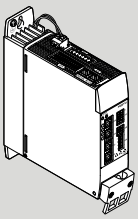
Servo drive
CMMT-AS-C2/C4-3A-...-S1



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Instructions | Assembly, Installation, Safety func.

8075777
2018-02
[8075779]

Translation of the original instructions

1 About this document

1.1 Target group

The document is targeted towards persons 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 Further applicable documents

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

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

Designation	Table of contents
Instruction manual CMMT-AS-...	Instruction manual for assembly, installation, and safety function
Description CMMT-AS-...-SY-...	Description for assembly and installation
Descriptions CMMT-AS-...	Descriptions on: – Operating modes and operational functions – specifically for each bus protocol/activation: Device profiles, controller and parameterisation – Safety function, STO, SBC, SS1
Help for commissioning software	Online help for: – Function of the commissioning software – Commissioning and parameterisation of the CMMT

Tab. 1 User documentation for the product

1.3 Product version

This documentation refers to the following version of the device:

– Servo drive CMMT-AS-...-S1, revision R01 and higher, see product labelling

1.4 Product labelling

• Observe the specifications on the product.

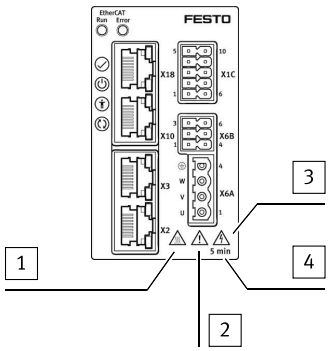
The product labelling is located on the left side of the device. The product labelling enables identification of the product and shows the following information:

Product labelling (example)	Meaning
CMMT-AS-C2-3A-EC-C000-V000-S1	Order code
5340819 J302 Rev 00	Part number, serial number, revision (Rev)
Main input: 100 V AC - 20 % ... 230 V AC + 15 % 48 ... 62 Hz 2.8 A_{RMS}	Technical data on power supply (alternating current supply connection)
Motor out: 3 x 0 ... input V AC 0 ... 599 Hz 2 A_{RMS} 350 W	Technical data for the motor output (output voltage, max. output frequency, nominal current, nominal output power)
T_{AMB}: max. 40 °C	Ambient temperature (T_{AMB})
SCCR: 10000 A	SCCR (short circuit current rating)
IP10/20	Degree of protection; without counterplug/with attached counterplug X9A
MSIP-REM-FTO-KC-2017-1001	Certificate KC mark (test mark for Korea)
See manual for internal overload protection and required external circuit breaker	Reference to the existing user documentation, which contains information on overload protection and the necessary external circuit breaker.
Data matrix code, 123456789ABC...	Product key as a data matrix code and an 11-character alphanumeric code
Festo AG & Co. KG	Manufacturer
DE-73734 Esslingen	Manufacturer's address
Made in Germany	Manufactured in Germany

Tab. 2 Product labelling (example)

1.4.1 Warning symbols on the front side of the product

The following warning symbols are located on the front side of the product:



1 Attention! Hot surface
2 Attention! General danger point
3 Attention! Dangerous voltage
4 5 minutes (wait)

Fig. 1

General meaning	Meaning with the CMMT-AS-...
Attention! Hot surface	Metallic housing parts of the device can have high temperatures during operation. In case of error, internal components can be overloaded. Overloading of components can result in high temperatures and release of hot gases.
Attention! General danger point	The touch current in the protective earth connector can exceed an alternating current of 3.5 mA or a DC current of 10 mA. The minimum cross-section of the protective earth connector must comply with the local safety regulations for protective earth connectors for equipment with high leakage current.
Attention! Dangerous voltage	The product is equipped with intermediate circuit capacitors, which store dangerous voltage for up to 5 minutes after the power supply is switched off. Do not touch power connections for 5 minutes after the power supply is switched off.
5 minutes (wait)	After the power supply is switched off, wait at least 5 minutes until the intermediate circuit capacitors have discharged.

Tab. 3 Meaning of the warning symbols

1.4.2 Warnings on the product

The following warnings are attached to the right side of the device:

Warnings on the product (en, fr)	Meaning
CAUTION Risk of Electric Shock! Do not touch electrical connectors for 5 minutes after switching power off! Read manual before installing! High leakage current! First connect to earth!	VORSICHT Gefahr des elektrischen Schlags! Berühren Sie keine elektrischen Anschlüsse innerhalb 5 Minuten nach dem Ausschalten! Lesen Sie das Handbuch vor der Installation! Hoher Ableitstrom nach PE! Gerät zuerst mit PE verbinden!
ATTENTION Risque de décharge électrique! Après la mise hors tension, ne pas toucher les connecteurs électriques pendant au moins 5 minutes! Lire le manuel avant installation! Courant de défaut élevé! Relier tout d´abord à la terre!	
DANGER Risk of Electric Shock! Disconnect power and wait 5 minutes before servicing.	Gefahr Gefahr des elektrischen Schlags! Vor dem Durchführen von Wartungsarbeiten die Stromversorgung trennen und 5 Minuten warten.
Risque de décharge électrique! Débranchez l'alimentation et attendez 5 min. avant de procéder à l'entretien.	

Tab. 4 Warnings on the product

1.5 Specified standards

Version status		
IEC 61800-5-1:2016		EN ISO 13849-1:2015
EN 61800-3:2004+A1:2012		EN 61508 Parts 1-7:2010
EN 61800-5-2:2017		EN 60204-1:2006+A1:2009+AC2010
EN 61800-2:2015		EN 62061:2005+AC:2010+A1:2013+A2:2015

Tab. 5 Standards specified in the document

2 Safety

2.1 Safety instructions

2.1.1 General safety instructions

– Assembly and installation should only be carried out by qualified personnel.
– Only use the product if it is in perfect technical condition.
– Only use the product in original status without unauthorised modifications.
– Do not carry out repairs on the product. If defective, replace the device immediately.
– Observe labelling on the product.

– Take into consideration the ambient conditions at the location of use.
  The safety functions might fail and malfunctions might occur if you do not comply with the parameters and conditions required for the surroundings and connections.
– Wear required personal protective equipment during transport and during assembly and disassembly of very heavy product versions.
– Never remove or insert a plug connector when powered.
– Loosen only the following screws on the product:
  – Earthing screw on the cooling element for mounting the PE connection on the mains side
  – Retaining screws of the shield clamp on the housing front
  – Only when used in IT networks: screw for connection of the internal mains filter to PE
– Install the product in a suitable control cabinet. The control cabinet requires at least degree of protection IP54.
– Operate product only in an installed condition when all required protective measures have been taken (➔ EN 60204-1).
– Completely insulate conducting lines on the product. We recommend cable end sleeves with plastic sleeves for wiring power connections.
– Ensure correct earth protection and shield connection.
– Prior to commissioning, ensure that the resulting movements of the connected actuators cannot endanger anyone.
– During commissioning: Systematically check all control functions and the communication and signal interface between controller and drive regulator.
– The product is equipped with intermediate circuit capacitors, which store dangerous voltage for up to 5 minutes after the power supply is switched off. Before working on the product, switch off the power supply via the master switch and secure it against being switched on again unintentionally. Before touching the power connections, wait at least 5 minutes.
– Take into consideration the legal regulations for the respective destination.
– Keep the documentation throughout the entire product lifecycle.

In the event of damage caused by unauthorised manipulation or any use other than that intended, the warranty is invalidated and the manufacturer is not liable for damages.
In the event of damage caused by using unauthorised software or firmware with the device, the warranty is invalidated and the manufacturer is not liable for damages.

2.1.2 Safety instructions on the safety functions

The suitability for certain applications can only be determined in connection with the assessment of further components of the subsystem.
Analyse and validate safety function of the entire system.
The safety functions are to be checked at adequate intervals for proper functioning. Selecting the type of test and time intervals within the stated time period is the responsibility of the operator. The check is to be conducted such that flawless functioning of the safety device can be verified in interaction with all components.
Time period for cyclical test ➔ 15.1 Technical data, safety equipment.
Prior to initial commissioning, connect the control inputs of the safety functions STO and SBC. The safety functions STO and SBC are available in the CMMT-AS as delivered without additional parameterisation.

2.2 Intended use

The servo drive CMMT-AS is intended for supply and control of AC servo motors.
The integrated electronics permit regulation of torque (current), rotational speed and position.
Use exclusively:
– in perfect technical condition
– in original status without unauthorised modifications; only the extensions described in the documentation supplied with the product are permitted
– within the limits of the product defined by the technical data
  ➔ 15 Technical data
– in an industrial environment

The safety functions might fail and malfunctions might occur if you do not comply with the parameters and conditions required for the surroundings and connections.
The CMMT-AS-...-S1 supports the following safety functions in accordance with EN 61800-5-2:
– Safe torque off Safe torque off
– Safe brake control Safe brake control
– Safe stop 1 Safe stop 1, achievable with suitable safety relay unit and appropriate connection of the servo drive

The safety function STO is intended to disconnect the torque of the connected motor, thereby preventing an unexpected restart of the motor.
The safety function SBC is intended to safely hold the motor and axle in their position at standstill.
The safety function SS1 is intended for rapid stop with subsequent torque switch off.

2.2.1 Application areas

The device is intended for use in an industrial environment. Outside of industrial environments, measures may need to be implemented for radio interference suppression, e.g. in commercial and mixed-residential areas.
The device is intended to be installed in a control cabinet. The control cabinet requires at least degree of protection IP54.
The device can be operated in TN, TT and IT systems if certain requirements are met.

📖 Information on allowed and prohibited electrical network types and necessary measures during use in IT networks ➔ textvar object does not exist.
Safety functions may only be used for applications for which the stated safety values are sufficient ➔ 15.1 Technical data, safety equipment.

2.2.2 Permissible components

The logic supply must meet the requirements of EN 60204-1 (protective extra-low voltage, PELV).
If holding brakes and clamping units without certification are used, the suitability for the related safety-oriented application must be determined through a risk assessment.
The motors must fulfil the requirements of EN 61800-5-2 appendix D.3.5 and D.3.6 and of EN 60204-1. Motors approved or specified by Festo for the CMMT-AS fulfil the requirements.
The motor cables and brake lines must fulfil the requirements of EN 61800-5-2 appendix D.3.1 and of EN 60204-1. Motor cables and brake lines approved by Festo for the CMMT-AS fulfil the requirements.

2.3 Foreseeable misuse

2.3.1 Foreseeable misuse, general

– Use outside the limits of the product defined in the technical data.
– Cross-wiring of the I/O signals of more than 10 servo drives CMMT-AS.
– Use in IT networks without insulation monitors for detection of earth faults. When operated in IT networks, the potential relations change in case of error (earth fault of the feeding mains supply) so that the rated voltage of 300 V against PE, which is important for the design of insulation and network disconnection, is exceeded. This error must be detected.
– Use of a diagnostic output for connection of a safety function.
  The diagnostic outputs STA and SBA are not part of the safety circuit. The diagnostic outputs are used to improve diagnostic coverage of the related safety function. The diagnostic outputs may only be used in combination with the related safe control signals (AND link) and a reliable time monitoring in the safety relay unit for switching additional safety-critical functions.

