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TURCK

TBEC-LL-4RFID-8DXP

RFID Interface

Instructions for Use



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1 About these instructions

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

1.1 Explanation of symbols used

The following symbols are used in these instructions:



DANGER

DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.



WARNING

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



CAUTION

CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.



NOTICE

NOTICE indicates a situation which may lead to property damage if not avoided.



NOTE

NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.



CALL TO ACTION

This symbol denotes actions that the user must carry out.



RESULTS OF ACTION

This symbol denotes relevant results of actions.

1.2 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 compact RFID interfaces:

- TBEC-LL-4RFID-8DXP

2.2 Scope of delivery

The scope of delivery includes:

- Compact RFID interface
- Closure caps for M12 connectors
- Quick Start Guide

2.3 Legal requirements

The device falls under the following EU directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS directive)
- 2014/34/EU (ATEX directive)

2.4 Turck service

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

The contact details of Turck subsidiaries worldwide can be found on p. [▶ 260].

3 For your safety

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

3.1 Intended use

The TBEC-LL-4RFID-8DXP block module is an RFID interface for use in the Turck RFID system. The device is connected between the controller and the read/write devices and transmits commands from the controller to the read/write devices. Read data is sent to the controller via the device.

The device supports the HF read/write heads from firmware version Vx.90 and UHF readers from firmware version FW 1.45.

Up to four RFID read/write heads can be connected to the device in normal operation. In Bus mode it is possible to connect up to 32 bus-capable HF read/write heads per channel. Eight configurable digital channels are also provided. The devices can be connected to the Ethernet-based EtherCAT fieldbus system.

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

3.2 General safety notes

- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.

3.3 Notes on Ex protection

- When operating the device in a hazardous area, the user must have a working knowledge of explosion protection (EN 60079-14, etc.).
- Observe national and international regulations for explosion protection.
- Use the device only within the permissible operating and ambient conditions (see approval data and Ex approval specifications).

3.4 Ex approval requirements for use in Ex area

- Only use the device in an area with no more than pollution degree 2.
- Only disconnect and connect circuits when no voltage is applied.
- Only operate the switches if no voltage is present.
- Connect the metal protective cover to the equipotential bonding in the Ex area.
- Ensure impact resistance in accordance with EN IEC 60079-0 – alternative measures:
 - Install the device in the TB-SG-L protective housing (available in the set with Ultem window: ID 100014865) and replace the service window with an Ultem window.
 - Install the device in an area offering impact protection (e.g. in robot arm) and attach a warning: "DANGER: Only connect and disconnect circuits when no voltage is present. Do not operate switches when energized."
- Do not install the device in areas critically exposed to UV light.
- Prevent risks caused by electrostatic charge.
- Protect unused connectors with dummy plugs to ensure protection class IP67.

3.5 Notes on UL approval

- Use UL-certified PVVA or CYJV cables suitable for the current/voltage rating and with an insulation temperature of at least 105 °C.
- The cables connected to XF1 and XF2 (Ethernet) must not be routed outside the plant.

4 Product description

The device is designed with a fully encapsulated housing with degree of protection IP67/IP69K. Four RFID channels are provided for connecting read/write devices. Sensors and actuators can also be connected via eight digital I/O channels. The digital I/O channels can be configured as inputs or outputs as required. The terminals for the read/write devices and for digital I/Os are M12 female connectors. An M12 female connector is provided for connection to the Ethernet-based EtherCAT fieldbus system.

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

4.1 Device overview

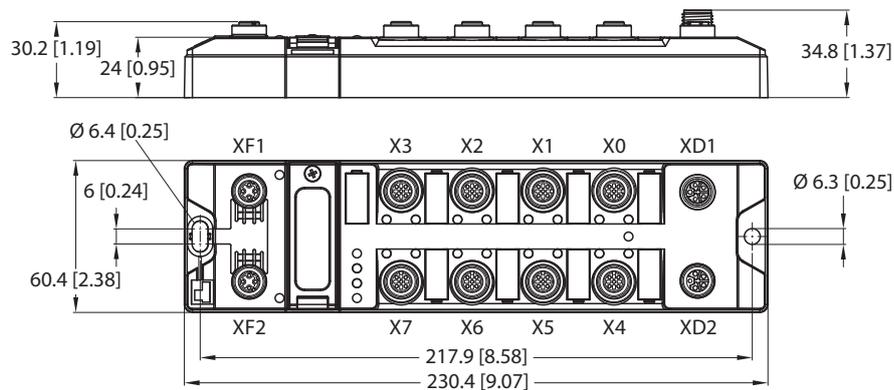


Fig. 1: Dimensions

4.1.1 Display elements

The device has the following LED indicators:

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

4.1.2 Operating elements

The device has the following operating elements:

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

4.2 Properties and features

- EtherCAT slave according to Modular Device Profile (ETG.5001.1)
- Glass fiber reinforced housing
- Shock and vibration tested
- Fully encapsulated module electronics
- Degree of protection IP65/IP67/IP69K
- Integration in PLC systems without special function block
- Up to 128 bytes of user data per read/write cycle per channel as well as the use of fragments with 16 kilobytes of FIFO memory
- Data interface for convenient use of the RFID functions
- Continuous HF bus mode with up to 32 HF-capable read/write heads per channel
- M12 L-coded M12 connector for the power supply
- 4 channels with M12 connector for RFID
- Mixed operation of HF and UHF read/write heads and UHF readers
- Eight universal digital channels as 2 A PNP inputs and/or outputs
- LED indications and diagnostics

4.3 Operating principle

The interfaces are equipped with a fieldbus interface for EtherCAT. The interface is linked to an (existing) fieldbus system as an EtherCAT device. The interfaces are provided with a fieldbus interface and fieldbus-independent I/O electronics with an RFID interface. During operation, the process data is exchanged between the fieldbus and RFID system. The read/write devices are connected to the interfaces via the RFID interfaces. The interface signals of indicators, sensors and actuators can also be processed via eight universal digital channels.

4.4 Functions and operating modes

The compact RFID interfaces transfer the data between the RFID level (read/write device and tag) and the controller level. HF read/write heads and UHF readers can be connected to the RFID channels. Parallel operation of HF read/write heads and UHF readers on the same device is also possible.

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

Sensors and actuators can be connected to the universal digital channels. In all, up to eight 3-wire PNP sensors or eight PNP DC actuators can be connected per input or output. The maximum output current per channel is 2 A.

4.4.1 Module object directory

The object directory of the device contains the following object areas in accordance with ETG 5001:

Index	Area in the object directory
0x1000...0x1FFF	Communication Area, as per ETG.5001.1
0x5000...0x5FFF	Configured Module ID (only for internal use, manufacturer specific)
0x6000...0x6FFF	Input Area (process input data)
0x7000...0x7FFF	Output Area (process output data)
0x8000...0x8FFF	Configuration Area (parameter data)
0xA000...0xAFFF	Diagnostic data
0xF000...0xFFFF	Device Area <ul style="list-style-type: none"> ■ Device Status (0xF100, 0xF110) ■ Device Control ■ Device Parameter

4.4.2 EtherCAT functions

The device supports the following EtherCAT communication profiles:

- CoE (CAN Application Protocol over EtherCAT): The object dictionary is provided via the CoE interface. The object dictionary contains all device-specific parameters.
- EoE (Ethernet over EtherCAT): The standard Ethernet protocol is tunneled via the EoE communication protocol. An IP address for EoE can be assigned to the device so that the device can be configured via the web server or via DTM.
- FoE (File Access over EtherCAT): The firmware update is carried out via the FoE communication protocol.

4.4.3 Data transfer to the PLC

In every write or read cycle, up to 128 bytes can be transferred on each channel. The data must be fragmented in order to transfer more than 128 bytes. The amount of write or read data transferred per cycle can be set as follows for EtherCAT:

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

4.4.4 RFID channels – operating modes

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

- HF compact
- HF extended
- HF bus mode
- UHF compact
- UHF extended

Different functions are available to the user, depending on the selected data interface.

HF compact mode

HF compact mode is suitable for transferring smaller data volumes of up to 128 bytes (e.g. UID) in single-tag applications.

HF extended mode

HF extended mode contains all the functions provided in **HF compact** mode. It is also possible with fragmentation to transfer more than the set data size per write or read cycle (example: 128 bytes). The operating mode is suitable for single-tag and multitag applications.



NOTE

Not all commands are supported in multitag mode.

The user can set a command timeout to define the time for the execution of a command.

HF extended mode enables the use of Continuous mode for the repeated execution of an Inventory, Tag info, Read or Write command. In Continuous mode the read/write head executes the commands autonomously. Different data is stored in the internal memory of the interface. The memory operates as a FIFO memory.

HF bus mode

In HF bus mode up to 32 bus-capable read/write heads per RFID channel can be connected to the RFID module. An additional power supply may be required depending on the number and power consumption of connected read/write heads. A power consumption analysis of the connected read/write heads is required in order to determine the additional power supply required. A tool is provided at www.turck.com/hf-busmodus for calculating the power.

