TURCK

Your Global Automation Partner

TN-UHF-...-CDS
UHF Reader

Instructions for Use

Contents

1 About these Instructions

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

1.1 Target groups

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

1.2 Explanation of symbols

The following symbols are used in these instructions:

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

1.3 Other documents

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

- Data sheet
- Approvals
- Configuration manual

1.4 Naming convention

Read/write devices in the HF are called “read/write heads” and “readers” in the UHF area. “Tag”, “transponder” and “mobile data memory” are common synonyms for “data carriers”.

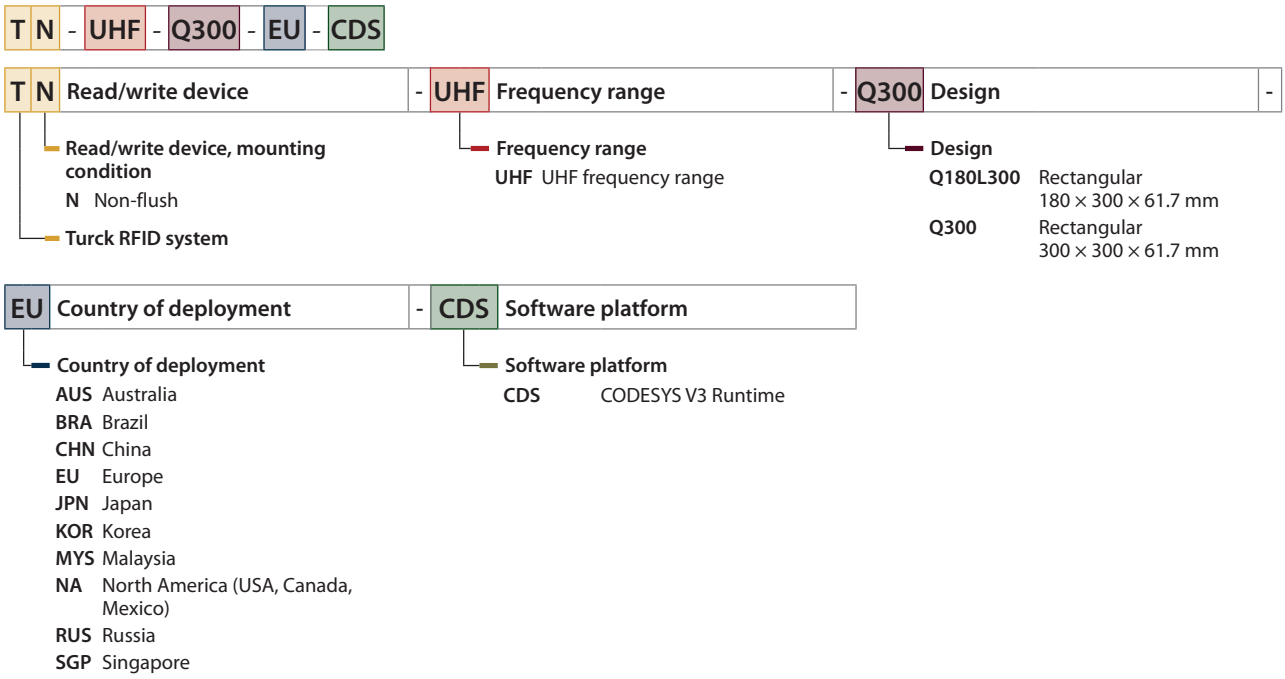
1.5 Feedback about these instructions

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

2 Notes on the product

2.1 Product identification

These instructions apply to the following UHF readers:



2.2 Scope of delivery

The delivery consists of the following:

- UHF reader
- Wall bracket (metal rail)
- Quick Start Guide

2.3 TURCK service

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

For the contact details of our branches worldwide, please see page [▷ 207].

3 For Your Safety

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

3.1 Intended use

The readers with an integrated RFID interface are used for contactless data exchange with the RFID tags in the TURCK UHF RFID system. The following table shows the operating frequency of the devices:

Type designation	Operating frequency	Region
TN-UHF-…-AUS-CDS	920…926 MHz	Australia, New Zealand
TN-UHF-…-BRA-CDS	915…928 MHz	Brazil
TN-UHF-…-CHN-CDS	920.5…924.5 MHz	China
TN-UHF-…-EU-CDS	865…868 MHz	Europe, Türkiye, India
TN-UHF-…-JPN-CDS	916.7…920.9 MHz	Japan
TN-UHF-…-KOR-CDS	917…920.8 MHz	Korea
TN-UHF-…-MYS-CDS	919…923 MHz	Malaysia
TN-UHF-…-NA-CDS	902…928 MHz	North America (USA, Canada, Mexico)
TN-UHF-…-RUS-CDS	866…868 MHz	Russia
TN-UHF-…-SGP-CDS	920…925 MHz	Singapore

These devices may only be started up under the following conditions:

- The particular frequency range is permissible for the use of UHF-RFID.
- The operating frequency range of the devices is compliant with the permissible UHF RFID range of the region.
- A valid certification and/or approval is available for the region of use.

The readers use the integrated RFID interface to communicate directly with the control unit or other higher-level systems. The read data is relayed via the device to the controller. The device can perform autonomous controller and diagnostics functions in order to reduce the workload of the controller. The functions of devices can be programmed using the IEC 61131-3 compliant CODESYS V3 programming software.

Four configurable digital channels are also provided for connecting digital sensors and actuators. The multiprotocol interfaces can be used as an EtherNet/IP device, Modbus TCP TURCK server or PROFINET RT device. In Modbus TCP systems, the devices can also be used as clients.

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

3.2 General safety notes

- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Any extended stay within the area of radiation of UHF readers may be harmful to health. Observe a minimum distance of > 0.35 m from the actively radiating surface of the UHF reader.
- The radiation of the UHF readers may have an adverse effect on the operation of electrically controlled medical equipment. Keep an additional distance from active radiation sources up to the maximum transmission distance.
- Change the default password of the integrated web server after the first login. TURCK recommends the use of a secure password.

3.3 Notes on EU Directive 2014/53/EU (RED Directive)

For safe and proper use of the device, ensure the following physical and logical safety measures in accordance with DIN EN 18031-1 in the environment:

- Access control: Enable access to security-related data and settings only to authorized persons, devices and services. Especially protect cryptographic keys in the device.
- Authentication: Manage access to security-related data and settings through appropriate authentication mechanisms. This also includes the regular verification and adjustment of passwords and other authentication methods.
- Firmware management: Regularly check the availability of new firmware versions at www.turck.com and carry out updates promptly. Check the integrity of firmware updates by comparing them with the hash values provided on the TURCK website.
- Data protection and communication: Protect the data stored in the device for integrity and confidentiality. Secure communication with the device against manipulation, unauthorized access and listening in.
- Attack protection: Take measures to prevent successful replay, denial of service or brute force attacks.
- Vulnerability management: Ensure that known vulnerabilities cannot be exploited.
- Interface control: Only send valid and authorized data to the device interfaces.

4 Product Description

The devices are designed with an aluminum housing and degree of protection IP67. The active face is made out of plastic. Devices are available with an integrated antenna (Q300) or for connecting external antennas (Q180). Both device variants are suitable for connecting up to four external passive UHF RFID antennas.

The terminals for the Ethernet and for digital I/Os are M12 sockets. The device has an M12 plug connector for connecting the power supply. Terminals are provided for up to four external antennas.

4.1 Device overview

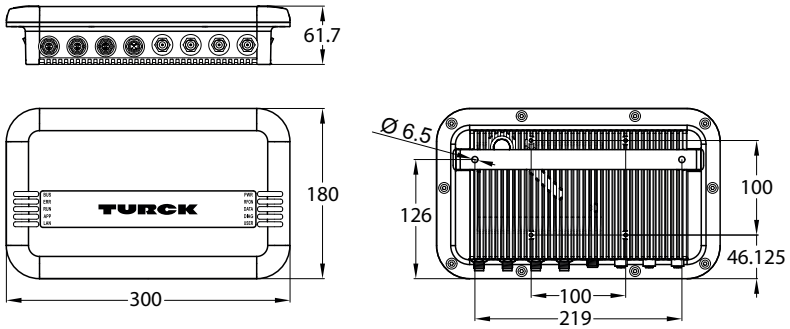


Fig. 1: Dimensions – TN-UHF-Q180L300…

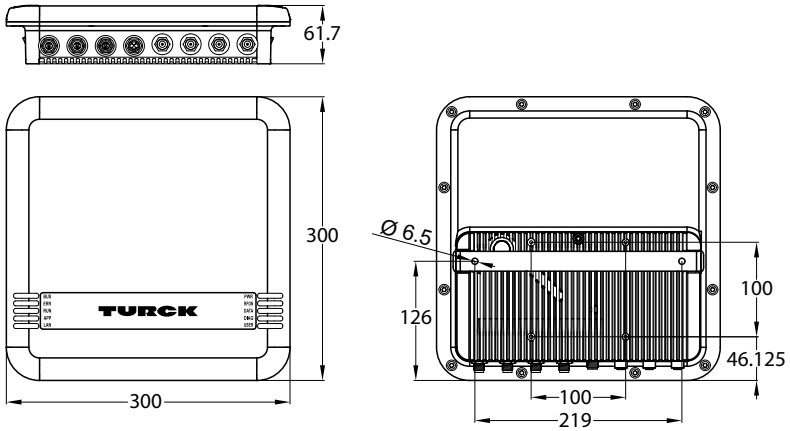


Fig. 2: Dimensions – TN-UHF-Q300…

4.1.1 Indication elements

The device has the following LED indicators:

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

An acoustic signal can also be set using software tools.

4.2 Properties and features

- Rectangular, height 180 or 300 mm
- Active front face, UV-resistant
- Four terminals for passive UHF RFID antennas
- Four configurable digital channels, which can be configured as PNP inputs and/or 0.5-A outputs
- 2-W (ERP) maximum output power
- Programmable according to IEC 61131-3 with CODESYS V3
- CODESYS V3 PLC runtime
- CODESYS OPC UA server
- Data interface “U” for convenient use of the RFID functionality
- Close-to-control integration in PLC systems without the use of a special function module
- Integrated web server
- LEDs and diagnostics

4.3 Operating principle

The readers are used for contactless data exchange with tags. For this the controller sends commands and data via the interface to the reader and receives the corresponding response data from the reader. The reading of the IDs of all RFID tags in the read area and the writing of an RFID tag with a specific production date are examples of typical commands. To communicate with the tag, the data of the reader is coded and transferred via an electromagnetic field, which at the same time supplies the tags with power.

A reader contains a transmitter and a receiver, an interface to the interface module and a coupling element (coil and dipole antenna) for communicating with the tag. Electromagnetic wave propagation is used for the transmission between reader and tag on devices for the UHF range.

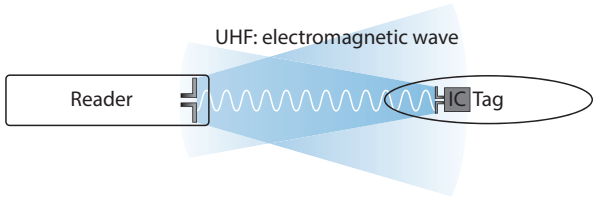


Fig. 3: Operating principle of UHF-RFID

The antenna of the reader generates electromagnetic waves. This produces a transmission window as a so-called air interface in which the data exchange with the tag takes place. The size of the transmission window depends on the combination of readers and tags, as well as on the relevant environmental conditions.

Each reader can communicate with a number of tags. This requires the reader and the tag to operate in the same frequency range. Depending on their power and the frequency in use, the devices have a range of a few millimeters up to several meters. The specified maximum distance between the read/write heads represents values measured under laboratory conditions, free from any influences caused by surrounding materials. Attainable distances may vary due to component tolerances, mounting conditions, ambient conditions and influences caused by surrounding materials (especially metal and liquids).

4.4 Functions and operating modes

The devices operate with an integrated or external antenna (TN-UHF-Q300…) or only with an external antenna (TN-UHF-Q180L300…). The devices enable passive UHF tags to be read or written in single and multitag operation. For this the devices form a transmission zone that varies in size and range according to the tags used and the operating conditions of the application. Refer to the data sheets for the applicable maximum read/write distances. The devices can be fully tested, configured and parameterized from a PC using the specified software tools.

The integrated RFID interfaces transfer data between the RFID level and the controller level. The devices can be used as an EtherNet/IP device, Modbus TCP TURCK slave, or PROFINET RT device. The devices can also be used as masters in the Modbus TCP fieldbus system.

The device enables the execution of different commands such as Inventory (single-tag and multitag applications), read, write and password protection. Additional functions are provided to optimize the speed, for the system to self trigger as well as for backup and restore operations. In every write or read cycle, up to 128 bytes can be transferred on each channel to the controller. The data must be fragmented in order to transfer more than 128 bytes.

Sensors and actuators can be connected to the configurable digital channels. Up to four 3-wire PNP sensors or two PNP DC actuators with a maximum output current of 0.5 A per output can be connected. The total output current of all devices connected to the DXP channels must not exceed max. 1 A.

The device can perform autonomous controller and diagnostics functions in order to reduce the workload of the controller. The devices can be programmed using the IEC 61131-3 compliant CODESYS 3 programming software.

4.4.1 Operating frequency

The TURCK UHF system operates at country-specific operating frequencies between the tags and the readers. These national operating frequencies for UHF are the frequency ranges that are individually specified by the national regulation bodies.

For example, the operating frequencies of the devices in the UHF band are 865.6…867.6 MHz for Europe and 902…928 MHZ for the USA. The UHF readers can only be used in the particular designated regions and must not be commissioned outside these regions. Since UHF tags do not emit their own radio waves, they may be used worldwide.

In order to achieve the biggest possible communication range, TURCK offers tags which are optimally tuned to country-specific frequency bands. Alternatively, broadband multi-area tags are also available for international use.

The different TURCK readers support the following operating frequencies:

- 920…926 MHz (e.g. Australia and New Zealand)
- 915…928 MHz (e.g. Brazil)
- 920.5…924.5 MHz (e.g. China and Thailand)
- 865.6…867.6 MHz (e.g. Europe, Türkiye, India)
- 916.7…920.9 MHz (e.g. Japan)
- 917…920.8 MHz (e.g. Korea)
- 919…923 MHz (e.g. Malaysia)
- 902…928 MHz (e.g. USA, Canada, Mexico)
- 920…925 MHz (e.g. Singapore)

All the country-specific details concerning UHF, such as frequency band, power supply, and any national regulations are available at:
https://www.gs1.org/docs/epc/uhf_regulations.pdf

For more detailed information please contact the regulation authorities of the country where you wish to use the UHF RFID system.

HF RFID systems can be operated in parallel with UHF RFID systems in a single system.

4.4.2 Combination of UHF readers and tags

The UHF readers form a transmission zone, the size of which may vary depending on the combination of reader and tag used. The listed maximum read/write distances only represent typical values under laboratory conditions without the effect of materials. The achievable distances may be different due to component tolerances, mounting location in the application, ambient conditions and the effect of materials (particularly metal).

For this reason, the application must be tested in all cases under real conditions (particularly with read and write operations in motion).

4.4.3 Multiprotocol function

The device can be used in the following Ethernet protocols:

- PROFINET
- EtherNet/IP
- Modbus TCP

The Ethernet protocol used must be selected in the CODESYS project.

Manual protocol selection

The protocol must be defined manually in the CODESYS program. After that only read access to the device is allowed with the other protocols. Manual protocol selection thus also provides an additional permanent locking feature.

4.4.4 Data transfer to the PLC

Each channel can transmit 128 bytes per read or write cycle. To transfer more than 128 bytes, the data must be fragmented. The amount of data transferred per read or write cycle can be set as follows for different Ethernet protocols:

PROFINET	EtherNet/IP	Modbus TCP
■ 16 bytes ■ 32 bytes ■ 64 bytes ■ 128 bytes (default setting)	■ 16 bytes ■ 64 bytes ■ 128 bytes (default setting)	■ 128 bytes (factory set) Adjustable fragment size: ■ 16 bytes ■ 32 bytes ■ 64 bytes ■ 128 bytes (default setting)

4.4.5 RFID channels — operating modes

Two different data interfaces can be selected for the RFID channels:

- UHF compact: Transfer of up to 128 bytes possible, recommended for single tag applications
- UHF extended: Transfer of more than 128 bytes possible, recommended for multi-tag applications

4.4.6 RFID commands

The device can perform the following commands and functions. A complete description of the commands is provided under "Settings."

- Idle
- Inventory
- Read
- Write
- Write and Verify
- Continuous Mode
- Read data from buffer (cont. mode)
- Stop Continuous (Presence Sensing) Mode
- UHF Continuous Presence Sensing Mode
- Read/write head identification
- Get UHF read/write head status/error
- Tag info
- Direct read/write head command
- Set read/write head password
- Reset read/write head password
- Set tag password
- Set tag protection
- Deactivate tag irrevocably (kill)
- Restore UHF read/write head settings
- Backup UHF read/write head setting
- Reset

4.4.7 Loop counter function

The loop counter function is provided for rapid command processing. The loop counter function only requires two PLC cycles to execute a command repeatedly (flow chart see [▷ 201]). This increments the loop counter to execute a command repeatedly. At least four PLC cycles are required in conventional command processing. In order to execute a command repeatedly with conventional command processing, a command has to be reset and then set again. The loop counter function is provided for special commands. If the command was successfully executed, the command code is output in the response data.

4.4.8 CODESYS OPC UA server

The device can exchange data with any OPC UA clients via the integrated CODESYS OPC UA server.

The device can be connected via OPC UA to higher-level systems such as MES, ERP or Cloud systems. The data transfer is defined according to the Micro Embedded Device Server protocol of the OPC Foundation for supporting OPC UA in field devices. For this data transfer, the integrated OPC UA server of the interface communicates with the OPC UA client of the higher-level system.

4.4.9 Compatible CODESYS versions

The device is compatible with the following CODESYS versions:

CODESYS programming environment	CODESYS runtime	Firmware version	CODESYS package
3.5.12.10	3.5.11.20	1.0.1.0	1.0.1.0

4.5 Technical accessories

Optionally available accessories for mounting, connecting and parameter setting can be found in the TURCK product database at www.turck.com. Accessories are not supplied with the device.

5 Installing

The device is designed for mounting on a bracket based on the VESA 100 × 100 standard. The device is provided with four M4 threaded holes spaced 100 mm apart (horizontally and vertically). The maximum length of the screws is 8 mm plus the thickness of the VESA bracket. The devices can be mounted in any position.

- ▶ Fasten the device with four M4 screws to a bracket in accordance with VESA 100 × 100.

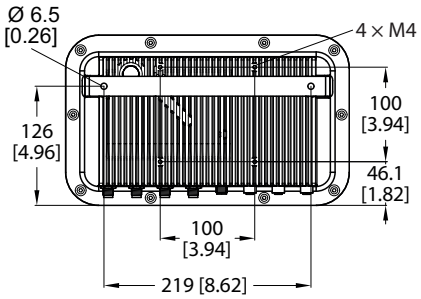


Fig. 4: Rear view – TN-UHF-Q180…

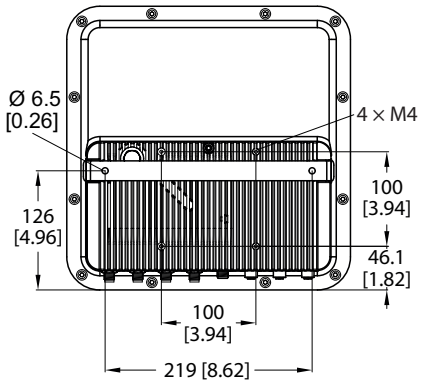


Fig. 5: Rear view – TN-UHF-Q300…

6 Connecting

6.1 Connecting devices to Ethernet

The device has a 4-pin M12 female connector for connection to an Ethernet system.

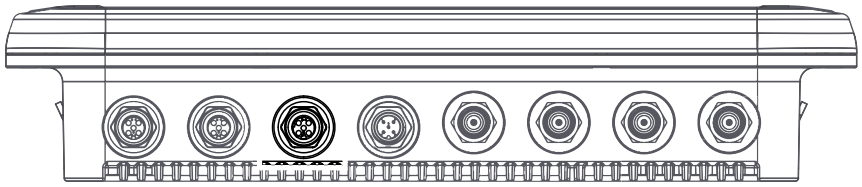


Fig. 6: M12 Ethernet connector

- ▶ Connect the device to Ethernet in accordance with the pin assignment below (max. tightening torque: 0.8 Nm).

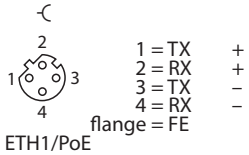


Fig. 7: Pin assignment for Ethernet connections

NOTE
With PoE, the supply voltage is transmitted via PoE Mode A with 4-wire cables.
The use of PoE and 24 VDC simultaneously is not supported.

6.2 Connecting the power supply

The device is provided with a 5-pin M12 plug connectors for connecting the power supply.

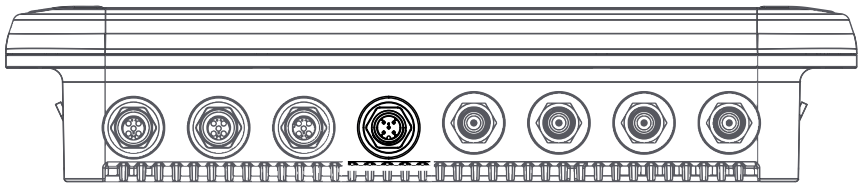


Fig. 8: M12 plug connector for connecting the power supply

- Connect the device to the power supply as per the following pin assignment (max. tightening torque 0.8 Nm).

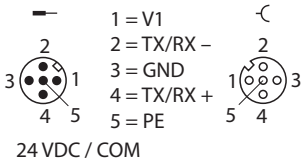


Fig. 9: Pin assignment of the power supply terminals

6.3 Connecting digital sensors and actuators

The device has two 5-pin M12 plug connectors for connecting digital sensors and actuators.

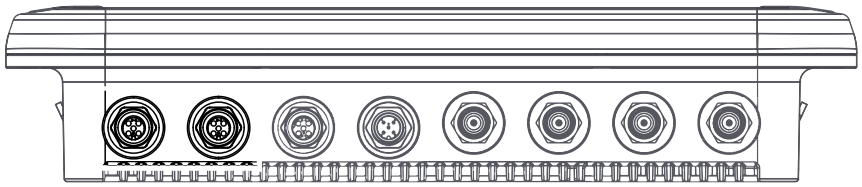


Fig. 10: M12 plug connectors for connecting digital sensors and actuators

NOTE
When operating via PoE (Power over Ethernet) the digital channels cannot be used as outputs.

- Connect sensors and actuators to the device as per the following pin assignment (max. tightening torque 0.8 Nm).

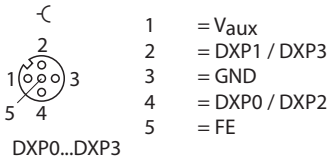


Fig. 11: Connections for digital sensors and actuators – pin assignment

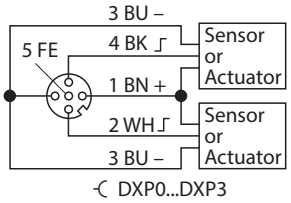


Fig. 12: Connections for digital sensors and actuators – wiring diagram

6.4 Connecting external antennas

The device is provided with four RP-TNC sockets for connecting up to four external antennas. The input impedance is 50 Ω.

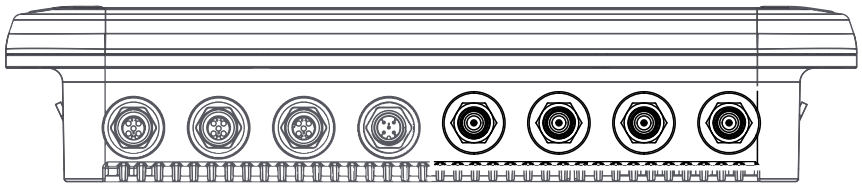


Fig. 13: RP-TNC sockets for connecting external antennas

- ▶ Connect external antennas with an RP-TNC antenna cable to the device (max. tightening torque 0.8 Nm).

7 Commissioning

7.1 Parameterizing readers with the DTM

The UHF settings of the device can be assigned additional parameters via the DTM.

All the required TURCK software components can be downloaded via the TURCK Software Manager. The TURCK Software Manager is available free of charge from www.turck.com.

NOTE
The parameterization function up to firmware version V2.0.39.3937 is only available in English. All parameters are written in the DTM.

The individual readers are available in different variants. When a connection is made to a connected reader, the DTM automatically detects the relevant device and deactivates menu items that are not supported. The connection cannot be established if a different variant than set in the project tree is connected.

NOTE
Adjustable parameters are indicated in the DTM with green arrows. Fixed parameters are indicated with gray arrows.

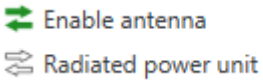


Fig. 14: DTM – example of adjustable and fixed parameters

Requirements for extended parameter setting

- PACTware must be installed.
- The DTM for UHF readers must be installed.
- The DTM for the BL20, BL67, BLcompact, FEN20, FXEN, FGEN and TBEN fieldbus I/O system must be installed.

7.1.1 Connecting the device with the PC

- Open PACTware.
- Right-click **Host PC** in the project tree.
- Click **Add device**.
- Add **BL Service Ethernet**.
- Confirm the selection with **OK**.

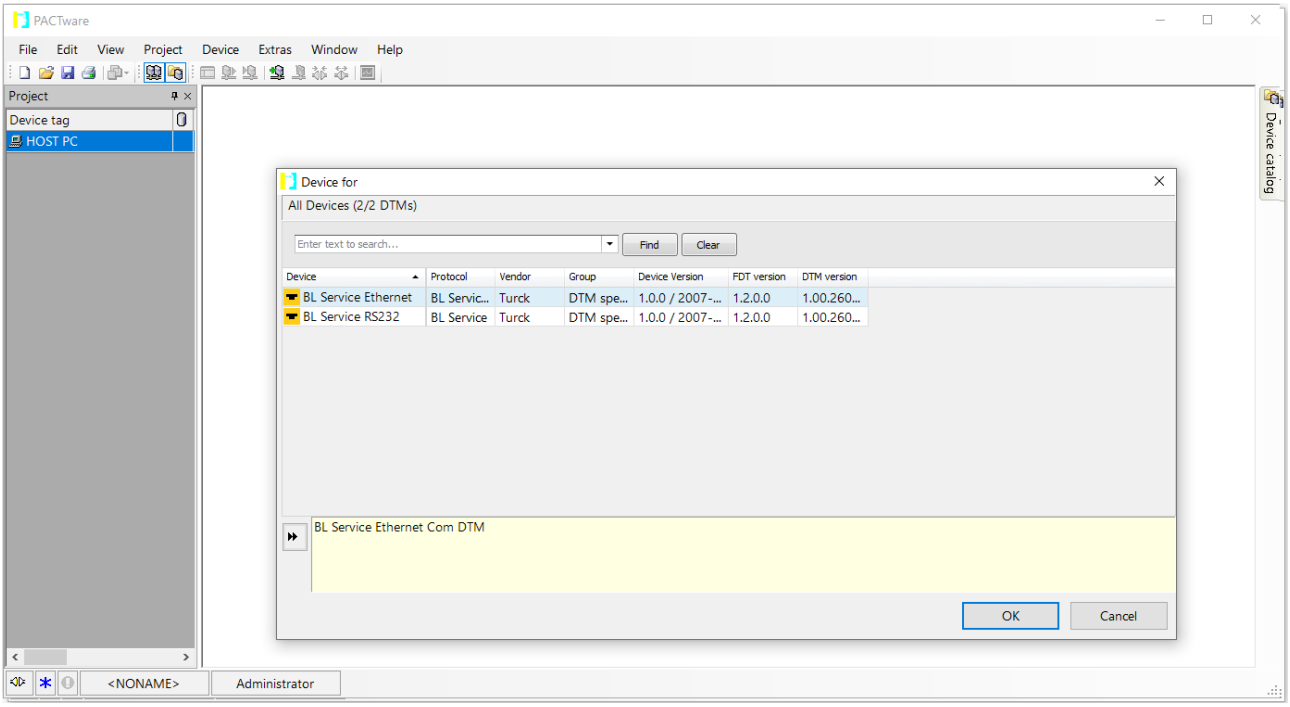


Fig. 15: Selecting an Ethernet adapter

- Right-click the Ethernet adapter.
- Start the **Topology scan**.

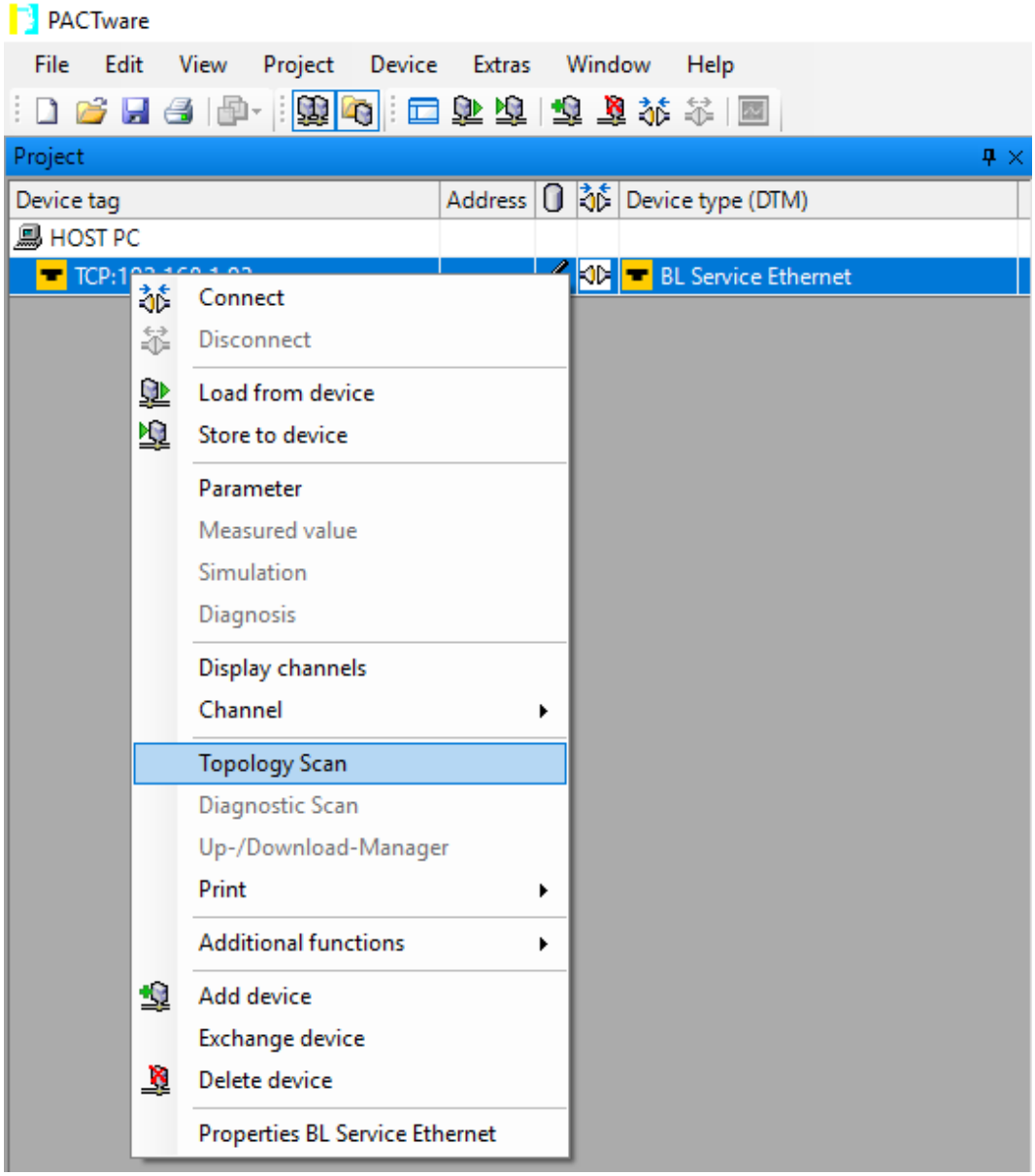


Fig. 16: Starting the Topology scan

The connected devices are automatically detected and added to the project tree.

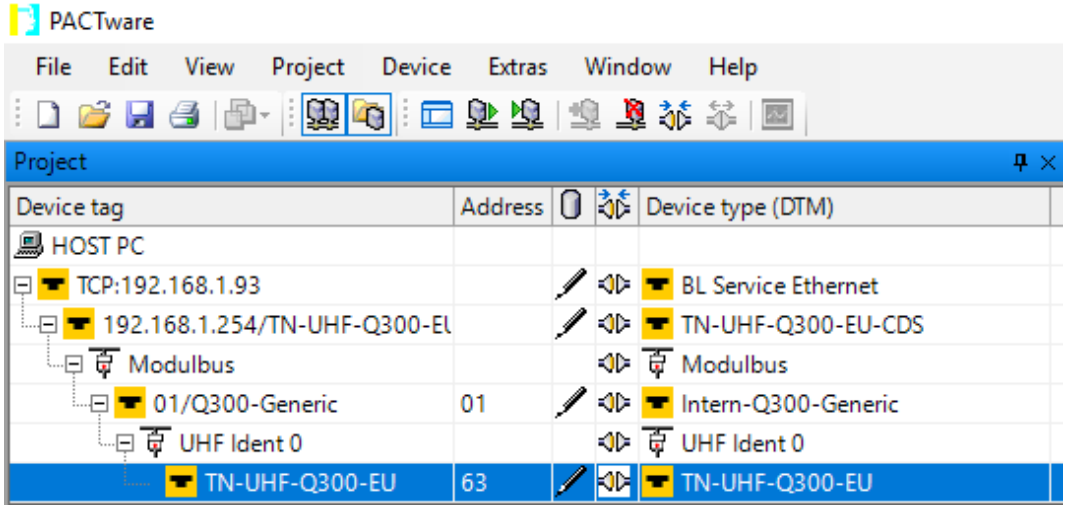


Fig. 17: Project tree

7.1.2 Starting extended reader parameterization

- Right-click the device.
- Start the parameter setting: Choose **Parameterization** or **Online Parameterization**. The device must be connected to the PC for the **Online Parameterization**.

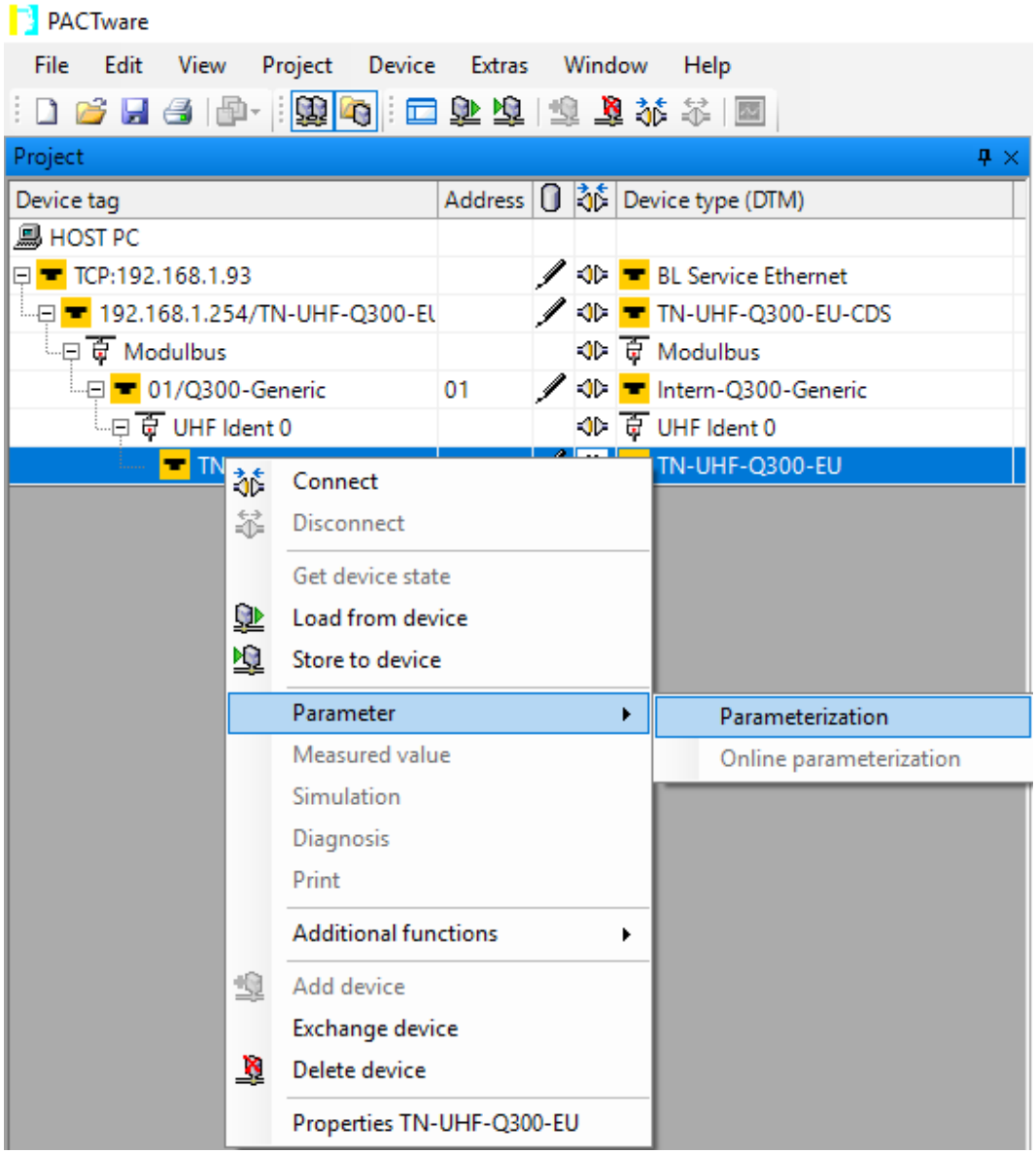


Fig. 18: Starting the parameterization

7.1.3 DTM main menu — overview

Fig. 19: DTM – main menu

The main menu provides the following functions:

Icon	Function	Description
	Switch display	Shows the information bar for the connected device and DTM version at the top of the screen.
	Help about DTM	Starts the DTM help.
	Help about device	Opens the data sheet of the connected reader.
	Activating and deactivating Expert mode	Opens the drop-down menu to select the access level. The following access levels are available: ■ Basic (default setting) ■ Advanced ■ Administrator (password-protected)
	Channel-wise display	Toggles the view between standard display and channel-wise display.
	Load data from database	Loads previously stored parameters from the database (e.g. an existing project).
	Store data in database	Transfers the current reader parameters to the database of the current project.
	Read data from device	Reads the set parameters from the device.
	Transmit data to device	Transfers the set parameters to the device.
	Compare displayed values with database	Compares the values displayed in the DTM with the values saved in the database.
	CSV export current values	Exports the current values from the DTM to a CSV file.

The following setup windows can be opened in tabs via the main menu:

- Basic setup
- Antenna
- Antenna configuration
- Communication
- EPC Class1 Gen2
- Post read filter
- Signaling

7.1.4 Choosing the access level

Three access levels are available for setting the device parameters. Different parameters can be set depending on the access level.

NOTE
Modifications made in the **Administrator** access level can result in serious changes to operation. The **Administrator** access level is therefore only available for TURCK service technicians. All relevant settings for the successful parameter setting of an application are available in the **Advanced** access level.

Access level	Description	Initial password
Basic	Basic access for configuration and commissioning	Not required
Advanced	Extended access, e.g. for applications	Not required
Administrator	Administrator access for critical security or wireless settings	Required

The current access level is displayed in the top right screen area of the DTM.

Fig. 20: Display of the access level

7.1.5 Setting multiplex operation

In multiplex operation, several antennas can be controlled or switched on in sequence. The example below shows the activation of the antennas in sequence. The multiplex operation can consist of up to 16 sequences and can be used, for example, for gate applications.

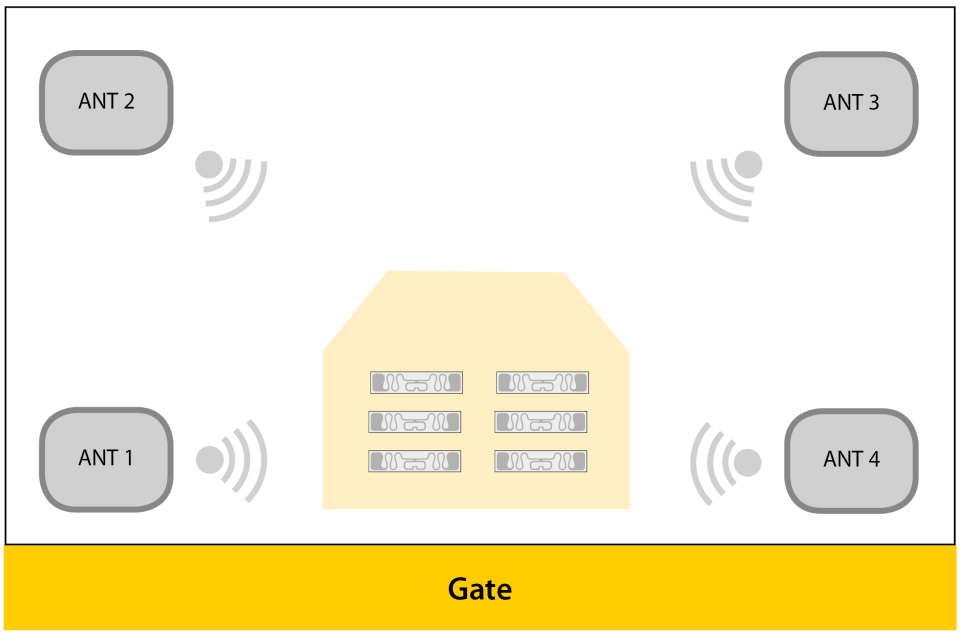


Fig. 21: Gate application – schematic representation

Configuring multiplex operation – example

- Choose the **Antenna** tab in the main menu.
- At **Antenna** → **Antenna multiplexing** → **Number of entries** enter the number of antennas.

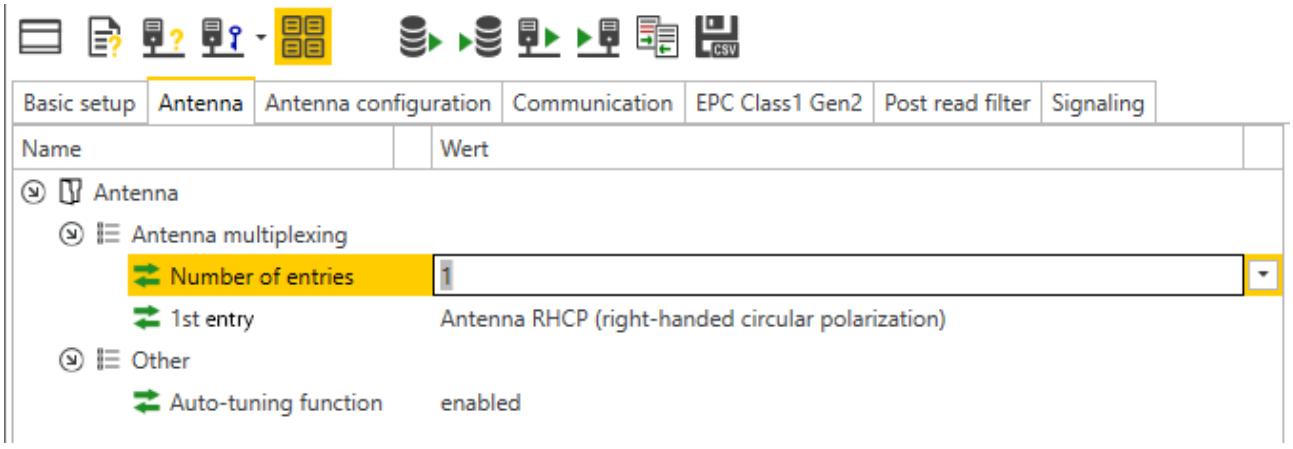


Fig. 22: Entering the number of antennas

- Assign antennas with functions (e.g. internal antenna: RHCP, LHCP, external antenna)

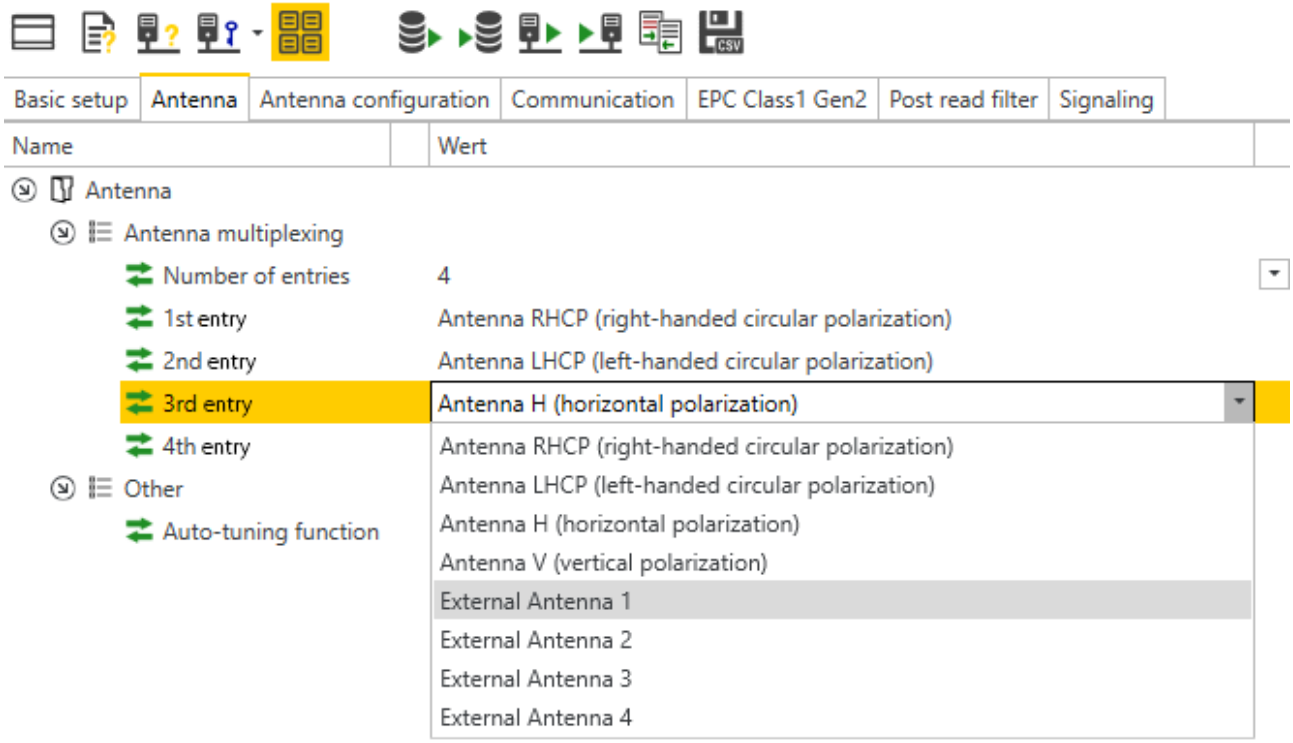


Fig. 23: Example: setting multiplex operation

- Click **Accept** to save the settings.
- For all antennas used set at **Antenna configuration** → **Maximal transmit time** the time in which the particular antenna is to remain active and stay switched on.

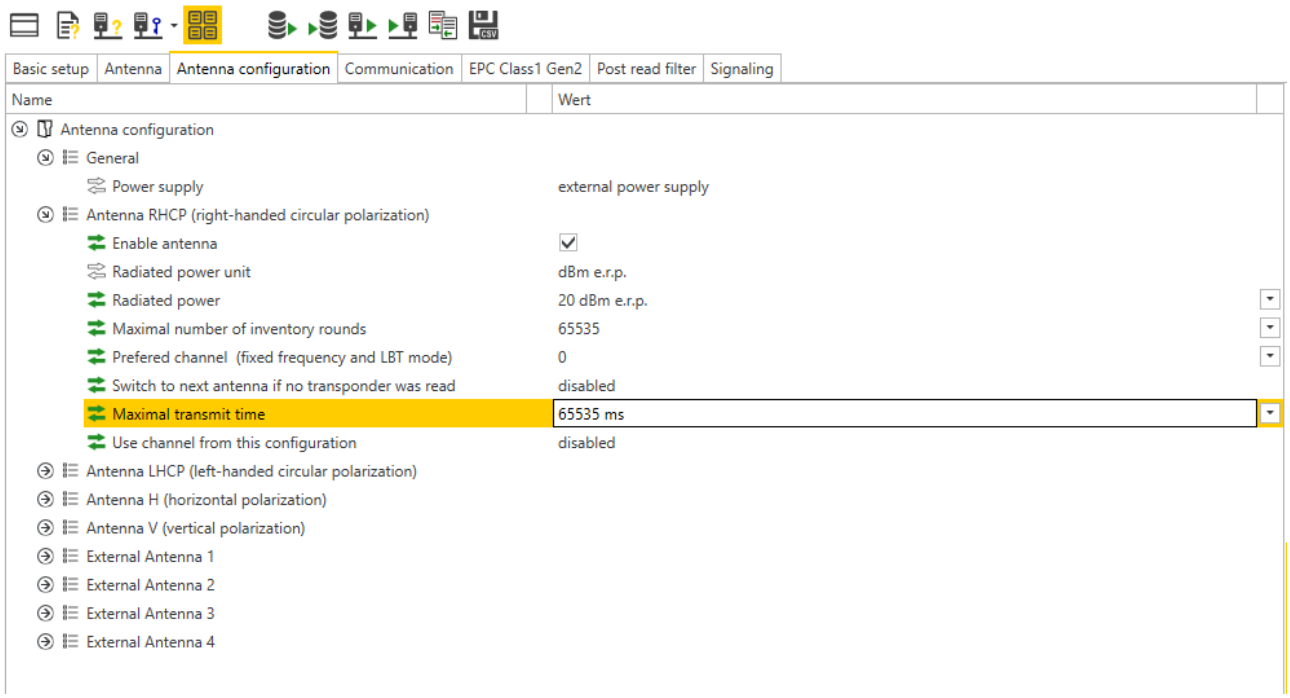


Fig. 24: Setting the maximum transmit time

7.1.6 Setting antenna power

The antenna power of the reader can be set for the specific application. The radiated power for the integrated antenna can be entered directly in the DTM. The power must be calculated for external antennas.

The following parameters must be used to calculate the radiated power (P_{ERP}):

P_{cond}	Power to be output at the TNC female connector of the reader
dB	Cable attenuation
G_{HW}	Antenna gain of the external antenna

NOTE
Refer to the data sheets of the components used for the cable attenuation and antenna gain.

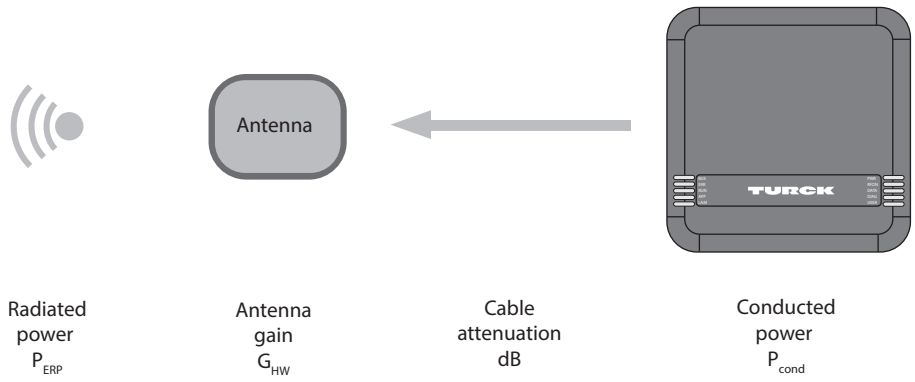


Fig. 25: Power calculation — Relevant variables (schematic representation)

The power can be calculated with the following formula:

$P_{ERP} = G_{HW} - dB + P_{cond}$

Setting antenna power — Restrictions of radio regulations

Some national regulations restrict the degree of freedom available for creating an RFID system. You as the operator are responsible for ensuring that regulations are observed.

- ETSI
  - Radiated power P_{ERP}: max. 33 dBm ERP
- FCC
  - Radiated power P_{ERP}: max. 36 dBm EIRP
  - P_{cond}: max. 30 dBm with antenna gain $G_{HW} \leq 6$ dbi

NOTE
The DTM indicates impermissible configurations with an exclamation mark. A transmission to the device is prevented.

Calculating radiated power

The effective radiated power (ERP) is the power that is radiated from an antenna into free space. To make it possible to compare the technical properties of different antenna, the power specifications given are always in relation to a reference antenna.

- EIRP = equivalent isotropic radiated power (reference: isotropic antenna)
- ERP = effective radiated power (reference: with the length of λ/2)

The radiated power can be stated in watts or in dBm. The following table shows approximate values as a guide for converting between dBm and mW:

dBm	mW	dBm	mW	dBm	mW	dBm	mW
1	1.25	9	8	17	50	25	316
2	1.6	10	10	18	63	26	400
3	2	11	13	19	80	27	500
4	2.5	12	16	20	100	28	630
5	3	13	20	21	125	29	800
6	4	14	25	22	160	30	1000
7	5	15	32	23	200	…	…
8	6	16	40	24	250	33	2000

The formula for calculating the exact values is: **dBm = 10 × lg (P/1 mW)**

Converting antenna gain

The antenna gain can be specified in the following units:

dBd	Antenna gain in relation to a dipole
dBi	Antenna gain in relation to an isotropic radiator (linear)
dBic	Antenna gain in relation to an isotropic radiator (circular)

The different units can be converted as follows:

- G_{HW} = dBd
- G_{HW} = dBi - 2.15
- G_{HW} = dBic - 5.15

Setting the power for external antennas via the DTM

When supplied via Power over Ethernet (PoE), the radiated power for the internal antenna is limited to 1 W. With external antennas 1 W of output power is provided at the TNC socket. The power supply type at **Antenna configuration** → **Power supply** is automatically set to the value **external power supply**.

- ▶ Set the radiated power at **Antenna Configuration** → **Radiated power** (here: 33 dBm ERP).

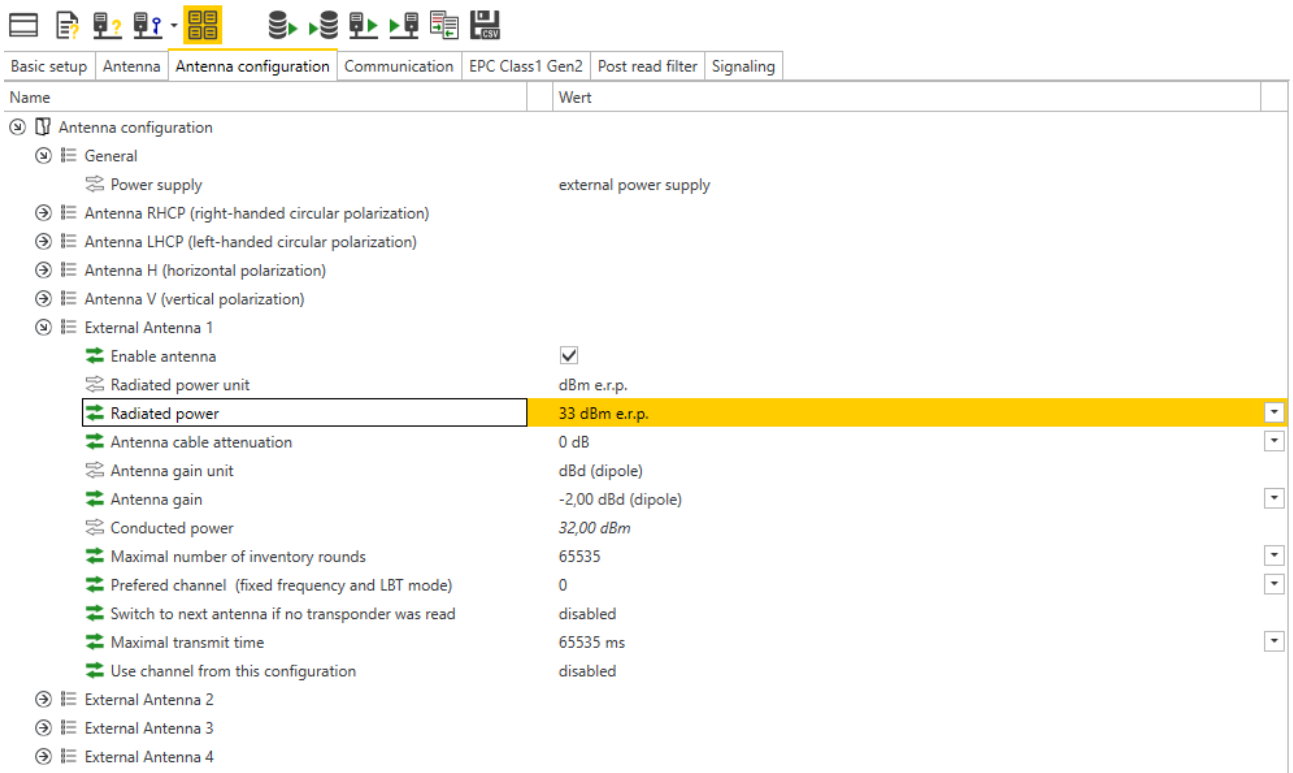


Fig. 26: Setting the radiated power

- Refer to the data sheet of the cable used for the cable attenuation.
- Enter the cable attenuation at **Antenna cable attenuation**.