2.3.2 Foreseeable misuse of the safety function STO

– Use of the STO function without external measures for drive axles influenced by external torques.
  If external torques influence the drive axle, the safetyfunction STO alone is not suitable to stop the axle reliably. Additional measures are required to prevent dangerous movements of the drive axle, such as use of a mechanical brake in combination with the safety function SBC.
– Disconnection of the motor from the energy supply.
  The safety function STO does not disconnect the drive from the power supply as defined by electrical safety.

2.3.3 Foreseeable misuse of the SBC function

– Use of an unsuitable holding brake or clamping unit, also in view of:
  – Holding or brake torque and emergency brake characteristics, if required.
  – Frequency of actuation
– Use of an unsuitable logic voltage supply

2.4 Training of skilled personnel

The product may be installed and placed in operation only by a qualified electro technician, who is familiar with the topics:
– installation and operation of electrical control systems
– applicable regulations for operating safety-engineering systems

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

2.5 Approvals and certifications

The product has the CE marking. Guidelines see
➔ 15.2 Technical data product conformity and approvals.
The product-relevant EC directives and standards are listed in the declaration of conformity ➔ www.festo.com/sp.
The product is a safety device in accordance with the Machinery Directive. Safety-oriented standards and test values that the product complies with and fulfils ➔ 15.1 Technical data, safety equipment. Observe that compliance with the named standards is limited to the CMMT-AS-...-S1.
Certain configurations of the product have been certified by Underwriters Laboratories Inc. (UL) for the USA and Canada.
These configurations bear the following mark:

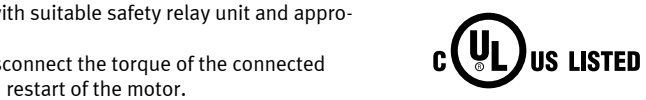


Fig. 2

UL Recognized Component Mark for Canada and the United States.
Only for connection to a NEC/CEC Class 2 supply.
Raccorder Uniquement a un circuit de NEC/CEC Classe 2.
During installation and operation of this product, comply with all safety requirements, statutes, codes, rules and standards relevant for the product, such as National Electrical Code (USA), Canadian Electrical Code (Canada), regulations of the US federal agency OSHA. When selecting the circuit breaker, comply with the maximum permissible electrical protection for UL.

3 Further information

– Accessories ➔ www.festo.com/catalogue
– Spare parts ➔ www.festo.com/spareparts.

– All available documents for the product and current versions of the firmware and commissioning software ➔ www.festo.com/sp.

4 Service

Contact your regional Festo contact person if you have technical questions ➔ www.festo.com.

5 Product overview

5.1 Scope of delivery

Component	Number
Servo drive CMMT-AS-...	1
Instruction manual CMMT-AS-...	1

Tab. 6 Scope of delivery

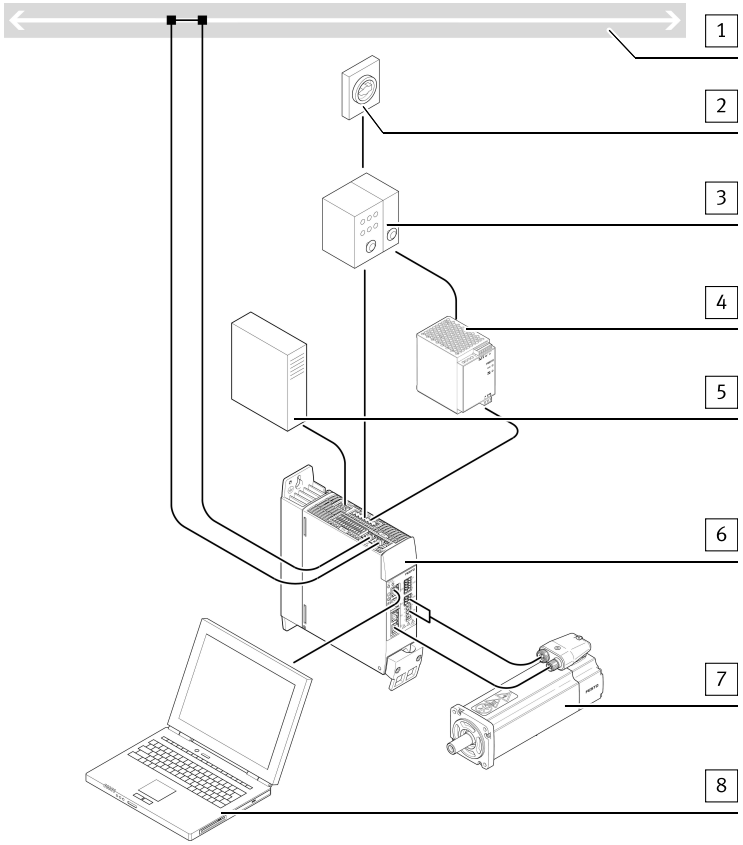
5.2 System structure

The servo drive CMMT-AS is a 1-axis servo drive. Depending on the product variant, the following components, which are necessary for standard applications, are integrated into the device or into the cooling profile of the device:
– Mains filter (guarantees immunity to interference and limits line-bound emitted interference)
– Electronics for intermediate circuit voltage processing
– Output stage (for motor activation)
– Braking resistor (integrated into the cooling element)
– Brake chopper (switches the braking resistor in the intermediate circuit, as needed)
– Temperature sensors (for monitoring the temperature of the power module and of the air in the device)
– Fan (dependent on the product variant in the cooling profile)

An Ethernet interface is available for parameterisation through a PC. The type of activations depends on the product design (e.g. over bus/network, over EtherCAT, EtherNet/IP or PROFINET).

i

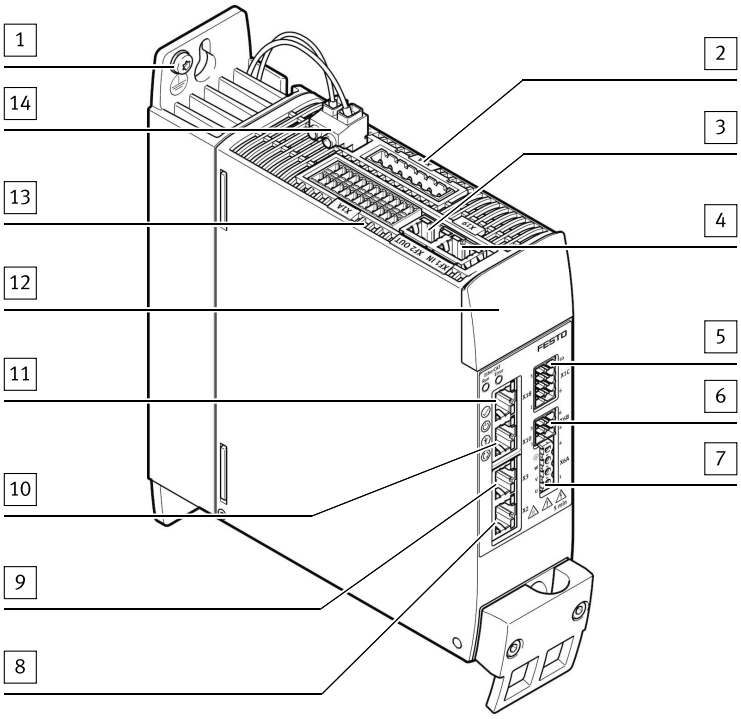
Festo recommends use of servo motors, electromechanical drives, lines and accessories from the Festo accessory programme.



1 Bus/network
2 Master switch
3 Circuit breaker/fuses and all-current-sensitive fault current circuit interrupter (RCD) (optional)
4 Power supply unit for logic voltage supply 24 V DC (PELV)
5 External braking resistor (optional)
6 Servo drive CMMT-AS
7 Servo motor (here EMME-AS)
8 PC with Ethernet connection for parameterisation

Fig. 3

5.2.1 Overview of connection technology



1 PE connection housing
2 [X9A] Mains voltage, intermediate circuit voltage and logic voltage
3 [XF2 OUT] RTE interface port 2
4 [XF1 IN] RTE interface port 1
5 [X1C] Inputs/outputs to the axle
6 [X6B] Motor auxiliary connection
7 [X6A] Motor phase connection
8 [X2] Sensor connection 1
9 [X3] Sensor connection 2
10 [X10] Device synchronisation
11 [X18] Standard Ethernet
12 [X5] Connection for operating unit (behind the blind plate)
13 [X1A] I/O interface
14 [X9B] Braking resistor

Fig. 4

5.3 Safety functions

5.3.1 Function and application

The servo drive CMMT-AS-...-S1 has the following safety-related performance features:
– Safe torque off Safe torque off
– Safe brake control Safe brake control
– Safe stop 1 (SS1) with use of a suitable external safety relay unit and suitable wiring of the servo drive
– Diagnostic outputs STA and SBA for feedback of the active safety function

5.3.2 Safety function STO

5.3.2.1 Function and application STO

The safety function STO switches off the driver supply for the power semiconductor, thus preventing the power end stage from supplying the energy required by the motor. The power supply to the drive is safely disconnected when the safety function STO is active. The drive cannot generate torque and so cannot make any hazardous movements. With suspended loads or other external forces, additional measures must be taken to ensure that the load does not drop (e.g. mechanical clamping units). In the STO status, the standstill position is not monitored.
The machines must be stopped and locked in a safe manner. This especially applies to vertical axles without automatic locking mechanics, clamping units or counterbalancing.

NOTICE!

If there are multiple errors in the servo drive, there is a danger that the drive will move. Failure of the servo drive output stage during the STO status (simultaneous short circuit of 2 power semiconductors in different phases) may result in a limited detent movement of the rotor. The rotation angle/travel corresponds to a pole pitch. Examples:
- Rotating motor, synchronous machine, 8-pin ➔ Movement < 45° at the motor shaft
- Linear motor, pole pitch 20 mm ➔ Movement < 20 mm at the moving part

5.3.2.2 STO request

The STO safety function is requested over 2 channels by switching off the control voltage at both control ports #STO-A and #STO-B.

5.3.2.3 STO feedback through STA diagnostic contact

The status of the STO safety function can be reported to the safety relay unit through the STA diagnostic output.
The STA diagnostic output displays whether the safe status has been reached for the STO safety functions. The STA diagnostic output switches to high level only when STO is active in 2 channels through the control inputs #STO-A and #STO-B.

#STO-A	#STO-B	STA
Low level	Low level	High level
Low level	High level	Low level
High level	Low level	Low level
High level	High level	Low level

Tab. 7 Level STA

If protective functions are triggered in both channels (STO-A and STO-B), e.g. with excessive voltage at STO-A and STO-B, the internal protective functions switch off and STA likewise delivers high level.
Recommendation: The safety relay unit should check the status of the diagnostic output at each STO request. The level of STA must change according to the logic-table. The safety relay unit can cyclically test the signals #STO-A and #STO-B, for high level with low testimpulses and for low level with high testimpulses.

5.3.3 Safety function SBC

5.3.3.1 SBC function and application

The SBC safety function provides safe output signals for the control of brakes (holding brakes or clamping units). Brakes are controlled over 2-channels by switching off the voltage at the following outputs:
– Safe output BR+/BR– [X6B] for the holding brake of the motor
– Safe output BR-EXT/GND [X1C] for the external brake/ clamping unit
The holding brake and/or clamping unit engage and slow the motor or axle. Dangerous movements should thus be braked mechanically. The braking time is dependent on how quickly the brake engages and how high the energy level is in the system.
The use of **only one brake** is possible
➔ Tab. 47 Safety reference data of the SBC safety functiononly in case of low performance requirements. To do this, connect the brake either to BR+/BR– **or** to BR-EXT.

