

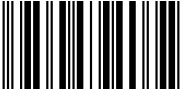
CMMT-ST-C8-1C-MP-S0

Servo drive



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8214115

Operating instruction | Installation, Safety sub-function

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Original instructions

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1 About this document

1.1 Target group

The document is targeted towards individuals who mount and operate the product. It is additionally targeted towards individuals who are entrusted with the planning and application of the product in a safety-related system (safety manual in accordance with EN 61508).

1.2 Applicable documents

 All available documents for the product ➔ www.festo.com/sp.

The user documentation for the product also includes the following documents:

Designation	Contents
Operating instructions for the product	Installation, safety sub-function
Manuals for the product	Detailed description of assembly, installation
	Detailed description of safety sub-function
Manual/online help plug-in	Plug-in: - Functions and operation of the software - Initial commissioning wizard Firmware functions: - Configuration and parameterisation - Operating modes and operational functions - Diagnostics and optimisation Bus protocol/control: - Device profile - Controller and parameterisation
Festo Automation Suite online help	- Function of the Festo Automation Suite - Management and integration of device-specific plug-ins

Tab. 1: User documentation for the product

1.3 Product variants

The following order code indicates the equipment features of the product variant.

Characteristic	Order code	Type
Servo drive	CMMT-	Servo drive, series T
Motor type	ST-	Stepper motor or EC motor
Nominal current	C8-	8 A
Nominal input voltage	1C-	24 ... 48 V DC
Bus protocol/control	MP-	Multi-protocol: EtherCAT, EtherNet/IP, Modbus TCP, PROFINET
Safety function	S0	Basic safety

Tab. 2: Key features CMMT-ST-C8-1C-MP-S0

This documentation refers to the following version:

- Servo drive CMMT-ST-C8-1C-MP-S0, revision 1 and higher, see product labelling.

This is the first available revision.

- For later revisions of the product, check whether updated documentation is available ➔ 3 Additional information.

1.4 Product labelling

- Observe the specifications on the product.
The product labelling is located on the right side of the device. The product labelling is for identification of the product and shows the following information:

Product labelling (example)	Meaning
CMMT-ST-C8-1C-MP-S0	Order code
8163946 MM-YYYY:XX SNM Rev 01SNW	Part number, serial number (production month and production year, plant number), revision
Main input: 1x 24 ... 48 V DC 8 A	Technical data for the power supply (PELV fixed power supply)
Motor out: 4x 0 ... input V AC 0 ... 20 kHz 8 Arms 300 W	Technical data for the motor output (output voltage, output frequency, nominal current, nominal output power)
TAMB: max. 50 °C	Ambient temperature (TAMB)
IP20 PD2	Degree of protection, pollution degree
MAC-ID: XF1 IN XX-XX-XX-XX-XX	First MAC address of the device for RTE communication XF1 IN, also represented as a bar code
R-R-FTO-KC-2018-1092	KC mark certificate (test mark for Korea)
Data matrix code, 123456789AB	Product Key as a data matrix code and an 11-character alphanumeric code
Festo SE & Co. KG	Manufacturer
DE-73734 Esslingen	Manufacturer's address
Made in Germany	Country of origin Germany

Tab. 3: Product labelling (example)

Warning symbol on the front of the product

The following warning symbol can be seen on the front of the product:

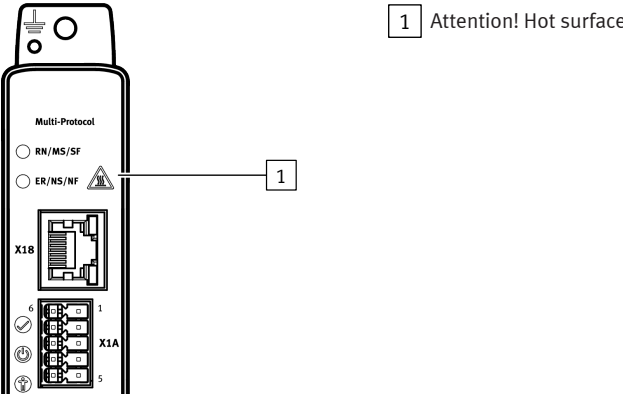


Fig. 1: Warning symbol on the front of the product

General meaning	Meaning for the CMMT-ST
Attention! Hot surface	Metallic housing parts of the device can reach high temperatures during operation.

Tab. 4: Meaning of the warning symbol

1.5 Specified standards

Version		
EN ISO 13849-1:2023	EN 61508 Parts 1-7:2010	
EN ISO 14118:2018-02		EN 61800-2:2015
EN 60204-1:2018-09		EN 61800-5-1:2007+A1:2017+A11:2021
EN 60715:2017-11		EN 61800-5-2:2017

Tab. 5: Standards specified in the document

2 Safety

2.1 Safety instructions

General safety instructions

- Assembly and installation are only to be carried out by qualified personnel.
- Only use the product if it is in perfect technical condition.
- Only use the product in its original condition without unauthorised modifications.
- Do not carry out repairs on the product. If defective, replace the product immediately.
- Observe the identifications on the product.
- The product may generate high frequency interference, which may require interference suppression measures in residential areas.
- Take into account the ambient conditions at the location of use.
The safety function might fail and malfunctions might occur if you do not comply with the parameters required for the ambient and connection conditions.
- Never remove or insert the plug connector when the power is switched on.
- Install the product in a suitable control cabinet. The minimum degree of protection required for the control cabinet is IP54.
- Prior to commissioning, ensure that the resulting movements of the connected actuator technology cannot endanger anyone.
- During commissioning: systematically check all control functions and the communication and signal interface between controller and servo drive.
- Keep the documentation available throughout the entire product lifecycle.

If the product is damaged by unauthorised manipulation or use other than the intended use, the guarantee will be invalidated and the manufacturer will not be liable for damages.

If the product is damaged by using unauthorised software or firmware with the device, the warranty will be invalidated, and the manufacturer will not be liable for damages.

Safety instructions for the safety sub-functions

It is only possible to determine whether the product is suitable for specific applications by also assessing further components of the overall system. Analyse and validate the safety function of the entire system. Check the safety functions at adequate intervals for proper functioning. It is the responsibility of the operator to choose the type and frequency of the checks within the specified time period. The manner in which the test is conducted must make it possible to verify that the safety device is functioning perfectly in interaction with all components. Time period for cyclical test ➔ 13.1 Technical data, safety engineering.

Prior to initial commissioning, wire the control inputs of the safety sub-function STO. The safety sub-function STO is always available without the need for any additional parameterisation.

2.2 Intended use

The servo drive CMMT-ST is intended to supply power to and to regulate a stepper motor or an EC motor. The integrated electronics enable regulation of torque (current), rotational speed and position.

Use exclusively:

- in perfect technical condition
- in its original condition, without unauthorised modifications
- within the limits of the product defined by the technical data ➔ 13 Technical data
- in an industrial environment

The safety function might fail, malfunctions might occur, and the connected actuator technology might move unintentionally if you do not comply with the parameters required for the ambient and connection conditions.

The CMMT-ST-...-S0 supports the following safety sub-functions in accordance with EN 61800-5-2:

- Safe torque off (STO/Safe torque off)
- Safe stop 1 time controlled (SS1-t/Safe stop 1 time controlled) can only be implemented with a suitable safety relay unit and appropriate servo drive circuitry

The safety sub-function STO is intended to switch off the torque of the connected motor, thereby preventing an unexpected restart of the motor.

The safety sub-function SS1-t is intended to perform a fast stop with subsequent torque switch-off.

Ensure that wiring is cross-circuit proof in accordance with EN ISO 13849-1.

2.2.1 Range of application

The device is intended for use in an industrial environment.

Safety sub-functions may only be used for applications for which the stated safety reference values are sufficient ➔ 13 Technical data.

2.2.2 Permissible components

The load and logic power supply must meet the requirements of EN 60204-1 (protective extra-low voltage, PELV).

Supported motors:

- Stepper motors
- EC motors

The servo drive supports motors with and without an integrated holding brake (electrically actuated spring-loaded brake). The holding brake is actuated automatically by the controller enable of the servo drive. The actuation concept is based on the assumption that a drive that is already stationary is being held. The actuation system is not designed for decelerating a moving drive. If a moving drive is decelerated, this can cause excessive wear on the brake.

Motor configuration	Behaviour following removal of controller enable
Motor without holding brake	The drive can move freely.
Motor with holding brake	The holding brake is applied and holds the motor and axis in position.

Tab. 6: Example: removal of controller enable

The holding brake must be designed for the load torque that is to be stopped. Detailed information about brake control ➔ Online help for the CMMT-ST plug-in.

Supported encoders:

- BiSS-C encoders
- Incremental encoders

Additional information ➔ www.festo.com/catalogue.

2.3 Foreseeable Misuse

Foreseeable misuse of the safety sub-function STO

- Use outside the limits of the product defined in the technical data.
- Bypassing of the safety function.
- Cross-wiring of the diagnostic feedback signals of more than 10 servo drives. This applies to all devices that are wired together, regardless of the type of equipment.
- Faults in the cross-wiring of passive diagnostic contacts and active diagnostic outputs will result in incorrect diagnostic feedback. It is therefore important to take extra care when carrying out the cross-wiring. Only wire devices as

follows: Always wire all devices with active diagnostic output, e.g. CMMT-AS, in parallel as a group. Connect the signal from the active diagnostic outputs with the first CMMT-ST. Wire the passive diagnostic contacts as a group in series and connect the last passive diagnostic contact directly to the safe controller for evaluation of the diagnostic information.

