TURCK

Your Global Automation Partner

TN-UHF-Q150-…-EC
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”.

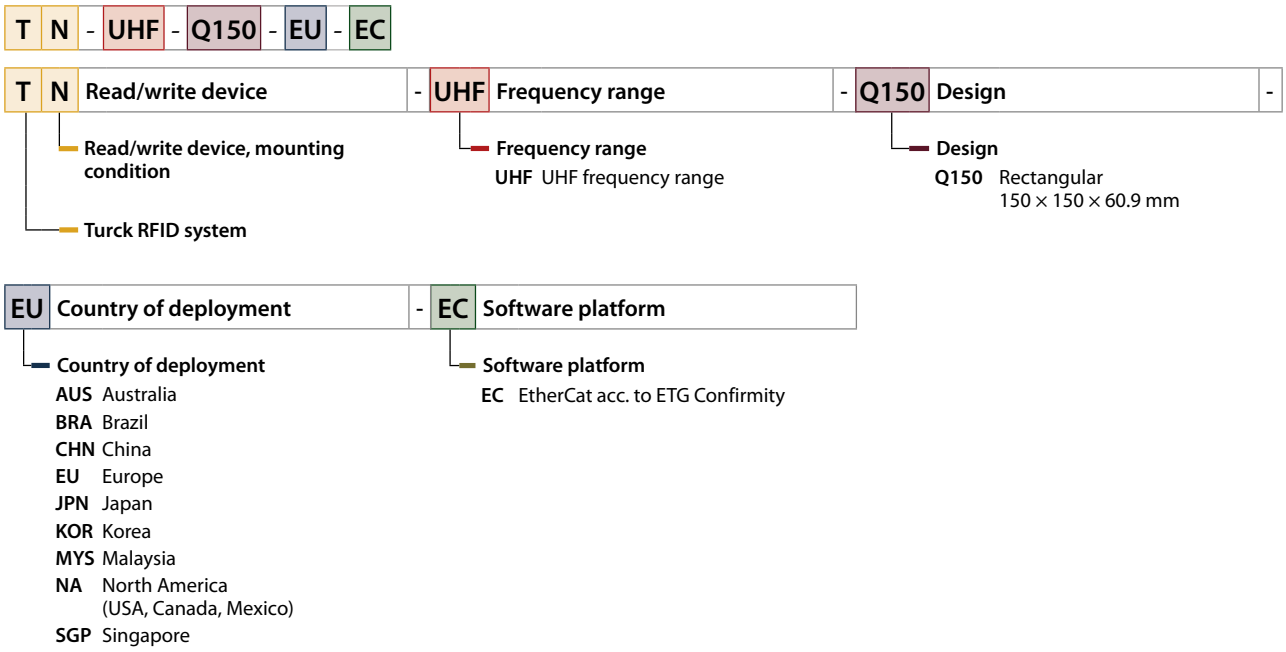
1.5 Feedback about these instructions

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 [▷ 134].

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-Q150-AUS-EC	920…926 MHz	Australia, New Zealand
TN-UHF-Q150-BRA-EC	915…928 MHz	Brazil
TN-UHF-Q150-CHN-EC	920.5…924.5 MHz	China and Thailand
TN-UHF-Q150-EU-EC	865.6…867.6 MHz	Europe, Türkiye, India
TN-UHF-Q150-JPN-EC	916.7…920.9 MHz	Japan
TN-UHF-Q150-KOR-EC	917…920.8 MHz	Korea
TN-UHF-Q150-MYS-EC	919…923 MHz	Malaysia
TN-UHF-Q150-NA-EC	902…928 MHz	North America (USA, Canada, Mexico)
TN-UHF-Q150-SGP-EC	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 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.
- 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.

4 Product Description

The devices are designed with an aluminum housing and degree of protection IP67. The active face is made out of plastic. An external antenna can be connected to the Q150.

The connection for the Ethernet is an M12 female connector. The device has an M12 plug connector for connecting the power supply.

4.1 Device overview

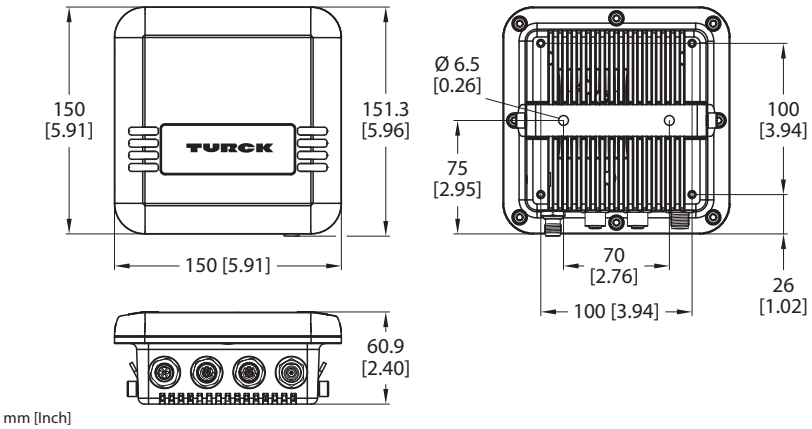


Fig. 1: Dimensions – TN-UHF-Q150…

4.1.1 Indication elements

The device is provided with the following LEDs:

- Power supply voltage
- Group and bus error
- Status
- Diagnostics

4.2 Properties and features

- EtherCAT sub-device in accordance with Modular Device Profile (ETG.5001.1)
- Supports security mechanisms and authentication
- Rectangular, height 150 mm
- Active front face, UV-resistant
- Connection for a passive UHF RFID antenna
- 0.5 W (ERP) maximum output power
- 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.

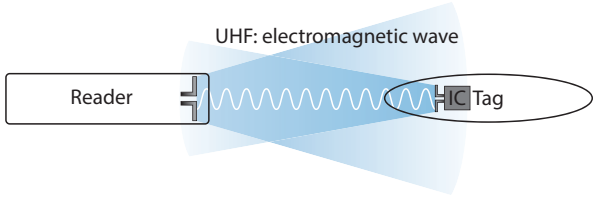


Fig. 2: Operating principle of UHF-RFID

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 device enables passive UHF tags to be read and written in single- and multi-tag operation. To do this, the device forms a transmission zone. The size and expansion of this zone may vary on account of several conditions, for example the tags used and the application conditions. The maximum distance permitted between the read/write heads is outlined in the data sheets. The device can be extensively tested, configured and parameterized from a PC using the software tools.

The integrated RFID interface transfers data between the RFID level and the control level.

Various commands can be performed with the device, such as inventory (single-tag and multi-tag applications), read, write and password protection. Additional functions are provided to optimize the speed, for self-triggering of the system and for backup and recovery. Each channel can transmit 128 bytes per read or write cycle to the controller. To transfer more than 128 bytes, the data must be fragmented.

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 EtherCAT functions

The device supports the following EtherCAT communication profiles:

- CoE (CAN Application Protocol over EtherCAT): The object dictionary is provided via the CoE interface. The object dictionary contains all device-specific parameters.
- FoE (File Access over EtherCAT): The firmware update is carried out via the FoE communication protocol.
- AoE (ADS over EtherCAT): The AoE communication protocol is used to read or write device data acyclically, e.g. from connected IO-Link devices.

4.4.4 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 write or read data transferred per cycle can be set as follows for EtherCAT:

- 16 bytes (default setting)
- 32 bytes
- 64 bytes
- 128 bytes

4.4.5 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

4.4.6 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 [▶ 138]). 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.

4.5 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 x 100.

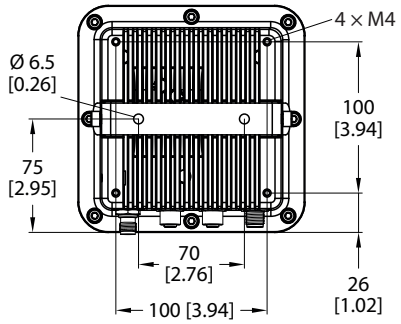


Fig. 3: Rear view – TN-UHF-Q150…

6 Connecting

6.1 Connecting devices to Ethernet

The device has two 4-pin M12 female connectors for connection to an Ethernet system.

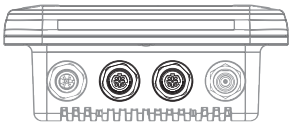


Fig. 4: M12 Ethernet connector

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

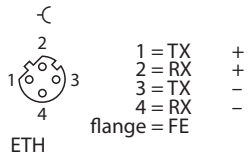


Fig. 5: Pin assignment for Ethernet connections

6.2 Connecting the power supply

The device has a 5-pin M12 connector for connecting to the power supply.

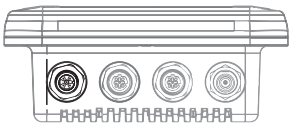


Fig. 6: M12 connector for connecting to the power supply

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

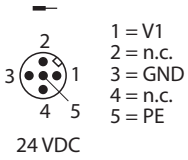


Fig. 7: Pin assignment for the power supply connection

6.3 Connecting the external antenna

The device has an RP-TNC female connector for connecting an external antenna. The input impedance is 50 Ω.

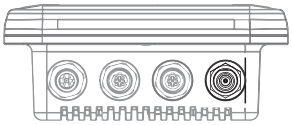


Fig. 8: RP-TNC female connector for connecting an external antenna

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

7 Commissioning

A connection to an EtherCAT main device is required for the commissioning. The device can only be configured and addressed via the EtherCAT main device. The EtherCAT device functions, e.g. FoE or communication via EoE, must be supported by the EtherCAT main device.

Once the cables and the supply voltage are connected, the device automatically goes into operation.

In the default configuration the idle command (0x0000) is active.

In order to execute further commands, the device must be set as follows:

- Establish communication with the EtherCAT main device.
- Activate EoE (see Assigning IP address for EoE).
- Configure reader via TAS (Turck Automation Suite), the device's web server or DTM.

7.1 Addressing a device on EtherCAT

EtherCAT uses an implicit addressing of the network nodes. The EtherCAT master automatically addresses all connected devices. Manual addressing or identification is only required with e.g. tool change applications (Hot Connect).

The device supports Configured Station Alias (ADO 0x0012) as an EtherCAT-specific identification capability for Hot Connect applications. The value for the Identification Value is written to the device via register 0x0012 of the EtherCAT master.

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

7.2 ESI files

Different ESI files must be used depending on the controller environment

Controller/configuration software	ESI file
TwinCAT	Turck_TN-UHF-Q150-…-EC_R1_ESI_….xml Example: Turck_TN-UHF-Q150-…- EC_R1_ESI_1-3_20230915_9071.xml
CODESYS	Turck_TN-UHF-Q150-…-EC_R1_ESI_….xml Example: Turck_TN-UHF-Q150-…- EC_R1_ESI_1-3_20230915_9071.xml

The current ESI files are available free of charge for download from www.turck.com.

7.3 Connecting the device to an EtherCAT master with TwinCAT

Naming convention

The following description uses the terms "EtherCAT master" and "EtherCAT slave" solely due to the naming convention in TwinCAT.

Hardware used

This example uses the following hardware components:

- Example device "EtherCAT Device"

Software used

This example uses the following software:

- TwinCAT Studio V3.1.0
- Microsoft Visual Studio 2013 or higher
- ESI file for EtherCAT device (download free of charge from www.turck.com)

7.3.1 Installing ESI files

The device is connected to a Beckhoff controller using an XML file, the EtherCAT Slave Information (ESI). To establish the connection, this device description file must be saved in TwinCAT Studio V3. The ESI file for the device is available as a free download from www.turck.com.

- ▶ Store the XML file in the TwinCAT installation directory: **TwinCAT → 3.1 → Config → Io → EtherCAT**.
- ▶ Launch TwinCAT Studio.
- ▶ Create a new project.
- ▶ Update the device catalog: **TwinCAT → EtherCAT Devices → Reload Device Descriptions**.
- ⇨ The device description is loaded.

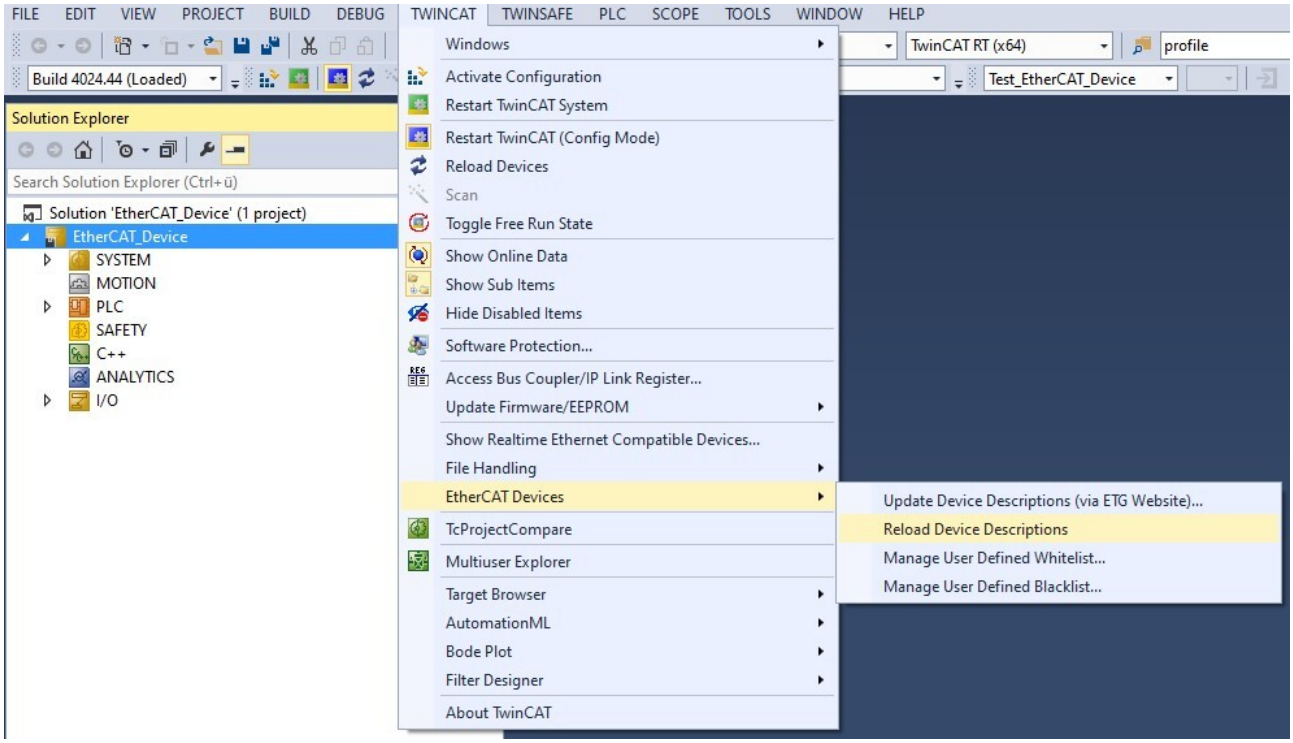


Fig. 9: Update the device catalog in TwinCAT

7.3.2 Connecting the device with the controller

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

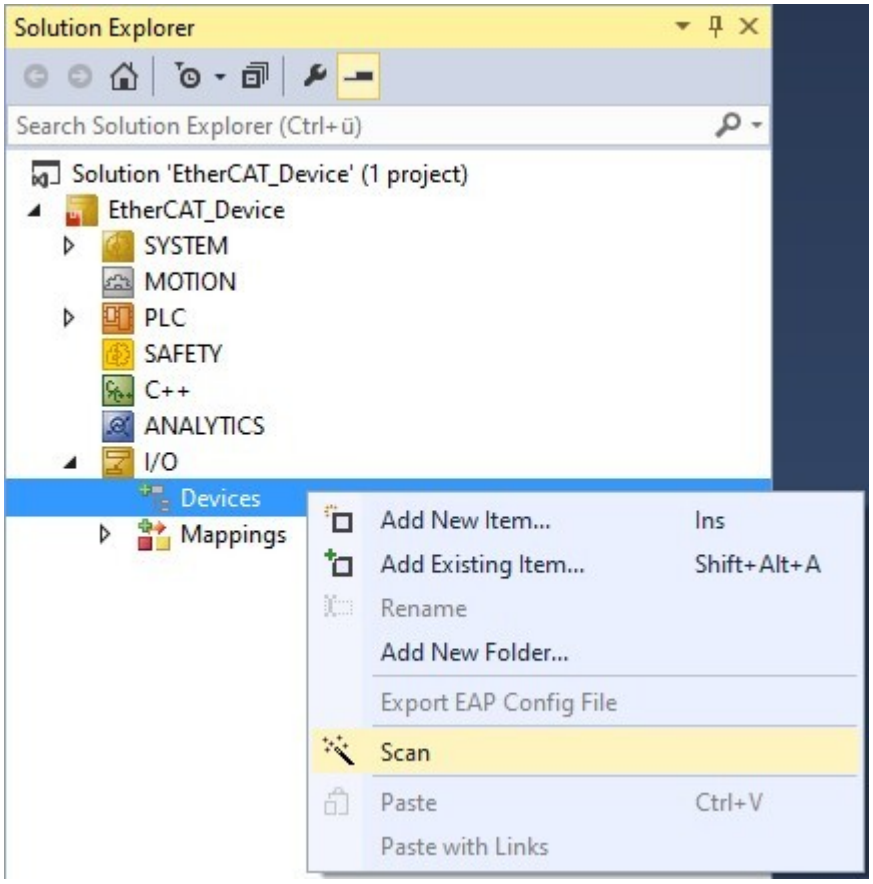


Fig. 10: Scan for devices in TwinCAT

⇨ All EtherCAT nodes (master and devices) are read in and automatically added to the I/O configuration. The EtherCAT device appears in Solution Explorer below the EtherCAT master as an **EtherCAT Device**.

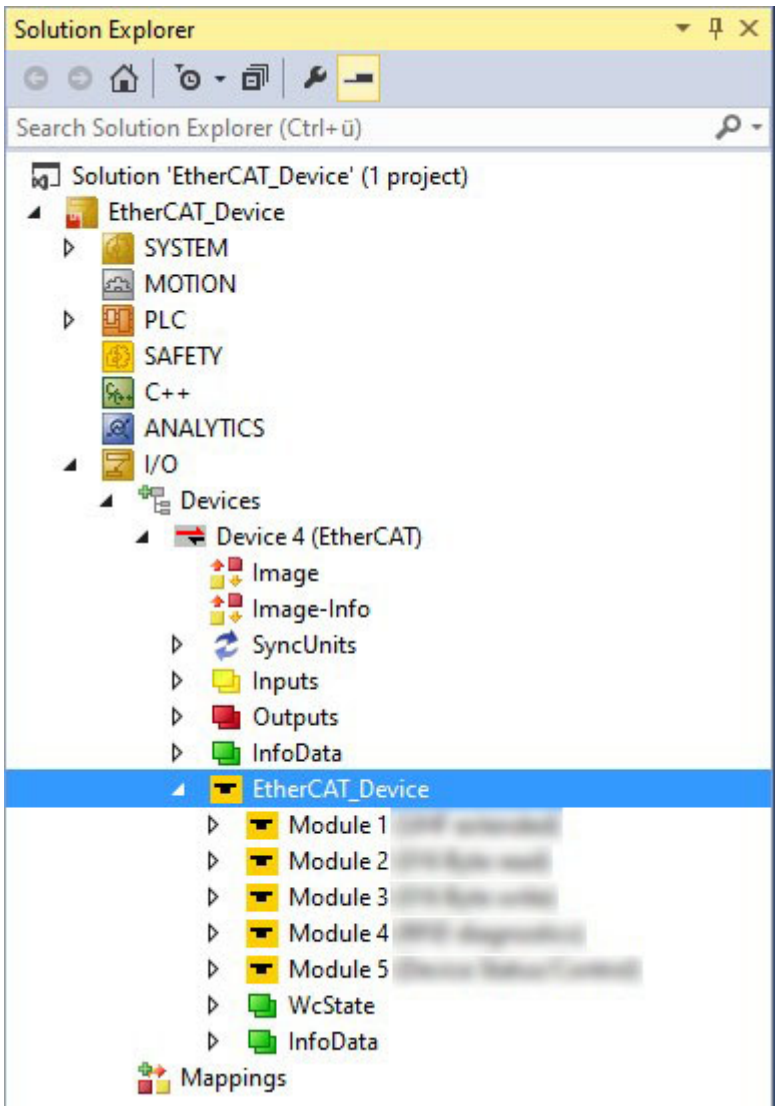


Fig. 11: EtherCAT Device in Solution Explorer

▶ At least one variable must be linked to connect online to the device.

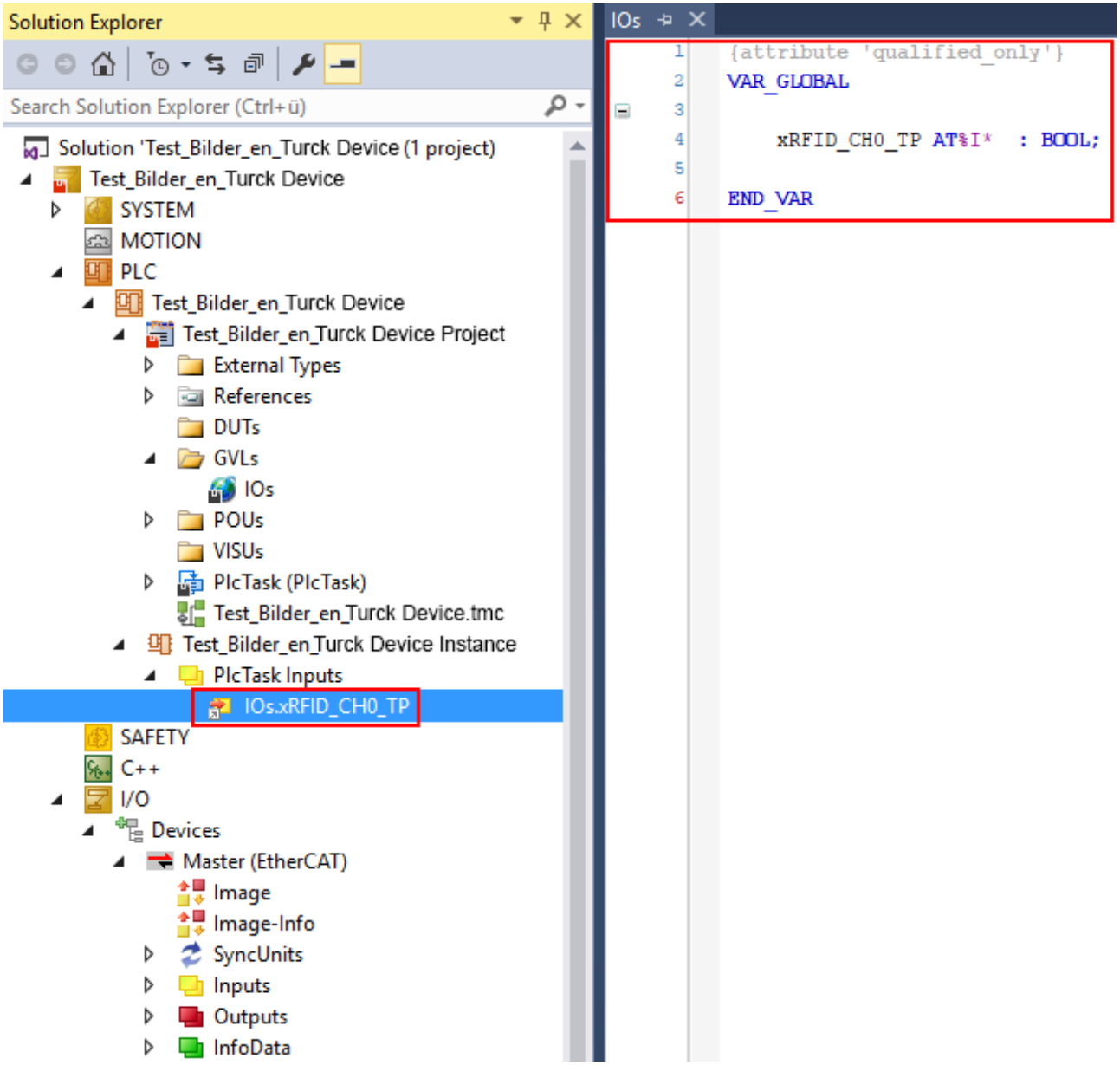


Fig. 12: Example of linking a variable

▶ Click the **Activate configuration** button.

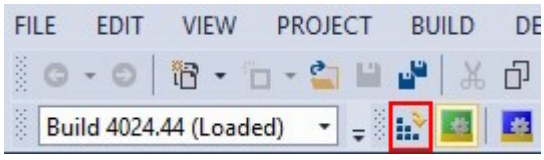


Fig. 13: Activating the configuration

⇨ The device configuration is activated.

▶ Click the **Run mode** button.

Fig. 14: Activating Run mode

⇨ The device is connected online with the EtherCAT master.

▶ Double-click on **EtherCAT Device** in the project tree.

