Your Global Automation Partner

TURCK

TBEC-LL-8IOL

IO-Link Master Module for EtherCAT

Instructions for Use

Table of Contents

1 About These Instructions

These operating instructions describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols used

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.
	**WARNING** WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.
	**CAUTION** CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.
	**NOTICE** NOTICE indicates a situation which may lead to property damage if not avoided.
	**NOTE** NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.
▶	**CALL TO ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULTS OF ACTION** This symbol denotes relevant results of actions.

1.3 Additional documents

The following additional documents are available online at **www.turck.com**

- Data sheet
- EU Declaration of Conformity
- Commissioning manual IO-Link devices
- Approvals

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to **techdoc@turck.com**.

2 Notes on the Product

2.1 Product identification

These instructions apply for the following IO-Link master module:

- TBEC-LL-8IOL (Ident-No. 100004614)

2.2 Scope of delivery

The scope of delivery includes:

- TBEC-LL-8IOL
- Closure caps for M12 female connectors
- Label clips

2.3 Legal requirements

The device falls under the following EU directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS Directive)

2.4 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 132].

3 For Your Safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

3.1 Intended use

These devices are designed solely for use in industrial areas.

The block I/O module TBEC-LL-8IOL is an IO-Link master according to IO-Link specification V1.1 for EtherCAT.

The IO-Link master module TBEC-LL-8IOL has eight IO-Link channels. Up to eight IO-Link sensors or IO hubs with IO-Link can be connected to the M12 sockets. In addition, up to 12 digital sensors can be connected directly it. When using I/O hubs, it is possible to connect up to 128 digital sensors per device.

The devices may only be used as described in these instructions. Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

3.2 General safety notes

- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device only meets the EMC requirements for industrial areas and is not suitable for use in residential areas.

4 Product description

The devices are designed in a fully encapsulated housing with degree of protection IP65/IP67/IP69K.

The IO-Link master module TBEC-LL-8IOL has eight IO-Link ports for connecting IO-Link devices. The IO-Link ports at the connectors X0…X3 are designed as Class A ports. The IO-Link ports at the connectors X4…X7 are designed as Class B ports. In addition to the eight IO-Link-channels, four universal digital DXP channels (PNP) are available. The eight IO-Link channels can be parameterized independently of each other and operated either in IO-Link mode or in SIO mode (DI).

The four universal digital channels are designed as DXP-channels and can therefore be parameterized as in- or output.

For connecting the supply voltage, the device has 5-pin, L-coded M12 connectors.

4.1 Device overview

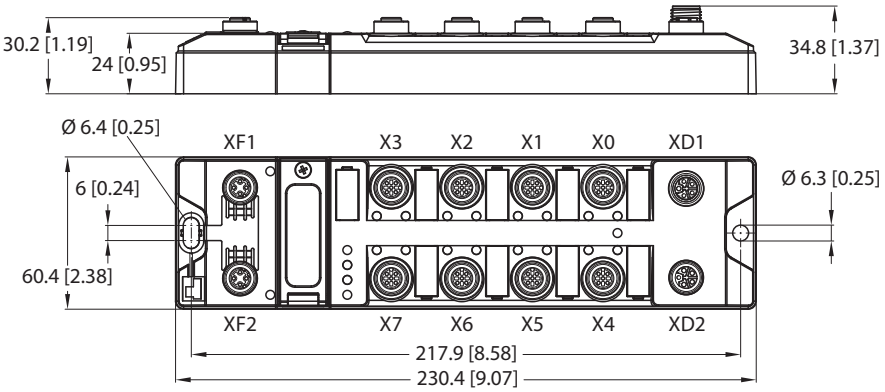


Fig. 1: Dimensions TBEC-LL-8IOL

Connector	LED	Function
XD1	PWR	Supply voltage V1
XD2		Supply voltage V2

Connector	LED	Channel	Function	Auxiliary voltage
X0	0	Ch0	IO-Link port 1 (Class A)	VAUX1
	1	Ch1	DXP1	
X1	2	Ch2	IO-Link port 2 (Class A)	VAUX1
	3	Ch3	DXP3	
X2	4	Ch4	IO-Link port 3 (Class A)	VAUX1
	5	Ch5	DXP5	
X3	6	Ch6	IO-Link port 4 (Class A)	VAUX1
	7	Ch7	DXP7	
X4	8	Ch8	IO-Link port 5 (Class B)	VAUX1
	9	Ch9		VAUX2
X5	10	Ch10	IO-Link port 6 (Class B)	VAUX1
	11	Ch11		VAUX2

Connector	LED	Channel	Function	Auxiliary voltage
X6	12	Ch12	IO-Link port 7 (Class B)	VAUX1
	13	Ch13		VAUX2
X7	14	Ch14	IO-Link port 8 (Class B)	VAUX1
	15	Ch15		VAUX2

Connector	LED	Function
XF1	L/A	EtherCAT, EC IN
XF2	L/A	EtherCAT, EC OUT

4.1.1 Operating elements

The device has the following operating elements:

- Hexadecimal rotary coding switches to set the device address (identification value) when addressing via explicit device identification
- Reset button for resetting to the factory settings

4.1.2 Display elements

The device has the following LED indicators:

- Power supply
- Group and bus errors
- Status
- Diagnostics

4.1.3 Block diagram

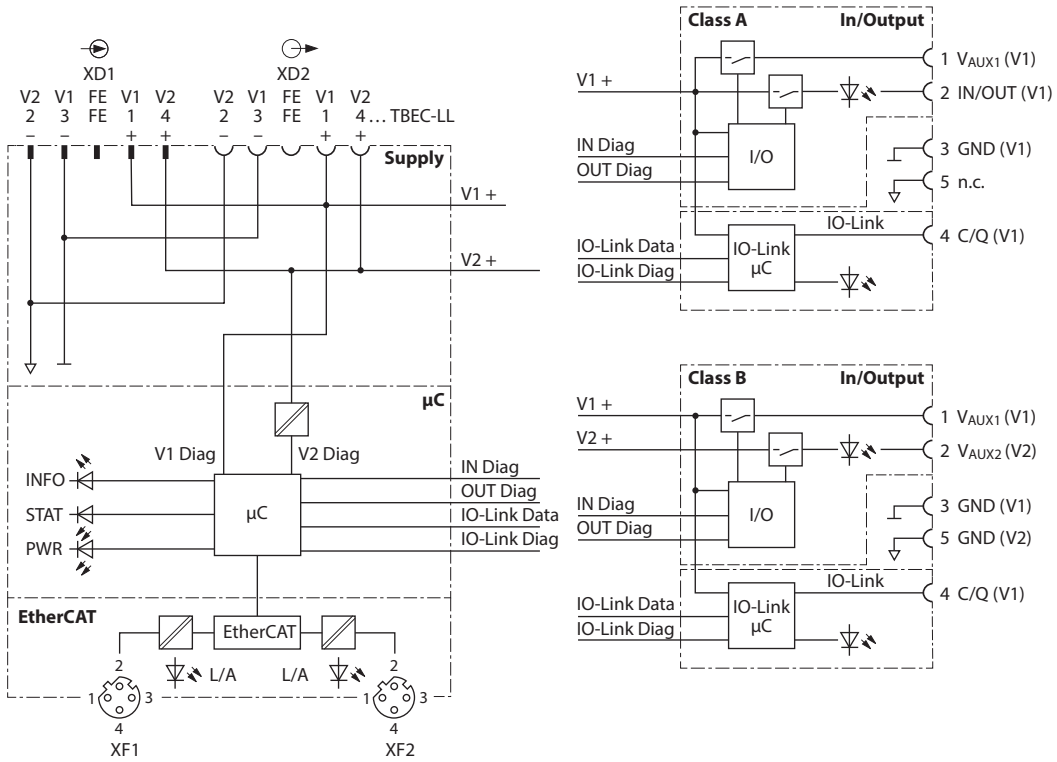


Fig. 2: Block diagram

4.2 Properties and features

- Fibre-glass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Degree of protection IP65/IP67/IP69K
- UV-resistant according to DIN EN ISO 4892-2
- Metal connectors
- 4 IO-Link ports Class A and 4 IO-Link ports Class B
- 4 universal DXP channels (PNP)
- EtherCAT slave according to Modular Device Profile
- Supported EtherCAT protocols CoE, EoE, FoE, AoE

4.3 Operating principle

The IO-Link master module TBEC-LL-8IOL connects IO-Link sensors and actuators with the higher-level control system. The device has an EtherCAT interface and fieldbus-independent I/O electronics with IO-Link master functionality (Class A and Class B ports). Via the EtherCAT interface the IO-Link master is coupled to an EtherCAT network as EtherCAT slave. During operation, the process data is exchanged between EtherCAT and IO-Link. In addition the devices can process signals from sensors and actuators via four universal digital channels.

4.4 Functions and operating modes

4.4.1 Module object directory

The object dictionary of the device contains the following object areas according to ETG 5001:

Index	Object dictionary area
0x0000…0x0FFF	Data Type area, according to ETG.5001.1
0x1000…0x1FFF	Communication area, according to ETG.5001.1
0x5000…0x5FFF	Configured Module ID (for internal use only, vendor specific)
0x6000…0x6FFF	Input area (TxPDOs of IO-Link devices) [▶ 86]
0x7000…0x7FFF	Output area (TxPDOs of IO-Link devices) [▶ 91]
0x8000…0x8FFF	Configuration area (configuration of IO-Link devices) [▶ 75]
0x9000…0x9FFF	Information area (read in configuration of IO-Link devices) [▶ 110]
0xA000…0xAFFF	Diagnosis Data [▶ 100]
0xF000…0xFFFF	Device area [▶ 73] ■ Device status [▶ 96] ■ Device control [▶ 73] ■ Device parameter [▶ 74]

4.4.2 EtherCAT functions

The device supports the following EtherCAT communication profiles:

- CoE (CAN Application Protocol over EtherCAT): The object dictionary is provided via the CoE interface. The object dictionary contains all device-specific parameters.
- EoE (Ethernet over EtherCAT): The standard Ethernet protocol is tunneled via the EoE communication protocol. An IP address for EoE can be assigned to the device so that the device can be configured via the web server or via DTM.
- FoE (File Access over EtherCAT): The firmware update is carried out via the FoE communication protocol.
- AoE (ADS over EtherCAT): The AoE communication protocol is used to read or write device data acyclically, e.g. from connected IO-Link devices.

4.4.3 IO-Link channels

The IO-Link master module TBEC-LL-8IOL has four Class A IO-Link ports (slots X0…X3) and four Class B IO-Link ports (slots X4…X7).

The eight IO-Link channels can be parameterized independently of each other and operated either in IO-Link mode or in SIO mode (DI).

4.4.4 Universal digital channels – functions

The device has four universal digital channels that can be used as inputs or outputs without configuration. Up to four 3-wire PNP sensors or four PNP DC actuators can be connected. The maximum output current per output is 2 A.

5 Installing

5.1 Mounting onto a mounting plate

NOTICE
Mounting on uneven surfaces
Device damage due to stresses in the housing
- ▶ Fix the device on a flat mounting surface.
- ▶ Use two M6 screws for mounting.

The device can be screwed onto a flat mounting plate.

- ▶ Attach the module to the mounting surface with two M6 screws. The maximum tightening torque for the screws is 1.5 Nm.
- ▶ Avoid mechanical stresses.
- ▶ Optional: Ground the device.

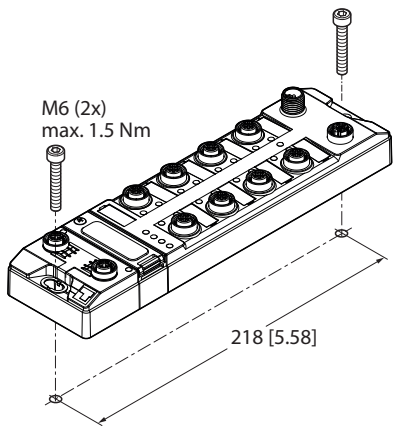


Fig. 3: Mounting the device onto a mounting plate

5.2 Mounting the device outdoors

The device is UV-resistant according to DIN EN ISO 4892-2. Direct sunlight can cause material abrasion and color changes. The mechanical and electrical properties of the device are not affected.

- ▶ To avoid material abrasion and color changes: Protect the device from direct sunlight, e.g. by using protective shields.

5.3 Grounding the device

5.3.1 Equivalent wiring diagram and shielding concept

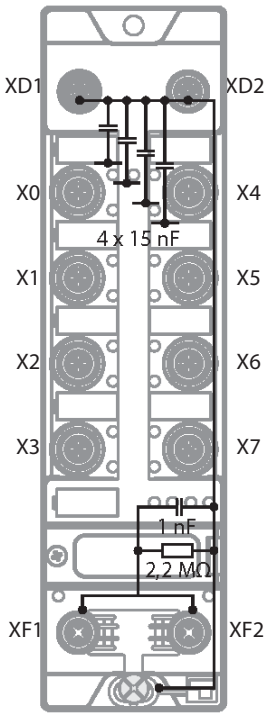


Fig. 4: TBEC-LL-8IOL– equivalent wiring diagram and shielding concept

5.3.2 Shielding of the fieldbus and I/O level

The fieldbus and the I/O level of the modules can be grounded separately.

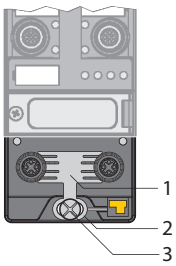


Fig. 5: Grounding clip (1), grounding ring (2) and metal screw (3)

The grounding ring (2) is the module grounding. The shielding of the I/O level is permanently connected to the module grounding. The module grounding is only connected to the reference potential of the installation when the module is mounted.

Shielding concept of the I/O modules (I/O level)

In the case of direct mounting on a mounting plate, the module grounding is connected to the reference potential of the system via the metal screw in the lower mounting hole (3). If module grounding is not desired, the electrical connection to the reference potential must be interrupted, e.g. by using a plastic screw.

Shielding concept of the fieldbus level

On delivery, a grounding clip is provided on the connectors for the fieldbus connection.

When mounted directly on a mounting plate, the shielding of the fieldbus cables is routed directly to the module ground via the grounding clip and the metal screw in the lower mounting hole.

If direct grounding of the fieldbus shield is not desired, the grounding clip must be removed. In this case, the fieldbus shield is connected to the module ground via an RC element.

5.3.3 Grounding the device – I/O level and fieldbus level

The grounding of the fieldbus level can either be connected directly via the grounding clip (1) or connected and routed indirectly via an RC element to the grounding of the I/O level. If the grounding is to be routed via an RC element, the grounding clip must be removed.

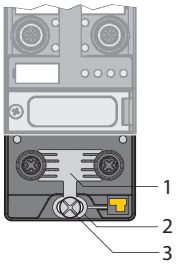


Fig. 6: Grounding clamp (1)

Removing the grounding clip: disconnect the direct grounding of the fieldbus level

- ▶ Use a flat screwdriver to slide the grounding clamp forward and remove it.

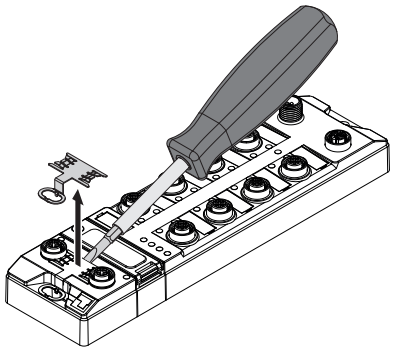


Fig. 7: Removing the grounding clamp

Mounting the grounding clip: grounding the fieldbus level directly

- ▶ Place the grounding clamp between the fieldbus connectors by using a screwdriver in such way that the clamp contacts the metal housing of the connectors.
- ▶ The shielding of the fieldbus cables is connected to the grounding clip.

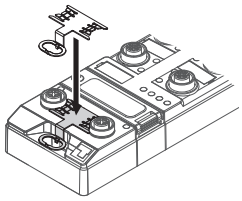


Fig. 8: Mounting the grounding clip

Grounding the device – mounting on a mounting plate

- ▶ For mounting onto a mounting plate: Fix the device with an M6 metal screw through the lower mounting hole.
- ⇨ The shielding of the M12 flanges for the I/O level is connected to the reference potential of the installation via the M6 metal screw.
- ⇨ With mounted grounding clip: The shielding of the fieldbus is connected to the reference potential of the installation via the module grounding of the I/O level.

6 Connecting

NOTE
Intrusion of liquids or foreign bodies through leaking connections
Loss of protection class IP65/IP67/IP69K, device damage possible
- ▶ Tighten M12 connectors with a tightening torque of 0.8 Nm.
- ▶ Only use accessories that guarantee the protection class.
- ▶ Always seal unused connectors with suitable screw caps or blind caps.

NOTE
The connection wires or conductors must have a rated operating temperature of min. 75 °C (UL requirement).

6.1 Connecting the power supply

For the connection to the power supply, the device has two 5-pin, L coded M12 connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.8 Nm.

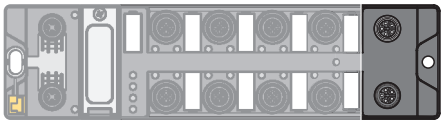


Fig. 9: M12 connector for connecting the supply voltage

- ▶ Connect the device to the power supply according to the pin assignment shown below.
- ▶ Seal unused slots with blind plugs.

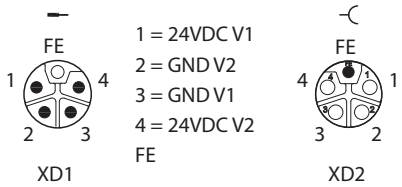


Fig. 10: Pin assignment power supply connectors

Connector	Function
XD1	Power feed
XD2	Continuation of the power to the next node
V1	System voltage: Supply voltage 1 (incl. supply of electronics)
V2	Load voltage: power supply 2

NOTE
The system voltage (V1) and the load voltage (V2) are supplied and monitored separately. If the voltage goes below the permissible lower limit, the sockets are disconnected according to the supply concept of the module type. If V2 goes below the permissible minimum voltage, the PWR LED changes from green to green flashing or red (depending on the configuration). If V1 goes below the permissible minimum, the PWR LED goes out.

6.1.1 Supply concept

The Device is supplied via two separate voltages V1 and V2.

V1 = supply of the module electronics and the respective slots
V2 = supply of module electronics and the respective connectors (separately detachable)

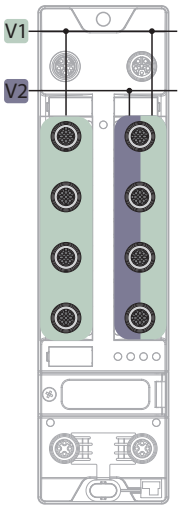


Fig. 11: Power supply TBEC-LL-8IOL

The supply concept enables the safety-related shutdown of parts of the plant via emergency stop circuits by externally switching off the V2 supply.

6.2 Connecting the device to the EtherCAT network

For connection to the Ethernet-based EtherCAT fieldbus system, the device features two integrated Ethernet connections with 4-pin, D-coded M12 connectors. The maximum tightening torque is 0.6 Nm.

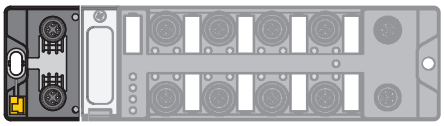


Fig. 12: M12 connector

- ▶ Connect the device to the EtherCAT netzwork according to the pin assignment shown below.
- ▶ Seal unused slots with blind plugs.

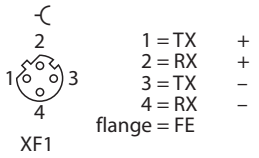


Fig. 13: Pin assignment EtherCAT IN

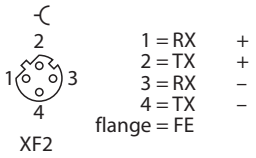


Fig. 14: Pin assignment EtherCAT OUT

6.3 Connecting IO-Link devices and digital sensors

The device has eight M12 female connectors for connecting IO-Link devices and digital sensors and actuators. The maximum tightening torque is 0.8 Nm.

NOTICE
Wrong supply of IO-Link devices
Damage to the device electronics
- ▶ Only supply IO-Link devices with the voltage provided at the M12 connectors.

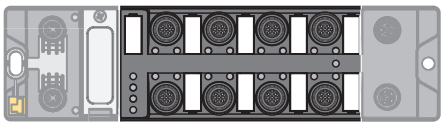
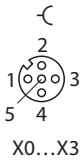


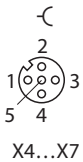
Fig. 15: M12 connectors, IO-Link master ports

- ▶ Connect the sensors and actuators to the device according to the pin assignment.
- ▶ Seal unused slots with blind plugs.



1 = V_{aux}1 (V1)
2 = DXP (V1)
3 = GND (V1)
4 = C/Q (V1)
5 = n.c.

Fig. 16: Pin assignment of IO-Link master ports, Class A, X0…X3



1 = V_{aux}1 (V1)
2 = V_{aux}2 (V2)
3 = GND (V1)
4 = C/Q (V1)
5 = GND (V2)

Fig. 17: Pin assignment of IO-Link master ports, Class B, X4…X7

NOTICE
Connection of Class A devices to Class B ports
Loss of the galvanic isolation with Class A devices at pin 2 and 5
- ▶ Only use Class A devices with interfaces on pin 1, pin 3 and pin 4 at Class B ports.

7 Commissioning

For commissioning, the connection to an EtherCAT master is necessary. The device can only be configured and addressed via the EtherCAT master. The EtherCAT specific device functions, e.g. FoE or communication via EoE, must be supported by the EtherCAT master.

The device automatically starts after the electrical wiring and connecting the supply voltage.

7.1 Addressing a device on EtherCAT

EtherCAT uses an implicit addressing of the network nodes. The EtherCAT master automatically addresses all connected slaves. A manual addressing or identification is only required for applications such as for toolchange applications (Hot Connect).

The device supports the following EtherCAT identification options for hot connect applications:

- Explicit Device Identification (ADO 0x0134): The device address (Identification Value) is set via the rotary coding switches (0...0x0FFF).
- Configured Station Alias (ADO 0x0012): The device address (Identification Value) is written via the EtherCAT master to the device.

NOTE
The device addressing via data word is not supported by the devices.

Explicit Device Identification

The Identification Value can be set via three hexadecimal rotary coding switches on the device. The switches are located together with the reset button under a cover. In the delivery state, the rotary coding switches are set to switch position "000".

- ▶ Open the cover above the switches.
- ▶ Set the rotary coding switches to the required position.
- ▶ Carry out a voltage reset.
- ▶ NOTICE! IP67 or IP69K protection is not guaranteed when the cover over the rotary coding switches is opened. Device damage through penetrating foreign objects or liquids is possible. Close the cover over the switches securely.

Configured Station Alias

The value for the Identification Value is written to the device via register 0x0012 of the EtherCAT master.

7.2 ESI files

Depending on the used controller, different ESI files must be used:

Controller/ engineering tool	ESI file
TwinCAT	Turck_TBEC-LL-8IOL_R1_ESI_….xml Example: Turck_TBEC-LL-8IOL_R1_ESI_1.3_20210325_8110.xml
CODESYS	
Sysmac Studio	Turck_TBEC-LL-8IOL_R1_ESI_….xml Example: Turck_TBEC-LL-8IOL_R1_ESI_1.3_omron_20210325_8110.xml

Turck provides the current ESI files for download free of charge at www.turck.com.

7.3 Connecting the device to a Beckhoff PLC with TwinCAT

Used hardware

The following hardware components are used in this example:

- EtherCAT PLC CX5120 from Beckhoff Automation
- IO-Link master TBEC-LL-8IOL with the following configuration:
  - Port 1: Turck ultra sonic sensor, RU130U-M18E-..., IO-Link V1.1
  - Port 2: Turck IO-Link hub: TBIL-M1-16DXP, IO-Link V1.1
  - Port 3: channel is DI
  - Port 4: channel is DI
  - Port 5: RGB LED indicator K50L2RGBKQ
  - Port 6: channel is DI
  - Port 7: unused
  - Port 8: unused

Used software

The following software tools are used in this example:

- Launch TwinCAT V3.1.0
- ESI file for TBEC-LL-8IOL (available as a free download at www.turck.com)

7.3.1 Installing ESI files

The device is connected to the Beckhoff controller with an xml file, the EtherCAT Slave Information (ESI). The device description file must be saved in TwinCAT Studio V3 for the connection. The ESI file for the device is available free of charge for download from www.turck.com.

▶ Storing an xml file in the installation directory: **TwinCAT → 3.1 →Config → Io → EtherCAT**.

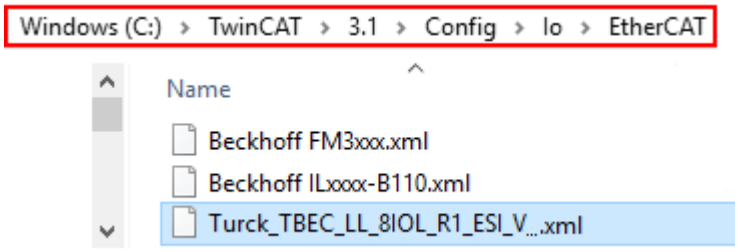


Fig. 18: TwinCAT – storing an xml file in the installation directory

- ▶ Launch TwinCAT Studio.
- ▶ Create a new project.
- ▶ Updating the device catalog: **TwinCAT → EtherCAT Devices → Reload Device Descriptions**.

⇨ The device description is loaded.

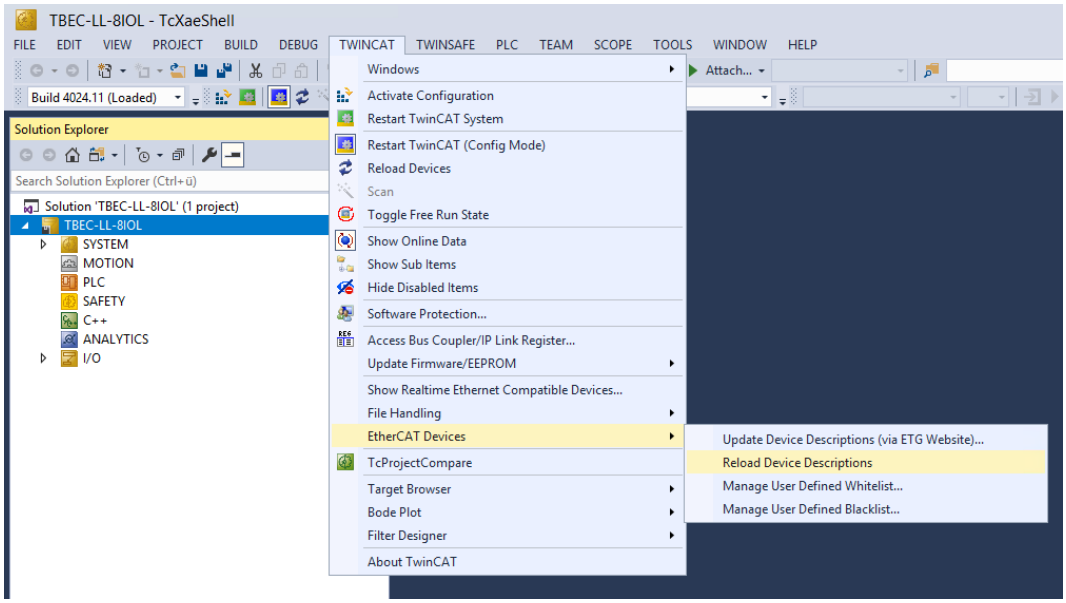


Fig. 19: TwinCAT – updating the device catalog

7.3.2 Connecting the device with the controller

- Select used EtherCAT master as target system.
- Scan the network for EtherCAT stations: Right-click **I/O** → **Devices**.
- Click **Scan**.

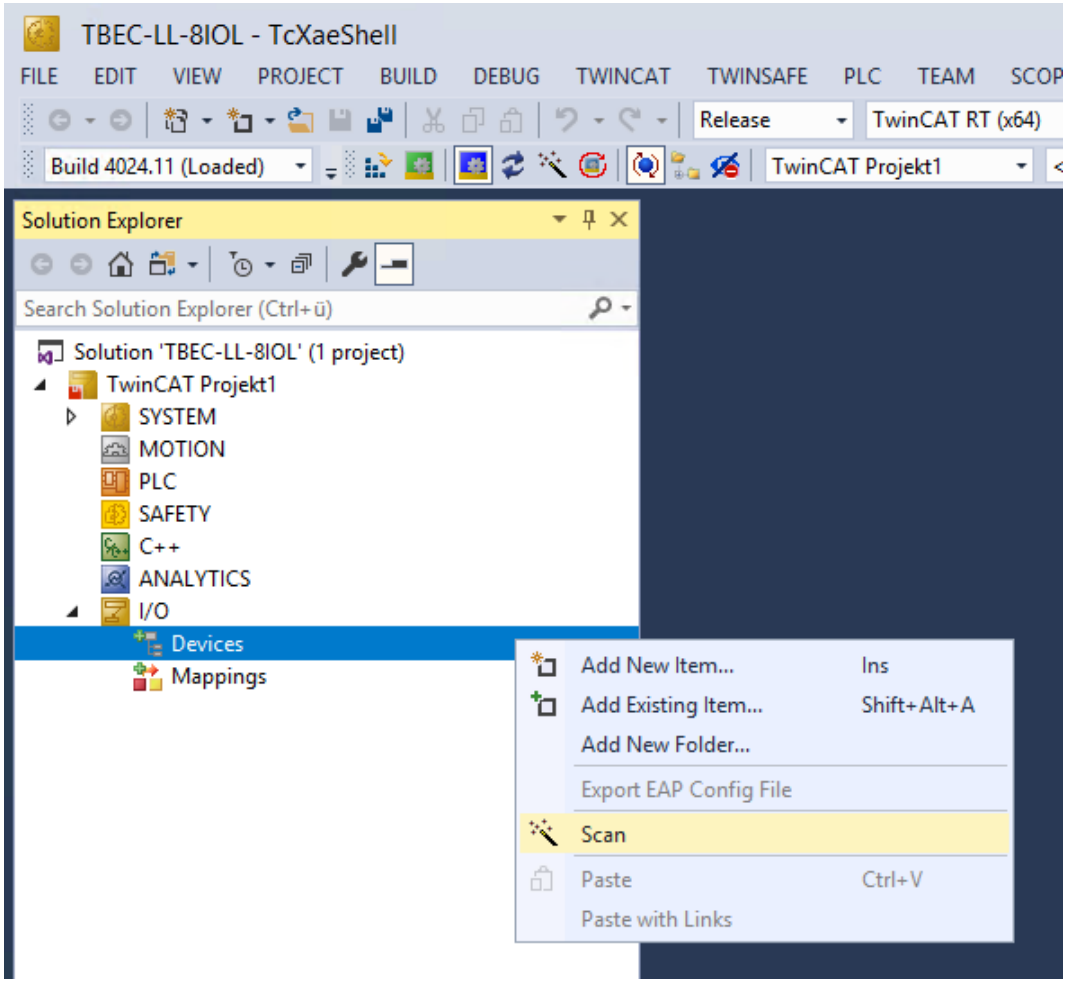


Fig. 20: Scanning for devices

⇨ The EtherCAT stations are read in and automatically added to the I/O configuration. The module appears in the Solution Explorer as **Box 1 (TBEC-LL-8IOL)**.

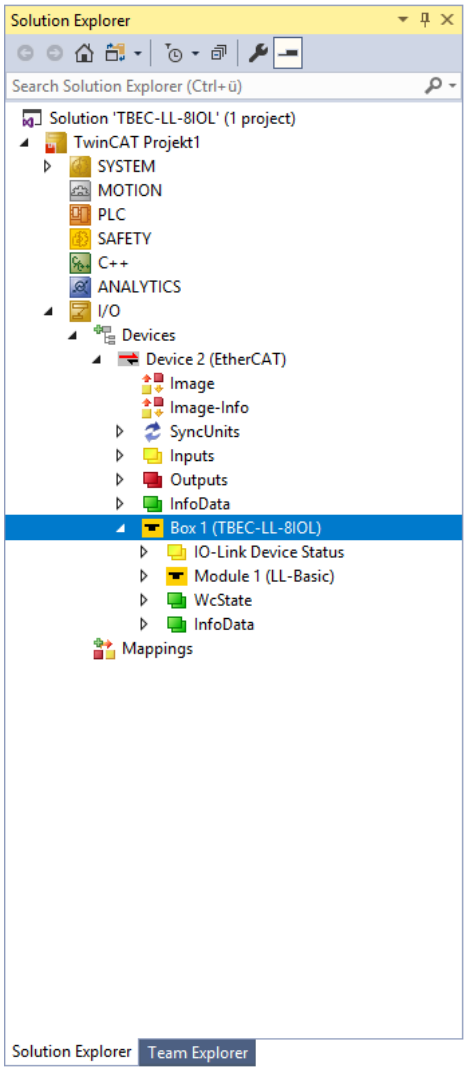


Fig. 21: EtherCAT device as Box 1 in the Solution Explorer

At least one variable must be linked to connect online.

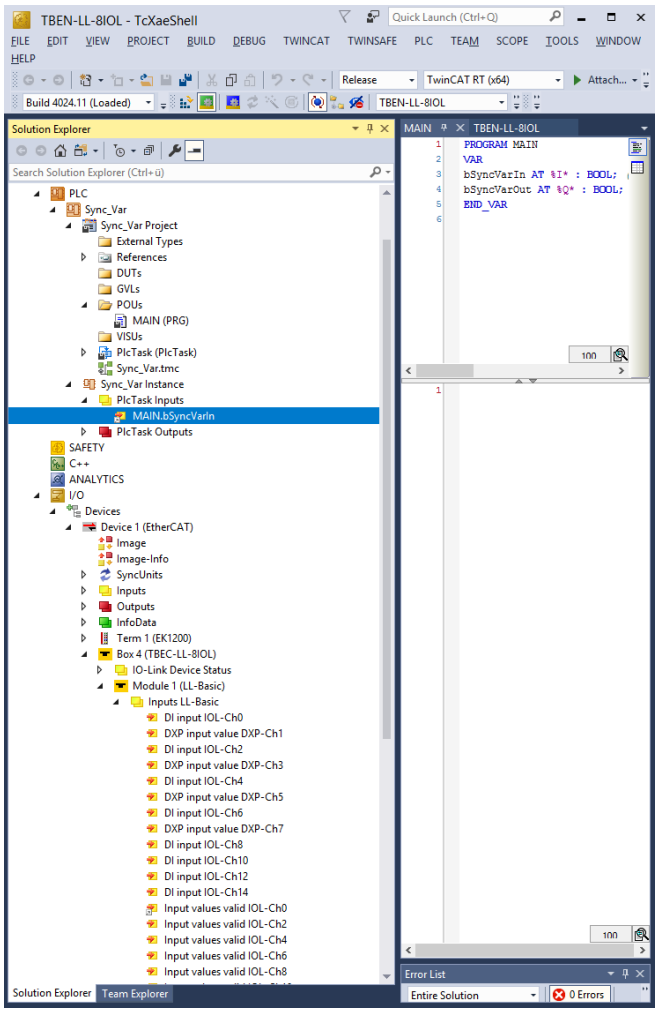


Fig. 22: Example of the linking of a variable

▶ Click the **Activate configuration** button.

Fig. 23: Activating the configuration

⇨ The device configuration is activated.

▶ Click the **Run mode** button.

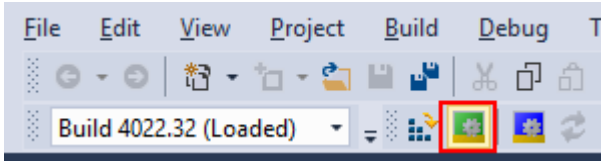


Fig. 24: Run mode

⇨ The device is connected online with the EtherCAT master.

▶ Double-click **Box 1 (TBEC-LL-8IOL)**.

⇨ The current status (here: **OP**) as well as the data points and the link are shown on the **Online** tab.

