

Inverter



8400

E84AVSCxxxxx...

Inverter Drives 8400 StateLine C -----

Operating Instructions

EN



13390878

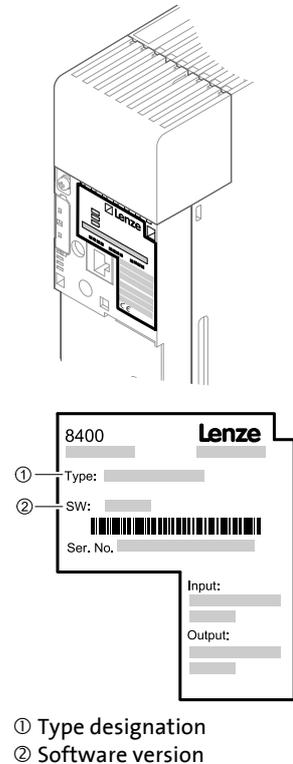
Lenze

Product key

Product key:

	E84	A	V	SC	x	xxx	x	x	x	x
Product range	8400 Inverter Drives									
Generation	A = 1. generation									
Type	V = vector-controlled inverter									
Version	SC = StateLine C									
Mounting type	E = installation D = Push-through technique C = cold-plate technique									
Power e.g.	251 = $25 \times 10^1 \text{ W} = 0.25 \text{ kW}$ 222 = $22 \times 10^2 \text{ W} = 2.2 \text{ kW}$									
Voltage class	2 = 230/240 V, 1/N/PE AC (0.25 ... 2.2 kW) 4 = 400/500 V, 3/PE AC (0.37 ... 45 kW)									
Ambient conditions	S = standard industrial environment IE33 according to IEC 60721-3-3 V = rough environment (coated printed circuit boards)									
Safety system	X = without safety technology B = with drive-based safety "safe torque off (STO)"									

Nameplate:



The product key serves to identify delivered products by nameplate data.
The product catalogue provides information on the possible configuration to order the products.



Tip!

Current instructions for the contents of the product CD and information and tools for the Lenze products are provided in the internet:

<http://www.Lenze.com> → Download

Contents

1	About this documentation	4
2	Safety instructions	5
2.1	General safety and application notes for Lenze controllers	5
2.2	General safety and application notes for Lenze motors	7
2.3	Residual hazards	8
3	Overview of terminals	9
4	Connection/wiring of the controller	11
5	Before commissioning	12
5.1	Selection of the appropriate commissioning tool	12
5.2	General notes on parameters	14
5.2.1	Changing the parameterisation with the keypad	14
5.2.2	Change parameter settings with PC and Lenze software	18
5.2.3	Save parameter settings in the memory module safe against mains failure	19
5.2.4	User menu for quick access to frequently used parameters	20
5.3	General notes on applications	21
5.3.1	Select control mode	22
5.4	Frequently used device commands	24
5.5	Check software version (firmware version)	25
6	Commissioning	26
6.1	Drive behaviour by default (Lenze setting)	26
6.2	Quick commissioning with the keypad	27
6.3	Adapting the most important parameters to the drive task	33
6.3.1	Basic settings	34
6.3.2	Application parameters	37
6.3.3	Motor control parameters	41
7	Diagnostics & troubleshooting	44
7.1	LED status displays for device status	44
7.2	Diagnostics using the »EASY Starter«	45
7.3	Diagnostic/Display parameters	46
7.4	Monitoring	47
7.5	Error messages	48
7.6	Maloperation of the drive	53
8	Adapting the application individually	55
8.1	Function block interconnection of the "Actuating drive speed" application	55
8.2	Activating additional functions in the signal flow	58
8.2.1	Speed limit values	59
8.2.2	Speed blocking zones	60
8.2.3	Ramp smoothing	61
8.3	Implementing more additional functions in the signal flow	62
8.3.1	Pre-assignment of the input and output interfaces	63
8.3.2	Motor potentiometer	65
8.3.3	Process controller	68
8.3.4	Parameter change-over	72
	Index	74

1 About this documentation

1 About this documentation

This documentation applies to the 8400 StateLine C controller with the following nameplate data:

Product range	Type designation	from software version
8400 StateLine C	E84AVSCxxxxx	06.00

- The documentation contains important technical information on how to commission and operate the 8400 StateLine C controller.
- The documentation applies to the "simple" "speed-controlled" operation preset by Lenze by default. The most important settings for commissioning will be explained so that many applications using the 8400 StateLine C controller and the preset application "actuating drive speed" can be solved quickly.
- The documentation supplements the mounting instructions, the hardware manual and the reference manual for the 8400 StateLine C controller.
- The hardware and reference manual are included in the scope of supply. in electronic format.

Definition of the notes used

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

Symbol	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.
	Note!	Important note to ensure trouble-free operation

2 Safety instructions

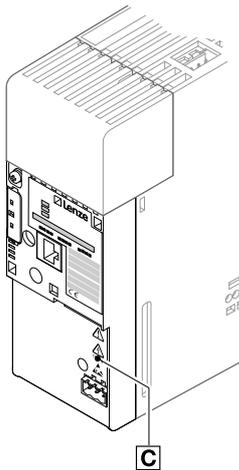
2.1 General safety and application notes for Lenze controllers

2 Safety instructions



Danger!

Sticker with warning note must be displayed prominently and close to the device!

	Description of the warning signs 	
		Long discharge time! All power terminals remain live for some minutes after mains disconnection! The time is given below the warning symbol on the device.
		High leakage current! Carry out fixed installation and PE connection in accordance with EN 61800-5-1!
		Electrostatic sensitive devices! Before working on the device, the staff must ensure to be free of electrostatic charge!
		Hot surface! Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

2.1 General safety and application notes for Lenze controllers

(according to Low-Voltage Directive 2006/95/EG)

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's 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, 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-authorized 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).

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

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.

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. 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 Safety instructions

2.2 General safety and application notes for Lenze motors

2.2 General safety and application notes for Lenze motors

(according to Low-Voltage Directive 2006/95/EG)

General

Lowvoltage machines have hazardous live and rotating parts and possibly also hot surfaces.

Synchronous machines induce voltages at open terminals during operation.

All operations concerning transport, connections, commissioning and maintenance must be carried out by qualified, skilled personnel (EN 501101 (VDE 0105100) and IEC 60364 must be observed). Inappropriate use creates the risk of severe injury to persons and damage to material assets.

Lowvoltage machines may only be operated under the conditions that are indicated in the section "Application as directed".

The conditions at the place of installation must comply with the data given on the nameplate and in the documentation.

Application as directed

Lowvoltage machines are intended for commercial installations. They comply with the harmonised standards of the series EN 60034 (VDE 0530). Their use in potentially explosive atmospheres is prohibited unless they are expressly intended for such use (follow additional instructions).

Lowvoltage machines are components for installation into machines as defined in the Machinery Directive 2006/42/EC. Commissioning is prohibited until the conformity of the end product with this directive has been established (follow i. a. EN 602041).

Lowvoltage machines with IP23 protection or less are only intended for outdoor use when applying special protective features.

The integrated brakes must not be used as safety brakes. It cannot be ruled out that factors which cannot be influenced, such as oil ingress due to a defective Aside shaft seal, cause a brake torque reduction.

Transport, storage

Damages must be reported immediately upon receipt to the forwarder; if required, commissioning must be excluded. Tighten screwed in ring bolts before transport. They are designed for the weight of the lowvoltage machines, do not apply extra loads. If necessary, use suitable and adequately dimensioned means of transport (e. g. rope guides).

Remove transport locking devices before commissioning. Reuse them for further transport. When storing lowvoltage machines, ensure a dry, dustfree and lowvibration ($v_{eff} \leq 0.2$ mm/s) environment (bearing damage while being stored).

Installation

Ensure an even surface, solid foot/flange mounting and exact alignment if a direct clutch is connected. Avoid resonances with the rotational frequency and double mains frequency which may be caused by the assembly. Turn rotor by hand, listen for unusual slipping noises. Check the direction of rotation when the clutch is not active (observe section "Electrical connection").

Use appropriate means to mount or remove belt pulleys and clutches (heating) and cover them with a touch guard. Avoid impermissible belt tensions.

The machines are half-key balanced. The clutch must be half-key balanced, too. This visible jutting out part of the key must be removed.

If required, provide pipe connections.

Designs with shaft end at bottom must be protected with a cover which prevents the ingress of foreign particles into the fan. Free circulation of the cooling air must be ensured. The exhaust air - als the exhaust air of other machines next to the drive system - must not be taken in immediately.

Electrical connection

All operations must only be carried out by qualified and skilled personnel on the low-voltage machine at standstill and deenergised and provided with a safe guard to prevent an unintentional restart. This also applies to auxiliary circuits (e. g. brake, encoder, blower).

Check safe isolation from supply!

If the tolerances specified in EN 60034-1; IEC 34 (VDE 0530-1) - voltage ± 5 %, frequency ± 2 %, waveform, symmetry - are exceeded, more heat will be generated and the electromagnetic compatibility will be affected.

Observe the data on the nameplate, operating notes, and the connection diagram in the terminal box.

The connection must ensure a continuous and safe electrical supply (no loose wire ends); use appropriate cable terminals. The connection to the PE conductor must be safe. The plug-in connectors must be bolt tightly (to stop).

The clearances between blank, live parts and to earth must not fall below 8 mm at $V_r \leq 550$ V, 10 mm at $V_r \leq 725$ V, 14 mm at $V_r \leq 1000$ V.

The terminal box must be free of foreign particles, dirt and moisture. All unused cable entries and the box itself must be sealed against dust and water.

Commissioning and operation

Before commissioning after longer storage periods, measure insulation resistance. In case of values ≤ 1 k Ω per volt of rated voltage, dry winding.

For trial run without output elements, lock the featherkey. Do not deactivate the protective devices, not even in a trial run.

Check the correct operation of the brake before commissioning low-voltage machines with brakes.

Integrated thermal detectors do not provide full protection for the machine. If necessary, limit the maximum current. Parameterise the controller so that the motor will be switched off with $I > I_r$ after a few seconds of operation, especially at the risk of blocking.

Vibrational severities $v_{eff} \leq 3.5$ mm/s ($P_N \leq 15$ kW) or 4.5 mm/s ($P_N > 15$ kW) are acceptable if the clutch is activated.

If deviations from normal operation occur, e.g. increased temperatures, noises, vibrations, find the cause and, if required, contact the manufacturer. In case of doubt, switch off the low-voltage machine.

If the machine is exposed to dirt, clean the air paths regularly.

Shaft sealing rings and roller bearings have a limited service life. Regrease bearings with relubricating devices while the low-voltage machine is running. Only use the grease recommended by the manufacturer. If the grease drain holes are sealed with a plug, (IP54 drive end; IP23 drive and non-drive end), remove plug before commissioning. Seal bore holes with grease. Replace prelubricated bearings (2Z bearing) after approx. 10,000 h - 20,000 h, at the latest however after 3 - 4 years.

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

2 Safety instructions

2.3 Residual hazards

2.3 Residual hazards

Protection of persons

Before working on the controller, check if no voltage is applied to the power terminals because

- - depending on the device - the power terminals U, V, W, +UG, - UG, Rb1 and Rb2 remain live for at least 3 ... 20 minutes after disconnecting the mains.
- the power terminals L1, L2, L3; U, V, W, +UG, - UG, Rb1 and Rb2 remain live when the motor is stopped.

Device protection

Connect/disconnect all pluggable terminals only in deenergised condition!

Detach the controller from the installation, e.g. from the rear panel of the control cabinet, only in deenergised condition!

Motor protection

With some settings of the controller, the connected motor can be overheated.

- E.g. longer operation of the DC injection brake.
- Longer operation of self-ventilated motors at low speed.

Protection of the machine/plant

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

Switch contactors in the motor cable only if the controller is inhibited. When switching contactors in the motor cable while the controller is enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.

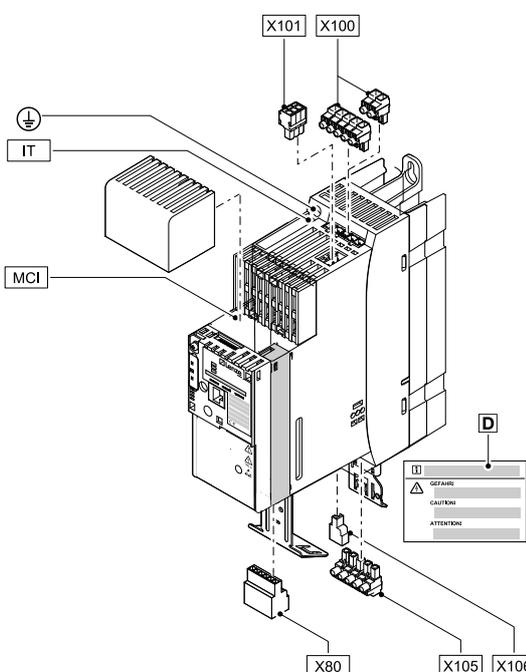
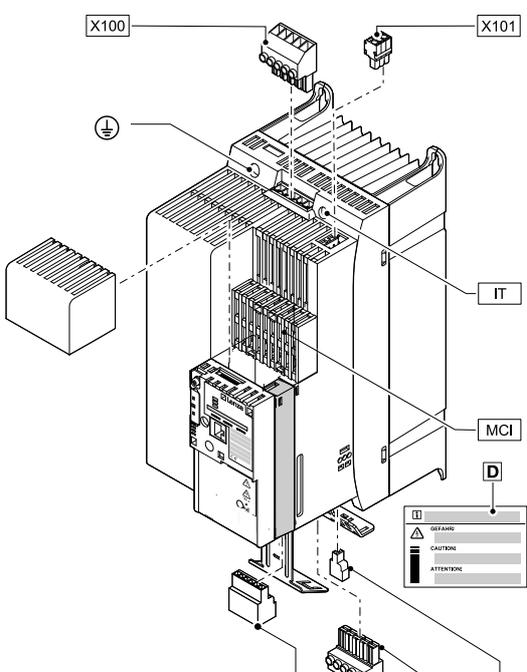
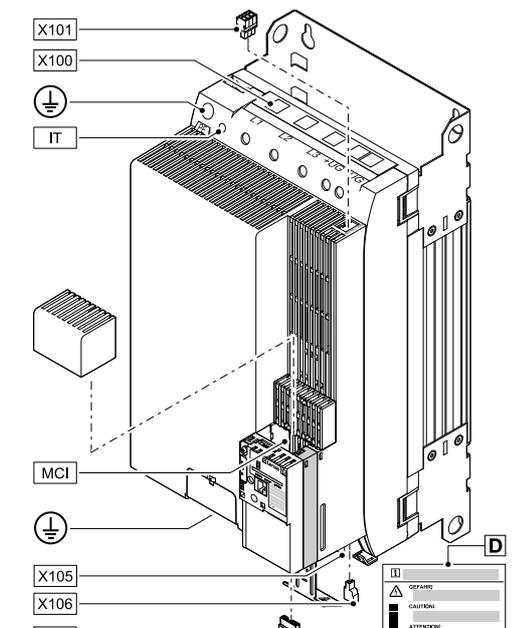
Parameter set transfer

During the parameter set transfer, control terminals of the controllers can adopt undefined states! Therefore it is required to disable the terminal X4 (digital input signals) before the transfer starts. This ensures that the controller is inhibited and all control terminals have the firmly defined "LOW" status.

3 Overview of terminals

3 Overview of terminals

Power terminals

<p>Power range 0.25 ... 3 kW (Device sizes 1 ... 3)</p> 	<p>Power range 3 ... 22 kW (Device sizes 4 ... 6)</p> 																
<p>Power range 30 ... 45 kW (Device size 7)</p> 	<table border="1"> <tr> <td>X80</td> <td>Terminal strip for drive-based safety "safe torque off (STO)" (option)</td> </tr> <tr> <td>X100</td> <td>Mains/DC-bus voltage for 400 V devices</td> </tr> <tr> <td>X101</td> <td>Relay output <ul style="list-style-type: none"> • AC 250 V, 3 A • DC 24V, 2A • DC 240 V, 0.16 A </td> </tr> <tr> <td>X105</td> <td>Motor/external brake resistor</td> </tr> <tr> <td>X106</td> <td>Motor temperature monitoring</td> </tr> <tr> <td>IT</td> <td>Contact screws for interference suppression (on the supply side and on the on the motor side) <ul style="list-style-type: none"> • Before using the controller in the IT system, loose both contact screws. • Please observe the notes in the hardware manual and in mounting instructions of the controller and filters. </td> </tr> <tr> <td>MCI</td> <td>Slot for communication module <ul style="list-style-type: none"> • MCI = abbreviation for "Module Communication Interface" </td> </tr> <tr> <td>D</td> <td>Sticker with warning</td> </tr> </table>	X80	Terminal strip for drive-based safety "safe torque off (STO)" (option)	X100	Mains/DC-bus voltage for 400 V devices	X101	Relay output <ul style="list-style-type: none"> • AC 250 V, 3 A • DC 24V, 2A • DC 240 V, 0.16 A 	X105	Motor/external brake resistor	X106	Motor temperature monitoring	IT	Contact screws for interference suppression (on the supply side and on the on the motor side) <ul style="list-style-type: none"> • Before using the controller in the IT system, loose both contact screws. • Please observe the notes in the hardware manual and in mounting instructions of the controller and filters. 	MCI	Slot for communication module <ul style="list-style-type: none"> • MCI = abbreviation for "Module Communication Interface" 	D	Sticker with warning
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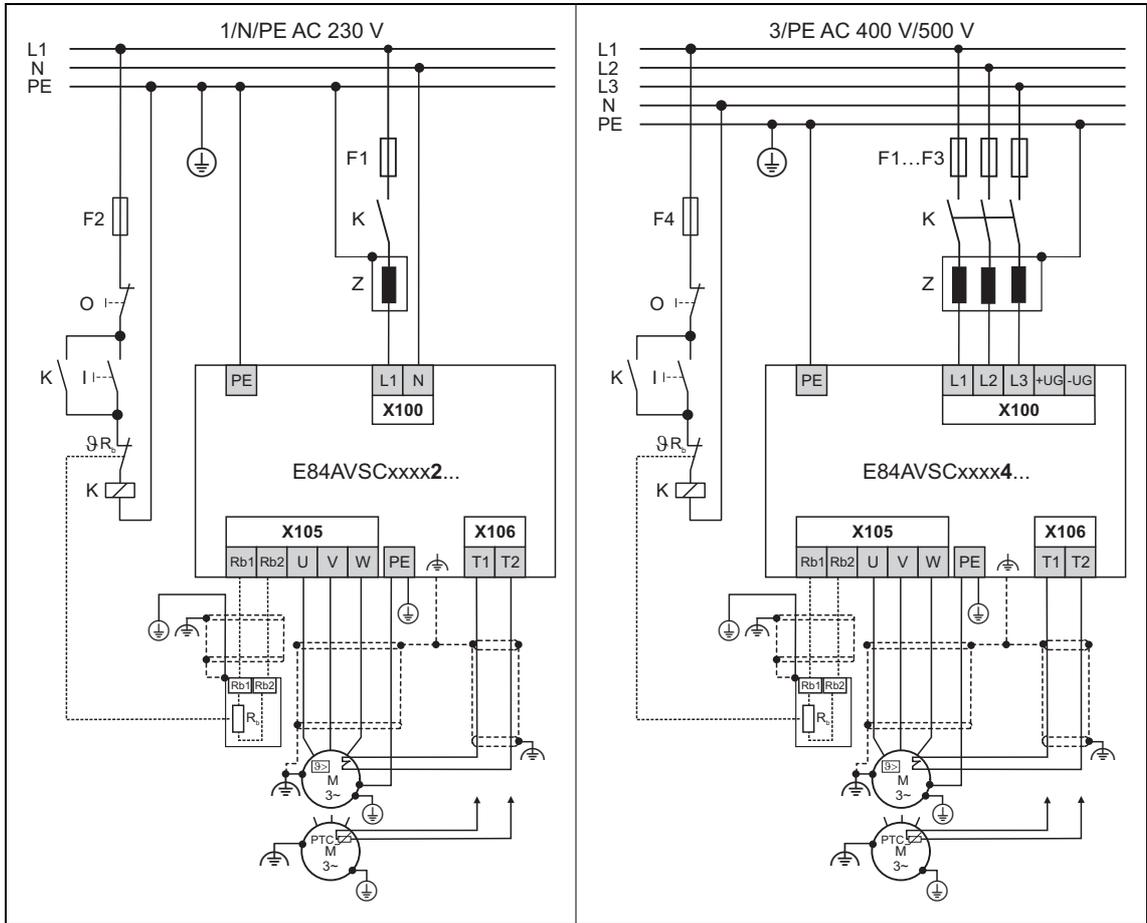
Control terminals

	X1	CANopen connection
	S1	CANopen settings (Bus terminating resistor, baud rate and node address)
	X3	<ul style="list-style-type: none"> Analog inputs/outputs 10 V reference voltage Note: Voltage input A1U and current input A1I must <u>not</u> be used simultaneously!
	X4	<ul style="list-style-type: none"> Digital inputs/outputs (according to IEC 61131-2, type 1) External 24 V supply voltage (for control electronics) 24 V voltage output
	X6	Diagnostic interface (DIAG) <ul style="list-style-type: none"> For keypad (14) or PC connection (18)
	MMI	Slot for memory module (19) <ul style="list-style-type: none"> MMI = abbreviation for "Memory Module Interface"
	LED	Status displays of the device status (44) <ul style="list-style-type: none"> ■ CAN-RUN ■ CAN-ERR ■ DRV-RDY ■ DRV-ERR

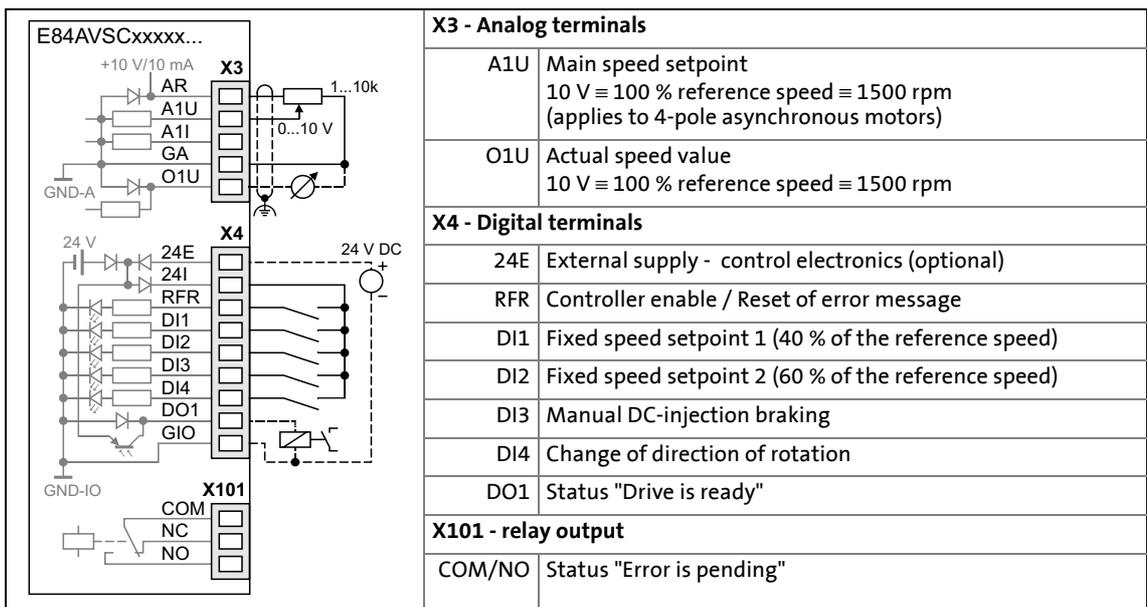
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	High leakage current! Carry out fixed installation and PE connection in accordance with EN 61800-5-1!
	Electrostatic sensitive devices! Before working on the device, the staff must ensure to be free of electrostatic charge!
	Hot surface! Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

4 Connection/wiring of the controller

4 Connection/wiring of the controller



[4-1] Wiring of the power and motor terminals of 230V devices (on the left) and 400V devices (on the right)



[4-2] Wiring of the control terminals / preconfigured assignment (Lenze setting)

5 Before commissioning

Being a component of a machine which includes a speed-variable drive system, the controller needs to be adjusted to its drive task. The controller is adjusted by changing parameters which are saved in the memory module. The parameters can be accessed by keypad, by the »EASY Starter« or by the »Engineer«. Access is also possible by a master control via fieldbus communication, e.g. via CAN bus.



