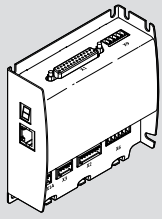


CMMO-ST-C5-1-DIOP/DION

Motor controller



FESTO

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Brief instruction

8178188
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[8178190]



Translation of the original instructions

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1 About this document

1.1 Applicable documents

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

These brief instructions are for initial information only. The full description of the motor controller CMMO-ST-C5-1-DIOP/DION includes the following documents:

Name, type	Contents
Brief instructions CMMO-ST-... ¹⁾	Brief product and functional description of the motor controller for initial information
Manual GDCP-CMMO-ST-EA-SY-...	Equipment and functional description of the motor controller for all product variants <ul style="list-style-type: none">– Mounting– Commissioning via web server/Festo Configuration Tool (FCT)– Communication via I/O interface– Technical data
Help system for the FCT software	Descriptions of the Festo Configuration Tool (FCT) for commissioning and parameterisation of: <ul style="list-style-type: none">– configurable axis/motor combinations– positioning systems in the Festo Optimised Motion Series (OMS)
Manual GDCP-CMMO-ST-EA-S1-...	Use of the STO safety function ("Safe Torque Off")
Parameter lists	List with standard settings of the parameter files for positioning systems in Festo's Optimised Motion Series (OMS)
Special documentation CMMO-ST_SPUL ¹⁾	Requirements for operating the product in the USA and Canada in accordance with certification by Underwriters Laboratories Inc. (UL)

¹⁾ The documentation is enclosed in printed format
Tab. 1: Documentation on the CMMO-ST

1.2 Specified standards

Specified standards

Version	
EN ISO 13849-1:2015-12	EN 62061:2005-04 + AC:2010-02 + A1:2013-02+A2:2015-08
EN 61800-5-2:2017-04	

Tab. 2: Standards specified in the document

2 Safety

- Observe the safety instructions and warnings in the documentation of the motor controller and the documentation of the other components used.
- Before mounting and installation work: switch off the supply voltage. Lock to prevent accidental reactivation. Only switch on the supply voltages again when mounting and installation work is complete.
- Never remove or insert a plug when the power is switched on.
- Observe the handling specifications for electrostatically sensitive devices.
- Do not enable the closed-loop controller until the drive has been professionally installed and fully parameterised.
- Do not perform any repairs on the motor controller. In the event of a defect: replace the complete motor controller.

⚠ WARNING

Serious injury or damage to components as a result of collisions.

- Make sure that there are no objects in the motion path while the system is connected to a source of electric power.
- Make sure that nobody is in or able to reach into the operating area of the connected actuators.
- Secure the danger zone with suitable protective measures, e.g. guards and warnings.

⚠ CAUTION

Personal injury and material damage

Falling loads in the event of a power failure or when the power supply is switched off when the drive is installed in an inclined or vertical position.

- Secure loads by external safety measures (e.g. toothed latches or moveable bolts).

⚠ CAUTION

High temperatures on the housing surfaces.

Touching the surface may cause a person to be startled and to react in an uncontrolled manner, causing subsequent secondary damage.

- Protect the product to prevent accidental touching.
- Before touching the product, e.g. for mounting or installation: allow the motor controller to cool down to room temperature.

2.1 Intended use of the CMMO-ST

The motor controller CMMO-ST is intended for controlling the following drives with Festo 2-phase stepper motors:

- Positioning systems in the Optimised Motion Series (OMS) with Festo axis/motor units.

– Configured drives (rotary/linear):

- Festo axes, e.g. EGC, DNCE, DGE
- User-defined axes

- Observe the specified standards as well as the regulations of the trade associations, the German Technical Control Board (TÜV), the VDE regulations or the relevant national regulations.
- Observe the limit values for all additional components (e.g. sensors, actuators).

Use the CMMO-ST only as follows

- in perfect technical condition
 - in its original condition, without unauthorised modifications
 - within the limits of the product defined by the technical data
 - within the specified service life of the switching elements for the safety function
 - as an installed device in a control cabinet
- Use outside the control cabinet is possible if all of the plugs are connected and all unused interfaces are sealed with protective caps.

2.2 Intended use of the STO function

The STO function ("Safe Torque Off") in accordance with EN 61800-5-2 is intended to shut off the torque of a motor connected to the CMMO-ST. The STO function prevents an unexpected start-up of the connected motor. The STO function should only be used for applications for which the stated safety characteristics are sufficient.

