Your Global Automation Partner

TURCK

# TBEN-L…-PLC-…
# Compact CODESYS V3 PLC

Operating instructions

# 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 personnel and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

## 1.2 Explanation of Symbols

The following symbols are used in these instructions:

**DANGER!**

DANGER indicates an immediately dangerous situation, with high risk, the death or severe injury, if not avoided.

**WARNING!**

WARNING indicates a potentially dangerous situation with medium risk, the death or severe injury, if not avoided.

**ATTENTION!**

ATTENTION indicates a situation that may lead to property damage, if it is not avoided.

**NOTE**

In NOTES you find tips, recommendations and important information. The notes facilitate work, provide more information on specific actions and help to avoid overtime by not following the correct procedure.

➤ **CALL TO ACTION**

This symbol identifies steps that the user has to perform.

➥ **RESULTS OF ACTION**

This symbol identifies relevant results of steps.

## 1.3 Additional Documents

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

- Data sheet
- Quick Start Guide
- Product flyer
- CAD data
- CODESYS package
- GDSML- and EDS-files

# 2 Notes on the Product

## 2.1 Product Identification

These instructions apply to the compact programmable CODESYS V3 PLC

- TBEN-L…-PLC-…

### 2.1.1 Scope of Delivery

The delivery scope contains:

- TBEN-L…-PLC-…
- Closure caps for 7/8" connectors
- Closure caps for M12 female connectors
- Closure cap for M12 male connector
- Quick Start Guide

### 2.1.2 Legal Requirements

The device falls under the following EU directives:

- 2014/30/EU (electromagnetic compatibility)

### 2.1.3 Manufacturer and Service

Hans Turck GmbH & Co. KG
Witzlebenstraße 7
45472 Muelheim an der Ruhr
Germany

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats. You can access the product database at the following address: **www.turck.de/products**

Should you have any further questions, please contact the sales and service team in Germany under the following telephone numbers:

Sales: +49 208 4952-380

Technology: +49 208 4952-390

Internet: **www.turck.de**

Outside Germany, please contact your local Turck representative.

# 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

The devices are only intended for use in industrial applications.

The TBEN-L…-PLC-… is a compact CODESYS V3-programmable controller in IP67. It can be operated in different Ethernet networks or fieldbus systems as Master/Controller (Modbus TCP, Modbus RTU, PROFINET, EtherNet/IP™, CANopen, SAE J1939) or Slave/Device (Modbus TCP, Modbus RTU, PROFINET, EtherNet/IP™, CANopen) and can communicate with bus nodes or higher-level controllers.

The serial interfaces COM0 and COM 0 serve to connect RS232 or RS485 devices.

Additionally, the device provides eight universal digital channels to connect up to eight digital sensors or actuators.

The devices may only be used as described in this manual. Any other usage shall be considered improper and Turck shall not be held liable for any resulting damage.

## 3.2 General Safety Instructions

- The device may only be assembled, installed, operated 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.

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# 4 Product description

The CODESYS V3 programmable TBEN-L…-PLC-… can be used as autonomous PLCs or as decentral PLCs in a network interconnection for a fast preprocessing of signals. The devices allow autonomous control of applications without higher-level control.

The Ethernet ports serve as interface for programming, configuration and Ethernet/ field bus communication.

Thanks to the multiprotocol Ethernet technology, the device can be used as slave/device with PLCs or PC based systems with PROFINET, EtherNet/IP™ or Modbus TCP, Modbus RTU and CANopen.

In addition to that, the device offers the following Master functionalities:

- Modbus TCP Master
- Modbus RTU Master
- PROFINET Controller
- EtherNet/IP™ Scanner
- CANopen Manager
- SAE J1939 Manager

Properties:

- Programmable according to IEC 61131-3 with ODESYS V3 in:
  - IL = Instruction List
  - LD = Ladder Logic
  - FBD = Function Block Diagram
  - SFC = Sequential Function Chart
  - ST = Structured Text
- Ethernet- and USB programming interface
- Integrated Gold CAP buffered Real Time Clock (RTC)
- USB Device port as programming and service interface
- USB Host port for connecting USB memory sticks for firmware-update, program backup, program restore, data synchronization
- Protocol converter - for example from Ethernet to serial communication
- LEDs for displaying the PLC status, supply voltage, common errors and bus errors as well a freely programmable LEDs for user-specific use
- Integrated Ethernet switch, allows line topology
- Integrated web server
- Field bus connection: Ethernet, 2 x M12-female connector, 4-pol. D-coded
- Power supply:
  TBEN-L5-PLC-…: 5-pole 7/8"-connector
  TBEN-L4-PLC-…: 4-pole 7/8"-connector
- Protection class: IP65/IP67/IP69K

## 4.1 Device overview

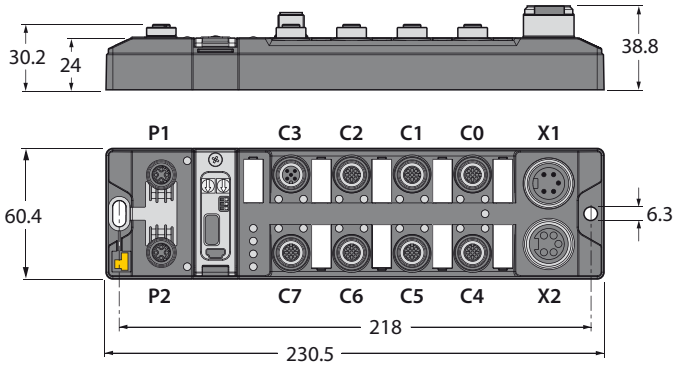


Fig. 1: Dimensions

## 4.2 Block Diagram

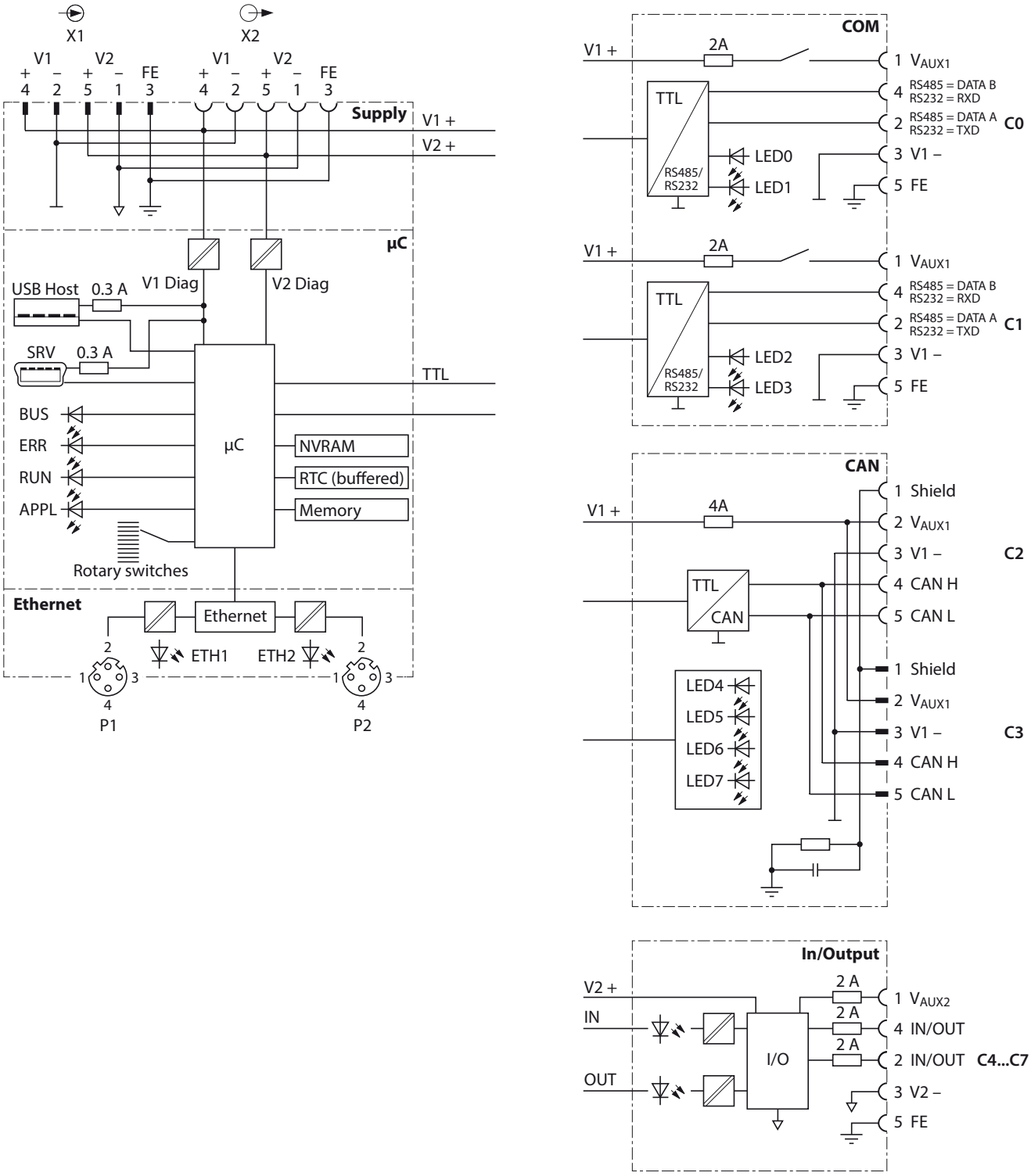


Fig. 2: Block Diagram

## 4.3 Technical data

| | |
|---|---|
| **Power supply** | |
| Supply voltage | 24 VDC |
| Permissible range | 18...30 VDC |
| Total current max. per voltage group | 9 A per voltage group |
| Operating current | < 280 mA |
| Connection technology | |
| TBEN-L4-PLC-… | 4-pole 7/8" male/female connector |
| TBEN-L5-PLC-… | 5-pole 7/8" male/female connector |
| Sensor/actuator supply VAUX1 | Supply of connectors C0 to C3 from V1, short-circuit proof,<br>C0 + C1: 2 A per connector,<br>C2 + C3: 4 A for both connectors |
| Sensor/actuator supply VAUX2 | Supply connectors C4 to C7 from V2,<br>short-circuit proof, 2 A per connector |
| Potential isolation | galvanic isolation of V1 and V2 voltage groups,<br>voltage proof up to 500 VDC |
| Power loss, typical | ≤ 5 W |
| **System data** | |
| Transmission Ethernet | 10 Mbps/100 Mbps |
| Connection to Ethernet | 2 x M12, 4-pole, D coded |
| Web server default address | 192.168.1.254 |
| Service interface | via P1, P2 or Mini USB port |
| **Controller** | |
| Processor | ARM Cortex A8, 32 Bit, 800 MHz |
| Program and data memory | 20 MB |
| Remanent memory | 64 kByte |
| Real time clock (RTC) | yes |
| Operating system | Linux |
| **PLC data** | |
| Programming | CODESYS 3 |
| Released for CODESYS version | V 3.5.8.10 or higher |
| Programming languages | IEC 61131-3 (IL, LD, FBD, SFC, ST) |
| OPC | yes |
| OPC UA | no |
| Application tasks | 10 |
| Number of POUs | 1024 |
| Programming interface | Ethernet, USB |
| Cycle time | < 1ms for 1000 IL- commands (without I/O cycle) |
| Input data | 8 kByte |
| Output data | 8 kByte |

| | |
|---|---|
| **Serial interface** | |
| Signal type | RS232 or RS485 |
| Number of channels | 2 |
| Operation mode RS232 | |
| Signal low level | -18 to -3 VDC |
| Signal high level | 3 to 18 VDC |
| Transmission signals | TxD, RxD |
| Transmission rate | 9600 to 230400 bps |
| Transmission type | Full duplex |
| Cable length | 15 m at 19200 baud<br>(max. line capacitance < 2000 pF) |
| Operation mode RS485 | |
| Transmission signals | TX/RX+, TX/RX- |
| Transmission rate | 9600 to 230400 bps |
| Transmission type | 2-wire half-duplex |
| Bus termination | internal or external |
| Biasing | internal or external |
| Line impedance | > 120 Ω |
| **Digital inputs** | |
| Number of channels | 8 |
| Connection technology inputs | M12, 5-pole |
| Input type | PNP |
| Type of input diagnostics | Short-circuit diagnostic of sensor supply per connector |
| Switching threshold | EN 61131-2 type 3, PNP |
| Signal voltage, low level | < 5 V |
| High-level signal voltage | > 11 V |
| Low-level signal current | < 1.5 mA |
| High-level signal current | > 2 mA |
| Sensor supply | 2 A, short-circuit proof, from V2,<br>can be switched via process data |
| Potential isolation | galvanic isolation to P1/P2,<br>voltage proof up to 500 VDC |
| **Digital outputs** | |
| Number of channels | 8 |
| Connection technology outputs | M12, 5-pole, a-coded |
| Output type | PNP |
| Type of output diagnostics | Short-circuit diagnostic per channel |
| Output voltage | 24 VDC from V2 |
| Output current per channel | 2 A, short-circuit proof, 4 A per connector |
| Simultaneity factor | 0.56 |
| Load type | ohmic, inductive, lamp load |
| Short-circuit protection | yes |

| | |
|---|---|
| Actuator supply | 2 A, short-circuit proof, from V2,<br>can be switched via process data |
| Potential isolation | galvanic isolation to P1/P2,<br>voltage proof up to 500 VDC |
| **Modbus TCP Slave** | |
| Address assignment | Static IP, BOOTP, DHCP |
| Supported Function Codes | FC1, FC2, FC3, FC4, FC5, FC6, FC15, FC16, FC23 |
| Input Registers | max. 1024 registers |
| Input register start address | 0x0000 |
| Holding Registers | max. 1024 registers |
| Output register start address | 0x0000 |
| **Modbus RTU Slave** | |
| Input Registers | max. 500 registers |
| Input register start address | 0x0000 |
| Holding Registers | max. 500 registers |
| Output register start address | 0x0000 |
| **EtherNet/IP™ Device** | |
| Address assignment | according to EtherNet/IP™ standard |
| Number of process data | max. 248 words input data<br>max. 246 words output data |
| **PROFINET Device** | |
| Address assignment | DCP |
| Conformance Class | B (RT) |
| MinCycleTime | 1 ms |
| Diagnostics | according to PROFINET Alarm Handling |
| Topology detection | supported |
| Automatic address assignment | supported |
| Number of process data | max. 512 words (in total for in- and output bytes) |
| **CAN Device** | |
| Baud rate | up to 1 Mbps |
| power supply | internal from V1 (no external power supply allowed) |
| Number of PDOs | max. 512 RxPDOs<br>max. 512 TxPDOs |
| **Modbus TCP Master** | |
| Max. number of devices | 64 |
| Min. cycle time | 2 ms |
| Max. number of devices at 2 ms | 8 |

| | |
|---|---|
| **EtherNet/IP™ Scanner** | |
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |
| Max. number of devices at 10 ms | 8 |
| **PROFINET Controller** | |
| Max. number of devices | 64 |
| Min. cycle time | 1 ms |
| Max. number of devices at 1 ms | 8 |
| **Modbus RTU Master** | |
| Max. number of devices | 64 |
| Min. cycle time | 5 ms |
| Max. number of slaves at 5 ms | 8 |
| **CANopen Manager** | |
| Max. number of devices | 127 |
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |
| **SAE J1939 Manager** | |
| Max. number of devices | 254 |
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |
| **Standard/directive conformity** | |
| Vibration test | according to EN 61131 |
| Shock test | according to IEC 68-2-27 |
| Drop and topple | according to EN 68-2-31 and free fall according to IEC 68-2-32 |
| Electro-magnetic compatibility | according to IEC 61131-2 |
| MTTF | 75 years according to SN 29500 (Ed. 99) 20 °C |
| **Ambient conditions** | |
| Operating temperature | -40…+ 70 °C |
| Storage temperature | -40…+ 85 °C |
| Operating altitude | max. 5000 m |
| Protection class | IP65, IP67, IP69K |
| **General** | |
| Dimensions (w × l × h) | 60,4 × 230,5 × 38,8 mm |
| Housing material | PA6-GF30 |
| Housing color | black |
| Window material | Lexan |
| Screw material | 303 stainless steel |
| Label material | Polycarbonate |
| Halogen-free | yes |
| Mounting | 2 mounting holes, Ø 6,3 mm |
| Approvals | CE |

# 5 Mounting

The devices must be attached to a level, pre-drilled and grounded mounting surface.

➤ Attach the module to the mounting surface with two M6 screws. The maximum tightening torque for the screws is 1.5 Nm.

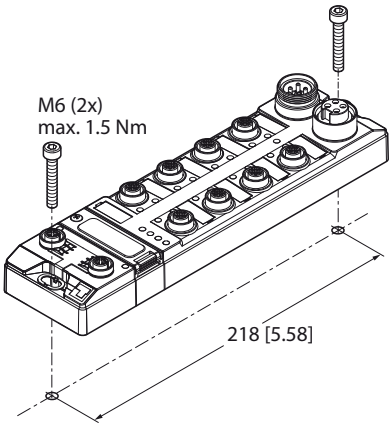


Fig. 3: Attaching the device to the mounting plate

## 5.1 Grounding the device

### 5.1.1 Grounding and shielding concept

The grounding and shielding concept of the TBEN-L modules allows the fieldbus and I/O parts to be grounded separately.

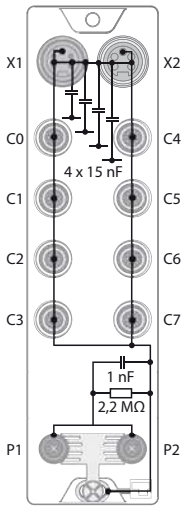


Fig. 4: Replacement wiring diagram, shielding concept

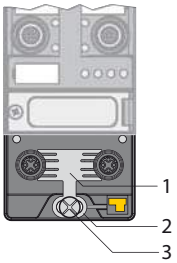


Fig. 5: Grounding components

The grounding clip (1) at the M12 connectors for the fieldbus connection (P1, P2) connects the shield of the fieldbus lines.
The grounding ring (2) is attached below the grounding clip and connects the functional ground of the 7/8" connector (pin 3) for the power supply with the functional ground of the M12 connector (pin 5) for connecting the sensors and actuators.
The grounding screw (3) connects the device with the system's reference potential.

### 5.1.2 Grounding the device (FE)

The grounding clip and the metal ring are connected to each other. A mounting screw through the bottom mounting hole in the module connects the shielding of the fieldbus lines to the functional ground of the power supply and the connected devices and to the reference potential of the system.

If a common reference potential is not required, remove the grounding clip to disconnect the fieldbus shield or attach the module with a plastic screw.

#### Removing the grounding clip

➤ Use a flat standard screwdriver to lever the grounding clip upwards and remove it.

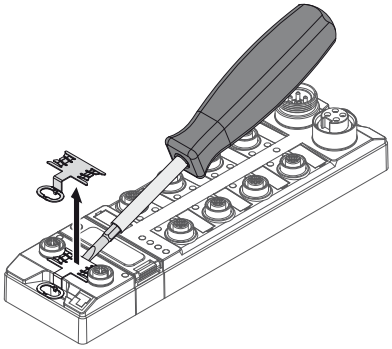

Fig. 6: Removing the grounding clip

#### Mounting the grounding clip

➤ Insert the grounding clip between the fieldbus connectors (using a screwdriver if necessary) so that it makes contact with the metal housing of the connector.

The shield of the fieldbus lines lies flush to the grounding clip.

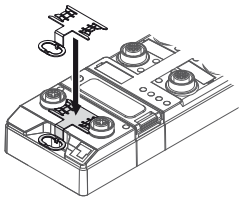

Fig. 7: Mounting the grounding clip

# 6 Connecting

## 6.1 Connecting the Power Supply

➤ Connect the device to the power supply according to **Fig. 8: Pin assignment TBEN-L4-PLC-…** or **Fig. 9: Pin assignment TBEN-L5-PLC-…**.

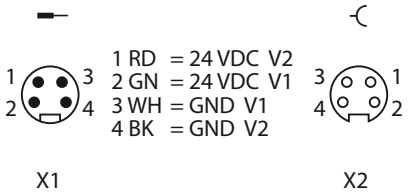


Fig. 8: Pin assignment TBEN-L4-PLC-…


Fig. 9: Pin assignment TBEN-L5-PLC-…

## 6.2 Connecting Ethernet

➤ Connect the device according to **Fig. 10: Ethernet connection**.

The connection is done via:
2 × M12-female connector, 4-pole, D-coded

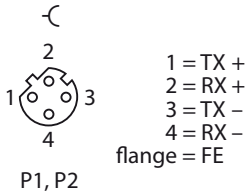


Fig. 10: Ethernet connection

A switch internally connects the two Ethernet ports which allows building up a line topology.

**NOTE**

Use a cross-over cable for connected device with deactivated "autonegotiation" at the ports.

## 6.3 Connecting serial devices (COM 0 and COM 1)

➤ Connect serial devices to the COM ports according to **Fig. 11: COM port x in RS232 mode** or **Fig. 12: COM port x in RS485 mode**.

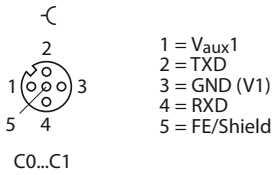


Fig. 11: COM port x in RS232 mode

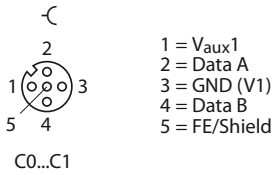


Fig. 12: COM port x in RS485 mode

## 6.4 Connecting CAN devices (CANout and CANin)

➤ Connect an CANopen or SAE J1939 device to the CAN network according to **Fig. 13: CANout (C2)** or **Fig. 14: CANin (C3)**.

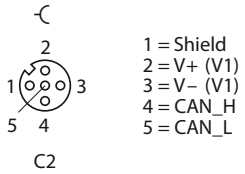


Fig. 13: CANout (C2)

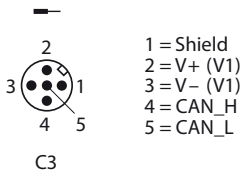


Fig. 14: CANin (C3)

## 6.5 Connecting digital sensors and actuators

➤ Connect digital sensors and actuators to the device according to **Fig. 15: DXP channels**.

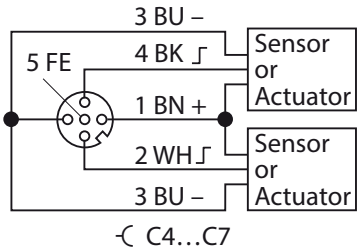


Fig. 15: DXP channels

## 6.6 USB Device port

The USB Device port is designed as mini USB socket and can be used as service interface for the device DTMs as well as programming interface for CODESYS.

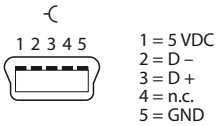


Fig. 16: USB Device port

### 6.6.1 RNDIS driver

The corresponding RNDIS driver is installed automatically during the DTM installation in PACTware™. The USB device port is shown in the DTM as additional Ethernet port.

**NOTE**

Use the interface BL Service Ethernet in the DTM for the connection to the device.

## 6.7 USB Host port

The USB Host port is designed as USB2.0-A-socket and serves for connecting USB memory sticks for the restore and backup of CODESYS programs and for the actualization of the device firmware (see **Functions of the USB Host port (page 94)**).

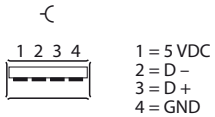


Fig. 17: USB Host port

# 7 Setting and Parameterizing

## 7.1 Address and operation mode setting

The device address and the operation mode are set using a combination of the 2 rotary coding switches and DIP switch no. 1 (Mode) at the device.

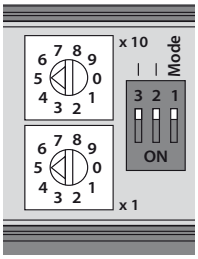


Fig. 18: Rotary coding and DIP switches

| DIP switches<br><br>Mode<br>(switch no. 1) | Rotary coding switches | Mode | Description | |
|---|---|---|---|---|
| ON (1) | 00 | Restore IP | Reset the device to default settings, see **Restore IP (page 28)**: | |
| | | | IP address | 192.168.1.254 |
| | | | Subnet mask | 255.255.255.0 |
| | | | gateway | 192.168.1.1 |
| | | | Auto-negotiation<br>AutoMDIX | active |
| ON (1) | 40 | DHCP | see **Address setting via DHCP mode (page 28)** | |
| ON (1) | 50 | PGM | see **Address setting via PGM mode (page 29)** | |
| ON (1) | 60 | PGM-DHCP | State of delivery<br>see **Address setting via the mode PGM-DHCP (universal mode) (page 29)** | |
| ON (1) | 90 | F_Reset | see **F_Reset (Reset to factory setting) (page 30)** | |
| OFF | 1-99 | Static rotary | Sets the last byte of the IP address,<br>see **Address setting via rotary coding switches (Static rotary) (page 28)**.<br>The other 3 byte are taken from the IP address, which was stored in the device before. | |

### 7.1.1 Restore IP

In order to activate the Restore IP-mode, the DIP-switch Mode is set to "ON", the rotary switches to address "00".

With this setting followed by a voltage reset, the module is set to the address 192.168.1.254 for IP-based services (see **Address and operation mode setting (page 27)**).

This setting allows for example the DTM to communicate with the device, the device's web server can be accessed using the IP-address 192.168.1.254.

**NOTE**

This setting is no operation mode! After having reset the IP address to the default values, the device has to be set to another mode.

### 7.1.2 Address setting via rotary coding switches (Static rotary)

For the address assignment via Rotary-mode, the DIP-switch Mode is set to "OFF", the rotary switches define the last Byte of the device's IP address.

All other network settings are stored in the module’s non-volatile EEPROM and can not be changed in rotary mode.

Addresses form 1 to 99 can be set. The address 0 is used for Broadcast-messages in the subnet.

The settings carried out in the rotary-mode are not stored in the module’s EEPROM. Thus, they will get lost in case of a subsequent address-assignment via a BootP/DHCP or PGM.

**NOTE**

After changing the position of the rotary coding-switches, a voltage reset must be carried out to store the new address.

### 7.1.3 Address setting via DHCP mode

In order to activate the DHCP-mode, the DIP-switch Mode is set to "ON", the rotary switches to address "40" (see **Address and operation mode setting (page 27)**).

Address setting is carried out by a DHCP-server in the network after the start-up of the device.

The subnet mask and the default gateway address assigned by the DHCP-server, are stored in the device’s EEPROM. If the device is subsequently switched to another address-mode, the settings (IP address, subnet mask, etc) will be read from the module’s EEPROM.

**NOTE**

After changing of the address-mode, a voltage reset must be done.

DHCP supports three mechanisms for IP address allocation:

- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time, or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

### DHCP in PROFINET

Please assure, that in PROFINET-applications, the address assigned via a BootP-server corresponds to the address, which is assigned in the configuration tool.

## 7.1.4 Address setting via PGM mode

In order to activate the PGM-mode, the DIP-switch MODE is set to "ON", the rotary switches to address "50" (see **Address and operation mode setting (page 27)**).

**NOTE**

After changing of the address-mode, a voltage reset must be done.

The PGM-mode allows access of the Turck DTMs to the module's network settings (see also **Address setting via DTM (page 33)**).

**NOTE**

In the PGM-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

## 7.1.5 Address setting via the mode PGM-DHCP (universal mode)

The PGM-DHCP mode is the delivery state of the device.

In order to activate the PGM-DHCP-mode, the DIP-switch Mode is set to "ON", the rotary switches to address "60" (see **Address and operation mode setting (page 27)**).

**NOTE**

After changing of the address-mode, a voltage reset must be done.

The device sends DHCP-requests until an IP address is assigned (DHCP-server, PROFINET-controller, PACTware™, web server, Turck Service Tool).

The assigned IP-address is stored to the device and the DHCP-client is stopped.

Even after a restart of the device, the device sends no further DHCP-requests.

### PGM-DHCP in PROFINET

This mode assures a PROFINET-compliant operation of the modules.

**NOTE**

If a DHCP-server is used within the network, problems may occur during IP-assignment.

In this case, both, the DHCP-server as well as the PROFINET-controller (via DCP), try an IP-address-assignment.

### 7.1.6 F_Reset (Reset to factory setting)

In order to reset the device to factory settings, the DIP-switch Mode is set to "ON", the rotary switches to address "90" (see Address and operation mode setting (page 27)).

**ATTENTION!**

System modification during operation

**Undefined device status due to device restart or loss of functionality!**

- Do not change system or network settings during operation.
- Before changing the system settings, always set the machine into the safe stop condition and disconnect the TBEN-L…-PLC-… from the machine.

This mode sets all device-settings back to the default values and deletes all data in the device's internal flash.

**NOTE**

This setting is no operation mode! Please set the device to another mode after having reset the IP address to the default values.

The following properties are reset to default or deleted during F_Reset:

| | | Default value | Comment |
|---|---|---|---|
| IP address/ subnet mask | reset | 192.168.1.254/ 255.255.255.0 | The device can be accessed by the web server/DTM using this IP address but the address is not permanently stored in the device. |
| PROFINET device name | reset | - | |
| CODESYS program | deleted | - | |
| Parameters | reset | see Operation (page 45) | |

**NOTE**

A network reset via DCP bases services (Turck Service Tool → "network reset" or TIA-Portal/Step7 → "Reset to factory settings") does **not** delete the CODESYS program (see also Reset to factory settings (page 36)).

### 7.1.7 Address setting with Turck Service Tool

The Turck Service Tool enables direct access to the Ethernet-network via Ethernet.

The IP configuration, as well as the PROFINET device name of the Ethernet device can be changed application specifically.

#### Search for devices

Scan the network using the "Search" button. All found PROFINET devices are shown.

