Controller CECC

Description
Controller CECC
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1 Important information

1.1 Designated use

The controller CECC documented in this manual is exclusively intended for installation in a machine or automated system.

The device is used for:
– controlling pneumatic and electric drives
– interrogating electric sensor signals
– communication via Ethernet.

The CECC must only be used as follows:
– as designated in industrial applications
– in its original condition without unauthorised modifications; only the conversions or modifications described in the documentation supplied with the product are permitted
– in faultless technical condition
– only in combination with released components (e.g. valves, drive/displacement encoder combinations).

• Make sure that all specified limits for temperature, electrical data, etc. are adhered to.
• Observe all local and national laws and regulations.

All notes on designated use, the safety instructions and all further provisions for the CECC also apply to the associated software libraries.

1.1.1 Safety instructions

Protection against dangerous movements

Warning
The connected actuators are subject to high acceleration forces. Uncontrolled movements can cause collisions which can lead to serious injury. Dangerous movements of connected drives can be caused, for example, by:
– untidy or faulty wiring
– errors during component operation
– faults in the transducers and signal generators
– defective or non-EMC-compliant components
– faults in the higher-order control system
– programming errors in user programs and projects.

Switching off load voltage is not a proper inhibit mechanism. Unintentional movement of drives may occur in the event of a malfunction.

• Before carrying out assembly, installation and maintenance work, place the system in a safe state (e.g. by placing the drive in a safe position and deactivating the controller).
• The power supply must be switched off before working in the area of the machine.
• Make sure that nobody enters the positioning range of the drives or other connected actuators.
• The load voltage supply should only be switched on if the system has been installed and parameterised by technically qualified staff.
1.1.2 Target group
This manual is intended exclusively for technicians trained in control and automation technology, who have experience in installing, commissioning, programming and diagnosing positioning systems.

1.1.3 Service
Please contact your local Festo Service partner if you have any technical problems (⇒ http://www.festo.com).

1.2 Important user information

1.2.1 Danger categories
This document contains information on possible dangers that can occur if the product is not used as designated. These danger warnings are marked with a signal word (warning, caution, etc.), placed on a grey background and additionally marked with a pictogram. A distinction is made between the following danger warnings:

- **Warning**
  ... means that serious injury to people and damage to property can occur if this warning is not heeded.

- **Caution**
  ... means that injury to people and damage to property can occur if this warning is not heeded.

- **Note**
  ... means that damage to property can occur if this warning is not heeded.

In addition, the following pictogram marks passages in the text that describe activities involving electrostatic sensitive components.

- **Note**
  Electrostatic sensitive components: inappropriate handling can result in damage to components.

1.3 Marking special information
You can find information on how danger warnings are represented under "Important user information".

1.3.1 Pictograms
The following pictograms mark passages in the text that contain special information:

- **Information**
  Recommendations, tips and references to other sources of information.

- **Accessory**
  Information on necessary or useful accessories for the Festo product.

- **Environment**
  Information on the environmentally friendly use of Festo products.

1.3.2 Text markings
1. Figures denote activities that must be carried out in the order specified.

- Bullets denote activities that may be carried out in any desired order.
- Hyphens denote general listings.
1.3.3 Further conventions

[File] [New Project...] Menu items are framed in square brackets, e.g. you can create a new project using the [New Project...] command in the [File] menu.

"OK" Names of windows, dialogs and buttons such as "Message Window," "Dearchive Project," "OK" as well as designations are shown in inverted commas.

CTRL Names of keys on the PC keyboard are represented in the text with uppercase letters (e.g. ENTER KEY, CTRL, C, F1, etc.).

CTRL+C For some functions you need to press two keys simultaneously. For example, press and hold down the CTRL key and also press the C key. This is written in the text as CTRL+C.

If "click" or "double-click" is mentioned, this always applies to the left-hand mouse button. If the right-hand mouse button is to be used, this will be explicitly mentioned.

1.4 Version information

The manual refers to the following versions:
– Festo controller CECC – firmware version 1.3.4.0 and later
– CODESYS V3 provided by Festo (pbF) software package

The manual contains information on the function of the CECC as well as its assembly, installation and commissioning.

Further information on the device can be found in the following documents:

<table>
<thead>
<tr>
<th>Title</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller CECC</td>
<td>Brief description</td>
<td>Connection and display components, assembly, installation and technical data.</td>
</tr>
<tr>
<td>Festo_CECC_3.library</td>
<td>Online Help</td>
<td>Configuration, use and error diagnosis in function blocks.</td>
</tr>
<tr>
<td>Festo_CECC_IOLink_3.library</td>
<td>Online Help</td>
<td></td>
</tr>
<tr>
<td>Festo_EasyIP_3.library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festo_Motion_3.library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festo_CVE_3.library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festo_CameraControl_3.library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festo_SerialComEx_3.library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festo Field Device Tool</td>
<td>Online Help</td>
<td>Servicing and commissioning of Ethernet-based Festo devices.</td>
</tr>
</tbody>
</table>
2 System overview

2.1 Controller CECC

<table>
<thead>
<tr>
<th>Variant</th>
<th>Features</th>
<th>Codesys target system ID&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| CECC-D  | - CANopen interface  
           - 14 inputs/8 outputs | 16#103D9C43 |
| CECC-LK | As for CECC-D plus:  
           - 4 IO-Link master interfaces  
           - 1 IO-Link device interface | 16#103D9C41 |
| CECC-S  | As for CECC-D plus:  
           - 2 RS232 interfaces  
           - 1 multiple communication interface, either encoder, RS485 or RS422  
           - 1 IO-Link master interface  
           - 1 IO-Link device interface | 16#103D9C42 |

1) Device type code for use in the communication settings (⇒ section "Adding a device").

Table: Variants of the CECC

All variants offer...
- Programming using CODESYS V3 provided by Festo (pbF) in accordance with IEC 61131-3
- Programming, communication and visualisation via Ethernet
- Communication via CANopen
- Controller configuration using CODESYS V3 pbF for commissioning, programming and diagnosing the system
- Process visualisation within CODESYS V3 pbF using a display and operator unit CDPX and the Software Designer Studio (available separately), use of the OPC server for connecting to an OPC client or use of the web visualisation under Codesys

- Use the CODESYS V3 pbF software package to configure the device. The current version of the software package can be found in the download area under www.festo.com/download.

2.2 Festo Service

The following information and data is required for speedy handling of a support inquiry by Festo Service:
- Response to the command "getdevinfo" (⇒ PLC shell)
- CECC project (⇒ menu command in Codesys: File - Project Archive - Save/Send Archive)
- Version of the programming environment (⇒ menu command in Codesys: Help - Information - Display detailed version Information)
- Controller data ⇒ Export of the device properties of the FFT
2.3 Programming software

Use the CODESYS V3 pbF programming software to commission and program the controller CECC. CODESYS V3 pbF offers a user-friendly interface with the following functions:
- Configuration and parameterisation of the CECC using the controller configuration
- Programming in accordance with IEC 61131-3
- Integrated module libraries
- Library Manager for integrating further libraries
- Simulation mode for testing projects on a PC without a PLC
- Integration of a visualisation; configuration using Designer Studio (available separately)
- Documentation using the integrated project documentation function
- Debugging function for testing program sequences, monitoring and changing variables, troubleshooting

2.3.1 Packages

The associated CECC package is required to use the controller CECC (target system) under CODESYS V3 pbF. This package enables the system functions of the target system to be accessed with the help of libraries and contains corresponding information in the form of online Helps. This enables Codesys functions to be used for the target system or, if necessary, restrict it.

CODESYS V3 pbF is supplied with the CECC package for the controller CECC.

2.3.2 Remanent variables

A maximum of 7,120 bytes are available on the CECC for storing remanent variables. They are automatically shared based on the variable declaration within the application.

The following sample combinations for distributing the remanent memory are possible:

<table>
<thead>
<tr>
<th>RETAIN variable</th>
<th>PERSISTENT RETAIN variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,120 bytes</td>
<td>0 bytes (only if there is no PERSISTENT variable list)</td>
</tr>
<tr>
<td>0 bytes</td>
<td>7,076 Byte (44 bytes for identification)</td>
</tr>
<tr>
<td>300 bytes</td>
<td>7,076 - 300 bytes = 6,776 bytes (44 bytes for identification)</td>
</tr>
<tr>
<td>x bytes</td>
<td>7,076 - x bytes (44 bytes for identification)</td>
</tr>
</tbody>
</table>

Note

- Make sure during programming that the total size of all the remanent data does not exceed the maximum available range of 7,120 bytes.
This will avoid errors when transferring an application to the CECC.

2.4 Overview of memory size

<table>
<thead>
<tr>
<th>Memory</th>
<th>CECC-LK</th>
<th>CECC-D</th>
<th>CECC-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global memory and constants (RAM)</td>
<td>16 MB</td>
<td>16 MB</td>
<td>44 MB</td>
</tr>
<tr>
<td>Available flash memory (boot project, project archive, web visualisation, application data)</td>
<td>2 MB</td>
<td>2 MB</td>
<td>16 MB</td>
</tr>
<tr>
<td>Flag memory</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
</tr>
<tr>
<td>Input</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
</tr>
<tr>
<td>Output</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
<td>8,192 bytes</td>
</tr>
</tbody>
</table>
2.5 Libraries

To simplify programming, CODESYS V3 pbF enables usable objects such as
- function blocks
- declarations
- visualisations
to be organised into project-independent libraries.

<table>
<thead>
<tr>
<th>Library</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Festo_CECC_3.library</td>
<td>For controlling and parameterising the CECC.</td>
</tr>
<tr>
<td>Festo_CECC_IOLink_3.library</td>
<td>For controlling and parameterising the IO-Link devices.</td>
</tr>
<tr>
<td>Festo_EasyIP_3.library</td>
<td>For simple networking of controllers via EasyIP.</td>
</tr>
<tr>
<td>Festo_Motion_3.library</td>
<td>For configuring motor controllers from Festo (e.g. CMMP-AS).</td>
</tr>
<tr>
<td>Festo_CVE_3.library</td>
<td>For actuating motor controllers that support the CVE protocol from Festo (e.g. CMMO-ST).</td>
</tr>
<tr>
<td>Festo_CameraControl_3.library</td>
<td>For accessing the Compact Vision System SBO...-Q.</td>
</tr>
<tr>
<td>Festo_SerialComEx_3.library</td>
<td>For configuring the serial interfaces RS232, RS422 and RS485.</td>
</tr>
</tbody>
</table>

Table: Libraries for programming the CECC

A Library Manager that can be used to integrate and view libraries is available for this.