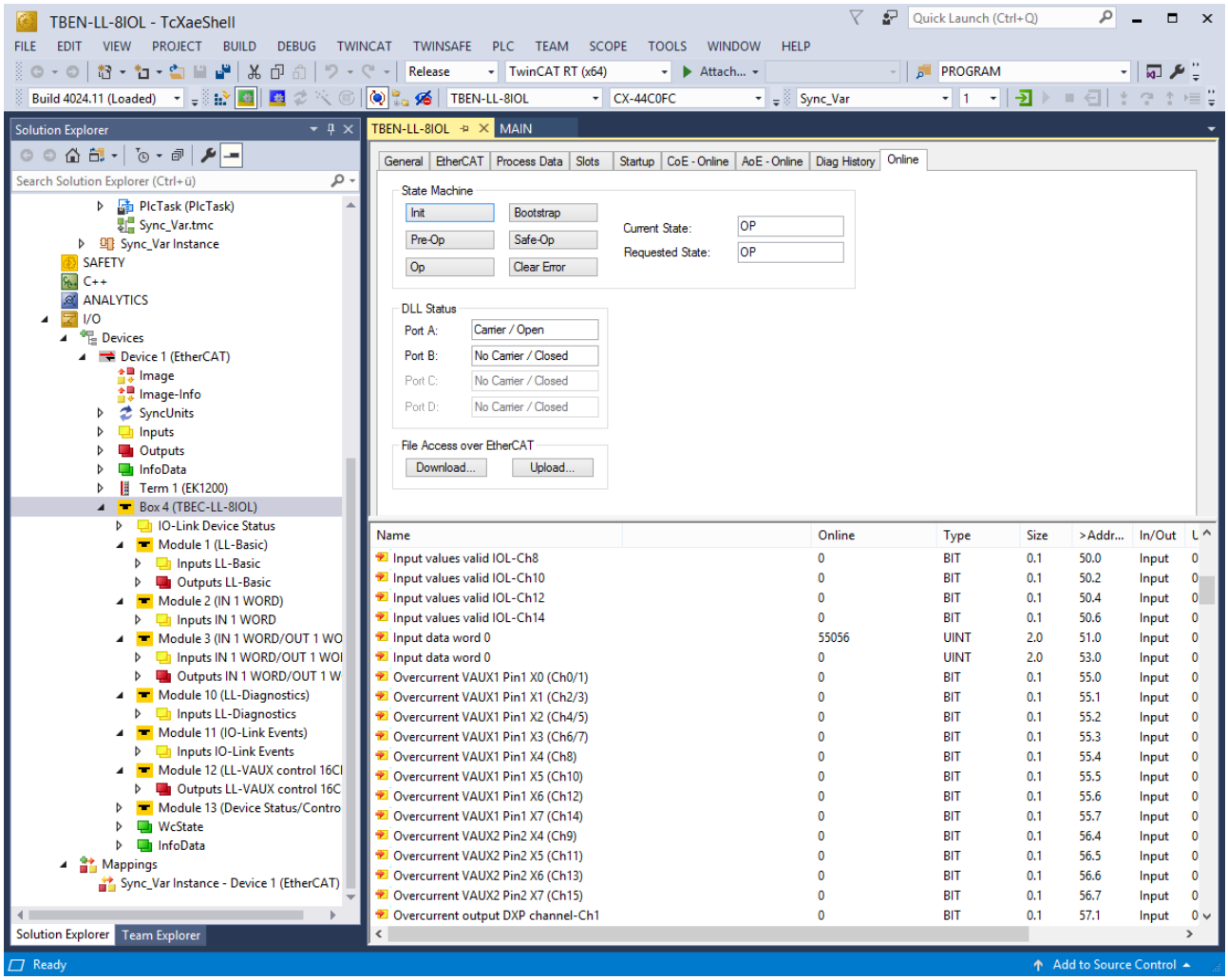


Fig. 25: EtherCAT Device – Online tab: status display (here: Operational), data points, link

Double-clicking the EtherCAT master causes the states of all connected devices to be displayed on the **Online** tab.

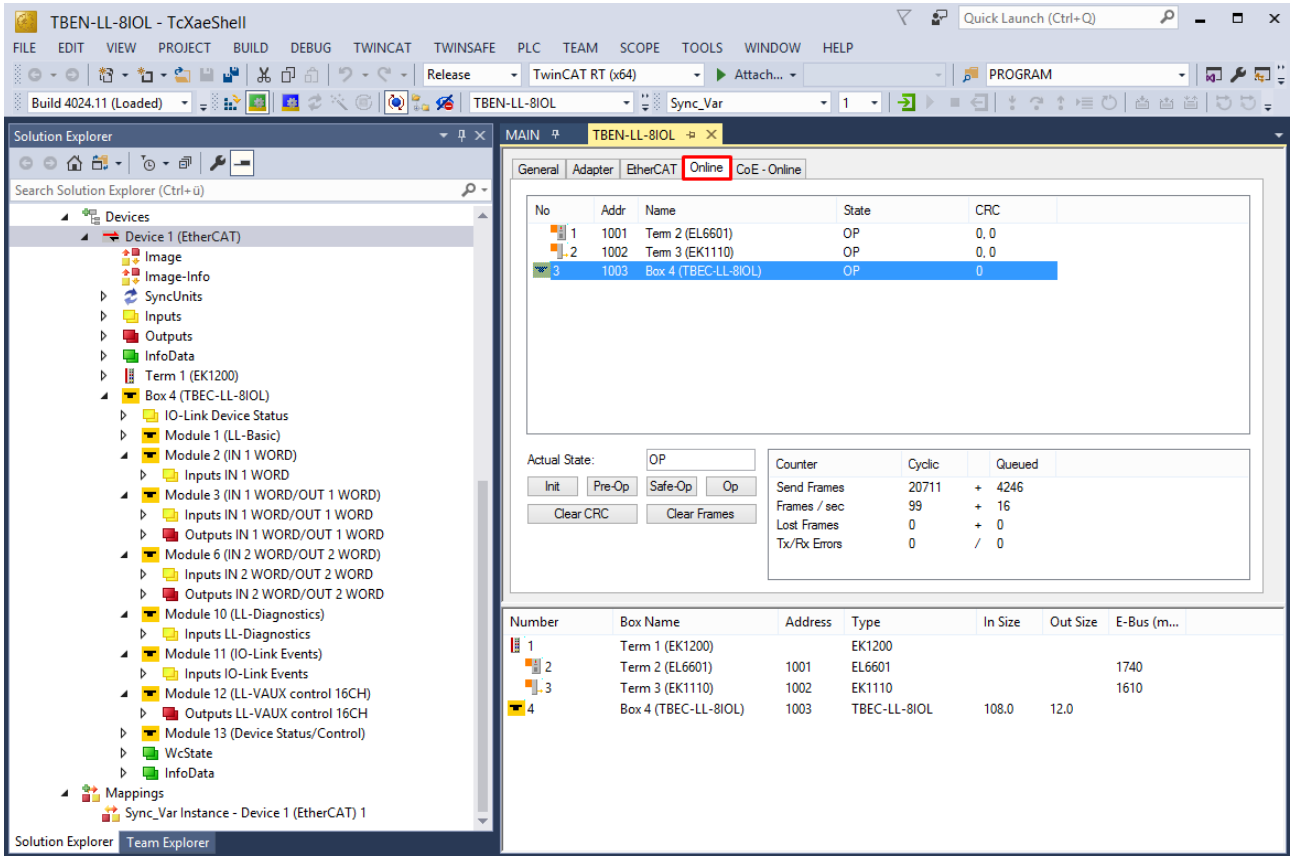


Fig. 26: EtherCAT Master – Online tab: status display of all connected devices

The following states are possible:

- Init: device starts, no SDO and no PDO transfer
- Pre-operational (Pre-Op): SDO transfer, no PDO transfer
- Safe-operational (Safe-Op): SDO and PDO transfer (input data)
  The input data is updated cyclically, all outputs of the slaves are switched to the safe state.
- Operational (Op): SDO and PDO transfer, input and output data valid
- Bootstrap: Firmware update can be executed

7.3.3 Configuring slots

On the slots tab, the functions can be assigned to the device slots.

Slot	Plugged module in TwinCAT	IO-Link device at port
Basic	LL-Basic	Always plugged Parameters/diagnostics for the DXP-channels of the device (DXP 1, 3, 5 and 7) and Input Valid Signal from the IO-Link ports.
IO-Link port 1	IN 1 WORD	Turck temperature sensor, TS-530-LI2UPN8X-...
IO-Link port 2	IN 1 WORD/OUT 1 WORD	Turck I/O hub, TBIL-M1-16DXP
IO-Link port 3	DI	The channel is configured as DI
IO-Link port 4	DI	The channel is configured as DI
IO-Link port 5	IN 2 WORD/OUT 2 WORD	RGB LED indicator K50L2RGBKQ
IO-Link port 6	DI	The channel is configured as DI
IO-Link port 7	unused	-
IO-Link port 8	unused	-
Diagnostics	LL-Diagnostics	The diagnostic data are mapped into the process image
IO-Link Events	IO-Link Events	IO-Link-Events are mapped into the process image
VAUX control	LL-VAUX control 16CH	Parameters for the VAUX voltage supply
Module Status	Device Status/Control	Status- and control for the complete module

- ▶ Select the device in the project tree and open the properties by double-clicking.
- ▶ Select the **Slots** tab.
- ▶ Select on the left the channel to be set.
- ▶ Select on the right the required data width or content.
- ▶ Click the **Add** button.

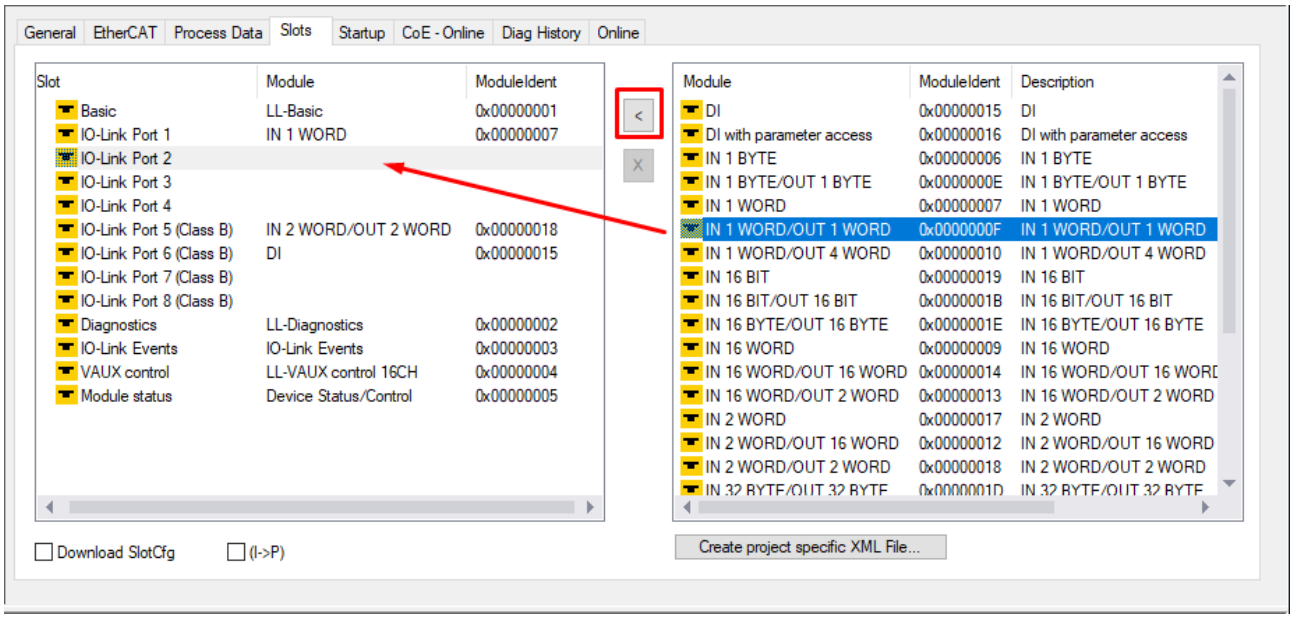


Fig. 27: TwinCAT – Configuring slots

⇨ The device entry in the project tree is extended by the process data of the plugged slots.

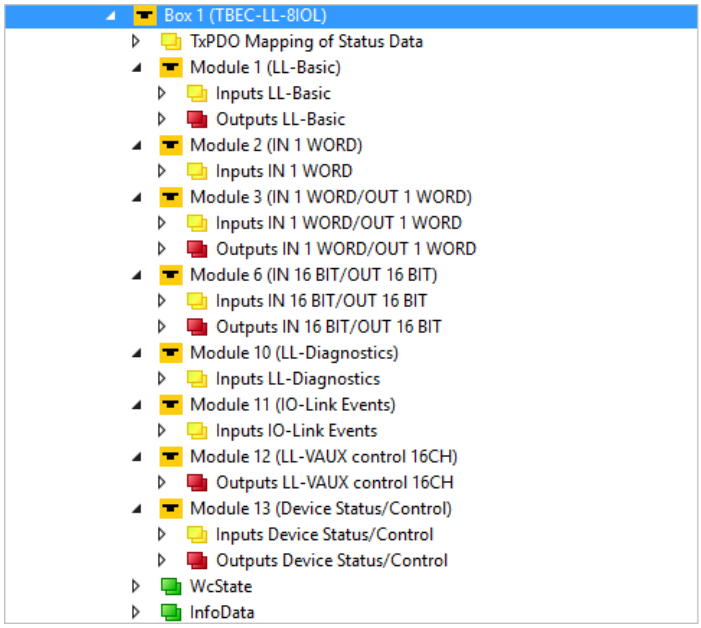


Fig. 28: TwinCAT - Device with plugged slots in the project tree

7.3.4 Setting startup parameters

Device parameters which should be permanently written at startup are set in the **Startup** tab.

> **NOTE**
> The parameters depend on the set operating mode.

Example: Set the operation mode "IO-Link with identical device" for IO-Link port 2

- In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.
- Select the **Startup** tab.
- Double-click CoE index **0x8028:01** "Mode".
- In the **Edit CANopen startup entry** submenu double-click **Mode**.
- In the submenu **Set Value Dialog** enter the value **3** for "IO-Link with identical device" (see parameter "Mode" [▶ 81]).
- Confirm with **OK**.

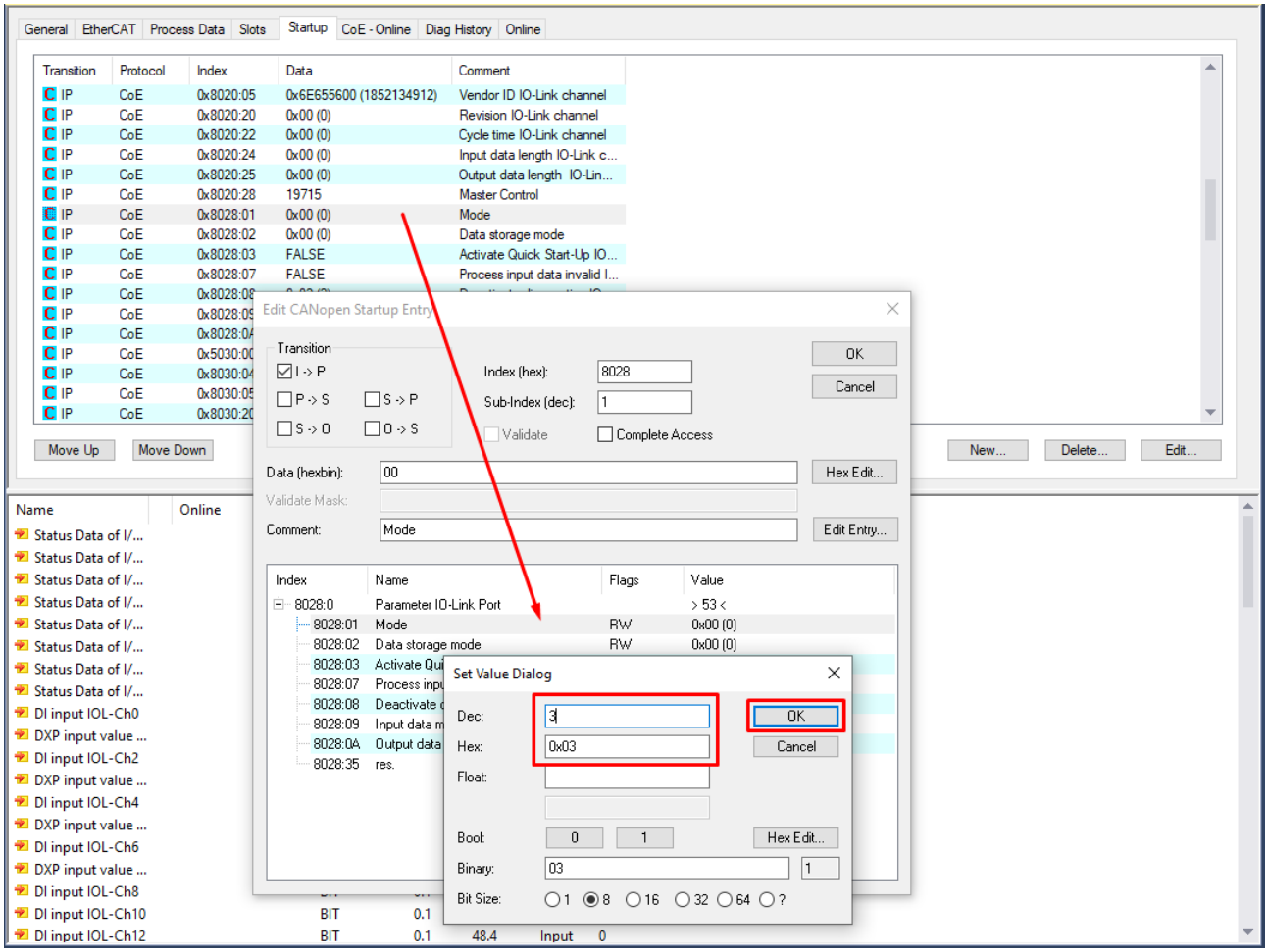


Fig. 29: TwinCAT – Setting startup parameters

➪ The operation mode at IO-Link port 2 is set to "IO-Link with identical device".

7.3.5 Reading process data

The process data of connected devices can be read and written at the respective slot in the **Online** tab.

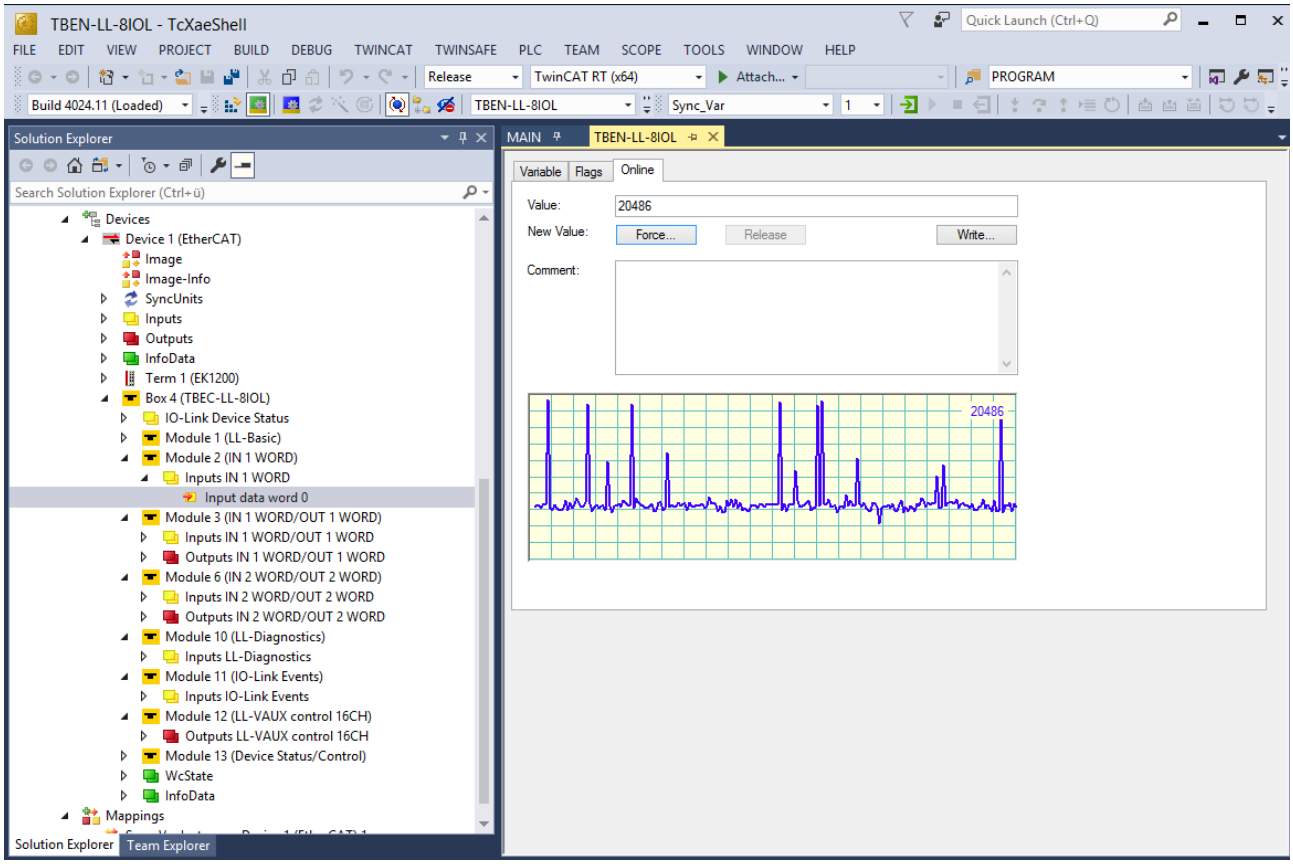


Fig. 30: TwinCAT – Reading process data

7.3.6 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

▶ In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.

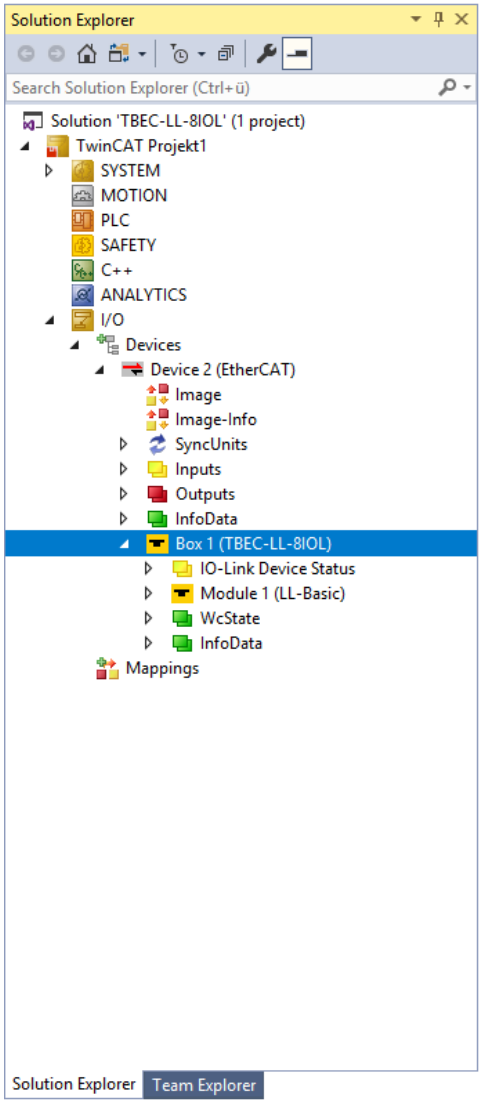


Fig. 31: Project tree

▶ Select the **CoE Online** tab.

⇨ The object dictionary of the device is displayed with all device-specific parameters.

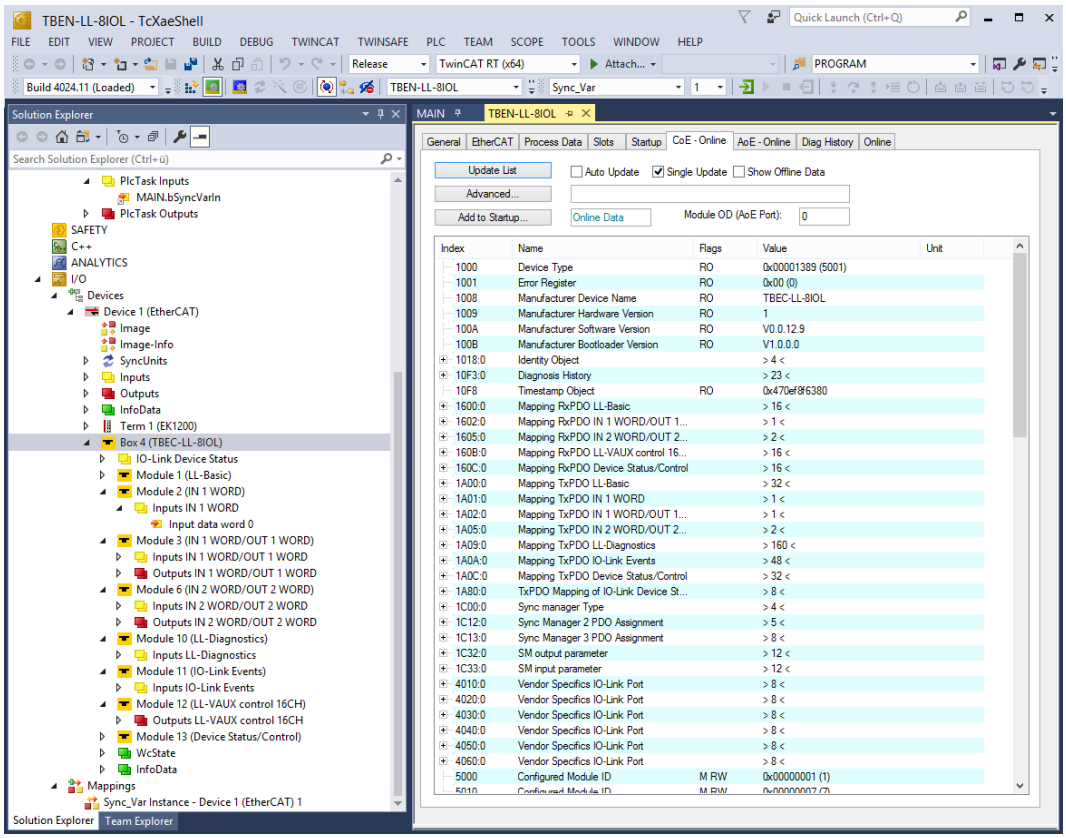


Fig. 32: CoE-Online – Object Dictionary

The display of the parameters depends on the device configuration. By double-clicking in the **Value** column, the parameters can be changed.

NOTE
The changing of parameters during the runtime can cause a faulty configuration of the device.

- Single Update (recommended): The directory is updated once if a parameter was changed.
- Auto Update: The directory is updated continuously.

7.3.7 Addressing a device via Explicit Device ID

- In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.
- Activate **Explicit Device Identification (ADO 0x0134): EtherCAT → Advanced Settings → General → Identification.**
- In the **Value** field enter the Identification Value (hex.) which must match the rotary coding switches on the device (see [▷ 21]).
- Confirm entries with **OK.**
- Carry out a voltage reset.

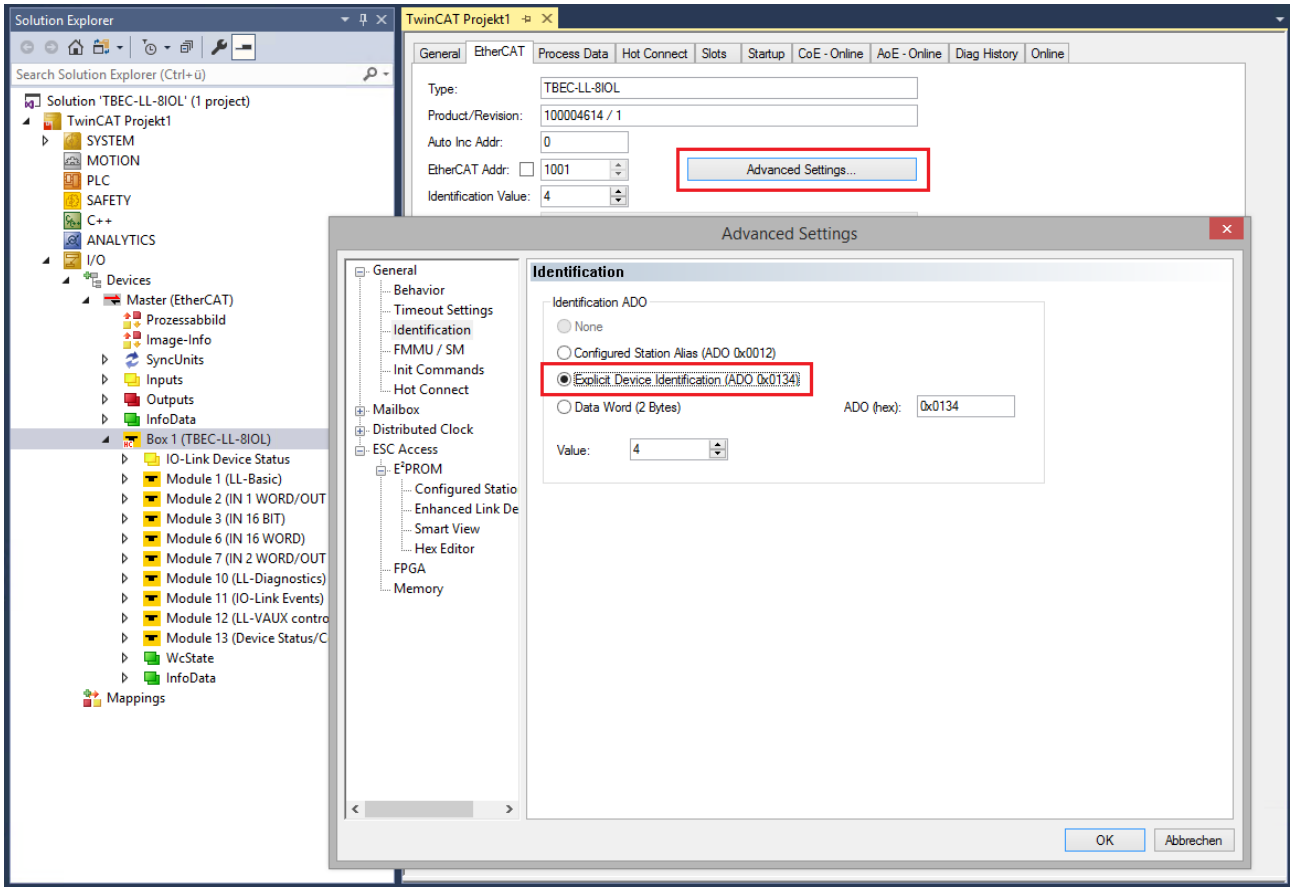


Fig. 33: TwinCAT – Select Explicit Device Identification

7.3.8 Addressing a device via Configured Station Alias

- In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.
- Activate **EtherCAT** tab → **Advanced settings** → **General** → **Identification** → **Configured Station Alias (ADO 0x0012)**.
- Confirm the entry with **OK**.

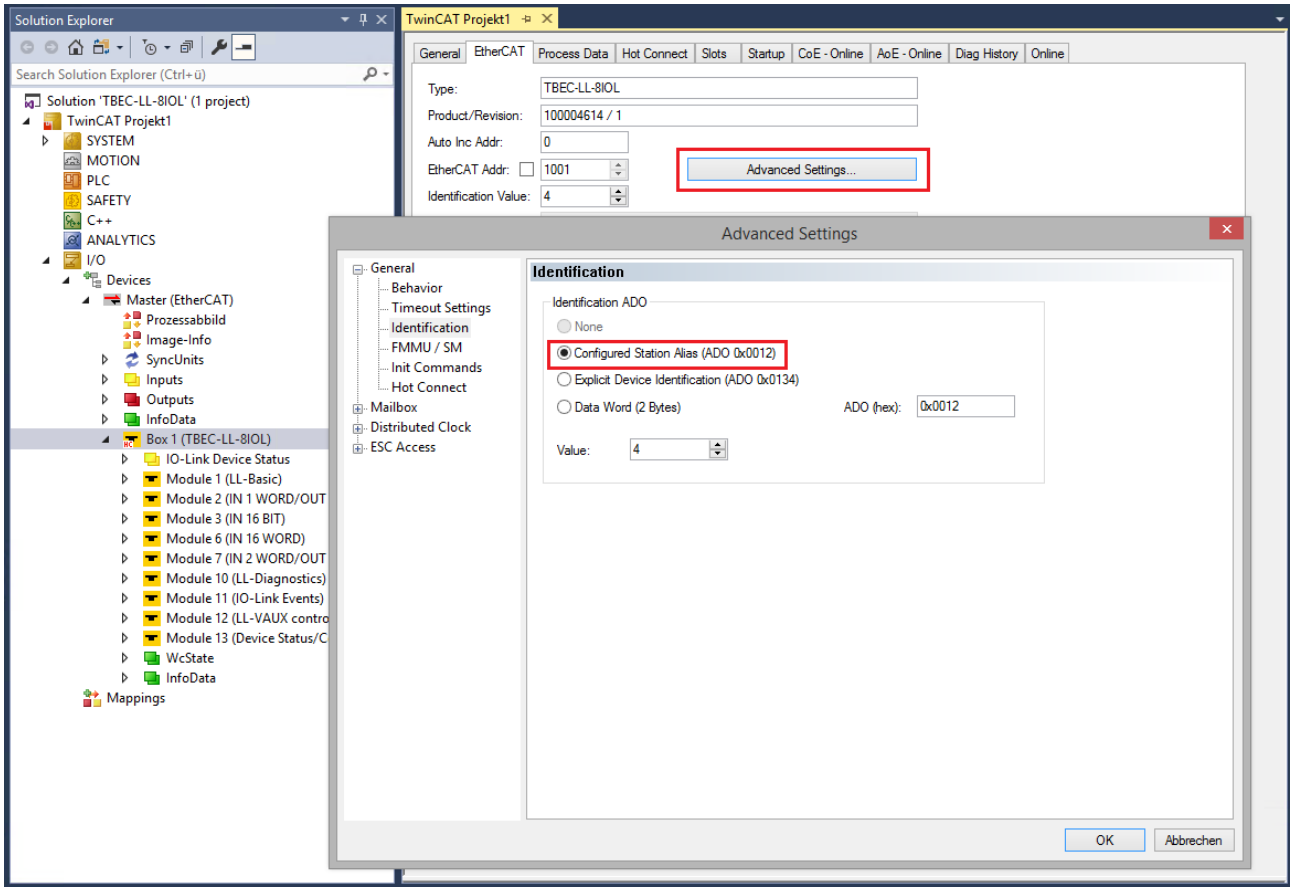


Fig. 34: TwinCAT – Selecting Configured Station Alias

- ▶ Activate **EtherCAT** tab → **Advanced Settings** → **ESC Access** → **E²PROM** → choose **Configured Station Alias**.
- ▶ Enter the Identification Value under **New value** (here: **4**).
- ▶ Click **Write to E²PROM**.

  ⇨ The master writes the identification value into the device.
- ▶ Confirm with **OK**.

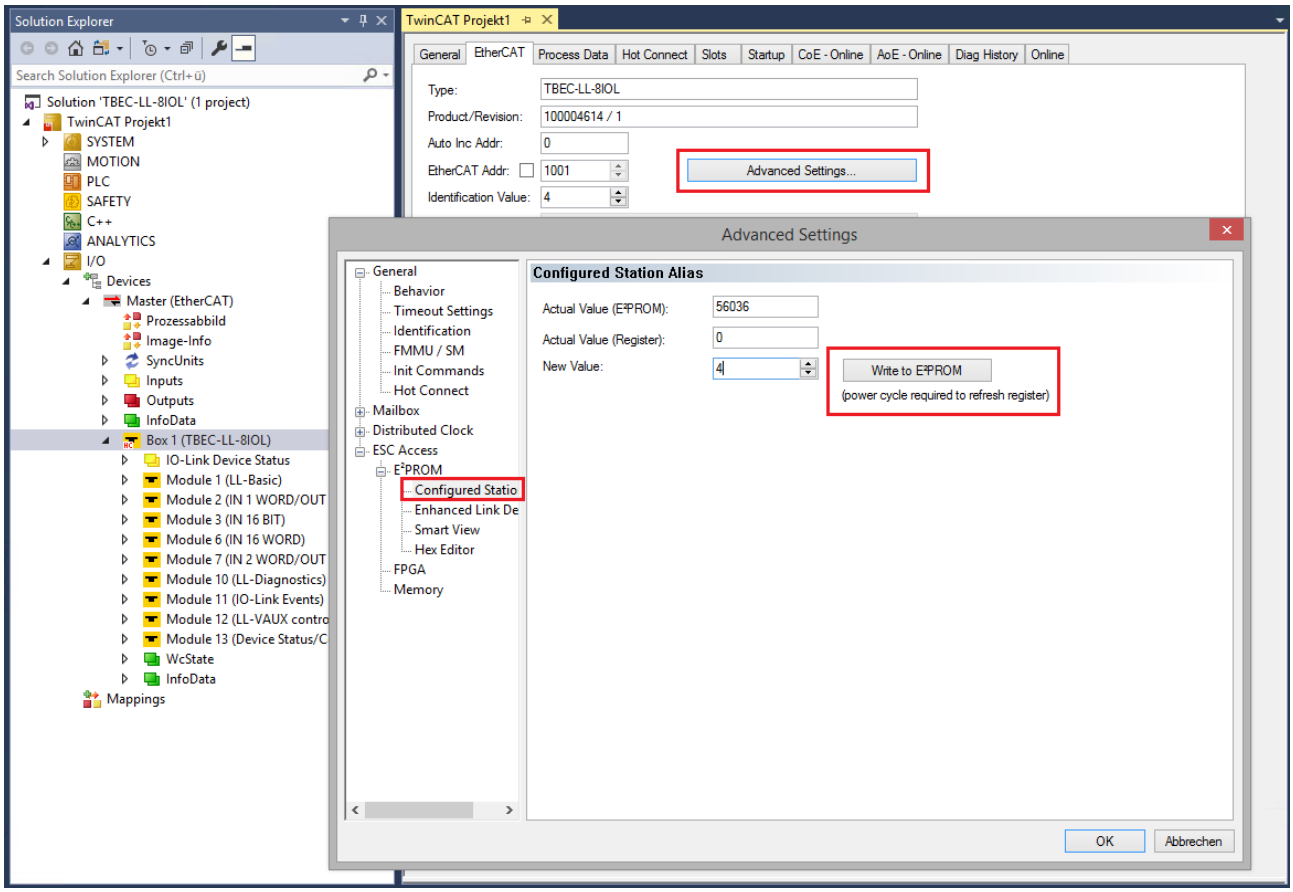


Fig. 35: TwinCAT – Configured Station Alias: Entering the Identification Value

- ▶ Carry out a voltage reset.
- ⇨ After switching on, the newly connected device is automatically recognized by the master. The status in the **Online** tab automatically changes to OP.