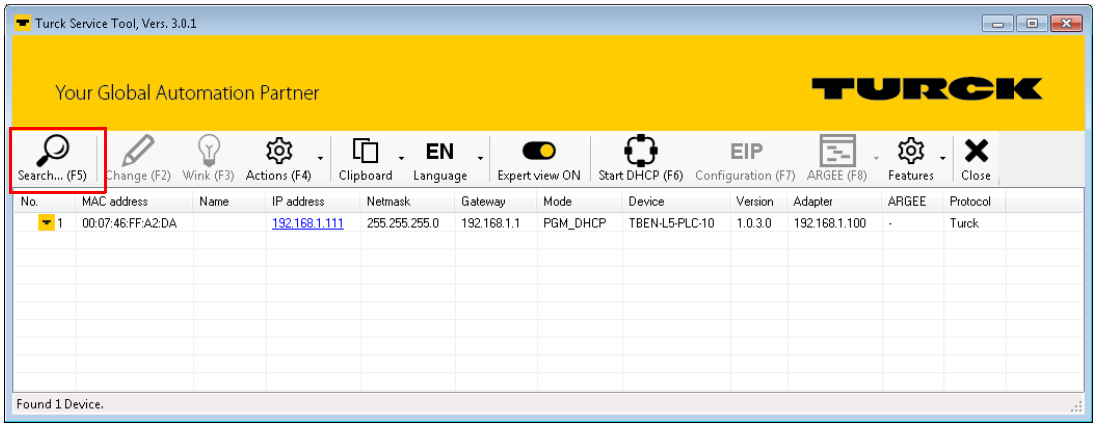


Fig. 19: Scan Ethernet network

#### Send WINK command

For clear device localization a Wink command can be send to the marked device using the "Wink" button. The device responds to this Wink command with a LED blink code (see LED displays (page 45)).

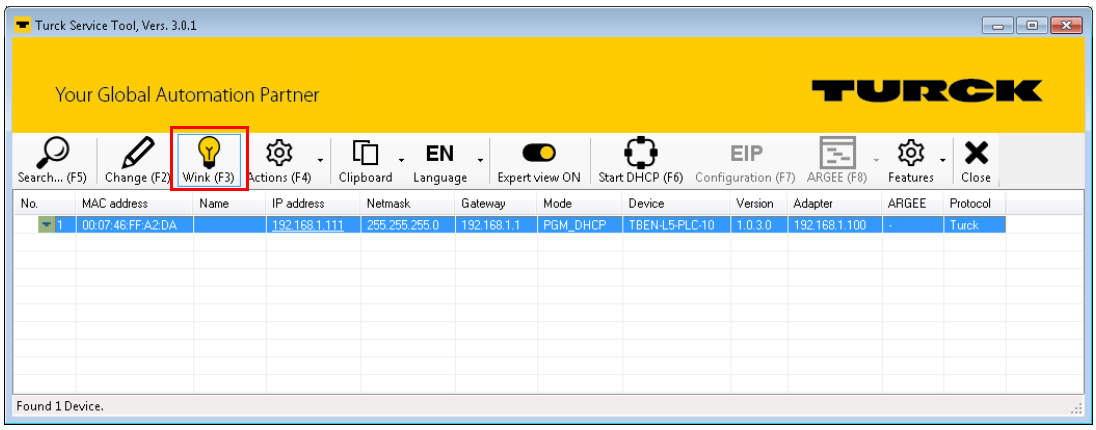


Fig. 20: Send WINK command

## Changing the IP address

The device's IP is set via the "Change (F2) button.

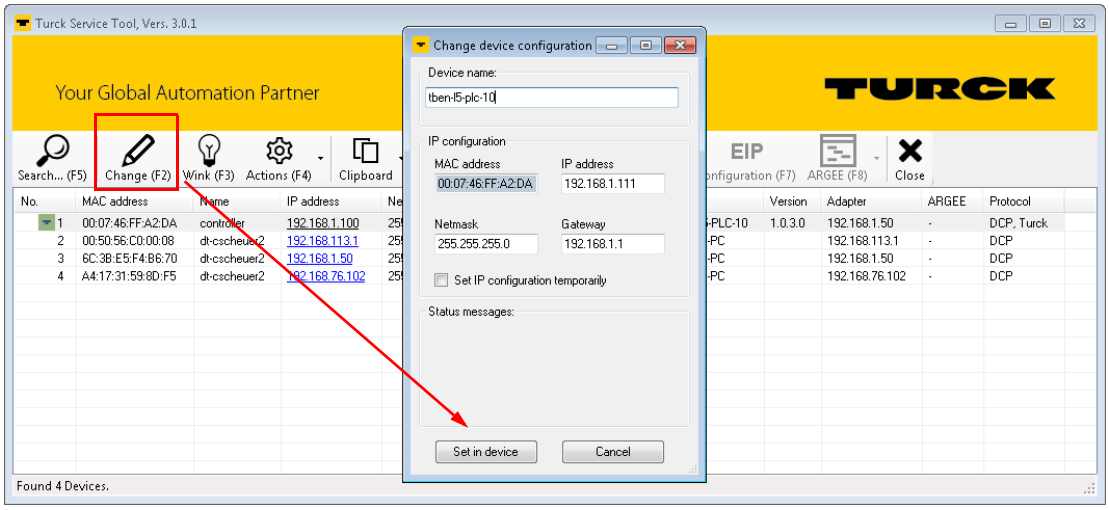


Fig. 21: Changing the IP configuration

## Changing the PROFINET device name

**NOTE**

A PROFINET device name can only be assigned, if the device has already been configured as PROFINET device via CODEYS and if the respective CODESYS project has been loaded to the device (see chapter 9, PROFINET-Device (page 68)).

The PROFINET device name is set via the "Change (F2) button.

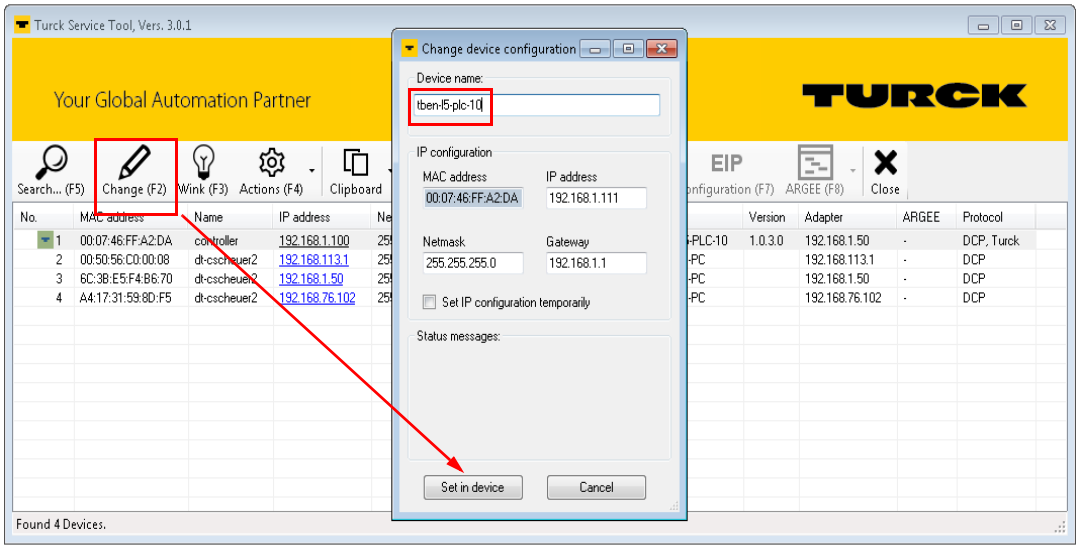


Fig. 22: Setting the PROFINET device name

### 7.1.8 Address setting via DTM

In a respective frame application e.g. PACTware™, the Turck DTMs allow direct access to Ethernet.

The IP address, as well as the subnet mask of the Ethernet device, can be changed according to the application by using the Busaddress Management function of the BL Service Ethernet interface (TCP/IP) in the DTM.

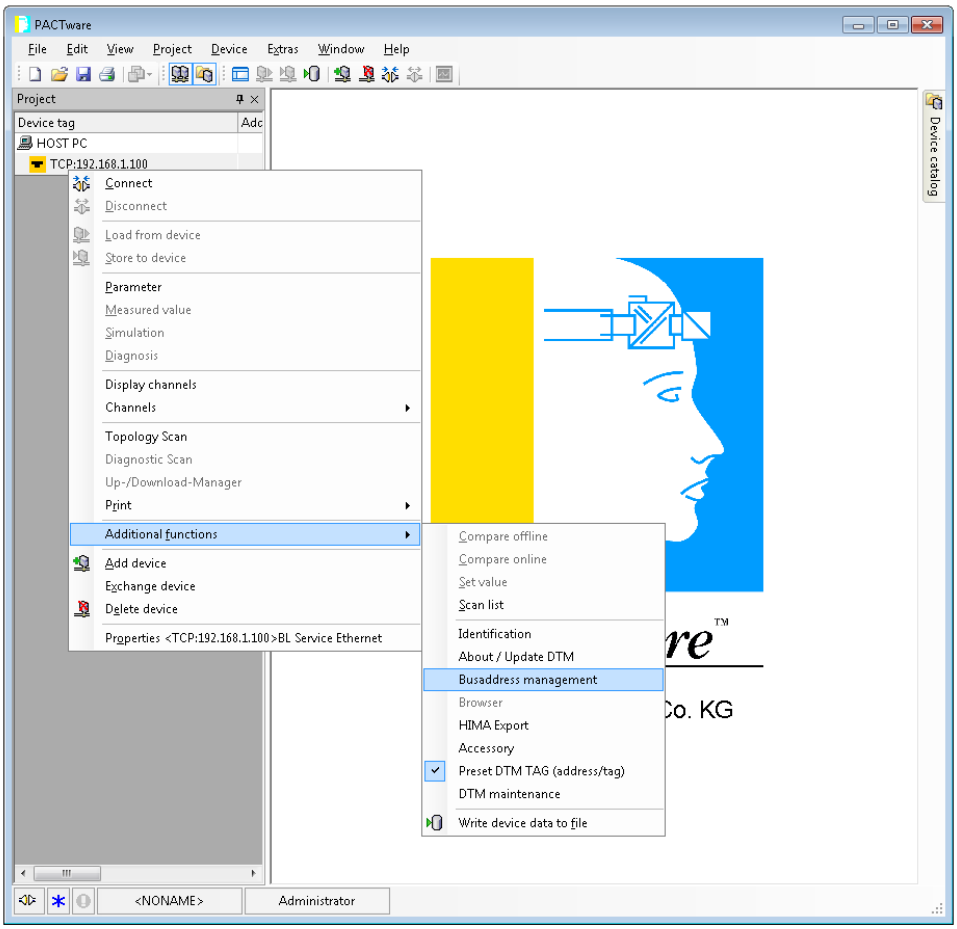


Fig. 23: Busaddress management

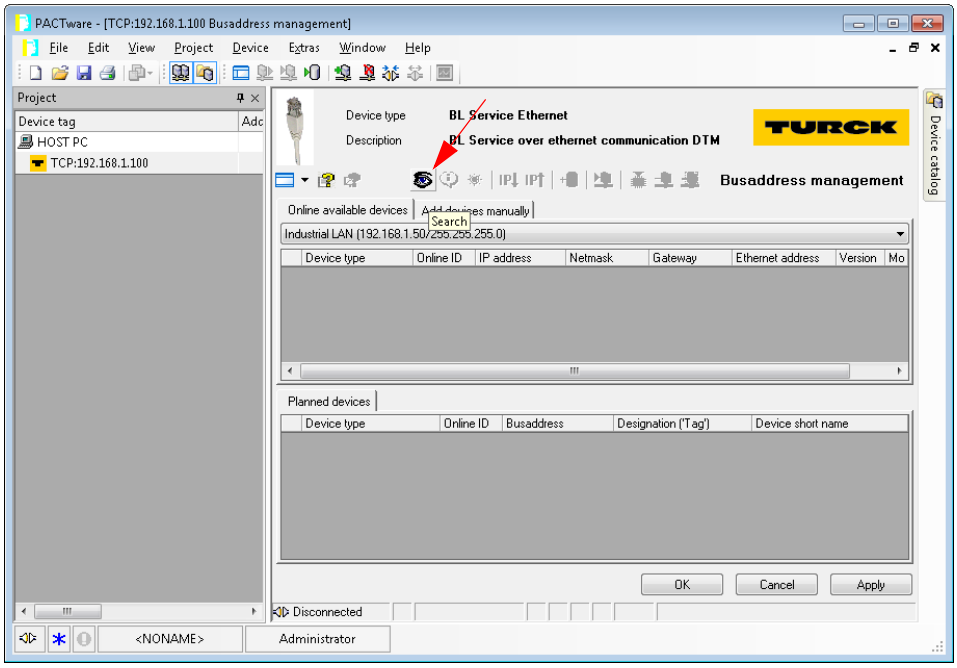


Fig. 24: Searching for network nodes in the Busaddress Management

**NOTE**

The access of the DTM to the device is only possible, if the device already has an IP-address (see **Address and operation mode setting (page 27)**)

The address setting via DTM is only possible if the device is operated in PGM or PGM-DHCP-mode.

**NOTE**

When using Windows XP as operating system, difficulties may occur with system-integrated firewall.

The firewall may inhibit the access of PACTware™ (FDT/DTM) to the Ethernet interface. In this case, please adapt your firewall respectively.

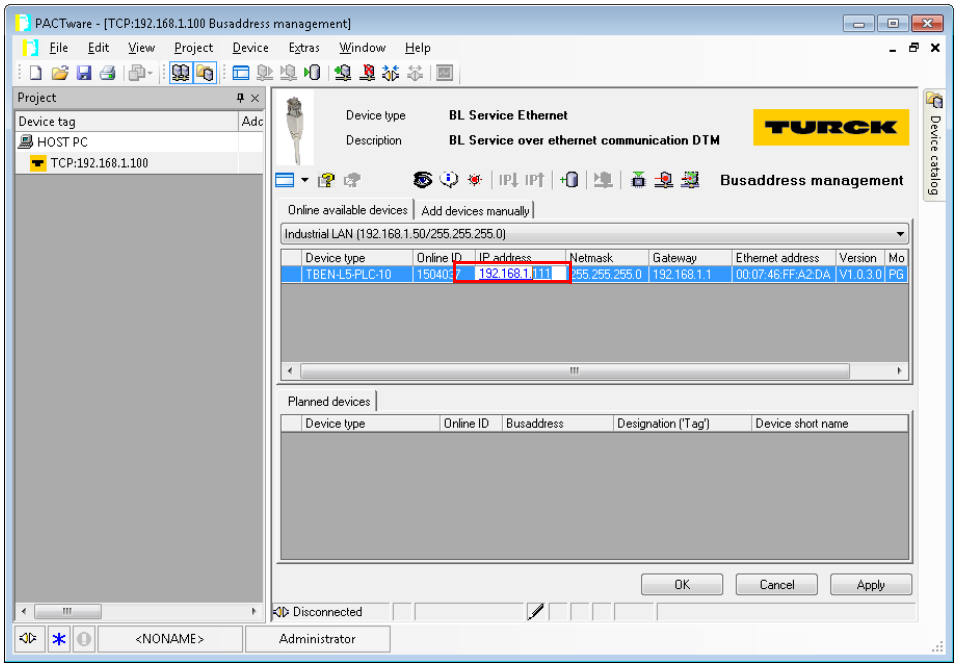


Fig. 25: Changing the IP address

### 7.1.9 SET button

Pressing the SET button activates the write access of the device's USB Host port functions, see also **chapter 10, USB-Host-Port-Funktionen (page 93)**.

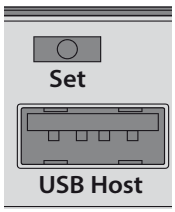


Fig. 26: SET button

### 7.1.10 Reset to factory settings

**ATTENTION!**

System modification during operation

**Undefined device status due to device restart or loss of functionality!**

- ➤ Do not change system or network settings during operation.
- ➤ Before changing the system settings, always set the machine into the safe stop condition and disconnect the TBEN-L…-PLC-… from the machine.

Besides the hardware rest using the rotary coding switches (see F_Reset (Reset to factory setting) (page 30)), the Turck Service Tool as well as the web server (see Reset to Factory Defaults (page 110)) offer the possibility to reset the devices to the factory settings.

**NOTE**

Resetting the device to factory settings via rotary coding/DIP switches or via the Turck Service Tool → "Factory reset" deletes the CODESYS-program in the device, see also F_Reset (Reset to factory setting) (page 30).

A network reset via DCP bases services (Turck Service Tool →"network reset" or TIA-Portal/ Step7 → "Reset to factory settings") does **not** delete the CODESYS program.

#### Turck Service Tool

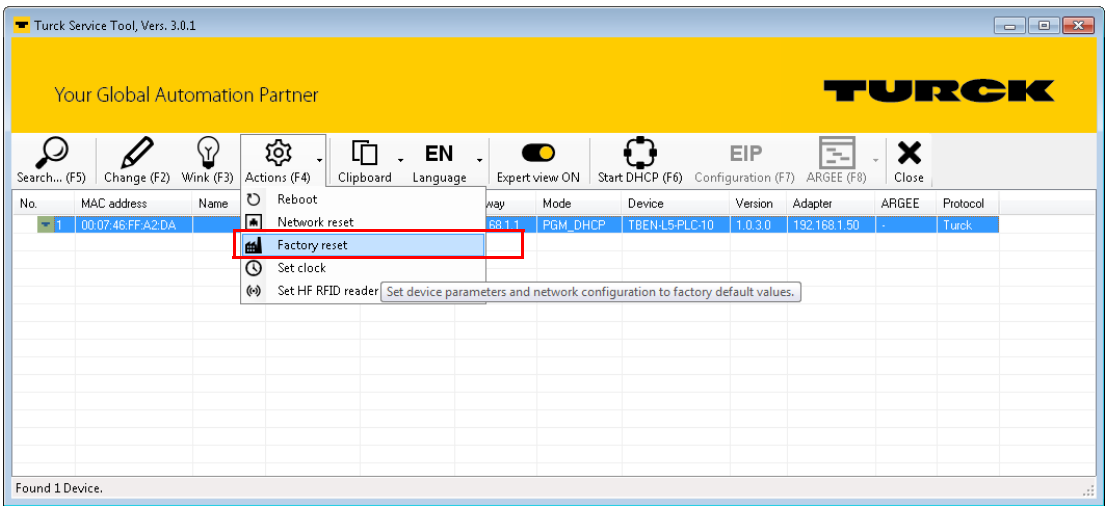


Fig. 27: Turck Service Tool, reset to factory settings

## Web server

The function is only available after a login.

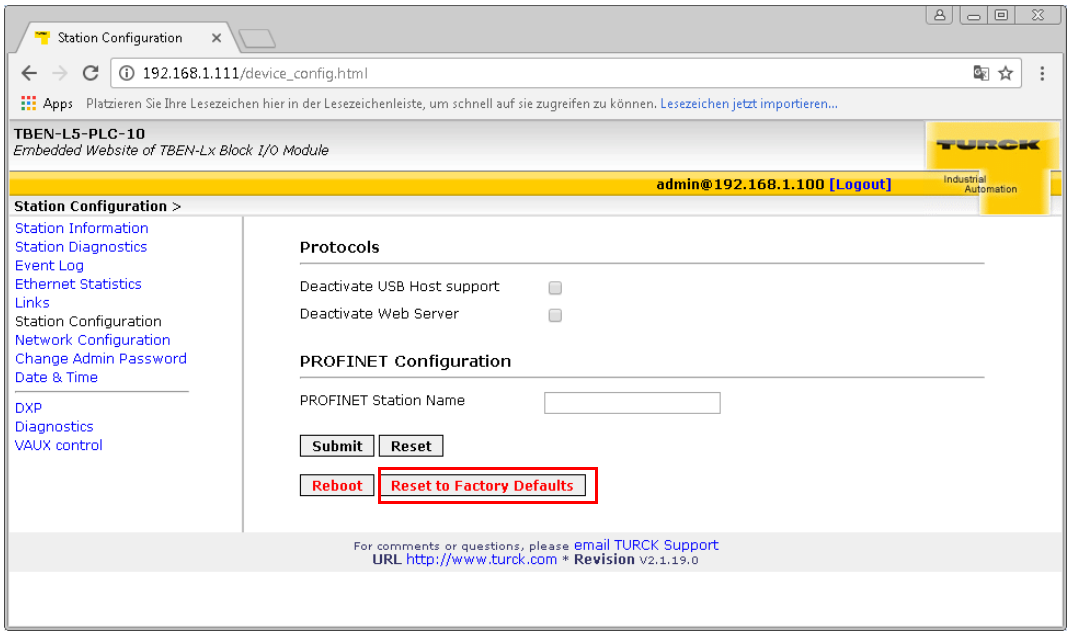


Fig. 28: Web server, reset to factory settings

## 7.2 Parameterizing

### 7.2.1 Device parameters

**NOTE**

Parameter changes become only valid after a device restart.

The TBEN-L…-PLC-… provides the following device parameters:

Default parameters are displayed in bold.

| Parameter name | Value | Description |
|---|---|---|
| Deactivate USB Host support | **no** | The USB Host port support for the device is activated. The USB Host port functions can be executed. |
| | yes | Deactivates the USB Host port support for the device. The USB Host port functions can not be executed. |
| Deactivate WEB server | **no** | Activates the web server in the device. |
| | yes | Deactivates the web server in the device. |
| Deactivate voltage diagnostics | **no** | Activates the voltage diagnostics for V1 and V2 |
| | yes | Deactivates the voltage diagnostics for V1 and V2 |
| Ethernet port 1/2 | **Auto-negotiation** | Sets the Ethernet port to Auto-negotiation or to a fixed value for transmission rate and transmission mode. |
| | 10 Mbps, half duplex | |
| | 10 Mbps, full duplex | |
| | 100 Mbps, half duplex | |
| | 100 Mbps, full duplex | |

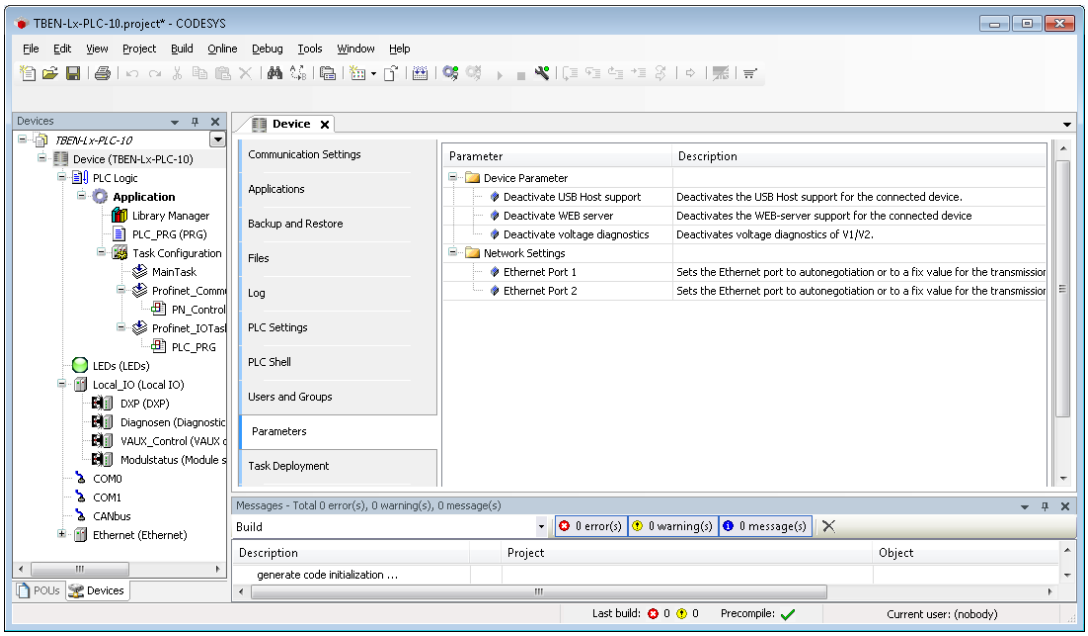


Fig. 29: Device parameters in CODESYS

## 7.2.2 Parameters of the local I/Os

### DXP channels

Default parameters are displayed in bold.

| Parameter name | Value | Description |
|---|---|---|
| **DXP** | | |
| Activate output | no | The output is deactivated. |
| | **yes** | The output is activated. |
| Manual output reset after overcurrent | **no** | The output switches on automatically after an overload. |
| | yes | The output is manually switched-off and on again. |

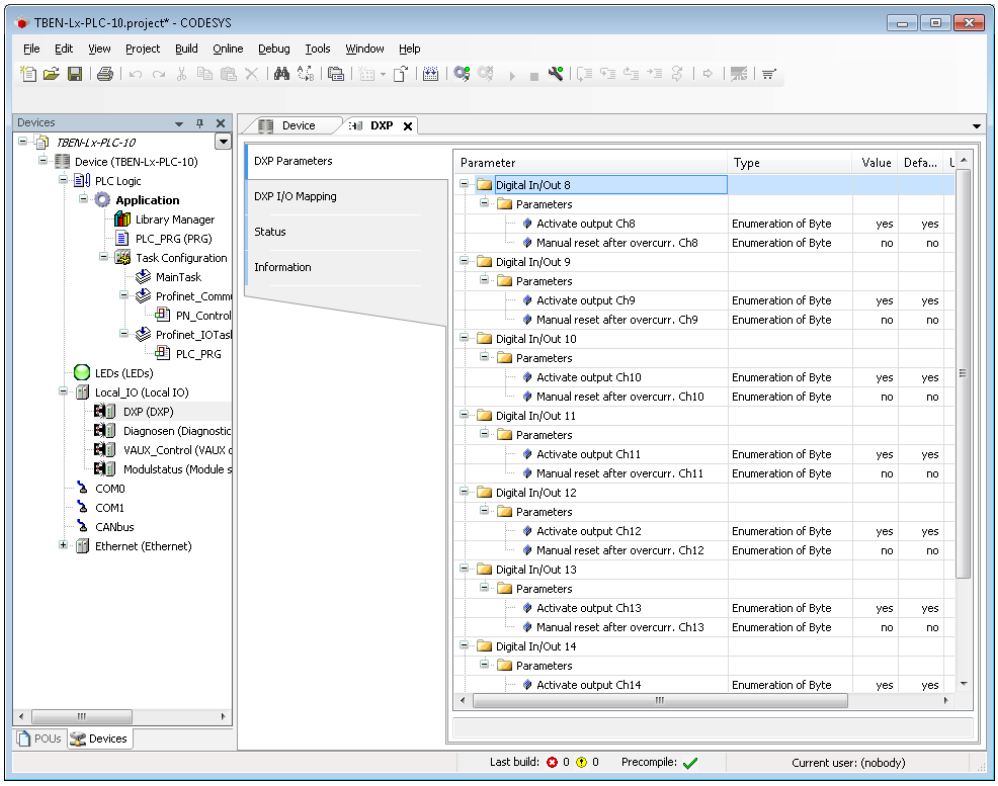


Fig. 30: Parameters of the DXP channels in CODESYS

## Parameters for sensor/actuator supply (VAUX control)

Default parameters are displayed in bold.

| VAUX Control | | |
|---|---|---|
| VAUX2 Pin 1 Cx (Chy - z) | **24 VDC** | The 24 VDC sensor/actuator supply at Pin1 of the connector is switched on. |
| | switchable | The 24 VDC sensor/actuator supply at pin1 of the respective connector is switchable via the process data. |
| | Out | The 24 VDC sensor/actuator supply at Pin1 of the connector is switched off. |

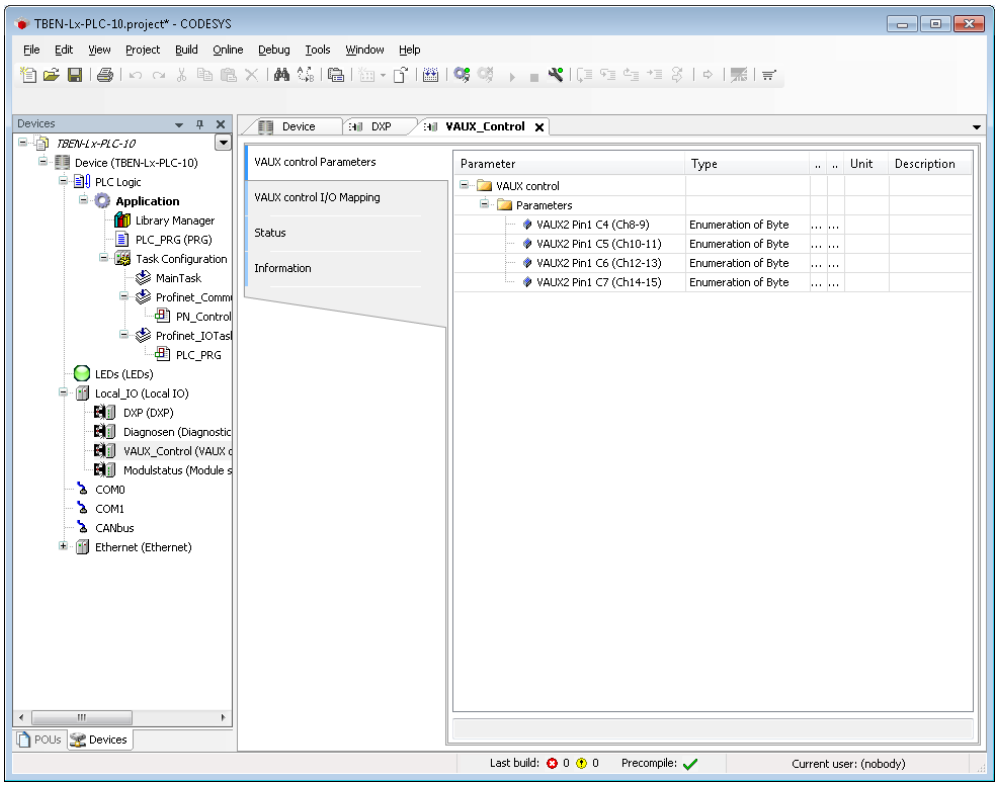


Fig. 31: Parameters of the DXP channels in CODESYS

## 7.3 Real time clock (RTC)

Properties:

| | |
|---|---|
| Buffering | via Gold CAP |
| Loading time for 95 % load | min. 10 minutes |
| Buffer time at ambient temperature | |
| 23 °C | 4 weeks |
| up to 60 °C | 168 hours |
| up to 70 °C | 36 hours |

The Real Time Clock can be set using by the Turck Service Tool, the device's web server or via CODESYS.