Detailed descriptions of the libraries and how to program them can be found in the respective online Helps.
3 Installation

3.1 General information

Caution
Risk of injury due to electric shock.
- Always switch off the power supply before mounting or removing the CECC.

Caution
The controller CECC contains electrostatically sensitive components.
- Therefore do not touch any contacts.
- Observe the handling specifications for electrostatically sensitive devices.

Note
The controller CECC only supports single-channel switch-off. All inputs and outputs are de-energised when the power supply is switched off.

3.2 Mounting and removal

The controller CECC is suitable for mounting on an H-rail as well as for wall mounting.

Note
- Mount the CECC so that there is sufficient space for heat dissipation and ensure that the maximum limits for temperatures are observed (section "Technical data").

3.2.1 H-rail

Mounting
No other accessories are required for mounting on an H-rail. The CECC can be snapped onto an H-rail (mounting rail to EN 50022) using the integrated mounting clip.

Mounting instructions:
1. Hook the CECC onto the top of the H-rail using the mounting clip [1].
2. Press the device onto the H-rail via the spring-loaded mounting clip [2].
3. The device automatically snaps onto the H-rail.
Removal

Note

- Never remove the CECC from the H-rail while it is still wired.
- Make sure that all cable connections are disconnected before removing the CECC.

Figure: Removal from an H-rail

Removal instructions:

1. Pull the mounting clip 2 on the CECC in the direction of the arrow using a suitable tool (e.g. screwdriver). This releases the device.
2. Tilt the released device away from the H-rail.
3. Remove the device from the H-rail via the mounting clip 1.
3.2.2 Wall mounting

The controller CECC has two holes for wall mounting.

Mounting

Note

Mounting the CECC on uneven, flexible surfaces can result in damage.

- The CECC must only be mounted on flat, torsionally rigid surfaces.

Mounting instructions:

1. Make sure that there is sufficient space for connecting the supply cables.
2. Drill holes into the mounting surface. Note the distances between the mounting holes on the CECC when doing so.
3. Screw the CECC onto the mounting surface.
    - Use screws of appropriate length with Ø M4 and a screw head diameter of max. 7.0 mm.
    - Make sure that the housing is not damaged (tightening torque: 0.8 Nm. +/- 20%).

Removal

1. Remove the mounting screws.
2. Remove the CECC from the mounting surface.
3.3 Connection and display components

1. Functional earth
2. CECC-LK: Provides load voltage supply for IO-Link
   CECC-S: Provides load voltage supply for IO-Link and power supply for encoder
3. CECC-LK: IO-Link communication interface
   CECC-S: ENC, RS232, RS422, RS485 and IO-Link communication interfaces
4. Mounting holes
5. LEDs for communication interfaces
6. CANopen interface
7. LEDs for I/O and LED for power supply to I/O
8. I/O power supply
9. I/O interface
10. Power supply to device
11. LED for power supply to device
12. Ethernet interface
13. USB interface
14. Status LEDs

Figure: Connection and display components

Note
Mixing up connections [2] and [10] can result in the destruction of the device.
- Make sure that the power supply to the device is only inserted at connection aJ.
3.4 Power supply X1

The connection for the power supply to the CECC (24 V) is located on the left on the lower contact strip (X1).

Figure: Power supply to the CECC

This connection also provides the power supply for the following interfaces:
- CANopen ➔ section CANopen
- USB ➔ section USB interface
- Ethernet ➔ section Ethernet interface
- RS232 ➔ section RS232 interfaces
- Multiple interface ➔ section Multiple interface
- IO-Link port class A (no internal fuse protection), ➔ section IO-Link

Note

IO-Link consumers with a current requirement > 200 mA require an additional load voltage supply via connection X11.

The following interface has a separate connection for the power supply:
- I/O interface: X5 (➔ section I/O interface)
3.5 Interfaces

3.5.1 I/O interface X2-X5

The I/O interface of the CECC enables sensors (inductive, capacitive, etc.) or signal generators (counters) to be evaluated and signal receivers to be actuated. All digital inputs and outputs as well as their power supply are connected to the CECC via the contact strip.

The I/O interface of the CECC has:
- 12 digital inputs (PNP, 24 V DC, typ. 3 ms input delay)
- 2 fast digital inputs (for fast counters)
- 8 digital outputs (positive switching, 24 V DC, 0.5 A/module, total current 4 A)

![I/O interface diagram]

1. Fast inputs X2.0 and X2.1
2. Inputs X2.2 to X2.7 (1 kHz)
3. Inputs X3.0 to X3.5 (1 kHz)
4. Outputs X4.0 to X4.7
5. Power supply for I/O interface X5 (24 V)

Figure: I/O interface of the CECC

Connecting the I/O interface

Note

- Using the wrong connections can damage the device.
  - Use connection 5 for the power supply to the E/A interfaces.
- Connect the digital inputs and outputs to sensors and actuators.
  Appropriate contact strips can be found at www.festo.com/catalogue.

Further information on using the I/O interface can be found in the online Help for the Festo CECC_3 library.
3.5.2 CANopen X6

The controller CECC has a CANopen interface with CANopen master functionality for connecting CANopen slaves.

The CANopen interface is designed as a 9-pin Sub-D plug.

<table>
<thead>
<tr>
<th>CAN bus plug</th>
<th>Pin</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>CAN_L 1)</td>
<td>CAN Low</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>CAN_GND</td>
<td>CAN Ground</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CAN_SHLD</td>
<td>Connection to functional earth</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>CAN_GND</td>
<td>CAN Ground (optional)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>CAN_H 1)</td>
<td>CAN High</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

1) If the CECC is at the end of the cable:
   • Connect pin 2 and pin 7 using a terminating resistor (120 ohms/0.25 W).

Table: Pin allocation of the CANopen interface

Connecting CANopen slaves

Note

If installation has not been carried out correctly and if high baud rates are used, data transmission errors may occur as a result of signal reflections and attenuations.

Causes of transmission faults may be:
- No terminating resistor between CAN_L (pin 2) and CAN_H (pin 7) ➔ Table Pin allocation of the CANopen interface
- Incorrect screened connection
- Branches
- Long distances
- Unsuitable cables

• Use a twisted, screened 2-wire cable for the CANopen bus.
• Connect the housing of the CAN bus plug to FE via CAN_SHLD (pin 5).

In the case of a motor controller with external power supply:
• Make sure that CAN_GND (pin 6) on the CECC is not used.

Note

CANopen slaves at the CANopen interface of the CECC are **not** supplied with power.
Connection using a CAN bus plug from Festo

- Use cables with a diameter of 5 ... 8 mm.

A CAN bus plug from Festo is a convenient way of connecting the CECC. You can disconnect the plug from the node without interrupting the bus cable (T-TAP function).

**Note**

The clamp strap in the CAN bus plug from Festo is connected internally only capacitively with the metallic housing of the sub-D plug. This is to prevent equalising currents flowing through the screen of the CAN bus.
- Clamp the screen under the clamp strap of the CAN bus plug (accompanying manual for the CAN bus plug).

Appropriate CAN bus plugs (adapters) from Festo can be found at www.festo.com/catalogue.

Connection using another CAN bus plug

**Notes**

- Observe the polarity of the CANopen interface.
- Connect the screen.

Further information on configuring a connected CANopen slave under CODESYS V3 pbF can be found in the section Configuring a CANopen slave.

### 3.5.3 USB interface X7

The USB interface enables external storage media to be connected using USB plug type A.

Using storage media enables
- data to be loaded onto the device
- data to be backed up.

**Note**

Impermissible operating states of the CECC.
Using a USB hard drive without its own power supply causes high current consumption.
- Use only storage media with current consumption < 0.1 A.

The USB interface is only intended for user-monitored operation. The use of storage media for continuous data recording is not recommended.
3.5.4 Ethernet interface X8

The Ethernet interface enables a PC or operator unit CDPX to be connected to the controller CECC. The Ethernet interface is designed as an RJ45 socket.

<table>
<thead>
<tr>
<th>Socket</th>
<th>Pin</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>TD+</td>
<td>Transmitted data+</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>TD–</td>
<td>Transmitted data–</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>RD+</td>
<td>Received data+</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>RD–</td>
<td>Received data–</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>n.c.</td>
<td>Not connected</td>
</tr>
<tr>
<td>Housing</td>
<td>–</td>
<td>–</td>
<td>Screen</td>
</tr>
</tbody>
</table>

Table: Pin allocation of the Ethernet interface

Connecting the Ethernet interface

- Connect the CECC to your network or directly to the PC via a hub/switch.
- Use a Cat 5/5e/6/7 shielded LAN/Ethernet cable (shielded twisted pair, STP) for this.

Ethernet protocols

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>EasyIP</td>
<td>Communication with controllers via EasyIP (port 995)</td>
</tr>
</tbody>
</table>
| Modbus TCP  | Communication with external controllers (TCP/IP, port 502)
|             | Communication with client/server characteristics possible |
| TCP/IP      | Supported by communication library (e.g. "SysSocket") |
| UDP         | Communication via network variables
|             | Supported by communication library (e.g. "SysSocket") |
3.5.5 RS232 interfaces X12 and X13 (CECC-S)

The controller CECC-S has two RS232 interfaces.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>X12 ... X13.1</td>
<td>G</td>
<td>Data reference potential</td>
</tr>
<tr>
<td>X12 ... X13.2</td>
<td>TX</td>
<td>Transmitted data</td>
</tr>
<tr>
<td>X12 ... X13.3</td>
<td>RX</td>
<td>Received data</td>
</tr>
<tr>
<td>X12 ... X13.4</td>
<td>S</td>
<td>Screen, connection to functional earth</td>
</tr>
</tbody>
</table>

Figure: CECC-S, top manifold rail with RS232 interfaces
3.5.6 Encoder/RS422/RS485 X14 (CECC-S)

The controller CECC-S has a combined interface with the following connection options:
- Encoder (ENC, RS422-based encoders only)
- RS422
- RS485

Note
Simultaneous use of these communication interfaces is not possible.
- Configure and use the signals from one of the three interfaces only.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>ENC</th>
<th>RS422</th>
<th>RS485</th>
</tr>
</thead>
<tbody>
<tr>
<td>X14.1</td>
<td>G</td>
<td>Ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X14.2</td>
<td>A+</td>
<td>Track A+</td>
<td>Transmitted data+</td>
<td>Transmitted/received data+ 1)</td>
</tr>
<tr>
<td>X14.3</td>
<td>A–</td>
<td>Track A–</td>
<td>Transmitted data–</td>
<td>Transmitted/received data– 1)</td>
</tr>
<tr>
<td>X14.4</td>
<td>B+</td>
<td>Track B+</td>
<td>Received data+</td>
<td>n.c.</td>
</tr>
<tr>
<td>X14.5</td>
<td>B–</td>
<td>Track B–</td>
<td>Received data–</td>
<td>n.c.</td>
</tr>
<tr>
<td>X14.6</td>
<td>N+</td>
<td>Zero track N+</td>
<td>n.c.</td>
<td>n.c.</td>
</tr>
<tr>
<td>X14.7</td>
<td>N–</td>
<td>Zero track N–</td>
<td>n.c.</td>
<td>n.c.</td>
</tr>
<tr>
<td>X14.8</td>
<td>S</td>
<td>Screen, connection to functional earth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) If the CECC is the first or last station on the RS485 cable, terminate the RS485 cable with a 120 Ω resistor at pins 14.2 and 14.3.
3.5.7 IO-Link (CECC-LK and CECC-S)
The following variants of the controller CECC have IO-Link connections.

