Controller CECC

FESTO

Description

Controller CECC

8004762
en 1206NH

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1 Important instructions

1.1 Designated use

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

The device is used for:

- controlling pneumatic and electric drives,
- scanning electrical sensor signals,
- communicating 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).

The maximum values specified for temperatures, electrical data, etc. must be observed.

- Observe the regulations of the employer's liability insurance association as well as relevant national regulations.

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 movement of connected drives can be caused, for example, by:

- untidy or faulty wiring,
- errors in component operation,
- faults in the transducers and signal generators,
- defective or non-EMC-compliant components,
- faults in the higher-level control system,
- programming errors in user programs and projects.

Switching off load voltage is not a proper inhibit mechanism. Unintentional movement of the drive 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).
- Only carry out work in the machine area when the power supply is switched off.
- Make sure that nobody enters the positioning range of the drives or other connected actuators.
- Only switch on the load voltage supply 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 consult your local Festo Service 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

Information on how danger warnings are represented can be found 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 and commands are framed in square brackets. Example: 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," "Extract Project" and "OK" as well as designations are shown in inverted commas.
CTRL	Names of keys on the PC keyboard are shown in uppercase letters in the text (e.g. ENTER, 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 represented 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 Notes on thismanual

Thismanual refers to the following versions:

- Festo controller CECC – firmware version 1.2.0 or later
- Software package CoDeSys V3 provided by Festo (pbF)

Thismanual contains information about the function of the CECC, as well as information on how to assemble, install and commission it.

Further information on the controller 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	Manual	Configuring, using and diagnosing errors in function blocks.
Festo_CECC_IOLink_3.library		
Festo_EasyIP_3.library		
Festo_Motion_3.library		
Festo_CameraControl_3.library		
Festo Field Device Tool.	Manual	Servicing and commissioning 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, but additionally with: – 4x IO-Link master interfaces – 1x IO-Link device interface	16#103D9C41
1) Code for the device type for use in the communication settings (➔ section "Adding a device").		

Table: Variants of the CECC

Both variants offer...

- programming by CoDeSys V3 provided by Festo (pbF) according to IEC 61131-3,
- programming, communication and visualisation via Ethernet,
- communication via CANopen,
- controller configuration by CoDeSys V3 pbF for commissioning, programming and diagnosing the system,
- process visualisation within CoDeSys V3 pbF, with an operator unit CDPX and the software Designer Studio (available separately), use of the OPC server to connect to an OPC client or use of the web visualisation under CoDeSys.

- Use the software package CoDeSys V3 pbF 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 Programming software

Use the programming software CoDeSys V3 pbF 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 with the controller configuration
- Programming according to IEC 61131-3
- Integrated libraries
- Library Manager for integrating further libraries
- Simulation mode (enables project testing on the PC without a PLC)
- Integration of a visualisation, configuration with Designer Studio (available separately)
- Documentation using the built-in project documentation functionality
- Debugging: testing the program sequence, monitoring and changing variables, fault finding.

2.2.1 Packages

To use the controller CECC (target system) under CoDeSys V3 pbF you will need the associated CECC package and the support package. These packages enable access to the system functions of the target system with the help of libraries and contain appropriate information in the form of online Helps. This makes the CoDeSys functions available for the target system or, if applicable, limits them.

CoDeSys V3 pbF is supplied with the support package as well as with the CECC package for the controller CECC.

2.2.2 Remanent variables

There are a maximum of 7,120 bytes available on the CECC for storing remanent variables. Allocation takes place automatically on the basis of the variable declaration within the application.

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

RETAIN variable	PERSISTENT RETAIN variable
7,120 bytes	0 bytes (only if there is no PERSISTENTvariable list created)
0 bytes	7,076 bytes (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 overall size of all remanent data does not exceed the maximum available range of 7,120 bytes.

This will avoid errors when transferring an application to the CECC.

2.3 Libraries

To make programming easier, CoDeSys V3 pbF enables usable objects like

- function blocks,
- declarations,
- visualisations

to be organised in libraries independently of projects.

Library	Comment
Festo_CECC_3.library	Function blocks for the Festo controller CECC.
Festo_CECC_IOLink_3.library	Function block for controlling the CECC via IO-Link.
Festo_EasyIP_3.library	Function block for easy networking of controllers via EasyIP.
Festo_Motion_3.library	Function block for actuating Festo motor controllers (e.g. CMMP-AS).
Festo_CameraControl_3.library	Function block for accessing the Compact Vision System SBO...-Q.

Table: Libraries for programming the CECC

A Library Manager that you can use to integrate and view libraries is provided for this.

Detailed descriptions of the libraries and programming 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 dismounting the CECC.

Caution

The controller CECC contains electrostatically sensitive components.

- Do not therefore touch any contacts.
- Observe the handling specifications for electrostatic sensitive devices.

Note

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

3.2 Mounting and dismounting

The controller CECC is suitable for H-rail and wall mounting.

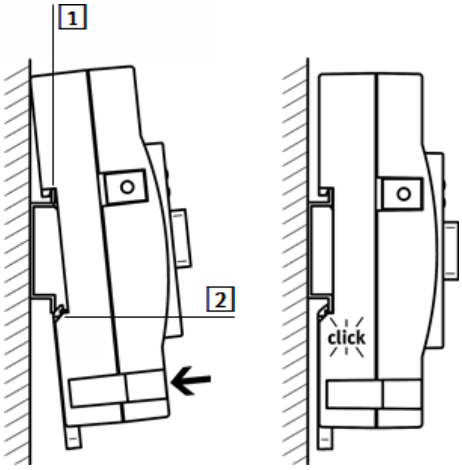
Note

- 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

Mounting

No other accessories are required for H-rail mounting. The controller CECC can be clicked into place on an H-rail (mounting rail to EN 50022) using the integrated clip.



1 Clip

2 Spring-loaded clip

Figure: Mounting on an H-rail

Instructions:

1. Hook the CECC onto the top of the H-rail by engaging clip 1.
2. Press the device onto the H-rail by applying pressure over spring-loaded clip 2.
3. The device automatically clicks into place on the H-rail.

Dismounting

Note

- The CECC must never be removed from the H-rail while still wired.
- Make sure that all cable connections are disconnected when removing the CECC.

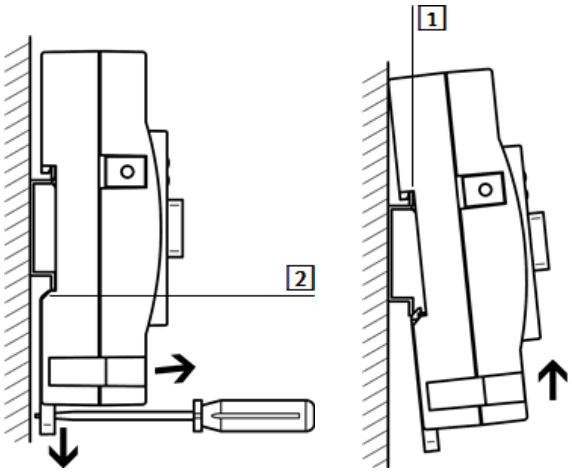


Figure: Dismounting from an H-rail

Instructions:

1. Pull clip 2 of the CECC in the direction of the arrow using an appropriate 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 by disengaging clip 1.

3.2.2 Wall mounting

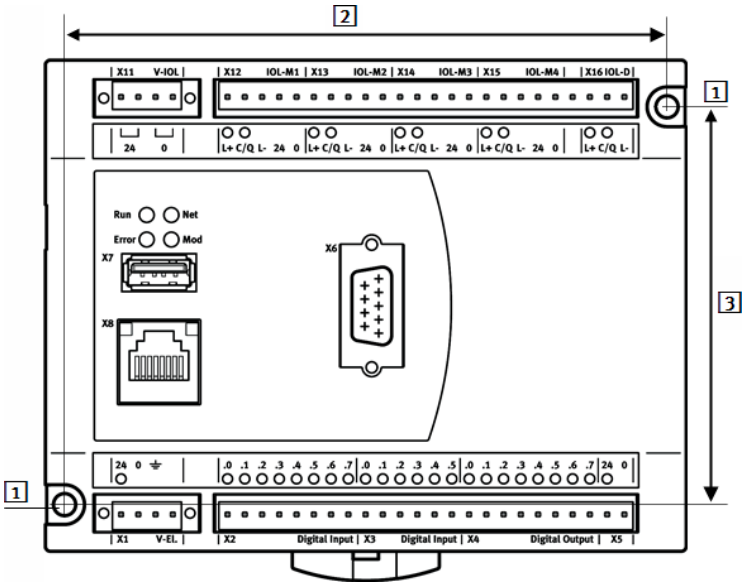
The controller CECC has two holes for mounting it on a wall.

Mounting

Note

Mounting the CECC on uneven, flexible surfaces can damage it.

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



1 Mounting holes, Ø 4.5 mm

2 Horizontal spacing between the mounting holes: 122.2 mm

3 Vertical spacing between the mounting holes: 81.0 mm

Figure: Holes on the CECC for wall mounting

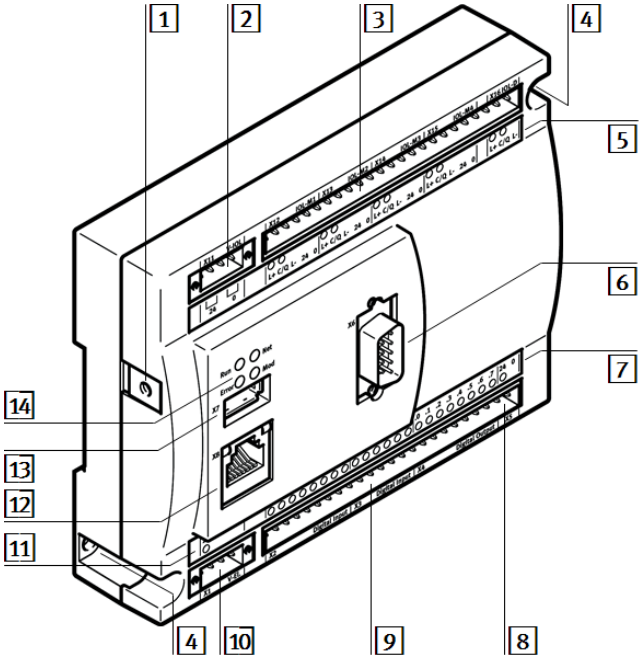
Instructions:

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

Dismounting

1. Loosen the mounting screws.
2. Remove the CECC from the mounting surface.

3.3 Connection and display components



1	Functional earth FE	8	I/O supply voltage
2	IO-Link load supply voltage (port class B)	9	I/O interface
3	IO-Link communication interface	10	Device power supply
4	Mounting holes	11	Device power supply LED
5	IO-Link LEDs	12	Ethernet interface
6	CANopen interface	13	USB interface
7	I/O LEDs and I/O power supply LED	14	Status LEDs

Figure: Connection and display components

3.4 Power supply

The power supply connection for the CECC (24 V) is on the left-hand side of the lower contact strip (X1).

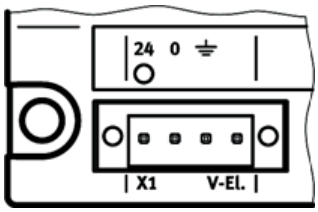


Figure: Power supply for the CECC

This connection also provides the power supply for the following interfaces:

- CANopen ☐section CANopen
- IO-Link port class A (no internal fuse), ☐section IO-Link
- Ethernet ☐section Ethernet interface
- USB ☐section USB interface.

