Controller CECC
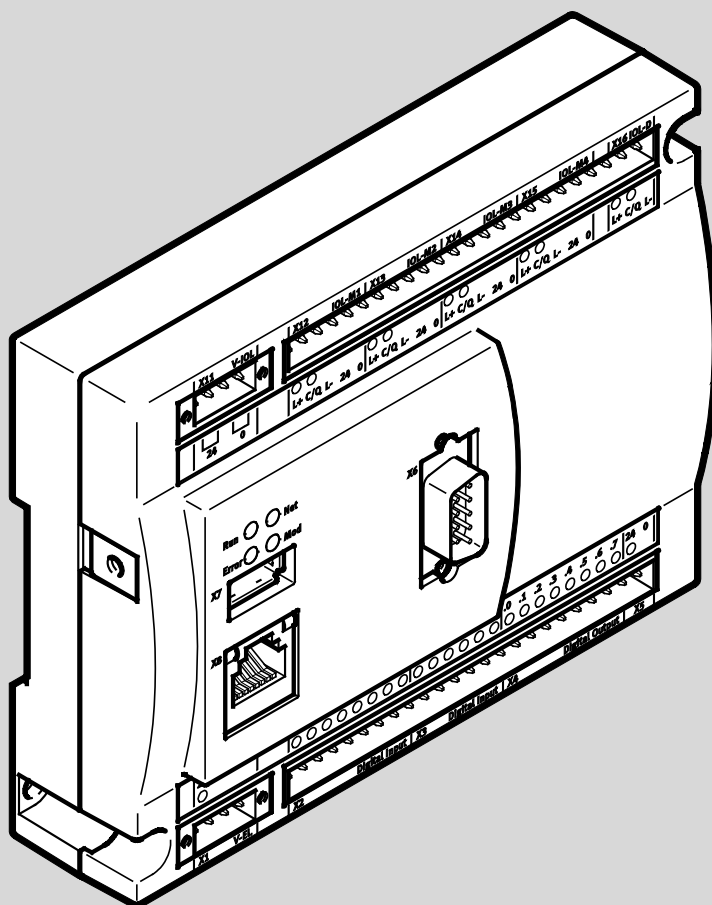
FESTO

Description

Controller CECC

8036062
en 1403a

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This product uses open–source software which is subject to the "GNU General Public License, Version 2". The licensing conditions of the GPL are located either in the product's engineering tool or at the following address:

– http://www.gnu.org/copyleft/gpl.html

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Internet: http://www.festo.com

E-Mail: service_international@festo.com

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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.

> **i** 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," "Dearchivate 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:

Title	Type	Description
Controller CECC	Brief description	Connection and display components, assembly, installation and technical data.
Festo_CECC_3.library	Online Help	Configuration, use and error diagnosis in function blocks.
Festo_CECC_IOLink_3.library		
Festo_EasyIP_3.library		
Festo_Motion_3.library		
Festo_CVE_3.library		
Festo_CameraControl_3.library		
Festo_SerialComEx_3.library		
Festo Field Device Tool	Online Help	Servicing and commissioning of Ethernet-based Festo devices.

2 System overview

2.1 Controller CECC

Variant	Features	Codesys target system ID[1]
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:

RETAIN variable	PERSISTENT RETAIN variable
7,120 bytes	0 bytes (only if there is no PERSISTENT variable list)
0 bytes	7,076 Byte (44 bytes for identification)
300 bytes	7,076 - 300 bytes = 6,776 bytes (44 bytes for identification)
x bytes	7,076 - x bytes (44 bytes for identification)

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

Memory	CECC-LK	CECC-D	CECC-S
Global memory and constants (RAM)	16 MB	16 MB	44 MB
Available flash memory (boot project, project archive, web visualisation, application data)	2 MB	2 MB	16 MB
Flag memory	8,192 bytes	8,192 bytes	8,192 bytes
Input	8,192 bytes	8,192 bytes	8,192 bytes
Output	8,192 bytes	8,192 bytes	8,192 bytes

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.

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

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.
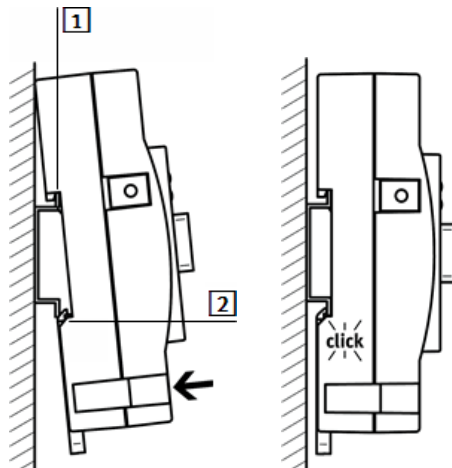
1 Mounting clip

2 Spring-loaded mounting clip

Figure: Mounting on an H-rail

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.
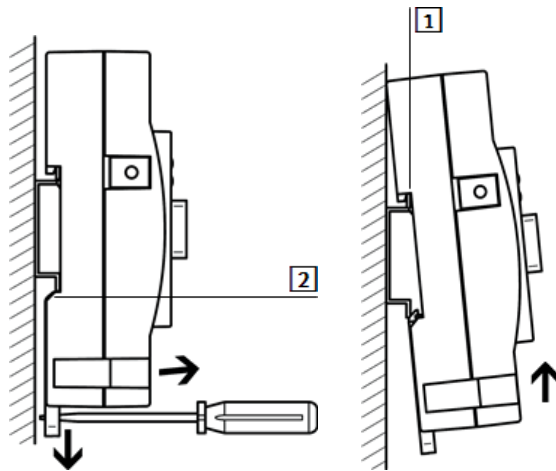
Figure: Removal from an H-rail

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.
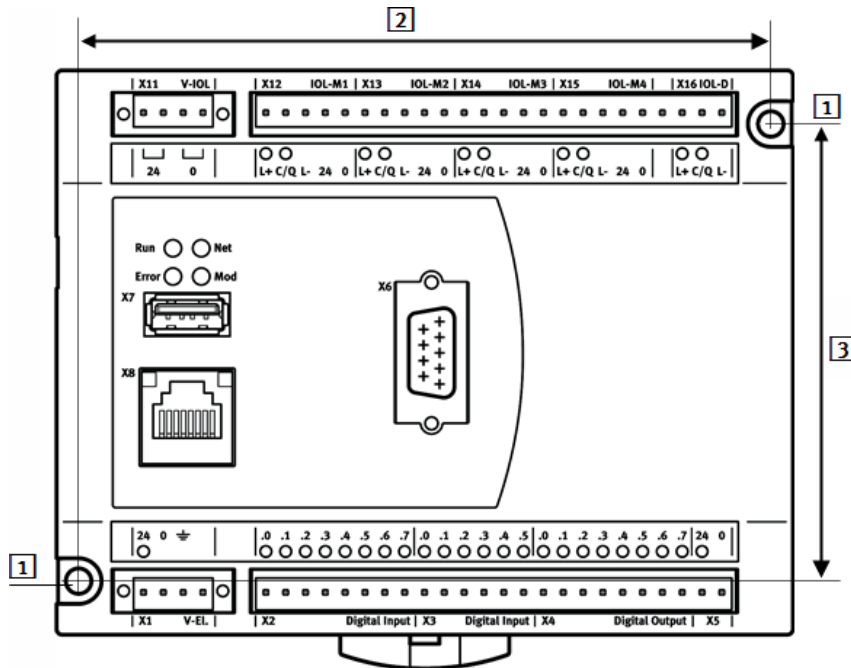
|1| Mounting holes Ø 4.5 mm

|2| Horizontal distance between the mounting holes: 122.2 mm

|3| Vertical distance between the mounting holes: 81.0 mm

Figure: Holes on the CECC for wall mounting

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

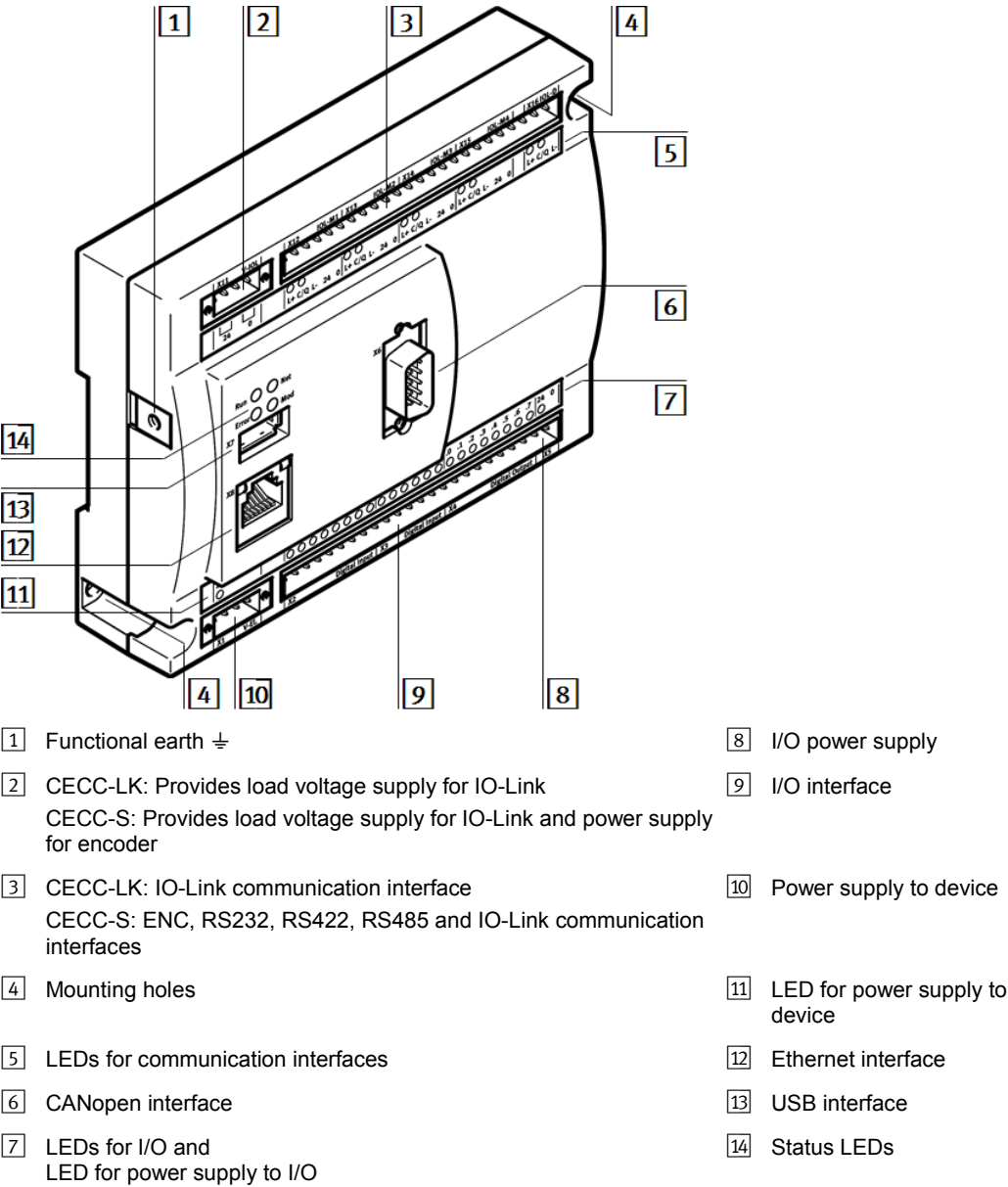| №		№	
1	Functional earth ⏚	8	I/O power supply
2	CECC-LK: Provides load voltage supply for IO-Link CECC-S: Provides load voltage supply for IO-Link and power supply for encoder	9	I/O interface
3	CECC-LK: IO-Link communication interface CECC-S: ENC, RS232, RS422, RS485 and IO-Link communication interfaces	10	Power supply to device
4	Mounting holes	11	LED for power supply to device
5	LEDs for communication interfaces	12	Ethernet interface
6	CANopen interface	13	USB interface
7	LEDs for I/O and LED for power supply to I/O	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.

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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).
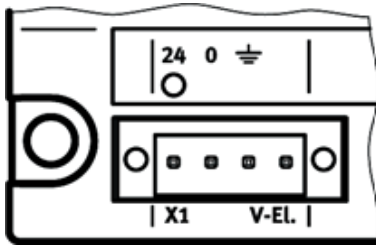

Figure: Power supply to the CECC

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:
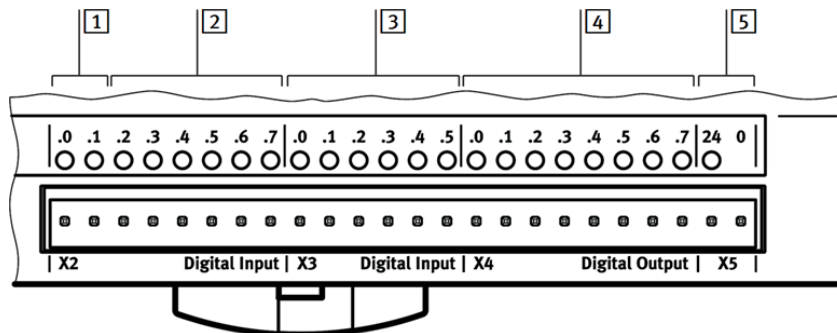
– I/O interface: X5 (➔ section I/O interface)

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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)

[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.

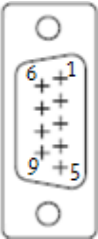The CANopen interface is designed as a 9-pin Sub-D plug.

CAN bus plug	Pin	Signal	Comment
	1	n.c.	Not connected
	2	CAN_L [1]	CAN Low
	3	CAN_GND	CAN Ground
	4	n.c.	Not connected
	5	CAN_SHLD	Connection to functional earth
	6	CAN_GND	CAN Ground (optional)
	7	CAN_H [1]	CAN High
	8	n.c.	Not connected
	9	n.c.	Not connected
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.

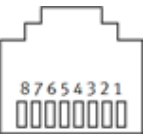The Ethernet interface is designed as an RJ45 socket.

Socket	Pin	Signal	Comment
87654321	1	TD+	Transmitted data+
	2	TD–	Transmitted data–
	3	RD+	Received data+
	4	n.c.	Not connected
	5	n.c.	Not connected
	6	RD–	Received data–
	7	n.c.	Not connected
	8	n.c.	Not connected
	Housing	–	Screen

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

Protocol	Comment
EasyIP	Communication with controllers via EasyIP (port 995)
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.
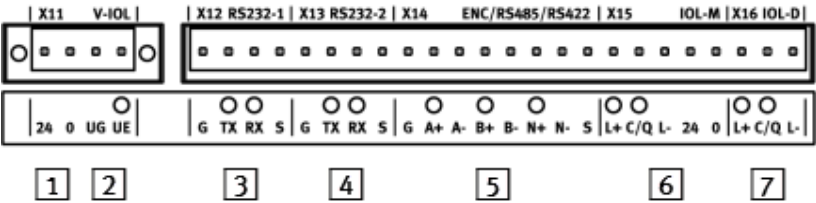
| 3 | Serial interface RS232-1 | X12 |
| 4 | Serial interface RS232-2 | X13 |

Figure: CECC-S, top manifold rail with RS232 interfaces

Pin	Signal	Comment
X12 ... X13.1	G	Data reference potential
X12 ... X13.2	TX	Transmitted data
X12 ... X13.3	RX	Received data
X12 ... X13.4	S	Screen, connection to functional earth

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
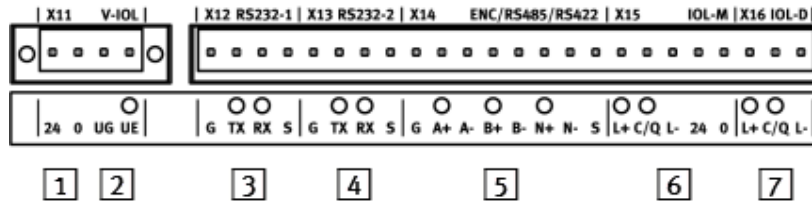
| 2 | UG/UE power supply for external encoder (5 V, max. 100 mA) | X11 |
| 5 | Multiple interface ENC/RS422/RS485 | X14 |

Figure: CECC-S, top manifold rail with multiple interface

➜ **Note**
Simultaneous use of these communication interfaces is **not** possible.