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

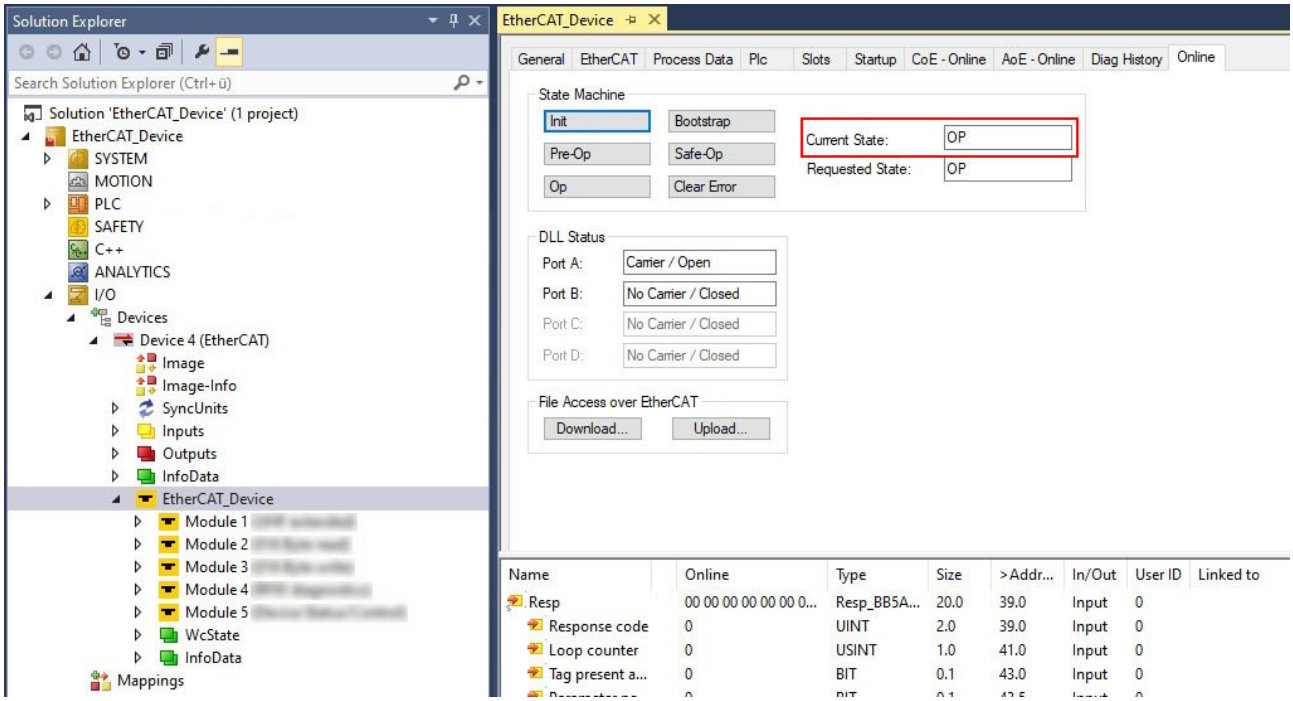


Fig. 15: Status of the EtherCAT device in TwinCAT

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

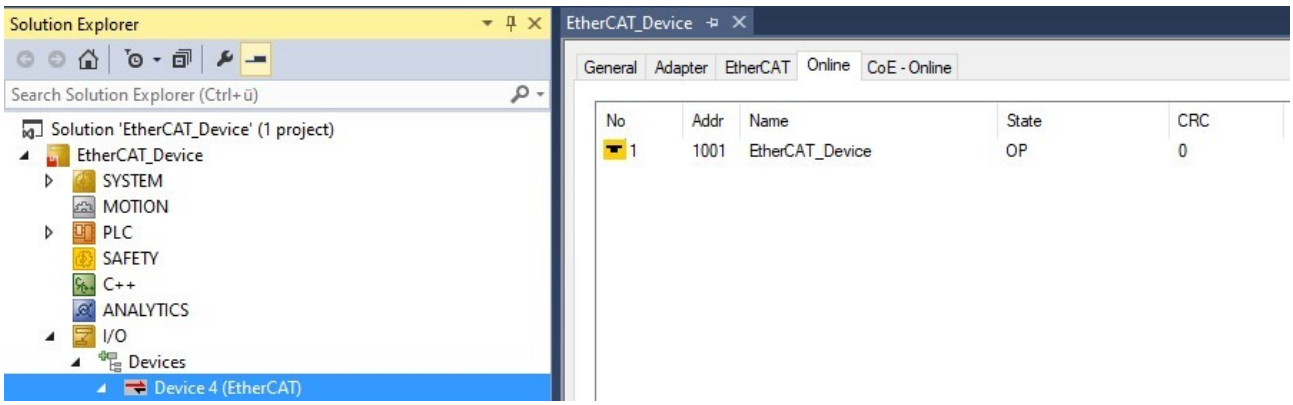


Fig. 16: Status of the EtherCAT master in TwinCAT

The following states are possible:

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

7.3.3 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

- ▶ Double-click on **EtherCAT Device** in the project tree.
- ▶ Select the **CoE – Online** tab.
- ⇨ The object dictionary of the device is displayed with all device-specific parameters.

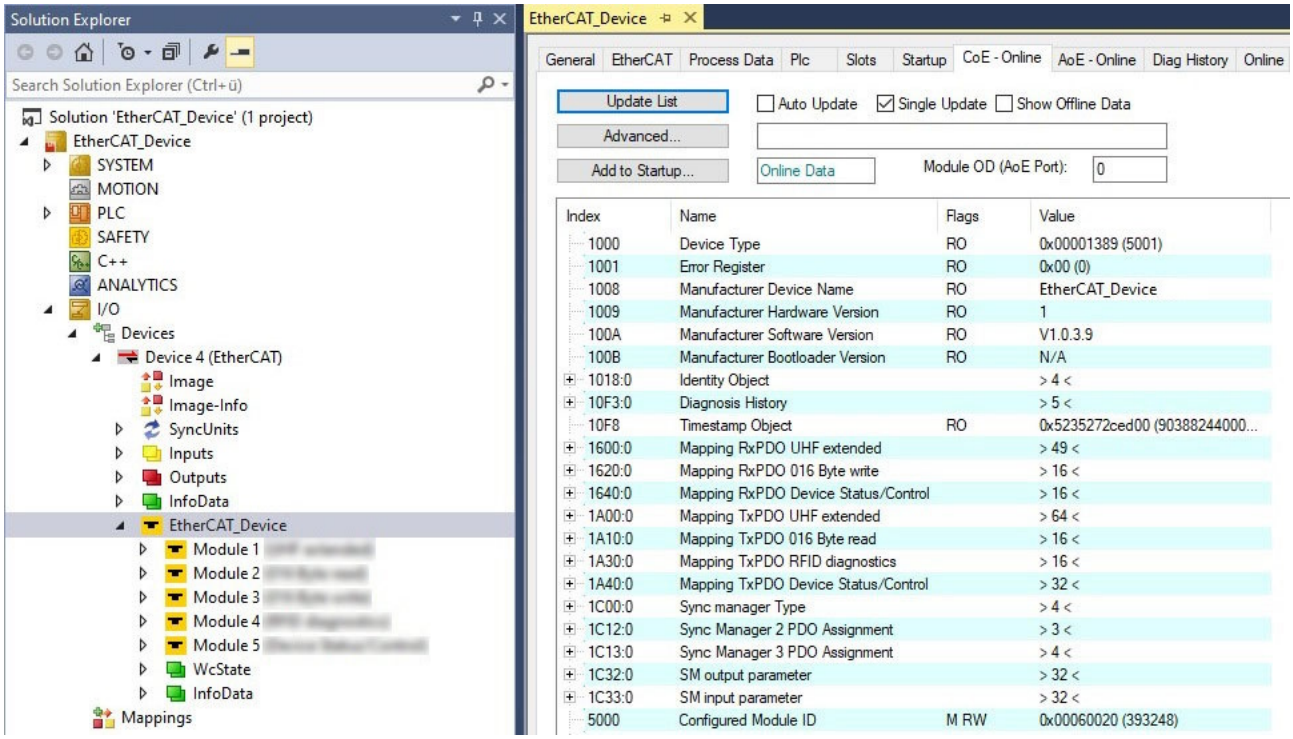


Fig. 17: Object Dictionary

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

NOTE
Changing the parameters during runtime can lead to an incorrect configuration of the device.

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

7.3.4 Addressing a device via Explicit Device ID

- Double-click on **EtherCAT Device** in the project tree.
- On the tab **EtherCAT** → **Advanced Settings** → **General** → **Identification** → activate **Explicit Device Identification (ADO 0x0134)**.
- In the **Value** field, enter the Identification Value (hex.); this value must match the rotary coding switches on the device (see [▶ 15]).
- Confirm entries with **OK**.
- Carry out a voltage reset.

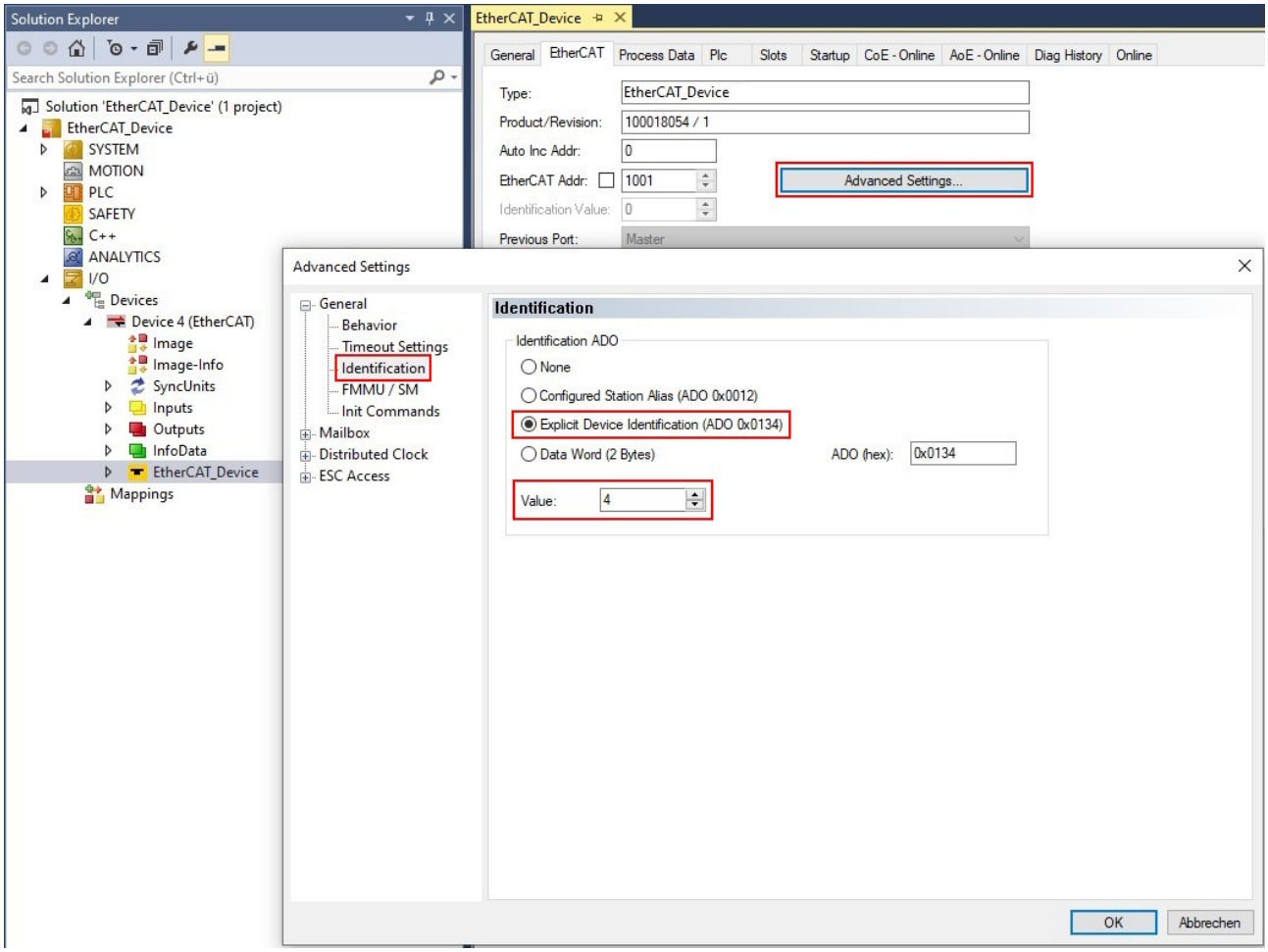


Fig. 18: Explicit Device Identification in TwinCAT

7.3.5 Addressing a device via Configured Station Alias

- Double-click on **EtherCAT Device** in the project tree.
- Activate the **EtherCAT** → **Advanced Settings** → **General** → **Identification** → **Configured Station Alias (ADO 0x0012)** tab.
- Confirm the entry with **OK**.

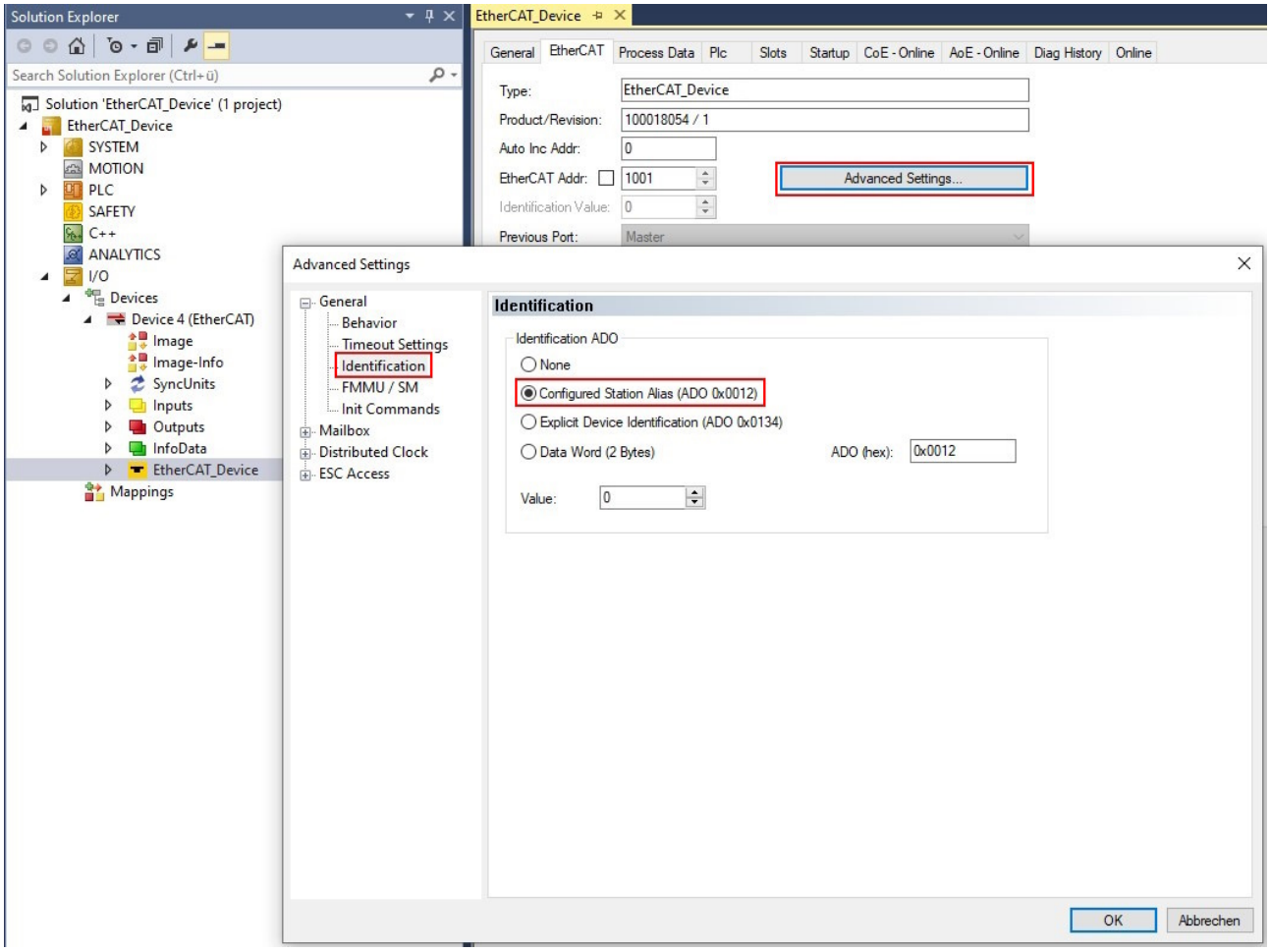


Fig. 19: Select Configured Station Alias in TwinCAT

- ▶ Select the **EtherCAT** → **Advanced Settings** → **ESC Access** → **E²PROM** → **Configured Station Alias** tab.
- ▶ In the **Value** field, enter the Identification Value (here: **4**).
- ▶ Click **Write to E²PROM**.
  - ⇨ The master writes the Identification Value to the device.
- ▶ Confirm with **OK**.

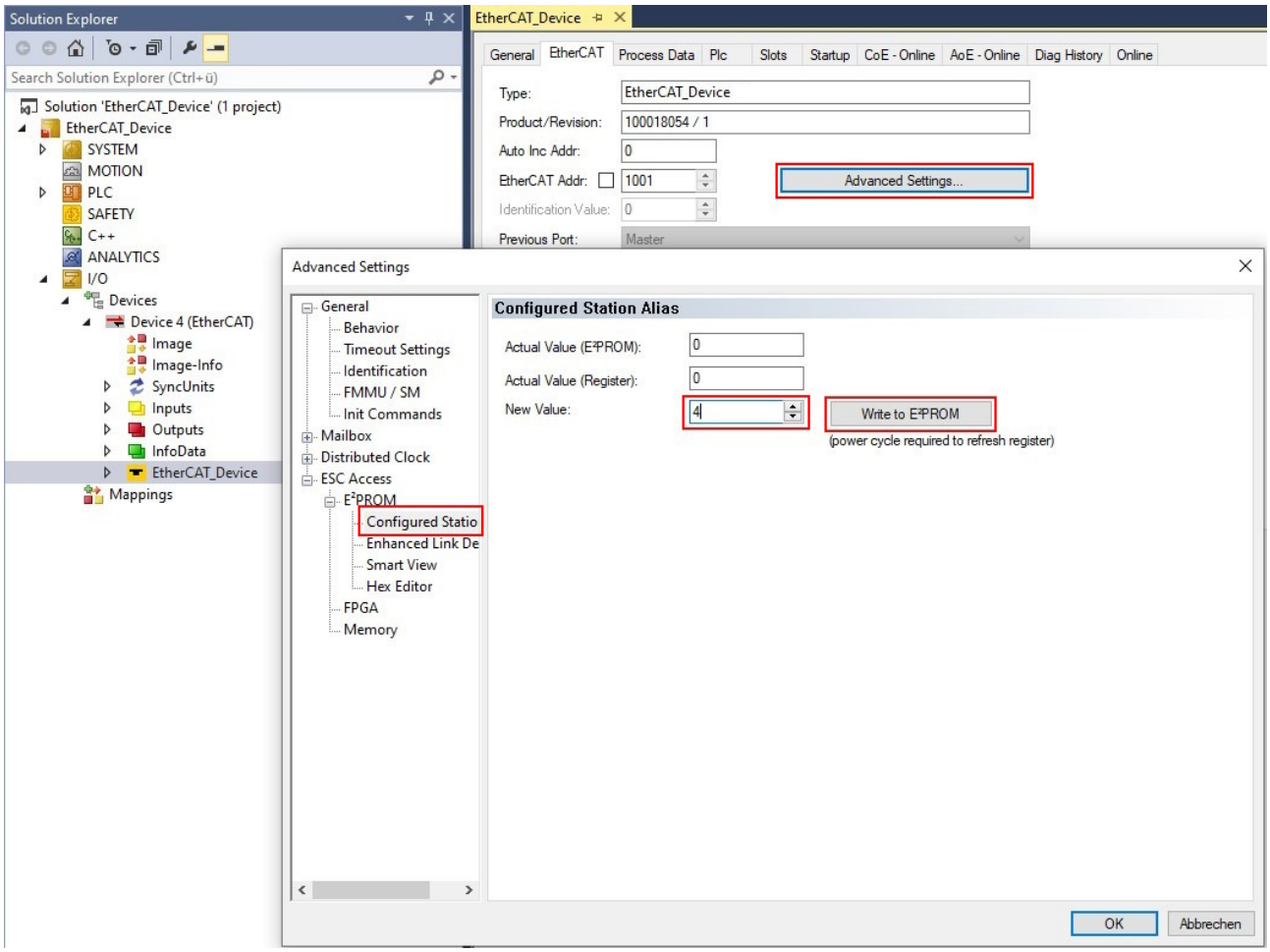


Fig. 20: Enter the Identification Value under Configured Station Alias in TwinCAT

- ▶ Carry out a voltage reset.
- ⇨ After the power up the newly inserted device is automatically detected by the master. The status in the **Online** tab switches automatically to **OP**.

7.3.6 Activating HotConnect

The Hot Connect function can be used to replace devices during ongoing plant operation (e.g. for tool-change applications). To use the Hot Connect function, a Hot Connect group must be set up.

- ▶ Right-click **EtherCAT Device** → **Add to HotConnect Group**.

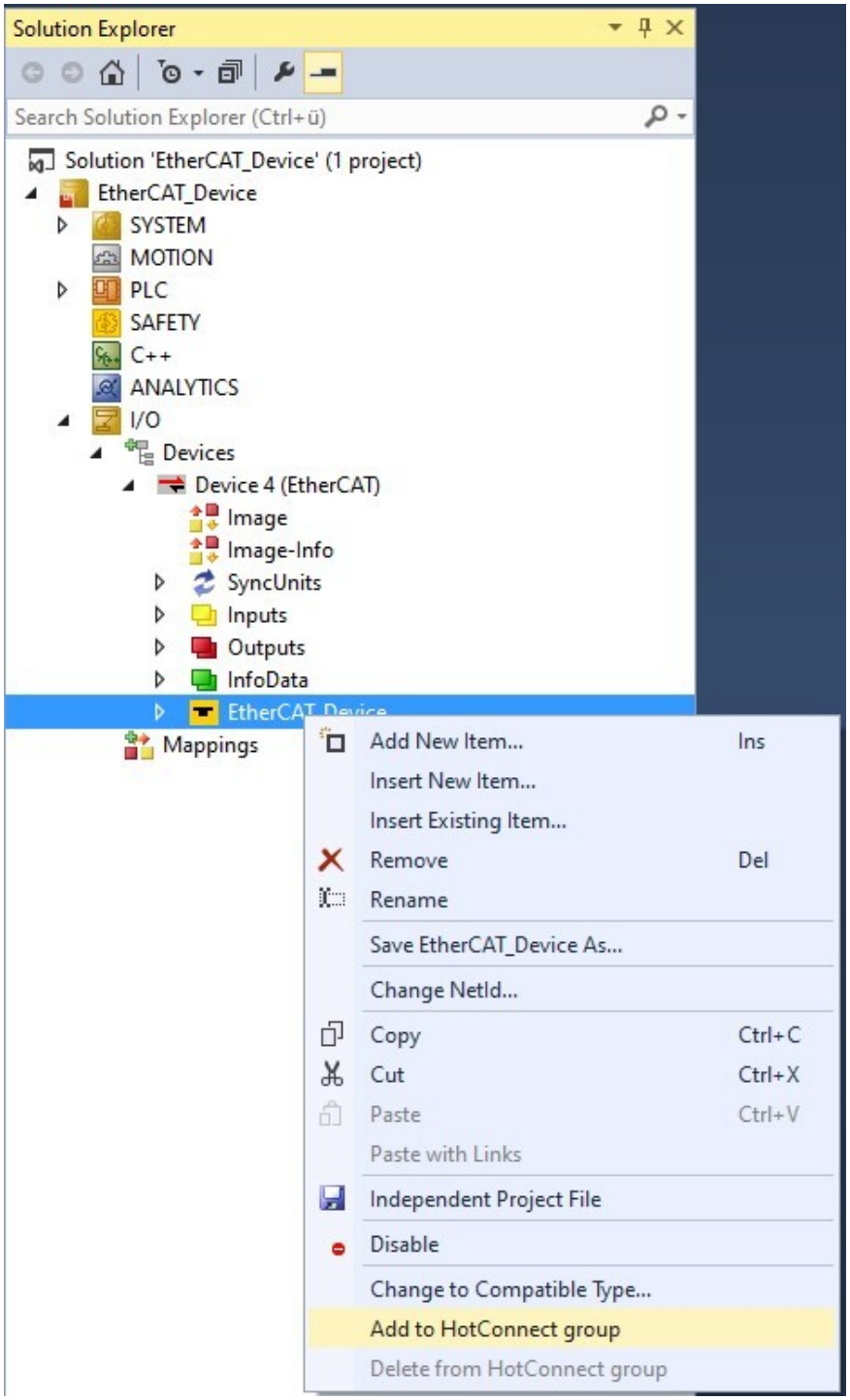


Fig. 21: Adding to HotConnect Group

- In the **Add Hot Connect Group** window, select the desired device (here: **EtherCAT Device**).
- Set the **Identification Value** (hex.) for the Hot Connect group (here: **4**).
- Confirm with **OK**.

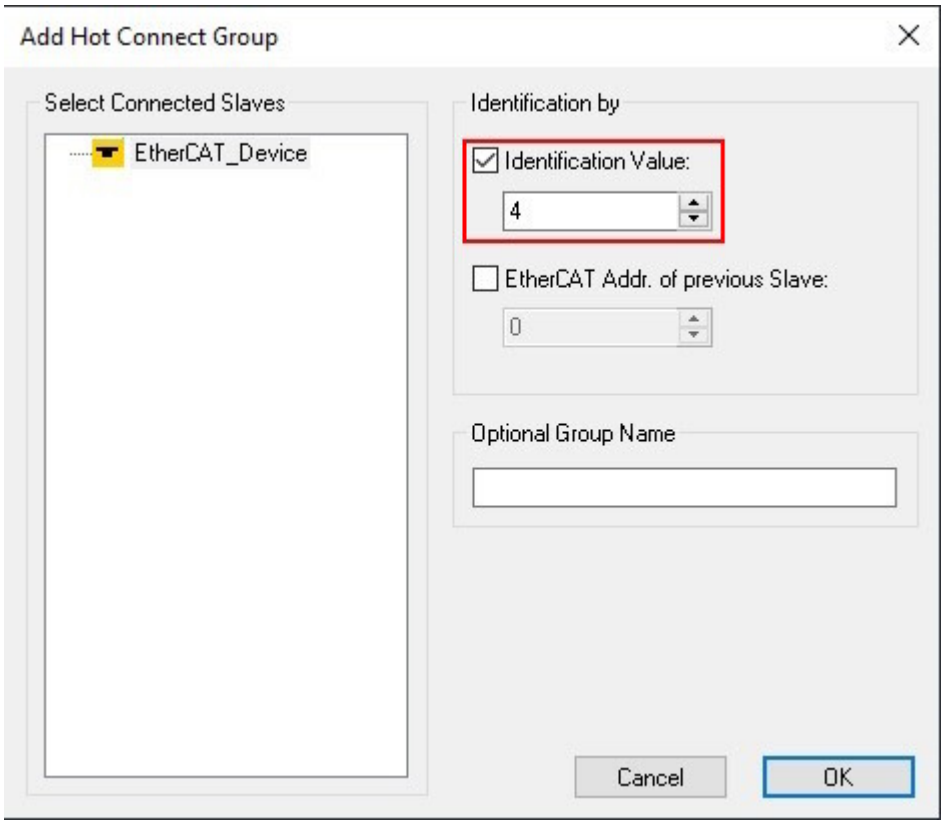


Fig. 22: Set the Identification Value for the HotConnect Group

⇨ The device has been added to a Hot Connect group; this can be identified by the small HC icon in the project tree.

NOTE
For a new device to be recognized by the master, the device address (Identification Value) must be set either via an Explicit Device ID or via a Configured Station Alias.

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

- Right-click **EtherCAT Device** → **Delete from HotConnect Group**.

7.3.7 Linking process data groups with variables

To link a process data group with variables, it is necessary to work with prefix structures (see mapping tables). The procedure for variable linking is described in the section "Incorporating a function block in TwinCAT" ([▶ 108]). The structures of the TwinCAT library must be accessed for the linking. The library is available free of charge for download from www.turck.com.

7.4 Connecting the device to an EtherCAT master with CODESYS

Naming convention

The following description uses the terms "EtherCAT master" and "EtherCAT slave" solely due to the naming convention in CODESYS.

Hardware used

This example uses the following hardware components:

- Block module TN-UHF-Q150-…-EC
- WinPLC as EtherCAT master

Software used

This example uses the following software:

- CODESYS 3.5 SP18 (download free of charge from www.turck.com)
- ESI file für TN-UHF-Q150-…-EC (download free of charge from www.turck.com)

7.4.1 Installing ESI files

The device is connected to controllers with an xml file containing EtherCAT slave information (ESI). To establish the connection, the device description file must be saved in CODESYS. The ESI file for the device is available as a free download from www.turck.com.

