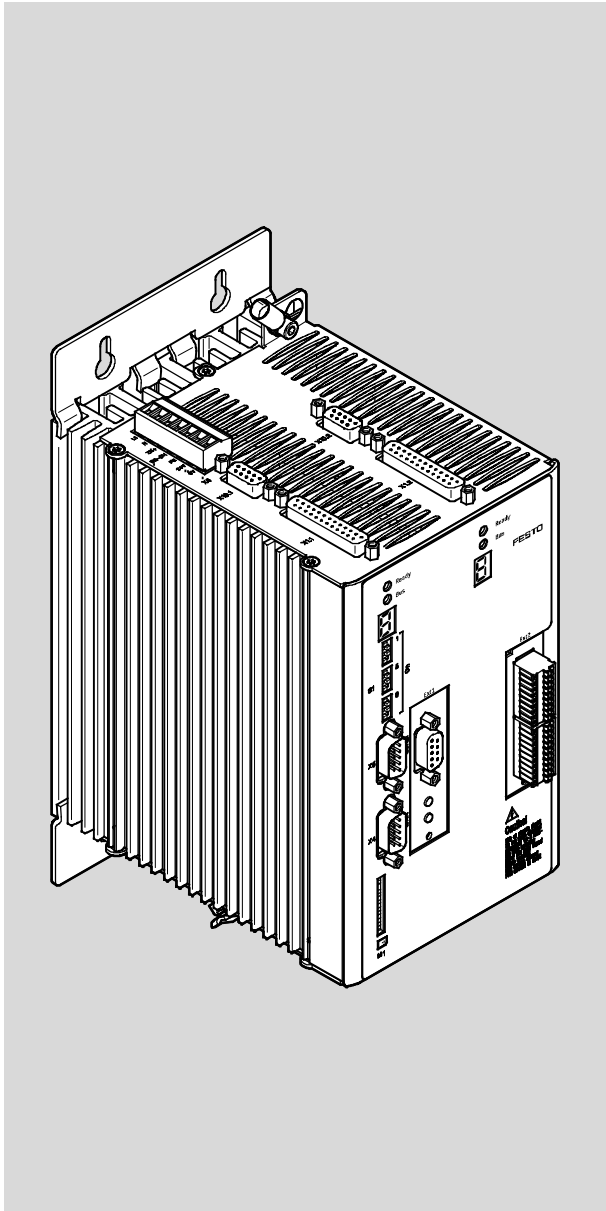


Motor controller

CMMD-AS-C8-3A



FESTO

Description

Mounting and
installation

8040103
1404NH
[8034480]

Translation of the original instructions

GDCP-CMMD-AS-HW-EN

CANopen®, DeviceNet®, EnDat®, Heidenhain®, PHOENIX®, PROFIBUS® are registered trademarks of the respective trademark owners in certain countries.

Identification of hazards and instructions on how to prevent them:



Warning

Hazards that can cause death or serious injuries.



Caution

Hazards that can cause minor injuries or serious material damage.

Other symbols:



Note

Material damage or loss of function.



Recommendations, tips, references to other documentation.



Essential or useful accessories.



Information on environmentally sound usage.

Text designations:

- Activities that may be carried out in any order.
- 1. Activities that should be carried out in the order stated.
- General lists.

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Instructions on this documentation

This documentation is intended to help you safely work with the motor controller CMMD-AS-C8-3A and describes the functions, commissioning and error messages.

Target group

This documentation is intended exclusively for technicians trained in control and automation technology, who have experience in installation, commissioning, programming and diagnostics of positioning systems.

Versions



This documentation refers to the following versions:

- Motor controller CMMD-AS-C8-3A from Rev 02 (→ Type plate).



Please note

Before using a newer firmware version, check whether a newer version of the FCT plug-in or user documentation is available for it (→ www.festo.com/sp).

servicing

Please consult your regional Festo contact if you have any technical problems.

Product identification

Rating plate CMMD-AS-C8-3A	Function
<p style="text-align: center;">CMMD-AS-C8-3A</p> <p style="text-align: center;">561406 Rev 02</p> <p style="text-align: center;">CN98 P0021912</p> <p style="font-size: 2em; font-weight: bold; margin-left: 20px;">CE</p> <p style="margin-left: 20px;">In: 1 ~ (95...250) V AC (50...60) Hz 8 A</p> <p style="margin-left: 20px;">Out 1/2: 3 ~ (0...to Input Voltage) V AC (0...1000) Hz 4 A</p>	<p>Type designation CMMD-AS-C8-3A</p> <p>Part number e.g. 561406</p> <p>Revision status e.g. Rev 02</p> <p>Serial number e.g. CN98 P0021912</p> <p>Input (In) 1-phase 95 ... 250 V AC 50 ... 60 Hz, 8 A</p> <p>Output 1, 2 (Out 1/2) 3-phase 0 ... Input voltage V AC 0 ... 1000 Hz, 4 A</p>

Tab. 1 Rating plate CMMD-AS-C8-3A (example)

Issue status of the specified standards

Standard: issue status	
EN 60034-1:2010-10	EN 61800-3:2004-12 + A1:2012-03
EN 60204-1:2006/A1:2009-02	EN 61800-5-1:2007-09

Tab. 2 Issue statuses

Production time period

On the type plate, the first 2 characters of the serial number indicate the production period in encrypted form (➔ Tab. 1) The letter specifies the manufacturing year and the character behind it (number or letter) indicates the month of production.

Manufacturing year					
X = 2009	A = 2010	B = 2011	C = 2012	D = 2013	E = 2014
F = 2015	H = 2016	J = 2017	K = 2018	L = 2019	M = 2020

Tab. 3 Manufacturing year (20-year cycle)

Manufacturing month	
1	January
3	March
5	May
7	July
9	September
N	November
2	February
4	April
6	June
8	August
O	October
D	December

Tab. 4 Manufacturing month

Type codes

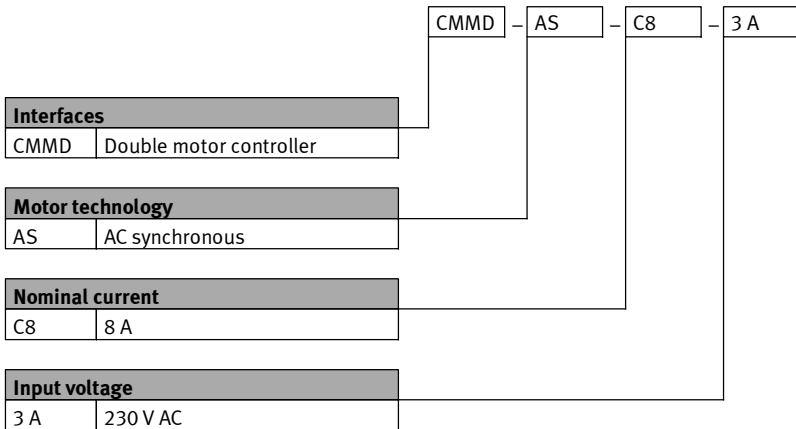


Fig. 1 Type codes

Documentation

Additional information on the motor controllers can be found in the following documentation:

Documentation		Device type	Table of contents
Mounting and installation	GDCP-CMMS-AS-G2-HW-...	CMMS-AS	– Mounting
	GDCP-CMMD-AS-HW-...	CMMD-AS	– Installation (pin allocation)
	GDCP-CMMS-ST-G2-HW-...	CMMS-ST	– Error messages – technical data
Functions and commissioning	GDCP-CMMS/D-FW-...	CMMS-AS CMMD-AS CMMS-ST	– Control interfaces – Operating modes/operational functions – Commissioning with FCT – Error messages
STO safety function	GDCP-CMMS-AS-G2-S1-...	CMMS-AS	– Functional safety engineering with the safety function STO (safe torque off))
	GDCP-CMMD-AS-S1-...	CMMD-AS	
	GDCP-CMMS-ST-G2-S1-...	CMMS-ST	
Device profile FHPP	GDCP-CMMS/D-C-HP-...	CMMS-AS CMMD-AS CMMS-ST	– Description of the interfaces: – CAN bus (CANopen) – Interface CAMC-PB (PROFIBUS) – Interface CAMC-DN (DeviceNet) – Control and parameterisation via the device profile FHPP (Festo profile for handling and positioning) with PROFIBUS, DeviceNet or CAN-open.
Device profile CiA 402,	GDCP-CMMS/D-C-CO-...	CMMS-AS CMMD-AS CMMS-ST	– Description of the interface: – CAN bus (CANopen, DriveBus) – Control and parameterisation via device profile CiA 402 (DS 402).
Software help	Help on the CMMS-AS plug-in	CMMS-AS	– Surface and functions in the Festo Configuration Tool for the plug-in
	Help on the CMMD-AS plug-in	CMMD-AS	
	Help for the CMMS-ST plug-in	CMMS-ST	

Tab. 5 Documentation on the motor controllers



The documentation is available on the following media:

- CD-ROM (scope of delivery)
- Support portal: www.festo.com/sp

1 Safety and requirements for product use

1.1 Security

1.1.1 Safety instructions



Warning

Danger of electric shock

Touching live parts causes severe injuries and can lead to death:

- When the module or cover plate is not mounted on the card slot [EXT]
- When cables are not mounted to the plugs [X6.1], [X6.2] and [X9]
- When connecting cables are disconnected when powered.

The product must be installed in a control cabinet and may only be used if all safeguarding has been initiated.

Before touching live parts during maintenance, repair and cleaning work and when there have been long service interruptions:

1. Switch off power to the electrical equipment via the mains switch and secure it against being switched on again.
2. After switch-off, wait at least 5 minutes discharge time and check that power is turned off before accessing the motor controller.



Warning

Danger of electric shock

This product can cause a DC current in the protective ground conductor. In cases where an error current protection unit (RCD) or an error current monitoring device (RCM) is used to protect against direct or indirect contact, only the Type B kind of RCD or RCM is permitted on the power supply side of this product.



Caution

Danger of burns from hot surfaces

Dependent on the load of the motor controller, housing temperatures > 80 °C are possible in operation.

- Protect hot surfaces from contact in operation.
- Touch them only in a switched-off, cooled-off status.





Note

Danger from unexpected movement of the motor or axis

- Make sure that the movement does not endanger anyone.
- Perform a risk assessment in accordance with the EC machinery directive.
- Based on this risk assessment, design the safety system for the entire machine, taking into account all integrated components. This also includes the electric drives. Bypassing of safety equipment is impermissible.

1.1.2 Intended use

The motor controller CMMD-AS-C8-3A. is intended for use as a controller for servo motors of the EMMS-AS series. It enables closed loop control of torque (current), speed and position, as well as positioning control with stored positioning records. The motor controller is designed for installation in a control cabinet.

The product is intended for use in industrial environments. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.

Use exclusively:

- In faultless technical condition
- In original status without unauthorised modifications; only the expansions described in the documentation supplied with the product are permitted.
- Within the limits of the product defined by the technical data (→ Appendix A.1)
- in an industrial environment
- In a control cabinet.

In the event of damage caused by unauthorised manipulation or other than intended use, the guarantee is invalidated and the manufacturer is not liable for damages.

The motor controller supports the following safety function:

- Safe Torque Off – “Safe Torque Off” (STO)



Additional information → STO safety function description, GDPC-CMMD-AS-S1-....

1.2 Requirements for product use

- Make this documentation available to the design engineer, installer and personnel responsible for commissioning the machine or system in which this product is used.
- Make sure that the specifications of the documentation are always complied with. Also consider the documentation for the other components and modules.
- Take into consideration the legal regulations applicable for the destination, as well as:
 - Regulations and standards,
 - regulations of the testing organizations and insurers,
 - National specifications.

1.2.1 Transport and storage conditions

- Protect the product during transport and storage from impermissible burdens, such as:
 - mechanical loads
 - impermissible temperatures
 - moisture
 - aggressive atmospheres
- Store and transport the product in its original packaging. The original packaging offers sufficient protection from typical stresses.

1.2.2 Technical requirements

For correct and safe use of the product:

- Comply with the connection and environmental conditions of the product (→ Appendix A) and all connected components specified in the technical data. Compliance with the limit values and load limits permits operation of the product in compliance with the relevant safety regulations.
- Observe the instructions and warnings in this documentation.

1.2.3 Qualification of trained personnel

The product may only be placed in operation by a qualified electrotechnician who is familiar with:

- the installation and operation of electrical control systems,
- the applicable regulations for operating safety-engineered systems,
- the applicable regulations for accident protection and occupational safety, and
- the documentation for the product.

1.2.4 Range of application and certifications

The motor controller with integrated STO safety function is a safety-related part of the control systems.

The motor controller carries the CE marking; for standards and test values

→ appendix A.1.

The product-relevant EU directives can be found in the declaration of conformity.



For certificates and the declaration of conformity for this product please refer to

→ www.festo.com/sp.