- Configure and use the signals from one of the three interfaces only.

Pin	Signal	ENC	RS422	RS485
X14.1	G	Ground		
X14.2	A+	Track A+	Transmitted data+	Transmitted/received data+ [1]
X14.3	A–	Track A–	Transmitted data–	Transmitted/received data– [1]
X14.4	B+	Track B+	Received data+	n.c.
X14.5	B–	Track B–	Received data–	n.c.
X14.6	N+	Zero track N+	n.c.	n.c.
X14.7	N–	Zero track N–	n.c.	n.c.
X14.8	S	Screen, connection to functional earth		
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.

Number of IO-Link connections	IO-Link master	IO-Link device
CECC-LK	4	1
CECC-S	1	1

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.
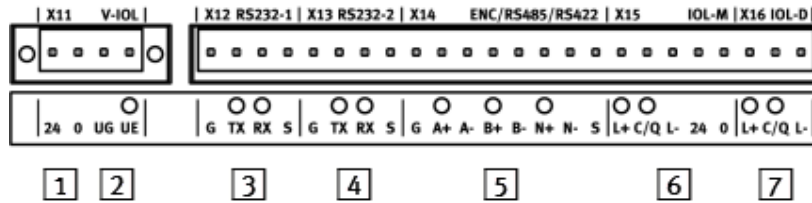
3.5.8 IO-Link on the CECC-LK
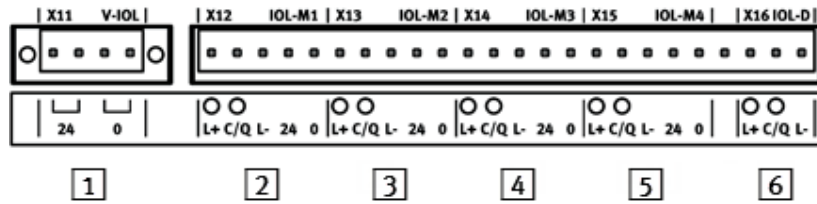
1	IO-Link load voltage supply X11
2 ... 5	IO-Link master ports for connecting IO-Link devices X12 ... X15
6	IO-Link device port for connecting the CECC-LK as an IO-Link device X16

Figure: CECC-LK, top manifold rail with IO-Link interfaces

IO-Link	Pin	Signal	Comment
1	X11.1	24	Connection for load voltage supply for IO-Link master ports[1]: UA+
	X11.2		
	X11.3	0	Connection for load voltage supply for IO-Link master ports[1]: UA– (GND)
	X11.4		
2 ... 5	X12...15.1	L+	24 V
	X12...15.2	C/Q	IO-Link communication signal
	X12...15.3	L–	0 V
	X12...15.4	24	UA+
	X12...15.5	0	UA–
6	X16.1	L+	24 V
	X16.2	C/Q	IO-Link communication signal
	X16.3	L–	0 V
1) Port class B			

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

3.5.9 IO-Link on the CECC-S

| 1 | IO-Link load voltage supply X11 |

| 6 | IO-Link master port for connecting an IO-Link device X15 |

| 7 | IO-Link device port for connecting the CECC-S as an IO-Link device X16 |

Figure: CECC-S, top manifold rail with IO-Link interfaces

IO-Link	Pin	Signal	Comment
1	X11.1	24	Connection for load voltage supply for IO-Link master ports[1]: UA+
	X11.2	0	Connection for load voltage supply for IO-Link master ports[1]: UA– (GND)
	X11.3	UG	Connection for encoder (GND) ➔ section Multiple interface
	X11.4	UE	Connection for encoder (5 V)
6	X15.1	L+	24 V
	X15.2	C/Q	IO-Link communication signal
	X15.3	L–	0 V
	X15.4	24	UA+
	X15.5	0	UA–
7	X16.1	L+	24 V
	X16.2	C/Q	IO-Link communication signal
	X16.3	L–	0 V
1) Port class B			

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

3.6 Operator unit CDPX

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

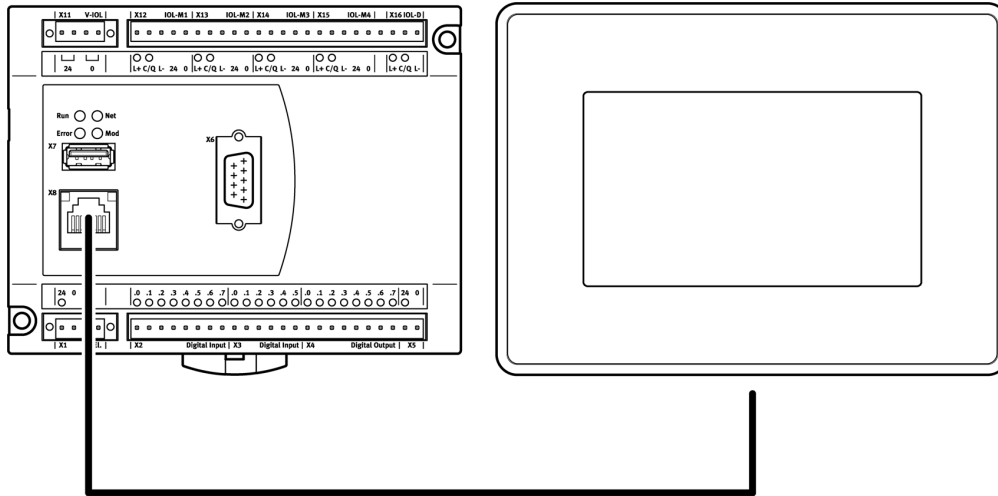- Note the accompanying user documentation when installing the device.

Figure: CECC with operator unit CDPX

- 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

i 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".
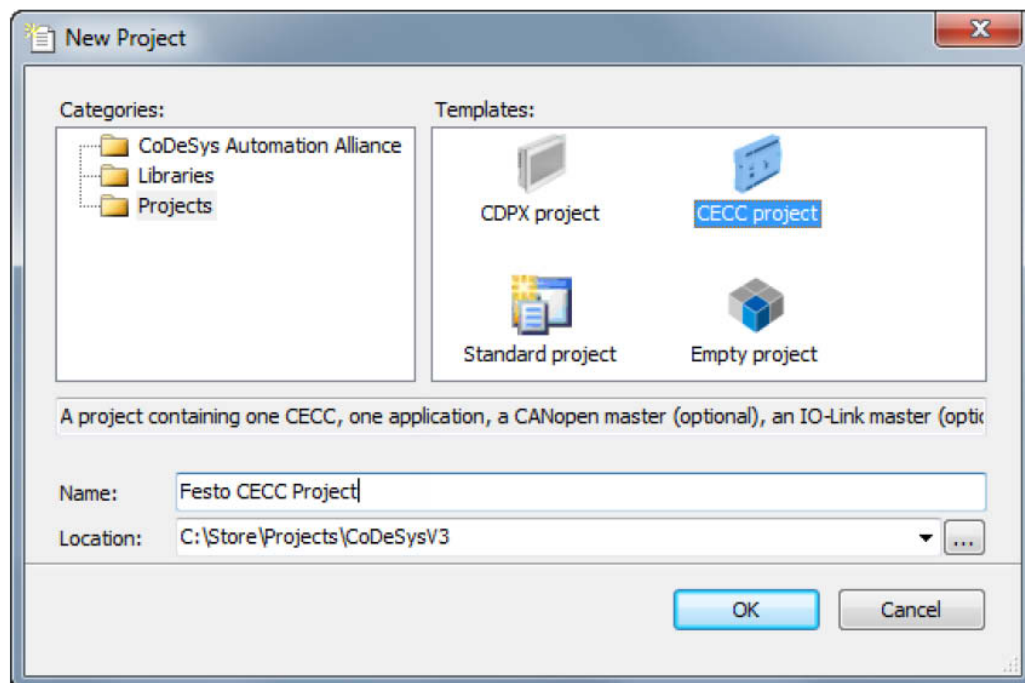

Figure: "New Project" dialog

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.
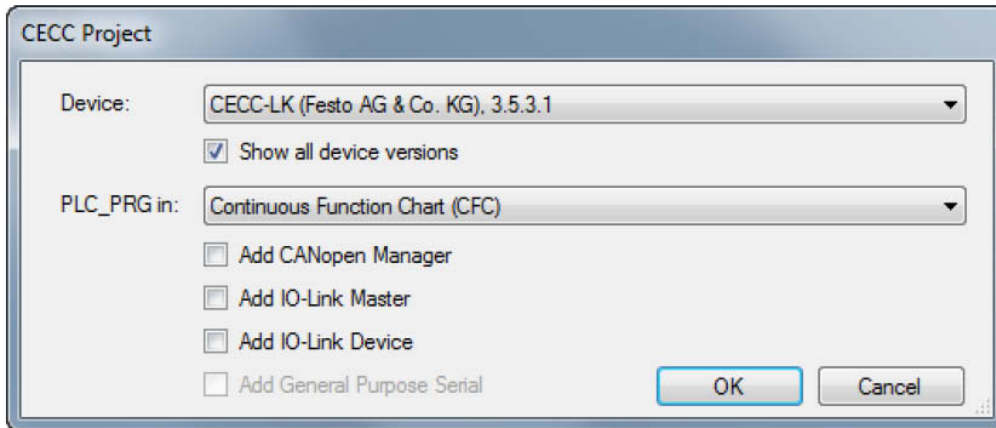

Figure: "New Project" dialog – selecting the device

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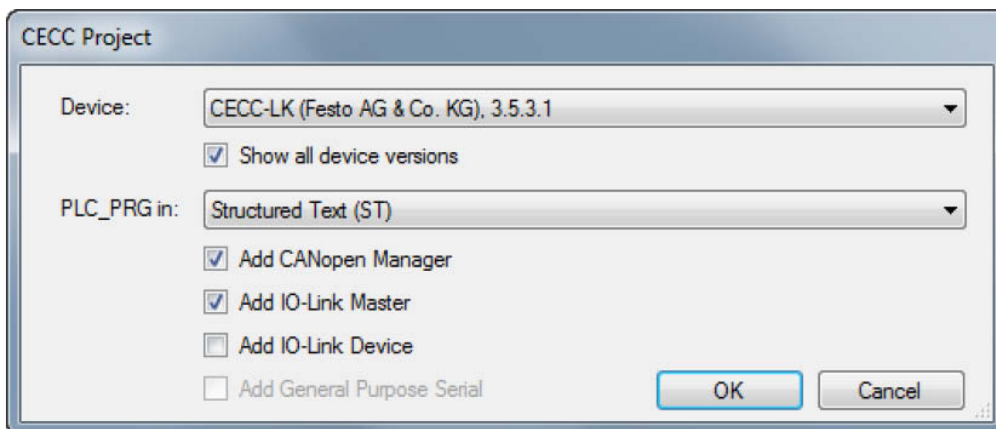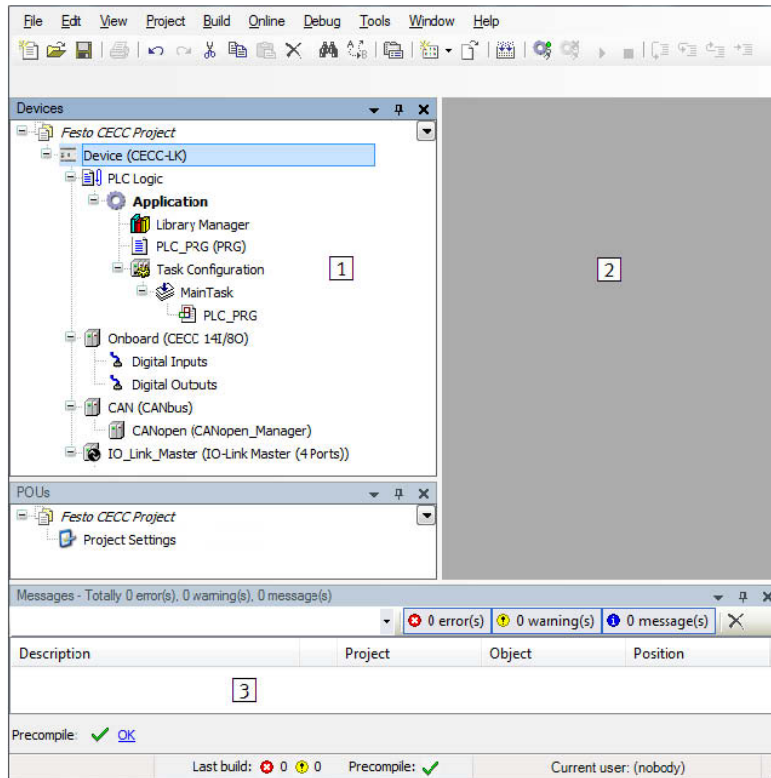
3.   Select the relevant interfaces.

Figure: "New Project" dialog – selecting the interfaces

Options not supported by the respective device are inactive (shown in grey) and cannot be selected.

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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:
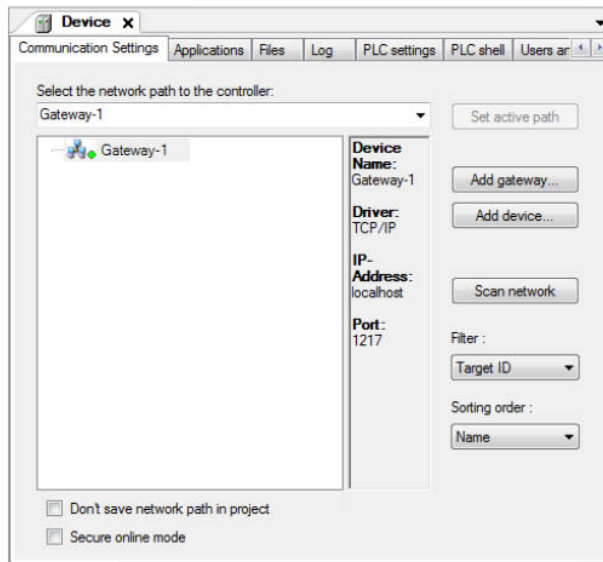

Figure: "Device" tab for CECC-...

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.
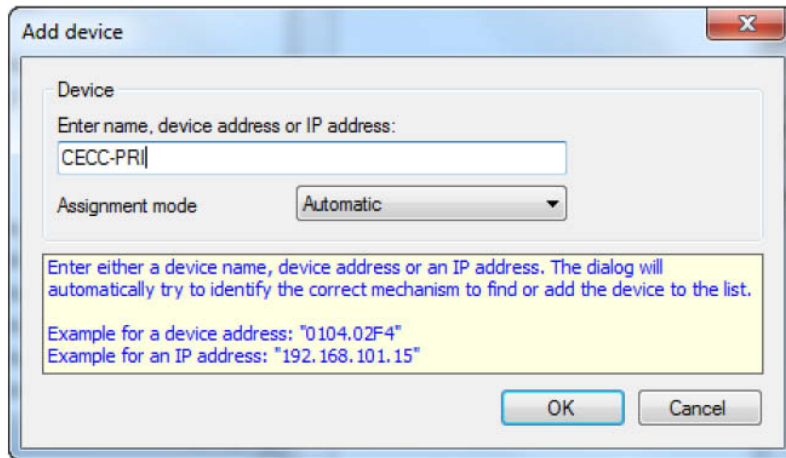2. Click the "Add device..." button.