NOTICE!

If there are suspended loads, they usually drop if SBC is requested simultaneously with STO. This can be traced back to the mechanical inertia of the holding brake or clamping unit and is thus unavoidable. Check whether the SS1 safety function is better suited.

SBC may only be used for holding brakes or clamping units which engage in the de-energised state. Ensure the lines are installed in a protected manner.

5.3.3.2 SBC request

The SBC safety function is requested over 2 channels by switching off the control voltage at both control ports #SBC-A and #SBC-B:
– The #SBC-A request switches off the power to the signals BR+/BR-.
– The #SBC-B request switches off the power to the signal BR-EXT.
If there is a power failure in the logic voltage supply of the servo drive, power is also cut off to the brake outputs.

5.3.3.3 SBC feedback through SBA diagnostic contact

The 2-channel switching of the brake is displayed over the SBA output. Through SBA, the status of the SBC safety function is reported for diagnosis, such as to an external safety relay unit.
The SBA diagnostic output displays whether the safe status has been reached for the SBC safety function. It is set if the following two conditions are fulfilled:
– Switching off of both brake outputs is requested (#SBC-A = #SBC-B = low level)
– The internal diagnostic functions have determined that there is no internal error and both brake outputs are de-energised (switched off).

5.3.3.4 Check of the SBC safety function

Test inputs #SBC-A and #SBC-B separately from each other and together. The diagnostic feedback may only be high level when both inputs #SBC-A and #SBC-B are requested. If the signal behaviour does not correspond to expectations, the system must be transferred into a safe condition within the reaction time. Time monitoring must be planned in the safety relay unit.
Testing of the SBC safety function with feedback over SBA is required at least 1x within 24 h.
• Check SBA feedback dependent on the level SBC-A and SBC-B according to the following table.

#SBC-A (BR+)	#SBC-B (BR-Ext)	SBA
Low level	Low level	High level
Low level	High level	Low level
High level	Low level	Low level
High level	High level	Low level

Tab. 8 Check of all SBC levels

5.3.3.5 Evaluation of SBA

Recommendation: evaluation with every actuation.
• Check SBA feedback at every request.

5.3.3.6 Requirements for the brake

Requirements for the brake➔ textvar object does not exist

5.3.3.7 Brake test

• Check whether a brake test is required. The DGUV information sheet “Gravity-loaded axis” provides information on this.

5.3.4 Safety function SS1

Together with a suitable safety relay unit, the following can be achieved:
– Safe stop with time control Safe stop 1 time controlled; triggering of motor deceleration and, after an application-specific time delay, triggering of the safety function STO
Safety function SS1 ➔ textvar object does not exist

5.3.5 Error exclusion

Plan suitable action to prevent wiring errors:
– Error exclusion in wiring according to EN 61800-5-2.
– Monitoring of the outputs and wiring up to the servo drive by the switching equipment.

5.3.6 Safety relay unit

Use suitable safety relay units with the following characteristics:
– 2-channel outputs with
  – cross-circuit detection
  – required output current (also for STO)
  – low test impulses up to a maximum length of 1 ms
– Evaluation of the diagnostic outputs of the servo drive
Safety relay units with high test impulses can be used with the following restrictions:
– Test impulses up to 1 ms in length
– Test impulses are not simultaneous/overlapping on #STO-A/B and #SBC-A/B
– The resulting safety-related classification depends on the evaluation of diagnostic feedbacks STA, SBA ➔ 15.1 Technical data, safety equipment, safety data STO and SBC.

6 Transport and storage

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

7 Assembly

7.1 Dimensions

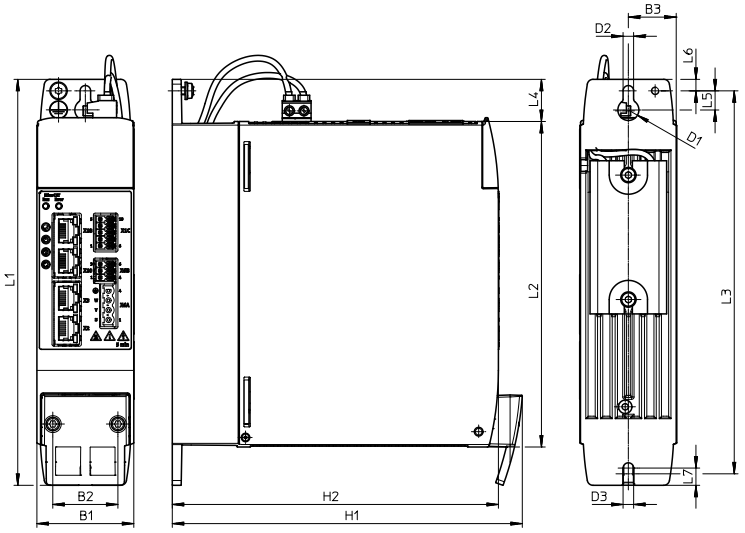


Fig. 5

Dimension	L1	L2	L3	L4	L5	L6	L7
[mm]	Approx. 212	170	200	22	10	6	9

Tab. 9 Dimensions part 1

Dimension	H1	H2	B1	B2	B3	D1	D2	D3
[mm]	Approx. 183	170	Approx. 50	34	Approx. 25	R5.5	5.5	5.5

Tab. 10 Dimensions part 2

7.2 Mounting distances CMMT-AS-...-3A (1-phase)

The servo drives of the series CMMT-AS can be arrayed next to each other. When arraying devices, the required minimum distance must be maintained, so that the heat arising in operation can be removed through sufficient air flow.

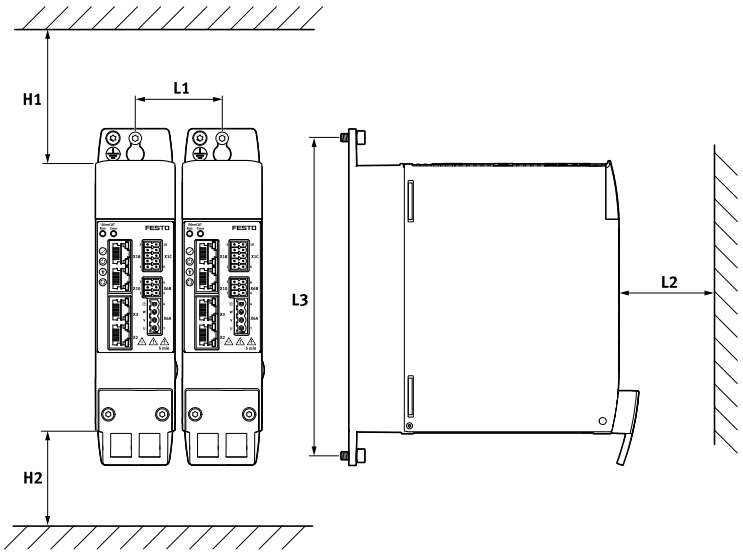


Fig. 6

Servo drive		H1	H2[1)]	L1	L2	L3
CMMT-AS-C2-3A-...	[mm]	70	70	52	70	200
CMMT-AS-C4-3A-...	[mm]					

1) An installation clearance of 150 mm underneath the device is recommended for optimum wiring of the motor or sensor cable!

Tab. 11 Mounting distances and installation clearance

The required minimum lateral distance from neighbouring CMMT-AS devices is thus 2 mm (52 mm – 50 mm).
For adjacent third-party devices, Festo recommends a distance of at least 10 mm (surface temperature of third-party device max. 40 °C). The double counterplug for cross wiring of the connection [X9A] projects approx. 6 ... 7 mm over the right side of the device. But this is not an obstacle for arraying additional CMMT-AS.

7.3 Installation

7.3.1 Assembly instructions

- Use a control cabinet with at least degree of protection IP54.
- Always install device vertically in the control cabinet (mains supply lines [X9A] point upwards).
- Screw device flat to a sufficiently stable mounting surface so that a good heat transfer from the cooling element to the mounting surface is ensured (e.g. to the rear wall of the control cabinet).
- Maintain minimum distances and installation clearance to ensure sufficient air flow. The surrounding air in the control cabinet must be able to flow through the device without hindrance.
- Take into account the required clearance for the wiring (connecting cables of the device are guided in from above and from the front).
- Do not mount any temperature-sensitive components near the device. The device can become very hot in operation (switch-off temperature of the temperature monitoring ➔ Technical data).
- When assembling several devices in a device compound, consider general rules for cross-wiring. For intermediate circuit coupling, devices with greater power use must be placed closer to the mains supply.

For assembling to the rear panel of the control cabinet, the cooling element of the servo drive has a slot on top in the shape of a keyhole and on the bottom in the shape of a simple slot.

Assembly of the servo drive

⚠ WARNING!

Danger of burns through hot escaping gases and hot surfaces.
In case of error, incorrect wiring or incorrect polarity of the connections [X9A], [X9B] and [X6A], internal components can be overloaded. High temperatures can develop and hot gases can be released.

- Have an authorised electrician perform the installation according to the documentation.

⚠ WARNING!

Danger of burns from hot housing surfaces.
Metallic housing parts can accept high temperatures in operation. In particular, the braking resistor installed in the profile on the back side can become very hot. 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 off to room temperature.

- Fasten the servo drive to the rear wall of the control cabinet with suitable screws while complying with the assembly instructions.

8 Installation

8.1 Safety

⚠ WARNING!

Risk of injury from electric shock.
Contact with conducting parts at the power connections [X6A], [X9A] and [X9B] can result in severe injuries or death.

- Do not pull power supply connectors when powered.
- Before touching, wait at least 5 minutes until the intermediate circuit has discharged.

⚠ WARNING!

Risk of injury from electric shock.
The leakage current of the device to earth (PE) is > 3.5 mA AC or 10 mA DC.
Touching the device if there is a fault can result in serious injuries or death.
Before commissioning, also for brief measuring and test purposes:

- Connect PE connection to the mains side at the following positions:
  - Protective conductor connection (earthing screw) of the housing
  - Pin PE of the connection [X9A] (power supply)
    The cross section of the protective conductor must equal at least the cross section of the outer conductor L [X9A].
- Connect motor cable to the connection [X6A] and the shield of the motor cable on the front side to PE via the shield clamp of the servo drive.
- Connect all additional PE protective conductors of the connections used.
- Observe the regulations of EN 60204-1 for the protective earthing.

⚠ WARNING!

Danger of burns through hot escaping gases and hot surfaces.
In case of error, incorrect wiring or incorrect polarity of the connections [X9A], [X9B] and [X6A], internal components can be overloaded. High temperatures can develop and hot gases can be released.

- Have an authorised electrician perform the installation according to the documentation.

⚠ WARNING!

Risk of injury from electric shock in case of incomplete insulation at the power connections [X6A], [X9A] and [X9B].
Before operating, plugging in or unplugging the display and operating unit CDSB or a connector from a hot-plug-capable interface, the following points must be fulfilled:

- The conducting lines at the device are completely insulated.
- The protective earth (PE) and the shield connection are correctly connected to the device.
- The housing is free of damage.