- Use of the diagnostic contact STA to switch a safety function. The diagnostic contact STA must not be used to open a secure locking mechanism directly, for example. The diagnostic contact STA is not part of the safety circuit. The diagnostic contact STA is used to improve diagnostic coverage of the related safety sub-function. The diagnostic contact STA may only be used in combination with the related safe control signals (AND operation) plus a reliable time monitoring function in the safety relay unit for the purpose of switching additional safety-critical functions.
- At low level, the safety relay unit used delivers a higher current than permissible (maximum permissible input current exceeded with low level at STO-/A/B ➔ Tab. 53 Control inputs #STO-A and #STO-B at [X1A]). When this occurs, the device cannot recognise when the safety sub-function is requested.
- Use of the safety sub-function STO without external measures for drive axes influenced by external torques. If external torques influence the drive axis, use of the safety sub-function STO on its own is not suitable for stopping the axis safely. Additional measures are required to prevent dangerous movements of the drive axis, such as use of a mechanical brake.
- Operation of EC motors requiring a safety classification of SIL 3, cat. 3, Pl e without evaluation of the diagnostic contact STA.
- Operation of the connected motor without the danger zone being restricted or enclosed by suitable means. The user must not be able to enter the danger zone without triggering the safety function.
- The safety sub-function STO does not provide protection against electric shock, only against dangerous movements.
- The safety sub-function STO cannot prevent non-safety-related sub-functions from failing, e.g. the braking ramp for the SS1-t function or the device's temperature monitoring function.

2.4 Training of qualified personnel

The product may be installed and commissioned only by a qualified electrical engineer who is familiar with:

- The installation, operation and maintenance of electrical control systems
- Applicable regulations for operating safety-related systems

Work on safety engineering systems may only be carried out by qualified personnel trained in safety engineering.

2.5 Product conformity

The product-relevant directives are listed in the declaration of conformity ➔ www.festo.com/sp.

Product conformity	
	in accordance with EU EMC Directive in accordance with EU Machinery Directive in accordance with EU RoHS Directive
	to UK EMC Regulations to UK Supply of Machinery Regulations to UK RoHS Regulations

Tab. 7: Product conformity

2.6 Safety engineering approval

The product is a safety device in accordance with the EC Machinery Directive. For details of the safety-oriented standards and test values with which the product complies and fulfils, see ➔ 13.1 Technical data, safety engineering. Please note that compliance with the listed standards is limited to the CMMT-ST-...-S0.

2.7 UL/CSA certification

Technical data and environmental conditions may be subject to change in order to comply with Underwriters Laboratories Inc. (UL) certification requirements for the USA and Canada.

Deviating values ➔ 13.5 Technical data UL/CSA certification.

3 Additional information

- Contact the regional Festo contact if you have technical problems ➔ www.festo.com.
- Accessories and spare parts ➔ www.festo.com/catalogue.
- Cyber security information ➔ www.festo.com/psirt.



Firmware, software or configuration files ➔ www.festo.com/sp.

4 Product overview

4.1 Scope of delivery

Component	Number
Servo drive CMMT-ST-...	1
Assortment of plugs NEKM-C-23	1

Component	Number
H-rail clamp (premounted)	1
Operating instruction CMMT-ST-C8-1C-MP-S0	1

Tab. 8: Scope of delivery

1

Up-to-date information on the accessories → www.festo.com/catalogue.

4.2 System structure

The servo drive CMMT-ST is a single-axis servo drive for controlling a stepper motor or an EC motor with connected mechanisms, e.g. a Festo axis. The device is controlled by a higher-order controller with, depending on the configuration, the EtherCAT, EtherNet/IP, Modbus TCP or PROFINET bus protocol over a real-time Ethernet interface.

The device can be parameterised with a PC using either the real-time Ethernet interface or the separate standard Ethernet interface.

The device is a low voltage controller. The load and logic power supply must be provided by a PELV fixed power supply.

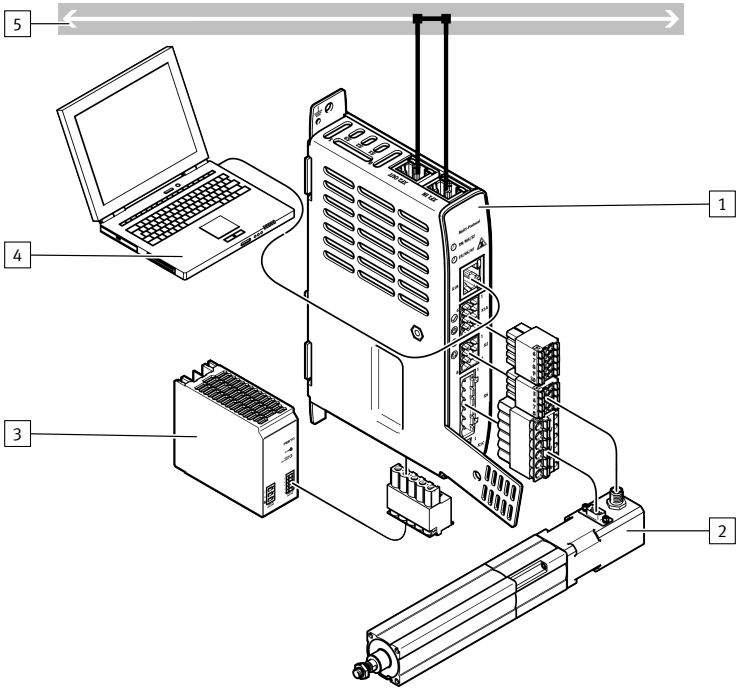


Fig. 2: System structure (example)

- 1 Servo drive CMMT-ST
- 2 Stepper motor or EC motor with drive
- 3 Fixed power supply (or supplies) for logic and load voltage supply (PELV)
- 4 PC with Ethernet connection for parameterisation
- 5 Bus/network

4.2.1 Overview of connection technology

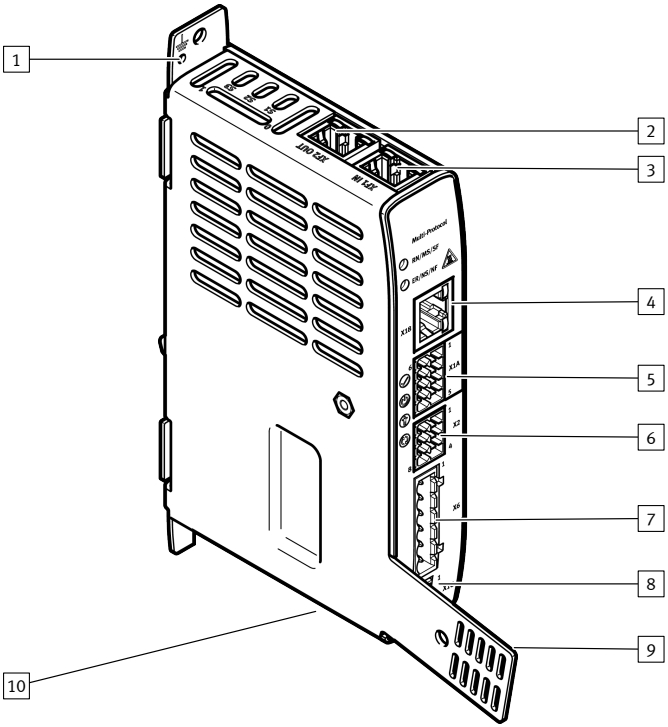


Fig. 3: Connections of the CMMT-ST-C8-1C-MP-S0

- 1 Functional earth connection with label
- 2 [XF2 OUT] RTE interface port 2
- 3 [XF1 IN] RTE interface port 1
- 4 [X18] standard Ethernet
- 5 [X1A] I/O interface
- 6 [X2] encoder connection
- 7 [X6] motor connection
- 8 [X1C] connection for the reference switch or limit switch
- 9 Sheet metal for connecting the cable shield and strain relief
- 10 [X9] load and logic voltage (underneath)

4.3 Setting bus protocol

The CMMT-ST-C8-1C-MP-S0 product variant supports multiple bus protocols.

The following options are available for setting the protocol:

- Configuration in the CMMT-ST plug-in
- Direct setting with DIL switches S1 to S3

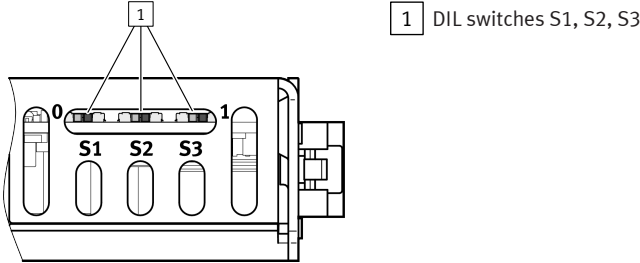


Fig. 4: DIL switches S1, S2, S3

The switches can be adjusted with a small slotted head screwdriver. The switch position is evaluated once when the device is started. A change in the switch position therefore only takes effect after the device has been restarted.

1

Protocols supported by the firmware version used → 1.2 Applicable documents, manual/online help plug-in, software, function, fieldbus, device profile.