### 7.3.1 Setting the RTC with Turck Service Tool

The turck Service Tool sets the RTC depending on the system time of the PC. based on the Coordinated Universal Time UTC.

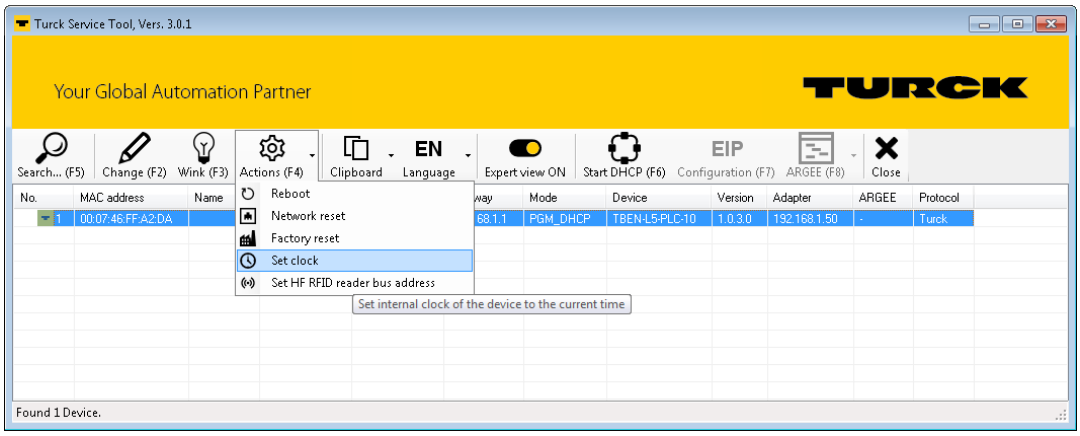


Fig. 32: Setting the RTC with Turck Service Tool

### 7.3.2 Setting the RTC via the web server

The web server allows the setting of the RTC directly or via SNTP server.

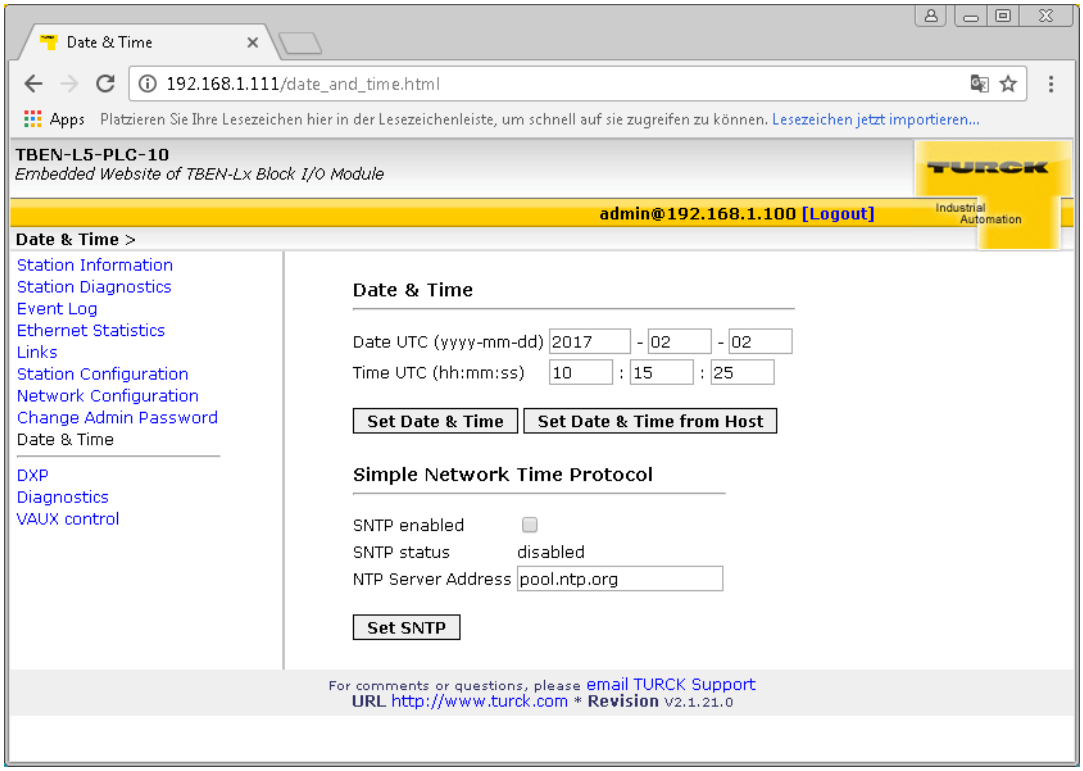


Fig. 33: Setting the RTC via the web server

## Setting the RTC via SNTP

Prerequisites:

- The device has to be placed in a network with access to the SNTP server.
- The SNTP server is defined and activated in the web server.

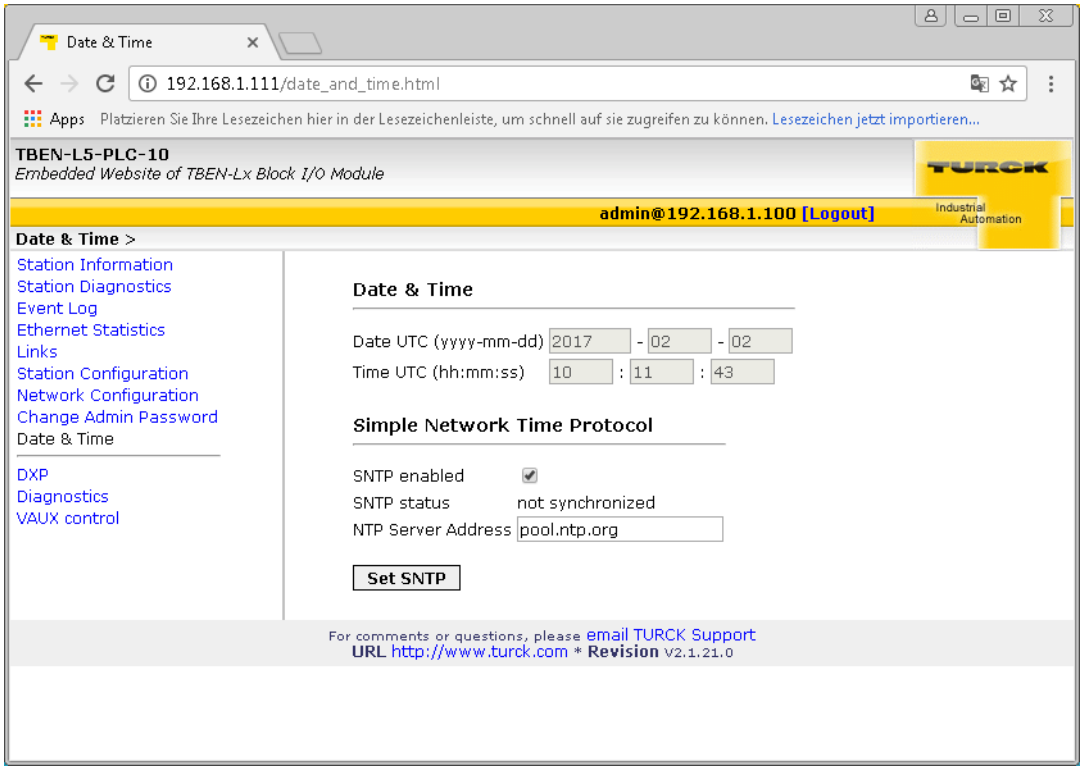


Fig. 34: Activating the SNTP server

**NOTE**

If the RTC is set via SNTP and the device has a connection to the SNTP server, than changes of the RTC via Turck Service Tool or the CODESYS library have no effect.

➤ Activate the SNTP server and enter the server address.

➤ Restart the device.

➥ The device receives Time and date from the defined SNTP server.

### 7.3.3 Setting the RTC via CODESYS

In CODESYS the RTC is set in the device for example using the CODESYS library "CAA Real time Clock Extern".

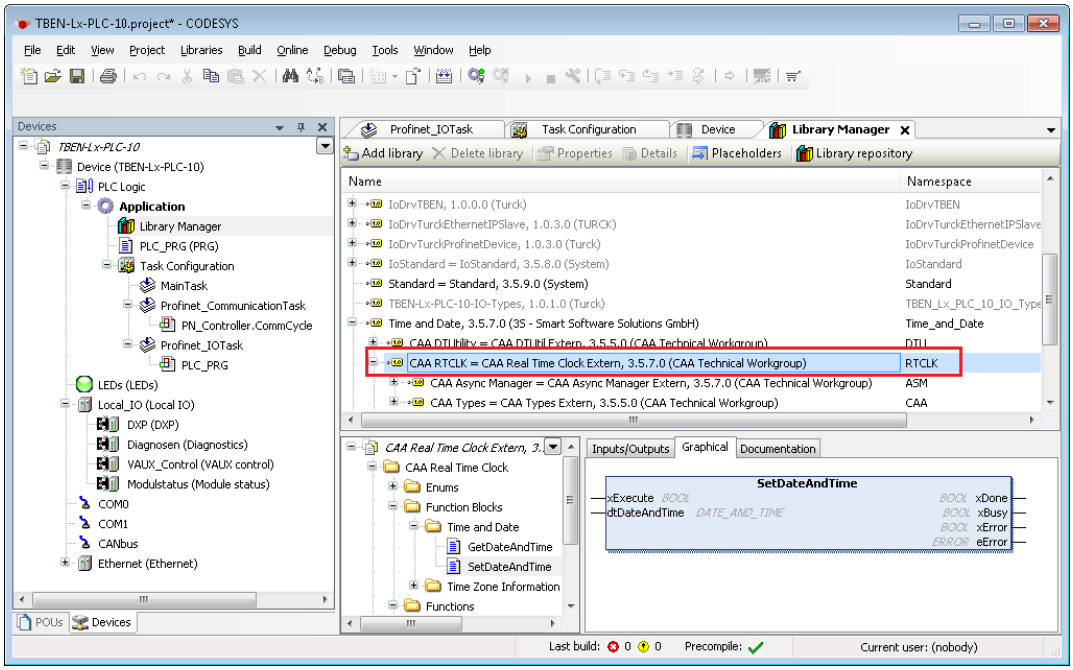


Fig. 35: CAA Real time Clock Extern in CODESYS

# 8 Operation

## 8.1 LED displays

Every device displays the following statuses via LEDs:

- PLC status (LED RUN),
- Application specific LED APPL (freely programmable via CODESYS)
- Supply voltage (LED PWR)
- Common error (LED ERR)
- Bus status (LED BUS)
- 2 LEDs for the Ethernet-communication ETH1 and ETH2
- 16 connector LEDs for indicating the respective functions/states

### 8.1.1 LED description

| LED | GREEN | YELLOW | Meaning | Remedy |
|---|---|---|---|---|
| **ETH1/ ETH2** | OFF | OFF | no link | Check the Ethernet connection |
| | OFF | ON | Active link,10 Mbps | |
| | OFF | Blink-ing | Ethernet traffic, 10 Mbps | |
| | ON | OFF | Active link,100 Mbps | |
| | Blinking | OFF | Ethernet traffic, 100 Mbps | |

| LED | GREEN | RED | Meaning | Remedy |
|---|---|---|---|---|
| **BUS** | OFF | OFF | No power supply of the CPU. | Check the connected voltage supply |
| | ON | OFF | Displays the logical connection to a mas-ter/controller.<br>If more than one slave/device is config-ured at the PLC, then the LED shows the status of the first configured slave in the CODESYS project. | |
| | Blinking | OFF | Device ready for operation | |
| | OFF | ON | Device reports an error:<br>– IP address conflict<br>– device in RESTORE-mode<br>– F_Reset activated | – Check the assigned IP addresses in the network.<br>– Check the DIP-switch setting |
| | OFF | Blink-ing | Blink/wink command active | |
| | blinking, alternating | | – Auto-negotiation and/or<br>– Autonegotiation and / or waiting for DHCP- / BootP-address assignment. | The device waits for IP-address assign-ment. Wait for the address assignment to be finished. |

| LED | GREEN | RED | Meaning | Remedy |
|---|---|---|---|---|
| **ERR** | ON | OFF | Device running, no diagnostics | |
| | OFF | ON | A diagnostic message from the device is pending. | Check the diagnostic messages |
| | OFF | OFF | Supply voltage V1 missing or below the defined value (18 V DC) | Check the connected voltage supply |

| LED | GREEN | RED | Meaning | Remedy |
|---|---|---|---|---|
| **RUN** | OFF | OFF | No power supply of the CPU. | Check the connected voltage supply |
| | ON | OFF | PLC status: RUN | - |
| | Blinking | OFF | USB Host port function active, the blinking pattern depends on the executed function. | see **USB Host port functions (page 93)** |
| | OFF | ON | PLC status: STOP | |
| | OFF | Blink-ing | No PLC program loaded | |
| | OFF | Blink-ing, 2 x, 1 Hz | Factory reset running | see **F_Reset (Reset to factory setting) (page 30)** |

| LED | GREEN | RED | WHITE | Meaning |
|---|---|---|---|---|
| **APPL** | ON/OFF/ blinking | | OFF | This LED is controlled by the CODESYS program and can be freely programmed by the user. |
| | OFF | OFF | ON | Blink-/wink-command active |

| LED | GREEN | RED | Meaning | Remedy |
|---|---|---|---|---|
| **PWR** | OFF | OFF | Supply voltage V1 missing or below the defined value (18 V DC) | Check the connected voltage supply |
| | ON | OFF | V1 and V2 within the nominal range | |
| | OFF | ON | Supply voltage V2 missing or below the defined value (18 V DC) | Check the connected voltage supply |

| LED | GREEN | RED | Meaning |
|---|---|---|---|
| **I/O 0** | OFF | OFF | COM 0: no TX data transmission |
| | ON | OFF | COM 0: TX data transmission |
| **I/O 1** | OFF | OFF | COM 0: no RX data transmission |
| | ON | OFF | COM 0: RX data transmission |
| **I/O 2** | OFF | OFF | COM 1: no TX data transmission |
| | ON | OFF | COM 1: TX data transmission |
| **I/O 3** | OFF | OFF | COM 1: no RX data transmission |
| | ON | OFF | COM 1: RX data transmission |
| **I/O 4 - 7** | ON/OFF/blinking | | These LEDs are controlled though the CODESYS program and can be freely programmed by the user. |
| **I/O 8 - 15** | OFF | OFF | In- or output inactive |
| | ON | OFF | In- or output active |
| | OFF | ON | Output active with overload/short circuit |
| | OFF | blink-ing | Short-circuit at the sensor/actuator supply for the respective connector. Both LEDs at the connector are blinking. |

## 8.2 Diagnostics

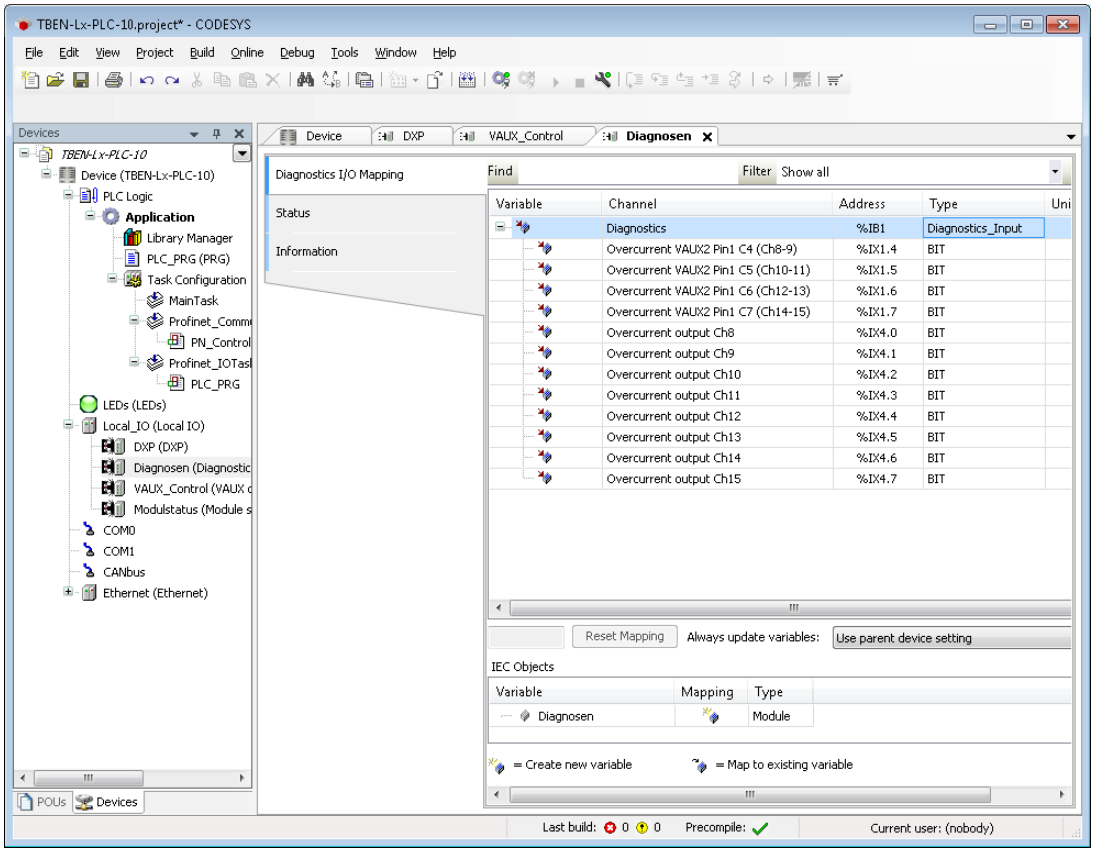


Fig. 36: Diagnostics in CODESYS

| Diagnostics | Description |
|---|---|
| Overcurrent VAUX2 pin 1 Cx (Chy - z) | Overcurrent VAUX2 at pin 1 of the channel |
| Overcurrent output Chx | Overcurrent at the respective output |

## 8.3 Module status

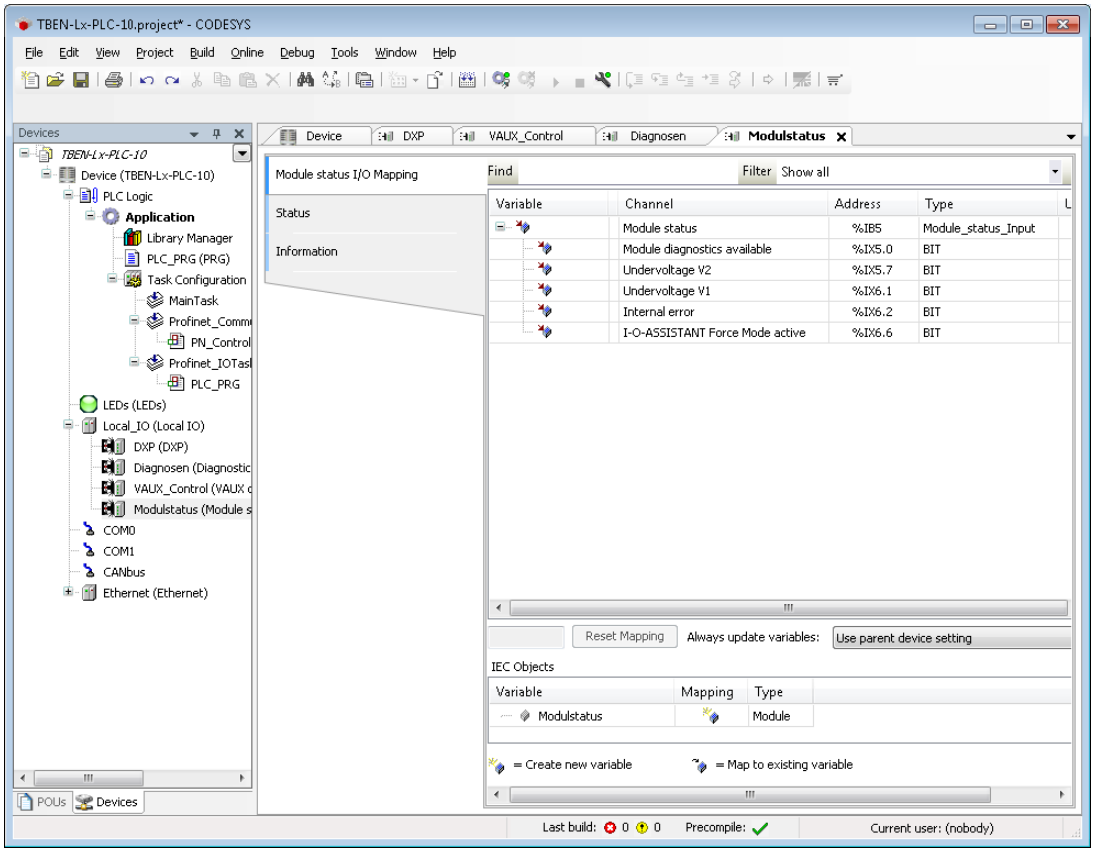


Fig. 37: Module status in CODESYS

| Module status | Description |
|---|---|
| Module diagnostics pending | Group diagnostics of the device. At least 1 channel sends diagnostics. |
| Undervoltage V2 | V2 is below the nominal range (< 18 V). |
| Undervoltage V1 | V1 is below the nominal range (< 18 V). |
| Internal error | Error in the device, the internal communication is disturbed. |
| I/O-ASSISTANT Force Mode active | The Force Mode of the DTM is activated. The output states may not correspond to the settings send from the field bus or resulting from the CODESYS program. |

## 8.4 SFTP access

The SFTP access is done via a FTP client program (e.g. FileZilla):

| | |
|---|---|
| Server (SFTP protocol) | IP address of the device |
| User name | sftpuser |
| Password | password |
| Port | 22 |

**NOTE**

The password for the SFTP access is synchronized to the password for the web server. Changing the password for the SFTP access also changes the web server password (see page 106).

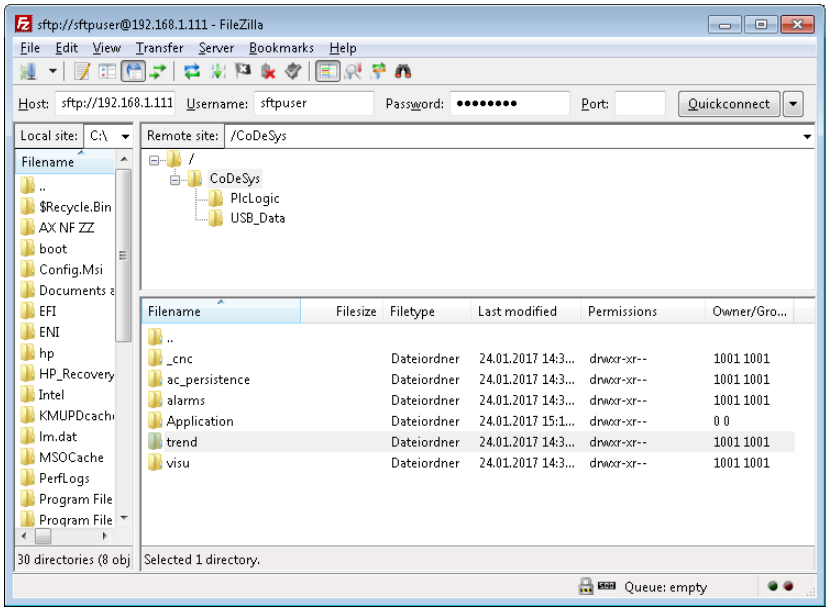


Fig. 38: SFTP access via FileZilla

## 8.5 Firmware Update

**NOTE**

A firmware update is only possible if no program is active on the device.

The firmware update can be done using a USB storage device at the USB Host port or via the Turck DTM.

- Stop the program which is running on the PLC.
- Execute the firmware update.
- After the firmware update, execute a voltage reset at the device.
- Compile and download an already existing CODESYS project.

### 8.5.1 Firmware update using USB storage device

For the firmware update via USB storage device, please read section **Functions of the USB Host port (page 94)**.

### 8.5.2 Firmware update via DTM

The firmware update via DTM is done in the DTM Busaddress Management in PACTware™.

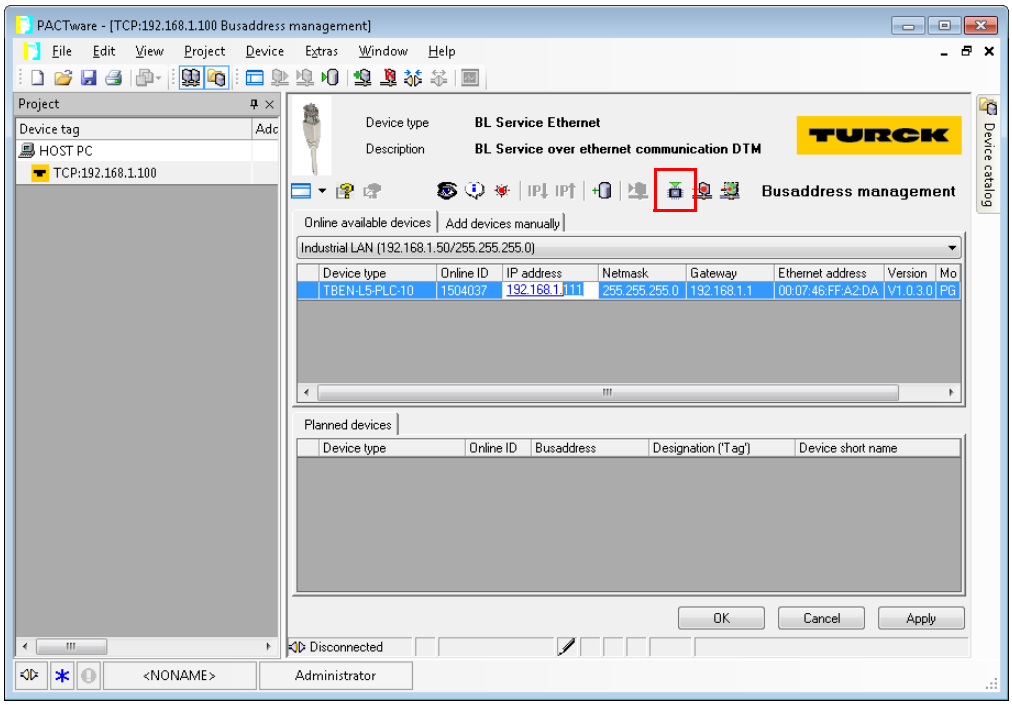


Fig. 39: Busaddress Management in PACTware™

# 9 CODESYS functions

The CODESYS 3 programmable TBEN-L…-PLC-… can be used as follows:

| Protocol | Master/Controller/ Scanner/Manager | | Slave/Device | |
|---|---|---|---|---|
| Modbus TCP | ✔ | page 56 | ✔ | page 60 |
| Modbus RTU | ✔ | page 62 | ✔ | page 60 |
| PROFINET | ✔ | page 66 | ✔ | page 69 |
| EtherNet/IP™ | ✔ | page 74 | ✔ | page 74 |
| CANopen | ✔ | page 82 | ✔ | page 84 |
| SAE J1939 | ✔ | page 56 | | |

## 9.1 Possible combinations Master/Slave

The following table is valid for combinations of one Master and one Slave.

| | Modbus TCP Slave | PROFINET Device | EtherNet/IP™ Device | Modbus RTU Slave | CANopen Device |
|---|---|---|---|---|---|
| **Modbus TCP Master** | ✔ | ✔ | ✔ | ✔ | ✔ |
| **PROFINET Controller** | ✔ | – | ✔ | ✔ | ✔ |
| **EtherNet/IP™ Scanner** | ✔ | ✔ | – | ✔ | ✔ |
| **Modbus RTU Master** | ✔ | ✔ | ✔ | ✔ **A** | ✔ |
| **CANopen Manager** | ✔ | ✔ | ✔ | ✔ | – |
| **SAE J1939 Manager** | ✔ | ✔ | ✔ | ✔ | – |

**A** *The functions Modbus RTU Master and Modbus RTU Slave can not be used in parallel on the same COM port. Each function has to be configured separately on one COM port, which means that both COM ports are occupied.*

## 9.2 Possible combinations Master/Master

| | Modbus TCP Master | PROFINET Controller | EtherNet/IP™ Scanner | Modbus RTU Master | CANopen Manager | SAE J1939 Manager |
|---|---|---|---|---|---|---|
| **Modbus TCP Master** | – | ✔ | ✔ | ✔ | ✔ | ✔ |
| **PROFINET Controller** | ✔ | – | – | ✔ | ✔ | ✔ |
| **EtherNet/IP™ Scanner** | ✔ | – | – | ✔ | ✔ | ✔ |
| **Modbus RTU Master** | ✔ | ✔ | ✔ | ✔ **A** | ✔ | ✔ |
| **CANopen Manager** | ✔ | ✔ | ✔ | ✔ | – | – |
| **SAE J1939 Manager** | ✔ | ✔ | ✔ | ✔ | – | – |

**A** *1 Master per COM port*

## 9.3 Possible combinations Slave/Slave

| | Modbus TCP Slave | PROFINET Device | EtherNet/IP™ Device | Modbus RTU Slave | CANopen Device |
|---|---|---|---|---|---|
| **Modbus TCP Slave** | – | ✔ | ✔ | ✔ | ✔ |
| **PROFINET Device** | ✔ | – | ✔ | ✔ | ✔ |
| **EtherNet/IP™ Device** | ✔ | ✔ | – | ✔ | ✔ |
| **Modbus RTU Slave** | ✔ | ✔ | ✔ | ✔ **A** | ✔ |
| **CANopen Device** | ✔ | ✔ | ✔ | ✔ | – |

**A** *1 Slave per COM port*

## 9.4 Supported CODESYS libraries

| **3S libraries** | |
|---|---|
| Network | SysSocket, 3.5.8.0 (System)<br>SysTarget, 3.5.5.0 (System) |
| Data access | SysFile, 3.5.6.0 (System)<br>SysDir, 3.5.8.0 (System)<br>SysTypes, 3.1.2.0 (System) |
| EtherNetIP™ Services | EtherNetIP Services, 3.5.7.0 |
| CommFB | CommFB, 3.5.8.0 |
| Serial communication | SysCom, 3.5.5.0 (System) |
| Time and date | SysTime, 3.5.5.0 (System)<br>SysTimeRtc, 3.5.5.0 (System) |
| Miscellaneous | SysEvent, 3.5.5.0 (System)<br>SysMem, 3.5.5.0 (System) |
| **CAA libraries** | |
| Network | CAA Net Base Services, 3.5.6.0 |
| Data access | CAA File, 3.5.6.0<br>CAA Types Extern, 3.5.5.0 |
| CAN | CAA CiA 405, 3.5.8.0 |
| Serial communication | CAA SerialCom, 3.5.6.0 |
| Time and date | CAA DTUtil Extern, 3.5.5.0<br>CAA Real Time Clock Extern, 3.5.5.4 |

## 9.5 General start-up

### 9.5.1 Installing the device package in CODESYS

➤ Download the CODESYS-Package "TBEN-Lx-PLC Vx.x.x.x.package" from www.turck.com.

