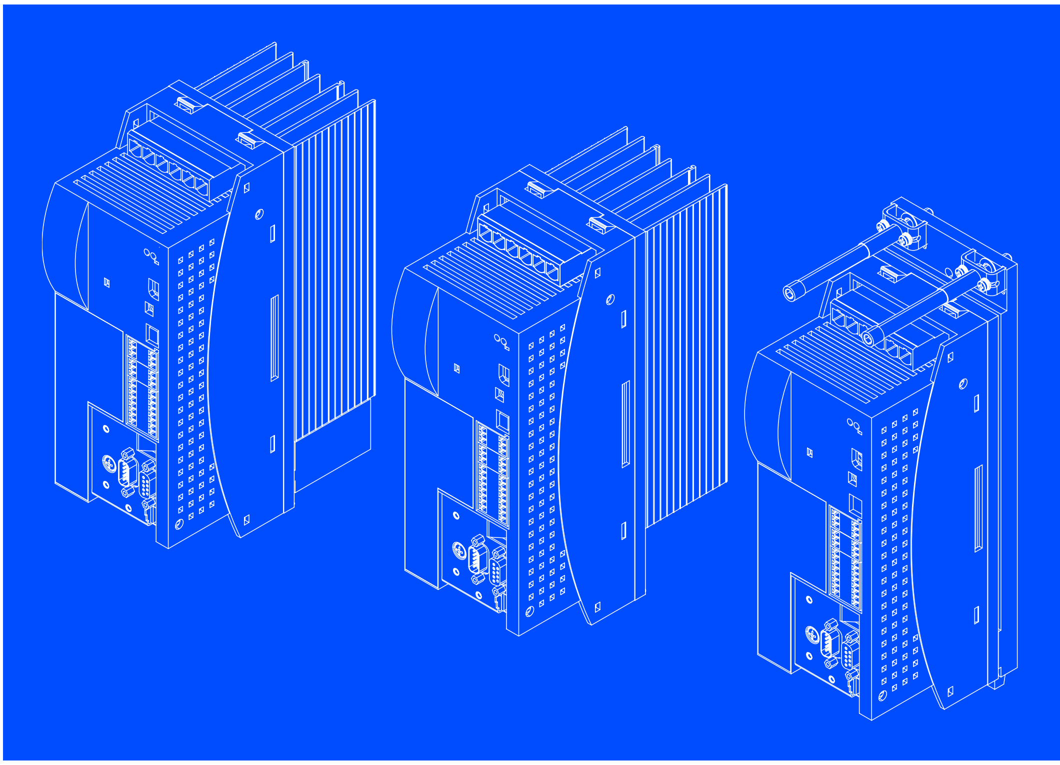
EDBCSXM064
13214966

Operating Instructions

ECS



ECSEMxxx / ECSDMxxx / ECSCMxxx

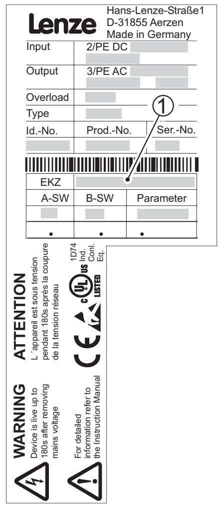
Axis module – "Motion" application

Lenze

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

These instructions are valid for ECSxM axis modules, application software V 1.2, as of version:

①										
ECS	x	M	xxx	x	4	x	xxx	XX	XX	XX



Device type

Design

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

Application

M = ”Motion”

Peak current

004 = 4 A	032 = 32 A
008 = 8 A	048 = 48 A
016 = 16 A	064 = 64 A

Fieldbus interface

C = CAN system bus

Voltage class

4 = 400 V/500 V

Technical version

B = Standard
I = For IT systems

Variant

Hardware version

1A or higher

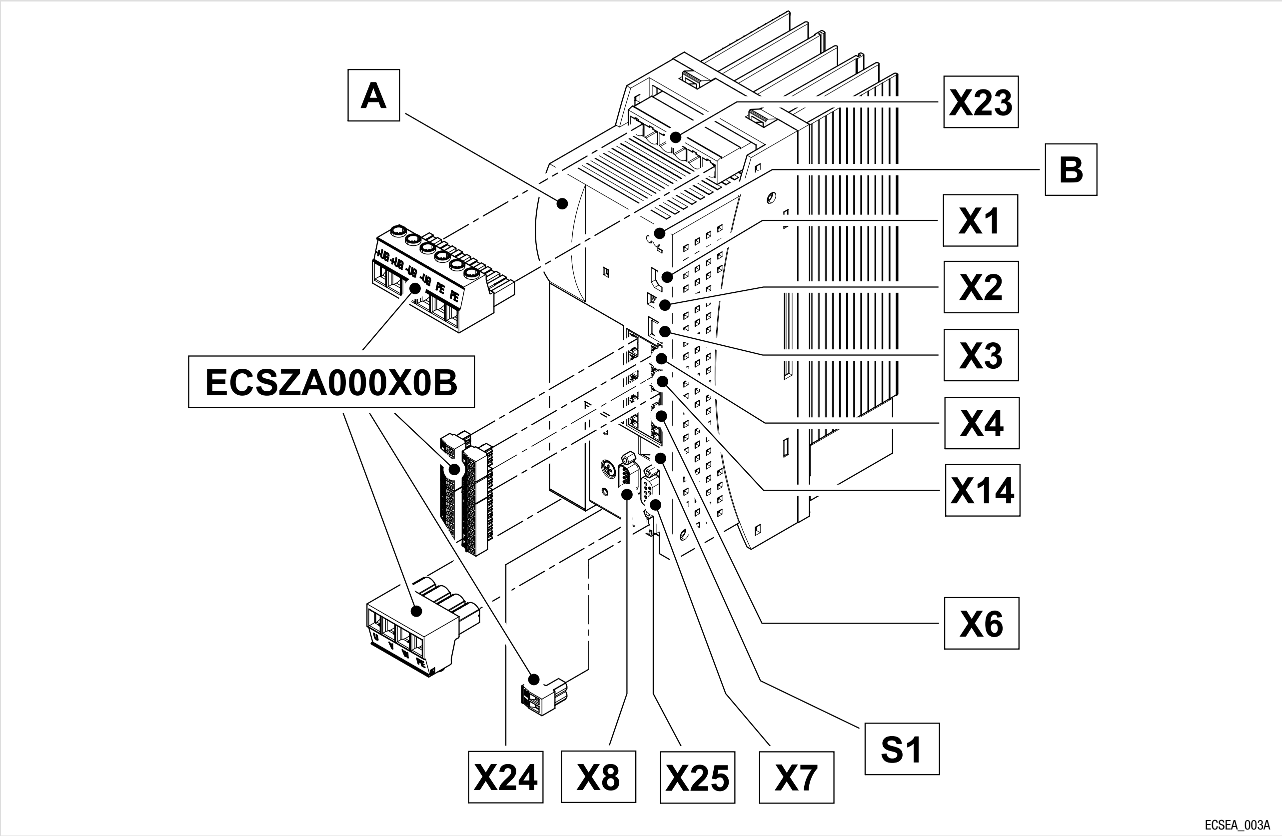
Version of operating software (B-SW)

6.0 or higher

Tip!

Current documentation and software updates concerning Lenze products can be found on the Internet in the ”Services & Downloads” area under

http://www.Lenze.com


A
X23
B
X1
X2
X3
X4
X14
X6
S1
ECSZA000X0B
X24
X8
X25
X7
ECSEA_003A

Scope of supply

Position	Description	Quantity
A	ECS☐M... axis module	1
	Accessory kit with fixing material corresponding to the design (☐): ● ”E” - standard panel-mounted unit ● ”D” - push-through technique ● ”C” - cold-plate technique	1
	Mounting Instructions	1
	Drilling jig	1
	Functional earth conductor (only ECS**D**M...)	1

> **Note!**
> The **ECSZA000X0B** connectors must be ordered separately.

Connections and interfaces

Position	Description	Detailed information
X23	Connections ● DC-bus voltage ● PE	🕮 47
B	LEDs: Status and fault display	
x1	Automation interface (AIF) for ● Communication module ● Operating module (keypad XT)	 🕮 69 🕮 160
x2	PE connection for AIF	
X3	Analog input configuration	🕮 59
X4	CAN connection ● MotionBus (CAN) / for ECSxA: System bus (CAN) ● Interface to higher-level control	🕮 70
X14	CAN-AUX connection ● System bus (CAN) ● PC interface/HMI for parameter setting and diagnostics	
X6	Connections ● 24 V supply ● Digital inputs and outputs ● Analog input ● ”Safe torque off” (formerly ”safe standstill”)	🕮 55 🕮 58 🕮 59 🕮 60
S1	DIP switch ● CAN address ● CAN baud rate	🕮 183
X7	Resolver connection	🕮 74
X8	Encoder connection ● Incremental encoder (TTL encoder) ● SinCos encoder	🕮 75
X25	Brake control connection	🕮 52
X24	Motor connection	🕮 51

Status displays

LED		Operating state	Check test
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibited (CINH), switch-on inhibit	Code C0183
Blinking	Off	Trouble/fault (TRIP) is active	Code C0168/1
Blinking	On	Warning/FAIL-QSP is active	Code C0168/1

1 Preface and general information

1.1 How to use these Operating Instructions

These Operating Instructions assist you in connecting and commissioning the ECSxM... axis modules with multi-axis positioning functionality in connection with a master control.

They contain safety instructions which must be observed!

All persons working on and with the ECSxM... axis modules must have the Operating Instructions available and must observe the information and notes relevant for their work.

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

1.2 Terminology used

Term	In the following text used for
Power supply module	ECSxE... power supply module
ECSxE...	Any power supply module of ECS series
Capacitor module	ECSxK... capacitor module
ECSxK...	Any capacitor module of ECS series
Axis module Controller	ECSxM... axis module
ECSxS... ECSxP... ECSxM... ECSxA ...	Any axis module of ECS series: ● ECSxS... application "Speed and Torque" ● ECSxP... application "Posi and Shaft" ● ECSxM... application "Motion" ● ECSxA... application "Application"
Drive system	Drive systems with: ● ECSxS... / ECSxP... / ECSxM... / ECSxA... axis modules ● ECSxE... power supply modules ● ECSxK... capacitor modules ● Other Lenze drive components
24 V supply Low-voltage supply	Voltage supply ● of the control card, voltage range 20 ... 30 V DC (±0 V) ● of the "safe torque off"(formerly "safe standstill"), voltage range 18 ... 30 V DC (±0 V) ● of the motor holding brake, voltage range 23 ... 30 V DC (±0 V)
AIF	**A**utomation **I**nter**F**ace
Cxxxx/y	Subcode y of code Cxxxx (e.g. C0470/3 = subcode 3 of code C0470)
Xk/y	Terminal y on the plug connector Xk (e.g. X6/B+ = terminal B+ on the plug connector X6)

1.3 Code descriptions

Lenze codes are described in the form of tables with the following structure:

Column	Abbreviation		Meaning
No.	Cxxxx		Code no. Cxxxx
	1		Subcode 1 of Cxxxx
	2		Subcode 2 of Cxxxx
	Cxxxx		Changed parameter of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]		Changed parameter of the code or subcode is accepted after pressing SHIFT PRG if the controller is inhibited.
Designation			LCD of XT EMZ9371BC keypad
Lenze/{Appl.}	x		Lenze setting: ● Value at delivery or after loading the Lenze setting with C0002.
	{xxx...}		Deviating application initialisation value: ● Value at delivery. ● After loading the Lenze setting with C0002, the application initialisation value is overwritten by the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
	⌚		The column "Important" contains further information
Selection	1 {%} 99		Minimum value {unit} maximum value
IMPORTANT			Short code description

Example

Code		Possible settings				IMPORTANT
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**			
C0003	Par save	0				Save parameter set
			0	Done		Saving completed
			1	Save parameter set 1		Non-volatile saving of parameter set 1
C1192						Selection of resistance characteristic for PTC
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	Resistance at temperature 1
2	Char.: OHM	2225				Resistance at temperature 2

1.4 Features of the axis module ECSxM

- Homing can be selected from 19 modes
- Brake logic can be connected
- Switching of operating modes
  – ”Velocity Mode”
  – ”Homing Mode”
  – ”Interpolated Position Mode” (for travel according to setpoint selection)
  – ”Manual Jog”
- Torque feedforward control
- Fine interpolation
- Interpolation cycle can be selected between 1 - 10 ms
- Sequence co-ordination with master control
- Toggle bit monitoring
- Status signals selectable via control words
- Safety function ”safe torque off” (formerly ”safe standstill”)
- Double CAN ON BOARD:
  – MotionBus (CAN): Control interface ”CAN” (PDO1, sync-based)
  – System bus (CAN): Interface ”CAN-AUX” for parameter setting/diagnostics
- Supported feedback systems:
  – Resolver with and without position storage
  – Encoder (incremental encoder (TTL encoder), sin/cos absolute value encoder)
- Commissioning and parameter setting with the Lenze parameter setting and operating program ”Global Drive Control” (GDC)

1.5 Structure

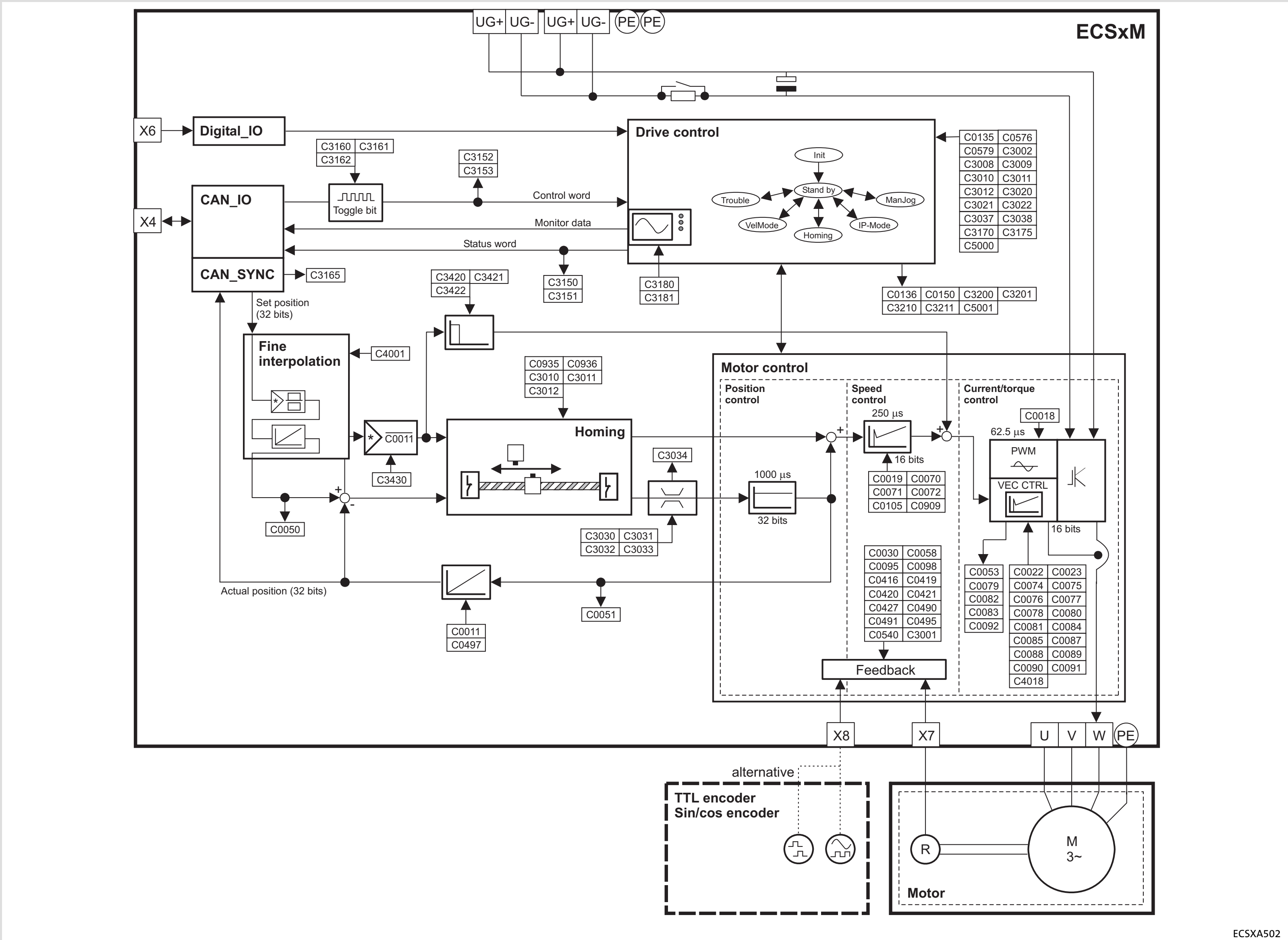


Fig.1-1 Structure of the ECS application "Motion"

1.6 Scope of supply

The scope of supply of the ECSxM... axis module contains:

- Basic device
- Accessory kit with fixing material corresponding to the design:
  – ”E” - standard panel-mounted unit
  – ”D” - push-through technique
  – ”C” - cold-plate technique
- Mounting Instructions
- Drilling jig
- Functional earth conductor (only ECS**D**M...)

Accessories

Information on the following accessories can be found in the appendix (📖 288).

- Connectors for
  – power supply modules: ECSZE000X0B
  – capacitor modules: ECSZK000X0B
  – axis modules: ECSZA000X0B
- ECSZS000X0B001 shield mounting kit (EMC accessories)
- Communication modules for the automation interface (AIF)
- ECSxE... power supply module
- ECSxK... capacitor module
- Brake resistors
- Mains fuses
- Mains chokes
- RFI filters
- Motors

1.7 Legal regulations

Identification	**Nameplate**	**CE identification**	**Manufacturer**
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze Drive Systems GmbH PO box 10 13 52 D-31763 Hameln
Application as directed	**ECSxM... axis modules** ● must only be operated under the conditions prescribed in these instructions. ● are components – for open and closed loop control of variable speed drives with PM synchronous motors and asynchronous motors. – for installation in a machine. – for assembly with other components to form a machine. ● are electrical equipment for the installation in control cabinets or similar closed operating areas. ● comply with the protective requirements of the EC Low-Voltage Directive. ● are not machines for the purpose of the EC Machinery Directive. ● are not to be used as domestic appliances, but for industrial purposes only. **Drive systems with ECSxM... axis modules** ● comply with the EC Directive "Electromagnetic compatibility" if they are installed according to the guidelines of CE-typical drive systems. ● can be used – at public and non-public mains. – in industrial premises. ● The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	● The information, data and notes in these instructions met the state of the art at the time of printing. Claims on modifications referring to axis modules and components which have already been supplied cannot be derived from the information, illustrations and descriptions given in these instructions. ● The specifications, processes and circuitry described in these instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. ● Lenze does not accept any liability for damages and failures caused by: – Disregarding the Operating Instructions – Unauthorised modifications to the axis module – Operating errors – Improper working on and with the axis module		
Warranty	● Terms of warranty: See terms of sales and delivery of Lenze Drive Systems GmbH. ● Warranty claims must be made to Lenze immediately after detecting the deficiency or fault. ● The warranty is void in all cases where liability claims cannot be made.		

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

(According to: Low-Voltage Directive 73/23/EEC)

General

Depending on their degree of protection, some parts of Lenze controllers (frequency inverters, servo inverters, DC controllers) and their accessory components can be live, moving and rotating during operation. Surfaces can be hot.

Non-authorised removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.

For more information please see the documentation.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and national regulations for the prevention of accidents must be observed).

According to this basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

Application as directed

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

When installing drive controllers into machines, commissioning of these controllers (i.e. the starting of operation as directed) is prohibited until it is proven that the machine corresponds to the regulations of the EC Directive 98/37/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of operation as directed) is only allowed when there is compliance with the EMC Directive (89/336/EEC).

The controllers meet the requirements of the Low-Voltage Directive 73/23/EEC. The harmonised standard EN 61800-5-1 applies to the controllers.

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

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

Transport, storage

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

Observe the climatic conditions according to the technical data.

Installation

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

Ensure proper handling and avoid 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 electrostatically sensitive components, which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live controllers, the valid national regulations for the prevention of accidents (e.g. VBG 4) must be observed.

Carry out the electrical installation in compliance with the corresponding regulations (e.g. cable cross-sections, fuses, PE connection). More detailed information is given in the corresponding documentation.

Notes about installation according to EMC regulations (shielding, earthing, filters and cable routing) are included in the documentation. These notes also apply to CE-marked controllers. The compliance with limit values required by the EMC legislation is the responsibility of the manufacturer of the machine or system. 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 should have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Lenze controllers can cause a DC residual current in the protective conductor. If a residual current device (RCD) is used as a protective means in the case of direct or indirect contact, only a residual current device (RCD) of type B may be used on the current supply side of the controller. Otherwise, another protective measure, such as separation from the environment through double or reinforced insulation or disconnection from the mains by means of a transformer must be used.

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 controller can be adapted to your application. Please observe the corresponding information given in the documentation.

After a controller has been disconnected from the voltage supply, all live components and power connections 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.

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

Safety functions

Special controller variants support safety functions (e.g. ”safe torque off”, formerly ”safe standstill”) according to the requirements of Annex I No. 1.2.7 of the EC Directive ”Machinery” 98/37/EC, EN 954-1 Category 3 and EN 1037. Strictly observe the notes on the safety functions given in the documentation on the respective variants.

Maintenance and servicing

The controllers do not require any maintenance, if the prescribed conditions of operation are observed.

If the ambient air is polluted, the cooling surfaces of the controller may become dirty or the air vents of the controller may be obstructed. Therefore, clean the cooling surfaces and air vents periodically under these operating conditions. Do not use sharp or pointed tools for this purpose!

Waste disposal

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

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

2.2 Residual hazards

Protection of persons

- Before working on the axis module, check that no voltage is applied to the power terminals,
  - because the power terminals +UG, -UG, U, V and W remain live for at least 3 minutes after mains switch-off.
  - because the power terminals +UG, -UG, U, V and W remain live when the motor is stopped.
- The heatsink has an operating temperature of > 70 °C:
  - Direct skin contact with the heatsink results in burns.
- The leakage current to PE is > 3.5 mA AC or > 10 mA DC.
  - EN 61800-5-1 requires a fixed installation.
  - The PE connection must be designed to EN 61800-5-1.
  - Comply with the additional requirements of EN 61800-5-1 for high leakage currents.

Device protection

- All pluggable connection terminals must only be connected or disconnected when no voltage is applied!
- The power terminals +UG, -UG, U, V, W, and PE are not protected against polarity reversal.
  - When wiring, observe the polarity of the power terminals!
- Power must not be converted until all devices of the power system are ready for operation. Otherwise, the input current limitation may be destroyed.

Frequent mains switching (e.g. inching mode via mains contactor) can overload and destroy the input current limitation of the axis module, if

- the axis module is supplied via the ECSXE power supply module and the input current limitation is activated depending on the DC bus voltage (C0175 = 1 or 2).
- the axis module is not supplied via a power supply module from Lenze.
- the low-voltage supply (24 V) is switched off.

Under these operating conditions allow a break of at least 3 minutes between two starting operations!

In case of frequent disconnections due to safety reasons, use the safety function ”Safe torque off” (STO).

Motor protection

- Only use motors with a minimum insulation resistance of û = 1.5 kV, min. du/dt = 5 kV/μs.
  – Lenze motors meet these requirements.
- When using motors with an unknown insulation resistance, please contact your motor supplier.
- Some settings of the axis module lead to an overheating of the connected motor, e.g. longer operation of self-ventilated motors with low speeds.
- Use PTC thermistors or thermostats with PTC characteristic for motor temperature monitoring.

2.3 Safety instructions for the installation according to U_L or U_R

Warnings!

General markings:

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

Markings provided for the supply units:

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

Markings provided for the inverter units:

- The inverter units shall be used with supply units which are provided with overvoltage devices or systems in accordance with UL840 2nd ed., Table 5.1.
- The devices are provided with integral overload and integral thermal protection for the motor.
- The devices are not provided with overspeed protection.

Terminal tightening torque of lb-in (Nm)

Terminal	lb-in	Nm
X 21, X 22, X 23, X 24	10.6 ... 13.3	1.2 ... 1.5
X4, X6, X14	1.95 ... 2.2	0.22 ... 0.25
X 25	4.4 ... 7.1	0.5 ... 0.8

Wiring diagram AWG

Terminal	AWG
X 21, X 22, X 23, X 24	12 ... 8
X4, X6, X14	28 ... 16
X 25	24 ... 12

2.4 Definition of notes used

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

Safety instructions

Structure of safety instructions:

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

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

Application notes

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

Special safety instructions and application notes for UL and UR

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

3 Technical data

3.1 General data and operating conditions

Standards and operating conditions			
Conformity		CE	Low-Voltage Directive (73/23/EWG)
Approvals		UL 508C	Power conversion equipment Underwriter Laboratories (File No. E132659) for USA and Canada
Max. permissible motor cable length	shielded	50 m	For rated mains voltage and switching frequency of 8 kHz
Packaging (DIN 4180)		Delivery packing	
Installation		• Installation in IP20 control cabinet • For the "safe torque off" function (formerly "safe standstill"): mounting in IP54 control cabinet	
Mounting position		Vertically suspended	
Free space	above	≥ 65 mm	
	below	≥ 65 mm With ECSZS000X0B shield mounting kit: > 195 mm	
	to the sides	Side-by-side mounting without any clearance	

Environmental conditions			
Climate		3k3 in accordance with IEC/EN 60721-3-3 Condensation, splash water and ice formation not permissible.	
	Storage	IEC/EN 60721-3-1	1K3 (-25 ... + 55 °C)
	Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
	Operation	IEC/EN 60721-3-3	3K3 (0 ... + 55 °C) • Atmospheric pressure: 86 ... 106 kPa • Above +40 °C: reduce the rated output current by 2 %/°C.
Site altitude			0 ... 4000 m amsl • reduce rated output current by 5 %/1000 m above 1000 m amsl. • Over 2000 m amsl: use is only permitted in environments with overvoltage category II
Pollution		VDE 0110 part 2 pollution degree 2	
Vibration resistance		Accelerational stability up to 0.7 g (Germanischer Lloyd, general conditions)	

<table>
<tr><th colspan="4">General electrical data</th></tr>
<tr><td>EMC</td><td colspan="3">Compliance with EN 61800-3</td></tr>
<tr><td>Noise emission</td><td colspan="3">Compliance with limit value class A to EN 55011
(achieved with application-typical collective filter)</td></tr>
<tr><td rowspan="7">Noise immunity</td><td colspan="3">Requirements to EN 61800-3</td></tr>
<tr><td>Requirements</td><td>Standard</td><td>Severity</td></tr>
<tr><td>ESD [1)]</td><td>EN 61000-4-2</td><td>3, i. e.
● 8 kV with air discharge
● 6 kV with contact discharge</td></tr>
<tr><td>High frequency in cables</td><td>EN 61000-4-6</td><td>10 V; 0.15 ... 80 MHz</td></tr>
<tr><td>RF interference (enclosure)</td><td>EN 61000-4-3</td><td>3, i. e. 10 V/m;
80 ... 1000 MHz</td></tr>
<tr><td>Burst</td><td>EN 61000-4-4</td><td>3/4, i. e. 2 kV/5 kHz</td></tr>
<tr><td>Surge (on mains cable)</td><td>EN 61000-4-5</td><td>3, i. e. 1.2/50 μs
● 1 kV phase-phase
● 2 kV phase PE</td></tr>
<tr><td>Insulation resistance</td><td colspan="3">Overvoltage category III to VDE 0110</td></tr>
<tr><td>Discharge current to PE (to EN 61800-5-1)</td><td colspan="3">> 3.5 mA AC during operation</td></tr>
<tr><td>Enclosure</td><td colspan="3">IP20 for
● standard mounting (built-in unit)
● Mounting in cold plate technique
● mounting with thermal separation (push-through technique), IP54 on the heatsink side</td></tr>
<tr><td>Protective measure against</td><td colspan="3">● Short circuit in power terminals
– Motor terminal has a limited protection against short circuit (after short circuit detection, the error message must be reset.)
● Short circuit in auxiliary circuits
– Digital outputs: protected against short circuit
– Bus and encoder systems: limited protection against short circuit (if necessary, monitoring functions can be switched off, in this case, error messages must be reset:)
● Short to earth (protected against short to earth during operation, limited protection against short to earth on mains power-up)
● Overvoltage
● Motor stalling
● Motor overtemperature (input for KTY, $I^2 \times t$ monitoring)</td></tr>
<tr><td>Protective insulation of control circuits</td><td colspan="3">Protective isolation of mains
Double/reinforced insulation to EN 61800-5-1</td></tr>
</table>

1) Noise immunity in the above-mentioned severities must be guaranteed through the control cabinet. The user must check the compliance with the severities!

3.2 Rated data

Rated data	Type	Axis module					
		ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains	S_N [kVA]	1.3		2.6		5.3	
Data for operation with upstream supply module on mains voltage	U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage	$U_{DC\ bus}$ [V]	15 ... 770					
DC-bus current	$I_{DC\ bus}$ [A]	2.5	2.0	4.9	3.9	9.8	7.8
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20 °C)	I_r [A]	2.0	1.6	4.0	3.2	8.0	6.4
Rated output current at 8 kHz (causes a heatsink temperature of 70 °C at an ambient temperature of 20 °C)	I_r [A]	1.4	1.1	2.7	2.2	5.3	4.2
Max. output current (acceleration current)	I_{max} [A]	4.0		8.0		16.0	
Permanent current at standstill (holding current at 90 °C, 4 kHz)	$I_{0,eff\ 4\ kHz}$ [A]	2.0	1.6	4.0	3.2	8.0	6.4
Short-time standstill current (holding current at 90 °C, 4 kHz) 2)	$I_{0,eff\ 4\ kHz}$ [A]	2.3		4.6		9.1	
Short-time standstill current (holding current at 70 °C, 4 kHz) 2)	$I_{0,eff\ 4\ kHz}$ [A]	3.0		6.0		12.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) 2)	$I_{0,eff\ 8\ kHz}$ [A]	1.5		3.0		6.0	
Power loss (operation with rated current at 4 kHz / 8 kHz) – Inside the device	P_{loss} [W]	13.3		17.3		20.7	
Power loss (operation with rated current at 4 kHz / 8 kHz) – Heatsink	P_{loss} [W]	14.0		29.0		64.0	
Max. output frequency	f_{out} [Hz]	600					
Mass	m [kg]	Approx. 2.4					

1) If the heatsink temperature reaches 70 °C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured temperature of the heatsink (C0061).

□ Application software: S = Speed & Torque; P = Posi & Shaft; M = Motion; A = Application

Rated data		Type	Axis module					
			ECSx□004		ECSx□008		ECSx□016	
Output power 400 V mains		S_N [kVA]	8.3		11.2		13.2	
Data for operation with upstream supply module on mains voltage		U_{mains} [V]	400	480	400	480	400	480
DC-bus voltage		$U_{DC\ bus}$ [V]	15 ... 770					
DC-bus current		$I_{DC\ bus}$ [A]	15.6	12.5	20.9	16.8	24.5	19.6
Rated output current at 4 kHz (causes a heatsink temperature of 70°C at an ambient temperature of 20 °C)		I_r [A]	12.7	10.2	17.0	13.6	20.0	16.0
Rated output current at 8 kHz (causes a heatsink temperature of 70 °C at an ambient temperature of 20 °C)		I_r [A]	8.5	6.8	11.3	9.0	13.3	10.6
Max. output current (acceleration current)		I_{max} [A]	32.0		48.0		64.0	
Permanent current at standstill [2] (holding current at 90 °C, 4 kHz)		$I_{0,eff\ 4\ kHz}$ [A]	16.0	12.8	23.0	18.4	27.0	21.6
Short-time standstill current (holding current at 90 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	18.1		27.2		36.3	
Short-time standstill current (holding current at 70 °C, 4 kHz) [2]		$I_{0,eff\ 4\ kHz}$ [A]	24.0		36.0		48.0	
Short-time standstill current (holding current at 70 °C, 8 kHz) [2]		$I_{0,eff\ 8\ kHz}$ [A]	12.1		18.1		24.2	
Power loss (operation with rated current at 4 kHz / 8 kHz)	Inside the device	P_{loss} [W]	27.5		34.5		41.0	
	Heatsink		117.0		132.0		158.0	
Max. output frequency		f_{out} [Hz]	600					
Mass		m [kg]	Approx. 2.4		Approx. 3.3			

1) If the heatsink temperature reaches 70 °C, the switching frequency automatically changes to 4 kHz.

2) The indicated temperature is the measured temperature of the heatsink (C0061).

□ Application software: S = Speed & Torque, P = Posi & Shaft, M = Motion, A = Application

3.3 Current characteristics

3.3.1 Increased continuous current depending on the control factor

In the lower speed range – the motor does not need the full motor voltage – particularly the more powerful ECS axis modules can be permanently operated with increased output current (cp. continuous current $I_{0,eff}$ 🕮 25).

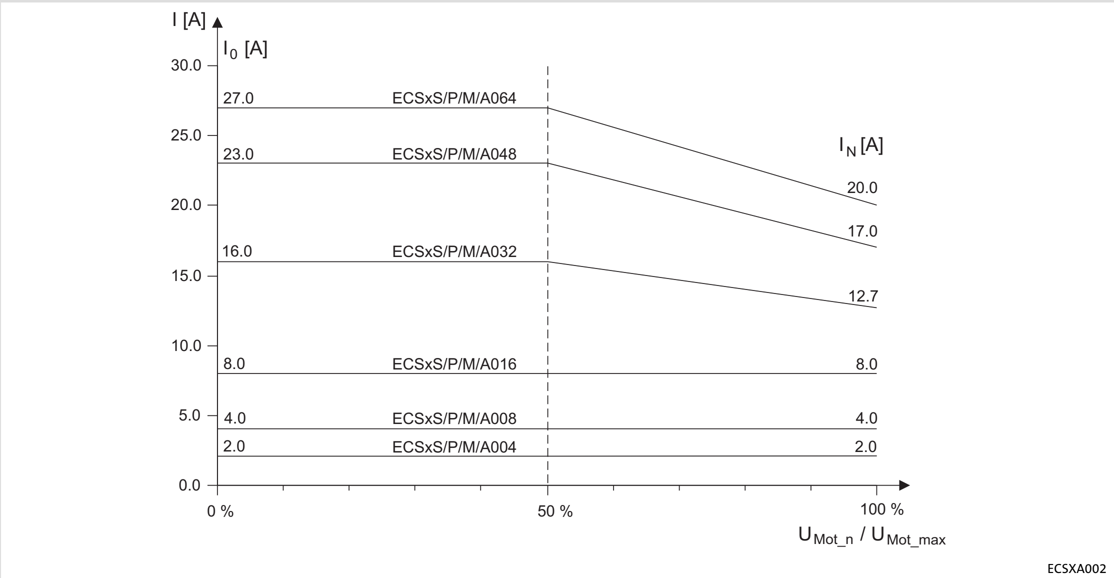


Fig.3-1 Continuous device current, depending on the output voltage for $U_{mains} \leq 400$ V at 4 kHz

I_r	Rated output current of the axis module
U_{Mot_n}	Actual controller output voltage
U_{Mot_max}	0.9 x current mains voltage

The permissible continuous current depends on the control factor of the power output stages, approximately on the ratio of the motor voltage output in the operating point (U_{Mot_n}) to the maximum possible output voltage (U_{Mot_max}). Due to voltage drops across the components involved at rated load and a control margin, U_{Mot_max} can be estimated with 90 % of the mains voltage.

The following table represents the connections between mains voltage, DC-bus voltage and motor voltage:

Mains voltage [U_{mains}]	DC-bus voltage [$U_{ZK} = U_{mains} \times 1.35$]	Output voltage (motor voltage) nominally achievable for 100 % modulation [$U_{mot} = 0.66 \times U_{ZK}$]
3 x 230 V AC	310 V DC	3 x 205 V AC
3 x 380 V AC	510 V DC	3 x 340 V AC
3 x 400 V AC	540 V DC	3 x 360 V AC
3 x 415 V AC	560 V DC	3 x 370 V AC
3 x 460 V AC	620 V DC	3 x 415 V AC
3 x 480 V AC	650 V DC	3 x 435 V AC
3 x 528 V AC	712 V DC	3 x 475 V AC

For steady-state operation in generator mode with increased DC-bus voltage or supply from a closed-loop controlled DC voltage source, interpolate accordingly between the values given in the table.

The increased rated currents are valid for the entire specified voltage range at switching frequencies of 4 kHz and 8 kHz.

Note!

If in this connection a heatsink temperature of > 70 °C is reached, the drive switches to a switching frequency of 4 kHz, independently of the adjusted switching frequency.

Tip!

The operating threshold of the I x t monitoring is automatically derived from the variable continuous currents.

Example:

The ECS axis module suitable for operation in conjunction with a Lenze motor of type MCS 14L32 is to be determined.

- Rated motor data
  – Rated motor torque (M_{mot}) = 17.2 Nm
  – Rated motor speed (n_{mot}) = 3225 rpm
  – Motor voltage at 3250 rpm (U_{mot_n3250}) = 275 V
  – Rated motor current (I_{mot}) = 15 A
  – Max. motor current (I_{mot_max}) = 92 A
- Application data:
  – Max. torque (M_{max}) = 35 Nm
  – Max. operating speed (n_{max}) = 2500 rpm
  – An effective process power (P_{eff}) of 4.5 kW arises on the basis of the Mn diagram.
  – The drive rating results in an effective motor current (I_{Mot_eff}) of 14.8 A.

A first estimation based on the rated current of the ECS axis module would probably lead to selecting the ECSxM048 module with a rated current of 17.0 A.

However, if we take into account the increased continuous current for smaller control factors, the more cost-effective ECSxM032 axis module with a rated current of 12.7 A can be used here.

- When the MCS 14L32 is operated with 2500 rpm, the real motor voltage is (U_{Mot_n2500}):

$$U_{Mot\_n2500} = U_{Mot\_n3250} \cdot \frac{n_{max}}{n_{Mot}} \quad \Rightarrow \quad 275\ \text{V} \cdot \frac{2500\ \text{rpm}}{3250\ \text{rpm}} = 212\ \text{V}$$

- This leads to the following max. control factor (α_{max}) of the axis module:

$$\alpha_{max} = \frac{U_{Mot\_n2500}}{U_{max}} \quad \Rightarrow \quad \frac{212\ \text{V}}{360\ \text{V}} = 0.59 = 59\ \%$$

  Using the current characteristic of Fig.3-1 (🕮 27), a continuous current of 15.5 A can be determined for the ECSxM032 axis module when the control factor (α_{max}) is 59 %.

- **Result:**

  Under the conditions mentioned above the MCS 14L32 Lenze motor can be operated continuously on the ECSxM032 axis module.

3.3.2 Device protection by current derating

The maximum output current is limited. With output frequencies < 5 Hz the limitation depends on the heatsink temperature.

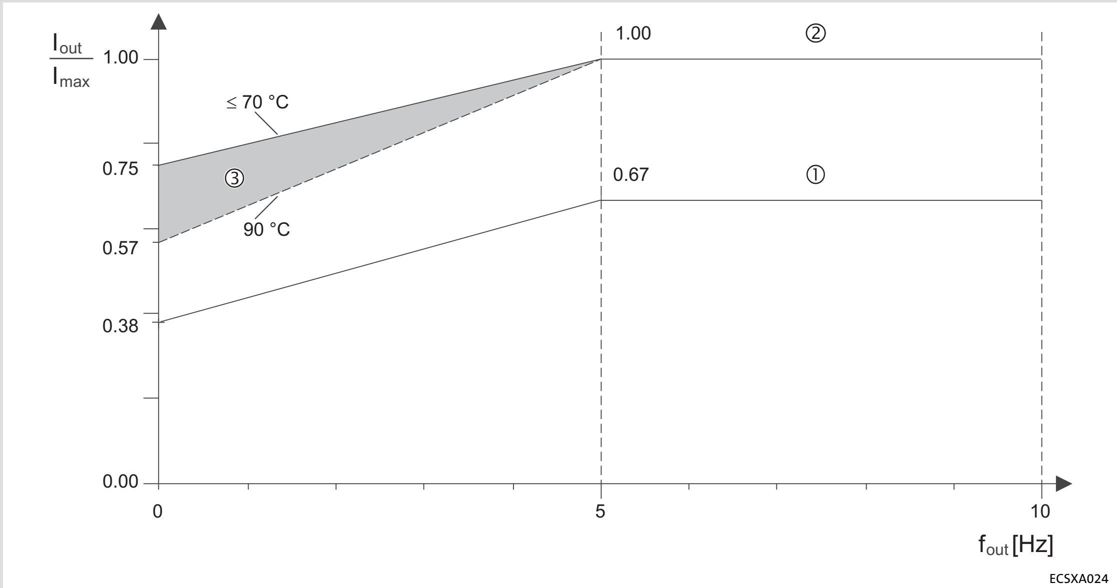


Fig.3-2 Current derating characteristics

① Operation with switching frequency = 8 kHz (C0018 = 1).
- If the current exceeds the characteristic ①, the switching frequency is automatically changed to 4 kHz (e.g. for higher torque in acceleration processes).

② Operation with switching frequency = 4 kHz (C0018 = 0).
- The current limitation follows the characteristic ②.
- With output frequencies < 5 Hz and heatsink temperatures between 70 and 90 °C the current limit is steplessly adjusted in the range ③.

Type	**I_{max} [A]**				
	Switching frequency 8 kHz ①		**Switching frequency 4 kHz ②**		
	f_{out} > 5 Hz	**f_{out} → 0 Hz**	**f_{out} > 5 Hz**	**f_{out} → 0 Hz ≤ 70 °C**	**f_{out} → 0 Hz 90 °C**
ECSxM004	2.7	1.5	4.0	3.0	2.3
ECSxM008	5.3	3.0	8.0	6.0	4.6
ECSxM016	10.7	6.0	16.0	12.0	9.1
ECSxM032	21.3	12.1	32.0	24.0	18.1
ECSxM048	32.0	18.1	48.0	36.3	27.2
ECSxM064	42.7	24.2	64.0	48.0	36.3

4 Mechanical installation

4.1 Important notes

- Axis modules of series ECS feature enclosure IP20 and, for this reason, are intended for installation in control cabinets.
- If the cooling air contains pollutants (dust, fluff, grease, aggressive gases):
  – Take suitable preventive measures, e.g. separate air duct, installation of filters, regular cleaning.
- Possible mounting positions:
  – Vertically at the mounting plate
  – DC-bus connections (X23) at the top
  – Motor connection (X24) at the bottom
- Maintain the specified free spaces above and below to other installations!
  – If the ECSZS000X0B shield mounting kit is used, an additional clearance is required.
  – Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  – Several modules of the ECS series can be installed in the control cabinet next to each other without any clearance.
- The mounting plate of the control cabinet
  – must be electrically conductive.
  – must not be varnished.
- In the case of continuous vibrations or shocks use shock absorbers.

4.2 Mounting with fixing rails (standard installation)

4.2.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

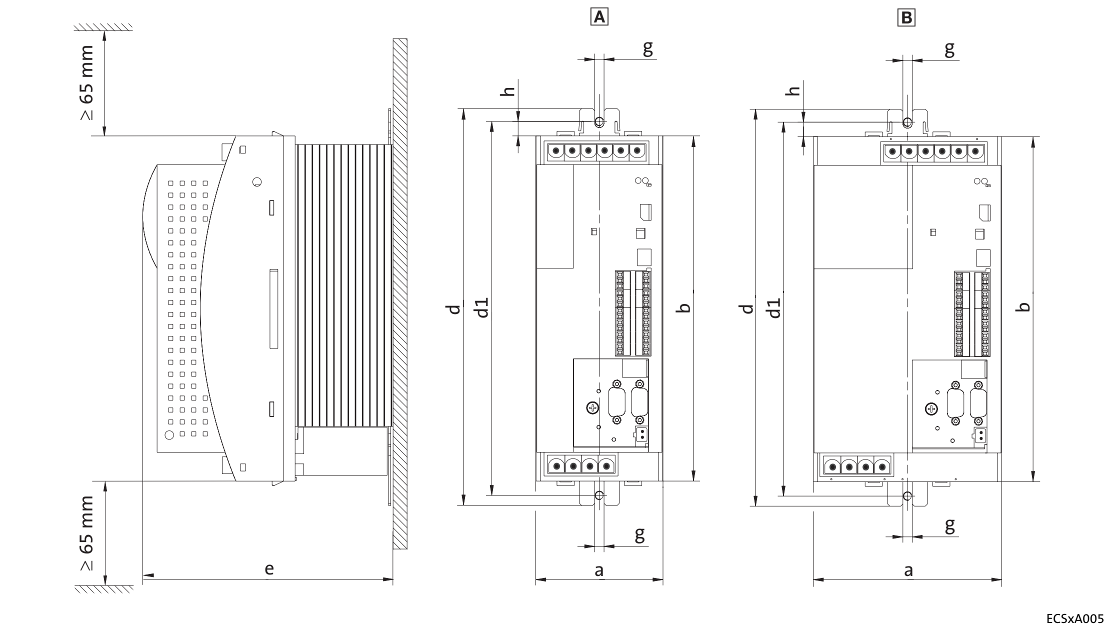


Fig.4-1 Dimensions for "panel-mounted" design

Axis module		Dimensions [mm]						
Type	Size	a	b	d	d1	e	h	g
ECSEM004	A	88.5	240	276	260	176 212 1)	10	6.5 (M6)
ECSEM008								
ECSEM016								
ECSEM032								
ECSEM048	B	131						
ECSEM064								

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

4.2.2 Assembly steps

How to install the axis module:

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

4.3 Mounting with thermal separation (push-through technique)

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

The edges of the mounting cutout and the fixing holes for the clamps must be slightly curved inwards (towards the axis module).

Cooling

With the separated heatsink the heat generation in the control cabinet can be reduced.

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

4.3.1 Dimensions

Note!

Mounting with ECSZS000X0B shield mounting kit:

► Mounting clearance below the module > 195 mm

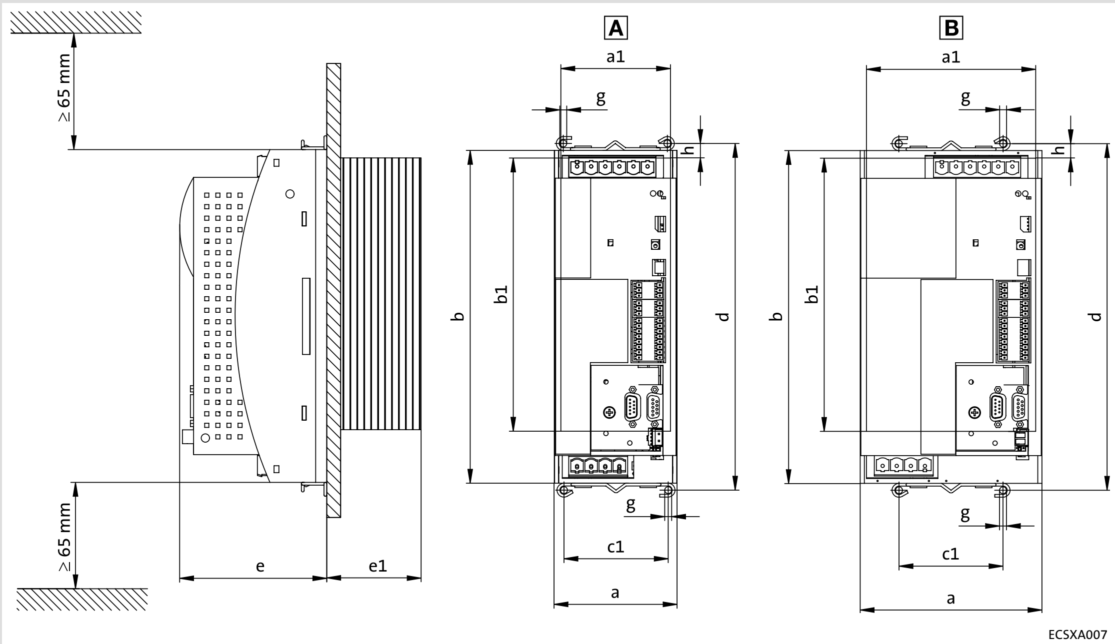


Fig.4-2 Dimensions for "push-through design"

Z Mounting cutout (a1 x b1), 36

Axis module		Dimensions [mm]									
Type	**Size**	**a**	**a1**	**b**	**b1**	**c1**	**d**	**e**	**e1**	**g**	**h**
ECSDM004	A	88.5	78.5	240	197	75	250	109 145 1)	67	M5	10.5
ECSDM008											
ECSDM016											
ECSDM032											
ECSDM048	B	131	121.5								
ECSDM064											

1) max. 145 mm, depending on the plugged-on communication module

Dimensions of mounting cutout

Note!

Mounting with shield mounting kit ECSZS000X0B001:

► Clearance below the mounting cutout > 220 mm

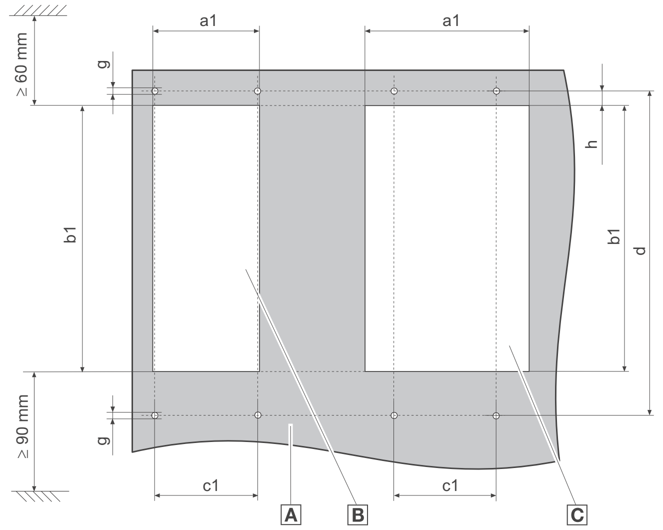


Fig.4-3 Dimensions of mounting cutout

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

Axis module		Dimensions [mm]					
Type	**Size**	**a1**	**b1**	**c1**	**d**	**g**	**h**
ECSDM004	A	78.5	197	75	250	M5	10.5
ECSDM008							
ECSDM016							
ECSDM032							
ECSDM048	B	121.5					
ECSDM064							

4.3.2 Assembly steps

How to mount the axis module:

1. Prepare the fixing holes for the wire clamps on the mounting area.
   – For this purpose, apply a drilling jig.
2. Prepare mounting cutout.
   – The edges of the mounting cutout and the fixing holes for the wire clamps have to be slightly arched inwardly (to the axis module).
3. Brush the threads of the screws for the wire clamps with liquid thread seal.
4. Fix the wire clamps together with the functional earth conductor supplied (Fig.4-4).
   – The functional earth conductor is part of the scope of supply of the ECS**D**M...axis modules.
5. Push the axis module into the mounting cutout.
6. Engage axis module in the wire clamp at the top and the bottom.
7. Connect the functional earth conductor to the axis module (Fig.4-4).

Note!
Fixing the functional earth conductor to the ECS**D**M... axis module is required for a better electromagnetic compatibility (EMC).

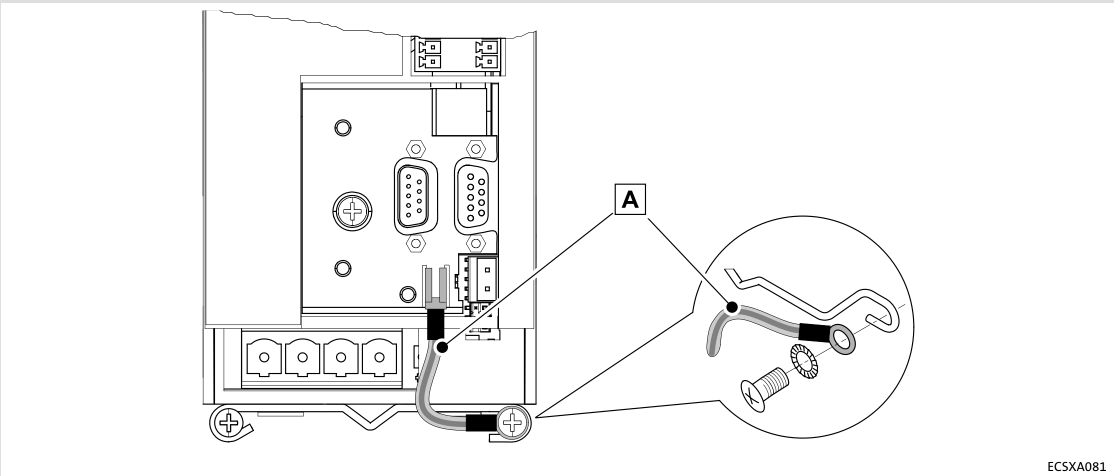


Fig.4-4 Functional earth conductor at the axis module ECSDM...
A Functional earth conductor

4.4 Mounting in cold-plate design

The axis modules ECSC... are intended for mounting in cold-plate design (e.g. on collective coolers).

Requirements for collective coolers

The following requirements must be met to ensure a safe operation of the axis modules:

- Good thermal contact with the cooler
  - The contact surface between collective cooler and axis module must be at least as large as the cooling plate of the axis module.
  - Smooth contact surface, max. deviation 0.05 mm.
  - Connect the collective cooler with all specified screwed connections to the axis module.
- Maintain the thermal resistance R_{th} according to the table.
  - The values apply for operating the axis modules under rated conditions.

Axis module Type	Power to be dissipated Ploss [W]	Heatsink - environment R_{th} [k/W]
ECSCM004	14.0	0.31
ECSCM008	29.0	
ECSCM016	64.0	
ECSCM032	117.0	0.13
ECSCM048	132.0	
ECSCM064	158.0	0.11

- Ambient conditions:
  - Furthermore the rated data regarding the ambient temperature and the derating factors at increased temperature apply to the axis modules (📖 23 et seqq.).
  - Temperature of the cooling plate (”Cold Plate”): max. +85 °C

4.4.1 Dimensions

Note!
Mounting with ECSZS000X0B shield mounting kit:
► Mounting clearance below the module > 195 mm

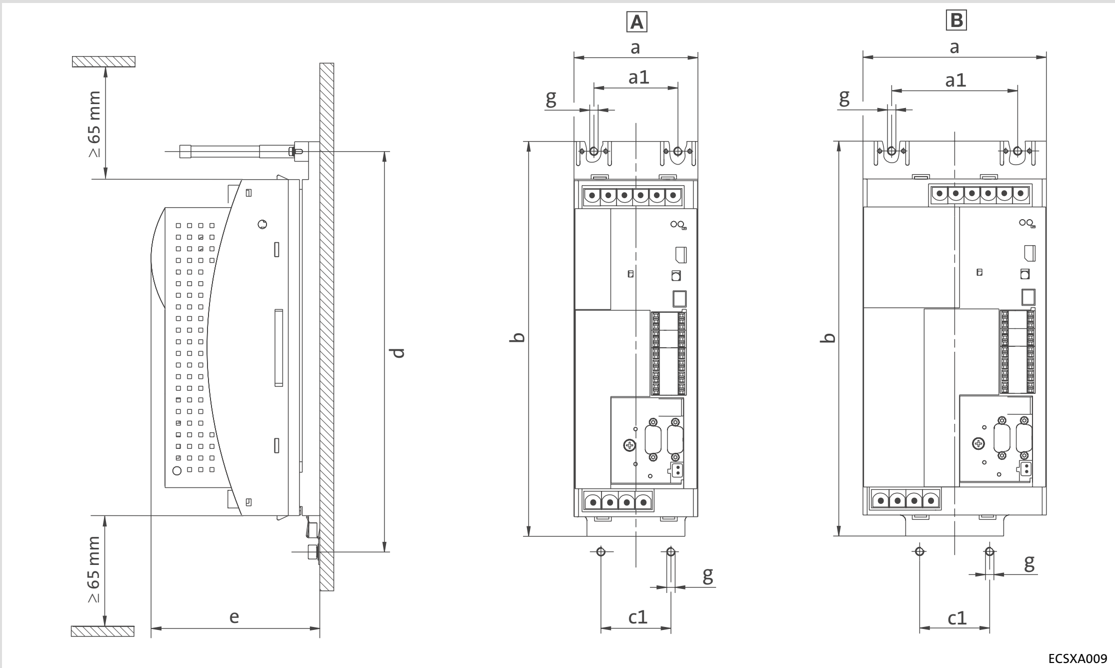


Fig.4-5 Dimensions for ”cold-plate design”

Axis module		Dimensions [mm]						
Type	**Size**	**a**	**a1**	**b**	**c1**	**d**	**e**	**g**
ECSCM004	A	88.5	60	282	50	286	121 157 1)	M6
ECSCM008								
ECSCM016								
ECSCM032								
ECSCM048	B	131	90					
ECSCM064								

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

4.4.2 Assembly steps

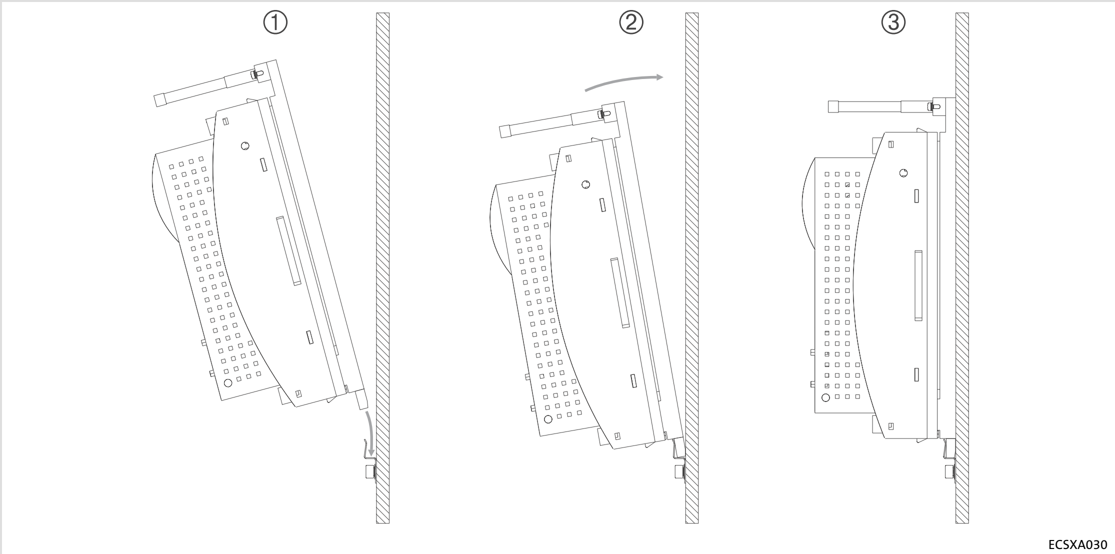


Fig.4-6 Mounting for "cold-plate design"

Proceed as follows to mount the axis module:

1. Prepare the fixing holes on the mounting plate.
   – Use a drilling jig for this purpose.
2. Clean and degrease the contact area of collective cooler and heatsink of the axis module (e.g. with methylated spirit).
3. Screw the support onto the collective cooler.
4. Insert the axis module from above ① into the support ② and fasten the two stud bolts with 3.5 ... 4.5 Nm ③.

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

Tip!
The heat transfer resistance is reduced if - following step 2. -
► a thin layer of heat conducting paste is applied to the contact surface or
► heat conducting foil is used.