Every connected read/write head supplies a “**Tag present**” signal in HF bus mode. HF bus mode is suitable for static applications and very slow dynamic applications because a command can only be processed by one read/write head at a time.

In Continuous HF bus mode, a command is performed simultaneously at all read/write heads in a bus topology. The logged data is stored in the ring memory of the module.

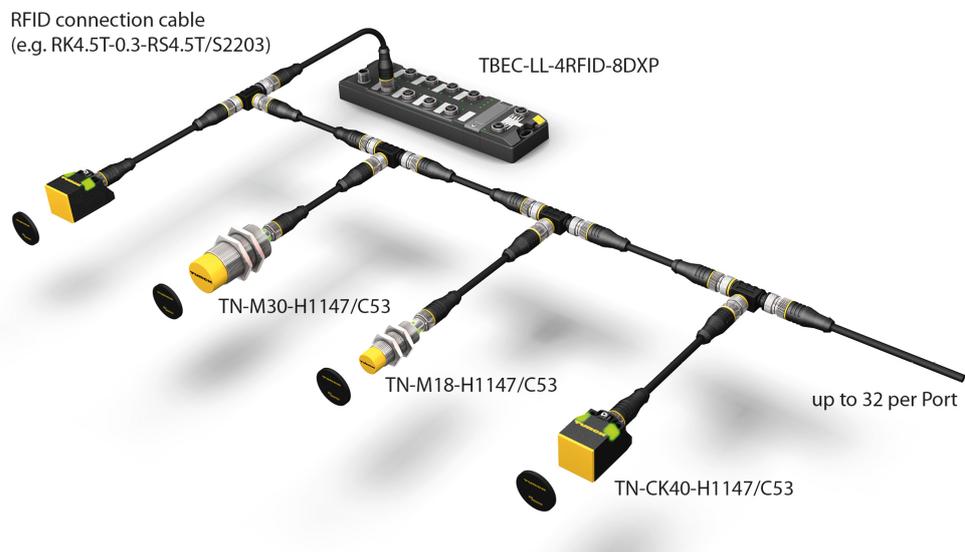


Fig. 2: HF bus mode setup

The following read/write heads can be used for HF bus mode:

- TN-M18-H1147/C53
- TB-M18-H1147/C53
- TN-M30-H1147/C53
- TB-M30-H1147/C53
- TN-CK40-H1147/C53
- TB-Q08-0.15-RS4.47T/C53
- TN-Q14-0.15-RS4.47T/C53
- TN-Q80-H1147/C53
- TN-R42TC-EX/C53
- TN-R42TC-EX/C65
- TNLR-Q80-H1147/C53
- TNSLR-Q42TWD-H1147/C53
- TNSLR-Q80WD-H1147/C53

HF bus mode supports the HF read/write heads from firmware version Vx.90.

Continuous bus mode supports HF read/write heads from firmware version Vx.93.

UHF compact mode

UHF compact mode enables up to 128 bytes of data to be transferred in single-tag applications (e.g. EPC).

UHF extended mode

All functions of the **UHF compact** mode are included in **UHF extended** mode. It is also possible to transfer more than 128 bytes of data. The operation mode is suitable for single-tag and multi-tag applications. The user can set a command timeout to define the time for the execution of a command.

UHF extended mode enables the use of Presence sensing mode for the repeated execution of an Inventory, read or write command. In Presence sensing mode the UHF readers are automatically switched on or off and also carry out the commands automatically. In this case, the read data is stored in the internal memory of the interface. The memory operates as a FIFO memory.

4.4.5 RFID commands

The device can perform the following commands and functions. A complete description of the commands is provided in the section "Setting".

- Idle
- Inventory
- Read
- Write
- Change EPC length and write new EPC (UHF)
- Write and verify
- Continuous mode
- Read buffer (Cont. mode)
- Stop Continuous (presence sensing) mode
- UHF continuous presence sensing mode
- HF read/write head off
- Read/write head identification
- Get UHF read/write head status/error
- Tag info
- Direct read/write head command
- Get HF read/write head address
- Set HF read/write head address
- Tune HF read/write head
- Set read/write head password
- Reset read/write head password
- Set tag password
- Set tag protection
- Get HF tag protection status
- Set permanent lock
- Kill UHF tag
- Restore settings UHF read/write head
- Backup settings UHF read/write head
- 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 [▶ 253]). This increments the loop counter to execute a command repeatedly. At least four PLC cycles are required in conventional command processing. In order to execute a command repeatedly with conventional command processing, a command has to be reset and then set again. The loop counter function is provided for special commands. If the command was successfully executed, the command code is output in the response data.