2 Product Overview

2.1 The entire system for the CMMD-AS-C8-3A

- 1 Power switch
- 2 Fuse → A.2.1
- 3 24 V power supply unit for control voltage
- 4 Motor controller CMMD-AS-C8-3A
- 5 PC with serial connecting cable for parameterisation and commissioning with the Festo Configuration Tool (FCT), Plugin CMMD-AS
- 6 Motor – EMMS-AS with encoder (motor and encoder cable NEBM)

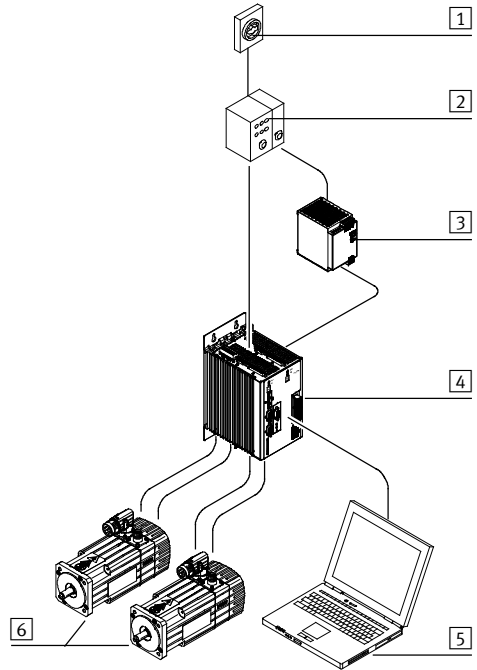


Fig. 2.1 Complete structure CMMD-AS-C8-3A

2.2 Scope of delivery

Number	Component
1	Motor controller CMMD-AS-C8-3A
1	Operator package <ul style="list-style-type: none"> – Brief description – CD-ROM with following contents: <ul style="list-style-type: none"> – Parameterization software 'Festo Configuration Tool' (FCT) – Documentation on the product – S7 module – Configuration files for the supported bus systems (e.g. device core data for PROFIBUS (GSD), electronic data sheet (EDS) for DeviceNet etc.) – Firmware
1	Assortment of plugs (plugged into connections)
2	Mounting bracket

Tab. 2.1 Scope of delivery



Accessories → www.festo.com/catalogue

2.3 Device view

The motor controller CMMD-AS-C8-3A provides the functionality of 2 motor controllers in one housing. The connection designations of the motor controller provide an assignment for connections to axes (→ Fig. 2.3 and Fig. 2.4). Connections with the index '1' are assigned to axis 1 (e.g. [X1.1]), connections with index '2' to axis 2 (e.g. [X1.2]). Connections that are used together do not have an index. The following connections are therefore available once and are used together:

- [X9] Power supply and braking resistor
- [X4]: CAN bus
- [X5]: RS232/RS485.

In this documentation the index '1/2' is written whenever both connections are meant. [X1.1/2] stands for connection [X1.1] and [X1.2].

- 1 LED status indicator - axis 1
- 2 LED status indicator - axis 2
- 3 Seven-segment display - axis 1
- 4 Seven-segment display - axis 2
- 5 [S1]: DIL switches for fieldbus settings and firmware update
- 6 [EXT 1/2]: slots for expansion options
- 7 [M1]: card slot for SD memory card
- 8 [X4]: CAN bus
- 9 [X5]: RS232/RS485
- 10 Earthing screw (central PE connection)

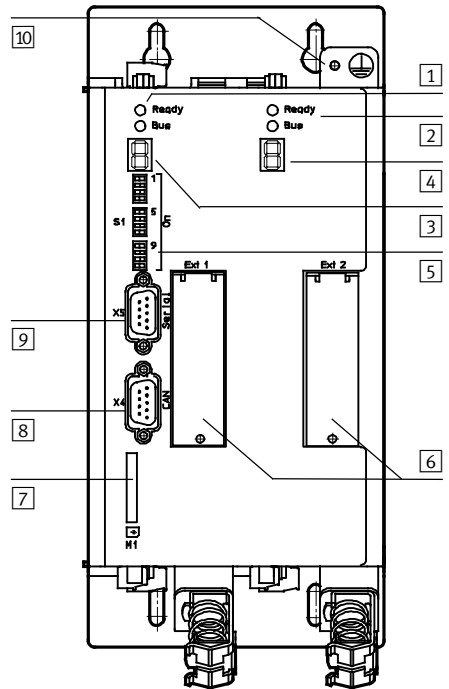


Fig. 2.2 Front view of CMMD-AS-C8-3A

- 1 [X1.1] I/O interface - axis 1
- 2 [X1.2] I/O interface - axis 2
- 3 [X10.1] Master/Slave (bidirectional interface) - axis 1
- 4 [X10.2] Master/Slave (bidirectional interface) - axis 2
- 5 [X9] Power supply and braking resistor

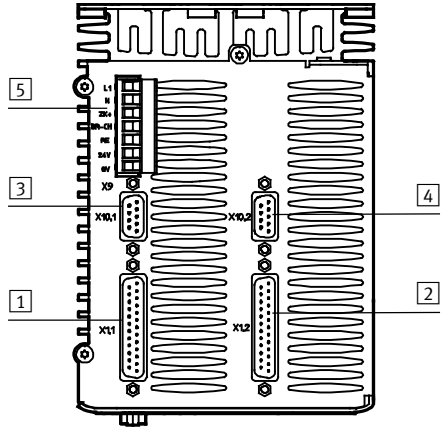


Fig. 2.3 Top view of CMMD-AS-C8-3A

- 1 [X3.1] STO interface - axis 1
- 2 [X3.2] STO interface - axis 2
- 3 [X2.1] Encoder - axis 1
- 4 [X2.2] Encoder - axis 2
- 5 [X6.1] Motor - axis 1
- 6 [X6.2] Motor - axis 2
- 7 Sheath connection terminal - axis 1
- 8 Sheath connection terminal - axis 2

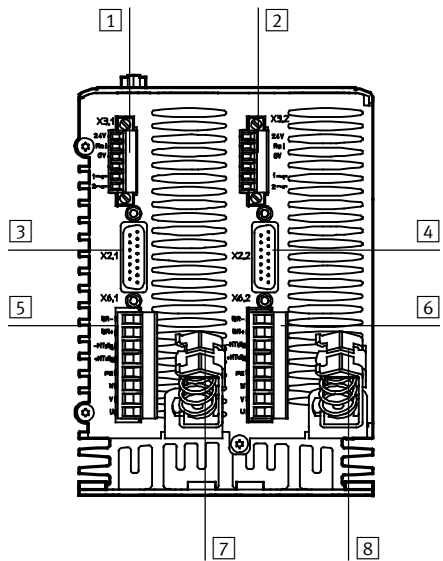








Fig. 2.4 Bottom view of CMMD-AS-C8-3A

2.4 Display and control elements

2.4.1 Seven-segment display

Display ¹⁾		Significance
Starting program		
	Dot	Start programme (bootloader) active
	Flashing point	– Firmware file (memory card) is being read
Operating modes		
	P x x x	Positioning mode, record number x x x
	000	– No positioning record active
	001...063	– Positioning record 001 ... 063 active
	064	– Manual procedure via FCT or FHPP direct record (direct operation)
	070/071	– Jog+/jog-
	PH x	Homing phase x
	0	– Searching travel to the primary destination (limit switch or stop)
	1	– Crawl to the reference point
	2	– Travel to the axis zero point
	Rotating outside segments	Speed mode (speed adjustment): Display changes in response to rotor position and speed.
	Middle segment	Controller enable active (motor is energised).
	I	Force/torque mode (current control)
Safety function		
	H	Two-channel safety function requested (DIN4 [X1.1/2] Pin 21 and Rel [X3 1/2] Pin 2)
Error/warning messages		
	E x x y	Error (E = error) Number: Two-position main index (x x), single-position sub-index (y) Example: E 0 1 0 → Appendix B.
	- x x y -	Warning Number: Two-position main index (x x), single-position subindex (y). Example: - 1 7 0 - → Appendix B.

1) Several characters are displayed one after the other.

Tab. 2.2 Seven-segment operation and error display (→ Fig. 2.2 [2])



Warnings are automatically acknowledged when the cause is no longer present. Error messages are acknowledged via:

- the parameterisation software FCT
- the fieldbus (control word)
- or a decreasing edge at [X1.1/2] DIN5.

2.4.2 LED indicators

LED	LED colour	Function
Ready	Green	Operating status/controller enable
	Flashing green	Parameter file *.DCO (memory card) is being read/written
Bus	Yellow	Bus status display lights up whenever CAN communication is taking place

Tab. 2.3 LED status indicator (→ Fig. 2.2 [1])

2.4.3 DIL switch

DIL switch	Function
S1.1 ... 7	Bus address or MAC-ID on first axis → Example Tab. 2.5 The second axis gets the address of the first axis +1 NodeNumberSlave = NodeNumberMaster +1
S1.8	Automatic loading of a new firmware file from the memory card by the start programme (bootloader): ¹⁾ - ON: Download from the SD memory card to the motor controller. - OFF: No download.
S1.9 ... 10	Setting the bus transmission rate → Example Tab. 2.6
S1.11	Activation of the CAN-bus interface
S1.12	Terminating resistor for CAN-bus

1) Additional information can be found in the firmware download → Description of functions and commissioning, GDCP-CMMS/D-FW-...

Tab. 2.4 Function of the DIL switches (→ Fig. 2.2 [3])

S1.1 ... 7	ON/OFF (example)	Significance ¹⁾
1	ON 1	DIL switch S1.1 is the low-order bit. Example: address = 1011011 = 91
2	ON 1	
3	OFF 0	
4	ON 1	
5	ON 1	
6	OFF 0	
7	ON 1	

1) Additional information → Description of functions and commissioning, GDCP-CMMS/D-FW-...

Tab. 2.5 CAN bus address or MAC-ID

S1.9 ... 10	ON/OFF (example)	Significance ¹⁾
9	ON 1	DIL switch S1.9 is the low-order bit. 00: 125 kBit/s
10	OFF 0	01: 250 kBit/s (example) 10: 500 kBit/s 11: 1000 kBit/s

1) Additional information → Description of functions and commissioning, GDCP-CMMS/D-FW-....

Tab. 2.6 CAN bus transmission rate

2.4.4 Slot [EXT 1/2]

The slot (→ Fig. 2.2 4) enables the option of expanding CMMD-AS-C8-3A by other interfaces, e.g.:

Interface	Brief description	Permitted slot	
CAMC-D-8E8A	Interface for additional I/O	EXT 1	EXT 2
CAMC-PB	Interface for PROFIBUS DP	EXT 1	–
CAMC-DN	Interface for DeviceNet	EXT 1	–

Tab. 2.7

A CAN interface is rigidly integrated in the motor controller. As an option, an interface for PROFIBUS or for DeviceNet can be integrated. However, a field bus interface can always be used for both axes. This must be located in the slot [Ext 1].



For installation, please observe the assembly instructions for the CAMC interface. If the interface is installed, it is automatically activated the next time the motor controller is switched on. Information about function can be found in the FHPP device profile description, GDCP-CMMS-/D-C-HP-...

2.4.5 Card slot [M1] for SD memory card



A parameter set can be loaded from/saved onto the memory card by using the FCT software. Additional information → Help for FCT plugin CMMD-AS and description of function and commissioning, GDCP-CMMS/D-FW-....

SD memory card	Description
Functions	Copying/loading a parameter set from the memory card to the CMMD-AS-C8-3A.
	Copying/saving a parameter set from the CMMD-AS-C8-3A to the memory card.
	Copying (loading) firmware from the memory card to the CMMD-AS-C8-3A (Bootloader)
Design on the device	1x12-pin SD card slot
Supported card types	SD ¹⁾ (version 1 and 2)
Supported file systems	FAT16
Format filename	8.3

1) Recommended are industry-suitable memory cards from the Festo accessories programme.

Tab. 2.8 Characteristics of the memory card (→ Fig. 2.2 [5])

3 Mechanical installation

3.1 Installation dimensions

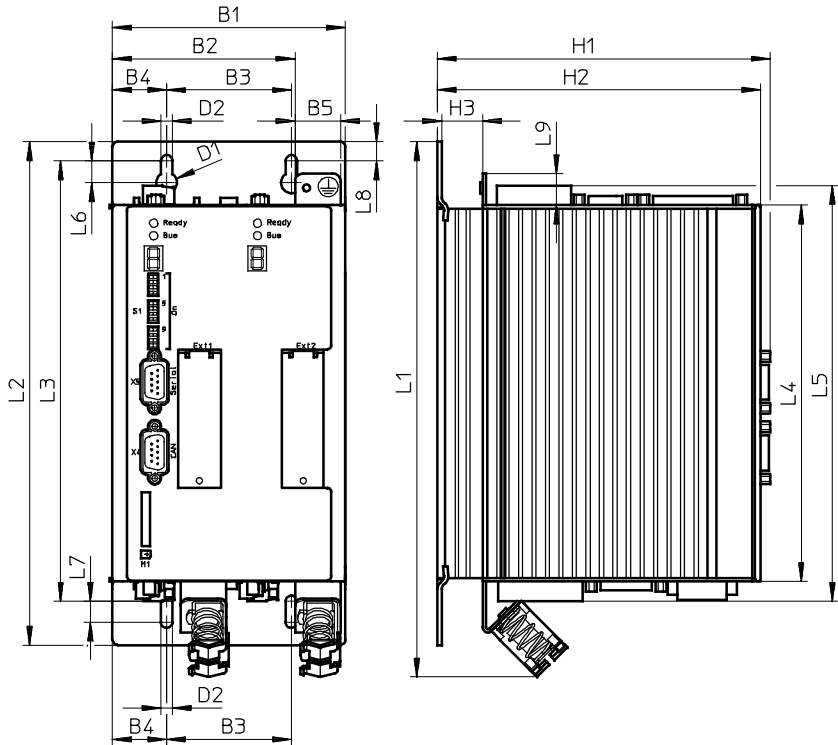


Fig. 3.1 Installation dimensions

Dim.	B1	B2	B3	B4	D1 \varnothing	D2 \varnothing	H1	H2	H3
[mm]	112	87.8	60	26	10	5.5	160	155.6	19.7

Dim.	L1	L2	L3	L4	L5	L6	L7	L8	L9
[mm]	257.55	242.14	211.9	181	200	10.5	10	9.25	15.3

Tab. 3.1 CMMD-AS-C8-3A: Installation dimensions

3.2 Mounting



Warning

Danger of electric shock.

Touching live parts causes severe injuries and can lead to death. Do not disconnect connecting cables when powered. Before mounting and installation work:

1. Switch off power to the electrical equipment via the mains switch and secure it against being switched on again.
2. After switch-off, wait at least 5 minutes discharge time and check that power is turned off before accessing the motor controller.



Caution

Danger of burns from hot surfaces

Dependent on the load of the motor controller, housing temperatures > 80 °C are possible in operation.

- Touch them only in a switched-off, cooled-off status.



Please note

Make sure that no metal shavings, metal dust or mounting parts (screws, nuts, pieces of wire) fall into the motor controller when mounting and during operation.

For vertical mounting onto a control cabinet mounting plate:

- Mount the accompanying mounting bracket to the motor controller.