<table>
<thead>
<tr>
<th>Number of IO-Link connections</th>
<th>IO-Link master</th>
<th>IO-Link device</th>
</tr>
</thead>
<tbody>
<tr>
<td>CECC-LK</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>CECC-S</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

One IO-Link device can be connected to each IO-Link master.
The CECC with a higher-order IO-Link master can be connected to the IO-Link device connection.

**Note**
When connecting two devices (CECC-LK or CECC-S) with a separate power supply via IO-Link, high equalising currents can occur and damage the devices.
- Connect the earth cables of the devices connected via IO-Link.
This equalises the ground potential.

**Note**
The maximum residual current for connected IO-Link devices is:
- CECC-LK: max. 10 A for max. 4 IO-Link devices
- CECC-S: max. 3.5 A for max. 1 IO-Link device
The maximum load current at an IO-Link master port (e.g. actuators) is 3.5 A.
- Use external fuse protection if necessary.

**Note**
A digital standard sensor/actuator can also be connected at each IO-Link master instead of an IO-Link device (operating mode SIO).
- Make sure that the power for these sensors/actuators is supplied via L+ in SIO operating mode.

Additional functions such as advanced diagnostics, parameters, alerts are handled via function blocks (Festo CECC_IOLink_3 library).
Further information on configuring connected IO-Link devices under CODESYS V3 pbF can be found in the sections Configuring an IO-Link master and Configuring an IO-Link device.
3.5.8 IO-Link on the CECC-LK

<table>
<thead>
<tr>
<th>IO-Link</th>
<th>Pin</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X11.1</td>
<td>24</td>
<td>Connection for load voltage supply for IO-Link master ports ¹: UA+</td>
</tr>
<tr>
<td></td>
<td>X11.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X11.3</td>
<td>0</td>
<td>Connection for load voltage supply for IO-Link master ports ¹: UA– (GND)</td>
</tr>
<tr>
<td></td>
<td>X11.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2...5</td>
<td>X12...15.1</td>
<td>L+</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td>X12...15.2</td>
<td>C/Q</td>
<td>IO-Link communication signal</td>
</tr>
<tr>
<td></td>
<td>X12...15.3</td>
<td>L–</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td>X12...15.4</td>
<td>24</td>
<td>UA+</td>
</tr>
<tr>
<td></td>
<td>X12...15.5</td>
<td>0</td>
<td>UA–</td>
</tr>
<tr>
<td>6</td>
<td>X16.1</td>
<td>L+</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td>X16.2</td>
<td>C/Q</td>
<td>IO-Link communication signal</td>
</tr>
<tr>
<td></td>
<td>X16.3</td>
<td>L–</td>
<td>0 V</td>
</tr>
</tbody>
</table>

1) Port class B

Table: Pin allocation of the IO-Link interfaces on the CECC-LK

Figure: CECC-LK, top manifold rail with IO-Link interfaces
### 3.5.9 IO-Link on the CECC-S

#### IO-Link Pin Signal Comment

<table>
<thead>
<tr>
<th>IO-Link</th>
<th>Pin</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X11.1</td>
<td>24</td>
<td>Connection for load voltage supply for IO-Link master ports (^1): UA+</td>
</tr>
<tr>
<td></td>
<td>X11.2</td>
<td>0</td>
<td>Connection for load voltage supply for IO-Link master ports (^1): UA– (GND)</td>
</tr>
<tr>
<td></td>
<td>X11.3</td>
<td>UG</td>
<td>Connection for encoder (GND) (\Rightarrow) section Multiple interface</td>
</tr>
<tr>
<td></td>
<td>X11.4</td>
<td>UE</td>
<td>Connection for encoder (5 V)</td>
</tr>
<tr>
<td>6</td>
<td>X15.1</td>
<td>L+</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td>X15.2</td>
<td>C/Q</td>
<td>IO-Link communication signal</td>
</tr>
<tr>
<td></td>
<td>X15.3</td>
<td>L–</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td>X15.4</td>
<td>24</td>
<td>UA+</td>
</tr>
<tr>
<td></td>
<td>X15.5</td>
<td>0</td>
<td>UA–</td>
</tr>
<tr>
<td>7</td>
<td>X16.1</td>
<td>L+</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td>X16.2</td>
<td>C/Q</td>
<td>IO-Link communication signal</td>
</tr>
<tr>
<td></td>
<td>X16.3</td>
<td>L–</td>
<td>0 V</td>
</tr>
</tbody>
</table>

1) Port class B

Table: Pin allocation of the IO-Link interfaces on the CECC-S

---

**Figure:** CECC-S, top manifold rail with IO-Link interfaces
3.6 Operator unit CDPX

The operator unit CDPX is a display for executing and monitoring automation tasks at the field level.

- Note the accompanying user documentation when installing the device.

![Figure: CECC with operator unit CDPX](image)

- Connect the CDPX to the CECC directly via the Ethernet interface or indirectly via a switch/hub.
- Make sure that the settings for the subnet mask are the same on both devices (e.g. 255.255.0.0).

Further information can be found in the user documentation for the CDPX.
4 Commissioning

4.1 Preparations

Administrator rights are required to install the CODESYS V3 pbF programming software on your PC.

1. Install the CODESYS V3 pbF programming software on the PC used to commission, configure and program the CECC.
2. Install required packages (CECC) if necessary. To do this, open the Package Manager in Codesys using the [Package Manager] command in the [Tools] menu.
3. After the last package is installed, restart Codesys to be able to use the modified plug-ins.
4. Connect the PC to the CECC directly via the Ethernet interface or indirectly via a switch/hub.

4.2 Getting started

- Launch CODESYS V3 pbF. You will find the program on your Windows PC in the Start menu directory [Programs] [Festo Software] [CODESYS V3].

4.2.1 Creating a project

- Create a new project ([File] [New Project...]), enter a name and the storage location and confirm your entries by clicking "OK".

Figure: "New Project" dialog
4.2.2 Selecting a device

1. Select the relevant device in the "CECC Project" dialog.
   - Check the "Show all device versions" box for an extended selection of older device variants. The respective version of the relevant device description file is appended to the name of the selected device.

   ![Figure: "New Project" dialog – selecting the device]

2. Select a programming language, e.g. structured text (ST).
3. Select the relevant interfaces.

   ![Figure: "New Project" dialog – selecting the interfaces]

   Options not supported by the respective device are inactive (shown in grey) and cannot be selected.
The CODESYS V3 pbF program window opens with the newly created project.

1. Device window with CECC, its interfaces and PLC logic
2. Editing window with tabs for the objects activated in the device window
3. Message window with information about the CECC as well as error messages and warnings

Figure: CODESYS V3 pbF program window with selected CECC
4.2.3 Adding a device

1. Double-click the device to be configured in the device window. The "Device" tab for making settings for the device opens in the editing window. The following information and setting options can be found in the sub-tab for the device:

![Image: "Device" tab for CECC-...]

2. Open the "Communication Settings" tab and highlight the local gateway (network path).
3. Click the "Scan network" button or double-click the highlighted gateway to add an updated list of devices to the local gateway.
   - If necessary, set the filter to "Target ID". Only devices that match the CECC currently used in the project will then be displayed (section "Selecting a device").
   - If necessary, change the sorting sequence to alter how the devices are displayed in the updated list.
   - Manually select a device if you know the name, node address or IP address of the CECC (section "Manually adding a device").
   - If necessary, change the network settings for the device (section "Scan Festo Devices") and repeat step 3. Changing the settings adds the device to the local gateway.

The list only contains devices that match the following criteria:
- The subnet mask settings for the network connection and CECC are the same
- The IP address settings for the network connection and CECC match

If these criteria are not met, the device must be detected using the Festo scan program (section "Scan Festo Devices"). The network settings for the device can be read out in the scan program and changed to suit your company network.
4.2.4 Manually adding a device
You can also manually add a known device as an alternative to automatic selection.
1. Highlight the local gateway.
2. Click the "Add device..." button.
3. Enter the name, node address or IP address of the device to be connected in the "Add device" dialog and confirm your entries by clicking "OK".

Following the update, a list of all CECC-... devices in the local gateway that match the filter settings is displayed.
4.2.5 Setting the communication channel
You need a communication channel to exchange data with the connected CECC.
- Highlight the desired device and click the "Set active path" button or double-click the highlighted device.

The currently active path is shown in bold in the list and "(active)" is appended to the name.

Figure: Activated device

4.2.6 Adding a CECC as a gateway
You can add a CECC as a gateway to extend the network. By doing so you extend the network by the subnet via which the CECC can be connected.
1. Click the “Add gateway...” button.
2. Enter a name for the new gateway in the input field.
3. Enter the known IP address for the relevant CECC.
4. Confirm your entries with "OK".
5. Repeat step 3 from the section "Adding a device" to add an updated list of devices to the CECC gateway (section "Getting started").
### 4.3 Scan Festo Devices

To launch the scan program "Scan Festo Devices":

1. Click the icon in the toolbar of the Codesys program window.
2. Click the menu command [Online] [Scan for].

![Scan Festo Devices scan program](image)

1. Select the device type "CECC" in the drop-down menu to filter the scan.
2. Start a new scan by clicking the "Scan for" button.

