1 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. Secure against accidental reactivation. Only switch on the supply voltage again when mounting and installation work is complete.
- Never remove or insert a plug connector when the motor controller is powered.
- Observe the handling specifications for electrostatically sensitive devices.
- Only enable the controller if 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 positioning range while the system is connected to a source of electric power.
- Make sure that nobody is in, or is able to reach into, the operating area of the connected actuators.
- Secure the danger zone through suitable safeguarding measures, e.g. guards and warnings.

Caution

Personal injury and material damage.
- Falling loads in the event of a voltage failure or disconnection of the power supply when installing the drive in an inclined or vertical position.
- Secure loads through external safety measures (e.g. toothed latches or movable bolts).

Caution

High temperatures on the housing surfaces.
- Touching the surface may cause a person to be startled and react in an uncontrolled manner, with subsequent damages.
- Protect the motor controller to prevent accidental touching.
- Inform operating and maintenance staff about any potential hazards.
- Before touching the product, e.g. for mounting or installation: Allow the motor controller to cool down to room temperature.

1.1 Intended use of the CMMO-ST

The intended use of the CMMO-ST is to control the following drives with 2-phase step motors from Festo:
- Positioning systems in the Optimised Motion Series (OMS) with axis/motor units from Festo
- Configured drives (rotary/linear):
  - Axes from Festo 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 through 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 this control cabinet is possible provided that all plug connectors are connected or are sealed with protective caps.

1.2 Intended use of the STO function

The STO function (“Safe Torque Off”) according to EN 61800-5-2 is intended to disconnect the torque from a motor that is connected to the CMMO-ST. The STO function prevents an unexpected start-up of the connected motor.

Use the STO function only should be used for applications in which the specified safety characteristics suffice.

Safety characteristics

The STO function of the CMMO-ST fulfills the requirements for the following safety characteristics:
- PL e/Cat. 3 according to EN ISO 13849-1
- SIL 3 according to EN 61508-5-2
- SIL CL 3 according to EN 62061

The achievable safety level depends on the other components used to implement the 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 according to EN ISO 13849-1, e.g. via an external safety switching device.

Qualification of specialists (personnel requirements)

The product may only be placed in operation by a qualified electrotechnician who is familiar with:
- Installation and operation of electrical control systems
- The applicable regulations for safety-engineered systems
- The applicable regulations for accident prevention and occupational safety
- The documentation for the product

Diagnostic coverage (DC) for the safety function

Diagnostic coverage depends on the interconnection of the motor controller with the control loop system as well as the implemented diagnostics measures.

If a potentially dangerous malfunction is recognised during the diagnostics, appropriate measures must be taken to maintain the safety level.

Note

The motor controller cannot detect a cross circuit in the input circuit by itself.
- If required, use a safety switching device with cross-circuit detection.
1.3 Possible misuse of the STO function
The following possibilities are among those not approved as intended use:
- Bridging of the STO function
- Use in applications where switching off can result in hazardous movements or conditions.

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

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

2 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 the documentation safe throughout the entire product lifecycle.
- Ensure compliance with the specifications in this documentation. Also comply with the supplementary documentation for the other components and modules (e.g. motor controller, circuits, etc.).
- Take into consideration all of the legal regulations that are applicable for the installation site, as well as the following documents:
  - Regulations and standards
  - Regulations of the testing organisations and insurers
  - National specifications
- Comply with the specified connection and operating conditions for all of the connected components (Chapter 7, Technical data).

2.1 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.

2.2 Technical prerequisites
- Conduct a risk assessment for your machine or system.
- Comply with the specified safety characteristics (Chapter 7, Technical data).

2.3 Scope of delivery

<table>
<thead>
<tr>
<th>Number</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor controller CMMO-ST-C5-1-LKP</td>
</tr>
<tr>
<td>1</td>
<td>Documentation for the product</td>
</tr>
<tr>
<td></td>
<td>– Brief documentation on the CMMO-ST + Quickguide for positioning systems (OMS)</td>
</tr>
<tr>
<td></td>
<td>– Special documentation in accordance with product approvals</td>
</tr>
<tr>
<td></td>
<td>– CD-ROM with further documentation</td>
</tr>
<tr>
<td>1</td>
<td>Connector range NEKM-C-14 with 6 connectors for control interface [X1], reference switch [X1A], safety function STO [X3], encoder [X2], motor [X6], power supply [X9]</td>
</tr>
<tr>
<td>1</td>
<td>H-rail clip (pre-assembled)</td>
</tr>
</tbody>
</table>