Safety characteristics

The STO function of the CMMO-ST satisfies the requirements for the following safety characteristics:

- PL e/Cat. 3 in accordance with EN ISO 13849-1
- SIL 3 in accordance with EN 61800-5-2
- SIL CL 3 in accordance with EN 62061

The achievable safety level depends on the other components used to implement a safety function.

To protect against unintended motor start-up, the motor controller must be activated via the connection [X3] with the category required for the application in accordance with EN ISO 13849-1, e.g. via an external safety relay unit.

Qualification of the specialist technicians (requirements for staff)

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

- The installation and operation of electrical control systems.
- The applicable instructions for operating safety engineering systems.
- The applicable regulations for accident prevention and occupational safety.
- The documentation for the product.

Diagnostic coverage (DC) for the safety function

The diagnostic coverage depends on the integration of the motor controller in the control chain as well as the implemented diagnostics measures. If a potentially dangerous malfunction is recognised during diagnostics, appropriate measures must be taken to maintain the safety level.

NOTICE

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

- If required, use a safety relay unit with detection of shorts across contacts.

2.3 Foreseeable misuse of the STO function

The following are examples of foreseeable misuse and are not approved as intended use:

- Bridging of the STO function.
- Use in applications where switching off can result in hazardous movements or conditions.

NOTICE

The STO function is not sufficient as the sole safety function for drives that are subject to permanent torque or force (e.g. suspended loads, vertical axes).

Note

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The STO function does not provide protection against electric shock, only against dangerous movements!

2.4 Requirements for product use

- Provide the complete product documentation to the following personnel:
 - The design engineer and the installer of the machine or system.
 - The personnel responsible for commissioning.
- Keep this documentation safe throughout the entire product lifecycle.
- Ensure compliance with the specifications in this documentation. Also comply with the documentation for the other components and modules (e.g. motor controller, circuits, etc.).
- Observe all of the legal regulations applicable for the installation site and the following documents:
 - Regulations and standards.
 - Regulations of the testing organisations and insurers.
 - National regulations.

For correct and safe use of the STO function:

- Conduct a risk assessment for your machine.
- Comply with the specified safety characteristics → 8 Technical data.

2.5 Product conformity

The motor controller with integrated STO safety function is a safety-related part of the control systems. Certain configurations of the product have been certified by Underwriters Laboratories Inc. (UL).

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. 3: Product conformity

2.6 Transport and storage conditions

- Protect the product during transport and storage from excessive stress factors, such as:
 - Mechanical loads.
 - Temperatures that are too high or too low.
 - Moisture.
 - Aggressive atmospheres.
- Store and transport the product in its original packaging. The original packaging offers sufficient protection from typical stresses.

2.7 Technical prerequisites

For correct and safe use of the product:

- Carry out a risk assessment for your machine or system.
- Comply with the specified safety characteristics → 8 Technical data.
- Comply with the specified connection and ambient conditions for all connected components → 8 Technical data. Only compliance with the limit values and/or load limits will enable operation of the product in accordance with the relevant safety directives.

3 Product description

3.1 Scope of delivery

Component	Number
Motor controller CMMO-ST	1
Documentation for the product: <ul style="list-style-type: none"> - Brief instructions for the CMMO-ST + quick guide for positioning systems (OMS) - Special documentation corresponding to the certifications of the product 	1
Assortment of plugs NEKM-C-10 with 5 plug connectors for motor, encoder, power supply, reference switch and for switching signals of the STO function	1
H-rail bracket, pre-assembled	1

Tab. 4: Scope of delivery

3.2 Product overview

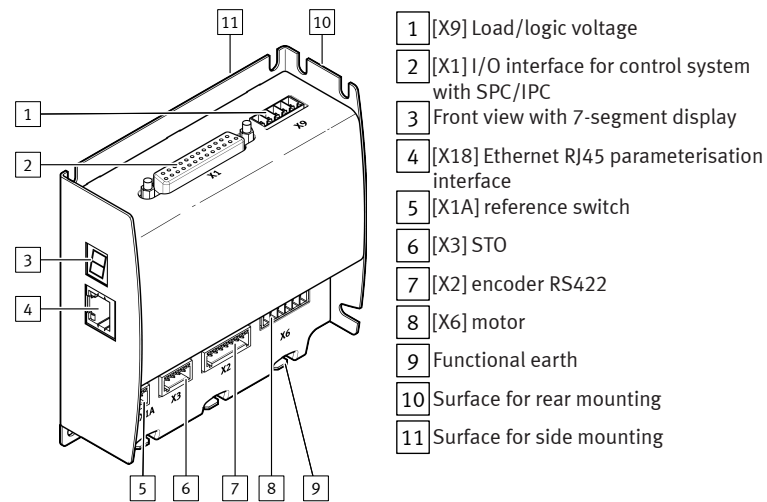


Fig. 1: Components of the CMMO-ST

4 Mounting

CAUTION

Unexpected and unintended movement of the drive during mounting, installation and maintenance work.