Protocol	S3	S2	S1
Parameterisation	0	0	0
PROFINET	0	0	1
EtherCAT	0	1	0
EtherNet/IP, Modbus TCP	0	1	1
Parameterisation	1	1	1

Tab. 9: Bus protocol switch setting

4.4 Safety sub-functions

4.4.1 Function and application

The servo drive CMMT-ST-...-S0 has the following safety-related performance features:

- Safe torque off (STO/Safe torque off)
- Safe stop 1 time controlled (SS1-t/Safe stop 1 time controlled) with use of a suitable external safety relay unit and appropriate servo drive circuitry
- Diagnostic contact STA for feedback of the active safety sub-function STO

4.4.2 Safety sub-function STO

Function and application of STO

The safety sub-function STO switches off the driver power supply for the power semiconductor, thus preventing the power output stage from supplying the energy required by the motor. The power supply to the drive is safely disconnected when the safety sub-function STO is active. The drive cannot generate torque and thus cannot perform any dangerous movements. With suspended loads or other external forces, additional measures must be put in place to prevent movements being performed (e.g. mechanical clamping units). The standstill position is not monitored in the STO state. The machines must be stopped and locked safely. This especially applies to vertical axes without automatic locking mechanism, clamping unit or counterbalancing.

STO request

The safety sub-function STO is requested on 2 channels by simultaneously switching off the control voltage at both control inputs #STO-A and #STO-B. The signals of inputs #STO-A/B are low active, so they are marked with #. The safe state is achieved after the safety sub-function STO has been requested if all motor coils are switched off and current cannot flow through them.

NOTICE

Detent movement if the power stage fails.

If power stage of the device fails, the drive can move once by the angle of rotation/travel of the pole pitch of the motor used.

- Take the possible movement into account when designing the safety function of the system.

After the safety sub-function STO has been requested and the request completed, the functional controller enable must be activated.

Feedback via diagnostic contact STA

The state of the safety sub-function STO can be reported to the safety relay unit via the diagnostic contact STA. If the safety classification of SIL 3, cat. 3, Pl e is required for operation with an EC motor, the diagnostic contact STA must be evaluated. The diagnostic feedback signal STA has been designed as a potential-free contact (Opto relay). The diagnostic contact STA is only closed (conductive) when STO is requested on 2 channels via the control inputs #STO-A and #STO-B. If the contact is closed (conductive), the STO state has been achieved (safe state).

#STO-A	#STO-B	STA-C1/C2
Low level	Low level	Diagnostic contact closed (low resistance)
Low level	High level	Diagnostic contact open (high resistance)
High level	Low level	
High level	High level	

Tab. 10: State of the diagnostic contact STA

If the safety sub-function STO is not requested but protective functions are triggered simultaneously on both channels (#STO-A and #STO-B), e.g. if the voltage at #STO-A and #STO-B is too high, the internal protective functions switch off the channels as if STO had been requested and the diagnostic contact STA is closed (safe state feedback). Recommendation: the safety relay unit should check the state of the diagnostic contact whenever there is an STO request. The state of STA must change according to the logic table. The safety relay unit can cyclically test the #STO-A and #STO-B signals for high level with low test pulses and for low level with high test pulses, within the specified limits → 4.4.5 Safety relay unit. The diagnostic contact STA is not evaluated in terms of safety engineering.

4.4.3 Safety sub-function SS1

Together with a suitable safety relay unit, the following can be achieved:

- Safe stop 1 time controlled (SS1-t/Safe stop 1 time controlled;) triggering of motor deceleration and, after an application-specific time delay, triggering of the safety sub-function STO

Safety sub-function SS1 → 1.2 Applicable documents, Manual Safety sub-function

4.4.4 Fault exclusion

Put suitable measures in place to prevent faulty wiring:

- Exclude wiring faults in accordance with EN 61800-5-2
- Configure the safety relay unit to monitor the outputs of the safety relay unit and wiring up to the servo drive

4.4.5 Safety relay unit

Use suitable safety relay units with the following characteristics:

- 2-channel outputs with
 - Detection of shorts across contacts
 - Required output current (also for STO)
- Evaluation of the diagnostic contact of the servo drive

Safety relay units with test pulses can be used with the following restrictions:

- High test pulses up to a maximum length of 1 ms
- Low test pulses up to a maximum length of 1 ms
- Test pulses are not simultaneous/overlapping on #STO-A/B

5 Transport and storage

- Protect the product from excessive stress during transport and storage. Excessive stress factors include:
 - mechanical stresses
 - impermissible temperatures
 - moisture
 - aggressive atmospheres
- Store and transport the product in its original packaging or installed in the control cabinet. The original packaging offers sufficient protection from typical stresses.

6 Assembly

Dimensions

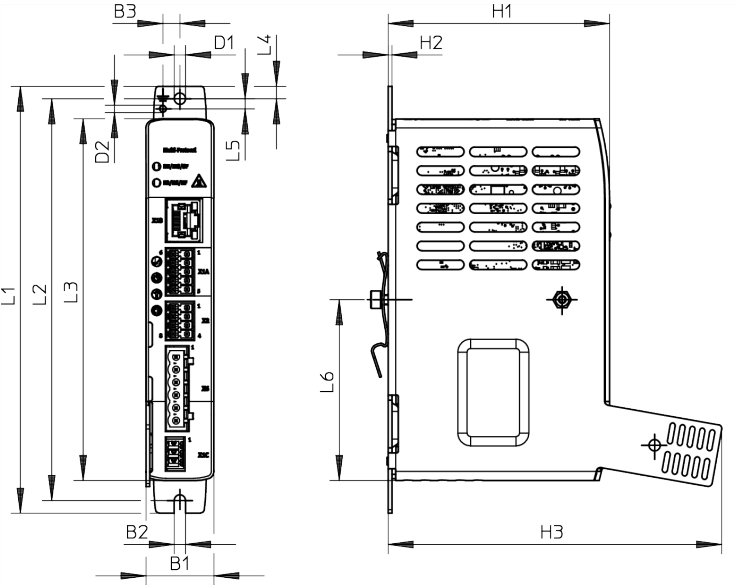


Fig. 5: Dimensions

Dimension	B1	B2	B3	D1	D2	H1	H2
[mm]	27	4.5	6.8	4.5	M3x0.5	88.3	1.5

Tab. 11: CMMT-ST-C8-1C-MP Part 1 dimensions

Dimension	H3	L1	L2	L3	L4	L5	L6
[mm]	133	170	160	144	5	4	85

Tab. 12: CMMT-ST-C8-1C-MP Part 2 dimensions

6.1 Mounting clearances

The CMMT-ST series servo drives can be connected in series. With effective output currents > 4.6 A mounting clearances may be required on both sides to allow dissipation of the heat generated during operation by allowing sufficient air flow. Detailed information about the required mounting clearances and any power reduction that may be necessary as a function of the ambient temperature → 13.4 Characteristic curves. The table below shows the mounting clearances for standard output currents and ambient temperatures.

Examples	Ambient operating temperature		
	30 °C	40 °C	50 °C
Continuous, constant output current in controlled operation [A]	Mounting clearances		
4	0 mm	0 mm	0 mm
5			3 mm
6			10 mm
7		3 mm	Impermissible
8		15 mm	

Tab. 13: Required mounting clearances (examples)

6.2 Mounting

Assembly instructions

- Always install the device vertically in the control cabinet (mains supply line [X9] underneath).
- Maintain minimum distances and mounting clearance to guarantee sufficient air flow. The ambient air in the control cabinet must be able to flow through the device from bottom to top without hindrance. Detailed information about the required mounting clearances and any power reduction that may be necessary as a function of the ambient temperature → 13.4 Characteristic curves.
- Take into account the required clearance for the wiring (connecting cables of the device must be routed from above, from below and from the front).

- Do not mount any temperature-sensitive components near the device. The device can become very hot during operation (switch-off temperature of the temperature monitoring ➔ 13 Technical data).
- When mounting on an H-rail: use a DIN mounting rail TH 35-7.5 or TH 35-15 in accordance with EN 60715.
- When mounting on the rear wall of the control cabinet: screw the device vertically and flush with the mounting surface.

Installation of the H-rail clamp

- If the H-rail clamp is not premounted, screw it to the back using the original screw.

Mounting on an H-rail

1. Attach the device by hooking the top of the H-rail clamp onto the H-rail from above.
2. Press the lower part of the device onto the H-rail until the H-rail clamp clicks into place on the H-rail.

Wall mounting

The backwall of the device has a hole at the top and a cutout at the bottom. The device is screwed vertically and flush with the mounting surface using the hole and the cutout.

1. If an H-rail clamp is mounted on the back, remove it.
2. Mount the servo drive on the backwall of the control cabinet with suitable screws while complying with the assembly instructions.

7 Installation

7.1 Safety

⚠ WARNING

Danger of burns from hot housing surfaces.

Metallic housing parts can reach high temperatures during operation. Contact with metal housing parts can cause burn injuries.

- Do not touch metallic housing parts.
- After the power supply is switched off, let the device cool down to room temperature.

Information for operation with safety function

NOTICE

Check the safety functions to conclude the installation process and after every modification to the installation.