Figure: "Add device" dialog

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.
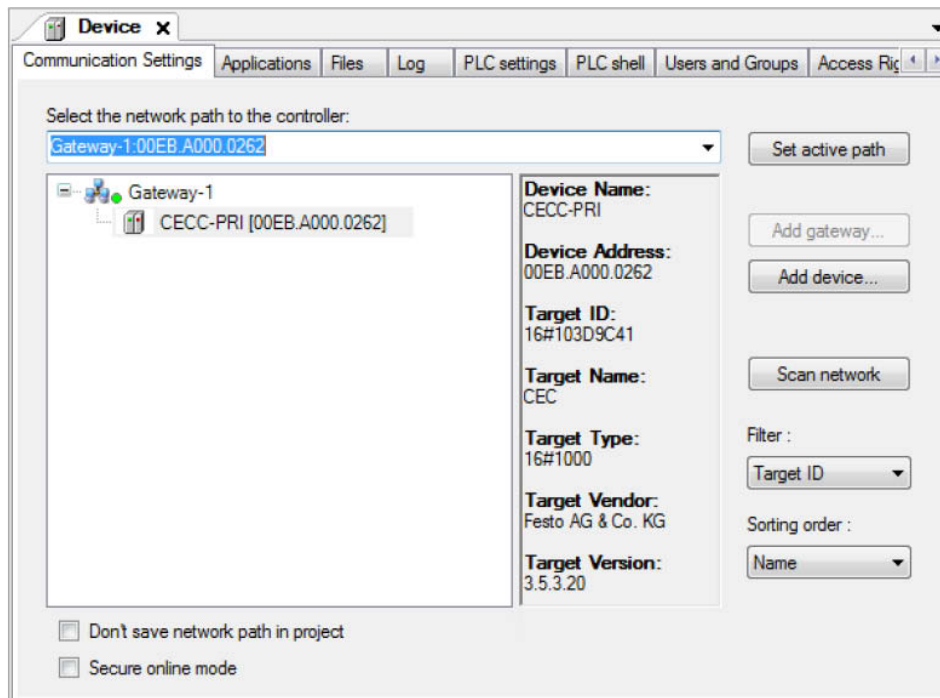

Figure: Local gateway with devices

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.
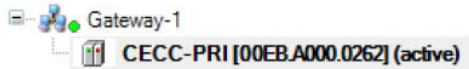

Figure: Activated device

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.
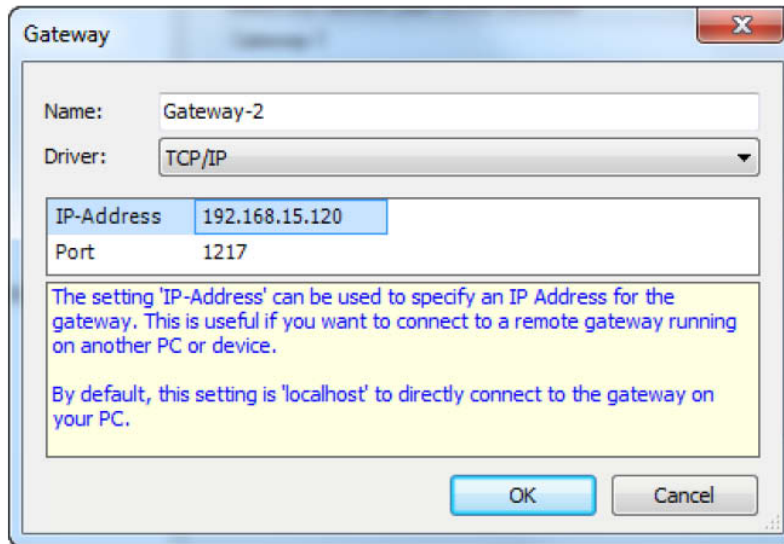   The "Gateway" dialog opens.

Figure: Gateway dialog

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.
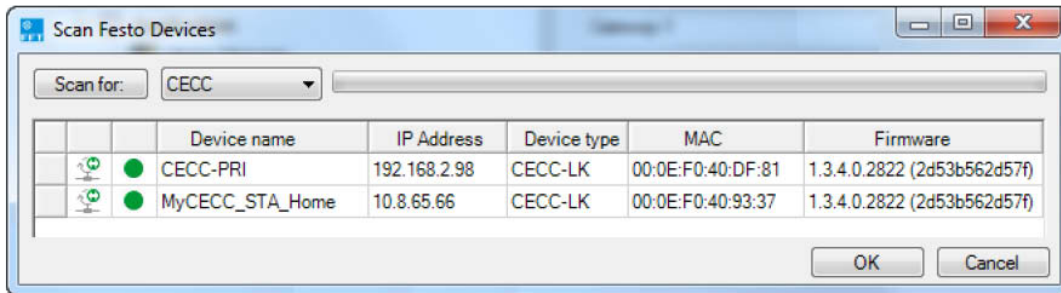2. Click the menu command [Online] [Scan for].

Figure: "Scan Festo Devices" scan program

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
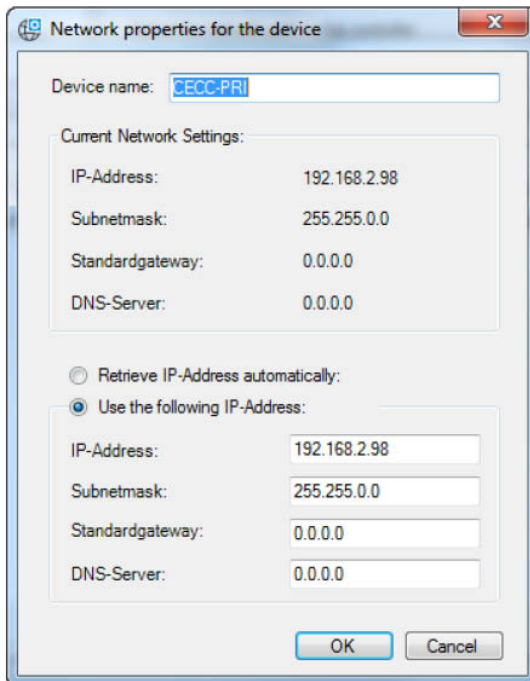   – context menu [Network].

Figure: "Network properties for the device" dialog

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 pbF device window.
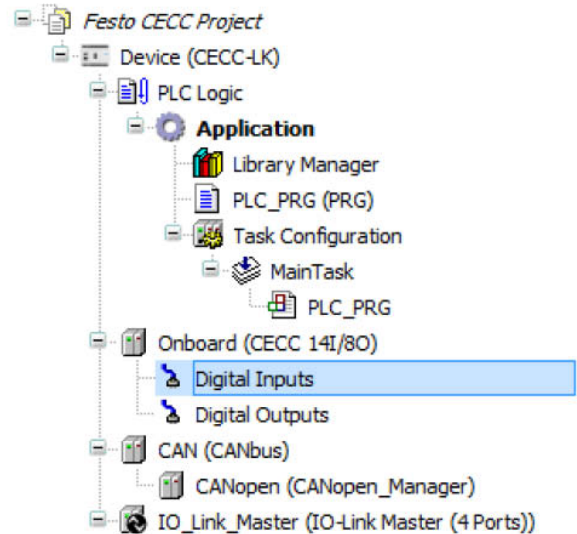

Figure: Device window - Onboard I/O interface

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.
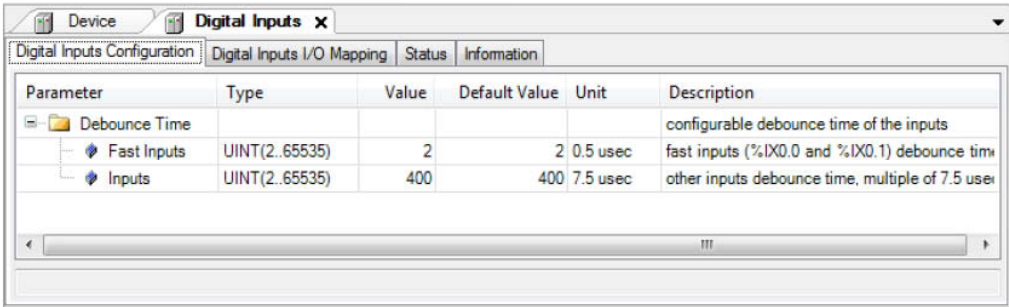

Figure: Digital inputs I/O configuration

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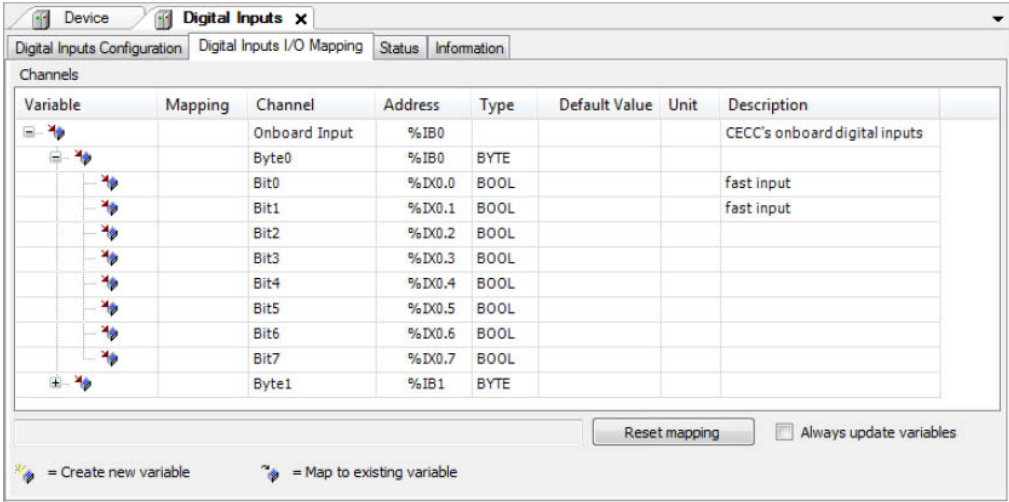

Figure: Digital inputs I/O mapping

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.
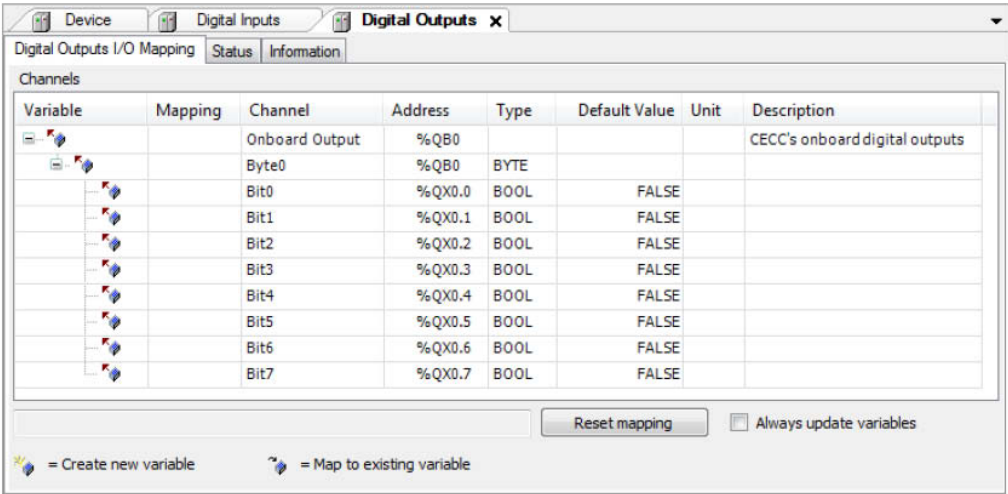

Figure: Digital outputs I/O mapping

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.
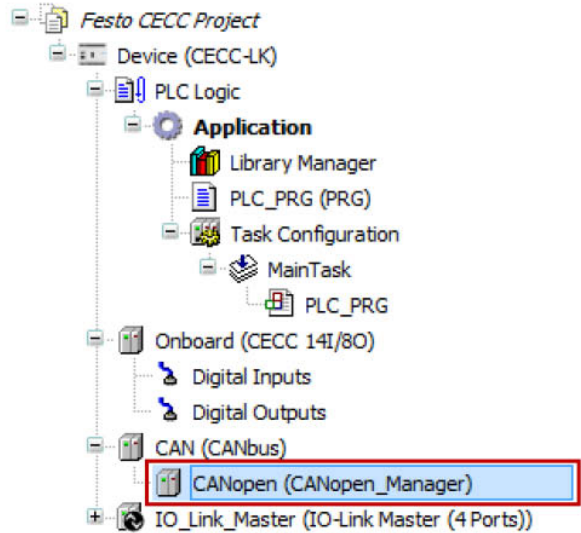

Figure: Device window - selecting "CANbus - CANopen_Manager"

2. Open the "Add Device" dialog
   – menu command [Project] [Add Device] or
   – context menu [Add Device].
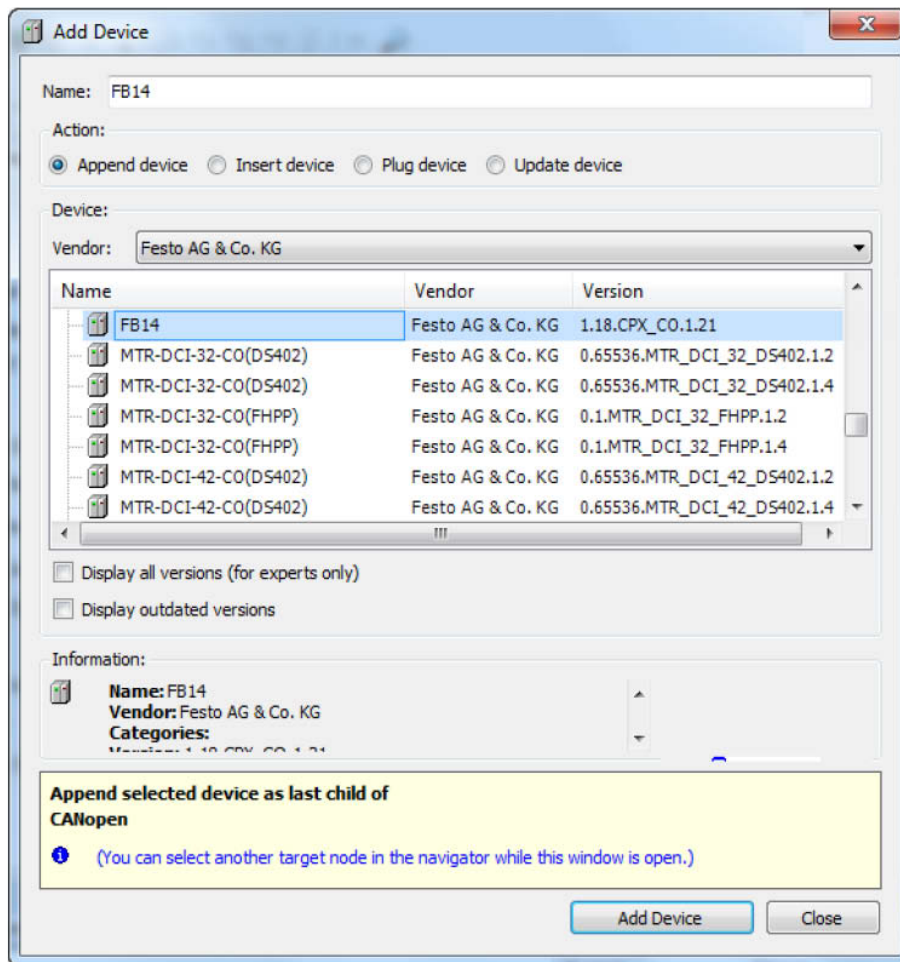