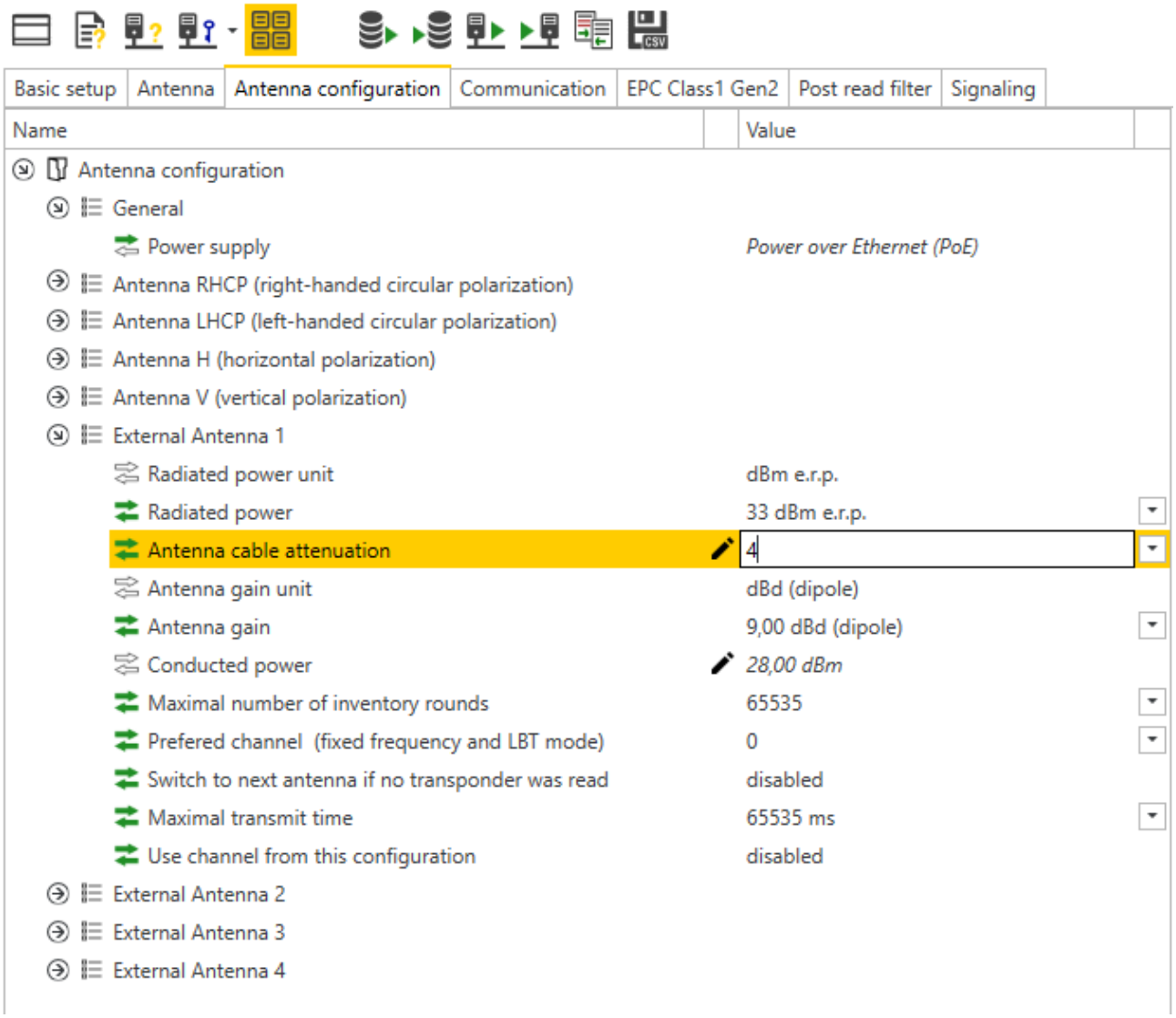


Fig. 27: DTM — Entering the cable attenuation

- Refer to the data sheet of the external antenna for the antenna gain.
- Set the unit for the antenna gain at **Antenna gain unit** (here: dBd).

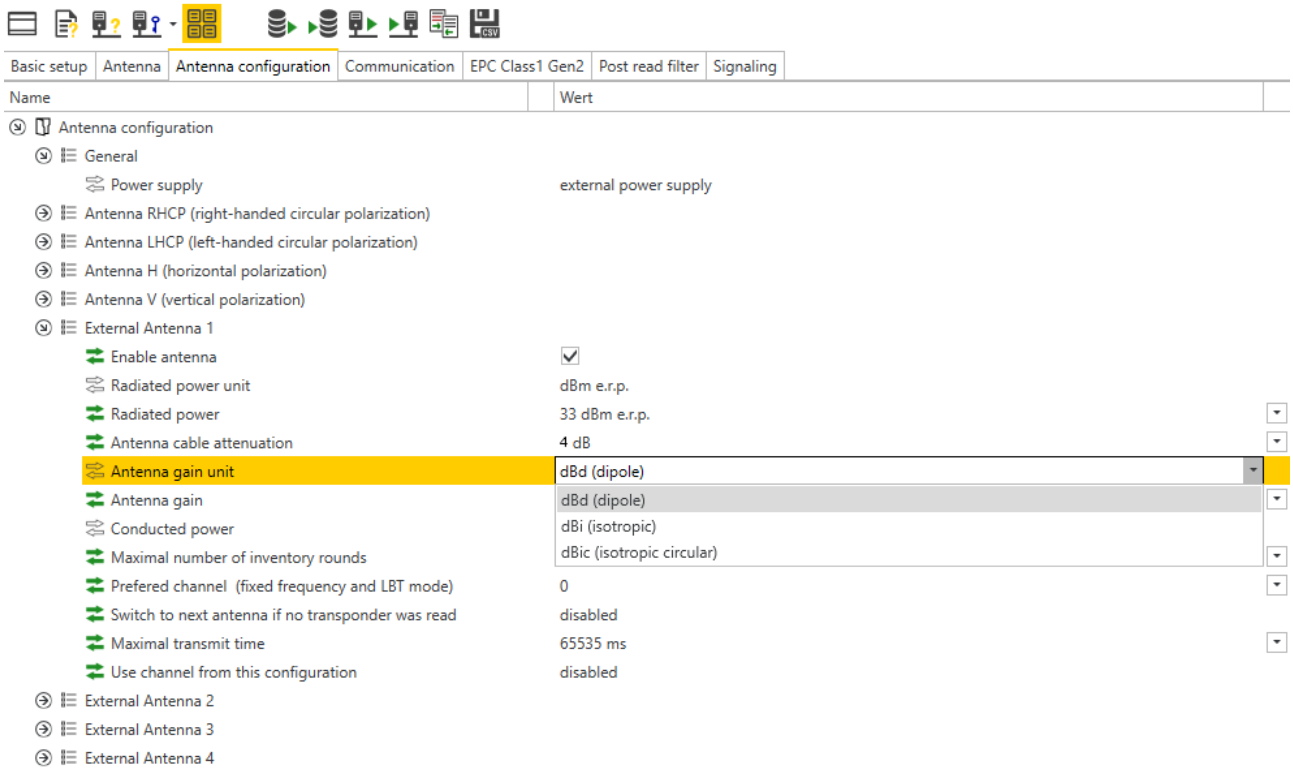


Fig. 28: Setting the unit for the antenna gain

- Set antenna gain at **Antenna gain** (here: 9.00).

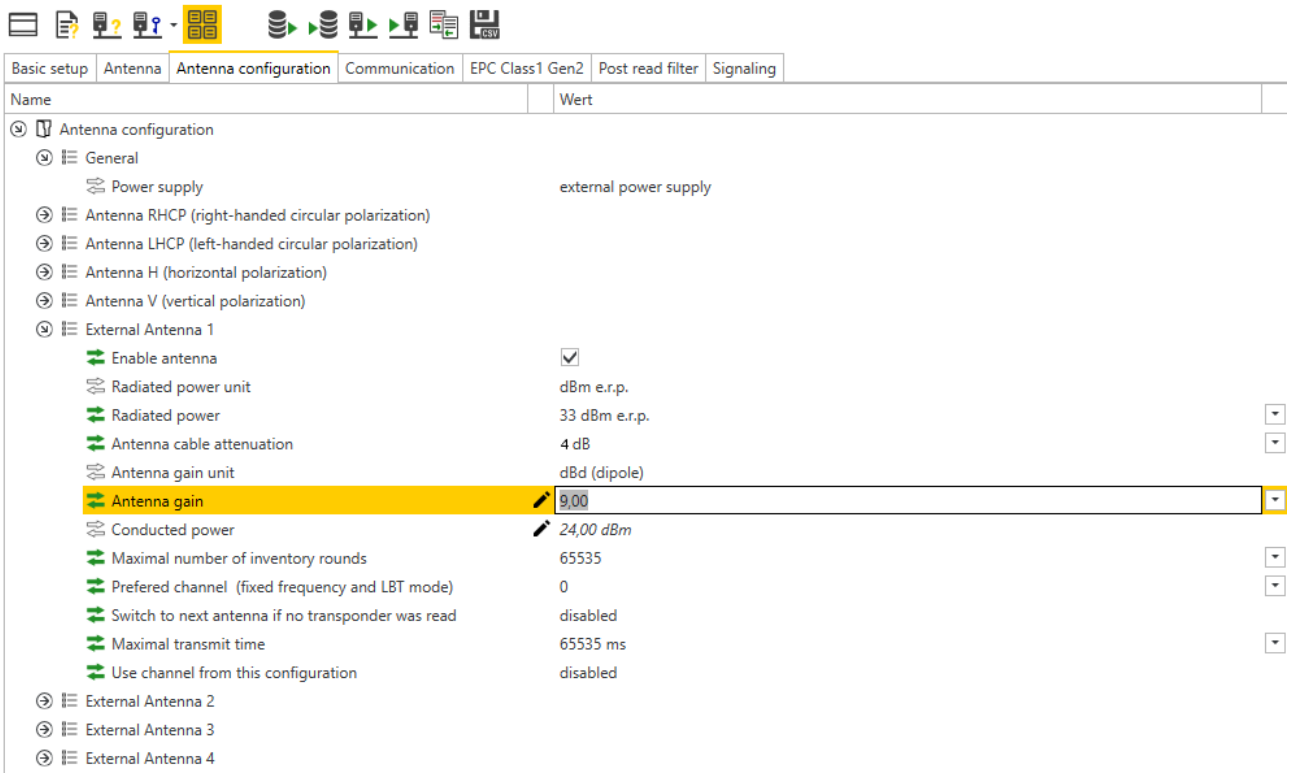


Fig. 29: Setting antenna gain

The power at the TNC socket (P_{cond}) is calculated automatically by the DTM and displayed at **Conducted power**.

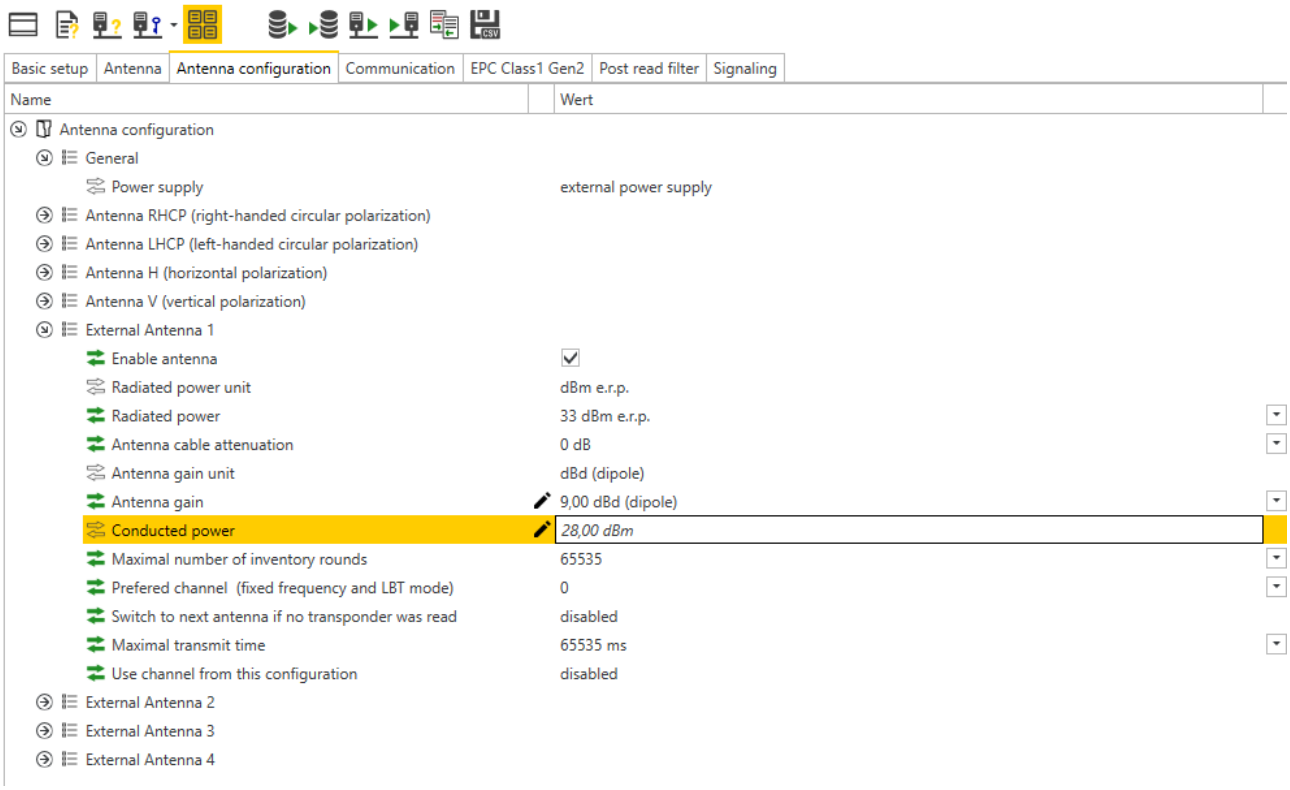


Fig. 30: Display of the power at the TNC socket

- ▶ Click **Accept** to save the settings.
- ▶ Set the power for each additional antenna separately.

7.1.7 Setting antenna polarization

The antenna polarization can be switched via the DTM. Switching the polarization makes it possible to change null spots caused by interference. The detection rate can be increased by switching the polarization. Polarization switching is suitable for example for single-tag applications in particularly metallic environments.

The following graphics schematically illustrate the possibilities of antenna polarization.

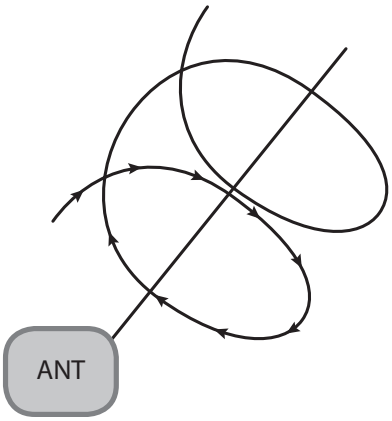


Fig. 31: Antenna polarization circular (RHCP)

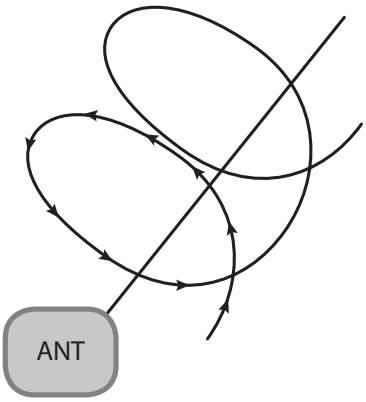


Fig. 32: Antenna polarization circular (LHCP)

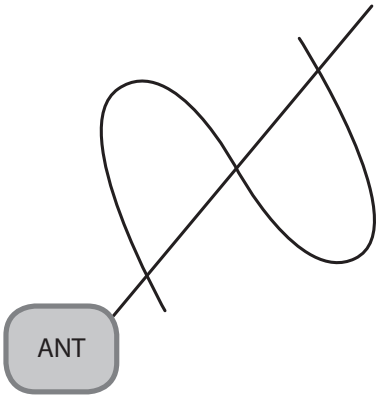


Fig. 33: Antenna polarization linear (vertical)

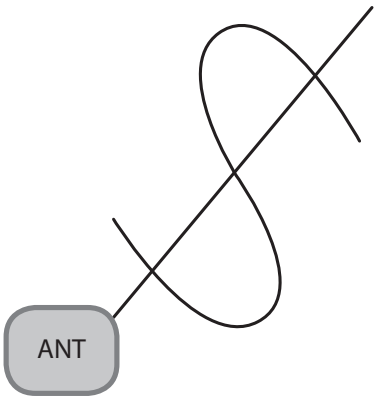


Fig. 34: Antenna polarization linear (horizontal)

Switching antenna polarization

Polarization switching is activated in the DTM via the multiplex settings.

- At **Antenna** → **Number of entries**, set the value **2**.
- Set **Antenna** → **1st entry** to the value **Antenna LHCP**.
- Set **Antenna** → **2nd entry** to the value **antenna RHCP**.

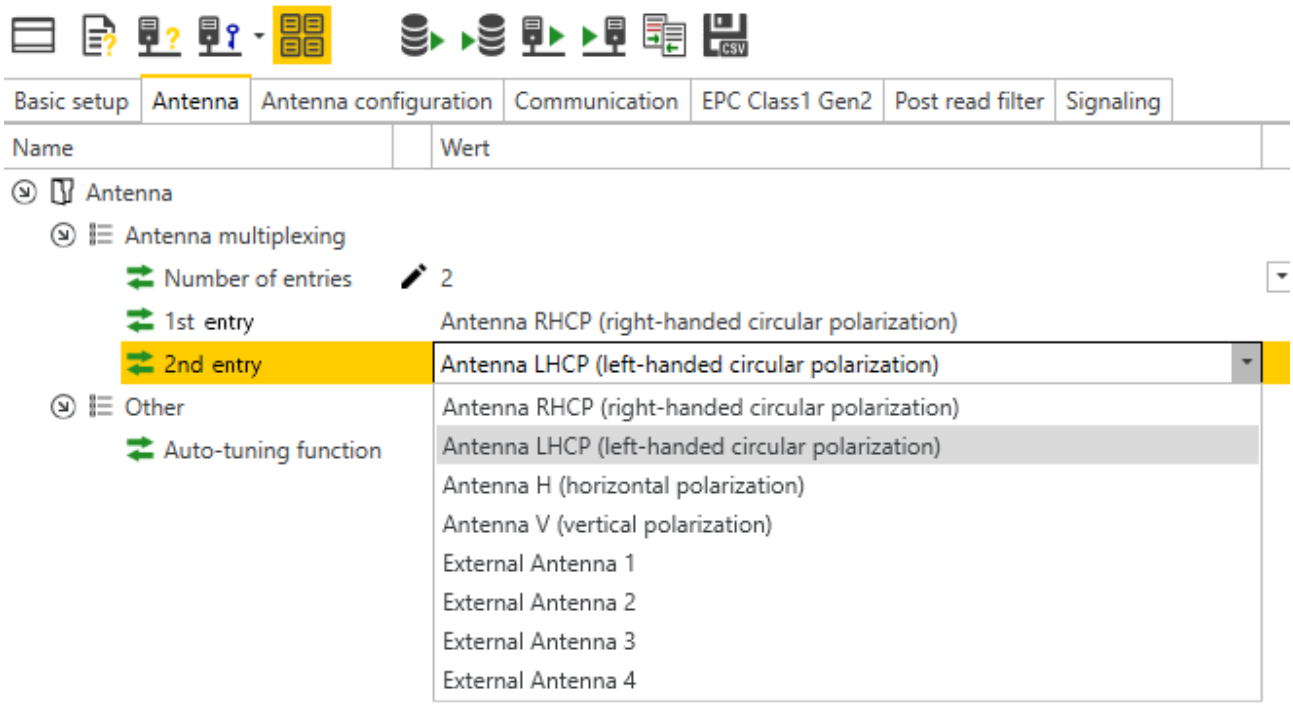


Fig. 35: Switching antenna polarization

- ▶ At **Antenna configuration** → **Maximal transmit time**, set the time up to the polarization switch or activate the **Switch to next antenna if no transponder was read** option.
- ⇨ If the **Switch to next antenna if no transponder was read** option is activated, the reader automatically switches after an inventory operation without reading to the next multiplex sequence (**Entry**).

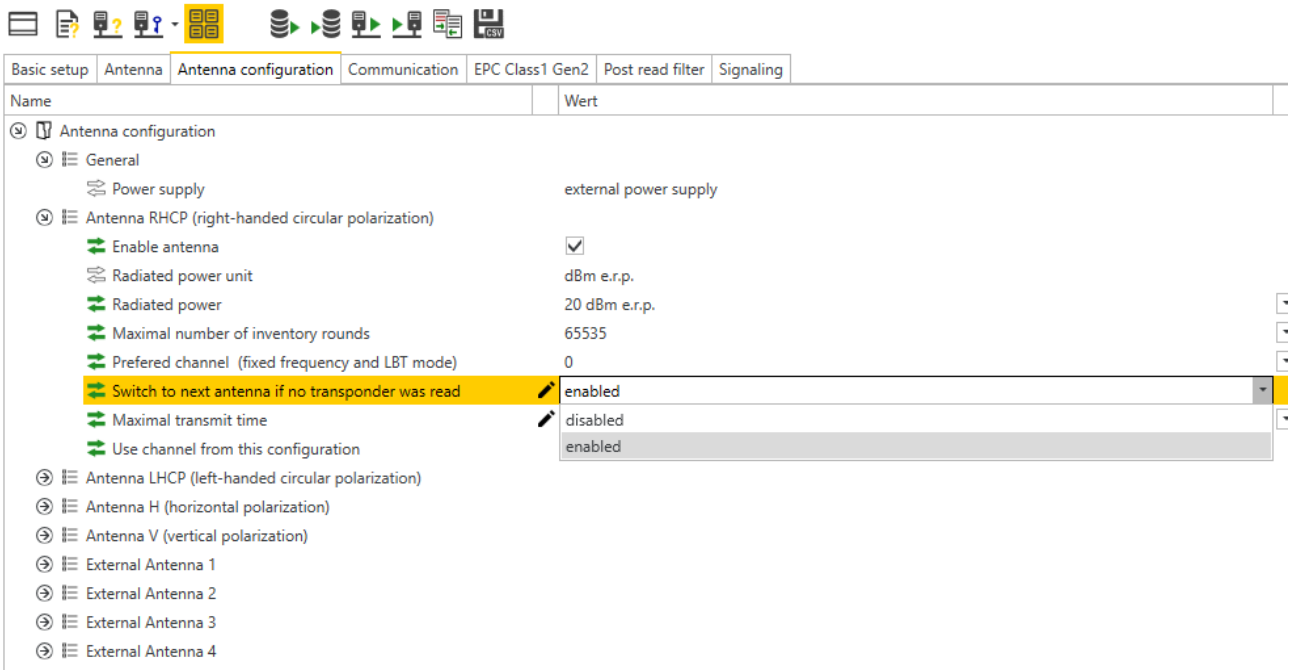


Fig. 36: Switching polarization automatically

7.1.8 Switching on presence sensing mode

In order to use the Continuous presence sensing mode command, the Presence sensing mode must be activated in the reader. In presence sensing mode, the readers are automatically switched on as soon as a tag is located in the detection range.

- ▶ At **Basic setup** → **General** → **Device mode**, set the **Presence sensing mode** option.

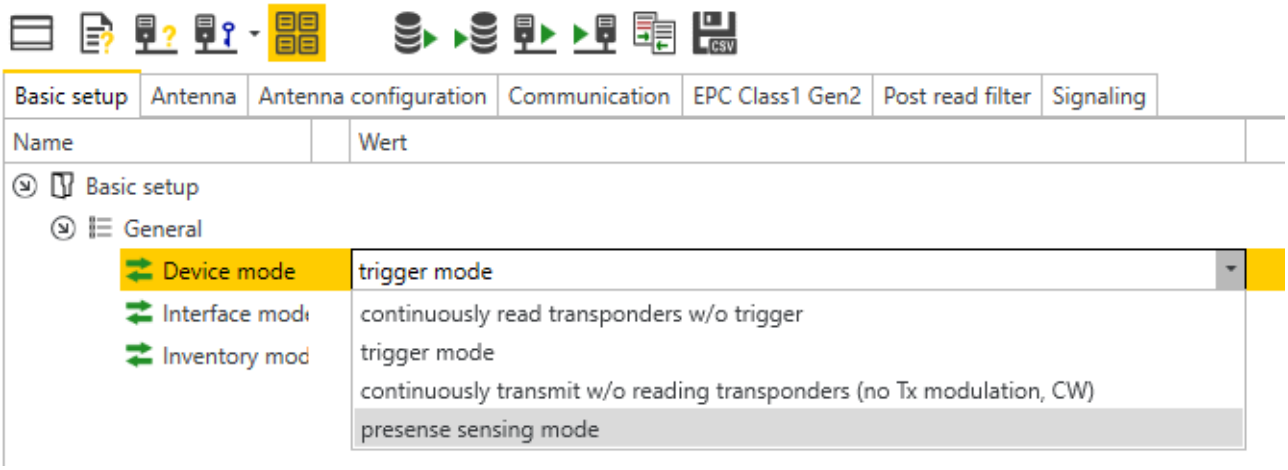


Fig. 37: Switching on presence sensing mode

The Advanced access level allows the **Tag data delay time** and **Carrier delay time** parameters to be set individually.

- **Tag data delay time**: Time in which the reader searches for a tag. If a tag is found, the field is switched on. In the Basic access level, the parameter is set by default to 100 ms.
- **Carrier delay time**: Time until the reader switches off the field after the last read operation. In the Basic access level, the parameter is set by default to 65535 ms.

NOTE
Report mode is recommended for the RFID test since the read tag information items appear in the RFID test window and do not have to be polled individually.

7.1.9 Transferring the RSSI value — communication

The **Communication** tab is used to set the parameters for the configuration of the deBus messages. All parameters and the settable values are written in the DTM.

Example: Switching on RSSI transmission

- ▶ Switch on RSSI transmission: At **Communication** → **Message data content** → **Transponder RSSI**, select the **enabled** option.
- ⇨ The RSSI value is displayed with the inventory in the read data.

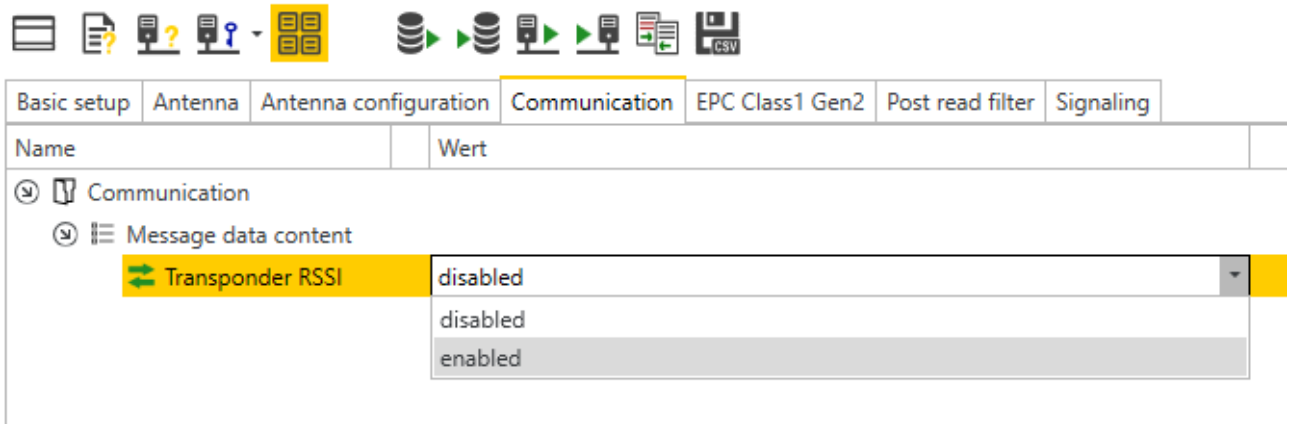


Fig. 38: Switching on RSSI transmission

7.1.10 Setting the air interface parameters – EPC Class 1 Gen 2

The EPC Class1 Gen2 tab is used to set the **EPC Class1 Gen2** parameters for the air interface. The parameters set here are used if the reader performs an Inventory command. All parameters and the settable values are written in the DTM.

Example: Setting the tag reset

The tag reset can be used to set the number of times a tag sends feedback to the reader during an inventory process. The tag reset function is only useful in single-tag applications.

- **EPC Class 1 Gen 2** → **Inventory** → **Inventory profile 1: Transponder reset** → Enter value (here: 150 ms).

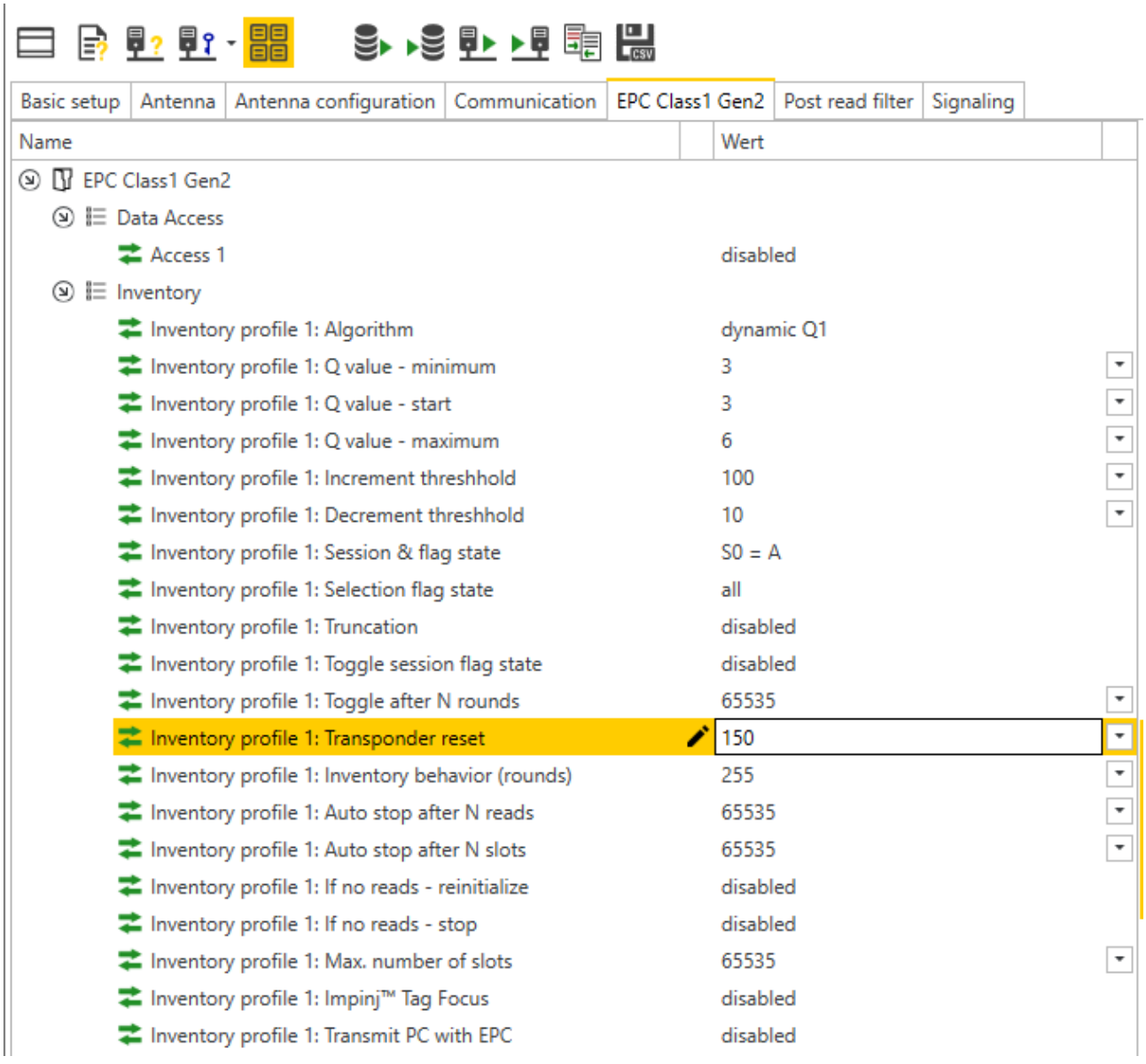


Fig. 39: Setting the tag reset

7.1.11 Setting the RSSI filter – post read filter

The **Post Read Filter** tab enables parameters to be set in order to filter event messages.

The set filters do not reduce the data traffic on the air interface and are not suitable for multi-tag applications with many tags or high passing speeds. All parameters and the settable values are written in the DTM.

Example: Set the RSSI filter

An RSSI filter makes it possible to prevent unwanted read operations. All read operations with an RSSI outside of the set limit values are filtered out and not displayed.

- At **Post read filter** → **RSSI filter**, enable the RSSI Filter.

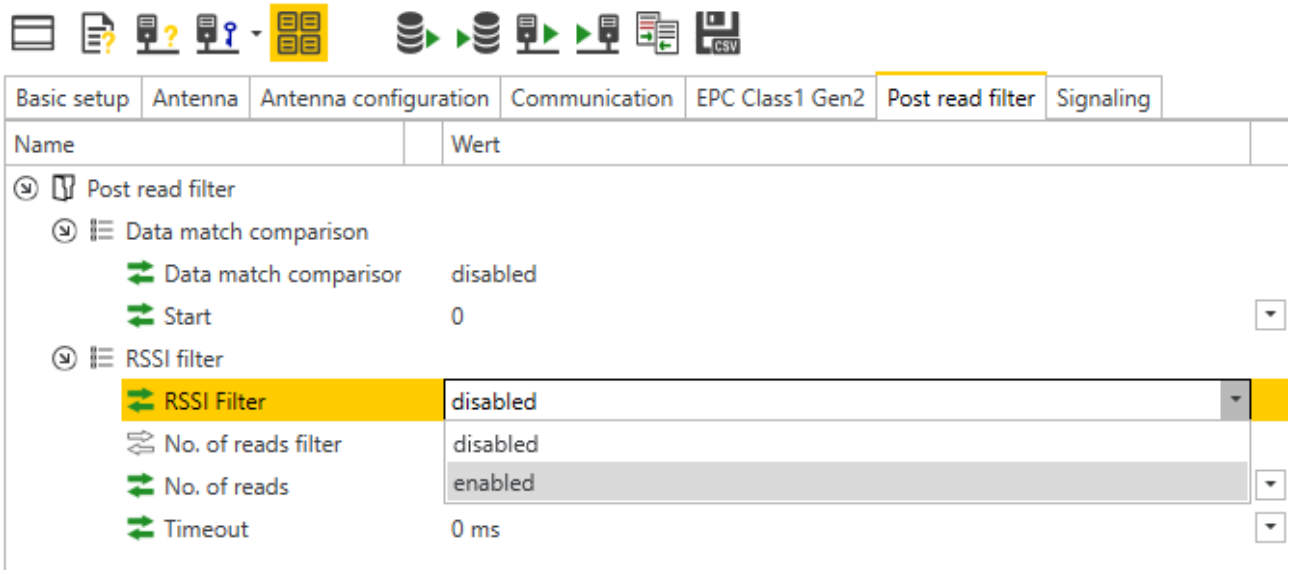


Fig. 40: Switching on the RSSI filter

▶ Set the threshold at **Post read filter** → **RSSI filter** → **Lower threshold**.
⇨ Example: All read operations below an RSSI value of -45 dBm are filtered out.

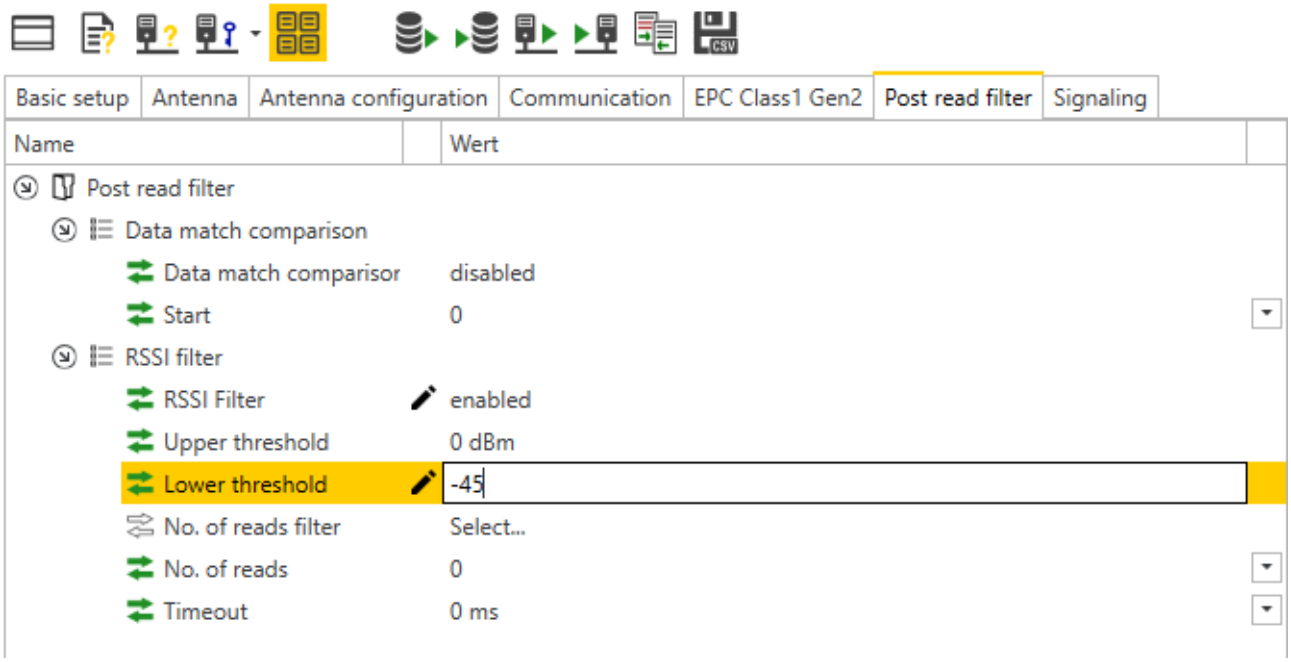


Fig. 41: Example — Setting the limit value for RSSI

7.1.12 Setting LED indication – signaling

The **Signaling** tab enables the default settings for the USER LEDs to be edited. All parameters and the settable values are written in the DTM.

7.2 Parameterizing the reader using the web server

NOTE
The web server always displays all setting options. Parameterization via the web server is possible for the TN-UHF-Q300-EU-CDS from firmware version >1.0.2.0.

The integrated web server can be used to set the devices and send commands to the devices. In order to be able to open the web server with a PC, the device and the PC must be in the same IP network.

7.2.1 Opening the web server

The web server can be opened from a web browser or from the TURCK Automation Suite (TAS). Accessing the web server via TAS is described in the section entitled "Adjusting network settings."

The device is factory set to IP address 192.168.1.254. To open the web server via a web browser, enter **http://192.168.1.254** in the address bar of the web browser.

7.2.2 Editing settings in the web server

A login is required to edit settings via the web server. The default password is "password".

NOTE
TURCK recommends changing the password after the first login for security reasons.

- Open the device's web server.
- Enter **Username** and **Password**.
- Click **Login**

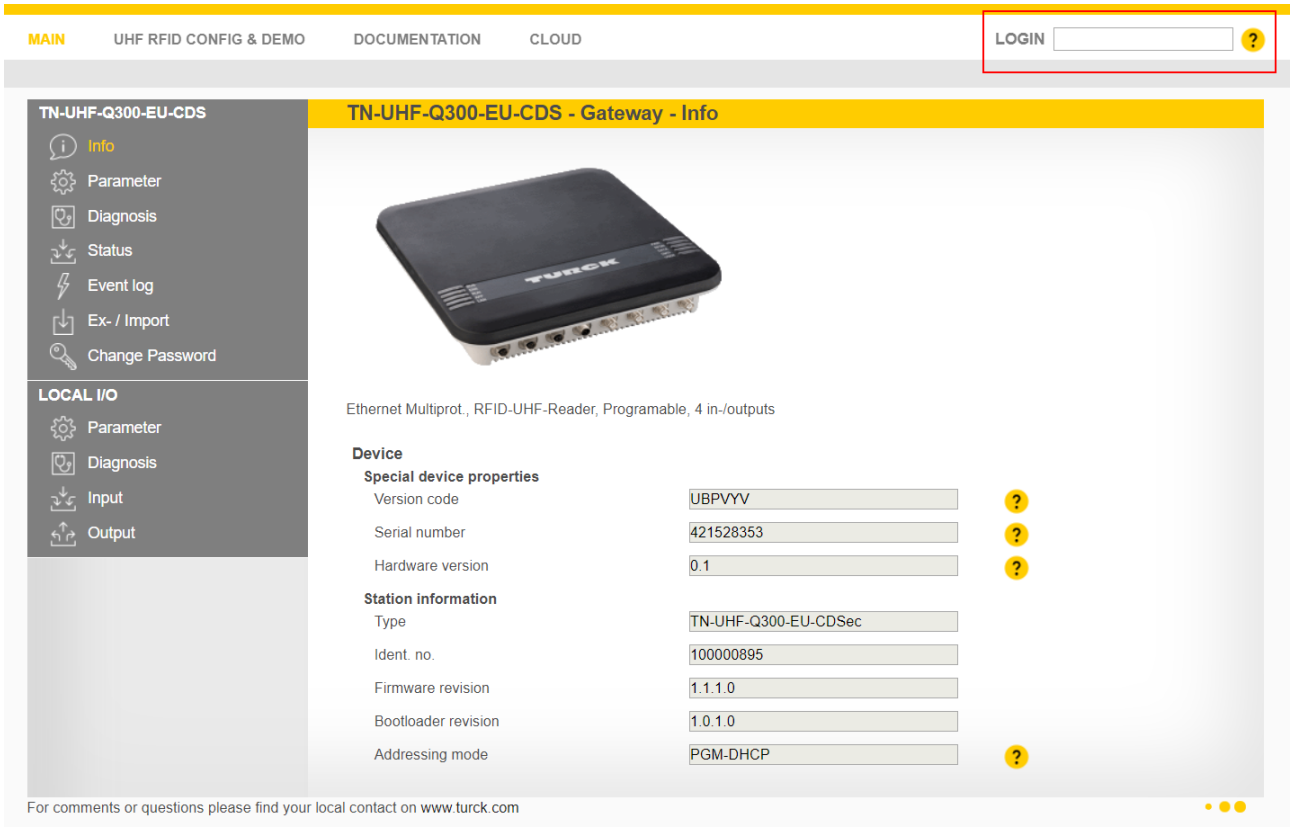


Fig. 42: Web server — login

- Change the password after the first login.

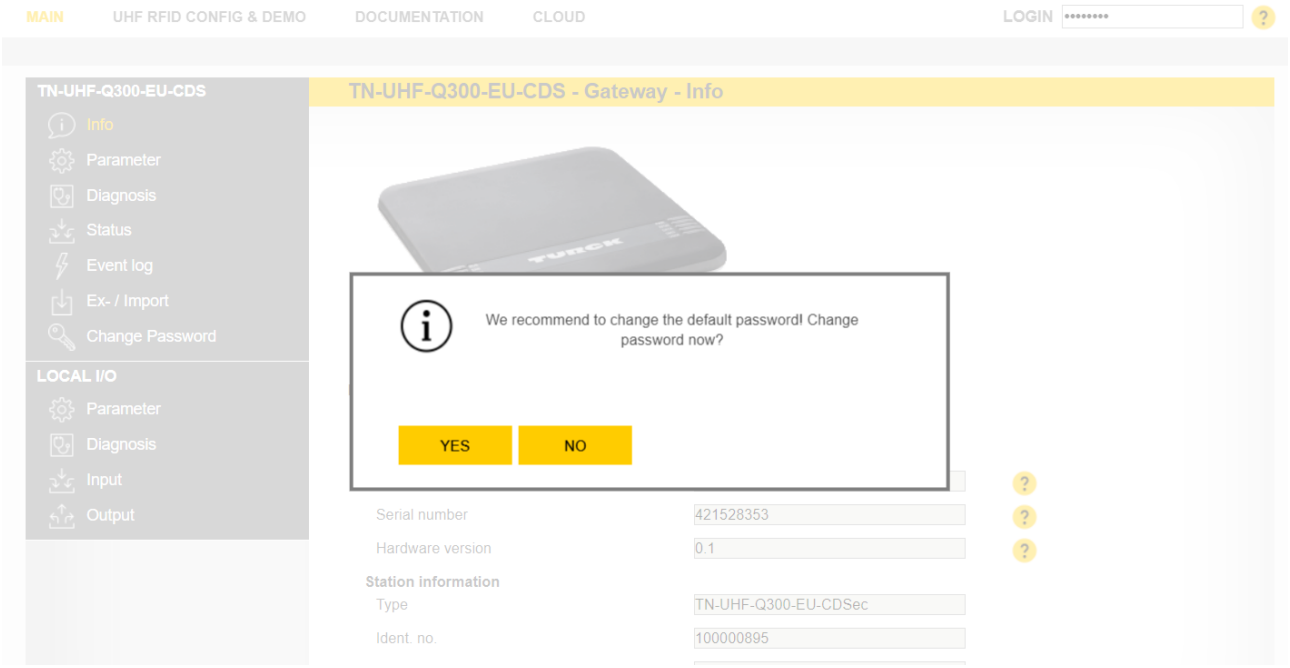


Fig. 43: Web server — password change dialog

The start page is displayed with the device information after the login.

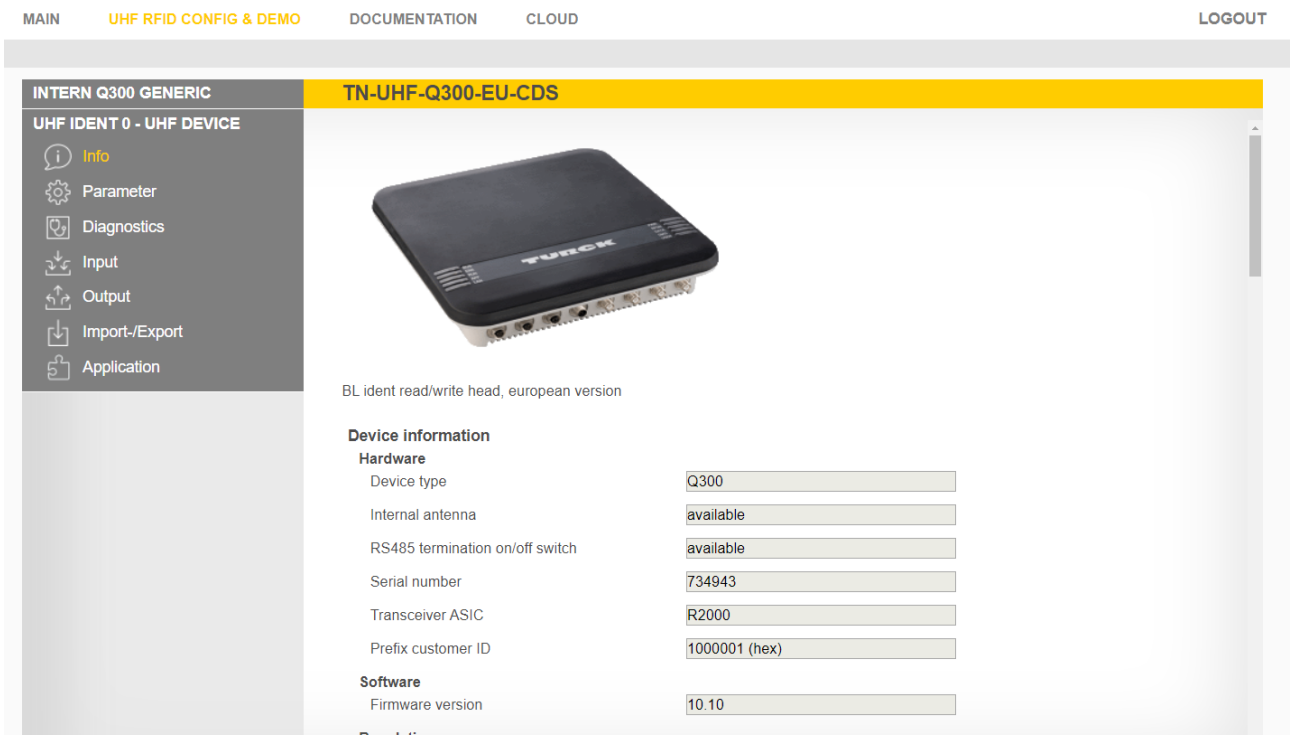


Fig. 44: Web server — home page

▶ Click **UHF RFID CONFIG & DEMO** to display and set the device parameters.

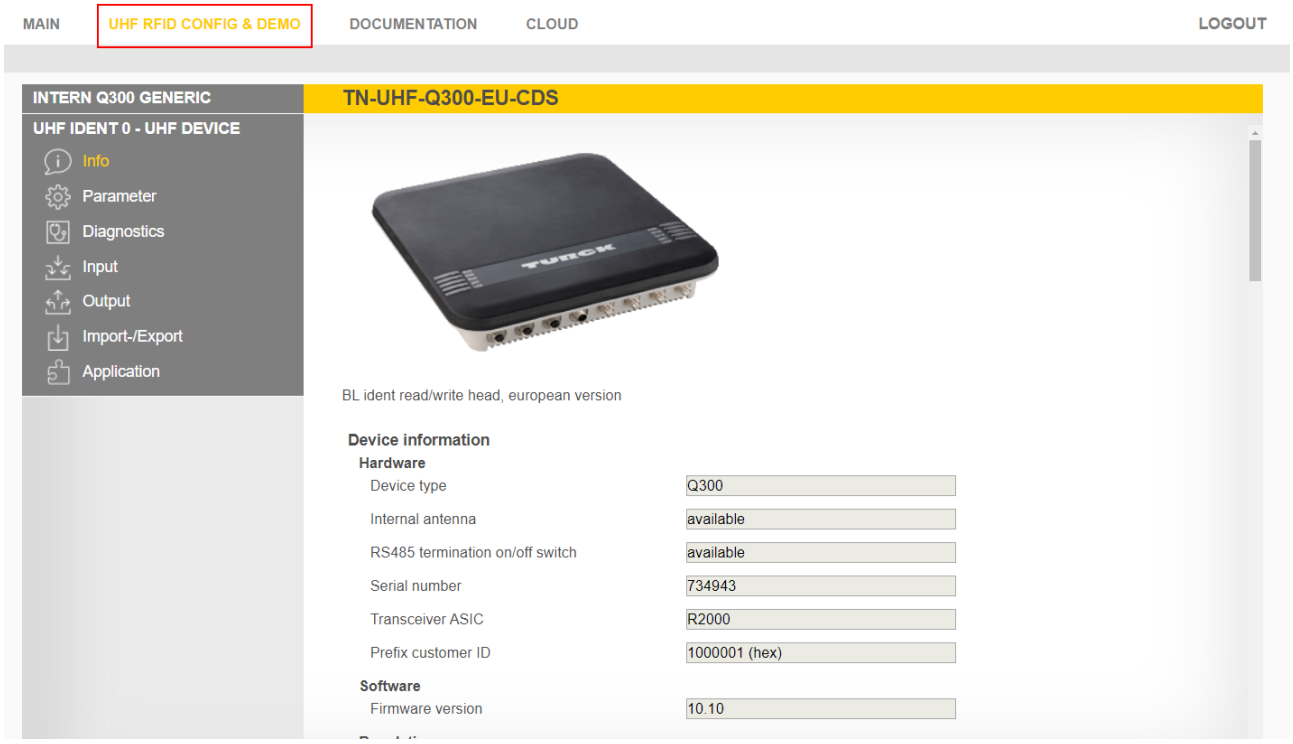


Fig. 45: Web server — UHF RFID CONFIG & DEMO

▶ Click **Go online** in the login window.

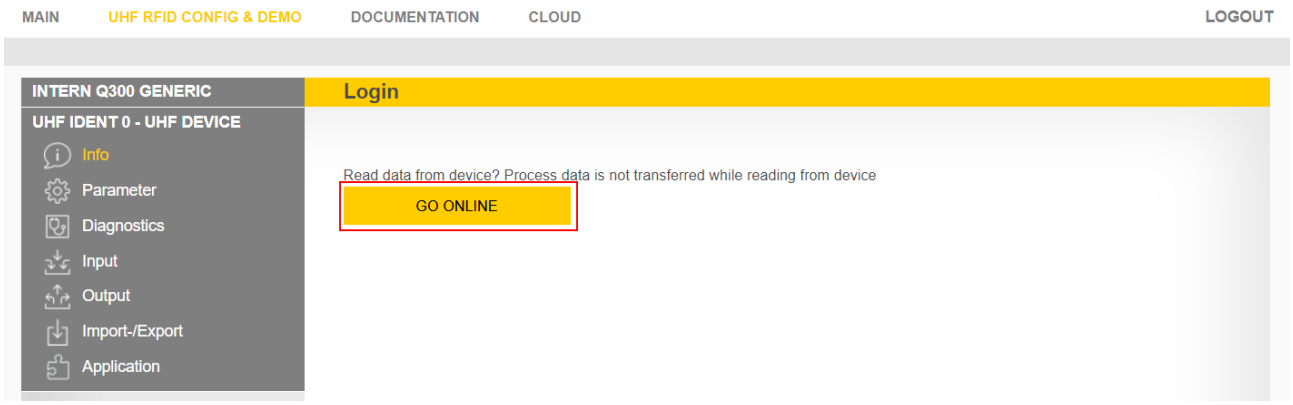


Fig. 46: Web server — Go online

▶ Click **Parameter** in the navigation bar on the left of the screen.

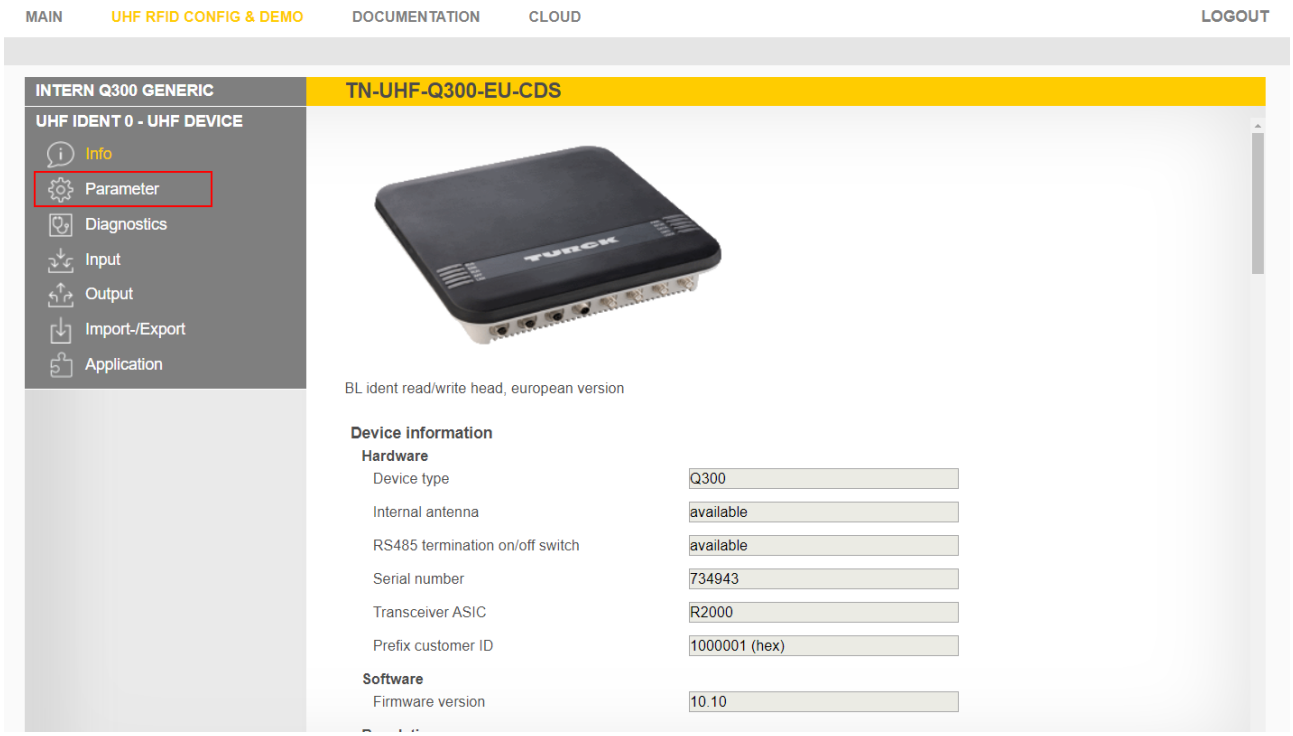


Fig. 47: Web server — Parameters

⇨ All parameters of the device are displayed.

NOTE
The parameters are arranged in the web server in the same way as in the UHF DTM. Information on the parameters is provided at [▷ 26]. The access level displayed in the web server corresponds to the Advanced level in the DTM.