All found devices are listed in the scan program table.

#### 4.3.1 Changing network settings:

1. Highlight the found device.
2. Open the "Network properties for the device" dialog
   - menu command [Right mouse click] [Device] [Network] or
   - context menu [Network].

![Network properties for the device](image)

3. If necessary, change the IP address.
4. If necessary, change the settings for the subnet mask, standard gateway and DNS server.
5. Transfer the changes to the device. To do this, click "OK".
6. Wait until the device has successfully completed the switch-on process ("Run" status LED lights up).
7. Close the "Scan Festo Devices" scan program.
4.4 Configuring the I/O interface

1. Highlight the "Digital Inputs" or "Digital Outputs" interfaces under the "Onboard" branch in the CODESYS V3 ptF device window.

![Figure: Device window - Onboard I/O interface](image)

2. Double-clicking the highlighted interface "Digital Inputs" opens a new tab in the editing window for configuring the inputs of the I/O interface. Settings for the debounce time for the inputs of the I/O interface can be found on the "Digital Inputs Configuration" sub-tab.

![Figure: Digital inputs I/O configuration](image)

3. Click the "Digital Inputs I/O Mapping" sub-tab to show the current values for the inputs.

![Figure: Digital inputs I/O mapping](image)

4. Double-clicking the interface "Digital Outputs" opens the corresponding tab in the editing window for configuring the outputs of the I/O interface.
5. Click the "Digital Outputs I/O Mapping" sub-tab to show the current values for the inputs.

Figure: Digital outputs I/O mapping

6. Check the "Always update variables" box in offline mode to show the output states in real time.

4.5 Configuring a CANopen slave

Connecting via CANopen requires an appropriate baud rate.
The CAN tab for setting the baud rate is opened by double-clicking the CANbus branch in the CODESYS V3 pbF device window.

4.5.1 Adding a CANopen slave

1. Highlight the CANopen_Manager branch in the CODESYS V3 pbF device window.

Figure: Device window - selecting "CANbus - CANopen_Manager"
2. Open the "Add Device" dialog
   – menu command [Project] [Add Device] or
   – context menu [Add Device].

Figure: "Add Device" dialog

3. Select a CANopen slave in the device table and highlight it.
   Example: FB14

4. Confirm the selection by clicking the "Add Device" button.

5. If necessary, repeat steps 3 and 4 to add further devices (max. number of CANopen slaves: 32).
   Example: Special case for integrating a valve terminal CPV-CO2

6. Close the dialog by clicking the "Close" button.
7. Highlight the added CANopen slave in the device window.

Figure: Device window - selecting "FB14"

8. Double-clicking the added device "FB14" or "CO2" opens a new tab in the editing window for configuring the CANopen slave.

Figure: Editing window with CANopen slave CO2

- If necessary, check the "Enable Expert Settings" box on the "CANopen Remote Device" tab in the editing window.
  All setting options are then visible.

  This option is activated by default for the CECC under CODESYS V3 pbF.

- If necessary, check the "Autoconfig PDO Mapping" box on the "CANopen Remote Device" tab in the editing window.
  This setting executes automatic configuration if the CANopen slave supports sub-modules.
The PDO mapping can be found in the sub-tab of the same name.

Figure: Editing window with CANopen slave CO2
4.5.2 Introducing CPV terminals

CPV terminals are added to CANopen slaves CO2 (CPV-CO2) as sub-modules (Adding a CANopen slave - step 3).

1. Highlight the CANopen slave “CO2” in the device window.
2. Open the “Add Device” dialog
   – menu command [Project] [Add Device] or
   – context menu [Add Device].
3. Select one of the following CPV terminals in the device table and highlight it.

<table>
<thead>
<tr>
<th>CPV terminal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPV basic unit</td>
<td>Local I/Os (valves)</td>
</tr>
<tr>
<td>CP input module</td>
<td>Optional CP input module for extending a CPV terminal</td>
</tr>
<tr>
<td>CPV/CPA valve terminal / CP output module</td>
<td>Optional valve terminal or CP output module for extending a CPV terminal</td>
</tr>
</tbody>
</table>

4. Confirm the selection by clicking the "Add Device" button.
5. Double-clicking the added CPV terminal opens a new tab in the editing window for configuring the terminal.

Figure: Editing window with CPV terminal as a CANopen slave
4.6 Configuring RS232 interfaces (CECC-S)

The CECC-S provides two serial interfaces:
- RS232-1
- RS232-2

- Use the appropriate libraries (e.g. "CAA SerialCom") together with the Festo SerialComEx_3 library to parameterise the serial interfaces.

4.7 Configuring an encoder (CECC-S)

4.7.1 Integration

To use an encoder, the device must be integrated in the controller configuration.

1. Add the "General Purpose Serial" interface to the device tree.
2. Highlight the "General Purpose Serial" branch in the device tree.
3. Right-click a free placeholder.
4. Select the "Plug Device" command in the context menu.
5. Select the device from the table.

![Figure: Integrating an encoder](image)

4.7.2 Parameterisation

![Figure: Parameterising an encoder](image)
### Encoder settings

| Parameter               | Setting                                      | Comment                                                                                       |
|-------------------------|----------------------------------------------|                                                                                               |
| Encoder type            | – Encoder deactivated                        | Activates and presets the encoder                                                            |
|                         | – Encoder 90° phase single eval.             |                                                                                               |
|                         | – Encoder 90° phase double eval.             |                                                                                               |
|                         | – Encoder 90° phase quad. eval.              |                                                                                               |
|                         | – Encoder with impulse and direct.           |                                                                                               |
| Debounce time A\(B\)0   | – Debounce time for signals A, B and N (0)    | The debounce time can be defined with an accuracy of 15 ns. Maximum value: 0.9 ms              |
| Polarity Channel A,     | – Not inverted                               | Setting for the polarity for the input signal of the respective channel.                      |
| Channel B, Channel N    | – Inverted                                   |                                                                                               |
| Upper limit             | – \(-2^n\) to \(2^{n-1}\)                   | Setting for the minimum and maximum value for the encoder position.                           |
| Lower limit             | – \(-2^n\) to \(2^{n-1}\)                   | If the set limits are exceeded ➔ Overflow behaviour                                          |
| Overflow behaviour      | – Wrap around                                | If the maximum value is exceeded, the current value jumps to the minimum value.               |
|                         |                                             | If the minimum value is fallen below, the current value jumps to the maximum value.           |
|                         | – No wrap around                              | If the maximum or minimum value is reached, the current value is retained. The rest of the increments are ignored until the direction of rotation reverses. |
Comparator settings

The current position value of the encoder is compared with the upper and lower compare value. The result is immediately set at a digital output of the I/O interface.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparator to output</td>
<td>– Condition for the signal curve at the digital output</td>
<td>The output set under the &quot;Digital Output&quot; parameter is used. Possible signal curves: Figure: Digital output as a function of the &quot;Comparator to output&quot; parameter [3][8].</td>
</tr>
<tr>
<td>Pulse lengthening</td>
<td>– Setting in µs</td>
<td>Pulse lengthening for the comparison: – Counter value = lower compare value (with pulse lengthening) The purpose of pulse lengthening is to improve signal detection. It can be defined with an accuracy of 1 µs. Maximum value: 8 s Figure: Digital output as a function of the &quot;Comparator to output&quot; parameter[9].</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>– Between 0 and 255 increments</td>
<td>The purpose of hysteresis is to prevent fluttery signals. The value is used in positive and negative direction Figure: Digital output as a function of the &quot;Hysteresis&quot; parameter.</td>
</tr>
<tr>
<td>Digital output</td>
<td>– No digital output</td>
<td>Defines a digital output that is switched by the comparator.</td>
</tr>
<tr>
<td></td>
<td>– Number of the digital output</td>
<td></td>
</tr>
<tr>
<td>Digital output polarity</td>
<td>– Not inverted</td>
<td>Setting for the output signal polarity.</td>
</tr>
<tr>
<td></td>
<td>– Inverted</td>
<td></td>
</tr>
</tbody>
</table>
1. Upper compare value = 10
2. Lower compare value = -10
3. Signal curve for "counter value = lower compare value"
4. Signal curve for "counter value <= lower compare value"
5. Signal curve for "counter value >= lower compare value"
6. Signal curve for "Counter value within compare values"
7. Signal curve for "Counter value outside compare values"
8. Signal curve for "counter value = lower compare value (with pulse lengthening)"
9. d: Pulse lengthening

Figure: Digital output as a function of the "Comparator to output" parameter (example)
Latch settings

A buffer memory (latch) can be used to record the position value of the encoder when an external signal (latch result) occurs. This buffer memory can be read out during the next PLC cycle.

The external signal is connected to the latch input. On the CECC-S, this is the fourth input on the I/O interface (X2.3).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latch function</td>
<td>– Latch function switched off</td>
<td>Defines the condition relating to whether and when the current encoder value is written to the buffer memory.</td>
</tr>
<tr>
<td></td>
<td>– Latch by rising edge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Latch by rising and falling edge</td>
<td></td>
</tr>
<tr>
<td>Latch input polarity</td>
<td>– Not inverted</td>
<td>Polarity setting for the latch input.</td>
</tr>
<tr>
<td></td>
<td>– Inverted</td>
<td></td>
</tr>
</tbody>
</table>
Reference mode settings
The reference point can be changed when an external signal occurs or using the zero track. This enables e.g. the current encoder value to be set to 0 when a limit switch is exceeded.
The external signal is connected to the reference mode input; on the CECC-S, this is the third input (X2.2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference mode</td>
<td>switched off</td>
<td>Defines the condition for whether and when referencing of the encoder takes place.</td>
</tr>
<tr>
<td></td>
<td>Immediate</td>
<td>Immediate: The current position value is used as the new reference point.</td>
</tr>
<tr>
<td></td>
<td>Rising edge</td>
<td>Rising edge: For exact referencing, the rising edge at the digital input X2.2 (I/O interface) is used.</td>
</tr>
<tr>
<td></td>
<td>Rising edge + pos. direction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rising edge + neg. direction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rising edge + pos. direction &amp; N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rising edge + neg. direction &amp; N</td>
<td></td>
</tr>
<tr>
<td>Reference input polarity</td>
<td>Not inverted</td>
<td>Polarity setting for the reference input.</td>
</tr>
<tr>
<td></td>
<td>Inverted</td>
<td></td>
</tr>
</tbody>
</table>
4.7.3 Encoder inputs and outputs
In addition to the actual position value, the encoder also supplies other values that are available as inputs and outputs.