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

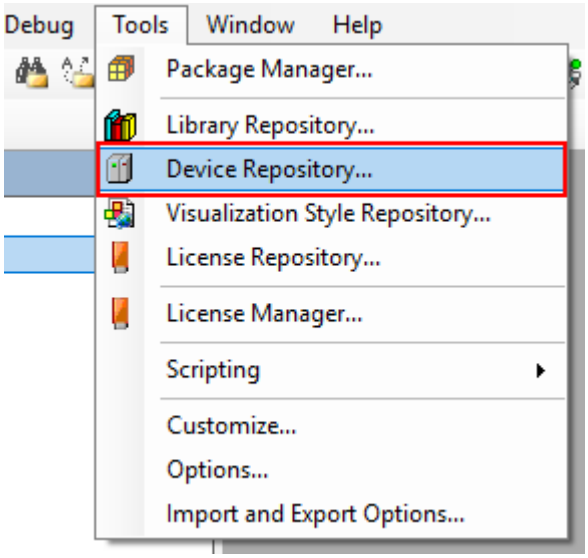


Fig. 23: Device repository

- ▶ Load the ESI file via the **Install** button.

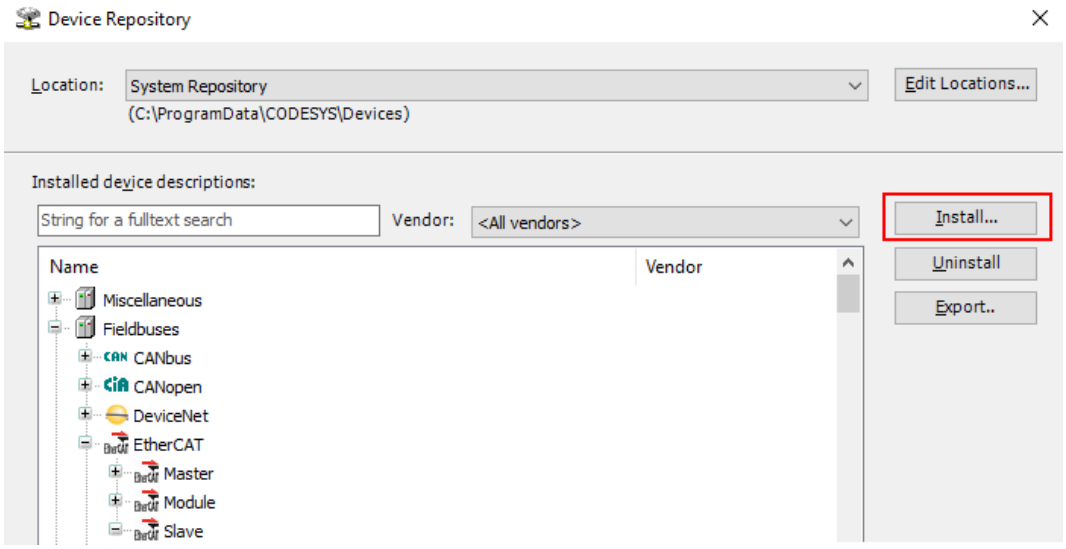


Fig. 24: Installing the device description file

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

7.4.2 Connecting the device with the controller

Requirements

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

Example: Creating a project with WinPLC

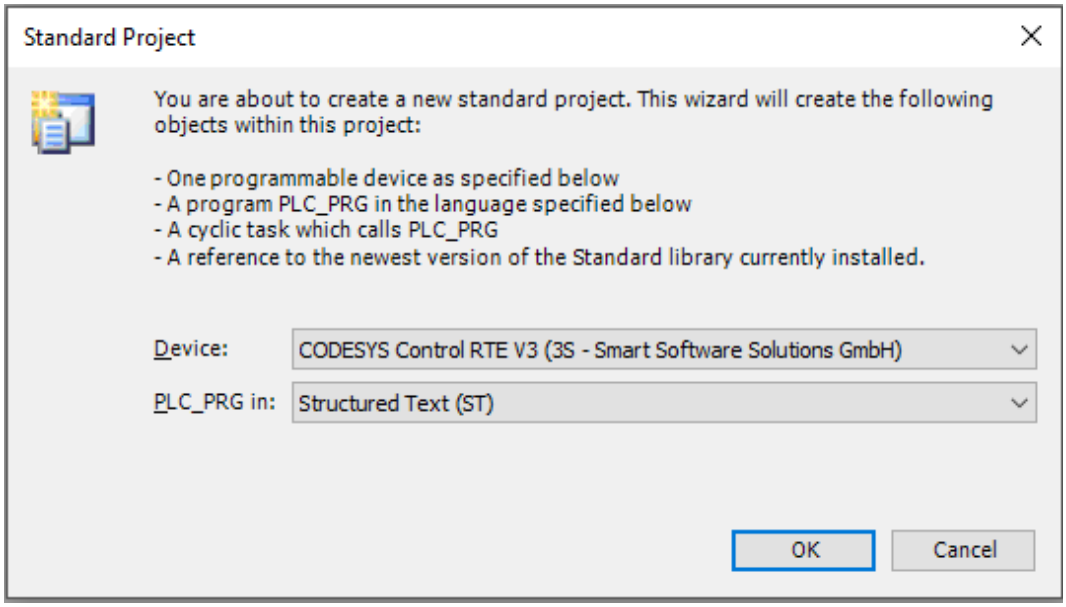


Fig. 25: Example: Create project

Adding an EtherCAT master

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

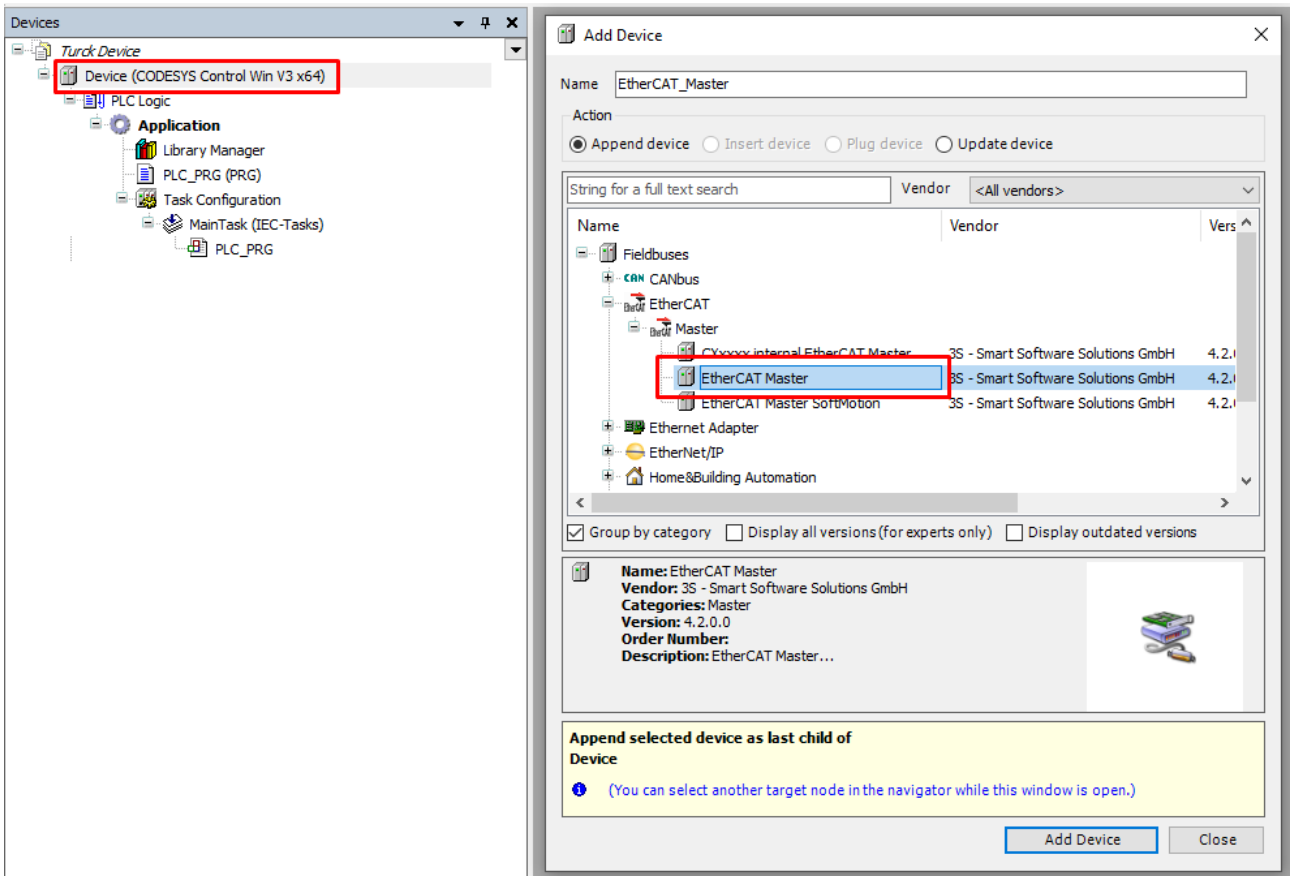


Fig. 26: Adding the device

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

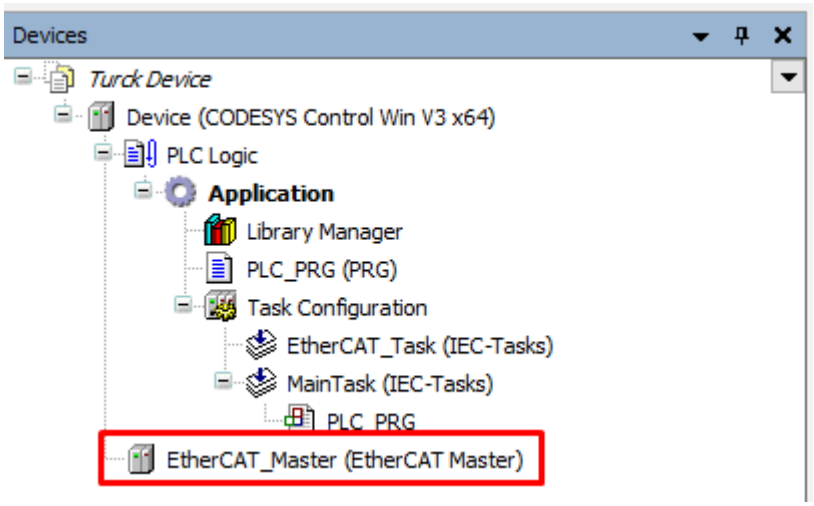


Fig. 27: Project tree

Selecting a network adapter

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

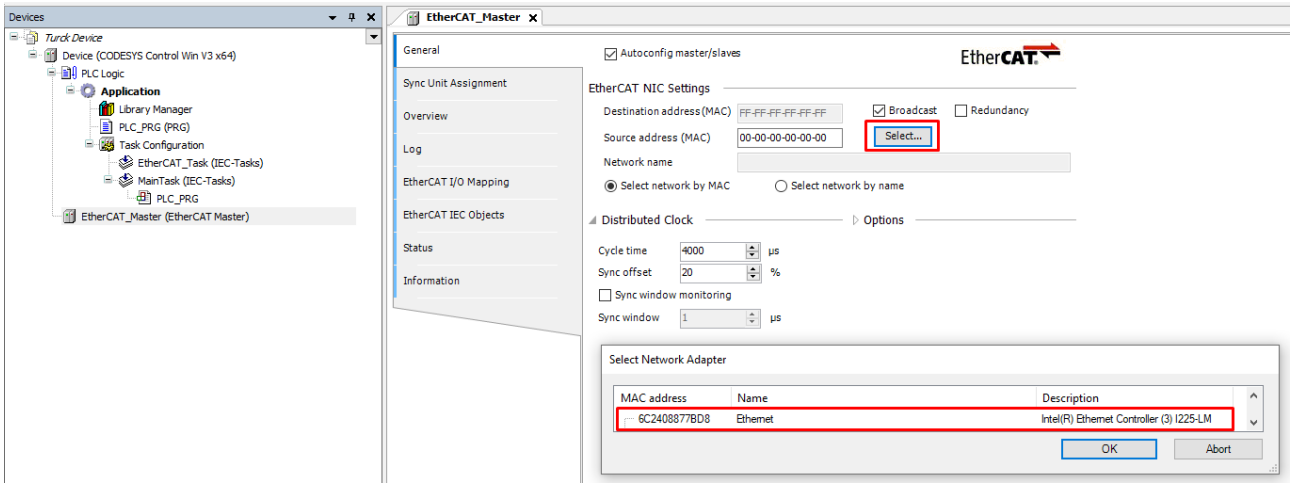


Fig. 28: Selecting a network adapter

- ▶ In the **General** tab open the **Options** menu item.
- ▶ Activate the **Automatic Restart Slaves** option.

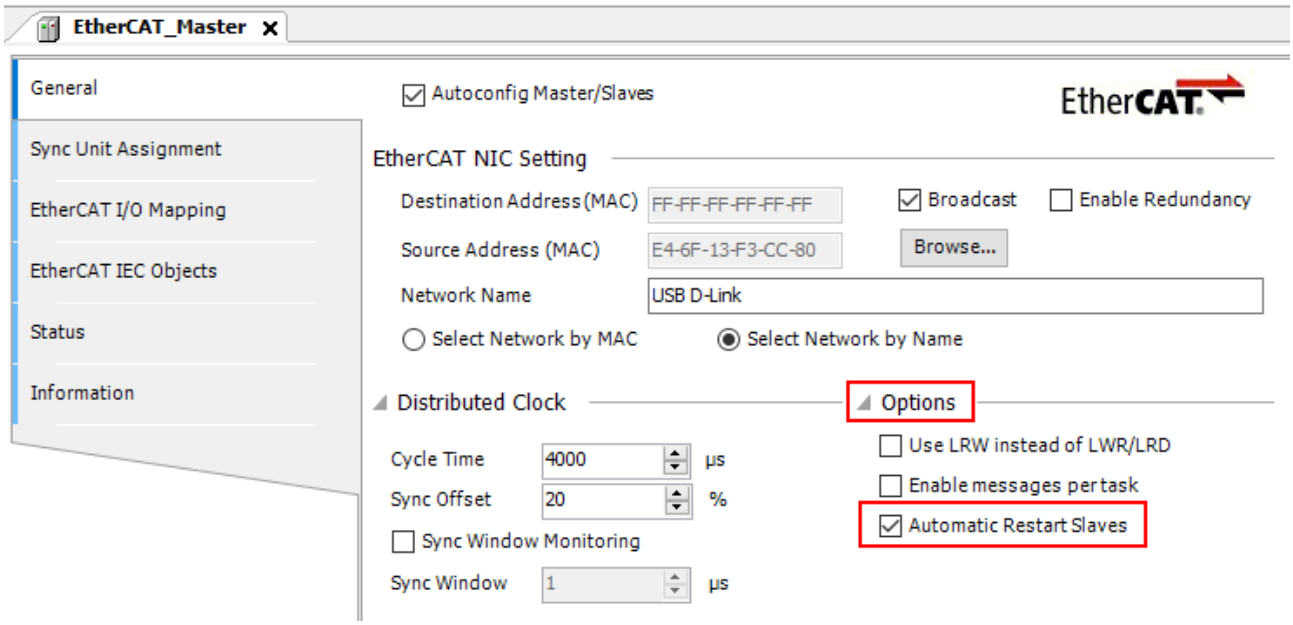


Fig. 29: Automatic Slaves Restart

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

Adding an EtherCAT slave

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

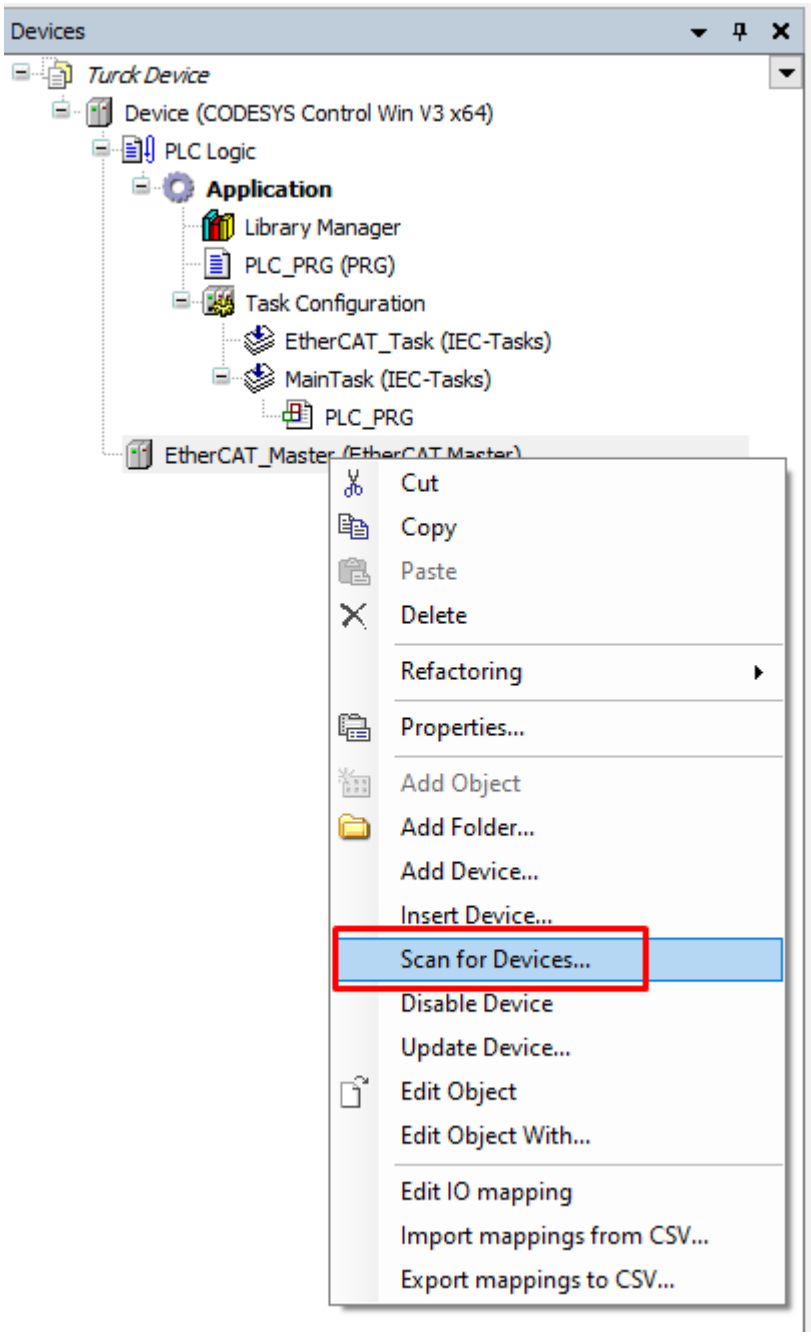


Fig. 30: Scanning for devices

▶ Select an EtherCAT slave (here: **TN-UHF-Q150-…-EC**) in the following window and click **Copy to Project**.

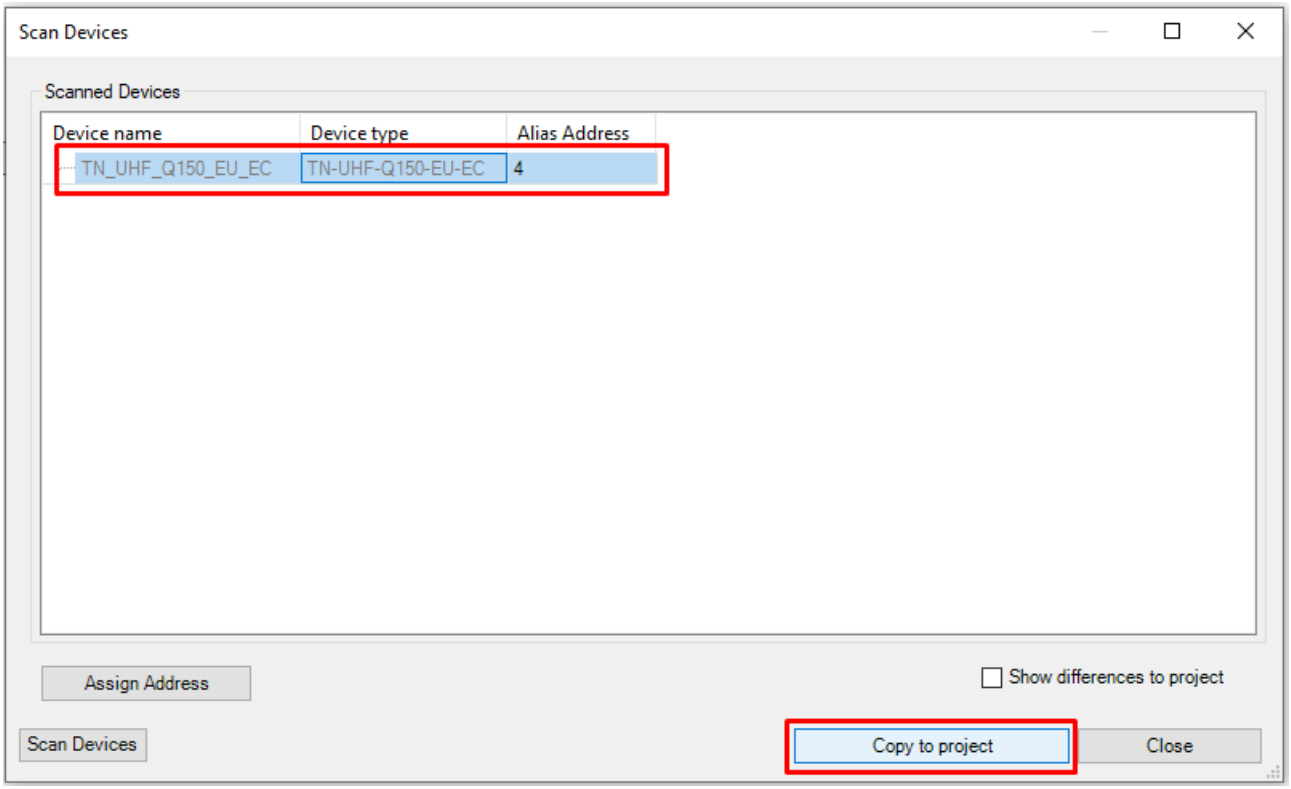


Fig. 31: Copying found devices to the project

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

Connecting the device online with the controller

▶ Click **Online** → **Login**.
⇨ The device is connected online with the PLC.
⇨ The green symbols in the project tree indicate the active connection.

▶ Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
⇨ On the **General** tab → **Diagnostics**, the **Operational** status indicates the active connection.

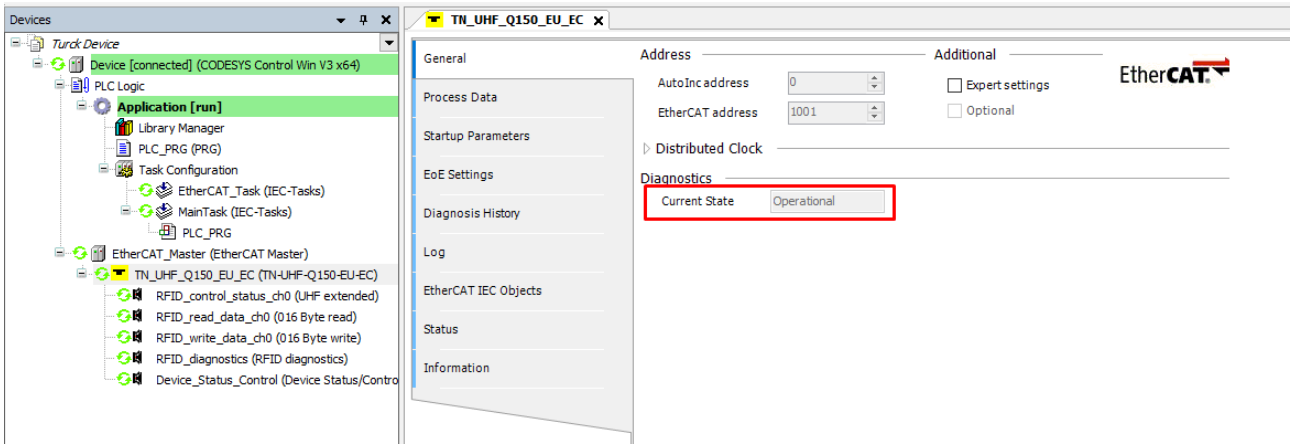


Fig. 32: Status: Operational

7.4.3 Setting startup parameters

NOTE
The **Configured Module ID** and **Reserved Elements (Res.)** parameters are set by the system and must not be changed.

- ▶ Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
- ▶ Select the **Startup Parameters** tab.
- ⇨ All set parameters of the module are displayed, but cannot be changed. The setting of the start parameters is carried out for each slot.

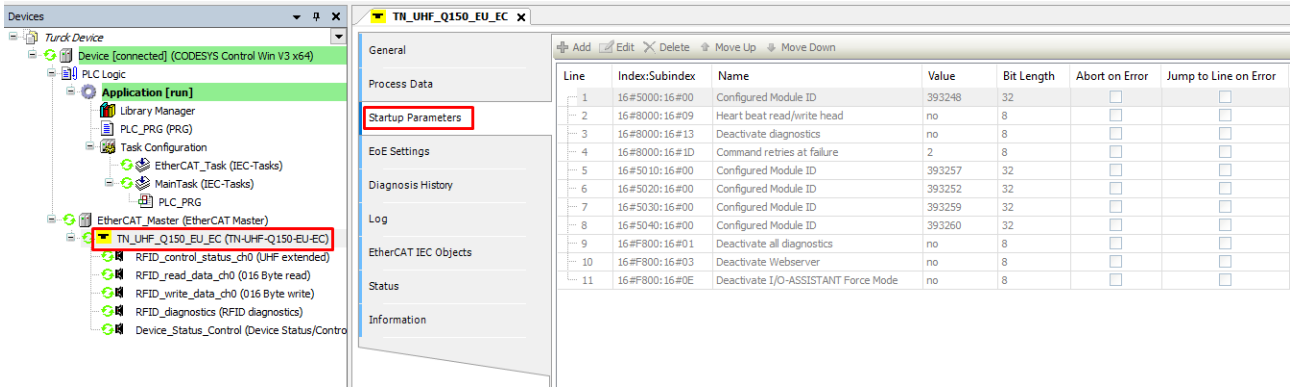


Fig. 33: Startup parameters of the module

Example: Deactivate diagnostics

- ▶ Double-click **RFID_control_status_ch0**
- ▶ Select the **Startup Parameters** tab.
- ▶ In line 3 **Deactivate diagnostics** choose the required tag type from the drop-down menu **(Yes)**
- ⇨ Diagnostics are deactivated.