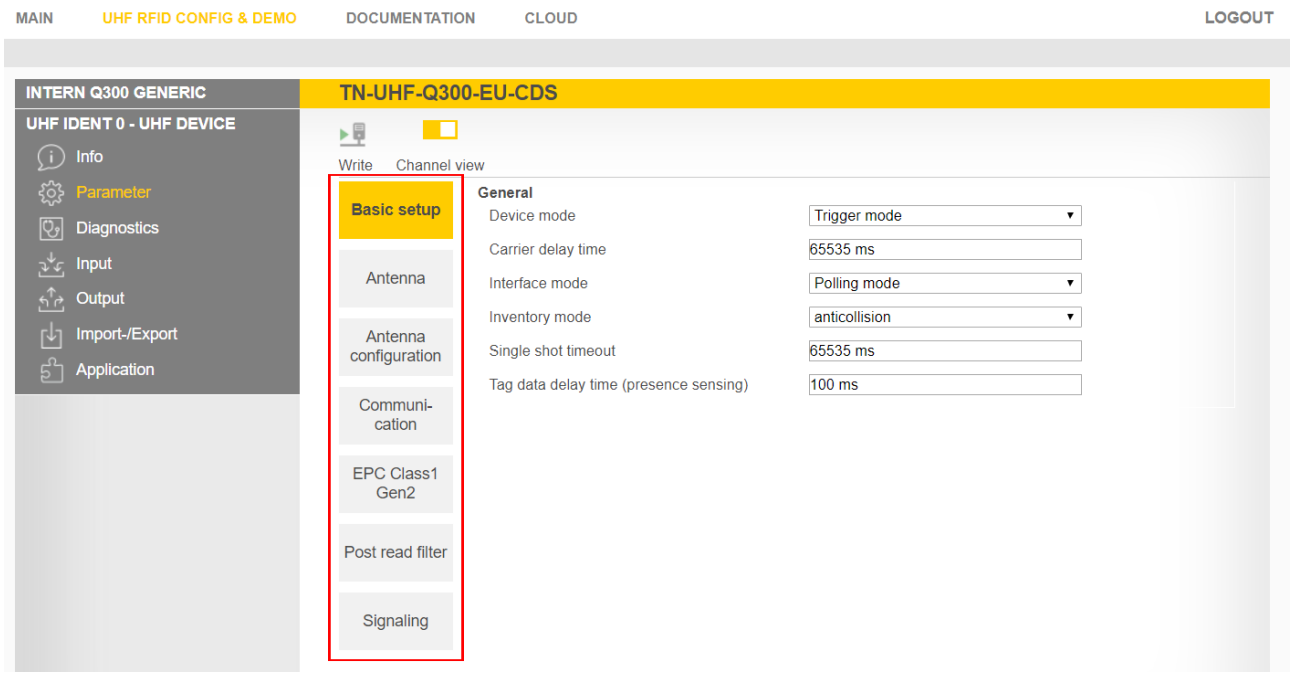


Fig. 48: Web server — Parameter arrangement

The following setup windows can be called up:

- Basic setup
- Antenna
- Antenna configuration
- Communication
- EPC Class1 Gen2
- Post read filter
- Signaling

▶ Set the parameters: Click **Write**.

NOTE
While a parameter is set, the ERR LED of the device is lit red and changes automatically to green.

7.3 Testing readers with the DTM

The following functions can be executed via the RFID Test in the DTM:

- Display read data
- Displaying the log of the communication between host or PC and reader
- Logging of the interface communication between host or PC and reader
- Send user-specific deBus commands
- Write tags with a user-defined number
- Send tag-specific commands

Requirements for the RFID test

- PACTware must be installed.
- The DTM for UHF readers must be installed.
- The DTM for the BL20, BL67, BLcompact, FEN20, FXEN, FGEN and TBEN fieldbus I/O system must be installed.
- The connection between the reader and the PC must be established.
- A project must have been created in PACTware.

7.3.1 Starting the RFID Test

- Right-click the device in the project tree.
- In the context menu choose **Additional functions → RFID Test**.

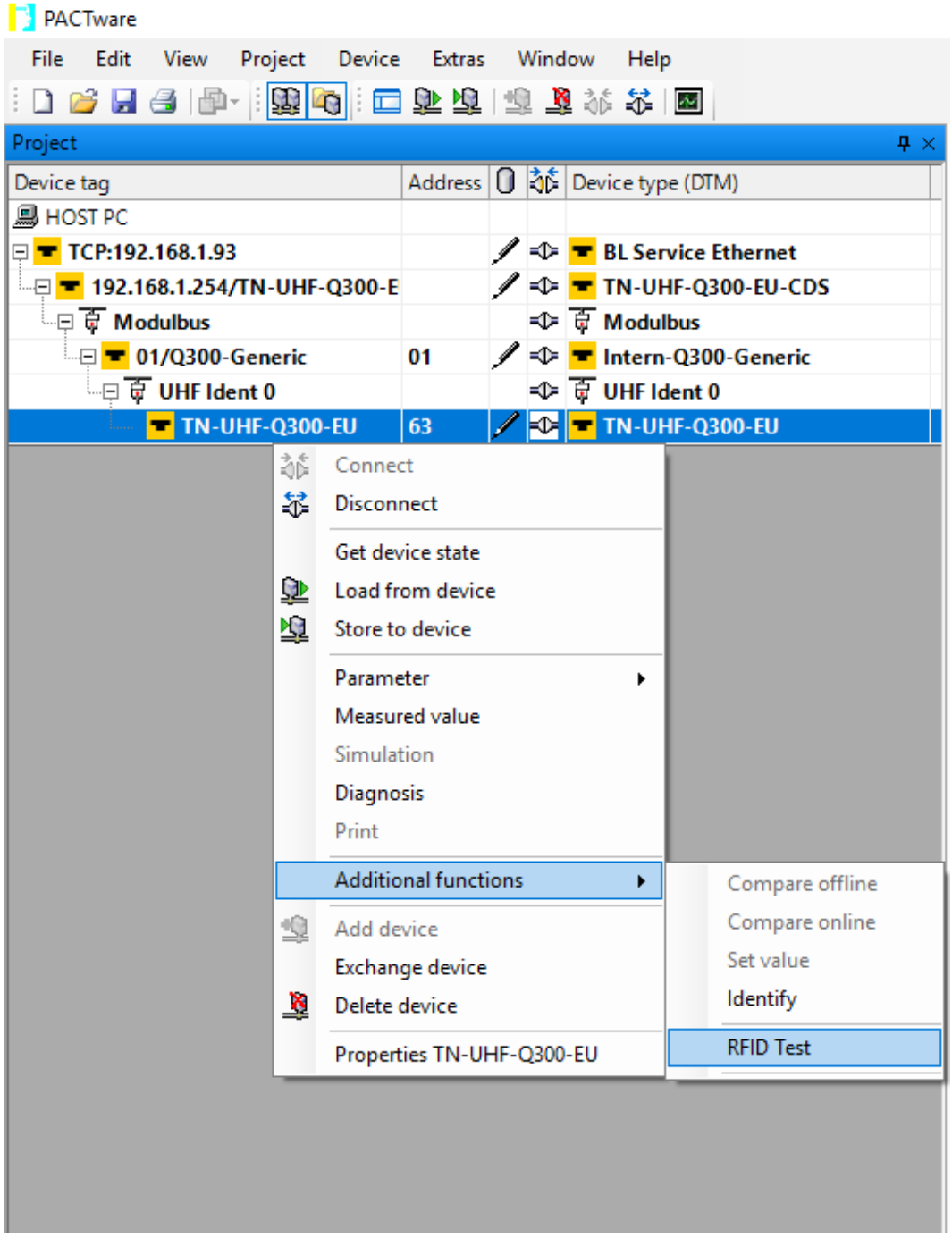


Fig. 49: Starting the RFID Test

7.3.2 Start window – overview

The **RFID Test** window consists of the following elements:

- Main menu
- Basic test
- Tag actions
- Reader Status
- Logger

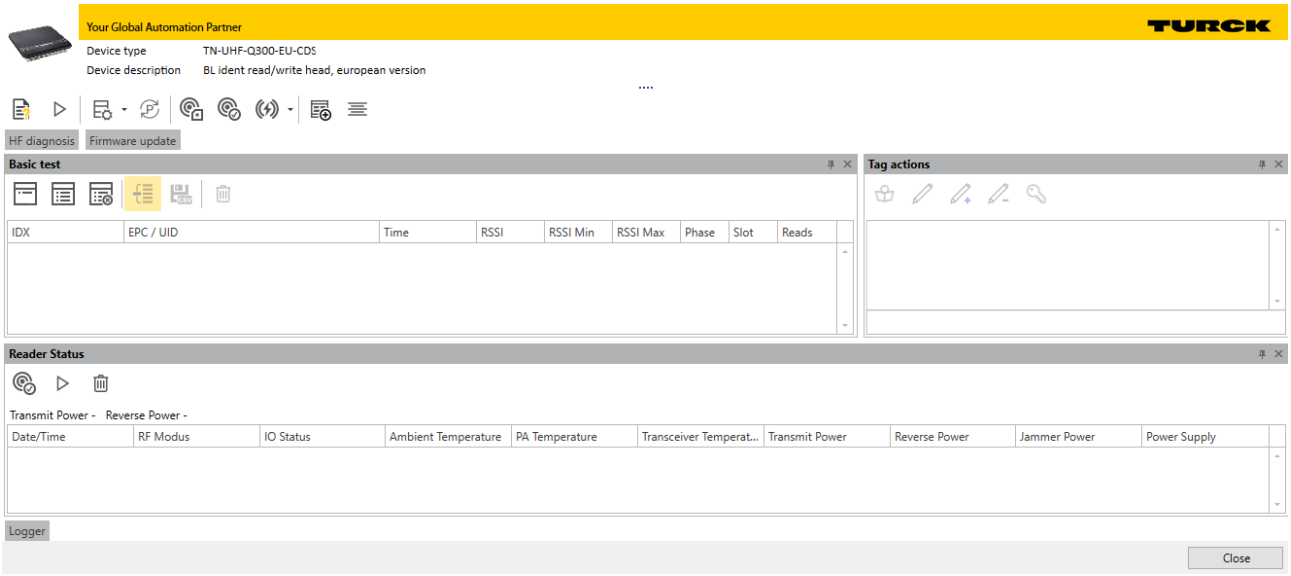


Fig. 50: RFID Test – overview of the start window

7.3.3 RFID Test – main menu

Fig. 51: RFID Test – main menu

The main menu provides the following functions:

Icon	Function	Description
	Help on the DTM	Starts the DTM help.
	Start trigger/ON or Stop trigger/OFF	Starts the trigger for command execution (standard view). Ends the trigger for command execution (displayed after clicking the start button).
	Configure message content	Displays the content to be transferred with a read operation. The following can be selected: ■ Phase ■ RSSI ■ Slot ■ Time
	Switch mode (report/polling)	Switches between Report mode (automatic read/write) and polling mode (read/write started through an explicit polling command).
	Reading the reader status	Calls the status of the reader and provides the information in the **Logger** window.
	Reading the reader version	Calls the following information from the reader and provides the information in the **Logger** window: ■ Hardware revision ■ Firmware status ■ Serial number
	Resetting the reader	Offers three ways of resetting the reader: ■ Voltage reset ■ Factory reset: Reset to factory settings ■ Reset the reader status When resetting to factory settings, any modified transfer rate or RS485 address is not changed because the reader could not otherwise be addressed any longer.
	Set the current window layout as the default	Saves the individually set window layout.
	Reset window layout	Resets the window layout.
HF diagnosis	HF diagnosis	Opens the window for HF diagnostics.
Firmware update	Firmware update	Opens the window for the firmware update.

7.3.4 RFID Test – basic test window

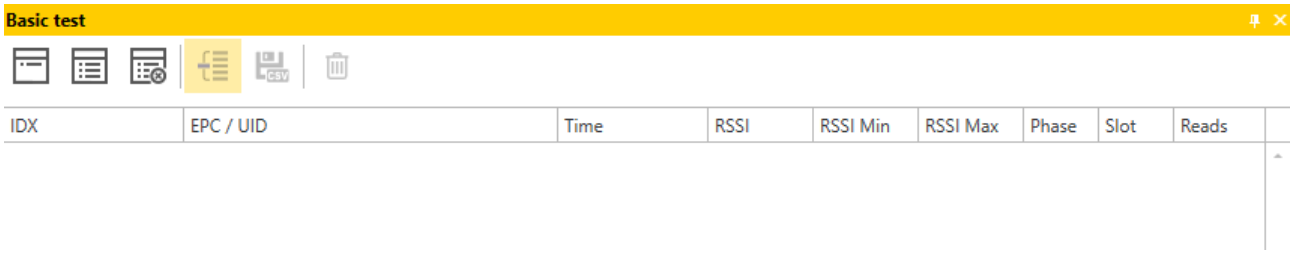


Fig. 52: RFID test – Basic test window

The following functions are available in the **Basic test** window:

Icon	Function	Description
	Polling	Shows the first tag in the polling memory of the device in the tag list. The function is only available in polling mode.
	Poll all	Shows all tags in the polling memory of the device in the tag list. The function is only available in polling mode.
	Delete tags polled by the reader	Clears the polling memory of the reader.
	EPC grouping	Combines readings of tags with the same EPC.
	CSV export of the current data	Saves the tag list in CSV format.
	Delete tag list	Deletes the list of displayed tags.

The queried data is displayed in the tag list. The content of the message can be set via the **Configure message content** function.

NOTE
If the polling memory of the reader is full, the ERR LED is lit red and indicates an internal error.

7.3.5 RFID Test – tag actions window

The functions in the **Tag actions** window are available if a tag is selected in the tag list of the **Basic test** window.

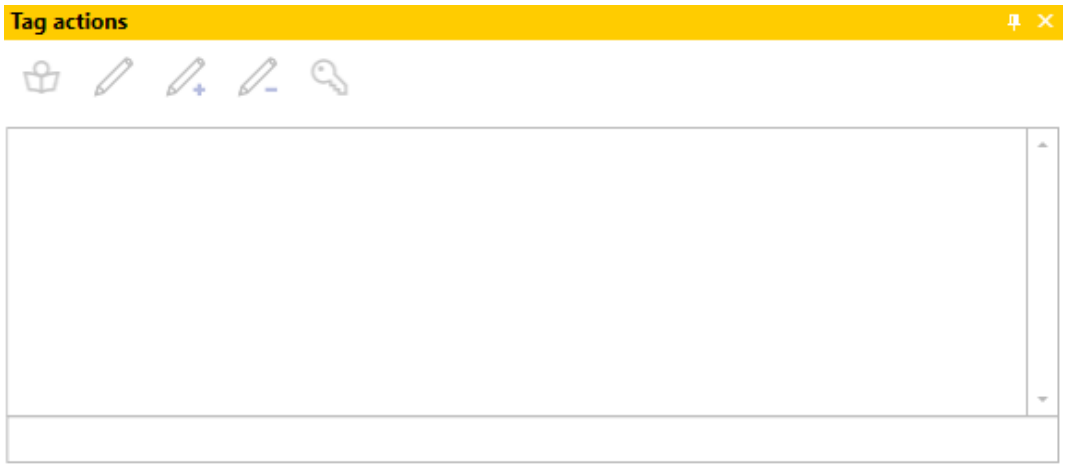


Fig. 53: RFID test – Tag actions window

The following functions are available in the **Tag actions** window:

Icon	Function	Description
	Read tag memory	Starts the read operation. The chip type is automatically displayed. One word is always read with the first read operation. The following parameters can be set for other read operations: ■ Memory bank (TID, EPC/UID, PC, access password or kill password) ■ Start word ■ Number of words The read data is displayed in the **Data** area.
	Write tag memory	Starts the write operation. The chip type is automatically displayed. The following parameters can be set for the write operations: ■ Memory bank (TID, EPC/UID, PC, access password or kill password) ■ Start word ■ Number of words Data to be written is displayed in the **Data** area.
	Auto-increment	The EPC is incremented automatically by 1.
	Auto-decrement	The EPC is decremented automatically by 1.
	Activate and deactivate the access password	Switches the password for write or read access on or off.

Example: execute tag actions

- Position the tag within the detection range of the reader.
- Activate the trigger for the reader in the main menu.

Fig. 54: Main menu – activating trigger

- **Basic test** window: Execute polling command in order to display tag in the tag list.
- **Basic test** window: Select tag from the tag list.

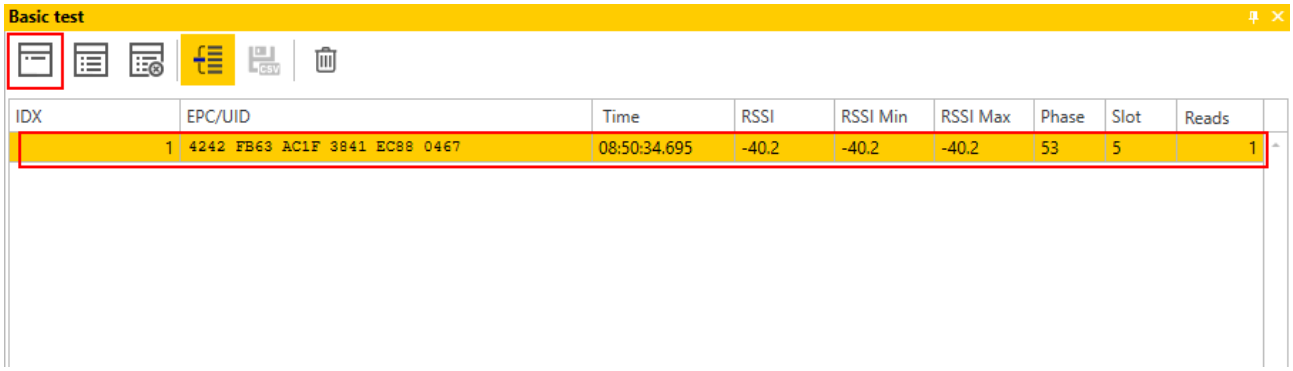


Fig. 55: Basic test – Tag selection

- **Tag actions** window: To read, select **Memory location**, **Start word** or **Word length** and click the appropriate icon.
- To write, enter values under **Data** and confirm with **OK**

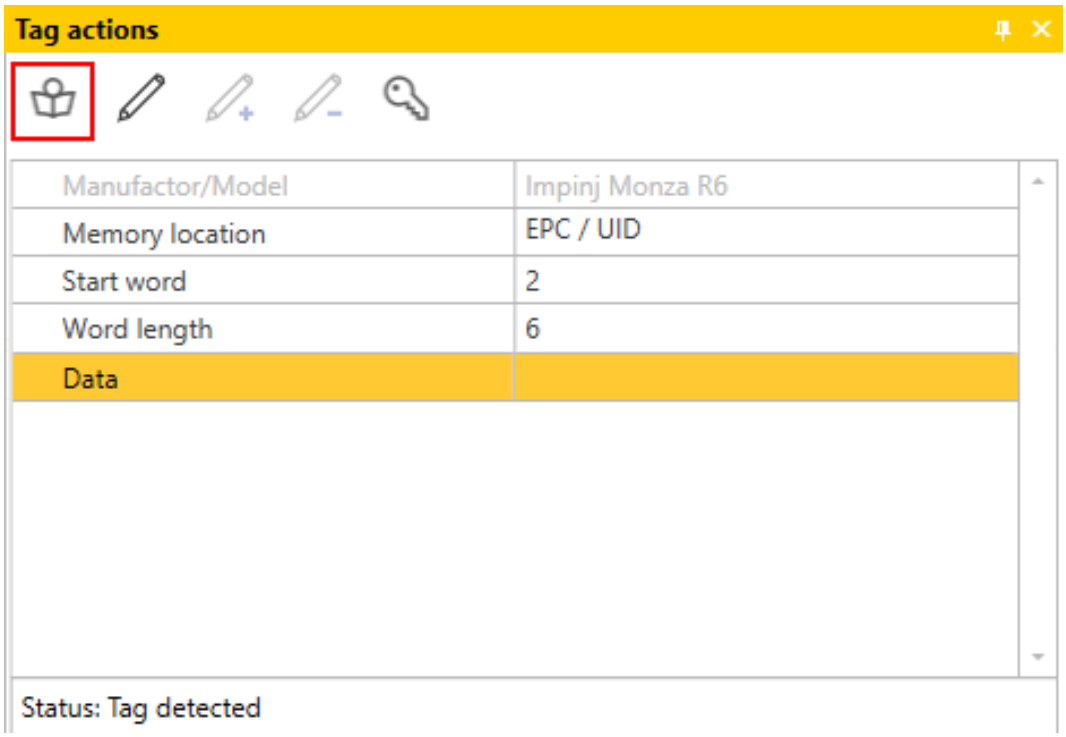


Fig. 56: Execute tag action (example: read)

⇨ Successful access is displayed via the status message at the bottom of the window.

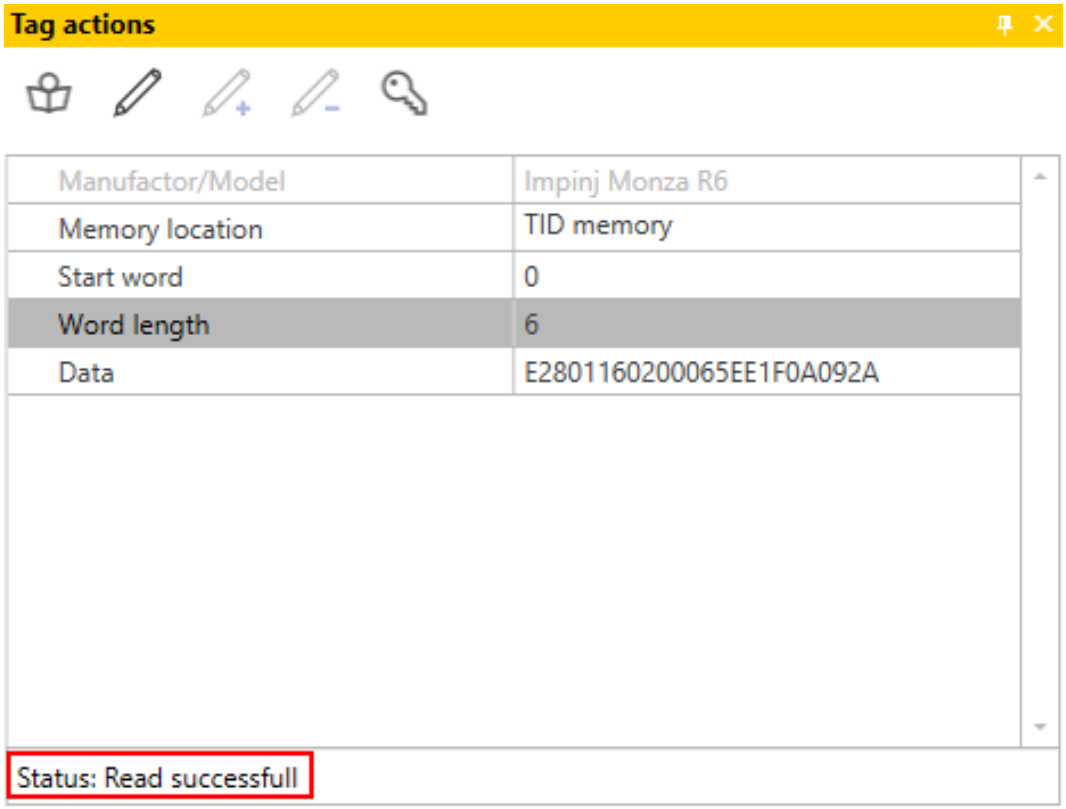


Fig. 57: Example: read successful

7.3.6 RFID Test – logger window

The **Logger** window displays read/write information and error messages. The list can be cleared via the **Delete** button.

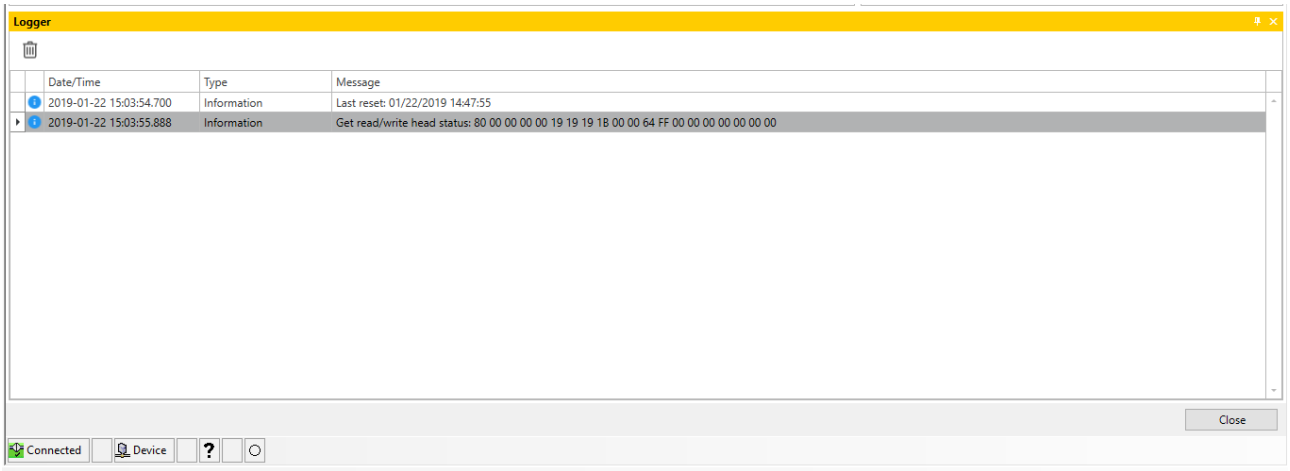


Fig. 58: Messages in the Logger window

7.3.7 HF diagnosis window

Interference frequencies affecting the respective channels are displayed in the **HF diagnosis** window.

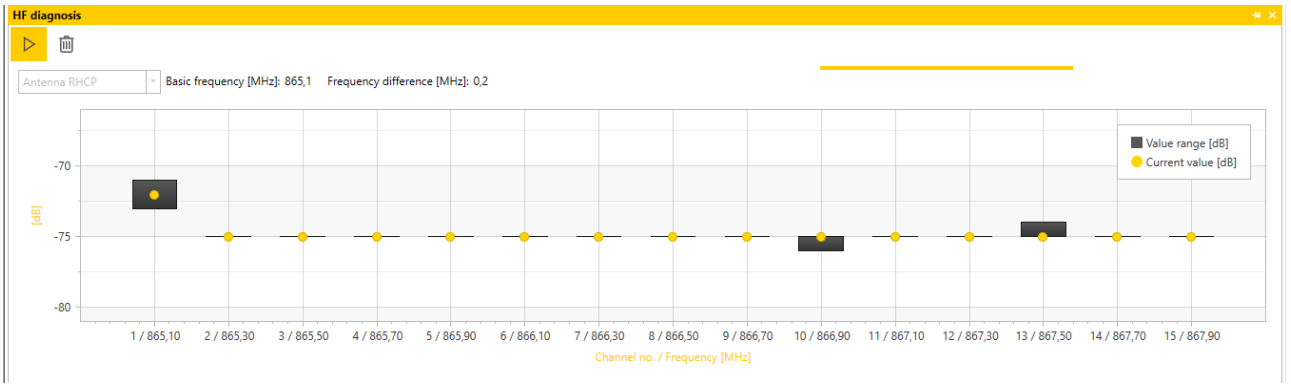


Fig. 59: HF diagnosis window

The following functions can be executed in the **HF diagnosis** window:

Icon	Function	Description
▷	Start/stop HF diagnosis	Starts or closes the HF diagnosis.
🗑	Clear values	Deletes the displayed values.

7.4 Testing the reader using the web server

The **Application** function enables the devices to be tested with the web server.

▶ Click **RFID READER** → **Application**

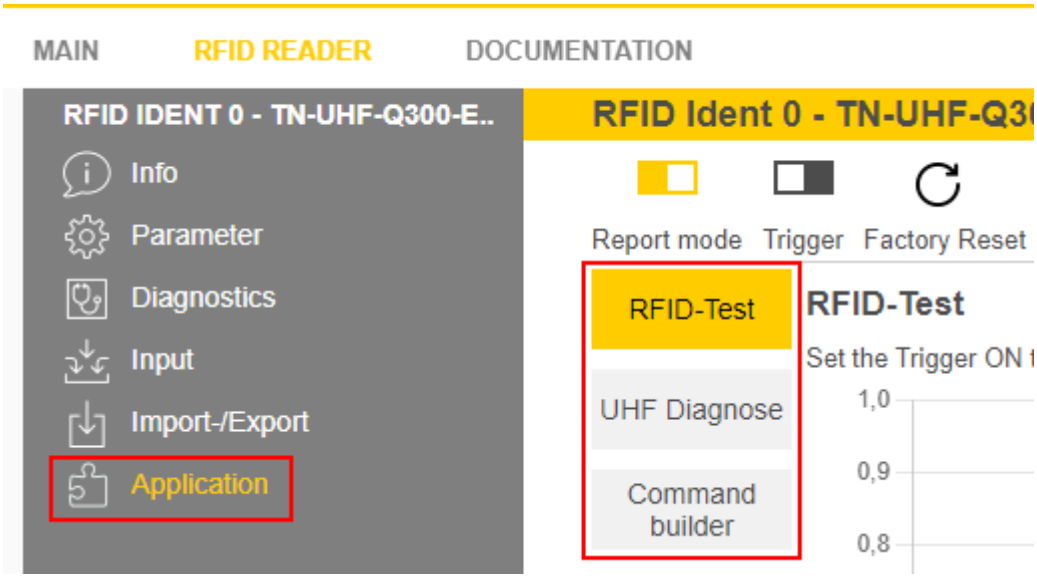


Fig. 60: Web server — application — RFID-Test

The RFID test, the UHF diagnostics and the command builder are provided in the application area:

- RFID-Test: If the trigger is set to ON, the RF field is activated and tags can be read.
- UHF Diag: The diagrams show the interference frequencies of all channels used.
- Command builder: Use of the command builder is reserved for TURCK Support and is not designed for setting device parameters or device operation.

RFID test allows EPC information from tags to be displayed and read out in single-tag and multi-tag mode. The received RSSI values are displayed as a curve in relation to time.

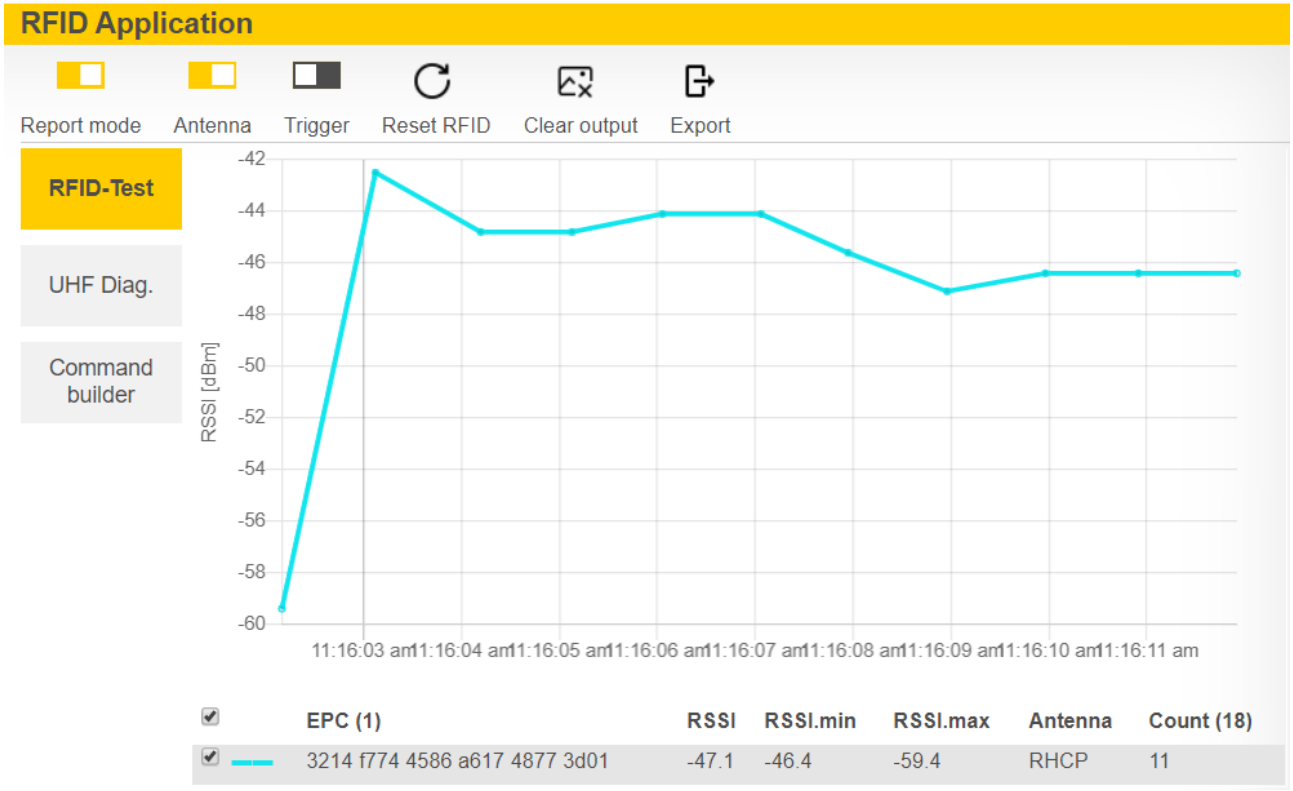


Fig. 61: Example of RFID test: Record of a tag with the received RSSI values over time and the number of read operations

The **UHF diagnostics** display the currently received power level per channel of the reader.

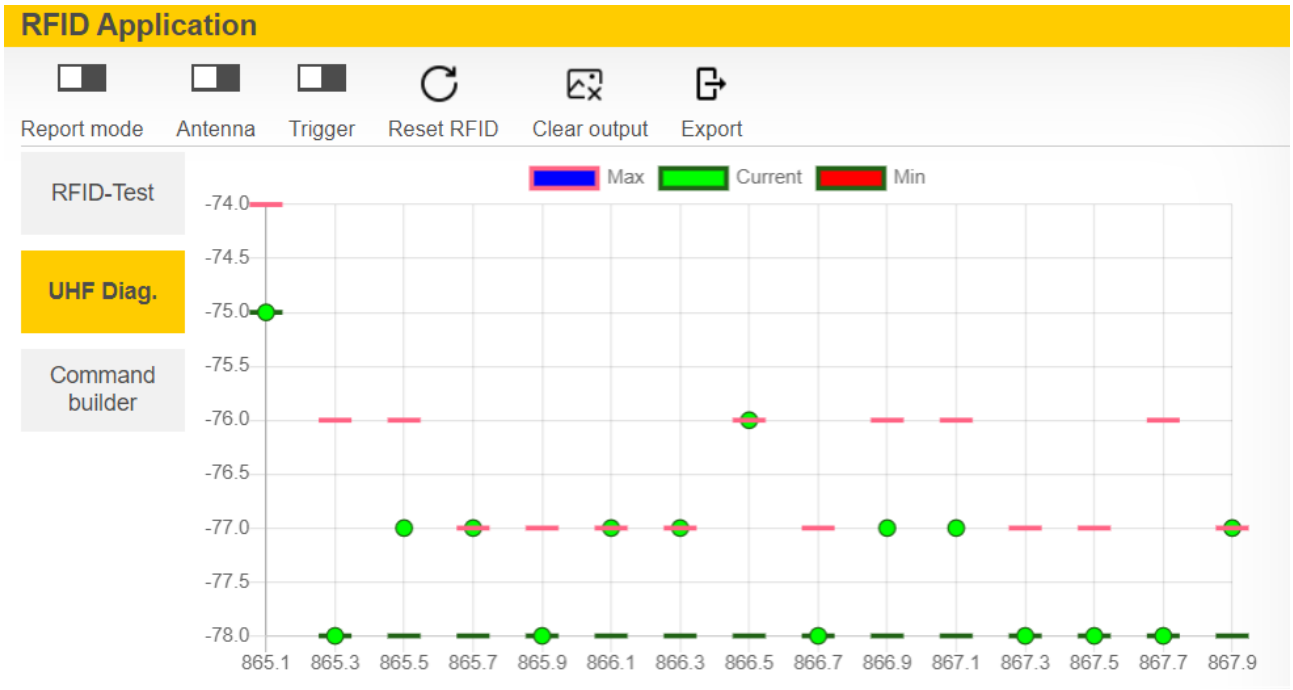


Fig. 62: Example of UHF diagnostics: Received power level per channel

7.5 Querying device information with the DTM

The DTM provides access to hardware and software information as well as regulations on the connected device.

- Right-click the device in the project tree.
- Choose **Additional functions** → **Identify**.

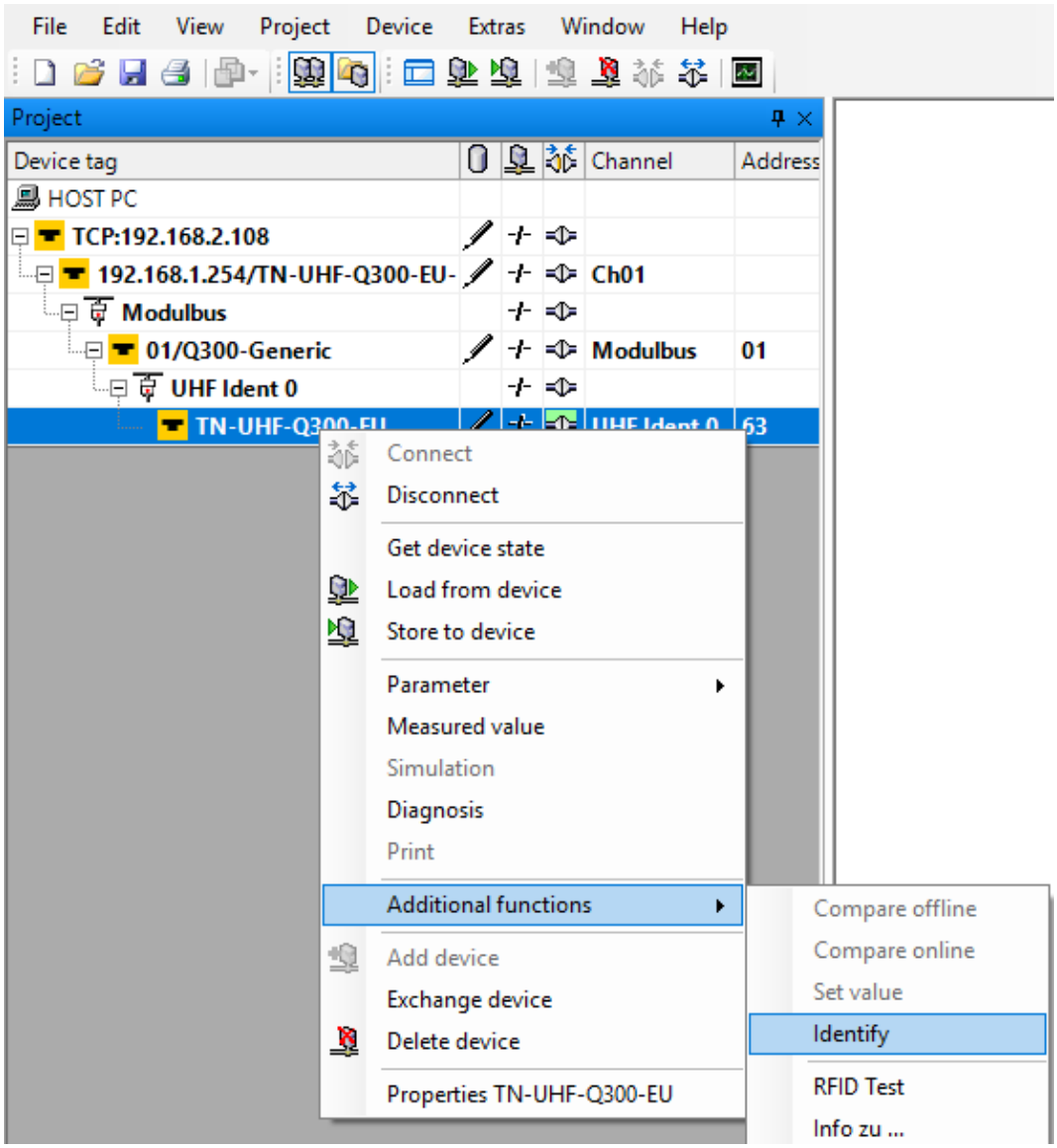


Fig. 63: Calling up Identification

➪ The DTM shows the available information on the device according to the selected access level.

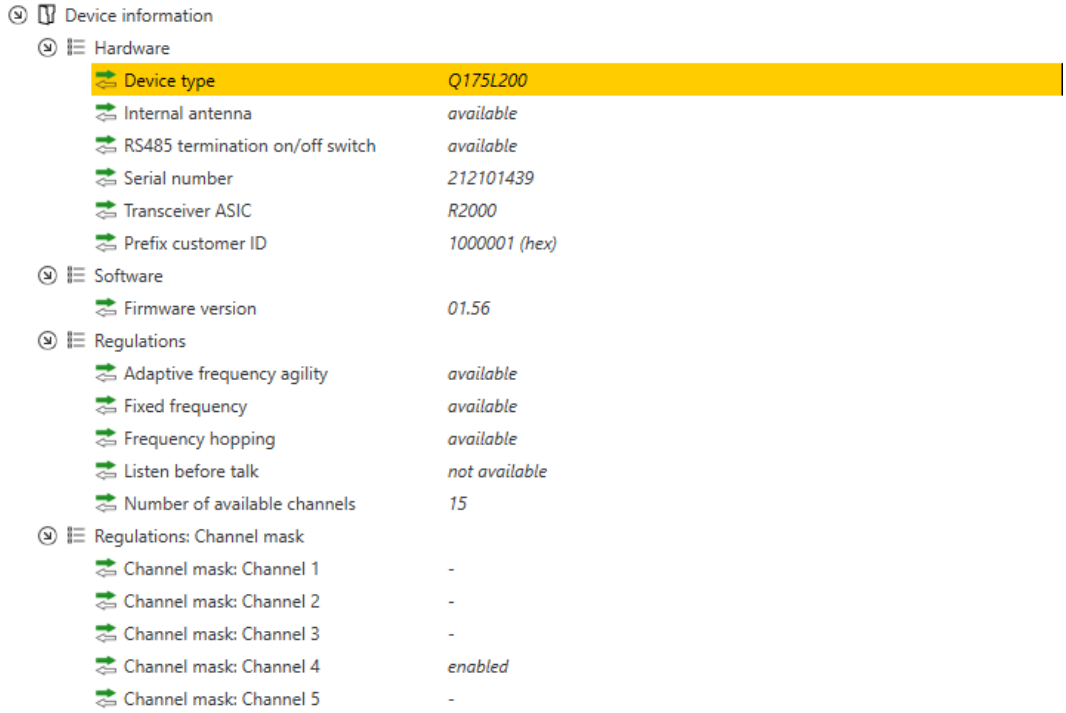


Fig. 64: Device information for TN865-Q175L200-H1147 in the Advanced access level

7.6 Adjusting network settings

The network settings can be adjusted via TAS or the web server.

7.6.1 Adjusting the network settings via the TURCK Service Tool

The device is factory set to IP address 192.168.1.254. The IP address can be set via the TURCK Service Tool. The TURCK Service Tool is available free of charge from www.turck.com.

- Connect the device to a PC via the Ethernet interface.
- Open the TURCK Service Tool.
- Click **Search** or press [F5].

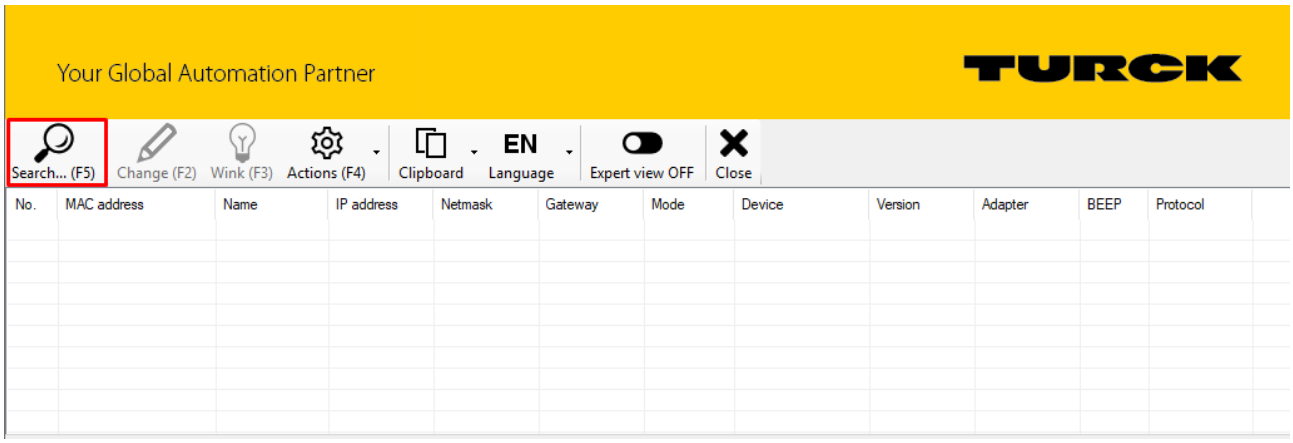


Fig. 65: TURCK Service Tool — home screen

The TURCK Service Tool displays the connected devices.

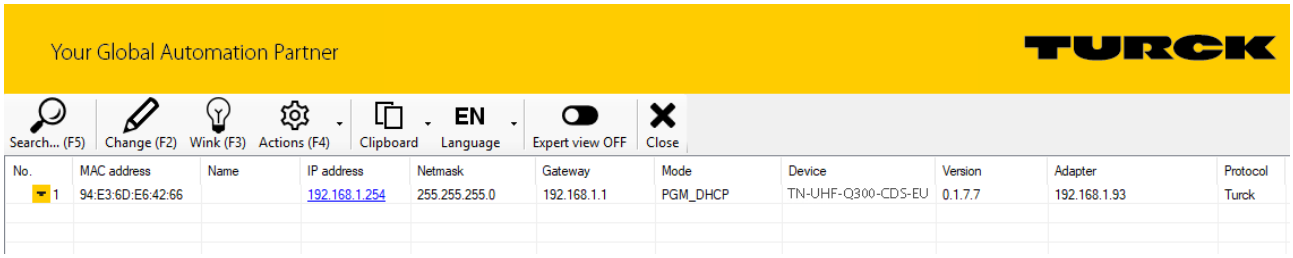


Fig. 66: TURCK Service Tool – found devices

- Select the device.
- Click **Change** or press [F2].

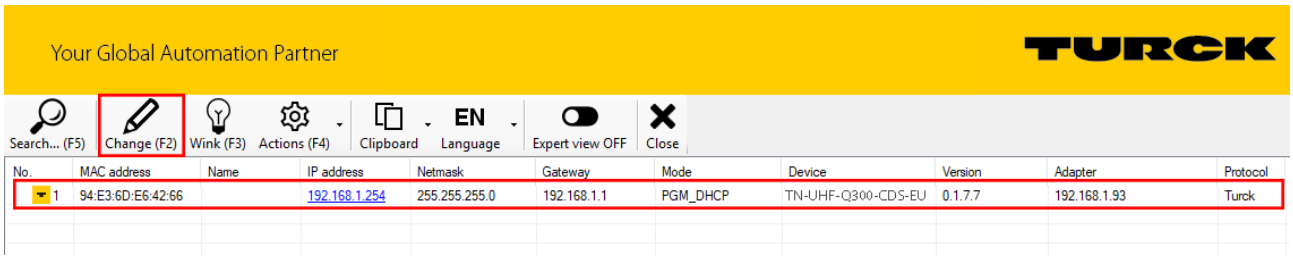


Fig. 67: TURCK Service Tool – selecting the device to be addressed

NOTE
Clicking the IP address of the device opens the web server.

- Change the IP address and if necessary the network mask and gateway.
- Accept the changes by clicking **Set in device**.

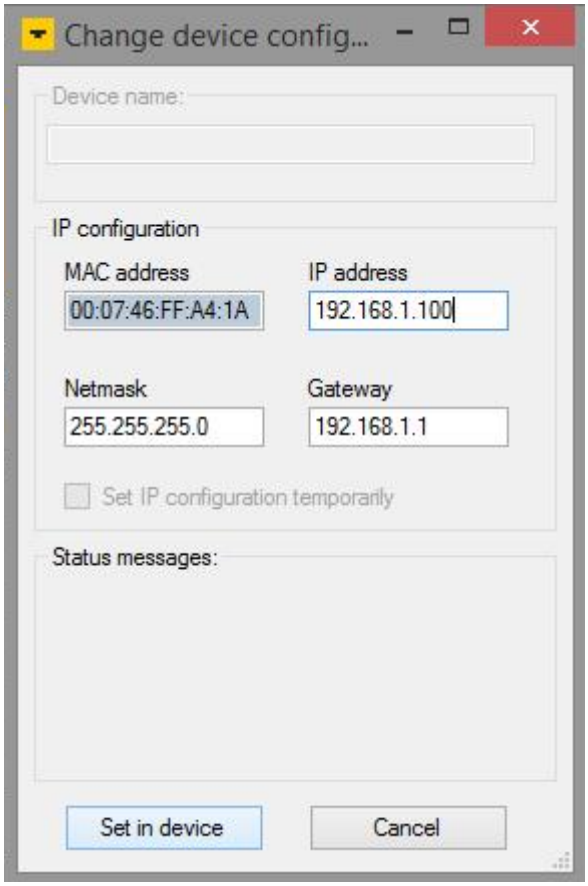


Fig. 68: TURCK Service Tool – Changing the device configuration

7.6.2 Adjusting network settings via the web server

- Open the web server.
- Log into the device as administrator.
- Click **Parameters** and then **Network**.
- Change the IP address and if necessary also the subnet mask and default gateway.
- Write the new IP address, subnet mask and default gateway via **Submit** to the device.

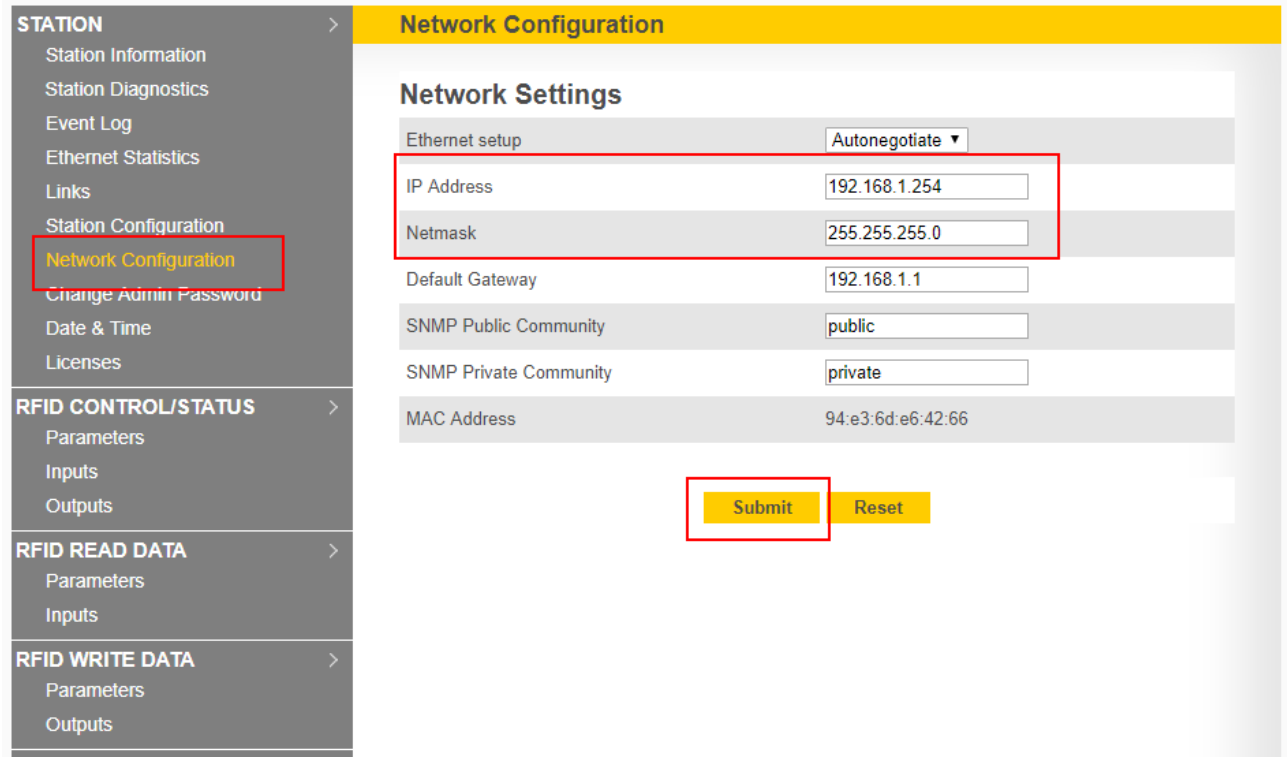


Fig. 69: Web server — changing the IP address

7.7 Connecting the device to a Modbus server with CODESYS

In this example, the **Continuous mode active** bit has to be set. This requires the network interface to be set up, the hardware configured and the I/O mapping defined.

Hardware used

This example uses the following hardware components:

- TURCK HMI TX707-P3CV01 (Modbus master)
- TN-UHF-Q300-EU-CDS UHF read/write head (IP address: 192.168.1.20)

Software used

This example uses the following software:

- CODESYS 3.5.12.1 (download free of charge from www.turck.com)

Prerequisites

- The software is started.
- A new project has been created.
- The controller has been added to the project.

7.7.1 Connecting the device with the controller

To connect the device to the controller, the following components must be added in CODESYS first of all:

- Ethernet adapter
- Modbus TCP master
- Modbus TCP slave

Adding an Ethernet adapter

▶ Right-click **Device (TX707-P3CV01)** in the project tree.

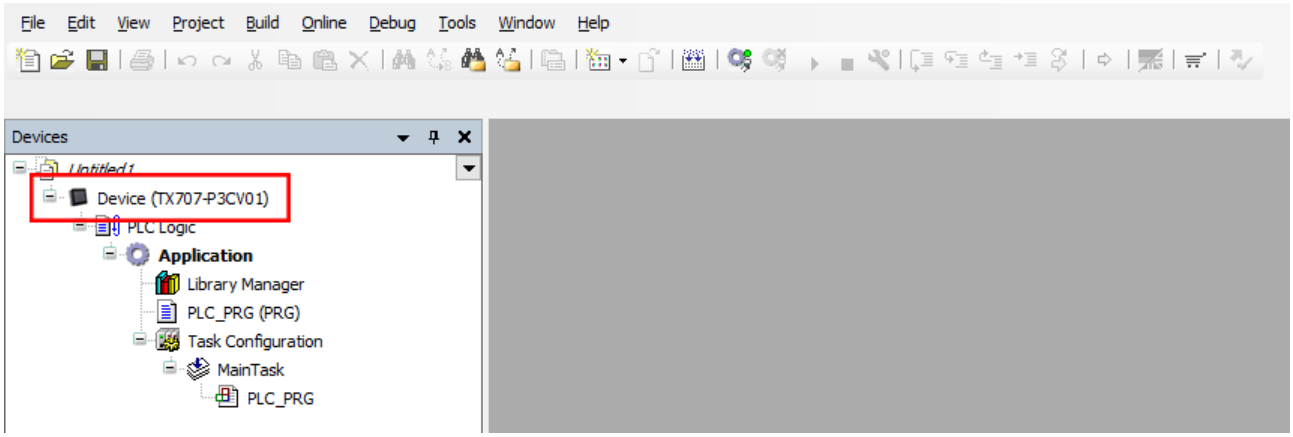


Fig. 70: Project tree

- ▶ Select **Append device**.
- ▶ Select an Ethernet adapter.
- ▶ Click **Append device**.
- ⇨ The Ethernet adapter appears as **Ethernet (Ethernet)** in the project tree.

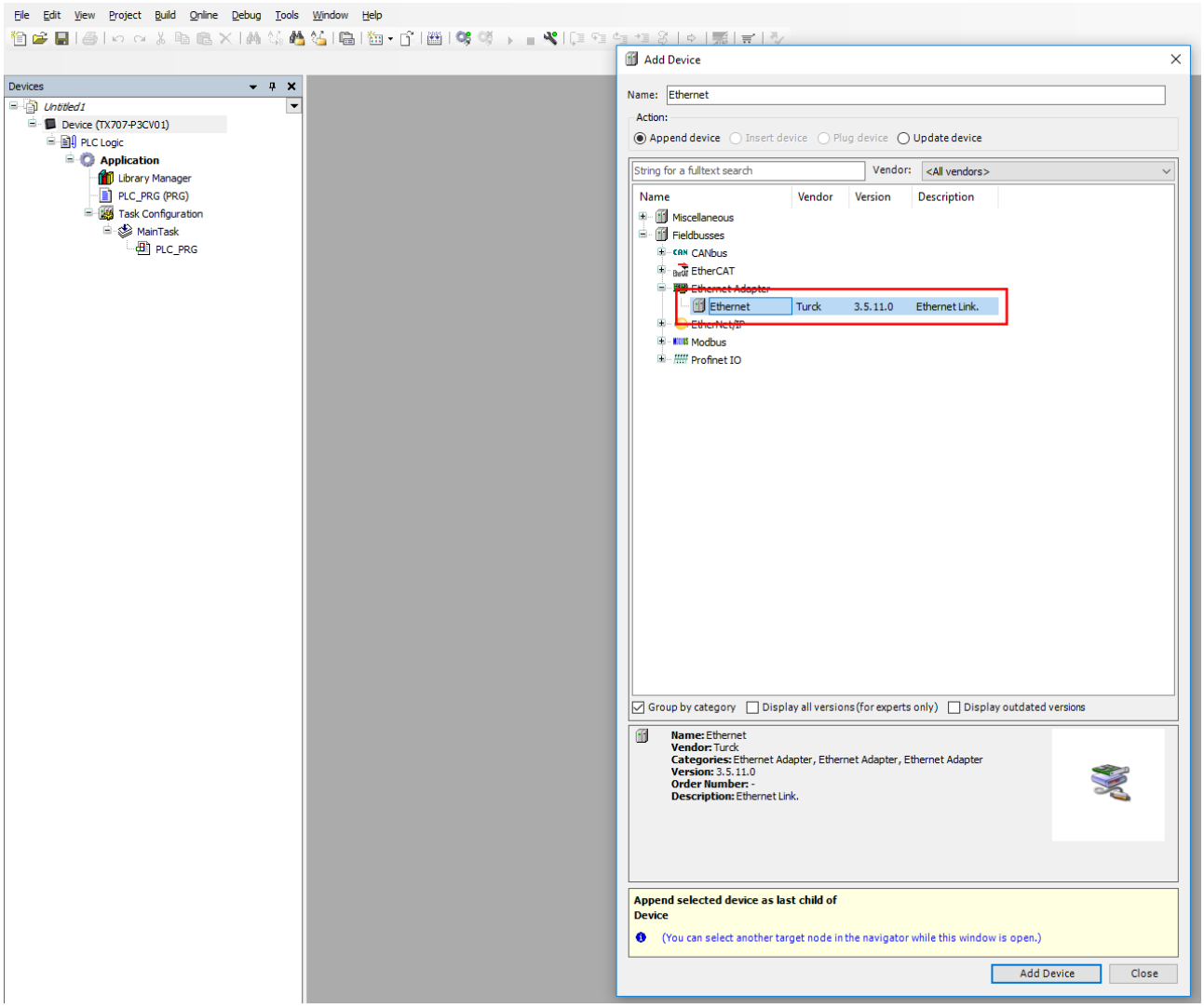


Fig. 71: Adding an Ethernet adapter

Adding a Modbus master

- ▶ Right-click **Ethernet (Ethernet)** in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click **Modbus TCP Master**.
- ⇨ The Modbus master appears as **Modbus_TCP_Master** in the project tree.