8.1.1 Information for operation with safety functions

NOTICE!

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

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

- Fulfil all named requirements, e.g.:
  - surrounding area (EMC)
  - logic and load voltage supply
  - counterplug
  - connecting cables
  - Cross wiring
- For additional information ➔ textvar object does not exist.
- The maximum permissible cable length between the safety relay unit and the connector of the I/O interface is 3 m.
- During installation, fulfil the requirements of the EN 60204-1. In case of error, the voltage must not be greater than 60 V DC. The safety relay unit must switch off its outputs in case of error.
- Carry out wiring between the safety relay unit and the I/O interface of the servo drive so that both a short circuit between the conductors or to 24 V as well as a cross circuit are excluded ➔ EN 61800-5-2, Table D.3.1. Otherwise, the safety relay unit must plan for a cross circuit detection and, in case of error, switch off the control signals in 2 channels.
- Use only suitable counter plugs and connection cables ➔ textvar object does not exist.
- Avoid conductive pollution between neighbouring plug pins.
- Make sure that no bridges or the like can be inserted parallel to the safety wiring. For example, use the maximum wire cross section of mm or appropriate wire end sleeves with plastic collars.
- To cross wire safety-relevant inputs and outputs, use twin cable end sleeves. In case of cross wiring by inputs and outputs, a maximum of 10 devices may be cross-wired ➔ textvar object does not exist.
- The safety relay unit and its inputs and outputs must meet the required safety classification of the respectively required safety function.
- Connect each of the control inputs in 2 channels with parallel wiring directly to the safety relay unit.
- Use only permitted motor cables for the connection BR+/BR– .

– If the diagnostic output of the used safety functions has to be evaluated: Connect diagnostic output directly to the safety relay unit. The evaluation of the diagnostic output is required or optional, dependent on the desired safety classification.
– If a cross wiring of diagnostic outputs is performed for a device compound: Wire diagnostic outputs as a ring. Guide the two ends of the ring to the safety relay unit and monitor for discrepancy.

8.2 Residual current device

⚠ WARNING!

Risk of injury from electric shock.
This product can cause a DC current in the residual-current conductor in case of error. In cases where a residual current device (RCD) or a residual current monitor (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.

Information on the residual current protective device ➔ textvar object does not exist.
The touch current in the protective earth connector can exceed an alternating current of 3.5 mA or a DC current of 10 mA. The minimum cross-section of the protective earth connector must comply with the local safety regulations for protective earth connectors for equipment with high leakage current.

8.3 Mains fuse

The CMMT-AS has no integrated fuse at the mains input or in the intermediate circuit. An external fuse at the mains supply of the device is required. Festo recommends the use of a line safety switch (circuit breaker). A device compound coupled in the intermediate circuit must be protected through a common line safety switch. Different requirements for line safety switches are specified for the UL approval and the CE approval.
- Use only line safety switches with corresponding approval and the specifications and fuse protections named in the following.

Line safety switch (circuit breaker)		
Requirement		Specification
Short circuit current rating SCCR	[kA]	Min. 10
I_{PEAK} (peak let through)	[kA]	Max. 7.5
Rated voltage	[V AC]	Min. 230
Overvoltage category		III
Degree of contamination		2
Characteristic		C

Tab. 12 Requirements for the line safety switch

The line safety switch is used for line protection. The rated current of the line safety switch must be less than or equal to the permissible current carrying capacity of the selected conductor cross section. The line safety switch must also take into account the overload case and must not be triggered (overload case: a maximum of 3-fold input current for 2 s).

Description	**Cable cross section at [X9A]**	**Mains fuse**	
	[mm²]	CMMT-AS-C2-3A-...	CMMT-AS-C4-3A-...
Possible minimum electrical protection	0.75	C6	
Permissible maximum electrical protection[1)]	1.5	In accordance with UL standard: C10	
		In accordance with IEC standard: C13	
	2.5	In accordance with UL standard: C15	
		In accordance with IEC standard: C16	

1) Data apply for an individual device and for the device compound

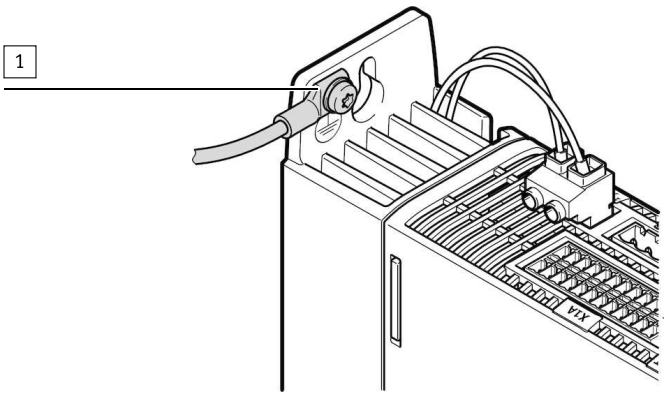
Tab. 13 Mains fuse

8.4 Permissible and impermissible electrical network types

Information on allowed and prohibited electrical network types and necessary measures during use in IT networks ➔ textvar object does not exist.

8.5 Connection of the mains side PE protective conductor

All PE protective conductors must always be connected prior to commissioning for safety reasons. Observe the regulations of EN 60204-1 when conducting protective earthing.
Always connect PE connection on the mains side (PE rail in the control cabinet) at the following positions:
– Pin PE of the connection [X9A]
– PE connection (earthing screw) next to the upper slot of the cooling element
The cross section of the protective conductor must equal at least the cross section of the outer conductor L [X9A]. For individually wired devices, carry out wiring in a star shape. For cross-wired devices, observe the requirements for cross wiring.
Recommendation: Use copper earth strap (advantageous for EMC).
1. Equip protective conductors for the earthing screw with a suitable cable lug.
2. Tighten earthing screw with a TORX® screwdriver of size T20 (tightening torque 1.8 Nm ± 15 %).



1 PE connection (earthing screw)

Fig. 7

8.6 Information on EMC-compliant installation

A mains filter is integrated into the device. The mains filter fulfils the following tasks:
– Guarantee of the immunity to interference of the device
– Limitation of the line-bound emitted interference of the device
If installed correctly and if all connecting cables are wired correctly, the device fulfils the specifications of the related product standard EN 61800-3.

The category that the device fulfils is dependent on the filter measures used and the motor line length. The integrated mains filter is designed so that the device fulfils the following categories:

Order code	**Category**	**PWM frequency [kHz]**	**Max. permissible length of the motor cable [m]**
CMMT-AS-C2-3A CMMT-AS-C4-3A	C2[1)]	8	15
		16	5[2)]
	C3	8	25
		16	25

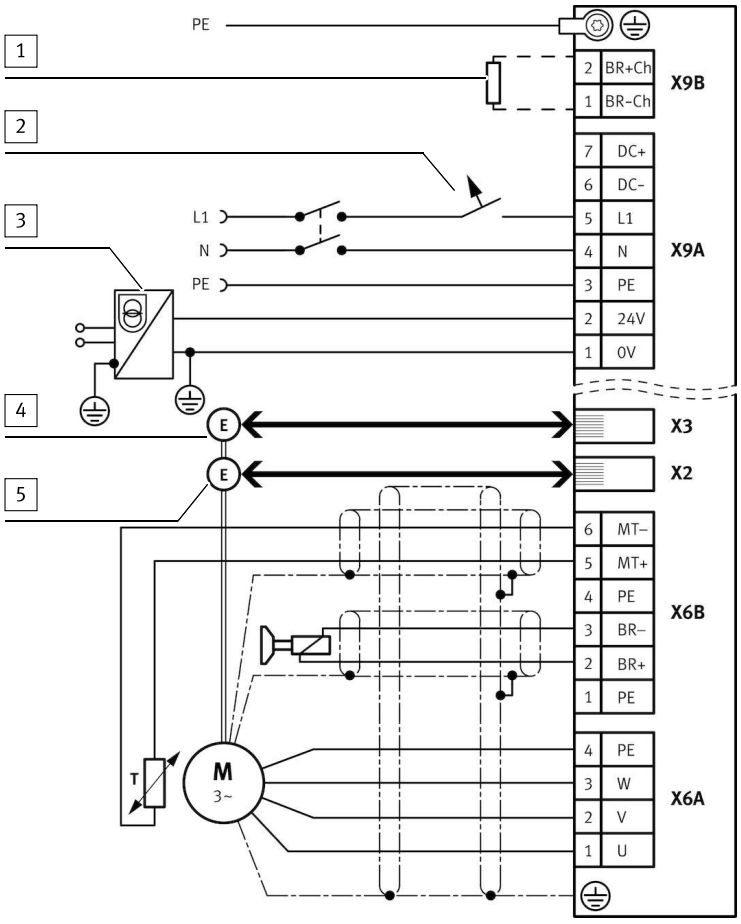
1) To comply with the line harmonics in accordance with EN 61000-3-2, installation of line inductors in the mains supply lines L1 and N (each L ≥5 mH) is required.
2) To comply with the malfunction limit values of the category C2 at 16 kHz cycle frequency, installation of a snap ferrite (Würth, art. no. 74272722 or compatible) on the motor phases U, V, W (without PE) is required. Perform flying leads 1x.

Tab. 14 Category dependent on the PWM frequency and the cable length

This product can generate high frequency malfunctions, which may make it necessary to implement interference suppression measures in residential areas.
For additional information on EMC-appropriate installation ➔ textvar object does not exist.

8.7 Connection examples

8.7.1 Connection plan, 1-phase mains connection



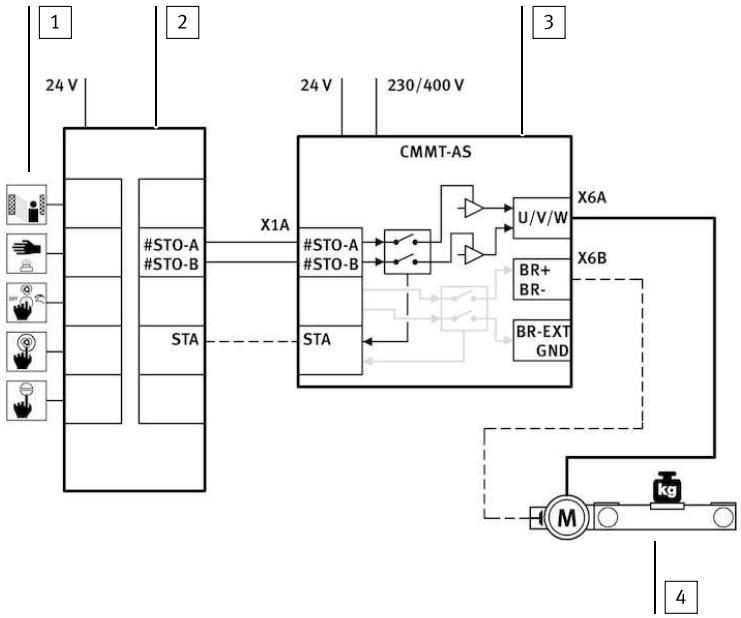
1 Braking resistor
2 Line safety switch
3 PELV power supply unit for 24 V supply
4 Sensor 2 (optional)
5 Sensor 1

Fig. 8

Measures for 2-phase mains connection ➔ textvar object does not exist

8.7.2 STO connection example

The STO safety function (safe torque off) is triggered by an input device that makes the safety request (e.g. light curtain).