7.4.4 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

- Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
- In the **General** tab, select the option **Activate expert settings**.

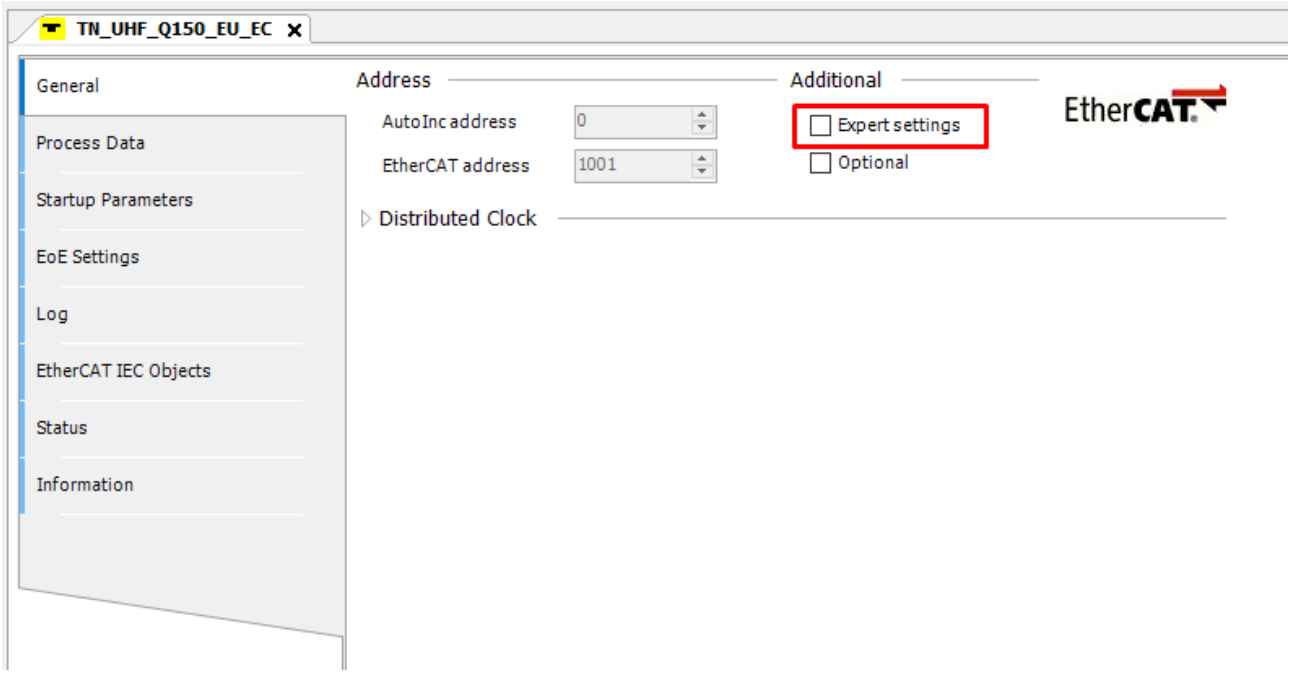


Fig. 34: Activate expert settings

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

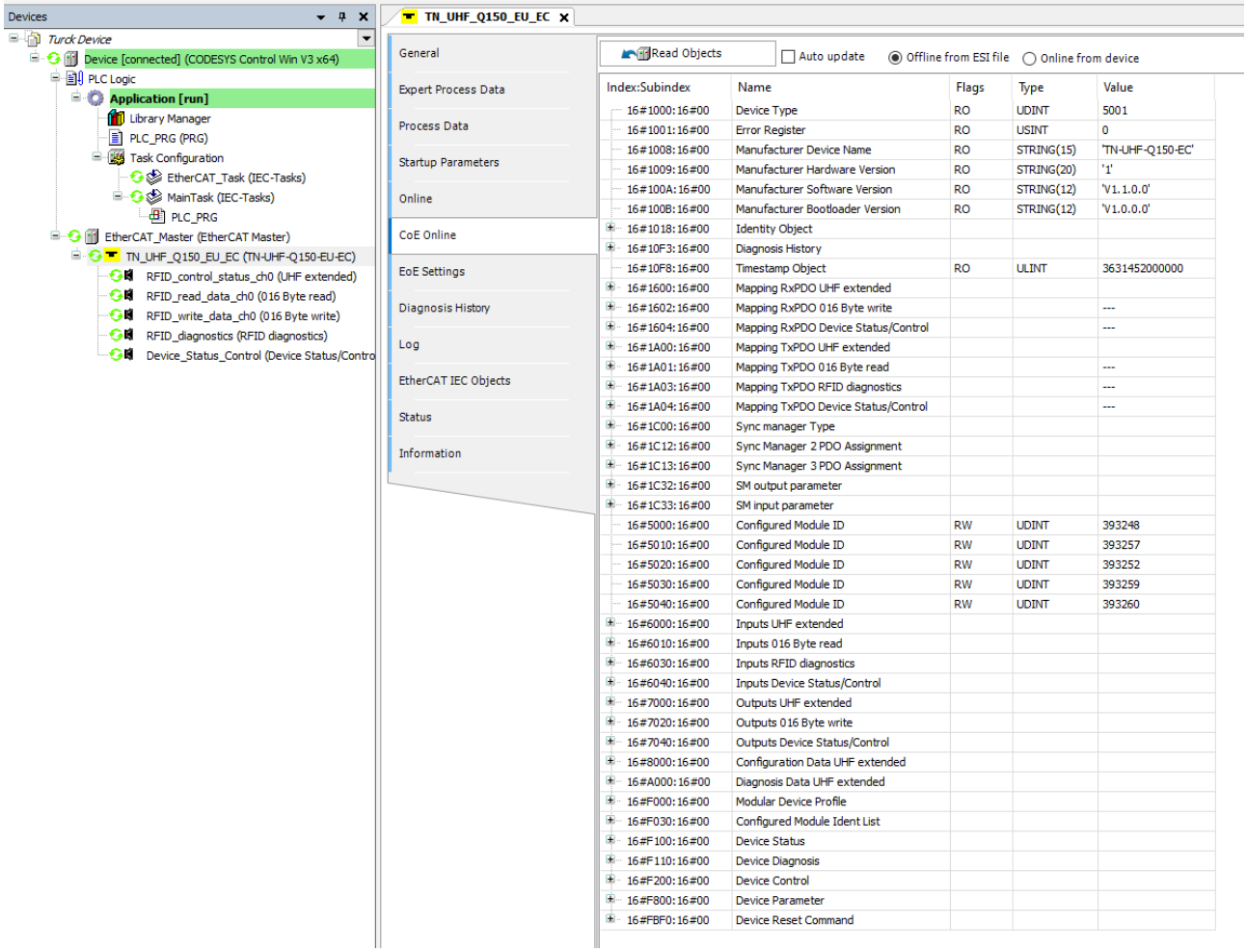


Fig. 35: Object Dictionary

The display of the parameters depends on the device configuration. The parameters can be changed in the Object Dictionary.

NOTE
Changing the parameters during runtime can lead to an incorrect configuration of the device.

7.4.5 Addressing a device via Configured Station Alias

- Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
- Click **Online → Login**.
- On the **General** tab activate the **Configured Station Alias (ADO 0x0012)** option under **Identification**.
- In the **Value** field enter the Identification Value.
- Click **Write to EEprom**.

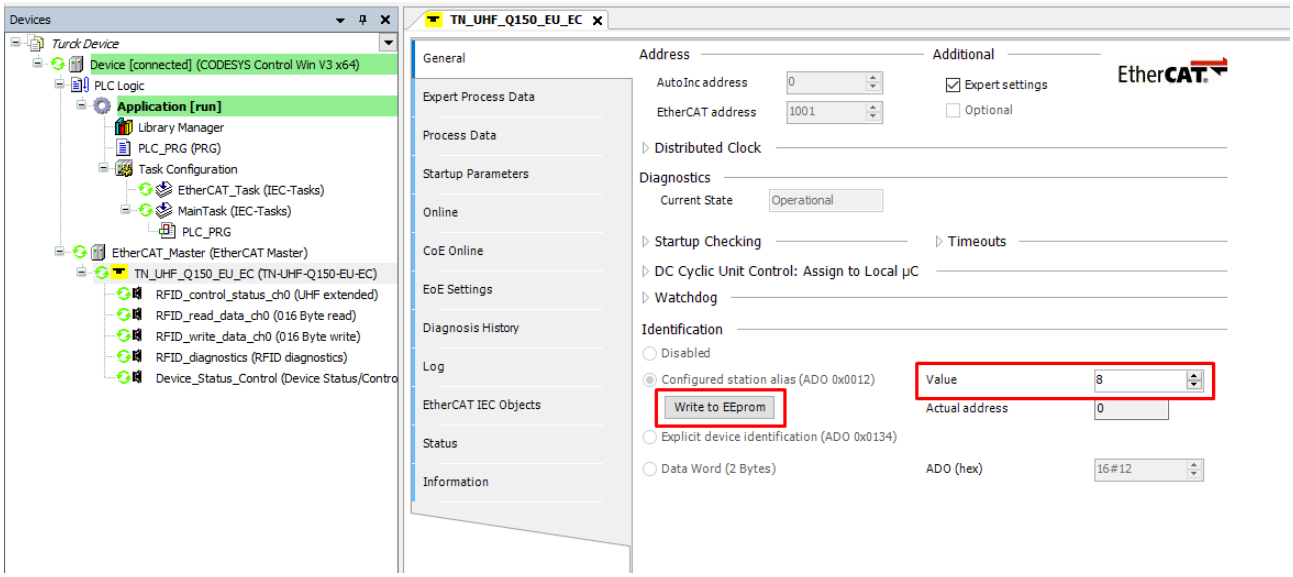


Fig. 36: Configured Station Alias: entering an Identification Value

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

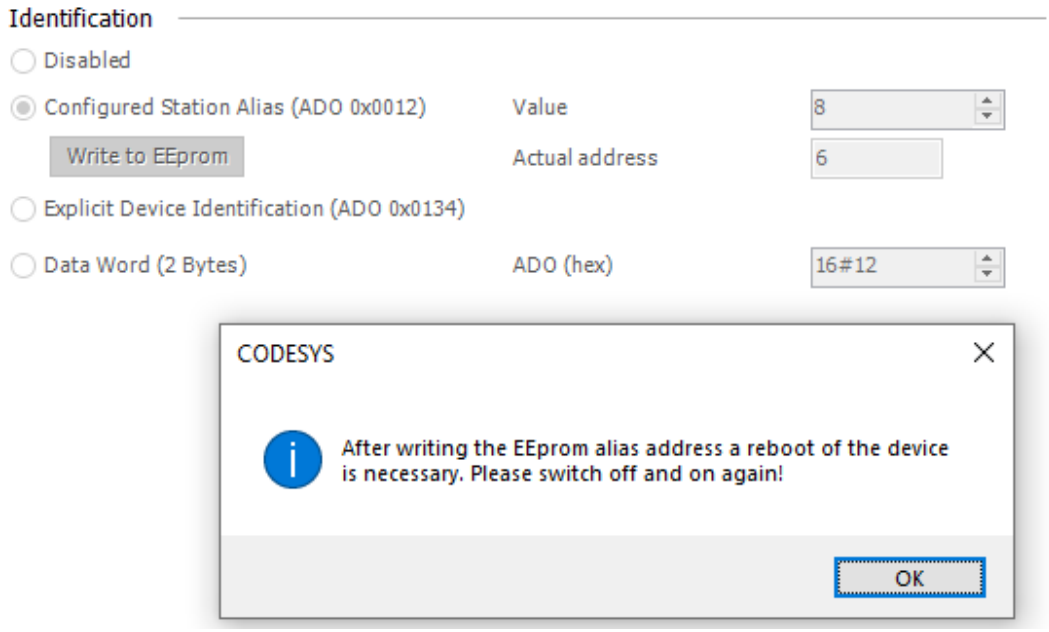


Fig. 37: Restart required

⇨ The Identification Value is written to the device.

▶ Carry out a voltage reset.

⇨ After the power up the newly inserted device is automatically detected by the master. The status in the Online tab switches automatically to OP.

7.5 Assigning an IP address for EoE

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

Activating EOE in TwinCAT

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

The following steps are required to activate the EoE function:

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

Activating EOE in the EtherCAT master:

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

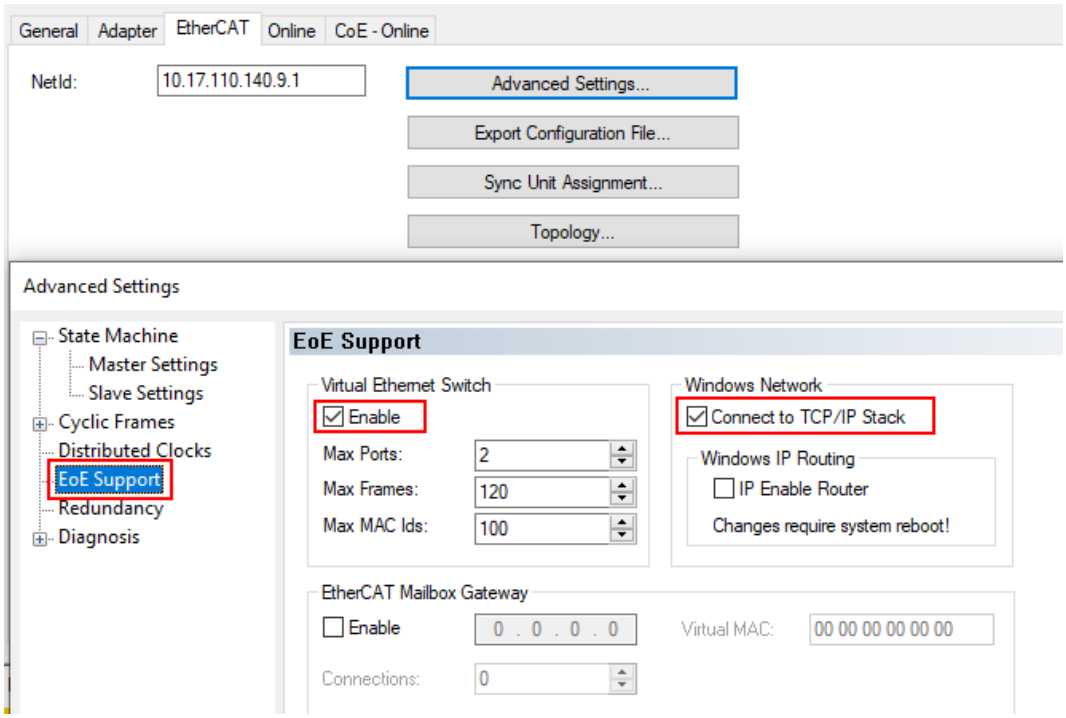


Fig. 38: TwinCAT – activating EoE in the master

Activating EoE in the EtherCAT slave:

- ▶ Double-click **Box 1 (TN-UHF-Q150-…-EC)**.
- ▶ Click on the **EtherCAT** tab → **Advanced Settings**.
- ▶ In the **Advanced Settings** window, select **EoE** under **Mailbox** on the left.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇨ The EoE function is activated in the EtherCAT slave.

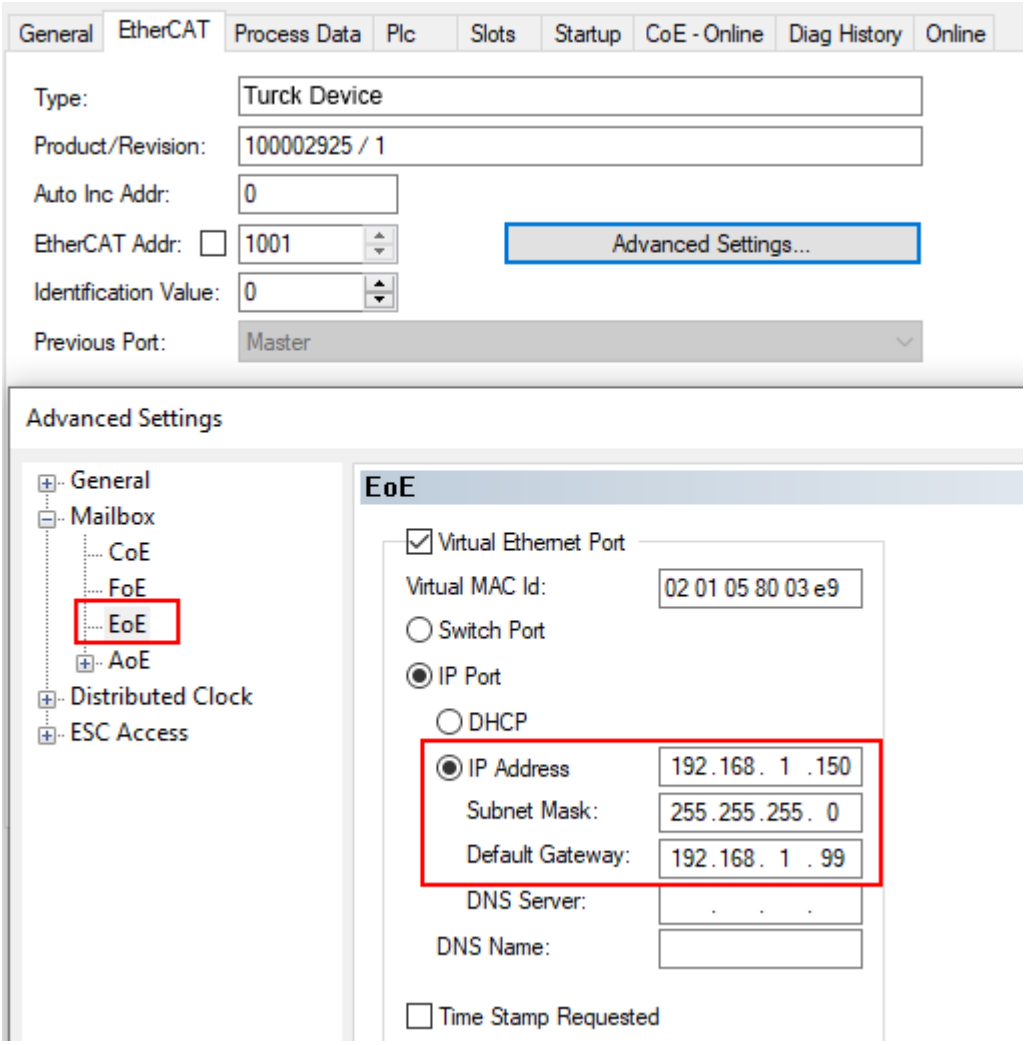


Fig. 39: TwinCAT— activating EoE in the EtherCAT slave

NOTE
DHCP is not supported by TN-UHF-Q150-…-EC.

Activating EoE in CODESYS

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

Activating EoE in the EtherCAT slave:

- ▶ Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
- ▶ Select the **EoE Settings** tab.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇨ The EoE function is activated in the EtherCAT slave.

Configuring a device

After EoE has been activated in the EtherCAT master and in the EtherCAT slave, the device can be configured via TAS or web server.

7.6 Parameterizing the reader using the web server

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.

7.6.1 Opening a 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.

7.6.2 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**

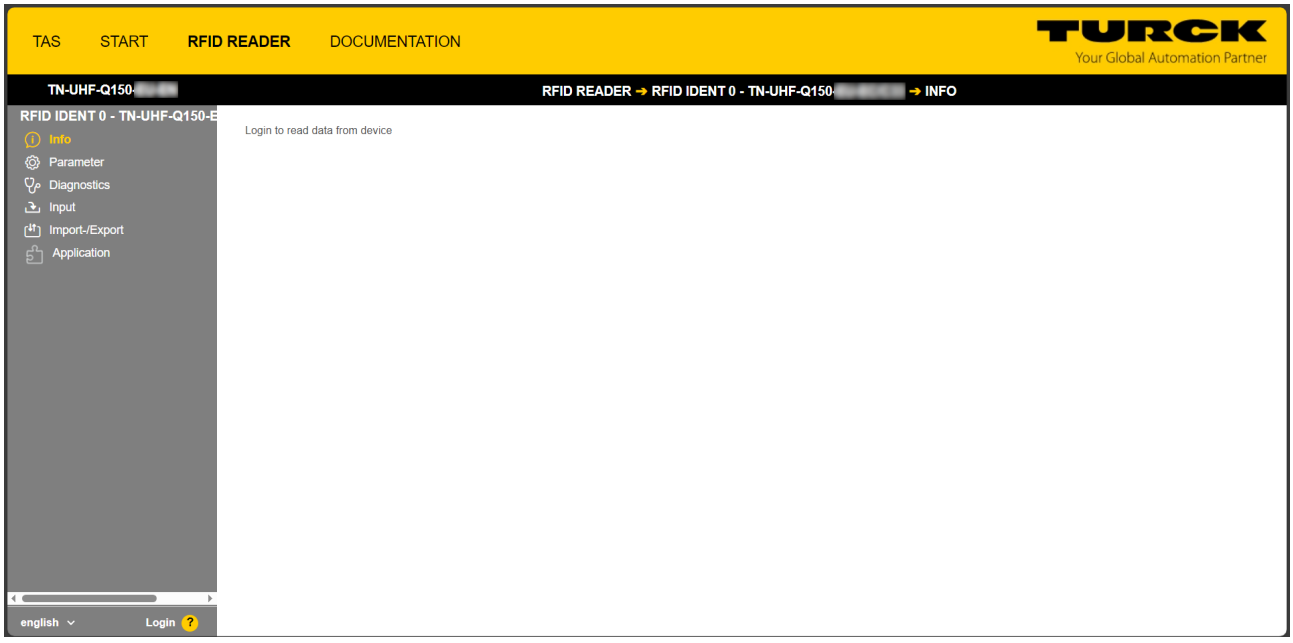


Fig. 40: Web server — login

▶ Change the password after you log in.

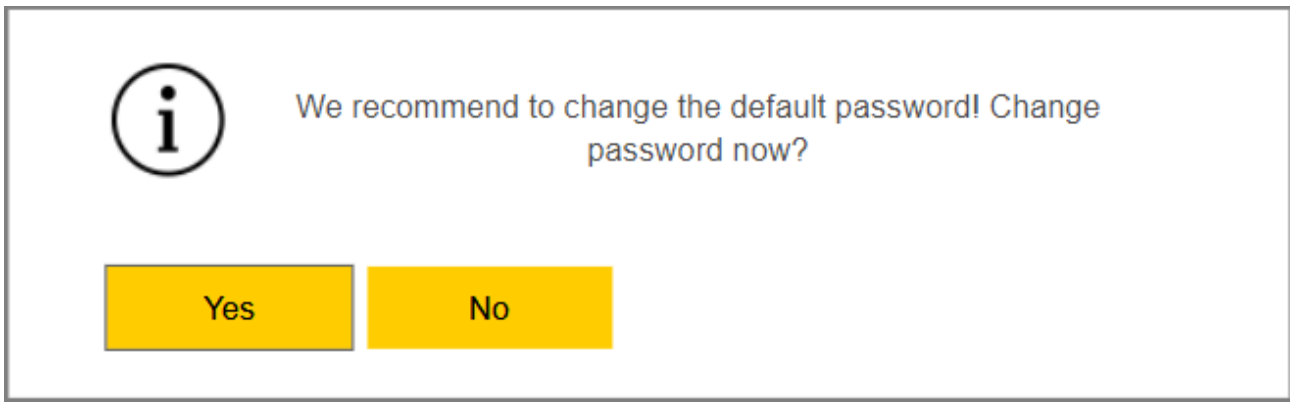


Fig. 41: Web server — password change dialog

After you log in, the home page is displayed with the device information.

▶ Click **RFID READER** to display and set the device parameters.

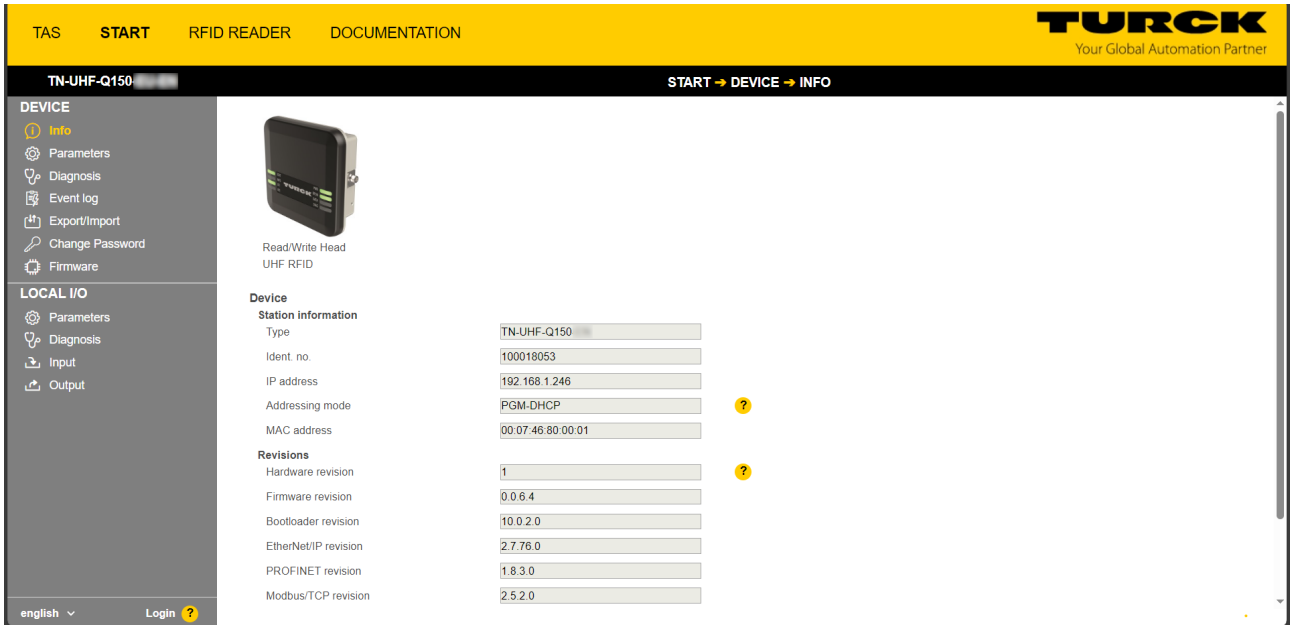


Fig. 42: Web server — RFID Reader — Info

▶ Click **Parameter** in the navigation bar on the left of the screen.
⇨ All parameters of the device are displayed.