7.3.9 Activating Hot Connect

The HotConnect function enables devices to be replaced during ongoing plant operation (e.g. with toolchange applications). To use the HotConnect function, a HotConnect group must be set up.

▶ Right-click **Box 1 (TBEC-LL-8IOL)** → **Add to HotConnect group**.

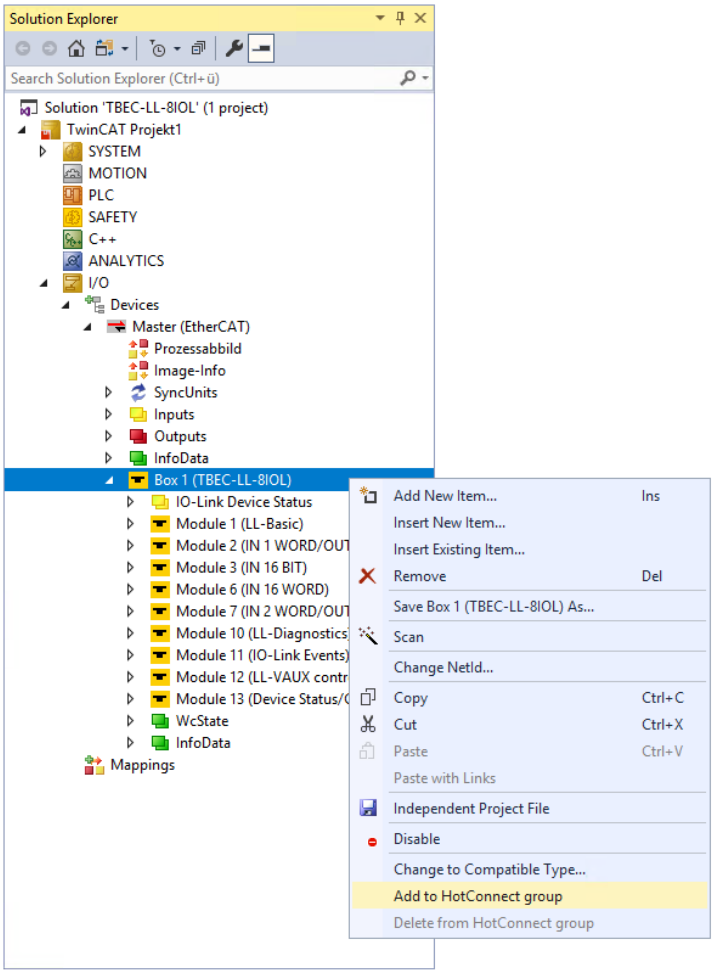


Fig. 36: TwinCAT – Add to HotConnect group

- Select the relevant slave in the **Add HotConnect group** window (here: **TBEC-LL-8IOL**).
- Define the **Identification Value** (hex.) for the HotConnect group (here: **4**).
- Confirm with **OK**.

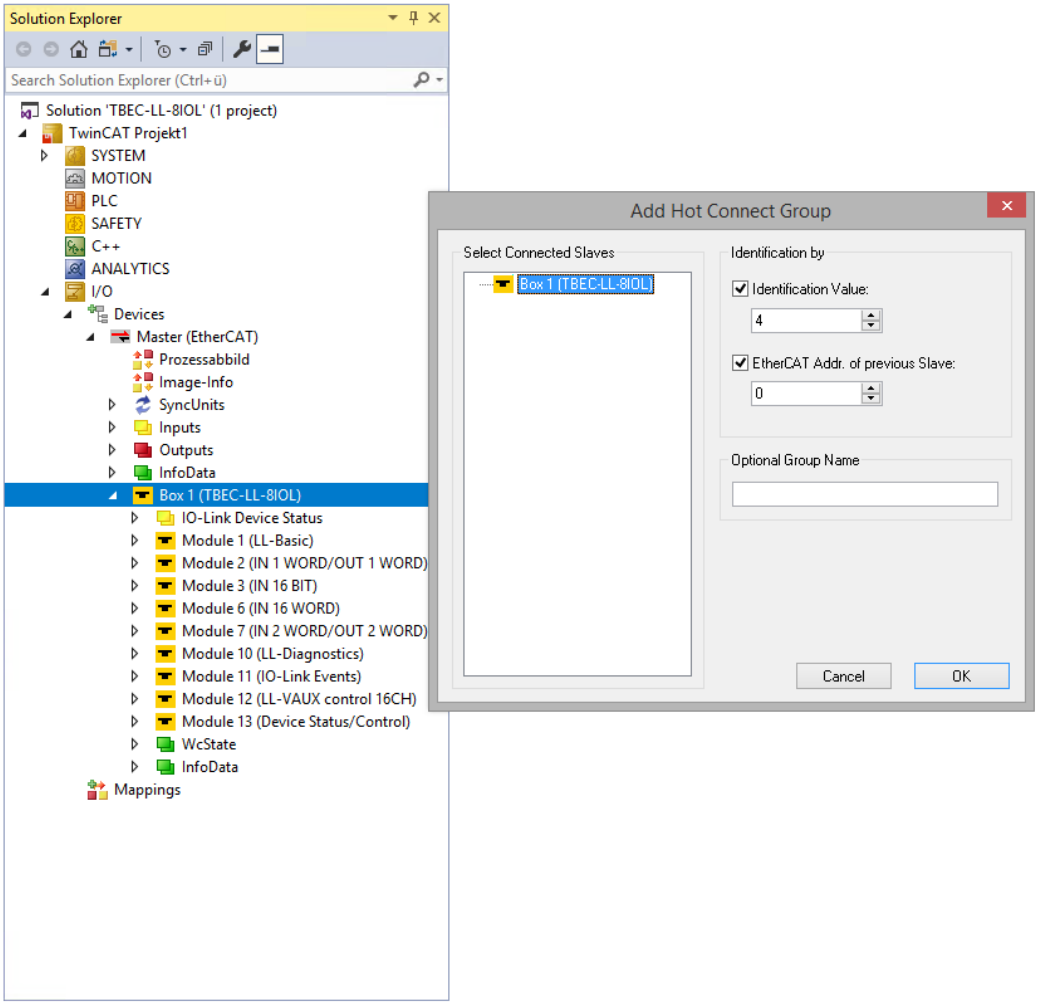


Fig. 37: TwinCAT – Add to HotConnect group

⇨ The device has been added to a HotConnect group, indicated by the small HC symbol at Box 1.

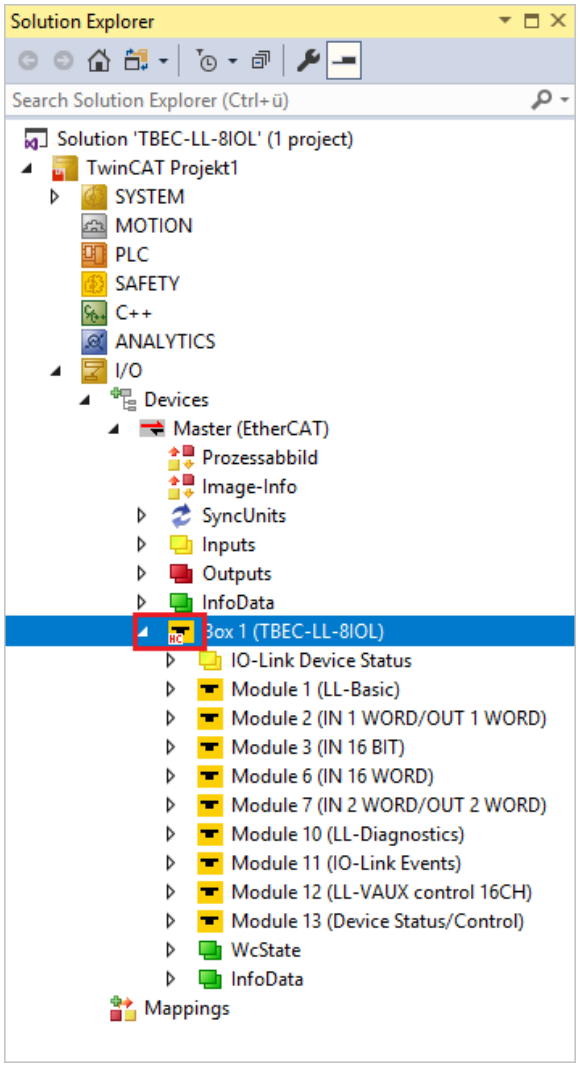


Fig. 38: TwinCAT – Add to HotConnect group

In order for a new device to be detected by the master, the device address (Identification Value) must either be set with Explicit Device ID or Configured Station Alias.

Devices that are part of a Hot Connect group can also be removed from it:

- Right-click **Box 1 (TBEC-LL-8IOL)** → **Delete from Hot Connect Group**.

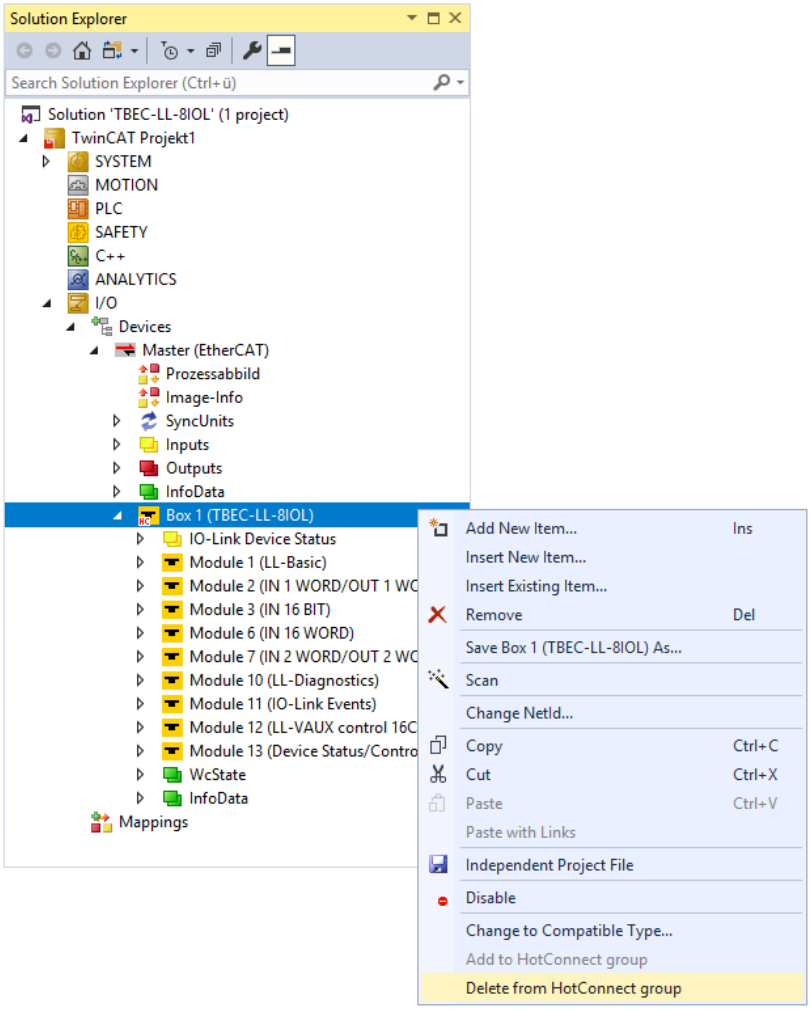


Fig. 39: Delete device from Hot Connect Group

7.4 Connecting a device to controllers with CODESYS

Used Hardware

The following hardware components are used in this example:

- IO-Link master TBEC-LL-8IOL with the following configuration:
  - Port 1: Turck ultra sonic sensor, RU130U-M18E-..., IO-Link V1.1
  - Port 2: Turck IO-Link hub: TBIL-M1-16DXP, IO-Link V1.1
  - Port 3: channel is DI
  - Port 4: channel is DI
  - Port 5: RGB LED indicator K50L2RGBKQ
  - Port 6: channel is DI
  - Port 7: unused
  - Port 8: unused

Used Software

The following software tools are used in this example:

- CODESYS 3.5. SP16 (available as a free download at www.turck.com)
- WinPLC as EtherCAT master
- ESI file for TBEC-LL-8IOL (available as a free download at www.turck.com)

7.4.1 Installing ESI files

The device is connected to controllers with an xml file containing EtherCAT slave information (ESI). The device description file must be stored in CODESYS for the connection. The ESI file for the device is available free of charge for download from www.turck.com.

- ▶ Launch CODESYS.
- ▶ Click **Tools** → **Device Repository**.

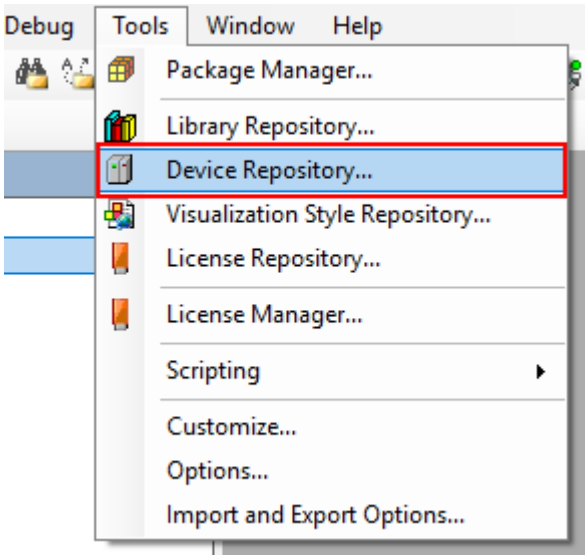


Fig. 40: Device Repository

▶ Store the ESI file via the **Install** button.

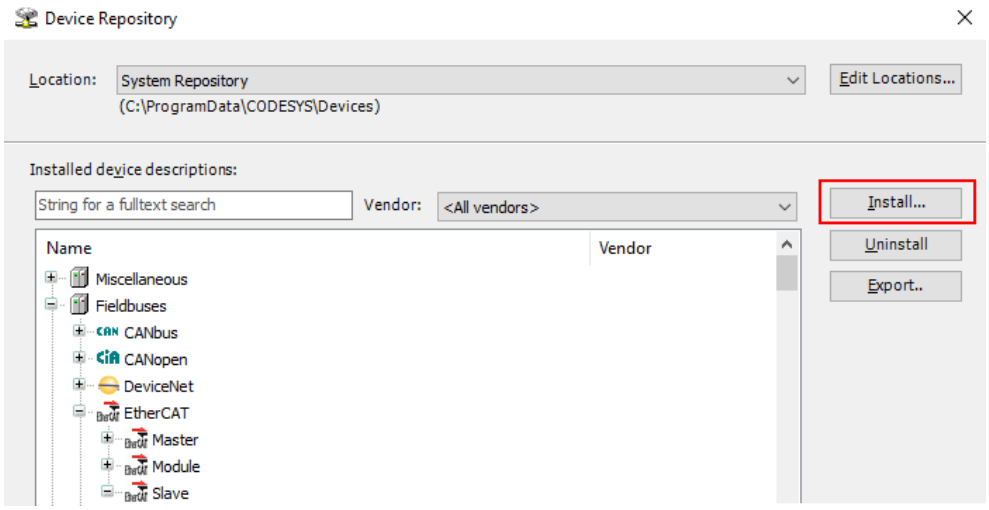


Fig. 41: Installing a device description file

⇨ The module is displayed as an installed device description in the device repository.

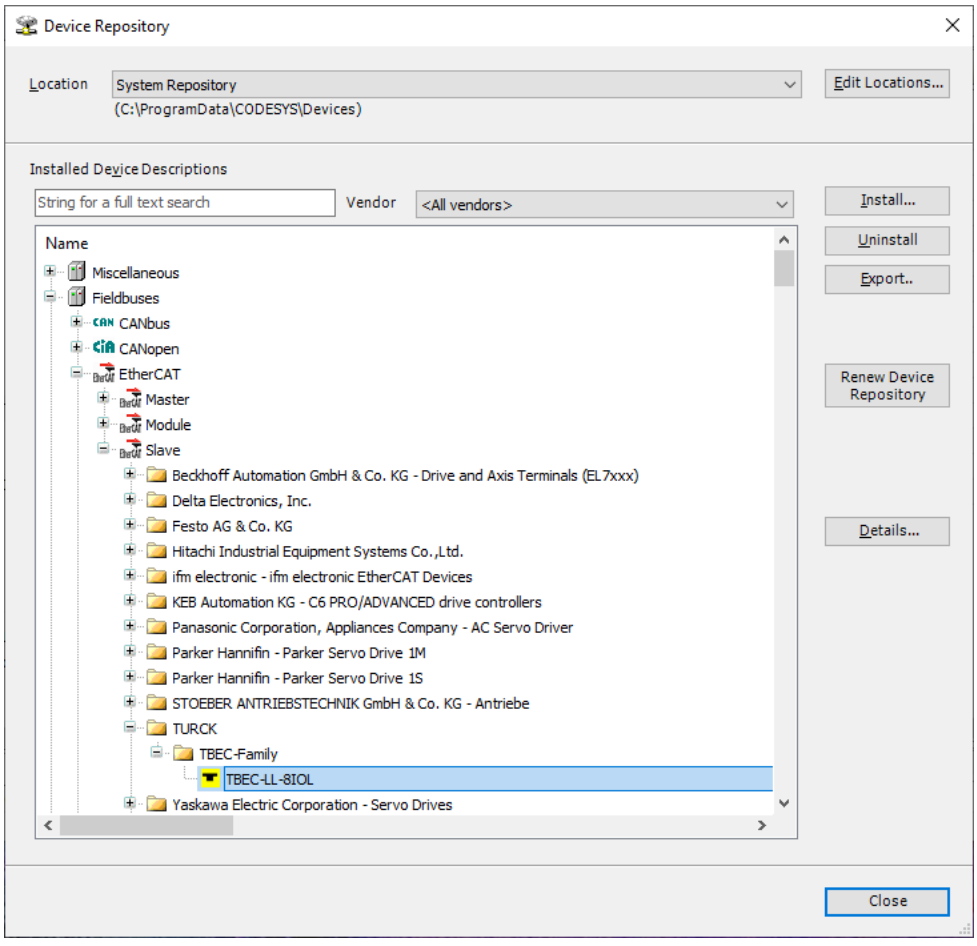


Fig. 42: Installed device description

7.4.2 Connecting the device with the controller

Prerequisites

- The used master must be EtherCAT-capable.
- The programming software has been opened.
- A new project has been created.

Example: Creating a project with WinPLC

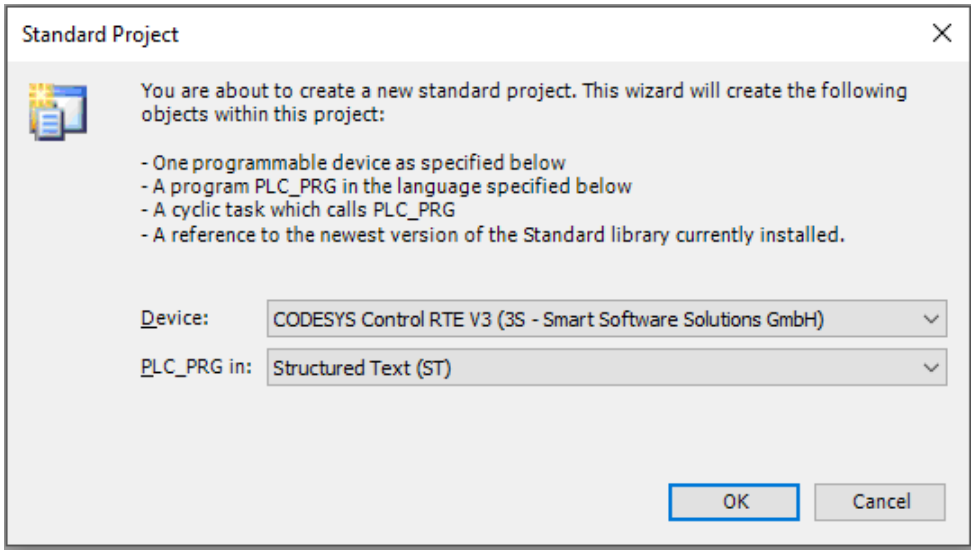


Fig. 43: Example: Creating a project

Adding an EtherCAT master

- Right-click **Device** → **Add Device**.
- Select the EtherCAT master in the following window.
- Click **Add Device**.

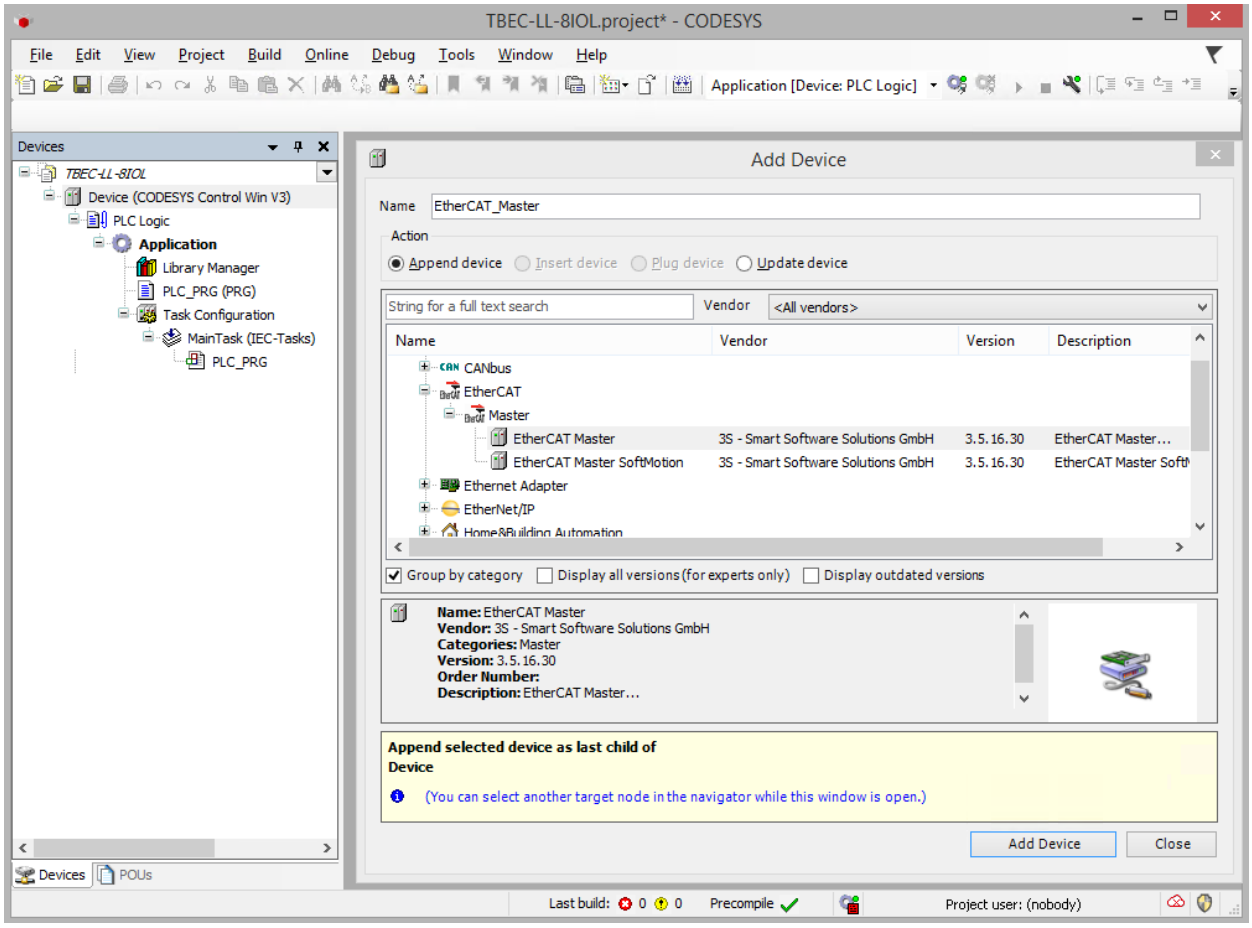


Fig. 44: Adding an EtherCAT master

➪ The EtherCAT master appears as **EtherCAT_Master (EtherCAT Master)** in the project tree.

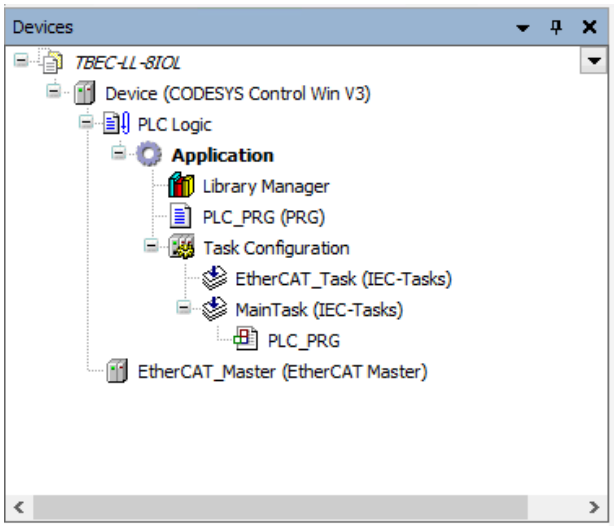


Fig. 45: Project tree

Selecting a network adapter

- ▶ Double-click **EtherCAT_Master (EtherCAT Master)** in the project tree.
- ▶ In the **General** tab open the **Select Network Adapter** dialog via the **Browse…** button.
- ▶ „Select the network adapter and confirm with **OK**.

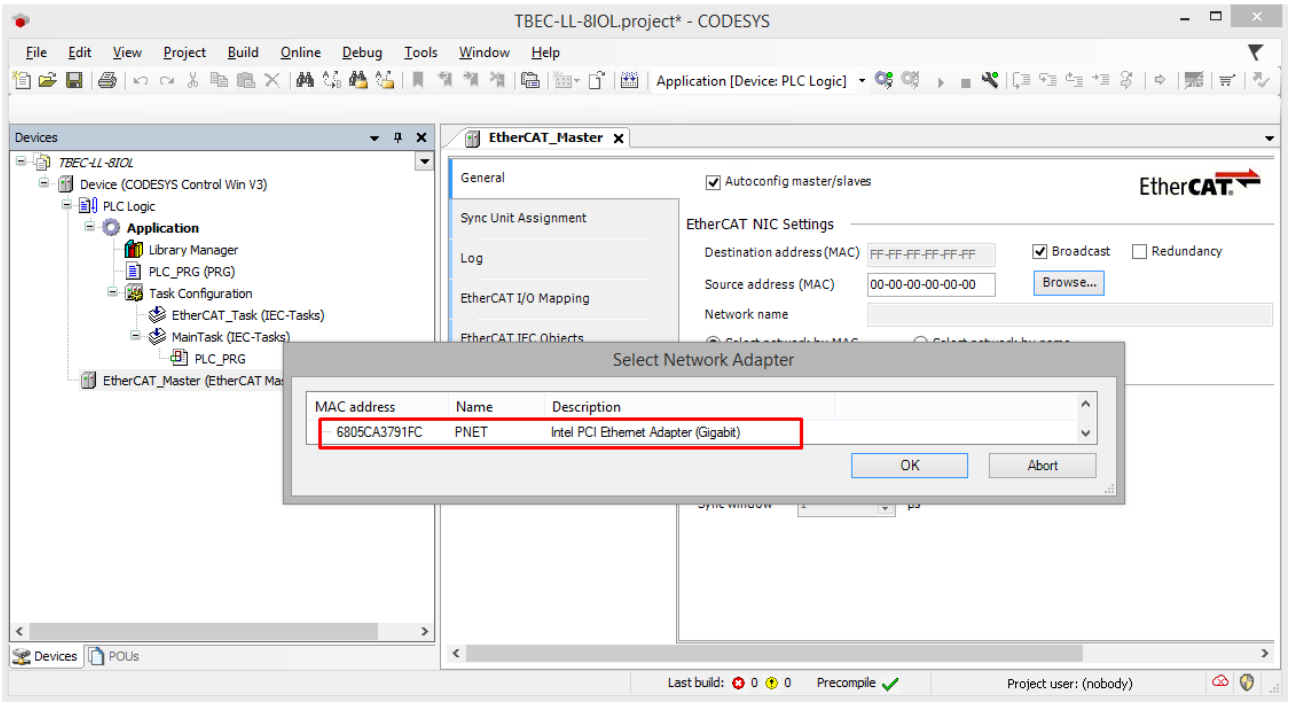


Fig. 46: Selecting a network adapter

- ▶ In the **General** tab open the **Options** menu item.
- ▶ Select the option **Restart slaves automatically**.

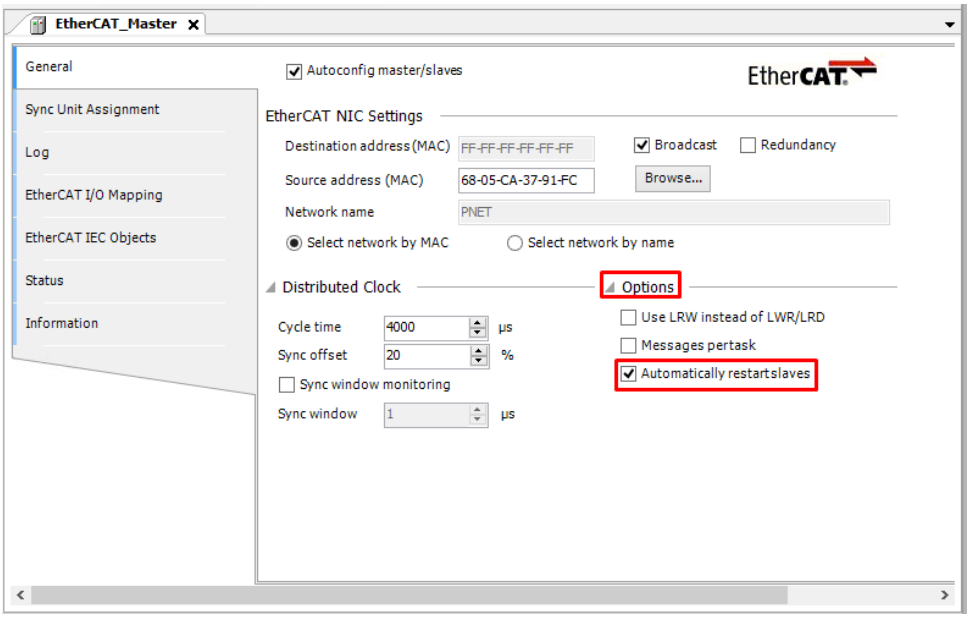


Fig. 47: Restart slaves automatically

- ▶ Click **Online** → **Login**.
- ⇨ The project is written to the controller.

- ▶ Click **Online** → **Logout**.
- ⇨ The configuration is possible in the logged-out state.
- ▶ Right-click **EtherCAT_Master (EtherCAT Master)** → select **Scan For Devices**.

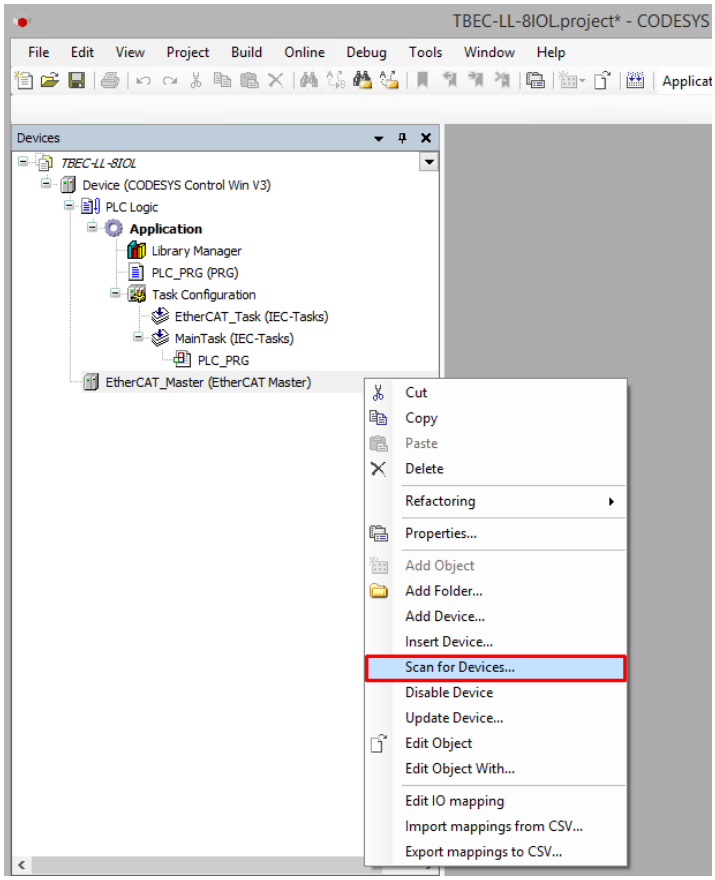


Fig. 48: Scan For Devices

- ▶ Select the EtherCAT slave (here: **TBEC-LL-8IOL**) in the following window and click **Copy to project**.

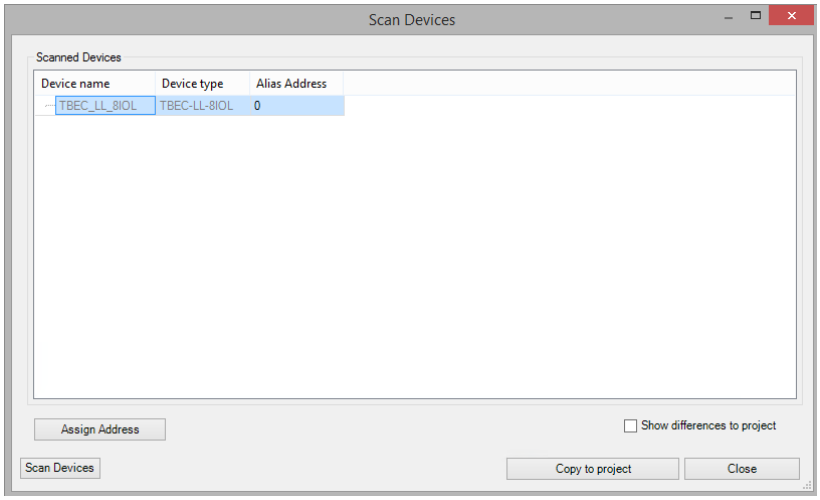


Fig. 49: Copying found devices to the project

- ⇨ The module appears with the standard settings from the ESI file in the project tree.

Connecting the device online with the controller

- ▶ Click **Online** → **Login** and start the program.
- ⇨ The device is connected online with the PLC.
- ⇨ The green symbols in the project tree indicate the active connection.
- ▶ Double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- ⇨ On the **General** tab → **Diagnostics** the **Operational** status indicates the active connection.

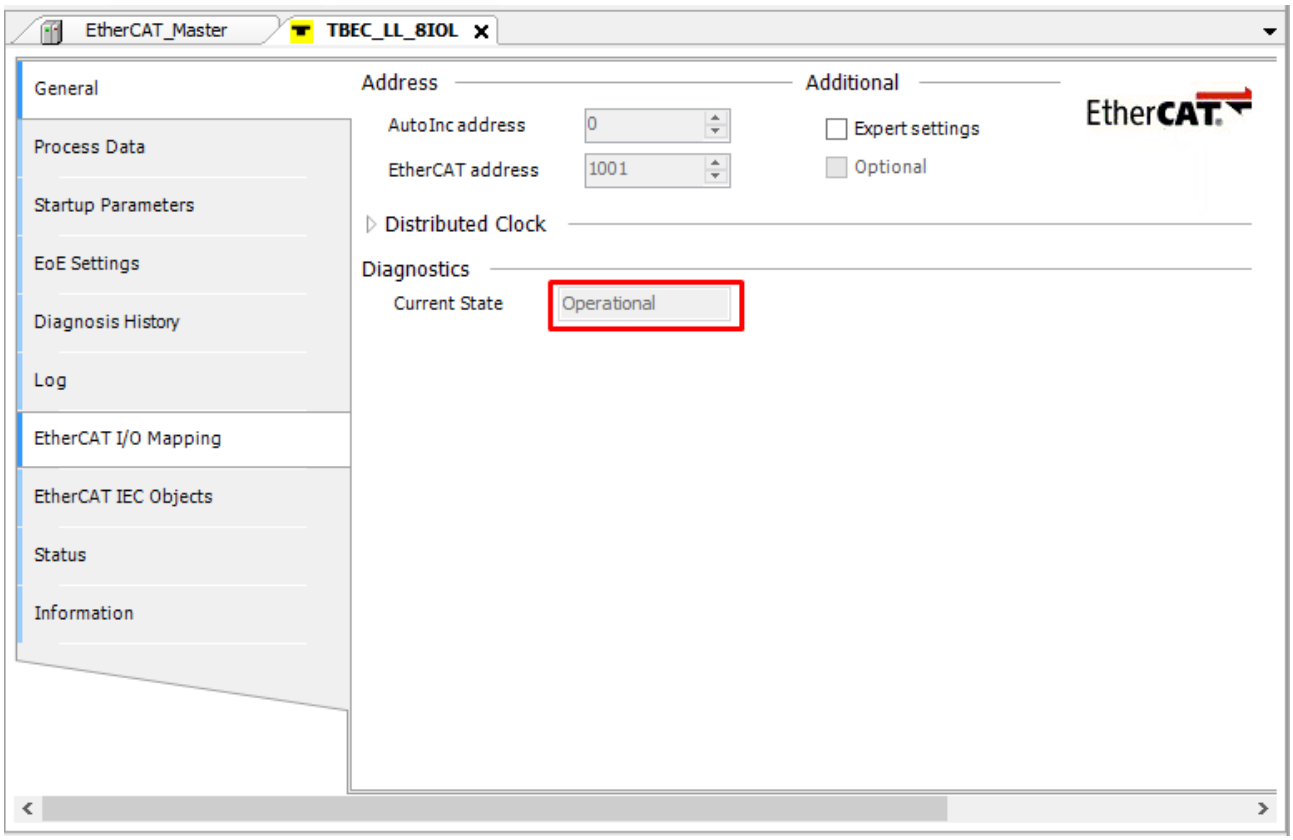


Fig. 50: Status: Operational

7.4.3 Configuring slots

The slots are configured via the "Plug device" function.