The two mounting brackets are part of the radiator profile and transfer heat to the mounting plate.

The motor controllers of the CMMx family are designed in such a way that they can be mounted on a heat-dissipating mounting plate if used as intended and installed correctly.

- Mount motor controller in the control cabinet as follows:
 - The mounting position is vertical with the power supply lines [X9] leading upwards
 - Mounting to the mounting brackets with M5 screws.

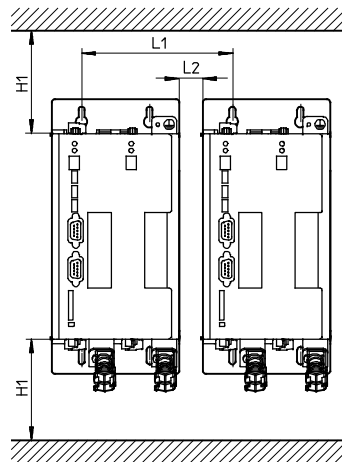


Fig. 3.2 Installation clearance

**Please note**

An excessive temperature increase results in premature aging or damage to the motor controller.

- Observe the specified installation clearances to ensure sufficient ventilation (→ Tab. 3.2).

Installation clearance		H ¹⁾	L1	L2
– at an output of 800 W	[mm]	100	133	21
– at a rated output of 1200 W	[mm]	100	192	80

1) Recommendation for optimum wiring of the motor and encoder cable: 150 mm installation clearance H1 on the underside.

Tab. 3.2 Installation clearance



The specified installation clearance L2 = 21 mm relates to an average motor output in continuous operation (S1 operation according to EN 60034-1). When subjected to a higher output, the clearance L2 = 21 mm is sufficient under the following conditions:

- The motor is operated at a higher peak load in intermittent operation (S3/S4 operation according to EN 60034-1: acceleration, constant movement with a low load, braking).
- An excessive temperature rise of the motor controller is prevented by forced ventilation.

3.3 Disassembly

**Warning****Danger of electric shock.**

Touching live parts causes severe injuries and can lead to death. Do not disconnect connecting cables when powered. Before mounting and installation work:

1. Switch off power to the electrical equipment via the mains switch and secure it against being switched on again.
2. After switch-off, wait at least 5 minutes discharge time and check that power is turned off before accessing the motor controller.

**Caution****Danger of burns from hot surfaces**

Dependent on the load of the motor controller, housing temperatures > 80 °C are possible in operation.

- Touch them only in a switched-off, cooled-off status.



4 Electrical installation

4.1 Safety instructions



Warning

Danger of electric shock

Motor controllers are devices with increased leakage current (> 10 mA). If wiring is incorrect or the device is defective, high voltage can occur on the housing, which can result in serious injury or even death if the housing is touched.

- Before commissioning, and also for brief measuring and test purposes, connect the PE protective conductor → Fig. 4.4:
 - to the earthing screw of the motor controller housing
 - to pin PE [X9.5], power supply.

The cross section of the protective conductor at PE [X9.5] must correspond at least to the cross section of the external conductor L [X9.1].
- Observe the regulations of the EN 60204-1 for the protective earthing.



Warning

Danger of electric shock

- When the module or cover plate is not mounted on the card slot [EXT1/2]
- When cables are not mounted to the plugs [X6.1/2] und [X9]
- When connecting cables are disconnected when powered.

Touching live parts causes severe injuries and can lead to death. Before mounting and installation work:

1. Switch off power to the electrical equipment via the mains switch and secure it against being switched on again.
2. After switch-off, wait at least 5 minutes discharge time and check that power is turned off before accessing the motor controller.



Warning

Danger of electric shock

This product can cause a DC current in the protective ground conductor. In cases where an error current protection unit (RCD) or an error current monitoring device (RCM) is used to protect against direct or indirect contact, only the Type B kind of RCD or RCM is permitted on the power supply side of this product.





Caution

Danger from unexpected movement

Faulty pre-assembled lines may destroy the electronics and trigger unexpected movements of the motor.

- When wiring the system, use only the supplied plug connectors and preferably the cables listed in the catalogue as accessories.
→ www.festo.com/catalogue
- Lay all flexible lines so that they are free of kinks and free of mechanical stress; if necessary use chain link trunking.



Please note

ESD (electrostatic discharge) can cause damage to the device or other system parts at plug connectors that are not used.

- Before installation: Earth the system parts and use appropriate ESD equipment (e.g. shoes, earthing straps etc.).
- After installation: Seal unassigned D-sub plug connectors with protective caps (available at authorized dealers).
- Observe the handling specifications for electrostatically sensitive devices.



4.2 Instructions for safe and EMC-compliant installation



The CMMD-AS-C8-3A motor controllers have been approved in accordance with product standard EN 61800-3 that is applicable to electric drives. Components from Festo have been used for this purpose (e.g. motor/encoder cables).

The declaration of conformity for the EMC directive (electromagnetic compatibility) is available at → www.festo.com.

4.2.1 Interference emission and resistance to interference

In order to increase the resistance to interference and decrease the emitted interference, the CMMD-AS-C8-3A motor controller already has integrated motor chokes and mains filters, which means that the motor controller can be operated without additional shielding and filters in most applications.

If installed correctly and if all connecting cables are wired correctly (→ Chap. 4.2.2), the motor controller fulfils product standard EN 61800-3 for the following range of application:

Permissible range of application	
Emitted interference	Second environment (industrial) ¹⁾
Resistance to interference	Second environment (industrial) ¹⁾

1) Locations outside of the residential area, or industrial areas that are supplied from the medium-voltage power supply network through their own transformer.

Tab. 4.1 Permissible range of application in accordance with EN 61800-3



Please note

The built-in filter can be thermally overloaded if an application involves long motor cables (15 ... 25 m) or motor cables with an impermissible high cable capacity:

- Use additional filters for cables 15 ... 25 m long (see Tab. 4.2).
- Only use cables with a capacitance per unit length of < 200 ... 150 pF/m between the motor phase and screening; contact the cable supplier if necessary.

category EN 61800-3	Motor cable length [m]	Filter (at the output)
C3 ¹⁾	< 15	None
	15 ... 25	Ferrite core via motor cable (Ferroxcube TX26/15/20 3C90) <ul style="list-style-type: none"> • Feed each of the 3 motor phases through the ferrite core twice in the same direction → 3 x 2 windings on the inside of the ring core. • Do not feed the PE wire through the ferrite core.

1) C3: Power drive systems with nominal voltages < 1000 V for exclusive use in the second environment.

Tab. 4.2 Additional EMC filter

4.2.2 EMC-compliant wiring



Routing cables:

- Do not run signal cables parallel to power cables
- The distance between signal cables and power cables should be at least 25 cm
- Avoided crossing power cables or running them at a 90° angle.

Screening:

- Always run motor and encoder cables so they are screened
- Twist unscreened signal cables
- When using screened cables with an unscreened plug housing: the maximum length of the unscreened wires at the end of the cable is 35 mm.

- Observe the permissible cable lengths and the required screening for the cables → Tab. 4.3.

Port	Interface	Cable length [m]	Screening
[X1.1] [X1.2]	I/O interface, axis 1 I/O interface, axis 2	≤ 5	Recommendation: screened
[X2.1] [X2.2]	Encoder axis 1 Encoder axis 2	≤ 25	- Screened - Apply the cable screening of the encoder cable flat on the plug housing of the encoder connection [X2 1/2] → Chapter 4.4
[X3.1] [X3.2]	STO interface axis 1 STO interface axis 2	≤ 30	When wiring outside the control cabinet: - Use screened cable - Guide screening into the control cabinet and attach to the side of the control cabinet.
[X4]	CAN	≤ 40 ¹⁾	-
[X5]	RS232/RS485	≤ 5	Screened
[X6.1] [X6.2]	Motor axis 1 Motor axis 2	≤ 15 ²⁾	- Screened - Apply cable screening to the shield connection terminal of the corresponding motor controller → Chapter 4.8.3
[X9]	Power supply	≤ 2	-
[X10.1] [X10.2]	Master/Slave axis 1 Master/Slave axis 2		Screened
	as input (slave)	≤ 30	
	as output (master)	≤ 5	

1) Permitted total line length of field bus at a bit rate of 1 Mbit/s. Observe details in the documentation of your control system or bus interface.

2) With additional EMC filter: cable length up to 25 m → Tab. 4.2.

Tab. 4.3 EMC-compliant wiring

When using motor cables from other manufacturers:

- Only use motor cables on which the cables for the temperature sensor (M_{T-} , M_{T+}) and the cable for the holding brake ($BR-$, $BR+$) are in twisted pairs and screened (→ Tab. 4.20).

4.2.3 Protective earthing of the motor controller



Warning

Danger of electric shock

Motor controllers are devices with increased leakage current (> 10 mA). If wiring is incorrect or the device is defective, high voltage can occur on the housing, which can result in serious injury or even death if the housing is touched.

- Before commissioning, and also for brief measuring and test purposes, connect the PE protective conductor → Fig. 4.4:
 - to the earthing screw of the motor controller housing
 - to pin PE [X9.5], power supply.The cross section of the protective conductor at PE [X9.5] must correspond at least to the cross section of the external conductor L [X9.1].
- Observe the regulations of the EN 60204-1 for the protective earthing.

4.2.4 Protective earthing of the motor



Warning

Danger of electric shock

The connected motor and the motor cable carry increased leakage current. Improper earthing can result in hazardous voltage levels and EMC interference.

- Connect the PE wire of the motor cable to connection PE [X6.5] → Chapter 4.8.3
- Apply the cable screening of the motor cable to the shield connection terminal of the motor controller → Chapter 4.8.3.
- Place cable sheath of encoder cable on connector housings of connections [X2.1] and [X2.2] around surface area → Chapter 4.4.

4.3 I/O-interface [X1.1/2]

Port	Version
[X1.1/2] on motor controller	Sub-D plug connector, 25-pin, sockets
Counterplug	Sub-D plug connector, 25-pin, pins

Tab. 4.4 Connection of I/O interface [X1.1/2]

Available as accessories: Screened control cable and sub-D connector
 → www.festo.com/catalogue.

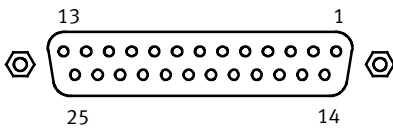


Fig. 4.1 Connection [X1.1/2] on motor controller

Configuration of the I/O interface:

The I/O interface is configured in positioning mode for the following functions via the digital inputs DIN9 (=mode bit 1) and DIN12 (=mode bit 0):

Mode	Function	DIN 9	DIN 12	Pin allocation
0	Positioning (single record) ¹⁾	0	0	→ Tab. 4.6
1	Jog/teach	0	1	→ Tab. 4.7
2	Record linking	1	0	→ Tab. 4.8
3	synchronization	1	1	→ Tab. 4.9

1) Standard allocation of the I/O interface

Tab. 4.5 Function-dependent configuration of the digital inputs

Pin	Value	Mode 0 – positioning (single record)	
1	SGND	0 V	Screening for analogue signals
2	DIN 12	–	Mode bit 0 = “0”
	AIn0	max. 30 V	Differential analogue input (setpoint input 0) ²⁾
3	DIN 10	–	Record selection bit 4 (high active)
4	+VREF	+10 V ±4 %	Reference output for setpoint value potentiometer
5	–	–	–
6	GND24	–	Reference potential for digital I/O modules
7	DIN 1	–	Record selection bit 1 (high active)
8	DIN 3	–	Record selection bit 3 (high active)
9	DIN 5	–	Controller enable (high active)
10	DIN 7	–	Limit switch 1
11	DIN 9	–	Mode bit 1 = “0”
	DIN 9	–	High-speed input (sample) ³⁾
12	DOU1	24 V 100 mA	Motion complete (high active) ¹⁾
13	DOU3	24 V 100 mA	Common error (low active) ¹⁾
14	AGND	0 V	Reference potential for analogue signals
15	DIN 13	Ri = 20 kΩ	Stop (low active)
	#AIN0		Reference potential for setpoint input 0 ²⁾
16	DIN 11	–	Record selection bit 5 (high active)
17	AMON0	0 ... 10 V ±4 %	Output: analogue monitor 0
18	+ 24 V DC	24 V 100 mA	Output: 24 V DC, looped through from [X9.6]
19	DIN 0	–	Record selection bit 0 (high active)
20	DIN 2	–	Record selection bit 2 (high active)
21	DIN 4	–	Output stage enable (high active)
22	DIN 6	–	Limit switch 0
23	DIN 8	–	Start for the positioning procedure (high active)
24	DOU0	24 V 100 mA	Output: Controller ready for operation (high active)
25	DOU2	24 V 100 mA	Start acknowledged (low active) ¹⁾

1) Default setting, configurable in the Festo Configuration Tool (FCT).

2) Pin allocation with control via analogue input

3) Pin allocation for flying measurement

Tab. 4.6 Pin allocation of the I/O interface [X1 1/2], positioning (single record)

Pin		Value	Mode = 1 - jog/teach
1	SGND	0 V	Screening for analogue signals
2	DIN 12	–	Mode bit 0 = “1”
3	DIN 10	–	Jog: jog + (high active) Teach: record selection bit 4
4	+VREF	+10 V ±4 %	Reference output for setpoint value potentiometer
5	–	–	–
6	GND24	–	Reference potential for digital inputs and outputs
7	DIN 1	–	Record selection bit 1 (high active)
8	DIN 3	–	Record selection bit 3 (high active)
9	DIN 5		Controller enable (high active) Teaching: Final saving of the taught positions in the permanent memory takes place with falling edge at DIN5
10	DIN 7	–	Limit switch 1
11	DIN 9	–	Mode bit 1 = “0”
12	DOUT1	24 V 100 mA	Motion complete (high active) ¹⁾
13	DOUT3	24 V 100 mA	Common error (low active) ¹⁾
14	AGND	0 V	Reference potential for analogue signals
15	DIN 13	–	Stop (low active)
16	DIN 11	–	Jog: jog - (high active) Teach: record selection bit 5
17	AMONO	0 ... 10 V ±4 %	Analogue monitor output 0
18	+24 V	24 V 100 mA	Output: 24 V DC, looped through from [X9.6]
19	DIN 0	–	Record selection bit 0 (high active)
20	DIN 2	–	Record selection bit 2 (high active)
21	DIN 4	–	Output stage enable (high active)
22	DIN 6	–	Limit switch 0
23	DIN 8	–	Teach (high active)
24	DOUT0	24 V 100 mA	Output: Controller ready for operation (high active)
25	DOUT2	24 V 100 mA	Teach confirmed

1) Default setting, configurable in the Festo Configuration Tool (FCT).