1 Input device for safety request (e.g. light curtain)
2 Safety relay unit
3 Servo drive CMMT-AS
4 Drive axle

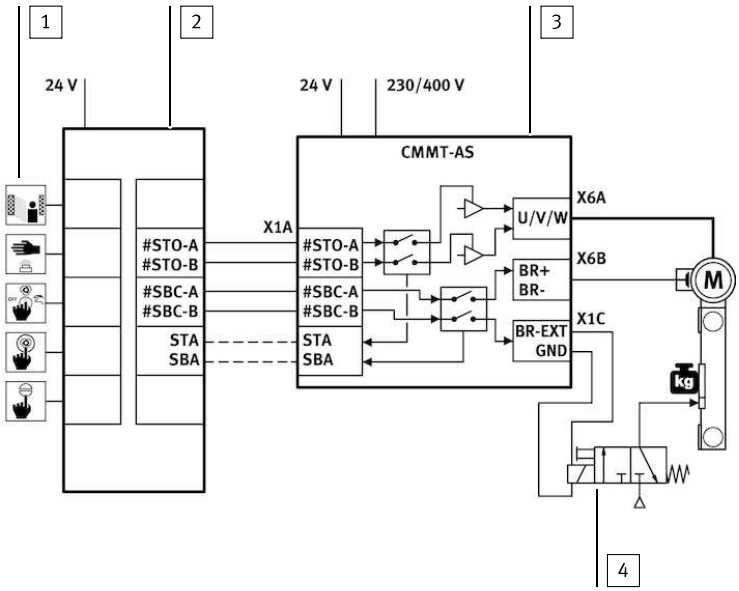
Fig. 9

Information on the sample circuit

The safety request is passed on through 2 channels over the inputs #STO-A and #STO-B at the connection [X1A] to the servo drive. This safety request results in the 2-channel switch-off of the driver supply of the power output stage of the servo drive. Through the STA diagnostic output, the safety relay unit can monitor whether the safe status has been reached for the STO safety functions.

8.7.3 SBC connection example

The SBC safety function (safe brake control) is triggered by an input device that makes the safety request.



1 Input device for safety request (e.g. light curtain)
2 Safety relay unit
3 Servo drive CMMT-AS
4 Control (here solenoid valve example) of the clamping unit

Fig. 10

Information on the sample circuit

The safety request is passed on through 2 channels over the inputs #SBC-A and #SBC-B at the connection [X1A] to the servo drive.

- The request over the input #SBC-A switches off power to the signals BR+ and BR- at the connection [X6B]. Through this, the holding brake is de-energised and closes.
- The request over the input #SBC-B switches off power to the signal BR-EXT at the connection [X1C]. This shuts off power to the control of the external clamping unit. The clamping unit closes.
- The safety relay unit monitors the SBA diagnostic output and checks whether the safe status has been reached for the SBC safety functions.

8.8 Interfaces

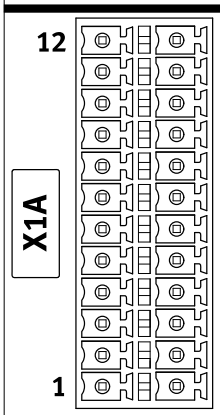
Observe requirements for counterplug ➔ textvar object does not exist.

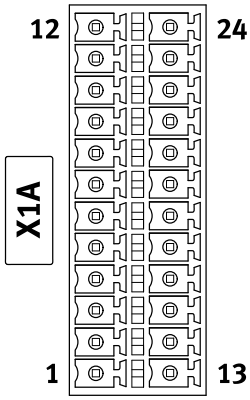
8.8.1 [X1A], Inputs and outputs for the higher-order PLC

The I/O interface [X1A] is located on the top of the device. This interface offers access to functional and safety-relevant inputs and outputs of the device. These include, for example:

- Digital inputs for 24 V level (PNP logic)
- Digital outputs for 24 V level (PNP logic)
- Signal contact for safety chain (RDY-C1, RDY-C2)
- Differential analogue input ±10 V control voltage

The inputs and outputs of this I/O interface are used for coupling with a higher-order PLC. The safety-relevant inputs and outputs are connected to a safety relay unit.

[X1A]	Pin	Function	Description
	24	RDY-C1	Normally open contact: ready for operation message (Ready)
	23	RDY-C2	
	22	STA	Diagnostic output Safe torque off acknowledge
	21	SBA	Diagnostic output Safe brake control acknowledge
	20	–	Reserved, do not connect
	19	–	
	18	SIN4	Release brake request
	17	GND	Reference potential
	16	TRG0	Fast output for triggering external components, channel 0
	15	TRG1	Like TRG0, but channel 1
	14	CAP0	Fast input for position detection, channel 0
	13	CAP1	Like CAP0, but channel 1

[X1A]	Pin	Function	Description
	12	#STO-A	Control input Safe torque off, channel A
	11	#STO-B	Control input Safe torque off, channel B
	10	#SBC-A	Control input Safe brake control, channel A
	9	#SBC-B	Control input Safe brake control, channel B
	8	–	Reserved, do not connect
	7		
	6		
	5		
	4	ERR-RST	Error acknowledgment
	3	CTRL-EN	Output stage enable
	2	AIN0	Analogue input differential
	1	#AIN0	

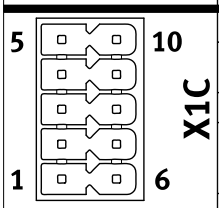
Tab. 15 Inputs and outputs for the higher-order PLC

Requirements for the connecting cable	Individual device	Device compound
Shielding	Unshielded	
Min. conductor cross section incl. cable end sleeve with plastic sleeve	0.25 mm²	–
Max. conductor cross section incl. cable end sleeve with plastic sleeve	0.75 mm²	–
Min. conductor cross section incl. double cable end sleeve with plastic sleeve	–	0.25 mm²
Max. conductor cross section incl. double cable end sleeve with plastic sleeve	–	0.5 mm²
Max. length	3 m	0.5 m

Tab. 16 Requirements for the connecting cable

8.8.2 [X1C], Inputs and outputs to the axle

The I/O interface [X1C] is located on the front side of the device. This interface makes available functional and safety-relevant inputs and outputs for components on the axle. The output BR-EXT is used in connection with the safety function Safe brake control ➔ textvar object does not exist.

[X1C]	Pin	Function	Description
	10	GND	Reference potential
	9	24 V	Power supply output for sensors
	8	GND	Reference potential
	7	LIM1	Digital input for limit switches 1 (PNP logic, 24 V DC)
	6	LIM0	Digital input for limit switches 0 (PNP logic, 24 V DC)
	5	GND	Reference potential
	4	24 V	Power supply output for sensors
	3	–	Reserved, do not connect
	2	REF-A	Digital input for reference switches (PNP logic, 24 V DC)
	1	BR-EXT	Output for connection of an external clamping unit (high side switch, low test impulses at #SBC-B are transferred to BR-EXT)

Tab. 17 Inputs and outputs to the axle

Requirements for the cable	
Shielding	Unshielded/shielded[1)]
Min. conductor cross section including cable end sleeve with plastic sleeve	0.25 mm²
Max. conductor cross section including cable end sleeve with plastic sleeve	0.75 mm²
Max. length	50 m

1) Use a shielded cable outside the control cabinet for safety-related applications. Otherwise, a shield is not absolutely required, but is recommended.

Tab. 18 Requirements for the cable

8.8.2.1 Requirements for the shield support

Put on shield

1. Place shield of the device-side cable on the shield clamp for the motor cable.
2. Place shield of the machine-side cable onto an earthed machine part.

8.8.3 [X2], Sensor interface 1

The sensor interface [X2] is located on the front side of the device. The sensor interface [X2] primarily serves to connect the position sensor integrated into the motor.

Supported standards/protocols	Supported sensors
Hiperface	SEK/SEL 37 SKS/SKM 36
EnDat 2.2	ECI 1118/EBI 1135 ECI 1119/EQI 1131 ECN 1113/EQN 1125 ECN 1123/EQN 1135
EnDat 2.1	Only in connection with motors of the series EMMS-AS from Festo that have an integrated sensor with EnDat 2.1 protocol
Digital incremental sensor with square wave signals and with RS422-compatible signal output (differential A, B, N signals)	ROD 426 or compatible
Analogue SIN/COS incremental sensor with differential analogue signals with 1 V_{ss}	HEIDENHAIN LS 187/LS 487 (20 µm signal period) or compatible
Position sensor with asynchronous two-wire communication interface (RS485)	Nikon MAR-M50A or compatible (18 bit data frames)

Tab. 19 Supported standards and protocols of the sensor interface [X2]

NOTICE!

Damage to the sensor when sensor type is changed.
The servo drive can provide 5 V or 10 V sensor supply. Through configuration of the sensor, the supply voltage is established for the sensor. The sensor can be damaged if the configuration is not adjusted before connection of another sensor type.

- When changing the sensor type: Comply with specified steps.

Change of the sensor type

1. Disconnect sensor from the device.
2. Set up and configure new sensor type in the CMMT-AS.
3. Save setting in the CMMT-AS.
4. Switch off CMMT-AS.
5. Connect new sensor type.
6. Switch CMMT-AS back on.

Requirements for the connecting cable	
Characteristics	– Sensor cable for servo drives, shielded – Optical shield cover › 85 % – Signal pairs separately twisted – Recommended design: (4 x (2 x 0.25 mm²))[1)]
Max. cable length	50 m

1) For sensors with no compensation for voltage drops, thicker supply lines may be required.

Tab. 20 Requirements for the connecting cable

8.8.3.1 Requirements for the shield support

Put on sensor cable shield

1. Place the sensor cable shield on the device side onto the plug housing.
2. Place the sensor cable shield on the motor side onto the sensor or sensor plug.

8.8.4 [X3], Sensor interface 2

The sensor interface [X3] is located on the front side of the device. The sensor interface [X3] primarily serves to connect a second position sensor to the axle (e.g. as redundant measuring system of a safety function).

Supported standards/protocols	Supported sensors
Digital incremental sensor with square wave signals and with RS422-compatible signal output (differential A, B, N signals)	ROD 426 or compatible ELGO LMIX 22
Analogue SIN/COS incremental sensor with differential analogue signals with 1 V_{ss}	HEIDENHAIN LS 187/LS 487 (20 µm signal period) or compatible

Tab. 21 Supported standards and protocols of the sensor interface [X3]

[X3] is designed to be electrically compatible with [X2], but does not support all sensors and functions like [X2].

8.8.5 [X10], SYNC IN/OUT

The interface [X10] is located on the front side of the device. The interface [X10] permits master-slave coupling. In the master-slave coupling, the axles of several devices (slave axles) are synchronised over a device (master axle). The function of the SYNC interface can be configured and is used as follows:

Possible functions	Description
Incremental sensor output	Output of a master axle that emulates encoder signals (encoder emulation)
Incremental encoder input	Input of a slave axle, through which the conductance values of a master axle are received
Pulse direction input	Input of a slave axle, through which the pulse direction signals or count signals with upward/downward count impulses are received

Tab. 22 Possible functions of the connection [X10]

Requirements for the connecting cable	
Characteristics	– Sensor cable for servo drives, shielded – Optical shield cover > 85 % – Signal pairs separately twisted – Recommended design: (4 x (2 x 0.25 mm²))
Max. cable length	3 m

Tab. 23 Requirements for the connecting cable

Requirements for the shield support
Place both sides of the connecting cable shield onto the plug housings.