Fig. 3 Scope of delivery

3 Product overview

<table>
<thead>
<tr>
<th>Number</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[X1] Load/logic voltage</td>
</tr>
<tr>
<td>2</td>
<td>[X1] Control interface to open look control with PLC/IPC:</td>
</tr>
<tr>
<td></td>
<td>– IO-Link/I-Port</td>
</tr>
<tr>
<td></td>
<td>– optional: digital inputs/outputs</td>
</tr>
<tr>
<td>3</td>
<td>7-segment display</td>
</tr>
<tr>
<td>4</td>
<td>[X18] Ethernet (RJ-45)</td>
</tr>
<tr>
<td></td>
<td>– Parameterisation interface TCP/IP</td>
</tr>
<tr>
<td></td>
<td>– Modbus TCP control interface</td>
</tr>
<tr>
<td>5</td>
<td>Link/activity LED C/Q</td>
</tr>
<tr>
<td></td>
<td>– LED green: Communication OK</td>
</tr>
<tr>
<td></td>
<td>– LED red: Communication error</td>
</tr>
<tr>
<td></td>
<td>– LED off: IO link/I-Port is not configured as a control interface.</td>
</tr>
<tr>
<td>6</td>
<td>[X1A] Reference switch</td>
</tr>
<tr>
<td>7</td>
<td>[X3] STO (Safe torque off)</td>
</tr>
<tr>
<td>8</td>
<td>[X2] Encoder (RS422)</td>
</tr>
<tr>
<td>9</td>
<td>[X6] Motor</td>
</tr>
<tr>
<td>10</td>
<td>FE function earth (3x)</td>
</tr>
<tr>
<td>11</td>
<td>Mounting surface (H-rail)</td>
</tr>
<tr>
<td>12</td>
<td>Mounting surface</td>
</tr>
</tbody>
</table>

Fig. 4 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.
- Secure the power supplies against accidental reactivation.

4.1 Mounting the motor controller
Mounting on an H-rail
1. Hang the CMMO-ST over the hook of the H-rail clip and into the H-rail from above.
2. Press the lower part of the CMMO-ST onto the H-rail until it clicks into place.

Fig. 5 Mounting on an H-rail

Mounting on an even surface
1. Remove the H-rail clip
2. Reverse side mounting surface
3. Notches (x3) for reverse side mounting
4. Side mounting surface
5. Recesses (x4) for side mounting

Fig. 6 Mounting on a side or reverse side mounting surface
5 Electrical installation

5.1 Connections and cables

- 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.
- Secure the power supplies against accidental reactivation.

5.2 [X1] IO-Link/I-port control interface and digital inputs/outputs

Note

The IO-Link/ I-Port interface is not electrically isolated. Under certain circumstances, the CMMO-ST can override the electrical isolation of an IO-Link master.

5.3 [X1A] Reference switch

- Unexpected and unintended movement of the drive as a result of incorrectly assembled cables.
- Only use the plug connectors provided 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 drag chain. Observe the instructions for the axis and the additional components.

5.4 [X2] Encoder

5.5 [X3] STO

- For the setup, an emergency stop switching device must be used.
- Two-channel switch-off via control ports STO1 ([X3.2]) and STO2 ([X3.3]).

5.6 [X6] Motor

5.7 [X9] Power supply

Warning

- Injury to people, damage to the machine and system.
- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Also observe the general requirements for PELV circuits IEC 60204-1.
- Use only voltage sources which guarantee reliable electrical isolation of the operating and load voltage in accordance with IEC 60204-1.

5 Electrical installation

5.1 Connections and cables

Caution

- Only use the plug connectors provided 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 drag chain. Observe the instructions for the axis and the additional components.

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Note

The IO-Link/ I-Port interface is not electrically isolated. Under certain circumstances, the CMMO-ST can override the electrical isolation of an IO-Link master.

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- Lay all flexible cables so that they are free of kinks and mechanical stress; if necessary in a drag chain. Observe the instructions for the axis and the additional components.

5.4 [X2] Encoder

5.5 [X3] STO

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

- Two-channel switch-off via control ports STO1 ([X3.2]) and STO2 ([X3.3]).

5.6 [X6] Motor

5.7 [X9] Power supply

Warning

- Injury to people, damage to the machine and system.
- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Also observe the general requirements for PELV circuits IEC 60204-1.
- Use only voltage sources which guarantee reliable electrical isolation of the operating and load voltage in accordance with IEC 60204-1.
Unauthorised access to the device can cause damage or malfunctions. When connecting the device to a network:

- Protect the network from unauthorised access.

Measures for protecting the network include:
- Firewall
- Intrusion Prevention System (IPS)
- Network segmentation
- Virtual LAN (VLAN)
- Virtual Private Network (VPN)
- Safety at physical access level (Port Security).

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

### Connection

<table>
<thead>
<tr>
<th>X18</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1D+</td>
<td>Transmitted data +</td>
</tr>
<tr>
<td>2</td>
<td>1D−</td>
<td>Transmitted data −</td>
</tr>
<tr>
<td>3</td>
<td>RD+</td>
<td>Received data +</td>
</tr>
<tr>
<td>4</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>5</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>6</td>
<td>RD−</td>
<td>Received data −</td>
</tr>
<tr>
<td>7</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>8</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

![Fig. 13 Ethernet interface connection [X18]](image1)

### Commissioning

To commission the CMMO-ST (DHCP server) with Ethernet cable via parameterisation interface directly with the computer/notebook (DHCP client) (point-to-point connection), 2 variants for commissioning:

- Simplified commissioning of positioning systems (OMS) via integrated webserver with English-language parameterisation and diagnostics website (http://192.168.178.1)
- Complete commissioning of positioning systems and of configured drives with FCT (Festo Configuration Tool)

The complete commissioning process for the motor controller is described in the manual GDCP-CMMO-ST-LK-C-HP-... and in the Online Help for the CMMO-ST plug-in of the FCT software.