During installation of safety-related inputs and outputs, also observe the following:

- Meet all specified requirements, e.g.:
 - Surrounding area (EMC)
 - Logic and load voltage supply
 - Mating plug
 - Connecting cables
 - Cross-wiring
- More information ➔ 1.2 Applicable documents, Manual Assembly, Installation.
- The maximum permissible cable length between the safety relay unit and the plug connector of the I/O interface is 25 m.
- During installation, make sure you meet the requirements of EN 60204-1 relating to the use of PELV fixed power supplies. In the event of a fault, the voltage must not exceed 60 V DC. The safety relay unit must switch off its outputs in the event of a fault.
- A PELV fixed power supply must be used for the safety relay unit and the logic power supply of the CMMT-ST. The GND (0 V) of each fixed power supply must also be connected to each another. The device power supply and the power supply of the STO inputs must be based on the same GND potential.
- The wiring between the safety relay unit and the I/O interface of the servo drive must be installed so as to ensure that the risk of a short circuit between the conductors or to 24 V, as well as a cross circuit can be eliminated; see EN 61800-5-2, Annex D.3.1. Otherwise, the safety relay unit must feature detection of shorts across contacts and, in the event of a fault, must switch off the control signals on 2 channels.
- Only use suitable mating plugs and connecting cables ➔ 1.2 Applicable documents, Manual Assembly, Installation. Use wire end sleeves for multicore wires.
- Prevent conductive contamination between neighbouring plug pins.
- Make sure that bridges or similar items cannot be inserted parallel to the safety wiring. For example, use the maximum wire cross section or appropriate plastic wire end sleeves.
- Use twin wire end sleeves for cross-wiring safety-related inputs. When cross-wiring STA diagnostic contacts, a maximum of 10 devices may be cross-wired ➔ 1.2 Applicable documents, Manual Assembly, Installation.
- The safety relay unit and its inputs and outputs must meet the necessary safety classification of the safety function that is required for the specific case.
- Connect each of the control inputs to the safety relay unit on 2 channels.
- If the STA feedback signal of the STO safety sub-function has to be evaluated: connect diagnostic contact directly to the safety relay unit. The diagnostic contacts must not be connected in parallel, since a device like this with an active safety sub-function would report a safe state for all devices.

- Whether the diagnostic contact needs to be evaluated depends on the type of motor that is connected and the desired safety classification.
- If diagnostic contacts are cross-wired for a device compound: wire diagnostic contacts in series.

Basic circuitry design

- Safe sensors, e.g. emergency stop switches, light curtains, are routed to the safety relay unit (or the safety PLC).
- The safety relay unit requests the safety sub-function on the servo drive via 2 channels and evaluates the STA feedback signal.

7.2 EMC-compliant installation

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A non-EMC-compliant installation can lead to signal interference on the encoder, motor or communication cables.

Cable lengths and cable shield

- Only use suitable cables that fulfil the requirements of EN 60204-1.
- Do not exceed maximum permissible cable lengths.

Connection		Max. cable length [m]	Cable shield
[X1A]	Inputs/outputs for the higher-order PLC	25	Not required
[X1C]	Inputs/outputs for the reference/limit switches	25	
[X2]	Encoder	25 ¹⁾	Shielded, twisted pair
[X6]	Motor phase connection	25	Shielded
[X9]	Logic power supply and load voltage supply	30	Not required
	Braking resistor	30	Not required
[X18]	Standard Ethernet	30	Double shielded (CAT 5)
[XF1 IN]	RTE (port 1)		
[XF2 OUT]	RTE (port 2)		

1) Comply with the maximum permissible cable length for the installed encoder.

Tab. 14: Cable lengths and cable shield

Laying cables

Follow the general guidelines for EMC-compliant installation, e.g.:

- Earth the servo drive at the functional earth terminal (➔ 4.2.1 Overview of connection technology) and the mounting plate with fine-wire copper strips.
- Use cables that are as short as possible; install the servo drive as close to the motor as possible.
- Do not run signal cables parallel to power cables. Avoid loops when laying the cables.
- Maintain required minimum distances between signal cables and power cables dependent on the installation conditions. Signal cables must be physically separated from the power cables as far as possible. For example, the encoder cable is a signal cable and the motor cable is a power cable. These cables must therefore be installed separated from each other. In hybrid motor cables the signal cables are internally shielded against the motor phases.
- Wherever possible, avoid crossing signal cables with power cables or running them at only a 90° angle to one another.
- Strip the motor cable and encoder cable from a length of 7 m at the switch cabinet input or in the vicinity of the servo drive and earth the entire surface on the shield connection on the metal of the servo drive or use a suitable shield clamp.

Shield connection on the metal housing

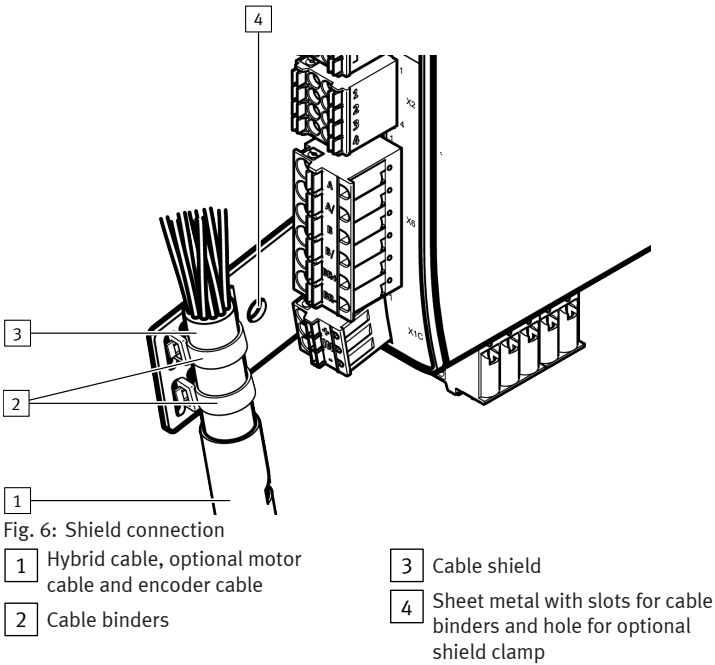


Fig. 6: Shield connection

- 1 Hybrid cable, optional motor cable and encoder cable
- 2 Cable binders

- 3 Cable shield
- 4 Sheet metal with slots for cable binders and hole for optional shield clamp

7.3 Connection example

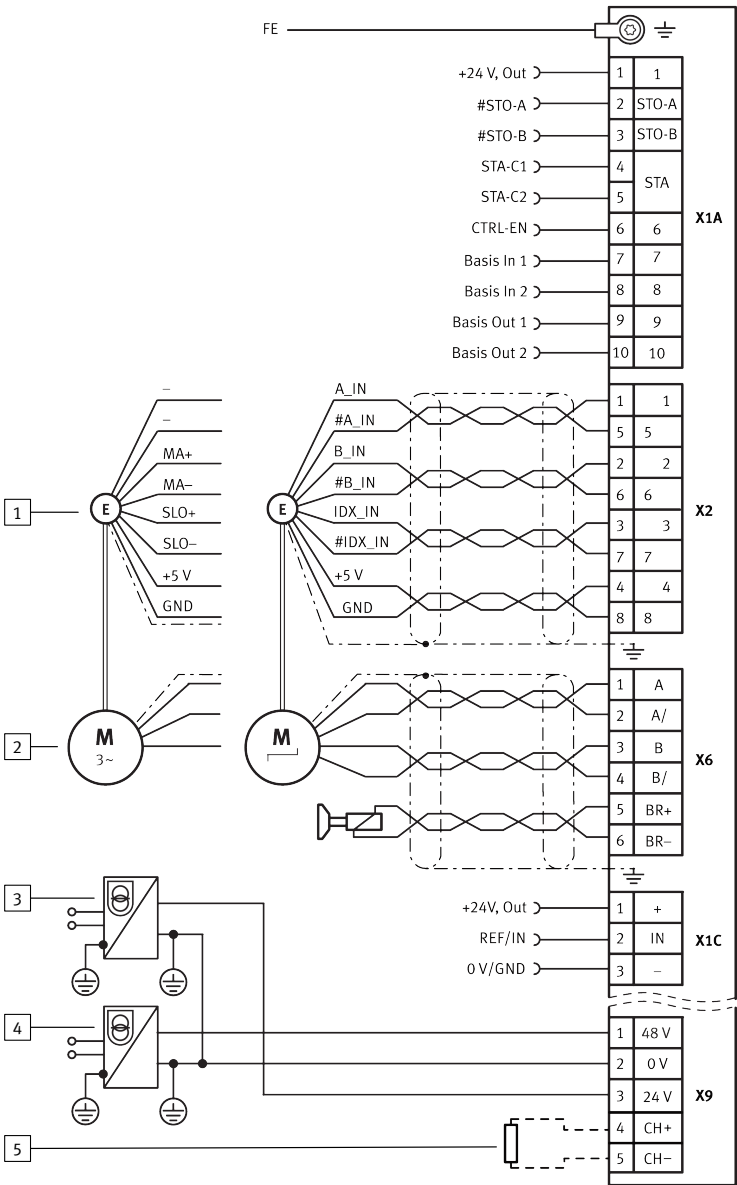


Fig. 7: Connection example

- 1 BiSS-C or incremental encoder
- 2 EC motor or stepper motor
- 3 PELV fixed power supply for logic voltage (24 V)
- 4 PELV fixed power supply for load voltage supply (24 V ... 48 V)
- 5 Braking resistor, optional

STO connection example

In this example, the STO safety sub-function (safe torque off) is triggered by an input device that makes the safety request (e.g. light curtain).