Example configuration

Slot	Module	IO-Link device at port
Basic	LL-Basic	Always plugged Parameters/diagnostics for the DXP-channels of the device (DXP 1, 3, 5 and 7) and Input Valid Signal from the IO-Link ports.
IO-Link port 1	IN 1 WORD	Turck temperature sensor, TS-530-LI2UP-N8X-...
IO-Link port 2	IN 1 WORD/OUT 1 WORD	Turck I/O hub, TBIL-M1-16DXP
IO-Link port 3	DI	The channel is configured as DI
IO-Link port 4	DI	The channel is configured as DI
IO-Link port 5	IN 2 WORD/OUT 2 WORD	RGB LED indicator K50L2RGBKQ
IO-Link port 6	DI	The channel is configured as DI
IO-Link port 7	Unused	-
IO-Link port 8	Unused	-
Diagnostics	LL-Diagnostics	The diagnostic data are mapped into the process image
IO-Link Events	IO-Link Events	IO-Link-Events are mapped into the process image
VAUX control	LL-VAUX control 16CH	Parameters for the VAUX voltage supply
Module Status	Device Status/Control	Status- and control for the complete module

▶ Click **Online** → **Logout**.

⇨ The configuration is possible in the logged-out state.

- Right-click an empty slot in the project tree → select **Plug Device.**

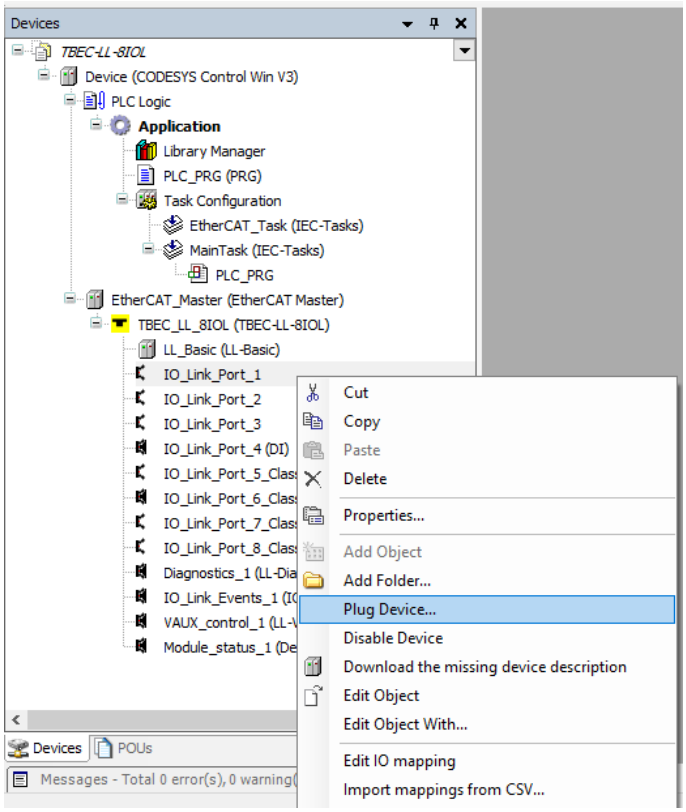


Fig. 51: CODESYS – Configuring slots

- Example: Select data width for IO-Link port 1(here: **IN 1 WORD**)
- Click **Plug Device**.

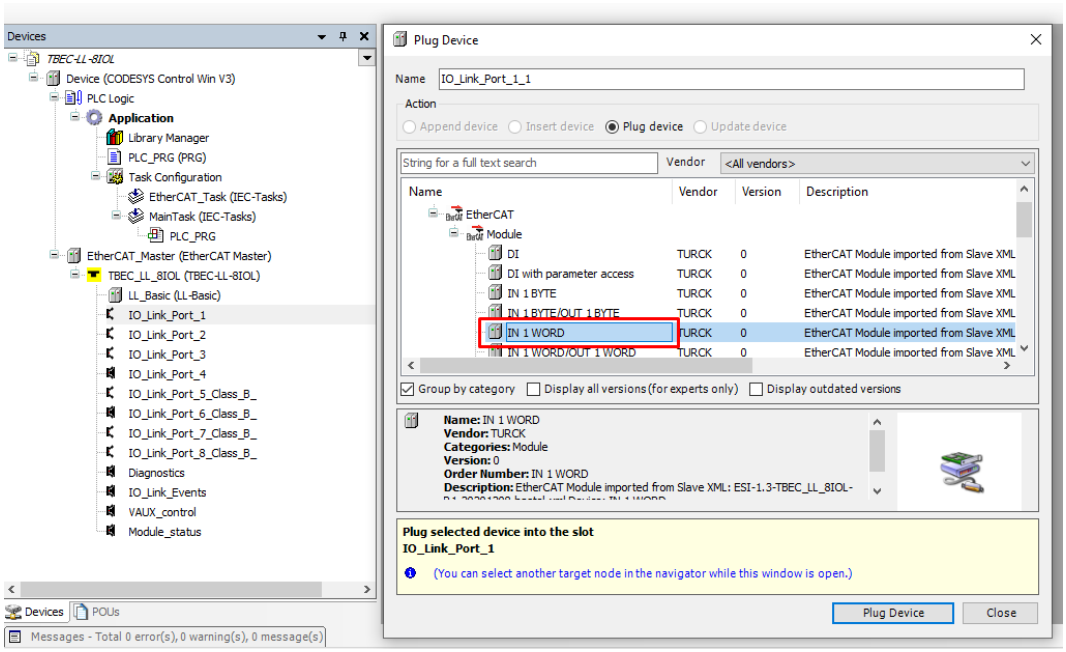


Fig. 52: CODESYS – Configured IO-Link port 1

▶ Configure all slots according to the example configuration above.

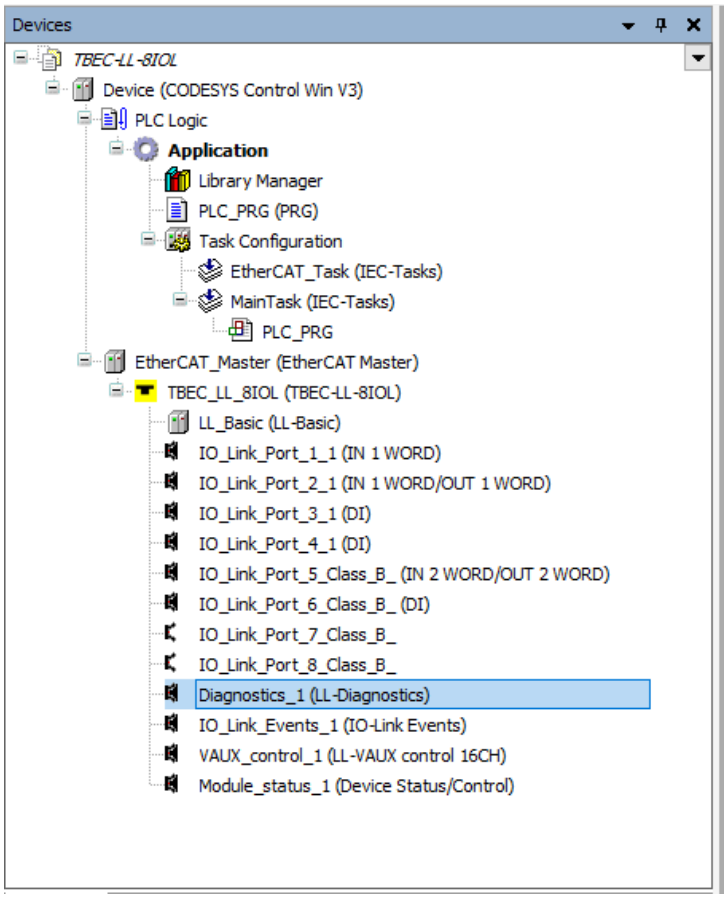


Fig. 53: CODESYS – Device with configured slots

7.4.4 Setting startup parameters

- ▶ Double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- ▶ Select the **Startup Parameters** tab
- ⇨ All set parameters of the module are displayed, but cannot be changed. Setting the startup parameters is done per slot.

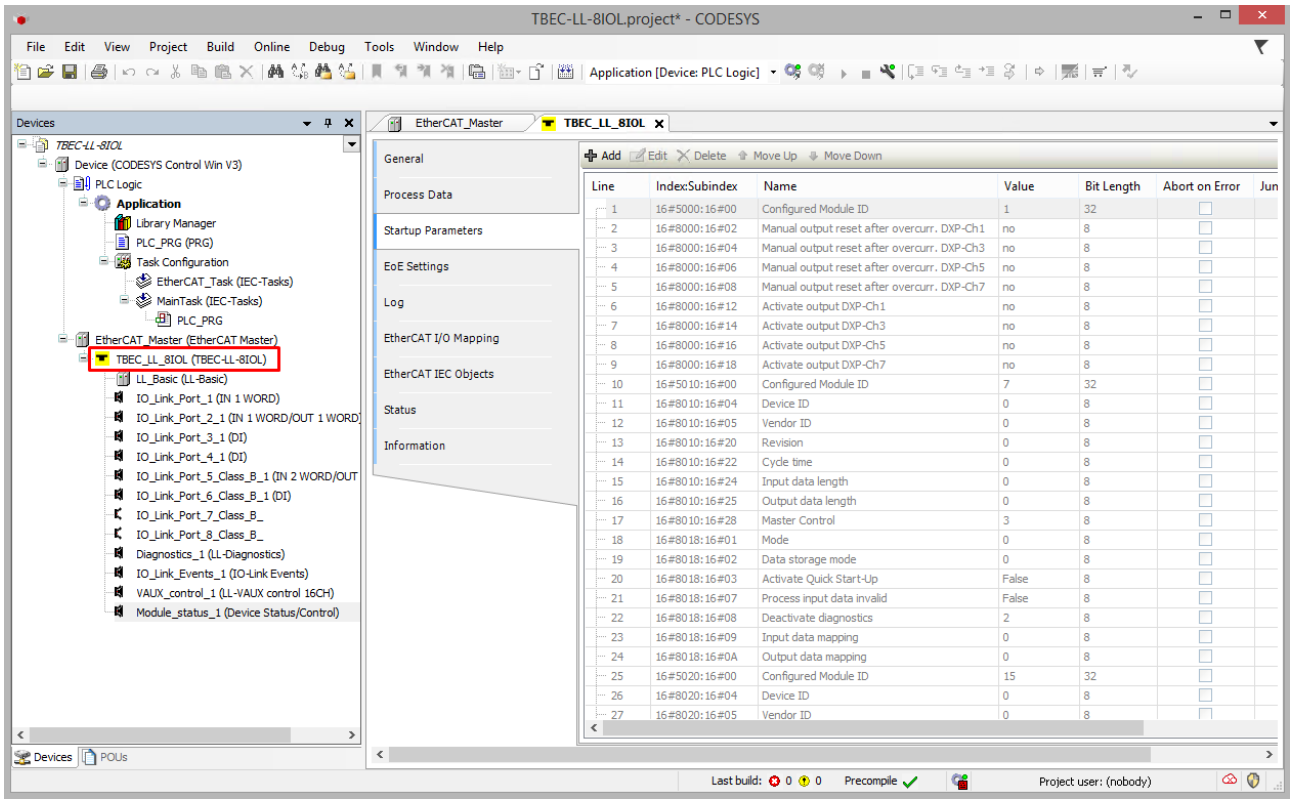


Fig. 54: Startup parameters of the module

Example: Set the operation mode "IO-Link with identical device" for IO-Link port 2

▶ Double-click **IO-Link Port 2** in the project tree.

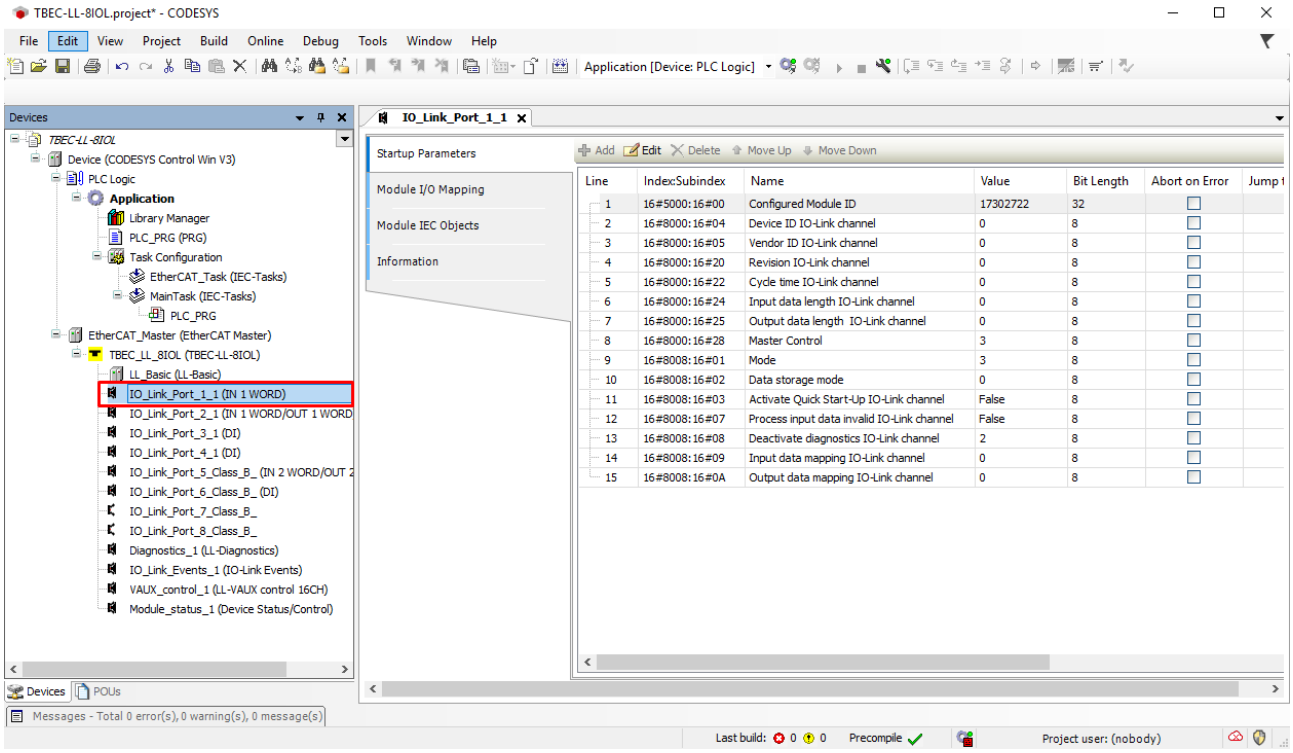


Fig. 55: CODESYS – Startup parameters for IO-Link port 2

- Select the **Startup Parameters** tab.
- In the submenu double-click **Mode**.
- Under **Value**, enter the value **3** for "IO-Link with identical device" (see parameter "Mode" [▶ 81]).
- For parameters that do not occupy a full byte (here: Mode is data type BIT4), the **Byte array** option must be enabled.
- Confirm with **OK**.

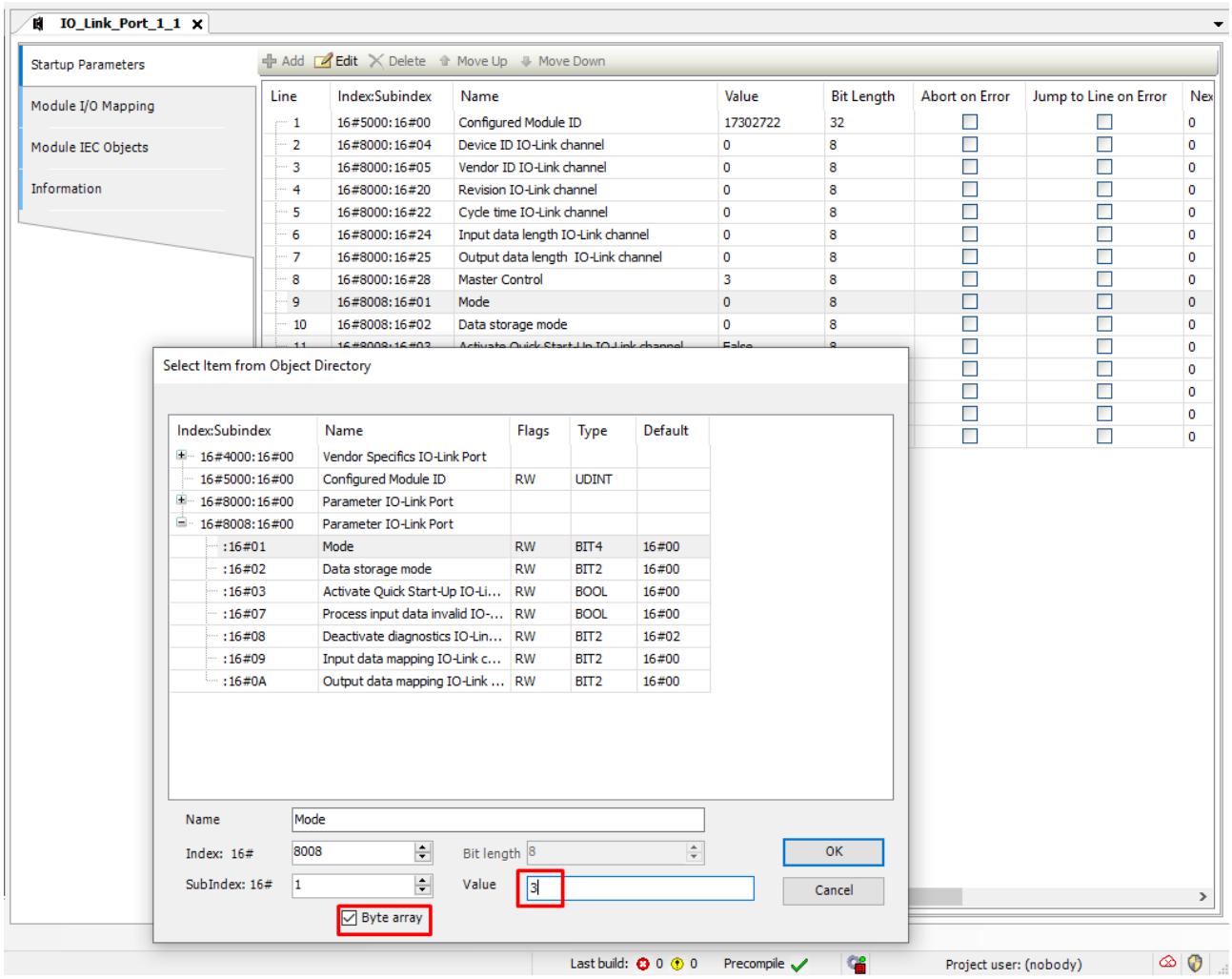


Fig. 56: CODESYS – Setting startup parameters

7.4.5 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

- In the project tree double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- In the **General** tab activate the **Expert Settings** option.

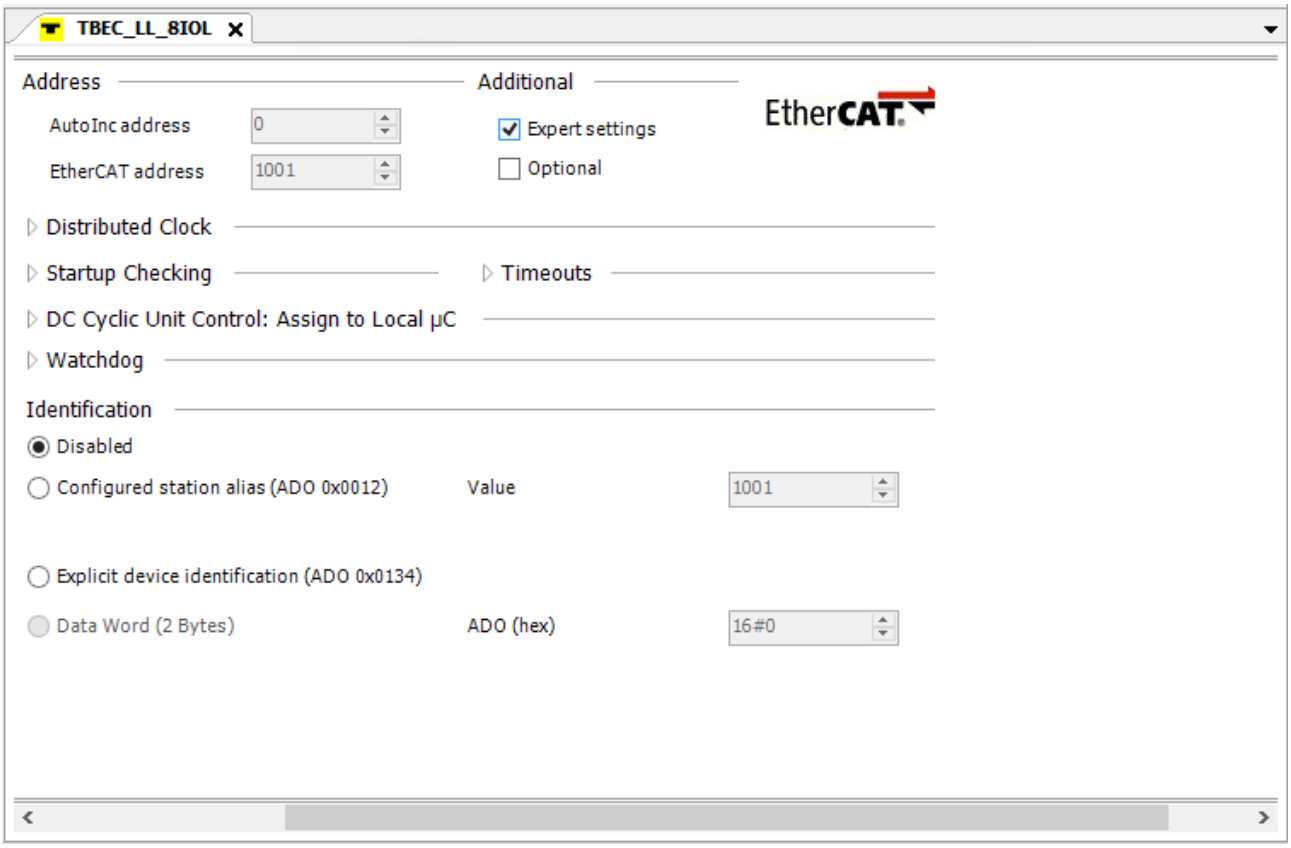


Fig. 57: Activate expert settings

- ▶ Click **Online** → **Login**.
- ▶ Select the **CoE Online** tab.
- ⇨ The object dictionary of the device is displayed with all device-specific parameters.

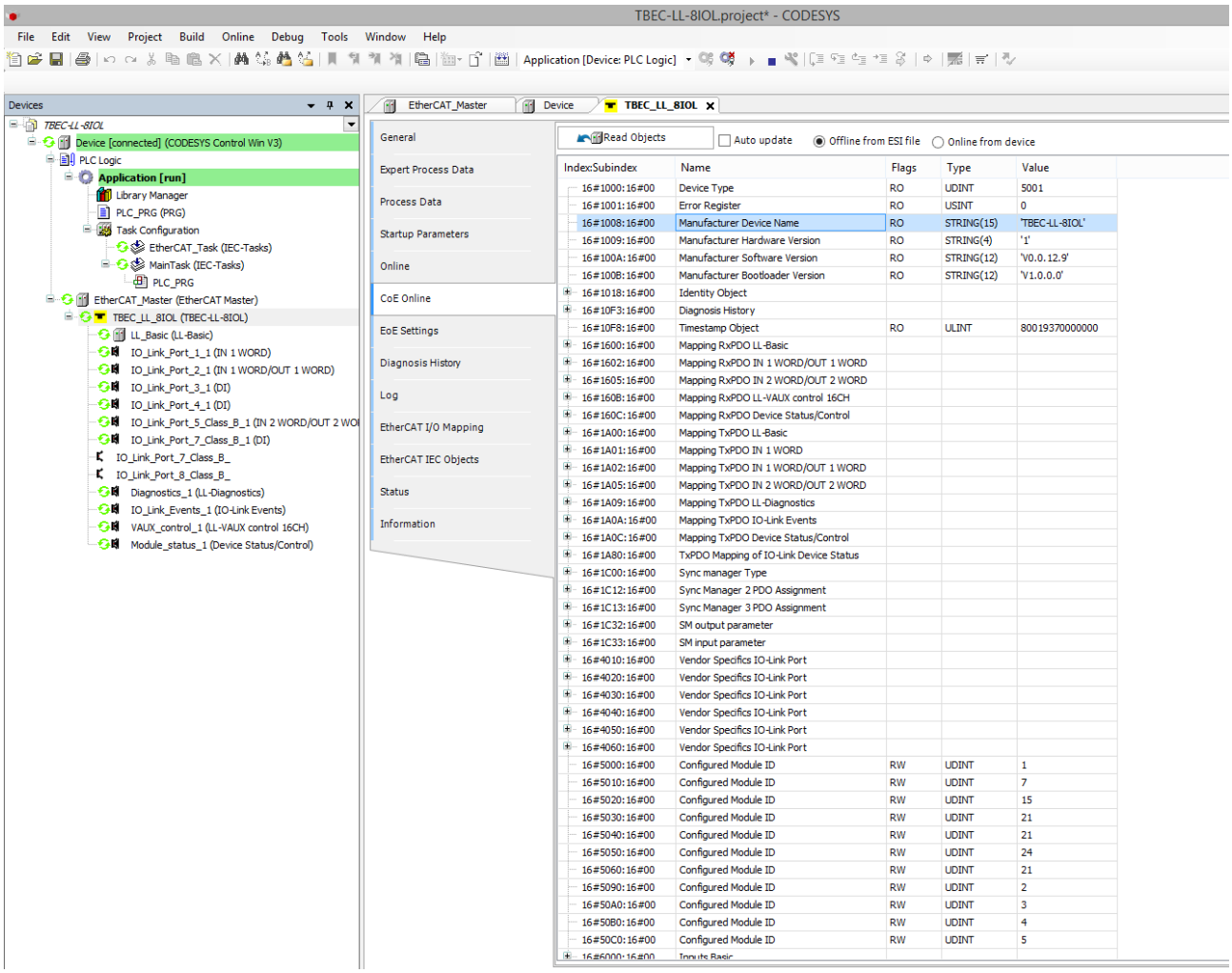


Fig. 58: CODESYS – Object Dictionary

The display of the parameters depends on the device configuration. The parameters can be changed in the object dictionary.

NOTE
The changing of parameters during the runtime can cause a faulty configuration of the device.

7.4.6 Addressing a device via Explicit Device ID

- In the project tree double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- In the **General** tab activate the **Optional** checkbox.
- **General → Identification → Explicit Device Identification (ADO 0x0134): In the Value** field enter the Identification Value (hex.) corresponding to the position of the rotary coding switches on the device.

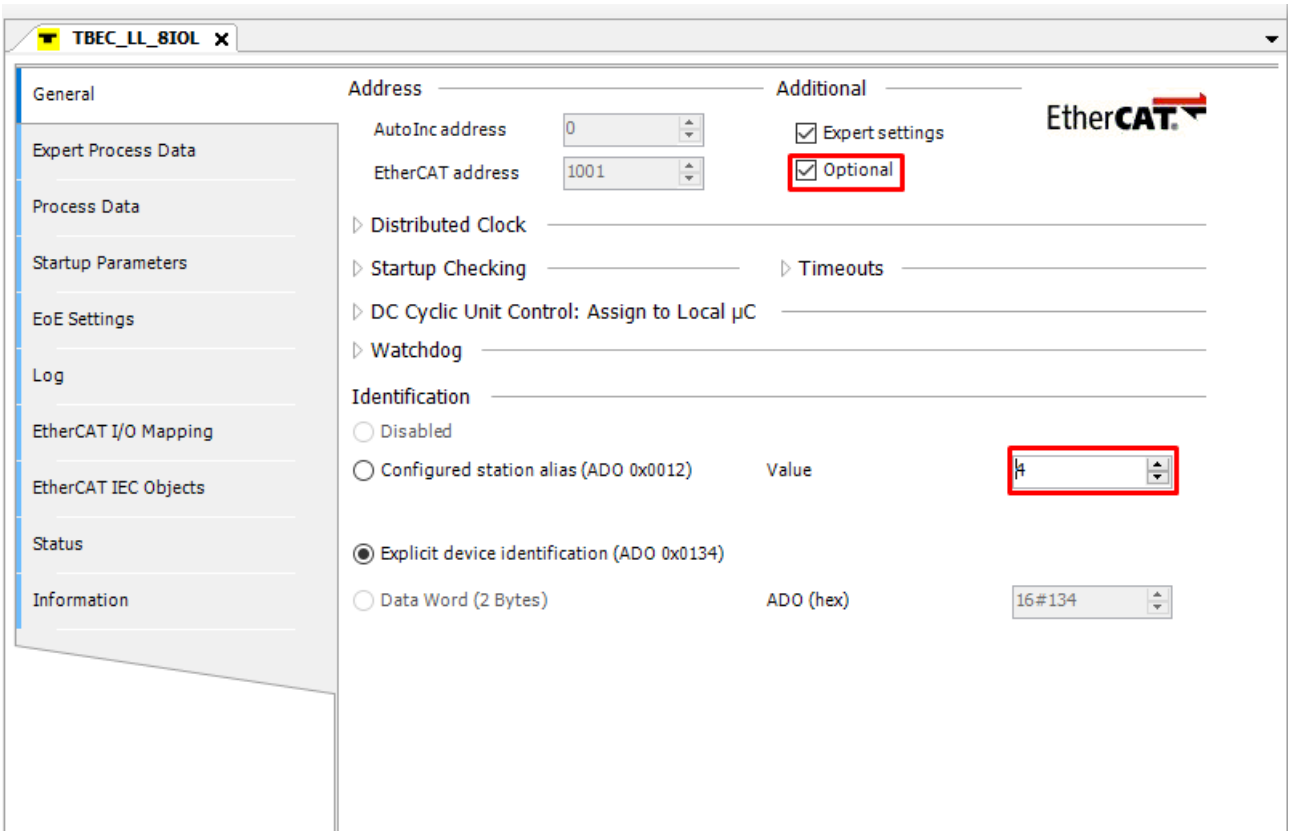


Fig. 59: CODESYS – Explicit Device ID: entering the Identification Value

- Click **Online → Login**.

7.4.7 Addressing a device via Configured Station Alias

- In the project tree double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- Click **Online** → **Login**.
- On the **General** tab activate the **Configured Station Alias (ADO 0x0012)** option under **Identification**.
- In the **Value** field enter the Identification Value.
- Click **Write to EEPROM**.

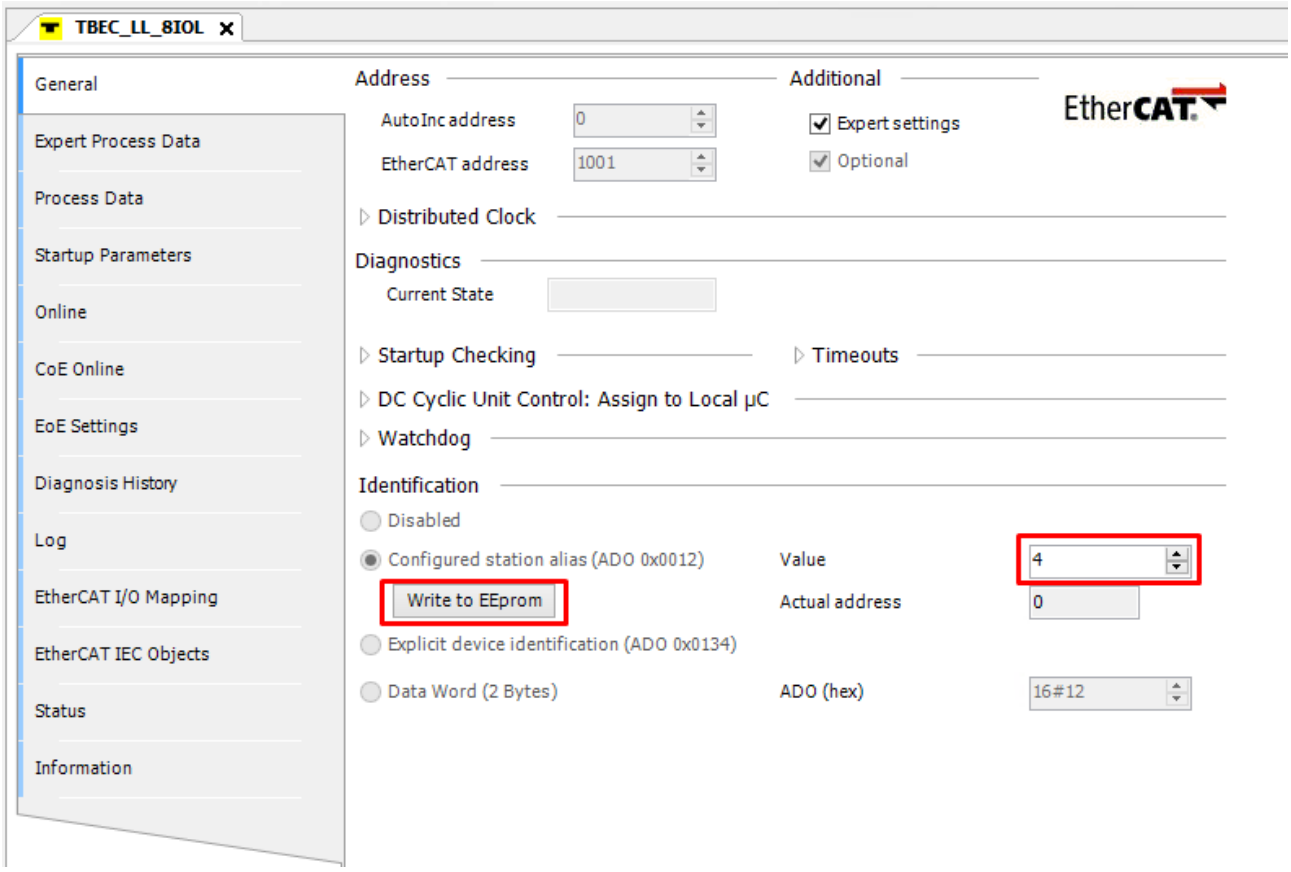


Fig. 60: CODESYS – Configured Station Alias: entering the Identification Value

- Confirm the following dialog with **OK**.

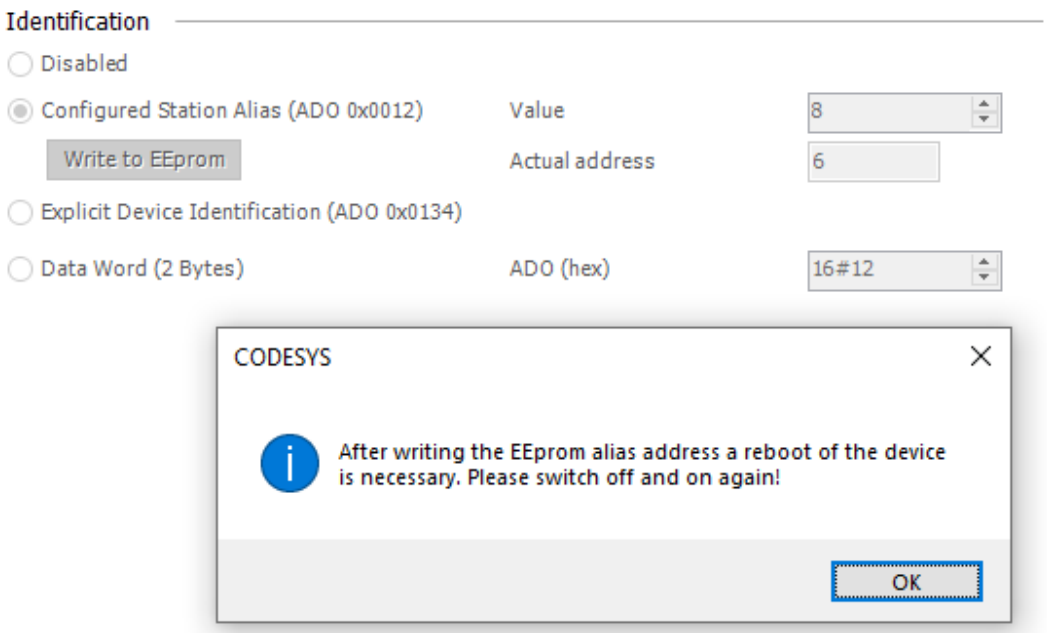


Fig. 61: CODESYS – restart required

⇨ The Identification Value is written to the device.