8.8.5.1 Possible connections

Connection possibilities	Description
Direct connection of 2 devices	Two devices can be connected directly with a patch cable (point-to-point connection). Recommendation: Use patch cable of category Cat 5E; maximum length: 25 cm
Connection of several devices over RJ45 T adapter and patch cables	A maximum of 16 devices may be connected. Recommendation: Use T adapter and patch cables of category Cat 5E; maximum length per cable: 25 cm
Connection of several devices over patch cables and a connector box (accessories ➔ www.festo.com/catalogue)	A maximum of 16 devices may be connected. Recommendation: Use patch cables of category Cat 5E, maximum length per cable: 100 cm

Tab. 24 Connection possibilities

8.8.6 [X18], standard Ethernet

The interface [X18] is located on the front side of the device. Through the interface [X18], the following can be performed with the commissioning software:
– Diagnostics
– Parameterisation
– Control
– Firmware update

The interface is designed to conform to the standard IEEE 802.3. The interface is galvanically separated and intended for use with limited cable lengths ➔ Tab. 25 Requirements for the connecting cable. Deviating from the IEEE 802.3, the isolation coordination is therefore done according to the valid product standard IEC 61800-5-1.

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

Tab. 25 Requirements for the connecting cable

Through the Ethernet interface, the following connections are possible:

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. 26 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 your network. This method is suitable for networks in which a DHCP server already exists.
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. 27 Options for IP configuration

8.8.7 [X19], Real-time Ethernet (RTE) port 1 and port 2

The interface [X19] is located on the top of the device. The interface [X19] permits RTE communication. The following protocols are supported by the interface [X19], depending on the product design:

Product variant	Supported protocol
CMMT-AS-...-EC	EtherCAT
CMMT-AS-...-EP	EtherNet/IP
CMMT-AS-...-PN	PROFINET

Tab. 28 Supported protocol

The physical level of the interface also fulfils the requirements according to IEEE 802.3. The interface is galvanically separated and intended for use with limited cable lengths ➔ Tab. 29 Requirements for the connecting cable.
The interface [X19] makes 2 ports available.
– Port 1, labelled on the device with [X19, XF1 IN]
– Port 2, labelled on the device with [X19, XF2 OUT]

Two LEDs are integrated into each of the two RJ45 sockets. The behaviour of the LEDs depends on the bus protocol. Both LEDs are not always used.

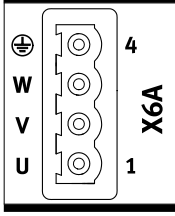
Requirements for the connecting cable	
Characteristics	CAT 5, patch cable, double shielded
Max. cable length	30 m

Tab. 29 Requirements for the connecting cable

8.9 Motor connection

8.9.1 [X6A], Motor phase connection

The connection [X6A] is located on the front side of the device. The following connections to the motor are created through the connection [X6A]:
– Motor phases U, V, W
– PE connection

[X6A]	Pin	Function	Description
	4	PE	Protective earth motor
	3	W	Third motor phase
	2	V	Second motor phase
	1	U	First motor phase

Tab. 30 Motor phase connection

The cable shield of the motor cable is placed on the support surface on the lower part of the housing and fastened with the shield clamp.

Requirements for the connecting cable	
Wires and shielding	At least 8 wires – 4 power wires shielded – 2 x holding brake, separately shielded – 2 x motor temperature, separately shielded
Design	Use only cables for which safe separation is ensured between the motor phases and the shielded signals of the holding brake and motor temperature sensor. ➔ 8.9.3 Shield support of the motor cable
Max. cable length	➔Technical data for the integrated mains filter
Max. capacity	< 250 pF/m
Nominal cross section of power wires	0.75 mm² ... 1.5 mm²
Cable diameter of the stripped cable or shield sleeve (clamping area of the shield clamp)	11 mm ... 15 mm
Only motor cables are permitted that fulfil the requirements of EN 61800-5-2 appendix D.3.1 and the requirements of EN 60204-1.	

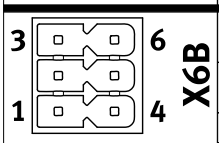
Tab. 31 Requirements for the connecting cable

Festo offers prefabricated motor cables as accessories
➔ www.festo.com/catalogue.
– Use only motor cables that have been approved for operation with the servo drive from Festo. Motor cables of other manufacturers are permitted if they meet the specified requirements.

8.9.2 [X6B], Motor auxiliary connection

The connection [X6B] is located on the front side of the device. The holding brake of the motor and the motor temperature sensor can be connected to the connection [X6B]. The output for the holding brake is used both functionally and in connection with the safety function Safe brake control ➔ textvar object does not exist.
To monitor the motor temperature, the following are supported:
– N/C and N/O contacts
– KTY 81 ... 84 (silicon temperature sensors)
– PTC (PTC resistor, positive temperature coefficient)
– NTC (negative temperature coefficient)
– Pt1000 (platinum measuring resistor)

The servo drive monitors whether the motor temperature violates an upper or lower limit. With switching sensors, only the upper limit value can be monitored (e.g. with a normally closed contact). The limit values and the error reactions can be parameterised.

[X6B]	Pin	Function	Description
	6	MT–	Motor temperature (negative potential)
	5	MT+	Motor temperature (positive potential)
	4	PE	Protective earth
	3	BR–	Holding brake (negative potential)
	2	BR+	Holding brake (positive potential)
	1	PE	Protective earth

Tab. 32 Motor auxiliary connection

Requirements for the connecting cable	
Design	– 2 wires for the line to the holding brake, twisted in pairs, separately shielded – 2 wires for the line to the temperature sensor, twisted in pairs, separately shielded
Min. conductor cross section including cable end sleeve with plastic sleeve	0.25 mm²
Max. conductor cross section including cable end sleeve with plastic sleeve	0.75 mm²
Max. length	50 m

Tab. 33 Requirements for the connecting cable

Requirement for the temperature sensor in the motor

– Electrically safe separation from the motor phases in accordance with IEC 61800-5-1, voltage class C, overvoltage category III.

Requirements for the shield support

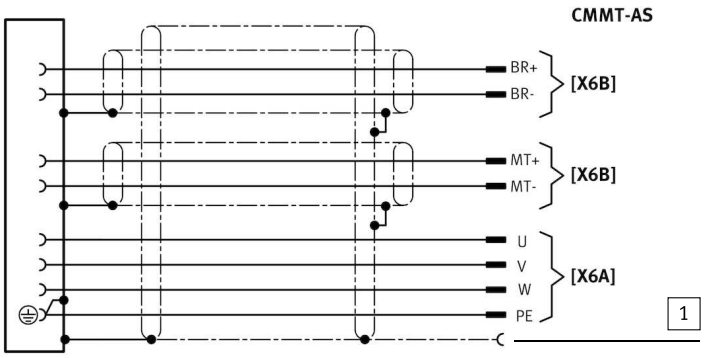
– Make unshielded cable ends as short as possible (max. 150 mm).
– Put in place both sides of the cable shield.

8.9.3 Shield support of the motor cable

8.9.3.1 Requirements for the device-side shield support of the motor cable

The type of shield support depends on the design of the motor cable. If, for example, a hybrid cable is used to connect the motor, holding brake, and temperature sensor, the following options exist for placing the shield on the device side:

Option 1: All motor cable shields are connected over a large surface with a shield sleeve at the cable end and placed below the shield clamp on the front side of the CMMT-AS.



1 Shield sleeve

Fig. 11

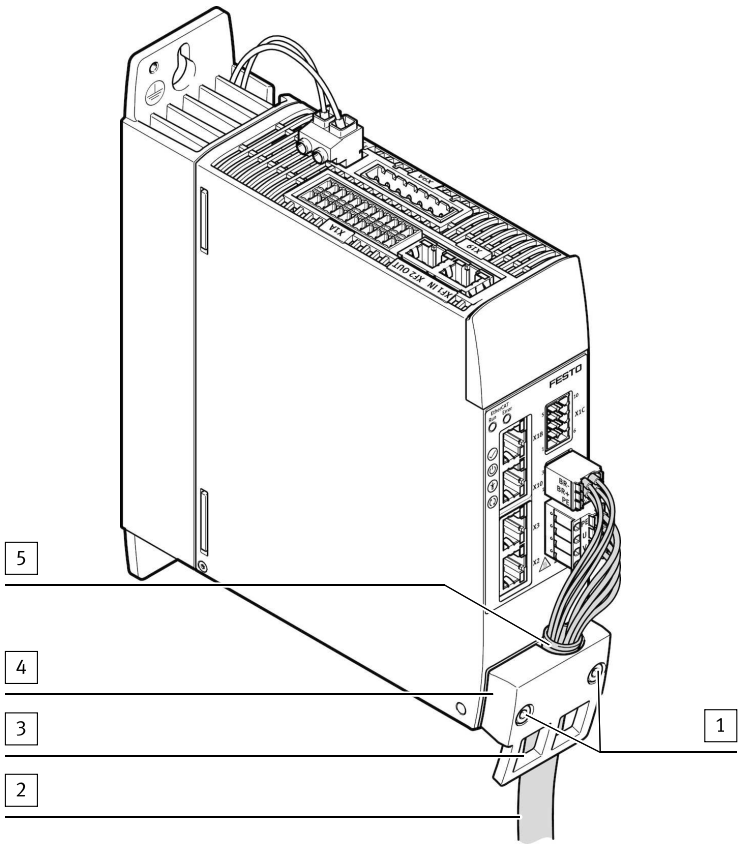
Option 2: The outside shield of the motor cable is placed separately over a large area below the shield clamp on the front of the CMMT-AS. The inside shields are placed separately on the intended PE pin of the connection [X6B].

- Make unshielded cable ends as short as possible.

8.9.3.2 Mounting the shield clamp

The lower area of the front of the housing serves as a shield support surface. The shield support surface, together with the shield clamp, permits large surface support of the motor cable shield.

1. Press the shield of the motor cable or the conducting shield end sleeve of the motor cable with the shield clamp onto the shield support surface of the housing ➔ Fig.12.
2. Tighten retaining screws (2x) of the shield clamp with a hexagon screwdriver of size 3 mm. In doing so, comply with the following tightening torques.
   – Cable diameter 11 mm (shield clamp in place): max. 1.8 Nm ± 15 %
   – Cable diameter › 11 mm (shield clamp not in place): min. 0.5 Nm ± 15 %



1 Retaining screws of the shield clamp
2 Motor cable
3 Cutout for fastening cable binders (2x)
4 Shield clamp
5 Shield of the motor cable is placed over a large area below the shield clamp

Fig. 12

8.9.3.3 Motor-side shield support of the motor cable

Detailed information on the motor-side connection with motor cables from Festo ➔ Assembly instructions of the motor cable used ➔ www.festo.com/sp.

