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Your Global Automation Partner

BL20-E-GW-EC-20
Gateway for EtherCAT

Instructions for Use

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1 About these Instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

These instructions describe the BL20 gateway for EtherCAT. The I/O modules of the BL20 system are independent of the fieldbus used and described in separate operating instructions.

1.1 Target groups

These instructions are written for specifically trained personnel and must be read carefully by anyone entrusted with the installation, commissioning, operation, maintenance, disassembly or disposal of the device.

When using the device in Ex areas, the user must also have knowledge of explosion protection (IEC/EN 60079-14 etc.).

1.2 Explanation of symbols

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

Besides this document, the following material can be found on the Internet at www.turck.com:

- Data sheet
- Instruction for use for BL20 I/O modules
- Declarations of conformity (current version)
- 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 to the following second generation BL20 gateway for EtherCAT:

- BL20-E-GW-EC-20 (ID 100037881)

2.2 Scope of delivery

The delivery consists of the following:

- BL20 gateway
- 2 × end bracket BL20-WEW-35/2-SW
- 1 × end plate BL20-ABPL
- Quick Start Guide

2.3 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

The contact data for Turck branches is provided at [▷ 78].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The BL20 gateway BL20-E-GW-EC-20 is part of the BL20 system. It forms the interface to an EtherCAT network and forwards the data collected from the field by BL20 I/O modules within the BL20 station to the higher-level EtherCAT master.

The device must 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 instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.

3.3 Notes on UL approval

- The connection lines must be designed for a temperature of at least 75 °C.

4 Product description

The components of the BL20 product series are designed with IP20 protection.

The BL20-E-GW-EC-20 EtherCAT gateway has two RJ45 sockets (XF1 EC IN and XF2 EC OUT) for the connection to EtherCAT. Two tension clamp terminals each are available for connecting system and load voltage.

DIP switches under the upper plug-in label of the gateway are used to set the EtherCAT device ID of the device.

4.1 Device overview

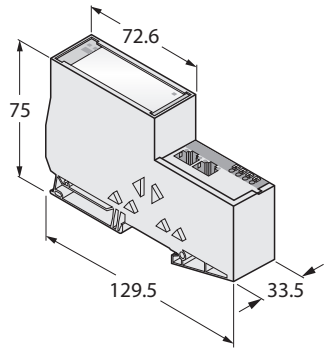


Fig. 1: Device overview BL20-E-GW-EC -20

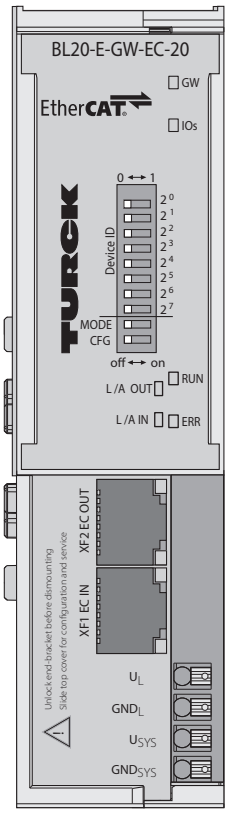


Fig. 2: Top view BL20-E-GW-EC -20

4.1.1 Block diagram

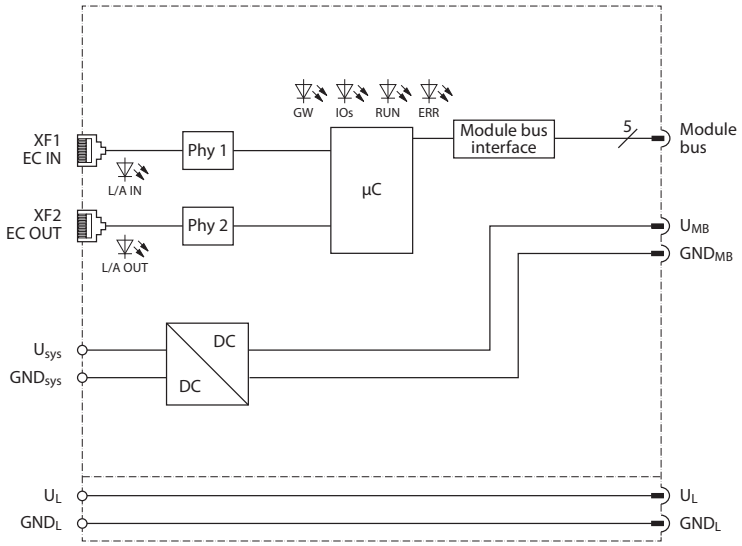


Fig. 3: Block diagram BL20-E-GW-EC -20

4.1.2 Display elements

The device has the following LED indicators [▶ 64]:

- Gateway diagnostics
- I/O module diagnostics
- Station diagnostics
- EtherCAT connection

4.1.3 Operating elements

- DIP switches $2^0 \ldots 2^7$ for setting the Identification Value (Device ID) [▶ 20]
- DIP switch "Mode" DIP switch "Mode" (in combination with DIP-switch 2^5) for the factory reset [▶ 70]
- DIP switch "CFG" (without function)

4.2 Properties and features

- Shock and vibration tested
- Degree of protection IP20
- Gateway between BL20 system and EtherCAT
- 2 x RJ45 female connector for EtherCAT
- Push-in terminals for system and field supply
- EtherCAT slave according to Modular Device Profile
- Supported EtherCAT protocols CoE, EoE, FoE, AoE
- Transmission rate: EtherCAT standard
- Auto MDIX
- LEDs for displaying supply voltage, group and EtherCAT errors

4.3 Operating principle

BL20 gateways are the head of a BL20 station. They are used to connect the modular bus nodes to the higher-level fieldbus. All BL20 modules communicate via an internal module bus whose data is forwarded to the fieldbus via the gateway. This means that all I/O modules can be configured independently of the bus system.

The BL20 station is connected to an EtherCAT network as EtherCAT slave via the EtherCAT gateway BL20-E-GW-EC-20. During operation the process data is exchanged between EtherCAT and the BL20 system

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, manufacturer specific)
0x6000…0x6FFF	Input Area (TxPDOs of the I/O modules) [▶ 63]
0x7000…0x7FFF	Output Area (RxPDOs of the I/O modules) [▶ 63]
0x8000…0x8FFF	Configuration Area (expected configuration of the I/O modules) [▶ 62]
0xA000…0xAFFF	Diagnosis Data [▶ 66]
0xF000…0xFFFF	Device Area ■ Device Status [▶ 65] ■ Device Control [▶ 59] ■ Device Parameter [▶ 62]

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 the web server.
- 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.

4.5 Maximum configuration of a BL20 station with EtherCAT gateway

The following limits must be observed when configuring a BL20 station with BL20-E-GW-EC-20:

Max. station lengths (FW version V 1.0.0.0)	32 modules
Max. size of input data	1024 byte
Max. size of output data	1024 byte
Max. current consumption of the I/O modules from the module bus	700 mA (provided by the gateway)

NOTE
When operating the gateway on a TwinCAT controller:
- ▶ Observe the limitation of the maximum number of startup parameters (max. 849 entries per EtherCAT device).

The following table shows a list of I/O module data widths, the number of startup parameter bytes, and the nominal current consumption of the I/O modules from the module bus.

Module type	ID	Data width		Current consumption	No. of start-up parameters
		Input	Output		
Digital input modules					
BL20-2DI-120/230VAC	6827011	1	-	≤ 28 mA	1
BL20-4DI-24VDC-N	6827013	1	-	≤ 28 mA	1
BL20-4DI-24VDC-P	6827012	1	-	≤ 28 mA	1
BL20-4DI-NAMUR	6827212	1	-	≤ 40 mA	33
BL20-E-8DI-24VDC-P	6827227	1	-	≤ 15 mA	1
BL20-E-16DI-24VDC-N	100000542	2	-	≤ 35 mA	1
BL20-E-16DI-24VDC-P	6727231	2	-	≤ 15 mA	1
Digital output modules					
BL20-2DO-120/230VAC-0.5A	6728137	-	1	≤ 35 mA	1
BL20-2DO-24VDC-0.5A-N	6728024	-	1	≤ 32 mA	1
BL20-2DO-24VDC-2A-P	6728026	-	1	≤ 33 mA	1
BL20-2DO-R-CO	6728030	-	1	≤ 28 mA	1
BL20-2DO-R-NO	6728029	-	1	≤ 28 mA	1
BL20-4DO-24VDC-0.5A-P	6728023	-	1	≤ 30 mA	1
BL20-E-8DO-24VDC-0.5A-P	6728226	-	1	≤ 15 mA	1
BL20-E-8DO-24VDC-0.5A-P/ET	100000400	-	1	≤ 15 mA	1
BL20-E-16DO-24VDC-0.5A-N	100000543	-	2	≤ 25 mA	1
BL20-E-16DO-24VDC-0.5A-P	6727230	-	2	≤ 25 mA	1
Analog input modules					
BL20-2AIH-I	6827331	24	-	≤ 30 mA	21
BL20-2AI-I(0/4…20MA)	6827021	4	-	≤ 35 mA	10
BL20-2AI-PT/NI-2/3	6827017	4	-	≤ 45 mA	14
BL20-2AI-THERMO-PI	6827020	4	-	≤ 45 mA	11
BL20-2AI-U(-10/0…+10VDC)	6827022	4	-	≤ 35 mA	10
BL20-4AI-U/I	6827217	8	-	≤ 50 mA	26
BL20-E-4AI-TC	6827367	8	-	≤ 50 mA	17

Module type	ID	Data width		Current consumption	No. of start-up parameters
		Input	Output		
BL20-E-4AI-TC/ET	100007647	8	-	≤ 50 mA	17
BL20-E-8AI-U/I-4PT/NI	6827325	16	-	≤ 35 mA	25
BL20-E-8AI-U/I-4PT/NI/ET	6827340	16	-	≤ 35 mA	25
Analog output modules					
BL20-2AOH-I	6827332	16	4	≤ 30 mA	23
BL20-2AO-I(0/4…20MA)	6827034	-	4	≤ 40 mA	13
BL20-2AO-U(-10/0…+10VDC)	6827033	-	4	≤ 43 mA	7
BL20-E-4AO-U/I	6827328	-	8	≤ 50 mA	21
BL20-E-4AO-U//ET	6827397	-	8	≤ 50 mA	21
Technology modules					
BL20-E-1CNT	100037880	8	8	≤ 40 mA	25
BL20-1RS232	6827169	8	8	≤ 140 mA	10
BL20-1RS485/422	6827165	8	8	≤ 60 mA	11
BL20-1SSI	6827166	8	8	≤ 50 mA	7
BL20-2RFID-S	6827306	24	24	≤ 30 mA	15
BL20-E-2CNT-2PWM	6827341	24	24	≤ 50 mA	44
BL20-E-4IOL	6827385	16	16	≤ 40 mA	49
BL20-E-4IOL-10	100001334	32	32	≤ 40 mA	53
BL20-E-3EMM-CT	100027913	32	32	≤ 55 mA	50
BL20-E-3EMM-RC	100027914	32	32	≤ 55 mA	49
Power supply modules					
BL20-BR-24VDC-D	6827006	-	-	-	1
BL20-PF-120/230VAC-D	6827007	-	-	≤ 25 mA	1
BL20-PF-24VDC-D	6827008	-	-	≤ 28 mA	1
Special modules					
empty slot	-	-	-	-	1
undefined module	-	-	-	-	1
unsupported module	-	-	-	-	1

4.6 BL20 accessories

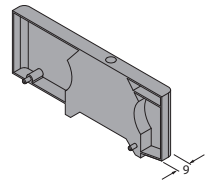
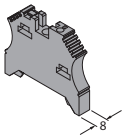
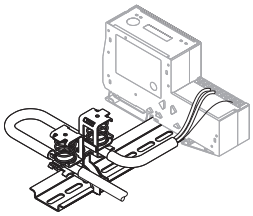
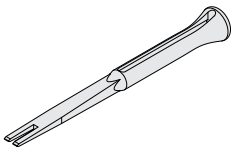
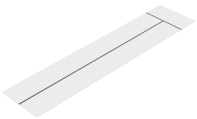
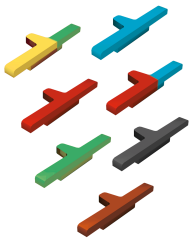
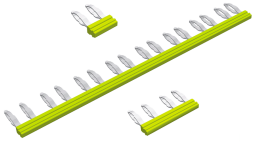
Figure	Type	ID	Description
	BL20-ABPL	6827123	End plate Mechanical end of BL20 station to the right, 2 pieces
	BL20-WEW-35/2-SW	6827124	End bracket black Mechanical fixation of BL20 station, 10 pieces
	BS3511/KLBUE4-31.5	6827342	Shielding terminal
	ZBW5	6827129	Tension spring tool
	BL20-LABEL/SCHEIBE	6827070	Labels for electronic modules in slice design, 3 × DIN A5 sheet, slice, pre-perforated (laser printing), 3 × 19 labels

Figure	Type	ID	Description
	BL20-ANBZ-…		Color coding for clear potential identification of the connection level on the base modules:
	BL20-ANBZ-BL	6827072	10 × strip of 6, blue
	BL20-ANBZ-RT	6827073	10 × strip of 6, red
	BL20-ANBZ-GN	6827074	10 × strip of 6, green
	BL20-ANBZ-SW	6827075	10 × strip of 6, black
	BL20-ANBZ-BR	6827076	10 × strip of 6, brown
	BL20-ANBZ-RT/BL-BED	6827077	10 × strip of 6, red/blue
	BL20-ANBZ-GN/GE-BED	6827078	10 × strip of 6, green/yellow
	BL20-ANBZ-WS	6827079	10 × strip of 6, white
	BL20-QV/…		Cross connector relay (QVR) For bridging the 4th connection level (14/24) for base modules for relays (10 pieces)
	BL20-QV/1	6827104	1 grid
	BL20-QV/2	6827105	2 grid
	BL20-QV/3	6827106	3 grid
	BL20-QV/4	6827107	4 grid
	BL20-QV/5	6827108	5 grid
	BL20-QV/6	6827109	6 grid
	BL20-QV/7	6827110	7 grid
	BL20-QV/8	6827111	8 grid

5 Installing

DANGER
Potentially explosive atmosphere
Explosion due to ignitable sparks
For use in zone 2:

- ▶ Only install the device if there is no potentially explosive atmosphere present.
- ▶ Disconnect and connect circuits only when no voltage is present.
- ▶ Only actuate the switches when there is no voltage present.
- ▶ Observe the Ex approval requirements.

WARNING
Open electrical contacts
Danger to life due to electric shock when using 120/230 V

- ▶ Cover open contacts on the last base module of each station with end plate or place a power feeding module (24 V) to form a new potential group.

- A BL20 station consists of at least one gateway and one electronic module.
- A BL20 station must be fixed securely onto the mounting rail using two end brackets (BL20-WEW-35/2-SW).
- The BL20 station can be mounted vertically or horizontally.
- For vertical installation, the gateway can be positioned either above or below. In this case, sufficient ventilation and heat dissipation must be ensured.
- Keep space to the left of the gateway free for the first end bracket.
- Mount the end plate after the last BL20 module.
- The gateway is the first electronics component on a BL20 station.
- The gateway is followed by the I/O modules in any order.
- Power Feeding and Bus Refreshing modules are used for potential separation and can be mounted between the other modules if necessary.
- If required, potential distribution modules can be used. A maximum of two potential distribution modules may be mounted directly next to each other.
- Protect the installation site against heat radiation, rapid temperature fluctuations, dust, dirt, moisture and other environmental influences.

Mounting the DIN rail

Recommendation for mounting the BL20 system on a DIN rail in the control cabinet:

- ▶ Mount the DIN rail on a rust-proof, electrically conductive mounting plate. A reference potential for protective and functional earth can be established through the mounting plate.

The minimum thickness of the mounting plate depends on the material:
- – Steel and stainless steel: min. 2 mm
- – Aluminum: min. 3 mm

- ▶ Fasten the DIN rail to the mounting plate using suitable rivets (A) or screws (B) as shown in the figure below. The choice of rivets or screws depends on the condition of the mounting plate.
- ▶ When mounting several DIN rails on top of each other: ensure sufficient distance between the top-hat rails (C). The arrangement of the components in the control cabinet depends on the application.
- ▶ Keep a distance of min. 10 mm to passive components.
- ▶ Keep a distance of min. 75 mm to active components.

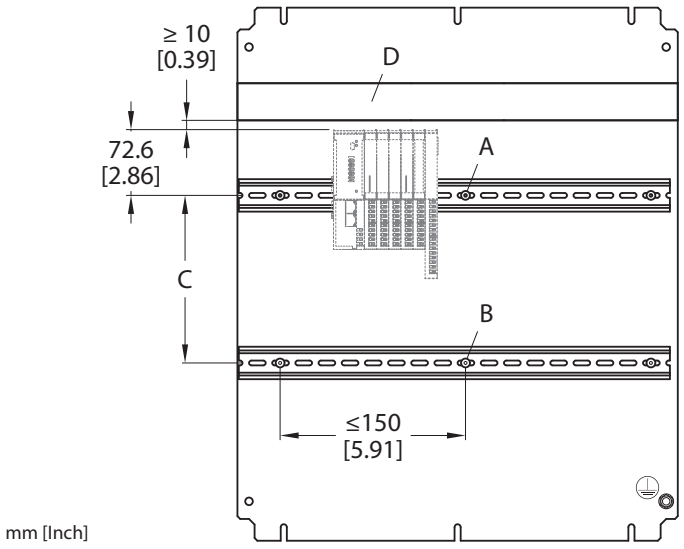


Fig. 4: DIN rail mounting

5.1 Mounting the gateway

- The DIN rail must already be mounted.
- An end bracket must be mounted in front of the gateway. The end bracket can be mounted at the beginning or after the complete station has been mounted.
- The gateway is the first electronic element of each BL20 station.

- ▶ Hang the groove of the gateway into the DIN rail from below.
- ▶ Turn the upper end of the gateway to the rear.
- ▶ Press the gateway against the DIN rail until the latching hook audibly engages.

5.2 Mounting end bracket and end plate

- BL20 stations must be mounted on the DIN rail using two end brackets (BL20-WEW-35/2-SW).
- The first end bracket must be mounted in front of the gateway.
- The second bracket is integrated in the end plate and must be mounted after the last module.

Mounting the end bracket in front of the gateway

- If necessary, loosen the screw in the end bracket.
- Snap the end bracket onto the DIN rail on the left of the gateway.
- Push the end bracket close to the gateway.
- Screw the end bracket tight.

Mounting the end plate

- If necessary, loosen the screw in the end bracket.
- Insert the end bracket into the recess provided in the end plate.
- The end bracket and end plate should be held so that the connectors on the end plate are facing the last module of the BL20 station.
- Snap the end plate with the end bracket onto the mounting rail.
- Press the end plate with the end bracket tightly against the last module of the BL20 station.
- Insert the connectors of the end plate firmly into the recesses of the module.
- Screw the end bracket tight (through the end plate).

6 Connecting

6.1 Connecting the power supply

The device has push-in terminals for connecting the supply voltages.

The system supply U_{SYS} supplies the gateway and the I/O modules. The field supply U_L supplies the connected sensors and actuators.

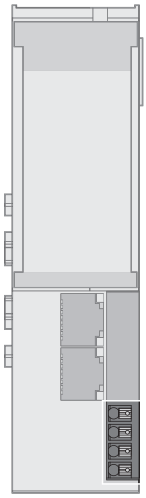


Fig. 5: Direct plug-in contacts for connecting the supply voltages

- ▶ Connect the device to the supply voltage according to the connection diagram.
- ▶ Insert the conductor into the respective contact. If rigid conductors or flexible conductors with ferrules are used, no tool is required.
- ▶ For flexible conductors without ferrules: Open the spring by pressing on the spring opener with the screwdriver and insert the conductor.

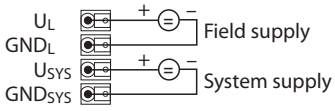


Fig. 6: Push-in terminals for voltage supply

Clampable conductors

Technical data	
Insulation stripping length	8 mm
Max. clamping range	0.2…1.5 mm²
Clampable wires (cross section)	
■ Rigid	0.2…1.5 mm²
■ Flexible	0.2…1.5 mm²
■ Flexible with ferrule without plastic sleeve	0.2…1.5 mm²
■ Flexible with ferrule with plastic sleeve	0.2…0.75 mm²
Wire cross section AWG	24…16

Initial commissioning without field supply U_L

If the field supply U_L is not connected for initial commissioning of a plant, certain I/O modules (z. B. BL20-2RFID-S) are not recognized by the gateway.

- ▶ Read the BL20 station again after switching on U_L.

6.2 Connecting the device to the EtherCAT network

For connection to the Ethernet-based EtherCAT fieldbus system, the device has two standard RJ45 female connectors.

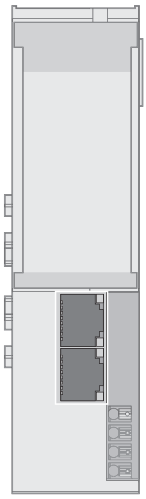


Fig. 7: RJ45 female connector for EtherCAT

- ▶ Connect device to EtherCAT via standard Ethernet cables with RJ45 connector according to the pin assignment below.

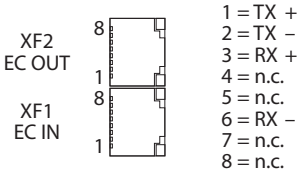


Fig. 8: Pin assignment RJ45 female connectors

7 Commissioning

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 e.g. tool change 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 is supported via a data word and not by the devices.