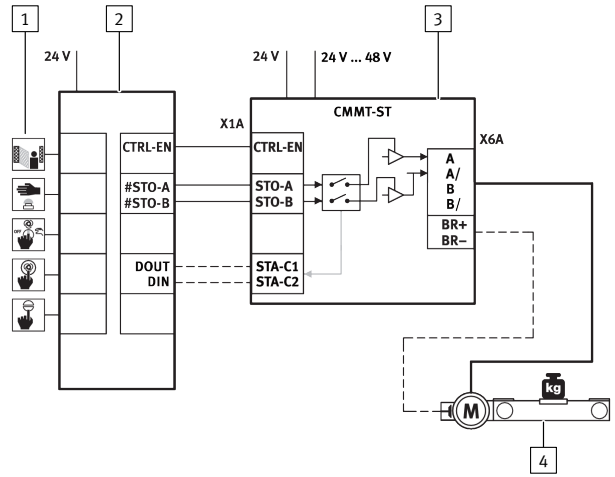


Fig. 8: STO sample circuit

- 1 Input device for safety request, e.g. light curtain
- 2 Safety relay unit
- 3 Servo drive
- 4 Drive axis

Information on the sample circuit

The safety request is passed on to the servo drive on 2 channels via the #STO-A and #STO-B inputs at the connection [X1A]. This safety request results in the 2-channel switch-off of the driver power supply to the servo drive's power output stage.

The safety relay unit can use the STA diagnostic contact to monitor whether the safe state has been reached for the safety sub-function STO. The CTRL-EN wiring shown is not required for the STO safety sub-function.

7.4 Interfaces

Observe the requirements for mating plugs → 1.2 Applicable documents, Manual Assembly, Installation.

7.4.1 [X1A], inputs and outputs for the higher-order PLC

The I/O interface [X1A] is located on the front of the device. This interface features:

- 2 freely configurable digital outputs (switching logic PNP)
- 2 freely configurable digital inputs (PNP switching logic)
- 1 digital input for the power stage enable and reset error functions; whether or not the function will be used can be parameterised in the plug-in (PNP switching logic)
- 2 inputs for the circuitry of the STO safety sub-function (#STO-A, #STO-B)
- 2 contacts for the circuitry of the diagnostic contact of the STO safety sub-function (STA-C1, STA-C2)

Detailed information on the circuitry of the safety sub-functions of the product → 1.2 Applicable documents, Manual Safety sub-function.

For example, the functional inputs and outputs of this I/O interface are used for coupling to a higher-order PLC.

The devices connected to the CMMT-ST all need to have the same switching logic (PNP).

Signal	Level	Input	Output
logic 0	0 V	Internal via pull-down resistor	Internal via pull-down resistor
logic 1	24 V	–	Via high-side driver (delivers current)

Tab. 15: PNP logic

[X1A]	Pin	Function	Description	Mating plug labelling
	1	+ 24 V, out	+ 24 V DC output (fused)	1
	2	#STO-A	Safe torque off control input, channel A	STO-A
	3	#STO-B	Safe torque off control input, channel B	STO-B
	4	STA-C1	STA diagnostic contact Safe torque off acknowledge	STA
	5	STA-C2		
	6	CTRL-EN	Power stage enable/acknowledge error	6
	7	Basic in 01	Configurable input	7
	8	Basic in 02	Configurable input	8
	9	Base Out 01	Configurable output	9
	10	Base Out 02	Configurable output	10

Tab. 16: Inputs and outputs for the higher-order PLC

The inputs and outputs are configured using the CMMT-ST plug-in → online help for the CMMT-ST plug-in.

The signals of the STO-A/B inputs are low active and are therefore marked with #.

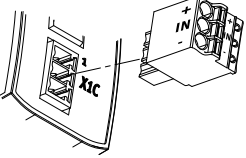
Requirements for the connecting cable	
Shielding	Not required
Min. conductor cross section including wire end sleeve with plastic sleeve ¹⁾	0.2 mm ²
Max. conductor cross section including wire end sleeve with plastic sleeve	1.5 mm ²
Max. length	25 m

1) The conductor cross section used must be suitable for the expected currents. If flexible leads are used with plastic wire end sleeves, minimum cross sections of 0.14 mm² are possible.

Tab. 17: Requirements for the connecting cable

7.4.2 [X1C], reference switch/limit switch

The connection [X1C] is located on the front of the device and is used to connect the reference switch or a limit switch.

[X1C]	Pin	Function	Description	Mating plug labelling
	1	+24 V, out	+ 24 V DC output (fused)	+
	2	REF/IN	Reference signal/limit switch signal	IN
	3	0 V/GND	Reference potential, reference switch	–

Tab. 18: Connection for the reference switch/limit switch

Cable requirements	
Shielding	Not required
Min. conductor cross section including wire end sleeve with plastic sleeve ¹⁾	0.14 mm ²
Max. conductor cross section including wire end sleeve with plastic sleeve	1.5 mm ²
Max. length	25 m

1) The conductor cross section used must be suitable for the expected currents.

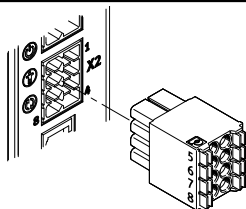
Tab. 19: Cable requirements

7.4.3 [X2], encoder interface

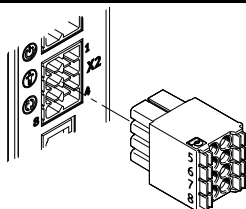
The encoder interface [X2] is located on the front panel of the device. Communication with the encoder is via this interface. The encoder signals are received, and the encoder is supplied with voltage.

The following encoders are supported:

- Incremental encoders with AB signals (quadrature encoder)
- Absolute encoders with BiSS C-protocol

[X2]	Pin	Function	Description	Mating plug labelling
	1	A_IN	A signal input	1
	2	B_IN	B signal input	2
	3	IDX_IN	Index signal input	3
	4	+5 V	5 V encoder supply	4
	5	#A_IN	A signal input, inverse	5
	6	#B_IN	B signal input, inverse	6
	7	#IDX_IN	Index signal input, inverse	7
	8	GND	Reference potential of encoder supply	8

Tab. 20: Incremental encoders with AB signals (quadrature encoder)

[X2]	Pin	Function	Description	Mating plug labelling
	1	–	–	1
	2	MA+	Clock line BiSS C, output	2
	3	SLO+	Data transmission line BiSS C, input	3
	4	+5 V	5 V encoder supply	4
	5	–	–	5
	6	MA–	Clock line BiSS C, output inverse	6
	7	SLO–	Data transmission line BiSS-C, input inverse	7
	8	GND	Reference potential of encoder supply	8

Tab. 21: Absolute encoders with BiSS C-protocol

Requirements for the connecting cable	
Shielding	Shielded, twisted pair
Min. cable cross section ¹⁾	0.2 mm ²

Requirements for the connecting cable	
Max. conductor cross section	1.5 mm ²
Max. length	25 m

1) The conductor cross section used must be suitable for the expected currents. If flexible leads are used with plastic wire end sleeves, minimum cross sections of 0.14 mm² are possible.

Tab. 22: Requirements for the connecting cable

7.4.4 [X18], standard Ethernet

The interface [X18] is located on the front panel of the device. The following can be performed via the interface [X18] using the commissioning software:

- Diagnostics
- Parameterisation
- Controller
- Firmware updates

The interface fulfils the requirements of IEEE 802.3:2012. The interface is galvanically isolated and intended for use with limited cable lengths.

The connection [X18] is designed as an RJ45 socket. 2 LEDs are integrated into the RJ45 socket. The green LED lights when the interface is activated and flashes during communication.

Requirements for the connecting cable	
Characteristics	CAT 5, patch cable, double shielded
Max. cable length	30 m

Tab. 23: Requirements for the connecting cable

The following connections are possible via the Ethernet interface:

Connections	Description
Point-to-point connection	The device is connected directly to the PC via an Ethernet cable.
Network connection	The device is connected to an Ethernet network.

Tab. 24: Options for connection

The device supports the following methods of IP configuration (based on IPv4):

Methods	Description
Obtain IP address automatically (DHCP client)	The device obtains its IP configuration from a DHCP server in the network. This method is suitable for networks with a DHCP server installed.
Fixed IP configuration	The device uses a fixed IP configuration. The IP configuration of the device can be permanently assigned manually. However, the device can only be addressed if the assigned IP configuration matches the IP configuration of the PC. Factory setting: 192.168.0.1

Tab. 25: Options for IP configuration

7.4.5 [XF1 IN] and [XF2 OUT], real-time Ethernet (RTE) ports 1 and 2

The real-time Ethernet interface [XF1 IN] and [XF2 OUT] is located on the top of the device. The interface enables RTE communication. Different protocols are supported depending on the bus configuration ➔ 4.3 Setting bus protocol.

The physical level of the interface fulfils the requirements according to IEEE 802.3:2012-00. The interface is galvanically isolated and intended for use with limited cable lengths.

2 LEDs are integrated into the RJ45 bushings. The behaviour of the LEDs depends on the bus protocol. Both LEDs are not always used.

Requirements for the connecting cable	
Characteristics	CAT 5, patch cable, double shielded
Max. cable length	30 m

Tab. 26: Requirements for the connecting cable

7.5 Motor connection

The connection [X6] is on the front panel of the device. The following functions are carried out via the connection [X6]:

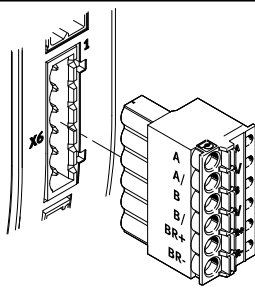
- Supply motor coils with current
- Control optional holding brake of the motor

The installed brakes are generally holding brakes. This means the brakes are well suited to keeping the motor at a standstill. The holding brake must be designed for the load torque that is to be held. Holding brakes are not usually suitable for braking moving masses or loads.

- Check that the holding brake used is suitable for the application.