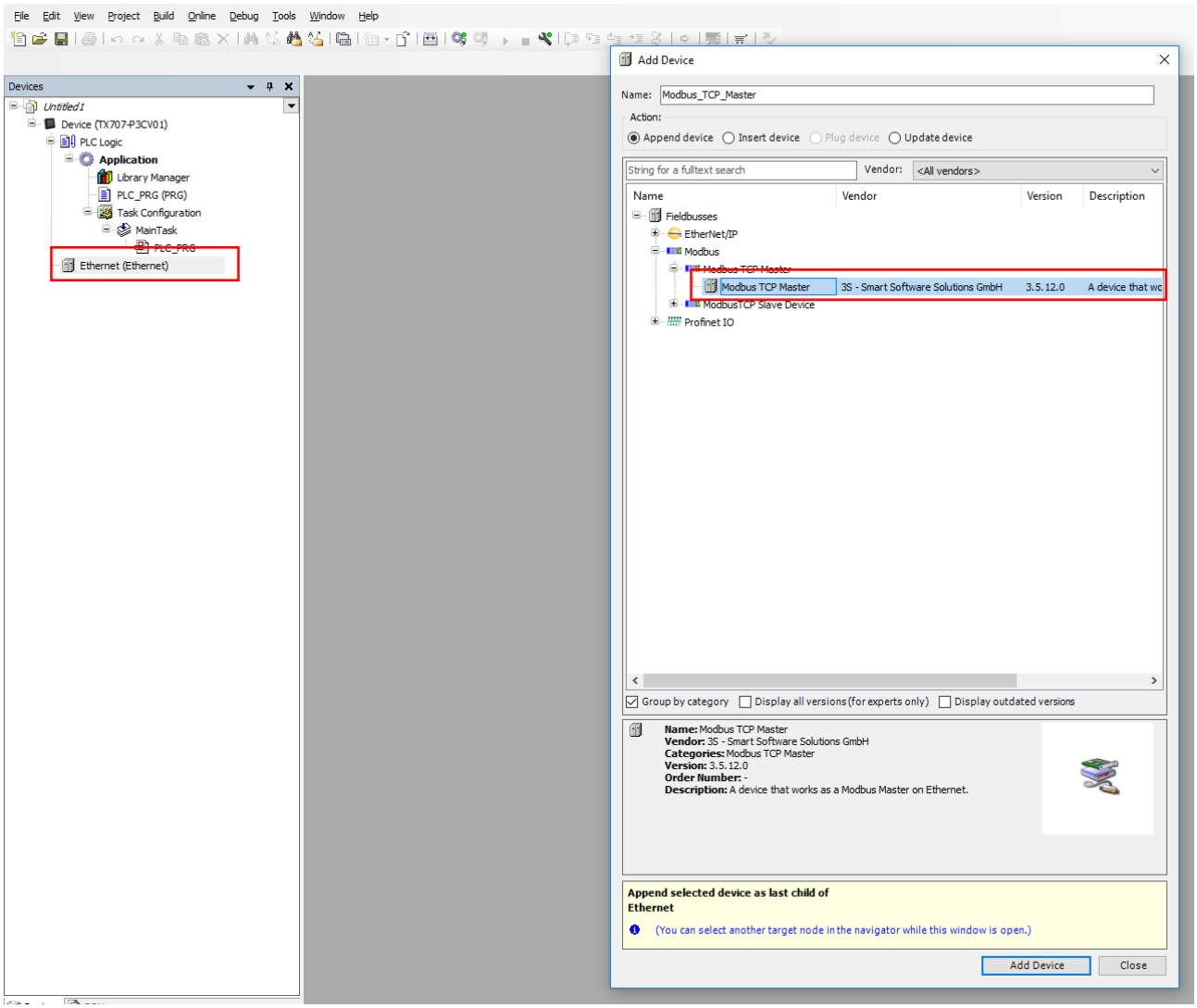


Fig. 72: Adding a Modbus master

Adding a Modbus slave

- ▶ In the project tree right-click **Modbus_TCP_Master (Modbus TCP Master)**.
- ▶ Select **Append device**.
- ▶ Double-click **Modbus TCP Slave**.
- ⇨ The Modbus slave appears as **Modbus_TCP_Slave** in the project tree.

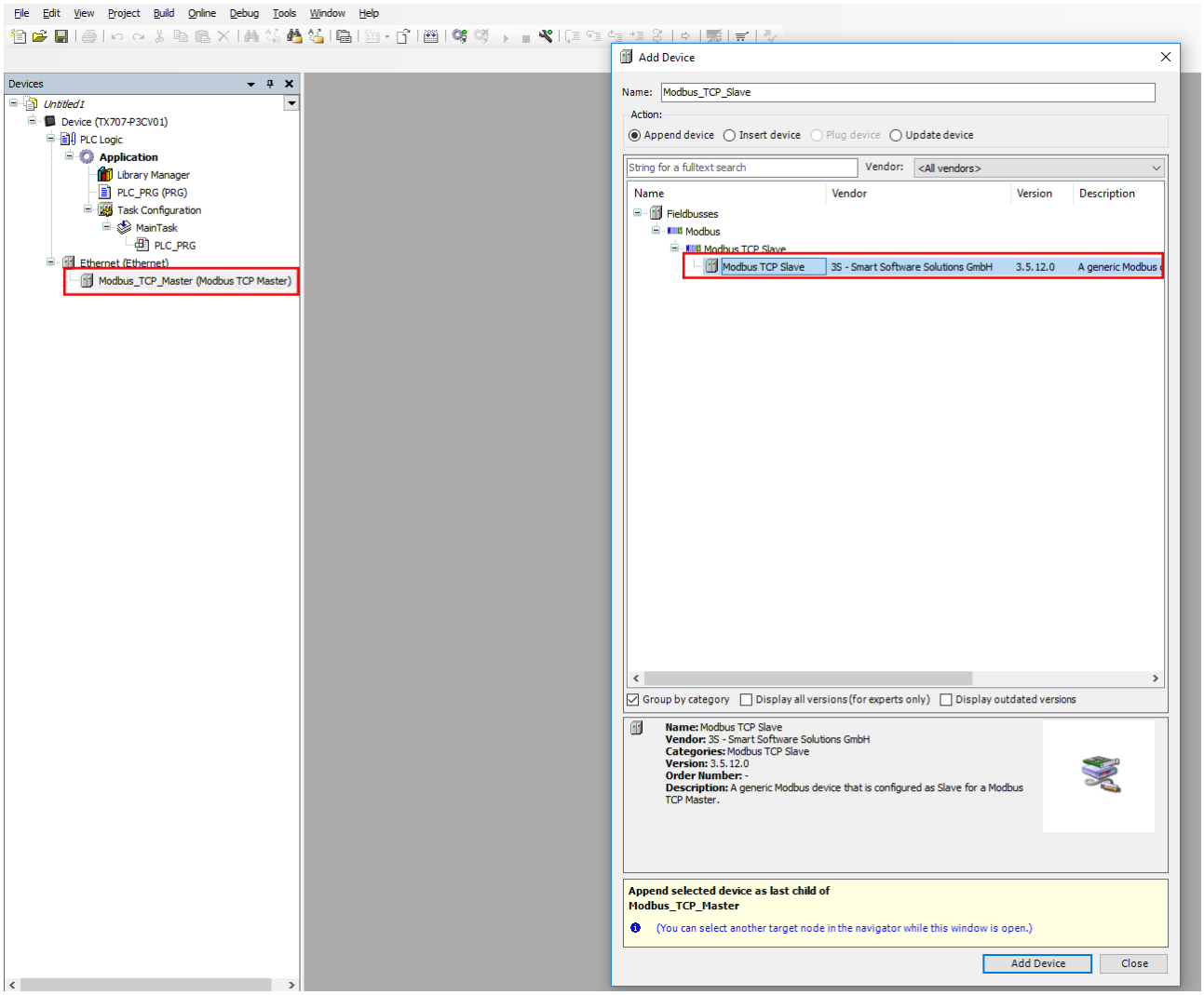


Fig. 73: Adding a Modbus slave

7.7.2 Renaming a Modbus slave

- Click Modbus slave in the project tree.
- Press [F2].
- Adapt the name of the slave in the project tree of the application (here: TN_UHF_Q300_EU_CDS).

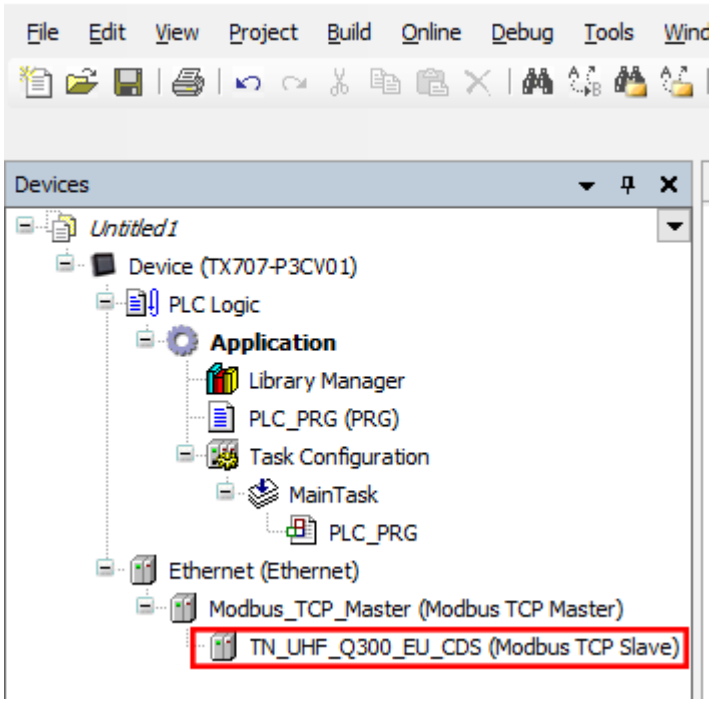


Fig. 74: Renaming a Modbus slave

7.7.3 Setting up network interfaces

- Click **Device** → **Scan network**.
- Select Modbus master (here: TX707-P3CV01) and confirm with **OK**.

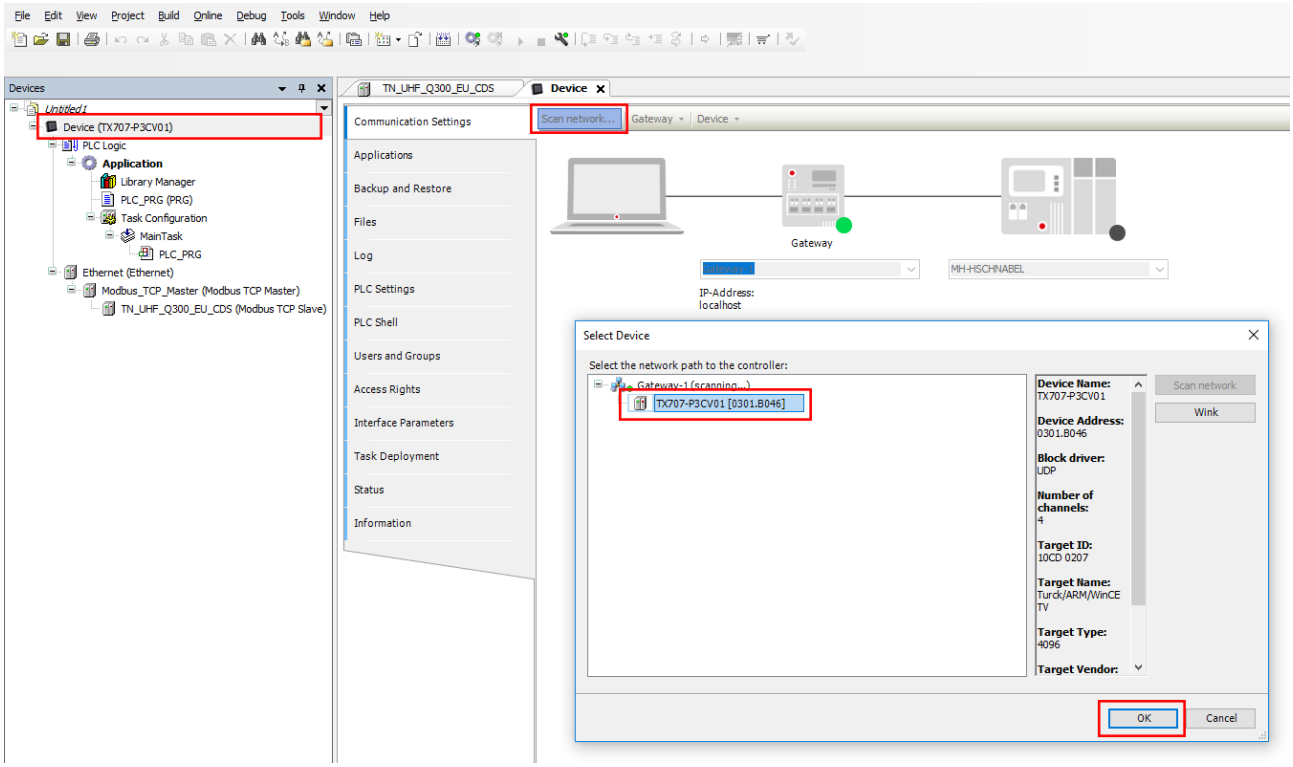


Fig. 75: Setting up a network interface to the Modbus master

- Select the **PLC Settings** tab.
- In the **Always update variables** drop-down menu, select the **Enabled 2 (always in bus cycle task)** option.

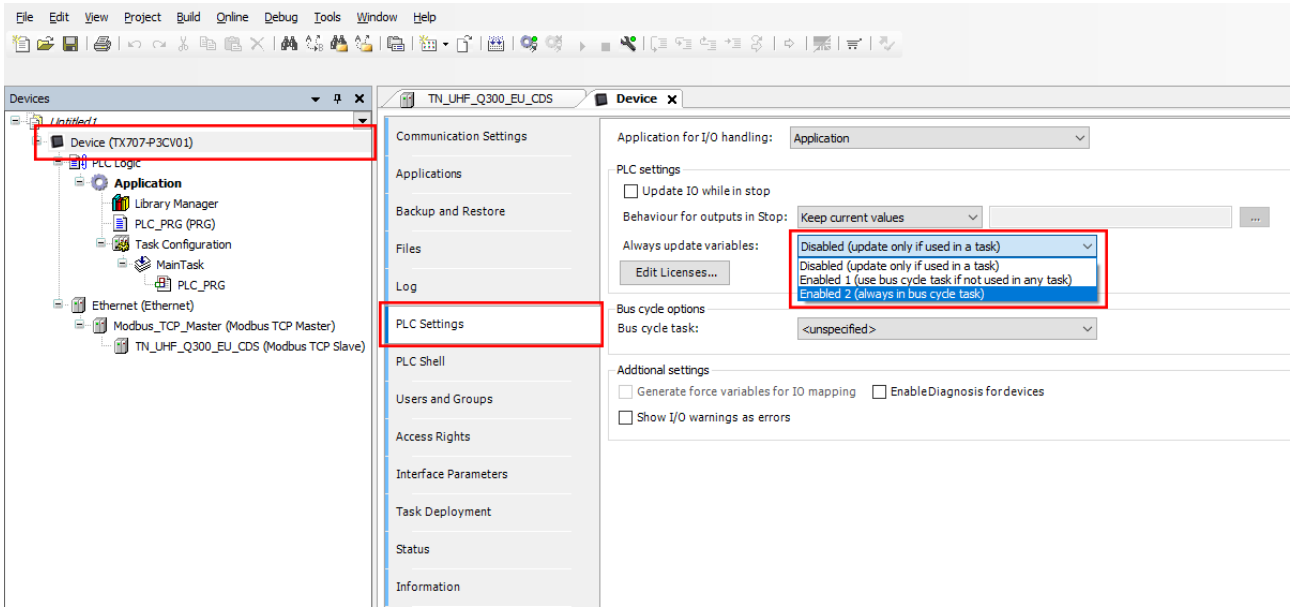


Fig. 76: Selecting the option: Always update variables

- Double-click **Ethernet**.
- Enter the IP address of the Modbus master (here: 192.168.1.70).

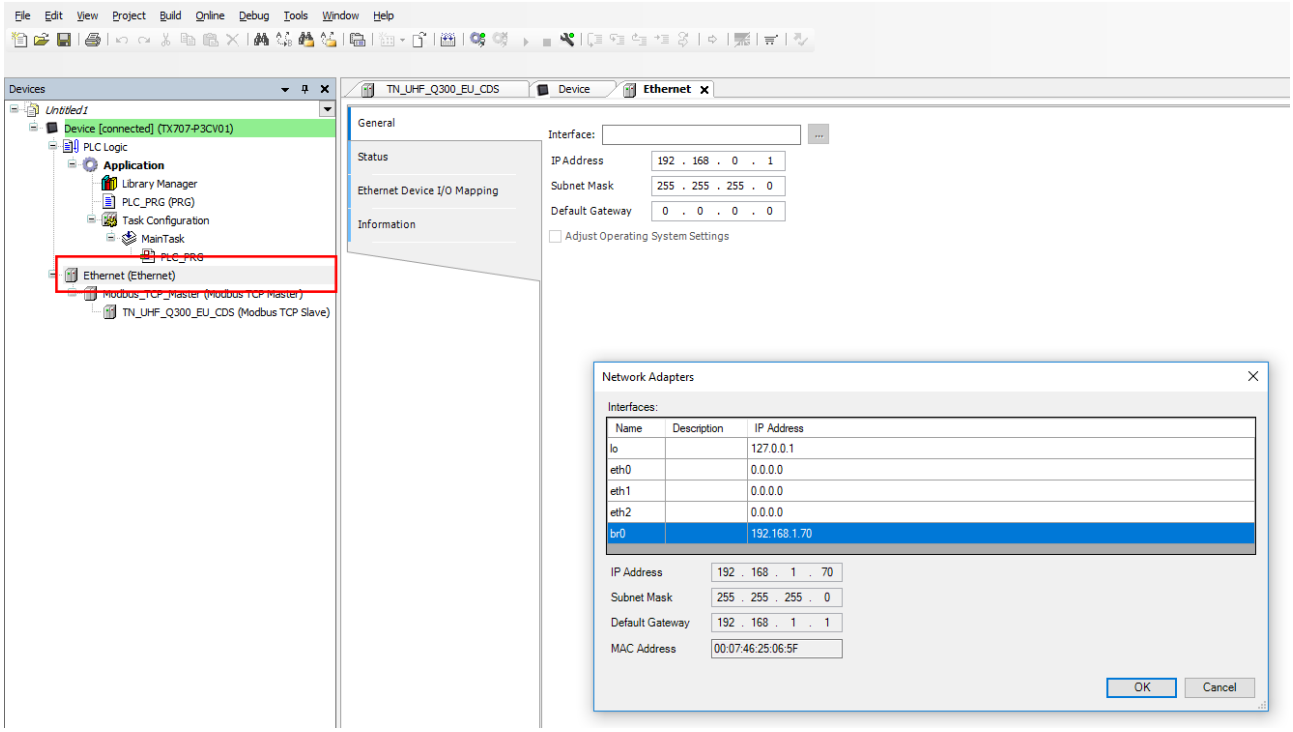


Fig. 77: Modbus master – enter the IP address

- Double-click the Modbus TCP slave.
- In the **General** tab enter the IP address of the slave (here: 192.268.1.20).

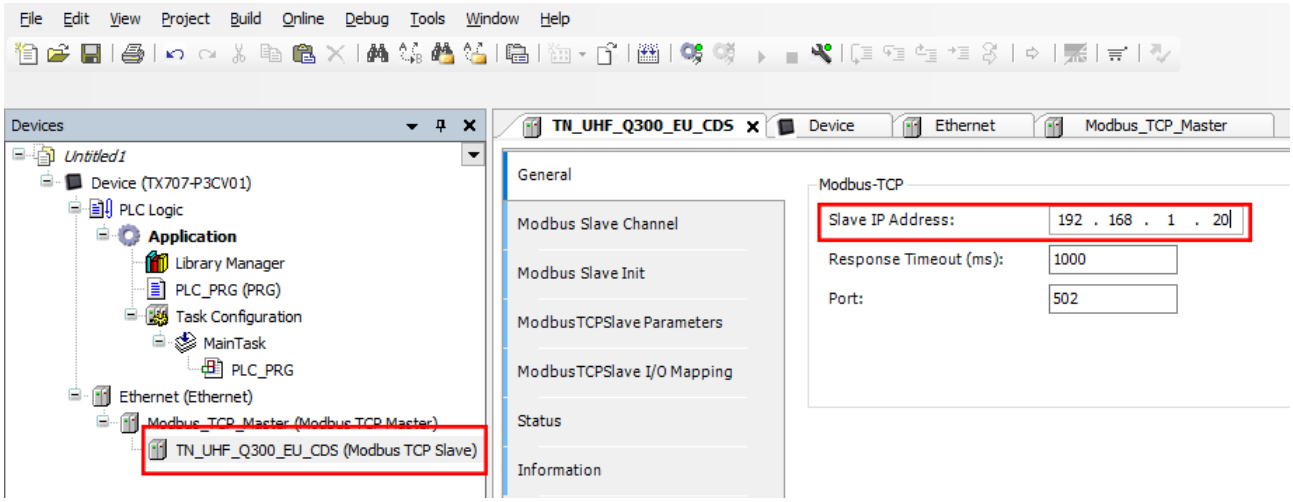


Fig. 78: Modbus slave – entering the IP address

7.7.4 Setting Modbus channels (registers)

Set channel 0 (input data)

- ▶ Double-click the Modbus TCP slave.
- ▶ Select in the **Modbus Slave Channel** tab → **Add channel**.
- ▶ Enter the following values:

- Name of channel
- Access type: Read holding registers
- Offset: 0x0000
- Length: 64 registers (128 bytes)

- ▶ Confirm with **OK**.

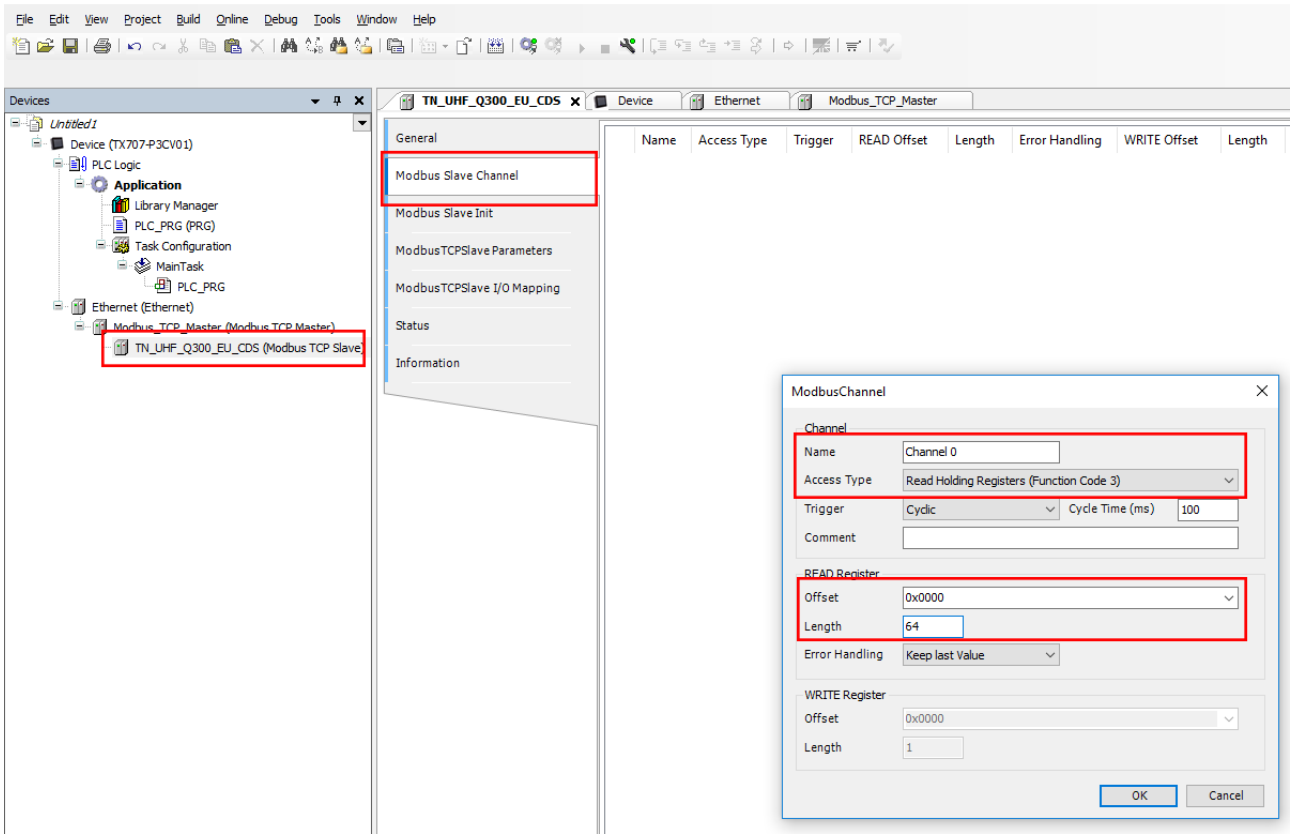


Fig. 79: Setting the READ register

Set channel 1 (output data)

- ▶ Double-click the Modbus TCP slave.
- ▶ Select in the **Modbus Slave Channel** tab → **Add channel**.
- ▶ Enter the following values:

- Name of channel
- Access type: Write holding registers
- Offset: 0x0000
- Length: 64 registers (128 bytes)

- ▶ Confirm with **OK**.

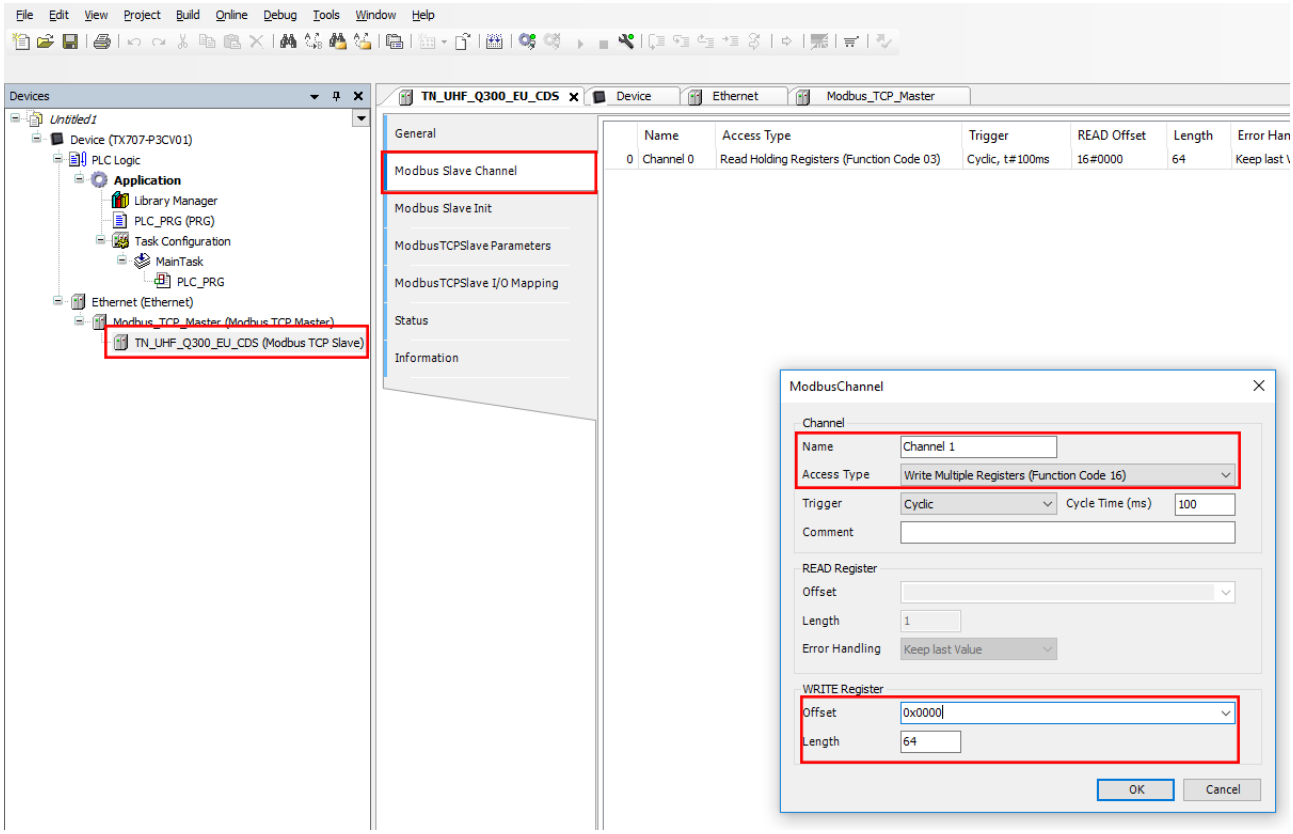


Fig. 80: Setting the WRITE registers

7.7.5 Setting the I/O mapping

To create I/O mapping the local I/Os must be added to the project and connected with the Modbus master.

- ▶ Right-click the name of the project in the project tree.
- ▶ Select **Add device**.
- ▶ Double-click **Q300**.
- ⇨ The local I/Os appear in the project tree.

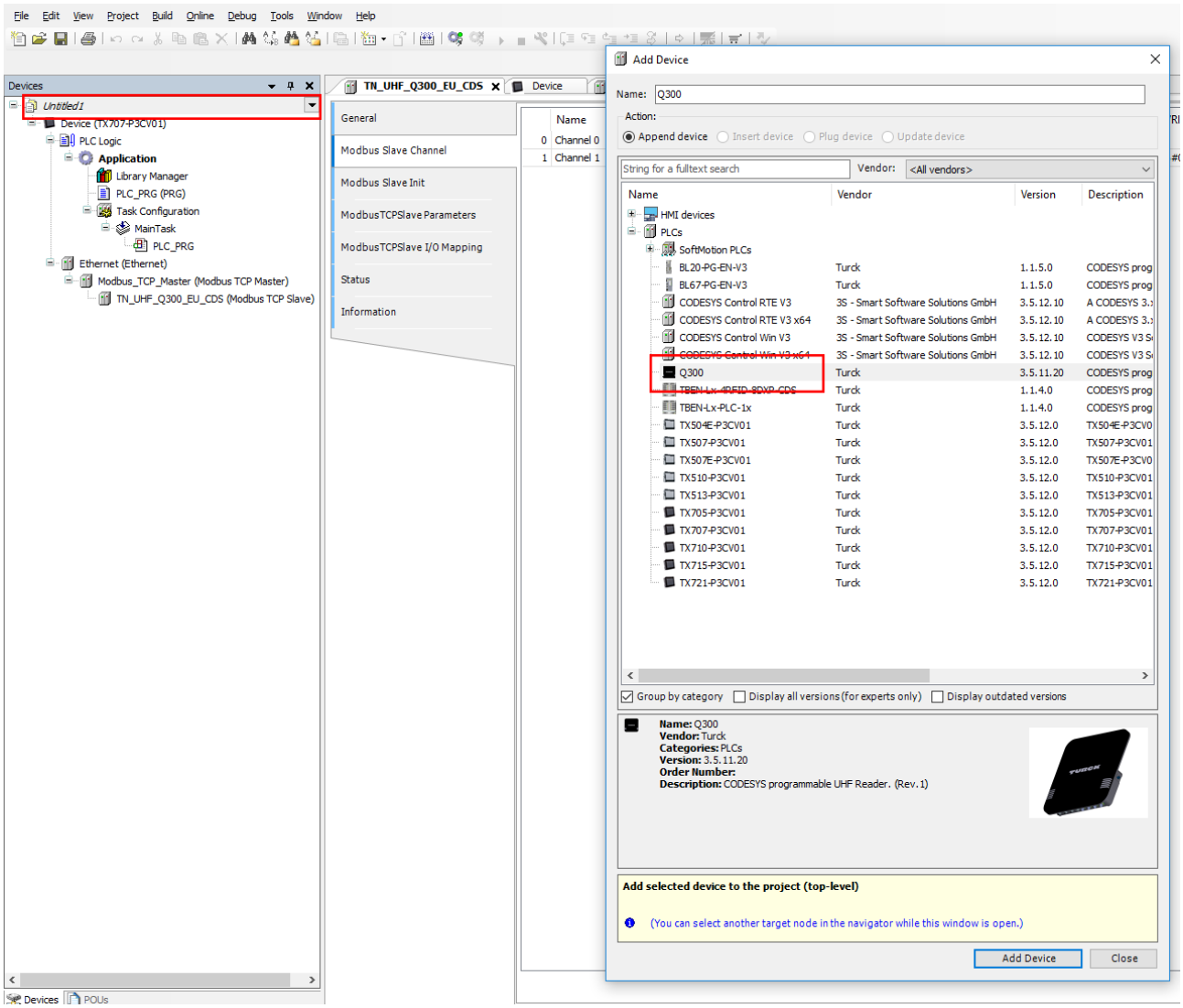


Fig. 81: Adding local I/Os to the project

Attaching the Ethernet adapter to the local I/Os

- Right-click **Q300 (Q300)** in the project tree.
- Select **Add device**.
- Double-click **Ethernet**.

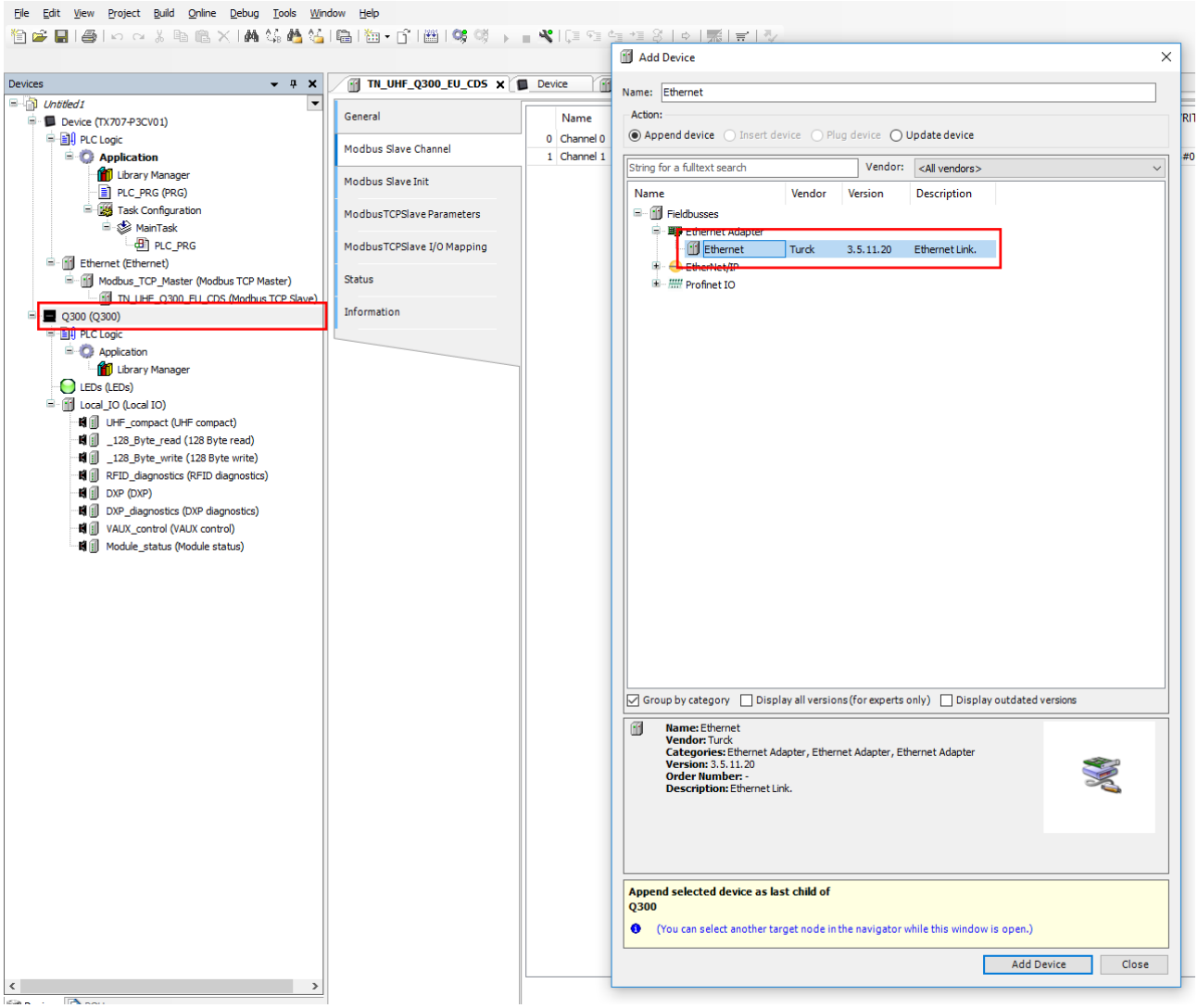


Fig. 82: Attaching the Ethernet adapter to the local I/Os

Attaching the Modbus TCP slave to the local I/Os

- Right-click **Ethernet (Ethernet)** in the project tree.
- Select **Add device**.
- Double-click **Modbus TCP Slave Device**.

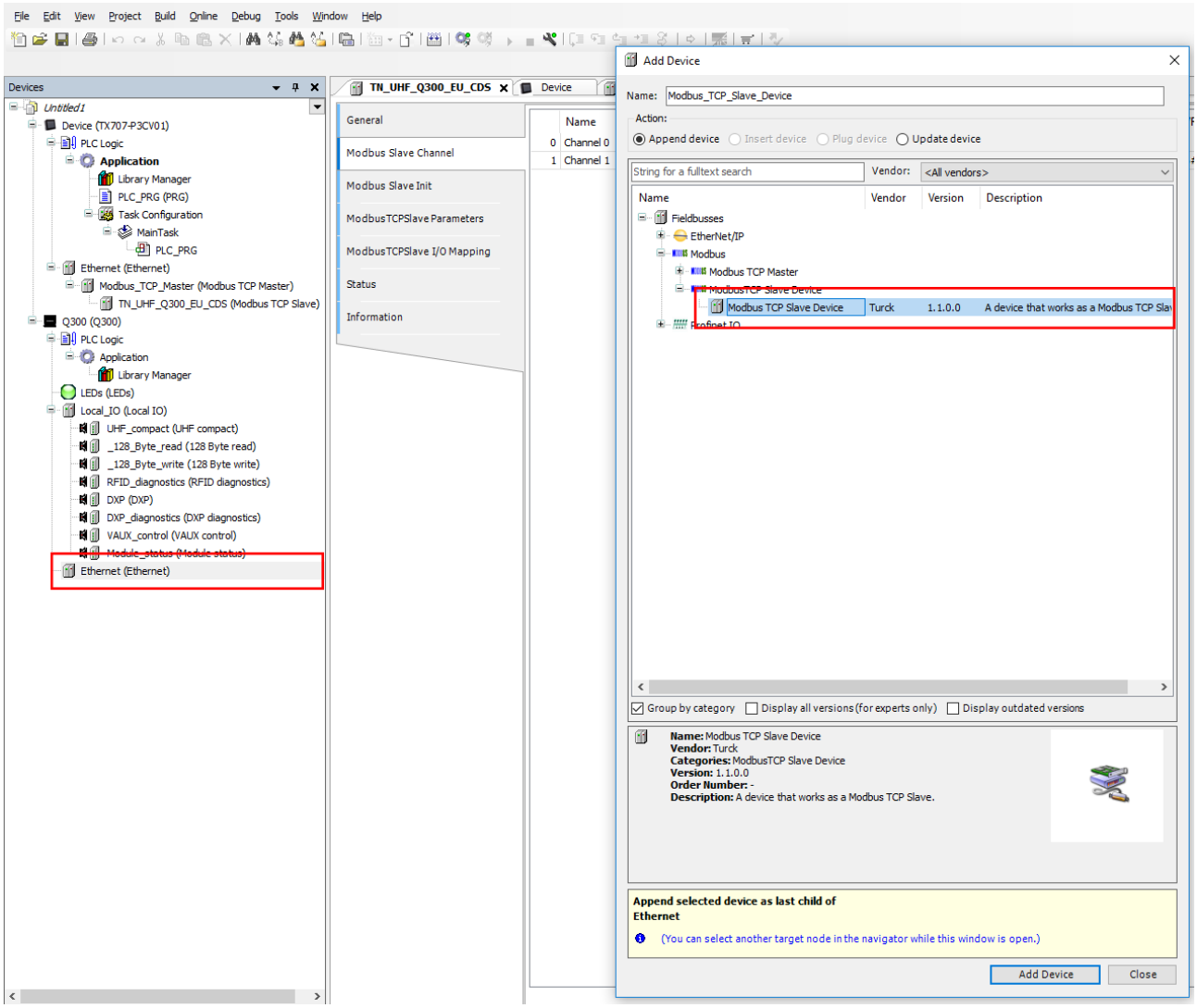


Fig. 83: Attaching the Modbus TCP slave to the local I/Os

▶ Define the size of the input and output data for the Modbus slave (here: 64 registers each)

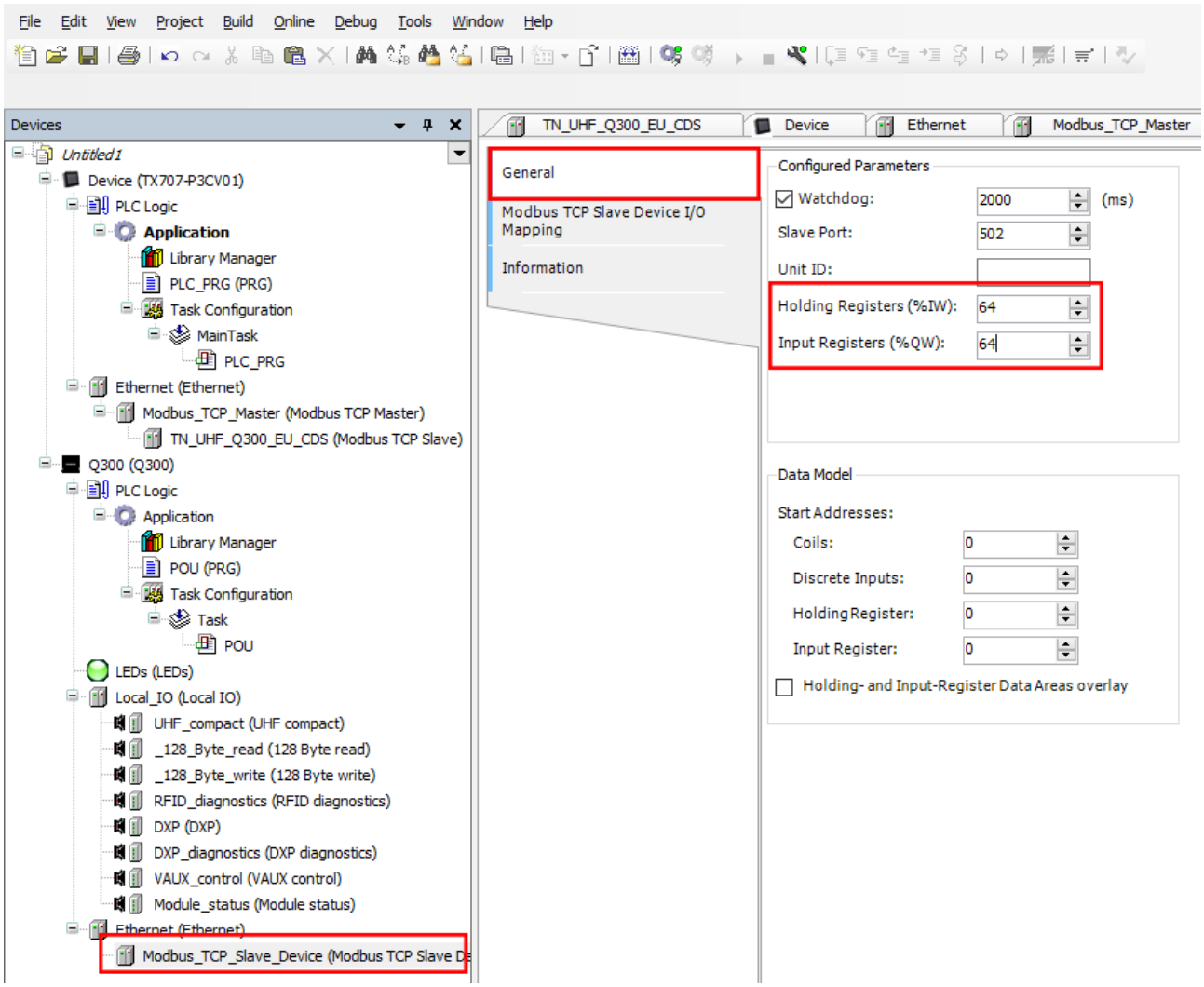


Fig. 84: Defining the size for input and output data

Local I/Os – setting the Ethernet interface

- Double-click **Q300 (Q300)** in the project tree.
- In the **Communication Settings** tab click the **Scan network** button.
- Select TN-UHF-Q300-CDS and confirm with **OK**.

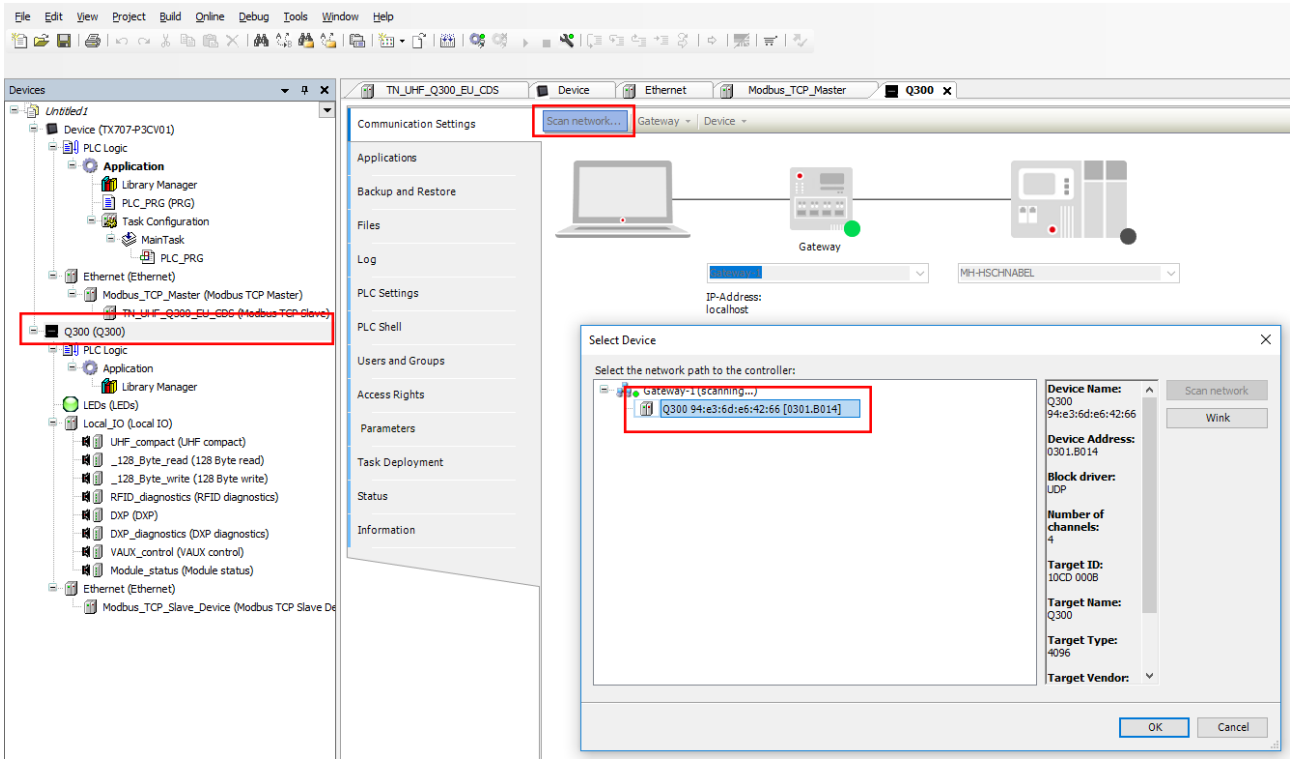


Fig. 85: Setting up an Ethernet interface to the read/write head

- Select the **PLC Settings** tab.
- In the **Always update variables** drop-down menu, select the **Enabled 2 (always in bus cycle task)** option.

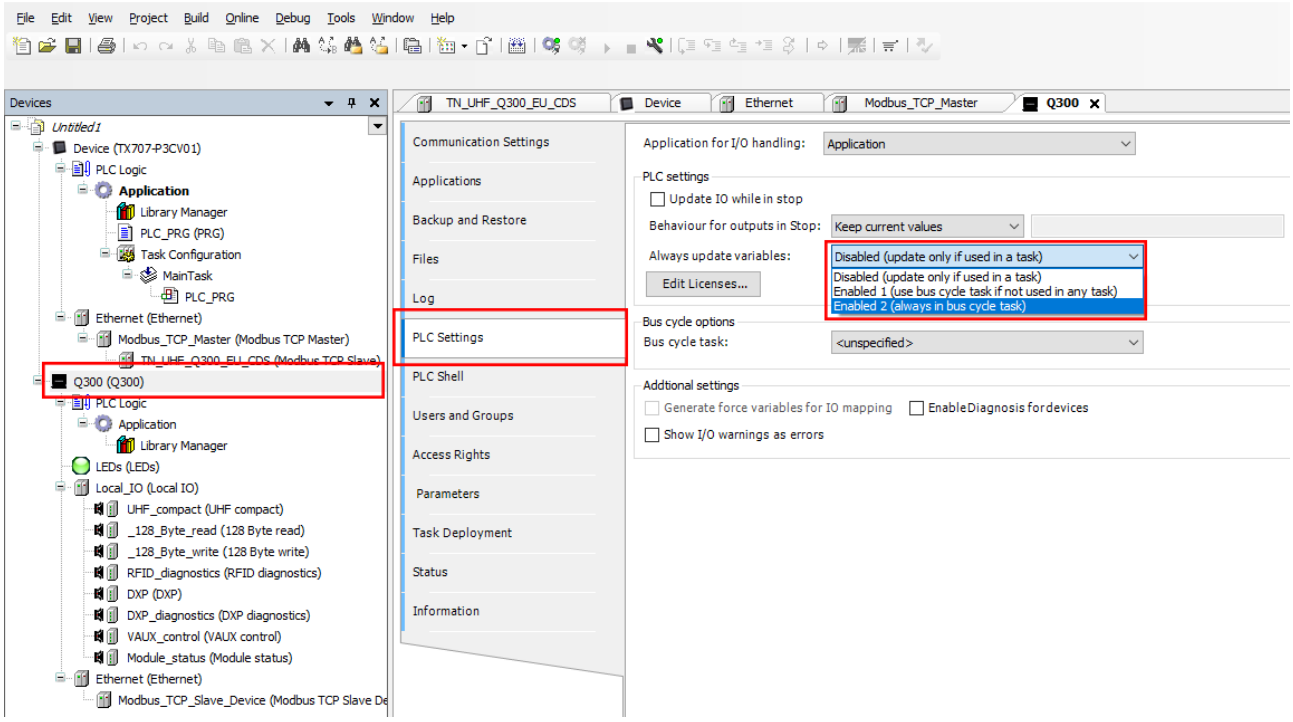


Fig. 86: Setting the option – Always update variables option

- Double-click **Q300 [connected] (Q300)**.
- Enter the IP address of the Modbus slave (here: 192.168.1.20).

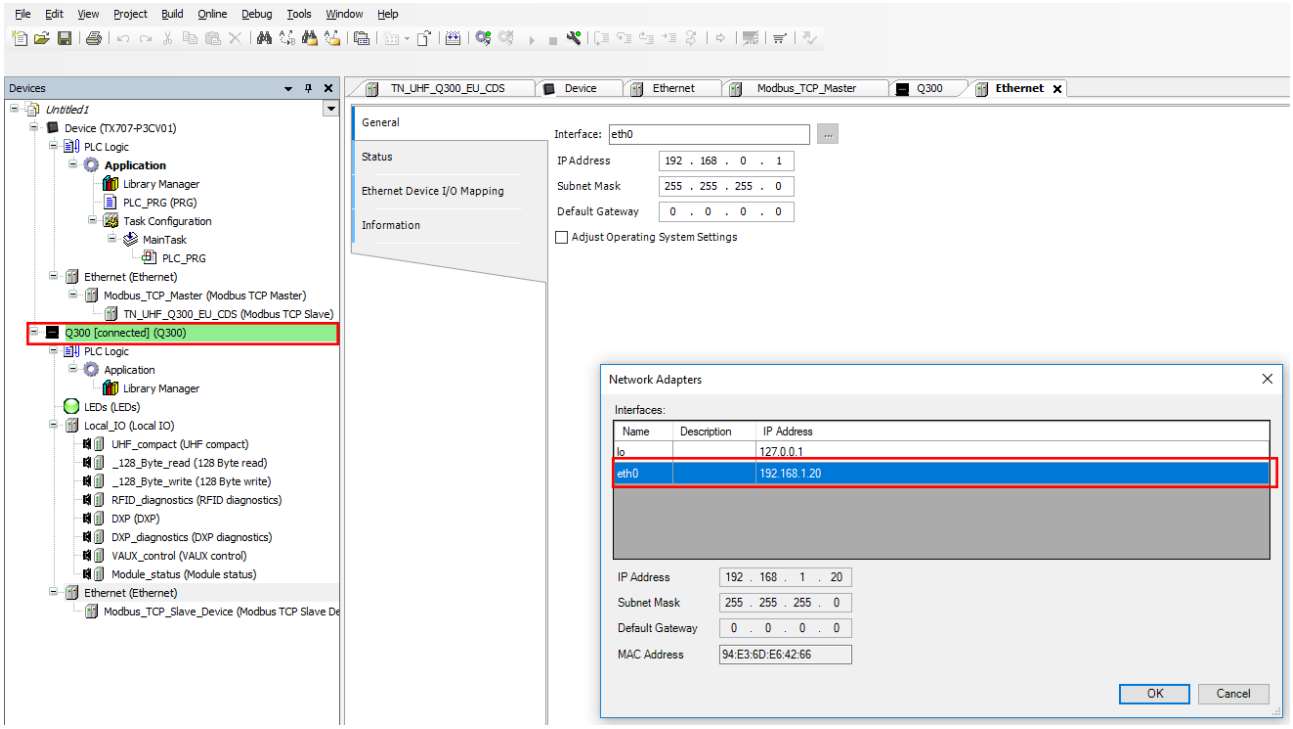


Fig. 87: Modbus master – entering the IP address

7.7.6 Writing the application to the device

An executable application must be present in the device in order to establish communication between Modbus master and TN-UHF-Q300-CDS.

- Right-click **Application** in the project tree.
- Choose **Add Object** → **Task Configuration** in the context menu.