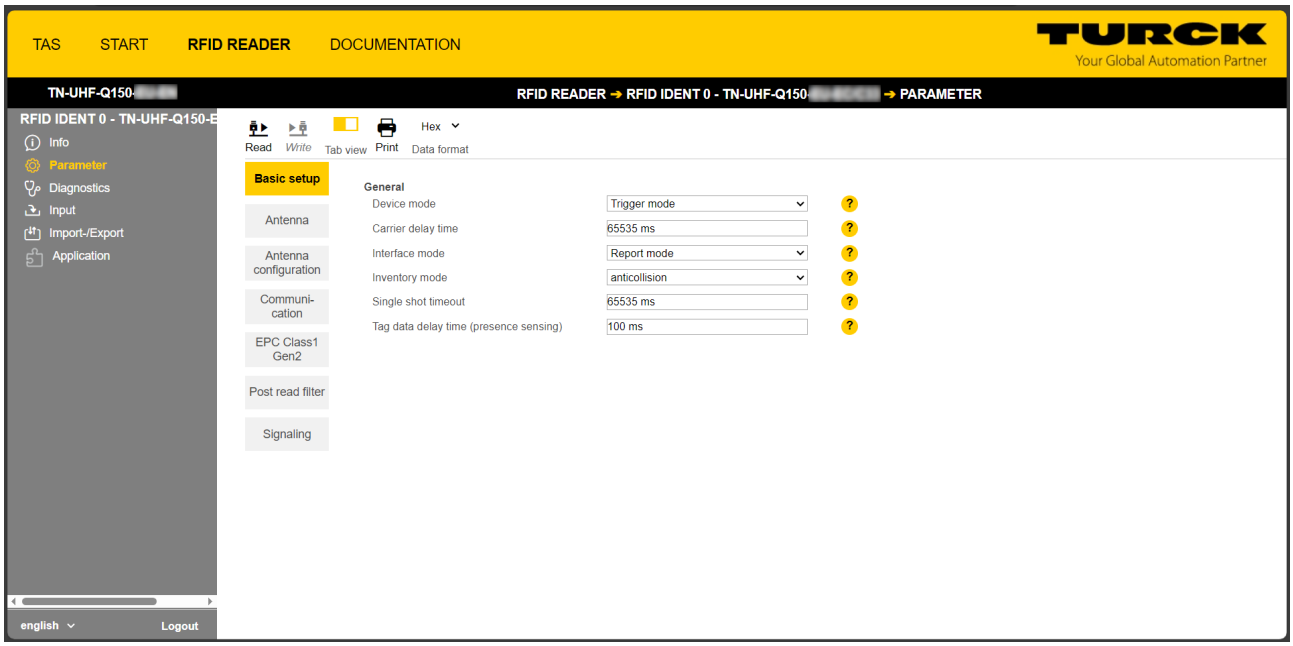


Fig. 43: Web server — RFID Reader — Parameter

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 being set, the ERR LED lights up red and automatically turns green.

7.6.3 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.

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**

Example: Configuring multiplex operation

- ▶ Select **RFID READER**.
- ▶ Select **Parameter**.

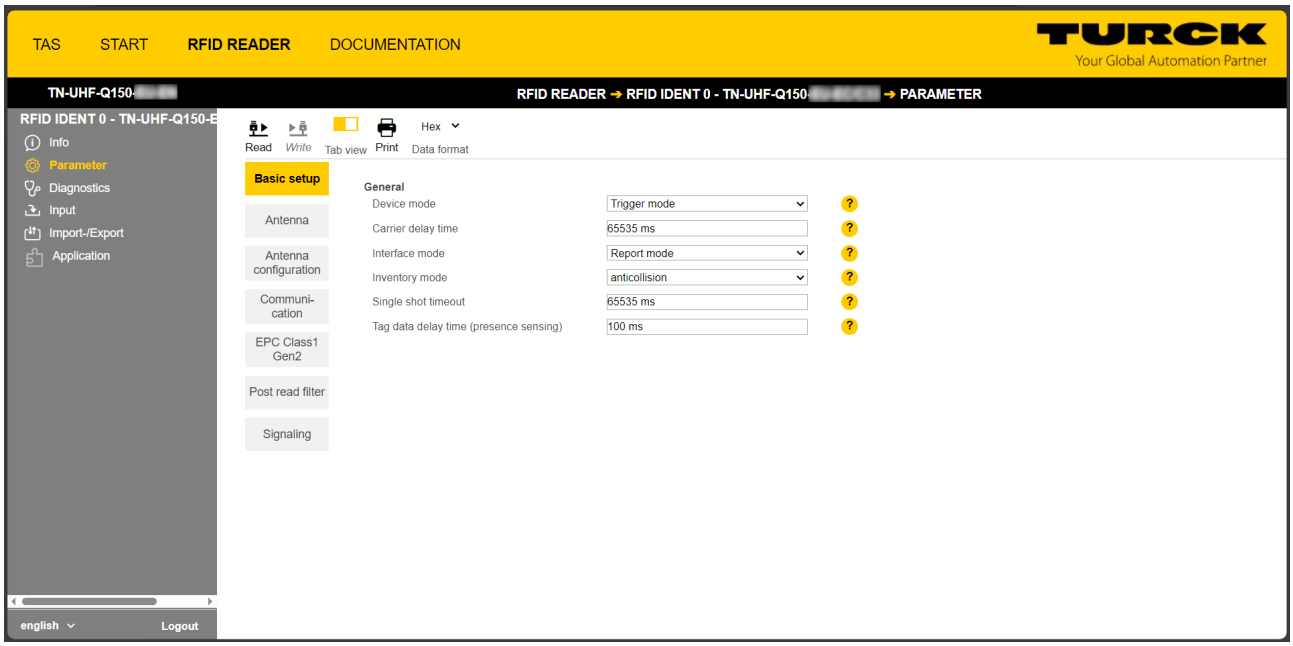


Fig. 44: RFID Reader — Parameter

- ▶ Select **Antenna**.

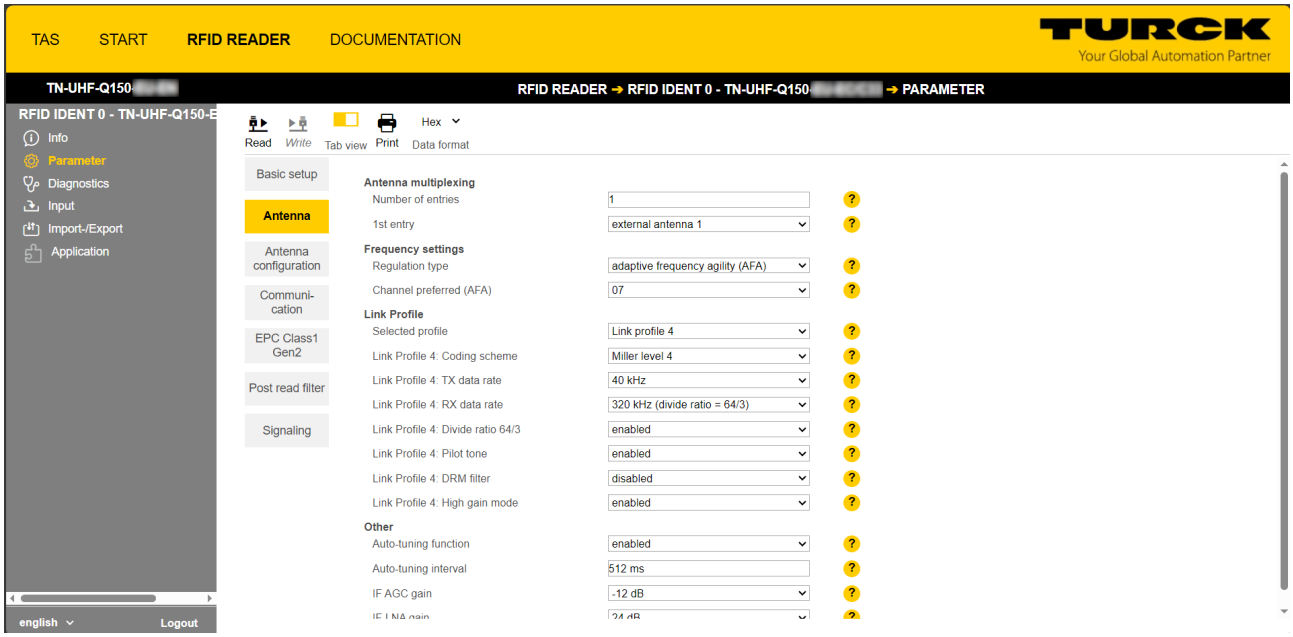


Fig. 45: RFID Reader — Parameter — Antenna

- Under **Antenna multiplexing**, enter the number of antennas in the **Number of entries** field.
- Select **Antenna configuration**.

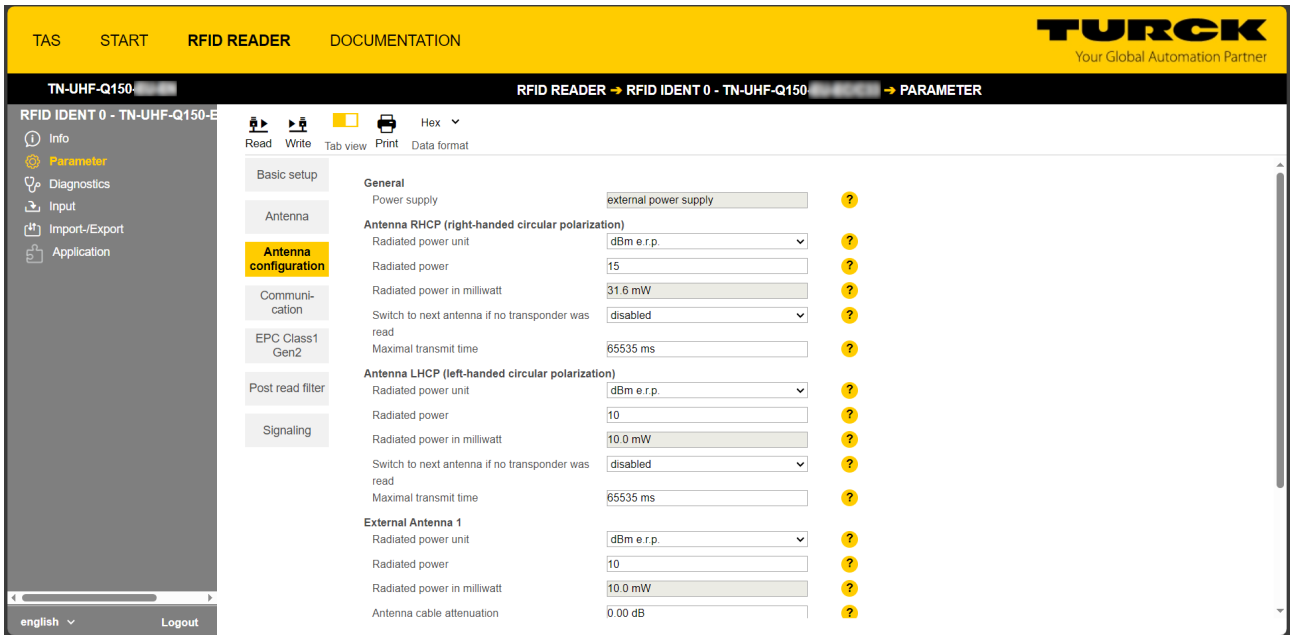


Fig. 46: RFID reader — Parameter — Antenna configuration

- For each antenna, enter in the **Maximum transmit time** field the amount of time for which that antenna should remain active.

7.6.4 Setting antenna power

The antenna power of the reader can be set for the specific application. The radiated power can be entered directly for the integrated antenna. 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.

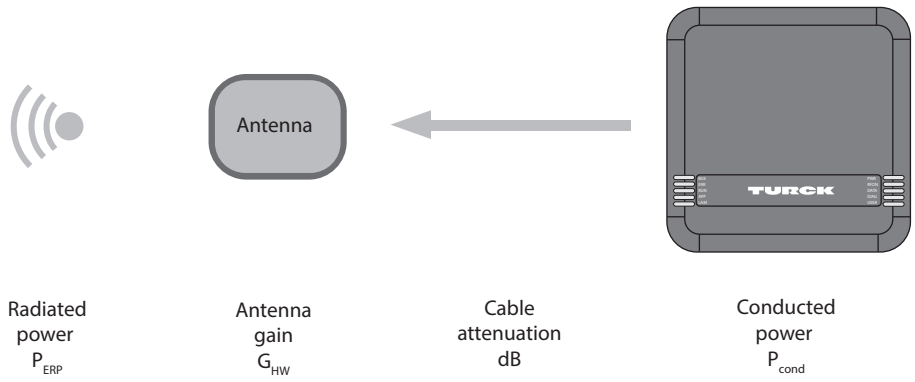


Fig. 47: Power calculation – Relevant variables (schematic representation)

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 $G_{HW} \leq 6$ db

NOTE
The web server uses an exclamation point to identify invalid configurations. 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

- ▶ Set the radiated power under **External Antenna 1** → **Radiated power** (here: 24 dBm e.r.p.).
- ▶ Refer to the data sheet of the cable used for the cable attenuation.
- ▶ Enter the cable attenuation at **Antenna 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).
- ▶ Set antenna gain at **Antenna gain** (here: 5.00).
  - ⇨ The power at the TNC female connector (P_{cond}) is calculated automatically and displayed under **Conducted power**.

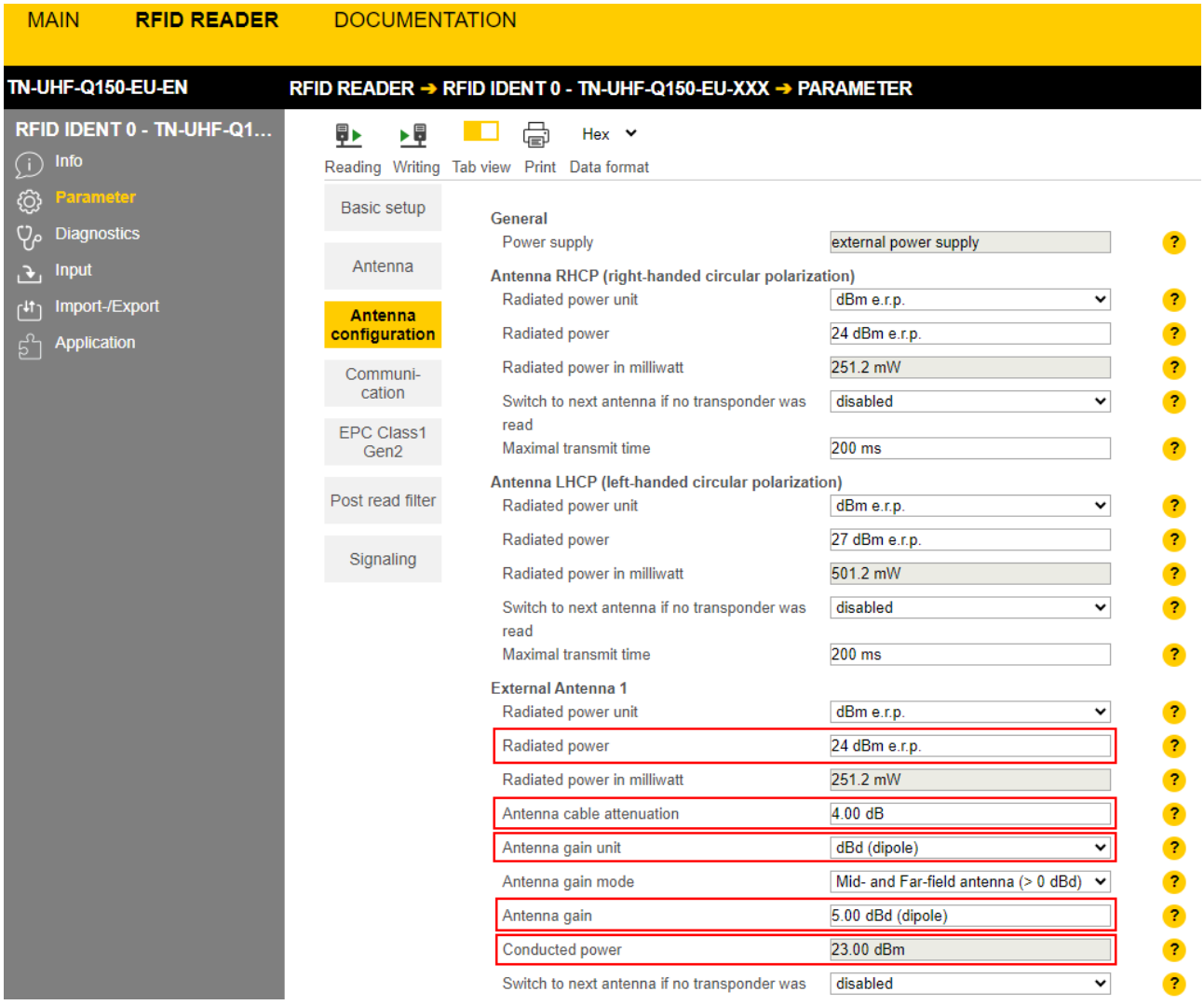


Fig. 48: Setting the antenna power

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

7.6.5 Setting antenna polarization

The antenna polarization can be set via the web server or via TAS. 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 in single-tag applications in particularly metallic environments.

The following graphics schematically illustrate the possibilities of antenna polarization.

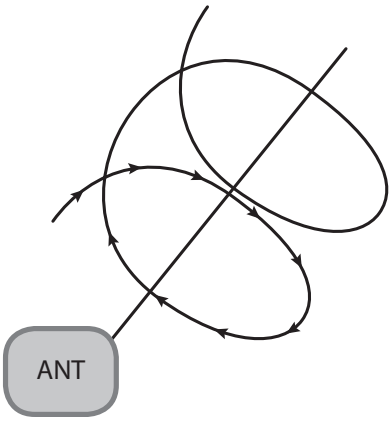


Fig. 49: Antenna polarization circular (RHCP)

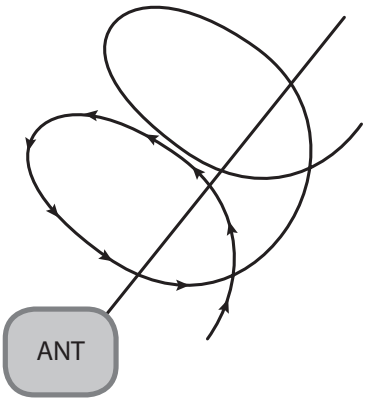


Fig. 50: Antenna polarization circular (LHCP)

Switching antenna polarization

Polarization switching is activated via the multiplex settings.

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

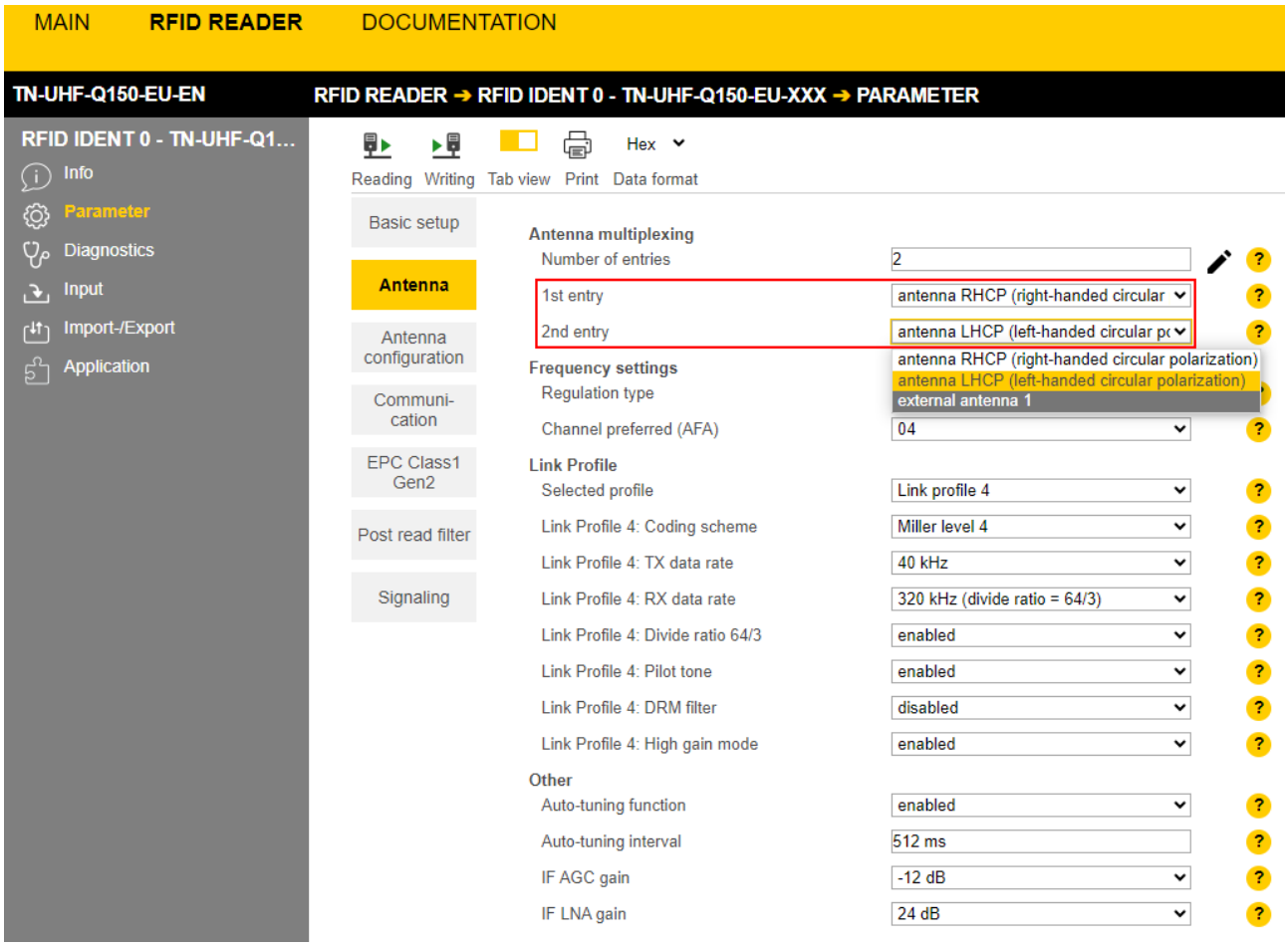


Fig. 51: Switching antenna polarization

- ▶ 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**).

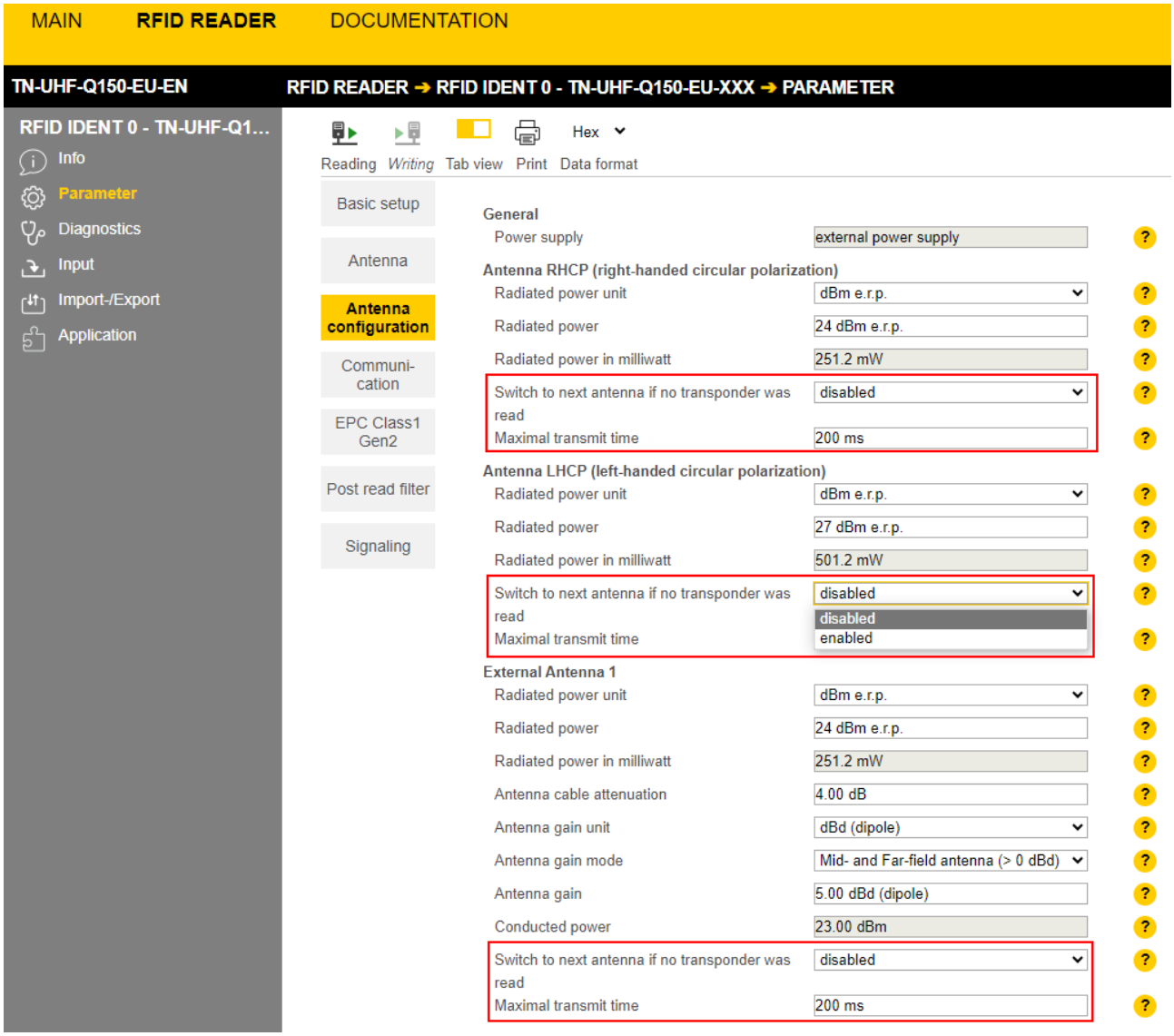


Fig. 52: Switching polarization automatically

7.6.6 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 the 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.

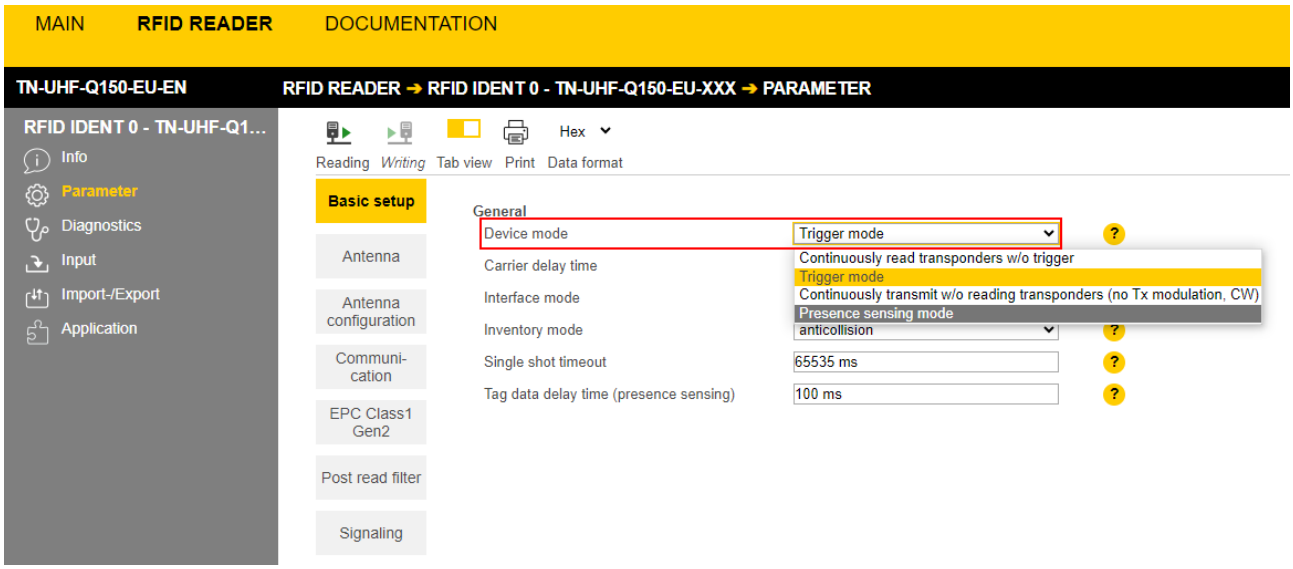


Fig. 53: Switching on presence sensing mode

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.