▶ Carry out a voltage reset.

⇨ After switching on, the newly connected device is automatically recognized by the master. The status in the **Online** tab automatically changes to OP.

7.5 Assigning an IP address for EoE

The normal Ethernet protocol is tunneled via the EoE communication protocol. An IP address for EoE can be assigned to the device so that the device can be configured via the web server or the DTM. Requirement: The set EtherCAT master supports the EoE function.

Activating EoE in TwinCAT

NOTE
In the following example, the communication between EtherCAT and standard Ethernet network is realized via a special Ethernet switch port terminal (e.g. EL6601) from Beckhoff Automation.

The following steps are required to activate the EoE function:

- activating EoE in EtherCAT master
- activating EoE in the switch port terminal
- activating EoE in EtherCAT slave

Activating EoE in the EtherCAT master:

- ▶ Double-click **Master (EtherCAT)** in the project tree in TwinCAT.
- ▶ Click **EtherCAT** tab → **Advanced Settings**.
- ▶ In the **Advanced Settings** window select **EoE Support** on the left.
- ▶ At **Virtual Ethernet Switch** activate the **Enable** option and the **Connect to TCP/IP Stack** option at **Windows Network.**
- ⇨ The EoE function is activated in the master.

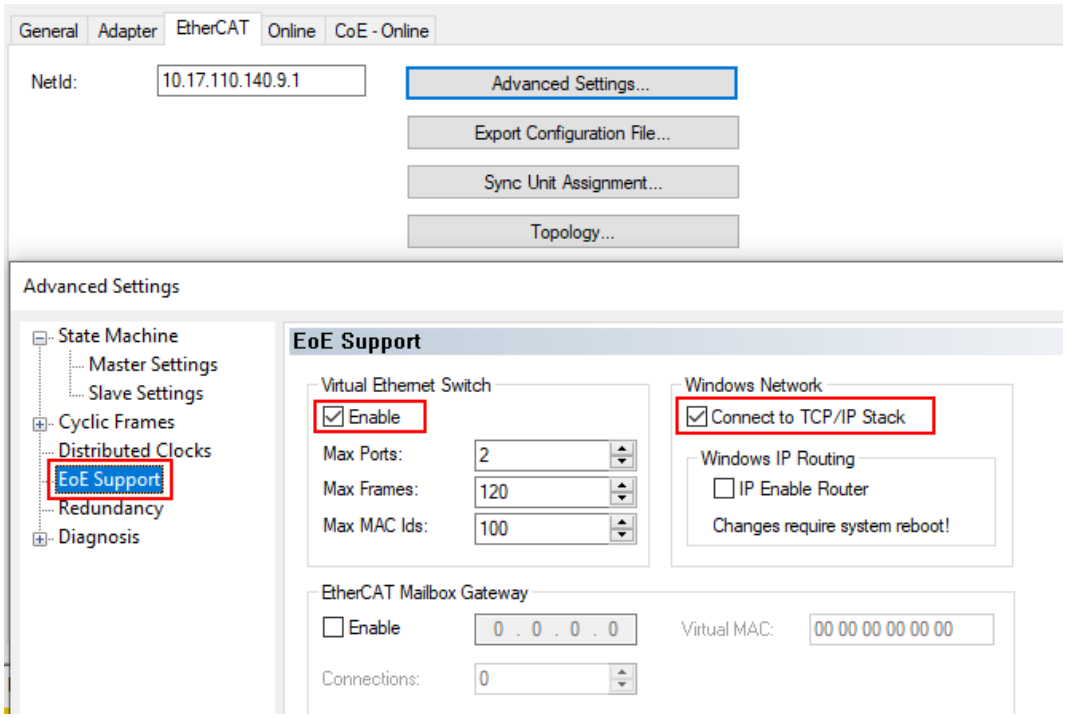


Fig. 62: TwinCAT – activating EoE in the master

Activating EoE in the switch port terminal (EL6601):

- ▶ Double-click the Ethernet switch port terminal **(EL6601)** in the project tree in TwinCAT.
- ▶ Click **EtherCAT** tab → **Advanced Settings**.
- ▶ In the **Advanced Settings** window select **Mailbox** → **EoE** on the left.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway.**
- ⇨ The EoE function is activated in the Ethernet switch port terminal.

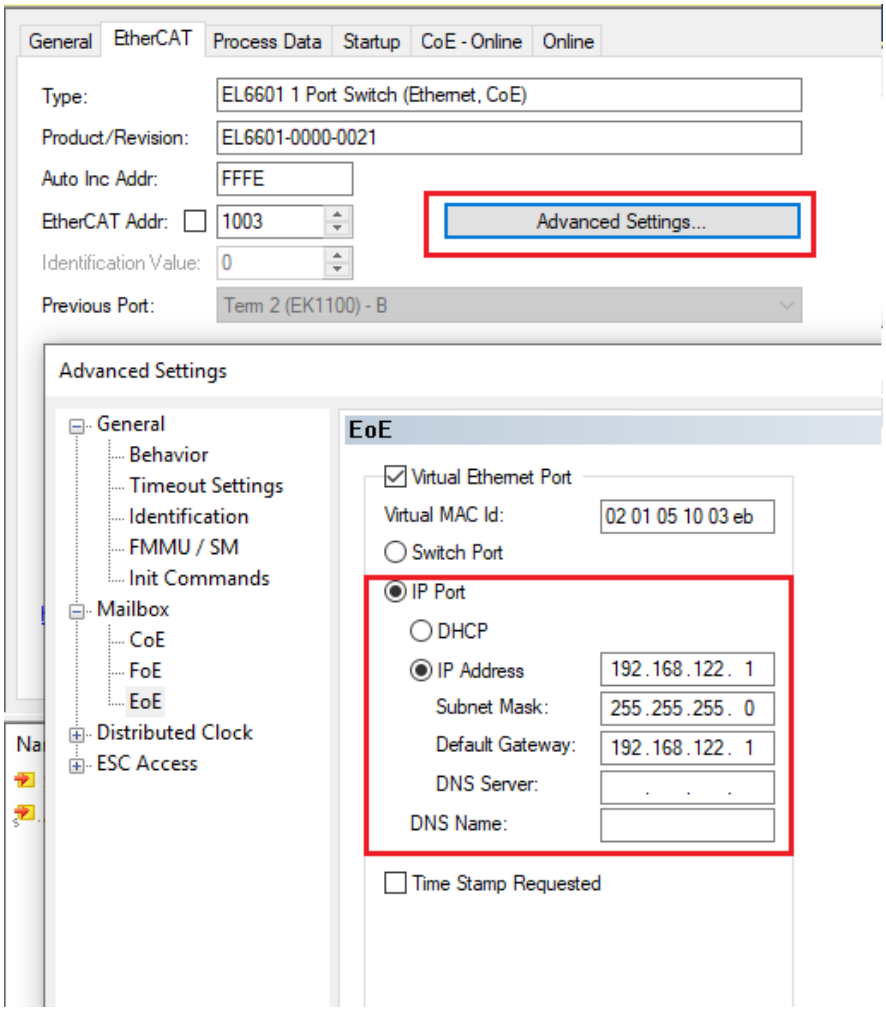


Fig. 63: TwinCAT – Activating EoE in switch port terminal

Activating EoE in EtherCAT slave:

- In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.
- Click **EtherCAT** tab → **Advanced Settings**.
- In the **Advanced Settings** window select **Mailbox** → **EoE** on the left.
- Enter the **IP Address**, **Subnet Mask** and **Default Gateway.**

⇨ The EoE function is activated in the EtherCAT slave.

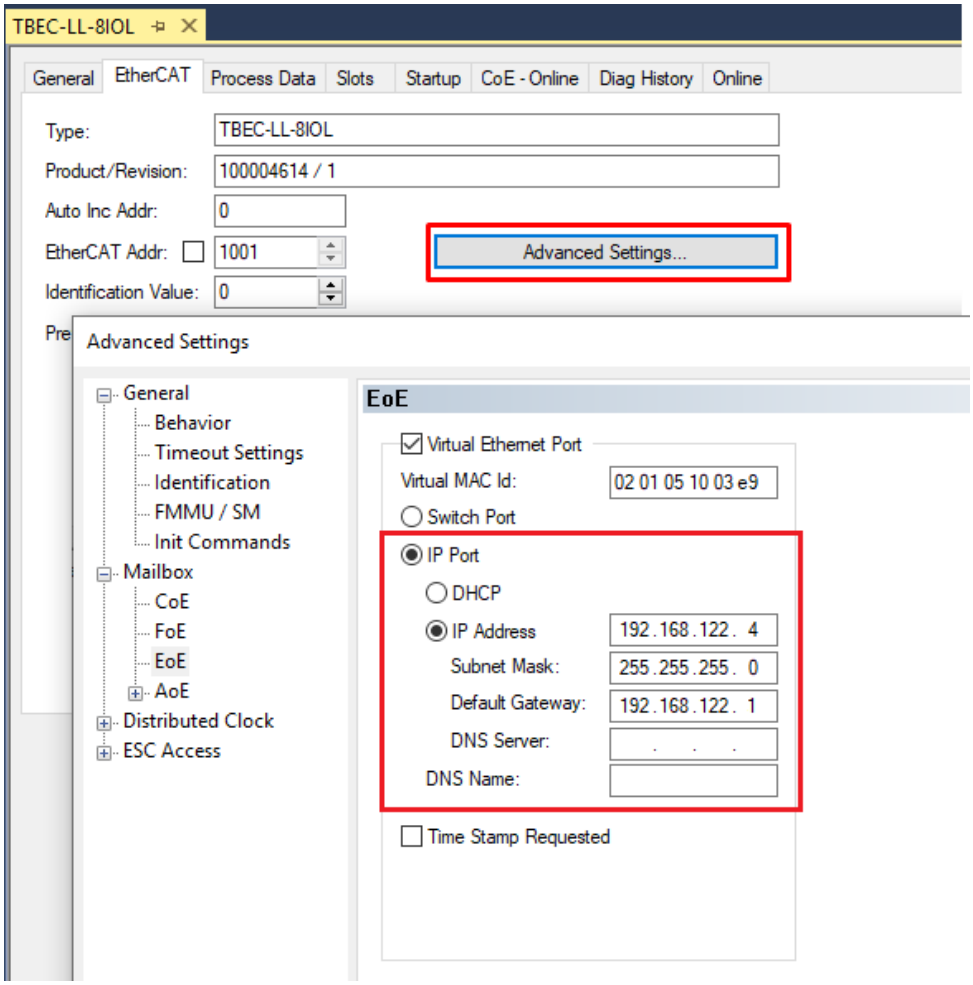


Fig. 64: TwinCAT – activating EoE in EtherCAT slave

NOTE
DHCP is not supported by TBEC-LL-8IOL.

Activating EoE in CODESYS

In CODESYS, EoE is activated in the EtherCAT master by default.

Activating EoE in EtherCAT slave:

- ▶ In the project tree double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- ▶ Select the **EoE Settings** tab.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway.**
- ⇨ The EoE function is activated in the EtherCAT slave.

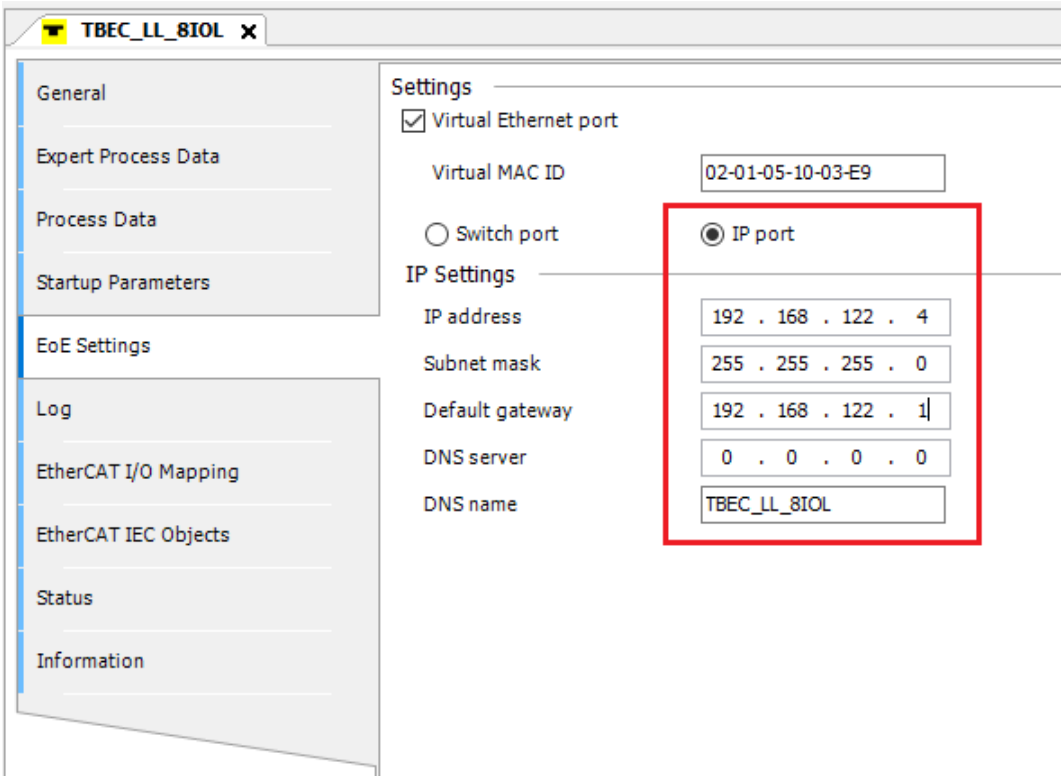


Fig. 65: CODESYS – activating EoE in EtherCAT slave

Configuring the Device

After EoE was activated in the EtherCAT master and in the EtherCAT slave, the device can be configured in the in the DTM or in the web server.

Configuring the device in the web server

Requirement: The TBEC-LL-8IOL already has an IP address.

- ▶ Access the web server by entering the IP address in the web browser.
- ▶ Log in to the device's web server.
- ▶ Configure the device and send the changes to the device via **Write**.

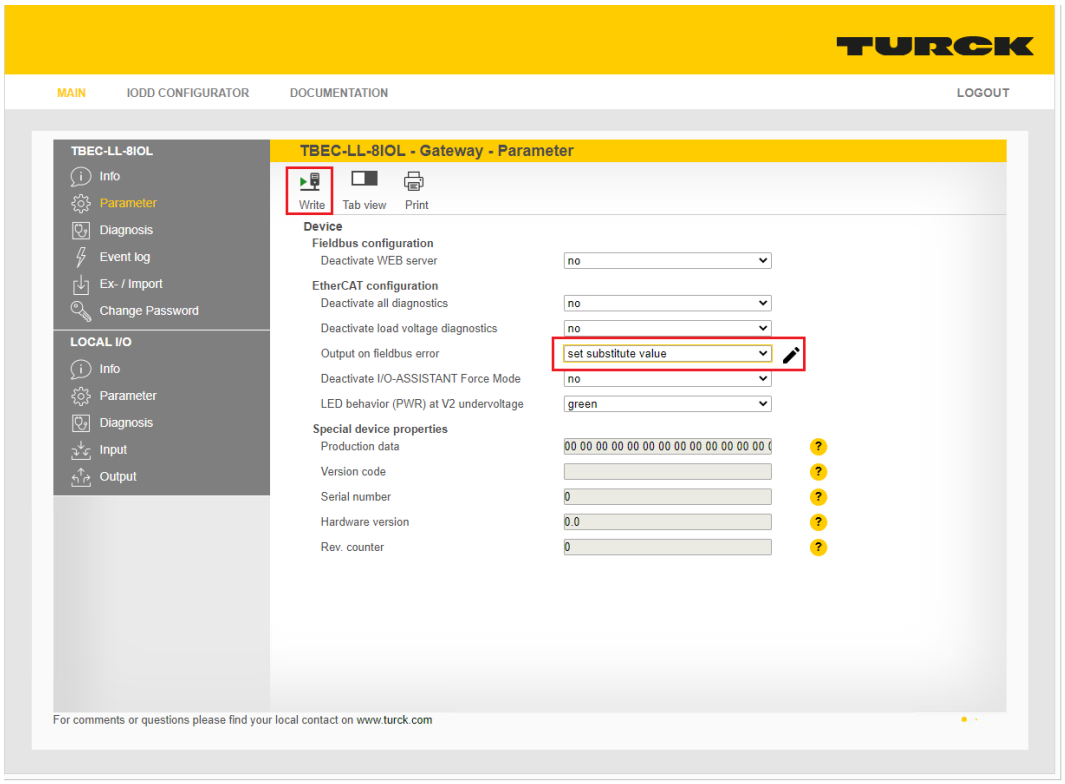


Fig. 66: Web server - configuring the device

Configuring the device in the DTM

Requirement: The TBEC-LL-8IOL already has an IP address.

- ▶ Add the Ethernet interface **BL Service Ethernet** to the project.
- ▶ Use the **Add device** function to add the TBEC-LL-8IOL to the interface.

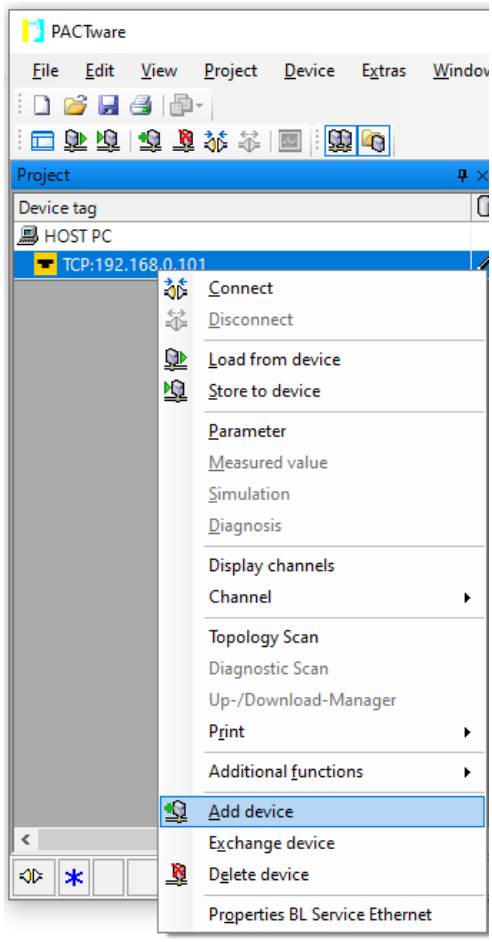


Fig. 67: DTM – Adding a device

- ▶ Select the TBEC-LL-8IOL from the device catalog.

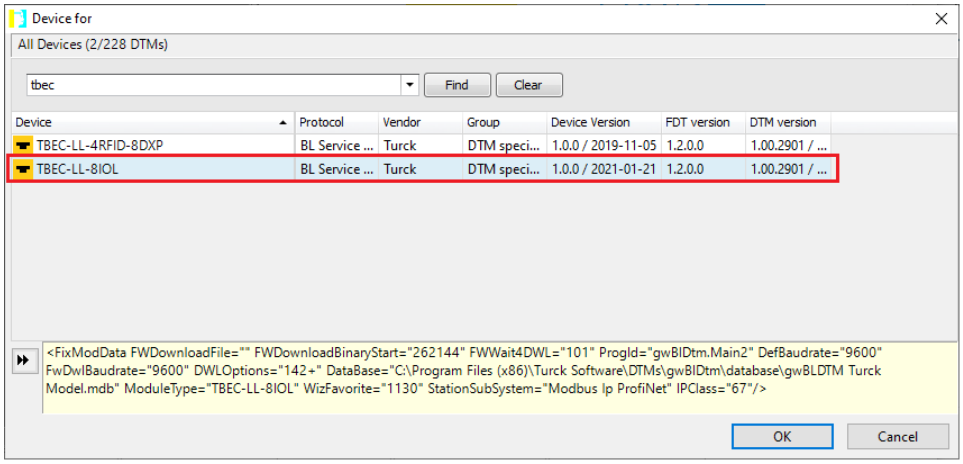


Fig. 68: DTM – Adding a device

▶ Enter the IP address for TBEC-LL-8IOL .

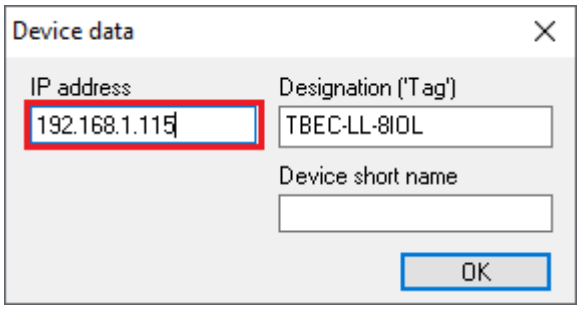


Fig. 69: DTM – Entering the IP addresses

▶ Configure the device in the DTM.

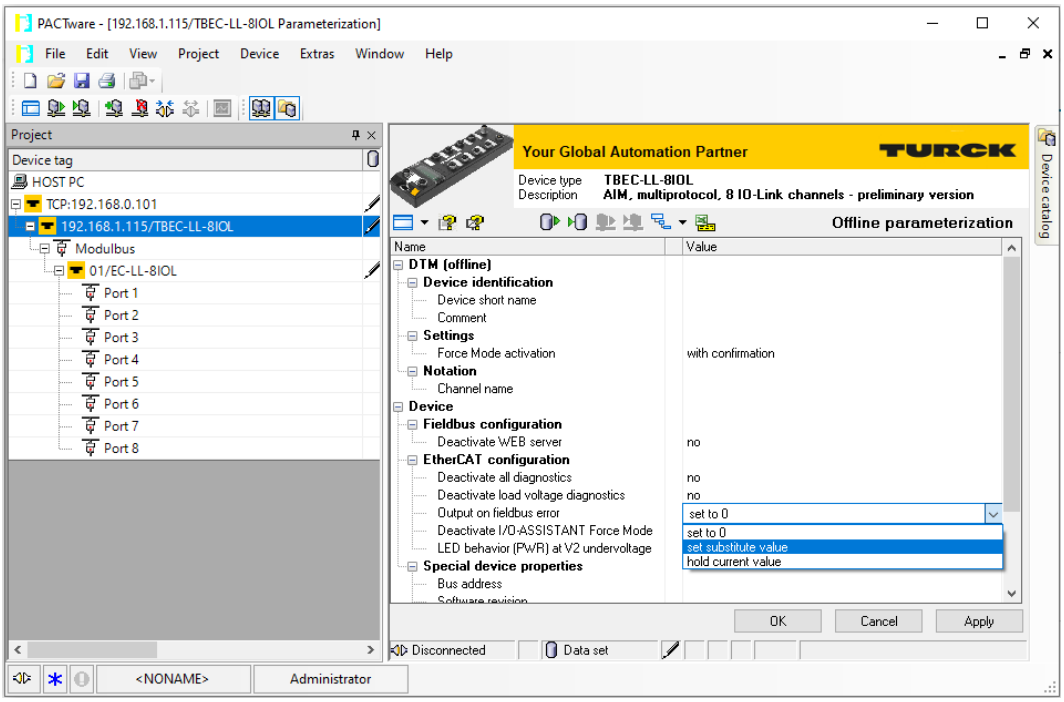


Fig. 70: DTM – Configuring the device

7.6 Commissioning IO-Link devices

7.6.1 Web server – manage IO-Link devices

The web server of the device can only be reached if the device has been assigned an IP address via EoE [▶ 60]. Requirement: The set EtherCAT master supports the EoE function.

Web server: integrated IODD Configurator

The integrated IODD configurator in the web server enables all IO-Link devices connected to the IO-Link master to be read in and thus enables the devices to be parameterized and monitored. Requirement: The ports of the device are configured as IO-Link ports in the EtherCAT configuration software.

- ▶ Access the web server by entering the device IP address in the web browser.
- ▶ Click **IODD Configurator** in the web server of the IO-Link master.
- ⇨ The IO-Link master automatically performs a topology scan. All connected IO-Link devices are read in. Devices whose IODD is not known are displayed as generic devices.

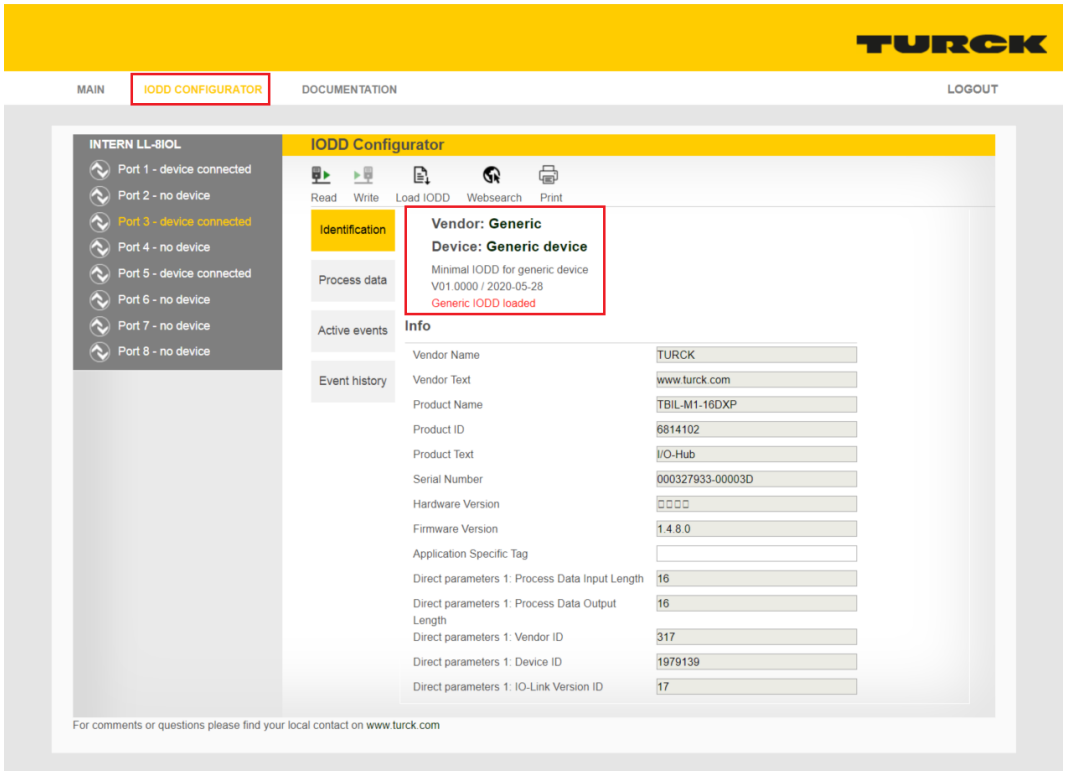


Fig. 71: Web server: IODD Configurator – generic IODD

Missing IODDs can be searched for locally using the **Load IODD** function or on the Internet using the **Websearch** function.

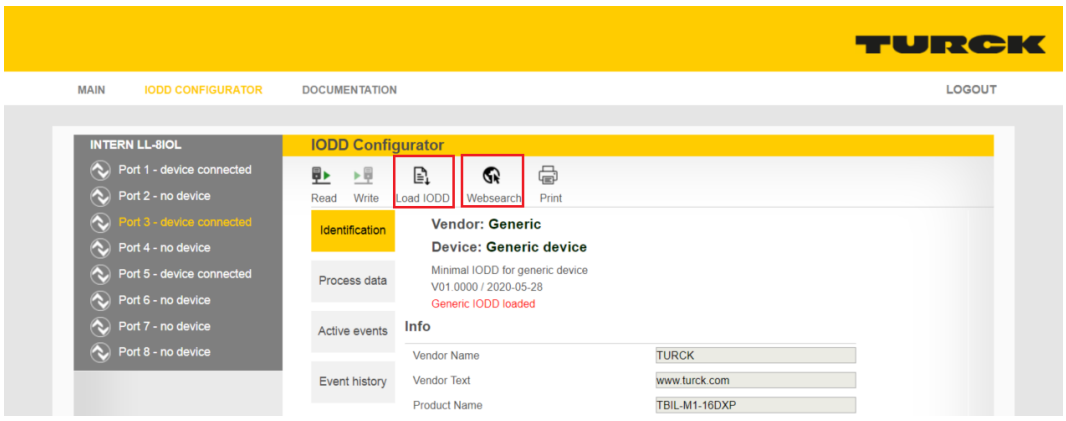


Fig. 72: Web server: IODD Configurator – load IODD

When the IODD for the device is loaded, access to all parameters, diagnostics and process data of the connected IO-Link device is possible.

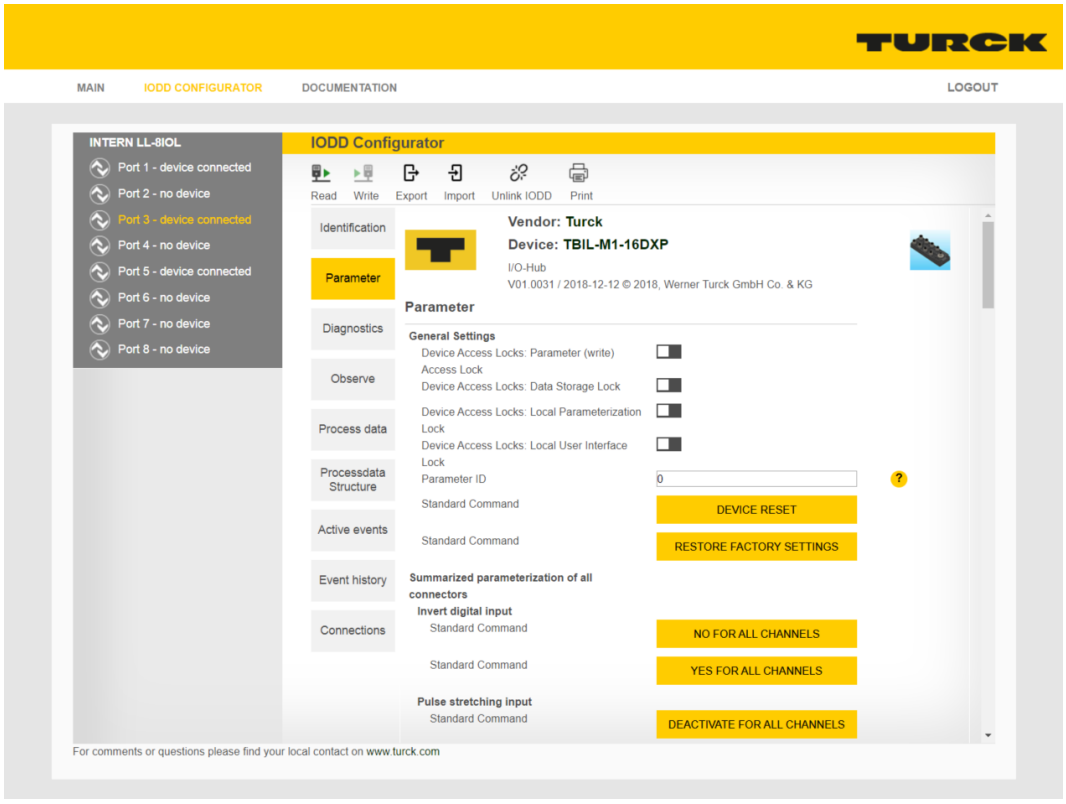


Fig. 73: Web server: IODD Configurator – access to IO-Link device via IODD

7.6.2 FDT/DTM – manage IO-Link devices

FDT/DTM enables parameterization and monitoring of the IO-Link devices connected to the IO-Link master. The DTM communicates via EoE with the connected devices. For commissioning, the IO-Link master must be connected to an EtherCAT master that supports the EoE function.

Read in connected IO-Link devices: topology scan in the DTM

The Topology Scan in PACTware allows to read-in of an IO-Link configuration down to the IO-Link device. IO-Link device, known in PACTware, are added to the IO-Link ports of the master. Either the respective sensor DTMs in PACTware or the sensor IODDs via IODD DTM Configurator have to be installed.

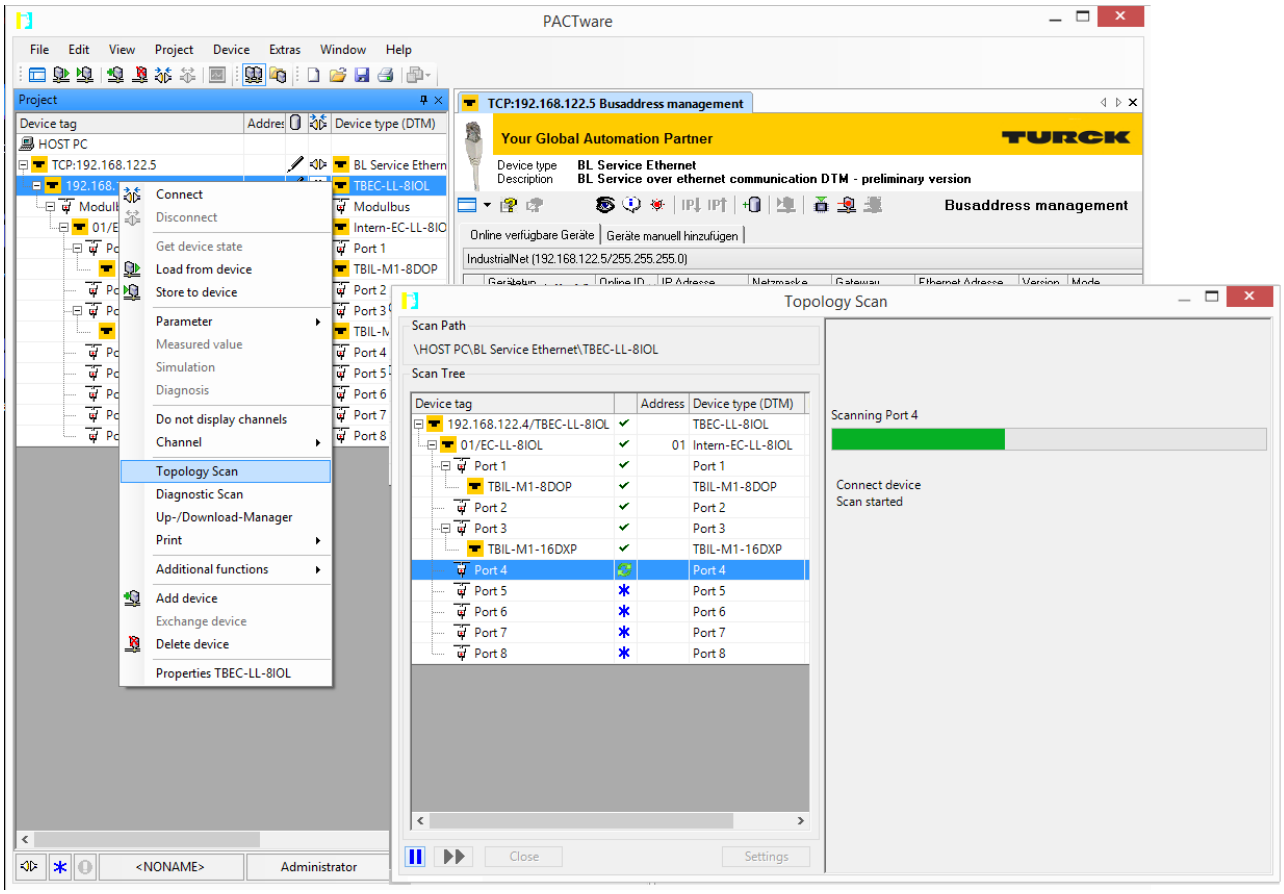


Fig. 74: PACTware – topology scan

7.6.3 Commissioning an IO-Link device with IO-Link V1.0

IO-Link devices in accordance with IO-Link specification V1.0 do not support data storage. If an IO-Link V1.0 device is used, data storage on the IO-Link port must be deactivated. The data storage is deactivated in the configuration software of the EtherCAT master via the parameter "Master Control", bit 4…15 = 0 (CoE index 0x80n0:28).

In the web server, data storage is disabled via the "Data storage mode" parameter.

- ▶ Set the parameter **Data storage mode** at the port to **deactivated, clear**.
- ▶ Use the **Write** button to write the parameter into the device.
- ▶ Connect the IO-Link V1.0 device.
- ⇨ The LED IOL at the IO-Link port is green, IO-Link communication active.

