

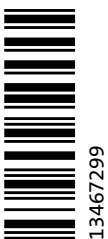
8400

"Position Sequencer" technology application
for 8400 TopLine C -----



Software manual

EN



13467299

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1 About this documentation

1.1 Document history

1 About this documentation

This documentation describes the software-based solution of a task. The transferability of the described solution to the respective application case needs to be checked by the user. If required, the user has to adapt the solution accordingly. Thus, physical aspects as e.g. drive dimensioning is not part of this documentation.



Danger!

The controller is a source of danger which may lead to death or severe injury of persons. To protect yourself and others against these dangers, observe the safety instructions before switching on the controller.

Please read the safety instructions provided in the **8400 mounting instructions** and in the **8400 hardware manual**. Both documents are supplied with the controller.

Target group

This documentation addresses to all persons

- who want to use the "Position Sequencer" technology application for the 8400 TopLine inverter, and
- who are familiar with handling the device and the »Engineer« software.

Validity

The information in this documentation are valid for the following technology applications:

Technology application	from version
Position Sequencer	2.0

Screenshots/application examples

All screenshots provided in this documentation are application examples. Depending on the software version of the controller and the version of the installed »Engineer« software, the screenshots in this documentation may differ from the representation in the »Engineer«.



Tip!

Information and tools for Lenze products are provided in the download area at

<http://www.lenze.com> → Download

1.1 Document history

Version			Description
1.0	07/2014	TD05	First edition

1.2

Conventions used

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

Type of information	Writing	Examples/notes
Spelling of numbers		
Decimal separator	Point	The decimal point is generally used. Example: 1234.56
Hexadecimal number	0x	For hexadecimal numbers, the prefix "0x" is used. Example: 0x60F4
Binary number	0b	For binary numbers, the prefix "0b" is used. Example: 0b00010111
Text		
Version information	Blue text colour	All information that only applies to a certain controller software version or higher is identified accordingly in this documentation. Example: This function extension is available from software version V3.0!
Program name	» «	The Lenze »Engineer« PC software ...
Window	<i>italics</i>	The <i>Message</i> window ... / The <i>Options</i> dialog box...
Variable name		By setting <i>bEnable</i> to TRUE...
Control element	bold	The OK button... / The Copy command... / The Properties tab... / The Name input field...
Sequence of menu commands		If the execution of a function requires several commands, the individual commands are separated by an arrow: Select File→Open to...
Shortcut	< bold >	Press < F1 > to open the online help.
		If a command requires a combination of keys, a "+" is placed between the key symbols: Use < Shift >+< ESC > to...
Hyperlink	<u>underlined</u>	Optically highlighted reference to another topic. In this documentation activated by mouse-click.
Icons		
Page reference	 4	Optically highlighted reference to another page. In this documentation activated by mouse-click.
Step-by-step instructions		Step-by-step instructions are indicated by a pictograph.

1.3

Terminology used

Term	Meaning
Engineering Tools	Software solutions for simple engineering at all stages
	 »EASY Navigator« – Ensures easy operator guidance • All practical Lenze engineering tools at a glance • Tools can be selected quickly • Clearly arranged, simplifying the engineering process from the start
	 »EASY Starter« – Simple tool for service technicians • Especially developed for the commissioning and maintenance of Lenze devices • Graphical user interface with few buttons • Simple online diagnostics, parameterisation and commissioning • No risk of accidentally changing the application • Ready applications can be loaded to the device
	 »Engineer« – Multi-device engineering • For all products from our L-force portfolio • Practice-oriented user interface • Easy handling due to graphical user interfaces • Suitable for all project stages (configuration, commissioning, production) • Parameter setting and configuration
Code	Parameter used for controller parameterisation or monitoring. The term is usually called "index".
Subcode	If a code contains several parameters, these are stored in "subcodes". This Manual uses a slash "/" as a separator between code and subcode (e.g. "C00118/3"). The term is usually called "subindex".
Lenze setting	This setting is the default factory setting of the device.
FB Editor	Abbreviation for function block editor. Graphic interconnection tool which is available in the »Engineer« for function block interconnections on the FB Editor .
Function block	General designation of a function block for free interconnection in the FB Editor. Ein Funktionsbaustein (kurz: "FB") kann mit einer integrierten Schaltung verglichen werden, die eine bestimmte Steuerungslogik enthält und bei der Ausführung einen oder mehrere Werte liefert. Example: "L_Arithmetic_1" (FB for arithmetic operations) Many function blocks are available several times (e.g. L_And_1, L_And_2, and L_And_3).
System block	In the function block editor of the »Engineer«, system blocks provide interfaces to basic functions, "free codes", and to the hardware of the inverter (e.g. to the digital inputs). Each system block is available only once.
Port block	Block for implementing the process data transfer via a fieldbus
LP	Abbreviation for Lenze Port block Example: "LP_CanIn1" (CAN1 port block)
LS	Abbreviation for Lenze System block Example: "LS_DigitalInput" (system block for digital input signals)
MCI	Abbreviation for M otionbus C ommunication I nterface (fieldbus interface) The Inverter Drives 8400 can accommodate plug-in communication modules and can therefore take part in the data transfer of an existing fieldbus system.
Technology application	A technology application is a drive solution based on the experience and know-how of Lenze in which function blocks interconnected to a signal flow form the basis for implementing typical drive tasks.
USB diagnostic adapter	The USB diagnostic adapter is used for the operation, parameterisation, and diagnostics of the controller. Data are exchanged between the PC (USB connection) and the controller (diagnostic interface on the front) via the diagnostic adapter. Order designation: E94AZCUS

1.4

Definition of notes used

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

Safety instructions

Layout of the safety instructions:

**Pictograph and signal word!**

(characterise the type and severity of danger)

Note

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

Pictograph	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	Signal word	Meaning
	Note!	Important note to ensure trouble-free operation
	Tip!	Useful tip for simple handling

2 Features of the technology application

With the "Position Sequencer" technology application, the drive can execute parameterisable travel profiles. The program flow is defined on the basis of a sequence table.

2.1 Functional overview

- Sequence control for several successive positioning steps with pause and abort functions and different auxiliary functions (e.g. branching, counting, waiting)
- Positioning in different positioning modes
 - Point-to-point positioning
 - Touch probe positioning (residual path positioning)
 - Profile linkage with velocity changeover (overchange)
- Homing (homing/reference setting)
 - For a homing process, different modes are provided.
- Profile data management
 - Support of S-profiles (jerk limitation)
 - Separate setting for acceleration and deceleration
- Use of the state machine of the Motion Control Kernel (MCK) and the following basic drive functions:
 - Homing
 - Manual jog
 - Positioning
 - Holding brake control
- Limit position monitoring (hardware limit switches and software limit positions)
- Following error monitoring system
- Control/status signals optionally via digital terminals and fieldbus interface (MCI)



Tip!

By means of the "Position Sequencer" technology application, the 8400 TopLine can also be used as master for slave drives with the "Electrical Shaft Slave" or "Position Follower" technology application.

2.2 Application ranges

- Transport devices
- Rotary tables
- Feed drives
- Dosing units
- Hoists
- ...

2.3 System requirements

The technology application was created with the L-force »Engineer« V2.20 and can only be used with the versions V2.20 or higher.

Software

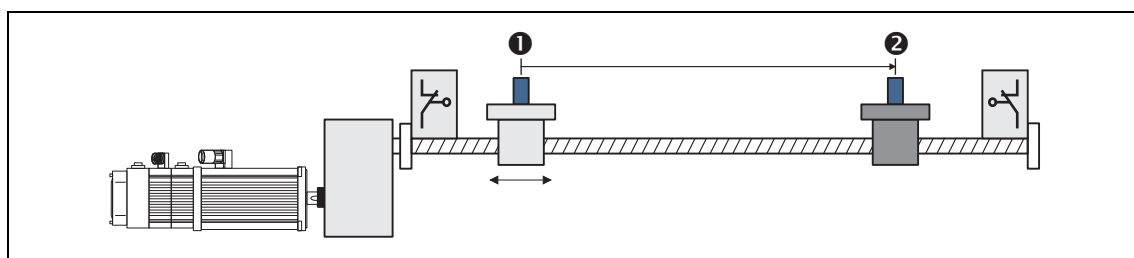
Product	Order designation	from version
L-force »Engineer« HighLevel	ESPEV-EHNNN	2.20

Hardware

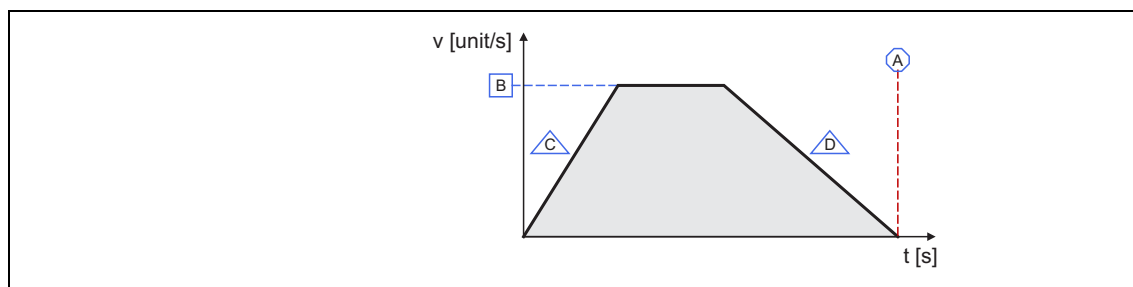
Product	Order designation	from hardware version	from software version
Inverter Drives 8400 TopLine C	E84AVTCxxxxx	VD	13.00

2.4 Basics of positioning

Positioning means that a workpiece/tool or material is moved from a starting position ❶ to a defined destination ❷:



To carry out positioning, a travel profile has to be stored in the drive controller for at least the following profile parameter:



Icon	Profile parameter
	Position Target position or distance to be traversed.
	Velocity Maximum speed during the positioning process.
	Acceleration Maximum acceleration during the positioning process.
	Delay Maximum deceleration during the positioning process.

- A profile describes a motion task that can be converted into a rotary motion of the motor shaft by the **Motion Control Kernel** in the "Positioning" operating mode.
- A positioning process can be composed of a large number of profiles that are executed in a fixed manner.
- For the 8400 TopLine inverter, 15 different profiles can be parameterised.



A detailed explanation of all profile parameters can be found in the appendix in the description for the "[Positioning](#)" action type. (📖 44)

2.5

Positioning sequence control

For the positioning sequence control, the **L_Sequencer_1** FB is used. This FB processes a positioning program on the basis of a sequence table (also referred to as "sequencer"), which can contain up to 100 references to so-called "Actions".



- An action comprises a clear functionality which is described with a few parameters.
- Different action types are available which serve to realise, for instance, program branching, switching operation, waiting times and counters.
- A certain number of actions are available from every action type which can be parameterised individually.
- An action can be called from several positions in the sequence table.
- After an action has been processed, the action entered in the sequence step of the sequence table is automatically processed unless a branching causes a jump to another step in the sequence table.
- Maximally one action can be processed per calculation cycle.
- The sequence table and the actions themselves are represented by parameters (codes with subcodes).



A detailed description of the action types can be found in the [appendix](#). (📖 42)

The **L_Sequencer_1** FB is described in detail in the reference manual/online help for the inverter in the "Function library »function blocks" chapter.



Note!

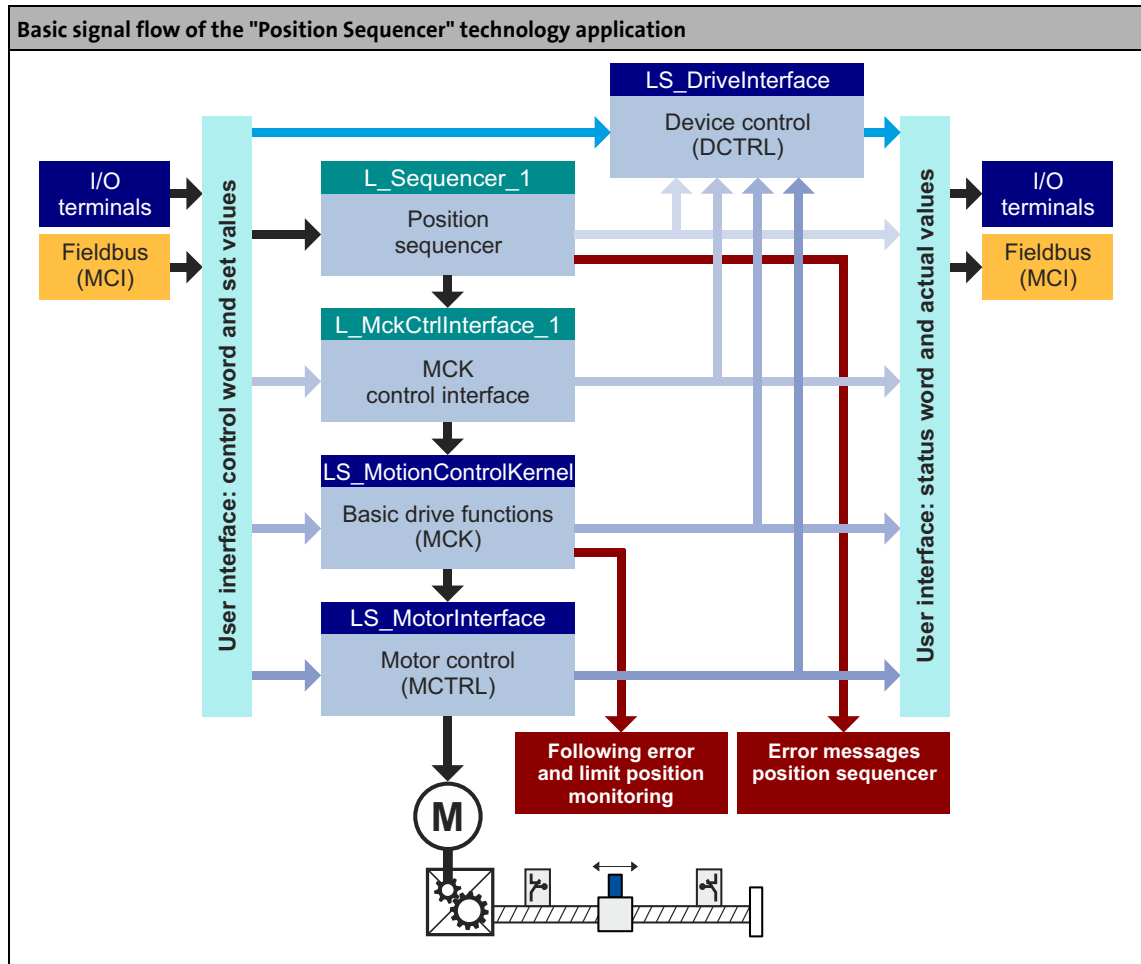
Additional logic operations in the application prevent the positioning program from being started if the basic function "Manual jog" or "Homing" is activated. On the other hand, it is avoided that these two basic functions can be activated if the positioning program is being processed.