The process control of the motor unit is performed by the control interface with device profile DHCP (Festo Handling and Positioning Profile):
- Information about the FHP ➔ Description GDCP-CMMO-ST-LK-C-HP-...
- Function elements (CODESYS, ...) ➔ [www.festo.com/sp](http://www.festo.com/sp)

Prior to integration in the network:

- Do not connect the motor controller to the network as a DHCP server if another DHCP server is already enabled on the network.
- For inclusion in a network, change the IP configuration of the motor controller with FCT or webserver.

### Technical data

#### Safety reference data and safety specifications

<table>
<thead>
<tr>
<th>Safety function</th>
<th>STD</th>
<th>Safe Torque Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>3</td>
<td>according to EN ISO 13849-1</td>
</tr>
<tr>
<td>Performance Level</td>
<td>PL e</td>
<td>according to EN ISO 13849-1</td>
</tr>
<tr>
<td>Safety Integrity Level</td>
<td>SIL 3</td>
<td>according to EN 61508-2</td>
</tr>
<tr>
<td>SIL Claim Limit</td>
<td>SIL CL 3</td>
<td>according to EN 62061</td>
</tr>
<tr>
<td>DCavg [%]</td>
<td>90</td>
<td>Average diagnostic coverage</td>
</tr>
<tr>
<td>MTFL [Years]</td>
<td>4500</td>
<td>Mean Time to dangerous failure</td>
</tr>
<tr>
<td>HFT</td>
<td>1</td>
<td>Hardware Failure Tolerance</td>
</tr>
<tr>
<td>PFH [1/hr]</td>
<td>1.3 x 10⁻⁸</td>
<td>Probability of dangerous failure per hour</td>
</tr>
<tr>
<td>Test interval [Years]</td>
<td>20</td>
<td>Test interval</td>
</tr>
<tr>
<td>Duration of use [years]</td>
<td>20</td>
<td>according to EN ISO 13849-1</td>
</tr>
<tr>
<td>Component/function</td>
<td>Suitable for use in category-1 systems and above according to EN ISO 13849-1</td>
<td></td>
</tr>
</tbody>
</table>

![Fig. 14 Safety reference data and safety specifications](image2)

#### General technical data

| Power supply | [V DC] | 24 ± 15 % |
| Protection against electric shock | PELV circuit (Protected Extra-Low Voltage) |
| Current load voltage (X9.3) [A] | 5.7 | Nominal current |
| Current load voltage (X9.3) [A] | 8 | Peak current |
| Current logic supply (X9.3) [A] | 0.3 | Nominal current (without power supply for outputs) |
| Max. total current consumption [A] | 9.4 | configuration-dependent |
| Fault signal | 7-segment display, LED C/Q |
| Parameterisation interface | Ethernet TCP/IP IEEE802.3 |
| Parameterisation software | – Festo Configuration Tool (FCT) |
| – Web server |
| Approvals | UL/RCM Mark |
| Type of mounting | – Hi-rail |
| – Mounting plate |

1) The component is intended for industrial use.

### 8 Diagnostics

#### 8.1 7-segments display

The 7-segment display on the CMMO-ST provides information about the current operating mode, errors and warnings. 4 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 format.

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 "nods".

![Fig. 15 General technical data](image3)

### General technical data

<table>
<thead>
<tr>
<th>Display</th>
<th>Operating mode</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>B LE</td>
<td>Bootloader error</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exxxx1)</td>
<td>Faults</td>
<td>2</td>
</tr>
<tr>
<td>Axxxx2)</td>
<td>Warning</td>
<td>3</td>
</tr>
<tr>
<td>HHHH</td>
<td>STO – Safe torque off</td>
<td>4</td>
</tr>
<tr>
<td>P000</td>
<td>Homing</td>
<td>5</td>
</tr>
<tr>
<td>P070</td>
<td>Jog positive</td>
<td></td>
</tr>
<tr>
<td>P071</td>
<td>Inch negative</td>
<td></td>
</tr>
<tr>
<td>P2xx1)</td>
<td>Positioning mode</td>
<td></td>
</tr>
<tr>
<td>P2xx2)</td>
<td>High-power mode</td>
<td></td>
</tr>
<tr>
<td>P3xx2)</td>
<td>High-speed mode</td>
<td></td>
</tr>
</tbody>
</table>

1) `xxx` = Fault number, hexadecimal
2) `xx` = Record number, decimal

![Fig. 16 Messages on the 7-segment display](image4)