Note

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

The following interface has its own power supply connection:

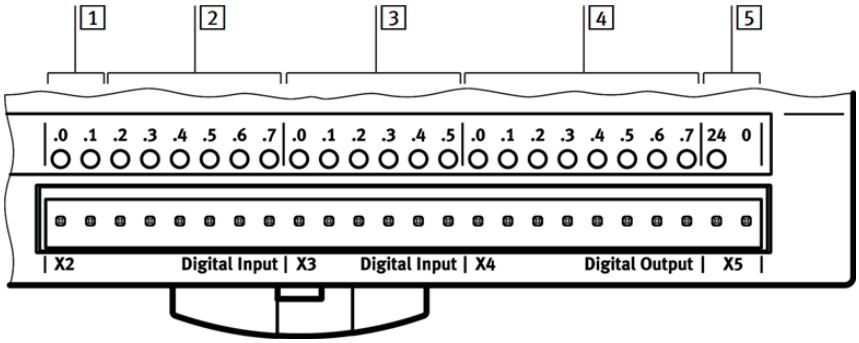
- I/O interface: X5 (☐section I/O interface).

3.5 I/O interface

The I/O interface of the controller CECC enables sensors (inductive, capacitive, etc.) or signal generators (counters) to be processed 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 /stage, total current 4 A)



1 Fast inputs X2.0 and X2.1 (200 kHz)

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

3.5.1 Connecting the I/O interface

Note
Using the wrong connections can damage the device.
- Use connection 5 to supply power to the I/O interfaces.

- Connect the digital inputs and outputs to sensors and actuators.
  Compatible contact strips can be found under www.festo.com/catalogue.

Further information on configuring the digital inputs and outputs under CoDeSys V3 pbF can be found in the section Configuring the I/O interface.

Further information on using the I/O interface can be found in themanual for the Festo CECC_3 library.

3.6 Ethernet interface

The Ethernet interface enables a PC or operator unit CDPX to be connected to the controller CECC.

The Ethernet interface is an RJ45 socket.

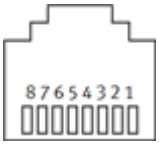
Socket	Pin	Signal	Comment
	1	TD+	Transmitted data+
	2	TD–	Transmitted data–
	3	RD+	Received data+
	4	n.c.	Not connected
	5	n.c.	Not connected
	6	RD–	Received data–
	7	n.c.	Not connected
	8	n.c.	Not connected
	Body	–	Screen

Table: Pin allocation for the Ethernet interface

3.6.1 Connecting the Ethernet interface

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

3.6.2 Ethernet protocols

Protocol	Comment
EasyIP	Communication with controllers via EasyIP (port 995)
Modbus TCP	Communication with third-party controllers (port 502) Communication with client/server characteristics possible
TCP/IP	Supported by communication library (port 502, e.g. "SysSocket")
UDP	Communication via network variables Supported by communication library (port 995, e.g. "SysSocket")

3.7 CANopen

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

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

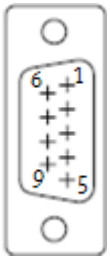
CAN bus plug	Pin	Signal	Comment
	1	n.c.	Not connected
	2	CAN_L [1)]	CAN Low
	3	CAN_GND	CAN Ground
	4	n.c.	Not connected
	5	CAN_SHLD	Connection to FE [2)]
	6	CAN_GND	CAN Ground (optional)
	7	CAN_H [1)]	CAN High
	8	n.c.	Not connected
	9	n.c.	Not connected
1) If the CECC is at the end of the cable: • Connect pins 2 and 7 using a terminating resistor (120 ohms /0.25 W). 2) FE = functional earth			

Table: Pin allocation for the CANopen interface

3.7.1 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 for the CANopen interface
- Incorrect screened connection
- Branches
- Long distances
- Unsuitable cables.

- Use a twisted, screened two-wire cable as 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 on the CANopen interface of the CECC are **not** supplied with power.

3.7.2 Connection with CAN bus plug from Festo

- Use cables with a diameter of 5 ... 8 mm for CAN bus plugs.

You can conveniently connect the CECC using a CAN bus plugfrom Festo. You can disconnect the plug from the node without interrupting the bus cable (T-TAP function).

Note

The clamp strap in the CAN bus plugfrom Festo is connected internally only capacitively with the metallic housing of the Sub-D plug. This prevents equalising currents flowing through the screening of the CAN bus.

- Clamp the screening under the cable clip of the CAN bus plug (☐accompanying manual for the CAN bus plug).

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

3.7.3 Connection using another CAN bus plug

Notes

- Note the polarity of the CANopen interface.
- Connect the screening.

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

3.8 IO-Link (CECC-LK only)

The controller CECC-LK has four IO-Link master connections. One IO-Link device can be connected to each of these connections. The CECC-LK can be connected to a higher-level IO-Link master as an IO-Link device at a further connection.

Note

High equalising currents can occur and damage the devices when connecting two CECC-LK with separate power supply via IO-Link.

- Connect the earth cables of the CECC-LK connected via IO-Link.

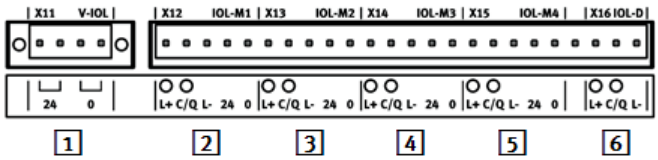
This equalises the ground potential.

Note

The maximum resultant current for the IO-Link load voltage supply is 10 A.

- If applicable, use an external fuse.

Additional functions such as extended diagnostics, parameters, alarms are handled via function blocks (➔ Festo CECC_IOLink_3 library).



1 IO-Link load voltage supply

2...5 IO-Link masterports for connecting IO-Link devices

6 IO-Link deviceport for connecting the CECC-LK as an IO-Link device

Figure: IO-Link interface

IO-Link	Pin	Signal	Comment
1	X11.1	24	Load voltage supply connection via IO-Link masterports: UA+
	X11.2		
	X11.3	0	Load voltage supply connection via IO-Link masterports: 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

Table: Pin allocation for the IO-Link interface

Note

The load voltage supply enables loads with a maximum current requirement of 3.5 A each (e.g. actuators) to be connected.

Note

Digital standard sensors/actuators can also be connected to the IO-Link master connections instead of IO-Link devices (operating mode SIO).

In SIO operating mode, the power for these sensors/actuators must be supplied via L+.

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.

3.9 USB interface

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

Using storage media enables:

- data to be loaded onto the device,
- data to be backed up.

Note

Impermissible operating states of the controller 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.

Using storage media for ongoing data recording is not recommended.

3.10 Operator unit CDPX

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

- Note the enclosed manual when mounting the device.

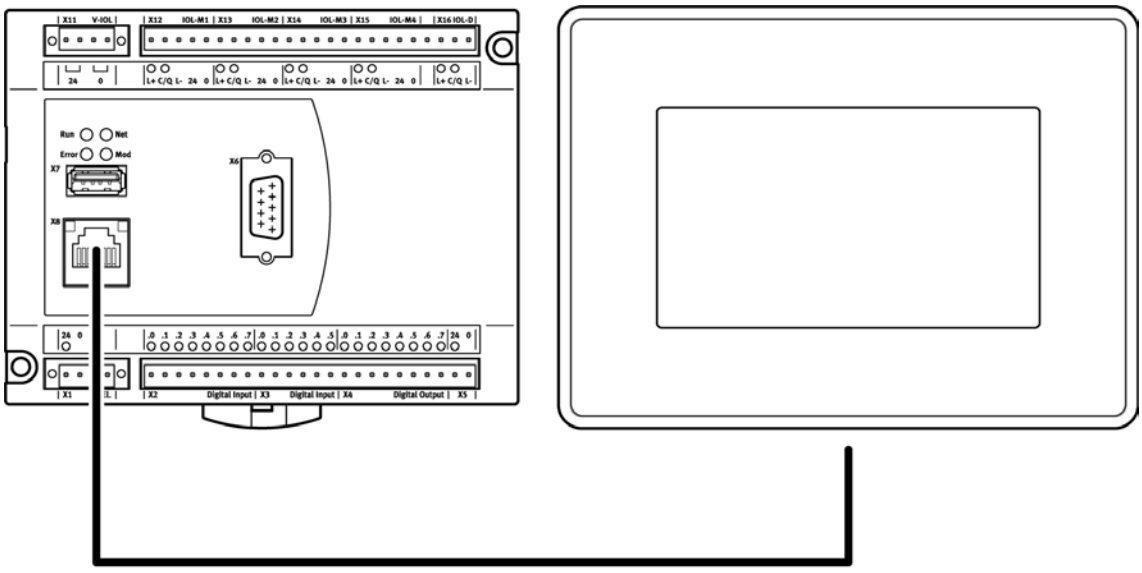


Figure: CECC with operator unit CDPX

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

Further information can be found in the manual for the CDPX.

4 Commissioning

4.1 Preparations

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

1. Install the CoDeSys V3 pbF programming software on the PC you will be using to commission, configure and program the controller CECC.
2. Install any required packages (CECC, Support). To do this, start the CoDeSys V3 pbF program and open the Package Manager using the [Tools] [Package Manager] menu command.
3. Connect the PC to the CECC directly via the Ethernet interface or via a switch/hub.

4.2 Getting started

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

4.2.1 Creating a project

- Create a new project using the [File] [New Project...] menu command, enter a name and the directory path and confirm your entries with "OK".