Figure: "Add Device" dialog

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.
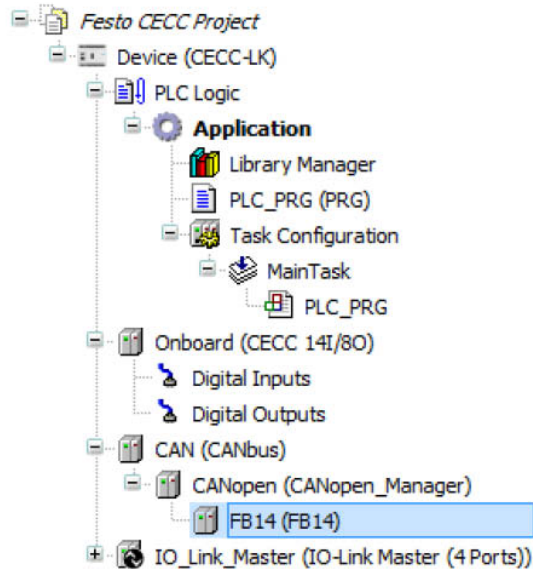
Figure: Device window - selecting "FB14"

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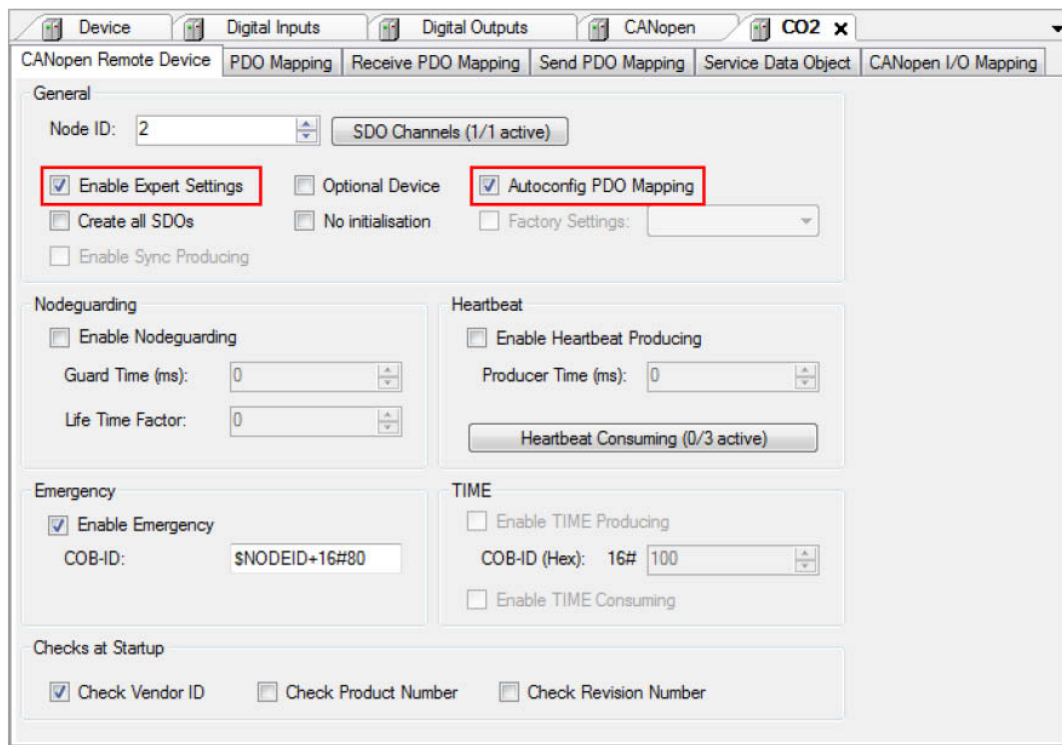
Figure: Editing window with CANopen slave CO2

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

    > **i**   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.

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The PDO mapping can be found in the sub-tab of the same name.
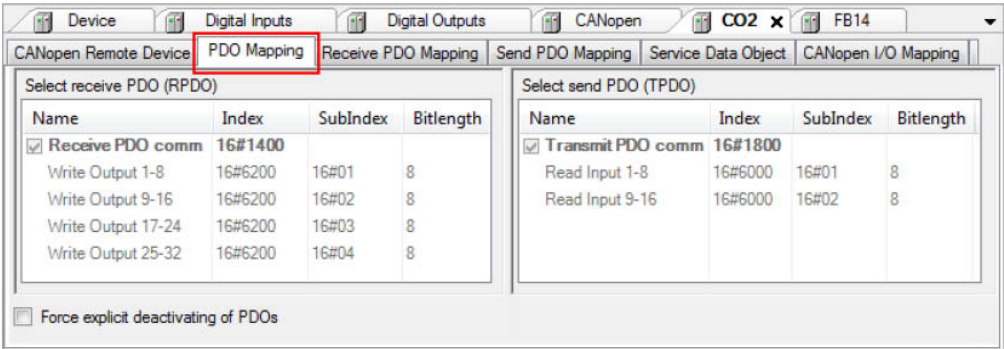
Figure: Editing window with CANopen slave CO2

4.5.2 Integrating 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.

CPV terminal	Comment
CPV basic unit	Local I/Os (valves)
CP input module	Optional CP input module for extending a CPV terminal
CPV/CPA valve terminal / CP output module	Optional valve terminal or CP output module for extending a CPV terminal

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
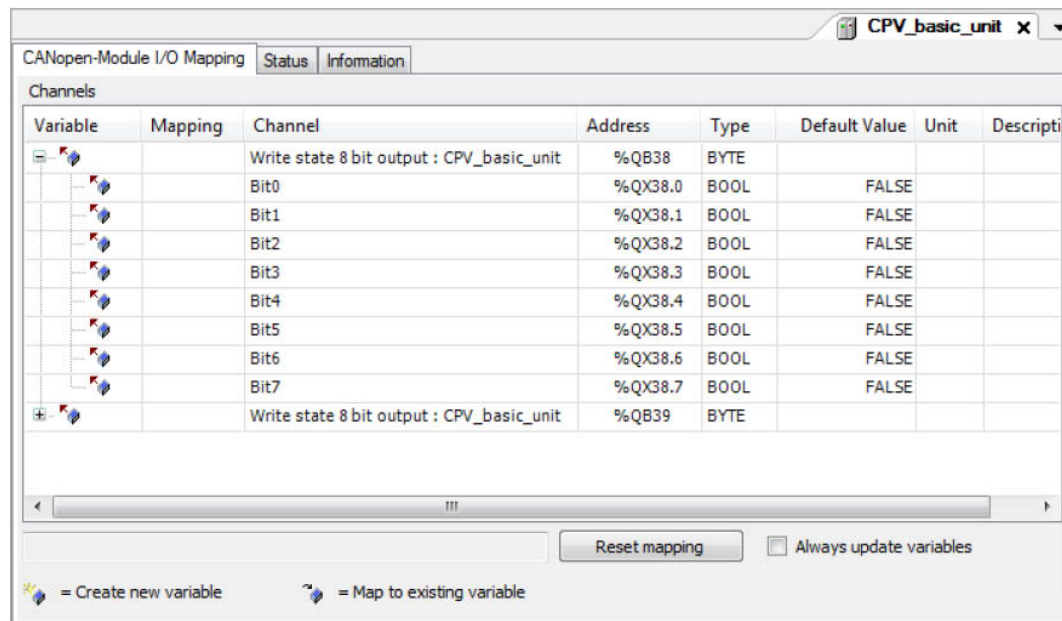
4.6   Configuring RS232 interfaces (CECC-S)

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.
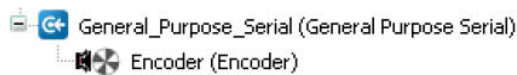5.   Select the device from the table.

General_Purpose_Serial (General Purpose Serial)
    Encoder (Encoder)

Figure: Integrating an encoder

4.7.2   Parameterisation

Parameter	Type	Value	Default Value	Unit	Description
Encoder settings					
Encoder type	Enumeration of BYTE	Encoder 90° phase single eval.	Encoder 90° phase single eval.		
Debounce time AB0	DWORD(0..900000)	30	30	nsec	Multiple of 15ns. (15,
Polarity Channel A	Enumeration of BYTE	Not inverted	Not inverted		
Polarity Channel B	Enumeration of BYTE	Not inverted	Not inverted		
Polarity Channel N	Enumeration of BYTE	Not inverted	Not inverted		
Upper limit	DINT	2147483647	2147483647		
Lower limit	DINT	-2147483648	-2147483648		
Overflow behaviour	Enumeration of BYTE	Wrap around	Wrap around		
Comparator settings					
Comparator to output	Enumeration of BYTE	Count = lower comp value	Count = lower comp value		
Pulse lengthening	DWORD(0..8000000)	0	0	usec	
Hysteresis	BYTE	0	0		
Digital output	Enumeration of BYTE	No digital output	No digital output		
Digital output polarity	Enumeration of BYTE	Not inverted	Not inverted		
Latch settings					
Latch function	Enumeration of BYTE	Latch function switched off	Latch function switched off		
Latch input polarity	Enumeration of BYTE	Not inverted	Not inverted		
Reference mode settings					
Reference mode	Enumeration of BYTE	Immediate	Immediate		
Reference input polarity	Enumeration of BYTE	Not inverted	Not inverted		

Figure: Parameterising an encoder

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 AB0	– 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, Channel B, Channel N	– Not inverted – Inverted	Setting for the polarity for the input signal of the respective channel.
Upper limit	– -2^{31} to $2^{31}-1$	Setting for the minumum and maximum value for the encoder position.
Lower limit	– -2^{31} to $2^{31}-1$	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.

Parameter	Setting	Comment
Comparator to output	– Condition for the signal curve at the digital output	The output set under the "Digital Output" parameter is used. Possible signal curves: ➔ Figure: Digital output as a function of the "Comparator to output" parameter ③ - ⑧.
Pulse lengthening	– Setting in µs	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 "Comparator to output" parameter ⑨.
Hysteresis	– Between 0 and 255 increments	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 "Hysteresis" parameter.
Digital output	– No digital output – Number of the digital output	Defines a digital output that is switched by the comparator.
Digital output polarity	– Not inverted – Inverted	Setting for the output signal polarity.
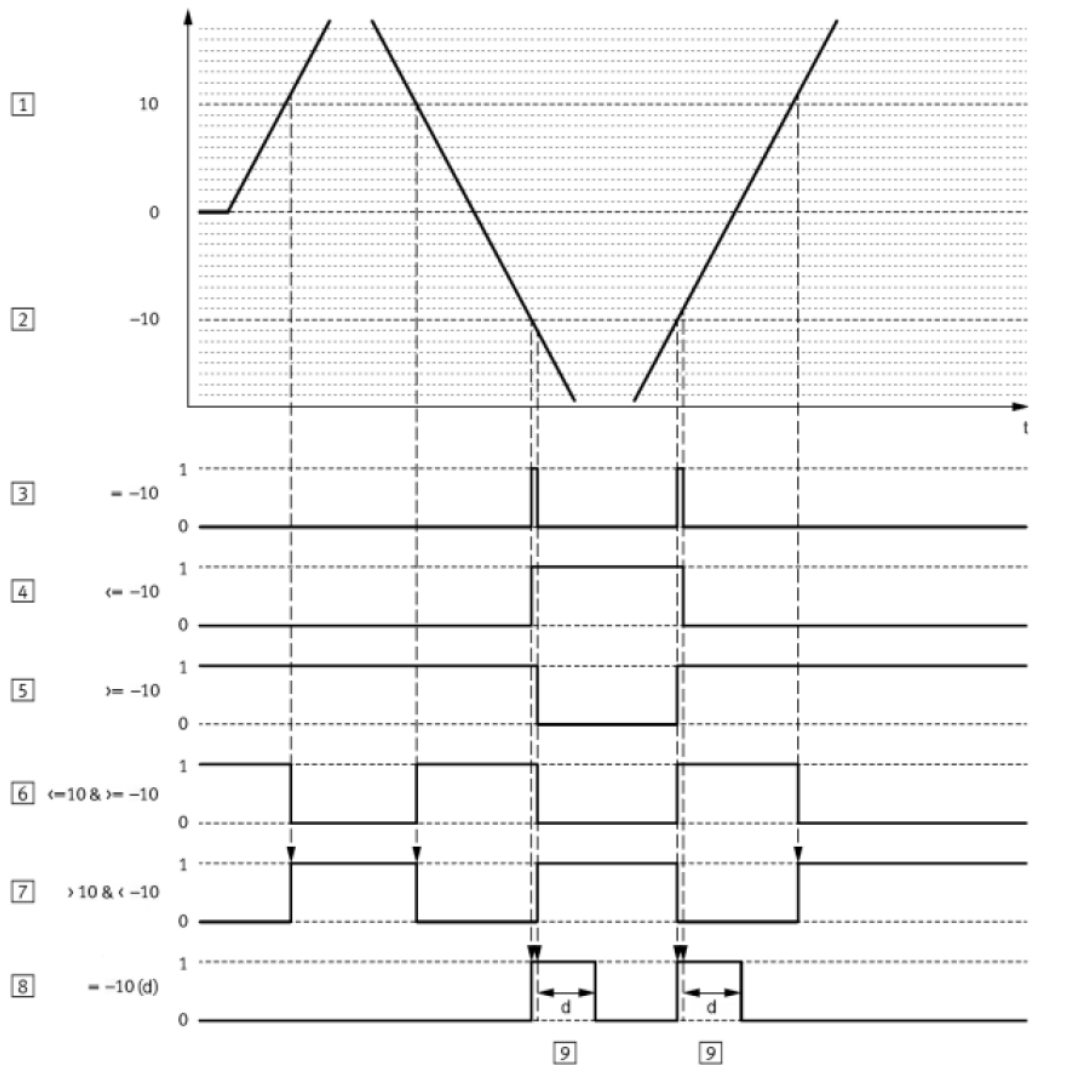
1	Upper compare value = 10
2	Lower compare value = -10
3	Signal curve for "counter value = lower compare value"
4	Signal curve for "counter value <= lower compare value"
5	Signal curve for "counter value >= lower compare value"
6	Signal curve for "Counter value within compare values"
7	Signal curve for "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)
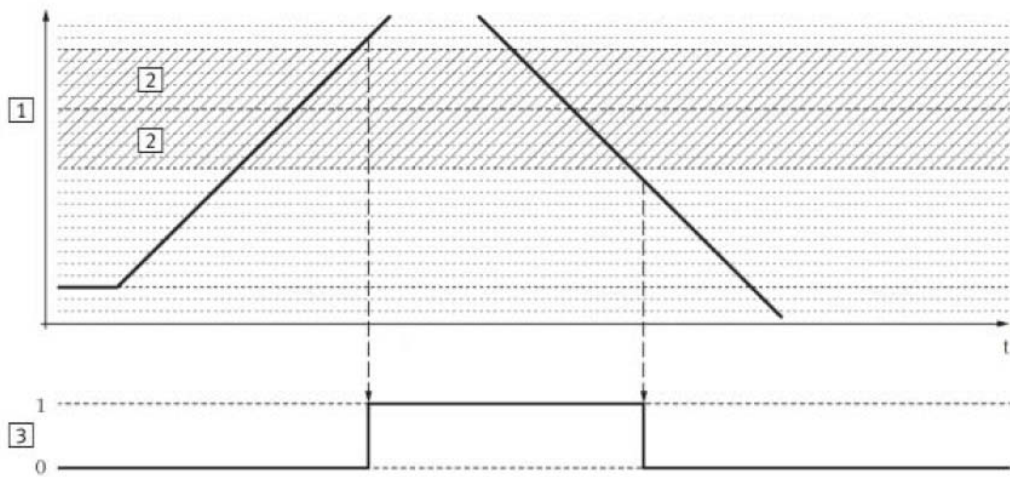
|1| Compare value |3| Signal curve at the digital output

|2| Hysteresis

Figure: Digital output as a function of the "Hysteresis" parameter

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).