2.6

Basic signal flow

In the technology application, function blocks and system blocks are interconnected so that a positioning sequence control can be implemented for the application ranges mentioned before.

The following describes the principal signal flow with the essential functions.



2.7 Parameter setting in the FB Editor view

You can make the settings of the application-specific parameters directly in the FB Editor. This has the advantage that the signal flow can be traced. The interaction of the modules becomes clear. Moreover, you can reconfigure the I/O interconnection using the FB Editor and carry out an online monitoring of the application running in the device (e.g. for diagnostic purposes).

- The  icon in the head of the module, a double-click on the module, or the **Parameter...** command in the *Context menu* of the module serve to open the parameterisation dialog or the parameter list for the module.
- Colour codes and comments support you in handling the FB Editor.
 - The areas highlighted in turquoise represent the "user interface". If required, the pre-assignment of the I/O terminals can be adapted here and a control via the fieldbus interface (MCI) can be established.
 - In the areas highlighted in yellow, application-specific settings are required.



Detailed information on how to work with the FB Editor can be found in the reference manual/online help of the controller in the chapter "Working with the FB Editor".

2.8 Pre-assignment of the I/O terminals

Terminal	Function		
Digital input terminals			
X5/RFR	Controller enable		
X5/DI1 X5/DI2	Connection of positive/negative limit switches for monitoring of the travel range limits The connection is configured in a fail-safe fashion (LOW = limit switch activated).		
	DI1	Function	
	LOW	Positive limit switch approached (activated)	
	HIGH	Positive limit switch not approached (not activated)	
	DI2	Function	
	LOW	Negative limit switch approached (activated)	
	HIGH	Negative limit switch not approached (not activated)	
	Note! If no limit switches are available: 1. Keep terminals DI1 and DI2 unconfigured. 2. Deactivate the inversion of DI1 and DI2: set bit 0 and bit 1 to "0" in C00114.		
X5/DI3	Start positioning program		
	DI3	Function	
	LOW↗HIGH	Start positioning program	
	Tip! The "USER" LED status display on the front of the inverter is lit when the positioning program is running.		
X5/DI4	Reference switch connection		
	DI4	Function	
	LOW	Reference switch activated	
	HIGH	Reference switch not activated	
X5/DI5 X5/DI6	Manual jog		
	DI5	DI6	Function
	LOW	LOW	-
	HIGH	LOW	Manual jog in positive direction
	LOW	HIGH	Manual jog in negative direction
	HIGH	HIGH	- / Manual jog in the direction selected first
X5/DI7	Reset error message and positioning program		
	DI7	Function	
	LOW	No reset	
	LOW↗HIGH	Reset error message	
	HIGH	Reset positioning program	
Analog input terminals			
X3/A1U	- (not assigned, can be used freely)		
X3/A2U	- (not assigned, can be used freely)		

Terminal	Function
Digital output terminals	
X4/DO1	HIGH $\equiv$ "Drive is ready" state
X4/DO2	HIGH $\equiv$ "Actual position is in target position window" state
X4/DO3	HIGH $\equiv$ "Home position is known" state
X107/BD1, BD2	Control of a holding brake by the basic function "holding brake control"
X101/COM, NO	Relay contact closed $\equiv$ "An error is pending" state
Analog output terminals	
X3/O1U	Actual speed value • Scaling: 10 V $\equiv$ 100 % reference speed (C00011)
X3/O2U	Actual torque • Scaling: 10 V $\equiv$ 100 % maximum torque (C00057)

3 Short setup of the technology application

3.1 Preconditions

For the execution of the short setup described in the following, the setting of the most important parameters (motor, feedback system, etc.) is assumed.

The "commissioning wizard 8400" serves to carry out a guided commissioning of the controller based on the Lenze setting of the parameters.

How to proceed:

1. Before switching on: Make sure that the inverter is inhibited (digital input terminal X5/RFR open).
2. Switch on voltage supply of the controller.
For parameter setting and diagnostics of the controller without motor operation, an external 24-V supply through a safely separated power supply unit (SELV/PELV) is sufficient.
3. Establish a communication link between controller and Engineering PC, e.g. via USB diagnostic adapter (E94AZCUS):
 - connect the USB diagnostic adapter to the X6 diagnostic interface.
 - establish a connection between the USB diagnostic adapter and the PC via a free USB port.
4. Start »Engineer« on the Engineering PC, e.g. via the Windows® start menu:
Start → All programs → Lenze → Engineering → L-force Engineer...
After the program start, no project has been loaded first and the *start-up wizard* is displayed.



You can find detailed information on the options of the start-up wizard and on the general use of the »Engineer« in the online help for the program which you can call with [F1].

5. Create a new project or open a project already available.
6. Go to *Project View* and select the 8400 controller.
7. Click the  icon to go online.
After a connection to the controller has been established, the following status is displayed in the *Status line*:



8. Click the  icon to start the *commissioning wizard 8400*.
 - Now the commissioning wizard guides you step by step through the setting of the important parameters for a quick commissioning.
 - The **Next** button can only be activated again after all parameter settings in the device have been reset via the **Load Lenze setting** button.
 - Execute the commissioning wizard right to the end.
 - You can skip the "Control mode" step by clicking **Next** (only relevant for "Speed actuating drive" technology application).

Step 1: Load "Position Sequencer" technology application

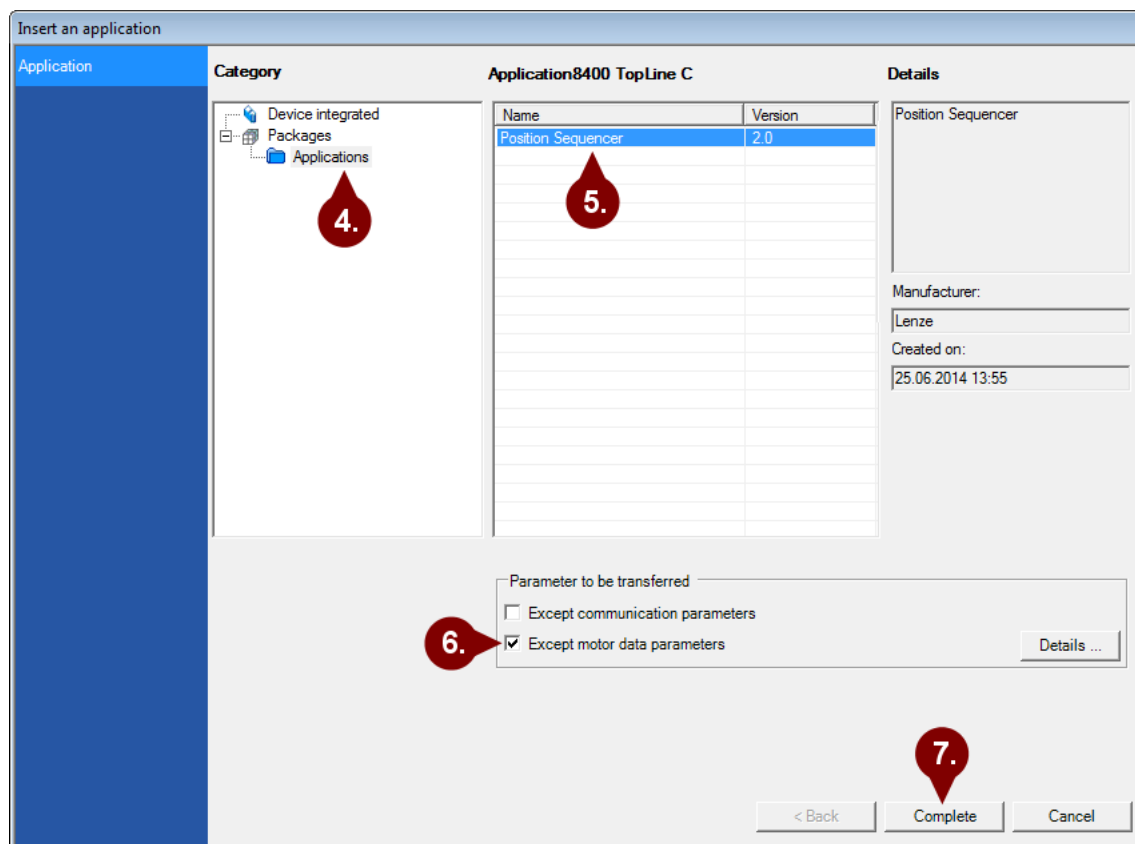
In the Lenze setting, the inverter uses the "Speed actuating drive" technology application integrated in the device. Execute the following steps to use the "Position Sequencer" technology application instead:

1. Select the controller in the *Project* view.
2. If there is still an online connection to the controller:

Click the  icon to go offline again.
(the application can only be selected offline.)

3. Click the icon to select another application.

The *Insert application* dialog box appears:



4. In the left field, select the "Packages" → "Applications" category.
5. In the right field, select the "Position Sequencer" application.
6. Activate the **Except motor data parameters** option in order that the settings of the motor data parameters made before will not be overwritten.
7. Press **Complete** to close the dialog box again and load the selected application into the »Engineer« project.
8. Confirm the prompt on whether the current application is to be replaced by the "Position Sequencer" application with **Yes**.

3.3

Step 2 (optional): Establish control via the fieldbus interface (MCI)

In the default setting, the application is controlled via the digital input terminals. For higher automated systems, mostly data bus systems are used for controlling the drives.

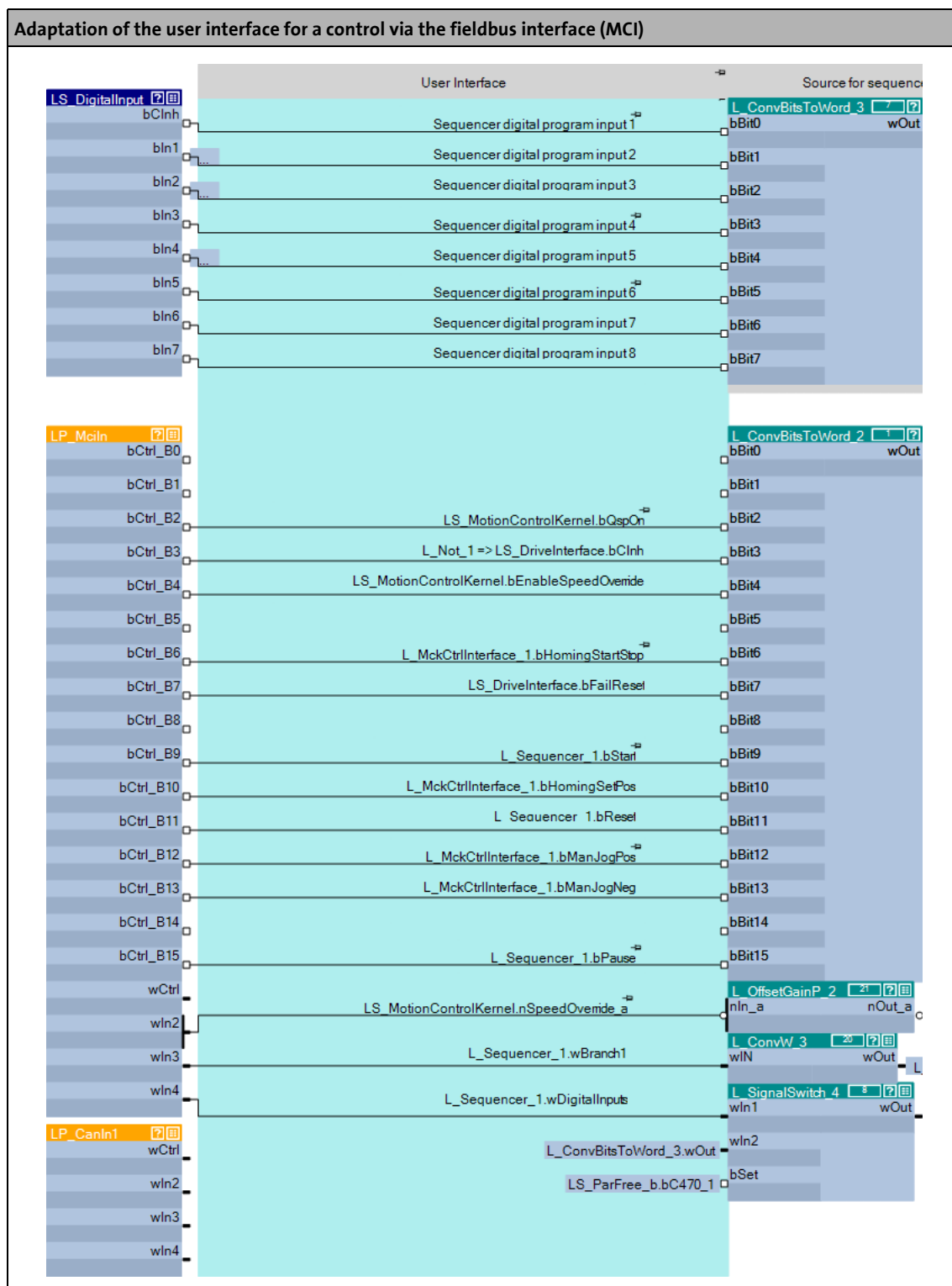
For control via the fieldbus interface (MCI), the user interface (area highlighted in turquoise) is to be adapted accordingly in the function block editor.