7.6.7 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 adjustable values are described in the web server.

Example: Switching on RSSI transmission

- ▶ Switch on RSSI transmission: At **Communication** → **Message data content** → **Transponder RSSI**, select the **enabled** option.

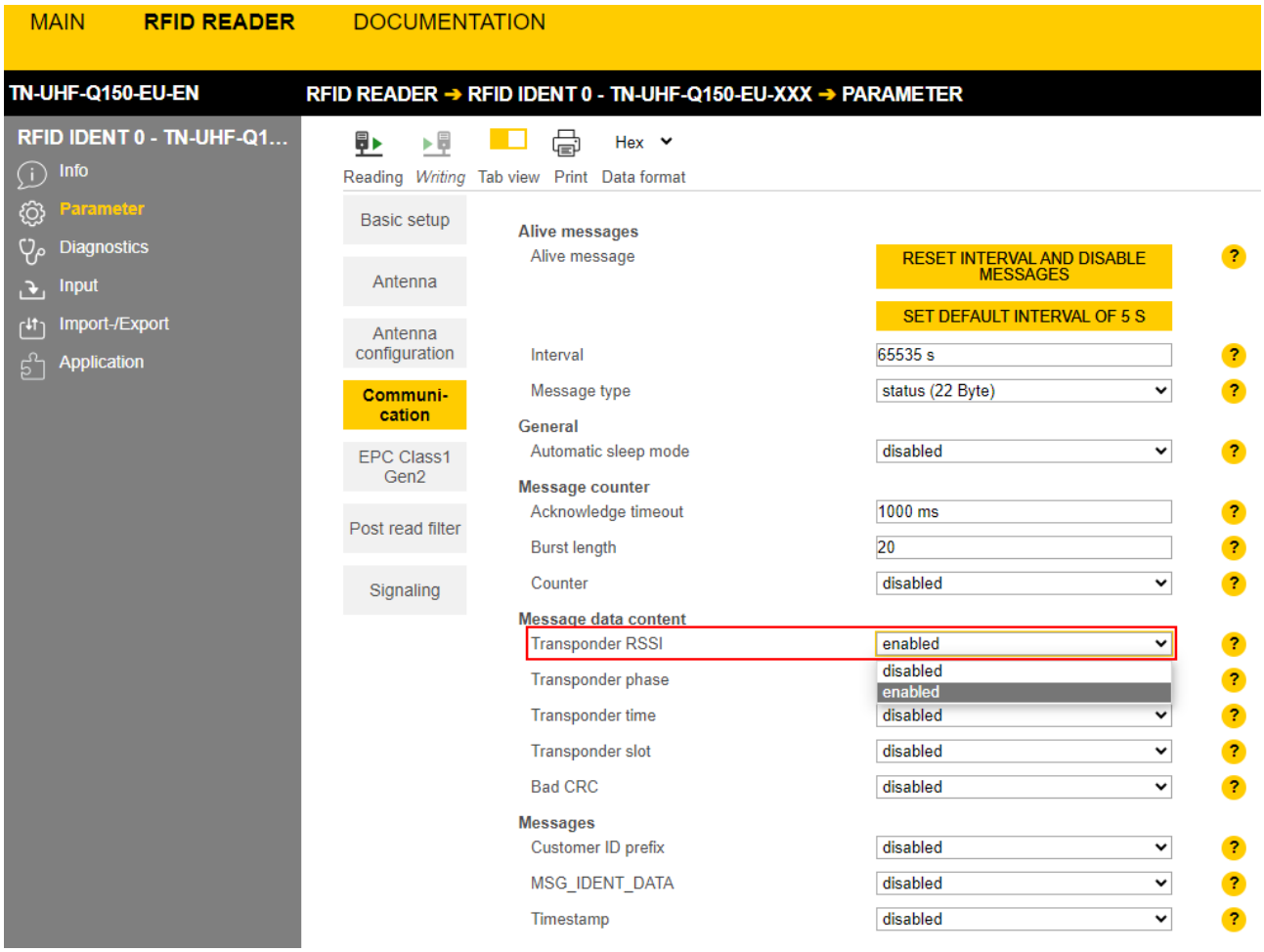


Fig. 54: Switching on RSSI transmission

⇨ The RSSI value is displayed with the inventory in the read data.

7.6.8 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 adjustable values are described in the web server.

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.
- Set the threshold at **Post read filter** → **RSSI filter** → **Lower threshold**.

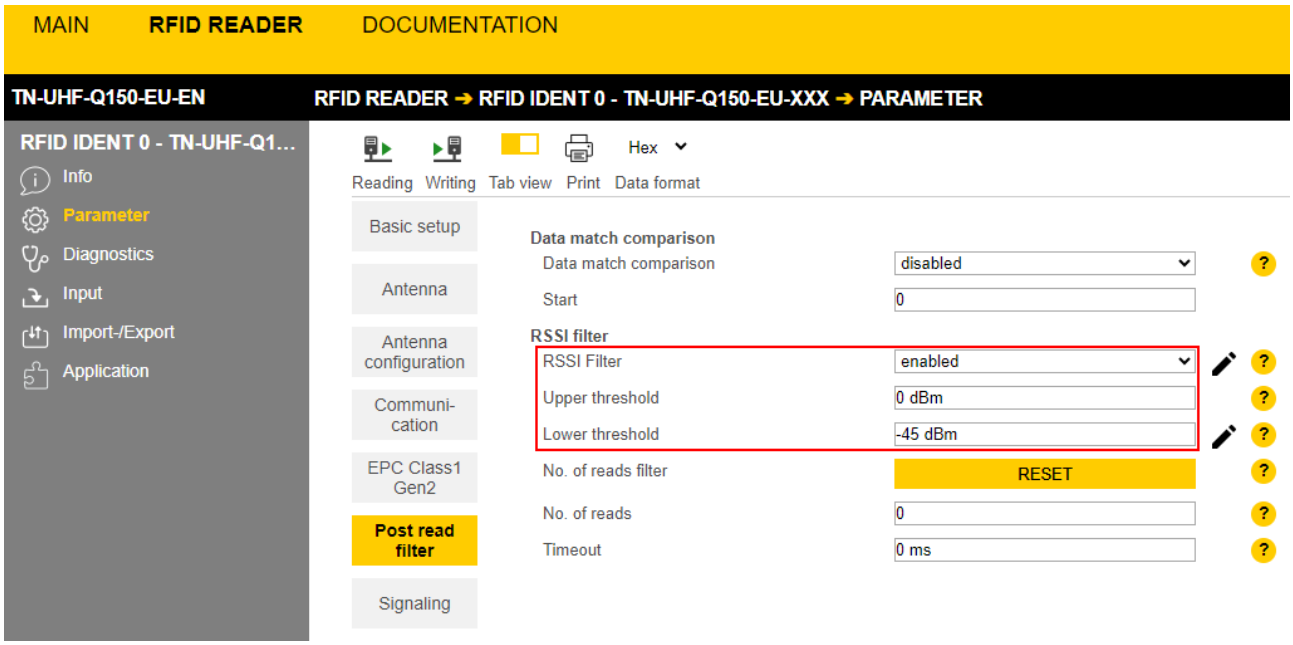


Fig. 55: Switching on the RSSI filter

⇨ Example: All read operations below an RSSI value of -45 dBm are filtered out.

8 Setting

The device can be controlled, read, and set via parameter data, process input data, process output data and diagnostic data. The following table shows the data mapping:

Slot	Channel	Parameter data		Process input data		Process output data		Diagnostic data	
		Bytes	Meaning	Bytes	Meaning	Bytes	Meaning	Bytes	Meaning
1	0	0…31	RFID parameters	0…23	RFID input data	0…23	RFID output data	0…1	RFID diagnostics
2		32…33	Length of read data	24…151	Read data				
3		34…35	Length of write data			24…151	Write data		
13	0			152…153	Diagnostics RFID channel 0				
25				154…157	Device Status (Device Status/Control)	152…153	Device Control (Device Status/Control)		

8.1 Modular device model/slot definition

The device appears in the configuration software as a modular EtherCAT sub-device with 25 configurable slots. The slots are configured by adding or fitting predefined EtherCAT modules.

The following table shows the possible slot and module assignments.

Slot	Module	Description
RFID control/status ch0 … RFID control/status ch3	UHF compact	Activates UHF compact mode on RFID channel 0…3
	UHF extended	Activates UHF extended mode on RFID channel 0…3
RFID read data ch0 … RFID read data ch3	008 bytes read	Read data module with 8 bytes communication width on RFID channel 0…3
	016 bytes read	Read data module with 16 bytes communication width on RFID channel 0…3
	032 bytes read	Read data module with 32 bytes communication width on RFID channel 0…3
	064 bytes read	Read data module with 64 bytes communication width on RFID channel 0…3
	128 bytes read	Read data module with 128 bytes communication width on RFID channel 0…3
RFID write data ch0 … RFID write data ch3	008 bytes write	Write data module with 8 bytes communication width on RFID channel 0…3
	016 bytes write	Write data module with 16 bytes communication width on RFID channel 0…3
	032 bytes write	Write data module with 32 bytes communication width on RFID channel 0…3
	064 bytes write	Write data module with 64 bytes communication width on RFID channel 0…3
	128 bytes write	Write data module with 128 bytes communication width on RFID channel 0…3
RFID diagnostics	RFID diagnostics	Diagnostic data of the RFID channels Diagnostic data — RFID channels
Device Status/Control	Device Status/Control	Status and control for the entire module See Device Area [▶ 60]

8.2 Device Area

If the Device status/control module was fitted, device status and device control can be accessed via the process data.

8.2.1 Device status (0xF100, 0xF110)

If the "Device status/control" module was fitted, device status can be mapped to the process input data.

CoE index	CoE sub index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF100	0x08…0x01	0	res.	res.	res.	res.	res.	res.	res.	res.
	0x10…0x09	1	res.	FCE	res.	res.	res.	res.	res.	res.
0xF110	0x08…0x01	0	res.	res.	res.	res.	res.	res.	res.	DIAG
	0x10…0x09	1	res.	res.	res.	res.	res.	res.	V1	res.

Meaning of the Device Status bits

Designation	Meaning
FCE	I/O-ASSISTANT Force Mode active I/O Assistant Force Mode active
DIAG	Module diagnostics available Module diagnostics available
V1	Undervoltage V1 Undervoltage at power supply connection V1

8.2.2 Device Control (0xF200)

Device control can be mapped to the process output data if the Device Status/Control module is fitted.

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

Meaning of the Device Control bits

Designation	Meaning
Wink	0: No 1: Yes, activates the Wink command

8.2.3 Device parameters (0xF800)

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

Meaning of the device parameters bits

The default values are shown in **bold** type.

Designation	Meaning
DDI Deactivate all diagnostics	**0: No** **All diagnostic messages are sent.** 1: Yes All diagnostic messages are suppressed.
DEWEB Deactivate web server	(the webserver is not yet supported by firmware version 1.0.4.0.) Note: The activation or deactivation of the web server requires a device restart. **0: No** **The web server in the device is activated.** 1: Yes The web server in the device is deactivated.
DEFC Deactivate I/O-ASSISTANT Force Mode	**0: No** **Force mode is activated, the DTM accesses the device.** 1: Yes Force mode is deactivated.

8.3 RFID channels – parameter data

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
Channel 0										
0x8000	0x01	0	Operating mode (OMRFID)							
	0x02	1	Reserved							
	0x03	2	Reserved							
		3								
	0x0B… 0x04	4								
	0x13… 0x0C	5	DDI							DXD
	0x14	6	Reserved							
	0x1C… 0x15	7	Reserved							
	0x1D	8	Command repetitions (CRET)							
	0x1E	9	Reserved							
	0x1F	10	Reserved							
		11								
	0x20	12	Reserved							
		13								
		14								
		15								
	0x28… 0x21	16	Reserved							
0x8010	0x01	0	Length of read data (RDS)							
		1								
0x8020	0x01	0	Length of write data (WDS)							
		1								

8.3.1 Meaning of the parameter bits

The default values are shown in **bold** type.

Designation	Meaning
OMRFID Operation mode	0: Deactivated **1: UHF compact** 2: UHF extended
DDI Deactivate diagnostics	**0: No (all diagnostic messages on)** 1: Yes (all diagnostic messages off)
CRET Command retries at failure	Number of command repetitions after a fault signal, default setting: **2**

8.3.2 UHF applications — 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).

8.3.3 UHF applications — 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.

8.4 RFID channels – process input data

Process input data — UHF compact module

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Channel 0											
Resp	0x6000	0x01	0	Response code (RESC)							
			1								
		0x02	2	Loop counter for rapid processing (RCNT)							
		0x0A… 0x03	3	Reserved							
		0x12… 0x0B	4		TRE1	PNS1					TP
		0x1A… 0x13	5							CMON	
		0x1B	6	Length (LEN)							
			7								
		0x1C	8	Error code (ERRC)							
			9								
		0x1D	10	Tag counter (TCNT)							
			11								
RD	0x6010	0x01	0	Read data byte 0							
		0x02	1	Read data byte 1							
		0x03	2	Read data byte 2							
		0x04	3	Read data byte 3							
		0x05	4	Read data byte 4							
		0x06	5	Read data byte 5							
		0x07	6	Read data byte 6							
		0x08	7	Read data byte 7							
		…	…	…							
		0x80	127	Read data byte 127							

Process input data — UHF extended module

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Channel 0											
Resp	0x6000	0x01	0	Response code (RESC)							
			1								
		0x02	2	Loop counter for rapid processing (RCNT)							
		0x0A… 0x03	3	Reserved							
		0x12… 0x0B	4		TRE1	PNS1					TP
		0x1A… 0x13	5							CMON	
		0x1B	6	Length (LEN)							
			7								
		0x1C	8	Error code (ERRC)							
			9								
		0x1D	10	Tag counter (TCNT)							
			11								
		0x1E	12	Data (bytes) available (BYFI)							
			13								
		0x1F	14	Read fragment number (RFN)							
		0x20	15	Write fragment number (WFN)							
		0x28… 0x21	16	Reserved							
		0x30… 0x29	17	Reserved							
		0x38… 0x31	18	Reserved							
		0x40… 0x39	19	Reserved							
RD	0x6010	0x01	0	Read data byte 0							
		0x02	1	Read data byte 1							
		0x03	2	Read data byte 2							
		0x04	3	Read data byte 3							
		0x05	4	Read data byte 4							
		0x06	5	Read data byte 5							
		0x07	6	Read data byte 6							
		0x08	7	Read data byte 7							
		…	…	…							
		0x80	127	Read data byte 127							

Process input data — module diagnostics

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Diagnostics RFID channel 0											
DgC0	0x6030	0x08… 0x01	0		PRMER	DTM	FIFO				
		0x10… 0x09	1	Reserved							
		0x18… 0x11	2	Reserved							
		0x20… 0x19	3	Reserved							

8.4.1 Meaning of the status bits

Designation	Meaning
RESC Response Code	Display of the last command executed
RCNT Loop counter for fast processing	Output of the command code requested by the loop counter
TP Tag present at read/write head	0: No (no tag in the detection range of the reader) 1: Yes (tag in the detection range of the reader)
PNS1 Parameter not supported by read/write head	0: No (no error) 1: Yes (parameter is not supported by the reader)
TRE1 Error reported by read/write head	0: No (no error) 1: Yes (fault signal from the reader)
CMON Continuous (Presence Sensing) Mode active	0: No (continuous mode not active) 1: Yes (continuous mode active)
LEN Length	Display of the length of the read data
ERRC Error code	Display of the specific error code if the error bit (ERROR) is set

Designation	Meaning
TCNT Tag counter	Display of the detected tags. The rising edges of the tags that are read by an inventory command are counted. A tag that moves along the reader is not counted again if it only leaves the detection range momentarily and re-enters it (within the set bypass time). If a tag continuously stays within the detection range, it is also only counted once. Exceptions: Continuous Mode with start address = 3 is active. The tag counter is reset by the following commands: ■ Inventory ■ Continuous Mode ■ Continuous presence sensing mode ■ Reset
BYFI Data (bytes) available	Number of bytes in the FIFO memory of the interface (only available with UHF extended modes) Ascending: new data read by a tag or received by the device Descending: command execution completed Fault signal 0xFFFF: memory overfilled, risk of loss of new data
RFN Read fragment no.	In idle mode, the size of the fragments is specified. With a read command, the number of fragments that contain data is specified. (only available with UHF extended) 0: No fragmentation If the data to be read exceeds the size of the read data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the read fragment no. appears in the process input data. After the confirmation, the next fragment is read.
WFN Write fragment no.	In idle mode, the size of the fragments is specified. With a write command, the number of fragments that contain data is specified. 0: No fragmentation If the data that is to be written exceeds the size of the write data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the write fragment no. appears in the process input data. Following confirmation, the next fragment is written.
Read data, byte 0...127	Read data

8.5 RFID channels – process output data

Process output data — UHF compact module

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex		Byte no.	Bit							
		HF	UHF		7	6	5	4	3	2	1	0
Channel 0												
Cmd	0x7000	0x01	0x01	0	Command code (CMDC)							
				1								
		0x02	0x02	2	Loop counter for rapid processing (LCNT)							
			0x03	3	Memory area (DOM) — available with UHF applications only							
		0x0B	0x04	4	Start address (ADDR)							
				5								
				6								
				7								
		0x0C	0x05	8	Length (LEN)							
				9								
		0x0D	0x06	10	UID/EPC (SOUID) length							
				11	Reserved							
WD	0x7020	0x01	0x01	0	Write data byte 0							
		0x02	0x02	1	Write data byte 1							
		0x03	0x03	2	Write data byte 2							
		0x04	0x04	3	Write data byte 3							
		0x05	0x05	4	Write data byte 4							
		0x06	0x06	5	Write data byte 5							
		0x07	0x07	6	Write data byte 6							
		0x08	0x08	7	Write data byte 7							
		…	…	…	…							
		0x80	0x80	127	Write data byte 127							

Writing process output data — UHF extended module

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex		Byte no.	Bit							
		HF	UHF		7	6	5	4	3	2	1	0
Channel 0												
Cmd	0x7000	0x01	0x01	0	Command code (CMDC)							
				1								
		0x02	0x02	2	Loop counter for rapid processing (LCNT)							
			0x03	3	Memory area (DOM)							
		0x0B	0x04	4	Start address (ADDR)							
				5								
				6								
				7								
		0x0C	0x05	8	Length (LEN)							
				9								
		0x0D	0x06	10	UID/EPC (SOUID) length							
				11	Reserved							
		0x16	0x0F	12	Timeout (TOUT)							
				13								
		0x17	0x10	14	Read fragment number (RFN)							
		0x18	0x11	15	Write fragment number (WFN)							
				16	Reserved							
				17	Reserved							
				18	Reserved							
				19	Reserved							
WD	0x7020	0x01	0x01	0	Write data byte 0							
		0x02	0x02	1	Write data byte 1							
		0x03	0x03	2	Write data byte 2							
		0x04	0x04	3	Write data byte 3							
		0x05	0x05	4	Write data byte 4							
		0x06	0x06	5	Write data byte 5							
		0x07	0x07	6	Write data byte 6							
		0x08	0x08	7	Write data byte 7							
		…	…	…	…							
		0x80	0x80	127	Write data byte 127							

8.5.1 Meaning of the command bits

Description	Meaning
CMDC Command code	Entry of the command code
LCNT Loop counter for fast processing	Loop counter for repeated processing of a command 0: Loop counter off
DOM UHF memory area	**0: Kill password** 1: EPC 2: TID 3: USER memory 4: Access password 5: PC (EPC length)
ADDR Start address	Enter the address in bytes to which a command is to be sent (e.g. memory area of a tag)
LEN Length	Entering the length of the data to be read or written
SOUID Length of EPC in bytes	**Inventory command:** 0: The actual length (bytes) of the transferred EPC is transferred with an inventory. > 0: EPC is output in full. **Other commands:** The EPC size should be entered in bytes if a particular tag is to be 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 device. > 0: EPC length of the tag that is to be read, written or protected if an EPC is present in the write data.
TOUT Command timeout	Time in ms in which a command is to be executed. If a command is not executed within the specified time, the device outputs a fault signal. 0: No timeout, command remains active until the first tag has been read 1: Command is executed once (if there is already a tag in the detection range) > 1…65535: Time in ms Inventory: Command remains active for the entire specified time
RFN Read fragment no.	If the data to be read exceeds the size of the read data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the read fragment no. appears in the process input data. After the confirmation, the next fragment is read. 0: No fragmentation In idle mode, the size of the fragments is specified. With a read command, the number of fragments that contain data is specified.

Description	Meaning
WFN Write fragment no.	If the data that is to be written exceeds the size of the write data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the write fragment no. appears in the process input data. Following confirmation, the next fragment is written. 0: No fragmentation In idle mode, the size of the fragments is specified. With a write command, the number of fragments that contain data is specified.
ANTN Read/write head address	Values are ignored or set automatically.
Write data byte 0…127	User-defined write data or entry of an EPC to select a specific tag for the command execution (if the **EPC [SOUID] length** command parameter is greater than 0)

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
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

9 Operation

NOTE
The read and write data stored in the device is reset after a power reset.

9.1 Executing a command and calling data

- ▶ 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.

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

9.2 Using fragmentation

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

- ▶ To read more data, increase the fragment counter in the output data.
- ▶ Repeat 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.

9.3 Using commands with a loop counter function

NOTE
The loop counter is only used for the commands with rapid execution.

- ▶ Set command: Specify the command code.
- ▶ Set loop counter to 1.
- ⇨ If the same command code appears in the process input data as that in the process output data, the command has been executed successfully. The RFID data is stored in the buffer of the interface.
- ▶ Repeat command: Increase the loop counter in the output data by 1.
- ⇨ If the same loop counter value appears in the process input data as that in the process output data, the command has been executed successfully. The RFID data is stored in the buffer of the interface.
- ▶ Set new command: Specify new command code and set loop counter to 0.

9.4 Using the UHF password function

A write protection for EPC and USER memory area can be set with an access password. If a Kill password is set, the UHF tag can be mechanically destroyed with a Kill command. The access password and the Kill password can also be protected from read or write accesses.

9.4.1 Setting the Kill password

The **Kill UHF tag** command is used to make the tag unusable. After a kill command, the tag can neither be read nor written. A kill command cannot be reversed. A kill password must be set beforehand in order to execute a kill command.

- ▶ Transfer the kill password to the relevant memory area of the tag:
  - Password: Write data (0…3) with 4 bytes
  - Command code 0x0004 (**Write**)
  - Memory area: Kill password
- ▶ Deactivate the tag irrevocably:
  - Command code 0x0200 (**Kill UHF tag**)

NOTE
The tag can also be protected with an access password Setting the access password, so that a Kill command can only be executed with a valid access password in tag and reader.