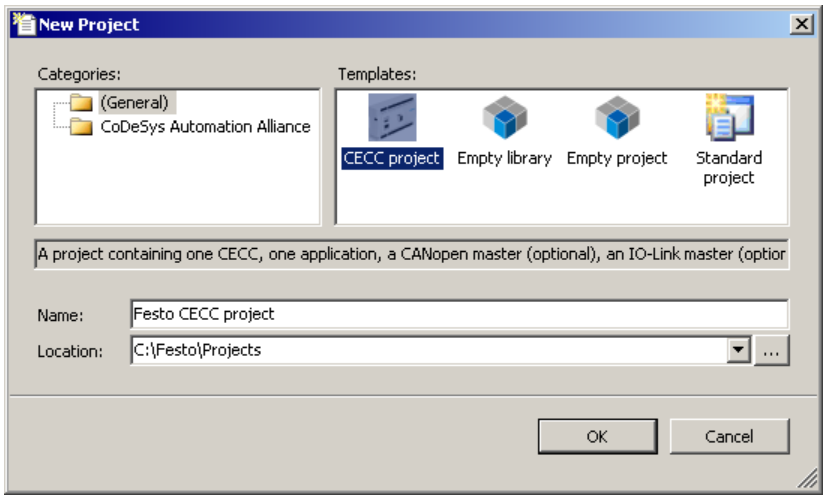


Figure: "New Project" dialog window

4.2.2 Selecting a device

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

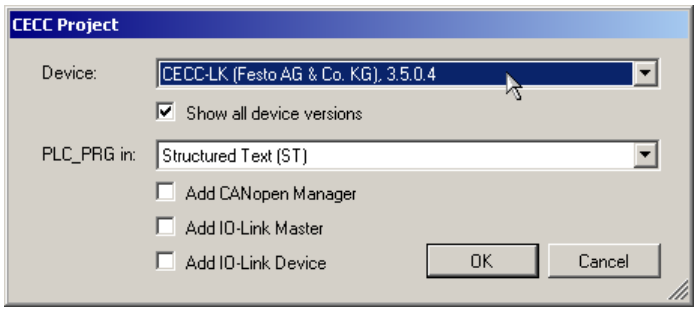


Figure: "New Project" dialog window – selecting the device

2. Select a programming language.

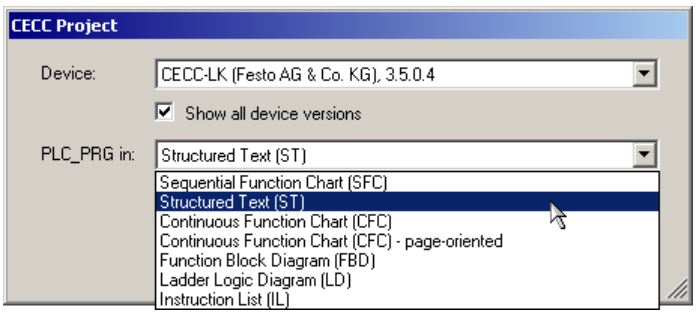


Figure: "New Project" dialog window – selecting the programming language

3. Select the relevant interfaces.

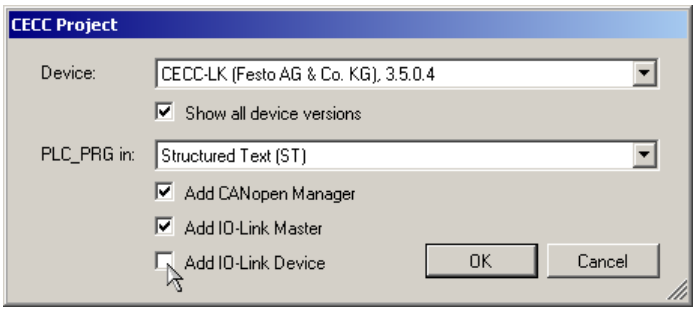
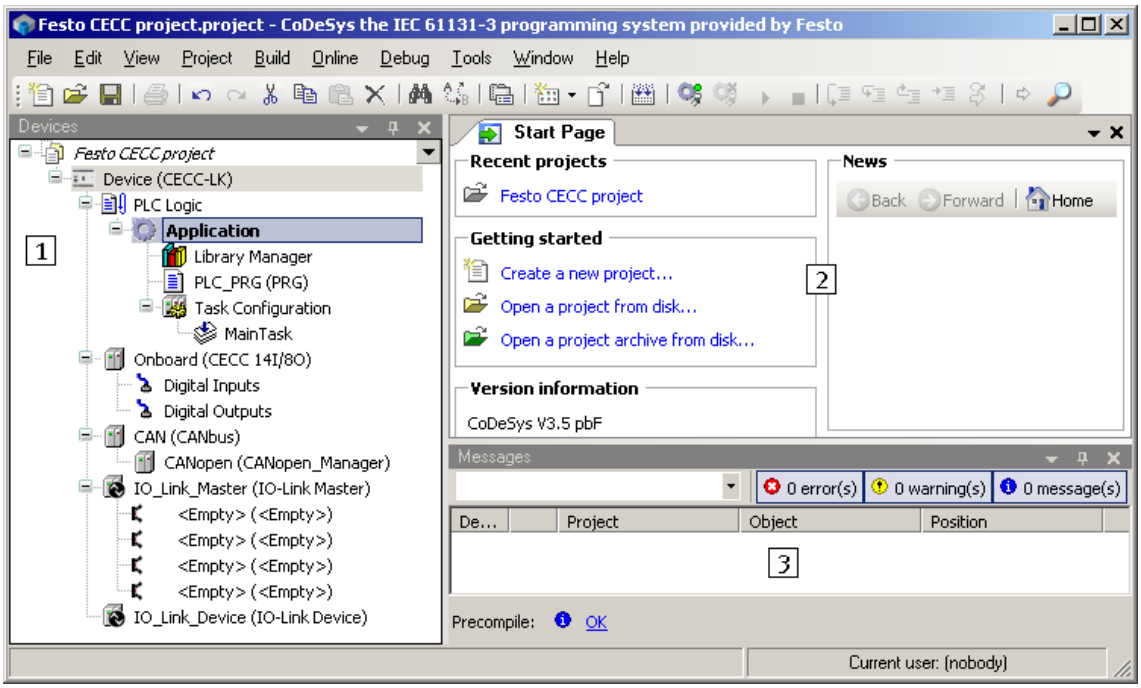


Figure: "New Project" dialog window – selecting the interfaces

Unsupported device options are inactive (shown in grey) and cannot be selected.

The CoDeSys V3 pbF program window opens with the newly created project.



1 Device window with CECC, its interfaces and PLC logic

2 Editing window with tabs for the objects activated in the device window

3 Message window with information about the CECC as well as error and warning messages

Figure: CoDeSys V3 pbF program window with selected CECC

4.2.3 Adding a device

1. In the device window, double-click the device to be configured.
   The "Device" tab for configuring the device opens in the editing window.

You will find the following information and configuration options on the subtab for the device:

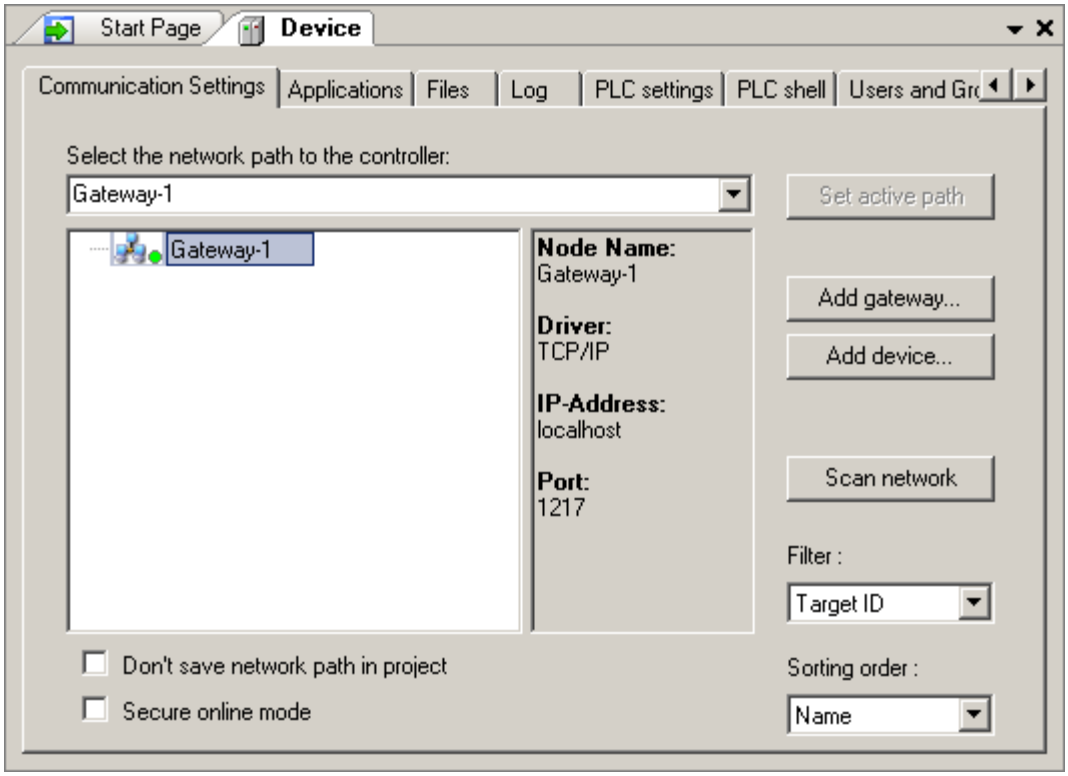


Figure: "Device" tab for CECC-...

2. Switch to the "Communication Settings" tab and highlight the local gateway (network path).
3. Click the "Scan network" button to add an updated list of devices to the local gateway or double-click the highlighted gateway.
   - If applicable, set the filter to "Target ID". Only devices matching the CECC currently used in the project will then be displayed (➔ section"Selecting a device").
   - If applicable, change the sorting order to change the display of devices in the updated list.
   - You can manually select a device if you know the name, node address or IP address of the CECC (➔ section"Manually adding a device").
   - If applicable, change the network properties for the device (➔ section"Scan Festo Devices") and repeat Step 3. The device will be added to the local gateway because of the change to the properties.

Only devices that meet the following criteria are displayed in the list:

– The subnet mask settings of the network connection and CECC are the same.

– The IP address settings of the network connection and CECC match.

If these criteria are **not** met, the device will only be detected with the help of Festo's scan program (➔ section"Scan Festo Devices"). The network properties of the device can be read out in this scan program and changed as appropriate to your company network.

4.2.4 Manually adding a device

Instead of automatically selecting a device, you can also manually add it.

1. Highlight the local gateway.
2. Click the "Add device..." button.

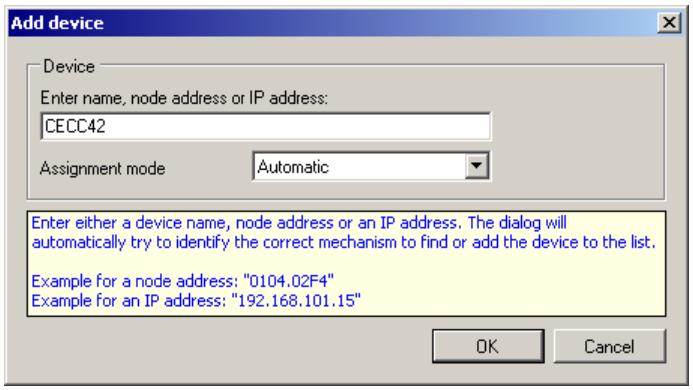


Figure: "Add device" dialog

3. Enter the name, node address or IP address of the device to be connected in the "Add device" dialog and confirm your entries with "OK".

Depending on the filter setting, you will see a list of all CECC-... devices in the local gateway after the tab is updated.

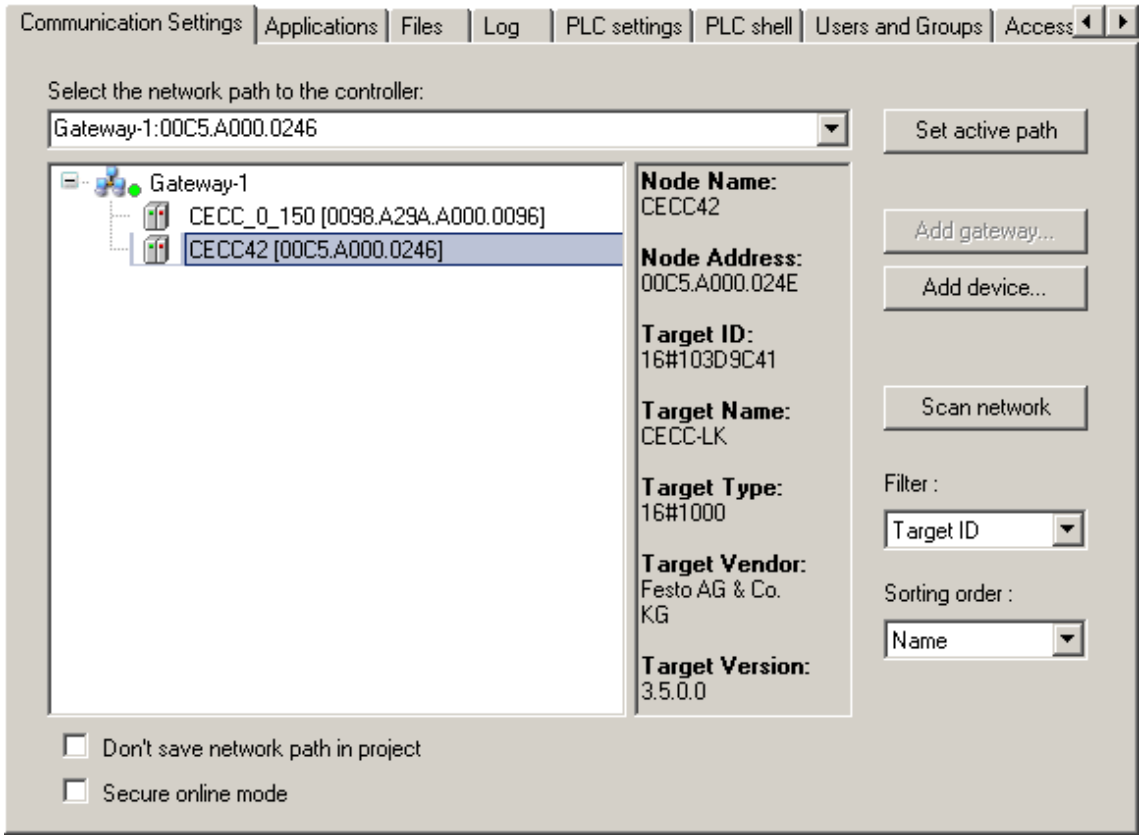


Figure: Local gateway with devices

4.2.5 Setting the communication channel

To exchange data with the connected CECC you need a communication channel.