![Encoder port I/O mapping](image)

<table>
<thead>
<tr>
<th>Input/output</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current value</td>
<td>Current encoder position value.</td>
</tr>
<tr>
<td>Latched value</td>
<td>Position value stored during the most recent latch event.</td>
</tr>
<tr>
<td>Latch event counter</td>
<td>Number of latch events. A new latch event can be detected based on a change in this value.</td>
</tr>
<tr>
<td>Comparator result</td>
<td>Six inputs with the results of the comparator.</td>
</tr>
<tr>
<td>Enable referencing</td>
<td>Signal for enabling referencing. The enable is reset as soon as referencing has been carried out under the preset conditions.</td>
</tr>
<tr>
<td>Reference value</td>
<td>Position value set during referencing.</td>
</tr>
<tr>
<td>Upper compare value</td>
<td>Limits for the comparator.</td>
</tr>
<tr>
<td>Lower compare value</td>
<td></td>
</tr>
</tbody>
</table>
4.7.4 Sample program

```plaintext
CASE state OF
  0:
    %QD5 := 1000;       // change referencing value to 1000
    %QX16.0 := TRUE;    // release referencing
    state := 10;
  10:
    IF %QX16.0 = FALSE THEN // wait for referencing
      state := 20;        // actual value equals 1000
    END_IF
  20:
    ...
END_CASE
```

4.8 Configuring RS422 (CECC-S)

4.8.1 Integration

To use the RS422 interface, it must be integrated in the controller configuration.
1. Add the "General Purpose Serial" interface to the device tree.
2. Highlight the "General Purpose Serial" branch in the device tree.
3. Right-click a free placeholder.
4. Select the "Plug Device" command in the context menu.
5. Select the interface from the table.

Figure: Integrating RS422

4.9 Configuring RS485 (CECC-S)

4.9.1 Integration

To use the RS485 interface, it must be integrated in the controller configuration.
1. Add the "General Purpose Serial" interface to the device tree.
2. Highlight the "General Purpose Serial" branch in the device tree.
3. Right-click a free placeholder.
4. Select the "Plug Device" command in the context menu.
5. Select the interface from the table.

Figure: Integrating RS485
4.10 Configuring an IO-Link master (CECC-LK and CECC-S)

4.10.1 Integration

**Note**
To use the IO-Link interface you need the IODD file for the relevant IO-Link device.
- Third-party device: Request the IODD file from the respective vendor.

1. Highlight the "IO-Link Master" branch in the CODESYS V3 pbF device window.

![Device window - selecting "IO-Link Master"](image)

Figure: Device window - selecting "IO-Link Master"

2. Open the context menu (right mouse button) and open the "Edit Object" dialog or alternatively double-click the highlighted object.

A new tab opens in the editing window for configuring:
- 4 IO-Link master ports (CECC-LK)
- 1 IO-Link master port (CECC-S)
The sub-tabs contain the following information and setting options:

<table>
<thead>
<tr>
<th>Sub-tab</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO-Link Master</td>
<td>Validation setting: Read in the serial number</td>
</tr>
<tr>
<td></td>
<td>Options</td>
</tr>
<tr>
<td></td>
<td>– Data storage: Save the parameters</td>
</tr>
<tr>
<td></td>
<td>– Autoswitch: Automatically switch to Operate mode (default)</td>
</tr>
<tr>
<td>I/O Mapping</td>
<td>Reserved (see IO-Link Devices for I/O Mapping)</td>
</tr>
<tr>
<td>Status</td>
<td>Status of communication</td>
</tr>
<tr>
<td>Information</td>
<td>Version information</td>
</tr>
</tbody>
</table>

- Click a port in the editing window to configure a master port. The selected port is highlighted in blue.
4.10.2 Selecting an IO-Link device

1. Highlight an "Empty" placeholder in the "IO-Link Master" branch in the device window for an IO-Link device to be connected.

Figure: Device window - selecting "Placeholder"
2. Open the context menu (right mouse button) and open the "Plug Device" dialog.

![Image: "Plug Device" dialog]

**Actions in the "Plug Device" dialog**

<table>
<thead>
<tr>
<th>Action</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Append device</td>
<td>Select device for connecting to the selected connection.</td>
</tr>
<tr>
<td>Insert device</td>
<td>Does not work, since the number of connections is clearly defined.</td>
</tr>
<tr>
<td>Plug device</td>
<td>Replace device for connecting to the selected connection.</td>
</tr>
<tr>
<td>Update device</td>
<td>Accept device with new firmware at the selected connection; the device name does not change in the device window during this process.</td>
</tr>
</tbody>
</table>

3. Change the list of devices available for selection by:
   - Selecting the vendor
   - Displaying all versions
   - Displaying outdated versions

4. Highlight an IO-Link device (e.g. VTUB-12 8 Valves) in the "Device" area in the table.

5. Click the "Plug Device" button to transfer the IO-Link device to the device window.
6. Select another/unoccupied connection for a further IO-Link device in the device window (only with CECC-LK, max. 4). The "Plug Device" dialog must be left open for this.
7. If necessary, repeat from step 3 onwards to plug further IO-Link devices (only with CECC-LK, max. 4).
8. Close the dialog by clicking the "Close" button.

A digital sensor or actuator can also be connected to the IO-Link master port instead of an IO-Link device.
- Select "Digital_Input" for a sensor
- Select "Digital_Output" for an actuator

![Image of CECC-LK with 4 plugged IO-Link master ports](image)

The names in the device window can be changed.
- Click a previously highlighted device to switch to editing mode (not double-click).
4.10.3 Scanning for an IO-Link device

Instead of manually selecting an IO-Link device, you can also have Codesys find it by scanning.

Prerequisites:
- There is a (temporary) connection to the device via the active path.
- CODESYS V3 pbF has been logged into the device at least once (section "Online mode").

1. Highlight the "IO-Link Master" branch in the CODESYS V3 pbF device window.

   ![Device window - selecting "IO-Link Master"](image)

   Figure: Device window - selecting "IO-Link Master"

2. Open the "Scan Device" dialog
   - menu command [Project] [Scan for Devices] or
   - context menu [Scan for Devices].

3. Note the safety prompt about connected actuators at the IO-Link master ports. If you answer "Yes", a dialog for scanning for connected IO-Link devices opens.

   !["Scan Devices" at the IO-Link master ports](image)

   Figure: "Scan Devices" at the IO-Link master ports

4. Check the "show differences to project" box to show the IO-Link configuration of the Codesys project in parallel.

5. Click the "Copy all devices to project" button to transfer the read-in configuration to the Codesys project.
4.10.4 Configuring an IO-Link device

1. Highlight a plugged device in the "IO-Link Master" branch in the device window (here: VTUB-12 8 Valves).

![Device window - selecting "Added IO-Link Device"](image)

2. Double-clicking the plugged device opens a new tab in the editing window for configuring the respective IO-Link device.

![Editing window with IO-Link device VTUB-12 8 Valves (example)](image)

The sub-tabs for the selected IO-Link device contain the following information and setting options (example: VTUB-12 8 Valves).

<table>
<thead>
<tr>
<th>Sub-tab</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO-Link Device Info</td>
<td>General information about the connected IO-Link device.</td>
</tr>
<tr>
<td>IO-Link Parameter</td>
<td>Specific parameters can be called up.</td>
</tr>
<tr>
<td>IO-Link I/O Mapping</td>
<td>Current process data for the components of the IO-Link device.</td>
</tr>
<tr>
<td>Status</td>
<td>General status of the IO-Link device.</td>
</tr>
</tbody>
</table>
4.10.5 Configuring an IO-Link device (CECC-LK and CECC-S)

Each of the specified controllers has an "IO-Link Device" interface for connecting to a higher-order IO-Link master.

**Note**
To use the IO-Link interface you need the associated IODD file (not with CAPC).
- Download the IODD file for the CECC from the Festo Support Portal (www.festo.com ➔ Support).

1. Highlight the "IO-Link Device" branch in the CODESYS V3 pbF device window.

![Figure: Device window - selecting "IO-Link Device"](image)

2. Open the context menu (right mouse button) and open the "Edit Object" dialog or alternatively double-click the highlighted object.

A new tab opens in the editing window for configuring the CECC as an IO-Link device.

![Figure: Tab for configuring the CECC as an IO-Link device](image)
The sub-tabs contain the following information and setting options:

<table>
<thead>
<tr>
<th>Sub-tab</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO-Link Device</td>
<td>Shows the IO-Link specification</td>
</tr>
<tr>
<td></td>
<td>Settings</td>
</tr>
<tr>
<td></td>
<td>– Data width for the process data</td>
</tr>
<tr>
<td></td>
<td>– Baud rate for the data transmission</td>
</tr>
<tr>
<td>I/O Mapping</td>
<td>Current process data for the controller as an IO-Link device.</td>
</tr>
<tr>
<td>Status</td>
<td>Status of communication</td>
</tr>
<tr>
<td>Information</td>
<td>Version information for the CECC as an IO-Link device.</td>
</tr>
</tbody>
</table>

Figure: Sample I/O mapping for the CECC as an IO-Link device
4.11 Configuring Modbus TCP

The controller CECC supports Modbus TCP Client as well as Modbus TCP Server. Operation with Modbus TCP Server is restricted to 8 simultaneously usable channels.

Detailed information on Modbus TCP can be found in the online Help for CODESYS V3 pbF.

The following steps describe how to prepare to control a CECC by means of a further CECC via Modbus TCP.

4.11.1 CECC as a Modbus TCP master

1. Highlight the "Device (CECC)" branch in the CODESYS V3 pbF device window.
2. Open the "Add Device" dialog
   - menu command [Project] [Add Device] or
   - context menu [Add Device].

   ![Add Device - selecting "Ethernet"](image)

3. Select the company "3S - Smart Software Solutions GmbH" in the "Vendor" drop-down list.
4. Accept "Ethernet" as the interface by clicking the "Add Device" button.
5. Highlight the new "Ethernet" branch in the device window.
6. Add a "Modbus TCP Master" module via the context menu.

Figure: Device window - selecting "Modbus TCP Master" in the "Ethernet" branch

7. Highlight the new "Modbus TCP Master" branch and add the "Modbus TCP Slave" module using the context menu.
8. Repeat this process for the other Modbus TCP slaves.