Parameter	Setting	Comment
Latch function	– Latch function switched off	Defines the condition relating to whether and when the current encoder value is written to the buffer memory.
	– Latch by rising edge	
	– Latch by rising and falling edge	
Latch input polarity	– Not inverted – Inverted	Polarity setting for the latch input.

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).

Parameter	Setting	Comment
Reference mode	– switched off	Defines the condition for whether and when referencing of the encoder takes place. Immediate: The current position value is used as the new reference point. Rising edge: For exact referencing, the rising edge at the digital input X2.2 (➔ I/O interface) is used.
	– Immediate	
	– Rising edge	
	– Rising edge + pos. direction	
	– Rising edge + neg. direction	
	– Rising edge + pos. direction & N	
	– Rising edge + neg. direction & N	
Reference input polarity	– Not inverted – Inverted	Polarity setting for the reference input.

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.
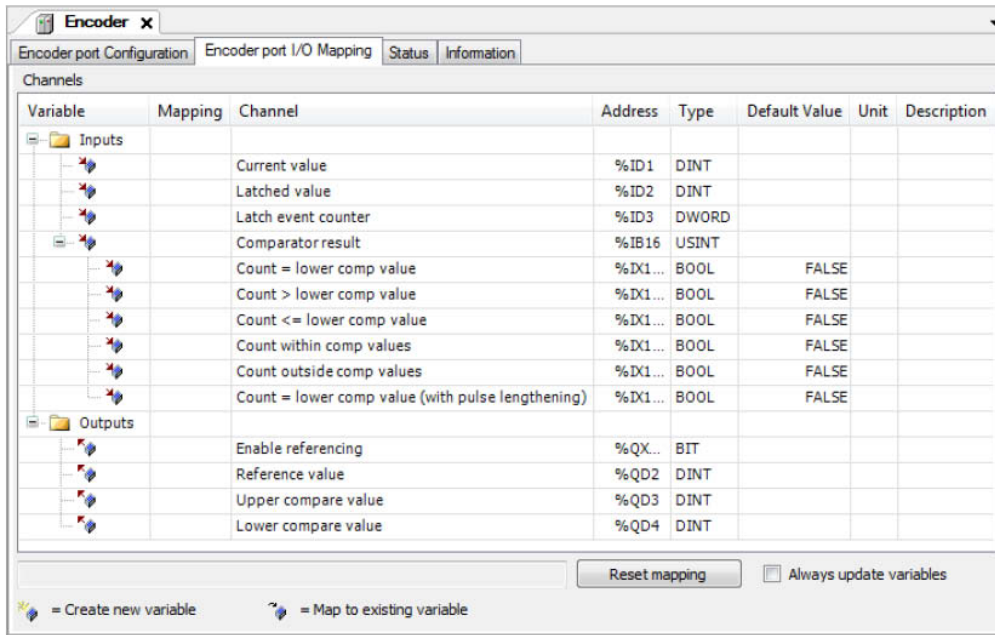