9.5 Using function blocks in CODESYS or TwinCAT

Function blocks are available for simplified integration into (existing) CODESYS or TwinCAT programs:

- FB_Compact
- FB_Extended

Function Block	Operating mode
FB_Compact	UHF compact
FB_Extended	UHF Advanced

The CODESYS and TwinCAT library contain the following elements:

- Documentation
- Function modules
- Enums
- Types/DUTs

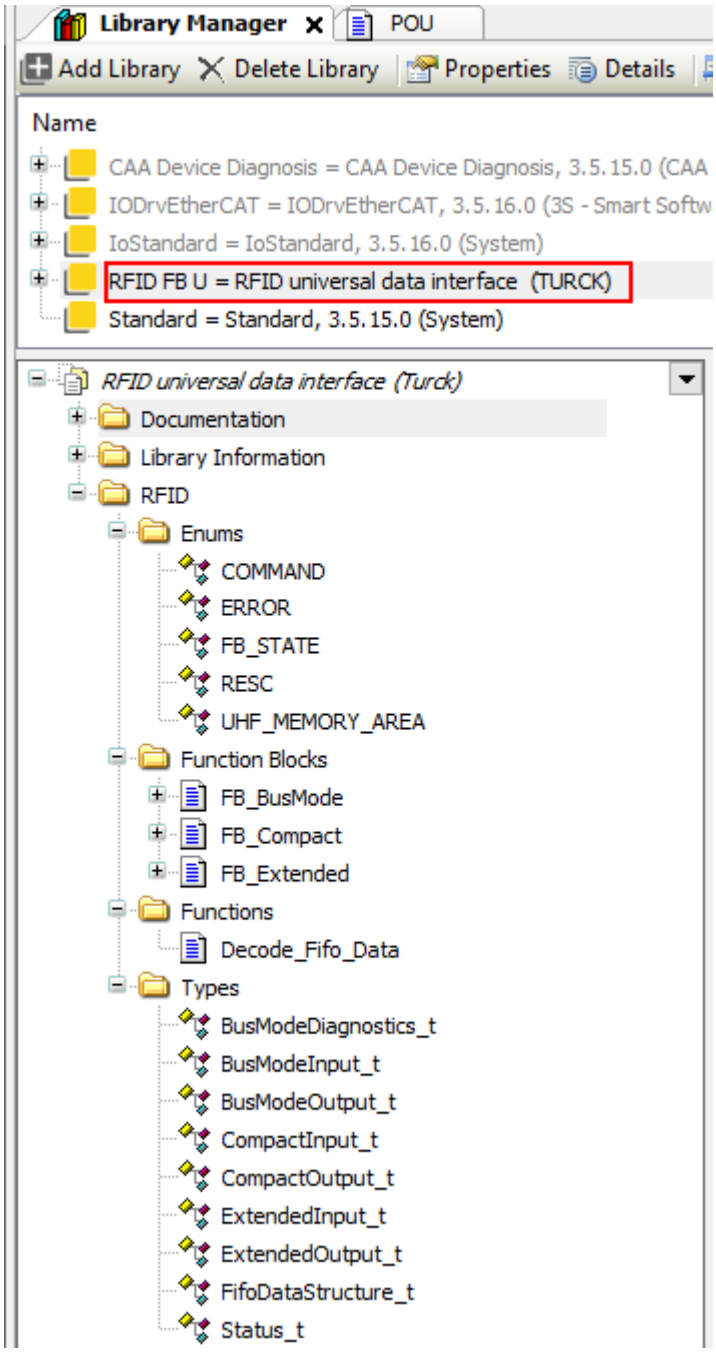


Fig. 56: CODESYS library

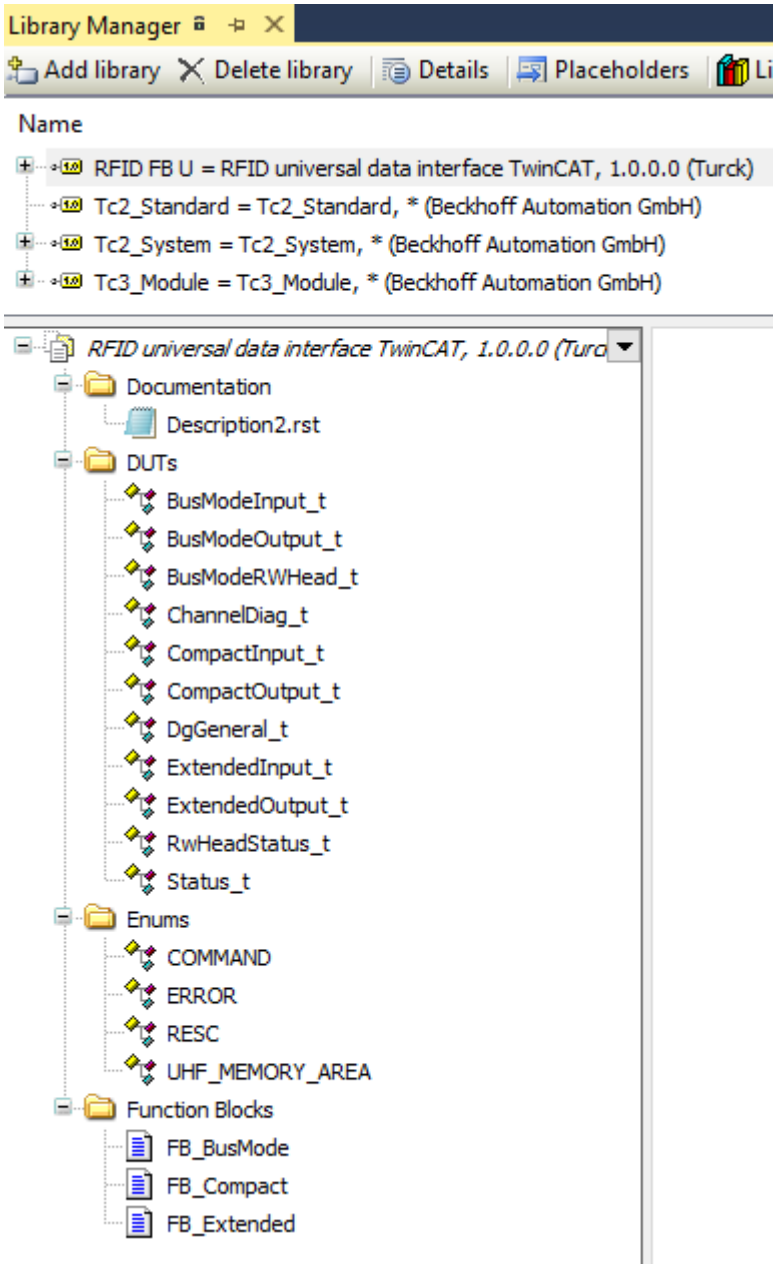


Fig. 57: TwinCAT library

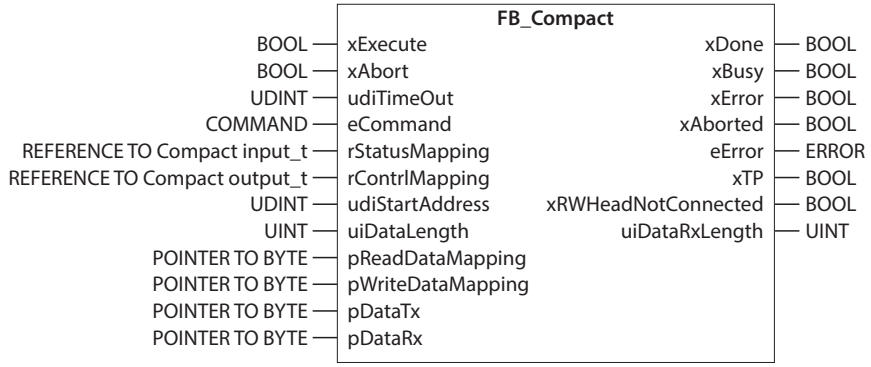


Fig. 58: FB_Compact function block

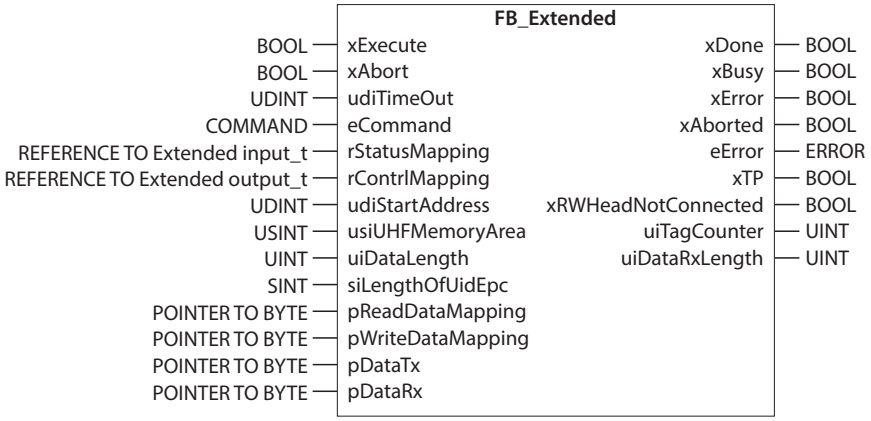


Fig. 59: FB_Extended function block

9.6 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 repetitively. Repeated execution of the same command by the controller is unnecessary.

The following lists the most important differences between an Inventory command and Continuous Mode:

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. Stopping the **Continuous (Presence Sensing) Mode command** or **Reset**	Terminate command: 1. Timeout 2. Stopping the **Continuous (Presence Sensing) Mode command** or **Reset**

9.7 LEDs

The device is provided with the following LEDs:

- Power supply voltage
- Group and bus error
- Status
- Diagnostics

LED INFO	Meaning
Off	No voltage connected
Red	Diagnostic message available
Green	No diagnostics
Orange	Firmware update running (see [▶ 126]")

The Ethernet terminals XF1 and XF2 each have an L/A LED.

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

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 is switched off
green	RF field is 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

9.8 Diagnostic data

9.8.1 Diagnostic data — RFID channels

If the **RFID diagnostics** module is fitted in the configuration software (see Mapping diagnostics data to the process input data), the diagnostics data of the RFID channels are also mapped to the process input data (CoE index 0x60C0…0x60CB, see RFID channels – Process input data).

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
Channel 0										
0xA000	0x08… 0x01	0	VAUX	PRMER	DTM	FIFO				
	0x10… 0x09	1	Reserved							
	0x18… 0x11	2	Reserved							
	0x20… 0x19	3	Reserved							
0xA001	0x08… 0x01	0	TNC1	TRE1	PNS1	XD1				
	0x10… 0x09	1	TNC2	TRE2	PNS2	XD2				
	0x18… 0x11	2	TNC3	TRE3	PNS3	XD3				
	…	…	…	…	…	…				
	0x80… 0x79	15	TNC16	TRE16	PNS16	XD16				
0xA002	0x08… 0x01	0	TNC17	TRE17	PNS17	XD17				
	…	…	…	…	…	…				
	0x80… 0x79	15	TNC32	TRE32	PNS32	XD32				

Meaning of the diagnostic bits

Designation	Meaning
FIFO	Buffer full Buffer full
DTM	Configuration via DTM active Configuration via the DTM active
PRMER	Parameterization error Parameter error
VAUX	Overcurrent supply VAUX Overcurrent supply VAUX
TNC1…16 TNC17…32	Not connected to read/write Expected read/write head not connected (Only works when the **HF: Heartbeat read/write head** parameter is activated:
TRE1…16 TRE17…32	Error reported by read/write head … Read/write head ... reports error
PNS1…16 PNS17…32	Parameter not supported by read/write head … Parameter not supported by read/write head …
XD1…16 XD17…32	Antenna detuned at HF read/write head … HF read/write head … detuned

9.8.2 Diagnostic data — device status

NOTE
The prefix for the variable link is not contained in the object dictionary.

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
DvStat	0x6180	0x08… 0x01	0	res.	res.	res.	res.	res.	res.	res.	ARGEE
		0x10… 0x09	1	res.	FCE	res.	res.	res.	res.	res.	res.
		0x18… 0x11	2	V2	res.	res.	res.	res.	res.	res.	DIAG
		0x20… 0x19	3	res.	res.	res.	res.	res.	res.	V1	res.

Meaning of the diagnostic bits

Designation	Meaning
ARGEE	ARGEE program active (ARGEE is not yet supported by version 1.0.4.0.)
FCE	I/O-ASSISTANT Force Mode active
DIAG	Module diagnostics available
V2	Undervoltage V2
V1	Undervoltage V1

9.9 Diag History Object (0x10F3)

The Diag History Object (0x10F3) is structured in accordance with ETG.1020. The maximum number of diagnostic messages is 50.

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

Subindex	Name	Data type	Access	PDO mapping	Description
0x01	Maximum messages	UNSIGNED8	R	no	Read: maximum number of diagnostic messages (here: 50 messages) that can be saved in the diagnostic history (see subindex 6 and higher).
0x02	Newest message	UNSIGNED8	RO	no	Subindex of the newest diagnostic message (6…255), Start value = 0
0x03	Newest acknowledged message	UNSIGNED8	RW	no	**Overwrite mode** (subindex 5, bit 4 = 0) ■ **Read = 0**: The slave sets subindex 3 to 0 if messages are overwritten in the message queue. ■ Writing = 0: (support optional) slave deletes all messages, i.e. resets subindex 2, 3, 4 and bit 5 in subindex 5. ■ Writing = 1…5: The slave returns an SDO abort with the codes 0x06090030 (value range of the parameters exceeded) or 0x06090032 (value of written parameter too low). ■ Writing = 6…55 subindex 3 = written value without check ■ Writing > 55…255: SDO abort with codes 0x06090030 or 0x06090031 (value of the written parameter too high)
					Acknowledge mode (subindex 5, bit 4 =1) ■ **Read = 0**: No messages acknowledged so far ■ Read <> 0: Subindex of the last acknowledged diagnostic message (6…255), ■ Writing = 0: (support optional) all acknowledged messages are deleted ■ Writing = 1…5: The slave returns an SDO abort with the codes 0x06090030 (value range of the parameters exceeded) or 0x06090032 (value of written parameter too low). ■ Writing = 6…55: messages are acknowledged ■ Writing > 55…255: SDO abort with codes 0x06090030 or 0x06090031 (value of the written parameter too high)
0x04	New messages available	BOOLEAN	RO	TxPDO	**Overwrite mode** ■ 0: Newest message was read ■ 1: Newest message was not read
					Acknowledge mode ■ 0: No unacknowledged message ■ 1: Diagnostic messages present that can be acknowledged

Subindex	Name	Data type	Access	PDO mapping	Description
0x05	Flags	UN-SIGNED16	RW	no	Flag for **controlling sending and storing of** diagnostic messages. ■ Bit 0: Enable sending of Emergencies see, “Sending Emergencies” – 0: Deactivated (default if the device does not support emergencies) – 1: New diagnostic messages are set as Emergencies ■ Bit 1: Deactivate Info messages – **0: Info messages are stored in the diagnostic buffer.** – 1: Info messages are not stored in the diagnostic buffer. ■ Bit 2: Deactivate warning messages – 0: **Warning messages are stored in the diagnostic buffer.** – 1: Warning messages are not stored in the diagnostic buffer. ■ Bit 3: Deactivate error messages – **0: Error messages are stored in the diagnostic buffer.** – 1: Error messages are not stored in the diagnostic buffer. ■ Bit 4: Mode for handling diagnostic history – 0: Overwrite mode: old messages are overwritten by new ones if the buffer is full – 1: Acknowledge mode: new messages only overwrite new messages that were previously acknowledged. ■ Bit 5: Overwrite/discard information – 1: in Overwrite mode: unacknowledged messages were overwritten (=buffer overflow) (subindex 3 is likewise set to 0) – 1: in Acknowledge mode: message buffer full of unconfirmed messages, a new message is discarded
0x06	Diagnostic message	OCTET STRING	RO	no	**Buffer for diagnostic messages** The EtherCAT sub-device can save up to 50 diagnostic messages depending on subindex 1; the first message is stored in subindex 6, the second in subindex 7, etc. If the buffer is full, the EtherCAT sub-device overwrites the subindices, starting with subindex 6. This ensures that the latest messages (max. 50 messages, see subindex 1) are always accessible to the EtherCAT main device.

Diagnostic message (from subindex 6)

Parameter	Data type	Description		
Diag Code	UNSIGNED32	Diagnostic code to identify the diagnostic message		
		Bit 0…15	0x0000…0xDFFF	Reserved
			0xE000…0xE7FF	Bit 16…31: can be used for specific manufacturers
			0xE800	Bit 16…31: Emergency Error Code as defined in DS301 or DS4xxx
			0xE801…0xEDFF	Reserved
			0xEE00…0xEFFF	Bit 16…31: profile specific
			0xF000…0xFFFF	Reserved
Flags	UNSIGNED16	Bit 0…3		Diagnostic type: 00 = Info message 01 = Warning message 10 = Error message
Text ID	UNSIGNED16	Text ID, reference to diagnostic text as per ESI file		
		0		No text ID
		1…65535		Text ID, manufacturer-specific text IDs, see: [▶ 118]
Time stamp	UNSIGNED64	Time stamp in ns		
		0		No time stamp
		≠ 0		Timestamp

Text IDs

Text ID	Meaning
0x10…0x21	State change request from x to y
0x11	Sync Manager x invalid address (y)
0x12	Sync Manager x invalid size (y)
0x13	Sync Manager x invalid settings (y)
0x0F	Calculate bus cycle time failed (Local timer too slow)
0x20	DC activation register is invalid
0x21	Configured SyncType (0x1C32.1 or 0x1C33.1) not supported. Check DC registers and supported SyncTypes (0x1C32.4 and 0x1C33.4)
Manufacturer specific text IDs Meaning of the text IDs, see diagnostic data (Diagnostic data, 0xA000…0xAFFF) Bit 15 = 0: incoming message (Appear), Example: 0x**0**101 Bit 15 = 1: outgoing message (Disappear), Example: 0x**8**101	

9.10 CANopen Emergencies

CAN Header	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x080+ Node ID	Error code		Error register	Vendor specific data				
				Channel number		Text ID, see [▶ 118]		

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

9.11 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 exceeds the size of the read fragment
0x8005	32773	Length larger than the size of the write fragment
0x8007	32775	When an address is allocated, only one read/write head may be connected.
0x8008	32776	Fragmenting must start with write fragment no. 1
0x8009	32777	Fragmenting incomplete. Write fragment no. > 0 expected
0x8100	33024	Parameter undefined
0x8101	33025	**Operation mode** parameter outside of the permissible range
0x8102	33026	**Tag type** parameter outside of the permissible range
0x8103	33027	**Operation mode** parameter in Continuous mode outside of the permissible range
0x8104	33028	**Length** parameter in Continuous mode outside of the permissible range
0x8105	33029	Size of the write fragment outside of the permissible range
0x8106	33030	Size of the read fragment outside of the permissible range
0x8107	33031	**Bypass time** parameter outside of the permissible range
0x8108	33032	**Address in Continuous mode** parameter outside of the permissible range
0x8200	33280	Command code unknown
0x8201	33281	Command not supported

Error code (hex.)	Error code (dec.)	Meaning
0x8203	33283	Command not supported in UHF applications
0x8204	33284	Command for multi-tag application with automatic tag detection not supported
0x8205	33285	Command for applications with automatic tag detection not supported
0x8206	33286	Command only supported for applications with automatic tag detection
0x8207	33287	Command not supported for multi-tag application
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
0x820E	33294	Next command not supported in multi-tag mode
0x820F	33295	Length of the UID outside of the permissible range
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
0x2200	8704	Automatic tuning active
0x2201	8705	Automatic tuning failed
0x2202	8706	Read/write head not tuned
0x2500	9472	Password function of the tag not supported
0x2501	9473	Password function not supported by the read/write head
0x2502	9474	Tag protection bit pattern not supported
0x2900	10496	Address outside of the block limits
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
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

Error code (hex.)	Error code (dec.)	Meaning
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
0xB0AD	45229	Error when setting the read/write head address
0xB0BD	45245	Error when setting the transfer rate
0xB0DA	45274	Error with the "Tag in detection range" function
0xB0E0	45280	Error when reading the read/write head version
0xB0E1	45281	Error when reading the advanced read/write head version
0xB0F1	45297	Error with automatic read/write head tuning
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…	UHF read/write head reports error
0xD001	53249	Error when resetting the UHF 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 UHF read/write head
0xD00A	53258	Error setting the transfer speed and the operating mode of the UHF 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
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)

Error code (hex.)	Error code (dec.)	Meaning
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
0xF0…	61…	ISO-15693 error
0xF001	61441	ISO-15693 error: Command not supported
0xF002	61442	ISO-15693 error: Command not detected, e.g. incorrect input format
0xF003	61443	ISO-15693 error: Command option not supported
0xF00F	61455	ISO-15693 error: undefined error
0xF010	61456	ISO-15693 error: Addressed memory area not available
0xF011	61457	ISO-15693 error: Addressed memory area locked
0xF012	61458	ISO-15693 error: Addressed memory area locked and not writable
0xF013	61459	ISO-15693 error: Write operation not successful
0xF014	61460	ISO-15693 error: Addressed memory area could not be locked
0xF0A0…0xF0DF	61600…61663	Air interface error
0xF101	61697	Air interface error: CRC error
0xF102	61698	Air interface error: Timeout
0xF8…	63…	UHF read/write head error
0xF820	63520	UHF read/write head: Command not supported
0xF821	63521	UHF read/write head: unspecified error
0xF822	63522	UHF read/write head: A valid password is expected before the command is accepted.
0xF824	63524	UHF read/write head: Read process not possible (e.g. invalid tag)
0xF825	63525	UHF read/write head: Write process not possible (e.g. tag readable only)
0xF826	63526	UHF read/write head: Write or read error
0xF827	63527	UHF read/write head: Access to unknown address (e.g. memory area outside of the range)
0xF828	63528	UHF read/write head: The data to be sent is not valid.
0xF82A	63530	UHF read/write head: The command needs a long time to execute.
0xF82C	63532	UHF read/write head: The requested object is not in the persistent memory.
0xF82D	63533	UHF read/write head: The requested object is not in the volatile memory.
0xF835	63541	UHF read/write head: The command is temporarily not permissible.
0xF836	63542	UHF read/write head: The Opcode is not valid for this type of configuration memory.
0xF880	63616	UHF read/write head: No tag in the field
0xF881	63617	UHF read/write head: The EPC of the command does not match the EPC in the detection range.
0xF882	63618	UHF read/write head: incorrect tag type in the command
0xF883	63619	Writing to a block failed

Error code (hex.)	Error code (dec.)	Meaning
0xFFFE	65534	Timeout on the RS485 interface
0xFFFF	65535	Command aborted

9.12 Using extended diagnostics

The following values can be displayed for advanced diagnostics and system tests. Actual as well as minimum and maximum values are available.

- Time in which the **Tag present** bit is set
- Duration of an inventory command
- Duration of a read command
- Duration of a write command

Example: Opening extended diagnostics with the PACTware FDT/DTM frame application

In order to use the extended diagnostics with PACTware, the EoE function must be activated in both the EtherCAT main device and the EtherCAT sub-device.

- ▶ Open diagnostics in PACTware.
- ▶ Select the RFID channel (here: **Channel 0**).
- ⇨ The **Expert mode on/off** button is displayed in the menu bar.
- ▶ Activate expert mode.
- ▶ The time measurement is shown.

Example: Opening extended diagnostics in the web server

- ▶ Open the web server.
- ▶ Log into the device.
- ▶ Select **LOCAL I/O** → **Diagnosis** → Select RFID channel (here: **RFID channel 0**).
- ⇨ The time measurement is shown.

9.13 Reset device (Reset)

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

- Via TAS if the EoE function is activated
- Via CoE index 0xFBF0 ”Device Reset Command”

9.13.1 Resetting the device via Object Dictionary

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

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

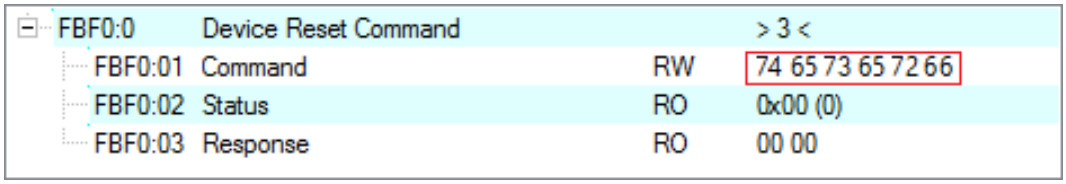


Fig. 60: TwinCAT (example) - Resetting the device to factory settings via CoE index

- ⇨ The device is reset to factory settings.

10 Troubleshooting

Proceed as follows if the device does not operate as expected:

- Exclude environmental interference.
- Check the terminals of the device for faults.
- Check the device for parameter errors.

A device fault is present if the malfunction continues. In this case, decommission the device and replace it with a new device of the same type.

10.1 Rectifying errors

Errors are displayed by an ERR LED lit red on the device.

Calling fault signals in the web server and rectifying them

NOTE
Contact Turck if the error persists after the device is reset.

- Log in to the web server (see page Editing settings in the web server).
- Click **Diagnostics** in the navigation bar on the left of the screen.

⇨ The fault signals are displayed in the device status.

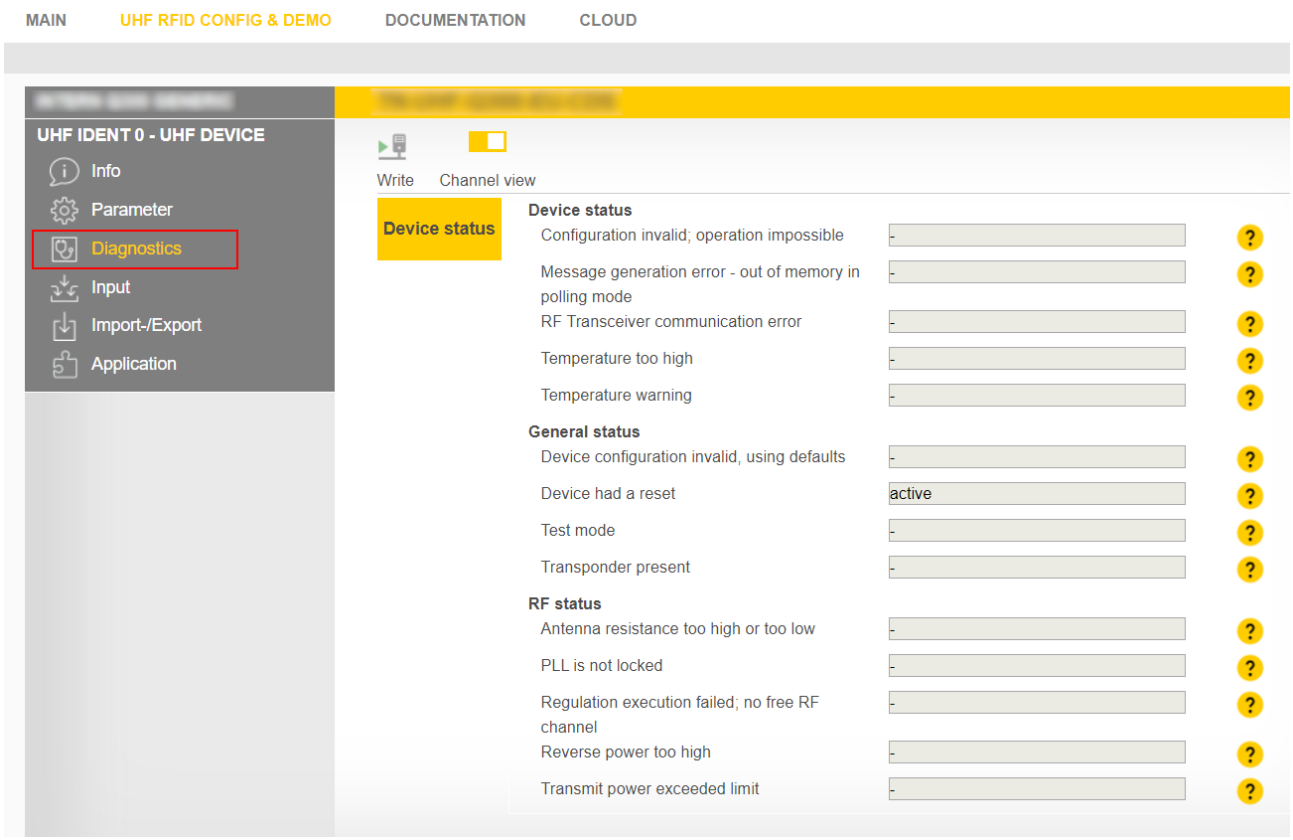


Fig. 61: Web server – Diagnostics

Rectifying fault signals:

- ▶ Click **Local I/O → Output** in the navigation bar on the left of the screen.
- ▶ Select **RFID control/status ch0**.
- ▶ Select the Reset command via the **Command code** drop-down menu: **0x8000 Reset**
- ⇨ The device is reset.