Figure: Device window - selecting "Modbus TCP Slave" in the "Modbus TCP Master" branch

9. Highlight one of the "Modbus TCP Slave" branches.
Several tabs for parameterising the selected "Modbus TCP Slave" are displayed in the workspace.

Figure: Workspace for "Modbus TCP Slave" (parameters)

10. Enter the IP address for the Modbus TCP slave.
11. Enter the unit ID for the Modbus TCP slave.
   If the unit ID is not the same as the unit ID configured in the slave, communication cannot take place.
12. Enter the port for the Modbus TCP slave.
   To configure the I/O mapping, appropriate channels must be added.

Figure: Workspace for "Modbus TCP Slave" - adding a channel

13. Click the "Add Channel..." button and set the desired parameters.

   The appropriate parameters are described in the Codesys Help.
Using the CECC as a Modbus TCP slave provides
- access to the range %QW with access type Read Input Registers (function code 04)
- access to the range %IW with access type Write Multiple Registers (function code 16)

The length specifies how many words should be read and written.

![Figure: Settings on channel 1](image1)

![Figure: Settings on channel 2](image2)
This gives the master an I/O map for the slave.

Figure: Workspace for “Modbus TCP Slave” - tab “Modbus TCP Slave I/O Mapping”

If the timeout option is activated and if this has a value greater than zero, the holding register values (%IW) are automatically reset after this time WITHOUT further remote access to the holding register range.
4.11.2 CECC as a Modbus TCP slave

1. Highlight the "Ethernet" branch and add the module "Modbus TCP Slave Device" via the context menu.

Figure: Device window - selecting "Modbus TCP Slave" in the "Ethernet" branch

2. Highlight the branch of the device being parameterised as a "Modbus TCP Slave Device". Several tabs for parameterising the selected "Modbus TCP Slave Device" are displayed in the workspace.

Figure: Workspace for "Modbus TCP Slave Device Configuration"

3. Enter the IP address for the Modbus TCP slave device.
4. Enter the unit ID for the Modbus TCP slave device.
5. Enter the port for the Modbus TCP slave device.
4.12 Online mode

Caution
Risk of injury due to uncontrolled movements of the connected actuators.
- Test projects and programs without active actuators initially.

A configured project including program (CECC application) is to be transferred to the CECC. Online mode must be activated for transfer, i.e. CODESYS V3 pbF must be "logged in" on the CECC.

4.12.1 Login

Use one of the following commands for login:
- Click the icon in the toolbar of the Codesys program window
- Menu command [Online] [Login]
- Shortcut ALT+F8

Codesys logs in to the CECC connected via the active path in the gateway. The first step is a comparison of whether the connected CECC is the same as the device selected in the project. An error message with information about the target system ID is displayed if necessary (section "Controller CECC").

Figure: Warning message about an incorrect target system ID

The next step is a comparison of the project and the application on the CECC. The following warning appears if the project has been changed.

Figure: Warning message about different versions

- Decide how to handle the version differences between the Codesys project and the CECC application (CODESYS V3 pbF online Help "Login").
Once online mode is active, the connection to the CECC as well as the application are highlighted in green in the device window. The CECC is online, the application is not started (not running), the "Run" status LED lights up yellow.

Figure: Device window with CECC logged in
4.12.2 Starting and monitoring the application

The application can be started on the CECC if error-free data has been transferred.

Use one of the following commands to start the application:

- Click the icon in the toolbar of the Codesys program window
- Menu command [Debug] [Start]
- Shortcut F5

The entries for the CECC as well as its application are shown against a green background in the device window; [run] appears after the application "CECC_Code". The circular arrows in front of the various devices of the CECC light up green.

The application on the CECC is running, the "Run" status LED lights up green.

Figure: Device window with CECC in debug mode
4.12.3 Manually setting I/Os

The editing window contains the online views for all program modules and offers the following options:

- Writing and forcing variables
- Using monitoring lists
- Troubleshooting in applications (debugging)

Example: IO-Link with VTUB_12 16 valves

1. Open the "IO-Link I/O Mapping" tab in the editing window.

![Figure: Editing window with IO-Link device "VTUB_12_16_Valves"](image)

2. Change the value of the valves by double-clicking in the "Prepared Value" column.

3. Use one of the following commands to transfer the prepared values:
   - Menu command [Debug] [Write Values] or shortcut CTRL+F7
   - Menu command [Debug] [Force Values] or shortcut F7

   The current configuration of the IO-Link outputs and therefore the current valve states are only immediately visible if the "Always update variables" box is checked.
   You can only check this box on the "IO-Link I/O Mapping" tab when Codesys is not logged into the CECC.

4.12.4 Logout

Use one of the following commands for logout:

- Click the icon in the toolbar of the Codesys program window
- Menu command [Online] [Logout]
- Shortcut CTRL+F8

Further information on monitoring and controlling the application can be found in the online Help for CODESYS V3 pfF.
4.13 PLC shell

The PLC shell is a text-based controller monitor (terminal). Commands for requesting certain information from the controller are entered in an input line and sent to the controller as a string. The returned response string is displayed in a results window in the browser. This functionality is used for diagnostic, debugging and configuration purposes.

To use the PLC shell:
1. Highlight the device (CECC) in the Codesys device window.
2. Double-clicking the device opens a new "Device" tab in the editing window for configuring the CECC.
3. Open the "PLC shell" sub-tab.

![CECC editing window with "PLC shell" sub-tab](image)

An online connection between Codesys and the CECC is required for communication using the PLC shell (→ section "Online mode"); if necessary, a temporary connection to the device in the active path is established.

- The target system ID of the controller in the active path must be the same as the device type in the project.

The list of standard commands for any target systems can be found in the online Help for CODESYS V3 pbF. The following commands are additionally available for the CECC.

<table>
<thead>
<tr>
<th>Command</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>getdevinfo</td>
<td>Shows all information about the device.</td>
</tr>
<tr>
<td>gethostname</td>
<td>Shows the host name of the device.</td>
</tr>
<tr>
<td>sethostname &lt;hostname&gt;</td>
<td>Sets the host name of the device.</td>
</tr>
<tr>
<td>getserial</td>
<td>Shows the serial number of the device.</td>
</tr>
<tr>
<td>getfirmwareversion</td>
<td>Shows the firmware version of the device.</td>
</tr>
<tr>
<td>getvendorname</td>
<td>Shows the name of the device vendor.</td>
</tr>
<tr>
<td>getuniqueid</td>
<td>Shows the unique ID of the device.</td>
</tr>
<tr>
<td>getsysversion</td>
<td>Shows the system version of the device.</td>
</tr>
<tr>
<td>getmacaddr</td>
<td>Shows the MAC address of the device.</td>
</tr>
<tr>
<td>getipaddr</td>
<td>Shows the current IP address of the PLC.</td>
</tr>
<tr>
<td>getipconfig &lt;IP-address&gt; [&lt;subnet-mask&gt; [&lt;gateway&gt; [&lt;dns-server&gt;]]] [dhcp</td>
<td>nodhcp]</td>
</tr>
<tr>
<td>Command</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>reboot</td>
<td>Reboots the device.</td>
</tr>
<tr>
<td>getrtc</td>
<td>Shows the current real-time clock data.</td>
</tr>
<tr>
<td>setrtc YYYY-mm-dd-HH:MM:SS</td>
<td>Sets the current real-time clock data</td>
</tr>
<tr>
<td>canlog</td>
<td>Functions for CAN logging.</td>
</tr>
<tr>
<td></td>
<td>Use the /? option to display the possible parameters.</td>
</tr>
<tr>
<td>cangetconfig</td>
<td>Shows the current CAN configuration parameters.</td>
</tr>
<tr>
<td>cansetconfig</td>
<td>Sets the CAN configuration parameters.</td>
</tr>
<tr>
<td></td>
<td>Use the /? option to display the possible parameters.</td>
</tr>
<tr>
<td>usbgetconfig</td>
<td>Shows the current USB configuration parameters.</td>
</tr>
<tr>
<td>usbsetconfig</td>
<td>Sets the USB configuration parameters.</td>
</tr>
<tr>
<td></td>
<td>Use the /? option to display the possible parameters.</td>
</tr>
<tr>
<td>shellcmd &lt;linux command&gt;</td>
<td>Executes a Linux shell command</td>
</tr>
<tr>
<td></td>
<td>Examples: shellcmd cat /proc/config/id</td>
</tr>
</tbody>
</table>

Table: PLC shell commands

A list of all the commands for the device in the active path can be called up by entering a question mark "?" (without quotation marks) in the command line of the PLC shell.
4.14 Transferring project data using a USB memory stick

The CECC supports reading in project data via the USB interface.

Prerequisites for transferring a project from a USB memory stick without any errors:

- Firmware version 1.3.4.0 or later
- USB memory stick is formatted: file system FAT or FAT32 only
- CECC used is selected: CECC-D, CECC-LK or CECC-S
- "Device Description in Project" and "CECC Runtime System" versions are the same (Version information)
- "Load Project Data from USB Memory" function in the USB configuration of the CECC is activated (= default setting PLC shell commands: "usbsetconfig" and "usbgetconfig")
- CECC is switched off

Note
Existing project data on the CECC is deleted before a project is transferred from a USB memory stick.

- Make sure that the current data on the CECC is available in a Codesys project and can be used for recovery in the event of errors.

To generate USB project data:

1. Plug a USB memory stick into your PC.
2. Open the project to be saved on the USB memory stick. (Click the program in the "PLC logic" branch of the CECC in the device window.)
3. Select the command [Online] [Create USB files].
4. Switch to the drive letter for the USB memory stick.
5. Start saving to the USB memory stick by clicking "OK".
6. If necessary remove the USB memory stick and unplug it from the PC.

To transfer the project from a USB memory stick to a CECC:

1. Plug the USB memory stick into your CECC.
2. Switch on the CECC.

The CECC detects the project data on the USB memory stick and uploads it to the flash memory (non-volatile memory) of the CECC. The uploaded project is then automatically started.