➤ Install the package using the CODESYS Package Manager "Tools → Package Manager".

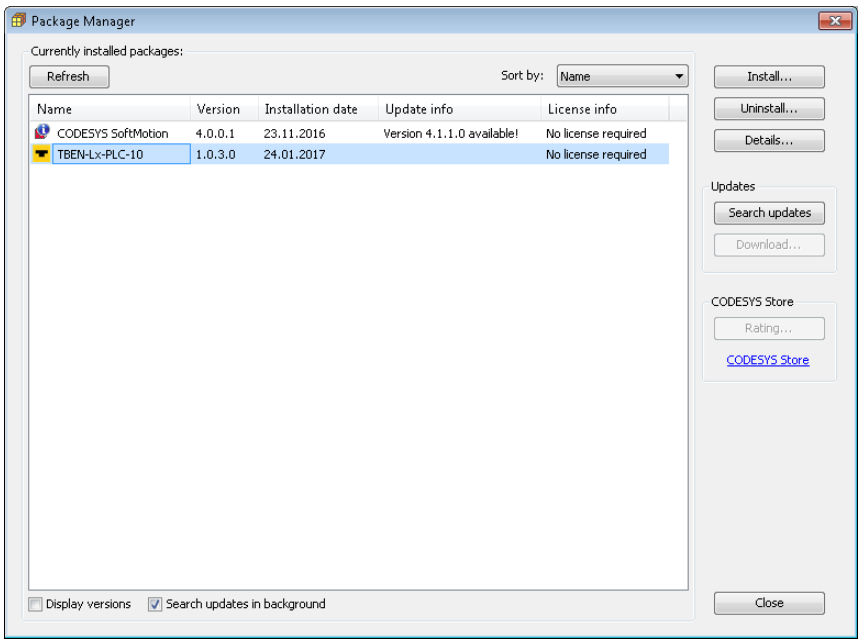


Fig. 40: Package Manager in CODESYS

The device package for CODESYS contains all necessary files

- CODESYS Device Description
- CODESYS libraries
- GSDML-file
- EDS file
- etc.

## 9.5.2 Creating a standard project with TBEN-L…-PLC-… in CODESYS V3.5.8.10

➤ Create a new standard project with TBEN-L…-PLC-… as CODESYS device.

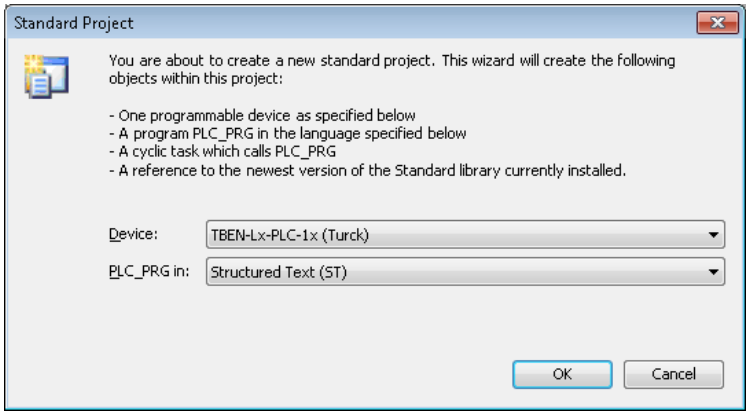


Fig. 41: Selecting the TBEN-L…-PLC-… as CODESYS device

➥ The CODESYS project is created.

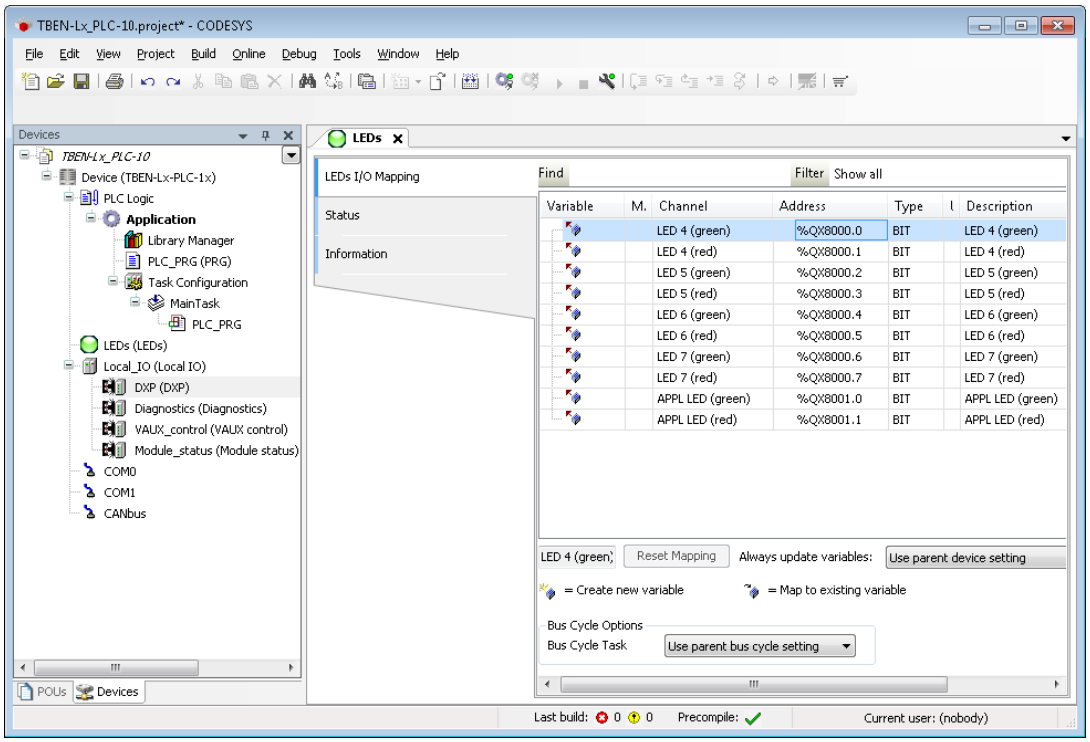


Fig. 42: CODESYS project

In addition to the PLC logic, the project contains:

- **5 LEDs for free use in the program**
  - Each LED uses 2 bit in the process output data of the device. They are automatically mapped to the output bits %QX8000.0 to %QX8001.1 (see **Fig. 42: CODESYS project (page 54)**).
- **Local_IO**
  - Configuration of the device's local I/Os and the VAUX diagnostics.
  - Diagnostics of the local I/Os and module status.
- **2 serial interfaces (COM0 and COM1)**
  - Connection of RS232 and RS485 devices
- **1 CAN interface (CANbus)**
  - Use of the device as CANopen Device, CANopen Manager or as SAE J1939 Manager

## 9.6 Modbus TCP Master

| Properties | |
|---|---|
| max. number of TCP slaves | 64 |
| Min. Cycle Time | 2 ms |
| Max. number of devices at 2 ms | 8 |

### 9.6.1 Configuring the Modbus TCP Master

The Modbus TCP Master from 3S - Smart Software Solutions GmbH is used.

- ➤ Configure the Ethernet interface The IP address of the TBEN-L…-PLC-… corresponds to the network interface.
- ➤ Select "eth0" under "network interface".
- ➥ The IP address is set automatically.

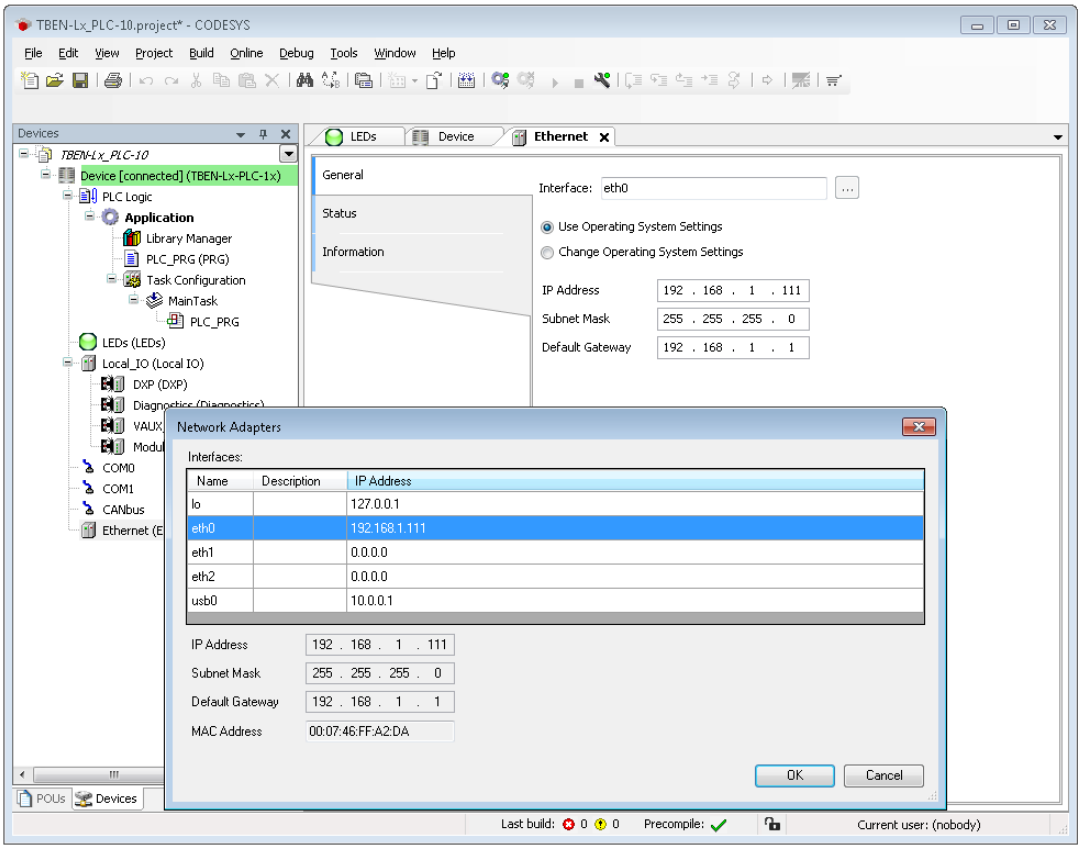


Fig. 43: Adding and configuring the Ethernet interface

➤ Add Modbus TCP Master.

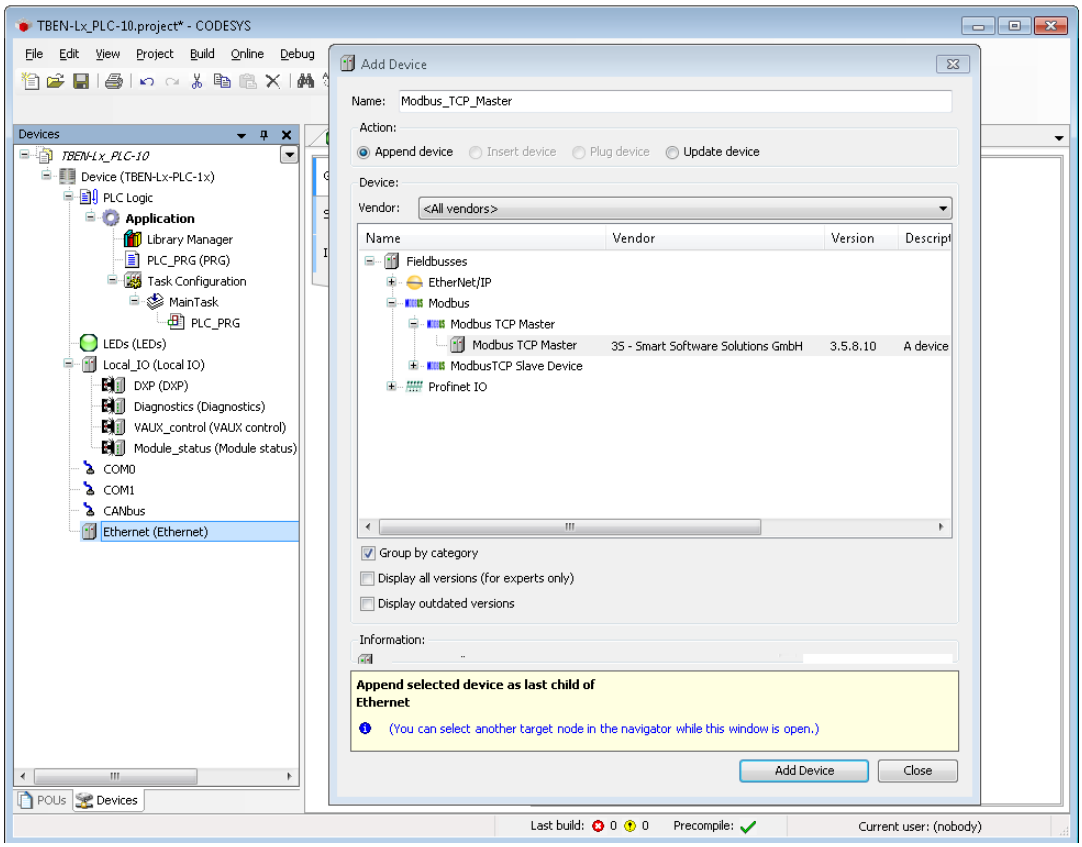


Fig. 44: Add Modbus TCP Master

➤ Activate the function "auto-reconnect" at the Master
to assure that CODESYS automatically confirms communication errors and tries to continue with executing Modbus commands instead of interrupting the Modbus communication. Otherwise the error has to be reset using a slave function block.

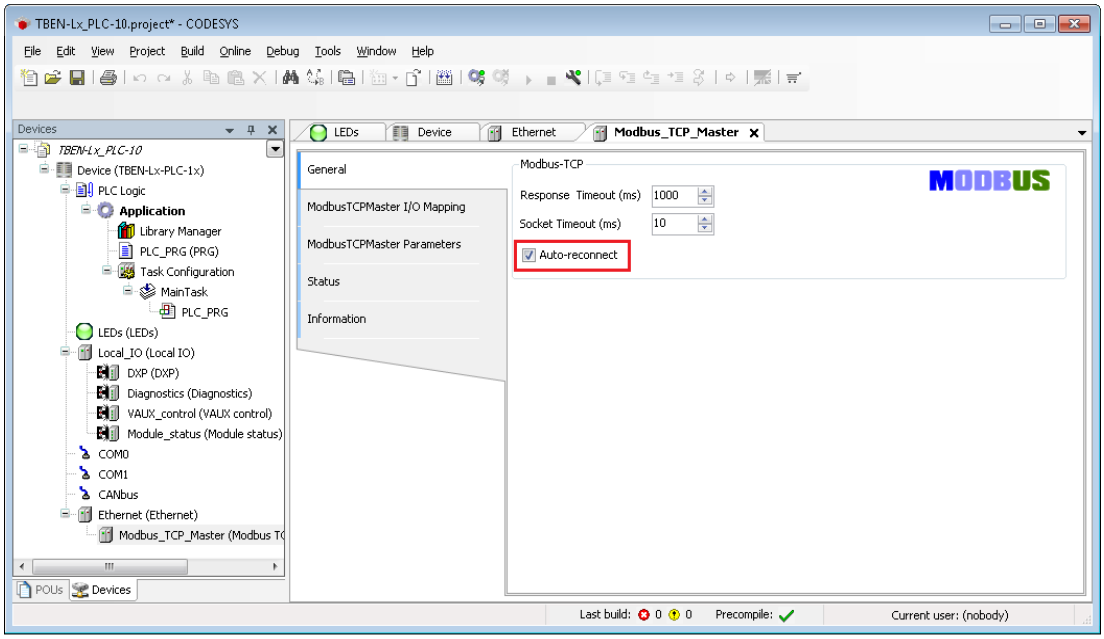


Fig. 45: Configuring the Modbus TCP Master

## 9.6.2 Configuring the external Modbus TCP Slave

➤ Add an external Modbus TCP slave using the "Add Device" function.
In this example the Turck multiprotocol device TBEN-S1-4DIP-4DOP is used as Modbus Slave.

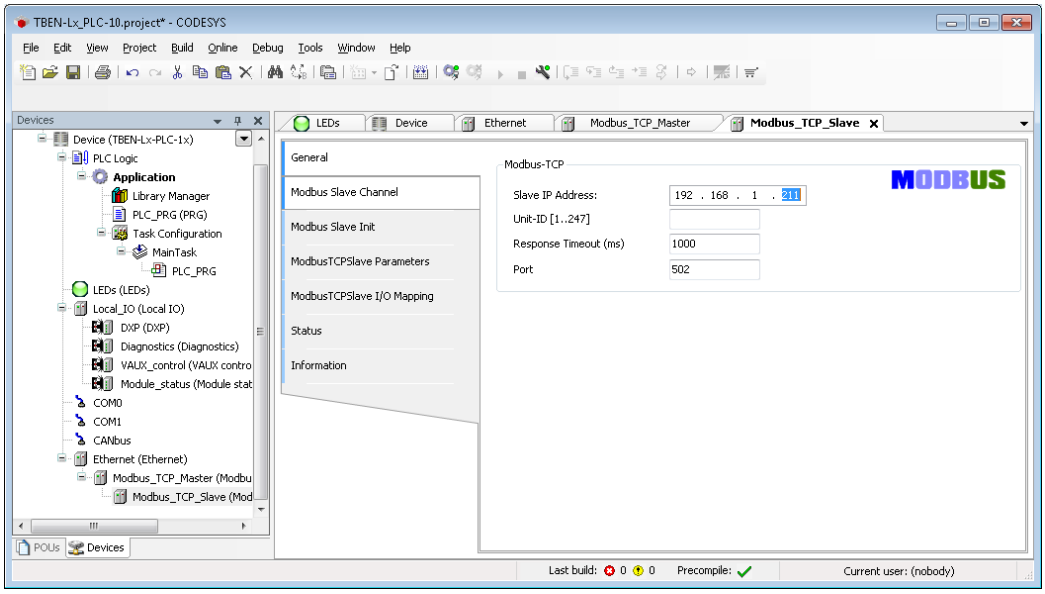


Fig. 46: Configuring the external Modbus TCP Slave

➤ Add Modbus Slave channels for the communication with the slave.

➤ Observe the process data offsets of the slave. In the example (**Fig. 47: Adding Modbus Slave channels**) the slave's process output data start with register 0x0800.

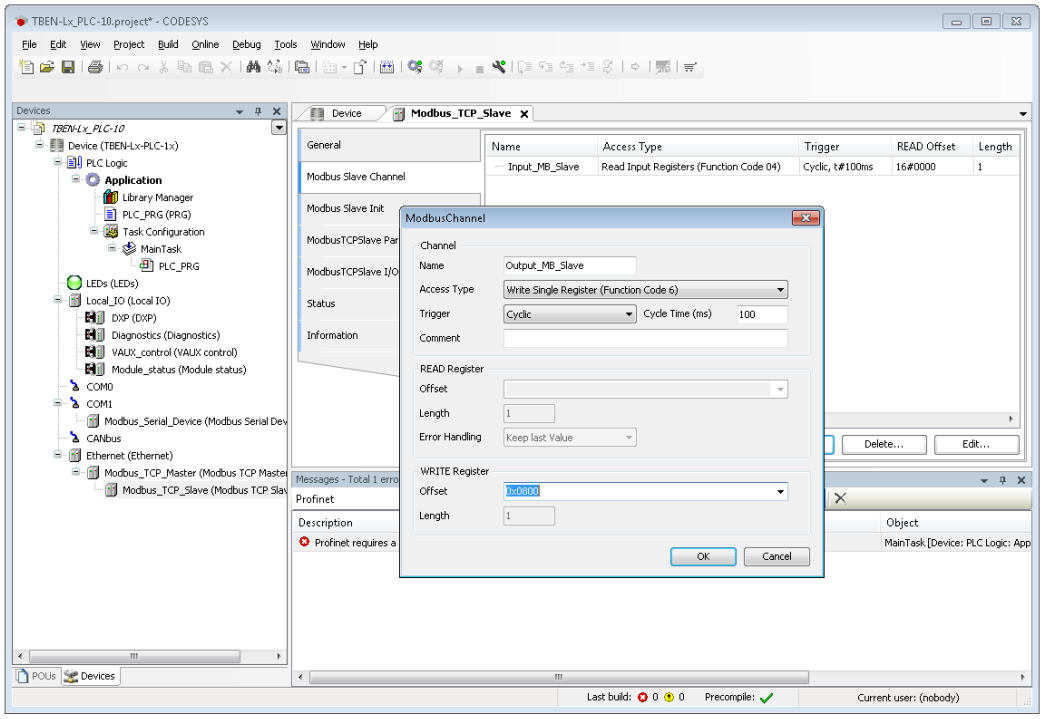


Fig. 47: Adding Modbus Slave channels

## 9.7 Modbus TCP-Slave Device

| Properties | |
|---|---|
| Max. number of input registers | 1024 |
| Max. number of holding registers | 1024 |

### 9.7.1 Configuring Modbus TCP Slave Device

The Modbus_TCP_Slave_Device from 3S - Smart Software Solutions GmbH is used.

➤ Add the Modbus_TCP_Slave_Device to the Ethernet interface using the "Add Device"-function and configure it.

➤ Therefore define the number of in- and output registers (input and holding registers) which have to be exchanged with the higher-level Modbus TCP-master.

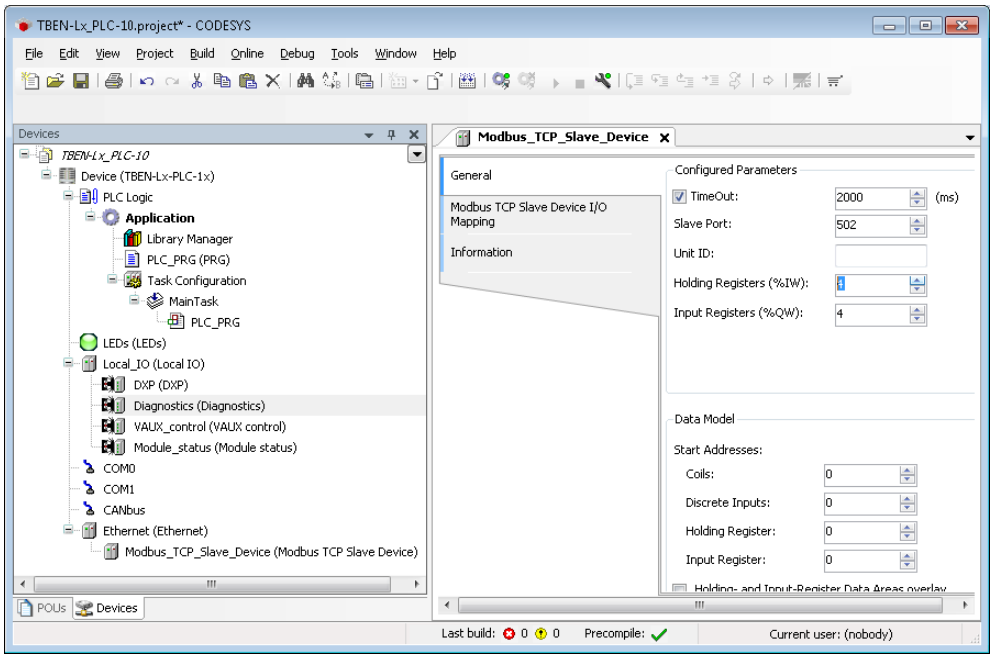


Fig. 48: Configuring Modbus TCP Slave Device

Which data will be mapped into the input and holding registers, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

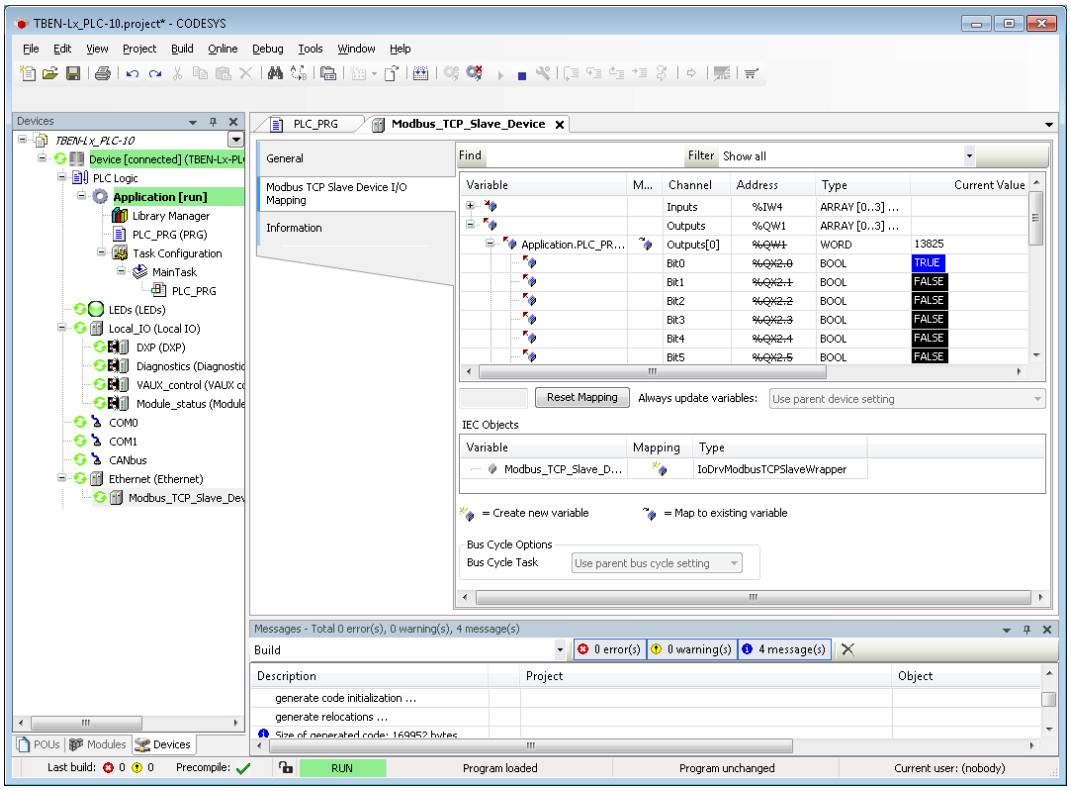


Fig. 49: Modbus TCP Slave Device data mapping

## 9.8 Modbus RTU Master

| Properties | |
|---|---|
| Max. number of devices | 64 |
| Min. cycle time | 5 ms |
| Max. number of slaves at 5 ms | 8 |

### 9.8.1 Configuring the Modbus RTU Master

The serial Modbus Master from 3S - Smart Software Solutions GmbH is used.

- Add the serial Modbus RTU Master to the respective COM interface.
- Activate the function "Auto-restart Communication" at the Master.
  to assure that CODESYS automatically confirms communication errors and tries to continue with executing Modbus commands instead of interrupting the Modbus communication.?
  Otherwise the error has to be reset using a slave function block.

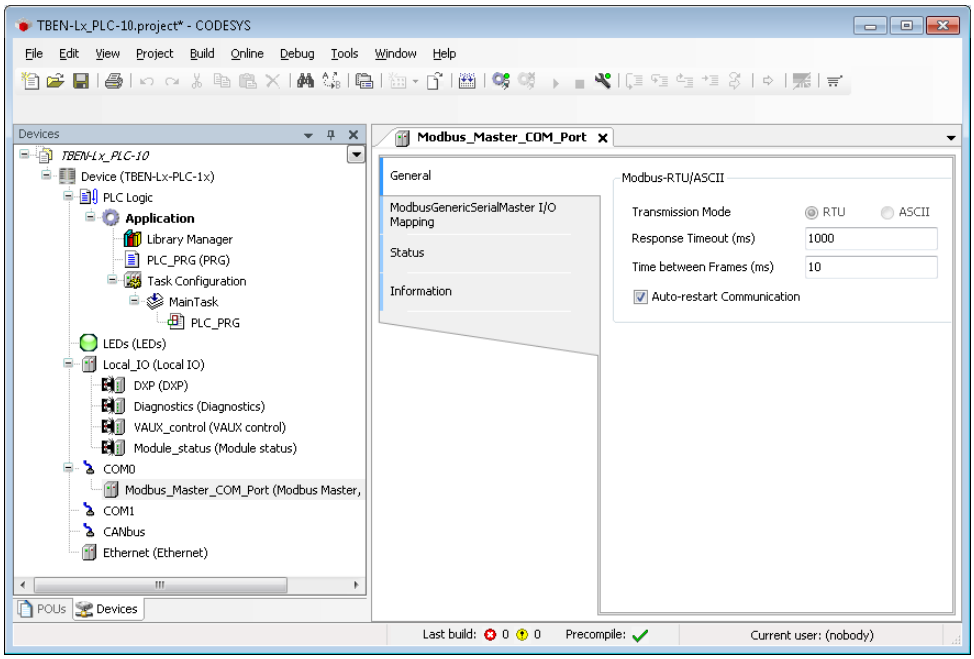


Fig. 50: Add Modbus RTU Master

## Configuring the external Modbus RTU Slave

- Add an external Modbus RTU slave using the "Add Device" function and configure it.
  In this example the Turck multiprotocol device TBEN-S2-2COM-4DXP is used as Modbus Slave.
- Add Modbus Slave Channels for the communication with the Slave.
  Observe the process data offsets of the slave. In the example the slave's process output data start with register 0x0800.