5 Electrical installation

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

General information

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

Structure

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

Filters

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

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

Shielding

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

Earthing

- Earth all metallically conductive components (e. g. power supply module, capacitor module, axis module, RFI filter, motor filter, mains choke) using suitable cables connected to a central point (PE bar).
- Maintain the minimum cross-sections prescribed in the safety regulations:
  – For the EMC, not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

5.2 Power terminals

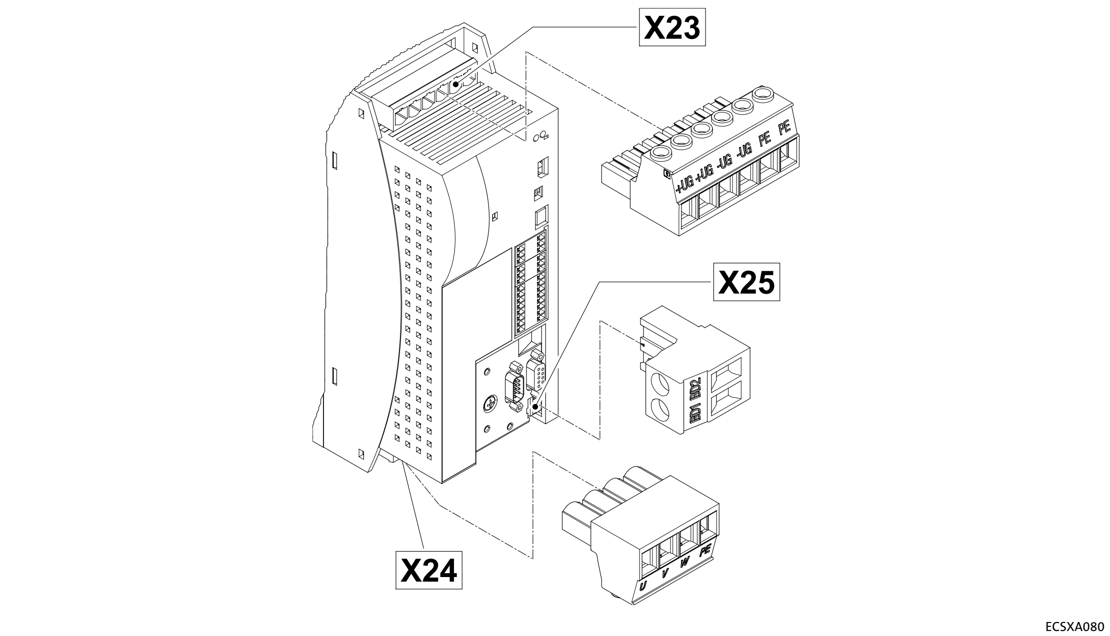


Fig.5-1 Plug connectors for power terminals

Danger!

Dangerous voltage

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

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
 – Fixed installation
 – PE connection must confirm to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection in the event of too high mains voltages

The mains input is not fused internally.

Possible consequences:

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

Protective measures:

► Observe the max. permissible mains voltage.

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

- All power connections are plug connections and are coded. The ECSZA000X0B connectors must be ordered separately.
- Installation of the cables according to EN 60204-1.
- The cables used must comply with the approvals required at the site of use (e.g. VDE, UL, etc.).

Assignment of the plug connectors

Plug connector/terminal	Function	Electrical data
X23	**DC-bus voltage connection**	
X23/+UG	Positive supply of DC-bus voltage	Application- and type-dependent 0 ... 770 V 2 ... 24.5 A (📖 25)
X23/+UG		
X23/-UG	Negative supply of DC-bus voltage	
X23/-UG		
X23/PE	Earth connection	
X23/PE		
X24	**Motor connection**	
X24/U	Motor phase U	Application- and type-dependent 0 ... 480 V 1.6 ... 20 A (📖 25)
X24/V	Motor phase V	
X24/W	Motor phase W	
X24/PE	Earth connection	
X25	**Motor holding brake connection**	
X25/BD1	Brake connection +	23 ... 30 V DC, max. 1.5 A
X25/BD2	Brake connection -	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Possible cable cross-sections	Tightening torque	Stripping length
Plug connectors X23 and X24				
Rigid	–	0.2 ... 10 mm^2 (AWG 24 ... 8)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm
Flexible	Without wire end ferrule	0.2 ... 10 mm^2 (AWG 24 ... 8)		
	With wire end ferrule	0.25 ... 6 mm^2 (AWG 22 ... 10)		
	With TWIN wire end ferrule	0.25 ... 4 mm^2 (AWG 22 ... 12)		
Plug connector X25				
Flexible	Without wire end ferrule	0.2 ... 2.5 mm^2 (AWG 24 ... 12)	0.5 ... 0.8 Nm (4.4 ... 7.1 lb-in)	5 mm

Shielded cables

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

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

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

5.2.1 Connection to the DC bus ($+U_G$, $-U_G$)

Stop!

No device protection for voltage surges of the DC bus

In passive axis modules (without 24 V supply) the charging connection can be overloaded by voltage surges of the DC bus.

Possible consequences:

► Destruction of the device

Protective measures:

► As a basic principle, supply all axis modules in the DC-bus connection with a 24 V control voltage.

► If the total cable length is > 20 m, install an axis module or a capacitor module directly at the power supply module.

► Design the $\pm U_G$ cables twisted and as short as possible. Ensure short-circuit-proof routing!

► Cable length (module ↔ module) > 30 cm: install $\pm U_G$ cables shielded.

Cable cross-sections

Cable length [1]	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Up to 20 m	Without wire end ferrule	6 mm^2 (AWG 10)	1.2 ... 1.5 Nm (10.6 ... 13.3 lb-in)	5 mm
	With wire end ferrule			
> 20 m	Without wire end ferrule	10 mm^2 (AWG 8)		
	With wire end ferrule **Use pin-end connectors for wiring!**			

[1] Respective cable length from module to module

Fuses

- When ECSxE series power supply modules with protection on the supply side are used, the DC-bus supply does not need to be fused.
- When ECS axis modules are supplied by devices of the **82xx** and **93xx** series with a **continuous DC current > 40 A**, install the following fuses between the supplying device and the ECS devices:

Fuse		Support
Value [A]	**Lenze type**	**Lenze type**
50	EFSGR0500ANIN	EFH20007

Warnings!

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

Replacing defective fuses

Danger!

Hazardous electrical voltage

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

Possible consequences:

- Death or severe injuries when touching the device.

Protective measures:

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

5.2.2 Connection plans

Observe...
the notes in the detailed documentation of the power supply module.

Mimimum wiring with power supply module ECSEE... / ECSDE...

A brake resistor is integrated in the ECS**E**E... and ECS**D**E... power supply modules. The internal brake resistor is used with the following jumpers:

- ► from X22/BR0 to X22/+UG
- ► from X6/T1 to X6/T2

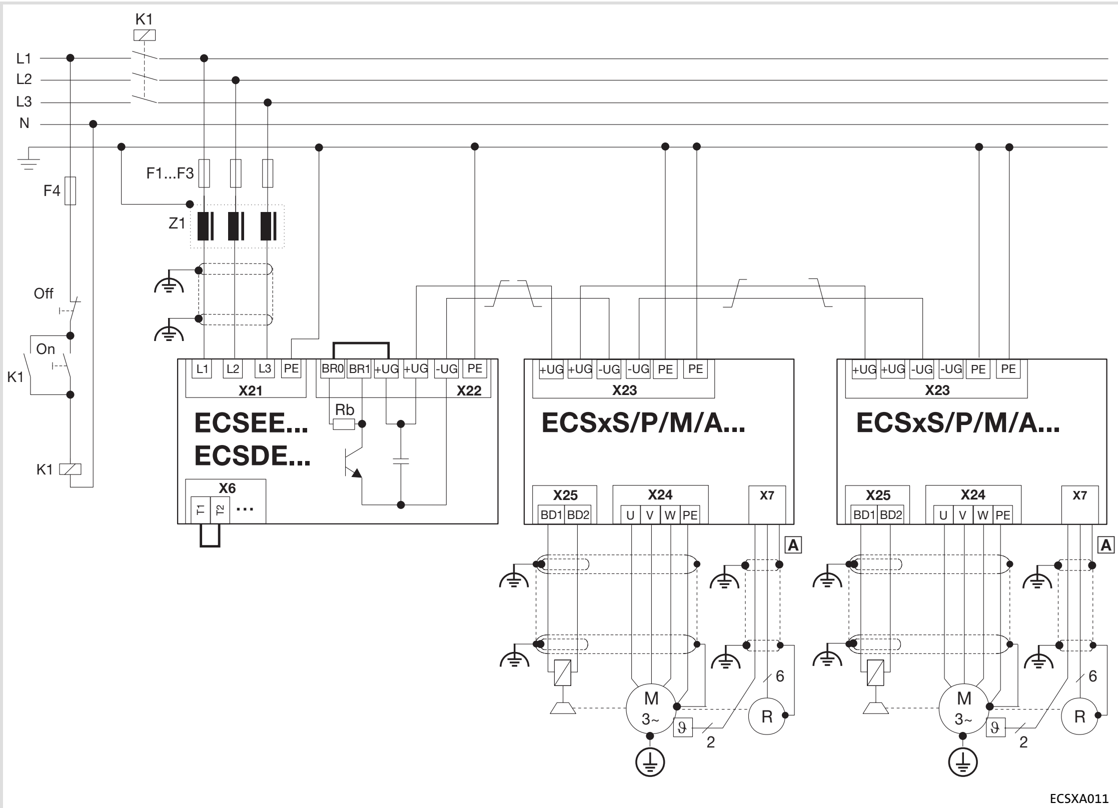


Fig.5-2 Interconnected power system with internal brake resistor

⏚	HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
ʃ	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb	Brake resistor
A	System cable – feedback

Mimimum wiring with power supply module ECSCE...

Based on the design, the ECS**C**E... power supply module is not provided with an integrated brake resistor. For this reason, install an external brake resistor of the ERBM..., ERBS... or ERBD... series:

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

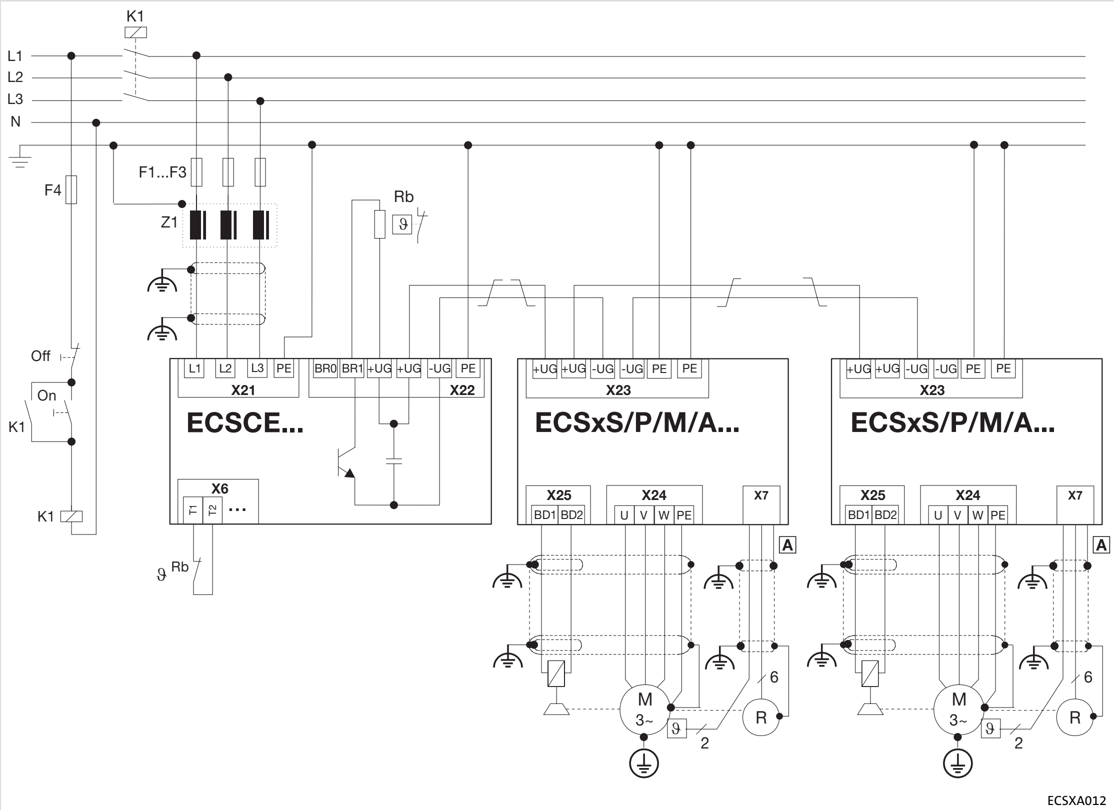


Fig.5-3 Interconnected power system with external brake resistor

⏚	HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)
ʃ	Twisted cables
K1	Mains contactor
F1 ... F4	Fuse
Z1	Mains choke / mains filter, optional
Rb	Brake resistor
A	System cable – feedback

5.2.3 Motor connection

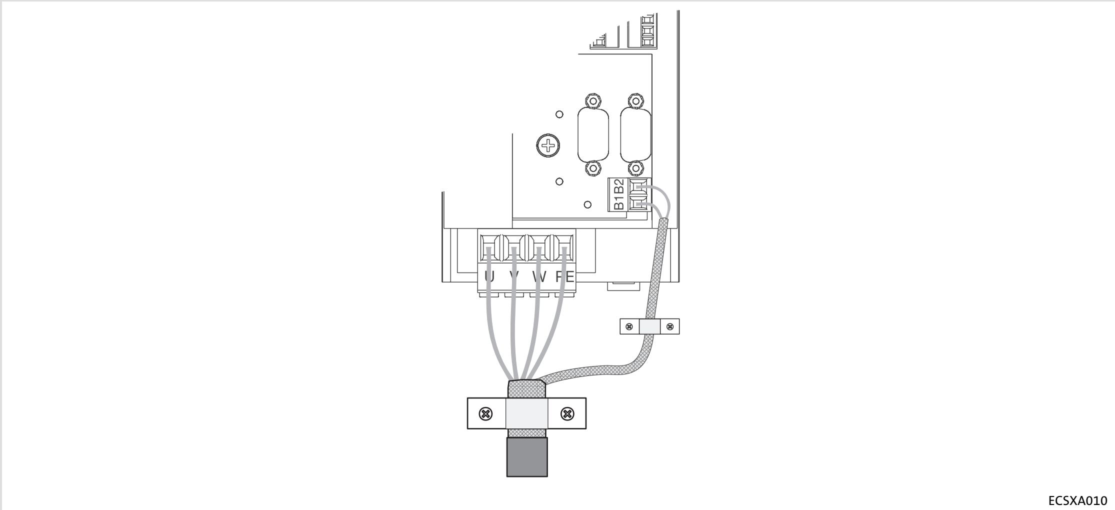


Fig.5-4 Motor and motor holding brake connection

Motor cables

- Use low-capacitance motor cables. Capacitance per unit length:
  - – Core/core: max. 75 pF/m
  - – Core/shield: max. 150 pF/m
- Length: max. 50 m, shielded
- The cross-section of the motor cables are selected according to the motor standstill current (I_0) when using synchronous motors or according to the rated motor current (I_N) for asynchronous motors.
- Length of the unshielded ends: 40 ... 100 mm (depending on the cable cross-section)
- Lenze system cables meet these requirements.
- Use the ECSZS000X0B shield mounting kit for EMC-compliant wiring.

Further information ....

with regard to the EMC-compliant wiring can be found in the Mounting Instructions of the ECSZS000X0B shield mounting kit.

5.2.4 Motor holding brake connection

The motor holding brake

- is connected to X25/BD1 and X25/BD2
- and is supplied with low voltage via the terminals X6/B+ and X6/B-:
  +23 ... +30 V DC, max.1.5 A

STOP

Stop!

- Protect X6/B+ with an F 1.6 A fuse.
- If no appropriate voltage (incorrect height, incorrect polarity) is applied to the brake, it engages and can be overheated and damaged by the motor that keeps rotating.

5.2.4.1 Spark suppressor

A spark suppressor is integrated into the axis module for the motor holding brake.

5.2.4.2 Brake monitoring

The connection of the motor holding brake can be monitored for voltage failure and cable breakage if monitoring is activated under C0602.

Motor holding brake open (inactive):

The connection of the motor holding brake is monitored with regard to voltage failure and cable breakage:

- Threshold value for cable breakage: 140 mA ±10 %
- Threshold value for voltage failure: +4 V ±10 %

Motor holding brake closed (active):

The connection of the motor holding brake is monitored with regard to cable breakage if the threshold value of the voltage supply X6/B+ and X6/B- exceeds 4 V.

5.2.4.3 Requirements on the brake cables

- Use Lenze system cable with integrated brake cable.
  – The shielding of the brake cable must be separated.
- Length: max. 50 m
- If a separately installed brake cable is required, lay it in a shielded manner.

Note!
By the current monitoring, an ohmic voltage loss of 1.5 V along the motor cable is produced. The voltage loss can be compensated by a higher voltage at the cable entry.

The following applies to Lenze system cables:

$$U_K\,[V] = U_B\,[V] + 0,08\left[\frac{V}{m \cdot A}\right] \cdot L_L\,[m] \cdot I_B\,[A] + 1,5\,[V]$$

U_K	Voltage for compensating the voltage loss at 6X/B+ and X6/B- [V]
U_B	Rated operating voltage of the brake [V]
L_L	Cable length [m]
I_B	Brake current [A]

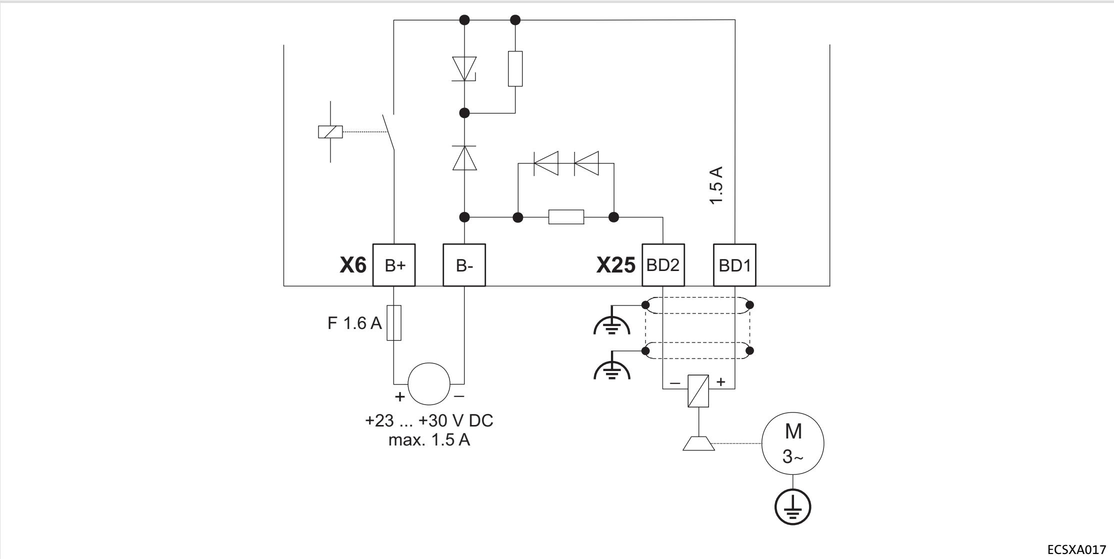


Fig.5-5 Connection of the motor holding brake to X25

⏚ HF-shield termination by large surface connection to functional earth (see Mounting Instructions of the ECSZS000X0B shield mounting kit)

5.2.5 Connection at capacitor module ECSxK... (optional)

Observe...
the notes in the detailed documentation of the capacitor module.

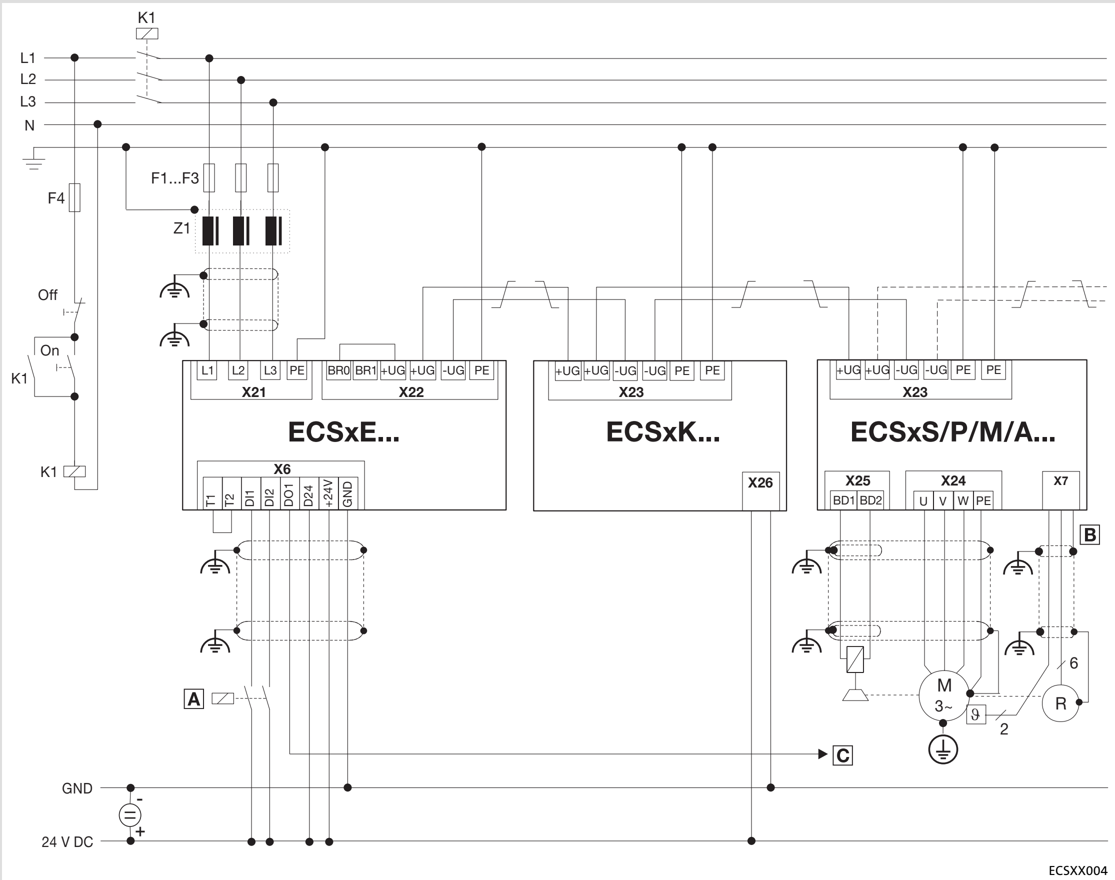


Fig.5-6 Wiring of capacitor module ECSxK...

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

5.3 Control terminals

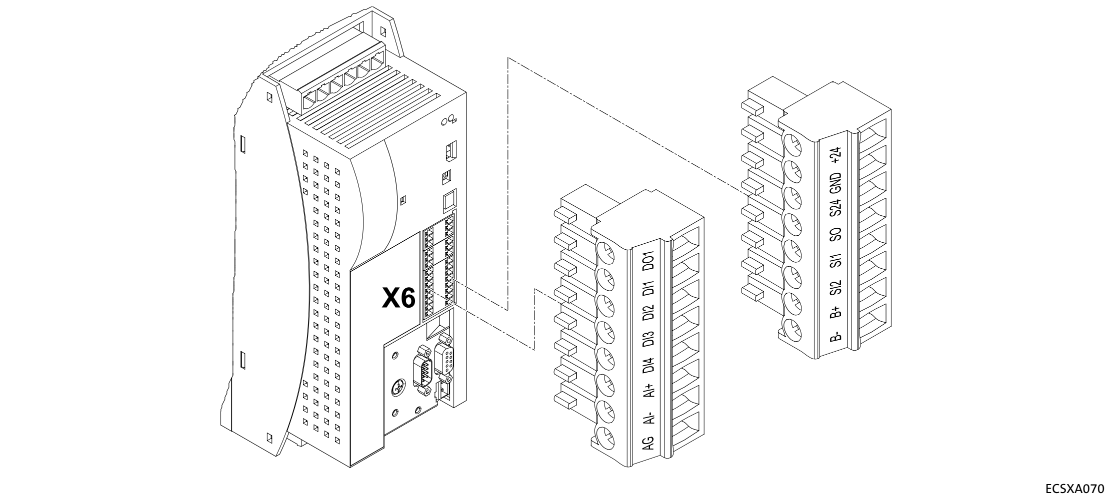


Fig.5-7 Plug connectors for control terminals (X6)

For the supply of the control electronics an external 24 V DC voltage at terminals X6/+24 and X6/GND is required.

STOP

Stop!

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

Shield connection of control cables and signal cables

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

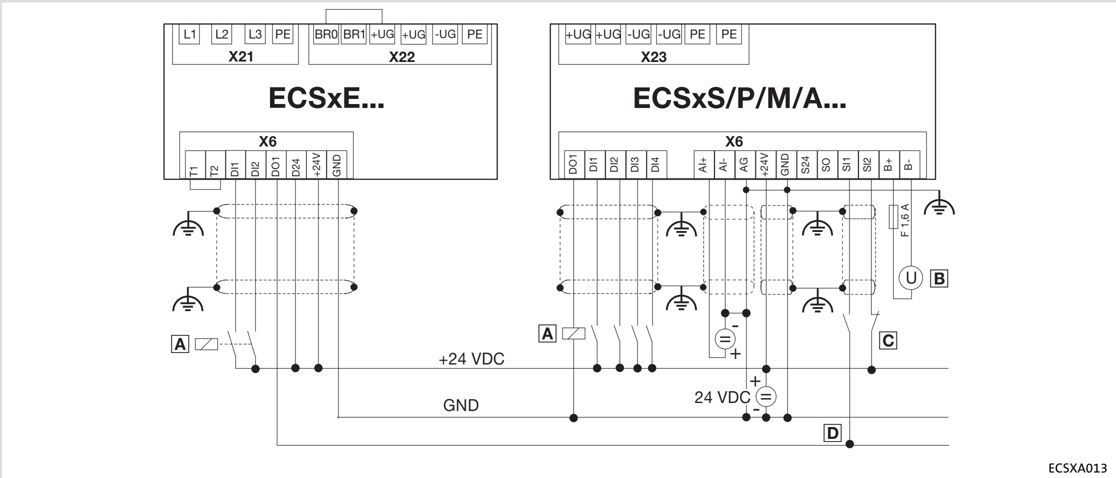


Fig.5-8 System: control signals with internal brake resistor

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

Assignment of the plug connectors

Plug connector X6		
Terminal	**Function**	**Electrical data**
X6/+24	Low-voltage supply of the control electronics	20 ... 30 V DC, 0. A (max. 1 A) for starting current of 24 V: max. 2 A for 50 ms
X6/GND	Reference potential of low-voltage supply	
X6/DO1	Digital output 1	24 V DC, 0.7 A (max. 1.4 A) short-circuit-proof
X6/DI1	Digital input 1	LOW: -3 ... +5 V; -3 ... +1.5 mA HIGH: +15 ... +30 V; +2 ... +15 mA Input current at 24 V DC: 8 mA per input
X6/DI2	Digital input 2	
X6/DI3	Digital input 3	
X6/DI4	Digital input 4	
X6/AI+	Analog input +	Adjustable with jumper strip X3: -10 ... +10 V, max. 2 mA -20 ... +20 mA Resolution: 11 bits + sign
X6/AI-	Analog input -	
X6/AG	Reference potential of analog input (internal ground)	
X6/B+	Brake supply +	23 ... 30 V DC max. 1.5 A **Set brake voltage so that the permissible voltage at the brake is not under-run or exceeded – otherwise malfunction or destruction!**
X6/B-	Brake supply -	
X6/S24	Connection of ”safe torque off” (formerly ”safe standstill”)	🕮 60
X6/SO		
X6/SI1		
X6/SI2		

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Starting torque	Stripping length
flexible	Without wire end ferrule	0.08 ... 1.5 mm^2 (AWG 28 ... 16)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm
	Insulated with wire end ferrule	0.25 ... 0.5 mm^2 (AWG 22 ... 20)		

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

5.3.1 Digital inputs and outputs

Stop!

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

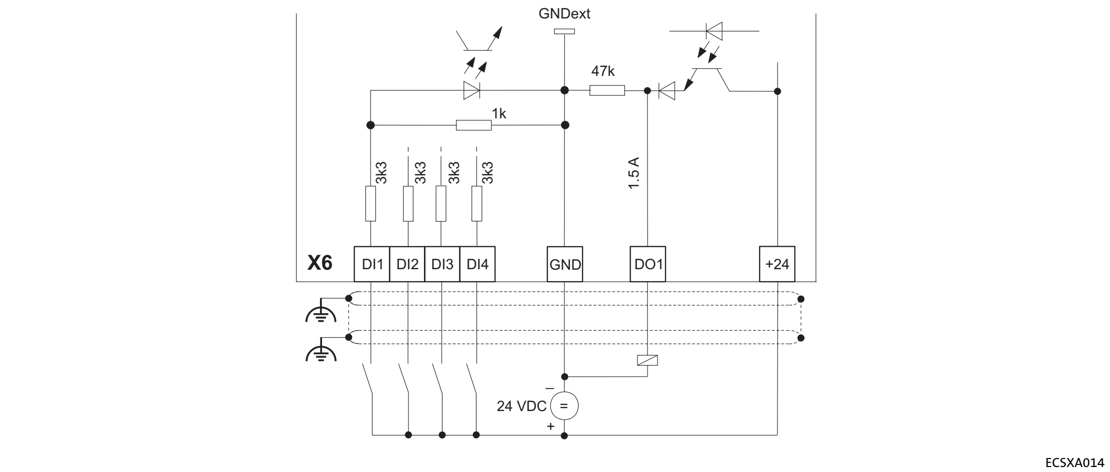


Fig.5-9 Digital inputs and outputs at X6

HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Terminal assignment

Plug connector X6			
Terminal	**Function**	**Level**	**Reaction**
X6/DI1	Quick stop (QSP)	LOW	The drive is decelerated to standstill within the deceleration time set in C0105.
		HIGH	The motor follows the setpoint selection.
X6/DI2	Reference switch/ touch probe sensor	LOW	No reaction
		HIGH	Activation of reference switch/touch probe sensor (both edge active)
X6/DI3	Positive hardware limit switch	LOW	The controller reports the activation of the positive hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No reaction
X6/DI4	Negative hardware limit switch	LOW	The controller reports the activation of the negative hardware limit switch to the control. A further safety measure can be implemented by wiring the emergency-off circuit.
		HIGH	No reaction
X6/DO1	Switching between reference switch and touch probe sensorat X6/DI2	LOW	X6/DI2 = reference switch
		HIGH	X6/DI2 = touch probe sensor
			Note: A switch-over is only required for homing modes 6 and 7 (117).

5.3.2 Analog input

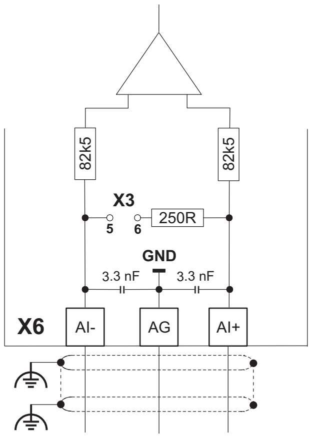


Fig.5-10 Analog input at X6

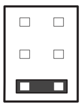
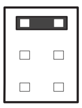
⏚ HF-shield termination by large-surface connection to functional earth (see Mounting Instructions for ECSZS000X0B shield mounting kit)

Analog input configuration

- ► Set via C0034 whether the input is to be used for a master voltage or a master current.
- ► Set jumper bar X3 according to setting in C0034:

Stop!

Do not plug the jumper on 3-4! The axis module cannot be initialised like this.

Jumper strip X3	Setting	Measuring range
5 6 3 4 1 2 	5-6 open Jumper on 1-2: parking position	**C0034 = 0** ● Level: -10 ... +10 V ● Resolution: 5 mV (11 bits + sign) ● Scaling: ±10 V ≡±16384 ≡±100%
5 6 3 4 1 2 	5-6 closed	**C0034 = 1** ● Level: +4 ... +20 mA ● Resolution: 20 µA (10 bits without sign) ● Scaling: ±4 mA ≡ ±0 ≡ ±0 % ±20 mA ≡ ±16384 ≡ ±100 %
		C0034 = 2 ● Level: -20 ... +20 mA ● Resolution: 20 µA (10 bits + sign) ● Scaling: ±20 mA ≡±16384 ≡±100%

5.3.3 Safe torque off

The axis modules support the safety function ”safe torque off” (formerly ”safe standstill”), ”protection against unexpected start-up”, in accordance with the requirements of control category 3 of EN 954 part 1 and part 2 (from 01.01.2007: EN ISO 13849). For this purpose, the axis modules are provided with two independent safety paths. Control category 3 is reached if the output signal at X6/SO is additionally verified.

5.3.3.1 Implementation

In the axis module, the ”safe torque off” connection is implemented with optocouplers. The optocouplers isolate the following areas electrically from each other:

- The digital inputs and outputs:
  – input X6/SI1 (controller enable/inhibit)
  – input X6/SI2 (pulse enable/inhibit)
  – brake output X6/B+, B-
  – output X6/SO (”safe torque off” active/inactive)
- The circuit for the internal control
- The final power stage

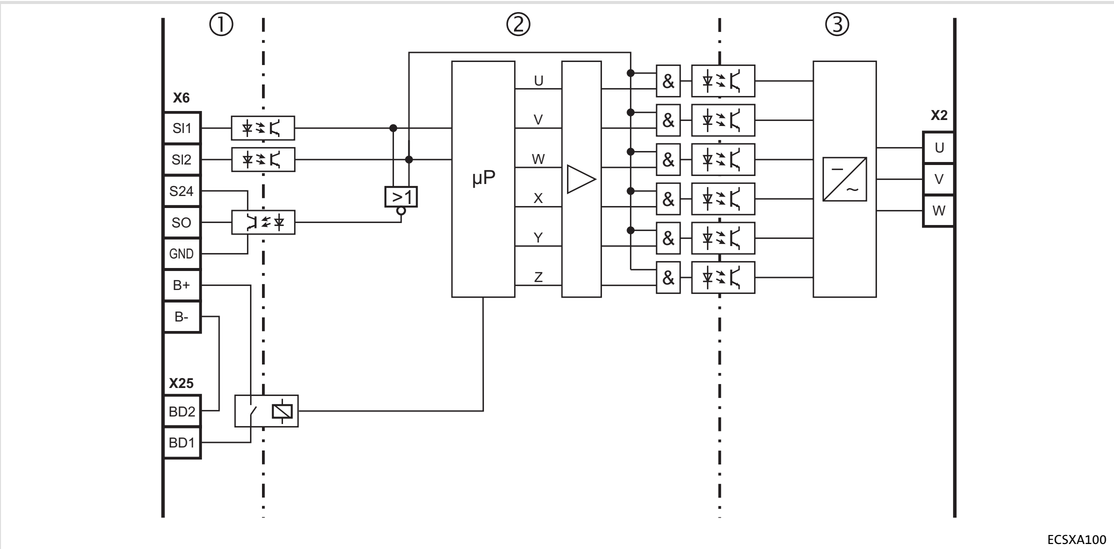


Fig.5-11 Implementation of the ”safe torque off” function

Area 1:	Inputs and outputs
Area 2:	Circuit for the internal control
Area 3:	Power output stage

Stop!

Use insulated wire end ferrules when wiring the ”safe torque off” circuits to X6.

5.3.3.2 Functional description

The ”safe torque off” state can be initiated any time via the input terminals X6/SI1 (controller enable/inhibit) and X6/SI2 (pulse enable/inhibit). For this purpose a LOW level has to be applied at both terminals:

- X6/SI1 = LOW (controller inhibited):

  The inverter is inhibited via the microcontroller system.

- X6/SI2 = LOW (pulses inhibited):

  The supply voltage for the optocouplers of the power section driver is switched off, i. e. the inverter can no longer be enabled and controlled via the microcontroller system.

  The input signal at X6/SI2 to the hardware is additionally directed to the microcontroller system and is evaluated for the state control there. For the external further processing a HIGH level is output for the state ”safe torque off active” at the digital output X6/SO.

The control of the inverter thus is prevented by two different methods that are independent of each other. Therefore an unexpected start-up by the motor is avoided.

5.3.3.3 Additional safety instructions

Installation/commissioning

- Only qualified personnel is permitted to install and set up the ”safe torque off” function.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849). These include among other things:
  - Switch, relay with enclosure IP54.
  - Control cabinet with enclosure IP54.
  - Gather all further requirements from EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849).
- Wiring with insulated wire end ferrules is essential.
- All safety-relevant cables (e. g. control cable for the safety relay, feedback contact) must be installed outside the control cabinet, e. g. in the cable duct. It must be ensured that short circuits between the single cables cannot occur. For further measures see EN 954-2 (of 01.01.2007: EN ISO 13849), table D4.
- When an external force is likely to act with the ”Safe torque off” function (e.g. sagging of hanging loads) additional measures have to be provided (e.g. mechanical brakes).

Danger!

When using the ”Safe torque off” function, additional measures are required for ”Emergency off”!

There is neither an electrical isolation between motor and axis module nor a ”service switch” or a ”repair switch”.

Possible consequences:

- Death or severest injuries
- Destruction or damage of the machine/drive

Protective measures:

- An ”Emergency-off” requires an electrical isolation of the cable path to the motor, e.g. by means of a central mains contactor with ”Emergency-off” connection.

During operation

- After installation the operator must check the ”Safe torque off” function.
- The function check must be repeated at regular intervals, after one year at the latest.

5.3.3.4 Technical data

Terminal assignment

Plug connector X6				
Terminal	**Function**	**Level**		**Electrical data**
X6/S24	Low-voltage supply			18 ... 30 V DC 0.7 A
X6/SO	"Safe torque off" feedback output	LOW	During operation	24 V DC 0.7 A (max. 1.4 A) Short-circuit-proof
		HIGH	"Safe torque off" active	
X6/SI1	Input 1 (controller enable/inhibit)	LOW	Controller inhibited	LOW level: -3 ... +5 V -3 ... +1.5 mA HIGH level: +15 ... +30 V +2 ... +15 mA Input current at 24 V DC: 8 mA per input
		HIGH	Controller enabled	
X6/SI2	Input 2 (pulse enable/inhibit)	LOW	Pulses for power section are inhibited	
		HIGH	Pulses for power section are enabled	

Cable cross-sections and screw-tightening torques

Cable type	Wire end ferrule	Cable cross-section	Tightening torque	Stripping length
Flexible	With insulated wire end ferrule	0.25 ... 0.5 mm^2 (AWG 22 ... 20)	0.22 ... 0.25 Nm (1.95 ... 2.2 lb-in)	5 mm

5.3.3.5 Minimum wiring

In order to reach the control category 3, the signal at X6/SO must be verified additionally. This requires external wiring. The external wiring must be adapted to the existing safety concepts and checked for a correct operation.

Tip!

For an example of wiring with an electronic safety control unit for category 3, please see 📖 68.

”Safe torque off” with multiple-contact switches

This circuit shows the minimum external wiring of the axis module with multiple-contact switches for a motor with brake.

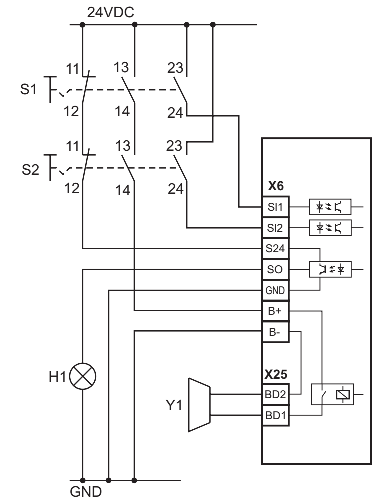


Fig.5-12 Minimum external wiring with multiple-contact switches

Stop!

Observe the reaction of the drive when activating controller enable and/or pulse enable (X6/SI1 or SI2 = HIGH level):

- ► The motor brake is applied immediately. This can lead to high wear on the motor holding brake (see data sheet of the brake).
- ► If the brake monitoring is active (C0602 = 0), TRIP ”Rel1” is set. Before recommissioning, the TRIP must be reset.

Requirements for external wiring with multiple-contact switches:

- The switches S1 and S2 must have at least three contacts:
  - At least one NC contact and two NO contacts being all electrically independent and positively driven.
  - The contacts must not be bridged.
- The switches S1 and S2 must be mechanically separated to avoid that all contacts switch at the same time when being operated.
- The NO contacts of S1 and S2 may only close when the NC contacts are open. NO contacts and NC contacts must not be operated at the same time.
- Design S1 and S2 for a voltage of 24 V DC. If a higher voltage occurs in the electrical environment, the switches must have an insulation voltage. This insulation voltage must at least correspond to the highest voltage that can occur in case of a fault.
- Ensure that two channels are available for control category 3:
  - At every switch off (even single channel) via contacts 13/14 of switches S1 and S2, the brake supply is interrupted and the brake is applied. In addition, the internal brake relay must be switched off by the application.
  - The output supply (X6/S24) via NC contacts 11/12 of switches S1 and S2 is only switched through if both controller channels are switched off. This ensures that the output X6/SO will not indicate a HIGH level if a short circuit occurs in the internal transistor and the drive is not switched off via both channels.
- The switch contacts must resist the maximum current of the 24 V DC voltage supply.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849). These include among other things:
  - Switches, relays in enclosure IP54.
  - Control cabinet in enclosure IP54.
  - Gather all further requirements from EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849).
- The wiring with wire end ferrules is essential.
- All safety-relevant cables (e. g. control cable for the safety relay, feedback contact) must be installed outside the control cabinet, e. g. in the cable duct. It must be ensured that short circuits between the single cables cannot occur. For further measures see EN 954-2, table D4 (of 01/01/2007: EN ISO 13849).

”Safe torque off” with safety PLC

The version ”safe torque off” with safety PLC must ensure the functions of the multiple-contact switches. The following conditions must be fulfilled:

- ► The NO contacts only close after the NC contacts are open.
- ► Voltage supply for the brake must be safely switched off in the event of LOW level at X6/SI1 and/or LOW level at X6/SI2.
- ► Voltage supply for the output X6/SO must be safely switched off in the event of HIGH level at X6/SI1 and/or HIGH level at X6/SI2.
- ► Safe processing of the output signal at X6/SO for higher-level safety concepts.
- ► The PLC must be programmed so that the following requirements are met:
  - – The input and output states of output X6/SO are checked for plausibility according to the following truth table.
  - – The entire system is put into a safe state, when the plausibility check results in an impermissible state.

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	**X6/SI2**	**X6/SO**	**X6/SO**
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

- ► All control components (switches relays, PLC, ...) and the control cabinet must comply with the requirements of the EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849). This includes among other things:
  - – Switches, relays with enclosure IP54.
  - – Control cabinet with enclosure IP54.
  - – Gather all further requirements from EN 954-1 and EN 954-2 (from 01.01.2007: EN ISO 13849).
- ► The wiring with wire end ferrules is essential.
- ► All safety-relevant cables (e. g. control cable for the safety relay, feedback contact) must be installed outside the control cabinet, e. g. in the cable duct. It must be ensured that short circuits between the single cables cannot occur! For further measures see EN 954-2 (from 01.01.2007:13849), table D4.

5.3.3.6 Function check

- After installation the operator must check the ”safe torque off” function.
- The function check must be repeated at regular intervals, after one year at the latest.

Stop!
If the function check leads to impermissible states at the terminals, commissioning cannot take place!

Test specifications

- Check the circuitry with regard to correct function.
- Check directly at the terminals whether the ”safe torque off” function operates faultlessly in the axis module:

States of the ”safe torque off” function on the axis module

Level at input terminal		Resulting level at output terminal	Impermissible level at output terminal
X6/SI1	X6/SI2	X6/SO	X6/SO
LOW	LOW	HIGH	LOW
LOW	HIGH	LOW	HIGH
HIGH	LOW	LOW	
HIGH	HIGH	LOW	

5.3.3.7 Example: Wiring with electronic safety control unit for category 3

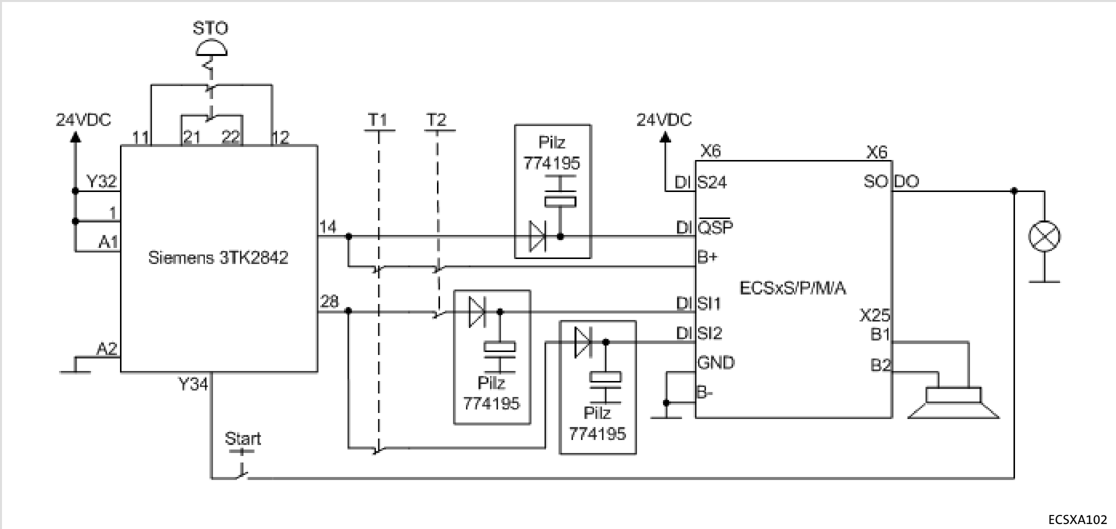


Fig.5-13 Example: Wiring with "Siemens 3TK2842"safety control unit

T1 Test key 1
T2 Test key 2

- The motor is shutdown in accordance with stop category 1 of EN 60204 when the safety function is requested.
- The delay time of the safety control unit and the quick stop deceleration time have to be coordinated with the brake closing time.
- The diode-capacitor combination prevents the test pulses of the safety control unit from disturbing the smooth running of the motor, as otherwise a short-time inhibit of the controller cannot be ruled out. It can be procured from the company Pilz (Pilz order number: 774195) as a complete terminal.

Manual test of the disconnecting paths

- The disconnecting paths have to be checked individually in succession.
- If the test keys (T1, T2) are pressed, the motor has to be torqueless immediately and the brake has to engage.
- When the safety control unit is switched off, or if both test keys are pressed at the same time, the feedback "STO" has to signalise. This feedback is not reliable and only serves as an information for the operator that a switch-on is possible now.
- If the actual state deviates from the facts described here, switch off the drive immediately. Eliminate the fault before the restart is carried out.

5.4 Automation interface (AIF)

A communication module can be plugged on or removed from the automation interface (X1). This can also be done during operation.

Various communication modules are available for supply modules and axis modules of the ECS series:

Communication module	Type/order number
Keypad XT	EMZ9371BC
Card module	EMZ2221IB
Diagnosis terminal (Keypad XT with hand-held)	E82ZBBXC
LECOM-A (RS232)	EMF2102IB-V004
LECOM-B (RS485)	EMF2102IB-V002
LECOM-A/B (RS232/485)	EMF2102IB-V001
LECOM-LI (optical fibre)	EMF2102IB-V003
FP interface	EMF2103IB
LON	EMF2141IB
INTERBUS	EMF2113IB
PROFIBUS-DP	EMF2133IB
DeviceNet/CANopen	EMF2175IB
CAN addressing	EMF2174IB

Further information ....
on wiring and application of communication modules can be found in the corresponding Mounting Instructions and Communication Manuals.

5.5 Wiring of MotionBus/system bus (CAN)

Basic wiring of the CAN buses

The two following schematic diagrams show drive systems with different master value concepts:

- ► In Fig.5-14 a higher-level control takes over the function of the master, e. g. ETC.
- ► In Fig.5-15 the function of the master is enabled by a controller that is assigned to the master.

In both representations the master value transmission is effected via the MotionBus (CAN).

The system bus (CAN) serves to diagnose and/or parameterise the drives.

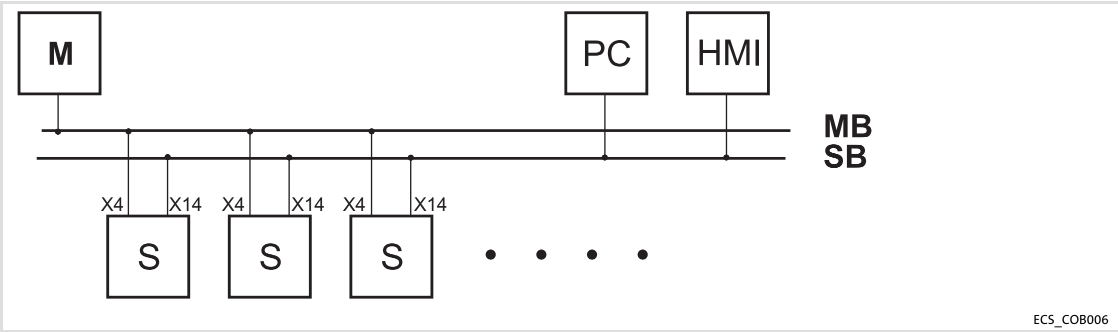


Fig.5-14 MotionBus (CAN) with higher-level control

MB	MotionBus (CAN), connection to plug connector X4
SB	System bus (CAN), connection to plug connector X14
M	Master
E	Slave
PC	PC
HMI	HMI / operating unit

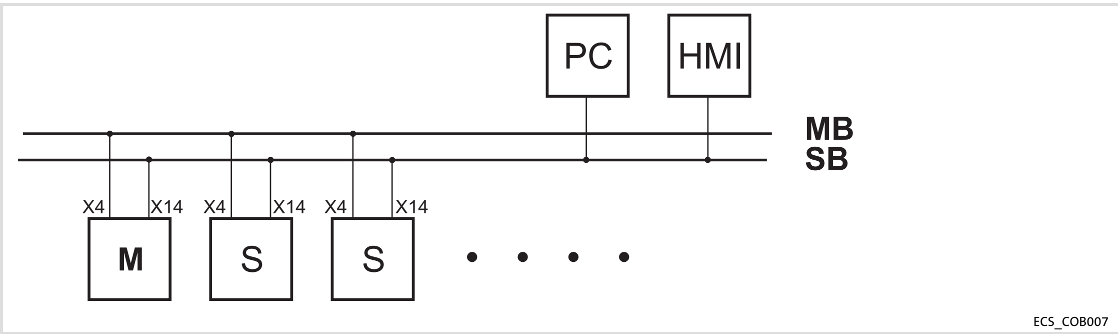


Fig.5-15 MotionBus (CAN) with controller as master

MB	MotionBus (CAN), connection to plug connector X4
SB	System bus (CAN), connection to plug connector X14
M	Master
E	Slave
PC	PC
HMI	HMI / operating unit

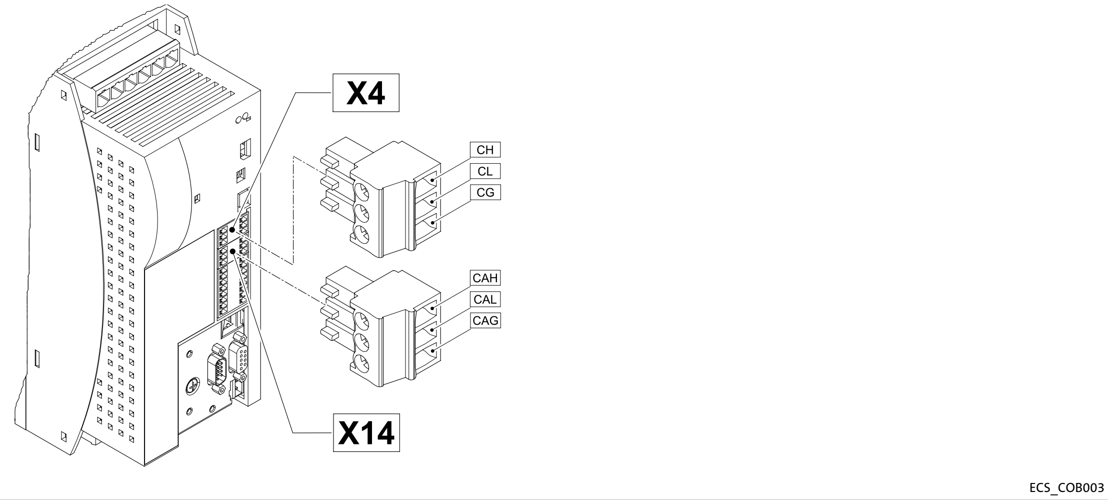


Fig.5-16 Bus connections on the controller

Assignment of the plug connectors

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

Specification of the transmission cable

For the use of the transmission cable, follow our recommendations:

Specification of the transmission cable		
Total length	≤ 300 m	≤ 1000 m
Cable type	LIYCY 2 x 2 x 0.5 mm2 (paired with shielding)	CYPIMF 2 x 2 x 0.5 mm^2 (paired with shielding)
Cable resistance	≤ 80 Ω/km	≤ 80 Ω/km
Capacitance per unit length	≤ 130 nF/km	≤ 60 nF/km

Wiring of the MotionBus (CAN)

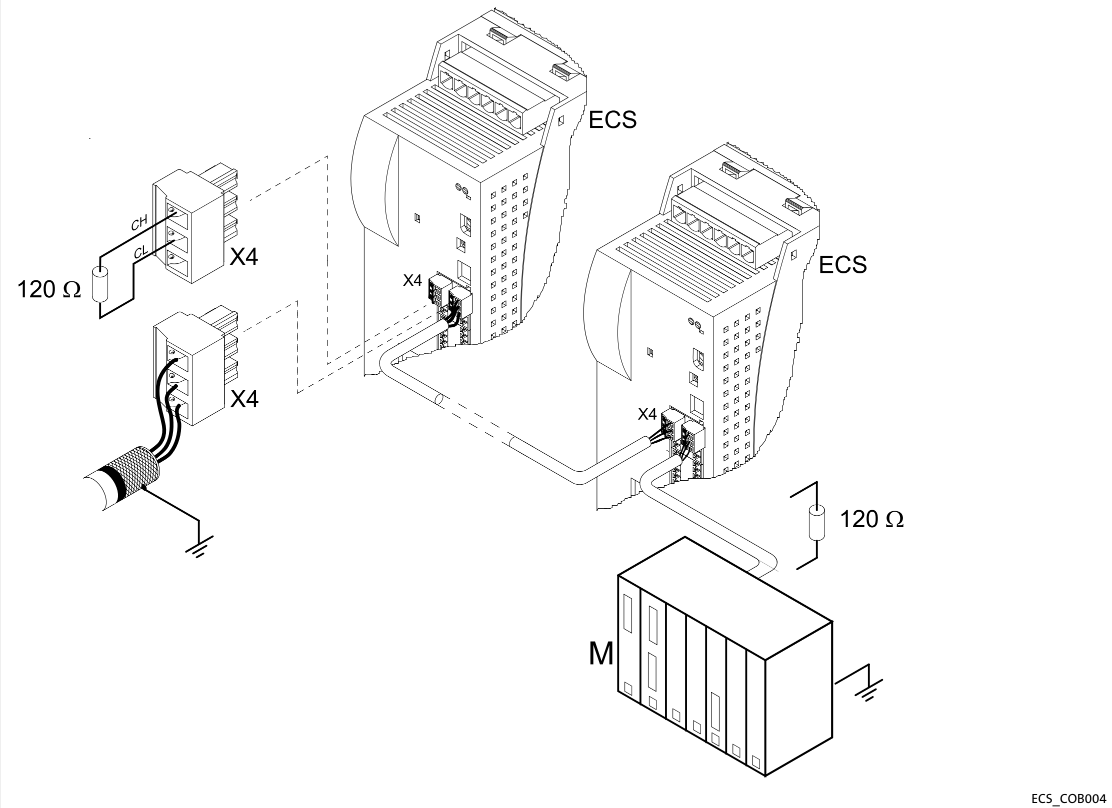


Fig.5-17 Example of wiring the MotionBus (CAN)

ECS ECS axis module
M Higher-level control, e. g. ETC

Note!

Respectively connect one bus terminating resistor (120 Ω) to the first and the last node of the MotionBus (CAN) / system bus (CAN).

Bus cable length

Note!
Be absolutely sure to observe the permissible cable lengths.

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

The total cable length is defined by the baud rate.

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

Tab. 5-1 Total cable length

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

The segment cable length is defined by the cable cross-section used and by the number of nodes. Without using a repeater, the segment cable length equals the total cable length.

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

Tab. 5-2 Segment cable length

3. Compare the two identified values to each other.

If the value determined from Tab. 5-2 is smaller than the total cable length from Tab. 5-1 that is to be realised, the use of repeaters is required. Repeaters divide the total cable length into segments.

Observe...
the information on the use of a repeater in the **CAN Communication Manual**.

5.6 Wiring of the feedback system

Different feedback system can be connected to the axis module:

- Resolver to X7 (📖 74)
- Encoder to X8 (📖 75)
  - Incremental encoder with TTL level
  - Sin/cos encoder with rated voltage (5 ... 8 V)
  - Sin/cos absolute value encoder (single-turn/multi-turn) with serial communication (Hiperface® interface)

Note!

If a ”safe isolation” acc. to EN 61140 between the encoder cable and motor cable (e.g. by using separating webs or separated draglines) is **not ensured** on the entire cable length cable due to an installation on the system side, the encoder cable must be provided with an insulation resistance of 300 V. Lenze encoder cables meet this requirement.

- We recommend to use Lenze encoder cables for wiring.
- In case of self-prepared cables
  - only use cables with shielded cores twisted in pairs.
  - observe the notes on wiring/preparation on the following pages.

5.6.1 Resolver connection

Note!

Before using a resolver from another manufacturer, please consult Lenze.

Connect a resolver via the 9-pole Sub-D socket X7.

Features

- Resolver: U = 10 V, f = 4 kHz
- Resolver and resolver supply cable are monitored for open circuit (fault message ”Sd2”).

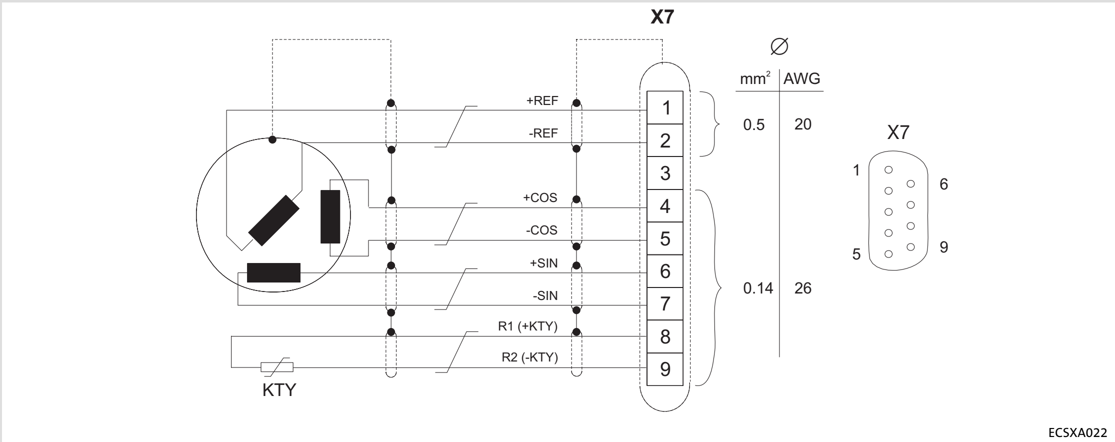


Fig.5-18 Resolver connection

Assignment of socket connector X7: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	R1 (+KTY)	R2 (-KTY)
	0.5 mm^2 (AWG 20)		–	0.14 mm^2 (AWG 26)					

5.6.2 Encoder connection

Danger!

