0219	overrun Cycl.-T	Time-out in cyclic task (PLC_PRG, ID 1)	Internal		●		✓	✓	2)
0220	noT-Fkt Credit	Not enough technology units available in the PLC.	Internal		●				
0230	No program	No PLC program loaded in the PLC.	Internal		●				
0231	Unallowed Lib	You have called the library function in the PLC program. This function is not supported.	Internal		●				
x232	NoCamData	Motion profiles (cam data) are not available.	Internal		●				
x240	ovrTrans Queue	Overflow of transmit request memory	Free CAN objects	C0608	●	✓	✓	✓	✓
x241	ovr Receive	Too many receive telegrams	Free CAN objects	C0609	●			✓	
Parameter setting									

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
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		●				
0080	PR6	● **For ECSxS/P/M:**Internal fault ● **For ECSxA:** Too many user codes	Internal		●				
Application-specific fault messages									
2402	PosPosLimit	Warning: Positive software limit position (C3040) has been reached.					●		
2403	NegPosLimit	Warning: Negative software limit position (C3041) has been reached.					●		
2404	FollowErrWarn	Warning: Following error tolerance (C3030) has been reached.					●		
2422	InvProfData	Impermissible positioning profile parameters					●		
2423	OverflIntPos	Position setpoint overflow					●		
2424	SWLimOut-OfRan	Warning: Impermissible setting of the software limit positions (C3040/C3041)					●		
3400	PosLimitSw	FAIL-QSP: Positive hardware limit switch has been approached.						●	
3401	NegLimitSw	FAIL-QSP: Negative hardware limit switch has been approached.						●	
3402	PosPosLimit	FAIL-QSP: Positive software limit position (C3040) has been reached.						●	
3403	NegPosLimit	FAIL-QSP: Negative software limit position (C3041) has been reached.						●	
3405	FollowErrFail	FAIL-QSP: Following error tolerance (C3031) has been reached.						●	
3406	HomePosErr	Home position has not been reached.						●	
3409	MaxVelErr	Max. speed in C1240 is set too high.						●	
3417	InSftw-Limits	FAIL-QSP: Impermissible setting of the software limit positions (C3040/C3041)						●	
0425	InvHoming-Offs	Reference measuring system offset (C3012) is invalid.			●				
3500	ExtTripSet	External fault has been triggered.						●	
3501	InvTpProfNo	Invalid positioning profile number with touch probe positioning						●	
3503	InvalidFeedb	Impermissible feedback system selection						●	
3504	InvalidOS	Version of operating system is not compatible.						●	

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
1) Adjustable in the DDS under **Project → Exceptional handling**
2) For ECSxA... only

9.3 Configuring monitoring functions

9.3.1 Monitoring times for process data input objects

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
x062	CE1	Communication error at the process data input object CAN1_IN	CAN_bCe1CommErrCanIn1_b	✓		✓	•
x063	CE2	Communication error at the process data input object CAN2_IN	CAN_bCe2CommErrCanIn2_b	✓		✓	•
x064	CE3	Communication error at the process data input object CAN3_IN	CAN_bCe3CommErrCanIn3_b	✓		✓	•
x065	CE4	BUS-OFF state of the CAN bus at interface X4 (CAN)	CAN_bCe4BusOffState_b	✓		✓	•
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux_bCe1CommErrCanIn1_b	✓		✓	•
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux_bCe2CommErrCanIn2_b	✓		✓	•
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux_bCe3CommErrCanIn3_b	✓		✓	•
x125	CE14	BUS-OFF state of the CAN bus at interface X14 (CAN-AUX)	CANaux_bCe4BusOffState_b	✓		✓	•

• Default setting
✓Setting possible

Each process data input object can monitor whether a telegram has been received within a specified time. As soon as a telegram arrives, the corresponding monitoring time (C0357/C02457) is restarted (”retriggerable monoflop” function).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 297
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 297
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

The following responses can be set for communication errors:

- 0 = Error (TRIP) - controller sets controller inhibit (CINH)
- 2 = Warning
- 3 = Monitoring is switched off

Codes for setting the response to the monitoring functions:

CAN bus interface	Code	Monitoring
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: System bus (CAN)	C0591	CAN1_IN (”CE1”)
	C0592	CAN2_IN (”CE2”)
	C0593	CAN3_IN (”CE3”)
	C0595	Bus off (”CE4”)
	C0603	Gateway function (”CE5”)
X14 System bus (CAN)	C2481	CANaux1_IN (”CE11”)
	C2482	CANaux2_IN (”CE12”)
	C2483	CANaux3_IN (”CE13”)
	C2484	Bus off (”CE14”)
	C2485	Gateway function (”CE15”)

The input signals (CAN1...3_IN/CANaux1...3_IN) can also be used 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 signal ”BusOffState” (CE4/CE14) is set.

”BusOffState” can activate an error (TRIP) or warning. The signal can also be switched off. The response is set under C0595/C2484. You can also assign the terminal output for this.

9.3.2 Time-out monitoring for activated remote parameterisation

If remote parameterisation is activated (gateway function (📖 289)) and a timeout occurs, the system error message CE5/CE15 is output.

The response to this can be configured via C0603/C2485.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 297 📖 289
			0 TRIP		
			2 Warning		
			3 Off		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 297 📖 289
			0 TRIP		
			2 Warning		
			3 Off		

9.3.3 Short circuit monitoring (OC1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
011	OC1	Short circuit	MCTRL_bShortCircuit_b	•			

• Default setting
✓Setting possible

The monitoring process is activated if a short circuit occurs in the motor phases. This can also be caused by an interturn fault in the machine.

► Monitoring can also be actuated at mains connection, if an **earth fault** occurs.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the short circuit has to be eliminated.

9.3.4 Earth fault monitoring (OC2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
012	OC2	Earth fault	MCTRL_bEarthFault_b	•			

• Default setting
✓Setting possible

The ECSxP... axis module is equipped with a standard earth fault detection.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the earth fault has to be eliminated.

Possible causes of an earth fault are:

► Short circuit to frame of the machine

► Short circuit of a phase to the shield

► Short circuit of a phase to PE

9.3.5 Motor temperature monitoring (OH3, OH7)

Stop!

The temperature sensor must only be connected to either X7 **or** X8, the other input of the temperature sensor must be left open!

Note!

This monitoring function only applies to temperature sensors specified by Lenze like the ones used on standard Lenze servo motors.

With regard to default setting, this monitoring is switched actively and is actuated when no Lenze servo motor is used!

The motor temperature is monitored by means of a continuous KTY temperature sensor.

The motor temperature monitoring functions (OH3/OH7) respond when the set temperature thresholds are exceeded.

Wire the KTY temperature sensor to the resolver cable at X7 (📖 86) or the encoder cable at X8 (📖 87).

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
053	OH3	Motor temperature (fixed, 150 °C)	MCTRL_bMotorTempGreaterSetValue_b	•		✓	✓
057	OH7	Motor temperature (adjustable, C0121)	MCTRL_bMotorTempGreaterC0121_b	✓		•	✓

• Default setting
✓Setting possible

► Adjustable warning threshold (OH7)
  – The warning threshold can be set under C0121
  – The reaction to exceeding the threshold can be set under C0584

► Fixed warning threshold (OH3)
  – Threshold = 150 °C
  – The reaction to exceeding the threshold can be set under C0583

The hysteresis is 15 K, i.e. the switching value for the fixed warning threshold is 135 °C.

Monitoring with the adjustable threshold (OH7) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH3). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0121	OH7 limit	120			Threshold for motor temperature monitoring	📖 301
			45 {1 °C} 150		Motor temperature > C0121 ⇨ fault message OH7 (C0584)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0583	MONIT OH3	0		Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	📖 301
			0 TRIP		
			2 Warning		
			3 Off		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 301
			0 TRIP		
			2 Warning		
			3 Off		

9.3.6 Heatsink temperature monitoring (OH, OH4)

The heatsink temperature of the controller can be monitored with two temperature thresholds:

- Adjustable temperature threshold (OH4)
  - Threshold can be set under C0122
  - The reaction to exceeding the threshold can be set under C0582
- Fixed temperature threshold (OH)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
050	OH	Heatsink temperature (fixed, 90 °C)	MCTRL_bKuehlGreaterSetValue_b	•			
054	OH4	Heatsink temperature (adjustable, C0122)	MCTRL_bKuehlGreaterC0122_b	✓		•	✓

• Default setting
✓Setting possible

The hysteresis is 5 K, i.e. the switching value for the fixed threshold is 85 °C.

Monitoring with the adjustable threshold (OH4) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0122	OH4 limit	80			Threshold for heatsink temperature monitoring	📖 303
			45 {1 °C} 90		Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0582	MONIT OH4	2			Setting of the fault response - monitoring of heatsink temperature in C0122	📖 303
			0	TRIP		
			2	Warning		
			3	Off		

The following causes can bring about an actuation of the monitoring process:

Cause	Remedy
The ambient temperature is too high.	Mount a fan in the control cabinet.
The drive controller is overloaded in the arithmetic mean, i. e. overload and recovery phase are above 100%.	• Mount a fan in the control cabinet. • Reduce overload phase. • Use more powerful drive controller.

9.3.7 Monitoring of internal device temperature (OH1, OH5)

The temperature inside the controller can be monitored with two temperature thresholds:

- Adjustable threshold (OH5)
  - The warning threshold can be set under C0124
  - The reaction to exceeding the threshold can be set under C0605
- Fixed threshold (OH1)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

The hysteresis is 5 K, i.e. the reset value for the fixed warning threshold is 85 °C.

The monitoring with the adjustable threshold (OH4) is designed as an early warning stage before final disconnection of the controller by means of TRIP (OH). Therefore, the process can be influenced accordingly, so that the final disconnection of the controller at unfavourable moments is avoided. Furthermore, for instance, additional fans can be activated, generating a noise load when switched to continuous operation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 304
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 304
			0	TRIP			
			2	Warning			
			3	Off			

9.3.8 Function monitoring of thermal sensors (H10, H11)

The function of the thermal sensors of the heatsink and the interior of the device is monitored. If the thermal sensors report values outside the measuring range, fault H10 (heatsink) or H11 (interior) is reported. The response to these faults can be defined under C0588.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 305
			0 TRIP		
			2 Warning		
			3 Off		

9.3.9 Current load of controller (I x t monitoring: OC5, OC7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
015	OC5	I x t overload	MCTRL_bIxtOverload_b	•			

• Default setting
✓Setting possible

The I x t monitoring function monitors the current load of the axis module. The monitoring function is set so that operation

- ► is permanently possible with a device output current = I_r.
- ► is possible for ≤ 30 s with a device output current ≤ 1.5 x I_r.

The overload protection of the axis module can be set with thresholds:

- ► adjustable threshold (OC7) via C0123
- ► fixed threshold (OC5) = 100 %

After an overcurrent phase, you can calculate with a recovery phase of 120 s. For a more precise consideration, see the overcurrent characteristic and the value 3 x $\tau_{axis\ module}$ (📖 307).

The response to exceeding the adjustable threshold can be defined under C0604.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	📖 300
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 300
			0	TRIP			
			2	Warning			
			3	Off			

Overcurrent characteristic

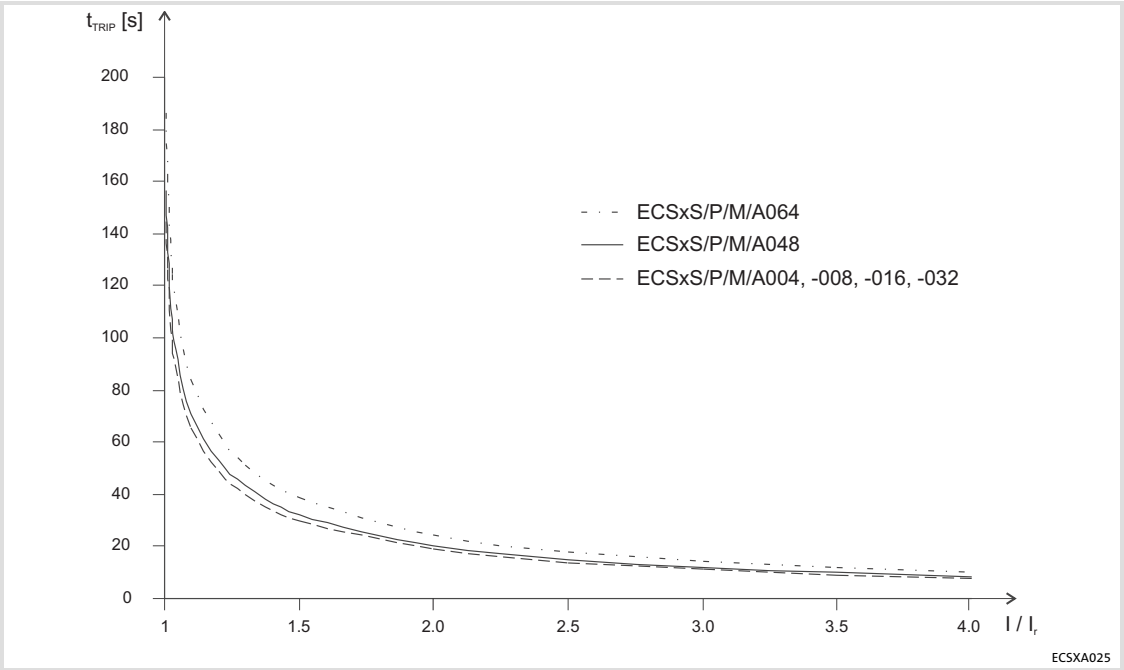


Fig. 9-1 Overcurrent characteristic ECSxP..., see also "Rated data" 📖 32

The overcurrent characteristic shows the maximum time t_{TRIP} till the axis module generates an I x t error. In order to reach this time t_{TRIP} again, the time 3 x $\tau_{axis\ module}$ with the load I/I_r = 0 A must be observed.

Device	$\tau_{axis\ module}$ [s]	Overcurrent characteristic
ECSxP004	54.6	$I \cdot t = \frac{I_{subprofile\_x}}{I_{rated}} - \left(\frac{I_{subprofile\_x}}{I_{rated}} - I \cdot t_{subprofile\_x-1} \right) \cdot e^{-\frac{t_{subprofile\_x}}{\tau_{axis\_module}}}$
ECSxP008	27.3	
ECSxP016	27.3	
ECSxP032	27.3	
ECSxP048	29.5	
ECSxP064	35.1	

Overcurrent diagram for OC5 fault message

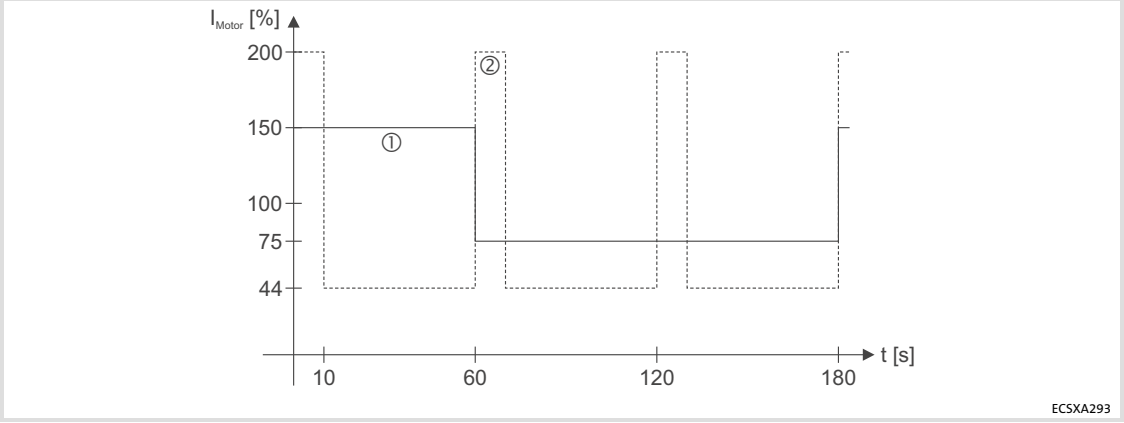


Fig. 9-2 Maximum overcurrent as a function of time

The maximum admissible overcurrent is dependent on the I_{max} limit set in C0022.

① I_{max} limit set in C0022 ≤ 150 % I_r:

► For **180 s**, the arithmetic mean value of the motor current must not exceed **100 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ①:

$$\frac{60\ s \cdot 150\ \% + 120\ s \cdot 75\ \%}{180\ s} = 100\ \%$$

② I_{max} limit set in C0022 > 150 % I_r:

► For **60 s**, the arithmetic mean value of the motor current must not exceed **70 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ②:

$$\frac{10\ s \cdot 200\ \% + 50\ s \cdot 44\ \%}{60\ s} = 70\ \%$$

The current device utilisation is displayed in C0064:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.

9.3.10 Current load of motor (I^2 x t monitoring: OC6, OC8)

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 %.

9.3.10.1 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):

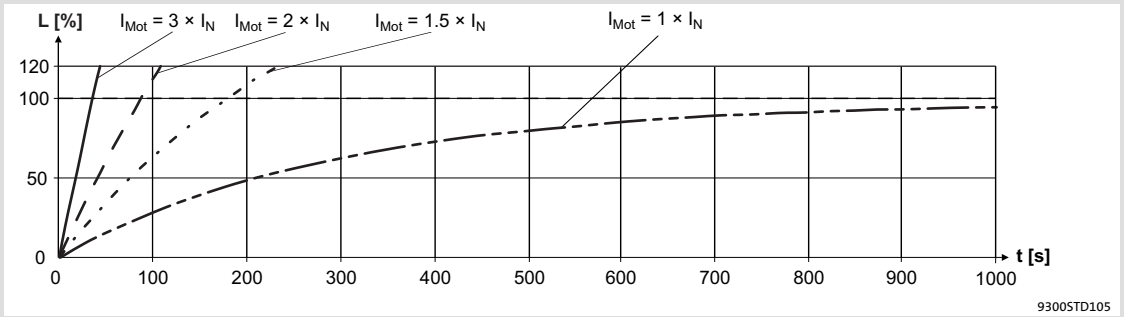


Fig. 9-3 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

9.3.10.2 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

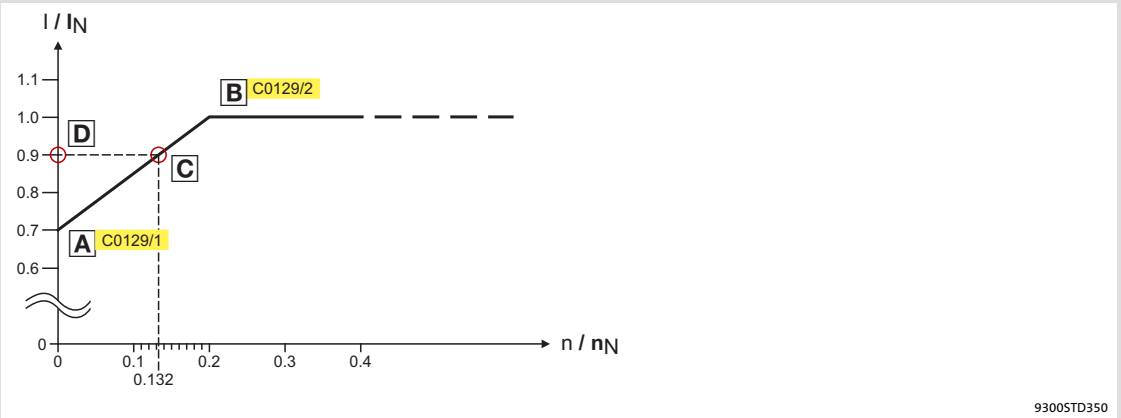


Fig. 9-4 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 9-4) 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. 9-4, 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", 📖 312).

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).

9.3.11 DC-bus voltage monitoring (OU, LU)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
020	OU	Overvoltage	MCTRL_bOvervoltage_b		•		
030	LU	Undervoltage	MCTRL_bUndervoltage_b		•		

• Default setting
✓Setting possible

These monitoring functions monitor the DC bus and protect the controller.

- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ exceeds the upper switch-off threshold set in C0173, an OU message is sent.
- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ falls below the lower switch-off threshold set in C0174, an LU message is sent.

The monitoring response remains active until the corresponding threshold is fallen below/exceeded again.

Note!
All drive components in DC-bus connections must have the same thresholds!

Switch-off and switch-on thresholds

- The switch-off threshold defines the voltage level of the DC-bus voltage, at which the pulse inhibit is activated.
- The switch-off and switch-on thresholds dependent on C0173 can be gathered from the following table:

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785



Tip!

If undervoltage is existent for more that 3 s, or if mains connection is carried out, an entry into the fault memory is effected.

- This operational mode can occur if the control module is fed via the terminals X6/+24 and X6/GND by means of an external supply and the mains are disconnected.
- If there is no undervoltage anymore (mains are reconnected again), the entry in the fault memory is not continued, but deleted. This case does not describe an error, but a state of the drive controller.

Undervoltages of less than 3 s are interpreted as a fault (e. g. mains fault) and are entered into the fault memory. In this case, the fault memory is updated.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0173	UG limit	11		Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 126
			0 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3 Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4 Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13 Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14 Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60		Undervoltage threshold of DC bus (LU)	📖 126
			15 {1 V} 342		

9.3.12 Voltage supply monitoring - control electronics (U15)

If the voltage at X6/DI1 or X6/DI3 falls below 17 V, TRIP ”U15” is triggered. The fault can only be reset if U > 19 V.

9.3.13 Motor phase failure monitoring (LP1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
032	LP1	Motor phase failure	MCTRL_bMotorphaseFail_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether a motor phase has failed.

Note!

- ► This monitoring function can only be used for asynchronous motors.
- ► When this monitoring function is activated, the calculating time available to the user is reduced.

- ► The response is set via C0597.
- ► The monitoring limit is set via C0599.

Reset fault message

1. Check motor cables.
2. Carry out TRIP-RESET.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0597	MONIT LP1	3			Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 316
			0	TRIP		
			2	Warning		
			3	Off		
C0599	Limit LP1	5.0			Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 316
			0.01	{0.01 %} 10.00		

9.3.14 Monitoring of the resolver cable (Sd2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
082	Sd2	Resolver error	MCTRL_bResolverFault_b	•		✓	✓

• Default setting
✓Setting possible

This monitoring function monitors the resolver cable and the resolver with regard to open circuit and protects the motor.

Stop!

If monitoring is disconnected, the machine can achieve very high speeds in case of faults (e. g. system cable is disconnected or not correctly screwed), which can result in the damage of the motor and of the driven machine! The same applies if ”warning” is set as a response.

- ► For commissioning C0586, always use the Lenze setting (TRIP).
- ► Only use the possibility of disconnection via C0586 if the monitoring is activated without apparent reason (e. g. by very long cables or intense interference injection of other drives).
- ► Configure C0586 = 2 (warning) only on the above-mentioned condition, because the pulses are enabled despite faulty feedback.

If a fault with regard to the actual value acquisition is available, it is not definitely ensured that monitoring is triggered by overspeed (NMAX, 📖 322).

This monitoring ...

- ► is automatically activated if a resolver is selected as an actual speed value encoder via C0419.
- ► is automatically activated if another actual speed value encoder is selected.

The response is set via C0586.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 317
			0 TRIP		
			2 Warning		
			3 Off		

9.3.15 Motor temperature sensor monitoring (Sd6)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
086	Sd6	Motor temperature sensor fault	MCTRL_bSensorFault_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether the motor temperature sensor supplies values within the measuring range of -50 ... +250 °C. If the values are outside this measuring range, monitoring is activated.

The response is set via C0594.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. "SensorFault" (Sd6)	📖 318
			0 TRIP		
			2 Warning		
			3 Off		

9.3.16 Monitoring of the absolute value encoder initialisation (Sd7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
087	Sd7	Absolute value encoder initialisation error	MCTRL_bEncoderFault_b	•			

• Default setting
✓Setting possible

When the ECSxP... axis module is switched on, this monitoring function repeatedly downloads the absolute value of the hiperface absolute value encoder to identify whether the same value is transferred to the drive.

The absolute value encoders (single-turn, multi-turn) are supported by a hiperface interface with various numbers of increments, e.g.: SRM50 with 1024 Sin/Cos periods/rev. or SKM38 with 128 periods/rev.(see also C0419).

If a deviation > 5° on the motor shaft is detected, the monitoring (TRIP) is actuated.

The fault message ”Sd7” can only be reset by mains switching!

9.3.17 Sin/cos signal monitoring (Sd8)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
088	Sd8	Sin/cos signal fault	MCTRL_bEncoderFault_b	✓			•

• Default setting
✓Setting possible

This monitoring function carries out a plausibility test to check that the encoder is available and that the sin/cos track supply plausible values with regard to each other.

- ► If required, the encoder has to move by several angular degrees for actuating a fault.
- ► The response is set via C0580.
- ► The filter time constant (C0559) serves to filter short-time trouble on the sin/cos track of the encoder without an SD8 trip being released immediately.
- ► The ”Sd8” fault message can only be reset by mains switching.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 320
			0	TRIP			
			3	Off			
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	

Note!

For the desired encoder monitoring, and in particular when using synchronous machines, set fault handling to ”TRIP”.

In order to achieve further encoder safety, monitoring of following errors can be activated for positioning systems. Set its fault response to ”TRIP”, too.

Visible faults	Non-visible faults
• Unplugged plug, all encoder signals open. • Singe wire breakage, one of the following signals is missing: – COS A – RefCOS A – SIN B – RefSIN B – GND – VCC • Double wire breakage with the following signal pairs: – COS A and RefCOS A – SIN B and RefSIN B – COS A and SIN B – RefCOS A and RefSIN B – and all four signals (COS A, RefCOS A, SIN B, RefSIN B) open.	• Short circuits, in particular between sine and cosine signals. • Cable/encoder faults with intermediate values • ”Semi”-short circuits (> 0 Ohm) • ”Semi”-interruptions (< infinite)

9.3.18 Monitoring of the speed system deviation (nErr)

Fault message		Monitoring function	System variable	Possible response				
				TRIP	Message	Warning	FAIL-QSP	Off
190	nErr	Speed outside of the tolerance window (C0576)	MCTRL_bSpeedLoopFault_b	✓	✓	✓	✓	•

• Default setting
✓Setting possible

This monitoring function compares the actual speed value provided by the speed sensor with the speed setpoint of the speed controller. If the difference between the two speed values exceeds the tolerance window set in C0576, the nErr monitoring function responds.

► If the system deviation exceeds a certain value, this may indicate a drive problem. The drive cannot follow the selected speed setpoint as fast as required. If the controller generally is in working condition, mechanical blockages on the load side or insufficient motor torque may be the cause.

Furthermore, this monitoring function can be used to additionally protect a speed sensor operating in the speed-controlled mode. The monitoring function thus supplements the individual encoder monitoring.

► Faults on the encoder system bring about an incorrect actual speed value. This normally results in a system deviation on the speed controller that is greater than that in the normal operating status.

► The tolerance margin is set via C0576.

► The response is set via C0579.

Note!

► Set the tolerance window (C0576) to at least twice the value of the system deviation occurring during operation. The value can be identified by respective tests when commissioning is effected.

► Please observe that the system deviation reaches higher values under normal operating conditions with short ramp times.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 321
			0	{1 %}	100		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 321
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

9.3.19 Monitoring of max. system speed (NMAX)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
200	NMAX	Max. system speed exceeded	MCTRL_bNmaxFault_b	•			

• Default setting
✓Setting possible

The monitoring function responds if the current speed exceeds the max. system speed or twice the value of C0011 (n_{max}).

Stop!

- ► With regard to active loads (e. g. hoists), pay attention to the fact that the drive in this case operates without torque. Specific on-site measures are required!
- ► If the actual speed value encoder fails, it is not provided that this monitoring will be activated.

The max. system speed can be set via C0596.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0596	NMAX limit	5500			Maximum system speed	📖 322
			0 {1 rpm}	16000		

9.3.20 Monitoring of the rotor position adjustment (PL)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
089	PL	Fault during rotor position adjustment	MCTRL_bRotorPositionFault_b	•			

• Default setting
✓Setting possible

This monitoring function observes the correct execution of the rotor position adjustment.

This monitoring function can occur during rotor position adjustment in connection with feedback systems:

- Resolver
- TTL encoder
- Sin/cos encoder
- Absolute value encoder (single/multi-turn)

Cause for this is a cancellation of the adjustment routine as a result of

- a supply voltage loss
- an encoder cable interruption
- a routine stop through the deactivation of C0095

Reset fault message

1. Remove the cause for the cancellation.
2. Inhibit controller
3. Deactivate rotor position adjustment with C0095 = 0.
4. Carry out TRIP-RESET.
5. Activate rotor position adjustment with C0095 = 1.

10 Diagnostics

10.1 Diagnostics with Global Drive Control (GDC)

The GDC **diagnostics** parameter menu contains the codes for diagnosing the drive system.

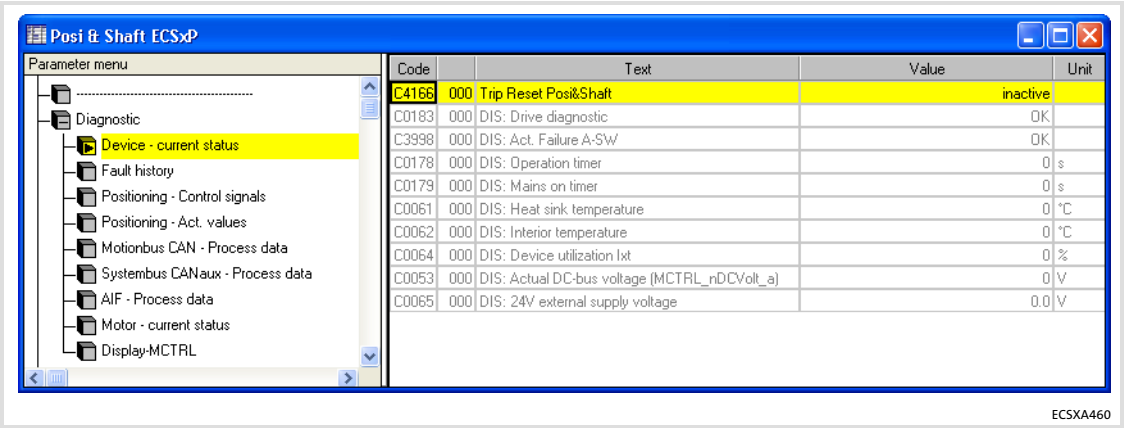


Fig. 10-1 GDC view: Diagnostics - Device - current status

The table in the GDC parameter menu under **Diagnostics → Positioning - actual values** shows the most important operating values:

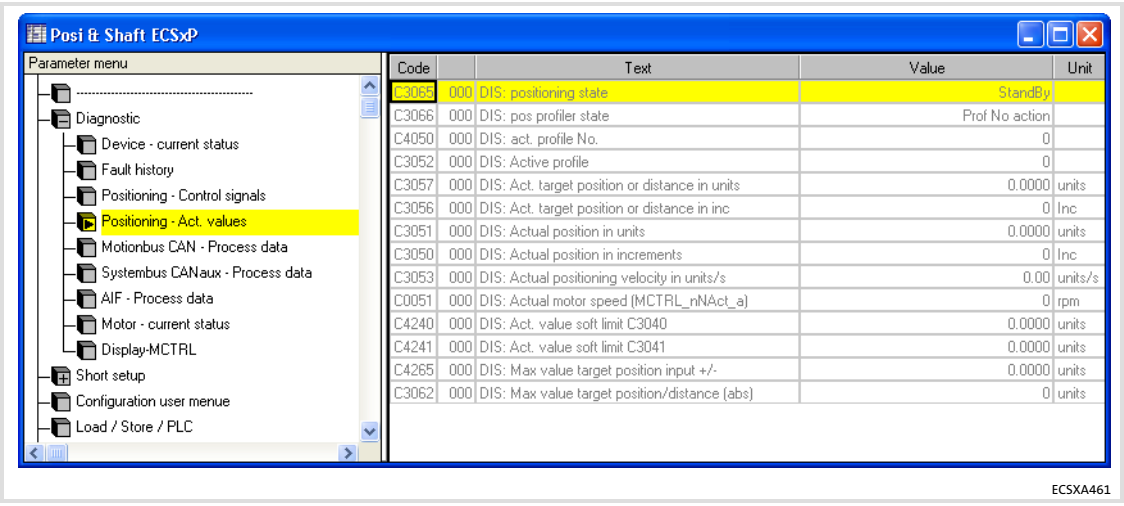


Fig. 10-2 GDC view: Positioning diagnostics - actual values

Information on the fault history are displayed under **Diagnostics → Faults**:

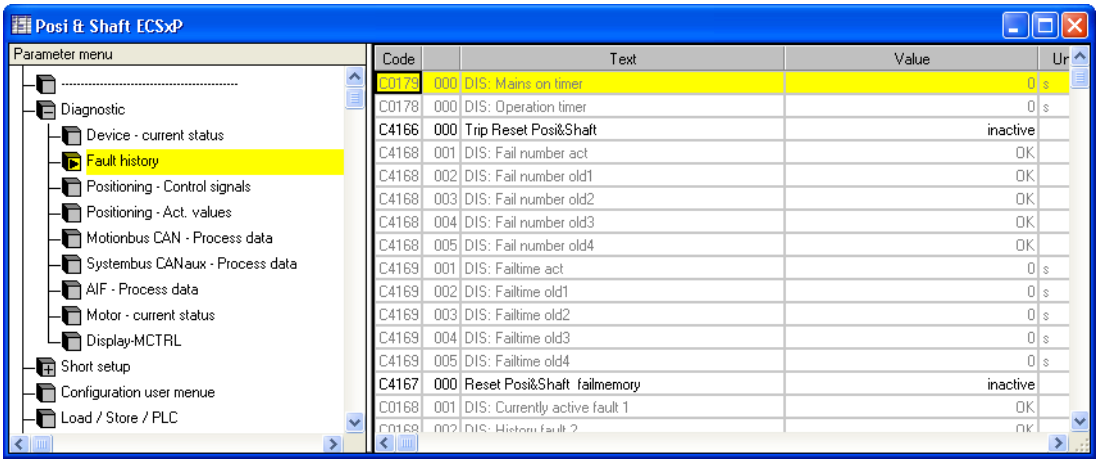


Fig. 10-3 GDC view: Fault diagnostics

10.2 Diagnostics with Global Drive Oscilloscope (GDO)

The ”Global Drive Oscilloscope” (GDO) is included in the scope of supply of the Lenze parameter setting and operating program ”Global Drive Control” (GDC) and the ”Drive PLC Developer Studio” (DDS) and can be used as an additional diagnostic program.

The GDO serves to record e.g. input and output data and device-internal states during controller operation.

Note!

Detailed information about the functionality and handling of GDO can be found in the Manual ”Global Drive Oscilloscope (GDO), Getting started”.

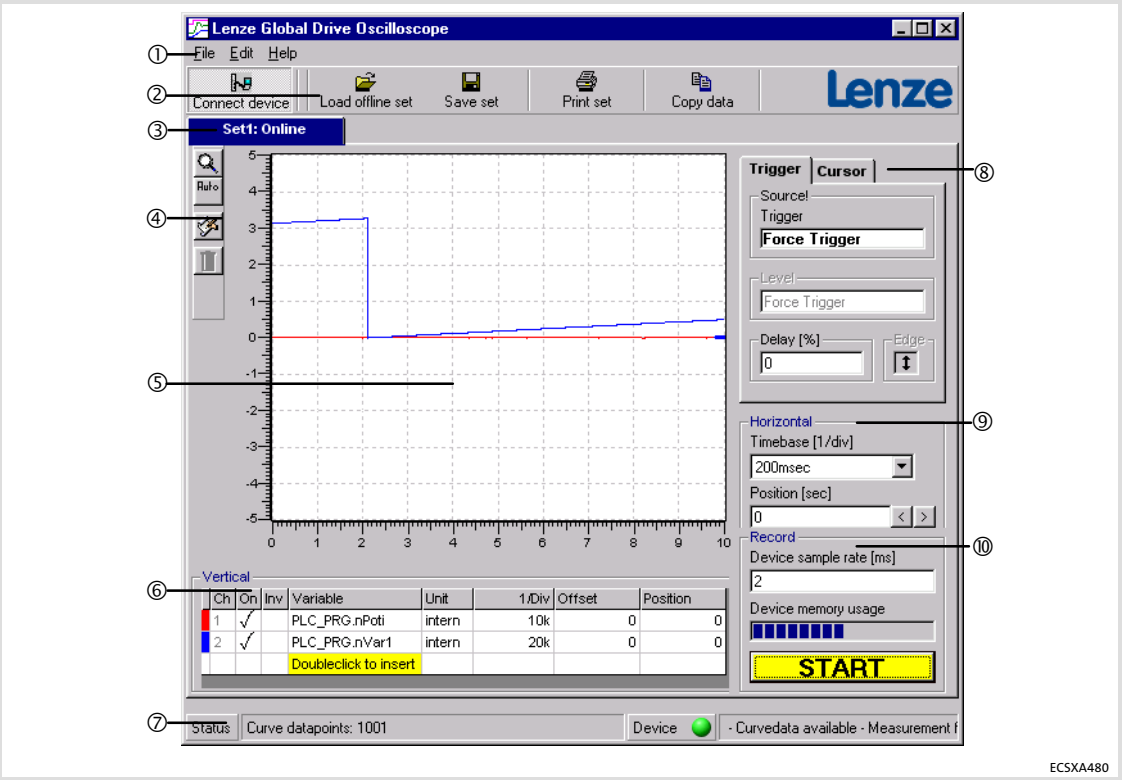


Fig. 10-4 Global Drive Oscilloscope (GDO)

① Menu bar
② Symbol bar at the top
③ Data sets
④ Symbol bar on the left
⑤ Graph display field
⑥ Vertical operating elements
⑦ Status display
⑧ Trigger/cursor operating elements
⑨ Horizontal operating elements
⑩ Operating elements for recording

10.2.1 GDO buttons

Clicking on the corresponding button executes the respective function.

Press the **<F1>** key to call the HTML online help.

Symbol bar at the top (②, Fig. 10-4)

Symbol (button)	Function
	**Connect device** Here a connection can be established to an attached module. This button has the same function as the menu command **File → Connect**.
	**Load offline set** Here saved data sets can be loaded.
	**Save set** Here recorded curves can be saved. This button has the same function as the menu command **File → Save**.
	**Print set** Here the recorded curve can be printed in different variants.
	**Copy data** Here data sets can be copied. This button has the same function as the menu command **Edit → Copy**.

Symbol bar on the left (④, Fig. 10-4)

Symbol (button)	Function
	**Zoom** Here different zoom functions can be executed.
	**Automatic scaling** Here all selected curves can be automatically scaled and repositioned and the offset value can be set to ”0”. The following data types are supported in automatic scaling: BYTE; WORD; DWORD; USINT; UINT; UDINT; SINT; INT; SDINT; Array; Struct
	**Comment** Here information concerning the current data set can be entered. This information is saved together with the current data set and after loading it is displayed as a short info.
	**Delete** Here the selected offline data set can be deleted.

10.2.2 Diagnostics with GDO

1. Connect controller via terminal X4 (CAN) or X14 (CAN-AUX) with PC system bus adapter to PC/laptop.
2. Supply controller with a control voltage of 24 V (📖 64).
3. Start the GDO on the PC/Laptop.
4. Press the button **Connect device**.
   – The dialog ”Select device” opens (Fig. 10-5).
   – The devices connected to the bus are listed under ”Online”.

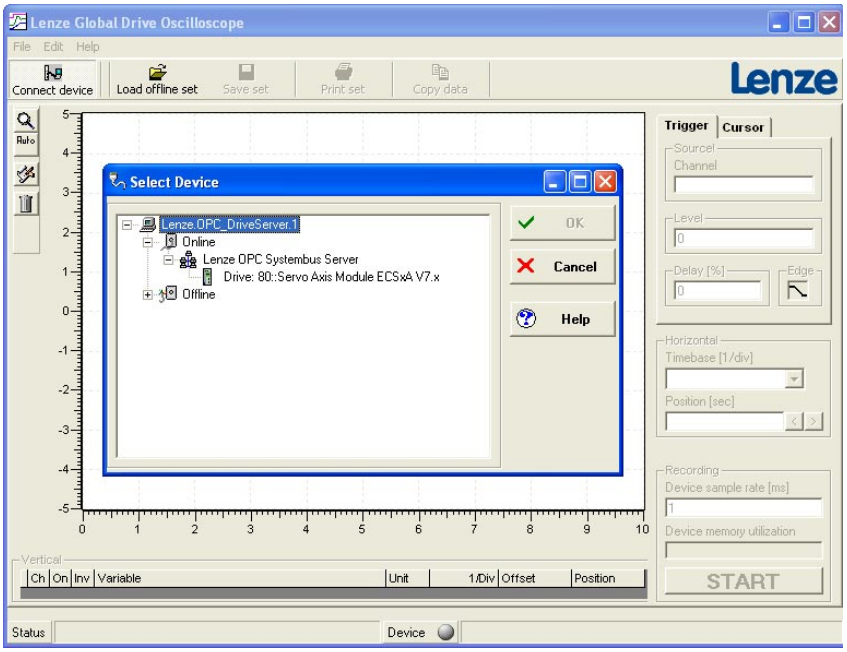


Fig. 10-5 GDO view: dialog ”Select device”

5. Select the corresponding device under **Online** and click on the **OK** button.
   – The dialog ”Select DDS project symbol file” opens:

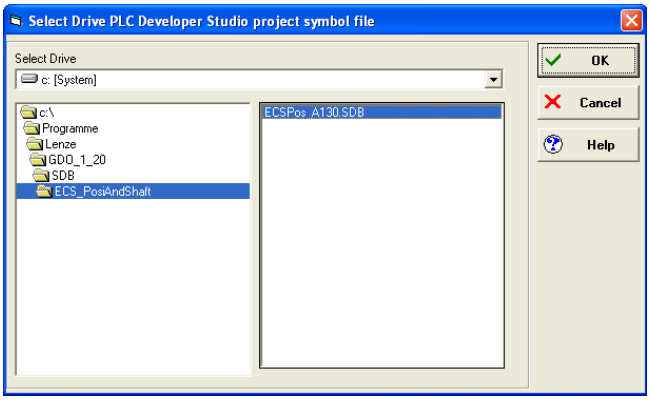


Fig. 10-6 GDO view: dialog ”Select DDS project symbol file”

6. Select symbol file **ECSPOS_Axxx.SDB** (xxx = version number) and press button **OK** .

7. Select the file **ECSPos_ModCycle.los** in the menu list under **File → Open Online Set** and press the button **OK**.

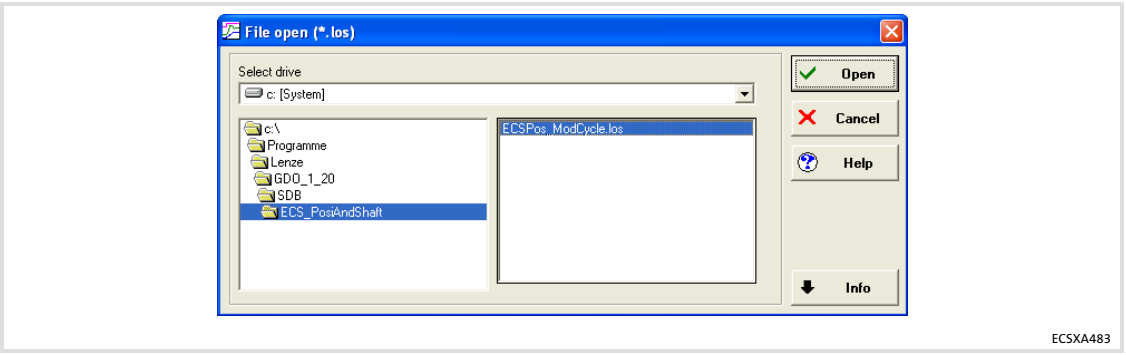


Fig. 10-7 GDO view: dialog "File open (*.los)"

8. Press **Start** button.
9. Position the drive (📖 123).
   – The profile mode C3095 = 251 enables simple cyclic positioning of the drive.

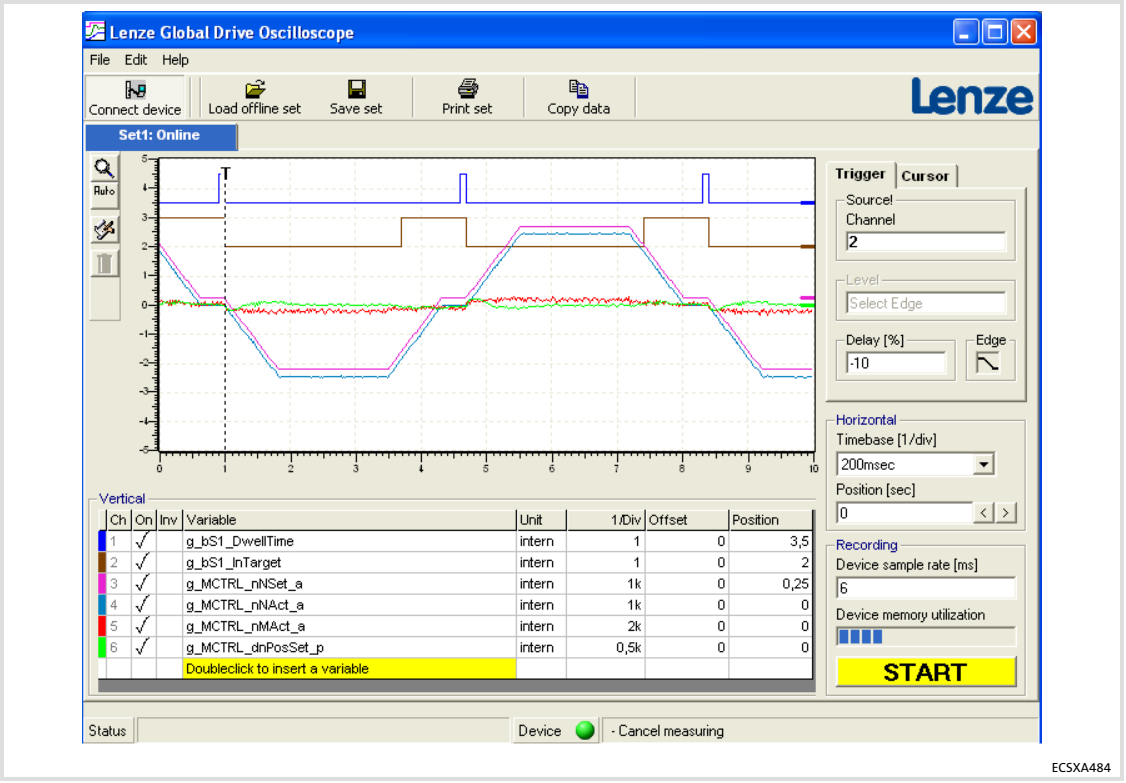


Fig. 10-8 GDO view: performing a positioning process

10. **Double-click on the last line of the "Variable" column** to delete variables from or add variables to the list.
    – The graph display field can display up to eight channels.

System variables

The meaning of the most important variables is shown in the following table:

Variable designation	Data type	Signal type	Display Code	Display format	Description
g_MCTRL_nNSet_a	integer	analog	C0906/1	dec [%]	Speed setpoint
g_MCTRL_nNSetIn_a			C0050	dec [%]	Speed setpoint ● in % of n_{max} (C0011)
g_MCTRL_nNAct_v	integer	velocity	-	-	Actual speed value [rpm]
g_MCTRL_nNAct_a	integer	analog	-	-	Actual speed value ● in % of n_{max} (C0011)
g_MCTRL_nMSetIn_a			C0056	dec [%]	Torque setpoint ● in % of M_{max} (C0057)
g_MCTRL_nMAct_a			-	-	Actual torque ● in % of M_{max} (C0057)
g_MCTRL_nIAct_a			-	-	Current motor current ● 16384 = 100 % I_{max} (C0022)
g_MCTRL_nDCVolt_a					DC bus voltage: 100 % = 1000 V
g_MCTRL_nPos_a			-	-	Rotor position within one revolution as analog signal ● 90° = 100 % = 16384 inc
g_MCTRL_dnPos_p	double integer	position	-	-	Actual position
g_MCTRL_dnPosSet_p			C0908	dec [inc]	Deviation of setpoint angle and actual angle for angle controllers (current following error)
g_bDigin_bCInh_b	Bool	binary	-	-	Controller inhibit – directly affects control(DCTR)
g_bC1...	-	-	-	-	Control bit (📖 158)
g_bS1...	-	-	-	-	Status bit (📖 161)
g_nMWStatWord1	Word	-	-	-	Status word 1 from the drive
g_nMWStatWord2					Status word 2 from the drive
g_nMW_txPar1					Word 3 (bytes 5+6) from the drive
g_nMW_txPar2					Word 4 (bytes 7+8) from the drive
g_dnMD_txPAr12					Double word 2 (bytes 5+6) from the drive
g_wMW_CtrlWord					Control word to the drive
g_nMW_RxPar1					Word 2 (bytes 3+4) to the drive
g_nMW_RxPar2					Word 3 (bytes 5+6) to the drive
g_nMW_RxPar3					Word 4 (bytes 7+8) to the drive
g_dnMD_RxPar2					Double word 2 (bytes 5 ... 8) to the drive
DCTRL_wCAN1Ctrl					CAN control word
DCTRL_wAIF1Ctrl	Word	-	-	-	AIF control word
g_DCTRL_bCInh1_b	Bool	binary	C0878/1	bin	Controller inhibit
g_DCTRL_bCInh2_b			C0878/2		
g_DCTRL_bTripSet_b			C0878/3		TRIP SET
g_DCTRL_bTripReset_b			C0878/4		TRIP RESET
g_DCTRL_bFail_b					TRUE = fault active
g_DCTRL_bImp_b					TRUE = high-resistance power output stage
g_DCTRL_bTrip_b					TRUE = fault active
g_DCTRL_bQspIn_b					TRUE = quick stop (QSP)

Variable designation	Data type	Signal type	Display Code	Display format	Description
g_DCTRL_bRdy_b			-	-	TRUE = ready for operation
g_DCTRL_bCwCCw_b					TRUE = counter-clockwise rotation, FALSE = clockwise rotation
g_DCTRL_bNActEq0_b					TRUE = motor speed < C0019
g_DCTRL_bCInh_b					TRUE = controller inhibit active
g_DCTRL_bExternalFault_b					TRUE = external fault
g_MCTRL_bQspOut_b			C0907/3	bin	TRUE = drive carries out quick stop (QSP)
g_MCTRL_nHiMLim_a	integer	analog	C0906/4	dec [%]	Upper torque limitation ● in % of C0057
g_MCTRL_nLoMLim_a			C0906/3		Lower torque limitation ● in % of C0057
g_MCTRL_bNMSwt_b	Bool	binary	C0907/2	bin	TRUE = torque control FALSE = speed control
g_MCTRL_bnNAdapt_a	integer	analog	-	-	Adaptive Vp of the speed controller
g_MCTRL_bILoad_b	Bool	binary	C0907/4	bin	TRUE = integral action component of the speed controller is accepted by *MCTRL_nISet_a*.
g_MCTRL_nISet_a	integer	analog	C0906/8	dec [%]	Integral action component of the speed controller
g_MCTRL_nPAdapt_a			C0906/9		Influence of C0254 on Vp (in %) ● The sum (without sign) is edited.
g_MCTRL_nPosLim_a			C0906/5	dec [%]	Influence of the angle controller ● in % of n_{max} (C0011)
g_MCTRL_bPosOn_b	Bool	binary	C0907/1	-	TRUE = activate angle controller
g_MCTRL_nNStartMLim_a	integer	nalog	C0906/6	dec [%]	Lower speed limit at speed limitation
g_MCTRL_nMAdd_a			C0906/2		Additional torque setpoint or torque setpoint
g_MCTRL_nFldWeak_a			C0906/7		Motor control
g_MCTRL_bQspIn_b	Bool	**binary**	C0042	bin	TRUE = drive carries out quick stop (QSP)
g_MCTRL_bMMax_b			-	-	TRUE = speed controller operates within the limitation.
g_MCTRL_bIMax_b	Bool	**binary**	-	-	TRUE = drive operates at current limit C0022.
g_MCTRL_bUndervoltage_b					Monitoring: undervoltage
g_MCTRL_bOvervoltage_b					Monitoring: overvoltage
g_MCTRL_bShortCircuit_b					Monitoring: short circuit
g_MCTRL_bEarthFault_b					Monitoring: earth fault
g_MCTRL_bIxtOverload_b					Monitoring: I x t overload
g_MCTRL_bNmaxFault_b					Monitoring: max. system speed exceeded.
g_MCTRL_nNmaxC11	integer	-	-	-	Display of max. speed (C0011)
g_MCTRL_bActTPReceived_b	Bool	binary	-	-	Touch Probe (TP) received.
g_MCTRL_bActIncLastScan_b	double integer	position	-	-	Δinc between Touch Probe (TP) and Start of Task
g_MCTRL_bResolverFault_b					Monitoring: Resolver fault
g_MCTRL_bEncoderFault_b					Monitoring: Encoder fault
g_MCTRL_bSensorFault_b					Monitoring: Absolute value encoder fault

Variable designation	Data type	Signal type	Display Code	Display format	Description
g_MCTRL_bMotorTempGreaterSetValue_b	Bool	binary	-	-	Monitoring: Motor temperature > 150 °C
g_MCTRL_bMotorTempGreaterC0121_b					Monitoring: Motor temperature > C0121
g_MCTRL_bPtcOverTemp_b					Monitoring: Motor overtemperature (PTC)
g_MCTRL_bKuehlGreaterSetValue_b					Monitoring: Heatsink temperature > 90 °C
g_MCTRL_bKuehlGreaterC0122_b					Monitoring: Heatsink temperature > C0122
g_bDigin_bIn1_b	Bool	binary	C0443	bin	Digital inputs
g_bDigin_bIn2_b					
g_bDigin_bIn3_b					
g_bDigin_bIn4_b					
g_bDigin_Save_Standstill_b					Safe torque off (formerly ”safe standstill”)
g_bDigout_bOut_b	Bool	binary	C0444/1	bin	Digital output
g_bDigout_bRelais_b			C0444/2		Feedback ”safe torque off” (formerly ”safe standstill”)
g_nAin_nIn_a	integer	analog	C0400	dec [%]	Analog input
g_nAin_bError_b	Bool	binary	-	-	TRUE if I < 2 mA

10.3 Diagnostics with the XT EMZ9371BC keypad

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	

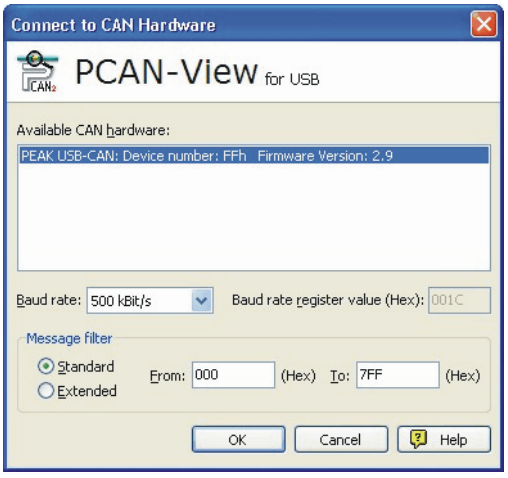
10.4 Diagnostics with PCAN-View

”PCAN-View” is the basic version of the ”PCAN-Explorer” program for Windows® of PEAK System Technik GmbH. The program permits a simultaneous transmission and reception of CAN messages which can be transmitted manually and periodically. Errors on the bus system and memory overflows of the triggered CAN hardware are displayed.

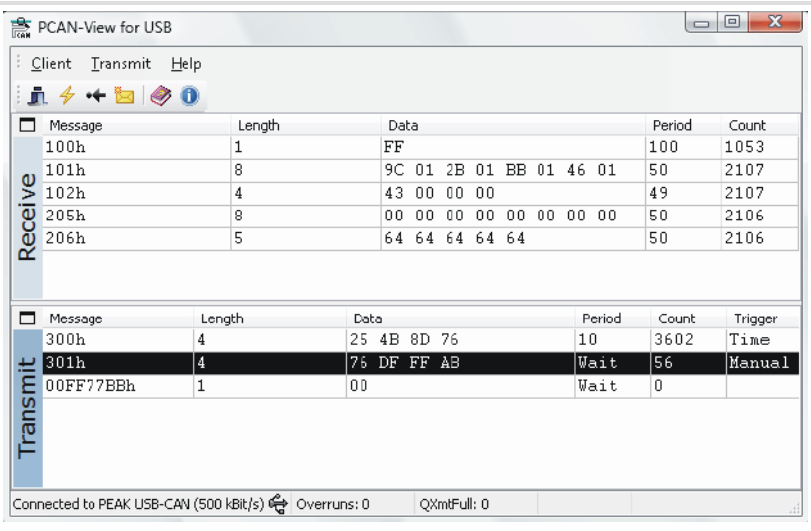
10.4.1 Monitoring of telegram traffic on the CAN bus

How to monitor the telegram traffic:

1. Connect the Engineering PC directly to the CANopen bus via the EMF2177IB USB system bus adapter.
2. Start the ”PCAN-View” program.
3. Connect ”PCAN-View” to ”Connect to CAN Hardware” using the USB system bus adapter and the desired baud rate.



The ”Receive” and ”Transmit” windows now continuously display the CAN telegrams.



On the basis of the IDs displayed, you can assign the telegrams to the devices.

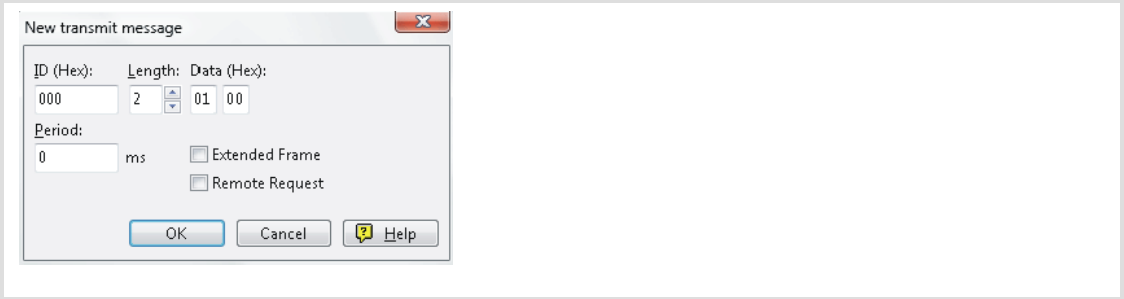
If no telegrams are displayed, this may be caused by various factors:

- Is your Engineering PC connected to the correct CAN bus?
- Is the correct system bus adapter activated under ”System control, CAN Hardware”?
- What does the status line of the »PCAN-View« contain?
  In case of ”Bus Heavy” mostly a node with a wrong baud rate disturbs the bus traffic.
- Do the devices are in the ”Operational” status?

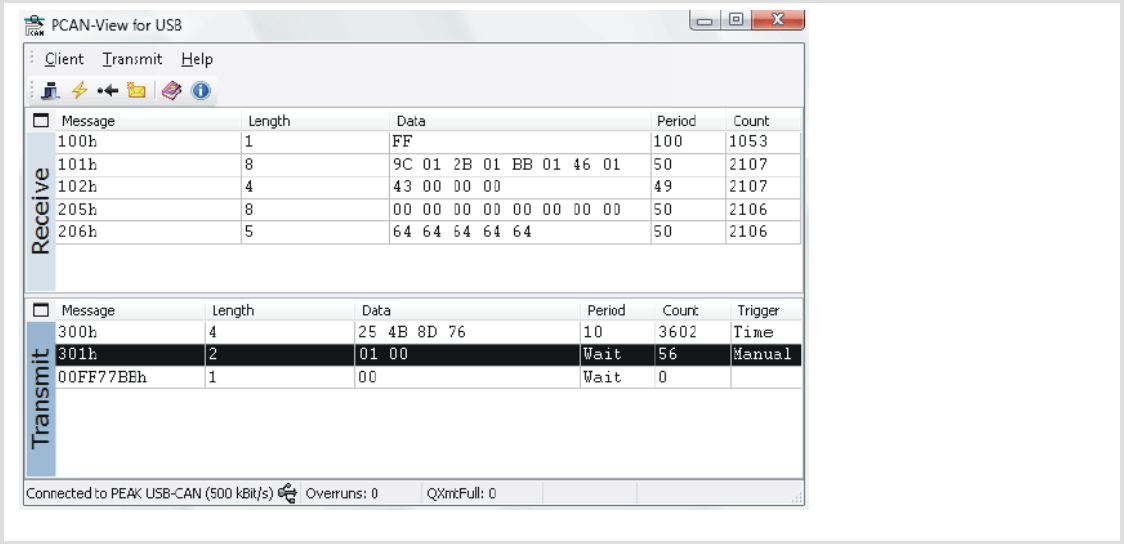
10.4.2 Setting all CAN nodes to the ”Operational” status

How to set all CAN nodes to the ”Operational” status:

1. Create the following CAN message under ”New transmit message”:



2. Select the CAN message in the ”Transmit” window and press the <space bar> once to transmit the CAN message.



11 Troubleshooting and fault elimination

Failures can be quickly detected and classified by means of display elements or status messages via the MotionBus (CAN).

Display elements and status messages provide a rough classification of the trouble.

The chapter ”11.3 Fault messages” (📖 343)contains notes on causes and deletion of faults.

11.1 Fault analysis

11.1.1 Fault analysis via the LED display

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibit (CINH) active, switch-on inhibit	C0183
Blinking	Off	Trouble/fault (TRIP) is active	C0168/1
Blinking	On	Warning/FAIL-QSP is active	C0168/1

11.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display indicate the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited.	C0183, C0168/1
IMP	Pulses at the power stage inhibited.	C0183, C0168/1
Imax	Maximum current reached.	
Mmax	Maximum torque reached.	
FAIL	Fault through TRIP, message, fail QSP or warning.	C0183, C0168/1

11.1.3 Fault analysis with the history buffer

The history buffer enables you to retrace faults. Fault messages are stored in the five memory locations in the order of their occurrence. The memory locations can be retrieved via codes C4168/1...5 and C4169/1...5.

Structure of the history buffer

- C4168/1...5 displays the five fault messages occurred last.
- C4169/1...5 displays the corresponding time based on the elapsed hour meter C0178.
- The fields under "Current fault" show information about the active fault message.
- If the fault message is no longer active or has been reset:
  - the contents of the memory locations 1 ... 5 are stored in a "higher" location.
  - the contents of the memory location 5 are eliminated from the history buffer and cannot be called any longer.
  - memory location 1 is deleted (no active fault).
- The history buffer contains the following information on every fault message occurred:
  - Fault message number and response
  - Time of the last occurrence

Note!

If several fault messages with different responses occur at the same time, only the fault message the response of which has the highest priority is entered into the history buffer.

► TRIP (highest) → Message → FAIL-QSP → Warning (lowest)

Assignment of information to the codes

Codes and retrievable information			Information on ...
C4168	C4169	Subcode	
Number and **response** of the fault message	**Time** of the last occurrence	1	Active fault message
		2	Last fault message
		3	Last but one fault message
		4	Last but two fault message
		5	Last but three fault message

Deleting entries in the history buffer

The entries in the history buffer can be deleted with C4167 = 1.

► This function only works when no trouble is active.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4166	TripAppReset	0		Application fault message reset.	📖 338
			0 Fault message active		
			1 Reset fault message		

Fault message reset

The current fault message can be reset with C4166 = 1.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C4167	AppHistReset	0		Deleting application fault message history buffer.	📖 338
			0 No reaction		
			1 Delete history buffer		

11.1.4 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	📖 163 📖 340
			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		

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
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		

11.2 Malfunction of the drive

Maloperation/fault	Cause	Remedy
Feedback system		
● Motor rotates CCW when viewed to the motor shaft. ● C0060 counts down after controller enable.	Feedback system is not connected in correct phase relation.	Connect feedback system in correct phase relation. The rotor position indicated under C0060 is derived from the position encoder (MCTRL_dnPos_p). Therefore observe the mounting position when using separate feedback systems for position (C0490) and speed (C0495).
Asynchronous motor		
● Motor rotates with I_{max} and half slip frequency. ● Motor does not react to setpoint change.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
Synchronous motor		
● Motor does not follow the setpoint change. ● I_{max} follows the setpoint selection in idle state.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
● Motor rotates CCW when viewed to the motor shaft. ● Synchronous motor accelerates with a speed setpoint = 0 to rated speed. ● Torque of synchronous motor is too low.	Rotor angle (offset of electrical and mechanical rotor angle) is not correct.	Carry out rotor position adjustment (C0095 = 1) or set rotor displacement angle manually. **Operate motor without load for this purpose!**
● Motor blocks in certain positions.	The number of pole pairs of the resolver or motor is not set correctly.	Number of pole pairs (C0080) must be set correctly.

11.3 Fault messages

11.3.1 Causes and remedies



Tip!

When the fault messages are retrieved via the MotionBus/system bus (CAN), the fault messages are displayed as numbers (see column "Fault message – No." in the following 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 TRIP (axis module, fix 100 %)	Current overload of the axis module, e.g. by: • frequent and too long acceleration processes • continuous overload with $I_{motor} > 1.05 \times I_{Nx}$	Check drive dimensioning.
0016	OC6	I^2 x t overload TRIP (motor, C0120)	Current overload of the motor, e.g. due to: • frequent or too long acceleration processes • impermissible continuous current	• Check drive dimensioning. • Check setting of C0120.
x017	OC7	I x t overload warning (axis module, C0123)	Current overload of the axis module > C0123 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0123.
x018	OC8	I^2 x t overload warning (motor, C0127)	Current overload of the motor > C0127 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0127.
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 DC bus	DC-bus voltage is lower than specified under C0174.	• Check mains voltage. • Check power supply module.
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.
x041	AP1	Internal fault		Contact Lenze.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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.
0051	OH1	Interior 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.
			Wrong mounting position	Change mounting position.
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.
x055	OH5	Interior temperature > C0124		• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0605 = 3).
			The value under C0124 is set too low.	Enter a higher value under C0124.
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x065	CE4	BUS-OFF state of system bus (CAN), interface X4	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X4: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C0595 = 3).
x066	CE5	System bus (CAN) time-out (communication error of gateway function), interface X4	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X4. • Check CAN bus configuration. • Switch off monitoring (C0603 = 3).
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
0074	PEr	Program error	Error in the program flow	• Check use of pointers. • Send module with PLC program and parameter set to Lenze (on floppy disk/CD-ROM).
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 parameter set transfer between two controllers. • Parameter set does not match the controller, e.g. when data were transmitted from a controller with more performance to a controller with less performance.	• Correct parameter set. • Check code initialisation values. **After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!**
0080	PR6	**With ECSxS/P/M:** internal error		Contact Lenze.
		With ECSxA: too many user codes		Reduce number of user codes.
0081	Rel1	Error on brake relay output (X25)	• Cable breakage • Short circuit • No supply voltage	• Check fuse. • Check supply. • Check cables. • Check motor holding brake
x082	Sd2	Resolver error at X7	Resolver cable is interrupted.	• Check cable for wire breakage. • Check resolver. • Switch off monitoring (C0586 = 3).
			Excitation amplitude is too low.	Increase excitation amplitude of resolver (C0416). Check control factor of resolver under C0414 (as of operating system V8.0).
x085	Sd5	Master current value encoder error at analog input X6/AI+, AI- (C0034 = 1)	Master current value at X6/AI+, AI- < 2mA	• Check cable for wire breakage. • Check master current value encoder. • Switch off monitoring (C0598 = 3). • Check control factor of resolver under C0414 (as of operating system V8.0).
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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. 📖 249 **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	• Sd7 fault during rotor position adjustment with absolute value encoder after mains switching • Cancellation of rotor position adjustment (e.g. by C0095 = 0 or switching off)	1. Activate rotor position adjustment with C0095 = 1. 2. Carry out TRIP reset. 3. Repeat rotor position adjustment.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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).
x095	FAN1	Fan monitoring (for built-in units)	Heatsink fan is locked, dirty or defect.	Clean or exchange heatsink fan.
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.
x108	H08	”Extension board” error	”Extension board” not connected correctly.	• Connect ”extension board” correctly. • Check connector.
			”Extension board” is not supported by PLC program.	• Adapt PLC program to ”extension board”. • Use ”extension board” which is supported by PLC program.
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).
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux1_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/1, if necessary. • Switch off monitoring (C2481 = 3).
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux2_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/2, if necessary. • Switch off monitoring (C2482 = 3).
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux3_IN object receives faulty data or communication is interrupted.	• Check wiring on X14. • Check transmitter. • Increase monitoring time under C2457/3, if necessary. • Switch off monitoring (C2483 = 3).
x125	CE14	BUS-OFF state of system bus (CAN), interface X14	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X14: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C2484 = 3).
x126	CE15	Communication error of the gateway function via interface X14 (CAN-AUX) • C0371 = 1: Gateway channel X14 (CAN-AUX) • C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	• Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X14. • Check CAN bus configuration. • Switch off monitoring (C2485 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
1131	PRM	Parameters of the motor model are faulty	The parameters calculated from the entered rated motor data are outside the permissible value range.	Check and correct the set rated motor data (especially C0084, C0085, C0088, C0090).
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.
x191	HSF	Internal error		Contact Lenze.
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)		
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.
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.
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
x260	Err Node Guard	”Life guarding event”	The controller configured as CAN slave does not receive a ”Node Guarding” telegram within the ”Node Life Time” from the CAN master.	● Check wiring at X4. ● Check CAN configuration. ● Make sure that ”Node Guarding” has been activated in the CAN master. ● Adapt ”Node Life Time” (C0382) to the setting in the CAN master.
2402	PosPosLimit	Positive software limit position (C3040) has been reached.	Positive software limit position reached in manual jog mode (inching mode).	● Check travel range. ● Check positive software limit position C3040.
2403	NegPosLimit	Negative software limit position (C3041) has been reached.	The negative software limit position has been reached in the manual control mode.	● Check travel range. ● Check negative software limit position C3041.
2404	FollowErrWarn	Following error tolerance (C3030) reached.	The drive cannot follow the setpoint.	● Reduce acceleration. ● Increase the limit value C3030. ● Increase current limit C0022 (observe max. motor current). ● Check drive dimensioning.
2422	InvProfData	Impermissible positioning profile parameters	E. g. acceleration, deceleration or traversing speed = 0	Correct the setting.
2423	OverflIntPos	Position setpoint overflow	Target position / distance > 2^{31} - 1 internal increments	Correct the setting.
2424	SWLimOutOfRan	Impermissible software limit positions	The software limit position C3040 / C3041 is not specified within the permissible range (C4265) and is internally limited to the value of C4240/C4241.	Correct the setting.
3400	PosLimitSw	Positive hardware limit switch has been approached.	Hardware limit switch supplies LOW signal.	● Check function of hardware limit switch. ● Check signal at the digital input (X6/DIx). ● Check position of the hardware limit switch. ● Check positioning profile mode C3095/x in the positioning profile.
3401	NegLimitSw	Negative hardware limit switch has been approached.	Hardware limit switch supplies LOW signal.	● Check function of hardware limit switch. ● Check signal at the digital input (X6/DIx). ● Check position of the hardware limit switch. ● Check positioning profile mode C3095/x in the positioning profile.
3402	PosPosLimit	Positive software limit position (C3040) has been reached.	Positive software limit position in the positioning profile mode reached.	● Check position selection C3095/x in the positioning profile. ● Check positive software limit position C3040.
3403	NegPosLimit	Negative software limit position (C3041) has been reached.	Negative software limit position in the positioning profile mode reached.	● Check position selection C3095/x in the positioning profile. ● Check negative software limit position C3041.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
3405	FollowErrFail	Following error tolerance (C3030) reached.	The drive cannot follow the setpoint.	• Reduce acceleration. • Increase the limit value C3030. • Increase current limit C0022 (observe max. motor current). • Check drive dimensioning.
3406	HomePosErr	Home position has not been reached.	Positioning profile mode in C3095/x requires homing.	Execute Homing or ”Set reference”.
3409	MaxVelErr	Max. speed in C1240 is set too high.	Maximum speed C1240 cannot be reached due to the maximum speed set in C0011.	Reduce C1240 or increase C0011. The highest possible value for C1240 is displayed in C3060.
3417	InvSftwLimits	Impermissible setting of the software limit positions	Positive software limit position is lower than the negative one (C3040 < C3041).	Correct the setting.
0425	InvHoming Offs	Reference measuring system offset (C3012) is invalid.	Entry of reference measuring system offset (C3012) with inverted motor-/encoder mounting position (C3000 <> C3001) and use of MT absolute value encoder not permitted	Reset reference measuring system offset (C3012 = 0)
3500	ExtTripSet	External fault has been activated.	Fault has been set externally with *Ctrl1.TripReset*.	C4040: reset *Ctrl1.TripReset* = 0.
3501	InvTpProfNo	Invalid positioning profile number with touch probe positioning	Invalid positioning profile number, e. g. for subsequent block in touch probe positioning	Select positioning profile number < 15.
0503	InvalidFeedb	Impermissible feedback system selection	The selected feedback system cannot be combined with the profile function (e. g. position feedback = encoder and C3095 = 31).	Correct the setting.
0504	InvalidOS	Version of operating system is not compatible.	Application software requires compact servo ECS with operating system version ≥ 3.2.	Use suitable hardware and operating system version ≥ 3.2.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

11.3.2 Reset fault messages (TRIP-RESET)

Response	Measures to reset the fault message
TRIP/FAIL-QSP	**Note!** As long as a TRIP/FAIL-QSP source is active, the TRIP/FAIL-QSP cannot be reset. The TRIP/FAIL-QSP can be reset by: ● Press keypad XT EMZ9371 BC ⇨ STOP. Then, press RUN to re-enable the axis module. ● Set code C4166 = 1. ● Control word "Ctrl1": Control bit *Ctrl1.TripReset* (📖 158) (Dependent on the control interface selected in C4010.) ● Control word AIF (from V3.0) After the TRIP/FAIL-QSP has been reset, the drive remains at standstill.
Message	**Danger!** After the fault has been removed, the fault message is removed automatically and the drive restarts automatically.
Warning	After eliminating the fault, the fault message is reset automatically.

12 Appendix

12.1 Code table

How to read the code table

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	1	Subcode 1 of Cxxxx
	2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0002	Par load	0			Load parameter set **The Lenze setting can only be loaded if the controller is inhibited (CINH).**
			0	Load Lenze setting	Load Lenze setting into the RAM and activate it. **Only possible if C2108 = 2 (PLC stopped).**
			1	Load parameter set 1	Load parameter set 1 into the RAM and activate it. **Parameter set 1 is loaded automatically after every mains connection.**
C0003	Par save	0			Save parameter set
			0	Saving completed	
			1	Save parameter set 1	
C0004	Op display	56			Selection of XT keypad status display
			1	{Code no.} 9999	The keypad displays the selected code in the operating level, if no status messages from C0183 are active (e. g.: 56 = torque setpoint (C0056))

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
[C0006]	Op mode	1				Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1	Servo PM-SM		Servo control of synchronous motors
			2	Servo ASM		Servo control of asynchronous motors
C0009	LECOM address	1				Entry of the device address for operation via AIF interface X1
			1	{1}	99	Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133
C0011	Nmax	3000				Maximum speed
			500	{1 rpm}	16000	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 (CINH)!**
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)
			-16000	{1 rpm}	16000	
C0018	fchop	2				Switching frequency
			1	4 kHz sin		4 kHz permanent PWM frequency
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0019	Thresh nact = 0	0				Threshold when actual speed value (n_{act}) = 0 is detected. (DCTRL_bNActEq0_b)
			0	{1 rpm}	16000	
C0022	Imax current	→				I_{max} limit
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.
C0023	Imax fld.weak	0				Maximum field weakening current for synchronous machines
			0	{1 %}	100	
C0026						Offset for relative analog signals (AIN)
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a
2	FCODE(offset)	0,0				FCODE_nC26_2_a

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0027						Gain for relative analog signals (AIN)	
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0030	DFOUT const	3				Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 136 📖 145
			0	256 incr./rev			
			1	512 incr./rev			
			2	1024 incr./rev			
			3	2048 incr./rev			
			4	4096 incr./rev			
			5	8192 incr./rev			
			6	16384 incr./rev			
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	
			-16000	{1 rpm}	16000		
C0040	Ctrl enable	1				Controller enable / controller inhibit (CINH) ● Writing: Controls the controller inhibit ● Reading: Reads the status of the controller inhibit	
			0	Controller inhibited			
			1	Controller enabled			
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 243
			0	QSP not active			
			1	QSP active			
C0043	Trip reset	0				Reset active fault message (TRIP-RESET)	📖 352
			0	Reset fault message (TRIP-RESET) / no fault			
			1	Active fault message			
C0050	MCTRL-NSET2					Speed setpoint on speed controller input (MCTRL_nNSetIn_a) Read only	
			-100,00	{0.01 %}	100.00		
C0051	MCTRL-NACT					Actual speed (MCTRL_nNAct_a) Read only	
			-30000	{1 rpm}	30000		
C0052	MCTRL Umot					Actual motor voltage Read only	
			0	{1 V}	800		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0053	UG-VOLTAGE					DC-bus voltage Read only	
			0	{1 V}	900		
C0054	Imot					Actual motor current Read only	
			0,0	{0.1 A}	500,0		
C0055	Phase current					Motor phase current Read only	
1	iu		0,0	{0.1 A}	500,0	Actual current in U phase	
2	iv					Actual current in V phase	
3	iw					Actual current in W phase	
4	Io					Actual theoretical star-point current	
C0056	MCTRL-MSET2					Torque setpoint on speed controller output (MCTRL_nMSetIn_a) Read only	
			-100	{1 %}	100		
C0057	Max Torque					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	
			0,0	{0.1 Nm}	500,0		
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 249
			-180.0	{0.1 °}	179.9		
C0059	Mot pole no.					Calculated number of motor pole pairs Read only	
			1	{1}	200		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 246
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
C0061	Heatsink temp					Heatsink temperature Read only	📖 303
			-200	{1 °C}	200		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0062	Interior temp					Interior device temperature Read only	📖 304
			-200	{1 °C}	200		
C0063	Mot temp					Motor temperature Read only	📖 301
			0	{1 °C}	200		
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display	
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.	
C0065	U24 ext					External low-voltage supply (U_{24}) Read only	
			0,0	{0.1V}	100,0		
C0066	Motor load					Thermal motor load $I^{2x}t$ Only display	📖 309
			0	{1 %}	250		
C0067	Act trip					Current fault (TRIP) (in case of FAIL-QSP, warning and message, "0" is displayed.) Only display	📖 343
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 252
			0.00	{ 0.01}	127.99		
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 252
			1.0	{0.5 ms}	6000.0		
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 252
			0.0	{0.1 ms}	32.0		
C0074	Dynamics	0				Pilot control of the current controller for higher dynamics	📖 247
			0	Normal			
			1	Enhanced			
C0075	Vp currCTRL	20.0				Proportional gain of current controller (V_{pi}) The upper limit is device-dependent.	📖 247
			0.00	{0.01 Ω}	381.80	ECSxS/P/M/A004	
					190.90	ECSxS/P/M/A008	
					95.46	ECSxS/P/M/A016	
					47.72	ECSxS/P/M/A032	
					31.82	ECSxS/P/M/A048	
					23.86	ECSxS/P/M/A064	
C0076	Tn currCTRL	5.0				Reset time of current controller (T_{ni})	📖 247
			0.01	{0.01 ms}	200.00		
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	📖 254
			0.00	{0.01}	63.99		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	📖 254
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Read only	
			0.00	{0.01 A}	327,67		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0093	Drive ident					Device identification of the ECS axis module Read only	
			0	Defective power section			
			1	No power section recognised			
			4	ECSxS/P/M/A004C4			
			8	ECSxS/P/M/A008C4			
			16	ECSxS/P/M/A016C4			
			32	ECSxS/P/M/A032C4			
			48	ECSxS/P/M/A048C4			
			64	ECSxS/P/M/A064C4			
			65	ECSxS/P/M/A064C2			
C0094	Password	0				Keypad password Parameter access protection for the keypad	
			0	{1}	9999	When the password is activated, only the codes of the user menu (C0517) can be accessed. Further possible selections: see C0096 0 = no password	
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 249
			0	Inactive			
			1	Active			
C0096						Extended password protection for bus systems with activated password (C0094) All codes in the user menu can be accessed.	
1	AIF/CAN prot.	0		No access protection		AIF access protection	
2	AIF/CAN prot.	0		No access protection		CAN access protection	
			0	No access protection		Full access	
			1	Read protection		Reading not possible	
			2	Write protection		Writing not possible	
			3	Read/write protection		Reading and writing not possible	
C0097	DIS:Lt-Ident	0				Power stage identification	
			0	{1}	255		
C0098	Set position	0				Home position of encoder	
			-2147483647	{1 inc}	2147483647		
C0099	S/W version					Firmware version Read only	
			0,0	{0,1}	25,5		
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 243
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0108						Gain for relative analog signals (AOUT)	
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0114						Polarity of the digital inputs	📖 172
1	DIGIN pol	0		HIGH level active		X6/DI1 (DIGIN_bIn1_b)	
2	DIGIN pol	0		HIGH level active		X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0		HIGH level active		X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0		HIGH level active		X6/DI4 (DIGIN_bIn4_b)	
			0	HIGH level active			
			1	LOW level active			
C0118						Polarity of the digital outputs (DIGOUT)	📖 172
1	DIGOUT pol	0		HIGH level active		X6/DO1	
2	DIGOUT pol	0		HIGH level active		X25/BD1, X25/BD2 (brake connection)	
			0	HIGH level active			
			1	LOW level active			
C0120	OC6 limit	105				Threshold for $I^2 x t$ monitoring (motor)	📖 309
			0	{1 %}	120	0 = $I^2 x t$ monitoring is switched off $I^2 x t$ > C0120 ⇨ OC6-TRIP	
C0121	OH7 limit	120				Threshold for motor temperature monitoring	📖 301
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault message OH7 (C0584)	
C0122	OH4 limit	80				Threshold for heatsink temperature monitoring	📖 303
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	

Code		Possible settings					IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection					
C0123	OC7 limit	90					Threshold for I x t warning (axis module)	📖 300
			0		{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0124	OH5 limit	75					Threshold for temperature monitoring inside the device	📖 304
			10		{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0125	Baud rate	0					Baud rate for operation via AIF interface X1	
			0	9600 bit/s			Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
			1	4800 bits/s				
			2	2400 bit/s				
			3	1200 bit/s				
			4	19200 bit/s				
C0126	MONIT CE0	3					Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	
			0	TRIP			A communication error activates the CE0 response set.	
			2	Warning				
			3	Off			Monitoring switched off.	
C0127	OC8 limit	100					Threshold for I^2 x t warning (motor)	📖 309
			0		{1 %}	120	I^2 x t > C0127 ⇨ fault message OC8 (C0606)	
C0128	Tau motor	5.0					Thermal time constant of the motor	📖 309
			0.5		{0.1 min}	25.0	For calculating the I^2 x t disconnection	
C0129	Charc.: Ix/Nx						Reduction of the speed/torque characteristic for UL-compliant thermal motor monitoring (I^2 x t) The reduced speed/torque characteristic reduces the permissible thermal load of self-ventilated standard motors.	📖 24
1		100	10		{1 %}	200	S1 torque characteristic I_1/I_{rated} This value also enables an increase of the maximally permissible utilisation.	
2		40					S1 torque characteristics n_2/n_{rated} With increasing speeds, the maximally permissible utilisation remains unchanged ($I_{Mot} = I_{rated}$).	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0135	Control word	0				System control word DCTRL
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)
			Bit 0	Not assigned		
			Bit 1	Not assigned		
			Bit 2	Not assigned		
			Bit 3	Quick stop (QSP)		
			Bit 4	Not assigned		
			Bit 5	Not assigned		
			Bit 6	Not assigned		
			Bit 7	Not assigned		
			Bit 8	Operation inhibit (DISABLE)		
			Bit 9	Controller inhibit (CINH)		
			Bit 10	TRIP-SET		
			Bit 11	TRIP-RESET		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		
C0136						Control words Hexadecimal value is bit-coded. Read only
1	CTRLWORD		0	{hex}	FFFF	Control word C0135
2	CTRLWORD					CAN control word
3	CTRLWORD					AIF control word
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)
			-199.99	{0.01 %}	199.99	
C0142	Start options	1				Starting condition for start after ● mains connection ● message (t > 0.5 s) ● TRIP
			0	Protection against unexpected start-up		
			1	Automatic start		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only	📖 163
			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			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0157						Status of free bits of DCTRL status word 1 (C0150) Only display	
1	Stat. FreeBit		0	{1 bit}	1	Bit 0 (DCTRL_bStat_B0_b)	
2	Stat. FreeBit					Bit 2 (DCTRL_bStat_B2_b)	
3	Stat. FreeBit					Bit 3 (DCTRL_bStat_B3_b)	
4	Stat. FreeBit					Bit 4 (DCTRL_bStat_B4_b)	
5	Stat. FreeBit					Bit 5 (DCTRL_bStat_B5_b)	
6	Stat. FreeBit					Bit 14 (DCTRL_bStat_B14_b)	
7	Stat. FreeBit					Bit 15 (DCTRL_bStat_B15_b)	
C0161	Act trip					Current TRIP ● as in C0168/1 ● In case of FAIL-QSP, warning, and message, ”0” is displayed. Only display	📖 343
C0167	Reset failmem	0				Delete history buffer (C0168)	📖 338
			0	No reaction			
			1	Delete history buffer			
C0168						Fault history buffer (list of faults occurred) Read only	📖 338 📖 343
1	Fail number					Currently active fault	
2	Fail number					Last fault	
3	Fail number					Last fault but one	
4	Fail number					Last fault but two	
5	Fail number					Last fault but three	
6	Fail number					Last fault but four	
7	Fail number					Last fault but five	
8	Fail number					Last fault but six	
			All fault indications (TRIP, FAIL-QSP, warning, message)				
C0169						Time at which the fault messages entered in the history buffer (C0168) occurred. Read only	📖 338
1	FailTime		Respective status of the operating hour counter (C0179)			Occurrence of the currently active fault message	
2	FailTime					Occurrence of the last fault message	
3	FailTime					Occurrence of the second-last fault message	
4	FailTime					Occurrence of the third-last fault message	
5	FailTime					Occurrence of the fourth-last fault message	
6	FailTime					Occurrence of the fifth-last fault message	
7	FailTime					Occurrence of the sixth-last fault message	
8	FailTime					Occurrence of the seventh-last fault message	
			0	{1 h}	65535		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0170				Frequency of successive occurrence of the fault messages entered in the history buffer (C0168) Read only	📖 338
			0 {1} 65535		
1	Counter			Frequency of the fault message currently active	
2	Counter			Frequency of the last fault message	
3	Counter			Frequency of the second-last fault message	
4	Counter			Frequency of the third-last fault message	
5	Counter			Frequency of the fourth-last fault message	
6	Counter			Frequency of the fifth-last fault message	
7	Counter			Frequency of the sixth-last fault message	
8	Counter			Frequency of the seventh-last fault message	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0173	UG limit	11			Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 126
			0	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3	Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4	Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13	Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14	Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 126
			15	{1 V} 342		
C0175	UG-Relais Fkt	1			Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 126
			1	Standard	Relay switches as a function of LU.	
			2	One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3	Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0178	Op timer					Running time meter Read only
			0	{1 sec}	4294967295	Time when the controller was enabled
C0179	Mains timer					Power-on time meter Only display
			0	{1 sec}	4294967295	Time when the mains was switched on
C0183	Diagnostics					Drive diagnostics Read only ● Indicates fault or status information ● If several fault or status information are to be shown at the same time, the information with the smallest number is displayed
			0	OK		No fault
			101	Initialisation phase		
			102	TRIP/trouble		
			103	Emergency stop activated		
			104	IMP message		
			105	Power off		
			111	Operation inhibit C0135		
			112	Operation inhibit AIF		
			113	Operation inhibit CAN		
			121	Controller inhibit via X6/SI1		
			122	Internal controller inhibit 1		
			123	Internal controller inhibit 2		
			124	Controller inhibit via STOP key of the keypad		
			125	Controller inhibit via AIF		
			126	Controller inhibit via CAN		
			131	Fail QSP		
			141	Restart protection		
			142	Pulse inhibit		High resistance power outputs
			151	Quick stop (QSP) via terminal		
			152	Quick stop (QSP) via STOP key of the keypad		
			153	Quick stop (QSP) via AIF		
			154	Quick stop (QSP) via CAN		
			160	PLC Stop		PLC must be started.
			250	Warning		
C0199	BuildNumber					Software identification Only display
C0200	S/W Id					Software identification Only display
C0201	S/W date					Software release date Read only

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0202						Service code Only display	
1						Product code 1	
...						...	
4						Product code 4	
C0203	Komm.-No.		x / xxxx / xxxxx			Commission number Only display	
C0204	Serial-No.					Serial number Read only	
C0205	PLC Target ID					Identification key Only display	
C0206	Product. date					Production date Only display	
C0207	DL info 1					Download info 1 Only display	
C0208	DL info 2					Download info 2 Only display	
C0209	DL info 3					Download info 3 Only display	
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	
			0		1		
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	
			0.0000	{ 0.0001}	3.9999		
C0300 ... C0302	Service Codes					**Only the Lenze service is allowed to make changes!**	
C0349						Status of the DIP switch for CAN bus interface X4 Read only	
1	CAN DIP-SW		0	{1}	63	Node address set on the DIP switch	
2	CAN DIP-SW		0		4	For setting the DIP switches > 4, the display is set to 0.	
C0350	CAN address	32				Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 266) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 266 📖 429
			1	{1}	63		
C0351	CAN baud rate	0				Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 266
			0	500 kbps			
			1	250 kbits/sec			
			2	125 kbit/s			
			3	50 kbps			
			4	1000 kbit/s			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0352	CAN mst	0				Boot-up master/slave configuration for CAN bus interface X4	📖 273
			0	Slave			
			1	Master boot-up		Device is active as CAN boot-up master.	
			2	Master node guarding			
			3	Slave heartbeat producer			
			4	Slave node guarding			
C0353						Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 271
1	CAN addr sel	0		CAN node address (C0350)		Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)		Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)		Address CAN3_IN/OUT	
			0	C0350 (auto)		Automatically determined by C0350.	
			1	C0354 (man.)		Determined by C0354.	
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 271
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C0355						Identifier for CAN_IN/CAN_OUT (CAN bus interface X4) Read only	📖 429
1	CAN Id		1	{1}	2047	Identifier CAN1_IN	
2	CAN Id					Identifier CAN1_OUT	
3	CAN Id					Identifier CAN2_IN	
4	CAN Id					Identifier CAN2_OUT	
5	CAN Id					Identifier CAN3_IN	
6	CAN Id					Identifier CAN3_OUT	
C0356						CAN time settings for CAN bus interface X4	📖 274
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 297
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0358	Reset node	0				Make a reset node for the CAN bus node.	📖 276
			0	No function			
			1	CAN reset			
C0359	CAN state					CAN bus status (interface X4) Read only	📖 286
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
			4	Stopped			
C0360						Telegram counter CAN_IN/CAN_OUT (CAN bus interface X4), number of telegrams Read only	📖 287
1	CAN Messages		0	{1}	65535	All sent telegrams	
2	CAN Messages		With a count value > 65535 the counter restarts with 0			All received telegrams	
3	CAN Messages					Sent to CAN1_OUT	
4	CAN Messages					Sent to CAN2_OUT	
5	CAN Messages					Sent to CAN3_OUT	
6	CAN Messages					Sent on parameter data channel 1	
7	CAN Messages					Sent on parameter data channel 2	
8	CAN Messages					Received from CAN1_IN	
9	CAN Messages					Received from CAN2_IN	
10	CAN Messages					Received from CAN3_IN	
11	CAN Messages					Received from parameter data channel 1	
12	CAN Messages					Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0361						Detected load CAN_IN/CAN_OUT (CAN bus interface X4) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 288
1	Load IN/OUT		0	{1 %}	100	All sent telegrams	
2	Load IN/OUT					All received telegrams	
3	Load IN/OUT					Sent to CAN1_OUT	
4	Load IN/OUT					Sent to CAN2_OUT	
5	Load IN/OUT					Sent to CAN3_OUT	
6	Load IN/OUT					Sent on parameter data channel 1	
7	Load IN/OUT					Sent on parameter data channel 2	
8	Load IN/OUT					Received from CAN1_IN	
9	Load IN/OUT					Received from CAN2_IN	
10	Load IN/OUT					Received from CAN3_IN	
11	Load IN/OUT					Received from parameter data channel 1	
12	Load IN/OUT					Received from parameter data channel 2	
C0362	Sync cycle					Time interval between 2 sync telegrams via the X4 CAN bus interface or EMF2192IB EtherCAT communication module at X1 AIF interface Read only	📖 278
			1	{1 ms}	30		
C0363	Sync correct.	1				Sync correction increment (for CAN and EtherCAT) ● Change correction value until C4264 reaches the minimum.	📖 279
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0365	DIS:CAN active					Input signal CAN active Only display	
			0	CAN not active			
			1	CAN active			
C0366	Sync Response	1				CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 281
			0	No response			
			1	Response			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 280
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 414 📖 278
			1	{1}	256		
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 279
			0	{1 ms}	65000	0 = switched off	
[C0370]	SDO gateway	0				Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 289
			0	{1}	63		
C0371	Gateway Ch.	1				Selection of the gateway channel	📖 289
			0	CAN		Use CAN bus interface X4	
			1	CAN-AUX		Use CAN bus interface X14	
C0381	HeartProdTime	0				Heartbeat (slave): HeartbeatProducerTime ● Time interval for sending the heartbeat message ● Only relevant for setting C0352 = 3.	
			0	{1 ms}	65535		
C0382	GuardTime	0				Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 284
			0	{1 ms}	65535		
C0383	LifeTimeFact	0				Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 284
			0	{1}	255		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0384	Err NodeGuard	3				Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	📖 284
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0400	DIS: AnalogIn					Signal at the analog input Read only	
			-199.99	{0.01 %}	199.99		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 133
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 257
			0	Ready			
			1	Start adjustment			
			2	Loading default values			
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	📖 247
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 136 📖 145
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 136 📖 145
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 136 📖 145
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
C0426	DIS: In				Signal at DFIN input Only display	
			-32767	{1 rpm} 32767		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 136 📖 145
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0428	DFIN TP sel.	0				DFIN touch probe signal source	
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP1		X6/DI1	
			2	Zero pulse of digital frequency input		X8	
C0429	TP1 delay	0				DFIN dead time compensation TP1 (DI1)	
			-32767	{1 inc}	32767		
C0431	DFIN TP Edge	0				DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	
			0	Rising edge TP1			
			1	Falling edge TP1			
			2	Rising and falling edge TP1			
			3	Switched off			
C0443	DIS: DIGIN					Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	
			0	{1}	255		
			Bit 0	DIGIN1		X6/DI1	168
			Bit 1	DIGIN2		X6/DI2	
			Bit 2	DIGIN3		X6/DI3	
			Bit 3	DIGIN4		X6/DI4	
			Bit 4	DIGIN_safe_standstill		X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	70
			Bit 5	Free			
			Bit 6	DIGIN_CInh		X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	70
			Bit 7	Free			
C0444						Status of the digital outputs Only display	
1	DIS: DIGOUT		0		1	Status of the digital output X6/DO1	
2	DIS: DIGOUT					Relay control status	
[C0469]	Fct STP key	2				Function of the STOP key of the keypad **Must not be changed if the "STOP" key is pressed!**	
			0	Inactive		Without function	
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	
			0	{1}	4294967295		
C0472	FCODE analog					Freely configurable code for relative analog signals	
1		0.0	-199.99	{0.01 %}	199.99	FCODE_bC472_1_a	
2		0.0				FCODE_bC472_2_a	
3		100.0				FCODE_bC472_3_a	
4		0.0				FCODE_bC472_4_a	
...		...				...	
20		0.0				FCODE_bC472_20_a	
C0473						Freely configurable code for absolute analog signals	
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 132
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0491]	X8 in/out	0			Function of X8	📖 132
			0	X8 is input	Use as encoder feedback or master frequency input for positioning profile mode C3095/x = 30 (electrical shaft with setpoint via X8)	
			1	X8 is output	Use as encoder feedback or master frequency output during master operation (electrical shaft as setpoint via X8)	
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 132
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
C0497	Nact filter	2.0			Time constant of actual speed value	
			0.0	{0.1 ms} 50.0	0.0 ms = switched off	
C0504 ... C0509	Service codes				**Only the Lenze service is allowed to make changes!**	
C0510	ProtAppFlash	0			Write-protection application FLASH	
			0	No write protection		
			1	Write protection is active		
C0517					User menu with up to 32 entries	
1	User menu	51.0	C0051	MCTRL-NACT	Display of actual speed	
2	User menu	54.0	C0054	Imot	Display of motor current	
3	User menu (Posi & Shaft)	56.0	C0056	MCTRL-MSET2	Torque setpoint (nMSetIn_a)	
		{3998.0}	C3998	Current fault	Current application fault	
4	User menu (Posi & Shaft)	0.0 {183.0}	C0183	Diagnostics		
5	User menu (Posi & Shaft)	0.0 {4166.0}	C4166	TripAppReset		
6	User menu (Posi & Shaft)	183.0 {2113.0}	C2113	PLC prog name		
7	User menu (Posi & Shaft)	168.01 {22.0}	C0022	Imax current	Input of maximum output current	
8	User menu (Posi & Shaft)	0.0 {11.0}	C0011	Nmax	Input of the maximum speed	
9	User menu (Posi & Shaft)	22.0 {105.0}	C0105	QSP Tif	Entry of deceleration time for quick stop (QSP)	
10	User menu (Posi & Shaft)	0.0 {70.0}	C0070	Vp speed CTRL	Input of gain for speed controller	
11	User menu (Posi & Shaft)	11.0 {71.0}	C0071	Tn speed CTRL	Input of integral-action time for speed controller	
12	User menu (Posi & Shaft)	0.0 {254.0}	C0254	Vpw	MCTRL_MotorControl: phase controller gain (V_p)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
13	User menu	0.0		Not assigned			
14	User menu	105.0	C0105	QSP Tif		Entry of deceleration time for quick stop (QSP)	
15	User menu	0.0		Not assigned			
16	User menu	70.0	C0070	Vp speed CTRL		Input of gain for speed controller	
17	User menu	71.0	C0071	Tn speed CTRL		Input of integral-action time for speed controller	
18	User menu	0.0		Not assigned			
19	User menu	2100.0	C2100	Time slice		Input of time slice for cyclic task	
20	User menu	2102.0	C2102	Task switch		Selection of switch function for cyclic task	
21	User menu	2104.0	C2104	PLC autorun		Automatic start of PLC program after power-up	
22	User menu	2106.0	C2106	Download protect		Write protection of PLC program	
23	User menu	2108.0	C2108	PLC run/stop		PLC program control	
24	User menu	2111.0	C2111	GDC ID		Creation date of PLC application program	
25	User menu	2113.0	C2113	PLC prog name		Name of PLC application program	
26	User menu	2115.0	C2115	T-Fct credit		Number of technology units	
27	User menu	0.0		Not assigned			
28	User menu	0.0		Not assigned			
29	User menu	0.0		Not assigned			
30	User menu	0.0		Not assigned			
31	User menu	94.0	C0094	Password			
32	User menu	3.0	C0003	Par save		Save parameter set	
			0.00	{0.01}	7999.00	• Enter the numbers of the required codes into the subcodes. • Entry in the format xxxx.yy – xxxx = code number – yy = subcode of the code • It is not checked whether the code entered exists.	
[C0540]	X8 Signal out	2				Function of the digital frequency output signals at X8 (DFOUT)	📖 87 📖 136 📖 145
			0	Reserved			
			1	Profile generator output →DFOUT			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	
			-32767	{1 rpm}	32767		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 321
			0	{1 %}	100		
C0577	Vp fld weak	0.100				Gain of the field weakening controller (V_p)	📖 254
			0.000	{0.001}	63.999		
C0578	Tn fld weak	3.0				Integral-action time of the field weakening controller (V_n)	
			0.1	{0.1 ms}	6000.0		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 321
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 320
			0	TRIP			
			3	Off			
C0581	MONIT EEr	0				Fault response - external fault monitoring ”ExternalFault” (EEr)	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0582	MONIT OH4	2				Setting of the fault response - monitoring of heatsink temperature in C0122	📖 303
			0	TRIP			
			2	Warning			
			3	Off			
C0583	MONIT OH3	0				Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	📖 301
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 301
			0 TRIP		
			2 Warning		
			3 Off		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 317
			0 TRIP		
			2 Warning		
			3 Off		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 305
			0 TRIP		
			2 Warning		
			3 Off		
C0591	MONIT CE1	3		Fault response - monitoring CAN1_IN (no telegrams) ”CommErrCANIN1” (CE1)	📖 297
			0 TRIP		
			2 Warning		
			3 Off		
C0592	MONIT CE2	3		Fault response - monitoring CAN2_IN (no telegrams) ”CommErrCANIN2” (CE2)	📖 297
			0 TRIP		
			2 Warning		
			3 Off		
C0593	MONIT CE3	3		Fault response - monitoring CAN3_IN (no telegrams) ”CommErrCANIN3” (CE3)	📖 297
			0 TRIP		
			2 Warning		
			3 Off		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. ”SensorFault” (Sd6)	📖 318
			0 TRIP		
			2 Warning		
			3 Off		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0595	MONIT CE4	3				Fault response - system bus (CAN) monitoring ”Bus-off” at X4 ”BusOffState” (CE4)	📖 297
			0	TRIP			
			2	Warning			
			3	Off			
C0596	NMAX limit	5500				Maximum system speed	📖 322
			0	{1 rpm}	16000		
C0597	MONIT LP1	3				Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 316
			0	TRIP			
			2	Warning			
			3	Off			
C0598	MONIT SD5	3				Fault response - master current monitoring at X6 < 2 mA ”MastISourceDef”	
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 316
			0.01	{0.01 %}	10.00		
C0602	MONIT REL1	3				Fault response - open circuit monitoring of relay output X25	
			0	TRIP			
			2	Message			
			3	Off			
			4	FAIL-QSP			
C0603	MONIT CE5	3				Fault response - gateway function monitoring (CE5) ”Timeout” when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 297 📖 289
			0	TRIP			
			2	Warning			
			3	Off			
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 300
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 304
			0	TRIP			
			2	Warning			
			3	Off			
C0606	MONIT OC8	2				Fault response - monitoring of I^2 x t motor utilisation. Threshold can be set under C0120.	📖 309
			0	TRIP			
			2	Warning			
			3	Off			
C0607	MONIT NMAX	0				Fault response - maximum speed monitoring of the machine	
			0	TRIP			
			2	Warning			
			3	Off			
C0608	ovr. Tx-Queue	2				Fault response - transmission memory overflow of free CAN objects	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0609	ovr. Rx-Isr	0				Fault response Receive memory overflow of free CAN objects	
			0	TRIP			
			4	FAIL-QSP			
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	
			-2147483648	{1}	2147483647		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	
			-2147483648	{1}	2147483647		
C0863						Digital process data input words for CAN bus interface X4	📖 418
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 418
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	

Code		Possible settings					IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection				
C0868	DIS:OUTx.Wx						Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only
1	CAN OUT words		-32768	{1 %}	32768		CAN1_OUT word 1
2	CAN OUT words						CAN1_OUT word 2
3	CAN OUT words						CAN1_OUT word 3
4	CAN OUT words						CAN2_OUT word 1
5	CAN OUT words						CAN2_OUT word 2
6	CAN OUT words						CAN2_OUT word 3
7	CAN OUT words						CAN2_OUT word 4
8	CAN OUT words						CAN3_OUT word 1
9	CAN OUT words						CAN3_OUT word 2
10	CAN OUT words						CAN3_OUT word 3
11	CAN OUT words						CAN3_OUT word 4
C0869							32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647		CAN1_OUT
2	CAN OUT phi						CAN2_OUT
3	CAN OUT phi						CAN3_OUT
C0878							Digital input signals to DCTRL Only display
1	DigInOfDCTRL		0		1		Controller inhibit (CINH) 1
2	DigInOfDCTRL						Controller inhibit (CINH) 2
3	DigInOfDCTRL						TRIP-set
4	DigInOfDCTRL						TRIP-RESET
C0879							
1	Reset C0135 Controlword	0		No reset			Reset DCTRL control word of C0135
2	Reset AIF Controlword	0		No reset			Reset DCTRL control word of AIF
3	Reset CAN Controlword	0		No reset			Reset DCTRL control word of CAN
			0	No reset			
			1	Reset			Performs one ”reset”

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0906						Analog input signals to MCTRL Read only	
1	MCTRL analog		-199.99	{0.01 %}	199.99	Speed controller input	
2	MCTRL analog					Torque setpoint	
3	MCTRL analog					Lower torque limit	
4	MCTRL analog					Upper torque limit	
5	MCTRL analog					Limit of the position controller	
6	MCTRL analog					Speed for activating the torque limitation	
7	MCTRL analog					Field weakening	
8	MCTRL analog					Integrator of the speed controller	
9	MCTRL analog					P adaptation of the position controller	
C0907						Digital input signals to MCTRL Only display	
1	MCTRL digital		0		1	Activating position controller	
2	MCTRL digital					Speed control or torque control	
3	MCTRL digital					Set quick stop (QSP)	
4	MCTRL digital					Loading integral-action component of the speed controller	
C0908	MCTRL PosSet					Set phase signal 1 revolution = 65536 increments Only display	
			-2147483648	{1 inc}	2147483647		
C0909	speed limit	1				Limitation of direction of rotation for speed setpoint	
			1	-175 ... +175 %			
			2	0 ... +175 %			
			3	-175 ... 0 %			
C0910	MCTRL TP2 delay	0				MCTRL dead time compensation TP2 (X6/DI2)	
			-32767	{1 inc}	32767	1 inc ≡ approx. 60 µs	
C0911	MCTRL TP2 sel.	0				MCTRL touch probe signal source	
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP2		X6/DI2	
C0912	MCTRL TP2 Edge	0				MCTRL touch probe TP2 edge (for touch probe via digital input X6/DI2 (C0911 = 1))	
			0	Rising edge TP2			
			1	Falling edge TP2			
			2	Rising and falling edge TP2			
			3	Switched off			
C1120	Sync mode	0				Sync signal source	📖 278
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	📖 282
			2	Terminal sync		Sync connection via terminal X6/DI1	📖 283

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1121	Sync cycle	2				Synchronisation cycle	📖 278
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	📖 278
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window ● When the sync telegram/signal transmitted by the master is within this "time slot", the status bit *Stat2.CANSyncInWin* switches to TRUE.	
			0.000	{0.001 ms}	6.500		
C1190	MPTC mode	0				Selection of PTC motor temperature sensor characteristic	
			0	Characteristic for PTC 83-110 (Lenze standard)			
			1	Can be specifically set by the user under C1191 and C1192			
			2	Characteristic for PTC 83-110 and 2 x PTC150 (e.g. in MCS motors)		This selection is only available as of operating system V 8.0. For the corresponding motors, the parameter is not automatically transferred into GDC by the motor data assistant. The parameter has to be set later!	
C1191						Selection of temperature characteristic for PTC	
1	Char.: temp	25	0	{1 °C}	255	PTC characteristic: lower temperature T1	
2	Char.: temp	150				PTC characteristic: upper temperature T2	
C1192						Selection of resistance characteristic for PTC	
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1	
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2	
C1200	Fdbk rat num	1				Feedback of gearbox factor numerator ● The gearbox ratio (i) specifies the number of revolutions of the motor axis at which the encoder axis revolves exactly once. ● i = Z2 / Z1 (ratio of the number of teeth or circumferences) ● i = n1 / n2 (ratio of the speeds)	
			1	{1}	65535		
C1201	Fdbk rat den	1				Feedback of gearbox factor denominator	
			1	{1}	65535		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1202	Gear num	1				Gearbox factor numerator The gearbox ratio specifies the number of revolutions of the motor axis at which the load revolves exactly once. ● i = Z2 / Z1 (ratio of the number of teeth or circumferences) ● i = n1 / n2 (ratio of the speeds)	📖 103
			1	{1}	65535		
C1203	Gear denom	1				Gearbox factor denominator	📖 103
			1	{1}	65535		
C1204	Feed const	360.0				The feed constant specifies the path (in units) which the load (slide) covers in one revolution.	📖 103
			0.0001	{0.0001 units/rev}	214000.0000		
C1240	Vel_max	18000.0				Max. permissible speed of the load (slide). **Note:** Enter the motor speed resulting from *Vel_max* plus 10% reserve in C0011!	📖 103
			0.0001	{0.0001 units/s}	214000.0000		
C1250	Acc_max	36000.0				Max. acceleration **Note:** This parameter among other things depends on the motor torque and the moment of inertia of the entire mechanics driven during the positioning process!	📖 103
			0.0001	{0.0001 units/s²}	214000.0000		
C1256	S-RMP: Jerk	1.0				The max. jerk is defined according to a selected time (t_{jerk_max}) after which the max. acceleration (a_{max}) is reached. **Note:** If disproportionately high S-ramp times (jerk times) are set for short accelerating times, the profile may be generated incorrectly!	
			0.000	{0.001 s}	10.000		
C1810	SW ID LECOM					Software identification LECOM Only display	
C1811	SW date LECOM					Software creation date LECOM Only display	
C2100	Time slice	13				Time slice for cyclic task	
			6	{1 ms}	26		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2102	Task switch	0			Change-over: System task →cycl. task (PLC)	
			0	Time slice	No change-over	
			1	Time slice + end of PLC_PRG		
			2	Time slice + end of PLC_PRG + end of system task		
C2104	PLC Autorun (Posi & Shaft)	1			Automatic start of PLC program after power-up	
			0	Off		
			1	On		
C2106	Downl.protect	0			Write protection of PLC program	
			0	Inactive		
			1	Active		
			2	Reserved		
C2108	PLC run/stop (Posi & Shaft)	2 {1}			PLC programcontrol	
			0	No function		
			1	Run		
			2	Stop		
			3	Reset		
C2111	GDC Id		27012006132510 = • Date (day.month.year): 27.01.2006 • Time (h:min:sec): 13:25:10		Creation date of PLC program Read only	
C2113	PLC Prog Name				Name of PLC program Read only	
C2115	T-Fkt Credit	0			Number of technology units	
C2116	CreditPinCode	0			Code for technology units if service is required (please consult Lenze)	
			0	{1} 4294967295		
C2117	Full Credit	0			Service code	
C2118	ParWriteChan.	0			CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	📖 289
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)		
			1	Parameter data channel 2		
C2120	AIF: Control	0			AIF-CAN: control word	
			0	{1} 255	Binary interpretation reflects bit states	
			0	No command	**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!	
			1	Read XCAN codes + reinitialisation		
			2	Read XCAN code		
			10	Read XCAN C2356/1 ... 4		
			11	Read XCAN C2357		
			12	Read XCAN C2375		
			13	Read XCAN C2376 ... C2378		
			14	Read XCAN C2382		
			255	Not assigned		

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C2121	AIF:State				AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only
			1 {1} 255		Binary interpretation reflects bit states.
			Bit 0	XCAN1_IN monitoring time	
			Bit 1	XCAN2_IN monitoring time	
			Bit2	XCAN3_IN monitoring time	
			Bit3	XCAN bus off	
			Bit4	XCAN operational	
			Bit5	XCAN pre-operational	
			Bit 6	XCAN warning	
			Bit 7	Assigned internally	
C2130	FileNameAdd Da		Symbolic data name		Information on the additional data that have been transmitted together with the application program. Only display
C2131	Type AddData		Specification identification of the data		
C2132	VersionAddDa ta		Data version		
C2133	TimeStamp		Time stamp of the data		
C2350	XCAN address	1			Node address XCAN (AIF interface X1)
			1 {1} 63		
C2351	XCAN baud rate	0			Baud rate XCAN (AIF interface X1)
			0	500 kbps	
			1	250 kbit/sec	
			2	125 kbits/s	
			3	50 kbps	
			4	1000 kbit/s	
C2352	XCAN mst	0			Establish XCAN master operation. (AIF interface X1)
			0	Slave	
			1	Master	
C2353					Source for system bus node addresses of XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr sel	0		CAN node address (C2350)	XCAN1_IN/OUTaddress
2	XCAN addr sel	0		CAN node address (C2350)	XCAN2_IN/OUTaddress
3	XCAN addr sel	0		CAN node address (C2350)	XCAN3_IN/OUTaddress
			0	C2350 (auto)	Automatically determined by C2350
			1	C2354 (man.)	Determined by C2354

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr.	129	1	{1}	512	XCAN1_INaddress 2
2	XCAN addr.	1				XCAN1_OUTaddress 2
3	XCAN addr.	257				XCAN2_INaddress 2
4	XCAN addr.	258				XCAN2_OUTaddress 2
5	XCAN addr.	385				XCAN3_INaddress 2
6	XCAN addr.	386				XCAN3_OUTaddress 2
C2355						Identifier for XCAN_IN/XCAN_OUT (AIF interface X1) Read only
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN
2	XCAN Id					Identifier XCAN1_OUT
3	XCAN Id					Identifier XCAN2_IN
4	XCAN Id					Identifier XCAN2_OUT
5	XCAN Id					Identifier XCAN3_IN
6	XCAN Id					Identifier XCAN3_OUT
C2356						Time settings for XCAN (AIF interface X1)
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time after mains connection for initialisation through the master.
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission
3	XCAN times	0				
4	XCAN times	0				
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to ”Operational”
C2357						Monitoring time for XCAN process data input objects (AIF interface X1) **Only ECSxA:** When the subcodes 1 ... 4 are set, consider the task runtime: C2357/1...4 = Desired monitoring time / task runtime
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time
2	CE monit time	3000				XCAN2_IN monitoring time
3	CE monit time	3000				XCAN3_IN monitoring time
4	CE monit time	3000				Bus-off
5	CE monit time	3000				AIF monitoring time (can only be set if C2357/6 = 0)
6	CE monit time	0				Sync monitoring time (can only be set if C2357/5 = 0)
C2359	AIF HW Set.	0				
			0	{1}	65535	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2367	Sync Rx Id	128				XCAN receive identifier of the sync telegram(AIF interface X1)
			1	{1}	2047	
C2368	Sync Tx Id	128				XCAN send identifier of the sync telegram (AIF interface X1)
			1	{1}	2047	
C2373						XCAN Sync counter (AIF interface X1)
1	Sync Rate IN	1	1	{1}	240	XCAN1_IN
2	Sync Rate IN	1				XCAN2_IN
3	Sync Rate IN	1				XCAN3_IN
C2374						XCAN Sync counter (AIF interface X1)
1	Sync Rate OUT	1	1	{1}	240	XCAN1_OUT
2	Sync Rate OUT	1				XCAN2_OUT
3	Sync Rate OUT	1				XCAN3_OUT
C2375						TX mode for XCANx_OUT (AIF interface X1)
1	XCAN Tx mode	0	Response to sync			XCAN1_OUT
2	XCAN Tx mode	0	Response to sync			XCAN2_OUT
3	XCAN Tx mode	0	Response to sync			XCAN3_OUT
			0	Response to sync		
			1	No response to sync		
			2	Event		
			3	Event, cycle C2356 superimposed		
C2376						XCAN1_OUT mask (AIF interface X1)
1	XCAN1 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN1 Mask	FFFF				Mask for process data output word 2
3	XCAN1 Mask	FFFF				Mask for process data output word 3
4	XCAN1 Mask	FFFF				Mask for process data output word 4
C2377						XCAN2_OUT mask (AIF interface X1)
1	XCAN2 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1
2	XCAN2 Mask	FFFF				Mask for process data output word 2
3	XCAN2 Mask	FFFF				Mask for process data output word 3
4	XCAN2 Mask	FFFF				Mask for process data output word 4

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2378						XCAN3_OUT mask (AIF interface X1)	
1	XCAN3 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN3 Mask	FFFF				Mask for process data output word 2	
3	XCAN3 Mask	FFFF				Mask for process data output word 3	
4	XCAN3 Mask	FFFF				Mask for process data output word 4	
C2382						The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)	
1	XCAN Conf. CE	0		Off		XCAN1_IN	
2	XCAN Conf. CE	0		Off		XCAN2_IN	
3	XCAN Conf. CE	0		Off		XCAN3_IN	
4	XCAN Conf. CE	0		Off		Bus-off	
5	XCAN Conf. CE	0		Off		Life Guarding / Heartbeat Event	
6	XCAN Conf. CE	0		Off		Response to sync reception	
			0	Off			
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C2450	CANa address	1				Node address for CAN bus interface X14 (CAN-AUX)	📖 266 📖 429
			1	{1}	63	This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to ”ON”.	
C2451	CANa baud rate	0				Baud rate for CAN bus interface X14 (CAN-AUX)	📖 266
			0	500 kBit/s			
			1	250 kBit/s			
			2	125 kBit/s			
			3	50 kBit/s			
			4	1000 kBit/s			
C2452	CANa mst	0				Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 273
			0	Slave			
			1	Master			
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 271
1	CANa addr sel	0		CAN node address (C2450)		Address CANaux1_IN/OUT	
2	CANa addr sel	0		CAN node address (C2450)		Address CANaux2_IN/OUT	
3	CANa addr sel	0		CAN node address (C2450)		Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	271
1	CANa addr.	129	1	{1}	512	CANaux1_INaddress 2	
2	CANa addr.	1				CANaux1_OUTaddress 2	
3	CANa addr.	257				CANaux2_INaddress 2	
4	CANa addr.	258				CANaux2_OUTaddress 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	
C2455						Identifier for CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only	429
1	CANa Id		1	{1}	2047	Identifier CANaux1_IN	
2	CANa Id					Identifier CANaux1_OUT	
3	CANa Id					Identifier CANaux2_IN	
4	CANa Id					Identifier CANaux2_OUT	
5	CANa Id					Identifier CANaux3_IN	
6	CANa Id					Identifier CANaux3_OUT	
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	274
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	297
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2458	Reset node	0				Resetting a node (CAN bus interface X14)	276
			0	No function			
			1	CAN-AUX reset			
C2459	CANa state					CAN bus status (CAN bus interface X14) Read only	286
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2460				Telegram counter CANaux_IN/CANaux_OUT (CAN bus interface X14), number of telegrams Read only	📖 287
1	CANa Messages		0 {1} 65535	All sent telegrams	
2	CANa Messages		With a count value > 65535 the counter restarts with 0	All received telegrams	
3	CANa Messages			Sent to CANaux1_OUT	
4	CANa Messages			Sent to CANaux2_OUT	
5	CANa Messages			Sent to CANaux3_OUT	
6	CANa Messages			Sent to parameter data channel 1	
7	CANa Messages			Sent to parameter data channel 2	
8	CANa Messages			Received from CANaux1_IN	
9	CANa Messages			Received from CANaux2_IN	
10	CANa Messages			Received from CANaux3_IN	
11	CANa Messages			Received from parameter data channel 1	
12	CANa Messages			Received from parameter data channel 2	
C2461				Detected load CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 288
1	Load IN/OUT		0 {1 %} 100	All sent telegrams	
2	Load IN/OUT			All received telegrams	
3	Load IN/OUT			Sent to CANaux1_OUT	
4	Load IN/OUT			Sent to CANaux2_OUT	
5	Load IN/OUT			Sent to CANaux3_OUT	
6	Load IN/OUT			Sent to parameter data channel 1	
7	Load IN/OUT			Sent to parameter data channel 2	
8	Load IN/OUT			Received from CANaux1_IN	
9	Load IN/OUT			Received from CANaux2_IN	
10	Load IN/OUT			Received from CANaux3_IN	
11	Load IN/OUT			Received from parameter data channel 1	
12	Load IN/OUT			Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2466	Sync Response	1				CAN sync response for interface X14 (CAN-AUX) **The value ”1” should always be set!**	
			0	No response			
			1	Response			
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 280
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 414 📖 281
			1	{1}	256		
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 278 📖 274
			0	{1 ms}	65000	0 = switched off	
C2470	ParWrite	0				CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 289
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)			
			1	Parameter data channel 2			
C2481	MONIT CE11	3				Fault response - monitoring CANaux1_IN error ”CommErrCANauxIN1” (CE11)	📖 297
			0	TRIP			
			2	Warning			
			3	Off			
C2482	MONIT CE12	3				Fault response - monitoring CANaux2_IN error ”CommErrCANauxIN2” (CE12)	📖 297
			0	TRIP			
			2	Warning			
			3	Off			
C2483	MONIT CE13	3				Fault response - monitoring CANaux3_IN error ”CommErrCANauxIN3” (CE13)	📖 297
			0	TRIP			
			2	Warning			
			3	Off			
C2484	MONIT CE14	3				Fault response - ”system bus (CAN-AUX) off” monitoring at CAN bus interface X14 ”BusOffState” (CE14)	📖 297
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2485	MONIT CE15	3				Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 297 📖 289
			0	TRIP			
			2	Warning			
			3	Off			
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1	
2	CANa IN words					CANaux1_IN word 2	
3	CANa IN words					CANaux1_IN word 3	
4	CANa IN words					CANaux2_IN word 1	
5	CANa IN words					CANaux2_IN word 2	
6	CANa IN words					CANaux2_IN word 3	
7	CANa IN words					CANaux2_IN word 4	
8	CANa IN words					CANaux3_IN word 1	
9	CANa IN words					CANaux3_IN word 2	
10	CANa IN words					CANaux3_IN word 3	
11	CANa IN words					CANaux3_IN word 4	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1	
2	CANa OUT words					CANaux1_OUT word 2	
3	CANa OUT words					CANaux1_OUT word 3	
4	CANa OUT words					CANaux2_OUT word 1	
5	CANa OUT words					CANaux2_OUT word 2	
6	CANa OUT words					CANaux2_OUT word 3	
7	CANa OUT words					CANaux2_OUT word 4	
8	CANa OUT words					CANaux3_OUT word 1	
9	CANa OUT words					CANaux3_OUT word 2	
10	CANa OUT words					CANaux3_OUT word 3	
11	CANa OUT words					CANaux3_OUT word 4	
C2500						PLC flag 1 ... 255	
			0	{1}	65535		
C2501						PLC flag 256 ... 512	
			0	{1}	65535		
C3000	MotDirInv	0				Motor mounting position	
			0	Normal (direction of rotation CW)			
			1	Inverse (direction of rotation CCW)			
C3001	EncDirInv	0				Position encoder mounting position	
			0	Normal (direction of rotation CW)		Direction of rotation with regard to the motor's direction of rotation	
			1	Inverse (direction of rotation CCW)			
C3002	NoChangeOfPos	0				Resolver as absolute value encoder	📖 135
			0	ChangeOfPos		After "mains off/on", homing has to be carried out. The actual position is initialised with the value "0".	
			1	NoChangeOfPos		The actual position value is initialised with the position value at "Mains off" and is used further at "Mains on". Homing is not required. **Note:** With "Mains off" the feedback system must rotate less than ± 0.5 revolutions.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3008	HomeMlim	10.0				Torque limit value for homing mode C3010 = 14 or 15 (homing to mechanical limit stop) 100 % = maximum torque from C0057	
			0.00	{0.01 %}	100.00		
C3009	TimeHome Mlim	100				Time required for detecting the mechanical limit stop for homing mode C3010 = 14 or 15.	
			0	{1 ms}	65535		
C3010	HomingMode	0				Homing mode	📖 179
			0	>_Rn_MP		**Selection symbolism:** >: Movement in pos. direction <: Movement in neg. direction Lp: Limit switch in pos. direction Ln: Limit switch in neg. direction Lp+: Pos. edge of the limit switch in pos. direction Lp-: Neg. edge of the limit switch in pos. direction Ln+: Pos. edge of the limit switch in neg. direction Ln-: Neg. edge of the limit switch in neg. direction Rp: Pos. edge of the reference switch Rn: Neg. edge of the reference switch MP: Zero pulse / zero position of the position encoder (once per motor revolution) Mlim: Mechanical limit stop (torque limit value) **Notes:** ● When using homing modes 0 ... 5, set C0540 = 2. ● The mechanical limit stop is defined as an excess of the torque limit C3008 for a period of C3009. ● When the last action listed is executed, the home position is set (e.g. zero pulse with "MP"), even if the drive continues traversing. ● In all modes without "Lp" or "Ln" it is not possible to retract from the limit switch.	
			1	<_Rn_MP			
			2	>_Lp_<_Rn_MP			
			3	<_Ln_>_Rn_MP			
			4	>_Rp_<_Rn_MP			
			5	<_Rp_>_Rn_MP			
			6	Reserved			
			7	Reserved			
			8	>_Rp			
			9	<_Rp			
			10	>_Lp_<_Rp			
			11	<_Ln_>_Rp			
			12	>_Lp+_<_Lp-			
			13	<_Ln+_>_Ln-			
			14	>_Mlim			
			15	<_Mlim			
C3011	Home offset	0.0				Offset between home position and standstill position	📖 187
			-214000.0000s	{0.0001 units}	214000.0000		
C3012	Measure offs.	0.0				Offset to shift the zero position compared to the standstill position	📖 187
			-214000.0000	{0.0001 units}	214000.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3013	Homing Vel	720.0				Homing speed	
			1.0000	{0.0001 units/s}	214000.0000		
C3014	Homing Acc	720.0				Homing acceleration	
			1.0000	{0.0001 units/s²}	214000.0000		
C3015	HomJerkTime	0.0				Homing - jerk time	
			0.000	{0.001 ms}	10.000		
C3017	Lim.n=0-Flag	0.10				Limit value for speed, (n_{min} signal)	📖 231
			0.01	{0.01 %}	100.00	If the value falls below the limit value, the status bit *Stat2.Nmin* is set to 1.	
C3018	Hyst.n=0-Flag	0.10				Hysteresis for speed (n_{min} signal)	📖 231
			0.00	{0.01 %}	100.00		
C3020	ManualVel	360.0				Traversing speed for manual jog (inching mode)	📖 173
			0.0001	{0.0001 units/s}	214000.0000		
C3021	ManualAcc	720.0				Acceleration for manual jog (inching mode)	📖 173
			0.0001	{0.0001 units/s²}	214000.0000		
C3022	ManualDec	720.0				Deceleration for manual jog (inching mode)	📖 173
			0.0001	{0.0001 units/s²}	214000.0000		
C3030	FollErrWarn	360.0				Following error tolerance (warning)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the "FollowErr" warning will be triggered. The status bit *Stat2.FollowErrWarn* is set to "1" (TRUE). **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	
C3031	FollowErrQSP	720.0				Following error tolerance (Fail-QSP)	📖 233
			0.0000	{0.0001 units}	214000.0000	If the tolerance is exceeded, the Fail-QSP "FollowErr" fault is triggered and the drive is stopped through the QSP ramp. **Note:** The acceptance of changed settings requires a status change via the "Stand-By" status!	
C3034	Target Window	360.0				Total width of the target position window Layout: Half of the window width before and after the target position	📖 229
			-0.0000	{0.0001 units}	65536.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3035	DwellTime	50				Dwell time after end of profile	📖 232
			0	{1 ms}	65535	Time required from positioning profile end (setpoint generator has reached target position) to the setting of status bit *Stat1.DwellTime* = 1	
C3036	BounceTime	0				Debounce time for touch probe input	
			0	{0.001 ms}	65535		
C3040	SW-LimPos	3600.0				Positive software limit position	📖 237
			0.0000	{0.0001 units}	214000.0000		
C3041	SW-LimNeg	-3600.0				Negative software limit position	📖 237
			-214000.0000	{0.0001 units}	0.0000		
C3042	SWLimCtrl Mode	0				Mode of the software limit position monitoring	
			0			Current setpoint position + defined direction of movement	
			1			Current actual position	
C3050	Act. position					Current position in increments Read only	
			-2.147.483.647	{1 inc}	2.147.483.647		
C3051	Current position					Current position in units Read only	
			-214000.0000	{0.0001 units}	214000.0000	The display is limited to +/- 214000.0000	
C3052	Act. profile					• Control bit *Ctrl1.ProfEnable* = 1: Number of the positioning profile currently active or executed last • Control bit *Ctrl1.ProfEnable* = 1 or 0: After cancelling the active profile, the profile number 0 is displayed. Read only	
			0	{1}	15		
C3053	Current velocity					Current speed in units/s Read only	
			-214000.0000	{0.0001 units/s}	214000.0000		
C3056	ActTargetPos					Current target position/distance in increments (inc)	
			-2.147.483.647	{1 inc}	2.147.483.647		
C3057	TargetPosReal					Current target position/distance in units	
			-214000.0000	{0.0001 units}	214000.0000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3060	Max for C1240					Nmax (C0011) converted from rpm to units/s based on the machine parameters C1202, C1203 and C1204. The speed indicated here is the max. possible machine speed due to the set machine parameters and the maximum speed nmax. Thus, the setting of the maximum machine speed (Vmax) under C1240 is only sensible up to this amount.	📖 173
			0	{1 units/s}	4294960000		
C3062	Max. distance					Max. traverse path (distance) considering C1202, C1203 and C1204. Read only	
			0.0000	{0.0001 units}	214000.0000		
C3063	Min velocity	0.0				Minimum profile speed ● Read only! ● Drive does not traverse below this value.	
			0.0000	{1 unit/s}	214748.0000		
C3065	PosState	0				Status of positioning Only display	
			0	StandBy			
			1	Trouble			
			20	ManualJog			
			30	Homing			
			40	Positioning			

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C3066	ProfilerState				State of the profile generator Only display
			15690	InvProfDist	Selected distance is too long or not plausible!
			15700	InvProfPar	Invalid profile parameter, travel is not possible!
			15788	ProfAuxVelEq0	Invalid value for speed of the touch probe positioning; e. g. value = 0
			15789	ProfAuxDecEq0	Invalid value for deceleration of the touch probe positioning; e. g. value = 0
			15790	ProfAuxAccEq0	Invalid value for acceleration of the touch probe positioning; e. g. value = 0
			15798	ProfVelEq0	Invalid value for speed; e. g. value = 0
			15799	ProfDecEq0	Invalid value for deceleration; e. g. value = 0
			15800	ProfAccEq0	Invalid value for acceleration; e. g. value = 0
			16000	NoAction	No action
			16001	PosDone	Positioning has been completed.
			16010	Acceleration	Acceleration phase
			16011	ConstSpeed	Constant travel phase (final speed has been reached)
			16012	Deceleration	Deceleration phase
			16013	Reversing	Direction of rotation is reversed.
			16100	ResetActive	Profile generator is reset to the initial state.
			16300	OverflowIntPos	Overflow of the internal position integral
			16101	LoadStartVal	Profile generator is loaded with starting values.
			16102	AbortActive	Positioning stopped
			16103	ExtSetVal	External setpoint source is active.
			16200	NoTPDetected	No touch probe signal

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3095					Mode selection for positioning profiles 1 ... 15	📖 191
1	Prof.Mode	1		modulo pos.	Positioning profile 1	
...	...	...		...	...	
15	Prof.Mode	1		modulo pos.	Positioning profile 15	
			0	absolute pos.	Absolute positioning	
			1	modulo pos.	Relative positioning in continuous measuring system	
			2	speed mode	Constant traversing	
			3	relative pos.	Relative positioning with absolute reference	
			10	absTP-rel_E3+	Absolute touch probe positioning (positive edge at X6/DI3)	
			11	modTP-rel_E3+	Relative touch probe positioning (positive edge at X6/DI3)	
			13	relTP-rel_E3+	Relative touch probe positioning with absolute reference (positive edge at X6/DI3)	
			20	absTP-rel_E3-	Absolute touch probe positioning (negative edge at X6/DI3)	
			21	modTP-rel_E3-	Relative touch probe positioning (negative edge at X6/DI3)	
			23	relTP-rel_E3-	Relative touch probe positioning with absolute reference (negative edge at X6/DI3)	
			30	EShaftX8_IS	Electrical shaft with setpoint via X8 and instant start	
			31	EShaftX4_IS	Electrical shaft with setpoint via X4 and instant start	
			100	homing	Homing	
			101	set home pos.	Set home position	
			102	reset home pos.	Reset home position	
			110	abs. direct	Absolute positioning (direct)	
			111	mod direct	Relative positioning in continuous measuring system (direct)	
			112	speed direct	Continuous constant travel (direct)	
			113	rel. direct	Relative positioning with absolute reference (direct)	
			251	mod cycle +/-	Positioning sequence for controller optimisation ● The distance travelled in positive/negative direction is selected under C3100.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3096						Additional function for positioning profile 1 ... 15	📖 96
1	Prof.Func1	0	No function			Additional function for positioning profile 1	
...	...	...	...			...	
15	Prof.Func1	0	No function			Additional function for positioning profile 15	
			0		65535	The controller interprets the information in bit codes (16 bits).	
			0000.0000.0000.0000:		No function	No function	
			xxxx.xxxx.xxxx.xxx1:		Vel_Ovr_Ain	Speed override is activated via analog input.	
			xxxx.xxxx.xxxx.xx1x:		pos_>Mlim	Torque limitation after positioning	
			xxxx.xxxx.xxxx.x1xx:		ProfEnable_>Continue	Profile continuation after profile stop	
			xxxx.xxxx.xxxx.1xxx:		Vel_Ovr_PDO	Speed override is activated via PDO "Rx_par1" (CAN, AIF, C4041).	
			xxxx.xxxx.xxx1.xxxx:		Direct change	Immediate profile change during positioning	
C3097						Function parameter 1 for positioning profiles 1 ... 15 **Use:** ● Torque limitation after positioning (📖 208) ● Stretch factor numerator for positioning profile mode C3095/x = 30/31 (electrical shaft, 📖 196)	
1	ProfFuncPar1	0	-2147483647	{1}	2147483647		
...	...	...					
15	ProfFuncPar1	0					
C3098						Function parameter 2 for positioning profiles 1 ... 15 **Use:** ● Torque limitation after positioning (📖 208) ● Stretch factor denominator for positioning profile mode C3095/x = 30/31 (electrical shaft, 📖 196)	
1	ProfFuncPar2	0	-2147483647	{1}	2147483647		
...	...	...					
15	ProfFuncPar2	0					
C3100						Parameter "Target position" for positioning profiles 1 ... 15 **Note:** Input value must be within the range of the ± value from C4265. ● Example: C4265 = 10000 ⇨ value range -10000 ... +10000	📖 97
1	Prof.Position	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Position	0					

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3200						Parameter "Traversing speed" for positioning profiles 1 ... 15 **Note:** C3063 < [input value] ≤ C3060	98
1	Prof.Velocity	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Velocity	0					
C3300						Parameter "Acceleration" for positioning profiles 1 ... 15	98
1	Prof.Acc	0	-0.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Acc	0					
C3400						Parameter "Deceleration" for positioning profiles 1 ... 15	98
1	Prof.Dec	0	-0.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.Dec	0					
C3500						Parameter reserved	98
1	Prof.FinalVel	0	-214000.0000	{0.0001 units}	214000.0000		
...	...	...					
15	Prof.FinalVel	0					
C3600						Parameter "Jerk time" for positioning profiles 1 ... 15	99
1	Prof.JerkTime	0	0.000	{0.001 s}	0.500		
...	...	...					
15	Prof.JerkTime	0					
C3998	Act. Failure		see coding of fault number			Current fault Read only	343
C3999	Templ.Version					Version of the application software Only display	
			0	{1}	65535		
[C4010]	Ctrl_Interf	0				Selection of the control interface	155
			0	CAN1 (PDO1 with Synch)		MotionBus (CAN) X4 (CAN PDO1, sync-controlled)	
			1	CANaux1 (PDO1 with Synch)		System bus (CAN) X14 (CAN-AUX PDO1, sync-controlled)	
			2	AIF (EtherCAT)		Automation interface (AIF) X1 with EMF2192IB EtherCAT communication module	
			3	C4040 (control via codes)		Control via C4040	
			4	CANaux2 (PDO2 cyclic)		Lenze I/O modules of the EPM series or Lenze Drive PLC via CAN-AUX (PDO2, cyclically)	
			5	CAN3 (PDO3 cyclic)		MotionBus (CAN) X4 (CAN PDO3, cyclically)	

Code		Possible settings						IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection						
[C4011]	DigIn_map	0						Assignment of the digital inputs X6/DI1 ... DI4 Acceptance only if the controller is inhibited (status word *Stat1.Imp* = 1).	168
				DI1	**DI2**	**DI3**	**DI4**	Ix: Input x is not assigned with a function. JogCW: Manual jog CW JogCCW: Manual jog CCW Ln: Limit switch in negative direction Lp: Limit switch in positive direction PNo1: Selection of positioning profile bit 2^0 PNo2: Selection of positioning profile bit 2^1 PNo4: Selection of positioning profile bit 2^2 PNo8: Selection of positioning profile bit 2^3 Penb: Positioning profile activated (enable) Qsp: Quick stop (QSP) R: TRIP-RESET Ref: Reference switch TP: Touch probe input	
			0	Ln	Ref	TP	Lp		
			1	PNo1	PNo2	PNo4	PNo8		
			2	PNo1	PNo2	PNo4	PEnb		
			3	PNo1	PNo2	R	PEnb		
			4	Qsp	JogCW	Tp	JogCCW		
			5	I1	I2	TP	I4		
			6	Ln	Qsp	Penb	Lp		
			7	PNo1	PNo2	TP	Penb		
			8	PNo1	PNo2	Ref	Penb		
			9	Ln	PNo1	PNo2	Lp		
			10	Ln	JogCW	JogCCW	Lp		
			11	Ln	Ref	Penb	Lp		
			12	Ln	Ref	Qsp	Lp		
			13	Ln	Qsp	TP	Lp		
[C4012]	DigOut_map	0						Assignment of digital output X6/DO1 Acceptance only if the controller is inhibited (status word *Stat1.Imp* = 1).	168
			0	RDY				Rdy: Drive is ready for operation.	
C4018	MmaxVal	100.0						Limit value for max. torque (M_{max})	
			0.01		{0.01 %}		100.00	• 100 % = maximum torque from C0057 • The value in C4018 is overwritten by the following functions: – Torque limitation after positioning – Homing modes 14 and 15 (C3010)	 208 186
[C4020]	Brake Logic	0						Activation of brake logic	130
			0	Brake Off					
			1	Brake On					
C4021	Brk: T_activ	500						Closing time of the motor holding brake (engagement time)	130
			0		{1 ms}		5000		
C4022	Brk: T_releas	500						Release time of the motor holding brake (disengagement time)	130
			0		{1 ms}		5000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4023	Brk: N_Thresh	0.1 %				Speed threshold for brake activation	130
			0.00	{0.01 %}	10.00		
C4040	AppControl	0				Control word to the drive Only active if C4010 = 3.	158
			0	{1}	65535		
C4041	App-Rx-W2	0				Data word 2 to the drive Only active if C4010 = 3.	
			-32767	{1}	32767		
C4042	App-Rx-W3/4	0				Double data word 3/4 to the drive Only active if C4010 = 3.	
			-2147483647	{1}	2147483647		
C4045	AppState 1					Status word 1 from the drive ● Read only	161
			0	{1}	65535		
C4046	AppState 2					Status word 2 from the drive ● Read only	161
			0	{1}	65535		
C4047	App-Tx-W2	0				Data word 2 from the drive	
			-32767	{1}	32767		
C4048	App-Tx-W3	0				Data word 3 from the drive	
			-32767	{1}	32767		
C4049	App-Tx-W3/4	0				Double data word 3/4 from the drive	
			-2147483647	{1}	2147483647		
C4050	PosProfSel					Number of the selected positioning profile Only display	
			0	{1}	15		
C4052	PO: Ctrl (W1)					Currently effective control word Ctrl1 Read only	
			0	{1}	65535		
C4053	PO: W2					Currently effective VelDirect value Read only	
			-32767	{1}	32767		
C4054	PO: W3/4					Currently effective PosDirect value Read only	
			-2147483647	{1}	2147483647		
C4060	ES_NOffs					Only for ”electrical shaft” function: default value (in increments) for speed-proportional angular trimming relating to 15000 rev./min. **Note:** Only change value when the controller is at standstill!	235
			-655360	{1 inc}	655360		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4061	ES_ActN Offset					Only for "electrical shaft" function: Currently active value of the angular trimming relating to 15000 rev./min at current speed. Read only	📖 235
[C4062]	ES_MCycle	0				Only for "electrical shaft" function: Setpoint cycle of master activates transmission of master angle in the selected time interval.	
			0	Off			
			1	2 ms		Value is written in C0369.	
			2	4 ms			
			3	6 ms			
			4	8 ms			
			5	10 ms			
C4166	TripAppReset	0				Application fault message reset.	📖 338
			0	Fault message active			
			1	Reset fault message			
C4167	AppHistReset	0				Deleting application fault message history buffer.	📖 338
			0	No reaction			
			1	Delete history buffer			
C4168						History buffer (list of application faults occurred) Read only	📖 338 📖 343
1	AppFailNo					Current fault	
2	AppFailNo					Last	
3	AppFailNo					Last but one	
4	AppFailNo					Last but two	
5	AppFailNo					Last but three	
			All fault messages (TRIP, KSB-TRIP, FAIL-QSP, warning, message)				
C4169						Time when the application faults entered into the history buffer (C4168) occurred. Read only	📖 338
1	FailTime		Individual power-on times (C0179)			Currently active fault	
2	FailTime					Last fault	
3	FailTime					Last but one fault	
4	FailTime					Last but two fault	
			0	{1 h}	65535		
C4240	ActVal C3040	0.0				Internal value C3040 (limitation possible via C3030)	
			-214000.0000	{0.0001 units}	2140000.0000		
C4241	ActVal C3041	0.0				Internal value C3041 (limitation possible via C3031)	
			-214000.0000	{0.0001 units}	2140000.0000		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4263	CanSetValCyc				Cycle time of the setpoint selection at control program synchronisation Only display	
			2	{2 ms} 12		
C4264	CanSync_Dev	0			Deviation of the control program synchronisation This also applies to synchronisation via the digital input X6/DI1. Read only	📖 279
			-32767	{1} 32767		
C4265	MaxTargetInp				Max. target position input (in units) Read only	📖 103
			-214000.0000	{0.0001 units} 214000.0000		
C4266	PosRes	0			Lenze-internal parameter set identifier Read only	📖 103
			0	{1 inc/unit} 2140000000	Position resolution in increments per unit 1 revolution of position encoder ≙ 65536 increments	
C4270	CAN Ctrl1				CAN application control word 1 Read only	
			Text[1]=DIS: Ctrl1 appl. control word from CAN1-Out			
			Text[2]=DIS: Ctrl1 appl. control word from CANaux1-In			
			Text[3]=DIS: Ctrl1 appl. control word from AIF			
			Text[4]=DIS: Ctrl1 appl. control word from C4040			
			Text[5]=DIS: Ctrl1 appl. control word from CANaux2-In			
			Text[6]=DIS: Ctrl1 appl. control word from CAN3-In			
C4271	CAN Stat1				CAN application status word 1 Read only	
			Text[1]=DIS: Stat1 appl. status word 1 to CAN1-Out			
			Text[2]=DIS: Stat1 appl. status word 1 to CANaux1-Out			
			Text[3]=DIS: Stat1 app. status word 1 to AIF1-Out			
			Text[4]=DIS: Stat1 appl. status word 1 to C4040			
			Text[5]=DIS: Stat1 appl. status word 1 to CANaux2-Out			
			Text[6]=DIS: Stat1 appl. status word 1 to CAN3-Out			
C4272	CAN Stat2				CAN application status word 2 Read only	
			Text[1]=DIS: Stat2 appl. status word 2 to CAN1-Out			
			Text[2]=DIS: Stat2 appl. status word 2 to CANaux1-Out			
			Text[3]=DIS: Stat2 appl. status word 2 to AIF1			
			Text[4]=DIS: Stat2 appl. status word 2 to C4040			
			Text[5]=DIS: Stat2 appl. status word 2 to CANaux2-Out			
			Text[6]=DIS: Stat2 appl. status word 2 to CAN3-Out			
C7900	L_GDC_Vers				Lenze-internal version identification (e.g. V1.2 = 1020000) Read only	

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C7901	Customer_ Vers	0			Customer's version identification ● Can be set by the customer.
			0	{1} 99999	

12.2 General information about the system bus (CAN)

All Lenze drive and automation systems are provided with an integrated system bus interface for networking control components on the field level.