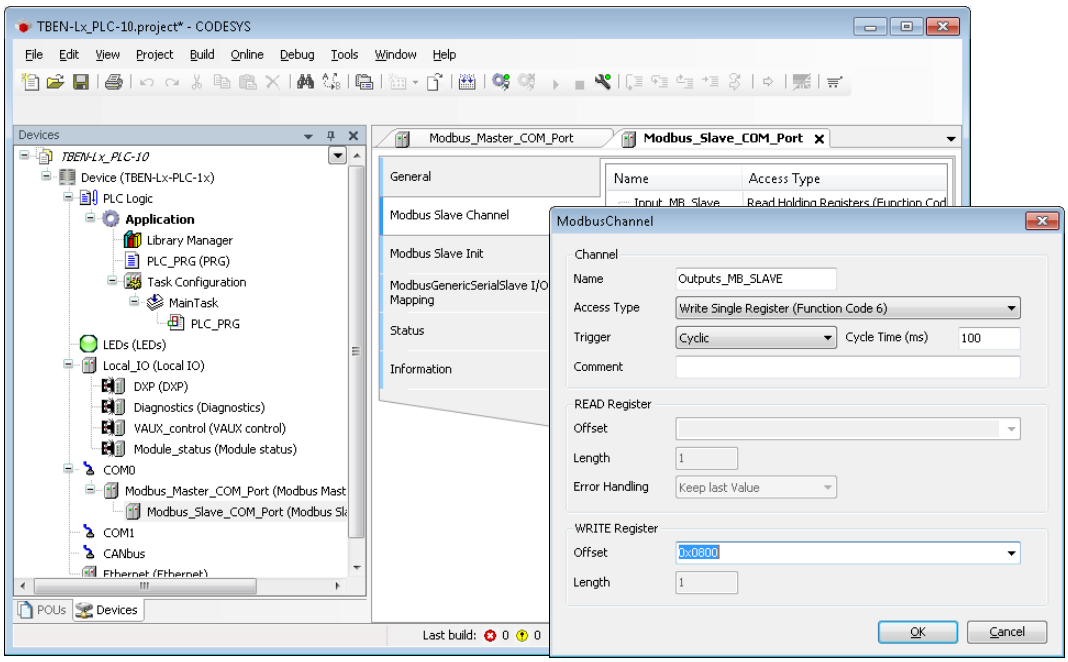


Fig. 51: Configuring the external Modbus RTU Slave

## 9.9 Modbus RTU Device

| Properties | |
|---|---|
| Max. number of input registers | 500 |
| Max. number of holding registers | 500 |

### 9.9.1 Configuring the Modbus RTU Device

The Modbus_Serial_Device from 3S - Smart Software Solutions GmbH is used.

- Add the Modbus_Serial_Device to the COM port using the "Add Device" function and configure it.
- Therefore define the number of in- and output registers (input and holding registers) which have to be exchanged with the higher-level Modbus TCP-master.

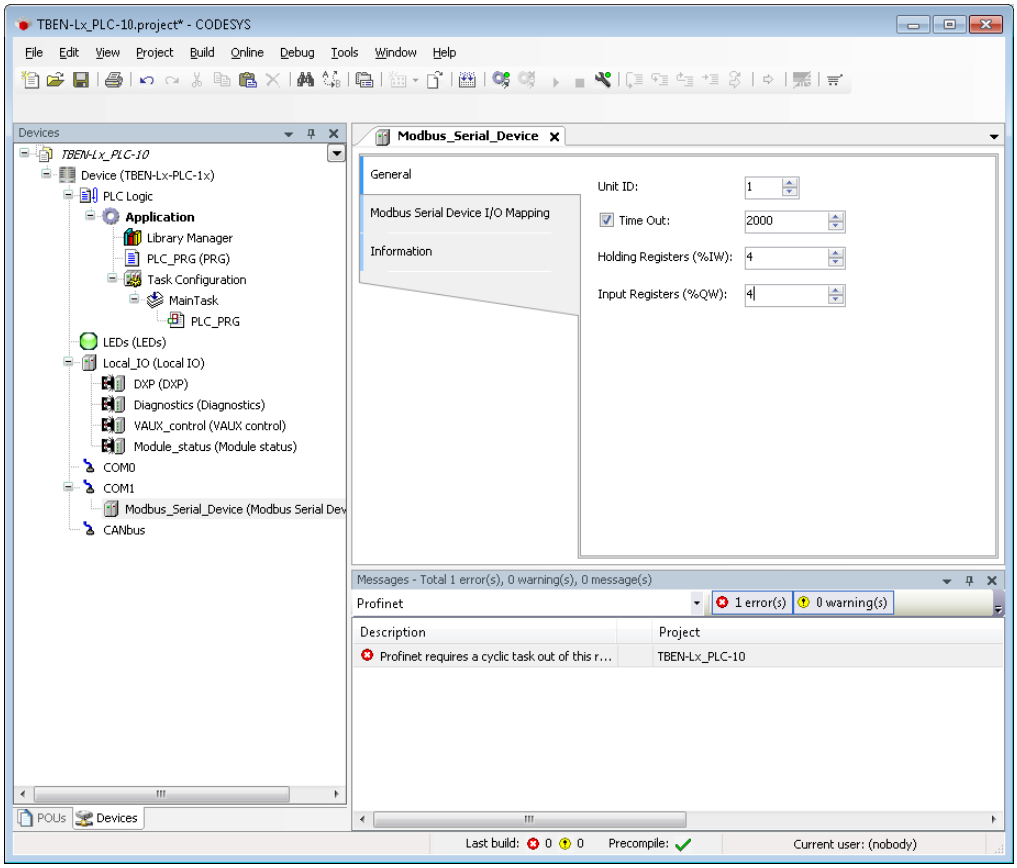


Fig. 52: Configuring the Modbus_Serial_Device

Which data will be mapped into the input and holding registers, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

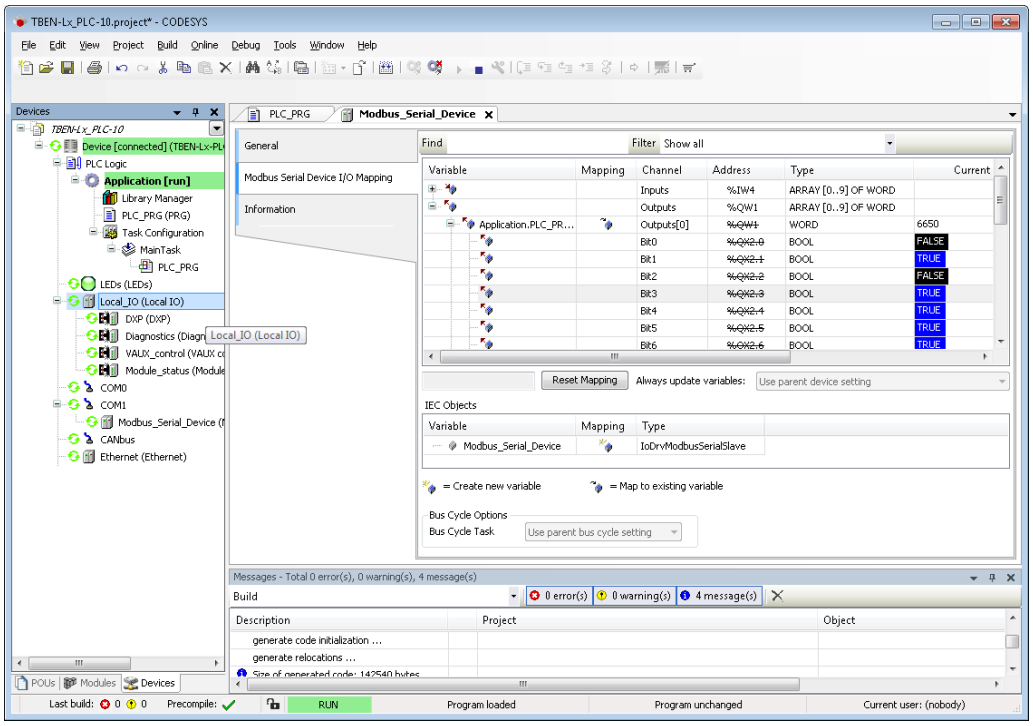


Fig. 53: Modbus_Serial_Device data mapping

## 9.10 PROFINET Controller

| Properties | |
|---|---|
| Max. number of devices | 64 |
| Min. cycle time | 1 ms |
| Max. number of devices at 1 ms | 8 |

### 9.10.1 Configuring the PROFINET Controller

The PN-Controller from 3S - Smart Software Solutions GmbH is used.

➤ Add the Ethernet interface and configure it. The IP address of the network interface corresponds to the IP address of the TBEN-L…-PLC-….

➤ Select "eth0" under "network interface".

➥ The IP address is set automatically.

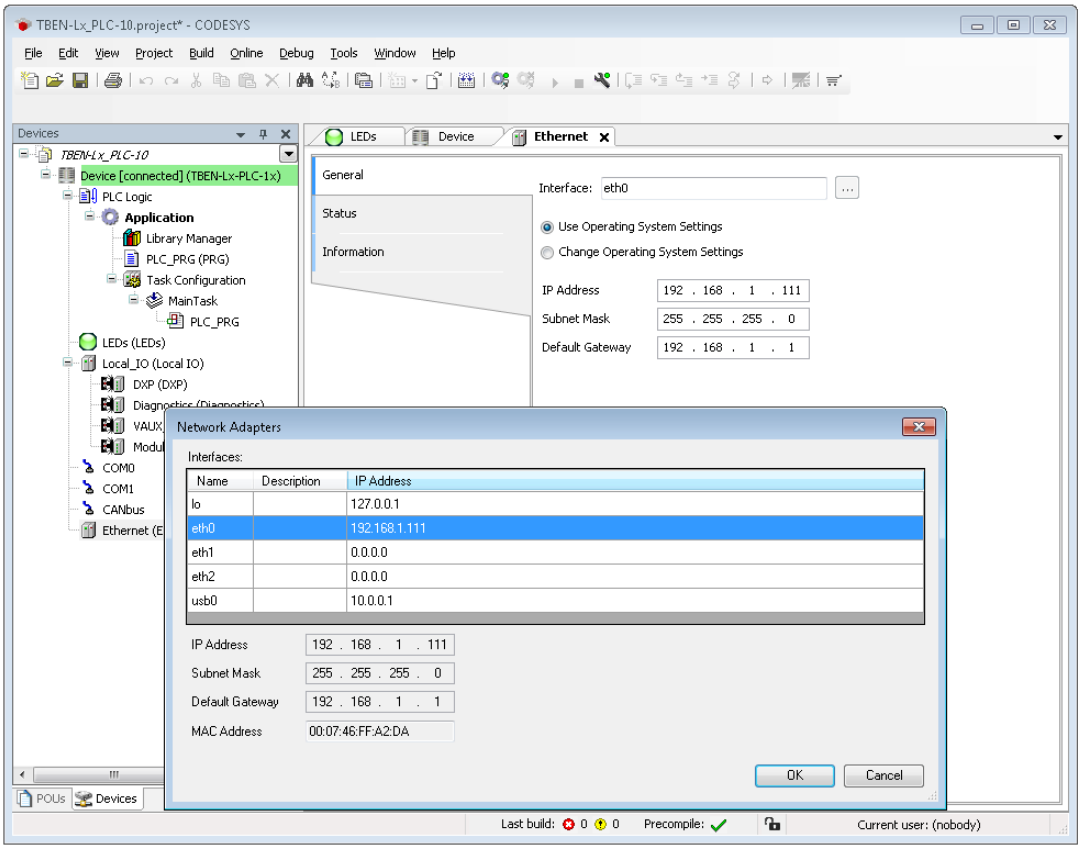


Fig. 54: Adding and configuring the Ethernet interface

➤ Add the PN Controller.

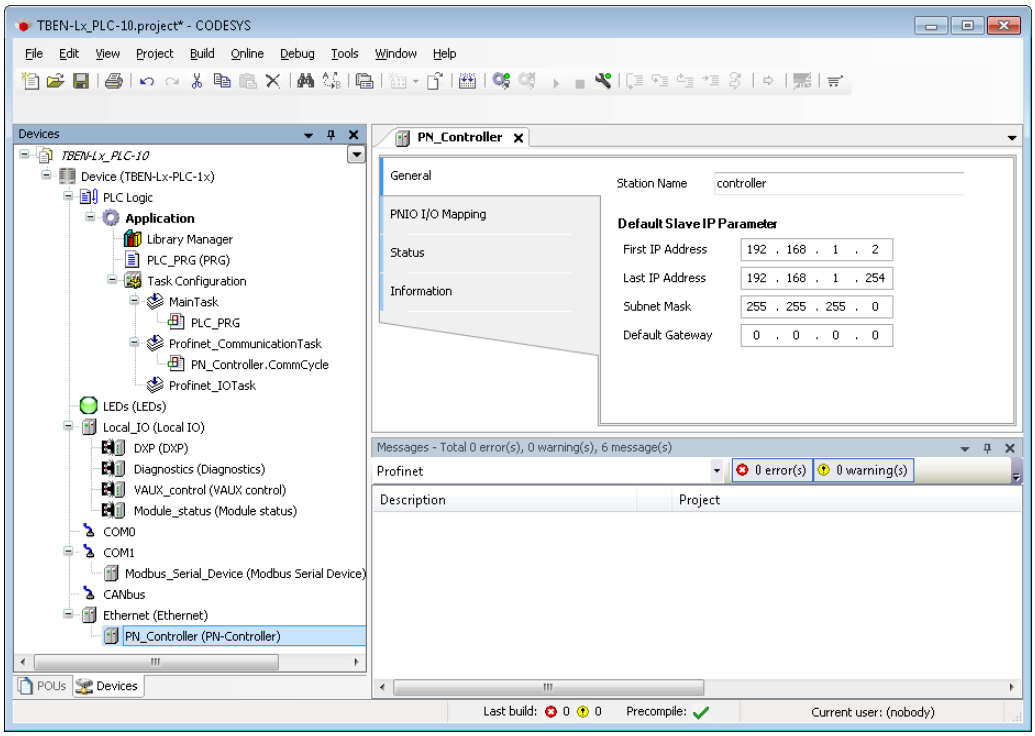


Fig. 55: Adding the PN Controller

**NOTE**

The Device addresses under "Default Slave IP Parameter" and the Ethernet interface of the TBEN-L…-PLC-… have to be in the same subnet.

### 9.10.2 Configuring an external PROFINET Device

Add an external PROFINET Device using the "Add Device" function and configure it.
In this example the Turck multiprotocol device TBEN-S1-4DIP-4DOP is used as PROFINET Device.

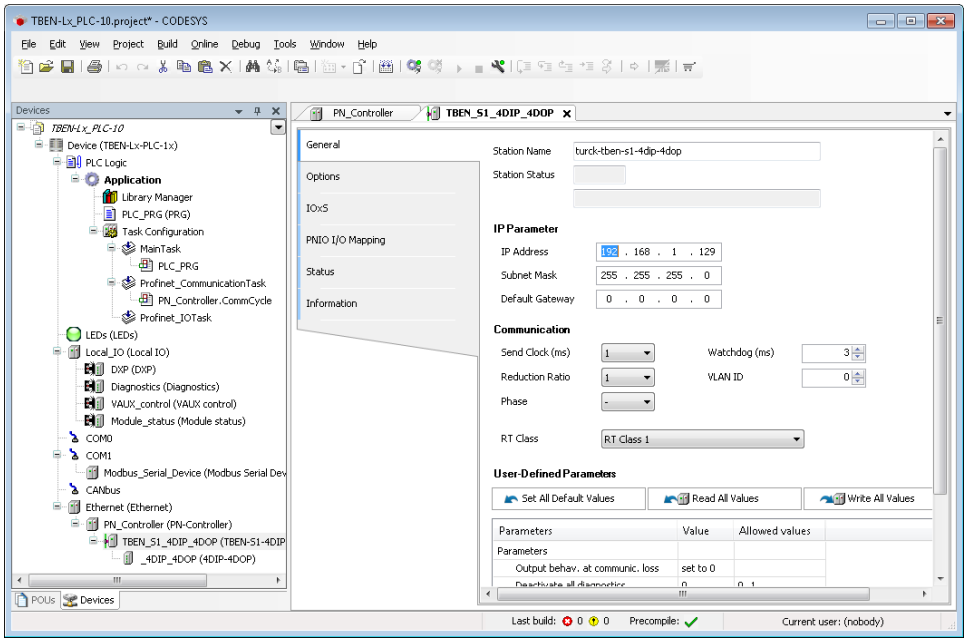


Fig. 56: Configuring an external PROFINET Device

**NOTE**

The IP addresses of the PROFINET Devices and the PN Controller have to be in the same subnet.

## 9.11 PROFINET Device

| Properties | |
|---|---|
| max. number of I/O data | 1024 byte in total<br>(512 IN + 512 OUT) |

### 9.11.1 Configuring the PROFINET Device in CODESYS

The Profinet_Device from 3S - Smart Software Solutions GmbH is used.

- ➤ Add the Profinet_Device to Ethernet using the "Add Device" function.
- ➤ Configure the in- and output data lengths which have to be exchanged with the higher-level PROFINET Master.

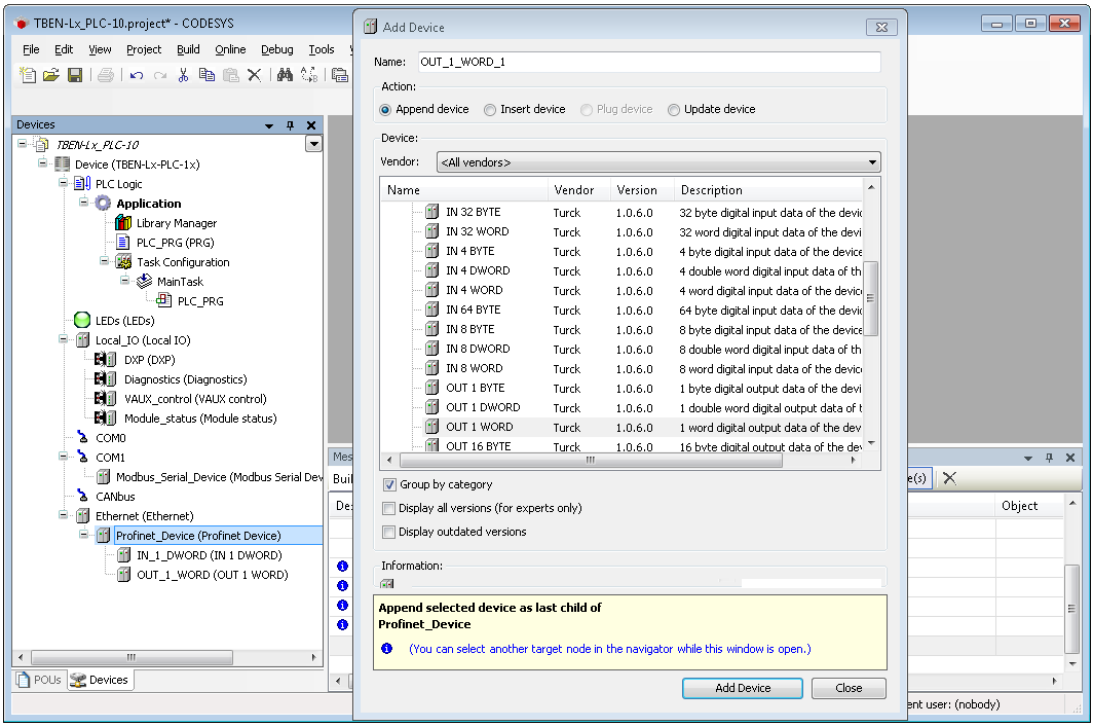


Fig. 57: Configuring the PROFINET Device in CODESYS

**NOTE**

When configuring the I/O-data the following has to be observed: The input data in CODESYS have to be configured as output data in the PROFINET Controller configuration and the output data in CODESYS as input data.
The data thus have to be configured in reverse order in the PROFINET Controller configuration (see also **Configuring the in- and output data (page 73)**).

Which data will be mapped into the configured input and output data, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

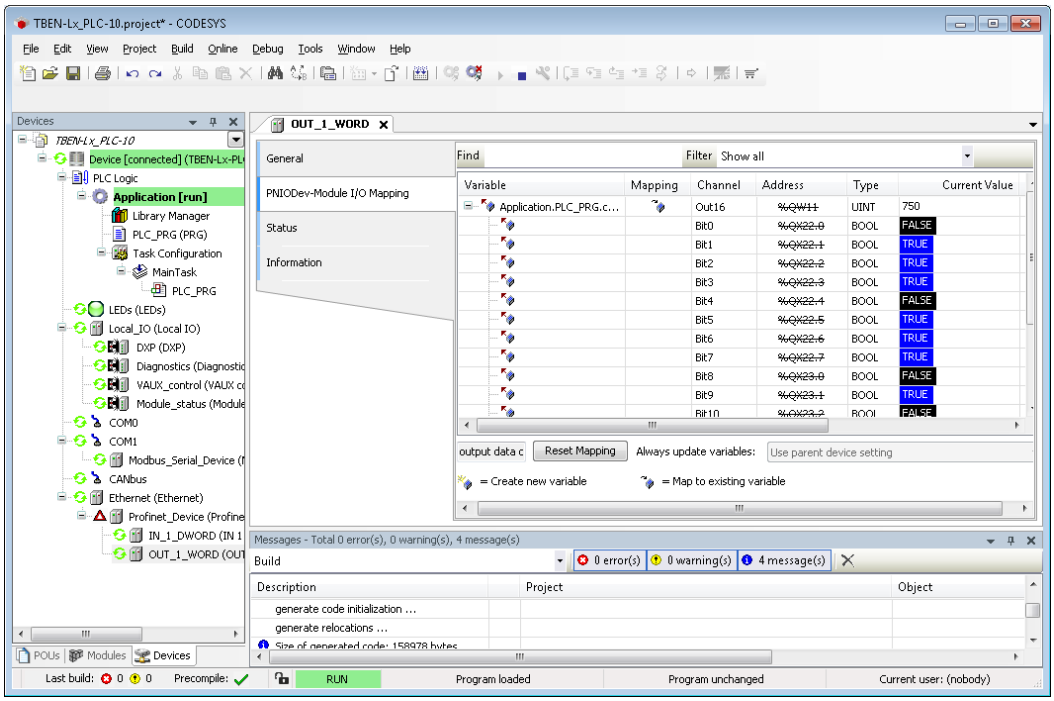


Fig. 58: PROFINET-device data mapping

**NOTE**

The PROFINET-device shows an error as long as a connection to the PROFINET Controller is established.

## 9.11.2 Configure the PROFINET Device in the PROFINET Controller.

The following example shows the PROFINET-device configuration in TIA-Portal V13 from Siemens.

The PROFINET-CODESYS-device is configured as standard PROFINET Device in TIA-Portal.

### Installing the GSDML-file

➤ Install the device's GSDML-file (GSDML-V2.3-TURCK-CDS3_PN_Device-…-….xml) in the PROFINET configuration software. It can be downloaded from www.turck.com

➥ The device is added to the hardware catalog "CDS 3 PN Device".

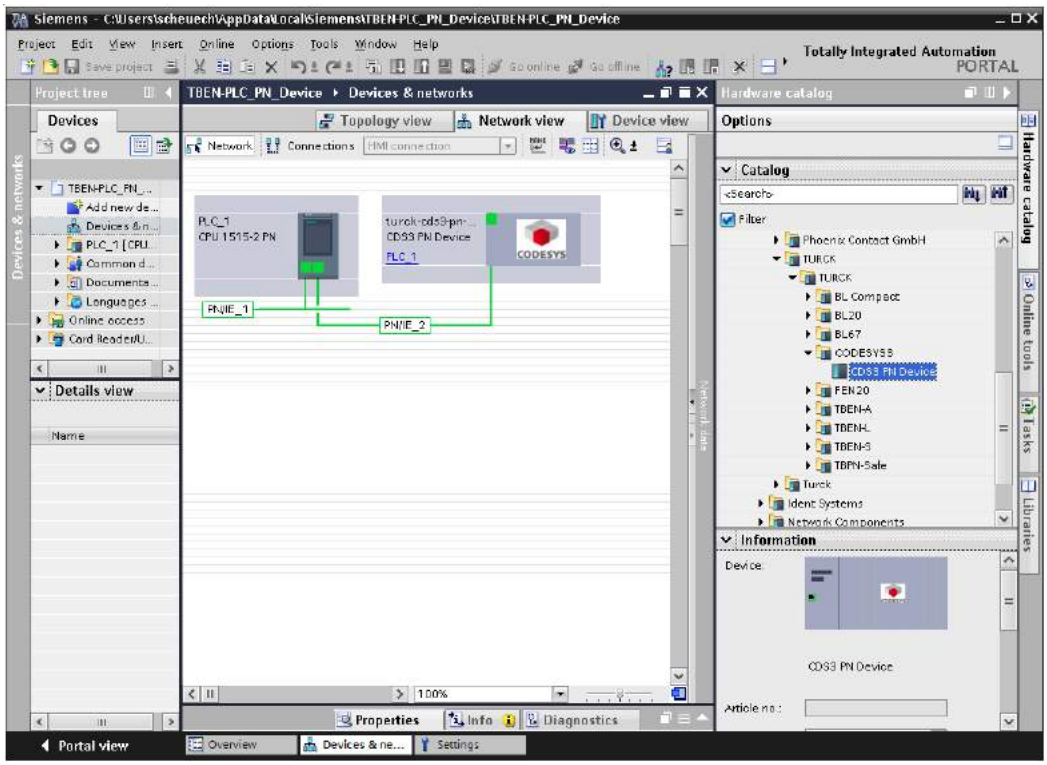


Fig. 59: Configuring the PROFINET-device in TIA-Portal

## Configuring the PROFINET parameters

Like for all other PROFINET Device, the PROFINET-interface has to be configured for the "CDS3 PN-Device" in the project.

➤ Set all necessary IP-settings and assign a PROFINET-device name or use the device name which has already been assigned to the device.

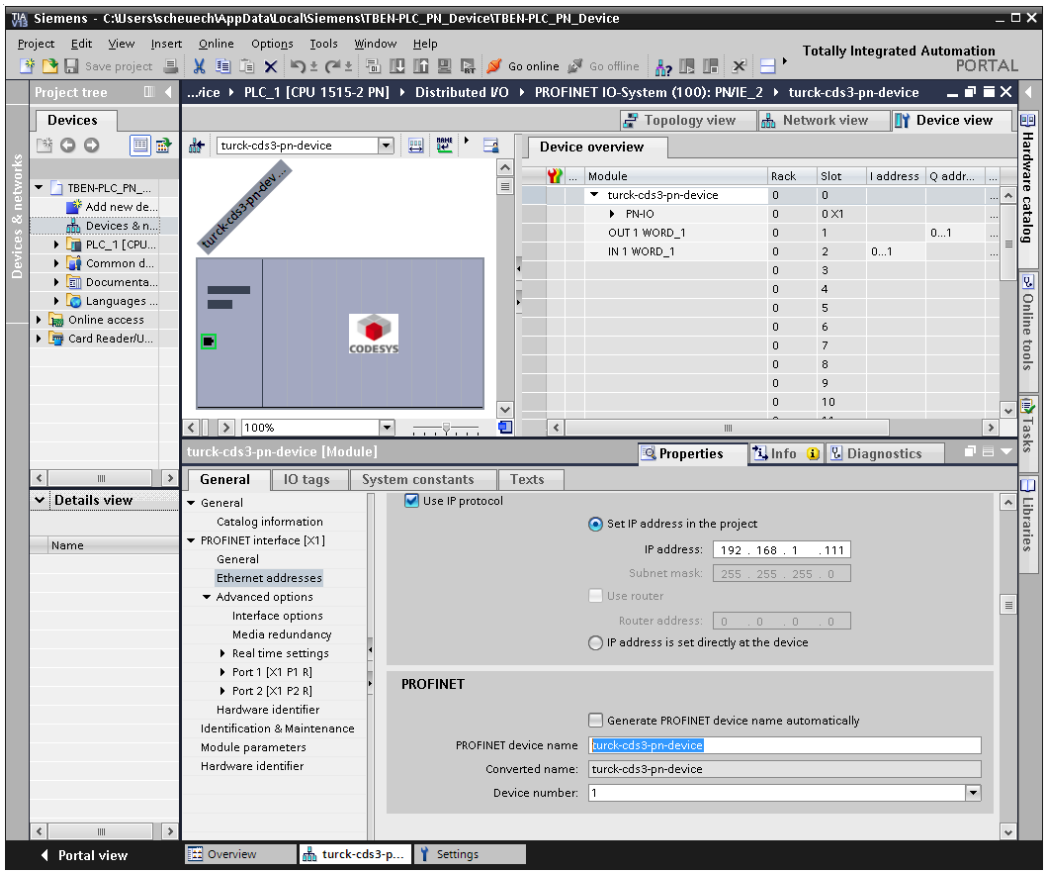


Fig. 60: Settings PROFINET-interface (CDS3 PN Device)

## Configuring the in- and output data

➤ Configure the in- and output data, which have to be exchanged with the CODESYS-device.