- The assignment of the outputs on the left to the inputs on the right can be changed at will.
- The inputs on the right are permanently linked to functions of the application.

**Tip!**

By means of some simple configuration changes, control via the integrated CANopen interface ("CAN on board") can also be implemented. The port blocks **LP_CanIn** and **LP_CanOut** required for this are already provided in the interconnection.

The following sample illustration shows the interconnection required for achieving the [Pre-assignment of the process data input words](#) described in the following subchapter:



[3-1] User interface for sequencer inputs, the application control word, and the speed override setpoint in the function block editor

3.3.1 Pre-assignment of the process data input words

After adapting the interconnection according to the [3-1] illustration, the process data input words for a control via the fieldbus interface (MCI) are assigned as follows:

Input words	Assignment
Word 1	Control word (for bit assignment see the following table)
Word 2	Setpoint for speed override
Word 3	Target for a variable branch in the positioning program (input signal for action 1 of the "Variable branch" type) When the positioning program contains an action 1 of "Variable branching" type, branching is carried out in the corresponding step depending on the value available at this input.
Word 4	Sequencer inputs 1 ... 16 (bit coded) The "Positioning", "Branch", "Wait", and "Standby" action types are provided with the "Input for..." parameter. If it is non-zero, it designates the number of the sequencer input at which the positioning program expects the level defined for this purpose before it executes the action. Note! If the sequencer inputs are to be triggered via the digital inputs instead, C00470/1 has to be set to the value "1: True".
Word 5 ... 16	- (not preconfigured)

Control word	Function		
Bit 0	- (not preconfigured)		
Bit 1	- (not preconfigured)		
Bit 2	1 ≡ activate quick stop (QSP)		
Bit 3	1 ≡ enable controller (RFR)		
Bit 4	1 ≡ activate speed override		
Bit 5	- (not preconfigured)		
Bit 6	0 ≡ stop homing 1 ≡ start homing		
Bit 7	1 ≡ Reset fault (trip reset)		
Bit 8	- (not preconfigured)		
Bit 9	1 ≡ start positioning sequence control		
Bit 10	1 ≡ set reference		
Bit 11	1 ≡ reset positioning sequence control		
Bit 12 ... 13	Manual jog		
	Bit 12	Bit 13	Function
	0	0	-
	1	0	Manual jog in positive direction
	0	1	Manual jog in negative direction
	1	1	- / Manual jog in the direction selected first
Bit 14	- (not preconfigured)		
Bit 15	1 ≡ stop positioning sequence control (pause)		

3.3.2 Pre-assignment of the process data output words

The **LP_MciOut** port block is already implemented in the technology application. The process data output words are assigned as follows:

Output words	Assignment
Word 1	Status word (for bit assignment see the following table)
Word 2	Actual speed value • Scaling: 16384 $\equiv$ 100 % reference speed (C00011)
Word 3	Actual torque • Scaling: 16384 $\equiv$ 100 % maximum torque (C00057)
Word 4 ... 16	- (not preconfigured)

Status word	Status																																																																														
Bit 0	1 ≡ Group error active (configurable in C00148)																																																																														
Bit 1	1 ≡ Inverter control inhibited (pulse inhibit is active)																																																																														
Bit 2	1 ≡ Drive controller is ready for operation																																																																														
Bit 3	1 ≡ Quick stop is active																																																																														
Bit 4	1 ≡ Setpoint torque is in the limitation																																																																														
Bit 5	1 ≡ actual position is inside the target position window																																																																														
Bit 6	During open-loop operation: 1 ≡ speed setpoint < comparison value (C00024) During closed-loop operation: 1 ≡ actual speed value < comparison value (C00024)																																																																														
Bit 7	1 ≡ Controller inhibited (controller inhibit is active)																																																																														
Bit 8 ... 11	Bit coded display of the active device status <table><tr><th>Bit 11</th><th>Bit 10</th><th>Bit 9</th><th>Bit 8</th><th>Device status</th><th>Meaning</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>FirmwareUpdate</td><td>Firmware update function is active</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Init</td><td>Initialisation active</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Ident</td><td>Identification active</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>ReadyToSwitchOn</td><td>Device is ready to start</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>SwitchedOn</td><td>Device is switched on</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>OperationEnabled</td><td>Operation</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>-</td><td>-</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Trouble</td><td>Trouble active</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Fault</td><td>Fault active</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>TroubleQSP</td><td>TroubleQSP is active</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>SafeTorqueOff</td><td>Safe torque off is active</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>SystemFault</td><td>System fault active</td></tr></table>	Bit 11	Bit 10	Bit 9	Bit 8	Device status	Meaning	0	0	0	0	FirmwareUpdate	Firmware update function is active	0	0	0	1	Init	Initialisation active	0	0	1	0	Ident	Identification active	0	0	1	1	ReadyToSwitchOn	Device is ready to start	0	1	0	0	SwitchedOn	Device is switched on	0	1	0	1	OperationEnabled	Operation	0	1	1	0	-	-	0	1	1	1	Trouble	Trouble active	1	0	0	0	Fault	Fault active	1	0	0	1	TroubleQSP	TroubleQSP is active	1	0	1	0	SafeTorqueOff	Safe torque off is active	1	0	1	1	SystemFault	System fault active
Bit 11	Bit 10	Bit 9	Bit 8	Device status	Meaning																																																																										
0	0	0	0	FirmwareUpdate	Firmware update function is active																																																																										
0	0	0	1	Init	Initialisation active																																																																										
0	0	1	0	Ident	Identification active																																																																										
0	0	1	1	ReadyToSwitchOn	Device is ready to start																																																																										
0	1	0	0	SwitchedOn	Device is switched on																																																																										
0	1	0	1	OperationEnabled	Operation																																																																										
0	1	1	0	-	-																																																																										
0	1	1	1	Trouble	Trouble active																																																																										
1	0	0	0	Fault	Fault active																																																																										
1	0	0	1	TroubleQSP	TroubleQSP is active																																																																										
1	0	1	0	SafeTorqueOff	Safe torque off is active																																																																										
1	0	1	1	SystemFault	System fault active																																																																										
Bit 12	1 ≡ a warning is indicated																																																																														
Bit 13	1 ≡ a fault is active. The inverter is in the "Trouble" device state. • The motor has no torque (is coasting) due to the inhibit of the inverter. • The "Trouble" device status is automatically abandoned if the error cause has been removed.																																																																														
Bit 14	1 ≡ positioning program running																																																																														
Bit 15	1 ≡ Home position is known																																																																														

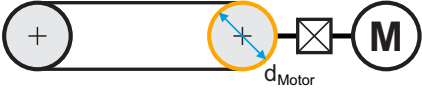
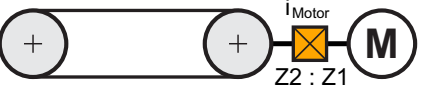
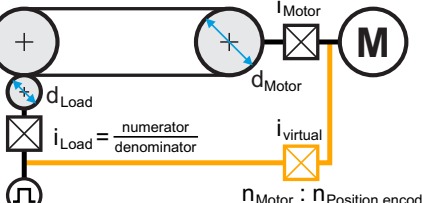
3.4

Step 3: Set commissioning parameters

For a quick commissioning, only the following application-specific parameters have to be set or their default setting has to be checked!

- In order that you quickly find the respective parameterisation dialog in the FB Editor, the following table lists the block related to each parameter.
- The  icon in the head of the module, a double-click on the module, or the **Parameter...** command in the *Context menu* of the module serve to open the parameterisation dialog or the parameter list for the module.

Parameter (Block)	Possible settings (Lenze setting printed in bold)			Info
C00470/1 (LS_ParFree_b)				Selection of the source for the sequencer inputs • The sequencer inputs can be used for the "Positioning", "Branch", "Wait", and "Standby" actions to control the program flow by this.
	0	MCI interface		Sequencer inputs = process data input word 3
	1	Digital inputs		For this setting, cancel all double assignments of the digital inputs, so that they only work as sequencer inputs.
C00470/2 (LS_ParFree_b)				Selection of the signal to be output via axis bus
	0	Setpoint		Line data words 1 & 2 = speed setpoint integrated to an angle (path) Line data word 3 = speed setpoint
	1	Actual value		Line data words 1 & 2 = actual speed value integrated to an angle (path) Line data word 3 = actual speed value
C00470/4 (LS_ParFree_b)				Operation as position follower master
	0	Off		The signals are output via axis bus according to the setting in C00470/2.
	1	On		This setting is only required if the drive is to be used as master for a slave drive with the "Position Follower" technology application. The following signals are then output via axis bus: Line data words 1 & 2 = current position Line data word 3 = current speed Note: With this setting, homing of the master causes a step in the slave position follower if the current position is set to the home position! <u>Remedy:</u> Inhibit the slave position follower when you are referencing the master!
Machine parameters/axis settings				
C01201/1 (LS_MotionControl Kernel)	0.0000	units	214748.3647	Cycle length
	Lenze setting: 0.0000 units			• For a modulo measuring system, the length of one cycle to the overflow is to be set. • For a limited measuring system, the Lenze setting "0.0000" is to be retained.

Parameter (Block)	Possible settings (Lenze setting printed in bold)			Info
C01204 (LS_MotionControl Kernel)	0.0001	units/re v.	214748.3647	Feed constant - The feed constant corresponds to the movement of the machine during one revolution of the gearbox output shaft. - The value is entered in application units relating to one gearbox revolution. - Schematic diagram of a conveyor drive: $\text{C01204} = \pi \cdot d_{\text{Motor}}$ 
C01206/1 (LS_MotionControl Kernel)	Lenze setting: 360.0000 units/U			
	0	not inverted		Motor mounting direction
	1	inverted		Motor is mounted with rotation by 180°
C01202/1..2 (LS_MotionControl Kernel)	1		65535	Gearbox ratio motor - load - Set the gearbox ratio with mathematical precision in the two subcodes: - Subcode 1: numerator term (Z2) - Subcode 2: denominator term (Z1) $i_{\text{Motor}} = \frac{\text{C01202/1}}{\text{C01202/2}} = \frac{Z2}{Z1}$ - Schematic diagram of a conveyor drive:  $\text{C01202/1} : \text{C01202/2}$
Position encoder				
If the motor encoder is used as position encoder, you do not need to parameterise a separate position encoder. Keep the Lenze setting for the following codes.				
C01206/2 (LS_MotionControl Kernel)				Position encoder mounting direction
	0	not inverted		Position encoder is mounted directly
	1	inverted		Position encoder mounted with rotation by 180
C01203/1..2 (LS_MotionControl Kernel)	1		65535	Speed ratio for motor - position encoder - Set the "virtual" speed ratio between the motor and the external position encoder with mathematical precision in the two subcodes: - Subcode 1: numerator term (motor speed) - Subcode 2: denominator term (encoder speed) - Schematic diagram of a conveyor drive:  $\text{C01203/1} : \text{C01203/2}$ - The "virtual" speed ratio can be calculated as follows: $i_{\text{virtual}} = \frac{\text{C01203/1}}{\text{C01203/2}} = \frac{i_{\text{Motor}}}{i_{\text{load}}} \cdot \frac{\pi \cdot d_{\text{load}}}{\pi \cdot d_{\text{Motor}}}$ $i_{\text{virtual}} = \frac{\text{C01202/1}}{\text{C01202/2}} \cdot \frac{\text{denominator}}{\text{numerator}} \cdot \frac{\pi \cdot d_{\text{load}}}{\text{C01204}}$

Parameter (Block)	Possible settings (Lenze setting printed in bold)			Info
Following error monitoring system				
C01215/1 (LS_MotionControl Kernel)	0.0001	units	214748.3647	Limit for following error monitoring 1 • The setting "0" deactivates following error monitoring 1
	Lenze setting: 500 units			
C01215/2 (LS_MotionControl Kernel)	0.0001	units	214748.3647	Limit for following error monitoring 2 • The setting "0" deactivates following error monitoring 2
	Lenze setting: 1000 units			
C00595/5...6 (LS_SetError_1)				Response at the activation of following error monitoring • Subcode 5: response at the activation of following error monitoring 1. • Subcode 6: response at the activation of following error monitoring 2.
	0	No Reaction		
	1	Fault		
	3	TroubleQuickStop		
	4	WarningLocked		
	5	Warning		
	6	Information		
Limit position monitoring				
C01229/1...2 (LS_MotionControl Kernel)	-214748.3647	units	214748.3647	Positive and negative software limit position for limiting the valid traversing range Note: The software limit positions are only evaluated if • the home position is known to the drive, and • the software limit positions for the respective operating mode have been activated, and • the positive software limit position is set to a greater value than the negative software limit position!
	Lenze setting: 0.0000 units			