For operating systems up to and including version 7.0:

Uncontrolled movements of the drive possible when absolute value encoders are used!

If an **absolute value encoder** is disconnected from the axis module during operation, a OH3-TRIP (fault no. ”0053”) occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. An SD8-TRIP (fault no. ”0088”) will not occur, as would be expected.

Possible consequences:

- ► Death or severest injuries
- ► Destruction or damage of the machine/drive

Protective measures:

- ► If a TRIP occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an SD8-TRIP (fault no. ”0088”) is at the second or third place, it is absolutely necessary to switch off and on again the supply of the control electronics (24 V supply).

Via the 9-pole Sub-D-plug X8, you can connect the following encoders:

- Incremental encoder
  - with two 5 V complementary signals (TTL encoders) that are electrically shifted by 90°.
  - Optionally, the zero track can be connected.
- Sin/cos encoder
  - with rated voltage (5 ... 8 V).
  - with serial communication (single-turn or multi-turn; the initialisation time of the axis module is extended to approx. 2 s).

The controller supplies the encoder with voltage.

Use C0421 to set the supply voltage V_{CC} (5 ... 8 V) to compensate, if required, the voltage loss [ΔU] on the encoder cable:

$$\Delta U \cong 2 \cdot L_L\,[m] \cdot R/m\,[\Omega/m] \cdot I_G\,[A]$$

ΔU	Voltage loss on the encoder cable [V]
L_L	Cable length [m]
R/m	Resistance per meter of cable length [Ω/m]
I_G	Encoder current [A]

STOP

Stop!

Observe the permissible connection voltage of the encoder used. If the values in C0421 are set too high, the encoder can be destroyed!

Incremental encoder (TTL encoder)

Features	
Input/output frequency:	0 ... 200 kHz
Current consumption:	6 mA per channel
Current on output V_{CC} (X8/pin 4):	Max. 200 mA

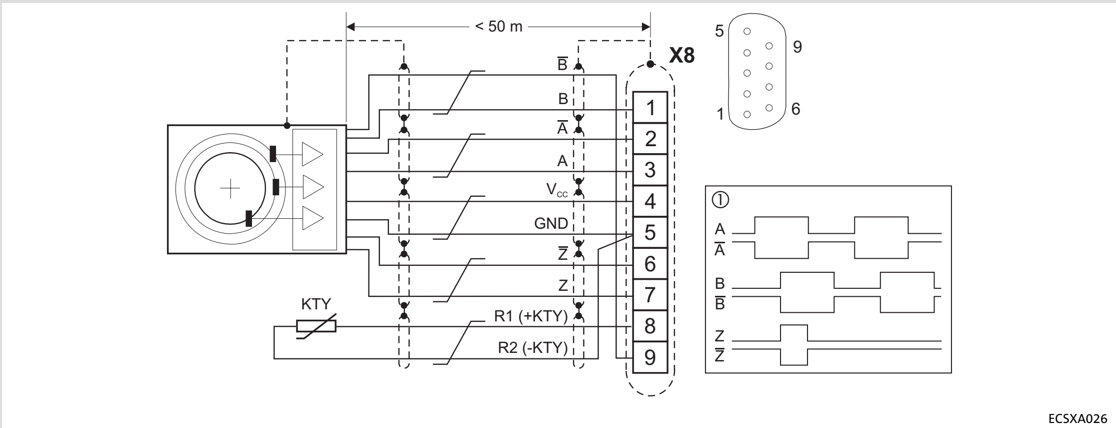


Fig.5-19 Connection of incremental encoder with TTL level

① Signals in case of clockwise rotation

Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	B	$\overline{A}$	A	V_{CC}	GND (R1/+KTY)	$\overline{Z}$	Z	R2 (-KTY)	$\overline{B}$
	0.14 mm^2 (AWG 26)			1 mm^2 (AWG 18)		0.14 mm^2 (AWG 26)			

SinCos encoder

Features	
Input/output frequency:	0 ... 200 kHz
Internal resistance (R_i):	221 Ω
Offset voltage for signals SIN, COS, Z:	2.5 V

- The differential voltage between signal track and reference track must not exceed 1 V ± 10 %.
- The connection is open-circuit monitored (fault message ”Sd8”)
- For encoders with tracks sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
  – Assign RefSIN with $\overline{\text{sine}}$.
  – Assign RefCOS with $\overline{\text{cosine}}$.

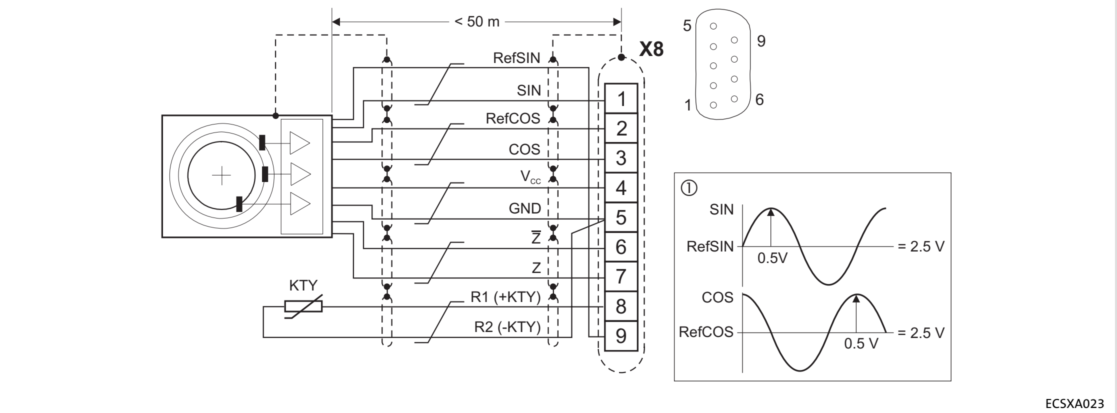
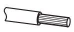


Fig.5-20 Sin/cos encoder connection

① Signals in case of clockwise rotation
Cores twisted in pairs

Assignment of plug connector X8: Sub-D 9-pole									
Pin	1	2	3	4	5	6	7	8	9
Signal	SIN	RefCOS ($\overline{\text{cos}}$)	COS	V_{CC}	GND (R2/-KTY)	$\overline{Z}$ or -RS458	Z or +RS485	R1 (+KTY)	RefSIN ($\overline{\text{sin}}$)
	0.14 mm² (AWG 26)			1 mm² (AWG 18)		0.14 mm² (AWG 26)			

6 Commissioning

6.1 Before you start

Note!

- In the description of the commissioning steps the use of a Lenze motor is assumed. For details on the operation with other motors see 📖 144.
- The operation with the Lenze parameter setting and operating program **Global Drive Control (GDC)** is taken as a basis. The parameters are displayed in the online mode, i.e. GDC can directly access the codes of the axis module.

Prior to initial switch-on of the drive system, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Polarity of the DC-bus voltage supply via terminals +UG, -UG
- Motor connection:
  – Connection to the motor in correct phase relation (direction of rotation)
- Wiring of “safe torque off” (formerly ”safe standstill”)
- Feedback system
- Control terminals:
  – Wiring adjusted to the signal assignment of the control terminals.

6.2 Commissioning steps (overview)

Start

Carry out the basic setting
(📖 81)

Set homing
(📖 83)

Optimise drive behaviour
(📖 152)

- Save parameters in the drive with C0003 = 1.
- Save parameter set with GDC in the parameter set file.

End

6.2.1 Basic settings with GDC

Note!
Follow the commissioning steps in the given order!

Setting		Short description	Detailed information
	Requirements	• Main is switched off. (Green LED is dark, red LED is blinking) • Controller inhibit is active. – Press the button <F9> in GDC. – X6/SI1 **or** X6/SI2 must be open (LOW). – Control bit 9 = 1	
1.	Switch on low-voltage supply.		
2.	Connect PC / laptop (with installed GDC parameter setting program) with the controller.	Connection to X14 (system bus (CAN)) with PC system bus adapter EMF2177IB.	🕮 159
3.	Start GDC and select the device to be set.	**Selecting a device:** Change to the online mode via the GDC tool bar with the <F4> key and select ”Searching for drives” using the <F2> key. ⇨ Drive is identified and the parameter menu is opened.	GDC online help
4.	Load Lenze setting.	• Not required for the first commissioning of the axis module. • Only recommended if the Lenze setting is unclear.	🕮 86
5.	Set communication parameters.	• CAN node address (via DIP switch or C0350/C2450) • Baud rate (via DIP switch or C0351/C2451) • C0356 (CAN boot up/cycle time) • C1120 = 1 (sync connection via MotionBus (CAN)) • C1121 (synchronisation cycle [in ms])	🕮 183 🕮 188 🕮 189
6.	Set mains data.	Set the following codes in the GDC parameter menu under **Short setup → Mains**: • C0173 (voltage thresholds) • C0175 (function of the charge relay) – For operation with power supply module ECSxE set C0175 = 3.	🕮 87
7.	Enter motor data.	Lenze motors: Use the motor assistant of the GDC.	🕮 89
		Motors of other manufacturers	🕮 144
8.	Configure holding brake.	• Not required if a holding brake is not available; *otherwise* • Set C0472/10 (speed threshold) > 0 (e. g. 1 %) for closing the holding brake.	🕮 91
9.	Set feedback system.	• Lenze resolvers do not require further settings. • Set other resolvers and encoders in the GDC parameter menu under **Motor/Feedback → Feedback**.	🕮 94
10.	Set toggle bit monitoring.	Set the following codes in the GDC parameter menu under **Monitoring**: • C3160 (toggle bit error handling) • C3161 (toggle bit error counter limit)	🕮 108

Setting		Short description	Detailed information
11.	Enter machine parameters.	Set the following codes in the GDC parameter menu under **Motion → Machine parameter**: ● C0011 (max. speed) ● C0105 (deceleration time for quick stop (QSP)) ● C0596 (max. system speed) ● C3030 (following error warning limit) ● C3031 (following error limit FAIL-QSP) ● C3032 (1st response when following error limit has been reached) ● C3033 (2nd response when following error limit has been reached)	🕮 110
12.	Switch on the mains.	● Green LED is blinking and red LED is off: – Controller is ready for operation. ● Green LED is off and red LED is blinking: – A fault has occurred! Eliminate the fault before you carry on with commissioning.	

The basic settings are completed now. Proceed with the settings for homing (🕮 83).

6.2.2 Setting of homing

Homing

By means of homing, the definition of the measuring system in the machine is effected, and therefore also the definition of the zero position within the traversing range that is physically possible.

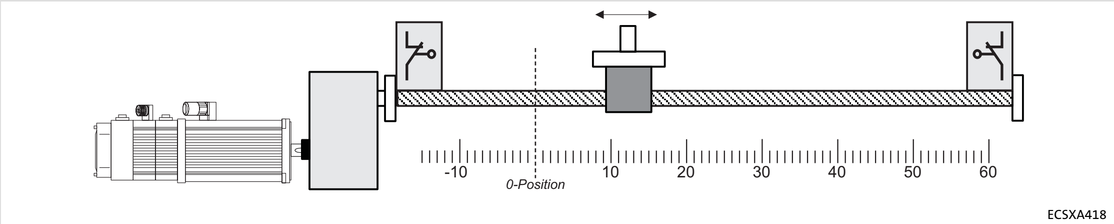


Fig.6-1 Homing (specification of the zero position)

The zero position (home position) can be defined by homing or by setting a reference:

- During homing the drive traverses in a defined mode (homing mode) to detect the zero position on its own and in a reproducible manner.
- When homing is carried out, the current position is defined as zero position (home position).

The homing setting described in this chapter requires the following system structure:

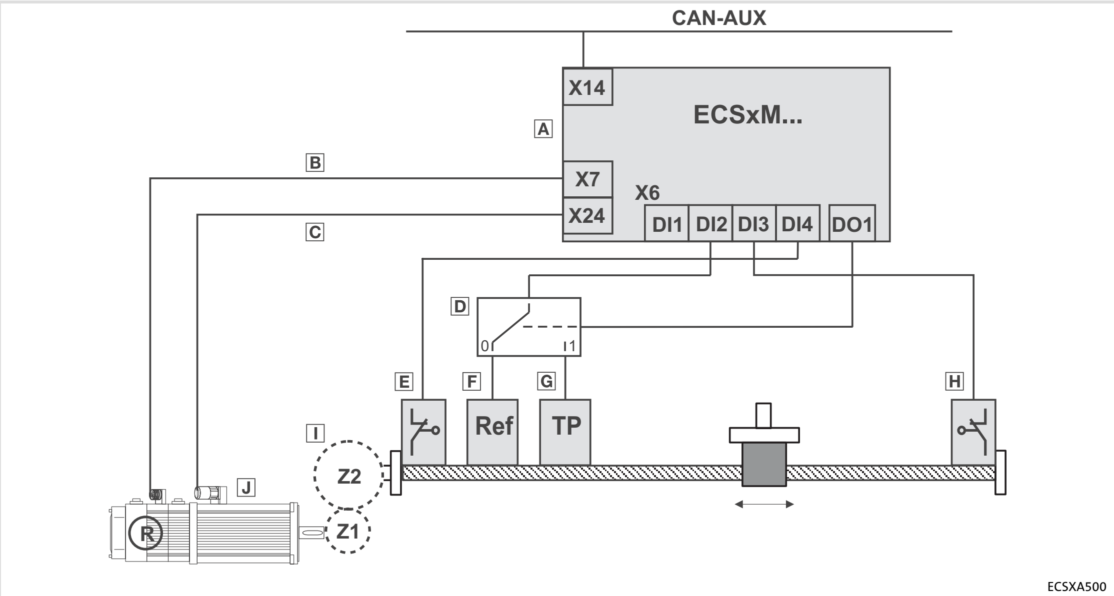


Fig.6-2 Basic system structure

- A ECSxM... axis module with "Motion" application software
- B Speed / position feedback
- C Motor power connection
- D Change-over between reference switch and touch probe sensor (only required in the homing modes 6 and 7! 📖 114)
- E Negative hardware limit switch
- F Reference switch
- G Touch probe sensor
- H Positive hardware limit switch
- I Gearbox with ratio i = Z2/Z1 (ratio of the number of teeth or circumferences) or i = n1/n2 (ratio of speeds)
- J Servo motor

Setting sequence:

Comply with ...

the safety and application instructions for multi-axis applications in the corresponding manuals and on the systems.

Note!

Follow the commissioning steps in the given order!

Setting		Short description	Detailed information
1.	Set homing parameters.	Set the following codes in the GDC parameter menu under **Motion → Homing**: ● C3010 (homing mode) ● C3011 (zero position offset with drive traversing) ● C3012 (zero position offset without drive traversing) ● C0935 (traversing speed of homing) ● C0936 (deceleration time (T_i) of homing)	🕮 112
2.	Save parameter set.	Set C0003 = 1.	
3.	A Select ”Homing Mode”.	The ”homing” mode is automatically selected by the master control: C5000 = 6 The operating mode can also be set manually in the GDC parameter menu under **Motion → Operating mode**.	🕮 132
	B Confirm setting of ”Homing Mode”.	In order that the drive performs homing, the ECSxM axis module must write the value from C5000 into C5001 (here C5001 = 6). If this is not the case, set the operating mode manually (step 3 A). If the value from C5000 has not been written into C5001 after repeating step 3 A), please contact Lenze!	
4.	Enable controller.	● The controller can only be enabled via a master control. ● Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the master control. ● Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. (No enable via master control!)	🕮 139
5.	Start homing.	The master control set the control bit 12 = 1 (TRUE). **Note:** In order to interrupt homing, the control bit 12 must be reset to ”0” using the master control.	🕮 104
	⇨ The drive approaches the home position according to the setting in C3010.		

Setting		Short description	Detailed information
6.	A Select ”Interpolated Position Mode”.	The ”Interpolated Position Mode” is automatically selected by the master control: C5000 = 7 The operating mode can also be set manually in the GDC parameter menu under **Motion → Operating mode**.	🕮 134
	B Confirm setting of ”Interpolated Position Mode”.	In order that the drive performs a travel according to the setpoint selection, the ECSxM axis module must write the value from C5000 into C5001 (here C5001 = 7). If this is not the case, repeat step 6 A. If the setting from C5000 has not been transferred to C5001 after repeating step 6 A, please contact Lenze!	
7.	Start travel according to the setpoint selection.	The master control sets the control bit 12 = 1 (TRUE). **Note:** In order to interrupt homing according to the setpoint selection, the control bit 12 must be reset to ”0” using the master control.	🕮 104

The settings for homing are completed now. Now you can optimise the drive behaviour (🕮 152).

6.3 Loading the Lenze setting

Note!
If an axis module with the "Motion" application software is reset to the Lenze setting, previous settings get lost (mains and motor data, feedback system settings, CAN node addresses)!

The GDC contains the parameters or codes to be set in the parameter menu under **Load / Store**:

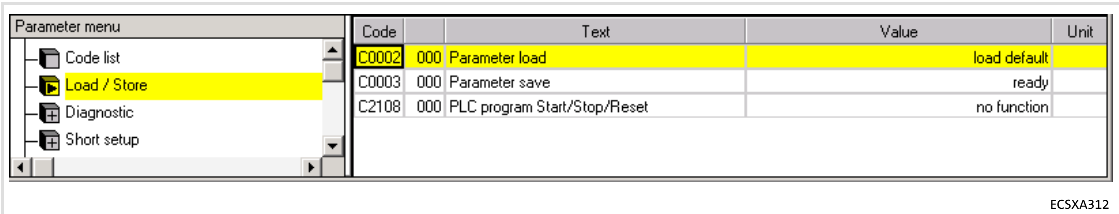


Fig.6-3 GDC view: Parameter set management

Setting sequence:

1. Stop the PLC program: C2108 = 2
2. Load Lenze setting: C0002 = 0
3. Continue with 3.1 **or** 3.2.

   3.1 (Switching the 24 V supply voltage is possible):

   A Switch off and on again 24 V supply voltage.

   B Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   3.2 (Switching the 24 V supply voltage is not possible):

   A Plug the keypad XT (EMZ9371BC) onto the AIF interface (X1).

   B Execute PLC Reset: C2108 = 3

4. Parameterise CAN node addresses via C0350 and C2450. (🕮 185)
5. Continue with basic settings from point 5 of the table on 🕮 81.
6. Automatic start of the PLC program after power-up: C2104 = 1
7. Start the PLC program: C2108 = 1
8. Save parameter set: C0003 = 1

6.4 Setting of mains data

The GDC includes the parameters and codes to be set in the parameter menu under **Short setup → Mains**:

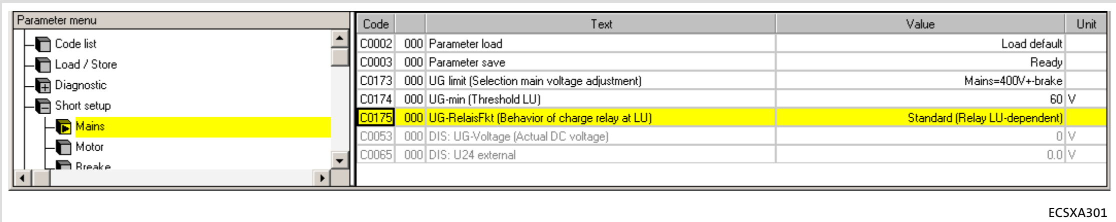


Fig.6-4 GDC view: Short setup of the mains data

6.4.1 Selecting the function of the charging current limitation

The ECS axis modules are provided with a charging current limitation by means of charge resistors and charge relays. In the Lenze setting the charging current limitation is activated (C0175 = 1).

At mains connection the charge relay remains open for a while so that the charging current of the DC bus is limited by the charging resistors. When a certain voltage level has been reached, the charging resistors are short circuited by switching on (closing) the charge relay contacts.

Stop!

- If the DC-bus voltage is generated with an **ECSxE** power supply module, the DC bus is loaded in a controlled way. Therefore, set **C0175 = 3** for the axis module.

  If the Lenze setting has been loaded via C0002, C0175 = 3 must be reset.
- Cyclic connection and disconnection of the mains voltage of the power supply module can overload and destroy the input current limitation of the axis module if C0175 = 1 or C0175 = 2.

  For this reason allow a break of three minutes between two starting operations in case of cyclic mains switching over a longer period of time!

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0175	UG-Relais Fkt	1				Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 87
			1	Standard		Relay switches as a function of LU.	
			2	One Time		Relay switches when LU is exceeded for the first time and remains on.	
			3	Fixed On		Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	

6.4.2 Setting the voltage thresholds

Note!

All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0174	UG min	60				Undervoltage threshold of DC bus (LU)	📖 87
			15	{1 V}	342		

6.5 Entry of motor data for Lenze motors

Note!

- ► The following only describes the parameter setting for Lenze motors! (For operation with motors of other manufacturers see: 🕮 144)
- ► If the Lenze setting has been loaded via C0002, the motor data must be re-entered.

Parameter setting with the "Input assistant for motor data" of the GDC

1. Go to the GDC menu bar and select the **Tool→ Motor data** menu item or click the button with the voltage divider symbol in the tool bar (rightmost in Fig.6-5):

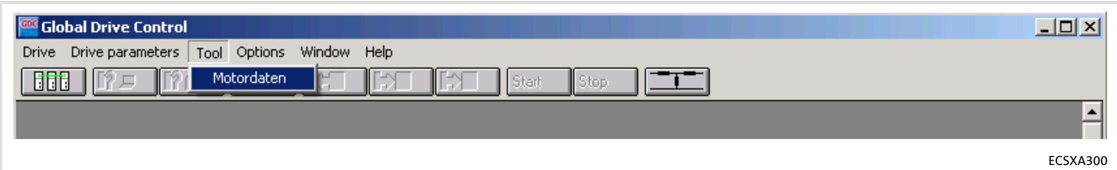


Fig.6-5 GDC view: menu bar and tool bar

– The "Input assistant for motor data" opens:

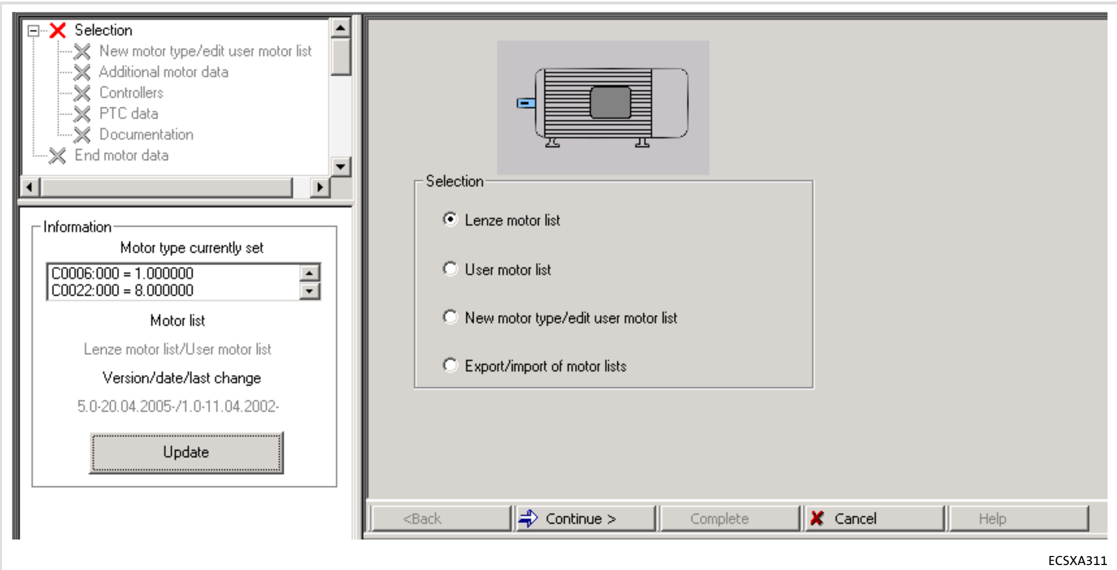


Fig.6-6 GDC view: Selection of motor list

2. Select the "Lenze motor list" and click the [Continue] button.

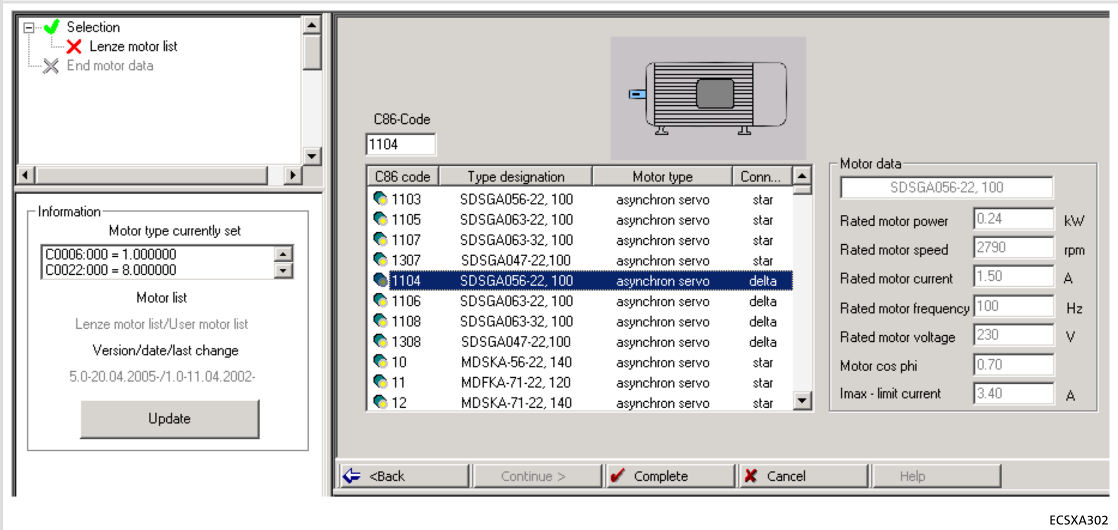


Fig.6-7 GDC view: Motor selection

3. Select the connected motor from the list (see motor nameplate).
   – The corresponding motor data is displayed on the right in the ”Motor data” fields.
4. Click the [Complete] button.
   – The data is transferred to the controller. This process can take a few seconds and is confirmed by a message after being completed.

6.6 Holding brake configuration

Tip!
If you use a motor without a holding brake, you can skip this chapter.

In the GDC, the parameters or codes to be set can be found in the parameter menu under **Short setup → Brake**.

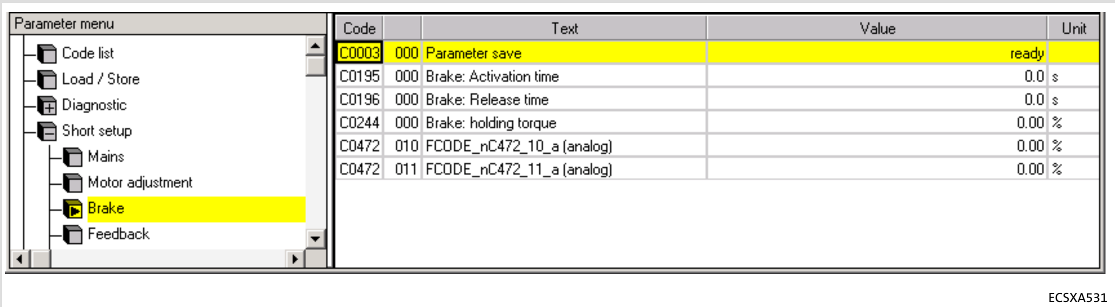
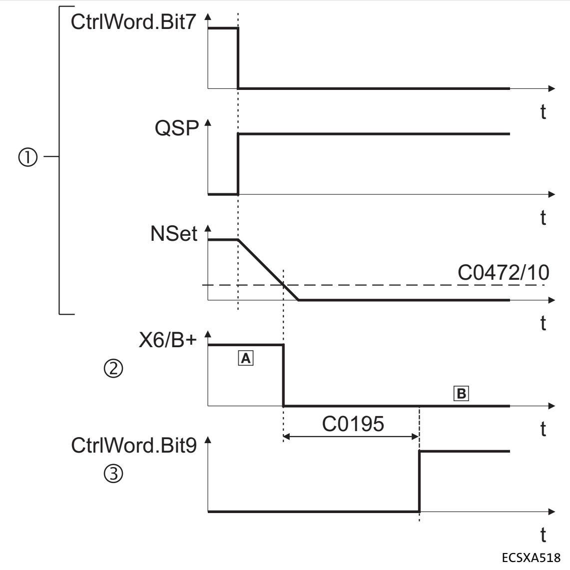


Fig.6-8 GDC view: Short setup of the holding brake

code	Designation	Description
C0195	Brake closing time/activation time	The time required for closing the holding brake. ● Only after this time has elapsed, the controller inhibit is activated (control bit 9 = 1 (TRUE)).
C0196	Brake opening time/release time	The time required for opening the holding brake. ● During the time set the drive generates the torque set under C0244 against the holding brake. ● If an actual speed higher than the value in C0472/10 is detected before the brake opening time (C0196) has expired, the drive can immediately change to speed-controlled operation.
C0244	Holding torque	Holding torque of the drive against the holding brake ● 100 % ≙ value of C0057
C0472/10	FCODE analog [%]	Speed threshold for closing the brake: ● Only if the actual speed value has fallen below the speed threshold, the ”close brake” signal is output. ● This code refers to the maximum speed set in C0011. **Note:** Enter a value > 0 so that the brake can be opened.
C0472/11	FCODE analog [%]	Value/direction of the torque against the holding brake.

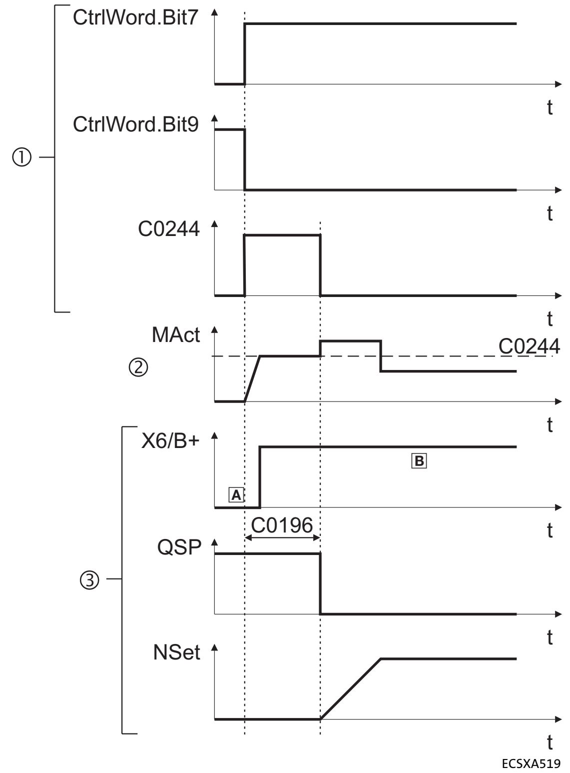
6.6.1 Closing the brake



①	Use control bit 7 = 0 (FALSE) to close the brake. At the same time the internal quick stop (QSP) is activated and the drive is braked to standstill within the deceleration time set in C0105 (NSet = 0).
②	If the speed falls below the speed threshold in C0472/10, the brake is activated via the digital output X6/B+.
③	After the brake closing time in C0195 has elapsed, the controller inhibit (CINH) is activated (control bit 9 = 1 (TRUE)).

CtrlWord.Bit7	Controller enable (control bit 7)
QSP	Quick stop
Nset	Setpoint speed
X6/B+	Digital output X6/B+
CtrlWord.Bit9	Controller inhibit (control bit 9)
A	Brake is open
B	Brake is closed

6.6.2 Opening the brake



① Use control bit 7 = 1 (TRUE) to enable the controller. The control bit 9 is set to 0 (FALSE) at the same time (controller inhibit (CINH) is deactivated) and the torque defined in C0244 is created. This happens within the brake opening time set in C0196.

② As soon as the torque (Mact) has reached the value in C0244, the brake is opened.

③ If the brake is opened via the digital output X6/B+, the following happens after the brake opening time has elapsed (C0196)
- Quick stop (QSP) is cancelled.
- Setpoint integrator is enabled.

CtrlWord.Bit7	Controller enable (control bit 7)
CtrlWord.Bit9	Controller inhibit (control bit 9)
Mact	Actual torque
X6/B+	Digital output X6/B+
QSP	Quick stop (QSP)
Nset	Setpoint speed
A	Brake is closed
B	Brake is open

6.7 Setting of the feedback system for position and speed control

These feedback systems can be set for position and speed control:

- ► Resolver at X7 (🕮 94)
- ► Incremental encoder/SinCos encoder without serial communication at X8 (🕮 97)
- ► Absolute value encoder (Hiperface®, single-turn/multi-turn) at X8 (🕮 98)

Note!
If the Lenze setting has been loaded via C0002, the feedback system must be reset.

6.7.1 Resolver for position and speed control

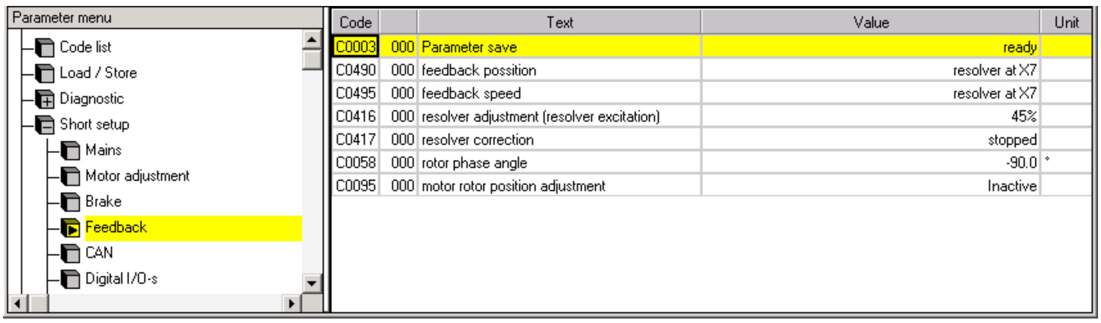
If a resolver is connected to X7 and used for position and speed control, no settings are required.

Lenze setting:

- ► Feedback system for position control: C0490 = 0
- ► Feedback system for speed control: C0495 = 0

6.7.2 Codes for setting the resolver feedback

The GDC includes the parameters or codes to be set in the parameter menu under **Short setup → Feedback**:



ECSXA532

Fig.6-9 GDC view: Commissioning of the feedback system

Code		Possible settings			IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	🕮 94
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	● Sets C0495 to the same value if C0495 > 0. ● Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute encoder (multi-turn) at X8		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 94
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0490 to the same value if C0490 > 0. • Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute encoder (multi-turn) at X8		

Codes for optimising the operation and display

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0058	Rotor diff	-90.0				Rotor displacement angle for synchronous motors (C0095)	📖 149
			-180.0	{0.1 °}	179.9		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment of a synchronous motor C0058 shows the rotor displacement angle.	📖 149
			0	Inactive			
			1	Active			
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 94
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 157
			0	Ready			
			1	Start adjustment			
			2	Loading default values			

6.7.3 Resolver as absolute value encoder

If the following requirements are met, a resolver (or single-turn absolute value encoder) can take over the function of a multi-turn absolute value encoder:

- When the axis module is switched off, the reference is known.
- It is ensured that the position of the machine part does not change (e.g. by using a brake) until the axis module is switched on again.
- C3002 = 1 (no change in position during ”POWER OFF”)

At switch off, the actual position is saved fail-safe. After switch on, the actual position is re-initialised with this value. Turning the drive by maximally ± ½ revolution of the position encoder when the axis module is switched off will be detected and considered when the actual position is initialised (loaded).

General formula for the calculation of the maximum encoder rotation when the axis module is switched off, in particular for multi-pole resolvers (number of pole pairs > 1):

$$\text{Max. rotation} = \pm \left(\frac{180°}{\text{Number of pole pairs}} \right)$$

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3002	NoChangeOfPos	0			Resolver as absolute value encoder	96
			0	ChangeOfPos	After ”mains off/on”, homing has to be carried out. The actual position is initialised with the value ”0”.	
			1	NoChangeOfPos	The actual position value is initialised with the position value at ”Mains off” and is used further at ”Mains on”. Homing is not required. **Note:** With ”Mains off” the feedback system must rotate less than ± 0.5 revolutions.	

6.7.4 Incremental encoder / sin/cos encoder without serial communication

If an incremental encoder or a sin/cos encoder without serial communication is connected to X8 and used for position and speed control, comply with the following setting sequence:

1. Select encoder for position and speed control.
   – Incremental encoder (TTL encoder): C0490 and C0495 = 1
   – Sin/cos encoder without serial communication: C0490 and C0495 = 2
   If X8 has been selected as output due to a change of C0491, an automatic reset to input is made due to the encoder selection.
2. Select encoder used.
   – Incremental encoder (TTL encoder): C0419 = 110 ... 113
   – Sin/cos encoder without serial communication: C0419 = 210 ... 213
   – Encoder used is not in the list: C0419 = 1 ("Common")
3. When setting C0419 = 1 ("Common") configure encoder data.

> **Note!**
> When setting **C0419 = 11x or 21x** do **not** configure encoder data.
> The encoder data (C0420, C0421, C0427) are set automatically in accordance with the selection.

   – C0420 (number of increments of the encoder)
   – C0421 (encoder voltage)
   – C0427 (signal type of the encoder)
4. Set encoder mounting position.
   – C3001 = 0: normal (direction of rotation CW with regard to direction of rotation of the motor)
   – C3001 = 1: inverse (direction of rotation CCW with regard to direction of rotation of the motor)
5. Save settings with C0003 = 1.

6.7.5 Absolute value encoder (Hiperface®, single-turn/multi-turn)

Danger!

For operating systems up to and including version 7.0:

Uncontrolled movements of the drive possible when absolute value encoders are used!

If an **absolute value encoder** is disconnected from the axis module during operation, a OH3-TRIP (fault no. ”0053”) occurs. If the **absolute value encoder** now is connected to X8 again and a TRIP-RESET is carried out, the drive may start up in an uncontrolled manner with a high speed and a high torque. An SD8-TRIP (fault no. ”0088”) will not occur, as would be expected.

Possible consequences:

- ► Death or severest injuries
- ► Destruction or damage of the machine/drive

Protective measures:

- ► If a TRIP occurs during commissioning when an **absolute value encoder** is used, check the history buffer C0168. If an SD8-TRIP (fault no. ”0088”) is at the second or third place, it is absolutely necessary to switch off and on again the supply of the control electronics (24 V supply).

If an absolute value encoder with a Hiperface® interface is connected to X8 and is used for position and speed control, comply with the following setting sequence:

1. Select absolute value encoder for position and speed control.
   – Single-turn encoder: C0490 and C0495 = 3
   – Multi-turn encoder: C0490 and C0495 = 4
   If X8 has been selected as output due to a change of C0491, an automatic reset of X8 as an input is effected due to the encoder selection.
2. Select an absolute value encoder.
   – Single-turn encoder: C0419 = 307 ... 311
   – Multi-turn encoder: C0419 = 407 ... 411
   The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.

Danger!

Uncontrolled movements of the drive possible when absolute value encoders are used!

In the case of an **operating system up to and including version 6.7**, the drive may start up in an uncontrolled manner with high speed and torque after mains connection and controller enable.

Possible consequences:

► Death or severest injuries
► Destruction or damage of the machine/drive

Protective measures:

► Do not parameterise codes C0420, C0421 and C0427!

3. Set the encoder mounting position.
   – C3001 = 0: normal (same direction of rotation as direction of rotation of motor)
   – C3001 = 1: inverse (opposite direction of rotation to direction of rotation of motor)
4. Save settings with C0003 = 1.

6.7.6 Codes for setting the encoder feedback

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/Feedback → Feedback**.

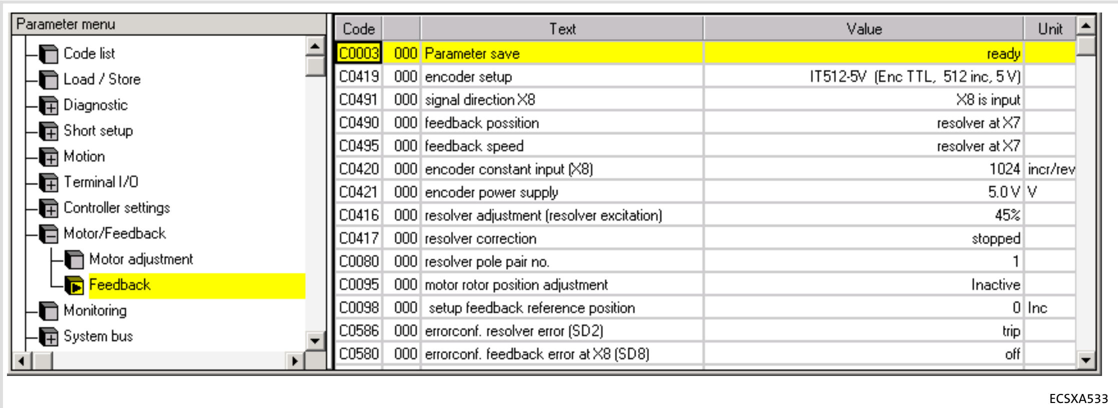


Fig.6-10 GDC view: Commissioning of further feedback systems

Code		Possible settings				IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**				
C0058	Rotor diff	-90.0				Rotor displacement angle for synchronous motors (C0095)	🕮 149
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment of a synchronous motor C0058 shows the rotor displacement angle.	🕮 149
			0	Inactive			
			1	Active			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0419]	Enc. Setup	110			Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	📖 97 📖 98
			0	Common		
			110	IT512-5V	Incremental encoder with TTL level	
			111	IT1024-5V		
			112	IT2048-5V		
			113	IT4096-5V		
			210	IS512-5V	SinCos encoder	
			211	IS1024-5V		
			212	IS2048-5V		
			213	IS4096-5V		
			307	AS64-8V	SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V		
			309	AS256-8V		
			310	AS512-8V		
			311	AS1024-8V		
			407	AM64-8V	SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V		
			409	AM256-8V		
			410	AM512-8V		
			411	AM1024-8V		
[C0420]	Encoder const.	512			Number of increments of the encoder	📖 97 📖 98
			1	{1 inc/rev} 8192	Sets C0419 = 0 (”Common”) if the value is changed.	
[C0421]	Encoder volt	0			Encoder voltage	📖 97 📖 98
			0	5.0 V	Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V		
			2	6.3 V		
			3	6.9 V		
			4	7.5 V		
			5	8.1 V		
[C0427]	Enc. signal	0			Function of the master frequency input signals on X8 (DFIN)	📖 97 📖 98
			0	2-phase		
			1	A: speed B: direction		
			2	A or B: speed or direction		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
[C0490]	Feedback pos	0			Selection of feedback system for positioning control	📖 94
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0495 to the same value if C0495 > 0. • Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute encoder (multi-turn) at X8		
[C0491]	X8 in/out	0			Function of X8	📖 97 📖 98
			0	X8 is input		
			1	X8 is output		
[C0495]	Feedback n	0			Selection of feedback system for speed control	📖 94
			0	Resolver at X7	Standard setting	
			1	TTL encoder at X8	• Sets C0490 to the same value if C0490 > 0. • Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8		
			3	Absolute value encoder (single-turn) at X8		
			4	Absolute encoder (multi-turn) at X8		
C3001	EncDirInv	0			Encoder mounting position	📖 97 📖 98
			0	Normal (direction of rotation CW)	Direction of rotation with regard to motor direction of rotation	
			1	Inverse (direction of rotation CCW)		

6.8 Configuration of control interface (control and status word)

The communication between control and drive system via fieldbus serves as

- synchronisation of the control clock rate to the control master
- master value transfer
- drive control
- diagnostics

The node address and baud rate are set via:

- C0350/C0351 (MotionBus (CAN) at X4)
  – alternatively via DIP switch on the device or AIF module
- C2450/C2451 (system bus (CAN) at X14)
- C0009 (LECOM)

Note!

- Only the process data channels **CAN1_IN** and **CAN1_OUT** of the MotionBus interface X4 are used for communication.
- The system bus interface X14 can only be used for parameter setting and diagnostics with the Lenze parameter setting and operating program ”Global Drive Control” (GDC).
  – The process data channel **CANaux2_OUT** is used to output the data for commissioning and diagnosing via GDC.
- Further information on communication can be found in chapter ”8 Configuration” (🕮 166).

6.8.1 Process data to the axis module

The process data is transmitted to the axis module via the process data channel **CAN1_IN** of the MotionBus interface X4.

Structure of the transmitted process data

User data							
Word 1		Word 2		DWord (word 3 + word 4)			
LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
Application control word (C3152, C3153)		Reserved		Set position			

The GDC parameter menu includes codes for displaying the control word (C3152 and C3153) under **Motion → Status/Control word**.

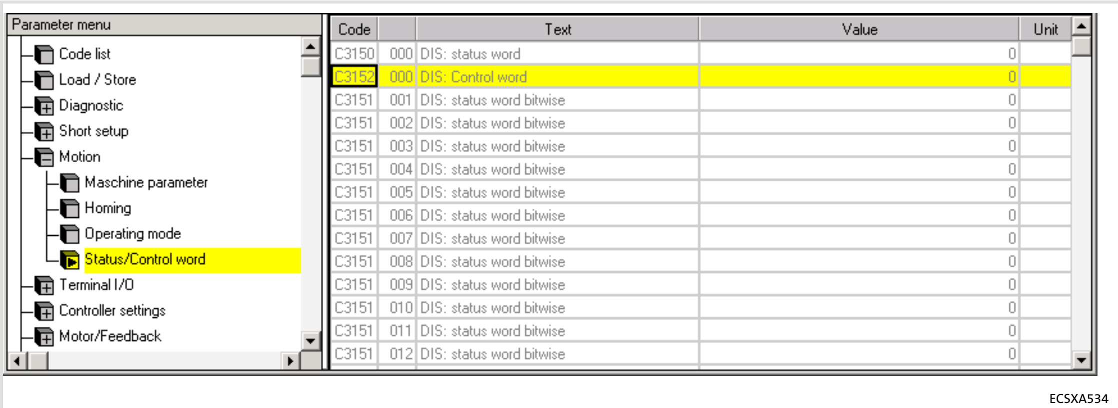


Fig.6-11 GDC view: Display of the control word

Control word

The control word (C3152, C3153) consists of 16 bits, each of them giving the following information:

Bit	Name	Level	Meaning			
0	Toggle	HIGH active	Toggle bit: The control changes the status of this bit with each telegram. The cyclic "toggling" is monitored in the controller. If the error counter exceeds the value in C3161, the drive reacts according to the function set in C3160.			
1	Release limit switch		Hardware limit switch monitoring: 0 = limit switch monitoring is active 1 = limit switch monitoring is not active: After a TRIP-RESET, the activated hardware limit switch can be retracted.			
2	Reserved		Reserved			
3	QSP		Quick stop (QSP): 0 = QSP not active 1 = QSP active: The drive is decelerated to standstill within the deceleration time set in C0105.			
4	Monitor data selection		Selection of data required for control. (106)			
5						
6						
7	Controller enable		Controller enable: 0 = controller not enabled 1 = controller enabled **Note:** This bit must be set to "1" (TRUE) in order that the controller can operate.			
8	Disable		Operation inhibit (DISABLE): 0 = operation inhibit not active 1 = operation inhibit active: The drive cannot be started by the command "Controller enable". The power output stages are inhibited. All controllers are reset.			
9	CINH		Controller inhibit (CINH): 0 = controller inhibit not active 1 = controller inhibit active: The power output stages are only inhibited if the holding brake is activated. All internal controllers are reset.			
10	TRIP-set		Set error (TRIP-SET): 0 = no error setting 1 = error setting: The drive is controlled into the status selected under C0581 and signals "EEr" (external monitoring).			
11	TRIP RESET	Positive edge	Reset error (TRIP-RESET): 0 = no error resetting 1 = error resetting: This function resets an active TRIP provided that the cause of malfunction has been eliminated. If the cause of malfunction is still active, there will be no reaction.			
12	Operation mode specific (1)	HIGH active	See operating modes:			
13	Operation mode specific (2)		"Velocity Mode" (130)	"Homing Mode" (132)	"IP Mode" (134)	"Manual Jog" (137)
14	Operation mode specific (3)					
15	Reserved	HIGH active	Reserved			

Monitor data selection (C3181)

Depending on the values of the control bits 4 ... 6, the following monitor data can be transmitted from the drive:

Value of the control bits 4 ... 6	Monitor data (CAN1_OUT)	Meaning
0	Free	
1	MCTRL_nPos_a	Axis position 16 bits
2	DINT_TO_INT (MCTRL_dnPosSet_p)	Following error (±2^{15} increments)
3	MCTRL_nNAct_a	Current speed (n_{max} = 2^{14} increments)
4	MCTRL_nMAct_a	Current torque (M_{max} = 2^{14} increments)
5	MCTRL_nIAct_a	Current motor current (I_{max} = 2^{14} increments)
6	MCTRL_nDCVolt_a	Current DC-bus voltage (2^{14} [units] = 1000 V)
7	nPosLatchDiff	Difference between actual position and actual position at touch probe (C6000)

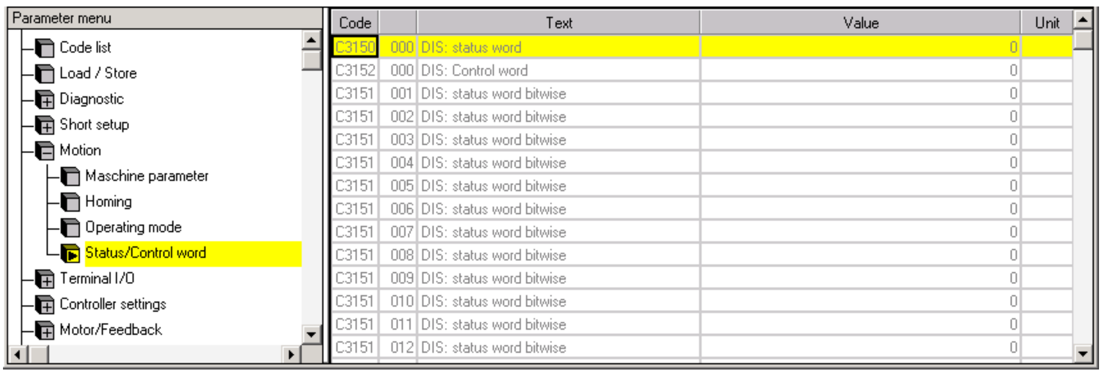
6.8.2 Process data from the axis module

The process data from the axis module are transmitted to the MotionBus (CAN) via the process data channel CAN1_OUT of the interface X4.

Structure of the transmitted process data

User data							
Word 1		Word 2		DWord (word 3 + word 4)			
LOW byte	HIGH byte	LOW byte	HIGH byte	LOW word		HIGH word	
Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**	**Byte 8**
Application status word (C3150, 3151)		Monitor data (C3181)		Actual position (2^{16} = 1 position encoder revolution)			

The GDC parameter menu includes the codes for displaying the status word (C3150 and C3151) under **Motion → Status/Control word**.



ECSXA549

Fig.6-12 GDC view: Display of the status word

Status word

The status word (C3150, C3151) consists of 16 bits each of them giving the following information:

Bit	Name	Level	Meaning	
			"Homing mode" operation (📖 132)	"IP mode"operation (📖 134)
0	Toggle	HIGH active	Toggle bit: The control changes the status of this bit with each telegram. The cyclic "toggling" is monitored in the controller. If the error counter exceeds the value in C3161, the drive reacts according to the function set in C3160.	
1	Operation mode specific (1)		Homing is active	IP mode is active
2	Operation mode specific (2)		Reference known	Evaluation of the position detection (Pos_Latch)
3	Operation mode specific (3)		Reference error	Pos_Latch error
4	Operation mode specific (4)		Reference switch	Touch probe sensor
5	Axis limit switch (positive)	LOW active	Hardware limit switch of the positive traversing range is activated.	
6	Axis limit switch (negative)		Hardware limit switch of the negative traversing range is activated.	
7	Reserved	HIGH active	Reserved	
8	Status information 0		The following possible values are binary coded. ● 0: Initialisation after connecting the supply voltage ● 1: Switch-on inhibit (LOCK-MODE), restart protection is active (C0142) ● 3: Controller inhibit (CINH) is active ● 6: Controller enabled ● 7: Response of monitoring caused a "message". ● 8: Response of monitoring caused a "TRIP". ● 10: Response of monitoring or external quick stop (QSP) via digital input X6/DI1 caused a "FAIL-QSP".	
9	Status information 1			
10	Status information 2			
11	Status information 3			
12	Warning		1 = Warning (Only display of the failure, the drive continues to run normally.)	
13	ActPositionOK		0 = The actual position is not valid anymore. Encoder error: Referencing must be repeated.	
14	FailToAckn		1 = An error must be reset.	
15	rdy		1 = Ready for operation	

6.8.3 Toggle-bit monitoring

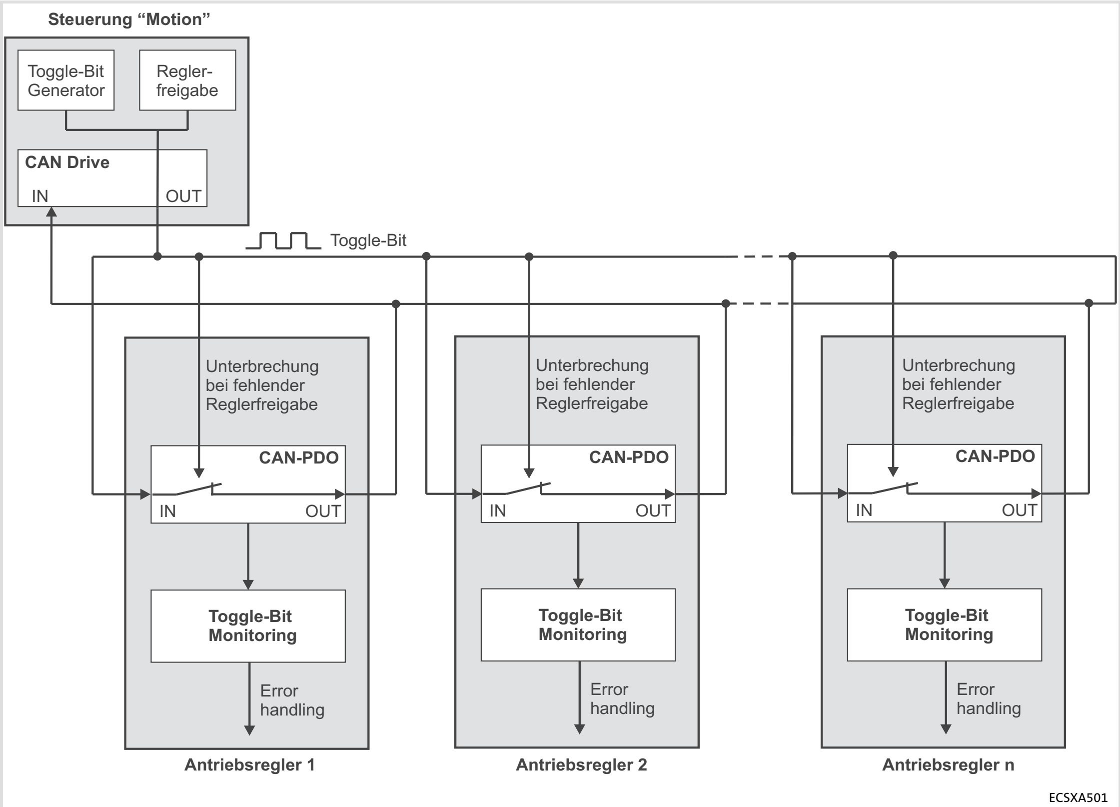


Fig.6-13 Basic principle of toggle bit monitoring

The toggle bit monitoring serves to control the sync-controlled transmission of telegrams on the CAN bus. In the "Motion" application a bit pattern is generated in the control which changes between the HIGH and LOW states. This bit pattern is cyclically transmitted to the next controller in the drive system via a process data channel of the MotionBus (CAN). Each controller monitors the status change of the toggle bit and simultaneously gives the bit pattern 1:1 back to the control. If errors occur in the drive system, they are evaluated independently in each controller involved.

In the event of an error (e. g. if a telegram is not transmitted) the toggle bit error counter is increased by 1. Depending on error limit (C3161) and error handling (3160) all controllers involved can react independently of the communication (error handling).

In the GDC, the error limit (C3161) and error handling (C3160) can be set in the parameter menu under **Monitoring**.

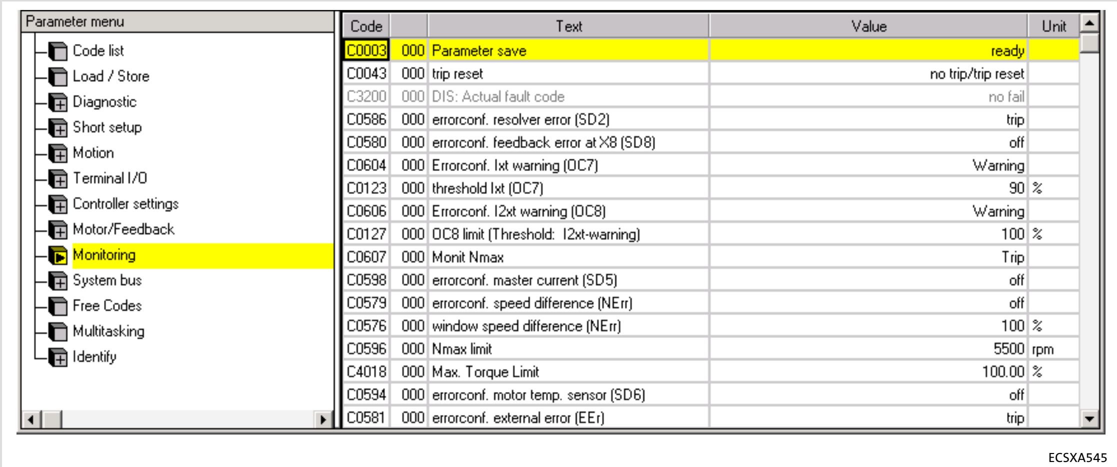


Fig.6-14 GDC view: Monitoring

Code		Possible settings			IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**			
C3160	ToggleErrReac	3			Toggle bit error handling	📖 108
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		
C3161	ToggleErLimit	4			Toggle bit error counter limit	📖 108
			0	{1 units} 65535		

6.9 Entry of machine parameters

The GDC parameter menu includes the codes for machine parameters (e.g. deceleration time for quick stop or maximum speeds) under **Motion → Machine parameter**.

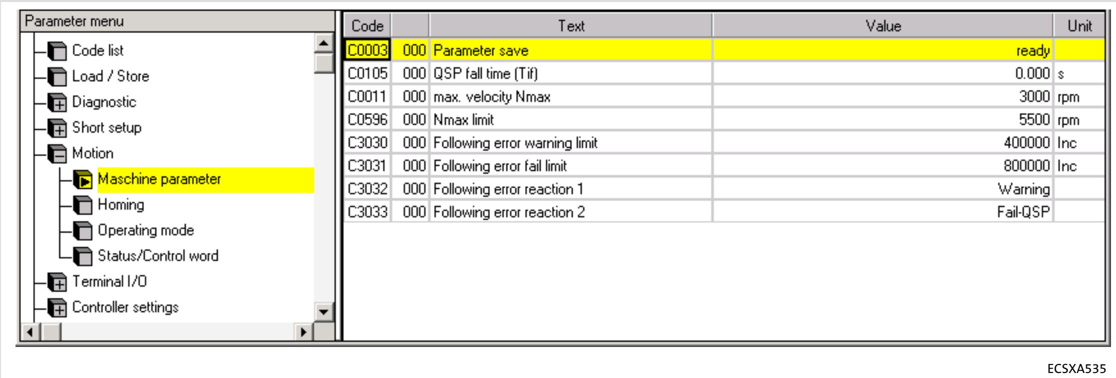


Fig.6-15 GDC view: Short setup, entry of machine parameters

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0011	Nmax	3000				Maximum speed	
			500	{1 rpm}	16000	Reference value for the absolute and relative setpoint selection for the acceleration and deceleration times. **For parameter setting via interface: greater changes in one step should only be made when the controller is inhibited (CINH)!**	
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	🕮 143
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	
C0596	NMAX limit	5500				Monitoring: Maximum speed of the machine	🕮 216
			0	{1 rpm}	16000		
C3030	FolloErrWarn	400000				Following error limit for enabling a warning	🕮 140
			0	{1 inc}	2140000000		
C3031	FolloErrFail	800000				Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	🕮 140
			0	{1 inc}	2140000000		
C3032	FollErr1reac	2				First reaction when following error limit has been reached	🕮 140
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3033	FollErr2reac	4			Second reaction when following error limit has been reached	🕮 140
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		

6.10 Setting of homing parameters

During homing the drive traverses in a preselected mode (C3010). While doing so, the zero position (reference) is detected by means of a reference mark and transmitted to the drive control. All position data refer to this reference.