Figure: Encoder port I/O mapping

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

4.7.4 Sample program

```
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.
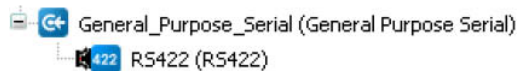5.   Select the interface from the table.

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.
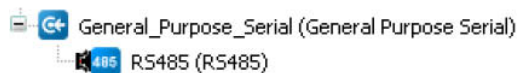5.   Select the interface from the table.

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.
> * Festo device: Download the IODD file from the Festo Support Portal (www.festo.com ➔ Support).
> * Third-party device: Request the IODD file from the respective vendor.

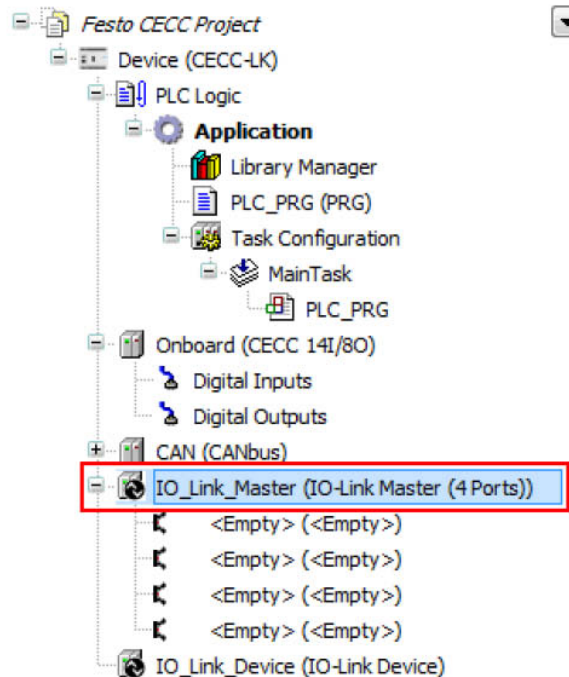1. Highlight the "IO-Link Master" branch in the CODESYS V3 pbF device window.

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)
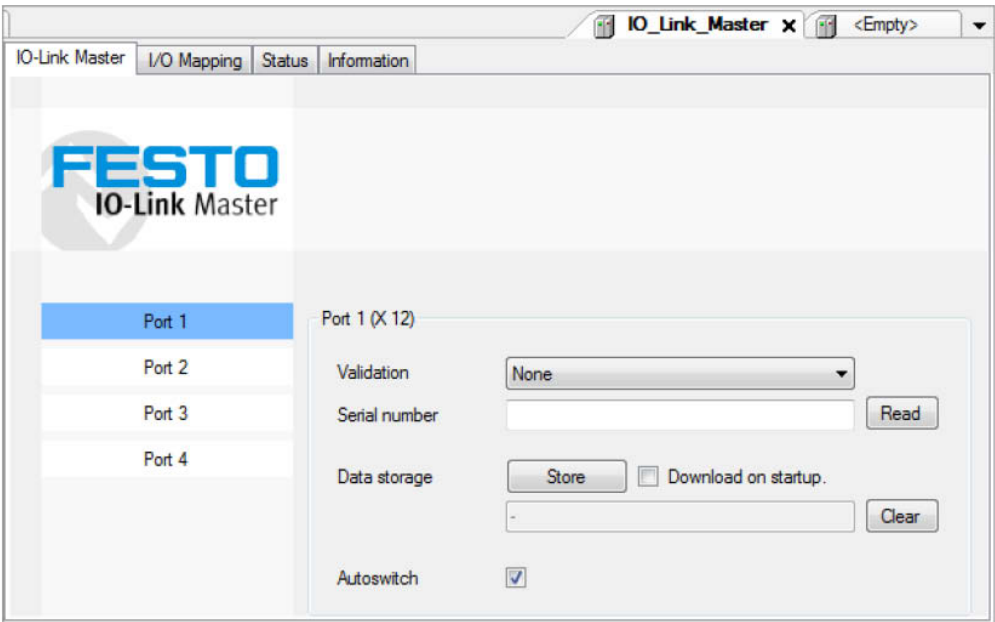– 1 IO-Link master port (CECC-S)

Figure: IO-Link master editing window (using the example of the CECC-LK)

The sub-tabs contain the following information and setting options:

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

- 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.
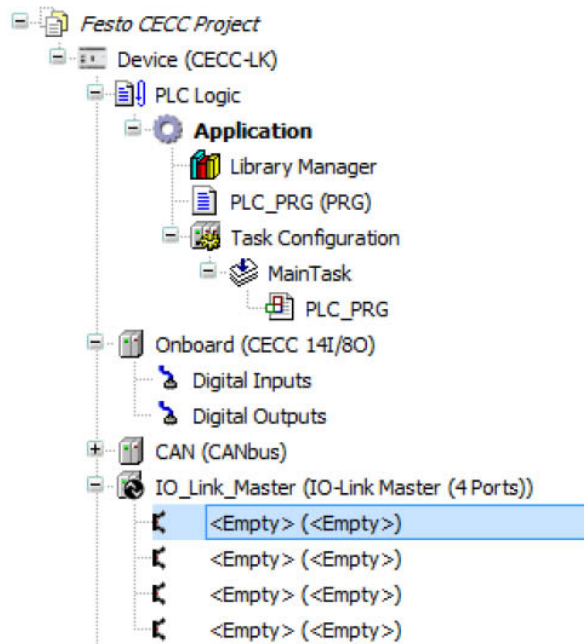
Figure: Device window - selecting "Placeholder"

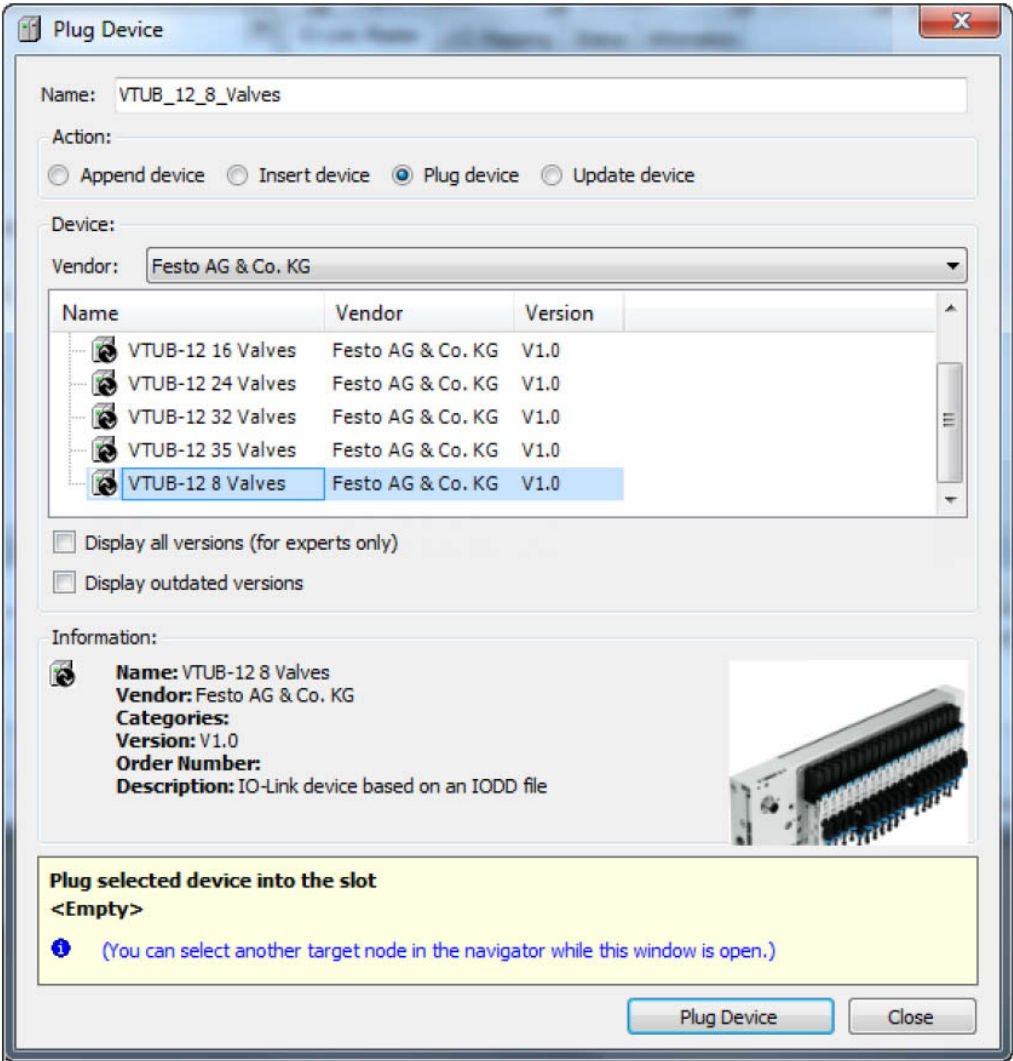2. Open the context menu (right mouse button) and open the "Plug Device" dialog.

Figure: "Plug Device" dialog

Actions in the "Plug Device" dialog

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

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.

> **i** 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
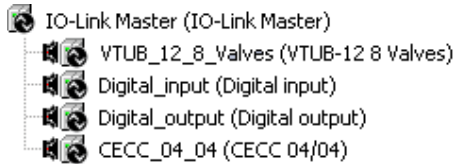> - Select "Digital_Output" for an actuator

IO-Link Master (IO-Link Master)
 VTUB_12_8_Valves (VTUB-12 8 Valves)
 Digital_input (Digital input)
 Digital_output (Digital output)
 CECC_04_04 (CECC 04/04)

Figure: Example of the CECC-LK with 4 plugged IO-Link master ports

> **i** 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.

i 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").

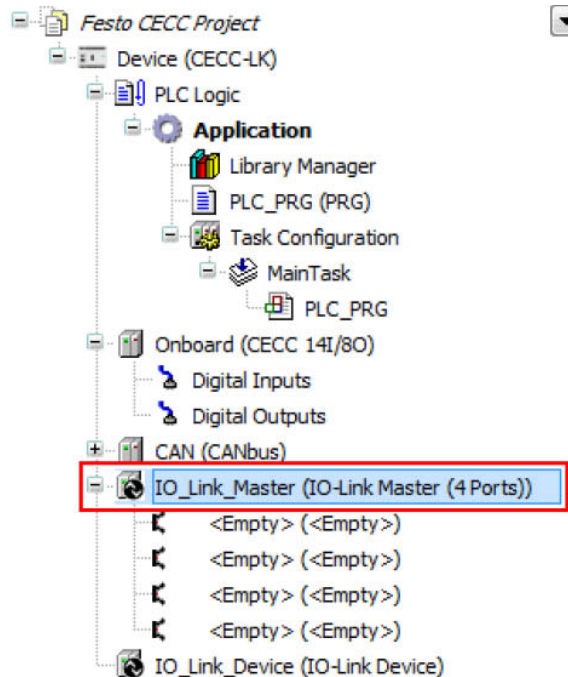1. Highlight the "IO-Link Master" branch in the CODESYS V3 pbF device window.

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.
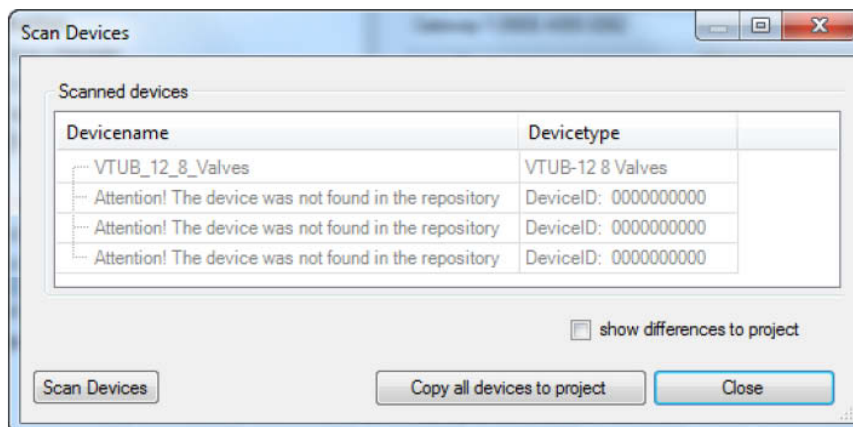

Figure: "Scan Devices" at the IO-Link master ports

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

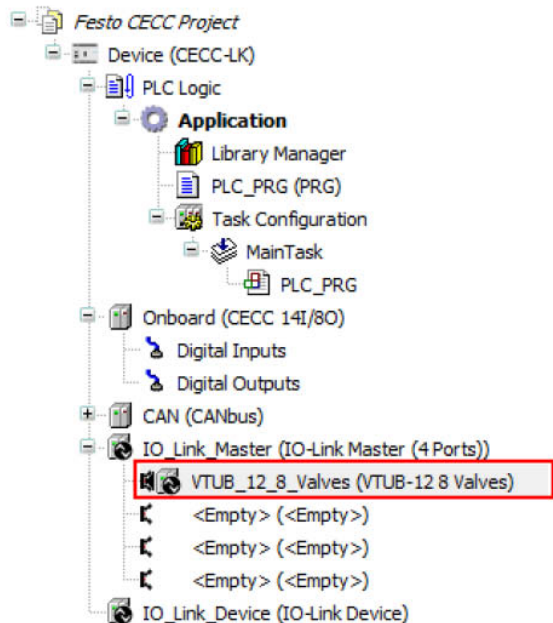1. Highlight a plugged device in the "IO-Link Master" branch in the device window (here: VTUB-12 8 Valves).

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

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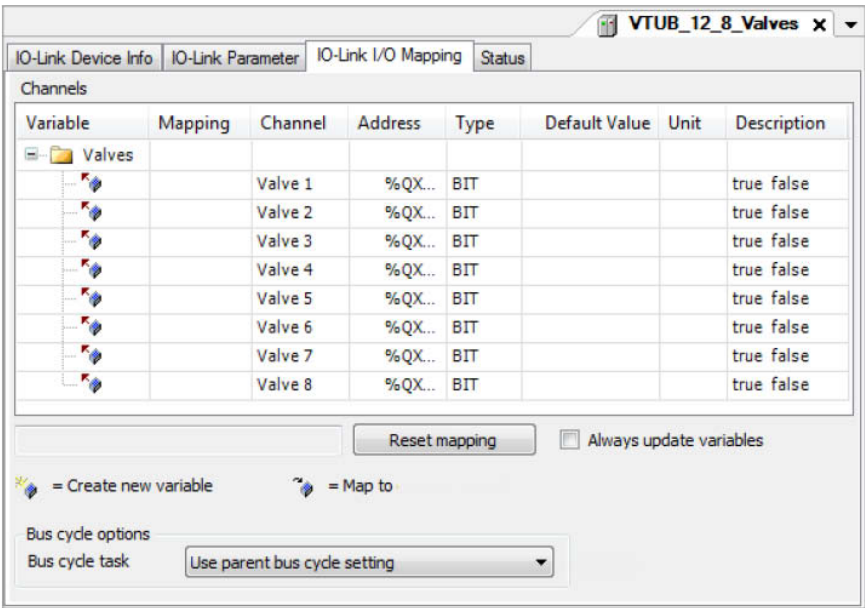

Figure: Editing window with IO-Link device VTUB-12 8 Valves (example)

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

Sub-tab	Comment
IO-Link Device Info	General information about the connected IO-Link device.
IO-Link Parameter	Specific parameters can be called up.
IO-Link I/O Mapping	Current process data for the components of the IO-Link device.
Status	General status of the IO-Link device.

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).

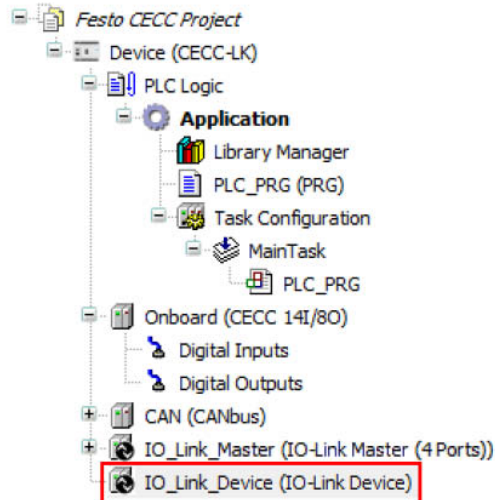1. Highlight the "IO-Link Device" branch in the CODESYS V3 pbF device window.

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

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.
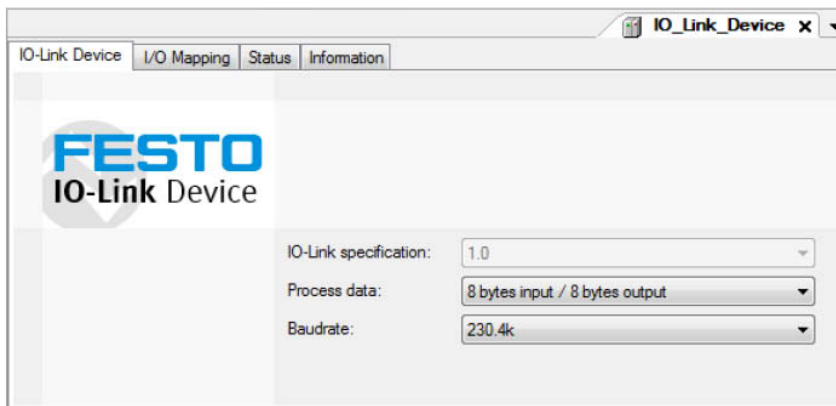

Figure: Tab for configuring the CECC as an IO-Link device

The sub-tabs contain the following information and setting options:

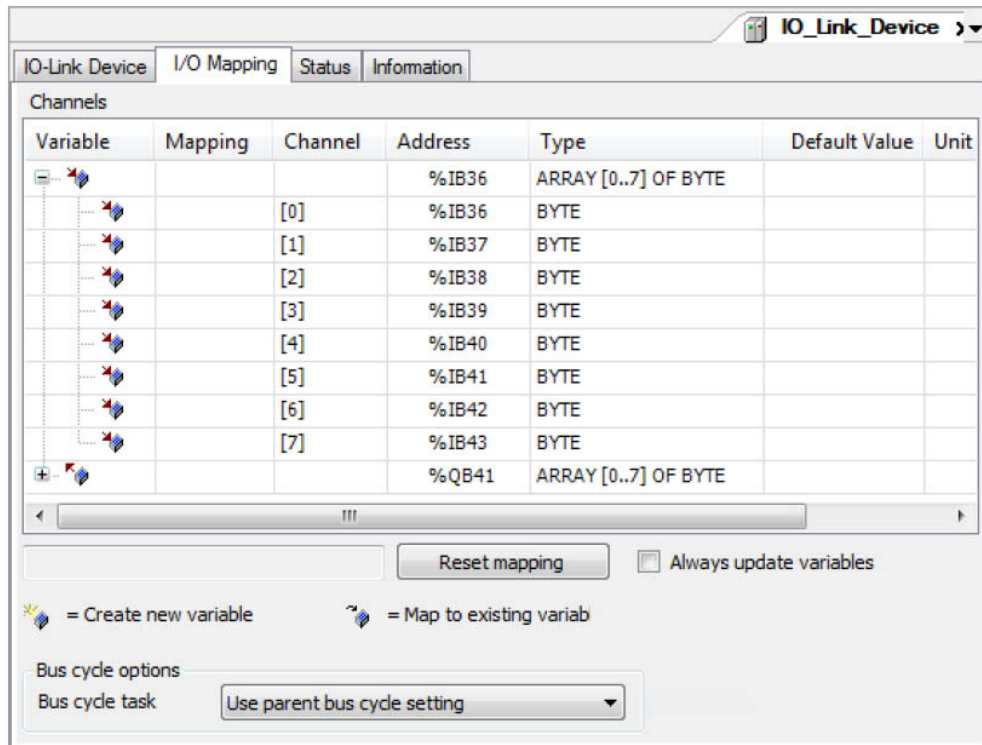| Sub-tab	Comment
IO-Link Device	Shows the IO-Link specification Settings – Data width for the process data – Baud rate for the data transmission
I/O Mapping	Current process data for the controller as an IO-Link device.
Status	Status of communication
Information	Version information for the CECC as an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

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.

> **i** 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
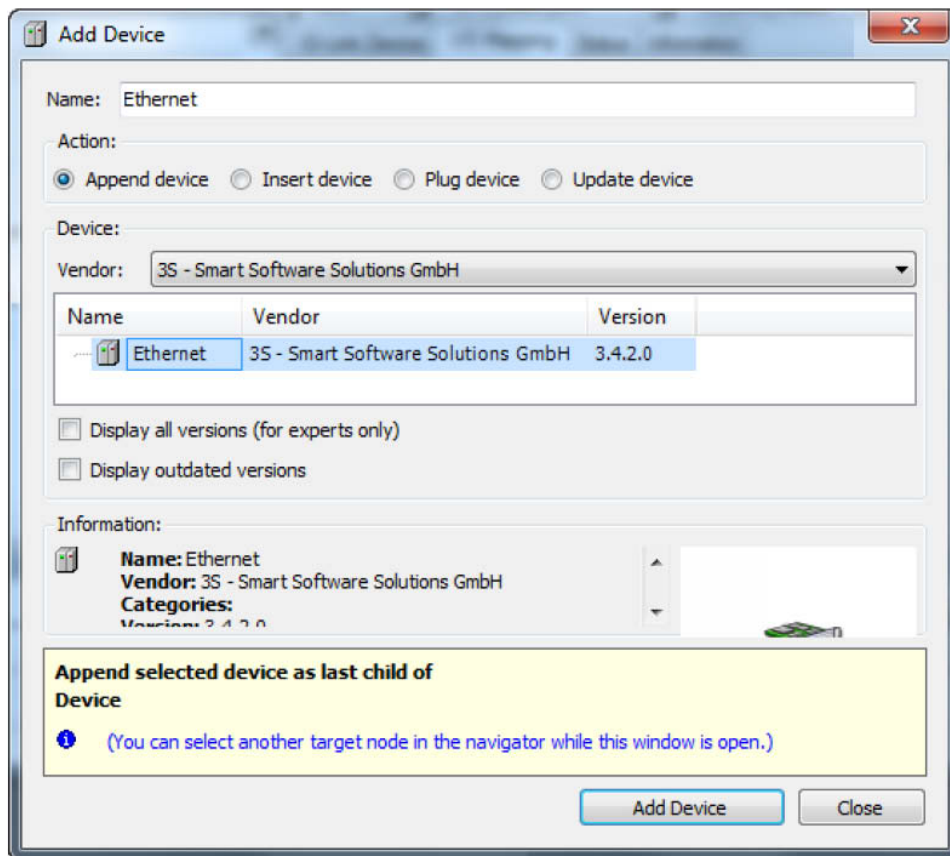   – context menu [Add Device].

Figure: Add Device - selecting "Ethernet"

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.

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5. Highlight the new "Ethernet" branch in the device window.
6. Add a "Modbus TCP Master" module via the context menu.
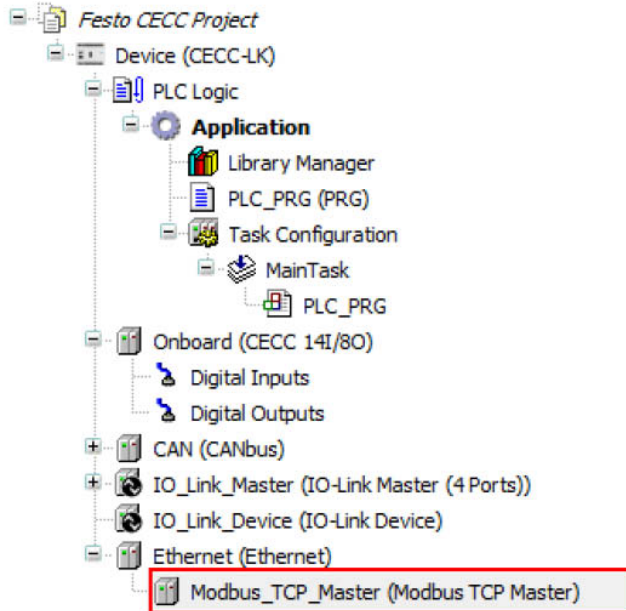

Figure: Device window - selecting "Modbus TCP Master" in the "Ethernet" branch

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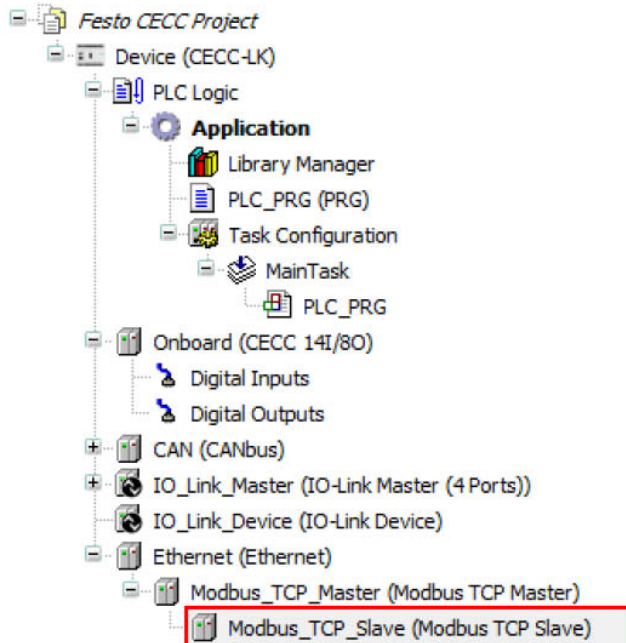8. Repeat this process for the other Modbus TCP slaves.

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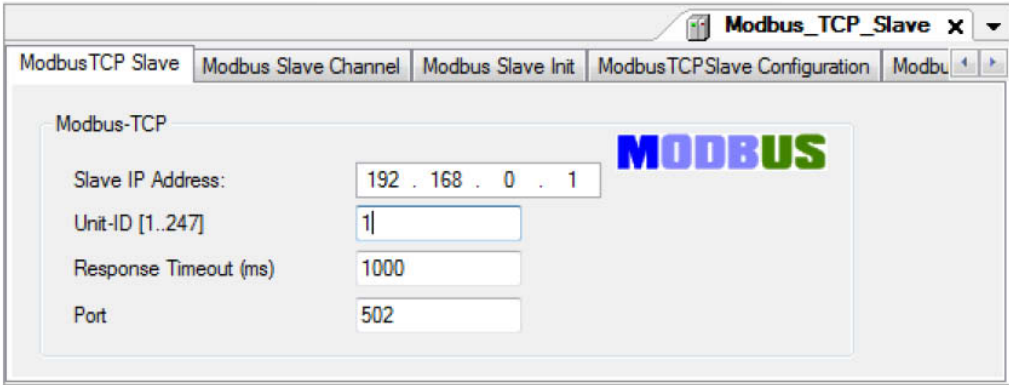
Figure: Workspace for "Modbus TCP Slave" (parameters)

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.
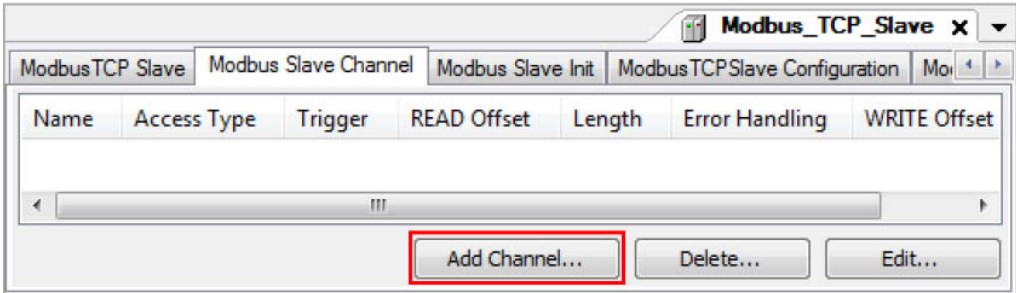
Figure: Workspace for "Modbus TCP Slave" - adding a channel
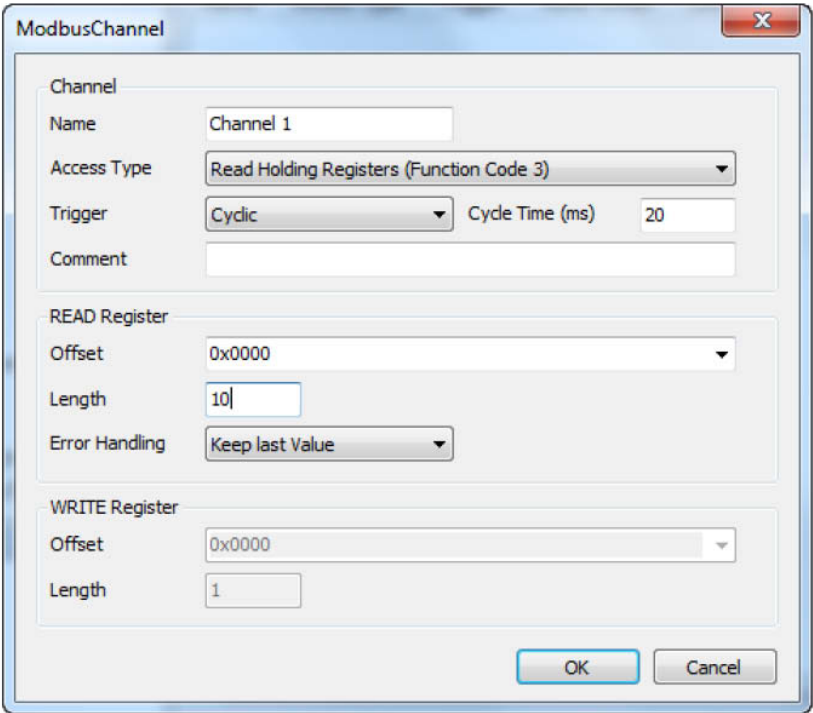
13. Click the "Add Channel..." button and set the desired parameters.

The appropriate parameters are described in the Codesys Help.

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Using the CECC as a Modbus TCP slave provides
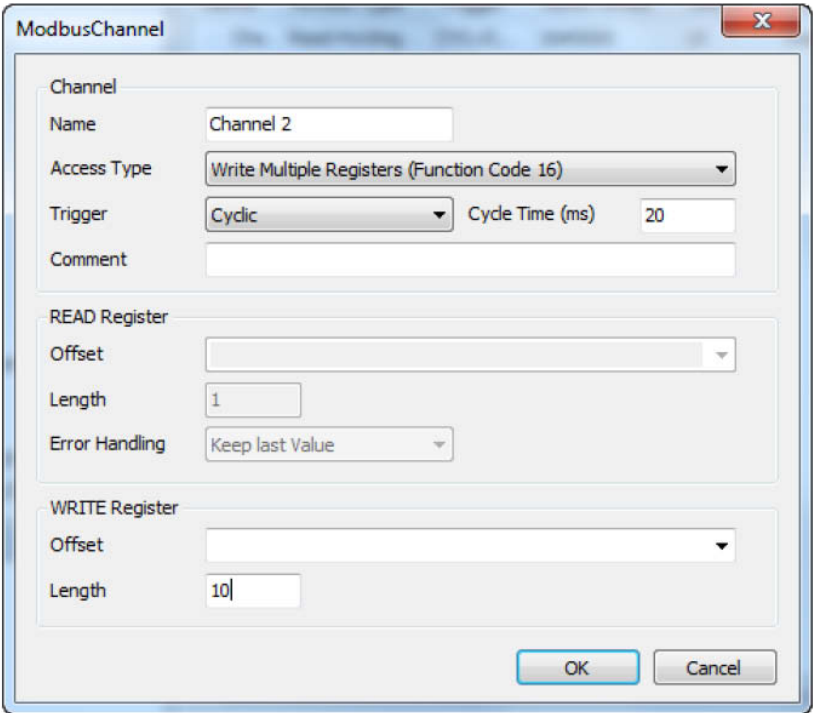
– access to the range %QW with access type Read Input Registers (function code 04)
– access to the range %IW with access type Write Multiple Registers (function code 16)

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

Figure: Settings on channel 1