Tab. 4.7 Pin allocation: I/O interface [X1 1/2], jog/teach

Pin		Value	Mode = 2 - record linking
1	SGND	0 V	Screening for analogue signals
2	DIN 12	–	Mode bit 0 = “0”
3	DIN 10	–	Next 1
4	+VREF	+10 V ±4 %	Reference output for setpoint value potentiometer
5	–	–	–
6	GND24	–	Reference potential for digital inputs and outputs
7	DIN 1	–	Record selection bit 1 (high active)
8	DIN 3	–	Halt record sequence
9	DIN 5	–	Controller enable (high active)
10	DIN 7	–	Limit switch 1
11	DIN 9		Mode bit 1 = “1”
12	DOUT1	24 V 100 mA	Motion complete (high active) ¹⁾
13	DOUT3	24 V 100 mA	Common error (low active) ¹⁾
14	AGND	0 V	Reference potential for analogue signals
15	DIN 13	–	Stop (low active)
16	DIN 11	–	Next 2
17	AMON0	0 ... 10 V ±4 %	Analogue monitor output 0
18	24 V	24 V 100 mA	Output 24 V DC, looped through from [X9.6]
19	DIN 0	–	Record selection bit 0 (high active)
20	DIN 2	–	Record selection bit 2 (high active)
21	DIN 4	–	Output stage enable (high active)
22	DIN 6	–	Limit switch 0
23	DIN 8	–	Start record sequence
24	DOUT0	24 V 100 mA	Output: Controller ready for operation (high active)
25	DOUT2	24 V 100 mA	Start confirmed (high active) ¹⁾

1) Default setting, configurable in the Festo Configuration Tool (FCT).

Tab. 4.8 Pin allocation: I/O interface [X1 1/2], record linking

Pin		Value	Mode = 3 - synchronization
1	SGND	0 V	Screening for analogue signals
2	DIN 12	–	Mode bit 0 = “1”
3	DIN 10	–	–
4	+VREF	+10 V ±4 %	Reference output for setpoint value potentiometer
5	–	–	–
6	GND24	–	Reference potential for digital inputs and outputs
7	DIN 1	–	–
8	DIN 3	24 V 20 kHz (max)	Direction DIR/control signal CCW
9	DIN 5	–	Controller enable (high active)
10	DIN 7	–	Limit switch 1
11	DIN 9		Mode bit 1 = “1”
12	DOUT1	24 V 100 mA	Output: standstill reached (high active)
13	DOUT3	24 V 100 mA	Output: common error (low active) ¹⁾
14	AGND	0 V	Reference potential for analogue signals
15	DIN 13	–	Stop (low active)
16	DIN 11	–	–
17	AMONO	0 ... 10 V ±4 %	Output: analogue monitor 0
18	24 V	24 V 100 mA	Output 24 V DC, looped through from [X9.6]
19	DIN 0	–	–
20	DIN 2	24 V 20 kHz (max)	Pulse CLK/control signal CW
21	DIN 4	–	Output stage enable (high active)
22	DIN 6	–	Limit switch 0
23	DIN 8	–	Start synchronization
24	DOUT0	24 V 100 mA	Output: Controller ready for operation (high active)
25	DOUT2	24 V 100 mA	Output: position synchronous (high active)

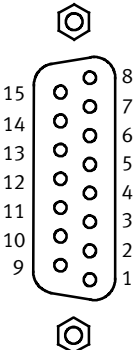
1) Default setting, configurable in the Festo Configuration Tool (FCT).

Tab. 4.9 Pin allocation: I/O interface [X 1/21], synchronization

4.4 Encoder [X2.1/2]

Connection	Version
[X2.1/2] on motor controller	Sub-D plug connector, 15-pin, sockets
Counterplug	Sub-D plug connector, 15-pin, pins

Tab. 4.10 Encoder connection

[X2.1/2]	Pin	Value	Description	
	1	M_{T+}	+3.3 V / 3 mA	Temperature sensor, motor temperature. Not occupied with NEBM lines.
	2	-U_SENS	0 V	Connected internally with pin 3
	3	GND	0 V	Reference potential of encoder power supply and motor temperature sensor
	4	-	-	-
	5	#DATA	$U_{SS} = 5 \text{ V}^1)$ $R_i = 120 \Omega^2)$	RS485 data transmission line (differential)
	6	#SCLK	$U_{SS} = 5 \text{ V}^1)$ $R_i = 120 \Omega^2)$	Cycle output RS485 (differential) for data transfer via the EnDat interface
	7	-	-	-
	8	-	-	-
	9	+U_SENS	5 V (-0 % ... +5 %) $I_{max} = 200 \text{ mA}$	Connected internally with pin 10
	10	US	5 V (-0 % ... +5 %) $I_{max} = 200 \text{ mA}$	Operating voltage for EnDat encoder
	11	-	-	-
	12	DATA	$U_{SS} = 5 \text{ V}^1)$ $R_i = 120 \Omega^2)$	RS485 data transmission line (differential)
	13	SCLK	$U_{SS} = 5 \text{ V}^1)$ $R_i = 120 \Omega^2)$	Cycle output RS485 (differential) for data transfer via the EnDat interface
	14	-	-	-
	15	-	-	-

1) U_{pp} = Peak-to-peak voltage2) R_i = Internal resistance

Tab. 4.11 Pin allocation: Encoder [X2.1/2]

The shaft encoder mounted on the motor shaft is used for commutation of a 3-phase synchronous motor and as an actual-value recorder for the built-in speed and position controller. The following encoders are supported depending on the motor type:

- Absolute encoder (single-turn, multi-turn)
- Digital EnDat 2.1 or 2.2 interface, digital angle information only (analogue SIN-COS signals from the encoders are not supported)
- Maximum current consumption of 200 mA.

Supply voltage for the encoders is taken from the internal +5 V logic supply. The supply voltage tolerance is limited downwards. Voltage drops on the connecting cable are not compensated.



Use of third-party cables

- Double wiring of the supply cable:

The wiring used for the supply cables is to be doubled depending on current consumption and cable length. Example:

when using encoder wiring that exhibits a cable diameter of 0.5 mm^2 , a cable length of 25 m (50 m supply and return), and a current consumption of 200 mA, the voltage drop for a single wiring configuration is $U_{\text{diff}} \sim 0.36 \text{ V}$. → A double wiring configuration is required ($U_{\text{diff}} \sim 0.18 \text{ V}$).

- Screening:

- Run the encoder cable so it is screened
- Twist differential (unscreened) signal cables in pairs (DATA/#DATA, SCLK/#SCLK, +5 V/0 V)
- Apply the screening to the plug housing on the motor and controller side.

For maximum resistance to interference:

- Use cables with individually twisted and screened pairs
- Place cable sheaths on screened pairs (internal screens), separating from outer screen and only on controller side on Pin 3 of the related connection [X2.1] or [X.2.2]
- Apply the complete screening to the plug housing on the motor and controller side.

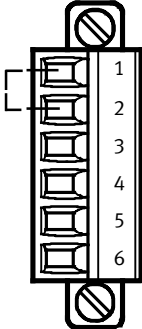
4.5 STO interface [X3.1/2]

4.5.1 Pin allocation

Connection	Version
[X3.1/2] on motor controller	Phoenix Contact - MC 1.5/6-GF3.81 BK
Counterplug (plug set NEKM-C-4)	Phoenix Contact - MC 1.5/6-STF3.81 BK

Tab. 4.12 Connection: STO interface [X3.1/2]

Ex factory, Pin 1 and Pin 2 on the connection [X3.1/2] are bridges (circuitry without use of the STO safety function). That means that the motor controller is prepared ex-factory for use **without** the STO safety function (→ Section 4.5.2).

[X3.1/2]	Pin	Designation	Value	Description
	1	24 V	+24 V DC	Voltage output (24 V DC logic supply carried out as auxiliary voltage)
	2	Rel	0 V / 24 V	Driver supply relay control.
	3	0 V	0 V	Reference potential for digital inputs and outputs.
	4	–	–	–
	5	1 \overline{f} (NC1)	Max. 25 V AC, 30 V DC, 2 A	Acknowledgment contact for the status “Safe Torque Off” (STO)
	6	2 \overline{f} (NC2)		

Tab. 4.13 Pin allocation: Interface [X3 1/2] (circuitry without use of the STO safety function)

4.5.2 Circuitry without use of the STO safety function [X3.1/2]



If you do **not** need the integrated STO safety function in your application, you must bridge Pin 1 and Pin 2 at interface [X3 1/2] to operate the motor controller → Tab. 4.13.

This deactivates the integrated safety function!

When using this circuitry for the CMMD-AS-C8-3A, safety in the application must be ensured through other appropriate measures.

4.5.3 Circuitry with use of the STO safety function [X3 1/2]



The safety function does not provide protection against electric shock, only against hazardous movements. For intended use of the safety function STO – “Safe Torque Off” (→ Description of STO safety function, GDPC-CMMD-AS-S1-...).

If you need the integrated STO safety function in your application, you must remove the bridge between Pin 1 and Pin 2 at interface [X3 1/2] to operate the motor controller → Tab. 4.13.

Recommendation for initial start-up without safety engineering:

Minimum circuitry with emergency stop switching device and two-channel switch-off via the control ports:

- REL ([X3.1/2] Pin 2)
- DIN4 ([X1.1/2] Pin 21).



Note

Loss of the safety function.

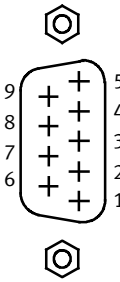
Lack of the safety function can result in serious, irreversible injuries, e.g. due to uncontrolled movements of the connected actuator technology. Bypassing of safety equipment is impermissible.

- Make sure that no jumpers or the like can be used parallel to the safety wiring, e.g. through the use of the maximum wire cross sections or appropriate wire end sleeves with insulating collars.
- Use twin wire end sleeves for looping through lines between neighbouring devices.

4.6 CAN [X4]

Connection	Version
[X4] on the motor controller	Sub-D plug connector, 9-pin, pins
Counterplug	Sub-D plug connector, 9-pin, sockets

Tab. 4.14 CAN connection

[X4]	Pin	Value	Description	
	1	–	–	
	2	CANL	5 V, Ri = 60 Ω	CAN low, signal line
	3	GND	–	CAN GND, not galvanically isolated
	4	–	–	–
	5	Screening	–	Connection for the cable screening
	6	GND	–	CAN GND, not galvanically isolated
	7	CANH	5 V, Ri = 60 Ω	CAN high signal line
	8	–	–	–
	9	–	–	–

Tab. 4.15 Pin allocation: CAN [X4]

4.7 Serial interface RS232/RS485 [X5]

Connection	Version
[X5] on the motor controller	Sub-D plug connector, 9-pin, pins
Counterplug	Sub-D plug connector, 9-pin, sockets

Tab. 4.16 Connection: RS232/RS485 [X5]

The CMMD-AS has a serial interface for both axes. If the CMMD-AS is to be controlled via the serial interface, the node number of the first axis must be set using DIL switch S1. The second axis automatically gets the address of the first axis +1.



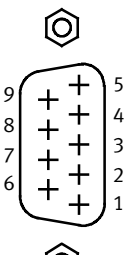
Please note

Transmission fault during simultaneous access.

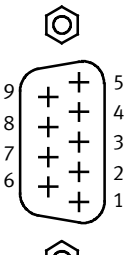
When RS 485 communication is activated, RS232 and RS485 interfaces on the motor controller can be accessed at the same time.

To prevent transmission faults caused by signal overlap:

- When communicating via the serial interface only use separate lines that are configured according to the specified pin allocation for RS485 or RS232.

[X5] RS232	Pin	Value	Description	
	1	–	–	
	2	RS232_RxD	10 V, $R_i > 2\text{ k}\Omega$	Receive signal
	3	RS232_TxD	10 V, $R_a < 2\text{ k}\Omega$	Transmission signal
	4	RS485_A	Do not connect!	
	5	GND	0 V	Reference potential 0 V DC, not galvanically isolated
	6	–	–	–
	7	–	–	–
	8	–	–	–
	9	RS485_B	Do not connect!	