The GDC parameter menu includes the codes for setting the homing parameters (e.g. homing mode, speed, offsets) under **Motion → Homing**.

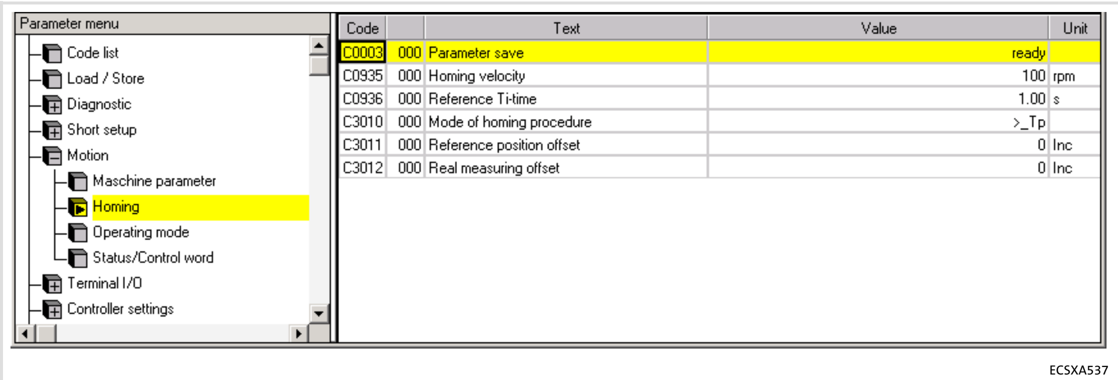


Fig.6-16 GDC view: Short setup, entry of homing parameters

6.10.1 Homing parameters

Code		Possible settings				IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**				
C0935	L_REF1 speed	100				Traversing speed of homing	🕮 112
			1	{1 rpm}	16000		
C0936	L_REF1 Ti	1,0				Deceleration time (T_i) of homing	🕮 112
			0,01	{0,01 s}	650,00		
C3008	HomeMlim	10,0				Torque limit value for homing mode C3010 = 16 or 17 (100,00 % = maximum torque from C0057)	🕮 122 🕮 122
			0,00	{0,01 %}	100,00		
C3009	TimeHomeMlim	100				Duration for detecting the mechanical limit stop for homing mode C3010 = 16 or 17	🕮 122 🕮 122
			0	{1 ms}	65535		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3010	HomingMode	8			Homing mode	112 114
			0	>_Rn_MP	**Selection symbolism:** • >: Movement in pos. direction • <: Movement in neg. direction • Lp: Limit switch in pos. direction • Ln: Limit switch in neg. direction • Rp: Pos. edge of the reference switch • Rn: Neg. edge of the reference switch • MP: Zero pulse/position of the position encoder, once per motor revolution • TP: Touch probe signal • Mlim: mechanical limit stop (torque limit value) **Notes:** • When using the homing modes 0 ... 5, set C0540 = 2. • The mechanical limit stop is defined as exceedance of the torque limit C3008 for the duration C3009. • When the last action listed is executed, the home position is set (e.g. zero pulse with ”MP”), even if the drive continues traversing. • In all modes without limit switch (”Lp” / ”Ln”) retracting from the limit switch with error handling set in C317 is not possible.	
			1	<_Rn_MP		
			2	>_Lp_<_Rn_MP		
			3	<_Ln_>_Rn_MP		
			4	>_Rp_<_Rn_MP		
			5	<_Rp_>_Rn_MP		
			6	>_Rn_>_TP		
			7	<_Rn_<_TP		
			8	>_TP		
			9	<_TP		
			10	>_Lp_<_TP		
			11	<_Ln_>_TP		
			12	>_Lp_<_MP		
			13	<_Ln_>_MP		
			14	>_MP		
			15	<_MP		
			16	>_MLim		
			17	<_MLim		
			99	Set reference		
C3011	Home offset	0			Offset between home position and standstill position	124
			-2140000000	{1 inc} 2140000000		
C3012	Measure offs.	0			Offset for shifting the zero position with regard to the standstill position	124
			-2140000000	{1 inc} 2140000000		

6.10.2 Homing modes

Modes 0 and 1

Travelling to zero pulse (zero position of the position encoder) via the reference switch.

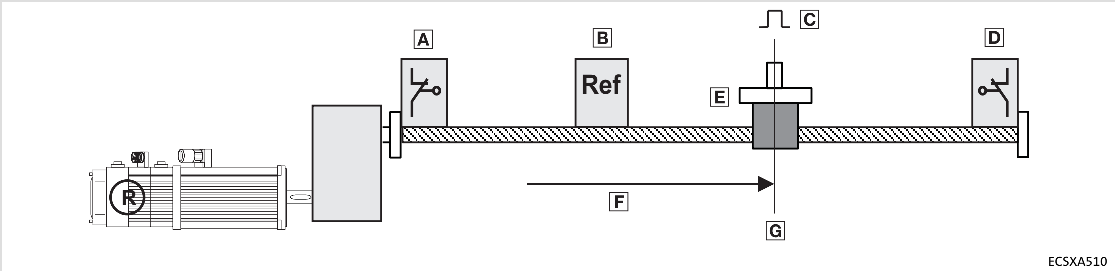


Fig.6-17 Homing in mode 0

- A Negative hardware limit switch
- B Reference switch
- C Zero pulse (zero position of the position encoder)
- D Positive hardware limit switch
- E Load (e.g. slide)
- F Direction of travel
- G Home position

The load (e. g. slide) travels from its starting position beyond the reference switch to the first zero pulse after leaving the reference switch. This zero pulse bears the home position. Before homing, the load may be positioned on the reference switch.

Settings

Mode 0 (Homing towards the positive hardware limit switch)	**Mode 1** (Homing towards the negative hardware limit switch)
• Set C3010 = 0. • Set C0540 = 2.	• Set C3010 = 1. • Set C0540 = 2.

Note!

- ► Single-turn absolute value encoders (sin/cos encoders) and resolvers do not have a zero pulse. Here, the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).

Modes 2 and 3

Approaching the hardware limit switch, reversing the direction of travel and travelling to the zero position (zero position of the position encoder) via the reference switch.

Note!
- While reversing, the hardware limit switch approached must be assigned (mechanics must be designed accordingly).
- In a 6 ms cycle, the negative/positive hardware limit switches are queried.

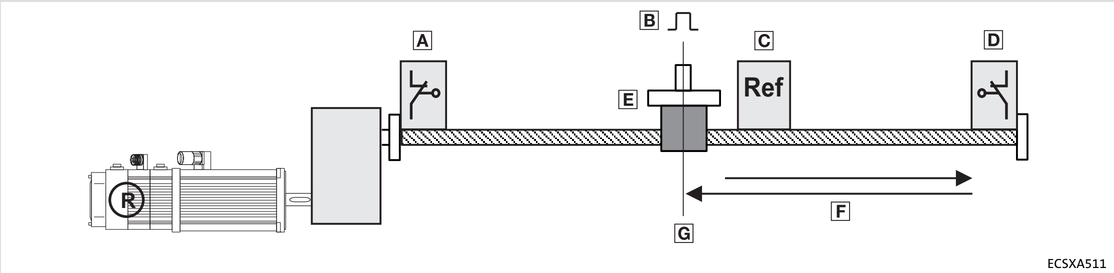


Fig.6-18 Homing in mode 2

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Positive hardware limit switch
- E Load (e.g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load, after leaving the reference switch, is traversed to the first zero pulse beyond the reference switch. This zero pulse bears the home position. If the drive has already approached a hardware limit switch before homing, the direction of travel is reversed immediately.

In homing modes 2 and 3, the reference switch is definitely found, since, in the most unfavourable case, the entire travel range is covered.

Settings

Mode 2 (Homing towards the positive hardware limit switch)	**Mode 3** (Homing towards the negative hardware limit switch)
• Set C3010 = 2. • Set C0540 = 2.	• Set C3010 = 3. • Set C0540 = 2.

Note!
- Single-turn absolute value encoders (sin/cos encoders) and resolvers do not have a zero pulse. Here, the zero position corresponds to the zero pulse.
- In the case of multi-turn absolute value encoders, only homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).

Modes 4 and 5

Approaching the reference switch, reversing, and travelling to the zero pulse (zero position of the position encoder).

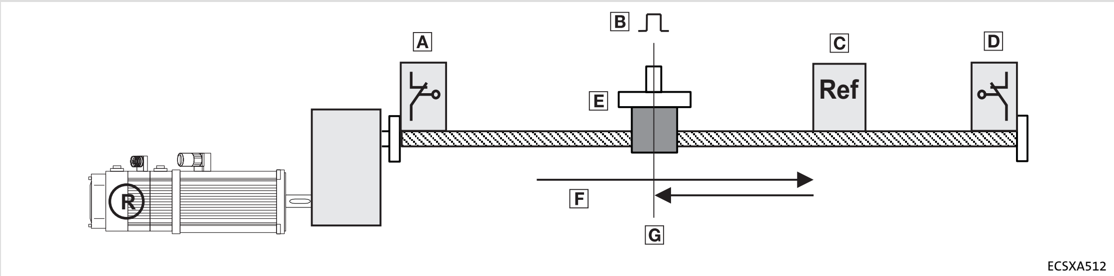


Fig.6-19 Homing in mode 4

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Reference switch
- D Positive hardware limit switch
- E Load (e.g. slide)
- F Direction of travel
- G Home position

The load (e.g. slide) travels from its original position to the reference switch. At the approached reference switch the direction of travel is reversed and the load travels to the first zero pulse after leaving the reference switch. The zero pulse bears the home position. If the drive is already situated at the reference switch, the direction of travel is reversed immediately.

Settings

Mode 4 (Homing towards the positive hardware limit switch)	**Mode 5** (Homing towards the negative hardware limit switch)
• Set C3010 = 4. • Set C0540 = 2.	• Set C3010 = 5. • Set C0540 = 2.

Note!

- ► Single-turn absolute value encoders (sin/cos encoders) and resolvers do not have a zero pulse. Here, the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).

Mode 6 and 7

Travelling to touch probe signal via reference switch.

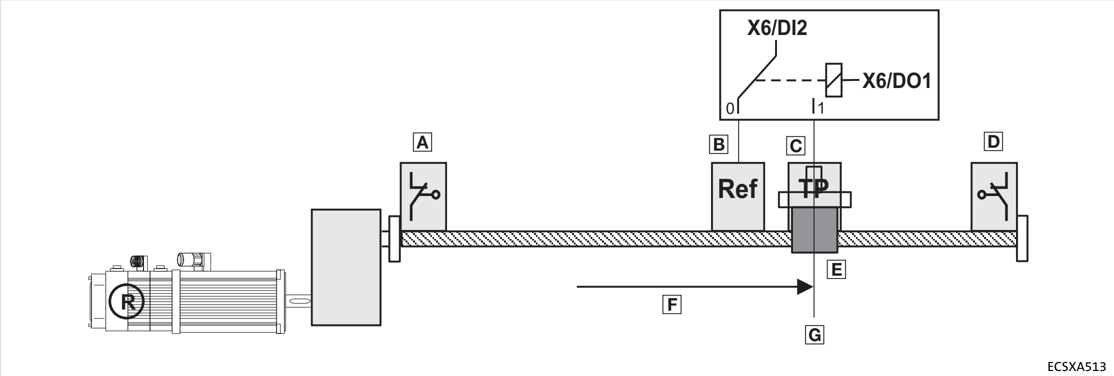


Fig.6-20 Homing in mode 6

- A Negative hardware limit switch
- B Reference switch
- C Touch probe signal (touch probe sensor)
- D Positive hardware limit switch
- E Load (e.g. slide)
- F Direction of travel
- G Home position

The touch probe is used if the zero pulse (zero position of the position encoder) does not occur reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor replacement.

The load (e.g. slide) travels from its original position beyond the reference switch to the first touch probe signal after leaving the reference switch. This touch probe signal bears the home position. A HIGH level is pending at the digital input X6/DI2. Before homing, the load may already be situated on the reference switch.

Use X6/DO1 to switch a relay which changes over between reference switch and touch probe sensor at X6/DI2. (📖 58)

Settings

Mode 6 (Homing towards the positive hardware limit switch)	**Mode 7** (Homing towards the negative hardware limit switch)
• Set C3010 = 6.	• Set C3010 = 7.

Modes 8 and 9

Travelling to touch probe signal.

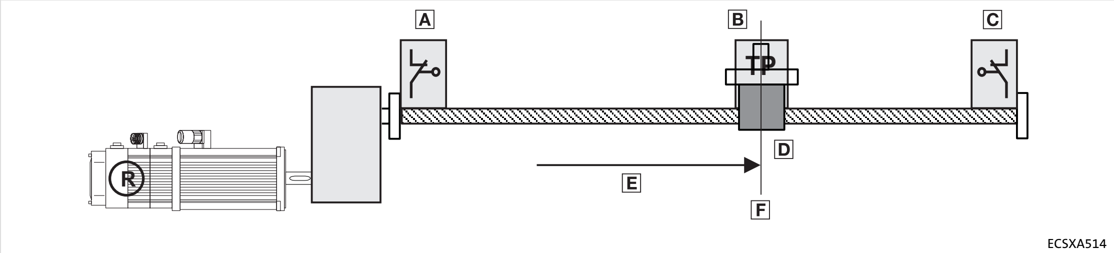


Fig.6-21 Homing in mode 8

- A Negative hardware limit switch
- B Touch probe signal (touch probe sensor)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Direction of travel
- F Home position

The touch probe is used if the zero pulse (zero position of the position encoder) does not occur reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor replacement.

The load (e.g. slide) travels from its original position to the first touch probe signal which lies in the direction of travel. This touch probe signal bears the home position.

Settings

Mode 8 (Homing towards the positive hardware limit switch)	**Mode 9** (Homing towards the negative hardware limit switch)
• Set C3010 = 2. • If the touch probe signal is already applied to X6/DI2, first of all retracting towards the positive hardware limit switch is performed.	• Set C3010 = 3. • If the touch probe signal is already applied to X6/DI2, first of all retracting towards the negative hardware limit switch is performed.

Modes 10 and 11

Approaching the hardware limit switch, reversing and travelling towards touch probe signal.

Note!

- While reversing, the hardware limit switch approached must be assigned (mechanics must be designed accordingly).
- In a 6 ms cycle, the negative/positive hardware limit switches are queried.

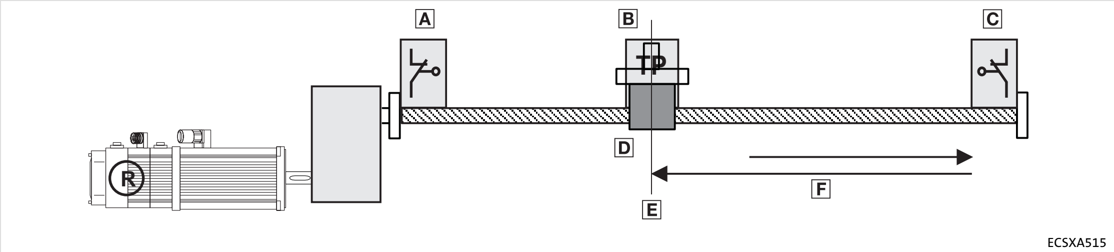


Fig.6-22 Homing in mode 10

A Negative hardware limit switch
B Touch probe signal (touch probe sensor)
C Positive hardware limit switch
D Load (e.g. slide)
E Home position
F Direction of travel

The touch probe is used if the zero pulse (zero position) of the position encoder occurs non-reproducibly at the same position due to the mechanical structure. It is also possible that the zero pulse is mechanically shifted after a motor exchange.

The load (e. g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load is traversed to the touch probe signal. This touch probe signal bears the home position. If the drive already is at the hardware limit switch before homing, the direction of travel is reversed immediately.

Settings

Mode 10 (Homing towards the positive hardware limit switch)	**Mode 11** (Homing towards the negative hardware limit switch)
• Set C3010 = 10.	• Set C3010 = 11.

Modes 12 and 13

Approaching the hardware limit switch, reversing and travelling to the zero pulse (zero position of the position encoder).

Note!
- ► While reversing, the hardware limit switch approached must be assigned (mechanics must be designed accordingly).
- ► In a 6 ms cycle, the negative/positive hardware limit switches are queried.

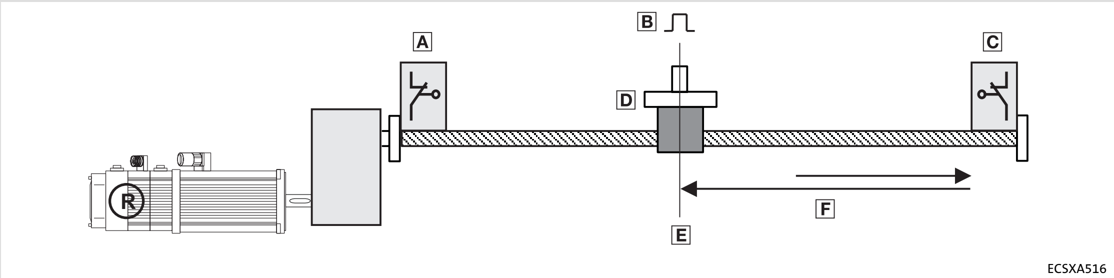


Fig.6-23 Homing in mode 12

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Home position
- F Direction of travel

Zero pulse and hardware limit switch are used if a reference switch and touch probe sensor are not available (e.g. in the case of rotary tables).

The load (e.g. slide) from its initial position is traversed to a hardware limit switch. During this process, no fault message is actuated. According to the direction of travel, a reversal takes place at the hardware limit switch approached, and the load travels to the first zero pulse (zero position of the position encoder) after leaving the limit switch. This zero pulse bears the home position. If the drive has already approached the hardware limit switch before homing, the direction of travel is reversed immediately.

Settings

Mode 12 (Homing towards the positive hardware limit switch)	**Mode 13** (Homing towards the negative hardware limit switch)
• Set C3010 = 12.	• Set C3010 = 13.

Note!
- ► Single-turn absolute value encoders (sin/cos encoders) and resolvers do not have a zero pulse. Here, the zero position corresponds to the zero pulse.
- ► In the case of multi-turn absolute value encoders, only homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).

Modes 14 and 15

Travelling to zero pulse (zero position of the position encoder).

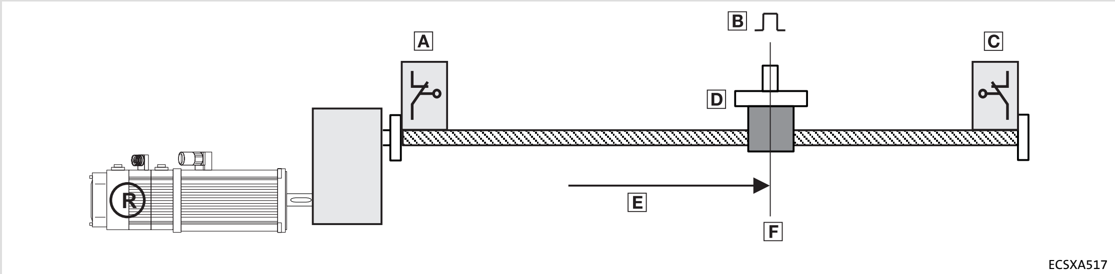


Fig.6-24 Homing in mode 14

- A Negative hardware limit switch
- B Zero pulse (zero position of the position encoder)
- C Positive hardware limit switch
- D Load (e.g. slide)
- E Direction of travel
- F Home position

The zero pulse is only used if a reference switch and touch probe sensor are not available (e.g. in case of rotary tables).

The load (e.g. slide) travels from its original position to the first zero pulse which lies in the direction of travel (zero position of the position encoder). This zero pulse bears the home position.

Settings

Mode 14 (Homing towards the positive hardware limit switch)	**Mode 15** (Homing towards the negative hardware limit switch)
• Set C3010 = 14.	• Set C3010 = 15.

Note!

- ► Single-turn absolute value encoders (sin/cos encoders) and resolvers do not have a zero pulse. Here, the zero position corresponds to the zero pulse.
- ► In case of multi-turn absolute value encoders, only the homing modes 6 ... 11 and 99 can be used (C3010 = 6 ... 11 or 99).

Modes 16 and 17

Approaching the mechanical limit stop and setting home position.

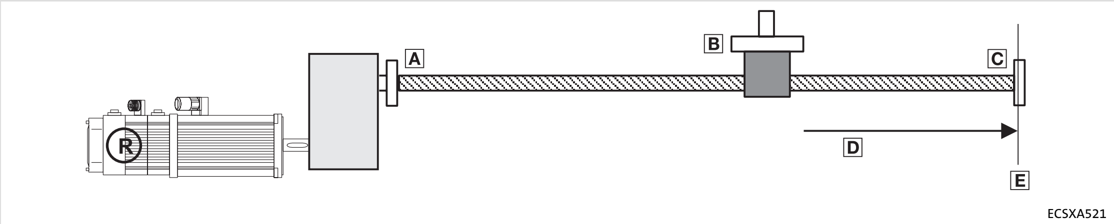


Fig.6-25 Homing in mode 16

A Mechanical limit stop (negative)
B Load (e.g. slide)
C Mechanical limit stop (positive)
D Direction of travel
E Home position

The load (e.g. slide) is travelled from its original position in positive or negative direction towards the mechanical limit stop. The motor torque is limited during homing to the torque limit value (C3008). If the motor torque reaches the torque limit value for a longer time than specified in C3009, the internal speed setpoint is travelled to ”0” within the deceleration time set (C0936). After that it is traversed by the offset set in C3011 (🕮 124). If the internal speed setpoint = 0, a home position is set at this position.

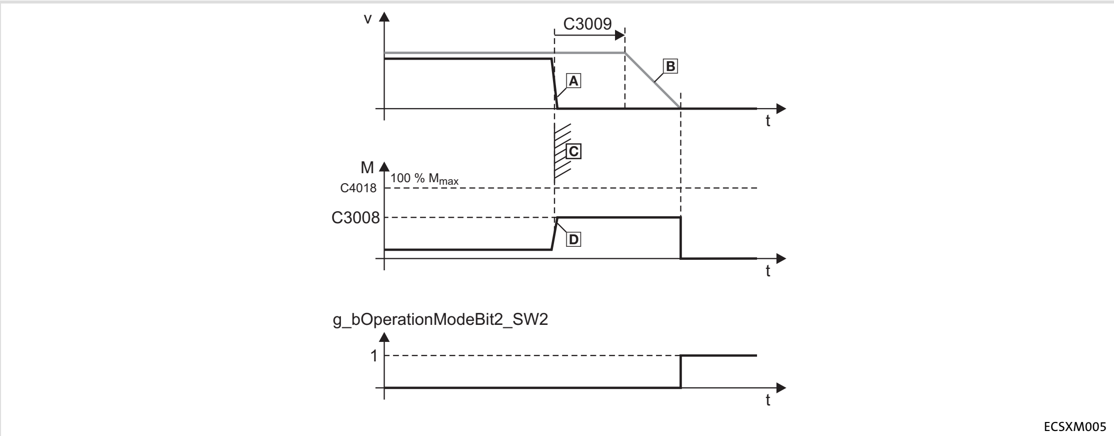


Fig.6-26 Sequence of homing in mode 16/17

A Actual speed value
B Speed setpoint
C Mechanical limit stop
D Actual torque

Settings

Mode 16 (Homing towards the positive mechanical limit stop)	**Mode 17** (Homing towards the negative mechanical limit stop)
• Set C3010 = 16.	• Set C3010 = 17.

Mode 99

Set reference

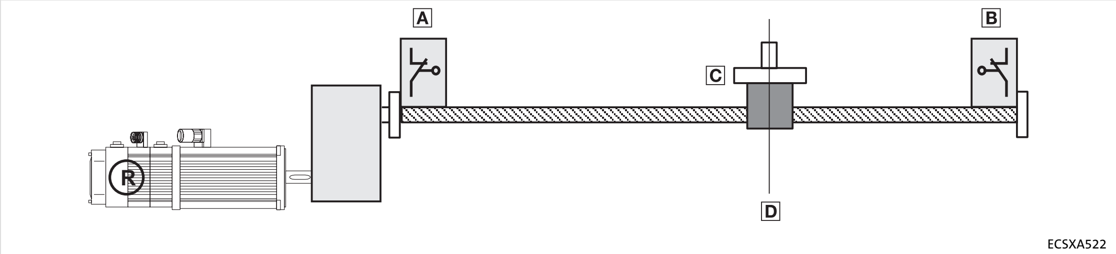


Fig.6-27 Set reference in the mode 99

- A Negative hardware limit switch
- B Positive hardware limit switch
- C Load (e.g. slide)
- D Home position

Use ”Set reference” if

- ► you want to determine the zero position yourself.
- ► no touch probe sensor is available (e.g. in case of rotary tables).
- ► a home position cannot be determined depending on sensors, switches, or zero pulses (e.g. in case of transformed axes).

The load (e.g. slide) is situated on a position. Here, it is switched to the homing mode and the reference is set to C3011 + C3012 (🕮 124) . The axis does not move. After an internal calculation ”Reference OK” is displayed.

Note!

In case of absolute value encoders (single-turn, multi-turn), ”Set reference” is only possible via C0098 (position offset) in combination with the controller inhibit (CINH).

6.10.3 Shifting of the zero position (offset selection)

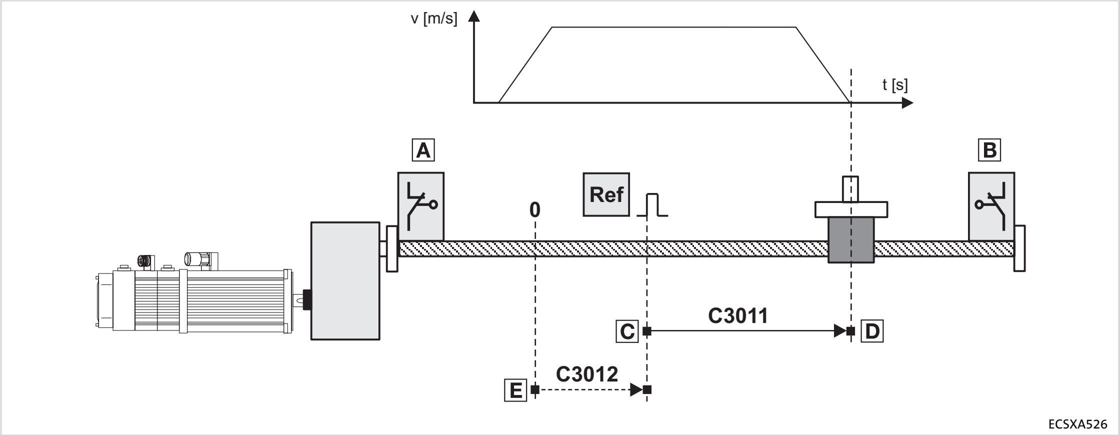


Fig.6-28 Shifting of the zero position

A Negative hardware limit switch
B Positive hardware limit switch
C Home position (zero pulse (zero position of position encoder))
D Standstill position after completion of homing
E Zero position of measuring system after shift by C3012
REF Reference switch

code	Description
C3011	Offset between home position and standstill position ● Distance still to be traversed [inc] after reaching the home position (e.g. zero pulse (zero position of the position encoder)). ● Positive values: Drive motion towards the positive hardware limit switch. ● Negative values: Drive motion towards the negative hardware limit switch. ● Value range: -2140000000 ... 2140000000 [inc]
C3012	Offset for shifting the zero position: ● Positive values: Offset of the zero position towards the negative hardware limit switch. ● Negative values: Offset of the zero position towards the positive hardware limit switch. ● The zero position is offset without any further drive motion. ● **Actual position via MotionBus (CAN) = C3011 + C3012** (the outcome of this is the offset of the zero position.) ● Value range: -2140000000 ... 2140000000 [inc]

Example

1. C3011 = 100000 [inc]:

   After reaching the home position (e.g. zero pulse (zero position of the position encoder)) the drive travels in **positive direction** by 100000 [inc].

   The zero position is situated at the home position.

2. a) C3012 = 50000 [inc] (compare Fig.6-28):

   The zero position is offset by 50000 [inc] in **negative direction**.

   Actual position = 100000 [inc] + 50000 [inc] = 150000 [inc]

   b) C3012 = -50000 [inc]:

   The zero position is offset by 50000 [inc] in **positive direction**.

   Actual position = 100000 [inc] + (-50000 [inc]) = 50000 [inc]

6.10.4 Example: Reference search with linear positioning axis

Settings for homing mode 13

- ► Set homing mode 13 with C3010 = 13.
- ► The negative hardware limit switch is to be used as reference switch at the same time:
  - – Connect hardware limit switch in parallel with X6/DI3 and X6/DI4. (For terminal assignment see 📖 58)
  - – Set C0114/3 and C0114/4 = 1 (LOW level is active).
- ► Set travelling speed with C0935.
- ► Set acceleration/deceleration with C0936.
- ► Define target position as offset to the home position via C3011.

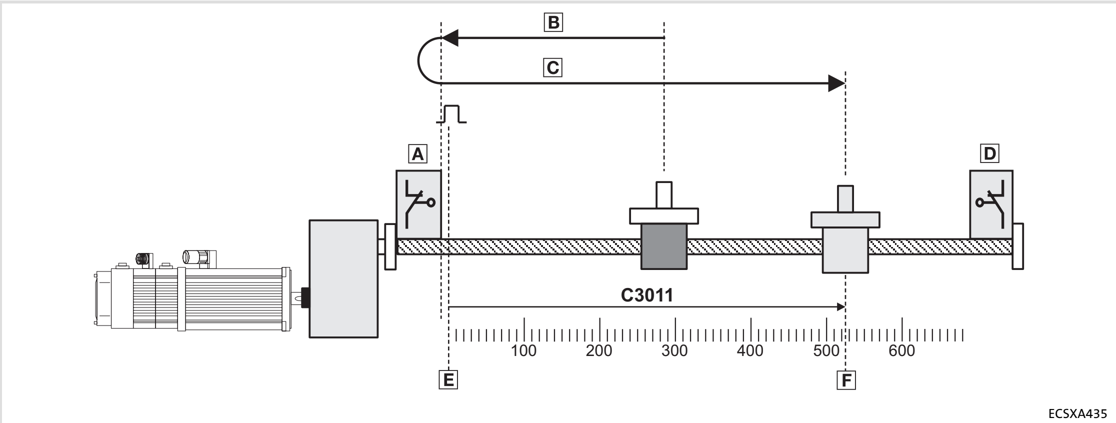


Fig.6-29 Homing in mode 3, negative hardware limit switch as reference switch

- A Negative hardware limit switch
- B Travel towards reference switch
- C Travel via the defined offset (C3011) towards target position
- D Positive hardware limit switch
- E Zero pulse (zero position of the position encoder)
- F Target position

Functional sequence

1. The ”Homing” operating mode is selected via SDO (📖 176) with C5000 and confirmed with C5001.
2. Homing is started by activating the control bit 12.
   – Control bit 12 = 1 (TRUE)
3. During the homing process the status bit 1 is active.
   – Status bit 1 = 1 (TRUE)
4. The drive travels towards the negative hardware limit switch (A) and reverses. B
   – Since the limit switch is also used as reference switch, the preliminary stop will be set when the drive leaves the limit switch, i.e. when the next zero pulse (E) of the position encoder is reached, the drive control will know the home position.
5. The drive continues traversing without interruption to the target position (F) which has been defined as offset to the home position under C3011. C
6. When the target position is reached, homing is completed.
   – Control bit 12 = 0 (FALSE)
   – Status bit 2 = 1 (TRUE)
7. The zero position (C3012 plus the distance covered in C3011) is transmitted as actual position to the master control.

6.10.5 Example: Reference search with continuous positioning axis

For applications with an unlimited traversing range (e. g. conveying belts and rotary tables) the reference is always searched via a mark. In that case, the reference switch serves as a mark sensor.

Settings for homing mode 8

- Set homing mode 8 with C3010 = 8.
- Set target position as the offset to the home position (TP) via C3011 and C3012.
- Set travelling speed via C0935.
- Set acceleration/deceleration via C0936.

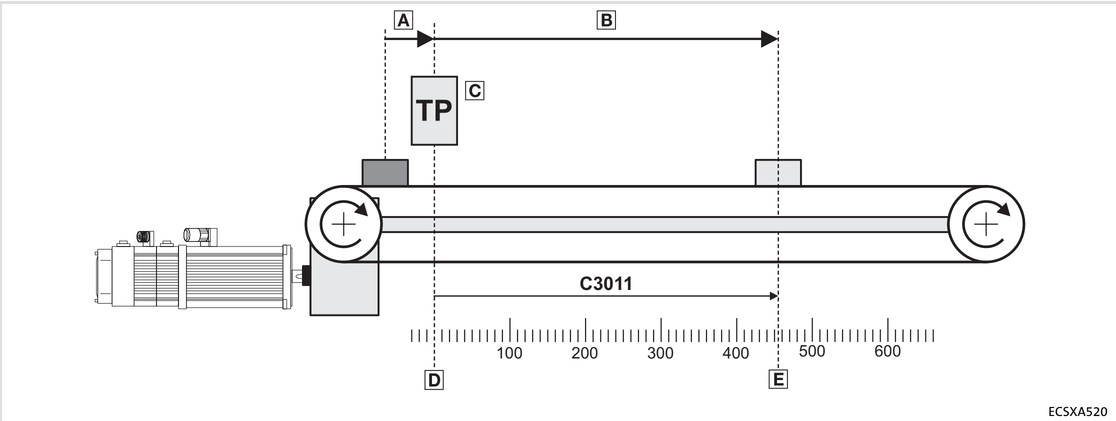


Fig.6-30 Homing in mode 8

- A Travel towards home position
- B Travel via the defined offset towards target position
- C Touch probe sensor (home position)
- D Zero position
- E Target position

Functional sequence

1. The ”Homing” operating mode is selected via SDO (🕮 176) with C5000 and confirmed with C5001.
2. Homing is started by activating the control bit 12.
   – Control bit 12 = 1 (TRUE)
3. During the homing process the status bit 1 is active.
   – Status bit 1 = 1 (TRUE)
4. The drive travels in positive direction. A
   When the positive edge of the touch probe sensor (C) has been reached, the drive control knows the reference.
5. The drive continues traversing without interruption to the target position (E) which has been defined as offset to the home position (TP) under C3011. B
6. When the target position is reached, homing is completed.
   – Control bit 12 = 0 (FALSE)
   – Status bit 2 = 1 (TRUE)
7. The zero position (C3012 plus the distance covered in C3011) is transmitted as actual position to the master control.

6.11 Selection of the operating mode

The ”Motion” application software supports the operating modes

- ”Velocity Mode”,
- ”Homing Mode”,
- ”Interpolated Position Mode” (for travel according to setpoint selection),
- ”Manual Jog” e.g. via GDC.

Use C5000 to select the operating mode manually. The display code C5001 serves to confirm the currently set operating mode.

The GDC includes the codes for selecting the operating mode in the parameter menu under **Motion → Operating mode**.

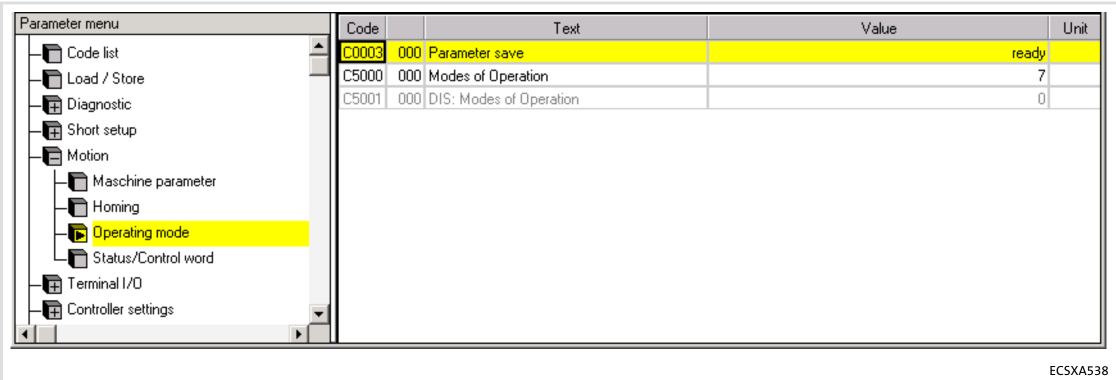


Fig.6-31 GDC view: Selection of the operating mode

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C5000	OpMode	7			Selection of the operating mode	🕮 129
			2	Velocity mode		🕮 130
			6	Homing Mode		🕮 132
			7	Interpolated Position Mode		🕮 134
			128	Manual jog		🕮 137
C5001	Mode_Op_Dis				Operating mode Only display	🕮 129
			2	Velocity mode		🕮 130
			6	Homing Mode		🕮 132
			7	Interpolated Position Mode		🕮 134
			128	Manual jog		🕮 137

6.11.1 ”Velocity” operating mode

The ”Velocity Mode” enables the master control to transfer a speed profile to the ECSxM axis module via the MotionBus (CAN).

Settings

► Select ”CAN” control interface: C4010 = 0

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4010	Ctrl_Interf	0			Control interface	📖 130 📖 137
			0	CAN	Control word is expected via PDO CAN1_IN.	
			1	No function	Not used	
			2	No function	Not used	
			3	C4040	Control word is generated by GDC/User or received by a master control via SDO.	
			4	No function	Not used	

► Select ”Velocity Mode”: C5000 = 2
– The code C5000 (4C77h) is written via SDO (📖 176).

► Selection confirmation: C5001 = 2
– The selection of ”Velocity Mode” is confirmed.
– Code C5001 (4C76h) must be read out via SDO.

► Activate ”Velocity Mode”: control bit 12 = 1 (TRUE)

► Definitions from the master control to the axis module:
– Speed signal (*CAN1_nInW1_a*)
– Ramp times (acceleration, deceleration and stop times)

Retracting hardware limit switch

1. Deactivate limit switch monitoring: Control bit 1 = 1 (TRUE)
   Retracting from an activated hardware limit switch is enabled.
2. Reset fault message: Set control bit 11 = 1.
3. Activate ”Velocity Mode”: control bit 12 = 1 (TRUE)

Note!
Select ”correct” direction of travel for speed profile. The active hardware limit switch must not be overtravelled while retracting.
► Positive hardware limit switch is active → Retracting in negative direction
► Negative hardware limit switch is active → Retracting in positive direction

4. Activate limit switch monitoring: Set control bit 1 = 0 (FALSE).

Operating mode-dependent bits in the control word

Bit	Name	Value	Reaction
1	Release limit switch	0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Activate "Velocity Mode"	0	Speed profile of the master control is not executed.
		0 → 1	Start of the speed profile
		1	Speed profile is executed.
		1 → 0	Speed profile is interrupted or executed.

6.11.2 "Homing" operating mode

Note!

- No homing with absolute value encoders.
- Use C0098 to set another position than the one transmitted by the absolute value encoder.

Settings

- Select "Homing Mode": C5000 = 6
  – Code C5000 (4C77h) is written via SDO (176).
- Selection confirmation: C5001 = 6
  – The selection of "homing mode" is confirmed.
  – Code C5001 (4C76h) must be read out via SDO.
- Start homing: Control bit 12 = 1 (TRUE)

Retracting hardware limit switch

1. Deactivate limit switch monitoring: Control bit 1 = 1 (TRUE)
   Retracting from an activated hardware limit switch is enabled.
2. Reset fault message: Set control bit 11 = 1.
3. Activate "Homing Mode": Control bit 12 = 1 (TRUE)

Note!

Select "correct" direction of travel for homing mode. The active hardware must not be overtravelled while retracting.

- Positive hardware limit switch is active → Retracting in negative direction
- Negative hardware limit switch is active → Retracting in positive direction

4. Activate limit switch monitoring: Set control bit 1 = 0 (FALSE).

Operating mode-dependent bits in the control word

Bit	Name	Value	Reaction
1	Release limit switch	0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Activate "Homing Mode"	0	Homing is not executed.
		0 → 1	Start of homing
		1	Homing is being executed.
		1 → 0	Homing is interrupted or completed.

Operating mode-dependent bits in the status word

Bit	Name	Value	Reaction
1	Homing is active	0	”Homing mode” is not active
		1	Homing has been started by setting the control bit 12 = 1. No external setpoint changes are considered.
2	Reference known	0	Homing is being executed or has been aborted.
		1	Homing is completed. → Reference is known.
3	Reference error	0	No error during homing
		1	Error during homing →Function abort
4	Reference switch	0	No reference switch
		1	Reference switch is active

6.11.3 Operating mode "Interpolated Position Mode" (IP-Mode)

The "IP mode"enables a travel according to setpoint selection.

Settings

- Select "IP mode": C5000 = 7
  – Code C5000 (4C77h) is written via SDO (📖 176).
- Selection confirmation: C5001 = 7
  – The selection of "IP mode" is confirmed.
  – Code C5001 (4C76h) must be read out via SDO. Travel according to setpoint selection has not started yet.
- Activate "IP Mode": Control bit 12 = 1 (TRUE)

Retracting hardware limit switch

1. Deactivate limit switch monitoring: Control bit 1 = 1 (TRUE)
   Retracting from an activated hardware limit switch is enabled.
2. Reset fault message: Set control bit 11 = 1.
3. Activate "IP Mode": Control bit 12 = 1 (TRUE)

Note!
Select "correct" direction of travel for position (setpoint). The active hardware must not be overtravelled while retracting.
- Positive hardware limit switch is active → Retracting in negative direction
- Negative hardware limit switch is active → Retracting in positive direction

4. Activate limit switch monitoring: Set control bit 1 = 0 (FALSE).

Operating mode-dependent bits in the control word

Bit	Name	Value	Reaction
1	Release limit switch	0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: • After a TRIP-RESET, the activated hardware limit switch can be retracted.
12	Activate IP mode	0	IP mode is not active
		1	IP mode is active
13	Activate Pos_Latch	0	No touch probe
		1	The position detection (📖 135) will be started with the next touch probe edge.

Note!
The external setpoint can only be read if the control bit 12 = 1 (IP mode active). Otherwise, the drive must control the motor with the internal setpoint.

Operating mode-dependent bits in the status word

Bit	Name	Value	Reaction
1	IP mode is active	0	IP mode is not active
		1	IP mode is active
2	Evaluate Pos_Latch	0	No touch probe
		1	The active touch probe edge has completed the position detection.
3	Pos_Latch error	0	No error during position detection
		1	Error during position detection → Function abort
4	Touch probe sensor	0	No touch probe
		1	Touch probe sensor is active

Position detection (Pos_Latch)

For position detection the drive traverses the sensor mark to a defined target. If ”Touch Probe” is activated in the controller, the current position is saved.

Note!

The digital input X6/DI2 is double-assigned with touch probe and homing switch. Ensure that both signals do not interact.

Setting sequence:

Setting		Short description
1.	Parameter setting.	Set the following codes in the GDC parameter menu under **Motion → PosLatch**: ● Set C3181 = 7 (nPosLatchDiff) *or* Set control word bits 4, 5 and 6 = 7 [dec]. ● C0911 (MCTRL selection zero pulse/touch probe)
2.	Save parameter set.	Set C0003 = 1.
3.	Activate position detection.	Set control word bit 13 = 1 (TRUE). *or* Set C6001 = 1, 2 or 3: 1 = wait for rising edge 2 = wait for falling edge 3 = wait for rising or falling edge
4.	Start positioning.	Start positioning via the sensor in the IP mode by selecting a setpoint.
5.	Evaluation of positioning	With touch probe (X6/DI2 = HIGH) ● the position where the touch probe has occurred is saved in C6000. ● the difference to the actual position in ”Word 2” of the process data telegram is transmitted. ● bit 4 in the status word is set to 1 (TRUE).

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0911	MCTRL TP sel.	0			MCTRL zero pulse/touch probe selection
			0	Master pulse	Feedback system at X7/X8
			1	Touch probe	Digital input X6/DI2

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3181	MonitorData	0			Monitor data selection	📖 106
			0	Off		
			1	MCTRL_nPos_a	Axis position 16 bits	
			2	DINT_TO_INT (MCTRL_dnPosSet_p)	Following error $\pm 2^{15}$	
			3	MCTRL_nNAct_a	Actual speed ($N_{max} = 2^{14}$)	
			4	MCTRL_nMAct_a	Actual torque ($M_{max} = 2^{14}$)	
			5	MCTRL_nIAct_a	Actual motor current ($I_{max} = 2^{14}$)	
			6	MCTRL_nDCVolt_a	Current DC-bus voltage ($2^{14} \triangleq 1000$ V)	
			7	nPosLatchDiff	Difference between actual position and position at touch probe (C6000)	
C6000	LatchPosition	0			Position at touch probe	📖 106
			-2147483647	{1 inc} -2147483647		
C6001	PosLatchAct	0			Activation: At touch probe (X6/DI2 = HIGH), the actual position is saved in C6000.	📖 106
			0	Not active		
			1	Wait for rising edge		
			2	Wait for falling edge		
			3	Wait for rising or falling edge		
C6002	TPReceived	0			Touch Probe (TP) recognised Only display	
			0	No TP recognised		
			1	TP with rising edge recognised		
			2	TP with falling edge recognised		
			3	TP with rising or falling edge recognised		

6.11.4 "Manual Jog" operating mode

When commissioning for the first time, it may be required to travel the axis module without active master control for optimisation reasons (e.g. using GDC). This is enabled by manual control through settings in C4010 and C4040.

Settings

- Select control interface "C4040": C4010 = 3

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4010	Ctrl_Interf	0			Control interface	📖 130 📖 137
			0	CAN	Control word is expected via PDO CAN1_IN.	
			1	No function	Not used	
			2	No function	Not used	
			3	C4040	Control word is generated by GDC/User or received by a master control via SDO.	
			4	No function	Not used	

- Set manual jog parameters:
  – C3020 (speed: 0.00 ... 100.00 % of C0011 (maximum speed))
  – C3021 (acceleration time: 0.000 ... 999.000 s)
  – C3022 (deceleration time: 0.000 ... 999.000 s)
- Select "Manual Jog" mode: C5000 = 128
  – Code C5000 (4C77h) is written via SDO (📖 176).
- Selection confirmation: C5001 = 128
  – The selection of the "Manual Jog" mode is confirmed.
  – Code C5001 (4C76h) must be read out via SDO.
- The drive does not respond to the application control word which is parameterised under C4040. (No response to the CAN control word.)

Retracting hardware limit switch

1. Deactivate limit switch monitoring: C4040/Bit 1 = 1 (TRUE)
   Retracting from an activated hardware limit switch is enabled.
2. Reset fault message: Set C4040/Bit 11 = 1.
3. Select "correct" direction of travel via C4040/bit 13 and bit 14.

Note!

The active hardware limit switch must not be overtravelled during the retracting phase.

- Positive hardware limit switch is active → Retracting in negative direction
- Negative hardware limit switch is active → Retracting in positive direction

4. Activate limit switch monitoring: Set C4040/bit 1 = 0 (FALSE).

Operating mode dependent bits in the application control word (C4040)

► Hardware limit switch monitoring:

Bit	Name	Value	Reaction
1	Release limit switch	0	Limit switch monitoring is active
		1	Limit switch monitoring is not active: ● After a TRIP-RESET, the activated hardware limit switch can be retracted.

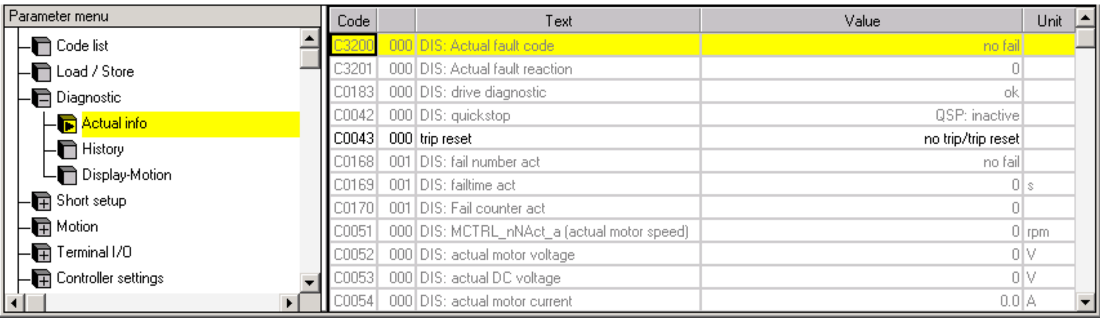
► Manual jog:

Value in		Reaction
Bit13 (JogCW)	Bit14 (JogCCW)	
0	0	Stop ● Within the deceleration time C3022 the drive is braked to standstill.
0	1	Travel towards the positive hardware limit switch ● Within the acceleration time C3021 the drive is accelerated to the speed C3020.
1	0	Travel towards the negative hardware limit switch ● Within the acceleration time C3021 the drive is accelerated to the speed C3020.
1	1	Stop ● Within the deceleration time C3022 the drive is braked to standstill.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C4040	AppControl	0				Application control word when C4010 = 3	🕮 130 🕮 137
			0	{1 bit}	1	Here, a drive can also be traversed without having a master control (e.g. using GDC). Moreover it is possible to assign a control word via an SDO of a master control to enable a manual jog (🕮 137) by the control.	
			Bit 0	Toggle			
			Bit1	Release limit switch			
			Bit2	Reserved			
			Bit3	QSP			
			Bit4	Monitor data selection bit 0			
			Bit5	Monitor data selection bit 1			
			Bit6	Monitor data selection bit 2			
			Bit 7	Controller enable			
			Bit 8	Operation inhibit (DISABLE)			
			Bit 9	Controller inhibit (CINH)			
			Bit10	Set fault message (TRIP-SET)			
			Bit11	Reset fault message (TRIP RESET)			
			Bit12	Not used			
			Bit13	JogCW			
			Bit14	JogCCW			
			Bit15	Reserved			

6.12 Controller enable

- ► The controller only is enabled when the release by all decisive signal sources is provided (AND operation).
- ► If the controller is not enabled (inhibited), the causative signal source is displayed under C0183 (drive diagnostics) in the parameter menu under **Diagnostics → Current operation**:



ECSXA546

Fig.6-32 GDC view: Diagnostics of current operation

The following table shows the conditions for controller enable:

Source of the Controller inhibit	Controller inhibited	Controller enabled	Note
Terminal X6/SI1	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	For controller enable, X6/SI1 must be = HIGH **and** X6/SI2 = HIGH.
Terminal X6/SI2	0 ... +4 V (LOW level)	+13 ... +30 V (HIGH level)	
C0040	C0040 = 0	C0040 = 1	
Operating module/keypad	STOP key	RUN key	Inhibiting with STOP key is only possible if the STOP key is assigned with "CINH" via C0469.
Trouble	• In case of TRIP • In case of message	TRIP RESET	For check see 📖 225.
Control word • MotionBus (CAN) (📖 104) • C4040	 C3153/Bit 9 = 1 C4040/Bit 9 = 1	 C3153/Bit 9 = 0 C4040/Bit 9 = 0	Observe the function keys in the GDC: • Key <F9> (inhibit/stop controller) **Note:** With ECS-M, the controller is enabled via the master control!
Fieldbus module	See Operating Instructions for the corresponding fieldbus module.		

- ► Green LED is lit continuously if X6/SI1 = HIGH, X6/SI2 = HIGH, and the controller has been enabled via the master control.
- ► Green LED is blinking if X6/SI1 = HIGH and X6/SI2 = HIGH. (No enable via master control!)

Note!

All signal sources act like a series connection of switches which are independent of each other.

6.13 Following error monitoring

Following errors are monitored in all motion states of the drive.

To configure the monitoring of following errors use C3030/C3031 (following error limits) and C3032/C3033 (reactions to following errors) in the GDC parameter menu under **Motion → Machine parameter**.

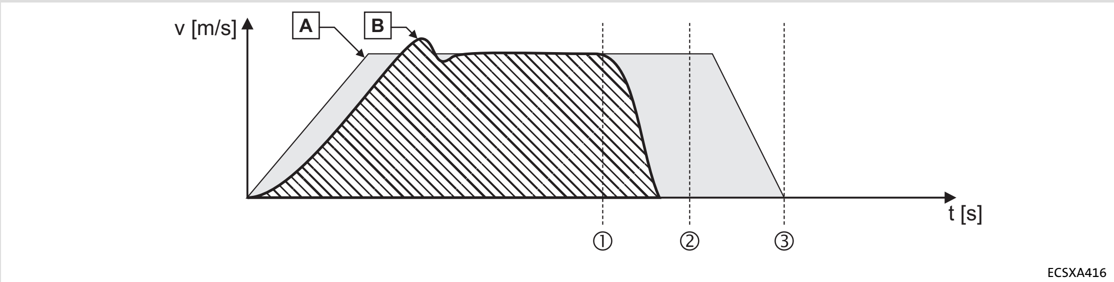


Fig.6-33 Following error

- A Set profile
- B Profile travelled
- ① The drive decelerates, there is no difference between set and actual position.
- ② Following error warning limit exceeded. (Difference between set position and actual position > C3030)
- ③ End of the set profile

If the difference between set position and actual position is higher than the following error limit, the higher-level control must activate a reaction according to the set error class.

- ► When the first following error limit in C3030 is reached, the first error reaction set in C3032 is activated.
- ► When the first following error limit in C3030 is reached, the second error reaction set in C3033 is activated.

Note!

For correct monitoring of following errors set:

► Limit value in C3031 > limit value in C3030 **and**

► error reaction in C3033 stronger than error reaction in C3032

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3030	FolloErrWarn	400000				Following error limit for enabling a warning	🕮 140
			0	{1 inc}	2140000000		
C3031	FolloErrFail	800000				Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	🕮 140
			0	{1 inc}	2140000000		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3032	FollErr1reac	2			First reaction when following error limit has been reached	📖 140
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		
C3033	FollErr2reac	4			Second reaction when following error limit has been reached	📖 140
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		

6.14 Evaluation of hardware limit switches

- Ensure a fail-safe design of the hardware limit switches (NC contact, LOW active).
- The active level is set with C0114/x.
- A response to active hardware limit switches can be set via C3175.
- If a hardware limit switch is activated, the drive reacts as set and an error message is displayed.
  Positive hardware limit switch is activated:
  – Fault no. x400 (”Pos HW End”)
  – Status bit 5 = 1
  Negative hardware limit switch is activated:
  – Fault no. x401 (”Neg HW End”)
  – Status bit 6 = 1

Note!
Depending on the reaction and detection in the master control, retracting may not be possible anymore. This must be considered when the system is planned (e. g. hardware limit switches with key switch).

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C3175	HW EndReac	4			Response when a hardware limit switch is activated.	142
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		

6.15 Quick stop (QSP)

The quick stop function serves to brake the drive to standstill within an adjustable deceleration time. The function is triggered by:

- ► Control word bit 3 (*QSP*) = 1 (TRUE)
- ► LOW level at X6/DI1

The deceleration time for the braking process can be set with C0105 in the GDC parameter menu under **Motion → Machine parameter**.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0042	DIS: QSP					Quick stop status (QSP) Only display	🕮 143
			0	QSP not active			
			1	QSP active			
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	🕮 143
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	

Behaviour when reaching the current limit

The actual quick stop deceleration time prolongs if C0105 is set so shortly that the controller must operated at its current limits (I_{max}, M_{max}). The following error occurring in this case in the position control loop is automatically modified internally so that the drive does not reverse when reaching standstill to process the following error but rests at standstill. Thus, the position control loop provides for a drift-free standstill at quick stop (QSP).

Tip!

The quick stop function may require a setting of the position controller gain under C0254.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	
			0.0000	{ 0.0001}	3.9999		

6.16 Operation with servo motors from other manufacturers

6.16.1 Entering motor data manually

If you operate servo motors of other manufacturers on the controller, you have to enter the motor data manually. The GDC includes the corresponding codes in the parameter menu under **Motor/Feedb. → Motor adjustment**.

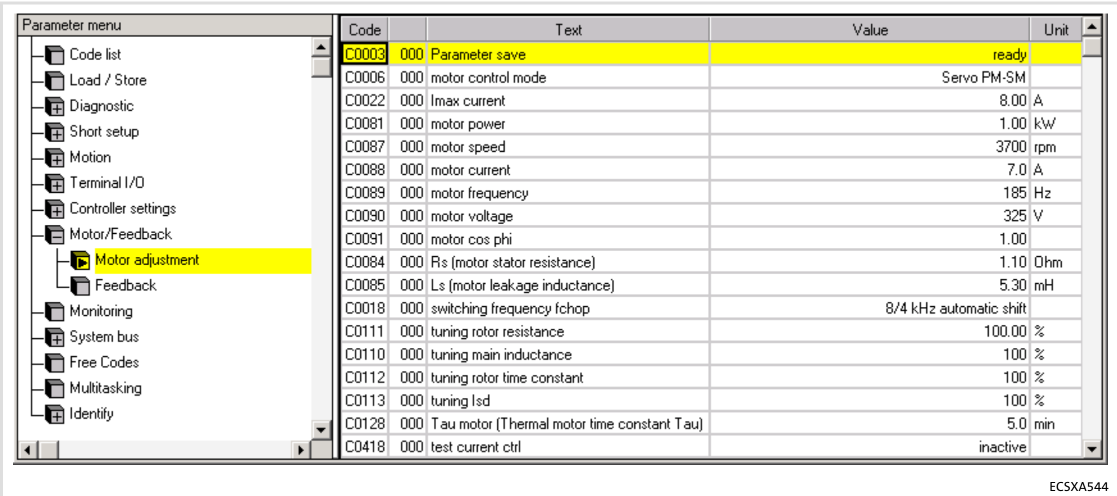


Fig.6-34 GDC view: Manual setting of the motor data

Code		Possible settings				IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**				
[C0006]	Op mode	1				Operating mode of the motor control	
			1	Servo PM-SM		Servo control of synchronous motors	
			2	Servo ASM		Servo control of asynchronous motors	
C0018	fchop	2				Switching frequency	
			1	4 kHz sin		4 kHz permanent PWM frequency	
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load	
C0022	Imax current	→				I_{max} limit	
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.	
C0058	Rotor diff	-90.0				Rotor displacement angle for synchronous motors (C0095)	🕮 149
			-180.0	{0.1 °}	179.9		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.	
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004	
					47.72	ECSxS/P/M/A008	
					23.86	ECSxS/P/M/A016	
					11.93	ECSxS/P/M/A032	
					7.95	ECSxS/P/M/A048	
					5.96	ECSxS/P/M/A064	
[C0085]	Mot Ls	5.30				Leakage inductance of the motor	
			0.00	{0.01 mH}	200.00		
[C0087]	Mot speed	3700				Rated motor speed	
			300	{1 rpm}	16000		
[C0088]	Mot current	7.0				Rated motor current	
			0.5	{0.1 A}	500.0		
[C0089]	Mot frequency	185				Rated motor frequency	
			10	{1 Hz}	1000		
[C0090]	Mot voltage	325				Rated motor voltage	
			50	{1 V}	500		
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor	
			0.50	{0.01}	1.00		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment of a synchronous motor C0058 shows the rotor displacement angle.	🕮 149
			0	Inactive			
			1	Active			
C0110 ... C0113	Service codes					**Only the Lenze service is allowed to make changes!**	
			50	{1 %}	200	For controlling an asynchronous motor	
C0128	Tau motor	5.0				Thermal time constant of the motor	🕮 210
			1.0	{0.1 min}	25.0	For calculating the I^2xt-disconnection	
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	🕮 147
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

6.16.2 Checking the direction of rotation of the resolver

The GDC contains the parameters/codes to be set in the parameter menu under **Motor/Feedb. → Motor adjustment**.