- Before starting work: switch off power supplies.
- Lock the power supplies to prevent accidental reactivation.

4.1 Mounting the motor controller

The controller can be mounted with an H-rail or on an even surface.

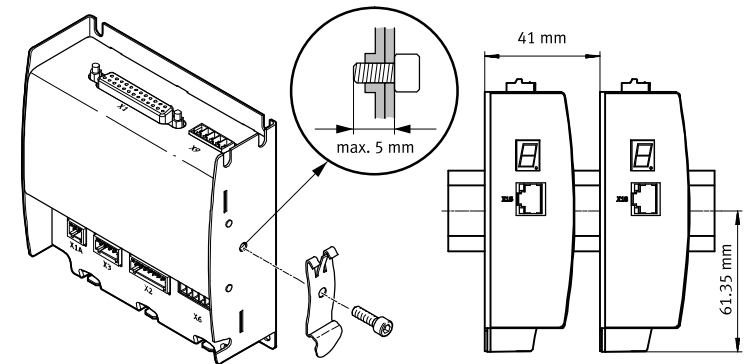


Fig. 2: Mounting on an H-rail

Mount the CMMO-ST on the H-rail as follows:

1. Attach the CMMO-ST to the H-rail from above with the hook of the H-rail clip.
2. Press down on the H-rail until the CMMO-ST clicks into place.

Mount the CMMO-ST on the side or rear mounting surface as follows:

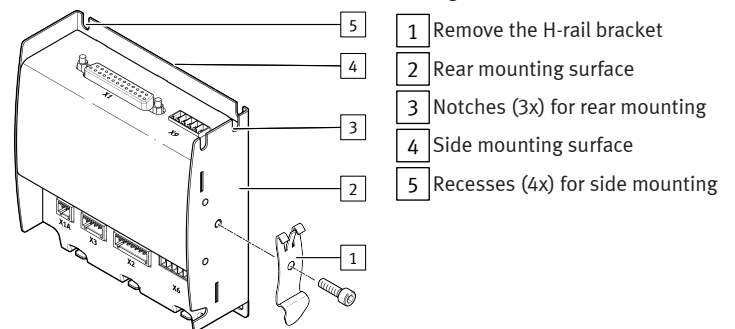


Fig. 3: Mounting on an even surface

5 Electrical installation

CAUTION

Unexpected and unintended movement of the drive during mounting, installation and maintenance work.

- Before starting work: switch off power supplies. Cancelling the enable signal on the controller is not sufficient.
- Lock the power supplies to prevent accidental reactivation.

5.1 Connections and cables

CAUTION

Unexpected and unintended movement of the drive as a result of incorrectly assembled cables.

- Use only the supplied plugs and preferably the cables listed in the specified accessories → www.festo.com/catalogue.
- Lay all flexible cables so that they are free of kinks and mechanical stress, if necessary in a carrier chain. Observe the instructions for the axis and the additional components.

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Damage may be caused to the device or to other system parts at unassigned plugs as a result of ESD (electrostatic discharge).

- Comply with the handling specifications for electrostatically sensitive components.
- Seal unassigned plugs with protective caps.
- Earth system parts prior to installation.
- Use appropriate ESD equipment (e.g. shoes, earthing straps etc.).

The plugs used for connecting the motor controller are included in the scope of delivery (assortment of plugs NEKM-C-10).

Additional accessories:

Control cable to the higher-level controller (I/O interface)

- Control cable: NEBC-S1G25-K-3.2-N-LE25
- 25-pin Sub-D plug: NEFC-S1G25-C2W25-S6

Connecting the I/O interface via a connection block

- Connection block: S1G25-C2W25-S7
- Cable CMMO-ST/connection block: NEBC-S1G25-K-...-N-S1G25

Motor and encoder cables

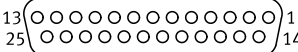
NEBM corresponding to the drive configuration in various plug types and lengths → www.festo.com/catalogue.

5.2 [X1] I/O interface

Communication with the higher-order controller (PLC/IPC) is via the I/O interface. The switching logic of the inputs and outputs is dependent on the interface variant of the controller:

- CMMO-ST-...-DIOP: positive logic PNP
- CMMO-ST-...-DION: negative logic NPN

Connection [X1]


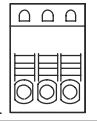


Pin	1	2	...	11	12	13	...	22	23	24	25
Function	Input (I)				Output (O)				–	LOGIC OUT ¹⁾	GND
	01	02	...	11	01	02	...	11	–	+ 24 V	0 V

1) Not overload-proof! Max. 100 mA permissible.