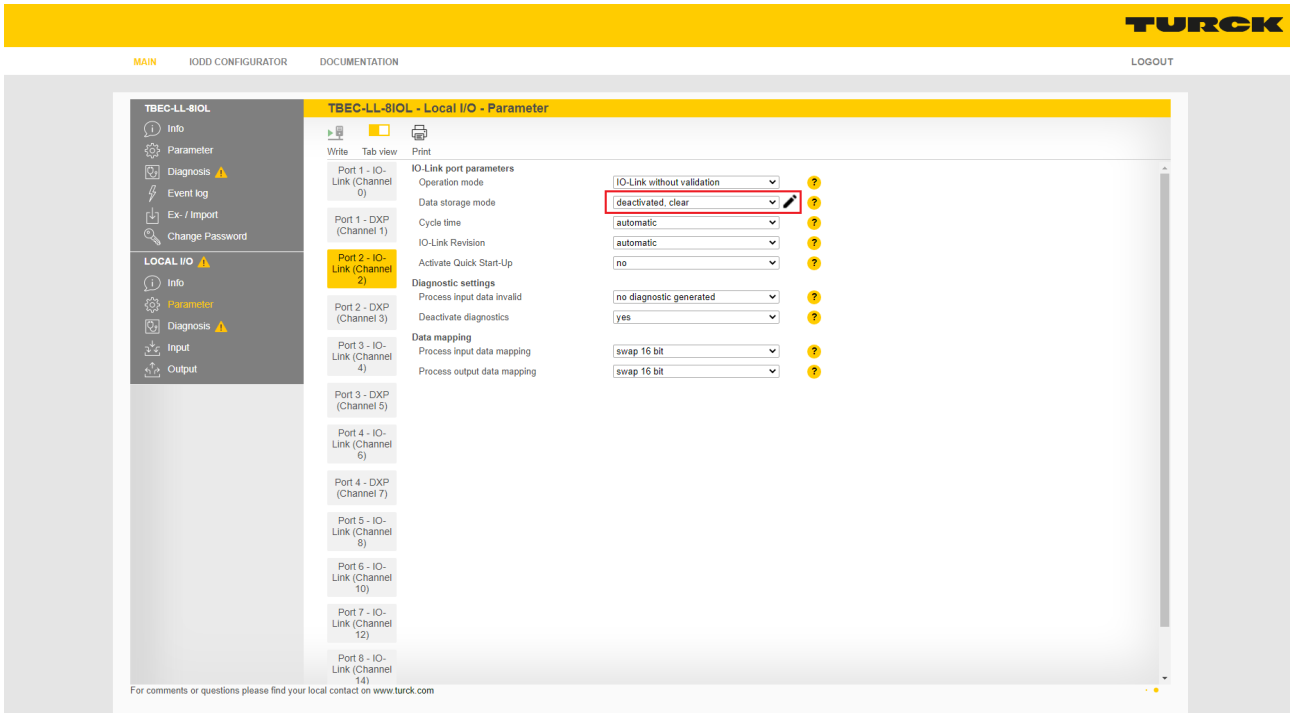


Fig. 75: Example: Deactivate data storage via **Data storage mode** in the web server.

7.6.4 Commissioning an IO-Link device with IO-Link V1.1

The data storage of the master should be cleared before a device with a different device type is connected to an IO-Link port which has already been used before.

There are two ways to clear the data memory:

- Set back the master to factory settings [▶ 122].
- Delete the data storage memory or deactivate the data storage via parameter “Master Control”.

Delete the data storage memory via parameters

Deleting the data storage memory or respectively deactivating the data storage is done via the parameter "Master Control", bit 4…15 = 0 (CoE index 0x80n0:28) in the configuration software of the EtherCAT master.

In the web server, data storage memory is deleted via the "Data storage mode" parameter.

▶ Set the parameter **Data storage mode** at the port to **deactivated, clear**.
▶ Use the **Write** button to write the parameter into the device.
⇨ The LED IOL at the IO-Link port is green, IO-Link communication active.

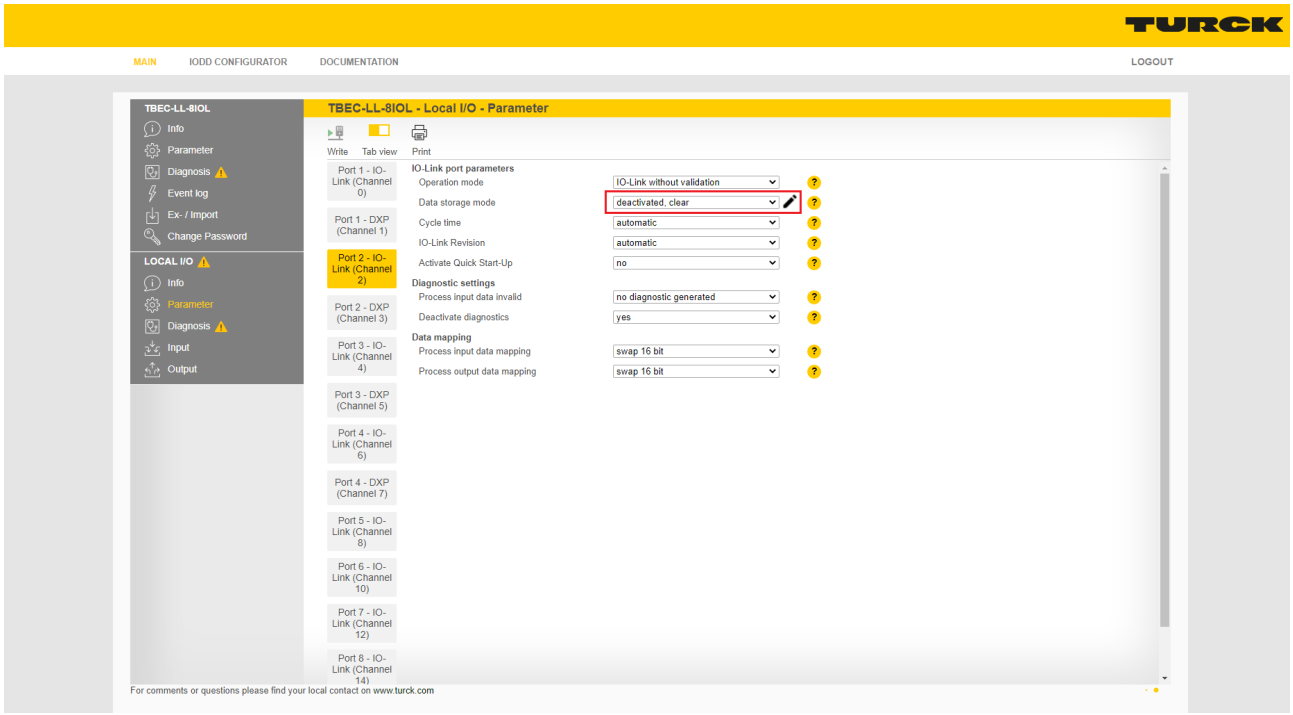


Fig. 76: Example: Deactivate data storage via **Data storage mode** in the web server.

▶ Re-activate the data storage, if necessary.
▶ Use the **Write** button to write the parameter into the device.
▶ Connect the IO-Link V1.1 device.
⇨ The LED IOL at the IO-Link port is green, IO-Link communication active.

8 Parameterizing and Configuring

8.1 Modular device model/slot definition

The TBEC-LL-8IOL appears in the configuration software as a modular EtherCAT slave with 13 configurable slots. The slots are configured by adding/plugging predefined EtherCAT modules.

The following table shows the possible slot/module assignments.

Slot	Module	Description	
Basic	LL-Basic	Parameters and diagnostics of the DXP and SIO channels of the device, as well as input valid signal of the IO-Link ports	
IO-Link port [1…8]	IO-Link Input/ Output Module	■ IN1 BYTE ■ IN 1 WORD ■ IN 1WORD/ OUT 1 WORD ■ …	Plugging in a module activates the "IO-Link" function for the port, i.e. the IO-Link port is operated in IO-Link mode. The length of the process data can be adapted to the connected IO-Link device by selecting a respective module. Sets the bits 0…4 in parameter "Master Control" (0x80n0:28) to the value 3. The mode of the IO-Link port (e.g. "IO-Link without validation") is defined via the "Mode" parameter (0x80n8:01) [▶ 79].
		DI	Plugging the module activates the "DI" function for the port, pin4 of the IO-Link port is operated as simple digital input mode. Data storage is not supported. Sets the bits 0…4 in parameter "Master Control" (0x80n0:28) to the value 1 [▶ 79].
		DI with parameter access	Plugging the module activates the "DI with parameter access" function for the port, pin 4 of the IO-Link port is operated as simple digital input mode. However, an acyclic parameter access from the PLC or the DTM is possible. The IO-Link master starts the port in IO-link mode, parameterizes the device and sets the port back into SIO mode (SI). The port remains in SIO mode (DI) until a new IO-Link request is sent from the higher-level control. Data storage is not supported. Connected devices have to support the SIO mode (DI). In case of a parameter access, the IO-Link communication at the port is started. Switching signals are interrupted. Sets the bits 0…4 in parameter "Master Control" (0x80n0:28) to the value 4 [▶ 79].
Diagnostics	LL-Diagnostics	Diagnostic data of DXP channels, IO-Link channels and VAUX diagnostics [▶ 99]	
IO-Link Events	IO-Link Events	Activates the mapping of IO-Link-Events to the process data [▶ 86].	
VAUX control	LL-VAUX control 16CH	Activates the VAUX voltage supply [▶ 79]	
Module Status	Device Status/ Control	Status- and control for the complete module see „Device Level Entries" [▶ 73]	

8.2 Device area – Device Control (0xF200)

Device Control

Device Control can be accessed via the process data if the module „Device Status/Control" is plugged.

CoE index	CoE sub index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF200	0x08…0x01	0	-	-	-	-	-	-	-	Wink
	0x10…0x09	1	-	-	-	-	-	-	-	-

Meaning of the Device control bits

CoE index	CoE sub index	Designation	Meaning
0xF200	0x01	Wink	0: no 1: yes, activates the Wink command (only settable in Status "Pre-OP")

8.3 Device area – general device parameters (0xF800)

CoE index	Sub index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF800	0x07…0x01	0	DEV2	V2LED	-	-	DEWEB	FFB		DDI
	0x0F…0x08	1	-	DEFC	-	-	-	-	-	-

Meaning of parameter bits

The default values are written in **bold**.

CoE index	Sub index	Designation		Meaning
0xF800	0x01	DDI	Deactivate all diagnostics	
			0: no	All diagnostic and alarm messages are sent.
			1: yes	All diagnostic and alarm messages are suppressed.
	0x02	FFB	Output behavior at communication loss	
			00: Set to 0	If EtherCAT communication fails, the DXP channels are set to 0. IO-Link devices receive 0 as a valid value ("output data valid").
			01: Substitute value	If EtherCAT communication fails, the DXP channels are set to 0. Values at IO-Link devices are marked as invalid ("output data invalid"). The substitute value is defined by the connected IO-Link device.
			10: Hold current value	If EtherCAT communication fails, the DXP channels hold the current value. IO Link devices receive the current value as a valid value ("output data valid").
	0x03	DEWEB	Deactivate Webserver NOTE: Activating or deactivating the web server requires a device restart.	
			0: no	The web server in the device is activated.
			1: yes	The web server in the device is deactivated.
	0x06	V2LED	LED behavior (PWR) at V2 undervoltage	
			0: red	PWR-LED is red at V2 undervoltage.
			1: green	PWR-LED is flashing green at V2 undervoltage.
	0x07	DEV2	Deactivate load voltage diagnostics	
			0: no	Load voltage diagnostics are activated.
			1: yes	All load voltage diagnostics are deactivated.
	0x0E	DEFC	Deactivate I/O-ASSISTANT Force Mode	
			0: no	The force mode is activated, the DTM accesses the device.
			1: yes	The force mode is deactivated.

8.4 I/O channel parameters (Configuration Area, 0x8000…0x8FFF)

The general device parameters are set via Device Level Entries [▶ 73].

The I/O channel parameters of the TBEC-LL-8IOL occupy the following CoE indices:

Slot no.	CoE index	Channel
0	-	Status word
Configuration Data Basic		
1	0x8000	Parameters for DXP channels Ch1, Ch3, Ch5, Ch7
Configuration Data IO-Link Port		
2	0x8010	Parameters for IO-Link port 1 (acc. to ETG 5001)
	0x8018	Parameters for IO-Link port 1 (vendor specific)
3	0x8020	Parameters for IO-Link port 2 (acc. to ETG 5001)
	0x8028	Parameters for IO-Link port 2 (vendor specific)
4	0x8030	Parameters for IO-Link port 3 (acc. to ETG 5001)
	0x8038	Parameters for IO-Link port 3 (vendor specific)
5	0x8040	Parameters for IO-Link port 4 (acc. to ETG 5001)
	0x8048	Parameters for IO-Link port 4 (vendor specific)
6	0x8050	Parameters for IO-Link port 5 (acc. to ETG 5001)
	0x8058	Parameters for IO-Link port 5 (vendor specific)
7	0x8060	Parameters for IO-Link port 6 (acc. to ETG 5001)
	0x8068	Parameters for IO-Link port 6 (vendor specific)
8	0x8070	Parameters for IO-Link port 7 (acc. to ETG 5001)
	0x8078	Parameters for IO-Link port 7 (vendor specific)
9	0x8080	Parameters for IO-Link port 8 (acc. to ETG 5001)
	0x8088	Parameters for IO-Link port 8 (vendor specific)
Configuration Data VAUX control		
12	0x80B0	Parameters for the switchable voltage supply VAUX

The device has 4 byte module parameters (Configuration Data Basic), 36 byte IO-Link port parameters (Configuration Data IO-Link-Port) and 16 byte parameters for the VAUX1/VAUX2 control (Configuration Data VAUX Control).

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Configuration Data Basic										
0x8000	0x08…0x01	0	SRO_ DXP7	-	SRO_ DXP5	-	SRO_ DXP3	-	SRO_ DXP1	-
	0x10…0x09	1	Reserved							
	0x18…0x11	2	ENDO_ DXP7	-	ENDO_ DXP5	-	ENDO_ DXP3	-	ENDO_ DXP5	-
	0x20	3	Reserved							
Configuration Data IO-Link port 1										
0x8010	0x04	0	Device ID (LSB)							
		…	…							
		3	Device ID (MSB)							
	0x05	4	Vendor ID (LSB)							
		…	…							
		7	Vendor ID (MSB)							
	0x20	8	IO-Link Revision							
	0x21	9	Reserved							
	0x22	10	Cycle time							
	0x23	11	Reserved							
	0x24	12	Process Data In Length							
	0x25	13	Process Data Out Length							
	0x26	14…15	Reserved							
	0x27	16…17								
	0x28	18	Master Control							
		19								
0x8018	0x04…0x01	0	-	Activate Quick Start-Up	Data storage mode		Mode			
	0x05	1	Reserved							
	0x0A… 0x06	2	Output data mapping		Input data mapping		Deactivate diagnostics		Process input data invalid	-
	0x0B	3	Reserved							
	…	…								
	0x35	15								
Configuration Data IO-Link port 2										
0x8020	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8028	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Configuration Data IO-Link port 3										
0x8030	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8038	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								
Configuration Data IO-Link port 4										
0x8040	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8048	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								
Configuration Data IO-Link port 5										
0x8050	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8058	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								
Configuration Data IO-Link port 6										
0x8060	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8068	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								
Configuration Data IO-Link port 7										
0x8070	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8078	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								
Configuration Data IO-Link port 8										
0x8080	0x04	0	Assignment similar to IO-Link port 1							
	…	…								
	0x28	19								
0x8088	0x01	0	Assignment similar to IO-Link port 1 (0x8018)							
	…	…								
	0x35	15								

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Configuration Data VAUX control										
0x80B0	0x01	0	-	-	-	-	-	-	VAUX1 pin1 X0 (Ch0/1)	
	0x08	1	-	-	-	-	-	-	VAUX1 pin1 X1 (Ch2/3)	
	0x0F	2	-	-	-	-	-	-	VAUX1 pin1 X2 (Ch4/5)	
	0x16	3	-	-	-	-	-	-	VAUX1 pin1 X3 (Ch6/7)	
	0x1D	4	-	-	-	-	-	-	VAUX1 pin1 X4 (Ch8)	
	0x24	5	-	-	-	-	-	-	VAUX1 pin1 X5 (Ch10)	
	0x2B	6	-	-	-	-	-	-	VAUX1 pin1 X6 (Ch12)	
	0x32	7	-	-	-	-	-	-	VAUX1 pin1 X7 (Ch14)	
	0x39	8	Reserved							
	…	9								
	0x54	11								
	0x55	12	-	-	-	-	-	-	VAUX2 pin2 X4 (Ch9)	
	0x5C	13	-	-	-	-	-	-	VAUX2 pin2 X5 (Ch11)	
	0x63	14	-	-	-	-	-	-	VAUX2 pin2 X6 (Ch13)	
	0x6A	15	-	-	-	-	-	-	VAUX2 pin2 X7 (Ch15)	

Meaning of parameter bits

Select the IO-Link port via (n = 0: port IOL1…n = 8: port IOL8)

The default values are written in **bold**.

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
0x8000		SRO_DXP Manual output reset after overcurrent DXP				
	0x02	SRO_DXP1	**0**	**0x00**	**No**	The output switches on automatically after an overload.
			1	0x01	Yes	The output is manually switched-off after an overload until a new set-command is given (rise and fall).
	0x04	SRO_DXP3	Acct. to sub index 0x02			
	0x06	SRO_DXP5				
	0x08	SRO_DXP7				
0x8000		ENDO_DXP Activate output DXP				
	0x12	ENDO_DXP1	**0**	**0x00**	**No**	The output at pin 2 is deactivated.
			1	0x01	Yes	The output at pin 2 is activated.
	0x14	ENDO_DXP3	Acct. to sub index 0x12			
	0x16	ENDO_DXP5				
	0x18	ENDO_DXP7				
0x80n0	0x04	Device ID				
			0… 16777215 0… 0x00FFFFFF		Device ID for the port configuration check 24 bit value	
	0x05	Vendor ID				
			0…65535 0x0000… 0xFFFF		Vendor ID for the port configuration check	
0x80n0	0x20	IO-Link Revision				
			0	**0x00**	**Automatic**	The Master defines the IO-Link-revision automatically.
			1	0x01	V1.0	IO-Link-Revision V 1.0 is used.
0x80n0	0x22	Cycle time				
			0	**0x00**	**Automatic**	The lowest cycle time supported by the device is taken from the table.
			16… 191	0x10 … 0xBF	1.6 = 132,8 ms	Settable in steps of 0.8 or 1.6 ms.
			255	0xFF	Automatic, compatible	Compatibility mode The mode solves possible communication problems with sensors of the SGB family from IFM.

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
0x80n0	0x24	Process Data In Length Content is only for information. Setting the bits has no effect. The process data length as well as the SIO indicator are defined by the module selection [▶ 72].				
		Bit 0…4			Process input data length in bit or byte	
		Bit 5			Reserved	
		Bit 6	1	0x01	SIO indicator: channel is set to „DI" or "DI with parameter access"	
		Bit 7	0	0x00	Process input data length in bit 0…4 is specified in bit	
			1	0x01	Process input data length in bit 0…4 is specified in byte	
0x80n0	0x25	Process Data Out Length The content is only for information. Setting the bits has no effect. The process data length as well as the SIO indicator are defined by the module selection [▶ 72].				
		Bit 0…4			Process output data length in bit or byte	
		Bit 5			Reserved	
		Bit 6			SIO indicator: not relevant, device does not support DO function.	
		Bit 7	0	0x00	Process output data length in bit 0…4 is specified in bit	
			1	0x01	Process output data length in bit 0…4 is specified in byte	
0x80n0	0x28	Master Control Requirement: Parameter „Data storage mode" (index 0x80n8, sub index 0x02) has to be „0" to set parameter „Master Control".				
		Bit 0…3	0	0x00	Channel inactive	
			1	0x01	DI	The functions of the IO-Link port are specified via predefined EtherCAT modules [▶ 72]
			2	0x02	DO (not supported)	
			3	0x03	IO-Link	
			4	0x04	DI with parameter access	
		Bit 4…15	0	0x00	No data storage	Synchronization of parameter data deactivated. The data set in the master is deleted. Data storage mode = deactivated, clear [▶ 122]
			2	0x02	Data storage active	Synchronization of parameter data activated. The actual data (master or device) serve as the reference data. Data storage mode = activated [▶ 119]
			6	0x06	Data storage active, upload deactivated	Synchronization of parameter data activated, the data in the master serve as reference data. Data storage mode = overwrite [▶ 121]

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
0x80n8	0x01	Mode Defines the IO-Link port function				
			0	**0x00**	**IO-Link without validation**	Pin 4 is operated in IO-Link mode. The master does not check if the connected device matches the configured one.
			1	0x01	IO-Link with family compatible device	Pin 4 is operated in IO-Link mode. The master checks if the Vendor ID and the MSB of the Device ID (this byte defines the product family) of the connected device match those of the configured one. If the master detects a mismatch, the IO-Link communication is established, but there is no process data exchange. The device remains in the safe state (Pre-Operate). Parameters and diagnostic information can be read and respectively written.
			2	0x02	IO-Link with compatible device	Pin 4 is operated in IO-Link mode. The master checks if the Vendor ID and the Device ID of the connected device match those of the configured one. If the Vendor ID matches, but the Device ID not, then the master tries to write the Device ID to the device. If the writing is successful, then the device is a compatible one, process data exchange is possible. If writing the Device ID is not successful, then process data exchange is not possible. The device remains in the safe state (Pre-Operate). Parameters and diagnostic information can be read and respectively written.
			3	0x03	IO-Link with identical device	Pin 4 is operated in IO-Link mode. The master checks if the device type (Vendor ID and Device ID) and the serial number of the connected device match the data of the configured one. If the master detects a mismatch, the IO-Link communication is established, but there is no process data exchange. The device remains in the safe state (Pre-Operate). Parameters and diagnostic information can be read and respectively written.

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
0x80n8	0x02	Data storage mode Completes the options for data management in the parameter "Master Control", (0x80n0, sub index 0x28, bit 4…15).				
			0	**0x00**	**Use Master Control setting**	Data storage behavior of the "Master Control" parameter is applied
			1	0x01	Read in	Synchronization of parameter data activated. The data in the connected IO-Link device serve as reference data. Data storage mode = read in [▶ 121] **NOTE:** By setting this bit, bits 4…15 in parameter ”Master Control” (index 0x80n0, sub index 0x28) are automatically forced and set to 2 = ”data storage active”.
0x80n8	0x03	Activate Quick Start-Up				
		For fast applications (e.g. tool changing applications) the start-up time of IO-Link devices can be shortened. The start-up time defined in the IO-Link specification (TSD = Device Detection Time) is reduced.				
			0	**0x00**	**No**	The start-up time is within the specified range (0.5 s). All IO-Link devices in accordance with the specification can be operated.
			1	0x01	Yes	The start-up time is reduced to approx. 100 ms. It is not supported by every IO-Link device. It can thus be necessary to check if the used IO-Link device starts in this mode.
0x80n8		PD invalid Process input data invalid				
	0x07		**0**	**0x00**	**Diagnostics generated**	If the process data are invalid, a respective diagnostic message is generated.
			1	0x01	No diagnostics generated	Invalid process data do not cause a diagnostic message.
0x80n8	0x08	Deactivate diagnostics				
		Influences the sending of IO-Link-Events from the master to the fieldbus. Depending on the parameterization, the master transmits Events based on their priority to the fieldbus or not.				
			0	0x00	No	The master transmits all IO-Link Events to the fieldbus.
			1	0x01	Notifications	The master transmits all IO-Link Events to the fieldbus except for IO-Link notifications.
			2	**0x02**	**Notifications and warnings**	The master transmits all IO-Link Events to the fieldbus except for IO-Link notifications and warnings.
			3	0x03	Yes	The master doesn't transmit any IO-Link Event to the fieldbus.

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
0x80n8	0x9	Input data mapping				
		Optimization of process data mapping: The IO-Link data can be rotated to achieve optimized data mapping.				
			0	0x00	Direct	The process data are not swapped. i.e.: 0x0123 4567 89AB CDEF
			1	**0x01**	**Swap 16 bit**	The bytes are swapped per word. i.e.: 0x2301 6745 AB89 EFCD
			2	0x02	Swap 32 bit	The bytes are swapped per double word. i.e.: 0x6745 2301 EFCD AB89
			3	0x03	Swap all	All bytes are swapped. i.e.: 0xEFCD AB89 6745 2301
	0x0A	Output data mapping				
		See “Input data mapping”				
0x80B0		Configuration Data VAUX control				
	0x01	VAUX1 pin 1 X0 (Ch0/1)	**0**	**0x00**	**24 VDC**	The 24 VDC sensor/actuator supply at pin1 of the connector is switched on.
			1	0x01	Switchable	The 24 VDC sensor/actuator supply at pin1 of the respective connector is switchable via the process data.
			2	0x02	Off	The 24 VDC sensor/actuator supply at pin1 of the connector is switched off.
	0x08	VAUX1 pin 1 X1 (Ch2/3)	See VAUX1 pin 1 X0 (Ch0/1)			
	0x0F	VAUX1 pin 1 X2 (Ch4/5)				
	0x16	VAUX1 pin 1 X3 (Ch6/7)				
	0x1D	VAUX1 pin 1 X4 (Ch8)				
	0x24	VAUX1 pin 1 X5 (Ch10)				
	0x2B	VAUX1 pin 1 X6 (Ch12)				
	0x32	VAUX1 pin 1 X7 (Ch15)				
	0x55	VAUX2 pin 2 X4 (Ch9)	**0**	**0x00**	**24 VDC**	The Class B supply at pin 2 of the respective connector is switched on.
			1	0x01	Switchable	The Class B supply at pin 2 of the respective connector is switchable via the process data.
			2	0x02	Off	The Class B supply at pin 2 of the respective connector is switched off.

CoE index	CoE sub index	Parameter name	Value Dec.	Value Hex.	Meaning	Description
	0x5C	VAUX2 pin 2 X5 (Ch11)	See VAUX2 pin 2 X4 (Ch9)			
	0x63	VAUX2 pin 2 X6 (Ch13)				
	0x6A	VAUX2 pin 2 X7 (Ch15)				

Values for the parameter "cycle time" in ms:

Time	Value	Time	Value	Time	Value	Time	Value	Time	Value	Time	Value
auto	0x00	16	0x58	31.2	0x7E	60.8	0x92	91.2	0xA5	121.6	0xB8
1.6	0x10	16.8	0x5A	32	0x80	62.4	0x93	92.8	0xA6	123.2	0xB9
2.4	0x18	17.6	0x5C	33.6	0x81	64	0x94	94.4	0xA7	124.8	0xBA
3.2	0x20	18.4	0x5E	35.2	0x82	65.6	0x95	96	0xA8	126.4	0xBB
4	0x28	19.2	0x60	36.8	0x83	67.1	0x96	97.6	0xA9	128	0xBC
4.8	0x30	20	0x62	38.4	0x84	68.8	0x97	99.2	0xAA	129.6	0xBD
5.6	0x38	20.8	0x67	40	0x85	70.4	0x98	100.8	0xAB	131.2	0xBE
6.4	0x40	21.6	0x66	41.6	0x86	72	0x99	102.4	0xAC	132.8	0xBF
7.2	0x42	22.4	0x68	43.2	0x87	73.6	0x9A	104	0xAD	Reserved	
8	0x44	23.2	0x6A	44.8	0x88	75.2	0x9B	105.6	0xAE		
8.8	0x46	24.0	0x6C	46.4	0x89	76.8	0x9C	107.2	0xAF		
9.6	0x48	24.8	0x6E	48	0x8A	78.4	0x9D	108.8	0xB0		
10.4	0x4A	25.6	0x70	49.6	0x8B	80	0x9E	110.4	0xB1		
11.2	0x4C	26.4	0x72	51.2	0x8C	81.6	0x9F	112	0xB2		
12.0	0x4E	27.2	0x74	52.8	0x8D	83.2	0xA0	113.6	0xB3		
12.8	0x50	28	0x76	54.4	0x8E	84.8	0xA1	115.2	0xB4		
13.6	0x52	28.8	0x78	56	0x8F	86.4	0xA2	116.8	0xB5		
14.4	0x54	29.6	0x7A	57.6	0x90	88	0xA3	118.4	0xB6		
15.2	1x56	30.4	0x7C	59.2	0x91	89.6	0xA4	120	0xB7	auto., comp.	0xFF

8.4.1 Adapting process data mapping

The mapping of process data can be adapted application-specifically via the IO-Link master's parameterization.

Depending on the used fieldbus, it can be necessary to swap process data word-wise, double word-wise or completely in order to align them to the data structure in the PLC. The process data mapping is determined channel by channel through the parameters **process input data mapping** and **process output data mapping**.

Example mapping for field buses with Little Endian-format

Mapping through the IO-Link master → field bus → PLC						
Byte	**Device at IO-Link-port**	**Device process data in IO-Link master**		**Parameter: Process data mapping**	**Device process data to fieldbus**	
Byte 0		Status/Control			Status/Control	
Byte 1						
IO-Link port 1						
Byte 2	Temperature sensor TS…	Temperature	Low byte	**Swap 16 bit**	Temperature	High byte
Byte 3			High byte			Low byte
IO-Link port 2						
Byte 4	Linearity sensor Li…	Position	Low byte	**Swap 16 bit**	position	High byte
Byte 5			High byte			Low byte
IO-Link port 3						
Byte 6	I/O hub TBIL-…	Digital signals	0…7	**Direct**	Digital signal	0…7
Byte 7		Digital signals	8…15		Digital signal	8…15
IO-Link port 4						
Byte 8		Diagnostics		**swap all**	Counter/position value	Most Significant Byte
Byte 9	Rotary encoder RI…	Counter/position value	Low byte			High byte
Byte 10			High byte			Low byte
Byte 11			Most Significant Byte		Diagnostics	

9 Operating

9.1 Input area, TxPDOs, 0x6000…0x6FFF

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Inputs Basic										
0x6000	0x08…0x01	0	DXP Ch7	DI Ch6 (SIO)	DXP Ch5	DI Ch4 (SIO)	DXP Ch3	DI Ch2 (SIO)	DXP Ch1	DI Ch0 (SIO)
	0x10…0x09	1	-	DI Ch14 (SIO)	-	DI Ch12 (SIO)	-	DI Ch10 (SIO)	-	DI Ch8 (SIO)
	0x18…0x11	2	-	DVS Ch6	-	DVS Ch4	-	DVS Ch2	-	DVS Ch0
	0x20…0x19	3	-	DVS Ch14	-	DVS Ch12	-	DVS Ch10	-	DVS Ch8
IO-Link process input data										
0x6010	0x01…0x20	0…31	IO-Link port 1, structure depends on the channel parameterization (0…32 byte per channel)							
0x6020	0x01…0x20	0…31	IO-Link port 2, structure depends on the channel parameterization (0…32 byte per channel)							
0x6030	0x01…0x20	0…31	IO-Link port 3, structure depends on the channel parameterization (0…32 byte per channel)							
0x6040	0x01…0x20	0…31	IO-Link port 4, structure depends on the channel parameterization (0…32 byte per channel)							
0x6050	0x01…0x20	0…31	IO-Link port 5, structure depends on the channel parameterization (0…32 byte per channel)							
0x6060	0x01…0x20	0…31	IO-Link port 6, structure depends on the channel parameterization (0…32 byte per channel)							
0x6070	0x01…0x20	0…31	IO-Link port 7, structure depends on the channel parameterization (0…32 byte per channel)							
0x6080	0x01…0x20	0…31	IO-Link port 8, structure depends on the channel parameterization (0…32 byte per channel)							
Inputs Diagnostics – VAUX1/VAUX2										
0x6090	0x08…0x01	0	VERR V1 X7 (Ch14)	VERR V1 X6 (Ch12)	VERR V1 X5 (Ch10)	VERR V1 X4 (Ch8)	VERR V1 X3 (Ch6/7)	VERR V1 X2 (Ch4/5)	VERR V1 X1 (Ch2/3)	VERR V1 X0 (Ch0/1)
	0x10…0x09	1	VERR V2 X7 (Ch15)	VERR V2 X6 (Ch13)	VERR V2 X5 (Ch11)	VERR V2 X4 (Ch9)	-	-	-	-
Inputs Diagnostics – DXP channels										
0x6090	0x18…0x11	2	ERR DXP Ch7	-	ERR DXP Ch5	-	ERR DXP Ch3	-	ERR DXP Ch1	-
	0x20…0x19	3	-	-	-	-	-	-	-	-

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Inputs Diagnostics – IO-Link ports										
0x6090	**IO-Link port 1 (Ch 0)**									
	0x28… 0x21	4	EVT2	EVT1	PDINV	HWERR	DSERR	CFGERR	PPE	-
	0x30… 0x29	5	GENERR	OVL	VHIGH	VLOW	ULVE	LLVU	OTMP	PRMERR
	IO-Link port 2 (Ch 2)									
	0x38… 0x31	6	Assignment similar to port 1 (Ch 0)							
	0x40… 0x39	7								
	IO-Link port 3 (Ch 4)									
	0x48… 0x41	8	Assignment similar to port 1 (Ch 0)							
	0x50… 0x49	9								
	IO-Link port 4 (Ch 6)									
	0x58… 0x51	10	Assignment similar to port 1 (Ch 0)							
	0x60… 0x59	11								
	IO-Link port 5 (Ch 8)									
	0x68… 0x61	12	Assignment similar to port 1 (Ch 0)							
	0x70… 0x69	13								
	IO-Link port 6 (Ch 10)									
	0x78… 0x71	14	Assignment similar to port 1 (Ch 0)							
	0x80… 0x79	15								
	IO-Link port 7 (Ch 12)									
	0x88… 0x81	16	Assignment similar to port 1 (Ch 0)							
	0x90… 0x89	17								
	IO-Link port 8 (Ch 14)									
	0x98… 0x91	18	Assignment similar to port 1 (Ch 0)							
	0xA0… 0x99	19								

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Inputs IO-Link Events										
0x60A0	0x01	0	Qualifier (1st Event)							
	0x02	1	Port (1st Event)							
	0x03	2	Event code LSB (1st Event)							
		3	Event code MSB (1st Event)							
	…	…								
	0x2E	60	Qualifier (16th Event)							
	0x2F	61	Port 16th Event)							
	0x30	62	Event code LSB (16th Event)							
		63	Event code MSB (16th Event)							
Inputs Device Status/Control										
0x60C0	0x08… 0x01	0	-	-	-	-	-	-	ARGEE	-
	0x10… 0x09	1	-	FCE	-	-	-	-	-	-
	0x18… 0x11	2	V2	-	-	-	-	-	-	DIAG
	0x20… 0x19	3	-	-	-	-	-	-	V1	-

Meaning of the process data bits

CoE index	CoE sub index	Name	Value	Meaning
I/O data				
0x6000	**DI input IOL – DI Ch… (SIO)**			
	0x01	DI Ch0 (SIO)	Digital input	
			0	No signal at DI (pin 4, SIO)
			1	Signal at DI (pin 4, SIO)
	0x03	DI Ch2 (SIO)	See DI0 (SIO)	
	0x05	DI Ch4 (SIO)		
	0x07	DI Ch6 (SIO)		
	0x09	DI Ch8 (SIO)		
	0x0B	DI Ch10 (SIO)		
	0x0D	DI Ch12 (SIO)		
	0x0F	DI Ch14 (SIO)		
	DXP input value – DXP Ch…			
	0x02	DXP Ch1	Configurable digital channel (DXP channel)	
			0	No input signal at DXP channel (pin 2)
			1	Input signal at DXP channel (pin 2)
	0x04	DXP Ch3	See DXP1	
	0x06	DXP Ch5		
	0x08	DXP Ch7		
	Input values valid (DVS Ch…)			
	0x11	DVS Ch0	Input value valid (Data Valid Signal)	
			0	The IO-Link data are invalid. Possible causes: ■ Sensor supply is below the admissible range. ■ The IO-Link port is parameterized as simple digital input. ■ No device connected to the master. ■ No input data received from the connected device (only valid for devices with an input data length > 0). ■ No reaction from the connected device to the sending of output data (only valid for devices with an output data length > 0). ■ The connected device sends an **process input data invalid** error.
			1	The IO-Link data are valid.
	0x13	DVS Ch2	See DVS Ch0	
	0x15	DVS Ch4		
	0x17	DVS Ch6		
	0x19	DVS Ch8		
	0x1B	DVS Ch10		
	0x1D	DVS Ch12		
	0x1F	DVS Ch14		

CoE index	CoE sub index	Name	Value	Meaning
0x6010… 0x6080		**Inputs IO-Link port**		Process input data of the connected device The order of the IO-Link process input data can be changed via the parameter **Input data mapping**.
0x6090		**Inputs Diagnostics**		[▶ 99]
0x60A0		**Inputs IO-Link Events**		
0x60C0		**Inputs Device Status/ Control**		[▶ 96]