Code C0060 indicates the rotational angle of a revolution as a numerical value between 0 ... 2047.

- This value must increase when the rotor rotates in CW direction (with view to the front of the motor shaft).
- If the values decrease, exchange the connections of Sin+ and Sin-.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0060	Rotor pos					Current rotor position Read only	🕮 146
			0	{1 inc}	2047	1 revolution = 2048 increments	

6.16.3 Adjusting current controller

For optimum machine operation, the current controller must be adapted to the electrical values of the motor.

Note!

When using MCS motors ...

adjust the current controller with the maximum current intended for operation.

Leakage inductance and stator resistance of the motor are known:

The gain of the current controller V_p and the integral-action time of the current controller T_n can be calculated by approximation:

Current controller gain (V_p)	Integral-action time of the current controller (T_n)
$V_p = \frac{L1_S}{250\ \mu s}$	$T_n = \frac{L1_S}{R1_S}$

$L1_S$ Motor leakage inductance
$R1_S$ Motor stator resistance

Note!

Depending on the leakage inductance of the motor, the calculated values can be outside the adjustable range. In this case

- ► set a lower gain and a higher integral-action time;
- ► adjust the current controller metrologically (📖 148).

For applications with high current controller dynamics the pilot control of the current controller outputs can be activated with C0074 (C0074 = 1). For this, it is vital to enter the correct values for the stator resistance (C0084) and leakage inductance (C0085).These can be obtained from the data sheet of the motor used!

Leakage inductance and stator resistance of the motor are not known:

The current controller can be optimised metrologically with a current probe and an oscilloscope. For this, a test mode is available in which the current C0022 x √2 flows in phase U after controller enable.

STOP

Stop!

Avoiding damage on the motor and the machine

- ► During the controller adjustment the motor must be able to rotate freely.
- ► The test current must not exceed the maximum permissible motor current.
- ► Always adjust the current controller at a switching frequency of 8 kHz.

Observe the current step in phase U to adjust the current controller.

Setting sequence

1. Switching frequency = set 8 kHz (C0018 = 2).
2. Set the quantity of the test current under C0022:
   – Start with low current, e.g. half rated motor current.
3. Activate the test mode with C0418 = 1.
4. Enable the controller (🕮 139)
   – Press key <F8> in the GDC.
   – Have the synchronous motor adjusted.
   – Asynchronous motor is in standstill.
5. Enable and inhibit the controller several times in a row. In doing this, alter the current controller gain (C0075) and the current controller reset time (C0076) so that the current characteristic is free of harmonics.
6. After the adjustment has been successfully completed, deactivate the test mode with C0418 = 0.
7. If necessary, change the switching frequency via C0018.

6.16.4 Effecting rotor position adjustment

> **Note!**
>
> **Resolver/absolute value encoder with Hiperface® interface**
>
> ► If the rotor zero phase is not known, the rotor position adjustment at commissioning only has to be carried out once.
>
> ► In the case of multi-turn absolute value encoders the traversing range has to be within the display area of the encoder if it is limited (0 ... 4095 revolutions).
>
> **Incremental encoder / SinCos encoder with zero track**
>
> ► If these encoder types are used for the operation of synchronous motors, the rotor position adjustment has to be carried out every time the low-voltage supply is switched on.

The rotor position must be adjusted if:

► A servo motor from another manufacturer is operated on the controller.

► Another encoder has been mounted subsequently.

► A defective encoder has been replaced.

The rotor position can only be adjusted if:

► The resolver is polarised correctly.

► The current controller has been adjusted.

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/Feedback → Feedback**.

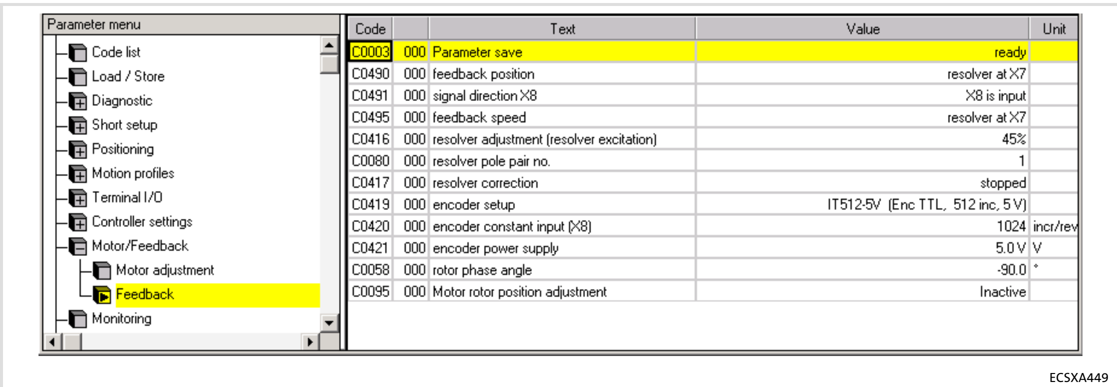


Fig.6-35 GDC view: Commissioning of further feedback systems

Setting sequence

1. Inhibit controller. (🕮 139)
   – Press key <F9> in the GDC.
   – Green LED is blinking, red LED is off
2. Unload motor mechanically.
   – Separate motor from gearbox or machine.
   – Where required, remove toothed lock washers, gear wheels, etc. from the motor shaft.
   – Where required, support holding torques held by a mounted engine brake by retainers.
3. Deactivate ”Safe torque off” (🕮 60), so that the motor can be energised during rotor position adjustment.
   – X6/SI1 = HIGH
   – X6/SI2 = HIGH
4. Open holding brake (if available).
5. Activate rotor position adjustment with C0095 = 1.
6. Enable controller. (🕮 139)
   – Press key <F8> in the GDC.

   The rotor position adjustment program of the controller is started:
   – The rotor rotates half a revolution in 16 steps (for resolver with 1 pole pair: 180° electrically ≙ 180° mechanically).
   – C0095 is reset to ’0’ after one revolution.
   – The rotor zero phase is saved in C0058. (For absolute value encoders (Hiperface®, single-turn/multi-turn) at X8, C0058 is always ”0”.)

⚠ Danger!

Uncontrolled movements of the drive after an Sd7 fault for absolute value encoders

If the rotor position adjustment in the case of absolute value encoders is completed with the fault message ”Sd7”, (🕮 230) an assignment of the rotor position to the feedback system could not be carried out. In this case the drive may perform uncontrolled movements after controller enable.

Possible consequences:

► Death or severest injuries
► Destruction or damage of the machine/drive

Protective measures:

► Repeat rotor position adjustment (starting with step 1).
► Check wiring and interference immunity of the encoder at X8.

7. Inhibit controller. (🕮 139)
   – Press key <F9> in the GDC.
   – Green LED is blinking, red LED is off

8. Save the data determined by the controller with C0003 = 1.

Tip!
The values for C0058 and C0095 only are displayed in the GDC if you place the bar cursor on them and read back the code using function key <F6>.

Code		Possible settings				IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**				
C0058	Rotor diff	-90.0				Rotor displacement angle for synchronous motors (C0095)	149
			-180.0	{0.1 °}	179.9		
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment of a synchronous motor C0058 shows the rotor displacement angle.	149
			0	Inactive			
			1	Active			

6.17 Optimising the drive behaviour after start

For applications with high current controller dynamics, the pilot control for the current controller can be adjusted under C0074:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0074	Dynamics	0 {1}			Pilot control of the current controller for higher dynamics	🕮 147
			0	Normal		
			1	Enhanced		

6.17.1 Speed controller adjustment

- The speed controller can only be set correctly when the system constellation has been completed.
- Observe that the input variables and output variables of the speed controller are scaled:
  - Input: scaling on n_{max} (C0011)
  - Output: scaling on I_{max} (C0022)
- C0011 and C0022 therefore have a direct influence on the proportional gain of the speed controller (C0070).
- The speed controller cannot be optimally adjusted if
  - the current controller is set incorrectly.
  - the time constant for the actual value filter is set too high (C0497).
  - the connection of the axis module to PE is bad, as then the speed signals and current signals are ”noisy”.
  - there are elastic or loose connections between the drive and the load.
- The speed controller is designed as an ideal PID controller.

The codes for adjusting the speed controller can be found in the parameter menu of the GDC under **Controller settings → Speed**.

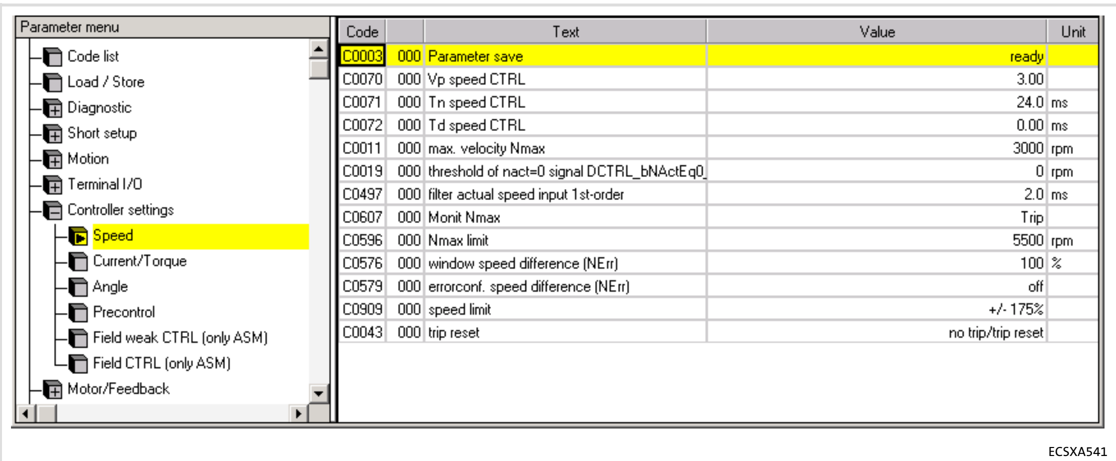


Fig.6-36 GDC view: Adjustment of the speed controller

Parameter setting

- Via C0070 you set the proportional gain (V_{pn}):
  – Enter approx. 50 % of the speed setpoint (100 % = 16384 = n_{max}).
  – Increase C0070 until the drive becomes instable (pay attention to engine noises).
  – Reduce C0070, until the drive runs stable again.
  – Reduce C0070 to approx. half the value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	📖 152
			0.00	{ 0.01}	127.99		

- The reset time (T_{nn}) is set via C0071:
  – Reduce C0071 until the drive becomes instable (pay attention to engine noises).
  – Increase C0071, until the drive runs stable again.
  – Increase C0071 to approx. the double value.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	📖 152
			1.0	{0.5 ms}	6000.0		

- The derivative gain (T_{dn}) is set via C0072:
  – Increase C0072 during operation until an optimal control mode is reached.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	📖 152
			0.0	{0.1 ms}	32.0		

6.17.2 Adjustment of field controller and field weakening controller

Stop!

- ► Field weakening operation can only be effected for asynchronous motors.
- ► The available torque is reduced by the field weakening.

In order to optimise the machine operation in the field weakening range, you can set the field controller and the field weakening controller accordingly.

- ► There is field weakening if the output voltage of the controller reaches its maximum with increasing speed and cannot be further increased.
- ► The maximum possible output voltage depends on
  – the respective DC-bus voltage (mains voltage).
  – the voltage reduction by the controller behaviour.
  – the voltage drop at the mains choke.
- ► Experience values for the voltage drop under the influence of the mains choke and inverter are between 6 ... 10 %.

Max. output voltage [V] = mains voltage [V] − voltage drop [%]

In the GDC you'll find the codes for adjusting the field controller or field weakening controller in the parameter menu under **controller setting**:

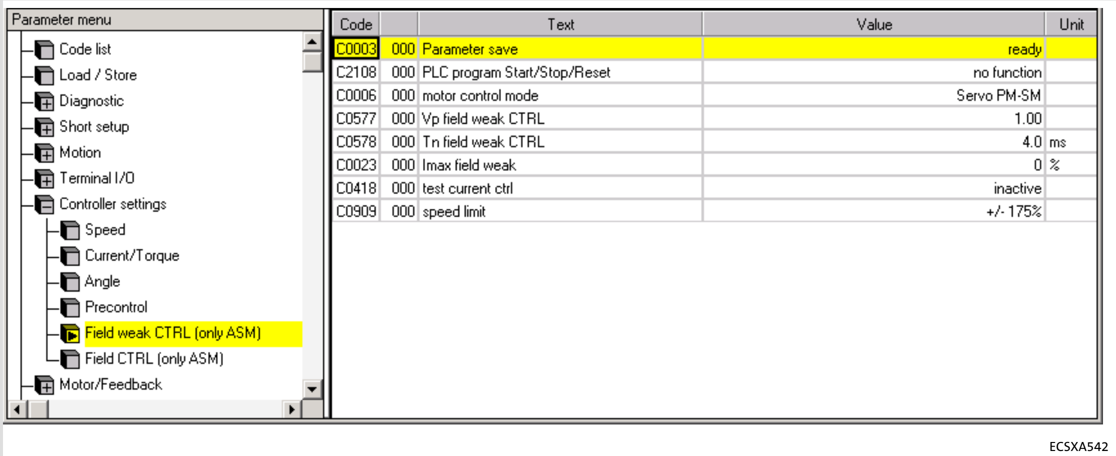


Fig.6-37 GDC view: Field controller / field weakening controller adjustment

6.17.2.1 Adjusting the field controller

The field controller settings depend on the motor data.

Setting sequence

1. Stop the PLC program: C2108 = 2
   – As of operating system version 7.0 (see nameplate), this is no longer necessary, because C0006 (see 2.) can also be written when the PLC program is running!
2. Set motor control for asynchronous motors: C0006 = 2
   – The motor nameplate data must be entered correctly!
3. Read rotor time constant T_r (C0083).
4. Read magnetising current I_d (C0092).
5. Calculate field controller gain V_{pF} and enter in C0077.

$$V_{pF} = \frac{T_r\,(C0083) \cdot I_d\,(C0092)}{875\,\mu s \cdot I_{max}}$$

I_{max} Maximum current of axis module

6. Enter rotor time constant T_r as field controller integral-action time T_{nF} in C0078.

6.17.2.2 Field weakening controller adjustment

- The field weakening controller determines the speed performance of the asynchronous motor in the field weakening range.
- The field weakening controller can only be set correctly when the system constellation has been completed and is under load.

Note!

An excessive value of I_{max} (C0022) can cause a malfunction of the drive in the field weakening range of the asynchronous motor. For this reason, the current is limited in terms of speed in the field weakening range. The limitation has a 1/n characteristic and is derived from the motor parameters.

The limitation can be adjusted with the stator leakage inductance (C0085):

- Low values cause a limitation at higher speeds.
- Higher values cause a limitation at lower speeds.

Setting sequence:

1. Set gain V_p: C0577 = 0.01 ... 0.99
   – V_p must not be ”0”!
2. Set integral-action time T_n: C0578 = 1 ... 40 ms
3. Select a speed setpoint so that the motor is operated in the field weakening range.
4. Observe the speed curve
   – If the speed takes an irregular course, the field weakening controller must be readjusted.
   – The field weakening controller must be provided with a distinct integral action.

6.17.3 Resolver adjustment

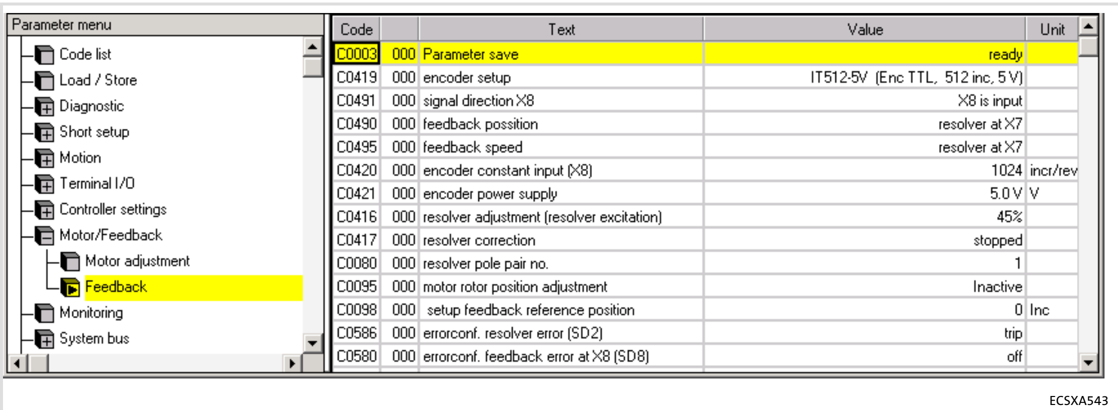
For resolver adjustment, mainly component tolerances of the resolver evaluation are compensated in the device. A resolver error characteristic is not included.

The resolver adjustment

- ► is required if the speed characteristic is unstable.
- ► is carried out by C0417 = 1 while the motor is idling.
- ► is started after controller enable has been effected. It stops automatically after 16 shaft revolutions by selecting a setpoint or by manual rotation in the inhibited state (X6/SI1 or X6/SI2 = LOW).

If it is not possible to adjust the resolver (due to a fault or a defective cable), the original adjustment values can be restored with C0417 = 2.

The GDC contains the parameters or codes to be set in the parameter menu under **Motor/Feedback → Feedback**.



Code		Text	Value	Unit
C0003	000	Parameter save	ready	
C0419	000	encoder setup	IT512-5V (Enc TTL, 512 inc, 5 V)	
C0491	000	signal direction X8	X8 is input	
C0490	000	feedback possition	resolver at X7	
C0495	000	feedback speed	resolver at X7	
C0420	000	encoder constant input (X8)	1024	incr/rev
C0421	000	encoder power supply	5.0 V	V
C0416	000	resolver adjustment (resolver excitation)	45%	
C0417	000	resolver correction	stopped	
C0080	000	resolver pole pair no.	1	
C0095	000	motor rotor position adjustment	Inactive	
C0098	000	setup feedback reference position	0	Inc
C0586	000	errorconf. resolver error (SD2)	trip	
C0580	000	errorconf. feedback error at X8 (SD8)	off	

Fig.6-38 GDC view: Resolver adjustment

7 Parameter setting

7.1 General information

- The controller can be adapted to your application by setting the parameters. A detailed description of the functions can be found in the chapter "Commissioning" (📖 79).
- The parameters for the functions are stored in numbered codes:
  - The codes are marked in the text with a "C".
  - The code table (📖 238) provides a quick overview of all codes. The codes are sorted in numerical ascending order, thus serving as a "reference book".

Parameter setting with keypad XT or PC/laptop

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

> **Detailed information ...**
> on the parameter setting with a PC/laptop can be found in the documentation of the parameter setting and operating program "Global Drive Control" (GDC).

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

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

Parameter setting with a bus system

> **Detailed information ...**
> on the parameter setting with a bus system can be found in the documentation of the communication module to be applied (📖 289).

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

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

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

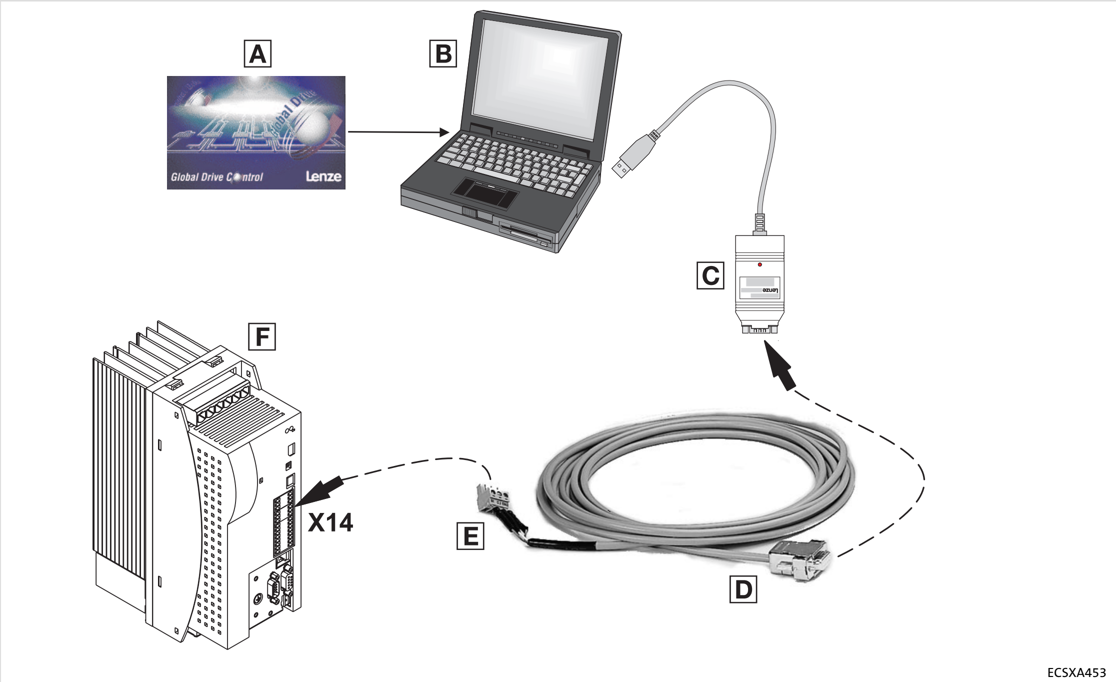


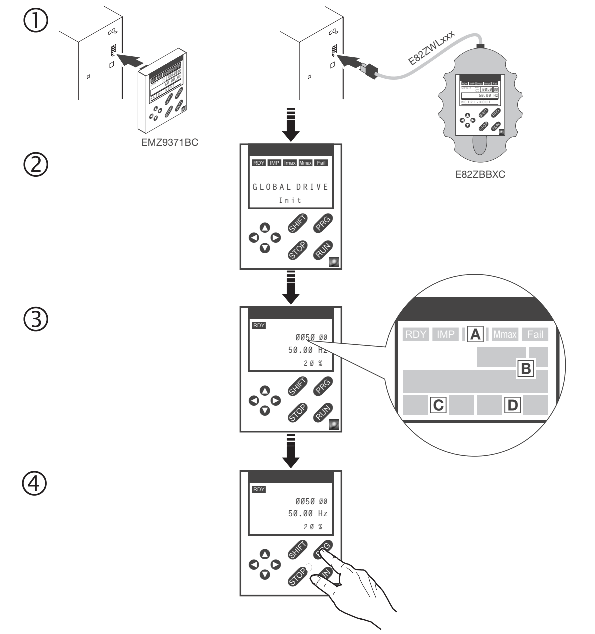
Fig.7-1 Using the GDC

A Lenze parameter program "Global Drive Control" (GDC)
B PC or laptop
C PC system bus adapter (EMF2173IB/EMF2177IB) with connecting cable
D Sub-D plug with 3-pole cable
E 3-pole plug (CAG – CAL – CAH) from ECSZA000X0B connector set
F ECSxS/P/M/A axis module

7.3 Parameter setting with the XT EMZ9371BC keypad

The keypad is available as an accessory.
A full description can be found in the documentation for the keypad.

7.3.1 Connecting the keypad



9371BC018

① Connect the keypad to the AIF interface (X1) of the axis module/power supply module.
It is possible to connect/disconnect the keypad during operation.
② As soon as the keypad is supplied with voltage, it carries out a short self-test.
③ The operation level indicates when the keypad is ready for operation:
A Current status of the axis module/power supply module
B Code number, subcode number, and current value
C Active fault message or additional status message
D Current value in % of the status display defined in C0004
④ Press PRG to leave the operating level.

7.3.2 Description of the display elements

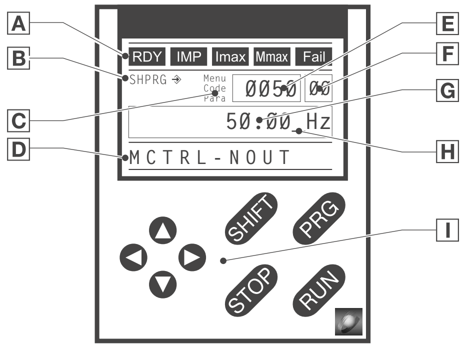


Fig.7-2 Keypad: front view

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

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

7.3.3 Description of the function keys

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

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

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

7.3.4 Altering and saving parameters

All parameters by means of which you can parameterise or monitor the axis module/power supply module are saved in so-called codes. The codes are numbered and are marked with a ”C” in the documentation. In some codes the parameters are saved in numbered ”Subcodes”, so that the parameter setting remains concise (e. g. C0517 user menu).

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

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

7.3.5 Menu structure

For easy operation, the codes are clearly arranged in function-related menus:

Main menu	Submenus	Description
Display	**Display**	
USER menu		**Codes defined under C0517**
Code list		**All available codes**
User code list		**List of all application-specific codes**
Load / Store		**Parameter set management** Parameter set transfer, restore delivery state
Multitasking		
Diagnostics		**Diagnostics**
	Actual info	Display codes to monitor the drive
	History	Fault analysis with history buffer
SystemBlocks		**Configuration of the main function blocks**
	MCTRL	Motor control
	DCTRL	Internal control
Terminal I/O		**Linkage of the inputs and outputs with internal signals**
	AIn1	Analog input 1
	DIGIN	Digital inputs
	DIGOUT	Digital outputs
	DFIN	Digital frequency input
	DFOUT	Digital frequency output
Controller		**Configuration of internal control parameters**
	Speed	Speed controller
	Current	Current controller or torque controller
	Phase	Phase controller
	Field	Field controller
	Field weak	Field weakening controller
Motor/Feedb.		**Input of motor data, configuration of speed feedback**
	Motor adj	Motor data
	Feedback	Configuration of feedback systems
Monitoring		**Configuration of monitoring functions**
LECOM/AIF		**Configuration of operation with communication modules**
	LECOM A/B	Serial interface
	AIF interface	Process data
	Status word	Display of status words

Main menu	Submenus	Description
Display	**Display**	
System bus [1]		**System bus/MotionBus (CAN) configuration**
	Management	CAN communication parameters
	CAN-IN1	CAN object 1
	CAN-OUT1	
	CAN-IN2	CAN object 2
	CAN-OUT2	
	CAN-IN3	CAN object 3
	CAN-OUT3	
	Status word	Display of status words
	Sync.manag.	
	Diagnostics	CAN diagnostics
FCODE		**Configuration of free codes**
Identify		**Identification**
	Drive	Software version of basic device
	Op Keypad	Software version of keypad

1) For **ECSxS/P/M...** ECS modules the configuration of the MotionBus (CAN) is carried out on the "System bus" menu level!

8 Configuration

By configuring the axis module you can adapt the drive system to your application. The axis module can be configured via the following interfaces:

- ► X1 – AIF (automation interface)
  - – For connecting the keypad XT EMZ9371BC or another communication module (📖 289) with which you can access the codes.
- ► X14 – system bus (CAN) interface
  - – PC interface/HMI for parameter setting and diagnostics (e.g. with the Lenze parameter setting and operating program ”Global Drive Control”)
    or
  - – Interface to a decentralised I/O system

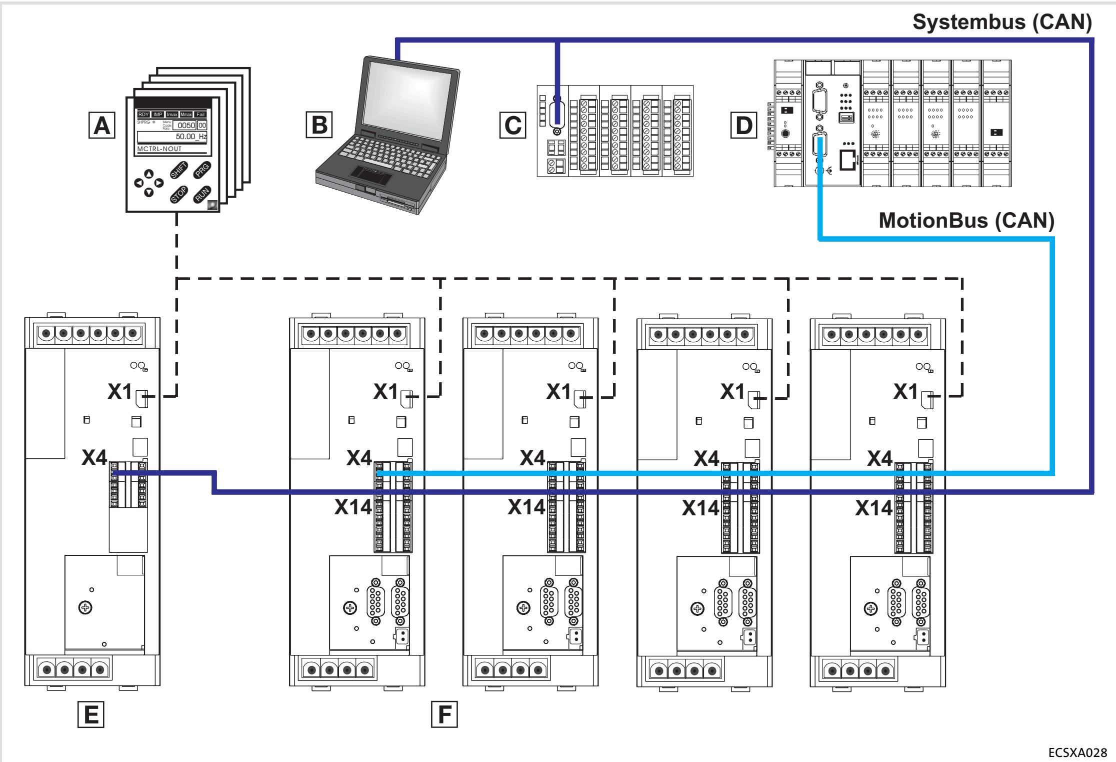


Fig.8-1 Example: Wiring of the MotionBus (CAN) and system bus (CAN)

A XT EMZ9371BC keypad or another communication module
B PC/laptop or HMI
C Decentralised I/O system
D Higher-level master system / MotionBus control
E ECSxE...power supply module
F ECSxx...axis modules

8.1 General information about the system bus (CAN)

Note!

The information on this chapter will be part of the "CAN Communication Manual" at a later date.

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

Via the system bus interface, for instance process data and parameter values can be exchanged between the nodes. In addition, the interface enables the connection of further modules such as distributed terminals, operator and input devices or external controls and host systems.

The system bus interface transmits CAN objects following the CANopen communication profile (CiA DS301, version 4.01) developed by the umbrella organisation of **CiA** (**C**AN **i**n **A**utomation) in conformity with the **CAL** (**C**AN **A**pplication **L**ayer).

Tip!

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

8.1.1 Structure of the CAN data telegram

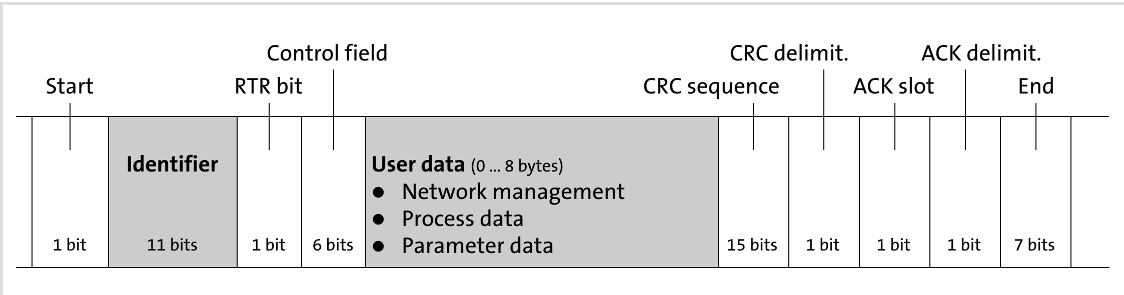


Fig.8-2 Basic structure of the CAN telegram

Identifier

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

- ► The CAN node address (device address in the CAN network) of the node which is to receive the CAN telegram.
  See also chapter "Addressing of the parameter and process data objects" (📖 182).
- ► The type of user data to be transferred

User data

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

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

Tip!

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

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

8.1.2 Communication phases of the CAN network (NMT)

With reference to communication the drive knows the following states:

State	Explanation
"Initialisation" (Initialisation)	After the controller is switched on the initialisation phase is run through. During this phase, the controller is not involved in the data transfer on the bus. Furthermore it is possible to run through a part of the initialisation in each NMT state due to the transfer of different telegrams (see "State transitions"). Here, all parameters already set are rewritten with their standard values. After completing the initialisation the drive is automatically in the "Pre-Operational" state.
"Pre-operational" (before operation)	The drive can receive parameter data. The process data are ignored.
"Operational" (ready for operation)	The drive can receive parameter data and process data.
"Stopped"	Only network management telegrams can be received.

Status transitions

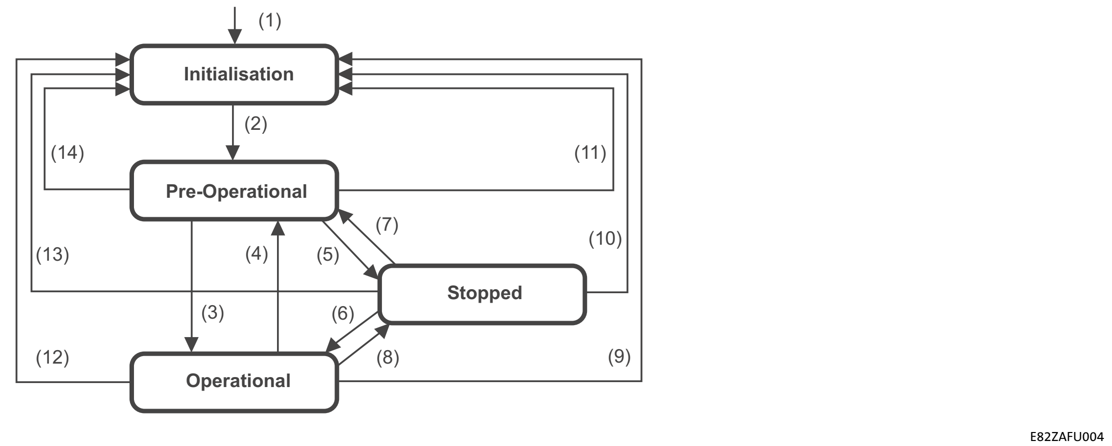


Fig.8-3 State transitions in the CAN network (NMT)

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

xx = 00_{hex} With this assignment, all devices connected are addressed by the telegram. The status can be changed for all devices at the same time.

xx = node ID If a node address is indicated, the status will only be changed for the device addressed.

Network management (NMT)

The telegram structure used for the network management contains the identifier and the command included in the user data which consists of the command byte and the node address.

	Identifier Value = 0 11 bits			**User data** Only contains command 2 bytes						

Fig.8-4 Telegram for switching over the communcation phases

The communication phases are changed over by a node, the network master, for the entire network. The changeover can also be effected by a controller.

After power-on a telegram is sent with a certain delay that changes the status of the whole drive system to ”Operational”. The delay time can be set via the following codes:

Interface		**code**
x1	Automation interface (AIF)	C2356/1
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356/1
X14	System bus (CAN)	C2456/1

Note!

Communication via process data is only possible with a status change to “operational”!

Example:
For changing the status of all nodes on the bus from ”pre-operational” to “operational” via the CAN master, the following identifier and user data must be set in the telegram:

- Identifier: 00 (broadcast telegram)
- User data: 0100 (hex)

8.1.3 Process data transfer

Definitions

- Process data telegrams between host and drive are distinguished as follows:
  – Process data telegrams **to** the drive
  – Process data telegrams **from** the drive
- The CANopen process data objects are designated as seen from the node's view:
  – RPDOx: process data object received by a node
  – TPDOx: process data object sent by a node

8.1.3.1 Available process data objects

The following process data objects are available for the ECS axis modules via the interfaces X1, X4 and X14:

Interface	RPDOs	TPDOs	In axis module			
			ECSxS	ECSxP	ECSxM	ECSxA
x1 Automation interface (AIF)	XCAN1_IN	XCAN1_OUT	✓	–	–	✓
	XCAN2_IN	XCAN2_OUT	✓	–	–	✓
	XCAN3_IN	XCAN3_OUT	✓	–	–	✓
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	CAN1_IN	CAN1_OUT	✓	✓	✓	✓
	CAN2_IN	CAN2_OUT	✓	✓	–	✓
	CAN3_IN	CAN3_OUT	✓	✓	–	✓
X14 System bus (CAN)	CANaux1_IN	CANaux1_OUT	–	✓	–	✓
	CANaux2_IN	CANaux2_OUT	–	✓	–	✓
	CANaux3_IN	CANaux3_OUT	–	–	–	✓

8.1.3.2 Structure of the process data

Each process data telegram has a maximum user data length of eight bytes.

Process data input telegram (RPDO)

- The process data input telegram transmits control information to the axis module.
- The 8 bytes of user data can be freely assigned.

	Identifier			User data (8 bytes)							
	11 bits			00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}

Fig.8-5 Structure of the process data input telegram (RPDO)

Process data output telegram (TPDO)

- The process data output telegram indicates status information from the axis module. E.g.:
  - Current status of the axis module
  - Status of the digital inputs
  - States of internal analog values
  - Fault/error messages

  This information enables the master system to react.
- The 8 bytes of user data can be freely assigned.

	Identifier			User data (8 bytes)								
	11 bits			00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	00_{hex}	

Fig.8-6 Structure of the process data output telegram (TPDO)

8.1.3.3 Transfer of the process data objects

Process data objects		Data transmission
RPDOs	XCAN1_IN CAN1_IN CANaux1_IN	cyclic (sync-controlled)
	XCAN2_IN CAN2_IN CANaux2_IN	cyclic
	XCAN3_IN CAN3_IN CANaux3_IN	cyclic
TPDOs	XCAN1_OUT CAN1_OUT CANaux1_OUT	cyclic (sync-controlled)
	XCAN2_OUT CAN2_OUT CANaux2_OUT	time or event-controlled
	XCAN3_OUT CAN3_OUT CANaux3_OUT	time or event-controlled

- The cyclic data transmission is activated for each PDO only by a sync telegram.
- The event-controlled data transmission is caused if a value in the corresponding output object changes.
- For the time-controlled transmission the boot-up time, cycle time or delay time can be set via the following codes.

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

8.1.3.4 Cyclic process data objects

Cyclic process data objects are determined for a master system.

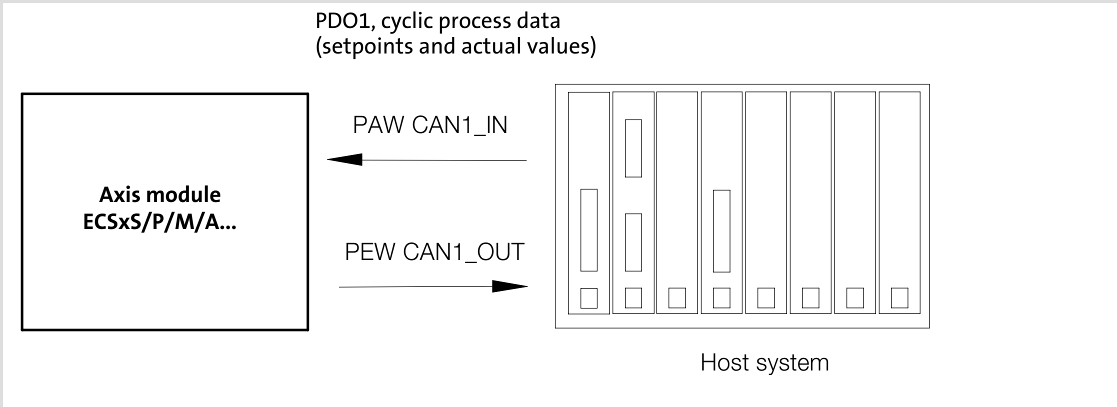


Fig.8-7 Example: Process data transfer via CAN1_IN and CAN1_OUT

PIW Process data input word
POW Process data output word

For the quick exchange of process data from or to the master respectively one process data object for input signals (Rx-PDO1) and one process data object for output signals (Tx-PDO1), each with eight bytes of user data, is provided.

Synchronisation of PDOs with SYNC-controlled transmission

A special telegram, the sync telegram, is used to ensure that the cyclic process data can be read and will be accepted by the controller.

The sync telegram is the trigger point for the transmission of process data from the controllers to the master and for the acceptance of process data from the master in the controllers.

For SYNC-controlled process data processing, the sync telegram is to be generated accordingly.

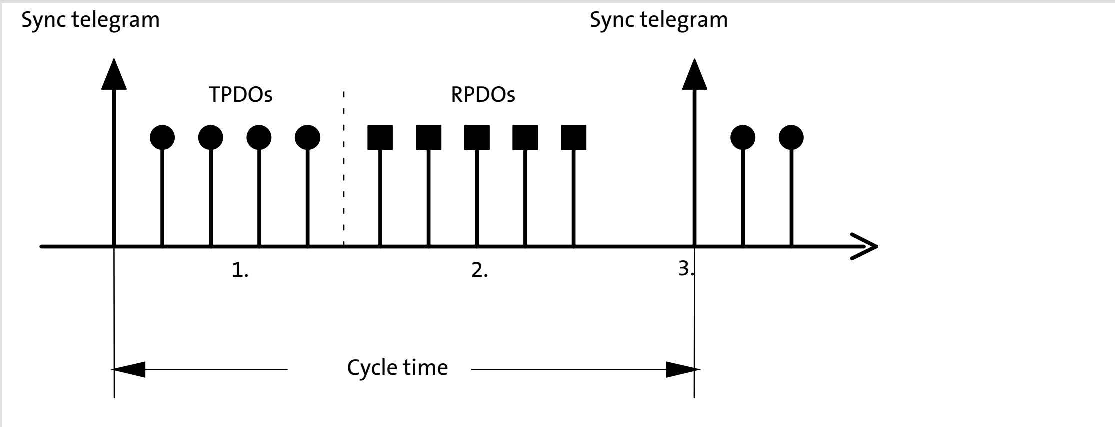


Fig.8-8 Sync telegram

1. After the sync telegram has been received, the controllers send the synchronous process data to the master (TPDOs). The master reads them as process input data.
2. When the transmission process has been completed, the controllers receive the process output data from the master (RPDOs).

   All further telegrams (e.g. parameters or event-controlled process data) are accepted non-cyclically by the controllers when the transmission is completed. The non-cyclic data are not represented in the above illustration. They must be taken into account when dimensioning the cycle time.
3. The data are accepted by the controller with the next sync telegram.

Tip!

The response to a sync telegram is determined by the transmission type selected.

Note!

Information on how to set the synchronisation can be found from 📖 189.

8.1.3.5 Event-controlled process data objects

The event-controlled process data objects in particular are suitable for the data exchange from axis module to axis module and for decentralised terminal extensions. However, they can also be used by a host system.

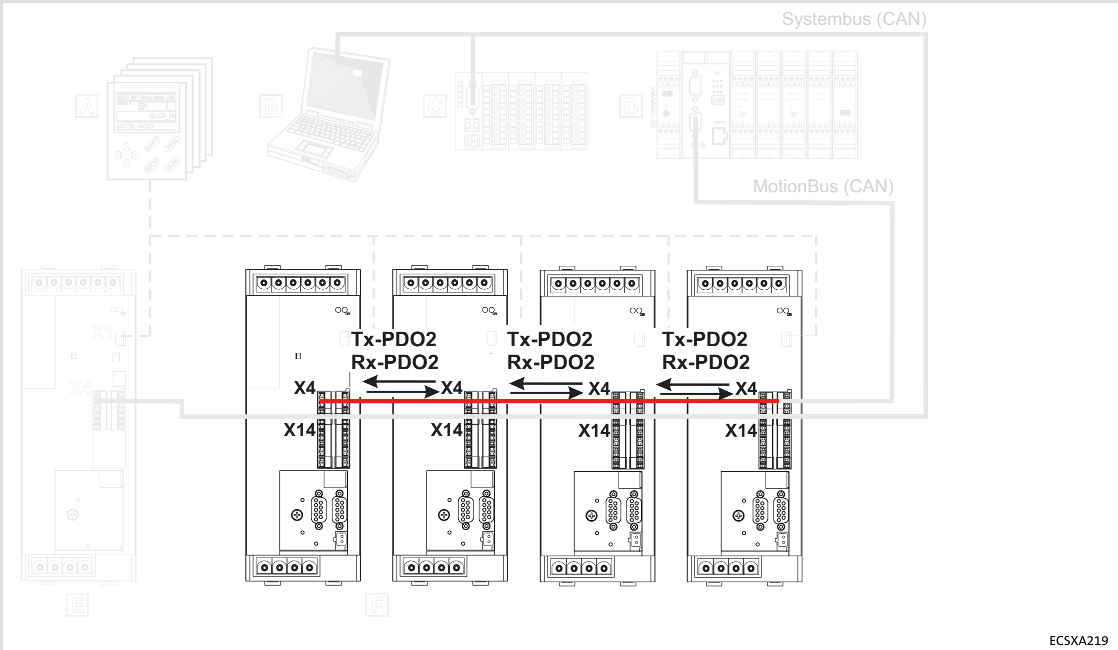


Fig.8-9 Example: Event-controlled process data objects PDO2

By means of the process data objects, simple binary signals (e. g. states of digital input terminals) or also complete values in 16 and 32 bit (e. g. analog signals) can be transmitted.

Event-controlled process data objects with adjustable cycle time (optional)

The output data is transmitted

- *event-controlled* if a value changes within the user data (8 bytes) or
- *cyclically* with the cycle time set:

Interface		Code
x1	Automation interface (AIF)	C2356
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0356
X14	System bus (CAN)	C2456

8.1.4 Parameter data transfer

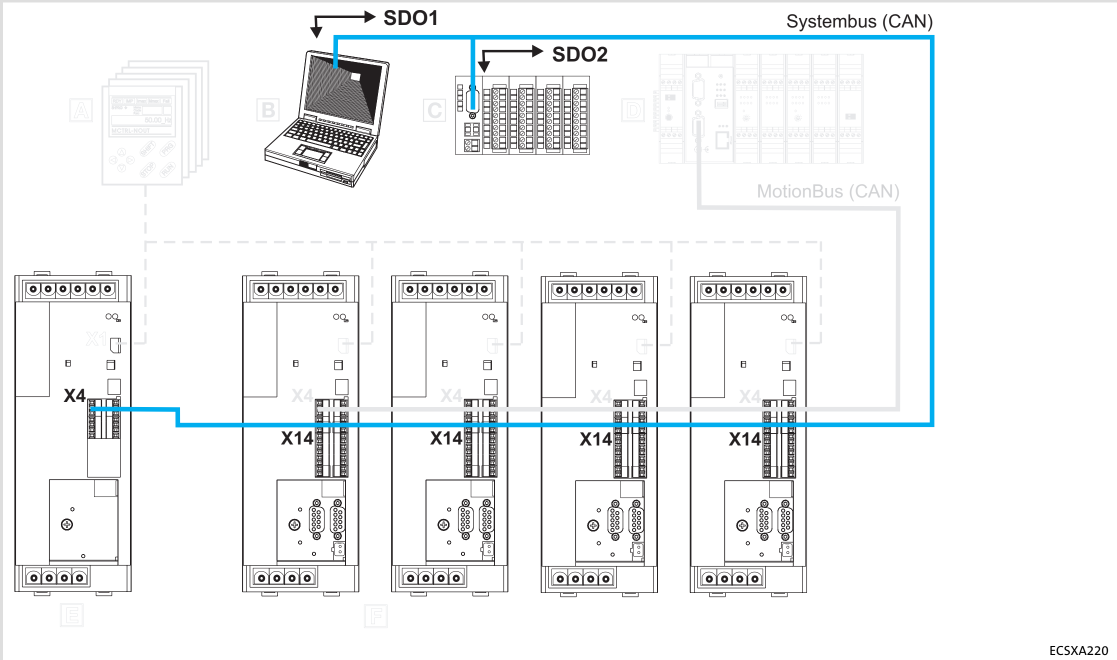


Fig.8-10 Parameter data channels for parameterising ECS

Parameters

- ► are values which are stored in Lenze controllers under a code.
- ► are carried out, for instance, for initial commissioning of a plant or when material of a production machine is exchanged.
- ► are transmitted with low priority.

Parameter data is transferred as SDOs (Service Data Objects) via the system bus and acknowledged by the receiver. The SDOs enable the reading and writing access to the object directory.

The CAN bus interfaces X4 and X14 are provided with two separated parameter data channels each which serve to simultaneously connect different devices for parameter setting and diagnostics.

The codes for parameter setting and diagnostics of the automation interface (AIF) X1 and the CAN bus interfaces X4 and X14 are divided in separated areas:

Interface		Code range
x1	Automation interface (AIF)	C23xx
X4	ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C03xx
X14	System bus (CAN)	C24xx

8.1.4.1 User data

Structure of the parameter data telegram

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
				Low word		High word	
				Low byte	High byte	Low byte	High byte
				Display			

Note!

The user data are displayed in Motorola format.

Examples of parameter data transfer can be found from 🕮 180.

Command

The command contains services for writing and reading parameters and the information on the length of the user data:

	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
Command	Command specifier (cs)			Toggle (t)	Length		e	s
Write request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write response	0	1	1	0			0	0
Read request	0	1	0	0			0	0
Read response	0	1	0	0			1	1
Error response	1	0	0	0	0	0	0	0

Tip!

Further commands are defined in the CANopen specifications DS301, V4.02 (e.g. segmented transfer).

The following information are contained or must be entered in the command.

Command	4 byte data (5th ... 8th byte)		2-byte data (5th and 6th byte)		1-byte data (5th byte)		Block	
	hex	dec	**hex**	dec	**hex**	dec	**hex**	dec
Write request (Transmit parameters to the drive)	**23**	35	**2B**	43	**2F**	47	**21**	33
Write response (Acknowledgement, controller response to write request)	**60**	96	**60**	96	**60**	96	**60**	96
Read request (Request to read a controller parameter)	**40**	64	**40**	64	**40**	64	**40**	64
Read response (Response to read request with current value)	**43**	67	**4B**	75	**4F**	79	**41**	65
Error response (The controller indicates a communication error)	**80**	128	**80**	128	**80**	128	**80**	128

Command ”ErrorResponse”: In the event of a communication error, the node addressed generates an ”error response”. This telegram always contains the value ”6” in data 4 and an error code in data 3.

The error codes are standardised according to DS301, V4.02.

Addressing by index and subindex

The parameter or Lenze code is addressed with these bytes according to the following formula:

Index = 24575 - (Lenze code number)

Data 1 ... Data 4

<table>
<tr><th colspan="4">Parameter value length depending on the data format</th></tr>
<tr><td>Parameter value (Length: 1 byte)</td><td>00</td><td>00</td><td>00</td></tr>
<tr><td colspan="2">Parameter value (length: 2 bytes)</td><td rowspan="2">00</td><td rowspan="2">00</td></tr>
<tr><td>Low byte</td><td>High byte</td></tr>
<tr><td colspan="4">Parameter value (length: 4 bytes)</td></tr>
<tr><td colspan="2">Low word</td><td colspan="2">High word</td></tr>
<tr><td>Low byte</td><td>High byte</td><td>Low byte</td><td>High byte</td></tr>
</table>

Note!

Lenze parameters are mainly represented as data type FIX32 (32 bit value with sign, decimally with four decimal positions). To obtain integer values, the desired parameter value must be multiplied by $10{,}000_{dec}$.

The parameters C0135 and C0150 must be transmitted bit-coded and without a factor.

Error messages

User data (up to 8 bytes)							
1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
Command	Index Low byte	Index High byte	Subindex	**Display**			

- Byte 1:
  In the **command** byte the code **128_{dec}** or **80_{hex}** indicates that a fault has occurred.
- Byte 2, 3 and 4:
  In these bytes the **index** (byte 2 and 3) and **subindex** (byte 4) of the code in which an error occurred are entered.
- Byte 5 to 8:
  In the data bytes 5 to 8 the **error code** is entered. The structure of the error code is reversed to the read direction.

Example:
The representation of the error code 06 04 00 41_{hex} in the bytes 5 to 8

← Read direction of the error code

41	**00**	**04**	**06**
5. byte	6. byte	7. byte	8. byte
Low word		High word	
Low byte	High byte	Low byte	High byte

Possible error codes:

Command	7th byte	8th byte	Meaning
80_{hex}	6	6	Wrong index
80_{hex}	5	6	Wrong subindex
80_{hex}	3	6	Access denied

8.1.4.2 Examples of the parameter data telegram

Read parameters

The heatsink temperature C0061 (value: 43 °C) is to be read out by the controller with the node address 5 via the parameter data channel 1.

- Identifier calculation

Identifier of SDO 1 to the controller	Calculation
1536 + node address	1536 + 5 = 1541

- Command "Read Request" (request to read controller parameter)

Command	Value
Read request	**40_{hex}**

- Index calculation

Index	Calculation
24575 - code number	24575 - 61 = 24514 = $5FC2_{hex}$

- Telegram to drive:

Identifier	User data							
	Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1541	40_{hex}	$C2_{hex}$	$5F_{hex}$	00	00	00	00	00

- Telegram from drive

Identifier:
SDO 1 from controller (= 1408) + node address = 1413

Command:
"Read Response" response to read request with the actual value = 43_{hex}

Index of read request:
$5FC2_{hex}$

Subindex:
0

Data 1 to data 4:
00 06 8F B0 = 430,000 → 430,000 : 10,000 = 43 °C

Identifier	User data							
	Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1413	43_{hex}	$C2_{hex}$	$5F_{hex}$	00	$B0_{hex}$	$8F_{hex}$	06_{hex}	00

Write parameters

The acceleration time C0012 (parameter set 1) of the controller with the node address 1 is to be changed via the SDO 1 (parameter data channel 1) to 20 seconds.

- Identifier calculation

Identifier of SDO 1 to the controller	Calculation
1536 + node address	1536 + 1 = 1537

- Command ”Write Request” (transmit parameters to the drive)

Command	Value
Write request	**23_{hex}**

- Index calculation

Index	Calculation
24575 - code number	24575 - 12 = 24563 = $5FF3_{hex}$

- Subindex: 0
- Calculation of the acceleration time

Data 1 ... 4	Calculation
Value of acceleration time	20 s · 10,000 = $200{,}000_{dec}$ = 00 03 0D 40_{hex}

- Telegram to drive

Identifier	User data							
	Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1537	23_{hex}	$F3_{hex}$	$5F_{hex}$	00	40_{hex}	$0D_{hex}$	03_{hex}	00

- Drive response to correct execution

Identifier	User data							
	Command	**Index** Low byte	**Index** High byte	**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
1409	60_{hex}	$F3_{hex}$	$5F_{hex}$	00	00	00	00	00

- Identifier SDO 1 from controller = 1408 + node address = 1409
- Command = ”Write Response” (controller response (acknowledgement)) = 60_{hex}

8.1.5 Addressing of the parameter and process data objects

The CAN bus system is based on a message-oriented data exchange between a transmitter and many receivers. Thus, all nodes can transmit and receive messages at the same time.

The identifier in the CAN telegram – also called *COB-ID (Communication Object Identifier)* controls which node is to receive a transmitted message. With the exception of the network management (NMT) and the sync telegram (Sync) the identifier contains the node address of the drive besides the basic identifier:

Identifier (COB-ID) = basic identifier + adjustable node address (node ID)

The basic identifier is preset with the following values:

Object			Direction		Basic identifier	
			to the drive	from the drive	dec	hex
NMT					0	0
Sync					128	80
PDO1 (Process data channel 1)	RPDO1	XCAN1_IN CAN1_IN CANaux1_IN	x		512	200
	TPDO1	XCAN1_OUT CAN1_OUT CANaux1_OUT		x	384	180
PDO2 (Process data channel 2)	RPDO1	XCAN2_IN CAN2_IN CANaux2_IN	x		640	280
	TPDO1	XCAN2_OUT CAN2_OUT CANaux2_OUT		x	641	281
PDO3 (Process data channel 3)	RPDO1	XCAN3_IN CAN3_IN CANaux3_IN	x		768	300
	TPDO1	XCAN3_OUT CAN3_OUT CANaux3_OUT		x	769	301
SDO1 (Parameter data channel 1)			x		1536	600
				x	1408	580
SDO2 (Parameter data channel 2)			x		1600	640
				x	1472	5C0
Node guarding			x		1792	700

Note!

Chapter ”8.2.1 Setting of CAN node address and baud rate” contains information on

► Setting of the node address (🕮 183).

► Selective addressing (🕮 186).

Display of the resulting identifiers

The display code for the resulting identifiers is for the

- MotionBus (CAN) C0355.
- System bus (CAN) C2455.

Here you cannot predefine values.

8.2 Configuring MotionBus/system bus (CAN)

Note!

ECSxM... axis modules

- only use the channels **CAN1_IN** and **CAN1_OUT** for communication via the MotionBus (CAN) interface X4.
- do not support process data via the system bus (CAN) interface X14, i.e. data cannot be processed using the channels CANaux_IN and CANaux_OUT.

8.2.1 Setting CAN node address and baud rate

- The node address and baud rate for the **MotionBus (CAN)** can be set via
  – DIP switch *or*
  – codes.
- The node address and baud rate for the **system bus (CAN)** must be set via codes only.

8.2.1.1 Settings via DIP switch

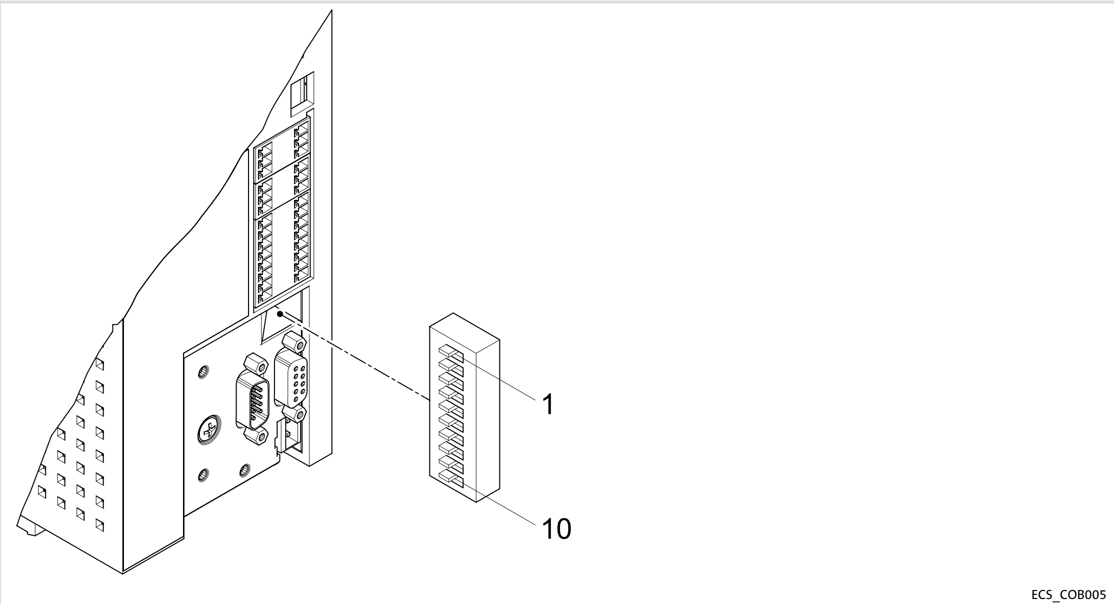


Fig.8-11 DIP switch for node address and baud rate (all switches: OFF)

Node address setting

The node address is set via DIP switches 2 ... 7. These switches are assigned to certain valencies. The sum of valencies results in the node address to be set (see example).