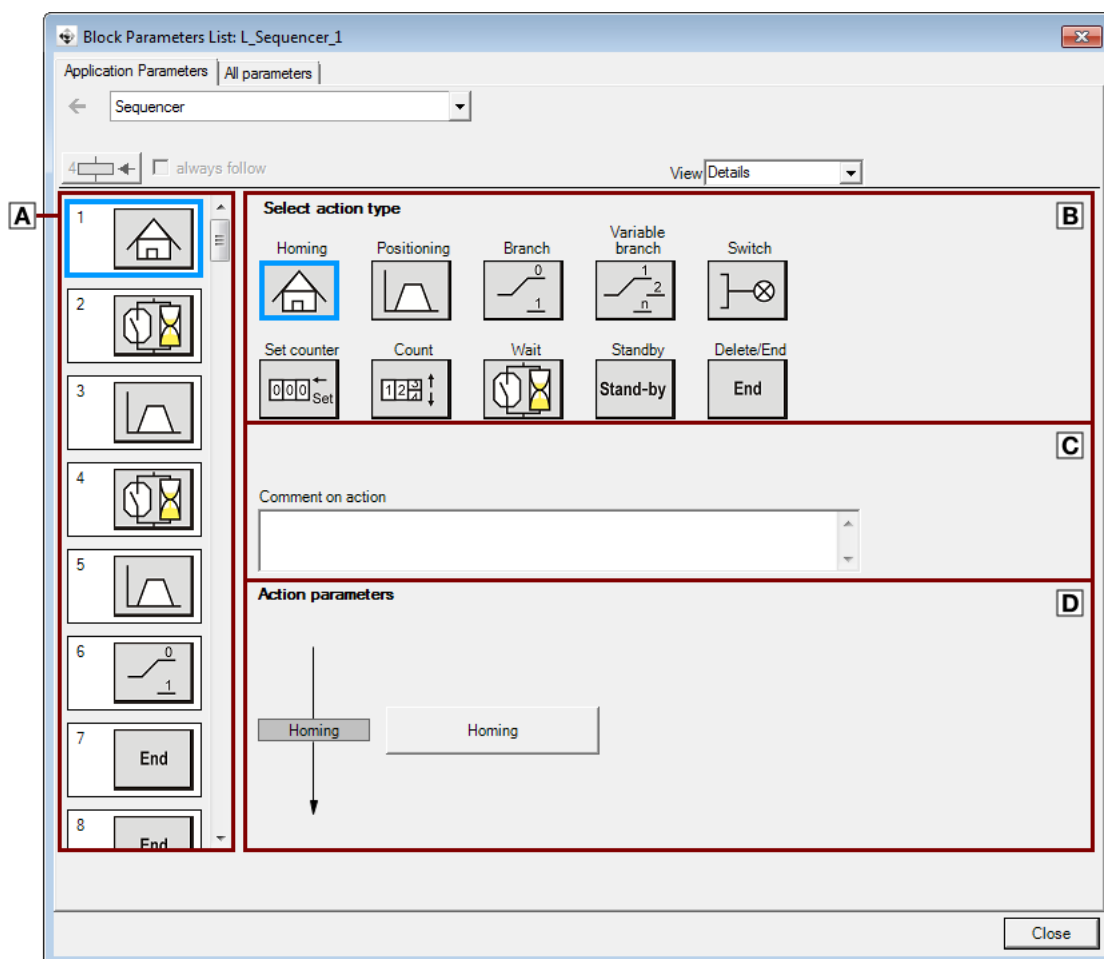
3.5

Step 4: create the positioning program (sequence table)

The sequence table is parameterised in the parameterisation dialog for the **L_Sequencer_1** FB.

**Note!**

In the default setting, the sequence table already contains a small "positioning program", which rotates the axis first by 360° in clockwise direction and then by 360° in counter-clockwise direction.



The parameterisation dialog is divided into four main areas:

Main area	Info	
A	Sequence table (sequencer)	The sequence table consists of 100 fields which can be filled with actions.
B	Selection of action type	In this area, the different action types are provided for selection, by means of which the sequence table can be filled.
C	Comment on the action	Optionally, a comment on the action selected can be entered here.
D	Action parameters	In this area, the parameters for the action selected are set.

General procedure

Proceed as follows to define the desired program flow:

1. Select the program step ((1 ... 100) that is to be edited in the **Sequence table** on the left.
2. Select the action type for the program step selected by clicking it in the **Selection of action type** area.
If more than one action is provided for the action type selected, the next free action in the **Selection of action number** list field is automatically proposed.
3. Optionally enter a comment on the action.
4. Set the action parameters.
Depending on the action type, further parameterisation dialogs can be called via buttons.
5. Repeat steps 1 ... 4 until all actions required for the program flow have been parameterised.
6. Click **Close** to change back to the function block editor.



A detailed description of the action types can be found in the [Appendix](#). (42)

The **L_Sequencer_1** FB is described in detail in the reference manual/online help for the inverter in the "Function library »function blocks" chapter.

3.6 Step 5: Go online and transfer parameter set to the inverter

In order to set the current parameter settings in the controller to the settings in the project, transmit the parameter set to the controller.

1. Click the  icon to go online.
2. Click the  icon to transmit the parameter set to the controller.
3. After a successful transmission, click the  icon to save the parameter set safe against mains failure in the integrated Memory Module.

3.7 Step 6: Enable inverter and start positioning program

After the parameter set has been transmitted to the inverter, the inverter can now be enabled and the control signals/setpoints can be selected via the corresponding interfaces.

- ▶ [Pre-assignment of the I/O terminals](#) (📖 12)
- ▶ [Pre-assignment of the process data input words](#) (📖 18)

Display parameters for diagnostic purposes

Parameter (Block)	Display area			Info
C01210/2 (LS_MotionControl Kernel)	-214748.3647	units	214748.3647	MCK: Set position • Display of the current setpoint position calculated by the MCK.
C01210/3 (LS_MotionControl Kernel)	-214748.3647	units	214748.3647	MCK: Actual position • Display of the current actual position calculated by an optional encoder system.
C01210/4 (LS_MotionControl Kernel)	-214748.3647	units	214748.3647	MCK: Following error • Display of the current following error as a difference between setpoint position and actual position.

Start positioning program

- The positioning program is started in a positive edge-controlled fashion via bit 4 of the application control word (**L_ConvBitsToWord_2** FB). In the default setting, bit 4 is linked with digital input DI3.
 - Counters and outputs are not reset automatically through this.
 - The positioning program started is processed up to its program end even if bit 4 is reset to FALSE again.
- A start via the fieldbus interface (MCI) is possible after the user interface has been adapted correspondingly. See commissioning; [Step 2 \(optional\): Establish control via the fieldbus interface \(MCI\)](#). (📖 16)

Resetting the positioning program (reset)

- Bit 11 of the application control word (**L_ConvBitsToWord_2** FB) can be used to reset the positioning program. In the default setting, bit 11 is linked with digital input DI7.
 - A reset can also be executed if the positioning program is interrupted.
 - If a positioning is active, the drive is brought to a standstill with the delay time for stop (C01251/1) without considering an acceleration override.
 - The program flow is cancelled ("program end").
 - The digital output signals, counters and timing elements are reset.
 - A possibly active action of the "[Standby](#)" type is aborted.
- A reset via the fieldbus interface (MCI) can be executed after the user interface has been adapted correspondingly. See commissioning; [Step 2 \(optional\): Establish control via the fieldbus interface \(MCI\)](#). (📖 16)

Interrupting the positioning program (pause)

- Bit 15 of the application control word (**L_ConvBitsToWord_2** FB) can be used to interrupt the current step of the positioning program (pause). In the default setting, bit 15 is linked with bit 15 of MCI process data input word 1. ▶ [Pre-assignment of the process data input words](#) (📖 18)

3.8 Step 7 (optional): Set optimisation parameters

The following application-specific parameters are used for optimisation and can also be adapted during operation.



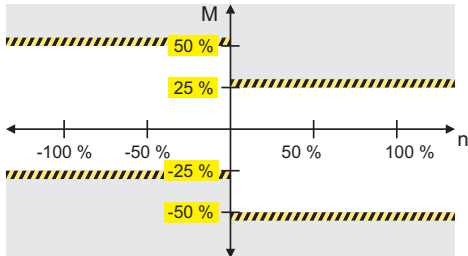
Stop!

If you change parameters in the »Engineer« during an online connection to the device, the changes are directly transferred to the device!



Tip!

Do not forget to save the parameter changes carried out with mains failure protection in the memory module implemented! (C00002/11 = "1: on/start")

Parameter (Block)	Possible settings			Info
Position controller				
C00472/1 (LS_ParFree_a)	-199.99	%	199.99	Limitation of the position controller output
	Lenze setting: 100 % reference speed (C00011)			
C00472/2 (LS_ParFree_a)	-199.99	%	199.99	Adaptation of the position controller gain
	Lenze setting: 100 % Vp (C00254)			
Torque limitation in motor mode/in generator mode				
The torque limitation set is always active.				Example: Definition of the torque limitations C00472/3 = 25 % C00472/4 = 50 % 
C00472/3 (LS_ParFree_a)	-199.99	%	199.99	Torque limitation in motor mode
	Lenze setting: 100 % maximum torque (C00057)			
C00472/4 (LS_ParFree_a)	-199.99	%	199.99	Torque limitation in generator mode
	Lenze setting: 100 % maximum torque (C00057)			
Following error monitoring system				
C01244/2...3 (LS_MotionControl Kernel)	0	ms	600000	Waiting time for following error monitoring 1 & 2 In order to avoid that an error is triggered by acceleration and a narrow tolerance limit can be nevertheless monitored at standstill in the target, the response of the following error monitoring system can be delayed by setting a waiting time.
	Lenze setting: 0 ms			

Parameter (Block)	Possible settings		Info
Limit position monitoring			
C01230 - Bit 3 (LS_MotionControl Kernel)			Consideration of the software limit positions in MCK "Manual jog" operating mode
	0	Software limit positions not active	
	1	Software limit positions active (if the home position is known)	
C00595/1...4 (LS_MotionControl Kernel)			Response at the activation of limit position monitoring • Subcode 1: response at the approach of the positive limit switch. • Subcode 2: response at the approach of the negative limit switch. • Subcode 3: response at overtravelling the positive software limit position (C01229/1). • Subcode 4: response at overtravelling the negative software limit position (C01229/2).
	0	No Reaction	
	1	Fault	
	3	TroubleQuickStop	
	4	WarningLocked	
	5	Warning	
	6	Information	
Error/status messages of the positioning sequence control			
C00581/1...2 (LS_SetError_1)			Response to errors of the positioning sequence control • Subcode 1: response if the time monitoring function for the "Positioning" action has been activated. • Subcode 2: response if the positioning sequence control reports an error.
	0	No Reaction	
	1	Fault	
	2	Trouble	
	3	TroubleQuickStop	
	4	WarningLocked	
	5	Warning	
	6	Information	
C00581/3 (LS_SetError_1)			Response if the positioning program has been started and is pausing.
	0	No Reaction	
	1	Fault	
	2	Trouble	
	3	TroubleQuickStop	
	4	WarningLocked	
	5	Warning	
	6	Information	

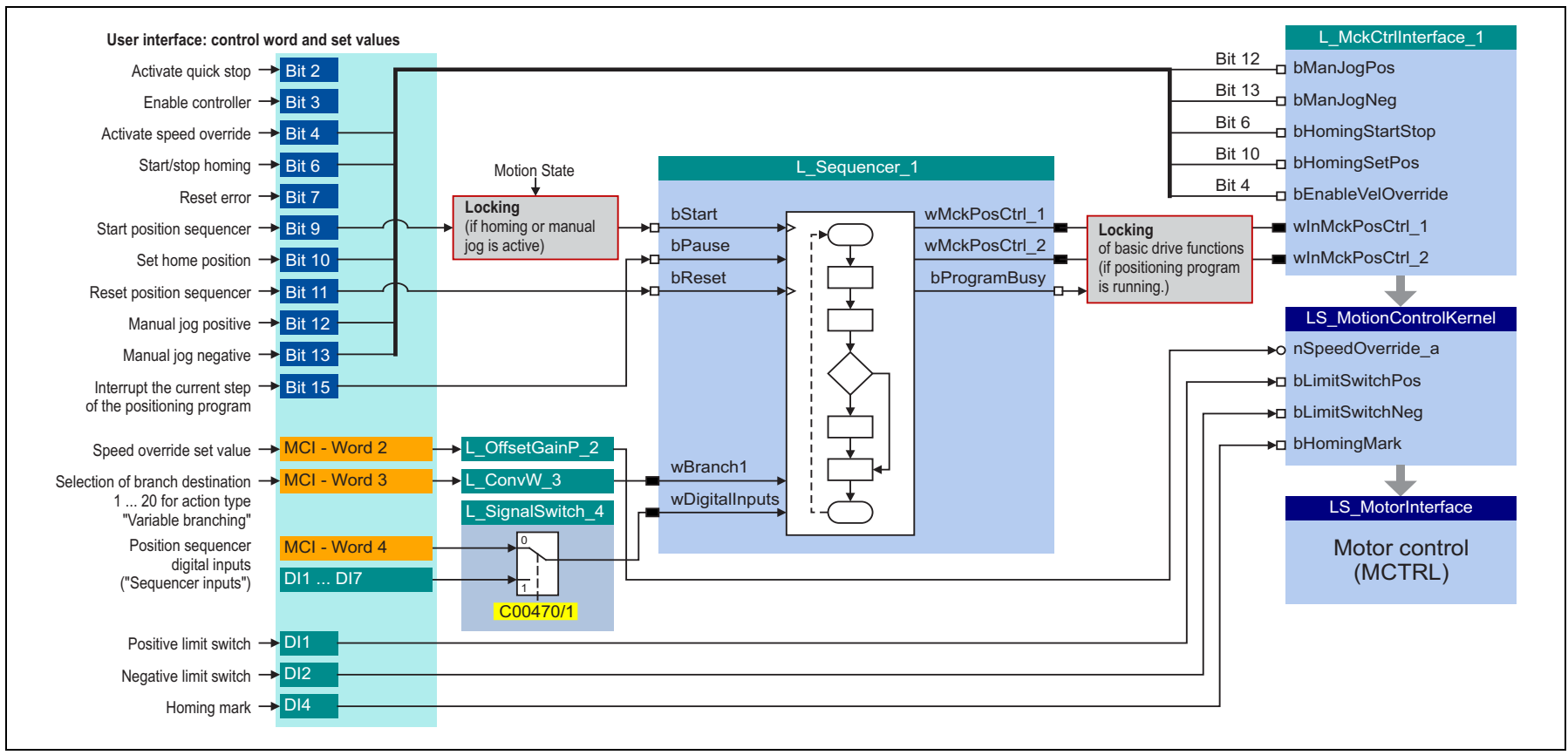
4 Detailed functions of the technology application

This chapter describes the functions implemented in the "Position Sequencer" technology application with the possible settings relevant for the application.