Danger!

In general, changing a parameter causes an immediate response in the controller!

This may lead to undesirable behaviour on the motor shaft if the controller has been enabled! Setpoint sources, for instance, may switch over all of a sudden (e.g. when configuring the signal source for the main setpoint).

Certain device commands or settings which may cause critical states of drive behaviour constitute exceptions. Such parameter changes are only possible if the controller is inhibited. Otherwise, a corresponding error message will be issued.

5.1 Selection of the appropriate commissioning tool

There are several possibilities for commissioning the 8400 StateLine controller:



Commissioning with keypad X400 (diagnosis terminal X400)

The keypad is an alternative to the PC for the local operation, parameterisation, and diagnostics in a simple manner. The keypad is especially suitable for test or demonstration purposes and if only a few parameters have to be adapted.



Commissioning with PC and »EASY Starter«

The »EASY Starter« is a Lenze tool for easy online diagnostics, parameter setting and commissioning of the controller.



Commissioning with PC and »Engineer«

The »Engineer« is a Lenze engineering software for parameter setting across all devices, configuring and diagnosing individual components (as for instance controllers, industrial PCs, motors, I/O systems) and machine control systems.

**Tip!**

The Engineering tools »EASY Starter« and »Engineer StateLevel« are provided free of charge in the internet:

<http://www.Lenze.com> → Download → Software downloads

For communication between PC and controller, the USB diagnostic adapter can be used for instance (see the following accessories overview).

Accessories for commissioning

Version	Features	Product key
Keypad X400 	<ul style="list-style-type: none"> • Menu navigation • Backlighted graphic display for comfortably representing information • 4 navigation keys, 2 context-sensitive keys • Adjustable RUN/STOP function • Hot-plug capable • Can be used for L-force Inverter Drives 8400 and Servo Drives 9400 	EZAEBK1001
Diagnosis terminal X400 	<ul style="list-style-type: none"> • Keypad X400 in a robust housing • Also suitable for installation into the control cabinet door • incl. 2.5 m cable • Enclosure IP20, in case of front installation in control cabinet IP65 	EZAEBK2001
USB diagnostic adapter 	<ul style="list-style-type: none"> • Input-side voltage supply via USB connection from PC • Output-side voltage supply via the diagnostic interface of the controller • Diagnostic LED • Electrical isolation of PC and controller • Hot-plug capable 	E94AZCUS
Connecting cable for USB diagnostic adapter	2.5 m length	EWL0070
	5 m length	EWL0071
	10 m length	EWL0072

5.2 General notes on parameters

All parameters for controller parameterising or monitoring are saved as so-called "codes".

- The codes are numbered and indicated by the prefix "C" before the code, e.g. "C00002".
- Moreover, each code has a name and specific attributes, as for example access type (reading, writing), data type, limit values and default setting ("Lenze setting").
- For the sake of clarity, some codes contain "subcodes" for saving parameters. This Manual uses a slash "/" as a separator between code and subcode, e.g. C00118/3".
- According to their functionality, the parameters are divided into three groups:
 - Setting parameters: For specifying setpoints and for setting device / monitoring functions.
 - Configuration parameters: For configuring signal connections and terminal assignments.
 - Diagnostic/display parameters: For displaying device-internal process factors, current actual values and status messages.

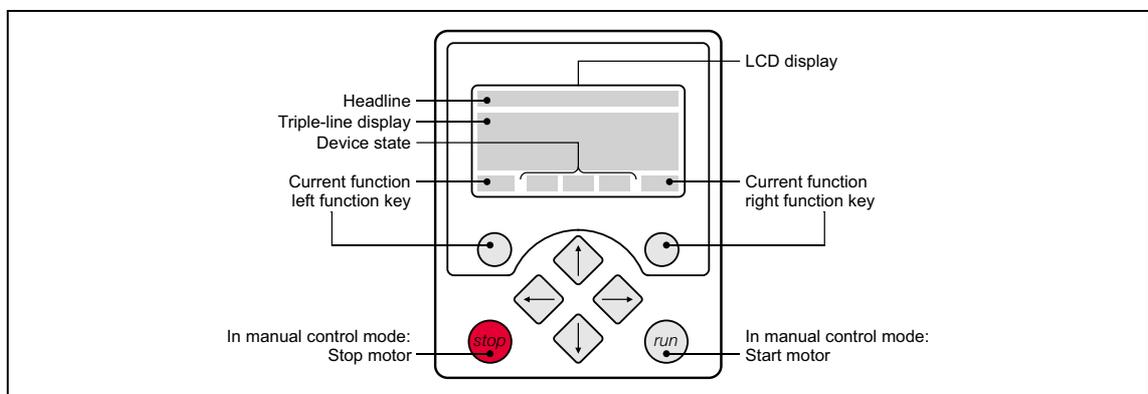
5.2.1 Changing the parameterisation with the keypad



The keypad is simply plugged on the diagnostic interface X6 ("DIAG") at the front of the standard device.

Plugging and unplugging the keypad is possible during operation.

Keypad display and control elements



LCD display			
Headline			
In the menu level: Menu name In the parameter level: Parameter name			
Three-part display			
In the menu level: List of available menus In the parameter level: Code/subcode and setting or actual value			
Device status			
RDY	Controller is switched on	IMP	Pulse inhibit is active
RUN	Controller is enabled	ISFLT	System fault is active
CINH	Controller is inhibited	IFLT	"Fault" device status is active
QSP	Quick stop is active	ITRB	Device status "Trouble" active
Imax	Current limit exceeded	ITQSP	Device status "TroubleQSP" active
Mmax	Speed controller 1 in the limitation	WRN	A warning is indicated
Function - left function key		Function - right function key	
EDIT	Change parameter setting (change to editing mode)	OK	Accept change in the controller (no saving with mains failure protection → SAVE)
	Back to main menu	ESC	Abort (discard change)
CINH!!	Parameter can only be changed when the controller is inhibited.		
SAVE	Save all parameter settings in the memory module safe against mains failure		

Control elements	
	Execute the function assigned to the function key (see LCD display)
	Execute the stop function set in C00469 (Lenze setting: Inhibit controller)
	Deactivate stop function again (Lenze setting: Enable controller again)
	In the menu level: Select menu/submenu
	In the parameter level: Select parameter In the editing mode: Change marked digits or select list entry
	In the menu level: Select submenu/change to parameter level In the editing mode: Cursor to the right
	In the menu level: One menu level higher (if available) In the parameter level: Back to menu level In the editing mode: Cursor to the left

Menu structure

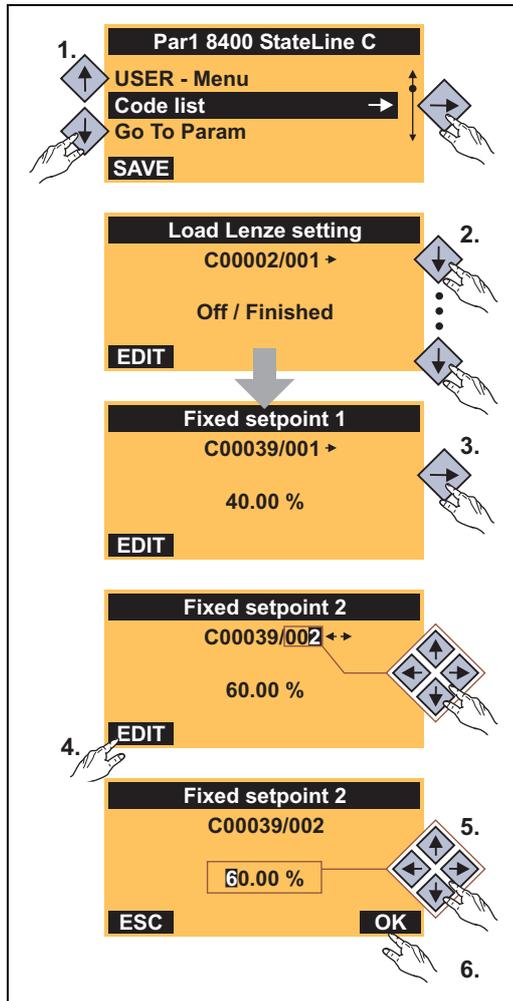
In the keypad, the parameters are classified into various menus and submenus.

- The **USER menu** includes a selection of frequently used parameters. (📖 20)
- The **Code list** contains all parameters.
- The **Go to param** function enables you to reach the corresponding parameter directly.
- The **Logbook** logs all errors and their chronological history.
- The **Diagnostics** menu contains diagnostic/display parameters for displaying device-internal process factors, current actual values and status messages.

5 Before commissioning

5.2 General notes on parameters

General operation



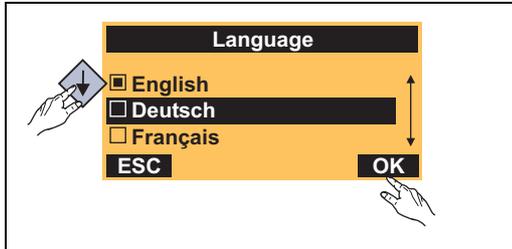
[5-1] Example: Change parameter with the keypad

1. Use the \uparrow/\downarrow navigation keys to select the desired menu.
 - Use the \leftarrow/\rightarrow navigation keys to reach a higher/lower menu level.
 - Use the \equiv function key to return to the main menu.
2. Use the \uparrow/\downarrow navigation keys to select the parameter to be set within a submenu.
3. In order to select another subcode in case of a parameter with subcodes:
 - Press the navigation key \leftarrow to change to the editing mode for the subcode.
 - Use the navigation keys to set the desired subcode.
4. Use the **EDIT** function key to switch over to the editing mode.
5. Use the navigation keys to set the desired value.
6. Use the **OK** function key to accept the change and to leave the editing mode.
 - Use the **ESC** function key to leave the editing mode without accepting the change.

Multilingualism

All texts displayed in the keypad are in English.

From version 11.00.00 onwards, the most important menus as well as diagnostic and configuration parameters can also be available in German and French. To set a different language, select the **Language selection** menu item in the main menu of the keypad.



- The multilingual texts are stored in the controller and do not have to be loaded into the device.
- For reasons of disc space, only the most important menus and parameters as well as the error messages are available in several languages.

User level

From version 12.00.00, the extension of the menus, submenus and codes shown in the keypad can be adapted by selecting the "user level" in C00001/1:

- **Standard** user level (Lenze setting): Only the most important menus and codes are displayed in the keypad.
- **Expert** user level: All menus and codes are displayed in the keypad.
- **Service** user level: Only for the purpose of service (Lenze Service).

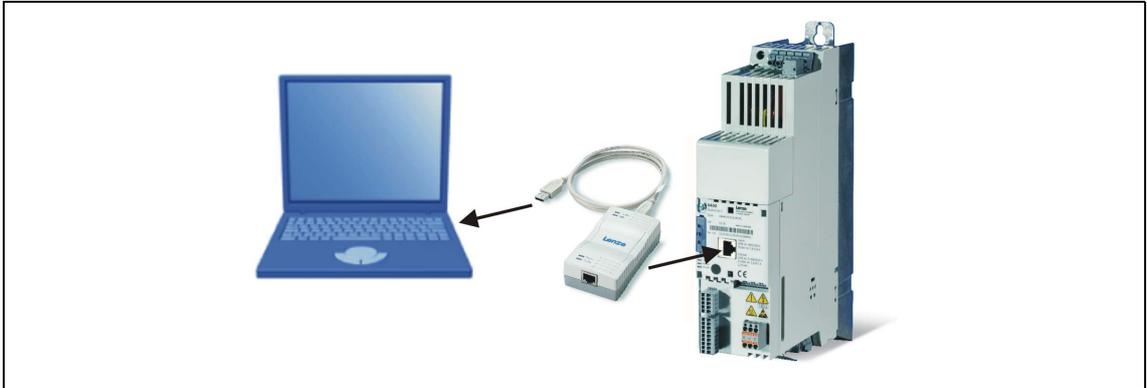
After changing the user level, the menus in the keypad are restructured according to the selected user level. The parameters of plugged-in communication module are always shown completely independent of the set user level.

5 Before commissioning

5.2 General notes on parameters

5.2.2 Change parameter settings with PC and Lenze software

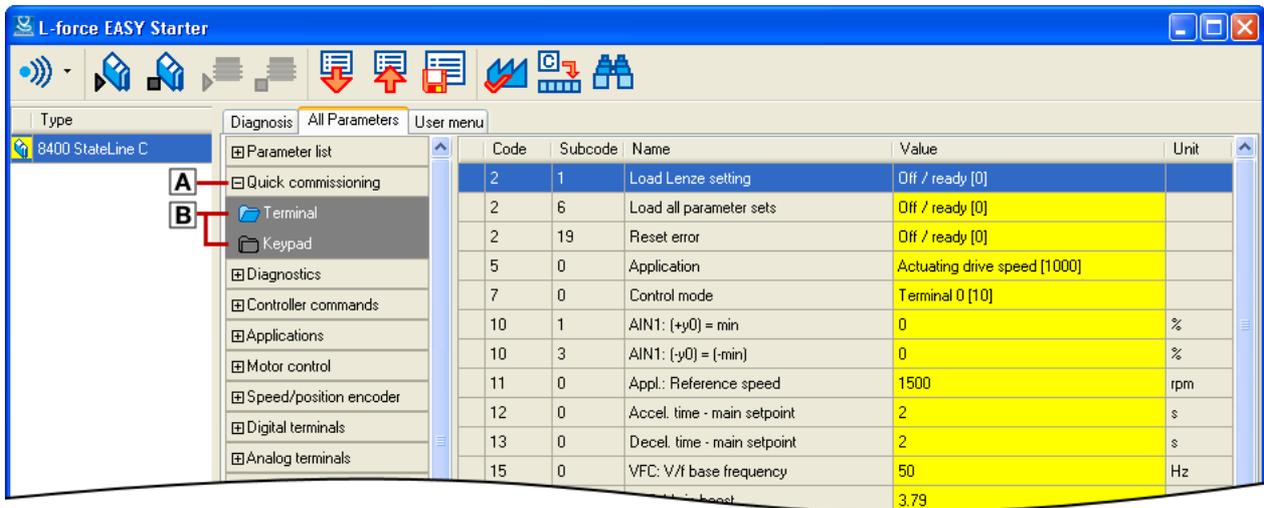
The USB diagnostic adapter, for instance, can be used for the communication between the PC (including the »EASY Starter« or »Engineer« software) and the controller, see the following illustration. The USB diagnostic adapter is the connection between the PC (free USB port) and the controller (X6 diagnostic interface).



[5-2] Exemplary constellation for parameterising the controller

The **All parameters** tab in the »EASY Starter« and the »Engineer« provides a quick access to all parameters of the controller.

The given categories (A) and subcategories (B) correspond 1:1 to the menus and submenus of the keypad:



[5-3] All parameters tab in the »EASY Starter«

Moreover, the »Engineer« provides a commissioning interface on the **Application parameters** tab where you can commission the application in a few steps.



Detailed information on how to handle the »Engineer« can be found in the integrated online help that you can call with the **[F1]** function key.

5.2.3 Save parameter settings in the memory module safe against mains failure

Controller parameter changes via the EASY Starter /»Engineer«, the keypad, or a master control via fieldbus communication will be lost after mains switching of the controller unless the settings have been explicitly saved to the integrated memory module.

General information

- In the delivery state, the Lenze setting of the parameters has been saved to the integrated memory module.
- When the device or the external 24 V voltage supply is switched on, all parameters are automatically loaded from the memory module into the main memory of the controller.
- Full functionality of the memory module is even provided if the power supply has been switched off and only the electronic components of the controller are externally supplied by a 24 V DC voltage, e.g. via the X4/24E terminal.

Save parameters

- Using the keypad, you can press function key **SAVE** to save the parameter settings.
- The »EASY Starter«/»Engineer« serves to execute the saving via the icon  in the *toolbar* or via the device command "Save all parameter sets" ([C00002/11](#) = "1: On / start").
 - The storage process may take a couple of seconds. After the device command has been called in [C00002/11](#), dynamic status information ("Work in progress 20%" → "Work in progress 40%" → "Work in progress 60%", etc.) is returned.



Note!

In order to prevent data inconsistencies during the saving process:

- Do not switch off the supply voltage!
- Do not remove the memory module from the device!

5.2.4 User menu for quick access to frequently used parameters

When a system is installed, parameters must be changed time and again until the system runs satisfactorily. The user menu of a device contains a selection of frequently used parameters to be able to access and change these parameters quickly.

Parameter	Name	Lenze setting
C00051	Display of actual speed value	-
C00053	Display of DC-bus voltage	-
C00054	Display of motor current	-
C00061	Display of heatsink temperature	-
C00137	Display of device status	-
C00166/3	Display of current error message	-
C00011	Reference speed	1500 rpm
C00039/1	Fixed setpoint 1	40.00 %
C00039/2	Fixed setpoint 2	60.00 %
C00012	Acceleration time - main setpoint	2.000 s
C00013	Deceleration time - main setpoint	2.000 s
C00015	V/f base frequency	50 Hz
C00016	Vmin boost	1.60 %
C00022	I _{max} in motor mode	depending on the device power
C00120	Setting of motor overload (I ² xt)	100.00 %
C00087	Rated motor speed	1460 rpm
C00099	Display of firmware version	-
C00200	Display of firmware product type	-
C00105	Decel. time - quick stop	2.000 s
C00173	Mains voltage	0: "3ph 400V / 1ph 230V"

Highlighted in grey = display parameter



Tip!

The user menu can be freely configured in C00517.

In the »Engineer«, you can configure the user menu comfortably via the **User menu** tab (see »Engineer« online help).

The password protection serves to restrict the access to the parameters of the user menu. Then, all other parameters cannot be accessed without knowing the password and thus protected against unwanted changes.

5 Before commissioning

5.3 General notes on applications

5.3 General notes on applications

The technology applications integrated in the drive controller provide the main signal flow for the implementation of a general or a special drive solution.



Technology application "Actuating drive speed"

This technology application preset in C00005 serves to solve speed-controlled drive tasks, e.g. conveyor drives (interconnected), extruders, test benches, vibrators, travelling drives, presses, machining systems, metering units.



Technology application "actuating drive speed (AC Drive profile)"

This technology application selectable from version 13.00.00 in C00005, enables a speed or torque control via "AC Drive profile". The fieldbuses EtherNet/IP™ and system bus (CANopen) are supported.



"Switch-off positioning" technology application

This technology application to be selected in C00005 is used to solve speed-controlled drive tasks which require a pre-switch off or stopping at certain positions, e.g. roller conveyors and conveying belts.