Figure: Settings on channel 2

This gives the master an I/O map for the slave.
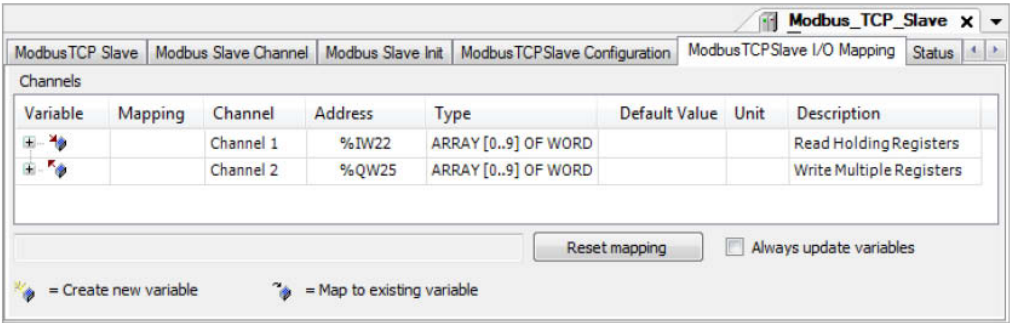
Figure: Workspace for "Modbus TCP Slave" - tab "Modbus TCP Slave I/O Mapping"

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.

Festo Controller CECC

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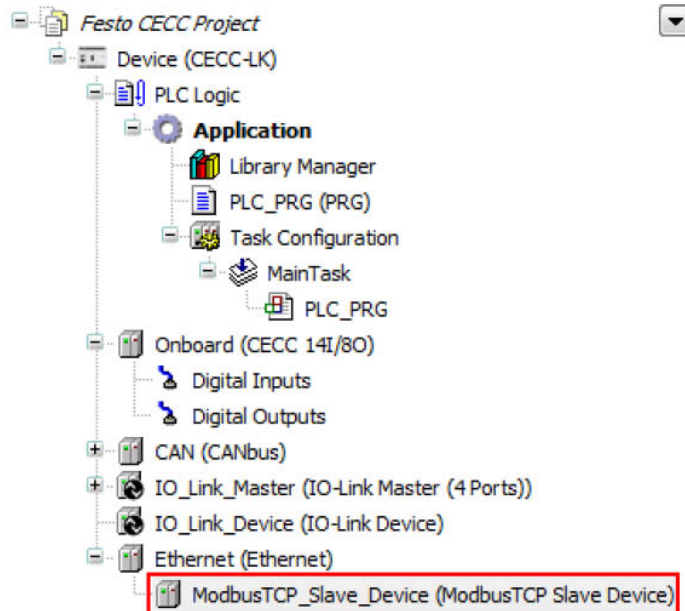
Figure: Device window - selecting "Modbus TCP Slave" in the "Ethernet" branch

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.
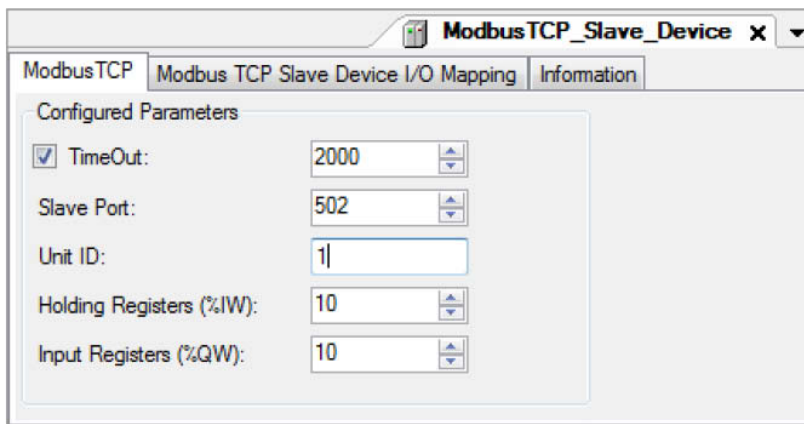
Figure: Workspace for "Modbus TCP Slave Device Configuration"

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.

Downloaded from www.Manualslib.com manuals search engine

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").
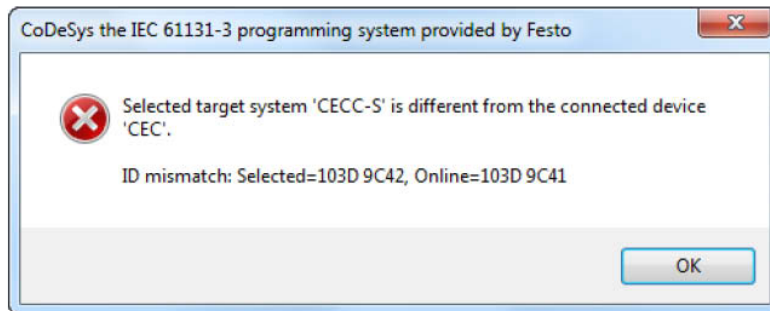
Figure: Warning message about an incorrect target system ID

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.
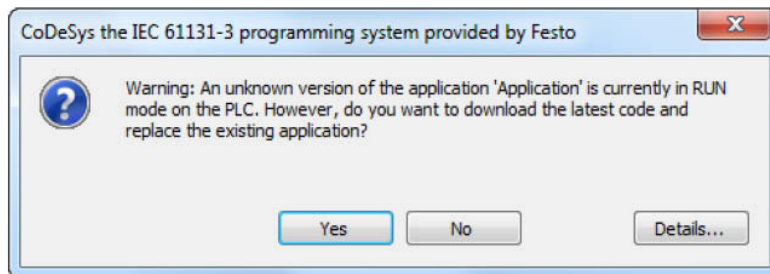
Figure: Warning message about different versions

- 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.
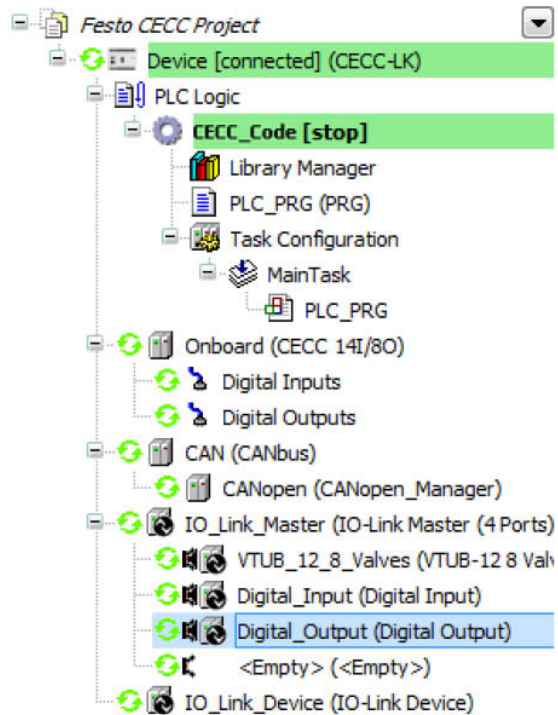
Figure: Device window with CECC logged in

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.
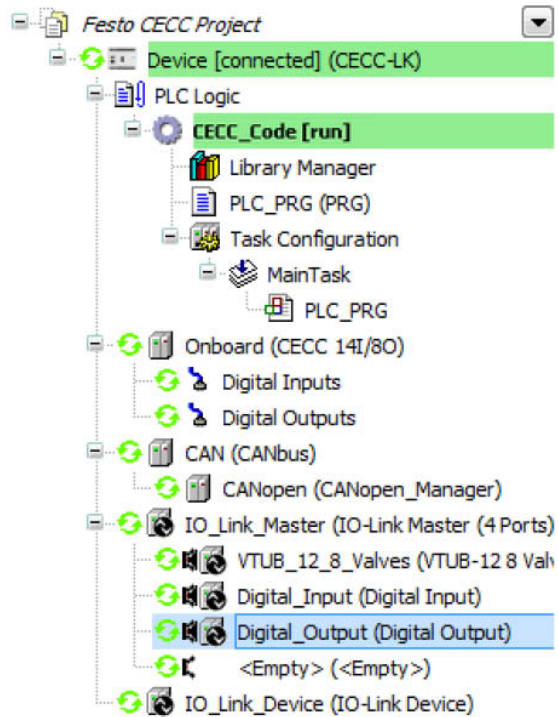
Figure: Device window with CECC in debug mode

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.
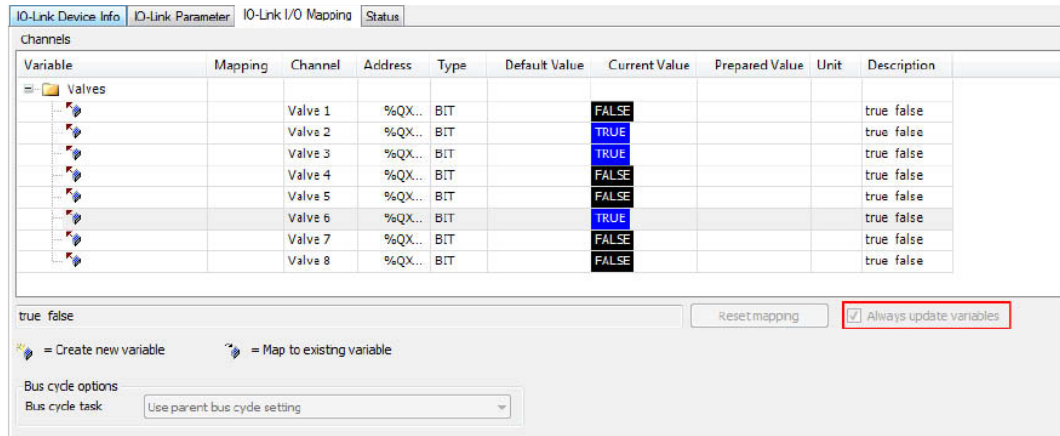
Figure: Editing window with IO-Link device "VTUB_12_16_Valves"

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 pbF.

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.

Figure: CECC editing window with "PLC shell" sub-tab

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.

Command	Comment
getdevinfo	Shows all information about the device.
gethostname	Shows the host name of the device.
sethostname <hostname>	Sets the host name of the device.
getserial	Shows the serial number of the device.
getfwversion	Shows the firmware version of the device.
getvendorname	Shows the name of the device vendor.
getuniqueid	Shows the unique ID of the device.
getsysversion	Shows the system version of the device.
getmacaddr	Shows the MAC address of the device.
getipaddr	Shows the current IP address of the PLC.
getipconfig	Shows the IP configuration: IP address, DHCP, settings after restart, etc.
setipconfig <IP-address> [<subnet-mask> [<gateway> [<dns-server>]]] [dhcp|nodhcp]	Sets the IP configuration (transferred after restart). Examples: setipconfig 192.168.2.20; setipconfig nodhcp

Command	Comment
reboot	Reboots the device.
getrtc	Shows the current real-time clock data.
setrtc YYYY-mm-dd-HH:MM:SS	Sets the current real-time clock data Example: setrtc 2011-01-25-15:13:26
canlog	Functions for CAN logging. Use the /? option to display the possible parameters.
cangetconfig	Shows the current CAN configuration parameters.
cansetconfig	Sets the CAN configuration parameters. Use the /? option to display the possible parameters.
usbgetconfig	Shows the current USB configuration parameters.
usbsetconfig	Sets the USB configuration parameters. Use the /? option to display the possible parameters.
shellcmd <linux command>	Executes a Linux shell command Examples: shellcmd cat /proc/config/id

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

FFT information	Error	Remedy
Missing entry "Wait for USB device connection …"	Project data transfer via the USB interface is deactivated.	• Activate this function using the PLC shell command usbsetconfig /bootaction=1
Missing entry in the "Inactive time" column of the entry "Wait for USB device connection …":	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.	• Check the timeout setting. • Check the file system of your USB memory stick (only FAT and FAT32 possible).
Error loading bootproject	Project cannot be transferred to the CECC.	• Check whether the CECC used is selected in the Codesys project.

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.
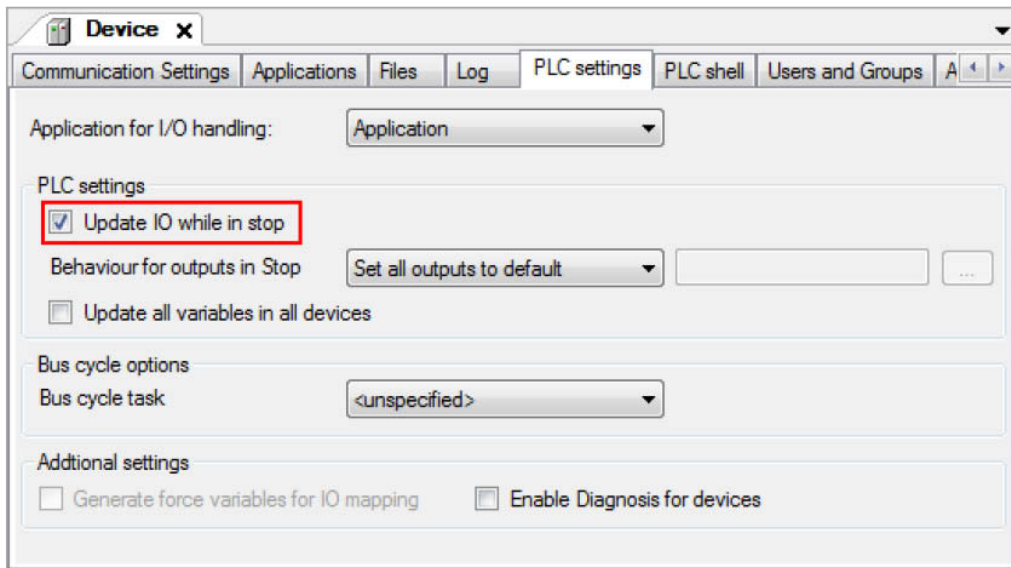
Figure: PLC settings for CECC controller

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:
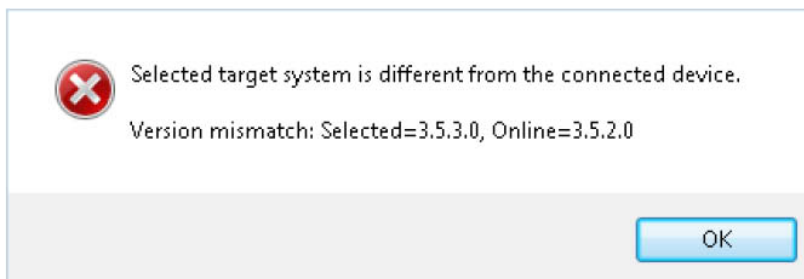
Figure: Selected target system is different from the connected device

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:

Diagnostics via	Advantages
Status LEDs	Fast, local error detection using – controller LEDs – CECC-specific LEDs
Controller configuration	Online diagnostics without programming
User program	Detailed diagnostic evaluation: – System event CECC_system_fault – Support for function blocks from the Festo CECC_3 library ➔ section "Diagnostics".

Table: Diagnostic options provided by the CECC

Error class	Weighting	Error no.	Evaluation via function block in Festo CECC_3 library	Display in the Codesys device log	Display in the FFT[1)
0	No error	0	X	–	–
1	Information	200 ... 255	X	X	X
2	Warning	1 ... 127	X	X	X
4	Error	128 ... 199	X	X	X
1) The Festo Field Device Tool (FFT) program can be downloaded via the Festo Support Portal ➔ www.festo.com.					

Table: Error evaluation options
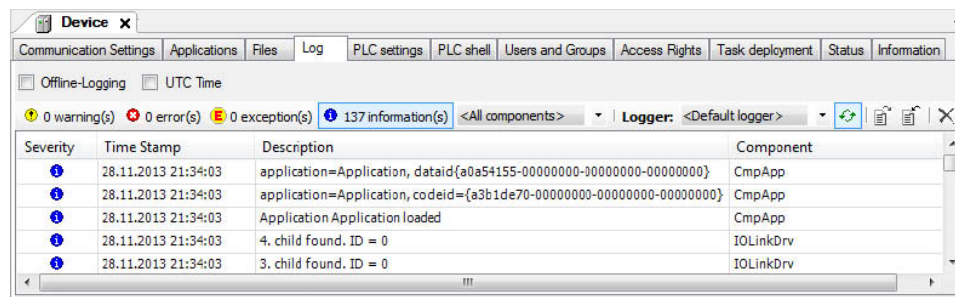
Figure: Editing window with "Device" tab - "Log" sub-tab

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

Table: Codesys error messages

Error message	Error no.	Error class	Remedy
IOLinkDrv: Initialization failed	150	Error	Check the connected IO-Link devices. Check the power supply.
IOLinkDrv: Stack halted (Error)	151	Error	
IOLinkDeviceDrv: Initialization failed	152	Error	
IOLinkDrv: Started	214	Information	–
IOLinkDeviceDrv: Started	215	Information	–