Detailed information on the function and parameterisation of the functions described in the following can be found in the reference manual/online help of the controller.

4.1 Signal flow of the technology application



4.2

Basic drive functions (MCK)

**Danger!**

During homing, manual jog, and positioning, specially assigned profile parameters are active. If they have not been set correctly, the drive may carry out an unexpected movement!



Detailed information relating to the basic drive functions and the corresponding parameters can be found in the reference manual/online help of the inverter in the "Basic drive functions (MCK)" chapter.

4.2.1

Homing

In order to be able to actuate the drive in a reasonable fashion, the position of the zero position within the physically possible travel range must be known. The zero position, also called the "reference", can be defined by homing or reference setting. This so-called "homing" is usually carried out after the mains is switched on. Furthermore homing is required after an encoder error has been eliminated.

- The homing is started/stopped manually via bit 6 of the application control word (**L_ConvBitsToWord_2** FB). In the default setting, bit 6 is linked with bit 6 of MCI process data input word 1. ▶ [Pre-assignment of the process data input words](#) (□ 18)
- The "100: SetRef" homing mode is preset in C01221. Homing is not executed; in this mode the current position is just accepted as zero point of the measuring system ("reference setting").
- Homing is to be configured according to the requirement of the application, as described in the reference manual/online help of the inverter.
- If the home position is known to the drive, a response is sent via digital output DO3 and bit 15 of the MCI process data output word 1.

**Note!**

Additional logic operations in the application prevent the basic function "Homing" from being activated if the positioning program is processed.

**Tip!**

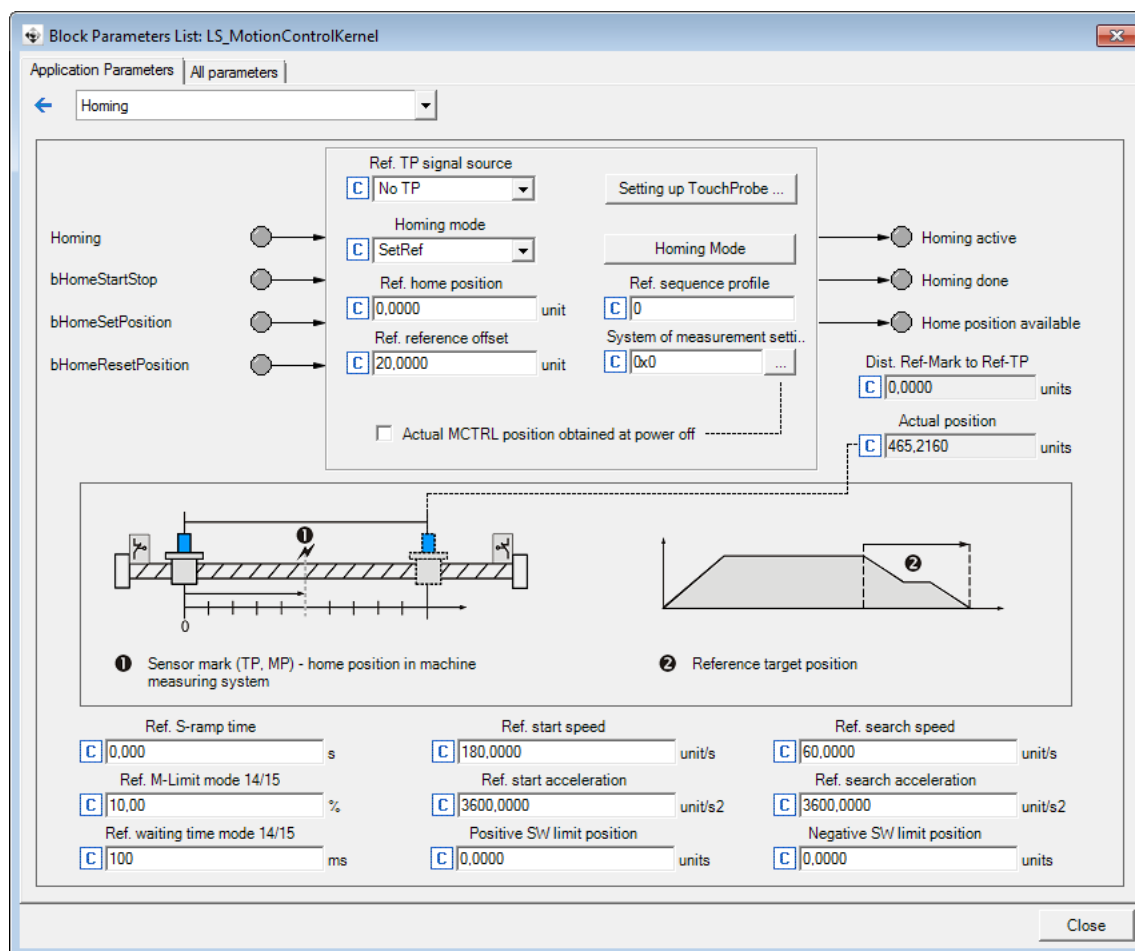
In addition to "manual" homing via bit 6, also the possibility of defining homing in the program flow of the positioning sequence control is provided (ideally as the first program step).

See description of the "[Homing](#)" action type in the appendix. (□ 43)



How to go to the parameterisation dialog of the basic "Homing" function:

1. Open the parameter list for the **LS_MotionControlKernel** SB.
2. In the *Block Parameters List...* dialog box on the **Application parameters** tab, select the "Homing" entry in the upper list field.



Note!

For a reference search with touch probe detection:

If the reference signal is to follow a real touch probe, the touch probe interface must be configured accordingly via the **Setting up TouchProbe...** button!

Parameter	Info	Lenze setting	
		Value	Unit
C01221	MCK: Homing mode	100	SetRef
C01224/1	MCK: Ref. initial speed	180.0000	unit/s
C01225/1	MCK: Ref. initial acceleration	3600.0000	unit/s2
C01224/2	MCK: Ref. search speed	60.0000	unit/s
C01225/2	MCK: Ref. search acceleration	3600.0000	unit/s2
C01226/1	MCK: Ref. S-ramp time	0.000	s

Parameter	Info	Lenze setting	
		Value	Unit
C01222	MCK: Ref. M limit mode 14/15	10.00	%
C01223	MCK: Ref. waiting time mode 14/15	100	ms
C01227/1	MCK: Ref. offset reference degree	20.0000	unit
C01227/2	MCK: Ref. home position	0.0000	unit
C01228	MCK: Ref. sequence profile	0	
C01229/1	MCK: Positive SW limit position	0.0000	units
C01229/2	MCK: Negative SW limit position	0.0000	units
C01246/1	MCK: Ref. TP signal source	0: No TP	

4.2.2 Manual jog

In this operating mode, the drive can be traversed manually in a clockwise or anticlockwise direction ("jogging mode").

- The basic function "Manual jog" is activated via bit 12 and bit 13 of the application control word (**L_ConvBitsToWord_2** FB). In the default setting, bit 12 and bit 13 are linked to digital inputs DI5 and DI6.
- An activation via the fieldbus interface (MCI) is possible after a corresponding adaptation of the user interface. See commissioning; [Step 2 \(optional\): Establish control via the fieldbus interface \(MCI\)](#). (16)



Note!

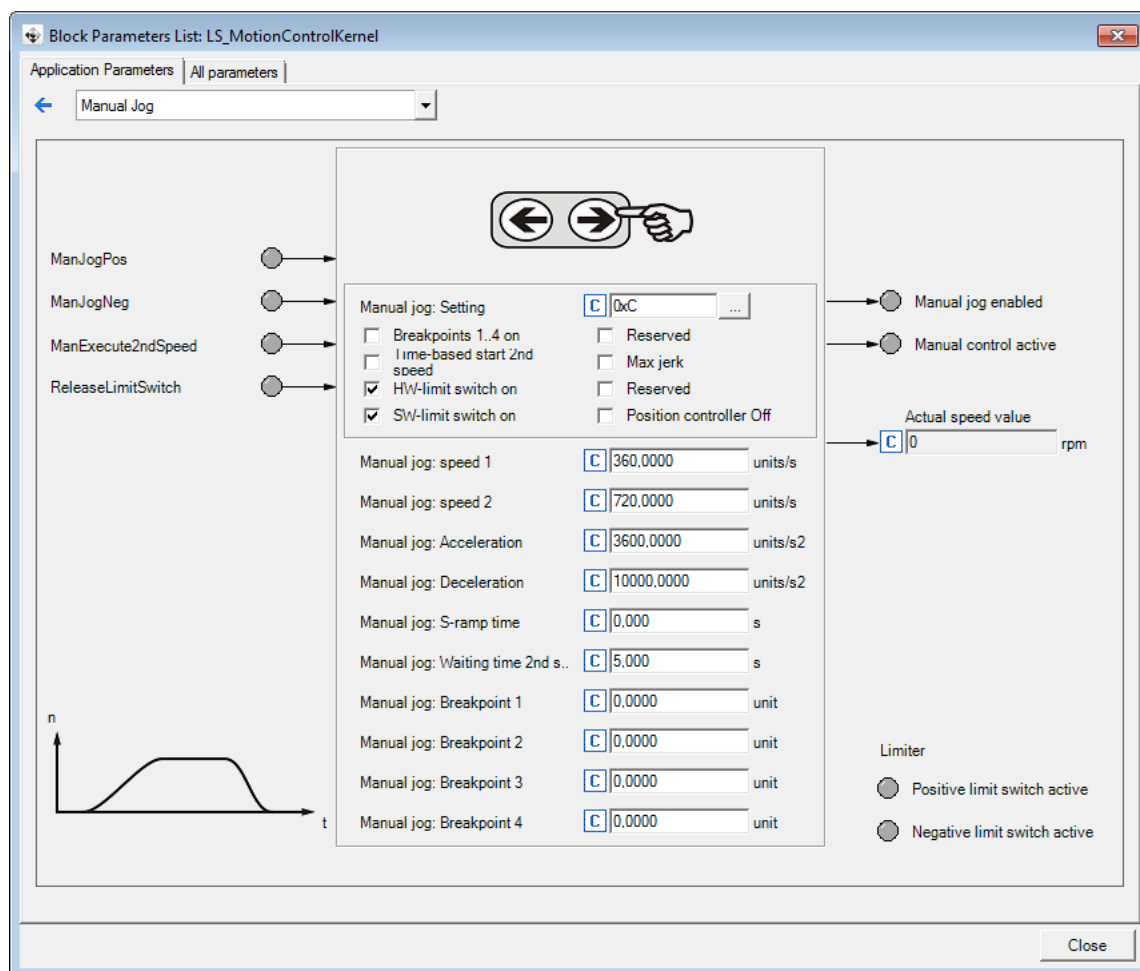
Additional logic operations in the application prevent the basic function "Manual jog" from being activated if the positioning program is processed.

In the Lenze setting, the software limit positions parameterised are active for manual jog if the home position is known. ▶ [Limit position monitoring](#) (39)



How to go to the parameterisation dialog of the basic "Manual jog" function:

1. Open the parameter list for the **LS_MotionControlKernel** SB.
2. In the *Block Parameters List...* dialog box on the **Application parameters** tab, select the "Manual Jog" entry in the upper list field.



Parameter	Info	Lenze setting	
		Value	Unit
C01230	MCK: Manual jog setting	Bit coded	
C01231/1	Manual jog: speed 1	360.0000	units/s
C01231/2	Manual jog: Speed 2	720.0000	units/s
C01232/1	Manual jog: Acceleration	3600.0000	units/s²
C01232/2	Manual jog: Deceleration	10000.0000	units/s²
C01233/1	Manual jog: S-ramp time	0.000	s
C01235/1	Waiting time 2nd speed	5.000	s
C01234/1	Manual jog: Breakpoint 1	0.0000	unit
C01234/2	Manual jog: Breakpoint 2	0.0000	unit
C01234/3	Manual jog: Breakpoint 3	0.0000	unit
C01234/4	Manual jog: Breakpoint 4	0.0000	unit

4.2.3 Positioning

For starting a positioning process, 50 actions of the "Positioning" type are provided for the positioning sequence control. If such an action is active, the basic function "Positioning" is requested by the **L_Sequencer_1** via corresponding control outputs.

- The profile is entered via the parameters of the basic function "Positioning".
- For the 8400 TopLine inverter, 15 different profiles can be parameterised.