9.2 Output area, RxPDOs, 0x7000…0x7FFF

CoE index	CoE sub index	Byte no.	Bit no.							
			7	6	5	4	3	2	1	0
Outputs Basic										
0x7000	0x08… 0x01	0	DXP Ch7	DD Ch6	DXP Ch5	DD Ch4	DXP Ch3	DD Ch2	DXP Ch1	DD Ch0
	0x10… 0x09	1	-	DD Ch14	-	DD Ch12	-	DD Ch10	-	DD Ch8
Outputs IO-Link port										
0x7010	0x01… 0x20	0…31	IO-Link port 1, structure depends on the channel parameterization (0…32 byte per channel)							
0x7020	0x01… 0x20	0…31	IO-Link port 2, structure depends on the channel parameterization (0…32 byte per channel)							
0x7030	0x01… 0x20	0…31	IO-Link port 3, structure depends on the channel parameterization (0…32 byte per channel)							
0x7040	0x01… 0x20	0…31	IO-Link port 4, structure depends on the channel parameterization (0…32 byte per channel)							
0x7050	0x01… 0x20	0…31	IO-Link port 5, structure depends on the channel parameterization (0…32 byte per channel)							
0x7060	0x01… 0x20	0…31	IO-Link port 6, structure depends on the channel parameterization (0…32 byte per channel)							
0x7070	0x01… 0x20	0…31	IO-Link port 7, structure depends on the channel parameterization (0…32 byte per channel)							
0x7080	0x01… 0x20	0…31	IO-Link port 8, structure depends on the channel parameterization (0…32 byte per channel)							
Outputs VAUX control – VAUX1/VAUX2										
0x70B0	0x08… 0x01	0	VAUX1 pin1 X7 (Ch14)	VAUX1 pin1 X6 (Ch12)	VAUX1 pin1 X5 (Ch10)	VAUX1 pin1 X4 (Ch8)	VAUX1 pin1 X3 (Ch6/7)	VAUX1 pin1 X2 (Ch4/5)	VAUX1 pin1 X1 (Ch2/3)	VAUX1 pin1 X0 (Ch0/1)
	0x10… 0x09	1	VAUX2 pin2 X7 (Ch15)	VAUX2 pin2 X6 (Ch13)	VAUX2 pin2 X5 (Ch11)	VAUX2 pin2 X4 (Ch9)	-	-	-	-
Outputs Device Status/Control										
0x70C0	0x08… 0x01	0	-	-	-	-	-	-	-	WINK
	0x10… 0x09	1	-	-	-	-	-	-	-	-

Meaning of the process data bits

CoE index	CoE sub index	Name	Value	Meaning
Outputs Basic				
	DXP Ch…			
0x7000	0x01	DXP Ch1	**DXP Output value**	
			0	Output inactive
			1	Output active, max. output current 2 A
	0x03	DXP Ch3	See DXP1	
	0x05	DXP Ch5		
	0x07	DXP Ch7		
	DD Ch…		**Deactivate diagnostics**	
	0x02	DD Ch0	0	Diagnostic messages are sent depending on the setting of parameter "Deactivate diagnostics" [▶ 82].
			1	All diagnostic and alarm messages are suppressed. Possible use case: Selective deactivation and activation of the diagnostic messages via the process data in the PLC program. In the case of tool change applications, no diagnostics are sent that would otherwise lead to system downtimes.
	0x04	DD Ch2	See DD Ch0	
	0x06	DD Ch4		
	0x08	DD Ch6		
	0x09	DD Ch8		
	0x0B	DD Ch10		
	0x0D	DD Ch12		
	0x0F	DD Ch14		
Outputs VAUX Control				
	VAUX1 pin1			
0x70B0	0x01	VAUX1 pin1 X0 (Ch0/1)	0	The 24 VDC sensor/actuator supply at pin1 of the connector is switched off.
			1	The 24 VDC sensor/actuator supply at pin 1 of the connector is switched on.
	0x02	VAUX1 pin1 X1 (Ch2/3)	See VAUX1 pin1 X0 (Ch0/1)	
	0x03	VAUX1 pin1 X2 (Ch4/5)		
	0x04	VAUX1 pin1 X3 (Ch6/7)		
	0x05	VAUX1 pin1 X4 (Ch8)		
	0x06	VAUX1 pin1 X5 (Ch10)		
	0x07	VAUX1 pin1 X6 (Ch12)		
	0x08	VAUX1 pin1 X7 (Ch14)		

CoE index	CoE sub index	Name	Value	Meaning
	VAUX2 pin2 – Class-B supply			
0x70B0	0x0D	VAUX2 pin2 X4 (Ch9)	0	The Class B supply at pin2 of the connector is switched off.
			0x0F	The Class B supply at pin2 of the connector is switched on.
	0x0E	VAUX2 pin2 X5 (Ch11)	See VAUX2 pin2 X4 (Ch9)	
	0x0F	VAUX2 pin2 X6 (Ch13)		
	0x10	VAUX2 pin2 X7 (Ch15)		
	Outputs Device Status/ Control			
0x70C0	0x01	WINK	Activate the WINK command	

9.3 LED displays

The device has the following LED displays:

- Supply voltage (PWR)
- Status messages (STAT), according to EtherCAT specification
- Device specific messages (INFO)
- Localization (WINK)

PWR LED	Meaning
Off	No voltage or undervoltage at V1
Green	Voltage at V1 and V2 ok
Green flashing	No voltage or undervoltage at V2 (depending on configuration of the "LED behavior (PWR) on V2 undervoltage" parameter)
Red	

LED STAT	Meaning
Green off	Status Init
Green flashing	Status Pre Operational
Green flashing 1 ×	Status Safe Operational
Green	Status Operational
Green flickering	Status Bootstrap
Red off	No error
Red flashing 1 ×	Local error, Synchronization error, device changes from status Operational to status Pre Operational
Red flashing 2 ×	Time out watchdog process data or time out watchdog EtherCAT
Red flashing	Invalid configuration

LED INFO	Meaning
Off	No voltage connected
Red	Diagnostic message available
Green	No diagnostics
Orange	Firmware update running (see "Maintenance")

LED WINK	Meaning
White flashing	Wink command active

The Ethernet ports XF1 AND XF2 each have an LED L/A.

LED L/A	Meaning
Off	No EtherCAT connection
Green	EtherCAT connection established
Green flashing	Data transfer

LED IOL 0, 2, 4, 6, 8, 10, 12, 14 (IO-Link port 1…8)	Meaning (Channel in IO-Link-mode)
Off	Port inactive, no IO-Link communication, diagnostics deactivated
Green flashing	IO-Link communication, process data valid
Red flashing	IO-Link communication active and module error, invalid process data
Red	IO-Link supply error free, no IO-Link communication and/ or module error, process data invalid

LED IOL 0, 2, 4, 6, 8, 10, 12, 14 (IO-Link port 1…8)	Meaning (channel in SIO mode (DI))
Off	No input signal
Green	Digital input signal active

LED IOL 9, 11, 13, 15 (IO-Link Class B ports 5…8)	Meaning
Off	VAUX2 at Pin 2 inactive
Green	VAUX2 at Pin 2 active
Red	VAUX2 at Pin 2 active, overload/short-circuit at VAUX2
Red flashing	Overcurrent supply VAUX1

LED DXP 1, 3, 5, 7	Meaning (input)	Meaning (output)
Off	Input not active	Output not active
Green	Input active	Output active (max. 2 A)
Red	–	Output active with overload/short circuit
Red flashing	Overcurrent supply VAUX1	

9.4 Device area – Device Status (0xF100, 0xF108)

IO-Link Device Status (0xF100)

0xF100 is mapped into the device process data.

CoE index	CoE sub index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF100	0x02	0	Error code IOL1				IO-Link status IOL1			
	0x03	1	Error code IOL2				IO-Link status IOL2			
	…	…								
	0x09	7	Error code IOL8				IO-Link status IOL8			

Error codes (according to ETG 5001.6220)

Error codes	Meaning	Description
0	No Error	
1	Watchdog Error	Not supported
2	Buffer Overflow	Not supported
3	Invalid Device ID	The device ID of the connected IO-Link device does not match the one expected by the master. The check is only done for an operating mode with validation [▶ 75].
4	Invalid Vendor ID	The vendor ID of the connected IO-Link device does not match the one expected by the master. The check is only done for an operating mode with validation [▶ 75].
5	Invalid IO-Link Revision	The IO-Link revision of the connected device does not match the parameterization of the IO-Link port.
6	Invalid Frame Capability	Not supported
7	Invalid Cycle Time	Invalid cycle time The cycle time set on the master is not supported by the connected IO-Link device or is too high.
8	Invalid Length process data In	Not supported
9	Invalid Length process data Out	Not supported
10	No device detected	No IO-Link Device connected
11	Error Pre-Op	Not supported

IO-Link status codes (acc. to ETG 5001.6220)

Status	Meaning	Description
0	Port Inactive	Port unused, no module plugged in the configuration software
1	SIO mode Digital In	Port configured as DI and in SIO mode
2	SIO mode Digital Out	Not supported
3	Communication OP	Port configured as IO-Link port, IO-Link device connected, IO-Link communication running
4	Communication STOP	Port configured as IO-Link port, IO-Link device connected, no IO-Link communication The cause is specified more precisely via the error code.

Device Status (0xF108)

Device Status can be accessed via the process data if the module „Device Status/Control" is plugged.

CoE index	CoE sub index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF108	0x08…0x01	0	-	-	-	-	-	-	ARGEE	-
	0x10…0x09	1	-	FCE	-	-	-	-	-	-
0xF110	0x08…0x01	0	V2	-	-	-	-	-	-	DIAG
	0x10…0x09	1	-	-	-	-	-	-	V1	-

Meaning of the Device Status bits

CoE index	CoE sub index	Designation	Meaning
0xF108	0x02	ARGEE	ARGEE project active (currently not supported)
	0x0F	FCE	Force Mode active
0xF110	0x01	DIAG	Module diagnostics available
	0x08	V2	Undervoltage at supply voltage V2 (undervoltage detection at 20.4…19.2 VDC)
	0x0A	V1	Undervoltage at supply voltage V1 (undervoltage detection at 20.4…19.2 VDC), DXP channels turn off

9.5 Diagnosis data, 0xA000…0xAFFF

The device provides the following software diagnostic messages:

- V1/V2 overcurrent diagnostics
  Overcurrent diagnostics for the sensor-/ actuator supply VAUX1 and the Class B supply VAUX2
- IO-Link master diagnostics
  The IO-Link-master reports problems within the IO-Link communication.
- IO-Link device diagnostics
  The device diagnostics map the IO-Link Event Codes (according to the IO-Link specification) sent from the IO-Link devices to the diagnostic telegram of the master.
  Event Codes can be read from the connected devices by using appropriate device tools (e.g. IODD-Interpreter).
  Further information concerning the IO-Link Event Codes and their meaning can be found in the IO-Link specification or in the documentation of the connected devices.

9.5.1 Diagnostic telegram

CoE index	CoE sub index	Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Configuration Data Basic										
			V1/V2 overcurrent diagnostics							
0xA000	0x08…0x01	0	VERR V1 X7 Ch14	VERR V1 X6 Ch12	VERR V1 X5 Ch10	VERR V1 X4 Ch8	VERR V1 X3 Ch6/7	VERR V1 X2 Ch4/5	VERR V1 X1 Ch2/3	VERR V1 X0 Ch0/1
	0x10…0x09	1	VERR V2 X7 Ch15	VERR V2 X6 Ch13	VERR V2 X5 Ch11	VERR V2 X4 Ch9	-	-	-	-
			DXP diagnostics							
	0x18…0x11	2	ERR DXP Ch7	-	ERR DXP Ch5	-	ERR DXP Ch3	-	ERR DXP Ch1	-
	0x20…0x19	3	-	-	-	-	-	-	-	-
Diagnosis Data IO-Link port 1										
			Lost Frames							
0xA010	0x01	0	reserved							
	0x02	1	Lost frames IO-Link port 1							
			IO-Link device/master diagnostics							
0xA018			Device diagnostics				Master diagnostics			
	0x08…0x01	0	EVT2	EVT1	PD INV	HW ERR	DSERR	CFG ERR	PPE	-
	0x10…0x09	1	GEN ERR	OVL	V HIGH	V LOW	ULVE	LLVU	OTEMP	PRM ERR
Diagnosis Data IO-Link port 2										
0xA020	0x08…0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA028	0x10…0x09	1	Assignment similar to IO-Link port 1 (0xA018)							
Diagnosis Data IO-Link port 3										
0xA030	0x08…0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA038	0x10…0x09	1	Assignment similar to IO-Link port 1 (0xA018)							
Diagnosis Data IO-Link port 4										
0xA040	0x08…0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA048	0x10…0x09	1	Assignment similar to IO-Link port 1 (0xA018)							
Diagnosis Data IO-Link port 5										
0xA050	0x08…0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
A058	0x10…0x09	1	Assignment similar to IO-Link port 1 (0xA018)							

CoE index	CoE sub index	Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Diagnosis Data IO-Link port 6										
0xA060	0x08… 0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA068	0x10… 0x09	1	Assignment similar to IO-Link port 1 (0xA018)							
Diagnosis Data IO-Link port 7										
0xA070	0x08… 0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA078	0x10… 0x09	1	Assignment similar to IO-Link port 1 (0xA018)							
Diagnosis Data IO-Link port 8										
0xA080	0x08… 0x01	0	Assignment similar to IO-Link port 1 (0xA010)							
0xA088	0x10… 0x09	1	Assignment similar to IO-Link port 1 (0xA018)							

NOTE
A “process data invalid” diagnostic (PD_INV) can be sent from both devices, IO-Link master or IO-Link device.

Meaning of Diagnostic Bits

CoE index	CoE sub index	Bit	Meaning
Diagnosis Data Basic – V1/V2 overcurrent and DXP diagnostics			
0xA000	0x01	VERR V1 X0 (Ch0/1)	Overcurrent VAUX1 (pin1) at connector/channel group
	0x02	VERR V1 X1 (Ch2/3)	
	0x03	VERR V1 X2 (Ch4/5)	
	0x04	VERR V1 X3 (Ch6/7)	
	0x05	VERR V1 X4 (Ch8)	Overcurrent VAUX1 (pin 1) at connector/channel
	0x06	VERR V1 X5 (Ch10)	
	0x07	VERR V1 X6 (Ch12)	
	0x08	VERR V1 X7 (Ch14)	
	0x0D	VERR V2 X4 (Ch9)	Overcurrent VAUX2 (pin 2) at connector/channel
	0x0E	VERR V2 X5 (Ch11)	
	0c0F	VERR V2 X6 (Ch13)	
	0x10	VERR V2 X7 (Ch15)	
	0x12	ERR_ DXP Ch1	Overcurrent at output (DXP channel used as output)
	0x14	ERR_ DXP Ch3	
	0x16	ERR_ DXP Ch5	
	0x18	ERR_ DXP Ch7	
Diagnosis Data IO-Link port – Lost Frames			
0xA010… 0xA080	0x02	Lost frames IO-Link port x	Counter for lost or faulty IO-Link frames
Diagnosis Data IO-Link Port – IO-Link port diagnostics			
0xA028… 0xA088	0x02	PPE	Port parameterization The port parameters are inconsistent. Possible causes: ■ The IO-Link-master did not receive parameters for a connected device. ■ Vendor or Device ID are "0". The connected device can not be identified and is thus not parameterizable.

CoE index	CoE sub index	Bit	Meaning	
	0x03	CFGER	Wrong or missing device The connected device does not match the channel configuration or there is no device connected to the channel. This diagnostic message depends on the parameterization of the channel.	
	0x04	DSER	Data storage error Possible causes: ■ Data storage mismatch: IO-Link device in accordance with IO-Link V1.0 connected. The data storage buffer contains data of another device. ■ Overflow of the data storage buffer ■ Parameter access for data storage not possible The connected device may be locked for parameter changes or for data storage.	
	0x05	HWER	Hardware error General hardware error or device malfunction.	
	0x06	PDINV	Process input data invalid The IO-Link master or the IO-Link device report invalid process input data. The connected device is not in status "operate", which means, it is not ready for operation. Possible cause: ■ The connected device does not match the configured one, additional diagnostic message **Wrong or missing device**. ■ Diagnostic message **Process input data invalid** because the process value can not be measured (depends on the IO-Link device).	
	0x07	EVT1	Maintenance events A Maintenance Event in accordance with the IO-Link specification occurred, maintenance necessary. Causes: ■ The master has received an event of type "Notification" from the device. or ■ The master has read the value 1 from the device status (index 36) of the connected IO-Link device.	**Note:** The IO-Link master reads index 36 every 20 s. Prerequisite: the connected device supports index 36. An event of type "Notification" (single shot) is present for 60 s in the diagnostic data (EVT1) of the master. The reception of the diagnostic messages can be filtered via the "Disable diagnostics" parameter. The slot "IO-Link Events" in the process data (CoE index 0x60A0 [▶ 86]) shows the Event Code. The meaning of the event code depends on the IO-Link device.
	0x08	EVT2	Out-of-specification events An Out-of-Specification Event in accordance with the IO-Link specification occurred. Causes: ■ The master has received an event of type "Warning" from the device. or ■ The master has read the value 2 from the device status (index 36) of the connected IO-Link device.	
	0x09	PRMERR	Parameterization error The connected device reports a parameterization error (loss of parameters, no parameter initialization, etc.).	
	0x0A	OTMP	Over temperature A temperature diagnosis is available on the connected device.	

CoE index	CoE sub index	Bit	Meaning
	0x0B	LLVU	Lower limit value underrun The process value has fallen below the parameterized measurement range or the measurement range has been chosen too high.
	0x0C	ULVE	Upper limit value exceeded The process value exceeds the parameterized measurement range or the measurement range has been chosen too low.
	0x0D	VLOW	Undervoltage One of the voltages at the connected device is below the defined range.
	0x0E	VHIGH	Overvoltage One of the voltages at the connected device exceeds the defined range.
	0x0F	OVL	Overload The connected device detected an overload.
	0x10	GENERR	Common error The device sends an error (device status 4, in accordance with IO-Link specification), which is not clearly specified. Read out the device event codes in order to be able to specify the error more precisely.

9.6 Diag History Object (0x10F3)

The Diag History Object (0x10F3) is implemented according to ETG.1020. The maximum number of diagnostic messages is 50.

The default values are written in **bold**.

Sub index	Name	Data type	Access	PDO mapping	Description
0x01	Maximum messages	UNSIGNED8	R	No	Read Number of diagnostic messages that can be stored in the diagnostic history (see from sub index 6).
0x02	Newest message	UNSIGNED8	RO	No	Sub index of the latest diagnostic message (6…255), standard value = 0
0x03	Newest acknowledged message	UNSIGNED8	RW	No	**Overwrite Mode** (sub index 5, bit 4 = 0) ■ **Read = 0:** The slave sets sub index 3 to 0 when messages in the message queue are overwritten. ■ Writing = 0: (support optional) Slave deletes all messages, i.e. resets sub index 2, 3, 4 and bit 5 in sub index 5. ■ Writing = 1…5: Slave returns an SDO abort with codes 0x06090030 (value range of parameter exceeded) or 0x06090032 (value of written parameter too low). ■ Writing = 6…55] sub index 3 = written value without check ■ Writing > 55…255: SDO abort with codes 0x06090030 or 0x06090031 (value of written parameter too high) **Acknowledge Mode** (sub index 5, bit 4 =1) ■ **Read = 0:** No messages acknowledged ■ Read <> 0: Sub index of the latest acknowledged diagnostic message (6…255) ■ Writing = 0: (support optional) All acknowledged messages are deleted ■ Writing = 1…5: Slave returns an SDO abort with codes 0x06090030 (value range of parameter exceeded) or 0x06090032 (value of written parameter too low) ■ Writing = 6…55: Messages are acknowledged ■ Writing > 55…255: SDO abort with codes 0x06090030 or 0x06090031 (value of written parameter too high)

Sub index	Name	Data type	Access	PDO mapping	Description
0x04	New messages available	BOOLEAN	RO	TxPDO	**Overwrite Mode** ■ 0: latest message was read ■ 1: latest message was not read **Acknowledge Mode** ■ 0: no unacknowledged message ■ 1: diagnostic messages are present and can be acknowledged
0x05	Flags	UNSIGNED16	RW	No	Flag for **controlling the sending and saving** of diagnostic messages. ■ Bit 0: Enable sending of emergencies, see "Sending emergencies". – 0: disabled – 1: New diagnostic messages are sent as emergencies ■ Bit 1: Disable info messages – 0: Info messages are stored in the diagnostic buffer. – 1: Info messages are not stored in the diagnostic buffer. ■ Bit 2: Deactivate warning messages – 0: Warning messages are stored in the diagnostic buffer. – 1: Warning messages are not stored in the diagnostic buffer. ■ Bit 3: Deactivate error messages – 0: Error messages are stored in the diagnostic buffer (default setting) – 1: Error messages are not stored in the diagnostic buffer. ■ Bit 4: Mode for handling the diagnostic history – 0: Overwrite mode: old messages are overwritten by new ones when the buffer is full. – 1: Acknowledge mode: new messages overwrite only messages that were previously acknowledged. ■ Bit 5: Overwrite/discard information – in Overwrite mode: unacknowledged messages have been overwritten (=buffer overflow) (sub index 3 is also set to 0) – 1: in Acknowledge mode: Message buffer full of unacknowledged messages, a new message is discarded.
0x06	Diagnosis message	OCTET-STRING	RO	No	**Diagnosis message buffer** Depending on sub index 1 the EtherCAT slave can store up to 50 diagnosis messages; the first message is stored in sub index 6, the second in sub index 7 and so on. When the buffer is full, the EtherCAT slave overwrites sub index 6 and so on. Thus always the latest maximum messages (in subindex 1) are made accessible for the EtherCAT master.

Diagnostic message (beginning with sub index 6)

Parameters	Data type	Description		
Diag Code	UNSIGNED32	Diagnosis code to identify the diagnosis message		
		Bit 0…15	0x0000…0xDFFF	Reserved
			0xE000…0xE7FF	Bit 16…31: can be used manufacturer specific
			0xE800	Bit 16…31: Emergency Error Code as defined in DS301 or DS4xxx
			0xE801…0xEDFF	Reserved
			0xEE00…0xEFFF	Bit 16…31: profile specific
			0xF000…0xFFFF	Reserved
Flags	UNSIGNED16	Bit 0…3		Diag type: 00 = no message 01 = warning message 10 = error message
Text ID	UNSIGNED16	Text ID as reference to Diagnosis text as defined in the ESI file		
		0		No text ID
		1…65535		Text ID, vendor specific text ID [▶ 108]
Time Stamp	UNSIGNED64	Time stamp in ms		
		0		No time stamp
		≠ 0		Time stamp

Text IDs

Text ID	Meaning
0x10…0x21	State change request from x to y
0x11	Sync Manager x invalid address (y)
0x12	Sync Manager x invalid Size (y)
0x13	Sync Manager x invalid settings (y)
0x0F	Calculate bus cycle time failed (Local timer too slow)
0x20	DC activation register is invalid
0x21	Configured SyncType (0x1C32.1 or 0x1C33.1) not supported. Check DC registers and supported SyncTypes (0x1C32.4 and 0x1C33.4)
Vendor specific text IDs Meaning of the text Ids, see Diagnosis Data, 0xA000…0xAFFF [▶ 99]. Bit 15 = 0: Appear, example: 0x**0**101 Bit 15 = 8: Diappear, example: 0x**8**101	
0x…101	Overcurrent output Chx
0x…102	Undervoltage
0x…103	Overvoltage
0x…104	Overload
0x…105	Overtemperature Chx
0x…106	Wrong or missing device Chx
0x…107	Upper limit value exceeded Chx
0x…108	Lower limit value underrun Chx
0x…109	Common error Chx
0x…110	Parameterization error Chx
0x…115	Hardware error Chx
0x…2D0	Overcurrent VAUX1 pin1 X0 (Ch0/1)
0x…2D1	Overcurrent VAUX1 pin1 X1 (Ch2/3)
0x…2D2	Overcurrent VAUX1 pin1 X2 (Ch4/5)
0x…2D3	Overcurrent VAUX1 pin1 X3 (Ch6/7)
0x…2E8	Overcurrent VAUX1 pin1 X4 (Ch8)
0x…2EA	Overcurrent VAUX1 pin1 X5 (Ch10)
0x…2EC	Overcurrent VAUX1 pin1 X6 (Ch12)
0x…2EE	Overcurrent VAUX1 pin1 X7 (Ch14)
0x…2F9	Overcurrent VAUX2 pin2 X4 (Ch9)
0x…2FB	Overcurrent VAUX2 pin2 X5 (Ch11)
0x…2FD	Overcurrent VAUX2 pin2 X6 (Ch13)
0x…2FF	Overcurrent VAUX2 pin2 X7 (Ch15)
0x…760	Port parameterization error
0x…761	Data storage error
0x…762	Process input data invalid
0x…763	Maintenance events
0x…764	Out of spec. error

9.7 CANopen Emergencies

CAN Header	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x080+ Node ID	Error code		Error register	Vendor specific data				
				Channel number		Text ID, see [▶ 108]		

Error code	Error register	
0x3100 (Mains voltage)	0x04 (voltage)	V1 undervoltage
0x3300 (Output voltage)		V2 undervoltage
0xFF00 (Vendor specific)	0x81 (generic, vendor specific)	Force Mode active
		Module diagnostics available
		ARGEE project active (currently not supported)
		I/O Diagnostic message available

9.8 IO-Link port – Information Area, 0x9000…0x9FF

The object area contains all data of the connected IO-Link devices. The contents of the sub indices correspond to those of the parameter objects of the IO-Link channels (0x8010...0x8090), see Parameters [▶ 75]

CoE index	CoE sub index	Byte no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Information Data IO-Link port – Port 1										
0x9010	0x04	4	0	Device ID LSB						
		…	…	…						
		7	3	Device ID MSB						
	0x05	8	4	Vendor ID LSB						
		…	…	…						
		11	7	Vendor ID MSB						
	0x20	12	8	IO-Link Revision						
	0x21	13	9	Reserved						
	0x22	14	10	Cycle time						
	0x23	15	11	Reserved						
	0x24	16	12	Process Data In Length						
	0x25	17	13	Process Data Out Length						
	0x28… 0x27	18… 23	14… 19	Reserved						
Information Data IO-Link port – Port 2										
0x9020	0x04… 0x28	40… 58	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 3										
0x9030	0x04… 0x28	75… 93	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 4										
0x9040	0x04… 0x28	110 … 128	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 5										
0x9050	0x04… 0x28	145 … 163	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 6										
0x9060	0x04… 0x28	180 … 198	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 7										
0x9070	0x04… 0x28	215 … 233	0… 19	Assignment similar to IO-Link port 1 (0x9010)						
Information Data IO-Link port – Port 8										
0x9090	0x04… 0x28	250 … 268	0… 19	Assignment similar to IO-Link port 1 (0x9010)						

9.9 Acyclic access to connected IO-Link devices via CoE

Access via CoE is done via object dictionary indices in the manufacturer specific area (0x40n0). A complete access to index 0x40n0 enables an IO-Link CALL via a single SDO transfer.

The index contains the following elements:

Index	Name	Data type	Access	Alignment (byte offset)	Comment
0x40n0:00	Number of Entries	USINT8	RO	0	Full access for the complete index
0x40n0:01	Control	USINT	RW	2	Initiates the IOL call after the element is written. ■ 2: Write operation ■ 3: Read operation
0x40n0:02	Status	USINT	RW	3	Contains the status of the IO-Link call: ■ 0: OK/ operation completed ■ 1: Busy ■ 2: Error
0x40n0:03	Index	UINT	RW	4	Index of the device entry from the IO-Link device at the IO-Link port
0x40n0:04	Sub index	USINT	RW	6	Sub index of the device entry from the IO-Link device at the IO-Link port
0x40n0:05	Data length	USINT	RW	7	Data length to be read or written in bytes Read operation: The actual length of the data according to the ISDU index of the connected IO-Link device is returned. The exact length of the data can be taken from the device documentation.
0x40n0:06	Data	ARRAY [0..231] OF BYTE	RW	8	Data buffer for data to be read or written
0x40n0:07	Error code	UDINT	RW	240	Error code according to IO-Link specification, see „IOL_Status" [▶ 114]

Example access, read operation – read product name (IO-Link device at IO-Link port 2)

Reading out the product name (product name, index 0x12) of the TURCK IO-Link I/O-hub TBIL-M1-16DXP at IO-Link port 2.

Index	Name	Value	Meaning
0x4020:01	Control	0x03	Read operation
0x4020:03	Index	0x12	Index for product name acc. to the documentation of the connected IO-Link device
0x4020:05	Data length	0x0D	Data length of the data to be read here: 13 bytes (length of the index "product name" of the connected TBIL-M1-16DXP.

- ▶ Enter the index for product name (**0x4020:2 = 0x12**) and length of the data to be read (**0x4020:3 = 0x0D**).
- ▶ Start the write operation with **0x4020:1 = 0x03.**

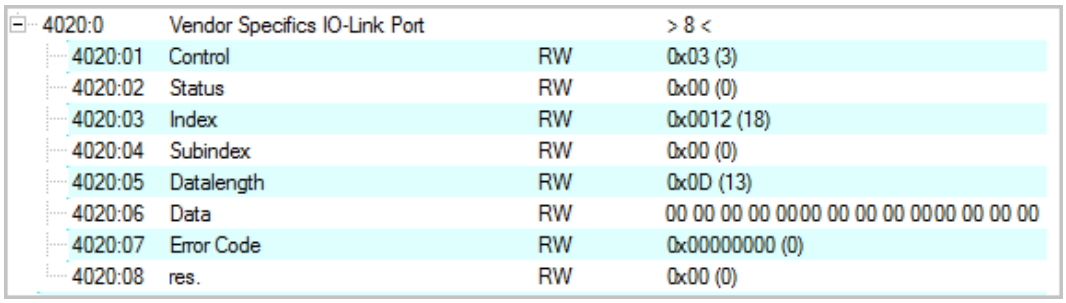


Fig. 77: TwinCAT – Reading out the product name

⇨ CoE index 0x4020:06 contains the product name of the IO-Link device at IO-Link port 2: 54 42 49 4c 2d 4d 31 2d 31 36 44 58 50 (TBIL-M1-16DXP)

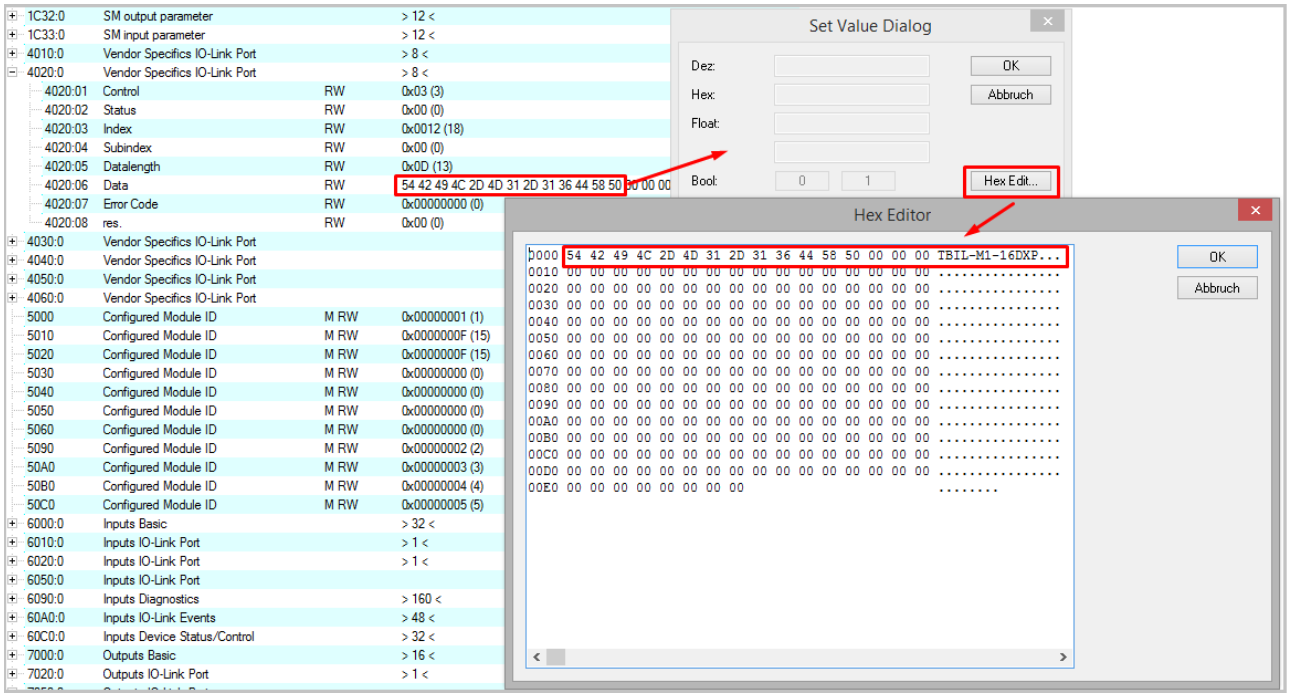


Fig. 78: TwinCAT – Product name in index 0x12

Example access write operation – writing the Application Specific Tag (IO-Link device at IO-Link port 1)

The Application Specific Tag (Index 0x18) of the IO Link-Device an IO-Link port 1 is written.

Index	Name	Value	Meaning
0x4050:01	Control	2	Write operation
0x4050:03	Index	18	Index for Application Specific Tag acc. to the documentation of the connected IO-Link device
0x4050:05	Data length	USINT	0x10
0x4050:06	Data	Status 1 = 53 74 61 74 75 73 20 31	Application Specific Tag

- ▶ Enter the index for the Application Specific Tag (**0x4050:03 = 0x18**), the data length (**0x4050:05 = 0x10**) and the data to be written (**0x4050:06 = 53 74 61 74 75 73 20 31**).
- ▶ Start the write operation with **0x4020:1 = 0x02.**

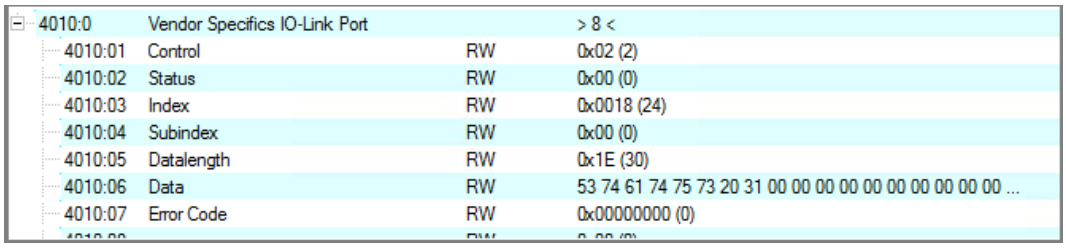


Fig. 79: TwinCAT – Writing the Application Specific Tag

- ▶ The written value can then be read out from register 0x18 for verification:

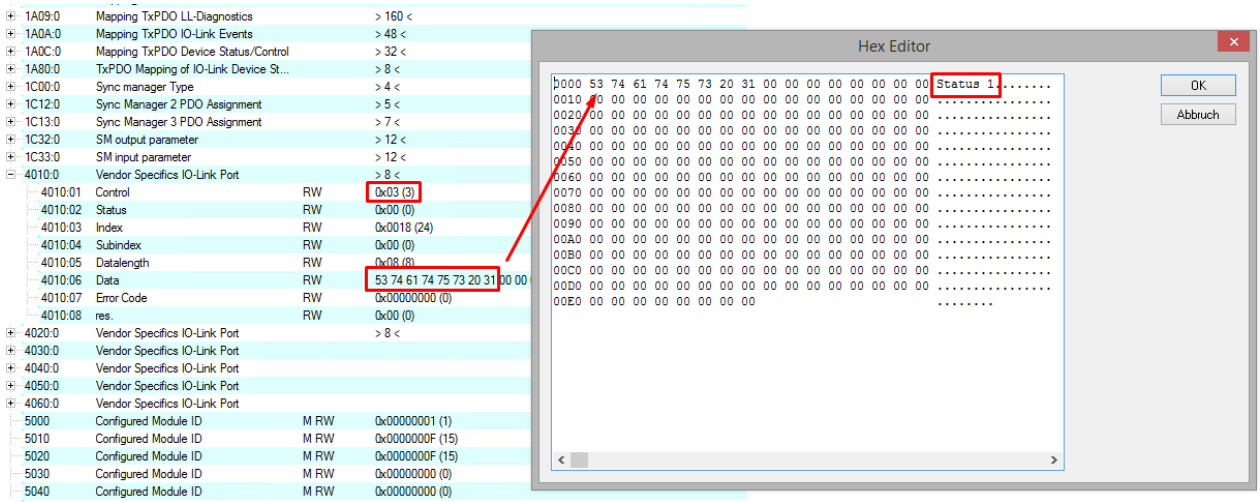


Fig. 80: TwinCAT – read the written Application Specific Tag

IOL_CALL – IOL_STATUS

The IOL_STATUS consists of 2 byte Error Code (IOL_M Error_Codes, according to "IO-Link Integration Part 1- Technical Specification for PROFIBUS and PROFINET") and 2 byte Error Type (according to "IO-Link Interface and System").