Table: IO-Link error messages

Error message	Error no.	Error class	Comment
multicast daemon started	216	Information	–
Kernel diagnosis daemon stopped	217	Information	–
Kernel diagnosis daemon started	218	Information	–
Redirect all kernel errors to diagnostics	219	Information	–

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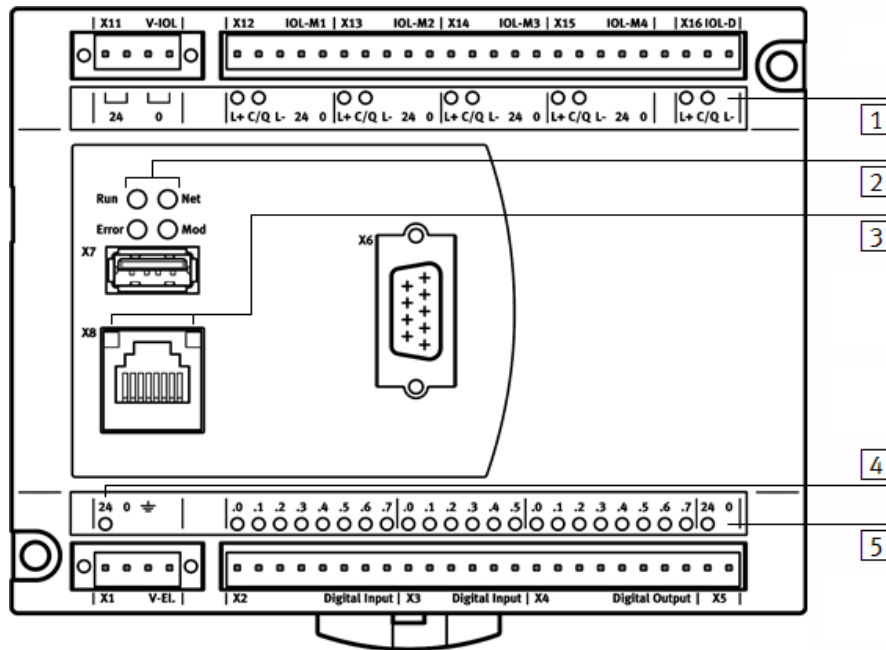
1	IO-Link (CECC-LK)
2	Operation (Run, Net, Error, Mod)
3	Ethernet
4	Power supply to the device (24 V)
5	I/O (inputs and outputs) and power supply for I/O

Figure: Status LEDs on the CECC-LK and CECC-D
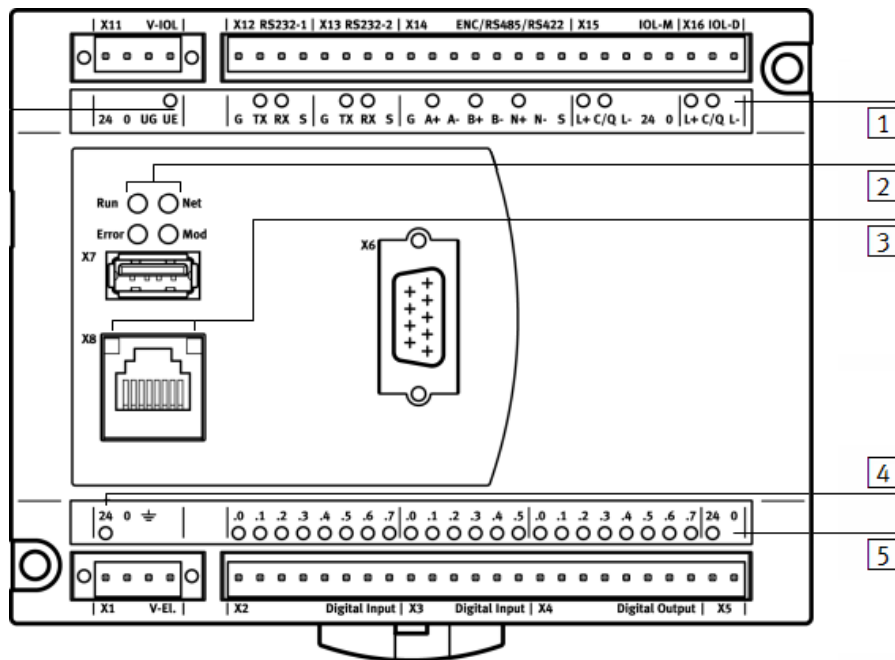
1 RS232, multiple interface ENC/RS422/RS485 and IO-Link

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

LED	Sequence	Meaning	Comment
24 Volt	Lights up green	Device ready for operation	Power supply
	Does not light up	Device switched off	
	Flashes green	Undervoltage of the device	
Run	Lights up green	Program running	Application status
	Lights up yellow	Program is stopped	
	Does not light up	Runtime system not started	
Error	Lights up red	Class 4 error	PLC runtime error
	Flashes red	Class 2 error	
	Does not light up	No error/class 1 error	
Net	Flashes red	Device identified	Identification by FFT
Mod	–	–	Reserved
Ethernet left	Lights up green	Data transfer with 100 Mbit	Speed LED = Speed of data transfer
	Does not light up	Data transfer with 10 Mbit	
Ethernet right	Lights up green	Connection established	Link/activity LED = connection and data transfer
	Flashes green	Data transfer active	
	Does not light up	No connection	
I/Os	Lights up green	24 V input	Inputs and outputs
	Lights up yellow	24 V output	

LED	Sequence	Meaning	Comment
RS232-1/-2 TX	Lights up green	CECC sending data	Data transmission
RS232-1/-2 RX	Lights up green	CECC receiving data	
Multiple interface A+	Flashes green	Encoder tics track A	LED flashing in time with the frequency of rotation. Encoder turning slowly.
	Lights up green		Encoder turning quickly.
	Flickers green	Transmitted data with RS422 Transmitted/received data with RS485	Shows data transmission depending on the relevant interface
Multiple interface B+	Flashes green	Encoder tics track B	LED flashing in time with the frequency of rotation. Encoder turning slowly.
	Lights up green		Encoder turning quickly.
	Flickers green	Received data with RS422	Shows data transmission depending on the relevant interface
Multiple interface N+	Flashes green	Encoder tics zero track	LED flashing in time with the frequency of rotation. Encoder turning slowly.
	Lights up green		Encoder turning quickly.
IO-Link L+	Lights up green	IO-Link master active	Status display
	Does not light up	IO-Link master not ready for operation	
IO-Link C/Q	Lights up green	Connection established	Link/activity LED = connection and data transfer
	Lights up red	Data transfer inactive	

Table: Status LED states

6 Technical appendix

6.1 Technical data

Feature	CECC
Certification	C-Tick
Operating voltage CECC-LK and CECC-D	19.2 ... 30 V DC
Operating voltage CECC-S	20.4 ... 30 V DC
Current consumption	100 mA nominal at 24 V DC
Ambient temperature	0 ... 55 °C
Storage temperature	-25 ... 70 °C
Relative air humidity	95%, non-condensing
Degree of protection	IP20
Protection class	III
Product weight	200 g
Resistance	
– To vibration	As per EN 61131-2
– To shock	As per EN 61131-2
Electrical connection technology for I/O	Socket strip, grid 3.5 mm
Status displays	LED
CPU data	Processor 400 MHz
Processing time	Approx. 250 µs/1k instructions
Digital inputs	
– Number	12
– Switching logic	Positive logic (PNP)
– Fast clock pulse inputs	2, each with max. 200 kHz
– Input signal delay	Typ. 3 ms
– Input voltage	24 V DC
– Nominal value for TRUE	≥ 15 V DC
– Nominal value for FALSE	≤ 5 V DC
– Electrical isolation	Yes, via optocoupler
– Status display	LED
– Permissible length of connecting cable	30 m

Feature	CECC
Digital outputs	
– Number	8
– Switching logic	Positive logic (PNP)
– Contact	Transistor
– Output voltage	24 V DC
– Output current	500 mA
– Electrical isolation	Yes, via optocoupler
– Switching frequency	Max. 1 kHz
– Short circuit proof	Yes
– Status display	LED
IO-Link (CECC-LK and CECC-S)	
– Protocol	Device V 1.0, master V 1.1
– Connection technology	Cage Clamp connector – Master: 5-pin – Device: 3-pin
– Communication mode	Can be configured via software – Master, 5-pin: SIO, COM1, COM2, COM3 – Device, 3-pin: COM1, COM2, COM3
– Permissible length of IO-Link cables	20 m
– Port type	Device: A Master: B
– Number of ports	Device: 1 Master: 4 (CECC-LK)/1 (CECC-S)
– Master, output current	3.5 A/port
– Communication	C/Q LED green C/Q LED red
– Ready status display	L+ LED green on L+ LED green off
– Process data width OUT	Master parameterisable 2 - 32 bytes
– Process data width IN	Master parameterisable 2 - 32 bytes
– Memory	Master 2 kBytes per port
– Minimum cycle time	Device: 3.2 ms Master: 5 ms
– Device ID	0x550000, 0x550001, 0x550002, 0x550003, 0x550004
Fieldbus interface	
– Type	CAN bus
– Connection technology	Plug, Sub-D, 9-pin
– Transmission rate	10, 20, 50, 100, 125, 250, 500, 800, 1000 kbps Can be set via software
– Electrical isolation	Yes
USB interface	USB 1.1

Feature	CECC
Ethernet	
– Connector plug	RJ45
– Number	1
– Data transmission speed	10/100 Mbit/s
– Supported protocols	TCP/IP, EasyIP, Modbus TCP
Programming software	CODESYS provided by Festo (pbF)
Programming language	To IEC 61131-3 SFC, IL, FCH, LDR, ST
CE symbol (see declaration of conformity)	To EU EMC Directive[1,2]
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.