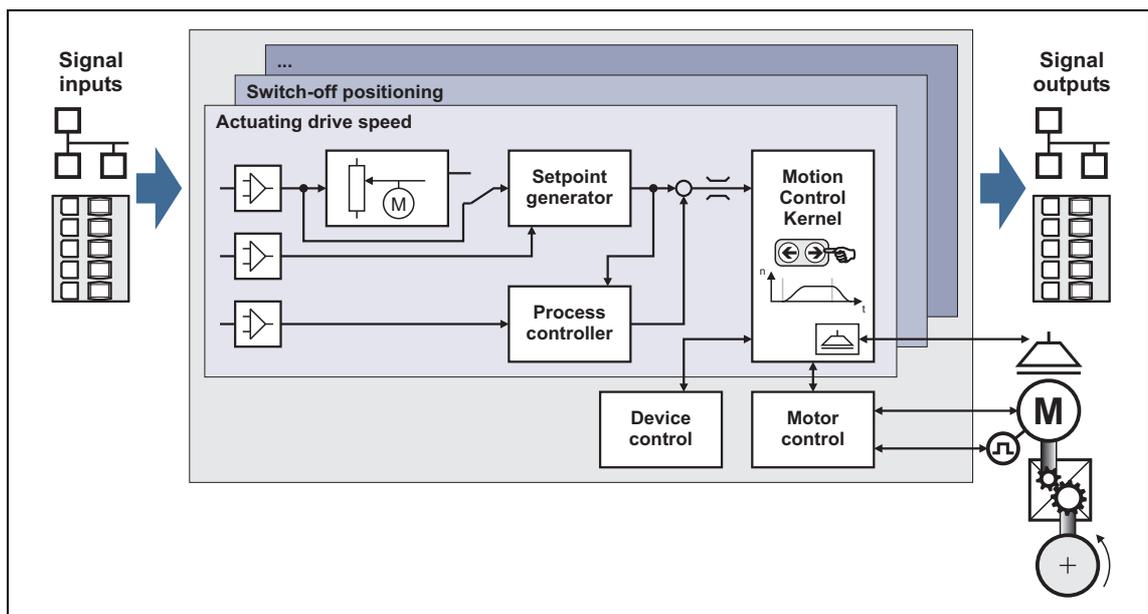


Detailed information on each application can be found in the reference manual of the 8400 StateLine in the "Technology application" chapter .

Basic components of a drive solution

A drive solution consists of the following basic components:

- Signal inputs (for control and setpoint signals)
- Signal flow of the technology application
- Signal outputs (for status and actual value signals)



[5-4] Basic components of a drive solution

5 Before commissioning

5.3 General notes on applications

5.3.1 Select control mode

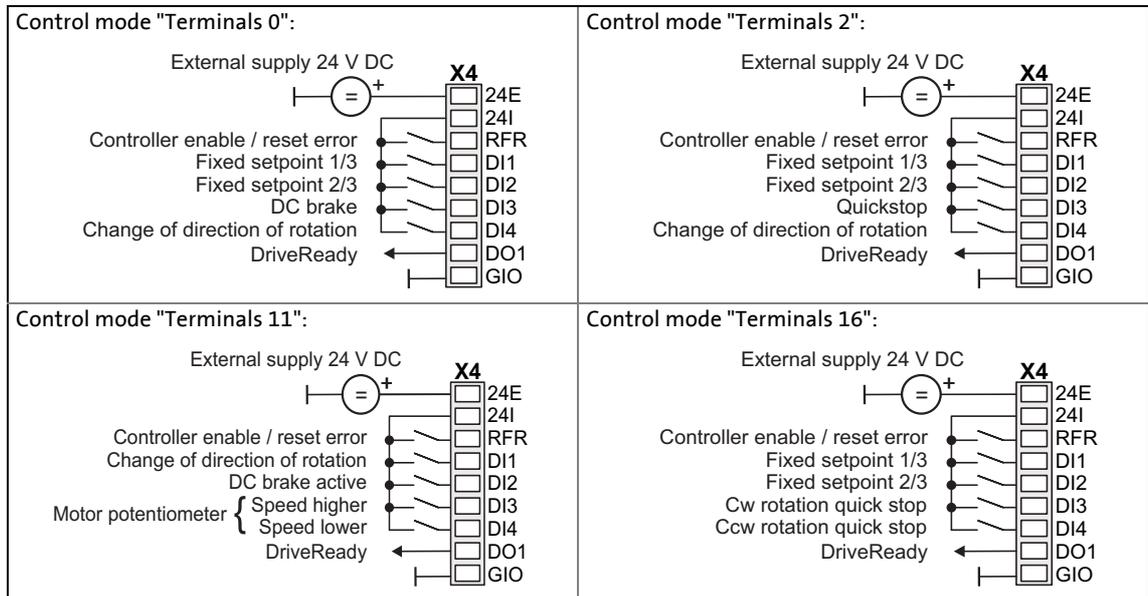
Different control modes can be selected for every application in C00007. By selecting the control mode you set the way the technology application should be controlled, e.g. via terminals or via a fieldbus.

C00007

Control mode		Info
Selection list (Lenze setting printed in bold)		
0	Wiring has changed	This display appears if the FB interconnection has been changed in the preconfigured I/O interconnection.
10	Terminals 0	The technology application is controlled via the digital and analog input terminals of the controller. • For a short overview of the preconfigured terminal assignment, see the following segment.
12	Terminals 2	
14	Terminals 11	
16	Terminal 16	
20	Keypad	The technology application is controlled via the keypad.
21	PC	See reference manual.
30	CAN	
40	MCI	

Pre-assignment of the digital terminals in the control modes "Terminals 0/2/11/16"

The four control modes "Terminals 0/2/11/16" only differ in the assignment of the digital terminals to the control inputs of the application:



Comparison of the control modes "Terminals 0/2/11/16"

The following table shows which functions of the preset application "actuating drive speed" have been preconfigured in the prevailing control mode for a control via terminals (Lenze setting printed in bold):

Control mode "terminals"...				Function of the application "actuating drive speed"	Info	
0	2	11	16			
DI1 DI2	DI1	-	DI1	Overriding fixed setpoints	Alternatively to the speed selection via the analog input, "fixed setpoints" (JOG values) can also be activated via the digital terminals.	
	DI2		DI2			DI1 DI2 Speed selection
						LOW LOW Via analog input 1 (Terminal A1U)
						HIGH LOW Fixed setpoint 1 (C00039/1: 40 %)
						LOW HIGH Fixed setpoint 2 (C00039/2: 60 %)
			HIGH HIGH Fixed setpoint 3 (C00039/3: 80 %)			
DI3	-	DI2	-	Manual DC-injection braking	Manual DC-injection braking allows the drive to be quickly braked to a standstill without the need to use an external brake resistor.	
-	DI3	-	-	Quick stop	The quick stop function decouples the motor control from the setpoint selection. The motor is braked to standstill with the adjustable ramp time ($n_{act}=0$).	
DI4	DI4	DI1	-	Change of direction of rotation		
-	-	-	DI3 DI4	Fail-safe selection of direction of rotation		
					DI3 DI4 Selection of direction of rotation	
					LOW LOW Quick stop	
					HIGH LOW Clockwise rotation	
					LOW HIGH Counter-clockwise rotation	
					HIGH HIGH No change	
-	-	DI3 DI4	-	Motor potentiometer	This motor potentiometer function replaces a hardware motor potentiometer and can be used as an alternative setpoint source which is controlled via two inputs. ▶ Motor potentiometer (📖 65)	
					DI3 DI4 Function	
					LOW LOW No change	
					HIGH LOW Increase speed	
					LOW HIGH Decrease speed	
					HIGH HIGH No change	
-	-	-	-	Process controller	If required, the process controller can be implemented in the signal flow of the application via configuration parameters. ▶ Process controller (📖 68)	

5 Before commissioning

5.4 Frequently used device commands

5.4 Frequently used device commands

The device commands available in the subcodes of C00002 serve, among other things, to directly control the controller, to organise parameter sets, and to call diagnostic services.

Regarding the execution of the device commands, a distinction is drawn between:

- Device commands which have an immediate effect on control (e.g. "Delete logbook")
 - After being called in C00002/x, these device commands provide static status information ("On" or "Off").
- Device commands with longer execution duration (several seconds)
 - After being called in C00002/x, these device commands provide dynamic status information ("work in progress 20 %" → "work in progress 40 %", etc.).
 - The execution of the device command has not finished successfully until the "Off / ready" status information is provided in C00002/x.
 - In the event of an error, the "Action cancelled" status information is provided in C00002/x. In this case, further details can be obtained from the status of the device command executed last which is displayed in C00003.

	Parameter	Name	Controller inhibit required	Status information
Commands	C00002/1	Load Lenze setting	●	dynamic
	C00002/11	Save all parameter sets		dynamic
	C00002/19	Reset error		static
	C00002/21	Delete logbook		static
	C00003	Status of the last device command		

C00002/1

Load Lenze setting		
This device command serves to reset all parameter settings in the device to the Lenze setting in order to keep a defined device configuration.		
Note: All parameter changes which have been carried out after the last time the parameter set was saved will be lost!		
<ul style="list-style-type: none"> • Only possible when the controller is inhibited. 		
Selection list (Lenze setting printed in bold)		Info
0	Off / ready	
1	On / start	Reset all parameters to the Lenze setting (Restore delivery status)

C00002/11

Save all parameter sets		
Note: During the storage process:		
<ul style="list-style-type: none"> • Do not switch off the supply voltage! • Do not remove the memory module from the device! 		
Selection list (Lenze setting printed in bold)		Info
0	Off / ready	
1	On / start	Save parameter settings in the memory module of the controller safe against mains failure

5 Before commissioning

5.5 Check software version (firmware version) | C00002/19

C00002/19

Reset error		
Note: After the reset (acknowledgement) of the current error, further errors may be pending which must also be reset. <ul style="list-style-type: none">The current error is displayed in C00170.		
Selection list (Lenze setting printed in bold)		Info
0	Off / ready	
1	On / start	Reset (acknowledge) current error

C00002/21

Delete logbook		
Selection list (Lenze setting printed in bold)		Info
0	Off / ready	
1	On / start	Delete all entries in the logbook of the controller

C00003

Status of the last device command		
Status of the device command executed last (C00002).		
Note: Before switching off the supply voltage after carrying out a device command, check whether the device command has been carried out successfully via the status display!		

5.5 Check software version (firmware version)

Particularly with regard to the use of older controllers (e.g. if the customer is using one from stock) it makes sense to check the software (firmware) version.



The software version of the controller can be seen on the nameplate in the "HW/SW" line and can be determined by reading out code C00099.

6 Commissioning

6.1 Drive behaviour by default (Lenze setting)

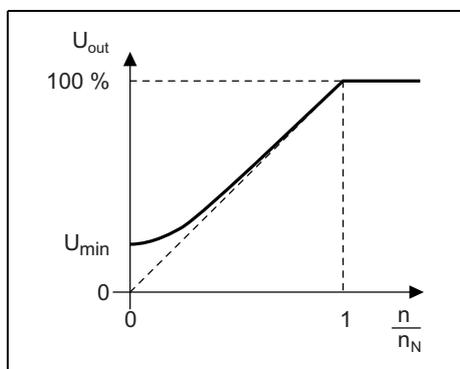
6 Commissioning

6.1 Drive behaviour by default (Lenze setting)

Preset motor control "V/f characteristic control (VFCplus)"

The 8400 StateLine controller supports various processes for motor control. By default, the V/f characteristic control (VFCplus) with linear characteristic for asynchronous motors is preset in C00006 as motor control.

The V/f characteristic control (VFCplus) is a motor control mode for standard frequency inverter applications based on a simple and robust control process which is suitable for the operation of asynchronous motors with linear or square-law load torque characteristic (e.g. fans). Furthermore, this motor control mode is also suitable for group drives and special motors. Due to the low parameterisation effort, commissioning of such applications is fast and easy.



The motor voltage of the inverter is determined by means of a linear characteristic depending on the field frequency or motor speed to be generated. The voltage follows a preselected characteristic.

[6-1] Principle of a linear V/f characteristic

The presettings of the parameters ensure that the controller is ready for operation right away and the motors works adequately without further parameterisation if a controller and a 50 Hz asynchronous machine with matching performances are assigned.



Tip!

More possible processes for motor control:

- Energy-saving V/f characteristic control (VFCplusEco)
- V/f control (VFCplus + encoder)
- Sensorless vector control (SLVC)
- Sensorless control for synchronous motors (SLPSM)



Detailed information on the various processes can be found in the reference manual of the 8400 StateLine in the "Motor control (MCTRL)" chapter.

6.2 Quick commissioning with the keypad

Target: For test and demonstration purposes, the load-free motor shall be rotated in best time with an amount of wiring as little as possible and few settings.

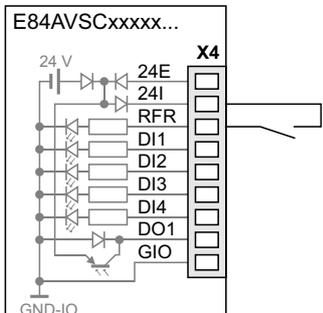
Control via terminals or keypad?

For this simple application, you can choose between two drive control options:

- Terminal control (default setting):
 - A setpoint potentiometer connected to the analog voltage input of the controller serves as speed setpoint source.
 - The control signals are selected via the digital inputs of the controller.
- Keypad control:
 - The speed setpoint is selected with the keypad via C00728/3.
 - The control signals are selected with the keypad via C00727/1...5.

Required commissioning steps

1. Wiring of power and control terminals.
 - Refer to the mounting instructions supplied with the drive controller to find help on how to correctly design the power connections to match the requirements of your device.
 - A wiring example can be found in the chapter "[Connection/wiring of the controller](#)". (11)
 - For keypad control, only terminal X4/RFR of the control terminals (for controller enable) must be wired:

Digital terminals (X4)	Name	Function	
	RFR	HIGH level	Controller enable
		HIGH↔LOW	Reset error message
		LOW level (or open)	Controller inhibit

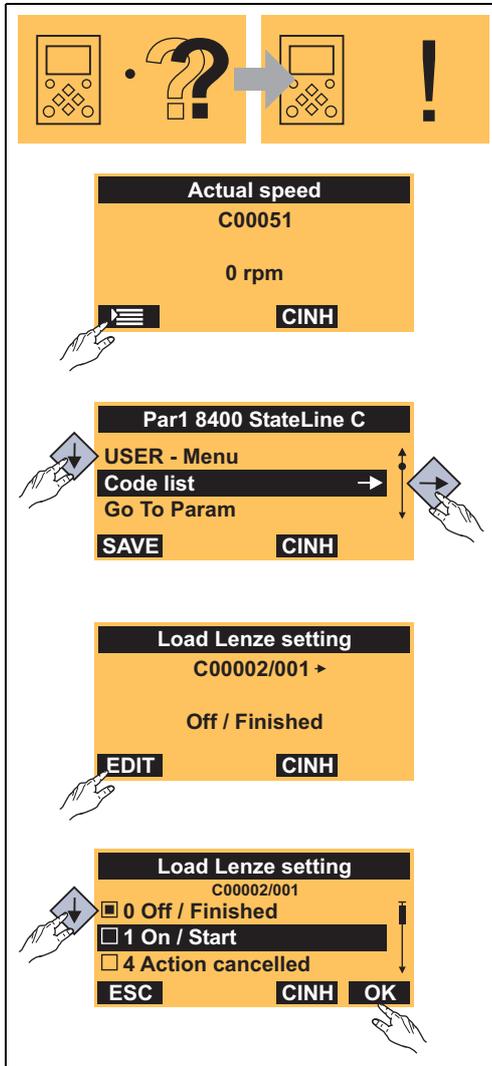
2. Inhibit controller: Set terminal X4/RFR to LOW level or open contact.
3. Switch on voltage supply of the controller.
 - Without motor operation: Connect external 24 V supply.
 - With motor operation: Connect mains voltage.

If the green "DRV-RDY" LED is blinking and the red "DRV-ERR" LED is off, the controller is ready for operation and commissioning can proceed.

4. Load Lenze setting to controller.

This step is recommended to get a defined device configuration. All parameter settings in the controller are reset to the Lenze setting.

The Lenze setting can only be loaded if the controller is inhibited!



After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established.

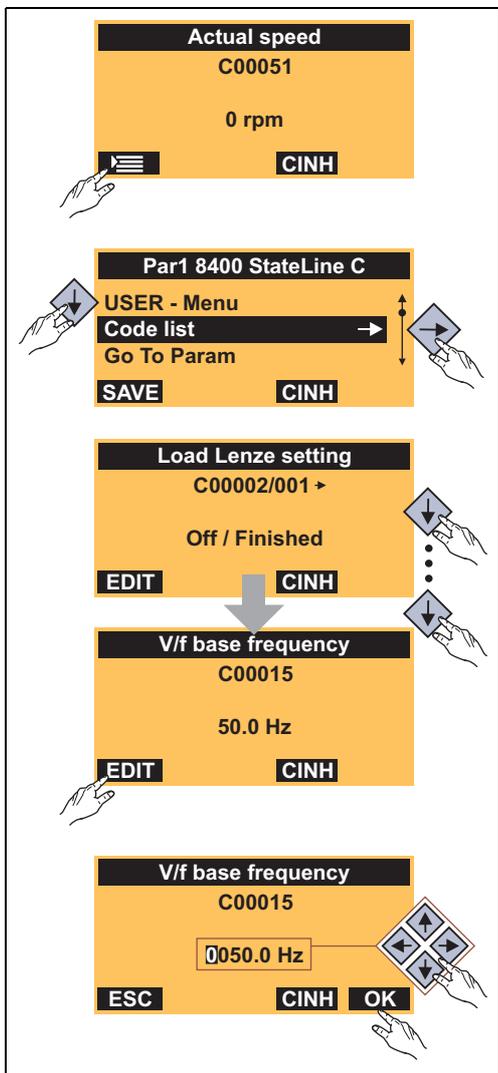
The connection has been established when the code C00051 appears in the display.

- Then press the function key **≡** to change to the main menu.
- Use the **⬆**/**⬇** navigation keys to select the "Code list" entry.
- Change to this level by pressing the navigation key **⬆**.
 - The **code list** contains all parameters of the controller.
 - The "Load Lenze setting" device command (C00002/001) is the first parameter in the **code list**.
- Use the **EDIT** function key to switch over to the editing mode.
- Use the **⬆**/**⬇** navigation keys to select the "1 On / Start" entry.
- Use the **OK** function key to accept the selection and to leave the editing mode.

Now the Lenze setting is being loaded and then the controller will be restarted.

5. Optional settings

V/f base frequency: If the rated motor voltage differs from the mains voltage, the V/f base frequency has to be adapted.



Based on the restart of the controller after loading the Lenze setting:

- Press the function key to change to the main menu.
- Go to the main menu and use the navigation keys to select the "Code list" entry.
- Change to this level by pressing the navigation key .
- Navigate to the parameter C00015 by repeatedly pressing the navigation key.
- Then use the **EDIT** function key to switch over to the editing mode.
- Set the value according to the following formula using the navigation keys:

$$C00015 \text{ [Hz]} = \frac{U_{FI} \text{ [V]}}{U_{Ratedmot} \text{ [V]}} \cdot f_{Rated} \text{ [Hz]}$$

$U_{frequency\ inverter}$: Mains voltage 400 V or 230 V

$U_{ratedmot}$: Rated motor voltage depending on the connection method

f_{rated} : Rated motor frequency

- Use the **OK** function key to accept the changed setting and to leave the editing mode.

Reference speed: Depending on the setting of the V/f base frequency, it may be required to adapt the setting of the reference speed in C00011 to go through the entire speed range of the motor. (for general procedure see above.)

Vmin boost: The Vmin boost of the motor voltage serves to select a load-independent magnetising current which is required for asynchronous motors. The torque behaviour of the motor can be optimised by adapting the setting in C00016. (for general procedure see above.)

6. For keypad control instead of terminal control:



- Navigate to the parameter C00007 (for general procedure with keypad see step 5).
- Set the "20 keypad" selection.

7. Save parameter settings safe against mains failure.

- Unless the settings have been changed explicitly in the integrated memory module, the executed parameter changes will get lost after mains switching of the controller.
- Using the keypad, you can press function key **SAVE** to save the parameter settings.

8. Enable controller and select speed setpoint.

For this purpose, observe the following segments!

Enable controller



Stop!

Before stipulating a speed setpoint, check whether the brake in the form of a holding brake on the motor shaft has been released!



Note!

If the controller is enabled at mains power-up, the controller remains in the "ReadyToSwitchOn" status when being in the Lenze setting (the green LED "DRV-RDY" flashes twice approx. every 1.25 seconds).

To be able to change to the "SwitchedOn" status, the controller enable must be deactivated first: set terminal X4/RFR to LOW level.

If the controller's status is "SwitchedOn", (the green LED "DRV-RDY" flashes every second):

- Enable controller: Set terminal X4/RFR to HIGH level.
 - Unless another source is active for controller inhibit, the controller switches from "SwitchedOn" to "OperationEnabled" (the green LED "DRV-RDY" is permanently on).
 - Now the drive follows the setpoint selection (see the following segment).
 - The actual speed value is displayed in C00051.
- Inhibit controller again: Set terminal X4/RFR to LOW level.