Explicit Device Identification

The Identification Value (Device ID) can be set via eight DIP switches (2^0…2^7) and the DIP switch "Mode" = "off" on the device. The DIP-switches are located under the upper label of the gateway. In the delivery state, the DIP switches are set to switch position "0".

▶ Pull the upper label upwards out of the housing.

✓ DIP switch "Mode" is set to "off".

▶ Set the DIP switches to the required position. Example: Device ID 50 = 0x32 = 00110010 (2^7…2^0)

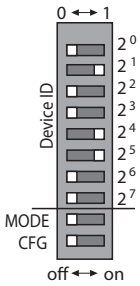


Fig. 9: Setting the Device ID, e.g. Device ID: 50 (0x32) 50 (0x32)

▶ Start the device.

If the DIP switch "Mode" is set to "on" during device startup or during operation, the Device ID of the gateway is set to 0.

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_BL20-E-GW-EC-20_R1_ESI_….xml Example: Turck_BL20-E-GW-EC-20_R1_ESI_1-3_20221116_8723.xml
CODESYS	
Sysmac Studio	Turck_BL20-E-GW-EC-20_R1_ESI_…_omron_….xml Example: Turck_BL20-E-GW-EC-20_R1_ESI_1-3_omron_20221116_8723.xml

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

7.3 Connecting the device to an EtherCAT master with TwinCAT

Used hardware

The following hardware components are used in this example:

- EtherCAT PLC CX5120 from Beckhoff Automation
- BL20-E-GW-EC-20 with the following I/O module list:
  - BL20-E-16DI-24VDC-P
  - BL20-E-16DI-24VDC-N
  - BL20-E-4IOL
  - BL20-E-16DO-24VDC-0.5A-P
  - BL20-E-4AO-U/I
  - BL20-E-4AI-TC
  - BL20-E-8DO-24VDC-0.5A-P
  - BL20-E-16DI-24VDC-P
  - BL20-2AIH-I

Used Software

The following software tools are used in this example:

- TwinCAT V3.1.0
- ESI file for BL20-E-GW-EC-20 (available as a free download at www.turck.com)

7.3.1 Connecting the device with the controller

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

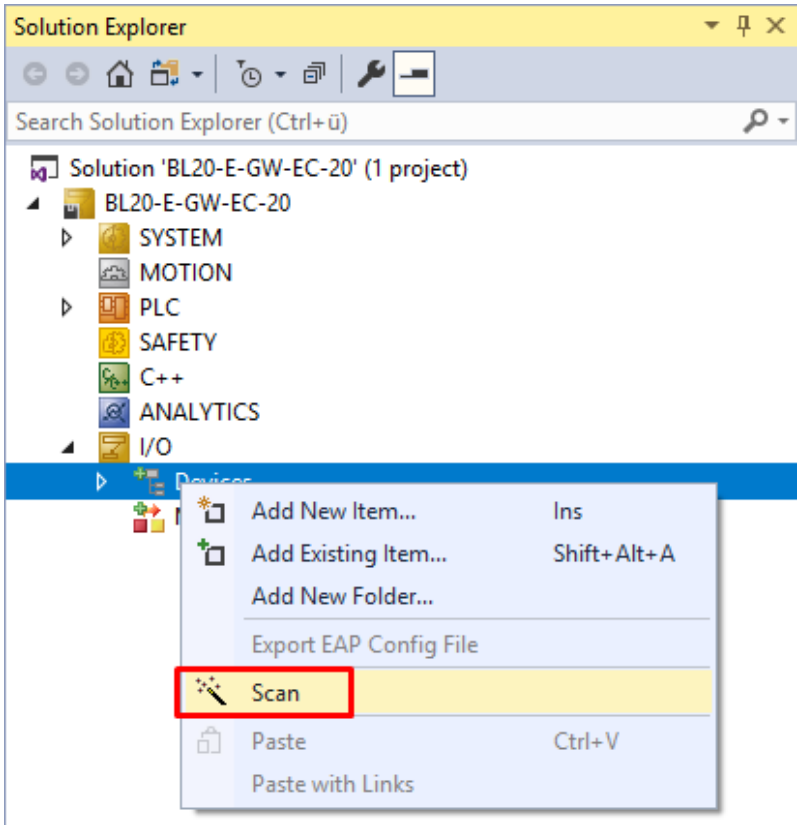


Fig. 10: Scanning for devices

- ⇨ All EtherCAT nodes (master and devices) are read in and automatically added to the I/O configuration. The BL20-E-GW-EC-20 appears in the Solution Explorer under the EtherCAT master as **Box 4 (BL20-E-GW-EC-20)**.
- ⇨ The scanned BL20 station shows all I/O modules with process data in the order in which they are plugged into the station. Modules without process data are not listed.

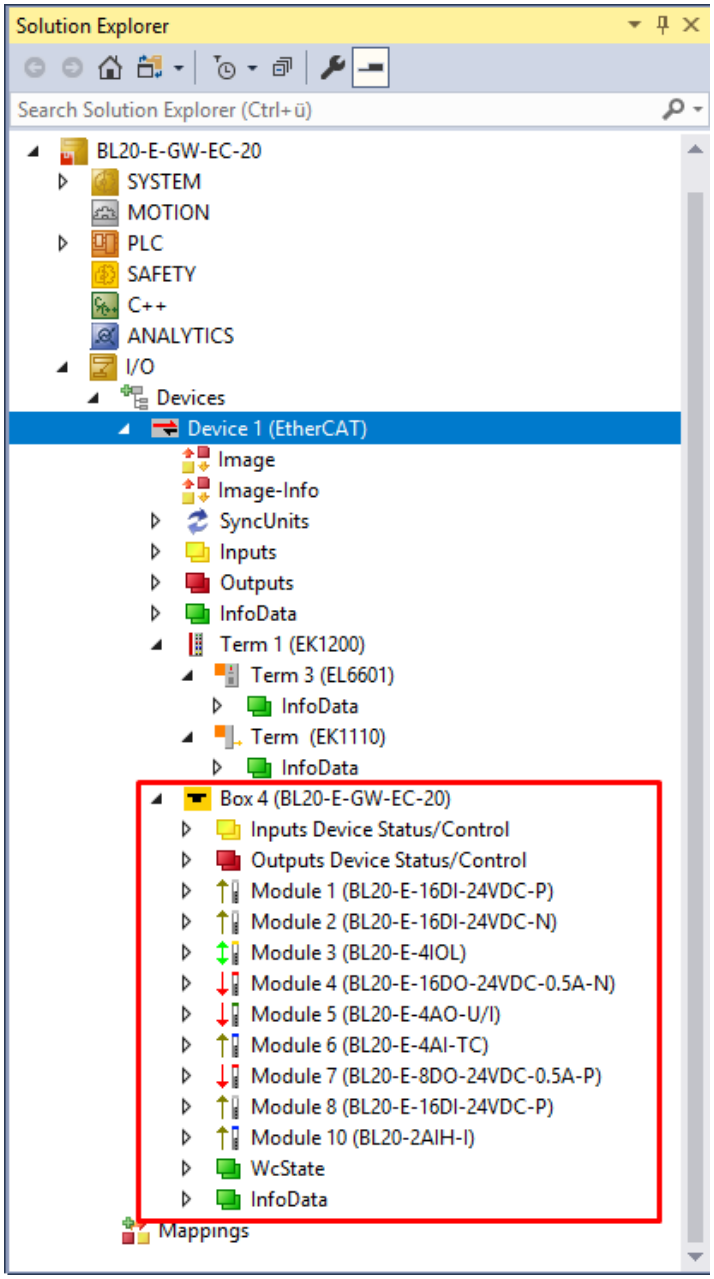


Fig. 11: EtherCAT device as Box 4 in the Solution Explorer

▶ Link at least one variable to be able to go online with the device.

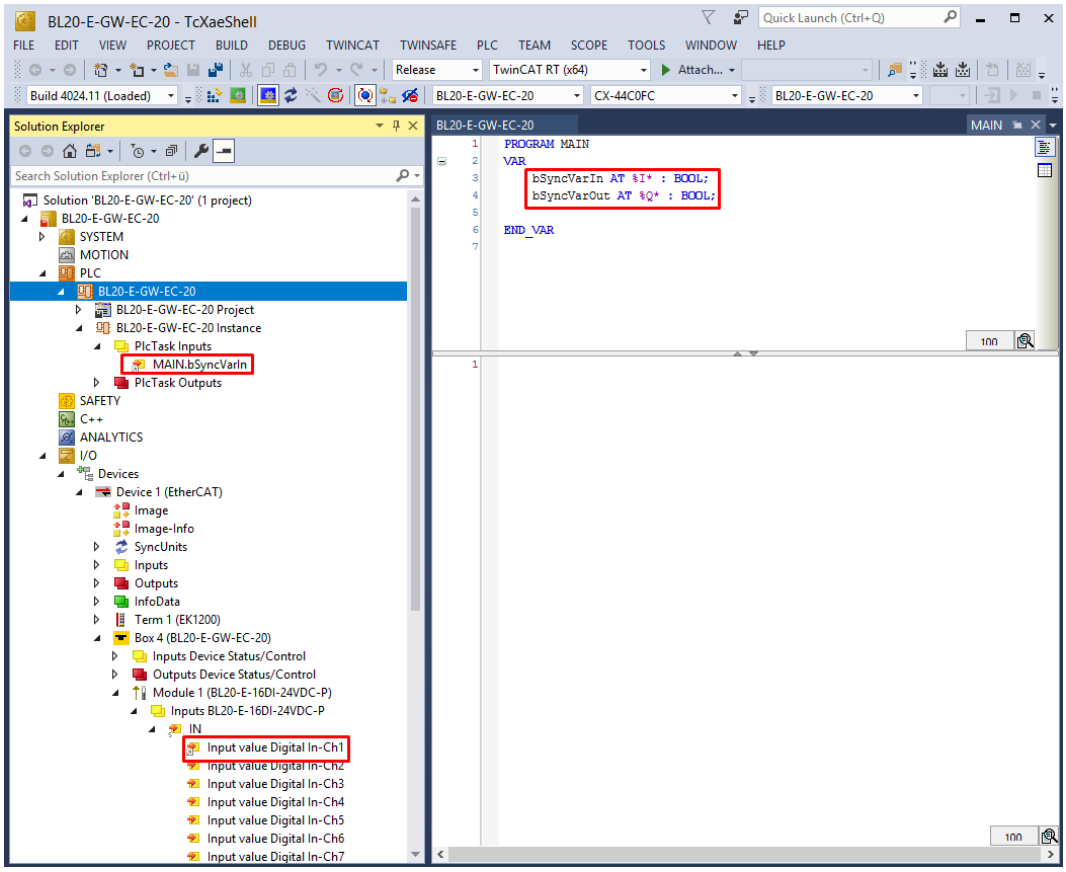


Fig. 12: Example of the linking of a variable

▶ Click the **Activate configuration** button.

Fig. 13: Activating the configuration

⇨ The device configuration is activated.

▶ Click the **Run mode** button.

Fig. 14: Run mode

⇨ The device is connected online with the EtherCAT master.

▶ Double-click **Box 4 (BL20-E-GW-EC-20)**.

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

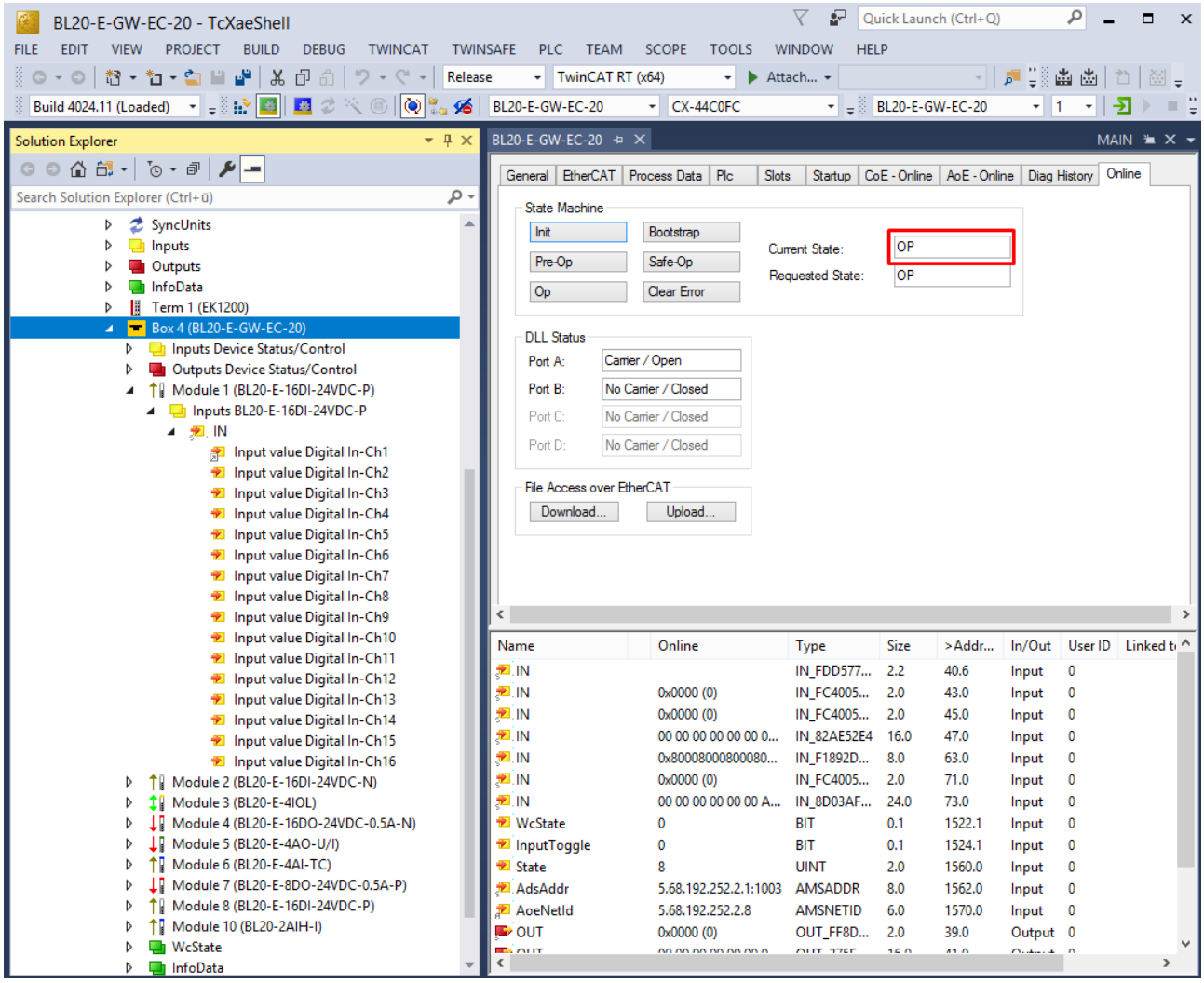


Fig. 15: EtherCAT Device, Online tab: status display (here: Operational), data points, link

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

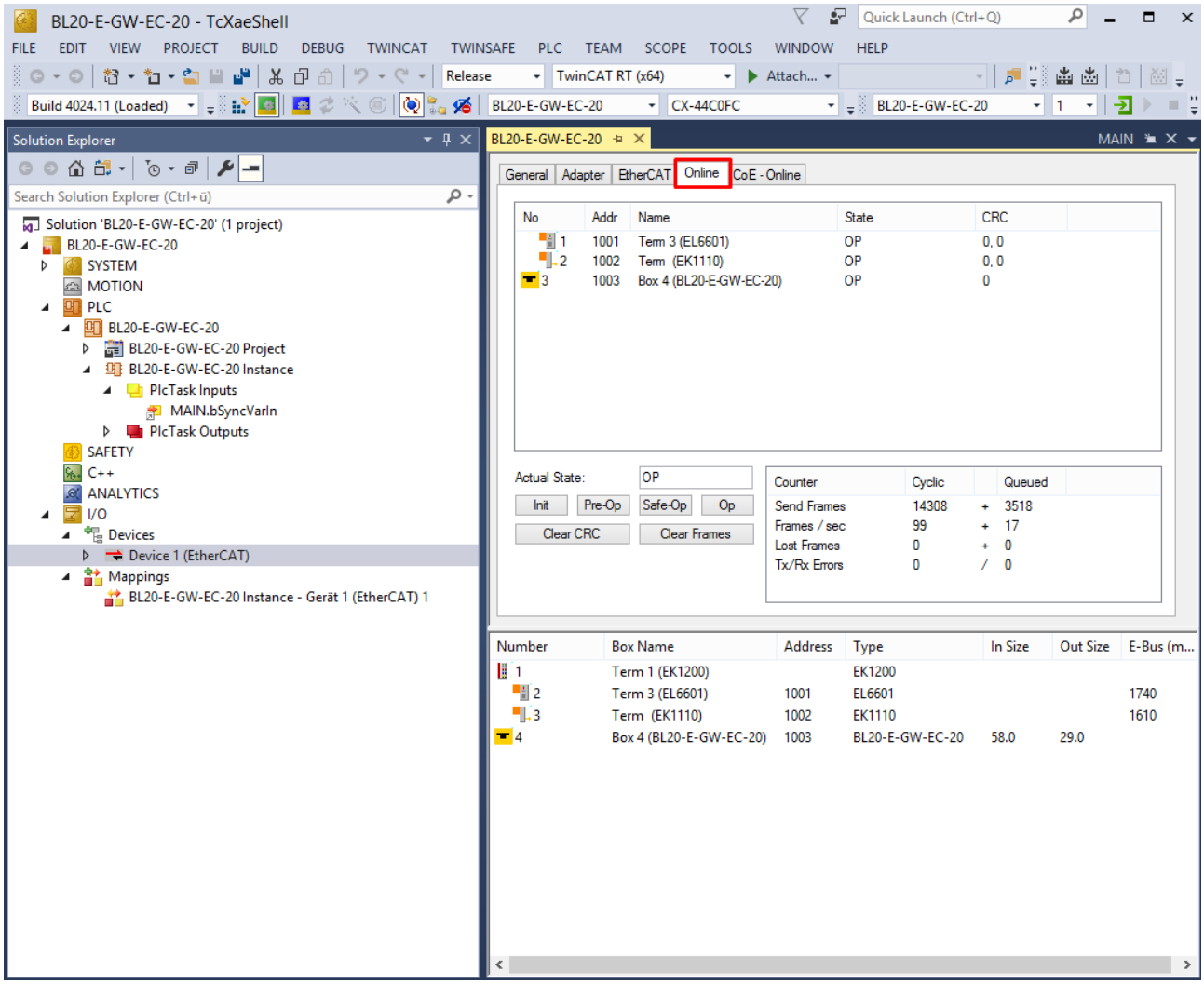


Fig. 16: EtherCAT Master, Online tab: status display of all connected devices

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

7.3.2 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.

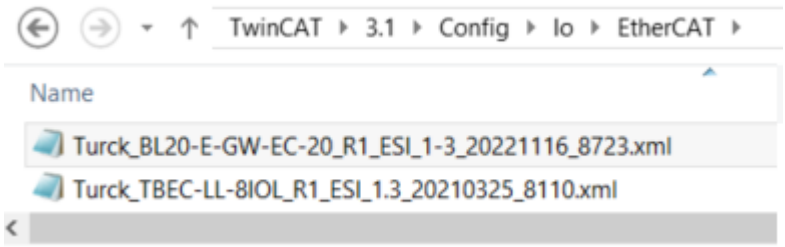


Fig. 17: TwinCAT, storing an xml file in the installation directory

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

⇨ The device description is loaded.

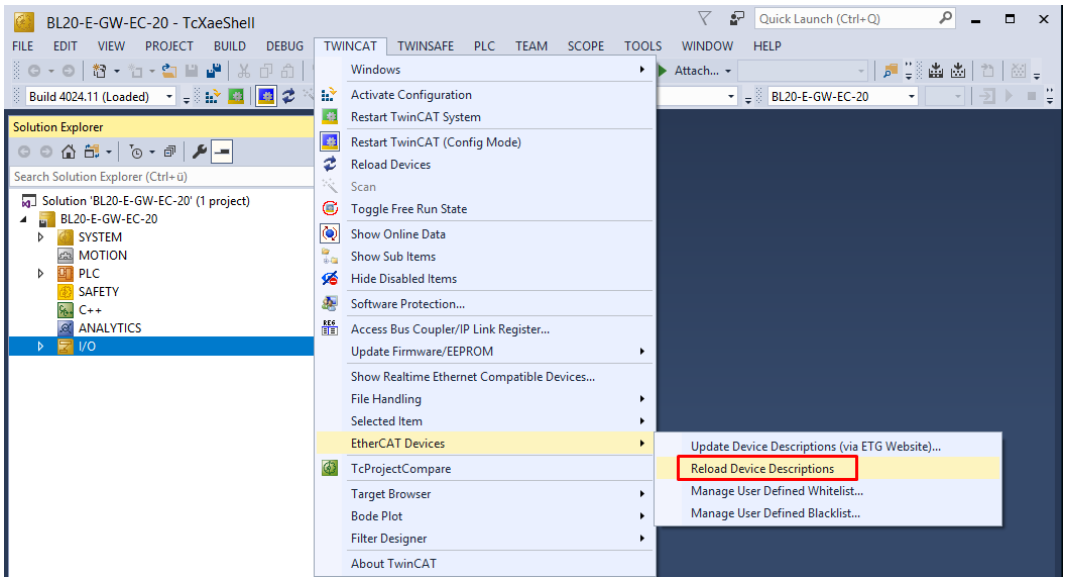


Fig. 18: TwinCAT, updating the device catalog

7.3.3 Setting startup parameters

Example: Deactivate load voltage diagnostics

- In the project tree double-click **Box 4 (BL20-E-GW-EC-20)**.
- Select the **Startup** tab.
- Double-click CoE index **0xF800:07** "Deactivate load voltage diagnostics".
- In the submenu **Edit CANopen startup entry** double click on **Deactivate load voltage diagnostics**.
- In the **Set Value Dialog** sub menu, enter the value **1 = yes**.
- Confirm with **OK**.