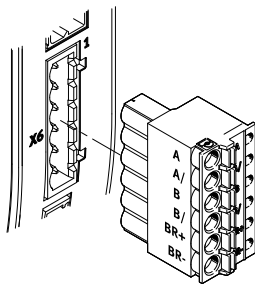
The servo drive controls the output for the holding brake automatically. Information about the brake controller ➔ Online help for the CMMT-ST plug-in.

Pin allocation for connecting a stepper motor:

[X6]	Pin	Function	Description	Mating plug labelling
	1	A	String A	A
	2	A/	String A/	A/
	3	B	String B	B
	4	B/	String B/	B/
	5	Br+	Brake +24 V	Br+
	6	Br-/0 V	Brake 0 V	Br-

Tab. 27: Motor phase connection for connecting a stepper motor

Pin allocation for connecting an EC motor:

[X6]	Pin	Function	Description	Mating plug labelling
	1	U	Phase U	A
	2	V	Phase V	A/
	3	W	Phase W	B
	4	Reserved	Do not connect	B/
	5	Br+	Brake +24 V	Br+
	6	Br-/0 V	Brake 0 V	Br-

Tab. 28: Motor phase connection for connecting an EC motor

Requirements for the connecting cable	
Shielding	Shielded
Min. cable cross section ¹⁾ including wire ferrule with plastic sleeve	0.2 mm²
Max. conductor cross-section without wire ferrule	2.5 mm²
Max. length	25 m

1) The conductor cross section used must be suitable for the expected currents.

Tab. 29: Requirements for the connecting cable

Festo offers prefabricated motor cables as accessories ➔ www.festo.com/catalogue.

7.6 Load and logic power supply

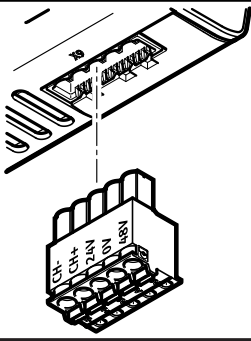
Power supply

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only PELV circuits that guarantee a reinforced isolation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

Power supply

[X9]	Pin	Function	Description	Mating plug labelling
	1	+ 48 V	Power supply for the load circuit 24 V DC to 48 V DC	48 V
	2	0 V	Reference potential for the load and logic voltage	0 V
	3	+24 V	Power supply for the logic circuit 24 V DC	24 V
	4	CH+	Braking resistor positive connection	CH+
	5	CH-	Braking resistor negative connection	CH-

Tab. 30: Power supply

Requirements for the connecting cable for the power supply	
Shielding	Not required
Min. cable cross section ¹⁾ including wire end sleeve with plastic sleeve	0.2 mm²
Max. conductor cross section including wire end sleeve with plastic sleeve	2.5 mm²
Max. length of power supply pins 1, 2 and 3	30 m

1) The conductor cross section used must be suitable for the expected currents.

Tab. 31: Requirements for the connecting cable for the power supply

7.7 Cross-wiring of multiple servo drives

Cross-wiring enables a device compound to be created.

- When cross-wiring configurable inputs/outputs, note the current rating of the cables and the mating plugs.

Whether cross-wiring the diagnostic contact is permissible depends on the required safety classification.

The diagnostic contact must be evaluated separately for EC motors with the classification SIL 3, cat. 3, PL e. It is not permissible to cross-wire the diagnostic contact. In all other cases, the following rules apply when cross-wiring multiple servo drives:

- Wire inputs #STO-A and #STO-B in parallel in each case.
- Wire diagnostic contacts STA-C1/C2 in series in each case.
- Wire the diagnostic contacts of a maximum of 10 servo drives in series. The maximum cable length applies to the entire line, from the safety relay unit to the final device.

①

Example of cross-wiring ➔ 1.2 Applicable documents, Manual Safety sub-function.

Mixed cross-wiring of diagnostic contacts and diagnostic outputs is not recommended.

The connections for the load and logic power supply can be cross-wired to create a device compound. Twin wire end sleeves or double mating plugs can be used for cross-wiring.

According to the datasheet of the mating plug, twin wire end sleeves allow conductor cross-sections of maximum 2 × 1 mm² per contact. With the double mating plug TFKC 2.5/3-ST-5.08 from PHOENIX CONTACT, conductor cross sections of maximum 2x 1.5 mm² per contact are possible.

Cross-wiring	Twin wire end sleeve	Double mating plug TFKC 2.5/ 3-ST-5.08
Max. conductor cross section per cable (2)	1 mm²	1.5 mm²
Max. permissible current with heat-resistant cable	19 A	24 A, according to mating plug data sheet max. 10 A for cUL

Tab. 32: Max. permissible current

Recommendation:

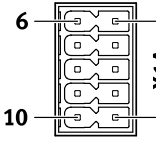
- Insert a suitable fuse for line protection. The rated current of the fuse must be less than or equal to the permissible current rating of the selected conductor cross section.
- The number of devices that can be cross-wired depends on the current consumption of the devices.

7.8 STO installation

Inputs and outputs for the safety sub-function STO

The 2-channel request for the safety sub-function is made via the digital inputs #STO-A and #STO-B. The digital input #STO-A must not be connected to the digital input #STO-B. Make sure that bridges or the like cannot be used parallel to the safety sub-function.

The diagnostic contact STA indicates whether the safe state has been reached for the safety sub-function STO.

[X1A]	Pin	Type	Identifier	Function
	X1A.2	Digital input	#STO-A	Safe torque off, channel A
	X1A.3		#STO-B	Safe torque off, channel B
	X1A.4	Contact	STA-C1	Safe torque off acknowledge, diagnostic contact
	X1A.5		STA-C2	

Tab. 33: Inputs and outputs for the safety sub-function STO

The motor controller cannot detect a cross circuit in the input circuit by itself.

- Find out if detection of shorts across contacts is needed for the input circuit and diagnostic contact wiring in the application.
- If required, use a safety relay unit with detection of shorts across contacts.

Information on using EC and stepper motors

When using stepper motors with a safety classification of SIL 3, cat. 3, PL e and EC motors with a safety classification of SIL 2, cat. 3, PL d, it is not mandatory to have a safety relay unit or to evaluate the feedback signal STA. The following components can be connected to the control inputs #STO-A and #STO-B to request the safety sub-function STO:

- Safe semiconductor outputs (electronic safety relay units, active safety sensors, e.g. light curtains with OSSD signals; OSSD = "Output Signal Switching Device")
- Switch contacts (safety relay units with relay outputs, passive safety sensors, e.g. forced position switches)

When using EC motors that require a safety classification of SIL 3, cat. 3, PL e, it is necessary to have a safety relay unit and to evaluate the feedback signal STA via the diagnostic contact STA. Direct connection of safe sensors is not permitted.

7.9 SS1-t installation

Inputs and outputs for the safety sub-function SS1-t

The safety sub-function SS1-t is wired like the safety sub-function STO but is supplemented by an emergency stop request (either directly by wiring CTRL-EN or indirectly via another functional controller) so that the braking ramp can be activated by the safety relay unit.

7.10 Installation for operation without safety function

For operation without the safety subfunction, wire inputs X1A.2 to X1A.5 as follows:

[X1A]	Pin	Type	Identifier	Function
6	1	Digital input	#STO-A	supplies each one with 24 V
			#STO-B	
10	5	Contact	STA-C1	do not connect
			STA-C2	

Tab. 34: Circuitry of inputs and outputs without safety sub-function

8 Commissioning

8.1 Safety

WARNING

Severe, irreversible injuries from accidental movements of the connected actuator technology.

Unintentional movements of the connected actuator technology can result from exchanging the connecting cables of a servo drive or between servo drives.

- Before commissioning: all cables must be correctly assigned and connected.

NOTICE

During commissioning: Keep the range of movement of the connected actuators clear, so that no persons are endangered.

NOTICE

Unauthorised Access to the Device Can Cause Damage or Malfunction.

- When connecting the device to a network, protect the network from unauthorised access.
Standards for security in information technology can be used for network protection measures, e.g. IEC 62443, ISO/IEC 27001.

Use of the safety functions

NOTICE

The safety sub-function STO is already available on the servo drive on delivery without the need for any additional parameterisation. Prior to initial commissioning, wire the safety sub-function STO as a minimum.

- Make sure that each safety function of the system is analysed and validated. It is the responsibility of the operator to determine and verify the required safety classification (safety integrity level, performance level and category) of the system.
- Put the servo drive into operation and validate its behaviour in a test run. During integration of the PDS, observe the measures stipulated by standard EN ISO 13849-1, Chapter G.4:
 - Functional test
 - Project management
 - Documentation
 - Performance of a black-box test

8.2 Preparation for commissioning

For initial commissioning, the Festo Automation Suite software must be installed along with the CMMT-ST plug-in → www.festo.com/sp.

Prepare for commissioning as follows:

- Check wiring of the CMMT-ST.
- Set switches → 4.3 Setting bus protocol.
- Install Festo Automation Suite plus CMMT-ST plug-in on the PC.
- Create project and add CMMT-ST device.
- Establish connection to the CMMT-ST and set network configuration.
- Identify the technical data of the components that is required for configuration.

8.3 Commissioning steps

NOTICE

Unwanted drive movements or damage to components.

Incorrect parameterisation may result in unwanted drive movements or overload when the closed-loop controller is enabled or may lead to connected components becoming overloaded or damaged.

- Do not enable the closed-loop controller until the configured components (servo drive, motor, axis, etc.) match those that are connected exactly.

During initial commissioning with the Festo Automation Suite with the CMMT-ST plug-in installed, the following steps must be performed, for example:

- Perform configuration and parameterisation with the CMMT-ST plug-in (hardware configuration, critical limits and parameters).