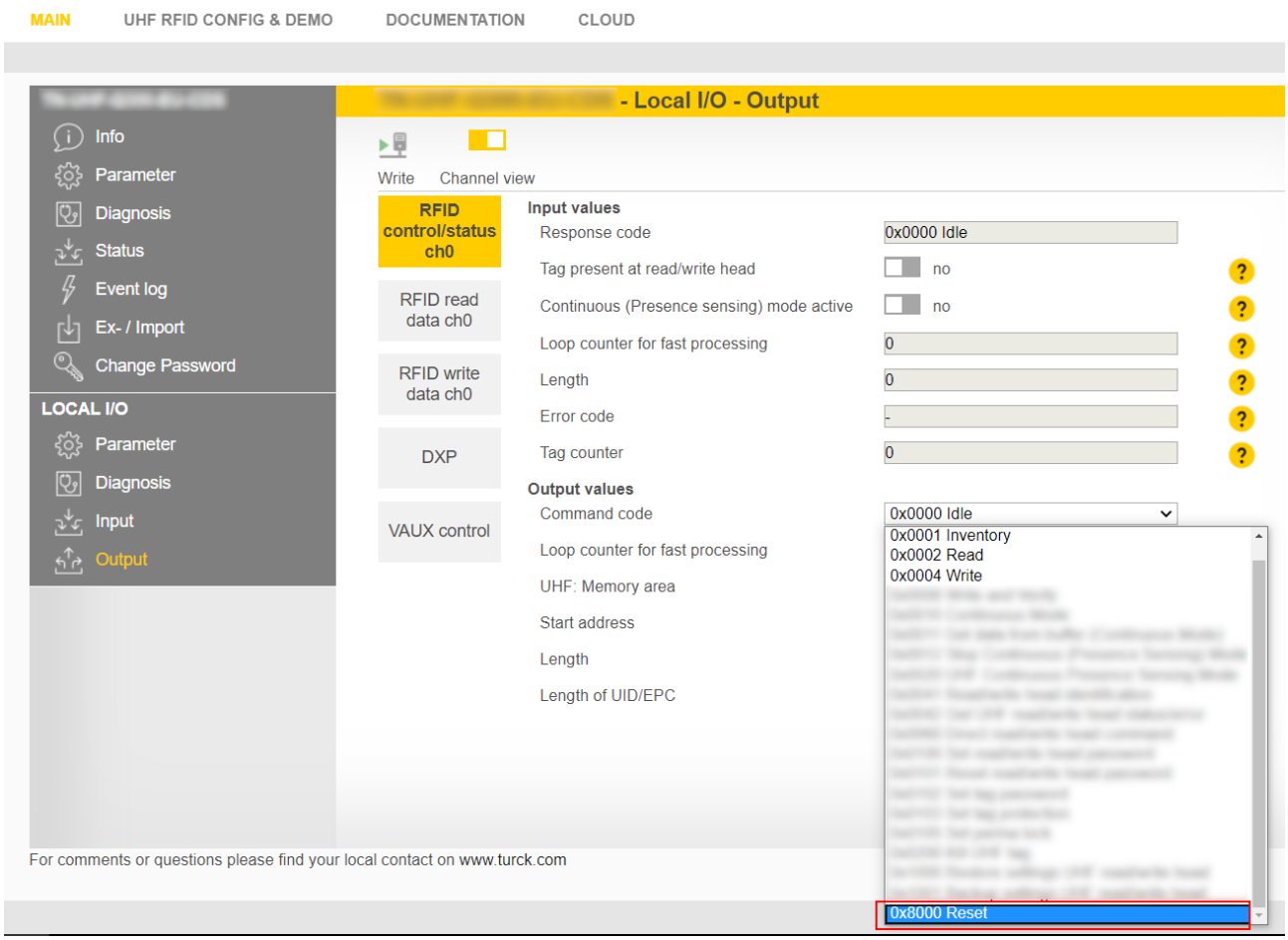


Fig. 62: Web server — reset the device

11 Maintenance

The firmware update is performed according to the ETG specification ETG.5003.0002. The FoE protocol (File access over EtherCAT) is used for the firmware update of the device. The device must be in Bootstrap status for the update process. The firmware can be updated via TwinCAT or CODESYS. An update via an Omron controller is not possible.

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

11.1 Updating the firmware via TwinCAT

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.

Downloading the firmware file

The firmware file for the device is available as a free download from www.turck.com.

- Double-click **Box 1 (TN-UHF-Q150-…-EC)**.
- Click the tab **Online** → **Status Machine** → **Bootstrap**.
- Click **File Access over EtherCAT** → **Download…**.

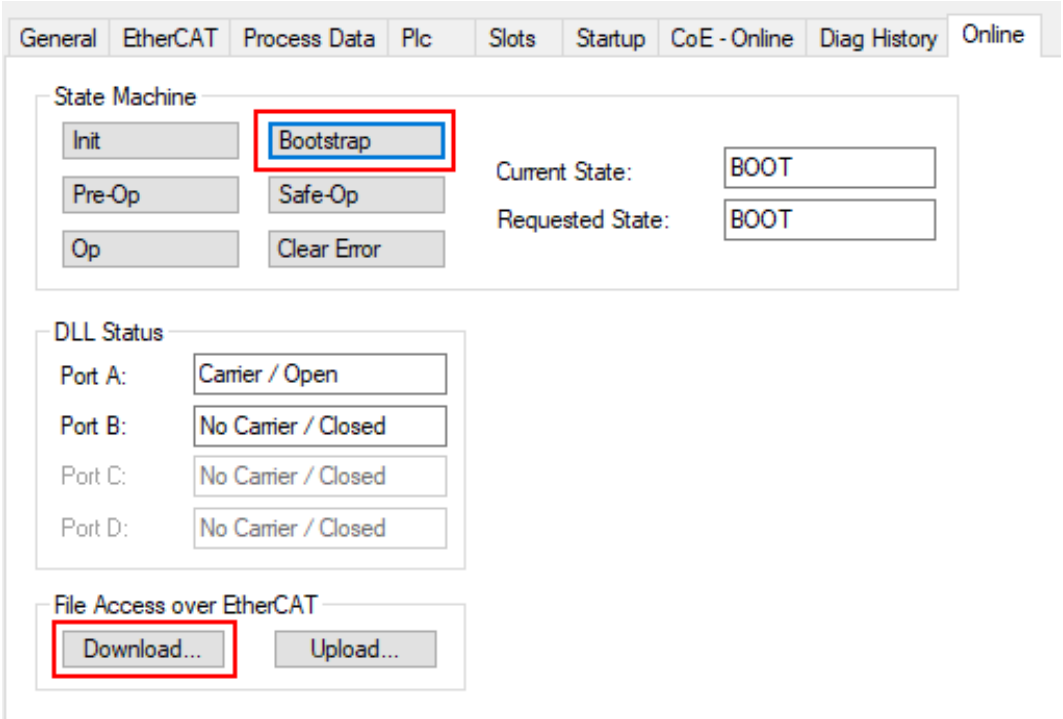


Fig. 63: Starting the firmware update

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

Performing the update

- ▶ Click the tab **Online** → **Status Machine** → **Init**.
- ⇨ The update is performed.
- ⇨ The INFO LED lights up orange during the firmware update.
- ⇨ When the update is complete, the device enters the normal operating mode.

11.2 Updating the firmware via CODESYS

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.

Requirements

- The EtherCAT master used supports the firmware update function.
- The device is logged in online.
- The **Expert settings** on the **General** tab are activated.
- The **Automatically restart slaves** option on the **General** tab is deactivated.

Downloading the firmware file

The firmware file for the device is available as a free download from www.turck.com.

- ▶ Double-click **TN_UHF_Q150_EU_EC (TN-UHF-Q150-EU-EC)**.
- ▶ Click the tab **Online** → **State Machine** → **Bootstrap**.
- ▶ Click **File access over EtherCAT** → **Download…**.
- ▶ Select the firmware file in the new window → **Open**.
- ⇨ The firmware file is loaded into the flash memory of the device.
- ⇨ The STAT LED flickers green.
- ⇨ CODESYS displays the download progress of the firmware file as a green bar.

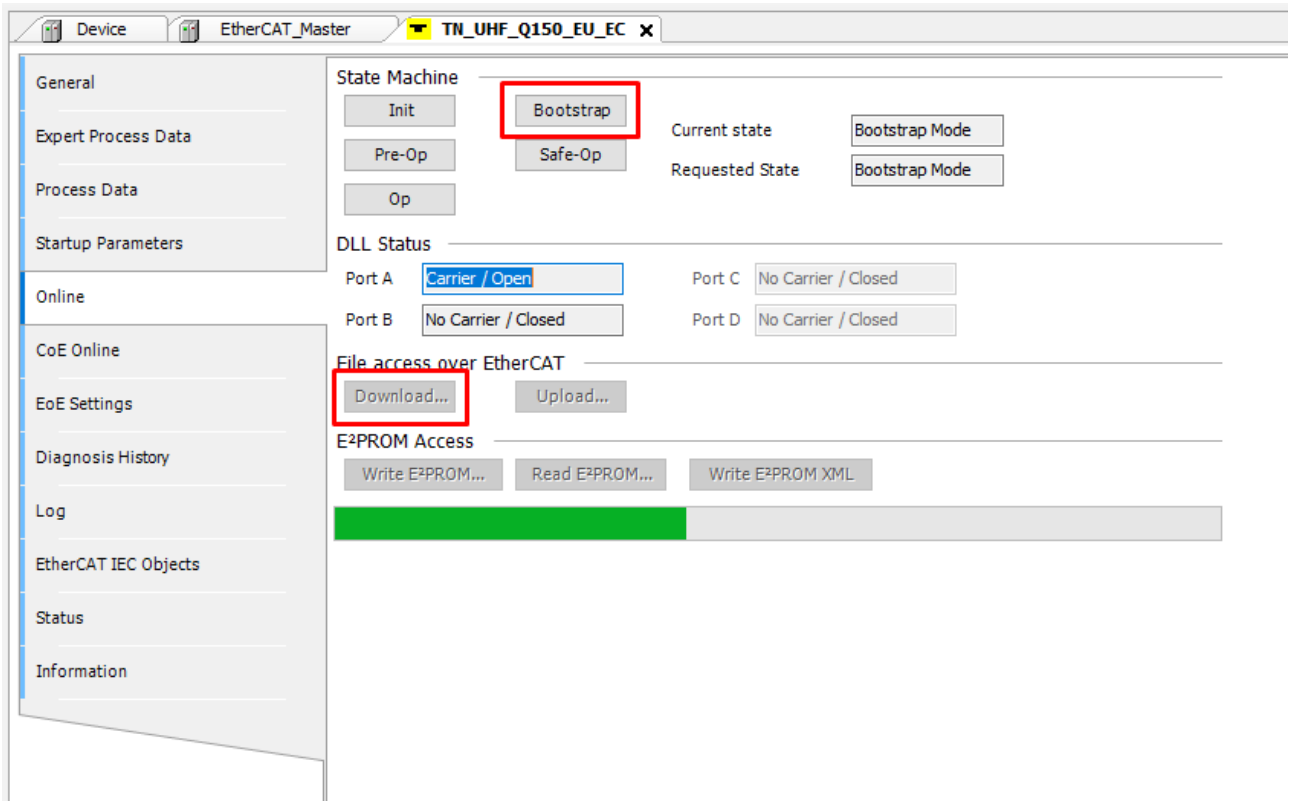


Fig. 64: Downloading the firmware file

Performing the update

- ▶ Click the tab **Online** → **State Machine** → **Init**.
- ⇨ The update is performed.
- ⇨ The INFO LED lights up orange during the firmware update.
- ⇨ When the update is complete, the device enters the normal operating mode.
- ▶ Activate the **Automatically restart slaves** option on the **General** tab.

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	≤ 3500 mA
Data transfer	Electromagnetic AC field
Technology	UHF RFID
Radio communication and protocol standards	ISO 18000-63 EPCglobal Gen 2
Antenna polarization	Circular/linear, adjustable
Antenna HPBW	65°
Output function	Read/write
Mechanical data	
Mounting condition	Non-flush
Ambient temperature	-20…+50 °C
Design	rectangular
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)
Protection class	IP67
Electrical connection	RP-TNC
Input impedance	50 ohm
MTTF	49 years acc. to SN 29500 (Ed. 99) 20 °C
System description	
Processor	ARM Cortex A8, 32-bit, 800 MHz
Memory	MB Flash
RAM	512 MB DDR3
System data	
Ethernet transfer rate	10/100 Mbps
Connection technology Ethernet	1 × M12, 4-pin, D-coded
Web server	Default: 192.168.1.100
Digital inputs	
Number of channels	4
Connection technology	M12, 5-pin
Input type	PNP
Switching threshold	EN 61131-2 Type 3, PNP
Low-level signal voltage	< 5 V
High-level signal voltage	> 11 V
Low-level signal current	< 1.5 mA
High-level signal current	> 2 mA

Technical Data	
Type of input diagnostics	Channel diagnostics
Digital outputs	
Number of channels	4
Connection technology	M12, 5-pin
Output type	PNP
Type of output diagnostics	Channel diagnostics

15 Turck branches — contact data

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

Korea	Turck Korea Co, Ltd. A605, 43, Iljik-ro, Gwangmyeong-si 14353 Gyeonggi-do www.turck.kr
Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor www.turckbanner.my
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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

16 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.

16.1 Flow chart: command processing

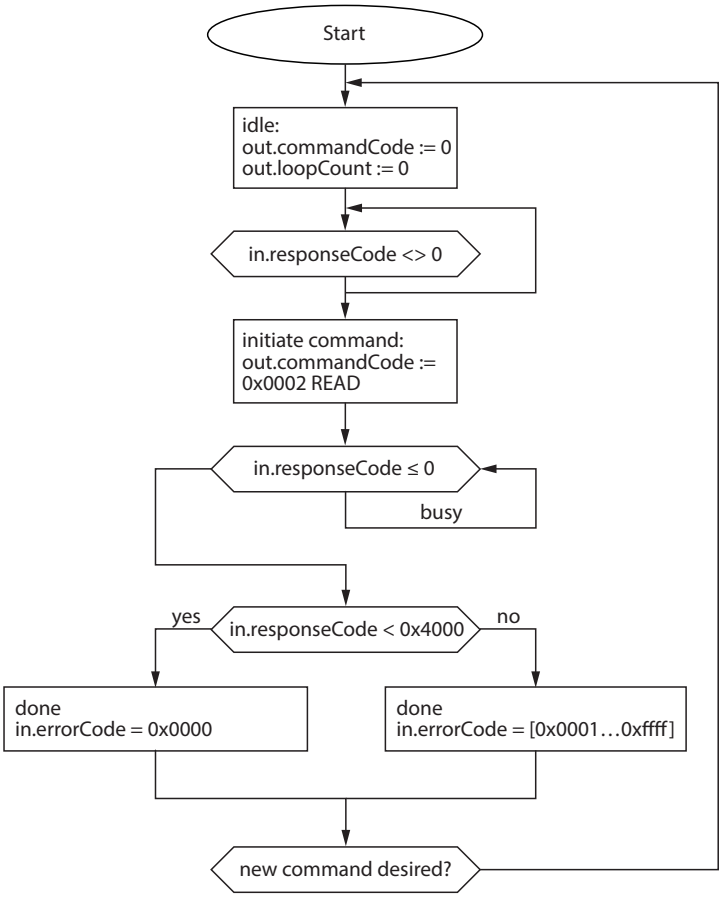


Fig. 65: Flow chart for command processing

16.1.1 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;
```

16.2 Flow chart: rapid command processing with loop counter

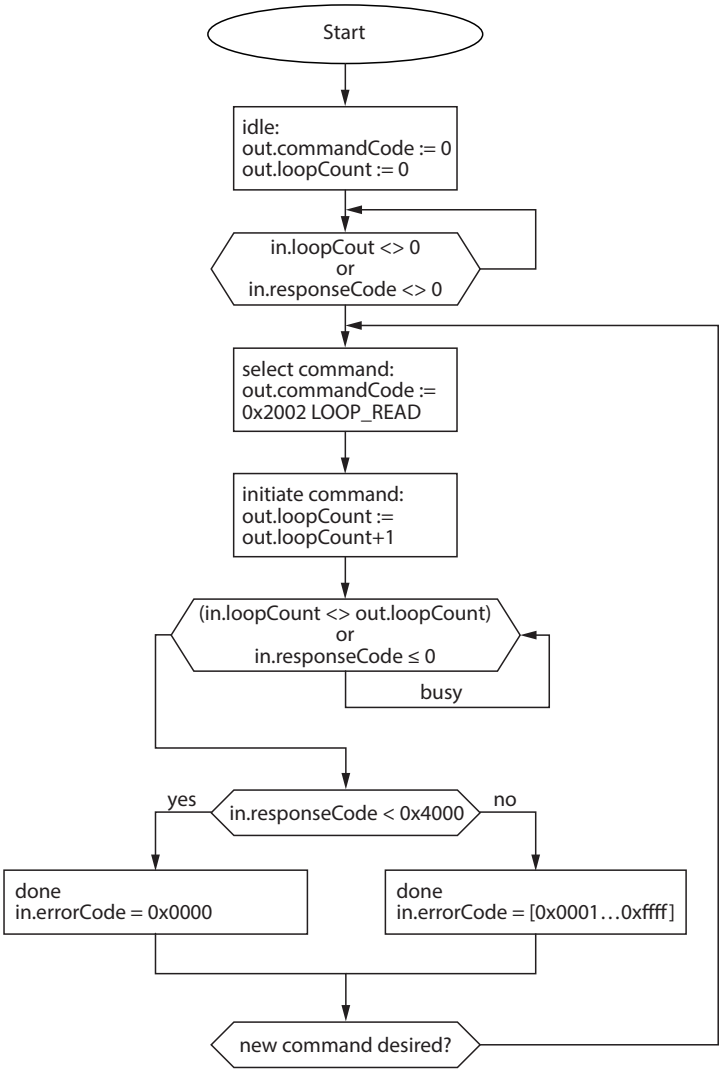


Fig. 66: Flow chart for fast command processing with loop counter

16.3 Flow chart: command processing with fragmentation

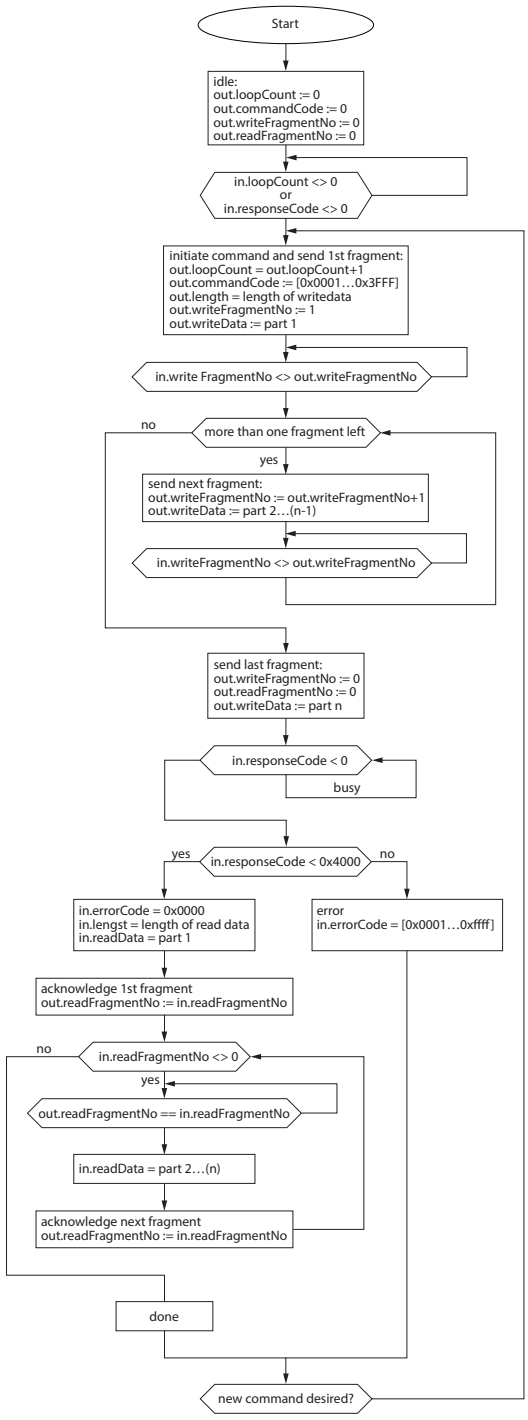


Fig. 67: Flow chart for command processing with fragmentation

16.4 Flow chart: Continuous Mode with interruption before reading data

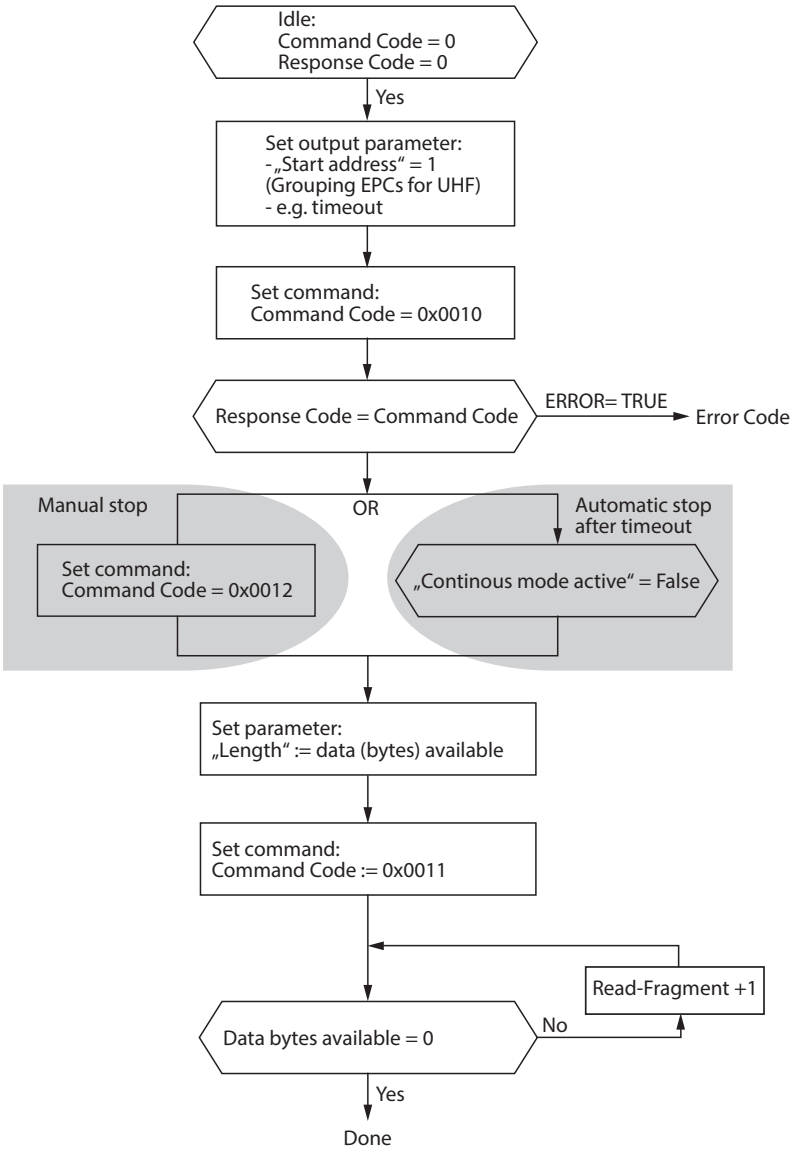
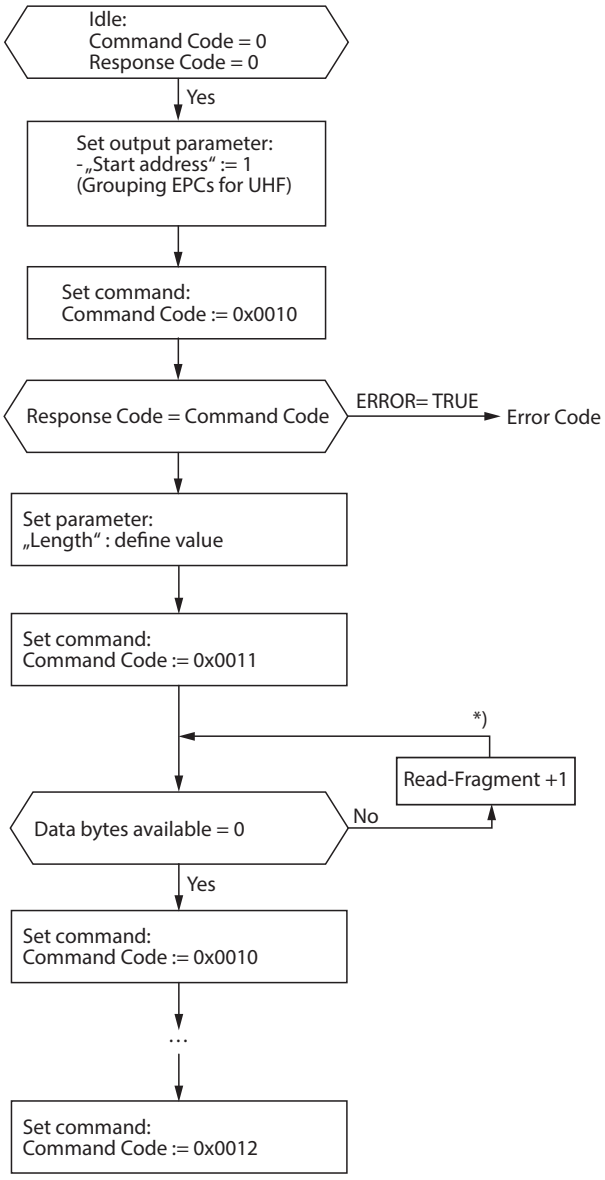


Fig. 68: Flow chart for Continuous Mode with interruption before reading data

16.5 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. 69: Flow chart for Continuous Mode without interruption before reading data

16.6 Flow chart: programming tags with a password

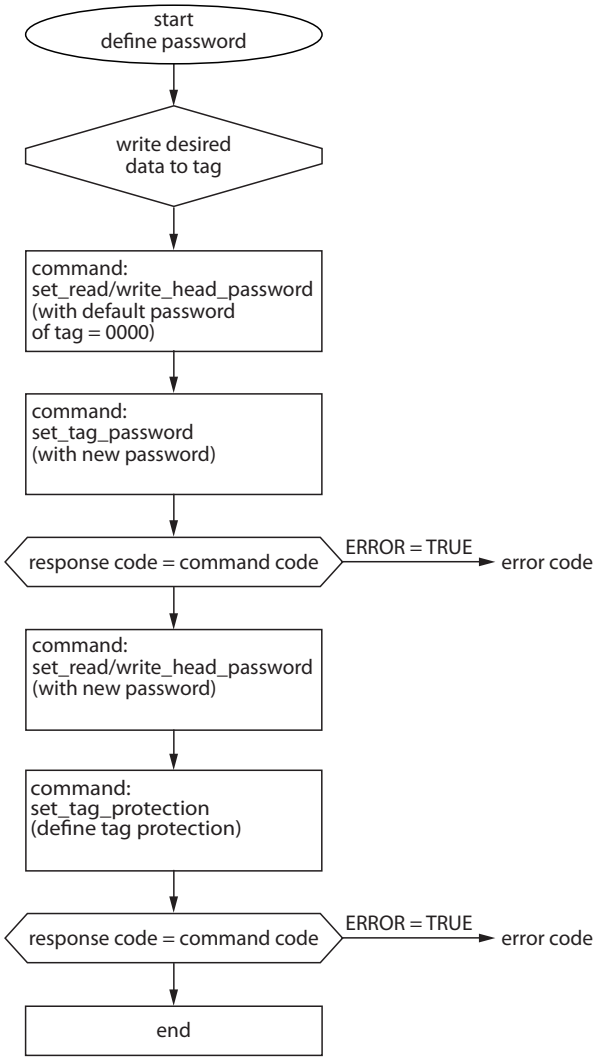


Fig. 70: programming tags with a password

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