A detailed explanation of all profile parameters can be found in the appendix in the description for the "[Positioning](#)" action type. (44)

4.2.4 Holding brake control

This basic function is used for low-wear control of a holding brake.



Danger!

Please note that the holding brake is an important element of the safety concept of the entire machine.

Thus, proceed very carefully when commissioning this system part!



Detailed information on how to parameterise the holding brake control can be found in the reference manual/online help of the controller in the chapter "Basic drive functions (MCK)".

The documentation of the holding brake control contains safety instructions which must be observed!

Application-specific notes on the holding brake control:

- In the Lenze setting, the mode 0 (brake control off) is preset in C02580.
- The technology application is prepared for the control of a 24 V holding brake via the high current output (terminal strip X107).
- The application of the holding brake causes controller inhibit, and when the inverter is inhibited, the following error is reset. [Starting from version 14.00.00](#), a following error value can be set in C01215/3 that remains stored even if the controller is inhibited.
- In mode 12 (controlled automatically), the speed thresholds do not apply to the operating modes with a setpoint request via control signal (e.g. "PosExecute" in the "Positioning" operating mode). Here the control logics open and close the holding brake by internal commands in the **Motion Control Kernel**.

4.3 Speed/position output via axis bus for a slave drive

In order to be able to directly connect a slave drive to the positioning drive, the **LS_AxisBusOut** SB is provided in the application.

- In the default setting, the speed setpoint integrated to an angle (path) is output via line data words 1 & 2, and the speed setpoint is output via line data word 3.
- A slave drive connected via axis bus with the "Electrical Shaft Slave" technology application is executable immediately after the initialisation of the axis bus; however, without the bus monitoring functions of the electrical shaft being available.
- If the drive is to be used as master for a slave drive with the "Position Follower" technology application, set the value "1" in C00470/4. Then, instead of the speed integrated, the current position is output via axis bus.



Stop!

If operation as master position follower is switched on (C00470/4 = "1"), homing of the master causes a step for the slave position follower if the current position is set to the home position!

Remedy: Inhibit the slave position follower when you are referencing the master!

The signal to be output via axis bus is selected using C00470/2 and C00470/4:

C00470/4		C00470/2		Axis bus output
Operation as position follower master		Setpoint/actual value selection		
0	Off	0	Setpoint	Line data words 1 & 2 = speed setpoint integrated to an angle (path) Line data word 3 = speed setpoint
		1	Actual value	Line data words 1 & 2 = current speed integrated to an angle (path) Line data word 3 = current speed
1	On			Line data words 1 & 2 = current position Line data word 3 = current speed

Details on the signal flow

The changeover between the setpoint and actual value is effected via the **L_SignalSwitch_2** FB.

In the default setting C00470/4 = 0, the position value for SB **LS_AxisBusOut** is generated with the **L_PhaseIntK_2** FB. Loading or a reset is not required, since in the slave drive merely consistency with the speed value is compared without attaching importance to the absolute value.

With the setting C00470/4 = 1 (operation as position follower master), as position value for SB **LS_AxisBusOut** the current position *dnMotorPosAct_p* is used by the **LS_MotorInterface** SB.

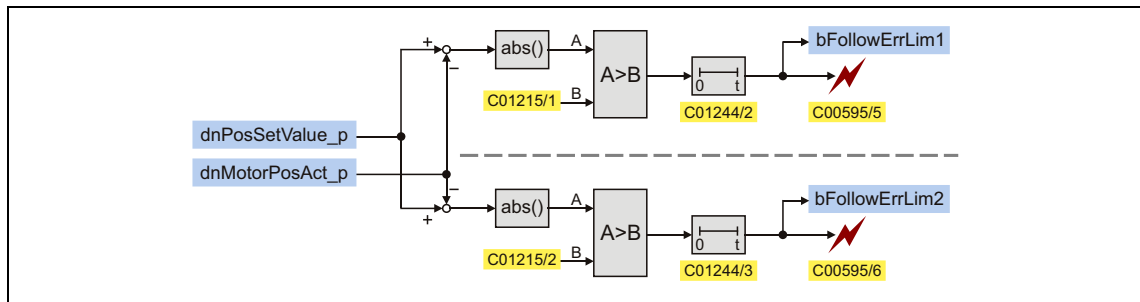
4.4 Monitoring functions

4.4.1 Following error monitoring system

The difference between set position and actual position is called the following error. Ideally, the following error should be "0". The set position is created by the internal definition of the traversing profiles of the **Motion Control Kernel**. The actual position is created by the integration of the speed supplied by the position encoder. The following error is always compensated dynamically. With an optimum setting of the position control, only a minimum following error occurs which does not increase continuously.

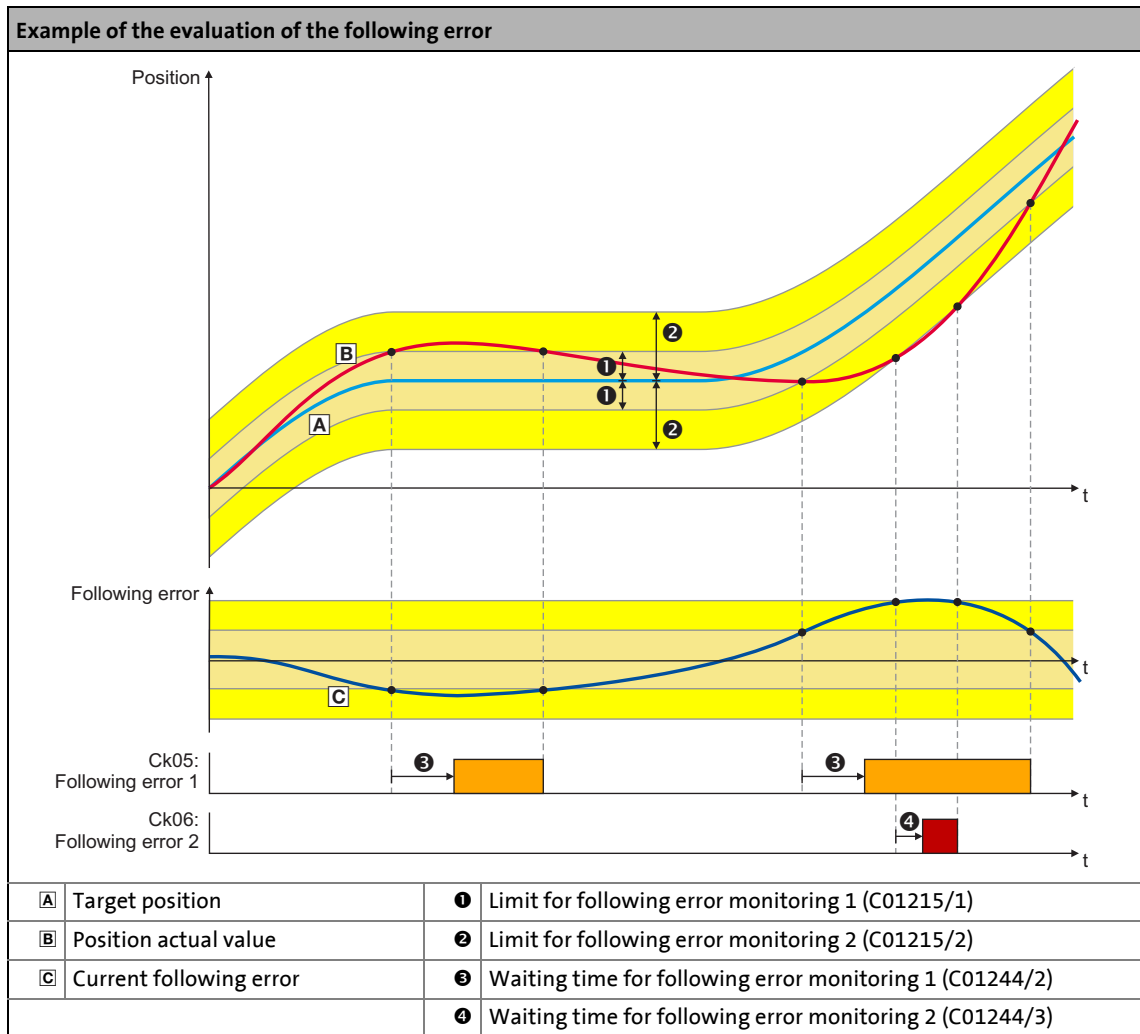
Certain processes, however, require that a defined limit as a difference between set position and actual position is not exceeded. If it is exceeded, it may have been caused by a mechanical blocking in the machine and the system part is not situated at the position defined at that time. In such a case, it makes sense to activate the "Fault" error response to make the motor torqueless.

In the 8400 TopLine controller, two independent following error monitoring systems can be parameterised:



[4-1] Two-channel following error monitoring system

Parameter (Block)	Possible settings			Info
C01215/1 (LS_MotionControl Kernel)	0.0001	units	214748.3647	Limit for following error monitoring 1 • The setting "0" deactivates following error monitoring 1
	Lenze setting: 5.0000 units			
C01215/2 (LS_MotionControl Kernel)	0.0001	units	214748.3647	Limit for following error monitoring 2 • The setting "0" deactivates following error monitoring 2
	Lenze setting: 10.0000 units			
C01244/2...3 (LS_MotionControl Kernel)	0	ms	60000	Waiting time for following error monitoring 1 & 2 • In order to avoid that an error is triggered by acceleration and a narrow tolerance limit can be nevertheless monitored at standstill in the target, the response of the following error monitoring system can be delayed by setting a waiting time.
	Lenze setting: 0 ms			
C00595/5...6 (LS_SetError_1)				Response at the activation of following error monitoring • Subcode 5: response at the activation of following error monitoring 1. • Subcode 6: response at the activation of following error monitoring 2.
	0	No Reaction		
	1	Fault		
	3	TroubleQuickStop		
	4	WarningLocked		
	5	Warning		
	6	Information		



The above example clearly shows that there are two monitoring functions acting independently of each other. Normally, one following error monitoring function with a low tolerance is set as warning, and the other with a higher tolerance is set as TroubleQuickStop.

By means of the waiting times (C1244/2 and C1244/3), the error responses can be delayed, so that disconnection does not result immediately when the following error limits are temporarily exceeded. This "switch-on delay" makes it possible to effectively distinguish between dynamic processes and actual error states such as mechanical obstacles or sluggishness.

4.4.2 Limit position monitoring

For safety reasons, drives with a limited traversing range must always be made safe using corresponding safety mechanisms. These are firstly the hardware limit switches, which must effect a standstill of the axes as quickly as possible during the approaching process. In addition, the parameterisable software limit positions are to inhibit all travel commands which would entail an exit of the permissible travel range.

Take the following items into consideration for placing the limit positions:

- The hardware limit switches must be mounted with a sufficient clearance in front of the mechanical limit positions of the linear axis. The clearance to the mechanical limit position should be calculated for a quick stop (QSP) from maximum speed, so that in the event of an error, standstill is attained safely before the mechanical limit position is reached.
- The software limit positions must be placed with a sufficient distance from the hardware limit switch positions. The distance should be calculated for a quick stop (QSP) from maximum speed without the hardware limit switches being approached.

4.4.2.1 Hardware limit switch

In the default setting, the two digital inputs DI1 and DI2 are provided for the connection of the hardware limit switches.

- The connection is configured in a fail-safe fashion (LOW = limit switch activated).
- The two digital inputs are linked with the *bLimitSwitchPos* and *bLimitSwitchNeg* monitoring inputs of the **LS_MotionControlKernel** system block.



Stop!

The limit switches are only evaluated if the limit switches for the respective operating mode have been activated (see the following table)!

Operating mode	Hardware limit switch effective
Homing	Depending on the homing mode selected (see description of the homing modes in the reference manual/online help of the inverter)
Manual jog	Yes (adjustable in C01230 - bit 2)
Positioning	Yes

Parameter (Block)	Possible settings	Info
C00595/1...2 (LS_MotionControl Kernel)	0 No Reaction	Response at the activation of limit position monitoring • Subcode 1: response at the approach of the positive limit switch. • Subcode 2: response at the approach of the negative limit switch.
	1 Fault	
	3 TroubleQuickStop	
	4 WarningLocked	
	5 Warning	
	6 Information	

Behaviour when hardware limit switches are active

If one of the two monitoring inputs is set to TRUE, in the Lenze setting the "TroubleQuickStop" error response is triggered: Irrespective of the setpoint selection, the drive is brought to a standstill in the deceleration time set for the quick stop function. Depending on the error response parameterised, the drive can then only be traversed again after the error has been acknowledged.

4.4.2.2 Software limit positions

The parameterisable limit positions are used by the software to limit the traversing range.



Stop!

The software limit positions are only evaluated and monitored if the home position is known to the drive and the software limit positions for the respective operating mode have been activated (see following table)!

If the drive is stopped at a high deceleration, depending on the mass inertia and friction, an overvoltage in the DC bus may occur, and pulse inhibit is set as error response. The use of a brake resistor can prevent this response.

Operating mode	Software limit positions active (if home position is known)
Homing	Yes
Manual jog	Yes (adjustable in C01230 - bit 3)
Positioning	Yes

Parameter (Block)	Possible settings			Info
C01229/1...2 (LS_MotionControl Kernel)	-214748.3647	units	214748.3647	Positive and negative software limit position for limiting the valid traversing range The positive software limit position must be set to a greater value than the negative software limit position!
	Lenze setting: 0.0000 units			
C00595/3...4 (LS_MotionControl Kernel)				Response at the activation of limit position monitoring - Subcode 3: response at overtravelling the positive software limit position (C01229/1). - Subcode 4: response at overtravelling the negative software limit position (C01229/2).
	0	No Reaction		
	1	Fault		
	3	TroubleQuickStop		
	4	WarningLocked		
	5	Warning		
6	Information			

Behaviour in the case of active software limit positions



Note!