**NOTE**

The configuration of the data in TIA-Portal has to be done in reverse order compared to the configuration in CODESYS. Input data in TIA-Portal are output-data in CODESYS, and vice versa.
The configured data lengths have to match.

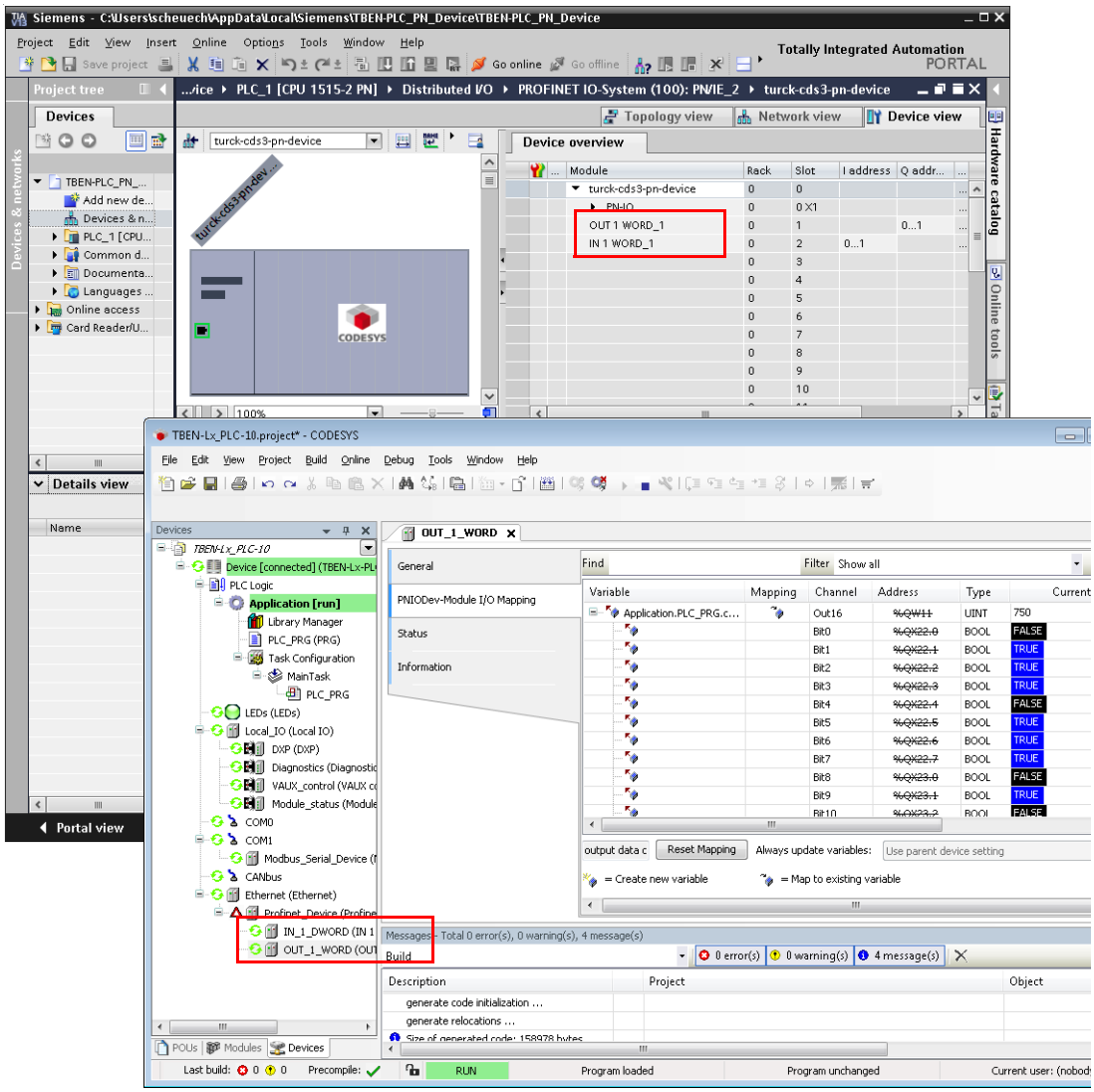


Fig. 61: Configuration of in- and output data in TIA-Portal/CODESYS

## 9.12 EtherNet/IP™ Scanner

| Properties | |
|---|---|
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |
| Max. number of devices at 10 ms | 8 |

### 9.12.1 Configuring the Ethernet/IP™ Scanner

The EtherNet/IP Scanner from 3S - Smart Software Solutions GmbH is used.

➤ Add the Ethernet interface and configure it. The IP address of the network interface corresponds to the IP address of the TBEN-L…-PLC-….

➤ Select "eth0" under "network interface".

➥ The IP address is set automatically.

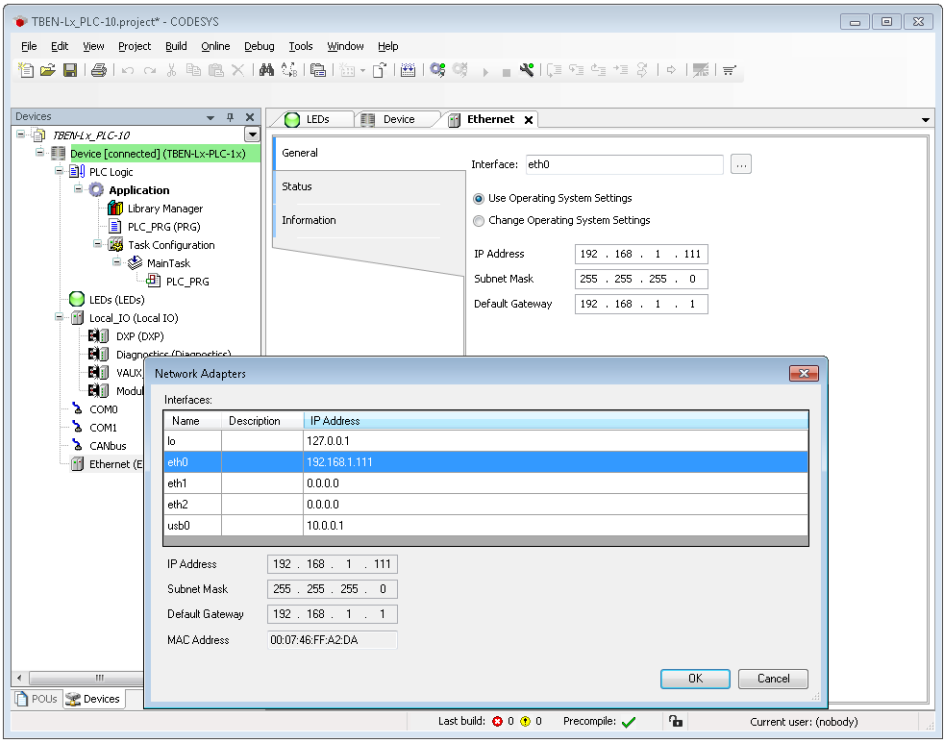


Fig. 62: Adding and configuring the Ethernet interface

➤ Add the Ethernet/IP™ Scanner

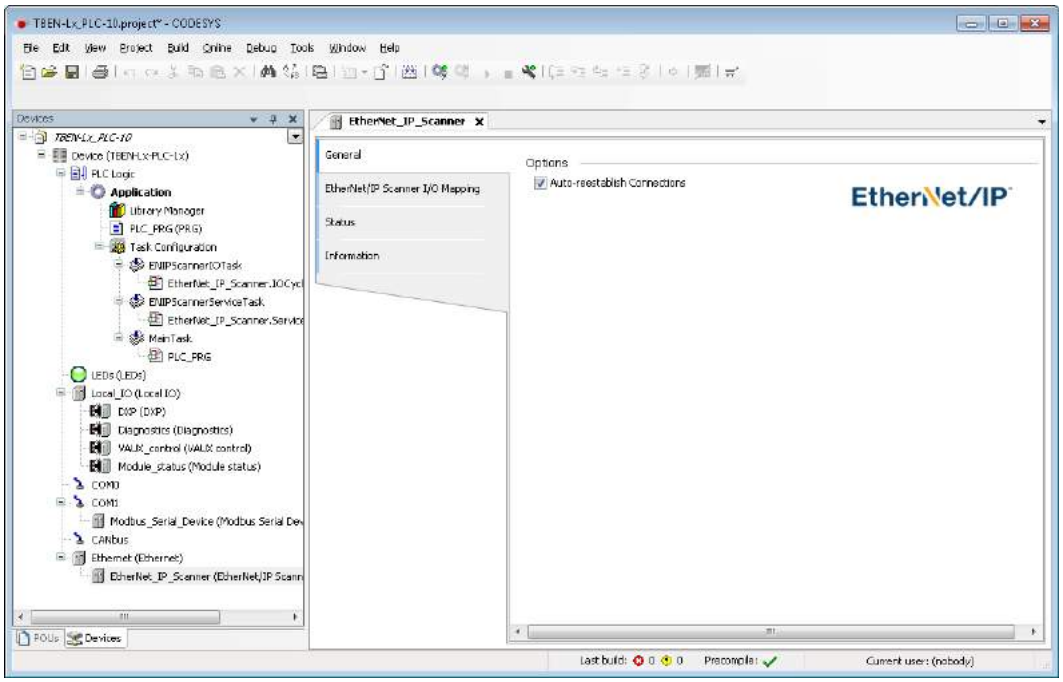


Fig. 63: Adding the Ethernet/IP™ Scanner

### 9.12.2 Configuring an external EtherNet/IP™ Device

➤ Add an external EtherNet/IP™ Device using the "Add Device" function and configure it.
In this example the Turck multiprotocol device TBEN-L5-8IOL is used as EtherNet/IP™ Device.

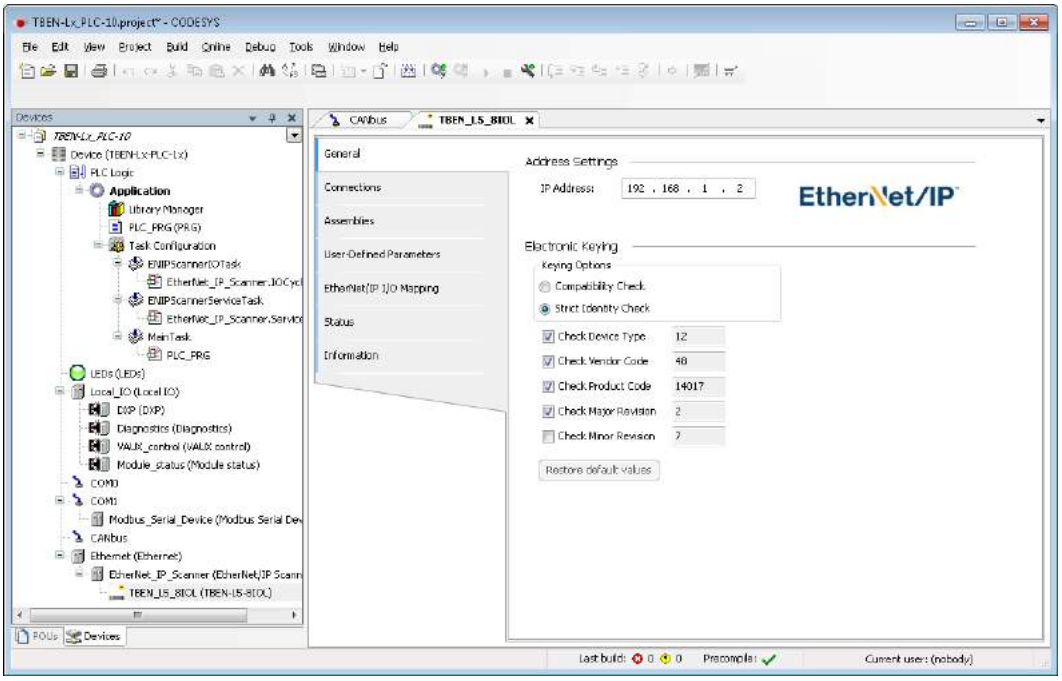


Fig. 64: Configuring an external EtherNet/IP™ Device

## 9.13 EtherNet/IP™ Slave (Device)

| Properties | |
|---|---|
| max. number of I/O data | 496 byte IN<br>492 byte OUT |

### 9.13.1 Configuring the EtherNet/IP™ Device in CODESYS

The "Ethernet IP Slave" from 3S - Smart Software Solutions GmbH is used.

- ➤ Add the EtherNet/IP™ Device to the Ethernet interface using the "Add Device" function.
- ➤ Configure the in- and output data lengths which have to be exchanged with the higher-level PLC.

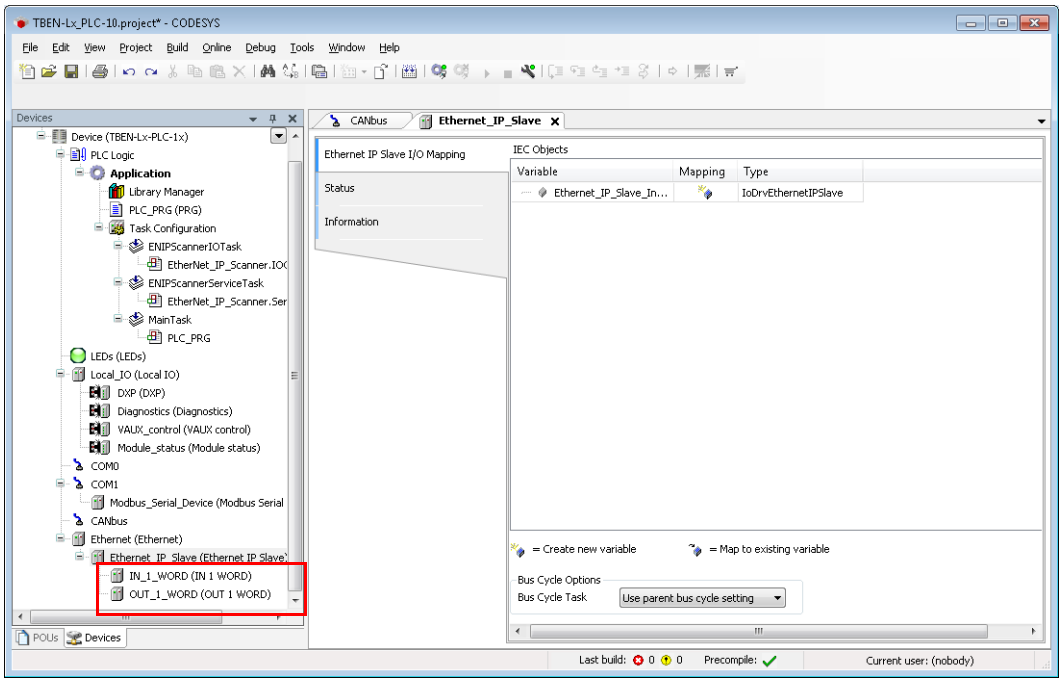


Fig. 65: Configuring an EtherNet/IP™ Device

Which data will be mapped into the configured input and output data, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

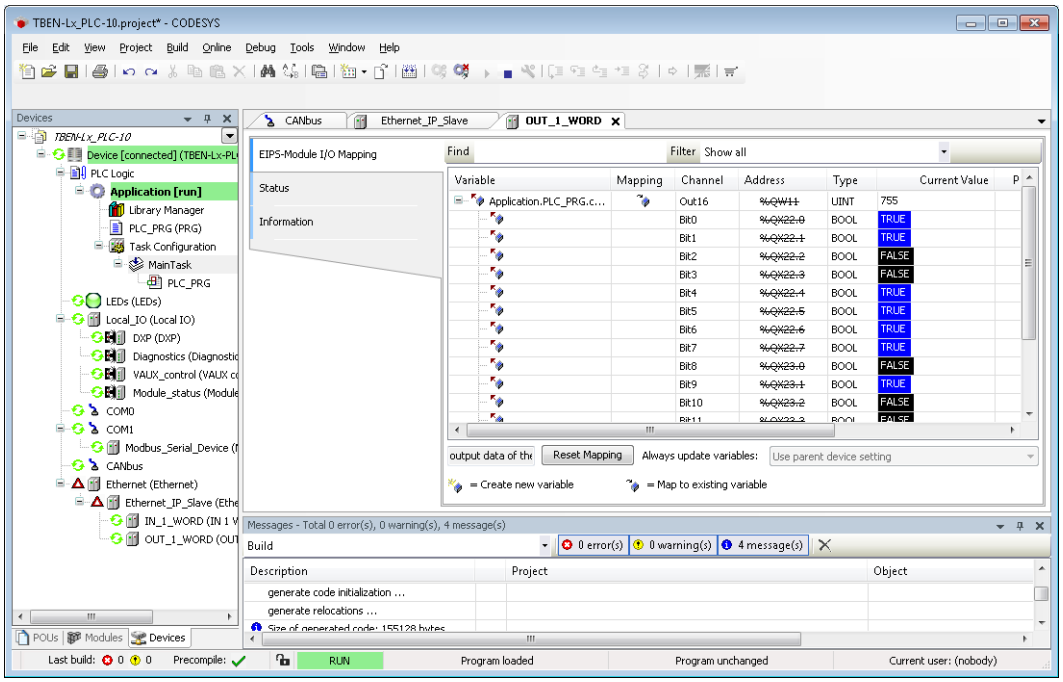


Fig. 66: EtherNet/IP™ Slave data mapping

## 9.13.2 Configuring the EtherNet/IP™ Device in EtherNet/IP™ Scanner

The following example describes the configuration of the EtherNet/IP™ Device in "RSLogix5000" V20.1. from Rockwell Automation.

The EtherNet/IP™ Device is configured as standard EtherNet/IP™ Device (Communications Adapter) in RSLogix.

Hardware in the example:

- Controller. Logix 5572™ (Allen Bradley)
- EtherNet/IP™-Bridge 1756EN2TR (Allen Bradley)
- TBEN-L…-PLC-…

### Installing the EDS-file

➤ Install the device's EDS-file (Turck CDS3.eds) in the configuration software. It can be downloaded from www.turck.com

➥ The device is added as "CDS 3 Ethernet/IP Slave" to the device catalog in RSLogix.

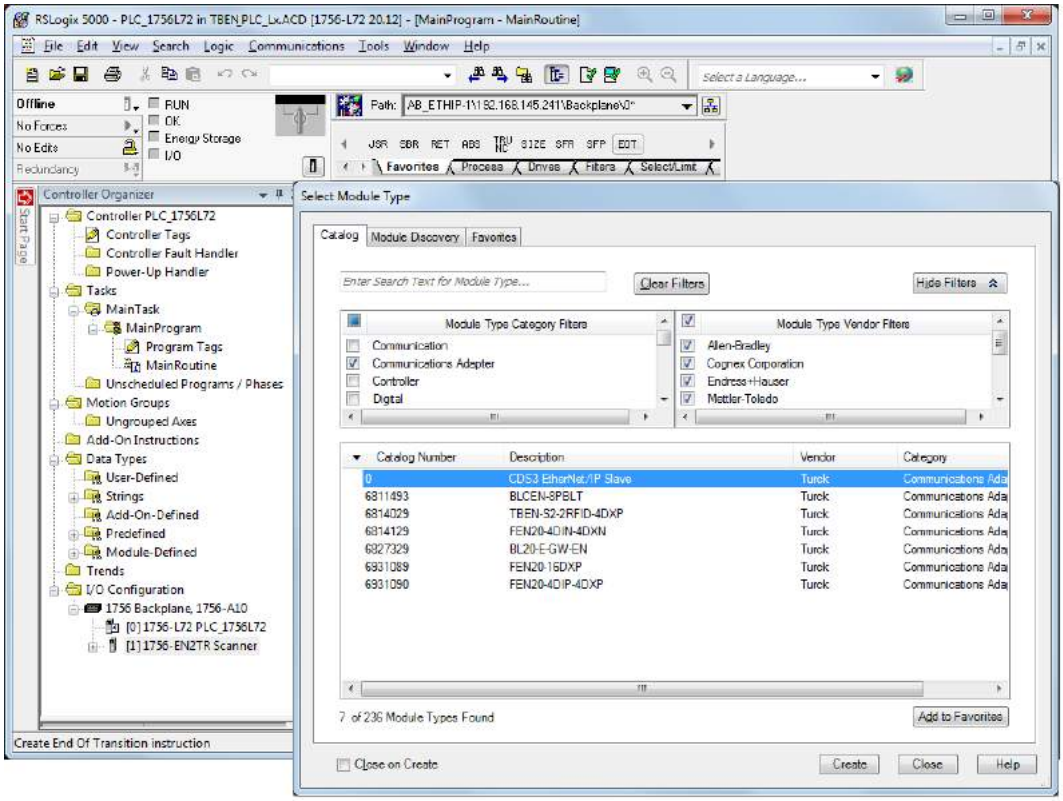


Fig. 67: "CDS 3 Ethernet/IP Slave" in the device catalog in RSLogix5000

## Configuring the Device

➤ Enter the device name and the device's IP address.

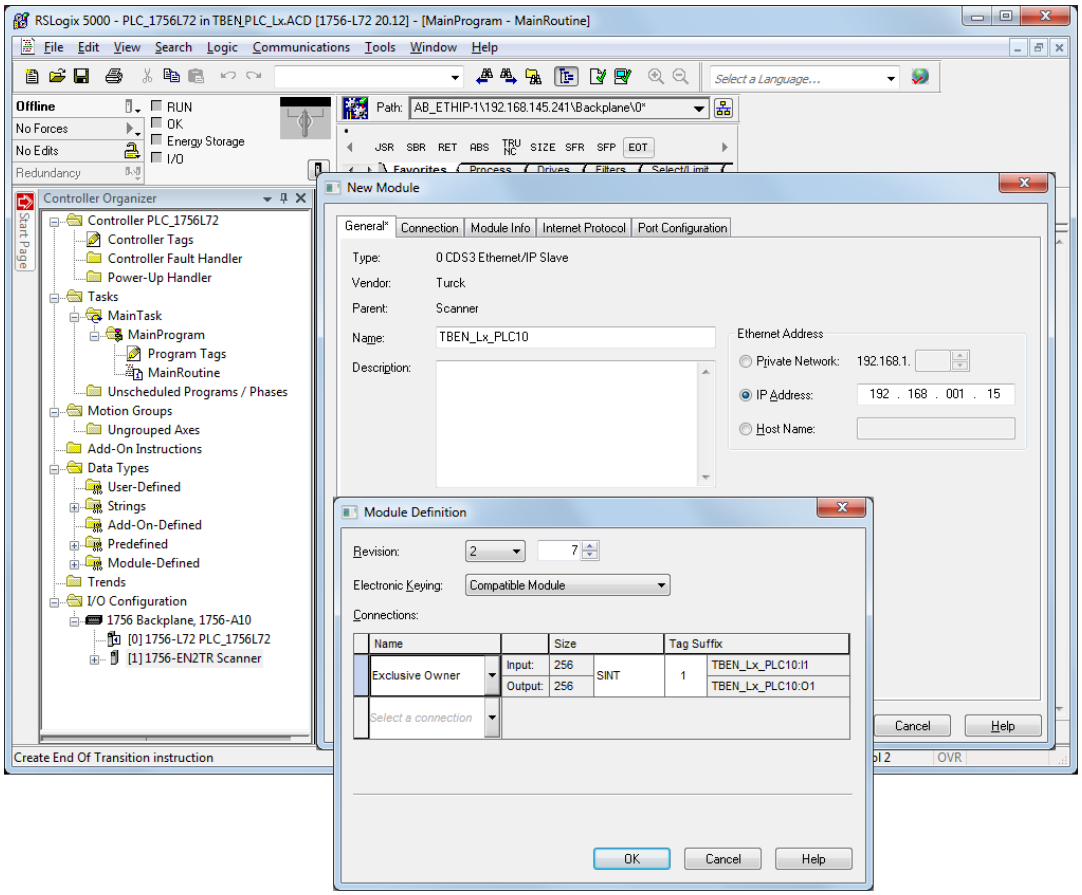


Fig. 68: Settings at the "CDS3 Ethernet/IP Slave"

## Configuring the in- and output data

The device is automatically configured with a data width of 256 byte in- and 256 byte output data.

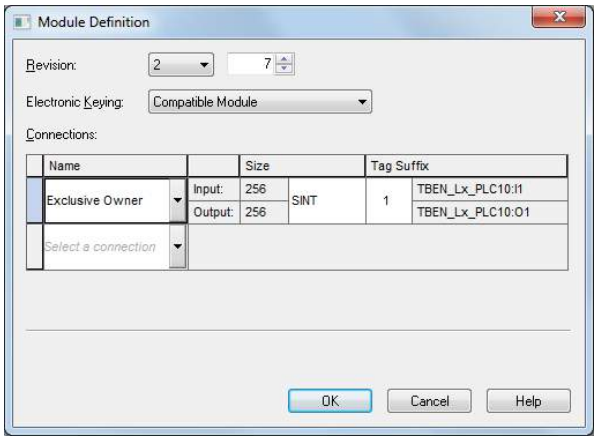


Fig. 69: EtherNet/IP™-Connection "CDS3 Ethernet/IP Slave"

**NOTE**

The EDS file limits the maximum number of in- and output data for the device to 256 Byte each. If the device is configured as generic device, than up to 496 Byte input data and 492 Byte output data are possible.

Configuring the in- and output data which have to be exchange with the CODESYS-device is not necessary. The Controller Tags are automatically generated.

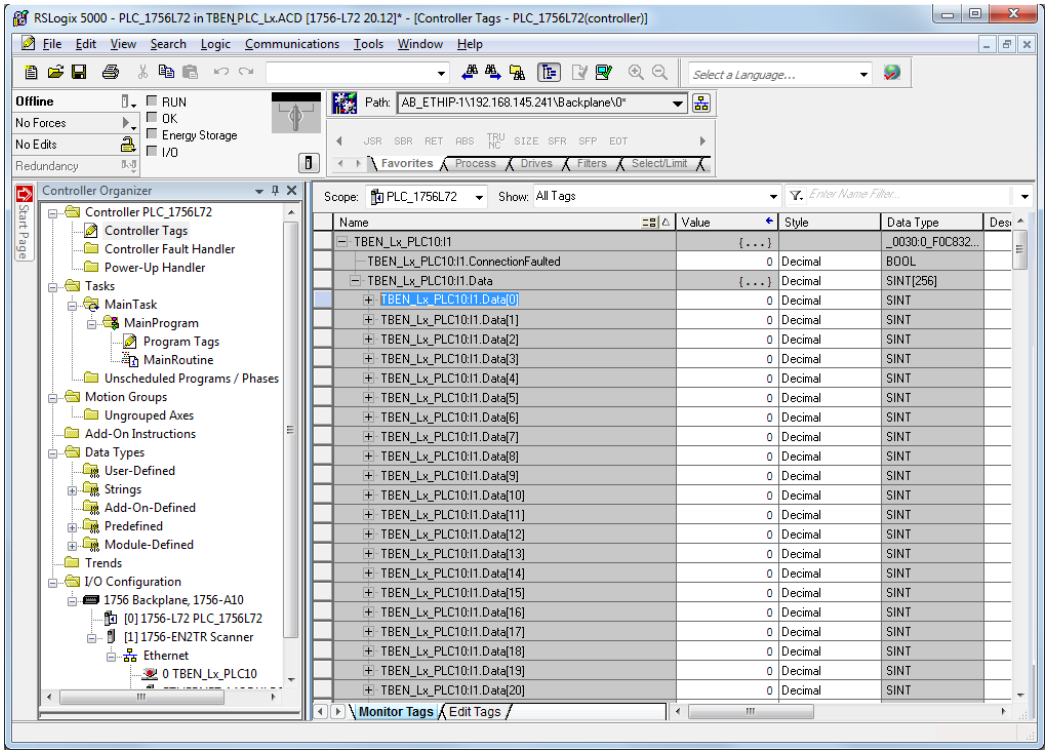


Fig. 70: Automatically generated Controller Tags of the "CDS3 Ethernet/IP Slave"

## 9.14 CANopen Manager

| Properties | |
|---|---|
| Max. number of devices | 127 |
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |

### 9.14.1 Configuring the CANopen Manager

The CANopen Manager from 3S - Smart Software Solutions GmbH is used.

➤ Add the CANopen Manager to the CANbus and configure it.

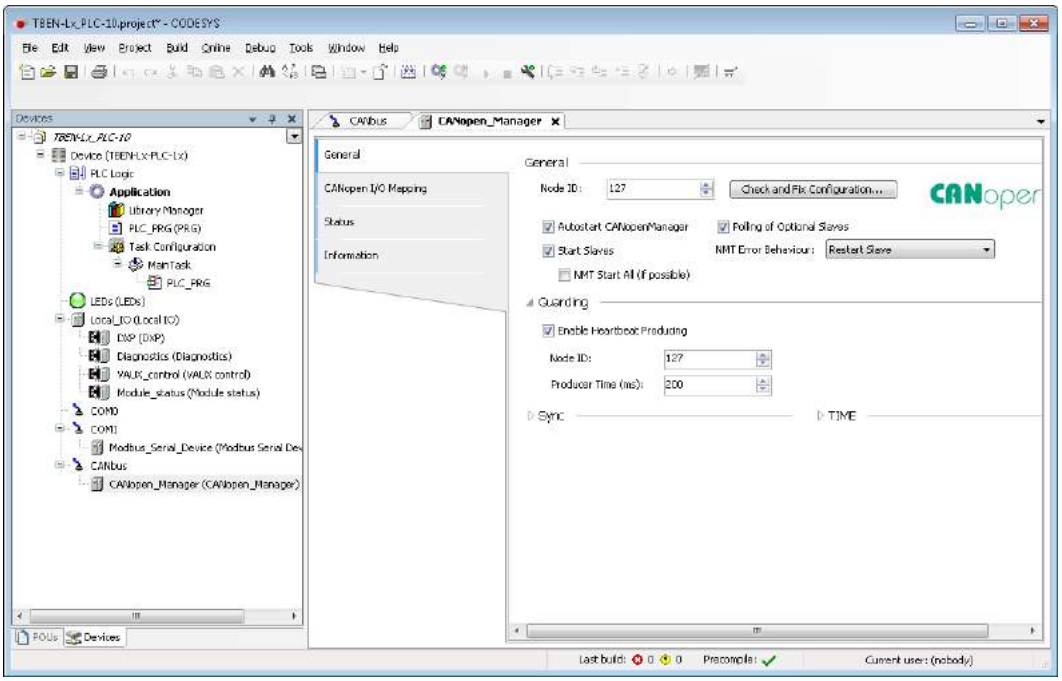


Fig. 71: Adding the CANopen Manager

### 9.14.2 Configuring an external CANopen device

➤ Add an external CANopen device to the CANopen Manager using the "Add Device" function and configure it.
In this example the Turck BL67-CANopen gateway BL67-GW-CO is used as CANopen device.