The system bus interface serves to exchange, for instance, process data and parameter values between the nodes. Moreover, the interface allows for the connection of further devices as e.g. decentralised terminals, operator and input devices and external control and host systems.

The system bus interface transfers CAN objects to the CANopen communication profile (CiA DS301, version 4.01) which has been created under the umbrella association of the der **CiA** (**C**AN **i**n **A**utomation) to conform with the **CAL** (**C**AN **A**pplication **L**ayer).



Tip!

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.



Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

12.3 Communication with MotionBus/system bus (CAN)

For communication between the components of the drive system the axis modules ECSxP... have two CAN interfaces:

- Interface X4 (”CAN”)
  - MotionBus (CAN)
  - For communication with a higher-level host system (PLC) or further controllers
  - The data is exchanged via process data channels and parameter data channels.
  - Parameter setting/diagnostics via code range **C03xx**
- Interface X14 (”CAN-AUX”)
  - System bus (CAN)
  - PC interface/HMI for parameter setting and diagnostics
  - Interface to a decentralised I/O system
  - The data is exchanged via parameter data channels only.
  - Parameter setting/diagnostics via code range **C24xx**

The communication is effected via data telegrams.

Note!

In case of the ECSxP axis module, the PDOs **CANaux1_IN/OUT** and **CANaux2_IN/OUT** can be used via the CAN interface X14 (system bus (CAN)). Configuration takes place via codes **C24xx**.

12.3.1 Structure of the CAN data telegram

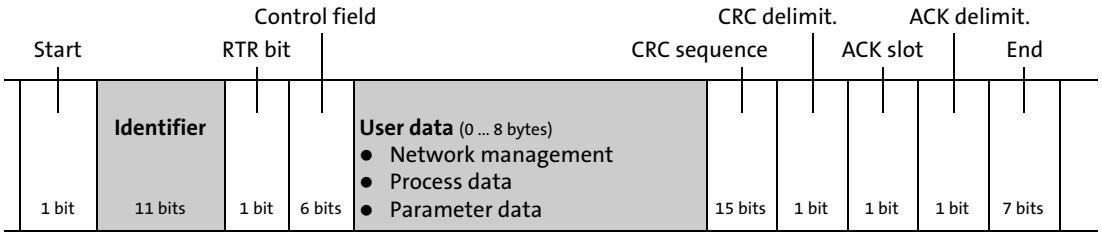


Fig. 12-1 Basic structure of the CAN telegram

Identifier

The identifier determines the priority of the message. Moreover, the following is coded:

- The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter ”Addressing of the parameter and process data objects” (📖 429).
- The type of user data to be transferred

User data

The user data area of the CAN telegram either contains network management data, process data or parameter data:

User data	Description
Network management data (NMT data)	The information serves to establish communication via the CAN network
Process data (PDO, Process Data Objects)	● Process data are transmitted via the process data channel. ● The process data serve to control the controller. ● Process data can be accessed directly by the higher-level host system. The data are, for instance, stored directly in the I/O area of the PLC. It is necessary that the data can be exchanged between the host system and the controller within the shortest time possible. In this connection, small amounts of data can be transferred cyclically. ● Process data are transmitted between the higher-level host system and the controllers to ensure a permanent exchange of current input and output data. ● Process data are not stored in the controller. ● Process data are, for instance, setpoints and actual values.
Parameter data (SDO, Service Data Objects)	● Parameter data are transferred via the parameter data channel and acknowledged by the receiver, i.e. the receiver gets a feedback whether the transmission was successful. ● Parameter data of Lenze devices are called codes. ● The parameter data channel enables access to all Lenze codes and all CANopen indexes. ● Parameters are set, for instance, for the initial commissioning of a plant or when material of a production machine is exchanged. ● Usually the transfer of parameters is not time-critical. ● Parameter changes are stored in the controller. ● Parameter data are, for instance, operating parameters, diagnostic information and motor data.



Tip!

The other signals refer to the transfer features of the CAN telegram that are not described in these instructions.

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

12.3.2 Communication phases of the CAN network (NMT)

Regarding communication, the controller knows the following statuses:

Status	Description
"Initialisation"	After the controller is switched on, the initialisation phase is run through. During this phase, the controller is not involved in the data exchange on the bus. A part of the initialisation or the complete initialisation can be run through again in every NMT status by transmitting different telegrams (see "state transition"). Here, all parameters are written with their set values. After completing the initialisation, the controller automatically adopts the "Pre-Operational" status.
"Pre-Operational"	The controller can receive parameter data. The process data are ignored.
"Operational"	The controller can receive parameter data and process data.
"Stopped"	Only network management telegrams can be received.

State transitions

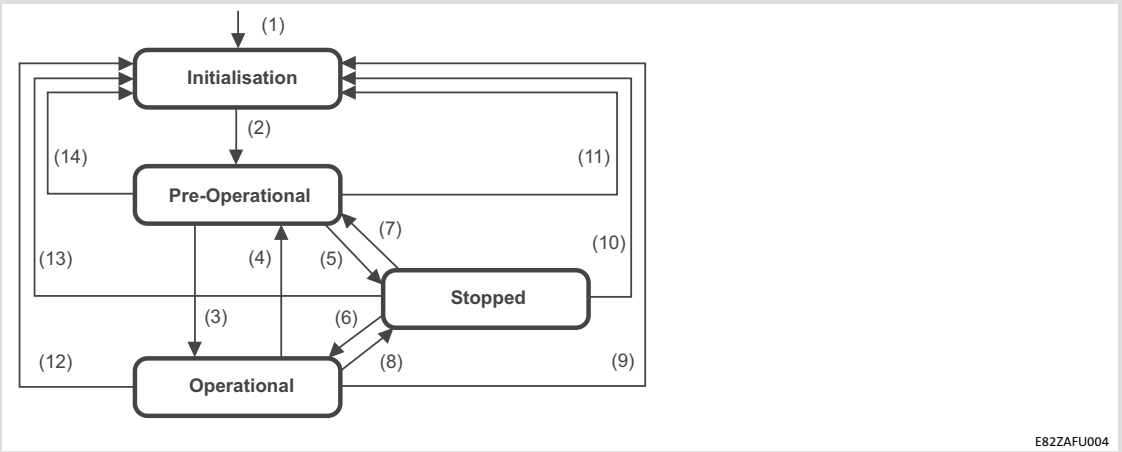


Fig. 12-2 State transitions in the CAN network (NMT)

State transition	Command (hex)	Network status after change	Effect on process or parameter data after state change
(1)	-	Initialisation	When the mains is switched on, the initialisation is started automatically. During the initialisation the controller is not involved in the data exchange. After the initialisation is completed, the node changes automatically to the ”Pre-Operational” status.
(2)	-	Pre-operational	In this phase the master decides how the controllers take part in the communication.
From here, the states are changed over by the master for the entire network. A target address included in the command specifies the receiver/s.			
(3), (6)	01xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active (corresponds to ”Start Remote Node”) Optional: In case of change, event-controlled and time-controlled process data (PDO) are sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency, and parameter data (SDO) are active (corresponds to ”Enter Pre-Operational State”)
(5), (8)	02 xx	Stopped	Only network management telegrams can be received.
(9)	81 xx	Initialisation	Initialisation of all parameters in the CAN fieldbus module with the values stored (corresponds to ”Reset Node”)
(10)			
(11)			
(12)	82 xx		Initialisation of communication-relevant parameters (CiA DS 301) in the CAN fieldbus module with the values stored (corresponds to ”Reset Communication”)
(13)			
(14)			

yy = 00	In case of this assignment, the telegram addresses all devices connected. The state of all devices can be changed at the same time.
yy = node ID	If a node address is given, only the state of the device with the corresponding address will be changed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

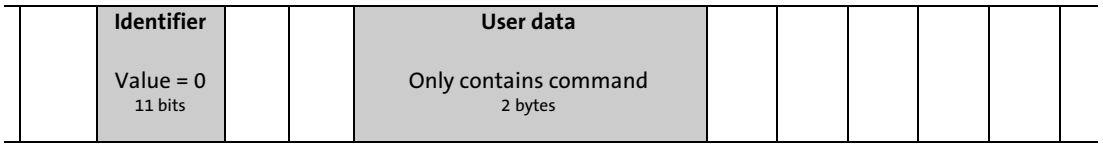


Fig. 12-3 Telegram for switching over the communication phases

The communication phases are changed over by a node, the network master, for the entire network. The change-over can also be done by a controller.

With a certain delay after mains connection, a telegram is sent once which changes the status of the entire drive system to ”Operational”. The delay time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356/4
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356/4
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456/4

Note!

Only a change to ”Operational” status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the ”Pre-Operational” communication status to the ”Operational” communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

12.3.3 Process data transfer

Agreements

- Process data telegrams between host (master) and controller (slave) are distinguished as follows with regard to their direction:
  - Process data telegrams **to** the controller
  - Process data telegrams **from** the controller
- In CANopen, the process data objects are named from the node's view:
  - RPDOx: A process data object received by a node
  - TPDOx: A process data object transmitted by a node

12.3.3.1 Available process data objects

The following process data objects (PDOs) are available for the ECS modules via the interfaces X1, X4 and X14:

Interface	PDOs RPDO: to ECS module TPDO: from ECS module		Availability in ECS modules				
			ECSxE	ECSxS	ECSxP	ECSxM	ECSxA
X1 Automation interface (AIF)	RPDO	AIF1_IN	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_IN	–	✓	–	–	✓
		AIF3_IN	–	✓	–	–	✓
	TPDO	AIF1_OUT	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_OUT	–	✓	–	–	✓
		AIF3_OUT	–	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	RPDO	CAN1_IN	✓	✓	✓	✓	✓
		CAN2_IN	–	✓	✓	–	✓
		CAN3_IN	✓	✓	✓	–	✓
	TPDO	CAN1_OUT	✓	✓	✓	✓	✓
		CAN2_OUT	✓ 1)	✓	✓	–	✓
		CAN3_OUT	✓	✓	✓	–	✓
X14 System bus (CAN) Interface is not available for ECSxE.	RPDO	CANaux1_IN	–	–	✓	–	✓
		CANaux2_IN	–	–	✓	–	✓
		CANaux3_IN	–	–	–	–	✓
	TPDO	CANaux1_OUT	–	–	✓	–	✓
		CANaux2_OUT	–	–	✓	–	✓
		CANaux3_OUT	–	–	–	–	✓

1) ECSxE from V5.0: CAN2_OUT (Diagnostic PDO)

Note!

Power supply module ECSxE

In case of the ECSxE power supply module, the PDOs CAN1_IN/OUT and CAN3_IN/OUT cannot be used simultaneously. The PDOs to be used are selected via C0360.

12.3.3.2 Structure of the process data

The process data telegrams have a maximum user data length of eight bytes each.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the controller.
- The control word is transmitted in byte 1 and 2 of the user data.

	Identifier			User data (8 bytes)							
				Control word		00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte						

Fig. 12-4 Structure of process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram reports status information from the controller. Status information can be as follows:
  – Current status of the controller
  – Status of the digital inputs
  – States about internal analog values
  – Fault/error messages
  This information enables the higher-level host system (PLC) to respond accordingly.
- The status word 1 is transmitted in byte 1 and 2 of the user data.
- In byte 3 and 4 of the user data, the extended status word 2 can be optionally transferred.

	Identifier			User data (8 bytes)							
				Status word 1		Status word 2 (optional)		00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte	LOW byte	HIGH byte				

Fig. 12-5 Structure of process data output telegram (TPDO)

12.3.3.3 Transfer of the process data objects

Process data objects		Data transmission	
		ECSxE	ECSxS/P/M/A
RPDOs (to ECS module)	AIF1_IN	–	cyclic (sync-controlled)
	CAN1_IN	cyclic (sync-controlled)	
	CANaux1_IN	–	
	AIF2_IN	–	event-controlled/cyclic without sync
	CAN2_IN	–	
	CANaux2_IN	–	
	AIF3_IN	–	event-controlled/cyclic without sync
	CAN3_IN	event-controlled/cyclic without sync	
	CANaux3_IN	–	
TPDOs (from ECS module)	AIF1_OUT	–	cyclic (sync-controlled)
	CAN1_OUT	cyclic (sync-controlled)	
	CANaux1_OUT	–	
	AIF2_OUT	–	event-controlled/cyclic without sync
	CAN2_OUT	–	
	CANaux2_OUT	–	
	AIF3_OUT	–	event-controlled/cyclic without sync
	CAN3_OUT	event-controlled/cyclic without sync	
	CANaux3_OUT	–	

- Cyclic data transmission with sync telegram (📖 421)
  (via AIF1, CAN1, CANaux1)
  The sync telegram enables the controller to accept the process data from the master (RPDOs) or send them to the master (TPDOs).
- Event-controlled data transmission
  (via AIF2/3, CAN2/3, CANaux2/3)
  The data will be transmitted if a value changes in the corresponding output object.
- Cyclic data transmission without sync telegram
  (via AIF2/3, CAN2/3, CANaux2/3)
  The data is transmitted in fixed times. The cycle time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456

  – Setting of cycle time > 0: data transmission with fixed cycle time
  – Setting of cycle time = 0: event-controlled data transmission

12.3.3.4 Cyclic process data objects

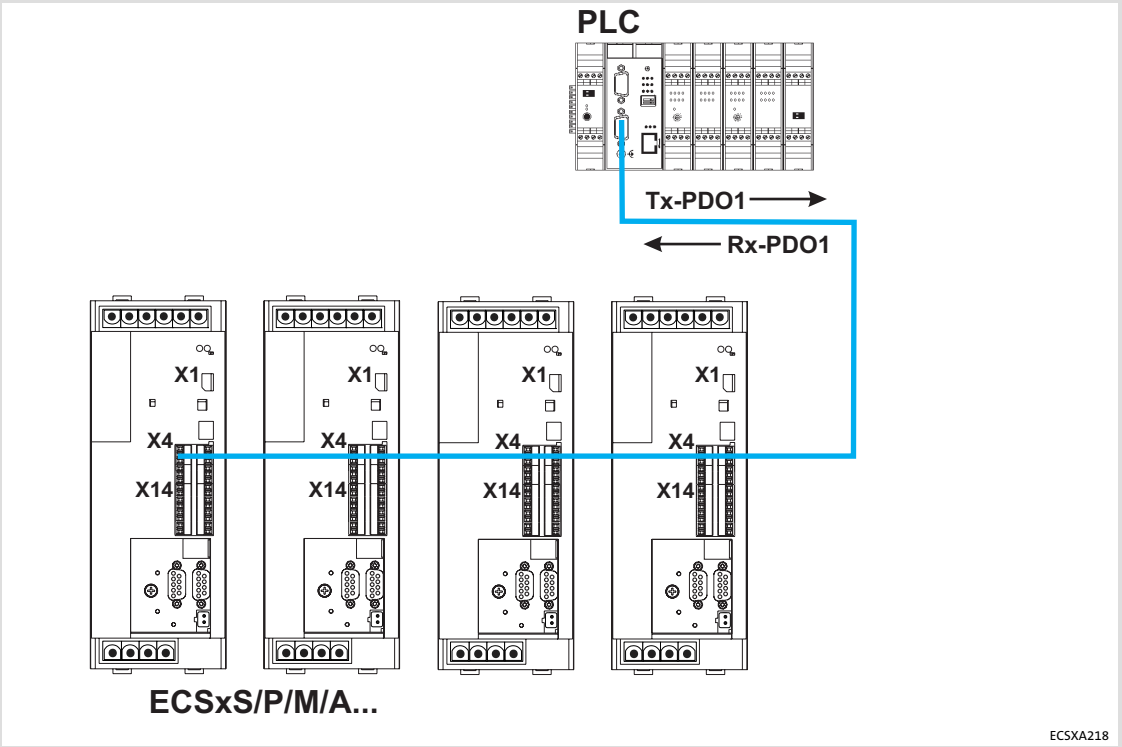


Fig. 12-6 Example: Cyclic process data transfer from/to master (PLC)

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO18), each with 8 bytes of user data, is provided.

Synchronisation of PDOs with sync-controlled transmission

In order that the cyclic process data can be read by the controller or the controller accepts the process data, a special telegram, the CAN sync telegram, is used in addition.

The CAN sync telegram is the trigger point for sending process data of the controller to the master and transferring process data from the master to the controller.

A sync-controlled process data processing requires a corresponding generation of the CAN sync telegram.

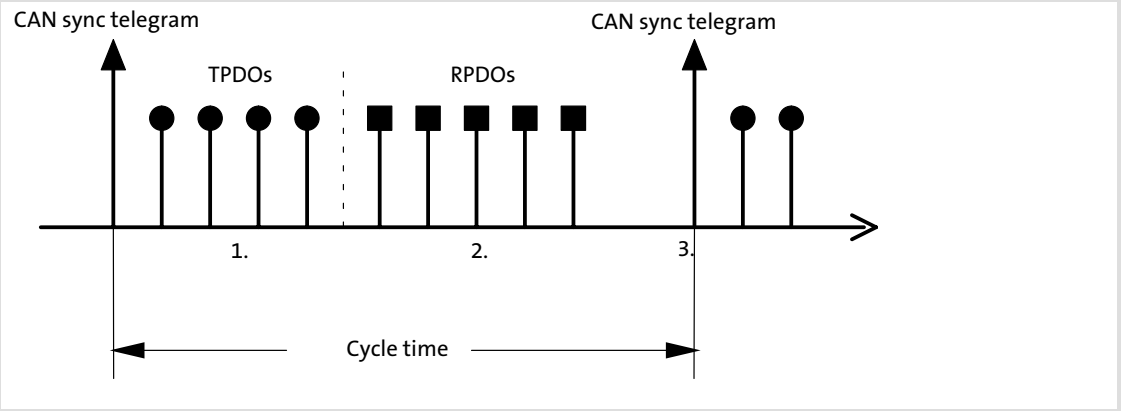


Fig. 12-7 Sync telegram

1. After the CAN sync telegram has been received, the synchronous process data from the controllers are sent to the master (TPDOs). They are read as process input data in the master.
2. When the transmission process is completed, the process output data (of the master) are received by the controllers (RPDOs).

   All other telegrams (e.g. parameters or event-controlled process data) are accepted acyclically by the controllers after transmission is completed. The acyclic data are not displayed in the above illustration. They must be considered when the cycle time is dimensioned.
3. The data in the controller is accepted with the next CAN sync telegram.

Tip!

The response to a CAN sync telegram is determined by the transmission type selected.

Note!

Information on how to set the synchronisation can be found from 📖 278.

12.3.3.5 Event-controlled process data objects

The event-controlled process data objects are particularly suitable for the data exchange between controllers and for distributed terminal extensions. They can, however, also be used by a host system.

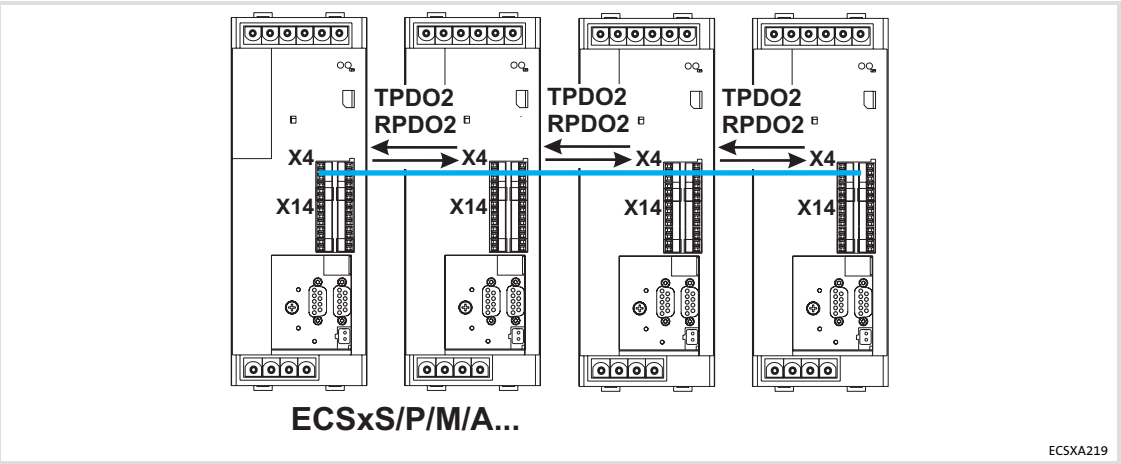


Fig. 12-8 Example: event-controlled process data objects PDO2

The process data objects serve to transmit simple binary signals (e.g. states of digital input terminals) or complete values in 16 and 32 bits (e.g. analog signals).

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

12.3.4 Parameter data transfer

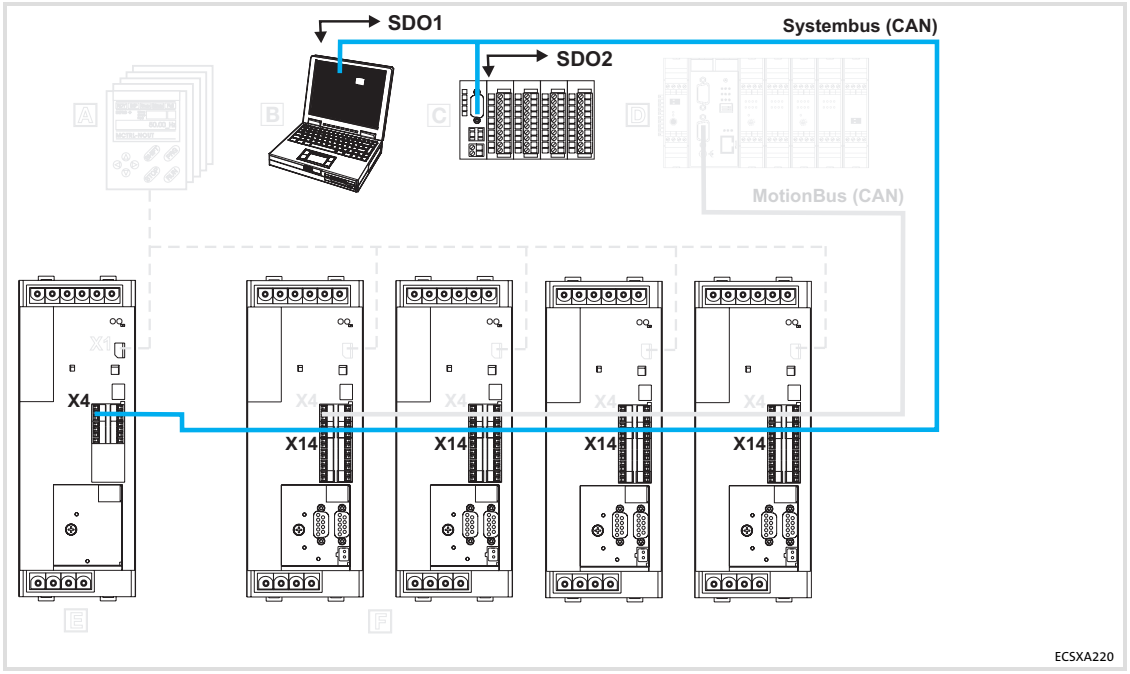


Fig. 12-9 Parameter data channels for parameterising ECS

Parameters ...

- ► are values which are stored under codes in the Lenze controllers.
- ► are set e.g. during initial commissioning or while changing materials in a machine.
- ► are transmitted with low priority.

Parameter data are transmitted as SDOs (Service Data Objects) via the system bus (CAN) and acknowledged by the receiver. The SDOs enable the writing and reading access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 as well as the CAN bus interfaces X4 and X14 are divided into separate ranges:

Interface		Code range
X1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C03xx
X14	System bus (CAN) ● Interface is not available for ECSxE.	C24xx

12.3.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1. byte	2. byte	3. byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data is shown in motorola format.

Examples for parameter data transfer can be found from 📖 427.

Command

The command contains the services for writing and reading the parameters and information on the length of the user data:

	Bit 7 MSB	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit 2**	**Bit 1**	**Bit 0** LSB
Command	Command specifier (cs)			toggle (t)	Length		e	E
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specification DS301, V4.02 (e.g. segmented transfer).

The command must contain the following information:

	4-byte data (5. ... 8. byte)		2-byte data (5. and 6. byte)		1-byte data (5. byte)		Block	
Command	**hex**	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameter to the controller)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller reports a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

”Error response” command: In case of a communication error an ”Error response” is generated by the addressed node. This telegram always contains the value ”6” in Data 4 and an error code in Data 3.

The error codes are standardised acc. to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

Parameter value length depending on the data format			
Parameter value **(Length: 1 byte)**	00	00	00
Parameter value **(length: 2 bytes)**		00	00
Low byte	High byte		
Parameter value **(length: 4 bytes)**			
Low word		High word	
Low byte	High byte	Low byte	High byte

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

12.3.4.2 Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	Index Low byte	Index High byte	Subindex	**Error code**			

- Byte 1:
  In the **command** byte, the code **128** (**0x80**) indicates that an error has occurred.
- Bytes 2 ... 4:
  In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.
- Bytes 5 ... 8:
  In the bytes 5 ... to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example: Representation of the error codes 0x06040041 in the bytes 5 ... 8

Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	**7th byte**	**8th byte**	**Meaning**
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

12.3.4.3 Examples of the parameter data telegram

Reading parameters

The heatsink temperature C0061 (43 °C) is to be read from the controller with node address 5 via the parameter data channel 1.

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 5 = 1541

► Command ”Read Request” (request to read a parameter from the controller)

Command	Value [hex]
Read request	**0x40**

► Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = 0x5FC2

► Subindex: 0

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1541	0x40	0xC2	0x5F	0x00	0x00	0x00	0x00	0x00

► Telegram from controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1413	0x43	0xC2	0x5F	0x00	0xB0	0x8F	0x06	0x00

– Command:
”Read Response” (response to the read request) = 0x43

– Identifier:
SDO1 from controller (1408) + node address (5) = 1413

– Index of the read request:
0x5FC2

– Subindex:
0

– Data 1 ... 4:
0x00068FB0 = 430000 ➞ 430000 : 10000 = 43 °C

Writing parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed to 20 seconds via the SDO1 (parameter data channel 1).

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 1 = 1537

► Command ”Write Request” (transmit parameter to drive)

Command	Value [hex]
Write request	**0x23**

► Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = 0x5FF3

► Subindex: 0

► Calculation of the acceleration time

Data 1 ... 4	Calculation
Value for acceleration time	20 s · 10000 = 200000 = 0x00030D40

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	0x23	0xF3	0x5F	0x00	0x40	0x0D	0x03	0x00

► Telegram from controller if executed faultlessly

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	0x60	0xF3	0x5F	0x00	0x00	0x00	0x00	0x00

– Command:
”Write Response” (response of the controller (acknowledgement)) = 0x60

– Identifier:
SDO1 from controller (= 1408) + node address (= 1) = 1409

12.3.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier is preset with the following values:

Object			Direction		Basic identifier	
			to the ECS module	from the ECS module	dec	hex
NMT					0	0
Sync					128	80
PDO1 (Process data channel 1)	RPDO1	XCAN1_IN CAN1_IN CANaux1_IN	X		512	200
	TPDO1	XCAN1_OUT CAN1_OUT CANaux1_OUT		X	384	180
PDO2 (Process data channel 2)	RPDO2	XCAN2_IN CAN2_IN CANaux2_IN	X		640	280
	TPDO2	XCAN2_OUT CAN2_OUT CANaux2_OUT		X	641	281
PDO3 (Process data channel 3)	RPDO3	XCAN3_IN CAN3_IN CANaux3_IN	X		768	300
	TPDO3	XCAN3_OUT CAN3_OUT CANaux3_OUT		X	769	301
SDO1 (Parameter data channel 1)			X		1536	600
				X	1408	580
SDO2 (Parameter data channel 2)			X		1600	640
				X	1472	5C0
Node guarding			X		1792	700

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- Interface X1 (AIF) C2355.
- Interface X4 (CAN) C0355.
- Interface X14 (CAN-AUX) C2455.

Here, no values can be entered.

- General addressing (📖 429):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 271):
  Identifier (COB-ID) = 384 + ID offset (C0354 or C2454)

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (CAN2_IO/CAN3_IO) are factory-set so that the devices are able to communicate with each other.

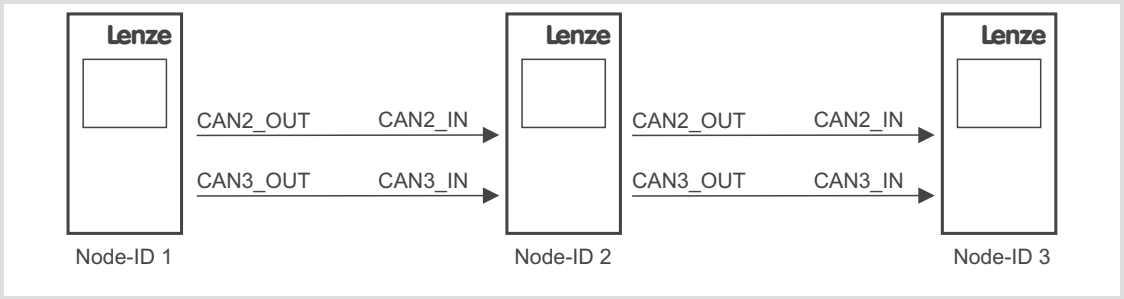


Fig. 12-10 Data exchange between Lenze devices

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

► A node address may not be assigned more than once within a network.

Note!

The ”8.1.1 Setting of CAN node address and baud rate” chapter contains information on

► Setting of the node address (📖 266).

► Individual addressing (📖 271).

12.4 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

12.4.1 Connector sets

To make purchasing easy, the connector sets are available as separate delivery units for the ECS power supply, capacitor and axis modules:

- ECSZ**E**000X0B (connector set for ECS power supply modules)
- ECSZ**K**000X0B (connector set for ECS capacitor modules)
- ECSZ**A**000X0B (connector set for ECS axis modules)

12.4.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

12.4.3 Components for operation and communication

Operating and communication modules

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrical isolation to CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1)]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1)]

1) ”xxxx” = Cable length in decimetre (example: ”xxxx” = ”0015” → length = 15 dm)

12.4.4 Brake resistor

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

12.4.5 Mains fuses

- Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- Use UL-approved cables, fuses and fuse holders only.
- UL fuse:
  – Voltage 500 ... 600 V
  – Tripping characteristic ”H”, ”K5” or ”CC”

12.4.6 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  - The waveform of the mains current is approximated to the sinusoidal shape.
  - Reduction of the effective mains current by up to 25%.
  - Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  - A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

12.4.7 RFI filters

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

13 Index

A

Absolute positioning, 193
- setting, 123

Absolute positioning , 97

Absolute positioning (direct), 198

Absolute value encoder (Hiperface, single-turn/multi-turn), 132
- as position and speed encoder, 145

Acceleration, 98

Accessories, 431
- brake resistors, 433
- communication modules, 432
- connector set, 431
- digital frequency cables, 432
- digital frequency distributor, 432
- mains chokes, 436
- operating modules, 432
- RFI filters, 437
- shield mounting kit, 431
- system bus components, 432

Additional functions for positioning profile, speed override, deactivating, 207

Additional functions of positioning profile, speed override, activating, 205

Additional functions of the positioning profile, 96 , 204
- Speed override, 96
- stretch factor for ”electrical shaft”, 96
- torque limitation after positioning, 96
  activating, 208

Additional functions of the positioning profiles, profile continuation function, activating, 209

Additional positioning profile functions, Immediate profile change (Direct Change), activate, 210

Address setting, 267

Addressing
- individual, 271
- parameter data objects, 429
- process data objects, 429

Adjusting current controller, 247

Adjusting the current controller, calculating the electrical motor values, 247

Adjustment of field controller / field weakening controller, Adjustment, 254

Analog input, 69

Analog inputs, Configuration, 69

Angular trimming, 235

Application, as directed, 17

Application as directed, 17

Approvals, 30

Assignment, external brake resistor, 433

Assignment of the plug connectors
- control connections, 67
- system bus (CAN), 81

Atmospheric pressure, 30

Automation interface (AIF), 79

Auxiliary relay, switch-on sequence, 66

Axis module, 13
- ECSCx...
  dimensions, 46
  mounting, 45
- ECSDx...
  dimensions, 42
  mounting, 41
- ECSEx...
  dimensions, 39
  mounting, 40

Axis synchronisation, 278

Axis synchronisation via CAN, 282

Axis synchronisation via terminal X6/DI1, 283

B

Basic identifier, 429

Basic settings with GDC, 117

Baud rate
- setting, 268
  via DIP switch, 268
- system bus (CAN). *Siehe* baud rate

Brake, connection, 61

Brake configuration, 130

Brake resistor, external, 433
- assignment, 433
- connection, 59
- type ERBD..., rated data, 433
- type ERBM..., rated data, 433
- type ERBS..., rated data, 434

Brake resistor, internal, Connection, 57

Bus cable length, 83

Bus load CAN, 288

Bus off, 298

C

Cable cross-section, 83

Cable cross-sections
- Control connections, 54 , 67
- control connections, 52
- control terminals, connection ”Safe torque off”, 73

Cable specification, 81

Cables, shielded, 53

Cables, specification, motor cables, 60

CAN bus
- assignment of the plug connectors, 81
- boot-up time setting, 274
- communication, 412
- configuring, 266
- cyclic process data objects, synchronisation, 421
- data telegram, 412
- determining the master in the drive system, 273
- event-controlled process data objects, 422
- Guiding angle selection and synchronisation, 277
- identifier, 412 , 429
  display code, 429
- individual addressing, 271
- making a reset node, 276
- network management data, 413
- parameter data, 413 , 423
- parameter data channels, 423
- parameter data objects, addressing, 429
- process data, 413
  from the axis module, 161
  to the axis module, 158
- process data objects, 417
  addressing, 429
  data transmission, 419
- process data telegrams, 418
- setting baud rate, 266
- setting delay time, 274
- setting node address, 266
- setting the cycle time, 274
- user data, 413 , 424

CAN bus load, 288

CAN bus status, 286

CAN data telegram, 412

CAN diagnostic codes, 286

CAN network
- communication phases, 414
- state transitions, 415
- statuses, 414

CAN network management (NMT), 416

CAN Sync correction increment, 279

CAN sync identifiers, 280

CAN sync response, 281

CAN synchronisation, 278

CAN synchronisation cycle, 278

CAN telegram counter , 287

CAN user organisation CiA, Homepage, 413

Capacitor module, 13

Capacitor module ECSxK..., Connection, 63

Capacitor modules, 63

CE-typical drive system, 48

- assembly, 49
- earthing, 50
- filters, 49
- installation , 48
- shielding, 50
  cables, 53

Charging current limitation, function selection, 126

COB-ID, 429

- display code, 429

Code descriptions, 14

Code table, 353

Commissioning, 92
- adjusting the current controller, calculating the electrical motor values, 247
- Adjustment of field controller / field weakening controller, 254
- Basic settings with GDC, 117
- basics of positioning, basic terms, 92
- before you start, 115
- commissioning steps, overview, 116
- configuration of digital inputs/outputs
  inputs for continuous positioning axis, 170
  inputs for linear positioning axis, 171
  setting the polarity, 172
- configuring the digital inputs/outputs, 168
- configuring the electrical shaft, 211
- Control sequence for starting positioning profile, 226
- controller enable, 241
- current controller adjustment, metrological determination of electrical motor values, 248
- defining the dwell time, 232
- Defining the positioning profile, setting of positioning profile parameters, 201
- defining the positioning profile, additional functions of the positioning profile, 96 , 204
- defining the window for standstill message, 231
- electrical shaft via digital frequency coupling, 215
- electrical shaft via EtherCAT, PLC as master, 224
- Electrical shaft via MotionBus (CAN), ECSxP as master, 217
- electrical shaft via MotionBus (CAN), PLC as master, 220
- entry of machine parameters, 165
- Entry of motor data, 128
- following error monitoring, 233
- holding brake configuration, 130
- limit positions and limit switches
  evaluation of hardware limit switches, 240
  manual control to hardware limit switch, 175
  manual control to software limit position, 175
  monitoring by software limit positions, 237
  retracting from hardware limit switches, 176
- loading the Lenze settings, 125
- operation with motors of other manufacturers, 244
- Operation with servo motors from other manufacturers, Motor feedback system - checking the direction of rotation, 246
- operation with servo motors of other manufacturers
  adjusting current controller, 247
  effecting rotor position adjustment, 249
  entering motor data, 244
- Optimising the drive behaviour, 252
- Positioning profile modes, Electrical shaft (”E-shaft”), 196
- positioning profile modes
  absolute positioning, 193
  absolute positioning (direct), 198
  absolute touch probe positioning, 194
  continuous constant travel, 195
  continuous constant travel (direct), 199
  homing, 197
  positioning sequence for controller optimisation, 200
  relative positioning in the continuous measuring system, 193
  relative positioning in the continuous measuring system (direct), 198
  relative positioning with absolute reference, 194
  relative positioning with absolute reference (direct), 199
  relative touch probe positioning in the continuous measuring system, 195
  relative touch probe positioning with absolute reference, 195
  reset reference, 197
  setting the reference, 197
- profile parameter jerk time, parameters, 202
- quick stop (QSP), 243
- Resolver adjustment, 257
- Select control interface, 155
- Select operating mode, 155
- selecting a positioning profile, selecting a positioning profile mode, 191
- Selecting the function of the charging current limitation, 126
- set reference, 119
- setting absolute positioning, 123
- setting homing
  reference search with continuous positioning axis, 189
  reference search with linear positioning axis, 188
- setting of feedback system
  absolute value encoder, 146
  SinCos encoder (single-turn, multi-turn), 146
- Setting of homing, 122
- setting of homing
  parameters, 177
  shifting of the zero position, 187
- setting of mains data, 126
- setting of manual control (inching mode)
  manual control to hardware limit switch, 175
  manual control to software limit position, 175
  parameters, 173
- setting of manual jog (inching mode), retracting from hardware limit switches, 176
- setting of the feedback system, 132
  resolver as multi-turn absolute value encoder, 135
- setting relative positioning (continuous measuring system), 123
- setting the feedback system
  absolute value encoder (position encoder), resolver (speed encoder), 150
  incremental encoder (TTL encoder), 136
  resolver as position and speed encoder, 133
  SinCos encoder, 136
  TTL/SinCos encoder (position encoder), resolver (speed sensor), 140
- setting the homing, homing modes, 179
- setting the polarity of digital inputs/outputs, 172
- setting the positioning profile, 191

- setting the target position window, 229
- setting the voltage threshold, 127
- Speed controller adjustment, 252
- speed-dependent angular trimming, 235
- state control, 110
  operating states, 111
  state change (transitions), 113

Communication modules, 432

Communication phases, 414

Configuration, 265
- axis synchronisation, 278
- Axis synchronisation (start), 279
- axis synchronisation via CAN, 282
- axis synchronisation via terminal X6/DI1, 283
- CAN bus load, 288
- CAN bus status, 286
- CAN diagnostic codes, 286
- CAN sync correction increment, 279
- CAN sync identifiers, 280
- CAN synchronisation, 278
- CAN synchronisation (start), 279
- CAN synchronisation cycle, 278
- CAN telegram counter , 287
- Code table, 353
- cyclic node monitoring (Node Guarding), 284
- monitoring, 291
  current load of the motor (I2 x t monitoring), 22 , 309
  voltage supply of control electronics, 316
- Monitoring functions, Motor temperature, 22
- monitoring functions
  bus off, 298
  current load of controller (I x t monitoring), 306
  DC-bus voltage, 313
  earth fault, 300
  heatsink temperature, 303
  max. system speed, 322
  monitoring times for process data input objects, 297
  motor phase failure, 316
  motor temperature, 301
  motor temperature sensor, 318
  overview, 292
  Resolver cable, 317
  rotor position adjustment, 323
  short circuit, 300
  sin/cos signal, 320
  speed system deviation, 321
  temperature inside the controller, 304
  thermal sensors, 305
- monitoring of the synchronisation, 281
- MotionBus (CAN)
  boot-up time setting, 274
  making a reset node, 276
  setting the baud rate, 266
  setting the node address, 266
- Sync phase displacement, 278
- sync phase displacement, correction value, 279
- system bus (CAN)
  determining the master in the drive system, 273
  individual addressing, 271
  setting delay time, 274
  setting the baud rate, 266
  setting the cycle time, 274
  setting the node address, 266
- Thermal motor monitoring, 22
- via automation interface (AIF), 265
- via system bus interface, 265

Configuration of CAN interface, node address (node ID), 430

Configuration of digital inputs/outputs
- inputs for continuous positioning axis, 170
- inputs for linear positioning axis, 171

Configuring CAN interface, monitoring, timeout with activated remote parameterisation, 299

Conformity, 30

Connection
- Capacitor module ECSxK..., 63
- DC bus, 52 , 54
- external brake resistor, 59
- Internal brake resistor, 57
- motor, 52
- motor holding brake, 52 , 61

Connection "Safe torque off", terminals, 73

Connection "safe torque off", 70
- functional description, 71
- Important notes, 72

connection "safe torque off", Important notes, 72

Connection of "safe torque off"
- function check, 74
- implementation, 70
- technical data, 73

Continuous constant travel, 195

Continuous constant travel (direct), 199

Control connections
- Analog inputs, configuration, 69
- assignment of the plug connectors, 67
- Cable cross-sections, 54 , 67
- cable cross-sections, 52
- Digital inputs, 68
- Digital outputs, 68
- Tightening torques, 54 , 67
- tightening torques, 52

Control factor, 34

Control sequence for starting positioning profile, 226

Control signals, 65

Control terminals, 64
- cable cross-sections, connection "Safe torque off", 73
- starting torques, connection "Safe torque off", 73

Control word Ctrl1, 159 , 160

Control/signal cables, shield connection, 65

Controller, 13
- application as directed, 17
- identification, 17

Controller enable, 241

controller enable, 241

Controller inhibit (CINH), 241

Current characteristics
- application example, 36
- device protection by current derating, 37
- rated output current, 34

Current controller adjustment, metrological determination of electrical motor values, 248

Current derating, 37

Current load of controller, I x t monitoring, 306

Current load of the motor, I2 x t monitoring, 22 , 309

Cyclic node monitoring (Node Guarding), 284

Cyclic process data objects, 420

D

Data telegram, 412

Data words, from the axis module, 164

Data, general electrical, 31

DC bus
- connection, 52 , 54
- fuses, 55 , 435

DC-bus voltage
- monitoring functions, 313
- overvoltage, 313
- undervoltage, 313

DC-bus voltage monitoring (OU, LU), 313

Deceleration, 98

Defining boot-up master, 273

Defining master in the drive system, 273

Defining the dwell time, 232

Defining the window for standstill message, 231

Definition of notes used, 29

Definitions of terms, 13

Device protection, 26

Device protection by current derating, 37

Device status, 163

device status, 163 , 340

Device structure, 108

Diagnostics, 324
- with Global Drive Control (GDC), 324
- with Global Drive Oscilloscope (GDO), 326
  Diagnostics with GDO, 328
  GDO buttons, 327
- with PCAN-View, 334
- with XT EMZ9371BC keypad, 333

Diagnostics codes, 286

Digital frequency cables, 432

Digital frequency distributor, 432

Digital frequency input, 90
- features, 90

Digital frequency output, 90
- features, 90

Digital inputs, 68
- configuring, 168
- setting the polarity, 172

Digital outputs, 68
- configuring, 168
- setting the polarity, 172

Dimensions, 39 , 42 , 46
- axis module ECSCx..., 46
- axis module ECSDx..., 42
- axis module ECSEx..., 39

DIP switch, 267

Direct Change, activate, 210

Direct positioning, 198

Discharge current to PE, 31

Disposal, 21

Drive system, 13

Dwell time, 232

E

Earth fault monitoring (OC2), 300

Earth-fault monitoring, 300

Earthing, EMC, 50

Effecting rotor position adjustment, 249

Electrical installation, 48
- connection ”Safe torque off”, terminals, 73
- connection ”safe torque off”, 70
  functional description, 71
  Important notes, 72
- connection of ”safe torque off”
  function check, 74
  implementation, 70
  technical data, 73
- Connection of capacitor module ECSxK..., 63
- control connections, 64
  assignment of the plug connectors, 67
  Digital inputs, 68
  Digital outputs, 68
- control terminals, 65
- feedback system, 85
  encoder, 87
  resolver, 86
- installation of a CE-typical drive system, 48
  assembly, 49
  earthing, 50
  filters, 49
  shielding, 50
- power connections, 52
  connection of external brake resistor, 59
  DC bus connection, 52
  internal brake resistor connection, 57
  motor connection, 52 , 60
  motor holding brake connection, 52
  plug connector assignment, 52
- power terminals
  connection of motor holding brake, 61
  DC bus connection, 54
- specification of the cables, motor cables, 60

Electrical shaft
- configuring, 211
- stretch factor, 212
- via digital frequency coupling, 215
- via EtherCAT, PLC as master, 224
- via MotionBus (CAN)
  ECSxP as master, 217
  PLC as master, 220

Electrical shaft (”E-shaft”), 196

Electrical shaft (”EShaft”), 107

Electromagnetic compatibility, 31

EMC, 31
- earthing, 50
- filters, 49
- shielding, 50
  cables, 53

EMF2131IB digital frequency distributor, wire, 91

EMF2131IB digital frequency distributor , wire, 91

Enclosure, 31

Encoder, 87
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 145
- absolute value encoder (Hiperface, single-turn/multi-turn), 132
- incremental encoder (TTL encoder), 88
- SinCos absolute value encoder, 89
- SinCos encoder, 89
  absolute value encoder (Hiperface, single-turn/multi-turn), 132
- supply voltage, 87

Encoder simulation, 90

Entering motor data, 244

Entry of machine parameters, 165

Entry of motor data, 128

Environmental conditions, 30
- atmospheric pressure, 30
- pollution, 30
- site altitude, 30
- temperature, 30
- vibration resistance, 30

Error analysis, 337
- Via history buffer, 338
- via LECOM status word, 340

Error messages, 426
- Causes and remedies, 343
- causes and remedies, 343
- configuration, 293
- reset (TRIP-RESET), 352

Error response, 425

Evaluation of hardware limit switches, 240

Event-controlled process data objects, 422

Examples
- reading parameters, 427
- Selection help for cable length / number of repeaters, 84
- writing parameters, 428

Executing a reset node, 276

Explanations, Code table, 353

External brake resistor, 433
- assignment, 433
- connection, 59
- type ERBD..., rated data, 433
- type ERBM..., rated data, 433
- type ERBS..., rated data, 434

F

FAIL-QSP, 292

Fault analysis, 337
- Via history buffer, 338
- via LECOM status word, 340
- via LEDs, 337
- with keypad XT EMZ9371BC, 337

Fault message, reset, 339

Fault messages, 343
- causes and remedies, 343
- configuration, 293
- reset (TRIP-RESET), 352

Fault responses, 292

Feed constant, 105

Feedback system, wiring, 85
- encoder, 87
- incremental encoder (TTL encoder), 88
- resolver, 86
- SinCos absolute value encoder, 89
- SinCos encoder, 89

Field controller / field weakening controller, 254

Filters, EMC, 49

Final speed, 98

Following errors, monitoring, 233

Free space, 30

Function monitoring of thermal sensors (H10, H11), 305

Functional earth conductor, 44

Fuses, 55 , 435
- DC bus, 55 , 435
- replacing, 55

G

Gateway function, 289

Gearbox ratio, 104

Global Drive Control (GDC)
- Diagnostics, 324
- Parameter setting, 259

Global Drive Oscilloscope (GDO), 326
- Diagnostics with GDO, 328
- GDO buttons, 327

Guiding angle default and synchronisation, CAN sync response, 281

Guiding angle selection and synchronisation, via MotionBus (CAN), 277

H

Hardware limit switches
- evaluation, 240
- manual control to, 175
- retracting, 176

Heatsink temperature, monitoring functions, 303

Heatsink temperature monitoring (OH, OH4), 303

History buffer, 338
- codes, 339
- deleting entries, 339
- fault message reset, 339

Holding brake configuration, 130

Homing, 101 , 112 , 197

Homing Modes, 179

Homing modes, 179
- modes 0 and 1, 179
- modes 6 and 7, 182
- modes 10 and 11, 184
- modes 12 and 13, 185
- modes 14 and 15, 186
- modes 2 and 3, 180
- modes 4 and 5, 182
- modes 8 and 9, 183

I

Identification, controller, 17

Identifier, 412 , 429

identifier, display code, 429

Immediate profile change (Direct Change), activate, 210

Inching mode (manual jog), setting, 101 , 121

Incremental encoder, as position and speed encoder, 136

Incremental encoder (TTL encoder), 88

Individual addressing, 271

Init, 111

Installation, 30
- system bus (CAN), 80

Installation of a CE-typical drive system, 48
- assembly, 49
- earthing, 50
- filters, 49
- shielding, 50
  cables, 53

Installation, electrical, 48
- connection "Safe torque off", terminals, 73
- connection "safe torque off", 70
  functional description, 71
  Important notes, 72
- connection of "safe torque off"
  function check, 74
  implementation, 70
  technical data, 73
- Connection of capacitor module ECSxK..., 63
- control connections, 64
  assignment of the plug connectors, 67
  Digital inputs, 68
  Digital outputs, 68
- control terminals, 65
- feedback system, 85
  encoder, 87
  resolver, 86
- installation of a CE-typical drive system, 48
  assembly, 49
  earthing, 50
  filters, 49
  shielding, 50
- power connections, 52
  connection of external brake resistor, 59
  DC bus connection, 52
  internal brake resistor connection, 57
  motor connection, 52 , 60
  motor holding brake connection, 52
  plug connector assignment, 52
- power terminals
  connection of motor holding brake, 61
  DC bus connection, 54
- specification of the cables, motor cables, 60

Installation, mechanical, 38
- push-through technique (ECSDx...), 41

Installation, mechanical
- cold-plate technique (ECSCx...), 45
- important notes, 38
- with fixing rails (ECSEx...), 40

Insulation resistance, 31

InTarget, 229

Interfaces to the control, 108

Internal brake resistor, Connection, 57

J

Jerk time, 99

Jitter, 278 , 279

K

Keypad XT EMZ9371BC
- changing and saving parameters, 264
- connecting the keypad, 260
- display elements, 261
- fault analysis, 337
- function keys, 263

L

L-profile, 99

LECOM, status word (C0150/C0155), 340

LEDs, 337

Legal regulations, 17

Liability, 17

Limit positions and limit switches
- hardware limit switches, 107
  evaluation, 240
  manual control to, 175
  retracting, 176
- software limit positions, 107
  manual control to, 175
  monitoring, 237

Loading the Lenze setting, 125

Low-voltage supply, 13

M

Machine parameters, 103
- feed constant, 105
- gearbox ratio, 104
- max. acceleration/deceleration, 106
- motor revolutions, 103
- software limit positions, 107
- target position selection, maximum, 106
- traversing speed, maximum, 106

machine parameters, position resolution, 106

Mains fuses, 435

Malfunction of drive, 342

Manual jog (inching mode), setting, 101 , 121

ManualJog, 112

Manufacturer, 17

Max. acceleration/deceleration, 106

Max. system speed, monitoring functions, 322

MCTRL_MotorControl (motor control), monitoring, absolute value encoder initialisation, 319

Measuring system for positioning, 102

Mechanical installation, 38
- cold-plate technique (ECSCx...), 45
- important notes, 38
- push-through technique (ECSDx...), 41
- with fixing rails (ECSEx...), 40

Message, 292

Modes for homing
- modes 0 and 1, 179
- modes 6 and 7, 182
- modes 14 and 15, 186
- modes 4 and 5, 182
- modes 8 and 9, 183

Monitoring
- absolute value encoder initialisation, 319
- by software limit positions, 237
- CAN interface, timeout with activated remote parameterisation, 299
- current load of the motor, I2 x t monitoring, 22 , 309
- FAIL-QSP, 292
- message, 292
- Monitoring times for process data input objects, 297
- of following errors, 233
- speed-dependent angular trimming, 235
- voltage supply of control electronics, 316
- warning, 292

Monitoring functions, 291
- bus off, 298
- configuring, 297
- current load of controller, I x t monitoring, 306
- DC-bus voltage, 313
- earth fault, 300
- heatsink temperature, 303
- max. system speed, 322
- motor phase failure, 316
- Motor temperature, 22
- motor temperature, 301
- motor temperature sensor, 318
- Overview, 293
- Resolver cable, 317
- rotor position adjustment, 323
- short circuit, 300
- sin/cos signal, 320
- speed system deviation, 321
- temperature inside the controller, 304
- thermal sensors, 305

Monitoring of internal device temperature (OH1, OH5), 304

Monitoring of the synchronisation, 281

Monitoring times for process data input objects, 297

Monitorings
- configuration, 293
- possible fault responses, 293

MotionBus (CAN), 412
- boot-up time setting, 274
- CAN data telegram, 412
- communication, 412
- configuring, 266
- cyclic process data objects, synchronisation, 421
- event-controlled process data objects, 422
- identifier, 412 , 429
- making a reset node, 276
- network management data, 413
- parameter data, 413 , 423
- parameter data channels, 423
- parameter data objects, addressing, 429
- process data, 413
- process data objects, 417
  addressing, 429
  data transmission, 419
- process data telegrams, 418
- setting the baud rate, 266
- setting the node address, 266
- user data, 413 , 424

Motor, connection, 52 , 60

motor, Thermal monitoring, Sensorless, 22

Motor cable length, 30

Motor cables, specification, 60

Motor feedback system, Checking the direction of rotation, 246

Motor holding brake, connection, 52

Motor monitoring, 22

Motor phase failure, monitoring functions, 316

Motor protection, 27

Motor revolutions, 103

Motor temperature, monitoring functions, 301

Motor temperature monitoring (OH3, OH7), 301

Motor temperature sensor, monitoring, 318

Motor temperature sensor monitoring (Sd6), 318

Motor, connection, , 60

Motors of other manufacturers, 244

Mounting
- axis module ECSCx..., 45
- axis module ECSDx..., 41
- axis module ECSEx..., 40
- cold-plate design, 45
- standard installation (with fixing rails), 39
- thermally separated (push-through technique), 41

Mounting position, 30

N

Network management (NMT), 416

Network management data, 413

Node address (node ID), CAN interface, 430

Node address setting, 267

Node guarding, 284

Node ID, 429

Node-ID, display code, 429

Noise emission, 31

Noise immunity, 31

Notes, definition, 29

O

Offset selection, 187

Operating conditions, 30

Operating modules, 432

Operating states, 111
- Homing, 112
- Init, 111
- ManualJog, 112
- PosFunctions, 111
- Positioning, 112
- Stand-by, 111
- state change (transitions), 113
- Trouble, 111

Operation with motors of other manufacturers, 244

Operation with servo motors from other manufacturers
- Checking the direction of rotation of the motor feedback system, 246
- current controller adjustment, metrological determination of electrical motor values, 248

Operation with servo motors of other manufacturers
- adjusting current controller, 247
- adjusting the current controller, calculating the electrical motor values, 247
- effecting rotor position adjustment, 249
- entering motor data, 244

Optimising the drive behaviour, 252

Overcurrent characteristic, 307

Overcurrent diagram, 307

Override (speed variation), 96
- activating, 205
- deactivating, 207

Overvoltage threshold, DC-bus voltage, 313

P

Packaging, 30

Parameter data, 413 , 423

Parameter data objects, addressing, 429

Parameter data telegram, 424
- examples, 427

Parameter data transfer, 423

Parameter setting, 258
- With Global Drive Control (GDC), 259
- with keypad XT EMZ9371BC
  changing and saving parameters, 264
  connecting the keypad, 260
  keypad display elements, 261
  keypad function keys, 263
- With XT EMZ9371BC keypad, 260

Parameters
- changing and saving, with keypad XT EMZ9371BC, 264
- for homing, 177
- for manual control (inching mode), 173
- for profile parameter jerk time, 202
- machine parameters, 103 , 165
- positioning profile parameters, 97
  setting, 201

PC system bus adapter, 432

PCAN-View, diagnostics, 334

Phase displacement, correction value, 279

Phase shift, 278

Plug connector assignment, power connections, 52

Plug connectors
- control connections, 67
- power connections, 52

”Point-to-point” positioning, 193

Polarity of digital inputs/outputs, 172

Pollution, 30

PosFunctions, 111

Position control, feedback system, 132
- absolute value encoder, 146
- Absolute value encoder (position encoder), resolver (speed encoder), 150
- incremental encoder (TTL encoder), 136
- resolver, 133
- resolver as multi-turn absolute value encoder, 135
- SinCos encoder, 136
- SinCos encoder (single-turn, multi-turn), 146
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 140

Position resolution, 106

Positioning, 92 , 112
- ”point-to-point” positioning, 193
- Basic terms
  Profile continuation after profile abort, 96
  Speed variation (override), 96
- basic terms, 92
  stretch factor for ”electrical shaft”, 96
  torque limitation after positioning, 96
  touch probe positioning, 93
- continuous constant travel, 195
- direct positioning, 198
- Electrical shaft (”E-shaft”), 196
- homing, 197
- positioning sequence for controller optimisation, 200
- relative positioning in the continuous measuring system, 97
- relative positioning with absolute reference, 97
- state control, operating states, 111
- States of the positioning drive
  Init, 111
  Stand-by, 111
- states of the positioning drive
  Homing, 112
  ManualJog, 112
  PosFunctions, 111
  Positioning, 112
  Trouble, 111
- touch probe positioning, 194

Positioning , absolute positioning , 97

Positioning profile mode, selecting, 191

Positioning profile, 94

Positioning profile additional features, Profile continuation function, Activate, 96

Positioning profile mode, 95

Positioning profile modes
- absolute positioning, 193
- absolute positioning (direct), 198
- continuous constant travel, 195
- continuous constant travel (direct), 199
- Electrical shaft (”E-shaft”), 196
- homing, 197
- positioning sequence for controller optimisation, 200
- relative positioning in the continuous measuring system, 193
- relative positioning in the continuous measuring system (direct), 198
- relative positioning with absolute reference, 194
- relative positioning with absolute reference (direct), 199
- reset reference, 197
- setting the reference, 197
- touch probe positioning
  absolute , 194
  relative in the continuous measuring system, 195
  relative with absolute reference, 195

Positioning profile parameters, 97
- acceleration, 98
- deceleration, 98
- final speed, 98
- jerk time, 99
- setting, 201
- target position, 97
- traversing speed, 98

Positioning sequence for controller optimisation, 200

Power connections, 52
- connection of external brake resistor, 59
- DC bus connection, 52
- Internal brake resistor connection, 57
- motor connection, 52 , 60
- motor holding brake connection, 52
- plug connector assignment, 52

Power reduction, 30

Power supply module, 13

Power terminals, 51
- connection of motor holding brake, 61
- DC bus connection, 54

Process data, 413
- from the axis module, 161
  data words, 164
- of the axis module, device status, 163
- structure, 418
- to the axis module, 158
  control word Ctrl1, 159 , 160

Process data objects
- addressing, 429
- available, 417
- cyclic, 420
- event-controlled, 422
- transfer, 419

Process data telegram, 418

Process data transfer, 417

Profile continuation function
- Activate, 96
- activating, 209

Protection of persons, 26

Protective insulation, 31

Protective measures, 31

Protective separation, 31

Q

Quick stop (QSP), 243

R

Rated data, 32 , 33
- external brake resistor
  type ERBD..., 433
  type ERBM..., 433
  type ERBS..., 434

Rated output current, 34

Reference search with continuous positioning axis, 189

Reference search with linear positioning axis, 188

Relative positioning
- in the continuous measuring system, 97
- with absolute reference, 97

Relative positioning (continuous measuring system), setting, 123

Relative positioning in the continuous measuring system, 193

Relative positioning in the continuous measuring system (direct), 198

Relative positioning with absolute reference, 194

Relative positioning with absolute reference (direct), 199

Remote parameterisation (gateway function), 289

Reset HomePosAvailable, 197

Reset reference, 197

Residual hazards, 26

Resolver, 86 , 257
- Adjustment, 257
- as position and speed encoder, 133
- setting as absolute value encoder, 135

Resolver cable, monitoring, 317

Responses, 292
- CAN sync response, 281

Rotor position adjustment, monitoring, 323

S

S-profile, 99

Safe standstill, 70

Safe torque off, 70

Safety instructions, 18
- definition, 29
- layout, 29

Sd7 - absolute value encoder initialisation, 319

Select control interface, 155

Select operating mode, 155

Selection help for cable length / number of repeaters, Example, 84

Set homing, homing modes
- modes 14 and 15, 186
- modes 8 and 9, 183

Set reference, 119

Setting a reference, 101

Setting homing
- homing modes
  modes 0 and 1, 179
  modes 6 and 7, 182
  modes 4 and 5, 182
- parameters, 177
- reference search with continuous positioning axis, 189
- reference search with linear positioning axis, 188

Setting node address, 266

Setting of boot up time , 274

Setting of cycle time, 274

Setting of feedback system
- absolute value encoder, 146
- SinCos encoder (single-turn, multi-turn), 146

Setting of homing, 122
- shifting of the zero position, 187

Setting of mains data, 126

Setting of manual control (inching mode)
- manual control to hardware limit switch, 175
- manual control to software limit position, 175
- parameters, 173

Setting of manual jog (inching mode), retracting from hardware limit switches, 176

Setting of the feedback system, 132
- resolver as multi-turn absolute value encoder, 135

Setting the address, via DIP switch, 267

Setting the baud rate, 266

Setting the feedback system
- absolute value encoder (position encoder), resolver (speed encoder), 150
- incremental encoder (TTL encoder), 136
- Resolver as position and speed encoder, 133
- SinCos encoder, 136
- TTL-/SinCos encoder (position encoder), resolver (speed sensor), 140

Setting the homing, homing modes, 179
- modes 10 and 11, 184
- modes 12 and 13, 185
- modes 2 and 3, 180

Setting the jerk time, parameters, 202

Setting the node address, via DIP switch, 267

Setting the polarity, digital inputs/outputs, 172

Setting the positioning profile, 191

Setting the reference, 197

Setting the target position window, 229

Setting the voltage thresholds, 127

Shield connection, control/signal cables, 65

Shielded cables, 53

Shielding
- cables, 53
- EMC, 50

Shifting the zero position (offset selection), 187

Short circuit monitoring (OC1), 300

Short-circuit monitoring, 300

Sin/cos signal, monitoring functions, 320

Sin/cos signal monitoring (Sd8), 320

SinCos absolute value encoder, 89

SinCos encoder, 89
- without serial communication, as position and speed encoder, 136

Site altitude, 30

Software limit positions, 107
- manual control to, 175
- monitoring, 237

Specification of the cables, motor cables, 60

Specification of the transmission cable, 81

Speed control, feedback system, 132
- absolute value encoder, 146
- Absolute value encoder (position encoder), resolver (speed encoder), 150
- incremental encoder (TTL encoder), 136
- resolver, 133
- resolver as multi-turn absolute value encoder, 135
- SinCos encoder, 136
- SinCos encoder (single-turn, multi-turn), 146
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 140

Speed controller, 252
- Adjustment, 252

Speed override, 96
- activating, 205
- deactivating, 207

Speed system deviation, monitoring functions, 321

Speed-dependent angular trimming, 235

Stand-by, 111

Standards, 30

Standstill message, defining window, 231

Starting torques, control terminals, connection "Safe torque off", 73

State change (transitions), 113

State control, 110
- operating stated, 111
- state change (transitions), 113

Status CAN, 286

status of the axis module, 163 , 340

Status word, LECOM (C0150/C0155), 340

Status word 1 (Stat1), 161

Status word 2 (Stat2), 161

Statuses, CAN network, 414

Stretch factor, 212

Stretch factor for "electrical shaft", 96

Structure of the process data, 418

Supply voltage, encoder, 87

Switch-off thresholds, 314

Switch-on thresholds, 314

Sync correction increment, 279

Sync identifiers, 280

Sync phase displacement, 278
- correction value, 279

Sync signal source, 278

Sync telegram, 421

Synchronisation
- CAN sync response, 281
- cyclic process data objects, 421

Synchronisation cycle, 278

Synchronisation via CAN, 282

Synchronisation via terminal X6/DI1, 283

System bus (CAN), 411 , 412
- assignment of the plug connectors, 81
- baud rate, 83 , 84
- communication, 412
- configuring, 266
- cyclic process data objects, synchronisation, 421
- determining the master in the drive system, 273
- event-controlled process data objects, 422
- identifier, 412 , 429
- individual addressing, 271
- network management data, 413
- parameter data, 413 , 423
- parameter data channels, 423
- process data, 413
- process data objects, 417
  addressing, 429
  data transmission, 419
- process data telegrams, 418
- setting delay time, 274
- setting the baud rate, 266
- setting the cycle time, 274
- setting the node address, 266
- user data, 413 , 424
- wiring, 80 , 82

system bus (CAN)
- CAN data telegram, 412
- parameter data objects, addressing, 429

System bus components, 432

System error messages, Causes and remedies, 343

T

Target position, 97
- setting the target position window, 229

Target position selection, maximum, 106

Technical data, 30
- current characteristics
  application example, 36
  device protection by current derating, 37
  rated output current, 34
- external brake resistor
  type ERBD..., 433
  type ERBM..., 433
  type ERBS..., 434
- general electrical data, 31
- rated data, 32 , 33
- standards and operating conditions, 30

Telegram counter CAN, 287

Temperature, 30

Temperature inside the controller, monitoring functions, 304

Terminology used, 13

Thermal monitoring, motor, Sensorless, 22

Thermal sensors, monitoring functions, 305

Thermal separation, 41

Tightening torques
- Control connections, 54 , 67
- control connections, 52

Time-out monitoring for activated remote parameterisation, 299

Timeout with activated remote parameterisation, CAN interface, 299

Torque, safe torque off, 70

Torque limitation after positioning, 96
- activating, 208

Touch probe positioning, 93 , 194
- absolute TP positioning, 194
- relative touch probe positioning in the continuous measuring system, 195
- relative with absolute reference, 195

Transmission cable, specification, 81

Traversing speed, 98

Traversing speed, maximum, 106

TRIP, 292

TRIP-RESET, 339 , 352

Trouble, 111

Troubleshooting
- fault messages, 343
- malfunction of drive, 342

Troubleshooting and fault elimination, 337

- monitoring
  current load of the motor (I2 x t monitoring), 22 , 309
  voltage supply of control electronics, 316
- monitoring functions
  bus off, 298
  current load of controller (I x t monitoring), 306
  DC-bus voltage, 313
  earth fault, 300
  heatsink temperature, 303
  max. system speed, 322
  monitoring times for process data input objects, 297
  motor phase failure, 316
  motor temperature, 301
  motor temperature sensor, 318
  Resolver cable, 317
  rotor position adjustment, 323
  short circuit, 300
  sin/cos signal, 320
  speed system deviation, 321
  temperature inside the controller, 304
  thermal sensors, 305

TTL encoder, 88

TTL incremental encoder, as position and speed encoder, 136

U

Undervoltage threshold, DC-bus voltage, 313

User data, 413 , 424 , 426

V

Vibration resistance, 30

Virtual gearbox, stretch factor, 212

Voltage supply of control electronics, monitoring, 316

W

Warning, 292

Warranty, 17

Wiring, system bus (CAN), 82

X

XT EMZ9371BC keypad, Diagnostics, 333

Z

Zero position
- defining (homing), 101 , 119
- shifting (offset selection), 187

© 07/2013

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

+49 (0)51 54 / 82-0

+49 (0)51 54 / 82 - 28 00

Lenze@Lenze.de

www.Lenze.com

Service

Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany

00 80 00 / 24 4 68 77 (24 h helpline)

+49 (0)51 54 / 82-11 12

Service@Lenze.de

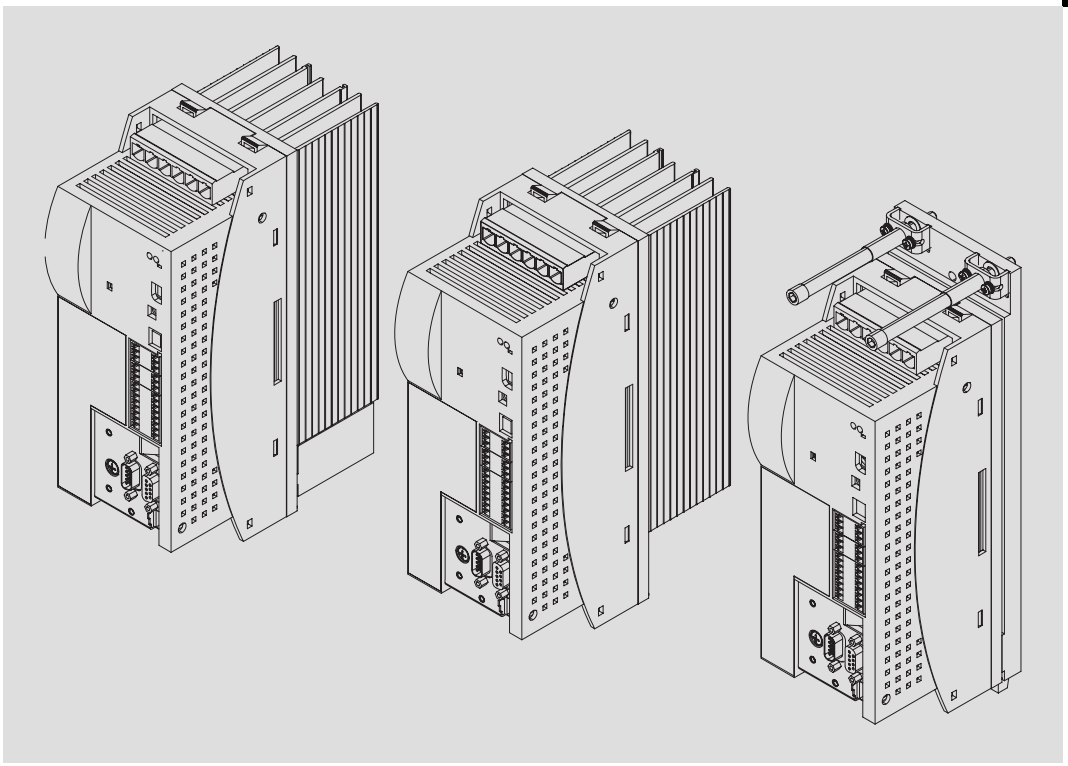
EDBCSXP064 ■ 13434281 ■ EN ■ 8.0 ■ TD17

10 9 8 7 6 5 4 3 2 1

EDBCSXS064
13434277

Operating Instructions

ECS



ECSESxxx / ECSDSxxx / ECSCSxxx

Axis module – "Speed & Torque"

Lenze

Please read these instructions before you start working!
Follow the enclosed safety instructions.

This documentation is valid for ECSxS axis modules, application software (A-SW) "Speed & Torque", as of version:

	①										
	ECS	x	S	xxx	C	4	x	xxx	XX	xx	xx

Device type

Design

E = standard panel-mounted unit, IP20
D = push-through technique (thermally separated)
C = cold-plate technique

Application

S = "Speed and Torque"

Peak current

004 = 4 A
008 = 8 A
016 = 16 A
032 = 32 A
048 = 48 A
064 = 64 A

Fieldbus interface

C = MotionBus/system bus (CAN)

Voltage class

4 = 400 V/500 V

Technical version

B = standard
V = coated
I = for IT systems, uncoated
K= for IT systems, coated

Variant

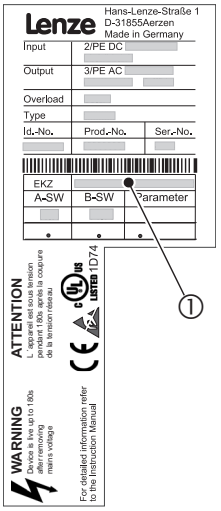
042 = Motion CiA402

Hardware version

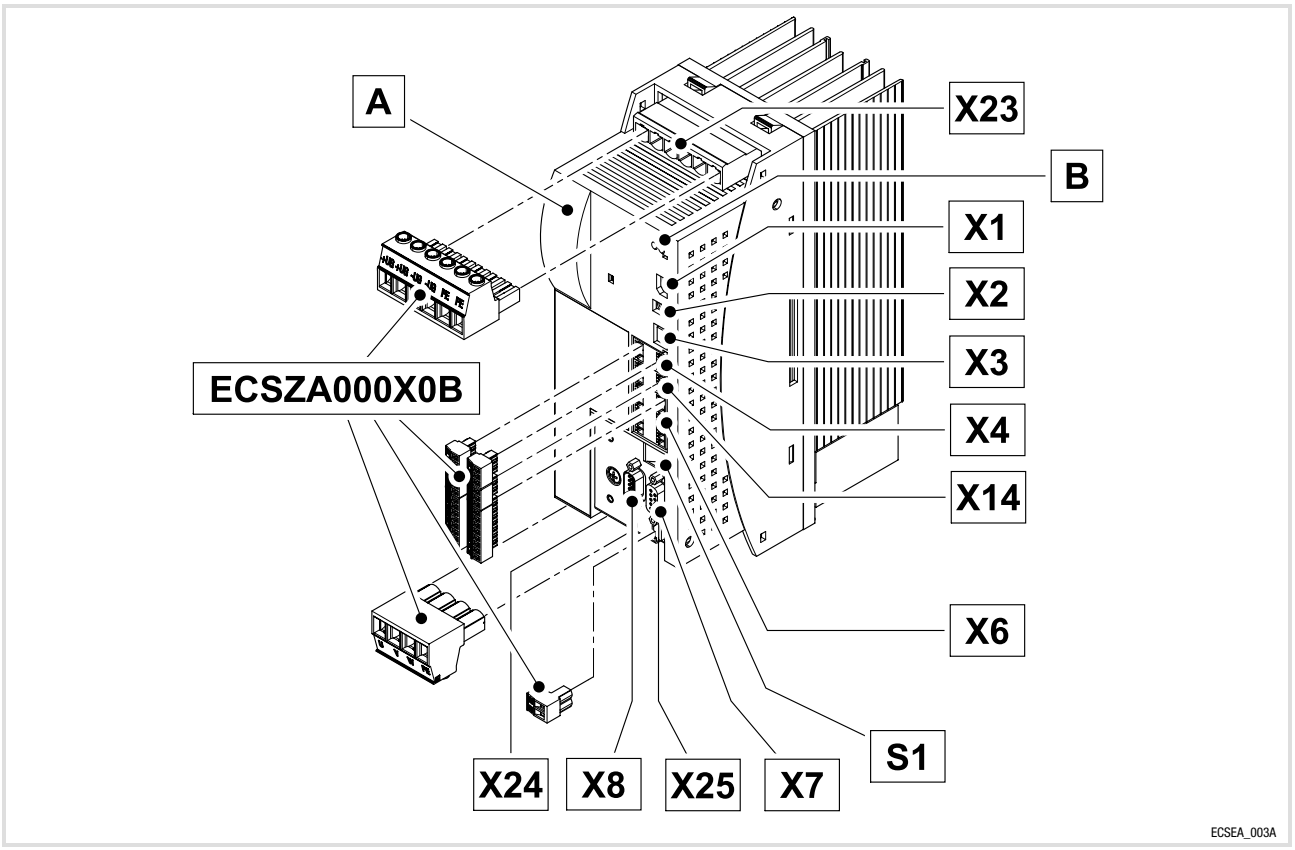
1A or higher

Operating software version (B-SW)

8.0 or higher



© 2013 Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Automation GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not take any responsibility or liability for any damage that may occur. Necessary corrections will be included in subsequent editions.


A
X23
B
X1
X2
X3
X4
X14
ECSZA000X0B
X6
S1
X24
X8
X25
X7
ECSEA_003A

Scope of supply

Position	Description	Quantity
A	ECS☐S... axis module	1
	Accessory kit with fixing material corresponding to the design (☐): ● ”E” - standard panel-mounted unit ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1
	Functional earth conductor (only ECS**D**S...)	1

Note!

The **ECSZA000X0B** connector set must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X23	Connections ● DC-bus voltage ● PE	📖 55
B	LEDs: Status and fault display	
X1	Automation interface (AIF) for ● Communication module ● Operating module (keypad XT)	 📖 80 📖 163
x2	PE connection of AIF	
X3	Analog input configuration	📖 70
X4	CAN connection ● MotionBus (CAN) / for ECSxA: System bus (CAN) ● Interface to the master control	📖 81
X14	CAN-AUXconnection ● System bus (CAN) ● PC interface/HMI for parameter setting and diagnostics	
X6	Connections ● Low-voltage supply ● Digital inputs and outputs ● Analog input ● ”Safe torque off” (formerly ”safe standstill”)	📖 65 📖 69 📖 70 📖 71
S1	DIP switch ● CAN node address ● CAN baud rate	📖 169
X7	Resolver connection	📖 87
X8	Encoder connection ● Incremental encoder (TTL encoder) ● Sin/cos encoder	📖 88
X25	Brake control connection	📖 62
X24	Motor connection	📖 61

Status displays

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibited (CINH), switch-on inhibit	Code C0183
Blinking	Off	Fault/error (TRIP) active	Code C0168/1
Blinking	On	Warning/FAIL-QSP active	Code C0168/1

1 Preface and general information 12

1.1 About these Operating Instructions 12
1.1.1 Terminology used 13
1.1.2 Code descriptions 14
1.1.3 Signal types and scaling 15
1.2 Features of the ECSxS axis module 16
1.3 Scope of supply 17
1.4 Legal regulations 18

2 Safety instructions 19

2.1 General safety and application notes for Lenze controllers 19
2.2 Thermal motor monitoring 23
2.2.1 Forced ventilated or naturally ventilated motors 24
2.2.2 Self-ventilated motors 25
2.3 Residual hazards 27
2.4 Safety instructions for the installation according to UL 29
2.5 Notes used 30

3 Technical data 31

3.1 General data and operating conditions 31
3.2 Rated data 33
3.3 Current characteristics 35
3.3.1 Increased continuous current depending on the control factor 35
3.3.2 Device protection by current derating 38

4 Mechanical installation 39

4.1 Important notes 39
4.2 Mounting with fixing rails (standard installation) 40
4.2.1 Dimensions 40
4.2.2 Mounting steps 41
4.3 Mounting with thermal separation (push-through technique) 42
4.3.1 Dimensions 43
4.3.2 Mounting steps 45
4.4 Mounting in cold-plate design 46
4.4.1 Dimensions 47
4.4.2 Mounting steps 48

5 Electrical installation 49

5.1 Installation according to EMC (installation of a CE-typical drive system) 49

5.2 Power terminals 52

5.2.1 Connection to the DC bus (+UG, -UG) 55

5.2.2 Connection plan for mimimum wiring with internal brake resistor 57

5.2.3 Connection plan for mimimum wiring with external brake resistor 59

5.2.4 Motor connection 61

5.2.5 Motor holding brake connection 62

5.2.6 Connection of an ECSxK... capacitor module (optional) 64

5.3 Control terminals 65

5.3.1 Digital inputs and outputs 69

5.3.2 Analog input 70

5.3.3 Safe torque off 71

5.4 Automation interface (AIF) 80

5.5 Wiring of system bus (CAN) 81

5.6 Wiring of the feedback system 86

5.6.1 Resolver connection 87

5.6.2 Encoder connection 88

5.6.3 Digital frequency input/output (encoder simulation) 91

6 Commissioning 93

6.1 Before you start 93

6.2 Commissioning steps (overview) 94

6.3 Carrying out basic settings with GDC 95

6.4 Loading the Lenze setting 97

6.5 Setting of mains data 98

6.5.1 Selecting the function of the charging current limitation 98

6.5.2 Setting the voltage thresholds 99

6.6 Entry of motor data for Lenze motors 100

6.7 Holding brake configuration 102

6.8 Setting of the feedback system for position and speed control 103

6.8.1 Resolver as position and speed encoder 104

6.8.2 TTL/SinCos encoder as position and speed encoder 106

6.8.3 TTL/SinCos encoder as position encoder and resolver as speed encoder 109

6.8.4 Absolute value encoder as position and speed encoder 113

6.8.5 Absolute value encoder as position encoder and resolver as speed encoder 117

6.9 Configuring the digital inputs and outputs 121
6.9.1 Setting the polarity 121
6.9.2 Setting the direction of rotation 121
6.9.3 Change of the terminal assignment 122
6.10 Selecting the operating mode/control structure 126
6.10.1 Speed control with setpoint via analog input 127
6.10.2 Speed control with setpoint via AIF 130
6.10.3 Speed control with setpoint via MotionBus (CAN) 132
6.10.4 Torque control with setpoint via analog input 134
6.10.5 Torque control with setpoint via AIF 137
6.10.6 Torque control with setpoint via MotionBus (CAN) 139
6.11 Entry of machine parameters 141
6.12 Setpoint selection 142
6.13 Controller enable (CINH = 0) 143
6.14 Quick stop (QSP) 144
6.15 Operation with motors from other manufacturers 145
6.15.1 Entering motor data manually 145
6.15.2 Checking the direction of rotation of the motor feedback system 148
6.15.3 Adjusting current controller 149
6.15.4 Effecting rotor position adjustment 151
6.16 Optimising the drive behaviour after start 154
6.16.1 Speed controller adjustment 154
6.16.2 Adjustment of field controller and field weakening controller 157
6.16.3 Resolver adjustment 160

7 Parameter setting 161
7.1 General information 161
7.2 Parameter setting with ”Global Drive Control” (GDC) 162
7.3 Parameter setting with the XT EMZ9371BC keypad 163
7.3.1 Connecting the keypad 163
7.3.2 Description of the display elements 164
7.3.3 Description of the function keys 166
7.3.4 Changing and saving parameters 167

8 Configuration 168
8.1 Configuring MotionBus/system bus (CAN) 169
8.1.1 Setting CAN node address and baud rate 169
8.1.2 Individual addressing 173
8.1.3 Defining boot-up master in the drive system 175
8.1.4 Setting of boot-up time/cycle time 176
8.1.5 Executing a reset node 178
8.1.6 Axis synchronisation (CAN synchronisation) 179
8.1.7 Monitoring of the synchronisation (sync time slot) 181
8.1.8 Axis synchronisation via CAN 182
8.1.9 Axis synchronisation via terminal X6/DI1 183
8.2 Node guarding 184
8.3 CAN management 186
8.4 Diagnostics codes 187
8.4.1 CAN bus status (C0359) 187
8.4.2 CAN telegram counter (C0360) 188
8.4.3 CAN bus load (C0361) 189
8.5 Remote parameterisation (gateway function) 190

9 Monitoring functions 192
9.1 Fault responses 193
9.2 Overview of monitoring functions 194
9.3 Configuring monitoring functions 198
9.3.1 Monitoring times for process data input objects 198
9.3.2 Time-out monitoring for activated remote parameterisation 200
9.3.3 Short circuit monitoring (OC1) 201
9.3.4 Earth fault monitoring (OC2) 201
9.3.5 Motor temperature monitoring (OH3, OH7) 202
9.3.6 Heatsink temperature monitoring (OH, OH4) 204
9.3.7 Monitoring of internal device temperature (OH1, OH5) 205
9.3.8 Function monitoring of thermal sensors (H10, H11) 206
9.3.9 Current load of controller (I x t monitoring: OC5, OC7) 207
9.3.10 Current load of motor (I2 x t monitoring: OC6, OC8) 210
9.3.11 DC-bus voltage monitoring (OU, LU) 214
9.3.12 Voltage supply monitoring - control electronics (U15) 217
9.3.13 Motor phase failure monitoring (LP1) 217
9.3.14 Monitoring of the resolver cable (Sd2) 218
9.3.15 Motor temperature sensor monitoring (Sd6) 219
9.3.16 Monitoring of the absolute value encoder initialisation (Sd7) 220
9.3.17 Sin/cos signal monitoring (Sd8) 221
9.3.18 Monitoring of the speed system deviation (nErr) 222
9.3.19 Monitoring of max. system speed (NMAX) 223
9.3.20 Monitoring of the rotor position adjustment (PL) 224

10 Diagnostics 225
10.1 Diagnostics with Global Drive Control (GDC) 225
10.2 Diagnostics with Global Drive Oscilloscope (GDO) 226
10.2.1 GDO buttons 227
10.3 Diagnostics with the XT EMZ9371BC keypad 228
10.4 Diagnostics with PCAN-View 229
10.4.1 Monitoring of telegram traffic on the CAN bus 229
10.4.2 Setting all CAN nodes to the ”Operational” status 231

11 Troubleshooting and fault elimination 232
11.1 Fault analysis 232
11.1.1 Fault analysis via the LED display 232
11.1.2 Fault analysis with keypad XT EMZ9371BC 232
11.1.3 Fault analysis with the history buffer 233
11.1.4 Fault analysis via LECOM status words (C0150/C0155) 235
11.2 Malfunction of the drive 237
11.3 Fault messages 238
11.3.1 Causes and remedies 238
11.3.2 Reset fault messages (TRIP-RESET) 246

12 Function library 247
12.1 AIF (Automation interface management) 247
12.2 AIF1In 248
12.3 AIF1Out 251
12.4 AIF2In 256
12.5 AIF2Out 258
12.6 AIF3In 261
12.7 AIF3Out 263
12.8 AIn1 266
12.9 CAN (CAN management) 267
12.10 CANSync (CAN bus synchronisation) 270
12.11 CAN1In 273
12.12 CAN1Out 276
12.13 CAN2In 282
12.14 CAN2Out 285
12.15 CAN3In 288
12.16 CAN3Out 291
12.17 DCTRL 294
12.17.1 Quick stop (QSP) 297
12.17.2 Operation inhibit (DISABLE) 297
12.17.3 Controller inhibit (CINH) 297
12.17.4 Setting TRIP (TRIP-SET) 298
12.17.5 Resetting TRIP (TRIP-RESET) 298
12.17.6 Axis module status 299
12.18 DFIN (master frequency input) 301
12.19 DFOUT (master frequency output) 304
12.20 DigIn (freely assignable digital inputs) 307
12.21 DigOut (freely assignable digital outputs) 308

12.22 FCODE (free codes) 309
12.23 FIXED (output of constant signals) 312
12.24 InNeg 313
12.25 OutNeg 315
12.26 SYS 317
12.27 Speed (speed control) 318
12.27.1 Changing the direction of rotation 325
12.27.2 Setpoint processing 326
12.27.3 Setting of motor control 332
12.27.4 Holding brake control 340
12.28 Torque (torque control) 343
12.28.1 Torque control with speed limitation 349
12.28.2 Changing the direction of rotation 350
12.28.3 Setpoint processing 351
12.28.4 Setting of motor control 354
12.28.5 Holding brake control 360

13 Appendix 363

13.1 Code table 363
13.2 Selection lists for signal linking 428
13.2.1 List of the digital signal sources 428
13.2.2 List of the analog signal sources 437
13.2.3 List of the phase signal sources 440
13.3 General information about the system bus (CAN) 441
13.4 Communication with MotionBus/system bus (CAN) 442
13.4.1 Structure of the CAN data telegram 442
13.4.2 Communication phases of the CAN network (NMT) 444
13.4.3 Process data transfer 447
13.4.4 Parameter data transfer 454
13.4.5 Addressing of the parameter and process data objects 460
13.5 Overview of accessories 462
13.5.1 Connector sets 462
13.5.2 Shield mounting kit 462
13.5.3 Components for operation and communication 463
13.5.4 Brake resistor 464
13.5.5 Mains fuses 466
13.5.6 Mains chokes 467
13.5.7 RFI filters 468

14 Index 469

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions will assist you in connecting and commissioning the ECSxS... axis modules.

They contain safety instructions which must be observed!

All persons working on and with the ECSxS... axis modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.1.1 Terminology used

Term	In the following text used for
Power supply module ECSxE...	ECSxE... power supply module
Capacitor module ECSxK...	ECSxK... capacitor module
Axis module Controller Standard device ECSxS... ECSxP... ECSxM... ECSxA ...	Axis module of the ECS series ● ECSxS... - ”Speed and Torque” ● ECSxP... - ”Posi and Shaft” ● ECSxM... - ”Motion” ● ECSxA... - ”Application”
Drive system	ECS drive system consisting of: ● ECSxE... power supply module ● Axis module ECSxS... / ECSxP... / ECSxM... / ECSxA... ● ECSxK series capacitor module (optional) ● further Lenze drive components (accessories)
24 V supply Low-voltage supply	Voltage supply ● of the control card, voltage range 20 ... 30 V DC (±0 V) ● of the ”safe torque off” function (formerly ”safe standstill”), voltage range 18 ... 30 V DC (±0 V) ● of the motor holding brake, voltage range 23 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
System bus (CAN)	Lenze standard bus system based on *CANopen* for ● communication with a higher-level host system (PLC) or further controllers. ● parameter setting and diagnostics.
MotionBus (CAN)	The ”MotionBus (CAN)” term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.
DDS	Drive PLC Developer Studio (Lenze software for PLC programming acc. to IEC 61131)
GDC	Global Drive Control (Lenze software for parameter setting and diagnostics)
GDO	Global Drive Oscilloscope (additional diagnostic tool of the GDC)
Cxxxx	Code Cxxxx (e.g. C0351) Parameters which serve to parameterise or monitor the controller.
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on terminal strip Xk (e.g. X6/B+ = terminal B+ on terminal strip X6)

1.1.2 Code descriptions

Lenze codes are described in the form of tables with the following structure:

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	Cxxxx 1	Subcode 1 of Cxxxx
	Cxxxx 2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Example

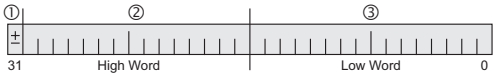
Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0003	Par save	0				Non-volatile saving of parameter set
			0	No response		
			1	Save parameter set		
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2

1.1.3 Signal types and scaling

A signal type can be assigned to most inputs and outputs of the Lenze function blocks/system blocks. The following signal types are distinguished:

- ► digital and analog signals
- ► position and speed signals

The identifier of the corresponding input/output variable has an ending (starting with an underscore). It indicates the signal type.

Signal		Ending	Memory	Scaling (external size ≡ internal size)
Type	Symbol			
Analog	H/L	_a (analog)	16 Bit1	100 % ≡ 16384
Digital	Disp	_b (binary)	1 bit	0 ≡ FALSE; 1 ≡ TRUE
Angular difference or speed (rot.)	Δ	_v (velocity)	16 Bit1	15000 rpm ≡ 16384
		● Angular difference/speed ref. to 1 ms ● Normalisation example: $Speed\ (on\ motor\ side) = 15000\ [rpm] = \frac{15000}{60\ [s]}$ $1\ motor\ revolution = 65536\ [inc]$ $Variable\ value\ (..._v) = \frac{15000}{60000\ [ms]} \cdot 65536\ [inc] = 16384\ \left[\frac{inc}{ms}\right]$		
Angle or position	▲	_p (position)	32 Bit	1 motor revolution ≡ 65536
		 ① Direction (0 ≡ clockwise rotation; 1 ≡ counter-clockwise rotation) ② No. of motor revolutions (0 ... 32767) ③ Angle or position (0 ... 65535)		

Due to their scaling, analog signals have an asymmetrical resolution range (-200 % ... +199.99 %):

External:	-200 %	-100 %	0 %	+100 %	+199.99 %
Internal:	-32768	-16384	0	+16384	+32767

1.2 Features of the ECSxS axis module

- Safety function ”safe torque off” (formerly ”safe standstill”)
- Speed control/torque control with the subfunctions:
  - Selectable direction of rotation
  - Setpoint conditioning
  - Motor control
  - Brake control
  - Monitoring functions
- The functions are described as **function blocks** (FB) according to IEC 61131-3 (see chapter ”12 Function library” (📖 247)).
- Selectable control interfaces (via code C3005):
  - Automation interface (AIF)
  - CAN (PDO1 (sync-based), PDO2, PDO3)
- Double CAN ON BORD
  - **MotionBus (CAN):**
    Interface X4 ”CAN” (PDO1, Sync-based) for communicating with a higher-level host system (PLC) or further controllers.
  - **System bus (CAN):**
    Interface X14 ”CAN-AUX” for parameter setting and diagnostics
- Automation interface (AIF)
  - Connection to other fieldbus systems with Lenze communication modules (e.g. EMF2133IB PROFIBUS-DP)
  - Connection of the XT EMZ9371BC keypad for parameter setting and diagnostics
- Supported feedback systems:
  - Resolver with and without position storage
  - Encoder (incremental encoder (TTL encoder), sin/cos encoder)
- Commissioning, parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC) or the XT EMZ9371BC keypad

1.3 Scope of supply

The scope of supply of the ECSxS... axis module includes:

- Standard device
- Accessory kit with fixings according to the design:
  – ”E” - panel-mounted device
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting Instructions
- Drilling jig
- Functional earth conductor (only ECS**D**S...)

Accessories

The appendix includes information on the following accessories: (📖 462).

- Connector sets for
  – power supply modules: ECSZE000X0B
  – capacitor modules: ECSZK000X0B
  – axis modules: ECSZA000X0B
- ECSZS000X0B001 shield mounting kit (EMC accessories)
- Components for operation and communication
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters



Tip!

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

http://www.Lenze.com

1.4 Legal regulations

Identification	Nameplate	CE designation	Manufacturer
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Automation GmbH Grünstraße 36 D-40667 Meerbusch
Application as directed	**ECSxS... axis modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for open and closed loop control of variable speed drives with PM synchronous motors and asynchronous motors. – for installation into a machine – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective 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 for industrial purposes only. **Drive systems with ECSxS... axis modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at public and non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to axis modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these Instructions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damages and failures caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the axis module – Operating errors – Improper working on and with the axis module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems 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

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

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):

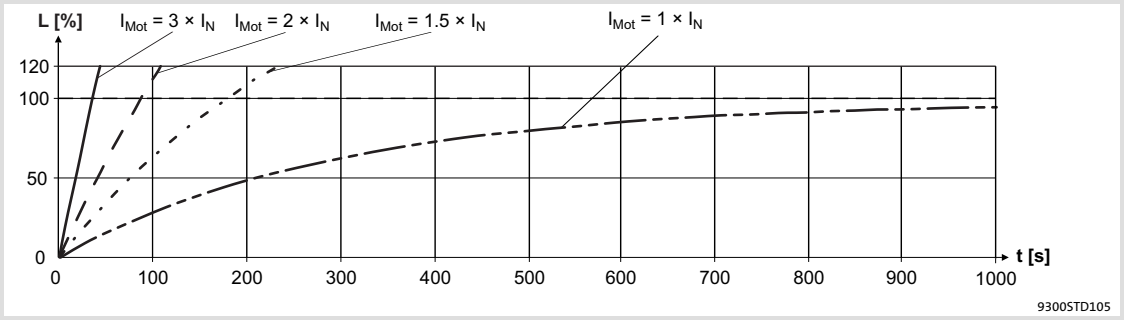


Fig. 2-1 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

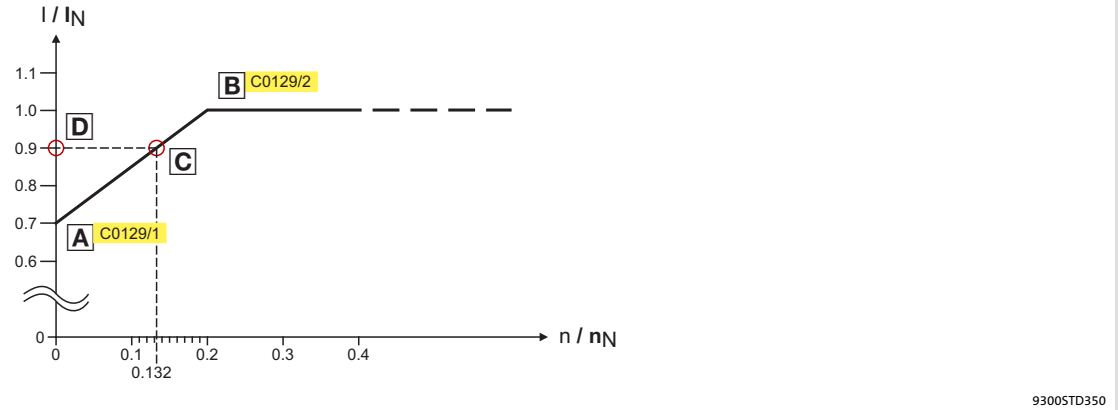


Fig. 2-2 Working point in the range of characteristic lowering

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", 📖 26)

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 axis module, check that no voltage is applied to the power terminals, because
  - the power terminals +UG, -UG, U, V and W remain live for at least 3 minutes after mains switch-off.
  - the power terminals +UG, -UG, U, V and W remain live when the motor is stopped.
- The heatsink has an operating temperature of > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The discharge current to PE is > 3.5 mA AC or. > 10 mA DC.
  - EN 61800-5-1 requires a fixed installation.
  - The PE connection must comply with EN 61800-5-1.
  - Comply with the further requirements of EN 61800-5-1 for high discharge currents!

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG, U, V, W and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Power must not be converted until all devices of the power system are ready for operation. Otherwise, the input current limitation may be destroyed.

Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the axis module, if

- the axis module is supplied via the ECSxE supply module and the input current limitation is activated depending on the DC-bus voltage (C0175 = 1 or 2).
- the axis module is not supplied via a supply module delivered by Lenze.
- the low-voltage supply (24 V) is switched off.

For this reason allow a break of at least three minutes between two starting operations!

Use the safety function ”Safe torque off” (STO) for frequent disconnections for safety reasons.

Motor protection

- Only use motors with a minimum insulation resistance of û = 1.5 kV, min. du/dt = 5 kV/µs.
  – Lenze motors meet these requirements.
- When using motors with an unknown insulation resistance, please contact your motor supplier.
- Some settings of the axis module lead to an overheating of the connected motor, e.g. longer operation of self-ventilated motors with low speeds.
- Use PTC thermistors or thermostats with PTC characteristic for motor temperature monitoring.

2.4 Safety instructions for the installation according to UL

Warnings!

General markings:

- ► Use 60/75 °C or 75 °C copper wire only.
- ► Maximum ambient temperature 55 °C, with reduced output current.

Markings provided for the supply units:

- ► Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480 V max, when protected by K5 or H Fuses (400/480 V devices).
- ► Alternate - Circuit breakers (either inverse-time, instantaneous trip types or combination motor controller type E) may be used in lieu of above fuses when it is shown that the let-through energy (i^2t) and peak let-through current (I_p) of the inverse-time current-limiting circuit breaker will be less than that of the non-semiconductor type K5 fuses with which the drive has been tested.
- ► Alternate - An inverse-time circuit breaker may be used, sized upon the input rating of the drive, multiplied by 300 %.

Markings provided for the inverter units:

- ► The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 2nd ed., Table 5.1.
- ► The devices are provided with integral overload and integral thermal protection for the motor.
- ► The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X 21, X 22, X 23, X 24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X 25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X 21, X 22, X 23, X 24	12 ... 8
X4, X6, X14	28 ... 16
X 25	24 ... 12

2.5 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.

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (2006/95/EG)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
		CSA 22.2 No. 14	
Max. permissible Motor cable length	shielded	50 m	For rated mains voltage and switching frequency of 8 kHz
Packaging (EN ISO 4180)		Shipping package	
Installation		• Installation into IP20 control cabinet • For the ”safe torque off” function (formerly ”safe standstill”): mounting in IP54 control cabinet	
Mounting position		vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm With ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	can be mounted directly side by side without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) • Atmospheric pressure: 86 ... 106 kPa • Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl • Reduce rated output current by 5 %/1000 m above 1000 m amsl. • Over 2000 m amsl: Use is only permitted in environments with overvoltage category II
Pollution		EN 61800-5-1, UL840: Degree of pollution 2	
Vibration resistance		Acceleration resistant up to 0.7 g (Germanischer Lloyd, general conditions)	

General electrical data			
EMC	Compliance with the requirements acc. to EN 61800-3		
Noise emission	Compliance with the limit class C2 acc. to EN 61800-3 (achieved by using collective filters typical for the application)		
Noise immunity	Requirements acc. to EN 61800-3		
	Requirement	**Standard**	**Severity**
	ESD [1]	EN 61000-4-2	3, i. e. ● 8 kV for air discharge ● 6 kV for contact discharge
	Conducted high frequency	EN 61000-4-6	10 V; 0.15 ... 80 MHz
	RF interference (housing)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (surge voltage on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase/phase ● 2 kV phase/PE
Insulation resistance	EN61800-5-1, UL840: Overvoltage category III		
Discharge current to PE (Acc. to EN 61800-5-1)	> 3.5 mA AC		
Enclosure	IP20 for ● Standard installation (built-in unit) ● Cold-plate technique ● Mounting with thermal separation (push-through technique), IP54 on heatsink side		
Protective measures against	● Short circuit in power terminals – Motor terminal has a limited protection against short circuit (after short circuit detection, the error message must be reset.) ● Short circuit in auxiliary circuits – Digital outputs: Short-circuit-proof – Bus and encoder systems: Limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:) ● Earth fault (earth-fault protected during operation, limited earth-fault protection on mains power-up) ● Overvoltage ● Motor stalling ● Motor overtemperature (input for KTY, I^2 x t monitoring)		
Protective insulation of control circuits	**Protective separation from the mains** Double/reinforced insulation acc. to EN 61800-5-1		

[1] Noise immunity in the above-mentioned severities must be guaranteed by the control cabinet! The user must check the compliance with the severities!

3.2 Rated data

Rated data		Type	Axis module					
			ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains		S_{rated} [kVA]	1.3		2.6		5.3	
Data for operation with upstream power supply module on mains voltage		V_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	2.5	2.0	4.9	3.9	9.8	7.8
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	2.0	1.6	4.0	3.2	8.0	6.4
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	1.4	1.1	2.7	2.2	5.3	4.2
Max. output current (acceleration current)		I_{max} [A]	4.0		8.0		16.0	
Continuous current at standstill (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	2.0	1.6	4.0	3.2	8.0	6.4
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	2.3		4.6		9.1	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	3.0		6.0		12.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	1.5		3.0		6.0	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	27.3		46.3		84.7	
	Inside the device		13.3		17.3		20.7	
	Heatsink		14.0		29.0		64.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4					

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Rated data		Type	Axis module					
			ECSx□032		ECSx□048		ECSx□064	
Output power 400 V mains		S_{rated} [kVA]	8.3		11.2		13.2	
Data for operation with upstream power supply module on mains voltage		U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		V_{DC-bus} [V]	15 ... 770					
DC-bus current		I_{DC-bus} [A]	15.6	12.5	20.9	16.8	24.5	19.6
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20°C)		I_r [A]	12.7	10.2	17.0	13.6	20.0	16.0
Rated output current at 8 kHz (at an ambient temperature of 20°C it causes a heatsink temperature of 70°C) [1]		I_r [A]	8.5	6.8	11.3	9.0	13.3	10.6
Max. output current (acceleration current)		I_{max} [A]	32.0		48.0		64.0	
Continuous current at standstill [2] (holding current at 90°C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	16.0	12.8	23.0	18.4	27.0	21.6
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	18.1		27.2		36.3	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	24.0		36.0		48.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	12.1		18.1		24.2	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Total	P_{loss} [W]	144.5		166.5		199.0	
	Inside the device		27.5		34.5		41.0	
	Heatsink		117.0		132.0		158.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	approx. 2.4		approx. 3.3			

1) If the heatsink temperature reaches 70°C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured heatsink temperature (C0061).

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

3.3 Current characteristics

3.3.1 Increased continuous current depending on the control factor

In the lower speed range – the motor does not need the full motor voltage – particularly the more powerful ECS axis modules can be permanently operated with increased output current (cp. continuous current $I_{0,eff}$ 📖 33).

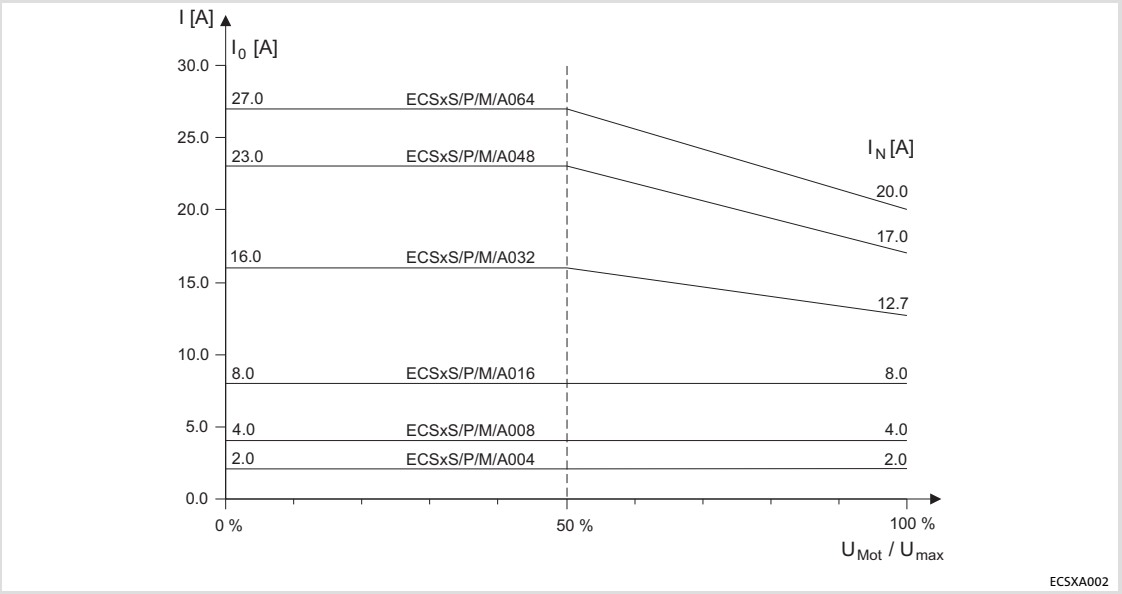


Fig. 3-1 Continuous device current, depending on the output voltage for $U_{mains} \leq 400$ V at 4 kHz

I_r	Rated output current of the axis module
U_{Mot_n}	Actual controller output voltage
U_{Mot_max}	0.9 x current mains voltage

The permissible continuous current depends on the control factor of the power output stages, approximately on the ratio of the motor voltage output in the operating point (U_{Mot_n}) to the maximum possible output voltage (U_{Mot_max}). Due to voltage drops across the components involved at rated load and a control margin, U_{Mot_max} can be estimated with 90 % of the mains voltage.

Tip!

The operating threshold of the device utilisation monitoring (I x t) function is automatically adapted to the continuous device current which changes depending on the output voltage (see fig.).

The following table shows the connections between mains voltage, DC-bus voltage and motor voltage:

Mains voltage [U_{mains}]	DC-bus voltage [$U_{DC} = U_{mains}$ x 1.35]	Output voltage (motor voltage) nominally achievable for 100 % modulation [$U_{mot} = 0.66 \times U_{DC}$]
3 x 230 V AC	310 V DC	3 x 205 V AC
3 x 380 V AC	510 V DC	3 x 340 V AC
3 x 400 V AC	540 V DC	3 x 360 V AC
3 x 415 V AC	560 V DC	3 x 370 V AC
3 x 460 V AC	620 V DC	3 x 415 V AC
3 x 480 V AC	650 V DC	3 x 435 V AC
3 x 528 V AC	712 V DC	3 x 475 V AC

For steady-state operation in generator mode with increased DC-bus voltage or supply from a closed-loop DC-voltage source, interpolate accordingly between the values given in the table.

The increased rated currents are valid for the entire voltage range specified at switching frequencies of 4 kHz and 8 kHz.

Note!

If in this connection a heatsink temperature of > 70 °C is reached, the drive switches to a switching frequency of 4 kHz, independently of the selected switching frequency.

Example:

The ECS axis module suitable for operation in conjunction with a Lenze motor of type MCS 14L32 is to be determined.

- Rated motor data
  - Rated motor torque (M_{mot}) = 17.2 Nm
  - Rated motor speed (n_{mot}) = 3225 rpm
  - Motor voltage at 3250 rpm (U_{mot_n3250}) = 275 V
  - Rated motor current (I_{mot}) = 15 A
  - Max. motor current (I_{mot_max}) = 92 A
- Application data:
  - Max. torque (M_{max}) = 35 Nm
  - Max. operating speed (n_{max}) = 2500 rpm
  - An effective process power (P_{eff}) of 4.5 kW arises on the basis of the Mn diagram.
  - The drive rating results in an effective motor current (I_{Mot_eff}) of 14.8 A.

A first estimation based on the rated current of the ECS axis module would probably lead to selecting the ECSxS048 module with a rated current of 17.0 A.

However, if we take into account the increased continuous current for smaller control factors, the more cost-effective ECSxS032 axis module with a rated current of 12.7 A can be used here.

- When the MCS 14L32 is operated with 2500 rpm, the real motor voltage is (U_{Mot_n2500}):

$$U_{Mot\_n2500} = U_{Mot\_n3250} \cdot \frac{n_{max}}{n_{Mot}} \quad \Rightarrow \quad 275\ V \cdot \frac{2500\ rpm}{3250\ rpm} = 212\ V$$

- This leads to the following max. control factor (α_{max}) of the axis module:

$$\alpha_{max} = \frac{U_{Mot\_n2500}}{U_{max}} \quad \Rightarrow \quad \frac{212\ V}{360\ V} = 0.59 = 59\ \%$$

  Using the current characteristic of Fig. 3-1 (📖 35), a continuous current of 15.5 A can be determined for the ECSxS032 axis module when the control factor (α_{max}) is 59 %.

- **Result:**

  Under the conditions mentioned above the MCS 14L32 Lenze motor can be operated continuously on the ECSxS032 axis module.