- Connect all shields on the motor side to PE over a large surface, e.g. over the intended shield connection of the motor plug or the shield contact surface in the motor junction box.

8.10 Power and logic voltage supply

8.10.1 [X9A], Power supply and intermediate circuit connection

8.10.1.1 Supply of the control element (logic voltage supply)

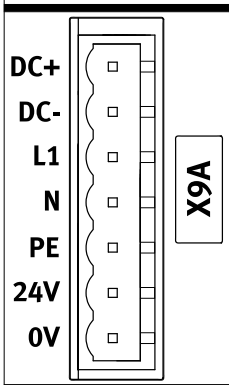
⚠ WARNING!

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only SELV circuits that ensure a reliable separation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

- Connect only PELV circuits with max. 25 A output current. Otherwise, use a separate external fuse: 25 A.

8.10.1.2 Power supply and intermediate circuit connection

[X9A]	Pin	Function	Description
	7	DC+	Intermediate circuit positive potential
	6	DC-	Intermediate circuit negative potential
	5	L1	Mains supply phase L1
	4	N	For 1-phase mains connection: mains supply, neutral conductor For 2-phase mains connection: mains supply phase L2
	3	PE	Protective earth
	2	24 V	Positive potential of the 24 V logic voltage
	1	0 V	Reference potential of the 24 V logic voltage

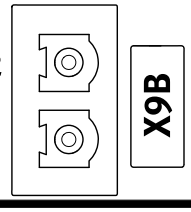
Tab. 34 Power supply and intermediate circuit connection

Requirements for the connecting cable	Individual device	Device compound
Number of wires and shielding	5 wires, unshielded	Without intermediate circuit coupling: 5 wires, unshielded With intermediate circuit coupling: 7 wires, unshielded
Min. conductor cross section including cable end sleeve with plastic sleeve	0.5 mm²	1 mm²
Max. conductor cross section including cable end sleeve with plastic sleeve	2.5 mm²	2.5 mm²
Max. length	2 m	≤ 0.5 m

Tab. 35 Requirements for the connecting cable

8.10.2 [X9B], Connection, braking resistor

The connection [X9B] is located on the top of the device. The internal braking resistor or a suitable external braking resistor is attached to the connection [X9B].

[X9B]	Pin	Function	Description
	2	BR+Ch	Braking resistor positive connection
	1	BR-Ch	Braking resistor negative connection

Tab. 36 Connection for the braking resistor

Requirements for the connecting cable[1)]	
Number of wires and shielding	2 wires, shielded
Min. conductor cross section incl. cable end sleeve with plastic sleeve	0.25 mm²
Max. conductor cross section incl. cable end sleeve with plastic sleeve	2.5 mm²
Max. cable length	2 m
Wiring	Within the control cabinet, shield on PE

1) with connection of an external braking resistor

Tab. 37 Requirements for the connecting cable

Selection of suitable braking resistors

Information for selection of suitable braking resistors ➔ textvar object does not exist

8.11 Cross wiring

Cross wiring permits the design of a device compound, consisting of up to 10 CMMT-AS servo drives. The following cross wiring options are differentiated:

– Cross wiring of I/O signals at the connection [X1A]
– Cross wiring of the mains and logic voltage supply without intermediate circuit coupling
– Cross wiring of the mains and logic voltage supply with intermediate circuit coupling

Information on cross wiring ➔ textvar object does not exist and textvar object does not exist.

8.12 Installation STO

8.12.1 Inputs and outputs for the STO safety functions

The 2-channel request of the safety function is made over the digital inputs #STO-A and #STO-B. The STA diagnostic output displays whether the safe status has been reached for the STO safety functions.

Connection	Pin	Type	Identifier	Function
[X1A]	X1A.11	DIN	#STO-B	Safe torque off, channel B
	X1A.12		#STO-A	Safe torque off, channel A
	X1A.22	DOUT	STA	Safe torque off acknowledge

Tab. 38 Inputs and outputs for the STO safety function

8.13 SBC installation

8.13.1 Inputs and outputs for the SBC safety functions

The 2-channel request of the safety function is made over the digital inputs #SBC-A and #SBC-B at the connection [X1A]. The SBA diagnostic output displays whether the safe status has been reached for the SBC safety functions. The holding brake is connected over the connection [X6B]. The external clamping unit is connected over the connection [X1C].

Connection	Pin	Type	Identifier	Function
[X1A]	X1A.9	DIN	#SBC-B	Safe brake control, channel B
	X1A.10		#SBC-A	Safe brake control, channel A
	X1A.21	DOUT	SBA	Safe torque off acknowledge
[X1C]	X1C.1	DOUT	BR-EXT	Output for connection of an external clamping unit (high side switch)
	X1C.5		GND	Reference potential
[X6B]	X6B.1	–	PE	Protective earth
	X6B.2	OUT	BR+	Holding brake (positive potential)
	X6B.3		BR–	Holding brake (negative potential)

Tab. 39 Inputs and outputs for the SBC safety function

8.14 SS1 installation

8.14.1 Inputs and outputs for the SS1 safety functions

The SS1 safety function is wired like the STO safety function, supplemented by the functional input CTRL-EN for activation of the braking ramp through the safety relay unit.

8.15 Installation for operation without safety function

8.15.1 Minimum wiring for operation without safety function

For operation without safety function, wire inputs X1A.9 to X1A.12 as follows:

Connection	Pin	Type	Identifier	Function
[X1A]	X1A.9	DIN	#SBC-B	Supply each with 24 V
	X1A.10		#SBC-A	
	X1A.11		#STO-B	
	X1A.12		#STO-A	
	X1A.21	DOUT	SBA	Do not connect
	X1A.22		STA	

Tab. 40 Wiring of the inputs and outputs without safety function

9 Commissioning

9.1 Safety

⚠ WARNING!

Risk of injury from electric shock in case of incomplete insulation at the power connections [X6A], [X9A] and [X9B].
Before operating, plugging in or unplugging the display and operating unit CDSB or a connector from a hot-plug-capable interface, the following points must be fulfilled:

- The conducting lines at the device are completely insulated.
- The protective earth (PE) and the shield connection are correctly connected to the device.
- The housing is free of damage.

⚠ 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.

⚠ WARNING!

Risk of injury from electric shock.
Contact with conducting parts at the power connections [X6A], [X9A] and [X9B] can result in severe injuries or death.

- Do not pull power supply connectors when powered.
- Before touching, wait at least 5 minutes until the intermediate circuit has discharged.

NOTICE!

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

9.1.1 Use of safety functions

NOTICE!

The safety functions STO and SBC are already available in the CMMT-AS as delivered, without additional parameterisation. Prior to initial commissioning, at a minimum connect the safety functions STO and SBC.

1. Make sure that the overall safety function of the system is analysed and validated. It is the responsibility of the operator to determine and verify the required safety rating (safety integrity level, performance level and category) of the system.
2. Place CMMT-AS in operation and validate its behaviour in a test run.

Observe measures during integration of the PDS in accordance with standard EN ISO 13849-1 chapter G.4:

– Function check
– Project management
– Documentation
– Performance of a black-box test

NOTICE!

Unauthorised access to the device can cause damage or malfunctions.
When connecting the device to a network, protect the network from unauthorised access.
Measures to protect the network include:

- Firewall
- Intrusion prevention system (IPS)
- Network segmentation
- Virtual LAN (VLAN)
- Virtual private network (VPN)
- Security at physical access level (port security)

Further information ➔ Directives and standards for security in information technology, e.g. IEC 62443, ISO/IEC 27001.

9.2 Preparation for commissioning

For commissioning, the Festo Automation Suite software with installed CMMT-AS plug-in is required ➔ www.festo.com/sp.

Prepare commissioning as follows:

1. Check wiring of the CMMT-AS.
2. Install Festo Automation Suite with CMMT plug-in on the PC.
3. Create project and add CMMT-AS device.
4. Establish connection to the CMMT-AS and set network configuration.

9.3 Commissioning steps

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

1. Perform configuration and parameterisation with the CMMT plug-in (hardware configuration, limit values and parameters).
2. When the safety function is used, check functioning of the safety function ➔ textvar object does not exist.
3. Check signal characteristics of the digital inputs/outputs (e.g. limit/reference switch).
4. Provide required control signals.
5. Check direction of rotation/direction of travel of the electromechanical drive (e.g. in jog operation).
6. Carry out homing.
7. Test positioning behaviour (test mode, ➔ Help for the CMMT plug-in).
8. If necessary, optimise controller setting (optional, ➔ Help for the CMMT plug-in).
9. Perform fieldbus configuration and test control profile (➔ Description for the device profile used).
10. Complete commissioning.

10 Operation

The safety functions are to be checked at adequate intervals for proper functioning. Selecting the type of test and time intervals within the stated time period is the responsibility of the operator. The check is to be conducted such that flawless functioning of the safety device can be verified in interaction with all components.
Time period for cyclical test ➔ 15.1 Technical data, safety equipment.
The CMMT-AS is maintenance-free during its period of use and specified service life. The test interval is different, depending on the safety function:

– STO: No check is specified during the period of use, but STA evaluation is recommended with each request for maximum diagnostic coverage and the highest safety-related classification.
– SBC: Cyclical check required at least every 24 h and STA evaluation with each request; SBC recommended for maximum diagnostic coverage and the highest safety-related classification.

11 Maintenance and care

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

11.1 Cleaning

⚠ WARNING!

Risk of injury from electric shock.
Contact with conducting parts at the power connections [X6A], [X9A] and [X9B] can result in severe injuries or death.

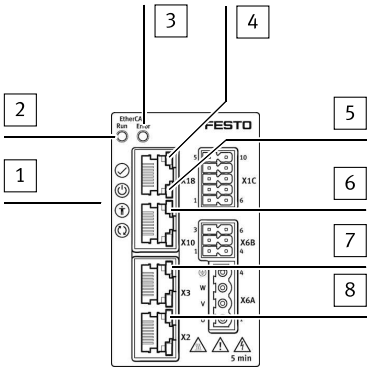
- Do not pull power supply connectors when powered.
- Before touching, wait at least 5 minutes until the intermediate circuit has discharged.

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

12 Malfunctions

12.1 Diagnostics via LED

The device has 12 LEDs for the display of status information. Ten LEDs are located on the front side of the device. Two LEDs are located on the top of the device at the connection [X19], XF1 IN and XF2 OUT.
The following image shows an example of the LEDs on the front side of the product variant CMMT-AS-...-EC. Labelling and function of the LED Run and LED Error depend on the product variant.



1 Device status (4 LED)
2 Run (example CMMT-AS-...-EC)
3 Error (example CMMT-AS-...-EC)
4 Ethernet interface activated [X18]
5 Communication activity [X18]
6 Sync interface activated [X10]
7 Sensor status, sensor interface [X3]
8 Sensor status, sensor interface [X2]

Fig. 13

12.1.1 Device status displays

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

Tab. 41 Device status LEDs (status, power, safety and application status LED)

12.1.1.1 ✓ Status LED, display of the device status

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

Tab. 42 Status LED

12.1.1.2 ⏻ Power LED, status of the power supply

LED	Meaning
Flashes yellow	The logic voltage and AC supply are present. The intermediate circuit is loaded.
Lights up yellow	The logic voltage supply is present, but the AC supply is lacking.
Lights up green	The logic voltage supply is present and the intermediate circuit is loaded.