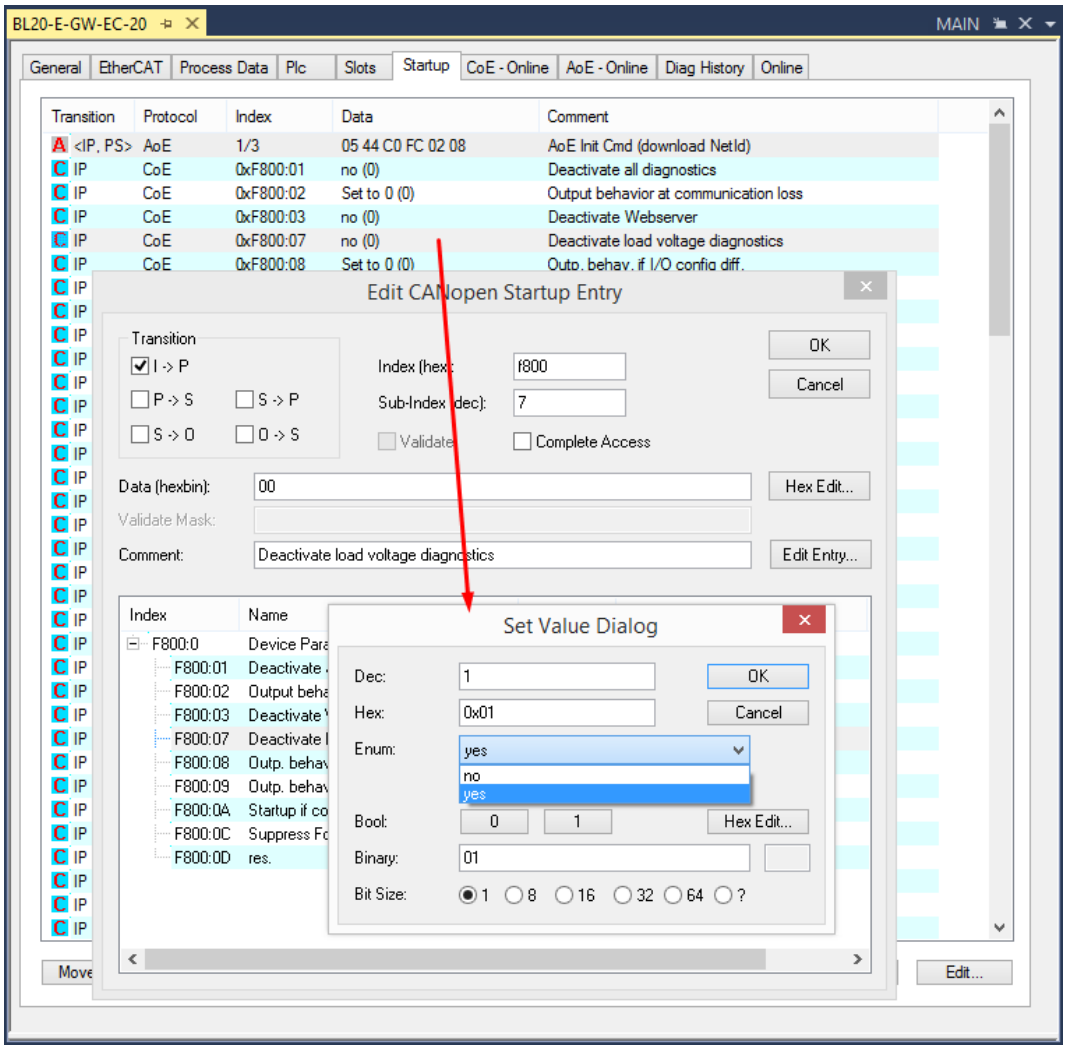


Fig. 19: TwinCAT: setting startup parameters

➪ The load voltage diagnostics are activated.

7.3.4 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 4 (BL20-E-GW-EC-20)**.
- ▶ Select the **CoE Online** tab.
- ⇨ The Object Dictionary with the parameters (Configuration Data, from index 0x8020) of all BL20 I/O modules present in the BL20 station is displayed. The data appears in the order in which the I/O modules are plugged into the BL20 station

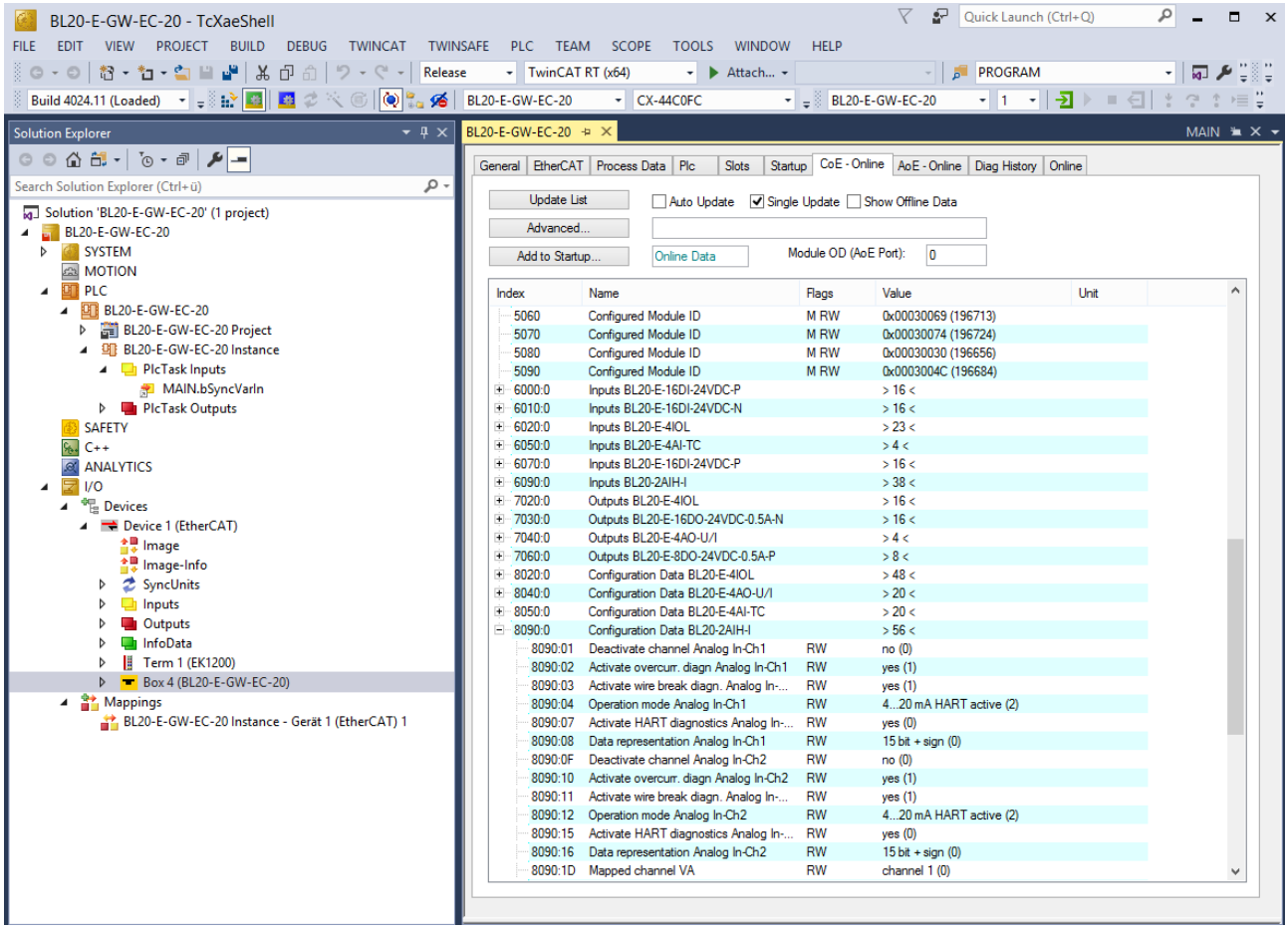


Fig. 20: CoE-Online, Object Dictionary

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.

7.3.5 Addressing a device via Explicit Device ID

- In the project tree double-click **Box 4 (BL20-E-GW-EC-20)**.
- Avtivate **EtherCAT → Advanced settings → General → Identification → Explicit Device Identification (ADO 0x0134)**.
- In the **Value** field enter the Identification Value (hex.) which must match the rotary coding switches on the device (see [▶ 20]).
- Confirm entries with **OK**.
- Carry out a voltage reset.

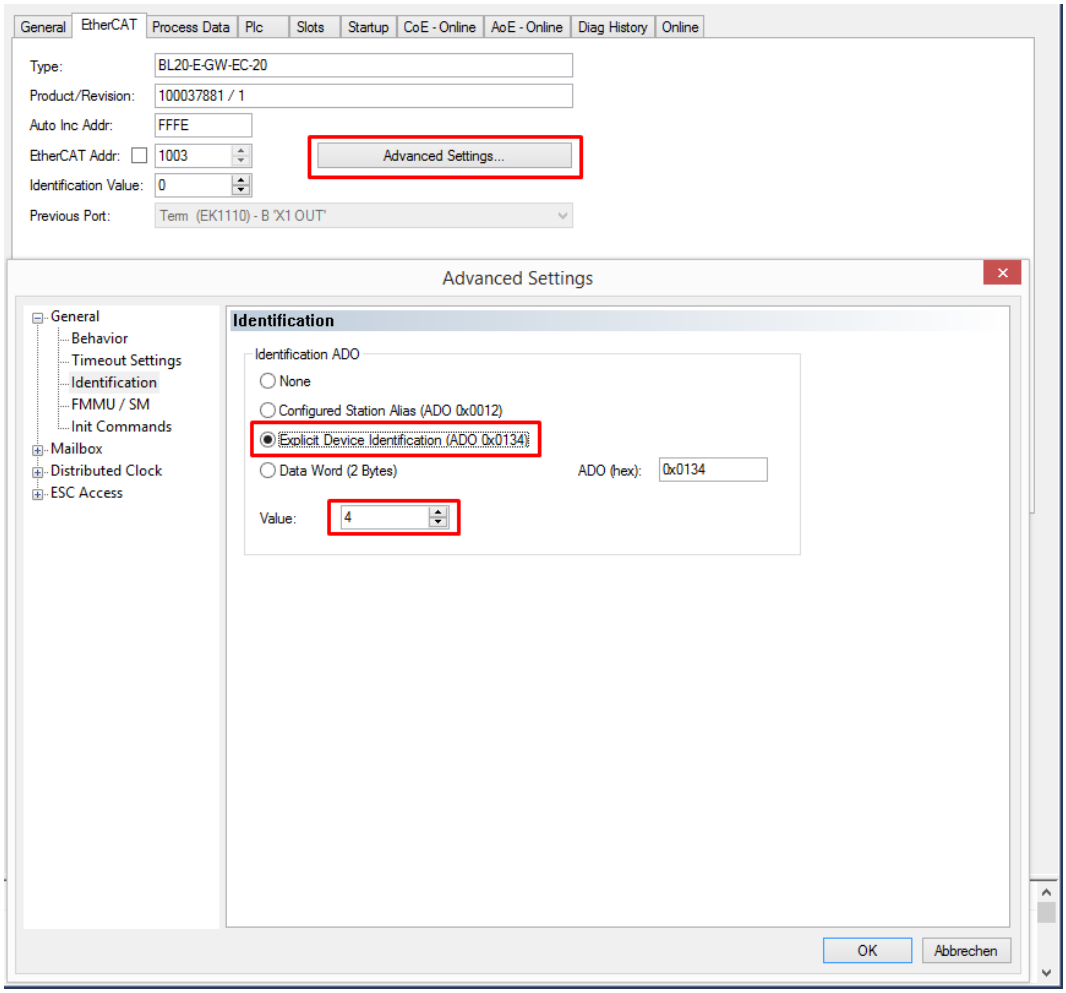


Fig. 21: TwinCAT – Select Explicit Device Identification

7.3.6 Addressing a device via Configured Station Alias

- In the project tree double-click **Box 4 (BL20-E-GW-EC-20)**.
- Activate **EtherCAT** tab → **Advanced settings** → **General** → **Identification** → **Configured Station Alias (ADO 0x0012)**.
- Confirm the entry with **OK**.

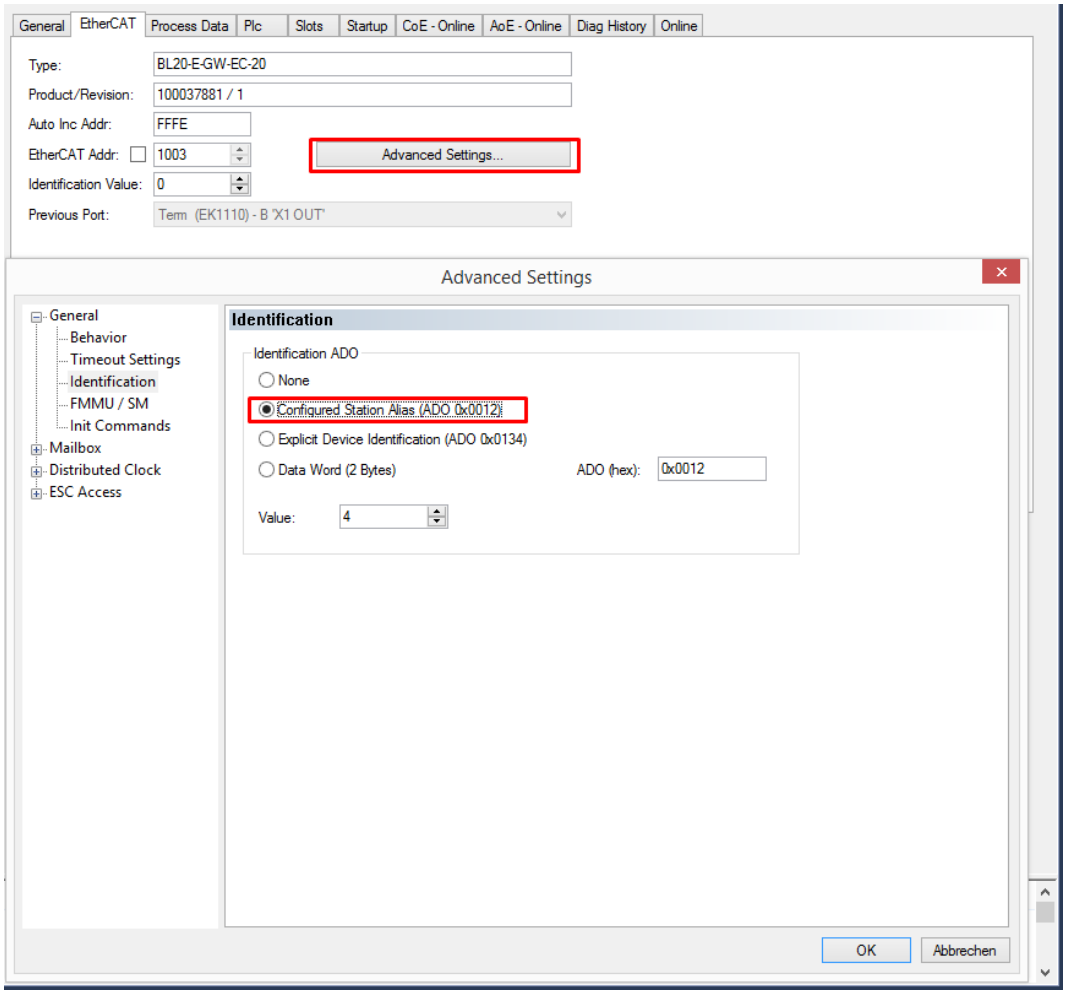


Fig. 22: TwinCAT – Selecting Configured Station Alias

- ▶ 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**.

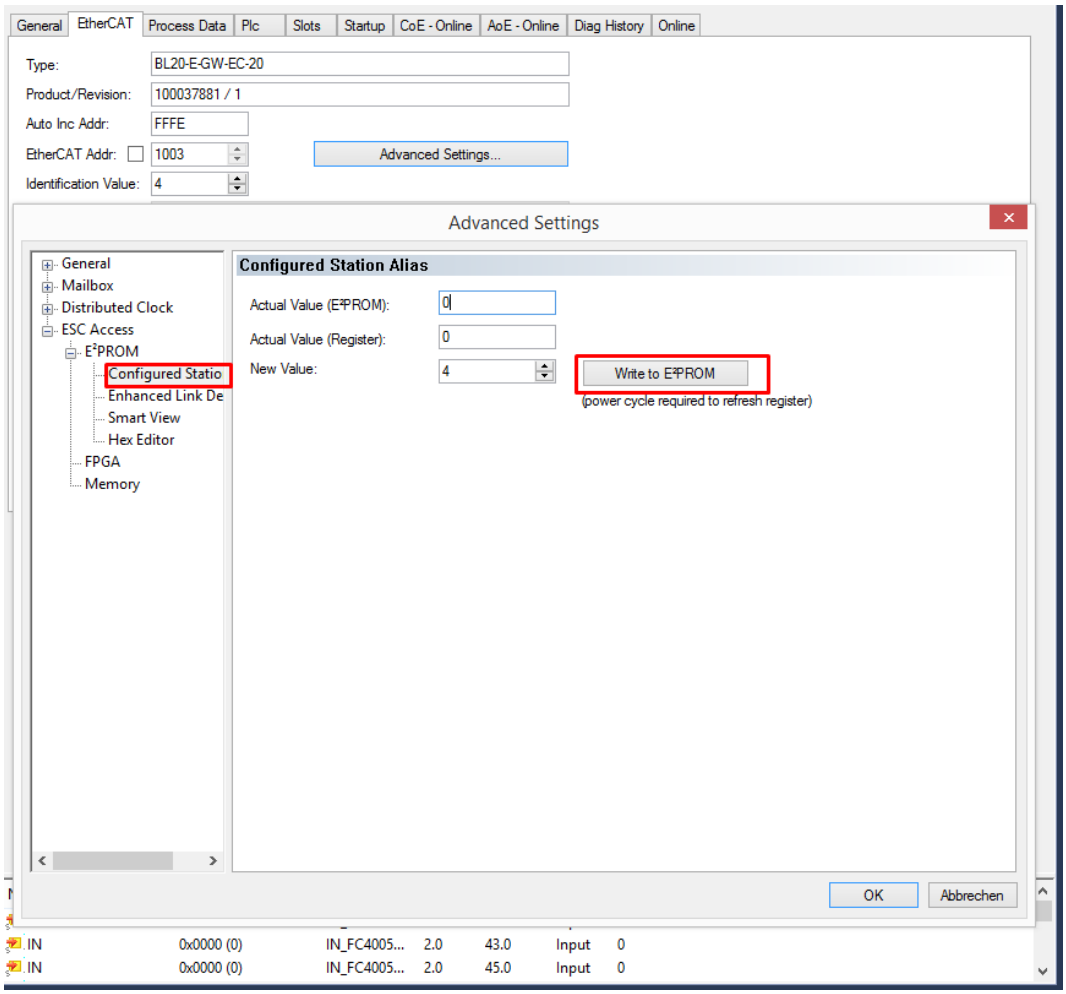


Fig. 23: TwinCAT – Configured Station Alias: entering the Identification Value

- ▶ 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.

7.3.7 Activating HotConnect

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

▶ Right-click **Box 4 (BL20-E-GW-EC-20)** → **Add to Hot Connect Group**.