3. Remove the USB memory stick so that this process is not repeated the next time the CECC is switched on.
4.14.1 Diagnostic options in the event of errors
- Check the status of the error LED (Status LEDs)
- Query using FFT (Festo Field Device Tool)
- Create a log file

4.14.2 Querying using FFT

<table>
<thead>
<tr>
<th>FFT information</th>
<th>Error</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing entry &quot;Wait for USB device connection …&quot;</td>
<td>Project data transfer via the USB interface is deactivated.</td>
<td>• Activate this function using the PLC shell command usbsetconfig /bootaction=1</td>
</tr>
<tr>
<td>Missing entry in the &quot;Inactive time&quot; column of the entry &quot;Wait for USB device connection …&quot;:</td>
<td>No valid project data was found within the specified time. Max. wait until the USB memory stick is available in the dec file system of the CECC: 3 seconds.</td>
<td>• Check the timeout setting. • Check the file system of your USB memory stick (only FAT and FAT32 possible).</td>
</tr>
<tr>
<td>Error loading bootproject</td>
<td>Project cannot be transferred to the CECC.</td>
<td>• Check whether the CECC used is selected in the Codesys project.</td>
</tr>
</tbody>
</table>

4.14.3 Create a log file
A log file is used for in-depth error analysis of the connected CECC.
- Activate the log function using the PLC shell command usbsetconfig /logaction=1
All USB boot actions are then logged in a log file. The log file can be found in the directory "/tmp/USB_boot_action.log".
- Use the PLC shell command "usbsetconfig" to customise the log contents.

4.14.4 Deactivating project transfer via the USB interface
To deactivate project data transfer from the USB memory stick:
- Use the following PLC shell command: usbsetconfig /bootaction = 0
This command also prevents delayed starting of the CECC.

4.14.5 Directory path for general reading and writing of files
The connected USB memory stick can be used for general reading and writing of files as of firmware version 1.3.6-cecc0 (library SysFile and library CAA_FILE).
The first partition of the USB memory stick is under the following directory path:
/mnt/usb
4.15 Node guarding

Node guarding telegrams can be interrupted in stop mode when using the CAN interface.

1. Open the "PLC settings" tab in the CECC controller.
2. Check the "Update IO while in stop" box.

![PLC settings for CECC controller](image)

4.16 Data incompatibility between the runtime project and controller

If the runtime data in the project and the operating system software used in the controller are incompatible, the following message appears:

![Selected target system is different from the connected device](image)

Figure: Selected target system is different from the connected device

Possible remedies:

- Update the CECC firmware using FFT.
- Use a compatible package (older/newer version).
5 Diagnostics

5.1 General error behaviour

Warning
When an error occurs, the controller carries on the active program instead of stopping. Unwanted actuator movements can cause collisions resulting in serious injury.

• Integrate error handling mechanisms for all error categories in the user program.
• Make sure that nobody enters the positioning range of the drives or other connected actuators.

The following diagnostic options are available for the controller CECC:

<table>
<thead>
<tr>
<th>Diagnostics via</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status LEDs</td>
<td>Fast, local error detection using</td>
</tr>
<tr>
<td></td>
<td>- controller LEDs</td>
</tr>
<tr>
<td></td>
<td>- CECC-specific LEDs</td>
</tr>
<tr>
<td>Controller configuration</td>
<td>Online diagnostics without programming</td>
</tr>
<tr>
<td>User program</td>
<td>Detailed diagnostic evaluation:</td>
</tr>
<tr>
<td></td>
<td>- System event CECC_system_fault</td>
</tr>
<tr>
<td></td>
<td>- Support for function blocks from the Festo CECC_3 library ➔ section &quot;Diagnostics&quot;.</td>
</tr>
</tbody>
</table>

Table: Diagnostic options provided by the CECC

<table>
<thead>
<tr>
<th>Error class</th>
<th>Weighting</th>
<th>Error no.</th>
<th>Evaluation via function block in Festo CECC_3 library</th>
<th>Display in the Codesys device log</th>
<th>Display in the FFT(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No error</td>
<td>0</td>
<td>X</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1</td>
<td>Information</td>
<td>200 ... 255</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Warning</td>
<td>1 ... 127</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Error</td>
<td>128 ... 199</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>


Table: Error evaluation options

Figure: Editing window with "Device" tab - "Log" sub-tab
### Festo Controller CECC

<table>
<thead>
<tr>
<th>Error message</th>
<th>Error no.</th>
<th>Error class</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoDrv: Overload</td>
<td>2</td>
<td>Warning</td>
<td>Check the outputs for possible short circuit.</td>
</tr>
<tr>
<td>IoDrv: IO power supply failure</td>
<td>4</td>
<td>Warning</td>
<td>Check the I/O power supply.</td>
</tr>
<tr>
<td>Undervoltage in power supply</td>
<td>5</td>
<td>Warning</td>
<td>Check the power supply.</td>
</tr>
<tr>
<td>Error loading boot project</td>
<td>120</td>
<td>Warning</td>
<td>Check your boot project.</td>
</tr>
<tr>
<td>FPGA open failed</td>
<td>140</td>
<td>Error</td>
<td>Replace the device.</td>
</tr>
<tr>
<td>FRAM open failed</td>
<td>141</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>Runtime license invalid</td>
<td>144</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>Codesys started</td>
<td>210</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Codesys shutdown</td>
<td>211</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Change to run state</td>
<td>212</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Change to stop state</td>
<td>213</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Wait for USB device connection</td>
<td>220</td>
<td>Information</td>
<td>Deactivate the function for transferring project data using a USB memory stick.</td>
</tr>
</tbody>
</table>

**Table: Codesys error messages**

<table>
<thead>
<tr>
<th>Error message</th>
<th>Error no.</th>
<th>Error class</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOLinkDrv: Initialization failed</td>
<td>150</td>
<td>Error</td>
<td>Check the connected IO-Link devices.</td>
</tr>
<tr>
<td>IOLinkDrv: Stack halted (Error)</td>
<td>151</td>
<td>Error</td>
<td>Check the power supply.</td>
</tr>
<tr>
<td>IOLinkDeviceDrv: Initialization failed</td>
<td>152</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>IOLinkDrv: Started</td>
<td>214</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>IOLinkDeviceDrv: Started</td>
<td>215</td>
<td>Information</td>
<td>–</td>
</tr>
</tbody>
</table>

**Table: IO-Link error messages**

<table>
<thead>
<tr>
<th>Error message</th>
<th>Error no.</th>
<th>Error class</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>multicast daemon started</td>
<td>216</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Kernel diagnosis daemon stopped</td>
<td>217</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Kernel diagnosis daemon started</td>
<td>218</td>
<td>Information</td>
<td>–</td>
</tr>
<tr>
<td>Redirect all kernel errors to diagnostics</td>
<td>219</td>
<td>Information</td>
<td>–</td>
</tr>
</tbody>
</table>

**Table: Internal error messages**
5.2 Status LEDs

The LEDs on the CECC indicate the operating status of the device and are arranged in five groups.

1. IO-Link (CECC-LK)
2. Operation (Run, Net, Error, Mod)
3. Ethernet
4. Power supply to the device (24 V)
5. I/O (inputs and outputs) and power supply for I/O

Figure: Status LEDs on the CECC-LK and CECC-D
Festo Controller CECC

1 RS232, multiple interface ENC/RS422/RS485 and IO-Link
2 Operation (Run, Net, Error, Mod)
3 Ethernet
4 Power supply to the device (24 V)
5 I/O (inputs and outputs) and power supply for I/O

Figure: Status LEDs on the CECC-S

<table>
<thead>
<tr>
<th>LED</th>
<th>Sequence</th>
<th>Meaning</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Volt</td>
<td>Lights up green</td>
<td>Device ready for operation</td>
<td>Power supply</td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>Device switched off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flashes green</td>
<td>Undervoltage of the device</td>
<td></td>
</tr>
<tr>
<td>Run</td>
<td>Lights up green</td>
<td>Program running</td>
<td>Application status</td>
</tr>
<tr>
<td></td>
<td>Lights up yellow</td>
<td>Program is stopped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>Runtime system not started</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>Lights up red</td>
<td>Class 4 error</td>
<td>PLC runtime error</td>
</tr>
<tr>
<td></td>
<td>Flashes red</td>
<td>Class 2 error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>No error/class 1 error</td>
<td></td>
</tr>
<tr>
<td>Net</td>
<td>Flashes red</td>
<td>Device identified</td>
<td>Identification by FFT</td>
</tr>
<tr>
<td>Mod</td>
<td>–</td>
<td>–</td>
<td>Reserved</td>
</tr>
<tr>
<td>Ethernet left</td>
<td>Lights up green</td>
<td>Data transfer with 100 Mbit</td>
<td>Speed LED = Speed of data transfer</td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>Data transfer with 10 Mbit</td>
<td></td>
</tr>
<tr>
<td>Ethernet right</td>
<td>Lights up green</td>
<td>Connection established</td>
<td>Link/activity LED = connection and data transfer</td>
</tr>
<tr>
<td></td>
<td>Flashes green</td>
<td>Data transfer active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>No connection</td>
<td></td>
</tr>
<tr>
<td>I/Os</td>
<td>Lights up green</td>
<td>24 V input</td>
<td>Inputs and outputs</td>
</tr>
<tr>
<td></td>
<td>Lights up yellow</td>
<td>24 V output</td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Sequence</td>
<td>Meaning</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>RS232-1/-2 TX</td>
<td>Lights up green</td>
<td>CECC sending data</td>
<td>Data transmission</td>
</tr>
<tr>
<td>RS232-1/-2 RX</td>
<td>Lights up green</td>
<td>CECC receiving data</td>
<td></td>
</tr>
<tr>
<td>Multiple interface A+</td>
<td>Flashes green</td>
<td>Encoder tics track A</td>
<td>LED flashing in time with the frequency of rotation. Encoder turning slowly.</td>
</tr>
<tr>
<td></td>
<td>Lights up green</td>
<td></td>
<td>Encoder turning quickly.</td>
</tr>
<tr>
<td></td>
<td>Flickers green</td>
<td>Transmitted/received data with RS422</td>
<td>Shows data transmission depending on the relevant interface</td>
</tr>
<tr>
<td>Multiple interface B+</td>
<td>Flashes green</td>
<td>Encoder tics track B</td>
<td>LED flashing in time with the frequency of rotation. Encoder turning slowly.</td>
</tr>
<tr>
<td></td>
<td>Lights up green</td>
<td></td>
<td>Encoder turning quickly.</td>
</tr>
<tr>
<td></td>
<td>Flickers green</td>
<td>Received data with RS422</td>
<td>Shows data transmission depending on the relevant interface</td>
</tr>
<tr>
<td>Multiple interface N+</td>
<td>Flashes green</td>
<td>Encoder tics zero track</td>
<td>LED flashing in time with the frequency of rotation. Encoder turning slowly.</td>
</tr>
<tr>
<td></td>
<td>Lights up green</td>
<td></td>
<td>Encoder turning quickly.</td>
</tr>
<tr>
<td>IO-Link L+</td>
<td>Lights up green</td>
<td>IO-Link master active</td>
<td>Status display</td>
</tr>
<tr>
<td></td>
<td>Does not light up</td>
<td>IO-Link master not ready for operation</td>
<td></td>
</tr>
<tr>
<td>IO-Link C/Q</td>
<td>Lights up green</td>
<td>Connection established</td>
<td>Link/activity LED = connection and data transfer</td>
</tr>
<tr>
<td></td>
<td>Lights up red</td>
<td>Data transfer inactive</td>
<td></td>
</tr>
</tbody>
</table>