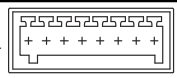
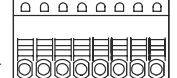
Tab. 5: I/O interface connection [X1]

5.3 [X1A] reference switch

Connection [X1A]	Pin	Function
	1	+ 24 V LOGIC OUT Power supply for the reference switch. Not overload-proof! Max. 100 mA permissible.
	2	SIGNAL REF CMMO-ST-...-DIOP: – Input for PNP switch – switches at + 24 V – NO/NC version CMMO-ST-...-DION: – Input for NPN switch – switches to GND – NO/NC version
	3	GND Reference potential (ground)

Tab. 6: Connection [X1A] reference switch with plug

5.4 [X2] Encoder

Connection [X2]	Pin	Function
	1	A ¹⁾ Incremental encoder signal A+
	2	A/ ¹⁾ Incremental encoder signal A–
	3	B ¹⁾ Incremental encoder signal B+
	4	B/ ¹⁾ Incremental encoder signal B–
	5	N ¹⁾ Incremental encoder signal zero pulse N+
	6	N/ ¹⁾ Incremental encoder signal zero pulse N–
	7	5 V ± 10% Supply of the encoder. Not overload-proof! Max. 100 mA permissible.
	8	0 V Reference potential

1) each 5 V and Ri = approx. 120 Ω

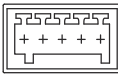
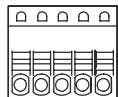
Tab. 7: Connection [X2] encoder with plug

5.5 [X3] STO

The STO safety function ("Safe Torque Off") is described in the document GDCP-CMMO-ST-STO-... in detail. The STO function should only be used in the manner described in this document.


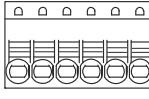
Recommendation for initial motor start-up without safety engineering:

- Minimum circuitry with emergency stop switching device.
- Two-channel switch-off via control inputs STO1 [X3.2] and STO2 [X3.3].

Connection [X3]	Pin	Function
	1	+ 24 V LOGIC OUT Logic voltage output [X9] Not overload-proof! Max. 100 mA permissible.
X3	2	STO1 Control input for STO function: channel 1
	3	STO2 Control input for STO function: channel 2
	4	DIAG1 The acknowledgment contact is closed (low impedance) when the STO function is active.
	5	DIAG2

Tab. 8: Connection [X3] STO with plug

5.6 [X6] motor

Connection [X6]	Pin	Function
	1	String A
	2	String A/
	3	String B
	4	String B/
	5	BR+
	6	BR–
	Connection of the holding brake Short-circuit and overload-protected. 24 V, max. 1.4 A → 33 W. BR– = GND; BR+ is switched (24 V load)	

Tab. 9: Connection [X6] motor with plug

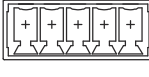
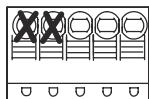
5.7 [X9] Power supply

WARNING

Electric shock.

Injury to people, damage to the machine and system.

- Use only PELV circuits in accordance with IEC 60204-1 (protective extra-low voltage (PELV)) for the electrical power supply.
- Also observe the general requirements for PELV circuits IEC 60204-1.
- Use only voltage sources that guarantee reliable electrical isolation of the operating and load voltage in accordance with IEC 60204-1.

Connection [X9]	Pin	Function
	1	Do not connect!
	2	Do not connect!
	3	Supply of the control electronics (logic supply)
X9	4	Reference potential (0 V) for load voltage, logic voltage, STO and controller interface
	5	Supply of the power output stage and the motor (load voltage)

Tab. 10: Connection [X9] with plug


5.8 [X18] Ethernet interface

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.

Connection [X18]	Pin	Function
	1	TD+
	2	TD–
	3	RD+
	4	–
	5	–
	6	RD–
	7	–
	8	–

Tab. 11: Ethernet interface connection [X18]

6 Commissioning

- Connect the CMMO-ST directly to the computer/notebook via an Ethernet cable (point-to-point connection).
- Simplified commissioning for positioning systems (OMS) via integrated web server with English-language parameterisation and diagnostics website (<http://192.168.178.1>)
- Complete commissioning of configured motor/axis combinations with FCT (Festo Configuration Tool).