- If the safety function is being used, check the functionality of the safety function → 1.2 Applicable documents, Manual Safety sub-function.
- Check signal behaviour of the digital I/Os, e.g. limit/reference switch.
- Provide required control signals.
- Check direction of rotation/direction of travel of the electromechanical drive, e.g. in jog operation.
- Carry out homing.
- Test positioning behaviour (test mode → 1.2 Applicable documents, manual/online help plug-in).
- If necessary, optimise controller setting (optional, → 1.2 Applicable documents, manual/online help plug-in).
- Perform fieldbus configuration and test control profile → 1.2 Applicable documents, manual/online help plug-in, description of the device profile used.
- Complete commissioning (e.g. save project with Festo Automation Suite and archive project).

9 Operation

Check the safety functions at adequate intervals for proper functioning. It is the responsibility of the operator to choose the type and frequency of the checks within the specified time period. The manner in which the test is conducted must make it possible to verify that the safety device is functioning perfectly in interaction with all components. Time period for cyclical test (PTI) → 13.1 Technical data, safety engineering.

After the safety sub-function STO has been requested and the request completed, the functional controller enable must be reactivated.

Have qualified personnel regularly check and document the function of the diagnostic contact. The machine manufacturer must specify the exact interval, based on their application.

The CMMT-ST is maintenance-free during its period of use and specified service life.

The machine manufacturer must ensure the device is protected against restart according to the EN ISO 14118 standard “Safety of machinery – Prevention of unexpected start-up”.

With suspended axes, additional measures must be put in place to protect against falling loads. The device does not feature a safety sub-function SBC (Safe brake control).

Measures must be put in place to protect against loads that are coasting down. We recommend decelerating the drive to a standstill before applying a brake. See information on implementing the safety function SS1-t.

10 Maintenance and care

If used as intended, the product is maintenance-free.

10.1 Cleaning

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

11 Malfunctions

11.1 Diagnostics via LED

The device has LEDs for displaying status information on the top and in the RJ45 sockets [XF1 IN], [XF2 OUT] and [X18].

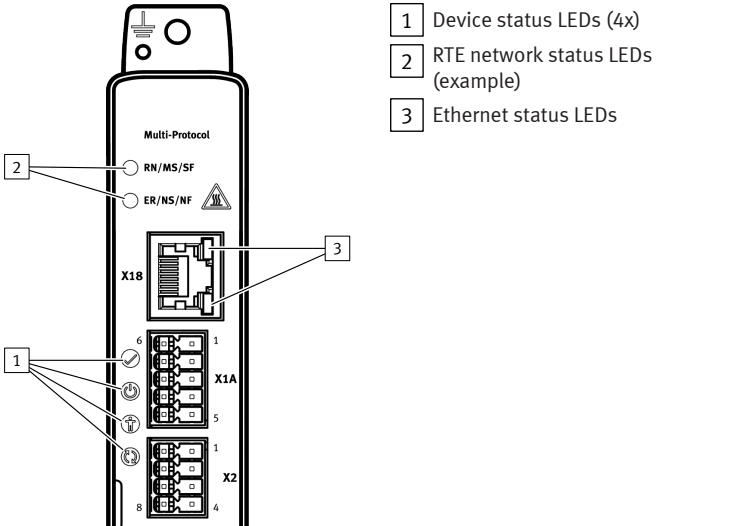


Fig. 9: LEDs on the front

11.1.1 Device status displays

LED	Designation	Brief description
✓	Status LED	Indicates the general device status
⏻	Power LED	Indicates the status of the power supply
⚠	Safety LED	Indicates the status of the safety equipment
↻	Application status LED	Indicates the identification sequence and is reserved for future extensions

Tab. 35: Device status LEDs (status, power, safety and application status LEDs)

✓ **Status LED, display of the device status**

LED	Meaning
 flashing red	An error is pending.
 flashing yellow	A warning is pending or the servo drive is currently performing a firmware update.
 yellow light	The servo drive is in the initialisation phase.
 flashing green	The servo drive is ready, and the power stage is switched off (Ready).
 green light	The power stage and the closed-loop controller are enabled.

Tab. 36: Status LED

🔌 **Power LED, status of the power supply**

LED	Meaning
 yellow light	The logic power supply is present, but the load voltage supply is not present or is currently being measured.
 green light	The load voltage supply and the logic power supply are present.

Tab. 37: Power LED

† **Safety LED, functional status of the safety engineering**

Malfunctions of the safety sub-function are detected and displayed in the functional device. The following are detected:

- Safety sub-function STO requested via 1 channel (discrepancy monitoring)
- Plausibility check of STO channel switch-off

Malfunctions are externally reported by the functional part, including via the additional communication interfaces (bus, commissioning software).

LED	Meaning
 flashing red	Error in the safety part or a safety condition has been violated.
 yellow light	The safety sub-function has been requested and is active.
 green light	Ready, a safety sub-function has not been requested.

Tab. 38: Safety LED

11.2 Repair

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

1. If there is a defect: always replace the product.
2. Return the defective product unchanged, together with a description of the fault and application, to Festo for analysis.
3. Check with your regional Festo contact person to clarify the conditions for the return shipment.
4. Validate the safety function after any modification to the installation. Validation check lists ➔ 1.2 Applicable documents, Manual Safety sub-function.

12 Disassembly

 WARNING

Danger of burns from hot housing surfaces.

Metallic housing parts can reach high temperatures during operation. Contact with metal housing parts can cause burn injuries.

- Do not touch metallic housing parts.
- After the power supply is switched off, let the device cool down to room temperature.

Disassemble in reverse order of mounting.

Before disassembly

1. Switch off the power supply at the main switch.
2. Secure the system against accidental reactivation.
3. Let the device cool down to room temperature.
4. Disconnect all electrical cables.

Disassembly for wall mounting

- Loosen retaining screws (2x) and remove the device from the mounting surface.

Disassembly for H-rail mounting

- Press the servo drive slightly downwards, then carefully tilt it upwards and remove it from the H-rail.

13 Technical data

13.1 Technical data, safety engineering

Approval information, safety engineering	
CE	
Type-examination	The functional safety engineering of the product has been certified by an independent testing body, see EC-type examination certificate ➔ www.festo.com/sp
Certificate issuing authority	TÜV Rheinland, Certification Body of Machinery, NB 0035
Certificate no.	01/205/5696.01/24
UKCA	
Type-examination	The functional safety engineering of the product has been certified by an independent body, see UK-type examination certificate ➔ www.festo.com/sp
Certificate issuing authority	TUV Rheinland UK Ltd, UK Approved Body No. 2571
Certificate no.	01/205U/5696.01/24

Tab. 39: Approval information, safety engineering

General safety reference data	
Request rate in accordance with EN 61508	High request rate
Reaction time when the safety sub-function is requested (t _{STO,in}) [ms]	With stepper motor: maximum 11 With EC motor: maximum 15

Tab. 40: Safety reference data and safety specifications

Safety reference data for the safety sub-function STO			
Circuitry	Stepper motor	EC motor without evaluation of STA	EC motor with evaluation of STA
Safety sub-function in accordance with EN 61800-5-2	Safe torque off (STO)		
Safety integrity level in accordance with EN 61508	SIL 3	SIL 2	SIL 3
Category in accordance with EN ISO 13849-1	Cat. 3		
Performance level in accordance with EN ISO 13849-1	PL e	PL d	PL e
Probability of dangerous failure per hour in accordance with EN 61508, PFH [1/h]	9.5 * 10 ⁻¹¹	6 * 10 ⁻¹⁰	3.6 * 10 ⁻¹⁰
Mean time to dangerous failure in accordance with EN ISO 13849-1, MTTF _d [a]	2000	1600	
Average diagnostic coverage in accordance with EN ISO 13849-1, DC _{avg}	medium	low	medium
Operating life (mission time) in accordance with EN ISO 13849-1, T _M [a]	20		
Proof test interval in accordance with EN 61800-5-2, PTI ¹⁾ [a]	20 ²⁾	20 ³⁾	20 ⁴⁾
Classification of components in accordance with EN 61508	Type B		
Hardware fault tolerance in accordance with EN 61508, HFT	1		
Common cause factor for dangerous undetected failures β in accordance with EN 61508 [%]	2		

- 1) Depending on the desired safety classification, the evaluation of the diagnostic contact STA by the safety relay unit is required or optional.
- 2) The evaluation of the diagnostic contact STA is optional for achieving the safety classification SIL 3 cat. 3, PL e with stepper motor. Testing annually is recommended.
- 3) To achieve the safety classification SIL 2 cat. 3, PL d with EC motor, the evaluation of the diagnostic contact STA is optional. Testing annually is recommended.
- 4) The evaluation of the diagnostic contact STA is required for achieving the safety classification SIL 3 cat. 3, PL e with EC motor. This requires a cyclical test that involves dynamically changing the input signals and then evaluating STA in accordance with EN 13849-1 at least once every 3 months in accordance with EN 61800-5-2.

Tab. 41: Safety reference data for the safety sub-function STO

i

The technical data for the safety sub-function SS1-t must be calculated individually according to the application. Use the specified safety reference data for STO for the calculation.