- Highlight the required 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 with the word "(active)" after it.

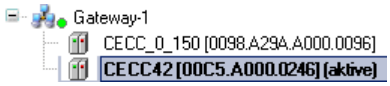


Figure: Activated device

4.2.6 Adding the CECC as a gateway

To extend the network you can add a CECC as a gateway. This extends the network to include the subnetwork via which the CECC can be connected.

1. Click the "Add gateway" button.
   The "Gateway" dialog window opens.

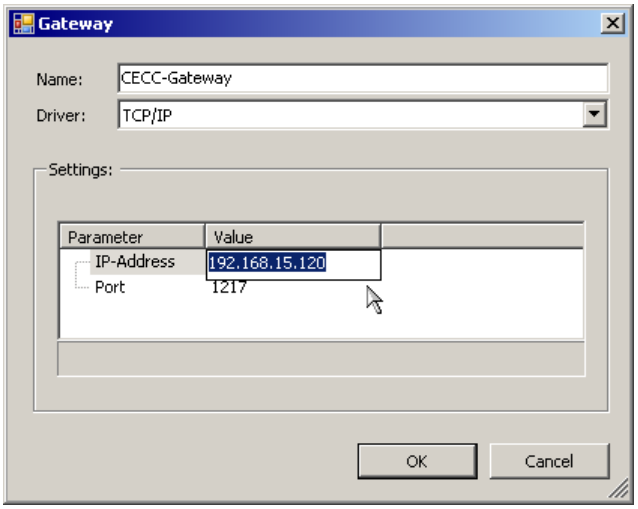


Figure: "Gateway" dialog

2. Enter a name for the new gateway in the input field.
3. Enter the known IP address of the relevant CECC.
4. Confirm your entries with "OK".
5. Repeat Step 3 of 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 start the scan program "Scan Festo Devices":

1. Click the icon in the toolbar of the CoDeSys program window.
2. Select the menu command [Online] [Scan Festo Devices].

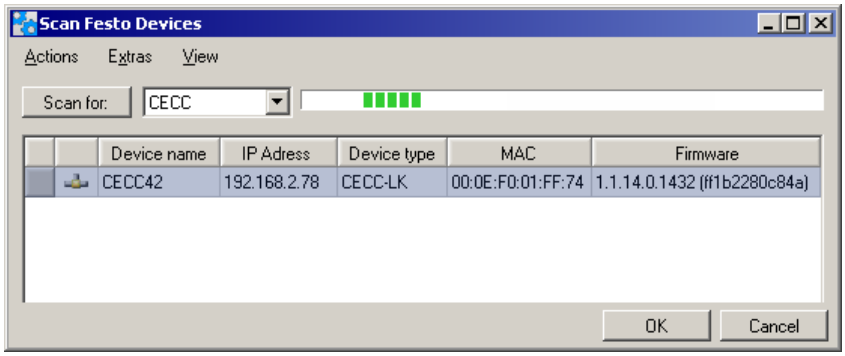


Figure: "Scan Festo Devices" scan program

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 the devices found are listed in the scan program table.

4.3.1 Changing network properties

1. Highlight the found device.
2. Open the dialog "Network properties for the device"
   – Menu command [Actions] [Device] [Network Properties] or
   – Context menu [Network Properties].

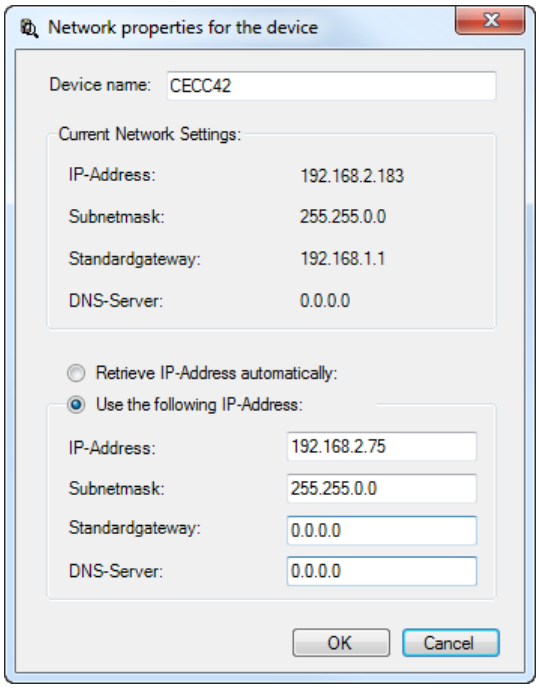


Figure: "Network properties for the device" dialog

3. If applicable, change the IP address.
4. If applicable, change the settings for subnet mask, standard gateway and DNS server.
5. Apply the changes to the device by clicking "OK".
6. Wait until the device has successful completed switching on ("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 belonging to the "Onboard" branch in the CoDeSys V3 pbF device window.

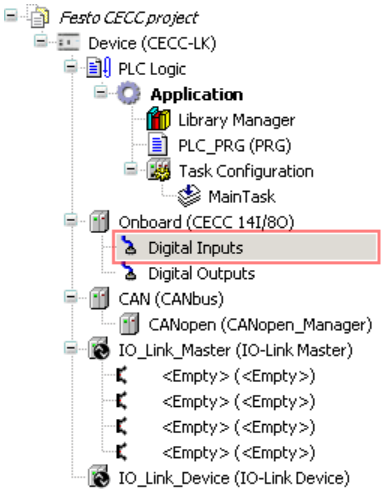


Figure: Device window - onboard I/O interface

2. Double-clicking the highlighted "Digital Inputs" interface opens a new tab in the editing window for configuring the I/O interface's inputs.
   You will find the settings for the debounce time of the I/O interface's inputs on the "Digital Inputs Configuration" subtab.

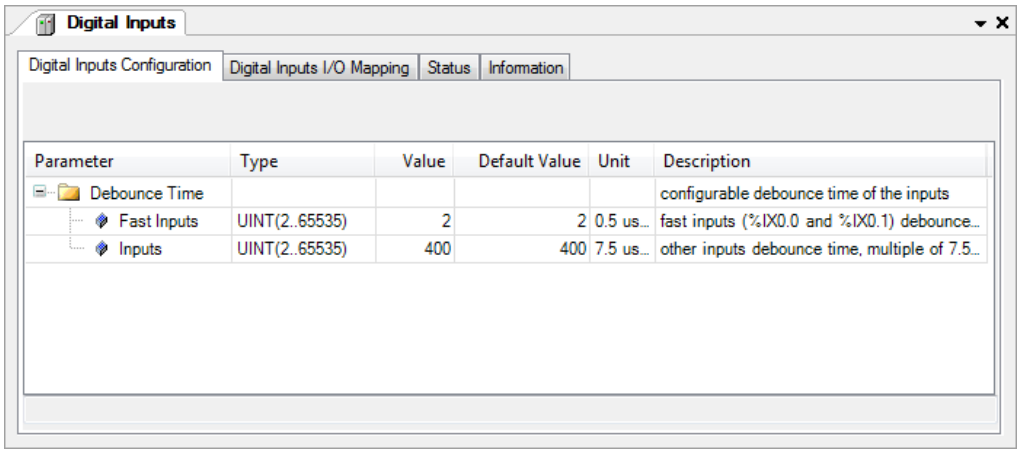


Figure: I/O configuration of the digital inputs

3. Click the "Digital Inputs I/O Mapping" subtab to show the current input values.

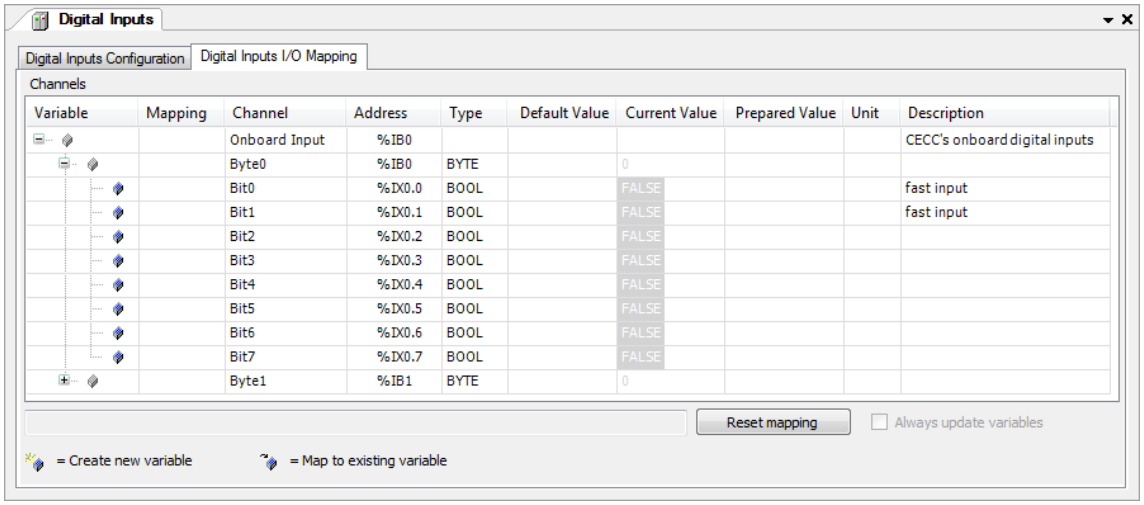


Figure: I/O mapping of the digital inputs

4. Double-clicking the "Digital Outputs" interface in the device window opens the corresponding tab in the editing window for configuring the I/O interface's outputs.
5. If applicable, click the "Digital Outputs I/O Mapping" subtab to show the current input values.

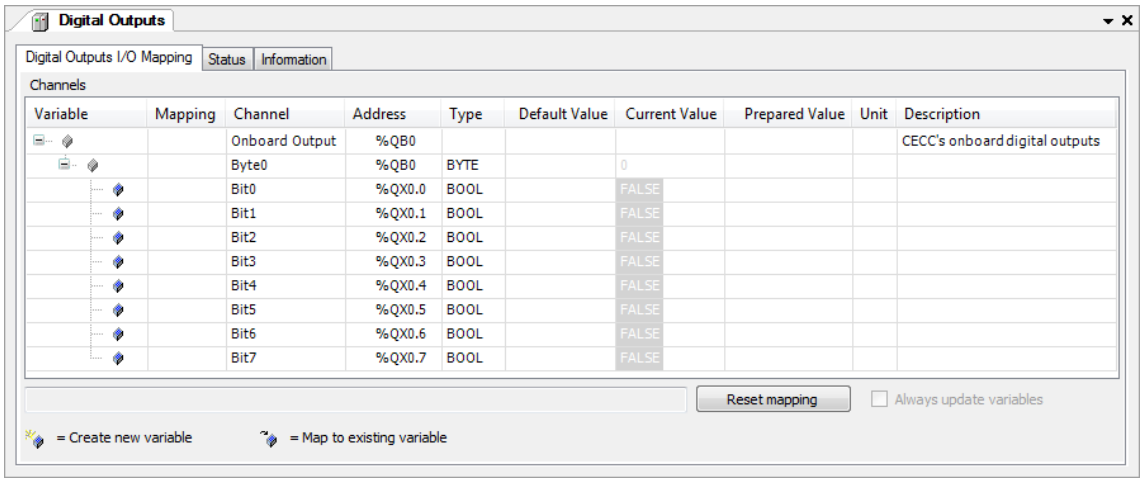


Figure: I/O mapping of the digital outputs

6. In offline mode, check the "Always update variables" box to have the output states displayed in real time.

4.5 Configuring a CANopen slave

The connection via CANopen requires an appropriate baud rate.