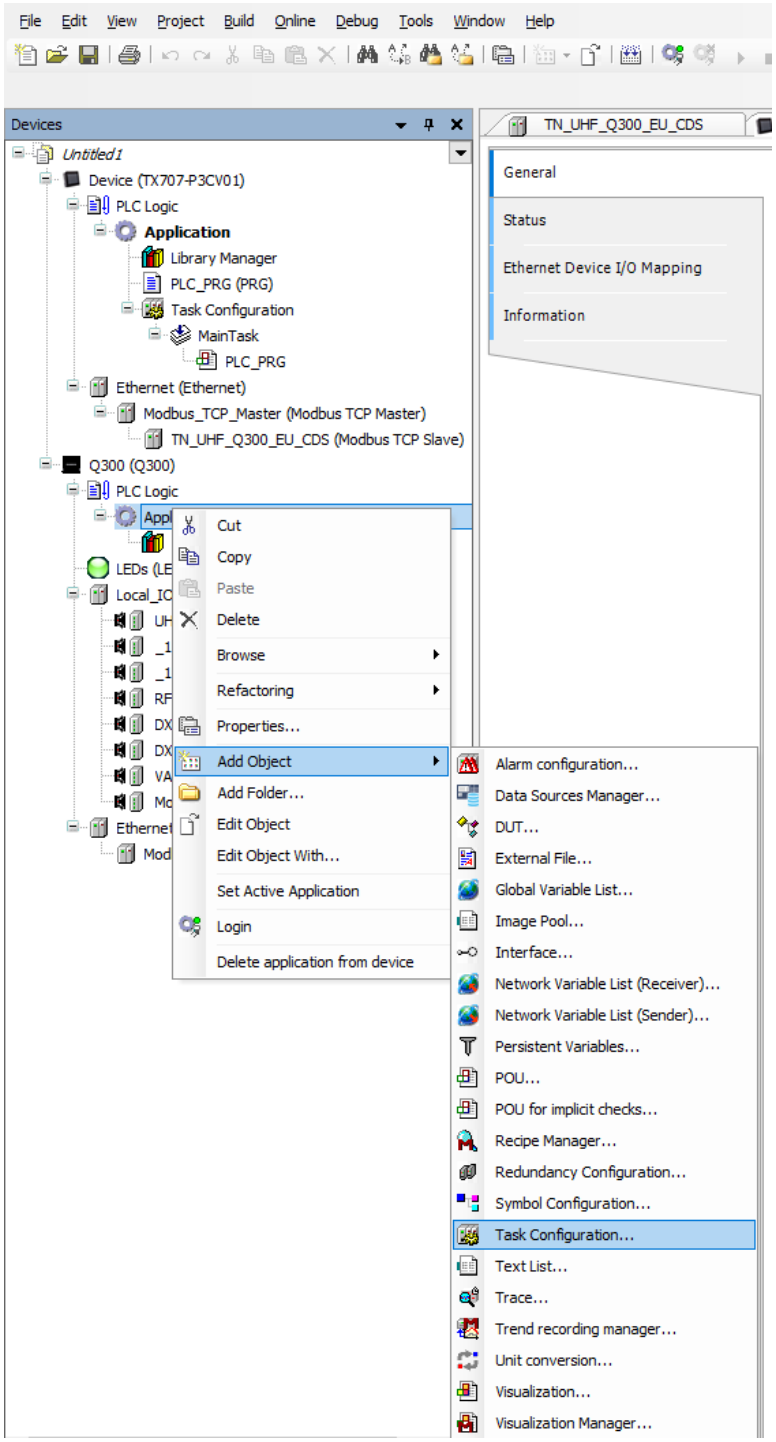


Fig. 88: Adding a task for the application

Adding a program organization unit (POU)

This example shows a simple program for mapping the **Continuous mode active** bit to the inputs of the Modbus master.

- Right-click **Application** in the project tree.
- Choose **Add Object** → **POU** in the context menu.

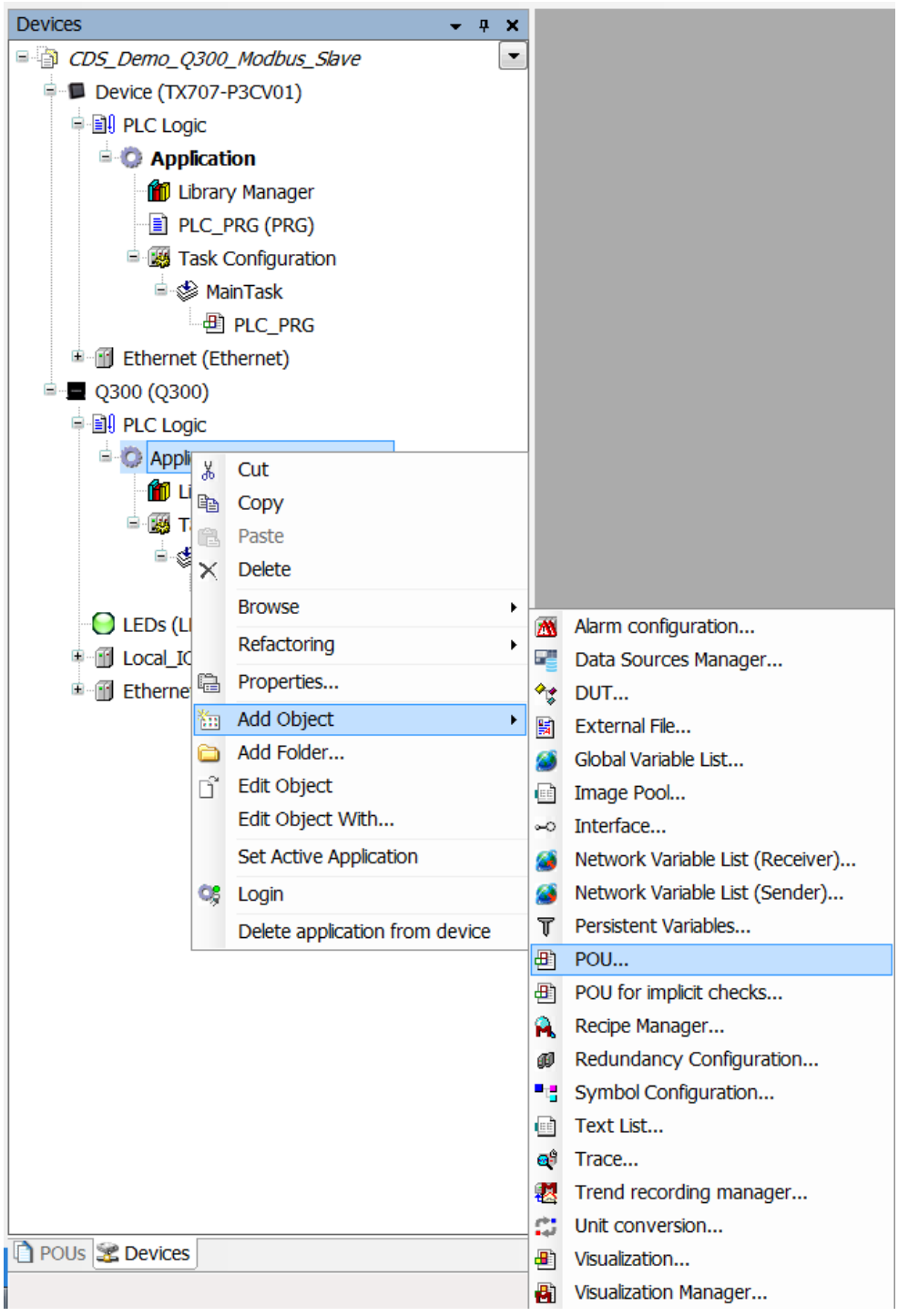


Fig. 89: Adding a POU

▶ Add the POU as a program to the application: Click **Add**.

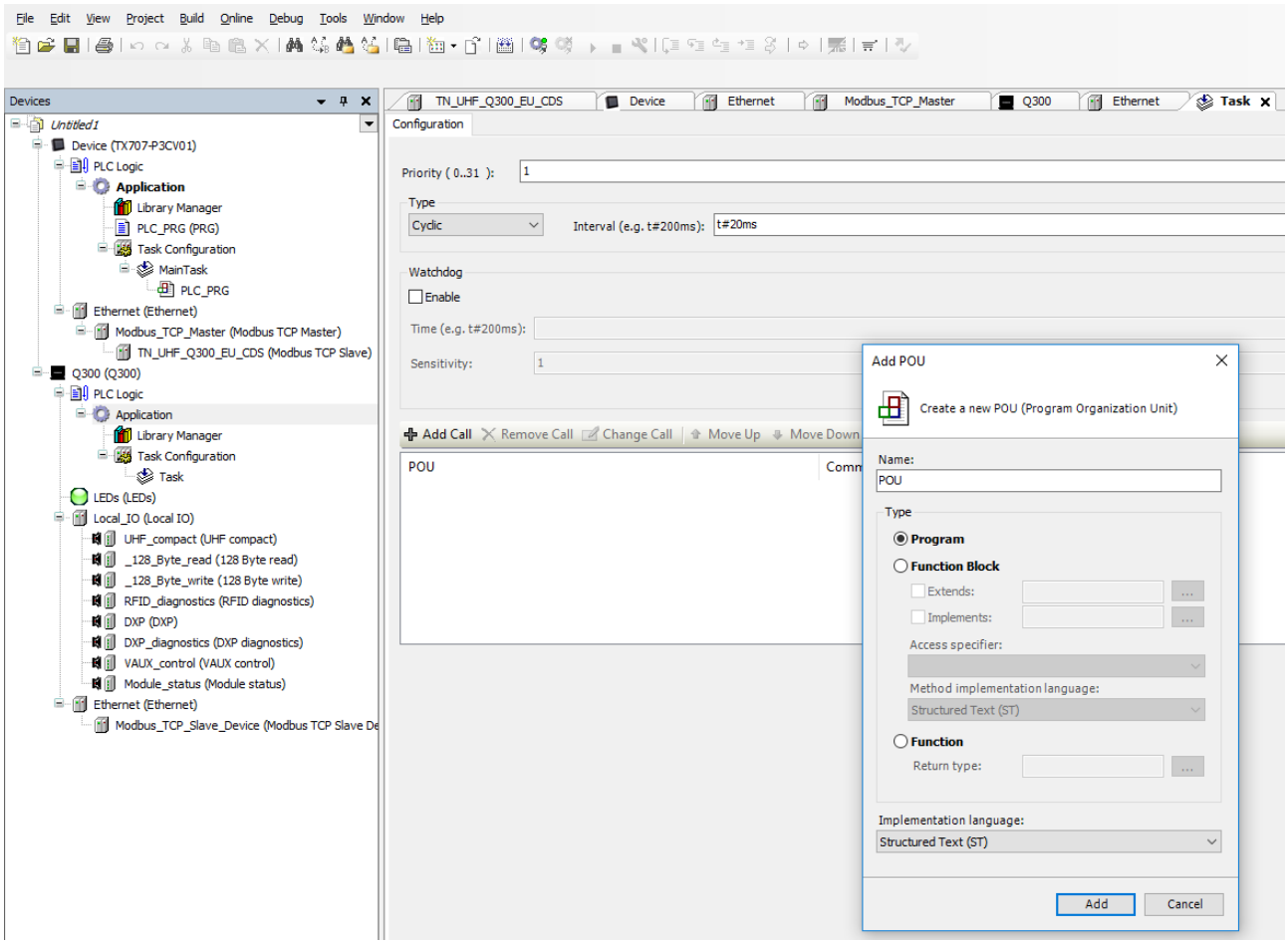


Fig. 90: Adding the POU to the application

▶ Confirm the adding of the POU in the entry dialog with **OK**.

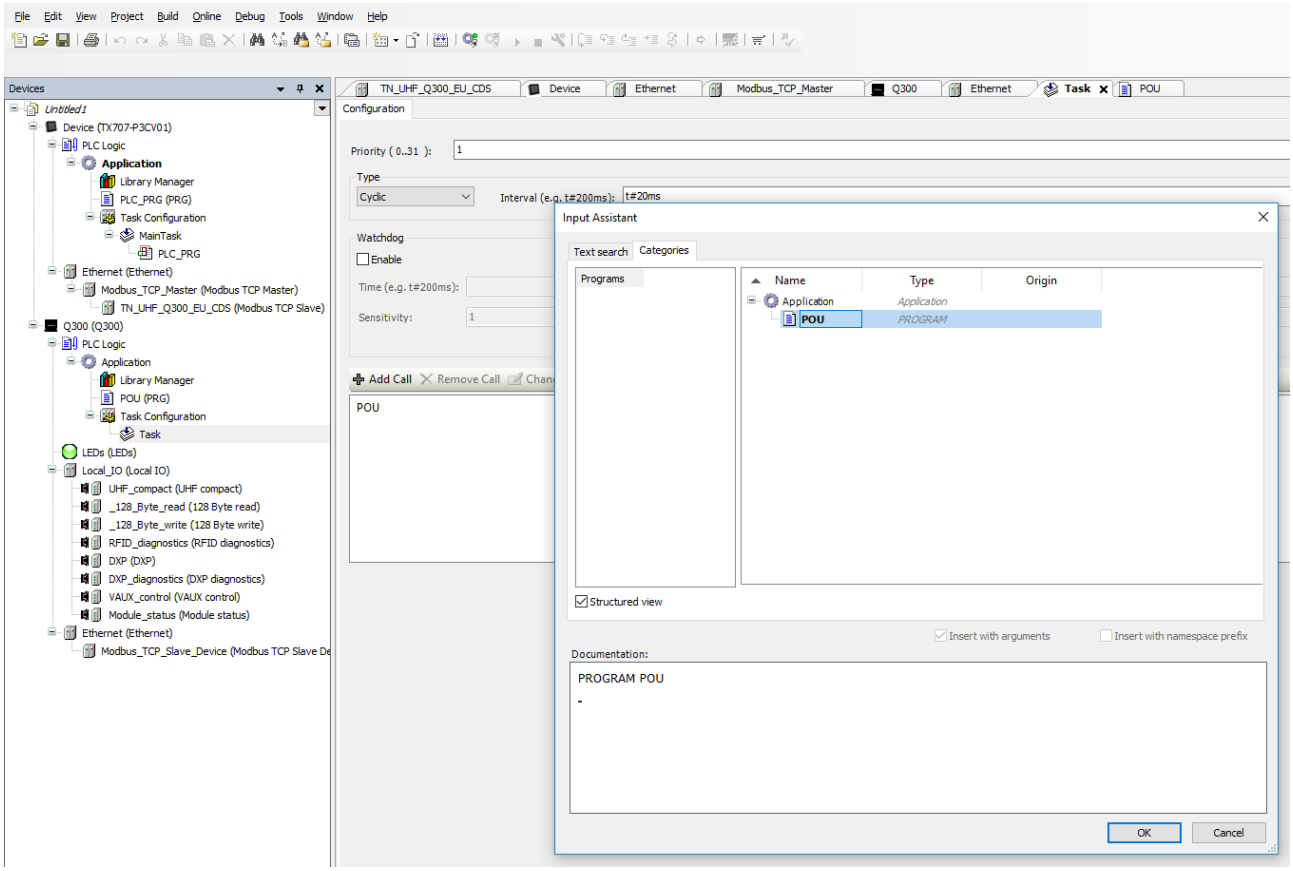


Fig. 91: Confirming the adding of the POU in the entry dialog

Mapping local I/Os to I/Os of the Modbus master

- Obtain the address of the **Continuous mode active** input bit from the mapping for the selected operating mode (here: UHF compact).

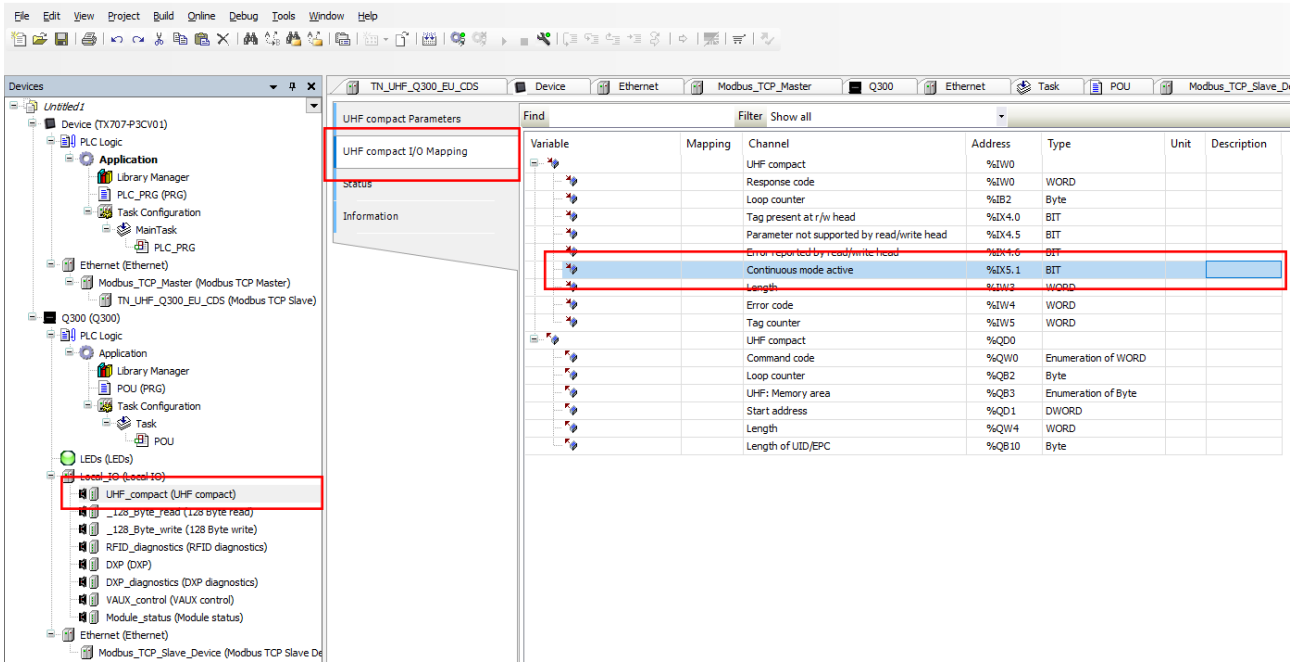


Fig. 92: Address of the input bit in the local I/Os of the RFID interface – Continuous mode active

- Obtain the address for the **Continuous mode active** output bit from the mapping for the slave device.

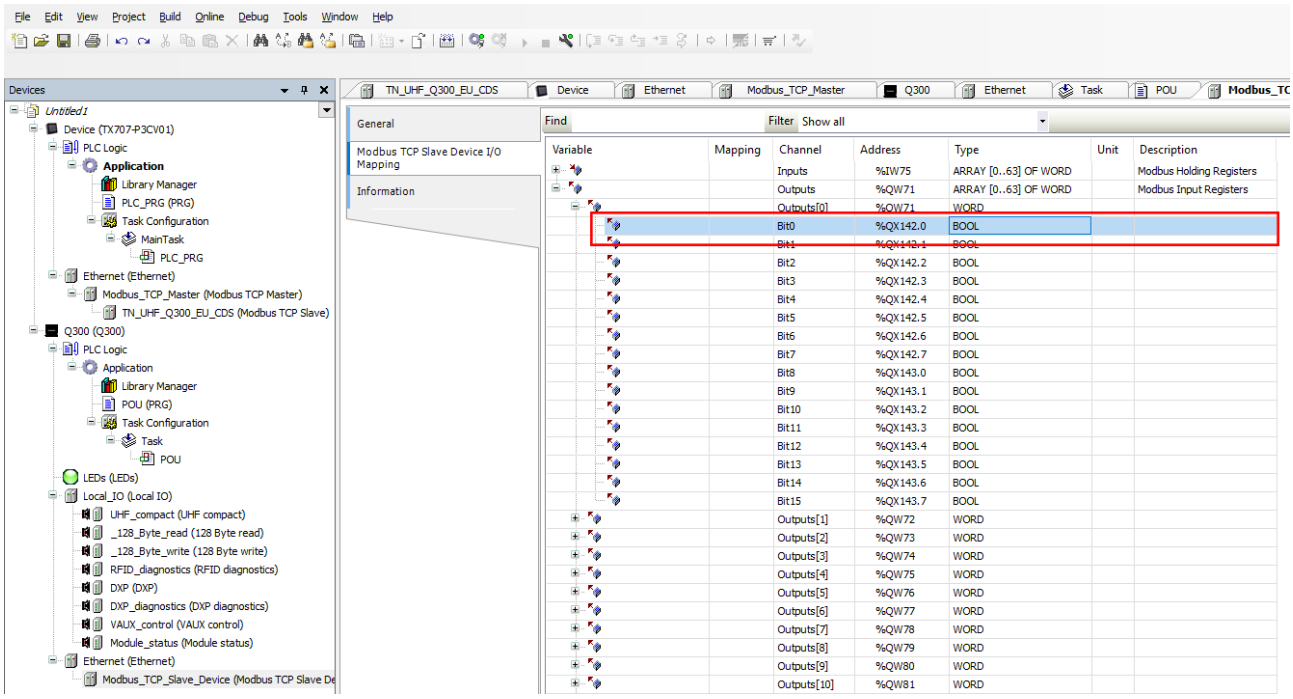


Fig. 93: Address for the output bit

- Transfer the mapping to the POU

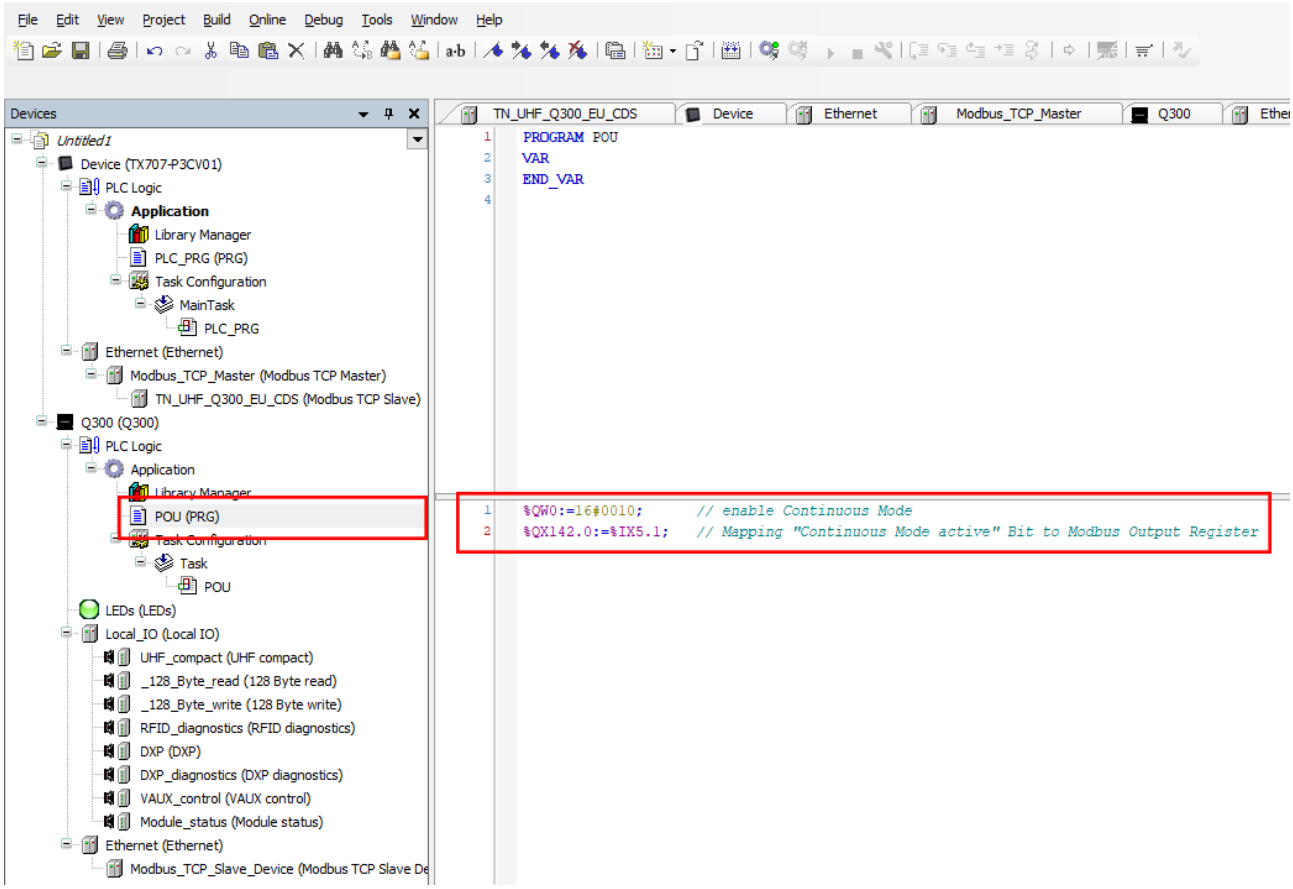


Fig. 94: Transferring the mapping to the POU

7.7.7 Connecting the device online with the controller

- ▶ Select device.
- ▶ Click **Online** → **Login**.

7.7.8 Reading out process data

The process data can be interpreted if the device is connected online with the controller.

- ▶ Double-click the Modbus TCP slave.
- ▶ Click the **Modbus TCP Slave I/O Mapping** tab.
- ⇨ The process data is displayed. In this example the **Continuous mode active** bit is set if the read/write head is in Continuous mode.

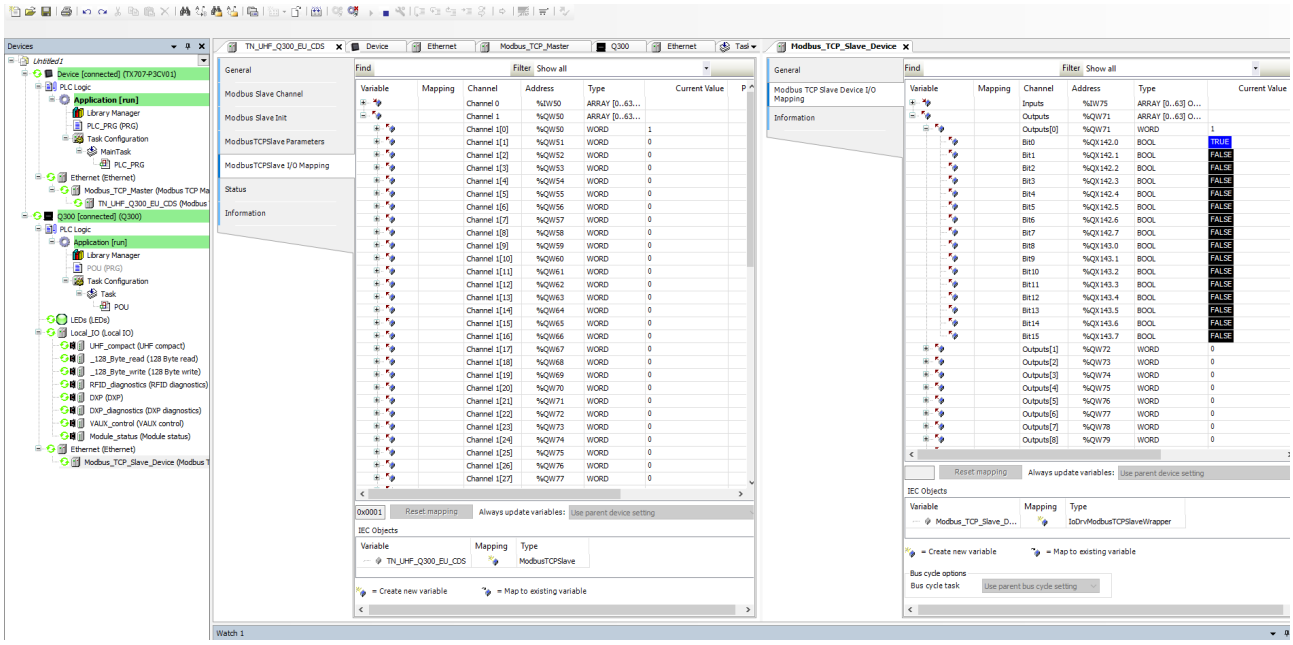


Fig. 95: Example: process data

7.8 Connecting the device to an EtherNet/IP scanner

The device can be linked to an EtherNet/IP scanner via an L5K file. Further information on commissioning in EtherNet/IP can be provided by TURCK on request.

7.9 Connecting the device to a PROFINET controller using CODESYS and the TIA portal

In this example the **Tag present** bit is queried. This requires the network interface to be set up, the hardware configured and the I/O mapping defined.

Hardware used

This example uses the following hardware components:

- Siemens controller S7-1500 with CPU 1513-1 PN
- UHF reader TN-UHF-Q300-CDS-EU (IP address: 192.168.1.254)

Software used

This example uses the following software:

- CODESYS 3.5.12.1 (download free of charge from www.turck.com)
- SIMATIC STEP7 Professional V15 (TIA Portal)
- GSDML file for TURCK UHF reader (download free of charge from www.turck.com)

Requirements

- The package file for TBEN-L…-4RFID-8DXP-CDS is installed.
- A new standard project has been created in CODESYS.
- The TN-UHF-Q300-CDS-EU UHF reader has been added to the CODESYS project.
- A new project has been created in the TIA portal.

7.9.1 Configuring the device in CODESYS as a PROFINET device

The device must have been created in the project tree.

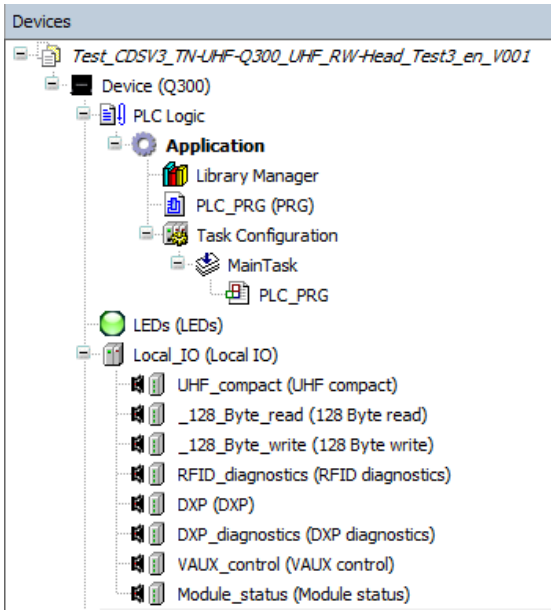


Fig. 96: TN-UHF-Q300-CDS-EU in the project tree

Adding an Ethernet adapter

- Right-click **Device (Q300)** in the project tree.
- Select **Append device**.
- Select an Ethernet adapter.
- Click **Add Device**.

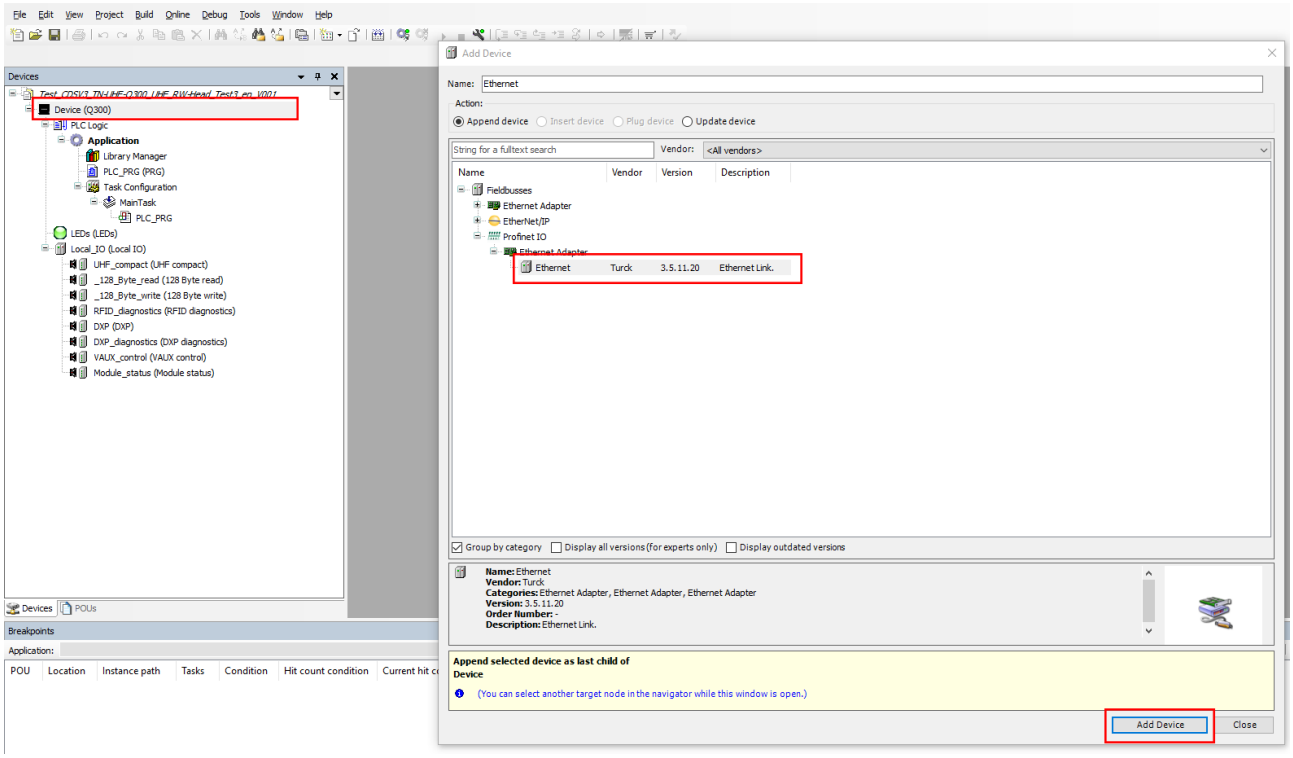


Fig. 97: Adding an Ethernet adapter

Attaching a PROFINET device

- Right-click **Ethernet (Ethernet)** in the project tree.
- Select **Append device**.
- Select **Profinet Device**.
- Click **Add Device**.

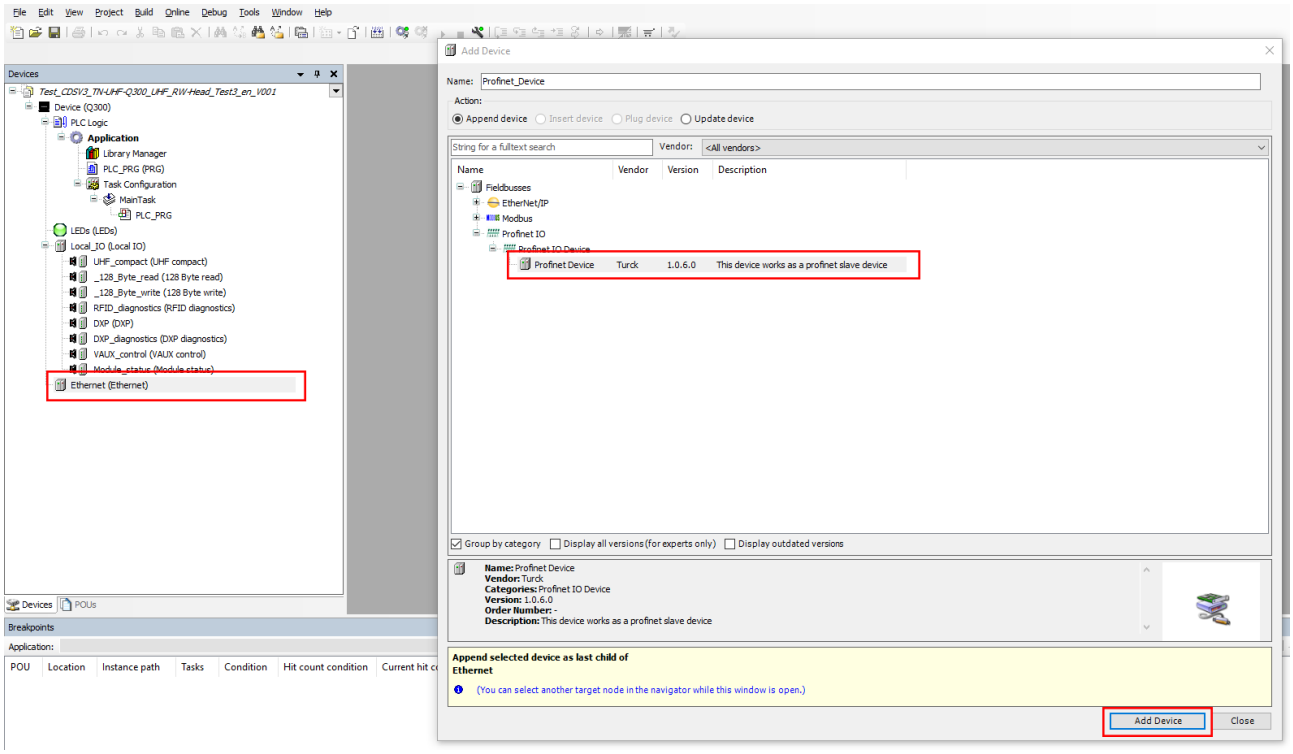


Fig. 98: Attaching the PROFINET device

Assigning inputs and outputs

- Right-click **Profinet_Device (Profinet Device)** in the project tree.
- Select **Append device**.
- Example: double-click **IN 1 BYTE**.
- Example: double-click **OUT 1 BYTE**.
- Click **Add Device**.

NOTE
The slots defined as inputs in CODESYS correspond to the outputs in the TIA Portal and vice versa.

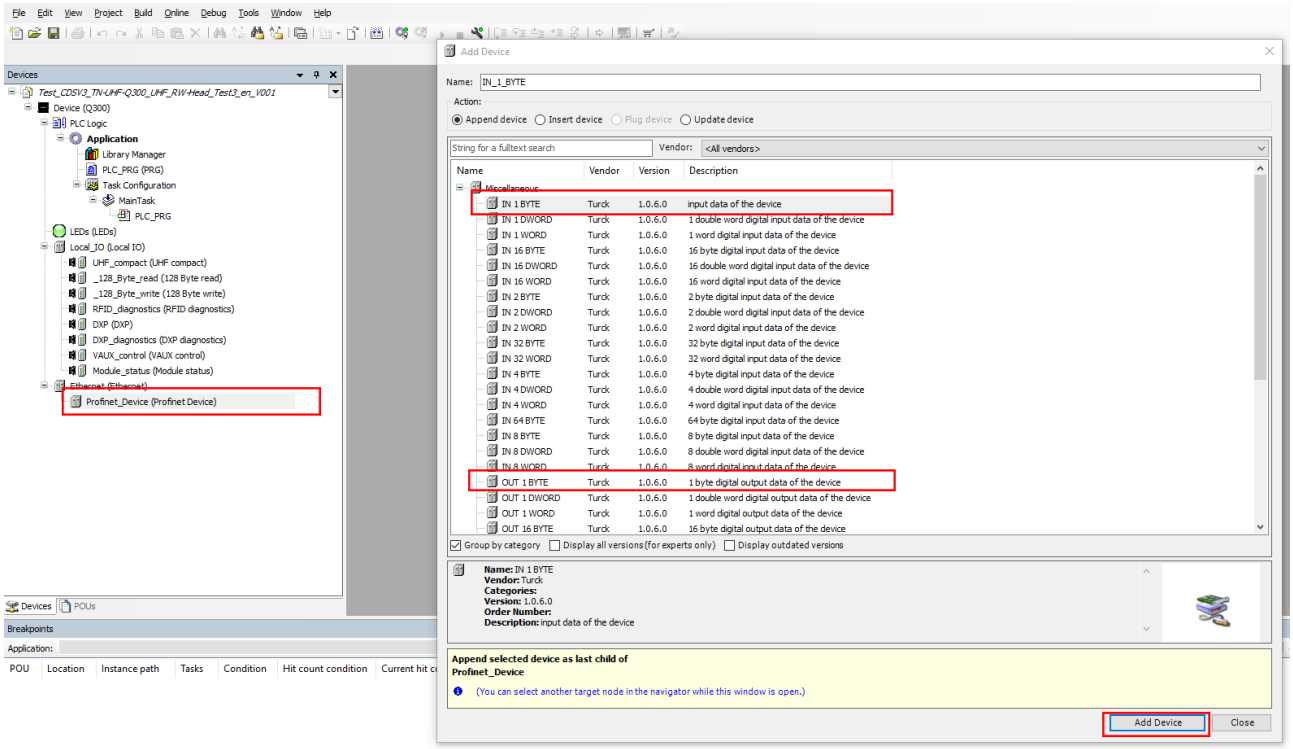


Fig. 99: Assigning inputs and outputs

Inputs and outputs – creating the mapping

Example: The **Continuous mode active** bit is sent to the controller via an output byte.

- ▶ Double-click the required operating mode in the project tree (here: HF compact).
- ▶ Select the **UHF compact I/O Mapping** tab.
- ▶ Find the internal device address of the **Continuous mode active** bit from the I/O image for the selected operating mode (here: UHF compact).

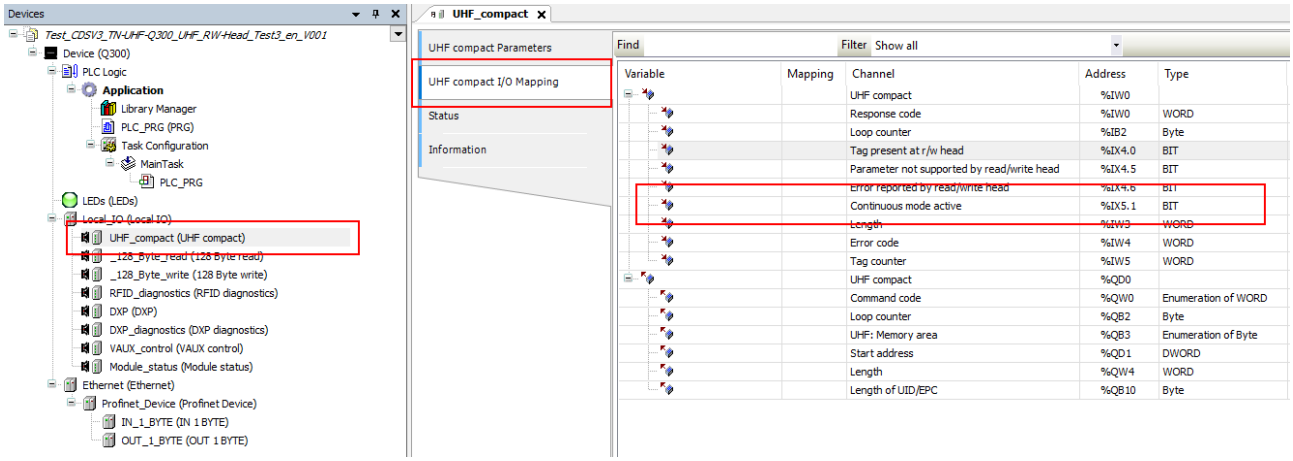


Fig. 100: Bit: Tag present – internal address

- Example: double-click **OUT_1_BYTE** in the project tree.
- Assign the internal address for the **Continuous mode active** bit to the output byte.

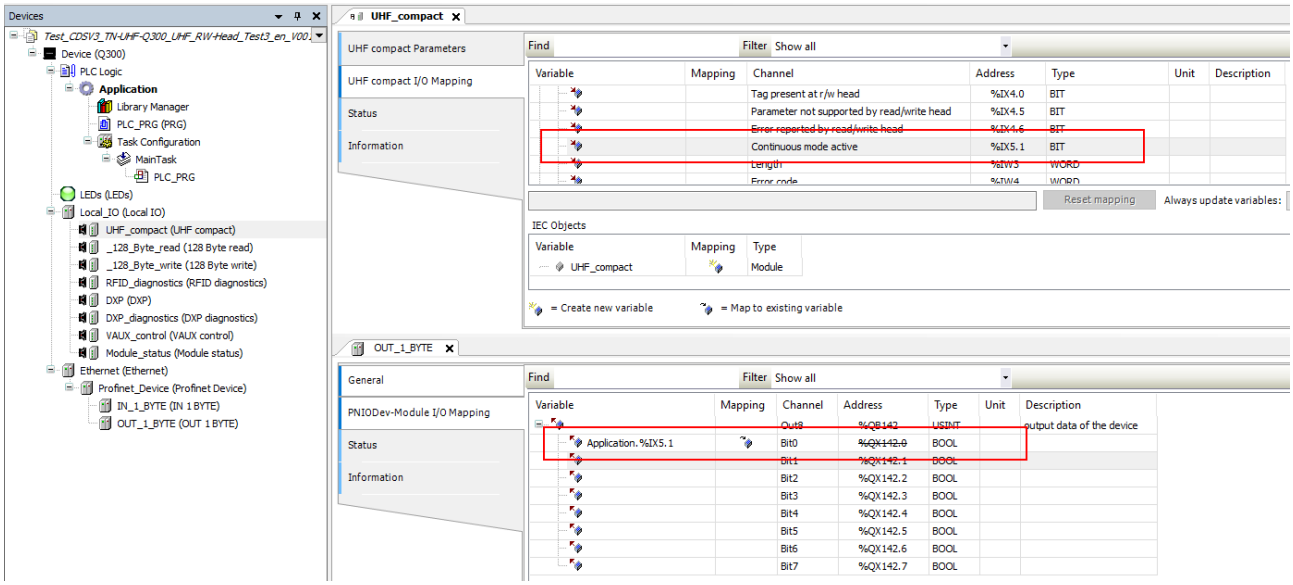


Fig. 101: Mapping the I/O address

7.9.2 Setting up the network interface

- Click **Device (Q300)** → **Scan network**.
- Select TN-UHF-Q300-EU-CDS and confirm with **OK**.

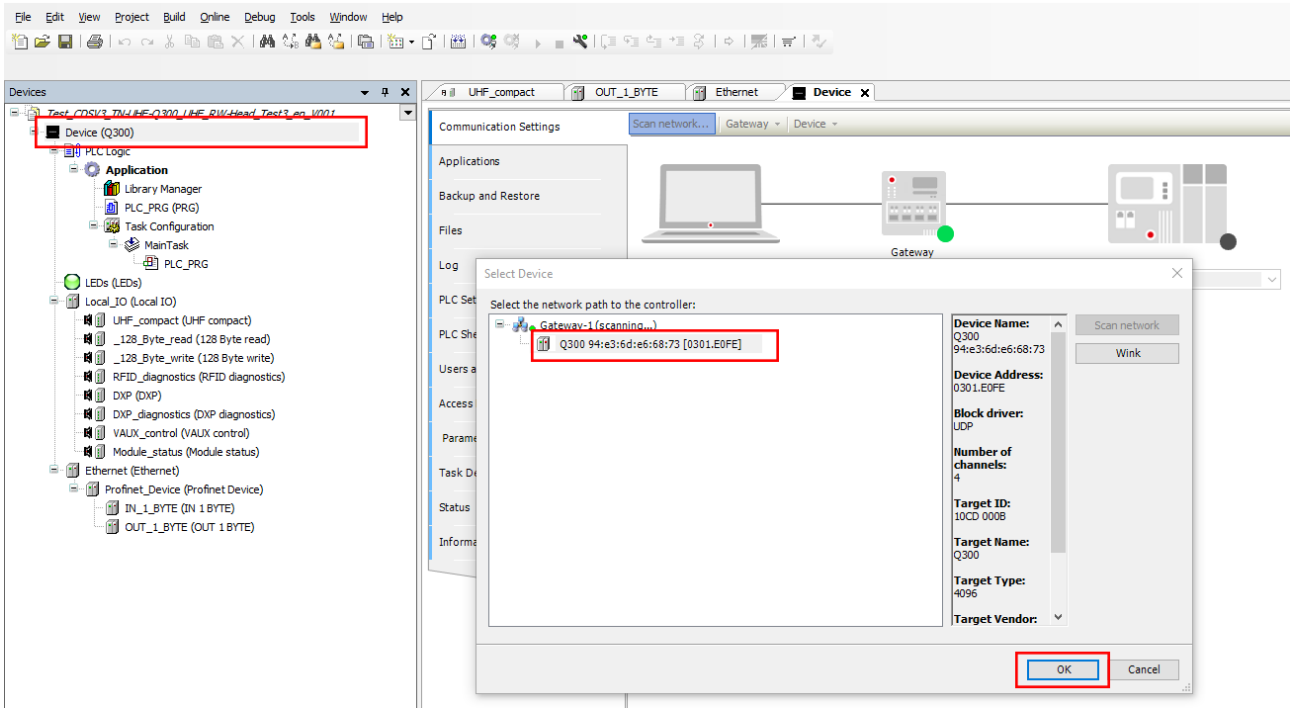


Fig. 102: Setting up the network interface

- Select the **PLC Settings** tab.
- In the **Always update variables** drop-down menu, select the **Enabled 2 (always in bus cycle task)** option.

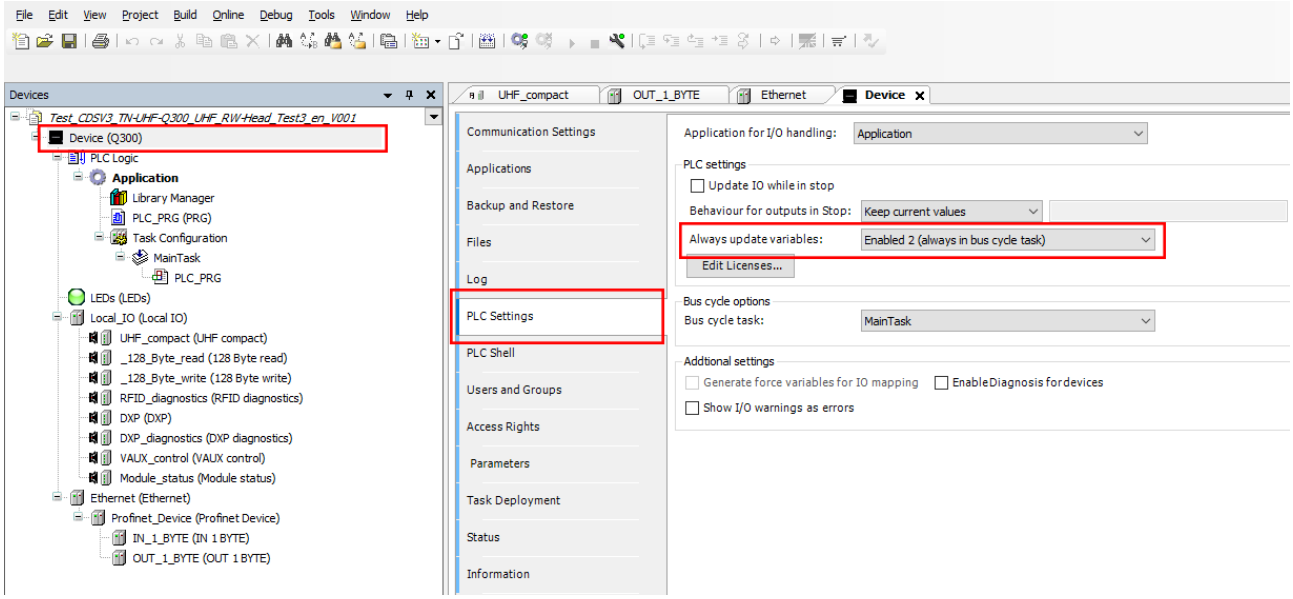


Fig. 103: Setting the option – Always update variables option

- Double-click **Ethernet (Ethernet)**.
- Select the network interface.
- Enter the IP address of the PROFINET master (here: 192.168.1.254).

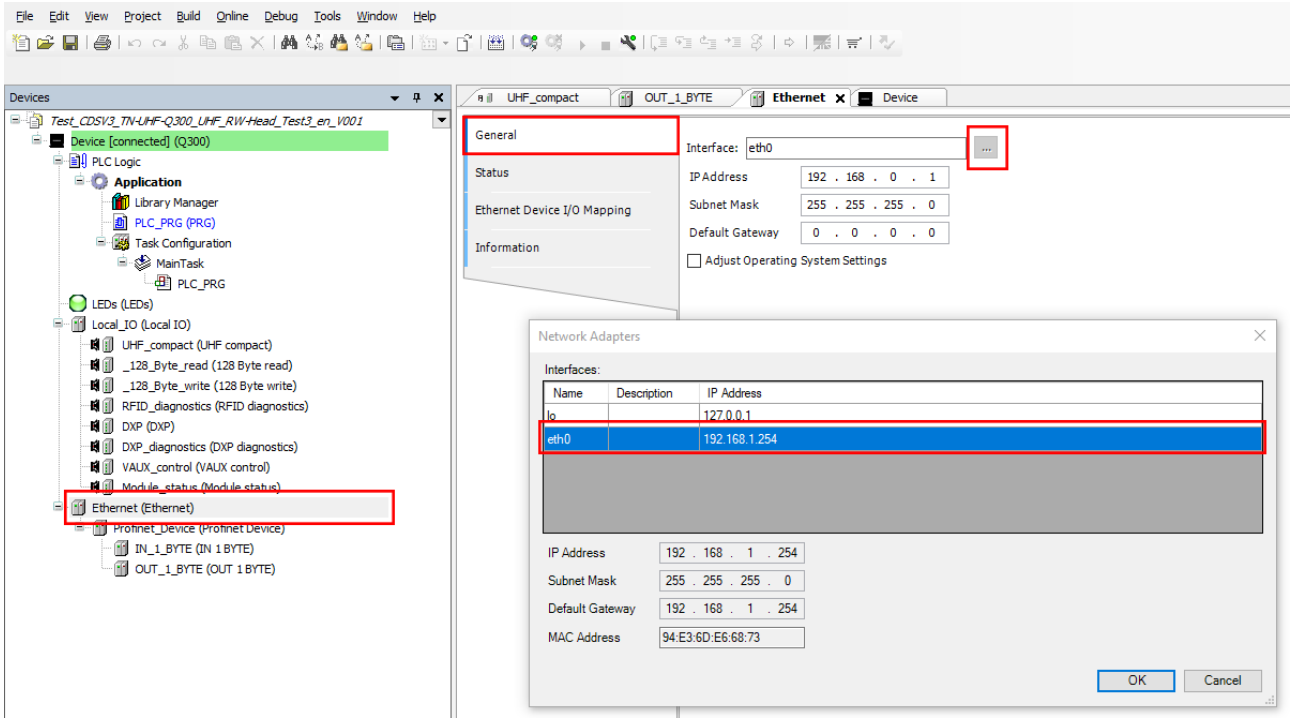


Fig. 104: PROFINET master – entering the IP address

Connecting the device online

- ▶ Click **Online** → **Login**.
- ▶ Click the **Start** button.
- ⇨ The connection is now displayed in the project tree.

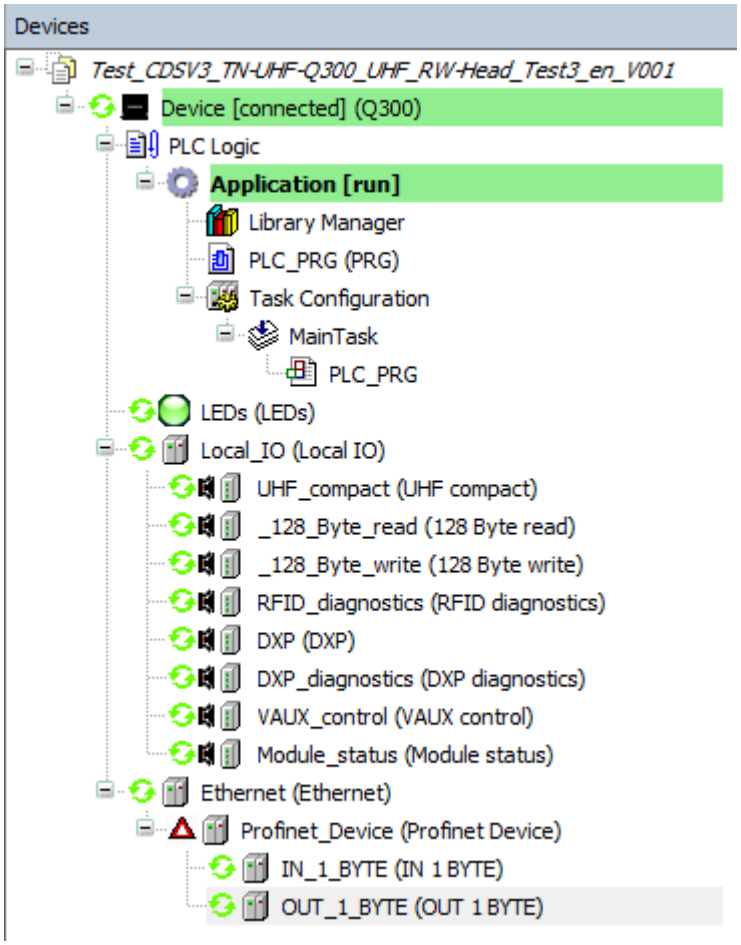


Fig. 105: Display of the connection in CODESYS

7.9.3 Connecting a device to a Siemens controller in the TIA Portal

- ▶ Add a controller to the project (here: CPU 1513-1 PN).

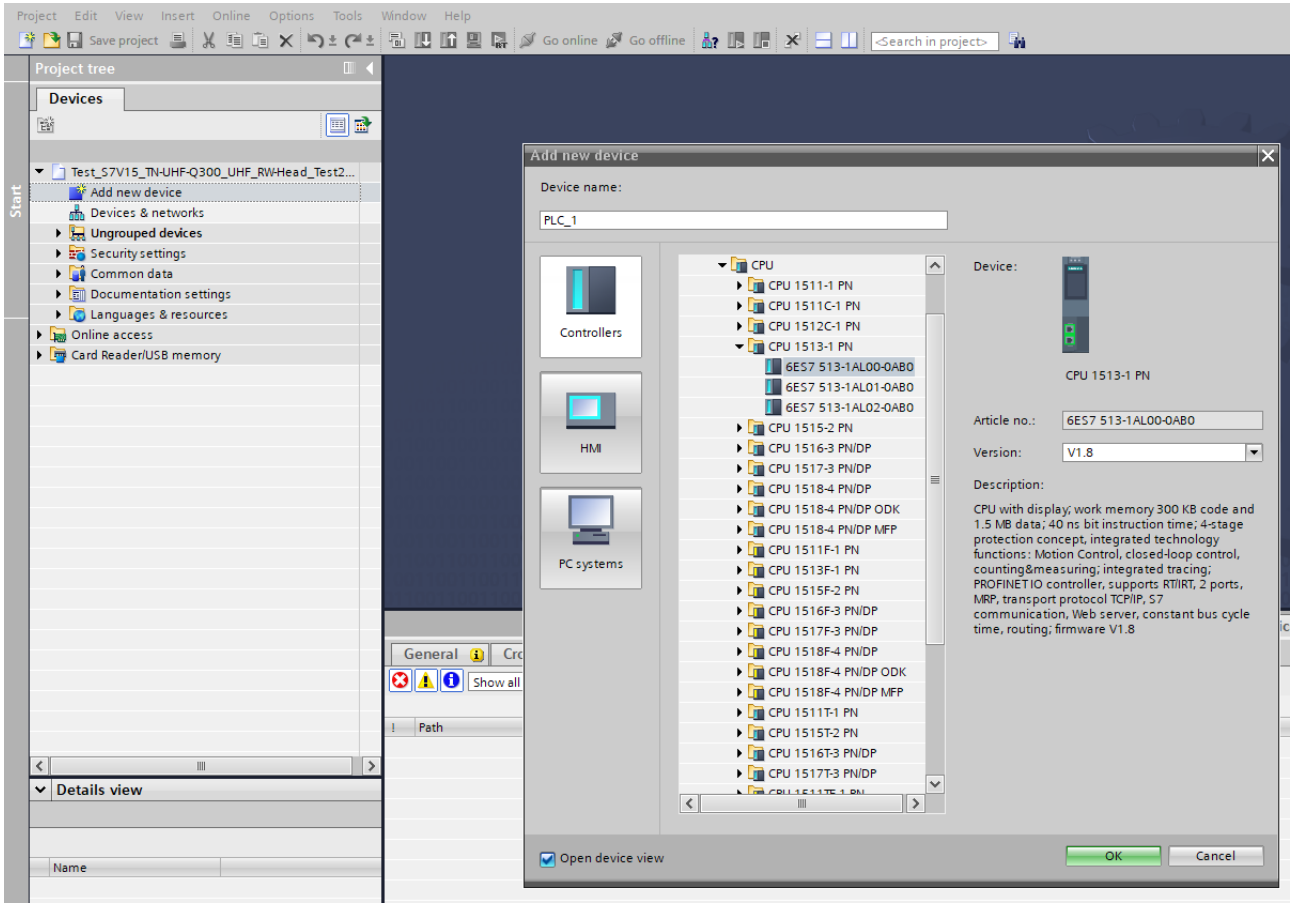


Fig. 106: Add controller

- Include the TURCK Codesys device in the project. To do this, select the generic GSDML file **CDS3 PN Device** from the **Turck** folder in the hardware catalog.