Select speed setpoint

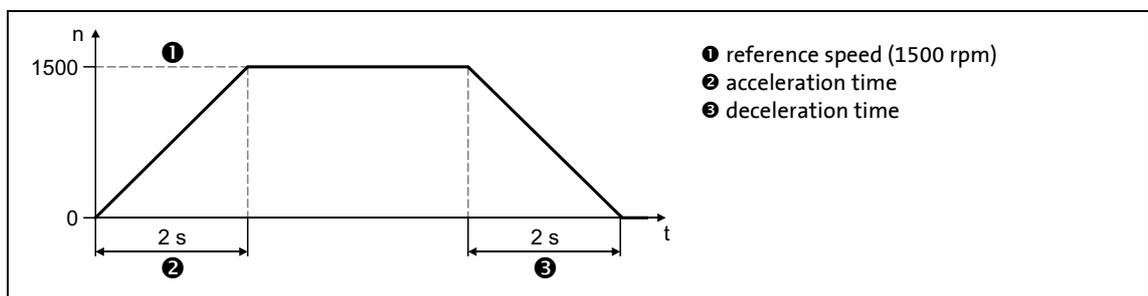
In case of terminal control in the preset control mode "Terminals 0":

- In the Lenze setting, the main speed setpoint is selected via the analog terminal X3/A1U (e.g. via a setpoint potentiometer).
 - Scaling: 10 V \equiv 100 % reference speed (C00011) \equiv 1500 rpm (applies to 4-pole asynchronous motors)

In case of keypad control:

1. Navigate to parameter C00728/3.
2. Set the desired setpoint speed in [%] with regard to the reference speed set in C00011 (CCW rotation: -199.99 % 0, CW rotation: 0 ... +199.99 %).

In order to prevent jumps, the main speed setpoint is led via a ramp generator with linear ramps:



[6-2] Speed profile with preset ramp generator with linear ramps

Using fixed setpoints

Alternatively to the setpoint selection via the analog input or C00728/3. "fixed setpoints" can also be activated according to the following truth table:

Terminal control		Keypad control		Speed selection
DI1	DI2	C00727/5	C00727/4	
LOW	LOW	0	0	The setpoint speed is selected via the analog input 1 or with keypad control via C00728/3.
HIGH	LOW	1	0	Setpoint speed = fixed setpoint 1 (C00039/1: 40 %)
LOW	HIGH	0	1	Setpoint speed = fixed setpoint 2 (C00039/2: 40 %)
HIGH	HIGH	1	1	Setpoint speed = fixed setpoint 3 (C00039/3: 40 %)

- Fixed setpoints refer to the reference speed set in C00011.

Other control functions

...in the preset control mode "Terminals 0" or with keypad control:

Terminal control	Keypad control	Function
DI3	C00727/2	
HIGH	1	Manual DC-injection braking <ul style="list-style-type: none"> • Manual DC-injection braking allows the drive to be quickly braked to a standstill without the need to use an external brake resistor. • The maximum braking torque to be generated by the DC braking current is approx. 20 ... 30 % of the rated motor torque. It is lower than that for braking in generator mode with an external brake resistor. • The DC-injection braking remains active as long DI3 is at HIGH level or C00727/2 is set to "1".

Terminal control	Keypad control	Function
DI4	C00727/3	
LOW	0	Direction of rotation CW (clockwise)
HIGH	1	Direction of rotation CCW (counter-clockwise)

**More information in this manual:**

- The following chapter contains the most important parameters for a quick commissioning.
- Chapter "[Diagnostics & troubleshooting](#)" informs about how detect and remove faults during commissioning. (44)
- Chapter "[Adapting the application individually](#)" describes further adaptation options of the application based on the respective function block interconnection. (55)

6.3 Adapting the most important parameters to the drive task

The following short overview contains the most important parameters for a quick commissioning.

- The following subchapters provide more detailed information on these parameters.
- A description of all parameters can be found in the reference manual of the controller and in the Engineer online help.

	Parameter	Name	Info/Lenze setting	
Basic settings	C00011	Appl.: Reference speed	1500 rpm	
	C00059	Appl.: Reference frequency C11	-	
	C00015	VFC: V/f base frequency	50.0 Hz	VFC = Voltage Frequency Control
	C00016	VFC: Vmin boost	1.60 %	
	C00022	I _{max} in motor mode	depending on the device power	
	C00120	Setting of motor overload (I ² xt)	100.00 %	
	C00142	Auto-start option	0x19 ≡ Controller inhibit when <ul style="list-style-type: none"> • the controller is switched on (device on) • Undervoltage • Loading of the Lenze setting 	
	C00173	Mains voltage	0: "3ph 400V / 1ph 230V"	
Application parameters	C00034/1	AIN1: Configuration	0: "-10...+10 v"	AIN1 = analog input
	C00026/1	AIN1: Offset	0.00 %	
	C00027/1	AIN1: Gain	1.0000	
	C00010/x	AIN1: Characteristic	see parameter description	
	C00012	Acceleration time - main setpoint	2.000 s	
	C00013	Deceleration time - main setpoint	2.000 s	
	C00039/1	Fixed setpoint 1	40.00 %	
	C00039/2	Fixed setpoint 2	60.00 %	
	C00039/3	Fixed setpoint 3	80.00 %	
	C00105	Decel. time - quick stop	2.000 s	
	C00114	Dlx: Polarity	No inversion	Dlx = digital inputs
	C00118	DOx: Polarity	No inversion	DOx = digital outputs
	C00434/1	O1U: Gain	100.00 %	O1U = analog output (voltage output)
	C00435/1	O1U: Offset	0.00 %	
Motor control	C00006	Motor control	6: "VFCplus:V /f linear"	
	C00018	Switching frequency	2: "8 kHz var./drive-opt."	
	C00021	Slip compensation	2.67 %	
	C00019	Auto-DCB: Threshold	3 rpm	DCB = DC-injection braking
	C00036	DC braking: Current	50.00 %	
	C00106	Auto-DCB: Hold time	0.500 s	
	C00910/1	Max. pos. output frequency	1000 Hz	
	C00910/2	Max. neg. output frequency	1000 Hz	
Highlighted in grey = display parameter				

6.3.1 Basic settings

Parameter	Name	Lenze setting	
Basic settings	C00011	Appl.: Reference speed	1500 rpm
	C00059	Appl.: Reference frequency C11	-
	C00015	VFC: V/f base frequency	50.0 Hz
	C00016	VFC: Vmin boost	1.60 %
	C00022	I _{max} in motor mode	depending on the device power
	C00120	Setting of motor overload (I ² t)	100.00 %
	C00142	Auto-start option	see parameter description
	C00173	Mains voltage	0: "3ph 400V / 1ph 230V"

C00011

Appl.: Reference speed			
Setting the reference speed			
<ul style="list-style-type: none"> In the controller, all speed-related signals are processed to one reference variable in percent. Set a reference speed here that corresponds to 100 %. The frequency that corresponds to the set reference speed is displayed in C00059. 			
Note:			
This is not a maximum limitation!			
All values in percent in the controller may be in a range of 0 ... 199.99 %.			
Setting range (min. value unit max. value)			Lenze setting
50	rpm	60000	1500 rpm

C00059

Appl.: Reference frequency			
Display of the field frequency which corresponds to the reference speed set in C00011 in the corresponding motor combination.			
Display range (min. value unit max. value)			
0.00	Hz	1300.00	

C00015

VFC: V/f base frequency			
V/f base frequency for V/f characteristic control and V/f control			
<ul style="list-style-type: none"> The V/f base frequency determines the slope of the V/f characteristic and has considerable influence on the current, torque, and power performance of the motor. 			
$00015 \text{ [Hz]} = \frac{U_{FI} \text{ [V]}}{U_{Ratedmot} \text{ [V]}} \cdot f_{Rated} \text{ [Hz]}$		V _{frequency inverter} : Mains voltage 400 V or 230 V V _{ratedmot} : Rated motor voltage depending on the connection method f _{rated} : Rated motor frequency	
When the motor to be used has been selected from the »Engineer« motor catalogue, the suitable value can be entered automatically. An automatic detection via the motor parameter identification is possible as well.			
Setting range (min. value unit max. value)			Lenze setting
7.5	Hz	2600.0	50.0 Hz

6

Commissioning

6.3

Adapting the most important parameters to the drive task

C00016

VFC: Vmin boost			
<p>Boost of the V/f voltage characteristic in the range of small speeds or frequencies with V/f characteristic control (VFCplus) and V/f control (VFCplus+encoder). This may increase the starting torque.</p> <ul style="list-style-type: none"> After the motor to be used has been selected from the »Engineer« motor catalogue, the suitable value can be entered automatically. An automatic detection via the motor parameter identification is possible as well. The general linear and quadratic V/f characteristics are shown in the illustrations below. The illustrations show the impacts of the parameters used to adapt the characteristic shape. 			
Setting range (min. value unit max. value)			Lenze setting
0.00	%	100.00	1.60 %

C00022

Imax in motor mode			
Maximum current in motor mode for all motor control modes			
Setting range (min. value unit max. value)			Lenze setting
0.00	A	655.35	depending on the device power

C00120

Setting of motor overload (I²xt)			
Operating threshold for the "OC6: Motor overload (I²xt)" error message			
<ul style="list-style-type: none"> If the calculated motor load reaches the operating threshold set here, the "Warning" error response is carried out in the Lenze setting. The error response can be set in C00606. 			
Setting range (min. value unit max. value)			Lenze setting
0.00	%	250.00	100.00 %

C00142

Auto-start option	
Starting performance of the controller after mains connection, undervoltage, loading of the Lenze setting as well as a reset of "Trouble" or "Fault" can be parameterised individually.	
Setting range (min. hex value max. hex value)	Lenze setting
0x00 0xFF	0x19 Decimal: 25 Binary: 00011001
The keypad displays the setting as bit string (bit 0 is at the rightmost position):	
	
Value is bit-coded: (☑ = bit set)	Info
Bit 0 <input checked="" type="checkbox"/> Inhibit at power-on	This option prevents the change to "SwitchedOn" after mains power-on if the controller is already enabled at mains power-on.  Danger! If the "Inhibit at power-on" auto-start option has been deactivated in , (bit 0 = 0), the motor can directly start to run if the controller is enabled after mains connection!
Bit 1 <input type="checkbox"/> Inhibit at trouble	
Bit 2 <input type="checkbox"/> Inhibit at fault	
Bit 3 <input checked="" type="checkbox"/> Inhibit at undervoltage	
Bit 4 <input checked="" type="checkbox"/> Inhibit at Lenze setting	After the Lenze setting has been loaded, this option prevents the change to the "SwitchedOn" status if the controller is already enabled again after the Lenze setting has been loaded.
Bit 5 ... 7 <input type="checkbox"/> Reserved	

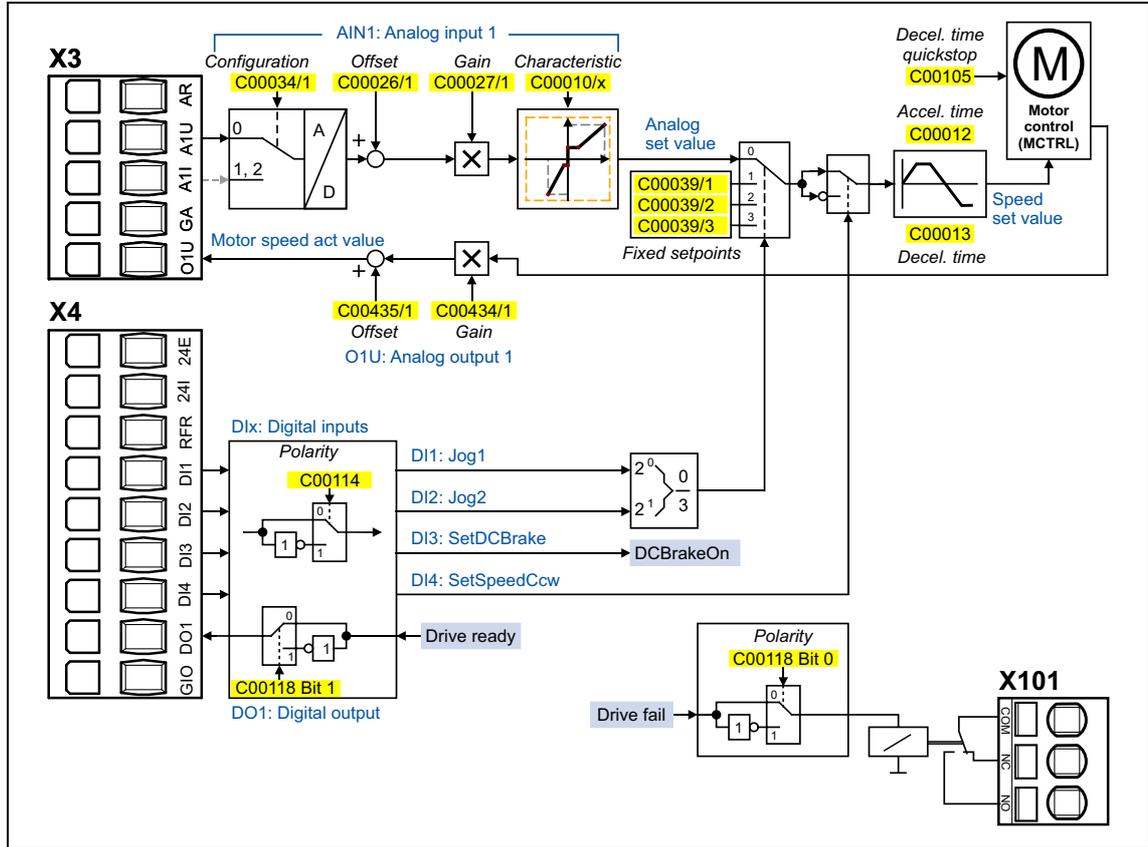
C00173

Mains voltage	
If the rated mains voltage differs from 230 V or 400 V, set the mains voltage the drive is operated with. The set mains voltage influences the brake chopper threshold, the monitoring of the device utilisation (lxt) and the switch-off threshold in case of undervoltage in the DC bus.	
Selection list (Lenze setting printed in bold)	Info
0 3ph 400V / 1ph 230V	3-phase 400 V or 1-phase 230 V
1 3ph 440V / 1ph 230V	3-phase 440 V or 1-phase 230 V
2 3ph 480V / 1ph 230V	3-phase 480 V or 1-phase 230 V
3 3ph 500V / 1ph 230V	3-phase 500 V or 1-phase 230 V

6.3.2 Application parameters

In the following, the signal flow of the "actuating drive speed" application is shown according to the Lenze setting.

- For a better readability, non-effective functions are not shown in this representation.
- A representation with all interfaces/parameters can be found in the appendix. (□ 58)



Parameter	Name	Info/Lenze setting	
C00034/1	AIN1: Configuration	0: "-10...+10 v"	AIN1 = analog input
C00026/1	AIN1: Offset	0.00 %	
C00027/1	AIN1: Gain	1.0000	
C00010/x	AIN1: Characteristic	see parameter description	
C00012	Acceleration time - main setpoint	2.000 s	
C00013	Deceleration time - main setpoint	2.000 s	
C00039/1	Fixed setpoint 1	40.00 %	
C00039/2	Fixed setpoint 2	60.00 %	
C00039/3	Fixed setpoint 3	80.00 %	
C00105	Decel. time - quick stop	2.000 s	
C00114	Dix: Polarity	No inversion	Dix = digital inputs
C00118	DOx: Polarity	No inversion	DOx = digital outputs
C00434/1	O1U: Gain	100.00 %	O1U = analog output (voltage output)
C00435/1	O1U: Offset	0.00 %	

C00034/1

Analog input (AIN1): Configuration		
Configuration of the analog input for current or voltage measurement		
Selection list (Lenze setting printed in bold)	Info	
0 -10...+10 V	Input signal is the voltage signal -10 V ... +10 V • -10 V ... +10 V \equiv -100 % ... +100 %	
1 0...20 mA	Input signal is the current signal 0 mA ... 20 mA • 0 mA ... 20 mA \equiv 0 % ... +100 %	
2 4...20 mA	Input signal is the current signal 4 mA ... 20 mA • 4 mA ... 20 mA \equiv 0 % ... +100 % • The current loop is monitored for open circuit (I < 4 mA) by the device.	

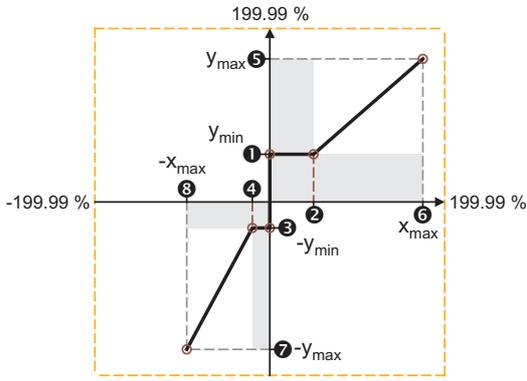
C00026/1

Analog input (AIN1): Offset			
Setting range (min. value unit max. value)			Lenze setting
-199.99	%	199.99	0.00 %

C00027/1

Analog input (AIN1): Gain			
Setting range (min. value unit max. value)			Lenze setting
-100.0000		100.0000	1.0000

C00010/x

Analog input (AIN1): characteristic		
An individual characteristic according to the right illustration can be parameterised for the analog input in order to provide different slopes and a dead band. In this case the input signal corresponds to the X axis and the output signal corresponds to the Y axis.		
		
Setting range (min. value unit max. value)		
0.00	%	199.99
Subcodes	Lenze setting	Info
C00010/1	0.00 %	① AIN1: (+y0) = min
C00010/2	0.00 %	② AIN1: (+x0) = Dead band
C00010/3	0.00 %	③ AIN1: (-y0) = (-min)
C00010/4	0.00 %	④ AIN1: (-x0) = (-Dead band)
C00010/5	100.00 %	⑤ AIN1: (+ymax)
C00010/6	100.00 %	⑥ AIN1: (+xmax)
C00010/7	100.00 %	⑦ AIN1: (-ymax)
C00010/8	100.00 %	⑧ AIN1: (-xmax)

C00012

Acceleration time - main setpoint			
Acceleration time of the ramp generator for the main speed setpoint <ul style="list-style-type: none"> • Time period for the acceleration from standstill to reference speed set in C00011. 			
Setting range (min. value unit max. value)			Lenze setting
0.000	s	999.999	2.000 s

C00013

Deceleration time - main setpoint			
Deceleration time of the ramp generator for the main speed setpoint <ul style="list-style-type: none"> • Time period for the deceleration from the reference speed set in C00011 to standstill. 			
Setting range (min. value unit max. value)			Lenze setting
0.000	s	999.999	2.000 s

C00039/x

Fixed setpoints 1 ... 3		
Fixed speed setpoints (Jog values) for the setpoint generator <ul style="list-style-type: none"> • With regard to the reference speed set in C00011. 		
Setting range (min. value unit max. value)		
-199.99	%	199.99
Subcodes	Lenze setting	Info
C00039/1	40.00 %	Fixed setpoint 1
C00039/2	60.00 %	Fixed setpoint 2
C00039/3	80.00 %	Fixed setpoint 3
Selection/activation of the fixed speed setpoints (Jog values)		
In the preset control mode "Terminals 0", the fixed setpoints 1 ... 3 for the "actuating drive speed" are selected via the digital terminals DI1 and DI2:		
DI2	DI1	Speed setpoint =
LOW	LOW	Selection via analog input 1
LOW	HIGH	Fixed setpoint 1
HIGH	LOW	Fixed setpoint 2
HIGH	HIGH	Fixed setpoint 3

C00105

Decel. time - quick stop			
Deceleration time for the "quick stop" function <ul style="list-style-type: none"> • Time period for the deceleration from the reference speed set in C00011 to standstill. 			
Setting range (min. value unit max. value)			Lenze setting
0.000	s	999.999	2.000 s
"Quick stop" function			
If the "quick stop" function is activated, the motor control is decoupled from the setpoint selection and within the deceleration time parameterised in C00105 the motor is brought to a standstill ($n_{act} = 0$). <ul style="list-style-type: none"> • The motor is kept at a standstill during closed-loop operation. • A pulse inhibit (CINH) is set if the auto-DCB function has been activated via C00019. 			
Activation of the "quick stop" function			
<ul style="list-style-type: none"> • With the device command C00002/17 = "1: On / start". • In the "Terminals 2" control mode by setting the digital input DI3 to HIGH level. • In the "Terminals 16" control mode by setting the digital inputs DI3 and DI4 to LOW level (function "fail-safe selection of direction of rotation"). 			
The "quick stop" function is also activated if the monitoring mode will be enabled the "TroubleQSP" error response has been parameterised for.			