The CAN tab for setting the baud rate is accessed 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.

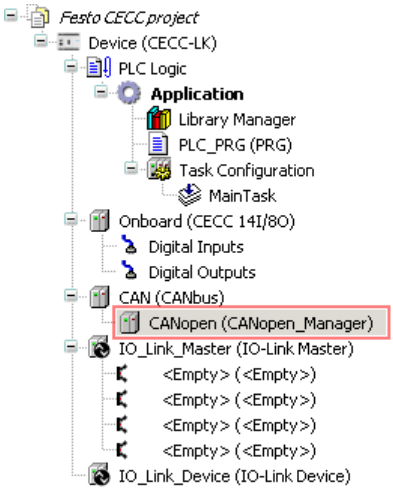


Figure: Device window - selecting "CANbus - CANopen_Manager"

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

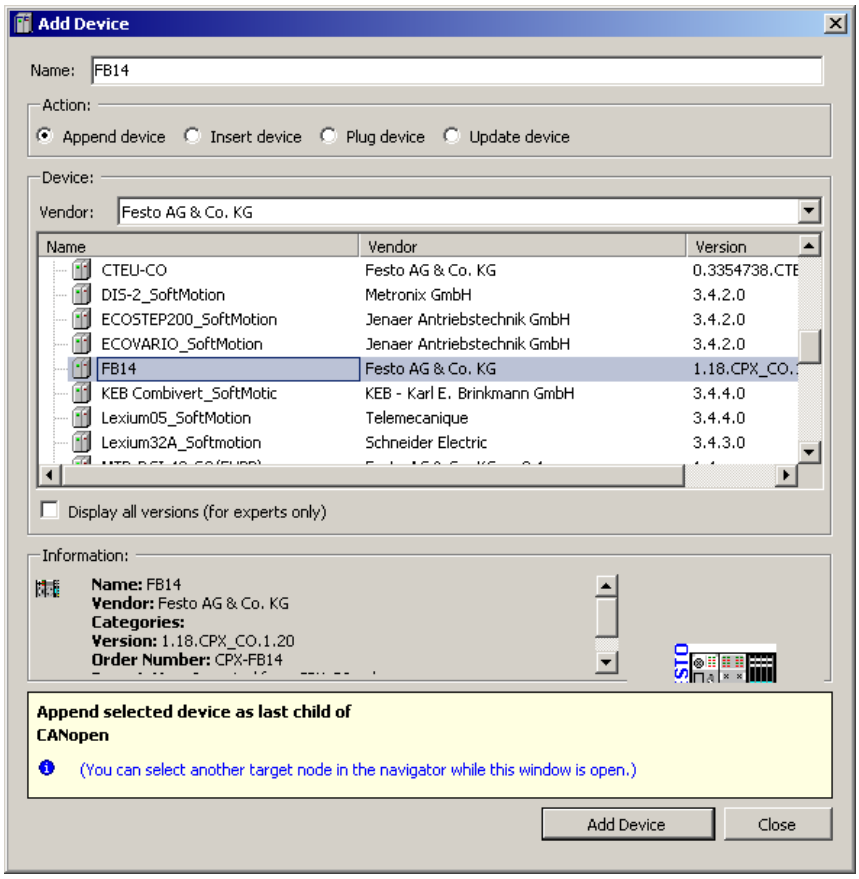


Figure: "Add Device" dialog

3. Select a CANopen slave in the device table and highlight it.
   Example: FB14
4. Confirm your selection by clicking the "Add Device" button.

5. If applicable, repeat Steps 3 and 4 to add further devices (maximum number of CANopen slaves: 32).
   Example: Special case for integrating a valve terminal CPV-CO2
6. Close the dialog by clicking "Close".
7. Highlight the added CANopen slave in the device window.

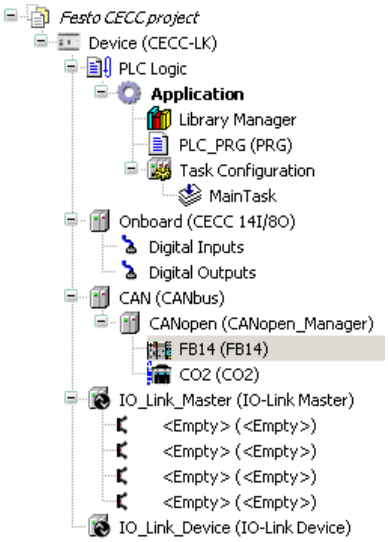


Figure: Device window - selecting "FB14"

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

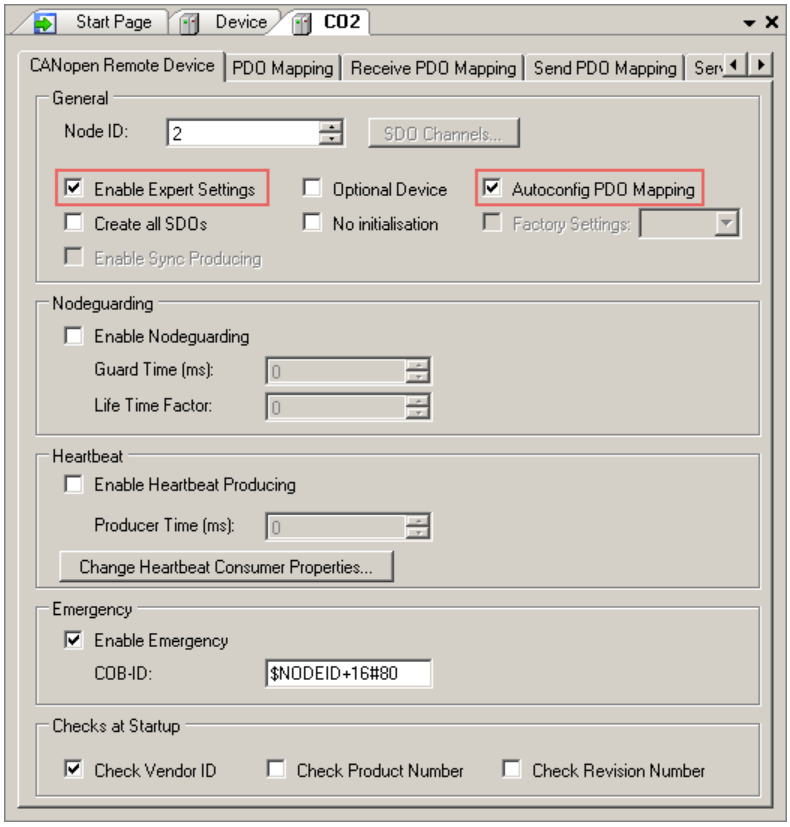


Figure: Editing window with CANopen slave FB14

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

This option is enabled by default for the CECC under CoDeSys V3 pbF.

- If applicable, check the "Autoconfig PDO Mapping" box on the "CANopen Remote Device" tab in the editing window.
  Configuration takes place automatically with this setting if the CANopen slave supports submodules.

The PDO mapping can be found on the subtab of the same name.

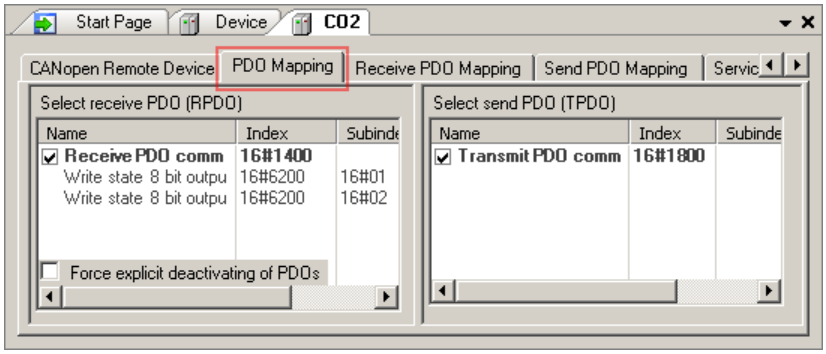


Figure: Editing window with CANopen slave FB14

4.5.2 Integrating CPV terminals

CPV terminals are added to CANopen slaves CO2 (CPV-CO2) as submodules (➔ Adding a CANopen slave - Step 3).

1. Highlight the CANopen slave "CO2" in the device window.
2. Open the dialog "Add Device"
   – 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 your 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.

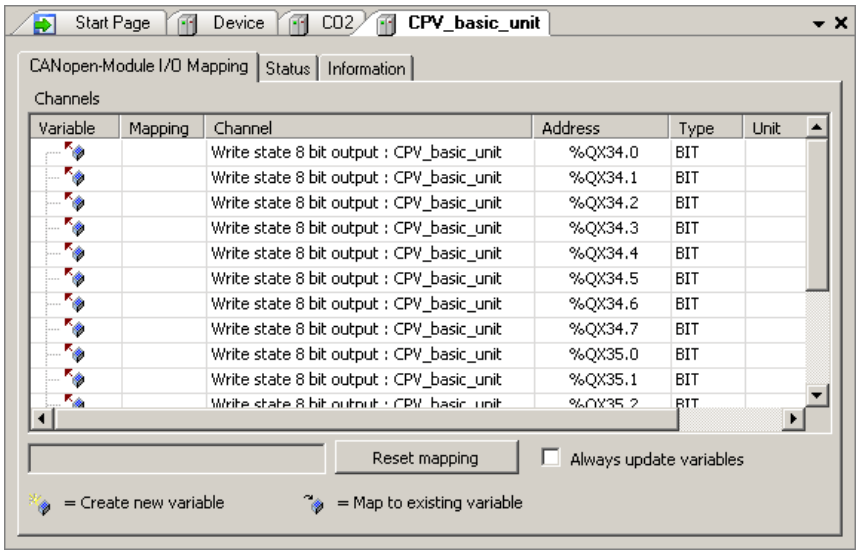


Figure: Editing window with CPV terminal as CANopen slave

4.6 Configuring an IO-Link master

Note

To operate the IO-Link interface of the CECC-LK you need the IODD file of the relevant IO-Link devices.

- 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 manufacturer.