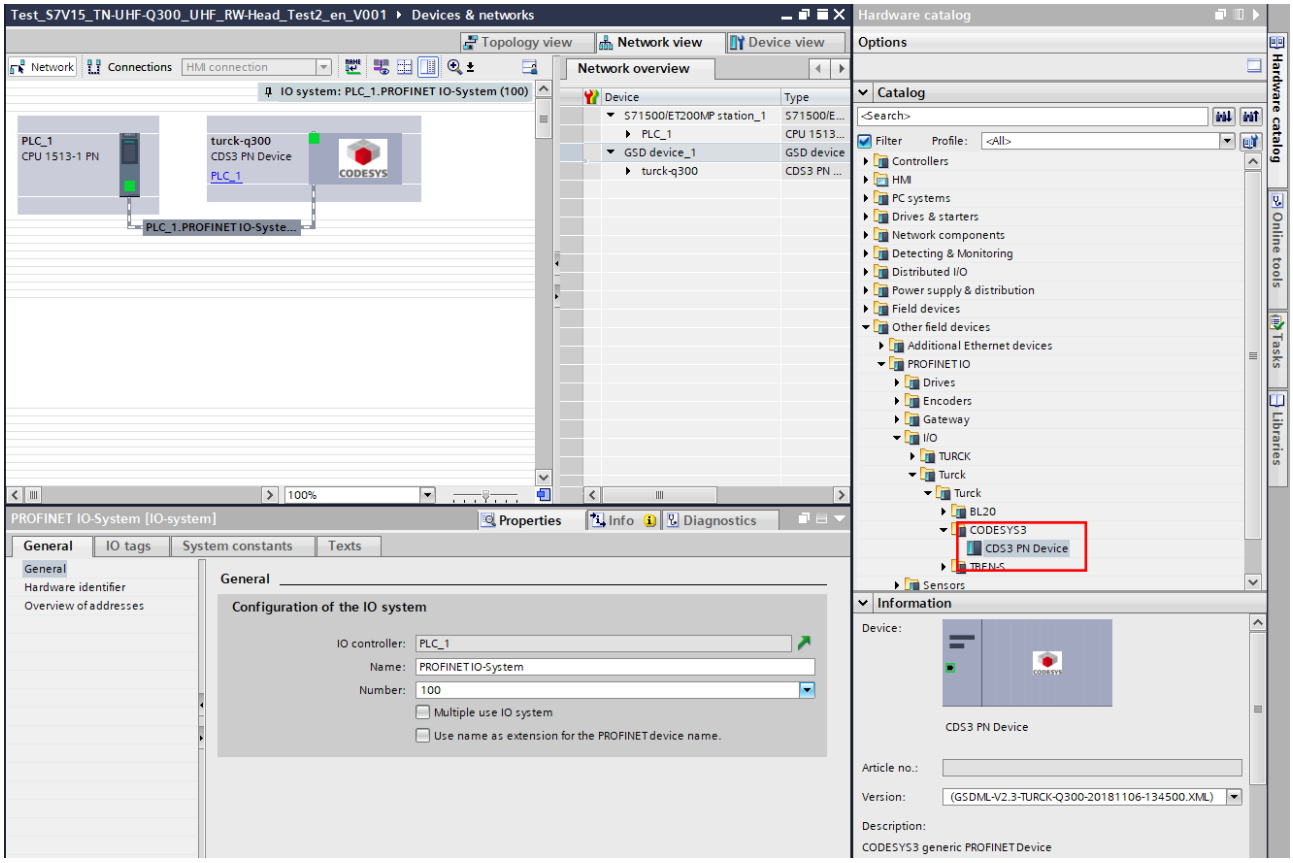


Fig. 107: Add TURCK Codesys device

TN-UHF-Q…-CDS… — assign IP address and PROFINET device name

- Assign the IP address and PROFINET device name for the UHF reader via the TURCK Service Tool if required.
- Enter the IP address and PROFINET device name in the TIA Portal (**Device configuration → Properties → General → Ethernet addresses**).

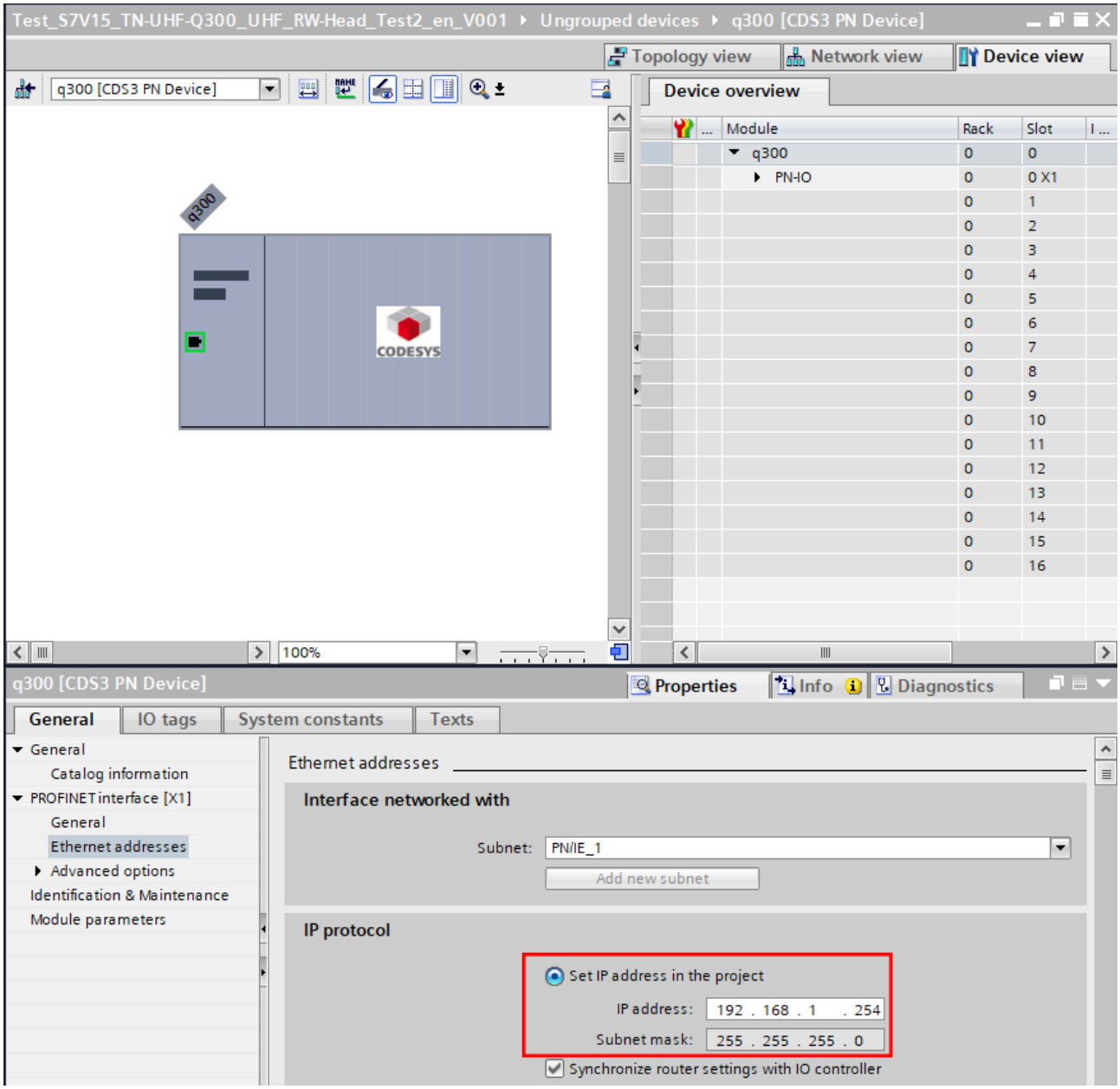


Fig. 108: Assign the IP address and PROFINET device name in the TIA Portal

Assigning inputs and outputs

NOTE
The slots defined as inputs in CODESYS correspond to the outputs in the TIA Portal and vice versa.

- Example: Assign **IN 1 Byte** and **OUT 1 Byte** from the hardware catalog to the device.

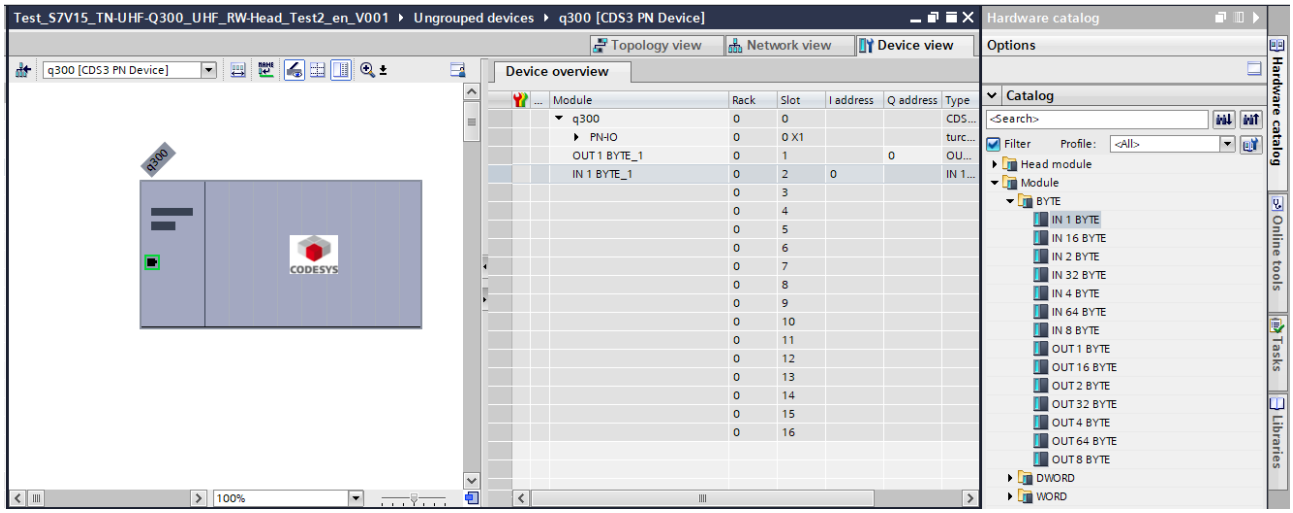


Fig. 109: Assign inputs and outputs in the TIA Portal

Creating a watch table

The process data (in this case, the **Continuous mode active** bit set) can be visualized using watch tables.

- ▶ Create a new watch table.

Load the configuration to the controller

- ▶ Load the configuration to the controller.

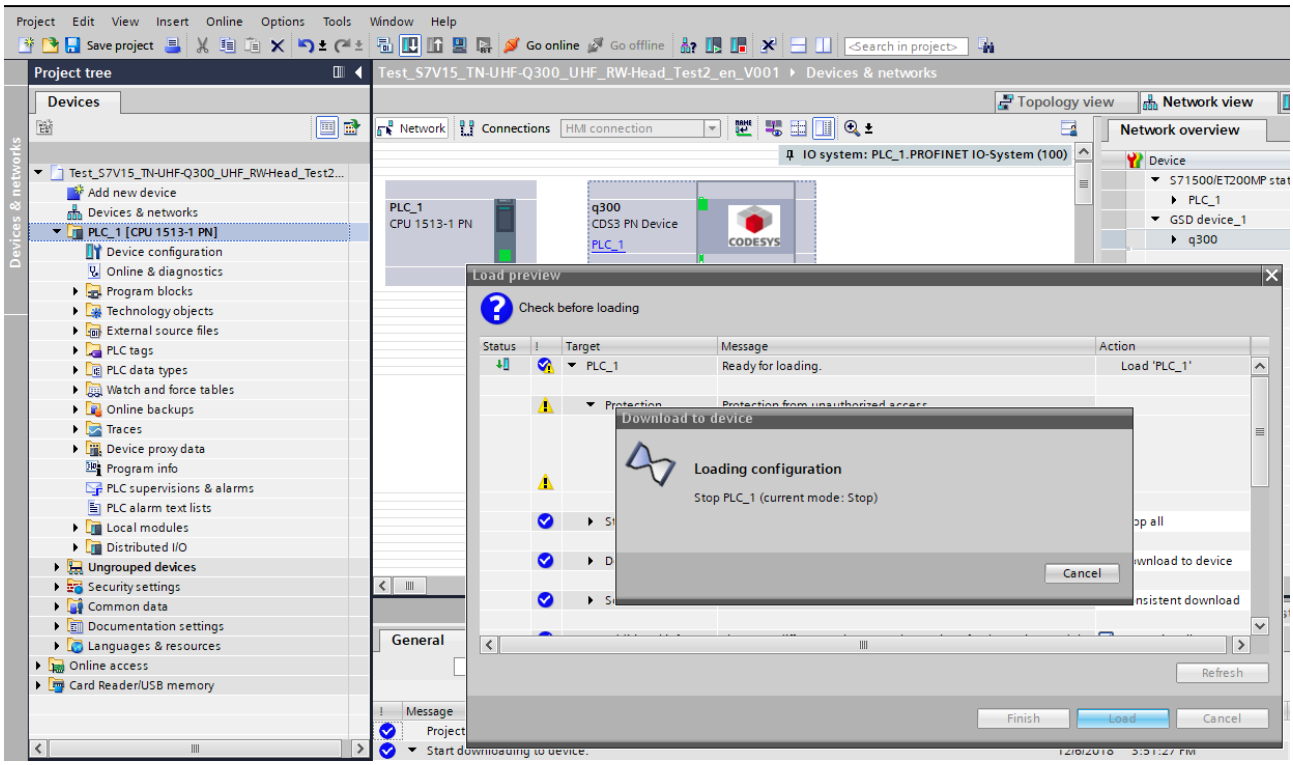


Fig. 110: Load the configuration to the controller

7.9.4 Reading out process data

In online mode, the **CONTINUOUS_MODE_ACTIVE** bit is displayed in the monitoring table.

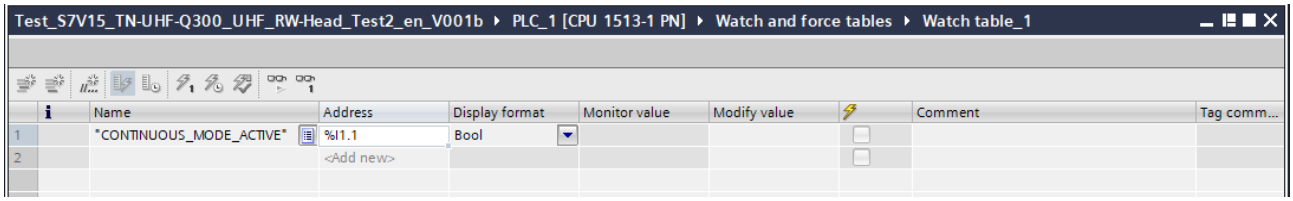


Fig. 111: Bit in the monitoring table – CONTINUOUS_MODE_ACTIVE

The successful connection is now displayed in the project tree in CODESYS.

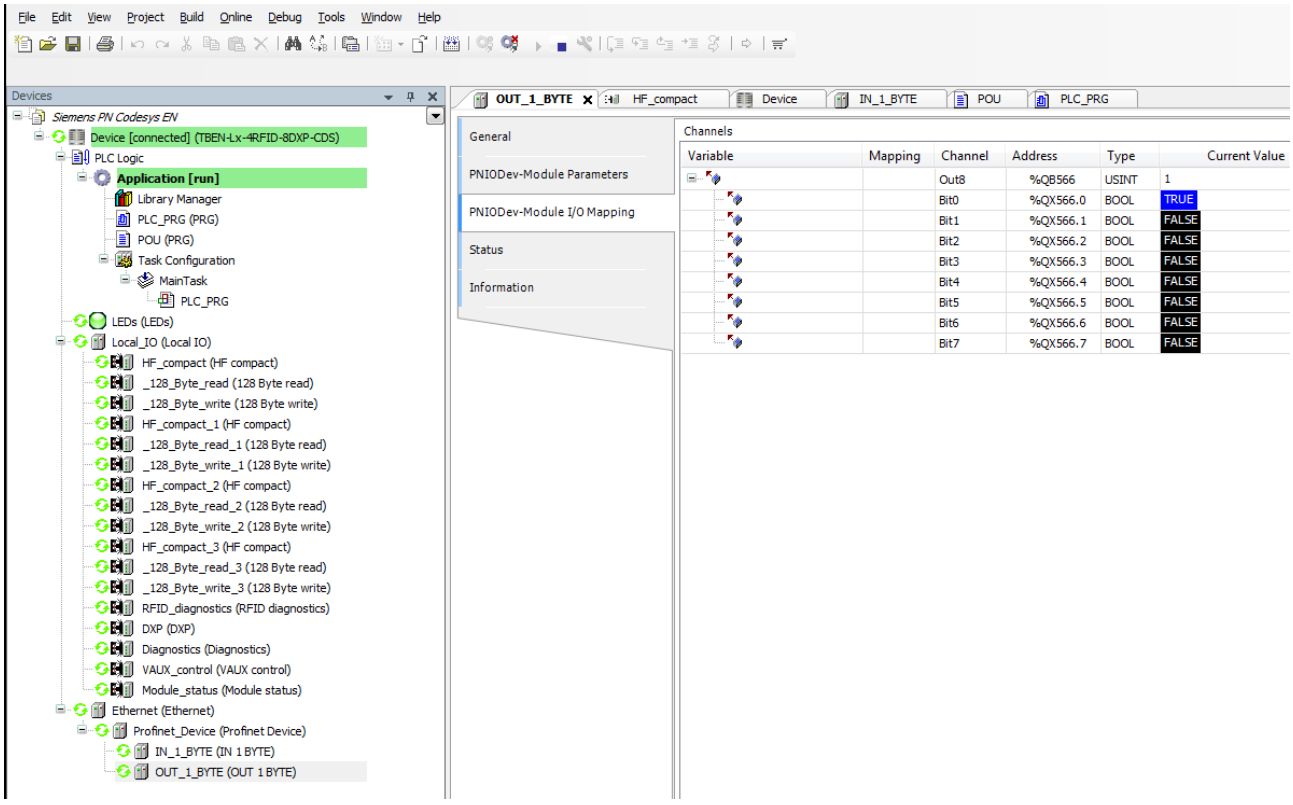


Fig. 112: Successfully established connection – display in CODESYS

7.10 Starting the device as the Modbus master

In this example the **Tag present** bit is queried. This requires the network interface to be set up, the hardware configured and the I/O mapping defined.

Hardware used

This example uses the following hardware components:

- TN-UHF-Q300-CDS-EU UHF reader (IP address 192.168.1.20)
- TBEN-S2-2RFID-4DXP block module (IP address 192.168.1.100)
- TN-Q80-H1147 HF read/write head

Software used

This example uses the following software:

- CODESYS 3.5.12.10 (download free of charge from www.turck.com)

Requirements

- The package file for TN-UHF-Q300-CDS has been installed.
- A new standard project has been created.

Define the device as the server in CODESYS

▶ Select the TN-UHF-Q300-CDS-EU (**Q300**) UHF reader as the server.

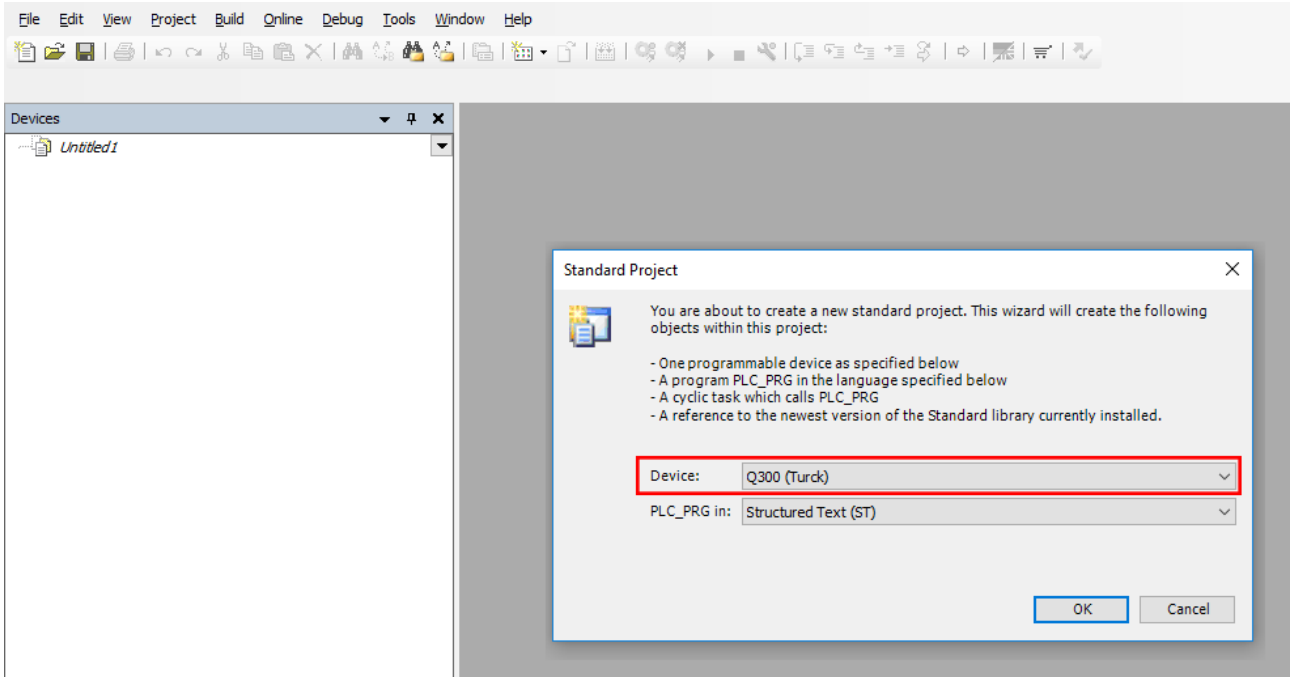


Fig. 113: Select the server

The device is displayed in the project tree.

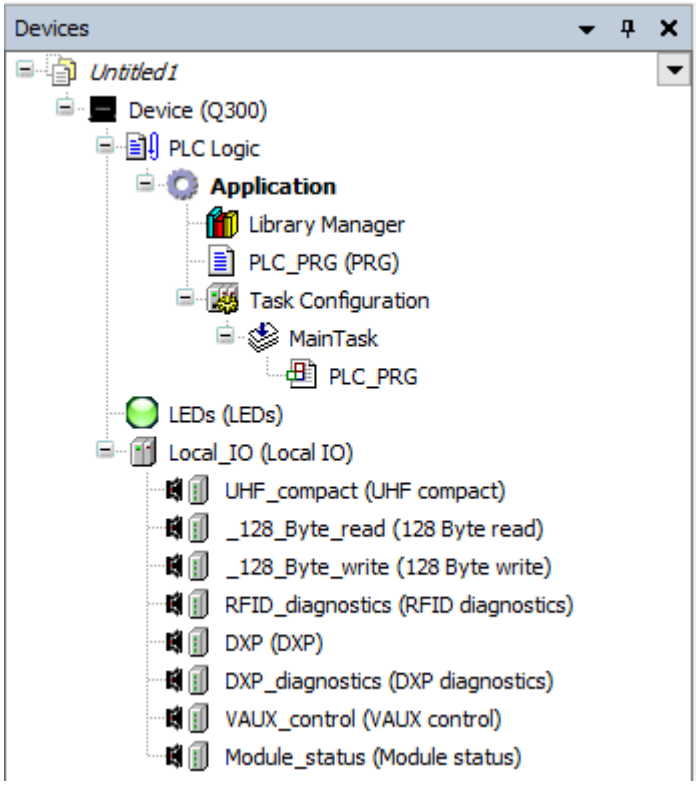


Fig. 114: TN-UHF-Q300-CDS-EU in the project tree

Adding an Ethernet adapter

- Right-click **Device (Q300)** in the project tree.
- Select **Add device**.
- Select Ethernet adapter.
- Click **Add device**.

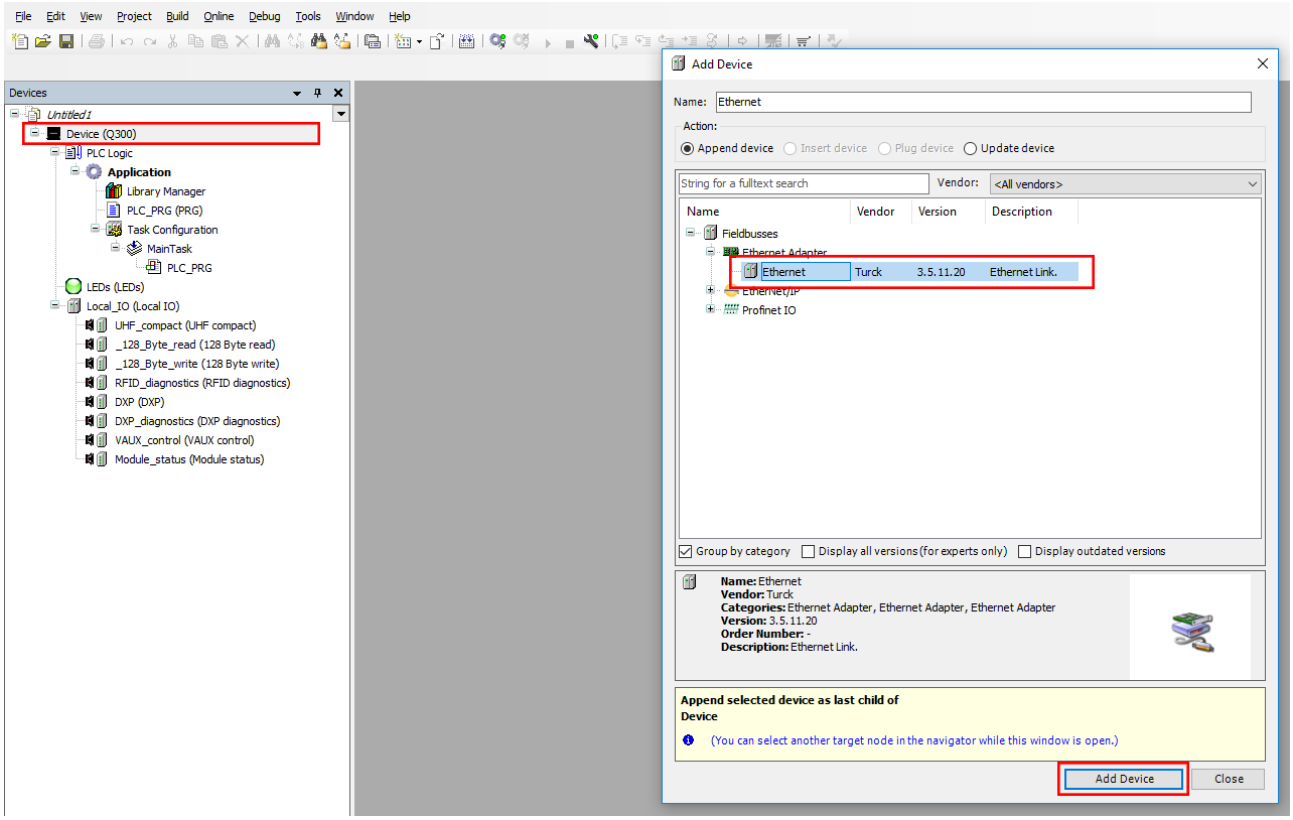


Fig. 115: Adding an Ethernet adapter

Adding a Modbus server

- ▶ Right-click **Ethernet (Ethernet)** in the project tree.
- ▶ Select **Add device**.
- ▶ Double-click the **Modbus TCP Server**.
- ⇨ The device appears as **Modbus_TCP_Server** in the project tree.
- ⇨ Modbus clients can be connected to the Modbus server.

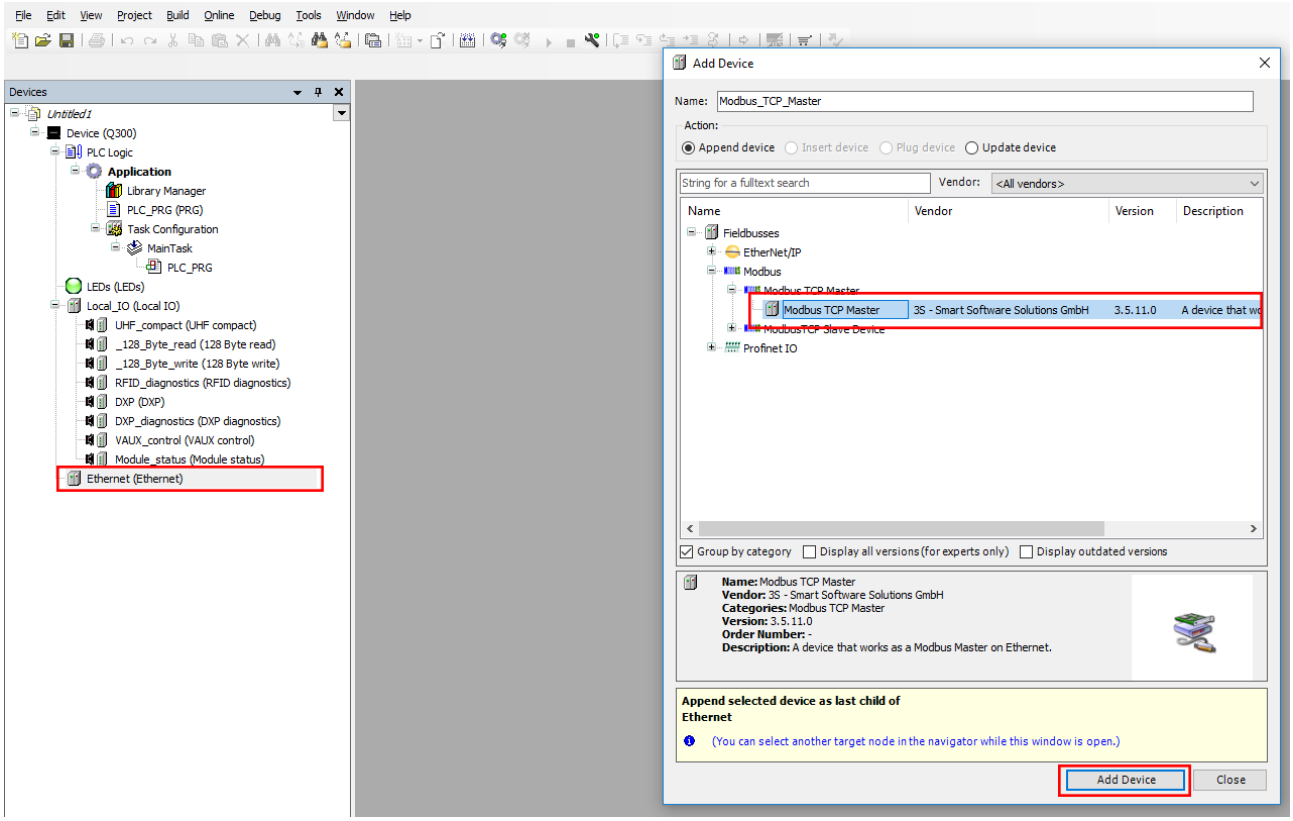


Fig. 116: Adding a Modbus server

Adding a Modbus client

- ▶ Right-click **Modbus_TCP_Server** in the project tree.
- ▶ Select **Add device**.
- ▶ Double-click **Modbus TCP Client**.
- ⇨ The device appears as **Modbus_TCP_Client** in the project tree.

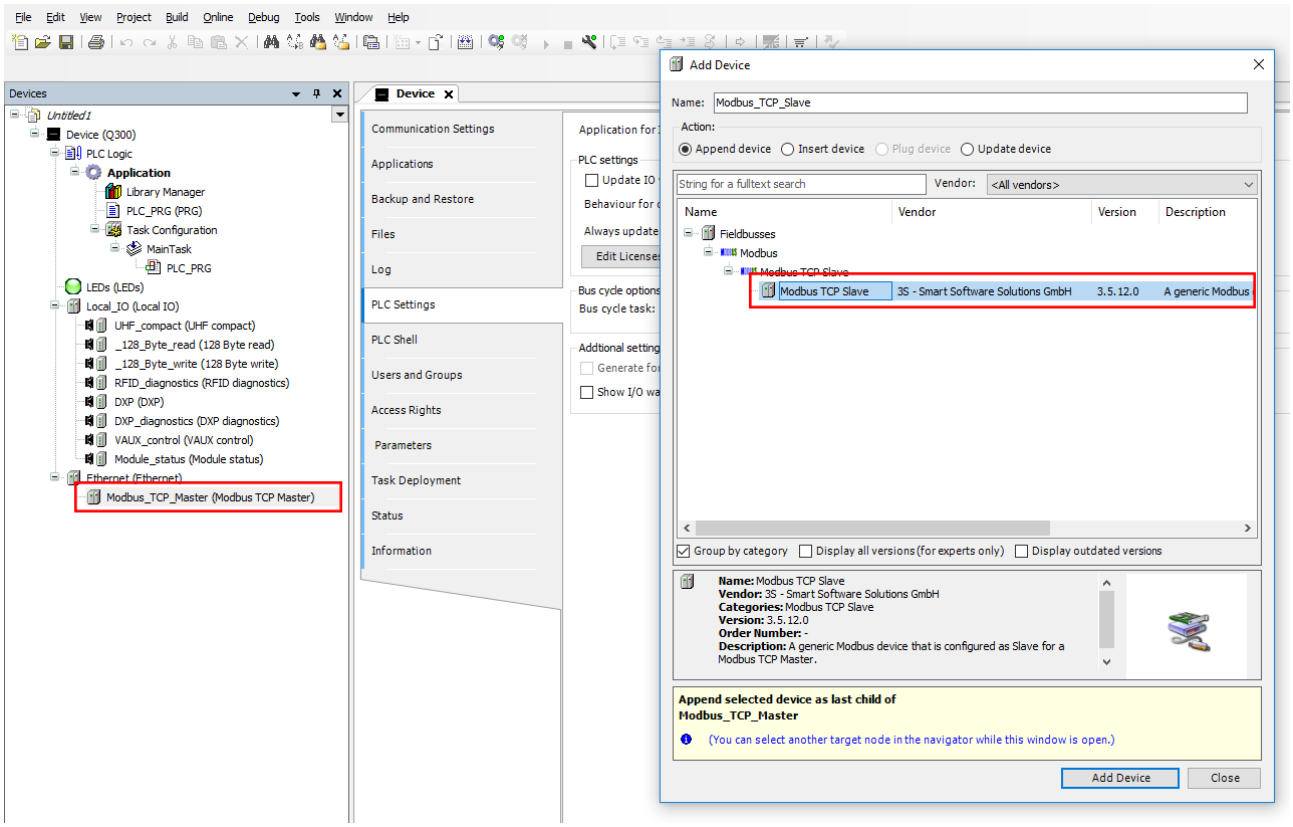


Fig. 117: Adding a Modbus client

7.10.1 Setting up the network interface

- Double-click **Device (Q300)** in the project tree.
- Choose the **Communication Settings** tab.
- Click **Scan network**.
- Select TN-UHF-Q300-CDS-EU and confirm with **OK** or a double-click.

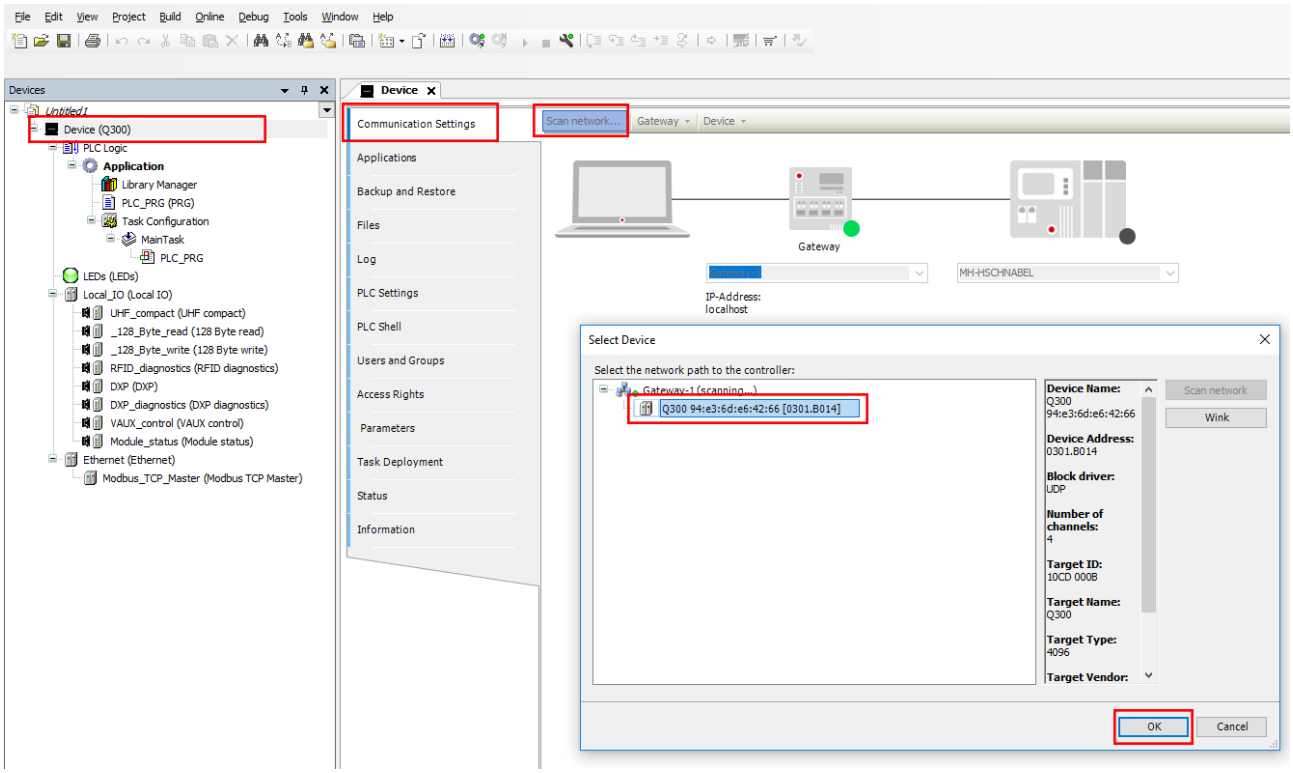


Fig. 118: Adding the network interface

- Select the **PLC Settings** tab.
- In the **Always update variables** drop-down menu, select the **Enabled 2 (always in bus cycle task)** option.

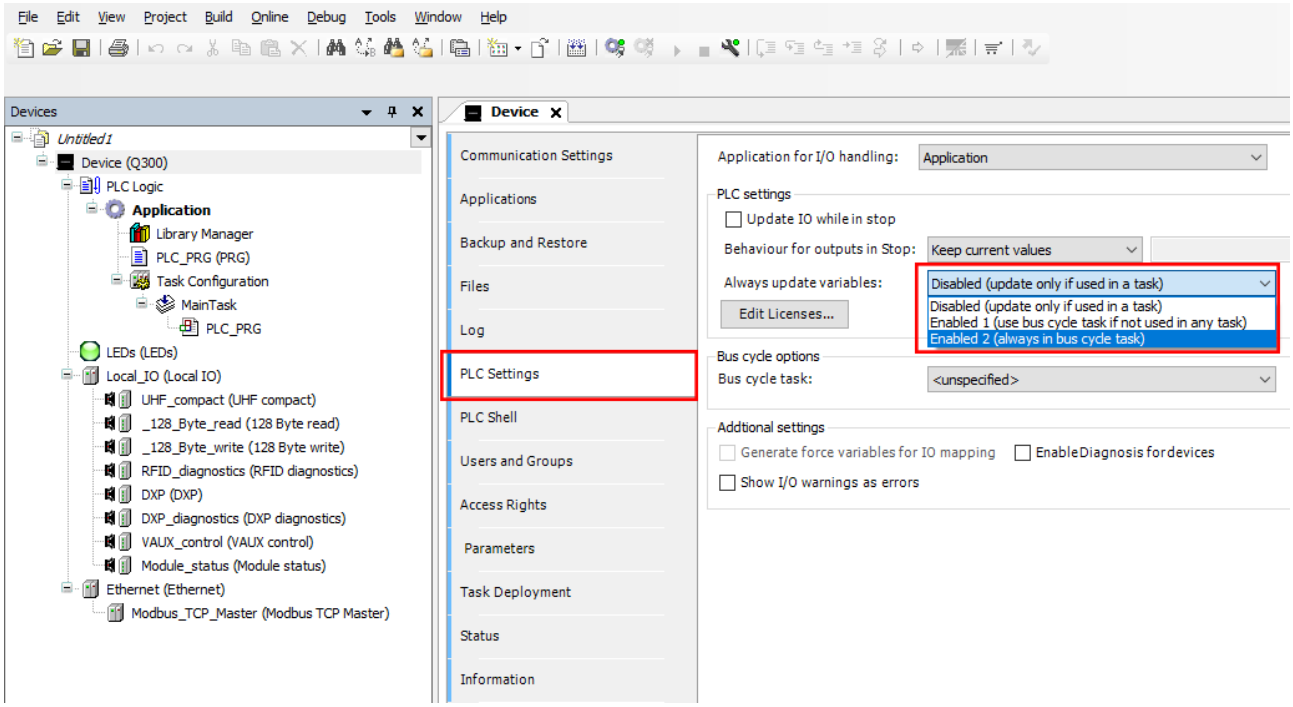


Fig. 119: Selecting an option – Always update variables option

- Double-click **Ethernet (Ethernet)** in the project tree.
- Enter the IP address of the Modbus master (here: 192.168.1.20).

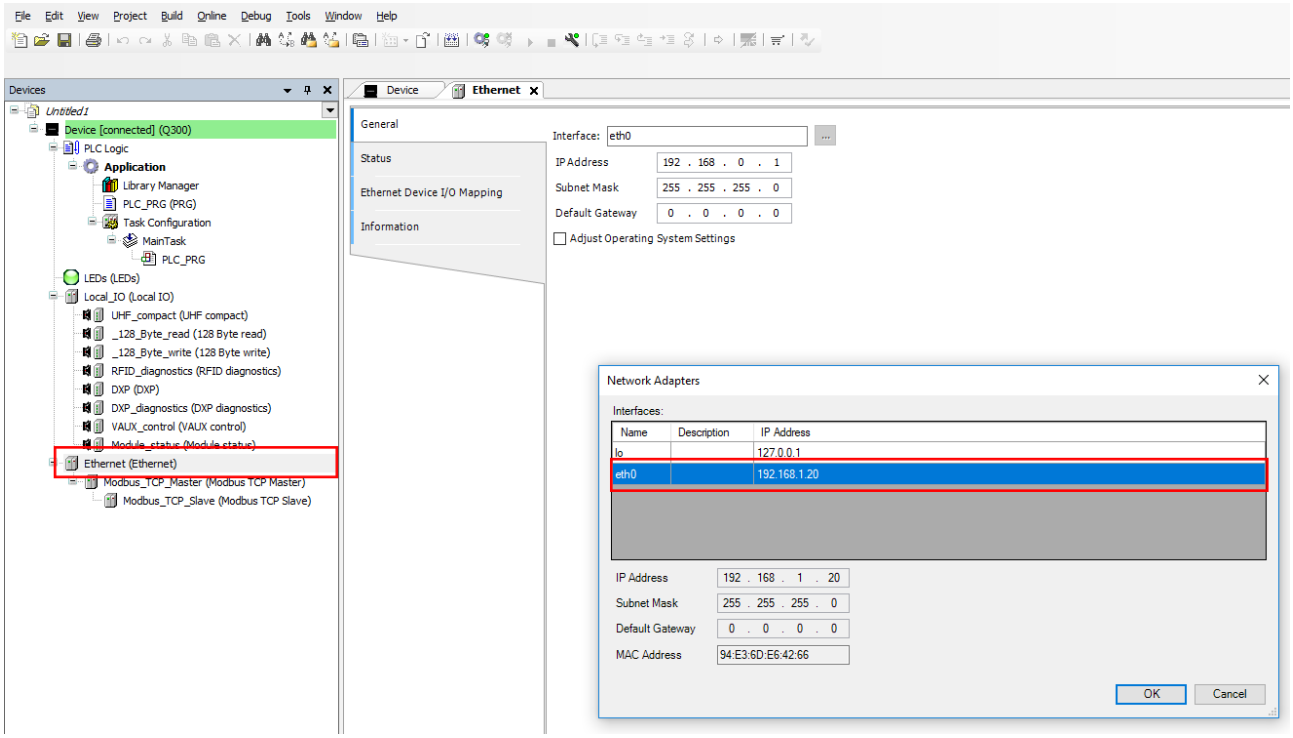


Fig. 120: Modbus master – enter the IP address

- Double-click **Modbus_TCP_Slave** in the project tree.
- Enter the IP address of the Modbus slave (here: 192.168.1.100).

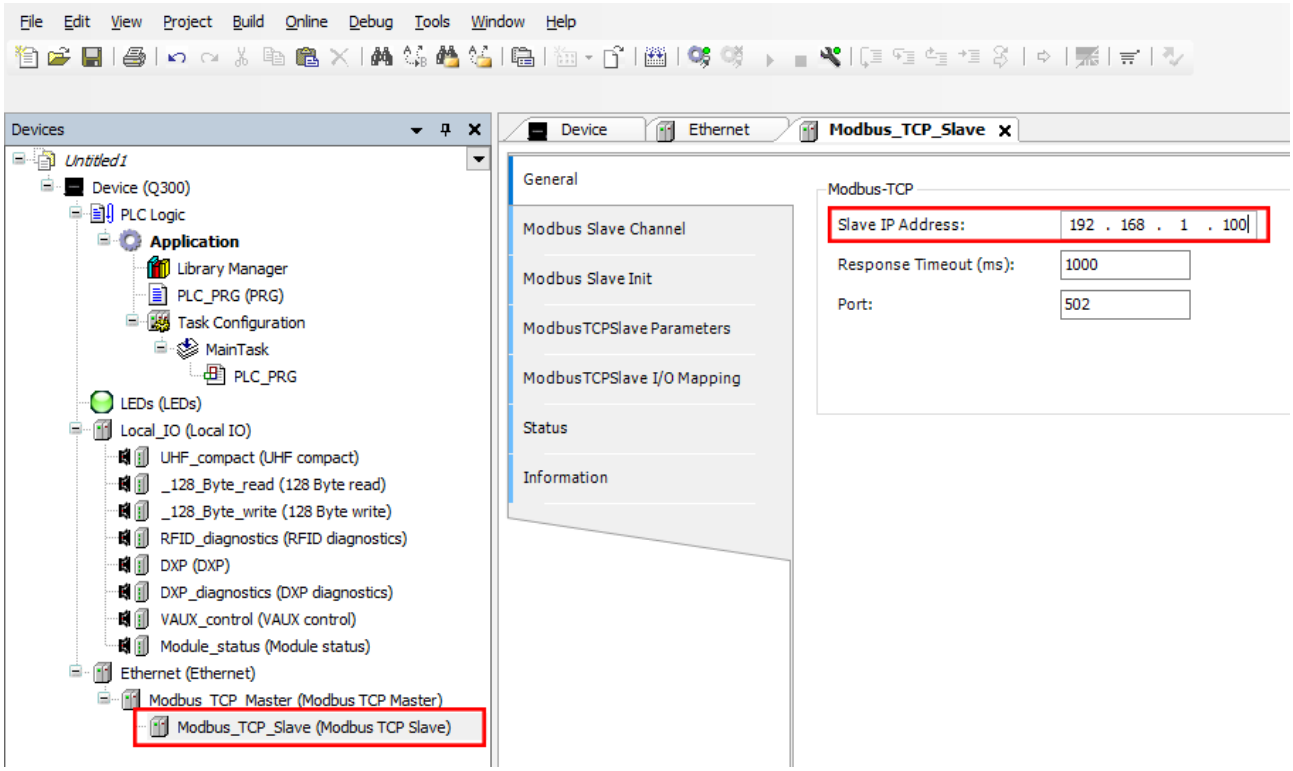


Fig. 121: Modbus slave – entering the IP address

7.10.2 Setting Modbus channels (registers)

Set channel 0 (input data)

- ▶ Double-click **Modbus TCP Slave**.
- ▶ Select in the **Modbus slave channel** tab → **Add channel**.
- ▶ Enter the following values:

- Name of channel
- Access type: Read input registers
- Offset: 0x0000
- Length: 64 registers (128 bytes)

- ▶ Confirm with **OK**.

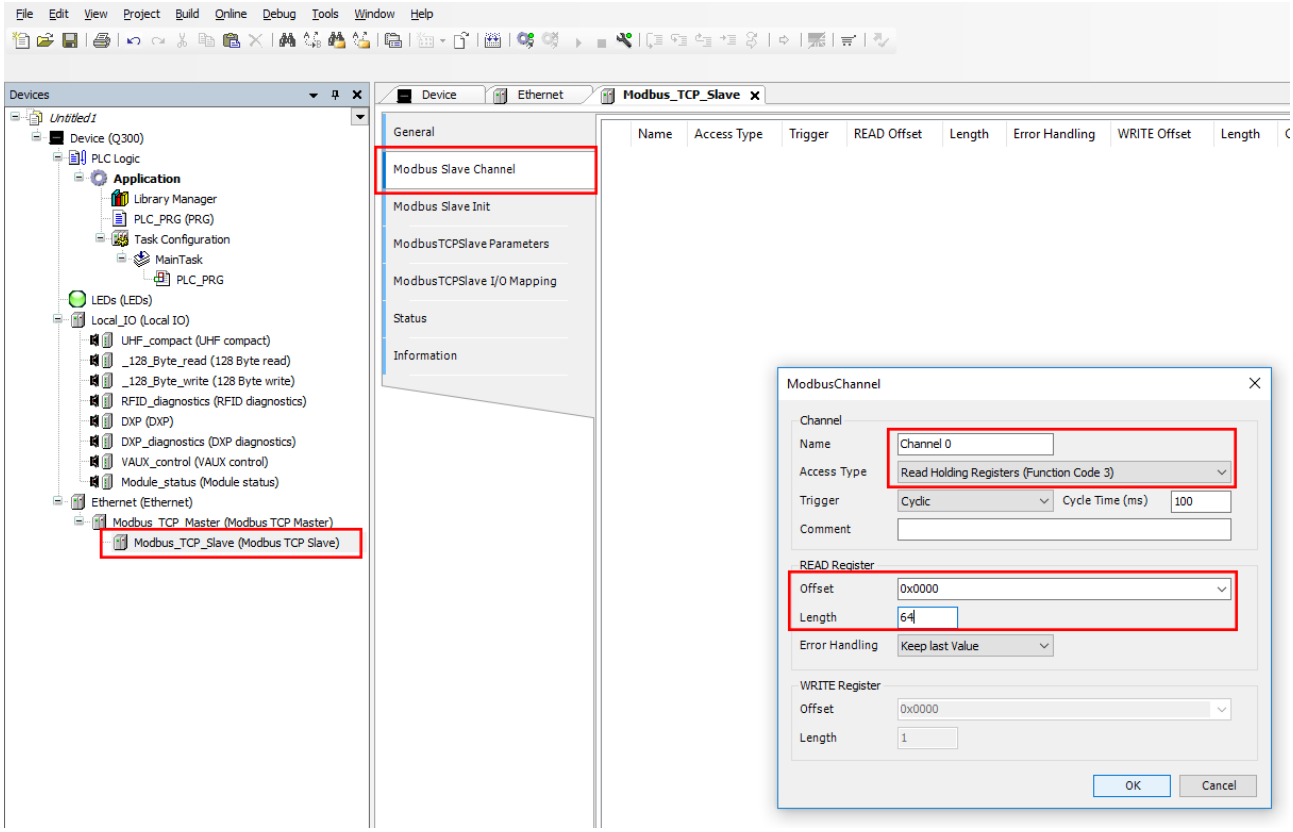


Fig. 122: Setting the READ register

Set channel 1 (output data)

- ▶ Double-click **Modbus TCP Slave**.
- ▶ Select in the **Modbus slave channel** tab → **Add channel**.
- ▶ Enter the following values:

- Name of channel
- Access type: Write multiple registers
- Offset: 0x0000
- Length: 64 registers (128 bytes)

- ▶ Confirm with **OK**.

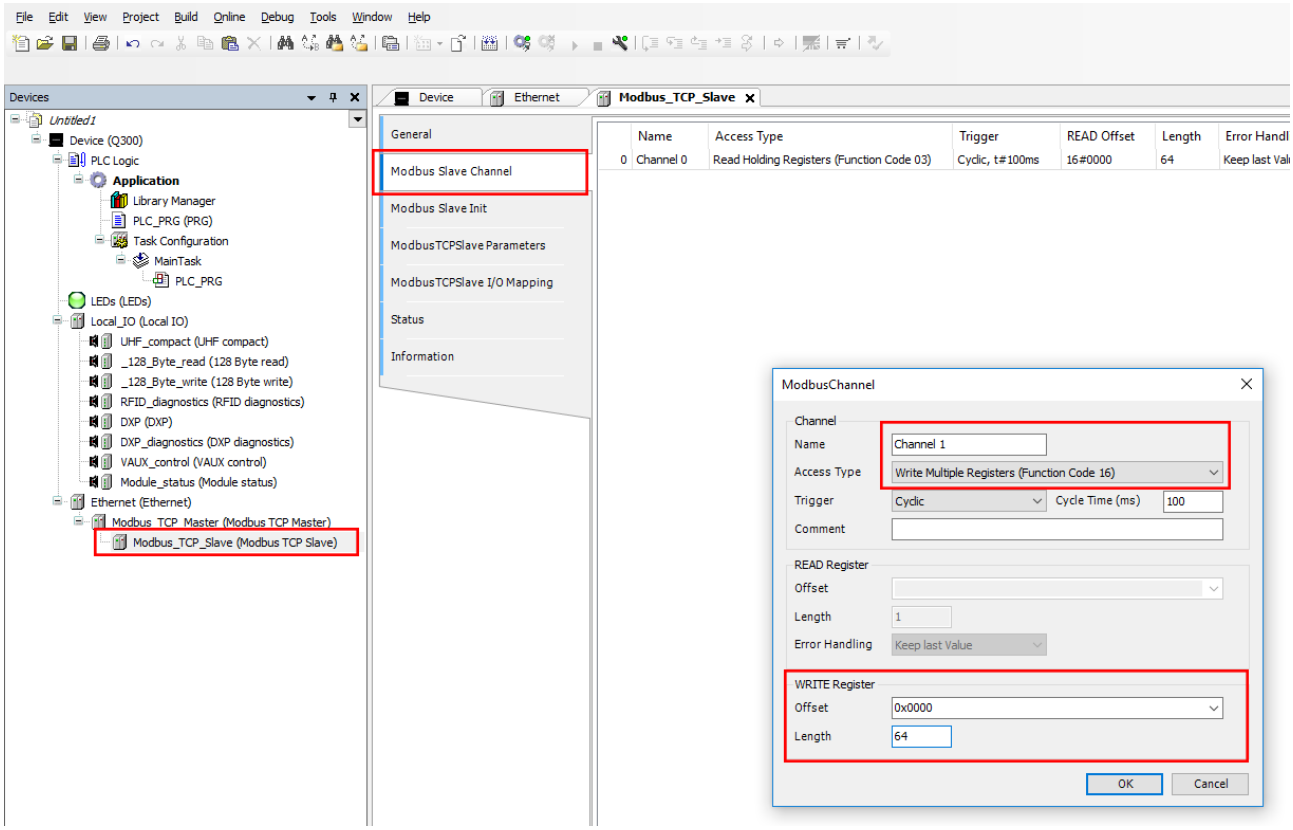


Fig. 123: Setting the WRITE registers

7.10.3 Connecting Modbus master and Modbus slave online

- ▶ Select the slave device.
- ▶ Click **Online** → **Login**.

7.10.4 Reading out process data

The I/O image of the slave can be viewed in Online mode.

- ▶ Double-click the Modbus TCP slave.
- ▶ Click the **Modbus TCP Slave I/O Mapping** tab.
- ⇨ The process data is displayed. In this example, the "Tag present" bit is set if a tag is present in the detection range of the read/write head connected to channel 1.