3.3.2 Device protection by current derating

The maximum output current is limited. With output frequencies < 5 Hz the limitation depends on the heatsink temperature.

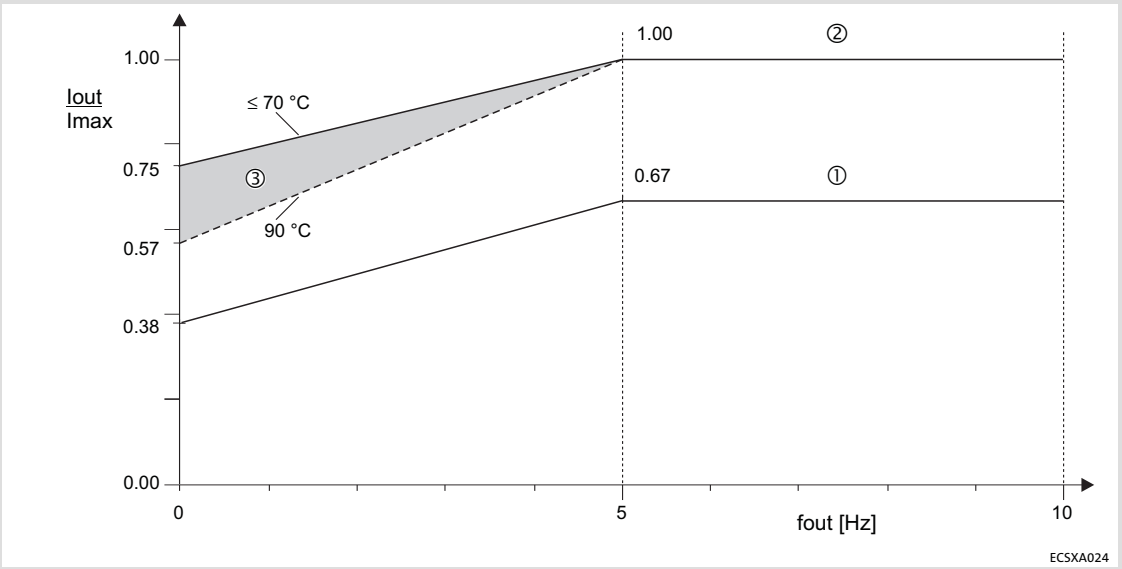


Fig. 3-2 Current derating characteristics

① Operation with switching frequency = 8 kHz (C0018 = 1).
- If the current exceeds the characteristic ①, the switching frequency is automatically changed to 4 kHz (e.g. for higher torque in acceleration processes).

② Operation with switching frequency = 4 kHz (C0018 = 0).
- The current limitation follows the characteristic ②.
- With output frequencies < 5 Hz and heatsink temperatures between 70 and 90 °C the current limit is steplessly adjusted in the range ③.

Type	I_{max} [A]				
	Switching frequency 8 kHz ①		Switching frequency 4 kHz ②		
	f_{out} > 5 Hz	f_{out} → 0 Hz	f_{out} > 5 Hz	f_{out} → 0 Hz ≤ 70 °C	f_{out} → 0 Hz 90 °C
ECSxS004	2.7	1.5	4.0	3.0	2.3
ECSxS008	5.3	3.0	8.0	6.0	4.6
ECSxS016	10.7	6.0	16.0	12.0	9.1
ECSxS032	21.3	12.1	32.0	24.0	18.1
ECSxS048	32.0	18.1	48.0	36.3	27.2
ECSxS064	42.7	24.2	64.0	48.0	36.3

4 Mechanical installation

4.1 Important notes

- Axis modules of the ECS series provide IP20 enclosure and can therefore only be used for installation in control cabinets.
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions:
  - Vertical at the mounting plate
  - DC bus connections (X23) at the top
  - Motor connection (X24) at the bottom
- Maintain the specified clearances (above and below) to other installations!
  - If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  - must be electrically conductive.
  - must not be varnished.
- In case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

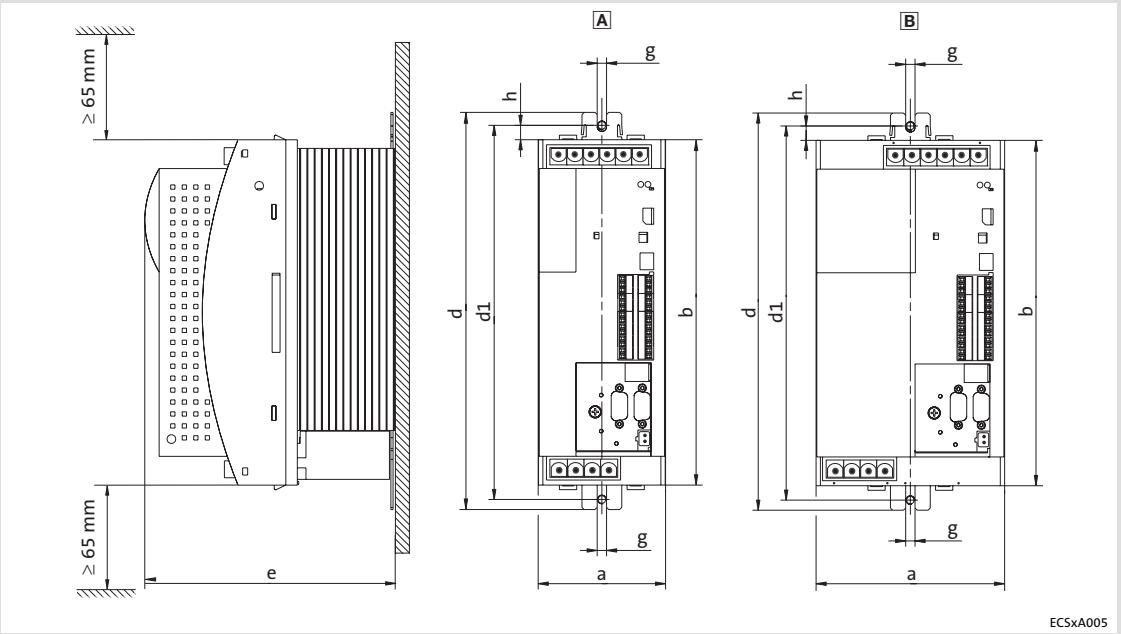


Fig. 4-1 Dimensions for ”panel-mounted” design

Axis module		Dimensions [mm]						
Type	Size	a	b	d	d1	e	h	g
ECSE☐004	A	88,5	240	276	260	176 212 1)	10	6,5 (M6)
ECSE☐008								
ECSE☐016								
ECSE☐032								
ECSE☐048	B	131						
ECSE☐064								

1) Max. 212 mm, depending on the plugged-on communication module

☐ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.2.2 Mounting steps

How to install the axis module:

1. Prepare the fixing holes on the mounting surface.
   – Use the drilling jig for this purpose.
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: Push in the long side.
   – From below: Push in the short side.
4. Attach the axis module to the mounting surface.

4.3 Mounting with thermal separation (push-through technique)

For the push-through technique the rear panel of the control cabinet must be a steel plate with a thickness of at least 2 mm.

The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the axis module).

Cooling

With the separated heatsink the heat generation in the control cabinet can be reduced.

- Distribution of the power loss:
  - approx. 65 % via separated cooler
  - approx. 35 % in the inside of the axis module
- Protection class of the separated cooler: IP54
  - The sealing surface at the heatsink of the axis module must rest completely against the mounting plate.
  - Use a liquid thread sealant to bond the screws of the clamps.
- For sufficient cooling of the drive system:
  - Air flow behind the rear panel of the control cabinet must be $\geq$ 3 m/s (e.g. by means of a collective fan).
- With sufficient cooling, the rated data of the axis modules remain valid.

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

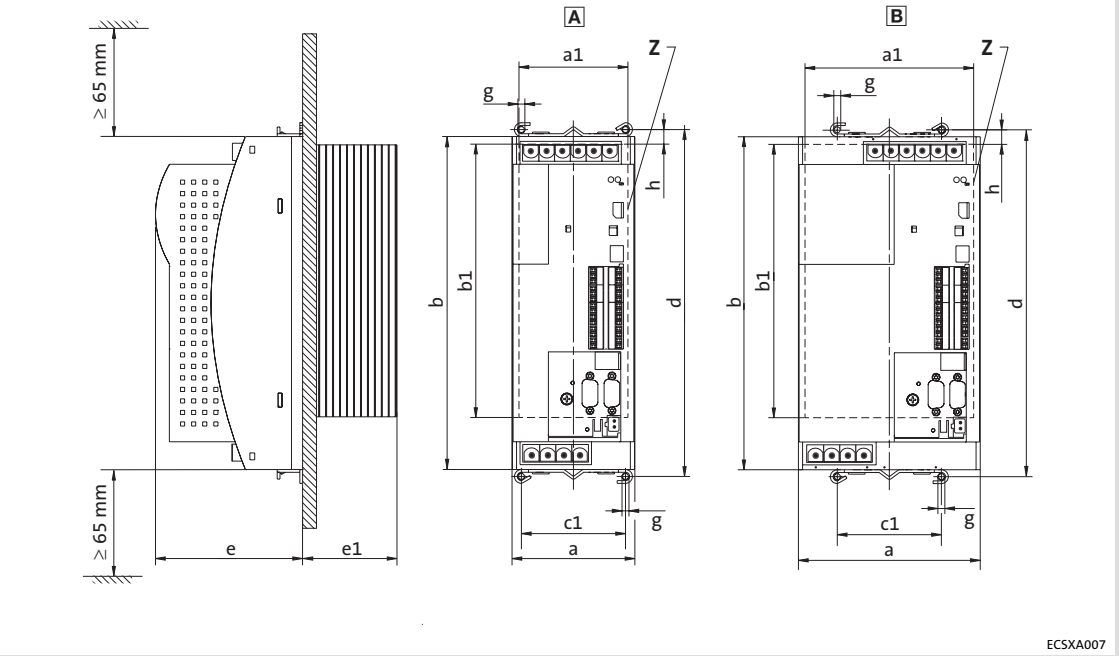


Fig. 4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 📖 44

Axis module		Dimensions [mm]									
Type	Size	a	a1	b	b1	c1	d	e	e1	g	h
ECSD□004	A	88,5	78,5	240	197	75	250	109 145 [1]	67	M5	10,5
ECSD□008											
ECSD□016											
ECSD□032											
ECSD□048	B	131	121,5								
ECSD□064											

1) Max. 145 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

Dimensions of mounting cutout

Note!

Installation with shield mounting ECSZS000X0B:

► Clearance below the mounting cutout > 220 mm

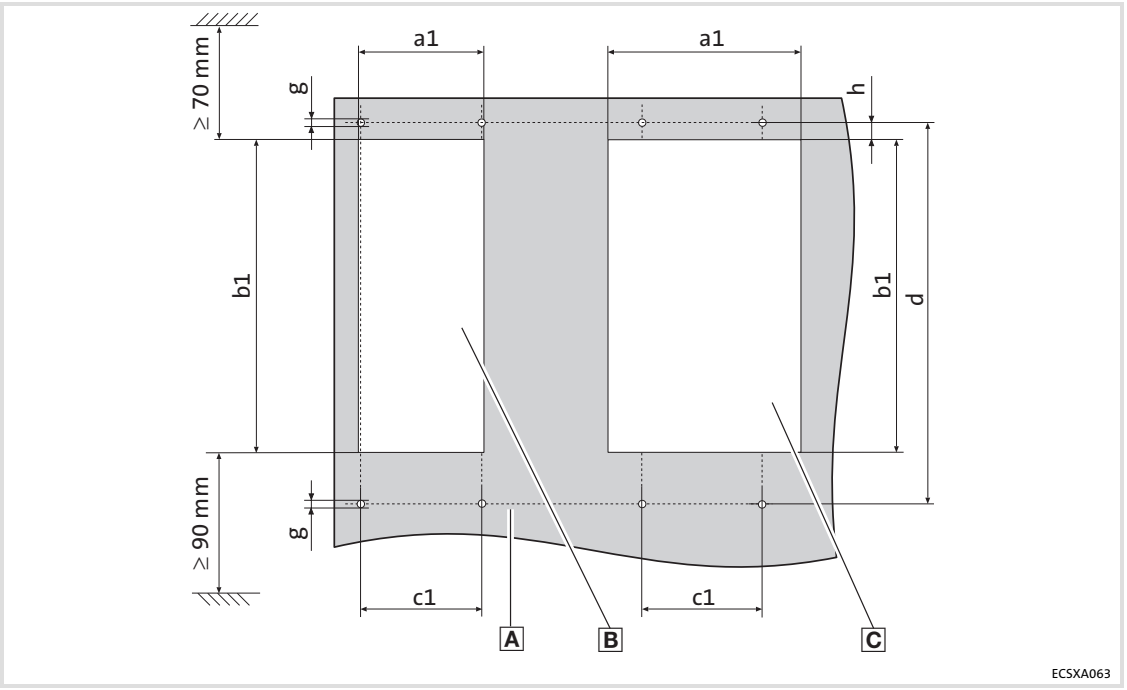


Fig. 4-3 Dimensions of mounting cutout

A Mounting surface
B Mounting cutout for size A
C Mounting cutout for size B

Axis module		Dimensions [mm]					
Type	Size	a1	b1	c1	d	g	h
ECSD□004	A	78,5	197	75	250	M5	10,5
ECSD□008							
ECSD□016							
ECSD□032							
ECSD□048	B	121,5					
ECSD□064							

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.3.2 Mounting steps

How to mount the axis module:

1. Prepare the fixing holes for the wire clamps on the mounting area.
   For this purpose, apply a drilling jig.
2. Prepare the mounting cutout.
   The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the axis module).
3. Apply liquid thread sealant to the threads of the screws for the wire clamps.
4. Fix the wire clamps together with the functional earth conductor supplied (Fig. 4-4).
   The functional earth conductor is part of the scope of supply of the ECS**D**x... axis module
5. Push the axis module into the mounting cutout.
6. Engage axis module in the wire clamp at the top and the bottom.
7. Connect the functional earth conductor to the axis module (Fig. 4-4).

Note!

Fixing the functional earth conductor to the ECS**D**x... axis module is required for a better electromagnetic compatibility (EMC).

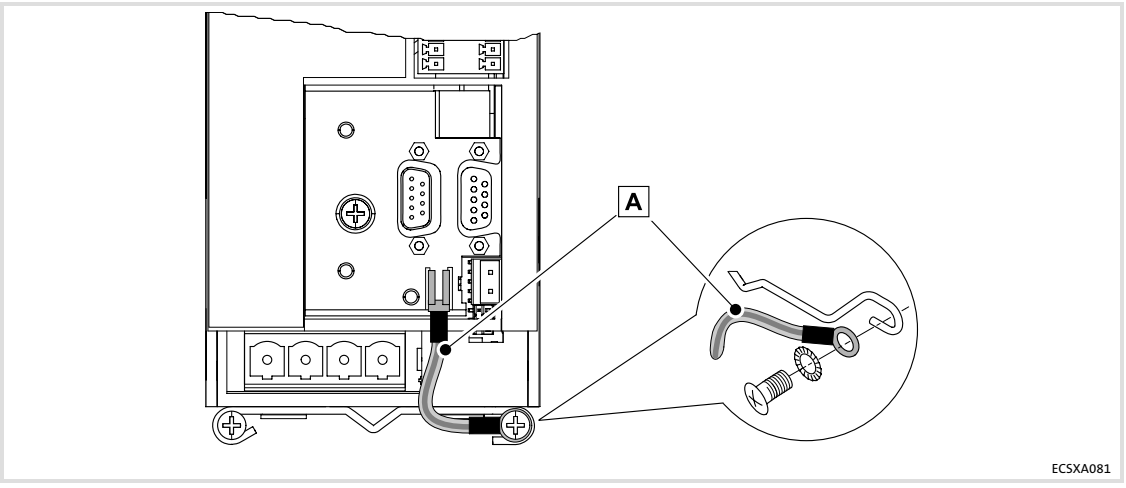


Fig. 4-4 Functional earth conductor at the ECSDx... axis module

A Functional earth conductor

4.4 Mounting in cold-plate design

The axis modules ECSC... are intended for mounting in cold-plate design (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure a safe operation of the axis modules:

- Good thermal contact with the cooler
  - The contact surface between collective cooler and axis module must be at least as large as the cooling plate of the axis module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Connect the collective cooler with all specified screwed connections to the axis module.
- Maintain the thermal resistance R_{th} according to the table.
  - The values apply for operating the axis modules under rated conditions.

Axis module Type	Power to be dissipated Ploss [W]	Heat sink - environment R_{th} [k/W]
ECSC□004	14.0	0,31
ECSC□008	29.0	
ECSC□016	64.0	
ECSC□032	117.0	0,13
ECSC□048	132.0	
ECSC□064	158.0	0,11

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

- Ambient conditions:
  - Furthermore the rated data regarding the ambient temperature and the derating factors at increased temperature apply to the axis modules (📖 31 et seqq.).
  - Temperature of the cooling plate (”Cold Plate”): max. +85 °C

4.4.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

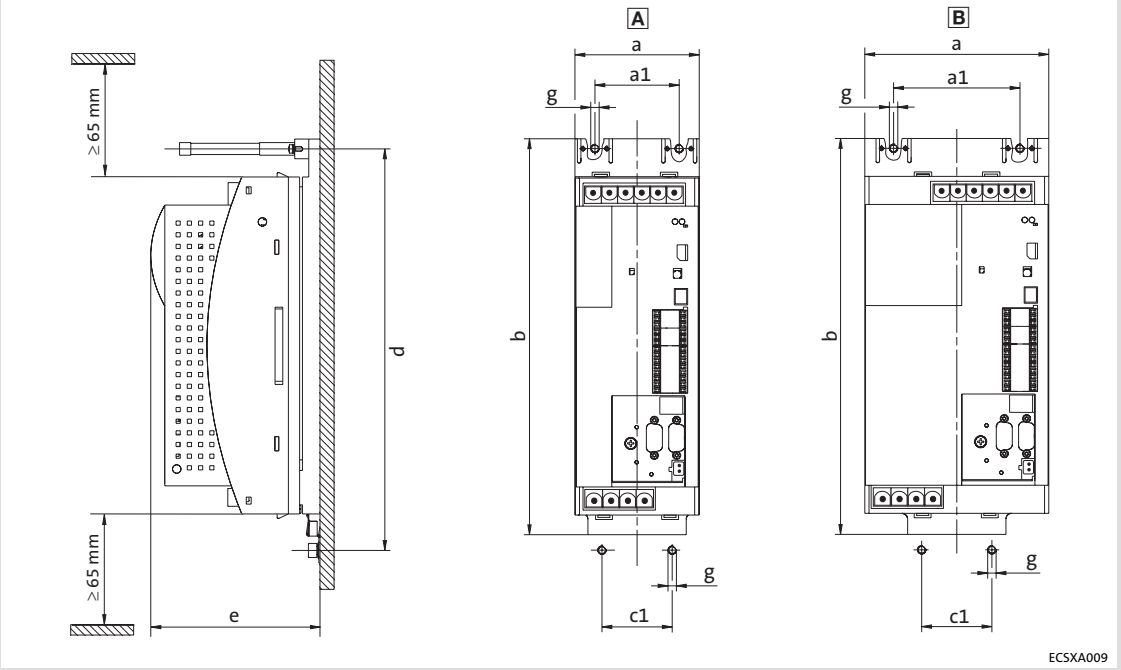


Fig. 4-5 Dimensions for "cold-plate design"

Axis module		Dimensions [mm]						
Type	**Size**	**a**	**a1**	**b**	**c1**	**d**	**e**	**g**
ECSC□004	A	88,5	60	282	50	287	121 157 1)	M6
ECSC□008								
ECSC□016								
ECSC□032								
ECSC□048	B	131	90					
ECSC□064								

1) Max. 157 mm, depending on the plugged-on communication module

□ Application software: S = Speed & Torque P = Posi & Shaft
M = Motion A = Application

4.4.2 Mounting steps

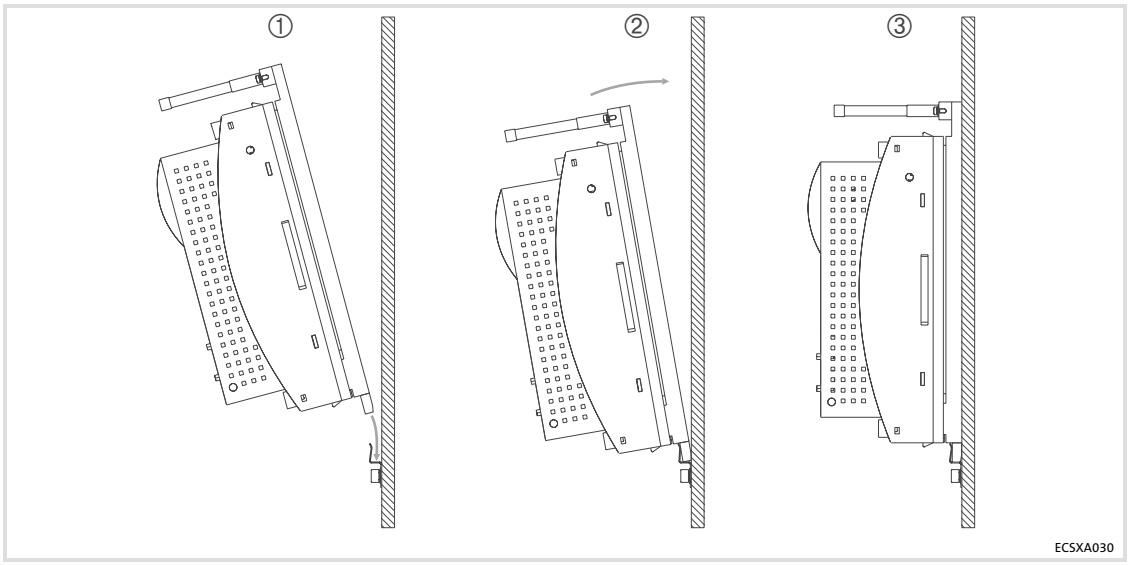


Fig. 4-6 Mounting for "cold-plate design"

Proceed as follows to mount the axis module:

1. Prepare the fixing holes on the mounting plate.
   – Use a drilling jig for this purpose.
2. Clean and degrease the contact area of collective cooler and heatsink of the axis module (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Insert the axis module from above ① into the support ② and fasten the two stud bolts with 3.5 ... 4.5 Nm ③.

Note!

Penetration depth of the screws into the collective cooler: approx. 15 mm!

Tip!

The heat transfer resistance is reduced if - following step 2. -
► a thin layer of heat conducting paste is applied to the contact surface or
► heat conducting foil is used.

5 Electrical installation

5.1 Installation according to EMC (installation of a CE-typical drive system)

General information

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Assembly
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the evaluation of the conformity to the EMC Directive requires a check of the machine or system regarding the EMC limit values. This for instance applies to:
  - Use of unshielded cables
  - Use of collective interference filters instead of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the ECS modules, these devices may be electromagnetically affected by the ECS modules.

Assembly

- Connect the ECS modules, RFI filters, and mains choke to the earthed mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow for permanent contact.
  - Painted plates are not suitable for an EMC-compliant installation.
- If you use the ECSxK... capacitor module:
  - Install the capacitor module between the power supply module and the axis module(s).
  - If the total cable length in the DC-bus connection is > 5 m, install the capacitor module as close as possible to the axis module with the greatest power.
- If you use several mounting plates:
  - Connect as much surface of the mounting plates as possible (e.g. with copper bands).
- Ensure the separation of the motor cable and the signal or mains cables.
- Avoid a common terminal/power strip for the mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filters

Only use RFI filters and mains chokes which are assigned to the power supply modules:

- RFI filters reduce impermissible high-frequency interferences to a permissible value.
- Mains chokes reduce low-frequency interferences which in particular depend on the motor cables and their lengths.

Shielding

- Connect the motor cable shield to the axis module
  - with the ECSZS000X0B shield mounting kit.
  - extensively to the mounting plate below the axis module.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor protection switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to each other and connect them to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing extensively to PE:
  - Metal glands at the motor terminal box ensure an extensive connection of the shield and the motor housing.
- Shield UG cables and control cables from a length of 0.3 m:
  - Connect both shields of the digital control cables.
  - Connect one shield end of the analog control cables.
  - Always connect the shields to the shield connection at the axis module over the shortest possible distance.
- Use of the ECS modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥10 dB . This can be achieved by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (e.g. ECS modules, RFI filters, motor filters, mains chokes) using suitable cables connected to a central earthing point (PE rail).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Power terminals

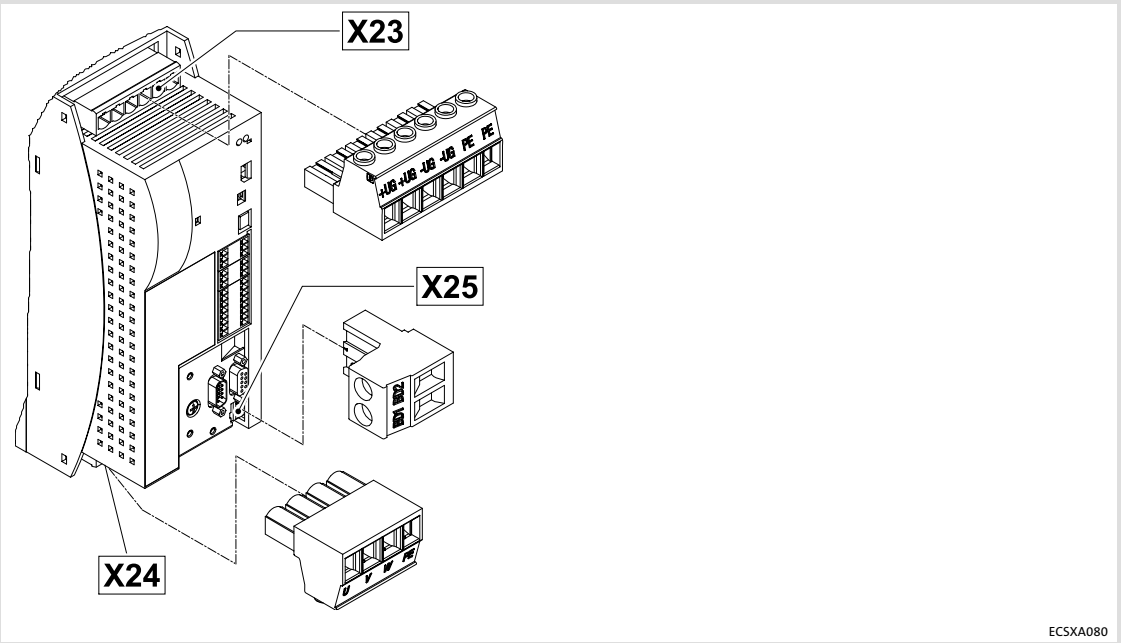


Fig. 5-1 Plug connectors for power terminals

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

- All power connections are plug connections and coded. The ECSZA000X0B plug connector set must be ordered separately.
- Installation of the cables to EN 60204-1.
- The cables used must comply with the approvals required at the site of use (e.g. VDE, UL, etc.).

Note!

ECSDS... axis modules:

For a better electromagnetic compatibility (EMC), connect the functional earth conductor to the ECS**D**S... axis module (📖 45).

This is not required for the ECS**E**S... (standard installation) and ECS**C**S... (cold plate) axis modules!

Assignment of the plug connectors

Plug connector/terminal	Function	Electrical data
X23	**DC-bus voltage connection**	
X23/+UG	Positive DC-bus voltage	Dependent on application and type 0 ... 770 V 2 ... 24.5 A (📖 33)
X23/+UG		
X23/-UG	Negative DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		
X24	**Motor connection**	
X24/U	Motor phase U	Dependent on application and type 0 ... 480 V 1.6 ... 20 A (📖 33)
X24/V	Motor phase V	
X24/W	Motor phase W	
X24/PE	Earth connection	
X25	**Motor holding brake connection**	
X25/BD1	Brake connection +	23 ... 30 V DC, max. 1.5 A
X25/BD2	Brake connection -	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Plug connectors X23 and X24				
Rigid	–	0.2 ... 10 mm² (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connections 10 mm for spring connections
Flexible	Without wire end ferrule	0.2 ... 10 mm² (AWG 24 ... 8)		
	Insulated with wire end ferrule	0.25 ... 6 mm² (AWG 22 ... 10)		
	Insulated with wire end ferrule	0.25 ... 4 mm² (AWG 22 ... 12)		
Plug connector X25				
Flexible	Insulated with wire end ferrule	0.25 ... 2.5 mm² (AWG 22 ... 12)	0.5 ... 0.8 Nm (4.4 ... 7.1 lb-in)	5 mm for screw connections 10 mm for spring connections
	Without wire end ferrule	0.2 ... 2.5 mm² (AWG 24 ... 12)		

Shielded cables

The following factors decisively determine the effect of the shielded cables:

- Good shield connection
  - Ensure a contact surface as large as possible
- Low shield resistance
  - Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- High overlap rate of the braid
  - At least 70 ... 80 % with 90° overlap angle

The ECSZS000X0B shield mounting kit includes a wire clamp and shield sheet.

5.2.1 Connection to the DC bus (+U_G, -U_G)

Stop!

No device protection for DC bus voltage surges

In passive axis modules (without 24 V-supply), the charging circuit can be overloaded through DC bus voltage surges.

Possible consequences:

► Destruction of the device

Protective measures:

► All axis modules in the DC-bus connection should be basically supplied with a control voltage of 24 V.

► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.

► Design the ±U_G cables twisted and as short as possible. Ensure short-circuit-proof routing!

► Cable length (module ↔ module) > 30 cm: install shielded ±U_G cables.

Cable cross-section

Cable length (module/ module)	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm² (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm for screw connection 10 mm for spring connection
	With insulated wire end ferrule			
> 20 m	Without wire end ferrule	10 mm² (AWG 8)		
	With insulated wire end ferrule **Use pin-end connectors for wiring!**			

Fuses

- ► Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- ► When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- ► When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- ► Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

Replacing defective fuses

Danger!

Hazardous electrical voltage

Components can carry hazardous voltages up to 3 minutes after power-off.

Possible consequences:

- ► Death or severe injuries when touching the device.

Protective measures:

- ► Replace fuses in the deenergised state only.
  - – Set controller inhibit (CINH) for all axis modules in DC-bus operation and disconnect all power supply modules from the mains.

5.2.2 Connection plan for mimimum wiring with internal brake resistor

Documentation of the ECSxE power supply module
Observe the enclosed notes.

Stop!
Always operate the ECS power supply modules with a brake resistor (internal/external).

The ECS power supply modules in the standard built-in unit and push-through design (ECSEE / ECSDE) are provided with a device-internal brake resistor.

In order to use the internal brake resistor (Rb), carry out the following wiring:

- Bridge between the terminals X22/+UG and X22/BR0 (CR)
  Current flow from +UG via the internal brake resistor (Rb) and the brake transistor to -UG.
- Bridge between the terminals X6/T1 and X6/T2 (CR)
  Deactivate the temperature monitoring of the non-existing external brake resistor.

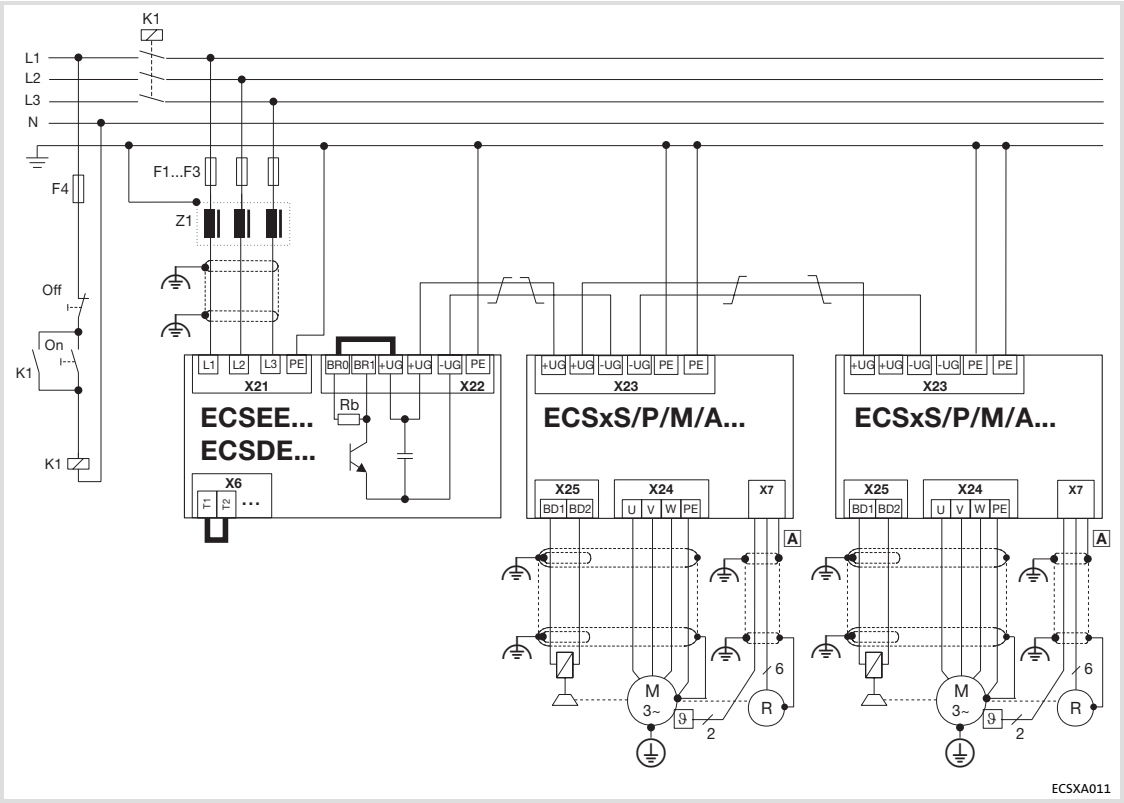


Fig. 5-2 Interconnected power system with internal brake resistor

- HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- Rb Internal brake resistor
- ϑ KTY thermal sensor of the motor
- A System cable for feedback

5.2.3 Connection plan for mimimum wiring with external brake resistor

Documentation of the ECSxE power supply module
Observe the enclosed notes.

Stop!

- ► Always operate the ECS power supply modules with a brake resistor.
- ► A parallel wiring of internal and external brake resistor is not permissible!
- ► Implement the thermal contact of the brake resistor into the system monitoring so that the mains supply of the power supply module will be switched off in case the brake resistor will be overheated.
- ► Read the documentation for the external brake resistor. Observe the safety instructions contained therein.

If the power supply module needs a high amount of braking power when it comes as standard built-in unit or in push-through technique design (**ECSEE / ECSDE**), an external and more powerful brake resistor can be connected instead of the internal brake resistor.

A power supply module in cold plate technique design (**ECSCE**) is not provided with an internal brake resistor so that this version always requires an external brake resistor (Rbext).

- ► Connect the brake resistor to X22/BR1 and X22/+UG.
- ► Connect the thermal contact (NC contact) of the external brake resistor to X6/T1 and X6/T2.

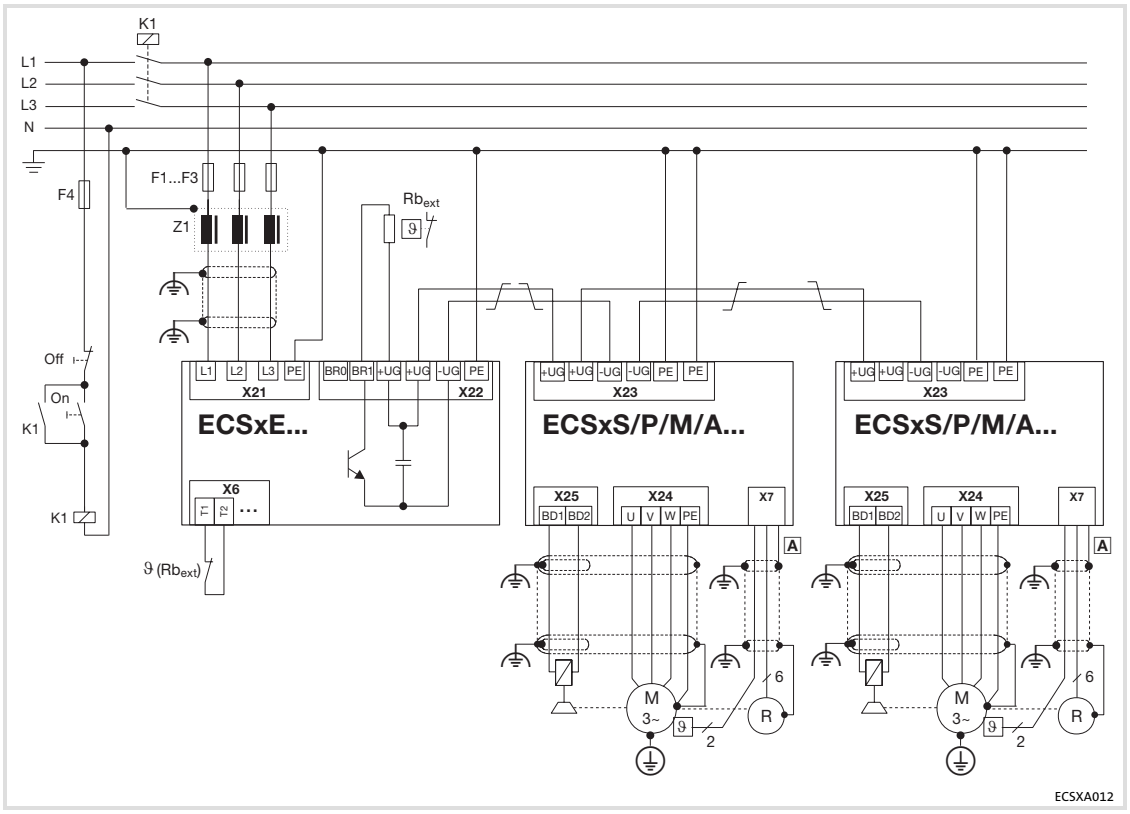


Fig. 5-3 Interconnected power system with external brake resistor

⏚	HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
∫	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb$_{ext}$	External brake resistor
ϑ	KTY thermal sensor of the motor
A	System cable for feedback

5.2.4 Motor connection

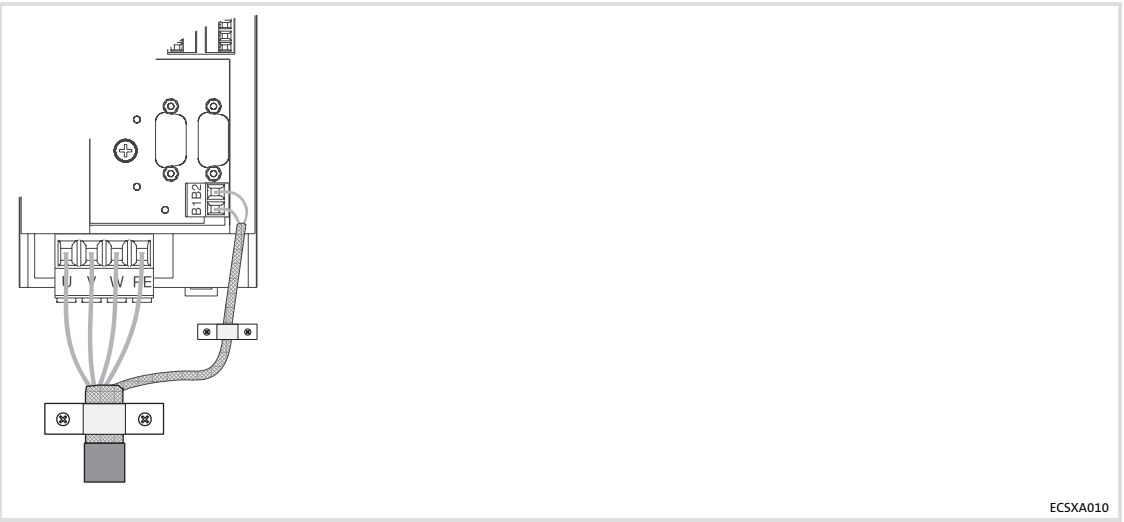


Fig. 5-4 Motor and motor holding brake connection

Motor cables

- Use low-capacitance motor cables. Capacitance per unit length:
  – Core/core: max. 75 pF/m
  – Core/shield: max. 150 pF/m
- Length: max. 50 m, shielded
- The cross-section of the motor cables are selected according to the motor standstill current (I_0) when using synchronous motors or according to the rated motor current (I_N) for asynchronous motors.
- Length of the unshielded ends: 40 ... 100 mm (depending on the cable cross-section)
- Lenze system cables meet these requirements.
- Use the ECSZS000X0B shield mounting kit for EMC-compliant wiring.

Mounting instructions for ECSZS000X0B shield mounting
Here you can find more information on wiring according to EMC.

5.2.5 Motor holding brake connection

The motor holding brake

- is connected to X25/BD1 and X25/BD2.
- is supplied with low voltage via the terminals X6/B+ and X6/B-:
  +23 ... +30 V DC, max.1.5 A

Stop!

- Protect X6/B+ with an F 1.6 A fuse.
- If no suitable voltage (incorrect amount, incorrect polarity) is connected to the brake, it is applied and can overheat or be destroyed by the continuously running motor.

5.2.5.1 Spark suppressor

The axis module comes with an integrated spark suppressor for protecting the contacts of the integrated brake relay when the motor holding brake (inductive load) is switched.

5.2.5.2 Monitoring the brake connection

The connection of the motor holding brake can be monitored for voltage failure and cable breakage if monitoring is activated under C0602.

The monitoring system of the brake connection trips under the following conditions:

Case 1, motor holding brake released (brake relay contact is closed):

- Current via holding brake (I_B) < 140 mA +/-10 % **or**
- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

Case 2, motor holding brake closed (brake relay contact is open):

- Voltage at X6/B+ and X6/B- (V_B) < +4 V +/-10 %

5.2.5.3 Requirements on the brake cables

- ► Use a Lenze system cable with integrated brake cable.
  – The shielding of the brake cable must be separated.
- ► Length: max. 50 m
- ► If a separately installed brake cable is required, lay it in a shielded manner.

Note!

Due to the monitoring circuit of the brake connection, an additional constant voltage drop of 1.5 V is produced. The voltage drop can be compensated by a higher voltage at the cable entry.

The voltage required at X6/B+ and X6/B- for the Lenze system cables is calculated as follows:

$$U_K\,[V] = U_B\,[V] + 0.08\left[\frac{V}{m \cdot A}\right] \cdot L_L\,[m] \cdot I_B\,[A] + 1.5\,[V]$$

V_{comp}	Voltage required at 6X/B+ and X6/B- [V]
V_B	Rated operating voltage of the brake [V]
L_L	Length of the brake cable [m]
I_B	Brake current [A]

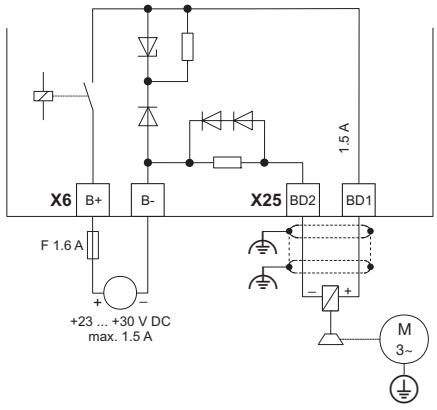


Fig. 5-5 Connection of the motor holding brake to X25

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

5.2.6 Connection of an ECSxK... capacitor module (optional)

The ECS capacitor modules support the DC-bus voltage for the drive system. These capacitor module types are available:

- ECSxK001 (705 µF, ±20 %)
- ECSxK002 (1410 µF, ±20 %)

x Design/mounting technique: E = standard installation
C = Cold-plate technique
D = push-through technique

Documentation of the ECSxK capacitor module
Observe the enclosed notes.

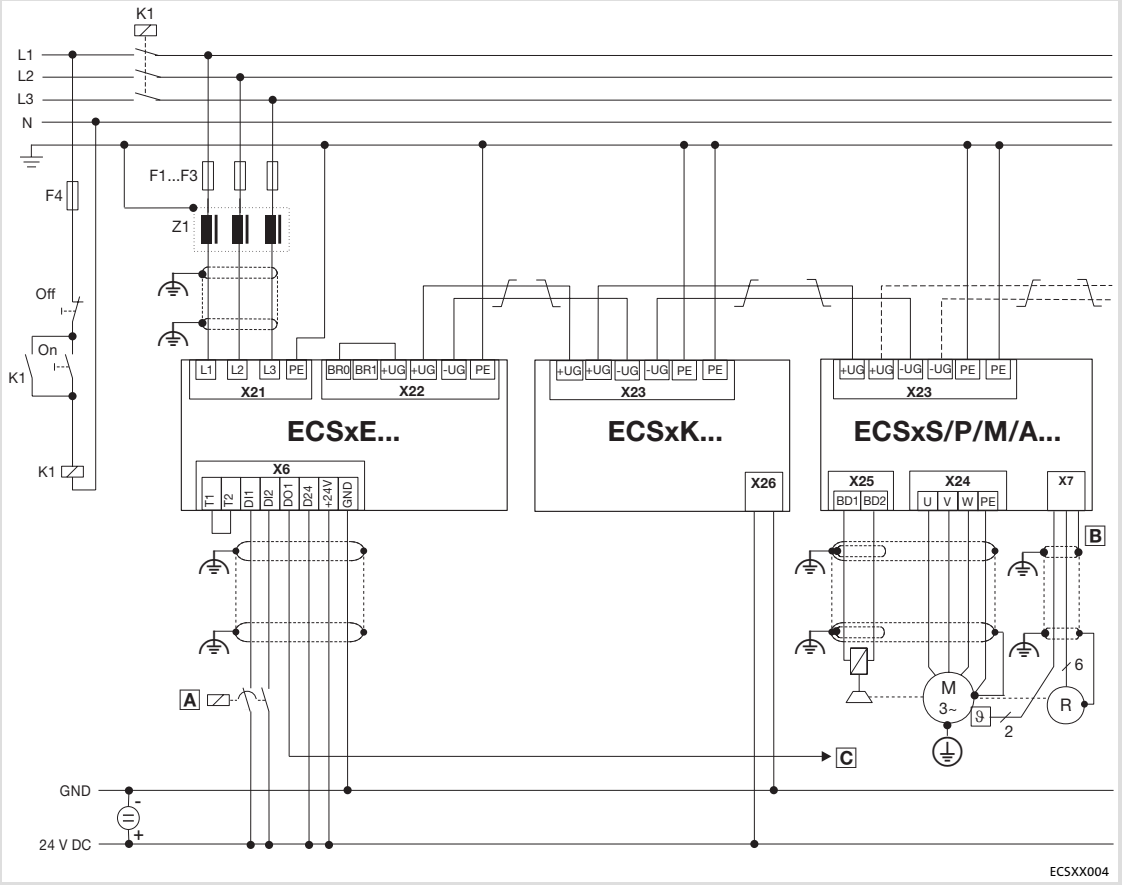


Fig. 5-6 Wiring of capacitor module ECSxK...

- HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
- Twisted cables
- K1 Mains contactor
- F1 ... F4 Fuse
- Z1 Mains choke / mains filter, optional
- A Contactor relay
- B System cable – feedback
- C Terminal X6/SI1 of the connected axis modules (controller enable/inhibit)

5.3 Control terminals

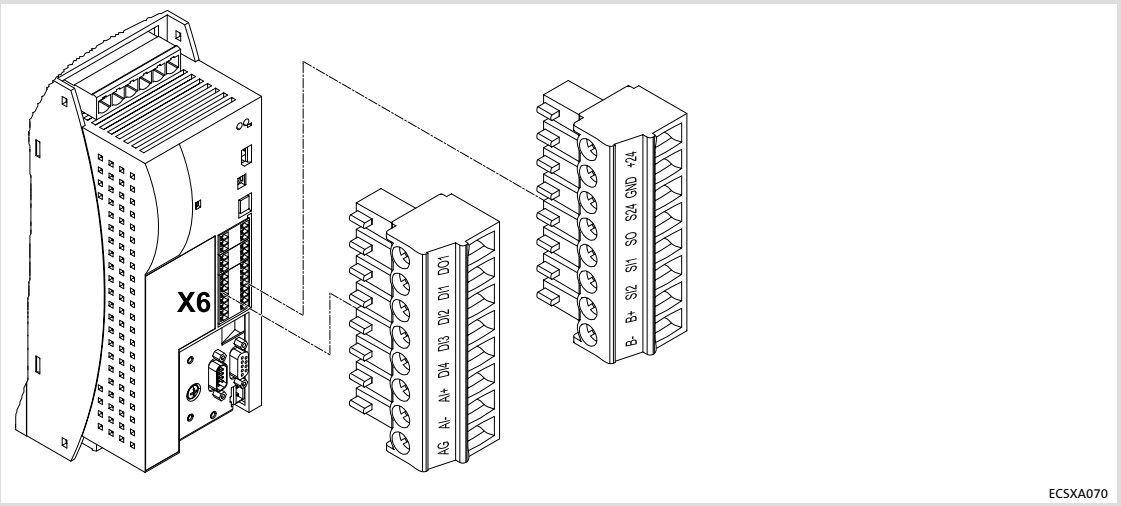


Fig. 5-7 Plug connectors for control terminals (X6)

For the supply of the control electronics an external 24 V DC voltage at terminals X6/+24 and X6/GND is required.

Stop!

- The control cables must always be shielded to prevent interference injections.
- The voltage difference between X6/AG, X6/GND and PE of the axis module may maximally amount to 50 V.
- The voltage difference can be limited by:
  – overvoltage-limiting components or
  – direct connection of X6/AG and X6/GND to PE.
- The wiring has to ensure that for X6/DO1 = 0 (LOW level) the connected axis modules do not draw energy from the DC bus. Otherwise, the power supply module may be damaged.

Shield connection of control cables and signal cables

The plate on the front of the device serves as the mounting place (two threaded holes M4) for the shield connection of the signal cables. The screws used may extend into the inside of the device by up to 10 mm. For optimum contact of the shield connection, use the wire clamps from the ECSZS000X0B shield mounting kit.

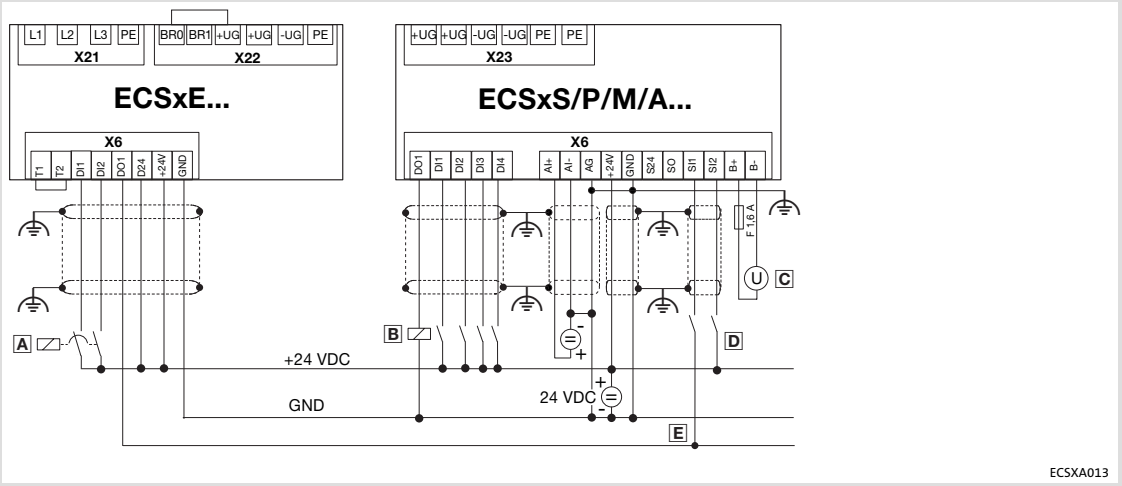


Fig. 5-8 Interconnection: Control signals with internal brake resistor

- ⏚ HF-shield termination by large surface connection to functional earth (see mounting instructions for shield mounting ECSZS000X0B)
- A / B Contactor relay
- C Voltage supply of motor holding brake 23 ... 30 V DC, max. 1.5 A
- D Safe torque off (formerly: ”Safe standstill”)
- E Controller enable/inhibit

Switch-on sequence for the auxiliary relay

Stop!

Overload of the charging connection in the power supply module

The controller enable for the axes may only take place when the charging process of the DC bus is completed and the power supply module is ready for operation.

Possible consequences:

► Destruction of the power supply module

Protective measures:

► Use of switching the central controller enable for the axes via the inputs and outputs DI2 and DO1 of the power supply module (see the following descriptions).

The switch-on sequence of the auxiliary relay [A] (see Fig. 5-8) is as follows:

1. The digital input X6/DI1 (power supply enable) of the power supply module is switched to HIGH by the higher-level control or by the operator.
   – The DC bus is charged.
2. The ready for operation output of the axis module (DO1) now switches the X6/DI2 digital input (central controller enable) of the power supply module via the relay [A].
   – In the default Lenze setting of the ECS axis modules, DO1 is set to ”ready”. ”Ready” is only present if a specified DC-bus voltage has been reached.
3. The central controller enable for the axis module takes place via the X6/DO1 output of the power supply module. The central controller enable DO1 only switches if the charging process of the DC bus is completed AND the X6/DI2 input is set.

Assignment of the plug connectors

Plug connector X6		
Terminal	**Function**	**Electrical data**
X6/+24	Low-voltage supply of the control electronics	20 ... 30 V DC, 0. A (max. 1 A) for starting current of 24 V: max. 2 A for 50 ms
X6/GND	Reference potential of low-voltage supply	
X6/DO1	Digital output 1	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
X6/DI1	Digital input 1	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
X6/DI2	Digital input 2	
X6/DI3	Digital input 3	
X6/DI4	Digital input 4	
X6/AI+	Analog input +	Adjustable with jumper strip X3: -10 ... +10 V, max. 2 mA -20 ... +20 mA Resolution: 11 bits + sign
X6/AI-	Analog input -	
X6/AG	Reference potential of analog input (internal ground)	
X6/B+	Brake supply +	23 ... 30 V DC max. 1.5 A **Set brake voltage so that the permissible voltage at the brake is not under-run or exceeded – otherwise malfunction or destruction!**
X6/B-	Brake supply -	
X6/S24	Connection of ”safe torque off” (formerly ”safe standstill”)	📖 71
X6/SO		
X6/SI1		
X6/SI2		

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	Without wire end ferrule	0.08 ... 1.5 mm² (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connection 9 mm for spring connection
	With insulated wire end ferrule	0.25 ... 0.5 mm² (AWG 22 ... 20)		

We recommend to use control cables with a cable cross-section of 0.25 mm².

5.3.1 Digital inputs and outputs

Stop!

If an inductive load is connected to X6/DO1, a spark suppressor with a limiting function to max. 50 V ± 0 % must be provided.

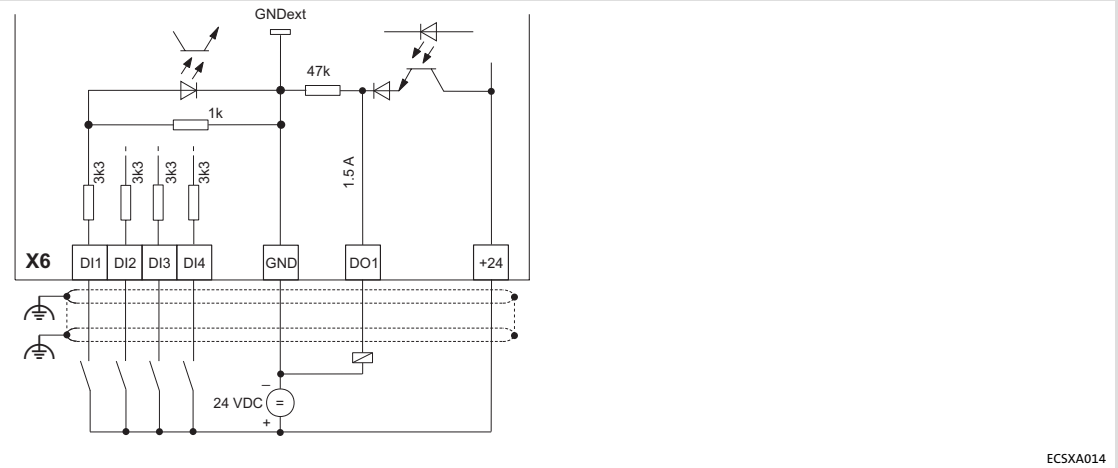


Fig. 5-9 Digital inputs and outputs at X6

HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

- The digital inputs X6/DI1 ... DI4 are freely assignable.
- The polarity of the digital inputs X6/DI1 ... DI4 is set under C0114/x.
- The polarity of the digital output (X6/DO1) is set under C0118/1.

5.3.2 Analog input

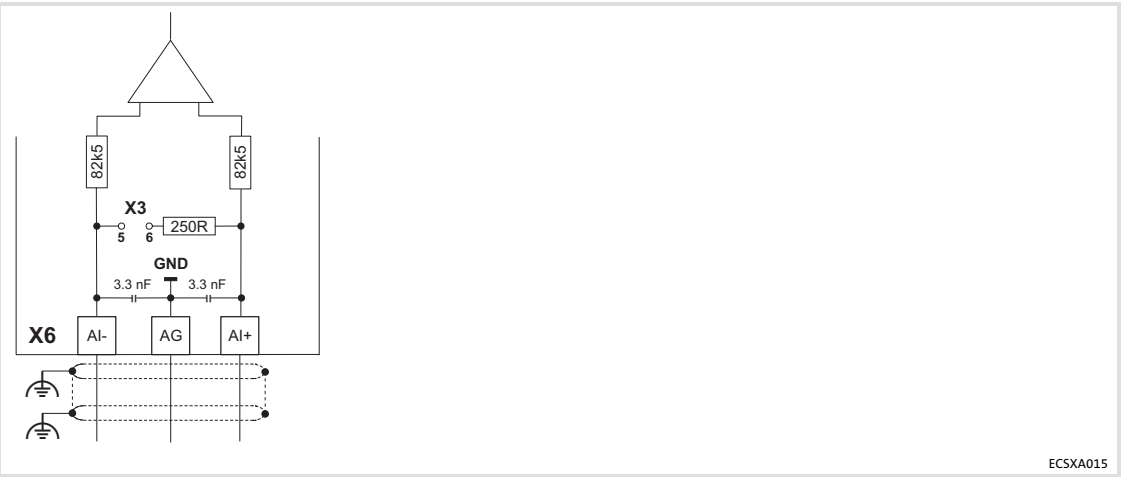


Fig. 5-10 Analog input at X6

⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Analog input configuration

► Use C0034 to set whether the input is to be used for a master voltage (±10 V) or a master current (+4 ... 20 mA or ±20 mA).

► Set jumper bar X3 according to the setting in C0034:

Stop!

Do not plug the jumper on the pins 3-4! The axis module cannot be initialised like this.

Jumper bar X3	Setting	Measuring range
5 6 3 4 1 2	5-6 open Jumper on 1-2: Parking position	**C0034 = 0 (master voltage)** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡ ±16384 ≡ ±100 %
5 6 3 4 1 2	5-6 closed	**C0034 = 1 (master current)** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: +4 mA ≡ 0 ≡ 0 % +20 mA ≡ 16384 ≡ 100 %
		C0034 = 2 (master current) ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡ ±16384 ≡ ±100 %

5.3.3 Safe torque off

The axis modules support the ”safe torque off” safety function (formerly ”safe standstill”), ”protection against unexpected start-up”, in accordance with the requirements of EN ISO 13849-1, Performance Level Pld. For this purpose, the axis modules are equipped with two independent safety paths. The Performance Level Pld is obtained if the output signal is additionally checked with regard to correctness at X6/SO.

5.3.3.1 Implementation

In the axis module, the ”safe torque off” connection is implemented with optocouplers. The optocouplers isolate the following areas electrically from each other:

- The digital inputs and outputs:
  - input X6/SI1 (controller enable/inhibit)
  - input X6/SI2 (pulse enable/inhibit)
  - brake output X6/B+, B-
  - output X6/SO (”safe torque off” active/inactive)
- The circuit for the internal control
- The final power stage

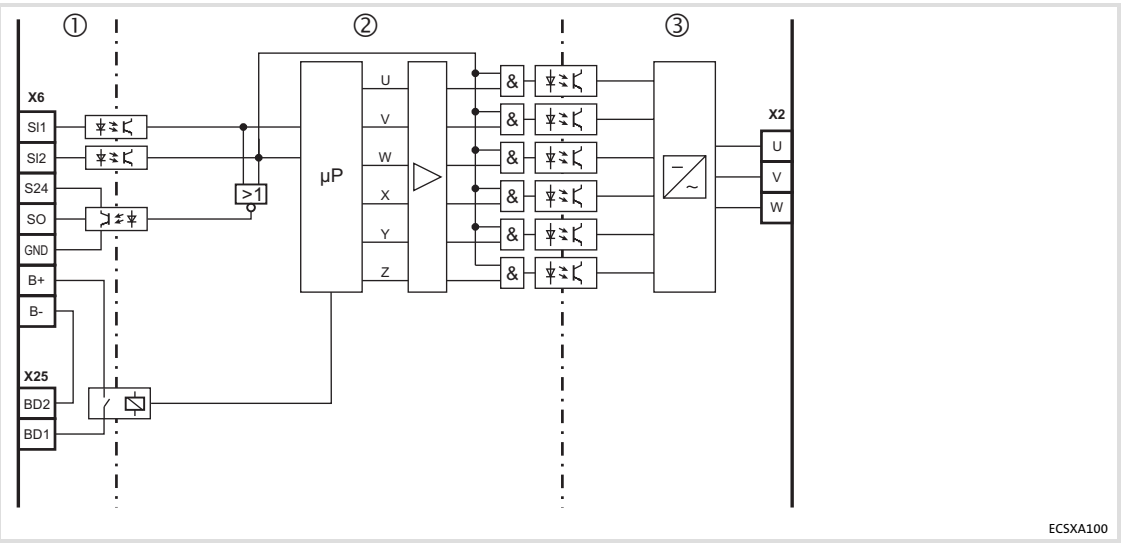


Fig. 5-11 Implementation of the ”safe torque off” function

Area 1:	Inputs and outputs
Area 2:	Circuit for the internal control
Area 3:	Power output stage

Stop!

Use insulated wire end ferrules when wiring the ”safe torque off” circuits to X6.

5.3.3.2 Functional description

The ”safe torque off” state can be initiated any time via the input terminals X6/SI1 (controller enable/inhibit) and X6/SI2 (pulse enable/inhibit). For this purpose a LOW level has to be applied at both terminals:

- X6/SI1 = LOW (controller inhibited):

  The inverter is inhibited via the microcontroller system.

- X6/SI2 = LOW (pulses inhibited):

  The supply voltage for the optocouplers of the power section driver is switched off, i. e. the inverter can no longer be enabled and controlled via the microcontroller system.

  The input signal at X6/SI2 to the hardware is additionally directed to the microcontroller system and is evaluated for the state control there. For the external further processing a HIGH level is output for the state ”safe torque off active” at the digital output X6/SO.

The control of the inverter thus is prevented by two different methods that are independent of each other. Therefore an unexpected start-up by the motor is avoided.

5.3.3.3 Important notes

Danger!

When using the ”safe torque off” function, additional measures are required for ”emergency stops”!

There is neither an electrical isolation between motor and axis module nor a ”service” or ”repair switch”.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

An ”emergency stop” requires the electrical isolation of the motor cable, e.g. by means of a central mains contactor with emergency stop wiring.

Installation/commissioning

► The ”safe torque off” function must only be installed and commissioned by qualified personnel.

► All control components (switches, relays, PLC, ...) and the control cabinet must meet the requirements of EN ISO 13849. These include for instance:

– Switches, relays in enclosure IP54.

– Control cabinet in enclosure IP54.

– All other requirements can be found in EN ISO 13849.

► Wiring with insulated wire end ferrules is essential.

► All safety-relevant cables (e.g. control cable for the safety relay, feedback contact) outside the control cabinet must be protected, e.g. in the cable duct. It must be ensured that short circuits between the individual cables cannot occur. For further measures, see EN ISO 13849.

► If force effects from outside (e.g. sagging of hanging loads) are to be expected when the ”safe torque off” function is active, additional measures have to be taken (e.g. mechanical brakes).

During operation

► After installation, the operator must check the ”safe torque off” function.

► The function check must be repeated at regular intervals, but no later than after one year.

5.3.3.4 Technical data

Terminal assignment

Plug connector X6				
Terminal	**Function**	**Level**		**Electrical data**
X6/S24	Low-voltage supply			18 ... 30 V DC 0.7 A
X6/SO	"Safe torque off" feedback output	LOW	During operation	24 V DC 0.7 A (max. 1.4 A) Short-circuit-proof
		HIGH	"Safe torque off" active	
X6/SI1	Input 1 (controller enable/inhibit)	LOW	Controller inhibited	LOW level: -3 ... +5 V -3 ... +1.5 mA HIGH level: +15 ... +30 V +2 ... +15 mA Input current at 24 V DC: 8 mA per input
		HIGH	Controller enabled	
X6/SI2	Input 2 (pulse enable/inhibit)	LOW	Pulses for power section are inhibited	
		HIGH	Pulses for power section are enabled	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Starting torque	Stripping length
Flexible	With insulated wire end ferrule	0.25 ... 1.5 mm^2 (AWG 22 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm for screw connections 9 mm for spring connections
	Without wire end ferrule	Not permitted when the "Safe torque off" function is used		

5.3.3.5 Function check

- ► After installation the operator must check the ”safe torque off” function.
- ► The function check must be repeated at regular intervals, after one year at the latest.

Stop!

If the function check leads to impermissible states at the terminals, commissioning cannot take place!

Test specifications

- ► Check the circuitry with regard to correct function.
- ► Check directly at the terminals whether the ”safe torque off” function operates faultlessly in the axis module:

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	X6/SI2	X6/SO	X6/SO
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

5.3.3.6 Example: Wiring with electronic safety switching device "Pilz PNOZ e1vp" for Performance Level PI_d

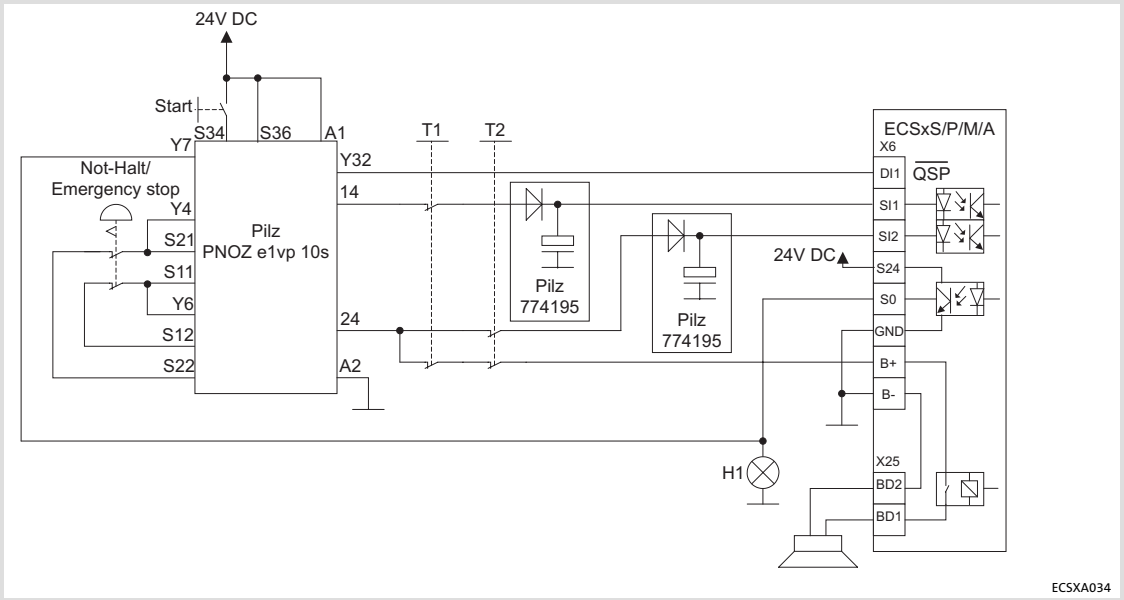


Fig. 5-12 Example: Wiring with "Pilz PNOZ e1vp 10s" safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.
- The diode-capacitor combination prevents the test pulses of the safety switching device from disturbing the smooth running of the motor, as otherwise a short-time inhibit of the controller cannot be ruled out. The diode-capacitor combination can be procured from the company Pilz (Pilz order number: 774195) as a complete terminal block.

Description of the function

- The "PNOZ" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 14 and 24) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- The safety switching device is provided with test pulses at the output side, so that short circuits within the wiring are detected.
- Diagnostics is effected via the wiring of diagnostic output SO to input Y7 of the safety switching device. Y7 is the input of the feedback loop which has to be on HIGH level (+24 V) before the outputs 14 and 24 are activated. There is only HIGH level if both disconnecting paths have switched off.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.3.3.7 Example: Wiring with electromechanical safety switching device "Siemens 3TK2827" for Performance Level Pl_d

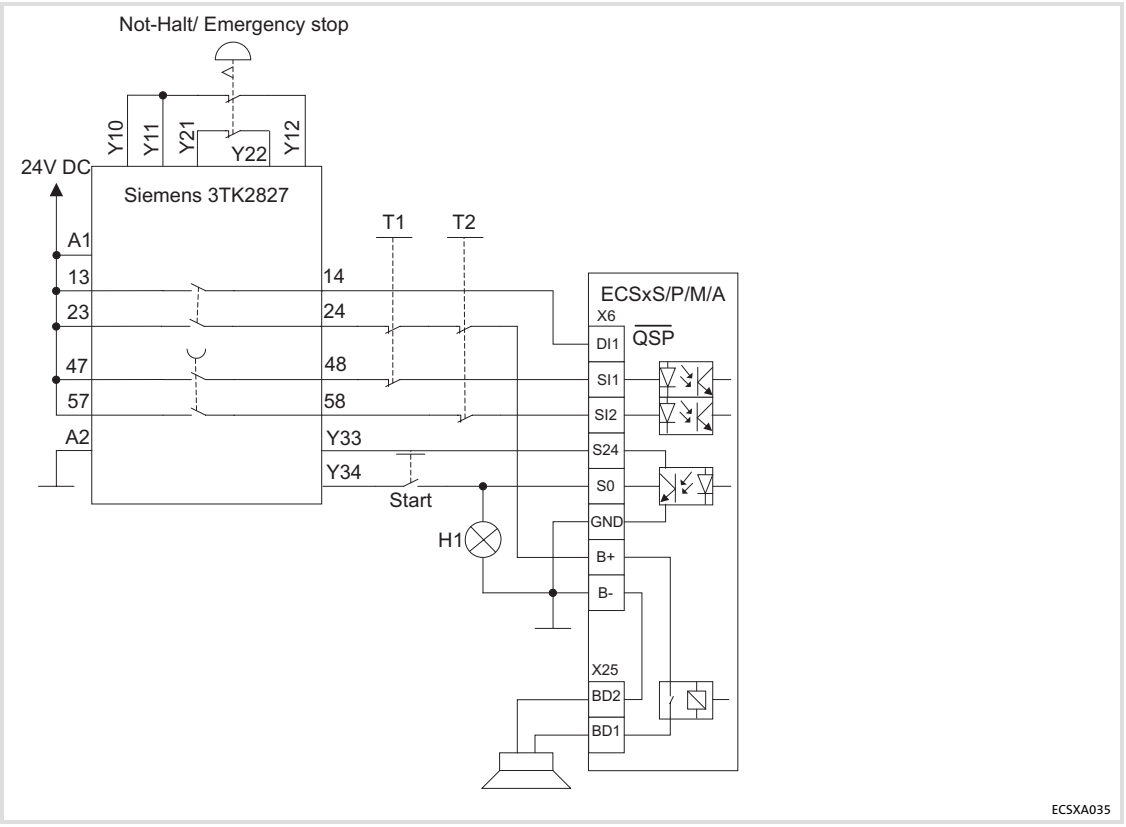


Fig. 5-13 Example: Wiring with "Siemens 3TK2827" safety switching device

T1 Test key 1
T2 Test key 2

- The motor is shut down in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety switching device and the quick stop deceleration time have to be coordinated with the brake closing time.

Description of the function

- The "Siemens 3TK2827" safety switching device has a two-channel effect on the controller. In the case of an emergency stop request the two channels (terminals 48 and 58) become deenergised. The safety switching device monitors the diagnostic output of the controller.
- If the "safe torque off" safety function is activated, output X6/SO is at HIGH level. This state is shown to the operator by means of the indicator light H1. Afterwards switch-on is possible again using the Start pushbutton.
- At least once a year a manual test has to be carried out to verify the independence and cutout ability of the two disconnecting paths.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- When any test key (T1, T2) is pressed the motor has to become torqueless immediately. Additionally the brake has to be applied, since the supply of the brake is switched off via contact X6/B+.
- When the safety switching device is switched off, or if both pushbuttons are pressed at the same time, the STO state has to be signalled via the indicator light H1. In all other states this message has to be inactive.

If a deviation from the response described above is determined, the controller must be switched off immediately. Eliminate the fault before restarting the controller.

For obtaining a Performance Level PL_d (SIL 2), only components which also comply with the requirements for PL_d in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061 are to be used in all upstream applications!



Interconnection examples can be found in the download area (Application Knowledge Base) at:
www.Lenze.com

5.4 Automation interface (AIF)

The keypad XT or a communication module can be attached to or removed from the automation interface (X1). This is also possible during operation.

- The keypad XT serves to enter and visualise parameters and codes.
- The communication modules serve to network the modules of the ECS servo system with the host system (PLC or PC).

The following combinations are possible:

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

Further information ....

on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

5.5 Wiring of system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...**axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Basic wiring of the CAN bus networks

The two following schematic diagrams show drive systems with different master value concepts:

- In Fig. 5-14 a higher-level control assumes the function of the master, e.g. ETC.
- In Fig. 5-15 the function of the master is enabled by a controller intended as master.

In both representations, the master value transmission is effected via the MotionBus (CAN), interface X4.

The system bus (CAN), interface X14, serves to diagnose and/or parameterise the drives.

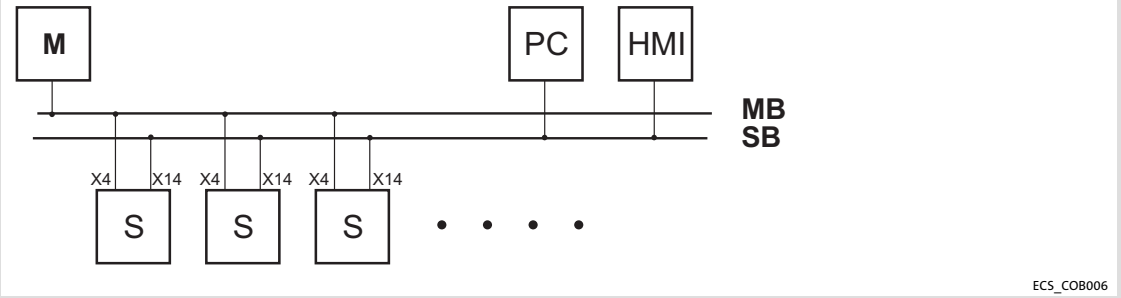


Fig. 5-14 MotionBus (CAN) with master control

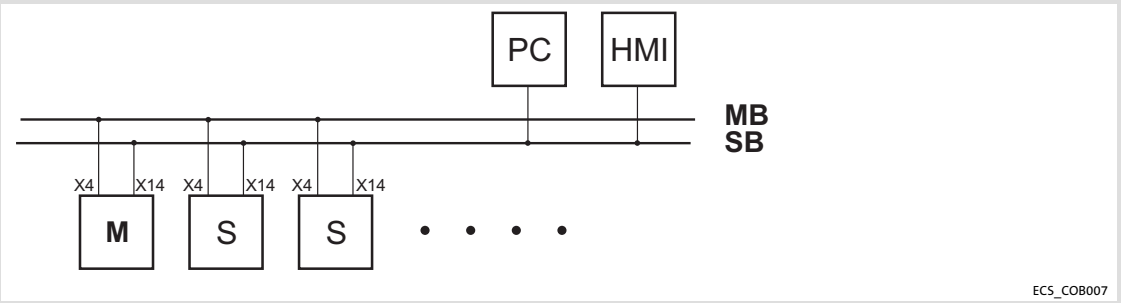


Fig. 5-15 MotionBus (CAN) with controller as master

MB	MotionBus (CAN), interface X4
SB	System bus (CAN), interface X14
M	Master
S	Slave
PC	PC with the Lenze parameter setting and operating software (GDC, GDL, GDO)
HMI	HMI / operating unit

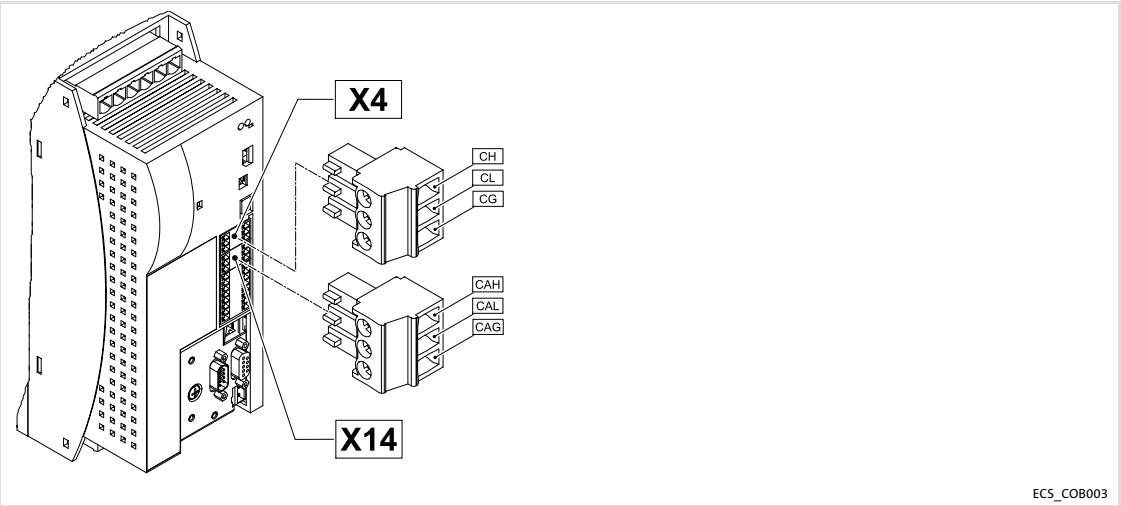


Fig. 5-16 Bus connections on the controller

Assignment of the plug connectors

X4 (CAN)	X14 (CAN-AUX)	Description
CH	CAH	CAN-HIGH
CL	CAL	CAN-LOW
CG	CAG	Reference potential

Specification of the transmission cable

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

System bus (CAN) wiring

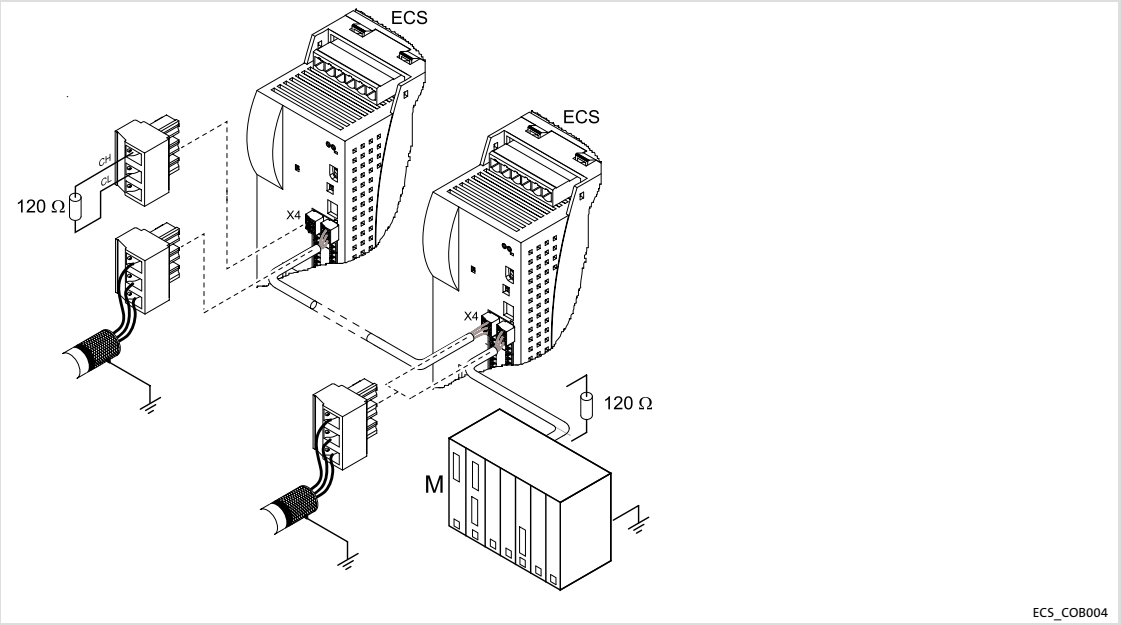


Fig. 5-17 Example: System bus (CAN) wiring via interface X4

ECS ECS axis module
M Master control, e.g. ETC

Note!

Connect one bus terminating resistor (120 Ω) each to the first and last node of the system bus (CAN).

Bus cable length

Note!
The permissible cable lengths must be observed.

1. Check the compliance with the total cable length in Tab. 5-1.

The baud rate determines the total cable length.

CAN baud rate [kbit/s]	**Max. bus length** [m]
50	1500
125	630
250	290
500	120
1000	25

Tab. 5-1 Total cable length

2. Check the compliance with the segment cable length in Tab. 5-2.

The segment cable length is determined by the cable cross-section used and the number of nodes. Without a repeater, the segment cable length corresponds to the total cable length.

Number of nodes	**Cable cross-section**			
	0.25 mm²	**0.5 mm²**	**0.75 mm²**	**1.0 mm²**
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 5-2 Segment cable length

3. Compare the two values detected.

If the value detected from Tab. 5-2 is smaller than the total cable length to be provided from Tab. 5-1 , repeaters must be used. Repeaters divide the total cable length into segments.

Example: Selection help

Specifications	
● Cable cross-section:	0.5 mm² (according to cable specifications 📖 82)
● Number of nodes:	63
● Repeater:	Lenze-repeater, type 2176 (cable reduction: 30 m)

For the max. number of nodes (63), the following cable lengths / number of repeaters from the specifications must be observed:

Baud rate [kbit/s]	**50**	**120**	**250**	**500**	**1000**
Max. cable length [m]	1500	630	290	120	25
Segment cable length [m]	310	310	290	120	25
Number of repeaters	5	2	-	-	-

Check repeater application

Given:	
● Baud rate:	125 kbps
● Cable cross-section:	0.5 mm²
● Number of nodes:	28
● Cable length:	450 m

Procedure	Cable length	See
1. Total cable length at 125 kbps:	630 m	Tab. 5-1
2. Segment cable length for 28 bus nodes and a cable cross-section of 0.5 mm²:	360 m	Tab. 5-2
3. Comparison: The value under point 2 is smaller than the required cable length of 450 m.		

Conclusion
● It is not possible to use a cable length of 450 m without using a repeater.
● After 360 m (point 2) a repeater must be installed.

Result
● The Lenze repeater type 2176 is used (cable reduction: 30 m)
● Calculation of the maximum cable length: First segment: 360 m Second segment: 360 m (according to Tab. 5-1) *minus* 30 m (cable reduction when a repeater is used)
→ Maximum possible cable length with repeater: 690 m.
→ Now it is possible to use the required cable length.

Note!

Repeaters are recommended as a

► Service interface
Advantage: Trouble-free connecting during bus operation is possible.

► Calibration interface
Advantage: Calibration/programming unit remains electrically isolated.

5.6 Wiring of the feedback system

You can connect various feedback systems to the axis module:

- Resolver on X7 (📖 87)
- Encoder on X8 (📖 88)
  - Incremental encoder with 5V-TTL level, RS-422
  - SinCos encoder with zero track without Hiperface, signal level 1 Vss
  - SinCos absolute value encoder (single-turn/multi-turn) with serial communication (Hiperface® interface), supply voltage 5 ... 8 V

Note!

If a "safe isolation" acc. to EN 61140 between the encoder cable and motor cable (e.g. by using separating webs or separated trailing cables) is **not ensured** on the entire cable length cable due to an installation on the system side, the encoder cable must be provided with an insulation resistance of 300 V. Lenze encoder cables meet this requirement.

- We recommend to use Lenze encoder cables for wiring.
- In case of self-prepared cables
  - only use cables with shielded cores twisted in pairs.
  - Observe the notes on wiring/preparation on the following pages.

5.6.1 Resolver connection

Note!

- ► Use the prefabricated Lenze system cables for the connection of a resolver.
- ► Cable length: max. 50 m
- ► Depending on the cable length and resolver used parameterise the code C0416 (resolver excitation amplitude).
  Check the resolver control with code C0414 (recommended values: 0.5 ... 1.2; ideal value: 1.0).
- ► Before using a resolver from another manufacturer, please consult Lenze.

Connect a resolver via the 9-pole Sub-D socket X7.

Features

- ► Resolver: U = 10 V, f = 4 kHz
- ► Resolver and resolver supply cable are monitored for open circuit (fault message ”Sd2”).

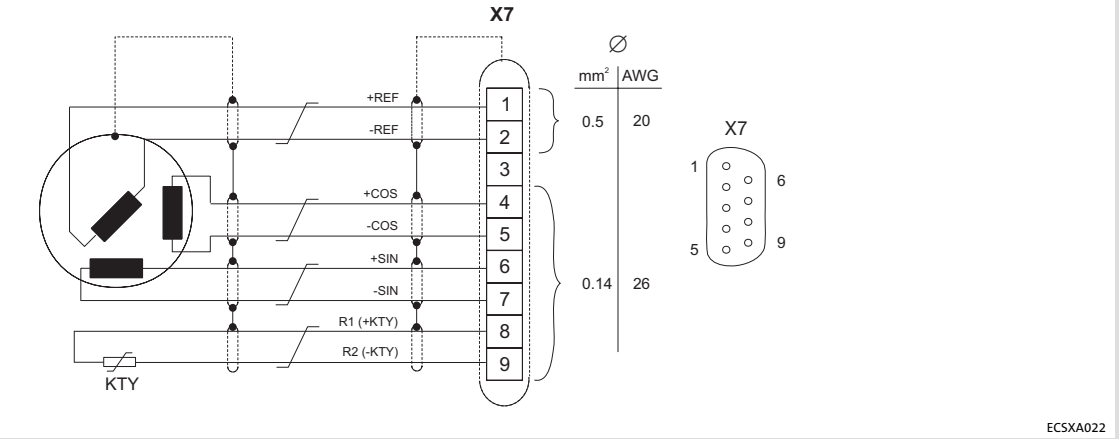


Fig. 5-18 Resolver connection

Assignment of socket connector X7: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	R1 (+KTY)	R2 (-KTY)
	0.5 mm² (AWG 20)		–	0.14 mm² (AWG 26)					

5.6.2 Encoder connection

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

Via the 9-pole Sub-D-plug X8, you can connect the following encoders:

► Incremental encoder (TTL encoder)
  – with two 5 V complementary signals (RS-422) that are electrically shifted by 90°.
  – with zero track that can be connected optionally.

► Sin/cos encoder (singleturn or multiturn rotary transducer)
  – with supply voltage (5 ... 8 V).
  – with serial communication.
    The initialisation time of the axis module is extended to approx. 2 s.

The controller supplies the encoder with voltage.

Use C0421 to set the supply voltage V_{CC} (5 ... 8 V) to compensate, if required, the voltage drop [ΔV] on the encoder cable:

$$\Delta U \cong 2 \cdot L_L\,[m] \cdot R/m\,[\Omega/m] \cdot I_G\,[A]$$

ΔV	Voltage drop on the encoder cable [V]
L_L	Cable length [m]
R/m	Ohmic resistance per meter of cable length [Ω/m]
I_G	Encoder current [A]

Stop!

Observe the permissible supply voltage of the encoder used. If the values in C0421 are set too high, the encoder can be destroyed!

Incremental encoder (TTL encoder)

Features	
Input/output frequency:	0 ... 200 kHz
Current consumption:	6 mA per channel
Current on output V_{CC} (X8/pin 4):	Max. 200 mA

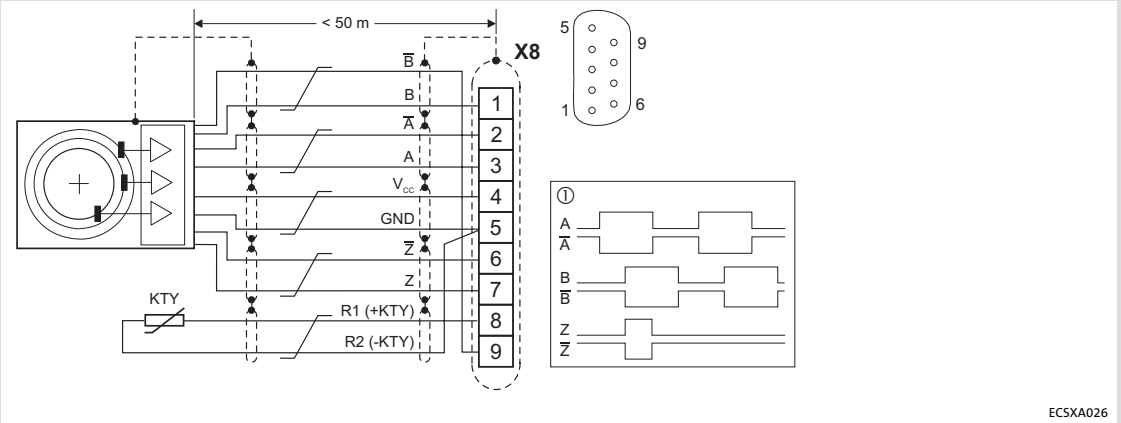


Fig. 5-19 Connection of incremental encoder with TTL level (RS-422)

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (R1/+KTY)	$\overline{Z}$	Z	R2 (-KTY)	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

SinCos encoders and SinCos absolute value encoders with Hiperface

Features	
Input/output frequency:	0 ... 200 kHz
Internal resistance (R_i):	221 Ω
Offset voltage for signals SIN, COS, Z:	2.5 V

- ► The differential voltage between signal track and reference track must not exceed 1 V ± 10 %.
- ► The connection is open-circuit monitored (fault message "Sd8")
- ► For encoders with tracks sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
  – Assign RefSIN with $\overline{\text{sine}}$.
  – Assign RefCOS with $\overline{\text{cosine}}$.
- ► For SinCos absolute value encoders with Hiperface, the serial interface (RS 485) is available instead of the zero track (Z track).

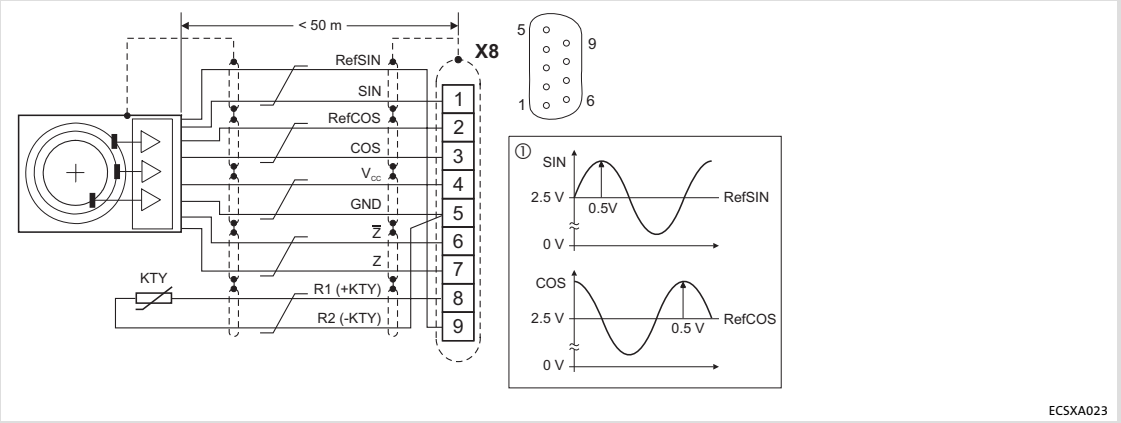


Fig. 5-20 Connection of SinCos encoder

① Signals in case of clockwise rotation
⌒ Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS ($\overline{\text{cos}}$)	COS	V_{CC}	GND (R2/-KTY)	$\overline{Z}$ or -RS458	Z or +RS485	R1 (+KTY)	RefSIN ($\overline{\text{sin}}$)
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

5.6.3 Digital frequency input/output (encoder simulation)

The digital frequency coupling of ECSxS/P/A axis modules basically is effected as a master-slave connection via the interface X8. This interface can either be used as a digital frequency input or as a digital frequency output (e. g. for encoder simulation) (configuration via C0491).

Features

X8 as digital frequency input	X8 as digital frequency output
● Input frequency: 0 ... 200 kHz ● Current consumption: max. 6 mA per channel ● Two-track with inverse 5 V signals and zero track ● Possible input signals: – incremental encoder with two 5 V complementary signals (TTL encoders) offset by 90° ● The function of the inputs signals can be set via C0427.	● Output frequency: 0 ... 200 kHz ● Permissible current loading: max. 20 mA per channel ● Two-track with inverse 5 V signals (RS422) ● The function of the output signals can be set via C0540.

Wiring

► 1 slave on the master:

Wire master and slave to each other directly via interface X8.

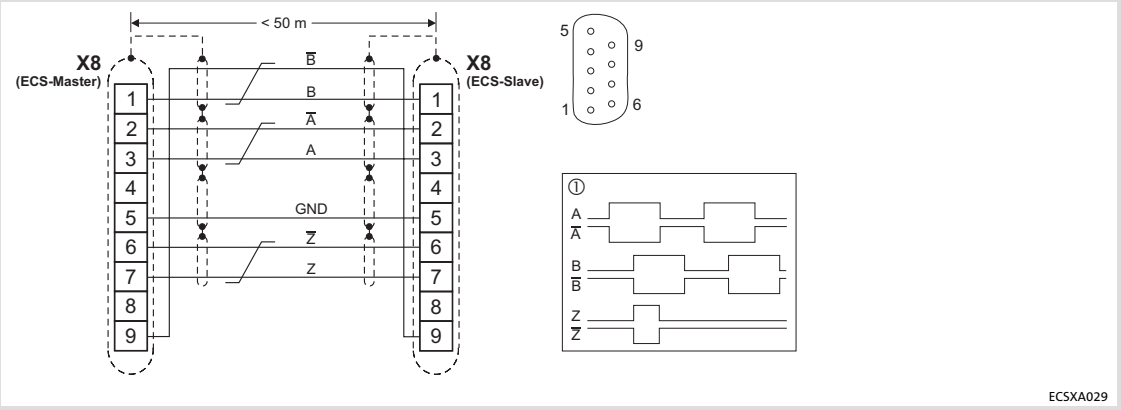


Fig. 5-21 Connection of the master frequency input/output X8 (master ↔ slave)

① Signals for clockwise rotation

Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Input signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
Output signal	B	$\overline{A}$	A	–	GND	$\overline{Z}$	Z	–	$\overline{B}$
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

► 2 to 3 slaves connected to the master:

Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

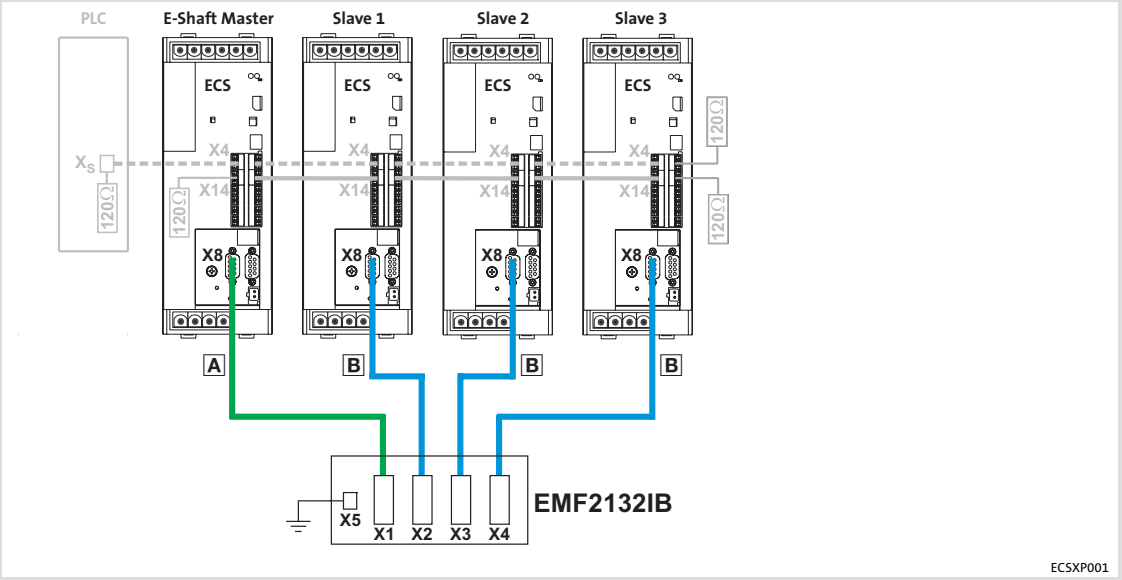


Fig. 5-22 ECS axis modules in the digital frequency network with digital frequency distributor EMF2132IB

PLC	Master control (PLC) or a PLC device to control the drive system
E-Shaft master	Master value master (axis module ECSxP)
Slave 1...3	Slave 1, slave 2, slave 3 (axis module ECSxP)
A	Master digital frequency cable EYD0017AxxxxW01W01 (socket/socket)
B	Slave digital frequency cable EYD0017AxxxxW01S01 (plug/socket)

Tip!

”xxxx” in the type designation of the digital frequency cables serves as a wildcard for the specification of the cable length in decimetres.

Example: EYD0017A**0015**W01W01 → cable length = 15 dm

6 Commissioning

6.1 Before you start

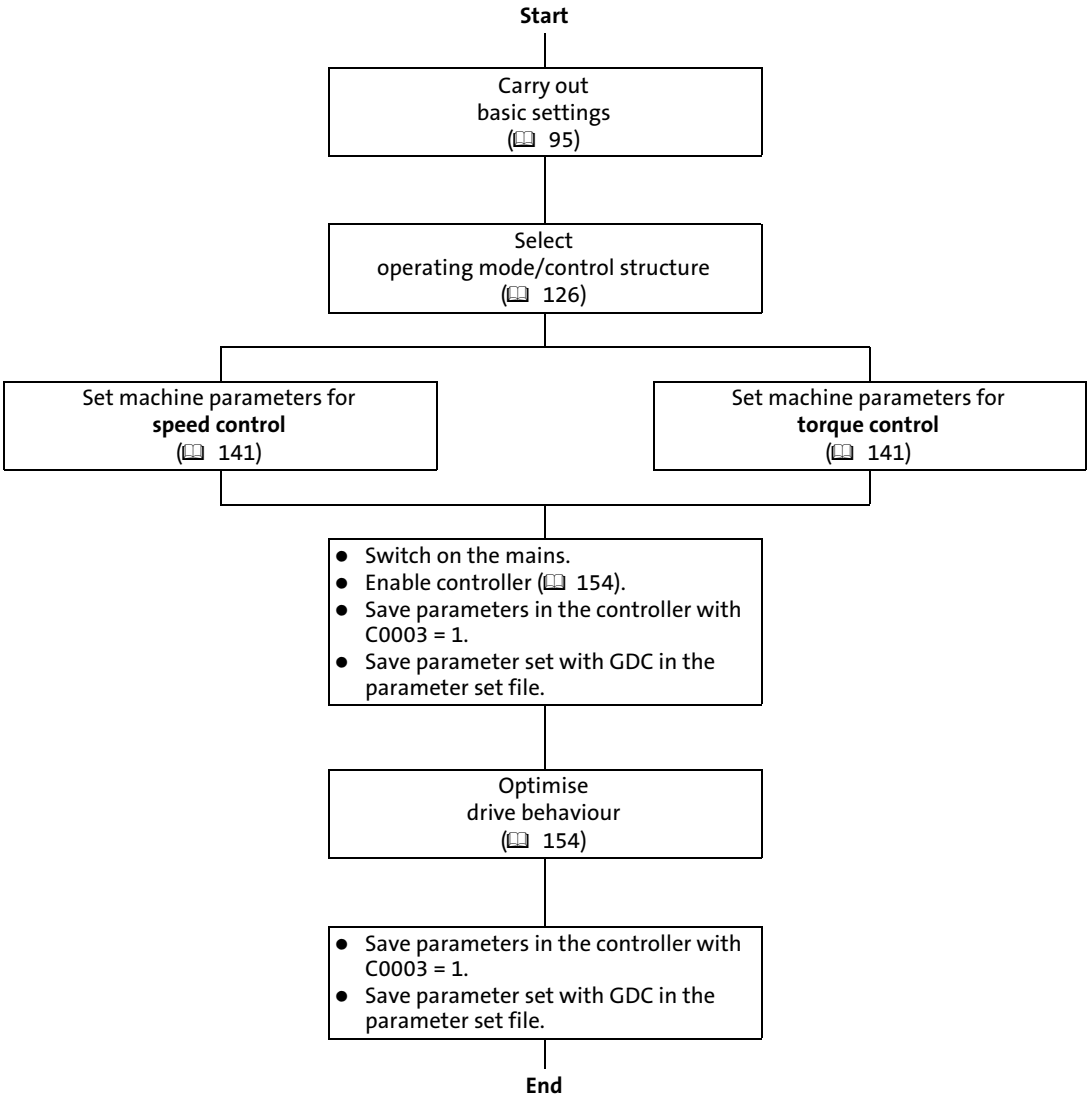
Note!

- The use of a Lenze motor is assumed in this description of the commissioning steps. For details on the operation with other motors see 📖 145.
- The operation with the Lenze parameter setting and operating program "Global Drive Control (GDC)" is taken as a basis. The parameters are displayed in the online mode, i.e. GDC can directly access the codes of the axis module.

Prior to initial switch-on of the drive system, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Polarity of the DC-bus voltage supply via terminals +UG, -UG
- Motor connection:
  – In-phase connection to the motor (direction of rotation)
- Wiring of "safe torque off" (formerly "safe standstill")
- Feedback system
- Control terminals:
  – Wiring adjusted to the signal assignment of the control terminals.

6.2 Commissioning steps (overview)



6.3 Carrying out basic settings with GDC

Note!
Follow the commissioning steps in the given order!

Settings		Brief description	Detailed information
Preconditions		● Mains is switched off. (Green LED is dark, red LED is blinking) ● Controller inhibit is active. – Press the <F9> key in GDC. – X6/SI1 **or**X6/SI2 must be open (LOW).	
1.	Switch on low-voltage supply (24 V DC).		
2.	Connect PC/laptop (with installed GDC parameter setting program) to controller.	Connection to terminal X14 (CAN-AUX) with PC system bus adapter.	📖 162
3.	Start GDC and select the device to be set.	Select device: Change to the online mode via the GDC toolbar with the <F4> key and select "Searching for drives" using the <F2> key. ⇨ Drive is identified and the parameter menu is opened.	GDC online help
4.	Load Lenze setting.	● Not required for initial commissioning of the axis module. ● Only recommended if the Lenze setting is unclear.	📖 97
5.	Set communication parameters according the interface used.	Comm. parameters - AIF interface: **Please read the documentation for the Lenze communication module used!**	
		Comm. parameters - CAN interface: ● CAN node address (via DIP switch or C0350/C2450) ● Baud rate (via DIP switch or C0351/C2451) ● C0356 (CAN boot up/cycle time) ● C1120 = 1 (sync connection via MotionBus (CAN)) ● C1121 (synchronisation cycle [in ms])	📖 169 📖 176 📖 179
6.	Set mains data.	Set the following codes in the GDC parameter menu under **Short setup → Mains**: ● C0173 (voltage thresholds) ● C0175 (function of the charge relay) – For operation with the power supply module ECSxE set C0175 = 3.	📖 98
7.	Enter motor data.	Lenze motors: Use the GDC motor assistant.	📖 100
		Motors from other manufacturers: Set the codes in the GDC parameter menu under **Motor/feedback systems → Motor setting**.	📖 145
8.	Configure holding brake.	● Not required if a holding brake is not available; *otherwise* ● set C0472/10 (speed threshold) > 0 (e. g. 1 %) for closing the holding brake.	📖 102
9.	Set feedback system.	● Set Lenze motors with resolvers (standard) in the GDC parameter menu under **Short setup → Feedback system**. ● Set other resolvers and encoders in the GDC parameter menu under **Motor/feedback systems → Feedback system**.	📖 103

	Settings	Brief description	Detailed information
10.	A Set direction of rotation of the motor/polarity of the digital inputs.	Set C0114/x (polarity of dig. inputs) in the parameter menu of the GDC under **Terminal I/O → Digital inputs** : ● CW rotation – C0114/1 = HIGH level active (X6/DI1) – C0114/2 = LOW level active (X6/DI2) ● CCW rotation – C0114/1 = LOW level active (X6/DI1) – C0114/2 = HIGH level active (X6/DI2) ● Quick stop (QSP) – C0114/1 = LOW level active (X6/DI1) – C0114/2 = LOW level active (X6/DI2)	📖 121 📖 144
	B Set polarity of the digital outputs.	Set C0118/1 (polarity of dig. output X6/DO1) in the GDC parameter menu under **Terminals I/O → Digital outputs**) .	📖 121
Control settings			
11.	Select operating mode/control structure.	A Speed control ... has to be set in the GDC parameter menu under **Short setup → Speed** : – C3005 = 1000: setpoint via analog input – C3005 = 1003: setpoint via AIF – C3005 = 1005: setpoint via MotionBus (CAN)	📖 126
		B Torque control ... has to be set in the GDC parameter menu under **Short setup → Torque** : – C3005 = 4000: setpoint via analog input – C3005 = 4003: setpoint via AIF – C3005 = 4005: setpoint via MotionBus (CAN)	
12.	Enter machine parameters.	A Set parameters for the speed control in the GDC parameter menu under **Short setup → Speed** .	📖 141
		B Set parameters for the torque control in the GDC parameter menu under **Short setup → Torque** .	
13.	Switch on the mains.	● Green LED is blinking and red LED is off: – Controller is ready for operation. ● Green LED is off and red LED is blinking: – An error has occurred. Eliminate the error before you continue commissioning.	

The basic settings are completed now.

Proceed as follows:

► Enable controller (📖 154).

► Save parameters in the controller with C0003 = 1.

► Save parameter set with GDC in the parameter set file.

► Optimise drive behaviour (📖 154).

6.4 Loading the Lenze setting

Note!

When loading the Lenze setting, all parameters are reset to the basic setting defined by Lenze. Settings that have been adjusted before get lost during this process!

Setting sequence

1. Stop the PLC program: C2108 = 2
2. Load the Lenze setting: C0002 = 0
3. Continue with 3.1 **or** 3.2.

   3.1 The 24-V supply voltage can be switched.

   A Switch off and on again the 24 V-supply voltage.

   B Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   3.2 The 24-V supply voltage cannot be switched.

   A Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   B Reset the PLC: C2108 = 3

4. Continue with basic settings from point 5 of the table on 📖 95.
5. Automatic start of the PLC program after power-up: C2104 = 1
6. Start the PLC program: C2108 = 1
7. Save parameter set: C0003 = 1

6.5 Setting of mains data

The GDC includes the parameters and codes to be set in the parameter menu under **Short setup → Mains**:

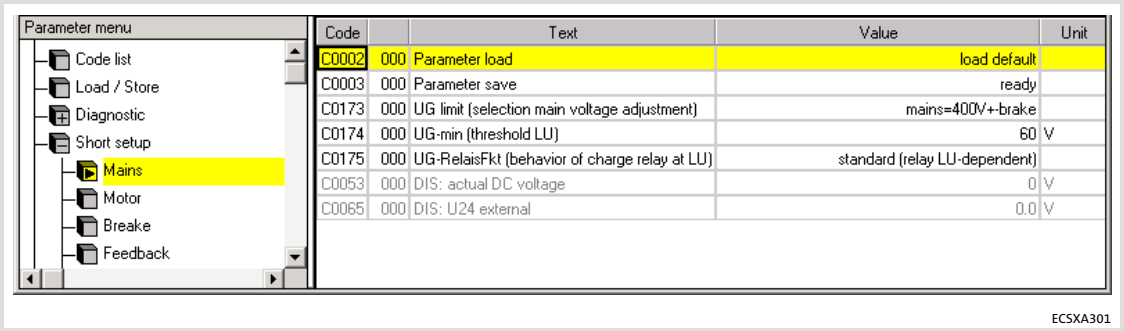


Fig. 6-1 GDC view: Short setup of the mains data

6.5.1 Selecting the function of the charging current limitation

The ECS axis modules are provided with a charging current limitation by means of charge resistors and charge relays. In the Lenze setting the charging current limitation is activated (C0175 = 1).

At mains connection the charge relay remains open for a while so that the charging current of the DC bus is limited by the charging resistors. When a certain voltage level has been reached, the charging resistors are short circuited by switching on (closing) the charge relay contacts.

Stop!

- In case of a mains supply via a power supply module **ECSxE** the entire DC bus is charged in a controlled way by a semiconductor circuit (thyristor) in the power supply module. Therefore, set **C0175 = 3** for the axis modules (charging current limitation inactive, charging resistor short-circuited).

  If the Lenze setting has been loaded via C0002, C0175 = 3 must be reset.
- Cyclic switching of the mains voltage at the power supply module can overload and destroy the charging current limitations of the axis modules if activated (C0175 = 1 or C0175 = 2).

  For this reason, allow a break of at least three minutes between two starting operations in case of cyclic mains switching over a longer period of time!

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 98
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

6.5.2 Setting the voltage thresholds

Note!

All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 98
			15	{1 V} 342		

6.6 Entry of motor data for Lenze motors

Note!

- The following only describes the parameter setting for Lenze motors! (If you use a motor from another manufacturer, see 145.)
- If the Lenze setting has been loaded via C0002, the motor data must be re-entered.
- The freely available "GDC-Easy" does not provide the "Input assistant for motor data" which is described in the following so that you must enter the motor data manually (145).

Parameter setting with the "Input assistant for motor data" of the GDC

1. Go to the GDC menu bar and select the **Tool → Motor data** menu item or click the button with the motor symbol in the tool bar:

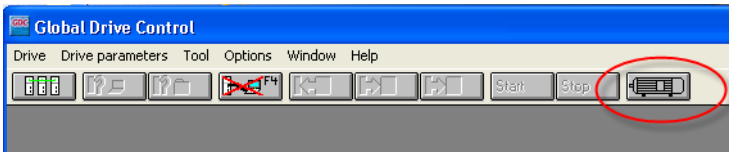


Fig. 6-2 GDC view: menu bar and tool bar

– The "Input assistant for motor data" opens:

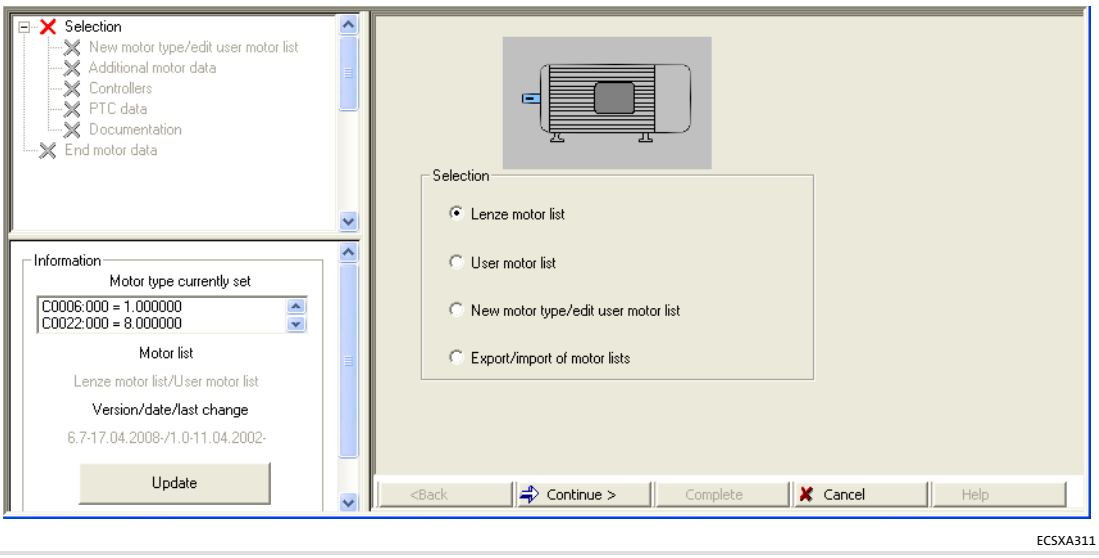


Fig. 6-3 GDC view: Selection of motor list

2. Select the "Lenze motor list" and click the [Continue] button.

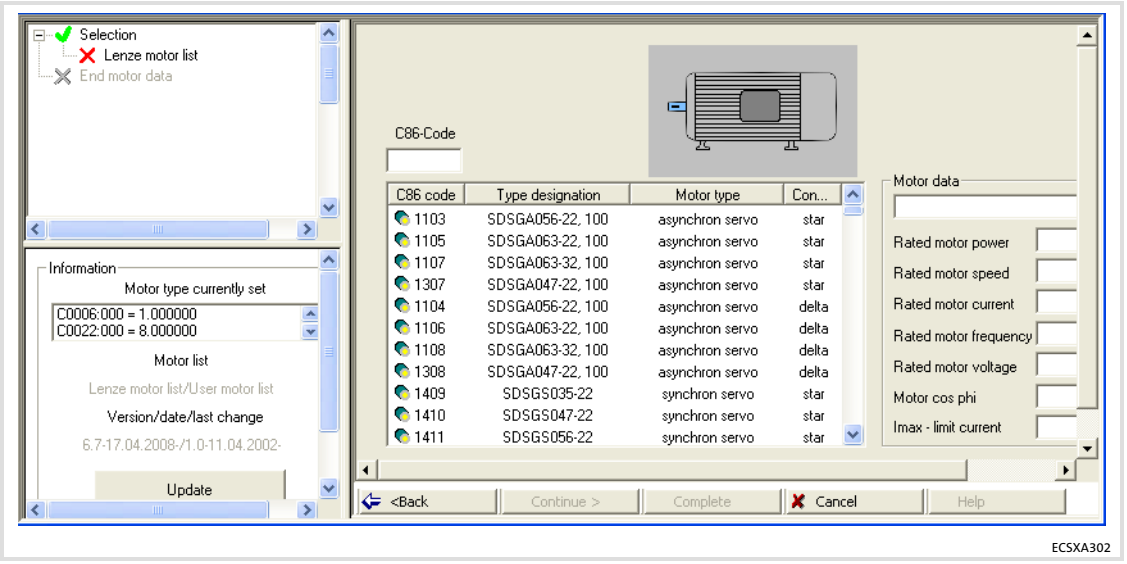


Fig. 6-4 GDC view: Motor selection

3. Select the connected motor from the list (see motor nameplate).
   – The corresponding motor data is displayed in the ”Motor data” fields on the right.
4. Click the [Complete] button.
   – The data is transferred to the controller. This process can take a few seconds and is confirmed by a message after being completed.

6.7 Holding brake configuration

Tip!

If you use a motor without a holding brake, you can skip this chapter.

In the GDC, the parameters or codes to be set can be found in the parameter menu under **Short setup → Brake**:

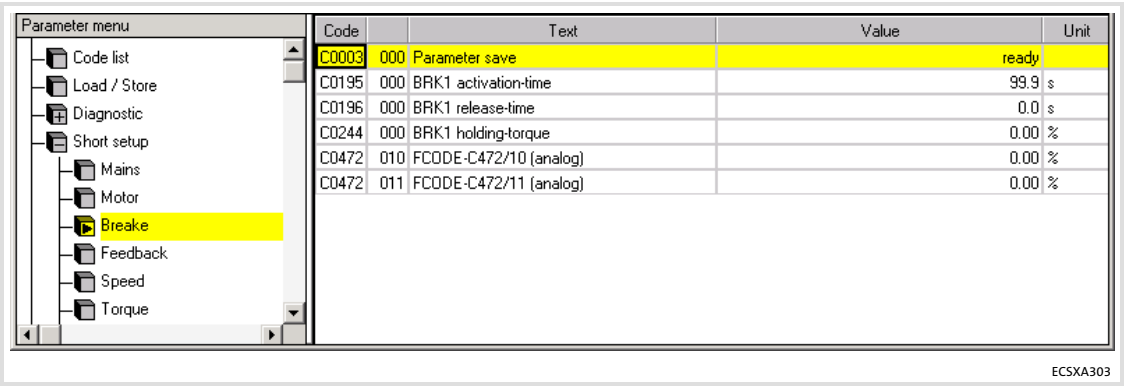


Fig. 6-5 GDC view: Short setup of the holding brake

Code	Name	Description
C0195	Brake closing time/engagement time	The time required for closing the holding brake. ● When Ctrl1.Bit7 = 0 (FALSE), the brake is closed. ● Only after this time has elapsed, the controller inhibit is activated.
C0196	Brake opening time/disengagement time	The time required for opening the holding brake. ● During the time set the drive generates the torque set under C0244 against the holding brake. ● If an actual speed higher than the value in C0472/10 is detected before the brake opening time (C0196) has expired, the drive can immediately change to speed-controlled operation.
C0244	Holding torque	Holding torque of the drive against the holding brake ● 100 % ≙ value of C0057
C0472/10	FCODE analog [%]	Speed threshold for closing the brake: ● Only if the actual speed value has fallen below the speed threshold, the ”close brake” signal is output. ● This code refers to the maximum speed set in C0011. **Note:** Enter a value > 0 so that the brake can be opened.
C0472/11	FCODE analog [%]	Value/direction of the torque against the holding brake.

6.8 Setting of the feedback system for position and speed control

The following feedback systems can be selected for position and speed control:

- Resolver (📖 104)
- TTL incremental encoder/SinCos encoder without serial communication (📖 106)
  - as position and speed encoder (📖 106)
  - as position encoder and resolver as speed encoder (📖 109)
- Absolute value encoder (Hiperface®, single-turn/multi-turn)
  - as position and speed encoder (📖 113)
  - as position encoder and resolver as speed encoder (📖 117)

The GDC includes the parameters or codes to be set in the parameter menu under **Short setup → Feedback system**:

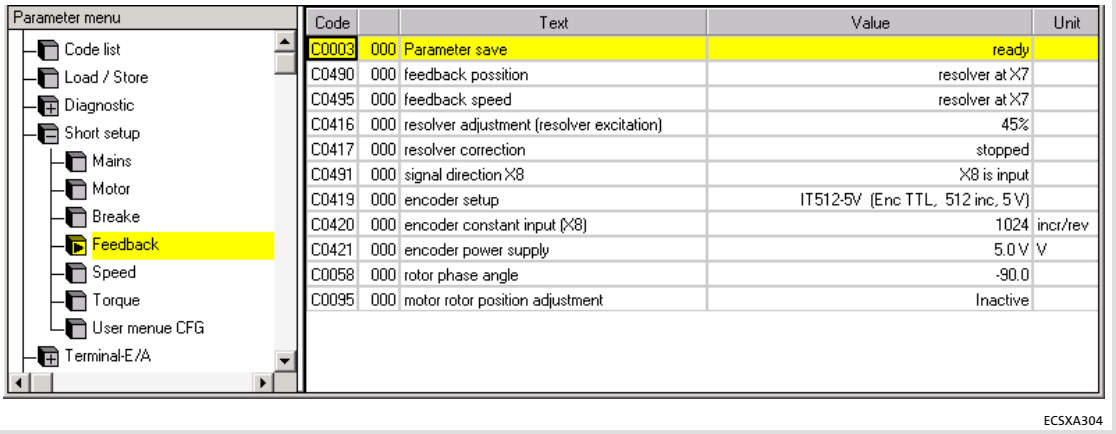


Fig. 6-6 GDC view: Short setup of the feedback system

Note!

If the Lenze setting has been loaded via C0002, the feedback system must be reset.

6.8.1 Resolver as position and speed encoder

If a resolver is connected to X7 and used as a position and speed encoder, no settings are necessary.

Lenze setting:

- ► Resolver as position encoder: C0490 = 0
- ► Resolver as speed encoder: C0495 = 0

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 103
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 103
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 148
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0095]	Rotor pos adj	0			Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 151
			0	Inactive		
			1	Active		
C0414	DIS: ResQual.				Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 104
			0.00	{0.01} 1,60		
[C0416]	Resolver adj.	5			Resolver excitation amplitude	📖 104
			0	100 %		
			1	80 %		
			2	68 %		
			3	58 %		
			4	50 %		
			5	45 %		
			6	40 %		
			7	37 %		
[C0417]	Resolver cor.	0			Resolver adjustment	📖 160
			0	Ready		
			1	Start adjustment		
			2	Loading default values		

6.8.2 TTL/SinCos encoder as position and speed encoder

If a TTL incremental encoder or a sin/cos encoder without serial communication is connected to X8 and used for position and speed control, the following setting sequence must be observed:

1. Select encoder for position and speed control.
   – Incremental encoder (TTL encoder): C0490 and C0495 = 1
   – Sin/cos encoder without serial communication: C0490 and C0495 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

When encoders are used for position and speed control, the same feedback system will automatically be set for both control modes under C0490 and C0495. Separate feedback systems can only be selected in connection with a resolver.

2. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – Sin/cos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
3. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.

The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 301 📖 106 📖 113
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 301 📖 106 📖 113
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106 📖 113
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 301 📖 304 📖 106 📖 113
			0	X8 is input		
			1	X8 is output		

6.8.3 TTL/SinCos encoder as position encoder and resolver as speed encoder

A TTL incremental encoder connected to X8 or a SinCos encoder without serial communication can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select TTL/SinCos encoder as position encoder.
   – Incremental encoder (TTL encoder): C0490 = 1
   – SinCos encoder without serial communication: C0490 = 2

   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – SinCos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 (”Common”)
4. When setting C0419 = 1 (”Common”) configure encoder data.

Note!

When setting **C0419 = 11x or 21x** do **not** configure encoder data.
The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
5. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	● Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0058	Rotor diff	-90.0			Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °} 179.9		
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 148
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1			Number of pole pairs of resolver	
			1	{1} 10		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0414	DIS: ResQual.				Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 104
			0.00	{0.01} 1,60		
[C0416]	Resolver adj.	5			Resolver excitation amplitude	📖 104
			0	100 %		
			1	80 %		
			2	68 %		
			3	58 %		
			4	50 %		
			5	45 %		
			6	40 %		
			7	37 %		
[C0417]	Resolver cor.	0			Resolver adjustment	📖 160
			0	Ready		
			1	Start adjustment		
			2	Loading default values		
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 301 📖 106 📖 113
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 301 📖 106 📖 113
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106 📖 113
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 301 📖 304 📖 106 📖 113
			0	X8 is input		
			1	X8 is output		

6.8.4 Absolute value encoder as position and speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

If an absolute value encoder with Hiperface® interface is connected to X8 and used as position and speed encoder, the following setting sequence must be observed:

1. Select absolute value encoder as position and speed encoder.
   – Single-turn encoder: C0490 and C0495 = 3
   – Multi-turn encoder: C0490 and C0495 = 4
   If X8 has been selected as output by changing C0491, X8 will be automatically reset to input through the encoder selection.

Note!

When encoders are used for position and speed control, the same feedback system will automatically be set for both control modes. Separate feedback systems can only be selected in connection with a resolver (see code table, C0490 and C0495).

2. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411
   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

3. Save settings with C0003 = 1.

Note!

When configuring the absolute value encoder, an "SD7" system error is activated. The error can only be reset by means of mains switching.

Codes for feedback system selection

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0490]	Feedback pos	0		Selection of feedback system for positioning control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	• Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0		Selection of feedback system for speed control	📖 103
			0 Resolver at X7	Standard setting	
			1 TTL encoder at X8	• Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2 SinCos encoder at X8		
			3 Absolute value encoder (single-turn) at X8		
			4 Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 301 📖 106 📖 113
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 301 📖 106 📖 113
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106 📖 113
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0491]	X8 in/out	0		Function of X8	📖 301
			0 X8 is input		📖 304 📖 106
			1 X8 is output		📖 113

6.8.5 Absolute value encoder as position encoder and resolver as speed encoder

Danger!

Valid when using an operating software up to and including V7.0:

When absolute value encoders are used, uncontrolled movements of the drive are possible!

If an **absolute value encoder** is disconnected from the axis module during operation, the fault OH3-TRIP occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. A SD8-TRIP will not occur, as would be expected.

Possible consequences:

► Death or severe injuries

► Destruction or damage of the machine/drive

Protective measures:

► If a fault (trip) occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an Sd8-TRIP is at the second or third place, a reinitialisation is absolutely necessary. For this purpose, switch off and on again the 24-V supply of the control electronics.

An absolute value encoder Hiperface® interface connected to X8 can be configured as a position encoder with a resolver connected to X7 being used as a speed encoder.

Observe the following setting sequence:

1. Select absolute value encoder as position encoder.
   – Single-turn encoder: C0490 = 3
   – Multi-turn encoder: C0490 = 4
2. Select resolver as speed encoder.
   – C0495 = 0
3. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411

   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

When absolute value encoders are used, uncontrolled movements of the drive are possible!

With **operating systems up to and including version 6.7**, the drive may start up in an uncontrolled manner with a high speed and a high torque after mains connection and controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

4. Save settings with C0003 = 1.

Codes for feedback system selection

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 103
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 103
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute value encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °}	179.9		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 148
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 104
			0.00	{0.01}	1,60		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 104
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 160
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. setup	110			Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 301 📖 106 📖 113
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0			Encoder voltage	📖 301 📖 106 📖 113
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106 📖 113
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
[C0491]	X8 in/out	0			Function of X8	📖 301 📖 304 📖 106 📖 113
			0	X8 is input		
			1	X8 is output		

6.9 Configuring the digital inputs and outputs

6.9.1 Setting the polarity

The polarity can be set for each digital input and output. This determines whether the input or output is HIGH active or LOW active.