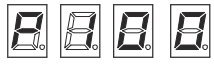


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The complete commissioning process for the motor controller is described in the GDCP-CMMO-ST-EA-SY... manual and in the Online Help for the FCT software CMMO-ST plug-in.

7 Diagnostics

7-segment display

The 7-segment display on the CMMO-ST provides information about the current operating mode, errors and warnings.

Example	Meaning
	Four characters are always displayed in succession, followed by a space. The numbers of diagnostic messages in the Error or Warning categories are coded in hexadecimal .
	During a firmware update, the display alternates between vertical and horizontal segments.
	The wave function enables a motor controller to be identified within a network that has multiple motor controllers. The point flashes in the display of the selected motor controller; the motor controller "waves".

Tab. 12: 7-segment display

Display	Operating mode/event	Priority
BLE	Bootloader error	1 Error during firmware update. – Switch the device off and back on again (reset). – Restart the firmware download process. If the error occurs repeatedly, contact your local Festo service.
Exxx ¹⁾	Errors	2 Error messages interrupt messages with a lower priority and must be acknowledged.
Axxx ¹⁾	Warning	3 Warnings have a lower priority than errors and are not displayed if they occur when an error is already displayed. Otherwise, they are displayed twice in succession. Warnings do not have to be confirmed (acknowledged).
HHHH	STO – safe torque off	4 The STO function has been requested.
P000	Referencing	5 Normal operation
P070	Positive jogging	
P071	Negative jogging	
P1xx ²⁾	Positioning mode	
P2xx ²⁾	High-power mode	
P3xx ²⁾	Velocity mode	

1) xxx = fault number, hexadecimal

2) xx = record number, decimal

Tab. 13: Messages on the 7-segment display

8 Technical data

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.	01/205/5252.02/20
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, Approved Body for Machinery, No. 2571
Certificate no.	01/205U/5252.00/22

Tab. 14: Approval information, safety engineering

Safety reference data and safety specifications		
Safety function	STO	Safe torque off (safe torque off)
Category	3	In accordance with EN ISO 13849-1
Performance Level	PL e	In accordance with EN ISO 13849-1
Safety Integrity Level	SIL 3	In accordance with EN 61800-5-2 (Safety Integrity Level)
SIL Claim Limit	SIL CL 3	in accordance with EN 62061 (SIL Claim Limit)

Safety reference data and safety specifications

DC _{avg}	[%]	90	Average Diagnostic Coverage (average diagnostic coverage)
MTTF _d	[years]	4500	Mean Time To dangerous Failure (mean time until a dangerous failure)
HFT		1	Hardware Failure Tolerance (hardware fault tolerance)
PFH	[1/h]	1.3 × 10 ⁻¹⁰	Probability of dangerous Failure per Hour (probability of dangerous failure per hour)
T Proof Test Interval	[years]	20	Test interval
T duration of use	[years]	20	In accordance with EN ISO 13849-1
Component/function	Suitable for use in category-1 systems and above in accordance with EN ISO 13849-1		

Tab. 15: Safety reference data and safety specifications

General technical data

Certificates, declaration of conformity	→ www.festo.com/sp The component is intended for operation in the industrial sector.		
Power supply	[V DC]	24 ± 15%	
Protection against electric shock	PELV circuit (Protected Extra-Low Voltage)		
Current load voltage (X9.5)	[A]	5.7	Nominal current
	[A]	8	Peak current
Current logic supply (X9.3)	[A]	0.3	Nominal current (without supply of the outputs) supply of the outputs of the I/O interface: per output max. 0.1 A; i.e. up to 1.1 A.
Max. total current consumption	[A]	9.4	Depending on the system configuration
Max. cable length	[m]	30	
Degree of protection	IP40 (with full pin allocation)		
Protective functions	<ul style="list-style-type: none"> – I²t monitoring – Power unit temperature monitoring – Current monitoring – Voltage failure detection – Undervoltage monitoring – Following error monitoring – Software end-position detection 		
Additional approvals	UL/RCM mark		
Type of mounting	<ul style="list-style-type: none"> – H-rail – Mounting plate 		
Fault message	7-segment display		
Parameterisation interface	Ethernet interface		
Parameterisation software	<ul style="list-style-type: none"> – Festo Configuration Tool (FCT) – Web servers 		
Control interfaces			
Digital I/O	<ul style="list-style-type: none"> – Valve profile: DIN1 ... DIN4, DOUT1 ... DOUT2 – Binary profile: DIN1 ... DIN11, DOUT1 ... DOUT11 		
Optional: Ethernet	– Control via Ethernet (CvE)		

Tab. 16: General technical data