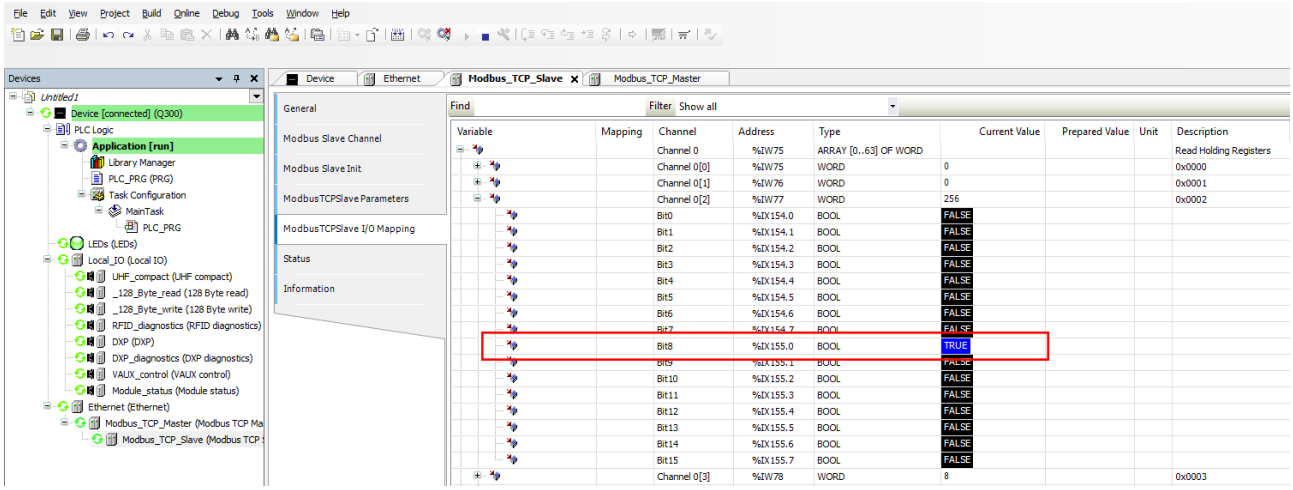


Fig. 124: Example: process data

Refer to the operating instructions of the connected slave for the mapping the channels (see figure below).

Description	Register		Bit offset	Bit length
	Channel 1	Channel 2		
Response code	0x0000	0x004C	0	14
Error	0x0000	0x004C	14	1
Busy	0x0000	0x004C	15	1
Tag within the detection range	0x0002	0x004E	0	1
Loop counter	0x0001	0x004D	0	8
Read/write head detuned	0x0002	0x004E	4	1

Fig. 125: Example: extract from the Modbus TCP mapping for the connected TBEN-S2-2RFID-4DXP slave device

7.11 Setting up a CODESYS OPC UA server

The following example shows the transfer of the **Tag present**, **Read UID** functions and a counter program to an OPC UA client. For this the symbol configuration must be set up in CODESYS.

Hardware used

- UHF reader TN-UHF-…-CDS

Software used

This example uses the following software:

- CODESYS 3.5.12 (available as a free download at www.turck.com)
- UA Expert

Prerequisites

- The software is started.
- A new project has been created.
- The controller has been added to the project.

Example: Setting up a CODESYS OPC UA server

- Add the symbol configuration in CODESYS.
- Activate OPC UA features.

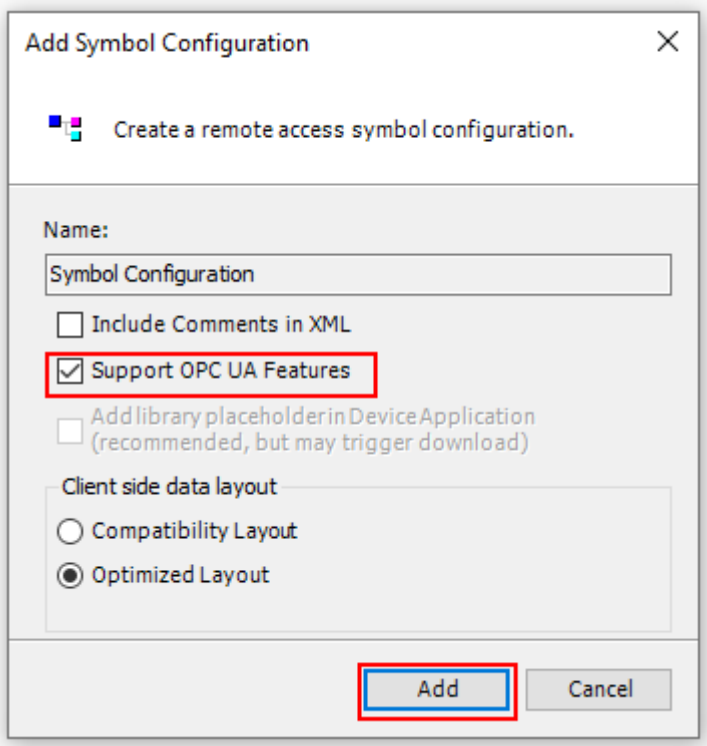


Fig. 126: CODESYS — Adding OPC UA features

- Optional: Activate OPC UA features in the settings at a later time.

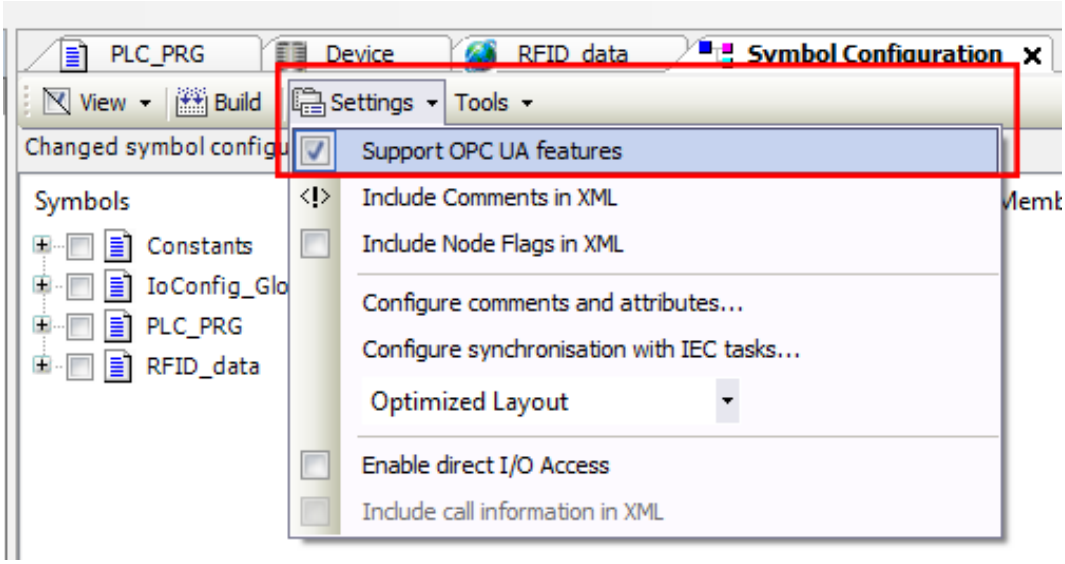


Fig. 127: CODESYS — Activating OPC UA features at a later time

- Select the functions in the symbol configuration that are to be transferred to the OPC UA client (in this case: test_counter, **TagPresent** and **UID**).

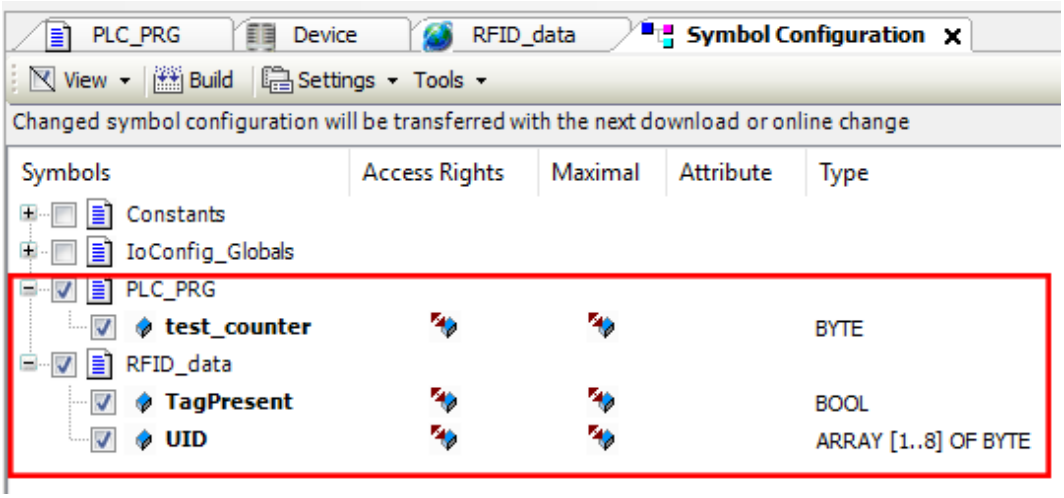


Fig. 128: CODESYS — Symbol configuration

- Write data to the device.
- Open the OPC UA client (example: UA Expert).
- Establish the connection between the OPC UA server and OPC UA client.

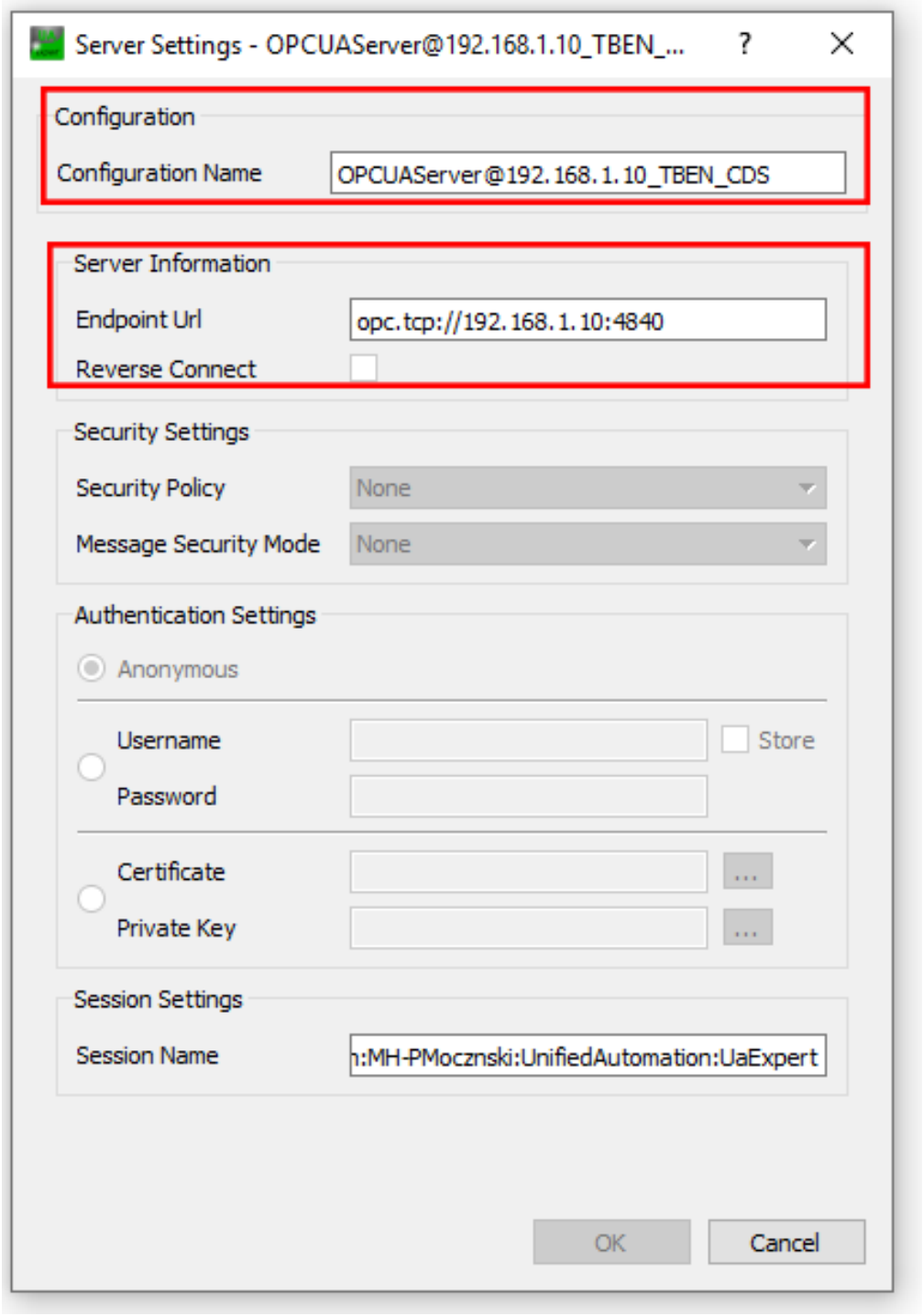


Fig. 129: UA Expert: Connect

The data is displayed in the OPC UA client.

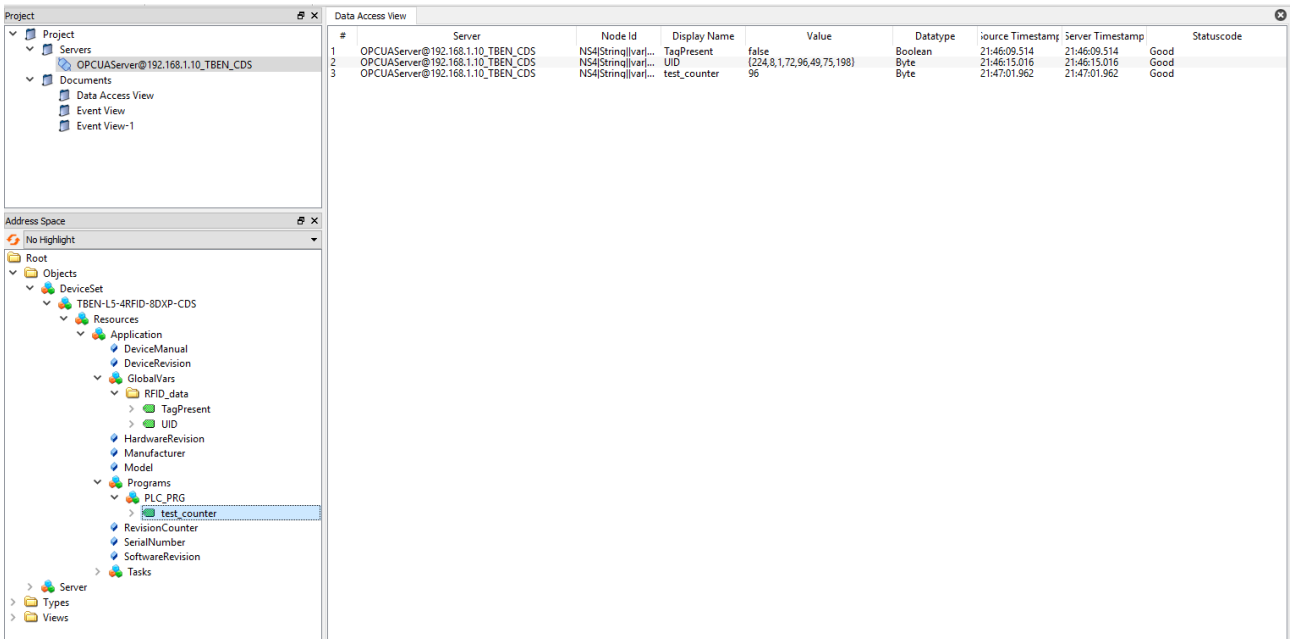


Fig. 130: UA Expert — Data in the OPC UA client

8 Setting

8.1 RFID channels – parameter data

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	Operating mode (Mode)							
1	Reserved							
2	Reserved							
3								
4								
5	DDI							
6	Reserved							
7	Reserved							
8	Command repetitions (CRET)							
9	Reserved							
10	Reserved							
11								
12	Reserved							
13								
14								
15								
16	Reserved							
17	…							
18								
19								
20								
21								
22								
23								
24								
25								
26								
27	Reserved							
28	Reserved							
29	Reserved							
30	Reserved							
31	Reserved							
32	Length of write data (WDS)							
33								
34	Length of read data (RDS)							
35								

8.1.1 Meaning of the parameter bits

The default values of the firmware, the DTM and the EDS file are shown in **bold** type. The default values for PROFINET may differ.

Designation	Meaning
Operating mode (OMRFID)	0: Deactivated **1: UHF compact** 2: UHF extended
Diagnostic input filter (DID)	**0: All diagnostic messages on** 1: Diagnostic messages off
Command repetitions in the event of an error (CRET)	Number of command repetitions after an error message, default setting: 2
Length of write data (WDS)	Size of the write data, default setting depends on the selected interface and fieldbus
Length of read data (RDS)	Size of the read data, default setting depends on the selected interface and fieldbus

8.1.2 Setting Continuous presence sensing mode

- ▶ Set adaptions to the presence sensing behavior in the DTM.
- ▶ Optional: Set the grouping of the EPCs via the **Start address** parameter:
  0: Grouping inactive
  1: Grouping active (same EPC is not detected, only the counter in the header is incremented)
- ▶ Execute the **Continuous Presence Sensing Mode** command.
- ⇨ The UHF-Reader head is switched to Presence Sensing Mode and sends all received data to the interface as soon as at least one tag is present in the detection range.
- ⇨ The data received by the UHF reader is stored in the FIFO memory of the interface.
- ▶ Send the **Idle** command (0x0000) to then read data from the buffer of the interface.

NOTE
The **Continuous Presence Sensing Mode** command also stays active after the idle command is sent.

- ▶ To pass on data from the FIFO memory of the interface to the controller, execute the **Read buffer (Cont. mode)** command (0x0011). The length of the data must be less than or equal to the value of the available data bytes (BYFI). Depending on the length of the data, the data is no longer used for grouping.

NOTE
With active grouping: Do not read data from the buffer until the number of available bytes is stable. If stable data has been collected, the command can be ended by a reset as the grouping is no longer based on the collected data, meaning that old EPCs are detected again.

- ▶ Do not perform a reset until the data has been read successfully from the buffer.
- ▶ To stop Continuous Presence Sensing Mode and clear the FIFO memory of the interface, send the **Reset** command (0x0800).

8.1.3 Transferring reader settings

The backup function enables the settings of a UHF reader to be transferred, e.g. when a device is replaced.

- ▶ Execute the **Backup settings UHF read/write head** command.
- ⇨ The settings of the UHF reader are stored in the interface.
- ▶ Replace the UHF reader.
- ▶ Execute the **Restore settings UHF read/write head** command.
- ⇨ The data stored in the interface is transferred to the UHF reader.

8.2 RFID channels – process input data

Process input data – UHF compact mode

Byte no.		Bit							
PROFINET	**Modbus EtherNet/ IP**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	Response code (RESCUHF)							
1	1								
2	2	Loop counter for rapid processing (RCNT)							
3	3	Reserved							
4	4		TRE1	PNS1					TP1
5	5							CMON	
6	6	Length (LEN)							
7	7								
8	8	Error code (ERRC)							
9	9								
10	10	Tag counter (TCNT)							
11	11								
12	16	Reserved							
13	17	Reserved							
14	18	Reserved							
15	19	Reserved							
16	20	Reserved							
17	21	Reserved							
18	22	Reserved							
19	23	Reserved							
20	24	Read data Byte 0							
…	…	…							
147	151	Read data Byte 127							

Process input data – UHF extended mode

Byte no.		Bit							
PROFINET	**Modbus EtherNet/ IP**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	Response code (RESCUHF)							
1	1								
2	2	Loop counter for rapid processing (RCNT)							
3	3	Reserved							
4	4		TRE1	PNS1					TP1
5	5							CMON	
6	6	Length (LEN)							
7	7								
8	8	Error code (ERRC)							
9	9								
10	10	Tag counter (TCNT)							
11	11								
12	12	Data (bytes) available (BYFI)							
13	13								
14	14	Read fragment no.							
15	15	Write fragment no.							
16	16	Reserved							
17	17	Reserved							
18	18	Reserved							
19	19	Reserved							
20	20	Reserved							
21	21	Reserved							
22	22	Reserved							
23	23	Reserved							
24	24	Read data Byte 0							
25	25	Read data Byte 1							
26	26	Read data Byte 2							
27	27	Read data Byte 3							
28	28	Read data Byte 4							
29	29	Read data Byte 5							
30	30	Read data Byte 6							
31	31	Read data Byte 7							
…	…	…							
151	151	Read data Byte 127							

8.2.1 Meaning of the status bits

Default values are shown in **bold** type.

Designation	Meaning
Response code (RESC)	Display of the last command executed
Loop counter for rapid processing (RCNT)	Output of the command code requested by the loop counter
Read/write head reports error (TRE1)	**0: No error** 1: Error message of the read/write head
Parameter not supported by read/write head (PNS1)	**0: No error** 1: Parameter not supported by read/write head
Tag within the detection range (TP1)	**0: No tag in detection range of read/write head** 1: Tag in detection range of read/write head
Continuous presence sensing mode active (CMON)	**0: Continuous presence sensing mode not active** 1: Continuous presence sensing mode active
Length (LEN)	Display of the length of the read data
Error code (ERRC)	Display of the specific error code if the error bit (ERROR) is set.
Tag counter (TCNT)	Display of the detected tags read with an Inventory command. The tag counter is reset by the following commands: ■ Inventory ■ Continuous presence sensing mode ■ Reset
Data (bytes) available (BYFI) (only available with UHF extended)	Shows the number of bytes in the FIFO memory of the interface. Ascending: New data from a tag read or received by the device Descending: Execution of a command completed Error message 0xFFFF: Memory overfilled, data loss of new data likely
Read fragment no. (RFN) (only available with UHF extended)	If the data to be read exceeds the size of the read data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the read fragment number appears in the process input data. After the confirmation the next fragment is read. 0: No fragmentation In Idle mode the size of fragments is stated. With a read command the number of fragments containing data is stated.
Write fragment no. (WFN) (only available with UHF extended)	If the data to be written exceeds the size of the write data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the write fragment number appears in the process input data. After the confirmation the next fragment is written. 0: No fragmentation In Idle mode the size of fragments is stated. With a write command the number of fragments containing data is stated.
Read data	User-defined read data

8.2.2 Tag in detection range (TP) – using bit or pre-loading the command

The **Tag in detection range** bit is set automatically if a read/write device detects a tag.

To set the bit in idle mode, the reader must be set to Presence sensing mode via the DTM.

All commands can be sent irrespective of whether the **Tag in detection range** bit (TP) is set. If no tag is present in the detection range when the command is sent, the command is executed by a rising edge at TP. A command is executed immediately if there is a tag in the detection range at the time of sending.

NOTE
If the reader detects a new tag in the detection range, the **Tag in detection range** bit and the UID are displayed simultaneously in idle mode. If two tags follow one another quickly, the TP bit may remain set. The UID of the second tag is displayed.

8.3 RFID channels – process output data

Process output data – UHF compact mode

Byte no.		Bit							
PROFINET	**Modbus EtherNet/ IP**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	Command code (CMDC)							
1	1								
2	2	Loop counter for rapid processing (RCNT)							
3	3	Memory area (DOM)							
4	4	Start address (ADDR)							
5	5								
6	6								
7	7								
8	8	Length (LEN)							
9	9								
10	10	Length of EPC (SOUID)							
11	11	Reserved							
12	24	Write data Byte 0							
13	25	Write data Byte 1							
14	26	Write data Byte 2							
15	27	Write data Byte 3							
16	28	Write data Byte 4							
17	29	Write data Byte 5							
18	30	Write data Byte 6							
19	31	Write data Byte 7							
…	…	…							
131	151	Write data Byte 127							

Process output data – UHF extended mode

Byte no.		Bit							
PROFINET	**Modbus EtherNet/IP**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	Command code (CMDCUHF)							
1	1								
2	2	Loop counter for rapid processing (RCNT)							
3	3	Memory area (DOM)							
4	4	Start address (ADDR)							
5	5								
6	6								
7	7								
8	8	Length (LEN)							
9	9								
10	10	Length of EPC (SOUID)							
11	11	reserved							
12	12	Timeout (TOUT)							
13	13								
14	14	Read fragment number (RFN)							
15	15	Write fragment number (WFN)							
16	16	Reserved							
17	17	Reserved							
18	18	Reserved							
19	19	Reserved							
20	24	Write data Byte 0							
21	25	Write data Byte 1							
22	26	Write data Byte 2							
23	27	Write data Byte 3							
24	28	Write data Byte 4							
25	29	Write data Byte 5							
26	30	Write data Byte 6							
27	31	Write data Byte 7							
…	…	…							
139	151	Write data Byte 127							

8.3.1 Meaning of the command bits

Description	Meaning
Command code (CMDCUHF)	Enter the command code
Loop counter for rapid processing (LCNT)	Loop counter for repeated processing of a command 0: Loop counter off
Memory area (DOM)	0: Kill password 1: EPC 2: TID 3: USER area 4: Access password 5: PC (size of EPC)
Start address (ADDR) in bytes	Enter the address where a command is to be sent (e.g. memory area of a tag)
Length (LEN) in bytes	Enter the length of the data to be read or written
Length of EPC (SOUID) in bytes	**Inventory command:** 0: Transfer the actual length (bytes) of the transferred EPC during an inventory operation. > 0: EPC completely output **Other commands:** Enter EPC size in bytes, if a particular tag is read, written or protected. The EPC must be defined in the write data (start byte: 0). The function of the length of the EPC depends on the command used. 0: No entry of an EPC for executing the command. Only one tag can be located in the detection range of the read/write head. > 0: EPC length of the tag to be read, written or protected if an EPC is present in the write data.
Timeout (TOUT)	Time in ms in which one command is to be executed. If a command is not executed within the entered time, the device outputs an error message. 0: No timeout, command stays active until the first tag was read. 1: Command is executed once (if there is already a tag in the detection range) > 1…65535: Time in ms Inventory: Command active for the entire specified time
Read fragment no. (RFN)	If the data to be read exceeds the size of the read data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the read fragment number appears in the process input data. After the confirmation the next fragment is read. 0: No fragmentation In Idle mode the size of fragments is stated. With a read command the number of the fragments containing data is stated.
Write fragment no. (WFN)	If the data to be written exceeds the size of the write data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the write fragment number appears in the process input data. After the confirmation the next fragment is written. 0: No fragmentation In Idle mode the size of fragments is stated. With a write command the number of the fragments is stated that contain data.
Write data	User-defined write data or entry of an EPC to select a specific tag for the command execution (if the **Length of EPC (SOUID)** command parameter is greater than 0).

8.4 Digital channels — parameter data

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	SRO7	SRO6	SRO5	SRO4				
1	OE7	OE6	OE5	OE4				

8.4.1 Meaning of the parameter bits

Default values are shown in **bold**.

Designation	Meaning
Manual reset after overcurrent (SRO…)	**0: No (the output automatically switches back on after an overcurrent.)** 1: Yes (the output only switches back on after the overcurrent is removed and the switch signal is reset.)
Activate output (OE…)	**0: No (output deactivated)** 1: Yes (output activated)

8.5 Digital channels — process input data

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	DXP7	DXP6	DXP5	DXP4				
1								

8.5.1 Meaning of the status bits

Designation	Meaning
DXP4	0: Off (digital channel 1 not active) 1: On (digital channel 1 active)
DXP5	0: Off (digital channel 2 not active) 1: On (digital channel 2 active)
DXP6	0: Off (digital channel 3 not active) 1: On (digital channel 3 active)
DXP7	0: Off (digital channel 4 not active) 1: On (digital channel 4 active)

8.6 RFID channels — overview of the commands

RFID commands are initiated via the command code in the process output data of an RFID channel. The commands can be executed with or without a loop counter function. The loop counter must be set individually for each new command.

NOTE
After commands are executed without the loop counter function, the device must be reset to the Idle state before a new command is sent.

▶ After a command is executed, send an idle command to the device.

Command	Command code		Possible for	
	hex.	dec.	UHF compact	UHF extended
Idle	0x0000	0	x	x
Inventory	0x0001	1	x	x
Fast inventory	0x2001	8193	x	x
Read	0x0002	2	x	x
Fast read	0x2002	8194	x	x
Write	0x0004	4	x	x
Fast write	0x2004	8196	x	x
Write and verify	0x0008	8	x	x
Continuous mode	0x0010	16	–	x
Get data from buffer (Continuous mode)	0x0011	17	Max. 128 bytes	x
Get data from buffer with fast command processing (Continuous mode)	0x2011	8209	Max. 128 bytes	x
Continuous presence sensing mode	0x0020	32	–	x
End Continuous (presence sensing) mode	0x0012	18	–	x
Read/write head identification	0x0041	65	x	x
Direct read/write head command	0x0060	96	x	x
Direct read/write head command with fast command processing	0x2060	8288	x	x
Set tag password	0x0102	258	x	x
Set tag password with fast command processing	0x2102	8450	x	x
Set read/write head password	0x0100	256	x	x
Reset read/write head password	0x0101	257	x	x
Set tag protection	0x0103	259	x	x
Set tag protection with fast command processing	0x2103	8451	x	x
Set permanent lock (Lock)	0x0105	261	x	x
Set permanent lock with fast command processing	0x2105	8453	x	x
Tag info	0x0050	80	x	x

Command	Command code		Possible for	
	hex.	dec.	UHF compact	UHF extended
Tag info with fast command processing	0x2050	8272	x	x
Kill UHF tag	0x0200	512	x	x
Kill UHF tag with fast command processing	0x2200	8704	x	x
Restore UHF read/write head settings	0x1000	4096	x	x
Backup settings of the UHF read/write head	0x1001	4097	x	x
Query error/status of UHF read/write head	0x0042	66	x	x
Reset	0x8000	32768	x	x

8.6.1 Command: Idle

The **Idle** command switches the interface to idle mode. Command execution is canceled. The EPC is displayed if the reader is configured in Presence Sensing Mode via TAS or the web server.

Overview of output data

Request	
Loop counter	Not required
Command code	0x0000 (hex.), 0 (dec.)
Read/write head address	Not required
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	Not required
Write fragment no.	Not required
Read fragment no.	Not required
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0000 (hex.), 0 (dec.)
Length	EPC length of the tag in the detection range
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	Size of the fragment
Read fragment no.	Size of the fragment
Read data, byte 0…n	EPC of the tag in the detection range

8.6.2 Command: Inventory

The **Inventory** command triggers the reader to search for tags in the detection range and to read the EPC or, if activated in the UHF reader, the RSSI of the tags. The inventory command can be executed in single-tag mode and in multi-tag mode.

NOTE
The command code for rapid processing with the loop counter is 0x2001 (hex.) or 8193 (dec.).

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0001 (hex.), 1 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	1: Grouping of the EPCs active 0: Grouping of the EPCs inactive
Length	0: The actual length (bytes) of the transferred EPC is transferred with an inventory. > 0: EPC is output in full.
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0001 (hex.), 1 (dec.)
Length	Length of the read data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	Ascending
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0…n	See example: UHF read data

Data format in UHF applications

The UHF read data is formatted by a header. The header has the following structure:

Type	Name	Meaning
uint8_t	Size	Data size
uint8_t	Block type	1: EPC etc. other values: reserved
uint8_t	Data [size]	EPC and read data

The size of EPC/RSSI etc. is dependent on the reader settings.

Reading out the RSSI value

The RSSI value is output in binary code in 2 bytes and corresponds to the two's complement of the output binary code. Mapped to a signed integer, the 2 bytes output correspond to ten times the actual RSSI value. Refer to the following table for an example of the RSSI value:

MSB…LSB (decimal)	MSB…LSB (binary)	Two's complement	RSSI (dBm)
252 253	11111100 11111101	-771	-77.1

Example: UHF read data (header and EPC, grouping deactivated)

Type	Name	Meaning
uint8_t	Size	14
uint8_t	Block type	1
uint8_t	Data [14]	uint8_t EPC [12] uint16_t Number of the antenna (LSB → MSB) [2]

Example: UHF read data (header and EPC, grouping activated)

Type	Name	Meaning
uint8_t	Size	16
uint8_t	Block type	1
uint8_t	Data [16]	uint8_t EPC [12] uint16_t Number of the antenna (LSB → MSB) [2] uint16_t Number of the read operations (LSB → MSB) [2]

Example: UHF read data (header and EPC, grouping with RSSI activated)

Type	Name	Meaning
uint8_t	Size	16
uint8_t	Block type	1
uint8_t	Data [20]	uint8_t EPC [12] uint16_t RSSI [2] uint16_t Number of the antenna (LSB → MSB) [2] uint16_t Number of the read operations (LSB → MSB) [2]

Byte	Content	Meaning
0	Data size (EPC + number of read operations)	2 byte header
1	UHF memory range	
3…13	EPC	12 bytes EPC
14	LSB	2 bytes RSSI
15	MSB	
16	LSB	2 bytes Number of the antenna: ■ 0: RHCP ■ 1: LHCP ■ 2: Horizontal ■ 3: Vertical ■ 4: External 1 ■ 5: External 2 ■ 6: External 3 ■ 7: External 4
17	MSB	
18	LSB	2 bytes Number of read operations
19	MSB	

Example: UHF read data (header, EPC, grouping with RSSI, slot, time, phase activated)

Type	Name	Meaning
uint8_t	Size	24
uint8_t	Block type	1
uint8_t	Data [24]	uint8_t EPC [12] uint16_t RSSI (LSB → MSB) uint16_t Slot (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of the antenna (LSB → MSB) [2] uint16_t Number of read operations (LSB → MSB)

8.6.3 Command: Read

The **Read** command is used by the reader to read data of tags in the detection range. 128 bytes are transferred by default in a read process. Larger data quantities can be transferred in fragments. If a specific EPC is specified, the reader reads the corresponding tags only. All other tags in the detection range are ignored in this case.

NOTE
The command code for rapid processing with the loop counter is 0x2002 (hex.) or 8194 (dec.).

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0002 (hex.), 2 (dec.)
Memory area	See description of the output data
Read/write head address	See description of the output data
EPC length	The EPC size should be entered in bytes if a particular tag is to be read. The EPC must be defined in the write data (start byte: 0). The function of the EPC length depends on the command used. 0: No entry of a EPC for executing the command. Only one tag may be in the detection range of the read/write head. > 0: EPC length of the tag to be read if a EPC is present in the write data.
Start address	Start address of the memory area on the tag that is to be read (specification in bytes)
Length	Length of the data to be read in bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0… (EPC size-1)	EPC of the tag to be read
Write data, byte (EPC size)…127	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0002 (hex.), 2 (dec.)
Length	Length of the read data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	increases during command execution
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0…n	read data

8.6.4 Command: Write

The **Write** command is used by the reader to write data to tags in the detection range. 128 bytes are transferred in a write operation by default. Larger data quantities can be transferred in fragments. If a specific EPC is specified, the reader writes the corresponding tags only. All other tags in the detection range are ignored in this case.

NOTE

▶ With multi-tag applications, specify the EPC of the tag that is to be written.

NOTE

The command code for rapid processing with the loop counter is 0x2004 (hex.) or 8196 (dec.).

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0004 (hex.), 4 (dec.)
Memory area	See description of the output data
Read/write head address	See description of the output data
EPC length	The EPC size should be entered in bytes if a particular tag is to be written. The EPC must be defined in the write data (start byte: 0). The function of the EPC length depends on the command used. 0: No entry of a EPC for executing the command. Only one tag may be in the detection range of the read/write head. > 0: EPC length of the tag to be written if a EPC is present in the write data.
Start address	Start address of the memory area on the destination tag (specified in bytes)
Length	Length of data to be written in bytes
Command timeout	See description of the output data
Write fragment no.	1: Using fragmentation 0: Do not use fragmentation
Read fragment no.	0
Write data, byte 0…(size of the EPC-1)	EPC of the tag to be written
Write data, byte (size of the EPC)...127	Write data

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0004 (hex.), 4 (dec.)
Length	Length of the read data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	increases during command execution
Tag counter	See description of the input data
Write fragment no.	See description of the input data
Read fragment no.	0
Read data, byte 0...127	Not required

8.6.5 Command: Write and verify

The **Write with validation** command writes a number of bytes defined by the user. The data written is also sent back to the interface and validated. When writing, up to 128 bytes are transferred by default. Larger data quantities can be transferred in fragments. The data written is validated in the interface only, and not sent back to the controller. If the validation fails, a fault signal is output. If the command is processed without a fault signal, the data has been validated successfully.

NOTE

▶ With multi-tag applications, specify the EPC of the tag that is to be written.

NOTE

The command code for rapid processing with the loop counter is 0x2008 (hex.) or 8200 (dec.).

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0008 (hex.), 8 (dec.)
Memory area	See description of the output data
Read/write head address	See description of the output data
EPC length	The EPC size should be entered in bytes if a particular tag is to be written. The EPC must be defined in the write data (start byte: 0). The function of the length of the EPC depends on the command used. 0: No entry of a EPC for executing the command. Only one tag can be located in the detection range of the reader. > 0: EPC length of the tag to be written if a EPC is present in the write data.
Start address	Start address of the memory area on the destination tag (specified in bytes)
Length	Length of data to be written in bytes
Command timeout	See description of the output data
Write fragment no.	1: Using fragmentation 0: Do not use fragmentation
Read fragment no.	0
Write data, byte 0… (EPC size-1)	Optional: EPC of the tag to be written
Write data, byte (EPC size)…127	Write data

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0008 (hex.), 8 (dec.)
Length	Length of the read data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	increases during command execution
Tag counter	See description of the input data
Write fragment no.	See description of the input data
Read fragment no.	0
Read data, Byte 0…MIN(127, set length-1)	Not required

8.6.6 Command: Continuous mode

In Continuous Mode, a user-defined command is sent to the reader and stored in the reader. The write, read and inventory commands can be executed in continuous mode. The parameters for Continuous Mode must be set direct in the reader.

The command is executed continuously until the user stops continuous mode. Continuous mode can be stopped with a reset command.

NOTE
The reset command resets all read data.

Readers in Continuous Mode send all command-specific data to the interface. The data is stored in the FIFO memory of the interface and can be queried by the controller via the **Get Data from FIFO** command.

Commands in Continuous Mode are triggered if the reader detects a tag. If there is a tag in the detection range of the reader when starting Continuous Mode, the command sent in Continuous Mode is not executed until the next tag.

NOTE
In Continuous mode the **Tag in detection range** signal is not updated.
Start address and length cannot be changed during the execution of Continuous mode.
After a restart of continuous mode, all data of the continuous mode already running is deleted.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0010 (hex.), 16 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	1: Grouping of the EPCs active (UHF inventory only) 0: Grouping of the EPCs inactive (UHF inventory only) >1: not defined
Length	Not required
Command timeout	Not required
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0010 (hex.), 16 (dec.)
Length	0
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	increases during command execution
Tag counter	increases with each read or written EPC
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	See description of the input data

8.6.7 Command: Get data from buffer (Continuous mode)

NOTE
The command code for fast processing with the loop counter is 0x2011 (hex.) or 8209 (dec.).

The **Get data from buffer (Continuous Mode)** command passes on data stored in the interface to the controller. The command is required to transfer read data to the controller in continuous mode or in continuous presence sensing mode. The data is transferred to the controller in fragments of up to 128 bytes. The size of the fragments can be set by the user. A EPC is not divided by fragment limits. If a EPC does not fit completely in a fragment, it is automatically moved to the next fragment.

NOTE
The **Get data from buffer** command does not end Continuous mode.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0011 (hex.), 17 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Not required
Length	Max. length of the data to be read by the device (≤ size of the data that the device has actually stored), entered in bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0011 (hex.), 17 (dec.)
Length	Length of the read data. The data is specified in complete blocks.
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	is reduced automatically after the command execution
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Read data

Data format in UHF applications

The UHF read data is formatted by a header. The header has the following structure:

Type	Name	Meaning
uint8_t	Size	Data size
uint8_t	Block type	1: EPC etc. other values: reserved
uint8_t	Data [size]	EPC and read data

The size of EPC/RSSI etc. is dependent on the reader settings.

Example: UHF read data (header and EPC, grouping deactivated)

Type	Name	Meaning
uint8_t	Size	14
uint8_t	Block type	1
uint8_t	Data [14]	uint8_t EPC [12] uint16_t Number of the antenna (LSB → MSB) [2]

Example: UHF read data (header and EPC, grouping activated)

Type	Name	Meaning
uint8_t	Size	16
uint8_t	Block type	1
uint8_t	Data [16]	uint8_t EPC [12] uint16_t Number of the antenna (LSB → MSB) [2] uint16_t Number of the read operations (LSB → MSB) [2]

Example: UHF read data (header, EPC, grouping with RSSI, slot, time, phase activated)

Type	Name	Meaning
uint8_t	Size	24
uint8_t	Block type	1
uint8_t	Data [24]	uint8_t EPC [12] uint16_t RSSI (LSB → MSB) uint16_t Slot (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of the antenna (LSB → MSB) [2] uint16_t Number of read operations (LSB → MSB)

8.6.8 Command: UHF continuous presence sensing mode

In Continuous Presence Sensing Mode, a user-defined command (write, read, inventory) is sent to the UHF reader and stored in the reader. In Continuous Presence Sensing Mode, the readers are automatically switched on as soon as a tag is located in the detection range. The duration of the query interval and the duty cycle can be adapted in the settings of the UHF reader. The command is executed continuously until the user ends the Continuous presence sensing mode by executing a reset command.

NOTE
The reset command resets all read data.

Readers in Continuous Presence Sensing Mode send all command-specific data to the interface. The data is stored in the buffer of the interface and can be queried by the controller via the **Get data from buffer** command. In Continuous presence sensing mode the **Tag in detection range** signal is not permanently updated.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0020 (hex.), 32 (dec.)
Read/write head address	See description of the output data
Length of EPC	Not required
Start address	0: Grouping inactive 1: Grouping active >1: not defined
Length	Not required
Command timeout	Not required
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0020 (hex.), 32 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	increases during command execution
Tag counter	Increases with each read or written EPC
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	See description of the input data

8.6.9 Command: End Continuous (presence sensing) mode

Continuous mode and presence sensing mode can be stopped via the **Shut down Continuous (presence sensing) mode** command. The data in the buffer of the interface is not deleted after the command is executed and can still be called up via the **Get data from buffer** command.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0012 (hex.), 18 (dec.)
Read/write head address	Not required
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0012 (hex.), 18 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.10 Command: Read/write head identification

The **Read/write head identification** command scans the following parameters of the connected reader:

- ID
- Serial number
- Hardware version
- Firmware version

The parameters are summarized in the reader in the identification record.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0041 (hex.), 65 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Start address in the identification record, specification in bytes
Length	Length of the data to be queried 0: Read full parameter set
Command timeout	Not required
Write fragment no.	Not required
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0041 (hex.), 65 (dec.)
Length	See description of the input data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	increases with each read or written EPC
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0...19	ID: ARRAY [0…19] of BYTE
Read data, byte 20...35	Serial number: ARRAY [0…15] of BYTE
Read data, byte 36...37	Hardware version: INT16 (Little Endian)
Read data, byte 38...41	Firmware status: ARRAY [0…] of BYTE: V (0x56), x, y, z (Vx.y.z)
Read data, byte 42...119	Not required

8.6.11 Direct read/write head command

NOTE
The command code for fast processing with the loop counter is 0x2060 (hex.) or 8288 (dec.).

Commands from the reader protocol can be sent direct to the reader via a direct command. The commands are defined and interpreted via specifications in the read and write data.

NOTE
The reader protocol is not part of this documentation and has to be requested from and specially released by TURCK. Questions on the reader protocol should be addressed to TURCK.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0060 (hex.), 96 (dec.)
Read/write head address	See description of the output data
EPC length	0
Start address	Not required
Length	Length of the description of the direct command in the write data, specification in bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Description of the direct command

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0060 (hex.), 96 (dec.)
Length	Length of the description of the direct command in the write data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Response to the direct command

Example: Direct command in UHF applications (query reader version)

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
Length of EPC	0
Start address	0
Length	2
Command timeout	200
Write fragment no.	0
Read fragment no.	0
Write data	0x02 (CMD), 0x00 (application) — see debus protocol

Response	
Loop counter	0
Response code	0x0060
Length	12
Error code	0
Tag in detection range	0
Data (bytes) available	0
Tag counter	0
Write fragment no.	0
Read fragment no.	0
Read data	0x02, 0x00, 0x01, 0x02, 0x03, 0x04, 0x8B, 0x20, 0x00, 0x01, 0x00, 0x01

The read data can be interpreted via the debus protocol as follows:

MSG	**ERR**	**SNR0**	**SNR1**	**SNR2**	**SNR3**	**GTYP**	**VERS**	**HW**
0x02	0x00	0x01	0x02	0x03	0x04	0x8B 0x20	0x00 0x01	0x00 0x01

- Serial number: 0x01020304
- Device type: 0x208B
- Software version: v1.00
- Hardware version: v1.00

8.6.12 Command: Set tag password

NOTE
The command code for fast processing with the loop counter is 0x2102 (hex.) or 8450 (dec.).

The **Set tag password** command sets a password in the tag. When sending the command, only one tag can be located in the detection range of the reader. After the password is sent, other commands (e.g. **Set tag protection**) can be sent to the tag. The **Set tag password** command prevents a kill password from being set in the tag.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0102 (hex.), 258 (dec.)
Read/write head address	See description of the output data
EPC length	The EPC size should be entered in bytes if a particular tag is to be protected. The EPC must be defined in the write data (start byte: 0). The function of the EPC length depends on the command used. 0: No entry of a EPC for executing the command. Only one tag may be in the detection range of the read/write head. > 0: EPC length of the tag to be protected if a EPC is present in the write data.
Start address	Not required
Length	4 bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0…3	Password: ARRAY [0…3] OF BYTE
Write data, byte 4…127	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0102 (hex.), 258 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.13 Command: Set read/write head password

The **Set read/write head password** command directly sets a password for write access, read access or a kill command in the tag. The password is stored temporarily in the memory of the reader. After a voltage reset of the reader, the password must be set again in the reader. With UHF applications, the password is stored in the memory of the interface.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0100 (hex.), 256 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0…3	Password: ARRAY [0…3] OF BYTE
Write data, byte 4…127	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0100 (hex.), 256 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.14 Command: Reset read/write head password

The **Reset read/write head password** command directly resets a password for write access, read access or a kill command in the reader. The password function is switched off and passwords are no longer exchanged between the reader and the password function.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0101 (hex.), 257 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0101 (hex.), 257 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.15 Command: Set tag protection

NOTE
The command code for rapid processing with the loop counter is 0x2103 (hex.) or 8451 (dec.).

The **Set tag protection** command is a direct command used to define the password protection for the tag. To do this, it must be specified whether read protection and/or write protection is to be set, and to which area of the tag the password applies. Protection for all areas is defined with one command. When sending the command, only one tag can be located in the detection range of the reader.

Read protection also always includes write protection.

NOTE
Write protection for UHF tags cannot be reversed.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0103 (hex.), 259 (dec.)
Read/write head address	See description of the output data
EPC length	The EPC size should be entered in bytes if a particular tag is to be protected. The EPC must be defined in the write data (start byte: 0). The function of the length of the EPC depends on the command used. 0: The command is executed for the tag that is in the detection range of the read/write head. > 0: EPC length of the tag to be protected if a EPC is present in the write data.
Start address	Not required
Memory area	Possible values: ■ PC and EPC (memory area 1) ■ USER memory (memory area 3) The entire memory selected is protected with a password.
Length	0 byte
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0	Not required
Write data, byte 1	0
Write data, byte 2	0
Write data, byte 3	0
Write data, byte 4	Not required
Write data, byte 5	0
Write data, byte 6	0
Write data, byte 7	0
Write data, byte 8…127	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0103 (hex.), 259 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.16 Command: Tag info

NOTE
The command code for rapid processing with the loop counter is 0x2050 (hex.) or 8272 (dec.).

The **Tag info** command enables the following chip information of a tag to be scanned:

- Allocation class identifier
- Tag mask designer identifier
- Tag Model Number

The data is queried from the GSI record of the tag.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0050 (hex.), 80 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Start address in the GSI record
Length	Length of the system data read (bytes) 0: All system data is read
Command timeout	Not required
Write fragment no.	Not required
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0050 (hex.), 80 (dec.)
Length	See description of the input data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, bytes 0…3	First 32 bytes of the TID (tag class, manufacturer, and chip type)
Read data, bytes 4…n	EPC (variable length)

Chip Information on the UHF Tags

Name	TID memory			Size (bits)		
	Allocation class identifier	Tag mask designer	Tag Model Number	EPC	TID	USER
Alien Higgs-3	0xE2	0x003	0x412	96…480	96	512
Alien Higgs-4	0xE2	0x003	0x414	16…128	96	128
NXP U-Code G2XM	0xE2	0x006	0x003	240	64	512
NXP U-Code G2XL	0xE2	0x006	0x004	240	64	–
NXP U-Code G2iM	0xE2	0x006	0x80A	256	96	512
NXP U-Code G2iM+	0xE2	0x006	0x80B	128…448	96	640…320
NXP U-Code G2iL	0xE2	0x006	0x806, 0x906, 0xB06	128	64	–
NXP U-Code G2iL+	0xE2	0x006	0x807, 0x907, 0xB07	128	64	–
NXP U-Code 7	0xE2	0x806	0x890	128	96	–
NXP U-Code 7xm (2k)	0xE2	0x806	0xF12	448	96	2048
Impinj Monza 4E	0xE2	0x001	0x10C	496	96	128
Impinj Monza 4D	0xE2	0x001	0x100	128	96	32
Impinj Monza 4QT	0xE2	0x001	0x105	128	96	512
Impinj Monza 5	0xE2	0x001	0x130	128	96	–
Impinj Monza R6	0xE2	0x001	0x160	96	96	–
Impinj Monza R6-P	0xE2	0x001	0x170	128	96	64

8.6.17 Command: Permanently deactivate UHF tags (Kill)

NOTE
The command code for rapid processing with the loop counter is 0x2200 (hex.) or 8704 (dec.).

The **Kill UHF tag** command makes the tag memory unusable. After a kill command, the tag can neither be read nor written. A kill command cannot be reversed.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0200 (hex.), 512 (dec.)
Read/write head address	See description of the output data
EPC length	Enter the EPC size in bytes if a particular tag is to be deleted. The EPC must be defined in the write data (start byte: 0). The function of the length of the EPC depends on the command used. 0: No entry of an EPC for executing the command. Only one tag can be located in the detection range of the reader. > 0: EPC length of the tag that is to be deleted if an EPC is present in the write data.
Start address	Not required
Length	1 byte
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0…3	Password: ARRAY [0…3] OF BYTE
Write data, byte 4…127	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0200 (hex.), 512 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.18 Command: Restore UHF read/write head settings

The **Restore UHF read/write head settings** command restores the parameters of the UHF reader from a backup. To execute the command, a backup must be created beforehand via the **Backup of the settings of the UHF read/write head** command.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x1000 (hex.), 4096 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x1000 (hex.), 4096 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.19 Command: Backup settings of the UHF read/write head

The **Backup of the settings of the UHF read/write head** command stores the current settings of the reader in the memory of the interface. The backup is retained even after a voltage reset. The backup data can be restored using the **Restore UHF read/write head settings** command.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x1001(hex.), 4097 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x1001(hex.), 4097 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.20 Command: Query error/status of UHF read/write head

Fault and status signals of the UHF reader can be read out using the **Read error/status of UHF read/write head** command.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x0042 (hex.), 66 (dec.)
Read/write head address	Not required
EPC length	Not required
Start address	Address in the **Get Status response** record
Length	Length of the data to be read from the **Get Status response** record 0: Read entire **Get Status response** record
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x0042 (hex.), 66 (dec.)
Length	See description of the input data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data

Response	
Read data, Byte 0…(Length-1)	■ Status general: 1 byte general status ■ RF status: 1 byte status of the RF module ■ Device status: 1 byte device-specific status information ■ RF mode: 1 byte, defines the reason for starting the read operation ■ Trigger status: 1 byte, trigger number of the RF mode ■ I/O status: 1 byte, status of the inputs and outputs (0 = low, 1 = high) ■ Ambient temperature: 1 byte, ambient temperature in °C (data format: 8 bit, two's complement) ■ PA temperature: 1 byte, PA temperature in °C (data format: 8 bit, two's complement) ■ RF antenna temperature: 1 byte, antenna temperature in °C (data format: 8 bit, two's complement) ■ Transmit power: 2 bytes, output power of the reader in 1/10-dBm steps, LSB…MSB (data format: 16-bit, two's complement) ■ Reverse power: 2 bytes, reverse power in 1/10-dBm steps, LSB…MSB (data format: 16-bit, two's complement) ■ Antenna DC resistance: 4 bytes, resistance at the antenna port in Ω, LSB…MSB ■ Jammer power: 2 bytes, input power at the RX port in 1/10-dBm steps, LSB…MSB (data format: 16-bit, two's complement) ■ Channel: Number of the currently used channel (offset from the next available channel)
Read data, Byte (Length)…127	Not required

Evaluating read data – General status

Bit	Meaning
7	Reader has been reset (after reset)
6	Reader configuration damaged; default settings are used
5	Test mode active
1	Tag present

Evaluating read data – RF status

Bit	Meaning
4	Limit value for radiated power exceeded
3	No free channel present
2	Antenna resistance too high or too low
1	Reverse power too high
0	PLL not locked

Evaluating read data – Device Status

Bit	Meaning
4	Error in message generation (in Polling mode outside of memory area)
3	Temperature warning
2	Temperature too high
1	Communication error
0	Configuration invalid. Command execution not possible.

Evaluating read data – RF mode

Value	Meaning
0x00	None (tag off)
0x01	Mode 1: Trigger is digital signal (edge), Timeout
0x02	Mode 2: Trigger is digital signal (edge), Timeout
0x03	Mode 3: Trigger is digital signal (level), no timeout
0x04	Trigger is a command
0x08	Reserved
0x10	DCU-controlled read operation
0x20	Continuous Mode
0x80	Automatic trigger (presence sensing mode)

Evaluating read data – I/O status

Value	Meaning
7	Output 4
6	Output 3
5	Output 2
4	Output 1
3	Input 4
2	Input 3
1	Input 2
0	Input 1

8.6.21 Command: Reset

The **Reset** command is used to reset the reader and interface.

Overview of output data

Request	
Loop counter	See description of the output data
Command code	0x8000 (hex.), 32768 (dec.)
Read/write head address	See description of the output data
EPC length	Not required
Start address	0: Software reset 1: Voltage reset
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Overview of input data

Response	
Loop counter	See description of the input data
Response code	0x8000 (hex.), 32768 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.7 Setting devices via the web server

The integrated web server can be used to set the devices and send commands to the devices.

- ▶ Open the web server and log in as a user (see the page entitled [▷ 46])
- ⇨ Write access to input data, output data and parameter data is possible after the login.

Example: Setting the Operating Mode

In the following example the operating mode is set to **UHF Compact**.

- ▶ Click **Local I/O** → **Parameter** in the navigation bar on the left of the screen.
- ▶ Select **RFID control/status ch0**.

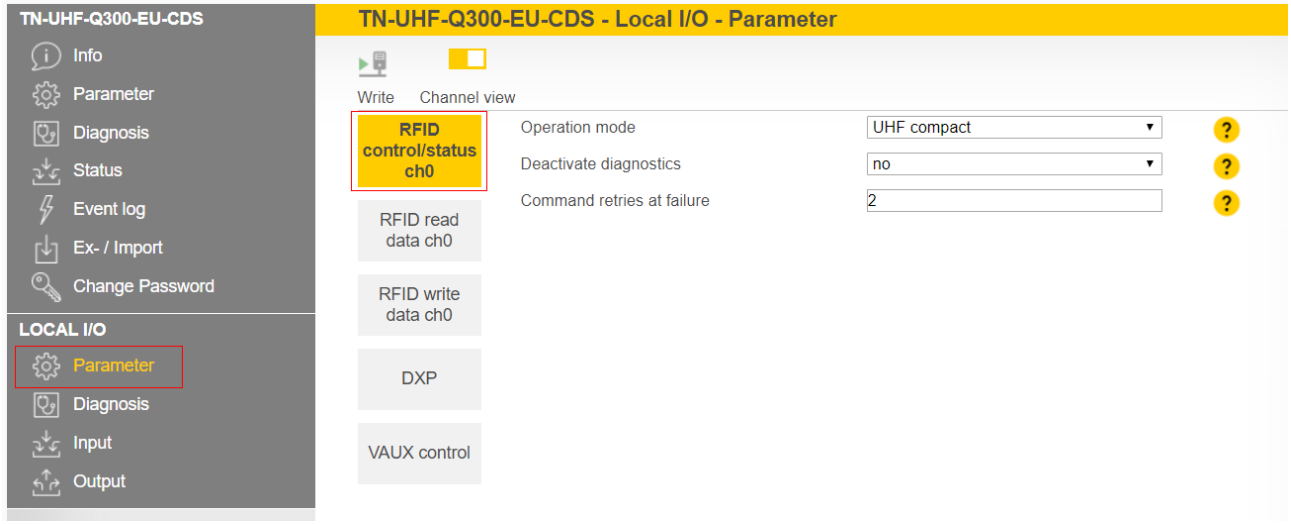


Fig. 131: Web server — Parameters

- ▶ Select the operating mode via the **Operation mode** drop-down menu.