The following are available:

- 4 digital inputs (X6/DI1 ... DI4)
- 1 digital output (X6/DO1)
- 1 relay output (X25/BD1, BD2)

The GDC contains codes for setting the polarity of digital inputs and outputs in the parameter menu under **Terminal I/O**:

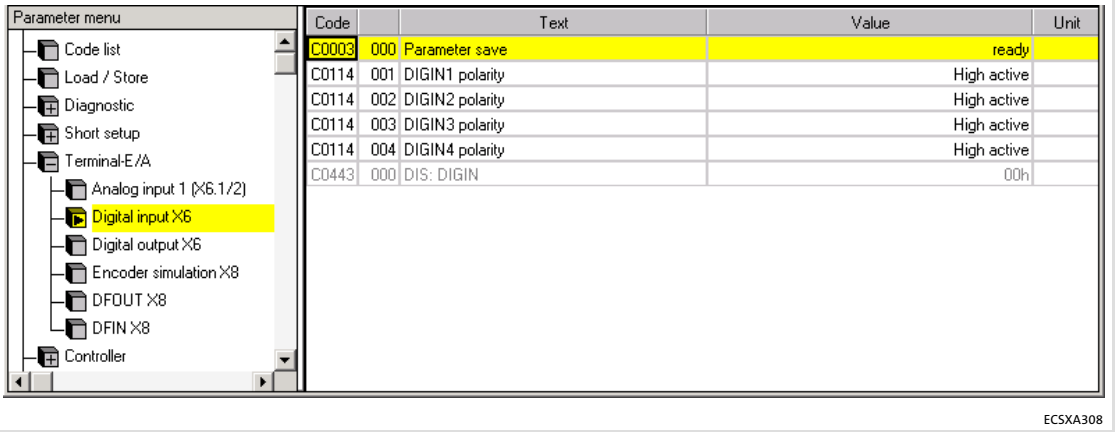


Fig. 6-7 GDC view: Setting of the polarity of digital inputs and outputs

6.9.2 Setting the direction of rotation

Based on the Lenze setting, the direction of rotation of the motor depends on

- the sign of the speed setpoint.
- the polarity of the digital inputs X6/DI1 and X6/DI2.

How to set the polarity/direction of rotation via C0114/x:

- **CW rotation**
  - C0114/1 = HIGH level active (X6/DI1)
  - C0114/2 = LOW level active (X6/DI2)
- **CCW rotation**
  - C0114/1 = LOW level active (X6/DI1)
  - C0114/2 = HIGH level active (X6/DI2)
- **Quick stop (QSP)**
  - C0114/1 = LOW level active (X6/DI1)
  - C0114/2 = LOW level active (X6/DI2)
  - See also page 144.

6.9.3 Change of the terminal assignment

The input terminals are to be considered as signal sources for the internal functions (signal name). The assignment of the digital inputs is effected indirectly, as a signal source for controlling the function is selected from the list of all digital signal sources on the basis of the internal function.

Stop!

- If you change the configuration via C3005, the assignment of all inputs and outputs is overwritten with the corresponding basic assignment. If necessary, the function assignment must be readjusted to your wiring.
- Signal sources, i. e. also digital inputs, can be connected parallel to more than one function (signal name).
- If you allocate (assign) an input as a new signal source, undesired connections have to be deleted, if required.

► **Example:** digital inputs/outputs in basic configuration C3005 = 1000

Here the most important targets for digital inputs and outputs for ”speed control” are listed:

Code	Subcode	Signal name	Controlled by Signal (interface)	Note
C7411	1	SPEED-RLQ.CW	DIGIn-In1 (terminal X6/DI1)	HIGH level = do not invert main setpoint (CW rotation)
	2	SPEED-RLQ.CCW	DIGIn-In2 (terminal X6/DI2)	HIGH level = Invert main setpoint (CCW rotation)
	3	SPEED-Nset.Jog1	DIGIn-In3 (terminal X6/DI3)	HIGH level = main setpoint is substituted by the fixed speed from C0039/x The signals are binary coded.
	4	SPEED-Nset.Jog2	FIXED 0, not interconnected	
	5	SPEED-NSET.Jog4	FIXED 0, not interconnected	
	6	SPEED-Nset.Jog8	FIXED 0, not interconnected	
	10	SPEED-BRK.SetBrake	DIGIn-In4 (terminal X6/DI4)	HIGH level = close holding brake when the speed falls below the threshold in C0472/10.
C6371	1	DigOut1-Out1	FIXED 0, not interconnected	
	2	DigOut relay	SPEED-BRK.NegOut	Control of the holding brake by the ”Speed” function block.

Note!

For ”Speed control”, carry out settings in C7511 and C6371.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3005	ControlMode	0			Selection of operating modes	📖 126
			0	Common	Display with changed standard application	
			100	None	Reset of all signal connections	
			1000	SpeedTerm	Speed-controlled, setpoint via analog input	📖 318
			1003	SpeedAIF	Speed-controlled, setpoint via AIF	
			1005	SpeedCAN	Speed-controlled, setpoint via MotionBus (CAN)	
			4000	TorqueTerm	Torque-controlled, setpoint via analog input	📖 343
			4003	TorqueAIF	Torque-controlled, setpoint via AIF	
			4005	TorqueCAN	Torque-controlled, setpoint via MotionBus (CAN)	
[C6371]					Selection of the digital output signals for the digital output and the brake relay	📖 308
1	DigoutIn-dig	1000		0 (FALSE, not assigned)	Source for the output signal at the digital output X6/DO1 (DigOut-Out1)	
2	DigoutIn-dig	1000		0 (FALSE, not assigned)	Source for the control of the brake relay (DigOut relay)	
			For possible signals see ”selection list - digital signals”			📖 428

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7411]				Selection of the signal source for the digital input signals of the ”Speed” function block	
1	SpeedIn-dig	1000	0 (FALSE, not assigned)	CW rotation (SPEED-RLQ.Cw)	📖 325
2	SpeedIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (SPEED-RLQ.CCw)	
3	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog1) saved in C0039	📖 326
4	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog2)saved in C0039	
5	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog4)saved in C0039	
6	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog8)saved in C0039	
7	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of the speed setpoint integrator to 0 along the adjusted ramps (SPEED-NSET.Rfg0)	📖 326
8	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional speed setpoint (SPEED-NAddInv)	
9	SpeedIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the speed setpoint integrator to the actual value (SPEED-NSET.RfgStop)	
10	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (SPEED-BRK.SetBrake)	📖 340
11	SpeedIn-dig	1000	0 (FALSE, not assigned)	Switching of speed - torque (SPEED-MCTRL.NMSwt)	📖 332
12	SpeedIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the speed controller (SPEED-MCTRL.ILoad)	
13	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI1)	📖 326
14	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI2)	
15	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI4)	
16	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI8)	
17	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set1)	📖 332
18	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set2)	
19	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of phase controller (SPEED-MCTRL.PosOn)	
20	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (SPEED-MAddInv)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
			For possible signals see ”selection list - digital signals”		📖 428
[C7511]				Selection of the signal source for the digital input signals of the ”Torque” function block	
1	TorqueIn-dig	1000	0 (FALSE, not assigned)	CW rotation (TORQUE-RLQ.Cw)	📖 350
2	TorqueIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (TORQUE-RLQ.CCw)	
3	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of the torque setpoint integrator to 0 along the adjusted ramps (TORQUE-NSET.Rfg0)	📖 351
4	TorqueIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (TORQUE-BRK.SetBrake)	📖 360
5	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set1)	📖 354
6	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set2)	
7	TorqueIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the controller (TORQUE-MCTRL.ILoad)	
8	TorqueIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the torque setpoint integrator to the current value (TORQUE-NSET.RfgStop)	
9	TorqueIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (TORQUE-MAddInv)	
			For possible signals see ”selection list - digital signals”		📖 428

6.10 Selecting the operating mode/control structure

For frequent applications, the controller-internal signal processing is saved in basic configurations hich can be selected via C3005:

► Speed control:

Code	Value	Interfaces	Application examples	Functional description
C3005	1000	Activation/setpoint via analog input	📖 127	📖 318
	1003	Control / setpoint via AIF	📖 130	
	1005	Control / setpoint via MotionBus (CAN)	📖 132	

► Torque control:

Code	Value	Interfaces	Application examples	Functional description
C3005	4000	Activation/setpoint via analog input	📖 134	📖 343
	4003	Control / setpoint via AIF	📖 137	
	4005	Control / setpoint via MotionBus (CAN)	📖 139	

Stop!

When the internal control structure is changed, another terminal assignment may result!

In the GDC the code C3005 can be found in the parameter menu under

► **Short setup → Speed** (for speed control).

► **Short setup → Torque** (for torque control).

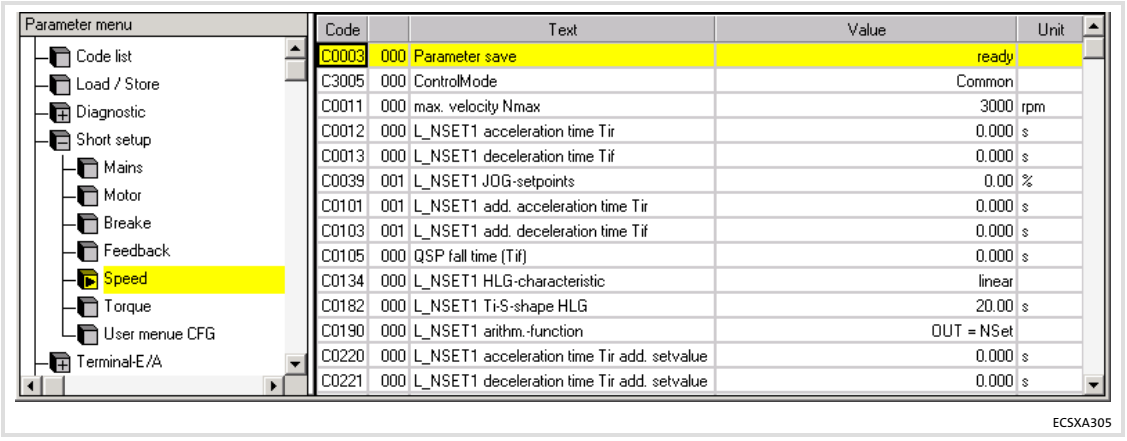


Fig. 6-8 GDC view: short setup of the speed control (”Speed”)

6.10.1 Speed control with setpoint via analog input

Configuration C3005 = 1000

Note!

Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 1000	Speed control with setpoint via analog input	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 333
C0012 = x [s]	Acceleration time	📖 327
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 338
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 333
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

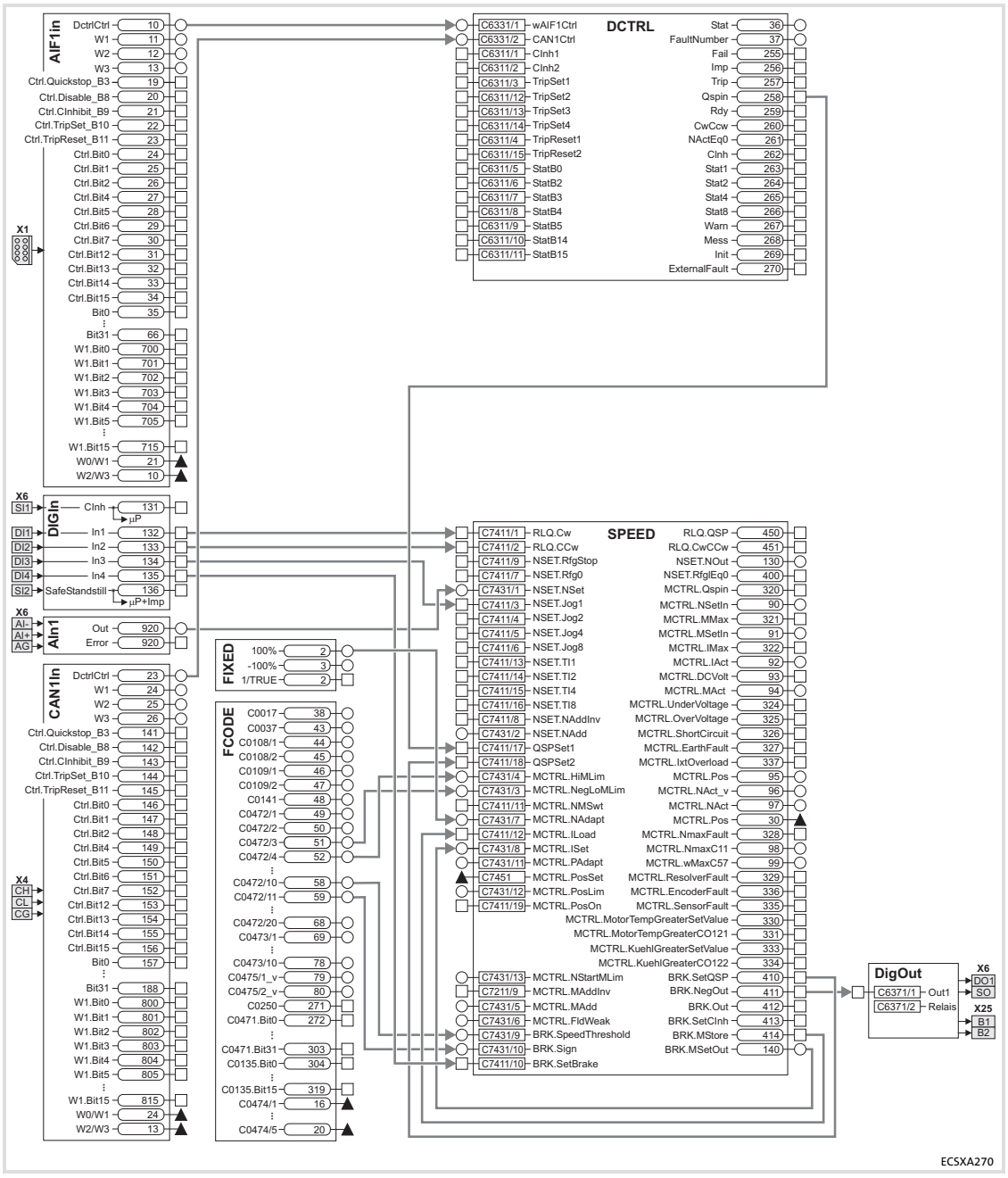


Fig. 6-9 Signal flow diagram for configuration 1000 (setpoint via analog input)

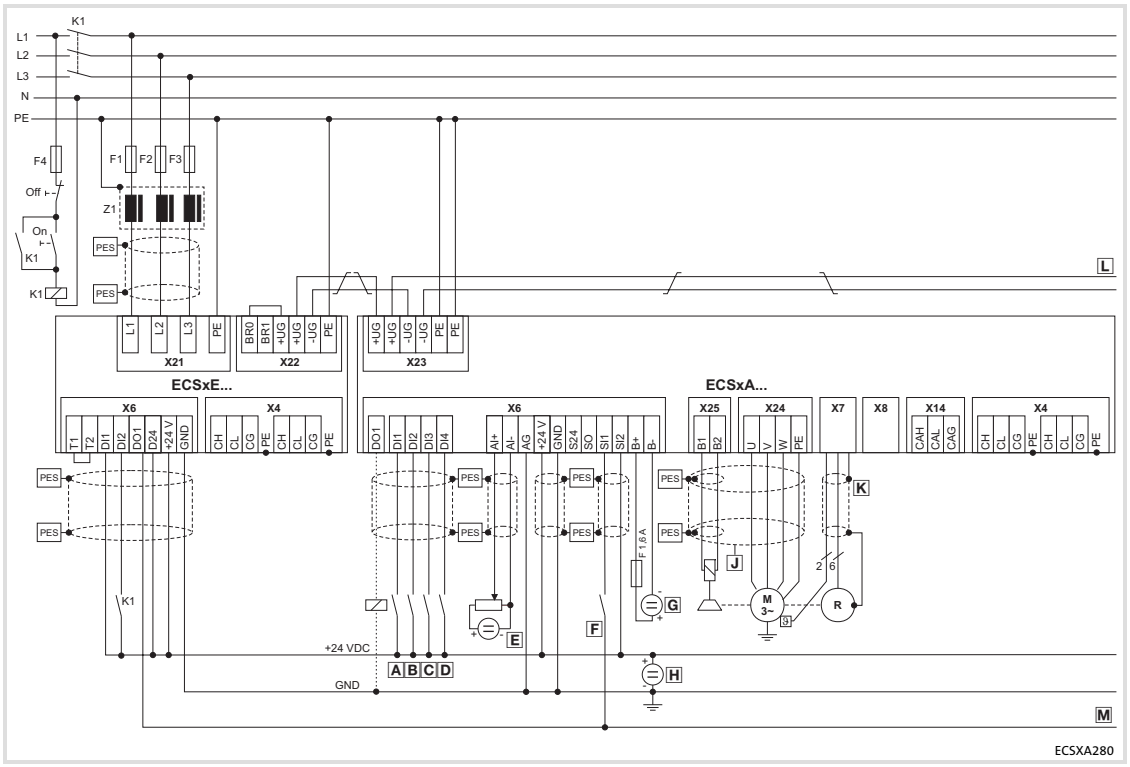


Fig. 6-10 Connection diagram for configuration 1000 (setpoint via analog input)

- A Direction of rotation / quick stop (QSP)
- B Direction of rotation / quick stop (QSP)
- C Fixed speed C0039/1
- D Holding brake
- E Analog input voltage supply
- F Switch for controller enable/inhibit
- G Motor system cable
- H Voltage supply of motor holding brake
- J Voltage supply of control
- K Controller enable
- L System cable feedback
- M DC-bus voltage
- PES HF shield termination by large-surface PE connection
- ∫ Twisted cables

Note!

In the wiring example (Fig. 6-10) a HIGH level is fixedly applied on X6/SI2 (pulses for power section enabled).

6.10.2 Speed control with setpoint via AIF

Configuration C3005 = 1003

Note!

- ► Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).
- ► Further information can be obtained from the documentation for the corresponding fieldbus module.

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 1003	Speed control with setpoint via AIF	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 333
C0012 = x [s]	Acceleration time	📖 327
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 338
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 333
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

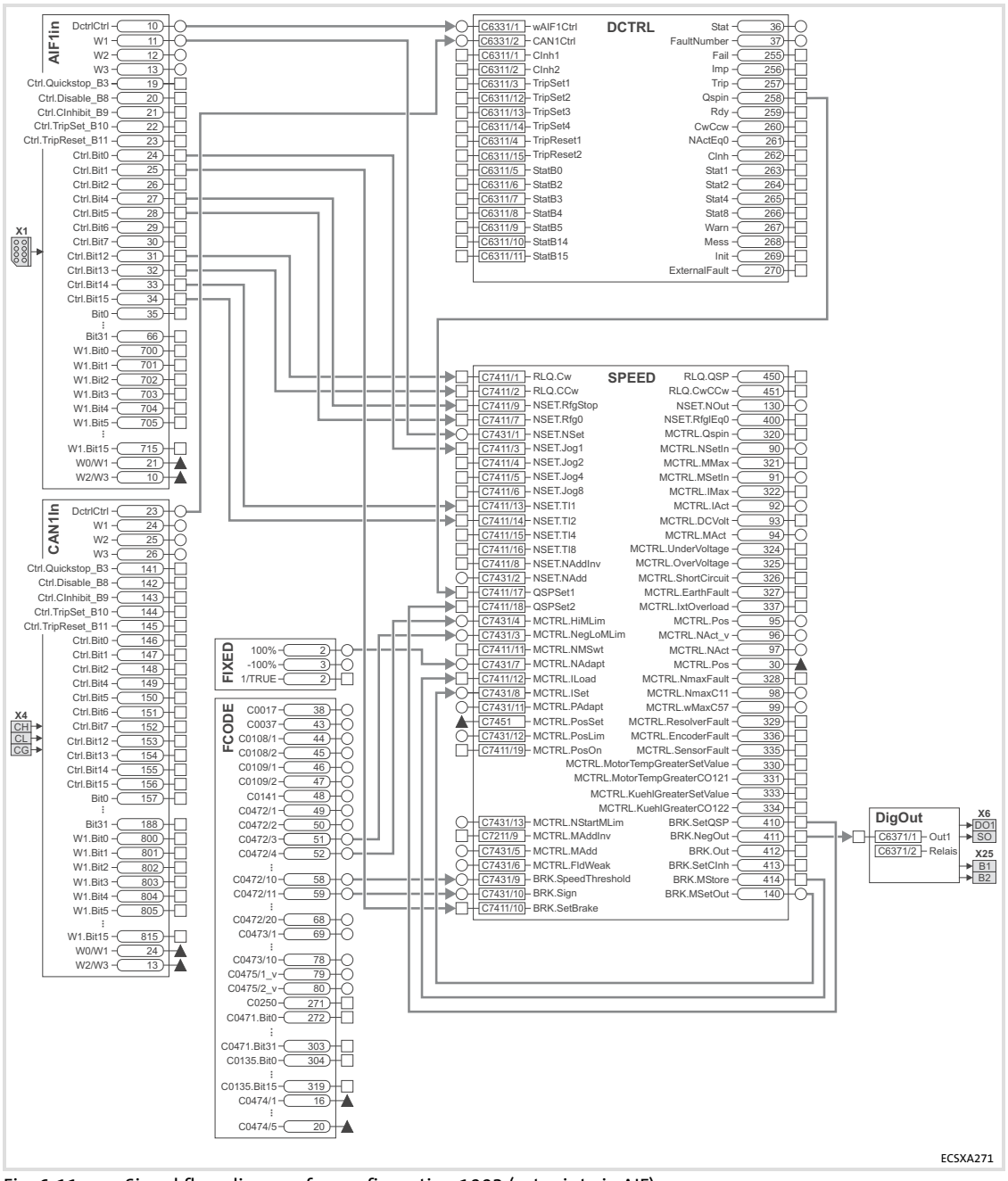


Fig. 6-11 Signal flow diagram for configuration 1003 (setpoint via AIF)

6.10.3 Speed control with setpoint via MotionBus (CAN)

Configuration C3005 = 1005

Note!

- ► Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).
- ► Reading the data via CAN1_In requires an external sync signal (from the master control).

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 1005	Speed control with setpoint via MotionBus (CAN)	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 333
C0012 = x [s]	Acceleration time	📖 327
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 338
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 333
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

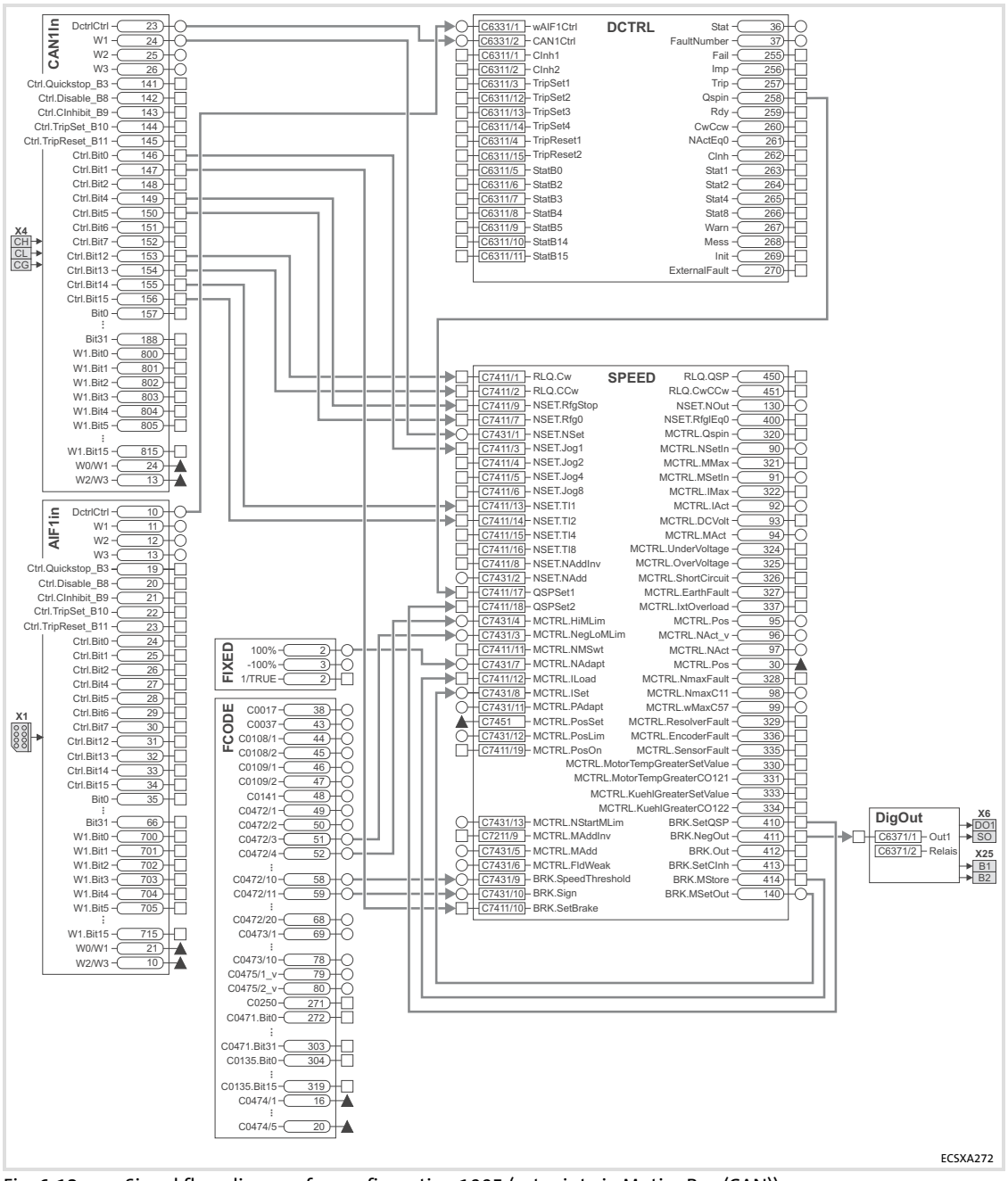


Fig. 6-12 Signal flow diagram for configuration 1005 (setpoint via MotionBus (CAN))

6.10.4 Torque control with setpoint via analog input

Configuration C3005 = 4000

Note!

Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 4000	Torque control with setpoint via analog input	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 355
C0012 = x [s]	Acceleration time	📖 351
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 358
Speed limitation		
C0472/4 = x [%]	Speed limit (positive value)	📖 349
C7131/1 = 52	FCODE C0472/4	
C7531/2 = 651	InNeg-AnOut1	
C7531/5 = 52	FCODE C0472/4	
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 355
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

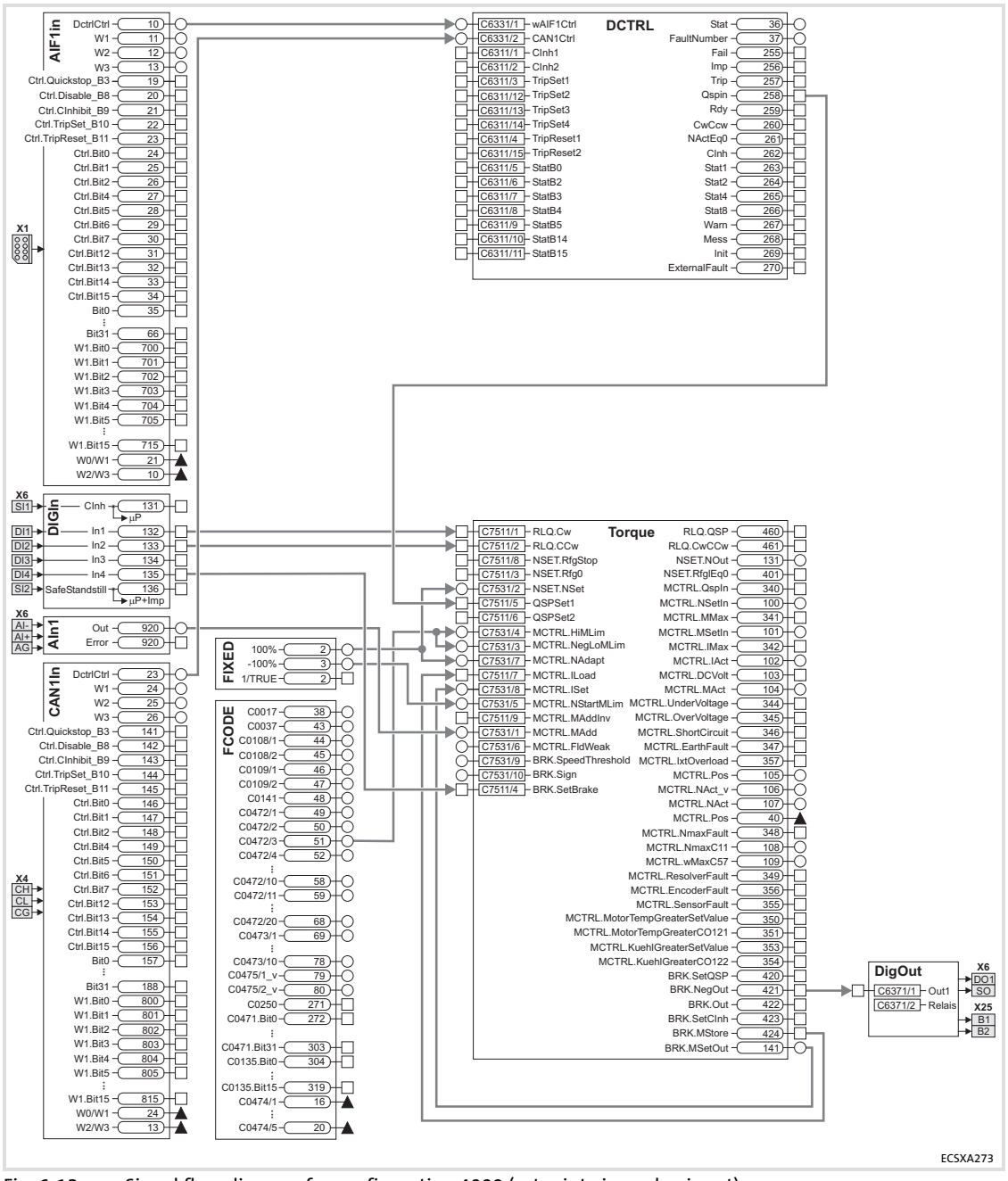


Fig. 6-13 Signal flow diagram for configuration 4000 (setpoint via analog input)

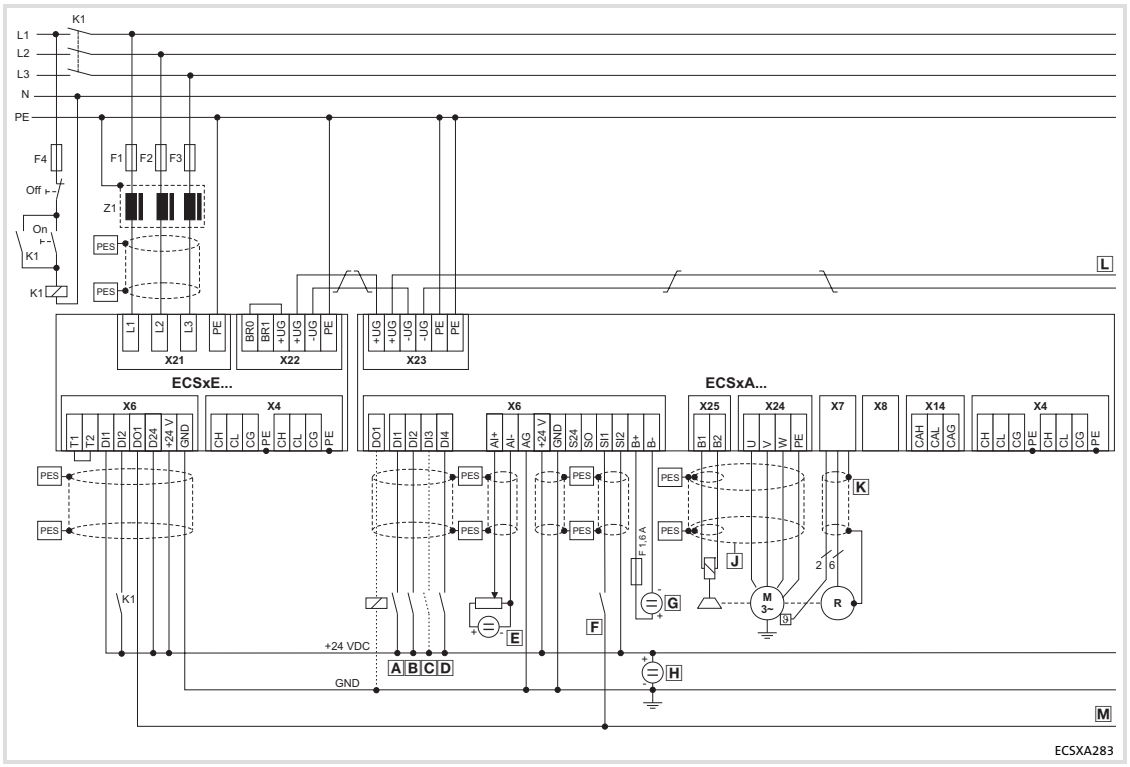


Fig. 6-14 Connection diagram for configuration 4000 (setpoint via analog input)

- A Direction of rotation / quick stop (QSP)
- B Direction of rotation / quick stop (QSP)
- C Fixed speed C0039/1
- D Holding brake
- E Analog input voltage supply
- F Switch for controller enable/inhibit
- G Motor system cable
- H Voltage supply of motor holding brake
- J Voltage supply of control
- K Controller enable
- L System cable feedback
- M DC-bus voltage
- PES HF shield termination by large-surface PE connection
- Twisted cables

Note!

In the wiring example (Fig. 6-14) a HIGH level is fixedly applied on X6/SI2 (pulses for power section enabled).

6.10.5 Torque control with setpoint via AIF

Configuration C3005 = 4003

Note!

- ► Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).
- ► Further information can be obtained from the documentation for the corresponding fieldbus module.

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 4003	Torque control with setpoint via AIF	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 355
C0012 = x [s]	Acceleration time	📖 351
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 358
Speed limitation		
C0472/4 = x [%]	Speed limit (positive value)	📖 349
C7131/1 = 52	FCODE C0472/4	
C7531/2 = 651	InNeg-AnOut1	
C7531/5 = 52	FCODE C0472/4	
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 355
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

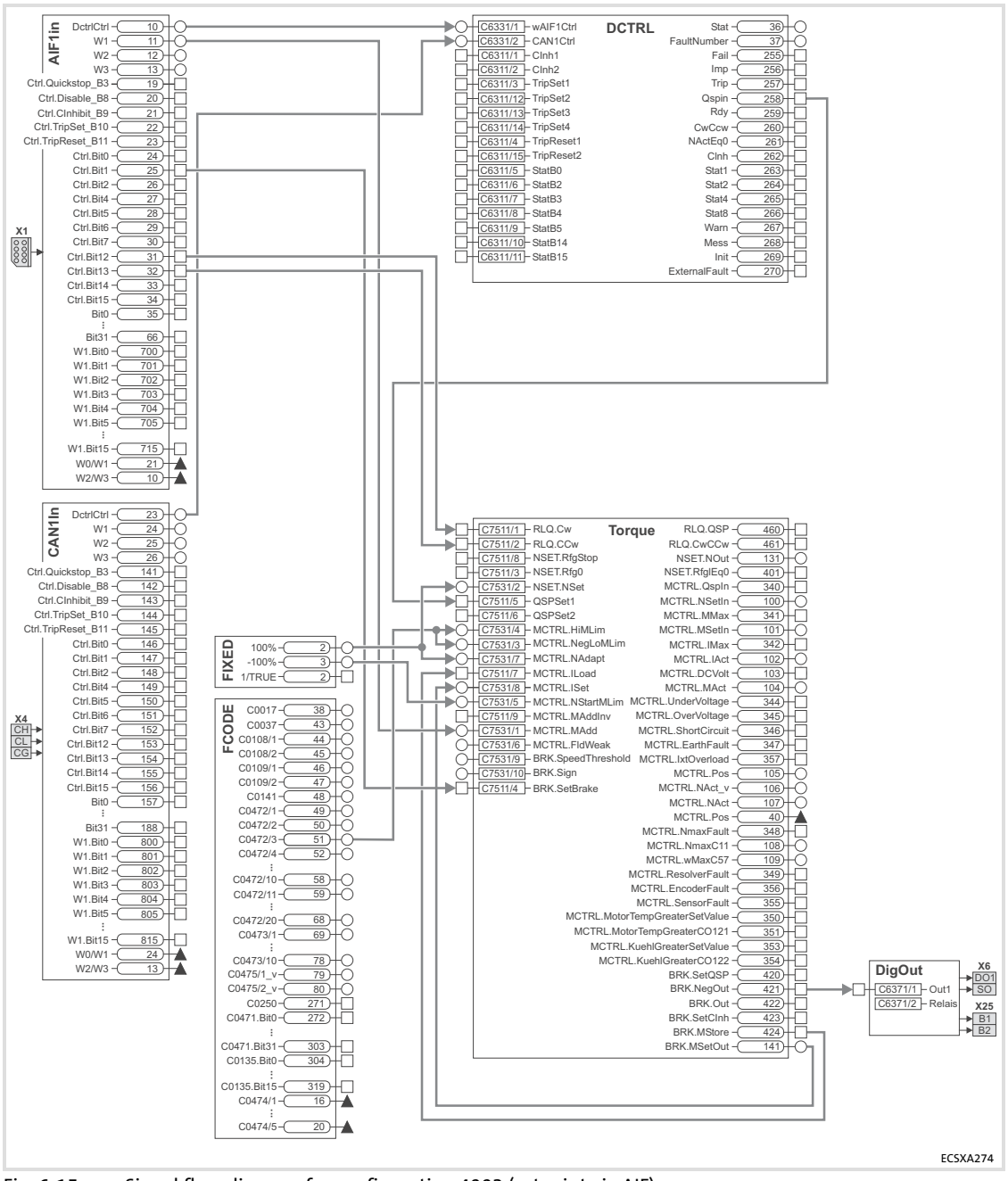


Fig. 6-15 Signal flow diagram for configuration 4003 (setpoint via AIF)

6.10.6 Torque control with setpoint via MotionBus (CAN)

Configuration C3005 = 4005

Note!

- ► Use the ”input assistant for motor data” of the GDC for setting the motor data (📖 100).
- ► Reading the data via CAN1In requires an external Sync signal (from the master control).

Set the following codes:

Code	Meaning	Further information
DC-bus voltage thresholds and charge relay function		
C0173 = x	DC-bus voltage thresholds	📖 99
C0175 = x	Charge relay function (when using an ECS supply module: C0175 = 3)	📖 98
Maximum motor current		
C0022 = x [A]	Maximum motor current (I_{max})	
Controller configuration and feedback system		
C3005 = 4005	Torque control with setpoint via MotionBus (CAN)	📖 126
C0495 = x	Feedback system	📖 103
Speed setpoint settings		
C0011 = x [rpm]	Maximum speed	📖 355
C0012 = x [s]	Acceleration time	📖 351
C0013 = x [s]	Deceleration time	
C0105 = x [s]	Quick stop deceleration time	📖 358
Speed limitation		
C0472/4 = x [%]	Speed limit (positive value)	📖 349
C7131/1 = 52	FCODE C0472/4	
C7531/2 = 651	InNeg-AnOut1	
C7531/5 = 52	FCODE C0472/4	
Application parameters		
C0070 = x	Proportional gain (V_p) of speed controller	📖 355
C0071 = x [ms]	Integral-action time (T_n) of speed controller	
Save parameters		
C0003 = 1	Save all parameters	

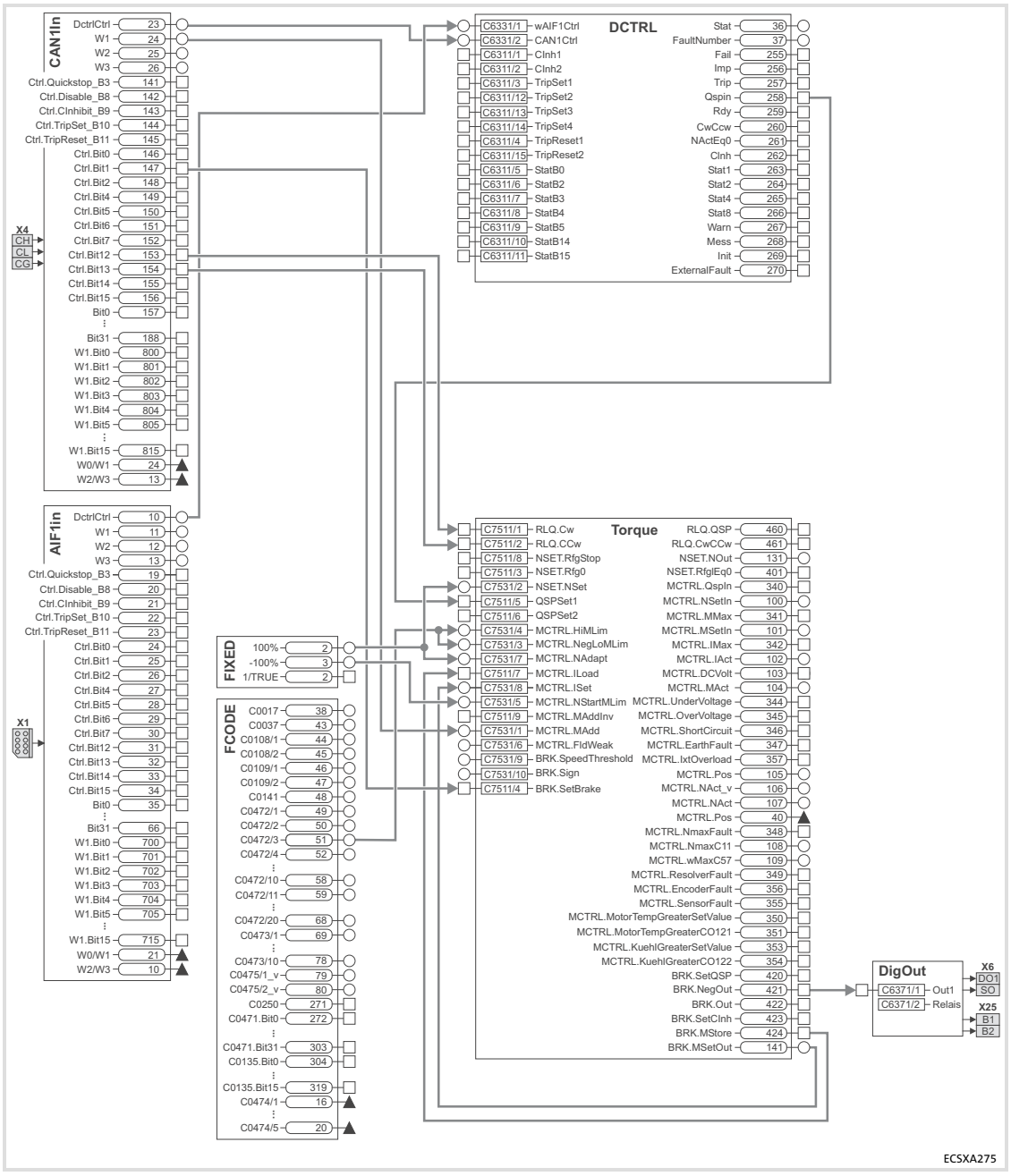


Fig. 6-16 Signal flow diagram for configuration 4005 (setpoint via MotionBus (CAN))

6.11 Entry of machine parameters

In the GDC the codes for machine parameters, like for example maximum speed and ramp times can be found in the parameter menu under

- **Short setup → Speed** (for speed control).
- **Short setup → Torque** (for torque control).

Note!

Detailed information concerning the possible settings can be gathered from the function block descriptions:

- Function block "Speed": 📖 318
- Function block "Torque": 📖 343

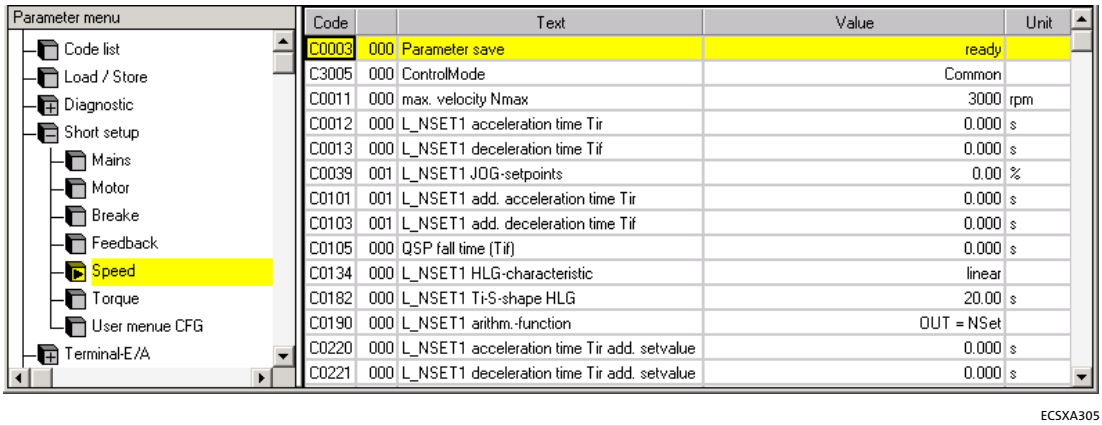


Fig. 6-17 GDC view: short setup of the speed control ("Speed")

6.12 Setpoint selection

The operating mode selected in C3005 enables a pre-assignment from different setpoint sources:

Code	Value [1]	Setpoint source	Setpoints
C3005	1000 4000	Analog input	• Fixed speed • Analog setpoints (e. g. master voltage or master current)
	1003 4003	AIF module	• Fixed speed • Fieldbus setpoints
	1005 4005	MotionBus (CAN)	• Fixed speed • CAN setpoints

[1] 100x = speed control (”Speed”)
400x = torque control (”Torque”)

Example: selection of analog setpoints

For selecting analog setpoints you can for instance configure the analog input signal in GDC in the parameter menu under **Function blocks → AIn1**:

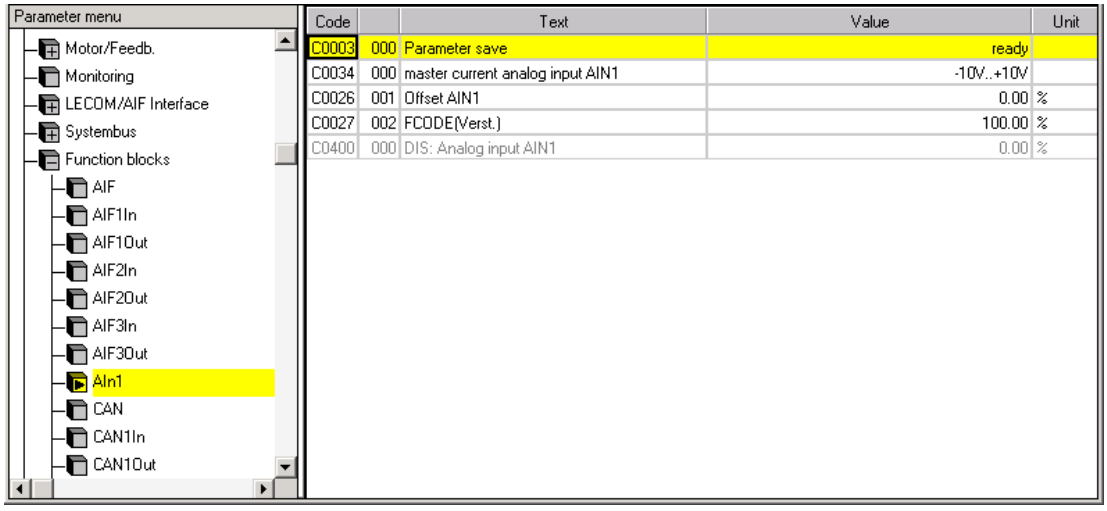


Fig. 6-18 GDC view: Codes of the function block AIn1

6.13 Controller enable (CINH = 0)

The controller will only be enabled internally if no signal sources relevant for the controller inhibit (CINH) are activated (i.e. CINH-signal sources = 0).

The following table shows the signal sources for controller enable:

Source for controller inhibit	Controller inhibit	Controller enable	Note
Terminal X6/SI1	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	For controller enable, X6/SI1 has to be = HIGH **and** X6/SI2 = HIGH.
Terminal X6/SI2	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	
C0040	C0040 = 0	C0040 = 1	
Operating module/keypad	STOP key	RUN key	Inhibiting with STOP key is only possible if the STOP key is assigned with "CINH" via C0469.
Fault	• In case of TRIP • In case of message	• No TRIP/message active • TRIP reset	For check see 📖 232.
Control word - system bus (CAN), C0135	C0135/bit 9 = 1	C0135/bit 9 = 0	GDC function keys: • <F8> key (controller enable/start) • <F9> key (controller inhibit/stop)
Fieldbus module	See Operating Instructions of the corresponding fieldbus module.		

Note!

All signal sources act like a series connection of switches which are independent of each other.

6.14 Quick stop (QSP)

By means of the quick stop function, the drive is braked to standstill within a set deceleration time (C0105).

Quick stop (QSP) is activated by the following signal sources:

Configuration/operating mode		QSP active if
Lenze setting	During mains connection	● X6/DI1 and DI2 = HIGH or ● X6/DI1 and DI2 = LOW
	During operation	● X6/DI1 and DI2 = LOW QSP is recognised device-internally if a LOW signal is applied to X6/DI1 and DI2 for more than 2 ms.
Speed control (”Speed”)		● SPEED-QSP.Set1 (C7411/17) = TRUE or ● SPEED-QSP.Set2 (C7411/18) = TRUE (further information: 📖 338)
Torque control (”Torque”):		● TORQUE-QSP.Set1 (C7511/17) = TRUE or ● TORQUE-QSP.Set2 (C7511/18) = TRUE (further information: 📖 358)

The deceleration time for the brake application is set via C0105 in the GDC parameter menu under

► **Short setup → Speed** (for speed control).

► **Short setup → Torque** (for torque control).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 297 📖 144
			0	QSP not active			
			1	QSP active			
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 297 📖 144
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

6.15 Operation with motors from other manufacturers

6.15.1 Entering motor data manually

If you use motors of other manufacturers together with the ECS axis module, you have to enter the motor data manually. The GDC includes the required codes in the parameter menu under **Motor/feedback systems → Motor adjustment**.

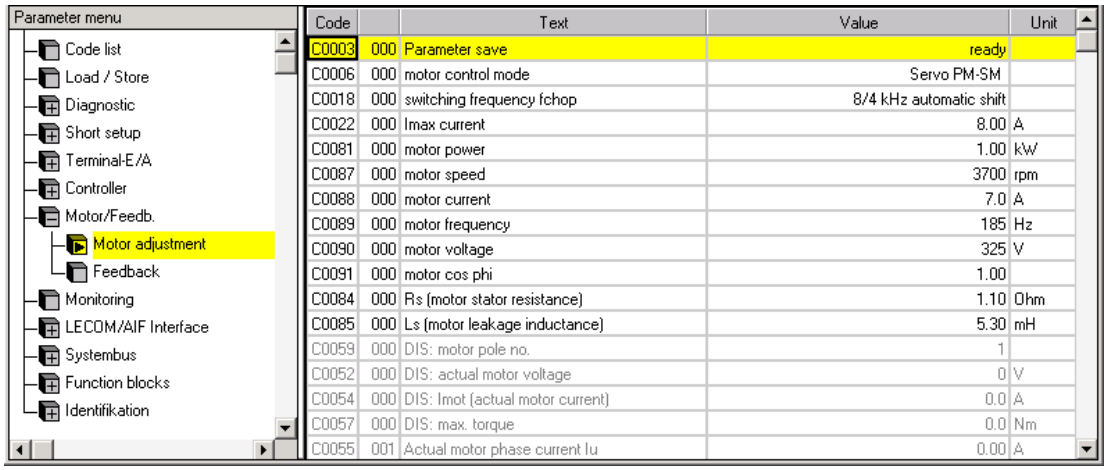


Fig. 6-19 GDC view: Manual setting of the motor data

Code		Possible settings		IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection	
[C0006]	Op mode	1		Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.
			1 Servo PM-SM	Servo control of synchronous motors
			2 Servo ASM	Servo control of asynchronous motors
C0018	fchop	2		Switching frequency
			1 4 kHz sin	4 kHz permanent PWM frequency
			2 8/4 kHz sin	8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0022	Imax current	→		I_{max} limit
			0 {0.01 A}	→ Device-dependent list Max. current can be gathered from the technical data.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °}	179.9		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 151
			0	Inactive			
			1	Active			
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0128	Tau motor	5.0				Thermal time constant of the motor	📖 210
			0.5	{0.1 min}	25.0	For calculating the $I^2 \times t$ disconnection	
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	📖 149
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

6.15.2 Checking the direction of rotation of the motor feedback system

In GDC, you can find the parameters and codes to be set in the parameter menu under **Motor/Feedback systems → Feedback system**.

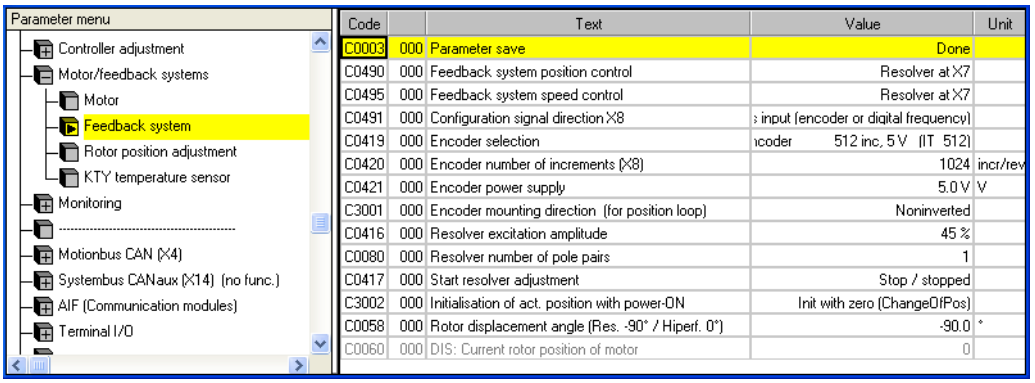


Fig. 6-20 GDC view: Feedback system

C0060 indicates the rotor position within one revolution as a numerical value between 0 and 2047. The indicated rotor position is derived from the selected position encoder (C0490) with reduced resolution.

Evaluation:

If the motor encoder (resolver) is set as position encoder (C0490) and the rotor rotates in CW direction (view on the front of the motor shaft), the numerical value must rise. If the values are falling, reverse the Sin+ and Sin- connections.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0060	Rotor pos				Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 148
			0	{1 inc} 2047	Display with reduced resolution: 1 revolution = 2048 increments	

6.15.3 Adjusting current controller

For an optimum machine operation, the current controller settings must be adapted to the electrical motor data.

The parameters of the current controller depend on the electrical motor data. They do not depend on mechanical data as with the speed and position control circuit. This is why the default current controller settings of the ”GDC motor data input assistant” can usually be used. A current controller adjustment is only required for third-party motors and for Lenze motors only in special cases.

Leakage inductance and stator resistance of the motor are known:

The gain of the current controller V_p and the integral-action time of the current controller T_n can be calculated by approximation:

Current controller gain (V_p)	Integral-action time of the current controller (T_n)
$V_p = \frac{L1_S}{250\ \mu s}$	$T_n = \frac{L1_S}{R1_S}$

$L1_S$ Motor leakage inductance

$R1_S$ Motor stator resistance

Note!

Depending on the leakage inductance of the motor, the calculated values can be outside the adjustable range. In this case

► set a lower gain and a higher integral-action time;

► adjust the current controller metrologically (📖 150).

For applications with high current controller dynamics the pilot control of the current controller outputs can be activated with C0074 (C0074 = 1). For this, it is vital to enter the correct values for the stator resistance (C0084) and leakage inductance (C0085).These can be obtained from the data sheet of the motor used!

Leakage inductance and stator resistance of the motor are not known:

The current controller can be optimised metrologically with a current probe and an oscilloscope. For this, a test mode is available in which the current C0022 x √2 flows in phase U after controller enable.

Stop!

Avoid damage to the motor and machine

- ► During the current controller adjustment, the motor must be freely rotatable.
- ► The test current must not exceed the maximum permissible motor current.
- ► Always adjust the current controller at a switching frequency of 8 kHz.

Observe the current step in phase U to adjust the current controller.

Setting sequence

1. Select 8 kHz as switching frequency (C0018 = 2).
2. Select the test current under C0022:
   – Start with a low current value, e.g. half the rated motor current.
3. Activate the test mode with C0418 = 1.
4. Enable the controller. (📖 143)
   – Adjust the synchronous motor.
   – The asynchronous motor remains at standstill.
5. Enable and inhibit the controller several times in a row changing the current controller gain (C0075) and the current controller adjustment time (C0076) such that the current characteristic is free of harmonics.
6. After the adjustment has been completed, deactivate the test mode with C0418 = 0.
7. If required, change the switching frequency under C0018.

6.15.4 Effecting rotor position adjustment

Note!

Resolver / absolute value encoder with Hiperface® interface

- If the rotor zero phase is not known, the rotor position only has to be adjusted once during commissioning.
- For multi-turn absolute value encoders, the traversing range must be within the display range of the encoder (0 ... 4095 revolutions) if the traversing range is limited.

TTL incremental encoder / sin/cos encoder with zero track

- If these encoder types are used for the operation of synchronous motors, the rotor position must be adjusted every time the low-voltage supply is switched on.

The rotor position must be adjusted if:

- A motor from another manufacturer is connected to the controller.
- Another encoder has been mounted subsequently.
- A defective encoder has been replaced.

The rotor position can only be adjusted if:

- The resolver is polarised correctly.
- The current controller has been adjusted.

The GDC contains the parameters or codes to be set on the parameter menu under **Motor/Feedb. → Rotor position adjustment**:

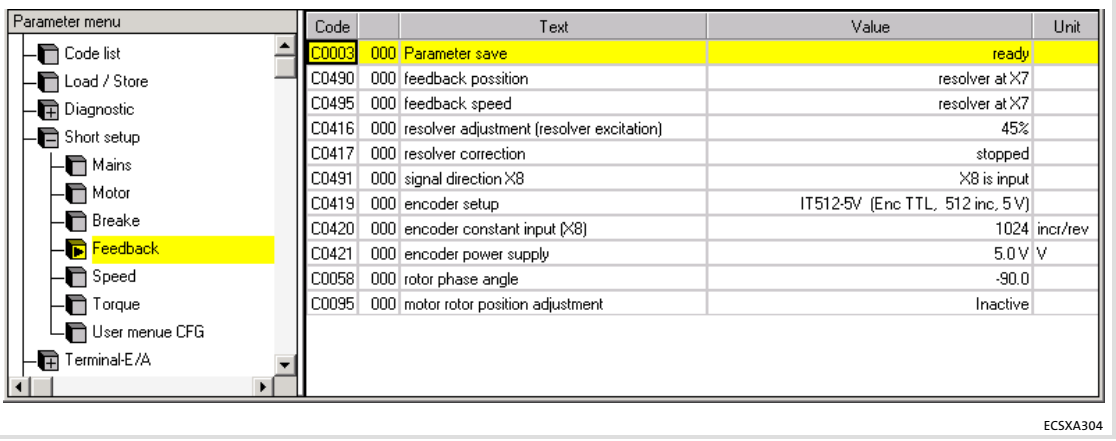


Fig. 6-21 GDC view: Short setup of the feedback system

Setting sequence

1. Inhibit controller. (📖 143)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
2. Unload motor mechanically.
   – Separate the motor from the gearbox or machine so that it can rotate freely.
3. Open holding brake (if available).
4. Activate rotor position adjustment with C0095 = 1.
5. Enable controller. (📖 143)
   – X6/SI1 = HIGH and X6/SI2 = HIGH and press the <F8> key in GDC.
   The rotor position adjustment program of the controller is started:
   – The rotor rotates half a revolution in 16 steps (for resolver with 1 pole pair: 180° electrically ≙ 180° mechanically).
   – After one revolution, C0095 is automatically reset to ”0”.
   – The rotor zero phase is stored under C0058. (For absolute value encoders (Hiperface®, single-turn/multi-turn) at X8, C0058 is always ”0”.)



Danger!

Uncontrolled drive movements after an Sd7 fault with absolute value encoders

If absolute value encoders are used and the rotor position adjustment is completed with the fault message ”Sd7” (📖 238), the rotor position could not be assigned to the feedback system. In this case, the drive may carry out uncontrolled movements after controller enable.

Possible consequences:

► Death or severe injuries

► The machine/drive may be destroyed or damaged

Protective measures:

► Repeat rotor position adjustment (starting with step 1).

► Check wiring and interference immunity of the encoder at X8.

6. Inhibit controller. (📖 143)
   – Press the <F9> key in GDC.
   – Green LED is blinking, red LED is off
7. Save the data determined by the controller with C0003 = 1.



Tip!

The values for C0058 and C0095 are only displayed in GDC if you place the bar cursor on them and read back the code using function key <F6>.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 151
			0	Inactive			
			1	Active			

6.16 Optimising the drive behaviour after start

For applications with high current controller dynamics, the pilot control for the current controller can be adjusted under C0074:

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0074	Dynamics	0		Pilot control of the current controller for higher dynamics	📖 149
			0 Normal		
			1 Enhanced		

6.16.1 Speed controller adjustment

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not ”noisy”.
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

In GDC, you can find the codes for adjusting the speed controller in the parameter menu under **Controller settings → Speed/position**.

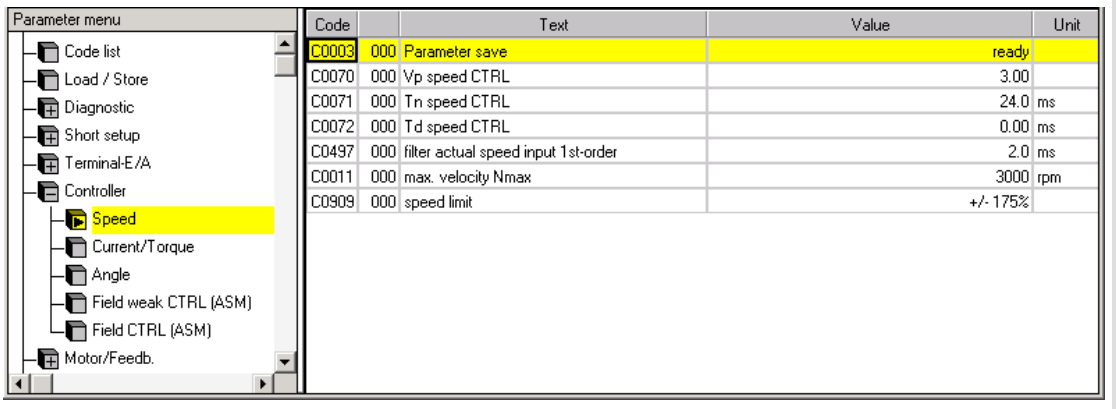


Fig. 6-22 GDC view: Adjustment of the speed controller

Parameter setting

► Set the proportional gain (V_{pn}) via C0070:
  – Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
  – Increase C0070 until the drive becomes instable (pay attention to engine noises).
  – Reduce C0070 until the drive runs stable again.
  – Reduce C0070 to approx. half the value.

Note!

For speed control (”Speed”):

The proportional gain (V_p) can be altered via SPEED-MCTRL.NAdapt (C7431/7):

► V_p = SPEED-MCTRL.NAdapt[%] x C0070

► If SPEED-MCTRL.NAdapt is not assigned, the following applies: V_p = 100 %, C0070 = C0070

For torque control (”Torque”):

The proportional gain (V_p) can be altered via TORQUE-MCTRL.NAdapt (C7531/7):

► V_p = TORQUE-MCTRL.NAdapt[%] x C0070

► If TORQUE-MCTRL.NAdap is not assigned, the following applies: V_p = 100 %, C0070 = C0070

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 154
			0.00	{ 0.01}	127.99		

► The reset time (T_{nn}) is set via C0071:
  – Reduce C0071 until the drive becomes instable (pay attention to engine noises).
  – Increase C0071 until the drive runs stable again.
  – Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 154
			1.0	{0.5 ms}	6000.0		

► The derivative gain (T_{dn}) is set via C0072:
– Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 154
			0.0	{0.1 ms}	32.0		

Signal limitation

► If the drive operates with the maximum torque, the speed controller operates within the limitation.

► The drive cannot follow the speed setpoint.

► The output SPEED-MCTRL.MMax is set to TRUE.

► The output TORQUE-MCTRL.MMax is set to TRUE.

Set the I component

For selecting torque starting values the integral component of the speed controller can be set externally (e.g. when using the brake control).

► **In case of speed control (”Speed”):**

SPEED-MCTRL.ILoad = TRUE (C7411/12):

– The speed controller accepts the value applied at SPEED-MCTRL.ISet (C7431/8) into its integral component.

– The value at SPEED-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

SPEED-MCTRL.ILoad = FALSE (C7411/12):

– The function is switched off.

► **In case of torque control (”Torque”):**

TORQUE-MCTRL.ILoad = TRUE (C7511/7):

– The speed controller accepts the value applied at TORQUE-MCTRL.ISet (C7531/8) into its integral component.

– The value at TORQUE-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

TORQUE-MCTRL.ILoad = FALSE (C7511/7):

– The function is switched off.

6.16.2 Adjustment of field controller and field weakening controller

Stop!

- ► Field weakening operation is only possible with asynchronous motors.
- ► The available torque is reduced by the field weakening.

In order to optimise the machine operation in the field weakening range, you can set the field controller and the field weakening controller accordingly.

Field weakening occurs if the maximum output voltage of the controller is reached with rising speed and cannot be increased further.

The maximum possible output voltage depends on

- ► the respective DC-bus voltage (mains voltage).
- ► the voltage reduction through the controller load.
- ► the voltage drop at the mains choke.

Experience values for the voltage drop under the influence of the mains choke and inverter are between 6 ... 10 %.

$$\text{Max. output voltage [V]} = \text{mains voltage [V]} - \text{voltage drop [\%]}$$

The GDC contains the codes for adjusting the field controller/field weakening controller in the parameter menu under **Controller adjustment → Field control/Field weakening**:

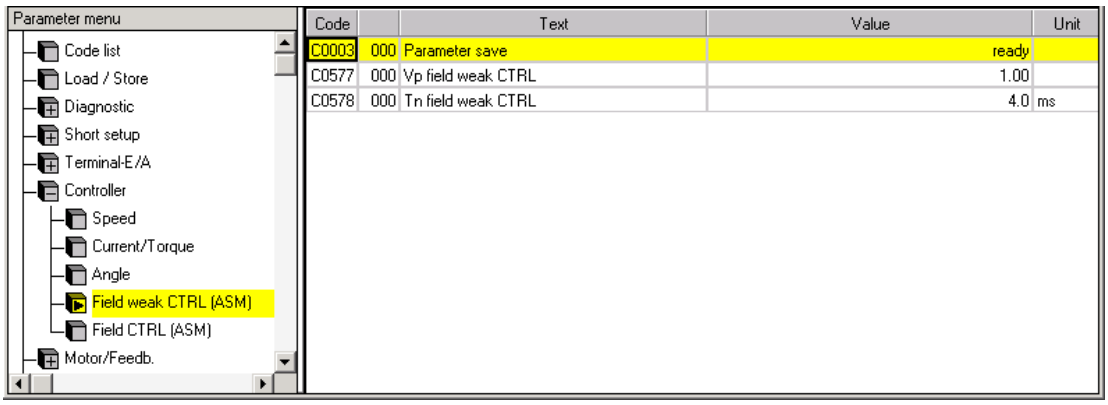


Fig. 6-23 GDC view: Field controller / field weakening controller adjustment

6.16.2.1 Adjusting the field controller

The field controller settings depend on the motor data.

Setting sequence

1. Stop the PLC program: C2108 = 2
   – As of operating system version 7.0 (see nameplate), this is no longer necessary, because C0006 (see 2.) can also be written when the PLC program is running!
2. Set motor control for asynchronous motors: C0006 = 2
   – The motor nameplate data must be entered correctly!
3. Read rotor time constant T_r (C0083).
4. Read magnetising current I_d (C0092).
5. Calculate field controller gain V_{pF} and enter in C0077.

$$V_{pF} = \frac{T_r\,(C0083) \cdot I_d\,(C0092)}{875\ \mu s \cdot I_{max}}$$

I_{max} Maximum current of axis module

6. Enter rotor time constant T_r as field controller integral-action time T_{nF} in C0078.

6.16.2.2 Field weakening controller adjustment

- The field weakening controller determines the speed performance of the asynchronous motor in the field weakening range.
- The field weakening controller can only be set correctly when the system constellation has been completed and is under load.

Note!

An excessive value of I_{max} (C0022) can cause a malfunction of the drive in the field weakening range of the asynchronous motor. For this reason, the current is limited in terms of speed in the field weakening range. The limitation has a 1/n characteristic and is derived from the motor parameters.

The limitation can be adjusted with the stator leakage inductance (C0085):

- Low values cause a limitation at higher speeds.
- Higher values cause a limitation at lower speeds.

Setting sequence

1. Set gain V_p: C0577 = 0.01 ... 0.99
   – V_p must not be ”0” (deactivates the field weakening controller)!
2. Set integral-action time T_n: C0578 = 1 ... 40 ms
3. Select a speed setpoint so that the motor is operated in the field weakening range.
4. Observe the speed curve
   – If the speed takes an irregular course, the field weakening controller must be readjusted.
   – The field weakening controller must be provided with a distinct integral action.

Tip!

Parameter setting with a distinct I component can improve the drive behaviour when changing to the field weakening range.

For this purpose, set the gain (V_p) in C0577 to at least 0.01.

The following applies:

- P component = V_p = C0577
- I component = V_I = C0577/C0578

If the P component (V_p) is reduced via C0577, adapt the reset time C0578 accordingly to keep the I component (V_I).

6.16.3 Resolver adjustment

When adjusting the resolver, mainly component tolerances of the resolver evaluation are compensated in the device. No resolver error characteristic is accepted. The resolver adjustment is only required if the speed behaviour is irregular despite optimised settings of the speed and position control loop.

The resolver adjustment is started via code C0417 = 1. Then the resolver is adjusted automatically during the next 16 motor revolutions.

If it is not possible to adjust the resolver (due to a fault or a defective cable), the original adjustment values can be restored with C0417 = 2.

C0417 can be found in the GDC in the parameter menu under **Motor/Feedback → Feedback**.

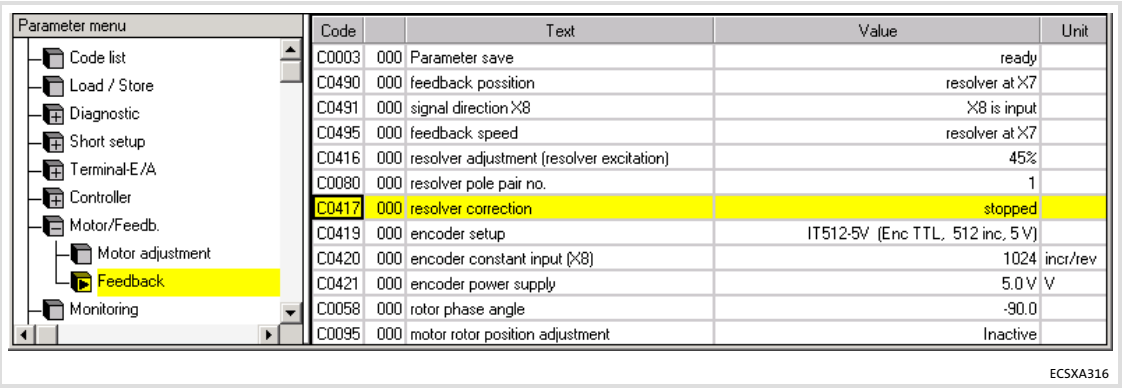


Fig. 6-24 GDC view: Commissioning of the feedback system

7 Parameter setting

7.1 General information

- Controllers and power supply modules can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter "Commissioning" (📖 93).
- The parameters for the functions are stored in numbered codes:
  - The codes are marked in the text with a "C".
  - The code table in the appendix (📖 363) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a "reference book".

Parameter setting with XT keypad or PC/laptop

Detailed information on parameter setting with the XT keypad can be found in the following chapters.

Detailed information ...

on the parameterisation by means of a PC/laptop can be found in the documentation for the "Global Drive Control" (GDC) parameterisation and operating program.

In addition to parameter setting, the XT keypad or PC/laptop serves to:

- Control the controller (e. g. inhibiting or enabling)
- Select the setpoints
- Display operating data
- Transfer parameter sets to other controllers (only with PC/laptop).

Parameter setting with a bus system

Detailed information ...

on the parameterisation with a bus system can be found in the documentation of the communication module to be applied (📖 463).

7.2 Parameter setting with ”Global Drive Control” (GDC)

With the ”Global Drive Control” (GDC) parameterisation and operating program, Lenze provides a plain, concise and compatible tool for the configuration of your application-specific drive task with the PC or laptop:

- The GDC input assistant offers a comfortable motor selection.
- The menu structure supports the commissioning process by its clear structuring.

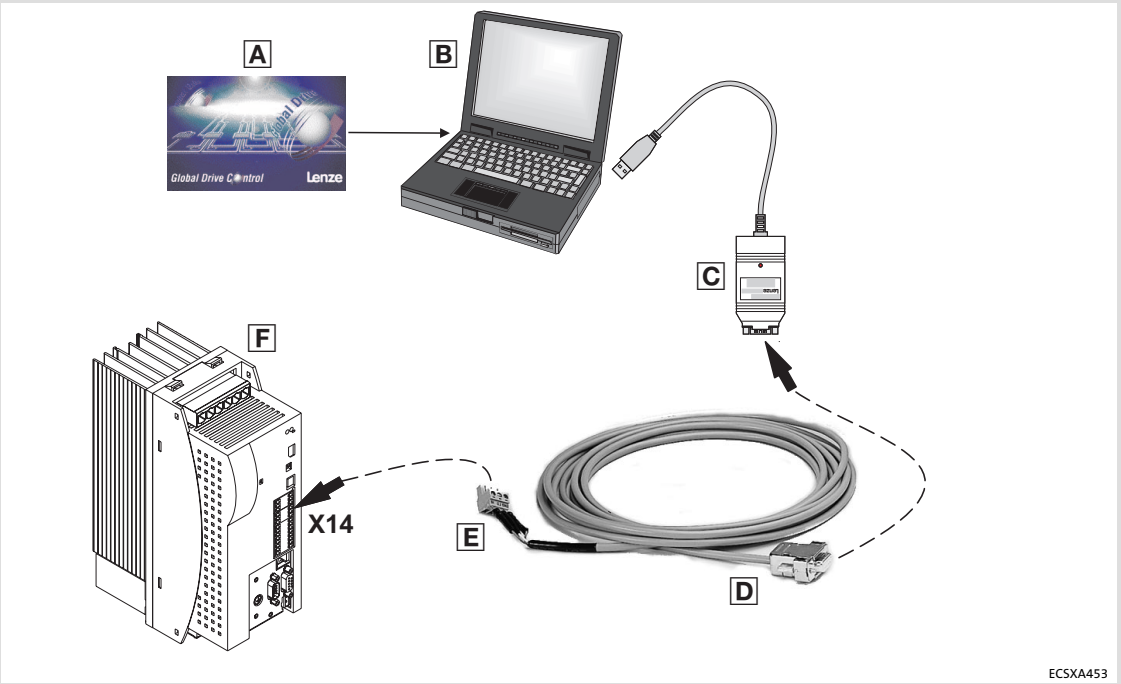


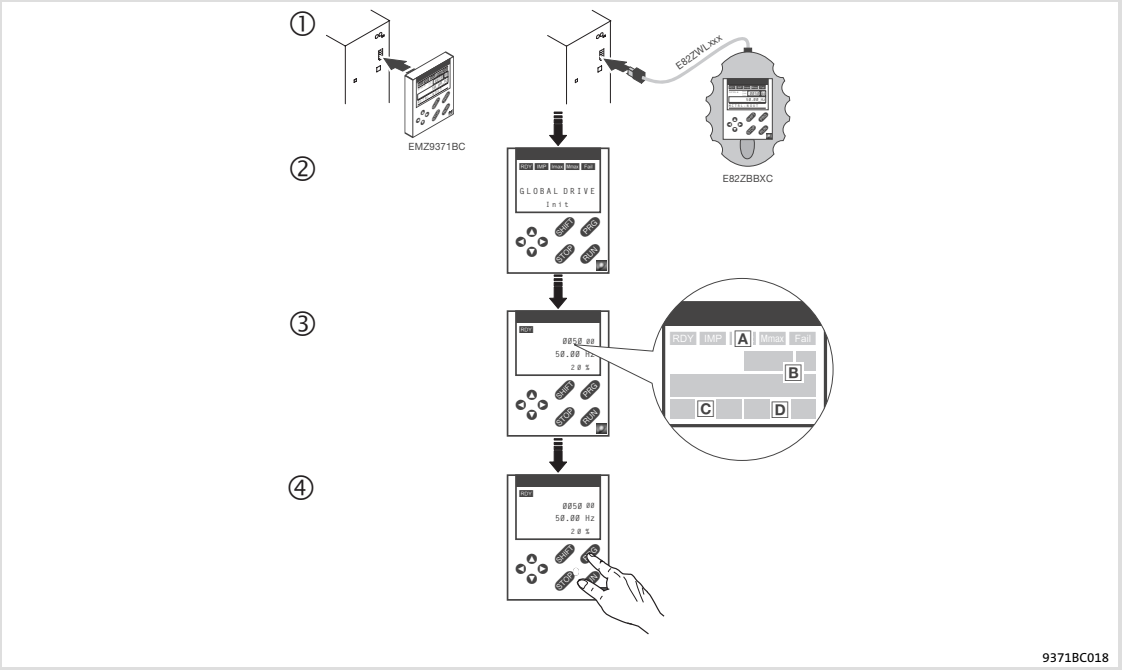
Fig. 7-1 Using the GDC

- A Lenze parameter program ”Global Drive Control” (GDC)
- B PC or laptop
- C PC system bus adapter (EMF2173IB/EMF2177IB) with connecting cable
- D Sub-D plug with 3-pole cable
- E 3-pole plug (CAG – CAL – CAH) from ECSZA000X0B connector set
- F ECSxS/P/M/A axis module

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as accessories.
A complete description is given in the documentation on the keypad.

7.3.1 Connecting the keypad



① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad 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 status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined under C0004
④ PRG must be pressed to leave the operation level.

7.3.2 Description of the display elements

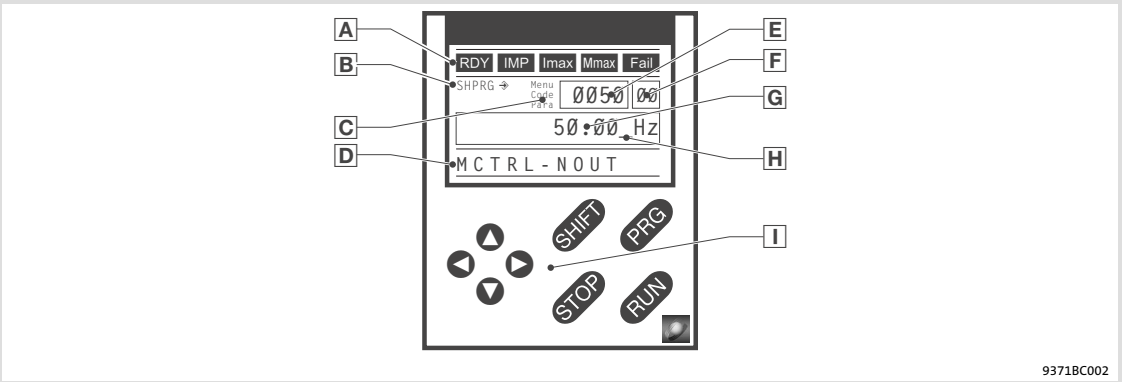


Fig. 7-2 Keypad front view

A	**Status displays**		
	Display	**Meaning**	**Explanation**
	RDY	Ready for operation	
	IMP	Pulse inhibit active	Power outputs inhibited
	Imax	Adjusted current limitation is exceeded in motor mode or generator mode	
	Mmax	Speed controller 1 within its limitation	• Drive is torque-controlled • Only active for operation with Lenze devices of the 9300 series!
	Fail	Active fault	
B	**Parameter acceptance**		
	Display	**Meaning**	**Explanation**
	↵	Parameter is accepted immediately	The device immediately operates with the new parameter value.
	SHPRG ↵	The parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after being confirmed.
	SHPRG	When the controller is inhibited, the parameter must be confirmed with SHIFT PRG	The device operates with the new parameter value after the controller has been released again.
	None	Display parameters	Cannot be changed.
C	**Active level**		
	Display	**Meaning**	**Explanation**
	Menu	Active menu level	• Selection of main menu and submenus • No menu for ECSxE power supply module
	Code	Active code level	Selection of codes and subcodes
	Para	Active parameter level	Change of parameters in the codes or subcodes
	None	Active operating level	Display of operating parameters
D	**Short text**		
	Display	**Meaning**	**Explanation**
	Alphanumerical	Contents of the menus, meaning of the codes and parameters	
		Display of C0004 in % and the active fault in the operating level	

E	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Menu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Four-digit code number	
F	**Number**		
	Active level	**Meaning**	**Explanation**
	Menu level	Submenu number	• Display is only active when operating Lenze devices of the 8200 vector or 8200 motec series. • No menu for ECSxE power supply module
	Code level	Two-digit subcode number	
G	**Parameter value**		
	Parameter value with unit		
H	**Cursor**		
	The figure over the cursor can be changed directly in the parameter level.		
I	**Function keys**		
	For description see the following table.		

7.3.3 Description of the function keys

Note!

Key combinations with SHIFT:

Press SHIFT and keep it pressed, then press second key in addition.

Key	Function			
	Menu level [1]	Code level	Parameter level	Operating level
PRG		Change to parameter level	Change to operating level	Change to code level
SHIFT PRG	Load predefined configurations in the menu "Short setup" [2]		Accept parameters when SHPRG ↵ or SHPRG is displayed	
▲ ▼	Change between menu items	Change code number	Change figure over cursor	
SHIFT ▲ SHIFT ▼	Quick change between menu items	Quick change of code number	Quick change of figure over cursor	
▶	Change between main menu, submenus and code level		Cursor to the right	
◀			Cursor to the left	
RUN	Cancel function of STOP key, the LED in the key goes out.			
STOP	Inhibit the controller, LED in the key lights up.			
	Reset fault (TRIP reset): 1. Remove cause of malfunction 2. Press STOP 3. Press RUN			

1) No menu for ECSxE power supply module
2) Only active when operating Lenze devices of the 8200 vector or 8200 motec series.

7.3.4 Changing and saving parameters

All parameters for the axis module/power supply module parameterisation or monitoring are stored in codes. The codes are numbered and marked with a ”C” in the documentation. Some codes store the parameters in numbered ”subcodes” to provide a clear structure for parameter setting (e.g. C0517 user menu).



Stop!

Your settings have an effect on the current parameters in the main memory. You must store your settings as a parameter set to prevent that they will get lost when switching the mains!

Step			Keys	Action
1.	Select menu		▲ ▼ ▶ ◀	Select the desired menu with arrow keys.
2.	Change to code level		▶	Display of first code in the menu
3.	Select code or subcode		▼ ▲	Display of the current parameter value
4.	Change to parameter level		PRG	
5.	If SHPRG is displayed, inhibit controller		STOP	The drive is coasting.
6.	Change parameter			
		A	▶ ◀	Move cursor under the digit to be changed
		B	▼ ▲	Change digit
			SHIFT ▼ SHIFT ▲	Change digit quickly
7.	Accept changed parameter			
	Display SHPRG or SHPRG →		SHIFT PRG	Confirm change to accept parameter Display ”OK”
	Display →		-	The parameter was accepted immediately.
8.	If necessary, enable controller		RUN	The drive should be running again.
9.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display of the code with changed parameters
10.	Change further parameters			Restart the ”loop” at step 1. or step 3.
11.	Save changed parameters			
		A	▲ ▼ ▶ ◀	Select Code C0003 ”PAR SAVE” in the menu ”Load/Store”
		B	PRG	Change to parameter level Display ”0” and ”Ready”
	Select parameter set in which the parameters are to be saved permanently	C	▶	Save as parameter set 1: ⇨ set ”1” ”Save PS1”
		D	SHIFT PRG	When ”OK” is displayed, the settings are permanently saved.
12.	Change to code level			
		A	PRG	Display of operating level
		B	PRG	Display C0003 ”PAR SAVE”

8 Configuration

By configuring the axis module you can adapt the drive system to your application. The axis module can be configured via the following interfaces:

- X1 – AIF (automation interface)
  - For connection of the keypad XT or communication modules (📖 463) which serve to access the codes.
- X14 – system bus interface (CAN-AUX)
  - PC interface/HMI for parameter setting and diagnostics (e.g. with the Lenze parameter setting and operating program "Global Drive Control")
    or
  - Interface to a decentralised I/O system

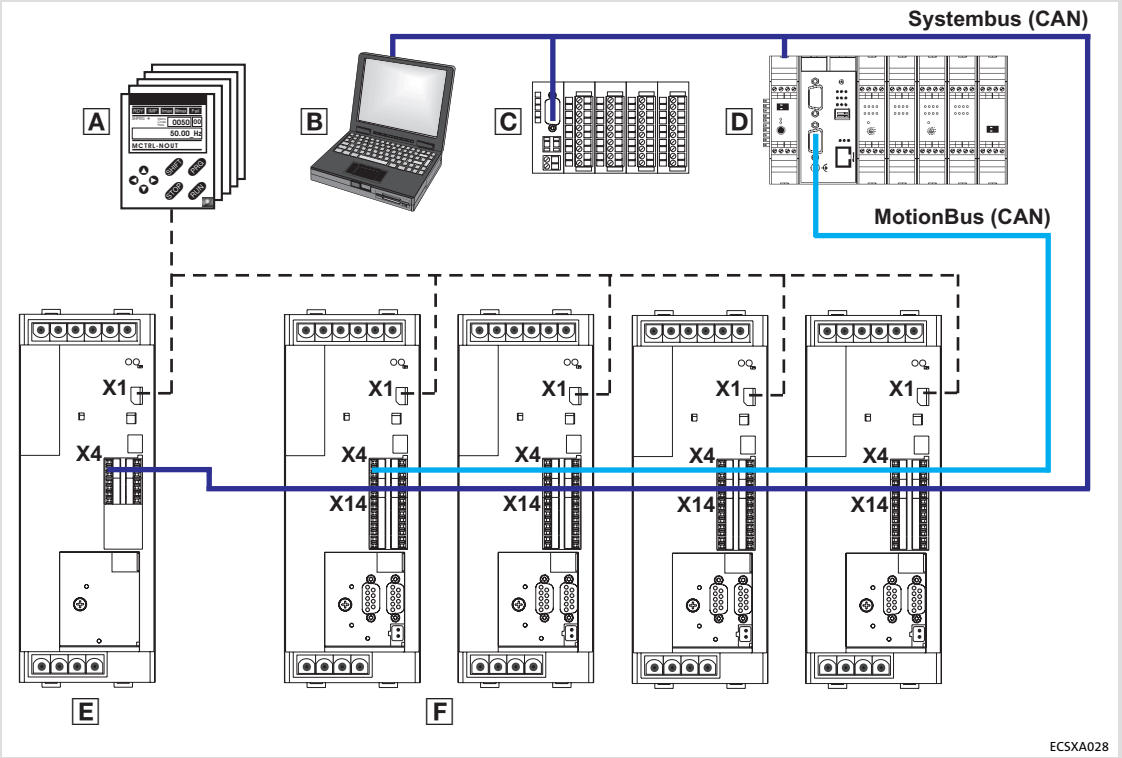


Fig. 8-1 Example: Wiring of the MotionBus (CAN) and system bus (CAN)

- A Keypad XT or another communication module
- B PC/laptop or HMI
- C Decentralised I/O system
- D Higher-level host system / MotionBus control
- E ECSxE... power supply module
- F ECSxS/P/M/A... axis module

8.1 Configuring MotionBus/system bus (CAN)

Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

Note!

In case of ECSxS... axis modules

only the parameter data channels (SDO) are supported for the system bus (CAN) – interface X14 (CAN-AUX).

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 441).

8.1.1 Setting CAN node address and baud rate

For the CAN interfaces **X4** (MotionBus) and **X14** (system bus), the CAN node address and the baud rate can be set via the DIP switch **S1** or via codes.

- The (address) switch **1** serves to define whether the set CAN node address shall only apply to the interface **X4**(MotionBus) or for both interfaces **X4** (MotionBus) and **X14** (system bus).
- If one of the (address) switches **2 ... 7** of the DIP switch is switched on (ON), and the low-voltage supply is connected, the setting of the DIP switch is evaluated and written into C0350/C2450 (CAN node address) and C0351/C2451 (baud rate).
- If the (address) switches **2 ... 7** are switched off (OFF), the switch position is not evaluated. The settings from C0350/C2450 (CAN node address) and C0351/C2451 (baud rate) are accepted.
- The settings for the baud rate with the switches **8 ... 10**are only written into C0351 (X4 CAN) when the low-voltage supply is switched on.
- The baud rate for X14 CAN-AUX can only be set via C2451.

8.1.1.1 Settings via DIP switch

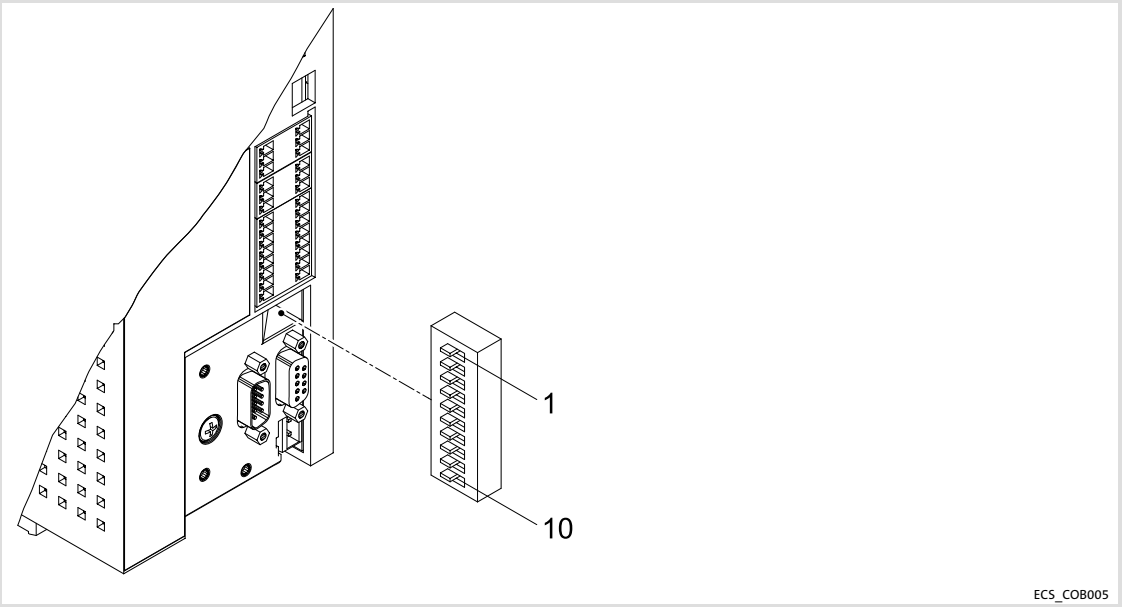
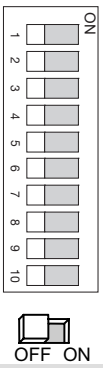


Fig. 8-2 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

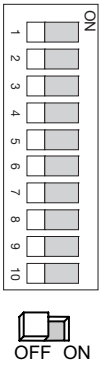
The node address is set by means of switches 2 ... 7 of the DIP switch. Specific values are assigned to the switches. The sum of the values specifies the node address to be set (see example).

Switch		Value	Example	
			Switching status	Node address
	S1	**OFF:** Node address setting is only valid for CAN (C0350 is overwritten if one of switches S2 ... S7 is in ON position.) **ON:** Node address setting is valid for CAN and CANaux (C0350 and C2450 are overwritten if one of switches S2 ... S7 is in ON position.)		-
	S2	32	**ON**	32 + 16 + 8 = **56**
	S3	16	**ON**	
	S4	8	**ON**	
	S5	4	OFF	
	S6	2	OFF	
	S7	1	OFF	

Baud rate setting

Note!

The baud rate must be set identically for all CAN nodes.

Switch		Baud rate [kbit/s]				
		1000	500	250	125	50
	8	**ON**	OFF	OFF	OFF	OFF
	9	OFF	OFF	OFF	**ON**	**ON**
	10	OFF	OFF	**ON**	OFF	**ON**

8.1.1.2 Settings via codes

Note!

- ► The settings in C0350 (CAN node address) and C0351 (baud rate) are only used if the (address) switches **2 ... 7** of the DIP switch **S1** are switched off (OFF).
- ► If only one (address) switch **2 ... 7** is switched on (ON), the settings of the DIP switch **S1** usually apply.
- ► The baud rate (C0351) must be set identically for all CAN bus nodes.
- ► If the Lenze setting has been loaded via C0002,
  - – C0351 is set to 0 (500 kbit/s);
  - – you have to reset the baud rate (C0351) and the CAN node address (C0350).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0350	CAN address	32		Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 169) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 169 📖 460
			1 {1} 63		
C0351	CAN baud rate	0		Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 169
			0 500 kbps		
			1 250 kbits/sec		
			2 125 kbit/s		
			3 50 kbps		
			4 1000 kbit/s		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- ► Renewed switch-on of the 24 V low-voltage supply
- ► Reset node via the bus system (by the network management (NMT))
- ► Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.2 Individual addressing

C0353 can be used to determine whether the identifier (COB-ID) is generated from a basic identifier (📖 460) and the node address in C0350 or individually with an ”ID offset”.

The ”ID offset” can be specified via C0354. Thus, the identifier for all process data input and output objects is as follows:

Identifier (COB-ID) = 384 + ID offset (C0354)

Note!

The identifier of the telegram to be sent must correspond to the identifier of the process data input object to be addressed.

To make the alternative node address valid, set the corresponding subcode of C0353 = 1.

Bus	code	Value	The addresses are defined by
MotionBus (CAN)	C0353/1	0	C0350 (Lenze setting)
		1	C0354/1 for CAN1_IN C0354/2 for CAN1_OUT
	C0353/2	0	C0350 (Lenze setting)
		1	C0354/3 for CAN2_IN C0354/4 for CAN2_OUT
	C0353/3	0	C0350 (Lenze setting)
		1	C0354/5 for CAN3_IN C0354/6 for CAN3_OUT

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 173
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 173
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.3 Defining boot-up master in the drive system

If the bus initialisation and the related state change from ”Pre-Operational” to ”Operational” is not carried out by a higher-level host system (PLC), another node can be determined as boot-up master to carry out this task.

The master functionality is only required for the initialisation phase of the drive system. C0356 serves to set a boot up time for the master for the initialisation phase (📖 176).

By means of the NMT telegram *start_remote_node* (broadcast telegram) **all** nodes are shifted to the NMT-state ”Operational” by the master. A data exchange via the process data objects can only be effected in this state.

The configuration is carried out via C0352.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0352	CAN mst	0		Boot-up master/slave configuration for CAN bus interface X4	📖 175
			0 Slave		
			1 Master boot-up	Device is active as CAN boot-up master.	
			2 Master node guarding		
			3 Slave heartbeat producer		
			4 Slave node guarding		

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.4 Setting of boot-up time/cycle time

Boot-up time (C0356/1) setting

In a CAN network without higher-level control (PLC), a bus node (boot-up master) has to initialise the CAN network. If the 24 V low-voltage supply is switched on, the boot-up time elapses. After the boot-up time has elapsed, the NMT telegram for initialising the CAN network is sent by the boot-up master and the process data transfer is started.

- Only valid if C0352 = 1 (master).
- Normally the Lenze setting (3000 ms) is sufficient.
- State change from ”Pre-operational” to ”Operational”

Cycle time for process output data (C0356/2...3)

Transmission cycle time for the process data objects CAN2...3_OUT (C0356/2...3) in cyclic operation (without sync)

- Setting ”0” = event-controlled data transmission
  The output data will only be sent if a value in the output object changes.

Activation delay for process output data (C0356/4)

Delay time for initial transmission of the process data objects CAN2...3_OUT after the CAN bus changed from ”Pre-Operational” to ”Operational” NMT state.

After the delay time has elapsed, the process data objects CAN2...3_OUT or CANaux2...3_OUT will be sent for the first time.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	📖 176
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to "Operational"	

Save changes with C0003 = 1.

The settings are only accepted after carrying out one of the following actions:

- Renewed switch-on of the 24 V low-voltage supply
- Reset node via the bus system (by the network management (NMT))
- Reset node with C0358 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

8.1.5 Executing a reset node

The following changes will only be valid after a reset node:

- Changes of the CAN node addresses and baud rates (📖 169)
- Changes of the addresses of process data objects (COB-IDs)
  – General addressing (📖 460)
  – Individual addressing (📖 173)
- Change of the master/slave boot-up configuration (📖 175)

A reset node can be made by:

- Renewed switch-on of the 24 V low-voltage supply
- the bus system (via the network management (NMT))
- C0358/C2458 = 1

Note!

If reset node is executed via GDC, communication will be interrupted. You therefore have to log in again manually or find the devices connected to the bus once again (fieldbus scan).

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0358	Reset node	0			Make a reset node for the CAN bus node.	📖 178
			0	No function		
			1	CAN reset		

8.1.6 Axis synchronisation (CAN synchronisation)

By means of the axis synchronisation, the internal time base can be synchronised with the instant of reception of the sync signal. By this, the start of cyclic internal processes of all drives involved in the synchronisation is synchronous.

Sync signal source

The sync signal source is set via C1120:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C1120	Sync mode	0			Sync signal source	📖 179
			0	Off	Off	
			1	CAN sync	Sync connection via interface X4 (CAN)	📖 182
			2	Terminal sync	Sync connection via terminal X6/DI1	📖 183

Synchronisation cycle

For the purpose of synchronisation the master sends a cyclic CAN sync telegram.

The controllers receive the CAN sync telegram and control the starting time of their own program cycle in relation to the instant of reception of the CAN sync signal. The start is to be offset by the synchronisation phase (C1122).

The synchronisation cycle set under C1121 must be set the same as the transmission cycle of the CAN sync telegrams.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1121	Sync cycle	2				Synchronisation cycle	📖 179
			1	{1 ms}	13		

Phase shift

The synchronisation phase (C1122) defines the period of time of the offset by which the start of the controller-internal cycle lags behind the sync signal received.

Note!

Always set the synchronisation phase higher than the maximum possible ”jitter” of the received CAN sync telegrams!

phase shifting and thus periodic changes of signal frequencies are called ”Jitter”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1122	Sync phase	0.460				Synchronisation phase	📖 179
			0.000	{0.001 ms}	6.500		

Start of axis synchronisation

After mains connection and the initialisation phase, the synchronisation is started. After the first sync telegrams have been received, it takes a few seconds until the system is compensated. The duration of this process is basically determined by the interval of the sync signals and the sync correction increment.

The CAN sync correction increment (C0363) indicates the increment used to extend or shorten the control cycle (e.g. to shift the start time).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1				CAN sync correction increment	📖 180
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 180
			0	{1 ms}	65000	0 = switched off	

CAN sync identifiers

The transmit and receive identifiers of the sync telegram can be configured via the following codes:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 180
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 444 📖 179
			1	{1}	256		

8.1.7 Monitoring of the synchronisation (sync time slot)

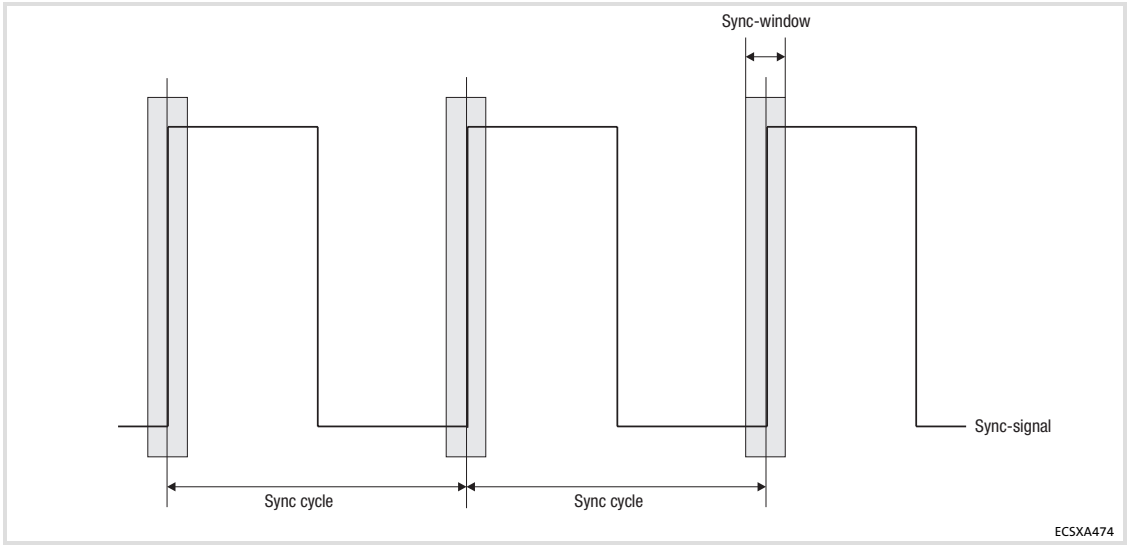


Fig. 8-3 ”Time slot” for the LOW-HIGH edges of the sync signal

Note!

A jitter (📖 179) up to ±200 µs on the LOW-HIGH edges of the sync signal is permissible. The amount of the jitter has an impact on the parameterisation of the ”time slot”.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1123	Sync window	0.010				Synchronisation window	📖 181
			0.000	{0.001 ms}	6.500		

CAN sync response

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0366	Sync Response	1			CAN sync response for interface X4 (CAN) **The value ”1” should always be set!**	📖 181
			0	No response		
			1	Response		

8.1.8 Axis synchronisation via CAN

The CAN interface X4 serves to transfer the CAN sync telegram as synchronisation signal and the process data.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	📖 143
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	C1120 = 1	Active synchronisation by sync telegram via CAN bus.
	5.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	6.	Define the telegram (identifier) sequence: A . Send new setpoint to all slaves. B Send sync telegram. C Receive response of all slaves.	
	7.	Start communication/send sync telegrams.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync telegram from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (📖 179), increase ”time slot”.
Slaves	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Synchronisation monitoring: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.1.9 Axis synchronisation via terminal X6/DI1

The transmission paths for the sync signal and the process data are separated.

- ► The process data are transmitted via the CAN interface X4.
- ► The sync signal is injected via the digital input X6/DI1.

Please observe the following sequence during commissioning:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the drive controllers. ● Press the <F9> key in GDC.	🕮 143
Slaves	3.	Connect "CANSync-InsideWindow" with digital output.	
	4.	Connect the sync signal of the master to terminal X6/DI1.	
Slaves	5.	C1120 = 2	Synchronisation through sync signal via terminal X6/DI1 (DigIn_bIn1_b) is active.
Slaves	6.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	7.	Start communication/send sync signals.	
Slaves	8.	Read C0362 from the master.	Retrieve cycle time of the sync signal from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync signal to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the "time slot". ● If the sync signal "jitters" heavily (🕮 179), increase "time slot".
	11.	Enable the controller via the signal "CANSync-InsideWindow" applied to the digital output.	Synchronisation monitoring: ● If "CANSync-InsideWindow" = TRUE, enable the controller.

8.2 Node guarding

In case of cyclic node monitoring (Node Guarding), the CAN master regularly enquired the states of the slaves participating in the monitoring process.

- ► The master starts the node guarding by sending the node guarding telegram.
- ► If the slave does not receive a node guarding telegram within the monitoring time (Node Life Time), the ”Life Guarding Event” is activated (fault message ”Err NodeGuard”).

Settings

In order that the device takes over the function of the ”Node Guarding Slave”, make the following settings:

1. Set C0352 = 2.
   (The device is configured as ”Node Guarding Slave”.)
2. Set the monitoring time (Node Guard Time) for the reception of the status enquiry by the master in C0383.
3. Set the factor (Node Life Time Factor) for the monitoring time in C0383.

   Node Life Time = Node Guard Time (C0382) · Node Life Time Factor (C0383)
4. Set the response to a ”Life Guarding Event” via C0384.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 175
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0382	GuardTime	0			Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 184
			0	{1 ms} 65535		
C0383	LifeTimeFact	0			Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 184
			0	{1} 255		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0384	Err NodeGuard	3		Node Guarding (slave) • Response for the occurrence of a NodeGuard-Event • Only relevant for setting C0352 = 4.	📖 184
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

8.3 CAN management

The function block **CAN** (CAN management)

- serves to activate a **reset node** to e.g. accept changes in the transfer rate and addressing.
- serves to process statuses as **Communication Error**, **Bus Off State**, etc.
- the instant of transmission of CAN2_Out and CAN3_Out can be influenced.
- serves to monitor the CAN communication.



Tip!

Detailed information on the FB **CAN** can be found in the chapter 12.9 (📖 267).



Note!

Even if the CAN function block has not been assigned to the control configuration, a reset node can be carried out via C0358.

8.4 Diagnostics codes

The following diagnostic codes are available for the MotionBus (CAN) (in the GDC parameter menu under **MotionBus CAN → Bus load CAN**):

- C0359: Bus state
- C0360/x: Telegram counter
- C0361/x: Bus load

8.4.1 CAN bus status (C0359)

C0359 shows the current operating state of the MotionBus (CAN).

Value of C0359	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-operational	Only parameters (codes) can be transferred via the bus system. Data exchange between controllers is not possible. A change into the state operational" can be made via a special signal on the MotionBus (CAN). A status change from "Pre-operational" to "Operational" is possible through: ● Master function of a higher-level host system ● If a drive is defined to be the master via C0352, the operating state is automatically changed for the entire drive system after mains connection when the boot-up time set in C0356/1 has elapsed. ● Reset node via C0358 (📖 178) ● With a binary input signal "Reset node", which can be set accordingly. ● Reset node via the connected hostsystem
2	Warning	Faulty telegrams have been received. The controller is passive (does not send any data). Possible causes: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Bus load is too high ● Controller is not connected to MotionBus (CAN)
3	Bus off	Too many faulty telegrams. The controller is disconnected from the MotionBus (CAN). It can be reconnected by: ● TRIP reset ● Reset node (📖 178) ● Mains reconnection

8.4.2 CAN telegram counter (C0360)

C0360 counts for all parameter channels those telegrams that are valid for the controller. The counters have a width of 16 bits. If a counter exceeds the value ’65535’, the counting process restarts with ’0’.

Counted messages:

C0360	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received from CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

8.4.3 CAN bus load (C0361)

It can be detected via C0361 which bus load in percent is needed by the controller or by the single data channels. Faulty telegrams are not considered.

Bus load of the individual subcodes:

C0361	Meaning
Subcode 1	All telegrams sent
Subcode 2	All telegrams received
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0”; channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0”; channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent of parameter data channel 2
Subcode 8	Telegrams received from CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0”; channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0”; channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received of parameter data channel 2

The data transfer is limited. The limits are determined by the number of telegrams transmitted per time unit and the baud rate.

The limits can be determined during data exchange in a drive network by adding all drives involved under code C0361/1.

Example:

Drive/host	Bus load
C0361/1 - controller 1	23.5 %
C0361/1 - controller 2	12.6 %
Host	16,0 %
	52.1 % (total)

Two drives and the host (PLC) are interconnected via the MotionBus (CAN).

Note!

- ► Max. bus load of all devices involved: 80 %
- ► If other devices are connected, as for instance decentralised inputs and outputs, their telegrams must be taken into consideration.
- ► If the time between the individual sync telegrams is too short the bus can be overloaded.
  - – **Remedy:** Change synchronisation cycle of the master control and the controller (C1121).

8.5 Remote parameterisation (gateway function)

From operating system V6.x onwards, the axis module supports the remote parameterisation of other fieldbus nodes. Then, all write/read accesses to parameters are not executed anymore in the axis module but redirected to the bus node selected for remote maintenance.

- ► The redirection takes place via the parameter data channel SDO1 of the selected node.
- ► The node to which the write/read accesses is to be redirected, is determined with the corresponding node address via C0370.
  (C0370 = 0: remote parameterisation deactivated)
- ► With C0371 = 1, determine the interface X14 (CAN-AUX) of the axis module as gateway channel.
- ► Use C2470 (CAN-AUX) to select the transmission channel for reading and writing parameter data.
- ► A time-out during remote parameterisation activates the system error message ”CE15”. The corresponding response can be configured under C2485 (📖 200).

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0370]	SDO gateway	0		Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 190
			0 {1} 63		
C0371	Gateway Ch.	1		Selection of the gateway channel	📖 190
			0 CAN	Use CAN bus interface X4	
			1 CAN-AUX	Use CAN bus interface X14	
C2470	ParWrite	0		CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 190
			0 Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)		
			1 Parameter data channel 2		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) ”Timeout” when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	198 190
			0 TRIP		
			2 Warning		
			3 Off		

9 Monitoring functions

Different monitoring functions (📖 194) 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) (📖 233).

In the fault history buffer (C0168/x), fault messages are saved in codes as 4-digit numbers. The first digit describes the type of fault response. The last three digits correspond to the fault number.

No. of the fault message	Type of response
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP (only for ECSxS/P/M/A axis modules)

Example: C0168/1 = 2061

- x061:

  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/no. ”x061”) between the AIF module and the ECS axis module.

- 2xxx:

  The fault response is a warning.

9.1 Fault responses

Response	⇨ Consequence	Display Keypad XT		
		RDY	IMP	Fail
TRIP		☐	■	■
TRIP active:	⇨ The power outputs U, V, W are switched to high resistance. ⇨ The drive is coasting (no control).			
TRIP reset:	⇨ The drive decelerates to its setpoint within the set deceleration times.			
Message	 **Danger!** The drive restarts automatically if the message is removed.	☐	■	■
Message active:	⇨ The power outputs U, V, W are switched to high resistance.			
≤ 0.5 s	⇨ The drive is coasting (no control).			
> 0.5 s	⇨ The drive is coasting (due to internal controller inhibit). If necessary, restart program.			
Message reset:	⇨ The drive runs to its setpoint with the maximum torque.			
FAIL-QSP	⇨ The drive is decelerated to standstill within the quick stop deceleration time (C0105).	–	–	■
Warning	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	■	☐	■
	⇨ The failure merely is displayed, the drive runs on in a controlled manner.			
Off	 **STOP!** The drive can be destroyed due to deactivated monitoring functions.	–	–	–
	⇨ There is no response to the failure.			

☐ = off ■ = on

Responses (📖 193) of monitoring functions can be parameterised partly via codes – in the GDC parameter menu under **Monitoring**.

9.2 Overview of monitoring functions

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 (activated via DCTRL)	FWM	C0581	●	✓	✓	✓	✓
x191	HSF	Internal error	Internal		●				
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus(C0174)	MCTRL			●			
0070	U15	Undervoltage of internal 15 V voltage supply	Internal		●				
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x041	AP1	Internal fault (signal processor)	Internal		●				
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 CAN bus at interface X4 (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x066	CE5	Communication error of the gateway function (C0370, C0371) via CAN bus at interface X4 (CAN)	CAN	C0603	✓		✓		●
x122	CE11	Communication error on the CANaux1_IN process data input object (time monitoring adjustable via C2457/1)	CANaux1_IN	C2481	✓		✓		●
x123	CE12	Communication error on the CANaux2_IN process data input object (time monitoring adjustable via C2457/2)	CANaux2_IN	C2482	✓		✓		●
x124	CE13	Communication error on the CANaux3_IN process data input object (time monitoring adjustable via C2457/3)	CANaux3_IN	C2483	✓		✓		●
x125	CE14	BUS-OFF state CAN bus at interface X14 (CAN-AUX) (too many faulty telegrams)	CANaux	C2484	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x126	CE15	Communication error of the gateway function via CAN bus at interface X14 (CAN-AUX) ● C0371 = 1: Gateway channel X14 (CAN-AUX) ● C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	CANaux	C2485	✓		✓		●
x260	Err Node Guard	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.	Node Guarding	C0384	●	✓	✓	✓2)	✓
Temperatures / sensors									
0050	OH	Device heatsink temperature > 90° C	MCTRL		●				
0051	OH1	Temperature inside the device > 90° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582	✓		●		✓
x055	OH5	Temperature inside the device > C0124	MCTRL	C0605	✓		●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584	✓		●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	MCTRL	C0585	✓		●		✓
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x095	FAN1	Devicefan monitoring (only for built-in units)			✓	●			
x110	H10	Device thermal sensor error on heatsink	FWM	C0588	●				✓
x111	H11	Device thermal sensor error in the interior of the device	FWM	C0588	●				✓
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				
0015	OC5	Device utilisation I x t (fix 100%)	MCTRL		●				
0016	OC6	Motor utilisation I^2 x t (threshold C0120)	MCTRL		●				
x017	OC7	Device utilisation I x t (clip C0123)	MCTRL	C0604	✓		●		✓
x018	OC8	Motor utilisation I^2 x t (threshold C0127)	MCTRL	C0606	✓		●		✓
x032	LP1	Motor phase failure **Note:** Can only be used for asynchronous motors. Activation of the motor phase failure detection minimises the computing time available to the user!	MCTRL	C0597	✓		✓		●
x081	Rel1	Open circuit monitoring of the brake relay output (X25)	FWM	C0602	✓	✓		✓	●
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	●		✓		✓

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	MCTRL	C0598	✓		✓		●
x087	Sd7	Absolute value encoder initialisation error at X8	MCTRL		●				
x088	Sd8	Sin&cos signal fault at X8	MCTRL	C0580	✓				●
x089	PL	Fault during rotor position adjustment	MCTRL		●				
Speed									
x190	nErr	Speed control error (monitoring window C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	NMAX	Max. system speed (C0596) has been exceeded.	MCTRL	C0607	●		✓		✓
Float error									
0209	float Sys-T	Float error in system task (ID 0)	Internal		●		✓	✓	2)
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)	Internal		●		✓	✓	2)
0211	float Task1	Float error in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0218	float Task8	Float error in task 8 (ID 9)							
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x108	H08	Extension board not connected properly or not supported by program.	Internal		●				
0201	overrun Task1	Time-out in task 1 (ID 2)	Internal		●		✓	✓	2)
...	...	...							
0208	overrun Task8	Time-out in task 8 (ID 9)							
0219	overrun Cycl.-T	Time-out in cyclic task (PLC_PRG, ID 1)	Internal		●		✓	✓	2)
0220	noT-Fkt Credit	Not enough technology units available in the PLC.	Internal		●				
0230	No program	No PLC program loaded in the PLC.	Internal		●				
0231	Unallowed Lib	You have called the library function in the PLC program. This function is not supported.	Internal		●				
x232	NoCamData	Motion profiles (cam data) are not available.	Internal		●				
x240	ovrTrans Queue	Overflow of transmit request memory	Free CAN objects	C0608	●	✓	✓	✓	✓
x241	ovr Receive	Too many receive telegrams	Free CAN objects	C0609	●			✓	
Parameter setting									

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible fault responses ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
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		●				
0080	PR6	● **For ECSxS/P/M:**Internal fault ● **For ECSxA:** Too many user codes	Internal		●				

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
1) Adjustable in the DDS under **Project → Exceptional handling**
2) For ECSxA... only

9.3 Configuring monitoring functions

9.3.1 Monitoring times for process data input objects

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
x062	CE1	Communication error at the process data input object CAN1_IN	CAN_bCe1CommErrCanIn1_b	✓		✓	•
x063	CE2	Communication error at the process data input object CAN2_IN	CAN_bCe2CommErrCanIn2_b	✓		✓	•
x064	CE3	Communication error at the process data input object CAN3_IN	CAN_bCe3CommErrCanIn3_b	✓		✓	•
x065	CE4	BUS-OFF state of the CAN bus at interface X4 (CAN)	CAN_bCe4BusOffState_b	✓		✓	•
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux_bCe1CommErrCanIn1_b	✓		✓	•
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux_bCe2CommErrCanIn2_b	✓		✓	•
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux_bCe3CommErrCanIn3_b	✓		✓	•
x125	CE14	BUS-OFF state of the CAN bus at interface X14 (CAN-AUX)	CANaux_bCe4BusOffState_b	✓		✓	•

• Default setting
✓Setting possible

Each process data input object can monitor whether a telegram has been received within a specified time. As soon as a telegram arrives, the corresponding monitoring time (C0357/C02457) is restarted (”retriggerable monoflop” function).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 198
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 198
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

The following responses can be set for communication errors:

- 0 = Error (TRIP) - controller sets controller inhibit (CINH)
- 2 = Warning
- 3 = Monitoring is switched off

Codes for setting the response to the monitoring functions:

CAN bus interface	Code	Monitoring
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: System bus (CAN)	C0591	CAN1_IN (”CE1”)
	C0592	CAN2_IN (”CE2”)
	C0593	CAN3_IN (”CE3”)
	C0595	Bus off (”CE4”)
	C0603	Gateway function (”CE5”)
X14 System bus (CAN)	C2481	CANaux1_IN (”CE11”)
	C2482	CANaux2_IN (”CE12”)
	C2483	CANaux3_IN (”CE13”)
	C2484	Bus off (”CE14”)
	C2485	Gateway function (”CE15”)

The input signals (CAN1...3_IN/CANaux1...3_IN) can also be used 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 signal ”BusOffState” (CE4/CE14) is set.

”BusOffState” can activate an error (TRIP) or warning. The signal can also be switched off. The response is set under C0595/C2484. You can also assign the terminal output for this.

9.3.2 Time-out monitoring for activated remote parameterisation

If remote parameterisation is activated (gateway function (📖 190)) and a timeout occurs, the system error message CE5/CE15 is output.

The response to this can be configured via C0603/C2485.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0603	MONIT CE5	3		Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 198 📖 190
			0 TRIP		
			2 Warning		
			3 Off		
C2485	MONIT CE15	3		Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	📖 198 📖 190
			0 TRIP		
			2 Warning		
			3 Off		

9.3.3 Short circuit monitoring (OC1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
011	OC1	Short circuit	MCTRL_bShortCircuit_b	•			

• Default setting
✓Setting possible

The monitoring process is activated if a short circuit occurs in the motor phases. This can also be caused by an interturn fault in the machine.

► Monitoring can also be actuated at mains connection, if an **earth fault** occurs.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the short circuit has to be eliminated.

9.3.4 Earth fault monitoring (OC2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
012	OC2	Earth fault	MCTRL_bEarthFault_b	•			

• Default setting
✓Setting possible

The ECSxS... axis module is equipped with a standard earth fault detection.

► If monitoring is actuated, the drive controller has to be disconnected from the mains, and the earth fault has to be eliminated.

Possible causes of an earth fault are:

► Short circuit to frame of the machine

► Short circuit of a phase to the shield

► Short circuit of a phase to PE

9.3.5 Motor temperature monitoring (OH3, OH7)

Stop!

The temperature sensor must only be connected to either X7 **or** X8, the other input of the temperature sensor must be left open!

Note!

This monitoring function only applies to temperature sensors specified by Lenze like the ones used on standard Lenze servo motors.

With regard to default setting, this monitoring is switched actively and is actuated when no Lenze servo motor is used!

The motor temperature is monitored by means of a continuous KTY temperature sensor.

The motor temperature monitoring functions (OH3/OH7) respond when the set temperature thresholds are exceeded.

Wire the KTY temperature sensor to the resolver cable at X7 (📖 87) or the encoder cable at X8 (📖 88).

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
053	OH3	Motor temperature (fixed, 150 °C)	MCTRL_bMotorTempGreaterSetValue_b	•		✓	✓
057	OH7	Motor temperature (adjustable, C0121)	MCTRL_bMotorTempGreaterC0121_b	✓		•	✓

• Default setting
✓Setting possible

► Adjustable warning threshold (OH7)
  – The warning threshold can be set under C0121
  – The reaction to exceeding the threshold can be set under C0584

► Fixed warning threshold (OH3)
  – Threshold = 150 °C
  – The reaction to exceeding the threshold can be set under C0583

The hysteresis is 15 K, i.e. the switching value for the fixed warning threshold is 135 °C.

Monitoring with the adjustable threshold (OH7) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH3). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0121	OH7 limit	120			Threshold for motor temperature monitoring	📖 202
			45 {1 °C} 150		Motor temperature > C0121 ⇨ fault message OH7 (C0584)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0583	MONIT OH3	0		Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	202
			0 TRIP		
			2 Warning		
			3 Off		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	202
			0 TRIP		
			2 Warning		
			3 Off		

9.3.6 Heatsink temperature monitoring (OH, OH4)

The heatsink temperature of the controller can be monitored with two temperature thresholds:

- Adjustable temperature threshold (OH4)
  - Threshold can be set under C0122
  - The reaction to exceeding the threshold can be set under C0582
- Fixed temperature threshold (OH)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
050	OH	Heatsink temperature (fixed, 90 °C)	MCTRL_bKuehlGreaterSetValue_b	•			
054	OH4	Heatsink temperature (adjustable, C0122)	MCTRL_bKuehlGreaterC0122_b	✓		•	✓

• Default setting
✓Setting possible

The hysteresis is 5 K, i.e. the switching value for the fixed threshold is 85 °C.

Monitoring with the adjustable threshold (OH4) is intended as an early warning stage prior to the final disconnection of the controller by means of TRIP (OH). In this way the process can be influenced accordingly, so that a final disconnection of the controller at an unfavourable moment is avoided. Furthermore, it is possible to activate e.g. additional fans which would generate an unacceptable noise nuisance when operated continuously.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0122	OH4 limit	80			Threshold for heatsink temperature monitoring	📖 204
			45 {1 °C} 90		Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0582	MONIT OH4	2			Setting of the fault response - monitoring of heatsink temperature in C0122	📖 204
			0	TRIP		
			2	Warning		
			3	Off		

The following causes can bring about an actuation of the monitoring process:

Cause	Remedy
The ambient temperature is too high.	Mount a fan in the control cabinet.
The drive controller is overloaded in the arithmetic mean, i. e. overload and recovery phase are above 100%.	• Mount a fan in the control cabinet. • Reduce overload phase. • Use more powerful drive controller.

9.3.7 Monitoring of internal device temperature (OH1, OH5)

The temperature inside the controller can be monitored with two temperature thresholds:

- Adjustable threshold (OH5)
  - The warning threshold can be set under C0124
  - The reaction to exceeding the threshold can be set under C0605
- Fixed threshold (OH1)
  - Threshold = 90 °C
  - Reaction to exceeding the threshold = TRIP

The hysteresis is 5 K, i.e. the reset value for the fixed warning threshold is 85 °C.

The monitoring with the adjustable threshold (OH4) is designed as an early warning stage before final disconnection of the controller by means of TRIP (OH). Therefore, the process can be influenced accordingly, so that the final disconnection of the controller at unfavourable moments is avoided. Furthermore, for instance, additional fans can be activated, generating a noise load when switched to continuous operation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 205
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 205
			0	TRIP			
			2	Warning			
			3	Off			

9.3.8 Function monitoring of thermal sensors (H10, H11)

The function of the thermal sensors of the heatsink and the interior of the device is monitored. If the thermal sensors report values outside the measuring range, fault H10 (heatsink) or H11 (interior) is reported. The response to these faults can be defined under C0588.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 206
			0 TRIP		
			2 Warning		
			3 Off		

9.3.9 Current load of controller (I x t monitoring: OC5, OC7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
015	OC5	I x t overload	MCTRL_bIxtOverload_b	•			

• Default setting
✓Setting possible

The I x t monitoring function monitors the current load of the axis module. The monitoring function is set so that operation

- is permanently possible with a device output current = I_r.
- is possible for ≤≤ 30 s with a device output current ≤≤ 1.5 x I_r.

The overload protection of the axis module can be set with thresholds:

- adjustable threshold (OC7) via C0123
- fixed threshold (OC5) = 100 %

After an overcurrent phase, you can calculate with a recovery phase of 120 s. For a more precise consideration, see the overcurrent characteristic and the value 3 x $\tau_{axis\ module}$ (📖 208).

The response to exceeding the adjustable threshold can be defined under C0604.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	📖 201
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 201
			0	TRIP			
			2	Warning			
			3	Off			

Overcurrent characteristic

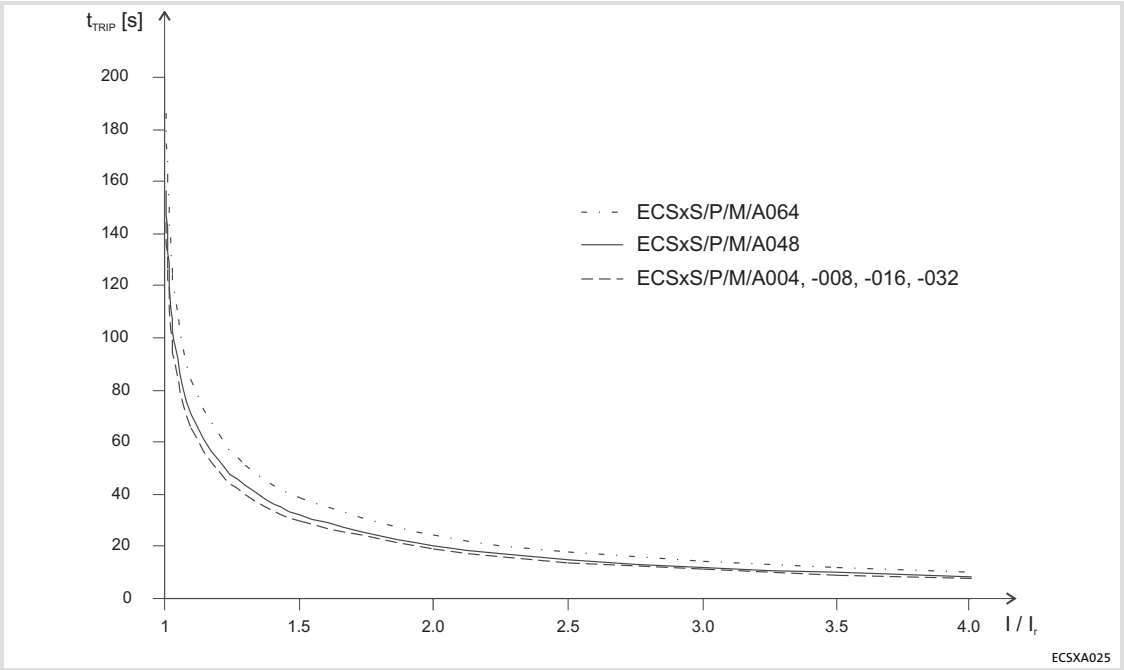


Fig. 9-1 Overcurrent characteristic ECSxS..., see also "Rated data" 📖 33

The overcurrent characteristic shows the maximum time t_{TRIP} till the axis module generates an I x t error. In order to reach this time t_{TRIP} again, the time 3 x $\tau_{axis\ module}$ with the load I/I_r = 0 A must be observed.