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

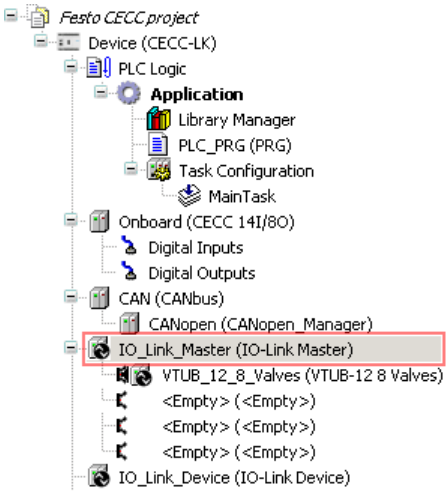


Figure: Device window - selecting "IO-Link Master"

2. Activate 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 master.

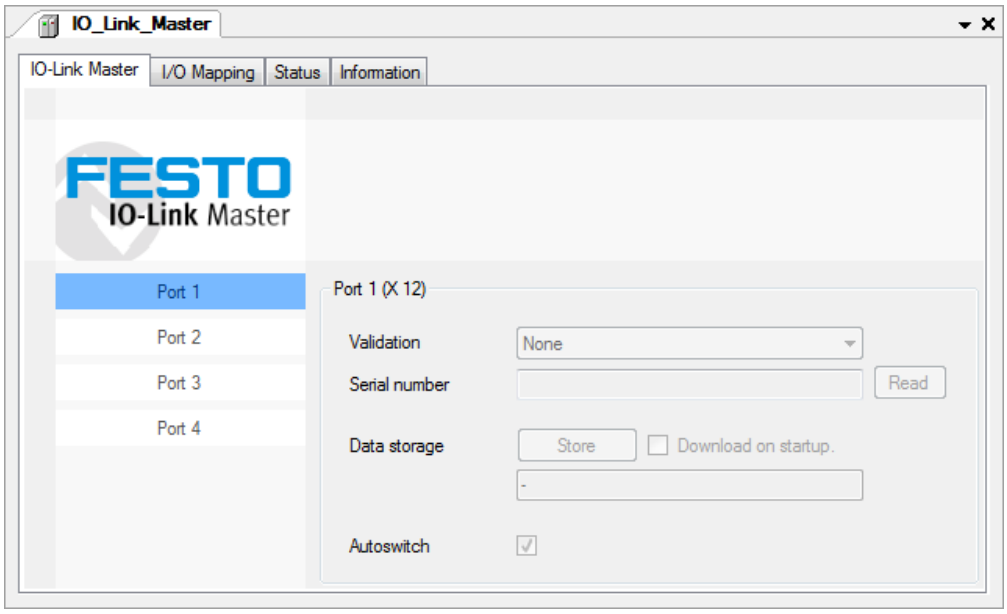


Figure: CECC-LK editing window - IO-Link master

You will find the following information and setting options on the subtab:

Subtab	Comment
IO-Link Master	Configures the validation: reads in the serial number Options – Data storage: stores the parameters – Autoswitch: automatically switches to operate mode (standard)
I/O Mapping	Reserved (see IO-Link devices for I/O mapping)
Status	Communication status
Information	Version information

- Switch to the masterport configuration by clicking one of the four possible ports with the mouse. The selected port is highlighted in blue.

4.6.1 Selecting an IO-Link device

The controller CECC-LK has four IO-Link master connections, each of which can accommodate one IO-Link device.

1. Highlight an "Empty" placeholder for an IO-Link master in the "IO-Link Master" branch in the device window.
2. Activate the context menu (right mouse button) and open the "Plug Device" dialog.

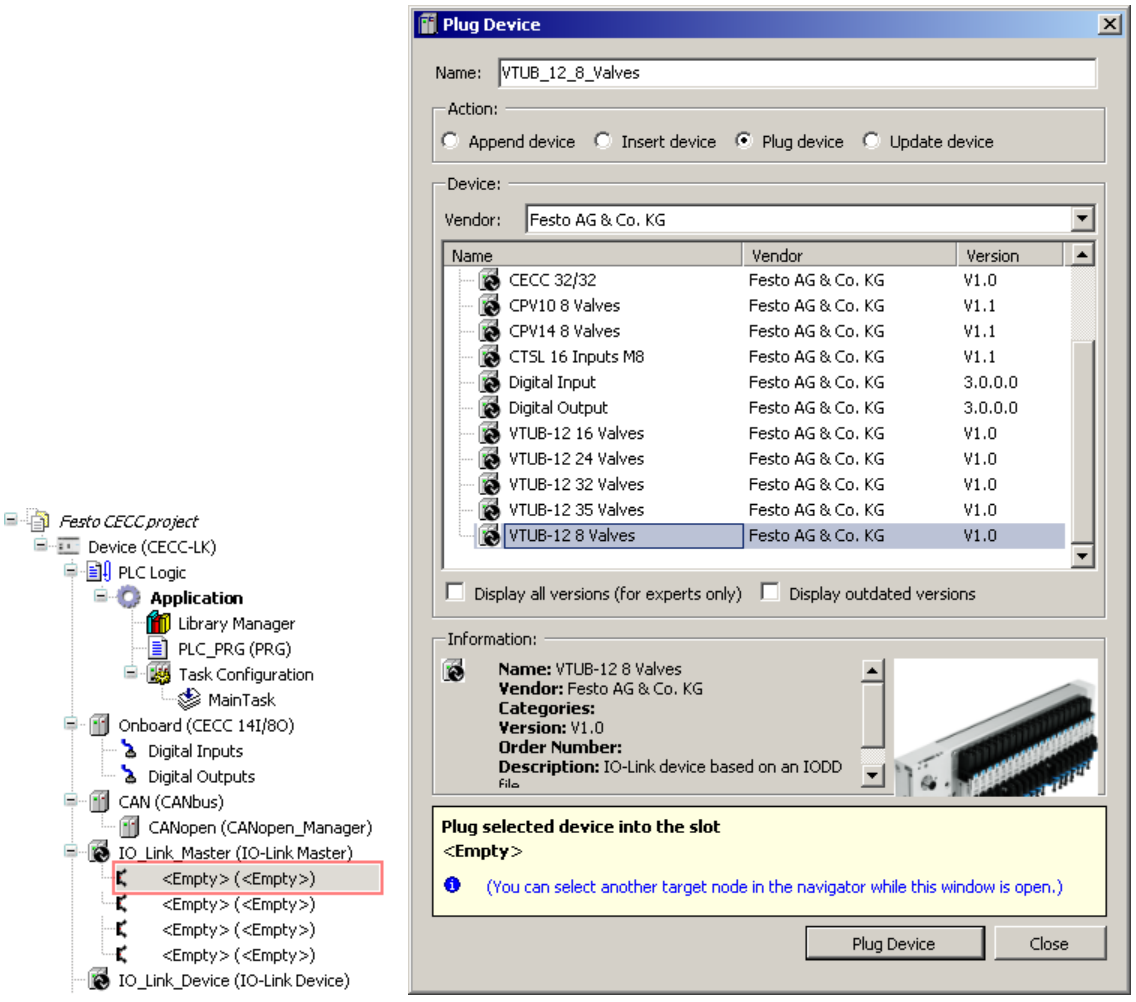


Figure: Device window - selecting a placeholder / "Plug Device" dialog

Actions in the "Plug Device" dialog

Action	Comment
Append device	Selects a device to append it to the selected connection.
Insert device	No function, because the CECC has exactly four connections.
Plug device	Replaces the device to be connected to the selected connection.
Update device	Accepts a device with new firmware at the selected connection; the device's name in the device window does not change.

3. You can change the list of devices that can be selected using the options
   - Display all versions (for experts only),
   - Display outdated versions.
4. Select the IO-Link device (e.g. VTUB-12 8 Valves) connected to the CECC's IO-Link master connection from the table in the "Device" area and highlight it. If applicable, limit the choice of devices uses the "Vendor" drop-down list.
5. Click the "Plug Device" button to copy the IO-Link device into the device window.
6. Select another/unassigned connection for a further IO-Link device in the device window.
   The "Plug Device" dialog must not be closed for this.
7. If applicable, repeat Step 3 to plug further IO-Link devices (max. 4).
8. Close the dialog by clicking "Close".

Simple digital I/Os or further controllers CECC instead of IO-Link devices can be connected to the IO-Link master and plugged in this dialog.

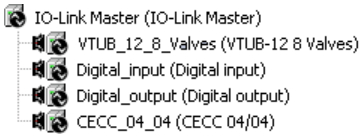


Figure: Example of an IO-Link master with four plugged IO-Link devices

The names in the device window can be changed after clicking (not double-clicking) a previously highlighted device again.

4.6.2 Performing a scan for an IO-Link device

Instead of manually selecting the IO-Link devices connected to the CECC, you can also have CoDeSys V3 pbF perform a scan for them.

Prerequisites:
- There is a (temporary) connection with the device via the active path.
- CoDeSys V3 pbF was logged into the device at least once (➔ section "Online mode").

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

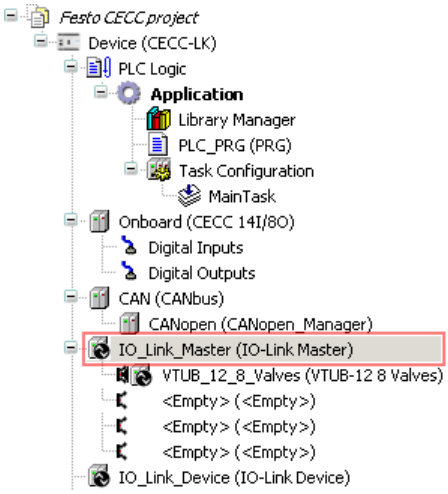


Figure: Device window - selecting "IO-Link Master"

2. Open the dialog "Scan Devices"
   – Menu command [Project] [Scan Device] or
   – Context menu [Scan Device].
3. Note the question about actuators connected to the IO-Link masterports. If you can answer this question with "yes", a dialog window opens for performing a scan for connected IO-Link devices.

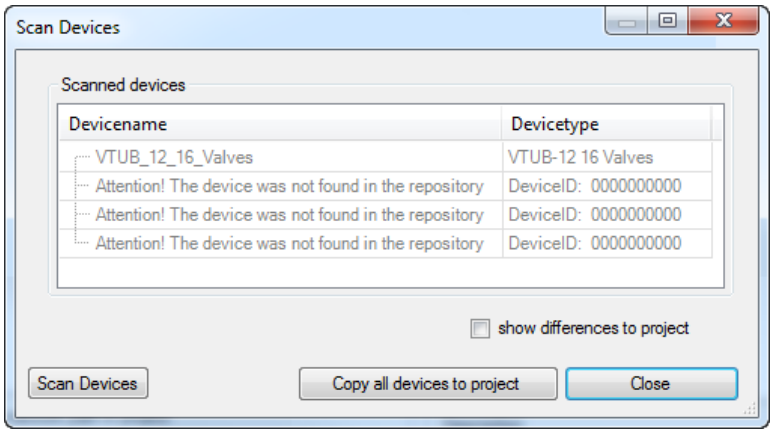


Figure: "Scan Devices" dialog window at the IO-Link masterports

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 copy the read in configuration to the CoDeSys project.