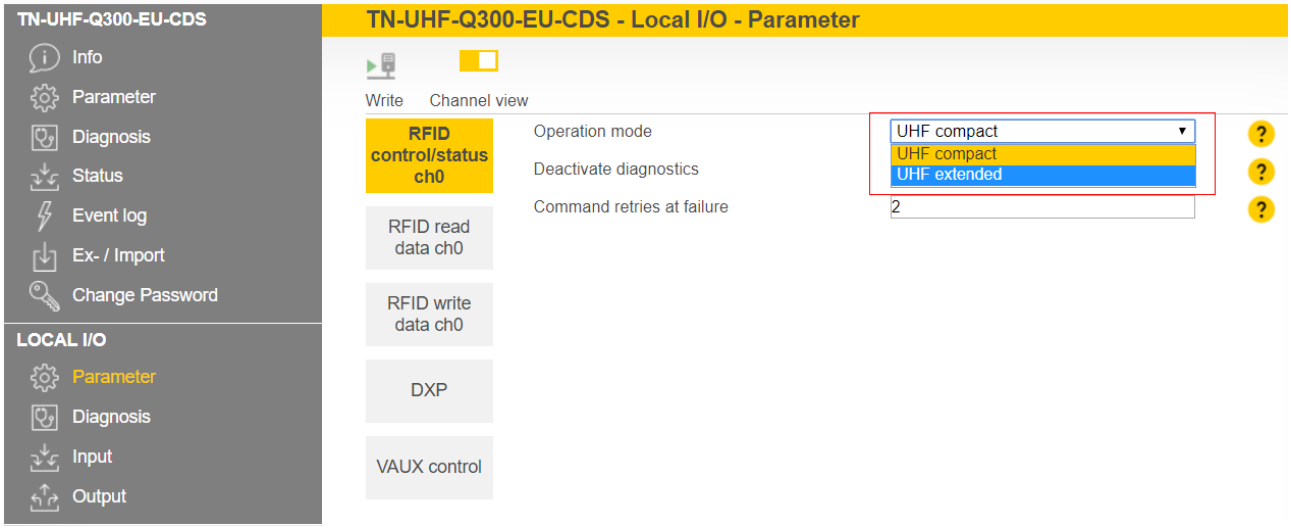


Fig. 132: Web server — Setting the operating mode

Example: Executing the Inventory command

In the following example an Inventory command is carried out via the web server.

- ▶ Click **Local I/O** → **Output** in the navigation bar on the left of the screen.
- ▶ Select the Inventory command via the **Command code** drop-down menu: **0x0001 Inventory**
- ▶ Activate Optional grouping: Set **Start address** parameter to **1**.
- ⇨ The receipt of the command is confirmed automatically in the input data at **Response code**.

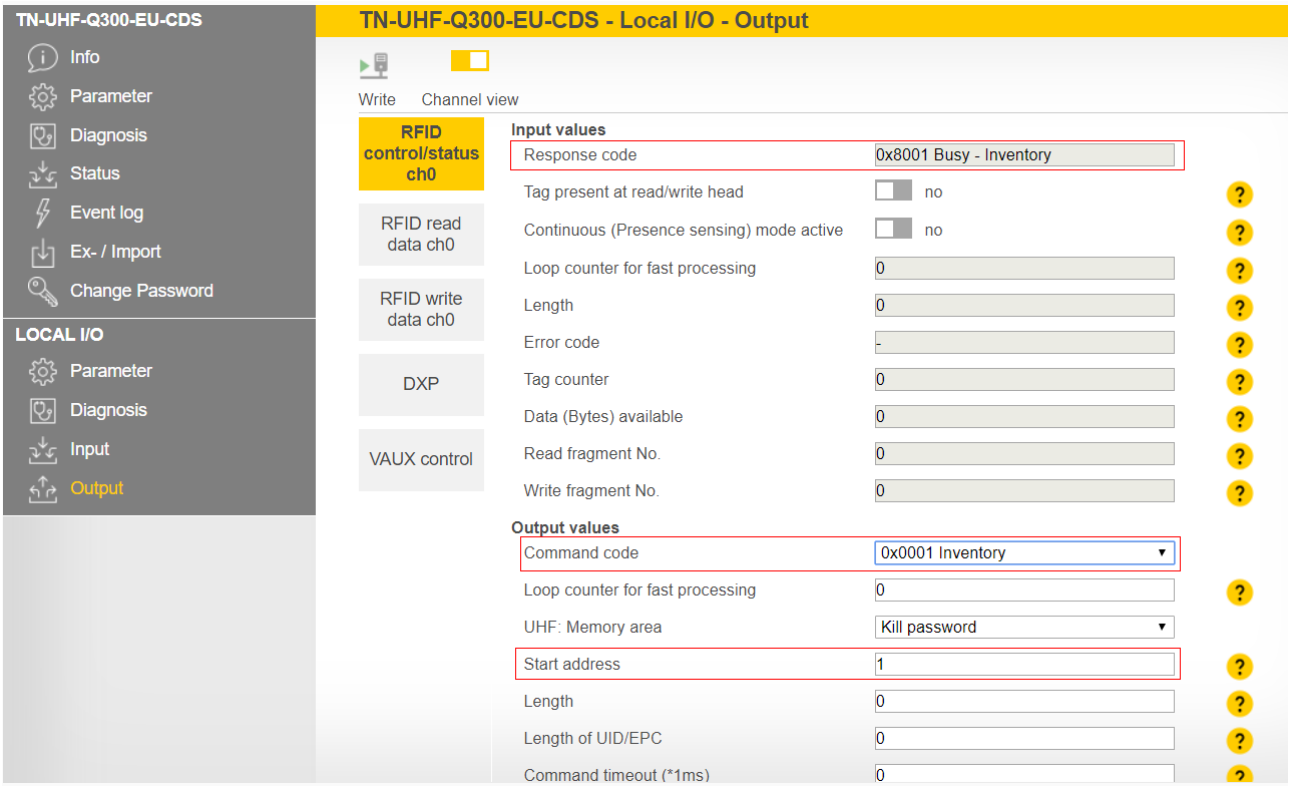


Fig. 133: Web server — Executing the Inventory command

The inventory command is executed as soon as a tag is present in the detection range of the reader.

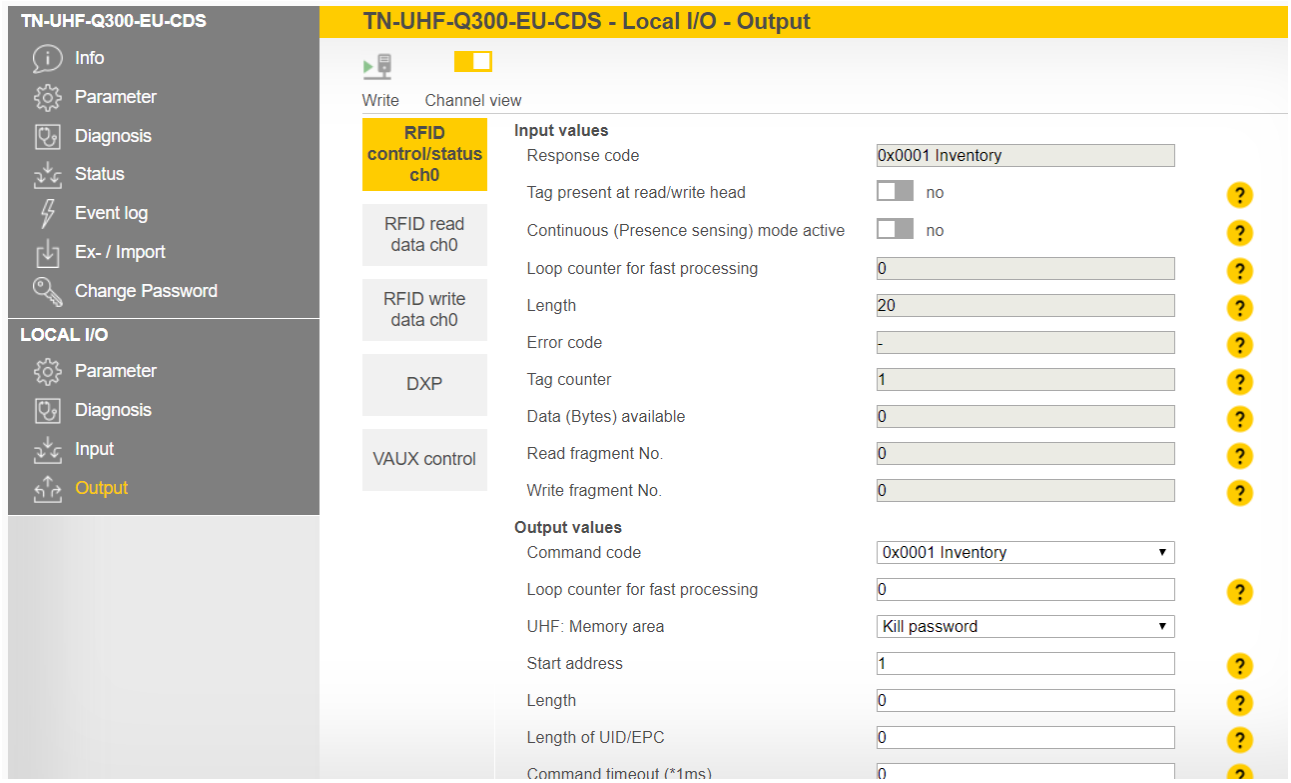


Fig. 134: Web server — Input data with successful Inventory command

The read data can be called at **RFID read data ch0**.

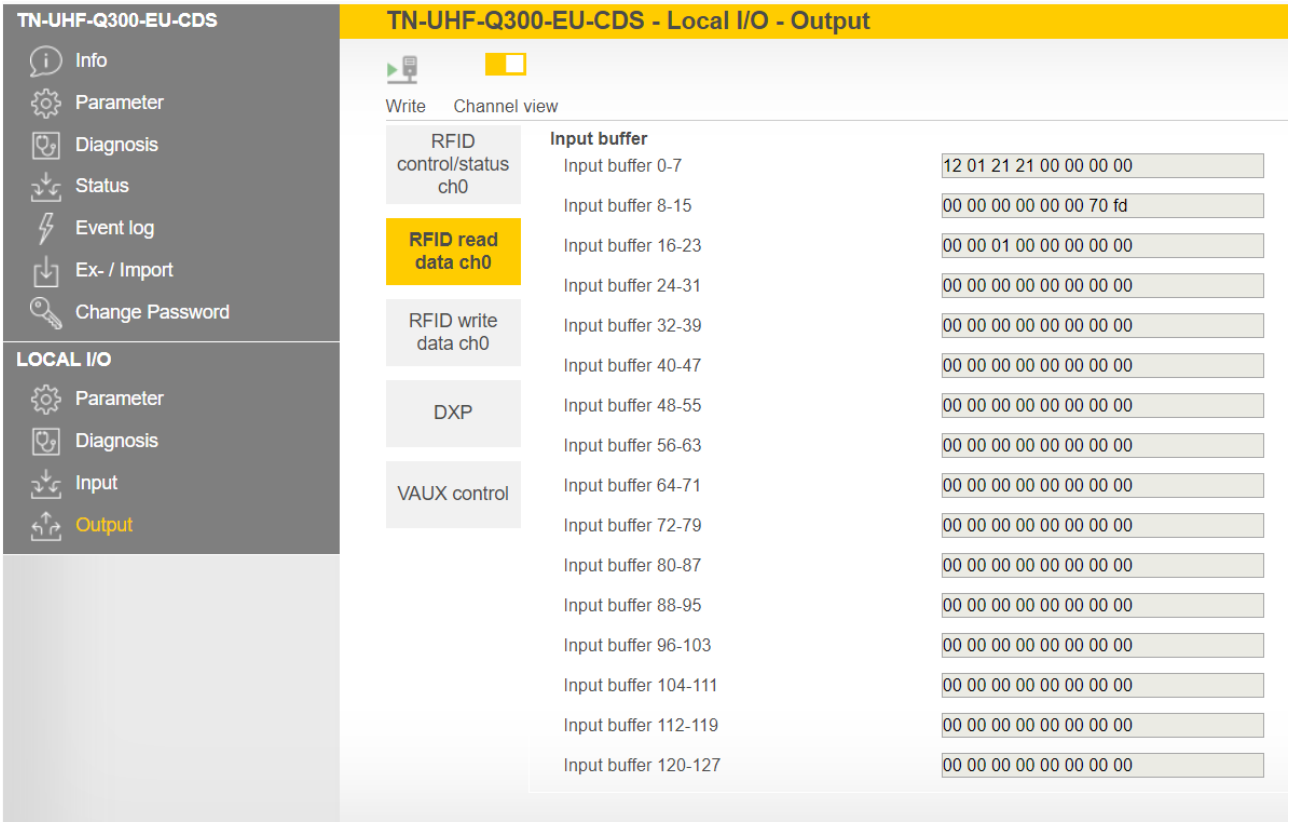


Fig. 135: Web server — Read data

9 Operation

9.1 Executing a command and calling data

NOTE
A command is successful when the response code is the same as the command code.

- ▶ Set the parameters for the command.
- ▶ Set command code.
- ⇨ Set the command code. The command is successful when the response code is the same as the command code and no error message is present.

9.2 Use fragmentation

If more data is read than the set size of the data interface, the fragment counter in the input data is incremented automatically.

- ▶ To read more data: increase the fragment counter in the output data.
- ▶ Repeat the process until the read or write fragment No. in the input data equals 0.

If less data is read than the set size of the data interface, the fragment counter stays at 0.

9.2.1 Example: Using fragmentation in the web server — read

The following example describes the reading of 500 bytes in fragments of 128 bytes each.

- ▶ Open the web server of the device.
- ▶ Log into the device as administrator.
- ▶ **Local I/O** → **Parameters** → **Operation mode**: Desired channel (here: Set **RFID channel 0**) to **HF extended**.
- ▶ Click **Write** to save.
- ▶ Click **Local I/O** → **Output** in the navigation bar on the left of the screen.
- ▶ **Output values** → **Length**: Enter the total number of bytes to be read (here: **500**). Observe the size of the tag.
- ▶ Select the read command via the **Command code** drop-down menu: **0x0002 Read**.
- ⇨ The read command is executed as soon as a tag is present in the detection range of the read/write head.

The following information is displayed in the input data (**Input values**):

- **Response code**: Read command successfully executed
- **Data (bytes) available**: Number of bytes that are still stored on the TBEN module and are not yet displayed in the read data (here: **372**)
- **Read fragment No.**: Sequential number of the next fragment to be read (here: **1**)

The first 128 bytes of the input data are displayed under **Input buffer**.

- ▶ At **Read fragment No.**, enter the sequential number of the next fragment to be read (here: **1**).

The following information is displayed in the input data (**Input values**):

- **Response code**: Read command successfully executed
- **Data (bytes) available**: Number of bytes that are still stored on the TBEN module and are not yet displayed in the read data (here: **244**)
- **Read fragment No.**: Sequential number of the next fragment to be read (here: **2**)

The second 128 bytes of the input data are displayed under **Input buffer**.

- ▶ Repeat the operation until no more data is present on the TBEN module.
- ⇨ If no more data is present on the TBEN module, **Read fragment No.** will show the value **0**.

9.2.2 Example: Using fragmentation in the web server — write

The following example describes the writing of 500 bytes in fragments of 128 bytes each.

- ▶ Open the web server of the device.
- ▶ Log into the device as administrator.
- ▶ **Local I/O** → **Parameters** → **Operation mode**: Desired channel (here: Set **RFID channel 0**) to **HF extended**.
- ▶ Save the set operating mode by clicking on **Write**.

NOTE
The tag must not leave the detection range of the read/write head during the write operation.
The write fragment number must always start with 1.

- ▶ Enter the first 128 bytes of write data under **Output buffer**.
- ▶ Click **Local I/O** → **Output** in the navigation bar on the left of the screen.
- ▶ **Output values** → **Length**: Enter the total number of bytes to be written (here: **500**). Observe the size of the tag.
- ▶ Under **Write fragment No.**, enter the sequential number of the fragment with the write data (here: **1** to enable the write data fragmentation).
- ▶ Select the write command via the **Command code** drop-down menu: **0x0004 Write**.
- ⇨ The write command is executed as soon as a tag is present in the detection range of the read/write head. If a tag is already present in the detection range of the read/write head, the data is written directly and not stored on the TBEN module.

The following information is displayed in the input data (**Input values**):

- **Response code**: **0x8004 Busy — write** (write command active)
- **Data (bytes) available**: Number of bytes that are still stored on the TBEN module and were not yet written to the tag
- **Write fragment No.**: Sequential number of the fragment with the write data (here: **1**)

- ▶ Enter the second 128 bytes of write data under **Output buffer**.
- ▶ Under **Write fragment No.**, enter the sequential number of the next fragment with the write data (here: **2**).

It is written directly if a tag is in the detection range. The data is stored in the TBEN module if there is no tag in the detection range.

The tag must stay in the detection range until the command is fully executed. The device outputs a fault signal if the tag is removed from the detection range before the command has been completed.

- ▶ Repeat the operation until all data is present on the TBEN module.
- ⇨ If the data was successfully written to the tag, the **Response code** changes to **0x0004 Write**.

9.3 Using commands with a loop counter function

NOTE
The loop counter is only supported for fast execution commands.

- ▶ Setting the command: Enter the command code.
- ▶ Set the loop counter to 1.
- ⇨ The command was successfully executed if the same command code appears in the process input data as in the process output data. The RFID data is stored in the buffer of the interface.
- ▶ Repeating the command: Increase the loop counter in the output data by 1.
- ⇨ The command was successfully executed if the same loop counter value appears in the process input data as in the process output data. The RFID data is stored in the buffer of the interface.
- ▶ Setting a new command: Enter the new command code and set the loop counter to 0.

9.4 Using Inventory command and Continuous (Presence Sensing) Mode

The Inventory command and Continuous (presence sensing) mode transfer data to the PLC in different ways. Continuous mode is suitable for high-speed applications in which a command (e.g. read or write) is to be performed repeatedly. Repeated execution of the same command by the controller is unnecessary.

The most important differences between an Inventory command and continuous mode are listed below:

Inventory	**Continuous Mode**	**Continuous presence sensing mode**
Triggered reading of EPCs	■ Repeated reading of EPCs ■ Automatic repetition of the same command (e.g. inventory, read, write)	■ UHF reader switches on as soon as a tag is detected ■ Repeated reading of EPCs ■ Automatic repetition of the same command (e.g. inventory, read, write)
Data is displayed in the read data after the command has ended.	Data must be read from the memory of the interface with a separate command.	Data must be read from the memory of the interface with a separate command.
Grouping of EPCs possible	Grouping of EPCs possible	Grouping of EPCs possible
No buffering on the read/write device	No buffering on the read/write device	No buffering on the read/write device
Terminate command: 1. Timeout 2. Automatically after command execution	Terminate command: 1. Timeout 2. Terminating the **Continuous (Presence Sensing) mode command** or **Reset**	Terminate command: 1. Timeout 2. Terminating the **Continuous (Presence Sensing) mode command** or **Reset**

9.5 LEDs

The device has the following LED indicators:

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

The APPL LED can be programmed in CODESYS according to the application.

PWR LED	Meaning
Off	No power supply
Green	Power supply error-free
Yellow	Undervoltage within tolerance range
Red	Undervoltage outside of tolerance range

RFON LED	Meaning
Off	RF field switched off
Green	RF field switched on

DATA LED	Meaning
Off	No tag in the field, no data transfer
Yellow flashing	Tag in the field, data transfer via the air interface

DIAG LED	Meaning
Off	No error
Red	Error

The USER LED can be adjusted according to the application.

BUS LED	Meaning
Off	No voltage present
Green	Connection to a master active
Flashing green (1 Hz)	Device is operational
Red	IP address conflict or Restore mode active
Flashing red	Wink command active
Flashing red/green (1 Hz)	Autonegotiation and/or wait for IP address allocation in DHCP or BootIP mode

ERR LED	Meaning
Off	No voltage present
Green	No diagnostics
Red	Diagnostics present

RUN LED	Meaning
Green	Program active
Red	Program stopped
Flashing red	No program present
Flashing red (double, 1 Hz)	F_Reset active
Flashing red/green (1 Hz)	OS starts

APP LED(programmable)	
Flashing white	Wink command active

LAN LED	Meaning
Off	No Ethernet connection
Lit green	Ethernet connection established, 100 Mbit/s
Green flashing	Data transfer, 100 Mbit/s
Lit yellow	Ethernet connection established, 10 Mbit/s
Yellow flashing	Data transfer, 10 Mbit/s

9.6 Software diagnostic messages

9.6.1 Diagnostic messages — gateway functions

Meaning of the diagnostic bits

Designation	Meaning
FCE	Force mode in the DTM active
COM	Internal error
V1oPoE	Undervoltage detected at power supply terminal V1 or power sourcing equipment (PSE) type 1
DIAG	Module diagnostics present

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0		FCE				COM	V1oPoE	
1								DIAG

9.6.2 Diagnostic messages — RFID channels

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	VAUX	PRMER	DTM	FIFO				
1	Reserved							
2	Reserved							
3	Reserved							
4		TRE1	PNS1					
5	Reserved							
…	…							
35	Reserved							

Meaning of the diagnostic bits

Designation	Meaning
VAUX	Overvoltage at power supply terminal VAUX
PRMER	Parameter error
DTM	Configuration via the DTM active
FIFO	Buffer full
TRE1	Read/write head reports error
PNS1	Parameter not supported by read/write head

9.6.3 Diagnostic messages — digital channels

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0							VErrV1C1	VErrV1C0
3					ERR3	ERR2	ERR1	ERR0

Meaning of the diagnostic bits

Designation	Meaning
VErrV1C0Ch0Ch1	Overcurrent at power supply terminal VAUX1 at socket C0 (channels 0 and 1)
VErrV1C1Ch2Ch3	Overcurrent at power supply terminal VAUX1 at socket C1 (channels 2 and 3)
ERRx	Error message on channel x

9.6.4 Diagnostic messages — device status

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0								DIAG
1		FCE				COM	V1oPoE	

Meaning of the diagnostic bits

Designation	Meaning
DIAG	Module diagnostics present
FCE	Force mode in the DTM active
COM	Internal error
V1oPoE	Undervoltage detected at power supply terminal V1 or power sourcing equipment (PSE) type 1

9.7 Reading error codes

The error codes are part of the process input data.

Error code (hex.)	Error code (dec.)	Meaning
0x8000	32768	Channel not active
0x8001	32769	Read/write head not connected
0x8002	32770	Memory full
0x8003	32771	Block size of the tag not supported
0x8004	32772	Length larger than the size of the read fragment
0x8005	32773	Length larger than the size of the write fragment
0x8008	32776	Fragmenting must start with write fragment no. 1
0x8009	32777	Fragmenting incomplete. Write fragment no. > 0 expected
0x8100	33024	Parameter undefined
0x8105	33029	Size of the write fragment outside of the permissible range
0x8106	33030	Size of the read fragment outside of the permissible range
0x81FF	33023	No read/write head selected
0x8200	33280	Command code unknown
0x8201	33281	Command not supported
0x8203	33283	Command not supported in UHF applications
0x8209	33289	Length outside of the permissible range
0x820A	33290	Address outside of the permissible range
0x820B	33291	Length and address outside of the permissible range
0x820C	33292	No tag found
0x820D	33293	Timeout
0x8210	33296	Length outside of the tag specification
0x8211	33297	Address outside of the tag specification
0x8212	33298	Length and address outside of the tag specification
0x8213	33299	Memory area of the tag outside of the permissible range
0x8214	33300	Read/write head address outside of the permissible range
0x8215	33301	Value for timeout outside of the permissible range
0x8300	33536	**Continuous mode** command not activated
0x8302	33538	Grouping not supported for read commands
0x8304	33540	Grouping not supported for write commands
0x0801	2049	Write or read error
0x2000	8192	Kill command not successful
0x2500	9472	Password function of the tag not supported
0x2501	9473	Password function not supported by the read/write head
0x2900	10496	Address outside of the block limits

Error code (hex.)	Error code (dec.)	Meaning
0x2901	10497	Length outside of the block limits
0xC000	49152	Internal error (response of the read/write head too short)
0xC001	49153	Command not supported by read/write head version
0xB0…	45…	Read/write head reports error
0xB062	45154	Read/write head error when executing an inventory command
0xB067	45159	Read/write head error when executing a lock block command
0xB068	45160	Read/write head error when executing a read multiple block command
0xB069	45161	Read/write head error when executing a write multiple block command
0xB06A	45162	Error when reading the system information
0xB06B	45163	Error when reading the protection status of the tags
0xB0BD	45245	Error when setting the transfer rate
0xB0DA	45274	Error with the **Tag in detection range** function
0xB0E1	45281	Error when reading the advanced read/write head version
0xB0F8	45304	Error when resetting a command in Continuous mode
0xB0FA	45306	Error when outputting the response code
0xB0FF	45311	Error when resetting the read/write head
0xB0B3	45235	Error when setting the tag password
0xB0B6	45238	Error when setting the write or read protection
0xB0B8	45240	Error when reading the protection status of the memory area on the tag
0xB0C3	45251	Error when setting the password in the read/write head
0xD0…	53…	Read/write head reports error
0xD001	53249	Error when resetting the read/write head
0xD002	53250	Error when reading the read/write head version
0xD003	53251	Error when reading the read/write head version when a tag is in the detection range
0xD004	53252	Error when setting the read/write head address
0xD009	53257	Error with the parameter setting of the read/write head
0xD00A	53258	Error when setting the transfer speed and the operating mode of the read/write head
0xD00B	53259	Error when polling
0xD00D	53261	Error when reading the device status
0xD00E	53262	Error when resetting the internal status bit
0xD00F	53263	Error when setting the read/write head outputs and/or LEDs
0xD011	53265	Error when reading the internal malfunctions
0xD014	53268	Diagnostics error
0xD016	53270	Error with the heartbeat message
0xD017	53271	Error when outputting the user settings
0xD01B	53275	Error when emptying the message memory in Polling mode
0xD081	53377	Error when switching the UHF tag on/off

Error code (hex.)	Error code (dec.)	Meaning
0xD083	53379	Error when reading from a tag
0xD084	53380	Error when writing to a tag
0xD085	53381	Software trigger error
0xD088	53384	Error when outputting a command in accordance with EPC Class1 Gen2
0xD100	53504	Error with the Backup function
0xD101	53505	Error with the Backup function (required memory not available)
0xD102	53506	Error when restoring a backup
0xD103	53507	Error when restoring a backup (no backup present)
0xD104	53508	Error when restoring a backup (backup data damaged)
0xD105	53509	Error when restoring the default settings
0xD106	53510	Error with the tag function
0xF8…	63…	Read/write head error
0xF820	63520	Read/write head: Command not supported
0xF821	63521	Read/write head: Unspecified error
0xF822	63522	Read/write head: A valid password is expected before the command is accepted.
0xF824	63524	Read/write head: Read process not possible (e.g. invalid tag)
0xF825	63525	Read/write head: Write process not possible (e.g. tag readable only)
0xF826	63526	Read/write head: Write or read error
0xF827	63527	Read/write head: Access to unknown address (e.g. memory area outside of the range)
0xF828	63528	Read/write head: The data to be sent is not valid
0xF82A	63530	Read/write head: The command needs a long time to execute.
0xF82C	63532	Read/write head: The requested object is not in the persistent memory.
0xF82D	63533	Read/write head: The requested object is not in the volatile memory.
0xF835	63541	Read/write head: The command is temporarily not permissible.
0xF836	63542	Read/write head: The Opcode is not valid for this type of configuration memory.
0xF880	63616	Read/write head: No tag in the field
0xF881	63617	Read/write head: The EPC of the command is inconsistent with the EPC in the detection range
0xF882	63618	Read/write head: Incorrect tag type specified in the command
0xF883	63619	Writing to a block failed
0xFFFE	65534	Timeout on the RS485 interface
0xFFFF	65535	Command aborted

10 Troubleshooting

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

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

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

11 Maintenance

11.1 Updating the firmware via TAS

NOTICE
Interruption of the power supply during the firmware update
Risk of device damage due to faulty firmware update
- ▶ Do not interrupt the power supply during the firmware update.
- ▶ During the firmware update do not reset the power supply.
- ▶ Do not interrupt the Ethernet connection during the firmware update.

NOTE
The firmware update function in TAS is locked when the controller connection is active. The device must first be disconnected from the controller before performing the update.

Starting a firmware update for a device

- ▶ Open TAS.
- ▶ Open the network view and scan the network.
- ▶ Select the device.
- ▶ Click **Firmware update**.
- ▶ In the following dialog: Click **Select file** and open the directory of the firmware file.
- ▶ Select the new firmware file and load it via **Open**.
- ▶ Click **Start** to start the firmware update.
- ▶ Enter the device password and click **Login**

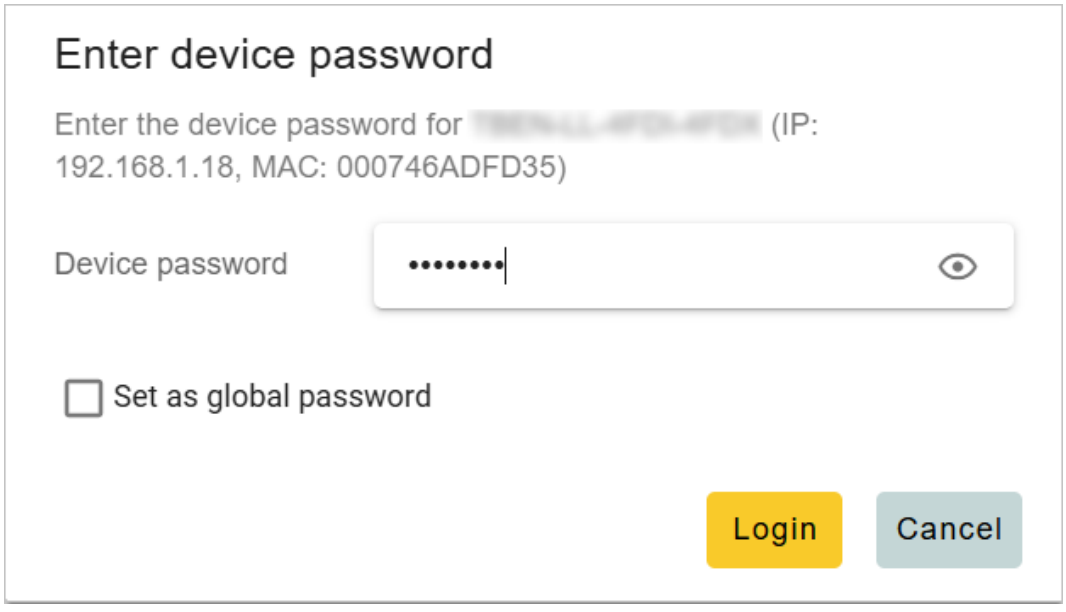


Fig. 136: Entering the device password

⇨ The progress of the firmware update is displayed.

NOTE
TAS makes it possible to set a global password with which all devices can be unlocked. This requires that all selected devices have the same device password and are in the same TCP network.

As an alternative to selecting a single device, it is also possible to select multiple devices. To do so, all devices to be updated must correspond to the same device type and be in the same TCP network.

This enables a firmware update to be performed for multiple devices at once.

Starting a firmware update for multiple devices

- Select all desired devices in the network view using the checkbox.
- Click **FW Update** in the header.

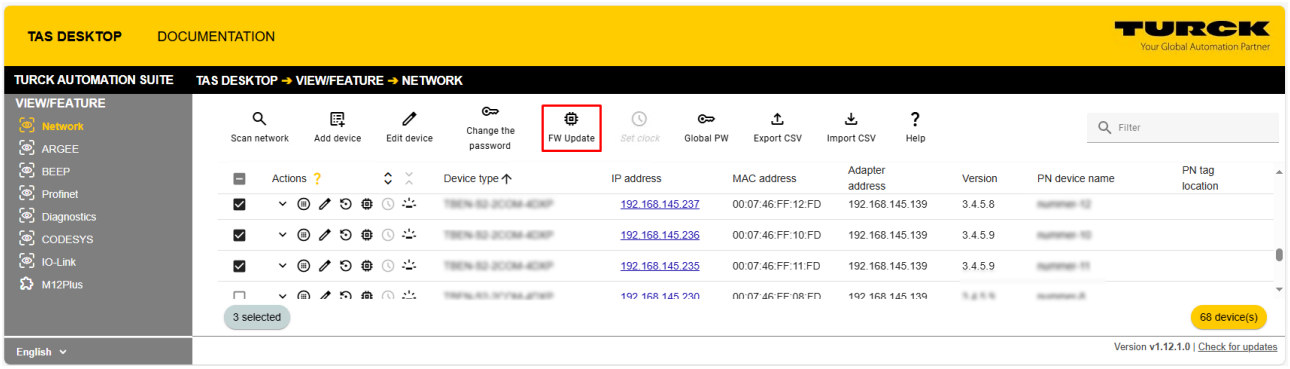


Fig. 137: Firmware update network view multiple devices

- In the following dialog: Click **Select file** and open the directory of the firmware file.
- Select the new firmware file and load it via **Open**.
- Click **Start** to start the firmware update.
- If a global password has not yet been defined: Enter the password and activate the **Set as global password** option.
  Note: If a global password has not yet been defined and the **Set as global password** option is not activated, the password is requested individually for each device.
- Click **Login**.

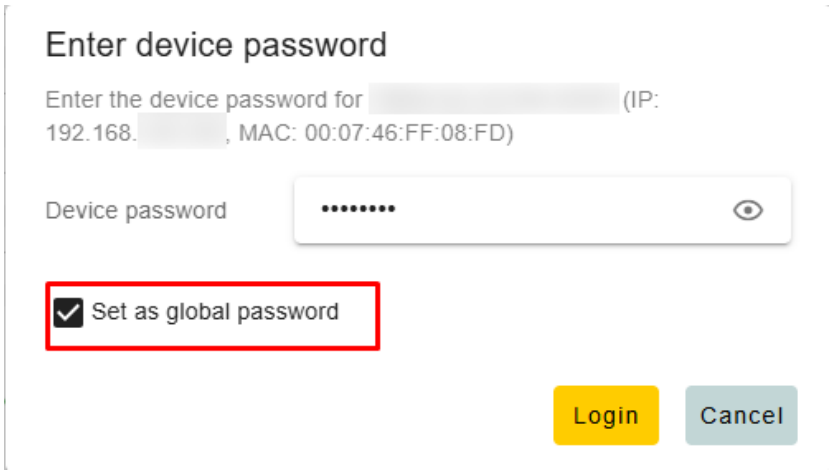


Fig. 138: Entering the device password and setting it as global password

➪ The progress of the firmware update is displayed.

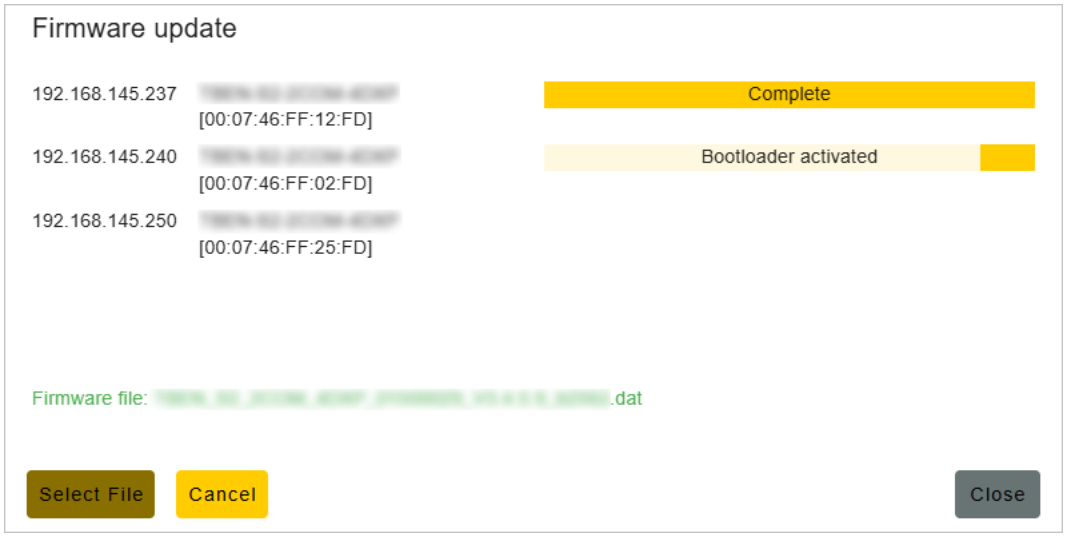


Fig. 139: Firmware update, progress

11.2 Updating the firmware via web server

NOTICE
Interruption of the power supply during the firmware update
Risk of device damage due to faulty firmware update
- ▶ Do not interrupt the power supply during the firmware update.
- ▶ During the firmware update do not reset the power supply.
- ▶ Do not interrupt the Ethernet connection during the firmware update.

- ▶ Open the web server.
- ▶ Log into the device as administrator. The default password for the web server is "password".
- ▶ Click **Firmware** → **SELECT FIRMWARE FILE**.
- ▶ Select a new firmware file and load it by clicking **Open**.

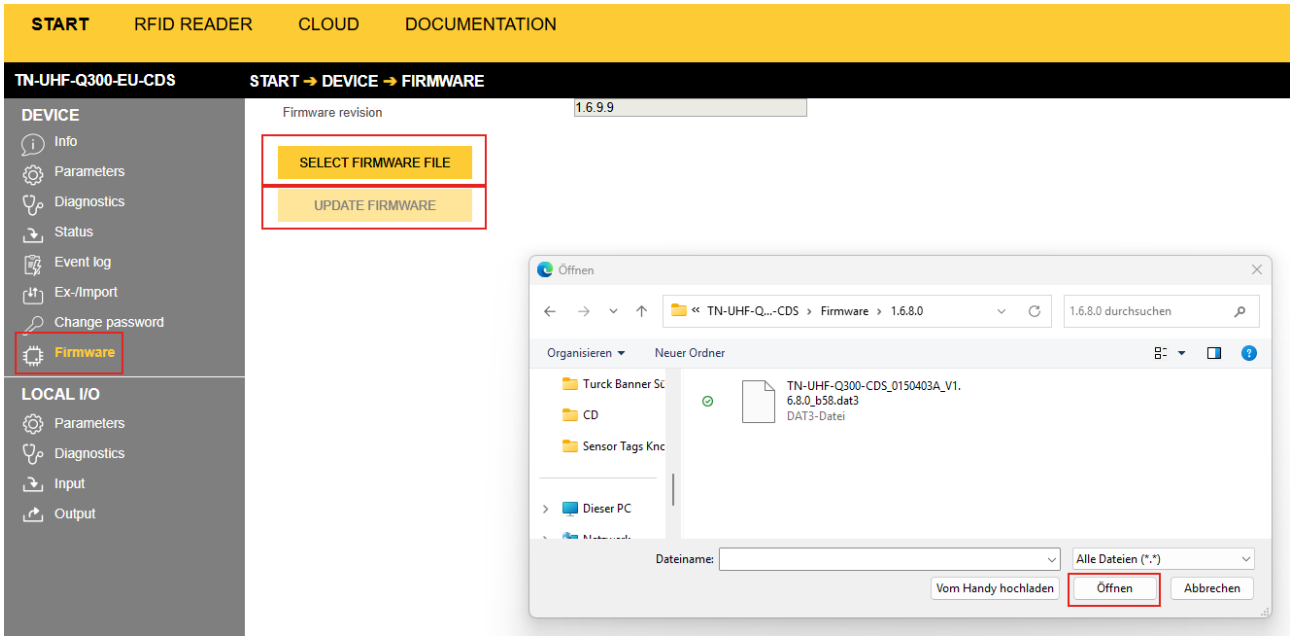


Fig. 140: Web server — firmware update

- ▶ Click **UPDATE FIRMWARE** and start the firmware update.
- ▶ Restart the device after the update process is complete by clicking **OK**.

12 Repair

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

12.1 Returning devices

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

13 Disposal

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

14 Technical Data

Technical Data	
Electrical data	
Operating voltage	18…30 VDC
DC rated operational current	≤ 1000 mA
Data transmission	Electromagnetic AC field
Wireless communication and protocol standards	ISO 18000-6C EN 302208 EPCglobal Gen 2
Antenna polarization	Circular/linear, adjustable
Antenna half power beam width	65°
Output function	Read/write
Mechanical data	
Mounting condition	Non-flush
Ambient temperature	-20…+50 °C
Dimensions	300 × 300 × 61.7 mm
Housing material	Aluminum, AL, silver
Material of active face	Fiber glass reinforced polyamide, PA6-GF30, black
Vibration resistance	55 Hz (1 mm)
Shock resistance	30 g (11 ms)
Type of protection	IP67
No. of channels	4
Electrical connection	RP-TNC
Input impedance	50 Ω
System description	
Processor	ARM Cortex A8, 32-bit, 800 MHz
ROM memory	256 MB Flash
RAM memory	512 MB DDR3
Programming	CODESYS V3
Released for CODESYS version	V3.5.11.20
Programming languages	IEC 61131-3 (IL, LD, FBD, SFC, ST)
Application tasks	10
Number of POUs	1024
Programming interface	Ethernet
Cycle time	< 1 ms for 1000 IL commands (without I/O cycles)
Input data	8
Output data	8
RFID data interface	UHF

Technical Data	
System data	
Ethernet transfer rate	10 Mbit/s / 100 Mbit/s
Ethernet connection technology	1 × M12, 4-pin, D-coded
Web server	Default: 192.168.1.254
Modbus TCP	
Addressing	Static IP, BOOTP, DHCP
Supported function codes	FC1, FC2, FC3, FC4, FC5, FC6, FC15, FC16, FC23
Number of TCP connections	8
Number of output data (PAA)	Max. 1024
Number of input data (PAE)	Max. 1024
EtherNet/IP	
Addressing	As per EtherNet/IP specification
Device level ring (DLR)	Supported
Input assembly instance	103
Number of input data (PAE)	248
Output assembly instance	104
Number of output data (PAA)	248
Class1 connections	10
Class3 connections	3
Configuration assembly instance	106
PROFINET	
Addressing	DCP
MinCycleTime	4ms
Diagnostics	According to PROFINET Alarm Handling
Automatic addressing	Supported
Media redundancy protocol (MRP)	Supported
Number of input data (PAE)	Max. 512
Number of output data (PAA)	Max. 512
Digital inputs	
No. of channels	2
Connection technology of inputs	M12, 5-pin
Input type	PNP
Switch threshold	EN 61131-2 Type 3, PNP
Signal voltage Low signal	< 5 V
Signal voltage High signal	> 11 V
Signal current Low signal	<1.5 mA
Signal current High signal	> 2 mA
Type of input diagnostics	Channel diagnostics
Digital outputs	
No. of channels	2
Connection technology of outputs	M12, 5-pin
Output type	PNP
Type of output diagnostics	Channel diagnostics

15 Appendix: flow charts showing the operation of the device

The flow charts explain the operation of the device as well as the processing of commands.

15.1 Flow chart: command processing

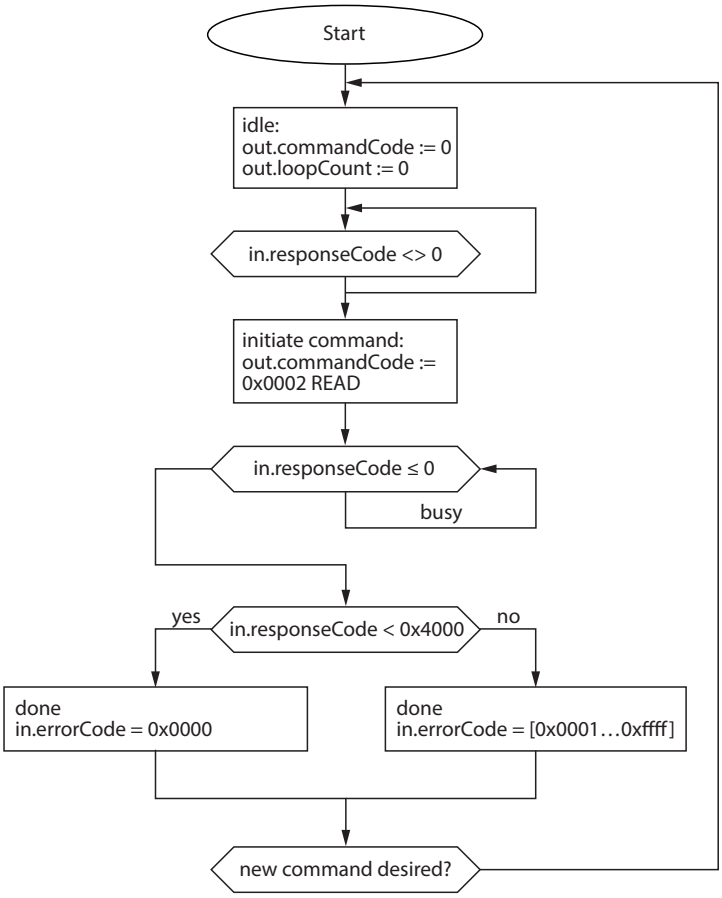


Fig. 141: Flow chart for command processing

15.1.1 Handling command execution with Busy and Error — sample code in CODESYS

The following is a sample code for evaluation in the PLC program.

```
commandCode: INT;
responseCode: INT;
responseCodePrevious: INT;

commandCode:= 0x0002; (* READ *)

(* … PLC cycle … *)

IF (responseCode <> responseCodePrevious) THEN
IF (responseCode < 0) THEN
(* BUSY *)
ELSE
IF (responseCode == commandCode) THEN
(* success *)
ELSIF (0x8000 == commandCode) AND (0x0000 == responseCode) THEN
(* reset success *)
ELSE
(* error *)
END_IF;
END_IF;
responseCodePrevious:= responseCode;
END_IF;
```

15.2 Flow chart: rapid command processing with loop counter

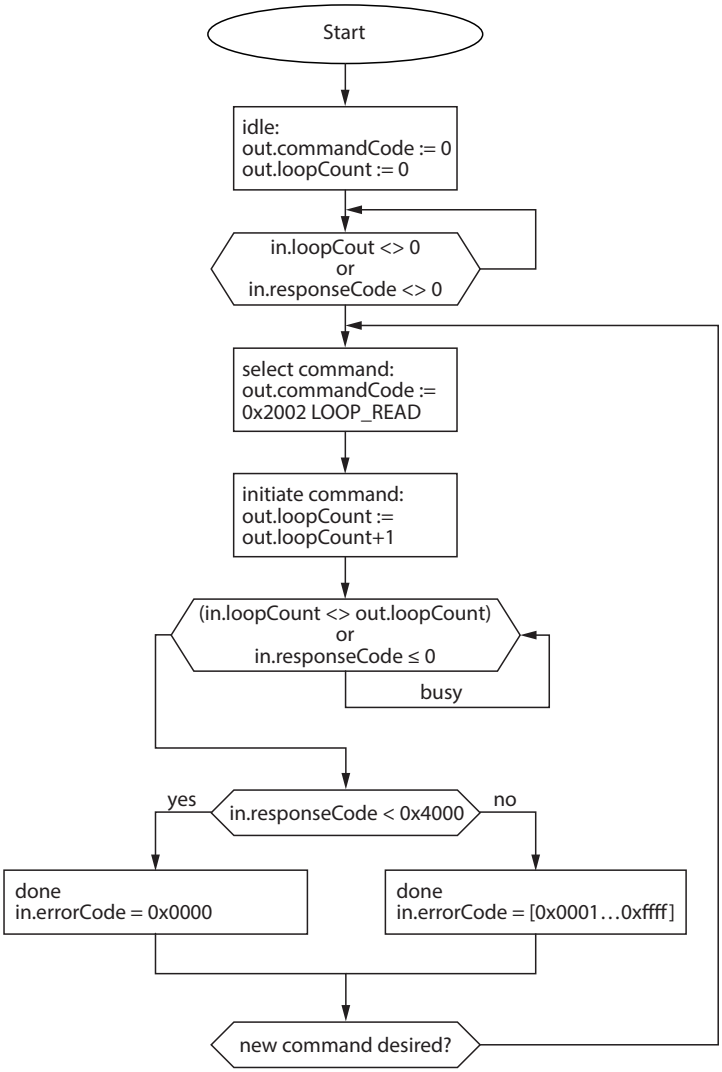


Fig. 142: Flow chart for fast command processing with loop counter

15.3 Flow chart: command processing with fragmentation

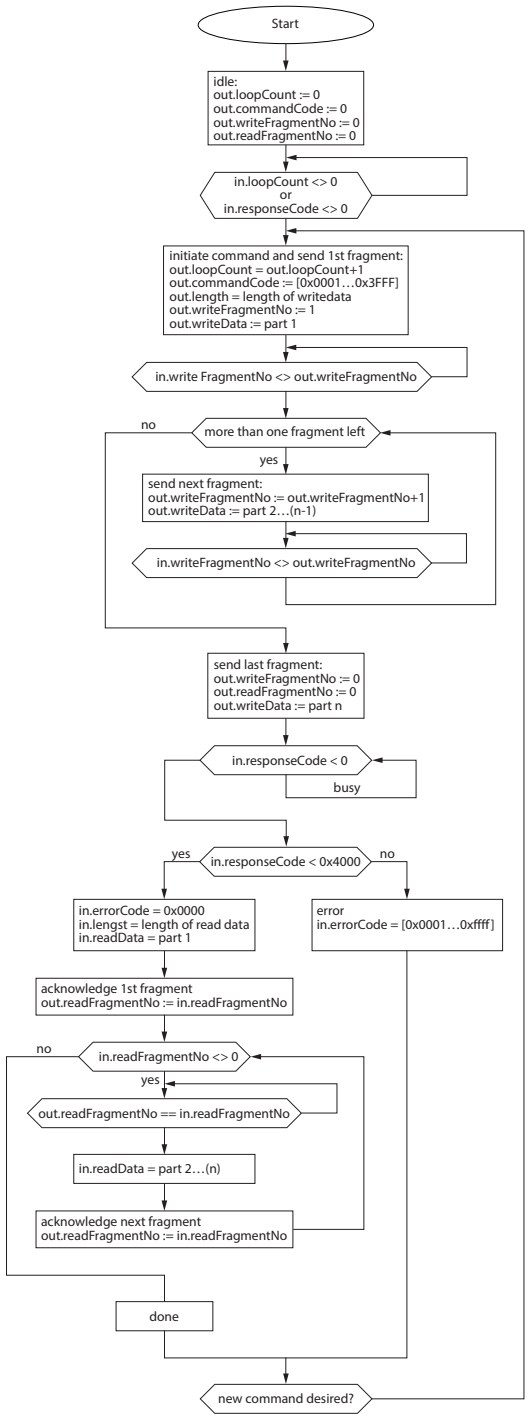


Fig. 143: Flow chart for command processing with fragmentation

15.4 Flow chart: Continuous Mode with interruption before reading data

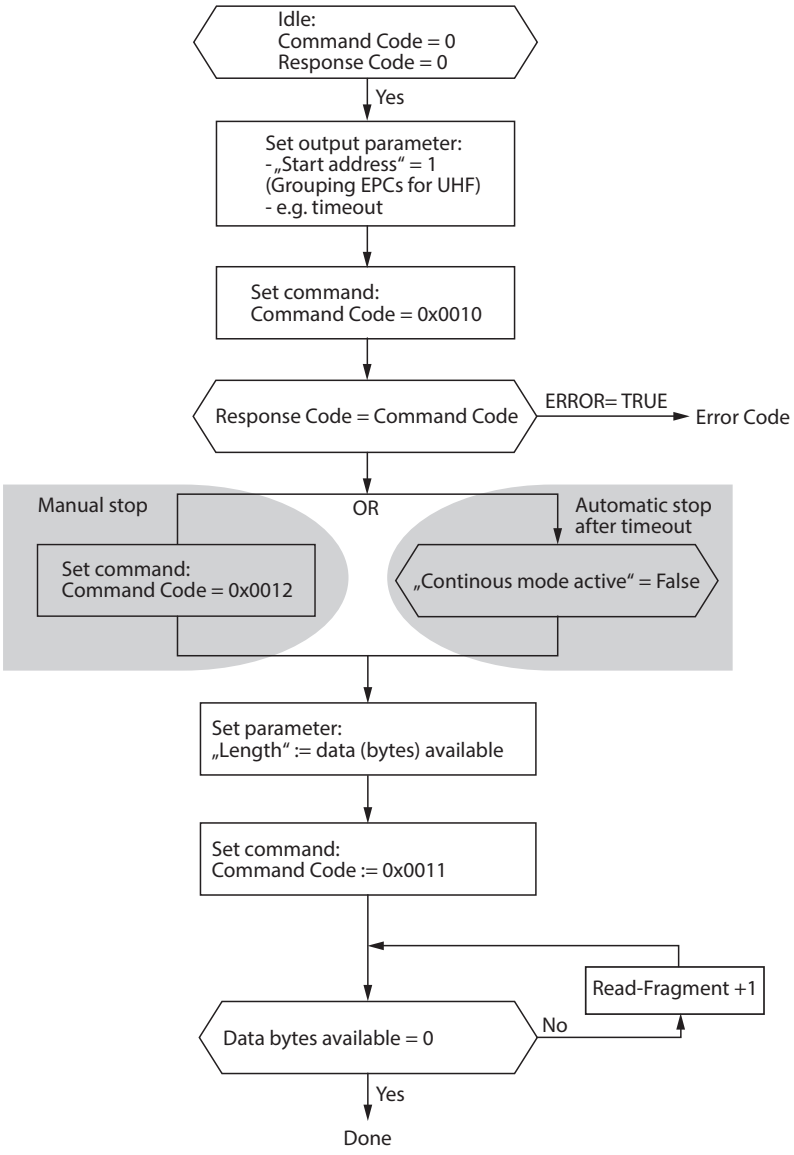
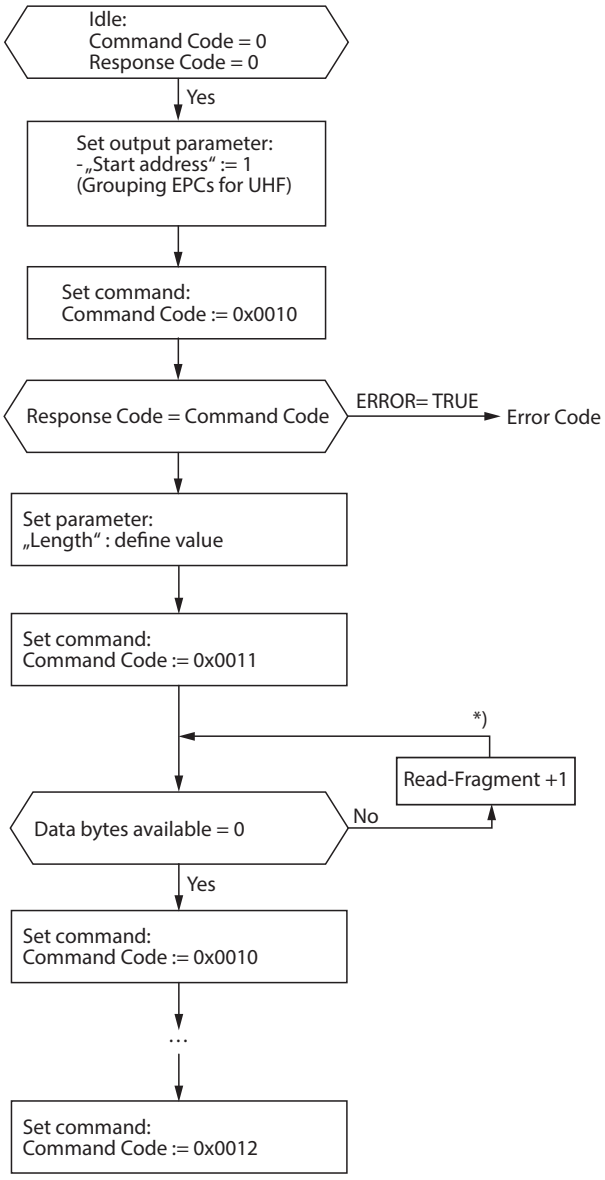


Fig. 144: Flow chart for Continuous Mode with interruption before reading data

15.5 Flow chart: Continuous Mode without interruption before reading data



*) After increasing the Read Fragment No., the new data will be shown in the read data input.

Fig. 145: Flow chart for Continuous Mode without interruption before reading data

15.6 Flow chart: programming tags with a password

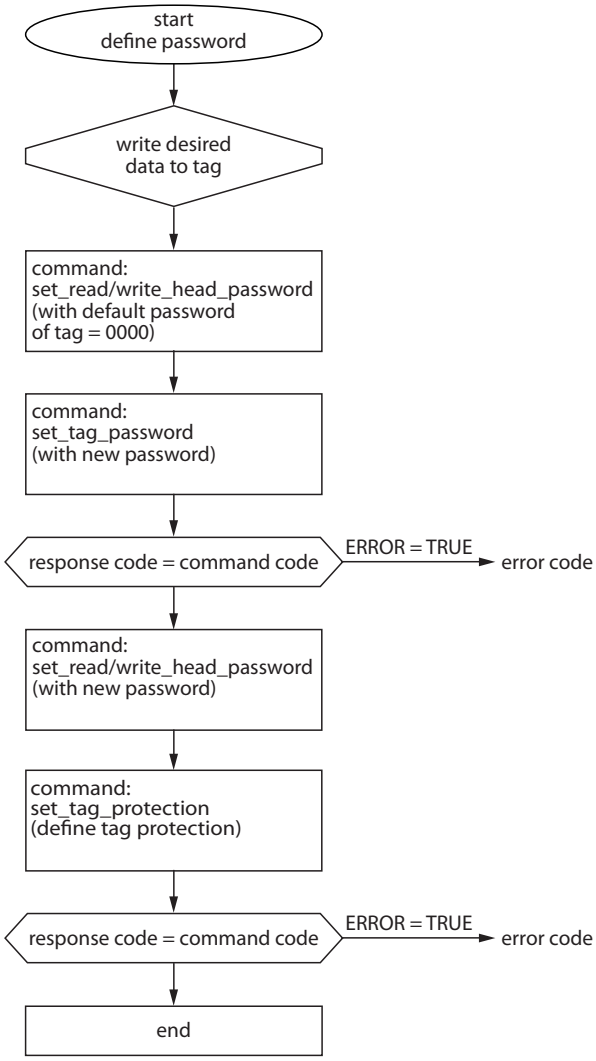


Fig. 146: programming tags with a password

16 EU Declaration of Conformity

Hereby, TURCK GmbH declares that the radio equipment type TN-UHF-Q…L…-EU… is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: **www.turck.com**

17 TURCK branches — contact data

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

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

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