Device	$\tau_{axis\ module}$ [s]	Overcurrent characteristic
ECSxS004	54.6	$I \cdot t = \frac{I_{subprofile\_x}}{I_{rated}} - \left(\frac{I_{subprofile\_x}}{I_{rated}} - I \cdot t_{subprofile\_x-1} \right) \cdot e^{-\frac{t_{subprofile\_x}}{\tau_{axis\_module}}}$
ECSxS008	27.3	
ECSxS016	27.3	
ECSxS032	27.3	
ECSxS048	29.5	
ECSxS064	35.1	

Overcurrent diagram for OC5 fault message

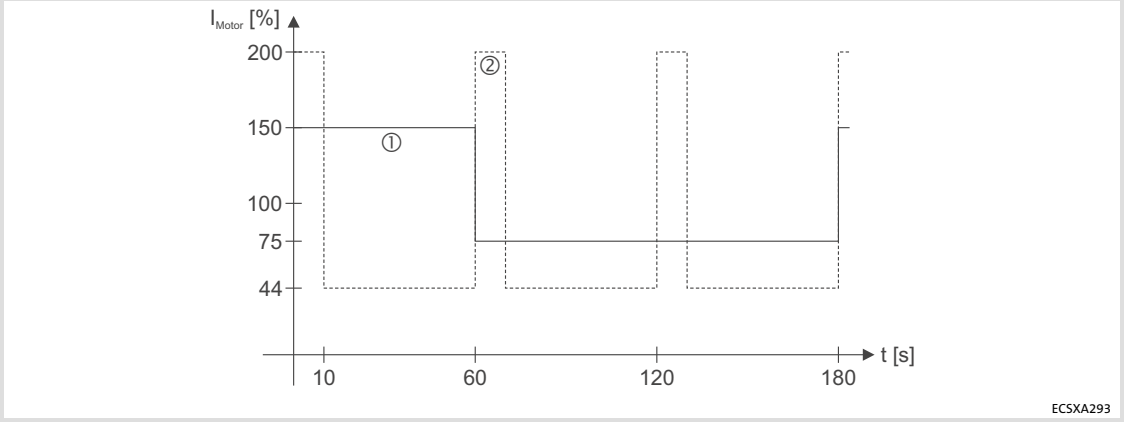


Fig. 9-2 Maximum overcurrent as a function of time

The maximum admissible overcurrent is dependent on the I_{max}limit set in C0022.

① I_{max} limit set in C0022 ≤ 150 % I_r:

► For **180 s**, the arithmetic mean value of the motor current must not exceed **100 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ①:

$$\frac{60\ \text{s} \cdot 150\ \% + 120\ \text{s} \cdot 75\ \%}{180\ \text{s}} = 100\ \%$$

② I_{max} limit set in C0022 > 150 % I_r:

► For **60 s**, the arithmetic mean value of the motor current must not exceed **70 %** of the rated device current.

► **Example:** Arithmetic mean for characteristic ②:

$$\frac{10\ \text{s} \cdot 200\ \% + 50\ \text{s} \cdot 44\ \%}{60\ \text{s}} = 70\ \%$$

The current device utilisation is displayed in C0064:

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display
			0	{1 %}	150	• C0064 > 100 % activates OC5-TRIP. • TRIP-RESET only is possible if C0064 < 95 %.

9.3.10 Current load of motor (I^2 x t monitoring: OC6, OC8)

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 %.

9.3.10.1 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):

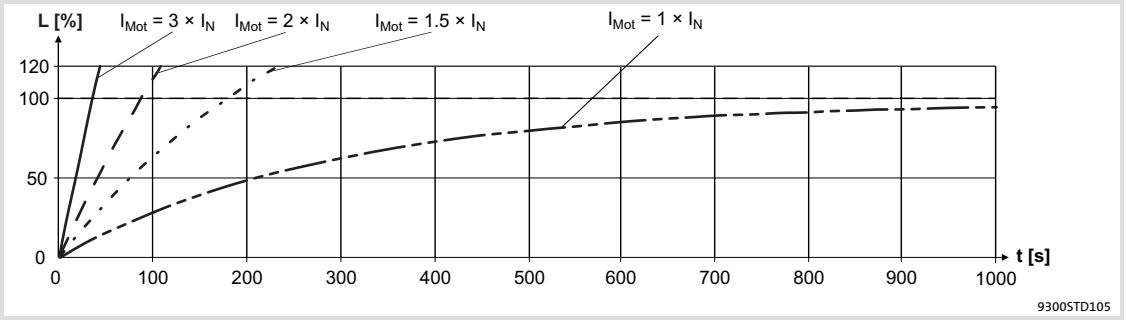


Fig. 9-3 I^2 × t-monitoring: Release times for different motor currents and trigger thresholds

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

9.3.10.2 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

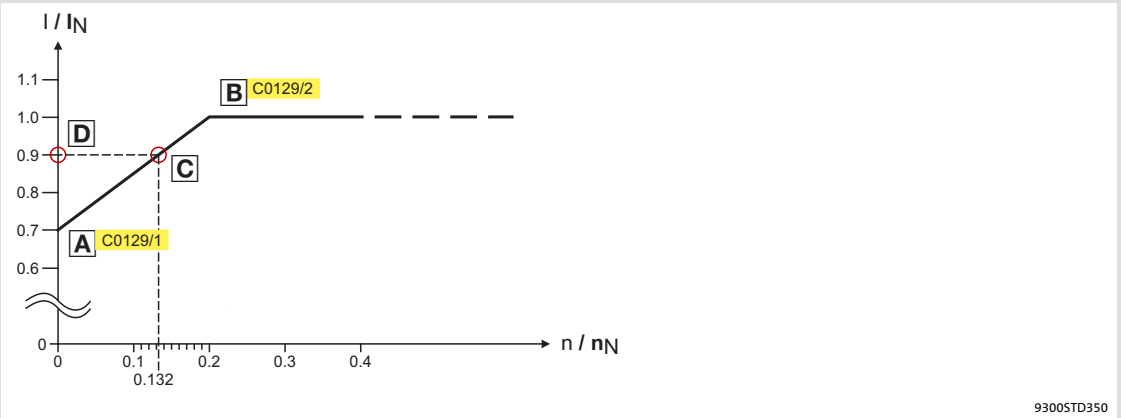


Fig. 9-4 Working point in the range of characteristic lowering

The lowered speed / torque characteristic (Fig. 9-4) 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. 9-4, 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", 📖 213)

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).

9.3.11 DC-bus voltage monitoring (OU, LU)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
020	OU	Overvoltage	MCTRL_bOvervoltage_b		•		
030	LU	Undervoltage	MCTRL_bUndervoltage_b		•		

• Default setting
✓Setting possible

These monitoring functions monitor the DC bus and protect the controller.

- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ exceeds the upper switch-off threshold set in C0173, an OU message is sent.
- If the DC-bus voltage at terminals $+U_G$ and $-U_G$ falls below the lower switch-off threshold set in C0174, an LU message is sent.

The monitoring response remains active until the corresponding threshold is fallen below/exceeded again.

Note!
All drive components in DC-bus connections must have the same thresholds!

Switch-off and switch-on thresholds

- The switch-off threshold defines the voltage level of the DC-bus voltage, at which the pulse inhibit is activated.
- The switch-off and switch-on thresholds dependent on C0173 can be gathered from the following table:

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785



Tip!

If undervoltage is existent for more that 3 s, or if mains connection is carried out, an entry into the fault memory is effected.

- This operational mode can occur if the control module is fed via the terminals X6/+24 and X6/GND by means of an external supply and the mains are disconnected.
- If there is no undervoltage anymore (mains are reconnected again), the entry in the fault memory is not continued, but deleted. This case does not describe an error, but a state of the drive controller.

Undervoltages of less than 3 s are interpreted as a fault (e. g. mains fault) and are entered into the fault memory. In this case, the fault memory is updated.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0173	UG limit	11			Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 98
			0	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3	Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4	Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10	Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11	Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12	Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13	Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14	Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60			Undervoltage threshold of DC bus (LU)	📖 98
			15	{1 V} 342		

9.3.12 Voltage supply monitoring - control electronics (U15)

If the voltage at X6/DI1 or X6/DI3 falls below 17 V, TRIP ”U15” is triggered. The fault can only be reset if U > 19 V.

9.3.13 Motor phase failure monitoring (LP1)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
032	LP1	Motor phase failure	MCTRL_bMotorphaseFail_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether a motor phase has failed.

Note!

- ► This monitoring function can only be used for asynchronous motors.
- ► When this monitoring function is activated, the calculating time available to the user is reduced.

- ► The response is set via C0597.
- ► The monitoring limit is set via C0599.

Reset fault message

1. Check motor cables.
2. Carry out TRIP-RESET.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0597	MONIT LP1	3			Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 217
			0	TRIP		
			2	Warning		
			3	Off		
C0599	Limit LP1	5.0			Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 217
			0.01	{0.01 %} 10.00		

9.3.14 Monitoring of the resolver cable (Sd2)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
082	Sd2	Resolver error	MCTRL_bResolverFault_b	•		✓	✓

• Default setting
✓Setting possible

This monitoring function monitors the resolver cable and the resolver with regard to open circuit and protects the motor.

Stop!

If monitoring is disconnected, the machine can achieve very high speeds in case of faults (e. g. system cable is disconnected or not correctly screwed), which can result in the damage of the motor and of the driven machine! The same applies if ”warning” is set as a response.

- ► For commissioning C0586, always use the Lenze setting (TRIP).
- ► Only use the possibility of disconnection via C0586 if the monitoring is activated without apparent reason (e. g. by very long cables or intense interference injection of other drives).
- ► Configure C0586 = 2 (warning) only on the above-mentioned condition, because the pulses are enabled despite faulty feedback.

If a fault with regard to the actual value acquisition is available, it is not definitely ensured that monitoring is triggered by overspeed (NMAX, 📖 223).

This monitoring ...

- ► is automatically activated if a resolver is selected as an actual speed value encoder via C0419.
- ► is automatically activated if another actual speed value encoder is selected.

The response is set via C0586.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 218
			0 TRIP		
			2 Warning		
			3 Off		

9.3.15 Motor temperature sensor monitoring (Sd6)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
086	Sd6	Motor temperature sensor fault	MCTRL_bSensorFault_b	✓		✓	•

• Default setting
✓Setting possible

This monitoring function checks whether the motor temperature sensor supplies values within the measuring range of -50 ... +250 °C. If the values are outside this measuring range, monitoring is activated.

The response is set via C0594.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. "SensorFault" (Sd6)	📖 219
			0 TRIP		
			2 Warning		
			3 Off		

9.3.16 Monitoring of the absolute value encoder initialisation (Sd7)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
087	Sd7	Absolute value encoder initialisation error	MCTRL_bEncoderFault_b	•			

• Default setting
✓Setting possible

When the ECSxS... axis module is switched on, this monitoring function repeatedly downloads the absolute value of the hiperface absolute value encoder to identify whether the same value is transferred to the drive.

The absolute value encoders (single-turn, multi-turn) are supported by a hiperface interface with various numbers of increments, e.g.: SRM50 with 1024 Sin/Cos periods/rev. or SKM38 with 128 periods/rev.(see also C0419).

If a deviation > 5° on the motor shaft is detected, the monitoring (TRIP) is actuated.

The fault message ”Sd7” can only be reset by mains switching!

9.3.17 Sin/cos signal monitoring (Sd8)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
088	Sd8	Sin/cos signal fault	MCTRL_bEncoderFault_b	✓			•

• Default setting
✓Setting possible

This monitoring function carries out a plausibility test to check that the encoder is available and that the sin/cos track supply plausible values with regard to each other.

- ► If required, the encoder has to move by several angular degrees for actuating a fault.
- ► The response is set via C0580.
- ► The filter time constant (C0559) serves to filter short-time trouble on the sin/cos track of the encoder without an SD8 trip being released immediately.
- ► The ”Sd8” fault message can only be reset by mains switching.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	📖 221
			0	TRIP			
			3	Off			
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	

Note!

For the desired encoder monitoring, and in particular when using synchronous machines, set fault handling to ”TRIP”.

In order to achieve further encoder safety, monitoring of following errors can be activated for positioning systems. Set its fault response to ”TRIP”, too.

Visible faults	Non-visible faults
• Unplugged plug, all encoder signals open. • Singe wire breakage, one of the following signals is missing: – COS A – RefCOS A – SIN B – RefSIN B – GND – VCC • Double wire breakage with the following signal pairs: – COS A and RefCOS A – SIN B and RefSIN B – COS A and SIN B – RefCOS A and RefSIN B – and all four signals (COS A, RefCOS A, SIN B, RefSIN B) open.	• Short circuits, in particular between sine and cosine signals. • Cable/encoder faults with intermediate values • ”Semi”-short circuits (> 0 Ohm) • ”Semi”-interruptions (< infinite)

9.3.18 Monitoring of the speed system deviation (nErr)

Fault message		Monitoring function	System variable	Possible response				
				TRIP	Message	Warning	FAIL-QSP	Off
190	nErr	Speed outside of the tolerance window (C0576)	MCTRL_bSpeedLoopFault_b	✓	✓	✓	✓	•

• Default setting
✓Setting possible

This monitoring function compares the actual speed value provided by the speed sensor with the speed setpoint of the speed controller. If the difference between the two speed values exceeds the tolerance window set in C0576, the nErr monitoring function responds.

► If the system deviation exceeds a certain value, this may indicate a drive problem. The drive cannot follow the selected speed setpoint as fast as required. If the controller generally is in working condition, mechanical blockages on the load side or insufficient motor torque may be the cause.

Furthermore, this monitoring function can be used to additionally protect a speed sensor operating in the speed-controlled mode. The monitoring function thus supplements the individual encoder monitoring.

► Faults on the encoder system bring about an incorrect actual speed value. This normally results in a system deviation on the speed controller that is greater than that in the normal operating status.

► The tolerance margin is set via C0576.

► The response is set via C0579.

Note!

► Set the tolerance window (C0576) to at least twice the value of the system deviation occurring during operation. The value can be identified by respective tests when commissioning is effected.

► Please observe that the system deviation reaches higher values under normal operating conditions with short ramp times.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	📖 222
			0	{1 %}	100		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	📖 222
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

9.3.19 Monitoring of max. system speed (NMAX)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
200	NMAX	Max. system speed exceeded	MCTRL_bNmaxFault_b	•			

• Default setting
✓Setting possible

The monitoring function responds if the current speed exceeds the max. system speed or twice the value of C0011 (n_{max}).

Stop!

- ► With regard to active loads (e. g. hoists), pay attention to the fact that the drive in this case operates without torque. Specific on-site measures are required!
- ► If the actual speed value encoder fails, it is not provided that this monitoring will be activated.

The max. system speed can be set via C0596.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0596	NMAX limit	5500				Maximum system speed	📖 223
			0	{1 rpm}	16000		

9.3.20 Monitoring of the rotor position adjustment (PL)

Fault message		Monitoring function	System variable	Possible response			
				TRIP	Message	Warning	Off
089	PL	Fault during rotor position adjustment	MCTRL_bRotorPositionFault_b	•			

• Default setting
✓Setting possible

This monitoring function observes the correct execution of the rotor position adjustment.

This monitoring function can occur during rotor position adjustment in connection with feedback systems:

- Resolver
- TTL encoder
- Sin/cos encoder
- Absolute value encoder (single/multi-turn)

Cause for this is a cancellation of the adjustment routine as a result of

- a supply voltage loss
- an encoder cable interruption
- a routine stop through the deactivation of C0095

Reset fault message

1. Remove the cause for the cancellation.
2. Inhibit controller
3. Deactivate rotor position adjustment with C0095 = 0.
4. Carry out TRIP-RESET.
5. Activate rotor position adjustment with C0095 = 1.

10 Diagnostics

10.1 Diagnostics with Global Drive Control (GDC)

In order to diagnose the current controller operation, click **Diagnostics → Actual info** in the GDC parameter menu. The table which appears then shows the current motor data, operating times, error messages, etc.:

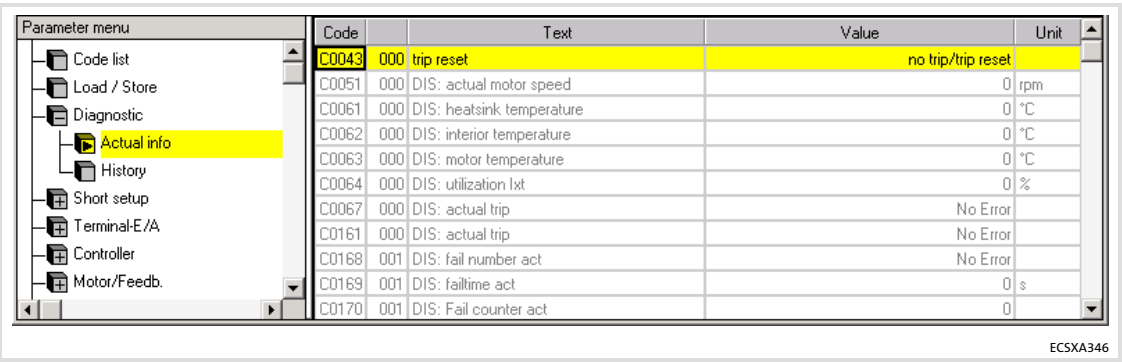


Fig. 10-1 GDC view: Diagnostics - Device - current status

The parameter menu of the GDC displays values regarding the fault history under **Diagnostics → History**:

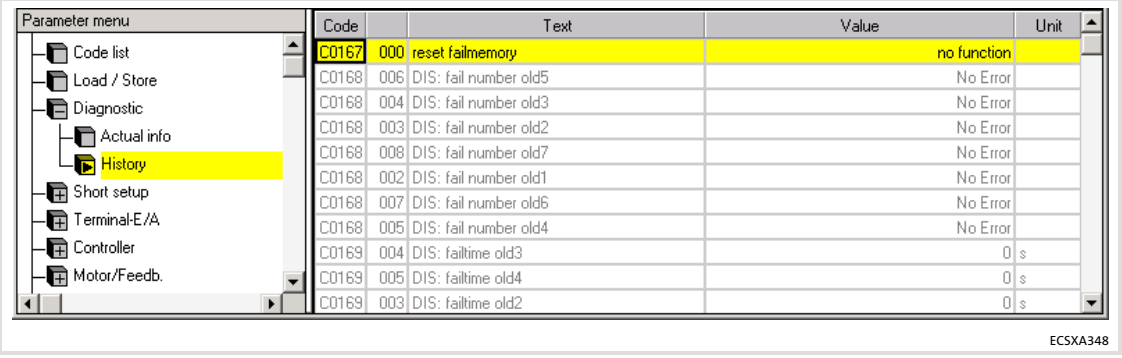


Fig. 10-2 GDC view: Fault diagnostics

10.2 Diagnostics with Global Drive Oscilloscope (GDO)

The ”Global Drive Oscilloscope” (GDO) is included in the scope of supply of the Lenze parameter setting and operating program ”Global Drive Control” (GDC) and the ”Drive PLC Developer Studio” (DDS) and can be used as an additional diagnostic program.

The GDO serves to record e.g. input and output data and device-internal states during controller operation.

Note!

- ► Detailed information concerning the handling and functional range of GDO can be gathered from the Manual ”Global Drive Oscilloscope (GDO), First steps”.
- ► Overview of the variables used in the GDO: 📖 428

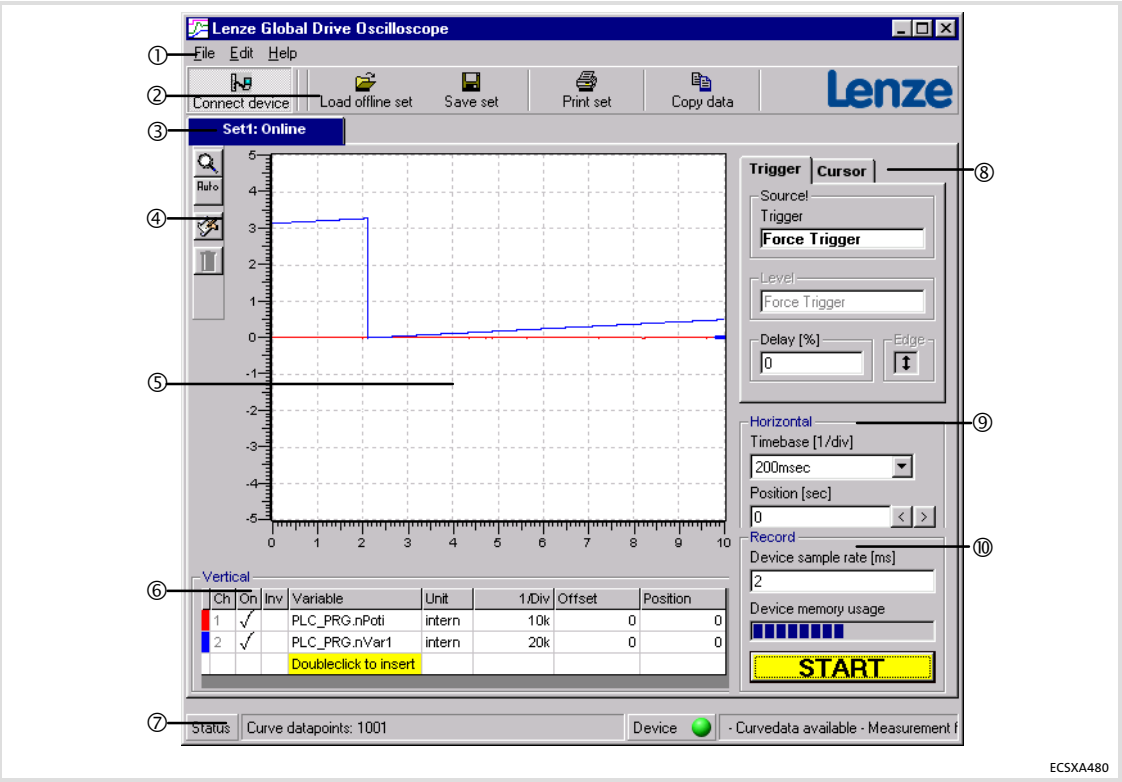


Fig. 10-3 Global Drive Oscilloscope (GDO)

① Menu bar
② Symbol bar at the top
③ Data sets
④ Symbol bar on the left
⑤ Graph display field
⑥ Vertical operating elements
⑦ Status display
⑧ Trigger/cursor operating elements
⑨ Horizontal operating elements
⑩ Operating elements for recording

10.2.1 GDO buttons

Clicking on the corresponding button executes the respective function.

Press the **<F1>** key to call the HTML online help.

Symbol bar at the top (②, Fig. 10-3)

Symbol (button)	Function
	**Connect device** Here a connection can be established to an attached module. This button has the same function as the menu command **File → Connect**.
	**Load offline set** Here saved data sets can be loaded.
	**Save set** Here recorded curves can be saved. This button has the same function as the menu command **File → Save**.
	**Print set** Here the recorded curve can be printed in different variants.
	**Copy data** Here data sets can be copied. This button has the same function as the menu command **Edit → Copy**.

Symbol bar on the left (④, Fig. 10-3)

Symbol (button)	Function
	**Zoom** Here different zoom functions can be executed.
	**Automatic scaling** Here all selected curves can be automatically scaled and repositioned and the offset value can be set to ”0”. The following data types are supported in automatic scaling: BYTE; WORD; DWORD; USINT; UINT; UDINT; SINT; INT; SDINT; Array; Struct
	**Comment** Here information concerning the current data set can be entered. This information is saved together with the current data set and after loading it is displayed as a short info.
	**Delete** Here the selected offline data set can be deleted.

10.3 Diagnostics with the XT EMZ9371BC keypad

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	

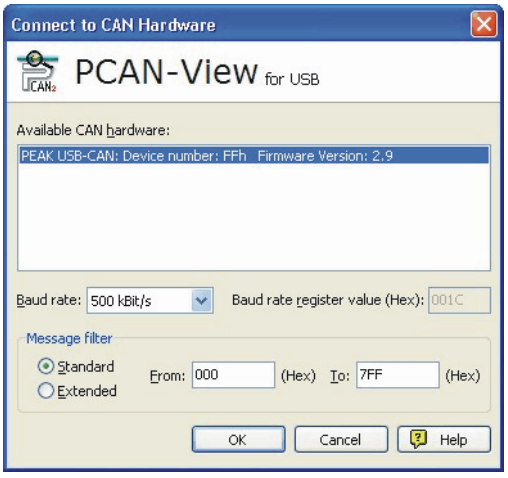
10.4 Diagnostics with PCAN-View

”PCAN-View” is the basic version of the ”PCAN-Explorer” program for Windows® of PEAK System Technik GmbH. The program permits a simultaneous transmission and reception of CAN messages which can be transmitted manually and periodically. Errors on the bus system and memory overflows of the triggered CAN hardware are displayed.

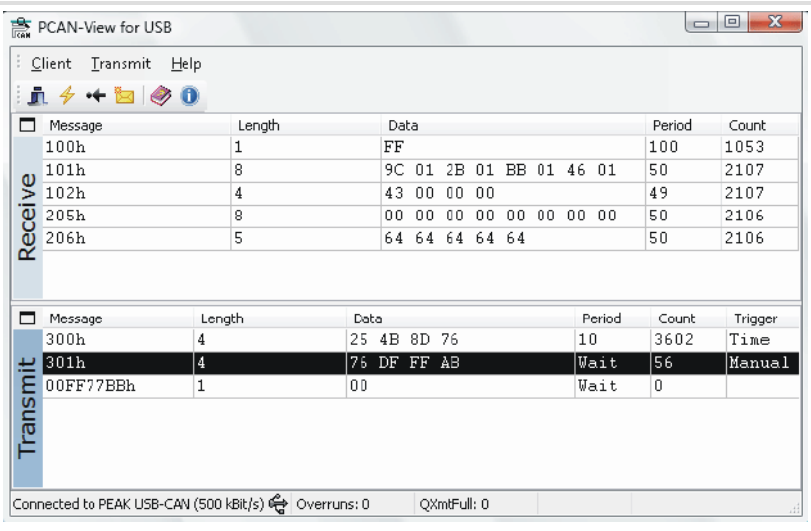
10.4.1 Monitoring of telegram traffic on the CAN bus

How to monitor the telegram traffic:

1. Connect the Engineering PC directly to the CANopen bus via the EMF2177IB USB system bus adapter.
2. Start the ”PCAN-View” program.
3. Connect ”PCAN-View” to ”Connect to CAN Hardware” using the USB system bus adapter and the desired baud rate.



The ”Receive” and ”Transmit” windows now continuously display the CAN telegrams.



On the basis of the IDs displayed, you can assign the telegrams to the devices.

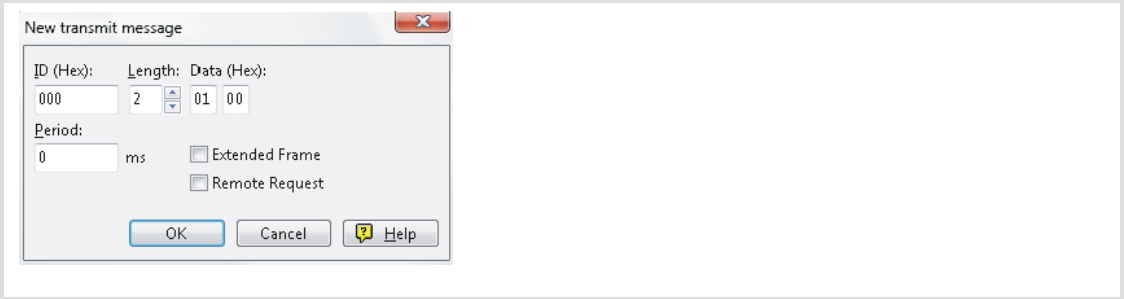
If no telegrams are displayed, this may be caused by various factors:

- Is your Engineering PC connected to the correct CAN bus?
- Is the correct system bus adapter activated under ”System control, CAN Hardware”?
- What does the status line of the »PCAN-View« contain?
  In case of ”Bus Heavy” mostly a node with a wrong baud rate disturbs the bus traffic.
- Do the devices are in the ”Operational” status?

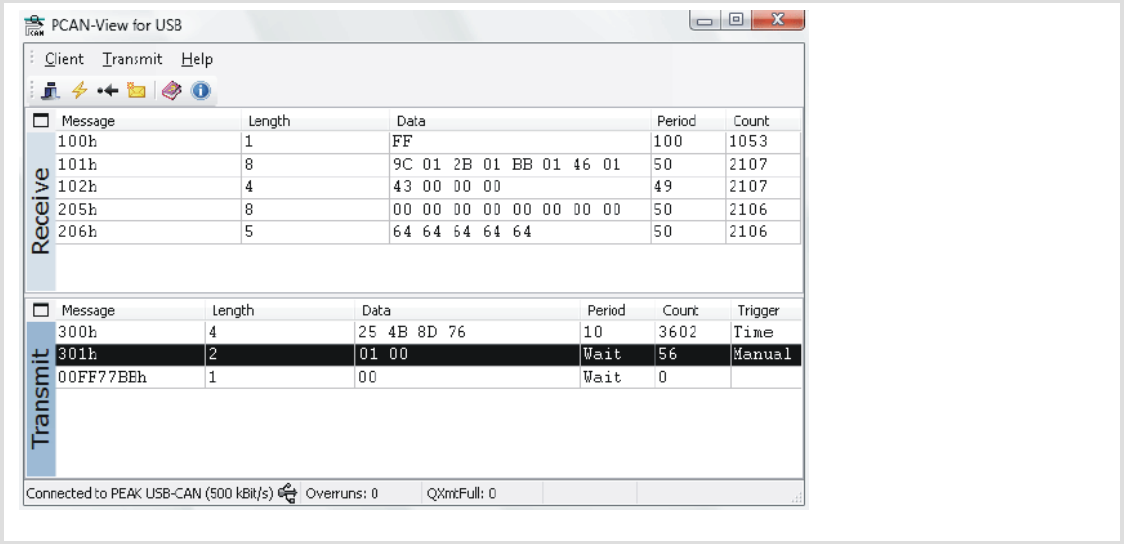
10.4.2 Setting all CAN nodes to the ”Operational” status

How to set all CAN nodes to the ”Operational” status:

1. Create the following CAN message under ”New transmit message”:



2. Select the CAN message in the ”Transmit” window and press the <space bar> once to transmit the CAN message.



11 Troubleshooting and fault elimination

Failures can be quickly detected and classified by means of display elements or status messages via the MotionBus (CAN).

Display elements and status messages provide a rough classification of the trouble.

The chapter ”11.3 Fault messages” (📖 238) contains notes on causes and deletion of faults.

11.1 Fault analysis

11.1.1 Fault analysis via the LED display

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibit (CINH) active, switch-on inhibit	C0183
Blinking	Off	Trouble/fault (TRIP) is active	C0168/1
Blinking	On	Warning/FAIL-QSP is active	C0168/1

11.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display indicate the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited.	C0183, C0168/1
IMP	Pulses at the power stage inhibited.	C0183, C0168/1
Imax	Maximum current reached.	
Mmax	Maximum torque reached.	
FAIL	Fault through TRIP, message, fail QSP or warning.	C0183, C0168/1

11.1.3 Fault analysis with the history buffer

The history buffer (C0168) enables you to trace faults. The corresponding fault messages are stored in eight memory locations in the sequence of their occurrence.

Structure of the history buffer

- The fields under ”fault history” show the memory locations 2 ... 7.
- The fields under ”current faults” indicate memory location 1. It gives information on the active fault.
- If the fault is no longer active or has been reset,
  - all information in the fault memory will be automatically shifted upwards by one subcode.
  - memory location 1 will be deleted (no active fault). The information on the formerly active fault is now in subcode 2.
  - the contents of subcode 8 will be eliminated from the history buffer and cannot be read any longer.
- The history buffer contains three information units for every fault occurred:
  - Fault number and response
  - Time of the last occurrence
  - Frequency of successive occurrence

Note!

- If several faults with different responses occur at the same time, only the fault the response of which has the highest priority is entered in the history buffer.
  - Power supply module ECSxE:
    TRIP/KSB-TRIP (highest) → message → warning (lowest)
  - Axis module ECSxS/P/M/A:
    TRIP (highest) → message → FAIL-QSP → warning (lowest)
- If several faults with the same response occur at the same time, (e.g. two messages) only the fault that occurred first is entered in the history buffer.
- If a fault occurs several times in quick succession, only the time of the last occurrence is entered in the history buffer.

Assignment of information to the codes

Code and retrievable information				contains information on ...
C0168	C0169	C0170	Subcode	
Number and **response** of the fault message	**Time** of the last occurrence of the fault message	**Frequency** of the occurrence of the fault message	1	active fault
			2	last fault
			3	second-to-last fault
			4	third-to-last fault
			5	fourth-to-last fault
			6	fifth-to-last fault
			7	six-to-last fault
			8	seventh-to-last fault

Reset fault message

The current fault message can be reset via a TRIP-RESET (e.g. via C0043):

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0043	Trip reset	0		Reset active fault message (TRIP-RESET)	📖 246
			0 Reset fault message (TRIP-RESET) / no fault		
			1 Active fault message		

Delete entries in the history buffer

The entries in the history buffer can be deleted via C0167.

► This function only works when no trouble is active.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0167	Reset failmem	0		Delete history buffer (C0168)	📖 233
			0 No reaction		
			1 Delete history buffer		

11.1.4 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	📖 235
			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		

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
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	

11.2 Malfunction of the drive

Maloperation/fault	Cause	Remedy
Feedback system		
● Motor rotates CCW when viewed to the motor shaft. ● C0060 counts down after controller enable.	Feedback system is not connected in correct phase relation.	Connect feedback system in correct phase relation. The rotor position indicated under C0060 is derived from the position encoder (MCTRL_dnPos_p). Therefore observe the mounting position when using separate feedback systems for position (C0490) and speed (C0495).
Asynchronous motor		
● Motor rotates with I_{max} and half slip frequency. ● Motor does not react to setpoint change.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
Synchronous motor		
● Motor does not follow the setpoint change. ● I_{max} follows the setpoint selection in idle state.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W.
● Motor rotates CCW when viewed to the motor shaft. ● Synchronous motor accelerates with a speed setpoint = 0 to rated speed. ● Torque of synchronous motor is too low.	Rotor angle (offset of electrical and mechanical rotor angle) is not correct.	Carry out rotor position adjustment (C0095 = 1) or set rotor displacement angle manually. **Operate motor without load for this purpose!**
● Motor blocks in certain positions.	The number of pole pairs of the resolver or motor is not set correctly.	Number of pole pairs (C0080) must be set correctly.

11.3 Fault messages

11.3.1 Causes and remedies



Tip!

When the fault messages are retrieved via the system bus (CAN) they are displayed as a number (see column “fault number –number” in the following 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 TRIP (axis module, fix 100 %)	Current overload of the axis module, e.g. by: • frequent and too long acceleration processes • continuous overload with $I_{motor} > 1.05 \times I_{Nx}$	Check drive dimensioning.
0016	OC6	I^2 x t overload TRIP (motor, C0120)	Current overload of the motor, e.g. due to: • frequent or too long acceleration processes • impermissible continuous current	• Check drive dimensioning. • Check setting of C0120.
x017	OC7	I x t overload warning (axis module, C0123)	Current overload of the axis module > C0123 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0123.
x018	OC8	I^2 x t overload warning (motor, C0127)	Current overload of the motor > C0127 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0127.
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 DC bus	DC-bus voltage is lower than specified under C0174.	• Check mains voltage. • Check power supply module.
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.
x041	AP1	Internal fault		Contact Lenze.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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.
0051	OH1	Interior 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.
			Wrong mounting position	Change mounting position.
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.
x055	OH5	Interior temperature > C0124		• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0605 = 3).
			The value under C0124 is set too low.	Enter a higher value under C0124.
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x065	CE4	BUS-OFF state of system bus (CAN), interface X4	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X4: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C0595 = 3).
x066	CE5	System bus (CAN) time-out (communication error of gateway function), interface X4	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X4. • Check CAN bus configuration. • Switch off monitoring (C0603 = 3).
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.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
0074	PEr	Program error	Error in the program flow	• Check use of pointers. • Send module with PLC program and parameter set to Lenze (on floppy disk/CD-ROM).
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)!
0076	PR5	Memory error	Error saving parameters in the fail-safe memory area.	Contact Lenze
0079	PI	Fault during parameter initialisation	• An error has been detected during parameter set transfer between two controllers. • Parameter set does not match the controller, e.g. when data were transmitted from a controller with more performance to a controller with less performance.	• Correct parameter set. • Check code initialisation values. **After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!**
0080	PR6	**With ECSxS/P/M:** internal error		Contact Lenze.
		With ECSxA: too many user codes		Reduce number of user codes.
x082	Sd2	Resolver error at X7	Resolver cable is interrupted.	• Check cable for wire breakage. • Check resolver. • Switch off monitoring (C0586 = 3).
			Excitation amplitude is too low.	Increase excitation amplitude of resolver (C0416). Check control factor of resolver under C0414 (as of operating system V8.0).
x085	Sd5	Master current value encoder error at analog input X6/AI+, AI- (C0034 = 1)	Master current value at X6/AI+, AI- < 2mA	• Check cable for wire breakage. • Check master current value encoder. • Switch off monitoring (C0598 = 3). • Check control factor of resolver under C0414 (as of operating system V8.0).
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).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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. 📖 151 **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	• Sd7 fault during rotor position adjustment with absolute value encoder after mains switching • Cancellation of rotor position adjustment (e.g. by C0095 = 0 or switching off)	1. Activate rotor position adjustment with C0095 = 1. 2. Carry out TRIP reset. 3. Repeat rotor position adjustment.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

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).
x095	FAN1	Fan monitoring (for built-in units)	Heatsink fan is locked, dirty or defect.	Clean or exchange heatsink fan.
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.
x108	H08	”Extension board” error	”Extension board” not connected correctly.	• Connect ”extension board” correctly. • Check connector.
			”Extension board” is not supported by PLC program.	• Adapt PLC program to ”extension board”. • Use ”extension board” which is supported by PLC program.
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).
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux1_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/1, if necessary. • Switch off monitoring (C2481 = 3).
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux2_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/2, if necessary. • Switch off monitoring (C2482 = 3).
x124	CE13	Communication error at the process data input object CANaux3_IN	CANaux3_IN object receives faulty data or communication is interrupted.	• Check wiring on X14. • Check transmitter. • Increase monitoring time under C2457/3, if necessary. • Switch off monitoring (C2483 = 3).
x125	CE14	BUS-OFF state of system bus (CAN), interface X14	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X14: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C2484 = 3).
x126	CE15	Communication error of the gateway function via interface X14 (CAN-AUX) • C0371 = 1: Gateway channel X14 (CAN-AUX) • C2470: Selection of the CANaux object for L_ParRead and L_ParWrite	• Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X14. • Check CAN bus configuration. • Switch off monitoring (C2485 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
1131	PRM	Parameters of the motor model are faulty	The parameters calculated from the entered rated motor data are outside the permissible value range.	Check and correct the set rated motor data (especially C0084, C0085, C0088, C0090).
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.
x191	HSF	Internal error		Contact Lenze.
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)		
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.
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.)

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
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).
x260	Err Node Guard	”Life guarding event”	The controller configured as CAN slave does not receive a ”Node Guarding” telegram within the ”Node Life Time” from the CAN master.	• Check wiring at X4. • Check CAN configuration. • Make sure that ”Node Guarding” has been activated in the CAN master. • Adapt ”Node Life Time” (C0382) to the setting in the CAN master.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

11.3.2 Reset fault messages (TRIP-RESET)

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.

12 Function library

12.1 AIF (Automation interface management)

Function

This function block serves to monitor communication faults by means of a fieldbus module connected to the automation interface (AIF).

- If a fault occurs, the monitoring sets "AIF-Ce0CommErr" to TRUE and releases the communication error CE0 (LECOM No. 61); the corresponding response can be configured via C0126 (default setting: Off).
- When using more current AIF fieldbus modules (e.g. EMF2133IB and EMF2175IB), a fault number is output in addition from the fieldbus module via the "AIF-FieldBusStateBit0 ...7".

Please read the documentation for the connected fieldbus module.

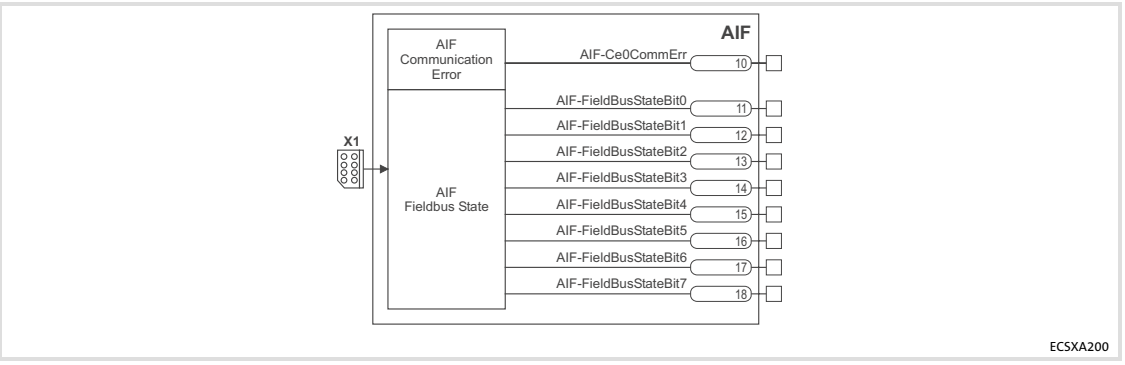


Fig. 12-1 AIF function block

Response to CE0 communication error

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0126	MONIT CE0	3		Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	📖 247
			0 TRIP	A communication error activates the CE0 response set.	
			2 Warning		
			3 Off	Monitoring switched off.	

12.2 AIF1In

Function

This function block serves as an interface for input signals (e. g. setpoint and actual values) from the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

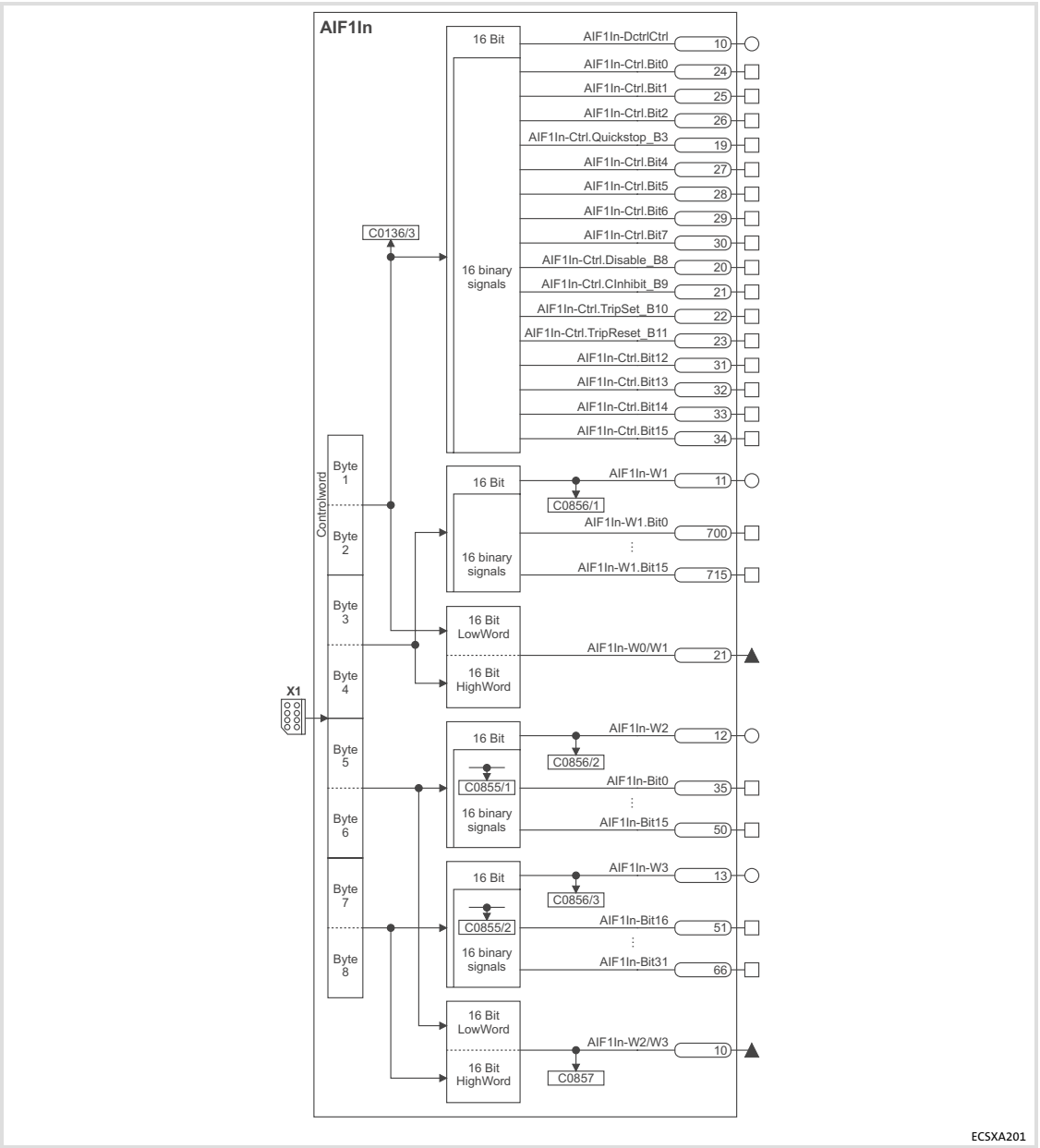


Fig. 12-2 AIF1In function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	📖 248
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	📖 248
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	📖 248
			-2147483648	{1}	2147483647		

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- control word / analog signals (16 bits)
- phase signals (32 Bit)

in the axis module:

<table>
<tr><th>Byte</th><th>Digital signals (1 bit)</th><th>Analog signals (16 bit)</th><th>Phase signals (32 Bit)</th></tr>
<tr><td>1, 2</td><td>AIF1In-Ctrl.Bit0
AIF1In-Ctrl.Bit1
AIF1In-Ctrl.Bit2
AIF1In-Ctrl.Quickstop_B3
AIF1In-Ctrl.Bit4
...
AIF1In-Ctrl.Bit7
AIF1In-Ctrl.Disable_B8
AIF1In-Ctrl.CInhibit_B9
AIF1In-Ctrl.TripSet_B10
AIF1In-Ctrl.TripReset_B11
AIF1In-Ctrl.Bit12
...
AIF1In-Ctrl.Bit15</td><td>AIF1In-DctrlCtrl</td><td rowspan="3">AIF1In-W0/W1</td></tr>
<tr><td></td><td colspan="2">Note:
The internal control word is firmly allocated to bytes 1 and 2. Via this control word it is possible touse
● signals for the functions ”quick stop” (QSP), DISABLE, CINH, TRIP-SET und TRIP-RESET and
● the other 11 control bits (AIF1In-Ctrl.Bit...)
in further functions/function blocks.</td></tr>
<tr><td>3, 4</td><td>AIF1In-W1.Bit0
...
AIF1In-W1.Bit15</td><td>AIF1In-W1</td></tr>
<tr><td>5, 6</td><td>AIF1In-Bit0
...
AIF1In-Bit15</td><td>AIF1In-W2</td><td rowspan="2">AIF1In-W2/W3</td></tr>
<tr><td>7, 8</td><td>AIF1In-Bit16
...
AIF1In-Bit31</td><td>AIF1In-W3</td></tr>
</table>

12.3 AIF1Out

Function

This function block provides the interface for output signals (e. g. setpoint and actual values) to the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

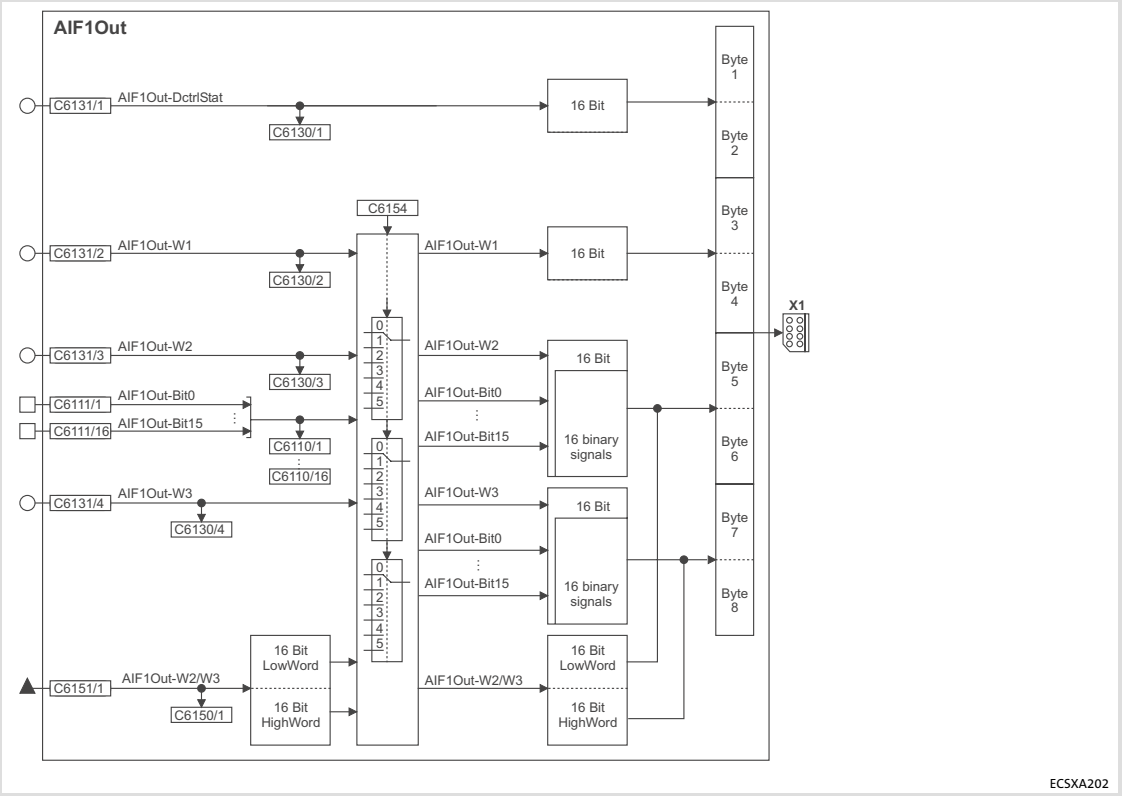


Fig. 12-3 AIF1Out function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6110				Display of the digital output signals to the fieldbus module	📖 251
			0 (= FALSE) 1 (= TRUE)		
1	AIF-DigOut			AIF1Out-Bit0 (bit 0)	
2	AIF-DigOut			AIF1Out-Bit1 (bit 1)	
3	AIF-DigOut			AIF1Out-Bit2 (bit 2)	
4	AIF-DigOut			AIF1Out-Bit3 (bit 3)	
5	AIF-DigOut			AIF1Out-Bit4 (bit 4)	
6	AIF-DigOut			AIF1Out-Bit5 (bit 5)	
7	AIF-DigOut			AIF1Out-Bit6 (bit 6)	
8	AIF-DigOut			AIF1Out-Bit7 (bit 7)	
9	AIF-DigOut			AIF1Out-Bit8 (bit 8)	
10	AIF-DigOut			AIF1Out-Bit9 (bit 9)	
11	AIF-DigOut			AIF1Out-Bit10 (bit 10)	
12	AIF-DigOut			AIF1Out-Bit11 (bit 11)	
13	AIF-DigOut			AIF1Out-Bit12 (bit 12)	
14	AIF-DigOut			AIF1Out-Bit13 (bit 13)	
15	AIF-DigOut			AIF1Out-Bit14 (bit 14)	
16	AIF-DigOut			AIF1Out-Bit15 (bit 15)	
[C6111]				Selection of the digital output signals to the fieldbus module	
1	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit0 (bit 0)	📖 251
2	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit1 (bit 1)	
3	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit2 (bit 2)	
4	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit3 (bit 3)	
5	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit4 (bit 4)	
6	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit5 (bit 5)	
7	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit6 (bit 6)	
8	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit7 (bit 7)	
9	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit8 (bit 8)	
10	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit9 (bit 9)	
11	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit10 (bit 10)	
12	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit11 (bit 11)	
13	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit12 (bit 12)	
14	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit13 (bit 13)	
15	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit14 (bit 14)	
16	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit15 (bit 15)	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6130				Display of the analog output signals to the fieldbus module	
			-32768 {1} 32767		
1	AIF-AnOut			Output word AIF1Out-DctrlStat	📖 251
2	AIF-AnOut			Output word AIF1Out-W1	
3	AIF-AnOut			Output word AIF1Out-W2	
4	AIF-AnOut			Output word AIF1Out-W3	
5	AIF-AnOut			Output word AIF2Out-W0	📖 258
6	AIF-AnOut			Output word AIF2Out-W1	
7	AIF-AnOut			Output word AIF2Out-W2	
8	AIF-AnOut			Output word AIF2Out-W3	
9	AIF-AnOut			Output word AIF3Out-W0	📖 263
10	AIF-AnOut			Output word AIF3Out-W1	
11	AIF-AnOut			Output word AIF3Out-W2	
12	AIF-AnOut			Output word AIF3Out-W3	
[C6131]				Selection of the analog output signals to the fieldbus module	
1	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-DctrlStat	📖 251
2	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W1	
3	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W2	
4	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W3	
5	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W0	📖 258
6	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W1	
7	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W2	
8	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W3	
9	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W0	📖 263
10	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W1	
11	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W2	
12	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6150				Display of the phase output signals to the fieldbus module	
			-2147483647 {1} 2147483647		
1	AIF-PhiOut			Output double word AIF1Out-W2/W3	📖 251
2	AIF-PhiOut			Output double word AIF2Out-W0/W1	📖 258
3	AIF-PhiOut			Output double word AIF3Out-W0/W1	📖 263

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6151]				Selection of the phase output signals to the fieldbus module	
1	AIF1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF1Out-W2/W3	📖 251
2	AIF2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF2Out-W0/W1	📖 258
3	AIF3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF3Out-W0/W1	📖 263
			For possible signals see ”selection list - phase signals”		📖 440
C6154	AIF1PdoMap	0		Assignment of the 8 byte user data of the AIF1Out function block to the fieldbus module	📖 251
			0 W2=Int W3=Int	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-W3	
			1 W2 / W3=Dint	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2/W3	
				Byte 7, byte 8 = AIF1Out-W2/W3	
			2 W2=Int W3=bit	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-Bit0...Bit15	
			3 W2=Bit W3=Int	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-Bit0...Bit15	
				Byte 7, byte 8 = AIF1Out-W3	
			4 W1=Bit W23=I	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-Bit0...Bit15	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-W3	
			5 W1=Bit W23=Di	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-Bit0...Bit15	
				Byte 5, byte 6 = AIF1Out-W2/W3	
				Byte 7, byte 8 = AIF1Out-W2/W3	

User data

The eight bytes of user data to the fieldbus module can be assigned with

- digital signals (1 bit).
- analog signals (16 bits).
- phase signals (32 bits).

The switch C6154 is used to assign the eight bytes of user data to the fieldbus module:

Value in C6154	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-W1** 16 bits (C6131/2)	**AIF1Out-W2** 16 bits (C6131/3)	**AIF1Out-W3** 16 bits (C6131/4)
1	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-W1** 16 bits (C6131/2)	**AIF1Out-W2/W3** 32 bits (C6151/1)	
2	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-W1** 16 bits (C6131/2)	**AIF1Out-W2** 16 bits (C6131/3)	**AIF1Out-Bit0 ... 15** 1 bit (C6111/1 ... 15)
3	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-W1** 16 bits (C6131/2)	**AIF1Out-Bit0 ... 15** 1 bit (C6111/1 ... 15)	**AIF1Out-W3** 16 bits (C6131/4)
4	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-Bit0 ... 15** 1 bit (C6111/1 ... 15)	**AIF1Out-W2** 16 bits (C6131/3)	**AIF1Out-W3** 16 bits (C6131/4)
5	**AIF1Out-DctrlStat** 16 bits (C6131/1)	**AIF1Out-Bit0 ... 15** 1 bit (C6111/1 ... 15)	**AIF1Out-W2/W3** 32 bits (C6151/1)	

Note!

You can use byte 1 and byte 2 to transfer the status word from the DCTRL function block (📖 294) to the fieldbus module.

12.4 AIF2In

Function

This function block serves as an interface for input signals (e. g. setpoint and actual values) from the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

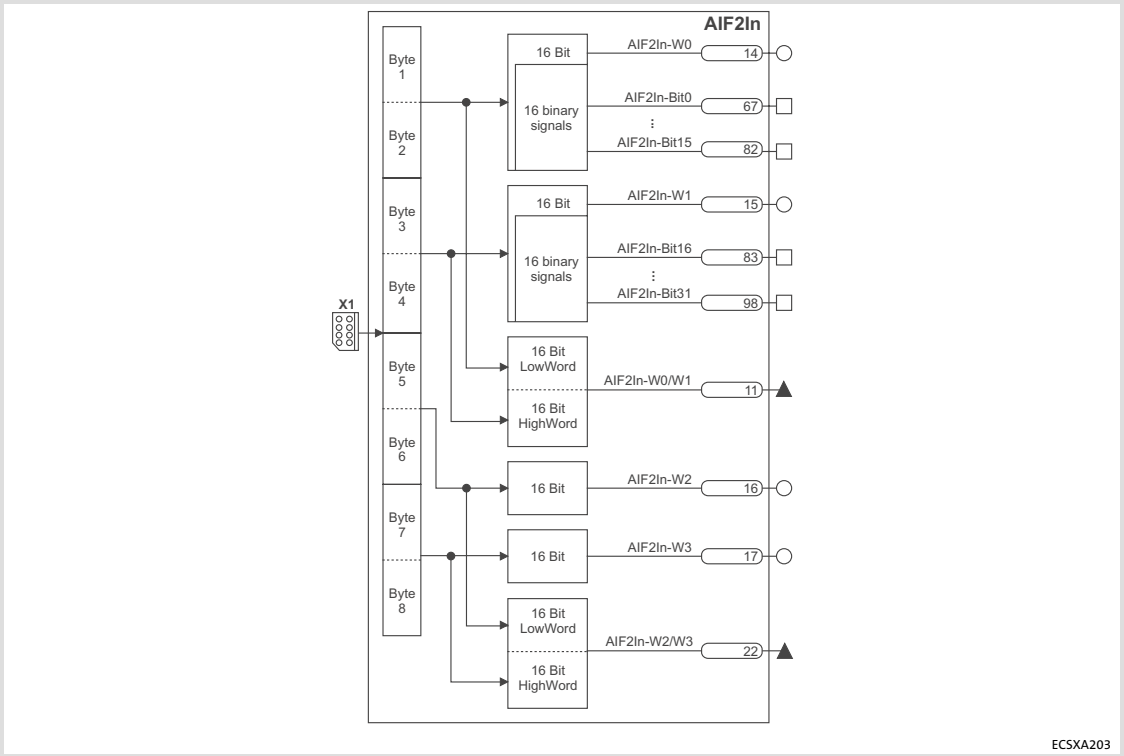


Fig. 12-4 AIF2In function block

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- analog signals (16 bit)
- phase signals (32 Bit)

in the axis module:

Byte	Digital signals (1 bit)	Analog signals (16 Bit)	Phase signals (32 Bit)
1, 2	AIF2In-Bit0 ... AIF2In-Bit15	AIF2In-W0	AIF2In-W0/W1
3, 4	AIF2In-Bit16 ... AIF2In-Bit31	AIF2In-W1	
5, 6		AIF2In-W2	AIF2In-W2/W3
7, 8		AIF2In-W3	

12.5 AIF2Out

Function

This function block provides the interface for output signals (e. g. setpoint and actual values) to the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

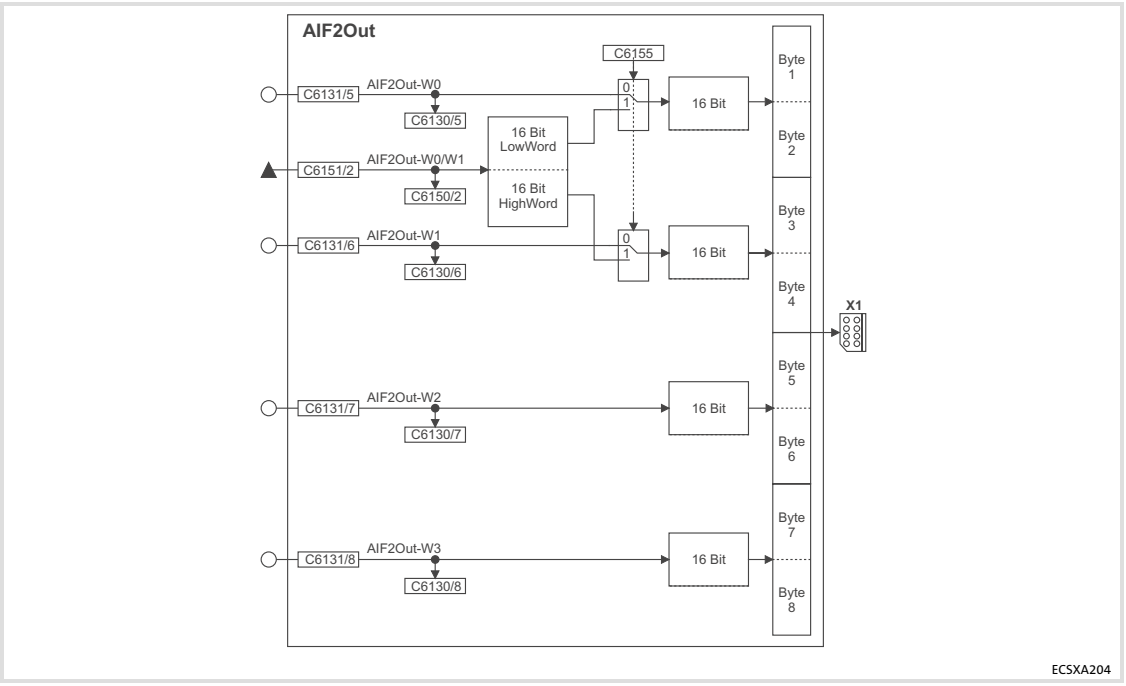


Fig. 12-5 AIF2Out function block

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C6130			-32768	{1} 32767	Display of the analog output signals to the fieldbus module	
1	AIF-AnOut				Output word AIF1Out-DctrlStat	📖 251
2	AIF-AnOut				Output word AIF1Out-W1	
3	AIF-AnOut				Output word AIF1Out-W2	
4	AIF-AnOut				Output word AIF1Out-W3	
5	AIF-AnOut				Output word AIF2Out-W0	📖 258
6	AIF-AnOut				Output word AIF2Out-W1	
7	AIF-AnOut				Output word AIF2Out-W2	
8	AIF-AnOut				Output word AIF2Out-W3	
9	AIF-AnOut				Output word AIF3Out-W0	📖 263
10	AIF-AnOut				Output word AIF3Out-W1	
11	AIF-AnOut				Output word AIF3Out-W2	
12	AIF-AnOut				Output word AIF3Out-W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6131]				Selection of the analog output signals to the fieldbus module	
1	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-DctrlStat	📖 251
2	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W1	
3	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W2	
4	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W3	
5	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W0	📖 258
6	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W1	
7	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W2	
8	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W3	
9	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W0	📖 263
10	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W1	
11	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W2	
12	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6150				Display of the phase output signals to the fieldbus module	
			-2147483647 {1} 2147483647		
1	AIF-PhiOut			Output double word AIF1Out-W2/W3	📖 251
2	AIF-PhiOut			Output double word AIF2Out-W0/W1	📖 258
3	AIF-PhiOut			Output double word AIF3Out-W0/W1	📖 263
[C6151]				Selection of the phase output signals to the fieldbus module	
1	AIF1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF1Out-W2/W3	📖 251
2	AIF2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF2Out-W0/W1	📖 258
3	AIF3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF3Out-W0/W1	📖 263
			For possible signals see ”selection list - phase signals”		📖 440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6155	AIF2PdoMap	0		Assignment of the 8 byte user data of the AIF2Out function block to the fieldbus module	📖 258
			0 W0=Int W1=Int	Byte 1, byte 2 = AIF2Out-W0	
				Byte 3, byte 4 = AIF2Out-W1	
				Byte 5, byte 6 = AIF2Out-W2	
				Byte 7, byte 8 = AIF2Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = AIF2Out-W0/W1	
				Byte 3, byte 4 = AIF2Out-W0/W1	
				Byte 5, byte 6 = AIF2Out-W2	
				Byte 7, byte 8 = AIF2Out-W3	

User data

The eight bytes of user data to the fieldbus module can be assigned with

- analog signals (16 bits).
- phase signals (32 bits).

The switch C6155 is used to assign the eight bytes of user data to the fieldbus module:

Value in C6155	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**AIF2Out-W0** 16 bits (C6131/5)	**AIF2Out-W1** 16 bits (C6131/6)	**AIF2Out-W2** 16 bits (C6131/7)	**AIF2Out-W3** 16 bits (C6131/8)
1	**AIF1Out-W0/W1** 32 bits (C6151/2)		**AIF2Out-W2** 16 bits (C6131/7)	**AIF2Out-W3** 16 bits (C6131/8)

12.6 AIF3In

Function

This function block serves as an interface for input signals (e. g. setpoint and actual values) from the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

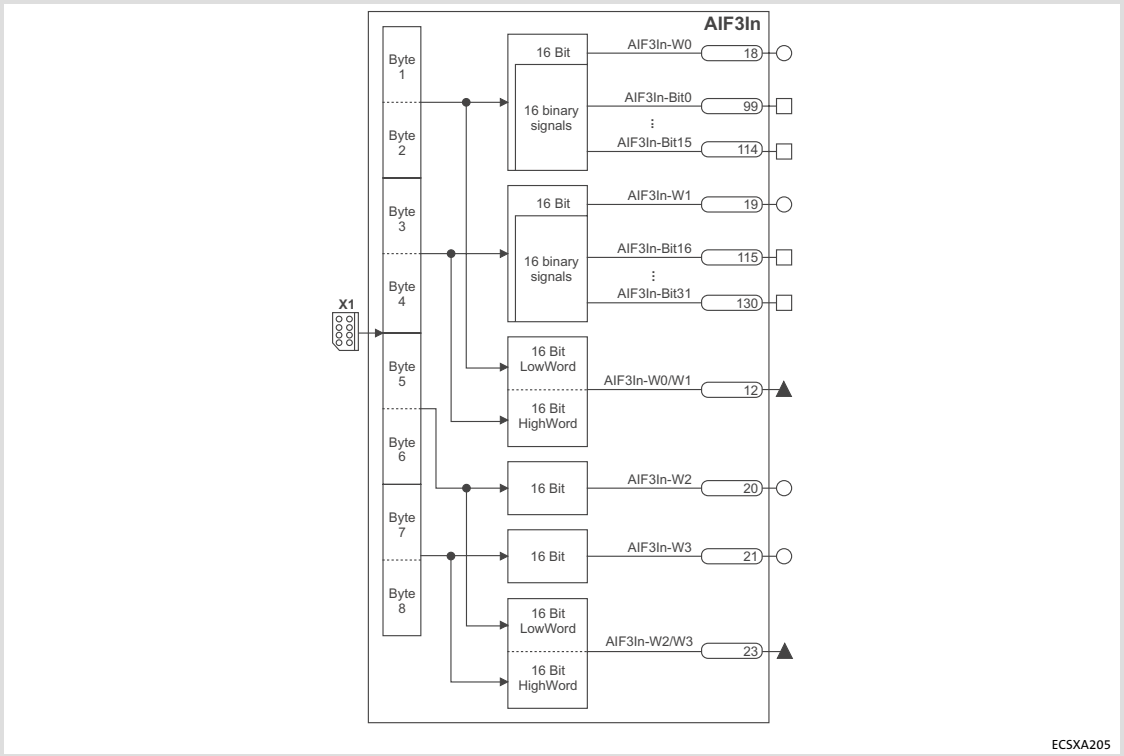


Fig. 12-6 AIF3In function block

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- analog signals (16 bit)
- phase signals (32 Bit)

in the axis module:

Byte	Digital signals (1 bit)	Analog signals (16 bit)	Phase signals (32 Bit)
1, 2	AIF3In-Bit0 ... AIF3In-Bit15	AIF3In-W0	AIF3In-W0/W1
3, 4	AIF3In-Bit16 ... AIF3In-Bit31	AIF3In-W1	
5, 6		AIF3In-W2	AIF3In-W0/W1
7, 8		AIF3In-W3	

12.7 AIF3Out

Function

This function block provides the interface for output signals (e. g. setpoint and actual values) to the attached fieldbus module.

Please read the documentation for the connected fieldbus module.

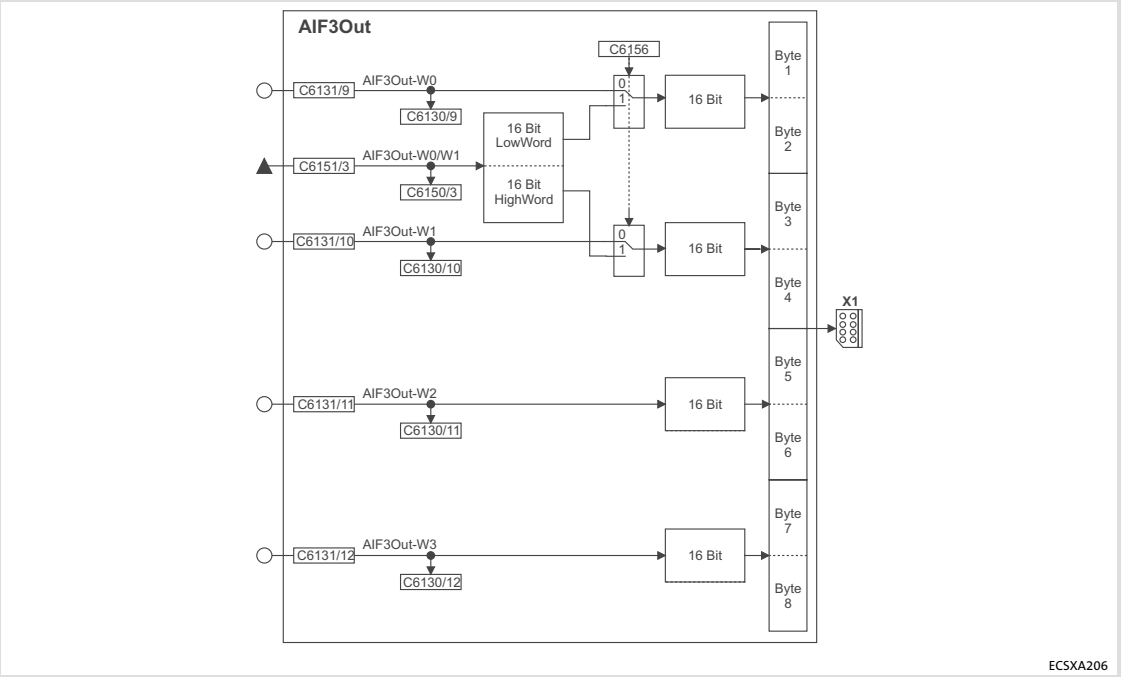


Fig. 12-7 AIF3Out function block

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C6130			-32768	{1} 32767	Display of the analog output signals to the fieldbus module	
1	AIF-AnOut				Output word AIF1Out-DctrlStat	📖 251
2	AIF-AnOut				Output word AIF1Out-W1	
3	AIF-AnOut				Output word AIF1Out-W2	
4	AIF-AnOut				Output word AIF1Out-W3	
5	AIF-AnOut				Output word AIF2Out-W0	📖 258
6	AIF-AnOut				Output word AIF2Out-W1	
7	AIF-AnOut				Output word AIF2Out-W2	
8	AIF-AnOut				Output word AIF2Out-W3	
9	AIF-AnOut				Output word AIF3Out-W0	📖 263
10	AIF-AnOut				Output word AIF3Out-W1	
11	AIF-AnOut				Output word AIF3Out-W2	
12	AIF-AnOut				Output word AIF3Out-W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6131]				Selection of the analog output signals to the fieldbus module	
1	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-DctrlStat	📖 251
2	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W1	
3	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W2	
4	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W3	
5	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W0	📖 258
6	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W1	
7	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W2	
8	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W3	
9	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W0	📖 263
10	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W1	
11	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W2	
12	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6150				Display of the phase output signals to the fieldbus module	
			-2147483647 {1} 2147483647		
1	AIF-PhiOut			Output double word AIF1Out-W2/W3	📖 251
2	AIF-PhiOut			Output double word AIF2Out-W0/W1	📖 258
3	AIF-PhiOut			Output double word AIF3Out-W0/W1	📖 263
[C6151]				Selection of the phase output signals to the fieldbus module	
1	AIF1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF1Out-W2/W3	📖 251
2	AIF2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF2Out-W0/W1	📖 258
3	AIF3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF3Out-W0/W1	📖 263
			For possible signals see ”selection list - phase signals”		📖 440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6156	AIF3PdoMap	0		Assignment of the 8 byte user data of the AIF3Out function block to the fieldbus module	📖 263
			0 W0=Int W1=Int	Byte 1, byte 2 = AIF3Out-W0	
				Byte 3, byte 4 = AIF3Out-W1	
				Byte 5, byte 6 = AIF3Out-W2	
				Byte 7, byte 8 = AIF3Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = AIF3Out-W0/W1	
				Byte 3, byte 4 = AIF3Out-W0/W1	
				Byte 5, byte 6 = AIF3Out-W2	
				Byte 7, byte 8 = AIF3Out-W3	

User data

The eight bytes of user data to the fieldbus module can be assigned with

- analog signals (16 bits).
- phase signals (32 bits).

The switch C6156 is used to assign the eight bytes of user data to the fieldbus module:

Value in C6156	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**AIF3Out-W0** 16 bits (C6131/9)	**AIF3Out-W1** 16 bits (C6131/10)	**AIF3Out-W2** 16 bits (C6131/11)	**AIF3Out-W3** 16 bits (C6131/12)
1	**AIF3Out-W0/W1** 32 bits (C6151/3)		**AIF3Out-W2** 16 bits (C6131/11)	**AIF3Out-W3** 16 bits (C6131/12)

12.8 AIn1

Function

This function block provides the interface for analog input signals (differential signals) via X6/AI-, AI+. The conditioned input signal is available at the function block output. When using X6/AI-, AI+ as a master current input, cable-break monitoring is possible.

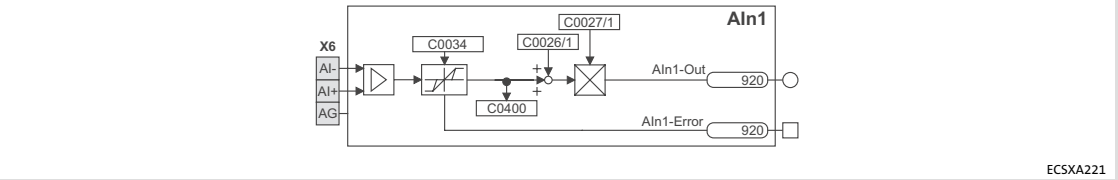


Fig. 12-8 AIn1 function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0026						Offset for relative analog signals (AIN)	📖 266 📖 309
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a	
2	FCODE(offset)	0,0				FCODE_nC26_2_a	
C0027						Gain for relative analog signals (AIN)	📖 266 📖 309
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	📖 266
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0400	DIS: AnalogIn					Signal at the analog input Read only	📖 266
			-199.99	{0.01 %}	199.99		

12.9 CAN (CAN management)

Function

By means of this function block,

- a **reset node**can be carried out, e. g. in order to accept changes with regard to the baud rate and addressing.
- the instant of transmission of CAN2_Out and CAN3_Out can be influenced.
- serves to monitor the MotionBus communication.

Note!

Even if the CAN function block has not been assigned to the control configuration, a reset node can be carried out via C0358.

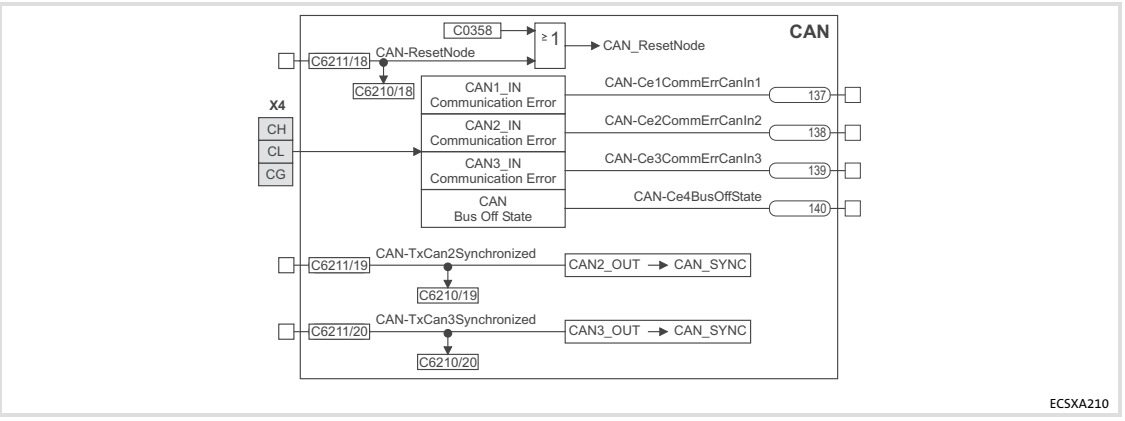


Fig. 12-9 CAN function block (system bus management)

Tip!

More detailed information on the CAN bus can be found in the appendix of this documentation (📖 441).

”CAN-TxCan2Syncronized”/”CAN-TxCan3Syncronized” function

- **FALSE**: data from CAN2_OUT/CAN3_OUT is sent at the end of the process image.
- **TRUE**: data from CAN2_OUT/CAN3_OUT is sent after the CAN bus synchronisation.
  - The identifiers for sync transmission and reception telegrams can be set via C0367/C0368.
  - The ”Sync Tx time” can be set via C0369.

Note!

Detailed information concerning the CAN bus synchronisation: 📖 179

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0358	Reset node	0		Make a reset node for the CAN bus node.	178
			0 No function		
			1 CAN reset		
C6210				Display of the digital output signals to the MotionBus (CAN)	
			0 (= FALSE) 1 (= TRUE)		
1	CAN-DigOut			CAN1Out-Bit0 (bit 0)	276
2	CAN-DigOut			CAN1Out-Bit1 (bit 1)	
3	CAN-DigOut			CAN1Out-Bit2 (bit 2)	
4	CAN-DigOut			CAN1Out-Bit3 (bit 3)	
5	CAN-DigOut			CAN1Out-Bit4 (bit 4)	
6	CAN-DigOut			CAN1Out-Bit5 (bit 5)	
7	CAN-DigOut			CAN1Out-Bit6 (bit 6)	
8	CAN-DigOut			CAN1Out-Bit7 (bit 7)	
9	CAN-DigOut			CAN1Out-Bit8 (bit 8)	
10	CAN-DigOut			CAN1Out-Bit9 (bit 9)	
11	CAN-DigOut			CAN1Out-Bit10 (bit 10)	
12	CAN-DigOut			CAN1Out-Bit11 (bit 11)	
13	CAN-DigOut			CAN1Out-Bit12 (bit 12)	
14	CAN-DigOut			CAN1Out-Bit13 (bit 13)	
15	CAN-DigOut			CAN1Out-Bit14 (bit 14)	
16	CAN-DigOut			CAN1Out-Bit15 (bit 15)	
17	CAN-DigOut			CANSync-ResetSyncForInterpolatord	267
18	CAN-DigOut			CAN-ResetNode	179
19	CAN-DigOut			CAN-TxCan2Synchronized	
20	CAN-DigOut			CAN-TxCan3Synchronized	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6211]				Selection of the digital output signals to the MotionBus (CAN)	
1	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit0 (bit 0)	📖 276
2	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit1 (bit 1)	
3	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit2 (bit 2)	
4	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit3 (bit 3)	
5	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit4 (bit 4)	
6	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit5 (bit 5)	
7	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit6 (bit 6)	
8	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit7 (bit 7)	
9	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit8 (bit 8)	
10	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit9 (bit 9)	
11	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit10 (bit 10)	
12	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit11 (bit 11)	
13	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit12 (bit 12)	
14	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit13 (bit 13)	
15	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit14 (bit 14)	
16	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit15 (bit 15)	
17	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CANSync-ResetSyncForInterpolat ord	📖 267
18	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN reset node	📖 179
19	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan2Synchronized	
20	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan3Synchronized	
			For possible signals see ”selection list - digital signals”		📖 428

12.10 CANSync (CAN bus synchronisation)

Function

By means of this function block, the internal time base of the controller can be synchronised with the instant of reception of the sync telegram or a terminal signal. Thereby the start of cyclical and time-controlled internal processes of all controllers involved in the synchronisation (e. g. data transfer from tasks to the DCTRL function block) is effected in a synchronuous manner.

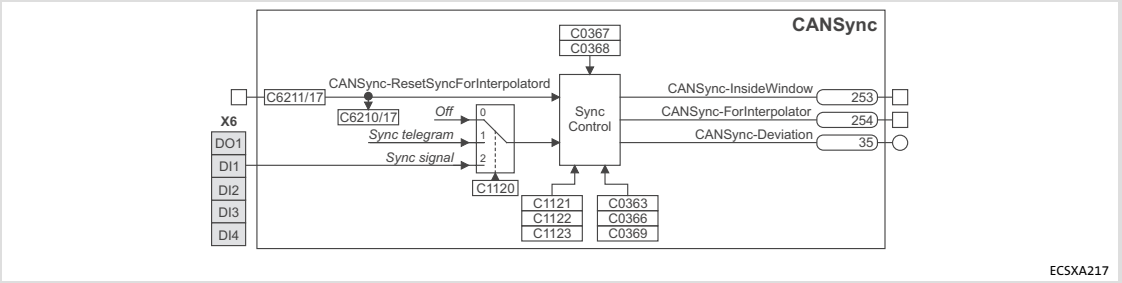


Fig. 12-10 CANSync function block

Tip!

Detailed information on CAN synchronisation and configuration via codes can be found in the chapter 8.1.6 ”Axis synchronisation (CAN synchronisation)” ((📖 179)).

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0363	Sync correct.	1			CAN sync correction increment	📖 180
			1	0.2 µs/ms		
			2	0.4 µs/ms		
			3	0.6 µs/ms		
			4	0.8 µs/ms		
			5	1.0 µs/ms		
C0366	Sync Response	1			CAN sync response for interface X4 (CAN) **The value ”1” should always be set!**	📖 181
			0	No response		
			1	Response		
C0367	Sync Rx ID	128			CAN sync receipt ID for CAN bus interface X4	📖 180
			1	{1} 256		
C0368	Sync Tx Id	128			CAN Sync transmission ID for CAN bus interface X4	📖 444 📖 179
			1	{1} 256		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 180
			0	{1 ms}	65000	0 = switched off	
C1120	Sync mode	0				Sync signal source	📖 179
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	📖 182
			2	Terminal sync		Sync connection via terminal X6/DI1	📖 183
C1121	Sync cycle	2				Synchronisation cycle	📖 179
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	📖 179
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window	📖 181
			0.000	{0.001 ms}	6.500		
C6210						Display of the digital output signals to the MotionBus (CAN)	
			0 (= FALSE)		1 (= TRUE)		
1	CAN-DigOut					CAN1Out-Bit0 (bit 0)	📖 276
2	CAN-DigOut					CAN1Out-Bit1 (bit 1)	
3	CAN-DigOut					CAN1Out-Bit2 (bit 2)	
4	CAN-DigOut					CAN1Out-Bit3 (bit 3)	
5	CAN-DigOut					CAN1Out-Bit4 (bit 4)	
6	CAN-DigOut					CAN1Out-Bit5 (bit 5)	
7	CAN-DigOut					CAN1Out-Bit6 (bit 6)	
8	CAN-DigOut					CAN1Out-Bit7 (bit 7)	
9	CAN-DigOut					CAN1Out-Bit8 (bit 8)	
10	CAN-DigOut					CAN1Out-Bit9 (bit 9)	
11	CAN-DigOut					CAN1Out-Bit10 (bit 10)	
12	CAN-DigOut					CAN1Out-Bit11 (bit 11)	
13	CAN-DigOut					CAN1Out-Bit12 (bit 12)	
14	CAN-DigOut					CAN1Out-Bit13 (bit 13)	
15	CAN-DigOut					CAN1Out-Bit14 (bit 14)	
16	CAN-DigOut					CAN1Out-Bit15 (bit 15)	
17	CAN-DigOut					CANSync-ResetSyncForInterpolator	📖 267
18	CAN-DigOut					CAN-ResetNode	📖 179
19	CAN-DigOut					CAN-TxCan2Synchronized	
20	CAN-DigOut					CAN-TxCan3Synchronized	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6211]				Selection of the digital output signals to the MotionBus (CAN)	
1	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit0 (bit 0)	📖 276
2	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit1 (bit 1)	
3	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit2 (bit 2)	
4	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit3 (bit 3)	
5	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit4 (bit 4)	
6	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit5 (bit 5)	
7	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit6 (bit 6)	
8	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit7 (bit 7)	
9	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit8 (bit 8)	
10	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit9 (bit 9)	
11	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit10 (bit 10)	
12	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit11 (bit 11)	
13	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit12 (bit 12)	
14	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit13 (bit 13)	
15	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit14 (bit 14)	
16	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit15 (bit 15)	
17	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CANSync-ResetSyncForInterpolatord	📖 267
18	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN reset node	📖 179
19	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan2Synchronized	
20	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan3Synchronized	
			For possible signals see ”selection list - digital signals”		📖 428

12.11 CAN1In

Function

This function block serves to transfer cyclic process data (📖 447) via the MotionBus (CAN).

For receiving the data, a sync telegram (📖 452) is required, which has to be generated by another node.

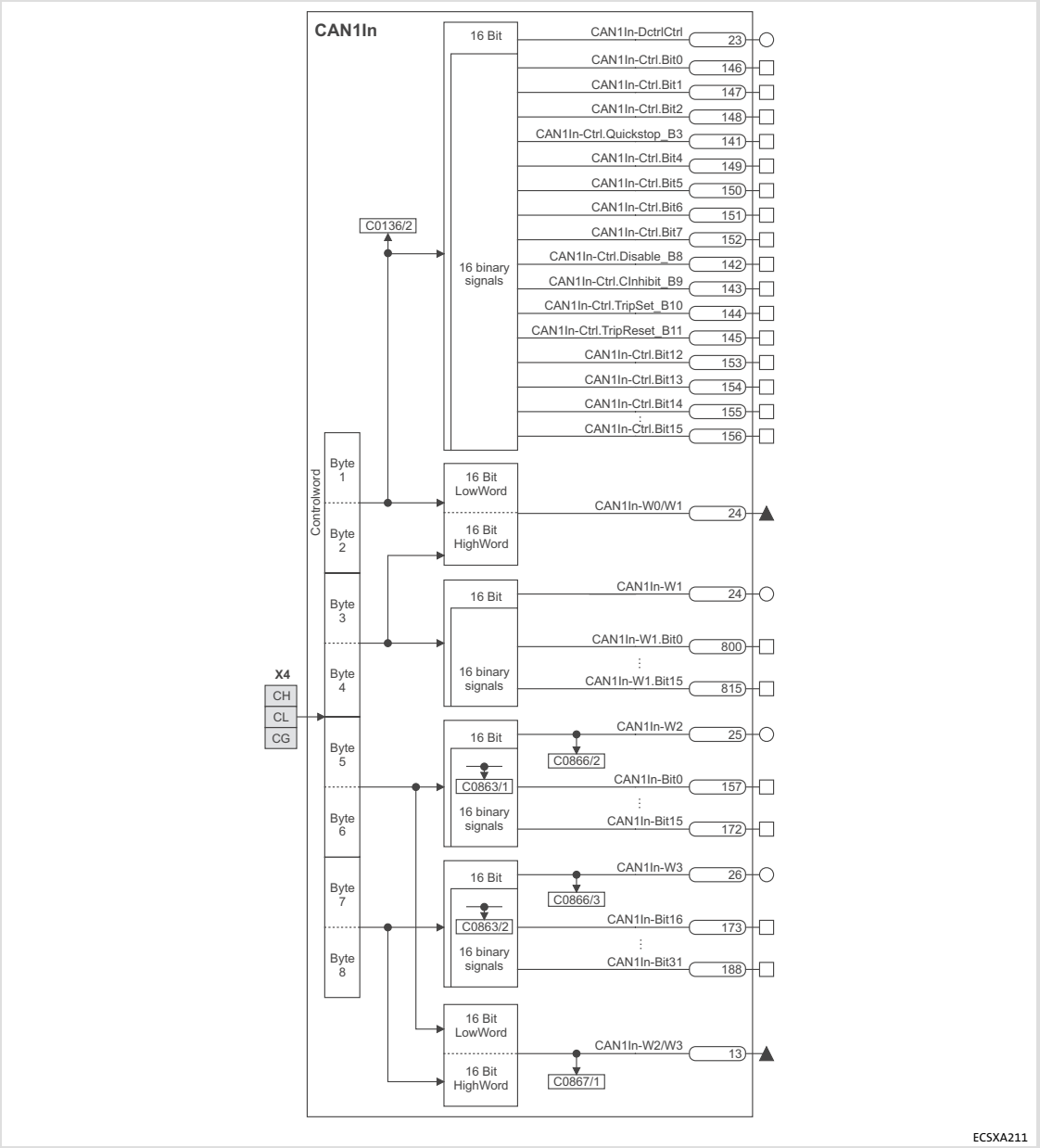


Fig. 12-11 CAN1In function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0863						Digital process data input words for CAN bus interface X4 Hexadecimal value is bit-coded. Read only	448 273
			0000	{hex}	FFFF		
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	448 273
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- control word / analog signals (16 bits)
- phase signals (32 Bit)

in the axis module:

<table>
<tr><th>Byte</th><th>Digital signals (1 bit)</th><th>Analog signals (16 bit)</th><th>Phase signals (32 Bit)</th></tr>
<tr><td>1, 2</td><td>CAN1In-Ctrl.Bit0
CAN1In-Ctrl.Bit1
CAN1In-Ctrl.Bit2
CAN1In-Ctrl.Quickstop_B3
CAN1In-Ctrl.Bit4
...
CAN1In-Ctrl.Bit7
CAN1In-Ctrl.Disable_B8
CAN1In-Ctrl.CInhibit_B9
CAN1In-Ctrl.TripSet_B10
CAN1In-Ctrl.TripReset_B11
CAN1In-Ctrl.Bit12
...
CAN1In-Ctrl.Bit15</td><td>CAN1In-DctrlCtrl</td><td rowspan="3">CAN1In-W0/W1</td></tr>
<tr><td></td><td colspan="2">Note:
The internal control word is firmly allocated to bytes 1 and 2. Via this control word it is possible touse
● signals for the functions ”quick stop” (QSP), DISABLE, CINH, TRIP-SET und TRIP-RESET and
● the other 11 control bits (CAN1In-Ctrl.Bit...)
in further functions/function blocks.</td></tr>
<tr><td>3, 4</td><td>CAN1In-W1.Bit0
...
CAN1In-W1.Bit15</td><td>CAN1In-W1</td></tr>
<tr><td>5, 6</td><td>CAN1In-Bit0
...
CAN1In-Bit15</td><td>CAN1In-W2</td><td rowspan="2">CAN1In-W2/W3</td></tr>
<tr><td>7, 8</td><td>CAN1In-Bit16
...
CAN1In-Bit31</td><td>CAN1In-W3</td></tr>
</table>

Note!

Via C0357 you can set the monitoring time (Lenze setting: 3000 ms) for data reception. (📖 198)

12.12 CAN1Out

Function

This function block serves to transfer cyclic process data (📖 447) via the MotionBus (CAN).

For receiving the data, a sync telegram (📖 452) is required, which has to be generated by another node.

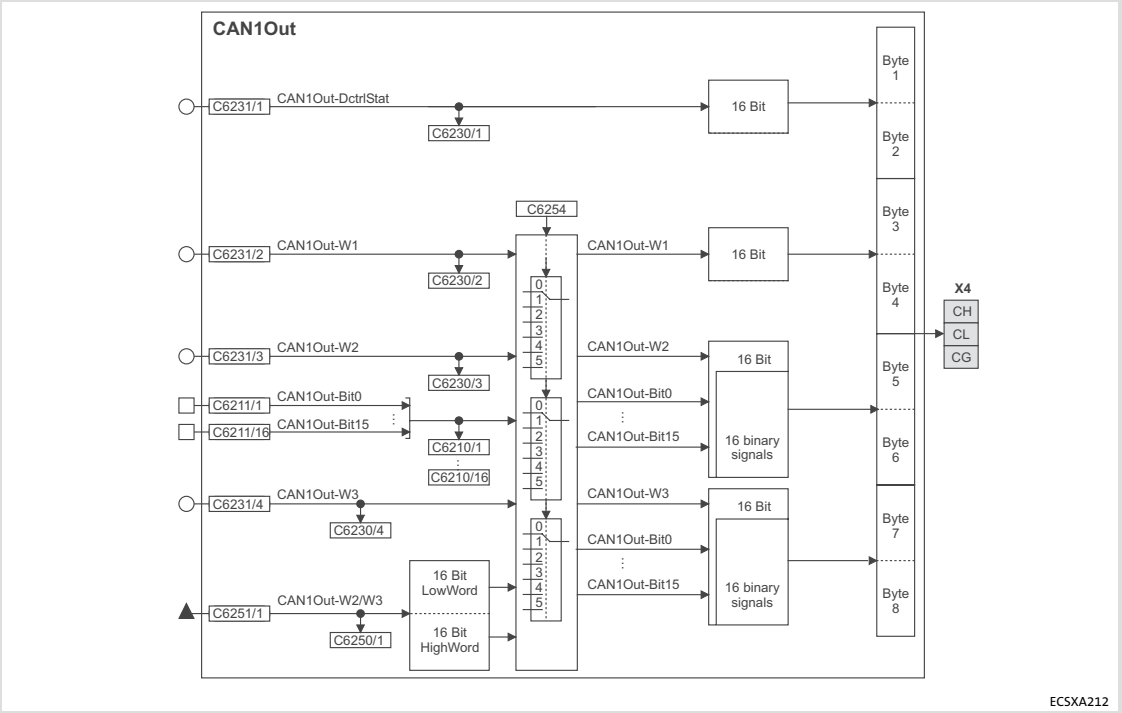


Fig. 12-12 CAN1Out function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6210				Display of the digital output signals to the MotionBus (CAN)	
			0 (= FALSE) 1 (= TRUE)		
1	CAN-DigOut			CAN1Out-Bit0 (bit 0)	📖 276
2	CAN-DigOut			CAN1Out-Bit1 (bit 1)	
3	CAN-DigOut			CAN1Out-Bit2 (bit 2)	
4	CAN-DigOut			CAN1Out-Bit3 (bit 3)	
5	CAN-DigOut			CAN1Out-Bit4 (bit 4)	
6	CAN-DigOut			CAN1Out-Bit5 (bit 5)	
7	CAN-DigOut			CAN1Out-Bit6 (bit 6)	
8	CAN-DigOut			CAN1Out-Bit7 (bit 7)	
9	CAN-DigOut			CAN1Out-Bit8 (bit 8)	
10	CAN-DigOut			CAN1Out-Bit9 (bit 9)	
11	CAN-DigOut			CAN1Out-Bit10 (bit 10)	
12	CAN-DigOut			CAN1Out-Bit11 (bit 11)	
13	CAN-DigOut			CAN1Out-Bit12 (bit 12)	
14	CAN-DigOut			CAN1Out-Bit13 (bit 13)	
15	CAN-DigOut			CAN1Out-Bit14 (bit 14)	
16	CAN-DigOut			CAN1Out-Bit15 (bit 15)	
17	CAN-DigOut			CANSync-ResetSyncForInterpolator	📖 267
18	CAN-DigOut			CAN-ResetNode	📖 179
19	CAN-DigOut			CAN-TxCan2Synchronized	
20	CAN-DigOut			CAN-TxCan3Synchronized	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6211]				Selection of the digital output signals to the MotionBus (CAN)	
1	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit0 (bit 0)	📖 276
2	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit1 (bit 1)	
3	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit2 (bit 2)	
4	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit3 (bit 3)	
5	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit4 (bit 4)	
6	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit5 (bit 5)	
7	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit6 (bit 6)	
8	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit7 (bit 7)	
9	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit8 (bit 8)	
10	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit9 (bit 9)	
11	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit10 (bit 10)	
12	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit11 (bit 11)	
13	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit12 (bit 12)	
14	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit13 (bit 13)	
15	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit14 (bit 14)	
16	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit15 (bit 15)	
17	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CANSync-ResetSyncForInterpolatord	📖 267
18	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN reset node	📖 179
19	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan2Synchronized	
20	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan3Synchronized	
			For possible signals see ”selection list - digital signals”		📖 428
C6230				Display of the analog output signals to the MotionBus (CAN)	
			-32768 {1} 32767		
1	CAN-AnOut			Output word CAN1Out-DctrlStat	📖 276
2	CAN-AnOut			Output word CAN1Out-W1	
3	CAN-AnOut			Output word CAN1Out-W2	
4	CAN-AnOut			Output word CAN1Out-W3	
5	CAN-AnOut			Output word CAN2Out-W0	📖 285
6	CAN-AnOut			Output word CAN2Out-W1	
7	CAN-AnOut			Output word CAN2Out-W2	
8	CAN-AnOut			Output word CAN2Out-W3	
9	CAN-AnOut			Output word CAN3Out-W0	📖 291
10	CAN-AnOut			Output word CAN3Out-W1	
11	CAN-AnOut			Output word CAN3Out-W2	
12	CAN-AnOut			Output word CAN3Out-W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6231]				Selection of the analog output signals to the MotionBus (CAN)	
1	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-DctrlStat	📖 276
2	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W1	
3	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W2	
4	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W3	
5	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W0	📖 285
6	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W1	
7	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W2	
8	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W3	
9	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W0	📖 291
10	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W1	
11	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W2	
12	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6250				Display of the phase output signals to the MotionBus (CAN)	
			-2147483647 {1} 2147483647		
1	CAN-PhiOut			Output double word CAN1Out-W2/W3	📖 276
2	CAN-PhiOut			Output double word CAN2Out-W0/W1	📖 285
3	CAN-PhiOut			Output double word CAN3Out-W0/W1	📖 291
[C6251]				Selection of the phase output signals to the MotionBus (CAN)	
1	CAN1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN1Out-W2/W3	📖 276
2	CAN2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN2Out-W0/W1	📖 285
3	CAN3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN3Out-W0/W1	📖 291
			For possible signals see ”selection list - phase signals”		📖 440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6254	CAN1PdoMap	0		Assignment of the 8 byte user data of the CAN1Out function block to the MotionBus (CAN)	📖 276
			0 W2=Int W3=Int	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-W3	
			1 W2 / W3=Dint	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2/W3	
				Byte 7, byte 8 = CAN1Out-W2/W3	
			2 W2=Int W3=bit	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-Bit0...Bit15	
			3 W2=Bit W3=Int	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-Bit0...Bit15	
				Byte 7, byte 8 = CAN1Out-W3	
			4 W1=Bit W23=I	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-Bit0...Bit15	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-W3	
			5 W1=Bit W23=Di	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-Bit0...Bit15	
				Byte 5, byte 6 = CAN1Out-W2/W3	
				Byte 7, byte 8 = CAN1Out-W2/W3	

User data

The eight bytes of user data to the MotionBus (CAN) can be assigned with

- digital signals (1 bit).
- analog signals (16 bits).
- phase signals (32 bits).

The switch C6254 is used to assign the eight bytes of user data to the MotionBus (CAN):

Value in C6254	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-W1** 16 bits (C6231/2)	**CAN1Out-W2** 16 bits (C6231/3)	**CAN1Out-W3** 16 bits (C6231/4)
1	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-W1** 16 bits (C6231/2)	**CAN1Out-W2/W3** 32 bits (C6251/1)	
2	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-W1** 16 bits (C6231/2)	**CAN1Out-W2** 16 bits (C6231/3)	**CAN1Out-Bit0 ... 15** 1 bit (C6211/1 ... 15)
3	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-W1** 16 bits (C6231/2)	**CAN1Out-Bit0 ... 15** 1 bit (C6211/1 ... 15)	**CAN1Out-W3** 16 bits (C6231/4)
4	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-Bit0 ... 15** 1 bit (C6211/1 ... 15)	**CAN1Out-W2** 16 bits (C6231/3)	**CAN1Out-W3** 16 bits (C6231/4)
5	**CAN1Out-DctrlStat** 16 bits (C6231/1)	**CAN1Out-Bit0 ... 15** 1 bit (C6211/1 ... 15)	**CAN1Out-W2/W3** 32 bits (C6251/1)	

Note!

You can use byte 1 and byte 2 to transfer the status word from the DCTRL function block (📖 294) to the MotionBus (CAN).

12.13 CAN2In

Function

This function block serves to transfer event-controlled or time-controlled process data (📖 447) via the MotionBus (CAN).

A sync telegram is not required.

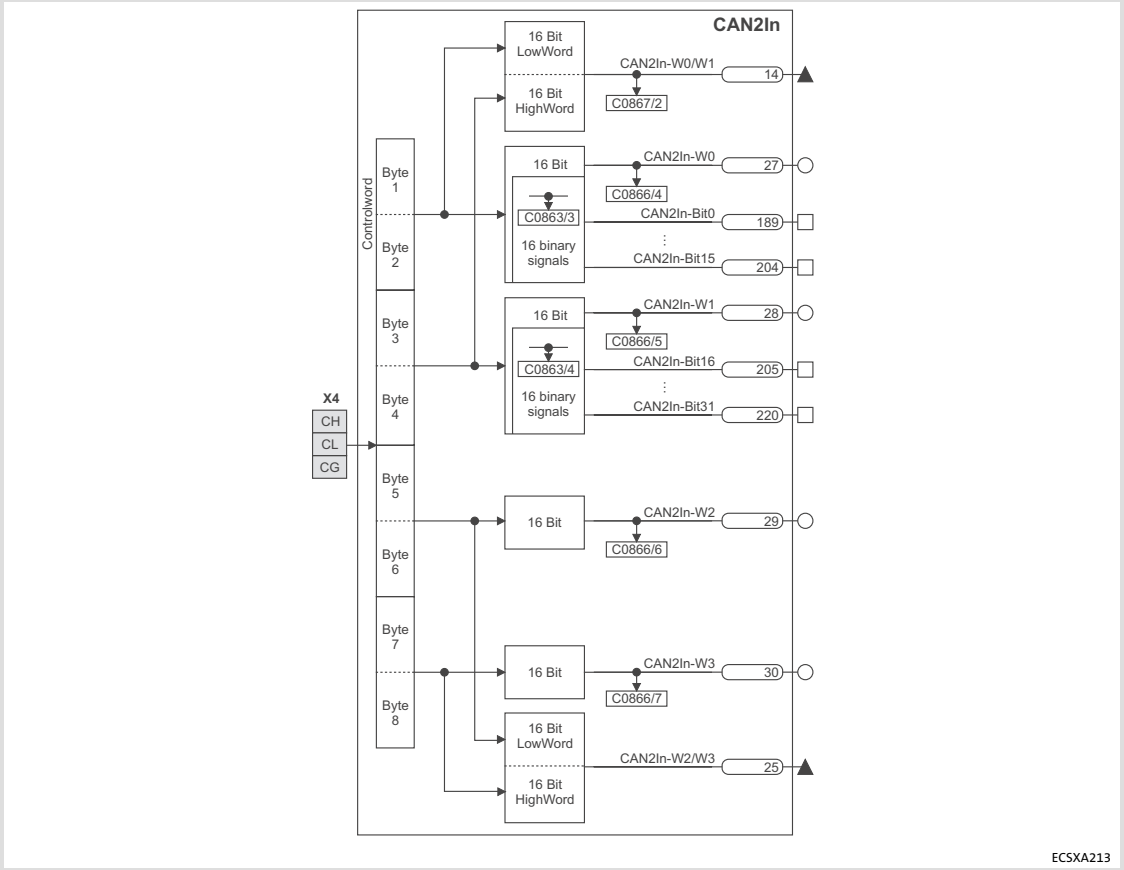


Fig. 12-13 CAN2In function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0863						Digital process data input words for CAN bus interface X4	📖 448 📖 273
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 448 📖 273
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- analog signals (16 bit)
- phase signals (32 Bit)

in the axis module:

Byte	Digital signals (1 bit)	Analog signals (16 bit)	Phase signals (32 Bit)
1, 2	CAN2In-Bit0 ... CAN2In-Bit15	CAN2In-W0	CAN2In-W0/W1
3, 4	CAN2In-Bit16 ... CAN2In-Bit31	CAN2In-W1	
5, 6		CAN2In-W2	CAN2In-W2/W3
7, 8		CAN2In-W3	

Note!

Via C0357 you can set the monitoring time (Lenze setting: 3000 ms) for data reception. (📖 198)

12.14 CAN2Out

Function

This function block serves to transfer event-controlled or time-controlled process data (📖 447) via the MotionBus (CAN).

- A sync telegram is not required.
- The process data is transmitted when a value within the eight bytes of user data has changed (event-controlled) or with the cycle time set under C0356/2 (time-controlled, (📖 176).

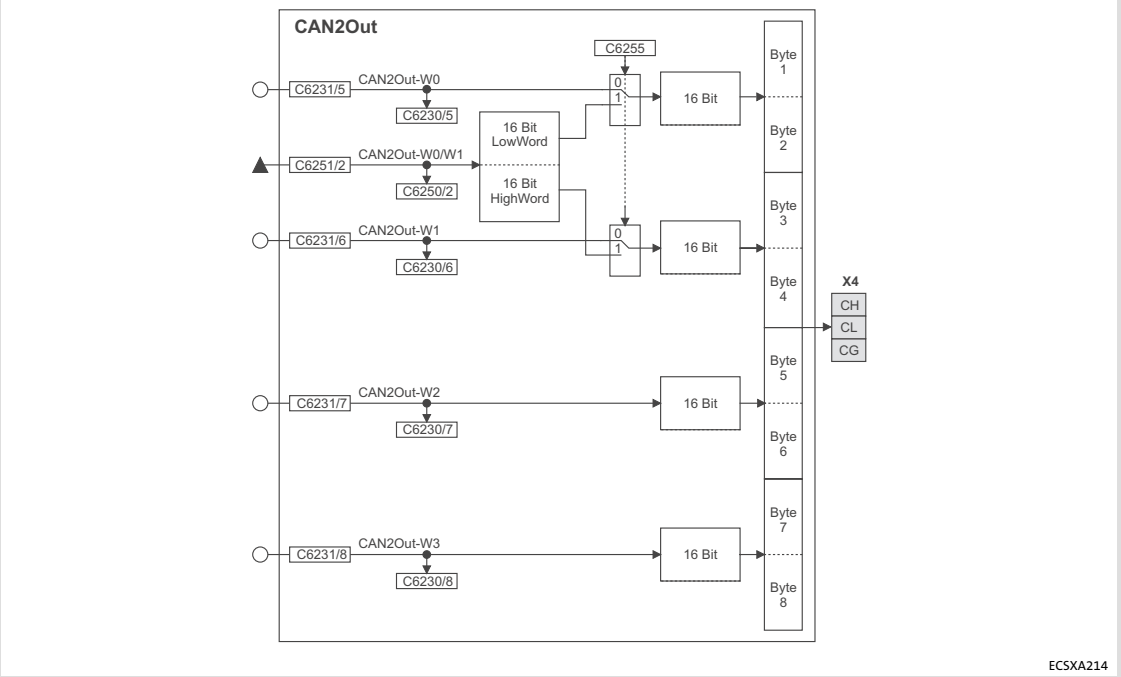


Fig. 12-14 CAN2Out function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6230				Display of the analog output signals to the MotionBus (CAN)	
			-32768 {1} 32767		
1	CAN-AnOut			Output word CAN1Out-DctrlStat	📖 276
2	CAN-AnOut			Output word CAN1Out-W1	
3	CAN-AnOut			Output word CAN1Out-W2	
4	CAN-AnOut			Output word CAN1Out-W3	
5	CAN-AnOut			Output word CAN2Out-W0	📖 285
6	CAN-AnOut			Output word CAN2Out-W1	
7	CAN-AnOut			Output word CAN2Out-W2	
8	CAN-AnOut			Output word CAN2Out-W3	
9	CAN-AnOut			Output word CAN3Out-W0	📖 291
10	CAN-AnOut			Output word CAN3Out-W1	
11	CAN-AnOut			Output word CAN3Out-W2	
12	CAN-AnOut			Output word CAN3Out-W3	
[C6231]				Selection of the analog output signals to the MotionBus (CAN)	
1	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-DctrlStat	📖 276
2	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W1	
3	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W2	
4	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W3	
5	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W0	📖 285
6	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W1	
7	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W2	
8	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W3	
9	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W0	📖 291
10	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W1	
11	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W2	
12	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6250				Display of the phase output signals to the MotionBus (CAN)	
			-2147483647 {1} 2147483647		
1	CAN-PhiOut			Output double word CAN1Out-W2/W3	📖 276
2	CAN-PhiOut			Output double word CAN2Out-W0/W1	📖 285
3	CAN-PhiOut			Output double word CAN3Out-W0/W1	📖 291

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6251]				Selection of the phase output signals to the MotionBus (CAN)	
1	CAN1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN1Out-W2/W3	📖 276
2	CAN2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN2Out-W0/W1	📖 285
3	CAN3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN3Out-W0/W1	📖 291
			For possible signals see ”selection list - phase signals”		📖 440
C6255	CAN2PdoMap	0		Assignment of the 8 byte user data of the CAN2Out function block to the MotionBus (CAN)	📖 285
			0 W0=Int W1=Int	Byte 1, byte 2 = CAN2Out-W0	
				Byte 3, byte 4 = CAN2Out-W1	
				Byte 5, byte 6 = CAN2Out-W2	
				Byte 7, byte 8 = CAN2Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = CAN2Out-W0/W1	
				Byte 3, byte 4 = CAN2Out-W0/W1	
				Byte 5, byte 6 = CAN2Out-W2	
				Byte 7, byte 8 = CAN2Out-W3	

User data

The eight bytes of user data to the MotionBus (CAN) can be assigned with

- analog signals (16 bits).
- phase signals (32 bits).

The switch C6255 is used to assign the eight bytes of user data to the MotionBus (CAN):

Value in C6255	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**CAN2Out-W0** 16 bits (C6231/5)	**CAN2Out-W1** 16 bits (C6231/6)	**CAN2Out-W2** 16 bits (C6231/7)	**CAN2Out-W3** 16 bits (C6231/8)
1	**CAN1Out-W0/W1** 32 bits (C6251/2)		**CAN2Out-W2** 16 bits (C6231/7)	**CAN2Out-W3** 16 bits (C6231/8)

12.15 CAN3In

Function

This function block serves to transfer event-controlled or time-controlled process data (📖 447) via the MotionBus (CAN).

A sync telegram is not required.

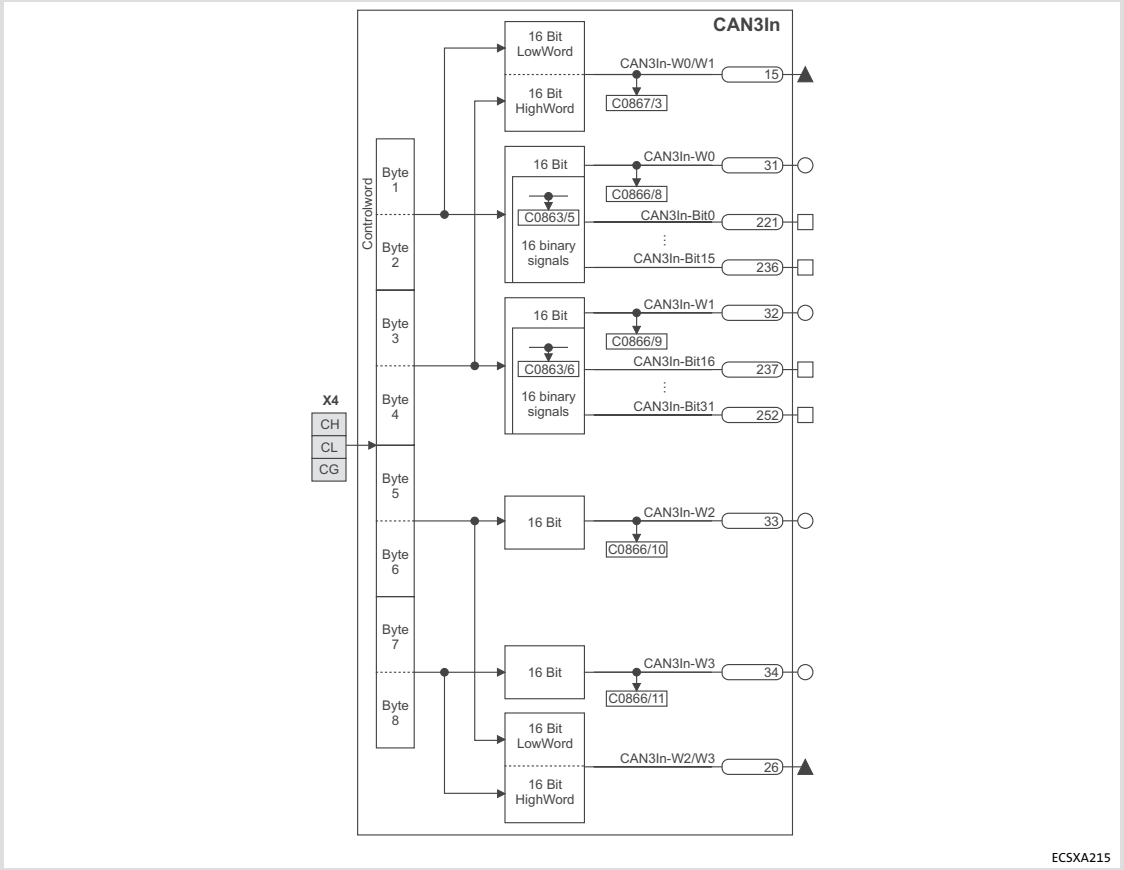


Fig. 12-15 CAN3In function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0863						Digital process data input words for CAN bus interface X4	📖 448 📖 273
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 448 📖 273
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	

User data

Each of the eight bytes of received user data is assigned to different signal types. For this reason, they can be evaluated –as required– as

- digital signals (1 bit)
- analog signals (16 bit)
- phase signals (32 Bit)

in the axis module:

Byte	Digital signals (1 bit)	Analog signals (16 bit)	Phase signals (32 Bit)
1, 2	CAN3In-Bit0 ... CAN3In-Bit15	CAN3In-W0	CAN3In-W0/W1
3, 4	CAN3In-Bit16 ... CAN3In-Bit31	CAN3In-W1	
5, 6		CAN3In-W2	CAN3In-W2/W3
7, 8		CAN3In-W3	

Note!

Via C0357 you can set the monitoring time (Lenze setting: 3000 ms) for data reception. (📖 198)

12.16 CAN3Out

Function

This function block serves to transfer event-controlled or time-controlled process data (📖 447) via the MotionBus (CAN).

- A sync telegram is not required.
- The process data is transmitted when a value within the eight bytes of user data has changed (event-controlled) or with the cycle time set under C0356/2 (time-controlled, (📖 176).

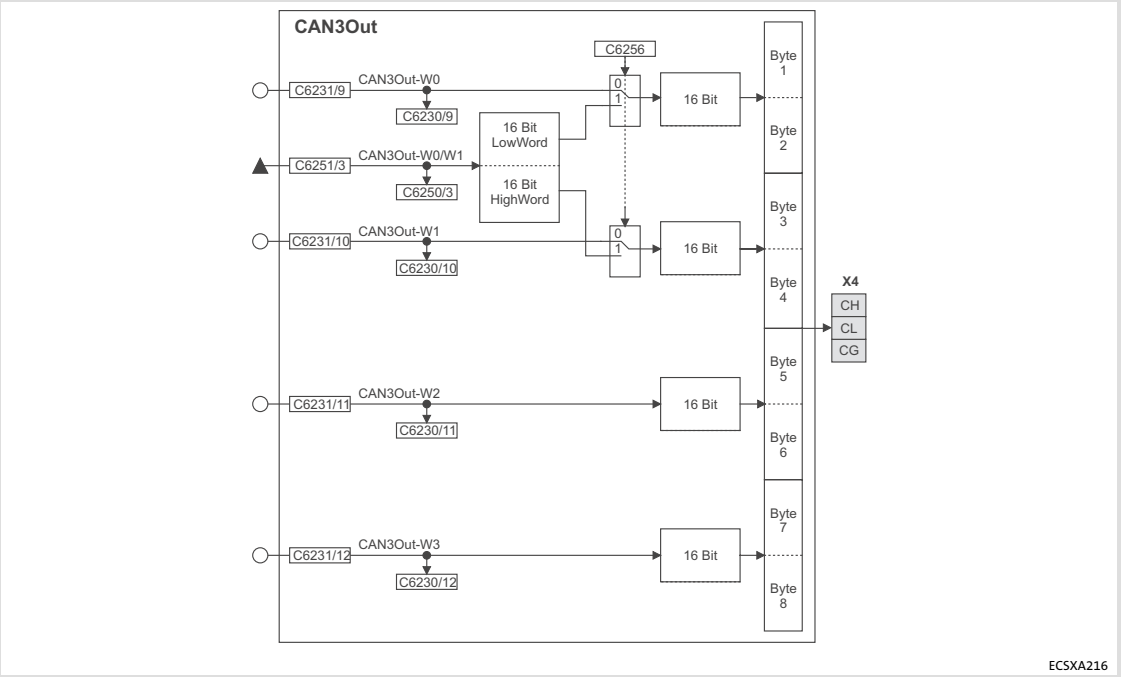


Fig. 12-16 CAN3Out function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6230				Display of the analog output signals to the MotionBus (CAN)	
			-32768 {1} 32767		
1	CAN-AnOut			Output word CAN1Out-DctrlStat	📖 276
2	CAN-AnOut			Output word CAN1Out-W1	
3	CAN-AnOut			Output word CAN1Out-W2	
4	CAN-AnOut			Output word CAN1Out-W3	
5	CAN-AnOut			Output word CAN2Out-W0	📖 285
6	CAN-AnOut			Output word CAN2Out-W1	
7	CAN-AnOut			Output word CAN2Out-W2	
8	CAN-AnOut			Output word CAN2Out-W3	
9	CAN-AnOut			Output word CAN3Out-W0	📖 291
10	CAN-AnOut			Output word CAN3Out-W1	
11	CAN-AnOut			Output word CAN3Out-W2	
12	CAN-AnOut			Output word CAN3Out-W3	
[C6231]				Selection of the analog output signals to the MotionBus (CAN)	
1	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-DctrlStat	📖 276
2	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W1	
3	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W2	
4	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W3	
5	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W0	📖 285
6	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W1	
7	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W2	
8	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W3	
9	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W0	📖 291
10	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W1	
11	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W2	
12	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6250				Display of the phase output signals to the MotionBus (CAN)	
			-2147483647 {1} 2147483647		
1	CAN-PhiOut			Output double word CAN1Out-W2/W3	📖 276
2	CAN-PhiOut			Output double word CAN2Out-W0/W1	📖 285
3	CAN-PhiOut			Output double word CAN3Out-W0/W1	📖 291

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6251]				Selection of the phase output signals to the MotionBus (CAN)	
1	CAN1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN1Out-W2/W3	📖 276
2	CAN2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN2Out-W0/W1	📖 285
3	CAN3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN3Out-W0/W1	📖 291
			For possible signals see "selection list - phase signals"		📖 440
C6256	CAN3PdoMap	0		Assignment of the 8 byte user data of the CAN3Out function block to the MotionBus (CAN)	📖 291
			0 W0=Int W1=Int	Byte 1, byte 2 = CAN3Out-W0	
				Byte 3, byte 4 = CAN3Out-W1	
				Byte 5, byte 6 = CAN3Out-W2	
				Byte 7, byte 8 = CAN3Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = CAN3Out-W0/W1	
				Byte 3, byte 4 = CAN3Out-W0/W1	
				Byte 5, byte 6 = CAN3Out-W2	
				Byte 7, byte 8 = CAN3Out-W3	

User data

The eight bytes of user data to the MotionBus (CAN) can be assigned with

- analog signals (16 bits).
- phase signals (32 bits).

The switch C6256 is used to assign the eight bytes of user data to the MotionBus (CAN):

Value in C6256	User data			
	Byte 1, 2	Byte 3, 4	Byte 5, 6	Byte 7, 8
0	**CAN3Out-W0** 16 bits (C6231/9)	**CAN3Out-W1** 16 bits (C6231/10)	**CAN3Out-W2** 16 bits (C6231/11)	**CAN3Out-W3** 16 bits (C6231/12)
1	**CAN3Out-W0/W1** 32 bits (C6251/3)		**CAN3Out-W2** 16 bits (C6231/11)	**CAN3Out-W3** 16 bits (C6231/12)

12.17 DCTRL

Function

This function block controls the controller into certain states:

- Quick stop (QSP, 📖 297)
- Operation inhibit (DISABLE, 📖 297)
- Controller inhibit (CINH, 📖 297)
- Setting a TRIP (TRIP-SET, 📖 298)
- Resetting a TRIP (TRIP-RESET, 📖 298)
- Status of the controller (📖 299)

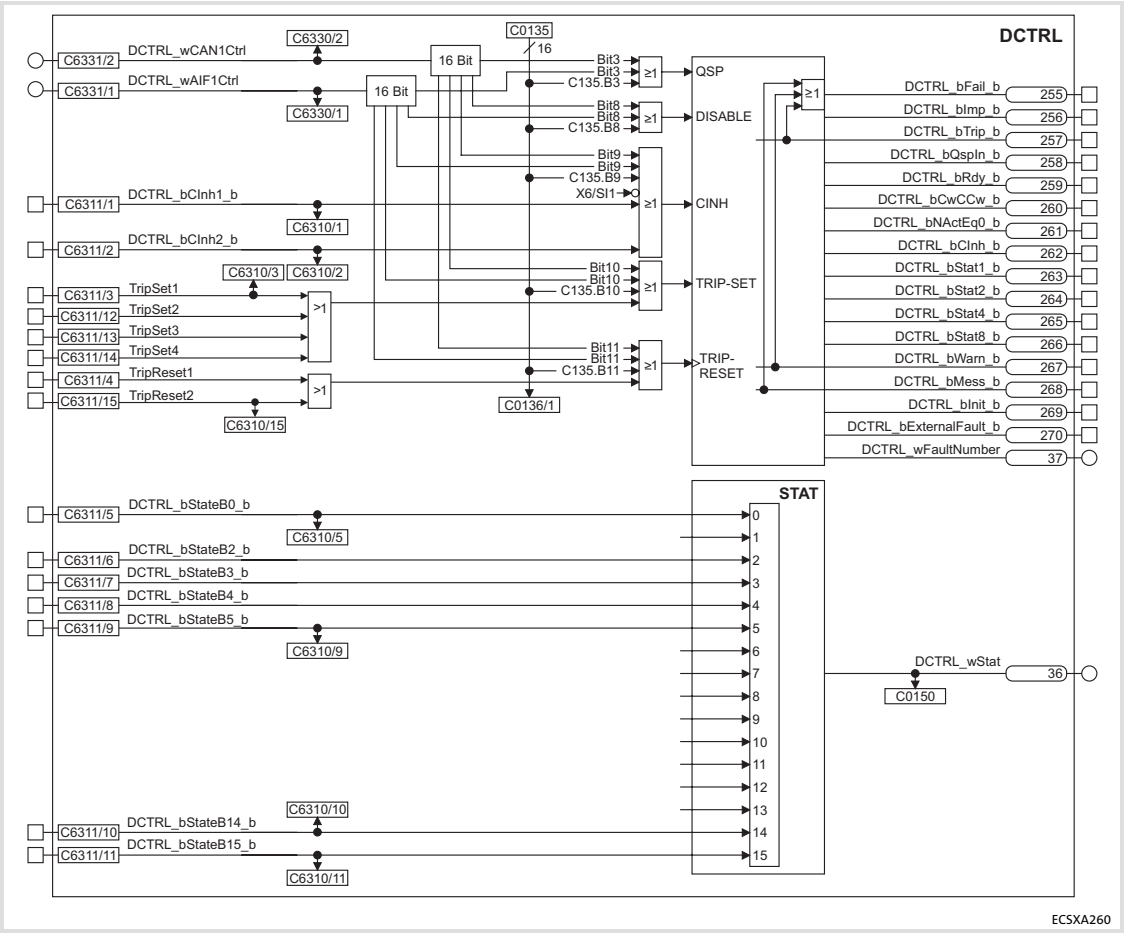


Fig. 12-17 DCTRL function block

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0135	Control word	0				System control word DCTRL	
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned			
			Bit 1	Not assigned			
			Bit 2	Not assigned			
			Bit 3	Quick stop (QSP)			
			Bit 4	Not assigned			
			Bit 5	Not assigned			
			Bit 6	Not assigned			
			Bit 7	Not assigned			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit 10	TRIP-SET			
			Bit 11	TRIP-RESET			
			Bit 12	Not assigned			
			Bit 13	Not assigned			
			Bit 14	Not assigned			
			Bit 15	Not assigned			
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0150	Status word	0				Device status word for networking via automation interface (AIF) Read only	📖 299
			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			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6310				Display of the digital input signals in the DCTRL function block	294
			0 (= FALSE) 1 (= TRUE)		
1	DCTRL-DigOut			DCTRL-CINH1	
2	DCTRL-DigOut			DCTRL-CINH2	
3	DCTRL-DigOut			DCTRL-TripSet1	
4	DCTRL-DigOut			DCTRL-TripReset1	
5	DCTRL-DigOut			DCTRL-StatB0	
6	DCTRL-DigOut			DCTRL-StatB2	
7	DCTRL-DigOut			DCTRL-StatB3	
8	DCTRL-DigOut			DCTRL-StatB4	
9	DCTRL-DigOut			DCTRL-StatB5	
10	DCTRL-DigOut			DCTRL-StatB14	
11	DCTRL-DigOut			DCTRL-StatB15	
12	DCTRL-DigOut			DCTRL-TripSet2	
13	DCTRL-DigOut			DCTRL-TripSet3	
14	DCTRL-DigOut			DCTRL-TripSet4	
15	DCTRL-DigOut			DCTRL-TripReset2	
[C6311]				Selection of the digital input signals of the DCTRL function block	294
1	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-CInh1	
2	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-CInh2	
3	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet1	
4	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripReset1	
5	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB0	
6	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB2	
7	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB3	
8	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB4	
9	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB5	
10	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB14	
11	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB15	
12	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet2	
13	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet3	
14	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet4	
15	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripReset2	
			For possible signals see ”selection list - digital signals”		428
C6330				Display of the analog input signals in the DCTRL function block	294
			-32768 {1} 32767		
1	DCTRL-AnOut			DCTRL-wAIF1Ctrl	
2	DCTRL-AnOut			DCTRL-CAN1Ctrl	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6331]				Selection of the analog input signals of the DCTRL function block	294
1	DCTRL-anl	1000	FIXED 0 % (not assigned)	Source for DCTRL-wAIF1Ctrl	
2	DCTRL-anl	1000	FIXED 0 % (not assigned)	Source for DCTRL-CAN1Ctrl	
			For possible signals see "selection list - analog signals"		437

12.17.1 Quick stop (QSP)

The QSP function serves to stop the drive in an adjustable time irrespective of the setpoint selection.