Tab. 4.17 Pin allocation RS232 [X5]

[X5] RS485	Pin	Value	Description	
	1	–	–	
	2	RS232_RxD	Do not connect!	
	3	RS232_TxD	Do not connect!	
	4	RS485_A	–	Positive transmission and reception signal
	5	GND	0 V	Reference potential 0 V DC, not galvanically isolated
	6	–	–	–
	7	–	–	–
	8	–	–	–
	9	RS485_B	–	Negative transmission and reception signal

Tab. 4.18 Pin allocation RS485 [X5]

4.8 Motor [X6.1/2]

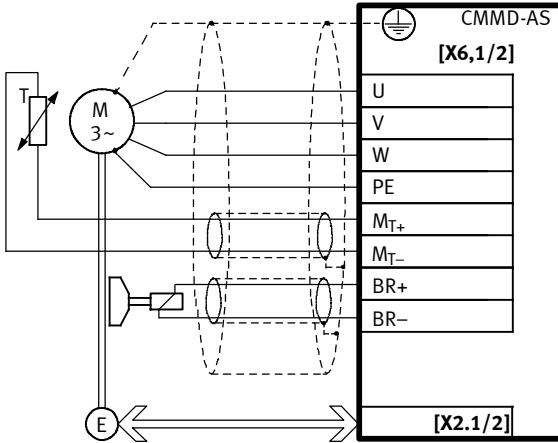


Fig. 4.2 Connection to the motor

4.8.1 Pin allocation

Connection	Version
[X6.1/2] on the motor controller	Phoenix Contact - MSTBA 2.5/8-G5.08 BK
Counterplug (plug set NEKM-C-4)	Phoenix Contact - MSTB 2.5/8-ST5.08 BK

Tab. 4.19 Motor connection

[X6.1/2]	Pin	Value	Description	
	1	BR- 0 V	For motors EMMS-AS-...- TSB/TMB: holding brake (motor) ²⁾	
	2	BR+ 24 V		
	3	MT- 0 V	- Temperature sensor ¹⁾²⁾ - Optional N/C contact, N/O contact, PTC or KTY ²⁾ - For EMMS-AS motors: PTC ²⁾	
	4	MT+ + 3.3 V 5 mA		
	5	PE -		PE connection of the motor cable
	6	W	3 x 0 ... Input voltage; Axis 1: max. 10 A _{eff} ³⁾ Axis 2: max. 10 A _{eff} ³⁾	Connection of the three motor phases ➔ Appendix A.2.7
	7	V		
	8	U		

- 1) In the motor and connecting cable, reliable separation of the motor temperature sensor from the motor circuit must be ensured.
- 2) Use cables with individually twisted and screened pairs.
- 3) Cumulative nominal current for both axes $\leq 8 A_{eff}$

Tab. 4.20 Pin allocation: Motor [X6.1/2]

4.8.2 Output power per axis

The intermediate circuits are connected internally. The nominal current of both axes together is 8 A. These 8 A can be distributed flexibly between axes 1 and 2. Here, the maximum nominal current for the first axis is 7 A. With distribution 7 A for axis 1 and 1 A for axis 2, the specified total rated output of the double output stage in S1 operation must be reduced. An increase in the maximum nominal current is permissible only for axis 1 due to the cooling profile (connection [X6 1]). Peak current per axis is 10 A (→ Appendix A, Tab. A.8). A distribution of peak current similar to that for nominal current is not possible.

4.8.3 Connecting the screening of the motor cable



If third-party cables are used: Place the complete screening of the motor-side cable flat on the plug or motor housing. Maximum length 40 mm.

- Place the complete screening of the motor cable at the screening connection terminal of the related motor controller so that the leaked current can flow back into the controller causing it.
- Do not use the complete screening as strain relief.

For further instructions regarding EMC-compliant wiring of the motor → Chapter 4.2.1.

4.8.4 Connection of a holding brake



Holding brakes are not appropriate for braking the motor. They only serve functional holding of the motor shaft. Additional measures are required for use in safety-oriented applications.



Warning

The holding brake integrated in the motor, or an external holding brake controlled by the motor controller, is not suitable for protecting personnel!

- Provide additional support to protect vertical axes from falling or slipping down when the motor is switched off through
 - mechanical locking of the vertical axis
 - an external brake/catch/clamping device or
 - sufficient counterbalance of the axis.

- Connect the holding brake to the terminals BR+ (Pin 2) and BR- (Pin 1) of the related connection [X6.1] or [X6.2]. The brake is supplied from the logic supply of the motor controller.



Please note

If the motor is warm and there is an insufficient supply voltage (outside tolerance values), the holding brake cannot open fully. Result: premature wearing of the brake.

- Make sure the nominal voltage tolerances are maintained at the terminals of the holding brake (→ Tab. A.10, logic supply).

- Observe the maximum output current provided by the motor controller (→ Tab. A.10). In the event of a high power requirement, a relay must be connected between the motor controller and holding brake.

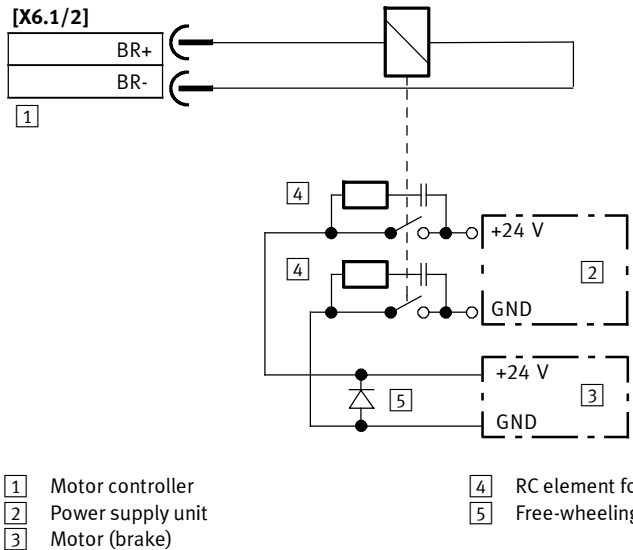


Fig. 4.3 Connection of a holding brake with high power requirement



High voltages with spark formation are created when inductive direct currents are connected via relays.

Recommendation:

Use an integrated RC interference suppressor, e. g.

- Company: Evox RIFA
- RC element: 22 Ω in series with 0.47 μF
- Designation: PMR205AC6470M022

4.9 Power supply [X9]

4.9.1 Logic power supply – protective extra-low voltage (PELV)



Warning

Danger of electric shock

- Use for the electrical power supply only PELV circuits in accordance with EN 60204-1 (Protective Extra-Low Voltage, PELV).
Also observe the general requirements for PELV circuits as per EN 60204-1.
- Use only voltage sources that ensure a reliable electric separation of operating voltage in accordance with EN 60204-1.

Through the use of PELV circuits, protection from electric shock (protection from direct and indirect contact) in accordance with EN 60204-1 is ensured (Electrical equipment of machines. General requirements). A 24 V power supply unit used in the system must meet the requirements of EN 60204-1 for DC power supply units (behaviour in case of voltage interruptions, etc.).

4.9.2 Pin allocation

Connection	Version
[X9] on the motor controller	Phoenix Contact - MSTBA 2.5/7-G-5.08 BK
Counterplug (plug set NEKM-C-4)	Phoenix Contact - MSTB 2.5/7-ST-5.08 BK

Tab. 4.21 Connection, power supply

The device is equipped with internal brake resistances. These are connected in parallel so that when operating a single axis, twice the continuous braking power is available. Alternatively, an external braking resistor can be connected. If an external braking resistor is connected, this must be connected parallel to the internal braking resistors.

[X9]	Pin	Value	Description
1	1	L1	single-phase
	2	N	95 ... 250 V AC
2	3	IC +	320 V DC (max. 400 V DC)
	4	BR-CH	0 V/400 V, Max. 4 A
3			Connection for the external braking resistor $R_{BR} > 100 \Omega$, parallel to the internal braking resistor, not short-circuit-proof in respect of L1, N, PE
4	5	PE	Mains-side PE connection
5	6	24 V	+24 V/3.6 A
6			Supply for the control section, with DCDC converter, DOUT0 to DOUT3 and holding brake, max. 3.6 A
7	7	0 V	GND
			Common reference potential for the logic power supply and control section

Tab. 4.22 Pin allocation: voltage supply [X9]

4.9.3 Connection to the supply voltage

- Before establishing the connection make sure the power supply is switched off.
- Before commissioning, and also for brief measuring and test purposes, connect the PE protective conductor → Fig. 4.4:
 - on the earthing screw of the motor controller housing
 - to pin PE [X9.5], power supply.

The cross section of the protective conductor at PE [X9.5] must correspond at least to the cross section of the external conductor L [X9.1].

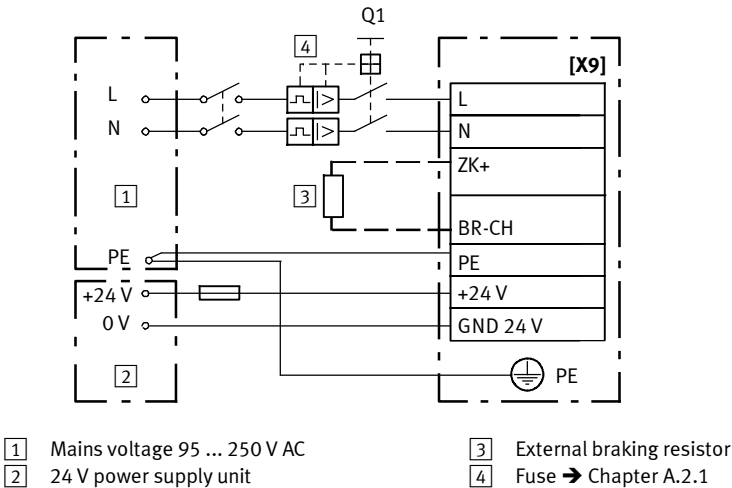


Fig. 4.4 Connection to the supply voltage

4.10 Master/slave interface [X10.1/2]

The master/slave interface is bi-directional and can be configured with the FCT software as an input or as an output for master/slave operation:

- Master (incremental encoder emulation): Output of tracking signals A/B/N of an incremental encoder for actuating a slave controller
- Slave (synchronization): Input for tracking signals A/B, pulse/direction signals CLK/DIR or forward/backward signals CW/CCW for synchronization with a master controller.

Connection	Version
[X10.1/2] on the motor controller	Sub-D plug connector, 9-pin, sockets
Counterplug	Sub-D plug connector, 9-pin, pins

Tab. 4.23 Connection of master/slave interface

[X10.1/2]	Pin	Designation	Value	Description
	1	A CLK CW	5 V DC Ri = 120 Ω max. 150 kHz	– Tracking signal A – Pulse CLK – Pulses clockwise CW – Positive polarity in accordance with RS422
	2	B DIR CCW	5 V Ri = 120 Ω max. 150 kHz	– Tracking signal B – Direction DIR – Pulses counterclockwise CCW – Positive polarity in accordance with RS422
	3	N	5 V Ri = 120 Ω max. 150 kHz	– Incremental encoder zero pulse N – Positive polarity in accordance with RS422
	4	GND ¹⁾	–	Reference GND for incremental encoder
	5	VCC	+5 V ±5 %, 100 mA	Auxiliary supply, max. load 100 mA, short-circuit proof
	6	#A #CLK #CW	5 V Ri = 120 Ω max. 150 kHz	– Tracking signal A – Pulse CLK – Pulses clockwise CW – Negative polarity in accordance with RS422
	7	#B #DIR #CCW	5 V Ri = 120 Ω max. 150 kHz	– Tracking signal B – Direction DIR – Pulses counterclockwise CCW – Negative polarity in accordance with RS422
	8	#N	5 V Ri = 120 Ω max. 150 kHz	– Zero pulse N – Negative polarity in accordance with RS422
	9	GND ¹⁾	–	Screening for the connecting cable

¹⁾ Pin 4 and pin 9 are connected internally

Tab. 4.24 Pin allocation: Master/slave interface [X10.1/2]

5 Commissioning



Note

Danger from unexpected movement of the motor or axis

- Make sure that the movement does not endanger anyone.
- Parameterize the motor controller with the Festo Configuration Tool (FCT) before enabling the controller via DIN5 [X1.1/2] Pin 9.
- Bypassing of safety equipment is impermissible.
Recommendation for initial start-up without safety engineering:
 - Minimum circuitry with emergency stop switching device at [X3 1/2]
 - Two-channel switch-off via control ports REL [X3.1/2] Pin 2 and DIN4 [X1.1/2] Pin 21.



Please note

Damage to the motor controller

The motor controller is damaged in case of

- excessive operating voltage
- polarity reversal of the operating voltage connections
- interchange of operating voltage and motor connections
- short circuits in the motor circuit between the motor phases and PE.
- Comply with the specified values for the supply voltage.
- Before switching on, check connections [X9] and [X6 1/2].
- Check to ensure there is no PE short in the motor connection circuit.

Before switching on the power supply:

Check the installation of the motor controller:

- Check all connections (→ Chapter 4).
- Connect all PE protective conductors, even for brief measuring and test purposes.
- Mounted module or cover plate on the card slot [EXT]. Mounted line on [X9] and [X6 1/2].

If activation via a bus connection requires a terminating resistor:

- Check the connection of the terminating resistor.

Implement the following settings:

- Make sure that controller enable is not present at DIN 5 [X1.1/2]. The I/O interface [X1 1/2] is activated when switched on.
- DIL switch [S1.8]:
 - OFF: No firmware download, standard setting
 - ON: Firmware download from the SD memory card to the motor controller.



Additional steps regarding preparation for commissioning → Description, functions and commissioning, GDCP-CMMS/D-FW-....

6 Maintenance, updating, repair and replacement

6.1 Maintenance and care



Warning

Danger of electric shock.

Touching live parts causes severe injuries and can lead to death. Do not disconnect connecting cables when powered.

Before touching live parts during maintenance, repair and cleaning work and when there have been long service interruptions:

1. Switch off power to the electrical equipment via the mains switch and secure it against being switched on again.
2. After switch-off, wait at least 5 minutes discharge time and check that power is turned off before accessing the controller.



Caution

Danger of burns from hot surfaces

Dependent on the load of the motor controller, housing temperatures $> 80\text{ }^{\circ}\text{C}$ are possible in operation.

- Touch them only in a switched-off, cooled-off status.



If used as intended in the operating instructions, the device will be maintenance-free.

- Clean the outside of the product with a soft cloth.

6.2 Repair



Repair or maintenance of the product is not permissible. If necessary, replace the complete product.

6.3 Replacement and disposal

Observe the disassembly instructions in section 3.3.

6.3.1 Disassembly and installation



Information on removing and installing can be found here:

- Assembly → Section 3.2
- Disassembly → Section 3.3.
- Commissioning → Section 5.

6.3.2 Disposal



Observe the local regulations for environmentally appropriate disposal of electronic modules. The product is RoHS-compliant.