C00114

Digital inputs (DIx): Polarity		
The polarity of each digital input of the device can be inverted via this bit field.		
Setting range (min. hex value max. hex value)		Lenze setting
0x0000	0xFFFF	0x0000 Decimal: 0 Binary: 00000000.00000000
The keypad displays the setting as bit string (bit 0 is at the rightmost position):		
		
Value is bit-coded: (<input checked="" type="checkbox"/> = bit set)		Info
Bit 0 <input type="checkbox"/>	DI1 inverted	Inversion of digital input 1
Bit 1 <input type="checkbox"/>	DI2 inverted	Inversion of digital input 2
Bit 2 <input type="checkbox"/>	DI3 inverted	Inversion of digital input 3
Bit 3 <input type="checkbox"/>	DI4 inverted	Inversion of digital input 4
Bit 4 ... 14 <input type="checkbox"/>	Reserved	
Bit 15 <input type="checkbox"/>	RFR inverted	Inversion of digital input RFR (controller enable)

C00118

Digital outputs (DOx): Polarity		
The polarity of each digital output of the device can be inverted via this bit field.		
Setting range (min. hex value max. hex value)		Lenze setting
0x00	0xFF	0x00 Decimal: 0 Binary: 00000000
The keypad displays the setting as bit string (bit 0 is at the rightmost position):		
		
Value is bit-coded: (<input checked="" type="checkbox"/> = bit set)		Info
Bit 0 <input type="checkbox"/>	Relay inverted	Relay inversion
Bit 1 <input type="checkbox"/>	DO1 inverted	Inversion of digital output 1
Bit 2 ... 7 <input type="checkbox"/>	Reserved	

C00434/1

Analog voltage output (O1U): Gain		
Setting range (min. value unit max. value)		Lenze setting
-199.99	%	199.99 100.00 %

C00435/1

Analog voltage output (O1U): Offset		
Setting range (min. value unit max. value)		Lenze setting
-199.99	%	199.99 0.00 %

6.3.3 Motor control parameters

Parameter	Name	Lenze setting		
Motor control	C00006	Motor control	6: "VFCplus:V /f linear"	
	C00018	Switching frequency	2: "8 kHz var./drive-opt."	
	C00021	Slip compensation	2.67 %	
	C00019	Auto-DCB: Threshold	3 rpm	DCB = DC-injection braking
	C00036	DC braking: Current	50.00 %	
	C00106	Auto-DCB: Hold time	0.500 s	
	C00910/1	Max. pos. output frequency	1000 Hz	
	C00910/2	Max. neg. output frequency	1000 Hz	

C00006

Motor control		
Selection of the motor control mode <ul style="list-style-type: none"> • In the following, all options for V/f characteristic control (VFCplus) are shown. • The V/f characteristic shape is defined by selecting the corresponding motor control mode. • A detailed description of this and other motor control types not mentioned here (e.g. vector control) can be found in the reference manual and in the »Engineer« online help for the controller. 		
Selection list (Lenze setting printed in bold)		Info
6	VFCplus: V/f linear	Linear V/f characteristic <ul style="list-style-type: none"> • For drives a constant, speed-independent load torque.
8	VFCplus: V/f quadr	Square-law V/f characteristic <ul style="list-style-type: none"> • For drives with a load torque curve which is quadratic or in relation to speed. Quadratic V/f characteristics are preferred in the case of centrifugal pumps and fan drives.
10	VFCplus: V/f definable	User-definable V/f characteristic <ul style="list-style-type: none"> • For drives that require adaptation of the magnetising current by means of the output speed. The freely definable V/f characteristic can be used e.g. for operation in conjunction with special machines such as reluctance motors in order to suppress oscillations at the machine or to optimise energy consumption.
11	VFCplusEco: V/f energy-saving	Linear V/f characteristic with voltage reduction <ul style="list-style-type: none"> • For drives which often work in partial load operation, the energy-saving V/f characteristic control (VFCplusEco) offers the opportunity to reduce the voltage at low load in order to save energy. At higher loads, the voltage reduction is cancelled and a linear characteristic is caused.

C00018

Switching frequency			
Selection of the pulse width modulated switching frequency transferred from the inverter to the motor			
<ul style="list-style-type: none"> • Select between an ideal setting for the drive which provides smooth running, and an optimal setting with regard to the inverter which keeps its losses to a minimum (min. Pv). • Both possibilities offer fixed and variable switching frequencies. • When a variable switching frequency is selected, the switching frequency may change as a function of the load and rotational frequency. 			
Selection list (Lenze setting printed in bold)			
1	4 kHz var./drive-optimised	15	2 kHz constant/min. Pv
2	8 kHz var./drive-optimised	16	4 kHz constant/min. Pv
3	16 kHz var./drive-optimised	17	8 kHz constant/min. Pv
5	2 kHz constant/drive-optimised	18	16 kHz constant/min. Pv
6	4 kHz constant/drive-optimised	21	8 kHz var./drive-opt./4 kHz min
7	8 kHz constant/drive-optimised	22	16 kHz var./drive-opt./4 kHz min
8	16 kHz constant/drive-optimised	23	16 kHz var./drive-opt./8 kHz min
11	4 kHz var./min. Pv	31	8 kHz var./min. Pv/4 kHz min
12	8 kHz var./min. Pv	32	16 kHz var./min. Pv/4 kHz min
13	16 kHz var./min. Pv	33	16 kHz var./min. Pv/8 kHz min

C00021

Slip compensation			
Slip compensation for V/f characteristic control and sensorless vector control			
<ul style="list-style-type: none"> • A higher slip compensation results in a higher increase in frequency and voltage when the machine is under load. • After the motor to be used has been selected from the »Engineer« motor catalogue, the suitable value can be entered automatically. An automatic detection via the motor parameter identification is possible as well. 			
Setting range (min. value unit max. value)			Lenze setting
-100.00	%	100.00	2.67 %

C00019

Auto-DCB: Threshold			
Setpoint speed threshold for automatic DC injection braking			
<ul style="list-style-type: none"> • For speed setpoints with values below the thresholds a DC current is injected or the motor is not supplied with current, depending on the setting. 			
Setting range (min. value unit max. value)			Lenze setting
0	rpm	60000	3 rpm

C00036

DC braking: Current			
Current value in [%] for DC-injection braking			
<ul style="list-style-type: none"> • 100 % \equiv I_{max} in motor mode (C00022) 			
Setting range (min. value unit max. value)			Lenze setting
0.00	%	200.00	50.00 %

C00106

Auto-DCB: Hold time			
Hold time of the automatic DC injection brake			
<ul style="list-style-type: none"> • The DC injection brake is applied for the time set here if the value falls below the speed setpoint set in C00019. 			
Setting range (min. value unit max. value)			Lenze setting
0.000	s	999.000	0.500 s

6

Commissioning

6.3

Adapting the most important parameters to the drive task

C00910/1

Max. pos. output frequency			
Max. positive output frequency for all motor control modes			
Setting range (min. value unit max. value)			Lenze setting
0	Hz	1000	1000 Hz

C00910/2

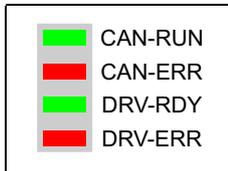
Max. neg. output frequency			
Max. negative output frequency for all motor control modes			
Setting range (min. value unit max. value)			Lenze setting
0	Hz	1000	1000 Hz

7 Diagnostics & troubleshooting

7.1 LED status displays for device status

7 Diagnostics & troubleshooting

7.1 LED status displays for device status



The control of the two LEDs "DRV-RDY" and "DRV-ERR" in the lower part on the front of the inverter depends on the device status.

The meaning can be seen from the table below:

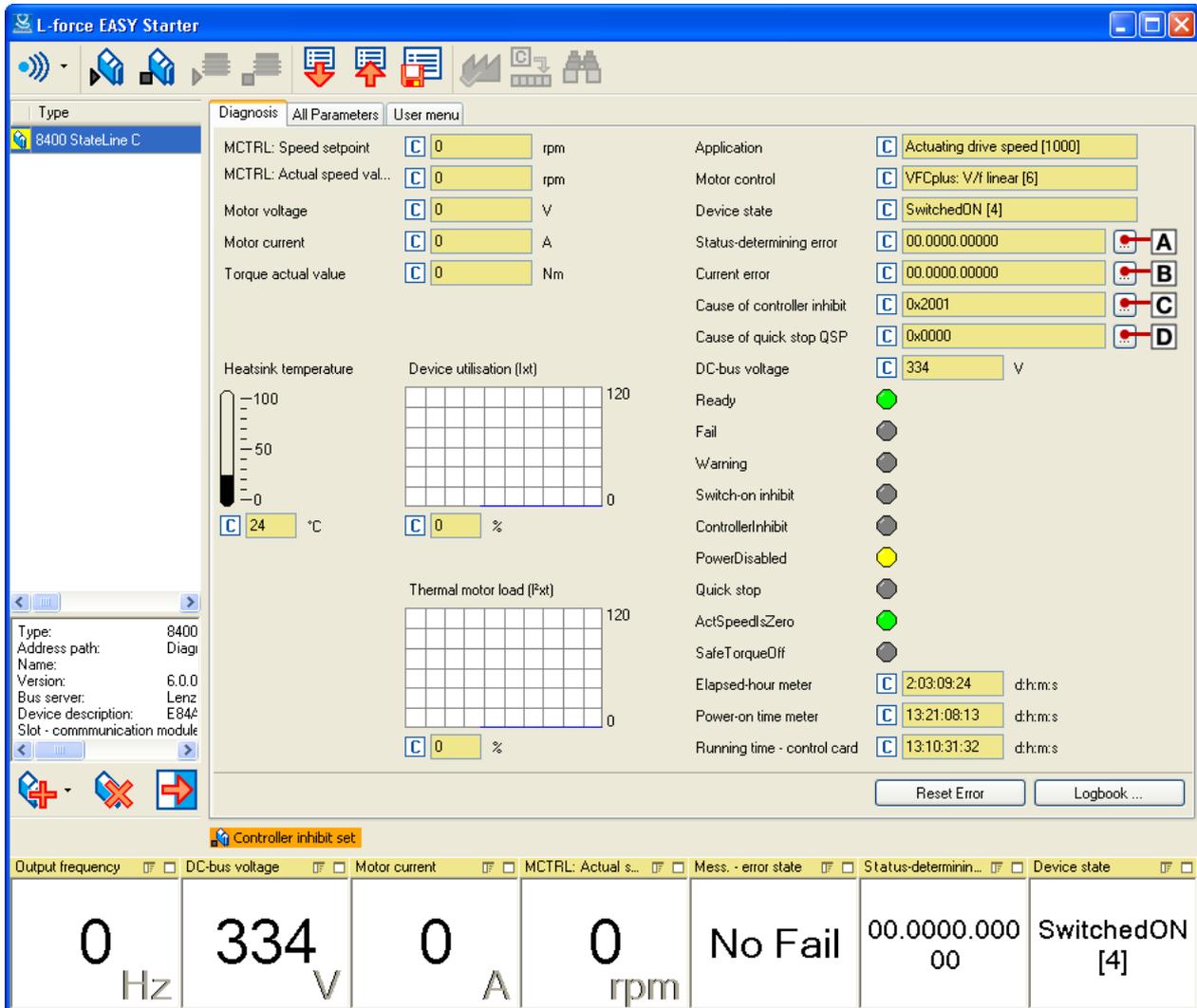
DRV-RDY	DRV-ERR	Description	Device status (Display in C00137)
OFF	OFF	OFF or initialisation active	Init
	OFF	Safe torque off is active	SafeTorqueOff
	OFF	Device is ready to start	ReadyToSwitchOn
	OFF	Device is switched on	SwitchedOn
	OFF	Motor data identification/operation	OperationEnabled
		The controller is ready to switch on, switched on or the operation is enabled and a warning is indicated.	
		Fault active, quick stop	TroubleQSP
OFF		Trouble is active	Trouble
OFF		Fault is active	Fault
OFF		System fault is active	SystemFault
Legend			
The symbols used for indicating the LED states have the following meaning:			
	LED is flashing once approx. every 3 seconds (<i>slow flash</i>)		
	LED is flashing once approx. every 1.25 seconds (<i>flash</i>)		
	LED is flashing twice approx. every 1.25 seconds (<i>double flash</i>)		
	LED is blinking every second		
	LED is permanently on		

7 Diagnostics & troubleshooting

7.2 Diagnostics using the »EASY Starter«

7.2 Diagnostics using the »EASY Starter«

When an online connection has been established to the controller, the most important information on the current operation, device status and operating time is indicated clearly in the »EASY Starter« on the **Diagnostics** tab:

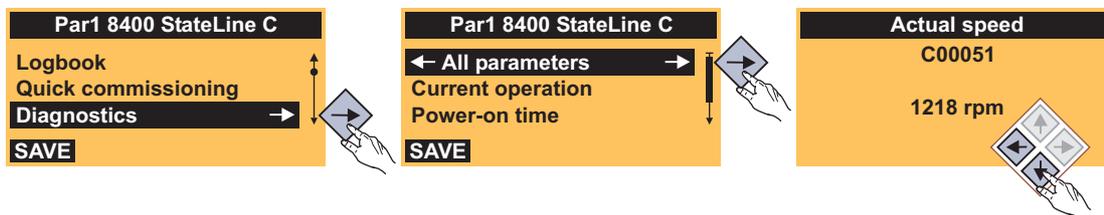


Button	Function
	[A] Display details of the status determining error.
	[B] Display details of the current error.
	[C] Display all active sources of a controller inhibit.
	[D] Display all active sources of a quick stop.
Resetting an error	Acknowledge fault message (if the error cause has been eliminated).
Logbook...	Display the logbook of the controller. <ul style="list-style-type: none"> The logbook chronologically logs important events within the system and plays an important role for troubleshooting and controller diagnostics.

7.3 Diagnostic/Display parameters

Diagnostic/display parameters serve to display device-internal process factors, current actual values, and status messages, e.g. for diagnostic purposes.

- In the keypad, these parameters can be found in the **Diagnostics** menu:



- In the »EASY Starter«, these parameters can be found on the **All parameters** tab in the **Diagnostics** category:

Code	Subi	Name	Value
51	0	MCTRL: Actual speed value	1218
52	0	Motor voltage	188
53	0	DC-bus voltage	322
54	0	Motor current	0.49
56	1	Torque setpoint	0
56	2	Torque actual value	0.3
58	0	Output frequency	40.8
61	0	Heatsink temperature	24
64	1	Device utilisation (1xt)	0
64	2	Device utilisation (1xt) 15s	0
64	3	Device utilisation (1xt) 3min	0
66	0	Thermal motor load (Fxt)	0
133	0	Utilisation - brake resistor	0
136	1	MCI control word	0x0009
136	2	CAN control word	0x0009
137	0	Device state	OperationEnable [5]
150	0	Status word	0x0500
158	0	Cause of controller inhibit	0x0000

C00058:000 Output frequency
 Value: 40.8 Hz
 Raw value decimal: 4080
 Raw value hexadecimal: 0x00000FF0
 Range: -1300 ... 1300
 Default setting: 0

7.4 Monitoring

The controller is provided with various monitoring functions which protect the drive against impermissible operating conditions.

If a monitoring function responds,

- an entry will be made into the [logbook](#) of the controller,
- the response (TroubleQSP, Warning, Fault, etc.) set for this monitoring function will be triggered,
- the status of the internal device control changes according to the selected response, controller inhibit is set, and the "DRV- ERR" LED on the front of the controller goes on:

Response	Entry in the logbook	Display in C00168	Pulse inhibit	Controller inhibit	Acknowledgement required	LED "DRV-ERR"
None						OFF
Fault	☑	☑	☑	☑	☑	▬▬▬▬
Trouble	☑	☑	☑	☑		▬▬▬▬
TroubleQSP	☑	☑			☑	▬▬▬▬
WarningLocked	☑	☑			☑	▬▬▬▬
Warning	☑	☑				
Information	☑					OFF
System error	☑	☑	☑	☑	Mains switching is required!	▬▬▬▬

7 Diagnostics & troubleshooting

7.5 Error messages

7.5 Error messages

Error message	Cause	Remedies
An01: AIN1_1 < 4 mA	Open-circuit monitoring for analog input 1 has tripped. <ul style="list-style-type: none"> Only if the analog input has been configured as a current loop of 4 ... 20 (C00034/1 = 2). 	<ul style="list-style-type: none"> Check wiring of the analog X3/A11 input terminal for open circuit. Check minimum current values of the signal sources.
Ck16: Time overflow manual control	Manual PC control: The connection monitoring has tripped. <ul style="list-style-type: none"> The online connection between the PC and the controller has been interrupted for a longer period of time than the timeout set in C00464/1. 	<ul style="list-style-type: none"> Check the communication link between the PC and the controller. Check the voltage supply/function of the controller. Adjust the timeout (C00464/1).
df10: AutoTrip Reset	Too frequent auto-trip reset.	<ul style="list-style-type: none"> Check the error cause that activates the auto-trip reset. Eliminate error cause and reset (acknowledge) error manually afterwards.
df14: SW/HW invalid	Device error	Consultation with Lenze required.
df18: BU RCOM error		
df21: BU Watchdog		
df22: CU watchdog		
df25: CU RCOM error	Mains switching too frequent. <ul style="list-style-type: none"> Cyclic mains switching every 3 min is permissible. 	<ul style="list-style-type: none"> After switching the mains 3 times in one minute, there must be a switching pause of 9 min. If the problem occurs again, you need to consult Lenze.
df50: Retain error	An error has occurred when accessing retain data. <ul style="list-style-type: none"> Either caused by an internal hardware error or by lack of mains switching after a firmware download. 	Mains switching <ul style="list-style-type: none"> If the problem occurs again, you need to consult Lenze.
dH09: EEPROM power section	Device error	Consultation with Lenze required.
dH10: Fan failure	The device fan has failed. Possible causes: <ul style="list-style-type: none"> The short-circuit check of the fan connection has tripped. The speed monitoring of the fan has tripped. 	<ul style="list-style-type: none"> Check the fan for short-circuit. Clean the fan.
dH68: Adjustment data error CU	Device error	Consultation with Lenze required.
dH69: Adjustment data error BU		
FC1: Field controller limitation	The output of the field controller has reached its maximum limit value. The drive is at the torque limit in the field weakening range.	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint from the field weakening range if necessary.
FCH1: Switching frequency reduction	Load-dependent switching frequency reduction	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint generation dynamics if necessary.
FCH2: Max. speed for Fchop	Maximum speed for chopper frequency has been reached. <ul style="list-style-type: none"> The maximum speed has been exceeded depending on the switching frequency. 	Select the correct maximum speed as a function of the switching frequency.

7 Diagnostics & troubleshooting

7.5 Error messages

Error message	Cause	Remedies
ID1: Motor data identification error	<p>During the identification of the motor parameters, an error has occurred.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> • Interrupted motor cable. • Switched-off power section during the identification. • Implausible start parameter settings. 	<ul style="list-style-type: none"> • Check the motor connections and the corresponding plug connector on the device and, if necessary, the motor terminal box. • Correct start parameters for the motor parameter identification (motor nameplate data). • Stable power supply of the device.
ID3: CINH motor data identification	<p>The device has detected controller inhibit during the motor data identification.</p> <ul style="list-style-type: none"> • This cancels the identification process. The Lenze setting of the motor data is used. 	<ul style="list-style-type: none"> • Do not set controller inhibit during the motor data identification. • Do not execute any device function which may activate controller inhibit.
ID4: Resistor identification error	<p>The device has recognised that an error has occurred in the calculation of the motor cable resistance.</p> <ul style="list-style-type: none"> • The parameters for cable cross-section and cable length are implausible. 	<p>Enter sensible values for cable cross-section and motor cable length.</p>
LP1: Motor phase failure	<p>Motor phase failure - power section</p> <ul style="list-style-type: none"> • This error message is displayed if a motor phase carries less current of one half-wave than set in C00599. 	<ul style="list-style-type: none"> • Check the motor connections and the corresponding plug connector on the device and, if necessary, the motor terminal box. • Check the trigger threshold (C00599).
LU: DC bus undervoltage	<p>The device has detected a DC bus undervoltage. The inverter control is switched off because the drive properties of the motor control cannot be provided anymore due to the DC bus undervoltage.</p> <ul style="list-style-type: none"> • Depending on the configuration of the auto-start lock function, C00142 serves to set that, if this error has been tripped, the controller only starts after the controller inhibit is switched. 	<ul style="list-style-type: none"> • Switch on mains supply or ensure sufficient supply via DC bus. • Adjust setting in C00142 if required.
MCI1: Module missing / incompatible	<p>The optional communication module has been removed or there is a connection problem or incompatibility with the standard device.</p>	<ul style="list-style-type: none"> • Check connection between the communication module and standard device. • Check if the module is plugged in correctly. • In case of an incompatibility, either the module or the software of the standard device is out of date. In this case, please contact Lenze.
OC1: Power section - short circuit	<p>The device has recognised a short circuit of the motor phases. To protect the device electronics, the inverter control is switched off.</p> <ul style="list-style-type: none"> • Mostly, incorrectly executed motor connections are the cause. • If the device is inappropriately dimensioned with regard to the motor load and the current limitation in the controller (I_{max} controller) is set incorrectly, this error message may also occur. 	<ul style="list-style-type: none"> • Check motor connections and the corresponding plug connector on the device. • Only use permissible combinations of device power and motor power. • Do not set the dynamics of the current limitation controller too high.