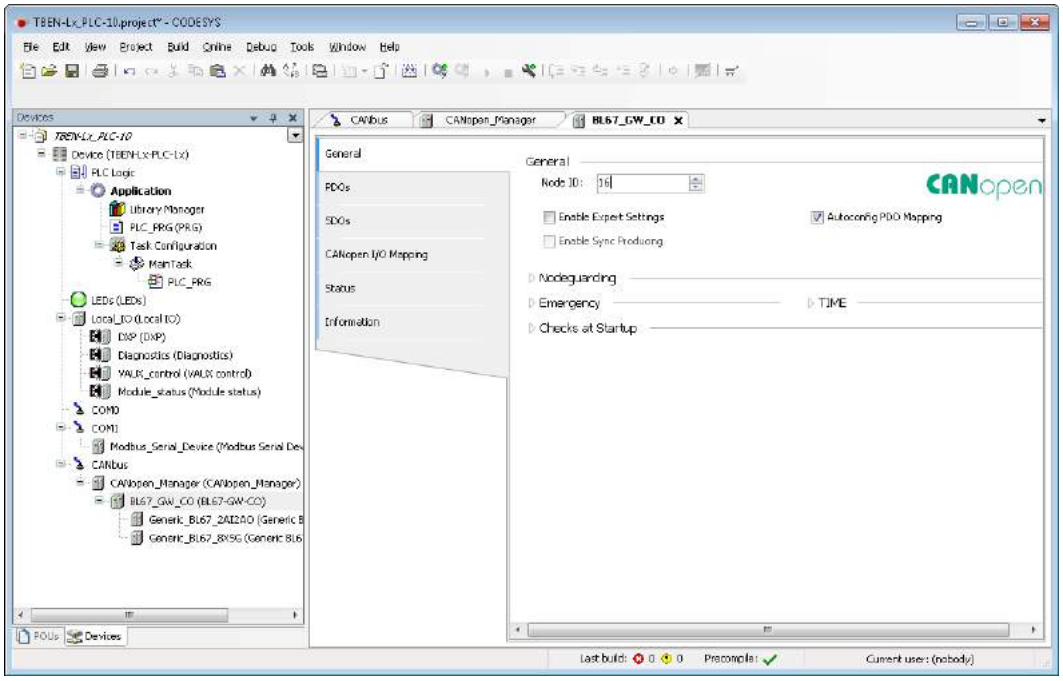


Fig. 72: Configuring the CANopen Device

## 9.15 CANopen Device

| Properties | |
|---|---|
| max. number of I/O data | max. 512 RxPDOs<br>max. 512 TxPDOs |

### 9.15.1 Configuring the CANopen Device in CODESYS

The "CANopen Device" from 3S - Smart Software Solutions GmbH is used.

- Add the CANopen Device to the CANbus using the "Add Device" function.
- Configure the Node ID etc.
- Add in- and output areas for the device via the "Edit I/O Area" function.

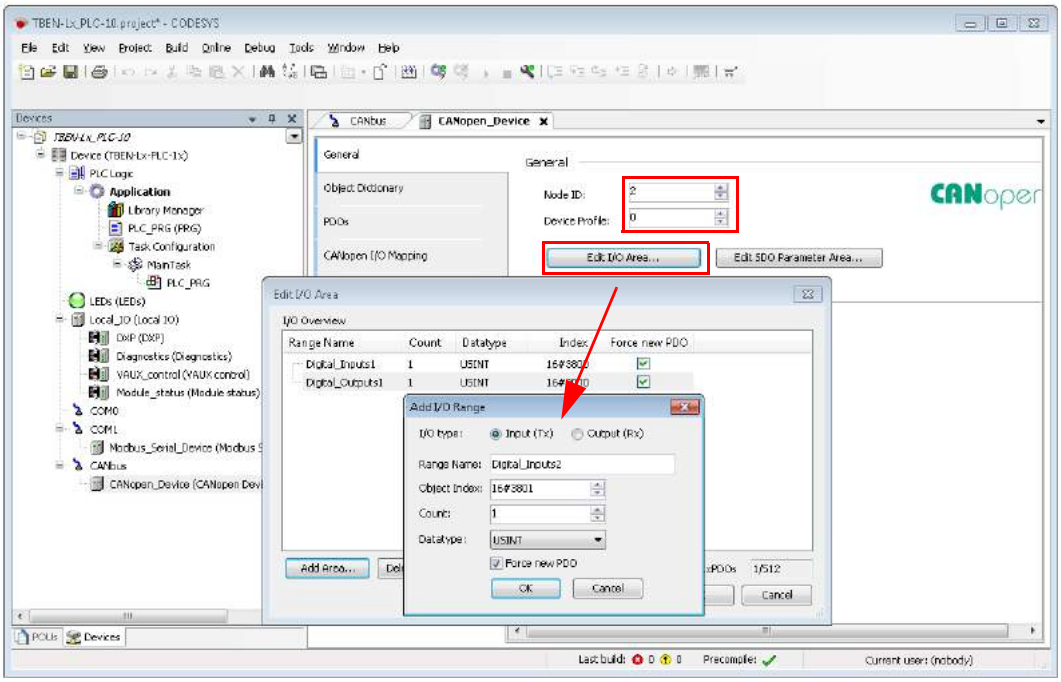


Fig. 73: Configuring the CANopen Device

Which data will be mapped into the configured input and output data, depends on assignments in the PLC program or in the I/O mapping of the TBEN-L…-PLC-….

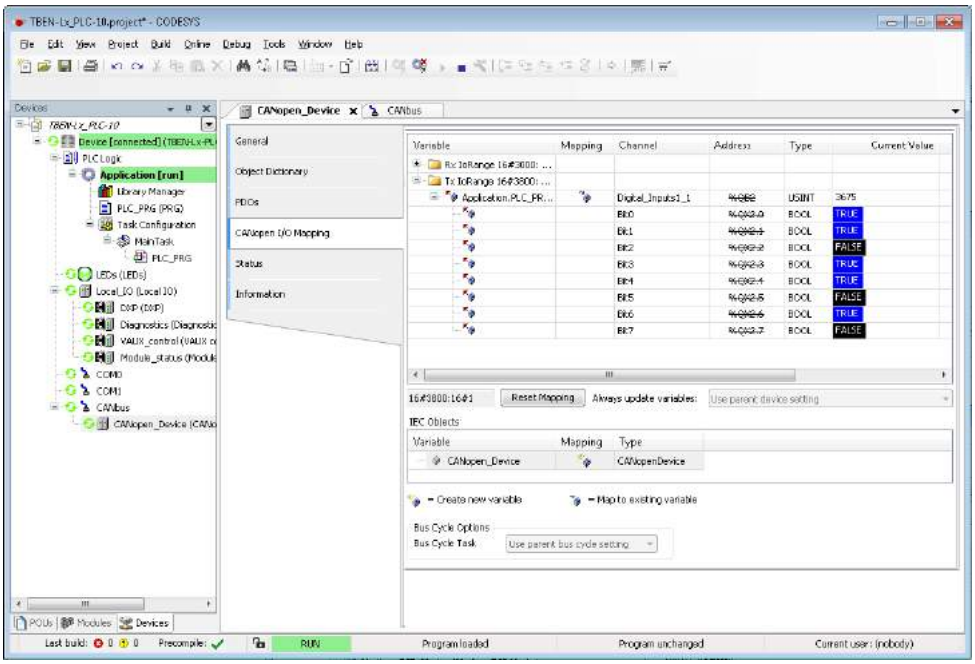


Fig. 74: CANopen Device data mapping

### 9.15.2 Export an EDS file for the CANopen Device

Use the "Export EDS File..." function to create and export a device specific EDS file for the use in a higher-level CANopen PLC.

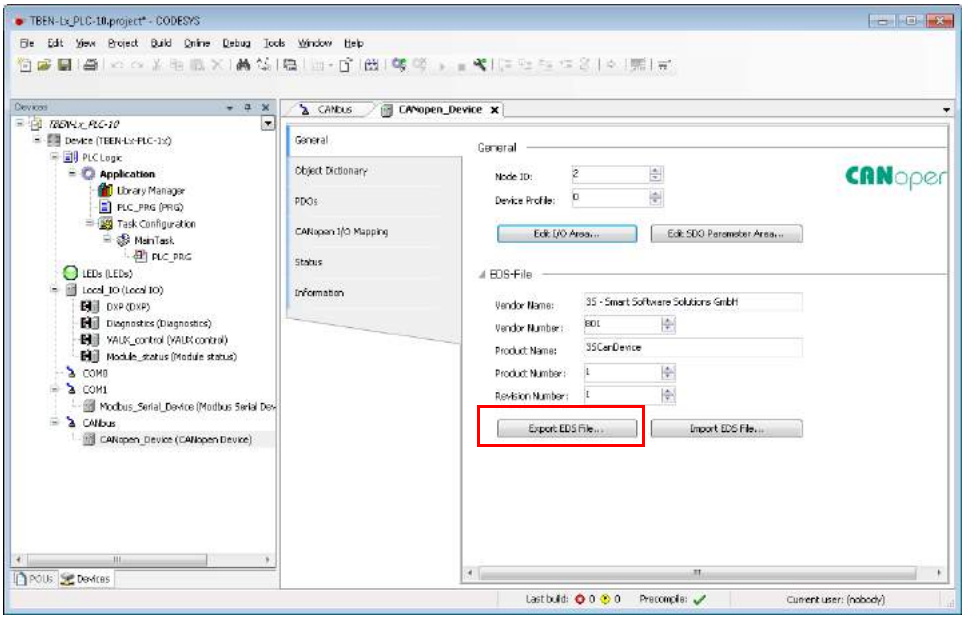


Fig. 75: Exporting the EDS-file

## 9.16 SAE J1939 Manager

| Properties | |
|---|---|
| Max. number of devices | 254 |
| Input data | max. 8 kByte |
| Output data | max. 8 kByte |

### 9.16.1 Configuring the J1939 Manager

The J1939 Manager from 3S - Smart Software Solutions GmbH is used.

➤ Add the J1939 Manager to the CANbus using the "Add Device" function and configure it.

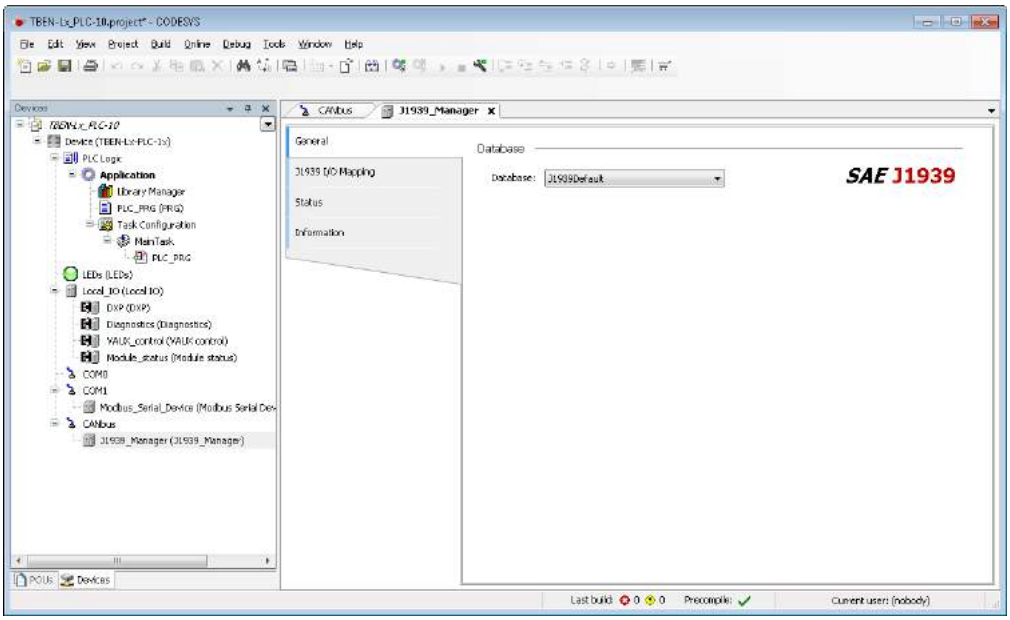


Fig. 76: Adding the SAE J1939 Manager

### 9.16.2 Configuring an external SAE J1939-Device (ECU)

➤ Add the "J1939_ECU" from 3S - Smart Software Solutions GmbH to the J1939 Manager and configure it according to the manufacturer specifications for the connected J1939 device.

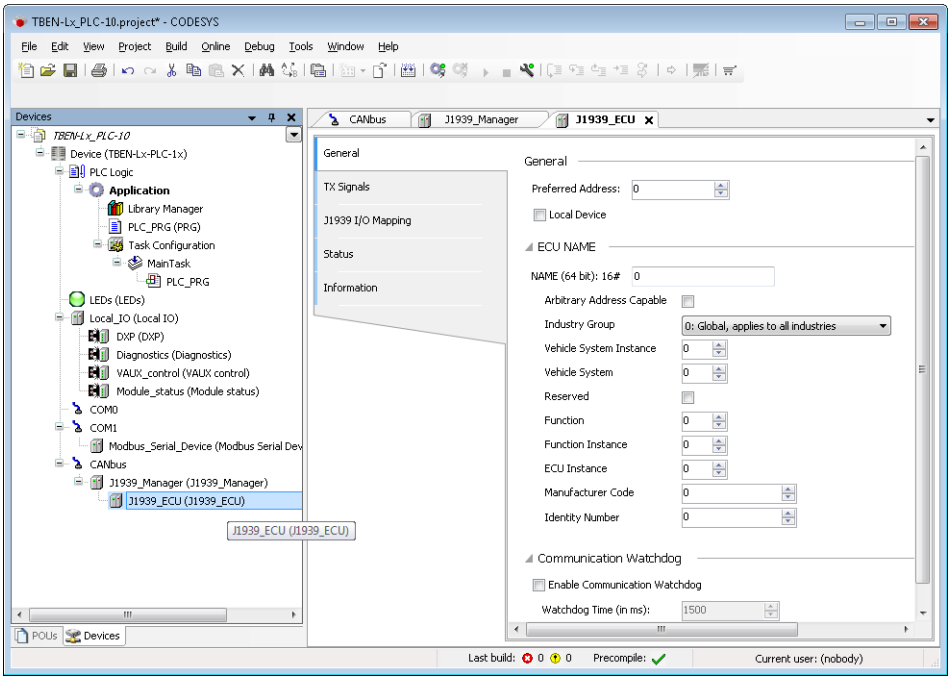


Fig. 77: Configuring the J1939_ ECU

## 9.17 Displaying task and processor information

### 9.17.1 Displaying the Average Cycle Time

The average cycle time for the task with the highest priority should not be higher than 80 % of the cycle time set for this task.

In the following example the Profinet_IOTask has the highest priority, the cycle time is set to 1 ms:

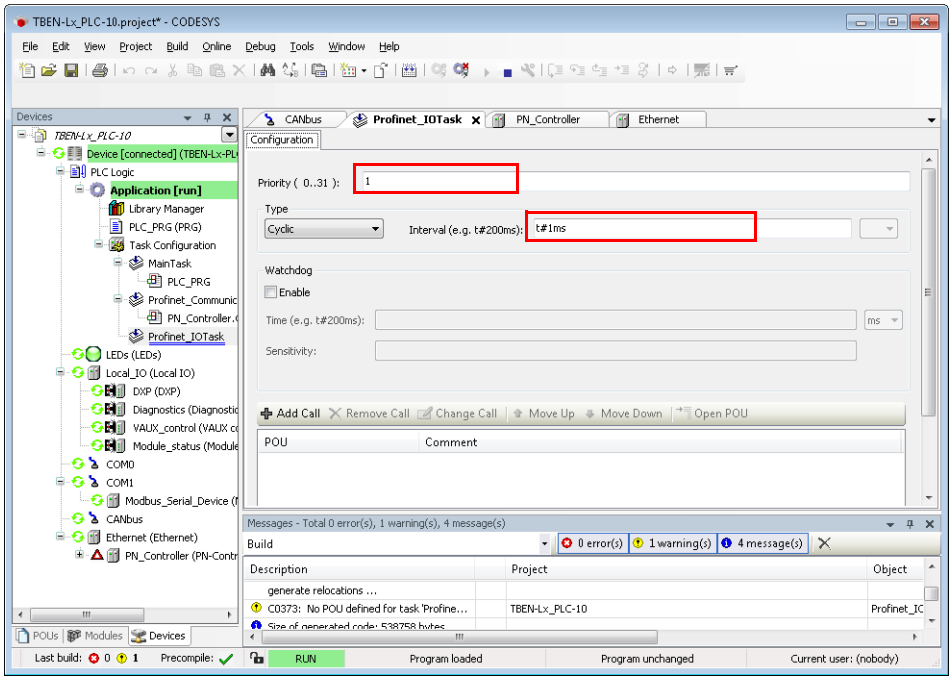


Fig. 78: Profinet_IOTask, priority1, cycle time 1 ms

The Average Cycle Time is shown in the register tab "Monitor" of the Task Configuration.

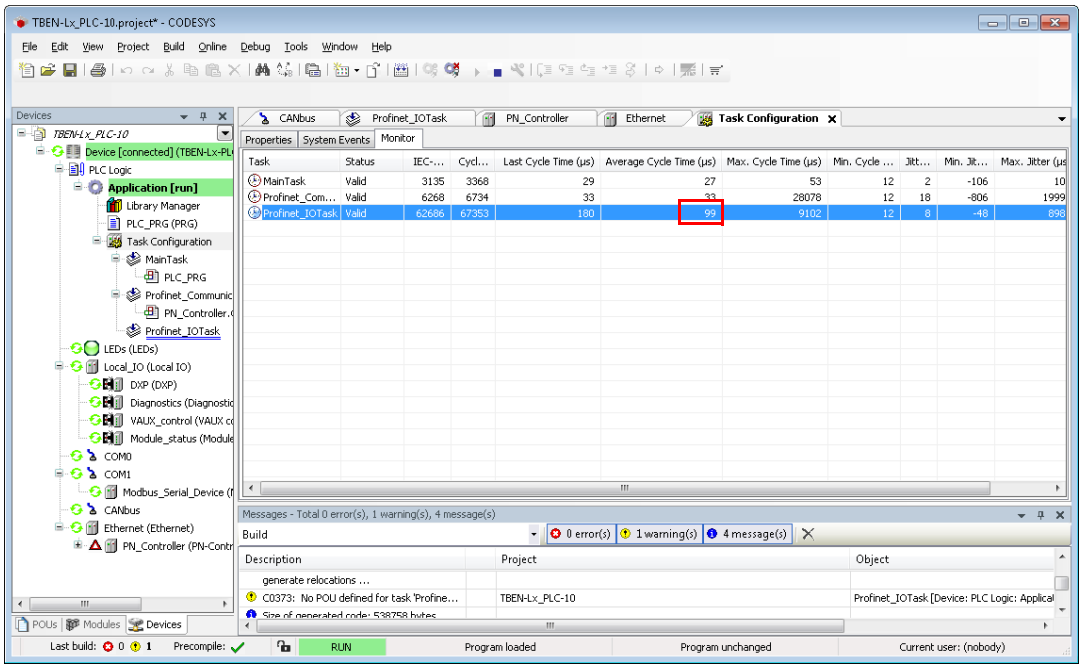


Fig. 79: Monitoring the Task Configuration

In the example, the average cycle time is 99 µs.

The maximum Average Cycle Time recommended for the example is calculated as follows:
1 ms × 80 % = 800 µs

An average cycle time of 800 µs should not be exceeded for this example.

### 9.17.2 Displaying processor information

Information about the processor load can be displayed in the PLC Shell of the TBEN-L…-PLC-… using the function "plcload".

➤ Call the function "plcload" in the device's PLC Shell.

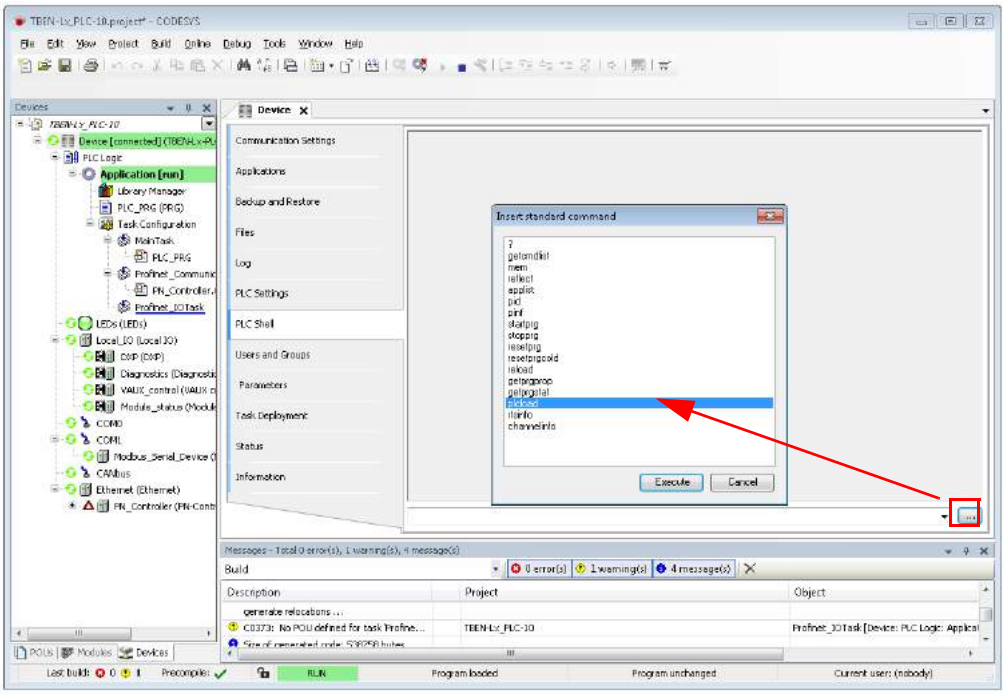

Fig. 80: Call the function "plcload"

➥ The PLC load for the TBEN-L…-PLC-… is displayed in %.

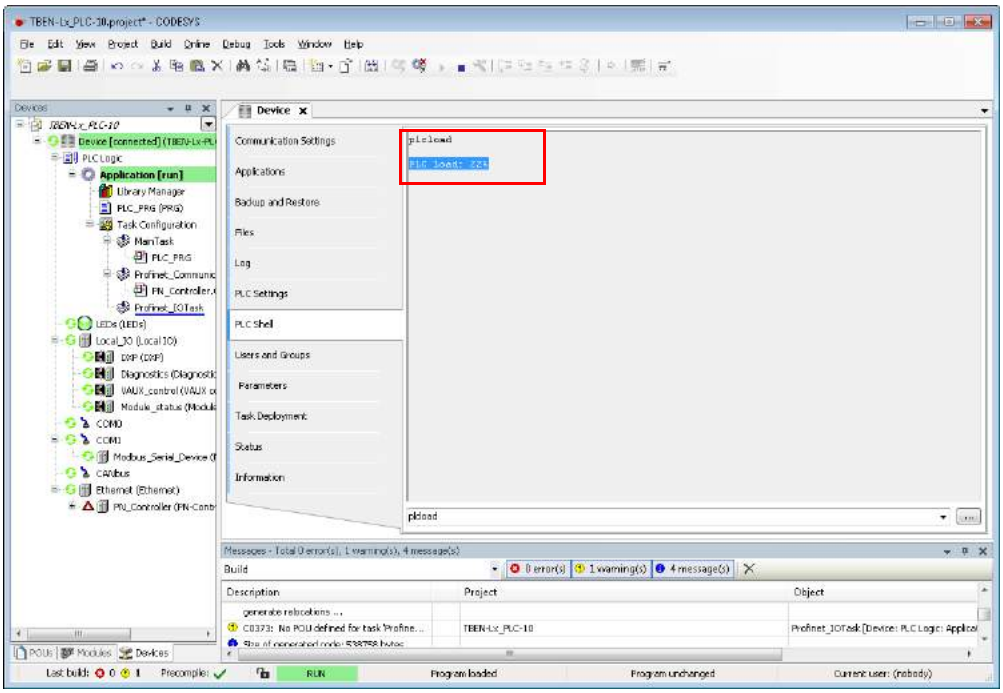

Fig. 81: Call the function "plcload"

### 9.17.3 CODESYS-exception "ProcessorLoadWatchdog"

In case of a PLC load of approximately 80 %, CODESYS generates the exception "ProcessorLoad-Watchdog". The TBEN-L…-PLC-… remains in Stop.

Reasons for the processor overload of the TBEN-L…-PLC-… may be:

- max. number of Devices/Slaves exceeded
- max. number of process data exceeded
- too low cycle times set for the number of connected devices, see also **Displaying the Average Cycle Time (page 89)**.

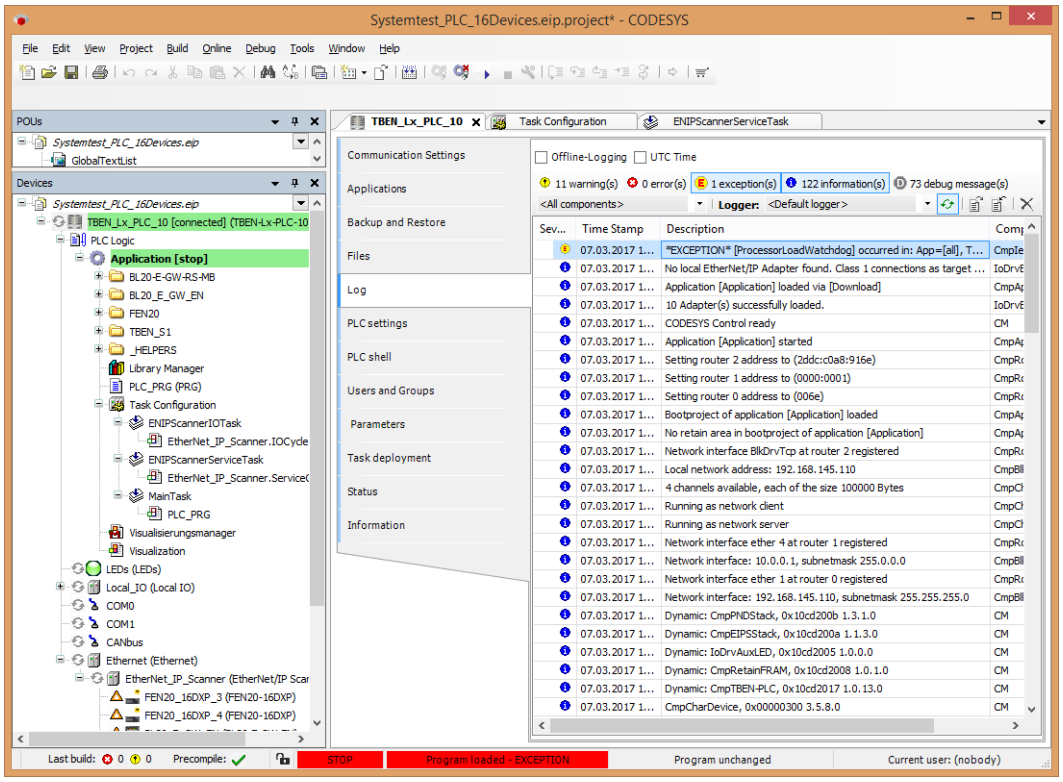


Fig. 82: Exception in CODESYS in case of processor overload

# 10 USB Host port functions

The USB Host port serves for connecting USB storage devices for the storage, restore and transfer of CODESYS applications as well as for updating the device firmware.

**NOTE**

The USB Host function can be deactivated using the web-server of the CODESYS program (see **chapter 7.2, Parameterizing, page 38**).

## 10.1 Compatible storage devices

The USB Host port is generally suitable to connect commercially available USB storage devices.

**NOTE**

Only use USB memory sticks formatted to FAT or FAT32. The use of memory sticks formatted to NFTS is not possible.

Depending on the current consumption of the devices, compatibility problems may occur in isolated cases.

In order to guarantee error-free operation, we recommend to use industrially tested storage devices. Ident-No. 6827348 - USB 2.0 Industrial Memory Stick.

**NOTE**

Connecting other USB devices like for example hard disks, keyboards, computer mouses, printers and bar code scanners etc. is not possible.

## 10.2 Functions of the USB Host port

For further information, see **Function overview, page 96**.

- Read access
  The read access does not require a user intervention.
  The CODESYS program continues to run.
  - BACKUP_1: Storing the CODESYS application on the storage device
  - BACKUP_2: Storing the CODESYS application and further device data on the storage device
  - USB_DATA: Storing of CODESYS recipes and/or log-files on the storage device.
- Write access

**ATTENTION!**

System modification during operation

**Undefined device status due to device restart or loss of functionality!**

➤ Do not change system or network settings during operation.

➤ Before changing the system settings, always set the machine into the safe stop condition and disconnect the TBEN-L…-PLC-… from the machine.

The write access requires the user's intervention, see **Executing the functions, page 98**. The CODESYS program is stopped.