Tab. 43 Power LED

12.1.1.3 🧍 Safety LED, status of the safety equipment

LED	Meaning
Flashes red	Error in the safety part, or a safety condition is violated.
Flashes yellow	The safety function is requested, but not yet active.
Lights up yellow	The safety function is requested and active.
Flashes green	Output stage, brake outputs and safety diagnostic outputs are blocked (safety parameterisation is running).
Lights up green	Ready, no safety function is requested.

Tab. 44 Safety LED

12.2 Repair

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

1. If there is an internal defect: Always replace the product.
2. Send the defective product unchanged, together with a description of the error and application, back to Festo.
3. Check with your regional Festo contact person to clarify the conditions for the return shipment.

13 Dismounting

Disassemble in reverse order of installation.

Before dismounting

1. Switch off the power supply at the master switch.
2. Protect the system from being switched back on accidentally.
3. Wait at least 5 minutes until the intermediate circuit has discharged.
4. Let the device cool off to room temperature.
5. Before touching the power connections [X6A], [X9A], [X9B], check to ensure they are free of voltage.
6. Disconnect all electrical lines.

To dismount the device

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

14 Disposal

ENVIRONMENT!

Send the packaging and product for environmentally sound recycling in accordance with the current regulations ➔ www.festo.com/sp.

15 Technical data

15.1 Technical data, safety equipment

General safety reference data		
Request rate in accordance with EN 61508		High request rate
Reaction time when requesting the safety function	[ms]	< 10 (applies for STO and SBC)
Error reaction time (correct status of the diagnostic output starting with request of the safety function)	[ms]	< 20 (applies for STA and SBA)

Tab. 45 Safety reference data and safety specifications

Safety reference data of the STO safety function				
Wiring		Without high test impulses, without or with STA evaluation	With high test impulses and with STA evaluation[1]	With high test impulses and without STA evaluation
Safety function in accordance with EN 61800-5-2		Safe torque off (STO)		
Safety integrity level in accordance with EN 61508		SIL 3	SIL 3	SIL 2
SIL pick-up threshold for a partial system in accordance with EN 62061		SIL CL 3	SIL CL 3	SIL CL 2
Category in accordance with EN ISO 13849-1		Cat. 4	Cat. 4	Cat. 3
Performance level in accordance with EN ISO 13849-1		PL e	PL e	PL d
Probability of dangerous failure per hour in accordance with EN 61508, PFH	[1/h]	3.70×10^{-11}	9.40×10^{-11}	5.90×10^{-10}
Mean time to dangerous failure in accordance with EN ISO 13849-1, $MTTF_d$	[a]	2400	1960	1960
Average diagnostic coverage in accordance with EN ISO 13849-1, DC_{AVG}	[%]	97	95	75
Operating life in accordance with EN ISO 13849-1, T_M	[a]	20		
Safe failure fraction SFF in accordance with EN 61508	[%]	99	99	99
Hardware fault tolerance in accordance with EN 61508, HFT		1		
Factor of failures as a result of shared cause for non-recognisable dangerous errors β in accordance with EN 61508	[%]	5		
Classification in accordance with EN 61508		Type A		

1) Check of the STO safety function and monitoring of the STA diagnostic output by the safety controller at least 1 x within 24 h.

Tab. 46 Safety reference data of the STO safety function

Safety reference data of the SBC safety function			
Wiring		Two brakes[1] With SBA evaluation[2]	One brake[3] Without SBA evaluation
Safety function in accordance with EN 61800-5-2		Safe brake control (SBC)	
Safety integrity level in accordance with EN 61508		SIL 3	SIL 1
SIL pick-up threshold for a partial system in accordance with EN 62061		SIL CL 3	SIL CL 1
Category in accordance with EN ISO 13849-1		Cat. 3	Cat. 1
Performance level in accordance with EN ISO 13849-1		PL e	PL c
Probability of dangerous failure per hour in accordance with EN 61508, PFH	[1/h]	3.00×10^{-10}	9.00×10^{-8}
Mean time to dangerous failure in accordance with EN ISO 13849-1, $MTTF_d$	[a]	1400	950
Average diagnostic coverage in accordance with EN ISO 13849-1, DC_{AVG}	[%]	93	–
Operating life in accordance with EN ISO 13849-1, T_M	[a]	20	
Safe failure fraction SFF in accordance with EN 61508	[%]	99	87
Hardware fault tolerance in accordance with EN 61508, HFT		1	0
Factor of failures as a result of shared cause for non-recognisable dangerous errors β in accordance with EN 61508	[%]	5	
Classification in accordance with EN 61508		Type A	

1) Connection of one brake to BR+/BR– and a second brake to BR-EXT; 2-channel wiring and request over #SBC-A and #SBC-B.

2) Monitoring of the safety function over the SBA diagnostic output through the safety controller at least 1 x within 24 h.

3) Connection of a brake either to BR+/BR– or to BR-EXT; 1-channel request over the safety controller through #SBC-A and #SBC-B; both inputs must be bridged externally.

Tab. 47 Safety reference data of the SBC safety function

i

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

15.2 Technical data product conformity and approvals

Product conformity and approvals	
CE marking (declaration of conformity ➔ www.festo.com/sp)	In accordance with EU-EMC Directive[1] In accordance with EU Machinery Directive In accordance with EU Low Voltage Directive

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

Tab. 48 Product conformity and approvals

Safety specifications	
Type test	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.	01/205/5640.00/18

Tab. 49 Safety specifications

15.3 General technical data

General technical data		
Type name code		CMMT
Type of mounting		Screw-clamped to mounting plate
Mounting position		Hanging vertically, with unhindered air flow from bottom to top
Product weight	[kg]	CMMT-AS-C2-3A: 1.3 CMMT-AS-C4-3A: 1.4

Tab. 50 General technical data

Ambient conditions, transport		
Transport temperature	[°C]	–25 … +70
Relative humidity	[%]	5 … 95 (non-condensing)
Max. transportation duration	[d]	30
Permissible altitude	[m]	12000 (above sea level) for 12 h
Vibration resistance		Vibration test and free fall in packaging in accordance with EN 61800-2

Tab. 51 Ambient conditions, transport

Ambient conditions, storage		
Storage temperature	[°C]	–25 … +55
Relative humidity	[%]	5 … 95 (non-condensing)
Permissible altitude	[m]	3000 (above sea level)

Tab. 52 Ambient conditions, storage

Ambient conditions for operation		
Ambient temperature at nominal power	[°C]	0 … +40
Ambient temperature with power reduction (–3 %/°C at 40 °C … 50 °C)	[°C]	0 … +50
Cooling		through surrounding air in the control cabinet
Temperature monitoring		Monitoring of: – Cooling element (power module) – Air in the device Switch off at temperature that is too high or too low
Relative humidity	[%]	5 … 90 (not condensing) No corrosive media permitted near the device
Permissible setup altitude above sea level at nominal power	[m]	0 … 1000
Permissible setup altitude above sea level with power reduction (–10 %/1000 m at 1000 m … 2000 m)	[m]	0 … 2000 Operation above 2000 m is not permitted!
Degree of protection		IP20 (with plugged-in counterplug X9A, otherwise IP10); use in a control cabinet with at least IP54, design as “closed electrical operating area” in accordance with IEC 61800-5-1, Chap.3.5
Protection class		I
Overvoltage category		III
Degree of contamination		2
Vibration resistance in accordance with		IEC 61800-5-1 and EN 61800-2
Shock resistance in accordance with		EN 61800-2

Tab. 53 Ambient conditions for operation

Service life		
Service life of the device with nominal load in S1 operation[1] and 40 °C ambient temperature	[h]	25000
Service life of the device with < 50 % nominal load in S1 operation[1] and 40 °C ambient temperature	[h]	50000

1) continuous operation with constant load

Tab. 54 Service life

15.4 Technical data, electrical

15.4.1 Load and logic voltage supply [X9A]

Electrical data, load voltage supply [X9A]			
CMMT-AS		C2-3A	C4-3A
Number of phases		1	
Voltage range	[V AC]	100 V AC – 20 % … 230 V AC + 15 %	
Nominal voltage	[V AC]	230	
System voltage in accordance with IEC61800-5-1	[V AC]	300	
Mains current consumption[1] at nominal power approx.	[A_{RMS}]	2.8	5.6
Mains frequency	[Hz]	48 … 62	
Network connection/allowed electrical network types		L ➔ N: TT, TN, IT L1 ➔ L2: TT, TN	

Electrical data, load voltage supply [X9A]			
CMMT-AS		C2-3A	C4-3A
Required quality of the mains supply		Corresponds to the requirements of EN 61800-3, if not specified otherwise	
Short circuit current rating (SCCR)	[A]	10000	
Alternative DC supply feed	[V DC]	80 … 360	

1) dependent on the network impedance; if a line inductor is used, somewhat less mains current results

Tab. 55 Load voltage supply

Electrical data, logic voltage supply			
CMMT-AS-		C2-3A	C4-3A
Logic voltage range	[V DC]	24 ± 20 %	
Nominal voltage	[V DC]	24	
Current consumption (without holding brake, CDSB, digital I/Os and auxiliary supply outputs without load)	[A]	0.5	
Current consumption (with holding brake)	[A]	1.3	1.5
Current consumption (with holding brake, with CDSB, digital I/Os and auxiliary supply outputs with load and with fan, if present)	[A]	2.1	2.3
Starting current (with 28.8 V)	[A]	< 20	
Protective functions		– Overvoltage – Polarity reversal – Short circuit to 0 V (24 V outputs)	

Tab. 56 Logic supply

15.4.2 Power specifications, motor connection [X6A]

Internal protective functions detect short circuits between 2 motor phases and short circuits of a motor phase against PE. If a short circuit is detected, the PWM signals are switched off.

Parameters for the power specifications			
CMMT-AS-		C2-3A	C4-3A
Nominal voltage of mains connection	[V_{RMS}]	230	
Ambient temperature (air)	[°C]	≤ 40	
Setup altitude	[m]	≤ 1000	

Tab. 57 Parameters

Power specifications in operation under the named parameters [X6A]					
CMMT-AS-		C2-3A		C4-3A	
PWM frequency	[kHz]	8	16	8	16
Current regulator cycle time	[µs]	62.5			
Nominal output power (S1 operation; cos(phi) > 0.8)	[W]	350	255	700	500
Nominal current (S1 operation)	[A_{RMS}]	2.0	1.5	4	2.5
Max. output power (S2 operation; cos(phi) > 0.8)	[W]	1000	700	2000	1400
Output voltage range	[V_{RMS}]	3 x 0 V … Input			
Output voltage with feeding of nominal voltage and nominal power	[V_{RMS}]	205			
Output frequency	[Hz]	0 … 599			
Maximum current	[A_{RMS}]	6	4.5	12	7.5
Duration for maximum current (f_s > 5 Hz)	[s]	2			
Duration for maximum current at standstill (f_s ≤ 5 Hz); minimum cycle time 1 s!	[s]	0.2			

Tab. 58 Power specifications, motor connection [X6A]

15.5 Additional technical data

Additional technical data on the product and detailed descriptions of all interfaces ➔ textvar object does not exist.