A Technical appendix

A.1 Technical data

General technical data	
Type of mounting	Screwed to a mounting plate
Fault signal	7-segment display (error code)
Parameterisation interface	RS232 (9600 ... 115 000 bit/s)
Parameterisation software	Festo Configuration Tool (FCT)
Control interfaces	
fieldbus,	<ul style="list-style-type: none"> – integrated: CANopen, RS485 – optional: PROFIBUS DP, DeviceNet
Digital I/O Analogue I/O	<ul style="list-style-type: none"> – DINO ... 13, DOUT0 ... 3 – AMON/AGND, AINO/#AIN0
Protective functions	<ul style="list-style-type: none"> – Short circuit in output stage – Intermediate circuit over/undervoltage – Temperature monitoring for motor and power section – I²t monitoring with early reduction in current when motor shaft is blocked
Dimensions and weight	
Dimensions	→ Fig. 3.1 and Tab. 3.1
Weight [kg]	2.5
Product conformity and certifications	
CE marking (Declaration of conformity → www.festo.com)	In accordance with EU Machinery Directive 2006/42/EC
	To EC Low Voltage Directive 2006/95/EC
	In accordance with EU EMC Directive 2004/108/EC ¹⁾
Additional certifications	UL/RCM mark/BIA

1) The device is intended for use in an industrial environment. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.

Tab. A.1 Technical data, general

Operating and Environmental Conditions		
Permissible setup altitude above sea level		
with rated output	[m]	1000
with power reduction: 10 % every 1000 m	[m]	1000 ... 2000 (max.)
Relative air humidity	[%]	0 ... 90 (non-condensing)
Protection class		IP20
Protection class		I
Overvoltage category		III
Degree of contamination		2
Ambient temperature		
with nominal power	[°C]	0 ... +40
with power reduction: 4 % per [K]	[°C]	+40 ... +50
Storage temperature	[°C]	-25 ... +70
Cooling		Passive
Switch-off temperature, heat sink	[°C]	≥ 95
Power section		
Vibration and shock resistance		
Operation		in accordance with EN 61800-5-1, section 5.2.6.4

Tab. A.2 Technical data: Operating and ambient conditions

A.2 Connection data

A.2.1 Mains fuse

Mains fuse	
Automatic circuit breaker	1-phase
Nominal current	16 A
Characteristic	B

Tab. A.3 Connection data: Mains fuse

A.2.2 I/O interface [X1.1], [X1.2]

I/O-interface [X1.1] – Axis 1		
cable	[m]	$l < 5$, recommendation: screened
Digital inputs		
Number		14
Nominal voltage	[V DC]	24 (related to 0 V)
Voltage range	[V DC]	19.2 ... 28.8
Signal level	[V DC]	0 ... 28.8 (PNP logic)
Nominal current	[mA]	typical: 2.5 maximum: 3
Voltage threshold		
High	[V DC]	≥ 13.1
Low	[V DC]	≤ 3.4
Input impedance	[k Ω]	10.5 ... 13.5
Reaction time to input	[ms]	≤ 5
Reaction time to sample input	[μ s]	≤ 100
Protective function		Against polarity reversal
Digital outputs		
Number		4
Signal level	[V DC]	24 (from logic supply)
Nominal current	[mA]	≤ 100
Voltage threshold		
High	[V DC]	$> (U_{Logic} - 1.0)$
Low	[V DC]	< 0.8
Output reaction time	[ms]	≤ 3
Protective function		Against polarity reversal, feedback Automatic shutdown of the output in the event of an overload; automatic restart when the short circuit has been remedied

I/O-interface – Axis 1	
Analogue input	
Number	1
Signal level [V]	-10 ... +10
version	Differential input
Resolution [bit]	12
Input reaction time [µs]	< 250
Protective function	Overvoltage to ±30 V
Analogue output	
Number	1
Signal level [V DC]	0 ... 10
version	Single-ended against AGND
Resolution [bit]	8
Output reaction time [µs]	< 250
Protective function	Short circuit against AGND

Tab. A.4 Connection data: I/O-interface [X1.1]

I/O-interface [X1.2] – Axis 2

Like I/O-interface [X1.1], but for axis 2 → Tab. A.4

A.2.3 Encoder [X2.1], [X2.2]

Encoder [X2.1] – axis 1	
Communication protocol	Heidenhain EnDat 2.1 and 2.2
cable [m]	l ≤ 25 m, screened Design in accordance with Heidenhain specification
Signal level DATA, SCLK [V]	5 V (differential, RS422, RS485)
Angle resolution/number of lines [Bit/U]	16
Limit frequency SCLK [MHz]	2
Encoder supply (from the controller)	
Voltage [V DC]	5 (-0 % ... +5 %)
Current [mA]	≤ 200
Sense line for power supply	not supported

Tab. A.5 Connection data: Encoder [X2.1/2] (input)

Encoder [X2.2] – axis 2

Like encoder [X2.1], but for axis 2 → Tab. A.5

A.2.4 STO interface [X3.1], [X3.2]



Technical data relating to the STO interfaces [X3.1/2] → Description of STO safety function, GDCP-CMMD-AS-S1-....

A.2.5 CAN [X4]

CAN	
Communication profile	CANopen CiA 301, CiA 402 and FHPP Rev.13
Bus connection	9-pin, pin, sub-D
Cable length - dependent on the bit rate [m]	≤ 40 at 1 Mbit/S ≤ 130 at 500 Kbit/s ≤ 270 at 250 Kbit/s ≤ 530 at 125 Kbit/s
Max. fieldbus transmission rate [Mbit/s]	1
Terminating resistor [Ω]	120 (can be activated via DIL switches)

Tab. A.6 Connection data: CAN-Bus [X4]

A.2.6 RS232/RS485 [X5]

Serial interface	
cable [m]	l ≤ 5, screened
Signal level	In accordance with RS232/RS485 specification
Transmission rate [bps]	9600...115200
Factory setting	
Transmission rate [bps]	9600
Data bits	8
Parity	none
Stop bit	1
ESD protection	Driver protected against electrostatic discharge up to 15 kV

Tab. A.7 Connection data: RS232/RS485 [X5]

A.2.7 Motor [X6.1], [X6.2]

Motor connection [X6.1] – Axis 1			
Cabling			
Thermal rated value	[°C]	60/75 class 1	
cable		Screened	
	without external filters	[m]	$l \leq 15$
	With ferrite core via motor cable (Ferroxcube TX26/15/20 3C90)	[m]	$l \leq 25$
Cable capacitance of one phase against screen or between two lines	[pF/m]	≤ 200	
Conductor cross-section (plug connector)			
Flexible conductor	[mm ²]	0.25 ... 2.5	
– Wire end sleeve without insulating collar	[mm ²]	0.25 ... 2.5	
– Wire end sleeve with insulating collar	[mm ²]	0.25 ... 2.5	
Terminal tightening torque	[Nm]	0.5 ... 0.6	
Output data			
Output voltage range	[V AC]	0 ... input voltage	
Nominal output current I_{eff}	[A]	➔ Tab. A.9	
Peak current I_{eff}	[A]	10 (➔ Section 4.8.2)	
Peak current duration			
	with running motor	[s]	2
	with stopped motor	[s]	0.5
Output frequency	[Hz]	1 ... 1000	
PWM frequency	[kHz]	10	
Holding brake			
Voltage range	[V DC]	18 ... 30	
Output current	[A]	1 A	
Voltage loss	[V]	≤ 1	
Short circuit/overcurrent protection	[A]	> 4	
Temperature protection T_j	[°C]	> 150	
Load			
Ohmic	[Ω]	> 24	
Inductive	[H]	10 (typical)	
Capacitive	[nF]	< 10	
Switching delay	[ms]	< 1	
Motor temperature monitoring			
Digital sensor (N/C contact) ¹⁾			
R_{Cold}	[kΩ]	< 1	
R_{Hot}	[kΩ]	> 10	

1) In the motor and connecting cable, reliable separation of the motor temperature sensor from the motor circuit must be ensured.

Tab. A.8 Connection data: Motor connection [X6.1]

Nominal output current¹⁾		
Nominal output current I_{eff} at a cumulative nominal current for both axes ≤ 8 A		
Axis 1, connection [X6.1]	[A]	0.2 ... 7
Axis 2, connection [X6.2]	[A]	0.2 ... 4

1) The intermediate circuits are connected internally. Additional information on this → Section 4.8.2.

Tab. A.9 Nominal output current: Motor connection [X6.1], [X6.2]

Motor connection [X6.2] – Axis 2

Like motor connection [X6.1], but for axis 2 → Tab. A.8 and Tab. A.9

A.2.8 Power supply and braking resistor [X9]

Power supply		
Cabling		
cable	[m]	$l \leq 2$, unshielded
Conductor cross-section (plug connector)		
Flexible conductor		
– Wire end sleeve without insulating collar	[mm ²]	0.25 ... 2.5
– Wire end sleeve with insulating collar	[mm ²]	0.25 ... 2.5
Terminal tightening torque	[Nm]	0.5 ... 0.6
Load supply		
Nominal operating voltage	[V AC]	230
Input voltage range	[V AC]	95 ... 250
Nominal operating voltage phases		1-phase
Nominal current	[A]	10
Rated output (intermediate circuit)		
Mounting grid 133 mm Equipment clearance 21 mm	[W]	800
Mounting grid 192 mm Equipment clearance 80 mm	[W]	1200
Intermediate circuit voltage	[V DC]	320
Max. intermediate circuit voltage	[V DC]	400
End stage power loss	[W]	60 ... 70
Own power loss control section	[W]	16
Mains frequency	[Hz]	50 ... 60
Surge resistance	[kV]	4
Logic supply		
Nominal voltage	[V DC]	24 ± 20%
Max. ripple in input voltage	[V]	1.0 at 100 Hz
current consumption	[A]	0.7
– Outputs load-free		
– Without current for holding brake		
Peak current (incl. holding brake)	[A]	3.6

Tab. A.10 Connection data: Power supply [X9]

Braking resistor		
Operating voltage range	[V DC]	380 ... 400
Integrated braking resistor		
Braking resistor	[Ω]	115
Pulse power (for 100 ms)	[W]	1400
Rated output	[W]	30
Rated trigger level	[V]	390
Hysteresis	[V]	10
Connection for external braking resistor		
Braking resistor	[Ω]	≥ 100
Pulse power (for 500 ms)	[W]	≤ 1600
Nominal power	[W]	≤ 100
Operating voltage	[V DC]	400

Tab. A.11 Technical data: braking resistor



Please note

- Make sure the external braking resistor is provided with sufficient pulse power (> 1600 Watt). The resistance value of the connected braking resistor must be at least 100 Ω.

The required impulse power must be calculated as follows: $P_{\text{peak}} = \frac{U_{\text{dc}}^2}{R_{\text{br}}}$

whereby: P_{peak} = pulse power; U_{dc} = max. response voltage; R_{br} = external brake resistor

A.2.9 Master/Slave interface [X10.1], [X10.2]

Master/Slave interface [X10.1] – Axis 1	
Bi-directional operation	
as input	Slave function (synchronisation)
as output	Master function (incremental encoder emulation)
cable	
Screened	
Slave function [m]	$l \leq 30$
Master function [m]	$l \leq 5$
Interface	
Input signals	A/B, CW/CCW, CLK/DIR
Output signals	A/B/N
Angle resolution/number of lines	1 ... 2048
Output impedance [Ω]	120
Critical frequency [kHz]	≤ 150

Tab. A.12 Connection data: Master/Slave interface [X10.1]

Master/Slave interface [X10.2] – Axis 2

Like Master/Slave interface [X10.1], but for axis 2 → Tab. A.12

B Diagnostic messages

B.1 Explanations of the diagnostic messages

The subsequent error tables include the following information:

Terms	Meaning
no.	Main index (error group) and sub-index of the diagnostic message
Code	The Code column includes the error code (Hex) via CiA 401.
Message	Message that is displayed in the FCT
Cause	Possible causes for the message
Action	Action by the user
Reaction	The Reaction column includes the error response (default setting, partially configurable): <ul style="list-style-type: none"> – PS off (block output stage) – QStop (quick stop with parametrised ramp) – Warn (Warning) – Ignore.

Tab. B.1 Explanations of the diagnostic messages



The Reaction column includes the error responses of the default parameter set. After configuration of the motor controller with FCT, the standard values defined in the FCT or the configured reactions apply.

For a complete list of the diagnostic messages that correspond to the firmware versions used at the time of printing this document, please refer to section B.2.

B.2 Diagnostic messages with instructions for fault clearance

Error group 01		Internal faults	
no.	Code	Message	Reaction
01-0	6180h	Stack overflow (internal error)	
		Cause	<ul style="list-style-type: none"> – Incorrect firmware? – Sporadic high processor load due to special compute-bound processes (save parameter set, etc.).
		Action	<ul style="list-style-type: none"> • Load approved firmware. • Contact Technical Support.

Error group 02		Intermediate circuit	
No.	Code	Message	Reaction
02-0	3220h	Undervoltage in intermediate circuit	
		Cause	– Intermediate circuit voltage falls below the parameterised threshold.
		Action	<ul style="list-style-type: none"> • Quick discharge due to switched-off mains supply. • Check mains voltage (mains voltage level or network impedance too high?). • Check intermediate circuit voltage (measure). • Check undervoltage monitor (threshold value). • Check travel profile: If travel with lower acceleration and/or travel speeds is possible, this reduces power consumption from the mains.

Error group 03		Temperature monitoring, motor	
no.	Code	Message	Reaction
03-1	4310h	Temperature monitoring, motor	
		Cause	Motor overloaded, temperature too high. <ul style="list-style-type: none"> – Motor too hot. – Sensor defective?
		Action	<ul style="list-style-type: none"> • Check parameters (current regulator, current limits). If the error persists when the sensor is bypassed: Device defective.

Error group 04		Temperature monitoring, electronics	
no.	Code	Message	Reaction
04-0	4210h	Excess/low temperature of power electronics	
		Cause	Motor controller is overheated. – Motor controller overloaded? – Temperature display plausible?
		Action	<ul style="list-style-type: none"> • Check installation conditions, cooling through the housing surface, integrated heat sink and back wall. • Check the drive layout (due to possible overloading in continuous operation).