- The function can be controlled via the following inputs (OR'd):
  - Control word "CAN1In-DctrlCtrl" bit 3 of CAN1In function block
  - Control word "AIF1In-DctrlCtrl" bit 3 of AIF1In function block
  - C0135/3 (control word for networking via AIF)
- C0136/1 indicates the control word C0135.
- The speed is reduced to "0" within the deceleration time set via C0105.

12.17.2 Operation inhibit (DISABLE)

This function sets "Operation inhibit" (DISABLE) in the drive, i.e. the power output stages are inhibited and all speed/current/position controllers are reset. In the "Operation inhibit" state, the drive cannot be started with the command "Controller enable".

- The function can be controlled via the following inputs (OR'd):
  - Control word "CAN1In-DctrlCtrl" bit 8 of CAN1_IN function block
  - Control word "AIF1In-DctrlCtrl" bit 8 of AIF1_IN function block
  - C0135/8 (control word for networking via AIF)
- C0136/1 indicates the control word C0135.

12.17.3 Controller inhibit (CINH)

This function sets "Controller inhibit" (CINH) in the drive, i.e. the power output stages are inhibited and all speed/current/position controllers are reset.

- The function can be controlled via the following inputs (OR'd):
  - Terminal X6 (FALSE = controller inhibit)
  - Control word "CAN1In-DctrlCtrl" bit 9 of CAN1In function block
  - Control word "AIF1In-DctrlCtrl" bit 9 of AIF1In function block
  - C0135/9 (control word for networking via AIF)
  - Signal "DCTRL-CInh1" and "DCTRL-CInh2" (ANDed, TRUE = set controller inhibit)
- C0136/1 indicates the control word C0135.

12.17.4 Setting TRIP (TRIP-SET)

This function sets TRIP" in the drive and indicates "External error" (error message "EEr").

- The function can be controlled via the following inputs (OR'd):
  – Control word "CAN1In-DctrlCtrl" bit 10 of CAN1In function block
  – Control word "AIF1In-DctrlCtrl" bit 10 of AIF1In function block
  – C0135/10 (control word for networking via AIF)
  – Signal "DCTRL-TripSet1" ... "DCTRL-TripSet4" (ANDed, TRUE = set TRIP)
- C0136/1 indicates the control word C0135.
- The response to TRIP can be set via C0581.

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0581	MONIT EEr	0		Fault response - external fault monitoring "ExternalFault" (EEr)	298
			0 TRIP		
			1 Message		
			2 Warning		
			3 Off		
			4 FAIL-QSP		

12.17.5 Resetting TRIP (TRIP-RESET)

This function resets an upcoming TRIP, provided that the cause of malfunction has been eliminated. If the cause of malfunction is still active, there will be no reaction.

- The function can be controlled via the following inputs (OR'd):
  – Control word "CAN1In-DctrlCtrl" bit 11 of CAN1In function block
  – Control word "AIF1In-DctrlCtrl" bit 11 of AIF1In function block
  – C0135/11 (control word for networking via AIF)
  – Signal "DCTRL-TripReset1" and "DCTRL-TripReset2" (ANDed, set TRUE = TRIP)
- C0136/1 indicates the control word C0135.

Note!

The function is only carried out by a FALSE-TRUE edge of the signal resulting from the OR operation.

If one input is assigned to TRUE, a FALSE-TRUE edge cannot occur.

12.17.6 Axis module status

Via ”DCTRL-Stat” a status word is output, consisting of signals generated by the DCTRL function block and signals of freely configurable function block inputs.

- ► The status is analog coded in the output 36.
- ► The status word can be displayed via C0150.

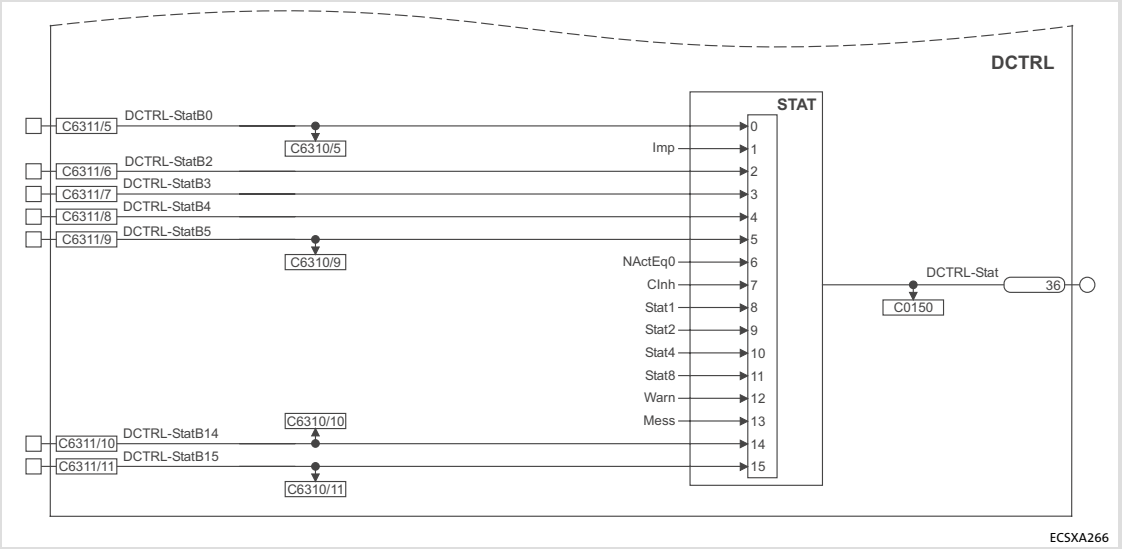


Fig. 12-18 DCTRL function block: Output of the status word DCTRL-Stat

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only	📖 299
			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		

The status bits 8 ... 11 in C0150 display the binary-coded **device status** of the axis module:

Status bit 11	Status bit 10	Status bit 9	Status bit 8	Description
0	0	0	0	Initialisation after connecting the supply voltage
0	0	0	1	Switch-on inhibit / restart protection active (C0142 = 0)
0	0	1	1	Controller inhibited
0	1	1	0	Controller enabled
0	1	1	1	A monitoring function returns a ”message”.
1	0	0	0	A monitoring function returns a ”TRIP”.
1	0	1	0	A monitoring function returns a ”FAIL-QSP”.

0 = FALSE 1 = TRUE

12.18 DFIN (master frequency input)

Function

This function block can convert a power pulse current at the master frequency input X8 into a speed value and scale it. A master frequency can be transferred with high precision without any offset and gain errors.

- The master frequency input X8 is designed for signals with TTL level.
- The zero track entry is optional.
- The master frequency input X8 can be configured as a master frequency output via C0491.
- An encoder can be selected and configured via the codes:
  – C0419 (encoder selection)
  – C0420 (encoder increments)
  – C0421 (encoder bias)
  – C0427 (Type of master frequency input signal)
- Output of the analog signal ”DFIN_In_v”
- 2 to 3 slaves connected to the master:
  Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

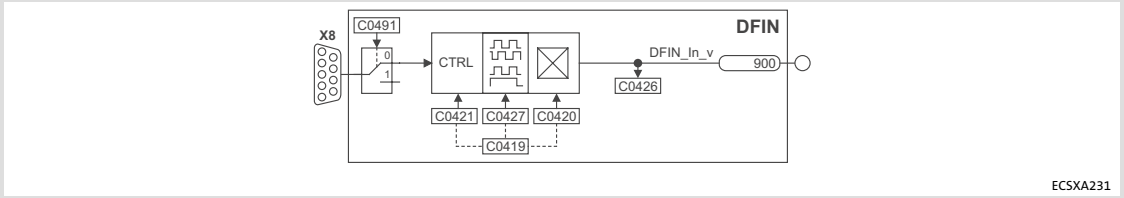


Fig. 12-19 DFIN function block

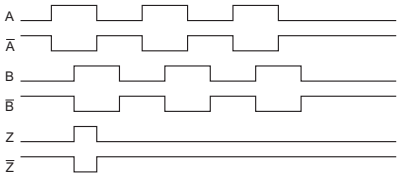
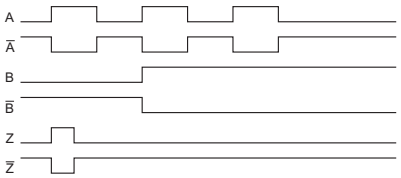
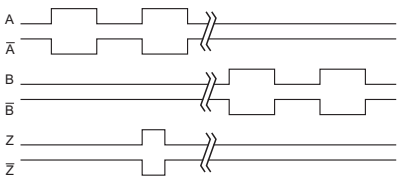
Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0419]	Enc. setup	110		Encoder selection • Selection of encoder type indicated on the nameplate of the Lenze motor. • The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0 Common		
			110 IT512-5V	Incremental encoder with TTL level	
			111 IT1024-5V		
			112 IT2048-5V		
			113 IT4096-5V		
			210 IS512-5V	SinCos encoder	
			211 IS1024-5V		
			212 IS2048-5V		
			213 IS4096-5V		
			307 AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308 AS128-8V		
			309 AS256-8V		
			310 AS512-8V		
			311 AS1024-8V		
			407 AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408 AM128-8V		
			409 AM256-8V		
			410 AM512-8V		
			411 AM1024-8V		
[C0420]	Encoder const.	512		Number of increments of the encoder	📖 301 📖 106 📖 113
			1 {1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	
[C0421]	Encoder volt	0		Encoder voltage	📖 301
			0 5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	📖 106 📖 113
			1 5.6 V		
			2 6.3 V		
			3 6.9 V		
			4 7.5 V		
			5 8.1 V		
C0426	DIS: In			Signal at DFIN input Only display	📖 301
			-32767 {1 rpm} 32767		
[C0427]	Enc. signal	0		Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106
			0 2-phase		📖 113
			1 A: speed B: direction		
			2 A or B: speed or direction		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C0491]	X8 in/out	0		Function of X8	📖 301
			0 X8 is input		📖 304 📖 106
			1 X8 is output		📖 113

Configuring the master frequency input signal

Via C0427, you configure the master frequency input signal:

Configuration C0427	Track	CW rotation	CCW rotation
C0427 = 0 (2 phases)			
 Signal sequence with phase shift (CW rotation)	**a**	Track A leads by 90º (positive value at *DFIN_In_v*)	Track A lags by 90º (negative value at *DFIN_In_v*)
	B	–	–
C0427 = 1 (A = speed, B = direction)			
 Control of the direction of rotation via track B	**a**	transmits the speed.	transmits the speed
	B	= FALSE (positive value at *DFIN_In_v*)	= TRUE (negative value at *DFIN_In_v*)
C0427 = 2 (A or B = speed or direction)			
 Control of speed and direction of rotation via track A or track B	**a**	transmits speed and direction of rotation (positive value at *DFIN_In_v*)	= FALSE
	B	= FALSE	transmits speed and direction of rotation (negative value at *DFIN_In_v*)

Transfer function

$$\text{DFIN\_In\_v} = \text{f [Hz]} \cdot \frac{60}{\text{C0420}} \cdot \frac{2^{14}}{15000}$$

Example:

- ► Input frequency = 200 kHz
- ► C0420 = 2048 (increments/revolution)

$$\text{DFIN\_In\_v [rpm]} = 200000\ \text{Hz} \cdot \frac{60}{2048} = 5859\ \text{rpm}$$

12.19 DFOUT (master frequency output)

Function

This function block converts internal speed signals into frequency signals. Transmission is effected with high precision (without offset and gain errors) with residual value treatment.

- The master frequency output X8 can be configured as a master frequency input via C0491.
- The type of the master frequency output signals can be set via C0540:
  – Output of an analog signal "DFOut-In_v"
  – Output of a speed signal
  – Encoder simulation of the resolver with zero track
- 2 to 3 slaves connected to the master:
  Use the **EMF2132IB** digital frequency distributor to wire the ECS axis modules with master digital frequency cable **EYD0017AxxxxW01W01** and slave digital frequency cable **EYD0017AxxxxW01S01**.

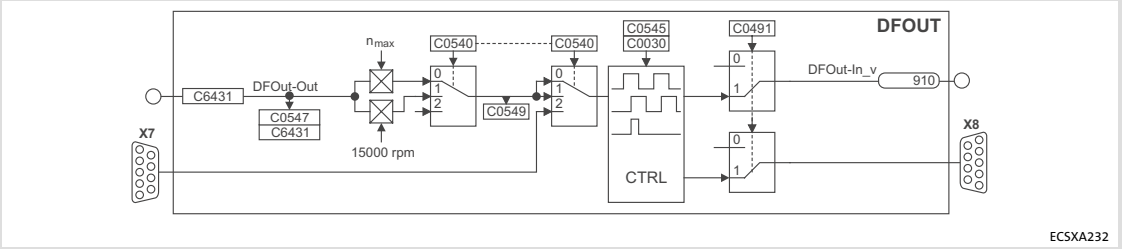


Fig. 12-20 DFOUT function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0030	DFOUT const	3		Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 304 📖 106 📖 113
			0 256 incr./rev		
			1 512 incr./rev		
			2 1024 incr./rev		
			3 2048 incr./rev		
			4 4096 incr./rev		
			5 8192 incr./rev		
			6 16384 incr./rev		
[C0491]	X8 in/out	0		Function of X8	📖 301 📖 304 📖 106 📖 113
			0 X8 is input		
			1 X8 is output		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0540]	X8 Signal out	2				Function of the digital frequency output signals on X8 (DFOUT)	📖 304 📖 103
			0	DFOUT in [%]			
			1	DFOUT in [rpm]			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	📖 304
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	📖 304
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	📖 304
			-32767	{1 rpm}	32767		
C6430	DFOUT					Display of the analog output signal DFOut-Out in the DFOUT function block	📖 304
			-32768	{1}	32767		
[C6431]	DFOUT	1000				Selection of the analog output signal DFOut-Out for the DFOUT function block	📖 304
			FIXED 0 % (not assigned)				
			For possible signals see ”selection list - analog signals”				📖 437

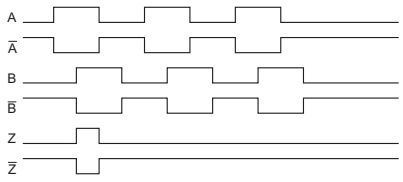
Configuring the master frequency output signal

Note!

Dependent on the system, the master frequency output X8 has a delay time of T_d = 1 ms.

Via code C0540 you configure the type of the master frequency output signal:

C0540 = 0	Output of an analog signal
Function	The input signal *DFOUT_nOut_v*is interpreted as an analog signal [%] and is output as a frequency signal on the master frequency output X8.
Scaling	100 % ≡ (INT)16384 ≡ C0011 (n_{max})
Transfer function	$f\,[Hz] = \text{DFOUT-Out}\,[\%] \cdot \frac{C0030}{100} \cdot \frac{C0011\,(n_{max})}{60}$ $\text{DFOUT-In\_v} = f\,[Hz] \cdot \frac{60}{C0030} \cdot \frac{2^{14}}{15000}$
Example	• *DFOUT_nOut_v* = 50 % • C0030 = 3, this corresponds to a number of increments of 2048 increments/revolution • C0011 = 3000 rpm $f\,[Hz] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ Hz$
C0540 = 1	**Output of a speed signal**
Function	The input signal *DFOUT_nOut_v*is interpreted as a speed signal [rpm] and is output as a frequency signal on the master frequency output X8.
Scaling	15000 rpm ≡ (INT)16384
Transfer function	$f\,[Hz] = \text{DFOUT-Out}\,[rpm] \cdot \frac{C0030}{60}$
Example	• *DFOUT_nOut_v* = 3000 rpm • C0030 = 3, this corresponds to a number of increments of 2048 increments/revolution $f\,[Hz] = 3000\ rpm \cdot \frac{2048}{60} = 102400\ Hz$
C0540 = 2	**Encoder simulation of the resolver with zero track in resolver position**
Function	• The function is used if a resolver is connected to X7. • The encoder constant for output X8 is set in C0030. • The output of the zero pulse with reference to the rotor depends on how the resolver is mounted to the motor. • The zero pulse can be shifted by +360 ° via code C0545 (65536 inc = 360 °).

Signal sequence	Track	CW rotation	CCW rotation
 Signal sequence with phase shift (CW rotation)	**A**	If the input values are positive, track A leads by 90º.	If the input values are negative, track A lags by 90º.
	B	–	–

► The output signal corresponds to the message of an incremental encoder:
  – Track A, B and, if selected, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  – The levels are TTL compatible.

► The zero track is output in accordance with the function set in code C0540.

12.20 DigIn (freely assignable digital inputs)

Function

This function block reads and conditions the signals on X6/DI1 ... DI4.

- The configuration of the terminal polarity for the inputs X6/DI1 ... DI4 is effected via C0114.
- The "safe torque off" safety function (📖 71) is controlled via X6/SI1 and X6/SI2.

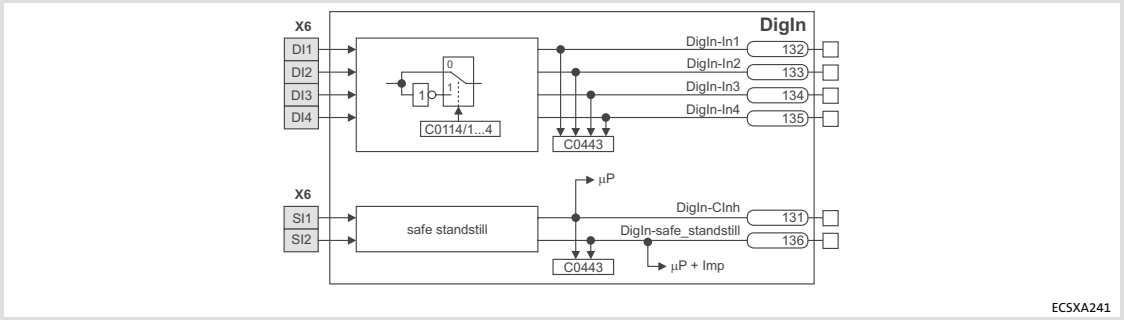


Fig. 12-21 DigIn function block

Codes

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0114					Polarity of the digital inputs	📖 307
1	DIGIN pol	0		HIGH level active	X6/DI1 (DIGIN_bIn1_b)	📖 121
2	DIGIN pol	0		HIGH level active	X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0		HIGH level active	X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0		HIGH level active	X6/DI4 (DIGIN_bIn4_b)	
			0	HIGH level active		
			1	LOW level active		
C0443	DIS: DIGIN				Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	📖 307
			0	{1} 255		
			Bit 0	DIGIN1	X6/DI1	📖 121
			Bit 1	DIGIN2	X6/DI2	
			Bit 2	DIGIN3	X6/DI3	
			Bit 3	DIGIN4	X6/DI4	
			Bit 4	DIGIN_safe_standstill	X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	📖 71
			Bit 5	Free		
			Bit 6	DIGIN_CInh	X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	📖 71
			Bit 7	Free		

12.21 DigOut (freely assignable digital outputs)

Function

This function block conditions the digital signal ”DigOut-Out1” and outputs it via X6/DO1.

- A motor holding brake supplied with low voltage via X6/B+ and X6/B- can be connected to X25/B1 and X25/B2 62
  - The motor holding brake can be switched by the signal DigOut-Relay .
  - The terminal polarity for the outputs X6/DO1, X25/B1 and X25/B2 can be configured via C0118.
- X6/SO serves to return information concerning the safety function ”safe torque off” (📖 71).

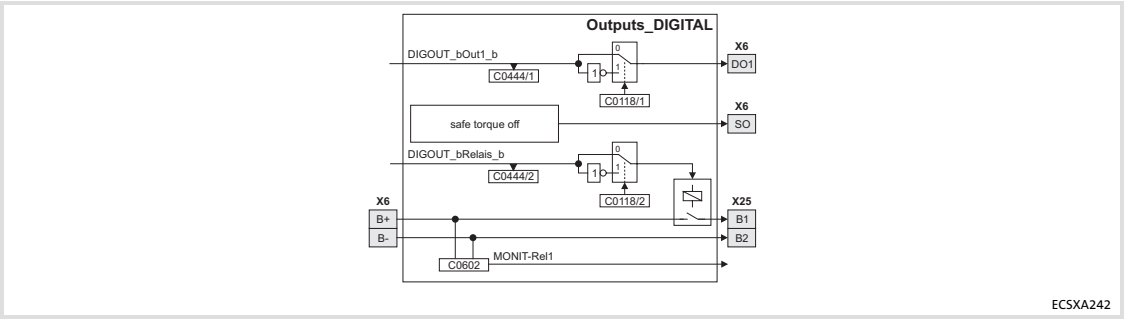


Fig. 12-22 DigOut function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0118				Polarity of the digital outputs	📖 308
1	DIGOUT pol	0	HIGH level active	X6/DO1 (DIGOUT_bOut1_b)	📖 121
2	DIGOUT pol	0	HIGH level active	X25 (DIGOUT_bRelais_b, brake connection)	
			0 HIGH level active		
			1 LOW level active		
C6370				Display of the output signals at the digital output and the brake relay	📖 308
			0 (= FALSE) 1 (= TRUE)		
1	DIGOUT			Output signal at the digital output X6/DO1 (DigOut-Out1)	
2	DIGOUT			Control of the brake relay (DigOut relay)	
[C6371]				Selection of the digital output signals for the digital output and the brake relay	📖 308
1	DigoutIn-dig	1000	0 (FALSE, not assigned)	Source for the output signal at the digital output X6/DO1 (DigOut-Out1)	
2	DigoutIn-dig	1000	0 (FALSE, not assigned)	Source for the control of the brake relay (DigOut relay)	
			For possible signals see ”selection list - digital signals”		📖 428

12.22 FCODE (free codes)

Function

This function block provides different signals. The signals can be directly read out and processed via the assigned ”free” codes of the controller.

- ► Values in the codes of the function block are assigned to the corresponding output signals.
- ► The code value is converted into a signal value via a fixed scaling routine.

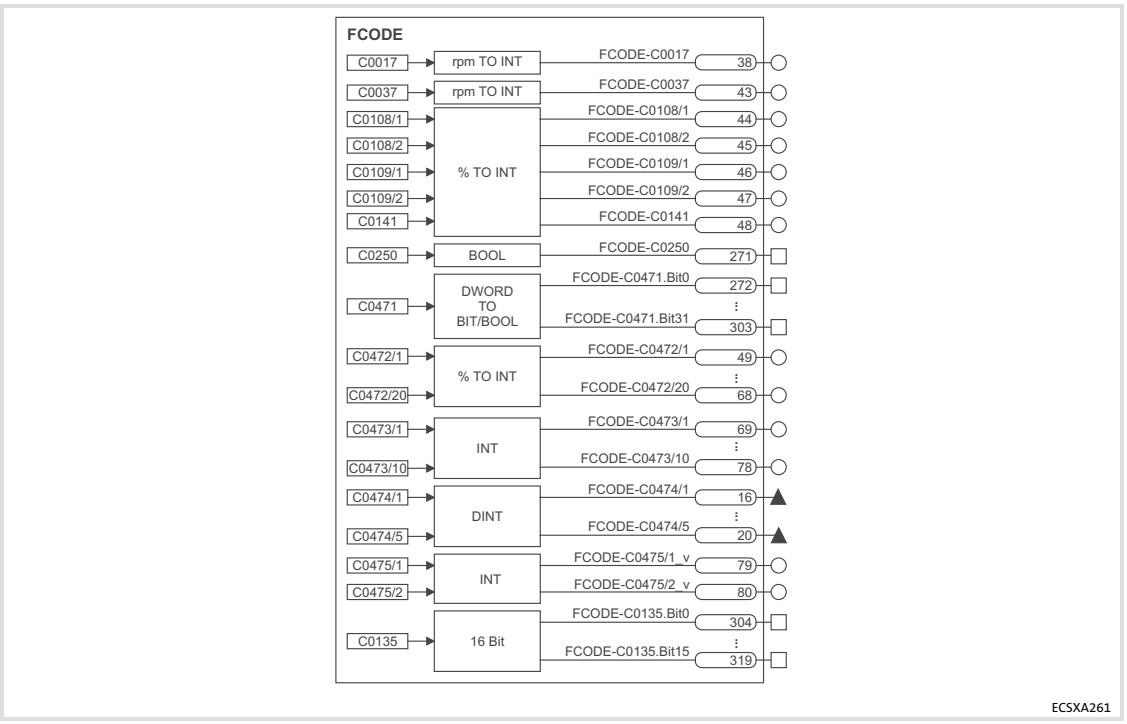


Fig. 12-23 FCODE function block

Beispiel

You can enter a percentage value [%] in C0472/1 (e.g. by using the keypad). The value is directly assigned to the signal ”FCODE-C0472/1” (data type ”integer”) via a fixed scaling routine and can be processed in the PLC program.

Note!

The free code C0470 has the same memory address as C0471. C0470 can be read out via the signals ”FCODE-C0471.Bit0 ... 31” in C0471.

In contrast to code C0471 which can accept a 32-bit value, code C0470 is divided into four subcodes with eight bits each.

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)	309
			-16000	{1 rpm}	16000		
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	309
			-16000	{1 rpm}	16000		
C0108						Gain for relative analog signals (AOUT)	309
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	309
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0135	Control word	0				System control word DCTRL	
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned			
			Bit 1	Not assigned			
			Bit 2	Not assigned			
			Bit 3	Quick stop (QSP)			
			Bit 4	Not assigned			
			Bit 5	Not assigned			
			Bit 6	Not assigned			
			Bit 7	Not assigned			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit 10	TRIP-SET			
			Bit 11	TRIP-RESET			
			Bit 12	Not assigned			
			Bit 13	Not assigned			
			Bit 14	Not assigned			
			Bit 15	Not assigned			
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)	309
			-199.99	{0.01 %}	199.99		
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	309
			0		1		
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	309
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	309
			0	{1}	4294967295		
C0472	FCODE analog					Freely configurable code for relative analog signals	309
1		0.0	-199.99	{0.01 %}	199.99	FCODE_bC472_1_a	
2		0.0				FCODE_bC472_2_a	
3		100.0				FCODE_bC472_3_a	
4		0.0				FCODE_bC472_4_a	
...		...				...	
20		0.0				FCODE_bC472_20_a	
C0473						Freely configurable code for absolute analog signals	309
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	309
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	309
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					

12.23 FIXED (output of constant signals)

Function

This function block outputs fixed values to provide easy programming in the standard calculation of percentage (100 % = 16384) of the drive technology.

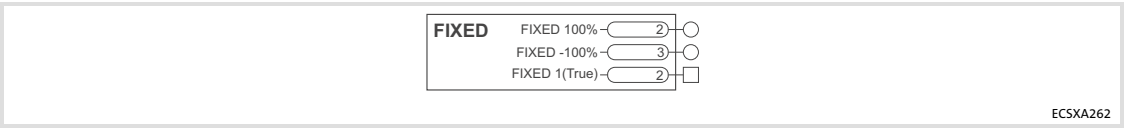


Fig. 12-24 FIXED function block (output of constant signals)

12.24 InNeg

Function

This function block serves to invert the input signals. The function block can invert digital, analog and phase signals.

- The values of the analog signals are in a decimal range of ±32767.
- The values of the phase signals are in a decimal range of ±2147483648.

The values are calculated before the selected main function block is calculated. Thus the calculated values are made available to the subsequent blocks in the current cycle.

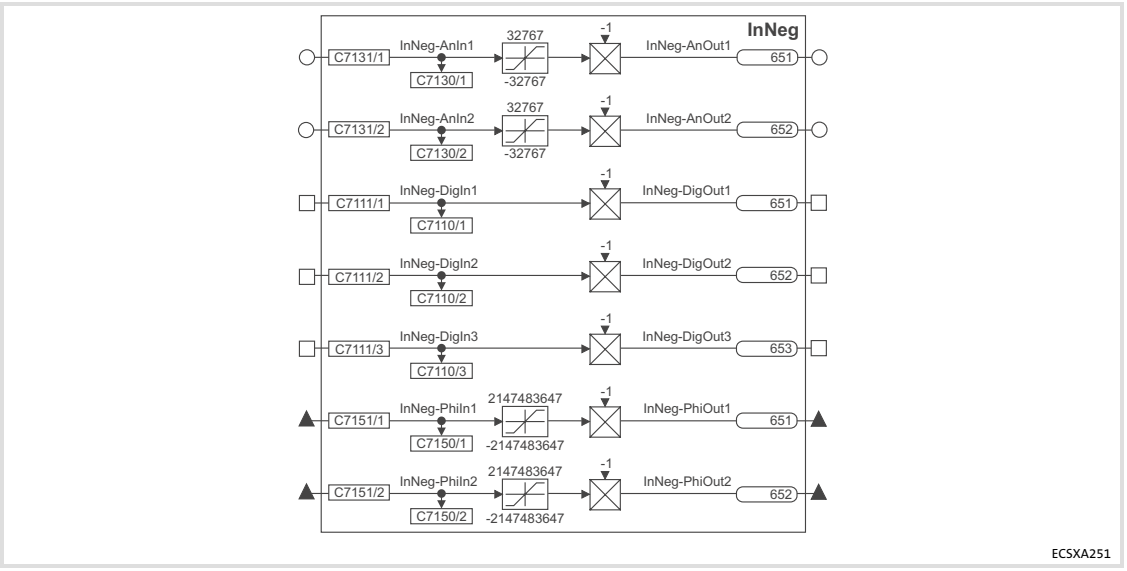


Fig. 12-25 InNeg function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7110				Display of the digital input signals in the function block InNeg (signal inversion)	📖 313
1	InNeg-digV			InNeg-DigIn1	
2	InNeg-digV			InNeg-DigIn2	
3	InNeg-digV			InNeg-DigIn3	
C7111				Selection of the digital input signals for the InNeg function block (signal inversion)	📖 313
1	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn1	
2	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn2	
3	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn3	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7130				Display of the analog input signals in the InNeg function block (signal inversion)	313
			-32768 (= -199.9 %) {1} 32767 (= 199.9 %)		
1	InNeg-AnV			InNeg-AnIn1	
2	InNeg-AnV			InNeg-AnIn2	
C7131				Selection of the analog input signals for the InNeg function block (signal inversion)	313
1	InNeg-An	1000	FIXED 0 % (not assigned)	Source for InNeg-AnIn1	
2	InNeg-An	1000	FIXED 0 % (not assigned)	Source for InNeg-AnIn2	
			For possible signals see "selection list - analog signals"		437
C7150				Display of the phase input signals in the InNeg function block (signal inversion)	313
			-2147483647 {1} 2147483647		
1	InNeg-PhiV			InNeg-PhiIn1	
2	InNeg-PhiV			InNeg-PhiIn2	
C7151				Selection of the phase input signals for the InNeg function block (signal inversion)	313
1	InNeg-Phi	1000	FIXED 0 (not assigned)	Source for InNeg-PhiIn1	
2	InNeg-Phi	1000	FIXED 0 (not assigned)	Source for InNeg-PhiIn2	
			For possible signals see "selection list - phase signals"		440

12.25 OutNeg

Function

This function block serves to invert the output signals. The function block can invert digital, analog and phase signals.

- The values of the analog signals are in a decimal range of ±32767.
- The values of the phase signals are in a decimal range of ±2147483648.

The values are calculated before the selected main function block is calculated. Thus the calculated values are made available to the subsequent blocks in the current cycle.

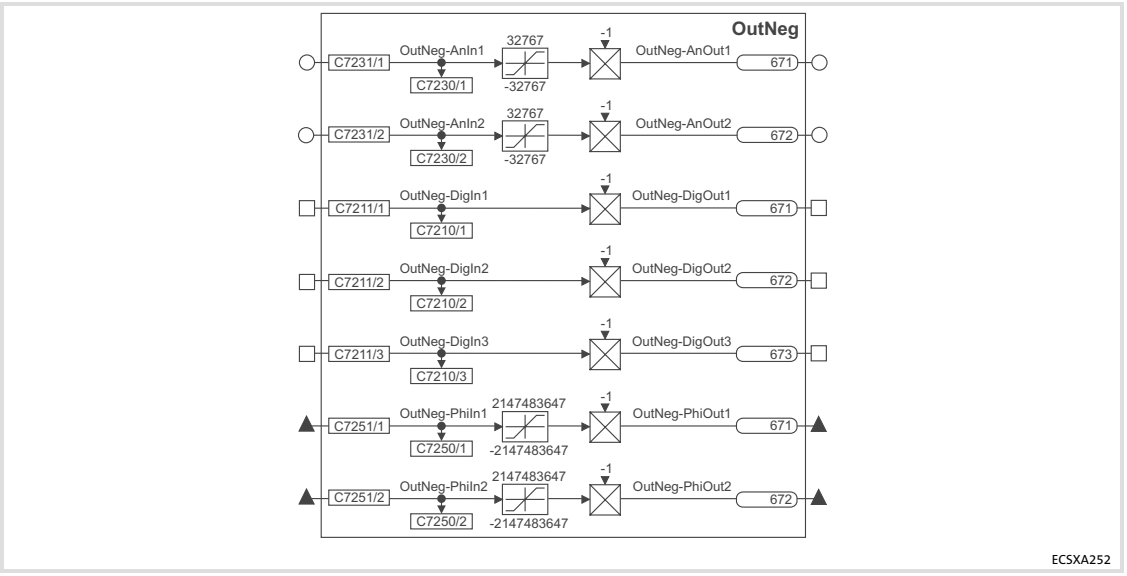


Fig. 12-26 OutNeg function block

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7210				Display of the digital input signals in the OutNeg function block (signal inversion)	📖 315
1	OutNeg-digV			OutNeg-DigIn1	
2	OutNeg-digV			OutNeg-DigIn2	
3	OutNeg-digV			OutNeg-DigIn3	
C7211				Selection of the digital input signals for the OutNeg function block (signal inversion)	📖 315
1	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn1	
2	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn2	
3	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn3	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7230				Display of the analog input signals in the OutNeg function block (signal inversion)	📖 315
			-32768 (= -199.9 %) {1} 32767 (= 199.9 %)		
1	OutNeg-AnV			OutNeg-AnIn1	
2	OutNeg-AnV			OutNeg-AnIn2	
C7231				Selection of the analog input signals for the OutNeg function block (signal inversion)	📖 315
1	OutNeg-An	1000	FIXED 0 % (not assigned)	Source for OutNeg-AnIn1	
2	OutNeg-An	1000	FIXED 0 % (not assigned)	Source for OutNeg-AnIn2	
			For possible signals see ”selection list - analog signals”		📖 437
C7250				Display of the phase input signals in the OutNeg function block (signal inversion)	📖 315
			-2147483647 {1} 2147483647		
1	OutNeg-PhiV			OutNeg-PhiIn1	
2	OutNeg-PhiV			OutNeg-PhiIn2	
C7251				Selection of the phase input signals for the OutNeg function block (signal inversion)	📖 315
1	OutNeg-Phi	1000	FIXED 0 (not assigned)	Source for OutNeg-PhiIn1	
2	OutNeg-Phi	1000	FIXED 0 (not assigned)	Source for OutNeg-PhiIn2	
			For possible signals see ”selection list - phase signals”		📖 440

12.26 SYS

Function

This function block contains global system variables which are firmly integrated into the run-time system. They provide functions for programming relief.

- On the function block outputs clock signals with the same pulse/pause ratio are output.
- The outputs are toggled in real time.
- If you use these output signals, observe the scanning frequency at which the outputs are scanned (Aliasing effect). It should at least be twice the toggle frequency.

The following outputs are integrated:

Output	Toggle frequency	Period
Clock01Hz	0.1 Hz	T = 10 s
Clock1Hz	1.0 Hz	T = 1 s
Clock10Hz	10 Hz	T = 100 ms
Clock0100Hz	100 Hz	T = 10 ms

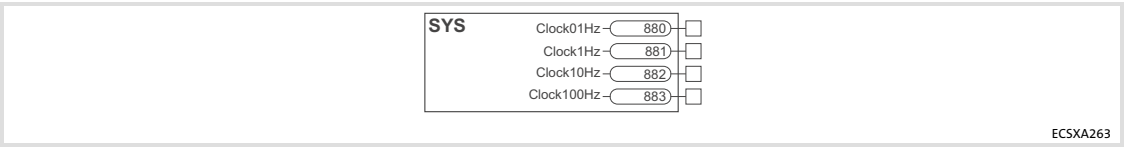


Fig. 12-27 SYS function block

12.27 Speed (speed control)

Function

Completely wired speed control with the subfunctions:

- Selectable direction of rotation (📖 325)
- Setpoint conditioning (📖 326)
- Motor control (📖 332)
- Brake control (📖 340)
- Monitoring functions (📖 192)

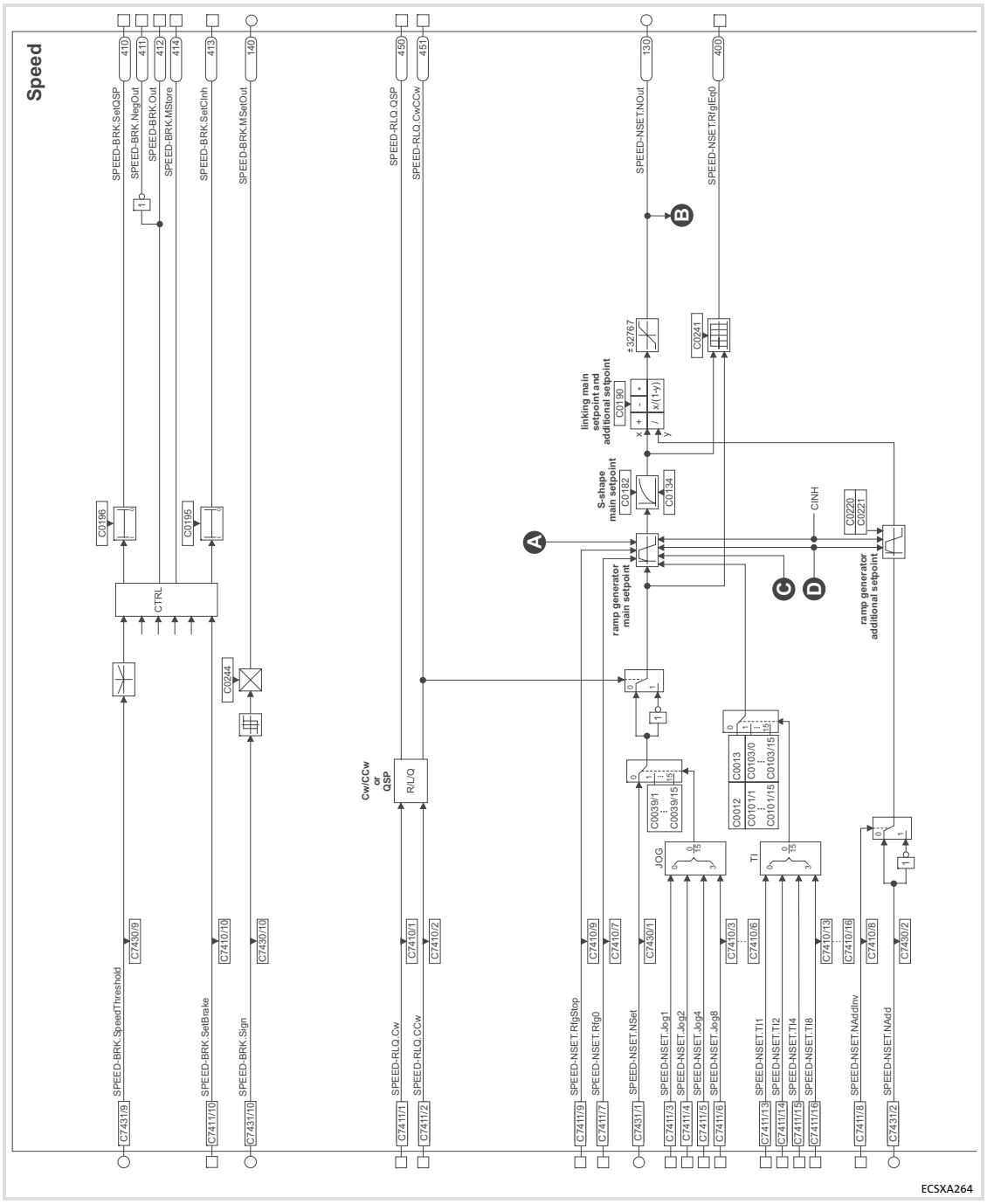


Fig. 12-28 ”Speed” function block (speed control) - Page 1 of 2

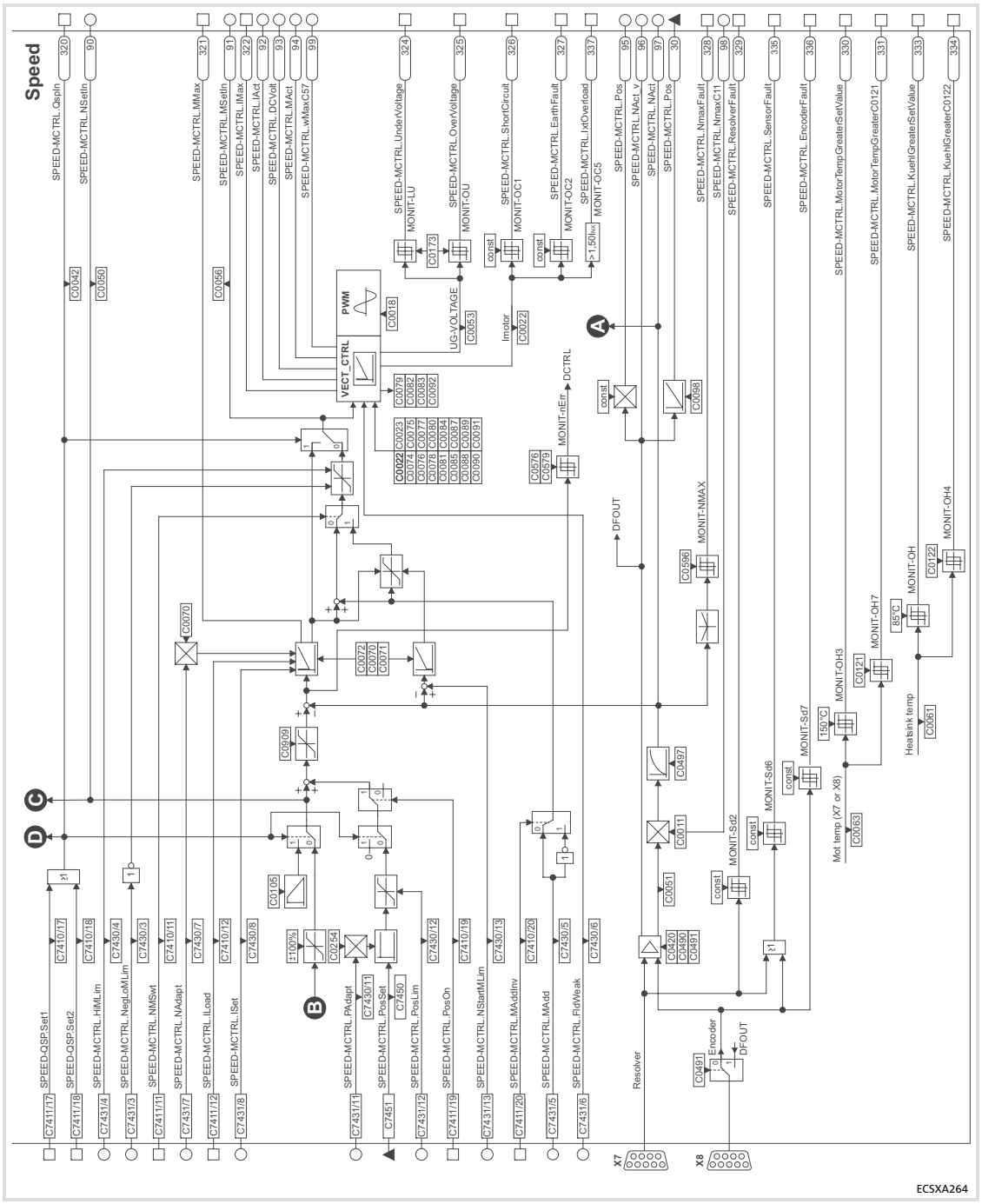


Fig. 12-29 ”Speed” function block (speed control) - Page 2 of 2

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7410				Display of the current signal states on the digital inputs of the ”Speed” function block	
			0 (= FALSE) 1 (= TRUE)		
1	Speed-dig			CW rotation (SPEED-RLQ.Cw)	📖 325
2	Speed-dig			CCW rotation (SPEED-RLQ.CCw)	
3	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog1)saved in C0039	📖 326
4	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog2)saved in C0039	
5	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog4)saved in C0039	
6	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog8)saved in C0039	
7	Speed-dig			Setting of the speed setpoint integrator to ”0” along the adjusted ramps (SPEED-NSET.Rfg0)	📖 326
8	Speed-dig			Inversion of additional speed setpoint (SPEED-NAddInv)	
9	Speed-dig			Keeping (freezing) the speed setpoint integrator to the actual value (SPEED-NSET.RfgStop)	
10	Speed-dig			Activation of the motor holding brake (SPEED-BRK.SetBrake)	📖 340
11	Speed-dig			Switching of speed/torque (SPEED-MCTRL.NMSwt)	📖 332
12	Speed-dig			Source for the integral-action component of the speed controller (SPEED-MCTRL.ILoad)	
13	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI1)	📖 326
14	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI2)	
15	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI4)	
16	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI8)	
17	Speed-dig			Setting of quick stop (SPEED-QSP.Set1)	📖 332
18	Speed-dig			Setting of quick stop (SPEED-QSP.Set2)	
19	Speed-dig			Activation of phase controller (SPEED-MCTRL.PosOn)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
20	Speed-dig			Inversion of additional torque setpoint (SPEED-MAddInv)	
[C7411]				Selection of the signal source for the digital input signals of the ”Speed” function block	
1	SpeedIn-dig	1000	0 (FALSE, not assigned)	CW rotation (SPEED-RLQ.Cw)	📖 325
2	SpeedIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (SPEED-RLQ.CCw)	
3	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog1) saved in C0039	📖 326
4	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog2)saved in C0039	
5	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog4)saved in C0039	
6	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog8)saved in C0039	
7	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of the speed setpoint integrator to 0 along the adjusted ramps (SPEED-NSET.Rfg0)	📖 326
8	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional speed setpoint (SPEED-NAddInv)	
9	SpeedIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the speed setpoint integrator to the actual value (SPEED-NSET.RfgStop)	
10	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (SPEED-BRK.SetBrake)	📖 340
11	SpeedIn-dig	1000	0 (FALSE, not assigned)	Switching of speed - torque (SPEED-MCTRL.NMSwt)	📖 332
12	SpeedIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the speed controller (SPEED-MCTRL.ILoad)	
13	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI1)	📖 326
14	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI2)	
15	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI4)	
16	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI8)	
17	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set1)	📖 332
18	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set2)	
19	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of phase controller (SPEED-MCTRL.PosOn)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
20	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (SPEED-MAddInv)	
			For possible signals see ”selection list - digital signals”		📖 428
C7430				Display of the current signal states on the analog input of the ”Speed” function block	
			-32768 (= -100 %) {1} 32767 (= 100 %)		
1	Speed-an			Speed setpoint (SPEED-NSET.NSet)	📖 326
2	Speed-an			Additional speed setpoint (SPEED-NSET.NAdd)	
3	Speed-an			Lower torque limit (SPEED-MCTRL.negLoMLim)	📖 332
4	Speed-an			Upper torque limit (SPEED-MCTRL.HiMLim)	
5	Speed-an			Additional torque setpoint (SPEED-MCTRL.MAdd)	
6	Speed-an			Manual field weakening (SPEED-MCTRL.FldWeak)	
7	Speed-an			Manual adaptation of the proportional gain of the speed controller (SPEED-MCTRL.NAdapt)	
8	Speed-an			Manual adaptation of the integral-action component of the speed controller (SPEED-MCTRL.ISet)	
9	Speed-an			Speed threshold for the motor holding brake (SPEED-BRK.SpeedThreshold)	📖 340
10	Speed-an			Direction of torque created by the drive against the motor holding brake (SPEED-BRK.Sign)	
11	Speed-an			Manual adaptation of the phase controller (SPEED-MCTRL.PAdapt)	📖 332
12	Speed-an			Limit value for influencing the phase controller (SPEED-MCTRL.PosLim)	
13	Speed-an			Lower speed limit for speed limitation (SPEED-MCTRL.NStartMLim)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7431]				Selection of the signal source for the analog input signals of the ”Speed” function block	
1	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Speed setpoint (SPEED-NSET.NSet)	📖 326
2	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Additional speed setpoint (SPEED-NSET.NAdd)	
3	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Lower torque limit (SPEED-MCTRL.negLoMLim)	📖 332
4	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Upper torque limit (SPEED-MCTRL.HiMLim)	
5	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Additional torque setpoint (SPEED-MCTRL.MAdd)	
6	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual field weakening (SPEED-MCTRL.FldWeak)	
7	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the proportional gain of the speed controller (SPEED-MCTRL.NAdapt)	
8	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the Integral-action component of the speed controller (SPEED-MCTRL.ISet)	
9	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Speed threshold for the motor holding brake (SPEED-BRK.SpeedThreshold)	📖 340
10	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Direction of torque created by the drive against the motor holding brake (SPEED-BRK.Sign)	
11	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the phase controller (SPEED-MCTRL.PAdapt)	📖 332
12	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Limit value for influencing the phase controller (SPEED-MCTRL.PosLim)	
13	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Lower speed limit for speed limitation (SPEED-MCTRL.NStartMLim)	
			For possible signals see ”selection list - analog signals”		📖 437
C7450	Speed-phi			Display of the setpoint for the phase controller in the ”Speed” function block (speed controlSPEED-MCTRL.PosSet)	📖 332
			-2147483647 {1} 2147483647		
[C7451]	SpeedIn-phi	1000		Setpoint for the phase controller in the ”Speed” function block (SPEED-MCTRL.PosSet)	📖 332
			FIXED 0 (not assigned)		
			For possible signals see ”selection list - phase signals”		📖 440

12.27.1 Changing the direction of rotation

By means of the inputs SPEED-RLQ.Cw (C7411/1) and SPEED-RLQ.CCw (C7411/2) of the function block ”Speed”, two functions are carried out:

- Changing the direction of rotation
- Set quick stop (QSP)

Note!

Both inputs only have an effect on the speed setpoint.

Stop!

The speed and direction of torque have to be selected according to the application.

Signal name		Response	
SPEED-RLQ.CW	SPEED-RLQ.CCW	Rotation	Quick stop (QSP)
0	0	None	Yes
1	0	To the right	No
0	1	To the left	No
1	1	No change	No

12.27.2 Setpoint processing

12.27.2.1 Selecting the source for the speed setpoint

The function block "Speed" is supplied with the speed setpoint via the input SPEED-NSET.NSet (C7431/1). The valid values are within the decimal range ±32767. The speed setpoint is conditioned by a ramp function generator and special controllers.

In C0039/1 ... 15, 15 fixed setpoints (JOG) can be stored. The values can be stored independent of the direction of rotation, since the direction of rotation can also be changed with activated JOG values.

The fixed setpoints can be activated via the inputs SPEED-NSET.Jogx (C7411/3 ... /6). When the fixed setpoints are active, the input SPEED-NSET.NSet is switched off.

Signal name				Source for the speed setpoint
SPEED-Nset.Jog8	SPEED-NSET.Jog4	SPEED-Nset.Jog2	SPEED-Nset.Jog1	
0	0	0	0	SPEED-NSET.NSet
0	0	0	1	C0039/1
0	0	1	0	C0039/2
0	0	1	1	C0039/3
0	1	0	0	C0039/4
0	1	0	1	C0039/5
0	1	1	0	C0039/6
0	1	1	1	C0039/7
1	0	0	0	C0039/8
1	0	0	1	C0039/9
1	0	1	0	C0039/10
1	0	1	1	C0039/11
1	1	0	0	C0039/12
1	1	0	1	C0039/13
1	1	1	0	C0039/14
1	1	1	1	C0039/15

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0039						15 fixed setpoints Can be retrieved via digital signals SPEED-NSET.Jogx.	📖 326
1	JOG SET-VALUE	0.00	-199.99	{0.01 %}	199.99	Relating to n_{max} (C0011)	
2	JOG SET-VALUE	0.00					
...	JOG SET-VALUE	0.00					
14	JOG SET-VALUE	0.00					
15	JOG SET-VALUE	0.00					

12.27.2.2 Setting acceleration and deceleration times

The speed setpoint is led via a ramp function generator. This enables input steps to be converted into a ramp.

The acceleration time (T_{ir}) and deceleration time (T_{if}) refer to a change in speed from ”0” to n_{max} (0 ... 100%). The times to be set are calculated according to the formulae:

Acceleration time (code C0012)	Deceleration time (code C0013)
$T_{ir} = t_{ir} \cdot \frac{100\ \%}{w2 - w1}$	$T_{if} = t_{if} \cdot \frac{100\ \%}{w2 - w1}$

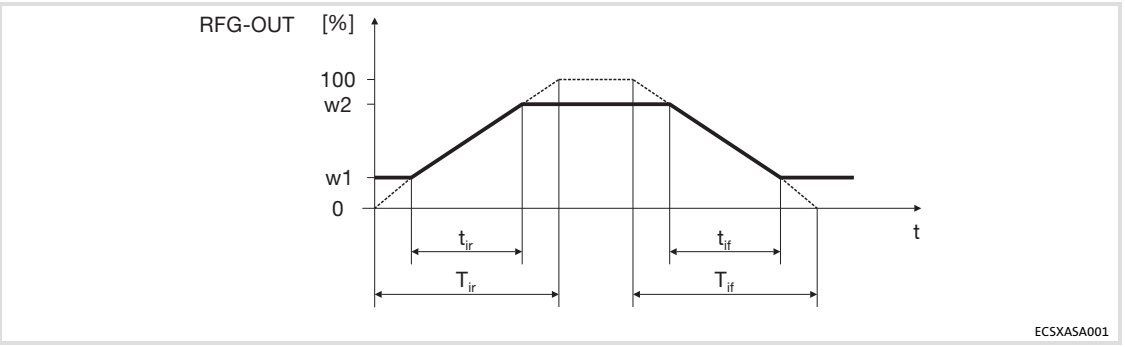


Fig. 12-30 Diagram for acceleration and deceleration time

In C0101/1 ... 15 and C0103/1 ... 15, 15 time pairs (T_i times) can be stored additionally. Via the inputs SPEED-NSET.TIx (C7411/13 ... C7411/16) the T_i times can be activated:

Signal name				Source for active time pair	
SPEED-NSET.TI8	SPEED-NSET.TI4	SPEED-NSET.TI2	SPEED-NSET.TI1	Acceleration time	Deceleration time
0	0	0	0	C0012	C0013
0	0	0	1	C0101/1	C0103/1
0	0	1	0	C0101/2	C0103/2
0	0	1	1	C0101/3	C0103/3
0	1	0	0	C0101/4	C0103/4
0	1	0	1	C0101/5	C0103/5
0	1	1	0	C0101/6	C0103/6
0	1	1	1	C0101/7	C0103/7
1	0	0	0	C0101/8	C0103/8
1	0	0	1	C0101/9	C0103/9
1	0	1	0	C0101/10	C0103/10
1	0	1	1	C0101/11	C0103/11
1	1	0	0	C0101/12	C0103/12
1	1	0	1	C0101/13	C0103/13
1	1	1	0	C0101/14	C0103/14
1	1	1	1	C0101/15	C0103/15

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0012	TIR (ACC)	0.000				Acceleration time for the • speed setpoint (for ”speed control”) • torque setpoint (for ”torque control”)	📖 327
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0013	TIF (DEC)	0.000				Deceleration time for the • speed setpoint (for ”speed control”) • torque setpoint (for ”torque control”)	📖 327
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0101						15 additional acceleration times for the speed setpoint. Can be retrieved via digital signals SPEED-NSET.TIx.	📖 327
1	add Tir	0.000	0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
2	add Tir	0.000					
...	add Tir	0.000					
14	add Tir	0.000					
15	add Tir	0.000					
C0103	add Tif					15 additional deceleration times for the speed setpoint. Can be retrieved via digital signals SPEED-NSET.TIx.	📖 327
1	add Tif	0.000	0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
2	add Tif	0.000					
...		0.000					
14	add Tif	0.000					
15	add Tif	0.000					

12.27.2.3 Influencing the ramp function generator

- If the controller is inhibited, the ramp function generator accepts the actual speed and passes it to the downstream function. This function has priority over all other functions.
- If the input SPEED-NSET.RfgStop = TRUE (C7411/9), the ramp function generator is stopped. Changes of the input of the ramp function generator have no effect on the output signal.
- If the input SPEED-NSET.Rfg0 = TRUE (C7411/7) the ramp function generator reaches zero along the deceleration ramp.
- The threshold in C0241 specifies when the message ”Setpoint reached” is output.

  On the ramp function generator for the speed setpoint, the following applies: input signal = output signal

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0241	NSET RFG I = O	1.00				Threshold for message ”Setpoint reached” On the ramp function generator for ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”) input signal = output signal.	📖 329 📖 352
			0.00	{0.01 %}	100.00	100 % = n_{max}	

12.27.2.4 Changing the characteristic of the ramp function generator

You can select two different characteristics for the ramp function generator of the speed setpoint via C0134:

- A linear characteristic for all acceleration processes that are required for a constant acceleration.
- S-shaped characteristic for all acceleration processes that require a jerk-free acceleration.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0134	RFG charac	0				Characteristic of the ramp function generator for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 330
			1	Linear		Ramp function generator operates linearly.	
			2	S-shaped		Ramp function generator operates without jerk (S-shaped).	
C0182	Ti S-shaped	20.00				Form of the S-curve for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”) of the ramp function generator (C0134 = 1)	📖 330
			0.01	{0.01 s}	50.00	The higher the value, the bigger the S-rounding.	

12.27.2.5 Connecting an additional setpoint

An additional setpoint can be connected via the input SPEED-NSET.NAdd (C7431/2). The additional setpoint is inverted by an analog switch. Then, a ramp function generator follows before the additional setpoint is connected to the speed setpoint in the arithmetic block. The additional setpoint can be used, for instance, as a correction signal for grinding machines for controlling a constant circumferential speed when the grinding wheel diameter decreases.

If you want to use the additional setpoint, set C0190 to the desired arithmetical connection. In the Lenze setting, the additional setpoint is switched off.

Value in C0190	Output signal SPEED-NSET.NOut =	Values used from the codes
0	SPEED-NSET.NSet	C7431/1
1	SPEED-NSET.NSet + SPEED-NSET.NAdd	C7431/1 + C7431/2
2	SPEED-NSET.NSet - SPEED-NSET.NAdd	C7431/1 - C7431/2
3	SPEED-NSET.NSet x SPEED-NSET.NAdd	C7431/1 x C7431/2
4	SPEED-NSET.NSet / I SPEED-NSET.NAdd I	$\frac{C7431/1}{\lvert C7431/2 \rvert}$
5	SPEED-NSET.NSet / (100 - SPEED-NSET.NAdd)	$\frac{C7431/1}{100 - C7431/2}$

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0190	NSET ARIT	0				Linking of speed setpoint (NSet) and additional setpoint (NAdd)	📖 331
			0	OUT = NAdd		Additional setpoint is not considered.	
			1	NSet + NAdd		Additional setpoint is added to speed setpoint.	
			2	NSET-NADD		Additional setpoint is subtracted from speed setpoint.	
			3	NSet x NAdd		Additional setpoint is multiplied by speed setpoint.	
			4	NSet / NAdd		Speed setpoint is divided by additional setpoint.	
			5	NSet / (100 - NAdd)		Speed setpoint is divided by (100 - additional setpoint).	
C0220	NSET Tir add	0.000				Acceleration time for the additional setpoint	📖 331
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0022)	
C0221	NSET Tif add	0.000				Deceleration time for the additional setpoint	📖 331
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	

12.27.3 Setting of motor control

12.27.3.1 Torque setpoint/additional setpoint

SPEED-MCTRL.MAdd (C7431/5) serves as a torque setpoint or additional torque setpoint, depending on the setting of SPEED-MCTRL.NMSwt (C7411/11). The controller calculates the maximum possible torque from the motor parameters. You can read it off C0057.

- Torque setpointtorque setpoint"#
  - If SPEED-MCTRL.NMSwt = TRUE, the torque control is active.
  - SPEED-MCTRL.MAdd acts as torque setpoint.
  - The speed controllers carry out a monitoring function.
  - The torque setpoint is defined in [%] of the maximum possible torque.
  - Negative values cause a torque in CCW rotation of the motor.
  - Positive values cause a torque in CW rotation of the motor.
- Additional torque setpoint "additional torque setpoint"#
  - If SPEED-MCTRL.NMSwt = FALSE, the speed control is active.
  - SPEED-MCTRL.MAdd is added to the output of the speed controller.
  - The limits determined by the torque limitation SPEED-MCTRL.NegLoMLim (C7431/3) and SPEED-MCTRL.HiMLim (C7431/4) are not exceeded.
  - The additional torque setpoint is used e. g. for friction compensation or increase in acceleration (dv/dt).

12.27.3.2 Torque limitation

An external torque limitation can be set via SPEED-MCTRL.NegLoMLim (C7431/3) and SPEED-MCTRL.HiMLim (C7431/4). This enables you to select different torques for the quadrants "driving" and "braking".

- SPEED-MCTRL.HiMLim is the upper limit in [%] of the maximum possible torque.
- SPEED-MCTRL.LoMLim is the lower limit [%] of the maximum possible torque.

The maximum possible torque depends on the motor parameters (C0057).

Note!

In case of quick stop (QSP), the torque limitation is switched to an inactive state, i. e. the operation runs with ±100 %.

12.27.3.3 Maximum speed

The maximum speed N_{max} speed is set via C0011. It is the reference value for:

- the absolute and relative setpoint selection for acceleration and deceleration times
- the upper and lower speed limit.
- n_{max} = 100 % = 16384 (data type ”Integer”).

12.27.3.4 Adjust speed controller

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not ”noisy”.
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

Parameter setting

- Set the proportional gain (V_{pn}) via C0070:
  - Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
  - Increase C0070 until the drive becomes instable (pay attention to engine noises).
  - Reduce C0070 until the drive runs stable again.
  - Reduce C0070 to approx. half the value.
- In the PLC program, the variable SPEED-MCTRL.NAdapt (C7431/7) serves to change the proportional gain (V_{pn}):
  - V_{pn} = SPEED-MCTRL.NAdapt [%] x C0070
  - If SPEED-MCTRL.NAdapt is not assigned, the following applies: V_{pn} = 100 %, C0070 = C0070

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 154
			0.00	{ 0.01}	127.99		

- The reset time (T_{nn}) is set via C0071:
  - Reduce C0071 until the drive becomes instable (pay attention to engine noises).
  - Increase C0071 until the drive runs stable again.
  - Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 154
			1.0	{0.5 ms}	6000.0		

- The derivative gain (T_{dn}) is set via C0072:
  - Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 154
			0.0	{0.1 ms}	32.0		

Signal limitation

- If the drive operates with the maximum torque, the speed controller operates within the limitation.
- The drive cannot follow the speed setpoint.
- The output SPEED-MCTRL.MMax is set to TRUE.
- The output TORQUE-MCTRL.MMax is set to TRUE.

Set the I component

For selecting torque starting values the integral component of the speed controller can be set externally (e.g. when using the brake control).

- **In case of speed control (”Speed”):**

  SPEED-MCTRL.ILoad = TRUE (C7411/12):

  – The speed controller accepts the value applied at SPEED-MCTRL.ISet (C7431/8) into its integral component.

  – The value at SPEED-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

  SPEED-MCTRL.ILoad = FALSE (C7411/12):

  – The function is switched off.

- **In case of torque control (”Torque”):**

  TORQUE-MCTRL.ILoad = TRUE (C7511/7):

  – The speed controller accepts the value applied at TORQUE-MCTRL.ISet (C7531/8) into its integral component.

  – The value at TORQUE-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

  TORQUE-MCTRL.ILoad = FALSE (C7511/7):

  – The function is switched off.

12.27.3.5 Torque control with speed limitation

If SPEED-MCTRL.NMSwt = TRUE (C7411/11), this function is activated. For the speed limitation, a second speed controller (auxiliary speed controller) is connected. SPEED-MCTRL.MAdd (C7431/5) operates as a bipolar torque setpoint. ”torque control with speed limitation”#

- The speed controller 1 is used to make up the upper speed limit.
  - The upper speed limit is defined at SPEED-NSET.NSet (C7431/8) in [%] by N_{max} (positive sign for CW rotation).
- The speed controller 2 (auxiliary speed controller) is used to make up the lower speed limit.
  - The lower speed limit is defined at SPEED-MCTRL.NStartMLim (C7431/13) in [%] by N_{max} (negative sign for CCW rotation).
- N_{max} is selected via C0011.

Stop!

The upper speed limit is only to be used for CW rotation (positive values) and the lower speed limit only for CCW rotation (negative values); Otherwise the drive may accelerate in an uncontrolled way.

Note!

The value at SPEED-MCTRL.NegLoMLim (C7431/3) is negated in the ”Speed” function block.

12.27.3.6 Phase controller

The phase controller is required, for instance, to achieve a phase-synchronous operation and a drift-free standstill.

Parameter setting:

1. Assign SPEED-MCTRL.PosSet (C7451) with a signal source, which provides the phase difference between set angle and actual angle.

> **Note!**
> For the application "Speed and Torque", the phase difference has to be generated externally (e .g. in a master control) and transferred via bus system.

2. Select a value > 0 at SPEED-MCTRL.PosLim (C7431/12).
3. Set SPEED-MCTRL.PosOn = TRUE (C7431/19) .
4. Set a highest possible proportional gain ($V_{pn)}$ of the speed controller in C0070.
   In the PLC program, the variable SPEED-MCTRL.NAdapt (C7431/7) serves to change the proportional gain (V_{pn}):
   – V_{pn} = SPEED-MCTRL.NAdapt [%] x C0070
   – If SPEED-MCTRL.NAdapt is not assigned, the following applies: V_{pn} = 100 %, C0070 = C0070
5. Set the gain of the phase controller > 0 via C0254.
   Increase C0254 during operation until the drive has the required control mode.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	📖 337
			0.0000	{ 0.0001}	3.9999		

Phase controller influence

The output of the angle controller is added to the speed setpoint.

- When the actual angle is lagging, the drive is accelerated.
- When the actual angle is leading, the drive is decelerated until the required angular synchronism has been reached.

The influence of the phase controller consists of:

- phase difference multiplied by the proportional gain V_p (C0254).
- Influence via an analog signal at SPEED-MCTRL.NAdapt (C7431/7).
  V_p = C0254 x SPEED-MCTRL.NAdapt / 16384
- Limitation of the phase controller output
  – The output of the angle controller is limited to the value ±SPEED-MCTRL.PosLim (C7431/12).
  – ±SPEED-MCTRL.PosLim limits the maximum speed-up of the drive with great angular displacements.

12.27.3.7 Quick stop (QSP)

By means of the QSP function, the drive can be stopped within an adujstable time, irrespective of the setpoint selection. The QSP function is active if:

- SPEED-QSP.Set1 (C7411/17) = TRUE

  or

- SPEED-QSP.Set2 (C7411/18) = TRUE

Function:

If a torque control has been selected, it is switched inactive. The drive is guided by the speed controller. The speed is reduced to zero within the deceleration time set under C0105. The torque limitation SPEED-MCTRL.NegLoMLim (C7431/3) and SPEED-MCTRL.HiMLim (C7431/4) is switched inactive, i. e. the operation runs with ±100 %. The phase controller is switched active, achieving a drift-free standstill. If the rotor position is actively displaced, the drive creates a torque against the displacement if

- C0254 $\neq$ 0

  or

- SPEED-MCTRL.PosLim (C7431/12) > 0 %

12.27.3.8 Field weakening

Stop!

The available torque is reduced by the field weakening.

The motor is operated in the field weakening range if

- the output voltage of the controller exceeds the rated motor voltage (C0090).
- The controller is no longer able to increase the output voltage with rising speed due to the mains voltage or DC-bus voltage.

Note!

An optimal machine operation in the field weakening range requires a correct setting of the field controller and field weakening controller (📖 157).

Manual field weakening

Stop!

If the field is weakened manually (SPEED-MCTRL.FldWeak (C7431/6) < 100 %), the drive cannot create the maximum torque.

A manual field weakening is possible via SPEED-MCTRL.FldWeak (7431/6).

- For a maximum excitation, SPEED-MCTRL.FldWeak must be triggered with +100 % (= 16384).
- If SPEED-MCTRL.FldWeak is not assigned (free), the field weakening automatically amounts to +100 %.

12.27.4 Holding brake control

By means of this function, you can control a motor holding brake. Possible applications are:

- Hoists
- Traverse drives
- Drives with active loads

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0195	BRK T act	99.9				Closing time of the motor holding brake	340 360
			0.0	{0.1 sec}	99.9	During the time set the drive continues to generate a torque. After the set time is expired, the status "mechanical brake closed" is reached.	102
C0196	BRK T rel	0.0				Opening time of the motor holding brake	340 360
			0.0	{0.1 sec}	60.0	During the time set the drive can generate the torque set under C0244 against the holding brake. After the set time is expired, the status "mechanical brake opened" is reached.	102
C0244	BRK M set	0.00				Holding torque of the drive against the motor holding brake	340 360
			-199.99	{0.01 %}	199.99	Referring to M_{max} (C0057). During the time set in C0196 the drive generates the set torque against the holding brake.	102

12.27.4.1 Closing holding brake

A HIGH level on the input SPEED-BRK.SetBrake (C7411/10 = TRUE) activates the function. At the same time, the output SPEED-BRK.SetQSP is set to HIGH. This signal can be used to brake the drive to standstill via a deceleration ramp (speed = 0).

If the setpoint speed falls below the value set at the input SPEED-BRK.SpeedThreshold (C7431/9), the output SPEED-BRK.Out is set to HIGH.

Note!

For a fail-safe design this signal must be inverted at the output (e. g. via C0118).

After the brake closing time set C0195 has lapsed, the output SPEED-BRK.SetCInh switches to TRUE. By means of this signal you can for example activate controller inhibit (device-internal on the function block DCTRL). The setting of the brake closing time is required because the brake is not immediately activated at SPEED-BRK.Out = TRUE (the drive has to provide another holding torque for the set time).

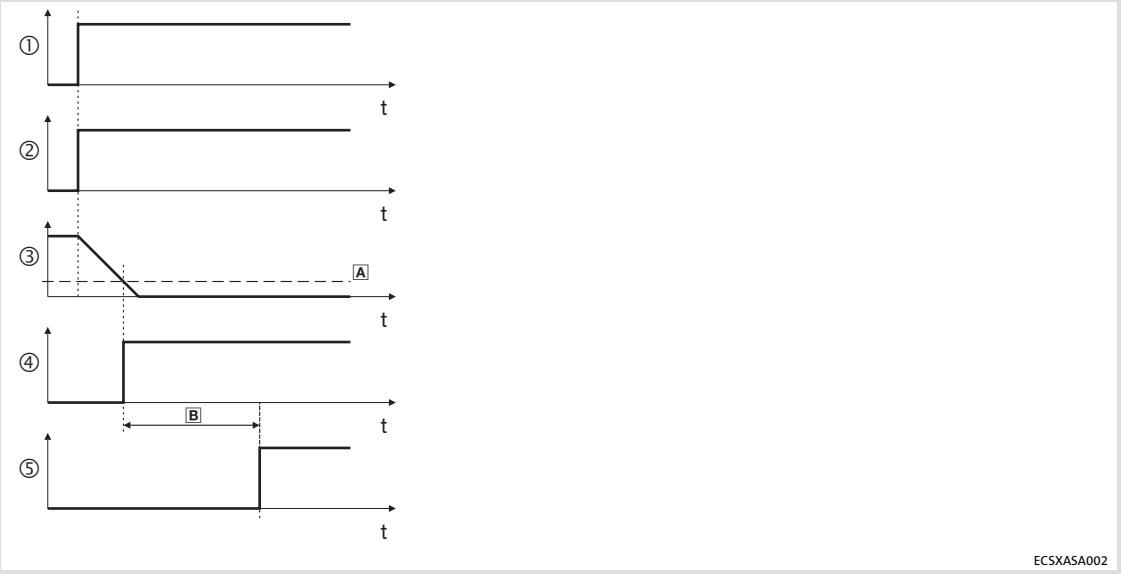


Fig. 12-31 Signal characteristic - closing of holding brake

① SPEED-BRK.SetBrake
② SPEED-BRK.SetQSP
③ SPEED-BRK.MSetOut
④ SPEED-BRK.Out
⑤ SPEED-BRK.SetCInh
A SPEED-BRK.SpeedThreshold
B Brake closing time (C0195)

12.27.4.2 Opening holding brake

A LOW level on the input SPEED-BRK.SetBrake (7411/10 = FALSE) immediately sets the output SPEED-BRK.SetCInh to LOW (controller inhibit is deactivated). At the same time, the output SPEED-BRK.MStore is set to HIGH. This signal can be used to let the drive create a defined torque against the brake. The drive takes over the torque while the brake is released. The signal is only reset after the brake opening time set in C0196 has lapsed.

After the brake opening time has lapsed, the output SPEED-BRK.SetQSP is reset to LOW. This signal serves to e. g. release the setpoint integrator after the brake opening time has expired.

If an actual speed value higher than the value at SPEED-BRK.SpeedThreshold (C7431/9) is recognised before the brake opening time has expired, the signals SPEED-BRK.SetQSP and SPEED-BRK.MStore are immediately reset to LOW. Then, the drive can immediately pass over to the speed-controlled operation.

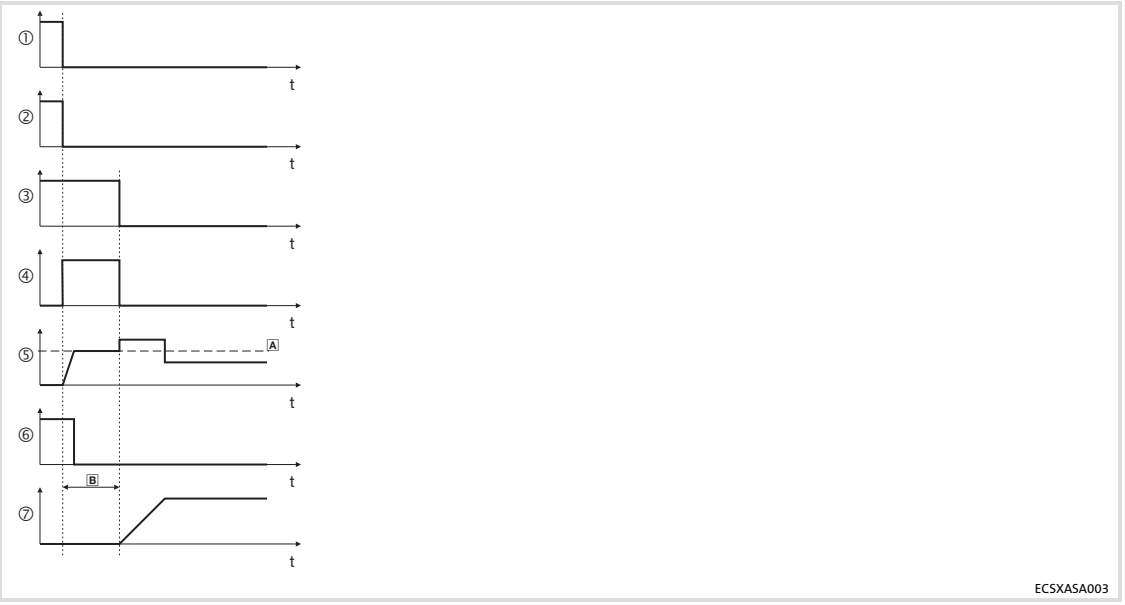


Fig. 12-32 Signal characteristic - opening of holding brake

① SPEED-BRK.SetBrake
② SPEED-BRK.SetCInh
③ SPEED-BRK.SetQSP
④ SPEED-BRK.MStore
⑤ SPEED-MCTRL.MAct
⑥ SPEED-BRK.Out
⑦ SPEED-BRK.MSetOut
A SPEED-MCTRL.MAct
B Brake opening time (C0196)

12.28 Torque (torque control)

Function

Completely wired torque control with the subfunctions:

- Torque control with speed limitation (📖 349)
- Selectable direction of rotation (📖 350)
- Setpoint conditioning (📖 351)
- Motor control (📖 354)
- Brake control (📖 360)
- Monitoring functions (📖 192)

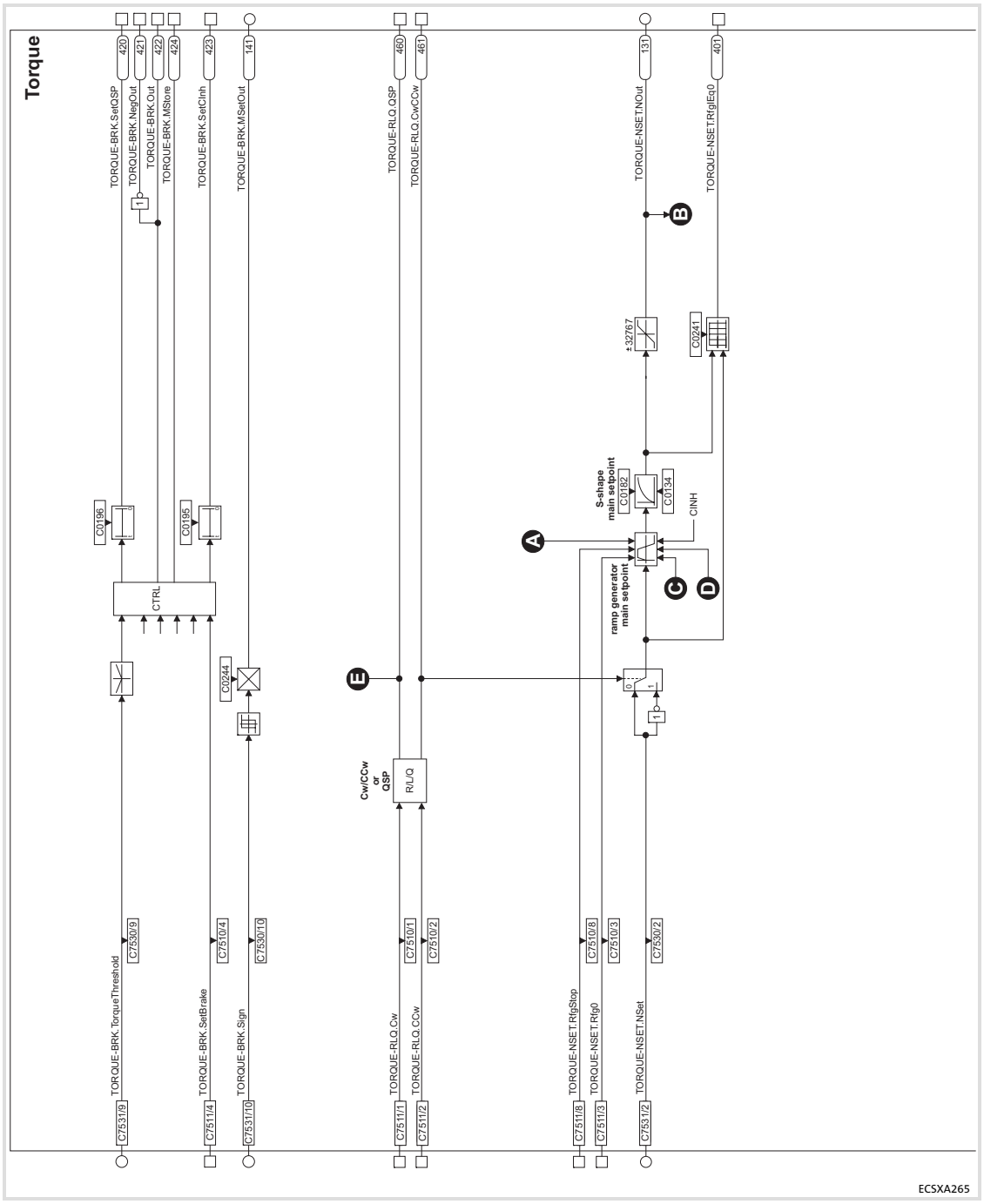


Fig. 12-33 ”Torque” function block (torque control) - Page 1 of 2

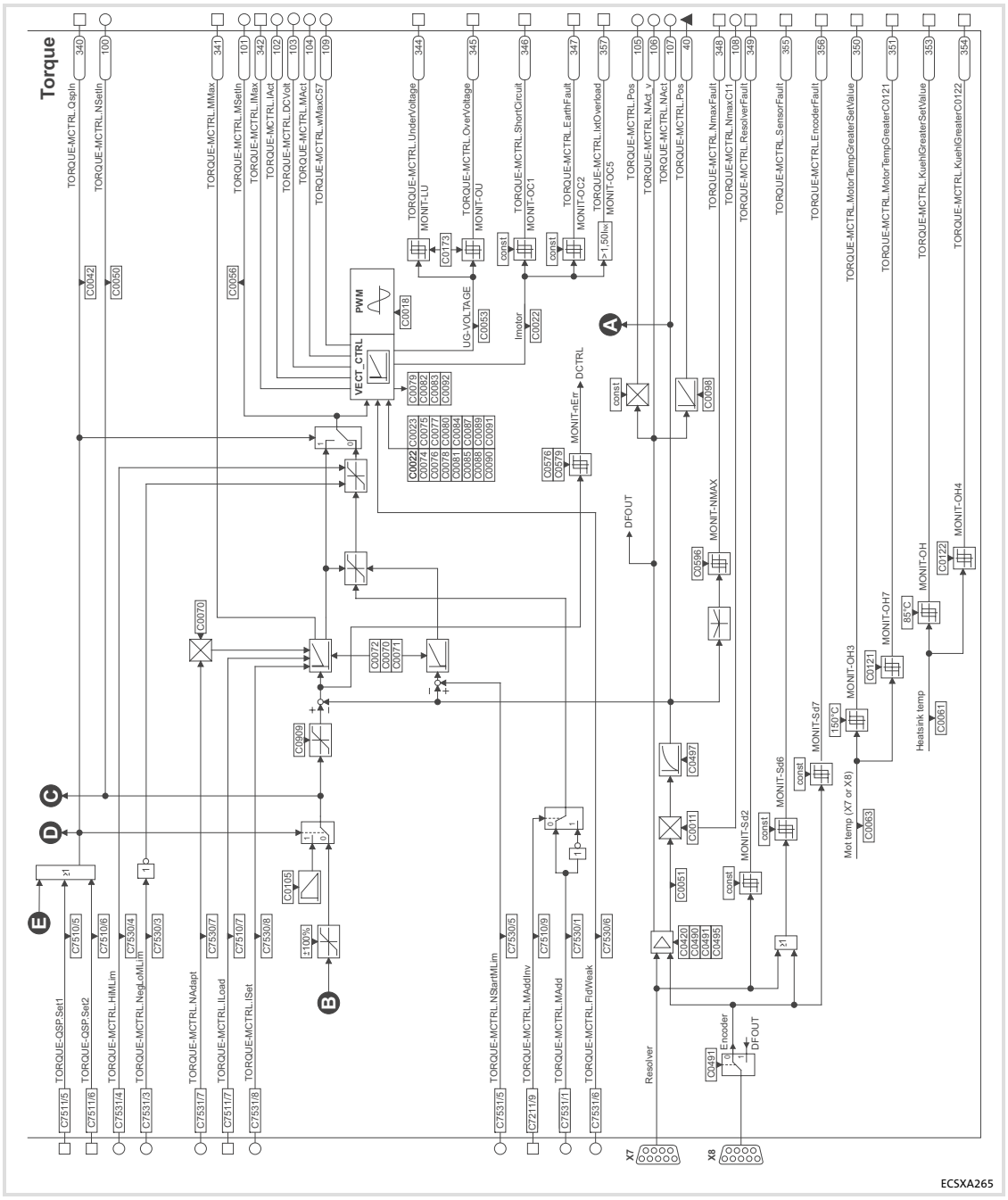


Fig. 12-34 ”Torque” function block (torque control) - Page 2 of 2

Codes

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7510				Display of the current signal states on the digital inputs of the ”Torque” function block	
			0 (= FALSE) 1 (= TRUE)		
1	TorqueIn-dig			CW rotation (TORQUE-RLQ.Cw)	📖 350
2	TorqueIn-dig			CCW rotation (TORQUE-RLQ.CCw)	
3	TorqueIn-dig			Setting of the torque setpoint integrator to ”0” along the adjusted ramps (TORQUE-NSET.Rfg0)	📖 351
4	TorqueIn-dig			Activation of the motor holding brake (TORQUE-BRK.SetBrake)	📖 360
5	TorqueIn-dig			Setting of quick stop (TORQUE-QSP.Set1)	📖 354
6	TorqueIn-dig			Setting of quick stop (TORQUE-QSP.Set2)	
7	TorqueIn-dig			Source for the integral-action component of the controller (TORQUE-MCTRL.ILoad)	
8	TorqueIn-dig			Keeping (freezing) the torque setpoint integrator to the current value (TORQUE-NSET.RfgStop)	
9	TorqueIn-dig			Inversion of additional torque setpoint (TORQUE-MAddInv)	
[C7511]				Selection of the signal source for the digital input signals of the ”Torque” function block	
1	TorqueIn-dig	1000	0 (FALSE, not assigned)	CW rotation (TORQUE-RLQ.Cw)	📖 350
2	TorqueIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (TORQUE-RLQ.CCw)	
3	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of the torque setpoint integrator to 0 along the adjusted ramps (TORQUE-NSET.Rfg0)	📖 351
4	TorqueIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (TORQUE-BRK.SetBrake)	📖 360
5	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set1)	📖 354
6	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set2)	
7	TorqueIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the controller (TORQUE-MCTRL.ILoad)	
8	TorqueIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the torque setpoint integrator to the current value (TORQUE-NSET.RfgStop)	
9	TorqueIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (TORQUE-MAddInv)	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C7530						Display of the current signal states on the analog input of the "Torque" function block	
			-32768 (= -100 %)	{1}	32767 (= 100 %)		
1	TorqueIn-anl					Torque setpoint (SPEED-MCTRL.MAdd)	📖 354
2	TorqueIn-anl					Setpoint for the upper limit of speed limitation (TORQUE-NSET.NSet)	📖 351
3	TorqueIn-anl					Lower torque limit (TORQUE-MCTRL.negLoMLim)	📖 354
4	TorqueIn-anl					Upper torque limit (TORQUE-MCTRL.HiMLim)	
5	TorqueIn-anl					Setpoint for the lower limit of speed limitation (TORQUE-MCTRL.NStartMLim)	
6	TorqueIn-anl					Manual field weakening (TORQUE-MCTRL.FldWeak)	
7	TorqueIn-anl					Manual adaptation of the proportional gain of the speed controller (TORQUE-MCTRL.NAdapt)	
8	TorqueIn-anl					Manual adaptation of the integral-action component of the speed controller (TORQUE-MCTRL.ISet)	
9	TorqueIn-anl					Torque threshold for the motor holding brake (TORQUE-BRK.TorqueThreshold)	📖 360
10	TorqueIn-anl					Direction of torque created by the drive against the motor holding brake (TORQUE-BRK.Sign)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7531]				Selection of the signal source for the analog input signals of the ”Torque” function block	
1	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Torque setpoint (SPEED-MCTRL.MAdd)	📖 354
2	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Setpoint for the upper limit of speed limitation (TORQUE-NSET.NSet)	📖 351
3	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Lower torque limit (TORQUE-MCTRL.negLoMLim)	📖 354
4	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Upper torque limit (TORQUE-MCTRL.HiMLim)	
5	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Setpoint for the lower limit of speed limitation (TORQUE-MCTRL.NStartMLim)	
6	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual field weakening (TORQUE-MCTRL.FldWeak)	
7	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the proportional gain of the speed controller (TORQUE-MCTRL.NAdapt)	
8	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the Integral-action component of the speed controller (TORQUE-MCTRL.ISet)	
9	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Torque threshold for the motor holding brake (TORQUE-BRK.TorqueThreshold)	📖 360
10	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Direction of torque created by the drive against the motor holding brake (TORQUE-BRK.Sign)	
			For possible signals see ”selection list - analog signals”		📖 437

12.28.1 Torque control with speed limitation

The ”torque control with speed limitation” is the basic function of the ”Torque” function block. Thereby, only the current control loop (torque control loop) is in the axis module. The torque setpoint is generated externally and is defined as a bipolar torque setpoint on TORQUE-MCTRL.MAdd (C7531/1). Within the external setpoint source, there can possibly be higher-level control loops (speed, position, pressure, ...). ”torque control with speed limitation”#

By means of the specification of speed limits (speed limitation in the ”Torque” function block it is provided that the drive does not operate in an uncontrolled manner if the load torque suddenly fails, e. g. due to a defect. The speed limits for positive and negative directions of rotations can be altered dynamically. For this purpose, the unused speed controller and a second speed controller (auxiliary speed controller) are used.

- The speed controller 1 is used to make up the upper speed limit.
  - The upper speed limit is defined at TORQUE-NSET.NSet (C7531/8) in [%] by N_{max} (positive sign for CW rotation).
- The speed controller 2 (auxiliary speed controller) is used to make up the lower speed limit.
  - The lower speed limit is defined at TORQUE-MCTRL.NStartMLim (C7531/5) in [%] by N_{max} (negative sign for CCW rotation).
- N_{max} is selected via code C0011.



Stop!

The upper speed limit is only to be used for CW rotation (positive values) and the lower speed limit only for CCW rotation (negative values); otherwise the drive may accelerate in an uncontrolled way.



Note!

The value at TORQUE-MCTRL.NegLoMLim (C7531/3) is negated in the ”Torque” function block.

12.28.2 Changing the direction of rotation

By means of the inputs TORQUE-RLQ.Cw (C7511/1) and TORQUE-RLQ.CCw (C7511/2) of the ”Torque” function block, two functions are carried out: ”changing the direction of rotation”#

- Changing the direction of rotation
- Set quick stop (QSP)

Stop!

The speed and direction of torque have to be selected according to the application.

Note!

Both input signals only have an effect on the torque setpoint path.

Signal name		Response	
TORQUE-RLQ.Cw	TORQUE-RLQ.CCw	Direction of rotation	Quick stop (QSP)
0	0	None	Yes
1	0	To the right	No
0	1	To the left	No
1	1	No change	No

12.28.3 Setpoint processing

12.28.3.1 Selecting the source for the torque setpoint

The ”Torque” function block is supplied with the torque setpoint via the input TORQUE-NSET.NSet (code C7531/2). The valid values are within the decimal range ±32767. The torque setpoint is conditioned by a ramp function generator and special controllers.

12.28.3.2 Setting acceleration and deceleration times

The torque setpoint is led via a ramp function generator. This enables input steps to be converted into a ramp.

The acceleration time (T_{ir}) and deceleration time (T_{if}) refer to a change in speed from ”0” to n_{max} (0 ... 100%). The times to be set are calculated according to the formulae:

Acceleration time (code C0012)	Deceleration time (code C0013)
$T_{ir} = t_{ir} \cdot \frac{100\ \%}{w2 - w1}$	$T_{if} = t_{if} \cdot \frac{100\ \%}{w2 - w1}$

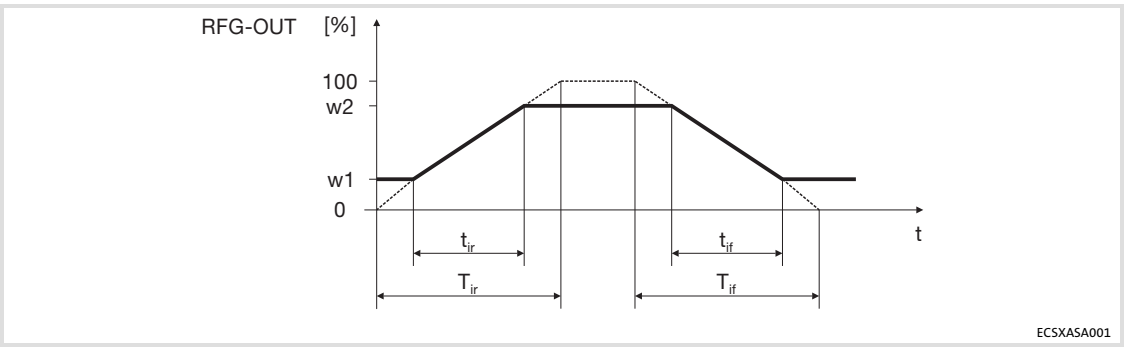


Fig. 12-35 Diagram for acceleration and deceleration time

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0012	TIR (ACC)	0.000			Acceleration time for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 327
			0.000 {0.001 s} 999.999		Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0013	TIF (DEC)	0.000			Deceleration time for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 327
			0.000 {0.001 s} 999.999		Relating to speed variation 0 rpm ... n_{max} (C0011)	

12.28.3.3 Influencing the ramp function generator

- If the controller is inhibited, the ramp function generator accepts the actual speed and passes it to the downstream function. This function has priority over all other functions.
- If the input TORQUE-NSET.RfgStop = TRUE (C7511/8), the ramp function generator is stopped. Changes of the input of the ramp function generator have no effect on the output signal.
- If the input TORQUE-NSET.Rfg0 = TRUE (C7511/3) the ramp function generator reaches zero along the deceleration ramp.
- The threshold in C0241 specifies when the message ”Setpoint reached” is output.

  On the ramp function generator for the torque setpoint, the following applies: input signal = output signal

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0241	NSET RFG I = O	1.00				Threshold for message ”Setpoint reached” On the ramp function generator for ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”) input signal = output signal.	📖 329 📖 352
			0.00	{0.01 %}	100.00	100 % = n_{max}	

12.28.3.4 Changing the characteristic of the ramp function generator

You can select two different characteristics for the ramp function generator via C0134:

- A linear characteristic for all acceleration processes that are required for a constant acceleration.
- S-shaped characteristic for all acceleration processes that require a jerk-free acceleration.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0134	RFG charac	0				Characteristic of the ramp function generator for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 330
			1	Linear		Ramp function generator operates linearly.	
			2	S-shaped		Ramp function generator operates without jerk (S-shaped).	
C0182	Ti S-shaped	20.00				Form of the S-curve for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”) of the ramp function generator (C0134 = 1)	📖 330
			0.01	{0.01 s}	50.00	The higher the value, the bigger the S-rounding.	

12.28.4 Setting of motor control

12.28.4.1 Torque setpoint

- The maximum possible torque is calculated from the motor parameters by the controller. It can be read in C0057.
- Torque setpoint "torque setpoint"#
  - TORQUE-MCTRL.MAdd (C7531/1) acts as a torque setpoint.
  - The speed controllers carry out a monitoring function.
  - The torque setpoint is defined in [%] of the maximum possible torque.
  - Negative values cause a torque in CCW rotation of the motor.
  - Positive values cause a torque in CW rotation of the motor.

12.28.4.2 Torque limitation

An external torque limitation can be set via TORQUE-MCTRL.NegLoMLim (C7531/3) and TORQUE-MCTRL.HiMLim (C7531/4). This enables you to select different torques for the quadrants "driving" and "braking".

- TORQUE-MCTRL.HiMLim is the limit in the positive direction in [%] of the maximum possible torque.
- TORQUE-MCTRL.HoMLim is the limit in the negative direction in [%] of the maximum possible torque.

The maximum possible torque (C0057) depends on the motor parameters (C0022, C0081, C0087, C0088).

Note!

In case of quick stop (QSP), the torque limitation is switched to an inactive state, i. e. the operation runs with ±100 %.

12.28.4.3 Maximum speed

The maximum speed N_{max} speed is set via C0011. It is the reference value for:

- The absolute and relative setpoint selection for the acceleration and deceleration times.
- The upper and lower speed limit.
- n_{max} = 100 % = 16384 (data type ”Integer”).

12.28.4.4 Adjust speed controller

The speed controller of the ECS is designed as an ideal PID controller.

Conditions for the speed controller adjustment:

- The speed controller can only be set correctly when the system constellation has been completed.
- The current controller is set correctly (given with a Lenze motor and setting via motor data input assistant in the GDC) .
- The PE connection of the axis module is sufficient so that the actual values are not ”noisy”.
- There are as few as possible elasticity and backlash between drive and load.
- The maximum current C0022 and the maximum speed C0011 are set to the values required for the operation. Due to the scaling of the input and output variables of the speed controller, C0011 and C0022 have an impact on the controller settings.
- The time constant for the actual speed value filter C0497 is set to the required value (usually remains in default setting).

Parameter setting

- Set the proportional gain (V_{pn}) via C0070:
  - Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
  - Increase C0070 until the drive becomes instable (pay attention to engine noises).
  - Reduce C0070 until the drive runs stable again.
  - Reduce C0070 to approx. half the value.
- In the PLC program, the variable TORQUE-MCTRL.NAdapt (C7531/7) serves to change the proportional gain (V_{pn}):
  - V_{pn} = TORQUE-MCTRL.NAdapt [%] x C0070
  - If TORQUE-MCTRL.NAdapt is not assigned, the following applies: V_{pn} = 100 %, C0070 = C0070.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 154
			0.00	{0.01}	127.99		

- The reset time (T_{nn}) is set via C0071:
  - Reduce C0071 until the drive becomes instable (pay attention to engine noises).
  - Increase C0071 until the drive runs stable again.
  - Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 154
			1.0	{0.5 ms}	6000.0		

- The derivative gain (T_{dn}) is set via C0072:
  - Increase C0072 during operation until an optimal control mode is reached, although the D component is mostly not used in praxis (C0072=0).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 154
			0.0	{0.1 ms}	32.0		

Signal limitation

- If the drive operates with the maximum torque, the speed controller operates within the limitation.
- The drive cannot follow the speed setpoint.
- The output SPEED-MCTRL.MMax is set to TRUE.
- The output TORQUE-MCTRL.MMax is set to TRUE.

Set the I component

For selecting torque starting values the integral component of the speed controller can be set externally (e.g. when using the brake control).

- **In case of speed control (”Speed”):**

  SPEED-MCTRL.ILoad = TRUE (C7411/12):

  – The speed controller accepts the value applied at SPEED-MCTRL.ISet (C7431/8) into its integral component.

  – The value at SPEED-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

  SPEED-MCTRL.ILoad = FALSE (C7411/12):

  – The function is switched off.

- **In case of torque control (”Torque”):**

  TORQUE-MCTRL.ILoad = TRUE (C7511/7):

  – The speed controller accepts the value applied at TORQUE-MCTRL.ISet (C7531/8) into its integral component.

  – The value at TORQUE-MCTRL.ISet (C7431/8) acts as a torque setpoint for the motor control.

  TORQUE-MCTRL.ILoad = FALSE (C7511/7):

  – The function is switched off.

12.28.4.5 Quick stop (QSP)

By means of the QSP function, the drive can be stopped within an adujstable time, irrespective of the setpoint selection. The QSP function is active if:

- Input TORQUE-QSP.Set1 (C7511/5) = TRUE
- Input TORQUE-QSP.Set2 (C7511/6) = TRUE
- Output TORQUE-RLQ.QSP = TRUE

Function:

If a torque control has been selected, it is switched inactive. The drive is guided by the speed controller. The speed is reduced to zero within the deceleration time set under C0105. The torque limitation TORQUE-MCTRL.NegLoMLim (C7531/3) and TORQUE-MCTRL.HiMLim (C7531/4) is switched inactive, i. e. the operation runs with ±100 %. The phase controller is switched active. If the rotor position is actively displaced, the drive creates a torque against the displacement if C0254 is unequal to 0.0

12.28.4.6 Field weakening

Stop!
The available torque is reduced by the field weakening.

The motor is operated in the field weakening range if

- the output voltage of the controller exceeds the rated motor voltage (C0090).
- The controller is no longer able to increase the output voltage with rising speed due to the mains voltage or DC-bus voltage.

Note!
An optimal machine operation in the field weakening range requires a correct setting of the field controller and field weakening controller (📖 157).

Manual field weakening

Stop!
If the field is weakened manually (TORQUE-MCTRL.FldWeak (C7531/6) < 100 %), the drive cannot create the maximum torque.

A manual field weakening is possible via TORQUE-MCTRL.FldWeak (7531/6).

- For a maximum excitation, TORQUE-MCTRL.FldWeak must be triggered with +100 % (= 16384).
- If TORQUE-MCTRL.FldWeak is not assigned (free), the field weakening automatically amounts to +100 %.

12.28.5 Holding brake control

By means of this function, you can control a motor holding brake. Possible applications are:

- Hoists
- Traverse drives
- Drives with active loads

Codes

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0195	BRK T act	99.9				Closing time of the motor holding brake	340 360
			0.0	{0.1 sec}	99.9	During the time set the drive continues to generate a torque. After the set time is expired, the status "mechanical brake closed" is reached.	102
C0196	BRK T rel	0.0				Opening time of the motor holding brake	340 360
			0.0	{0.1 sec}	60.0	During the time set the drive can generate the torque set under C0244 against the holding brake. After the set time is expired, the status "mechanical brake opened" is reached.	102
C0244	BRK M set	0.00				Holding torque of the drive against the motor holding brake	340 360
			-199.99	{0.01 %}	199.99	Referring to M_{max} (C0057). During the time set in C0196 the drive generates the set torque against the holding brake.	102

12.28.5.1 Closing the holding brake

A HIGH level on the input TORQUE-BRK.SetBrake (C7511/4 = TRUE) activates the function. At the same time, the output TORQUE-BRK.SetQSP is set to HIGH. This signal can be used to brake the drive to standstill via a deceleration ramp (speed = 0).

If the setpoint speed falls below the value set at the input TORQUE-BRK.SpeedThreshold (C7531/9), the output TORQUE-BRK.Out is set to HIGH.

Note!

For a fail-safe design this signal must be inverted at the output (e. g. via C0118).

After the brake closing time set C0195 has lapsed, the output TORQUE-BRK.CInh switches to TRUE. By means of this signal you can for example activate controller inhibit (device-internal on the DCTRL function block). The setting of the brake closing time is required because the brake is not immediately activated at TORQUE-BRK.Out = TRUE (the drive has to provide another holding torque for the set time).



Fig. 12-36 Signal characteristic - closing of holding brake

① TORQUE-BRK.SetBrake
② TORQUE-BRK.SetQSP
③ TORQUE-BRK.MSetOut
④ TORQUE-BRK.Out
⑤ TORQUE-BRK.SetCInh
A TORQUE-BRK.TorqueThreshold
B Brake closing time (C0195)

12.28.5.2 Opening the holding brake

A LOW level on the input TORQUE-BRK.SetBrake (C7511/4 = FALSE) immediately sets the output TORQUE-BRK.SetCInh to LOW (controller inhibit is deactivated). At the same time, the output TORQUE-BRK.MStore is set to HIGH. This signal can be used to let the drive create a defined torque against the brake. The drive takes over the torque while the brake is released. The signal is only reset after the brake opening time set in C0196 has lapsed.

After the brake opening time has lapsed, the output TORQUE-BRK.SetQSP is reset to LOW. This signal serves to e. g. release the setpoint integrator after the brake opening time has expired.

If an actual speed value higher than the value at TORQUE-BRK.TorqueThreshold (C7531/9) is recognised before the brake opening time has expired, the signals TORQUE-BRK.SetQSP and TORQUE-BRK.MStore are immediately reset to LOW. Then, the drive can immediately pass over to the speed-controlled operation.

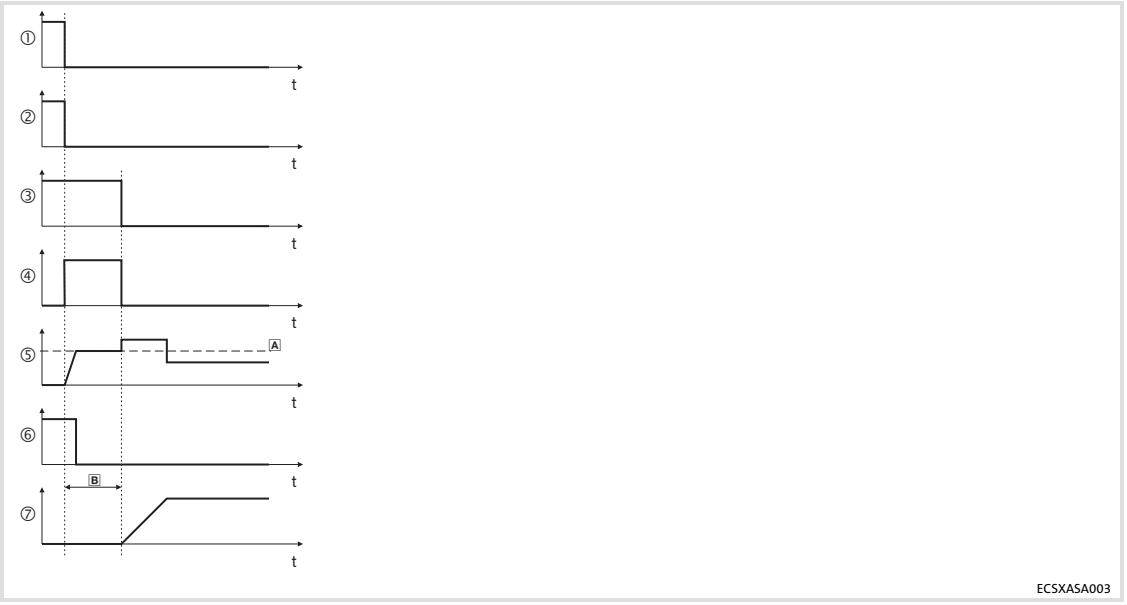


Fig. 12-37 Signal characteristic - opening of holding brake

① TORQUE-BRK.SetBrake
② TORQUE-BRK.SetCInh
③ TORQUE-BRK.SetQSP
④ TORQUE-BRK.MStore
⑤ TORQUE-MCTRL.MAct
⑥ TORQUE-BRK.Out
⑦ TORQUE-BRK.MSetOut
A TORQUE-MCTRL.MAct
B Brake opening time (C0196)

13 Appendix

13.1 Code table

How to read the code table

Column	Abbreviation	Meaning
No.	Cxxxx	Code no. Cxxxx
	1	Subcode 1 of Cxxxx
	2	Subcode 2 of Cxxxx
	Cxxxx	Changed input value of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]	Changed input value of the code or subcode is accepted after pressing SHIFT PRG when the controller is inhibited.
Name		LCD display of the keypad XT EMZ9371BC
Lenze/{Appl.}	x	Lenze setting: ● Value at the time of delivery or after loading the Lenze setting using C0002.
	{xxx...}	Different application initialisation value ● Value at the time of delivery ● After loading the Lenze setting using C0002, the application initialisation value is overwritten with the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	→	The "Important" column contains further information
Selection	1 {%} 99	minimum value {unit} maximum value
IMPORTANT		Short code description

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0002	Par load	0			Load parameter set **The Lenze setting can only be loaded if the controller is inhibited (CINH).**
			0	Load Lenze setting	Load Lenze setting into the RAM and activate it. **Only possible if C2108 = 2 (PLC stopped).**
			1	Load parameter set 1	Load parameter set 1 into the RAM and activate it. **Parameter set 1 is loaded automatically after every mains connection.**
C0003	Par save	0			Non-volatile saving of parameter set
			0	No response	
			1	Save parameter set	
C0004	Op display	56			Selection of XT keypad status display
			1 {Code no.} 9999		The keypad displays the selected code in the operating level, if no status messages from C0183 are active (e. g.: 56 = torque setpoint (C0056))

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0006]	Op mode	1				Operating mode of the motor control ● If the master pulse (via MCTRL: C0911 = 0 or DfIn: C0428 = 0) is used, the voltage supply has to be switched off and then on again when the operating mode is changed. ● Otherwise, the master pulses will not be recognised.	
			1	Servo PM-SM		Servo control of synchronous motors	
			2	Servo ASM		Servo control of asynchronous motors	
C0009	LECOM address	1				Entry of the device address for operation via AIF interface X1	
			1	{1}	99	Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
C0011	Nmax	3000				Maximum speed	
			500	{1 rpm}	16000	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 (CINH)!**	
C0012	TIR (ACC)	0.000				Acceleration time for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 327
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0013	TIF (DEC)	0.000				Deceleration time for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 327
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0017	FCODE (Qmin)	50				Free code for using speed signals (Speed signal FCODE_nC17_a)	📖 309
			-16000	{1 rpm}	16000		
C0018	fchop	2				Switching frequency	
			1	4 kHz sin		4 kHz permanent PWM frequency	
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load	
C0019	Thresh nact = 0	0				Threshold when actual speed value (n_{act}) = 0 is detected. (DCTRL_bNActEq0_b)	
			0	{1 rpm}	16000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0022	Imax current	→				I_{max} limit	
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
C0023	Imax fld.weak	0				Maximum field weakening current for synchronous machines	
			0	{1 %}	100		
C0026						Offset for relative analog signals (AIN)	📖 266 📖 309
1	FCODE(offset)	0,0	-199,99	{0.01 %}	199,99	FCODE_nC26_1_a	
2	FCODE(offset)	0,0				FCODE_nC26_2_a	
C0027						Gain for relative analog signals (AIN)	📖 266 📖 309
1	FCODE(gain)	100,0	-199,99	{0.01 %}	199,99	FCODE_nC27_1_a	
2	FCODE(gain)	100,0				FCODE_nC27_2_a	
C0030	DFOUT const	3				Constant for the digital frequency signal DFOUT_nOut_v on X8 in increments per revolution	📖 304 📖 106 📖 113
			0	256 incr./rev			
			1	512 incr./rev			
			2	1024 incr./rev			
			3	2048 incr./rev			
			4	4096 incr./rev			
			5	8192 incr./rev			
			6	16384 incr./rev			
C0032	FCODE Gearbox	1				Freely configurable code for gearbox factor ? (FCODE_nC32_a)	📖 309
			-32767	{1}	32767		
C0034	Mst current	0				Master voltage/master current on analog input (AIN1_nIn_a)	📖 266
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0037	Set-value rpm	0				Setpoint selection in rpm (FCODE_nC37_a)	📖 309
			-16000	{1 rpm}	16000		
C0039						15 fixed setpoints Can be retrieved via digital signals SPEED-NSET.Jogx.	📖 326
1	JOG SET-VALUE	0.00	-199.99	{0.01 %}	199.99	Relating to n_{max} (C0011)	
2	JOG SET-VALUE	0.00					
...	JOG SET-VALUE	0.00					
14	JOG SET-VALUE	0.00					
15	JOG SET-VALUE	0.00					

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0040	Ctrl enable	1				Controller enable / controller inhibit (CINH) • Writing: Controls the controller inhibit • Reading: Reads the status of the controller inhibit	
			0	Controller inhibited			
			1	Controller enabled			
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 297 📖 144
			0	QSP not active			
			1	QSP active			
C0043	Trip reset	0				Reset active fault message (TRIP-RESET)	📖 246
			0	Reset fault message (TRIP-RESET) / no fault			
			1	Active fault message			
C0050	MCTRL-NSET2					Speed setpoint on speed controller input (MCTRL_nNSetIn_a) Read only	
			-100,00	{0.01 %}	100.00		
C0051	MCTRL-NACT					Actual speed (MCTRL_nNAct_a) Read only	
			-30000	{1 rpm}	30000		
C0052	MCTRL Umot					Actual motor voltage Read only	
			0	{1 V}	800		
C0053	UG-VOLTAGE					DC-bus voltage Read only	
			0	{1 V}	900		
C0054	Imot					Actual motor current Read only	
			0,0	{0.1 A}	500,0		
C0055	Phase current					Motor phase current Read only	
1	iu		0,0	{0.1 A}	500,0	Actual current in U phase	
2	iv					Actual current in V phase	
3	iw					Actual current in W phase	
4	Io					Actual theoretical star-point current	
C0056	MCTRL-MSET2					Torque setpoint on speed controller output (MCTRL_nMSetIn_a) Read only	
			-100	{1 %}	100		
C0057	Max Torque					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	
			0,0	{0.1 Nm}	500,0		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle (offset angle) Input in case of Lenze motor with ● resolver: -90° ● hiperface absolute value encoder: 0° Code value is adapted by the rotor position adjustment function (C0095). Only relevant for the operation of synchronous motors.	📖 151
			-180.0	{0.1 °}	179.9		
C0059	Mot pole no.					Calculated number of motor pole pairs Read only	
			1	{1}	200		
C0060	Rotor pos					Current rotor position; value is derived from position encoder. Therefore, it is only valid as rotor position if the position encoder settings under C0490 are identical with the settings of the speed encoder on the motor shaft under C0495. Read only	📖 148
			0	{1 inc}	2047	Display with reduced resolution: 1 revolution = 2048 increments	
C0061	Heatsink temp					Heatsink temperature Read only	📖 204
			-200	{1 °C}	200		
C0062	Interior temp					Interior device temperature Read only	📖 205
			-200	{1 °C}	200		
C0063	Mot temp					Motor temperature Read only	📖 202
			0	{1 °C}	200		
C0064	Utilization					Device utilisation (I x t) over the last 180 s Only display	
			0	{1 %}	150	● C0064 > 100 % activates OC5-TRIP. ● TRIP-RESET only is possible if C0064 < 95 %.	
C0065	U24 ext					External low-voltage supply (U_{24}) Read only	
			0,0	{0.1V}	100,0		
C0066	Motor load					Thermal motor load I^2xt Only display	📖 210
			0	{1 %}	250		
C0067	Act trip					Current fault (TRIP) (in case of FAIL-QSP, warning and message, ”0” is displayed.) Only display	📖 238

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 154
			0.00	{ 0.01}	127.99		
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 154
			1.0	{0.5 ms}	6000.0		
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 154
			0.0	{0.1 ms}	32.0		
C0074	Dynamics	0				Pilot control of the current controller for higher dynamics	📖 149
			0	Normal			
			1	Enhanced			
C0075	Vp currCTRL	20.0				Proportional gain of current controller (V_{pi}) The upper limit is device-dependent.	📖 149
			0.00	{0.01 Ω}	381.80	ECSxS/P/M/A004	
					190.90	ECSxS/P/M/A008	
					95.46	ECSxS/P/M/A016	
					47.72	ECSxS/P/M/A032	
					31.82	ECSxS/P/M/A048	
					23.86	ECSxS/P/M/A064	
C0076	Tn currCTRL	5.0				Reset time of current controller (T_{ni})	📖 149
			0.01	{0.01 ms}	200.00		
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	📖 157
			0.00	{0.01}	63.99		
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	📖 157
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004
					47.72	ECSxS/P/M/A008
					23.86	ECSxS/P/M/A016
					11.93	ECSxS/P/M/A032
					7.95	ECSxS/P/M/A048
					5.96	ECSxS/P/M/A064
[C0085]	Mot Ls	5.30				Leakage inductance of the motor
			0.00	{0.01 mH}	200.00	
[C0087]	Mot speed	3700				Rated motor speed
			300	{1 rpm}	16000	
[C0088]	Mot current	7.0				Rated motor current
			0.5	{0.1 A}	500.0	
[C0089]	Mot frequency	185				Rated motor frequency
			10	{1 Hz}	1000	
[C0090]	Mot voltage	325				Rated motor voltage
			50	{1 V}	500	
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor
			0.50	{0.01}	1.00	
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Read only
			0.00	{0.01 A}	327,67	
C0093	Drive ident					Device identification of the ECS axis module Read only
			0	Defective power section		
			1	No power section recognised		
			4	ECSxS/P/M/A004C4		
			8	ECSxS/P/M/A008C4		
			16	ECSxS/P/M/A016C4		
			32	ECSxS/P/M/A032C4		
			48	ECSxS/P/M/A048C4		
			64	ECSxS/P/M/A064C4		
			65	ECSxS/P/M/A064C2		
C0094	Password	0				Keypad password Parameter access protection for the keypad
			0 0 = no password	{1}	9999	When the password is activated, only the codes of the user menu (C0517) can be accessed. Further possible selections: see C0096

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment for automatic determination of the rotor displacement angle. C0058 displays the determined rotor displacement angle (offset angle).	📖 151
			0	Inactive			
			1	Active			
C0096						Extended password protection for bus systems with activated password (C0094) All codes in the user menu can be accessed.	
1	AIF/CAN prot.	0		No access protection		AIF access protection	
2	AIF/CAN prot.	0		No access protection		CAN access protection	
			0	No access protection		Full access	
			1	Read protection		Reading not possible	
			2	Write protection		Writing not possible	
			3	Read/write protection		Reading and writing not possible	
C0097	DIS:Lt-Ident	0				Power stage identification	
			0	{1}	255		
C0098	Set position	0				Home position of encoder	
			-2147483647	{1 inc}	2147483647		
C0099	S/W version					Firmware version Read only	
			0,0	{0,1}	25,5		
C0101						15 additional acceleration times for the speed setpoint. Can be retrieved via digital signals SPEED-NSET.TIx.	📖 327
1	add Tir	0.000	0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
2	add Tir	0.000					
...	add Tir	0.000					
14	add Tir	0.000					
15	add Tir	0.000					
C0103	add Tif					15 additional deceleration times for the speed setpoint. Can be retrieved via digital signals SPEED-NSET.TIx.	📖 327
1	add Tif	0.000	0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
2	add Tif	0.000					
...		0.000					
14	add Tif	0.000					
15	add Tif	0.000					
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 297 📖 144
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0108						Gain for relative analog signals (AOUT)	309
1	FCODE(gain)	100.0	-199.99	{0.01 %}	199.99	FCODE_nC108_1_a	
2	FCODE(gain)	100.0				FCODE_nC108_2_a	
C0109						Offset for relative analog signals (AOUT)	309
1	FCODE(offset)	0.0	-199.99	{0.01 %}	199.99	FCODE_nC109_1_a	
2	FCODE(offset)	0.0				FCODE_nC109_2_a	
C0110	Service Code					Fine adjustment - mutual inductance	
			50	{1 %}	200		
C0111	Service Code					Fine adjustment - rotor resistance	
			50.00	{1 %}	199.99		
C0112	Service Code					Fine adjustment - rotor time constant	
			50	{1 %}	200		
C0113	Service Code					Fine adjustment - magnetising current (I_{sd})	
			50	{1 %}	200		
C0114						Polarity of the digital inputs	307
1	DIGIN pol	0	HIGH level active			X6/DI1 (DIGIN_bIn1_b)	121
2	DIGIN pol	0	HIGH level active			X6/DI2 (DIGIN_bIn2_b)	
3	DIGIN pol	0	HIGH level active			X6/DI3 (DIGIN_bIn3_b)	
4	DIGIN pol	0	HIGH level active			X6/DI4 (DIGIN_bIn4_b)	
			0	HIGH level active			
			1	LOW level active			
C0118						Polarity of the digital outputs	308
1	DIGOUT pol	0	HIGH level active			X6/DO1 (DIGOUT_bOut1_b)	121
2	DIGOUT pol	0	HIGH level active			X25 (DIGOUT_bRelais_b, brake connection)	
			0	HIGH level active			
			1	LOW level active			
C0120	OC6 limit	105				Threshold for $I^2 x t$ monitoring (motor)	210
			0	{1 %}	120	0 = $I^2 x t$ monitoring is switched off $I^2 x t$ > C0120 ⇨ OC6-TRIP	
C0121	OH7 limit	120				Threshold for motor temperature monitoring	202
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault message OH7 (C0584)	
C0122	OH4 limit	80				Threshold for heatsink temperature monitoring	204
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault message OH4 (C0582)	
C0123	OC7 limit	90				Threshold for I x t warning (axis module)	201
			0	{1 %}	100	C0064 > C0123 ⇨ fault message OC7 (C0604)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Threshold for temperature monitoring inside the device	📖 205
			10	{1 %}	90	C0062 > C0124 ⇨ fault message OH5 (C0605)	
C0125	Baud rate	0				Baud rate for operation via AIF interface X1	
			0	9600 bit/s		Communication modules on AIF interface X1: ● LECOM-A/B/LI 2102 ● PROFIBUS-DP 2133	
			1	4800 bits/s			
			2	2400 bit/s			
			3	1200 bit/s			
			4	19200 bit/s			
C0126	MONIT CE0	3				Fault response regarding the monitoring of communication via AIF interface X1. ● Via C2382 you can select whether controller inhibit (CINH) or quick stop (QSP) is activated when a CE0 fault occurs.	📖 247
			0	TRIP		A communication error activates the CE0 response set.	
			2	Warning			
			3	Off		Monitoring switched off.	
C0127	OC8 limit	100				Threshold for $I^2 x t$ warning (motor)	📖 210
			0	{1 %}	120	$I^2 x t$ > C0127 ⇨ fault message OC8 (C0606)	
C0128	Tau motor	5.0				Thermal time constant of the motor	📖 210
			0.5	{0.1 min}	25.0	For calculating the $I^2 x t$ disconnection	
C0129	Charc.: Ix/Nx					Reduction of the speed/torque characteristic for UL-compliant thermal motor monitoring ($I^2 x t$) The reduced speed/torque characteristic reduces the permissible thermal load of self-ventilated standard motors.	📖 25
1		100	10	{1 %}	200	S1 torque characteristic I_1/I_{rated} This value also enables an increase of the maximally permissible utilisation.	
2		40				S1 torque characteristics n_2/n_{rated} With increasing speeds, the maximally permissible utilisation remains unchanged ($I_{Mot} = I_{rated}$).	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0134	RFG charac	0				Characteristic of the ramp function generator for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”)	📖 330
			1	Linear		Ramp function generator operates linearly.	
			2	S-shaped		Ramp function generator operates without jerk (S-shaped).	
C0135	Control word	0				System control word DCTRL	
			0	{1}	65535	Controller evaluates information as 16 bits (binary-coded)	
			Bit 0	Not assigned			
			Bit 1	Not assigned			
			Bit 2	Not assigned			
			Bit 3	Quick stop (QSP)			
			Bit 4	Not assigned			
			Bit 5	Not assigned			
			Bit 6	Not assigned			
			Bit 7	Not assigned			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit 10	TRIP-SET			
			Bit 11	TRIP-RESET			
			Bit 12	Not assigned			
			Bit 13	Not assigned			
			Bit 14	Not assigned			
			Bit 15	Not assigned			
C0136						Control words Hexadecimal value is bit-coded. Read only	
1	CTRLWORD		0	{hex}	FFFF	Control word C0135	
2	CTRLWORD					CAN control word	
3	CTRLWORD					AIF control word	
C0141	FCODE(setval)	0.0				Main setpoint (FCODE_C141_a)	📖 309
			-199.99	{0.01 %}	199.99		
C0142	Start options	1				Starting condition for start after ● mains connection ● message (t > 0.5 s) ● TRIP	
			0	Protection against unexpected start-up			
			1	Automatic start			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0			Device status word for networking via automation interface (AIF) Read only	📖 235
			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		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0157						Status of free bits of DCTRL status word 1 (C0150) Only display	
1	Stat. FreeBit		0	{1 bit}	1	Bit 0 (DCTRL_bStat_B0_b)	
2	Stat. FreeBit					Bit 2 (DCTRL_bStat_B2_b)	
3	Stat. FreeBit					Bit 3 (DCTRL_bStat_B3_b)	
4	Stat. FreeBit					Bit 4 (DCTRL_bStat_B4_b)	
5	Stat. FreeBit					Bit 5 (DCTRL_bStat_B5_b)	
6	Stat. FreeBit					Bit 14 (DCTRL_bStat_B14_b)	
7	Stat. FreeBit					Bit 15 (DCTRL_bStat_B15_b)	
C0161	Act trip					Current TRIP ● as in C0168/1 ● In case of FAIL-QSP, warning, and message, ”0” is displayed. Only display	📖 238
C0167	Reset failmem	0				Delete history buffer (C0168)	📖 233
			0	No reaction			
			1	Delete history buffer			
C0168						Fault history buffer (list of faults occurred) Read only	📖 233 📖 238
1	Fail number					Currently active fault	
2	Fail number					Last fault	
3	Fail number					Last fault but one	
4	Fail number					Last fault but two	
5	Fail number					Last fault but three	
6	Fail number					Last fault but four	
7	Fail number					Last fault but five	
8	Fail number					Last fault but six	
			All fault indications (TRIP, FAIL-QSP, warning, message)				
C0169						Time at which the fault messages entered in the history buffer (C0168) occurred. Read only	📖 233
1	FailTime		Respective status of the operating hour counter (C0179)			Occurrence of the currently active fault message	
2	FailTime					Occurrence of the last fault message	
3	FailTime					Occurrence of the second-last fault message	
4	FailTime					Occurrence of the third-last fault message	
5	FailTime					Occurrence of the fourth-last fault message	
6	FailTime					Occurrence of the fifth-last fault message	
7	FailTime					Occurrence of the sixth-last fault message	
8	FailTime					Occurrence of the seventh-last fault message	
			0	{1 h}	65535		