Table: Status LED states
6 Technical appendix

6.1 Technical data

<table>
<thead>
<tr>
<th>Feature</th>
<th>CECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification</td>
<td>C-Tick</td>
</tr>
<tr>
<td>Operating voltage CECC-LK and CECC-D</td>
<td>19.2 ... 30 V DC</td>
</tr>
<tr>
<td>Operating voltage CECC-S</td>
<td>20.4 ... 30 V DC</td>
</tr>
<tr>
<td>Current consumption</td>
<td>100 mA nominal at 24 V DC</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 ... 55 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-25 ... 70 °C</td>
</tr>
<tr>
<td>Relative air humidity</td>
<td>95%, non-condensing</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP20</td>
</tr>
<tr>
<td>Protection class</td>
<td>III</td>
</tr>
<tr>
<td>Product weight</td>
<td>200 g</td>
</tr>
<tr>
<td>Resistance</td>
<td></td>
</tr>
<tr>
<td>– To vibration</td>
<td>As per EN 61131-2</td>
</tr>
<tr>
<td>– To shock</td>
<td>As per EN 61131-2</td>
</tr>
<tr>
<td>Electrical connection technology for I/O</td>
<td>Socket strip, grid 3.5 mm</td>
</tr>
<tr>
<td>Status displays</td>
<td>LED</td>
</tr>
<tr>
<td>CPU data</td>
<td>Processor 400 MHz</td>
</tr>
<tr>
<td>Processing time</td>
<td>Approx. 250 μs/1k instructions</td>
</tr>
<tr>
<td>Digital inputs</td>
<td></td>
</tr>
<tr>
<td>– Number</td>
<td>12</td>
</tr>
<tr>
<td>– Switching logic</td>
<td>Positive logic (PNP)</td>
</tr>
<tr>
<td>– Fast clock pulse inputs</td>
<td>2, each with max. 200 kHz</td>
</tr>
<tr>
<td>– Input signal delay</td>
<td>Typ. 3 ms</td>
</tr>
<tr>
<td>– Input voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>– Nominal value for TRUE</td>
<td>≥ 15 V DC</td>
</tr>
<tr>
<td>– Nominal value for FALSE</td>
<td>≤ 5 V DC</td>
</tr>
<tr>
<td>– Electrical isolation</td>
<td>Yes, via optocoupler</td>
</tr>
<tr>
<td>– Status display</td>
<td>LED</td>
</tr>
<tr>
<td>– Permissible length of connecting cable</td>
<td>30 m</td>
</tr>
<tr>
<td>Feature</td>
<td>CECC</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Digital outputs</td>
<td></td>
</tr>
<tr>
<td>- Number</td>
<td>8</td>
</tr>
<tr>
<td>- Switching logic</td>
<td>Positive logic (PNP)</td>
</tr>
<tr>
<td>- Contact</td>
<td>Transistor</td>
</tr>
<tr>
<td>- Output voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>- Output current</td>
<td>500 mA</td>
</tr>
<tr>
<td>- Electrical isolation</td>
<td>Yes, via optocoupler</td>
</tr>
<tr>
<td>- Switching frequency</td>
<td>Max. 1 kHz</td>
</tr>
<tr>
<td>- Short circuit proof</td>
<td>Yes</td>
</tr>
<tr>
<td>- Status display</td>
<td>LED</td>
</tr>
<tr>
<td>IO-Link (CECC-LK and CECC-S)</td>
<td></td>
</tr>
<tr>
<td>- Protocol</td>
<td>Device V 1.0, master V 1.1</td>
</tr>
<tr>
<td>- Connection technology</td>
<td>Cage Clamp connector</td>
</tr>
<tr>
<td></td>
<td>- Master: 5-pin</td>
</tr>
<tr>
<td></td>
<td>- Device: 3-pin</td>
</tr>
<tr>
<td>- Communication mode</td>
<td>Can be configured via software</td>
</tr>
<tr>
<td></td>
<td>- Master, 5-pin: SIO, COM1, COM2, COM3</td>
</tr>
<tr>
<td></td>
<td>- Device, 3-pin: COM1, COM2, COM3</td>
</tr>
<tr>
<td>- Permissible length of IO-Link cables</td>
<td>20 m</td>
</tr>
<tr>
<td>- Port type</td>
<td>Device: A</td>
</tr>
<tr>
<td></td>
<td>Master: B</td>
</tr>
<tr>
<td>- Number of ports</td>
<td>Device: 1</td>
</tr>
<tr>
<td></td>
<td>Master: 4 (CECC-LK)/1 (CECC-S)</td>
</tr>
<tr>
<td>- Master, output current</td>
<td>3.5 A/port</td>
</tr>
<tr>
<td>- Communication</td>
<td>C/Q LED green</td>
</tr>
<tr>
<td></td>
<td>C/Q LED red</td>
</tr>
<tr>
<td>- Ready status display</td>
<td>L+ LED green on</td>
</tr>
<tr>
<td></td>
<td>L+ LED green off</td>
</tr>
<tr>
<td>- Process data width OUT</td>
<td>Master parameterisable 2 - 32 bytes</td>
</tr>
<tr>
<td>- Process data width IN</td>
<td>Master parameterisable 2 - 32 bytes</td>
</tr>
<tr>
<td>- Memory</td>
<td>Master 2 kBytes per port</td>
</tr>
<tr>
<td>- Minimum cycle time</td>
<td>Device: 3.2 ms</td>
</tr>
<tr>
<td></td>
<td>Master: 5 ms</td>
</tr>
<tr>
<td>- Device ID</td>
<td>0x550000, 0x550001, 0x550002, 0x550003, 0x550004</td>
</tr>
<tr>
<td>Fieldbus interface</td>
<td></td>
</tr>
<tr>
<td>- Type</td>
<td>CAN bus</td>
</tr>
<tr>
<td>- Connection technology</td>
<td>Plug, Sub-D, 9-pin</td>
</tr>
<tr>
<td>- Transmission rate</td>
<td>10, 20, 50, 100, 125, 250, 500, 800, 1000 kbps</td>
</tr>
<tr>
<td></td>
<td>Can be set via software</td>
</tr>
<tr>
<td>- Electrical isolation</td>
<td>Yes</td>
</tr>
<tr>
<td>USB interface</td>
<td>USB 1.1</td>
</tr>
</tbody>
</table>
### Festo Controller CECC

<table>
<thead>
<tr>
<th>Feature</th>
<th>CECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td></td>
</tr>
<tr>
<td>– Connector plug</td>
<td>RJ45</td>
</tr>
<tr>
<td>– Number</td>
<td>1</td>
</tr>
<tr>
<td>– Data transmission speed</td>
<td>10/100 Mbit/s</td>
</tr>
<tr>
<td>– Supported protocols</td>
<td>TCP/IP, EasyIP, Modbus TCP</td>
</tr>
<tr>
<td>Programming software</td>
<td>CODESYS provided by Festo (pbF)</td>
</tr>
<tr>
<td>Programming language</td>
<td>To IEC 61131-3</td>
</tr>
<tr>
<td></td>
<td>SFC, IL, FCH, LDR, ST</td>
</tr>
<tr>
<td>CE symbol (see declaration of conformity)</td>
<td>To EU EMC Directive&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

1) The device is intended for use in industrial areas. Interference suppression measures may be required in residential areas.

2) The device is categorised in Zone A to EN 61131-2:2007.

Table: Technical data
7  Glossary

C

CANopen: CAN-based fieldbus protocol standardised as a European standard.

CODESYS pbF: CODESYS provided by Festo allows the configuration, commissioning and programming of different Festo components and devices. It is called "CODESYS pbF" for short in this online Help/manual.

Codesys target system ID: See target system ID.

D

DHCP: Dynamic Host Configuration Protocol; dynamic protocol for automatic assignment of IP addresses.

E

EasyIP: UDP-based protocol on port 995 for high-speed exchange of operands between controllers.

EDS file: Electronic data sheet; this file describes the functions and features of a CANopen device in standardised form (e.g. number of I/Os, number of diagnostic bytes, etc.).

Ethernet: Physical protocol and network for connecting various devices.

F

FB: Function block; in this document, "function block" is used as a general term for function module, function and program.

FFT: Festo Field Device Tool

Fieldbus node: Provides the connection to specific field buses. Transmits control signals to the connected modules and monitors their ability to function.

I

I/Os: Digital inputs and outputs.

IO-Link: IO-Link is a point-to-point connection for sensors and actuators. It can be used to automatically parameterise IO-Link devices (e.g. sensors), diagnose system states and transfer measured values.

IODD: File for configuring IO-Link devices.

L

Login/logout: Codesys with project is logged in/out.

M

Modbus TCP: Communication standard via TCP/IP (port 502) in automation technology.

N

Node ID: Serves to clearly identify a bus slave on the CANopen fieldbus.

O

OLE: Object Linking and Embedding.

OPC: OLE for Process Control; standardised software interface that provides access to process data.
**P**

**Package:** All of the configuration and expansion files that are required to make a specific controller (target system) usable for the Codesys programming environment are combined in a package.

**PLC:** Programmable logic controller.

**T**

**Target system ID:** Unique device type code. Projects can only be uploaded to controllers if the set device type matches.

**TCP:** Transmission Control Protocol; protocol for data transport and backup.

**TCP/IP:** Combination of the protocols TCP and IP, the most-widely used protocol in communication via Ethernet.

**U**

**UDP:** User Datagram Protocol; a minimal, connection-free network protocol that has a lower protocol overhead compared to TCP. This protocol has the advantage of a faster exchange of data. Correct transmission must be monitored (e.g. by a user program) due to the absence of feedback.

**User data:** Telegram data without protocol frame data. The length of the user data is defined in the configuration of the field bus slave.