Error message	Cause	Remedies
OC2: Power section - earth fault	<p>The device has recognised an earth fault at one of the motor phases. To protect the device electronics, the inverter control is switched off.</p> <ul style="list-style-type: none"> • Mostly, incorrectly executed motor connections are the cause. • If motor filter, motor cable length, and cable type (shielding capacity) are dimensioned incorrectly, this error message may occur due to leakage currents to PE. • If motor filters with additional terminals for +UG and –UG and devices greater or equal 3 kW are used, the earth fault detection may be triggered due to leakage currents to +UG and –UG. • A cause can also be the use of shielded motor cables longer than 50 m. 	<ul style="list-style-type: none"> • Check motor connections and the corresponding plug connector on the device. • Use motor filters, cable lengths, and cable types recommended by Lenze. • If motor filters with additional terminals for +UG and –UG and devices greater or equal 3 kW are used: Deactivate earth fault detection during operation by setting the filter time (C01770) to 250 ms. • If shielded motor cables longer than 50 m are used: Increase the filter time for earth fault detection during operation (C01770).
OC5: Ixt overload	<p>The Ixt overload check has tripped.</p> <ul style="list-style-type: none"> • Operating threshold = 100 % Ixt (adjustable in C00123) <p>Possible causes:</p> <ul style="list-style-type: none"> • Wrong dimensioning of the device with regard to its motor load. • Load cycles are not complied with. 	<ul style="list-style-type: none"> • Check and, if required, correct dimensioning of the device and the motor load with regard to technical data. • Reduce motor load cycles (observe load cycles according to documentation).
OC6: I2xt motor overload	<p>Thermal overload of the motor.</p>	<ul style="list-style-type: none"> • Observe load requirements. • Correct dimensioning if necessary. • In case of VFCplus operation: Check Vmin boost (C00016).
OC7: Motor overcurrent	<p>The maximum current monitoring has tripped.</p> <ul style="list-style-type: none"> • The instantaneous value of the motor current has exceeded the limit value set in C00939. 	<p>Check and, if required, correct dimensioning of the load with regard to the installed device power.</p>
OC10: Max. current reached	<p>The device displays that the maximum current has been reached.</p>	<ul style="list-style-type: none"> • Check and, if required, correct dimensioning of the load with regard to the installed device power. • Check the maximum current settings in C00022 (I_{max} in motor mode) and C00023 (I_{max} in generator mode).
OC11: Active clamp operation	<p>The device indicates that the "CLAMP" overcurrent limitation has been activated.</p> <ul style="list-style-type: none"> • A permanent clamp operation causes an overload disconnection. 	<p>Reduce setpoint generation dynamics or motor load.</p>
OC12: I2xt overload - brake resistor	<p>Too frequent and too long braking processes.</p>	<p>Check drive dimensioning.</p>
OC13: Max. current for Fch exceeded	<p>The device has detected a motor current which exceeds the maximum current limit at permanent switching frequency of the inverter.</p> <ul style="list-style-type: none"> • If a permanent switching frequency inverter is set, a certain limit arises for the maximum current, depending on the setting. If this current limit is exceeded due to a load impulse or overload, an error message is displayed. 	<ul style="list-style-type: none"> • Observe the maximum current setting depending on the set switching frequency of the inverter. • Reduce the required load or setting of the dynamic switching frequency if necessary.

Error message	Cause	Remedies
OC14: Direct-axis current controller limitation	Direct-axis current controller limitation is active.	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint generation dynamics if necessary.
OC15: Cross current controller limitation	Cross current controller limitation is active.	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint generation dynamics if necessary. Check parameter setting of the current controller with regard to the motor controllers (e.g. reduce Vp).
OC16: Torque controller limitation	Actuator limitation according to speed controller.	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint generation dynamics if necessary.
OC17: Clamp sets pulse inhibit	Due to a short overcurrent, the inverter was switched off for a short time (clamp disconnection).	<ul style="list-style-type: none"> Check and, if required, correct dimensioning of the load with regard to the installed device power. Reduce the dynamics of the setpoint change or speed control.
OH1: Heatsink overtemperature	The heatsink temperature is higher than the fixed limit temperature (90 °C). Maybe the ambient temperature of the controller is too high or the fan or its ventilation slots are dirty.	<ul style="list-style-type: none"> Check control cabinet temperature. Clean filter. Clean controller. If required, clean or replace the fan. Provide for sufficient cooling of the device.
OH3: Motor temperature (X106) triggered	The motor temperature monitoring function at the plug connector X106, terminal T1 /T2, has tripped. Possible causes: <ul style="list-style-type: none"> The motor is overheated so that the thermal contact integrated into the motor has been switched. An open circuit or a loose contact at the connections mentioned above has occurred. 	<ul style="list-style-type: none"> Check motor temperature monitoring. Provide for sufficient cooling of the motor. Check terminals for open circuit or loose contact.
OH4: Heatsink temp. > shutdown temp. - 5°C	The heatsink temperature now only differs by 5 °C from the shutdown temperature of the motor.	Prevent further heating, i.e. reduce motor load or set controller inhibit so that the heatsink can cool down again.
OS1: Max. speed limit reached	The device has recognised that the maximum speed has been reached.	<ul style="list-style-type: none"> Limit setpoint selection to maximum values. Adjust set speed limitation (C00909) and frequency limitation (C00910) if necessary.
OT1: Max. torque reached	The device indicates that the maximally possible torque at the motor shaft has been reached. <ul style="list-style-type: none"> C00057 displays the current torque. 	Reduce motor load.
OT2: Speed controller output limited	The output of the speed controller has reached the internal limit value. In this state, the speed controller is not able anymore to correct the system deviation. <ul style="list-style-type: none"> Only with "Closed loop" operation or vector control (SLVC). 	<ul style="list-style-type: none"> Observe load requirements. Correct dimensioning or reduce setpoint generation dynamics if necessary.
OU: DC bus overvoltage	The device has detected an overvoltage in the DC bus. To protect the device hardware, the inverter control is switched off. <ul style="list-style-type: none"> If this error message remains active longer than the time set in C00601, a "Fault" is tripped. 	<ul style="list-style-type: none"> Reduce load in generator mode. Use a brake resistor. Use a regenerative power supply unit. Establish a DC-bus connection.

7 Diagnostics & troubleshooting

7.5 Error messages

Error message	Cause	Remedies
PS01: No memory module	Memory module is either not available or not snapped into place correctly.	<ul style="list-style-type: none"> If a memory module has been provided: Plug the memory module into the slot of the standard device intended for this purpose. If a memory module has been provided: Check if the memory module has been plugged-in correctly.
PS02: Invalid par. set	The parameter set saved to the memory module is invalid because it has not been saved completely.	Ensure voltage supply during the storage process and that the module remains plugged into the slot.
PS03: Invalid device par. set	The parameter set saved to the memory module is incompatible to the standard device.	When the memory module is exchanged, observe the downward compatibility.
PS04: Invalid MCI par. set	The parameter set saved to the communication module is incompatible to the standard device.	
PS07: Invalid memory module par. set	The parameter set saved to the memory module is invalid.	Consultation with Lenze required.
PS08: Invalid device par.	The parameter set in the device is invalid.	
PS09: Invalid par. format	The code format is invalid.	
PS10: Memory module binding invalid	Active device personalisation: The memory module and the controller do not have identical binding IDs.	<ul style="list-style-type: none"> Use memory modules/controllers with matching binding IDs. Consult the machine manufacturer.
SD3: Open circuit - feedback system	The device has detected open circuit in the feedback system.	Check wiring of the feedback system and the corresponding terminals.
SD10: Speed limit - feedback system 12	Maximally permissible speed of the feedback system connected to DI1/DI2 reached.	Reduce speed of the rotation shaft/feedback system. $n_{Encoder} \leq (f_{max} \times 60) / \text{encoder increment}$ (at $f_{max} = 10 \text{ kHz}$)
Su02: One mains phase is missing	One mains phase of a three-phase supply has failed.	Check mains connection (terminal X100).
Su03: Too frequent mains switching	Too frequent mains switching of the power section. <ul style="list-style-type: none"> The device recognises if the power section is switched on and off too frequently. To protect internal charging connections from destruction, the device reports this error and prevents the controller inhibit. All other functions are active. 	The error must be acknowledged. The minimum waiting time between two mains switching processes is approximately three seconds.
Su04: CU insufficiently supplied	After switching on the device, the 24V supply voltage for the control electronics is too low (100ms after switch-on U is < 19V). <ul style="list-style-type: none"> The current supply voltage is displayed in C00065. 	The error must be acknowledged. With internal supply voltage via the power electronics, the controller must be replaced. With external supply voltage, check the correct connection and/or the stability of the supply voltage.

7.6 Maloperation of the drive

Motor does not rotate

Cause	Remedy
DC-bus voltage is too low <ul style="list-style-type: none"> Red LED is blinking every 1 s Display in the keypad: LU 	Check mains voltage
Controller is inhibited <ul style="list-style-type: none"> Green LED is blinking Display in the keypad: CINH 	Deactivate controller inhibit <ul style="list-style-type: none"> Note: Controller inhibit can be set via several sources ! C00158 displays all active sources for controller inhibit.
Automatic start is inhibited (Bit 0 in C00142 = 1)	LOW/HIGH edge at RFR If required, correct starting condition with C00142
DC-injection braking (DCB) is active	Deactivate DC injection brake
Mechanical motor brake is not released	Release mechanical motor brake manually or electrically
Quick stop (QSP) is active <ul style="list-style-type: none"> Display in the keypad: IMP 	Deactivate quick stop <ul style="list-style-type: none"> Note: Quick stop can be set via several sources! C00159 displays all active sources of quick stop.
Setpoint = 0	Select setpoint
JOG frequency = 0 at activated JOG setpoint	Set JOG setpoint in C00039/1...15
Trouble is active	Clear fault
Assignment of several mutually exclusive functions with a signal source in C00701	Correct configuration in C00701

Motor rotates irregularly

Cause	Remedy
Motor cable is defective	Check motor cable
Maximum motor current in motor or generator mode is set too low	Adjust settings to the application: C00022: I _{max} in motor mode C00023: I _{max} in generator mode
Motor is underexcited or overexcited	Check parameterisation: C00006: Motor control C00015: VFC: V/f base frequency C00016: VFC: V _{min} boost
Rated motor data (stator resistance, speed, current, frequency, voltage) and cos φ and/or magnetising inductance is not adapted to the motor data	Execute automatic motor parameter identification with the C00002/23 device command - or - Adjust motor parameters manually: C00084: Motor stator resistance C00087: Rated motor speed C00088: Rated motor current C00089: Rated motor frequency C00090: Rated motor voltage C00091: Motor cosine phi C00092: Motor magnetising inductance
Motor windings are wired incorrectly	Reverse from star connection to delta connection

Motor consumes too much current

Cause	Remedy
V_{\min} boost has been selected too high	Correct setting with C00016
V/f base frequency has been selected too low	Correct setting with C00015
Rated motor data (stator resistance, speed, current, frequency, voltage) and $\cos \varphi$ and/or magnetising inductance is not adapted to the motor data	Execute automatic motor parameter identification with the C00002/23 device command - or - Adjust motor parameters manually: C00084: Motor stator resistance C00087: Rated motor speed C00088: Rated motor current C00089: Rated motor frequency C00090: Rated motor voltage C00091: Motor cosine phi C00092: Motor magnetising inductance

Torque dip in the field weakening range or motor stalling during operation in the field weakening range

Cause	Remedy
Motor is overloaded	Check motor load
Motor windings are wired incorrectly	Reverse from star connection to delta connection
V/f reference point is set too high	Correct setting with C00015
Override point of field weakening is set too low	Correct setting with C00080

Asynchronous motor with feedback rotates without control and with too low speed

Cause	Remedy
<p>Motor phases have been interchanged</p> <ul style="list-style-type: none"> • Thus the rotating field of the motor is not identical anymore with the rotating field of the feedback system. • Therefore, the drive shows the following behaviour if V/f characteristic control (C00006 = 7) is performed: <ul style="list-style-type: none"> • The motor rotates faster than the speed setpoint by the value set in C00074. • After the controller has been enabled, the controller will not stop if the speed setpoint = 0 or a quick stop (QSP) occurs. • Among other things, the final motor current depends on the value set for the V_{\min} boost and may rise up to I_{\max} which can trigger the "OC5: Ixt overload" fault message. 	<p>Check the phase position of the motor cable</p> <p>If possible: Operate the motor with deactivated feedback (C00006 = 6) and check direction of rotation of the motor</p>

Motor phase (LP1) monitoring does not respond if the motor phases are interrupted

Cause	Remedy
Monitoring is not active (C00597 = 0)	Activate monitoring (C00597 = 1)

8 Adapting the application individually

This chapter describes further adaptation options of the application based on the respective function block interconnection.

- Further functions that are first deactivated by default (e.g. ramp smoothing for the main speed setpoint, speed limit values and speed blocking zones) can be activated in the main signal flow through parameter setting.
- Moreover, the assignment of inputs and outputs can be reconfigured via configuration parameters to e.g. use the process controller or the motor potentiometer sensibly.

8.1 Function block interconnection of the "Actuating drive speed" application

In case of the 8400 device version, every drive solution is realised as a "function block interconnection" (abbr.: "FB interconnection"). Using this FB interconnection, any signal interconnection can be implemented. Various function blocks are available for digital processing, signal conversion and logic modules.

For special tasks it has proved of value to use the integrated technology applications as a basis for modifications or extensions of the available FB interconnections.

I/O level & application level

The interconnection of the interfaces is shown in the I/O level of the function block editor according to the selected control mode. In the "deeper" application level, the main signal flow is realised in the form of an interconnection of various function and system blocks.

The following applies to the "StateLine C" version:

- The preconfigured signal links can be reconfigured in the I/O level if required. ▶ [Pre-assignment of the input and output interfaces](#) (63)
- Moreover, the applications integrated in the inverter can be reconfigured and extended by individual functions.
- **From version 12.00.00 and »Engineer« V2.17 onwards**, experienced users are offered the opportunity to implement their own drive solutions independent of the predefined technology applications by using so-called "free interconnections".

Within the FB interconnection, the following modules are distinguished:

Module type	Task	Examples	
Function block	Implementation of a certain function in the signal flow	L_NSet_1	Ramp generator
		L_PCTRL_1	Process controller
		L_MPot_1	Motor potentiometer
		L_Or_1	Logic OR
		L_OffsetGainP_1	Offset & gain
System block	Signal interface to inverter-internal functions	LS_AnalogInput	Analog inputs
		LS_AnalogOutput	Analog outputs
		LS_DigitalInput	Digital inputs
		LS_DigitalOutput	Digital outputs
		LS_DriveInterface	Drive interface
		LS_MotorInterface	Motor interface
Port block	Process data communication via a fieldbus using a communication module	LP_MciIn	Input ports
		LP_MciOut	Output ports
	Process data communication via CAN on board	LP_CanIn1...3	Input ports
		LP_CanOut1...3	Output ports
Application block	Block for a technology application	LA_NCtrl	Actuating drive speed
		LA_SwitchPos	Switch-off positioning



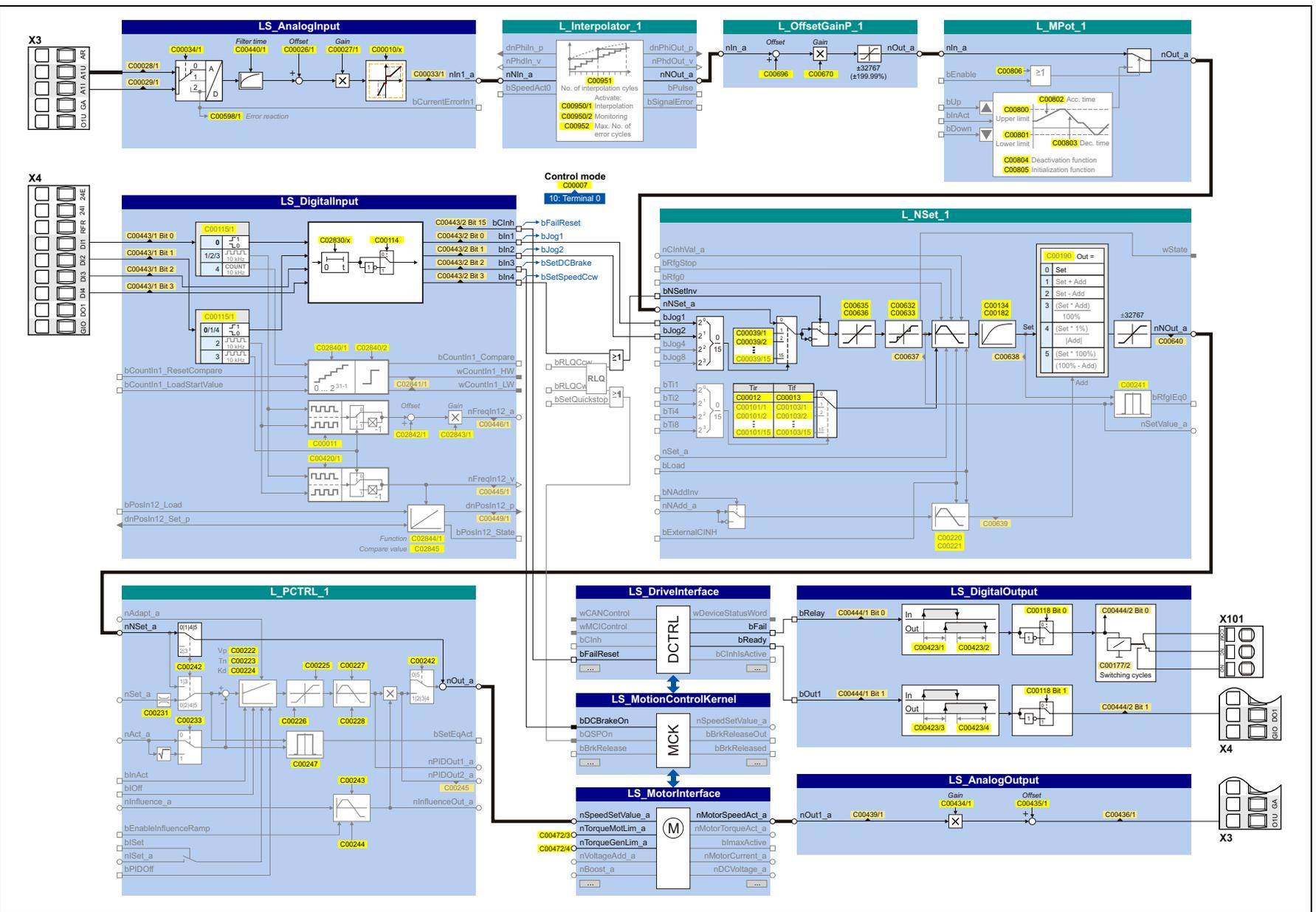
More information can be found in the reference manual for the 8400 StateLine in the following chapters:

- Technology application → TA "actuating drive..." → Configuration parameters
- Working with the FB Editor

The following page shows the basic FB interconnection of the application.

8 Adapting the application individually

8.1 Function block interconnection of the "Actuating drive speed" application



8.2 Activating additional functions in the signal flow

The following parameters serve to activate further functions in the main signal flow that are first deactivated by default:

Parameter	Name	Info
C00598/1	Resp. to open circuit AIN1	Response to open circuit at the analog input when being configured as 4 ... 20 mA current loop. Lenze setting: "TroubleQuickStop". The drive is braked to standstill within the deceleration time parameterised for quick stop independently of the defined setpoint and can be kept there.
C00950/1	Activation of signal interpolation	Signal interpolation and monitoring (see reference manual; FB L_Interpolator_1)
C00950/2	Activation of signal monitoring	
C00951	L_Interpolator_1: No. of interpolation steps	
C00952	L_Interpolator_1: Limit value - error cycles	
C00696	L_OffsetGainP_1: Offset	Offset and gain (see reference manual; FB L_OffsetGainP_1)
C00670	L_OffsetGainP_1: Gain	
C00635	L_NSet_1: nMaxLimit	▶ Speed limit values (□ 59)
C00636	L_NSet_1: nMinLimit	▶ Speed blocking zones (□ 60)
C0632/1...3	L_NSet_1: Blocking speed 1 ... 3 max	
C0633/1...3	L_NSet_1: Blocking speed 1 ... 3 min	
C00134	Ramp smoothing main setpoint	▶ Ramp smoothing (□ 61)
C00182	S-ramp time PT1	
C02830	DIx: Debounce time	Debounce and delay times for digital inputs and outputs
C00423	DOx: Delay times	
C00472/3	LS_ParFree_a: Value 3	Torque limitation in motor mode and in generator mode. Lenze setting: 100 % <ul style="list-style-type: none"> • The drive cannot output a higher torque in motor/generator mode than set here. • If V/f characteristic control (VFCplus) is selected, limitation is <u>indirectly</u> performed via the I_{max} controller.
C00472/4	LS_ParFree_a: Value 4	

8.2.1 Speed limit values

C00635

L_NSet_1: nMaxLimit			
Maximum speed setpoint for speed setpoint limitation			
Setting range (min. value unit max. value)			Lenze setting
-199.99	%	199.99	199.99 %

C00636

L_NSet_1: nMinLimit			
Minimum speed setpoint for speed setpoint limitation			
Setting range (min. value unit max. value)			Lenze setting
-199.99	%	199.99	-199.99 %

C02611/x

MCK: Limitations

Speed setpoint limits for the determination of limited validity ranges

Note:
Traversing with setpoints through resulting blocking zones is executed with the ramp set in [C02610/2](#):

A setpoint range
 B synchronisation range

Setting range (min. value unit max. value)		
0.00	%	199.99
Subcodes	Lenze setting	Info
C02611/1	199.99 %	MCK: Pos. max. speed • Upper limit of the speed setpoint limitation in positive direction of rotation.
C02611/2	0.00 %	MCK: Pos. min. speed • Lower limit of the speed setpoint limitation in positive direction of rotation.
C02611/3	0.00 %	MCK: Neg. min. speed • Lower limit of the speed setpoint limitation in negative direction of rotation.
C02611/4	199.99 %	MCK: Neg. max. speed • Upper limit of the speed setpoint limitation in negative direction of rotation.

8.2.2 Speed blocking zones

If the speed setpoints in speed-variable drives are linearly increasing, for instance, the frequency/speed range is divided into a number of equal time segments. Therefore, there may be speeds during acceleration time which must be bridged very fast (e.g. natural resonant frequencies).

The skip frequency function offers the opportunity to select a range in which the initial speed is maintained. If the speed setpoint leaves that range, the drive will be accelerated to reach the desired speed.

Definition of the blocking zones

The subcodes of codes [C00632](#) and [C00633](#) can be used to define three zones which are to be skipped by the output setpoint and which are to be passed as fast as possible by the ramp function generator.



Note!

- Skip frequencies only affect main setpoints.
- It is not possible to exclude "0" speed if there is a sign reversal of the speed setpoint.