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0170				Frequency of successive occurrence of the fault messages entered in the history buffer (C0168) Read only	📖 233
			0 {1} 65535		
1	Counter			Frequency of the fault message currently active	
2	Counter			Frequency of the last fault message	
3	Counter			Frequency of the second-last fault message	
4	Counter			Frequency of the third-last fault message	
5	Counter			Frequency of the fourth-last fault message	
6	Counter			Frequency of the fifth-last fault message	
7	Counter			Frequency of the sixth-last fault message	
8	Counter			Frequency of the seventh-last fault message	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0173	UG limit	11		Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	98
			0 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3 Mains = 480V - B	Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4 Mains = 480V + B	Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10 Mains = 230 V ± B	Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11 Mains = 400 V ± B	Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12 Mains = 460 V ± B	Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13 Mains = 480V - B	Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14 Mains = 480V + B	Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	
C0174	UG min	60		Undervoltage threshold of DC bus (LU)	98
			15 {1 V} 342		
C0175	UG-Relais Fkt	1		Charge relay behaviour with undervoltage (LU) in the DC bus.	98
			1 Standard	Relay switches as a function of LU.	
			2 One Time	Relay switches when LU is exceeded for the first time and remains on.	
			3 Fixed On	Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0178	Op timer					Running time meter Read only	
			0	{1 sec}	4294967295	Time when the controller was enabled	
C0179	Mains timer					Power-on time meter Only display	
			0	{1 sec}	4294967295	Time when the mains was switched on	
C0182	Ti S-shaped	20.00				Form of the S-curve for the ● speed setpoint (for ”speed control”) ● torque setpoint (for ”torque control”) of the ramp function generator (C0134 = 1)	📖 330
			0.01	{0.01 s}	50.00	The higher the value, the bigger the S-rounding.	
C0183	Diagnostics					Drive diagnostics Read only ● Indicates fault or status information ● If several fault or status information are to be shown at the same time, the information with the smallest number is displayed	
			0	OK		No fault	
			101	Initialisation phase			
			102	TRIP/trouble			
			103	Emergency stop activated			
			104	IMP message			
			105	Power off			
			111	Operation inhibit C0135			
			112	Operation inhibit AIF			
			113	Operation inhibit CAN			
			121	Controller inhibit via X6/SI1			
			122	Internal controller inhibit 1			
			123	Internal controller inhibit 2			
			124	Controller inhibit via STOP key of the keypad			
			125	Controller inhibit via AIF			
			126	Controller inhibit via CAN			
			131	Fail QSP			
			141	Restart protection			
			142	Pulse inhibit		High resistance power outputs	
			151	Quick stop (QSP) via terminal			
			152	Quick stop (QSP) via STOP key of the keypad			
			153	Quick stop (QSP) via AIF			
			154	Quick stop (QSP) via CAN			
			160	PLC Stop		PLC must be started.	
			250	Warning			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0190	NSET ARIT	0				Linking of speed setpoint (NSet) and additional setpoint (NAdd)	📖 331
			0	OUT = NAdd		Additional setpoint is not considered.	
			1	NSet + NAdd		Additional setpoint is added to speed setpoint.	
			2	NSET-NADD		Additional setpoint is subtracted from speed setpoint.	
			3	NSet x NAdd		Additional setpoint is multiplied by speed setpoint.	
			4	NSet / NAdd		Speed setpoint is divided by additional setpoint.	
			5	NSet / (100 - NAdd)		Speed setpoint is divided by (100 - additional setpoint).	
C0195	BRK T act	99.9				Closing time of the motor holding brake	📖 340 📖 360
			0.0	{0.1 sec}	99.9	During the time set the drive continues to generate a torque. After the set time is expired, the status ”mechanical brake closed” is reached.	📖 102
C0196	BRK T rel	0.0				Opening time of the motor holding brake	📖 340 📖 360
			0.0	{0.1 sec}	60.0	During the time set the drive can generate the torque set under C0244 against the holding brake. After the set time is expired, the status ”mechanical brake opened” is reached.	📖 102
C0199	BuildNumber					Software identification Only display	
C0200	S/W Id					Software identification Only display	
C0201	S/W date					Software release date Read only	
C0202						Service code Only display	
1						Product code 1	
...						...	
4						Product code 4	
C0203	Komm.-No.		x / xxxx / xxxxx			Commission number Only display	
C0204	Serial-No.					Serial number Read only	
C0205	PLC Target ID					Identification key Only display	
C0206	Product. date					Production date Only display	
C0207	DL info 1					Download info 1 Only display	
C0208	DL info 2					Download info 2 Only display	
C0209	DL info 3					Download info 3 Only display	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0220	NSET Tir add	0.000				Acceleration time for the additional setpoint	📖 331
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0022)	
C0221	NSET Tif add	0.000				Deceleration time for the additional setpoint	📖 331
			0.000	{0.001 s}	999.999	Relating to speed variation 0 rpm ... n_{max} (C0011)	
C0241	NSET RFG I = O	1.00				Threshold for message "Setpoint reached" On the ramp function generator for ● speed setpoint (for "speed control") ● torque setpoint (for "torque control") input signal = output signal.	📖 329 📖 352
			0.00	{0.01 %}	100.00	100 % = n_{max}	
C0244	BRK M set	0.00				Holding torque of the drive against the motor holding brake	📖 340 📖 360
			-199.99	{0.01 %}	199.99	Referring to M_{max} (C0057). During the time set in C0196 the drive generates the set torque against the holding brake.	📖 102
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	📖 309
			0		1		
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	📖 337
			0.0000	{ 0.0001}	3.9999		
C0300 ... C0302	Service Codes					**Only the Lenze service is allowed to make changes!**	
C0304 ... C0310	Service Codes					**Only the Lenze service is allowed to make changes!**	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0349					Status of the DIP switch for CAN bus interface X4 Read only	
1	CAN DIP-SW		0	{1} 63	Node address set on the DIP switch	
2	CAN DIP-SW		0	4	For setting the DIP switches > 4, the display is set to 0.	
C0350	CAN address	32			Node address for CAN bus interface X4 ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". (📖 169) ● After the setting process, a reset node is required. ● A definite node address must be assigned to each CAN node.	📖 169 📖 460
			1	{1} 63		
C0351	CAN baud rate	0			Baud rate for CAN bus interface X4 ● The baud rate must be set identically for all CAN nodes. ● This code is not active if one of the switches 2 ... 7 of the DIP switch is set to "ON". ● After the setting process, a reset node is required.	📖 169
			0	500 kbps		
			1	250 kbits/sec		
			2	125 kbit/s		
			3	50 kbps		
			4	1000 kbit/s		
C0352	CAN mst	0			Boot-up master/slave configuration for CAN bus interface X4	📖 175
			0	Slave		
			1	Master boot-up	Device is active as CAN boot-up master.	
			2	Master node guarding		
			3	Slave heartbeat producer		
			4	Slave node guarding		
C0353					Source for node address of CAN_IN/CAN_OUT (CAN bus interface X4)	📖 173
1	CAN addr sel	0		CAN node address (C0350)	Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)	Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)	Address CAN3_IN/OUT	
			0	C0350 (auto)	Automatically determined by C0350.	
			1	C0354 (man.)	Determined by C0354.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0354						Alternative node address for CAN_IN/CAN_OUT (CAN bus interface X4)	📖 173
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C0355						Identifier for CAN_IN/CAN_OUT (CAN bus interface X4) Read only	📖 460
1	CAN Id		1	{1}	2047	Identifier CAN1_IN	
2	CAN Id					Identifier CAN1_OUT	
3	CAN Id					Identifier CAN2_IN	
4	CAN Id					Identifier CAN2_OUT	
5	CAN Id					Identifier CAN3_IN	
6	CAN Id					Identifier CAN3_OUT	
C0356						CAN time settings for CAN bus interface X4	📖 176
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation through the master.	
2	CAN times	0				CAN2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CAN times	0					
4	CAN times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 198
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0358	Reset node	0				Make a reset node for the CAN bus node.	📖 178
			0	No function			
			1	CAN reset			
C0359	CAN state					CAN bus status (interface X4) Read only	📖 187
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
			4	Stopped			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0360				Telegram counter CAN_IN/CAN_OUT (CAN bus interface X4), number of telegrams Read only	📖 188
1	CAN Messages		0 {1} 65535 With a count value > 65535 the counter restarts with 0	All sent telegrams	
2	CAN Messages			All received telegrams	
3	CAN Messages			Sent to CAN1_OUT	
4	CAN Messages			Sent to CAN2_OUT	
5	CAN Messages			Sent to CAN3_OUT	
6	CAN Messages			Sent on parameter data channel 1	
7	CAN Messages			Sent on parameter data channel 2	
8	CAN Messages			Received from CAN1_IN	
9	CAN Messages			Received from CAN2_IN	
10	CAN Messages			Received from CAN3_IN	
11	CAN Messages			Received from parameter data channel 1	
12	CAN Messages			Received from parameter data channel 2	
C0361				Detected load CAN_IN/CAN_OUT (CAN bus interface X4) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 189
1	Load IN/OUT		0 {1 %} 100	All sent telegrams	
2	Load IN/OUT			All received telegrams	
3	Load IN/OUT			Sent to CAN1_OUT	
4	Load IN/OUT			Sent to CAN2_OUT	
5	Load IN/OUT			Sent to CAN3_OUT	
6	Load IN/OUT			Sent on parameter data channel 1	
7	Load IN/OUT			Sent on parameter data channel 2	
8	Load IN/OUT			Received from CAN1_IN	
9	Load IN/OUT			Received from CAN2_IN	
10	Load IN/OUT			Received from CAN3_IN	
11	Load IN/OUT			Received from parameter data channel 1	
12	Load IN/OUT			Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0362	Sync cycle					Time interval between 2 sync telegrams via the X4 CAN bus interface or EMF2192IB EtherCAT communication module at X1 AIF interface Read only	📖 179
			1	{1 ms}	30		
C0363	Sync correct.	1				CAN sync correction increment	📖 180
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C0365	DIS:CAN active					Input signal CAN active Only display	
			0	CAN not active			
			1	CAN active			
C0366	Sync Response	1				CAN sync response for interface X4 (CAN) **The value "1" should always be set!**	📖 181
			0	No response			
			1	Response			
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 180
			1	{1}	256		
C0368	Sync Tx Id	128				CAN Sync transmission ID for CAN bus interface X4	📖 444 📖 179
			1	{1}	256		
C0369	SyNc Tx time	0				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier of C0368 is sent with the cycle time set. **ECSxP:** The setting is effected automatically depending on C4062!	📖 180
			0	{1 ms}	65000	0 = switched off	
[C0370]	SDO gateway	0				Activate address gateway/remote parameterisation ● C0370 ≠ 0: All code write/read accesses are redirected to the CAN node with the CAN node address set here. ● The corresponding code is accessed via parameter data channel 1 of the target device. ● C0370 = 0: remote parameterisation is deactivated	📖 190
			0	{1}	63		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0371	Gateway Ch.	1				Selection of the gateway channel	📖 190
			0	CAN		Use CAN bus interface X4	
			1	CAN-AUX		Use CAN bus interface X14	
C0381	HeartProdTime	0				Heartbeat (slave): HeartbeatProducerTime ● Time interval for sending the heartbeat message ● Only relevant for setting C0352 = 3.	
			0	{1 ms}	65535		
C0382	GuardTime	0				Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master ● Only relevant for setting C0352 = 4.	📖 184
			0	{1 ms}	65535		
C0383	LifeTimeFact	0				Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant for setting C0352 = 4.	📖 184
			0	{1}	255		
C0384	Err NodeGuard	3				Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	📖 184
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0400	DIS: AnalogIn					Signal at the analog input Read only	📖 266
			-199.99	{0.01 %}	199.99		
C0414	DIS: ResQual.					Resolver modulation Quality of the resolver excitation amplitude set under C0416 (recommendation: 0.5 ... 1.2; ideal 1.0)	📖 104
			0.00	{0.01}	1,60		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0416]	Resolver adj.	5			Resolver excitation amplitude	📖 104
			0	100 %		
			1	80 %		
			2	68 %		
			3	58 %		
			4	50 %		
			5	45 %		
			6	40 %		
			7	37 %		
[C0417]	Resolver cor.	0			Resolver adjustment	📖 160
			0	Ready		
			1	Start adjustment		
			2	Loading default values		
[C0418]	Test Cur.Ctrl	0			Controller adjustment:	📖 149
			0	Deactivated	Deactivate test mode	
			1	Activated	Activate test mode	
[C0419]	Enc. setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 301 📖 106 📖 113
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 301 📖 106 📖 113
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”common”) if the value is altered.	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0421]	Encoder volt	0			Encoder voltage	📖 301
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	📖 106 📖 113
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
C0426	DIS: In				Signal at DFIN input Only display	📖 301
			-32767	{1 rpm} 32767		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 301 📖 106 📖 113
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		
C0428	DFIN TP sel.	0			DFIN touch probe signal source	
			0	Zero pulse of position encoder (C0490)	X7/X8	
			1	Touch probe input TP1	X6/DI1	
			2	Zero pulse of digital frequency input	X8	
C0429	TP1 delay	0			DFIN dead time compensation TP1 (DI1)	
			-32767	{1 inc} 32767		
C0431	DFIN TP Edge	0			DFIN touch probe TP1 edge (for touch probe via digital input X6/DI1 (C0428 = 1))	
			0	Rising edge TP1		
			1	Falling edge TP1		
			2	Rising and falling edge TP1		
			3	Switched off		
C0443	DIS: DIGIN				Signal status of the digital inputs on X6 after consideration of the polarity set under C0114. Only display	📖 307
			0	{1} 255		
			Bit 0	DIGIN1	X6/DI1	📖 121
			Bit 1	DIGIN2	X6/DI2	
			Bit 2	DIGIN3	X6/DI3	
			Bit 3	DIGIN4	X6/DI4	
			Bit 4	DIGIN_safe_standstill	X6/SI2 0: Pulse inhibit is active 1: Pulse inhibit is inactive	📖 71
			Bit 5	Free		
			Bit 6	DIGIN_CInh	X6/SI1 0: Controller is inhibited (CINH) 1: Controller is enabled	📖 71
			Bit 7	Free		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0444						Status of the digital outputs Only display	
1	DIS: DIGOUT		0		1	Status of the digital output X6/DO1	
2	DIS: DIGOUT					Relay control status	
[C0469]	Fct STP key	2				Function of the STOP key of the keypad **Must not be changed if the "STOP" key is pressed!**	
			0	Inactive		Without function	
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	📖 309
1	FCODE 8bit	0	00	{hex}	FF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	📖 309
			0	{1}	4294967295		
C0472	FCODE analog					Freely configurable code for relative analog signals	📖 309
1		0.0	-199.99	{0.01 %}	199.99	FCODE_bC472_1_a	
2		0.0				FCODE_bC472_2_a	
3		100.0				FCODE_bC472_3_a	
4		0.0				FCODE_bC472_4_a	
...		...				...	
20		0.0				FCODE_bC472_20_a	
C0473						Freely configurable code for absolute analog signals	📖 309
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	📖 309
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	📖 309
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	📖 103
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
[C0491]	X8 in/out	0				Function of X8	📖 301 📖 304 📖 106 📖 113
			0	X8 is input			
			1	X8 is output			
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 103
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0419 = 0 (”Common”) if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute value encoder (multi-turn) at X8			
C0497	Nact filter	2.0				Time constant of actual speed value	
			0.0	{0.1 ms}	50.0	0.0 ms = switched off	
C0504 ... C0509	Service codes					**Only the Lenze service is allowed to make changes!**	
C0510	ProtAppFlash	0				Write-protection application FLASH	
			0	No write protection			
			1	Write protection is active			
C0517						User menu with up to 32 entries	
			0.00	{0.01}	7999.00	• Enter the numbers of the required codes into the subcodes. Format: xxxx.yy – xxxx = code number – yy = subcode of the code • It is not checked whether the entered code exists.	
1	User menu	51.00	C0051	MCTRL-NACT		Display of actual speed	
2	User menu	54.00	C0054	Imot		Display of motor current	
3	User menu	56.00	C0056	MCTRL-MSET2		Display of torque setpoint	
4	User menu	0.00		Not assigned			
5	User menu	0.00		Not assigned			
6	User menu	183.00	C0183	Diagnostics		Display for diagnostics	
7	User menu	168.01	C0183	Fail number		Display of current fault message	
8	User menu	0.00		Not assigned			
9	User menu	22.00	C0022	Imax current		Input of maximum output current	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
10	User menu	0.00		Not assigned			
11	User menu	11.00	C0011	Nmax		Input of the maximum speed	
12	User menu	0.00		Not assigned			
13	User menu	0.00		Not assigned			
14	User menu	105.00	C0105	QSP Tif		Input of quick stop deceleration time	
15	User menu	0.00		Not assigned			
16	User menu	70.00	C0070	Vp speed CTRL		Input of speed controller gain (Vp)	
17	User menu	71.00	C0071	Tn speed CTRL		Input of speed controller reset time (Tn)	
18	User menu	0.00		Not assigned			
19	User menu	2100.00	C2100	Time slice		Input of time dial for cycl. task	
20	User menu	2102.00	C2102	Task switch		Selection of the switching function for cycl. task	
21	User menu	2104.00	C2104	PLC autorun		Autom. start of the PLC program after mains power-up	
22	User menu	2106.00	C2106	Download protect		Write protection of the PLC program	
23	User menu	2108.00	C2108	PLC run/stop		Control of the PLC program	
24	User menu	2111.00	C2111	GDC ID		Creation date of the PLC program	
25	User menu	2113.00	C2113	PLC prog name		Name of the PLC program	
26	User menu	2115.00	C2115	T-fct Credit		Number of technology units	
27	User menu	0.00		Not assigned			
28	User menu	0.00		Not assigned			
29	User menu	0.00		Not assigned			
30	User menu	0.00		Not assigned			
31	User menu	94.00	C0094	Password		Parameter access protection for the keypad	
32	User menu	3.00	C0003	Par save		Save parameter set	
[C0540]	X8 Signal out	2				Function of the digital frequency output signals on X8 (DFOUT)	📖 304 📖 103
			0	DFOUT in [%]			
			1	DFOUT in [rpm]			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	📖 304
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	📖 304
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	📖 304
			-32767	{1 rpm}	32767		
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr tolerance	100				Tolerance window for the speed system deviation referring to n_{max} 100 % = lowest monitoring sensitivity	222
			0	{1 %}	100		
C0577	Vp fld weak	0.100				Gain of the field weakening controller (V_p)	157
			0.000	{0.001}	63.999		
C0578	Tn fld weak	3.0				Integral-action time of the field weakening controller (V_n)	
			0.1	{0.1 ms}	6000.0		
C0579	nErr response	3				Fault response - monitoring of speed system deviation	222
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0580	Monit SD8	3				Fault response - monitoring of SinCos signals at X8	221
			0	TRIP			
			3	Off			
C0581	MONIT EEr	0				Fault response - external fault monitoring ”ExternalFault” (EEr)	298
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0582	MONIT OH4	2				Setting of the fault response - monitoring of heatsink temperature in C0122	204
			0	TRIP			
			2	Warning			
			3	Off			
C0583	MONIT OH3	0				Fault response - monitoring of motor temperature (fixed temperature threshold). Detection through KTY thermal sensor via resolver input X7 or encoder input X8.	202
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C0584	MONIT OH7	2		Fault response - motor temperature monitoring Temperature threshold can be set under C0121. Detection through KTY thermal sensor via resolver input X7 or encoder input X8. Only effective if OH3 is switched on under C0583.	📖 202
			0 TRIP		
			2 Warning		
			3 Off		
C0586	MONIT SD2	0		Fault response - monitoring Resolver ”ResolverFault” (Sd2)	📖 218
			0 TRIP		
			2 Warning		
			3 Off		
C0588	MONIT H10/H11	0		Fault response - monitoring Thermal sensors in the controller. H10: Sensor inside the device H11: Heatsink sensor	📖 206
			0 TRIP		
			2 Warning		
			3 Off		
C0591	MONIT CE1	3		Fault response - monitoring CAN1_IN (no telegrams) ”CommErrCANIN1” (CE1)	📖 198
			0 TRIP		
			2 Warning		
			3 Off		
C0592	MONIT CE2	3		Fault response - monitoring CAN2_IN (no telegrams) ”CommErrCANIN2” (CE2)	📖 198
			0 TRIP		
			2 Warning		
			3 Off		
C0593	MONIT CE3	3		Fault response - monitoring CAN3_IN (no telegrams) ”CommErrCANIN3” (CE3)	📖 198
			0 TRIP		
			2 Warning		
			3 Off		
C0594	MONIT SD6	3		Fault response - monitoring KTY sensor for the motor temperature. ”SensorFault” (Sd6)	📖 219
			0 TRIP		
			2 Warning		
			3 Off		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0595	MONIT CE4	3				Fault response - system bus (CAN) monitoring "Bus-off" at X4 "BusOffState" (CE4)	📖 198
			0	TRIP			
			2	Warning			
			3	Off			
C0596	NMAX limit	5500				Maximum system speed	📖 223
			0	{1 rpm}	16000		
C0597	MONIT LP1	3				Fault response - monitoring of motor phase failure (LP1) **When this function is activated, the calculating time provided for the user program is reduced!**	📖 217
			0	TRIP			
			2	Warning			
			3	Off			
C0598	MONIT SD5	3				Fault response - master current monitoring at X6 < 2 mA "MastISourceDef"	
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase failure monitoring (LP1) with regard to the current limit.	📖 217
			0.01	{0.01 %}	10.00		
C0602	MONIT REL1	3				Fault response - open circuit monitoring of relay output X25	
			0	TRIP			
			2	Message			
			3	Off			
			4	FAIL-QSP			
C0603	MONIT CE5	3				Fault response - gateway function monitoring (CE5) "Timeout" when remote parameter setting (C0370) is activated via interface X4 (CAN)	📖 198 📖 190
			0	TRIP			
			2	Warning			
			3	Off			
C0604	MONIT OC7	2				Fault response - monitoring of Ixt device utilisation. Ixt threshold can be set under C0123.	📖 201
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0605	MONIT OH5	2				Fault response - monitoring of temperature inside the controller. Temperature threshold can be set under C0124.	📖 205
			0	TRIP			
			2	Warning			
			3	Off			
C0606	MONIT OC8	2				Fault response - monitoring of I^2 x t motor utilisation. Threshold can be set under C0120.	📖 210
			0	TRIP			
			2	Warning			
			3	Off			
C0607	MONIT NMAX	0				Fault response - maximum speed monitoring of the machine	
			0	TRIP			
			2	Warning			
			3	Off			
C0608	ovr. Tx-Queue	2				Fault response - transmission memory overflow of free CAN objects	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0745						**Only the Lenze service is allowed to make changes!** Oscilloscope - internal service	
C0746						**Only the Lenze service is allowed to make changes!** Oscilloscope - internal service	
1							
...							
24							
C0747						**Only the Lenze service is allowed to make changes!** Oscilloscope - internal service	
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only	📖 248
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)	
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only	📖 248
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1	
2	AIF1 IN words					Input word 2	
3	AIF1 IN words					Input word 3	
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only	📖 248
			-2147483648	{1}	2147483647		
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	
			-2147483648	{1}	2147483647		
C0863						Digital process data input words for CAN bus interface X4 Hexadecimal value is bit-coded. Read only	📖 448 📖 273
			0000	{hex}	FFFF		
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	📖 448 📖 273
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1	
2	CAN OUT words					CAN1_OUT word 2	
3	CAN OUT words					CAN1_OUT word 3	
4	CAN OUT words					CAN2_OUT word 1	
5	CAN OUT words					CAN2_OUT word 2	
6	CAN OUT words					CAN2_OUT word 3	
7	CAN OUT words					CAN2_OUT word 4	
8	CAN OUT words					CAN3_OUT word 1	
9	CAN OUT words					CAN3_OUT word 2	
10	CAN OUT words					CAN3_OUT word 3	
11	CAN OUT words					CAN3_OUT word 4	

Code		Possible settings					IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection				
C0869							32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647		CAN1_OUT
2	CAN OUT phi						CAN2_OUT
3	CAN OUT phi						CAN3_OUT
C0878							Digital input signals to DCTRL Only display
1	DigInOfDCTRL		0			1	Controller inhibit (CINH) 1
2	DigInOfDCTRL						Controller inhibit (CINH) 2
3	DigInOfDCTRL						TRIP-set
4	DigInOfDCTRL						TRIP-RESET
C0879							
1	Reset C0135 Controlword	0		No reset			Reset DCTRL control word of C0135
2	Reset AIF Controlword	0		No reset			Reset DCTRL control word of AIF
3	Reset CAN Controlword	0		No reset			Reset DCTRL control word of CAN
			0	No reset			
			1	Reset			Performs one ”reset”
C0906							Analog input signals to MCTRL Read only
1	MCTRL analog		-199.99	{0.01 %}	199.99		Speed controller input
2	MCTRL analog						Torque setpoint
3	MCTRL analog						Lower torque limit
4	MCTRL analog						Upper torque limit
5	MCTRL analog						Limit of the position controller
6	MCTRL analog						Speed for activating the torque limitation
7	MCTRL analog						Field weakening
8	MCTRL analog						Integrator of the speed controller
9	MCTRL analog						P adaptation of the position controller
C0907							Digital input signals to MCTRL Only display
1	MCTRL digital		0			1	Activating position controller
2	MCTRL digital						Speed control or torque control
3	MCTRL digital						Set quick stop (QSP)
4	MCTRL digital						Loading integral-action component of the speed controller
C0908	MCTRL PosSet						Set phase signal 1 revolution = 65536 increments Only display
			-2147483648	{1 inc}	2147483647		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0909	speed limit	1				Limitation of direction of rotation for speed setpoint	
			1	-175 ... +175 %			
			2	0 ... +175 %			
			3	-175 ... 0 %			
C0910	MCTRL TP2 delay	0				MCTRL dead time compensation TP2 (X6/DI2)	
			-32767	{1 inc}	32767	1 inc ≡ approx. 60 µs	
C0911	MCTRL TP2 sel.	0				MCTRL touch probe signal source	
			0	Zero pulse of position encoder (C0490)		X7/X8	
			1	Touch probe input TP2		X6/DI2	
C0912	MCTRL TP2 Edge	0				MCTRL touch probe TP2 edge (for touch probe via digital input X6/DI2 (C0911 = 1))	
			0	Rising edge TP2			
			1	Falling edge TP2			
			2	Rising and falling edge TP2			
			3	Switched off			
C1120	Sync mode	0				Sync signal source	📖 179
			0	Off		Off	
			1	CAN sync		Sync connection via interface X4 (CAN)	📖 182
			2	Terminal sync		Sync connection via terminal X6/DI1	📖 183
C1121	Sync cycle	2				Synchronisation cycle	📖 179
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	📖 179
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0.010				Synchronisation window	📖 181
			0.000	{0.001 ms}	6.500		
C1190	MPTC mode	0				Selection of PTC motor temperature sensor characteristic	
			0	Characteristic for PTC 83-110 (Lenze standard)			
			1	Can be specifically set by the user under C1191 and C1192			
			2	Characteristic for PTC 83-110 and 2 x PTC150 (e.g. in MCS motors)		This selection is only available as of operating system V 8.0. For the corresponding motors, the parameter is not automatically transferred into GDC by the motor data assistant. The parameter has to be set later!	
C1191						Selection of temperature characteristic for PTC	
1	Char.: temp	25	0	{1 °C}	255	PTC characteristic: lower temperature T1	
2	Char.: temp	150				PTC characteristic: upper temperature T2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1192						Selection of resistance characteristic for PTC	
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	PTC characteristic: resistance R1 at T1	
2	Char.: OHM	2225				PTC characteristic: resistance R2 at T2	
C1810	SW ID LECOM					Software identification LECOM Only display	
C1811	SW date LECOM					Software creation date LECOM Only display	
C2100	Time slice	13				Time slice for cyclic task	
			6	{1 ms}	26		
C2102	Task switch	0 {2}				Change-over: System task →cycl. task (PLC)	
			0	Time slice		No change-over	
			1	Time slice + end of PLC_PRG			
			2	Time slice + end of PLC_PRG + end of system task			
C2104	PLC Autorun	0 {1}				Automatic start of the PLC program after mains connection	
			0	Off			
			1	On			
C2106	Downl.protect	0				Write protection of PLC program	
			0	Inactive			
			1	Active			
			2	Reserved			
C2108	PLC run/stop	2 {1}				PLC programcontrol	
			0	No function			
			1	Run			
			2	Stop			
			3	Reset			
C2111	GDC Id		27012006132510 = • Date (day.month.year): 27.01.2006 • Time (h:min:sec): 13:25:10			Creation date of PLC program Read only	
C2113	PLC Prog Name					Name of PLC program Read only	
C2115	T-Fkt Credit	0				Number of technology units	
C2116	CreditPinCode	0				Code for technology units if service is required (please consult Lenze)	
			0	{1}	4294967295		
C2117	Full Credit	0				Service code	
C2118	ParWriteChan.	0				CAN object for L_ParRead and L_ParWrite (byComChannel = 10)	📖 190
			0	Unused PDO channel free for reconfiguration (CAN1...3_IN/CAN1...3_OUT)			
			1	Parameter data channel 2			

Code		Possible settings		IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection	
C2120	AIF: Control	0		AIF-CAN: control word
			0 {1} 255	Binary interpretation reflects bit states
			0 No command	**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!
			1 Read XCAN codes + reinitialisation	
			2 Read XCAN code	
			10 Read XCAN C2356/1 ... 4	
			11 Read XCAN C2357	
			12 Read XCAN C2375	
			13 Read XCAN C2376 ... C2378	
			14 Read XCAN C2382	
			255 Not assigned	
C2121	AIF:State			AIF status More detailed information can be found in the documentation of the plugged-in fieldbus module. Read only
			1 {1} 255	Binary interpretation reflects bit states.
			Bit 0 XCAN1_IN monitoring time	
			Bit 1 XCAN2_IN monitoring time	
			Bit2 XCAN3_IN monitoring time	
			Bit3 XCAN bus off	
			Bit4 XCAN operational	
			Bit5 XCAN pre-operational	
			Bit 6 XCAN warning	
			Bit 7 Assigned internally	
C2130	FileNameAddDa		Symbolic data name	Information on the additional data that have been transmitted together with the application program. Only display
C2131	Type AddData		Specification identification of the data	
C2132	VersionAddData		Data version	
C2133	TimeStamp		Time stamp of the data	
C2350	XCAN address	1		Node address XCAN (AIF interface X1)
			1 {1} 63	
C2351	XCAN baud rate	0		Baud rate XCAN (AIF interface X1)
			0 500 kbps	
			1 250 kbit/sec	
			2 125 kbits/s	
			3 50 kbps	
			4 1000 kbit/s	
C2352	XCAN mst	0		Establish XCAN master operation. (AIF interface X1)
			0 Slave	
			1 Master	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2353						Source for system bus node addresses of XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr sel	0		CAN node address (C2350)		XCAN1_IN/OUTaddress
2	XCAN addr sel	0		CAN node address (C2350)		XCAN2_IN/OUTaddress
3	XCAN addr sel	0		CAN node address (C2350)		XCAN3_IN/OUTaddress
			0	C2350 (auto)		Automatically determined by C2350
			1	C2354 (man.)		Determined by C2354
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT (AIF interface X1)
1	XCAN addr.	129	1	{1}	512	XCAN1_INaddress 2
2	XCAN addr.	1				XCAN1_OUTaddress 2
3	XCAN addr.	257				XCAN2_INaddress 2
4	XCAN addr.	258				XCAN2_OUTaddress 2
5	XCAN addr.	385				XCAN3_INaddress 2
6	XCAN addr.	386				XCAN3_OUTaddress 2
C2355						Identifier for XCAN_IN/XCAN_OUT (AIF interface X1) Read only
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN
2	XCAN Id					Identifier XCAN1_OUT
3	XCAN Id					Identifier XCAN2_IN
4	XCAN Id					Identifier XCAN2_OUT
5	XCAN Id					Identifier XCAN3_IN
6	XCAN Id					Identifier XCAN3_OUT
C2356						Time settings for XCAN (AIF interface X1)
1	XCAN times	0	0	{1 ms}	65000	XCAN boot-up time: Delay time after mains connection for initialisation through the master.
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = event-controlled transmission
3	XCAN times	0				
4	XCAN times	0				
5	XCAN times	0				Delay time for initial transmission of the process data objects after the NMT status changed to "Operational"

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2357						Monitoring time for XCAN process data input objects (AIF interface X1) **Only ECSxA:** When the subcodes 1 ... 4 are set, consider the task runtime: C2357/1...4 = Desired monitoring time / task runtime
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time
2	CE monit time	3000				XCAN2_IN monitoring time
3	CE monit time	3000				XCAN3_IN monitoring time
4	CE monit time	3000				Bus-off
5	CE monit time	3000				AIF monitoring time (can only be set if C2357/6 = 0)
6	CE monit time	0				Sync monitoring time (can only be set if C2357/5 = 0)
C2359	AIF HW Set.	0				
			0	{1}	65535	
C2367	Sync Rx Id	128				XCAN receive identifier of the sync telegram(AIF interface X1)
			1	{1}	2047	
C2368	Sync Tx Id	128				XCAN send identifier of the sync telegram (AIF interface X1)
			1	{1}	2047	
C2373						XCAN Sync counter (AIF interface X1)
1	Sync Rate IN	1	1	{1}	240	XCAN1_IN
2	Sync Rate IN	1				XCAN2_IN
3	Sync Rate IN	1				XCAN3_IN
C2374						XCAN Sync counter (AIF interface X1)
1	Sync Rate OUT	1	1	{1}	240	XCAN1_OUT
2	Sync Rate OUT	1				XCAN2_OUT
3	Sync Rate OUT	1				XCAN3_OUT
C2375						TX mode for XCANx_OUT (AIF interface X1)
1	XCAN Tx mode	0		Response to sync		XCAN1_OUT
2	XCAN Tx mode	0		Response to sync		XCAN2_OUT
3	XCAN Tx mode	0		Response to sync		XCAN3_OUT
			0	Response to sync		
			1	No response to sync		
			2	Event		
			3	Event, cycle C2356 superimposed		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2376						XCAN1_OUT mask (AIF interface X1)	
1	XCAN1 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN1 Mask	FFFF				Mask for process data output word 2	
3	XCAN1 Mask	FFFF				Mask for process data output word 3	
4	XCAN1 Mask	FFFF				Mask for process data output word 4	
C2377						XCAN2_OUT mask (AIF interface X1)	
1	XCAN2 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN2 Mask	FFFF				Mask for process data output word 2	
3	XCAN2 Mask	FFFF				Mask for process data output word 3	
4	XCAN2 Mask	FFFF				Mask for process data output word 4	
C2378						XCAN3_OUT mask (AIF interface X1)	
1	XCAN3 Mask	FFFF	0000	{hex}	FFFF	Mask for process data output word 1	
2	XCAN3 Mask	FFFF				Mask for process data output word 2	
3	XCAN3 Mask	FFFF				Mask for process data output word 3	
4	XCAN3 Mask	FFFF				Mask for process data output word 4	
C2382						The XCAN monitoring is configured if no telegrams have been received. (AIF interface X1)	
1	XCAN Conf. CE	0	Off			XCAN1_IN	
2	XCAN Conf. CE	0	Off			XCAN2_IN	
3	XCAN Conf. CE	0	Off			XCAN3_IN	
4	XCAN Conf. CE	0	Off			Bus-off	
5	XCAN Conf. CE	0	Off			Life Guarding / Heartbeat Event	
6	XCAN Conf. CE	0	Off			Response to sync reception	
			0	Off			
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C2450	CANa address	1				Node address for CAN bus interface X14 (CAN-AUX)	📖 169 📖 460
			1	{1}	63	This code is inactive if one of DIP switches 2 ... 7 and switch 1 are set to "ON".	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2451	CANa baud rate	0				Baud rate for CAN bus interface X14 (CAN-AUX)	📖 169
			0	500 kBit/s			
			1	250 kBit/s			
			2	125 kBit/s			
			3	50 kBit/s			
			4	1000 kBit/s			
C2452	CANa mst	0				Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 175
			0	Slave			
			1	Master			
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 173
1	CANa addr sel	0		CAN node address (C2450)		Address CANaux1_IN/OUT	
2	CANa addr sel	0		CAN node address (C2450)		Address CANaux2_IN/OUT	
3	CANa addr sel	0		CAN node address (C2450)		Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 173
1	CANa addr.	129	1	{1}	512	CANaux1_INaddress 2	
2	CANa addr.	1				CANaux1_OUTaddress 2	
3	CANa addr.	257				CANaux2_INaddress 2	
4	CANa addr.	258				CANaux2_OUTaddress 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	
C2455						Identifier for CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only	📖 460
1	CANa Id		1	{1}	2047	Identifier CANaux1_IN	
2	CANa Id					Identifier CANaux1_OUT	
3	CANa Id					Identifier CANaux2_IN	
4	CANa Id					Identifier CANaux2_OUT	
5	CANa Id					Identifier CANaux3_IN	
6	CANa Id					Identifier CANaux3_OUT	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 176
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time: Delay time after mains connection for initialisation through the master.	
2	CANa times	0				CANaux2...3_OUT cycle times: Factor for the task time to send process data telegram. 0 = event-controlled transmission	
3	CANa times	0					
4	CANa times	20				Delay time for initial transmission of the process data objects 2 and 3 after the CAN bus changed to ”Operational”	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 198
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2458	Reset node	0				Resetting a node (CAN bus interface X14)	📖 178
			0	No function			
			1	CAN-AUX reset			
C2459	CANa state					CAN bus status (CAN bus interface X14) Read only	📖 187
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C2460				Telegram counter CANaux_IN/CANaux_OUT (CAN bus interface X14), number of telegrams Read only	📖 188
1	CANa Messages		0 {1} 65535	All sent telegrams	
2	CANa Messages		With a count value > 65535 the counter restarts with 0	All received telegrams	
3	CANa Messages			Sent to CANaux1_OUT	
4	CANa Messages			Sent to CANaux2_OUT	
5	CANa Messages			Sent to CANaux3_OUT	
6	CANa Messages			Sent to parameter data channel 1	
7	CANa Messages			Sent to parameter data channel 2	
8	CANa Messages			Received from CANaux1_IN	
9	CANa Messages			Received from CANaux2_IN	
10	CANa Messages			Received from CANaux3_IN	
11	CANa Messages			Received from parameter data channel 1	
12	CANa Messages			Received from parameter data channel 2	
C2461				Detected load CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 189
1	Load IN/OUT		0 {1 %} 100	All sent telegrams	
2	Load IN/OUT			All received telegrams	
3	Load IN/OUT			Sent to CANaux1_OUT	
4	Load IN/OUT			Sent to CANaux2_OUT	
5	Load IN/OUT			Sent to CANaux3_OUT	
6	Load IN/OUT			Sent to parameter data channel 1	
7	Load IN/OUT			Sent to parameter data channel 2	
8	Load IN/OUT			Received from CANaux1_IN	
9	Load IN/OUT			Received from CANaux2_IN	
10	Load IN/OUT			Received from CANaux3_IN	
11	Load IN/OUT			Received from parameter data channel 1	
12	Load IN/OUT			Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2466	Sync Response	1				CAN sync response for interface X14 (CAN-AUX) **The value ”1” should always be set!**	
			0	No response			
			1	Response			
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 180
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 444 📖 181
			1	{1}	256		
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 179 📖 176
			0	{1 ms}	65000	0 = switched off	
C2470	ParWrite	0				CANaux channel used by L_ParWrite/L_ParRead (byComChannel = 11)	📖 190
			0	Unused PDO channel free for reconfiguration (CANaux1...3_IN/CANaux1...3_OUT)			
			1	Parameter data channel 2			
C2481	MONIT CE11	3				Fault response - monitoring CANaux1_IN error ”CommErrCANauxIN1” (CE11)	📖 198
			0	TRIP			
			2	Warning			
			3	Off			
C2482	MONIT CE12	3				Fault response - monitoring CANaux2_IN error ”CommErrCANauxIN2” (CE12)	📖 198
			0	TRIP			
			2	Warning			
			3	Off			
C2483	MONIT CE13	3				Fault response - monitoring CANaux3_IN error ”CommErrCANauxIN3” (CE13)	📖 198
			0	TRIP			
			2	Warning			
			3	Off			
C2484	MONIT CE14	3				Fault response - ”system bus (CAN-AUX) off” monitoring at CAN bus interface X14 ”BusOffState” (CE14)	📖 198
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2485	MONIT CE15	3				Fault response - gate function monitoring (CE15) "Timeout" when remote parameterisation (C0370) is activated via interface X14 (CAN-AUX)	198 190
			0	TRIP			
			2	Warning			
			3	Off			
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1	
2	CANa IN words					CANaux1_IN word 2	
3	CANa IN words					CANaux1_IN word 3	
4	CANa IN words					CANaux2_IN word 1	
5	CANa IN words					CANaux2_IN word 2	
6	CANa IN words					CANaux2_IN word 3	
7	CANa IN words					CANaux2_IN word 4	
8	CANa IN words					CANaux3_IN word 1	
9	CANa IN words					CANaux3_IN word 2	
10	CANa IN words					CANaux3_IN word 3	
11	CANa IN words					CANaux3_IN word 4	

Code		Possible settings					IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection					
C2493							Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only	
1	CANa OUT words		-199.99	{0.01 %}	199.99		CANaux1_OUT word 1	
2	CANa OUT words						CANaux1_OUT word 2	
3	CANa OUT words						CANaux1_OUT word 3	
4	CANa OUT words						CANaux2_OUT word 1	
5	CANa OUT words						CANaux2_OUT word 2	
6	CANa OUT words						CANaux2_OUT word 3	
7	CANa OUT words						CANaux2_OUT word 4	
8	CANa OUT words						CANaux3_OUT word 1	
9	CANa OUT words						CANaux3_OUT word 2	
10	CANa OUT words						CANaux3_OUT word 3	
11	CANa OUT words						CANaux3_OUT word 4	
C2500							PLC flag 1 ... 255	
			0	{1}	65535			
C2501							PLC flag 256 ... 512	
			0	{1}	65535			
C3005	ControlMode	0					Selection of operating modes	📖 126
			0	Common			Display with changed standard application	
			100	None			Reset of all signal connections	
			1000	SpeedTerm			Speed-controlled, setpoint via analog input	📖 318
			1003	SpeedAIF			Speed-controlled, setpoint via AIF	
			1005	SpeedCAN			Speed-controlled, setpoint via MotionBus (CAN)	
			4000	TorqueTerm			Torque-controlled, setpoint via analog input	📖 343
			4003	TorqueAIF			Torque-controlled, setpoint via AIF	
			4005	TorqueCAN			Torque-controlled, setpoint via MotionBus (CAN)	
C3998	BuildNo						Build no. of the application software Read only	
C3999	Version						Version of the application software Read only	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6110				Display of the digital output signals to the fieldbus module	📖 251
			0 (= FALSE) 1 (= TRUE)		
1	AIF-DigOut			AIF1Out-Bit0 (bit 0)	
2	AIF-DigOut			AIF1Out-Bit1 (bit 1)	
3	AIF-DigOut			AIF1Out-Bit2 (bit 2)	
4	AIF-DigOut			AIF1Out-Bit3 (bit 3)	
5	AIF-DigOut			AIF1Out-Bit4 (bit 4)	
6	AIF-DigOut			AIF1Out-Bit5 (bit 5)	
7	AIF-DigOut			AIF1Out-Bit6 (bit 6)	
8	AIF-DigOut			AIF1Out-Bit7 (bit 7)	
9	AIF-DigOut			AIF1Out-Bit8 (bit 8)	
10	AIF-DigOut			AIF1Out-Bit9 (bit 9)	
11	AIF-DigOut			AIF1Out-Bit10 (bit 10)	
12	AIF-DigOut			AIF1Out-Bit11 (bit 11)	
13	AIF-DigOut			AIF1Out-Bit12 (bit 12)	
14	AIF-DigOut			AIF1Out-Bit13 (bit 13)	
15	AIF-DigOut			AIF1Out-Bit14 (bit 14)	
16	AIF-DigOut			AIF1Out-Bit15 (bit 15)	
[C6111]				Selection of the digital output signals to the fieldbus module	
1	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit0 (bit 0)	📖 251
2	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit1 (bit 1)	
3	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit2 (bit 2)	
4	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit3 (bit 3)	
5	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit4 (bit 4)	
6	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit5 (bit 5)	
7	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit6 (bit 6)	
8	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit7 (bit 7)	
9	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit8 (bit 8)	
10	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit9 (bit 9)	
11	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit10 (bit 10)	
12	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit11 (bit 11)	
13	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit12 (bit 12)	
14	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit13 (bit 13)	
15	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit14 (bit 14)	
16	AIF1Out-dig	1000	0 (FALSE, not assigned)	Source for AIF1Out-Bit15 (bit 15)	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6130				Display of the analog output signals to the fieldbus module	
			-32768 {1} 32767		
1	AIF-AnOut			Output word AIF1Out-DctrlStat	📖 251
2	AIF-AnOut			Output word AIF1Out-W1	
3	AIF-AnOut			Output word AIF1Out-W2	
4	AIF-AnOut			Output word AIF1Out-W3	
5	AIF-AnOut			Output word AIF2Out-W0	📖 258
6	AIF-AnOut			Output word AIF2Out-W1	
7	AIF-AnOut			Output word AIF2Out-W2	
8	AIF-AnOut			Output word AIF2Out-W3	
9	AIF-AnOut			Output word AIF3Out-W0	📖 263
10	AIF-AnOut			Output word AIF3Out-W1	
11	AIF-AnOut			Output word AIF3Out-W2	
12	AIF-AnOut			Output word AIF3Out-W3	
[C6131]				Selection of the analog output signals to the fieldbus module	
1	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-DctrlStat	📖 251
2	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W1	
3	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W2	
4	AIF1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF1Out-W3	
5	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W0	📖 258
6	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W1	
7	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W2	
8	AIF2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF2Out-W3	
9	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W0	📖 263
10	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W1	
11	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W2	
12	AIF3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word AIF3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6150				Display of the phase output signals to the fieldbus module	
			-2147483647 {1} 2147483647		
1	AIF-PhiOut			Output double word AIF1Out-W2/W3	📖 251
2	AIF-PhiOut			Output double word AIF2Out-W0/W1	📖 258
3	AIF-PhiOut			Output double word AIF3Out-W0/W1	📖 263

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6151]				Selection of the phase output signals to the fieldbus module	
1	AIF1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF1Out-W2/W3	📖 251
2	AIF2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF2Out-W0/W1	📖 258
3	AIF3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word AIF3Out-W0/W1	📖 263
			For possible signals see ”selection list - phase signals”		📖 440
C6154	AIF1PdoMap	0		Assignment of the 8 byte user data of the AIF1Out function block to the fieldbus module	📖 251
			0 W2=Int W3=Int	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-W3	
			1 W2 / W3=Dint	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2/W3	
				Byte 7, byte 8 = AIF1Out-W2/W3	
			2 W2=Int W3=bit	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-Bit0...Bit15	
			3 W2=Bit W3=Int	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-W1	
				Byte 5, byte 6 = AIF1Out-Bit0...Bit15	
				Byte 7, byte 8 = AIF1Out-W3	
			4 W1=Bit W23=I	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-Bit0...Bit15	
				Byte 5, byte 6 = AIF1Out-W2	
				Byte 7, byte 8 = AIF1Out-W3	
			5 W1=Bit W23=Di	Byte 1, byte 2 = AIF1Out-DctrlStat	
				Byte 3, byte 4 = AIF1Out-Bit0...Bit15	
				Byte 5, byte 6 = AIF1Out-W2/W3	
				Byte 7, byte 8 = AIF1Out-W2/W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6155	AIF2PdoMap	0		Assignment of the 8 byte user data of the AIF2Out function block to the fieldbus module	📖 258
			0 W0=Int W1=Int	Byte 1, byte 2 = AIF2Out-W0	
				Byte 3, byte 4 = AIF2Out-W1	
				Byte 5, byte 6 = AIF2Out-W2	
				Byte 7, byte 8 = AIF2Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = AIF2Out-W0/W1	
				Byte 3, byte 4 = AIF2Out-W0/W1	
				Byte 5, byte 6 = AIF2Out-W2	
				Byte 7, byte 8 = AIF2Out-W3	
C6156	AIF3PdoMap	0		Assignment of the 8 byte user data of the AIF3Out function block to the fieldbus module	📖 263
			0 W0=Int W1=Int	Byte 1, byte 2 = AIF3Out-W0	
				Byte 3, byte 4 = AIF3Out-W1	
				Byte 5, byte 6 = AIF3Out-W2	
				Byte 7, byte 8 = AIF3Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = AIF3Out-W0/W1	
				Byte 3, byte 4 = AIF3Out-W0/W1	
				Byte 5, byte 6 = AIF3Out-W2	
				Byte 7, byte 8 = AIF3Out-W3	
C6210				Display of the digital output signals to the MotionBus (CAN)	
			0 (= FALSE) 1 (= TRUE)		
1	CAN-DigOut			CAN1Out-Bit0 (bit 0)	📖 276
2	CAN-DigOut			CAN1Out-Bit1 (bit 1)	
3	CAN-DigOut			CAN1Out-Bit2 (bit 2)	
4	CAN-DigOut			CAN1Out-Bit3 (bit 3)	
5	CAN-DigOut			CAN1Out-Bit4 (bit 4)	
6	CAN-DigOut			CAN1Out-Bit5 (bit 5)	
7	CAN-DigOut			CAN1Out-Bit6 (bit 6)	
8	CAN-DigOut			CAN1Out-Bit7 (bit 7)	
9	CAN-DigOut			CAN1Out-Bit8 (bit 8)	
10	CAN-DigOut			CAN1Out-Bit9 (bit 9)	
11	CAN-DigOut			CAN1Out-Bit10 (bit 10)	
12	CAN-DigOut			CAN1Out-Bit11 (bit 11)	
13	CAN-DigOut			CAN1Out-Bit12 (bit 12)	
14	CAN-DigOut			CAN1Out-Bit13 (bit 13)	
15	CAN-DigOut			CAN1Out-Bit14 (bit 14)	
16	CAN-DigOut			CAN1Out-Bit15 (bit 15)	
17	CAN-DigOut			CANSync-ResetSyncForInterpolator	📖 267
18	CAN-DigOut			CAN-ResetNode	📖 179
19	CAN-DigOut			CAN-TxCan2Synchronized	
20	CAN-DigOut			CAN-TxCan3Synchronized	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6211]				Selection of the digital output signals to the MotionBus (CAN)	
1	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit0 (bit 0)	📖 276
2	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit1 (bit 1)	
3	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit2 (bit 2)	
4	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit3 (bit 3)	
5	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit4 (bit 4)	
6	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit5 (bit 5)	
7	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit6 (bit 6)	
8	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit7 (bit 7)	
9	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit8 (bit 8)	
10	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit9 (bit 9)	
11	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit10 (bit 10)	
12	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit11 (bit 11)	
13	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit12 (bit 12)	
14	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit13 (bit 13)	
15	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit14 (bit 14)	
16	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN1Out-Bit15 (bit 15)	
17	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CANSync-ResetSyncForInterpolatord	📖 267
18	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN reset node	📖 179
19	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan2Synchronized	
20	CAN1Out-dig	1000	0 (FALSE, not assigned)	Source for CAN-TxCan3Synchronized	
			For possible signals see ”selection list - digital signals”		📖 428
C6230				Display of the analog output signals to the MotionBus (CAN)	
			-32768 {1} 32767		
1	CAN-AnOut			Output word CAN1Out-DctrlStat	📖 276
2	CAN-AnOut			Output word CAN1Out-W1	
3	CAN-AnOut			Output word CAN1Out-W2	
4	CAN-AnOut			Output word CAN1Out-W3	
5	CAN-AnOut			Output word CAN2Out-W0	📖 285
6	CAN-AnOut			Output word CAN2Out-W1	
7	CAN-AnOut			Output word CAN2Out-W2	
8	CAN-AnOut			Output word CAN2Out-W3	
9	CAN-AnOut			Output word CAN3Out-W0	📖 291
10	CAN-AnOut			Output word CAN3Out-W1	
11	CAN-AnOut			Output word CAN3Out-W2	
12	CAN-AnOut			Output word CAN3Out-W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6231]				Selection of the analog output signals to the MotionBus (CAN)	
1	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-DctrlStat	📖 276
2	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W1	
3	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W2	
4	CAN1Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN1Out-W3	
5	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W0	📖 285
6	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W1	
7	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W2	
8	CAN2Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN2Out-W3	
9	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W0	📖 291
10	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W1	
11	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W2	
12	CAN3Out-anl	1000	FIXED 0 % (not assigned)	Source for output word CAN3Out-W3	
			For possible signals see ”selection list - analog signals”		📖 437
C6250				Display of the phase output signals to the MotionBus (CAN)	
			-2147483647 {1} 2147483647		
1	CAN-PhiOut			Output double word CAN1Out-W2/W3	📖 276
2	CAN-PhiOut			Output double word CAN2Out-W0/W1	📖 285
3	CAN-PhiOut			Output double word CAN3Out-W0/W1	📖 291
[C6251]				Selection of the phase output signals to the MotionBus (CAN)	
1	CAN1Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN1Out-W2/W3	📖 276
2	CAN2Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN2Out-W0/W1	📖 285
3	CAN3Out-phi	1000	FIXED 0 (not assigned)	Source for output double word CAN3Out-W0/W1	📖 291
			For possible signals see ”selection list - phase signals”		📖 440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6254	CAN1PdoMap	0		Assignment of the 8 byte user data of the CAN1Out function block to the MotionBus (CAN)	📖 276
			0 W2=Int W3=Int	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-W3	
			1 W2 / W3=Dint	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2/W3	
				Byte 7, byte 8 = CAN1Out-W2/W3	
			2 W2=Int W3=bit	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-Bit0...Bit15	
			3 W2=Bit W3=Int	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-W1	
				Byte 5, byte 6 = CAN1Out-Bit0...Bit15	
				Byte 7, byte 8 = CAN1Out-W3	
			4 W1=Bit W23=I	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-Bit0...Bit15	
				Byte 5, byte 6 = CAN1Out-W2	
				Byte 7, byte 8 = CAN1Out-W3	
			5 W1=Bit W23=Di	Byte 1, byte 2 = CAN1Out-DctrlStat	
				Byte 3, byte 4 = CAN1Out-Bit0...Bit15	
				Byte 5, byte 6 = CAN1Out-W2/W3	
				Byte 7, byte 8 = CAN1Out-W2/W3	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C6255	CAN2PdoMap	0		Assignment of the 8 byte user data of the CAN2Out function block to the MotionBus (CAN)	285
			0 W0=Int W1=Int	Byte 1, byte 2 = CAN2Out-W0	
				Byte 3, byte 4 = CAN2Out-W1	
				Byte 5, byte 6 = CAN2Out-W2	
				Byte 7, byte 8 = CAN2Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = CAN2Out-W0/W1	
				Byte 3, byte 4 = CAN2Out-W0/W1	
				Byte 5, byte 6 = CAN2Out-W2	
				Byte 7, byte 8 = CAN2Out-W3	
C6256	CAN3PdoMap	0		Assignment of the 8 byte user data of the CAN3Out function block to the MotionBus (CAN)	291
			0 W0=Int W1=Int	Byte 1, byte 2 = CAN3Out-W0	
				Byte 3, byte 4 = CAN3Out-W1	
				Byte 5, byte 6 = CAN3Out-W2	
				Byte 7, byte 8 = CAN3Out-W3	
			1 W0 / W1=Dint	Byte 1, byte 2 = CAN3Out-W0/W1	
				Byte 3, byte 4 = CAN3Out-W0/W1	
				Byte 5, byte 6 = CAN3Out-W2	
				Byte 7, byte 8 = CAN3Out-W3	
C6310				Display of the digital input signals in the DCTRL function block	294
			0 (= FALSE) 1 (= TRUE)		
1	DCTRL-DigOut			DCTRL-CINH1	
2	DCTRL-DigOut			DCTRL-CINH2	
3	DCTRL-DigOut			DCTRL-TripSet1	
4	DCTRL-DigOut			DCTRL-TripReset1	
5	DCTRL-DigOut			DCTRL-StatB0	
6	DCTRL-DigOut			DCTRL-StatB2	
7	DCTRL-DigOut			DCTRL-StatB3	
8	DCTRL-DigOut			DCTRL-StatB4	
9	DCTRL-DigOut			DCTRL-StatB5	
10	DCTRL-DigOut			DCTRL-StatB14	
11	DCTRL-DigOut			DCTRL-StatB15	
12	DCTRL-DigOut			DCTRL-TripSet2	
13	DCTRL-DigOut			DCTRL-TripSet3	
14	DCTRL-DigOut			DCTRL-TripSet4	
15	DCTRL-DigOut			DCTRL-TripReset2	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6311]				Selection of the digital input signals of the DCTRL function block	294
1	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-CInh1	
2	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-CInh2	
3	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet1	
4	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripReset1	
5	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB0	
6	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB2	
7	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB3	
8	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB4	
9	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB5	
10	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB14	
11	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-StatB15	
12	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet2	
13	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet3	
14	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripSet4	
15	DCTRL-dig	1000	0 (FALSE, not assigned)	Source for DCTRL-TripReset2	
			For possible signals see ”selection list - digital signals”		428
C6330				Display of the analog input signals in the DCTRL function block	294
			-32768 {1} 32767		
1	DCTRL-AnOut			DCTRL-wAIF1Ctrl	
2	DCTRL-AnOut			DCTRL-CAN1Ctrl	
[C6331]				Selection of the analog input signals of the DCTRL function block	294
1	DCTRL-anl	1000	FIXED 0 % (not assigned)	Source for DCTRL-wAIF1Ctrl	
2	DCTRL-anl	1000	FIXED 0 % (not assigned)	Source for DCTRL-CAN1Ctrl	
			For possible signals see ”selection list - analog signals”		437
C6370				Display of the output signals at the digital output and the brake relay	308
			0 (= FALSE) 1 (= TRUE)		
1	DIGOUT			Output signal at the digital output X6/DO1 (DigOut-Out1)	
2	DIGOUT			Control of the brake relay (DigOut relay)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C6371]				Selection of the digital output signals for the digital output and the brake relay	📖 308
1	DigoutIn-dig	1000	0 (FALSE, not assigned)	Source for the output signal at the digital output X6/DO1 (DigOut-Out1)	
2	DigoutIn-dig	1000	0 (FALSE, not assigned)	Source for the control of the brake relay (DigOut relay)	
			For possible signals see ”selection list - digital signals”		📖 428
C6430	DFOUT			Display of the analog output signal DFOut-Out in the DFOUT function block	📖 304
			-32768 {1} 32767		
[C6431]	DFOUT	1000		Selection of the analog output signal DFOut-Out for the DFOUT function block	📖 304
			FIXED 0 % (not assigned)		
			For possible signals see ”selection list - analog signals”		📖 437
C7110				Display of the digital input signals in the function block InNeg (signal inversion)	📖 313
1	InNeg-digV			InNeg-DigIn1	
2	InNeg-digV			InNeg-DigIn2	
3	InNeg-digV			InNeg-DigIn3	
C7111				Selection of the digital input signals for the InNeg function block (signal inversion)	📖 313
1	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn1	
2	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn2	
3	InNeg-dig	1000	0 (FALSE, not assigned)	Source for InNeg-DigIn3	
			For possible signals see ”selection list - digital signals”		📖 428
C7130				Display of the analog input signals in the InNeg function block (signal inversion)	📖 313
			-32768 {1} 32767 (= -199.9 %) (= 199.9 %)		
1	InNeg-AnV			InNeg-AnIn1	
2	InNeg-AnV			InNeg-AnIn2	
C7131				Selection of the analog input signals for the InNeg function block (signal inversion)	📖 313
1	InNeg-An	1000	FIXED 0 % (not assigned)	Source for InNeg-AnIn1	
2	InNeg-An	1000	FIXED 0 % (not assigned)	Source for InNeg-AnIn2	
			For possible signals see ”selection list - analog signals”		📖 437
C7150				Display of the phase input signals in the InNeg function block (signal inversion)	📖 313
			-2147483647 {1} 2147483647		
1	InNeg-PhiV			InNeg-PhiIn1	
2	InNeg-PhiV			InNeg-PhiIn2	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7151				Selection of the phase input signals for the InNeg function block (signal inversion)	313
1	InNeg-Phi	1000	FIXED 0 (not assigned)	Source for InNeg-PhiIn1	
2	InNeg-Phi	1000	FIXED 0 (not assigned)	Source for InNeg-PhiIn2	
			For possible signals see "selection list - phase signals"		440
C7210				Display of the digital input signals in the OutNeg function block (signal inversion)	315
1	OutNeg-digV			OutNeg-DigIn1	
2	OutNeg-digV			OutNeg-DigIn2	
3	OutNeg-digV			OutNeg-DigIn3	
C7211				Selection of the digital input signals for the OutNeg function block (signal inversion)	315
1	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn1	
2	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn2	
3	OutNeg-dig	1000	0 (FALSE, not assigned)	Source for OutNeg-DigIn3	
			For possible signals see "selection list - digital signals"		428
C7230			-32768 (= -199.9 %) {1} 32767 (= 199.9 %)	Display of the analog input signals in the OutNeg function block (signal inversion)	315
1	OutNeg-AnV			OutNeg-AnIn1	
2	OutNeg-AnV			OutNeg-AnIn2	
C7231				Selection of the analog input signals for the OutNeg function block (signal inversion)	315
1	OutNeg-An	1000	FIXED 0 % (not assigned)	Source for OutNeg-AnIn1	
2	OutNeg-An	1000	FIXED 0 % (not assigned)	Source for OutNeg-AnIn2	
			For possible signals see "selection list - analog signals"		437
C7250			-2147483647 {1} 2147483647	Display of the phase input signals in the OutNeg function block (signal inversion)	315
1	OutNeg-PhiV			OutNeg-PhiIn1	
2	OutNeg-PhiV			OutNeg-PhiIn2	
C7251				Selection of the phase input signals for the OutNeg function block (signal inversion)	315
1	OutNeg-Phi	1000	FIXED 0 (not assigned)	Source for OutNeg-PhiIn1	
2	OutNeg-Phi	1000	FIXED 0 (not assigned)	Source for OutNeg-PhiIn2	
			For possible signals see "selection list - phase signals"		440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7410				Display of the current signal states on the digital inputs of the ”Speed” function block	
			0 (= FALSE) 1 (= TRUE)		
1	Speed-dig			CW rotation (SPEED-RLQ.Cw)	📖 325
2	Speed-dig			CCW rotation (SPEED-RLQ.CCw)	
3	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog1)saved in C0039	📖 326
4	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog2)saved in C0039	
5	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog4)saved in C0039	
6	Speed-dig			Selection of the fixed speeds (SPEED-NSET.Jog8)saved in C0039	
7	Speed-dig			Setting of the speed setpoint integrator to ”0” along the adjusted ramps (SPEED-NSET.Rfg0)	📖 326
8	Speed-dig			Inversion of additional speed setpoint (SPEED-NAddInv)	
9	Speed-dig			Keeping (freezing) the speed setpoint integrator to the actual value (SPEED-NSET.RfgStop)	
10	Speed-dig			Activation of the motor holding brake (SPEED-BRK.SetBrake)	📖 340
11	Speed-dig			Switching of speed/torque (SPEED-MCTRL.NMSwt)	📖 332
12	Speed-dig			Source for the integral-action component of the speed controller (SPEED-MCTRL.ILoad)	
13	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI1)	📖 326
14	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI2)	
15	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI4)	
16	Speed-dig			Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI8)	
17	Speed-dig			Setting of quick stop (SPEED-QSP.Set1)	📖 332
18	Speed-dig			Setting of quick stop (SPEED-QSP.Set2)	
19	Speed-dig			Activation of phase controller (SPEED-MCTRL.PosOn)	
20	Speed-dig			Inversion of additional torque setpoint (SPEED-MAddInv)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7411]				Selection of the signal source for the digital input signals of the ”Speed” function block	
1	SpeedIn-dig	1000	0 (FALSE, not assigned)	CW rotation (SPEED-RLQ.Cw)	📖 325
2	SpeedIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (SPEED-RLQ.CCw)	
3	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog1) saved in C0039	📖 326
4	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog2)saved in C0039	
5	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog4)saved in C0039	
6	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the fixed speeds (SPEED-NSET.Jog8)saved in C0039	
7	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of the speed setpoint integrator to 0 along the adjusted ramps (SPEED-NSET.Rfg0)	📖 326
8	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional speed setpoint (SPEED-NAddInv)	
9	SpeedIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the speed setpoint integrator to the actual value (SPEED-NSET.RfgStop)	
10	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (SPEED-BRK.SetBrake)	📖 340
11	SpeedIn-dig	1000	0 (FALSE, not assigned)	Switching of speed - torque (SPEED-MCTRL.NMSwt)	📖 332
12	SpeedIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the speed controller (SPEED-MCTRL.ILoad)	
13	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI1)	📖 326
14	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI2)	
15	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI4)	
16	SpeedIn-dig	1000	0 (FALSE, not assigned)	Selection of the acceleration and deceleration times stored in C0101 and C0103 (SPEED-NSET.TI8)	
17	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set1)	📖 332
18	SpeedIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (SPEED-QSP.Set2)	
19	SpeedIn-dig	1000	0 (FALSE, not assigned)	Activation of phase controller (SPEED-MCTRL.PosOn)	
20	SpeedIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (SPEED-MAddInv)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
			For possible signals see ”selection list - digital signals”		📖 428
C7430				Display of the current signal states on the analog input of the ”Speed” function block	
			-32768 {1} 32767 (= -100 %) (= 100 %)		
1	Speed-an			Speed setpoint (SPEED-NSET.NSet)	📖 326
2	Speed-an			Additional speed setpoint (SPEED-NSET.NAdd)	
3	Speed-an			Lower torque limit (SPEED-MCTRL.negLoMLim)	📖 332
4	Speed-an			Upper torque limit (SPEED-MCTRL.HiMLim)	
5	Speed-an			Additional torque setpoint (SPEED-MCTRL.MAdd)	
6	Speed-an			Manual field weakening (SPEED-MCTRL.FldWeak)	
7	Speed-an			Manual adaptation of the proportional gain of the speed controller (SPEED-MCTRL.NAdapt)	
8	Speed-an			Manual adaptation of the integral-action component of the speed controller (SPEED-MCTRL.ISet)	
9	Speed-an			Speed threshold for the motor holding brake (SPEED-BRK.SpeedThreshold)	📖 340
10	Speed-an			Direction of torque created by the drive against the motor holding brake (SPEED-BRK.Sign)	
11	Speed-an			Manual adaptation of the phase controller (SPEED-MCTRL.PAdapt)	📖 332
12	Speed-an			Limit value for influencing the phase controller (SPEED-MCTRL.PosLim)	
13	Speed-an			Lower speed limit for speed limitation (SPEED-MCTRL.NStartMLim)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7431]				Selection of the signal source for the analog input signals of the ”Speed” function block	
1	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Speed setpoint (SPEED-NSET.NSet)	📖 326
2	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Additional speed setpoint (SPEED-NSET.NAdd)	
3	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Lower torque limit (SPEED-MCTRL.negLoMLim)	📖 332
4	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Upper torque limit (SPEED-MCTRL.HiMLim)	
5	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Additional torque setpoint (SPEED-MCTRL.MAdd)	
6	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual field weakening (SPEED-MCTRL.FldWeak)	
7	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the proportional gain of the speed controller (SPEED-MCTRL.NAdapt)	
8	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the Integral-action component of the speed controller (SPEED-MCTRL.ISet)	
9	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Speed threshold for the motor holding brake (SPEED-BRK.SpeedThreshold)	📖 340
10	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Direction of torque created by the drive against the motor holding brake (SPEED-BRK.Sign)	
11	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the phase controller (SPEED-MCTRL.PAdapt)	📖 332
12	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Limit value for influencing the phase controller (SPEED-MCTRL.PosLim)	
13	SpeedIn-anl	1000	FIXED 0 % (not assigned)	Lower speed limit for speed limitation (SPEED-MCTRL.NStartMLim)	
			For possible signals see ”selection list - analog signals”		📖 437
C7450	Speed-phi			Display of the setpoint for the phase controller in the ”Speed” function block (speed controlSPEED-MCTRL.PosSet)	📖 332
			-2147483647 {1} 2147483647		
[C7451]	SpeedIn-phi	1000		Setpoint for the phase controller in the ”Speed” function block (SPEED-MCTRL.PosSet)	📖 332
			FIXED 0 (not assigned)		
			For possible signals see ”selection list - phase signals”		📖 440

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
C7510				Display of the current signal states on the digital inputs of the ”Torque” function block	
			0 (= FALSE) 1 (= TRUE)		
1	TorqueIn-dig			CW rotation (TORQUE-RLQ.Cw)	📖 350
2	TorqueIn-dig			CCW rotation (TORQUE-RLQ.CCw)	
3	TorqueIn-dig			Setting of the torque setpoint integrator to ”0” along the adjusted ramps (TORQUE-NSET.Rfg0)	📖 351
4	TorqueIn-dig			Activation of the motor holding brake (TORQUE-BRK.SetBrake)	📖 360
5	TorqueIn-dig			Setting of quick stop (TORQUE-QSP.Set1)	📖 354
6	TorqueIn-dig			Setting of quick stop (TORQUE-QSP.Set2)	
7	TorqueIn-dig			Source for the integral-action component of the controller (TORQUE-MCTRL.ILoad)	
8	TorqueIn-dig			Keeping (freezing) the torque setpoint integrator to the current value (TORQUE-NSET.RfgStop)	
9	TorqueIn-dig			Inversion of additional torque setpoint (TORQUE-MAddInv)	
[C7511]				Selection of the signal source for the digital input signals of the ”Torque” function block	
1	TorqueIn-dig	1000	0 (FALSE, not assigned)	CW rotation (TORQUE-RLQ.Cw)	📖 350
2	TorqueIn-dig	1000	0 (FALSE, not assigned)	CCW rotation (TORQUE-RLQ.CCw)	
3	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of the torque setpoint integrator to 0 along the adjusted ramps (TORQUE-NSET.Rfg0)	📖 351
4	TorqueIn-dig	1000	0 (FALSE, not assigned)	Activation of the motor holding brake (TORQUE-BRK.SetBrake)	📖 360
5	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set1)	📖 354
6	TorqueIn-dig	1000	0 (FALSE, not assigned)	Setting of quick stop (TORQUE-QSP.Set2)	
7	TorqueIn-dig	1000	0 (FALSE, not assigned)	Source for the integral-action component of the controller (TORQUE-MCTRL.ILoad)	
8	TorqueIn-dig	1000	0 (FALSE, not assigned)	Keeping (freezing) the torque setpoint integrator to the current value (TORQUE-NSET.RfgStop)	
9	TorqueIn-dig	1000	0 (FALSE, not assigned)	Inversion of additional torque setpoint (TORQUE-MAddInv)	
			For possible signals see ”selection list - digital signals”		📖 428

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C7530						Display of the current signal states on the analog input of the "Torque" function block	
			-32768 (= -100 %)	{1}	32767 (= 100 %)		
1	TorqueIn-anl					Torque setpoint (SPEED-MCTRL.MAdd)	📖 354
2	TorqueIn-anl					Setpoint for the upper limit of speed limitation (TORQUE-NSET.NSet)	📖 351
3	TorqueIn-anl					Lower torque limit (TORQUE-MCTRL.negLoMLim)	📖 354
4	TorqueIn-anl					Upper torque limit (TORQUE-MCTRL.HiMLim)	
5	TorqueIn-anl					Setpoint for the lower limit of speed limitation (TORQUE-MCTRL.NStartMLim)	
6	TorqueIn-anl					Manual field weakening (TORQUE-MCTRL.FldWeak)	
7	TorqueIn-anl					Manual adaptation of the proportional gain of the speed controller (TORQUE-MCTRL.NAdapt)	
8	TorqueIn-anl					Manual adaptation of the integral-action component of the speed controller (TORQUE-MCTRL.ISet)	
9	TorqueIn-anl					Torque threshold for the motor holding brake (TORQUE-BRK.TorqueThreshold)	📖 360
10	TorqueIn-anl					Direction of torque created by the drive against the motor holding brake (TORQUE-BRK.Sign)	

Code		Possible settings		IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection		
[C7531]				Selection of the signal source for the analog input signals of the ”Torque” function block	
1	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Torque setpoint (SPEED-MCTRL.MAdd)	📖 354
2	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Setpoint for the upper limit of speed limitation (TORQUE-NSET.NSet)	📖 351
3	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Lower torque limit (TORQUE-MCTRL.negLoMLim)	📖 354
4	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Upper torque limit (TORQUE-MCTRL.HiMLim)	
5	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Setpoint for the lower limit of speed limitation (TORQUE-MCTRL.NStartMLim)	
6	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual field weakening (TORQUE-MCTRL.FldWeak)	
7	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the proportional gain of the speed controller (TORQUE-MCTRL.NAdapt)	
8	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Manual adaptation of the Integral-action component of the speed controller (TORQUE-MCTRL.ISet)	
9	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Torque threshold for the motor holding brake (TORQUE-BRK.TorqueThreshold)	📖 360
10	TorqueIn-anl	1000	FIXED 0 % (not assigned)	Direction of torque created by the drive against the motor holding brake (TORQUE-BRK.Sign)	
			For possible signals see ”selection list - analog signals”		📖 437

13.2 Selection lists for signal linking

13.2.1 List of the digital signal sources

Symbol in signal flow diagrams: □

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
2	FIXED 1(TRUE)	FI 1 / TRUE	gC_bTrue
10	AIF-bCe0CommErr	AIF-Ce0	AIF_bCe0CommErr_b
11	AIF-bFieldBusStateBit0	AIF-Bit0	AIF_bFieldBusStateBit0_b
12	AIF-bFieldBusStateBit1	AIF-Bit1	AIF_bFieldBusStateBit1_b
13	AIF-bFieldBusStateBit2	AIF-Bit2	AIF_bFieldBusStateBit2_b
14	AIF-bFieldBusStateBit3	AIF-Bit3	AIF_bFieldBusStateBit3_b
15	AIF-bFieldBusStateBit4	AIF-Bit4	AIF_bFieldBusStateBit4_b
16	AIF-bFieldBusStateBit5	AIF-Bit5	AIF_bFieldBusStateBit5_b
17	AIF-bFieldBusStateBit6	AIF-Bit6	AIF_bFieldBusStateBit6_b
18	AIF-bFieldBusStateBit7	AIF-Bit7	AIF_bFieldBusStateBit7_b
19	AIF1In-Ctrl.Quickstop_B3	AIF1-CB3	AIF1_bCtrlQuickstop_b
20	AIF1In-Ctrl.Disable_B8	AIF1-CB8	AIF1_bCtrlDisable_b
21	AIF1In-Ctrl.CInhibit_B9	AIF1-CB9	AIF1_bCtrlCInhibit_b
22	AIF1In-Ctrl.TripSet_B10	AIF1-CB10	AIF1_bCtrlTripSet_b
23	AIF1In-Ctrl.TripReset_B11	AIF1-CB11	AIF1_bCtrlTripReset_b
24	AIF1In-Ctrl.Bit0	AIF1-CB0	AIF1_bCtrlB0_b
25	AIF1In-Ctrl.Bit1	AIF1-CB1	AIF1_bCtrlB1_b
26	AIF1In-Ctrl.Bit2	AIF1-CB2	AIF1_bCtrlB2_b
27	AIF1In-Ctrl.Bit4	AIF1-CB4	AIF1_bCtrlB4_b
28	AIF1In-Ctrl.Bit5	AIF1-CB5	AIF1_bCtrlB5_b
29	AIF1In-Ctrl.Bit6	AIF1-CB6	AIF1_bCtrlB6_b
30	AIF1In-Ctrl.Bit7	AIF1-CB7	AIF1_bCtrlB7_b
31	AIF1In-Ctrl.Bit12	AIF1-CB12	AIF1_bCtrlB12_b
32	AIF1In-Ctrl.Bit13	AIF1-CB13	AIF1_bCtrlB13_b
33	AIF1In-Ctrl.Bit14	AIF1-CB14	AIF1_bCtrlB14_b
34	AIF1In-Ctrl.Bit15	AIF1-CB15	AIF1_bCtrlB15_b
35	AIF1In-Bit0	AIF1-Bit0	AIF1_bInB0_b
36	AIF1In-Bit1	AIF1-Bit1	AIF1_bInB1_b
37	AIF1In-Bit2	AIF1-Bit2	AIF1_bInB2_b
38	AIF1In-Bit3	AIF1-Bit3	AIF1_bInB3_b
39	AIF1In-Bit4	AIF1-Bit4	AIF1_bInB4_b
40	AIF1In-Bit5	AIF1-Bit5	AIF1_bInB5_b
41	AIF1In-Bit6	AIF1-Bit6	AIF1_bInB6_b
42	AIF1In-Bit7	AIF1-Bit7	AIF1_bInB7_b
43	AIF1In-Bit8	AIF1-Bit8	AIF1_bInB8_b
44	AIF1In-Bit9	AIF1-Bit9	AIF1_bInB9_b
45	AIF1In-Bit10	AIF1-Bit10	AIF1_bInB10_b
46	AIF1In-Bit11	AIF1-Bit11	AIF1_bInB11_b
47	AIF1In-Bit12	AIF1-Bit12	AIF1_bInB12_b
48	AIF1In-Bit13	AIF1-Bit13	AIF1_bInB13_b
49	AIF1In-Bit14	AIF1-Bit14	AIF1_bInB14_b
50	AIF1In-Bit15	AIF1-Bit15	AIF1_bInB15_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
51	AIF1In-Bit16	AIF1-Bit16	AIF1_bInB16_b
52	AIF1In-Bit17	AIF1-Bit17	AIF1_bInB17_b
53	AIF1In-Bit18	AIF1-Bit18	AIF1_bInB18_b
54	AIF1In-Bit19	AIF1-Bit19	AIF1_bInB19_b
55	AIF1In-Bit20	AIF1-Bit20	AIF1_bInB20_b
56	AIF1In-Bit21	AIF1-Bit21	AIF1_bInB21_b
57	AIF1In-Bit22	AIF1-Bit22	AIF1_bInB22_b
58	AIF1In-Bit23	AIF1-Bit23	AIF1_bInB23_b
59	AIF1In-Bit24	AIF1-Bit24	AIF1_bInB24_b
60	AIF1In-Bit25	AIF1-Bit25	AIF1_bInB25_b
61	AIF1In-Bit26	AIF1-Bit26	AIF1_bInB26_b
62	AIF1In-Bit27	AIF1-Bit27	AIF1_bInB27_b
63	AIF1In-Bit28	AIF1-Bit28	AIF1_bInB28_b
64	AIF1In-Bit29	AIF1-Bit29	AIF1_bInB29_b
65	AIF1In-Bit30	AIF1-Bit30	AIF1_bInB30_b
66	AIF1In-Bit31	AIF1-Bit31	AIF1_bInB31_b
67	AIF2In-Bit0	AIF2-Bit0	AIF2_bInB0_b
68	AIF2In-Bit1	AIF2-Bit1	AIF2_bInB1_b
69	AIF2In-Bit2	AIF2-Bit2	AIF2_bInB2_b
70	AIF2In-Bit3	AIF2-Bit3	AIF2_bInB3_b
71	AIF2In-Bit4	AIF2-Bit4	AIF2_bInB4_b
72	AIF2In-Bit5	AIF2-Bit5	AIF2_bInB5_b
73	AIF2In-Bit6	AIF2-Bit6	AIF2_bInB6_b
74	AIF2In-Bit7	AIF2-Bit7	AIF2_bInB7_b
75	AIF2In-Bit8	AIF2-Bit8	AIF2_bInB8_b
76	AIF2In-Bit9	AIF2-Bit9	AIF2_bInB9_b
77	AIF2In-Bit10	AIF2-Bit10	AIF2_bInB10_b
78	AIF2In-Bit11	AIF2-Bit11	AIF2_bInB11_b
79	AIF2In-Bit12	AIF2-Bit12	AIF2_bInB12_b
80	AIF2In-Bit13	AIF2-Bit13	AIF2_bInB13_b
81	AIF2In-Bit14	AIF2-Bit14	AIF2_bInB14_b
82	AIF2In-Bit15	AIF2-Bit15	AIF2_bInB15_b
83	AIF2In-Bit16	AIF2-Bit16	AIF2_bInB16_b
84	AIF2In-Bit17	AIF2-Bit17	AIF2_bInB17_b
85	AIF2In-Bit18	AIF2-Bit18	AIF2_bInB18_b
86	AIF2In-Bit19	AIF2-Bit19	AIF2_bInB19_b
87	AIF2In-Bit20	AIF2-Bit20	AIF2_bInB20_b
88	AIF2In-Bit21	AIF2-Bit21	AIF2_bInB21_b
89	AIF2In-Bit22	AIF2-Bit22	AIF2_bInB22_b
90	AIF2In-Bit23	AIF2-Bit23	AIF2_bInB23_b
91	AIF2In-Bit24	AIF2-Bit24	AIF2_bInB24_b
92	AIF2In-Bit25	AIF2-Bit25	AIF2_bInB25_b
93	AIF2In-Bit26	AIF2-Bit26	AIF2_bInB26_b
94	AIF2In-Bit27	AIF2-Bit27	AIF2_bInB27_b
95	AIF2In-Bit28	AIF2-Bit28	AIF2_bInB28_b
96	AIF2In-Bit29	AIF2-Bit29	AIF2_bInB29_b
97	AIF2In-Bit30	AIF2-Bit30	AIF2_bInB30_b
98	AIF2In-Bit31	AIF2-Bit31	AIF2_bInB31_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
99	AIF3In-Bit0	AIF3-Bit0	AIF3_bInB0_b
100	AIF3In-Bit1	AIF3-Bit1	AIF3_bInB1_b
101	AIF3In-Bit2	AIF3-Bit2	AIF3_bInB2_b
102	AIF3In-Bit3	AIF3-Bit3	AIF3_bInB3_b
103	AIF3In-Bit4	AIF3-Bit4	AIF3_bInB4_b
104	AIF3In-Bit5	AIF3-Bit5	AIF3_bInB5_b
105	AIF3In-Bit6	AIF3-Bit6	AIF3_bInB6_b
106	AIF3In-Bit7	AIF3-Bit7	AIF3_bInB7_b
107	AIF3In-Bit8	AIF3-Bit8	AIF3_bInB8_b
108	AIF3In-Bit9	AIF3-Bit9	AIF3_bInB9_b
109	AIF3In-Bit10	AIF3-Bit10	AIF3_bInB10_b
110	AIF3In-Bit11	AIF3-Bit11	AIF3_bInB11_b
111	AIF3In-Bit12	AIF3-Bit12	AIF3_bInB12_b
112	AIF3In-Bit13	AIF3-Bit13	AIF3_bInB13_b
113	AIF3In-Bit14	AIF3-Bit14	AIF3_bInB14_b
114	AIF3In-Bit15	AIF3-Bit15	AIF3_bInB15_b
115	AIF3In-Bit16	AIF3-Bit16	AIF3_bInB16_b
116	AIF3In-Bit17	AIF3-Bit17	AIF3_bInB17_b
117	AIF3In-Bit18	AIF3-Bit18	AIF3_bInB18_b
118	AIF3In-Bit19	AIF3-Bit19	AIF3_bInB19_b
119	AIF3In-Bit20	AIF3-Bit20	AIF3_bInB20_b
120	AIF3In-Bit21	AIF3-Bit21	AIF3_bInB21_b
121	AIF3In-Bit22	AIF3-Bit22	AIF3_bInB22_b
122	AIF3In-Bit23	AIF3-Bit23	AIF3_bInB23_b
123	AIF3In-Bit24	AIF3-Bit24	AIF3_bInB24_b
124	AIF3In-Bit25	AIF3-Bit25	AIF3_bInB25_b
125	AIF3In-Bit26	AIF3-Bit26	AIF3_bInB26_b
126	AIF3In-Bit27	AIF3-Bit27	AIF3_bInB27_b
127	AIF3In-Bit28	AIF3-Bit28	AIF3_bInB28_b
128	AIF3In-Bit29	AIF3-Bit29	AIF3_bInB29_b
129	AIF3In-Bit30	AIF3-Bit30	AIF3_bInB30_b
130	AIF3In-Bit31	AIF3-Bit31	AIF3_bInB31_b
131	DIGIN-CINH	DIG-CInh	DIGIN_bCInh_b
132	DigIn-In1	DIG-In1	DIGIN_bIn1_b
133	DigIn-In2	DIG-In2	DIGIN_bIn2_b
134	DigIn-In3	DIG-In3	DIGIN_bIn3_b
135	DigIn-In4	DIG-In4	DIGIN_bIn4_b
136	DigIn-safe_standstill	DIG-SS	DIGIN_b_safe_standstill_b
137	CAN-Ce1CommErrCanIn1	CAN-Ce1	CAN_bCe1CommErrCanIn1_b
138	CAN-Ce2CommErrCanIn2	CAN-Ce2	CAN_bCe2CommErrCanIn2_b
139	CAN-Ce3CommErrCanIn3	CAN-Ce3	CAN_bCe3CommErrCanIn3_b
140	CAN-Ce4BusOffState	CAN-Ce4	CAN_bCe4BusOffState_b
141	CAN1In-Ctrl.Quickstop_B3	CAN1-CB3	CAN1_bCtrlQuickstop_b
142	CAN1In-Ctrl.Disable_B8	CAN1-CB8	CAN1_bCtrlDisable_b
143	CAN1In-Ctrl.CInhibit_B9	CAN1-CB9	CAN1_bCtrlCInhibit_b
144	CAN1In-Ctrl.TripSet_B10	CAN1-CB10	CAN1_bCtrlTripSet_b
145	CAN1In-Ctrl.TripReset_B11	CAN1-CB11	CAN1_bCtrlTripReset_b
146	CAN1In-Ctrl.Bit0	CAN1-CB0	CAN1_bCtrlB0_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
147	CAN1In-Ctrl.Bit1	CAN1-CB1	CAN1_bCtrlB1_b
148	CAN1In-Ctrl.Bit2	CAN1-CB2	CAN1_bCtrlB2_b
149	CAN1In-Ctrl.Bit4	CAN1-CB4	CAN1_bCtrlB4_b
150	CAN1In-Ctrl.Bit5	CAN1-CB5	CAN1_bCtrlB5_b
151	CAN1In-Ctrl.Bit6	CAN1-CB6	CAN1_bCtrlB6_b
152	CAN1In-Ctrl.Bit7	CAN1-CB7	CAN1_bCtrlB7_b
153	CAN1In-Ctrl.Bit12	CAN1-CB12	CAN1_bCtrlB12_b
154	CAN1In-Ctrl.Bit13	CAN1-CB13	CAN1_bCtrlB13_b
155	CAN1In-Ctrl.Bit14	CAN1-CB14	CAN1_bCtrlB14_b
156	CAN1In-Ctrl.Bit15	CAN1-CB15	CAN1_bCtrlB15_b
157	CAN1In-Bit0	CAN1-Bit0	CAN1_bInB0_b
158	CAN1In-Bit1	CAN1-Bit1	CAN1_bInB1_b
159	CAN1In-Bit2	CAN1-Bit2	CAN1_bInB2_b
160	CAN1In-Bit3	CAN1-Bit3	CAN1_bInB3_b
161	CAN1In-Bit4	CAN1-Bit4	CAN1_bInB4_b
162	CAN1In-Bit5	CAN1-Bit5	CAN1_bInB5_b
163	CAN1In-Bit6	CAN1-Bit6	CAN1_bInB6_b
164	CAN1In-Bit7	CAN1-Bit7	CAN1_bInB7_b
165	CAN1In-Bit8	CAN1-Bit8	CAN1_bInB8_b
166	CAN1In-Bit9	CAN1-Bit9	CAN1_bInB9_b
167	CAN1In-Bit10	CAN1-Bit10	CAN1_bInB10_b
168	CAN1In-Bit11	CAN1-Bit11	CAN1_bInB11_b
169	CAN1In-Bit12	CAN1-Bit12	CAN1_bInB12_b
170	CAN1In-Bit13	CAN1-Bit13	CAN1_bInB13_b
171	CAN1In-Bit14	CAN1-Bit14	CAN1_bInB14_b
172	CAN1In-Bit15	CAN1-Bit15	CAN1_bInB15_b
173	CAN1In-Bit16	CAN1-Bit16	CAN1_bInB16_b
174	CAN1In-Bit17	CAN1-Bit17	CAN1_bInB17_b
175	CAN1In-Bit18	CAN1-Bit18	CAN1_bInB18_b
176	CAN1In-Bit19	CAN1-Bit19	CAN1_bInB19_b
177	CAN1In-Bit20	CAN1-Bit20	CAN1_bInB20_b
178	CAN1In-Bit21	CAN1-Bit21	CAN1_bInB21_b
179	CAN1In-Bit22	CAN1-Bit22	CAN1_bInB22_b
180	CAN1In-Bit23	CAN1-Bit23	CAN1_bInB23_b
181	CAN1In-Bit24	CAN1-Bit24	CAN1_bInB24_b
182	CAN1In-Bit25	CAN1-Bit25	CAN1_bInB25_b
183	CAN1In-Bit26	CAN1-Bit26	CAN1_bInB26_b
184	CAN1In-Bit27	CAN1-Bit27	CAN1_bInB27_b
185	CAN1In-Bit28	CAN1-Bit28	CAN1_bInB28_b
186	CAN1In-Bit29	CAN1-Bit29	CAN1_bInB29_b
187	CAN1In-Bit30	CAN1-Bit30	CAN1_bInB30_b
188	CAN1In-Bit31	CAN1-Bit31	CAN1_bInB31_b
189	CAN2In-Bit0	CAN2-Bit0	CAN2_bInB0_b
190	CAN2In-Bit1	CAN2-Bit1	CAN2_bInB1_b
191	CAN2In-Bit2	CAN2-Bit2	CAN2_bInB2_b
192	CAN2In-Bit3	CAN2-Bit3	CAN2_bInB3_b
193	CAN2In-Bit4	CAN2-Bit4	CAN2_bInB4_b
194	CAN2In-Bit5	CAN2-Bit5	CAN2_bInB5_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
195	CAN2In-Bit6	CAN2-Bit6	CAN2_bInB6_b
196	CAN2In-Bit7	CAN2-Bit7	CAN2_bInB7_b
197	CAN2In-Bit8	CAN2-Bit8	CAN2_bInB8_b
198	CAN2In-Bit9	CAN2-Bit9	CAN2_bInB9_b
199	CAN2In-Bit10	CAN2-Bit10	CAN2_bInB10_b
200	CAN2In-Bit11	CAN2-Bit11	CAN2_bInB11_b
201	CAN2In-Bit12	CAN2-Bit12	CAN2_bInB12_b
202	CAN2In-Bit13	CAN2-Bit13	CAN2_bInB13_b
203	CAN2In-Bit14	CAN2-Bit14	CAN2_bInB14_b
204	CAN2In-Bit15	CAN2-Bit15	CAN2_bInB15_b
205	CAN2In-Bit16	CAN2-Bit16	CAN2_bInB16_b
206	CAN2In-Bit17	CAN2-Bit17	CAN2_bInB17_b
207	CAN2In-Bit18	CAN2-Bit18	CAN2_bInB18_b
208	CAN2In-Bit19	CAN2-Bit19	CAN2_bInB19_b
209	CAN2In-Bit20	CAN2-Bit20	CAN2_bInB20_b
210	CAN2In-Bit21	CAN2-Bit21	CAN2_bInB21_b
211	CAN2In-Bit22	CAN2-Bit22	CAN2_bInB22_b
212	CAN2In-Bit23	CAN2-Bit23	CAN2_bInB23_b
213	CAN2In-Bit24	CAN2-Bit24	CAN2_bInB24_b
214	CAN2In-Bit25	CAN2-Bit25	CAN2_bInB25_b
215	CAN2In-Bit26	CAN2-Bit26	CAN2_bInB26_b
216	CAN2In-Bit27	CAN2-Bit27	CAN2_bInB27_b
217	CAN2In-Bit28	CAN2-Bit28	CAN2_bInB28_b
218	CAN2In-Bit29	CAN2-Bit29	CAN2_bInB29_b
219	CAN2In-Bit30	CAN2-Bit30	CAN2_bInB30_b
220	CAN2In-Bit31	CAN2-Bit31	CAN2_bInB31_b
221	CAN3In-Bit0	CAN3-Bit0	CAN3_bInB0_b
222	CAN3In-Bit1	CAN3-Bit1	CAN3_bInB1_b
223	CAN3In-Bit2	CAN3-Bit2	CAN3_bInB2_b
224	CAN3In-Bit3	CAN3-Bit3	CAN3_bInB3_b
225	CAN3In-Bit4	CAN3-Bit4	CAN3_bInB4_b
226	CAN3In-Bit5	CAN3-Bit5	CAN3_bInB5_b
227	CAN3In-Bit6	CAN3-Bit6	CAN3_bInB6_b
228	CAN3In-Bit7	CAN3-Bit7	CAN3_bInB7_b
229	CAN3In-Bit8	CAN3-Bit8	CAN3_bInB8_b
230	CAN3In-Bit9	CAN3-Bit9	CAN3_bInB9_b
231	CAN3In-Bit10	CAN3-Bit10	CAN3_bInB10_b
232	CAN3In-Bit11	CAN3-Bit11	CAN3_bInB11_b
233	CAN3In-Bit12	CAN3-Bit12	CAN3_bInB12_b
234	CAN3In-Bit13	CAN3-Bit13	CAN3_bInB13_b
235	CAN3In-Bit14	CAN3-Bit14	CAN3_bInB14_b
236	CAN3In-Bit15	CAN3-Bit15	CAN3_bInB15_b
237	CAN3In-Bit16	CAN3-Bit16	CAN3_bInB16_b
238	CAN3In-Bit17	CAN3-Bit17	CAN3_bInB17_b
239	CAN3In-Bit18	CAN3-Bit18	CAN3_bInB18_b
240	CAN3In-Bit19	CAN3-Bit19	CAN3_bInB19_b
241	CAN3In-Bit20	CAN3-Bit20	CAN3_bInB20_b
242	CAN3In-Bit21	CAN3-Bit21	CAN3_bInB21_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
243	CAN3In-Bit22	CAN3-Bit22	CAN3_bInB22_b
244	CAN3In-Bit23	CAN3-Bit23	CAN3_bInB23_b
245	CAN3In-Bit24	CAN3-Bit24	CAN3_bInB24_b
246	CAN3In-Bit25	CAN3-Bit25	CAN3_bInB25_b
247	CAN3In-Bit26	CAN3-Bit26	CAN3_bInB26_b
248	CAN3In-Bit27	CAN3-Bit27	CAN3_bInB27_b
249	CAN3In-Bit28	CAN3-Bit28	CAN3_bInB28_b
250	CAN3In-Bit29	CAN3-Bit29	CAN3_bInB29_b
251	CAN3In-Bit30	CAN3-Bit30	CAN3_bInB30_b
252	CAN3In-Bit31	CAN3-Bit31	CAN3_bInB31_b
253	CANSync-InsideWindow	CSync-IW	CAN_bSyncInsideWindow_b
254	CANSync-ForInterpolator	CSync-FIn	CAN_bSyncForInterpolator_b
255	DCTRL-FAIL	DCT-Fail	DCTRL_bFail_b
256	DCTRL-IMP	DCT-Imp	DCTRL_bImp_b
257	DCTRL-TRIP	DCT-Trip	DCTRL_bTrip_b
258	DCTRL-QspIn	DCT-QspIn	DCTRL_bQspIn_b
259	DCTRL-RDY	DCT-Rdy	DCTRL_bRdy_b
260	DCTRL-CwCcw	DCT-CwCcw	DCTRL_bCwCcw_b
261	DCTRL-NActEq0	DCT-NEq0	DCTRL_bNActEq0_b
262	DCTRL-CINH	DCT-CInh	DCTRL_bCInh_b
263	DCTRL-Stat1	DCT-Stat1	DCTRL_bStat1_b
264	DCTRL-Stat2	DCT-Stat2	DCTRL_bStat2_b
265	DCTRL-Stat4	DCT-Stat4	DCTRL_bStat4_b
266	DCTRL-Stat8	DCT-Stat8	DCTRL_bStat8_b
267	DCTRL-WARN	DCT-Warn	DCTRL_bWarn_b
268	DCTRL-MESS	DCT-Mess	DCTRL_bMess_b
269	DCTRL-INIT	DCT-Init	DCTRL_bInit_b
270	DCTRL-ExternalFault	DCT-EEr	DCTRL_bExternalFault_b
271	FCODE-C0250	FC-250	FCODE_bC250_b
272	FCODE-C0471.Bit0	FC-471.0	FCODE_bC471Bit0_b
273	FCODE-C0471.Bit1	FC-471.1	FCODE_bC471Bit1_b
274	FCODE-C0471.Bit2	FC-471.2	FCODE_bC471Bit2_b
275	FCODE-C0471.Bit3	FC-471.3	FCODE_bC471Bit3_b
276	FCODE-C0471.Bit4	FC-471.4	FCODE_bC471Bit4_b
277	FCODE-C0471.Bit5	FC-471.5	FCODE_bC471Bit5_b
278	FCODE-C0471.Bit6	FC-471.6	FCODE_bC471Bit6_b
279	FCODE-C0471.Bit7	FC-471.7	FCODE_bC471Bit7_b
280	FCODE-C0471.Bit8	FC-471.8	FCODE_bC471Bit8_b
281	FCODE-C0471.Bit9	FC-471.9	FCODE_bC471Bit9_b
282	FCODE-C0471.Bit10	FC-471.10	FCODE_bC471Bit10_b
283	FCODE-C0471.Bit11	FC-471.11	FCODE_bC471Bit11_b
284	FCODE-C0471.Bit12	FC-471.12	FCODE_bC471Bit12_b
285	FCODE-C0471.Bit13	FC-471.13	FCODE_bC471Bit13_b
286	FCODE-C0471.Bit14	FC-471.14	FCODE_bC471Bit14_b
287	FCODE-C0471.Bit15	FC-471.15	FCODE_bC471Bit15_b
288	FCODE-C0471.Bit16	FC-471.16	FCODE_bC471Bit16_b
289	FCODE-C0471.Bit17	FC-471.17	FCODE_bC471Bit17_b
290	FCODE-C0471.Bit18	FC-471.18	FCODE_bC471Bit18_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
291	FCODE-C0471.Bit19	FC-471.19	FCODE_bC471Bit19_b
292	FCODE-C0471.Bit20	FC-471.20	FCODE_bC471Bit20_b
293	FCODE-C0471.Bit21	FC-471.21	FCODE_bC471Bit21_b
294	FCODE-C0471.Bit22	FC-471.22	FCODE_bC471Bit22_b
295	FCODE-C0471.Bit23	FC-471.23	FCODE_bC471Bit23_b
296	FCODE-C0471.Bit24	FC-471.24	FCODE_bC471Bit24_b
297	FCODE-C0471.Bit25	FC-471.25	FCODE_bC471Bit25_b
298	FCODE-C0471.Bit26	FC-471.26	FCODE_bC471Bit26_b
299	FCODE-C0471.Bit27	FC-471.27	FCODE_bC471Bit27_b
300	FCODE-C0471.Bit28	FC-471.28	FCODE_bC471Bit28_b
301	FCODE-C0471.Bit29	FC-471.29	FCODE_bC471Bit29_b
302	FCODE-C0471.Bit30	FC-471.30	FCODE_bC471Bit30_b
303	FCODE-C0471.Bit31	FC-471.31	FCODE_bC471Bit31_b
304	FCODE-C0135.Bit0	FC-135.0	FCODE_bC135Bit0_b
305	FCODE-C0135.Bit1	FC-135.1	FCODE_bC135Bit1_b
306	FCODE-C0135.Bit2	FC-135.2	FCODE_bC135Bit2_b
307	FCODE-C0135.Bit3	FC-135.3	FCODE_bC135Bit3_b
308	FCODE-C0135.Bit4	FC-135.4	FCODE_bC135Bit4_b
309	FCODE-C0135.Bit5	FC-135.5	FCODE_bC135Bit5_b
310	FCODE-C0135.Bit6	FC-135.6	FCODE_bC135Bit6_b
311	FCODE-C0135.Bit7	FC-135.7	FCODE_bC135Bit7_b
312	FCODE-C0135.Bit8	FC-135.8	FCODE_bC135Bit8_b
313	FCODE-C0135.Bit9	FC-135.9	FCODE_bC135Bit9_b
314	FCODE-C0135.Bit10	FC-135.10	FCODE_bC135Bit10_b
315	FCODE-C0135.Bit11	FC-135.11	FCODE_bC135Bit11_b
316	FCODE-C0135.Bit12	FC-135.12	FCODE_bC135Bit12_b
317	FCODE-C0135.Bit13	FC-135.13	FCODE_bC135Bit13_b
318	FCODE-C0135.Bit14	FC-135.14	FCODE_bC135Bit14_b
319	FCODE-C0135.Bit15	FC-135.15	FCODE_bC135Bit15_b
320	SPEED-MCTRL.QspIn	SP-M.Qsp	MCTRL_bQspIn_b
321	SPEED-MCTRL.MMax	SP-M.MMax	MCTRL_bMMax_b
322	SPEED-MCTRL.IMax	SP-M.IMax	MCTRL_bIMax_b
324	SPEED-MCTRL.UnderVoltage	SP-M.UnV	MCTRL_bUnderVoltage_b
325	SPEED-MCTRL.OverVoltage	SP-M.OvV	MCTRL_bOverVoltage_b
326	SPEED-MCTRL.ShortCircuit	SP-M.ShC	MCTRL_bShortCircuit_b
327	SPEED-MCTRL.EarthFault	SP-M.EaF	MCTRL_bEarthFault_b
328	SPEED-MCTRL.NmaxFault	SP-M.NmaF	MCTRL_bNmaxFault_b
329	SPEED-MCTRL.ResolverFault	SP-M.ResF	MCTRL_bResolverFault_b
330	SPEED-MCTRL.MotorTempGreaterSetValue	SP-M.MoVa	MCTRL_bMotorTempGreaterSetValue_b
331	SPEED-MCTRL.MotorTempGreaterC0121	SP-M.M121	MCTRL_bMotorTempGreaterC0121_b
333	SPEED-MCTRL.KuehlGreaterSetValue	SP-M.KuVa	MCTRL_bKuehlGreaterSetValue_b
334	SPEED-MCTRL.KuehlGreaterC0122	SP-M.K122	MCTRL_bKuehlGreaterC0122_b
335	SPEED-MCTRL.SensorFault	SP-M.SenF	MCTRL_bSensorFault_b
336	SPEED-MCTRL.EncoderFault	SP-M.EncF	MCTRL_bEncoderFault_b
337	SPEED-MCTRL.IxtOverload	SP-M.Ixt	MCTRL_bIxtOverload_b
340	TORQUE-MCTRL.QspIn	T-M.Qsp	MCTRL_bQspIn_b
341	TORQUE-MCTRL.MMax	T-M.MMax	MCTRL_bMMax_b
342	TORQUE-MCTRL.IMax	T-M.IMax	MCTRL_bIMax_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
344	TORQUE-MCTRL.UnderVoltage	T-M.UnV	MCTRL_bUnderVoltage_b
345	TORQUE-MCTRL.OverVoltage	T-M.OvV	MCTRL_bOverVoltage_b
346	TORQUE-MCTRL.ShortCircuit	T-M.ShC	MCTRL_bShortCircuit_b
347	TORQUE-MCTRL.EarthFault	T-M.EaF	MCTRL_bEarthFault_b
348	TORQUE-MCTRL.NmaxFault	T-M.NmaF	MCTRL_bNmaxFault_b
349	TORQUE-MCTRL.ResolverFault	T-M.ResF	MCTRL_bResolverFault_b
350	TORQUE-MCTRL.MotorTempGreaterSetValue	T-M.MoVa	MCTRL_bMotorTempGreaterSetValue_b
351	TORQUE-MCTRL.MotorTempGreaterC0121	T-M.M121	MCTRL_bMotorTempGreaterC0121_b
353	TORQUE-MCTRL.KuehlGreaterSetValue	T-M.KuVa	MCTRL_bKuehlGreaterSetValue_b
354	TORQUE-MCTRL.KuehlGreaterC0122	T-M.K122	MCTRL_bKuehlGreaterC0122_b
355	TORQUE-MCTRL.SensorFault	T-M.SenF	MCTRL_bSensorFault_b
356	TORQUE-MCTRL.EncoderFault	T-M.EncF	MCTRL_bEncoderFault_b
357	TORQUE-MCTRL.IxtOverload	T-M.Ixt	MCTRL_bIxtOverload_b
400	SPEED-NSET.RfgIEqO	SP-N.REqO	ECS_MAIN.L_NSET1.bRfgIEqO_b
401	TORQUE-NSET.RfgIEqO	T-N.REqO	ECS_MAIN.L_NSET1.bRfgIEqO_b
410	SPEED-BRK.SetQSP	SP-B.QSP	ECS_MAIN.L_BRK1.bQSP_b
411	SPEED-BRK.NegOut	SP-B.NOut	ECS_MAIN.BRK_bNegOut_b
412	SPEED-BRK.Out	SP-B.Out	ECS_MAIN.L_BRK1.bOut_b
413	SPEED-BRK.SetCInh	SP-B.CInh	ECS_MAIN.L_BRK1.bCInh_b
414	SPEED-BRK.MStore	SP-B.MSt	ECS_MAIN.L_BRK1.bMStore_b
420	TORQUE-BRK.SetQSP	T-B.QSP	ECS_MAIN.L_BRK1.bQSP_b
421	TORQUE-BRK.NegOut	T-B.NOut	ECS_MAIN.BRK_bNegOut_b
422	TORQUE-BRK.Out	T-B.Out	ECS_MAIN.L_BRK1.bOut_b
423	TORQUE-BRK.SetCInh	T-B.CInh	ECS_MAIN.L_BRK1.bCInh_b
424	TORQUE-BRK.MStore	T-B.MSt	ECS_MAIN.L_BRK1.bMStore_b
450	SPEED-RLQ.QSP	SP-RL.QSP	ECS_MAIN.L_RLQ1.bQSP_b
451	SPEED-RLQ.CwCCw	SP-RL.Cw	ECS_MAIN.L_RLQ1.bCwCCw_b
460	TORQUE-RLQ.QSP	T-RL.QSP	ECS_MAIN.L_RLQ1.bQSP_b
461	TORQUE-RLQ.CwCCw	T-RL.Cw	ECS_MAIN.L_RLQ1.bCwCCw_b
651	InNeg-DigOut1	IN-AnOut1	InNeg_bDigOut1
652	InNeg-DigOut2	IN-AnOut2	InNeg_bDigOut2
653	InNeg-DigOut3	IN-AnOut3	InNeg_bDigOut3
671	OutNeg-DigOut1	ON-AnOut1	OutNeg_bDigOut1
672	OutNeg-DigOut2	ON-AnOut2	OutNeg_bDigOut2
673	OutNeg-DigOut3	ON-AnOut3	OutNeg_bDigOut3
700	AIF1In-W1.Bit0	AIF1-1.0	AIF1_bInWord1B0_b
701	AIF1In-W1.Bit1	AIF1-1.1	AIF1_bInWord1B1_b
702	AIF1In-W1.Bit2	AIF1-1.2	AIF1_bInWord1B2_b
703	AIF1In-W1.Bit3	AIF1-1.3	AIF1_bInWord1B3_b
704	AIF1In-W1.Bit4	AIF1-1.4	AIF1_bInWord1B4_b
705	AIF1In-W1.Bit5	AIF1-1.5	AIF1_bInWord1B5_b
706	AIF1In-W1.Bit6	AIF1-1.6	AIF1_bInWord1B6_b
707	AIF1In-W1.Bit7	AIF1-1.7	AIF1_bInWord1B7_b
708	AIF1In-W1.Bit8	AIF1-1.8	AIF1_bInWord1B8_b
709	AIF1In-W1.Bit9	AIF1-1.9	AIF1_bInWord1B9_b
710	AIF1In-W1.Bit10	AIF1-1.10	AIF1_bInWord1B10_b
711	AIF1In-W1.Bit11	AIF1-1.11	AIF1_bInWord1B11_b
712	AIF1In-W1.Bit12	AIF1-1.12	AIF1_bInWord1B12_b

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
713	AIF1In-W1.Bit13	AIF1-1.13	AIF1_bInWord1B13_b
714	AIF1In-W1.Bit14	AIF1-1.14	AIF1_bInWord1B14_b
715	AIF1In-W1.Bit15	AIF1-1.15	AIF1_bInWord1B15_b
800	CAN1In-W1.Bit0	CAN1-1.0	CAN1_bInWord1B0_b
801	CAN1In-W1.Bit1	CAN1-1.1	CAN1_bInWord1B1_b
802	CAN1In-W1.Bit2	CAN1-1.2	CAN1_bInWord1B2_b
803	CAN1In-W1.Bit3	CAN1-1.3	CAN1_bInWord1B3_b
804	CAN1In-W1.Bit4	CAN1-1.4	CAN1_bInWord1B4_b
805	CAN1In-W1.Bit5	CAN1-1.5	CAN1_bInWord1B5_b
806	CAN1In-W1.Bit6	CAN1-1.6	CAN1_bInWord1B6_b
807	CAN1In-W1.Bit7	CAN1-1.7	CAN1_bInWord1B7_b
808	CAN1In-W1.Bit8	CAN1-1.8	CAN1_bInWord1B8_b
809	CAN1In-W1.Bit9	CAN1-1.9	CAN1_bInWord1B9_b
810	CAN1In-W1.Bit10	CAN1-1.10	CAN1_bInWord1B10_b
811	CAN1In-W1.Bit11	CAN1-1.11	CAN1_bInWord1B11_b
812	CAN1In-W1.Bit12	CAN1-1.12	CAN1_bInWord1B12_b
813	CAN1In-W1.Bit13	CAN1-1.13	CAN1_bInWord1B13_b
814	CAN1In-W1.Bit14	CAN1-1.14	CAN1_bInWord1B14_b
815	CAN1In-W1.Bit15	CAN1-1.15	CAN1_bInWord1B15_b
880	SYS-Clock01Hz	SYS-0.1Hz	SYSTEM_bClock01Hz
881	SYS-Clock1Hz	SYS-1Hz	SYSTEM_bClock1Hz
882	SYS-Clock10Hz	SYS-10Hz	SYSTEM_bClock10Hz
883	SYS-Clock100Hz	SYS-100Hz	SYSTEM_bClock100Hz
920	AIn1-Error	AIN1-Err	AIN1_bError_b
1000	FIXED 0/FALSE	0/FALSE	gC_bFalse

13.2.2 List of the analog signal sources

Symbol in signal flow diagrams: O

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
2	FIXED100%	FIXED100%	gC_wPos16384
3	FIXED-100%	FIXED-100%	gC_wNeg16384
10	AIF1In-DctrlCtrl	AIF1-Dctrl	AIF1_wDctrlCtrl
11	AIF1In-W1	AIF1In-W1	AIF1_nInW1_a
12	AIF1In-W2	AIF1In-W2	AIF1_nInW2_a
13	AIF1In-W3	AIF1In-W3	AIF1_nInW3_a
14	AIF2In-W1	AIF2In-W1	AIF2_nInW1_a
15	AIF2In-W2	AIF2In-W2	AIF2_nInW2_a
16	AIF2In-W3	AIF2In-W3	AIF2_nInW3_a
17	AIF2In-W4	AIF2In-W4	AIF2_nInW4_a
18	AIF3In-W1	AIF3In-W1	AIF3_nInW1_a
19	AIF3In-W2	AIF3In-W2	AIF3_nInW2_a
20	AIF3In-W3	AIF3In-W3	AIF3_nInW3_a
21	AIF3In-W4	AIF3In-W4	AIF3_nInW4_a
23	CAN1In-DctrlCtrl	CAN1-Dctrl	CAN1_wDctrlCtrl
24	CAN1In-W1	CAN1In-W1	CAN1_nInW1_a
25	CAN1In-W2	CAN1In-W2	CAN1_nInW2_a
26	CAN1In-W3	CAN1In-W3	CAN1_nInW3_a
27	CAN2In-W1	CAN2In-W1	CAN2_nInW1_a
28	CAN2In-W2	CAN2In-W2	CAN2_nInW2_a
29	CAN2In-W3	CAN2In-W3	CAN2_nInW3_a
30	CAN2In-W4	CAN2In-W4	CAN2_nInW4_a
31	CAN3In-W1	CAN3In-W1	CAN3_nInW1_a
32	CAN3In-W2	CAN3In-W2	CAN3_nInW2_a
33	CAN3In-W3	CAN3In-W3	CAN3_nInW3_a
34	CAN3In-W4	CAN3In-W4	CAN3_nInW4_a
35	CANSync-Deviation	CANSync-De	CAN_nSyncDeviation
36	DCTRL-Stat	DCTRL-Stat	DCTRL_wStat
37	DCTRL-FaultNumber	DCTRL-FNr	DCTRL_wFaultNumber
38	FCODE-C0017	FCODE-C17	FCODE_nC17_a
43	FCODE-C0037	FCODE-C37	FCODE_nC37_a
44	FCODE-C0108/1	FC-C108_1	FCODE_nC108_1_a
45	FCODE-C0108/2	FC-C108_2	FCODE_nC108_2_a
46	FCODE-C0109/1	FC-C109_1	FCODE_nC109_1_a
47	FCODE-C0109/2	FC-C109_2	FCODE_nC109_2_a
48	FCODE-C0141	FC-C141	FCODE_nC141_a
49	FCODE-C0472/1	FC-C472_1	FCODE_nC472_1_a
50	FCODE-C0472/2	FC-C472_2	FCODE_nC472_2_a
51	FCODE-C0472/3	FC-C472_3	FCODE_nC472_3_a
52	FCODE-C0472/4	FC-C472_4	FCODE_nC472_4_a
53	FCODE-C0472/5	FC-C472_5	FCODE_nC472_5_a
54	FCODE-C0472/6	FC-C472_6	FCODE_nC472_6_a
55	FCODE-C0472/7	FC-C472_7	FCODE_nC472_7_a
56	FCODE-C0472/8	FC-C472_8	FCODE_nC472_8_a

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
57	FCODE-C0472/9	FC-C472_9	FCODE_nC472_9_a
58	FCODE-C0472/10	FC-C472_10	FCODE_nC472_10_a
59	FCODE-C0472/11	FC-C472_11	FCODE_nC472_11_a
60	FCODE-C0472/12	FC-C472_12	FCODE_nC472_12_a
61	FCODE-C0472/13	FC-C472_13	FCODE_nC472_13_a
62	FCODE-C0472/14	FC-C472_14	FCODE_nC472_14_a
63	FCODE-C0472/15	FC-C472_15	FCODE_nC472_15_a
64	FCODE-C0472/16	FC-C472_16	FCODE_nC472_16_a
65	FCODE-C0472/17	FC-C472_17	FCODE_nC472_17_a
66	FCODE-C0472/18	FC-C472_18	FCODE_nC472_18_a
67	FCODE-C0472/19	FC-C472_19	FCODE_nC472_19_a
68	FCODE-C0472/20	FC-C472_20	FCODE_nC472_20_a
69	FCODE-C0473/1	FC-C473_1	FCODE_nC473_1_a
70	FCODE-C0473/2	FC-C473_2	FCODE_nC473_2_a
71	FCODE-C0473/3	FC-C473_3	FCODE_nC473_3_a
72	FCODE-C0473/4	FC-C473_4	FCODE_nC473_4_a
73	FCODE-C0473/5	FC-C473_5	FCODE_nC473_5_a
74	FCODE-C0473/6	FC-C473_6	FCODE_nC473_6_a
75	FCODE-C0473/7	FC-C473_7	FCODE_nC473_7_a
76	FCODE-C0473/8	FC-C473_8	FCODE_nC473_8_a
77	FCODE-C0473/9	FC-C473_9	FCODE_nC473_9_a
78	FCODE-C0473/10	FC-C473_10	FCODE_nC473_10_a
79	FCODE-C0475/1_v	FC-475_1_v	FCODE_nC475_1_v
80	FCODE-C0475/2_v	FC-475_2_v	FCODE_nC475_2_v
90	SPEED-MCTRL.NSetIn	SP-MC.NSe	MCTRL_nNSetIn_a
91	SPEED-MCTRL.MSetIn	SP-MC.MSe	MCTRL_nMSetIn_a
92	SPEED-MCTRL.IAct	SP-MC.IAct	MCTRL_nIAct_a
93	SPEED-MCTRL.DCVolt	SP-MC.DCV	MCTRL_nDCVolt_a
94	SPEED-MCTRL.MAct	SP-MC.MAct	MCTRL_nMAct_a
95	SPEED-MCTRL.Pos	SP-MC.Pos	MCTRL_nPos_a
96	SPEED-MCTRL.NAct_v	SP-MC.NA_v	MCTRL_nNAct_v
97	SPEED-MCTRL.NAct	SP-MC.NAct	MCTRL_nNAct_a
98	SPEED-MCTRL.NmaxC11	SP-MC.NC11	MCTRL_nNmaxC11
99	SPEED-MCTRL.wMmaxC57	SP-MC.MC57	MCTRL_wMmaxC57
100	TORQUE-MCTRL.NSetIn	T-MC.NSe	MCTRL_nNSetIn_a
101	TORQUE-MCTRL.MSetIn	T-MC.MSe	MCTRL_nMSetIn_a
102	TORQUE-MCTRL.IAct	T-MC.IAct	MCTRL_nIAct_a
103	TORQUE-MCTRL.DCVolt	T-MC.DCV	MCTRL_nDCVolt_a
104	TORQUE-MCTRL.MAct	T-MC.MAct	MCTRL_nMAct_a
105	TORQUE-MCTRL.Pos	T-MC.Pos	MCTRL_nPos_a
106	TORQUE-MCTRL.NAct_v	T-MC.NA_v	MCTRL_nNAct_v
107	TORQUE-MCTRL.NAct	T-MC.NAct	MCTRL_nNAct_a
108	TORQUE-MCTRL.NmaxC11	T-MC.NC11	MCTRL_nNmaxC11
109	TORQUE-MCTRL.wMmaxC57	T-MC.MC57	MCTRL_wMmaxC57
130	SPEED-NSET.NOut	SP-NS.NOu	ECS_MAIN.L_NSET1.nNOut_a
131	TORQUE-NSET.NOut	T-NS.NOu	ECS_MAIN.L_NSET1.nNOut_a
140	SPEED-BRK.MSetOut	SP-BR.MOu	ECS_MAIN.L_BRK1.nMSetOut_a
141	TORQUE-BRK.MSetOut	T-BR.MOu	ECS_MAIN.L_BRK1.nMSetOut_a

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
651	InNeg-AnOut1	IN-AnOut1	InNeg_nAnOut1
652	InNeg-AnOut2	IN-AnOut2	InNeg_nAnOut2
671	OutNeg-AnOut1	ON-AnOut1	OutNeg_nAnOut1
672	OutNeg-AnOut2	ON-AnOut2	OutNeg_nAnOut2
900	DFIn-In_v	DFIn-In_v	DFIN_nIn_v_Shadow
910	DFOut-In_v	DFOUT-I_v	DFOUT_nIn_v_Shadow
920	AIN1-OUT	AIN1-OUT	L_AIN1.nOut_a

13.2.3 List of the phase signal sources

Symbol in signal flow diagrams: ▲

Selection No.	Signal	Keypad display	Variable for Global Drive Oscilloscope (GDO)
10	AIF1In-W2/W3	AIF1-W2/W3	AIF1_dnInD1_p
11	AIF2In-W0/W1	AIF2-W0/W1	AIF2_dnInD1_p
12	AIF3In-W0/W1	AIF3-W0/W1	AIF3_dnInD1_p
13	CAN1In-W2/W3	CAN1-W2/W3	CAN1_dnInD1_p
14	CAN2In-W0/W1	CAN2-W0/W1	CAN2_dnInD1_p
15	CAN3In-W0/W1	CAN3-W0/W1	CAN3_dnInD1_p
16	FCODE-C0474/1	FCE-474_1	FCODE_dnC474_1_p
17	FCODE-C0474/2	FC-474_2	FCODE_dnC474_2_p
18	FCODE-C0474/3	FC-474_3	FCODE_dnC474_3_p
19	FCODE-C0474/4	FC-474_4	FCODE_dnC474_4_p
20	FCODE-C0474/5	FC-474_5	FCODE_dnC474_5_p
21	AIF1In-W0/W1	AIF1-W0/W1	AIF1_dnInD0_p
22	AIF2In-W2/W3	AIF2-W2/W3	AIF2_dnInD2_p
23	AIF3In-W2/W3	AIF3-W2/W3	AIF3_dnInD2_p
24	CAN1In-W0/W1	CAN1-W0/W1	CAN1_dnInD0_p
25	CAN2In-W2/W3	CAN2-W2/W3	CAN2_dnInD2_p
26	CAN3In-W2/W3	CAN3-W2/W3	CAN3_dnInD2_p
30	SPEED-MCTRL.Pos	SP-M.Pos	MCTRL_dnPos_p
40	TORQUE-MCTRL.Pos	T-M.Pos	MCTRL_dnPos_p
651	InNeg-PhiOut1	IN-PhiO1	InNeg_dnPhiOut1
652	InNeg-PhiOut2	IN-PhiO2	InNeg_dnPhiOut2
671	OutNeg-PhiOut1	ON-PhiO1	OutNeg_dnPhiOut1
672	OutNeg-PhiOut2	ON-PhiO2	OutNeg_dnPhiOut2

13.3 General information about the system bus (CAN)

All Lenze drive and automation systems are provided with an integrated system bus interface for networking control components on the field level.

The system bus interface serves to exchange, for instance, process data and parameter values between the nodes. Moreover, the interface allows for the connection of further devices as e.g. decentralised terminals, operator and input devices and external control and host systems.

The system bus interface transfers CAN objects to the CANopen communication profile (CiA DS301, version 4.01) which has been created under the umbrella association of the der **CiA** (**C**AN **i**n **A**utomation) to conform with the **CAL** (**C**AN **A**pplication **L**ayer).



Tip!

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.



Note!

System bus (CAN)

The **ECSxA...** axis module can communicate with a higher-level host system (PLC) or further controllers via both CAN interfaces (X4 or X14).

MotionBus (CAN)

The "MotionBus (CAN)" term expresses the functionality of the CAN interface X4 in case of **ECSxS/P/M...** axis modules, where communication takes place using a higher-level host system (PLC) or further controllers exclusively via the X4 interface. Interface X14 (CAN-AUX) is exclusively used for parameter setting and diagnostics.

13.4 Communication with MotionBus/system bus (CAN)

Note!

In case of ECSxS... axis modules

only the parameter data channels (SDO) are supported for the system bus (CAN) – interface X14 (CAN-AUX).

For communication between the components of the drive system the axis modules ECSxS... have two CAN interfaces:

- Interface X4 (”CAN”)
  - MotionBus (CAN)
  - For communication with a higher-level host system (PLC) or further controllers
  - The data is exchanged via process data channels and parameter data channels.
  - Parameter setting/diagnostics via code range **C03xx**
- Interface X14 (”CAN-AUX”)
  - System bus (CAN)
  - PC interface/HMI for parameter setting and diagnostics
  - Interface to a decentralised I/O system
  - The data is exchanged via parameter data channels only.
  - Parameter setting/diagnostics via code range **C24xx**

The communication is effected via data telegrams.

13.4.1 Structure of the CAN data telegram

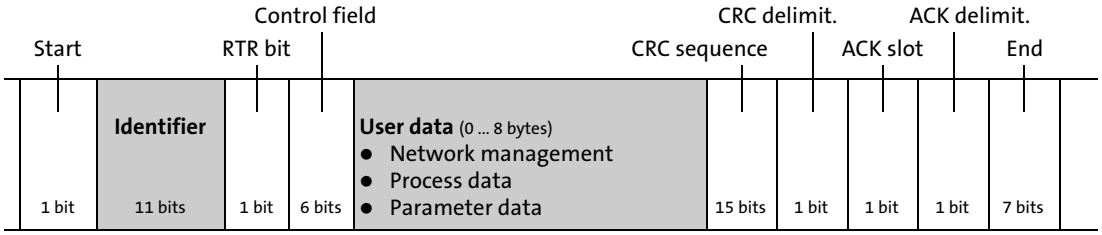


Fig. 13-1 Basic structure of the CAN telegram

Identifier

The identifier determines the priority of the message. Moreover, the following is coded:

- The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter ”Addressing of the parameter and process data objects” (📖 460).
- The type of user data to be transferred

User data

The user data area of the CAN telegram either contains network management data, process data or parameter data:

User data	Description
Network management data (NMT data)	The information serves to establish communication via the CAN network
Process data (PDO, Process Data Objects)	● Process data are transmitted via the process data channel. ● The process data serve to control the controller. ● Process data can be accessed directly by the higher-level host system. The data are, for instance, stored directly in the I/O area of the PLC. It is necessary that the data can be exchanged between the host system and the controller within the shortest time possible. In this connection, small amounts of data can be transferred cyclically. ● Process data are transmitted between the higher-level host system and the controllers to ensure a permanent exchange of current input and output data. ● Process data are not stored in the controller. ● Process data are, for instance, setpoints and actual values.
Parameter data (SDO, Service Data Objects)	● Parameter data are transferred via the parameter data channel and acknowledged by the receiver, i.e. the receiver gets a feedback whether the transmission was successful. ● Parameter data of Lenze devices are called codes. ● The parameter data channel enables access to all Lenze codes and all CANopen indexes. ● Parameters are set, for instance, for the initial commissioning of a plant or when material of a production machine is exchanged. ● Usually the transfer of parameters is not time-critical. ● Parameter changes are stored in the controller. ● Parameter data are, for instance, operating parameters, diagnostic information and motor data.



Tip!

The other signals refer to the transfer features of the CAN telegram that are not described in these instructions.

For further information visit the homepage of the CAN user organisation CiA (CAN in Automation): www.can-cia.org.

13.4.2 Communication phases of the CAN network (NMT)

Regarding communication, the controller knows the following statuses:

Status	Description
”Initialisation”	After the controller is switched on, the initialisation phase is run through. During this phase, the controller is not involved in the data exchange on the bus. A part of the initialisation or the complete initialisation can be run through again in every NMT status by transmitting different telegrams (see ”state transition”). Here, all parameters are written with their set values. After completing the initialisation, the controller automatically adopts the ”Pre-Operational” status.
”Pre-Operational”	The controller can receive parameter data. The process data are ignored.
”Operational”	The controller can receive parameter data and process data.
”Stopped”	Only network management telegrams can be received.