Switch	Valency	Example	
		Switching status	Node address
1	–	Any	32 + 16 + 8 = 56
2	32	**ON**	
3	16	**ON**	
4	8	**ON**	
5	4	OFF	
6	2	OFF	
7	1	OFF	

Baud rate setting

Note!
The baud rate must be set identically for all controllers and the master computer.

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

8.2.1.2 Settings via codes

Note!

- The codes C0350 (node address) and C0351 (baud rate) are inactive if one of the DIP switches is set to the "ON" position.
- In order that communication via the CAN bus can take place, the baud rate must be identical for all controllers and the master control.
- If the Lenze setting has been loaded via C0002,
  – C0351 is set to 0 (500 KBit/s).
  – The CAN baud rate and CAN node address must be reset.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0350	CAN address	1			Node address for CAN bus interface X4	🕮 183 🕮 182
			1 {1} 63			
C0351	CAN baud rate	0 {4}			Baud rate for CAN bus interface X4 **Note:** When the Lenze setting is loaded via C0002, C0351 is set to 0 (500 KBit/s).	🕮 183
			0	500 kbit/s		
			1	250 kbits/sec		
			2	125 kbit/s		
			3	50 kbit/s		
			4	1000 kbit/s		

Save changes with C0003 = 1.

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

- Switching-on of the low-voltage supply
- Command "Reset node" via the bus system
- Reset node via C0358 (🕮 188)

8.2.1.3 Selective addressing

Use C0354 to set the controller address independent of the node address in C0350.

To make the alternative node address valid, set the corresponding subcode C0353/x = 1.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0353						Source for alternative bus node addresses of CAN_IN/CAN_OUT (CAN bus interface X4)	🕮 186
1	CAN addr sel	0		CAN node address (C0350)		Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)		Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)		Address CAN3_IN/OUT	
			0	C0350 (auto)		Automatically determined by C0350	
			1	C0354 (man.)		Determined by C0354	
C0354						Alternative node addresses for CAN_IN/CAN_OUT (CAN bus interface X4)	🕮 186
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	

Save changes with C0003 = 1.

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

- ► Switching-on of the low-voltage supply
- ► Command “Reset node” via the bus system
- ► Reset node via C0358 (🕮 188)

8.2.2 Defining boot-up master in the drive system

If the bus initialisation and the related state change of ”Pre-Operational” to ”Operational” is not executed by a higher-level master system, the controller can be intended for the master to execute this task.

The MotionBus (CAN) is configured via code C0352.

The master functionality is only required for the initialisation phase of the drive system. In the initialisation phase, C0356 serves to set a boot-up time for the master. (188).

With the NMT telegram *start_remote_node* (broadcast telegram) the master sets **all** nodes in the NMT status ”Operational”. Data via the process data objects can only be exchanged during this status.

Note!

The change of the master/slave operation only becomes effective after a renewed mains switching of the controller or by sending one of the NMT telegrams *reset_node* or *reset_communication* to the controller.

As an alternative to the NMT telegram *reset_node* the code C0358 (”Reset Node”) is available for a reinitialisation of the CAN-specific device parameters.

Code		**Possible settings**			**IMPORTANT**	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**			
C0352	CAN mst	0			Master/slave configuration for CAN bus interface X4	187
			0	Slave	CAN boot-up is not active	
			1	Master	CAN boot up is active	
			2	Master with node guarding		
			3	Slave and heartbeat producer		
			4	Slave with node guarding		

8.2.3 Setting of boot-up time/cycle time

Setting boot-up time

code	Meaning
C0356/1	● Time (in ms) when the activation starts after the low-voltage supply is switched on. – Only valid if C0352 = 1 (master). – Normally the Lenze setting (3000 ms) is sufficient. ● If several controllers are interconnected and there is no higher-level host, one of the controllers must initialise the CAN network. The master activates the entire network once at a specific instant and thus starts the process data transfer. – Status changes from ”pre-operational” to operational”.

Set the cycle time for output data:

code	Meaning
C0356/2	Cycle time (in ms) CAN2_OUT ● Setting ”0” = event-controlled transmission (The output data will only be sent if a value changes in the output object.
C0356/3	Cycle time (in ms) CAN3_OUT ● Setting ”0” = event-controlled transmission (The output data will only be sent if a value changes in the output object.
C0356/4	Delay time (in ms) for sending telegrams via the process data object CAN2_OUT/CAN3_OUT ● When the Operational NMT status (after Pre-Operational) has been reached, the ”CANdelay” delay time is started. After the delay time has elapsed, the PDOs CAN2_OUT and CAN3_OUT is sent for the first time.

8.2.4 Executing a reset node

The following changes only become valid after a reset node:

- ► Changes of the baud rates
- ► Changes of the addresses of process data objects
- ► Changes of the MotionBus node addresses.

Reset node can be made by:

- ► Switching on the low-voltage supply
- ► Reset node via the bus system
- ► Reset node via C0358

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0358	Reset Node	0			Execute reset node (CAN bus)	🕮 188
			0	No function		
			1	CAN reset		

8.2.5 CAN bus synchronisation

By means of the system bus synchronisation, the internal time base can be synchronised with the instant of reception of the sync signal. By this, the start of cyclic and time-controlled internal processes of all drives involved in the synchronisation is synchronous.

Operating mode

The operating mode (sync signal source) is set via C1120:

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C1120	Sync mode	0 {1}			Sync signal source	
			0	OFF	Off	
			1	CAN Sync	Sync connection via CAN bus	🕮 190
			2	Terminal Sync	Sync connection via terminal	🕮 194

Synchronisation time

The synchronisation process requires an additional period of time after the mains connection and the initialisation phase.

The synchronisation time depends on

- the baud rate of the CAN bus,
- the starting time (arrival of the first sync signal),
- the time interval between the sync signals,
- the sync correction factor (C0363),
- the operating mode (C1120).

The synchronisation time can be set via the code C0369.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0369	SyNc Tx Time	0 {0}				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier set in C0368 is sent with the set cycle time.	🕮 189
			0	{1 ms}	65000	0 = switched off	

8.2.6 Axis synchronisation via CAN bus interface

The CAN bus transmits the sync signal and the process signals.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis applications via the CAN bus

Synchronisation cycle

For the purpose of synchronisation the master sends a periodic sync signal.

The controllers receive the sync signal and compare the time between two LOW-HIGH edges of the signal with the preselected cycle time (C1121).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1121	Sync cycle	2				Synchronisation cycle	🕮 190
			1	{1 ms}	13		

CAN sync identifier

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	🕮 190
			1	{1}	256		

Phase shift

The synchronisation phase (C1122) defines the period of time of the offset by which the start of the controller-internal cycle lags behind the sync signal received.

Note!

Always set the synchronisation phase greater than the maximum possible temporal jitter* of the sync signals received!

* Jitters are phase shiftings and hence periodic changes of signal frequencies. They are shiftings of fixed instants of a digital signal (e.g. the transition instant from one signal amplitude to another). Jitters especially occur at high frequencies and may cause data losses.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1122	Sync phase	0.460				Synchronisation phase	🕮 191
			0.000	{0.001 ms}	6.500		

Correction value of phase controller

The CAN sync correction increment (C0363) specifies the increment by means of which the rule cycle is extended or shortened (e. g. in order to shift the starting time).

As a rule, the factory-set smallest value can be maintained. Only in disadvantageous cases (e. g. if the sync master does not observe its cycle time precisely enough), it may be necessary to extend the CAN sync correction increment so that the value in C4264 becomes minimal. Otherwise, an extension has rather disdavantageous effects on the drive features.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0363	Sync correct.	1.0				CAN sync correction increment ● Change correction value until C4264 reaches the minimum.	🕮 191
			1	0.2 µs/ms			
			2	0.4 µs/ms			
			3	0.6 µs/ms			
			4	0.8 µs/ms			
			5	1.0 µs/ms			
C4264	CanSync_Dev	0				Deviation of the control program synchronisation Only display	🕮 191
			-32767	{1}	32767		

Monitoring of the synchronisation (time slot)

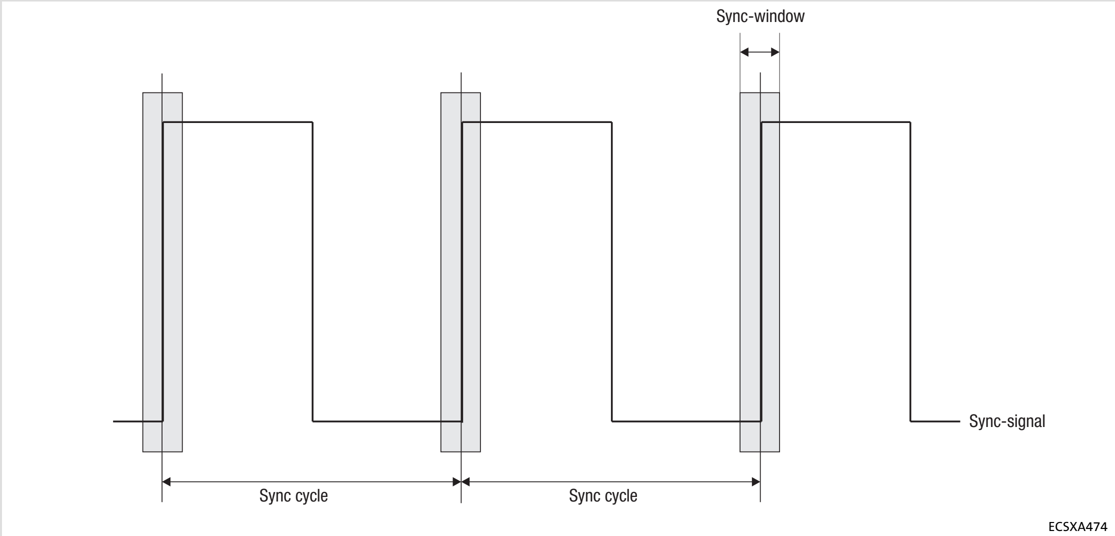


Fig.8-12 ”Time slot” for the LOW-HIGH edges of the sync signal

Note!
A jitter (see note 🕮 191) up to ±200 μs on the LOW-HIGH edges of the sync signal is permissible. The amount of the jitter has an impact on the parameterisation of the ”time slot”.

C3165 can be used for monitoring the synchronisation.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1123	Sync window	0,010				Synchronisation window ● If the sync telegram/signal sent by the master is inside this ”time slot”, C3165 is set to 1.	🕮 192
			0,000	{0.001 ms}	6,500		
C3165	SyncInsideWin	0				CAN synchronisation inside the window Only display	🕮 192
			0	{1 bit}	1		

CAN sync response

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0366	Sync Response	1			CAN sync response for CAN bus interface X4	🕮 192
			0	No response		
			1	Response		

Note!
In C0366 the value ”1” must be set permanently.

Setting sequence:

Observe the following sequence in the commissioning phase:

Device	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the controller. ● Press key <F9> in the GDC.	🕮 139
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	C1120 = 1	Active synchronisation by sync telegram via CAN bus.
	5.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	6.	Define the telegram (identifier) sequence: A . Send new setpoint to all slaves. B Send sync telegram. C Receive response of all slaves.	
	7.	Start communication/send sync telegrams.	
Slaves	8.	Read C0362 of the master.	Retrieve cycle time of the sync telegram from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync telegrams to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (🕮 191), increase ”time slot”.
Slaves	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Monitoring of the synchronisation: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.2.7 Axis synchronisation via terminal

The transmission paths for the sync signal and the process signals are separated.

- ► The process signals are connected via a freely selectable input channel (e.g. AIF interface, digital frequency input).
- ► The sync signal is injected via the digital input X6/DI2.

Application examples:

- ► Entry of cyclic, synchronised position setpoint information for multi-axis applications via other bus systems (e.g. INTERBUS).
- ► Synchronisation of the internal processing cycles to superimposed process controls.

Observe the following sequence in the commissioning phase:

Site	Step		Description
All devices	1.	Commission the controller and the CAN bus.	
	2.	Inhibit the controller. ● Press key <F9> in the GDC.	🕮 139
Slaves	3.	Connect ”CANSync-InsideWindow” with digital output.	
	4.	Apply the sync signal of the master to terminal X4/CH.	
Slaves	5.	C1120 = 2	Active synchronisation by sync signal via terminal X4/CH.
Slaves	6.	C0366 = 1 (Lenze setting)	CAN sync reaction: ● Slaves respond to sync telegram.
Master	7.	Start communication/send sync signals.	
Slaves	8.	Read C0362 of the master.	Retrieve cycle time of the sync signal from the master.
	9.	Set C1121 according to C0362 of the master.	Adjust the time distance of the sync signal to be received to the cycle time of the master.
	10.	Set C1123.	Set optimum size for the ”time slot”. ● If the sync signal ”jitters” heavily (🕮 191), increase ”time slot”.
	11.	Enable the controller via the signal ”CANSync-InsideWindow” applied to the digital output.	Monitoring of the synchronisation: ● If ”CANSync-InsideWindow” = TRUE, enable the controller.

8.2.8 Diagnostic codes

The operation via the MotionBus (CAN) can be observed via the following diagnostic codes:

- C0359: Bus state
- C0360: Telegram counter
- C0361: Bus load

8.2.8.1 Bus status (C0359)

C0359 shows the current operating state of the MotionBus (CAN).

Value of C0359	Operating state	Description
0	Operational	The bus system is fully operational.
1	Pre-Operational	Only parameters (codes) can be transferred via the bus system. Data exchange between controllers is not possible. A change into the state operational" can be made via a special signal on the MotionBus (CAN). Changing from "pre-operational" to "operational" can be carried out by the following actions: ● Master functionality of a higher-level host system ● If a drive is determined as master via C0352, the operating state is automatically changed for the entire drive system after the set boot-up time C0356 (subcode 1), when power is switched on. ● Reset node via C0358 (🕮 188) ● With a binary input signal Reset node", which can be set correspondingly. ● Reset node via connected host system
2	Warning	Faulty telegrams have been received. The controller remains passive (does not send any data). Possible reasons: ● Missing bus termination ● Insufficient shielding ● Potential differences in the grounding of the control electronics ● Bus load is too high ● Controller is not connected to MotionBus (CAN)
3	Bus off	Too many faulty telegrams. The controller is disconnected from the MotionBus (CAN). It can be reconnected by: ● TRIP reset ● Reset node (🕮 188) ● Renewed mains connection

8.2.8.2 Telegram counter (C0360)

C0360 counts for all parameter channels those telegrams that are valid for the controller. The counters have a width of 16 bits. If a counter exceeds the value ’65535’, the counting process restarts with ’0’.

Counted messages:

C0360	Meaning
Subcode 1	All sent telegrams
Subcode 2	All received telegrams
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0” since channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0” since channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent from parameter data channel 2
Subcode 8	Telegrams received from CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0” since channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0” since channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received from parameter data channel 2

8.2.8.3 Bus load (C0361)

It can be detected via C0361 which bus load in percent is needed by the controller or by the single data channels. Faulty telegrams are not considered.

Bus load of the single subcodes:

C0361	Meaning
Subcode 1	All sent telegrams
Subcode 2	All received telegrams
Subcode 3	Sent telegrams of CAN1_OUT
Subcode 4	Telegrams sent from CAN2_OUT ● Always ”0” since channel is not used!
Subcode 5	Telegrams sent from CAN3_OUT ● Always ”0” since channel is not used!
Subcode 6	Telegrams sent from parameter data channel 1
Subcode 7	Telegrams sent from parameter data channel 2
Subcode 8	Received telegrams of CAN1_IN
Subcode 9	Telegrams received from CAN2_IN ● Always ”0” since channel is not used!
Subcode 10	Telegrams received from CAN3_IN ● Always ”0” since channel is not used!
Subcode 11	Telegrams received from parameter data channel 1
Subcode 12	Telegrams received from parameter data channel 2

The data transfer is limited. The limits are determined by the number of telegrams transferred per time unit and by the data transfer speed.

The limits can be determined during data exchange in a drive network by adding all drives involved under code C0361/1.

Example:

Drives/host system	Bus load
C0361/1 - controller 1	23.5 %
C0361/1 - controller 2	12.6 %
Host system	16.0 %
	52.1 % (total)

Two drives and the master system are interconnected via the MotionBus (CAN).

Note!

► Max. bus load of all devices involved: 80 %

► If other devices are connected, as for instance decentralised inputs and outputs, their telegrams must be taken into consideration.

► Bus overload can, for instance, be caused by sync telegrams sent with a too short time interval.
  – **Remedy:** Change synchronisation cycle of higher-level control and controller (C1121).

8.3 Monitoring functions (overview)

The responses (📖 202) to monitoring functions partly can be parameterised via codes.

Monitoring				Possible reactions ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x071	CCR	System fault	Internal		●				
x091	EEr	External monitoring (activated via DCTRL)	FWM	C0581	●	✓	✓	✓	✓
x191	HSF	Internal error	Internal		●				
Voltage supply									
1020	OU	Overvoltage in the DC bus (C0173)	MCTRL			●			
1030	LU	Undervoltage in the DC bus(C0174)	MCTRL			●			
0070	U15	Undervoltage of internal 15 V voltage supply	Internal		●				
0107	H07	Internal fault (power section)	Internal		●				
Communication									
x041	AP1	Internal fault (signal processor)	Internal		●				
x061	CE0	Communication error on the automation interface (AIF)	AIF	C0126	✓		✓		●
x062	CE1	Communication error on the CAN1_IN process data input object (monitoring time adjustable via C0357/1)	CAN1_IN	C0591	✓		✓		●
x063	CE2	Communication error on the CAN2_IN process data input object (monitoring time adjustable via C0357/2)	CAN2_IN	C0592	✓		✓		●
x064	CE3	Communication error on the CAN3_IN process data input object (monitoring time adjustable via C0357/3)	CAN3_IN	C0593	✓		✓		●
x065	CE4	BUS-OFF status of MotionBus (CAN) (too many faulty telegrams)	CAN	C0595	✓		✓		●
x066	CE5	Communication error of the Gateway function (C0370, C0371) via MotionBus (CAN)	CAN	C0603	✓		✓		●
x122	CE11	Communication error on the CANaux1_IN process data input object (time monitoring adjustable via C2457/1)	CANaux1_IN	C2481	✓		✓		●
x123	CE12	Communication error on the CANaux2_IN process data input object (time monitoring adjustable via C2457/2)	CANaux2_IN	C2482	✓		✓		●
x124	CE13	Communication error on the CANaux3_IN process data input object (time monitoring adjustable via C2457/3)	CANaux3_IN	C2483	✓		✓		●
x125	CE14	BUS-OFF status of system bus (CAN) (too many faulty telegrams)	CANaux	C2484	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
[1] Adjustable in the DDS under **Project → Exceptional handling**
[2] For ECSxA... only

Monitoring				Possible reactions ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x126	CE15	Communication error of the Gateway function (C0370, C0371) via system bus (CAN)	CANaux	C2485	✓		✓		●
x260	Err Node Guard	”Life Guarding Event”: The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.	Node Guarding	C0384	●	✓	✓	✓[2]	✓
Temperatures / sensors									
0050	OH	Heatsink temperature > 90° C	MCTRL		●				
0051	OH1	Interior temperature > 90° C	MCTRL		●				
x053	OH3	Motor temperature > 150° C	MCTRL	C0583	●		✓		✓
x054	OH4	Heatsink temperature > C0122	MCTRL	C0582	✓		●		✓
x055	OH5	Interior temperature > C0124	MCTRL	C0605	✓		●		✓
x057	OH7	Motor temperature > C0121	MCTRL	C0584	✓		●		✓
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	MCTRL	C0585	✓		●		✓
x086	Sd6	Thermal sensor error on the motor (X7 or X8)	MCTRL	C0594	✓		✓		●
x095	FAN1	Fan monitoring (only for built-in units)			✓	●			
X110	H10	Thermal sensor error on heatsink	FWM	C0588	●				✓
x111	H11	Thermal sensor error in the interior of the device	FWM	C0588	●				✓
Motor / feedback system									
0011	OC1	Short circuit of motor cable	MCTRL		●				
0012	OC2	Motor cable earth fault	MCTRL		●				
0015	OC5	I x t overload TRIP (axis module, fix 100 %)	MCTRL		●				
0016	OC6	I^2 x t overload TRIP (motor, C0120)	MCTRL		●				
x017	OC7	I x t overload warning (axis module, C0123)	MCTRL	C0604	✓		●		✓
x018	OC8	I^2 x t overload warning (motor, C0127)	MCTRL	C0606	✓		●		✓
x032	LP1	Motor phase failure **Note:** Can only be used for asynchronous motors. By activation of the motor phase failure detection, the calculating time provided to the user is minimised!	MCTRL	C0599	✓		✓		●
x081	Rel1	Open circuit monitoring of the brake relay output (X25)	FWM	C0602	✓				●
x082	Sd2	Resolver error at X7 **Note:** If monitoring is switched off or in the case of ”Warning”, the machine can reach very high speeds in the case of fault, which may result in the damage of the motor and the machine that is driven!	MCTRL	C0586	●		✓		✓
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	MCTRL	C0598	✓		✓		●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP

1) Adjustable in the DDS under **Project → Exceptional handling**

2) For ECSxA... only

Monitoring				Possible reactions ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
x087	Sd7	Absolute value encoder error at X8	MCTRL		●				
x088	Sd8	SinCos encoder error on X8	MCTRL	C0580	✓				●
x089	PL	Error with regard to rotor position adjustment	MCTRL		●				
Speed									
x190	nErr	Speed control error (monitoring window C0576)	MCTRL	C0579	✓	✓	✓	✓	●
x200	Nmax	Maximum speed (C0596) has been exceeded.	MCTRL	C0607	●		✓		✓
Float error									
0209	float Sys-T	Float error in system task (ID 0)	Internal		●		✓	✓	1)
0210	float Cycl.-T	Float error in cyclic task (PLC_PRG ID 1)	Internal		●		✓	✓	1)
0211 ... 0218	float Task1 ... float Task8	Float error in task 1 (ID 2) ... Float error in task 8 (ID 9)	Internal		●		✓	✓	1)
Time-out / overflow									
0105	H05	Internal fault (memory)	Internal		●				
x108	H08	Extension board not connected properly or not supported by program.	Internal		●				
0201 ... 0208	overrun Task1 ... overrun Task8	Time-out in task 1 (ID 2) ... Time-out in task 8 (ID 9)	Internal		●		✓	✓	1)
0219	overrun Cycl.-T	Time-out in cyclic task (PLC_PRG, ID 1)	Internal		●		✓	✓	
0220	noT-Fkt Credit	Not enough technology units available in the PLC.	Internal		●				
0230	No program	No PLC program loaded in the PLC.	Internal		●				
0231	Unallowed Lib	You have called the library function in the PLC program. This function is not supported.	Internal		●				
x240	ovrTrans Queue	Overflow of the transmit request memory	Free CAN objects		●	✓	✓	✓	✓
x241	ovr Receive	Too many receive telegrams	Free CAN objects		●			✓	

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
1) Adjustable in the DDS under **Project → Exceptional handling**
2) For ECSxA... only

Lenze

Monitoring				Possible reactions ● Lenze setting ✓ Can be set					
Fault message		**Description**	**Source**	Code	TRIP	Message	Warning	Fail-QSP	Off
Parameter setting									
0072	PR1	Check sum error in parameter set 1	Internal		●				
0074	PEr	Program error	Internal		●				
0075	PR0	Error in the parameter sets	Internal		●				
0079	PI	Error during parameter initialisation	Internal		●				
0080	PR6	● **For ECSxS/P/M:**Internal fault ● **For ECSxA:** Too many user codes	Internal		●				
Application-specific fault messages									
x400	Pos HW End	Positive hardware limit switch has bee approached.		C3175	✓		✓	✓	●
x401	Neg HW End	Negative hardware limit switch has been approached.		C3175	✓		✓	✓	●
x404	Follow Err 1	Warning against exceeding the following error limit (C3030).		C3032	✓	✓	●	✓	✓
x405	Follow Err 2	Following error limit (C3031) has been exceeded.		C3033	✓	✓	✓	●	✓
x406	Home Pos Err	Home position is unknown.		C3170	✓	✓	✓	✓	●
x407	Toggle Bit Err	Toggle bit error		C3160	✓	✓	✓	●	✓
3408	External QSP	Externally enabled quick stop (QSP) via X6/DI1 (A reset of the fault message is required.)						●	
x410	VelModeErr	Speed error in "Velocity Mode" (C5000 = 2)		C3038	✓	✓	✓	✓	●

x: 0 = TRIP, 1 = message, 2 = warning, 3 = FAIL-QSP
1) Adjustable in the DDS under **Project → Exceptional handling**
2) For ECSxA... only

8.4 Configuring monitoring functions

8.4.1 Reactions

Different monitoring functions (📖 198) protect the drive system from impermissible operating conditions.

If a monitoring function is activated,

- the corresponding response for device protection is initiated.
- the fault message is entered in position 1 in the history buffer (📖 226).

In the history buffer (C0168/x), the fault messages are saved with an offset indicating the type of reaction:

Fault message number	Type of reaction
0xxx	TRIP
1xxx	Message
2xxx	Warning
3xxx	FAIL-QSP

Example: C0168/1 = 2061

- x061:
  The current fault (subcode 1 of C0168) is a communication error (fault message ”CE0”/No. ”x061”) between the AIF module and the ECS axis module.
- 2xxx:
  The reaction to this is a warning.

Effects of responses

Response		⇨ Impact	Display Operating unit		
			RDY	IMP	Fail
TRIP			☐	■	■
	TRIP active:	⇨ The power outputs U, V, W are switched to high resistance. ⇨ The drive is idling (no control!).			
	TRIP reset:	⇨ The drive runs to its setpoint within the deceleration times set.			
Message		**Danger!** The drive restarts automatically if the message is removed!	☐	■	■
	Message active:	⇨ The power outputs U, V, W are switched to high resistance.			
	≤ 0.5 s	⇨ The drive is idling (no control!).			
	> 0.5 s	⇨ The drive is idling (due to internal controller inhibit!). If required, restart program.			
	Message reset:	⇨ The drive runs to its setpoint with the maximum torque.			
FAIL-QSP		⇨ The drive is braked to standstill within the quick stop time (C0105).	–	–	■
Warning	STOP	**Stop!** The drive can be destroyed as a result of deactivated monitoring functions!	■	☐	■
		⇨ The failure merely is displayed, the drive runs on in a controlled manner.			
Off	STOP	**Stop!** The drive can be destroyed as a result of deactivated monitoring functions!	–	–	–
		⇨ No response to the failure is effected!			

☐ = off ■ = on

8.4.2 Monitoring times for process data input objects

Each process data input object can monitor whether a telegram has been received within a specified time. As soon as a telegram arrives, the corresponding monitoring time (C0357/C02457) is restarted (”retriggerable monoflop” function).

The following assignments are valid:

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	📖 204
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	📖 204
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	

The following responses can be set for communication errors:

- 0 = Fault (TRIP) - controller sets controller inhibit (CINH)
- 2 = Warning
- 3 = Monitoring is switched off

Codes for setting the response to the monitoring:

CAN bus interface	Code	Monitoring
X4 ECSxS/P/M: MotionBus (CAN) ECSxA: system bus (CAN)	C0591	CAN1_IN (”CE1”)
	C0592	CAN2_IN (”CE2”)
	C0593	CAN3_IN (”CE3”)
	C0595	Bus Off (”CE4”)
	C0603	Gateway function (”CE5”)
X14 System bus (CAN)	C2481	CANaux1_IN (”CE11”)
	C2482	CANaux2_IN (”CE12”)
	C2483	CANaux3_IN (”CE13”)
	C2484	Bus Off (”CE14”)
	C2485	Gateway function (”CE15”)

The input signals (CAN1...3_IN/CANaux1...3_IN) can also be used as binary output signals, e. g. for the assignment of the output terminal.

Bus off

If the controller separates from the MotionBus/system bus (CAN) due to faulty telegrams, the ”BusOffState” signal (CE4/CE14) is set.

”BusOffState” can trip an error (TRIP) or warning. It is also possible to switch off the signal. The response can be set via C0595/C2484. For this, the terminal output can be assigned, too.

Reset node

Changes with regard to baud rates, CAN node addresses, or addresses of process data objects only are valid after a reset node.

A node can be reset by:

- Switching on the low-voltage supply again
- Reset node via the bus system
- Reset node via C0358/C2458 (🕮 188)

8.4.3 Motor temperature (OH3, OH7)

The motor temperature is monitored by means of a continuous thermal sensor (KTY). Wire the thermal sensor to the resolver cable on X7 (🕮 74) or to the encoder cable on X8 (🕮 75).

- Adjustable warning threshold (OH7) via C0121
- Fixed threshold (OH3) = 150 °C

The reaction to exceeding the thresholds can be defined via:

- C0584 (adjustable threshold)
- C0583 (fixed threshold)

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0121	OH7 limit	120				Adjustable threshold for early motor temperature warning	🕮 205
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault OH7	
C0583	MONIT OH3	0				Configuration of motor temperature monitoring via resolver input X7 or encoder input X8	🕮 205
			0	TRIP			
			2	Warning			
			3	Off			
C0584	MONIT OH7	2				Configuration of motor temperature monitoring via resolver input X7 or encoder input X8 Set threshold in C0121	🕮 205
			0	TRIP			
			2	Warning			
			3	Off			

8.4.4 Heatsink temperature (OH, OH4)

The heatsink temperature of the controller can be monitored with a temperature threshold:

- ► Adjustable threshold (OH4) via C0122
- ► Fixed threshold (OH) = 90 °C

The reaction to exceeding the adjustable threshold can be defined via C0582.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0122	OH4 limit	80				Adjustable threshold for early heatsink temperature warning	📖 206
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault OH4	
C0582	MONIT OH4	2				Configuration of heatsink temperature monitoring Set threshold in C0122	📖 206
			0	TRIP			
			2	Warning			
			3	Off			

8.4.5 Interior temperature (OH1, OH5)

The temperature inside the device is permanently monitored with two temperature thresholds:

- Adjustable threshold (OH5) via C0124
- Fixed threshold (OH1) = 90 °C

The reaction to exceeding the adjustable threshold can be defined via C0605.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0124	OH5 limit	75				Adjustable threshold for early warning of temperature inside the device	🕮 207
			10	{1 %}	90	C0062 > C0124 ⇨ fault OH5	
C0605	MONIT OH5	2				Configuration of early warning of temperature inside the device (threshold in C0124)	🕮 207
			0	TRIP			
			2	Warning			
			3	Off			

8.4.6 Function monitoring of the thermal sensors (H10, H11)

The function of the thermal sensors of heatsink and the interior of the device. If the thermal sensors report values beyond the measuring range, the fault H10 (heatsink) or H11 (interior) is reported. The response to the faults can be defined via C0588.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0588	MONIT H10/H11	0			Configuration of monitoring Thermal sensors (H10, H11) in the controller ”SensFaultTht/SensFaultTid” (FWM H10/H11)	🕮 207
			0	TRIP		
			2	Warning		
			3	Off		

8.4.7 Controller current load (I x t-monitoring: OC5, OC7)

The I x t-monitoring monitors the current load of the axis module. The monitoring is set in a way that operation

- is permanently enabled with a device output current = I_N.
- is possible for ≤ 30 s with a device output current ≤ 1.5 x I_N.

The overload protection of the axis module can be set with thresholds:

- adjustable threshold (OC7) via C0123
- fixed threshold (OC5) = 100 %

After an overcurrent phase you can calculate with a recovery phase of 120 s. For a more precise consideration consult the overcurrent characteristic and the value 3 x $\tau_{\text{axis module}}$ (🕮 209).

The response for the excess of the adjustable threshold is defined via C0604.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0123	OC7 limit	90				Adjustable threshold for I x t advance warning (axis module)	🕮 208
			0	{1 %}	100	C0064 > C0123 ⇨ fault OC7	
C0604	MONIT OC7	2				Configuration of early warning I x t threshold (C0123)	🕮 208
			0	TRIP			
			2	Warning			
			3	Off			

Overcurrent characteristic

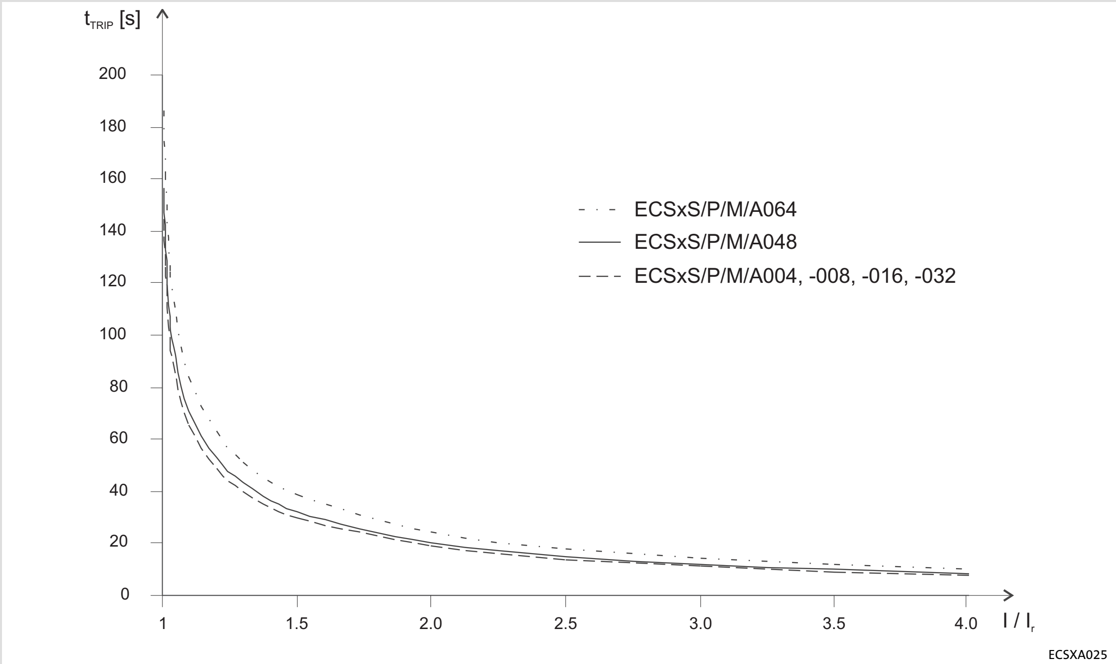


Fig.8-13 Overcurrent characteristic ECSxM..., see also “Rated data“ 📖 25

The overcurrent characteristic shows the maximum time t_{TRIP} till the axis module generates an I x t error. In order to reach this time t_{TRIP} again, the time 3 x $\tau_{axis\ module}$ with the load I/I_r = 0 A must be observed.

Device	$\tau_{axis\ module}$ [s]	Overcurrent characteristic
ECSxM004	54.6	$$I \cdot t = \frac{I_{subprofile\_x}}{I_{rated}} - \left(\frac{I_{subprofile\_x}}{I_{rated}} - I \cdot t_{subprofile\_x-1} \right) \cdot e^{-\frac{t_{subprofile\_x}}{\tau_{axis\_module}}}$$
ECSxM008	27.3	
ECSxM016	27.3	
ECSxM032	27.3	
ECSxM048	29.5	
ECSxM064	35.1	

8.4.8 Motor current load (I^2 x t-monitoring: OC6, OC8)

The I^2 x t-load of the motor is continually calculated by the axis module and is displayed in C0066. Via C0120 and C0127 you can set two actuation thresholds. If threshold 1 is exceeded, the response set in C0606 (OC8) is activated. If threshold 2 is exceeded, OC6-TRIP is activated.

The I^2 x t-monitoring is designed in a way that it is activated after 179 s for a motor current of 1.5 x I_r and a set threshold of 100 % (thermal motor time constant C0128 = 5 min).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0120	OC6 limit	105				Threshold for I^2 x t disconnection (motor)	🕮 210
			0	{1 %}	120	0 = I^2 x t monitoring is switched off I^2 x t > C0120 ⇨ TRIP 006	
C0127	OC8 limit	100				Threshold for I^2 x t advance warning (motor)	🕮 210
			0	{1 %}	120	I^2 x t > C0127 ⇨ response as set in C0606	
C0128	Tau motor	5.0				Thermal time constant of the motor	🕮 210
			1.0	{0.1 min}	25.0	For calculating the I^2xt-disconnection	
C0606	MONIT OC8	2				Configuration of I^2 x t early warning (threshold in C0120)	🕮 210
			0	TRIP			
			2	Warning			
			3	Off			

Calculation of the release time:

$$t = -(C0128) \cdot \ln\left[1 - \frac{y+1}{\left(\frac{I_M}{I_r}\right)^2 \cdot 100}\right]$$

I_M Current motor current

I_r Rated motor current

y C0120 or C0127

The release time for different motor currents and thresholds can be taken from the diagram (C0128 = 5.0 min):

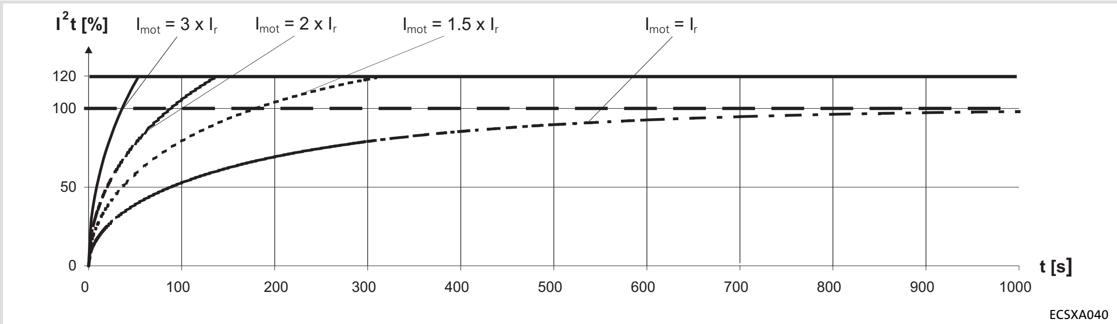


Fig.8-14 I^2 x t monitoring: Release times with different motor currents

Imot	Motor current
I_r	Rated motor current
I^2t	I^2t load
T	Time

8.4.9 DC-bus voltage (OU, LU)

- If the DC-bus voltage exceeds the upper switch-off threshold set in C0173, an OU message is actuated.
- If the DC-bus voltage falls below the lower switch-off threshold set in C0174, an LU message is actuated.

Note!
All drive components in DC-bus connections must have the same thresholds!

Selection	Mains voltage	Brake unit	LU message (Undervoltage)		OU message (Overvoltage)	
C0173	Power supply module [V AC]		Setting [V DC]	Resetting [V DC]	Setting [V DC]	Resetting [V DC]
0	230	yes/no	130	275	400	390
1	400	yes/no	285	430	800	790
2	400 ... 460	yes/no	328	473	800	790
3	480	no	342	487	800	785
4	480	yes	342	487	800	785
10	230	yes/no	C0174	C0174 + 5 V	400	390
11	400 (Lenze setting)	yes/no	C0174	C0174 + 5 V	800	790
12	400 ... 460	yes/no	C0174	C0174 + 5 V	800	790
13	480	no	C0174	C0174 + 5 V	800	785
14	480	yes	C0174	C0174 + 5 V	800	785

8.4.10 Voltage supply of the control electronics (U15)

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

8.4.11 Motor phases (LP1)

This monitoring function checks whether a motor phase has failed.

Note!
- This monitoring function can only be used for asynchronous motors.
- When this monitoring function is activated, the calculating time provided to the user is reduced.

- The response is set via C0597.
- The monitoring limit is set via C0599.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0597	MONIT LP1	3				Configuration of motor phase monitoring (LP1) **When this monitoring function is activated, the calculating time which is provided to the user is reduced!**	🕮 212
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase monitoring (LP1) referred to the current limit.	🕮 212
			0,01	{0.01 %}	10.00		

8.4.12 Resolver supply cable (Sd2)

This monitoring function monitors the resolver feed cable and the resolver with regard to open circuit and protects the motor.

Stop!

If monitoring is disconnected, the machine can achieve very high speeds in case of faults (e. g. system cable is disconnected or not correctly screwed), which can result in the damage of the motor and of the driven machine! The same applies if ”warning” is set as a response.

- For commissioning C0586, always use the Lenze setting (TRIP).
- Only use the possibility of disconnection via C0586 if the monitoring is activated without apparent reason (e. g. by very long cables or intense interference injection of other drives).

If a fault with regard to the survey of the actual speed value is available, it is not definitely ensured that monitoring is activated with regard to overspeed (NMAX, 216).

This monitoring ...

- is automatically activated if a resolver is selected as an actual speed value encoder via C0419.
- is automatically activated if another actual speed value encoder is selected.

The response is set via C0586.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0586	MONIT SD2	0			Configuration of monitoring Resolver ”ResolverFault” (MCTRL Sd2)	213
			0	TRIP		
			2	Warning		
			3	Off		

8.4.13 Motor temperature sensor (Sd6)

This monitoring function checks whether the motor temperature sensor provides values within the measuring range of -50 ... +250 °C. If the values are beyond this measuring range, monitoring is activated.

The response is set via C0594.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0594	MONIT SD6	3			Configuration of monitoring Motor temperature sensor ” SensorFault” (MCTRL Sd6)	213
			0	TRIP		
			2	Warning		
			3	Off		

8.4.14 SinCos encoder (Sd8)

This monitoring function identifies via a plausibility check whether the encoder is available and the sin/cos tracks supply plausible values with regard to each other.

- The following SinCos encoder types are supported:
  – Stegmann SCS 60/70 ST 512 single-turn absolute value encoder (512 incr./rev.).
  – Stegmann SCM 60/70 ST 512 multi-turn absolute value encoder (512 incr./rev.).
- The fault "Sd8" can only be reset by mains switching.
- If required, the encoder has to move by several angular degrees for actuating a fault.
- The response is set via C0580.
- The filter time constant (C0559) serves to filter short-time trouble on the sin/cos track of the encoder without an SD8 trip being released immediately.

Note!
- For the desired encoder monitoring, and in particular when using synchronous machines, set fault handling to "TRIP".
- In order to attain further encoder safety, additionally configure the following error monitoring (□ 140).

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0580	Monit SD8	3				Configuration of open-circuit monitoring for sin/cos encoders	□ 214
			0	TRIP			
			3	Off			
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is "10 ms", a SD8-TRIP is actuated after 10 ms.	

Visible faults	Non-visible faults
• Unplugged plug, all encoder signals open. • Singe wire breakage, one of the following signals is missing: – COS A – RefCOS A – SIN B – RefSIN B – GND – VCC • Double wire breakage with the following signal pairs: – COS A and RefCOS A – SIN B and RefSIN B – COS A and SIN B – RefCOS A and RefSIN B – and all four signals (COS A, RefCOS A, SIN B, RefSIN B) open.	• Short circuits, in particular between sine and cosine signals. • Cable/encoder faults with intermediate values • "Semi"-short circuits (> 0 Ohm) • "Semi"-interruptions (< infinite)

8.4.15 Speed beyond the tolerance margin (nErr)

This monitoring function compares the actual speed value supplied by the tacho generator to the speed setpoint on the speed controller. If the difference of the two speed values exceeds the tolerance window set in C0576, the monitoring function is actuated.

The subsequent speed behaviour of the drive controller can be evaluated by means of this monitoring.

- ► If the system deviation exceeds a certain value, this may indicate a drive problem. In this case, the drive somehow is inhibited from following the set speed setpoint. With regard to a generally functional drive controller, this may be caused by mechanical blockades on the load side, or by a motor torque that is not sufficient.

Furthermore, a tacho generator in speed-controlled operation can be protected further on by this monitoring. Thus, the monitoring presents a supplementation to the individual encoder monitoring systems.

- ► Faults on the encoder system bring about an incorrect actual speed value. This normally results in a system deviation on the speed controller that is greater than that in the normal operating status.
- ► The tolerance margin is set via C0576.
- ► The response is set via C0579.

Note!

- ► Where required, adjust the setpoint ramps and/or the quick stop deceleration time by longer times to the application, so that no fault messages are output.
- ► Set the tolerance window (C0576) to at least twice the value of the system deviation occurring during operation. The value can be identified by respective tests when commissioning is effected.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0576	nErr Window	100				Monitoring window of the speed control error referring to n_{max}. 100 % = lowest monitoring sensitivity	🕮 215
			0	{1 %}	100		
C0579	Monit nErr	3				Configuration of speed control error monitoring	🕮 215
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			

8.4.16 Maximum speed exceeded (NMAX)

The monitoring process is activated when the current speed exceeds the upper speed limit of the system or the double value of C0011 (n_{max}).

Stop!

- With regard to active loads (e. g. hoists), pay attention to the fact that the drive in this case operates without torque. Specific on-site measures are required!
- If the actual speed value encoder fails, it is not provided that this monitoring will be activated.

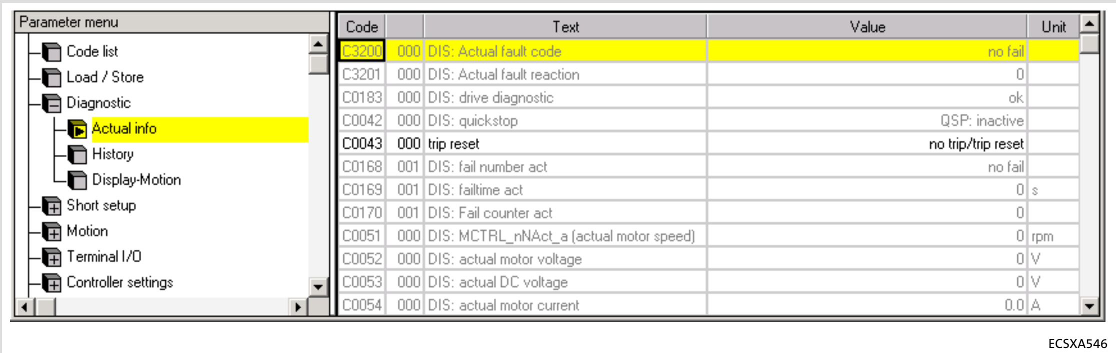
The upper speed limit of the system (maximum speed) is set via C0596.

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0596	NMAX limit	5500				Monitoring: Maximum speed of the machine	216
			0	{1 rpm}	16000		

9 Diagnostics

9.1 Diagnostics with Global Drive Control (GDC)

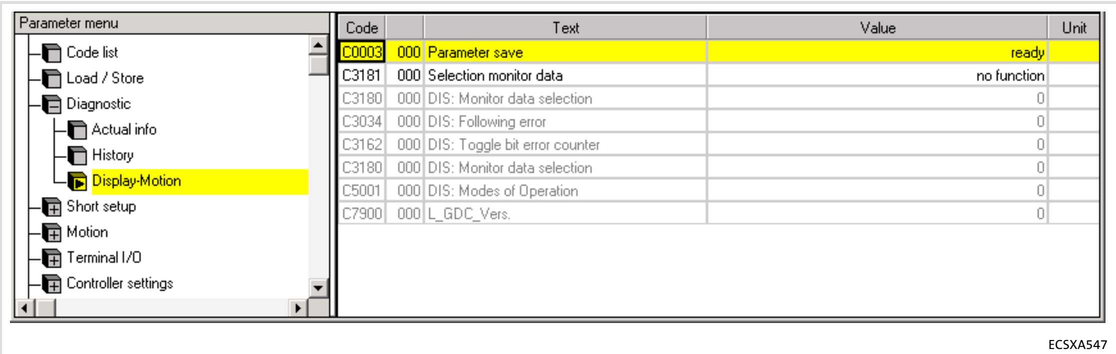
In order to diagnose the current controller operation, click on **Diagnostics → Actual info** in the GDC parameter menu. The table which appears then shows the current motor data, operating times, fault messages, etc.



Code		Text	Value	Unit
C3200	000	DIS: Actual fault code	no fail	
C3201	000	DIS: Actual fault reaction	0	
C0183	000	DIS: drive diagnostic	ok	
C0042	000	DIS: quickstop	QSP: inactive	
C0043	000	trip reset	no trip/trip reset	
C0168	001	DIS: fail number act	no fail	
C0169	001	DIS: failtime act	0	s
C0170	001	DIS: Fail counter act	0	
C0051	000	DIS: MCTRL_nNAct_a (actual motor speed)	0	rpm
C0052	000	DIS: actual motor voltage	0	V
C0053	000	DIS: actual DC voltage	0	V
C0054	000	DIS: actual motor current	0.0	A

Fig.9-1 GDC view: Diagnostic of the current operation

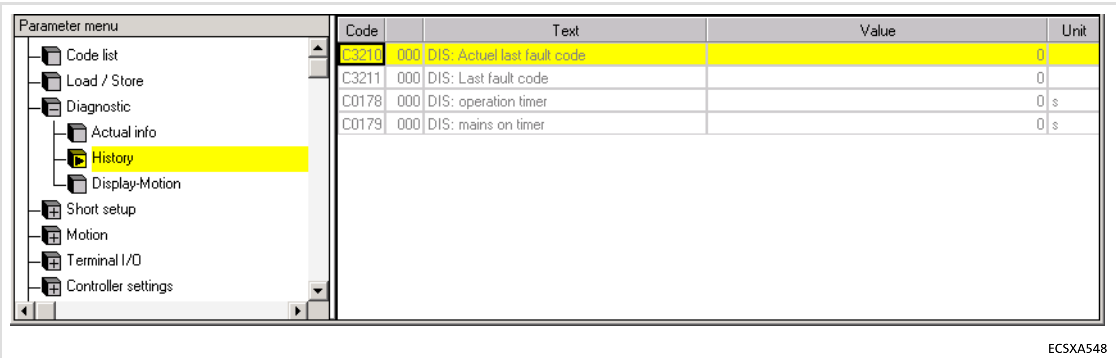
The most important operating values are displayed in the parameter menu of the GDC under **Diagnostic → Display-Motion**:



Code		Text	Value	Unit
C0003	000	Parameter save	ready	
C3181	000	Selection monitor data	no function	
C3180	000	DIS: Monitor data selection	0	
C3034	000	DIS: Following error	0	
C3162	000	DIS: Toggle bit error counter	0	
C3180	000	DIS: Monitor data selection	0	
C5001	000	DIS: Modes of Operation	0	
C7900	000	L_GDC_Vers.	0	

Fig.9-2 GDC view: Diagnostic of Display-Motion

The GDC parameter menu shows fault history values under **Diagnostics → History**:



Code		Text	Value	Unit
C3210	000	DIS: Actuel last fault code	0	
C3211	000	DIS: Last fault code	0	
C0178	000	DIS: operation timer	0	s
C0179	000	DIS: mains on timer	0	s

Fig.9-3 GDC view: Diagnostic history

9.2 Diagnostics with Global Drive Oscilloscope (GDO)

The **Global Drive Oscilloscope (GDO)** is included in the scope of supply of the Lenze parameter setting and operating program "Global Drive Control (GDC)" and can be used as an additional diagnostics program.

The GDO serves to e. g. record input and output data and device-internal states during the controller operation.

Note!
Detailed information about the functionality and handling of GDO can be found in the Manual "Global Drive Oscilloscope (GDO), Getting started".

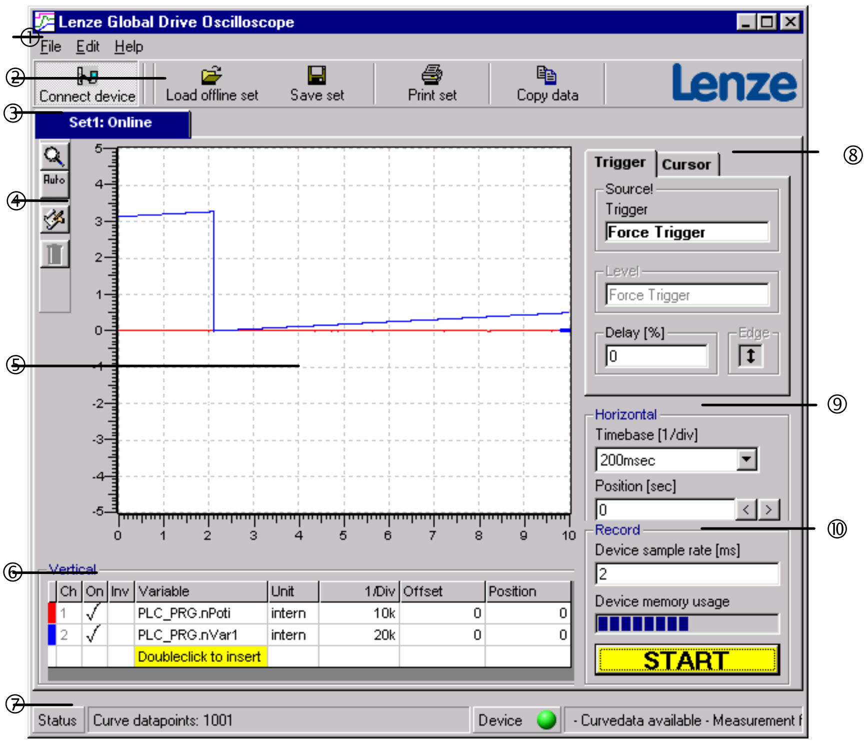


Fig.9-4 Global Drive Oscilloscope (GDO)

① Menu bar
② Symbol bar at the top
③ Data sets
④ Symbol bar on the left
⑤ Graph display field
⑥ Vertical operating elements
⑦ Status display
⑧ Trigger/cursor operating elements
⑨ Horizontal operating elements
⑩ Operating elements for recording

9.2.1 GDO buttons

Clicking on the corresponding button executes the respective function.

Press the **<F1>** key to call the HTML online help.

Symbol bar at the top (②, Fig.9-4)

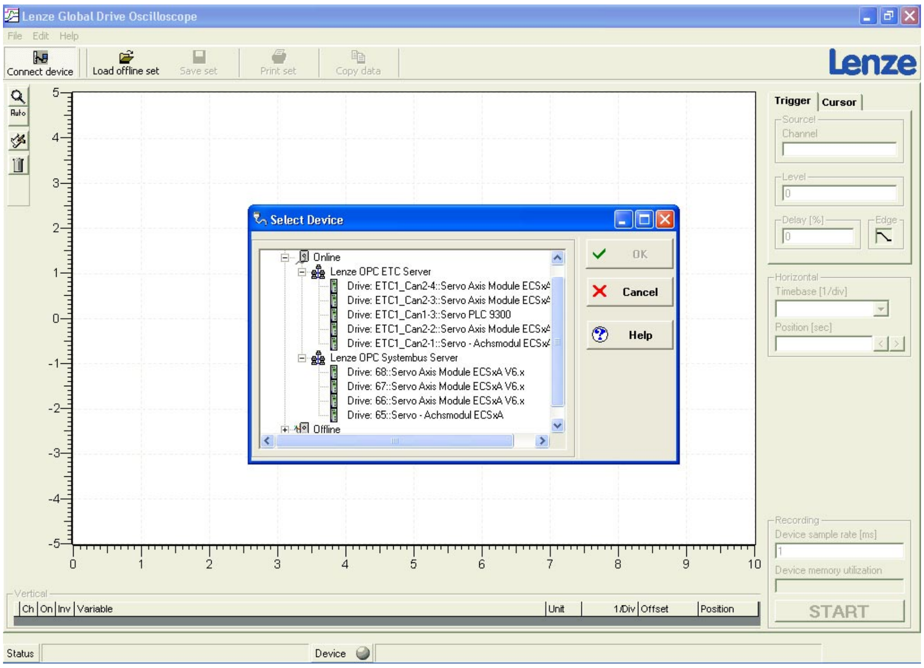
Symbol (button)	Function
	**Connect device** Here a connection can be established to an attached module. This button has the same function as the menu command **File → Connect**.
	**Load offline set** Here saved data sets can be loaded.
	**Save set** Here recorded curves can be saved. This button has the same function as the menu command **File → Save**.
	**Print set** Here the recorded curve can be printed in different variants.
	**Copy data** Here data sets can be copied. This button has the same function as the menu command **Edit → Copy**.

Symbol bar on the left (④, Fig.9-4)

Symbol (button)	Function
	**Zoom** Here different zoom functions can be executed.
	**Automatic scaling** Here all selected curves can be automatically scaled and repositioned and the offset value can be set to ”0”. The following data types are supported in automatic scaling: BYTE; WORD; DWORD; USINT; UINT; UDINT; SINT; INT; SDINT; Array; Struct
	**Comment** Here information concerning the current data set can be entered. This information is saved together with the current data set and after loading it is displayed as a short info.
	**Delete** Here the selected offline data set can be deleted.

9.2.2 Diagnostics with GDO

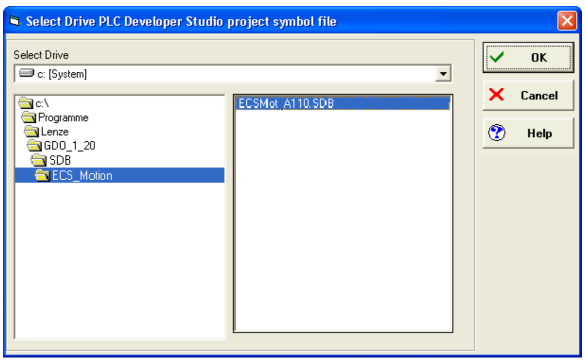
1. Connect axis module to the PC/laptop.
   – Connection to terminal X14 (system bus (CAN)) with a PC system bus adapter.
2. Supply the axis module with a control voltage of 24 V (🕮 55).
3. Start the GDO on the PC/Laptop.
4. Click on the [Connect device] button.
   – The dialog ”Select Device” opens (Fig.9-5).
   – The devices connected to the bus are listed under ”Online”.



ECSXA561

Fig.9-5 GDO view: Dialog ”Select Device”

5. Select the corresponding device under ”Online” and click on the [OK] button.
   – The dialog ”Select Drive PLC Developer Studio project symbol file” opens:



ECSXA562

Fig.9-6 GDO view: Dialog ”Select Drive PLC Developer Studio project symbol file”

6. Select symbol file **ECSMot_Axxx.SDB** (xxx = version number) and click on the [OK] button.

7. Select the variables the values of which are to be recorded during positioning .
   – Double-click on the yellow text box ”Variable” in the group box ”Vertical”.
   – Select the variables in the dialog box appearing now.
   – The values of up to 8 variables can be displayed in the graph box.