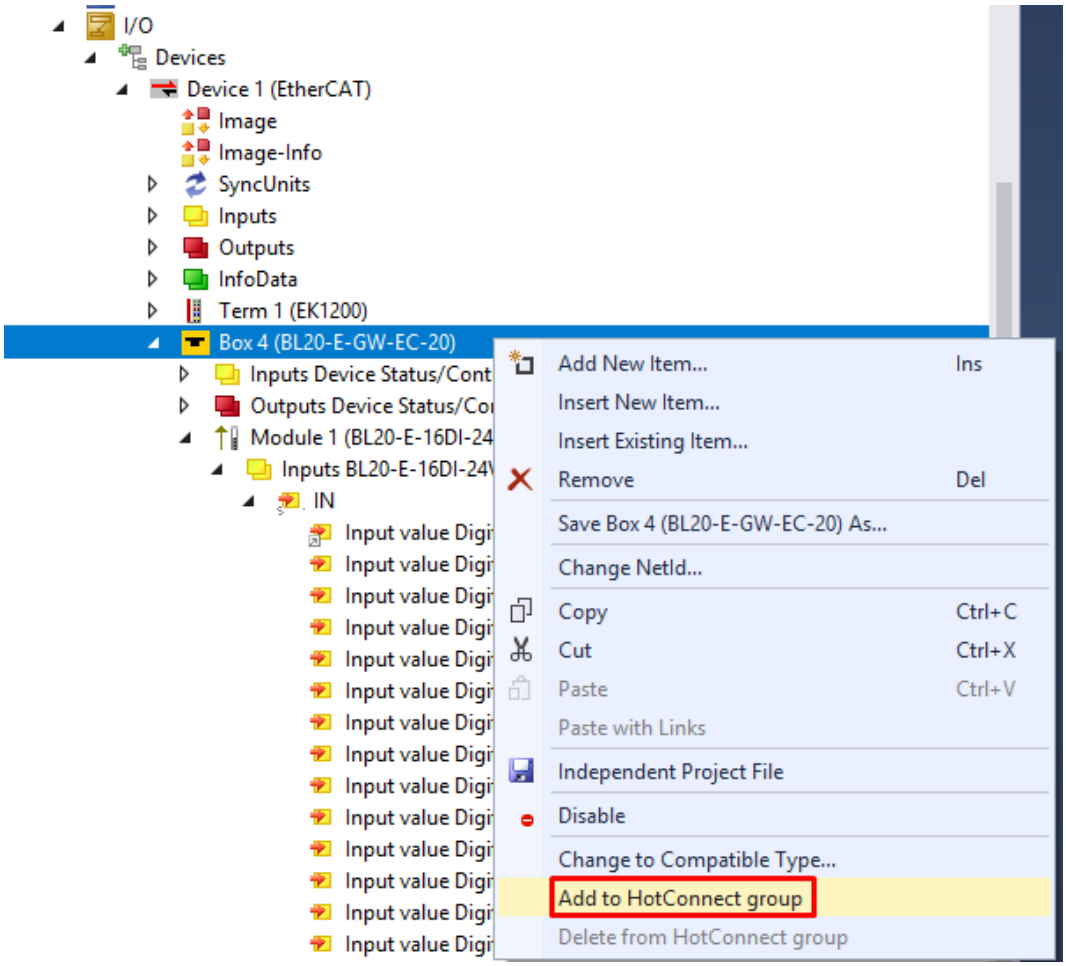


Fig. 24: TwinCAT: Add to HotConnect group

- Select the relevant slave in the **Add Hot Connect Group** window (here: **BL20-E-GW-EC-20**).
- Define the **Identification Value** (hex.) for the HotConnect group (here: **4**).
- Confirm with **OK**.

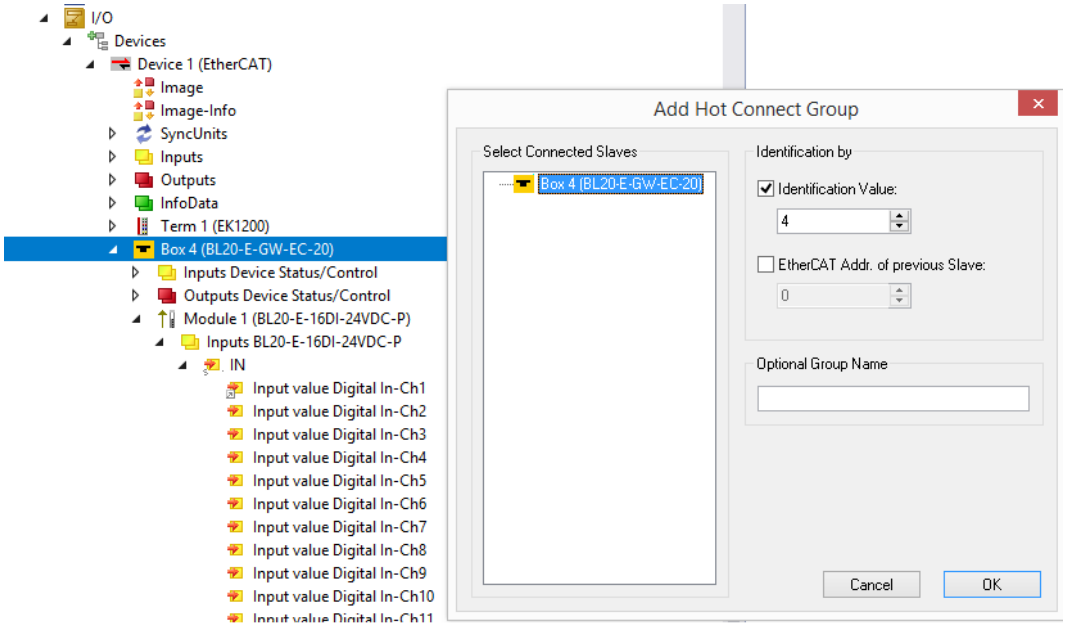


Fig. 25: TwinCAT – Add to HotConnect group

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

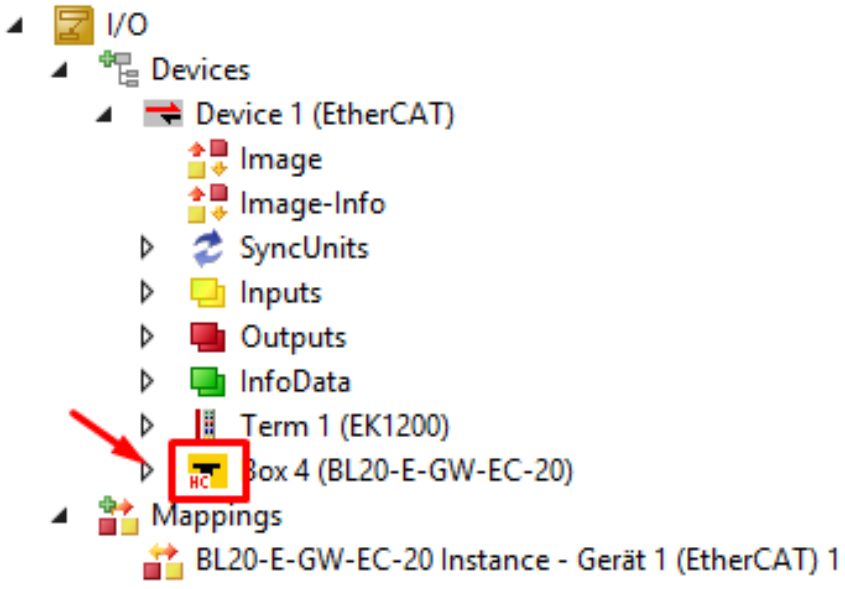


Fig. 26: TwinCAT: Add to HotConnect group

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 4 (BL20-E-GW-EC-20)** → **Delete from Hot Connect Group**.

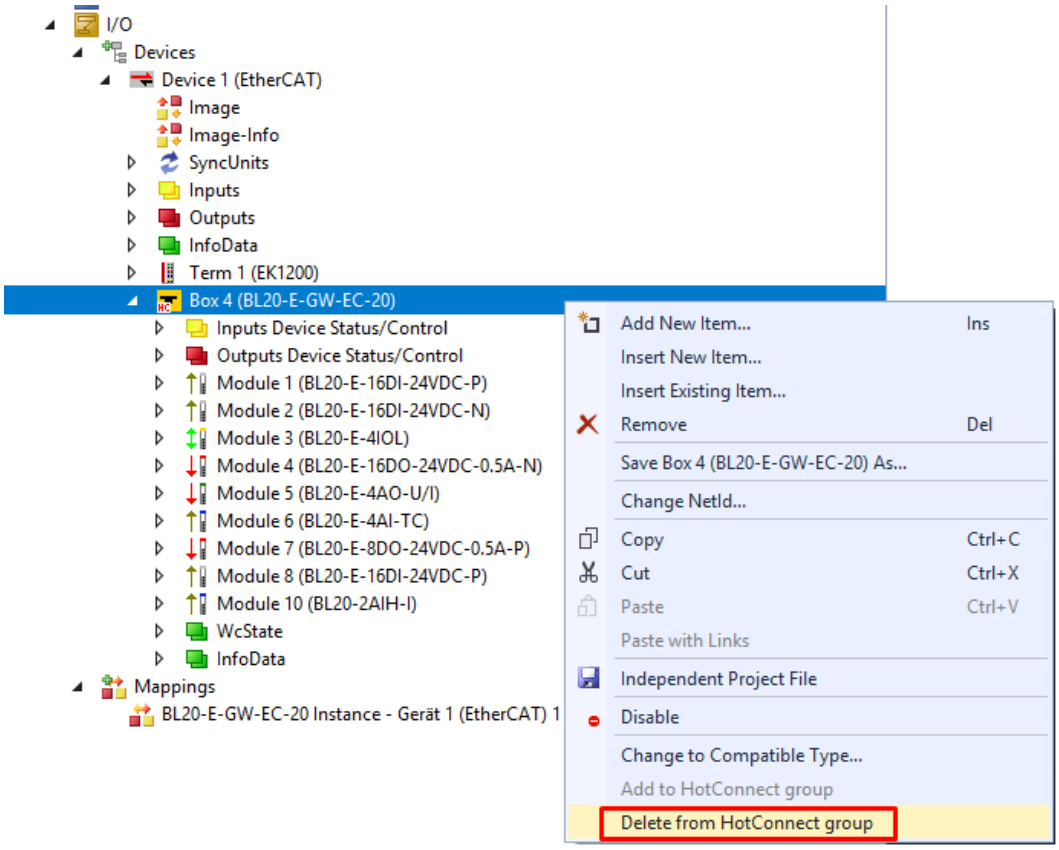


Fig. 27: Delete device from Hot Connect Group

7.4 Connecting the device to an EtherCAT master with CODESYS

Used hardware

The following hardware components are used in this example:

- BL20-E-GW-EC-20 with the following I/O module list:
  - BL20-E-16DI-24VDC-P
  - BL20-E-16DI-24VDC-N
  - BL20-E-4IOL
  - BL20-E-16DO-24VDC-0.5A-P
  - BL20-E-4AO-U/I
  - BL20-E-4AI-TC
  - BL20-E-8DO-24VDC-0.5A-P
  - BL20-E-16DI-24VDC-P
  - BL20-2AIH-I

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 BL20-E-GW-EC-20 (available as a free download at www.turck.com)

7.4.1 Installing ESI files

The device is connected to the Beckhoff controller via an xml file, the EtherCAT Slave Information (ESI). For the connection, the device description file must be stored in CODESYS. The ESI file for the device is available free of charge for download from www.turck.com.

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

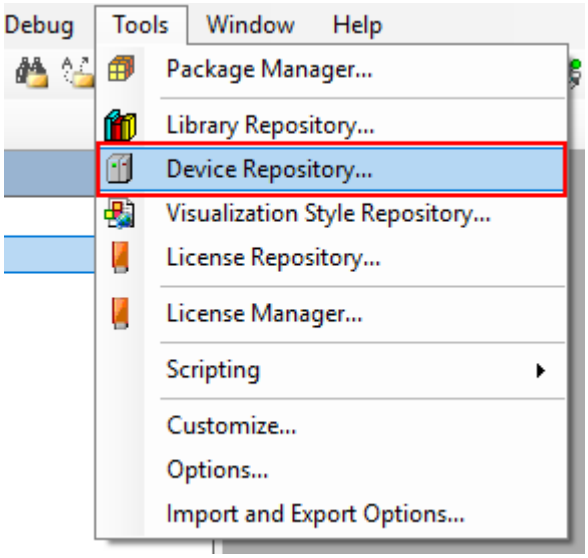


Fig. 28: Device Repository

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

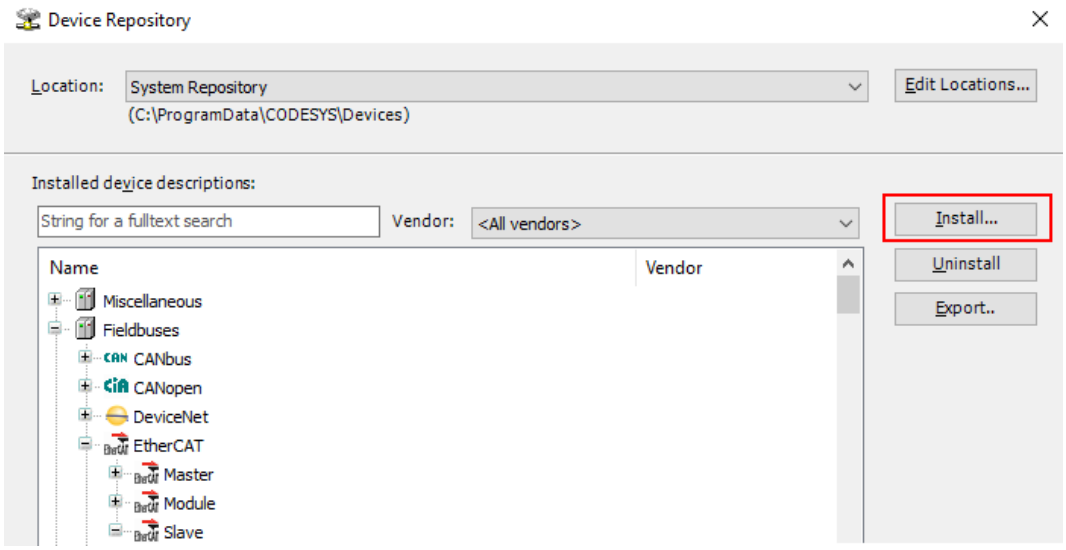


Fig. 29: Installing a device description file

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

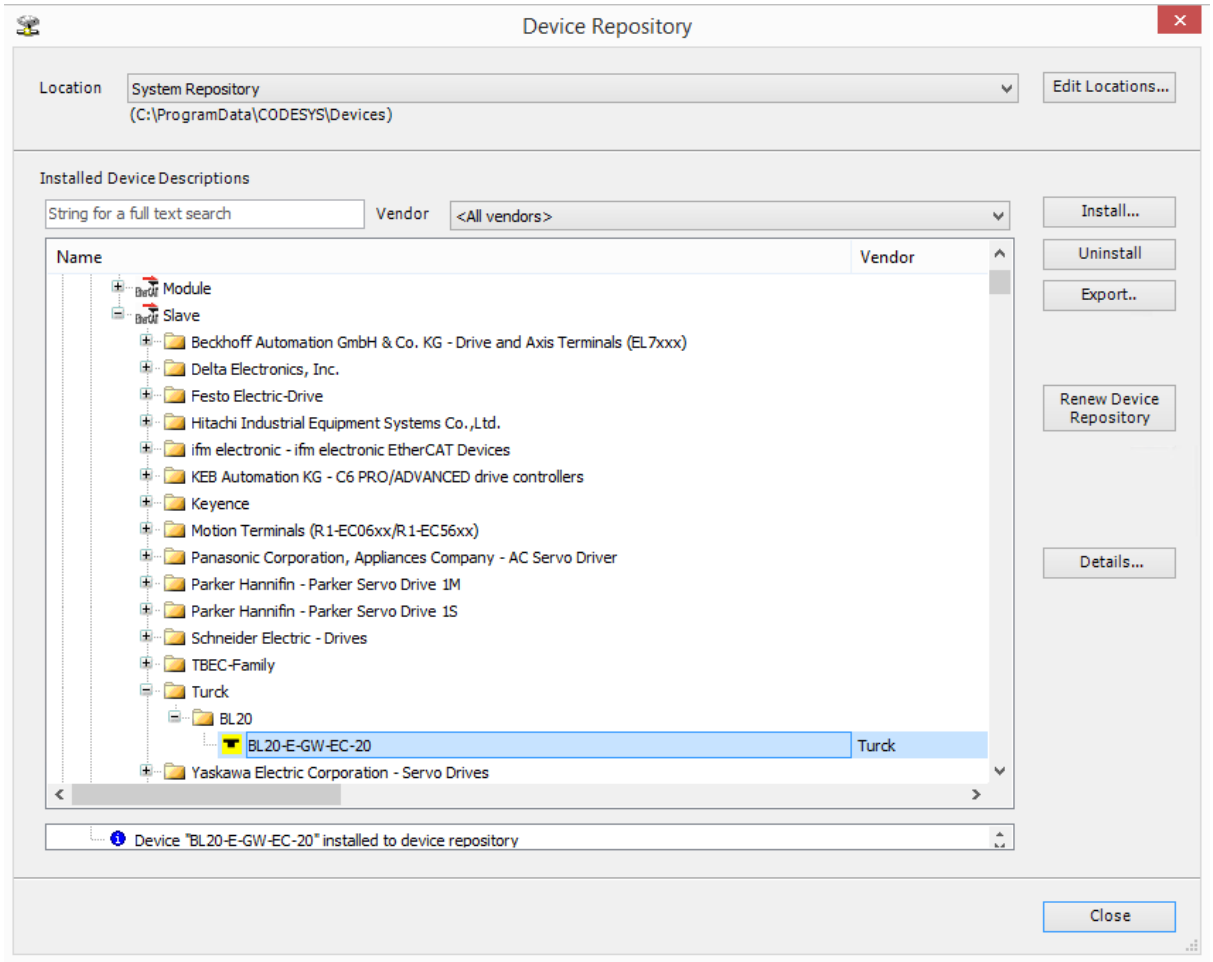


Fig. 30: Installed device description

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

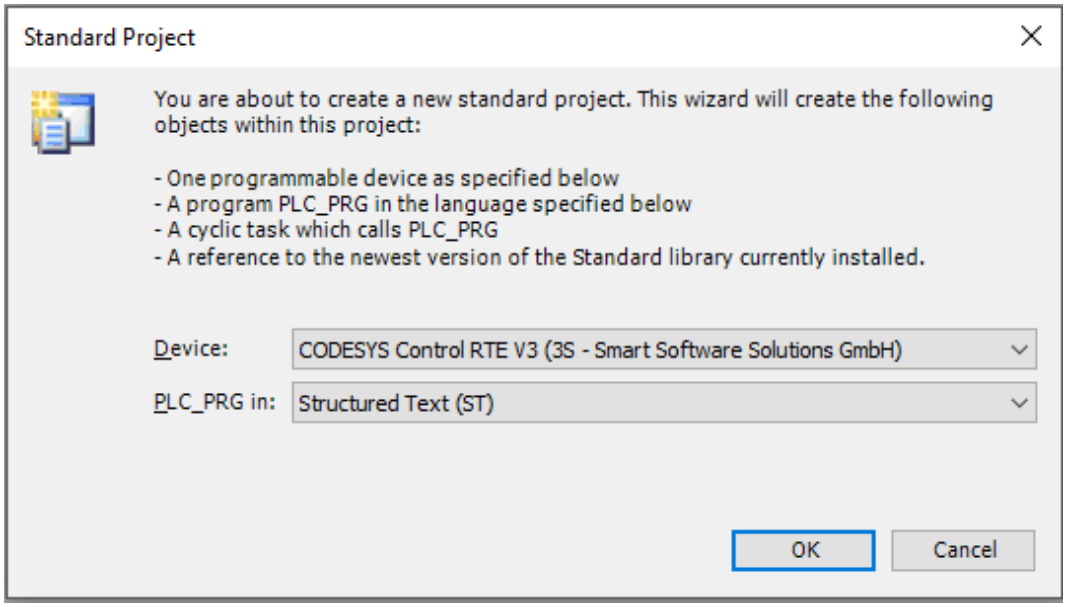


Fig. 31: Example: Creating a project

Adding an EtherCAT master

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

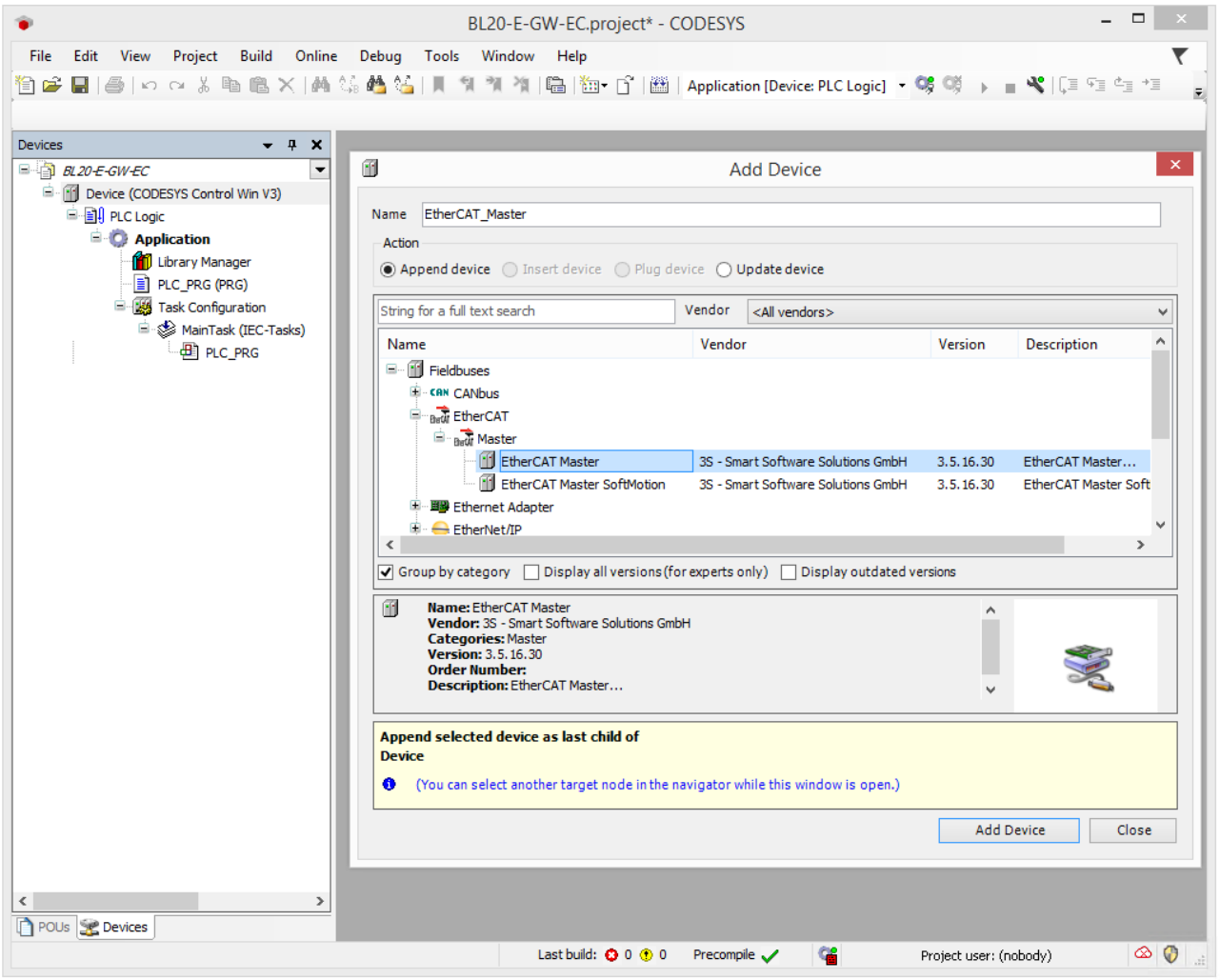


Fig. 32: Adding an EtherCAT master

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

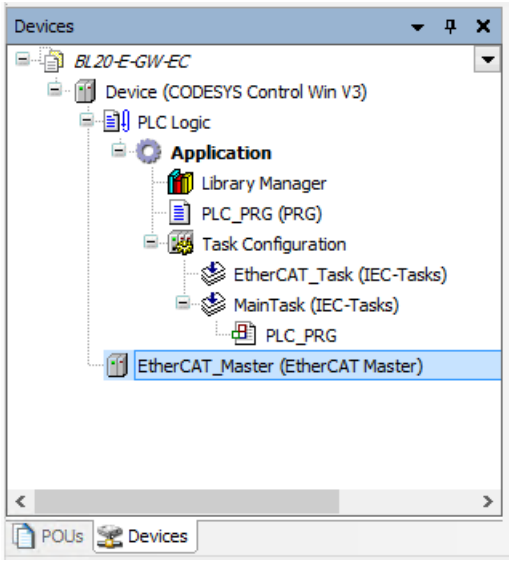


Fig. 33: Project tree

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**.