State transitions

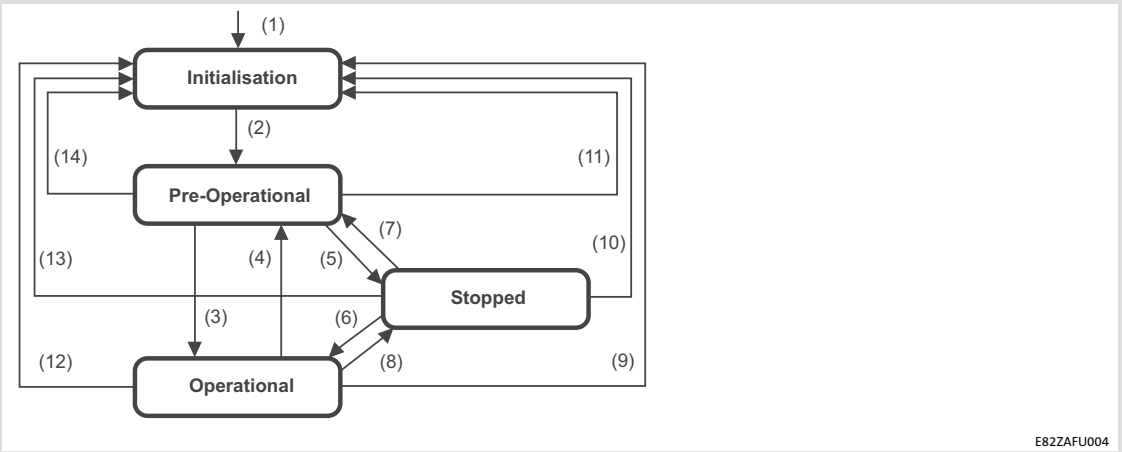


Fig. 13-2 State transitions in the CAN network (NMT)

State transition	Command (hex)	Network status after change	Effect on process or parameter data after state change
(1)	-	Initialisation	When the mains is switched on, the initialisation is started automatically. During the initialisation the controller is not involved in the data exchange. After the initialisation is completed, the node changes automatically to the ”Pre-Operational” status.
(2)	-	Pre-operational	In this phase the master decides how the controllers take part in the communication.
From here, the states are changed over by the master for the entire network. A target address included in the command specifies the receiver/s.			
(3), (6)	01xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active (corresponds to ”Start Remote Node”) Optional: In case of change, event-controlled and time-controlled process data (PDO) are sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency, and parameter data (SDO) are active (corresponds to ”Enter Pre-Operational State”)
(5), (8)	02 xx	Stopped	Only network management telegrams can be received.
(9)	81 xx	Initialisation	Initialisation of all parameters in the CAN fieldbus module with the values stored (corresponds to ”Reset Node”)
(10)			
(11)			
(12)	82 xx		Initialisation of communication-relevant parameters (CiA DS 301) in the CAN fieldbus module with the values stored (corresponds to ”Reset Communication”)
(13)			
(14)			

yy = 00	In case of this assignment, the telegram addresses all devices connected. The state of all devices can be changed at the same time.
yy = node ID	If a node address is given, only the state of the device with the corresponding address will be changed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

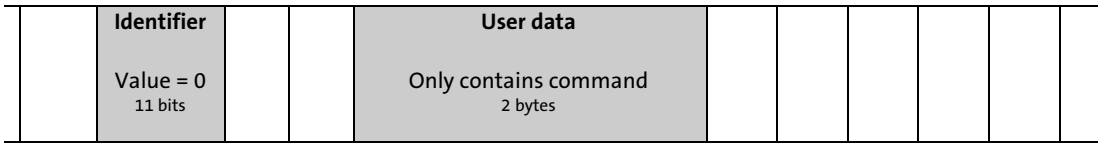


Fig. 13-3 Telegram for switching over the communication phases

The communication phases are changed over by a node, the network master, for the entire network. The change-over can also be done by a controller.

With a certain delay after mains connection, a telegram is sent once which changes the status of the entire drive system to ”Operational”. The delay time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356/4
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356/4
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456/4

Note!

Only a change to ”Operational” status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the ”Pre-Operational” communication status to the ”Operational” communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

13.4.3 Process data transfer

Agreements

- Process data telegrams between host (master) and controller (slave) are distinguished as follows with regard to their direction:
  - Process data telegrams **to** the controller
  - Process data telegrams **from** the controller
- In CANopen, the process data objects are named from the node's view:
  - RPDOx: A process data object received by a node
  - TPDOx: A process data object transmitted by a node

13.4.3.1 Available process data objects

The following process data objects (PDOs) are available for the ECS modules via the interfaces X1, X4 and X14:

Interface	PDOs RPDO: to ECS module TPDO: from ECS module		Availability in ECS modules				
			ECSxE	ECSxS	ECSxP	ECSxM	ECSxA
X1 Automation interface (AIF)	RPDO	AIF1_IN	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_IN	–	✓	–	–	✓
		AIF3_IN	–	✓	–	–	✓
	TPDO	AIF1_OUT	–	✓	V3.0 or higher	V3.0 or higher	✓
		AIF2_OUT	–	✓	–	–	✓
		AIF3_OUT	–	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	RPDO	CAN1_IN	✓	✓	✓	✓	✓
		CAN2_IN	–	✓	✓	–	✓
		CAN3_IN	✓	✓	✓	–	✓
	TPDO	CAN1_OUT	✓	✓	✓	✓	✓
		CAN2_OUT	✓ 1)	✓	✓	–	✓
		CAN3_OUT	✓	✓	✓	–	✓
X14 System bus (CAN) Interface is not available for ECSxE.	RPDO	CANaux1_IN	–	–	✓	–	✓
		CANaux2_IN	–	–	✓	–	✓
		CANaux3_IN	–	–	–	–	✓
	TPDO	CANaux1_OUT	–	–	✓	–	✓
		CANaux2_OUT	–	–	✓	–	✓
		CANaux3_OUT	–	–	–	–	✓

1) ECSxE from V5.0: CAN2_OUT (Diagnostic PDO)

Note!

Power supply module ECSxE

In case of the ECSxE power supply module, the PDOs CAN1_IN/OUT and CAN3_IN/OUT cannot be used simultaneously. The PDOs to be used are selected via C0360.

- The process data objects are integrated into the ECSxS... axis modules in the form of function blocks (📖 247).
- In the function blocks the user data is converted to corresponding signal types for further use.

13.4.3.2 Structure of the process data

The process data telegrams have a maximum user data length of eight bytes each.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the controller.
- The control word is transmitted in byte 1 and 2 of the user data.

	Identifier			User data (8 bytes)							
				Control word		00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte						

Fig. 13-4 Structure of process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram reports status information from the controller. Status information can be as follows:
  - Current status of the controller
  - Status of the digital inputs
  - States about internal analog values
  - Fault/error messages

  This information enables the higher-level host system (PLC) to respond accordingly.
- The status word 1 is transmitted in byte 1 and 2 of the user data.
- In byte 3 and 4 of the user data, the extended status word 2 can be optionally transferred.

	Identifier			User data (8 bytes)							
				Status word 1		Status word 2 (optional)		00_{hex}	00_{hex}	00_{hex}	00_{hex}
	11 bits			LOW byte	HIGH byte	LOW byte	HIGH byte				

Fig. 13-5 Structure of process data output telegram (TPDO)

13.4.3.3 Transfer of the process data objects

Process data objects		Data transmission	
		ECSxE	ECSxS/P/M/A
RPDOs (to ECS module)	AIF1_IN	–	cyclic (sync-controlled)
	CAN1_IN	cyclic (sync-controlled)	
	CANaux1_IN	–	
	AIF2_IN	–	event-controlled/cyclic without sync
	CAN2_IN	–	
	CANaux2_IN	–	
	AIF3_IN	–	event-controlled/cyclic without sync
	CAN3_IN	event-controlled/cyclic without sync	
	CANaux3_IN	–	
TPDOs (from ECS module)	AIF1_OUT	–	cyclic (sync-controlled)
	CAN1_OUT	cyclic (sync-controlled)	
	CANaux1_OUT	–	
	AIF2_OUT	–	event-controlled/cyclic without sync
	CAN2_OUT	–	
	CANaux2_OUT	–	
	AIF3_OUT	–	event-controlled/cyclic without sync
	CAN3_OUT	event-controlled/cyclic without sync	
	CANaux3_OUT	–	

► Cyclic data transmission with sync telegram (📖 452)
(via AIF1, CAN1, CANaux1)
The sync telegram enables the controller to accept the process data from the master (RPDOs) or send them to the master (TPDOs).

► Event-controlled data transmission
(via AIF2/3, CAN2/3, CANaux2/3)
The data will be transmitted if a value changes in the corresponding output object.

► Cyclic data transmission without sync telegram
(via AIF2/3, CAN2/3, CANaux2/3)
The data is transmitted in fixed times. The cycle time can be set via the following codes:

Interface		Code
X1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C0356
X14	System bus (CAN) ● Interface is not available for ECSxE.	C2456

– Setting of cycle time > 0: data transmission with fixed cycle time
– Setting of cycle time = 0: event-controlled data transmission

13.4.3.4 Cyclic process data objects

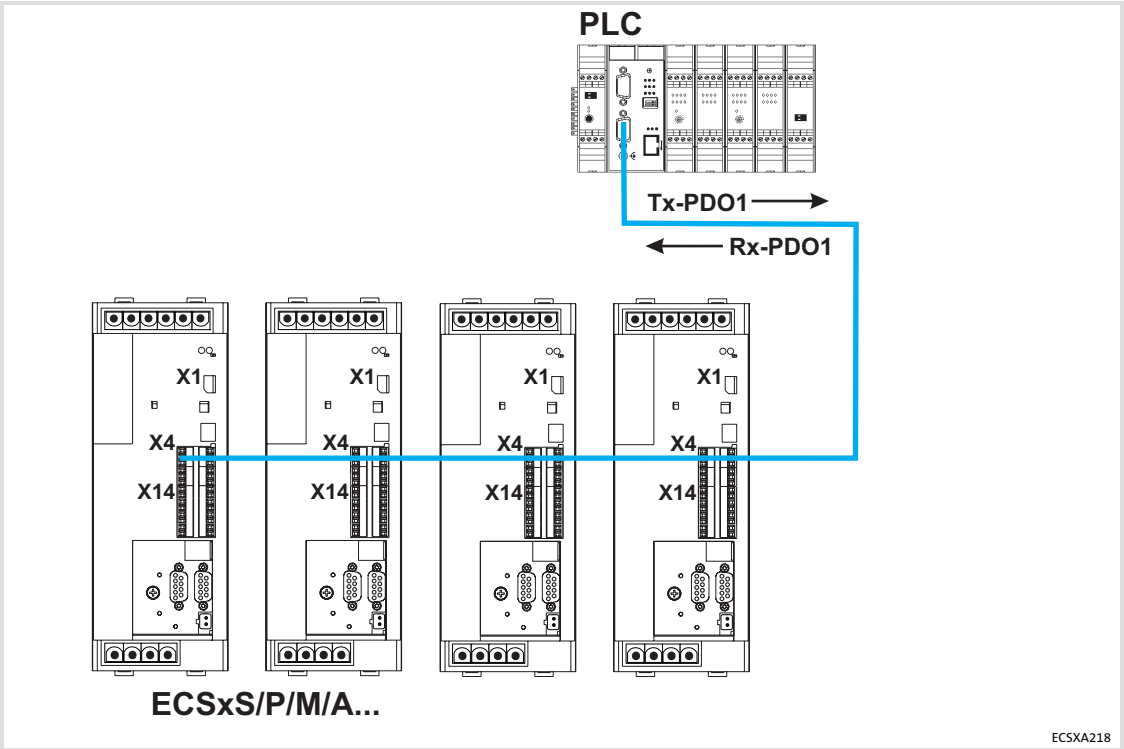


Fig. 13-6 Example: Cyclic process data transfer from/to master (PLC)

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO18), each with 8 bytes of user data, is provided.

Synchronisation of PDOs with sync-controlled transmission

In order that the cyclic process data can be read by the controller or the controller accepts the process data, a special telegram, the CAN sync telegram, is used in addition.

The CAN sync telegram is the trigger point for sending process data of the controller to the master and transferring process data from the master to the controller.

A sync-controlled process data processing requires a corresponding generation of the CAN sync telegram.

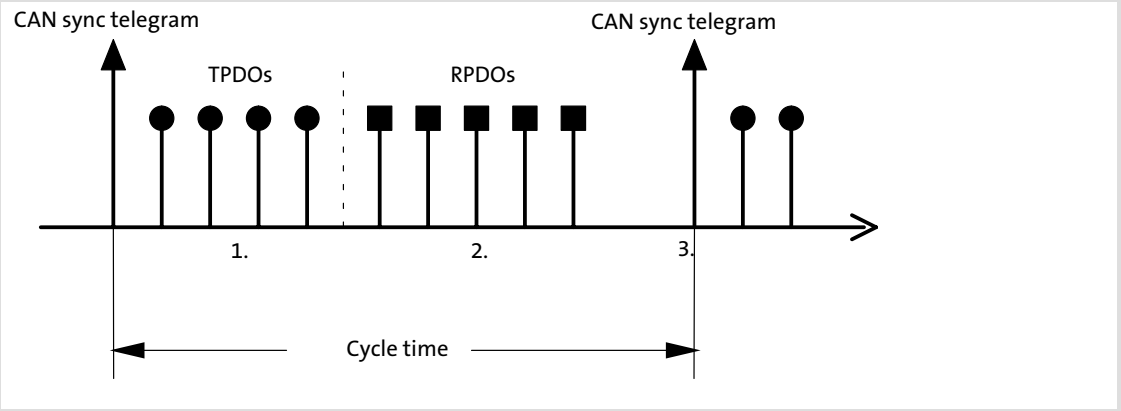


Fig. 13-7 Sync telegram

1. After the CAN sync telegram has been received, the synchronous process data from the controllers are sent to the master (TPDOs). They are read as process input data in the master.
2. When the transmission process is completed, the process output data (of the master) are received by the controllers (RPDOs).

   All other telegrams (e.g. parameters or event-controlled process data) are accepted acyclically by the controllers after transmission is completed. The acyclic data are not displayed in the above illustration. They must be considered when the cycle time is dimensioned.
3. The data in the controller is accepted with the next CAN sync telegram.

Tip!

The response to a CAN sync telegram is determined by the transmission type selected.

Note!

Information on how to set the synchronisation can be found from 📖 179.

13.4.3.5 Event-controlled process data objects

The event-controlled process data objects are particularly suitable for the data exchange between controllers and for distributed terminal extensions. They can, however, also be used by a host system.

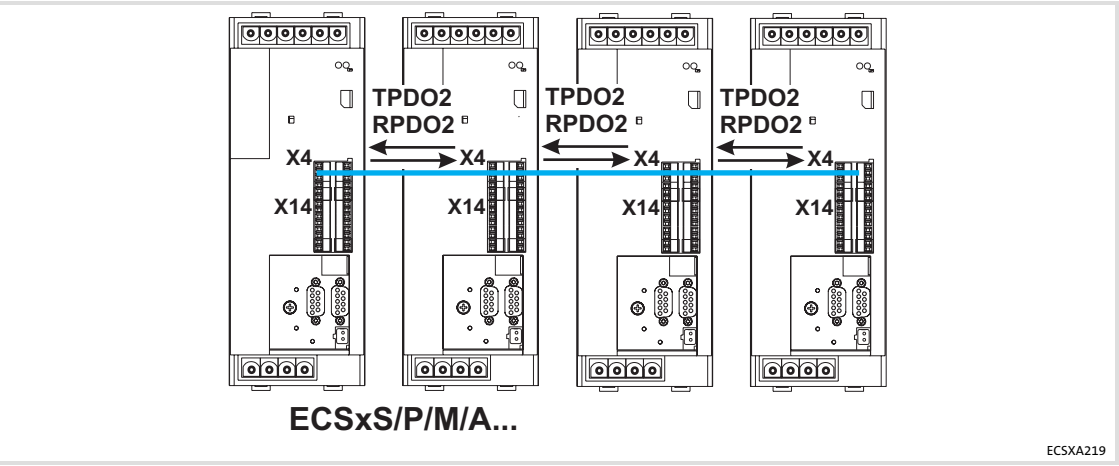


Fig. 13-8 Example: event-controlled process data objects PDO2

The process data objects serve to transmit simple binary signals (e.g. states of digital input terminals) or complete values in 16 and 32 bits (e.g. analog signals).

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

13.4.4 Parameter data transfer

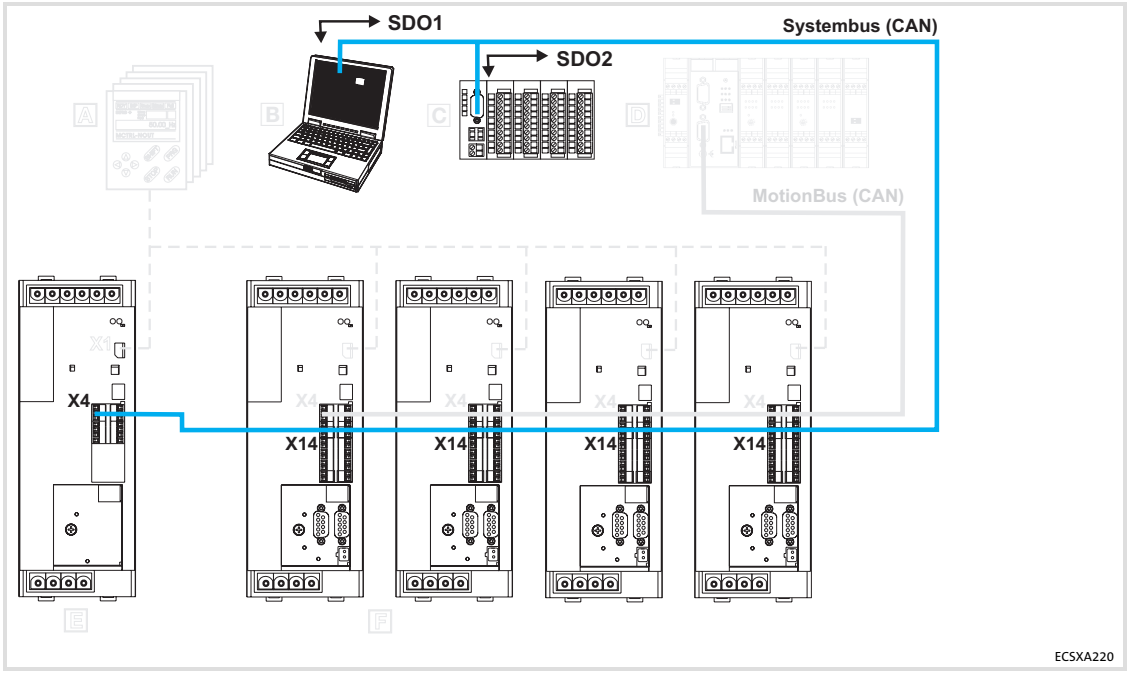


Fig. 13-9 Parameter data channels for parameterising ECS

Parameters ...

- ► are values which are stored under codes in the Lenze controllers.
- ► are set e.g. during initial commissioning or while changing materials in a machine.
- ► are transmitted with low priority.

Parameter data are transmitted as SDOs (Service Data Objects) via the system bus (CAN) and acknowledged by the receiver. The SDOs enable the writing and reading access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 as well as the CAN bus interfaces X4 and X14 are divided into separate ranges:

Interface		Code range
X1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA/E: System bus (CAN)	C03xx
X14	System bus (CAN) ● Interface is not available for ECSxE.	C24xx

13.4.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1. byte	2. byte	3. byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data is shown in motorola format.

Examples for parameter data transfer can be found from 📖 458.

Command

The command contains the services for writing and reading the parameters and information on the length of the user data:

	Bit 7 MSB	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit 2**	**Bit 1**	**Bit 0** LSB
Command	Command specifier (cs)			toggle (t)	Length		e	E
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specification DS301, V4.02 (e.g. segmented transfer).

The command must contain the following information:

Command	4-byte data (5. ... 8. byte)		2-byte data (5. and 6. byte)		1-byte data (5. byte)		Block	
	hex	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameter to the controller)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller reports a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

”Error response” command: In case of a communication error an ”Error response” is generated by the addressed node. This telegram always contains the value ”6” in Data 4 and an error code in Data 3.

The error codes are standardised acc. to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

Parameter value length depending on the data format			
Parameter value **(Length: 1 byte)**	00	00	00
Parameter value **(length: 2 bytes)**		00	00
Low byte	High byte		
Parameter value **(length: 4 bytes)**			
Low word		High word	
Low byte	High byte	Low byte	High byte

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

13.4.4.2 Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4. byte	5. byte	6. byte	7. byte	8. byte
Command	Index Low byte	Index High byte	Subindex	**Error code**			

- Byte 1:
  In the **command** byte, the code **128** (**0x80**) indicates that an error has occurred.
- Bytes 2 ... 4:
  In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.
- Bytes 5 ... 8:
  In the bytes 5 ... to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example: Representation of the error codes 0x06040041 in the bytes 5 ... 8

Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	7th byte	8th byte	Meaning
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

13.4.4.3 Examples of the parameter data telegram

Reading parameters

The heatsink temperature C0061 (43 °C) is to be read from the controller with node address 5 via the parameter data channel 1.

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 5 = 1541

► Command ”Read Request” (request to read a parameter from the controller)

Command	Value [hex]
Read request	**0x40**

► Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = 0x5FC2

► Subindex: 0

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1541	0x40	0xC2	0x5F	0x00	0x00	0x00	0x00	0x00

► Telegram from controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1413	0x43	0xC2	0x5F	0x00	0xB0	0x8F	0x06	0x00

– Command:
”Read Response” (response to the read request) = 0x43

– Identifier:
SDO1 from controller (1408) + node address (5) = 1413

– Index of the read request:
0x5FC2

– Subindex:
0

– Data 1 ... 4:
0x00068FB0 = 430000 ➞ 430000 : 10000 = 43 °C

Writing parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed to 20 seconds via the SDO1 (parameter data channel 1).

► Identifier calculation

Identifier from SDO1 to controller	Calculation
1536 + node address	1536 + 1 = 1537

► Command ”Write Request” (transmit parameter to drive)

Command	Value [hex]
Write request	**0x23**

► Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = 0x5FF3

► Subindex: 0

► Calculation of the acceleration time

Data 1 ... 4	Calculation
Value for acceleration time	20 s · 10000 = 200000 = 0x00030D40

► Telegram to controller

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	0x23	0xF3	0x5F	0x00	0x40	0x0D	0x03	0x00

► Telegram from controller if executed faultlessly

	User data							
Identifier	**Command**	**Index** LOW byte	**Index** HIGH byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	0x60	0xF3	0x5F	0x00	0x00	0x00	0x00	0x00

– Command:
”Write Response” (response of the controller (acknowledgement)) = 0x60

– Identifier:
SDO1 from controller (= 1408) + node address (= 1) = 1409

13.4.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier is preset with the following values:

Object			Direction		Basic identifier	
			to the ECS module	from the ECS module	dec	hex
NMT					0	0
Sync					128	80
PDO1 (Process data channel 1)	RPDO1	XCAN1_IN CAN1_IN CANaux1_IN	X		512	200
	TPDO1	XCAN1_OUT CAN1_OUT CANaux1_OUT		X	384	180
PDO2 (Process data channel 2)	RPDO2	XCAN2_IN CAN2_IN CANaux2_IN	X		640	280
	TPDO2	XCAN2_OUT CAN2_OUT CANaux2_OUT		X	641	281
PDO3 (Process data channel 3)	RPDO3	XCAN3_IN CAN3_IN CANaux3_IN	X		768	300
	TPDO3	XCAN3_OUT CAN3_OUT CANaux3_OUT		X	769	301
SDO1 (Parameter data channel 1)			X		1536	600
				X	1408	580
SDO2 (Parameter data channel 2)			X		1600	640
				X	1472	5C0
Node guarding			X		1792	700

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- Interface X1 (AIF) C2355.
- Interface X4 (CAN) C0355.
- Interface X14 (CAN-AUX) C2455.

Here, no values can be entered.

- General addressing (📖 460):
  Identifier (COB-ID) = basic identifier + adjustable node address (node ID)
- Individual addressing (📖 173):
  Identifier (COB-ID) = 384 + ID offset (C0354 or C2454)

Assignment of the node address for the data exchange between Lenze devices

If Lenze devices are assigned with node addresses in a complete ascending order, the identifiers of the event-controlled data objects (CAN2_IO/CAN3_IO) are factory-set so that the devices are able to communicate with each other.

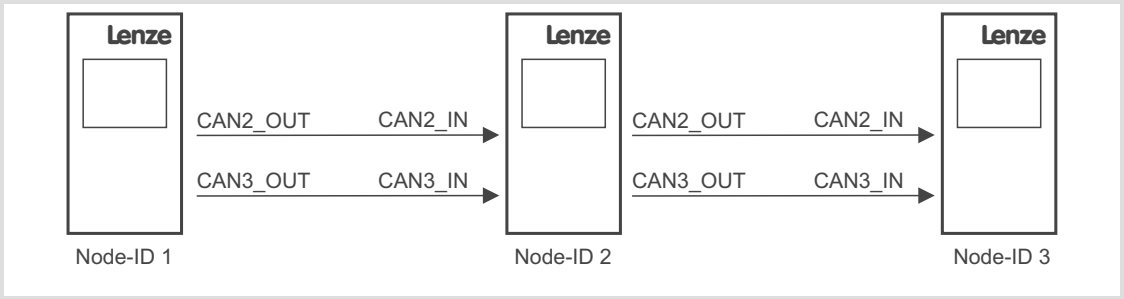


Fig. 13-10 Data exchange between Lenze devices

Assign each node within the system bus network to a node address – also called *node ID* – for a clear identification in the range 1 to 63.

► A node address may not be assigned more than once within a network.

Note!

The ”8.1.1 Setting of CAN node address and baud rate” chapter contains information on

► Setting of the node address (📖 169).

► Individual addressing (📖 173).

13.5 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

13.5.1 Connector sets

To make purchasing easy, the connector sets are available as separate delivery units for the ECS power supply, capacitor and axis modules:

- ECSZ**E**000X0B (connector set for ECS power supply modules)
- ECSZ**K**000X0B (connector set for ECS capacitor modules)
- ECSZ**A**000X0B (connector set for ECS axis modules)

13.5.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

13.5.3 Components for operation and communication

Operating and communication modules

Operating/communication module	Type/order number	Can be used together with	
		ECSxE	ECSxS/P/M/A
Keypad XT	EMZ9371BC	✓	✓
Diagnosis terminal (keypad XT with hand-held)	E82ZBBXC	✓	✓
LECOM-A (RS232)	EMF2102IB-V004	✓	✓
LECOM-B (RS485)	EMF2102IB-V002	✓	✓
LECOM-A/B (RS232/485)	EMF2102IB-V001	✓	✓
LECOM-LI (optical fibre)	EMF2102IB-V003	✓	✓
LON	EMF2141IB	–	✓
INTERBUS	EMF2113IB	–	✓
PROFIBUS-DP	EMF2133IB	–	✓
CANopen	EMF2178IB	–	✓
DeviceNet	EMF2179IB	–	✓
EtherCAT	EMF2192IB	✓	✓

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrical isolation to CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1)]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1)]

1) ”xxxx” = Cable length in decimetre (example: ”xxxx” = ”0015” → length = 15 dm)

13.5.4 Brake resistor

Assignment of external brake resistors

Brake resistor	Ω	P_d [kW]	Power supply module (standard variants)								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.20	●	●		●	●		●	●	
ERBD022R03K0	22	3.00			●			●			●
ERBS039R01K6	39	1.64	●	●		●	●		●	●	
ERBS020R03K2	20	3.20			●			●			●

P_d Continuous power

Brake resistors of type ERBM...

Brake resistors with specifically adapted pulse capability in IP50 design

Rated data	Type	Brake resistor	
		ERBM039R120W	ERBM020R150W
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	120	150
Amount of heat	Q_B [kWs]	6	13
Max. running time	t_e [s]	5	
Required recovery time	t_a [s]	90	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBD...

Brake resistors with an increased power loss in IP20 design (protection against accidental contact acc. to NEMA 250 type 1)

Rated data	Type	Brake resistor	
		ERBD047R01K2	ERBD022R03K0
Resistance	R_B [Ω]	47	22
Continuous power	P_d [W]	1200	3000
Amount of heat	Q_B [kWs]	174	375
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

Brake resistors of type ERBS...

Brake resistors with an increased power loss in IP65 design (NEMA 250 type 4x)

Rated data	Type	Brake resistor	
		ERBS039R01K6	ERBS020R03K2
Resistance	R_B [Ω]	39	20
Continuous power	P_d [W]	1640	3200
Amount of heat	Q_B [kWs]	246	480
Max. running time	t_e [s]	15	
Required recovery time	t_a [s]	135	
Operating voltage	U_{max} [V_{DC}]	800	
Max. braking power	P_{Bmax} [kW]	$P_{Bmax} = \frac{\text{Wärmemenge } Q_B}{\text{Einschaltzeit}}$	

13.5.5 Mains fuses

- Mains fuses are not included in the Lenze delivery program. Use standard fuses.
- When using ECSxE power supply modules which are fused on the supply side the DC-bus supply need not be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

- Observe the national and regional regulations (VDE, UL, EVU, ...).

Warnings!

- Use UL-approved cables, fuses and fuse holders only.
- UL fuse:
  – Voltage 500 ... 600 V
  – Tripping characteristic ”H”, ”K5” or ”CC”

13.5.6 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  - The waveform of the mains current is approximated to the sinusoidal shape.
  - Reduction of the effective mains current by up to 25%.
  - Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  - A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

13.5.7 RFI filters

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

14 Index

A

Absolute value encoder (Hiperface, single-turn/multi-turn), 103
- as position and speed encoder, 113

Acceleration time
- Operating mode "Speed control", 327
- operating mode "Torque control", 351

Accessories, 462
- brake resistors, 464
- communication modules, 463
- connector set, 462
- digital frequency cables, 463
- digital frequency distributor, 463
- mains chokes, 467
- operating modules, 463
- RFI filters, 468
- shield mounting kit, 462
- system bus components, 463

Activating brake, speed control
- closing holding brake, 341
- opening holding brake, 342

Activating holding brake, speed control
- closing holding brake, 341
- opening holding brake, 342

Activating the brake, torque control
- closing the holding brake, 361
- opening the holding brake, 362

Activating the holding brake, torque control
- closing the holding brake, 361
- opening the holding brake, 362

Additional setpoint, 331

Additional torque setpoint, operating mode "Speed control", 332

Address setting, 170

Addressing
- individual, 173
- parameter data objects, 460
- process data objects, 460

Adjusting current controller, 149

Adjusting the current controller, calculating the electrical motor values, 149

Adjustment of field controller / field weakening controller, Adjustment, 157

AIF (automation interface management), 247

AIF1In, 248

AIF1Out, 251

AIF2In, 256

AIF2Out, 258

AIF3In, 261

AIF3Out, 263

AIn1, 266

Analog input, 70

Analog inputs, 266
- Configuration, 70

Analog signals, list, 437

Application, as directed, 18

Application as directed, 18

Approvals, 31

Assignment, external brake resistor, 464

Assignment of the plug connectors
- control connections, 68
- system bus (CAN), 82

Atmospheric pressure, 31

Automation interface (AIF), 80
- AIF1In, 248
- AIF1Out, 251
- AIF2In, 256
- AIF2Out, 258
- AIF3In, 261
- AIF3Out, 263
- management, 247

Auxiliary relay, switch-on sequence, 67

Axis module, 13
- ECSCx...
  dimensions, 47
  mounting, 46
- ECSDx...
  dimensions, 43
  mounting, 42
- ECSEx...
  dimensions, 40
  mounting, 41

Axis module status, 299

Axis synchronisation, 179

Axis synchronisation via CAN, 182

Axis synchronisation via terminal X6/DI1, 183

B

Basic identifier, 460

Baud rate
- setting, 171
  via DIP switch, 171
- system bus (CAN). *Siehe* baud rate

Brake, connection, 62

Brake configuration, 102

Brake resistor, external, 464
- assignment, 464
- connection, 60
- type ERBD..., rated data, 464
- type ERBM..., rated data, 464
- type ERBS..., rated data, 465

Brake resistor, internal, Connection, 58

Bus cable length, 84

Bus load CAN, 189

Bus off, 199

C

Cable cross-section, 84

Cable cross-sections
- Control connections, 55 , 68
- control connections, 53
- control terminals, connection "Safe torque off", 74

Cable specification, 82

Cables, shielded, 54

Cables, specification, motor cables, 61

CAN bus
- assignment of the plug connectors, 82
- boot-up time setting, 176
- communication, 442
- configuring, 169
- cycle time setting, 176
- cyclic process data objects, synchronisation, 452
- data telegram, 442
- delay time setting, 176
- determining the master in the drive system, 175
- event-controlled process data objects, 453
- function blocks
  CAN (CAN management), 267
  CAN1In, 273
  CAN1Out, 276
  CAN2In, 282
  CAN2Out, 285
  CAN3In, 288
  CAN3Out, 291
  CANSync, 270
- identifier, 442 , 460
  display code, 460
- Individual addressing, 173
- making a reset node, 178
- network management data, 443
- parameter data, 443 , 454
- parameter data channels, 454
- parameter data objects, addressing, 460
- process data, 443
- process data objects, 447
  addressing, 460
  data transmission, 450
- process data telegrams, 448
- setting baud rate, 169
- setting node address, 169
- user data, 443 , 455

CAN bus load, 189

CAN bus status, 187

CAN data telegram, 442

CAN diagnostic codes, 187

CAN management, 186

CAN management (function block), 267

CAN network
- communication phases, 444
- state transitions, 445
- statuses, 444

CAN network management (NMT), 446

CAN Sync correction increment, 180

CAN sync identifiers, 180

CAN sync response, 181

CAN synchronisation, 179

CAN synchronisation cycle, 179

CAN telegram counter , 188

CAN user organisation CiA, Homepage, 443

CAN-AUX management, 186

CAN-TxCan2Syncronized, 267

CAN-TxCan3Syncronized, 267

CAN1In, 273

CAN1Out, 276

CAN2In, 282

CAN2Out, 285

CAN3In, 288

CAN3Out, 291

CANSync, 270

Capacitor module, 13

Capacitor module ECSxK..., Connection, 64

Capacitor modules, 64

Carrying out basic settings with GDC, 95

Carrying out reset node, 267

CCW rotation, 121

CE-typical drive system, 49
- assembly, 50
- earthing, 51
- filters, 50
- installation , 49
- shielding, 51
  cables, 54

CE0 communication error, 247

Changing the direction of rotation, 325 , 350
- operating mode "Speed control", 325
- operating mode "Torque control", 350

Characteristic
- Ramp function generator, 330
- ramp function generator, 353

Charging current limitation, function selection, 98

COB-ID, 460
- display code, 460

Code descriptions, 14

Code table, 363

Commissioning, 93
- adjusting the current controller, calculating the electrical motor values, 149
- Adjustment of field controller / field weakening controller, 157
- before you start, 93
- carrying out basic settings with GDC, 95
- commissioning steps, overview, 94
- configuration of digital inputs/outputs, setting the polarity, 121
- configuring digital inputs/outputs
  altering the terminal assignment, 122
  setting the direction of rotation, 121
- configuring the digital inputs/outputs, 121
- controller enable, 143
- current controller adjustment, metrological determination of electrical motor values, 150
- entry of machine parameters, 141
- Entry of motor data, 100
- holding brake configuration, 102
- loading the Lenze settings, 97
- operation with motors of other manufacturers, 145
- Operation with servo motors from other manufacturers, Motor feedback system - checking the direction of rotation, 148
- operation with servo motors of other manufacturers
  adjusting current controller, 149
  effecting rotor position adjustment, 151
  entering motor data, 145
- Optimising the drive behaviour, 154
- quick stop (QSP), 144
  operating mode "Speed control", 338
- Resolver adjustment, 160
- Selecting the function of the charging current limitation, 98
- selecting the operating mode/control structure, 126
- setpoint selection, 142
- setting of mains data, 98
- setting of the feedback system, 103
- setting the feedback system
  absolute value encoder (Hiperface, single-turn/multi-turn), 113
  absolute value encoder (position encoder), resolver (speed encoder), 117
  resolver as position and speed encoder, 104
  sin/cos encoder without serial communication, 106
  TTL incremental encoder, 106
  TTL/SinCos encoder (position encoder), resolver (speed sensor), 109
- setting the voltage threshold, 99
- Speed controller adjustment, 154

Communication modules, 463
Communication phases, 444
Configuration, 168
- axis synchronisation, 179
- Axis synchronisation (start), 180
- axis synchronisation via CAN, 182
- axis synchronisation via terminal X6/DI1, 183
- CAN bus load, 189
- CAN bus status, 187
- CAN diagnostic codes, 187
- CAN management, 186
- CAN sync correction increment, 180
- CAN sync identifiers, 180
- CAN synchronisation, 179
- CAN synchronisation (start), 180
- CAN synchronisation cycle, 179
- CAN telegram counter , 188
- Code table, 363
- cyclic node monitoring (Node Guarding), 184
- Function library, 247
- monitoring, 192
  current load of the motor (I2 x t monitoring), 23 , 210
  voltage supply of control electronics, 217
- Monitoring functions, Motor temperature, 23
- monitoring functions
  bus off, 199
  current load of controller (I x t monitoring), 207
  DC-bus voltage, 214
  earth fault, 201
  heatsink temperature, 204
  max. system speed, 223
  monitoring times for process data input objects, 198
  motor phase failure, 217
  motor temperature, 202
  motor temperature sensor, 219
  overview, 193
  Resolver cable, 218
  rotor position adjustment, 224
  short circuit, 201
  sin/cos signal, 221
  speed system deviation, 222
  temperature inside the controller, 205
  thermal sensors, 206
- monitoring of the synchronisation, 181
- MotionBus (CAN)
  boot-up time setting, 176
  cycle time setting, 176
  delay time setting, 176
  determining the master in the drive system, 175
  making a reset node, 178
  setting the baud rate, 169
  setting the node address, 169
- speed control
  setpoint via AIF, 130
  setpoint via analog input, 127
  setpoint via MotionBus (CAN), 132
- Sync phase displacement, 179
- sync phase displacement, correction value, 180
- system bus (CAN)
  Individual addressing, 173
  setting the baud rate, 169
  setting the node address, 169
- Thermal motor monitoring, 23
- torque control
  setpoint via AIF, 137
  setpoint via analog input, 134 , 137
  setpoint via CAN, 139
  setpoint via MotionBus (CAN), 139
- via automation interface (AIF), 168
- via system bus interface, 168

Configuration of CAN interface, node address (node ID), 461
Configuring CAN interface, monitoring, timeout with activated remote parameterisation, 200
Conformity, 31
Connection
- Capacitor module ECSxK..., 64
- DC bus, 53 , 55
- external brake resistor, 60
- Internal brake resistor, 58
- motor, 53
- motor holding brake, 53 , 62

Connection "Safe torque off", terminals, 74
Connection "safe torque off", 71
- functional description, 72
- Important notes, 73

connection "safe torque off", Important notes, 73
Connection of "safe torque off"
- function check, 75
- implementation, 71
- technical data, 74

Control connections
- Analog inputs, configuration, 70
- assignment of the plug connectors, 68
- Cable cross-sections, 55 , 68
- cable cross-sections, 53
- Digital inputs, 69
- Digital outputs, 69
- Tightening torques, 55 , 68
- tightening torques, 53

Control factor, 35
Control signals, 66
Control terminals, 65
- cable cross-sections, connection "Safe torque off", 74
- starting torques, connection "Safe torque off", 74

Control/signal cables, shield connection, 66

Controller, 13
- application as directed, 18
- identification, 18

Controller enable, 143

Controller inhibit (CINH), DCTRL function block, 297

Current characteristics
- application example, 37
- device protection by current derating, 38
- rated output current, 35

Current controller adjustment, metrological determination of electrical motor values, 150

Current derating, 38

Current load of controller, I x t monitoring, 207

Current load of the motor, I2 x t monitoring, 23 , 210

CW rotation, 121

Cyclic node monitoring (Node Guarding), 184

Cyclic process data objects, 451

D

Data telegram, 442

Data, general electrical, 32

DC bus
- connection, 53 , 55
- fuses, 56 , 466

DC-bus voltage
- monitoring functions, 214
- overvoltage, 214
- undervoltage, 214

DC-bus voltage monitoring (OU, LU), 214

DCTRL, 294
- axis module status, 299
- controller status
  controller inhibit (CINH), 297
  operation inhibit (DISABLE), 297
  quick stop (QSP), 297
  TRIP-RESET, 298
  TRIP-SET, 298

Deceleration time
- Operating mode "Speed control", 327
- operating mode "Torque control", 351

Defining boot-up master, 175

Defining master in the drive system, 175

Definition of notes used, 30

Definitions of terms, 13

Device control, 294

Device protection, 27

Device protection by current derating, 38

Device status, 299

device status, 235 , 300

DFIN (master frequency input), 301
- configuring the input signal, 303

DFOUT (master frequency output), 304
- configuring the output signal, 306

Diagnostics, 225
- with Global Drive Control (GDC), 225
- with Global Drive Oscilloscope (GDO), 226
  GDO buttons, 227
- with PCAN-View, 229
- with XT EMZ9371BC keypad, 228

Diagnostics codes, 187

DigIn (freely assignable digital inputs), 307

Digital frequency cables, 463

Digital frequency distributor, 463

Digital frequency input, 91
- features, 91

Digital frequency output, 91
- features, 91

Digital inputs, 69
- altering the terminal assignment, 122
- configuring, 121
- setting the direction of rotation, 121
- setting the polarity, 121

Digital inputs (DigIn), 307

Digital outputs, 69
- altering the terminal assignment, 122
- configuring, 121
- setting the direction of rotation, 121
- setting the polarity, 121

Digital outputs (DigOut), 308

Digital signals, list, 428

DigOut (freely assignable digital outputs), 308

Dimensions, 40 , 43 , 47
- axis module ECSCx..., 47
- axis module ECSDx..., 43
- axis module ECSEx..., 40

DIP switch, 170

Discharge current to PE, 32

Disposal, 22

Drive control, 294

Drive system, 13

E

Earth fault monitoring (OC2), 201

Earth-fault monitoring, 201

Earthing, EMC, 51

Effecting rotor position adjustment, 151

Electrical installation, 49
- connection "Safe torque off", terminals, 74
- connection "safe torque off", 71
  functional description, 72
  Important notes, 73
- connection of "safe torque off"
  function check, 75
  implementation, 71
  technical data, 74
- Connection of capacitor module ECSxK..., 64
- control connections, 65
  assignment of the plug connectors, 68
  Digital inputs, 69
  Digital outputs, 69
- control terminals, 66
- feedback system, 86
  encoder, 88
  resolver, 87
- installation of a CE-typical drive system, 49
  assembly, 50
  earthing, 51
  filters, 50
  shielding, 51
- power connections, 53
  connection of external brake resistor, 60
  DC bus connection, 53
  internal brake resistor connection, 58
  motor connection, 53 , 61
  motor holding brake connection, 53
  plug connector assignment, 53
- power terminals
  connection of motor holding brake, 62
  DC bus connection, 55
- specification of the cables, motor cables, 61

Electromagnetic compatibility, 32

EMC, 32
- earthing, 51
- filters, 50
- shielding, 51
  cables, 54

EMF2131IB digital frequency distributor, wire, 92 , 301 , 304

EMF2131IB digital frequency distributor , wire, 92 , 301 , 304

Enclosure, 32

Encoder, 88
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 113
- absolute value encoder (Hiperface, single-turn/multi-turn), 103
- incremental encoder (TTL encoder), 89
- SinCos absolute value encoder, 90
- SinCos encoder, 90
  absolute value encoder (Hiperface, single-turn/multi-turn), 103
- supply voltage, 88

Encoder simulation, 91

Entering motor data, 145

Entry of machine parameters, 141

Entry of motor data, 100

Environmental conditions, 31
- atmospheric pressure, 31
- pollution, 31
- site altitude, 31
- temperature, 31
- vibration resistance, 31

Error analysis, 232
- Via history buffer, 233
- via LECOM status word, 235

Error messages, 457
- Causes and remedies, 238
- causes and remedies, 238
- configuration, 194
- reset (TRIP-RESET), 246

Error response, 456

Event-controlled process data objects, 453

Examples
- reading parameters, 458
- Selection help for cable length / number of repeaters, 85
- writing parameters, 459

Executing a reset node, 178

Explanations, Code table, 363

External brake resistor, 464
- assignment, 464
- connection, 60
- type ERBD..., rated data, 464
- type ERBM..., rated data, 464
- type ERBS..., rated data, 465

F

FAIL-QSP, 193

Fault analysis, 232
- Via history buffer, 233
- via LECOM status word, 235
- via LEDs, 232
- with keypad XT EMZ9371BC, 232

Fault elimination, fault analysis with history buffer, 233

Fault messages, 238
- causes and remedies, 238
- configuration, 194
- reset (TRIP-RESET), 234 , 246

Fault responses, 193

FCODE (free codes), 309

Feedback system, wiring, 86
- encoder, 88
- incremental encoder (TTL encoder), 89
- resolver, 87
- SinCos absolute value encoder, 90
- SinCos encoder, 90

Field controller / field weakening controller, 157

Field weakening
- Operating mode "Speed control", 339
- operating mode "Torque control", 359

Filters, EMC, 50

FIXED (output of constant signals), 312

Free codes (FCODE), 309

Free space, 31

Function blocks
- AIF (automation interface management), 247
- AIF1In, 248
- AIF1Out, 251
- AIF2In, 256
- AIF2Out, 258
- AIF3In, 261
- AIF3Out, 263
- AIn1, 266
- CAN (CAN management), 267
- CAN1In, 273
- CAN1Out, 276
- CAN2In, 282
- CAN2Out, 285
- CAN3In, 288
- CAN3Out, 291
- CANSync, 270
- DCTRL, 294
  axis module status, 299
  controller inhibit (CINH), 297
  operation inhibit (DISABLE), 297
  quick stop (QSP), 297
  TRIP-RESET, 298
  TRIP-SET, 298
- DFIN (master frequency input), 301
- DFOUT (master frequency output), 304
- DigIn (freely assignable digital inputs), 307
- DigOut (freely assignable digital outputs), 308
- FCODE (free codes), 309
- FIXED (output of constant signals), 312
- InNeg, 313
- OutNeg, 315
- Speed (speed control), 318
  Holding brake control, 340
  Setting of motor control, 332
- speed (speed control)
  changing the direction of rotation, 325
  torque control with speed limitation, 336
- SYS, 317
- Torque (torque control), 343
  Holding brake control, 360
  Setpoint processing, 351
  Setting of motor control, 354
- torque (torque control)
  changing the direction of rotation, 350
  torque control with speed limitation, 349

Function library, 247

Function monitoring of thermal sensors (H10, H11), 206

Functional earth conductor, 45

Fuses, 56 , 466
- DC bus, 56 , 466
- replacing, 56

G

Gateway function, 190

Global Drive Control (GDC)
- Diagnostics, 225
- Parameter setting, 162

Global Drive Oscilloscope (GDO), 226
- GDO buttons, 227

Guiding angle default and synchronisation, CAN sync response, 181

H

Heatsink temperature, monitoring functions, 204

Heatsink temperature monitoring (OH, OH4), 204

History buffer, 233
- codes, 233
- delete entries, 234
- for fault elimination, 233

Holding brake configuration, 102

Holding brake control
- Operating mode ”speed control”, 340
- Operating mode ”torque control”, 360

I

I component setting
- operating mode ”Speed control”, 156 , 335 , 357
- operating mode ”torque control”, 156 , 335 , 357

Identification, controller, 18

Identifier, 442 , 460

identifier, display code, 460

Incremental encoder, as position and speed encoder, 106

Incremental encoder (TTL encoder), 89

Individual addressing, 173

InNeg, 313

Installation, 31
- system bus (CAN), 81

Installation of a CE-typical drive system, 49
- assembly, 50
- earthing, 51
- filters, 50
- shielding, 51
  cables, 54

Installation, electrical, 49
- connection ”Safe torque off”, terminals, 74
- connection ”safe torque off”, 71
  functional description, 72
  Important notes, 73
- connection of ”safe torque off”
  function check, 75
  implementation, 71
  technical data, 74
- Connection of capacitor module ECSxK..., 64
- control connections, 65
  assignment of the plug connectors, 68
  Digital inputs, 69
  Digital outputs, 69
- control terminals, 66
- feedback system, 86
  encoder, 88
  resolver, 87
- installation of a CE-typical drive system, 49
  assembly, 50
  earthing, 51
  filters, 50
  shielding, 51
- power connections, 53
  connection of external brake resistor, 60
  DC bus connection, 53
  internal brake resistor connection, 58
  motor connection, 53 , 61
  motor holding brake connection, 53
  plug connector assignment, 53
- power terminals
  connection of motor holding brake, 62
  DC bus connection, 55
- specification of the cables, motor cables, 61

Installation, mechanical, 39
- push-through technique (ECSDx...), 42

Installation, mechanical
- cold-plate technique (ECSCx...), 46
- important notes, 39
- with fixing rails (ECSEx...), 41

Insulation resistance, 32

Internal brake resistor, Connection, 58

J

Jitter, 179 , 180

K

Keypad XT EMZ9371BC
- changing and saving parameters, 167
- connecting the keypad, 163
- display elements, 164
- fault analysis, 232
- function keys, 166

L

LECOM, status word (C0150/C0155), 235

LEDs, 232

Legal regulations, 18

Liability, 18

Loading the Lenze setting, 97

Low-voltage supply, 13

M

Main setpoint
- Influencing the ramp function generator, 329
- influencing the ramp function generator, 352

Mains fuses, 466

Malfunction of drive, 237

Manufacturer, 18

Master frequency input (DFIN), 301
- configuring the input signal, 303

Master frequency input signal, configuring, 303

Master frequency output (DFOUT), 304

Master frequency output signal, configuring, 306

Max. system speed, monitoring functions, 223

Maximum speed
- Operating mode "Speed control", 333
- operating mode "Torque control", 355

MCTRL_MotorControl (motor control), monitoring, absolute value encoder initialisation, 220

Mechanical installation, 39
- cold-plate technique (ECSCx...), 46
- important notes, 39
- push-through technique (ECSDx...), 42
- with fixing rails (ECSEx...), 41

Message, 193

Monitoring
- absolute value encoder initialisation, 220
- CAN interface, timeout with activated remote parameterisation, 200
- current load of the motor, I2 x t monitoring, 23 , 210
- FAIL-QSP, 193
- message, 193
- Monitoring times for process data input objects, 198
- voltage supply of control electronics, 217
- warning, 193

Monitoring functions, 192
- bus off, 199
- configuring, 198
- current load of controller, I x t monitoring, 207
- DC-bus voltage, 214
- earth fault, 201
- heatsink temperature, 204
- max. system speed, 223
- motor phase failure, 217
- Motor temperature, 23
- motor temperature, 202
- motor temperature sensor, 219
- Overview, 194
- Resolver cable, 218
- rotor position adjustment, 224
- short circuit, 201
- sin/cos signal, 221
- speed system deviation, 222
- temperature inside the controller, 205
- thermal sensors, 206

Monitoring of internal device temperature (OH1, OH5), 205

Monitoring of the synchronisation, 181

Monitoring times for process data input objects, 198

Monitorings
- configuration, 194
- possible fault responses, 194

MotionBus (CAN), 442
- boot-up time setting, 176
- CAN data telegram, 442
- communication, 442
- configuring, 169
- cycle time setting, 176
- cyclic process data objects, synchronisation, 452
- delay time setting, 176
- determining the master in the drive system, 175
- event-controlled process data objects, 453
- identifier, 442 , 460
- making a reset node, 178
- network management data, 443
- parameter data, 443 , 454
- parameter data channels, 454
- parameter data objects, addressing, 460
- process data, 443
- process data objects, 447
  addressing, 460
  data transmission, 450
- process data telegrams, 448
- setting the baud rate, 169
- setting the node address, 169
- user data, 443 , 455

Motor, connection, 53 , 61

motor, Thermal monitoring, Sensorless, 23

Motor cable length, 31

Motor cables, specification, 61

Motor control setting
- Operating mode "Speed control", I component setting, 156 , 335 , 357
- operating mode "speed control", speed controller adjustment, 334
- operating mode "torque control"
  I component setting, 156 , 335 , 357
  speed controller adjustment, 356

Motor feedback system, Checking the direction of rotation, 148

Motor holding brake, connection, 53

Motor monitoring, 23

Motor phase failure, monitoring functions, 217

Motor protection, 28

Motor temperature, monitoring functions, 202

Motor temperature monitoring (OH3, OH7), 202

Motor temperature sensor, monitoring, 219

Motor temperature sensor monitoring (Sd6), 219

Motor, connection, , 61

Motors of other manufacturers, 145

Mounting
- axis module ECSCx..., 46
- axis module ECSDx..., 42
- axis module ECSEx..., 41
- cold-plate design, 46
- standard installation (with fixing rails), 40
- thermally separated (push-through technique), 42

Mounting position, 31

N

Network management (NMT), 446

Network management data, 443

Node address (node ID), CAN interface, 461

Node address setting, 170

Node guarding, 184

Node ID, 460

Node-ID, display code, 460

Noise emission, 32

Noise immunity, 32

Notes, definition, 30

O

Operating conditions, 31

Operating modules, 463

Operation inhibit (DISABLE), DCTRL function block, 297

Operation with motors of other manufacturers, 145

Operation with servo motors from other manufacturers
- Checking the direction of rotation of the motor feedback system, 148
- current controller adjustment, metrological determination of electrical motor values, 150

Operation with servo motors of other manufacturers
- adjusting current controller, 149
- adjusting the current controller, calculating the electrical motor values, 149
- effecting rotor position adjustment, 151
- entering motor data, 145

Optimising the drive behaviour, 154

OutNeg, 315

Output of constant signals (FIXED), 312

Overcurrent characteristic, 208

Overcurrent diagram, 208

Overvoltage threshold, DC-bus voltage, 214

P

Packaging, 31

Parameter data, 443 , 454

Parameter data objects, addressing, 460

Parameter data telegram, 455
- examples, 458

Parameter data transfer, 454

Parameter setting, 161
- With Global Drive Control (GDC), 162
- with keypad XT EMZ9371BC
  changing and saving parameters, 167
  connecting the keypad, 163
  keypad display elements, 164
  keypad function keys, 166
- With XT EMZ9371BC keypad, 163

Parameterising the speed controller, signal limitation, 156 , 335 , 357

Parameters
- changing and saving, with keypad XT EMZ9371BC, 167
- machine parameters, 141

PC system bus adapter, 463

PCAN-View, diagnostics, 229

Phase controller, Operating mode "Speed control", 337

Phase controller influence, operating mode "Speed control", 337

Phase displacement, correction value, 180

Phase shift, 179

Phase signals, list, 440

Plug connector assignment, power connections, 53

Plug connectors
- control connections, 68
- power connections, 53

Pollution, 31

Position control, feedback system, 103
- absolute value encoder (Hiperface, single-turn/multi-turn), 113
- Absolute value encoder (position encoder), resolver (speed encoder), 117
- resolver, 104
- sin/cos encoder, without serial communication, 106
- TTL incremental encoder, 106
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 109

Power connections, 53
- connection of external brake resistor, 60
- DC bus connection, 53
- Internal brake resistor connection, 58
- motor connection, 53 , 61
- motor holding brake connection, 53
- plug connector assignment, 53

Power reduction, 31

Power supply module, 13

Power terminals, 52
- connection of motor holding brake, 62
- DC bus connection, 55

Process data, 443
- structure, 448

Process data objects
- addressing, 460
- available, 447
- cyclic, 451
- event-controlled, 453
- transfer, 450

Process data telegram, 448

Process data transfer, 447

Protection of persons, 27

Protective insulation, 32

Protective measures, 32

Protective separation, 32

Q

Quick stop (QSP), 121 , 144
- , 338 , 358
- DCTRL function block, 297
- operating mode "Speed control", 338
- operating mode "Torque control", 358

R

Ramp function generator
- Changing the characteristic, 330 , 353
- influence, 329 , 352

Rated data, 33 , 34
- external brake resistor
  type ERBD..., 464
  type ERBM..., 464
  type ERBS..., 465

Rated output current, 35

Remote parameterisation (gateway function), 190

Resetting TRIP (TRIP-RESET), DCTRL function block, 298

Residual hazards, 27

Resolver, 87 , 160
- Adjustment, 160
- as position and speed encoder, 104

Resolver cable, monitoring, 218

Responses, 193
- CAN sync response, 181

Rotor position adjustment, monitoring, 224

S

Safe standstill, 71

Safe torque off, 71

Safety instructions, 19
- definition, 30
- layout, 30

Scaling, 15

Sd7 - absolute value encoder initialisation, 220

Selecting the control structure, 126

Selecting the operating mode, 126

Selection help for cable length / number of repeaters, Example, 85

Selection lists
- signal combinations
  analog signals, 437
  digital signals, 428
  phase signals, 440
- Signal links, 428

Setpoint processing
- Operating mode , 326
- Operating mode "torque control", 351

Setpoint selection, 142

Setting node address, 169

Setting of boot up time , 176

Setting of cycle time, 176

Setting of mains data, 98

Setting of motor control
- Operating mode "speed control", 332
- Operating mode "torque control", 354

Setting of the feedback system, 103

Setting the address, via DIP switch, 170

Setting the baud rate, 169

Setting the direction of rotation, 121

Setting the feedback system
- Absolute value encoder (Hiperface, single-turn/multi-turn), as position and speed encoder, 113
- absolute value encoder (position encoder), resolver (speed encoder), 117
- Resolver as position and speed encoder, 104
- sin/cos encoder, without serial communication, 106
- TTL incremental encoder, 106
- TTL-/SinCos encoder (position encoder), resolver (speed sensor), 109

Setting the motor control
- Operating mode "Speed control"
  Field weakening, 339
  Maximum speed, 333
  Phase controller, 337
  Torque limitation, 332
- operating mode "Speed control"
  additional torque setpoint, 332
  phase controller influence, 337
  quick stop (QSP), 338
  torque setpoint, 332
- operating mode "Torque control"
  field weakening, 359
  maximum speed, 355
  quick stop (QSP), 358
  torque limitation, 354
  torque setpoint, 354

Setting the node address, via DIP switch, 170

Setting the polarity, 121
- digital inputs/outputs, 121

Setting the voltage thresholds, 99

Setting TRIP (TRIP-SET), DCTRL function block, 298

Shield connection, control/signal cables, 66

Shielded cables, 54

Shielding
- cables, 54
- EMC, 51

Short circuit monitoring (OC1), 201

Short-circuit monitoring, 201

Signal combinations, selection lists
- analog signals, 437
- digital signals, 428
- phase signals, 440

Signal flow diagrams
- speed control
  setpoint via AIF, 131
  setpoint via analog input, 128
  setpoint via MotionBus (CAN), 133
- torque control
  setpoint via AIF, 138
  setpoint via analog input, 135
  setpoint via MotionBus (CAN), 140

Signal links, selection lists, 428

Signal types, 15

Sin/cos signal, monitoring functions, 221

Sin/cos signal monitoring (Sd8), 221

SinCos absolute value encoder, 90

SinCos encoder, 90
- without serial communication, as position and speed encoder, 106

Site altitude, 31

Source for the speed setpoint, operating mode "Speed control", 326

Source for torque setpoint, operating mode "Torque control", 351

Specification of the cables, motor cables, 61

Specification of the transmission cable, 82

Speed (speed control), 318
- changing the direction of rotation, 325
- Holding brake control, 340
- motor control setting
  I component setting, 156 , 335 , 357
  speed controller adjustment, 334
- Setpoint processing, 326
- Setting of motor control, 332
- Setting the motor control
  Field weakening, 339
  Maximum speed, 333
  Phase controller, 337
  Torque limitation, 332
- setting the motor control
  additional torque setpoint, 332
  phase controller influence, 337
  quick stop (QSP), 338
  torque setpoint, 332
- torque control with speed limitation, 336

Speed control
- setpoint via AIF, 130
- setpoint via analog input, 127
- setpoint via CAN, 132
- setpoint via MotionBus (CAN), 132

Speed control (, function block), setting the motor control, 338

Speed control ("Speed"), 126

Speed control (FB Speed), 318
- changing the direction of rotation, 325
- Holding brake control, 340
- motor control setting
  I component setting, 156 , 335 , 357
  speed controller adjustment, 334
- Setpoint processing, 326
- Setting of motor control, 332
- Setting the motor control
  Field weakening, 339
  Maximum speed, 333
  Phase controller, 337
  Torque limitation, 332
- setting the motor control, phase controller influence, 337

Speed control (function block,), 336
- setting the motor control, 332

Speed control (function block , , , , , 332

Speed control, feedback system, 103
- absolute value encoder (Hiperface, single-turn/multi-turn), 113
- Absolute value encoder (position encoder), resolver (speed encoder), 117
- resolver, 104
- sin/cos encoder, without serial communication, 106
- TTL incremental encoder, 106
- TTL/SinCos encoder (position encoder), resolver (speed encoder), 109

Speed controller, 154
- Adjustment, 154

Speed setpoint, operating mode "Speed control", 326

Speed system deviation, monitoring functions, 222

Standards, 31

Starting torques, control terminals, connection "Safe torque off", 74

Status CAN, 187

status of the axis module, 235 , 300

Status word, LECOM (C0150/C0155), 235

Statuses, CAN network, 444

Structure of the process data, 448

Supply voltage, encoder, 88

Switch-off thresholds, 215

Switch-on thresholds, 215

Sync correction increment, 180

Sync identifiers, 180

Sync phase displacement, 179
- correction value, 180

Sync signal source, 179

Sync telegram, 452

Synchronisation
- CAN sync response, 181
- cyclic process data objects, 452

Synchronisation cycle, 179

Synchronisation via CAN, 182

Synchronisation via terminal X6/DI1, 183

SYS, 317

System blocks
- scaling, 15
- signal types, 15

System bus (CAN), 441 , 442
- assignment of the plug connectors, 82
- baud rate, 84 , 85
- communication, 442
- configuring, 169
- cyclic process data objects, synchronisation, 452
- event-controlled process data objects, 453
- identifier, 442 , 460
- Individual addressing, 173
- network management data, 443
- parameter data, 443 , 454
- parameter data channels, 454
- process data, 443
- process data objects, 447
  addressing, 460
  data transmission, 450
- process data telegrams, 448
- setting the baud rate, 169
- setting the node address, 169
- user data, 443 , 455
- wiring, 81 , 83

system bus (CAN)
- CAN data telegram, 442
- parameter data objects, addressing, 460

System bus components, 463

System error messages, Causes and remedies, 238

T

Technical data, 31
- current characteristics
  application example, 37
  device protection by current derating, 38
  rated output current, 35
- external brake resistor
  type ERBD..., 464
  type ERBM..., 464
  type ERBS..., 465
- general electrical data, 32
- rated data, 33 , 34
- standards and operating conditions, 31

Telegram counter CAN, 188

Temperature, 31

Temperature inside the controller, monitoring functions, 205

Terminology used, 13

Thermal monitoring, motor, Sensorless, 23

Thermal sensors, monitoring functions, 206

Thermal separation, 42

Tightening torques
- Control connections, 55 , 68
- control connections, 53

Time-out monitoring for activated remote parameterisation, 200

Timeout with activated remote parameterisation, CAN interface, 200

Torque, safe torque off, 71

Torque (torque control), 343
- changing the direction of rotation, 350
- Holding brake control, 360
- motor control setting
  I component setting, 156 , 335 , 357
  speed controller adjustment, 356
- Setpoint processing, 351
- Setting of motor control, 354
- setting the motor control
  field weakening, 359
  maximum speed, 355
  quick stop (QSP), 358
  torque limitation, 354
  torque setpoint, 354
- torque control with speed limitation, 349

Torque control
- setpoint via AIF, 137
- setpoint via analog input, 134
- setpoint via MotionBus (CAN), 139
- with speed limitation, 336 , 349

Torque control (, function block), 349 , 350
- setting the motor control, 354 , 355 , 358

Torque control ("Torque"), 126

Torque control (FB Torque), 343
- Holding brake control, 360
- motor control setting
  I component setting, 156 , 335 , 357
  speed controller adjustment, 356
- Setpoint processing, 351
- Setting of motor control, 354
- setting the motor control
  field weakening, 359
  torque limitation, 354

Torque limitation
- Operating mode "Speed control", 332
- operating mode "Torque control", 354

Torque setpoint
- operating mode "Speed control", 332
- operating mode "Torque control", 351 , 354

Transmission cable, specification, 82

TRIP, 193

TRIP-RESET, 234 , 246
- DCTRL function block, 298

TRIP-SET, DCTRL function block, 298

Troubleshooting
- fault analysis with history buffer, 233
- fault messages, 238
- malfunction of drive, 237

Troubleshooting and fault elimination, 232
- monitoring
  current load of the motor (I2 x t monitoring), 23 , 210
  voltage supply of control electronics, 217
- monitoring functions
  bus off, 199
  current load of controller (I x t monitoring), 207
  DC-bus voltage, 214
  earth fault, 201
  heatsink temperature, 204
  max. system speed, 223
  monitoring times for process data input objects, 198
  motor phase failure, 217
  motor temperature, 202
  motor temperature sensor, 219
  Resolver cable, 218
  rotor position adjustment, 224
  short circuit, 201
  sin/cos signal, 221
  speed system deviation, 222
  temperature inside the controller, 205
  thermal sensors, 206

TTL encoder, 89

TTL incremental encoder, as position and speed encoder, 106

U

Undervoltage threshold, DC-bus voltage, 214

User data, 443 , 455 , 457
- AIF1In function block, 250
- AIF1Out function block, 255
- AIF2In function block, 257
- AIF2Out function block, 260
- AIF3In function block, 262
- AIF3Out function block, 265
- CAN1In function block, 275
- CAN1OUT function block, 281
- CAN2In function block, 284
- CAN2OUT function block, 287
- CAN3In function block, 290
- CAN3OUT function block, 293

V

Vibration resistance, 31

Voltage supply of control electronics, monitoring, 217

W

Warning, 193

Warranty, 18

Wiring, system bus (CAN), 83

X

XT EMZ9371BC keypad, Diagnostics, 228

© 06/2013

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

+49 (0)51 54 / 82-0

+49 (0)51 54 / 82 - 28 00

Lenze@Lenze.de

www.Lenze.com

Service

Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany

00 80 00 / 24 4 68 77 (24 h helpline)

+49 (0)51 54 / 82-11 12

Service@Lenze.de

EDBCSXS064 ■ 13434277 ■ EN ■ 4.0 ■ TD17

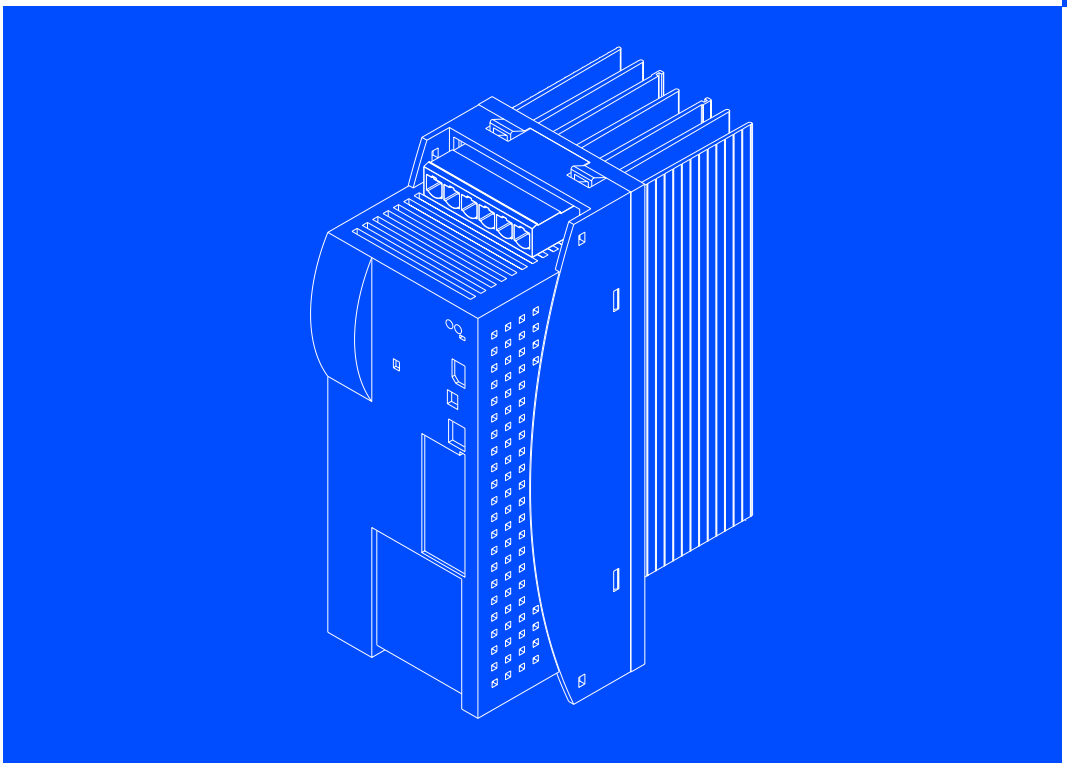
10 9 8 7 6 5 4 3 2 1

Show/Hide Bookmarks

EDBCSXKXXX
13018327

Operating Instructions

ECS



Capacitor module of ECSxK series

Lenze

This documentation is valid for ECS capacitor modules as of version:

	ECS	x	K	xxx	x	4	B	xxx	1A
①									

Type

Design

E = Enclosure IP20
D = Push-through technique (thermally separated)
C = Cold plate

Capacity

001 = 705 µF (±20 %)
002 = 1410 µF (±20 %)

Voltage class

4 = 400 V/480 V

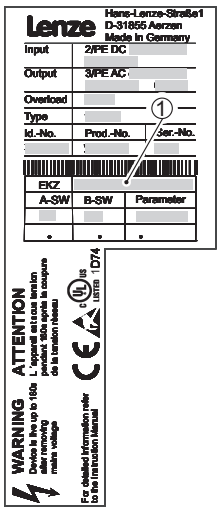
Technical version

B = Standard

Variant

Hardware version

1A or higher

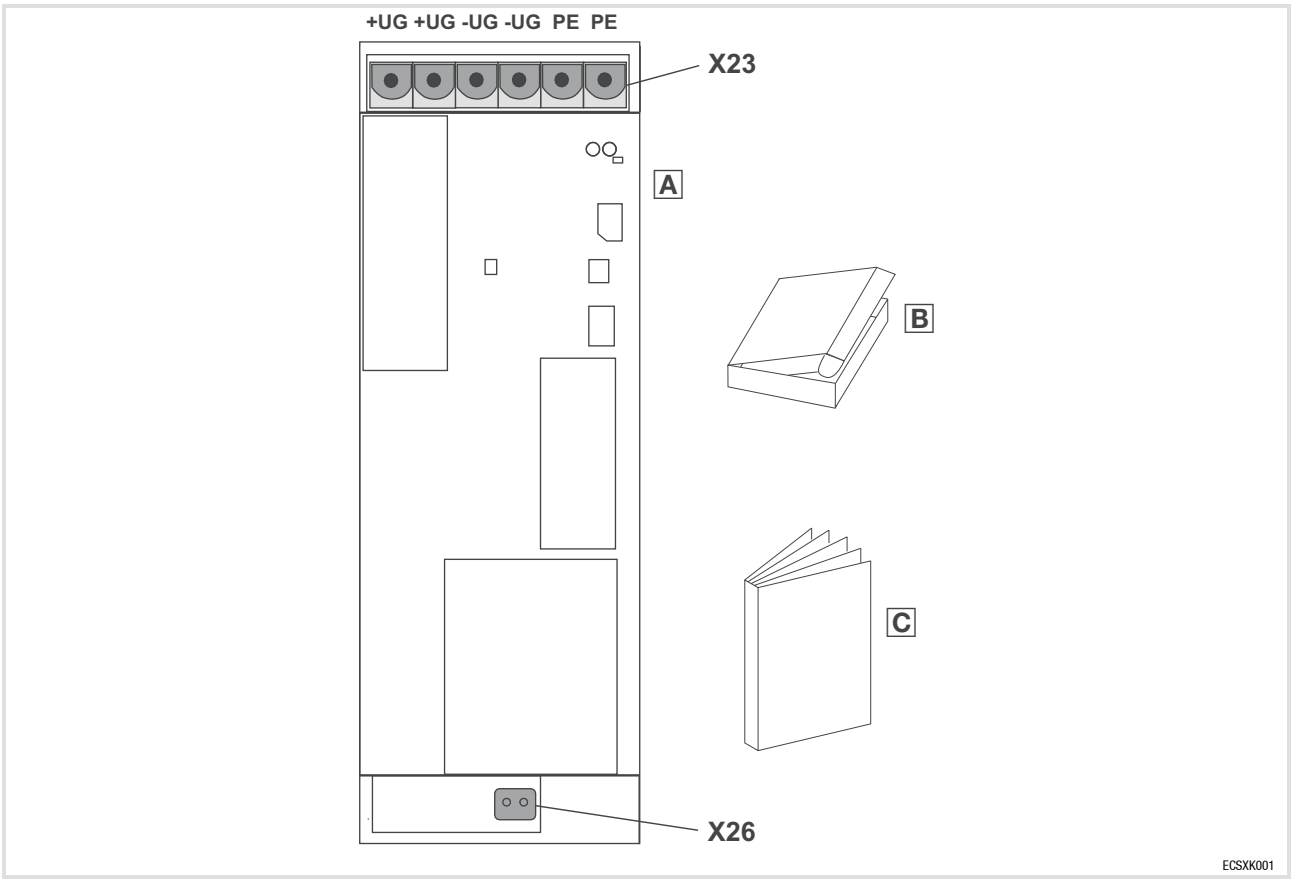


Tip!

Current documentations and software updates for Lenze products can be found on the Internet in the ”Downloads” area under

http://www.Lenze.com

© 2004 Lenze Drive Systems GmbH, Hans-Lenze-Straße 1, 31855 Aerzen
No part of this documentation may be reproduced or made accessible to third parties without written consent by Lenze Drive Systems GmbH.
All information given in this documentation has been selected carefully and complies with the hardware and software described. Nevertheless, deviations cannot be ruled out. We do not take any responsibility or liability for damages which might possibly occur. Necessary corrections will be included in subsequent editions.



A	Capacitor module ECSxK
B	Accessory kit with fixing material
C	Safety instructions for modules of the ECS series
X23	Connections: - DC-bus supply - PE
X26	Control connection for bridging the charging current limitation

1 Preface and general information 7
1.1 About these Operating Instructions 7
1.2 Terminology used 7
1.3 Legal regulations 8

2 Safety instructions 9
2.1 General safety and application information for Lenze capacitor modules 9
2.2 Residual hazards 12
2.3 Safety instructions for the installation according to UL or UR 13
2.4 Definition of notes used 14

3 Technical data 15
3.1 General data/operating conditions 15
3.2 Rated data 16

4 Mechanical installation 17
4.1 Important notes 17
4.2 Mounting with fixing rails (standard) 18
4.3 Thermally separated mounting (”push-through technique”) 19
4.4 Mounting in ”cold plate” technique 21

5 Electrical installation 23
5.1 Important notes 23
5.1.1 Protection of persons 23
5.1.2 Device protection 24
5.1.3 Electrical isolation 24
5.2 Drive system on the mains 25
5.2.1 Supply form/electrical supply conditions 25
5.2.2 Operation on public supply systems (compliance with EN 61000-3-2) 25
5.3 Installation of a DC-typical drive system 26
5.4 Power connections 28
5.4.1 Terminal assignment of the power connections 28
5.4.2 Fusing the DC-bus supply 28
5.4.3 Specification of the cables used 28
5.5 Control connection 30
5.6 Wiring 31
5.6.1 Operation with ECSxE power supply module 31
5.6.2 Operation with another supplier 33

i Contents

6 Commissioning 34

7 Appendix 35

7.1 Overview of accessories 35

7.1.1 Connectors 35

7.1.2 DC bus fuses 35

7.2 Index 36

1 Preface and general information

1.1 About these Operating Instructions

These Operating Instructions assist you in connecting and commissioning the ECSxKxxx capacitor modules. They include safety instructions which must be observed.

All persons working on and with the ECSxKxxx capacitor modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

The Operating Instructions must always be in a complete and perfectly readable state.

1.2 Terminology used

Term	In the following text used for
Power supply module	Any type of power supply module
ECSxExxx	ECSxExxx power supply module
Capacitor module	Any type of capacitor module
ECSxKxxx	ECSxKxxx capacitor module
Axis module Controller	Any axis module
ECSxAxxx	ECSxAxxx axis module
Drive system	Drive systems with: ● ECSxAxxx axis modules ● ECSxExxx power supply modules ● ECSxKxxx capacitor modules ● Other Lenze drive components
24 V supply Low-voltage supply	24 V DC supply ● of the control card in a voltage range of 20 ... 30 V DC (±0 V) ● of "Safe standstill" in a voltage range of 18 ... 30 V DC (±0 V) ● of the motor holding brake in a voltage range of 18 ... 30 V DC (±0 V)
KSB	Short-circuit braking: Quick discharge of the DC bus via the brake resistor
AIF	**A**utomation**I**nter**F**ace
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0470/3 = Subcode 3 of code C0470)
Xk/y	Terminal y on the terminal strip Xk (e. g. X6/B+ = terminal B+ on the terminal strip X6)

1.3 Legal regulations

Labelling	**Nameplate**	**CE-identification**	**Manufacturer**
	Lenze capacitor modules are clearly designated by the date on the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Drive Systems GmbH Postfach 101352 D-31763 Hameln
Application as directed	**ECSxKxxx capacitor modules** ● must only be operated under the conditions prescribed in these Instructions. ● are components – for backing up the DC-bus voltage for the drive system. – for installation into a machine – for assembly with other components to form a machine. ● are electric units for the installation into control cabinets or similar enclosed operating housing. ● comply with the requirements of the Low-Voltage Directive. ● are not machines for the purpose of the Machinery Directive. ● are not to be used as domestic appliances, but for industrial purposes only. **Drive systems with ECSxKxxx capacitor modules** ● comply with the EMC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – for operation on public and non-public mains – in industrial areas. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data, and notes in these Instructions met the state of the art at the time of printing. Claims on modifications referring to capacitor modules and components which have already been supplied cannot be derived from the information, illustrations, and descriptions. ● The specifications, processes, and circuitry described in these Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damage and operating interference caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the capacitor modules – Operating errors – Improper working on and with the capacitor module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems 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.		
Disposal	**Material**	**recycle**	**dispose**
	Metal	●	-
	Plastic	●	-
	Assembled PCBs	-	●

2 Safety instructions

2.1 General safety and application information for Lenze capacitor modules

(according to Low-Voltage Directive 73/23/EWG)

General

During operation, Lenze capacitor modules can include live parts, depending on their type of protection. Surfaces can be hot.

If the required cover is removed or the modules are used inappropriately or installed or operated incorrectly, severe damage to persons or material can occur.

For more information please see the documentation.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and national regulations for the prevention of accidents must be observed).

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.

Application as directed

Capacitor modules are components which are designed for the installation into electrical systems or machinery. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2. The documentation contains information about the compliance with the limit values to EN 61000-3-2.

When installing capacitor modules into machines, commissioning of the drive controllers (i.e. the starting of operation as directed) is prohibited until it is proven that the machine corresponds to the regulations of the EC Directive 98/37/EG (Machinery Directive); EN 60204 (VDE 0113) must be observed.

Commissioning (i.e. starting of operation as directed) is only allowed when there is compliance with the EMC Directive (89/336/EEC).

The capacitor modules meet the requirements of the Low-Voltage Directive 73/23/EWG. The harmonised standards of EN 50178 / DIN VDE 0160 apply to the capacitor modules.

The technical data and information on the connection conditions can be obtained from the nameplate and the documentation. The instructions must be strictly observed.

Warning: The capacitor modules are products with restricted availability according to EN 61800-3. These products can cause interferences in residential premises. If capacitor modules are used in residential premises, corresponding measures are required.

Transport, storage

The notes on transport, storage and appropriate handling must be observed.

Observe the climatic conditions required to EN 50178.

Installation

The capacitor modules must be installed and cooled according to the regulations given in the corresponding Instructions.

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

Capacitor modules contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this means hazards for your health!

Electrical connection

When working on live capacitor modules, the valid national regulations for the prevention of accidents (e. g. VBG 4) must be observed.

The electrical installation must be carried out in compliance with the corresponding regulations (e. g. cable cross-sections, fusing, PE connection). Additional information can be obtained from the documentation.

The documentation contains notes for EMC-compliant installation (shielding, earthing, filters and cable routing). These notes must also be observed when using CE-marked capacitor modules. The manufacturer of the system or machine is responsible for the compliance with the limit values required by the EMC legislation.

Operation

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

After the capacitor module has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors can be charged. Please observe the corresponding labels on the capacitor module.

All protection covers and doors must be shut during operation.

Note for UL-approved system with integrated capacitor modules:

UL warnings are notes which only apply to UL systems. The documentation contains special UL-related information.

Maintenance and servicing

The capacitor modules are free of maintenance if the prescribed conditions of operation are observed.

In operating areas with polluted ambient air, the cooling surfaces of the capacitor module can get dirty or the cooling openings can block. Under these conditions a regular cleaning of the cooling surfaces and cooling openings is essential. Do not use sharp or pointed objects for this purpose!

Disposal

Recycle metals and plastics. Dispose of printed circuit board assemblies according to the state of the art.

The product-specific safety and application notes in these Instructions must also be observed!

2.2 Residual hazards

Protection of persons

- Before working on the capacitor module, check that no voltage is applied to the power terminals,
  - because the power terminals +UG and -UG at the supply module remain live for at least 3 minutes after mains switch-off.
  - because the power terminals +UG and -UG remain live when the motor is stopped.
- If an error occurs (short circuit to frame or earth fault) a DC residual current may occur in the PE conductor. If an earth-leakage circuit breaker (residual current device) is used to protect against direct or indirect contact, only the use of an earth-leakage circuit breaker of type B is permissible on the current supply side. If not, another protective measure is to be used, as for example, separation from the environment by double or reinforced insulation or separation from the mains by using a transformer.

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied.
- The power terminals +UG, -UG and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals.
- The power may only be converted if the power supply module in the power system is ready for operation and the charging current limitation is bridged. Otherwise the charging current limitation can be destroyed.
- If the charging current limitation is active, a cyclic switching of the mains voltage at the power supply module can overload and destroy the capacitor. Therefore, at least three minutes have to pass between two starting operations in case of cyclic mains switching over a longer period of time.

2.3 Safety instructions for the installation according to U_L or U_R

Warnings!

General markings:

► Use 60/75 °C or 75 °C copper wire only.

► Maximum ambient temperature 55 °C, with reduced output current.

Terminal tightening torque of lb-in (Nm)

► x23
– 10.6 ... 13.3 lb-in (1.2 ... 1.5 Nm)

► x26
– 4.4 ... 7.1 lb-in (0.5 ... 0.8 Nm)

Wiring diagram AWG

► x23
– AWG 12 ... AWG 8

► x26
– AWG 24 ... AWG 12

2.4 Definition of notes used

The following signal words and symbols 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 trouble-free 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.

3 Technical data

3.1 General data/operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (73/23/EWG)
Approvals		UL 508C	Power Conversion Equipment Underwriter Laboratories (File No. E132659) for USA and Canada
Vibration resistance		Accelerational stability up to 0.7 g (Germanischer Lloyd, general conditions)	
Climatic conditions		Class 3K3 to EN 50178 (without condensation, relative humidity 30 ... 95 %)	
Degree of pollution		VDE 0110 part 2 pollution degree 2	
Packaging (DIN 4180)		Delivery packing	
Permissible temperature range	Transport	-25 ... +70 °C	
	Storage	-25 ... +55 °C	
	Operation	0 ... +55 °C	reduce the rated AC current by 2 %/°C above +40°C
Permissible installation height		0 ... 4000 m amsl	reduce rated AC current by 5%/1000 m above 1000 m amsl
Installation		Installation into control cabinet	
Mounting position		Vertically suspended	
Free space	Above/below	≥ 50 mm	
	To the sides	Side-by-side mounting without any clearance	

General electrical data			
EMC		Compliance with EN 61800-3	
Noise emission		Compliance with limit value class A to EN 55011 (achieved with application-specific collective filter)	
Noise immunity		Requirements to EN 61800-3	
		Requirements	**Standard**	**Severity**
		ESD [1]	EN 61000-4-2	3, i. e. ● 8 kV with air discharge ● 6 kV with contact discharge
		High frequency in cables	EN 61000-4-6	10 V; 0.15 ... 80 MHz
		RF interference (enclosure)	EN 61000-4-3	3, i. e. 10 V/m; 80 ... 1000 MHz
		Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
		Surge (on mains cable)	EN 61000-4-5	3, i. e. 1.2/50 µs ● 1 kV phase-phase ● 2 kV phase PE
Insulation resistance		Overvoltage category III to VDE 0110		
Discharge current against PE (to EN 50178)		> 3.5 mA AC for operation with corresponding controllers		
Enclosure		● IP20 for standard mounting ● IP20 for mounting in cold-plate technique ● IP20 for mounting in push-through technique; IP54 on the heatsink side		
Protective insulation of control circuits		Safe disconnection from supply: Double/reinforced insulation to EN 50178; Rated insulation voltage 300 V x √2		

[1] Noise immunity in the above-mentioned severities must be guaranteed through the control cabinet! The user must check the compliance with the severities!

3.2 Rated data

Rated data		Type	ECSxK001xxx		ECSxK002xxx	
Data for operation with upstream supply module on mains voltage		U_{mains} [V]	400	480	400	480
DC-bus voltage		U_{DC} [V]	0 ... 770			
Rated AC current		I_r [A]	17,5		35	
Rated power		P_B [kW]	10		20	
Rated power with mains choke		P_{BN} [kW]	14		28	
Capacity		C [µF]	705 (±20 %)		1410 (±20 %)	
Time constant for charging the capacitors		τ [ms]	150			
Charging time after mains connection		$t_{C\_charging}$ [s]	1			
Weight	ECSEKxxx	m [kg]	2.1		3.2	
	ECSDKxxx	m [kg]	2.1		3.2	
	ECSCKxxx	m [kg]	2.4		3.4	
Dimensions	ECSEKxxx	(W x H x D) [mm]	88.5 x 247 x 176		132 x 247 x 176	
	ECSDKxxx	(W x H x D) [mm]	88.5 x 247 x 176		132 x 247 x 176	
	ECSCKxxx	(W x H x D) [mm]	88.5 x 282 x 123		132 x 282 x 123	

4 Mechanical installation

4.1 Important notes

- ECSxKxxx capacitor modules are provided with IP20 protection and can therefore only be used for installation into control cabinets.
  - For thermally separated mounting (ECS**D**Kxxx): IP54 on the heatsink side
- If the cooling air contains air pollutants (dust, fluff, grease, aggressive gases):
  - Take suitable preventive measures , e.g. separate air duct, installation of filters, regular cleaning.
- Ensure free space!
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - You can install several capacitor modules next to each other without any clearance in a control cabinet.
  - Allow a free space of 50 mm above and below other installations or limitations.
- The mounting plate of the control cabinet must be electrically conductive.
- In case of continuous vibrations or shocks use shock absorbers.

Possible mounting positions

Vertically on the mounting plate with DC-bus connections at the top

Mounting techniques

- With fixing rails (standard, 📖 18)
- Thermal separation (”push-through technique”, 📖 19)
- In ”cold plate” technique (📖 21)

4.2 Mounting with fixing rails (standard)

Type ECS**E**Kxxx

For standard mounting into the control cabinet the capacitor module types ECSEKxxx must be used. The accessories required for mounting are included in the scope of supply.

Dimensions

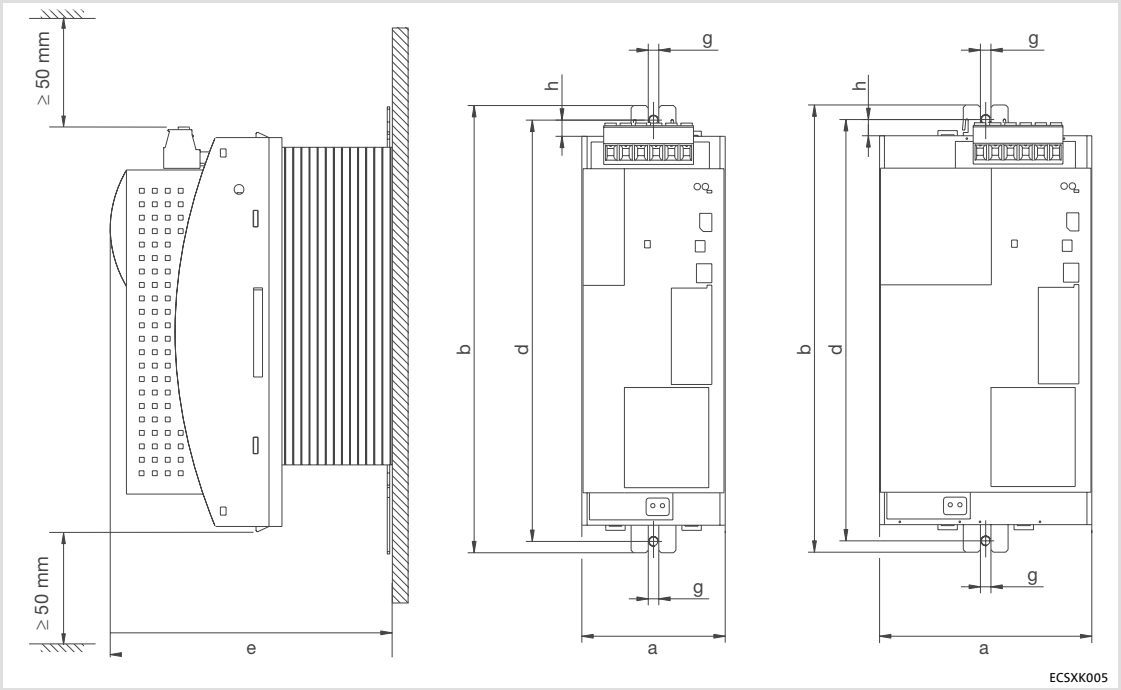


Fig.4-1 Dimensions for standard mounting with fixing rails, ECSEKxxx type

Capacitor modules		Dimensions [mm]					
Type	Size	O	B	D	E	g	h
ECSEK001	1	88.5	276	260	176	6.5 (M6)	10
ECSEK002	2	132					

Mounting

For mounting the capacitor module ECSEKxxx proceed as follows:

1. Prepare the fixing holes (see drawing)
2. Take the fixing rails from the accessory kit in the cardboard box.
3. Push the rails into the slots of the heatsink:
   – From above: push in the long side.
   – From below: push in the short side.
4. Fix the capacitor module onto the mounting plate.

4.3 Thermally separated mounting (”push-through technique”)

Type ECS**D**Kxxx

For thermally separated mounting the capacitor modules of ECSDKxxx type must be used. The accessories required for mounting are included in the scope of supply.

- Protection class of the separated cooler: IP54
- When using the push-through technique the pack panel of the control cabinet must be a steel plate with a thickness of 3 mm. The plate must be flat or slightly arched inwards (to the capacitor module). This applies to the transverse and lengthwise direction.

Dimensions

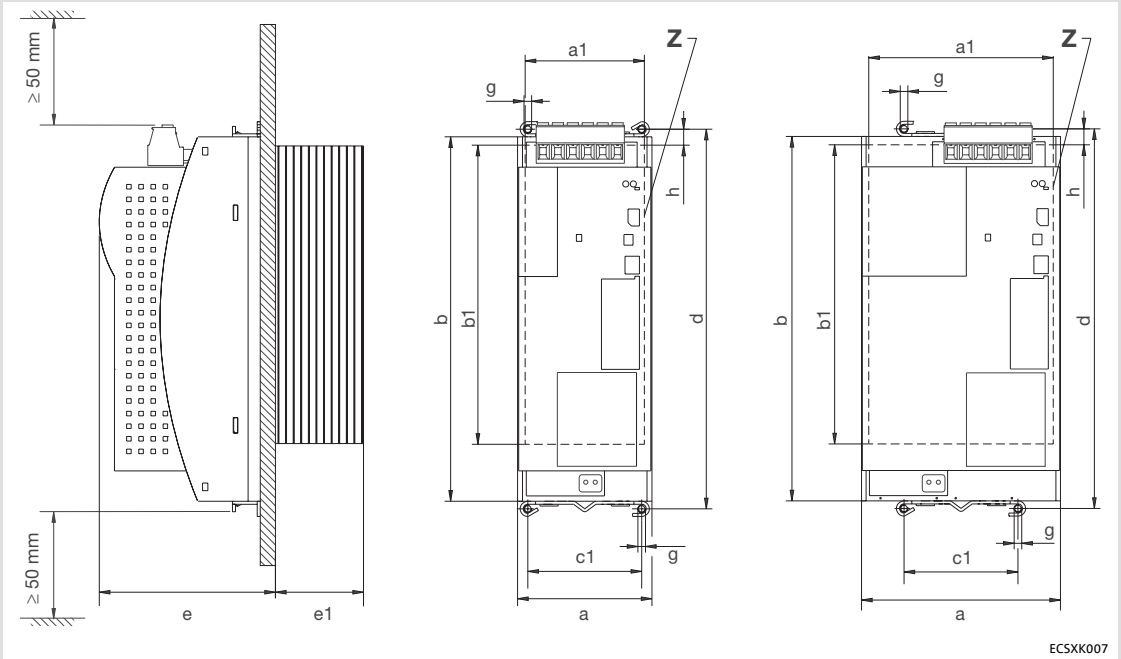


Fig.4-2 Dimensions for thermally separated mounting, ECSDKxxx type

Z Mounting cutout (a1 x b1)

Capacitor modules		Dimensions [mm]									
Type	Size	O	A1	B	b1	c1	D	E	e1	g	h
ECSDK001	1	88.5	78.5	240	197	75	250	116	58	M5	10.5
ECSDK002	2	132	121.5								

Dimensions of mounting cutout

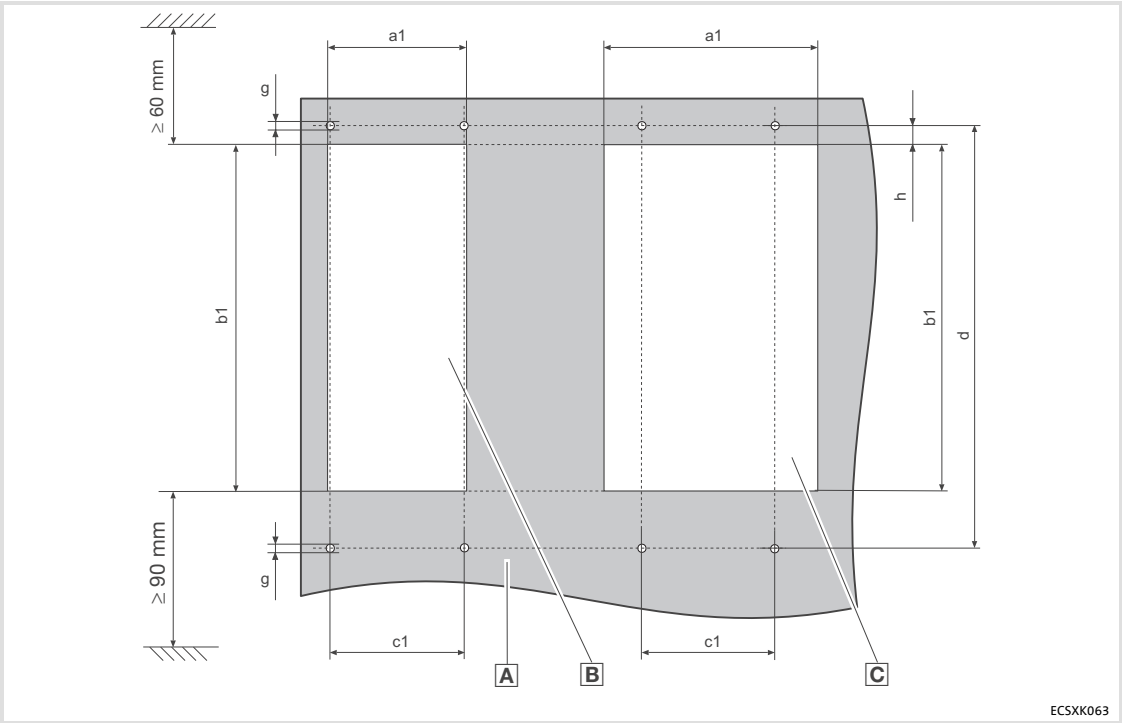


Fig.4-3 Dimensions of mounting cutout for thermally separated mounting, ECSDKxxx type

- A Mounting plate
- B Mounting cutout for ECSDK001
- C Mounting cutout for ECSDK002

Capacitor modules		Dimensions [mm]					
Type	Size	A1	b1	c1	D	g	h
ECSDK001	1	78.5	197	75	250	M5	10.5
ECSDK002	2	121.5					

Mounting

Stop!

When boring through the rear panel of the control cabinet:

Seal the fixing screws with a liquid thread seal to ensure the protection class IP54 for the separated heatsink.

For mounting the capacitor module ECSDKxxx proceed as follows:

1. Prepare fixing holes for the clips (see drawing).
2. Prepare mounting cutout.
3. Fix the clips.
4. Push the capacitor module into the mounting cutout.
5. Let the capacitor module snap into place at the top and bottom.

4.4 Mounting in ”cold plate” technique

Type ECS**C**Kxxx

It is possible to mount the capacitor modules in cold-plate technique, for instance, onto collective coolers. For this mounting, the capacitor modules type ECSCAxxx must be used.

Dimensions

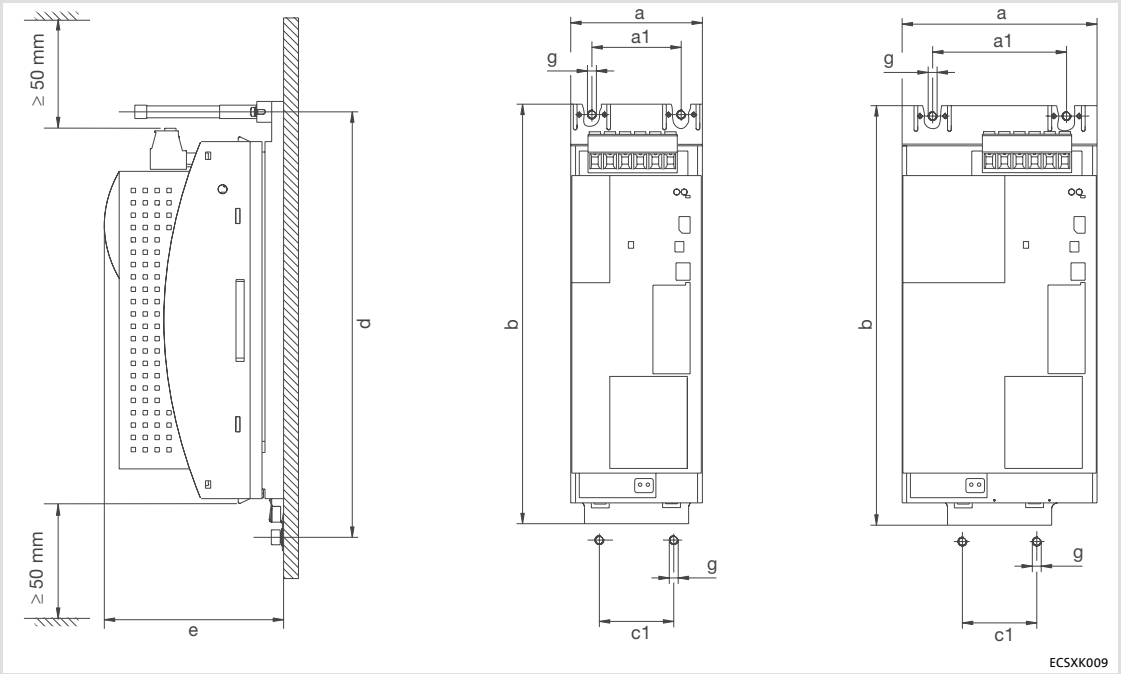


Fig.4-4 Dimensions for mounting in ”cold plate” technique, ECSCKxxx type

Capacitor modules		Dimensions [mm]						
Type	Size	O	A1	B	c1	D	E	g
ECSCK001	1	88.5	60	282	50	286	123	M6
ECSCK002	2	132	90					

Stop!
Penetration depth of the screws into the cooler: Approx. 15 mm!

Mounting

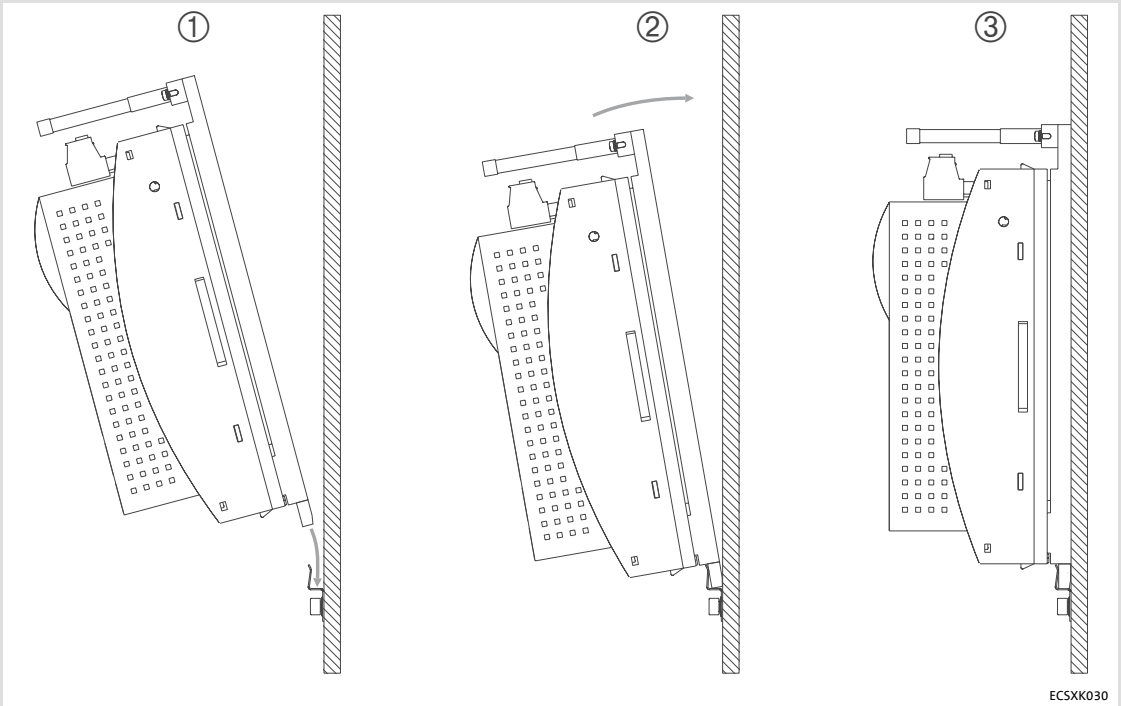


Fig.4-5 Mounting in ”cold plate” technique

For mounting the capacitor module ECSCKxxx proceed as follows:

1. Prepare the fixing holes (see drawing)
2. Clean and degrease the contact area of cooler and heatsink (e. g. with methylated spirit).
3. Screw the support onto the cooler.
4. Insert the capacitor module from above ① into the support ② and fasten both studs with 3.5 ... 4.5 Nm③.

5 Electrical installation

5.1 Important notes

Stop!

The capacitor module contains electrostatically sensitive components.

Prior to assembly and service operations, the personnel must be free of electrostatic charge.

5.1.1 Protection of persons

Danger!

- Before working on the capacitor module, check that no voltage is applied to the power terminals,
  - because the power terminals +UG and -UG remain live for at least three minutes after mains switch-off.
  - because the power terminals +UG and -UG remain live when the motor is stopped.
- If an error occurs (short circuit to frame or earth fault), a DC residual current may occur in the PE conductor. If an earth-leakage circuit breaker (residual current device) is used to protect against direct or indirect contact, only the use of an earth-leakage circuit breaker of type B is permissible on the current supply side. If not, another protective measure is to be used, as for example, separation from the environment by double or reinforced insulation or separation from the mains by using a transformer.

5.1.2 Device protection

Stop!

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied.
- The power terminals +UG, -UG and PE are not protected against polarity reversal.
  – When wiring, observe the polarity of the power terminals!
- The power may only be converted if the power supply module in the power system is ready for operation and the charging current limitation is bridged. Otherwise the charging current limitation can be destroyed.
- If the charging current limitation is active, a cyclic switching of the mains voltage at the power supply module can overload and destroy the capacitor. Therefore, at least three minutes have to pass between two starting operations in case of cyclic mains switching over a longer period of time!

5.1.3 Electrical isolation

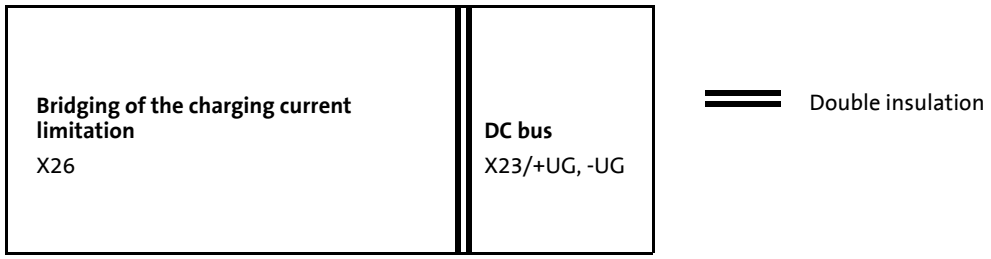


Fig.5-1 Electrical isolation

5.2 Drive system on the mains

These information apply to the drive system, consisting of:

- ECSxExxx power supply module
- ECSxKxxx capacitor module
- ECSxAxxx axis module
- Motor
- Accessories
- Wiring

5.2.1 Supply form/electrical supply conditions

Please observe the restrictions for the respective supply forms.

Mains	Operation of the capacitor modules	Notes
With earthed neutral (TT/TN systems)	No restrictions	The capacitor module will be destroyed if +UG conductor or -UG conductor are earthed.
With isolated neutral (IT systems)	The operation on symmetrical IT systems with PE is permitted.	
DC-supply via +UG/-UG	Permitted if the DC voltage is symmetrical with PE.	The capacitor module will be destroyed if +UG conductor or -UG conductor are earthed.

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

The European standard EN 61000-3-2 specifies limit values for limiting harmonic currents in the supply system. Non-linear loads (e. g. frequency inverters) create harmonic currents, which impair the supply system and thus may disturb other loads. The objective of this standard is to ensure the quality of the public supply systems and reduce the mains load.

Note!

This standard only applies to public supply systems. Supply systems with an own transformer station which are standard in industrial firms are not public and are out of the scope of the standard.

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

5.3 Installation of a DC-typical drive system

General notes

- The electromagnetic compatibility of a machine depends on the type of installation and care taken.Especially consider the following:
  - Structure
  - Filtering
  - Shielding
  - Earthing
- For diverging installations, the conformity to the CE EMC Directive requires a check of the machine or system regarding the EMC limit values. This is valid, for instance, when:
  - Using unshielded cables
  - Using collective suppression filters in place of the assigned RFI filters
  - Operating without RFI filters
- The compliance of the machine application with the EMC Directive is in the responsibility of the user.
  - If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system and that compliance with the EMC Directive and the EMC law is achieved.
  - If devices which do not comply with the CE requirement concerning noise immunity EN 61000-6-2 are operated close to the axis modules, these devices may be disturbed electromagnetically by the axis modules.

Structure

- Install the capacitor module between the power supply module and the axis module(s)..
  - For cable lengths > 5 m we recommend to install the capacitor module as close as possible to the axis module with the highest power.
- Connect power supply modules, capacitor modules, axis modules, RFI filters, and mains choke to the earthed mounting plate with a large surface:
  - Mounting plates with conductive surfaces (zinc-coated or stainless steel) allow permanent contact.
  - Painted plates are not suitable for the installation in accordance with the EMC.
- If you use several mounting plates:
  - Connect the mounting plates electrically with a large surface (e.g. with copper bands).
- Ensure the separation of motor cable and signal or mains cable.
- Do not use the same terminal strip for mains input and motor output.
- Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.

Filtering

- Use RFI filters and mains chokes which are assigned to the power supply modules:
  - RFI filters reduce impermissible high-frequency interferences to a permissible value.
  - Mains chokes reduce low-frequency interferences which depend on the motor cable and its length.

Shielding

- Connect the motor cable shield to the axis module
  - with the EMC accessories ECSZS000X0B.
  - to the mounting plate below the axis module with a large surface.
  - Recommendation: For the shield connection, use earthing clamps on bare metal mounting surfaces.
- If contactors, motor-protecting switches or terminals are located in the motor cable:
  - Connect the shields of the connected cables to the mounting plate, too, with a surface as large as possible.
- Connect the shield in the motor terminal box or on the motor housing to PE:
  - Metal glands at the motor terminal box ensure a connection of the shield and the motor housing.
- Shield the control cables:
  - Connect both shields of the digital control cables.
  - Connect one shields of the analog control cables.
  - Always connect the shields to the shield connection at the controller over the shortest possible distance.
- Using the axis modules in residential areas:
  - Additionally dampen the shield in order to limit the interfering radiation: ≥ 10 dB . This can be realised by using standard, closed, metallic, and earthed control cabinets or boxes.

Earthing

- Earth all metallically conductive components (power supply module, capacitor module, axis module, RFI filter, motor filter, mains choke) using suitable cables connected to a central point (PE bar).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  - For the EMC, not the cable cross-section is important, but the surface and the contact with a cross-section as large as possible, i.e. large surface.

5.4 Power connections

5.4.1 Terminal assignment of the power connections

Terminal	Function	Electrical data
X23	**Connection of DC-bus voltage**	Dependent on application and type 0 ... 770 V
X23/+UG	Positive supply of DC-bus voltage	
X23/+UG		
X23/-UG	Negative supply of DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		

5.4.2 Fusing the DC-bus supply

When ECSxE power supply modules with a mains-side protection are used, the DC-bus cables do not need to be fused.

When using capacitor modules in the DC-bus connection with basic devices of the **82xx** and **93xx** series, use the following fuses:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

Warnings!

- ► Use UL-approved cables, fuses and fuse holders only.
- ► UL fuse:
  - – Voltage 500 ... 600 V
  - – Tripping characteristic ”H”, ”K5” or ”CC”

5.4.3 Specification of the cables used

The cables used must comply with the required approvals at the place of installation (e. g. UL).

Installation of the cables to EN 60204-1 (1998)

Shielded cables

Observe the following to increase the effect of shielded cables:

- ► A good shield connection:
  - – Ensure a contact surface as large as possible
- ► Low shield resistance:
  - – Only use shields with tin-plated or nickel-plated copper braids (shields with steel braids cannot be used).
- ► High contact ratio of the shield braid:
  - – At least 70 ... 80 % with 90 ° overlap angle

Cable cross-sections

Terminal	Function	Screw tightening torques	Possible cable cross-sections
X23	**Connection of DC-bus voltage**	1.2 ... 1.5 Nm 10.6 ... 13.3 lb-in	• rigid – 0.2 ... 10 mm² – AWG 24 ... 8 • flexible – 0.2 ... 10 mm² – AWG 24 ... 10 • With wire end ferrule – 0.25 ... 6 mm² – AWG 22 ... 10 • With TWIN wire end ferrule – 0.25 ... 4 mm² – AWG 22 ... 12
X26	**Control connection for bridging the charging current limitation**	0.5 ... 0.8 Nm 4.4 ... 7.1 lb-in	• flexible – 0.2 ... 2.5 mm² – AWG 24 ... 12

5.5 Control connection

Terminal	Function	Electrical data
X26	Connection for bridging the charging current limitation	21.8 ... 30 V DC, max. 1.5 A

The polarity does not influence the function of the charging current limitation.

5.6 Wiring

5.6.1 Operation with ECSxE power supply module

Install the capacitor module ECSxKxxx between the power supply module and the axis module(s).

If the total cable length in the DC-bus connection is longer than 5 m, install the capacitor module as close as possible to the axis module with the highest power.

Stop!

- ► Permanently bridge the charging current limitation (X26) of the capacitor module (X26 = HIGH).
- ► Only release the controller (X6/SI1 = HIGH) if the power supply module ECSxE displays ”Ready for operation” (X6/DO1 = HIGH).

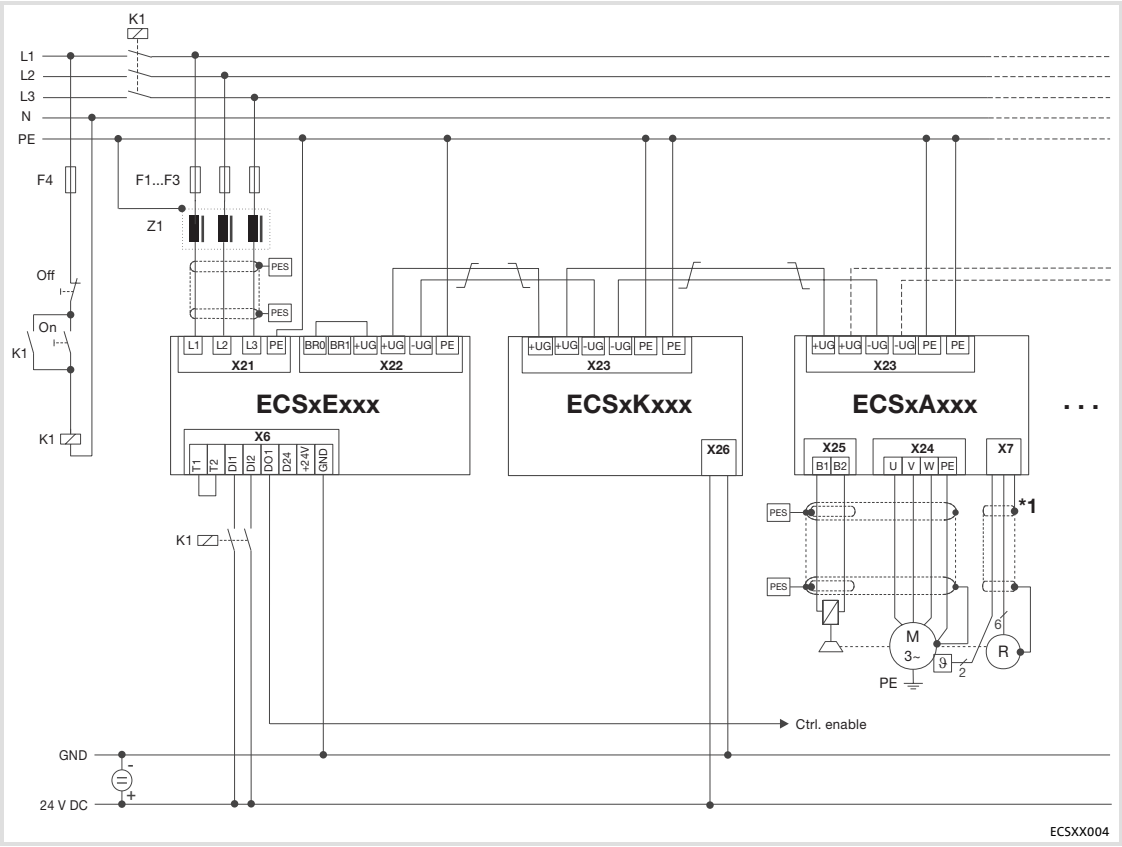


Fig.5-2 Wiring of the capacitor module ECSxK with power supply module ECSxE

PES	HF shield termination by large-surface PE connection
	Twisted cables
* 1	System cable - feedback
Ctrl. enable	Terminal X6/SI1 of the connected axis modules (controller enable)

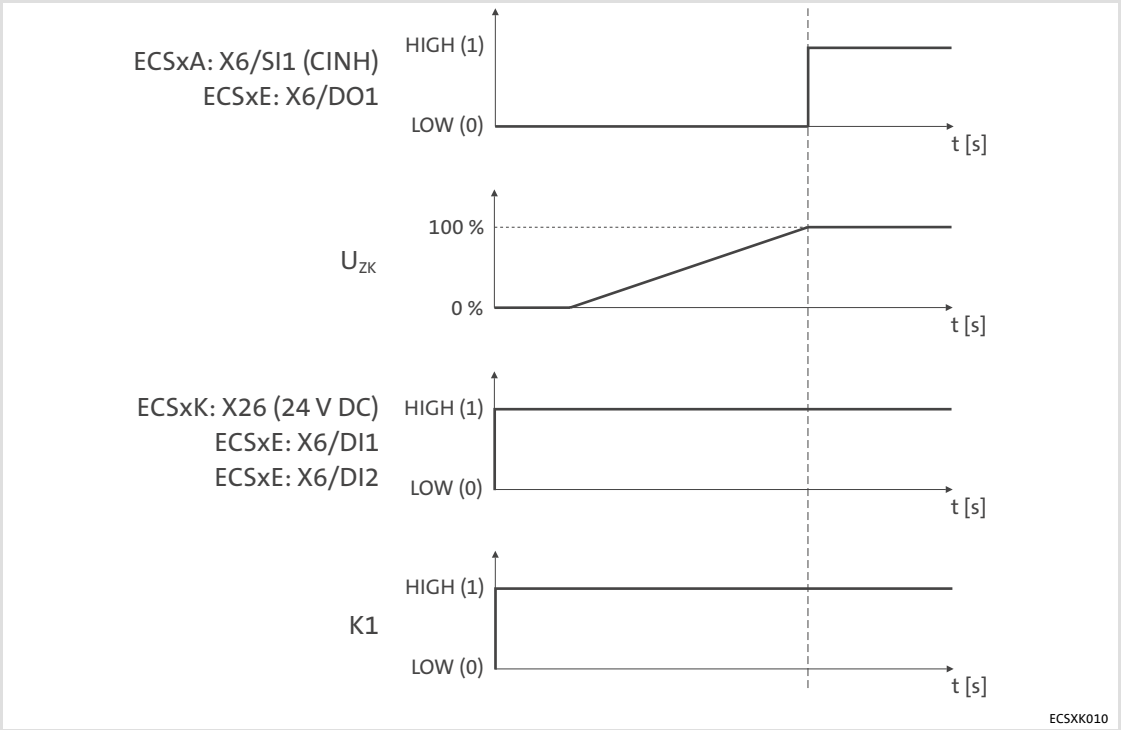


Fig.5-3 Level/time diagrams for operation with ECSxE power supply module

5.6.2 Operation with another supplier

Stop!

- ► After mains connection, wait at least one second before bridging the charging current limitation (X26 = HIGH).
- ► Only release the controller (X6/SI1 = HIGH) if the charging current limitation is bridged.

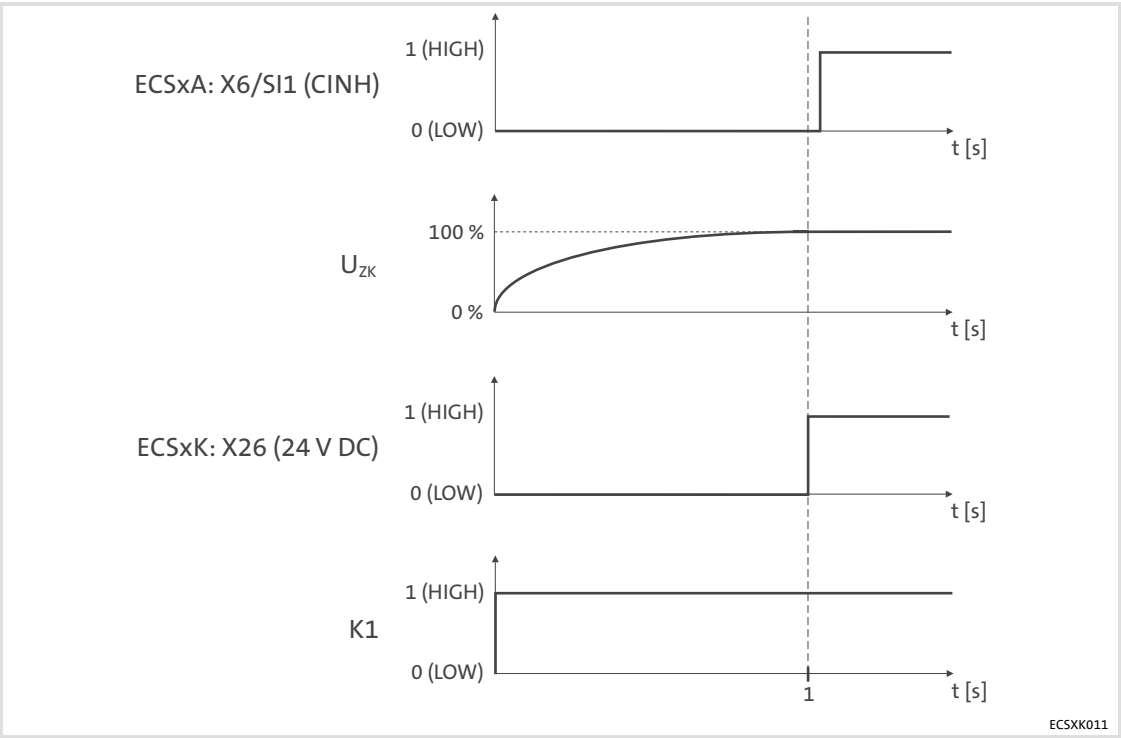


Fig.5-4 Level/time diagrams for operation with other supplier

6 Commissioning

Before you start

Prior to initial switch-on of the drive system, check the wiring of the capacitor module for completeness, short-circuit, and earth fault:

- Power connection (X23):
  - Polarity of the DC-bus voltage supply via terminals +UG and -UG
- Control connection (X26):
  - Wiring adjusted to the signal assignment of the control terminals.



Further information on commissioning the drive system can be obtained from the documentations for the power supply module and axis module.

7 Appendix

7.1 Overview of accessories

The accessories are not included in the scope of supply. The capacitor module and accessories are carefully coordinated.

7.1.1 Connectors

In order to provide a flexible purchasing, the connectors are available as a separate delivery unit.

► ECSZ**K**000X0B (connectors for capacitor modules)

7.1.2 DC bus fuses

The DC bus must only be fused when using the capacitor module with basic device of **82xx** and **93xx** series. Here, the following fuses must be used:

Fuse		Support
Value [A]	Lenze type	Lenze type
50	EFSGR0500ANIN	EFH20007

7.2 Index

A

Accessories, 35
- connectors, 35
- DC bus fuses, 35

Appendix, 35

Application as directed, 8

Approvals, 15

B

Bridging of charging current limitation, connection, 30

C

Cable cross-sections, 29

Capacitor module, 7
- application as directed, 8
- labelling, 8
- type ECSCKxxx, mounting in "cold plate" technique, 21
- type ECSDKxxx, thermally separated mounting, 19
- type ECSEKxxx, mounting with fixing rails, 18

Capacitor module, connection, 31

Capacity, 16

CE-typical drive system, 26
- earthing, 27
- filtering, 27
- installation, 26
- shielding, 27
- structure, 26

Charging current limitation, bridging, connection, 30

Charging time, capacitors, 16

Climatic conditions, 15

Commissioning, 34

Conformity, 15

Connection - bridging of charging current limitation, 30

Connection of DC bus voltage, 28

Connection, capacitor module, 31

Connectors, 35

Control connection (X26), terminal assignment, 30

Controller, 7

D

DC bus fuses, 28

DC bus supply, fusing, 28

DC bus voltage, 16

DC bus voltage, connection, 28

DC-bus fuses, 35

Definition of notes used, 14

Definitions, 7

Degree of pollution, 15

Device protection, 12

Dimensions, 16

Discharge current against PE, 15

Disposal, 8 , 11

Drive system, 7

Drive system on the mains, 25
- operation on public supply systems, EN 61000-3-2, 25
- supply forms / electrical supply conditions, 25

E

Earthing, EMC, 27

Electrical data, general, 15

Electrical installation, 23
- control connection (X26), terminal assignment, 30
- drive system on the mains, 25
  operation on public supply systems, 25
  supply forms / electrical supply conditions, 25
- important notes, 23
  electrical isolation, 24
  protection of persons, 23
- installation of a CE-typical drive system, 26
  earthing, 27
  filtering, 27
  shielding, 27
  structure, 26
- power connections
  connection of capacitor module, 31
  DC bus supply, fusing, 28
  specification of cables used, 28
- power connections (X23), terminal assignment, 28

Electrical isolation, 24

Electromagnetic compatibility, 15

EMC, 15
- earthing, 27
- filtering, 27
- shielding, 27

EN 61000-3-2, operation on public supply systems, 25

Enclosure, 15

F

Filtering, EMC, 27

Free space, 15

Fuses, 28 , 35

G

General electrical data, 15

I

Installation, 15

Installation height, 15

Installation of a CE-typical drive system, 26
- earthing, 27
- filtering, 27
- shielding, 27
- structure, 26

Installation, electrical, 23
- control connection (X26), terminal assignment, 30
- drive system on the mains, 25
  operation on public supply systems, 25
  supply forms / electrical supply conditions, 25
- important notes, 23
  electrical isolation, 24
  protection of persons, 23
- installation of a CE-typical drive system, 26
  earthing, 27
  filtering, 27
  shielding, 27
  structure, 26
- power connection, connection of capacitor module, 31
- power connections
  DC bus supply, fusing, 28
  specification of cables used, 28
- power connections (X23), terminal assignment, 28

Installation, mechanical, 17
- important notes, 17
- mounting in ”cold plate” technique, type ECSCKxxx, 21
- mounting with fixing rails, type ECSEKxxx, 18
- thermally separated mounting, type ECSDKxxx, 19

Insulation resistance, 15

L

Labelling, capacitor module, 8

Legal regulations, 8

Liability, 8

Low-voltage supply, 7

M

Manufacturer, 8

Mechanical installation, 17
- important notes, 17
- mounting in ”cold plate” technique, type ECSCKxxx, 21
- mounting with fixing rails, type ECSEKxxx, 18
- thermally separated mounting, type ECSDKxxx, 19

Mounting in ”cold plate” technique, type ECSCKxxx, 21

Mounting position, 15

Mounting with fixing rails, type ECSEKxxx, 18

N

Noise emission, 15

Noise immunity, 15

Notes, definition, 14

O

Operating conditions, 15

Operation on public supply systems, EN 61000-3-2, 25

P

Packaging, 15

Power, 16

Power connection, connection of capacitor module, 31

Power connections, 28
- DC bus supply, fusing, 28
- specification of cables used, 28
  cable cross-sections, 29
  shielded cables, 28

Power connections (X23), terminal assignment, 28

Power reduction, 15

Power supply module, 7

Protection of persons, 12

R

Rated current, 16

Rated data, 16

Rated power, 16

Residual hazards, 12

S

Safety instructions, 9
- definition, 14
- design, 14
- device protection, 12
- general, for Lenze capacitor modules, 9
- protection of persons, 12

Shielded cables, 28

Shielding, EMC, 27

Specification of cables used, 28
- cable cross-sections, 29
- shielded cables, 28

Standards, 15

Supply forms / electrical supply conditions, 25

T

Technical data, 15
- general electrical data, 15
- operating conditions, 15
- rated data, 16
- standards, 15

Temperature range, 15

Terminal assignment
- control connection (X26), 30
- power connections (X23), 28

Thermally separated mounting, type ECSDKxxx, 19

V

Vibration resistance, 15

W

Warranty, 8

Weight, 16

Wiring, 31

Show/Hide Bookmarks

CE

Lenze Drive Systems GmbH
Hans-Lenze-Straße 1
31855 Aerzen
Germany

☎ +49 (0) 51 54 82-0
☎ Service 00 80 00 24 4 68 77 (24 h helpline)
Service +49 (0) 51 54 82-1112

E-Mail Lenze@Lenze.de
Internet www.Lenze.com

EDBCSXKXXX 1.0 09/2004 TD14
© 2004