Error group 05		Internal power supply	
no.	Code	Message	Reaction
05-0	5114h	5 V electronics supply fault	
		Cause	Monitoring of the internal power supply has recognised under-voltage. This is either due to an internal defect or an overload/short circuit caused by connected peripherals.
		Action	<ul style="list-style-type: none"> • Separate device from the entire peripheral equipment and check whether the error is still present after reset. If so, an internal defect is present → Repair by the manufacturer.
05-1	5115h	Error in 24 V supply	
		Cause	Monitoring of the internal power supply has recognised under-voltage.
		Action	<ul style="list-style-type: none"> • Check 24 V logic supply. • Separate device from the entire peripheral equipment and check whether the error is still present after reset. If so, an internal defect is present → Repair by the manufacturer.
05-2	8000h	Error in driver supply/driver supply failed	
		Cause	Error in the plausibility check of the driver supply (safe torque off)
		Action	<ul style="list-style-type: none"> • Separate device from the entire peripheral equipment and check whether the error is still present after reset. If so, an internal defect is present → Repair by the manufacturer.

Error group 06		Intermediate circuit	
No.	Code	Message	Reaction
06-0	2320h	Over-current of the intermediate circuit/output stage	
		Cause	<ul style="list-style-type: none"> – Motor defective. – Short circuit in the cable. – Output stage defective.
		Action	<ul style="list-style-type: none"> • Check motor, cable and motor controller.

Error group 07		Intermediate circuit	
No.	Code	Message	Reaction
07-0	3210h	Overvoltage in intermediate circuit	
		PS off	
		Cause	Braking resistor is overloaded; too much braking energy, which cannot be dissipated quickly enough. <ul style="list-style-type: none"> – Resistor capacity is incorrect? – Resistor not connected correctly? – Check design (application)
Action	<ul style="list-style-type: none"> • Check the design of the braking resistor (positioning drives); resistance value may be too great. • Check the connection to the braking resistor (internal/external). 		

Error group 08		Angle encoder	
no.	Code	Message	Reaction
08-6	7386h	Angle encoder communication fault	
		PS off	
		Cause	Communication to serial angle encoders is disrupted (EnDat encoders). <ul style="list-style-type: none"> – Angle encoder connected? – Angle encoder cable defective? – Angle encoder defective?
Action	<ul style="list-style-type: none"> • Check whether encoder signals are faulty. • Test with another encoder. • Check angle encoder cable. For operation with long motor cables: <ul style="list-style-type: none"> • Observe notes on EMC-compliant installation! Additional anti-interference measures required from 15 m cable length. 		
08-8	7388h	Internal angle encoder error	
		PS off	
		Cause	Internal monitoring of the angle encoder has detected an error and forwarded it via serial communication to the controller. Possible causes: <ul style="list-style-type: none"> – Excess rotational speed. – Angle encoder defective.
Measure	If the error occurs repeatedly, the encoder is defective. → Replace encoder including encoder cable.		

Error group 11		Homing	
no.	Code	Message	Reaction
11-1	8A81h	Homing error	
		Cause	Homing was interrupted, e.g. by: <ul style="list-style-type: none"> – withdrawal of controller enable. – reference switch located beyond the limit switch. – external stop signal (termination of a homing phase).
		Action	<ul style="list-style-type: none"> • Check homing sequence. • Check arrangement of the switches. • If applicable, lock the STOP input during homing if it is not desired.

Error group 12		CAN	
no.	Code	Message	Reaction
12-0	8181h	CAN: general error	
		Cause	Other CAN error. Triggered by the CAN controller itself and is used as a common error for all further CAN errors.
		Action	<ul style="list-style-type: none"> • Re-start CAN controller. • Check CAN configuration in the controller. • Check wiring.
12-1	8181h	CAN: error bus off	
		Cause	Errors can occur if the CAN control malfunctions or is deliberately requested by the controller of the bus-off status.
		Action	<ul style="list-style-type: none"> • Re-start CAN controller. • Check CAN configuration in the controller. • Check wiring.
12-2	8181h	CAN: Error when transmitting	
		Cause	Error when sending a message (e.g. no bus connected).
		Action	<ul style="list-style-type: none"> • Re-start CAN controller • Check CAN configuration in the controller • Check wiring
12-3	8181h	CAN: Error when receiving	
		Cause	Error receiving a message.
		Action	<ul style="list-style-type: none"> • Re-start CAN controller. • Check CAN configuration in the controller. • Check wiring: Cable specification adhered to, broken cable, maximum cable length exceeded, correct terminating resistors, cable screening earthed, all signals terminated?

Error group 12		CAN	
no.	Code	Message	Reaction
12-4	8130h	CAN: Time-out nodeguarding	
		Cause	Node guarding telegram not received within the parametrised time. Signals corrupted?
		Action	<ul style="list-style-type: none"> • Compare cycle time of the remote frames with that of the controller. • Check: Failure of the controller?
12-5	8181h	CAN: Error in the IPO mode	
		Cause	Over a period of 2 SYNC intervals, the SYNC telegram or the PDO of the controller has failed.
		Action	<ul style="list-style-type: none"> • Re-start CAN controller. • Check CAN configuration in the controller (SYNC telegram must be parameterised). • Check wiring.

Error group 14		Motor identification	
no.	Code	Message	Reaction
14-9	6197h	Error, motor identification	
		Cause	Error in automatic determination of the motor parameters.
		Action	<ul style="list-style-type: none"> • Ensure sufficient intermediate circuit voltage. • Encoder cable connected to the right motor? • Motor blocked, e.g. holding brake does not release?

Error group 16		Initialization	
no.	Code	Message	Reaction
16-2	6187 h	Initialization fault	
		Cause	Error in initialising the default parameters.
		Action	<ul style="list-style-type: none"> • In case of repetition, load firmware again. If the error occurs repeatedly, the hardware is defective.
16-3	6183h	Unexpected status / programming error	
		Cause	The software has taken an unexpected status. For example, unknown status in the FHPP state machine.
		Action	<ul style="list-style-type: none"> • In case of repetition, load firmware again. If the error occurs repeatedly, the hardware is defective.

Error group 17		Following error monitoring	
no.	Code	Message	Reaction
17-0	8611h	Following error monitoring	
		Cause	Comparison threshold for the limit value of the following error exceeded.
		Action	<ul style="list-style-type: none"> Enlarge error window. Parameterise acceleration to be less. Motor overloaded (current limiter from the I²t monitoring active?).

Error group 18		Output stage temperature monitoring	
no.	Code	Message	Reaction
18-1	4280h	Output stage temperature 5 °C below maximum	
		Cause	The output stage temperature is greater than 90 °C.
		Action	<ul style="list-style-type: none"> Check installation conditions, cooling through the housing surface, integrated heat sink and back wall.

Error group 19		I²t monitoring	
no.	Code	Message	Reaction
19-0	2380h	I²t at 80 %	
		Cause	Of the maximum I ² t workload of the controller or motor, 80 % has been achieved.
		Action	<ul style="list-style-type: none"> Check whether motor/mechanics are blocked or sluggish.

Error group 21		Current measurement	
no.	Code	Message	Reaction
21-0	5210h	Error, offset current measurement	
		Cause	The controller performs offset compensation of the current measurement. Tolerances that are too large result in an error.
		Measure	If the error occurs repeatedly, the hardware is defective. <ul style="list-style-type: none"> Send motor controller to the manufacturer.

Error group 22		PROFIBUS	
no.	Code	Message	Reaction
22-0	7500h	Error in PROFIBUS initialization	
		Cause	Fieldbus interface defective.
		Action	<ul style="list-style-type: none"> Please contact Technical Support.

Error group 22		PROFIBUS	
no.	Code	Message	Reaction
22-2	7500h	PROFIBUS communication error	
		Cause	<ul style="list-style-type: none"> – Faulty initialisation of the Profibus interface. – Interface defective.
		Action	<ul style="list-style-type: none"> • Check the set slave address. • Check bus termination. • Check wiring.

Error group 25		Firmware	
no.	Code	Message	Reaction
25-1	6081 h	Incorrect firmware	
		Cause	Motor controller and firmware are not compatible.
		Action	<ul style="list-style-type: none"> • Update the firmware.

Error group 26		Data flash	
no.	Code	Message	Reaction
26-1	5581h	Checksum error	
		Cause	Checksum error of a parameter set.
		Action	<ul style="list-style-type: none"> • Load factory setting. • If the error is still present, the hardware is defective.

Error group 29		SD card	
no.	Code	Message	Reaction
29-0	7680h	No SD available	
		Cause	An attempt was made to access a missing SD card.
		Action	Check: <ul style="list-style-type: none"> • whether the SD card is inserted properly, • whether the SD card is formatted, • whether a compatible SD card is plugged in.
29-1	7681h	SD initialization error	
		Cause	<ul style="list-style-type: none"> – Error during initialization. – Communication not possible.
		Action	<ul style="list-style-type: none"> • Plug card back in. • Check card (file format FAT 16). • If necessary, format card.

Error group 29		SD card	
no.	Code	Message	Reaction
29-2	7682h	SD parameter set error	
		Cause	<ul style="list-style-type: none"> – Checksum incorrect. – File not present. – File format incorrect. – Error saving the parameter file on the SD card.
		Action	<ul style="list-style-type: none"> • Check content (data) of the SD card.

Error group 31		I²t monitoring	
no.	Code	Message	Reaction
31-0	2312h	I²t error motor (I²t at 100%)	
		Cause	I ² t monitoring of the controller has been triggered. <ul style="list-style-type: none"> – Motor/mechanical system blocked or sluggish. – Motor under-sized?
		Action	<ul style="list-style-type: none"> • Check motor and mechanical system.
31-1	2311h	I²t error controller (I²t at 100%)	
		Cause	I ² t monitoring of the controller has been triggered.
		Action	<ul style="list-style-type: none"> • Check power dimensioning of drive package.

Error group 32		Intermediate circuit	
No.	Code	Message	Reaction
32-0	3280h	Intermediate circuit charging time exceeded	
		Cause	The intermediate circuit could not be charged after the mains voltage was applied. <ul style="list-style-type: none"> – Fuse possibly defective. – Internal braking resistor defective. – In operation with external braking resistor, the resistor is not connected
		Action	<ul style="list-style-type: none"> • Check mains voltage (intermediate circuit voltage < 150 V) • Check interface to the external braking resistor. • If the interface is correct, the internal braking resistor or the built-in fuse is presumably faulty → Repair by the manufacturer.
32-8	3285h	Power supply failure during controller enable	
		Cause	Interruption/power failure while the controller enable was active.
		Action	<ul style="list-style-type: none"> • Check mains voltage/power supply.

Error group 35		Fast stop	
no.	Code	Message	Reaction
35-1	6199h	Time out with fast stop	
		Cause	The parameterised time for fast stop was exceeded.
		Action	<ul style="list-style-type: none"> • Check parameterisation.

Error group 40		Software limit	
sorNo.	Code	Message	Reaction
40-0	8612h	Negative software limit switch reached	
		Cause	The position setpoint value has reached or exceeded the negative software limit switch.
		Action	<ul style="list-style-type: none"> • Check the target data. • Check positioning area.
40-1	8612h	Positive software limit switch reached	
		Cause	The position setpoint value has reached or exceeded the positive software limit switch.
		Action	<ul style="list-style-type: none"> • Check the target data. • Check positioning area.
40-2	8612h	Target position lies behind the negative software limit switch	
		Cause	Start of a positioning task was suppressed because the target lies behind the negative software limit switch.
		Action	<ul style="list-style-type: none"> • Check the target data. • Check positioning area.
40-3	8612h	Target position lies behind the positive software limit switch	
		Cause	The start of a positioning task was suppressed because the target lies behind the positive software limit switch.
		Action	<ul style="list-style-type: none"> • Check the target data. • Check positioning area.

Error group 41		Path program	
no.	Code	Message	Reaction
41-8	6193h	Path program error, unknown command	
		Cause	Unknown command found during record continuation.
		Action	<ul style="list-style-type: none"> • Check parameterisation.
41-9	6192h	Error in path program jump destination	
		Cause	Jump to a positioning record outside the permitted range.
		Action	<ul style="list-style-type: none"> • Check parameterisation.

Error group 42		Positioning	
no.	Code	Message	Reaction
42-1	8681h	Positioning: Error in pre-computation	
		Cause	Positioning cannot be reached through the options of the positioning (e.g. final speed) or parameters.
		Action	<ul style="list-style-type: none"> • Check parameterisation of the position records in question.
42-4	8600h	Message, homing required	
		Cause	<ul style="list-style-type: none"> – Positioning not possible without homing. – Homing must be carried out.
		Action	<ul style="list-style-type: none"> • Reset optional parameterisation "Homing required". • Carry out a new homing run after acknowledgement of an angle encoder error.
42-9	6191h	Error in position data record	
		Cause	<ul style="list-style-type: none"> – An attempt is being made to start an unknown or deactivated position record. – The set acceleration is too small for the permissible maximum speed. – (Danger of a calculation overflow in the trajectory calculation).
		Action	<ul style="list-style-type: none"> • Check parameterisation and sequence control and correct, if necessary.

Error group 43		Limit switch error	
no.	Code	Message	Reaction
43-0	8612h	Negative limit switch error	
		Cause	Negative hardware limit switch reached.
		Action	<ul style="list-style-type: none"> • Check parameterisation, wiring and limit switches.
43-1	8612h	Positive limit switch error	
		Cause	Positive hardware limit switch reached.
		Action	<ul style="list-style-type: none"> • Check parameterisation, wiring and limit switches.
43-9	8612h	Error in limit switch	
		Cause	Both hardware limit switches are active simultaneously.
		Action	<ul style="list-style-type: none"> • Check parameterisation, wiring and limit switches.