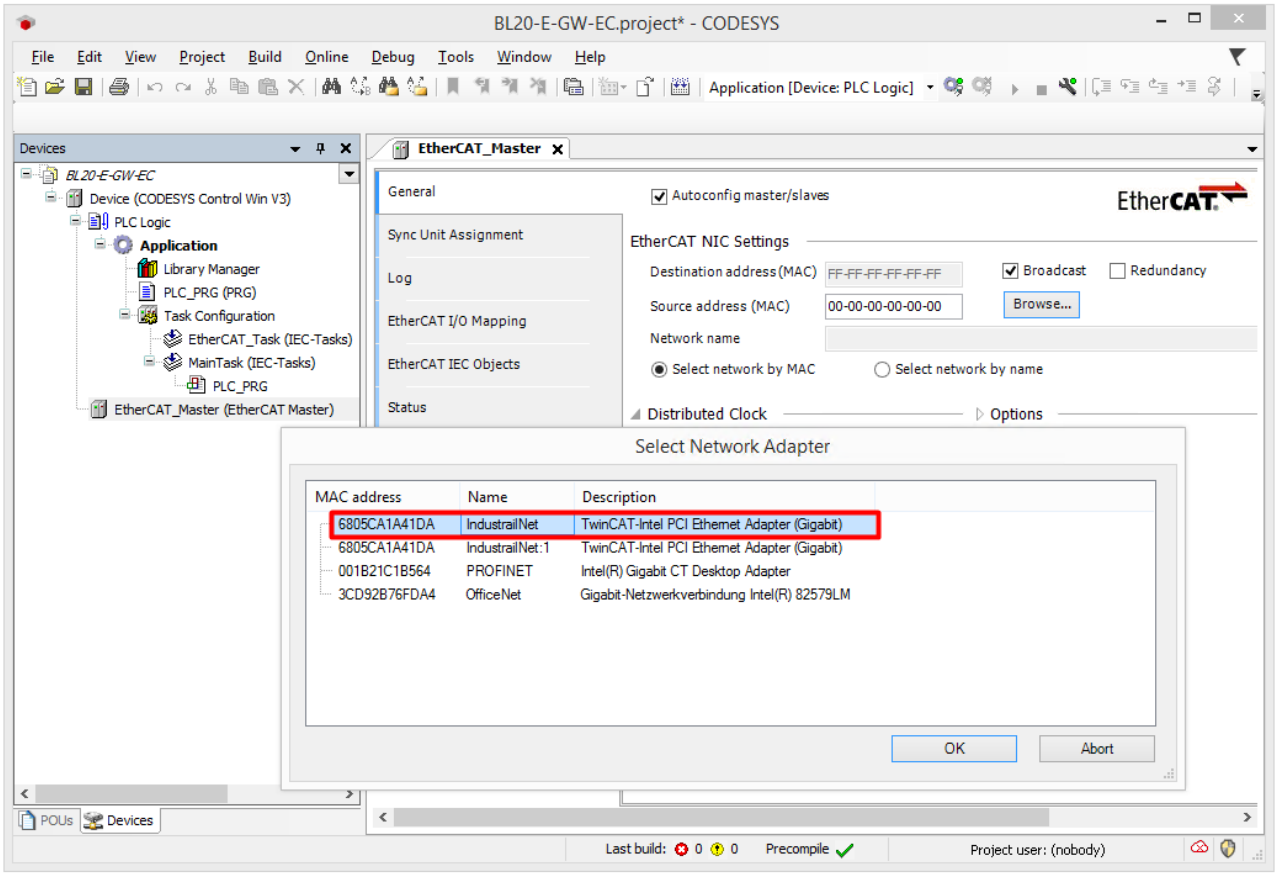


Fig. 34: Selecting a network adapter

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

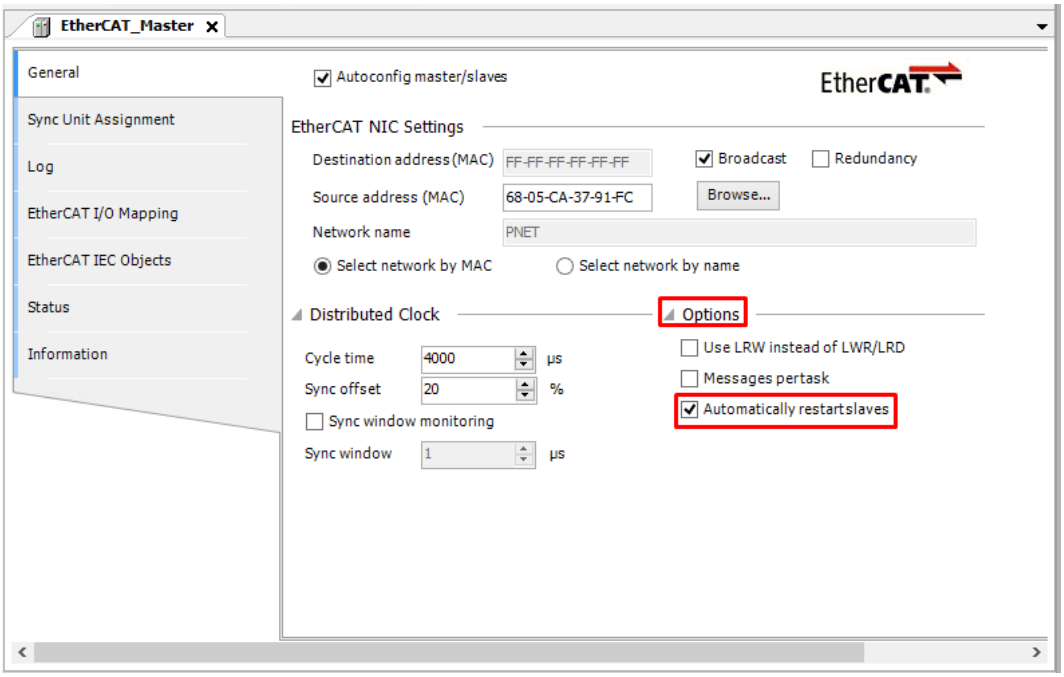


Fig. 35: Restart slaves automatically

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

Adding an EtherCAT slave

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

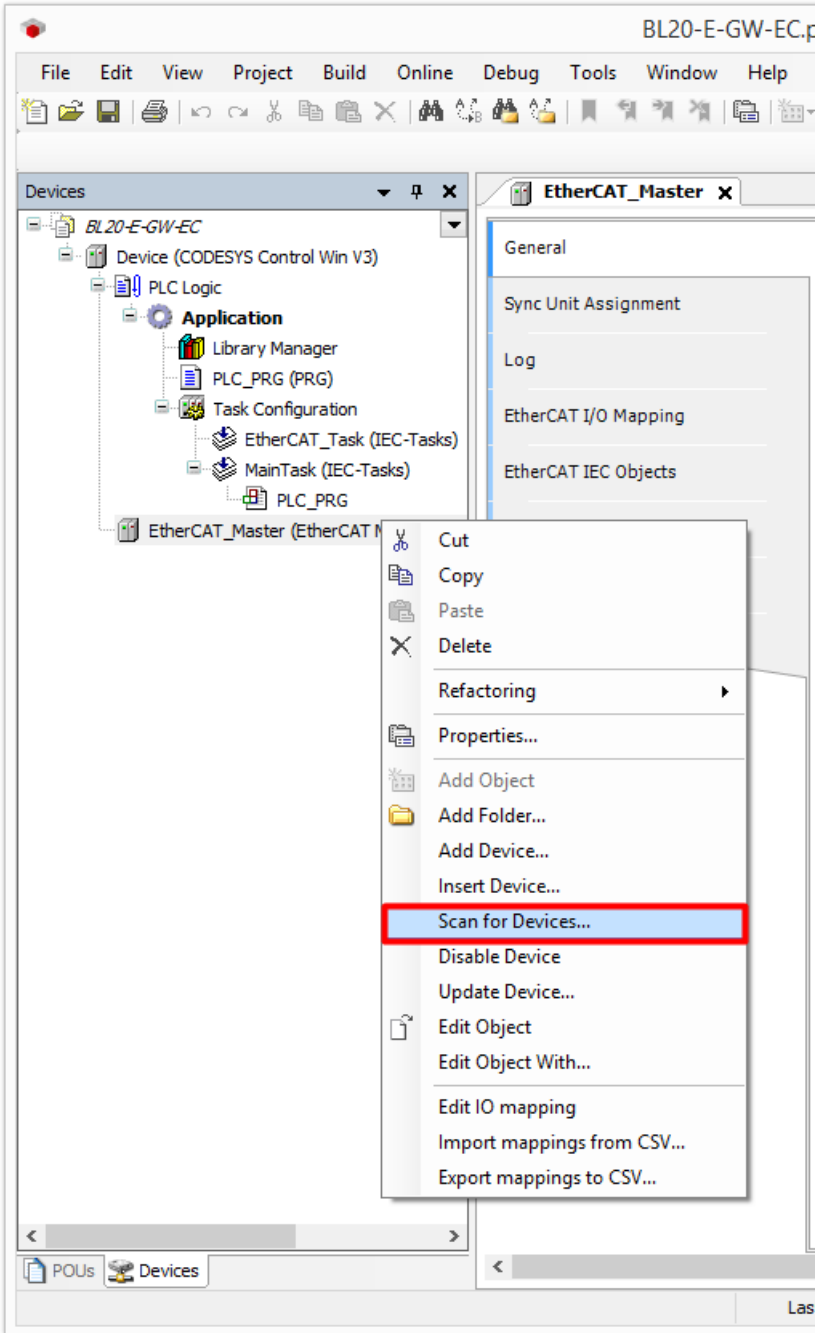


Fig. 36: Scan For Devices

▶ Select the EtherCAT slave (here: **BL20-E-GW-EC-20**) in the following window and click **Copy to project**.

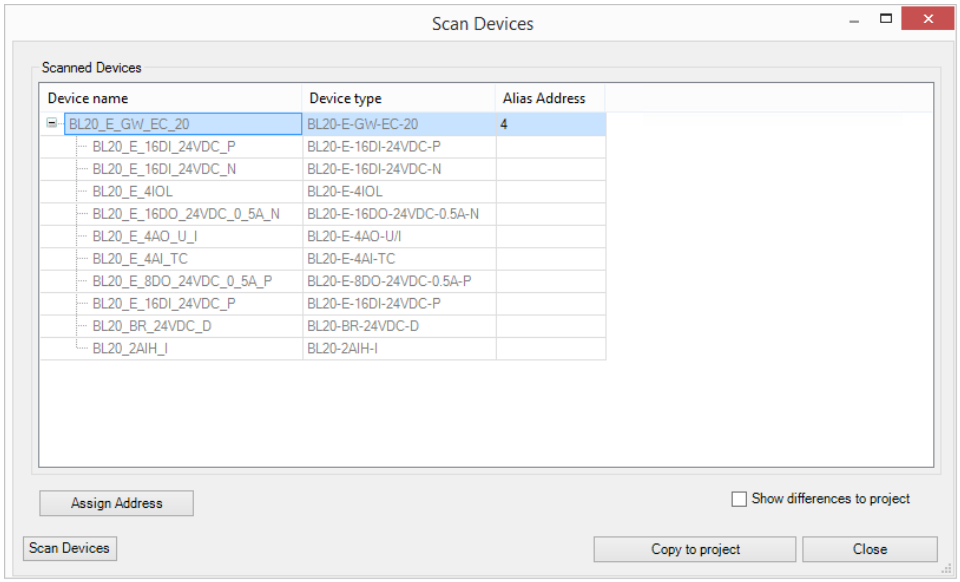


Fig. 37: Copying found devices to the project

➪ The BL20 station (gateway and connected modules) appears in the project tree with the default settings from the ESI file.

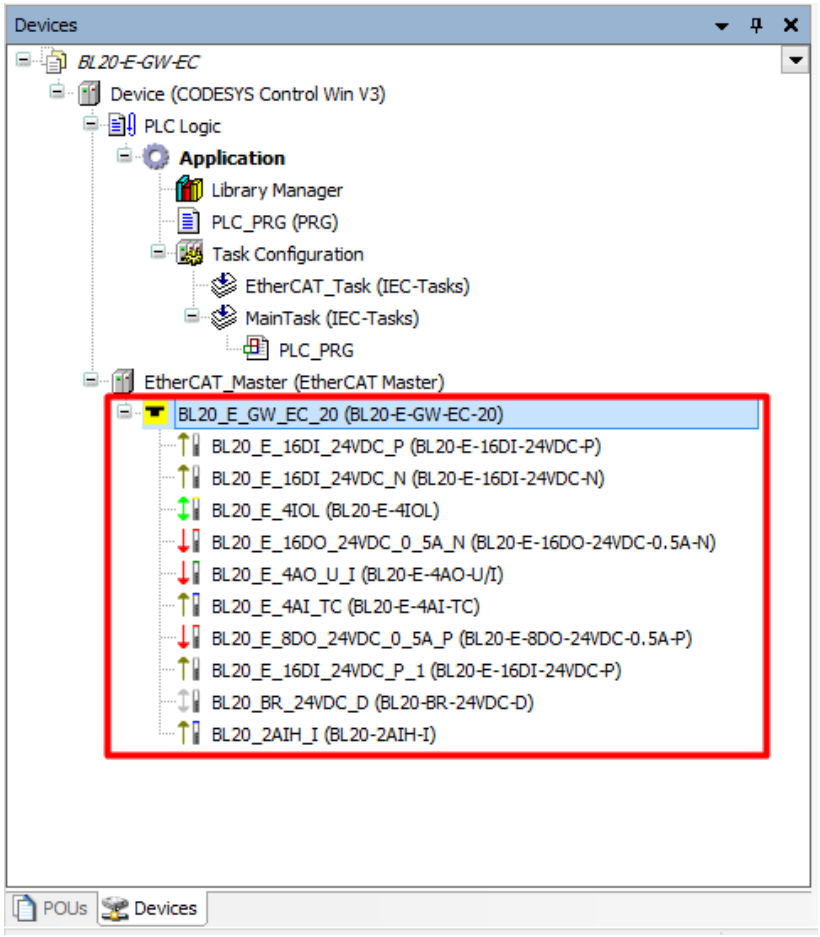


Fig. 38: BL20 station in the project tree

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 **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- ⇨ On the **General** tab → **Diagnostics** the **Operational** status indicates the active connection.

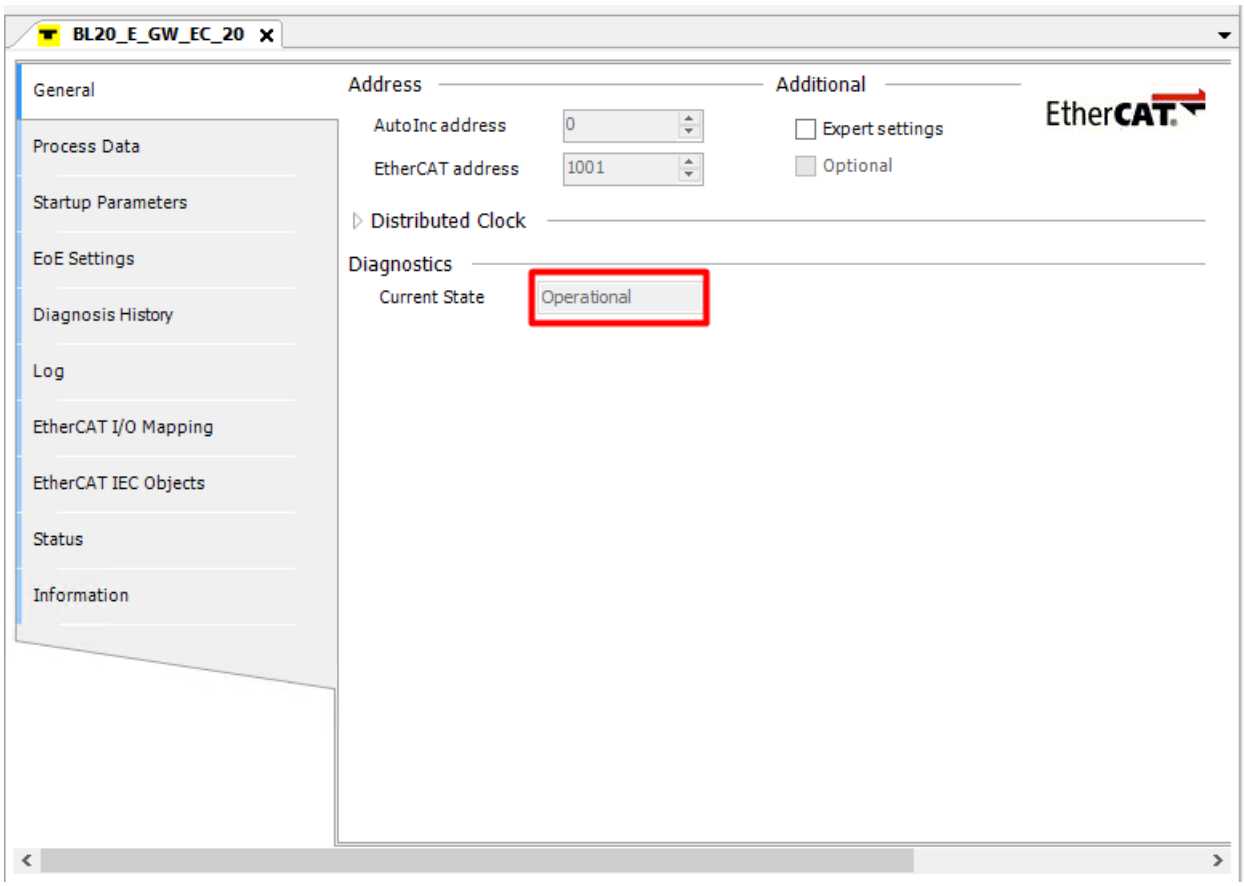


Fig. 39: Status: Operational

7.4.3 Setting startup parameters

The parameters are set in plain text either on the gateway or on the individual I/O modules of the BL20 station.

- ▶ Double-click **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- ▶ Select the **Startup Parameters** tab
- ⇨ The parameters of the BL20 gateway (0xF800) and all I/O modules of the BL20 station are displayed. The start-up parameters of the gateway can be changed here.