The "travel commands" mentioned in the following description are no speed setpoint selections. In the "Speed follower" and "Position follower" operating modes, an acknowledged software limit position error ensures that traversing to the impermissible travel range remains possible afterwards. This is because in these two operating modes, there is no preview of whether a software limit position is approached with a setpoint selection.

If the software limit positions are active, travelling commands that would result in the exit from the permissible travel range can no longer be executed.

In positioning operation, the warning "Ck14: target position outside SW limit position" is output for target positions that are outside of the software limit positions. The positioning process is not aborted, but is executed to the software limit position instead of to the target position outside the software limit position.

If the drive is already outside the permissible travel range and the software limit positions have been activated, only travel commands that result in the drive moving back into the permissible travel range can be executed.

If the software limit positions are active, and one of the software limit positions is overtravelled, in the Lenze setting the "TroubleQuickStop" error response is triggered: Irrespective of the setpoint selection, the drive is brought to a standstill in the deceleration time set for the quick stop function. Depending on the error response parameterised, the drive can then only be traversed again after the error has been acknowledged.

4.4.3 Error and status messages of the positioning sequence control

The application provides the **LS_SetError_1** SB for the purpose of error handling.

- The application can trip up to four different user error messages with parameterisable error IDs and error responses via the four boolean inputs of the **LS_SetError_1** SB.
- In the "Position Sequencer" technology application, the inputs of the **LS_SetError_1** SB are linked with error/status outputs of the **L_Sequencer_1** FB.
- You can gather the application-specific meaning of the user errors as well as the preset response from the following table:

Error message	Meaning	Response (Lenze setting)	can be set in
User error 1	Time monitoring for "positioning" action has been triggered.	TroubleQuickStop	C00581/1
User error 2	Positioning sequence control reports an error.	TroubleQuickStop	C00581/2
User error 3	Positioning program started, break active.	Information	C00581/3
User error 4	- (not assigned, can be used freely)	No Reaction	C00581/4

5 Appendix: Action types for the positioning sequence control

For the positioning sequence control, the **L_Sequencer_1** FB is used. This FB processes a positioning program on the basis of a sequence table (also referred to as "sequencer"), which can contain up to 100 references to so-called "Actions".

Overview

Action type	Number of actions available	Info	
Homing	1	Start of homing	These action types are "active". When these action types are processed, the respective basic function is triggered via corresponding control outputs.
Positioning	50	Execution of a profile	
Branch	16	Conditional or unconditional branch (jump)	These action types are "passive". When these action types are processed, the "Stop" operating mode are active, and a brake will be applied, if available. * The "Standby" action type is active when a setpoint has been set for the speed follower or a setpoint position is transferred to the LS_MotionControlKernel SB when "Position follower" has been selected.
Variable branch	2	Variable branch as a function of the input value of <i>wBranch1</i> or <i>wBranch2</i> .	
Switch	16	Switching of digital output signals	
Set counter	5	Setting one of the 5 counters available to a specific starting value	
Count	8	Counting processes including comparison operation	
Wait	8	Entering waiting times into the program flow	
Standby*	5	Temporary activation of a setpoint follower	
End	1	Determination of the program end	

You can find detailed information on the action types in the following subchapters.



Tip!

For users switching from 9300 to 8400:

Whereas with the Servo Drive 9300 it was usual to query several digital inputs in succession to then obtain a specific positioning process, for 8400 and 9400 the "[Variable branch](#)" action can be used.

5.1 Homing

For starting a homing process, the "Homing" action type is provided. When homing has been completed (*bHomingDone* = TRUE), the program flow is continued with the next step.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count Wait Standby Delete/End

Comment on action

Action parameters

Homing Homing



Note!

The "Homing" action has no individual parameters. The settings for homing (e.g. homing mode) are carried out via the parameters of the basic function "Homing". Click the **Homing** button to navigate to the corresponding parameterisation dialog.

5.2

Positioning

For starting a positioning process, 50 actions of the "Positioning" type are provided.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count Wait Standby Delete/End

Selection Action Number

1

Comment on action

Action parameters

Wait for level

Start profile

Pos. action n: Start with

Pos. action n: Profile number

Pos. action n: Monitoring time

Pos. action n: Jump destination m..

Pos. action n: Jump destination

Jump

**Note!**

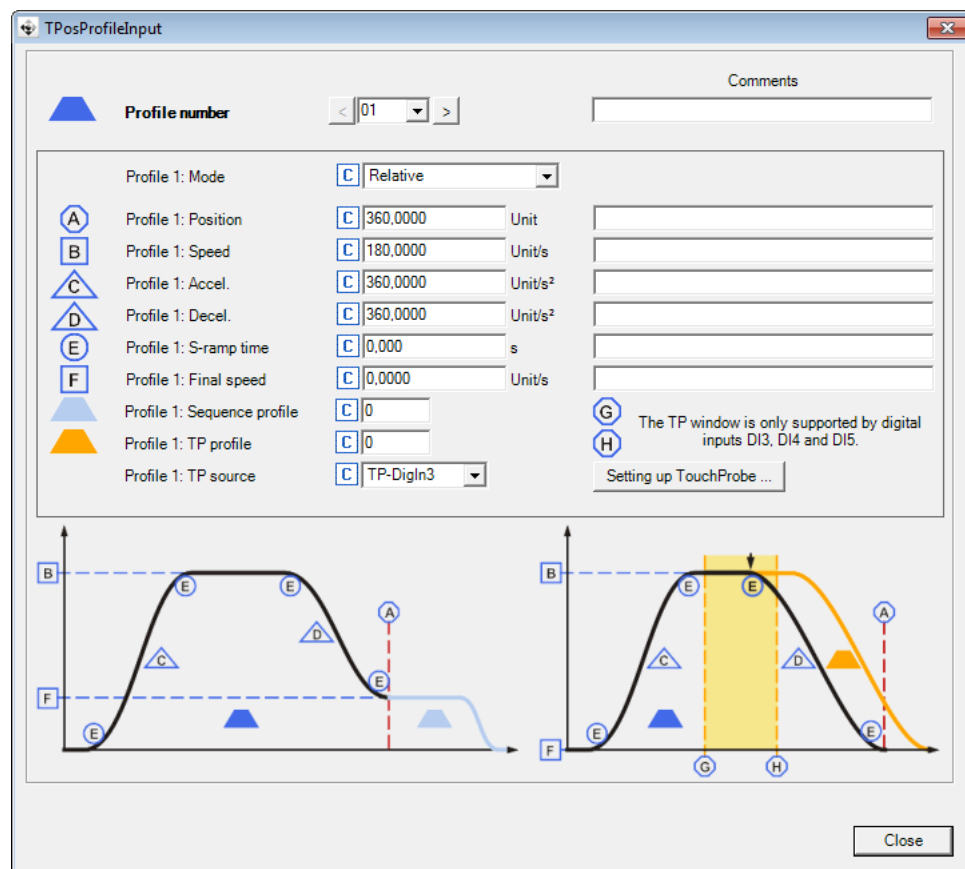
Although 50 "Positioning" action types are provided, only 15 different profiles can be parameterised.

The profile is entered via the parameters of the basic function "Positioning". Click the **Profile settings** button to navigate to the corresponding parameterisation dialog (see "[Profile settings](#)" section).

Parameter	Possible settings	Info
Start with (C01405/1...50)	0 Waiting function deactivated	In the default setting, execution of the profile is started immediately.
	1 Sequencer input 1 (Bit 0 of <i>wDigitalInputs</i>)	"Wait for level": Execution of the profile is only started when the sequencer input selected has the polarity set.
	2 Sequencer input 2 (Bit 1 of <i>wDigitalInputs</i>)	
		
	16 Sequencer input 16 (Bit 15 of <i>wDigitalInputs</i>)	
Polarity of input (C01406/1...50)	☐ Condition is bit state "0"	State which the sequencer input selected for the profile start must have.
	☐ Condition is bit state "1"	
Profile number (C01407/1...50)	0 No profile executed	Selection of the profile which is to be executed. A sequence profile can be set in the corresponding profile parameter.
	1 Execute profile No. 1.	
	2...15 Execute profiles No. 2 ... 15	

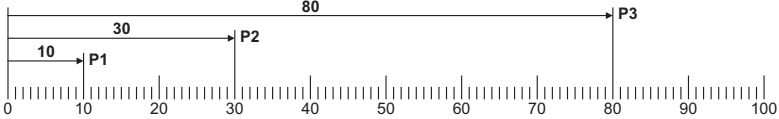
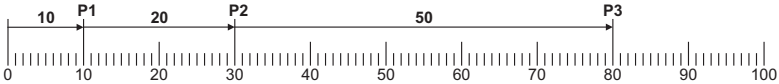
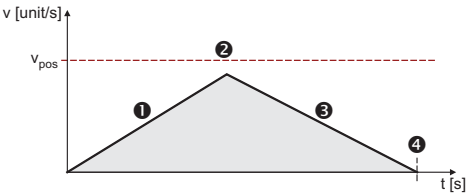
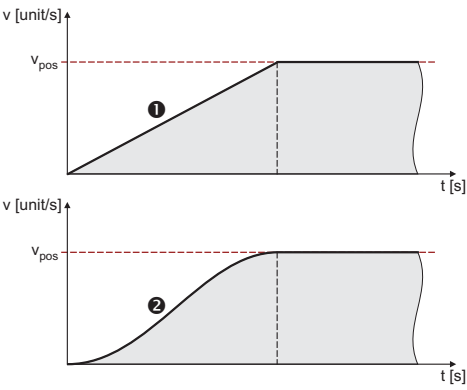
Parameter	Possible settings			Info
Monitoring time (C01409/1...50)	0.000	s	2147480.000	If the positioning process takes longer than the monitoring time set, user error 1 is set. The response to this error can be set in C00581/1 (Lenze setting: "TroubleQuickStop").
	When "0.000 s" is set (Lenze setting), the time monitoring function is deactivated.			
Jump destination monit. (C01410/1...50)	0	Sequence step		Step which is executed after the monitoring time has been exceeded.
	1...100	Step 1 ... 100		
Jump destination (C01408/1...50)	0	Sequence step		Step within the sequence table which is processed after the profile has been executed.
	1...100	Step 1 ... 100		

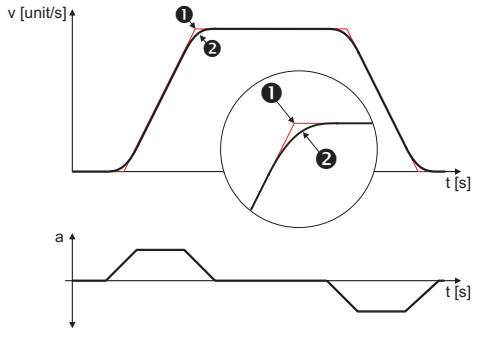
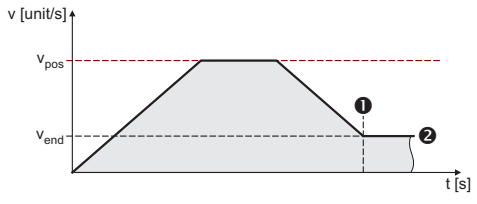
Profile settings



A profile is described by the following profile parameters:

Icon	Profile parameter
	(Standard) profile Profile data set (profile numbers 1 ... 15), in which the profile data are stored.
	Mode (C01300/1...15) Selection of the way in which positioning is to be carried out.

Icon	Profile parameter
	Position (C01301/1...15) Target position or distance to be traversed. When the position is indicated, a distinction is made between absolute position and relative position: - An absolute position always indicates the distance to the defined zero position: Absolute position = Target position  - A relative position indicates the distance to the starting position (current position): Relative position = Target position - Starting position 
	Speed (C01302/1...15) Maximum speed during the positioning process. - Depending on the profile parameters of position, acceleration and deceleration, it is possible that the drive will not even reach the maximum speed. In this case, the graphic representation will be a trapezium instead of a triangle:  1 Acceleration 2 Travelling speed (is not reached in this case) 3 Deceleration 4 Target position (or traversing distance)
	Acceleration (C01303/1...15) Maximum acceleration during the positioning process. - Two types of acceleration are distinguished: - Constant acceleration: the speed increases linearly. - Linearly increasing acceleration: Speed increases in S-shape. A linearly increasing acceleration (S-profile) results from the setting of an S-ramp time (see more below).  1 Constant acceleration (L-profile) 2 Linearly increasing acceleration (S-profile)
	Deceleration (C01304/1...15) Maximum deceleration during the positioning process.