Fig.9-7 GDO view: Variable selection

8. Click on the [START] button to perform a positioning process.

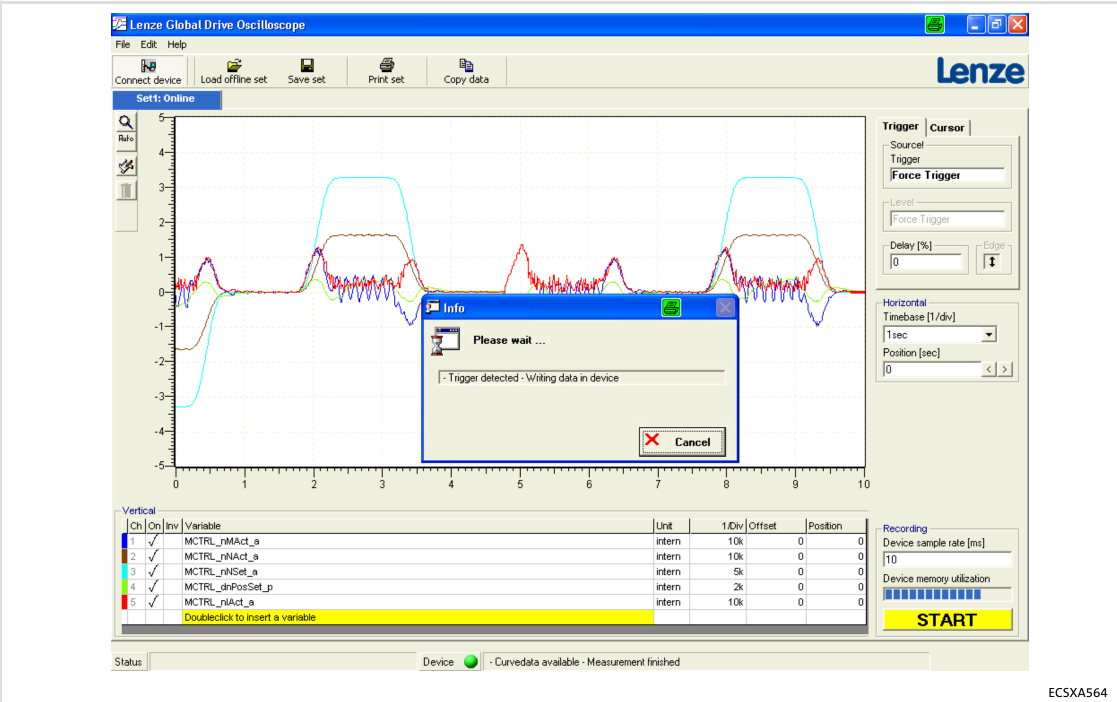


Fig.9-8 GDO view: Performing a positioning process

System variables

The meaning of the most important variables is shown in the following table:

Variable	Data type	Signal type	Code	Display format	Description
Brake.L_BRK1.bSet_b	Bool	Binary	–	–	Demands on brake logic
Brake.L_BRK1.bOut_b	Bool	Binary	–	–	Set brake
CAN1_wDctrlCtrl	Word	–	–	–	Control word (🕮 104)
CAN1_wDctrlStat					Status word (🕮 106)
CAN1_dnInD1_p	Double integer	Position	–	–	Set position [inc] 65536 inc = 1 revolution
CAN1_dnOutD1_p	Double integer	Position	–	–	Actual position [inc] 65536 inc = 1 revolution
CAN1_bSyncInsideWindow_b	Bool	Binary	C3165	bin	Synchronisation telegram within the set window (🕮 192)
CAN1_nSyncDeviation	Integer	Analog	C4264	–	Deviation of the control program synchronisation

Variable	Data type	Signal type	Code	Display format	Description
DCTRL_bCInh1_b	Bool	Binary	C0878/1	bin	Controller inhibit
DCTRL_bCInh2_b			C0878/2		
DCTRL_bTripSet_b			C0878/3		TRIP-SET
DCTRL_bTripReset_b			C0878/4		TRIP-RESET
DCTRL_bFail_b	Bool	Binary	–	–	TRUE = active error
DCTRL_bImp_b					TRUE = high-resistance power output stages
DCTRL_bTrip_b					TRUE = active fault
DCTRL_bQspIn_b					TRUE = QSP
DCTRL_bRdy_b					TRUE = ready for operation
DCTRL_bCwCCw_b					TRUE = CCW rotation FALSE = CW rotation
DCTRL_bNActEq0_b					TRUE = motor speed < C0019
DCTRL_bCInh_b					TRUE = controller inhibit
DCTRL_bExternalFault_b					TRUE = external error
MCTRL_bQspOut_b	Bool	Binary	C0907/3	bin	TRUE = drive executes QSP
MCTRL_nHiMLim_a	Integer	Analog	C0906/4	dec [%]	Upper torque limitation (in % of C0057)
MCTRL_nLoMLim_a			C0906/3		Lower torque limitation (in % of C0057)
MCTRL_bNMSwt_b	Bool	Binary	C0907/2	bin	TRUE = torque control FALSE = speed control
MCTRL_bnNAdapt_a	Integer	Analog	–	–	Adaptive Vp of the speed controller
MCTRL_bILoad_b	Bool	Binary	C0907/4	bin	TRUE = integral action component of the speed controller is accepted by *MCTRL_nISet_a*.
MCTRL_nISet_a	Integer	Analog	C0906/8	dec [%]	Integral action component of the speed controller
MCTRL_nNSet_a			C0906/1		Speed setpoint
MCTRL_nPAdapt_a			C0906/9		Influence of C0254 on Vp (in %) ● The amount is processed (without sign).
MCTRL_dnPosSet_p	Double integer	Position	C0908	dec [inc]	Setpoint phase differs from actual phase for phase controller
MCTRL_nPosLim_a	Integer	Analog	C0906/5	dec [%]	Influence of the phase controller ● In % of n_{max} (C0011)
MCTRL_bPosOn_b	Bool	Binary	C0907/1	–	TRUE = Activation of phase controller
MCTRL_nNStartMLim_a	Integer	Analog	C0906/6	dec [%]	Lower speed limit for speed limitation
MCTRL_nMAdd_a			C0906/2		Additional torque setpoint or torque setpoint
MCTRL_nFldWeak_a			C0906/7		Motor control
MCTRL_bQspIn_b	Bool	Binary	C0042	bin	TRUE = drive executes QSP
MCTRL_nNSetIn_a	Integer	Analog	C0050	dec [%]	Speed setpoint ● In % of n_{max} (C0011)
MCTRL_bMMax_b	Bool	Binary	–	–	TRUE = speed controller operates within the limits.
MCTRL_nMSetIn_a	Integer	Analog	C0056	dec [%]	Torque setpoint ● In % of M_{max} (C0057)
MCTRL_bIMax_b	Bool	Binary	–	–	TRUE =drive operates at the current limit C0022.

Variable	Data type	Signal type	Code	Display format	Description
MCTRL_nIAct_a	Integer	Analog	–	–	Actual motor current
MCTRL_nDCVolt_a					100% = 1000V
MCTRL_nMAct_a					In % of M_{max} (C0057)
MCTRL_bUndervoltage_b	Bool	Binary	–	–	Monit: Undervoltage
MCTRL_bOvervoltage_b					Monit: Overvoltage
MCTRL_bShortCircuit_b					Monit: Short circuit
MCTRL_bEarthFault_b					Monit: Earth fault
MCTRL_bIxtOverload_b					Monit: I x t overload
MCTRL_nPos_a	Integer	Analog	–	–	Actual phase value as analog signal ● 90° = 100 %
MCTRL_nNAct_v	Integer	Velocity	–	–	Actual speed value [rpm]
MCTRL_nNAct_a	Integer	Analog	–	–	Actual speed value ● In % of n_{max} (C0011)
MCTRL_dnPos_p	Double integer	Position	–	–	Rotor position of the motor
MCTRL_bNmaxFault_b	Bool	Binary	–	–	Monit: Max. system speed exceeded.
MCTRL_nNmaxC11	Integer	–	–	–	Display of max. speed (C0011)
MCTRL_bActTPReceived_b	Bool	Binary	–	–	Reception of touch probe (TP).
MCTRL_bActIncLastScan_b	Double integer	Position	–	–	Δinc between TP and start of the task
MCTRL_bResolverFault_b	Bool	Binary	–	–	Monit: Resolver fault
MCTRL_bEncoderFault_b					Monit: Encoder fault
MCTRL_bSensorFault_b					Monit: Absolute value encoder fault
MCTRL_bMotorTempGreaterSetValue_b					Monit: Motor temperature > 150 °C
MCTRL_bMotorTempGreaterC0121_b					Monit: Motor temperature > C0121
MCTRL_bPtcOverTemp_b					Monit: Motor overtemperature (PTC)
MCTRL_bKuehlGreaterSetValue_b					Monit: Cooling temperature > 90 °C
MCTRL_bKuehlGreaterC0122_b					Monit: Cooling temperature > C0122

9.3 Diagnostics with the XT EMZ9371BC keypad

The two submenus ”Actual info” and ”History” in the ”Diagnostics” menu contain all codes for the

- drive monitoring
- fault/error diagnostics

Status messages are additionally displayed in the operating level. If several status messages are active, the message with the highest priority is displayed:

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

10 Troubleshooting and fault elimination

A failure can be quickly detected by means of display elements or status information via the MotionBus (CAN)

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

In the chapter ”10.3 Fault messages”, (🕮 230) you can find notes on causes and fault elimination.

10.1 Fault analysis

10.1.1 Fault analysis via the LED display

LED		Operating state	Check
Red	Green		
Off	On	Controller enabled, no fault	
Off	Blinking	Controller inhibit (CINH) active, switch-on inhibit	C0183
Blinking	Off	Trouble/fault (TRIP) is active	C0168/1
Blinking	On	Warning/FAIL-QSP is active	C0168/1

10.1.2 Fault analysis with keypad XT EMZ9371BC

The status messages in the display indicate the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited.	C0183, C0168/1
IMP	Pulses at the power stage inhibited.	C0183, C0168/1
Imax	Maximum current reached.	
Mmax	Maximum torque reached.	
FAIL	Fault through TRIP, message, fail QSP or warning.	C0183, C0168/1

10.1.3 Fault analysis with the history buffer

The history buffer enables you to trace faults. The corresponding fault messages are stored in 8 memory locations in the sequence of their occurrence.

The memory locations can be retrieved via the codes.

Structure of the history buffer

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

Note!

- If several faults with different responses occur at the same time, only the fault the response of which has the highest priority is entered in the fault memory.
  - TRIP (highest) → message → FAIL-QSP → warning (lowest)
- If several faults with the same response occur at the same time, (e.g. two fault messages) only the fault that occurred first is entered in the fault memory.
- If a fault occurs several times in quick succession, only the time of the last occurrence is entered in the fault memory.

Assignment of information to the codes

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

Delete entries in the history buffer

The entries in the history buffer can be deleted via C0167.

► This function only works when no trouble is active.

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0167	Reset failmem	0			Delete history buffer (C0168)	📖 226
			0	No reaction		
			1	Delete history buffer		

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

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

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0150	Status word	0			Status word for networking via automation interface (AIF) Only display
			0 {1} 65535		Controller evaluates information as 16 bits (binary coded)
			Bit 0	Not assigned	
			Bit 1	Pulse inhibit (IMP) is active	
			Bit 2	Not assigned	
			Bit 3	Not assigned	
			Bit 4	Not assigned	
			Bit 5	Not assigned	
			Bit 6	n=0	
			Bit 7	Controller inhibit (CINH) is active	
			Bit 8	Controller status	
			Bit 9	Controller status	
			Bit 10	Controller status	
			Bit 11	Controller status	
			Bit 12	Warning is active	
			Bit 13	Message is active	
			Bit 14	Not assigned	
			Bit 15	Not assigned	
C0155	Status word 2	0			Status word 2 (extended status word) Only display
			0 {1} 65535		Controller evaluates information as 16 bits (binary coded)
			Bit 0	Fail	
			Bit 1	Mmax	
			Bit 2	Imax	
			Bit 3	Pulse inhibit is active (IMP)	
			Bit 4	Ready for operation (RDY)	
			Bit 5	Controller inhibited (CINH)	
			Bit 6	TRIP is active	
			Bit 7	Init	
			Bit 8	Direction of rotation of the motor (CW/CCW)	
			Bit 9	Not assigned	
			Bit 10	Not assigned	
			Bit 11	Not assigned	
			Bit 12	Not assigned	
			Bit 13	Not assigned	
			Bit 14	Not assigned	
			Bit 15	Not assigned	

10.2 Malfunction of the drive

Maloperation / fault	Cause	Remedy
Feedback system		
• Motor rotates CCW when viewed to the motor shaft. • C0060 counts down after controller enable.	Feedback system is not connected in correct phase relation.	Connect feedback system in correct phase relation.
Asynchronous motor		
• Motor rotates with I_{max} and half slip frequency. • Motor does not react to setpoint change.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W
Synchronous motor		
• Motor does not follow the setpoint change. • I_{max} follows the setpoint selection in idle state.	Motor is not connected in correct phase relation.	Connect motor in correct phase relation at the terminals U, V, W
• Motor rotates CCW when viewed to the motor shaft. • The synchronous motor accelerates with a speed setpoint = 0 to the rated speed. • The torque of the synchronous motor is too low.	The rotor angle (offset of electrical and mechanical rotor angle) is not correct.	Carry out rotor position adjustment (C0095 = 1) or set rotor displacement angle manually. **Operate motor without load for this purpose!**
• Motor blocks in certain positions.	The number of pole pairs of the resolver or motor is not set correctly.	Number of pole pairs (C0080) must be set correctly.

10.3 Fault messages

10.3.1 Causes and remedies

Tip!

When the fault messages are retrieved via the MotionBus/system bus (CAN), the fault messages are displayed as numbers (see column ”Fault message – No.” in the following table).

Fault message		Description	Cause	Remedy
No.	Display			
---	---	No fault	-	-
0011	OC1	Short circuit of motor cable	Short circuit	• Search for cause of short circuit. • Check motor cable.
			Excessive capacitive charging current in the motor cable.	Use motor cable which is shorter or of lower capacitance.
0012	OC2	Motor cable earth fault	One of the motor phases has earth contact.	• Search for cause of short circuit. • Check motor cable.
0015	OC5	I x t overload TRIP (axis module, fix 100 %)	Current overload of the axis module, e.g. by: • frequent and too long acceleration processes • continuous overload with $I_{motor} > 1.05 \times I_{Nx}$	Check drive dimensioning.
0016	OC6	I^2 x t overload TRIP (motor, C0120)	Current overload of the motor, e.g. due to: • frequent or too long acceleration processes • impermissible continuous current	• Check drive dimensioning. • Check setting of C0120.
x017	OC7	I x t overload warning (axis module, C0123)	Current overload of the axis module > C0123 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0123.
x018	OC8	I^2 x t overload warning (motor, C0127)	Current overload of the motor > C0127 (e.g. due to frequent or too long acceleration phases)	• Check drive dimensioning. • Check setting of C0127.
1020	OU	Overvoltage in DC bus	Braking energy is too high. (DC-bus voltage is higher than set in C0173.)	• Use braking unit or regenerative module. • Check dimensioning of the brake resistance.
1030	LU	Undervoltage in DC bus	DC-bus voltage is lower than specified under C0174.	• Check mains voltage. • Check power supply module.
x032	LP1	Motor phase failure	A current-carrying motor phase has failed.	• Check motor. • Check motor cable. • Switch off monitoring (C0597 = 3).
			The current limit value is set too low.	• Set higher current limit value via C0599.
x041	AP1	Internal fault		Contact Lenze.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message No.	Display	Description	Cause	Remedy
0050	OH	Heatsink temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heatsink is very dirty.	Clean heatsink.
			Wrong mounting position	Change mounting position.
0051	OH1	Interior temperature > +90 °C	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Wrong mounting position	Change mounting position.
x053	OH3	Motor temperature > +150 °C threshold (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: • Impermissible continuous current • Frequent or too long acceleration processes	• Check drive dimensioning. • Switch off monitoring (C0583 = 3).
			No PTC/temperature contact connected.	Correct wiring.
x054	OH4	Heatsink temperature > C0122	Ambient temperature T_u > +40 °C or > +50 °C	• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0582 = 3).
			Heatsink is very dirty.	Clean heatsink
			Wrong mounting position	Change mounting position.
			The value specified under C0122 is set too low.	Enter a higher value under C0122.
x055	OH5	Interior temperature > C0124		• Allow module to cool and ensure better ventilation. • Check ambient temperature in the control cabinet. • Switch off monitoring (C0605 = 3).
			The value under C0124 is set too low.	Enter a higher value under C0124.
x057	OH7	Motor temperature > C0121 (temperature detection via resolver or incremental value encoder)	Motor is thermally overloaded due to: • Impermissible continuous current • Frequent or too long acceleration processes	• Check drive dimensioning. • Switch off monitoring (C0584 = 3).
			No PTC/temperature contact connected.	Correct wiring.
			The value specified under C0121 is set too low.	Enter a higher value in C0121.
x058	OH8	Motor temperature via inputs T1 and T2 is too high.	Motor is thermally overloaded due to: • Impermissible continuous current • Frequent or too long acceleration processes	• Check drive dimensioning. • Switch off monitoring (C0585 = 3).
			Terminals T1 and T2 are not connected	Connect PTC/temperature contact.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message No.	Display	Description	Cause	Remedy
x061	CE0	Automation interface (AIF) communication error	Faulty transfer of control commands via AIF.	• Plug on the communication module/keypad XT firmly, screw down, if necessary. • Switch off monitoring (C0126 = 3).
x062	CE1	Communication error at the process data input object CAN1_IN	CAN1_IN object receives faulty data or communication is interrupted.	• Check wiring at X4. • Check transmitter. • Increase monitoring time under C0357/1, if necessary. • Switch off monitoring (C0591 = 3).
x063	CE2	Communication error at the process data input object CAN2_IN	CAN2_IN object receives faulty data or communication is interrupted.	• Check wiring at X4. • Check transmitter. • Increase monitoring time under C0357/2, if necessary. • Switch off monitoring (C0592 = 3).
x064	CE3	Communication error at the process data input object CAN3_IN	CAN3_IN object receives faulty data or communication is interrupted.	• Check wiring at X4. • Check transmitter. • Increase monitoring time under C0357/3, if necessary. • Switch off monitoring (C0593 = 3).
x065	CE4	BUS-OFF state of system bus (CAN), interface X4	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X4: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C0595 = 3).
x066	CE5	System bus (CAN) time-out (communication error of gateway function), interface X4	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X4. • Check CAN bus configuration. • Switch off monitoring (C0603 = 3).
0070	U15	Undervoltage of internal 15 V voltage supply		Check voltage supply.
x071	CCR	System fault	Strong interference on the control cables	Control cables must be shielded.
			Ground or earth loops in wiring	• Check wiring. • Check PE connection.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
0072	PR1	Check sum error in parameter set 1 **ATTENTION: Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption during the transmission of the parameter set via keypad.	• Set the desired parameters and store with C0003 = 1. • For PLC devices check the use of pointers.
			The saved parameters do not match the software version loaded	In order to be able to reset the fault, first save the parameter set with C0003 = 1.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message No.	Display	Description	Cause	Remedy
0074	PEr	Program error	Error in the program flow	• Check use of pointers. • Send module with PLC program and parameter set to Lenze (on floppy disk/CD-ROM).
0075	PR0	Parameter set error **ATTENTION: Lenze setting is loaded automatically!**	• Fault when loading a parameter set. • Interruption during the transmission of the parameter set via keypad.	• Set the desired parameters and store with C0003 = 1. • Additionally switch off the supply voltage. • For PLC devices check the use of pointers.
			The saved parameters do not match the software version loaded	In order to be able to reset the fault, first save the parameter set with C0003 = 1.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
0079	PI	Fault during parameter initialisation	• An error has been detected during parameter set transfer between two controllers. • Parameter set does not match the controller, e.g. when data were transmitted from a controller with more performance to a controller with less performance.	• Correct parameter set. • Check code initialisation values. **After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!**
0080	PR6	**With ECSxS/P/M:** internal error		Contact Lenze.
		With ECSxA: too many user codes		Reduce number of user codes.
0081	Rel1	Error on brake relay output (X25)	• Cable breakage • Short circuit • No supply voltage	• Check fuse. • Check supply. • Check cables. • Check motor holding brake
x082	Sd2	Resolver error on X7	Resolver cable is interrupted.	• Check cable for wire breakage. • Check resolver. • Switch off monitoring (C0586 = 3).
			Excitation amplitude is too low.	Increase excitation amplitude of resolver (C0416).
x085	Sd5	Master current value encoder error on analog input X6/AI+, AI- (C0034 = 1)	Master current value on X6/AI+, AI- < 2mA	• Check cable for wire breakage. • Check master current value encoder. • Switch off monitoring (C0598 = 3).
x086	Sd6	Motor temperature sensor error (X7 or X8)	Encoder for detecting the motor temperature at X7 or X8 indicates undefined values.	• Check cable for firm connection. • Switch off the monitoring (C0594 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
x087	sd7	Initialisation error of absolute value encoder at X8	• Defect of the encoder electronics • Absolute value encoder at X8 does not send any data. **Tip:** The encoder may not rotate during mains switching.	• Check cable at X8 with regard to tight fit and open circuit. • Check absolute value encoder with regard to correct function. • Set voltage supply to 8.1 V via C0421. • No Stegmann encoder connected. • Replace defective encoder.
		Communication error of absolute value encoder at X8 during rotor position adjustment	A rotor position adjustment via C0095 = 1 could not be completed successfully.	Repeat rotor position adjustment. **Note:** After an Sd7 fault it is absolutely required to carry out a further rotor position adjustment. Otherwise the drive may carry out uncontrolled movements after controller enable. The drive may not be commissioned without having carried out a rotor position adjustment successfully!
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x088	SD8	SinCos encoder at X8 sends inconsistent data.	The tracks in the SinCos encoder are damaged.	Replace SinCos encoder.
			Interference level on the encoder cable is too high.	• Check correct shield connection of encoder cable. • Where required, decelerate the actuation of the fault message via the filter time constant. Setting: – for ECSxS/P/M/A in C0559. – for 9300 servo cam in C0575.
		SinCos encoder at X8 does not send any data.	Open circuit.	Check cable with regard to open circuit.
			Incorrect encoder connected.	Connect SinCos encoder of the company Stegmann.
			SinCos encoder defective.	Replace SinCos encoder.
			Supply voltage set incorrectly.	Set voltage supply in C0421.
				After fault correction: completely deenergise the device (switch off 24 V supply, discharge DC bus)!
x089	PL	Error during rotor position adjustment	• Sd7 fault during rotor position adjustment with absolute value encoder after mains switching • Cancellation of rotor position adjustment (e.g. by C0095 = 0 or switching off)	1. Activate rotor position adjustment with C0095 = 1. 2. Carry out TRIP reset. 3. Repeat rotor position adjustment.
x091	EEr	External monitoring has been actuated via **DCTRL**.	A digital signal assigned to the TRIP-SET function has been activated.	• Check external encoder. • Switch off the monitoring (C0581 = 3).
x095	FAN1	Fan monitoring (for built-in units)	Heatsink fan is locked, dirty or defect.	Clean or exchange heatsink fan.
0105	H05	Internal fault (memory)		Contact Lenze.
0107	H07	Internal fault (power stage)	During initialisation of the controller, an incorrect power stage was detected.	Contact Lenze.

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message No.	Display	Description	Cause	Remedy
x108	H08	”Extension board” error	”Extension board” not connected correctly.	• Connect ”extension board” correctly. • Check connector.
			”Extension board” is not supported by PLC program.	• Adapt PLC program to ”extension board”. • Use ”extension board” which is supported by PLC program.
X110	H10	Heatsink temperature sensor error	Sensor for detecting the heatsink temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x111	H11	Temperature sensor error: Temperature inside the controller	Sensor for detecting the internal temperature indicates undefined values.	• Contact Lenze. • Switch off the monitoring (C0588 = 3).
x122	CE11	Communication error at the process data input object CANaux1_IN	CANaux1_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/1, if necessary. • Switch off monitoring (C2481 = 3).
x123	CE12	Communication error at the process data input object CANaux2_IN	CANaux2_IN object receives faulty data or communication is interrupted.	• Check wiring at X14. • Check transmitter. • Increase monitoring time under C2457/2, if necessary. • Switch off monitoring (C2482 = 3).
x124	ce13	Communication error at the process data input object CANaux3_IN	CANaux3_IN object receives faulty data or communication is interrupted.	• Check wiring on X14. • Check transmitter. • Increase monitoring time under C2457/3, if necessary. • Switch off monitoring (C2483 = 3).
x125	CE14	BUS-OFF state of system bus (CAN), interface X14	The module has received too many incorrect telegrams via the system bus (CAN) and has disconnected from the bus	• Check wiring at X14: bus termination available? • Check screen contact of the cables. • Check PE connection. • Check bus load, reduce baud rate, if necessary (Observe cable length!) • Switch off monitoring (C2484 = 3).
x126	CE15	System bus (CAN) time-out (communication error of gateway function), interface X14	For remote parameterisation (C0370, C0371) via system bus (CAN): • Slave does not respond. • Communication monitoring time has been exceeded.	• Check wiring at X14. • Check CAN bus configuration. • Switch off monitoring (C2485 = 3).
x190	nErr	Speed control error (speed out of tolerance margin (C0576))	• Active load (e.g. for hoists) is too high. • Mechanical blockades on the load side	Check drive dimensioning.
x191	HSF	Internal error		Contact Lenze.
x200	Nmax	Maximum speed (C0596) has been exceeded.	• Active load (e.g. for hoists) is too high • Drive is not speed-controlled, torque is excessively limited.	• Check drive dimensioning. • Possibly increase torque limit. • Switch off monitoring (C0607 = 3).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

<table>
<tr><th colspan="2">Fault message</th><th rowspan="2">Description</th><th rowspan="2">Cause</th><th rowspan="2">Remedy</th></tr>
<tr><th>No.</th><th>Display</th></tr>
<tr><td>0201

...

0208</td><td>overrun Task1
...
overrun Task8</td><td>Time-out in task 1 (ID 2)
...
Time-out in task 8 (ID 9)</td><td>Task processing takes longer than the monitoring time set.</td><td>● Adjust the length of the task runtime.
● Adjust monitoring time.
● Determine the cause of time-out by checking the task runtime at the task monitor.
● Swap out time-critical program parts in a slower task.</td></tr>
<tr><td>0209</td><td>float Sys-T</td><td>Float error in system task (ID 0)</td><td rowspan="3">Error in real calculation (e. g. division by 0)</td><td rowspan="3">Check calculations (program code).</td></tr>
<tr><td>0210</td><td>float Cycl.-T</td><td>Float error in cyclic task (PLC_PRG ID 1)</td></tr>
<tr><td>0211
...
0218</td><td>float Task1
...
float Task8</td><td>Float error in task 1 (ID 2)
...
Float error in task 8 (ID 9)</td></tr>
<tr><td>0219</td><td>overrun Cyc.-T</td><td>Time-out in cyclic task (PLC_PRG ID 1)</td><td>Task processing takes longer than the monitoring time set.</td><td>● Adjust the length of the task runtime.
● Adjust monitoring time.
● Determine the cause of time-out by checking the task runtime at the task monitor.
● Swap out time-critical program parts in a slower task.</td></tr>
<tr><td>0220</td><td>noT-Fkt Credit</td><td>Not enough technology units available.</td><td>A program with technology functions has been tried to be loaded to a controller not providing the corresponding units.</td><td>● Use technology variant of the controller.
● Contact Lenze, if necessary.</td></tr>
<tr><td>0230</td><td>No Program</td><td>Missing PLC program</td><td>No PLC program loaded.</td><td>Load PLC program.</td></tr>
<tr><td>0231</td><td>Unallowed Lib</td><td>PLC program calls invalid library function.</td><td>In the PLC program a library function has been called which is not supported by the controller (e.g. because the corresponding hardware is missing).</td><td>● Remove library function or ensure that the corresponding hardware is available.
● Contact Lenze, if necessary.</td></tr>
<tr><td>x240</td><td>ovrTrans Queue</td><td rowspan="2">”Free CAN objects” error</td><td>Overflow of the transmit request memory</td><td>● Reduce the number of transmit requests.
● Prolong the cycle time.</td></tr>
<tr><td>x241</td><td>ovr Receive</td><td>Too many receive telegrams</td><td>Reduce the number of telegrams on the system bus (CAN).</td></tr>
<tr><td>x260</td><td>Err Node Guard</td><td>”Life guarding event”</td><td>The controller configured as CAN slave does not receive a ”Node Guarding” telegram with the ”Node Life Time” from the CAN master.</td><td>● Check wiring on X4/X14.
● Check CAN configuration.
● Ensure that ”Node Guarding” has been activated in the CAN master.
● Adjust ”Node Life Time” (C0383) to the setting in the CAN master.</td></tr>
<tr><td>x400</td><td>Pos HW End</td><td>Positive hardware limit switch has been approached.</td><td>● Hardware limit switch has been overtravelled or has not been set.
● Cable is interrupted.
● ECSxS/P/A:
Terminal polarity X6/DI3, DI4 (C0114/3, C0114/4) is set incorrectly.</td><td>● Check traversing range.
● Check position/function of the limit switches.
● Check cable for wire breakage.
● ECSxS/P/A:
Correct setting C0114/3 and C0114/4.</td></tr>
</table>

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

Fault message		Description	Cause	Remedy
No.	Display			
x401	Neg HW End	Negative hardware limit switch has been approached.	• Hardware limit switch has been overtravelled or has not been set. • Cable is interrupted. • **ECSxS/P/A**: Terminal polarity X6/DI3, DI4 (C0114/3, C0114/4) is set incorrectly.	• Check traversing range. • Check position/function of the limit switches. • Check cable for wire breakage. • **ECSxS/P/A**: Correct setting C0114/3 and C0114/4.
x404	Follow Err 1	Warning against exceeding the following error limit (C3030).	• Following error input of the motor control (MCTRL) exceeds the limit value set (C3030/C3031). • Difference between setpoint and actual value is too big.	• Reduce acceleration. • Increase limit value (C3030/C3031). • Increase current limit (C0022). (Observe max. motor current!) • Avoid setpoint step-change of the higher-level control. • Check drive dimensioning.
x405	Follow Err 2	Following error limit (C3031) has been exceeded.		
x406	Home Pos Err	Home position is unknown.	• No homing executed. • Error in the feedback system	• Start homing. • Check feedback. • Switch off monitoring in C3170.
x407	Toggle Bit Err	Toggle bit error	• Telegrams with the same toggle bit value have arrived. • Communication is interrupted. • Bus load is too high.	• Check bus cable. • Does the master control change the bit? • Reduce bus load. • Set toggle bit error limit (C3161) an error response (C3160).
3408	External QSP	Externally enabled quick stop (FAIL-QSP)	Digital input X6/DI1 has been set.	• Check cable for wire breakage. • Check setting C0114/1. • Check emergency stop circuit.
x410	VelModeErr	Speed error in "Velocity Mode" (C5000 = 2)	The actual speed value cannot follow the speed setpoint: Difference > 25.00 % (Lenze setting C3037).	Set error threshold (C3037) and error response (C3038).

x: 0 = TRIP, 1 = Message, 2 = Warning, 3 = FAIL-QSP

10.3.2 Reset fault messages (TRIP-RESET)

Reaction	Measures to reset the fault message
TRIP/ FAIL-QSP	**Note!** As long as a TRIP/FAIL-QSP source is active, the TRIP/FAIL-QSP cannot be reset. The TRIP/FAIL-QSP can be reset by: • Press keypad XT EMZ9371 BC ⇨ STOP. Then, press RUN to re-enable the axis module. • Set C0043 = 1. • MotionBus (CAN) control word: set C3153/12 (Bit 11) = 1. • Set control word C4040/Bit 11 = 1. (Dependent on the control interface selected in C4010.) After the TRIP/FAIL-QSP has been reset, the drive remains at standstill.
Message	**Danger!** After the fault has been removed, the fault message is removed automatically and the drive restarts automatically.
Warning	After eliminating the fault, the fault message is reset automatically.

11 Appendix

11.1 Code table

Column	Abbreviation		Meaning
No.	Cxxxx		Code no. Cxxxx
	1		Subcode 1 of Cxxxx
	2		Subcode 2 of Cxxxx
	Cxxxx		Changed parameter of the code or subcode is accepted after pressing SHIFT PRG.
	[Cxxxx]		Changed parameter of the code or subcode is accepted after pressing SHIFT PRG if the controller is inhibited.
Designation			LCD of XT EMZ9371BC keypad
Lenze/{Appl.}	x		Lenze setting: ● Value at delivery or after loading the Lenze setting with C0002.
	{xxx...}		Deviating application initialisation value: ● Value at delivery. ● After loading the Lenze setting with C0002, the application initialisation value is overwritten by the Lenze setting. ● The application initialisation values can be restored by loading the application software with "Global Drive Loader" (GDL).
			The column "Important" contains further information
Selection	1 {%} 99		Minimum value {unit} maximum value
IMPORTANT			Short code description

Code		Possible settings			IMPORTANT
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**		
C0002	Par load	0			Load parameter set
			0	Load Lenze setting	Load Lenze setting in the RAM and activate: **Only possible if C2108 = 2.**
			1	Load parameter set1	Load parameter set 1 in the RAM and activate: **Parameter set 1 is loaded automatically after every mains connection.**
C0003	Par save	0			Save parameter set
			0	Done	Saving completed
			1	Save parameter set 1	Non-volatile saving of parameter set 1
C0004	Op display	56			Keypad status display
			1	{Code no.} 9999	The keypad displays the selected code in the operating level, if no status messages from C0183 are active (e. g.: 56 = torque setpoint (C0056))
[C0006]	Op mode	1			Operating mode of the motor control
			1	Servo PM-SM	Servo control of synchronous motors
			2	Servo ASM	Servo control of asynchronous motors

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0009	LECOM ADDRESS	1				Device address for operation via AIF interface
			1	{1}	99	Communication modules on AIF interface: ● LECOM-A/B/LI 2102 – 10, 20, ..., 90 are reserved for broadcast to groups of nodes ● PROFIBUS-DP 213x Operation via MotionBus (CAN): ● Set CAN node address in C0350
C0011	Nmax	3000				Maximum speed
			500	{1 rpm}	16000	Reference value for the absolute and relative setpoint selection for the acceleration and deceleration times. **For parameter setting via interface: greater changes in one step should only be made when the controller is inhibited (CINH)!**
C0017	FCODE (QMIN)	50				Used for speed signals
			-16000	{1 rpm}	16000	
C0018	fchop	2				Switching frequency
			1	4 kHz sin		4 kHz permanent PWM frequency
			2	8/4 kHz sin		8 kHz PWM frequency with automatic derating to 4 kHz at high load
C0019	Thresh nact = 0	0				Threshold, when N_{act} = 0 rpm is detected
			0	{1 rpm}	16000	
C0022	Imax current	→				I_{max} limit
			0	{0.01 A}		→ Device-dependent list Max. current can be gathered from the technical data.
C0023	Imax fld.weak	0				Maximum field weakening current for synchronous machines
			0	{1 %}	100	
C0026						Used for relative analog signals
1	FCODE (offset)	0,0	-199,99	{0,01 %}	199,99	
2	FCODE (offset)	0,0				
C0027						Used for relative analog signals
1	FCODE (gain)	100,0	-199,99	{0,01 %}	199,99	
2	FCODE (gain)	100,0				

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0030	DFOUT CONST	3				Constant for the master frequency output in increments per revolution	📖 97 📖 98
			0	256 inc/rev			
			1	512 inc/rev			
			2	1024 inc/rev			
			3	2048 inc/rev			
			4	4096 inc/rev			
			5	8192 inc/rev			
			6	16384 inc/rev			
C0034	MST CURRENT	0				Selection: master voltage/master current for analog setpoint selection	
			0	-10 ... + 10 V		Master voltage	
			1	+4 ... +20 mA		Master current	
			2	-20 ... +20 mA			
C0037	Set-value rpm	0				Setpoint selection in rpm	
			-16000	{1 rpm}	16000		
C0040	Ctrl enable	1				Controller inhibit (CINH) ● Writing: Controls the controller inhibit ● Reading: Reads the status of the controller inhibit	
			0	Controller inhibited			
			1	Controller enabled			
C0042	DIS: QSP					Quick stop status (QSP) Only display	📖 143
			0	QSP not active			
			1	QSP active			
C0043	Trip reset					Reset active fault message (TRIP RESET)	📖 237
			0	Reset fault message (TRIP RESET)			
			1	Active fault message			
C0050	MCTRL-NSET2					Speed setpoint on the input of the speed controller Read only	
			-100.00	{0.01 %}	100.00		
C0051	MCTRL-NACT					Actual speed Only display	
			-30000	{1 rpm}	30000		
C0052	MCTRL Umot					Actual motor voltage Only display	
			0	{1 V}	800		
C0053	UG-VOLTAGE					DC-bus voltage Only display	
			0	{1 V}	900		
C0054	Imot					Actual motor current Read only	
			0.0	{0.1 A}	500.0		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0055	Phase current					Instantaneous phase current Read only	
1	iu		0.0	{0.1 A}	500.0	Instantaneous current in U phase	
2	iv					Instantaneous current in V phase	
3	iw					Instantaneous current in W phase	
4	Io					Instantaneous theoretical star-point current	
C0056	MCTRL-MSET2					Speed setpoint on the output of the speed controller Only display	
			-100	{1 %}	100		
C0057	MAX TORQUE					Maximum possible torque of the drive configuration Dependent on C0022, C0081, C0087, C0088 Read only	
			0.0	{0.1 Nm}	500.0		
C0058	Rotor diff	-90.0				Rotor displacement angle for synchronous motors (C0095)	🕮 149
			-180.0	{0.1 °}	179.9		
C0059	Mot pole no.					Pole pair number of the motor Only display	
			1	{1}	200		
C0060	Rotor pos					Current rotor position Read only	🕮 146
			0	{1 inc}	2047	1 revolution = 2048 increments	
C0061	Heatsink temp					Heatsink temperature Read only	🕮 206
			0	{1 °C}	100		
C0062	Interior temp					Interior temperature Read only	🕮 207
			0	{1 °C}	100		
C0063	Mot temp					Motor temperature Only display	🕮 205
			0	{1 °C}	200		
C0064	Utilization					Device utilisation I x t during the last 180 s Read only	🕮 208
			0	{1 %}	150	• C0064 > 100 % actuates OC5-TRIP • TRIP reset is only possible if C0064 < 95 %	
C0065	U24 ext					External supply voltage Read only	
			0.0	{0.1V}	100.0		
C0066	Motor load					Thermal motor load $I^{2x}t$ Only display	🕮 210
			0	{1 %}	250		
C0067	Act trip					Current TRIP (In case of FAIL-QSP, warning, and message, "0" is displayed.) Only display	🕮 230

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0070	Vp speedCTRL	3.0				Proportional gain of speed controller (V_{pn})	🕮 152
			0.00	{ 0.01}	127.99		
C0071	Tn speedCTRL	24.0				Reset time - speed controller (T_{nn})	🕮 152
			1.0	{0.5 ms}	6000.0		
C0072	Td speedCTRL	0.0				Derivative gain of speed controller (T_{dn})	🕮 152
			0.0	{0.1 ms}	32.0		
C0074	Dynamics	0 {1}				Pilot control of the current controller for higher dynamics	🕮 147
			0	Normal			
			1	Enhanced			
C0075	Vp currCTRL	20.0				Proportional gain of current controller (V_{pi}) The upper limit is device-dependent.	🕮 147
			0.00	{0.01 Ω}	381.80	ECSxS/P/M/A004	
					190.90	ECSxS/P/M/A008	
					95.46	ECSxS/P/M/A016	
					47.72	ECSxS/P/M/A032	
					31.82	ECSxS/P/M/A048	
					23.86	ECSxS/P/M/A064	
C0076	Tn currCTRL	5.0				Reset time of current controller (T_{ni})	🕮 147
			0.01	{0.01 ms}	200.00		
C0077	Vp fieldCTRL	5.0				Field controller gain (V_{pF})	🕮 154
			0.00	{0.01}	63.99		
C0078	Tn fieldCTRL	20.0				Field controller reset time (T_{nF})	🕮 154
			1.0	{0.5 ms}	6000.0		
C0079	DIS:Lh					Mutual inductance of the asynchronous motor Read only	
			0.0	{0.1 mH}	3276.7		
[C0080]	Res pole no.	1				Number of pole pairs of resolver	
			1	{1}	10		
[C0081]	Mot power	3.20				Rated motor power according to nameplate	
			0.01	{0.01 kW}	500.00		
[C0082]	DIS:Rr					Rotor resistance of the asynchronous motor Read only	
			0.000	{0.001 Ω}	32.767		
C0083	DIS:Tr					Rotor time constant of the asynchronous motor Read only	
			0.00	{0.01 ms}	327.67		

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
[C0084]	Mot Rs	1.10				Stator resistance of the motor The upper limit is device-dependent.
			0.00	{0.01 Ω}	95.44	ECSxS/P/M/A004
					47.72	ECSxS/P/M/A008
					23.86	ECSxS/P/M/A016
					11.93	ECSxS/P/M/A032
					7.95	ECSxS/P/M/A048
					5.96	ECSxS/P/M/A064
[C0085]	Mot Ls	5.30				Leakage inductance of the motor
			0.00	{0.01 mH}	200.00	
[C0087]	Mot speed	3700				Rated motor speed
			300	{1 rpm}	16000	
[C0088]	Mot current	7.0				Rated motor current
			0.5	{0.1 A}	500.0	
[C0089]	Mot frequency	185				Rated motor frequency
			10	{1 Hz}	1000	
[C0090]	Mot voltage	325				Rated motor voltage
			50	{1 V}	500	
[C0091]	Mot cos phi	1.0				cos φ of the asynchronous motor
			0.50	{0.01}	1.00	
C0092	DIS:Isdeff					Magnetising current of the asynchronous motor Only display
			0.00	{0.01 A}	327.67	
C0093	Drive ident					Device identification of the ECS axis module Read only
			0	Defective power section		
			1	No power section recognised		
			4	ECSxS/P/M/A004C4		
			8	ECSxS/P/M/A008C4		
			16	ECSxS/P/M/A016C4		
			32	ECSxS/P/M/A032C4		
			48	ECSxS/P/M/A048C4		
			64	ECSxS/P/M/A064C4		
			65	ECSxS/P/M/A064C2		
C0094	Password	0				Password Parameter access protection for the keypad
			0 0 = no password	{1}	9999	When the password is activated, only the codes of the user menu (C0517) can be accessed. Further possible selections: see C0096

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0095]	Rotor pos adj	0				Activation of rotor position adjustment of a synchronous motor C0058 shows the rotor displacement angle.	📖 149
			0	Inactive			
			1	Active			
C0096						Extended password protection for bus systems with activated password (C0094) All codes in the user menu can be accessed.	
1	AIF/CAN prot.	0		No access protection		AIF access protection	
2	AIF/CAN prot.	0		No access protection		CAN access protection	
			0	No access protection		Full access	
			1	Write protection		Reading not possible	
			2	Write protection		Writing not possible	
			3	Read/write protection		Reading and writing not possible	
C0097	DIS:Lt-Ident					Without function	
C0098	Set position	0				Position offset	
			-2147483647	{1 inc}	2147483647		
C0099	S/W version					Software version Only display	
C0105	QSP Tif	0.0				Deceleration time for quick stop (QSP)	📖 143
			0.000	{0.001 s}	999.999	Relating to speed variation n_{max} (C0011) ...0 rev./min.	
C0108						Used for relative analog signals	
1	FCODE (gain)	100,0	-199,99	{0,01 %}	199,99		
2	FCODE (gain)	100,0					
C0109						Used for relative analog signals	
1	FCODE (offset)	0,0	-199,99	{0,01 %}	199,99		
2	FCODE (offset)	0,0					
C0110 ... C0113	Service codes					**Only the Lenze service is allowed to make changes!**	
			50	{1 %}	200	For controlling an asynchronous motor	
C0114						Polarity of the digital inputs (DIGIN)	
1	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI1	
2	DIGIN pol	0 {0}		HIGH level active) {HIGH level active}		X6/DI2	
3	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI3	
4	DIGIN pol	0 {1}		HIGH level active) {LOW level active}		X6/DI4	
			0	HIGH level active)			
			1	LOW level active			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0118						Polarity of the digital outputs (DIGOUT)	
1	DIGOUT pol	0		HIGH level active)		X6/DO1	
2	DIGOUT pol	0		HIGH level active)		X25/BD1, X25/BD2 (Brake connection)	
			0	HIGH level active)			
			1	LOW level active			
C0120	OC6 limit	105				Threshold for I^2 x t disconnection (motor)	🕮 210
			0	{1 %}	120	0 = I^2 x t monitoring is switched off I^2 x t > C0120 ⇨ TRIP 006	
C0121	OH7 limit	120				Adjustable threshold for early motor temperature warning	🕮 205
			45	{1 °C}	150	Motor temperature > C0121 ⇨ fault OH7	
C0122	OH4 limit	80				Adjustable threshold for early heatsink temperature warning	🕮 206
			45	{1 °C}	90	Heatsink temperature > C0122 ⇨ fault OH4	
C0123	OC7 limit	90				Adjustable threshold for I x t advance warning (axis module)	🕮 208
			0	{1 %}	100	C0064 > C0123 ⇨ fault OC7	
C0124	OH5 limit	75				Adjustable threshold for early warning of temperature inside the device	🕮 207
			10	{1 %}	90	C0062 > C0124 ⇨ fault OH5	
C0125	Baud rate	0				Baud rate for accessory module LECOM A/B/LI	
			0	9600 bit/s			
			1	4800 bit/s			
			2	2400 bit/s			
			3	1200 bit/s			
			4	19200 bit/s			
C0126	MONIT CE0	3				Communication monitoring on the automation interface (AIF).	
			0	TRIP		A communication error ("CommErr") actuates the response set.	
			2	Warning			
			3	Off		Monitoring switched off.	
C0127	OC8 limit	100				Threshold for I^2 x t advance warning (motor)	🕮 210
			0	{1 %}	120	I^2 x t > C0127 ⇨ response as set in C0606	
C0128	Tau motor	5.0				Thermal time constant of the motor	🕮 210
			1.0	{0.1 min}	25.0	For calculating the I^2xt-disconnection	