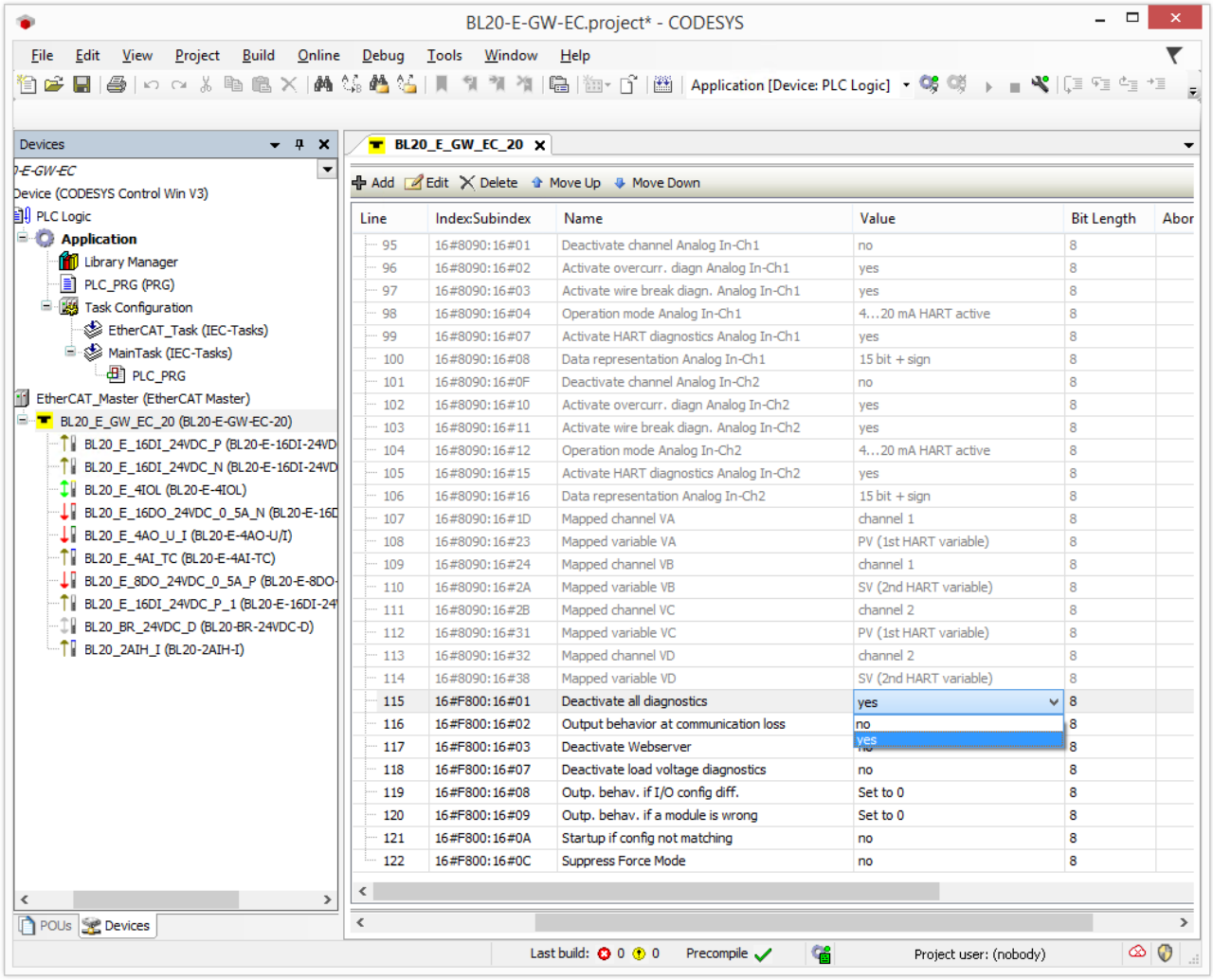


Fig. 40: Start-up parameters of the BL20 gateway

The startup parameters of the I/O modules are set at the respective module.

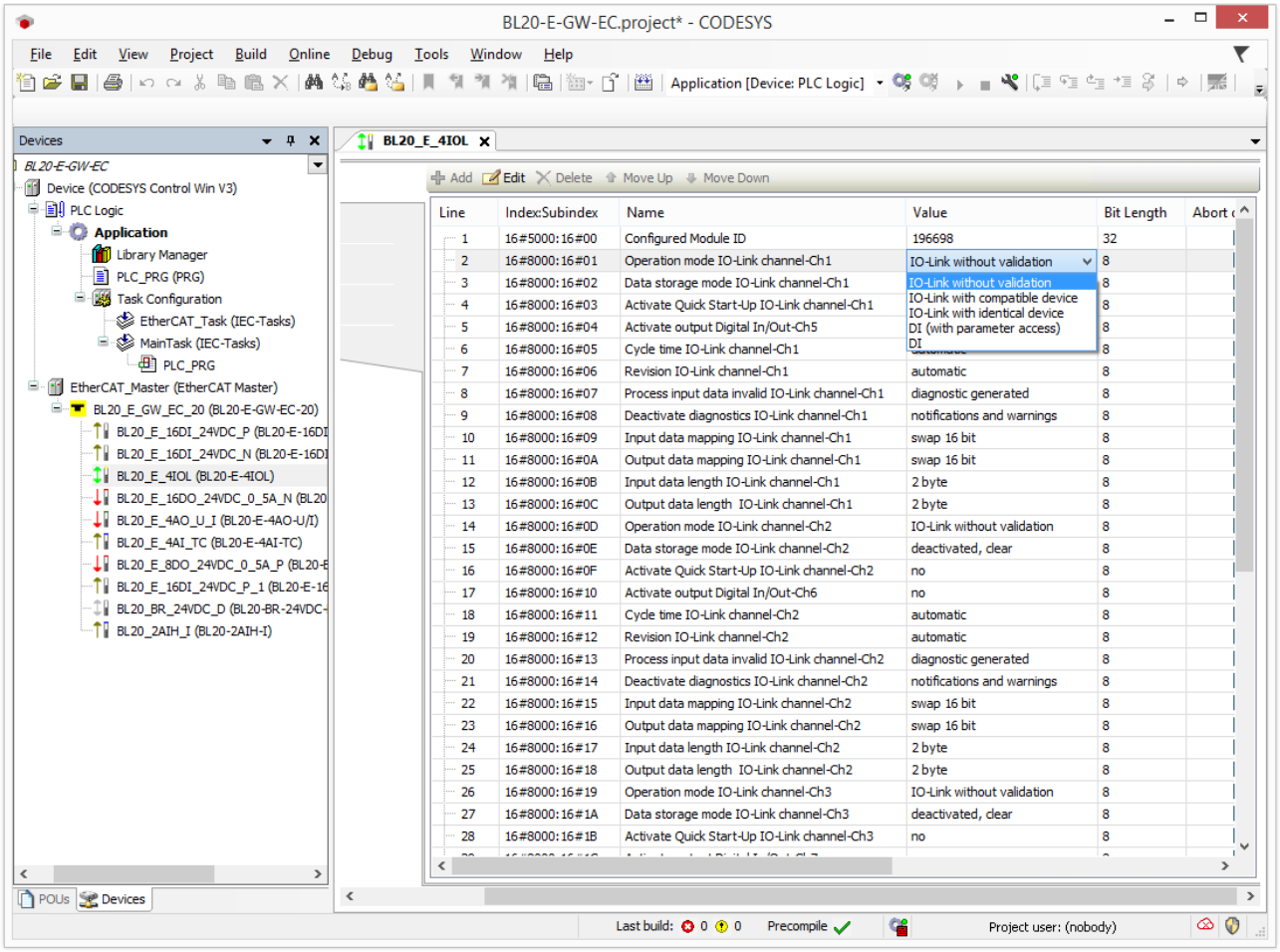


Fig. 41: CODESYS: Setting the start-up parameters at the BL20 I/O module

7.4.4 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

- In the project tree double-click **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- In the **General** tab activate the **Expert Settings** option.

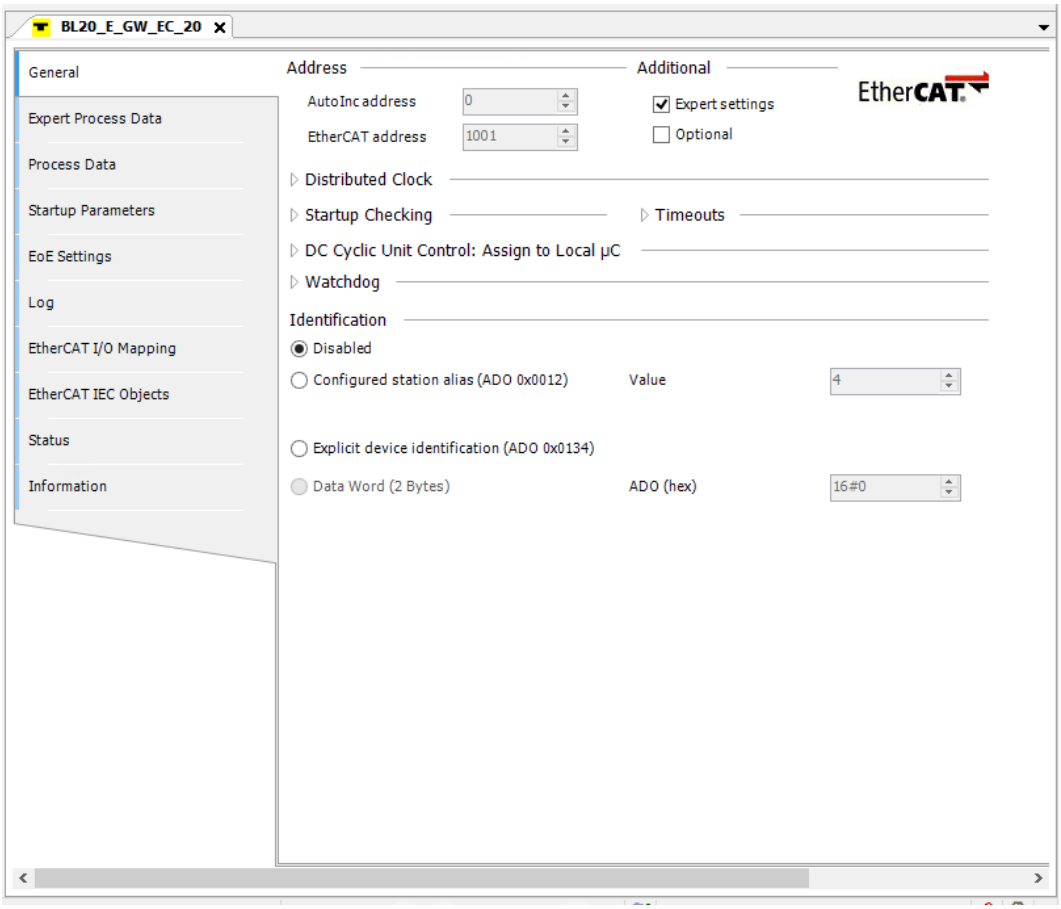


Fig. 42: Activate expert settings

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

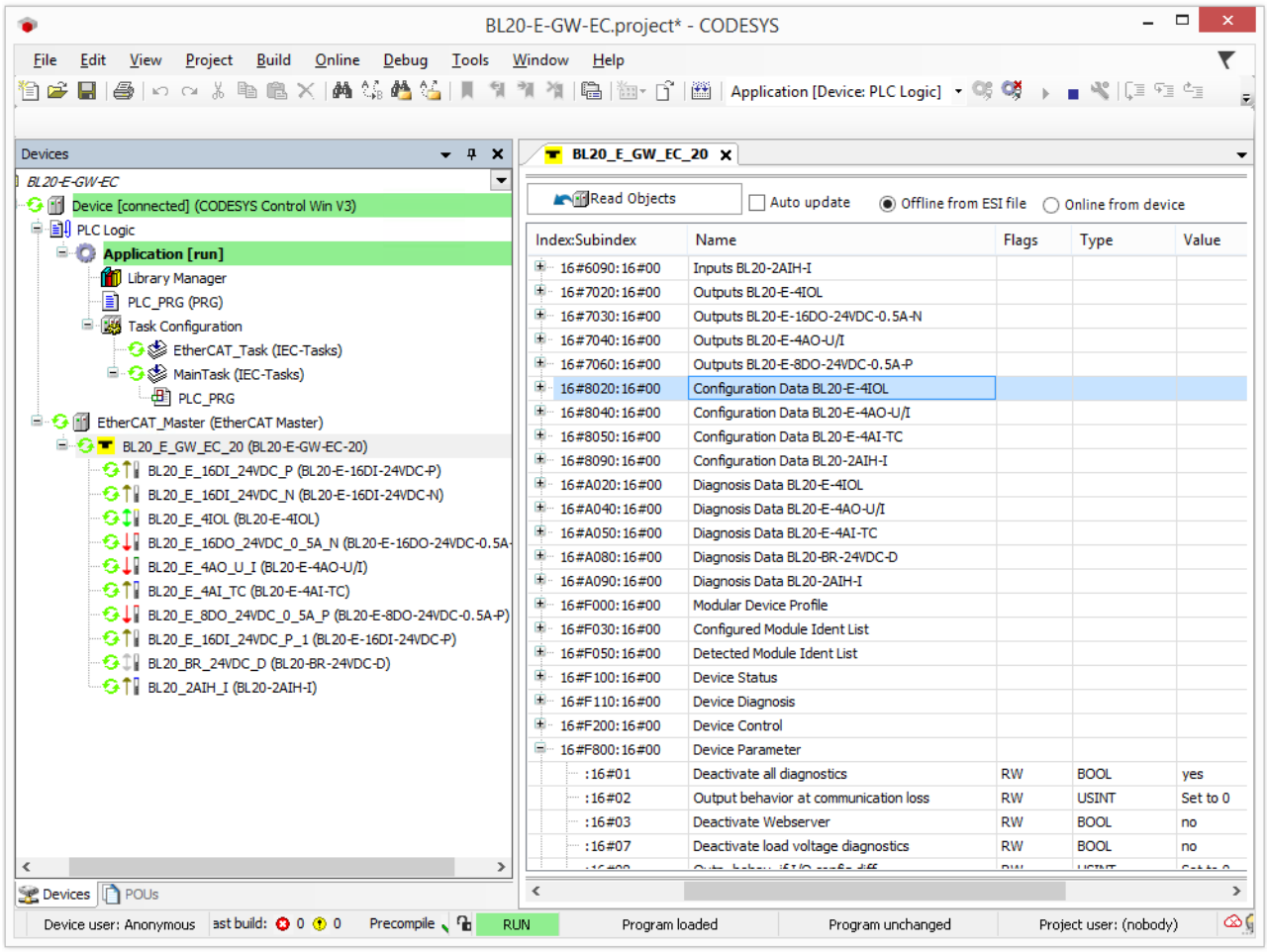


Fig. 43: CODESYS: Object Dictionary

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.

7.4.5 Addressing a device via Explicit Device ID

- In the project tree double-click **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- 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.

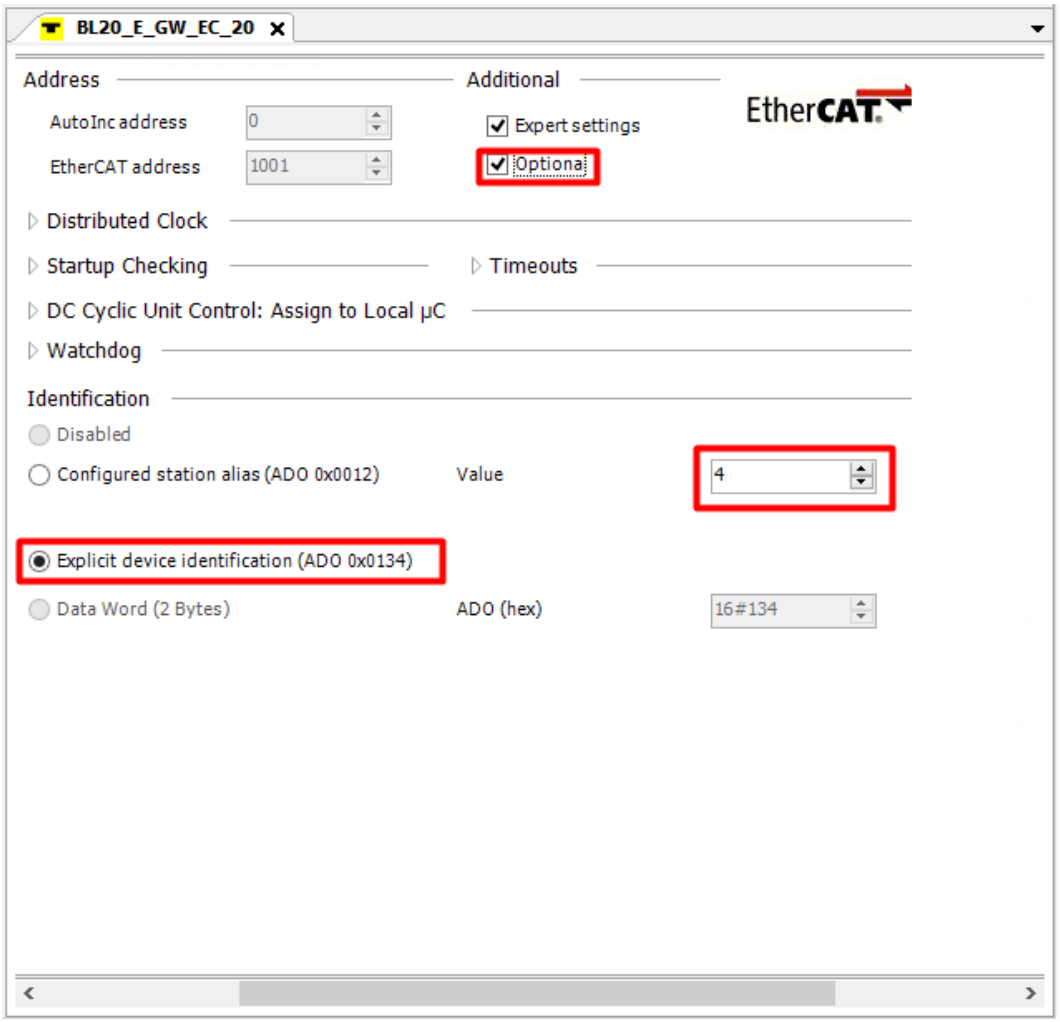


Fig. 44: CODESYS: Explicit Device ID: entering the Identification Value

- Click **Online → Login**.

7.4.6 Addressing a device via Configured Station Alias

- In the project tree double-click **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- 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**.

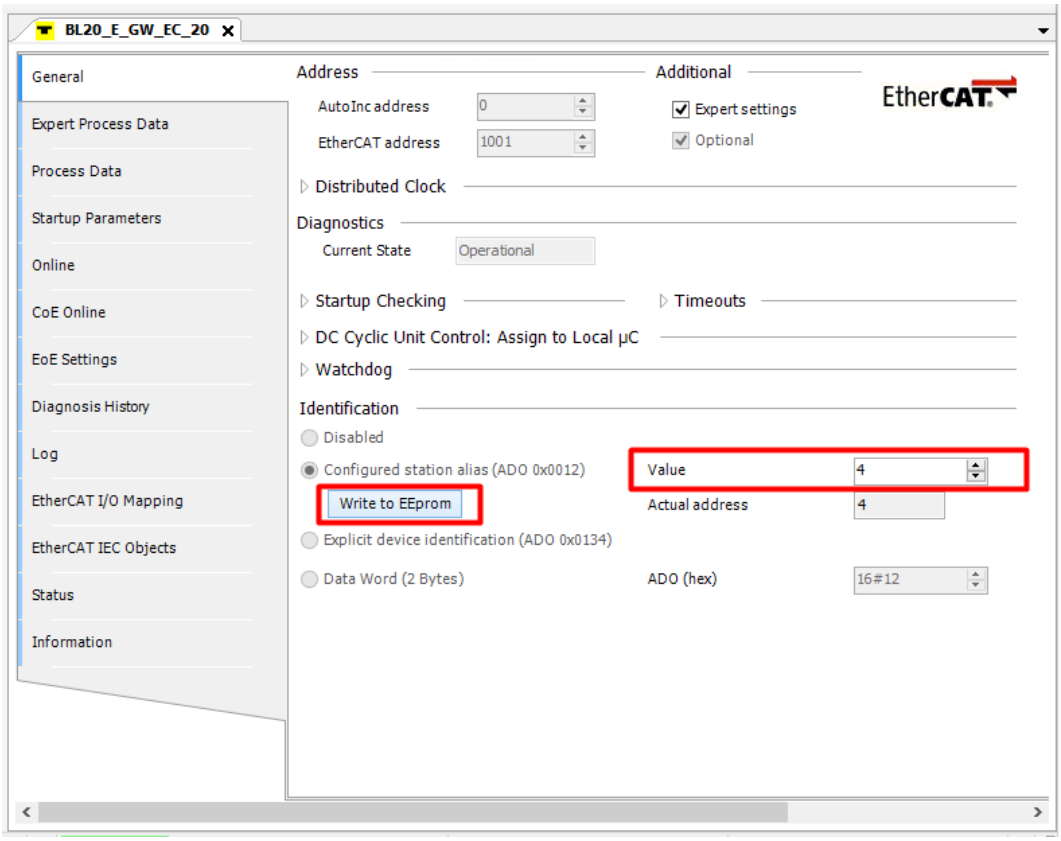


Fig. 45: CODESYS: Configured Station Alias: entering the Identification Value

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

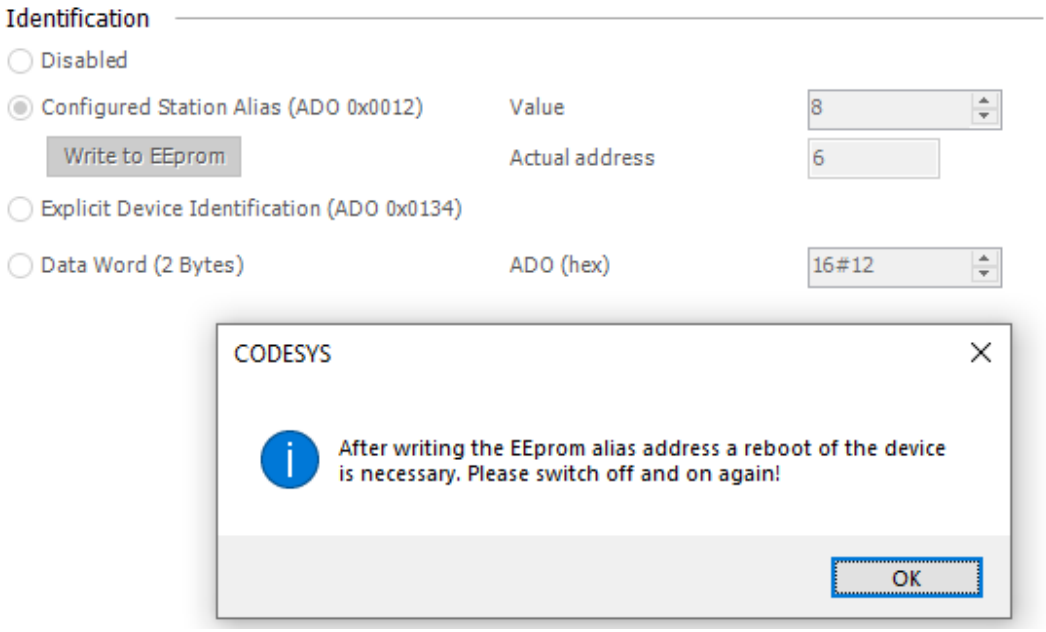


Fig. 46: CODESYS: Restart required

⇨ 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 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.