- RESTORE_1: Loading the CODESYS application from the storage device into the device
- RESTORE_2: Loading the CODESYS application and further device data from the storage device into the device
- USB_DATA_WRITE: Loading of CODESYS recipes and/or log-files from the storage device into the device
- FW_UPDATE: Firmware update of the device

### 10.2.1 General notes/prerequisites

- The storage device is formatted in FAT (FAT or FAT32).
- The storage device does contain only **one** folder. If the storage device contains more than one folder, not function is executed. The RUN-LED displays errors, see **Behavior of the RUN-LED in case of an error, page 99**.
- The folder name defines the function to be executed (for further information, see **Function overview, page 96**.
- Folder names must not contain special characters.
- RESTORE:
  This function is only available for devices with identical firmware.
- Boot application:
  The names of the CODESYS-application and the file names of the boot application (*.app and *.crc) have to be identical and must not be renamed.
- Write access:
  Press the SET-button within 30 seconds after having plugged the storage device. If not, the function is not executed an the storage device is unmounted.

**ATTENTION!**

Restart or reset of the device with plugged storage device
**Destruction of the running application possible!**
➤ Remove the storage device from in normal operation.

**NOTE**

Unplug the storage device only if the RUN-LED flashes orange (read/write operation finished) or red/green (error).

### 10.2.2 Function overview

**ATTENTION!**

Using CODESYS recipes

**Corrupt data due to manipulation of data in USB_Data file directory**

➤ Only use 1:1-copies with Backup_2/Restore_2 when using recipes:

| Function | Folder name | Description | CODESYS program | autom. device restart |
|---|---|---|---|---|
| **Read access** | | | | |
| Backup 1 | BACKUP_1 | Copying the CODESYS application from the device to the storage device.<br>The following files are stored to the storage device.<br>– All *.app and *.crc files.<br>– PlcLogic folder<br>Existing files with the same name will be overwritten. All other data remain unchanged. | RUN | NO |
| Backup 2 | BACKUP_2 | Copying the CODESYS application and the device data from the device to the storage device.<br>The following files are stored to the storage device.<br>– All *.app and *.crc files.<br>– PlcLogic folder<br>– Folder USB_Data<br>– IP address<br>– PROFINET device name<br>– Retain-data (retain.bin)<br>Existing files with the same name will be overwritten. All other data remain unchanged. | RUN | NO |
| Read user data | USB_DATA | Storing the folder "USB_Data" from the BLxx-PG-EN-V3 to the storage device.<br>The following files are stored to the storage device.<br>– CODESYS recipes and/or Log files<br>Existing files with the same name will be overwritten. All other data remain unchanged. | RUN | NO |
| **Write access** | | | | |
| Restore 1 | RESTORE_1 | Loading the CODESYS application from the storage device into the device<br>The following files are loaded from the storage device to the device:<br>– All *.app and *.crc files.<br>– PlcLogic folder<br>The folder must contain only one application file (*.app).<br>All other applications on the device are deleted without further warnings.<br>The device automatically executes a restart after unplugging the storage device. | STOP | YES |

| Function | Folder name | Description | CODESYS program | autom. device restart |
|---|---|---|---|---|
| Restore 2 | RESTORE_2 | Loading the CODESYS application and further device data from the storage device into the device.<br>The following files are loaded from the storage device:<br>– All *.app and *.crc files.<br>– PlcLogic folder<br>– Folder USB_Data<br>– IP address<br>– PROFINET device name<br>– Retain-data (retain.bin)<br>The folder must contain only one application file (*.app).<br>All other applications on the device except for the retain data are deleted without further warnings. The retain data will only be overwritten if the storage device contains a newer file.<br>The device automatically executes a restart after unplugging the storage device. | STOP | YES |
| Firmware Update | FW_UPDATE | Update of the device firmware.<br>The PLC has to be in Stop in order to execute a firmware update.<br>The IP address, the PROFINET device name and the CODESYS application will not be overwritten.<br>File name (example):<br>TBEN-L5-PLC-10_01504037_V1.0.3.0.bin<br>The device automatically executes a restart after unplugging the storage device. | STOP | YES |
| Write user data | USB_DATA _WRITE | Loading the folder "USB_Data" from the storage device into the device.<br>Existing files with the same name will be overwritten. All other data remain unchanged. | STOP | YES |

### 10.2.3 Executing the functions

**BACKUP_1/BACKUP_2**

➢ Plug the storage device into the device.

➥ The RUN-LED flashes green with 4 Hz.

➥ The backup is executed.

➥ The RUN-LED flashes orange with 1 Hz.

➥ The backup is completed.

➢ Unplug the storage device.

**USB_DATA**

➢ Plug the storage device into the device.

➥ The RUN-LED flashes green with 2 Hz.

➥ The data are stored to the storage device.

➥ The RUN-LED flashes orange with 1 Hz.

➥ The storing is completed.

➢ Unplug the storage device.

**RESTORE_1/RESTORE_2**

➢ Plug the storage device into the device.

➥ The RUN-LED flashes green with 0.5 Hz.

➢ Press the SET-button within the next 30 seconds for at least 3 seconds.

➥ The RUN-LED flashes in the following order **2x green - pause (1 Hz) - 2 x green- pause (1 Hz) -** ….

➥ The loading of data into the device is executed.

➥ The RUN-LED flashes orange with 1 Hz. The loading is completed.

➢ Unplug the storage device.

➥ The device is automatically restarted.

**FW_UPDATE**

The PLC has to be in Stop in order to execute a firmware update.

➢ Plug the storage device into the device.

➥ The RUN-LED flashes green with 0.5 Hz.

➢ Press the SET-button within the next 30 seconds for at least 3 seconds.

➥ The RUN-LED flashes in the following order **3x green - pause (1 Hz) - 3 x green- pause (1 Hz) -** ….

➥ The loading of data into the device is executed.

➥ The RUN-LED flashes orange with 1 Hz. The firmware update is completed.

➢ Unplug the storage device.

➥ The device is automatically restarted.

**USB_DATA_WRITE**

➤ Plug the storage device into the device.

➥ The RUN-LED flashes green with 0.5 Hz.

➤ Press the SET-button within the next 30 seconds for at least 3 seconds.

➥ The RUN-LED flashes green with 2 Hz. The data are stored to the device.

➥ The RUN-LED flashes orange with 1 Hz. The storing is completed.

➤ Unplug the storage device.

➥ The device is automatically restarted.

### 10.2.4 Behavior of the RUN-LED in case of an error

| Error | Description | LED behavior |
|---|---|---|
| Timeout | – The SET-button has not been pressed within the 30 seconds after the plugging of the storage device. | Red/green flashing (1 Hz) |
| Invalid folder | – The storage device contains one folder with an invalid folder name.<br>– The storage device contains several folders with valid folder names. | |
| Empty folder | – The storage device contains one valid, but empty folder. | |
| USB deacti-vated | – The USB Host function has been deactivated using via web server or CODESYS program. | Red/green flashing (0.5 Hz) |

# 11 The web server

## 11.1 Safety in the web server

In the web server, a default-password is assigned to the Turck devices for the administrator access.

**We strongly recommend to use an individual password, in order to avoid possible misuse by a third party!**

This should be done in the context of the network security concept for the complete facility in which the modules are placed.

The password is transfered as plain text.

**NOTE**

Please change the password as described in **Change Admin Password, page 106**.

## 11.2 IP address

In the delivery status, neither an IP address nor a PROFINET name is stored into the devices.

In order to be able to access the device per web server, the web server can be opened using the IP address 192.168.1.254.

If the PC used for the configuration is part of the same IP network, the page

http://192.168.1.254

can be opened in order to initially change some settings.

## 11.3 Start page of the web server (Home)

The start page of the web server shows general device information, network settings etc.

The "PLC Information" part contains information concerning the CODESYS program status.

A read access to the items "Station Diagnostics", "Ethernet Statistics", "Event Log" and "Links" as well as to the process data of the local I/Os, the diagnostic information and the data for the control of the sensor/actuator supply is possible without administrator login.

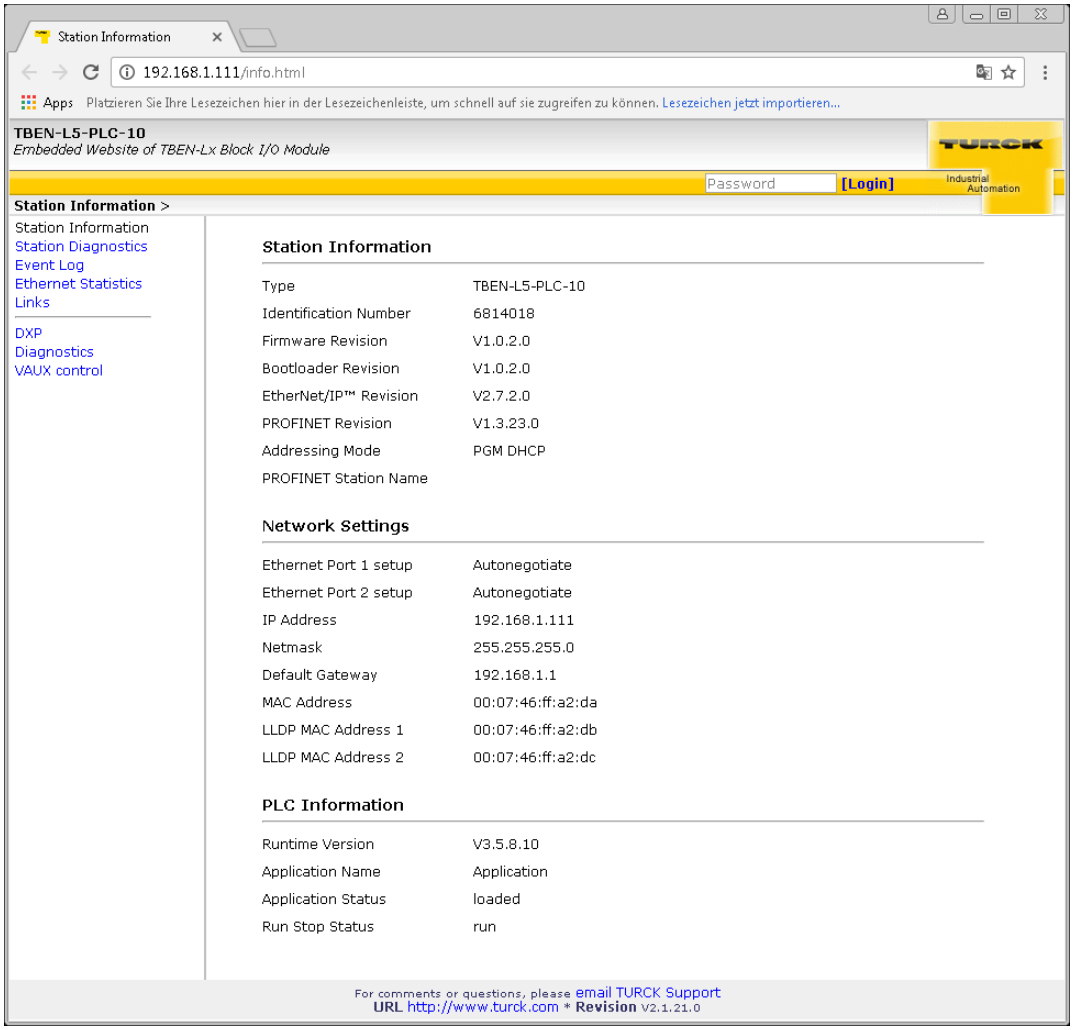


Fig. 83: Start page of the web server (Home)

## 11.4 Station Diagnostics

Diagnostic messages of the device are displayed on the "Station Diagnostics"-page.


Fig. 84: Diagnostics in the web server

## 11.5 Event Log

The Event Log shows the login information as well as the diagnostic information for the device.

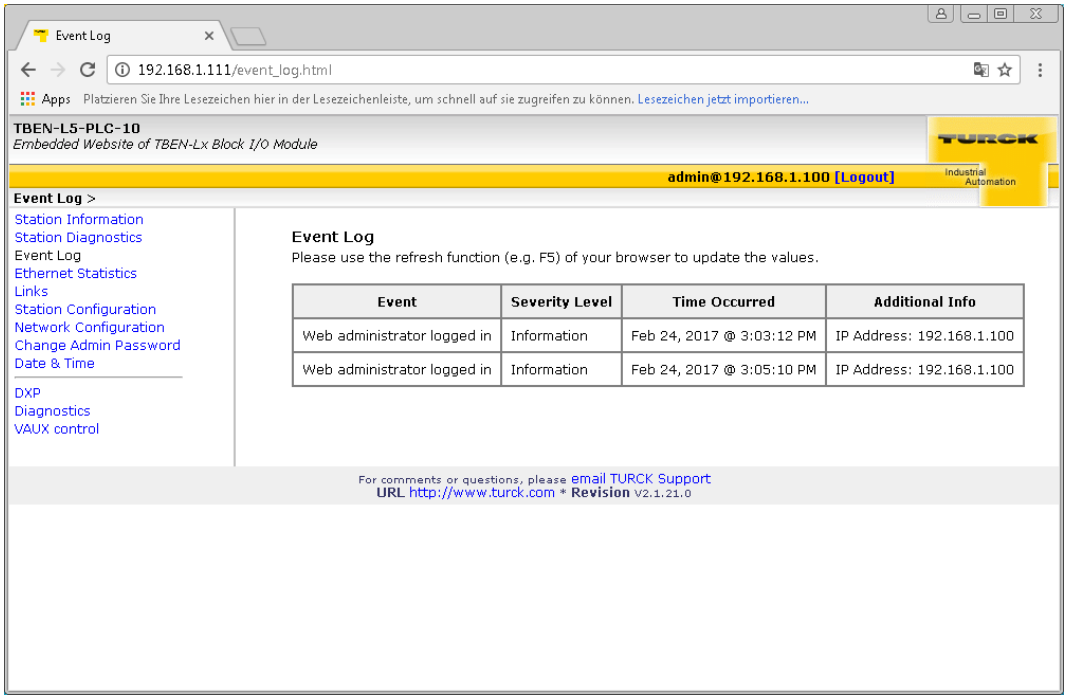


Fig. 85: Event Log

## 11.6 Ethernet Statistics

The page "Ethernet Statistics" shows information like the port-status, telegram and error counters etc. The page can above all be useful for analyzing network problems.

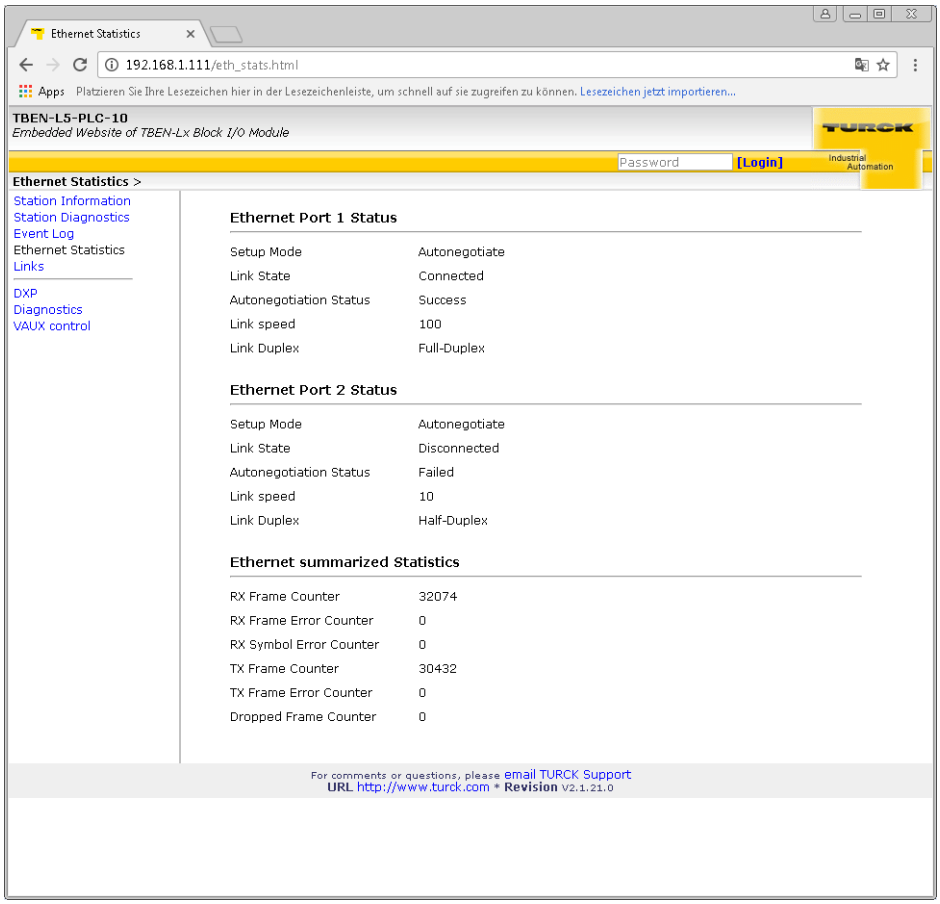


Fig. 86: Ethernet Statistics

**NOTE**

The "Ethernet summarized statistics" contain the statistics for both Ethernet ports.

## 11.7 Links

This page contains a link to the product page on the Turck website, on which further information (data sheets, configuration files, CAD data, etc.) for the device can be found.

## 11.8 Login /password

In order to get access to the extended functions of the web server (Network Configuration, Station Configuration, etc.), you have to log-in to the web server as administrator.

For the first login use the default password "password".

The default-password should be changed by the administrator. To do so, please follow the instructions under **Change Admin Password, page 106**.

**NOTE**

Executing the "Reset to Factory Defaults" also resets the password to "password".

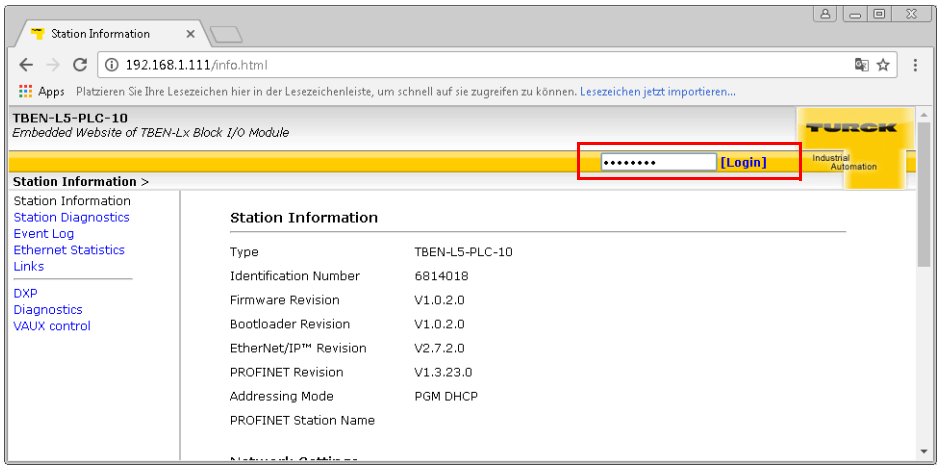


Fig. 87: Web server "password"

## 11.9 Change Admin Password

The function is only available after a login.

**NOTE**

For security aspects when working with the web server, please observe the notes under **Safety in the web server, page 101**.

**NOTE**

The password for the web server is synchronized to the password for the SFTP access. Changing the web server password also changes the see password for the SFTP access (page **page 49**).

Define an individual password for administrator rights

Default password "password"

**NOTE**

Executing the "Reset to Factory Defaults" (see also **Reset to Factory Defaults, page 110**) also resets the password to "password".

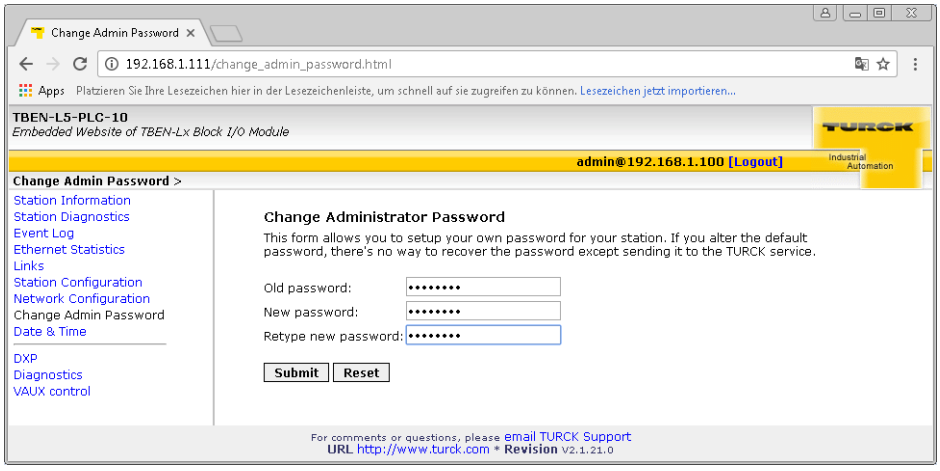


Fig. 88: Change Admin password

### Change password

➤ Change the password in the web server.

➤ Write the changes into the device via "Submit".

➤ Restart the device.

➥ The device has accepted the new settings, the settings have become active.

**NOTE**

"Reset" only resets the changes done in the web server mask back to the original values. The function does not influence the device itself.

## 11.10 Network Configuration

On the "Network Configuration"-page, network-relevant settings can be changed.

The function is only available after a login.

### 11.10.1 Change network parameters (port settings, IP address, etc.)

The device's network settings can be changed under "Network Configuration" only by users having administrator rights.

**NOTE**

After a reset to factory settings, the device can be accessed using the IP address 192.168.1.254. This IP address is not stored permanently in the device.

If the device is set to "ROTARY" mode (**Address setting via rotary coding switches (Static rotary), page 28**), than the last byte of the IP address can not be changed via the web server.

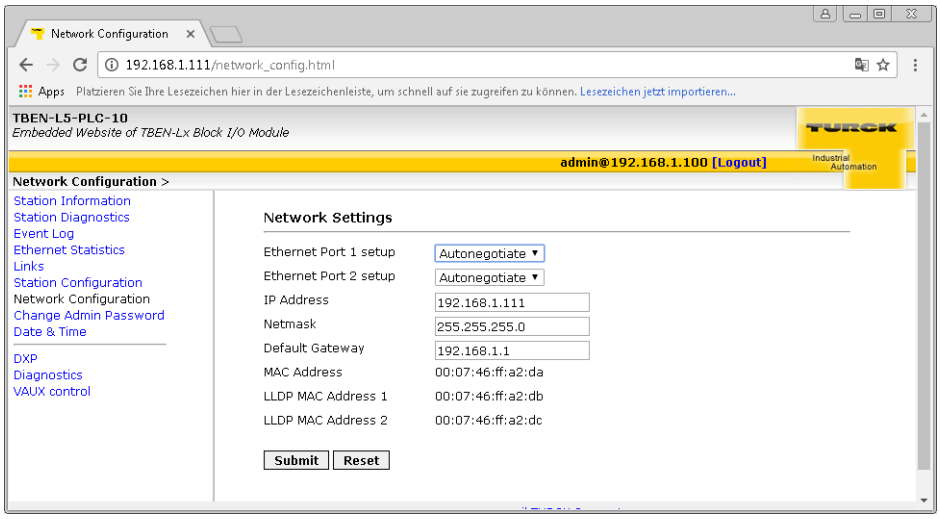


Fig. 89: Web server with Network Configuration

**Change network parameters**

➤ Change the network parameters in the web server.

➤ Write the changes into the device via "Submit".

➥ The device has accepted the new settings, the settings have become active.

**NOTE**

"Reset" only resets the changes done in the web server mask back to the original values. The function does not influence the device itself.

## 11.11 Station Configuration

The "Station Configuration"-page serves for parameterizing the following device functions:

- Deactivating the USB Host port or the web server
- Assigning a PROFINET device name

The function is only available after a login.

### 11.11.1 Configuring the Ethernet interface

➤ Change the configuration in the web server.

➤ Write the changes into the device via "Submit".

➥ The device has accepted the new settings, the settings have become active.

### 11.11.2 Reboot

"Reboot" executes a restart of the device.

### 11.11.3 Reset to Factory Defaults

**ATTENTION!**

System modification during operation

**Undefined device status due to device restart or loss of functionality!**

- ➤ Do not change system or network settings during operation.
- ➤ Before changing the system settings, always set the machine into the safe stop condition and disconnect the TBEN-L…-PLC-… from the machine.

Resets the device to the default settings (factory settings), see also **F_Reset (Reset to factory setting), page 30**.

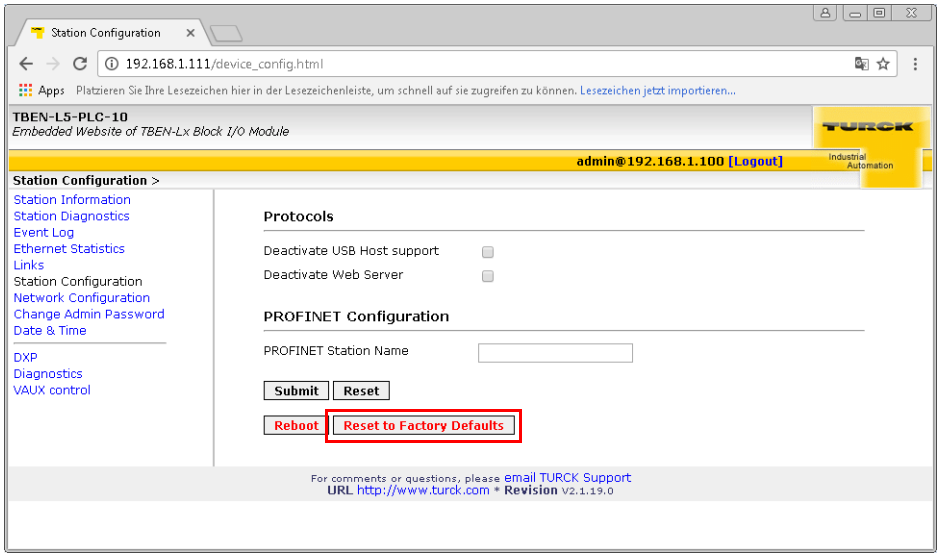


Fig. 90: Web server "Station Configuration"

**NOTE**

"Reset" only resets the changes done in the web server mask back to the original values. The function does not influence the device itself.

## 11.12 Slot Parameters

### 11.12.1 Parameterizing the in- and outputs

The "Parameters"-page is used to parameterize the device's in- and outputs.

**NOTE**

Parameter changes via the web server are only valid until the CODESYS program is downloaded to the device again, the device is started with an active Boot application or parameters are changed in CODESYS by online change.

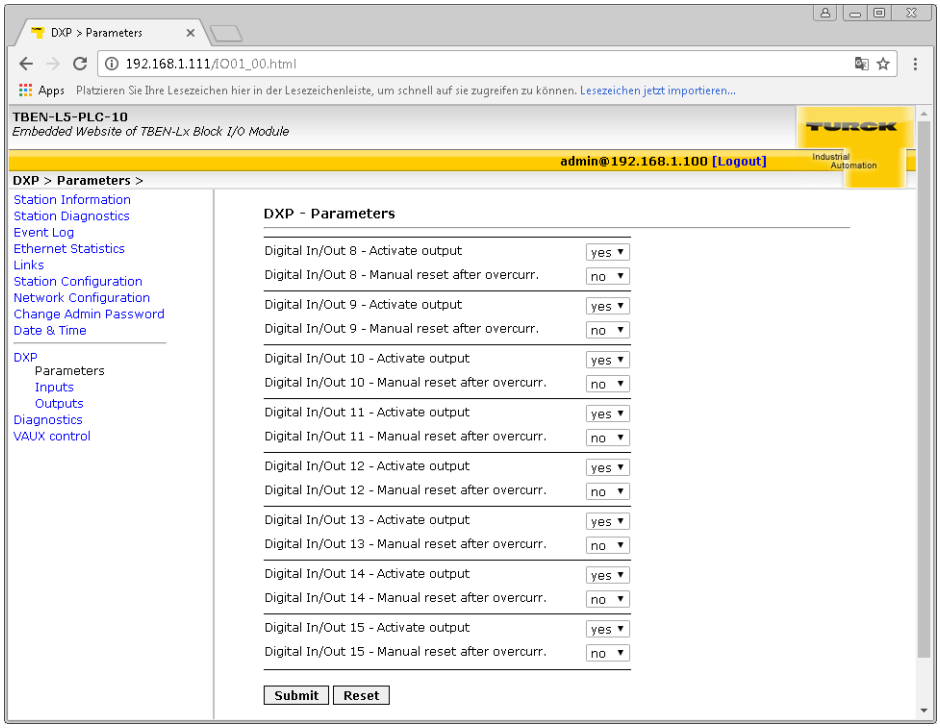


Fig. 91: Web server "Parameters"

**Change parameters**

- ➤ Change the module parameters in the web server.
- ➤ Write the changes into the device via "Submit".
- ➥ The device has accepted the new settings, the settings have become active.

**NOTE**

"Reset" only resets the changes done in the web server mask back to the original values. The function does not influence the device itself.

## 11.13 Using mobile devices

The internal web server has a responsive design. This means, the web functions can also be executed using a mobile device, e.g. a smartphone.

The web content is automatically adapted to the smaller display in order to assure an optimized web server representation.

The Turck device and the mobile device have to be nodes of the same network. Please assure therefore that the IP addresses of both devices are part of the same subnet (e.g. 255.255.255.0).

In addition to that, a network access has to be available for the mobile device.

## 11.14 Web server logout

In order to disconnect a logged in user/PC with administrator rights from the web server, a logout is necessary.

**NOTE**

If the web browser is closed without a logout, the last active access is reactivated when opening the web server again from the same PC within 30 minutes,
which means, the access to the device with all administrator rights may be possible.

## 11.15 Web server deactivated

**NOTE**

If, for safety reasons, the web serves has to be deactivated completely, this is possible via the device parameters in CODESYS or in the web server itself.
If the web server is deactivated using the web server itself, further access to it is only possible after a device reset to factory settings (see page 30) or via CODESYS (see page 38).

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