Error group 45		STO error	
no.	Code	Message	Reaction
45-0	8000h	Error in driver supply	
		Cause	Driver supply is still active despite the STO requirement.
		Action	The internal logic for the STO requirement may be disturbed due to high-frequency switching operations at the input. <ul style="list-style-type: none"> • Check activation; the error must not recur. • If the error occurs repeatedly when the STO is called: • Check firmware (approved version?). If all the above options have been excluded, the hardware of the motor controller is defective.
45-1	8000h	Error in driver supply	
		Cause	The driver supply is active again, although STO is still required.
		Action	The internal logic for the STO requirement may be disturbed due to high-frequency switching operations at the input. <ul style="list-style-type: none"> • Check activation; the error must not recur. • If the error occurs repeatedly when the STO is called: • Check firmware (approved version?). If all the above options have been excluded, the hardware of the motor controller is defective.
45-2	8000h	Error in driver supply	
		Cause	The driver supply is not active again, although STO is no longer required.
		Action	If the error occurs again after the STO requirement is ended, the hardware of the motor controller is defective.
45-3	8087h	DIN4 plausibility error	
		Cause	Output stage no longer switches off → Hardware defective.
		Action	Repair by the manufacturer.

Error group 64		DeviceNet error	
no.	Code	Message	Reaction
64-0	7582h	DeviceNet communication error	
		Cause	Node number exists twice.
		Action	<ul style="list-style-type: none"> • Check the configuration.
64-1	7584h	DeviceNet general error	
		Cause	The 24 V bus voltage is missing.
		Action	<ul style="list-style-type: none"> • In addition to the motor controller, the DeviceNet interface must also be connected to 24 V DC.
64-2	7582h	DeviceNet communication error	
		Cause	<ul style="list-style-type: none"> – Receive buffer overflow. – Too many messages received within a short period.
		Action	<ul style="list-style-type: none"> • Reduce the scan rate.

Error group 64		DeviceNet error	
no.	Code	Message	Reaction
64-3	7582h	DeviceNet communication error	
		Cause	<ul style="list-style-type: none"> – Send buffer overflow. – Insufficient free space on the CAN bus to transmit messages.
		Action	<ul style="list-style-type: none"> • Increase the baud rate. • Reduce the number of nodes. • Reduce the scan rate.
64-4	7582h	DeviceNet communication error	
		Cause	IO-message could not be sent
		Action	<ul style="list-style-type: none"> • Check that the network is connected correctly and does not malfunction.
64-5	7582h	DeviceNet communication error	
		Cause	Bus off.
		Action	<ul style="list-style-type: none"> • Check that the network is connected correctly and does not malfunction.
64-6	7582h	DeviceNet communication error	
		Cause	Overflow in the CAN controller.
		Action	<ul style="list-style-type: none"> • Increase the baud rate. • Reduce the number of nodes. • Reduce the scan rate.

Error group 65		DeviceNet error	
no.	Code	Message	Reaction
65-0	7584h	DeviceNet general error	
		Cause	<ul style="list-style-type: none"> – Communication is activated, even though no interface is plugged in. – The DeviceNet interface is attempting to read an unknown object. – Unknown DeviceNet error.
		Action	<ul style="list-style-type: none"> • Check whether the DeviceNet interface is plugged in correctly. • Check that the network is connected correctly and does not malfunction.
65-1	7582h	DeviceNet communication error	
		Cause	I/O connection timeout. No I/O message received within the expected time.
		Action	<ul style="list-style-type: none"> • Please contact Technical Support.

Error group 70		Operating mode error	
no.	Code	Message	Reaction
70-2	6195h	General arithmetic error	
		Cause	The fieldbus factor group cannot be calculated correctly.
		Action	<ul style="list-style-type: none"> • Check the factor group.
70-3	6380h	Operating mode error	
		Cause	This operating mode change is not supported by the motor controller.
		Action	<ul style="list-style-type: none"> • Check your application. Not every change is permissible.

Error group 76		SSIO error	
no.	Code	Message	Reaction
76-0	8100h	Error SSIO communication (axis 1 - axis 2)	
		Cause	checksum error during transfer of the SSIO protocol. – time-out during transmission.
		Action	<ul style="list-style-type: none"> • Check wiring. • Check whether the screening of the motor cable is correctly applied (EMC problem). If the SSIO communication is not unavoidably required (e.g. no fieldbus interface used and separate control of the axes via I/Os, this error can possibly be ignored.
76-1	8100h	Error SSIO communication (axis 2)	
		Cause	SSIO partner has error 76-0.
		Action	The error is triggered when the other axis has reported an SSIO communication error. If, for example, axis 2 reports error 76-0, the error 76-1 is triggered for axis 1. Actions and description for error response as with error 76-0.

Error group 79		RS232 error	
no.	Code	Message	Reaction
79-0	7510h	RS232 communication error	
		Cause	Overflow when receiving RS232 commands.
		Action	<ul style="list-style-type: none"> • Check wiring. • Check the transmitted data.

B.3 Error codes via CiA 301/402

Diagnostic messages				
Code	no.	No. Bit	Message	Reaction
2311h	31-1	19	I ² t error controller (I ² t at 100%)	configurable
2312h	31-0	18	I ² t error motor (I ² t at 100%)	configurable
2320h	06-0	13	Over-current of the intermediate circuit/output stage	PS off
2380h	19-0	25	I ² t at 80 %	configurable
3210h	07-0	15	Overvoltage in intermediate circuit	PS off
3220h	02-0	14	Undervoltage in intermediate circuit	configurable
3280h	32-0	16	Intermediate circuit charging time exceeded	PS off
3285h	32-8	17	Power supply failure during controller enable	PS off
4210h	04-0	3	Excess/low temperature of power electronics	configurable
4280h	18-1	27	Output stage temperature 5 °C below maximum	configurable
4310h	03-1	2	Temperature monitoring, motor	configurable
5114h	05-0	8	5 V electronics supply fault	PS off
5115h	05-1	10	Error in 24 V supply	PS off
5210h	21-0	12	Error, offset current measurement	PS off
5581h	26-1	62	Checksum error	PS off
6081h	25-1	11	Incorrect firmware	PS off
6180h	01-0	61	Stack overflow (internal error)	PS off
6183h	16-3	60	Unexpected status / programming error	PS off
6187h	16-2	63	Initialization fault	PS off
6191h	42-9	56	Error in position data record	PS off
6192h	41-9	42	Error in path program jump destination	configurable
6193h	41-8	43	Path program error, unknown command	configurable
6195h	70-2	58	General arithmetic error	PS off
6197h	14-9	39	Error, motor identification	PS off
6199h	35-1	34	Time out with fast stop	PS off
6380h	70-3	57	Operating mode error	configurable
7386h	08-6	5	Angle encoder communication error	PS off
7388h	08-8	6	Internal angle encoder error	PS off
7500h	22-0	47	Error in PROFIBUS initialization	PS off
	22-2	53	PROFIBUS communication error	configurable
7510h	79-0	55	RS232 communication error	configurable

Diagnostic messages				
Code	no.	No. Bit	Message	Reaction
7582h	64-0	52	DeviceNet communication error	PS off
	64-2	52	DeviceNet communication error	PS off
	64-3	52	DeviceNet communication error	PS off
	64-4	52	DeviceNet communication error	PS off
	64-5	52	DeviceNet communication error	PS off
	64-6	52	DeviceNet communication error	PS off
	65-1	52	DeviceNet communication error	configurable
7584h	64-1	44	DeviceNet general error	PS off
	65-0	44	DeviceNet general error	configurable
7680h	29-0	48	No SD available	configurable
7681h	29-1	49	SD initialization error	configurable
7682h	29-2	50	SD parameter set error	configurable
8000h	45-0	21	Error in driver supply	PS off
	45-1	21	Error in driver supply	PS off
	45-2	21	Error in driver supply	PS off
	05-2	21	Error in driver supply/driver supply failed	PS off
8087h	45-3	22	DIN4 plausibility error	PS off
8100h	76-0	41	Error SSIO communication (axis 1 - axis 2)	configurable
	76-1	40	Error SSIO communication (axis 2)	configurable
8130h	12-4	23	CAN: Time-out nodeguarding	configurable
8181h	12-0	54	CAN: general error	configurable
	12-1	54	CAN: error bus off	configurable
	12-2	54	CAN: Error when transmitting	configurable
	12-3	54	CAN: Error when receiving	configurable
	12-5	54	CAN: Error in the IPO mode	configurable
8600h	42-4	29	Message, homing required	configurable
8611h	17-0	28	Following error monitoring	configurable
8612h	40-0	31	Negative software limit switch reached	configurable
	40-1	31	Positive software limit switch reached	configurable
	40-2	31	Target position lies behind the negative software limit switch	configurable
	40-3	31	Target position lies behind the positive software limit switch	configurable
	43-0	30	Negative limit switch error	configurable
	43-1	30	Positive limit switch error	configurable
	43-9	30	Error in limit switch	configurable
8681h	42-1	59	Positioning: Error in pre-computation	configurable
8A81h	11-1	35	Homing error	PS off

B.4 Profibus diagnostics

Diagnostic messages						
Unit_Diag_Bit		no.	Message	Reaction		
00	E429		“Position dataset”	42-9	Error in position data record	PS off
01	E703		“Operating mode”	70-3	Operating mode error	configurable
02	E702		“Arithmetic error”	70-2	General arithmetic error	PS off
03	E421		“Position precomputation”	42-1	Positioning: Error in pre-computation	configurable
04	E163		“Unexpected state”	16-3	Unexpected status / programming error	PS off
05	E010		“Stack overflow”	01-0	Stack overflow (internal error)	PS off
06	E261		“Checksum error”	26-1	Checksum error	PS off
07	E162		“Initialization”	16-2	Initialization fault	PS off
08	E290		“No SD available”	29-0	No SD available	configurable
09	E291		“SD initialization”	29-1	SD initialization error	configurable
10	E292		“SD parameter set”	29-2	SD parameter set error	configurable
13	E222		“PROFIBUS communication”	22-2	PROFIBUS communication error	configurable
14	-		“unknown”	12-0	CAN: general error	configurable
				12-1	CAN: error bus off	configurable
				12-2	CAN: Error when transmitting	configurable
				12-3	CAN: Error when receiving	configurable
				12-5	CAN: Error in the IPO mode	configurable
15	E790		“RS232 communication error”	79-0	RS232 communication error	configurable
16	E761		“SSIO communication”	76-1	Error SSIO communication (axis 2)	configurable
17	E760		“SSIO communication”	76-0	Error SSIO communication (axis 1 - axis 2)	configurable
18	E418		“Record seq. Unknown cmd”	41-9	Error in path program jump destination	configurable
19	E419		Record seq. Invalid dest.”	41-8	Path program error, unknown command	configurable
20			“unknown”	64-1	DeviceNet general error	PS off
				64-2	DeviceNet communication error	PS off
				64-3	DeviceNet communication error	PS off
				64-4	DeviceNet communication error	PS off
				64-5	DeviceNet communication error	PS off
				64-6	DeviceNet communication error	PS off
				65-0	DeviceNet general error	configurable
				65-1	DeviceNet communication error	configurable
23	E220		“PROFIBUS assembly”	22-0	Error in PROFIBUS initialization	PS off
26	E351		“Time out: Quick stop”	35-1	Time out with fast stop	PS off

Diagnostic messages					
Unit_Diag_Bit	no.	Message	Reaction		
27	E111	“Error during homing”	11-1	Homing error	PS off
31	E149	“Motor identification”	14-9	Error, motor identification	PS off
33	E190	“I ² t at 80%”	19-0	I ² t at 80 %	configurable
35	E181	“Outp. stage temp. 5 < max.”	18-1	Output stage temperature 5 °C below maximum	configurable
36	E170	“Following error”	17-0	Following error monitoring	configurable
37	E424	“Enforce homing run”	42-4	Message, homing required	configurable
38	E43x	“limit switches”	43-0	Negative limit switch error	configurable
			43-1	Positive limit switch error	configurable
			43-9	Error in limit switch	configurable
39	E40x	“Software limit”	40-0	Negative software limit switch reached	configurable
			40-1	Positive software limit switch reached	configurable
			40-2	Target position lies behind the negative software limit switch	configurable
			40-3	Target position lies behind the positive software limit switch	configurable
40	E320	“Loading time link overflow”	32-0	Intermediate circuit charging time exceeded	PS off
41	E328	“Fail. power supply ctr.ena.”	32-8	Power supply failure during con- troller enable	PS off
42	E310	“I ² t-error motor”	31-0	I ² t error motor (I ² t at 100 %)	configurable
43	E311	“I ² t-error controller”	31-1	I ² t error controller (I ² t at 100 %)	configurable
45	E052	“Driver supply”	45-0	Error in driver supply	PS off
			45-1	Error in driver supply	PS off
			45-2	Error in driver supply	PS off
			05-2	Error in driver supply/driver sup- ply failed	PS off
46	E453	“Plausibility DIN 4”	45-3	DIN4 plausibility error	PS off
47	E124	“Time out Nodeguarding”	12-4	CAN: Time-out nodeguarding	configurable
48	E050	“5V - Internal supply”	05-0	5 V electronics supply fault	PS off
50	E051	“24V - Internal supply”	05-1	Error in 24 V supply	PS off
51	E251	“Hardware error”	25-1	Incorrect firmware	PS off
52	E210	“Offset current metering”	21-0	Error, offset current measure- ment	PS off
53	E060	“Overcurrent output stage”	06-0	Over-current of the intermediate circuit/output stage	PS off
54	E020	“Undervoltage power stage”	02-0	Undervoltage in intermediate circuit	configurable

B Diagnostic messages

Diagnostic messages					
Unit_Diag_Bit		no.	Message	Reaction	
55	E070	“Overvoltage output stage”	07-0	Overvoltage in intermediate circuit	PS off
58	E03x	“Overheating error (motor)”	03-1	Temperature monitoring, motor	configurable
59	E040	“Overtemperature power stage”	04-0	Excess/low temperature of power electronics	configurable
61	E086	“SINCOS-RS485 communication”	08-6	Angle encoder communication error	PS off
62	E088	“SINCOS track signals”	08-8	Internal angle encoder error	PS off

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Copyright:
Festo AG & Co. KG
Postfach
73726 Esslingen
Germany

Phone:
+49 711 347-0

Fax:
+49 711 347-2144

e-mail:
service_international@festo.com

Internet:
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