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.

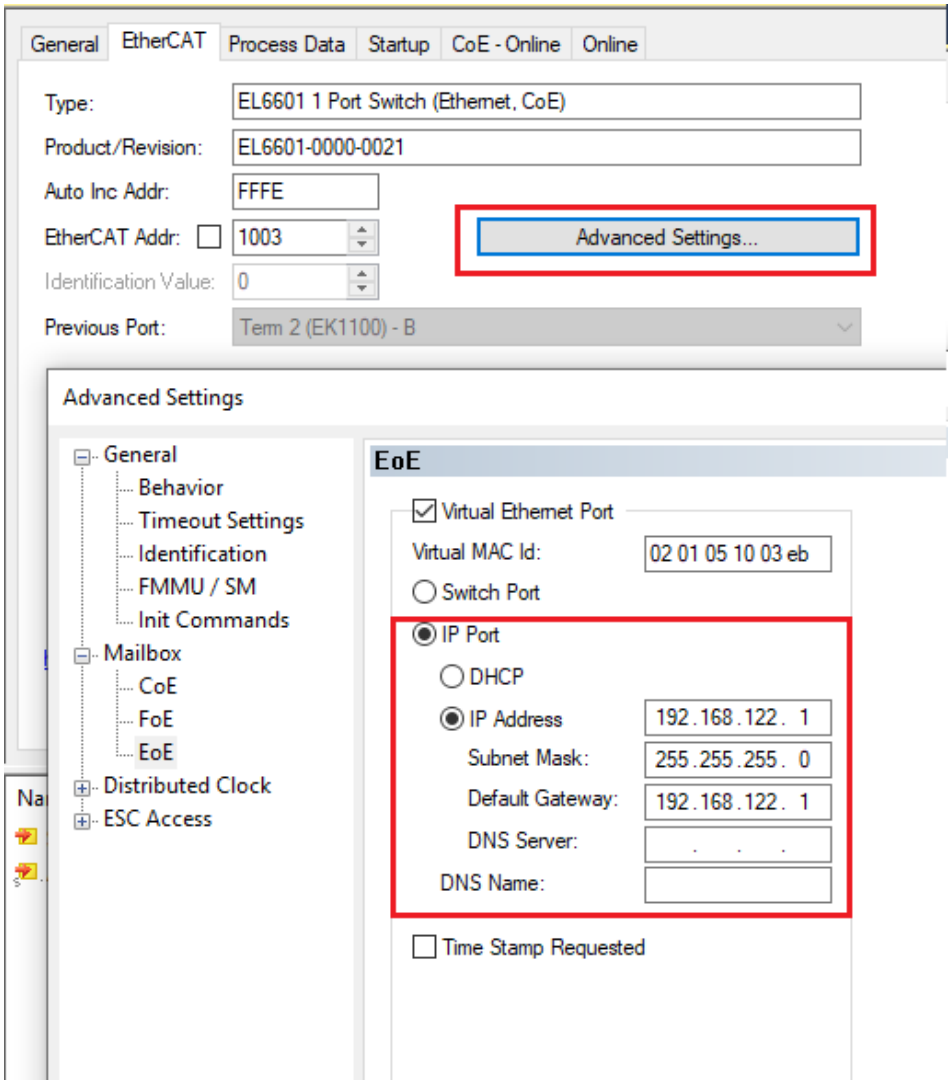


Fig. 47: TwinCAT – Activating EoE in switch port terminal

Activating EoE in EtherCAT slave:

- In the project tree double-click **Box 4 (BL20-E-GW-EC-20)**.
- 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.

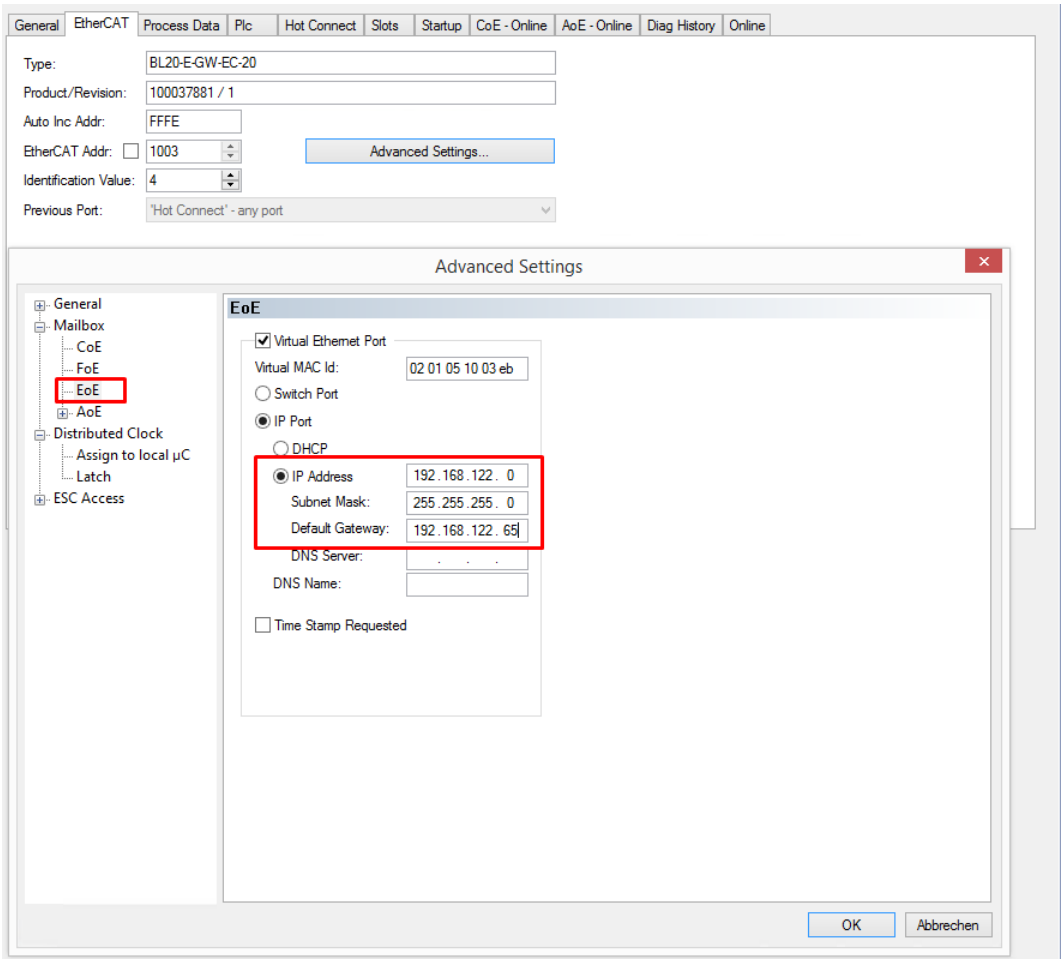


Fig. 48: TwinCAT: activating EoE in EtherCAT slave

NOTE
DHCP is not support by BL20-E-GW-EC-20.

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 **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- ▶ Select the **EoE Settings** tab.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway.**
- ⇨ The EoE function is activated in the EtherCAT slave.

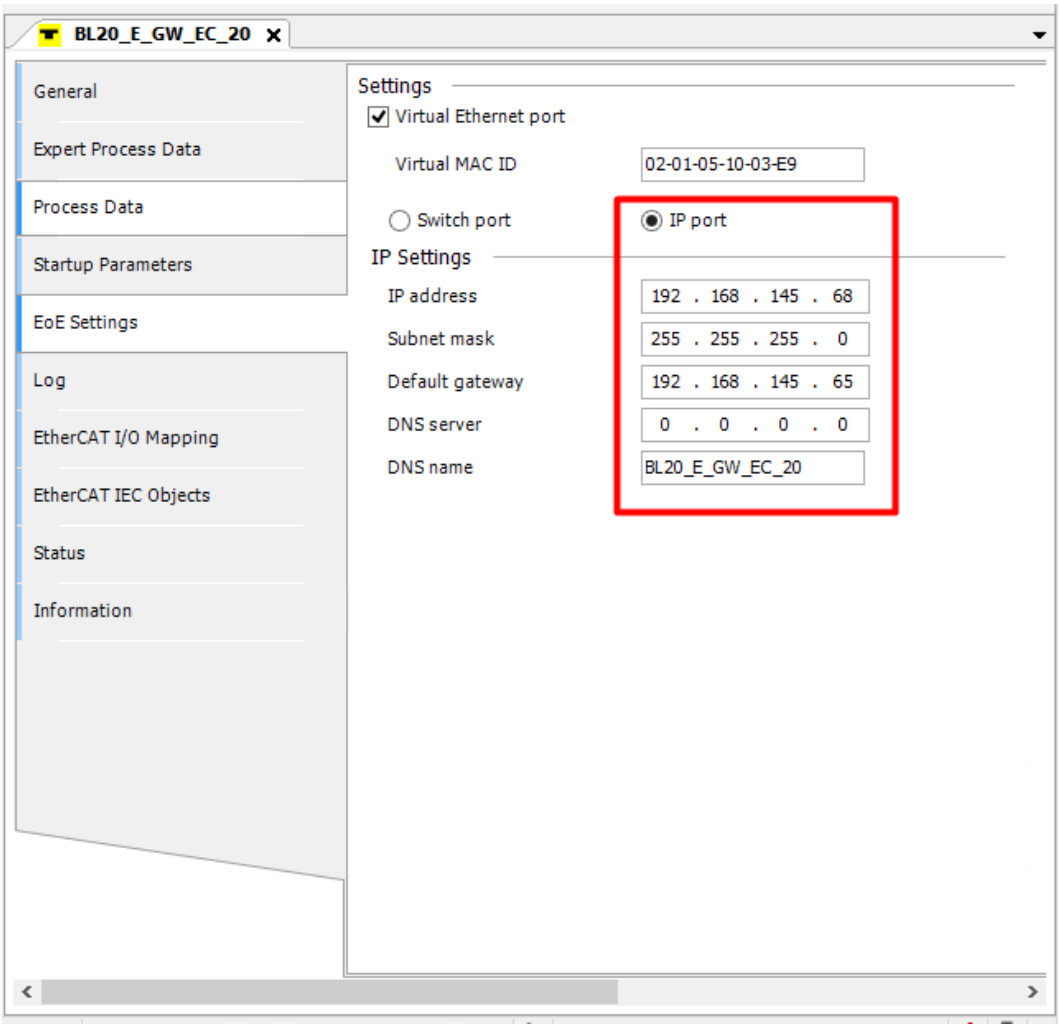


Fig. 49: CODESYS: activating EoE in EtherCAT slave

Configuring the device

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

Configuring the device in the web server

Requirement: The BL20-E-GW-EC-20 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**.

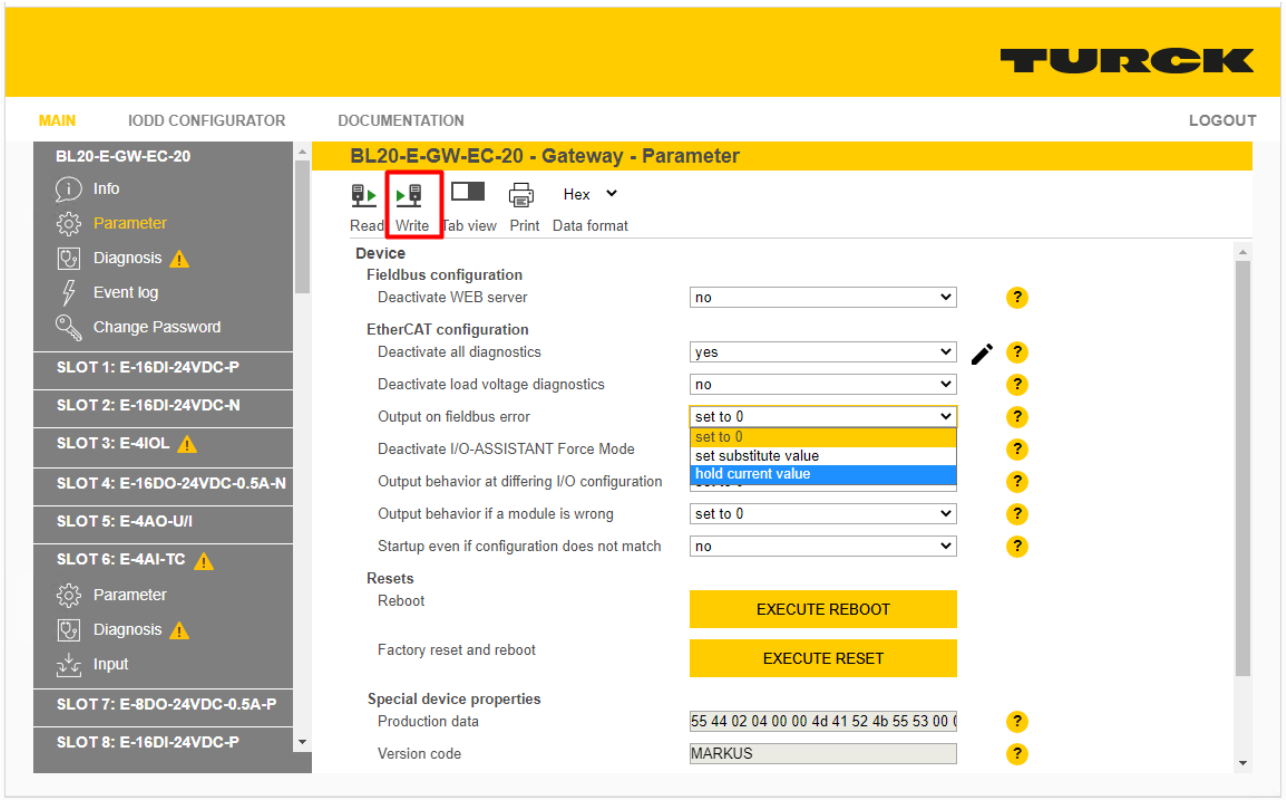


Fig. 50: Web server: configuring the device

7.6 Loading the reference configuration into the gateway

The station configuration (module list) configured in the Engineering Tool is stored as reference configuration in the volatile memory of the gateway when the PLC is started or when the connected EtherCAT slaves are read (scanned).

8 Parameterizing and Configuring

8.1 Modular device model/slot definition

The BL20-E-GW-EC-20 appears in the configuration software as a modular EtherCAT slave with 32 configurable slots (**Terminals**). The slots are configured by adding/plugging predefined EtherCAT modules.

The following table shows a list of supported I/O module types.

Module type	EtherCAT module ID
Digital input modules	
BL20-2DI-120/230VAC	0x00030056
BL20-4DI-24VDC-N	0x00030062
BL20-4DI-24VDC-P	0x0003005C
BL20-4DI-NAMUR	0x00030032
BL20-E-8DI-24VDC-P	0x0003006A
BL20-E-16DI-24VDC-N	0x00030076
BL20-E-16DI-24VDC-P	0x00030074
Digital output modules	
BL20-2DO-120/230VAC-0.5A	0x00030059
BL20-2DO-24VDC-0.5A-N	0x00030053
BL20-2DO-24VDC-2A-P	0x00030057
BL20-2DO-R-CO	0x00030045
BL20-2DO-R-NO	0x00030050
BL20-4DO-24VDC-0.5A-P	0x00030031
BL20-E-8DO-24VDC-0.5A-P/ET	0x00030069
BL20-E-16DO-24VDC-0.5A-N	0x00030075
BL20-E-16DO-24VDC-0.5A-P	0x00030073
Analog input modules	
BL20-2AIH-I	0x0003004C
BL20-2AI-I(0/4…20MA)	0x00030054
BL20-2AI-PT/NI-2/3	0x0003004A
BL20-2AI-THERMO-PI	0x00030049
BL20-2AI-U(-10/0…+10VDC)	0x00030058
BL20-4AI-U/I	0x0003005F
BL20-E-4AI-TC(/ET)	0x00030063
BL20-E-8AI-U/I-4PT/NI(/ET)	0x0003006D
Analog output modules	
BL20-2AOH-I	0x0003004F
BL20-2AO-I(0/4…20MA)	0x00030052
BL20-2AO-U(-10/0…+10VDC)	0x00030047
BL20-E-4AO-U/I(/ET)	0x00030060
Technology modules	
BL20-E-1CNT	0x00030034
BL20-1RS232	0x00030033

Module type	EtherCAT module ID
BL20-1RS485/422	0x0003003F
BL20-1SSI	0x00030041
BL20-2RFID-S	0x0003004D
BL20-E-2CNT-2PWM	0x0003003B
BL20-E-4IOL	0x0003005A
BL20-E-4IOL-10	0x0003005B
BL20-E-3EMM-CT	0x0003007D
BL20-E-3EMM-RC	0x0003007C
Power supply modules	
BL20-BR-24VDC-D	0x00030030
BL20-PF-120/230VAC-D	0x00030042
BL20-PF-24VDC-D	0x0003003E
Special modules	
empty slot	0x00030078
undefined module	0x0003007A
unsupported module	0x00030079

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	Deactivate load voltage diagnostics	-	-	-	Deact. web server	Output behavior at communica-tion loss		Deactivate all diags
	0x0F… 0x08	1	-	Deactivate Force Mode	-	Startup if config not matching	Output behavior if one module is wrong		Output behavior at I/O config difference	

Meaning of parameter bits

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

CoE index	Sub index	Designation		Meaning
0xF800	0x01	Deactivate all Diags	**0: No**	All diagnostic and alarm messages are sent.
			1: Yes	All diagnostic and alarm messages are suppressed.
	0x02	Output behavior at communication loss	Failure of the EtherCAT communication	
			00: Set to 0	If the EtherCAT communication fails, the gateway switches the digital output channels to 0.
			01: Substitute value	The gateway sends an error information to the I/O modules and switches the outputs of I/O modules that do not have a substitute value parameter (e.g. digital output modules) to 0. Outputs of I/O modules with substitute value parameter (e.g. example BL20-E-4AO-U/I) send the substitute value, which may also have been parame-terized channel-specific in the module.
			10: Hold cur-rent value	The gateway holds the instantaneous value for the outputs of the I/O modules.
	0x03	Deact. Web server	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.
	0x07	Deactivate load voltage diagnostics		
			0: No	Load voltage diagnostics are activated.
			1: Yes	All load voltage diagnostics are deactivated.

CoE index	Sub index	Designation		Meaning
	0x08	Output behavior if I/O config differs	The module list has been changed adaptably, i.e. it contains at least one module that has not been configured but whose process data width matches that of the configured module.	
			00: Set to 0	The gateway switches the outputs of modules to 0.
			01: Substitute value	The gateway sends an error information to the I/O modules and switches the outputs of I/O modules that do not have a substitute value parameter (e.g. digital output modules) to 0. Outputs of I/O modules with substitute value parameter (e.g. example BL20-E-4AO-U/I) send the substitute value, which may also have been parameterized channel-specific in the module.
			10: Hold current value	The gateway holds the instantaneous value for the outputs of the I/O modules.
			11: Exchange process data	The gateway continues to exchange process data with the other module bus stations.
	0x09	Output behavior if a module is wrong	The module list has been changed in a non-adaptable way, i.e. the process data width of the currently plugged I/O modules no longer corresponds to the process data width of the previously configured modules. The BL20 station contains at least one wrong module.	
			00: Set to 0	The gateway switches the outputs of modules to 0. The gateway does not send error information.
			01: Substitute value	The gateway sends an error information to the I/O modules and switches the outputs of I/O modules that do not have a substitute value parameter (e.g. digital output modules) to 0. Outputs of I/O modules with substitute value parameter (e.g. example BL20-E-4AO-U/I) send the substitute value, which may also have been parameterized channel-specific in the module.
			10: Hold current value	The gateway holds the instantaneous value for the outputs of the I/O modules.
			11: Exchange process data	The gateway continues to exchange process data with the other module bus stations.
	0x0A	Startup if config not matching	Startup also if configuration does not match	
			0: No	After a configuration change during operation, a dynamic configuration transfer is initiated (applies e.g. to acyclic parameterization). The communication to EtherCAT is interrupted immediately. The behavior is independent of the parameterization for the error case.
			1 = Yes	The start-up of the BL20 station with a deviating module list is possible. Depending on the gateway parameterization ("Output behavior at I/O config differing" or "Output behavior if one module is wrong"), the process data exchange can continue. A station with an unsupported I/O module does not start.
	0x0C	Deactivate Force Mode	**0: No**	-
			1: Yes	The force mode is deactivated. The use of the DTM is currently not supported.

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

The Gateway parameters are set via Device Level Entries [▶ 59].