Byte 3	Byte 2	Byte 1	Byte 0
IOL_M-Error-Code		IOL-Error Type	

IOL_M-Error-Code	Designation acc. to IO-Link Spec.	Meaning
0x0000	No error	
0x7000	IOL_CALL Conflict	Unexpected write-request, read request expected
0x7001	Wrong IOL_CALL	Decoding error
0x7002	Port blocked	The accessed port is occupied by another task
…	Reserved	
0x8000	Timeout	Timeout, IOL master or IOL device port busy
0x8001	Wrong index	Error: IOL index < 32767 or > 65535 selected
0x8002	Wrong port address	Port address not available
0x8003	Wrong port function	Port function not available
…	Reserved	

IOL-Error-Type	Designation acc. to IO-Link Spec.	Meaning
0x1000	COM_ERR	Communication error Possible source: the addressed port is parameterized as digital input DI and is not in IO-Link mode
0x1100	I_SERVICE_TIMEOUT	Timeout in communication, device does not respond in time
0x5600	M_ISDU_CHECKSUM	Master reports checksum error, access to device not possible
0x5700	M_ISDU_ILLEGAL	Device can not respond to master request
0x8000	APP_DEV	Application error in the device
0x8011	IDX_NOTAVAIL	Index not available
0x8012	SUBIDX_NOTAVAIL	Sub-Index not available
0x8020	SERV_NOTAVAIL	The service is temporarily not available.
0x8021	SERV_NOTAVAIL_ LOCCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device via the master active)
0x8022	SERV_NOTAVAIL_ DEVCTRL	Service temporarily not available, device is busy (e. g. teaching or parameterization of the device via DTM/ PLC etc. active)
0x8023	IDX_NOT_WRITEABLE	Access denied, index cannot be written
0x8030	PAR_VALOUTOFRNG	Parameter value out of the valid range
0x8031	PAR_VALGTLIM	Parameter value value above the upper limit
0x8032	PAR_VALLTLIM	Parameter value value below the lower limit

IOL-Error-Type	Designation acc. to IO-Link Spec.	Meaning
0x8033	VAL_LENOVRRUN	Length of data to be written does not match the length defined for this parameter
0x8034	VAL_LENUNDRUN	
0x8035	FUNC_NOTAVAIL	Function not available in the device
0x8036	FUNC_UNAVAILTEMP	Function temporarily not available in the device
0x8040	PARA_SETINVALID	Invalid parameter: Parameters not consistent with other parameters in the device.
0x8041	PARA_SETINCONSIST	Inconsistent parameters
0x8082	APP_DEVNOTRDY	Application not ready, device busy
0x8100	UNSPECIFIC	Vendor specific, according to device documentation
0x8101… 0x8FFF	VENDOR_SPECIFIC	

9.10 Acyclic access via AoE

The device supports ADS via EtherCAT (AoE) according to ETG.5001.6220.

In TwinCAT the function blocks ADSREAD and ADSWRITE from Beckhoff Automation are supported.

MAIN* | Bibliotheksverwalter

```
PROGRAM MAIN
VAR

    ReadData : ADSREAD;

    ayArrayRead : ARRAY [0..31] OF BYTE;
    pBuffRead : pvoid := ADR(ayArrayRead) ;

    WriteData: ADSWRITE;

    ayArrayWrite : ARRAY [0..1] OF BYTE;
    pBuffWrite : pvoid := ADR(ayArrayWrite) ;

    Output AT %Q* :BOOL;
END_VAR
```

```
// Read
ReadData (NETID:= '5.68.192.252.2.5',
PORT:= 16#1001,
IDXGRP:= 16#F302,
IDXOFFS:= 16#00180000,
LEN:= 16#2,
DESTADDR := pbuffRead);

IF ReadData.BUSY = TRUE THEN
    ReadData.READ := FALSE;
END_IF

// Write
WriteData (NETID:= '5.68.192.252.2.5',
PORT:= 16#1001,
IDXGRP:= 16#F302,
IDXOFFS:= 16#00180000,
LEN:= 16#2,
SRCADDR := pbuffWrite);

IF WriteData.BUSY = TRUE THEN
    WriteData.Write := FALSE;
END_IF
```

Fig. 81: Example call – Function blocks ADSREAD and ADSWRITE

9.10.1 Function block ADSREAD

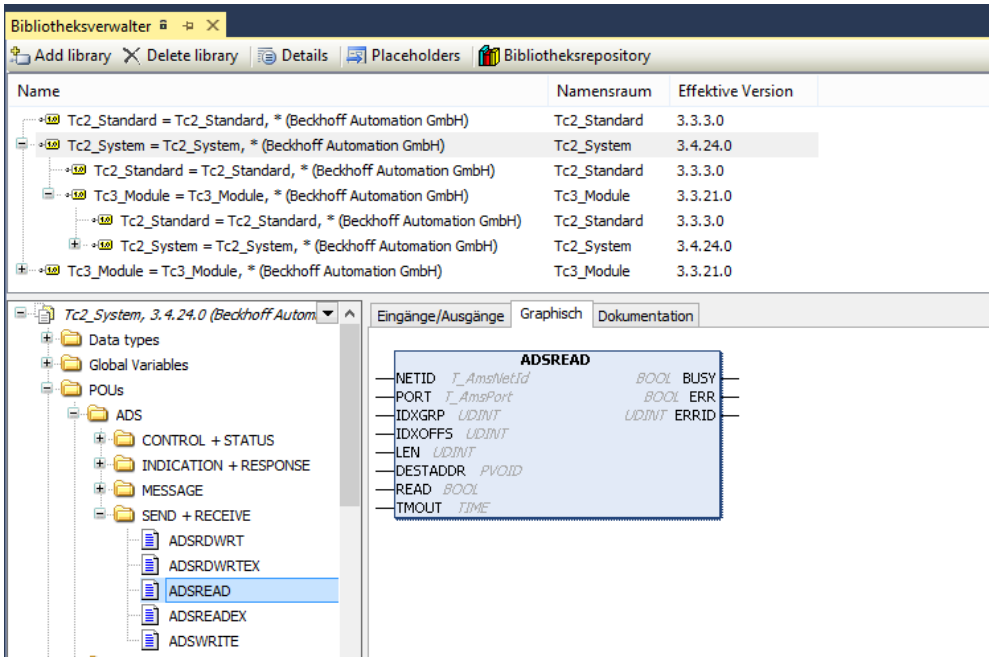


Fig. 82: TwinCAT – ADSREAD

Block variables – inputs

Variable	Meaning
NETID	Network identifier of the device, automatically assigned The network identifier can be read out at the device in TwinCAT e.g. in the **EtherCAT** tab under **Advanced Settings** → **Mailbox** → **AoE**.
PORT	Port number of the IO-Link port at which the IO-link device is connected: ■ IO-Link port 1 = 16#1001 ■ IO-Link port 2 = 16#1002 ■ …
IDXGRP	Fix value: 0xF302
IDXOFFS	32 bit value, structure acc. to ETG.5001.6220: 16 bit for the index, 8 ´bit = reserved, 8 bit for the sub index: Example: Index 18 ”product name”, sub index 0 = 16#0012 0000
LEN	Number of the data to be read in bytes
DESTADDR	Address of the buffer which is to receive the read data
READ	A rising edge triggers the send command.
TMOUT	Time before the function is canceled

Block variables – outputs

Variable	Meaning
BUSY	TRUE until the read command is executed
ERR	TRUE, if an error occurs during the execution of a command
ERRID	Error code, structure acc. to ETG.5001.6220: ■ Low word: ADS error code (0x0700) ■ High word: contains the IOL_STATUS of the IO-Link call acc. to IO-Link specification [▶ 114]

9.10.2 Function block ADSWRITE

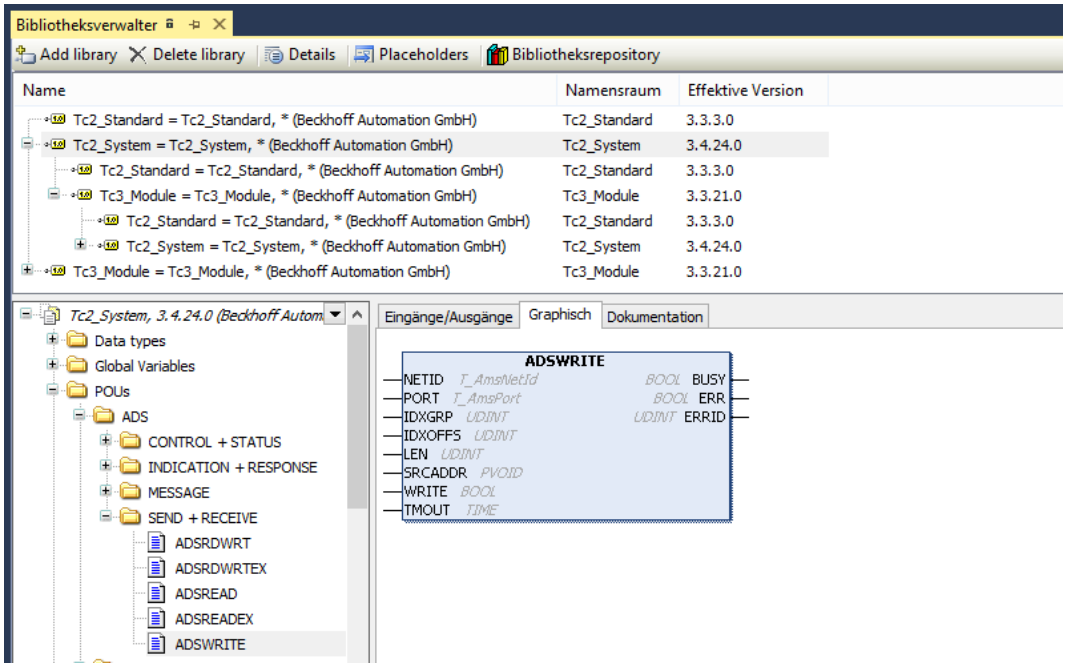


Fig. 83: TwinCAT – ADSWRITE

Block variables – inputs

Variable	Meaning
NETID	Network identifier of the device, automatically assigned The network identifier can be read out at the device in TwinCAT e.g. in the **EtherCAT** tab under **Advanced Settings** → **Mailbox** → **AoE**.
PORT	Port number of the IO-Link port at which the IO-link device is connected: ■ IO-Link port 1 = 16#1001 ■ IO-Link port 2 = 16#1002 ■ …
IDXGRP	Fix value: 0xF302
IDXOFFS	32 bit value, structure acc. to ETG.5001.6220: 16 bit for the index, 8 ´bit = reserved, 8 bit for the sub index: Example: Index 24 ” Application Specific Tag”, sub index 0 = 16#0018 0000
LEN	Number of the data to be written in bytes
SRCADDR	Address of teh buffer which contains the data to be written
WRITE	A rising edge triggers the write command.
TMOUT	Time before the function is canceled

Block variables – outputs

Variable	Meaning
BUSY	TRUE until the write command is executed
ERR	TRUE, if an error occurs during the execution of a command
ERRID	Error code, structure acc. to ETG.5001.6220: ■ Low word: ADS error code (0x0700) ■ High word: contains the IOL_STATUS of the IO-Link call acc. to IO-Link specification [▶ 114]

9.11 IO-Link – using the Data storage mode

Data storage mode

NOTE
Data storage mode is only available for devices complying with the IO-Link specification V1.1.

The Data storage mode is set and configured in the IO-Link master via parameter "Master Control" and "Data storage mode" [▶ 75].

Master Control: Object 0x80**n0** (n = 1…8 = IOL1…IOL8), sub index 0x28

Requirement: Data storage mode (DSM) = 0

- Bit 4…15 = 0 = deactivated, delete (no data storage)
- Bit 4…15 = 2 = activated (data storage active)
- Bit 4…15 = 6 = overwrite (data storage active, upload deactivated)

Data storage mode (DSM): Object 0x80**n8** (n = 1…8 = IOL1…IOL8), sub index 0x02

- 0= Use Master Control setting (see above)
- 1 = read in

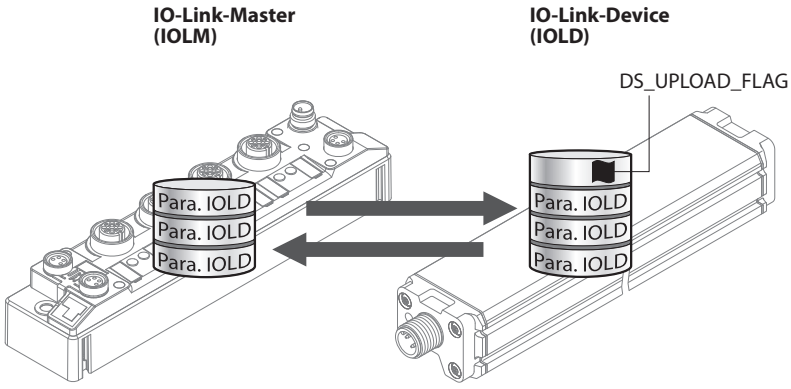


Fig. 84: Data storage mode – general principle, Para. IOLD = parameters of the IO-Link device

A change of parameters in the device is indicated by the status of the DS_UPLOAD_FLAG bit:

- 0 = no changes in the device's parameter set
- 1 = changes in the device's parameter set (e. g. via DTM, at the device, etc.)

9.11.1 Parameter "Data storage mode" = activated

The synchronization of the parameter sets is bidirectional.
The actual data set (master or device) is valid:
The following applies:

- The data set in the device is actual, if DS_UPLOAD_FLAG = 1.
- The data set in the master is actual, if DS_UPLOAD_FLAG = 0.

Use case 1: parameterizing the device using e.g. a DTM

✓ The IO-Link device is already installed in the system and connected to the master.
▶ Parameterizing the device via DTM.
⇨ DS_UPLOAD_FLAG = 1, parameter set in the device changed.
⇨ The parameter data are transferred from the new IO-Link device to the IO-Link master.

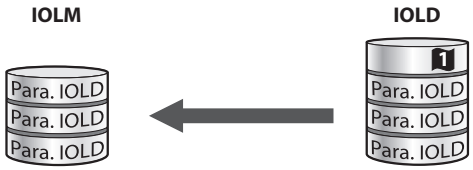


Fig. 85: Data storage mode activated – parameter set in the device changed

Use case 2: replace a defective device with a device in the delivery state.

✓ The **new** IO-Link device has **not** been connected to the master before.
▶ The parameters of the new device remain unchanged, DS_UPLOAD_FLAG = 0.
⇨ The parameter data of the defective device are transferred from the IO-Link master to the new IO-Link device.

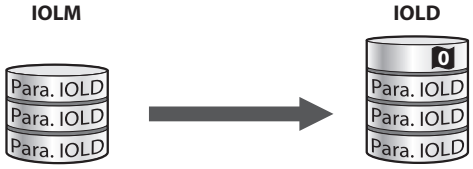


Fig. 86: Data storage mode activated – parameter set in the device unchanged

Use case 3: replace a defective device with a device with unknown (changed) parameters

✓ The **new** IO-Link device has **not** been connected to the master before.
▶ The parameters of the new device remain unchanged, DS_UPLOAD_FLAG = 1.
⇨ The parameter data are transferred from the new IO-Link device to the IO-Link master.

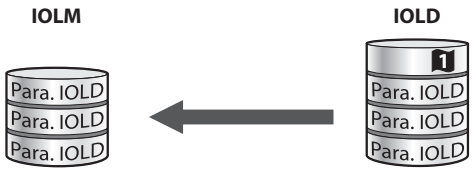


Fig. 87: Data storage mode activated – parameter set in the device changed

NOTE
If device replacement is necessary when data storage is activated, an IO-Link replacement device with unknown parameter data should be reset to its factory settings before connection to the IO-Link master.
Turck IO-Link devices can be reset to factory settings via a system command using a generic IO-Link-DTM and the device-specific IODD. For the reset of third party devices, please read the corresponding manufacturer documentation.

9.11.2 Parameter "Data storage mode" = read in

- The data set in the device is **always** the reference data set.
- The synchronization of the parameter sets is unidirectional towards to the master.
- The status of the DS_UPLOAD_FLAG is ignored.

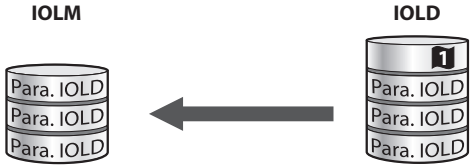


Fig. 88: Data storage mode = read in – parameter set in the device changed

9.11.3 Parameter "Data storage mode" = overwrite

- The data set in the master is **always** the reference data set.
- The synchronization of the parameter sets is unidirectional towards to the device.
- The status of the DS_UPLOAD_FLAG is ignored.

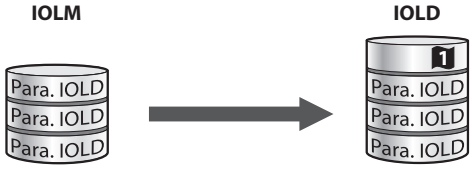


Fig. 89: Data storage mode = overwrite – parameter set in the master changed

9.11.4 Parameter "Data storage mode" = deactivated, clear

- The data set in the master is deleted.
- The synchronization of parameter sets is deactivated.

Fig. 90: Data storage mode deactivated – no synchronization

9.12 Reset device (Reset)

The device is provided with the following options to reset to the default settings:

- Reset button
- via the Turck Service Tool, if the EoE function is activated
- via FDT/DTM
- Via CoE index 0xFBF0 "Device Reset Command"

9.12.1 Resetting the device with Turck Service Tool

Requirement: The EoE function must be activated so that the device can be found in the Turck Service Tool.

NOTE
The device search is based on multicasts or broadcasts. Routers in the network must be configured in such a way that multicasts or broadcasts are passed through.

- ▶ Click **search** and browse network for devices.
- ▶ Mark the device that is to be reset.
- ▶ Execute a factory reset via **Actions (F4)**→ **Factory settings.**

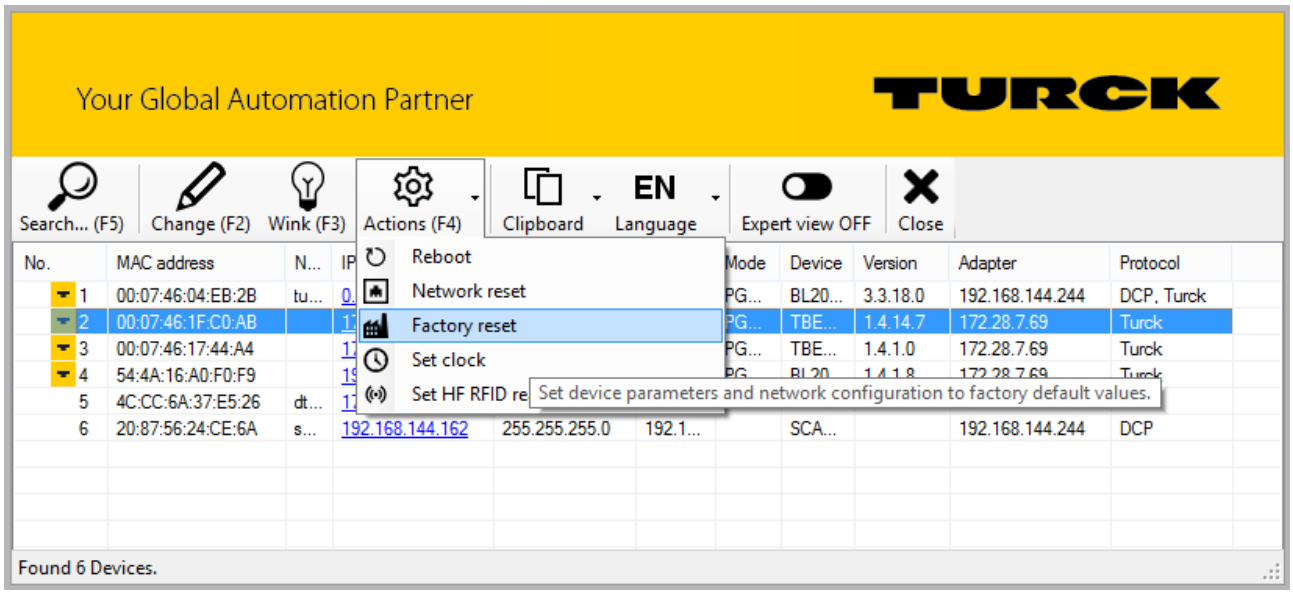


Fig. 91: Turck Service Tool – resetting the device to factory settings

⇨ The device is reset to factory settings.

9.12.2 Resetting the device via FDT/DTM

Requirement: The EoE function must be activated so that the device can be operated with the DTM.

- ▶ Select EC-LL-8IOL in the DTM project and reset the device under **Global → Factory settings**.

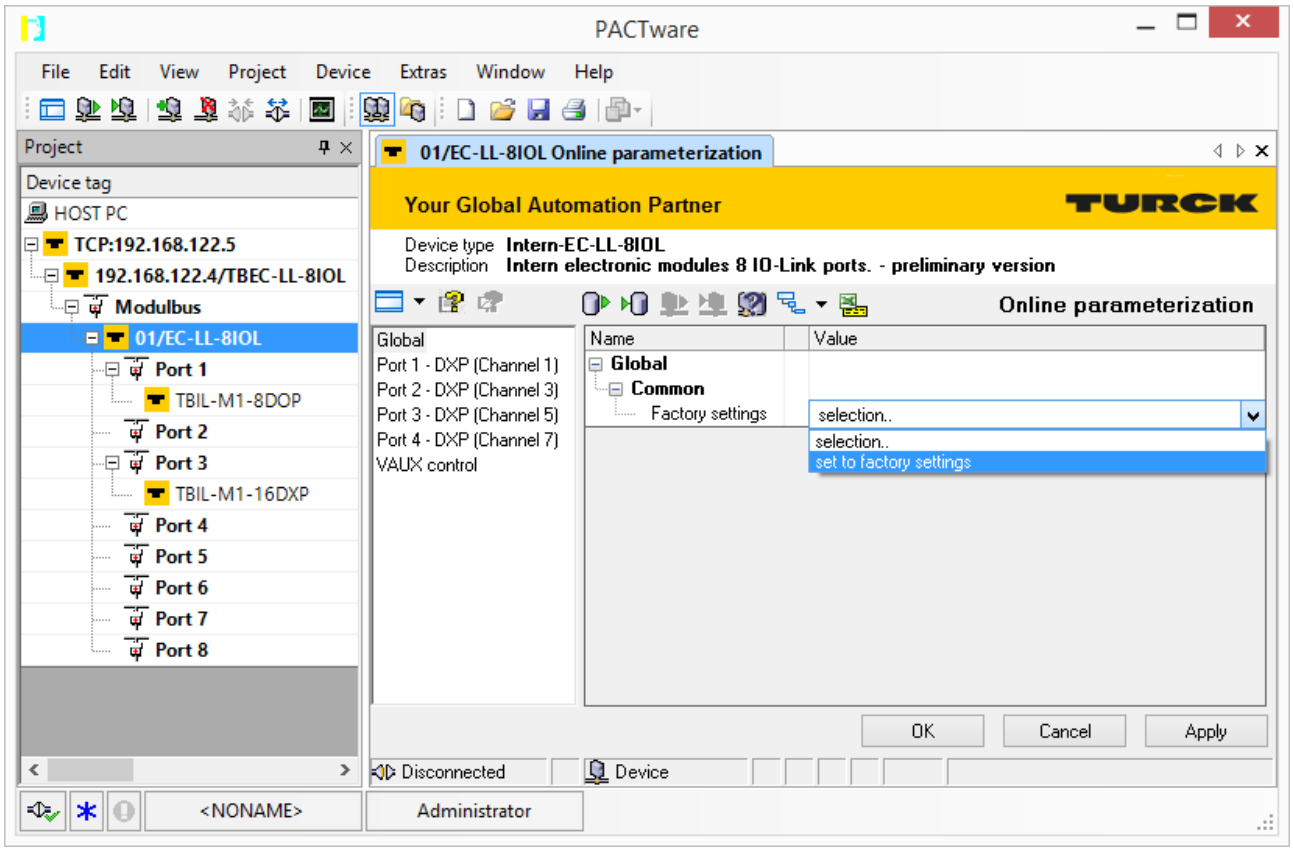


Fig. 92: FDT/DTM –Resetting the device to factory settings

9.12.3 Resetting the device via Object Dictionary

The device is reset via the CoE index 0xFBF0 "Device Reset Command", subindex 0x01 "Command".

- ▶ Write the reset command **74 65 73 65 72 66** as hexadecimal value in CoE index 0xFBF0:01.

FBF0:0	Device Reset Command		> 3 <
FBF0:01	Command	RW	74 65 73 65 72 66
FBF0:02	Status	RO	0x00 (0)
FBF0:03	Response	RO	00 00

Fig. 93: TwinCAT (example) - Resetting the device to factory settings via CoE index

- ⇨ The device is reset to factory settings.

10 Troubleshooting

If the device does not work as expected, proceed as follows:

- ▶ Exclude environmental disturbances.
- ▶ Check the connections of the device for errors.
- ▶ Check device for parameterization errors.

If the malfunction persists, the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

10.1 Eliminate parameterization errors

DXP channels

Error	Possible causes:	Remedy
DXP output does not switch	The output is deactivated per default.	▶ Switch on the output via parameter **Activate output** (DXP_EN_DO =1).

IO-Link channels

LED behavior	Diagnostics	Possible causes:	Remedy
LED ERR constant red, LED IOL red blinking	Data storage error	IO-Link device according to IO-Link V1.0 connected IO-Link devices in accordance with IO-Link specification V1.0 do not support data storage.	▶ Set parameter Data storage mode to **deactivated, clear**. ⇨ Data storage remain deactivated.
		The data storage buffer contains data of another device.	▶ Set parameter Data storage mode to **deactivated, clear**. ▶ Re-activate the data storage if necessary.
	Wrong or missing device	The connected device does not match the configured one (wrong vendor-ID, device-ID etc.)	▶ Adapt the parameterization of the IO-Link port (Vendor ID, Device ID, etc.) at the master. The parameterization can be done manually via DTM, the web server or similar or by teaching the master using the IO-Link-Call (port 0 function, sub index 67: Teach mode).
	Process input data invalid	Certain IO-Link devices send a **process input data invalid** diagnosis if the process value cannot be measured.	▶ Deactivate the sending of the diagnosis for the IO-Link port with the parameter **Process input data invalid → No diagnostic generated.**

11 Maintenance

The firmware update is performed according to ETG specification ETG.5003.0002. The FoE protocol (File access over EtherCAT) is used for the firmware update of the device. The device must be in "Bootstrap" status for the update process.

The current firmware version of the device can be read from CoE index 0x100A "Manufacturer Software Version" , the current hardware version from CoE index 0x1009 "Manufacturer Hardware Version".

NOTICE
Interruption of data connection and power supply during firmware update
Risk of device damage due to faulty firmware update

- ▶ Do not interrupt the data connection and the power supply during the firmware update.

11.1 Carrying out a firmware update via TwinCAT

Downloading the firmware file

The firmware file for the device is available free of charge for download from www.turck.com.

- ▶ In the project tree double-click **Box 1 (TBEC-LL-8IOL)**.
- ▶ Click **Online** tab → **State Machine** → **Bootstrap**.
- ▶ Click **File Access over EtherCAT** → **Download…**.

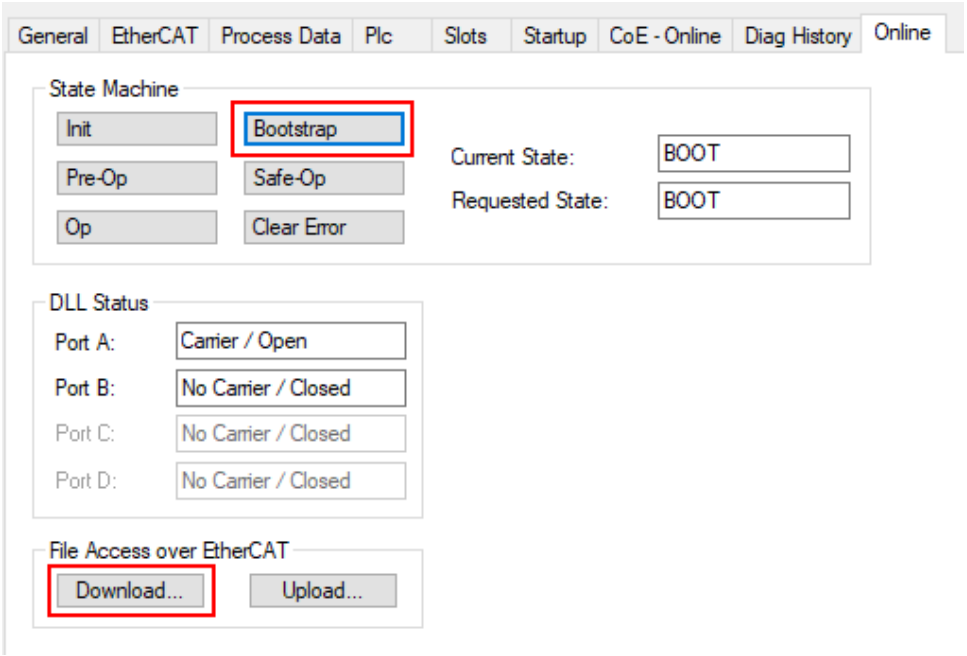


Fig. 94: Starting the firmware update

- ▶ Select the firmware file in the new window.
- ▶ Confirm with **OK**.
- ⇨ The firmware file is loaded in the flash memory of the device.
- ⇨ The STAT LED flickers green.
- ⇨ TwinCAT displays a progress bar at the bottom of the screen to indicate the download of the firmware file.

Carrying out an update

- ▶ Click **Online** tab → **State Machine** → **Init**.
- ⇨ The update is carried out.
- ⇨ The INFO LED is orange during this.
- ⇨ If the update is completed the device switches to normal operating mode.

11.2 Carrying out a firmware update via CODESYS

Prerequisites

- The device is logged in online.
- The **Expert settings** are activated on the **General** tab.
- The option **Restart slaves automatically** on the **General** tab is deactivated.

Downloading the firmware file

The firmware file for the device is available free of charge for download from www.turck.com.

- ▶ In the project tree double-click **TBEC_LL_8IOL (TBEC-LL-8IOL)**.
- ▶ Click **Online** tab → **State Machine** → **Bootstrap**.
- ▶ Click **File access over EtherCAT** → **Download…**.
- ▶ In the new window select the firmware file and click → **Open**.
- ⇨ The firmware file is loaded in the flash memory of the device.
- ⇨ The STAT LED flickers green.
- ⇨ CODESYS displays a progress bar at the bottom of the screen to indicate the download of the firmware file.

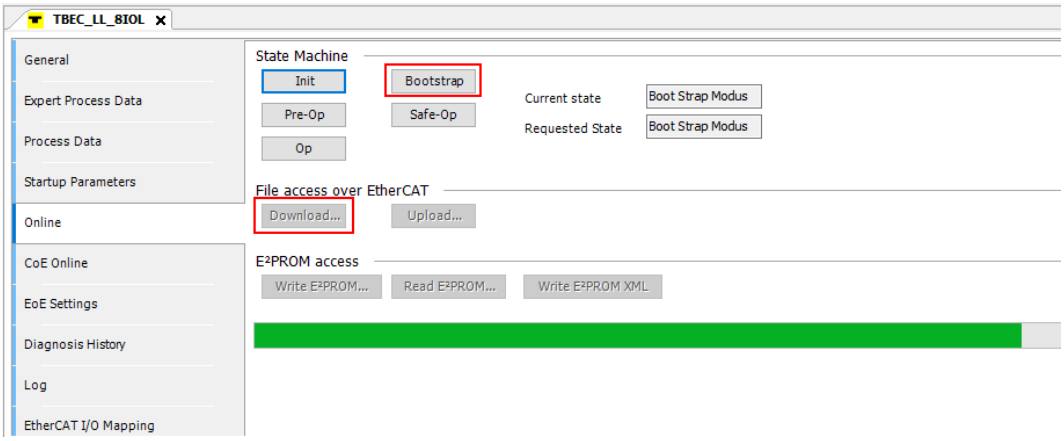


Fig. 95: Download of the firmware file

Carrying out an update

- ▶ Click **Online** tab → **State Machine** → **Init**.
- ⇨ The update is carried out.
- ⇨ The INFO LED is orange during this.
- ⇨ If the update is completed the device switches to normal operating mode.
- ▶ Activate the option **Restart slaves Slave automatically** on the **General** tab.

12 Disposal

The devices must be disposed of correctly and must not be included in general household garbage.

13 Technical data

Technical data	
Supply	
Supply voltage	24 VDC
Permissible range	18…30 VDC
Total current	Max. 9 A per voltage group V1 + V2: max. 11 A
Power consumption	
Operating current (at 24 VDC nominal voltage)	< 120 mA (outputs inactive)
Operating current (at 28.8…18.0 VDC)	■ V1: 120…180 mA ■ V2: 90…40 mA Operating conditions: ■ All outputs active without load ■ Ethernet communication active
Sensor/actuator supply V_{AUX1}	Supply from V1, short circuit proof ■ Max. 4 A per connector X0 and X4 (marked on the device with "+") ■ Max. 2 A per connector X1…X3, X5…X7
Sensor/actuator supply V_{AUX2}	Class - B-supply from V2, short circuit proof ■ Max. 4 A per connector X4… X5 (marked on the device with "+") ■ Max. 2 A per connector X6… X7
Potential isolation	Galvanic isolation from V1 and V2 voltage group, voltages up to 500 VDC
Connectors	
Power supply	2 × M12 male, L coded
EtherCAT	2 × M12, 4-pin, D coded
IO-Link ports	M12, 5-pole, A-coded
Permissible torques ■ Ethernet ■ I/O channels/supply ■ Mounting (M6 screws)	 0.6 Nm 0.8 Nm 1.5 Nm
Isolation voltages	
V1 to V2	≥ 500 V AC
V1/V2 to field bus	≥ 500 V AC
System data	
Transmission rate	10 Mbps/100 Mbps
Web server	Integrated, via EoE
Service interface	EoE
EtherCAT	
CAN over EtherCAT	According to Modular Device Profile (ETG.5001.1)
Supported EtherCAT protocols	CoE, EoE, FoE, AoE
Diagnostics	CoE Emergencies, Diag History Object
Address assignment	Automatic, Explicit Device Identification, Configured Station Alias

Technical data	
Communikation cycle	Min. 125 µs
Digital inputs	
Number of channels	4 DXP and 8 SIO
Max. input current	7 mA at pin 2 12 mA at pin 4
Input type	PNP
Type of input diagnostics	Channel diagnosis
Switching threshold	EN 61131-2 type 3, PNP
Signal voltage low level	< 5 V
Signal voltage high level	> 11 V
Signal current low level	< 1.5 mA
Signal current high level	> 2 mA
Input delay	0.05 ms
Potential isolation	Galvanic isolation to XF1/XF2, voltage proof up to 500 V AC
Digital outputs	
Number of channels	4 DXP
Output type	PNP
Type of output diagnostics	Channel diagnostics
Output voltage	24 VDC from potential group
Output current per channel	2 A, short-circuit-proof
Leakage current	≤ 2.5 µA
Residual voltage (ON)	≤ 0.8 V
Potential isolation	Galvanic isolation to XF1/XF2, voltage proof up to 500 V AC
IO-Link	
Number of channels	8
IO-Link	Pin 4 operated in IO-Link mode
IO-Link specification	Version 1.1
IO-Link port type	Class A at X0…X3 Class B at X4…X7
Frame type	Supports all specified frame types
Supported devices	Max. 32 byte input/32 byte output
■ Input data	Max. 32 Byte per channel
■ Output data	Max. 32 Byte per channel
Transmission rate	4.8 kbps (COM 1), 38.4 kbps (COM 2), 230.4 kbps (COM 3)
Transmission cable	Length: max. 20 m standard lines, 3- or 4-wire (depending on the application), un-shielded

Technical data	
Mounting	
Type of mounting	Via 2 mounting holes, Ø 6.3 mm
Mounting distance (device to device)	≥ 50 mm Valid for operation in ambient temperatures defined below with sufficient ventilation and maximum load (horizontal nominal position). At ambient temperatures of < 30 °C, the devices can also be mounted directly next to each other.
Standard/Directive conformity	
Vibration test	According to EN 60068-2-6
Acceleration	Up to 20 g
Shock test	According to EN 60068-2-27
Drop and topple	According to IEC 60068-2-31/IEC 60068-2-32
Electro magnetic compatibility	According to EN 61131-2
Approvals and certificates	CE UV-resistant according to DIN EN ISO 4892-2013
UL cond.	cULus LISTED 21 W2, Encl.Type 1 IND.CONT.EQ.
General information	
Dimensions (B × L × H)	60.4 × 230.4 × 39 mm
Operating temperature	-40…+70 °C
Storage temperature	-40…+85 °C
Operating height	Max. 5000 m
Protection class	IP65/IP67/IP69K
MTTF	146 years acc. to SN 29500 (Ed. 99) 20 °C
Housing material	PA6-GF30
Housing color	Black
Material window	Lexan
Material label	Polycarbonate
Halogen-free	Yes

FCC declaration

NOTE
This device complies with the limits for a Class A digital device, according to Part 15 of the FCC Rules. Operation of this equipment in a residential area may cause harmful interference. In this case, the user must correct the interference at his own expense.

14 Turck Subsidiaries - Contact Information

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