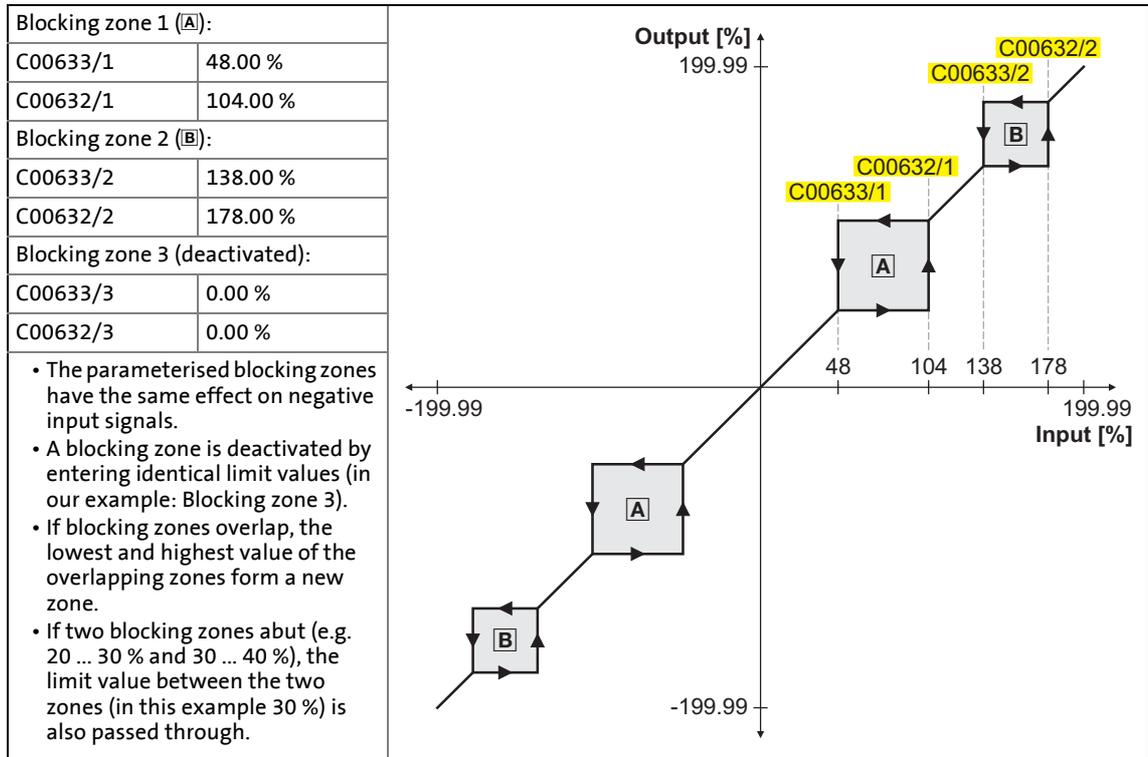
C00632/x

L_NSet_1: Max. skip freq.		
Maximum limit values for the speed blocking zones		
• Selection of the maximum limit values for the blocking zones in which the speed must not be constant.		
Setting range (min. value unit max. value)		
0.00	%	199.99
Subcodes	Lenze setting	Info
C00632/1	0.00 %	L_NSet_1: Blocking speed 1 max
C00632/2	0.00 %	L_NSet_1: Blocking speed 2 max
C00632/3	0.00 %	L_NSet_1: Blocking speed 3 max

C00633/x

L_NSet_1: Min. skip freq.		
Minimum limit values for the speed blocking zones		
• Selection of the minimum limit values for the blocking zones in which the speed must not be constant.		
Setting range (min. value unit max. value)		
0.00	%	199.99
Subcodes	Lenze setting	Info
C00633/1	0.00 %	L_NSet_1: Blocking speed 1 min
C00633/2	0.00 %	L_NSet_1: Blocking speed 2 min
C00633/3	0.00 %	L_NSet_1: Blocking speed 3 min

Example: Parameter setting of two blocking zones



C02610/2

MCK: Ramp time synchr. setpoint			
Time for synchronisation ramps between setpoint jumps occurring through the exceedance of minimum and maximum speed setpoint limit ranges.			
Note:			
Adapt this ramp time to the acceleration time (C00012) and deceleration time (C00013) of the main setpoint.			
Setting range (min. value unit max. value)			Lenze setting
0.000	s	999.999	2.000 s

8.2.3

Ramp smoothing

C00134

Ramp smoothing main setpoint	
Configuration of the ramp smoothing for the main setpoint	
Selection list (Lenze setting printed in bold)	Info
0 Off	Ramp rounding deactivated
1 PT1 behaviour	Ramp rounding with PT1 behaviour

C00182

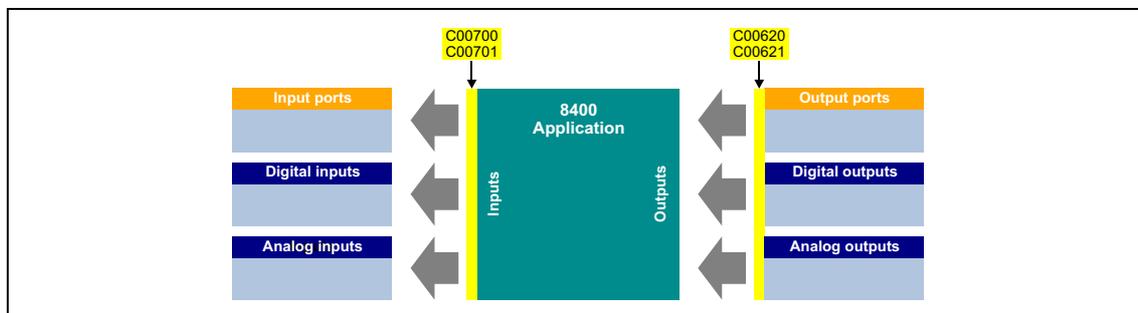
S-ramp time PT1	
PT1 S-ramp time for the main setpoint ramp function generator	
• Only effective with activated ramp rounding (C00134 = "1").	
Setting range (min. value unit max. value)	
0.01	s
50.00	20.00 s

8 Adapting the application individually

8.3 Implementing more additional functions in the signal flow

8.3 Implementing more additional functions in the signal flow

The pre-assignment of the application can be reconfigured via configuration parameters. Thus, additional functions can be implemented in the signal flow as well.



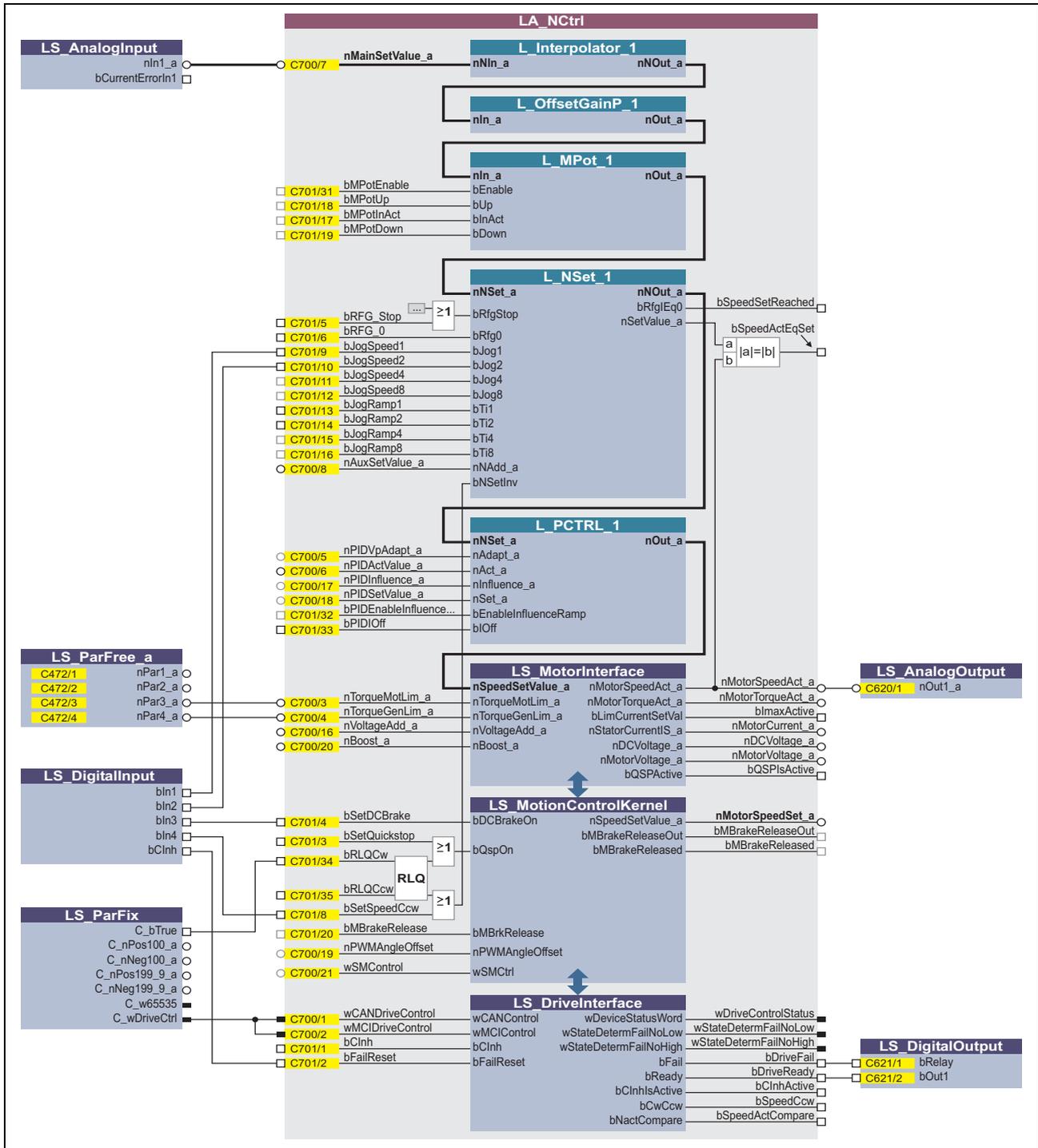
Please observe the "source/destination principle" in this connection:

- A device input terminal can be linked to several input interfaces of the application.
- Each input interface of the application can only be linked to one input signal.
- An output interface of the application can be linked to several device output terminals.

The following subchapter "[Pre-assignment of the input and output interfaces](#)" shows in detail the configuration parameters for the "actuating drive speed" application.

8.3.1 Pre-assignment of the input and output interfaces

In the preset control mode "terminals 0", the input and output terminals of the "actuating drive speed" application are preassigned as follows:



[8-1] Pre-assignment of the application

Brief description of the input and output interfaces

For a detailed interface description see the reference manual.

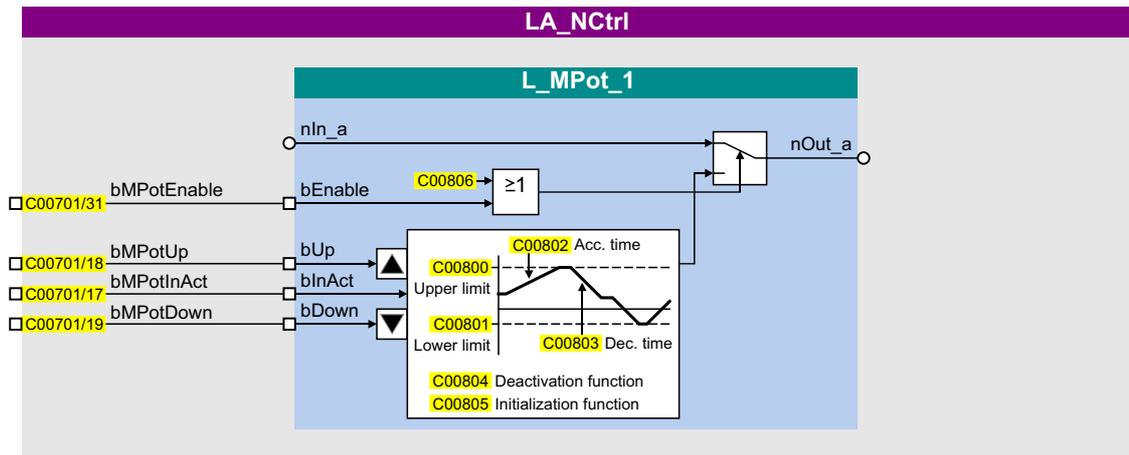
Input interface	Function
nMainSetValue_a	Main speed setpoint
Motor potentiometer (L_MPot_1)	
bMPotEnable	Activating the motor potentiometer function
bMPotInAct	Activating the inactive function
bMPotUp	Increasing the speed setpoint
bMPotDown	Decreasing the speed setpoint
Ramp function generator (L_NSet_1)	
bRFG_Stop	Maintain the current value of the main setpoint integrator
bRFG_0	Lead the main setpoint integrator to "0" within the current Ti times
bLogSpeed1/2/4/8	Selection inputs for fixed changeover setpoints
bLogRamp1/2/4/8	Selection inputs for alternative acceleration/deceleration times
nAuxSetValue_a	Additional speed setpoint
Process controller (L_PCTRL_1)	
nPIDVpAdapt_a	Percentage adaptation of gain Vp
nPIDActValue_a	Speed or actual sensor value (actual process value)
nPIDInfluence_a	Limitation of the influencing factor in percent
nPIDSetValue_a	Sensor or process setpoint
bPIDEnableInfluenceRamp	Activate ramp for influencing factor
bPIDOff	Switch off the I component of the process controller
Motor interface (LS_MotorInterface)	
nTorqueMotLim_a	Torque limitation in motor mode
nTorqueGenLim_a	Torque limitation in generator mode
nVoltageAdd_a	Additive voltage impression
nBoost_a	Additional setpoint for the motor voltage at speed = 0
Motion Control Kernel	
bSetDCBrake	Manual DC-injection braking (DCB)
bSetQuickstop	Enable quick stop (QSP)
bRLQCw	Activate clockwise rotation (fail-safe)
bRLQCcw	Activate counter-clockwise rotation (fail-safe)
bSetSpeedCcw	Change of direction of rotation
bMBRKRelease	Holding brake control: Release/apply brake
nPWMAngleOffset	Additional offset for the electrical angle of rotation
wSMControl	Interface to optional safety engineering
Device control (LS_DriveInterface)	
wCANDriveControl	Control word via system bus (CAN)
wMCIDriveControl	Control word via communication module
bCInh	Enable/Inhibit controller
bFailReset	Reset error message

Output interface	Function
Ramp function generator (L_NSet_1)	
bSpeedSetReached	Status signal "setpoint = 0"
bSpeedActEqSet	Status signal "actual speed value = speed setpoint"
Motor interface (LS_MotorInterface)	
nMotorSpeedAct_a	Actual speed value
nMotorTorqueAct_a	Actual torque
blmaxActive	"Current setpoint inside the limitation" status signal
nMotorCurrent_a	Current stator current/effective motor current
nDCVoltage_a	Actual DC-bus voltage
nMotorVoltage_a	Current motor voltage/inverter output voltage
bQSPisActive	Status signal "quick stop is active"
Motion Control Kernel	
nMotorSpeedSet_a	Speed setpoint
bBrakeReleaseOut	Holding brake control: Trigger signal for the holding brake control switching element via a digital output
bBrakeReleased	Holding brake control: Status signal of the brake control with regard to the release and application times of the brake
Device control (LS_DriveInterface)	
wDriveControlStatus	Status word of the controller (based on DSP-402)
wStateDetermFailNoLow	Display of the status determining error (Low word)
wStateDetermFailNoHigh	Display of the status determining error (High word)
bDriveFail	Status signal "controller in error status"
bDriveReady	Status signal "controller is ready for operation"
bCInhActive	Status signal "controller inhibit is active"
bSpeedCcw	FALSE = Clockwise rotation (Cw) TRUE = Counter-clockwise rotation (Ccw)
bSpeedActCompare	Status signal "speed setpoint or actual value < comparison value (C00024)"

8.3.2 Motor potentiometer

Alternatively, the main speed setpoint can be generated via a motor potentiometer function.

- In the Lenze setting, the motor potentiometer function is deactivated.
- Activation is possible via C00806 or the *bMPotEnable* process input.
- The behaviour of the motor potentiometer during switch-on of the device can be selected in C00805.



Interface description

Identifier	Information/possible settings
bMPotEnable	Activating the motor potentiometer function <ul style="list-style-type: none"> • This input and C00806 are OR'd.
	TRUE The motor potentiometer function is active; the speed setpoint can be changed via the <i>bMPotUp</i> and <i>bMPotDown</i> control inputs.
bMPotUp	Increasing the speed setpoint
	TRUE Approach the upper speed limit value set in C00800 with the acceleration time set in C00802.
bMPotInAct	Activating the inactive function
	TRUE The speed setpoint behaves according to the inactive function set in C00804. <ul style="list-style-type: none"> • In the Lenze setting, the speed setpoint is maintained.
bMPotDown	Decreasing the speed setpoint
	TRUE Approach the lower speed limit value set in C00801 with the deceleration time set in C00803.

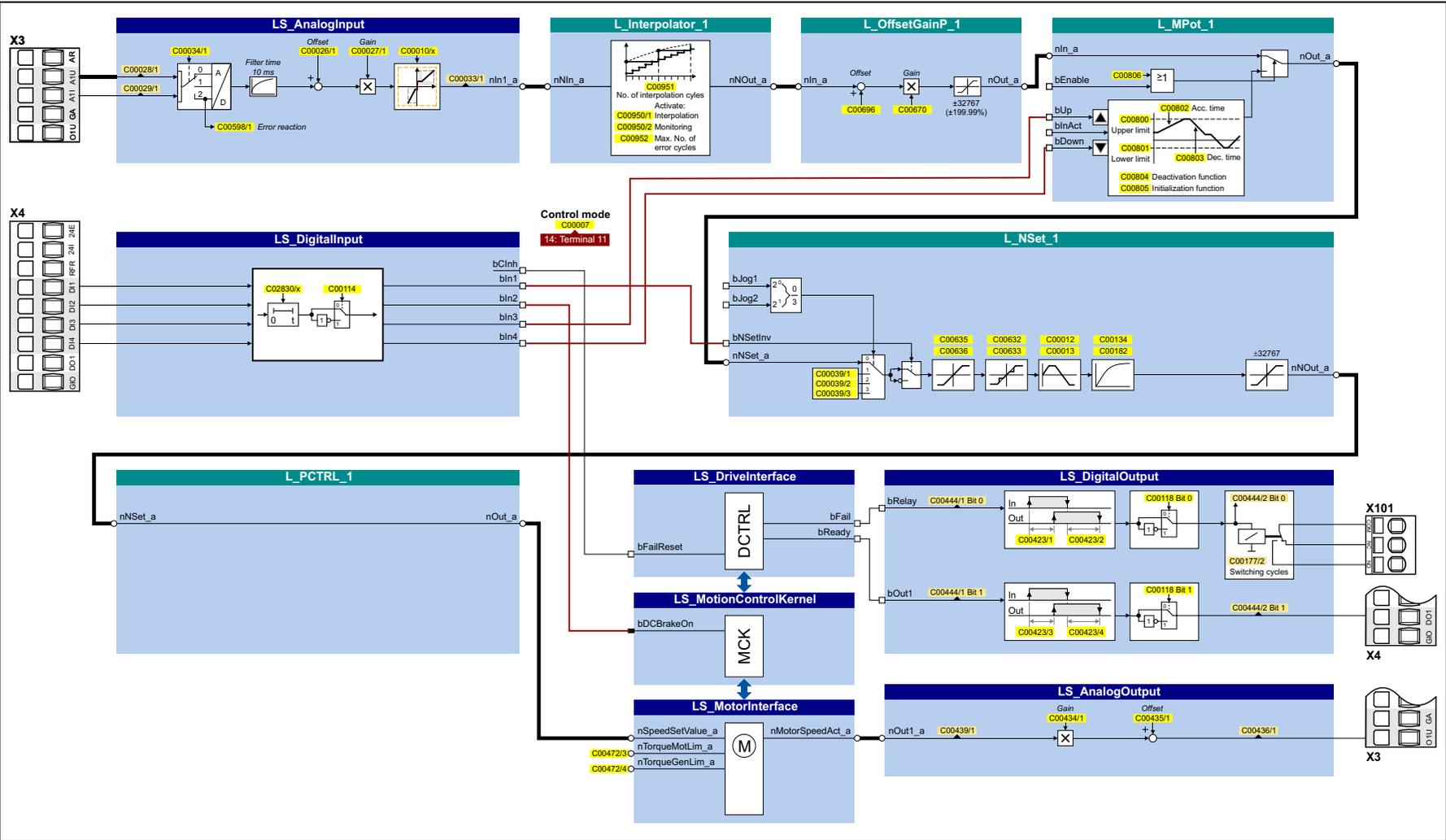


A detailed description of the motor parameter function can be found in the 8400 StateLine reference manual in the following chapter:

Function library → Function blocks → L_MPot_1

Signal flow

For a quick implementation of the motor potentiometer function, the "Terminals 11" control mode is available in C00007. In this control mode, the digital inputs DI3 and DI4 are linked with the control inputs "increase speed" and "reduce speed" of the motor potentiometer function:



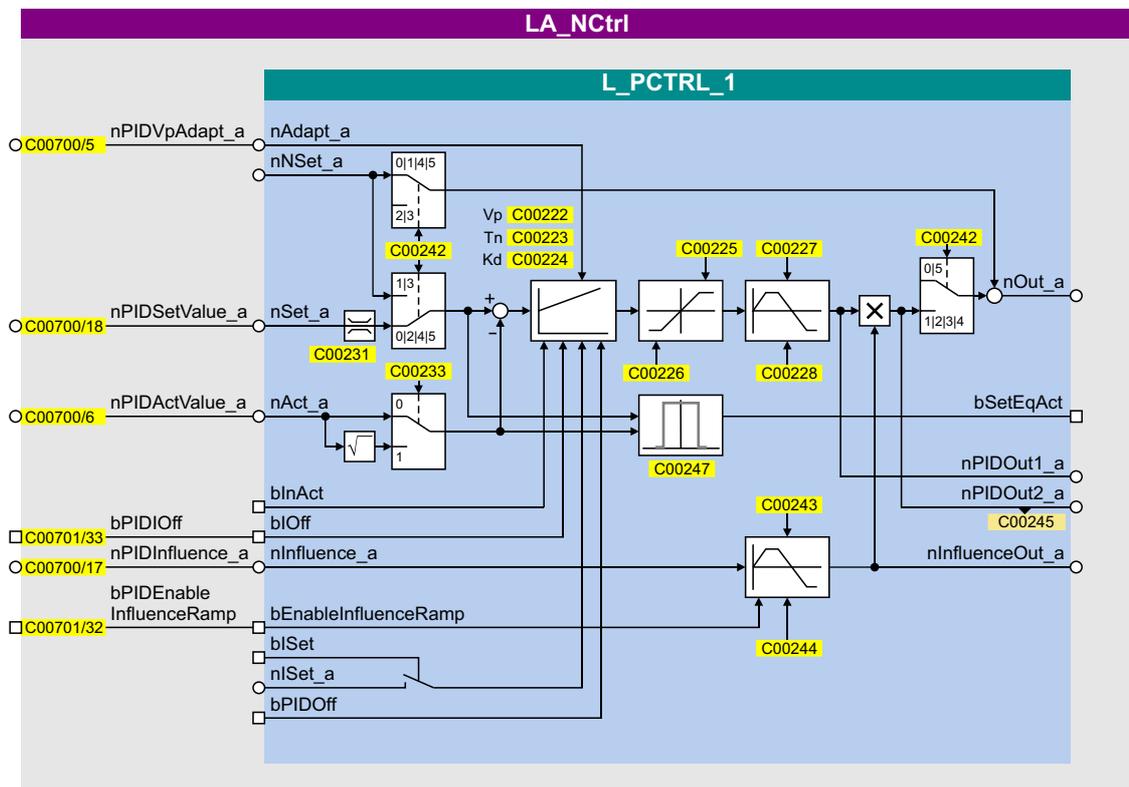
Parameter

Parameter	Name	Info/Lenze setting	
Motor potentiometer	C00806	Use of motor potentiometer	
		0 The motor potentiometer is not used. • The analog value applied to the <i>nIn_a</i> input is looped through without any changes to the <i>nOut_a</i> output.	
	1 The motor potentiometer is used. • The analog value applied at the <i>nIn_a</i> input is led via the motor potentiometer and provided at the <i>nOut_a</i> output.		
	C00800	L_MPot_1: Upper limit	100.00 %
	C00801	L_MPot_1: Lower limit	-100.00 %
	C00802	L_MPot_1: Acceleration time	10.0 s
	C00803	L_MPot_1: Deceleration time	10.0 s
	C00804	L_MPot_1: Inactive fct.	Behaviour of the motor potentiometer function when being deactivated via the <i>blnAct</i> input:
			0 Keep output value
			1 Deceleration via ramp to 0
			2 Deceleration via ramp to the lower limit (C00801)
			3 Step change to 0
			4 Jump to lower limit (C00800)
	C00805	L_MPot_1: Init fct.	Behaviour of the motor potentiometer function when the device is switched on:
0 Load last value			
1 Load lower limit			
2 Load 0			

8.3.3 Process controller

The process controller can be used as PID controller for various control tasks (e.g. as dancer position controller, tension controller or pressure controller).

- The process controller is provided with the following functions:
 - Adjustable control algorithm (P, PI, PID)
 - Ramp function generator for preventing setpoint step-changes at the input
 - Limitation of the controller output
 - Factorisation of the output signal
 - Vp adaptation
 - Integral action component can be switched off
 - Comparison function "Actual value = setpoint"
- In the Lenze setting, the process controller is deactivated.
- The process controller is activated by selecting the operating mode in C00242.
- Configuration parameters serve to link the inputs of the process controller to the required process signals.



Interface description

Identifier	Information/possible settings
bPIDEnable InfluenceRamp	Activate ramp for influencing factor
	FALSE Influencing factor of the PID controller is ramped down to "0".
	TRUE Influencing factor of the PID controller is ramped up to the value <i>nPIDInfluence_a</i> .
bPIDIOff	Switch off the I component of the process controller <ul style="list-style-type: none"> • In conjunction with the operating mode set in C00242 (Lenze setting: "Off").
	TRUE I-component of the process controller is switched off.
nPIDVpAdapt_a	Adaptation of gain Vp set in C00222 in percent <ul style="list-style-type: none"> • Scaling: 16384 \equiv 100 % • Internal limitation to \pm 199.99 % • Changes can be done online.
nPIDSetValue_a	Sensor and process setpoint for operating modes 2, 4 and 5 <ul style="list-style-type: none"> • Scaling: 16384 \equiv 100 % • Internal limitation to \pm 199.99 %
nPIDActValue_a	Speed or actual sensor value (actual process value) <ul style="list-style-type: none"> • Offset and gain for this input signal can be set in C00698 and C00672. • Scaling: 16384 \equiv 100 % • Internal limitation to \pm 199.99 %
nPIDInfluence_a	Limitation of the influencing factor in percent <ul style="list-style-type: none"> • The influence factor of the PID controller can be limited to a certain value (- 199.99% ... + 199.99%) via <i>nPIDInfluence_a</i>. • Scaling: 16384 \equiv 100 % • Internal limitation to \pm 199.99 %

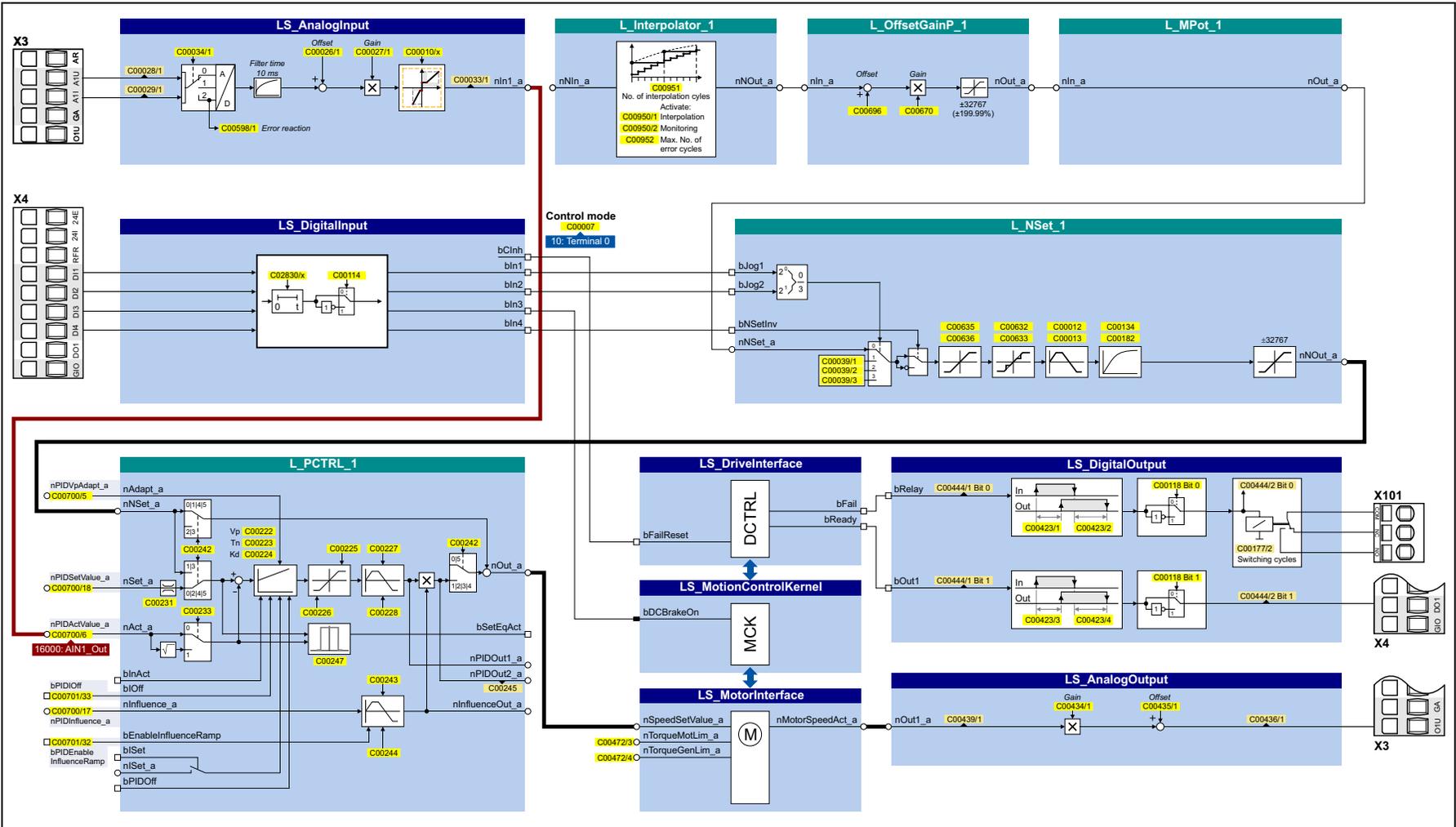


A detailed description of the process controller can be found in the 8400 Stateline reference manual in the following chapter:

Function library \rightarrow Function blocks \rightarrow L_PCTRL_1

Signal flow

The following signal flow shows an example configuration where the analog input is used for defining the actual speed or sensor value (actual process value). In this case, the main speed setpoint is selected via fixed setpoints (C00039/1...3).



Parameter

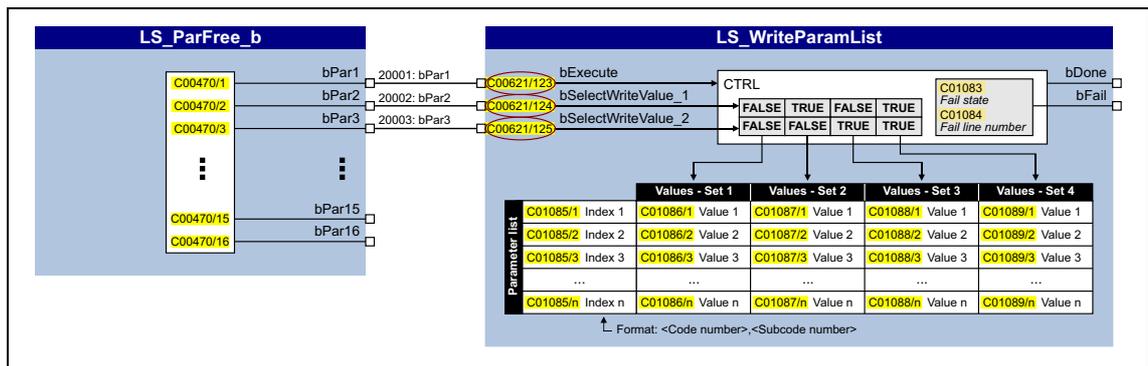
Parameter	Name	Info/Lenze setting
C00242	Operating mode - process controller	Selection of the operating mode of the PID process controller
Basic signal flow (NSet = main setpoint generator/ramp function generator, MCTRL = motor control, PCTRL = PID process controller)		
Process controller		0 Off • MCTRL setpoint = main setpoint (PID controller is not in the circuit)
		1 nNSet + nNSet_PID • MCTRL setpoint = main setpoint + PID output • PID setpoint = main setpoint
		2 nNSet_PID • MCTRL setpoint = PID output • PID setpoint = main setpoint
		3 nNSet_PID • MCTRL setpoint = PID output • PID setpoint = main setpoint
		4 nNSet + nNSet_PID • MCTRL setpoint = main setpoint + PID output • PID setpoint = own setpoint
		5 nNSet nNSet_PID • MCTRL setpoint = main setpoint • PID setpoint = own setpoint
C00222	L_PCTRL_1: Vp	1.0 Gain factor Vp
C00223	L_PCTRL_1: Tn	400 ms Reset time Tn
C00224	L_PCTRL_1: Kd	0.0 Differential component Kd
C00225	L_PCTRL_1: MaxLimit	199.99 % Maximum output value
C00226	L_PCTRL_1: MinLimit	-199.99 % Minimum output value
C00227	L_PCTRL_1: Acceleration time	0.010 s Acceleration time for the output value
C00228	L_PCTRL_1: Deceleration time	0.010 s Deceleration time for the output value
C00233	L_PCTRL_1: Root function	Use of the root function in the actual value input
		0 Root function inactive • The actual value nAct_a remains unchanged for further processing
		1 Root function active • The root is extracted of the actual value nAct_a for further processing
C00243	L_PCTRL_1: Accel. time influence	5.000 s Acceleration time for showing the PID output value
C00244	L_PCTRL_1: Deceleration time influence	5.000 s Deceleration time for masking out the PID output value
C00247	L_PCTRL_1: ActEqSet window	2.00 % Window for comparison operation "actual value = setpoint" of the PID process controller

8.3.4 Parameter change-over

For up to 32 freely selectable parameters, the basic function "parameter change-over" provides a change-over between four sets with different parameter values.

- The value set to be used is selected binary-coded via the selection inputs *bSelectWriteValue_1* and *bSelectWriteValue_2* of the SB *LS_WriteParamList*.
- The writing of the parameter list is activated by a FALSE/TRUE edge at the *bExecute* control input.

In the following example, the control inputs of the parameter change-over are linked to the free parameters C00470/1...3 by parameterising the respective configuration parameters (C00621/x):



[8-2] Example: Linking the control inputs of the parameter change-over to "free" parameters

Configuring the list by means of parameterisation

The parameter list is combined similarly to the user menu via parameter setting. The following application example shows the required procedure for configuring the list without using the »Engineer« parameterisation dialog.

Task:

The parameters C00012, C00026/1 and C00027/1 are to be written.

1. Compiling the parameter list

Specify the given parameters in C01085/1 ... n in the <code>,<subcode> format:

- C01085/1 = 12.000
- C01085/2 = 26.001
- C01085/3 = 27.001
- C01085/4 ... n = 0.000 (no parameter)

2. Entering values for the parameters (value set 1)

In C01086/1 ... n, specify the values to be used to describe the selected parameters. The values are entered according to the scaling format/scaling factor of the respective parameter.

- C01086/1 = <value> for list entry 1 (in our example: for parameter C00012)
- C01086/2 = <value> for list entry 2 (in our example: for parameter C00026/1)
- C01086/3 = <value> for list entry 3 (in our example: for parameter C00027/1)

These values are used in the writing process if the two *bSelectWriteValue_1* and *bSelectWriteValue_2* inputs are not assigned or both set to FALSE.

3. Entering other values for the parameters (value sets 2 ... 4)

If required, up to three other sets can be set in the same way in C01087/1 ... n to C01089/1 ... n which can optionally be written to the parameters. The decision as to which value set is finally used is dependent upon the assignment of the two *bSelectWriteValue_1* and *bSelectWriteValue_2* inputs:

4. Selecting a value set

The value set to be used in this example is selected via the free parameters DC00470/2...3 linked to the selection inputs:

C00470/2 → bSelectWriteValue_1	C00470/2 → bSelectWriteValue_2	Value set used
FALSE	FALSE	Value set 1 (C01086/1 ... n)
TRUE	FALSE	Value set 2 (C01087/1 ... n)
FALSE	TRUE	Value set 3 (C01088/1 ... n)
TRUE	TRUE	Value set 4 (C01089/1 ... n)

5. Activating the writing of the parameters

In this example, the parameter list is written via the free parameter C00470/1 linked to the *bExecute* control input. A change from FALSE to TRUE in C00470/1 activates the writing of the parameter list.

Index

A

- Accel. time - main setpoint (C00012) [39](#)
- Accessories for commissioning [13](#)
- Adapt keypad menus [17](#)
- Analog input (AIN1)
 - Characteristic (C00010/x) [38](#)
 - Configuration (C00034/1) [38](#)
 - Gain (C00027/1) [38](#)
 - Offset (C00026/1) [38](#)
- Analog voltage output (O1U)
 - Gain (C00434/1) [40](#)
 - Offset (C00435/1) [40](#)
- Application [21](#)
 - Reference frequency C11 (C00059) [34](#)
 - Reference speed (C00011) [34](#)
- Auto-DCB
 - Hold time (C00106) [42](#)
 - Threshold (C00019) [42](#)
- Auto-start option (C00142) [36](#)

C

- C10/x [38](#)
- C105 [39](#)
- C106 [42](#)
- C11 [34](#)
- C114 [40](#)
- C118 [40](#)
- C12 [39](#)
- C120 [35](#)
- C13 [39](#)
- C134 [61](#)
- C142 [36](#)
- C15 [34](#)
- C16 [35](#)
- C173 [36](#)
- C18 [42](#)
- C19 [42](#)
- C2 [24](#)
- C2/1 [24](#)
- C2/11 [24](#)
- C2/19 [25](#)
- C2/21 [25](#)
- C21 [42](#)
- C22 [35](#)
- C222 [71](#)
- C223 [71](#)
- C224 [71](#)
- C225 [71](#)
- C226 [71](#)
- C227 [71](#)
- C228 [71](#)
- C233 [71](#)
- C242 [71](#)

- C243 [71](#)
- C244 [71](#)
- C247 [71](#)
- C26/1 [38](#)
- C2611/x [59](#)
- C27/1 [38](#)
- C3 [25](#)
- C34/1 [38](#)
- C36 [42](#)
- C39/1...3 [39](#)
- C434/1 [40](#)
- C435/1 [40](#)
- C59 [34](#)
- C6 [41](#)
- C632/x [60](#)
- C633/x [60](#)
- C635 [59](#)
- C636 [59](#)
- C7 [22](#)
- C800 [67](#)
- C801 [67](#)
- C802 [67](#)
- C803 [67](#)
- C804 [67](#)
- C805 [67](#)
- C806 [67](#)
- C910/1 [43](#)
- C910/2 [43](#)
- Control mode (C00007) [22](#)
- Control terminals [10](#)

D

- DC braking
 - Current (C00036) [42](#)
- DC-injection braking (DCB) [33](#), [41](#)
- Decel. time - main setpoint (C00013) [39](#)
- Decel. time - quick stop (C00105) [39](#)
- Delete logbook (C00002/21) [25](#)
- Device commands (C00002) [24](#)
- Device statuses (LED status display) [44](#)
- Diagnosis terminal X400 [13](#)
- Diagnostic interface (DIAG) [10](#), [14](#)
- Digital inputs (DIx)
 - Polarity (C00114) [40](#)
- Digital outputs (DOx)
 - Polarity (C00118) [40](#)
- DRV-ERR (LED) [44](#)
- DRV-RDY (LED) [44](#)

Index

E

EASY Starter [12](#)

Engineer [12](#)

F

Fixed setpoint 1...3 (C00039/1...3) [39](#)

I

I_{max} in motor mode (C00022) [35](#)

K

Keypad [13](#), [14](#)

Change language [17](#)

User level [17](#)

L

L_MPot_1

Acceleration time (C00802) [67](#)

Deceleration time (C00803) [67](#)

Inactive fct. (C00804) [67](#)

Init fct. (C00805) [67](#)

Lower limit (C00801) [67](#)

Upper limit (C00800) [67](#)

Use (C00806) [67](#)

L_NSet_1

Max.SkipFrq. (C00632/x) [60](#)

Min.SkipFrq. (C00633/x) [60](#)

nMaxLimit (C00635) [59](#)

nMinLimit (C00636) [59](#)

L_PCTRL_1

Acceleration time (C00227) [71](#)

Acceleration time influence (C00243) [71](#)

ActEqSet window (C00247) [71](#)

Deceleration time (C00228) [71](#)

Deceleration time influence (C00244) [71](#)

K_d (C00224) [71](#)

MaxLimit (C00225) [71](#)

MinLimit (C00226) [71](#)

Operating mode (C00242) [71](#)

Root function (C00233) [71](#)

T_n (C00223) [71](#)

V_p (C00222) [71](#)

Language of keypad [17](#)

L-force »EASY Starter« [12](#)

L-force »Engineer« [12](#)

Load Lenze setting (C00002/1) [24](#)

M

Main setpoint

Acceleration time [39](#)

Deceleration time [39](#)

Ramp smoothing [61](#)

Mains voltage (C00173) [36](#)

Max. neg. output frequency (C00910/2) [43](#)

Max. pos. output frequency (C00910/1) [43](#)

MCK

Limitations (C02611/x) [59](#)

Memory module [10](#), [19](#)

Monitoring [47](#)

Motor control (C00006) [41](#)

Multilingualism [17](#)

P

Power terminals [9](#)

Q

QSP (Quick stop) [39](#)

Quick stop (QSP) [39](#)

R

Ramp rounding main setpoint (C00134) [61](#)

Reset error (C00002/19) [25](#)

Restore delivery status [24](#)

S

Save all parameter sets (C00002/11) [24](#)

Setting of motor overload (I²xt) (C00120) [35](#)

Slip compensation (C00021) [42](#)

Status of last device command (C00003) [25](#)

Switching frequency (C00018) [42](#)

U

USB diagnostic adapter [13](#)

User level [17](#)

User menu [20](#)

V

V/f characteristic control (VFCplus) [26](#)

VFC - Voltage Frequency Control [26](#)

V/f base frequency (C00015) [34](#)

V_{min} boost (C00016) [35](#)



Lenze Drives GmbH

Breslauer Straße 3

D-32699 Extertal

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