13.2 Technical data, general

General technical data	
Certificates, declaration of conformity	➔ www.festo.com/sp
Type ID code	CMMT-ST
Type of mounting	Mounting plate, attached with screws H-rail mounting

General technical data		
Mounting position		vertical, free convection with unhindered air flow from bottom to top
Product weight	[kg]	approx. 0.35

Tab. 42: General technical data

Ambient conditions, transport in original packaging or in control cabinet		
Transport temperature	[°C]	–25 ... +70
Relative humidity	[%]	5 ... 95 (non-condensing)
Max. transportation duration	[d]	56 at 70 °C
Permissible altitude	[m]	12000 (above sea level) for 12 h
Vibration resistant		Vibration test and free fall in packaging in accordance with EN 61800-2

Tab. 43: Ambient conditions, transport

Ambient conditions, storage in original packaging or in control cabinet		
Storage temperature	[°C]	–25 ... +55
Relative humidity	[%]	5 ... 95 (non-condensing)
Permissible altitude	[m]	3000 (above sea level)

Tab. 44: Ambient conditions, storage

Ambient conditions, operation		
Ambient temperature	[°C]	0 ... +50
Relative humidity	[%]	5 ... 90 (non-condensing) corrosive media not permitted in the vicinity of the device
Permissible setup altitude above mean sea level	[m]	0 ... 2000 Operation above 2000 m is not permitted!
Degree of protection		IP20 Use in a control cabinet with at least IP54, design as “closed electrical operating area” in accordance with EN 61800-5-1, Chap. 3.5
Protection class		III (safety extra-low voltage)
Overvoltage category		I
Pollution degree		2
Vibration resistance in accordance with		EN 61800-5-1 and EN 61800-2
Shock resistance in accordance with		EN 61800-2
EMC in accordance with		EN 61800-5-2

Tab. 45: Ambient conditions, operation

Service life		
Service life of the device at rated load	[h]	25000 Dependent on the required current and the ambient temperature in compliance with the necessary mounting clearances and derating ➔ 13.4 Characteristic curves

Tab. 46: Service life

13.3 Technical data, electrical

13.3.1 Load and logic voltage supply, braking resistor [X9]

Electrical data, load voltage supply [X9], pin 1		
Voltage range	[V DC]	24 – 15% ... 48 + 15%
Nominal operating voltage	[V DC]	24 ... 48
Nominal current	[A]	8
Peak current	[A]	20 for 3 s
Nominal power	[W]	300 at 48 V
Load efficiency	[%]	96.5 at nominal power 300 W
Short circuit current rating (SCCR)	[A]	5000
Protective functions		– Protection against polarity reversal – Overcurrent protection input (20 A fuse, cannot be reset) – Adjustable protection against feedback on DC link rise

Tab. 47: Load voltage supply

Electrical data, logic power supply [X9], pin 3		
Logic voltage range	[V DC]	24 ± 15 %
Nominal voltage	[V DC]	24
Current consumption (without holding brake)	[A]	1
Current consumption (with holding brake)	[A]	2
Logic efficiency	[%]	82
Protective functions		– Protection against polarity reversal – Overvoltage protection (from approx. 31 V) – Overcurrent protection input (4 A fuse, cannot be reset) – Overcurrent protection + 24 V DC output [X1A] pin 1 and [X1C] pin 1 (0.5 A fuse, can be reset, PTC)

Tab. 48: Logic supply

Requirements on external braking resistor [X9], pin 4 and pin 5		
Max. resistance	[Ω]	50
Min. resistance	[Ω]	6 ± 10%
Nominal power	[W]	60
Permissible pulse energy (for the brake chopper)	[Ws]	2300
Operating voltage	[V DC]	≥ 100
Thermal protection		Yes, possible to monitor the power in the braking resistor in the device firmware

Tab. 49: Braking resistor

13.3.2 Power specifications, motor connection [X6]

Power specifications during operation		
Nominal output current	[A]	8

Tab. 50: Power specifications during operation

Any derating that may be necessary as a function of the ambient temperature ➔ Fig. 10.

The CMMT-ST does not have integrated electronic overload and overtemperature protection functions for the motor. An I²t monitoring function can be parameterised for the motor current in order to protect the motor, such as by using the device-specific plug-in.

Power unit temperature monitoring (parameterisable)		
Warning	[°C]	85
Shutdown	[°C]	› 95

Tab. 51: Temperature monitoring

Output of holding brake at [X6]		
Design		High-Side-Switch
Max. continuous output current	[A]	1 (parameterisable holding current reduction)
Max. voltage drop from + 24 V input at connection [X9] to brake output at [X6]	[V DC]	1
Protective functions		Short-circuit and overload-protected

Tab. 52: Output of holding brake at [X6]

13.3.3 Digital inputs and outputs [X1A]

Control inputs #STO-A and #STO-B at [X1A]		
Nominal voltage	[V DC]	24; relative to 0 V at X9
Permissible voltage range ¹⁾	[V DC]	–3 ... 30
Max. input voltage, high level (U _{H max})	[V]	28.8
Min. input voltage, high level (U _{H min})	[V]	20
Max. input voltage, low level (U _{L max})	[V]	5
Min. input voltage, low level (U _{L min})	[V]	–3
Max. input current with high level (I _{H max})	[mA]	15
Min. input current with high level (I _{H min})	[mA]	8
Max. input current with low level (I _{L max})	[mA]	0.5
Tolerance for low test pulses		
Tolerated low test pulses (t _{STO,TP}) up to max.	[ms]	1
Min. time between low test pulses	[ms]	50
Tolerance for high test pulses ²⁾		
Tolerated high test pulses (t _{STO,TP}) up to max.	[ms]	1
Min. time between high test pulses at U _{STO-A/B} < U _{L max}	[ms]	50

- Every channel has a separate overvoltage monitor for the power supply at the input. If the voltage at the input exceeds the permissible maximum value, the channel is shut down.
- High test pulses must never occur simultaneously at inputs #STO-A and #STO-B but only with a time offset.

Tab. 53: Control inputs #STO-A and #STO-B at [X1A]

Diagnostic contact STA at [X1A]		
Design		Potential-free contact
Voltage range	[V DC]	18 ... 30
Max. current	[mA]	100; not short-circuit proof
Max. internal resistance	[Ω]	< 6
Off-state current (contact open)	[µA]	< 2
Closing reaction time t _{STA,Rise}	[ms]	< 30
Opening reaction time t _{STA,Fall}	[ms]	< 20

Diagnostic contact STA at [X1A]	
Galvanic isolation	Via optocoupler
Protective functions	Overvoltage-resistant up to 60 V DC

Tab. 54: Diagnostic contact STA-C1/C2 at [X1A]

13.4 Characteristic curves

Required derating

Mounting clearances may be required at output currents > 4.6 A to ensure the device reaches its specified service life. The required mounting clearances depend on the ambient temperature and the output current. Mounting clearances from 0 mm are possible for a device compound consisting of several servo drives CMMT-ST. The following characteristic curves show the maximum permissible effective currents for the lateral mounting clearances 0 mm, 3 mm, 10 mm and 15 mm → 6.1 Mounting clearances.

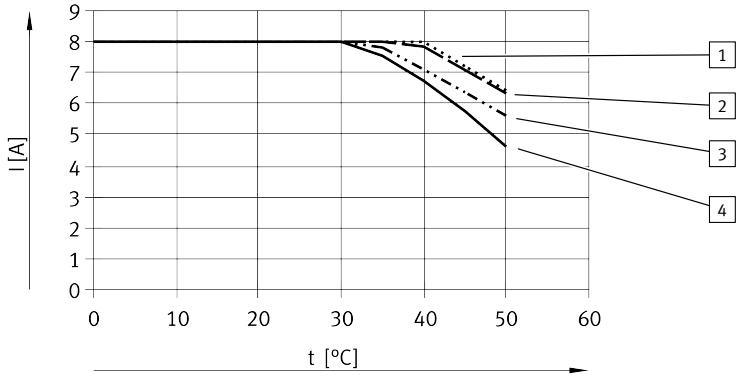


Fig. 10: Derating as a function of the ambient temperature and mounting clearance

- 1

Mounting clearance 15 mm
- 2

Mounting clearance 10 mm
- 3

Mounting clearance 3 mm
- 4

Mounting clearance 0 mm

13.5 Technical data UL/CSA certification

In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

UL/CSA certification information	
Product category code	NMMS / NMMS7 (Power Conversion Equipment)
File number	E331130_Vol-3_Sec-1
Considered standards	UL 61800-5-1 Adjustable Speed Electrical Power Drive Systems CSA C22.2 No. 274-17 – Adjustable Speed Drive
UL mark	
UL control number	4PU8

Tab. 55: UL/CSA certification information

Electrical Data and Ambient Conditions UL	
Overvoltage category	II
Pollution degree	2 (or better)
Protection class	Class III (SELV/PELV)
Installation site	for indoor use only
Max. installation height	2000 m
SCCR (short circuit current rating)	5000 A

Tab. 56: Electrical Data and Ambient Conditions UL/CSA

- Use 60/75 °C copper conductors only:
 - [X6], motor connection
 - [X9], load and logic voltage
- Use in an environment with pollution degree 2 (or better).
- Maximum surrounding air temperature: 50 °C
- With correct parameterisation of the nominal motor current, the motor is protected against overloading by the I²t monitoring function.
- For the load voltage supply, the use of a suitable fuse is recommended in accordance with the following table.

Fuse requirements	
Overcurrent protective device	UL Listed JDDZ class K5
Max. permissible rated current [A]	30
Min. short circuit current rating SCCR of mains fuse [kA]	5
Min. rated voltage [V DC]	125

Tab. 57: Fuse requirements for load voltage supply

Example: Littelfuse NLN 30, Bussmann NON-30

13.6 Additional technical data

Additional technical data on the product and detailed descriptions of all interfaces
→ 1.2 Applicable documents, Manual Assembly, Installation.