Icon	Profile parameter
	S-ramp time (C01305/1...15) Due to stipulation of an S-ramp time for a profile, the profile is executed with S-shaped ramps, i.e. acceleration and braking processes are initiated smoothly in order to reduce jerk and thus the stress on the drive components. • The acceleration/deceleration stipulated in the profile is not achieved until after the specified S-ramp time. • This kind of acceleration/deceleration is needed for sensitive machine parts with a certain amount of play. • The unavoidable consequence of the slower increase in acceleration in the case of the S profile is that the positioning time is longer compared to the L profile, which is more efficient in terms of time.
	 1 Without jerk limitation (L profile) 2 With jerk limitation (S profile)
	Final speed (C01305/1...15) This specifies the speed at which the drive is to start the next profile after reaching the target position. With a final speed not equal to "0", "velocity changeover" or "overchange" is possible, i.e. when the target position is reached, a second positioning process is started immediately without the drive coming to a standstill at the first target position.
	 1 Target position 2 Final speed (in this case, not equal to "0")
	Sequence profile (C01307/1...15) for profile linkage/subsequent block control A special feature is the automatic advancing to sequence profiles with and without velocity changeover. For this purpose, the profile number of the desired sequence profile (1 ... 15) is simply set in the "Sequence profile" profile parameter. After execution of the profile (target position reached), the set following (subsequent) profile is started automatically. In this way, profile chains can be stipulated without additional control processes. • If the "Final speed" profile parameter is set to $\neq$ "0", a velocity changeover to the sequence profile takes place at the final speed set. • If "0" is set for the following (i.e. subsequent) profile, profile linkage does not take place. • This function can be performed in all positioning modes.
	TP profile (C01308/1...15) Profile number of the profile (1 ... 15) that is to be executed after a touch probe has been detected. • If "0" is set, there will be no profile stepping through touch probe. • Only relevant for positioning modes with touch-probe.
	TP signal source (C01309/1...15) Selection of the signal source for touch probe detection. • Only relevant for positioning modes with touch-probe.

5.3

Branching

For conditional and unconditional branching (jumps), 16 actions of "Branching" Type are available.

Select action type

Homing Positioning **Branch** Variable branch Switch

Set counter Count Wait Standby Delete/End

Selection Action Number

1

Comment on action

Action parameters

Branch act. n: Input for jump

[C] Unconditional branch [U]

Branch act.1: Jump destination

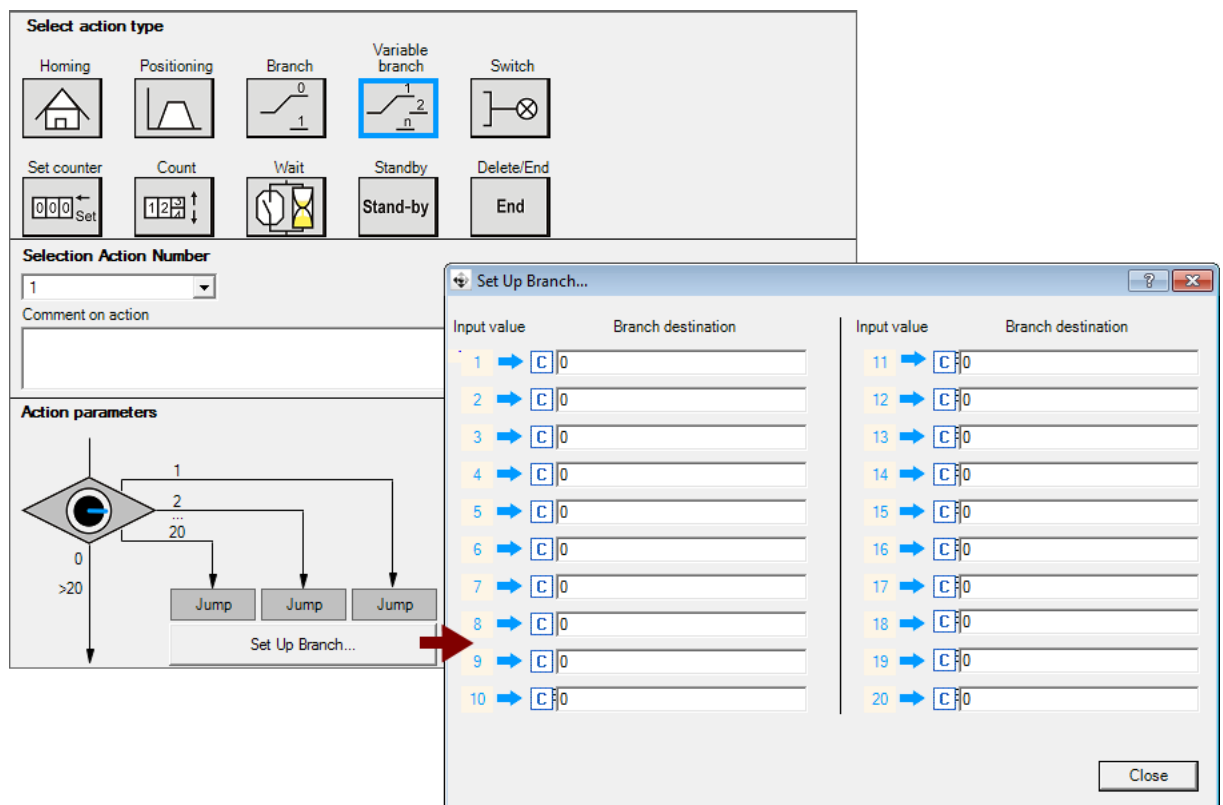
Jump [C] 2

Parameter	Possible settings	Info
Input f. jump (C01415/1...16)	0 Unconditional branch	"Unconditional branch": There is always a branch to the jump destination set.
	1 Sequencer input 1 (Bit 0 of <i>wDigitalInputs</i>)	"Conditional branch": There only is a branch to the jump destination set if the sequencer input selected has the polarity set. Otherwise the next step in the sequence table is processed.
	2 Sequencer input 2 (Bit 1 of <i>wDigitalInputs</i>)	
		
	16 Sequencer input 16 (Bit 15 of <i>wDigitalInputs</i>)	
Polarity of input (C01416/1...16)	[U] Condition is bit state "0"	State which the sequencer input selected must have for a conditional branch.
	[C] Condition is bit state "1"	
Jump destination (C01417/1...16)	0 Sequence step	For a conditional branch, there only is a branch to the jump destination set here if the sequencer input selected has the polarity set. Otherwise the next step in the sequence table is processed.
	1...100 Step 1 ... 100	

5.4 Variable branch

For variable branching (jumps), two actions of "variable branching" type are available.

- Branching to one of 20 possible branching destinations is carried out as a function of the input value of *wBranch1* or *wBranch2* at the time of processing.
 - The input value of *wBranch1* defines branching for action 1.
 - The input value of *wBranch2* defines branching for action 2.
 - If the input value is 0 or greater 20, the next step in the sequence table is processed.
- In the default setting, the *wBranch1* input is linked with MCI process data input word 3. ▶ [Pre-assignment of the process data input words](#) (18)
- In the default setting, the *wBranch2* input is not connected.



For entering the branch destinations, click the **Set Up Branch...** button in the parameterisation dialog.

Parameter	Possible settings	Info
Branch destination (C01418/1...2 - C01437/1...2)	0 Branching deactivated (The following step in the sequence table is processed.)	Branch destinations for input values 1 ... 20 of <i>wBranch1</i> ...2.
	1...100 Step 1 ... 100	

5.5

Switch

For switching digital output signals, 16 actions of the "Switch" type are provided. Each action can set two bits of the *wDigitalOutputs* output signal, which can be selected, to "0" or "1", alternatively and independently of each other.

Select action type

Homing Positioning Branch Variable branch **Switch**

Set counter Count Wait Standby Delete/End

Selection Action Number

1

Comment on action

Action parameters

Switch:

Set Switch. act. n: output switch. A C Deactivated U

Set Switch. act. n: output switch. B C Deactivated U

Parameter	Possible settings	Info
Output switch. A (C01411/1...16)	0 Deactivated	Selection of the sequencer output which is to be set to the set polarity by this action.
	1 Sequencer output 1 (Bit 0 of <i>wDigitalOutputs</i>)	
	2 Sequencer output 2 (Bit 1 of <i>wDigitalOutputs</i>)	
		
	16 Sequencer output 16 (Bit 15 of <i>wDigitalOutputs</i>)	
Pol. switch. A (C01412/1...16)	U Set output bit to "0"	State to which the sequencer output is to be set.
	L Set output bit to "1"	
Output switch. B (C01413/1...16)	0 Deactivated	Selection of the sequencer output which is to be set to the set polarity by this action.
	1 Sequencer output 1 (Bit 0 of <i>wDigitalOutputs</i>)	
	2 Sequencer output 2 (Bit 1 of <i>wDigitalOutputs</i>)	
		
	16 Sequencer output 16 (Bit 15 of <i>wDigitalOutputs</i>)	
Pol. switch. B (C01414/1...16)	U Set output bit to "0"	State to which the sequencer output is to be set.
	L Set output bit to "1"	

5.6 Counter setting

For setting one of the 5 available counters to a certain starting value, 5 actions of "Counter setting" type are available.

- The 5 actions of "counter setting" type are not permanently assigned to the 5 counters.
- You can, e.g., set a counter to a value using an action of "counter setting" type and at a later program time set the same counter to a different value using another action of "counter setting" type.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count Wait Standby Delete/End

Selection Action Number

1

Comment on action

Action parameters

Counter set act. 1: Counter no.

1

Counter set act. n: Starting value

0



Tip!

Since for the "Count" action also negative step values can be set, it is also possible to count down from a starting value that is set.

Parameter	Possible settings			Info
Counter No. (C01441/1....5)	0	Counter setting deactivated		Selection of the counter
	1	Counter 1		
	...	...		
	5	Counter 5		
Starting value (C01442/1....5)	-2147483647		2147483647	Value to which the counter selected is to be set.
	Initialisation: 0			

5.7

Count

For counting processes, 8 actions of the "Count" type are provided. Each time the action is processed, the counter content of the corresponding counter is increased or decreased by the step value set (counting up or down).

- The comparison operation enables a conditional branch depending on the current counter content.
- For setting a counter to a starting value, 5 actions of "[counter setting](#)" type are available.

Parameter	Possible settings			Info
Counter No. (C01444/1...5)	0	Counting deactivated (Sequence step is processed.)		Selection of the counter
	1	Counter 1		
	...	...		
	5	Counter 5		
Comparison operation (C01448/1...8)	1	Counter content = comparison value		If the comparison operation is true, a branch to the jump destination set is executed. Otherwise the next step in the sequence table is processed.
	2	Counter content > comparison value		
	3	Counter content ≥ comparison value		
	4	Counter content < comparison value		
	5	Counter content ≤ comparison value		
Jump destination (C01447/1...8)	0	Sequence step		Jump destination if the comparison operation is true.
	1...100	Step 1 ... 100		
Current counter content (C01443/1...5)	-2147483647		2147483647	Read only
Step value (C01445/1...8)	-2147483647		2147483647	Value by which the counter is increased or decreased.
	Initialisation: 1			
Comparison value (C01446/1...8)	-2147483647		2147483647	Value to which the counter is compared.
	Initialisation: 0			

5.8

Wait

For integrating waiting times into the program flow, 8 actions of the "Wait" type are provided.

The sequence step is only processed

- after a waiting time has elapsed,
OR
- when a selectable sequencer input has a specific level.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count **Wait** Standby Delete/End

Selection Action Number

1

Comment on action

Action parameters

Wait. act. n: Waiting time s

Wait. act. n: Input for "Next"

Parameter	Possible settings			Info
Waiting time (C01438/1...8)	0.000	s	2127480.000	Waiting time for "Wait" function • The setting "0" deactivates the waiting time.
	Initialisation: 1.000 s			
Input for "Next" (C01439/1...8)	0	Input deactivated		"Wait": Sequence step is only processed after the waiting time set has elapsed.
	1	Sequencer input 1 (Bit 0 of <i>wDigitalInputs</i>)		"Wait for level": Sequence step is only processed when the sequencer input selected has the polarity set. Note! However, if a waiting time > 0 s is set, the sequence step is processed at the latest after the waiting time set has elapsed.
	2	Sequencer input 2 (Bit 1 of <i>wDigitalInputs</i>)		
	...	...		
	16	Sequencer input 16 (Bit 15 of <i>wDigitalInputs</i>)		
Polarity of input (C01440/1...16)		Condition is bit state "0"		State which the sequencer input selected must have so that the sequence step is processed.
		Condition is bit state "1"		

5.9

Standby

For temporary activation of a speed or position follower, 5 actions of the "Standby" type are provided.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count Wait **Standby** Delete/End

Selection Action Number

1

Comment on action

Action parameters

Standby:

Standby act. n: Input for "End"

Standby act. n: Follower mode

Standby act. n: Setpoint

Parameter	Possible settings	Info
Input f. "End" (C01449/1...5)	1 Sequencer input 1 (Bit 0 of <i>wDigitalInputs</i>)	The follower mode selected remains enabled until the sequencer input selected here has the polarity set.
	2 Sequencer input 2 (Bit 1 of <i>wDigitalInputs</i>)	
		
	16 Sequencer input 16 (Bit 15 of <i>wDigitalInputs</i>)	
Polarity of input (C01450/1...5)	☐ Condition is bit state "0"	State which the sequencer input selected must have so that "Standby" is exited and the sequence step is processed.
	☐ Condition is bit state "1"	
Follower mode (C01451/1...5)	0 Speed follower	Selection of the follower that is to be activated in standby mode.
	1 Position follower	
Setpoint (C01452/1...5)	-200 % 200	Setpoint for the speed follower (displayed at <i>nSet_a</i> output).
	Initialisation: 0.15 %	



Detailed information relating to the basic drive functions "Speed follower" and "Position follower" as well as to the corresponding parameters can be found in the reference manual/online help of the inverter in the "Basic drive functions (MCK)" chapter.

5.10 End

In order to define the program end within the sequence table, one action of the "End" type is provided. If, at the **L_Sequencer** FB, the *bStart* input is reset to FALSE while the positioning program is running, processing is only continued until the program end.

Select action type

Homing Positioning Branch Variable branch Switch

Set counter Count Wait Standby Delete/End

End

Comment on action

Action parameters

The "End" action has no individual parameters.



Your opinion is important to us

These instructions were created to the best of our knowledge and belief to give you the best possible support for handling our product.

If you have suggestions for improvement, please e-mail us to:

feedback-docu@Lenze.de

Thank you for your support.

Your Lenze documentation team



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