4.6.3 Configuring an IO-Link device

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

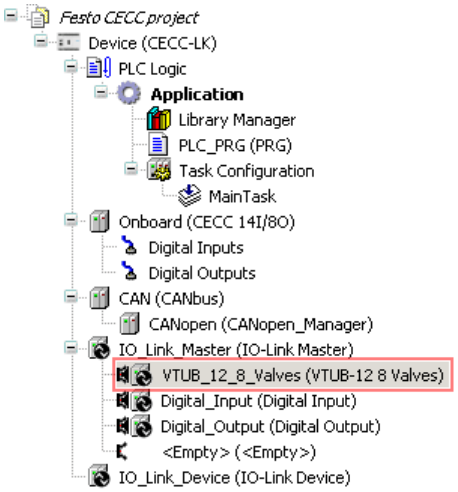


Figure: Device window - selecting an appended IO-Link device

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

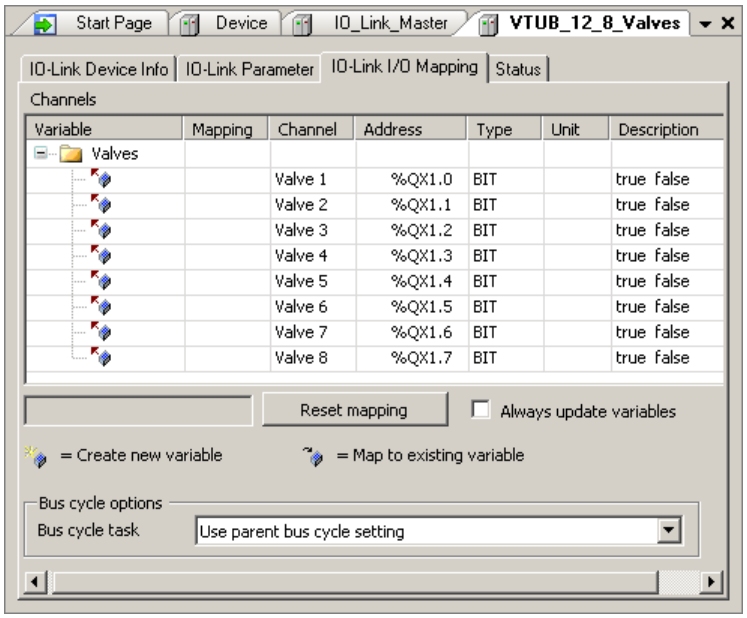


Figure: Editing window with IO-Link device VTUB-12 8 Valves (example)

You will find the following information and setting options in the subtab for the selected IO-Link device (example: VTUB-12 8 Valves):

Subtab	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 of the IO-Link device components.
Status	General status of the IO-Link device.

4.7 Configuring an IO-Link device

The controller CECC has an "IO-Link Device" interface for connecting to a higher-level IO-Link master.

Note

To operate the IO-Link interface of the CECC-LK 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.

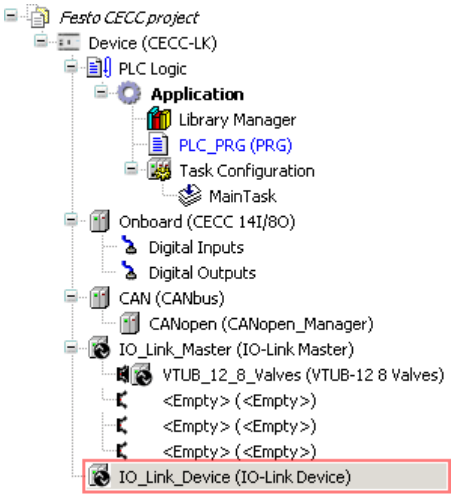


Figure: Device window - selecting "IO-Link Device"

2. Activate 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.

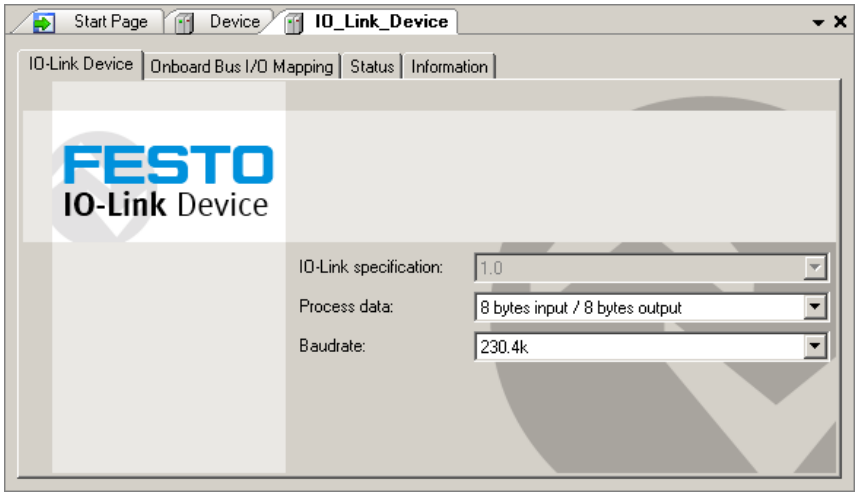


Figure: CECC-LK editing window - IO-Link device

You will find the following information and setting options on the subtab:

Subtab	Comment
IO-Link Device	Shows the IO-Link specification Settings: – Data width for the process data – Baud rate for data transmission
Onboard Bus I/O Mapping	Current process data of the components of the CECC-LK as an IO-Link device.

Subtab	Comment
Status	Communication status
Information	Version information for the CECC-LK as an IO-Link device.

4.7.1 Onboard Bus I/O Mapping

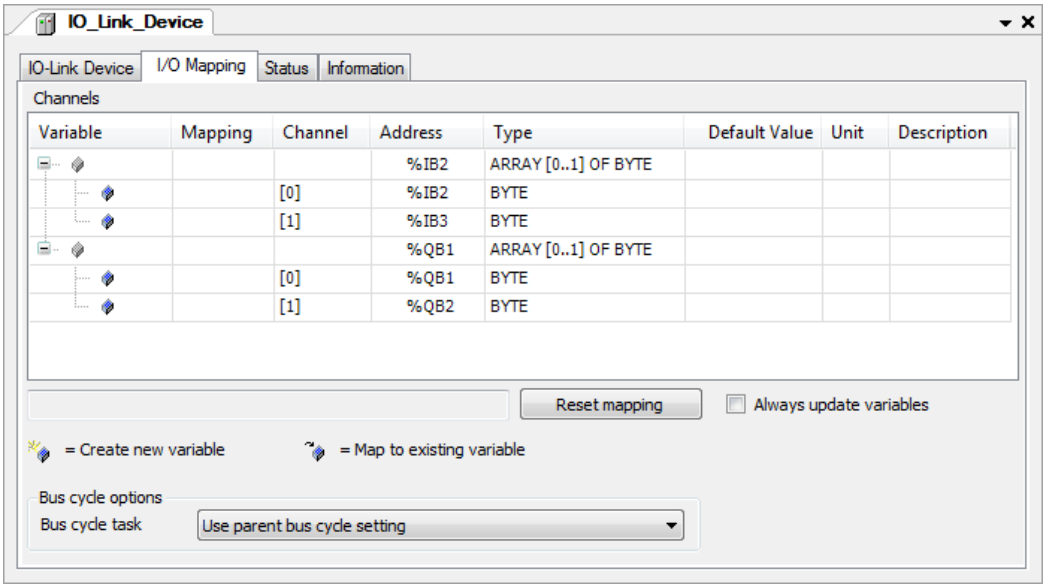


Figure: Sample onboard bus of the CECC-LK as an IO-Link device

This tab contains the current I/O mapping for the onboard bus.

4.7.2 Modbus TCP

The controller CECC supports both Modbus TCP Client and Modbus TCP Server.

The maximum numbers of channels that can be used in Modbus TCP Server mode is limited to eight channels for simultaneous use.

Detailed information about Modbus TCP can be found in the online Help for 3S in the CoDeSys V3 pbF installation directory.

4.8 Online mode

Caution

Sudden uncontrolled movements of the actuators can cause injury.

- When testing projects and programs, you should always start without the actuators active.

A configured project including program (CECC application) is to be transferred to the CECC. Online mode must be established for the transfer, i.e. CoDeSys V3 pbF must be "logged into" the CECC.

4.8.1 Logging in

Use one of the following commands to log in:

- Click the icon in the toolbar of the CoDeSys program window
- Menu command [Online] [Log In]
- Shortcut ALT+F8

CoDeSys V3 pbF logs into the CECC connected in the gateway via the active path.

First the connected CECC is compared with the device selected in the project to see if they match. If applicable, an error message about the target system ID is displayed (➔ section"Controller CECC").

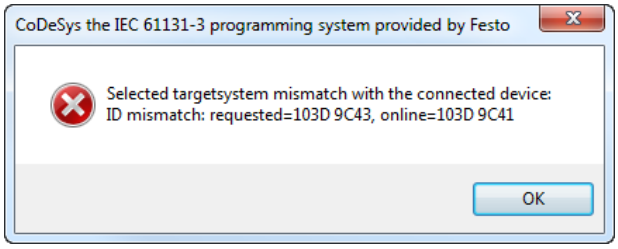


Figure: Warning message if the target system ID does not match

Then the project is compared with the application on the CECC. The following warning is displayed if the project has changed:

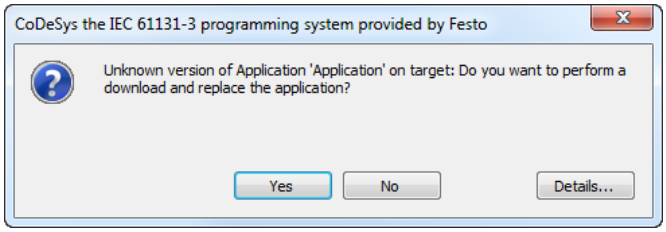


Figure: Warning message if the versions are different

- Deal with the version differences between the CoDeSys project and the CECC application as appropriate (☐CoDeSys V3 pbF online Help "Logging in").

As soon as online mode is active, the connection with the CECC as well as the application in the device window are highlighted in green. The CECC is online, the application is not started (not running), the "Run" status LED lights up green.

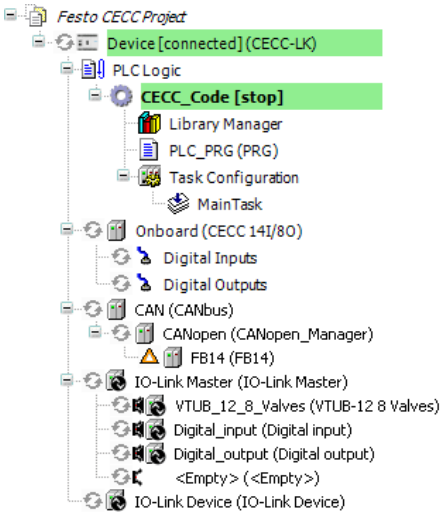


Figure: Device window with CECC logged in

4.8.2 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 highlighted in green in the device window; the text [run] is appended to the application "CECC_Code". The round arrows in front of the various CECC devices light up green.

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

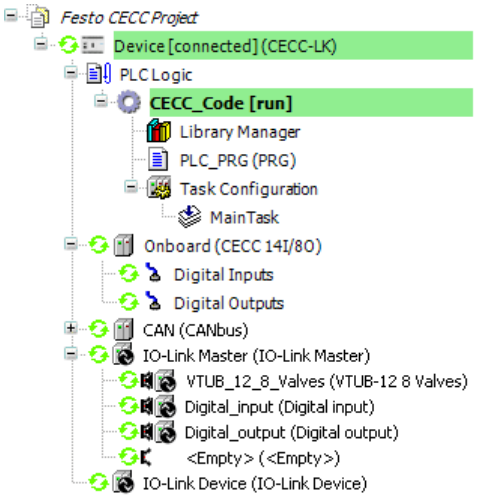


Figure: Device window with CECC in debug mode

4.8.3 Manually setting I/Os

In the editing window you will find the online views of all the program modules and have the following options:

- Writing and forcing variables
- Using monitoring lists
- Fault finding in applications (debugging).