The parameters of the I/O modules plugged into the BL20 station occupy the CoE indices 0x8000…0x8FFF. 16 byte parameters are reserved for each I/O module. A maximum of 32 I/O modules can follow the gateway. The parameters of the I/O modules occupy the indices according to the module sequence in the BL20 station:

- I/O module 1: 0x8000…0x800F
- I/O module 2: 0x8010…0x801F
- I/O module 3: 0x8020…0x803F
- …
- I/O module 32: 0x81F0…0x81FF

9 Operating

9.1 Input Area, TxPDOs, 0x6000…0x6FFF

The input data of the I/O modules plugged into the BL20 station occupy the CoE indices 0x6000…0x6FFF. 16 byte input data are reserved for each I/O module. A maximum of 32 I/O modules can follow the gateway. The input data of the I/O modules occupy the indices according to the module sequence in the BL20 station:

- I/O module 1: 0x6000…0x600F
- I/O module 2: 0x6010…0x601F
- I/O module 3: 0x6020…0x603F
- …
- I/O module 32: 0x61F0…0x61FF

9.2 Output Area, RxPDOs, 0x7000…0x7FFF

The output data of the I/O modules plugged into the BL20 station occupy the CoE indices 0x7000…0x7FFF. 16 byte output data data are reserved for each I/O module. A maximum of 32 I/O modules can follow the gateway. The output data of the I/O modules occupy the indices according to the module sequence in the BL20 station:

- I/O module 1: 0x7000…0x700F
- I/O module 2: 0x7010…0x701F
- I/O module 3: 0x7020…0x703F
- …
- I/O module 32: 0x71F0…0x71FF

9.3 LED displays

LED GW	Meaning
Off	No voltage
Green	Gateway ready for operation
Green flashing	Undervoltage U_{SYS} and or U_L
Orange (LED lights up red and green at the same time)	Internal flashing of the device after firmware download via FoE
Red	At least one I/O module sends active diagnosis.
Red flashing	Wink command active

LED IOs	Meaning
Green	The configured modules match the plugged modules.
Red blinking	No communication via the module bus At least one module has to be plugged and has to be able to communicate with the gateway.
Red/green flashing	■ The current and the projected module list do not match. The data exchange is still in progress. ■ The gateway is still in INIT status, the module list has not yet been written to the gateway.

LED RUN	Meaning
Off	Status Init
Green flashing	Status Pre Operational
Green flashing, 1 ×	Status Safe Operational
Green	Status Operational
Green flickering	Status Bootstrap

LED ERR	Meaning
Off	No error
Red	Controller error (Application controller Failure)
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

9.4 Device Area: Device Status (0xF100)

The CoE index "Device Status" (0xF100) contains the cross-station status word.

CoE index	Byte no.	Bit (sub index)							
		7	6	5	4	3	2	1	0
0xF100	0	-	-	-	-	-	-	-	-
	1	-	Force Mode active (0x0F)	-	-	-	-	-	-
	2	Reserved							
	3								

Meaning of the status bits

CoE sub index	Diagnostics	Meaning
0x0F	Force mode active	Currently not supported The force mode has been activated via the service interface (by DTM).

9.5 Device Area: Device Diagnosis (0xF110)

The CoE index "Device Diagnosis (0xF110) contains the cross-station status diagnostic

CoE index	Byte no.	Bit (sub index)							
		7	6	5	4	3	2	1	0
0xF110	0	Under-voltage U_L (0x08)	-	-	-	I/O configura-tion changed (0x04)	-	-	Summarized module diagnosis (0x01)
	1	-	-	-	-	Master config-uration error (0x0C)	Module bus error (0x0B)	Undervoltage U_{SYS} (0x0A)	Overvoltage U_{SYS} (0x09)
	2	reserved							
	3								

Meaning of Diagnostic Bits

CoE sub index	Diagnostics	Meaning
0x01	Summarized module diagnosis	Group diagnostics, at least one I/O module with diagnostics function reports a diagnosis
0x04	I/O configuration changed	The real module list was changed so that process data can still be exchanged with the I/O modules. The module list created in the configuration software of the EtherCAT master serves as reference.
0x08	Undervoltage U_L	Load voltage U_L too low
0x09	Overvoltage U_{SYS}	System supply U_{SYS} too high (> 30 VDC)
0x0A	Undervoltage U_{SYS}	System supply U_{SYS} too low (< 18 VDC)
0x0B	Module bus error	No communication of the I/O modules on the module bus
0x0C	Master configuration error	The module list of the station (hardware) has been changed in such a way that process data can no longer be exchanged with the I/O modules.

9.6 Diagnosis Data, 0xA000…0xAFFF

The diagnostic data of the I/O modules plugged into the BL20 station occupy the CoE indices 0xA000…0xAFFF. 16 byte diagnostic data are reserved for each I/O module. A maximum of 32 I/O modules can follow the gateway. The diagnostic data of the I/O modules occupy the indices according to the module sequence in the BL20 station:

- I/O module 1: 0xA000…0xA00F
- I/O module 2: 0xA010…0xA01F
- I/O module 3: 0xA020…0xA03F
- …
- I/O module 32: 0xA1F0…0xA1FF

9.7 Diag History Object (0x10F3)

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

The default values (if available) are written in **bold**.

Sub index	Name	Data type	Access type	PDO mapping	Description
0x01	Maximum messages	UNSIGNED8	R	No	Read: Max. number of diagnostic messages (here: 50 messages) that can be stored in the diagnostic history (see sub index 6 ff.).
0x02	Newest message	UNSIGNED8	RO	No	Sub index of the latest diagnostic message (6…255), Start 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)
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

Sub index	Name	Data type	Access type	PDO mapping	Description
0x05	Flags	UN-SIGNED16	RW	No	Flag for **controlling the sending and saving** of diagnostic messages. ■ Bit 0: Enable sending of emergencies, see "Sending emergencies". – 0: Disabled (default, if the device does not support emergencies) – 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** – 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 messages (max. 50 messages, see 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 = nfo message 01 = warning messag 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 [▶ 69]
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)
Manufacturer specific text IDs Meaning of the text IDs, see diagnostic data (Diagnostic data, 0xA000…0xAFFF) Bit 15 = 0: incoming message (Appear), Example: 0x**0**101 Bit 15 = 1: outgoing message (Disappear), Example: 0x**8**101	

9.8 Resetting the device (Reset)

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

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

9.8.1 Resetting the device via DIP switches

The gateway is reset via the DIP switches as follows:

▶ Before starting the device: Set DIP switch 2^5 = "1" and DIP switch "Mode" = "on".

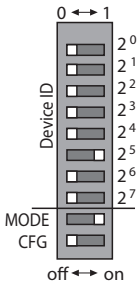


Fig. 51: Resetting the device via DIP switches

▶ Start the device.
⇨ The device is reset to factory settings.

NOTE
DIP switch "Mode" = "on" is no valid operation mode.
▶ After the reset to factory settings: Set DIP switch "Mode" back to "off".
▶ If necessary, set device ID via DIP switch 2^0…2^7.

9.8.2 Resetting the device with Turck Service Tool

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

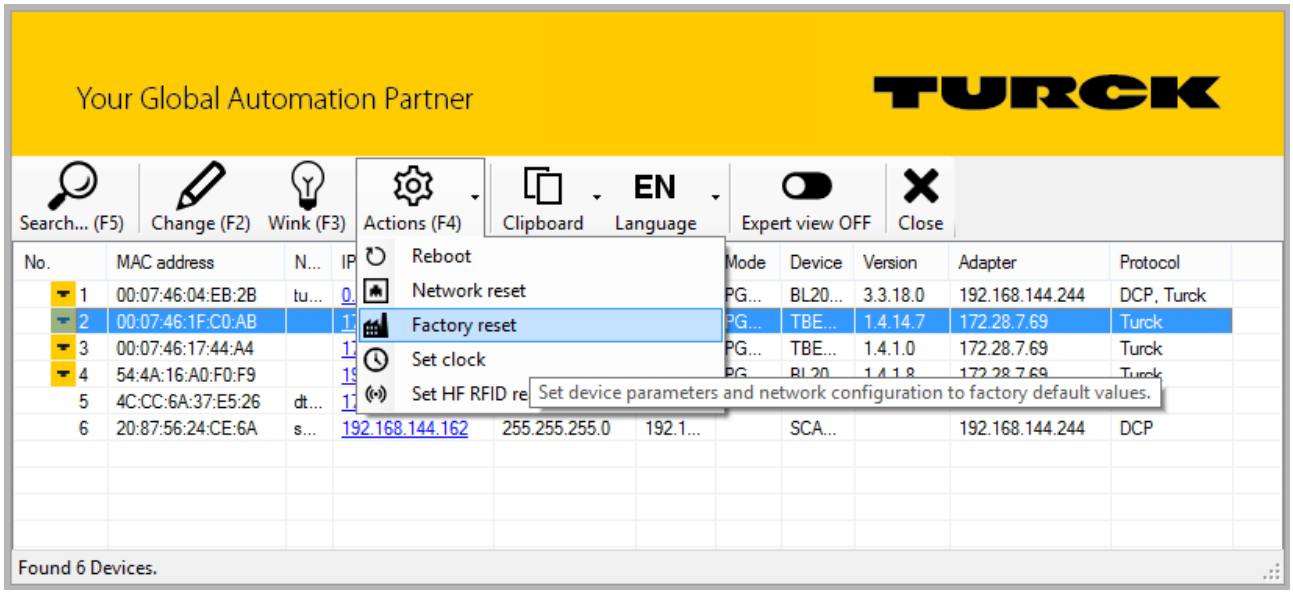


Fig. 52: Turck Service Tool – resetting the device to factory settings

➪ The device is reset to factory settings.

9.8.3 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.

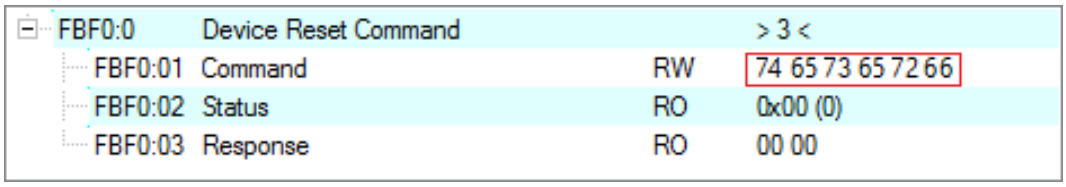


Fig. 53: TwinCAT (example) - Resetting the device to factory settings via CoE index

➪ The device is reset to factory settings.

10 Maintenance

Ensure regularly that the plug connections and cables are in good condition.

The devices are maintenance-free, clean dry if required.

10.1 Carrying out the firmware update

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.

10.1.1 Updating the firmware 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 4 (BL20-E-GW-EC-20)**.
- ▶ Click **Online** tab → **Status Machine** → **Bootstrap**.
- ▶ Click **File access over EtherCAT** → **Download…**.

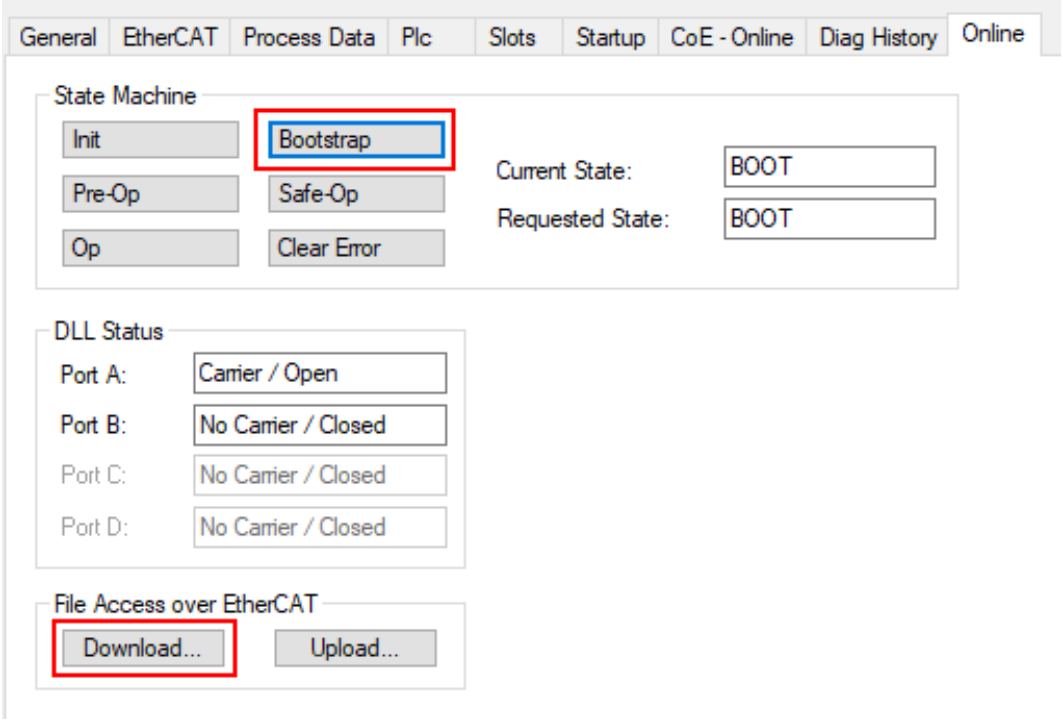


Fig. 54: Starting the firmware update

- ▶ In the new window select the firmware file.
- ▶ Confirm with **OK**.
- ⇨ The firmware file is loaded in the flash memory of the device.
- ⇨ The RUN 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 → **Status Machine** → **Init**.
- ⇨ The update is carried out.
- ⇨ The GW LED lights up orange during the firmware update.
- ⇨ When the update is complete, the device switches to normal operating mode.

10.1.2 Updating the firmware via CODESYS

Prerequisites

- The used EtherCAT master supports the firmware update function.
- The device is logged in online.
- The **Expert settings** are activated on the **General** tab.
- The option **Automatically restart slaves** 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 **BL20_E_GW_EC_20 (BL20-E-GW-EC-20)**.
- ▶ 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 RUN LED flickers green.
- ⇨ CODESYS displays a progress bar at the bottom of the screen to indicate the download of the firmware file.

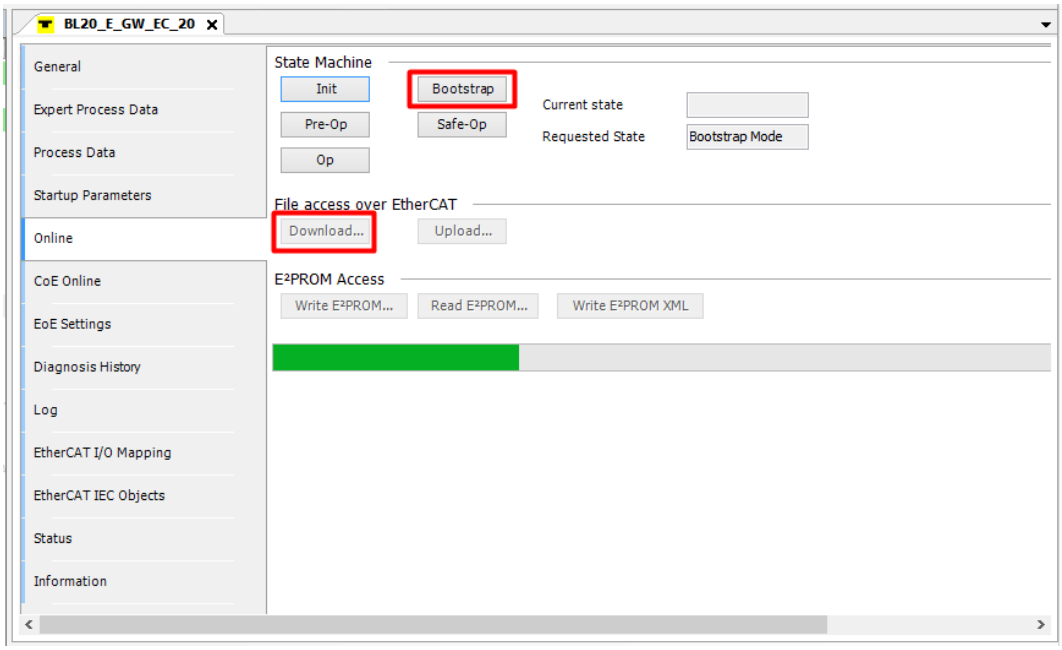


Fig. 55: Download of the firmware file

Carrying out an update

- ▶ Click **Online** tab → **State Machine** → **Init**.
- ⇨ The update is carried out.
- ⇨ The GW LED lights up orange during the firmware update.
- ⇨ If the update is completed the device switches to normal operating mode.
- ▶ Activate the option **Automatically restart slaves** on the **General** tab.

11 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to Turck.

11.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

12 Dismounting the BL20 station from the DIN rail

Dismount the BL20 station step by step in the following sequence:

WARNING
Dangerous electric voltage at modules with 120/230 VAC
Acute danger to life due to electric shock!

- ▶ Switch off the power supply.
- ▶ Secure the power supply against being switched on again.
- ▶ Ensure that the unit is de-energized.

- ▶ Switch off voltage at gateway and supply modules.
- ▶ Disconnect the connection to the fieldbus.
- ▶ Pull the electronics modules out of the base modules.
- ▶ Disconnect the wiring.
- ▶ Loosen the screws in the end brackets and remove end brackets from the DIN rail.
- ▶ Loosen the base modules and ECO modules from the right and remove them from the DIN rail. If a module in the middle of a station is to be removed, all modules mounted to the right of it must first be removed from the DIN rail.
- ▶ If necessary, remove cross-connectors beforehand (base modules for relay modules).
- ▶ Loosen the gateway from the DIN rail and remove it from the DIN rail.

13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

14 Technical data

Technical data	
Supply	
Power supply	24 VDC
System supply U_{SYS}	24VDC/5 VDC
Field supply U_L	24 VDC
Permissible range	18…30 VDC
Nominal current from module bus	≤ 200 mA
Max. field supply current	8 A
Max. system supply current	0.7 A
Isolation voltages	
■ U_L to U_{SYS}	500 V_{eff}
■ Supply to Ethernet	500 VAC
■ ETH1 to ETH2	500 VAC
Connectors	
Power supply	Push-in terminals
Ethernet	2 × RJ45, female connector
System data	
Max. no. of modules	32
Transmission rate	EtherCAT standard
Web server	Integrated, via EoE
Service interface	EoE
Max. line length Ethernet	100 m (per segment
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
Communikation cycle	Min. 125 µs
Installing	
Type of mounting	On DIN rail with 2 × end plate BL20-WEW-35/2-SW, 1 × end plate BL20-ABPL The end brackets and the end plate are included in the scope of delivery.
Mounting direction	Horizontal or vertical For vertical installation, the gateway can be positioned either above or below. In this case, sufficient ventilation and heat dissipation must be ensured.
Standard/directive conformity	
Vibration test	According to IEC 60068-2-6
Acceleration	Up to 20 g
Shock test	According to IEC 60068-2-27(shock resistance), IEC 60068-2-29 (resistance to repetitive shocks)

Technical data	
Drop and topple	According to EN 60068-2-31, according to IEC 60068-2- 2 (free fall)
Electro magnetic compatibility	According to EN 61131-2
Approvals and certificates	CE, cULus UKCA
UL cond.	cULus LISTED 3ZF0, Encl.Type 1 IND.CONT.EQ.
General information	
Dimensions (w × l × h)	33.5 × 129.5 × 74.4 mm
Operating temperature	0…+55 °C For vertical installation, the gateway can be positioned either above or below. In this case, sufficient ventilation and heat dissipation must be ensured.
Storage temperature	-25…+85 °C
Relative humidity	5… 95 % (indoor), Level RH-2, no condensation (storage at 45 °C, no function test)
Pollution degree according to IEC 664 (EN 61 131)	2
Degree of protection to IEC 529/EN 60529	IP20 (not evaluated by UL)
MTTF	294 years acc. to SN 29500 (Ed. 99) 20 °C
Halogen free	Yes

Technical data push-in terminals

Technical data	
Insulation stripping length	8 mm
Max. clamping range	0.2…1.5 mm²
Clampable wires (cross section)	
■ Rigid	0.2…1.5 mm²
■ Flexible	0.2…1.5 mm²
■ Flexible with ferrule without plastic sleeve	0.2…1.5 mm²
■ Flexible with ferrule with plastic sleeve	0.2…0.75 mm²
Wire cross section AWG	24…16

15 Turck branches — contact data

Germany	Hans Turck GmbH & Co. KG Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna www.turck.at
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 www.turck.ca
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin www.turck.com.cn
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové www.turck.cz
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 www.turckbanner.fr
Hungary	TURCK Hungary kft. Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest www.turck.hu
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra www.turck.co.in
Italy	TURCK BANNER S.R.L. Via San Domenico 5, IT-20008 Bareggio (MI) www.turckbanner.it
Japan	TURCK Japan Corporation ISM Akihabara 1F, 1-24-2, Taito, Taito-ku, 110-0016 Tokyo www.turck.jp

Korea	Turck Korea Co, Ltd. A605, 43, Iljik-ro, Gwangmyeong-si 14353 Gyeonggi-do www.turck.kr
Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor www.turckbanner.my
Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila www.turck.com.mx
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle www.turck.nl
Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole www.turck.pl
Romania	Turck Automation Romania SRL Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti www.turck.ro
Sweden	Turck AB Fabriksstråket 9, 433 76 Jonsered www.turck.se
Singapore	TURCK BANNER Singapore Pte. Ltd. 25 International Business Park, #04-75/77 (West Wing) German Centre, 609916 Singapore www.turckbanner.sg
South Africa	Turck Banner (Pty) Ltd Boeing Road East, Bedfordview, ZA-2007 Johannesburg www.turckbanner.co.za
Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul www.turck.com.tr
United Kingdom	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex www.turckbanner.co.uk
USA	Turck Inc. 3000 Campus Drive, USA-MN 55441 Minneapolis www.turck.us

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