Code		Possible settings			IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection		
C0135	Control word	0			Control word for networking via automation interface (AIF)
			0 {1} 65535		Controller interprets information as 16 bits (binary coded)
			Bit 0	Not assigned	
			Bit1	Not assigned	
			Bit2	Not assigned	
			Bit3	Activate quick stop (QSP)	
			Bit4	Not assigned	
			Bit5	Not assigned	
			Bit6	Not assigned	
			Bit 7	Not assigned	
			Bit 8	Activate operation inhibit (DISABLE)	
			Bit 9	Activate controller inhibit (CINH)	
			Bit10	Set fault message (TRIP-SET)	
			Bit11	Reset fault message (TRIP RESET)	
			Bit12	Not assigned	
			Bit13	Not assigned	
			Bit14	Not assigned	
			Bit15	Not assigned	
C0136					Control words Hexadecimal value is bit-coded. Read only
1	CTRLWORD		0 {hex} FFFF		Control word C0135
2	CTRLWORD				CAN control word
3	CTRLWORD				AIF control word
C0141	FCODE (setval)	0.0			Used for relative analog signals
			-199.99 {0.01 %} 199.99		
C0142	Start options	1			Starting condition for start-up (controller enable) carried out ● after mains connection ● after message (t > 0.5 s) ● after TRIP
			0	Protection against unexpected start-up	
			1	Automatic start-up	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0150	Status word	0				Status word for networking via automation interface (AIF) Only display
			0	{1}	65535	Controller evaluates information as 16 bits (binary coded)
			Bit 0	Not assigned		
			Bit 1	Pulse inhibit (IMP) is active		
			Bit 2	Not assigned		
			Bit 3	Not assigned		
			Bit 4	Not assigned		
			Bit 5	Not assigned		
			Bit 6	n=0		
			Bit 7	Controller inhibit (CINH) is active		
			Bit 8	Controller status		
			Bit 9	Controller status		
			Bit 10	Controller status		
			Bit 11	Controller status		
			Bit 12	Warning is active		
			Bit 13	Message is active		
			Bit 14	Not assigned		
			Bit 15	Not assigned		
C0155	Status word 2	0				Status word 2 (extended status word) Only display
			0	{1}	65535	Controller evaluates information as 16 bits (binary coded)
			Bit 0	Fail		
			Bit 1	Mmax		
			Bit 2	Imax		
			Bit 3	Pulse inhibit is active (IMP)		
			Bit 4	Ready for operation (RDY)		
			Bit 5	Controller inhibited (CINH)		
			Bit 6	TRIP is active		
			Bit 7	Init		
			Bit 8	Direction of rotation of the motor (CW/CCW)		
			Bit 9	Not assigned		
			Bit 10	Not assigned		
			Bit 11	Not assigned		
			Bit 12	Not assigned		
			Bit 13	Not assigned		
			Bit 14	Not assigned		
			Bit 15	Not assigned		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0157						State of the user-definable bits of the status word (C0150) Read only	
1	Stat. FreeBit		0	{1 bit}	1	Bit 0	
2	Stat. FreeBit					Bit 2	
3	Stat. FreeBit					Bit3	
4	Stat. FreeBit					Bit4	
5	Stat. FreeBit					Bit 5	
6	Stat. FreeBit					Bit 14	
7	Stat. FreeBit					Bit 15	
C0161	Act trip					Current TRIP ● as in C0168/1 ● In case of FAIL-QSP, warning, and message, ”0” is displayed. Only display	🕮 230
C0167	Reset failmem	0				Delete history buffer (C0168)	🕮 226
			0	No reaction			
			1	Delete history buffer			
C0168						Fault history buffer (list of faults occurred) Read only	🕮 226 🕮 230
1	Fail number					Currently active fault	
2	Fail number					Last fault	
3	Fail number					Last fault but one	
4	Fail number					Last fault but two	
5	Fail number					Last fault but three	
6	Fail number					Last fault but four	
7	Fail number					Last fault but five	
8	Fail number					Last fault but six	
			All fault indications (TRIP, FAIL-QSP, warning, message)				
C0169						Time at which the faults entered into the history buffer (C0168) occurred Only display	🕮 226
1	Failtime		Respective power-on time (C0179)			Currently active	
2	Failtime					Last	
3	Failtime					Last but one	
4	Failtime					Last but two	
5	Failtime					Last but three	
6	Failtime					Last but four	
7	Failtime					Last but five	
8	Failtime					Last but six	
			0	{1 h}	65535		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0170						Frequency of successive occurrence of the faults entered in the history buffer (C0168) Read only	📖 226
			0	{1}	65535		
1	Counter					Currently active	
2	Counter					Last	
3	Counter					Last but one	
4	Counter					Last but two	
5	Counter					Last but three	
6	Counter					Last but four	
7	Counter					Last but five	
8	Counter					Last but six	
C0173	UG limit	11				Adaptation of the DC-bus voltage thresholds: ● Check during commissioning and adapt, if necessary. ● All drive components in DC bus connections must have the same thresholds. – LU = Undervoltage threshold – OU = Overvoltage threshold	📖 211 📖 87
			0	Mains = 230 V ± B		Operation on 230 V mains with or without brake unit LU = 130 V, OU = 400 V	
			1	Mains = 400 V ± B		Operation on 400 V mains with or without brake unit LU = 285 V, OU = 800 V	
			2	Mains = 460 V ± B		Operation on 460 V mains with or without brake unit LU = 328 V, OU = 800 V	
			3	Mains = 480V - B		Operation on 480 V mains without brake unit LU = 342 V, OU = 800 V	
			4	Mains = 480V + B		Operation on 480 V mains with brake unit LU = 342 V, OU = 800 V	
			10	Mains = 230 V ± B		Operation on 230 V mains with or without brake unit LU = C0174, OU = 400 V	
			11	Mains = 400 V ± B		Operation on 400 V mains with or without brake unit LU = C0174, OU = 800 V	
			12	Mains = 460 V ± B		Operation on 460 V mains with or without brake unit LU = C0174, OU = 800 V	
			13	Mains = 480V - B		Operation on 480 V mains without brake unit LU = C0174, OU = 800 V	
			14	Mains = 480V + B		Operation on 480 V mains with brake unit LU = C0174, OU = 800 V	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0174	UG min	60				Undervoltage threshold of DC bus (LU)	📖 87
			15	{1 V}	342		
C0175	UG-Relais Fkt	1				Charge relay behaviour with undervoltage (LU) in the DC bus.	📖 87
			1	Standard		Relay switches as a function of LU.	
			2	One Time		Relay switches when LU is exceeded for the first time and remains on.	
			3	Fixed On		Charging current limitation is inactive. ● Relay is always switched on and the charging resistors of the axis module are thus permanently jumpered. ● Setting for operation with ECSxE power supply module.	
C0178	Op timer					Running time meter Read only	
			0	{1 sec}	4294967295	Time when the controller was enabled	
C0179	Mains timer					Power-on time meter Only display	
			0	{1 sec}	4294967295	Time when the mains was switched on	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0183	Diagnostics					Drive diagnostics Read only ● Indicates fault or status information ● If several fault or status information are to be shown at the same time, the information with the smallest number is displayed	
			0	OK		No fault	
			101	Initialisation phase			
			102	TRIP/trouble			
			103	Emergency stop activated			
			104	IMP message			
			105	Power off			
			111	Operation inhibit C0135			
			112	Operation inhibit AIF			
			113	Operation inhibit CAN			
			121	Controller inhibit via X6/SI1			
			122	Internal controller inhibit 1			
			123	Internal controller inhibit 2			
			124	Controller inhibit via STOP key of the keypad			
			125	Controller inhibit via AIF			
			126	Controller inhibit via CAN			
			131	Fail QSP			
			141	Restart protection			
			142	Pulse inhibit		High resistance power outputs	
			151	Quick stop (QSP) via terminal			
			152	Quick stop (QSP) via STOP key of the keypad			
			153	Quick stop (QSP) via AIF			
			154	Quick stop (QSP) via CAN			
			160	PLC Stop		PLC must be started.	
			250	Warning			
C0195	BRK T act	99.9 {0.0}				Closing time of the motor holding brake	🕮 91
			0.0	{0.1 s}	99.9	During the time set the drive continues to generate a torque. After the set time has elapsed, the status "mechanical brake closed" is reached.	
C0196	BRK T rel	0.0				Opening time of the motor holding brake	🕮 91
			0.0	{0.1 s}	60.0	During the time set the drive can generate the torque set under C0244 against the holding brake. After the set time has elapsed, the status "mechanical brake opened" is reached.	
C0199	BuildNumber					Software identification Only display	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0200	S/W Id					Software identification Only display	
C0201	S/W date					Software release date Only display	
C0202						Service code Only display	
1						Product code 1	
...						...	
4						Product code 4	
C0203	Komm.-No.		x / xxxx / xxxxx			Commission number Only display	
C0204	Serial No.					Serial number Only display	
C0205	PLC Target ID					Identification key Only display	
C0206	Product. date					Production date Only display	
C0207	DL info 1					Download info 1 Only display	
C0208	DL info 2					Download info 2 Only display	
C0209	DL info 3					Download info 3 Only display	
C0244	BRK M set	0.0				Holding torque of the drive against the motor holding brake, with reference to M_{max} (C0057).	📖 91
			0.00	{0.01 %}	199.99	During the time set in C0196 the drive generates the set torque against the holding brake.	
C0250	FCODE 1 Bit	0				Freely selectable digital signal (1 bit)	
			0		1		
C0254	Vp angle CTRL	0.4000				Phase controller gain (V_p)	
			0.0000	{ 0.0001}	3.9999		
C0300 ... C0302	Service Codes					**Only the Lenze service is allowed to make changes!**	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0349						Status of the DIP switch for CAN bus interface X4 Read only	
1	CAN DIP-SW		0	{1}	63	Node address set on the DIP switch	
2	CAN DIP-SW		0		4	For setting the DIP switches > 4, the display is set to 0.	
C0350	CAN address	1				Node address for CAN bus interface X4	🕮 183 🕮 182
			1	{1}	63		
C0351	CAN baud rate	0 {4}				Baud rate for CAN bus interface X4 **Note:** When the Lenze setting is loaded via C0002, C0351 is set to 0 (500 KBit/s).	🕮 183
			0	500 kbit/s			
			1	250 kbits/sec			
			2	125 kbit/s			
			3	50 kbit/s			
			4	1000 kbit/s			
C0352	CAN mst	0				Master/slave configuration for CAN bus interface X4	🕮 187
			0	Slave		CAN boot-up is not active	
			1	Master		CAN boot up is active	
			2	Master with node guarding			
			3	Slave and heartbeat producer			
			4	Slave with node guarding			
C0353						Source for alternative bus node addresses of CAN_IN/CAN_OUT (CAN bus interface X4)	🕮 186
1	CAN addr sel	0		CAN node address (C0350)		Address CAN1_IN/OUT	
2	CAN addr sel	0		CAN node address (C0350)		Address CAN2_IN/OUT	
3	CAN addr sel	0		CAN node address (C0350)		Address CAN3_IN/OUT	
			0	C0350 (auto)		Automatically determined by C0350	
			1	C0354 (man.)		Determined by C0354	
C0354						Alternative node addresses for CAN_IN/CAN_OUT (CAN bus interface X4)	🕮 186
1	CAN addr.	129	1	{1}	512	Address 2 CAN1_IN	
2	CAN addr.	1				Address 2 CAN1_OUT	
3	CAN addr.	257				Address 2 CAN2_IN	
4	CAN addr.	258				Address 2 CAN2_OUT	
5	CAN addr.	385				Address 2 CAN3_IN	
6	CAN addr.	386				Address 2 CAN3_OUT	
C0355						Identifier for CAN_IN/CAN_OUT (CAN bus interface X4) Read only	🕮 182
1	CAN Id		1	{1}	2047	Identifier CAN1_IN	
2	CAN Id					Identifier CAN1_OUT	
3	CAN Id					Identifier CAN2_IN	
4	CAN Id					Identifier CAN2_OUT	
5	CAN Id					Identifier CAN3_IN	
6	CAN Id					Identifier CAN3_OUT	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0356						CAN time settings for CAN bus interface X4	🕮 188
1	CAN times	3000	0	{1 ms}	65000	CAN boot-up time: Delay time after mains connection for initialisation by the master.	
2	CAN times	0				CAN2_OUT/CAN3_OUT cycle times: Factor for the task time to send process data telegram. 0 = Event-controlled transmission	
3	CAN times	0					
4	CAN times	20				CAN2_OUT/CAN3_OUT delay time When the NMT state "Operational" has been reached (after "Pre-operational"), the delay time "CANdelay" is started. After the delay time has expired, the PDOs CAN2_OUT and CAN3_OUT are sent for the first time.	
C0357						Monitoring time for CAN1...3_IN (CAN bus interface X4)	🕮 204
1	CE monit time	3000	1	{1 ms}	65000	CE1 monitoring time	
2	CE monit time	3000				CE2 monitoring time	
3	CE monit time	3000				CE3 monitoring time	
C0358	Reset Node	0				Execute reset node (CAN bus)	🕮 188
			0	No function			
			1	CAN reset			
C0359	CAN state	0				CAN bus status (CAN bus interface X4) Read only	🕮 195
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
			4	Stopped			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0360						Telegram counter CAN_IN/CAN_OUT (CAN bus interface X4), number of telegrams Read only	🕮 196
1	CAN Messages		0	{1}	65535	All sent telegrams	
2	CAN Messages		With a count value > 65535 the counter restarts with 0			All received telegrams	
3	CAN Messages					Sent to CAN1_OUT	
4	CAN Messages					Sent to CAN2_OUT	
5	CAN Messages					Sent to CAN3_OUT	
6	CAN Messages					Sent on parameter data channel 1	
7	CAN Messages					Sent on parameter data channel 2	
8	CAN Messages					Received from CAN1_IN	
9	CAN Messages					Received from CAN2_IN	
10	CAN Messages					Received from CAN3_IN	
11	CAN Messages					Received from parameter data channel 1	
12	CAN Messages					Received from parameter data channel 2	
C0361						Detected load CAN_IN/CAN_OUT (CAN bus interface X4) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	🕮 197
1	Load IN/OUT		0	{1 %}	100	All sent telegrams	
2	Load IN/OUT					All received telegrams	
3	Load IN/OUT					Sent to CAN1_OUT	
4	Load IN/OUT					Sent to CAN2_OUT	
5	Load IN/OUT					Sent to CAN3_OUT	
6	Load IN/OUT					Sent on parameter data channel 1	
7	Load IN/OUT					Sent on parameter data channel 2	
8	Load IN/OUT					Received from CAN1_IN	
9	Load IN/OUT					Received from CAN2_IN	
10	Load IN/OUT					Received from CAN3_IN	
11	Load IN/OUT					Received from parameter data channel 1	
12	Load IN/OUT					Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0362	Sync cycle					Time interval between two Sync telegrams via CAN bus interface X4 Read only	📖 189
			1	{1 ms}	30		
C0363	Sync correct.	1.0				CAN sync correction increment ● Change correction value until C4264 reaches the minimum.	📖 191
			1	0.2 μs/ms			
			2	0.4 μs/ms			
			3	0.6 μs/ms			
			4	0.8 μs/ms			
			5	1.0 μs/ms			
C0365	DIS:CAN active					Input signal CAN active Only display	
			0	CAN not active			
			1	CAN active			
C0366	Sync Response	1				CAN sync response for CAN bus interface X4	📖 192
			0	No response			
			1	Response			
C0367	Sync Rx ID	128				CAN sync receipt ID for CAN bus interface X4	📖 190
			1	{1}	256		
C0368	Sync Tx ID	128				Sync transmission ID for CAN bus interface X4	📖 168
			1	{1}	256		
C0369	SyNc Tx Time	0 {0}				CAN sync transmission cycle for CAN bus interface X4 A sync telegram with the identifier set in C0368 is sent with the set cycle time.	📖 189
			0	{1 ms}	65000	0 = switched off	
[C0370]	SDO Gateway	0				Gateway address Activating remote parameter setting ● When selecting a setting ≠0, all code read/write accesses will be redirected to the system bus device with the corresponding CAN node address. ● The respective code is accessed via parameter data channel 1 of the target device.	📖 188
			0	{1}	63	0 = remote parameterisation deactivated	
C0371	Gateway Ch.	1				Selection of the gateway channel	
			0	CAN		Use CAN bus interface X4	
			1	CAN-AUX		Use CAN bus interface X14	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0381	HeartProdTime	0				Heartbeat (slave): HeartbeatProducerTime ● Time interval for sending the heartbeat message ● Only relevant for setting C0352 = 3.	
			0	{1 ms}	65535		
C0382	GuardTime	0				Node Guarding (slave): NodeGuardTime ● Time interval of the status inquiry of the master. ● Only relevant if C0352 = 4.	
			0	{1 ms}	65535		
C0383	LifeTimeFact	0				Node Guarding (slave): NodeLifeTime factor ● Factor for the monitoring time of NodeLifeTime ● NodeLifeTime = C0383 x C0382 (NodeGuardTime) ● Only relevant if C0352 = 4.	
			0	{1}	255		
C0384	Err NodeGuard	3				Node Guarding (slave) ● Response for the occurrence of a NodeGuard-Event ● Only relevant for setting C0352 = 4.	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C0400	DIS: AnalogIn					Signal at the analog input Read only	
			-199.99	{0.01 %}	199.99		
[C0416]	Resolver adj.	5				Resolver excitation amplitude	📖 94
			0	100 %			
			1	80 %			
			2	68 %			
			3	58 %			
			4	50 %			
			5	45 %			
			6	40 %			
			7	37 %			
[C0417]	Resolver cor.	0				Resolver adjustment	📖 157
			0	Ready			
			1	Start adjustment			
			2	Loading default values			
[C0418]	Test Cur.Ctrl	0				Controller adjustment:	📖 147
			0	Deactivated		Deactivate test mode	
			1	Activated		Activate test mode	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0419]	Enc. Setup	110				Encoder selection ● Selection of encoder type indicated on the nameplate of the Lenze motor. ● The encoder data (C0420, C0421, C0427) is set automatically in accordance with the selection.	🕮 97 🕮 98
			0	Common			
			110	IT512-5V		Incremental encoder with TTL level	
			111	IT1024-5V			
			112	IT2048-5V			
			113	IT4096-5V			
			210	IS512-5V		SinCos encoder	
			211	IS1024-5V			
			212	IS2048-5V			
			213	IS4096-5V			
			307	AS64-8V		SinCos absolute value encoder with Hiperface® interface (single-turn) Selections 307, 308, 309 are only possible with operating system 7.0 or higher.	
			308	AS128-8V			
			309	AS256-8V			
			310	AS512-8V			
			311	AS1024-8V			
			407	AM64-8V		SinCos absolute value encoder with Hiperface® interface (multi-turn) Selections 407, 408, 409 are only possible with operating system 7.0 or higher.	
			408	AM128-8V			
			409	AM256-8V			
			410	AM512-8V			
			411	AM1024-8V			
[C0420]	Encoder const.	512				Number of increments of the encoder	🕮 97 🕮 98
			1	{1 inc/rev}	8192	Sets C0419 = 0 (”Common”) if the value is changed.	
[C0421]	Encoder volt	0				Encoder voltage	🕮 97 🕮 98
			0	5.0 V		Sets C0419 = 0 (”common”) if the value is altered.	
			1	5.6 V			
			2	6.3 V			
			3	6.9 V			
			4	7.5 V			
			5	8.1 V			
C0426	DIS: In					Signal at DFIN input Only display	
			-32767	{1 rpm}	32767		
[C0427]	Enc. signal	0				Function of the master frequency input signals on X8 (DFIN)	🕮 97 🕮 98
			0	2-phase			
			1	A: speed B: direction			
			2	A or B: speed or direction			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0428	DFIN TP sel.	0				Digital frequency input (DFIN): Selection of zero pulse/touch probe	
			0	Master pulse		Encoder connection X8	
			1	Touch probe		Digital input X6/DI1	
C0429	TP1 delay	0				Touch probe offset	
			-32767	{1 inc}	32767		
C0431	DFIN TP Edge	0				Digital frequency input (DFIN): Touch probe edge	
			0	Rising edge			
			1	Falling edge			
			2	Rising and falling edge			
			3	Switched off			
C0443	DIS: DIGIN					Signal states of the digital inputs at X6 after considering the polarities set under C0114. Read only	
			0	{1}	255		
			Bit 0	DIGIN1		X6/DI1	
			Bit 1	DIGIN2		X6/DI2	
			Bit 2	DIGIN3		X6/DI3	
			Bit 3	DIGIN4		X6/DI4	
			Bit 4	X6/SI2		0: Pulse inhibit active 1: Pulse inhibit inactive	🕮 60
			Bit 5	Free			
			Bit 6	X6/SI1		0: Controller inhibited (CINH) 1: Controller enabled	🕮 60
			Bit 7	Free			
C0444						Status of the digital outputs Only display	
1	DIS: DIGOUT		0		1	Status of the digital output X6/DO1	
2	DIS: DIGOUT					Relay control status	
[C0469]	Fct STP key	2				Function of the STOP key of the keypad **Must not be changed if the ”STOP” key is pressed!**	
			0	Inactive		Without function	
			1	Controller inhibit (CINH)			
			2	Quick stop (QSP)			
C0470						Freely configurable code for digital signals Hexadecimal value is bit-coded.	
1	FCODE 8bit	0	0000	{hex}	FFFF	C0470/1 = C0471, bit 0 ... 7	
2	FCODE 8bit	0				C0470/2 = C0471, bit 8 ... 15	
3	FCODE 8bit	0				C0470/3 = C0471, bit 16 ... 23	
4	FCODE 8bit	0				C0470/4 = C0471, bit 24 ... 31	
C0471	FCODE 32bit	0				Hexadecimal 32-bit interpretation of C0470	
			0	{1}	4294967295		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0472						Freely configurable code for relative analog signals	
1	FCODE analog	0.00	-199.99	{0.01 %}	199.99		
2	FCODE analog	0.00					
3	FCODE analog	100.00					
4	FCODE analog	0.00					
...	...	...					
10	FCODE analog	0.00 {10.00}				Speed threshold for closing the holding brake with reference to the value in C0011 (maximum speed n_{max}).	
11	FCODE analog	0.00				Value/direction of the torque against the holding brake	
...	...	...					
20	FCODE analog	0.00					
C0473						Freely configurable code for absolute analog signals	
1	FCODE abs	1	-32767	{1}	32767		
2	FCODE abs	1					
3	FCODE abs	0					
...	...	...					
10	FCODE abs	0					
C0474						Freely configurable code for phase signals	
1	FCODE PH	0	-2147483647	{1}	2147483647		
...	...	...					
5	FCODE PH	0					
C0475						Freely configurable code for phase difference signals	
1	FCODE DF	0	-16000	{1 rpm}	16000		
2	FCODE DF	0					
[C0490]	Feedback pos	0				Selection of feedback system for positioning control	🕮 94
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		• Sets C0495 to the same value if C0495 > 0. • Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute encoder (multi-turn) at X8			
[C0491]	X8 in/out	0				Function of X8	🕮 97 🕮 98
			0	X8 is input			
			1	X8 is output			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
[C0495]	Feedback n	0				Selection of feedback system for speed control	📖 94
			0	Resolver at X7		Standard setting	
			1	TTL encoder at X8		● Sets C0490 to the same value if C0490 > 0. ● Sets C0419 = 0 ("Common") if a different encoder type as under C0419 is set here.	
			2	SinCos encoder at X8			
			3	Absolute value encoder (single-turn) at X8			
			4	Absolute encoder (multi-turn) at X8			
C0497	Nact filter	2.0				Time constant of actual speed value	
			0.0	{0.1 ms}	50.0	0.0 ms = switched off	
C0504 ... C0509	Service codes					**Only the Lenze service is allowed to make changes!**	
C0510	ProtAppFlash	0				Write-protection application FLASH	
			0	No write protection			
			1	Write protection is active			
C0517						User menu with up to 32 entries	
			0.00	{0.01}	7999.00	● Enter the numbers of the required codes into the subcodes. Format: xxxx.yy – xxxx = code number – yy = subcode of the code ● It is not checked whether the entered code exists.	
1	User menu	51.00	C0051	MCTRL-NACT		Display of actual speed	
2	User menu	54.00	C0054	Imot		Display of motor current	
3	User menu	56.00	C0056	MCTRL-MSET2		Display of torque setpoint	
4	User menu	0.00		Not assigned			
5	User menu	0.00		Not assigned			
6	User menu	183.00	C0183	Diagnostics		Display for diagnostics	
7	User menu	168.01	C0183	Fail number		Display of current fault message	
8	User menu	0.00		Not assigned			
9	User menu	22.00	C0022	Imax current		Input of maximum output current	
10	User menu	0.00		Not assigned			
11	User menu	11.00	C0011	Nmax		Input of the maximum speed	
12	User menu	0.00		Not assigned			
13	User menu	0.00		Not assigned			
14	User menu	105.00	C0105	QSP Tif		Input of quick stop deceleration time	
15	User menu	0.00		Not assigned			
16	User menu	70.00	C0070	Vp speed CTRL		Input of speed controller gain (Vp)	
17	User menu	71.00	C0071	Tn speed CTRL		Input of speed controller reset time (Tn)	
18	User menu	0.00		Not assigned			
19	User menu	2100.00	C2100	Time slice		Input of time dial for cycl. task	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
20	User menu	2102.00	C2102	Task switch		Selection of the switching function for cycl. task	
21	User menu	2104.00	C2104	PLC autorun		Autom. start of the PLC program after mains power-up	
22	User menu	2106.00	C2106	Download protect		Write protection of the PLC program	
23	User menu	2108.00	C2108	PLC run/stop		Control of the PLC program	
24	User menu	2111.00	C2111	GDC ID		Creation date of the PLC program	
25	User menu	2113.00	C2113	PLC prog name		Name of the PLC program	
26	User menu	2115.00	C2115	T-fct Credit		Number of technology units	
27	User menu	0.00		Not assigned			
28	User menu	0.00		Not assigned			
29	User menu	0.00		Not assigned			
30	User menu	0.00		Not assigned			
31	User menu	94.00	C0094	Password		Parameter access protection for the keypad	
32	User menu	3.00	C0003	Par save		Save parameter set	
[C0540]	X8 Signal out	2				Function of the digital frequency output signals at X8 (DFOUT)	🕮 94
			0	No function			
			1	No function			
			2	Encoder simulation + zero pulse → DFOUT			
C0545	PH offset	0				Phase offset	
			0	{1 inc}	65535	1 revolution = 65535 increments	
C0547	DIS: AN-IN					Analog signal on the input of the DFOUT block Read only	
			-199.99	{0.00 %}	199.99		
C0549	DIS: DF-IN					Speed on the input of the DFOUT block Only display	
			-32767	{1 rpm}	32767		
C0559	SD8 filter t	1				Filter time constant (SD8)	
			1	{1 ms}	200	Example: If the setting is ”10 ms”, a SD8-TRIP is actuated after 10 ms.	
C0576	nErr Window	100				Monitoring window of the speed control error referring to n_{max}. 100 % = lowest monitoring sensitivity	🕮 215
			0	{1 %}	100		
C0577	Vp fld weak	1.0				Gain of field weakening controller (V_p)	🕮 154
			0.00	{0.01}	63.99		
C0578	Tn fld weak	3.0				Integral-action time of field weakening controller (V_n)	
			0.1	{0.1 ms}	6000.0		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C0579	Monit nErr	3			Configuration of speed control error monitoring	📖 215
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		
C0580	Monit SD8	3			Configuration of open-circuit monitoring for sin/cos encoders	📖 214
			0	TRIP		
			3	Off		
C0581	MONIT EEr	0			Configuration of external fault monitoring "ExternalFault" (FWM EEr)	
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	FAIL-QSP		
C0582	MONIT OH4	2			Configuration of heatsink temperature monitoring Set threshold in C0122	📖 206
			0	TRIP		
			2	Warning		
			3	Off		
C0583	MONIT OH3	0			Configuration of motor temperature monitoring via resolver input X7 or encoder input X8	📖 205
			0	TRIP		
			2	Warning		
			3	Off		
C0584	MONIT OH7	2			Configuration of motor temperature monitoring via resolver input X7 or encoder input X8 Set threshold in C0121	📖 205
			0	TRIP		
			2	Warning		
			3	Off		
C0586	MONIT SD2	0			Configuration of monitoring Resolver "ResolverFault" (MCTRL Sd2)	📖 213
			0	TRIP		
			2	Warning		
			3	Off		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0588	MONIT H10/H11	0				Configuration of monitoring Thermal sensors (H10, H11) in the controller ”SensFaultTht/SensFaultTid” (FWM H10/H11)	📖 207
			0	TRIP			
			2	Warning			
			3	Off			
C0591	MONIT CE1	3				Configuration of monitoring CAN1_IN error ”CommErrCANIN1” (CE1)	📖 204
			0	TRIP			
			2	Warning			
			3	Off			
C0592	MONIT CE2	3				Configuration of monitoring CAN2_IN error ”CommErrCANIN2” (CE2)	📖 204
			0	TRIP			
			2	Warning			
			3	Off			
C0593	MONIT CE3	3				Configuration of monitoring CAN3_IN error ”CommErrCANIN3” (CE3)	📖 204
			0	TRIP			
			2	Warning			
			3	Off			
C0594	MONIT SD6	3				Configuration of monitoring Motor temperature sensor ” SensorFault” (MCTRL Sd6)	📖 213
			0	TRIP			
			2	Warning			
			3	Off			
C0595	MONIT CE4	3				Configuration of ”system bus (CAN) off” monitoring at the CAN bus interface X4 ”BusOffState” (CE4)	📖 204
			0	TRIP			
			2	Warning			
			3	Off			
C0596	NMAX limit	5500				Monitoring: Maximum speed of the machine	📖 216
			0	{1 rpm}	16000		
C0597	MONIT LP1	3				Configuration of motor phase monitoring (LP1) **When this monitoring function is activated, the calculating time which is provided to the user is reduced!**	📖 212
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	**Designation**	**Lenze/ {Appl.}**	**Selection**				
C0598	MONIT SD5	3				Configuration of master current monitoring at X6 < 2 mA ”MastISourceDef”	
			0	TRIP			
			2	Warning			
			3	Off			
C0599	Limit LP1	5.0				Monitoring limit for motor phase monitoring (LP1) referred to the current limit.	🕮 212
			0,01	{0.01 %}	10.00		
C0602	MONIT REL1	3				Configuration of the open circuit monitoring of relay output X25	
			0	TRIP			
			3	Off			
C0603	MONIT CE5	3				Configuration of gateway function monitoring (CE5) ”Time-out” when remote parameter setting is activated (C0370)	🕮 204
			0	TRIP			
			2	Warning			
			3	Off			
C0604	MONIT OC7	2				Configuration of early warning I x t threshold (C0123)	🕮 208
			0	TRIP			
			2	Warning			
			3	Off			
C0605	MONIT OH5	2				Configuration of early warning of temperature inside the device (threshold in C0124)	🕮 207
			0	TRIP			
			2	Warning			
			3	Off			
C0606	MONIT OC8	2				Configuration of I^2 x t early warning (threshold in C0120)	🕮 210
			0	TRIP			
			2	Warning			
			3	Off			
C0607	MONIT NMAX	0				Configuration of maximum speed monitoring	
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0608	ovr. Tx-Queue	2				Fault configuration Transmission memory overflow of free CAN objects
			0	TRIP		
			1	Message		
			2	Warning		
			3	Off		
			4	Fail-QSP		
C0609	ovr. Rx-Isr	0				Fault configuration Receipt memory overflow of free CAN objects
			0	TRIP		
			4	Fail-QSP		
C0651	Delay T	0.006 {1.000}				DT1-1 time constant
			-0.005	{0.001 s}	199.999	
C0653	Sensibility	1				DT1-1 sensitivity
			1	15 bits		
			2	14 Bit		
			3	13 bits		
			4	12 bits		
			5	11 bits		
			6	10 bits		
			7	9 bits		
C0855						Digital process data input words are indicated on the AIF interface (AIF1_IN) Hexadecimal value is bit-coded. Read only
1	AIF1 IN bits		0000	{hex}	FFFF	Input word 2 (bit 0 ... 15)
2	AIF1 IN bits					Input word 3 (bit 0 ... 15)
C0856						Analog process data input words are indicated decimally on the AIF interface (AIF1_IN) 100.00% = 16384 Read only
1	AIF1 IN words		-199.99	{0.01 %}	199.99	Input word 1
2	AIF1 IN words					Input word 2
3	AIF1 IN words					Input word 3
C0857	AIF1 IN phi					32 bits of phase information on the AIF interface (AIF1_IN) Read only
			-2147483648	{1}	2147483647	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C0858						Analog process data output words are indicated decimally on the AIF interface (AIF1_OUT) 100.00% = 16384 Read only	
1	AIF1 OUT words		-199.99	{0.01 %}	199.99	Output word 1	
2	AIF1 OUT words					Output word 2	
3	AIF1 OUT words					Output word 3	
C0859	AIF1 OUT phi					32-bit phase information at the AIF interface (AIF1_OUT) Only display	
			-2147483648	{1}	2147483647		
C0863						Digital process data input words for CAN bus interface X4	🕮 171
			0000	{hex}	FFFF	Hexadecimal value is bit-coded. Read only	
1	CAN IN bits		Bit 0	...	Bit15	CAN1_IN: Process data input word 1	
2	CAN IN bits		Bit 16	...	Bit 31	CAN1_IN: Process data input word 2	
3	CAN IN bits		Bit 0	...	Bit15	CAN2_IN: Process data input word 1	
4	CAN IN bits		Bit 16	...	Bit 31	CAN2_IN: Process data input word 2	
5	CAN IN bits		Bit 0	...	Bit15	CAN3_IN: Process data input word 1	
6	CAN IN bits		Bit 16	...	Bit 31	CAN3_IN: Process data input word 2	
C0866						Analog process data input words (decimal) for CAN bus interface X4 100.00% = 16384 Read only	🕮 171
1	CAN IN words		-199.99	{0.01 %}	199.99	CAN1_IN word 1	
2	CAN IN words					CAN1_IN word 2	
3	CAN IN words					CAN1_IN word 3	
4	CAN IN words					CAN2_IN word 1	
5	CAN IN words					CAN2_IN word 2	
6	CAN IN words					CAN2_IN word 3	
7	CAN IN words					CAN2_IN word 4	
8	CAN IN words					CAN3_IN word 1	
9	CAN IN words					CAN3_IN word 2	
10	CAN IN words					CAN3_IN word 3	
11	CAN IN words					CAN3_IN word 4	
C0867						32-bit phase information for CAN bus interface X4 Read only	
1	CAN IN phi		-2147483648	{1}	2147483647	CAN1_IN	
2	CAN IN phi					CAN2_IN	
3	CAN IN phi					CAN3_IN	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C0868	DIS:OUTx.Wx					Analog process data output words (decimal) for CAN bus interface X4 100.00% = 16384 Read only
1	CAN OUT words		-32768	{1 %}	32768	CAN1_OUT word 1
2	CAN OUT words					CAN1_OUT word 2
3	CAN OUT words					CAN1_OUT word 3
4	CAN OUT words					CAN2_OUT word 1
5	CAN OUT words					CAN2_OUT word 2
6	CAN OUT words					CAN2_OUT word 3
7	CAN OUT words					CAN2_OUT word 4
8	CAN OUT words					CAN3_OUT word 1
9	CAN OUT words					CAN3_OUT word 2
10	CAN OUT words					CAN3_OUT word 3
11	CAN OUT words					CAN3_OUT word 4
C0869						32-bit phase information for CAN bus interface X4 Read only
1	CAN OUT phi		-2147483648	{1}	2147483647	CAN1_OUT
2	CAN OUT phi					CAN2_OUT
3	CAN OUT phi					CAN3_OUT
C0878						Digital input signals to DCTRL Only display
1	DigInOfDCTRL		0		1	Controller inhibit (CINH) 1
2	DigInOfDCTRL					Controller inhibit (CINH) 2
3	DigInOfDCTRL					TRIP-set
4	DigInOfDCTRL					TRIP-RESET
C0879						
1	Reset CTRL	0		No reset		Reset C0135
2	Reset CTRL	0		No reset		Reset AIF
3	Reset CTRL	0		No reset		Reset CAN
			0	No reset		
			1	Reset		Performs one ”reset”

Code No.	Designation	Lenze/ {Appl.}	Selection			IMPORTANT	
C0906						Analog input signals to MCTRL Read only	
1	MCTRL analog		-199.99	{0.01 %}	199.99	Speed controller input	
2	MCTRL analog					Torque setpoint	
3	MCTRL analog					Lower torque limit	
4	MCTRL analog					Upper torque limit	
5	MCTRL analog					Limit of the position controller	
6	MCTRL analog					Speed for activating the torque limitation	
7	MCTRL analog					Field weakening	
8	MCTRL analog					Integrator of the speed controller	
9	MCTRL analog					P adaptation of the position controller	
C0907						Digital input signals to MCTRL Only display	
1	MCTRL digital		0		1	Activating position controller	
2	MCTRL digital					Speed control or torque control	
3	MCTRL digital					Set quick stop (QSP)	
4	MCTRL digital					Loading integral-action component of the speed controller	
C0908	MCTRL PosSet					Set phase signal 1 revolution = 65536 increments Only display	
			-2147483648	{1 inc}	2147483647		
C0909	speed limit	1				Limitation of direction of rotation for speed setpoint	
			1	-175 ... +175 %			
			2	0 ... +175 %			
			3	-175 ... 0 %			
C0910	TP2 delay	0				Touch probe delay Compensation of delay times of the TP signal source X6/DI2	
			-32767	{1 inc}	32767	1 inc ≡ approx. 60 μs	
C0911	MCTRL TP sel.	0				MCTRL zero pulse/touch probe selection	
			0	Master pulse		Feedback system at X7/X8	
			1	Touch probe		Digital input X6/DI2	
C0912	MCTRL TP Edge	0				MCTRL touch probe edge	
			0	Rising edge			
			1	Falling edge			
			2	Rising and falling edge			
			3	Switched off			
C0935	L_REF1 speed	100				Traversing speed of homing	🕮 112
			1	{1 rpm}	16000		
C0936	L_REF1 Ti	1,0				Deceleration time (T_i) of homing	🕮 112
			0,01	{0,01 s}	650,00		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C1120	Sync mode	0 {1}				Sync signal source	
			0	OFF		Off	
			1	CAN Sync		Sync connection via CAN bus	🕮 190
			2	Terminal Sync		Sync connection via terminal	🕮 194
C1121	Sync cycle	2				Synchronisation cycle	🕮 190
			1	{1 ms}	13		
C1122	Sync phase	0.460				Synchronisation phase	🕮 191
			0.000	{0.001 ms}	6.500		
C1123	Sync window	0,010				Synchronisation window ● If the sync telegram/signal sent by the master is inside this ”time slot”, C3165 is set to 1.	🕮 192
			0,000	{0.001 ms}	6,500		
C1190	MPTC mode	0				Selection of PTC evaluation for motor	
			0	Standard			
			1	Characterist.			
C1191						Selection of PTC temperature characteristic	
1	Char.: temp	25	0	{1 °C}	255	Temperature 1	
2	Char.: temp	150				Temperature 2	
C1192						Selection of resistance characteristic for PTC	
1	Char.: OHM	1000 {0}	0	{1 Ω}	30000	Resistance at temperature 1	
2	Char.: OHM	2225				Resistance at temperature 2	
C2100	Time slice	13				Time slice for cyclic task	
			6	{1 ms}	26		
C2102	Task switch	0				Change-over: System task →cycl. task (PLC)	
			0	Time slice		No change-over	
			1	Time slice + end of PLC_PRG			
			2	Time slice + end of PLC_PRG + end of system task			
C2104	PLC Autorun	0 {1}				Automatic start of PLC program after power-up	
			0	Off			
			1	On			
C2106	Downl.protect	0				Write protection of PLC program	
			0	Inactive			
			1	Active			
			2	Reserved			
C2108	PLC run/stop	0				Control PLC program	
			0	No function			
			1	Run			
			2	Stop			
			3	Reset			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2111	GDC Id		27012006132510 = ● Date (day.month.year): 27.01.2006 ● Time (h:min:sec): 13:25:10			Creation date of PLC program Read only
C2113	PLC Prog Name					Name of PLC program Read only
C2115	T-Fkt Credit	0				Number of technology units
C2116	CreditPinCode	0				Code for technology units if service is required (please consult Lenze)
			0	{1}	4294967295	
C2117	Full Credit	0				Service code
C2118	ParWriteChan.	0				CAN object for L_ParRead and L_ParWrite
			0	Process data channel (CAN1...3_IN/CAN1...3_OUT)		
			1	Parameter data channel 2		
C2120	AIF: Control	0				AIF-CAN: control word
			0	{1}	255	Binary interpretation reflects bit states
			0	No command		**Note:** The MSB (bit 7) of the control word automatically changes its state with every access to the code. Observe this when interpreting the data!
			1	Read XCAN codes + reinitialisation		
			2	Read XCAN code		
			10	Read XCAN C2356/1 ... 4		
			11	Read XCAN C2357		
			12	Read XCAN C2375		
			13	Read XCAN C2376 ... C2378		
			14	Read XCAN C2382		
			255	Not assigned		
C2121	AIF:State					AIF-CAN: Status ● For detailed information: see description of the corresponding fieldbus module. Read only
			1	{1}	255	Binary interpretation reflects bit states.
			Bit 0	XCAN1_IN monitoring time		
			Bit 1	XCAN2_IN monitoring time		
			Bit2	XCAN3_IN monitoring time		
			Bit 3	XCAN bus off		
			Bit4	XCAN operational		
			Bit5	XCAN pre-operational		
			Bit 6	XCAN warning		
			Bit 7	Assigned internally		
C2130	FileNameAddDa		Symbolic data name			Information on the additional data that have been transmitted together with the application program. Only display
C2131	Type AddData		Specification identification of the data			
C2132	VersionAddData		Data version			
C2133	TimeStamp		Time stamp of the data			

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2350	XCAN address	1				Node address XCAN **XCAN = system bus (CAN) on AIF**
			1	{1}	63	
C2351	XCAN baud rate	0				Baud rate XCAN ● Modifications are only valid after reset node!
			0	500 kbit/s		
			1	250 kbit/s		
			2	125 kbit/s		
			3	50 kbit/s		
			4	1000 kbit/s		
C2352	XCAN mst	0				Establish XCAN master operation.
			0	Slave		
			1	Master		
C2353						Source for system bus node addresses of XCAN_IN/XCAN_OUT
1	XCAN addr sel	0		CAN node address (C2350)		XCAN1_IN/OUT address
2	XCAN addr sel	0		CAN node address (C2350)		XCAN2_IN/OUT address
3	XCAN addr sel	0		CAN node address (C2350)		XCAN3_IN/OUT address
			0	C2350 (auto)		Automatically determined by C2350
			1	C2354 (man.)		Determined by C2354
C2354						Alternative node addresses for XCAN_IN/XCAN_OUT
1	XCAN addr.	129	1	{1}	512	XCAN1_IN address 2
2	XCAN addr.	1				XCAN1_OUT address 2
3	XCAN addr.	257				XCAN2_IN address 2
4	XCAN addr.	258				XCAN2_OUT address 2
5	XCAN addr.	385				XCAN3_IN address 2
6	XCAN addr.	386				XCAN3_OUT address 2
C2355						Identifier for XCAN_IN/XCAN_OUT Only display
1	XCAN Id		1	{1}	2047	Identifier XCAN1_IN
2	XCAN Id					Identifier XCAN1_OUT
3	XCAN Id					Identifier XCAN2_IN
4	XCAN Id					Identifier XCAN2_OUT
5	XCAN Id					Identifier XCAN3_IN
6	XCAN Id					Identifier XCAN3_OUT

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2356						Time settings for XCAN
1	XCAN times	3000	0	{1 ms}	65000	XCAN boot-up time: Delay time after mains connection for initialisation by the master.
2	XCAN times	0				XCAN1...3_OUT cycle times: Factor for the task time to send process data object. 0 = Event-controlled transmission
3	XCAN times	0				
4	XCAN times	0				
5	XCAN times	0				XCAN delay time: When the NMT state ”Operational” has been reached (after ”Pre-operational”), the delay time ”CANdelay” is started. After the delay time has expired, the PDOs XCAN2_OUT and XCAN3_OUT are sent for the first time.
C2357						Monitoring time for XCAN process data input objects
1	CE monit time	3000	1	{1 ms}	65000	XCAN1_IN monitoring time
2	CE monit time	3000				XCAN2_IN monitoring time
3	CE monit time	3000				XCAN3_IN monitoring time
4	CE monit time	1				Bus off
C2359	AIF HW Set.	0				
			0	{1}	65535	
C2367	Sync Rx ID	128				XCAN receipt identifier of the sync telegram
			1	{1}	2047	
C2368	Sync Tx ID	128				XCAN transmission identifier of the sync telegram
			1	{1}	2047	
C2373						Sync counter
1	Sync Rate IN	1	1	{1}	240	XCAN1_IN
2	Sync Rate IN	1				XCAN2_IN
3	Sync Rate IN	1				XCAN3_IN
C2374						Sync counter
1	Sync Rate OUT	1	1	{1}	240	XCAN1_OUT
2	Sync Rate OUT	1				XCAN2_OUT
3	Sync Rate OUT	1				XCAN3_OUT
C2375						TX mode for XCANx_OUT
1	XCAN Tx-Mode	0		Response to sync		XCAN1_OUT
2	XCAN Tx-Mode	0		Response to sync		XCAN2_OUT
3	XCAN Tx-Mode	0		Response to sync		XCAN3_OUT
			0	Response to sync		
			1	No response to sync		
			2	Event		
			3	Event, cycle C2356 superimposed		

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C2376					XCAN1_OUT mask	
1	XCAN1 Mask	FFFF	0000 {hex} FFFF		Mask for process data output word 1	
2	XCAN1 Mask	FFFF			Mask for process data output word 2	
3	XCAN1 Mask	FFFF			Mask for process data output word 3	
4	XCAN1 Mask	FFFF			Mask for process data output word 4	
C2377					XCAN2_OUT mask	
1	XCAN2 Mask	FFFF	0000 {hex} FFFF		Mask for process data output word 1	
2	XCAN2 Mask	FFFF			Mask for process data output word 2	
3	XCAN2 Mask	FFFF			Mask for process data output word 3	
4	XCAN2 Mask	FFFF			Mask for process data output word 4	
C2378					XCAN3_OUT mask	
1	XCAN3 Mask	FFFF	0000 {hex} FFFF		Mask for process data output word 1	
2	XCAN3 Mask	FFFF			Mask for process data output word 2	
3	XCAN3 Mask	FFFF			Mask for process data output word 3	
4	XCAN3 Mask	FFFF			Mask for process data output word 4	
C2382					Configuration of XCAN monitoring (no telegrams received)	
1	XCAN Conf. CE	0		Off	XCAN1_IN	
2	XCAN Conf. CE	0		Off	XCAN2_IN	
3	XCAN Conf. CE	0		Off	XCAN3_IN	
4	XCAN Conf. CE	0		Off	Bus-off	
5	XCAN Conf. CE	0		Off	Life guarding event	
			0	Off		
			1	Controller inhibit (CINH)		
			2	Quick stop (QSP)		
C2450	CANa address	1			Node address for CAN bus interface X14 (CAN-AUX)	🕮 183 🕮 182
			1 {1} 63			
C2451	CANa baud rate	0			Baud rate for CAN bus interface X14 (CAN-AUX)	🕮 183
			0	500 kBit/s		
			1	250 kBit/s		
			2	125 kBit/s		
			3	50 kBit/s		
			4	1000 kBit/s		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2452	CANa mst	0				Configuration of master/slave for CAN bus interface X14 (CAN-AUX)	📖 187
			0	Slave			
			1	Master			
C2453						Source for system bus node addresses of CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 186
1	CANa addr sel	0		CAN node address (C2450)		Address CANaux1_IN/OUT	
2	CANa addr sel	0		CAN node address (C2450)		Address CANaux2_IN/OUT	
3	CANa addr sel	0		CAN node address (C2450)		Address CANaux3_IN/OUT	
			0	C2450 (auto)		Automatically determined by C2450	
			1	C2454 (man.)		Determined by C2454	
C2454						Alternative node addresses for CANaux_IN/CANaux_OUT (CAN bus interface X14)	📖 186
1	CANa addr.	129	1	{1}	512	CANaux1_IN address 2	
2	CANa addr.	1				CANaux1_OUT address 2	
3	CANa addr.	257				CANaux2_IN address 2	
4	CANa addr.	258				CANaux2_OUT address 2	
5	CANa addr.	385				CANaux3_IN address 2	
6	CANa addr.	386				CANaux3_OUT address 2	
C2455						Identifier for CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only	📖 182
1	CANa Id		1	{1}	2047	Identifier CANaux1_IN	
2	CANa Id					Identifier CANaux1_OUT	
3	CANa Id					Identifier CANaux2_IN	
4	CANa Id					Identifier CANaux2_OUT	
5	CANa Id					Identifier CANaux3_IN	
6	CANa Id					Identifier CANaux3_OUT	
C2456						CAN time settings for CAN bus interface X14 (CAN-AUX)	📖 188
1	CANa times	3000	0	{1 ms}	65000	CAN-AUX boot-up time	
2	CANa times	0				CANaux2_OUT/CANaux3_OUT cycle times: Factor for the task time to send process data telegram. 0 = Event-controlled transmission	
3	CANa times	0					
4	CANa times	20				CAN-AUX delay time: When the NMT state ”Operational” has been reached (after ”Pre-operational”), the delay time ”CANdelay” is started. After the delay time has expired, the PDOs CANaux2_OUT and CANaux3_OUT are sent for the first time.	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2457						Monitoring time for CANaux1...3_IN (CAN bus interface X14)	🕮 204
1	CE monit time	3000	1	{1 ms}	65000	CE11 monitoring time	
2	CE monit time	3000				CE12 monitoring time	
3	CE monit time	3000				CE13 monitoring time	
C2458	Reset node	0				Resetting a node (CAN bus interface X14)	🕮 188
			0	No function			
			1	CAN-AUX reset			
C2459	CANa state					CAN bus status (CAN bus interface X14) Read only	🕮 195
			0	Operational			
			1	Pre-operational			
			2	Warning			
			3	Bus off			
C2460						Telegram counter CANaux_IN/CANaux_OUT (CAN bus interface X14), number of telegrams Read only	🕮 196
1	CANa Messages		0	{1}	65535	All sent telegrams	
2	CANa Messages		With a count value > 65535 the counter restarts with 0			All received telegrams	
3	CANa Messages					Sent to CANaux1_OUT	
4	CANa Messages					Sent to CANaux2_OUT	
5	CANa Messages					Sent to CANaux3_OUT	
6	CANa Messages					Sent to parameter data channel 1	
7	CANa Messages					Sent to parameter data channel 2	
8	CANa Messages					Received from CANaux1_IN	
9	CANa Messages					Received from CANaux2_IN	
10	CANa Messages					Received from CANaux3_IN	
11	CANa Messages					Received from parameter data channel 1	
12	CANa Messages					Received from parameter data channel 2	

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2461						Detected load CANaux_IN/CANaux_OUT (CAN bus interface X14) Read only **A faultless operation is only guaranteed if the total bus load of all connected nodes amounts to a value ≤ 80 %.**	📖 197
1	Load IN/OUT		0	{1 %}	100	All sent telegrams	
2	Load IN/OUT					All received telegrams	
3	Load IN/OUT					Sent to CANaux1_OUT	
4	Load IN/OUT					Sent to CANaux2_OUT	
5	Load IN/OUT					Sent to CANaux3_OUT	
6	Load IN/OUT					Sent to parameter data channel 1	
7	Load IN/OUT					Sent to parameter data channel 2	
8	Load IN/OUT					Received from CANaux1_IN	
9	Load IN/OUT					Received from CANaux2_IN	
10	Load IN/OUT					Received from CANaux3_IN	
11	Load IN/OUT					Received from parameter data channel 1	
12	Load IN/OUT					Received from parameter data channel 2	
C2466	Sync Response	1				CAN-AUX sync response for CAN bus interface X14	
			0	No response			
			1	Response			
C2467	Sync Rx ID	128				CAN-AUX sync receipt ID for CAN bus interface X14	📖 190
			1	{1}	256		
C2468	Sync Tx ID	128				CAN-AUX Sync-transmission ID for CAN bus interface X14	📖 168 📖 192
			1	{1}	256		
C2469	Sync Tx time	0				CAN-AUX sync transmission cycle for CAN bus interface X14 A sync telegram with the identifier of C2468 is sent with the set cycle time.	📖 189 📖 188
			0	{1 ms}	65000	0 = switched off	
C2481	MONIT CE11	3				Configuration of monitoring CANaux1_IN error ”CommErrCANauxIN1” (CE11)	📖 204
			0	TRIP			
			2	Warning			
			3	Off			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2482	MONIT CE12	3				Configuration of monitoring CANaux2_IN error ”CommErrCANauxIN2” (CE12)	🕮 204
			0	TRIP			
			2	Warning			
			3	Off			
C2483	MONIT CE13	3				Configuration of monitoring CANaux3_IN error ”CommErrCANauxIN3” (CE13)	🕮 204
			0	TRIP			
			2	Warning			
			3	Off			
C2484	MONIT CE14	3				Configuration of ”system bus (CAN-AUX) off” monitoring at CAN bus interface X14 ”BusOffState” (CE14)	🕮 204
			0	TRIP			
			2	Warning			
			3	Off			
C2485	MONIT CE15	3				Configuration of the gateway function	🕮 204
			0	TRIP			
			2	Warning			
			3	Off			
C2491						Process data input words (hexadecimal) for CAN bus interface X14 Hexadecimal value is bit-coded. Read only	
1	CANa IN bits		0	{1 hex}	FFFF	CANaux1_IN (bit 0 ... 15)	
2	CANa IN bits					CANaux1_IN (bit 16 ... 31)	
3	CANa IN bits					CANaux2_IN (bit 0 ... 15)	
4	CANa IN bits					CANaux2_IN (bit 16 ... 31)	
5	CANa IN bits					CANaux3_IN (bit 0 ... 15)	
6	CANa IN bits					CANaux3_IN (bit 16 ... 31)	

Code		Possible settings				IMPORTANT
No.	Designation	Lenze/ {Appl.}	Selection			
C2492						Process data input words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa IN words		-199.99	{0.01 %}	199.99	CANaux1_IN word 1
2	CANa IN words					CANaux1_IN word 2
3	CANa IN words					CANaux1_IN word 3
4	CANa IN words					CANaux2_IN word 1
5	CANa IN words					CANaux2_IN word 2
6	CANa IN words					CANaux2_IN word 3
7	CANa IN words					CANaux2_IN word 4
8	CANa IN words					CANaux3_IN word 1
9	CANa IN words					CANaux3_IN word 2
10	CANa IN words					CANaux3_IN word 3
11	CANa IN words					CANaux3_IN word 4
C2493						Process data output words (decimal) for CAN bus interface X14 100.00% = 16384 Read only
1	CANa OUT words		-199.99	{0.01 %}	199.99	CANaux1_OUT word 1
2	CANa OUT words					CANaux1_OUT word 2
3	CANa OUT words					CANaux1_OUT word 3
4	CANa OUT words					CANaux2_OUT word 1
5	CANa OUT words					CANaux2_OUT word 2
6	CANa OUT words					CANaux2_OUT word 3
7	CANa OUT words					CANaux2_OUT word 4
8	CANa OUT words					CANaux3_OUT word 1
9	CANa OUT words					CANaux3_OUT word 2
10	CANa OUT words					CANaux3_OUT word 3
11	CANa OUT words					CANaux3_OUT word 4

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C2500						PLC flag 1 ... 255	
			0	{1}	65535		
C2501						PLC flag 256 ... 512	
			0	{1}	65535		
C3001	EncDirInv	0				Encoder mounting position	🕮 97 🕮 98
			0	Normal (direction of rotation CW)		Direction of rotation with regard to motor direction of rotation	
			1	Inverse (direction of rotation CCW)			
C3002	NoChangeOfPos	0				Resolver as absolute value encoder	🕮 96
			0	ChangeOfPos		After "mains off/on", homing has to be carried out. The actual position is initialised with the value "0".	
			1	NoChangeOfPos		The actual position value is initialised with the position value at "Mains off" and is used further at "Mains on". Homing is not required. **Note:** With "Mains off" the feedback system must rotate less than ± 0.5 revolutions.	
C3008	HomeMlim	10,0				Torque limit value for homing mode C3010 = 16 or 17 (100,00 % = maximum torque from C0057)	🕮 122 🕮 122
			0,00	{0,01 %}	100,00		
C3009	TimeHomeMlim	100				Duration for detecting the mechanical limit stop for homing mode C3010 = 16 or 17	🕮 122 🕮 122
			0	{1 ms}	65535		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3010	HomingMode	8				Homing mode	🕮 112 🕮 114
			0	>_Rn_MP		**Selection symbolism:** ● >: Movement in pos. direction ● <: Movement in neg. direction ● Lp: Limit switch in pos. direction ● Ln: Limit switch in neg. direction ● Rp: Pos. edge of the reference switch ● Rn: Neg. edge of the reference switch ● MP: Zero pulse/position of the position encoder, once per motor revolution ● TP: Touch probe signal ● Mlim: mechanical limit stop (torque limit value) **Notes:** ● When using the homing modes 0 ... 5, set C0540 = 2. ● The mechanical limit stop is defined as exceedance of the torque limit C3008 for the duration C3009. ● When the last action listed is executed, the home position is set (e.g. zero pulse with ”MP”), even if the drive continues traversing. ● In all modes without limit switch (”Lp” / ”Ln”) retracting from the limit switch with error handling set in C317 is not possible.	
			1	<_Rn_MP			
			2	>_Lp_<_Rn_MP			
			3	<_Ln_>_Rn_MP			
			4	>_Rp_<_Rn_MP			
			5	<_Rp_>_Rn_MP			
			6	>_Rn_>_TP			
			7	<_Rn_<_TP			
			8	>_TP			
			9	<_TP			
			10	>_Lp_<_TP			
			11	<_Ln_>_TP			
			12	>_Lp_<_MP			
			13	<_Ln_>_MP			
			14	>_MP			
			15	<_MP			
			16	>_MLim			
			17	<_MLim			
			99	Set reference			
C3011	Home offset	0				Offset between home position and standstill position	🕮 124
			-2140000000	{1 inc}	2140000000		
C3012	Measure offs.	0				Offset for shifting the zero position with regard to the standstill position	🕮 124
			-2140000000	{1 inc}	2140000000		
C3020	ManJog	25,0				Manual jog speed in % of C0011 (maximum speed)	🕮 137
			-0,00	{0,01 %}	100,00		
C3021	ACC-CTRL enable	1,0				Acceleration time: Within this time, the manual jog speed (C3020) is reached.	🕮 137
			0,000	{1 s}	999,000		
C3022	DCC-CTRL enable	1,0				Deceleration time: Within this time, the manual jog speed (C3020) is reduced to zero.	🕮 137
			0,000	{1 s}	999,000		
C3030	FolloErrWarn	400000				Following error limit for enabling a warning	🕮 140
			0	{1 inc}	2140000000		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3031	FolloErrFail	800000				Following error limit for enabling a FAIL-QSP (Quick stop (QSP) is executed.)	🕮 140
			0	{1 inc}	2140000000		
C3032	FollErr1reac	2				First reaction when following error limit has been reached	🕮 140
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3033	FollErr2reac	4				Second reaction when following error limit has been reached	🕮 140
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3034	FollowErrDisp	0				Following error Only display	🕮 140
			-2147483647	{1 units}	2147483647		
C3037	VelModeErr	25,0				Speed deviation for enabling the response to speed errors (C3038)	
			0,00	{0,01 %}	100,00		
C3038	VelModeErrRe ac	3				Response to speed errors in "Velocity Mode" (C5000 = 2)	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3150	Stateword	0				Status word Only display	🕮 106
			0	{1 units}	65535		

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3151						Status word (in bits) Only display	🕮 106
			0	{1 bit}	1		
1	StateBit	0	Bit 0	Toggle bit			
2	StateBit	0	Bit1	Operating mode-oriented function			
3	StateBit	0	Bit2	Operating mode-oriented function			
4	StateBit	0	Bit3	Operating mode-oriented function			
5	StateBit	0	Bit4	Operating mode-oriented function			
6	StateBit	0	Bit5	Positive hardware limit switch			
7	StateBit	0	Bit6	Negative hardware limit switch			
8	StateBit	0	Bit 7	Reserved			
9	StateBit	0	Bit 8	Status information 0			
10	StateBit	0	Bit 9	Status information 1			
11	StateBit	0	Bit10	Status information 2			
12	StateBit	0	Bit11	Status information 3			
13	StateBit	0	Bit12	Warning			
14	StateBit	0	Bit13	Actual position OK			
15	StateBit	0	Bit14	FailToAckn (Reset fault message)			
16	StateBit	0	Bit15	Controller is ready for operation			
C3152	Controlword	0				Control word Only display	🕮 104
			0	{1 units}	65535		
C3153						Control word (in bits) Only display	🕮 104
			0	{1 bit}	1		
1	ControlBit	0	Bit 0	Toggle bit			
2	ControlBit	0	Bit1	Not assigned			
3	ControlBit	0	Bit2	Reserved			
4	ControlBit	0	Bit3	Quick stop (QSP)			
5	ControlBit	0	Bit4	Monitor data selection			
6	ControlBit	0	Bit5	Monitor data selection			
7	ControlBit	0	Bit6	Monitor data selection			
8	ControlBit	0	Bit 7	Controller enable			
9	ControlBit	0	Bit 8	Operation inhibit			
10	ControlBit	0	Bit 9	Controller inhibit (CINH)			
11	ControlBit	0	Bit10	Set fault message (TRIP-SET)			
12	ControlBit	0	Bit11	Reset fault message (TRIP RESET)			
13	ControlBit	0	Bit12	Operating mode-oriented function			
14	ControlBit	0	Bit13	Operating mode-oriented function			
15	ControlBit	0	Bit14	Not assigned			
16	ControlBit	0	Bit15	Reserved			

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3160	ToggleErrReac	3				Toggle bit error handling	🕮 108
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3161	ToggleErLimit	4				Toggle bit error counter limit	🕮 108
			0	{1 units}	65535		
C3162	ToggleBitFail	0				Toggle bit error counter Only display	
			0	{1 units}	65535		
C3165	SyncInsideWi n	0				CAN synchronisation inside the window Only display	🕮 192
			0	{1 bit}	1		
C3170	NoHoming Reac	3				Reaction, when the reference is not known.	
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3175	HW EndReac	4				Response when a hardware limit switch is activated.	🕮 142
			0	TRIP			
			1	Message			
			2	Warning			
			3	Off			
			4	FAIL-QSP			
C3180	MonitorData	0				Monitor data selection Only display	🕮 106
			0	{1 units}	7		
C3181	MonitorData	0				Monitor data selection	🕮 106
			0	Off			
			1	MCTRL_nPos_a		Axis position 16 bits	
			2	DINT_TO_INT (MCTRL_dnPosSet_p)		Following error $\pm 2^{15}$	
			3	MCTRL_nNAct_a		Actual speed ($N_{max} = 2^{14}$)	
			4	MCTRL_nMAct_a		Actual torque ($M_{max} = 2^{14}$)	
			5	MCTRL_nIAct_a		Actual motor current ($I_{max} = 2^{14}$)	
			6	MCTRL_nDCVolt_a		Current DC-bus voltage ($2^{14} \triangleq 1000$ V)	
			7	nPosLatchDiff		Difference between actual position and position at touch probe (C6000)	
C3200	Act.Fault	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Current fault Only display	🕮 230

Code		Possible settings				IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection				
C3201	FailReaction	0				Fault handling Only display	
			0	TRIP			
			1	Message			
			2	Warning			
			3	FAIL-QSP			
			4	Not assigned			
C3210	Failnumber	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Current fault number Only display	🕮 230
C3211	FailNumber Old	0	All fault indications (TRIP, FAIL-QSP, warning, message)			Previous fault number Only display	🕮 230
C3420	M_Pilot_ Contr	1				Torque feedforward control	
			0	Off			
			1	On			
C3421	M_Operate_T H	10				Torque operating threshold	
			0	{1 units}	16384		
C3422	PilotConMGai n	1,0				Gain of torque feedforward control	
			1,00	{0,01 units}	100,00		
C3430	NPilotControl	1				Speed feedforward control	
			0	Off			
			1	On			
C4000	GlobalReset	0				Global reset of the PRG	
			0	Off			
			1	On			
C4010	Ctrl_Interf	0				Control interface	🕮 130 🕮 137
			0	CAN		Control word is expected via PDO CAN1_IN.	
			1	No function		Not used	
			2	No function		Not used	
			3	C4040		Control word is generated by GDC/User or received by a master control via SDO.	
			4	No function		Not used	

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C4040	AppControl	0			Application control word when C4010 = 3	🕮 130 🕮 137
			0 {1 bit} 1		Here, a drive can also be traversed without having a master control (e.g. using GDC). Moreover it is possible to assign a control word via an SDO of a master control to enable a manual jog (🕮 137) by the control.	
			Bit 0	Toggle		
			Bit1	Release limit switch		
			Bit2	Reserved		
			Bit3	QSP		
			Bit4	Monitor data selection bit 0		
			Bit5	Monitor data selection bit 1		
			Bit6	Monitor data selection bit 2		
			Bit 7	Controller enable		
			Bit 8	Operation inhibit (DISABLE)		
			Bit 9	Controller inhibit (CINH)		
			Bit10	Set fault message (TRIP-SET)		
			Bit11	Reset fault message (TRIP RESET)		
			Bit12	Not used		
			Bit13	JogCW		
			Bit14	JogCCW		
			Bit15	Reserved		
C4018	MmaxVal	100,0			Limit value for max. torque ● 100 % = maximum torque from C0057 ● Change become effective in the "Interpolated Position Mode".	
			0,01 {0,01 %} 100,00			
C4264	CanSync_Dev	0			Deviation of the control program synchronisation Only display	🕮 191
			-32767 {1} 32767			
C5000	OpMode	7			Selection of the operating mode	🕮 129
			2	Velocity mode		🕮 130
			6	Homing Mode		🕮 132
			7	Interpolated Position Mode		🕮 134
			128	Manual jog		🕮 137
C5001	Mode_Op_Dis				Operating mode Only display	🕮 129
			2	Velocity mode		🕮 130
			6	Homing Mode		🕮 132
			7	Interpolated Position Mode		🕮 134
			128	Manual jog		🕮 137
C6000	LatchPosition	0			Position at touch probe	🕮 106
			-2147483647 {1 inc} -2147483647			

Code		Possible settings			IMPORTANT	
No.	Designation	Lenze/ {Appl.}	Selection			
C6001	PosLatchAct	0			Activation: At touch probe (X6/DI2 = HIGH), the actual position is saved in C6000.	106
			0	Not active		
			1	Wait for rising edge		
			2	Wait for falling edge		
			3	Wait for rising or falling edge		
C6002	TPReceived	0			Touch Probe (TP) recognised Only display	
			0	No TP recognised		
			1	TP with rising edge recognised		
			2	TP with falling edge recognised		
			3	TP with rising or falling edge recognised		
C7900	L_GDC_Vers				Lenze-internal versioning (e.g. V1.2 = 1020000) Read only	
C7901	Costumer_ Vers	0			Customer's version identification ● Can be set by the customer.	
			0	{1} 99999		

11.2 Overview of accessories

The accessories are not included in the scope of supply. Lenze's basic devices and accessories are carefully matched to each other. With the basic device and the accessories, all components for a complete drive system are available. The component selection must be matched to the respective application.

11.2.1 Connectors

In order to provide a flexible purchasing, the connectors are available as separate delivery units complementing the power supply, capacitor and axis modules of the ECS series:

- ECSZ**E**000X0B (connectors for power supply modules)
- ECSZ**K**000X0B (connectors for capacitor modules)
- ECSZ**A**000X0B (connectors for axis modules)

11.2.2 Shield mounting kit

The shield mounting kit ECSZS000X0B001 contains components for reliable and quick fixing of the cable shields. The scope of supply includes:

- Shield sheet for motor cable
- Wire clamp for shield connection of motor cable
- Wire clamp for shield connection of control cables
- Wire clamp for shield connection of motor monitoring cable

11.2.3 Power supply modules

For generating the DC-bus voltage for the axis modules:

- ECSxE012
- ECSxE020
- ECSxE040

The modules are delivered in three different mounting designs (x): standard panel mounting **(E)**, push-through mounting **(D)** and cold-plate mounting **(C)**.

11.2.4 Capacitor modules

For backing up the DC-bus voltage for the drive system:

- ECSxK001
- ECSxK002

The modules are delivered in three different mounting designs (x): standard panel mounting **(E)**, push-through mounting **(D)** and cold-plate mounting **(C)**.

11.2.5 Components for communication

Communication modules

Various communication modules are available for supply modules and axis modules of the ECS series:

Communication module	Type/order number
Keypad XT	EMZ9371BC
Card module	EMZ2221IB
Diagnosis terminal (Keypad XT with hand-held)	E82ZBBXC
LECOM-A (RS232)	EMF2102IB-V004
LECOM-B (RS485)	EMF2102IB-V002
LECOM-A/B (RS232/485)	EMF2102IB-V001
LECOM-LI (optical fibre)	EMF2102IB-V003
FP interface	EMF2103IB
LON	EMF2141IB
INTERBUS	EMF2113IB
PROFIBUS-DP	EMF2133IB
DeviceNet/CANopen	EMF2175IB
CAN addressing	EMF2174IB

System bus components

PC system bus adapter	Type/order number
Voltage supply via DIN connection	EMF2173IB
Voltage supply via PS2 connection	EMF2173IB-V002
Voltage supply via PS2 connection (electrically isolated from CAN bus)	EMF2173IB-V003
USB system bus adapter	EMF2177IB

Components for digital frequency coupling

Digital frequency distributor/cables	Type/order number
Digital frequency distributor	EMF2132IB
Master digital frequency cable	EYD0017AxxxxW01W01 [1)]
Slave digital frequency cable	EYD0017AxxxxW01W01 [1)]

1) ”xxxx” = Cable length in decimetre (example: ”xxxx” = ”0015” → length = 15 dm)

11.2.6 Brake resistors

External brake resistors with specially adjusted pulse capability for the cold-plate variant in IP50 design:

- ERBM039R120W (39 Ω, 0.12 kW)
- ERBM020R150W (20 Ω, 0.15 kW)

External brake resistors with increased power loss in IP20 design (protection against accidental contact according to NEMA 250 type 1):

- ERBD047R01K2 (47 Ω, 1.2 kW)
- ERBD022R03K0 (22 Ω, 3.0 kW)

External brake resistors with increased power loss in IP65 design (NEMA 250 type 4x):

- ERBS039R01K6 (39 Ω, 1.6 kW)
- ERBS020R03K2 (20 Ω, 3.2 kW)

Assignment of external brake resistors

Brake resistor	Ω	P_D [kW]	Power supply module								
			ECSEE...			ECSDE...			ECSCE...		
			012	020	040	012	020	040	012	020	040
ERBM039R120W	39	0.12							●	●	
ERBM020R150W	20	0.15									●
ERBD047R01K2	47	1.2	●	●		●	●		●	●	
ERBD022R03K0	22	3.0			●			●			●
ERBS039R01K6	39	1.6	●	●		●	●		●	●	
ERBS020R03K2	20	3.2			●			●			●

P_D Permanent power

11.2.7 Mains fuses

Fuses are not offered by Lenze. Please use standard fuses.

Observe the national and regional regulations (VDE, UL, EVU, ...).

Only circuit-breakers or UL-approved fuses can be used for cable protection.

In UL-approved systems, only UL-approved cables, fuses and fuse holders are to be used.

11.2.8 Mains chokes

It is not mandatory to use a mains choke for operating the ECS modules. The respective application determines whether a mains choke is required or not.

Advantages when using a mains choke:

- Lower system perturbations
  - The waveform of the mains current is approximated to the sinusoidal shape.
  - Reduction of the effective mains current by up to 25%.
  - Reduction of the mains, cable and fuse load.
- The effective DC-bus current also decreases by up to 25%.
- Increased service life of the connected axis modules
  - A mains choke reduces the AC current load of the DC-bus capacitors and thus increases their service life.
- Low-frequency radio interference voltages are reduced.

Please note:

- With mains choke operation the maximally possible output voltage does not fully reach the value of the mains voltage.
- For operation of drives for accelerating duty with high peak currents, it is recommended to use mains chokes with linear L/I characteristic (Lenze types ELN3...).
- The choke rating is to be checked and adapted to the respective conditions.

Mains chokes for the power supply modules:

Power supply module type	Mains choke type	I_r [A]	L_r [mH]	Short-circuit voltage (U_k)
ECSxE012	ELN3-0150H024	3 x 24	3 x 1.5	4 %
ECSxE020	ELN3-0088H035	3 x 35	3 x 0.88	
ECSxE040	ELN3-0055H055	3 x 55	3 x 0.55	

11.2.9 RFI filter

According to the application, different measures for reducing the mains current and for radio interference suppression are required on the supply side for servo systems. As a rule, these measures are not mandatory, but protect the universal application of a servo system.

Lenze offers a built-on filter for each power supply module for the interference level A. The RFI filters are designed for the ECS power supply module assigned and up to 10 axes with a motor cable length of 25 m each (Lenze system cable). The interference level A is observed as long as the motor cable length per axis module is 25 m at a maximum (Lenze sytem cables) and the number of the ECS axis modules is maximally 10.

RFI filter type	ECS power supply module type
ECSZZ020X4B	ECSxE012
	ECSxE020
ECSZZ040X4B	ECSxE040

Type of RFI filter	U [V]	I [A]	P_{loss} [W]	Weight [kg]
ECSZZ020X4B	3/PE AC 500 V at 50 ... 60 Hz	16	6.2	3.0
ECSZZ040X4B		32	9.3	

U Rated mains voltage
I Rated mains current
P_{loss} Power loss

11.2.10 Motors

Matched motors can be obtained under the following type designations:

- MCA series asynchronous motor (high speeds by means of wide field weakening range)
- MCS series synchronous motor (for high-dynamic applications)
- MDxMA series asynchronous motor (cost-effective)

12 Index

E

K

L

M

N

O

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Lenze Drive Systems GmbH
Hans-Lenze-Straße 1
D-31855 Aerzen
Germany

☎ +49 (0) 51 54 82-0
☎ Service 00 80 00 24 4 68 77 (24 h helpline)
Service +49 (0) 51 54 82-1112
E-Mail Lenze@Lenze.de
Internet www.Lenze.com

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