Sample IO-Link

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

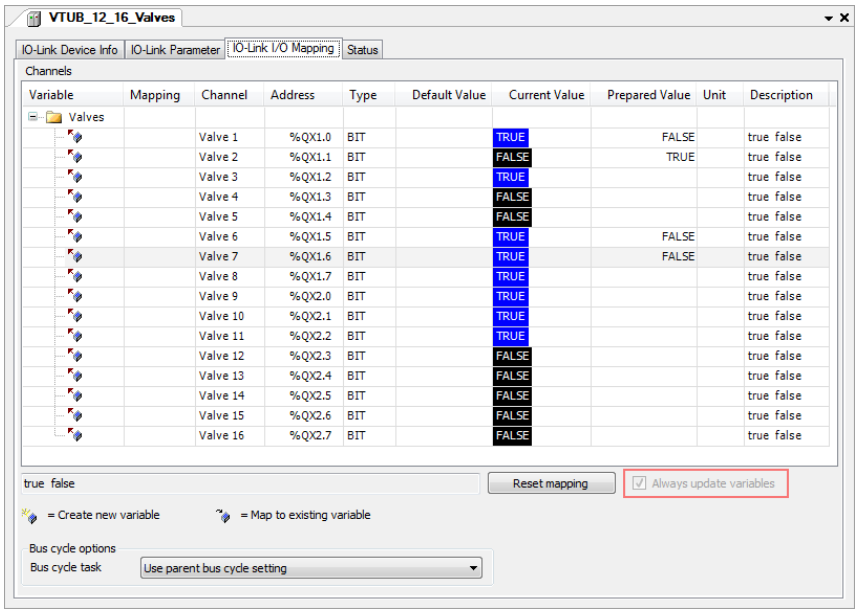


Figure: Editing window with IO-Link device "VTUB_12_16_Valves"

2. Change the value for the valves by double-clicking 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 if CoDeSys V3 pbF is not logged into the CECC.

4.8.4 Logging out

Use one of the following commands to log out:

- Click the icon in the toolbar of the CoDeSys program window
- Menu command [Online] [Log Out]
- Shortcut CTRL+F8.

Further information on monitoring and controlling the application can be found in the online Help for CoDeSys V3 pbF.

4.9 PLC shell for CECC

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 as a string to the controller. The returned response string is shown in a results window in the browser. This functionality is provided for diagnostic and debugging purposes.

To use the PLC shell:

1. Highlight the device (CECC) in the CoDeSys V3 pbF device window.
2. Double-clicking the device opens a new "Device" tab in the editing window for configuring the CECC.
3. Switch to the "PLC shell" subtab.

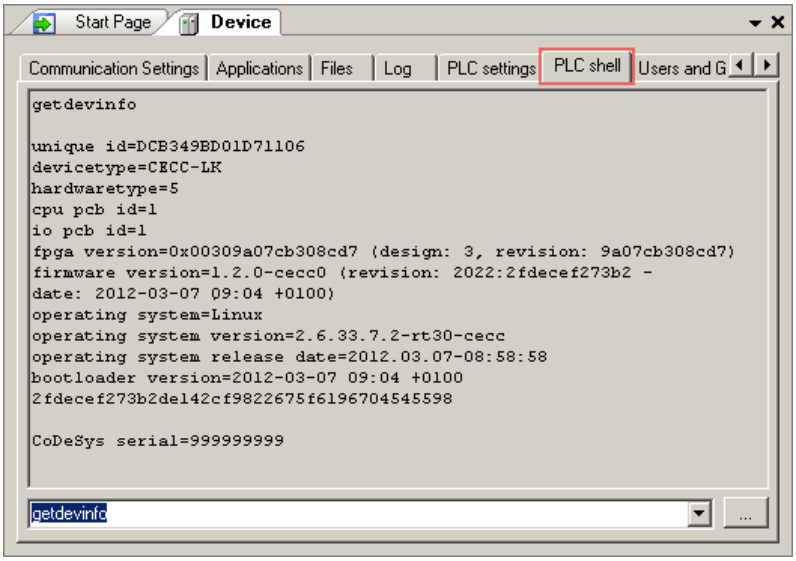


Figure: CECC editing window with "PLC shell" subtab

An online connection between CoDeSys V3 pbF and the CECC is required to communicate using the PLC shell (➔ section "Online mode"); a temporary connection will be established with the device in the active path if necessary.

The target system ID of the controller in the active path must match 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 the device information.
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]	IP configuration setting (applied after restart). Examples: setipconfig 192.168.2.20; setipconfig nodhcp

Command	Comment
reboot	Restarts 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
cangetstat	Shows the status information of the CAN driver.

Table: PLC shell commands

You can call up a list of all commands for the device in the active path by entering a question mark "?" (without quotation marks) in the command line of the PLC shell.

5 Diagnostics

5.1 General error characteristics

Warning

If an error occurs, the controller carries on processing 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 error detection locally using – controller LEDs – CECC-specific LEDs
Controller configuration	Online diagnostics without the need for programming.
User program	Detailed diagnostic evaluation: – System event CECC_system_error – Support for function blocks from the Festo CECC_3 library ➔ section "Diagnostics".

Table: Diagnostic options offered by the CECC

Error class	Weighting	Error number	Evaluation via function block in Festo CECC_3 library	Display in CoDeSys device log	Display in 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 program Festo Field Device Tool (FFT) can be downloaded via the Festo support portal ➔ www.festo.com.					

Table: Error evaluation options

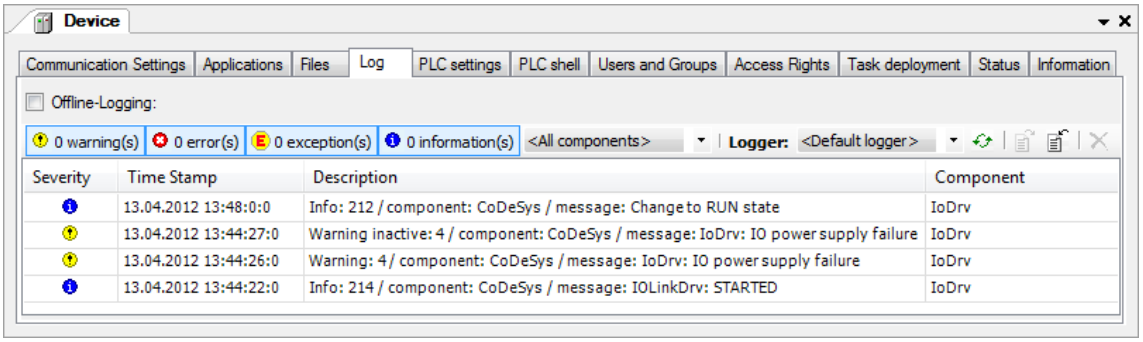


Figure: Editing window with "Device" tab - "Log" subtab

Error message	Error number	Error class	Remedy
Short circuit/overload of outputs	2	Warning	Check the outputs for a possible short circuit.
Failure of the I/O load supply	4	Warning	Check the I/O power supply.
Undervoltage at the power supply unit	5	Warning	Check the power supply.
FPGA fault	140	Error	Replace the device.
FRAM fault	141	Error	
License error	144	Error	
CoDeSys started	210	Information	–
CoDeSys terminated	211	Information	–
CoDeSys in RUN mode	212	Information	–
CoDeSys in STOP mode	213	Information	–

Table: CoDeSys V3 pbF error messages

Error message	Error number	Error class	Remedy
IO-Link master initialisation error	150	Error	Check the connected IO-Link devices. Check the power supply unit.
IO-Link master switched off	151	Error	
IO-Link device initialisation error	152	Error	
IO-Link master started	214	Information	–
IO-Link device started	215	Information	–

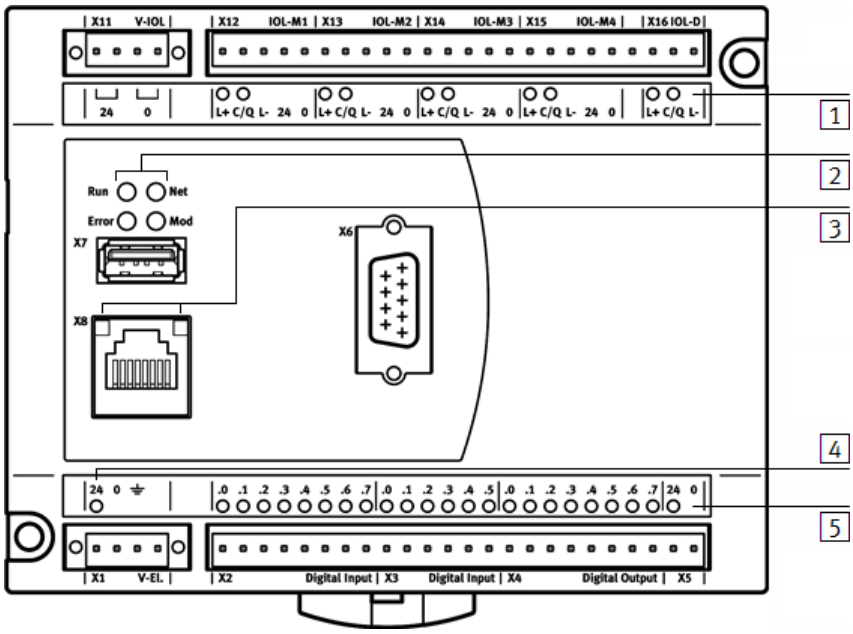
Table: IO-Link error messages

Error message	Error number	Error class	Comment
Multicast daemon started	216	Information	–
Kernel diagnostics (function) stopped	217	Information	–
Kernel diagnostics (function) started	218	Information	–
Redirect all kernel errors for diagnostics	219	Information	–

Table: Internal error messages

5.2 Status LEDs

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



1 IO-Link (only with CECC-LK)

2 Operation (Run, Net, Error, Mod)

3 Ethernet

4 Power supply for the device (24 V)

5 I/O (inputs and outputs) and power supply for I/Os

Figure: Status LEDs of the CECC

LED	Sequence	Meaning	Comment
24 Volt	Lights up green	Device ready for operation	Power supply
	Does not light up	Device switched off	
	Flashes green	Device undervoltage	
Run	Lights up green	Program running	Status of the application
	Lights up yellow	Program stopped	
Error	Lights up red	Error class 4	PLC runtime error
	Flashes red	Error class 2	
	Does not light up	No error/error class 1	
Net	Flashes red	Device identified	Identification by FFT
Mod	–	–	Reserved
Ethernet left	Lights up green	Data transfer with 100 Mbit	Speed LED Data transfer speed
	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
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 LEDs

6 Technical appendix

6.1 Technical data:

Feature	CECC
Certification	C-Tick
Operating voltage	19.2 - 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	400 MHz processor
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
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

Feature	CECC
IO-Link (CECC-LK only)	
– Protocol	Device V 1.0, Master V 1.1
– Connection technology	Cage Clamp, device 3-pin, master 5-pin, plug Device: COM1 (4.8 kB), COM2 (38.4 kB), COM3 (230 kB) Master SIO: COM1 (4.8 kB), COM2 (38.4 kB), COM3 (230 kB) can be configured via software
– Permissible length of IO-Link cables	20 m
– Port type	Device: A Master: B
– Number of ports	Device: 1 Master: 4
– 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 kB 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	125, 250, 500, 800, 1000 kbps can be set via software
– Electrical isolation	Yes
USB interface	USB 1.1
Ethernet	
– Connector plug	RJ45
– Number	1
– Data transmission speed	10/100 Mbps
– Supported protocols	TCP/IP, EasyIP, Modbus TCP
Programming software	CoDeSys provided by Festo (pbF)
Programming language	To IEC 61131-3 SFC, STL, 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 classified in Zone A according to EN 61131-2:2007.	

Table: Technical data

7 Glossary

C

CANopen: Fieldbus protocol based on CAN; formalised as a European standard.

CoDeSys: CoDeSys provided by Festo allows the configuration, commissioning and programming of different Festo components and devices. 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 fast exchange of operands between controllers.

EDS file: Electronic data sheet; this file describes the functionality and properties of a CANopen device in standardised format (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. 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: Used 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 provided by Festo programming software are combined

in a package.

PLC: Programmable logic controller.

T

Target system ID: Unique code for the device type. Projects can only be loaded on controllers if the set device type matches.

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

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 work data is defined in the configuration of the field bus slave.