4.4.7 Universal digital channels – functions

The device is provided with eight universal digital channels, which can be used as inputs or outputs according to the application requirements. In all, up to eight 3-wire PNP sensors or eight PNP DC actuators can be connected per input or output. The maximum output current per channel is 2 A.

4.5 Technical accessories

Accessories for mounting, connecting and parameterizing can be found in product database under www.turck.com. The accessories are not part of the scope of delivery.

5 Installing

5.1 Installing the device in Zone 2 and Zone 22

In Zone 2 and Zone 22, the devices can be used in conjunction with the protective housing set TB-SG-L (ID 100014865).



DANGER

Potentially explosive atmosphere

Risk of explosion through spark ignition

For use in Zone 2 and Zone 22:

- ▶ Only install the device if there is no potentially explosive atmosphere present.
 - ▶ Observe requirements for Ex approval.
-

- ▶ Unscrew the housing. Use Torx T8 screwdriver.
- ▶ Replace the service window with the enclosed Ultem window.
- ▶ Place the device on the base plate of the protective housing and fasten both together on the mounting plate, see [▶ 19].
- ▶ Connect the device, see [▶ 22].
- ▶ Mount and screw the housing cover according to the following figure. The tightening torque for the Torx T8 screw is 0.5 Nm.

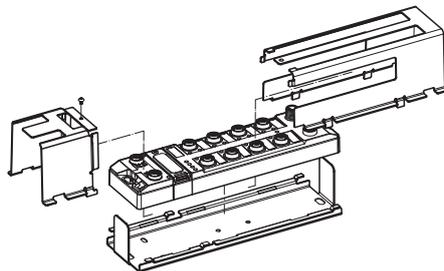


Fig. 3: Mounting the device in protection housing TB-SG-L

5.2 Mounting onto a mounting plate



NOTICE

Mounting on uneven surfaces

Device damage due to stresses in the housing

- ▶ Fix the device on a flat mounting surface.
- ▶ Use two M6 screws to mount the device.

The device can be screwed onto a flat mounting plate.

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

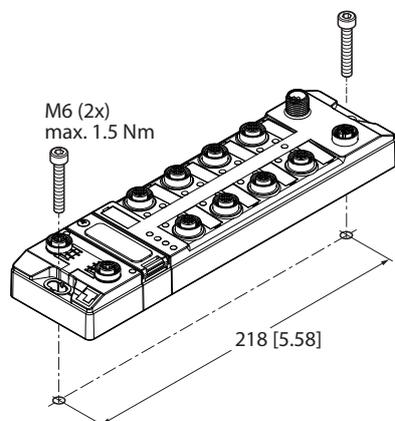


Fig. 4: Mounting the device onto a mounting plate

5.3 Mounting the device outdoors

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

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

5.4 Grounding the device

5.4.1 Equivalent wiring diagram and shielding concept

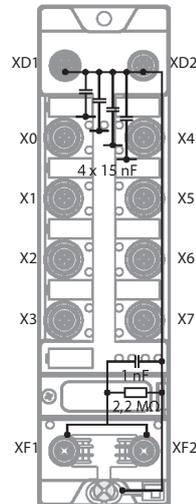


Fig. 5: Equivalent wiring diagram and shielding concept

5.4.2 Shielding of the fieldbus and I/O level

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

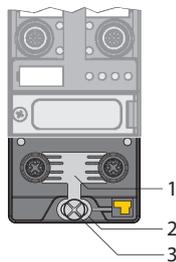


Fig. 6: Grounding clip (1), grounding ring (2) and metal screw (3)

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

I/O level shielding

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

Fieldbus level shielding

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

In the delivery state, the grounding clip is mounted.

5.4.3 Disconnecting the direct grounding of the fieldbus level: removing the grounding clip

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

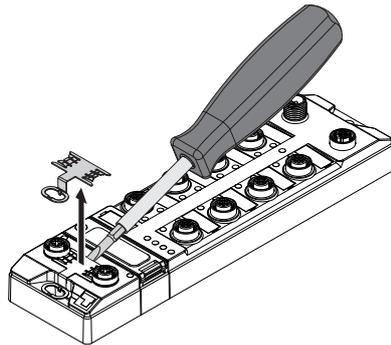


Fig. 7: Removing the grounding clamp

5.4.4 Grounding the fieldbus level directly: inserting the grounding clip

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

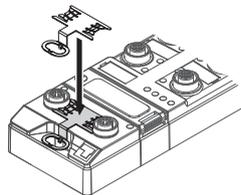


Fig. 8: Mounting the grounding clip

5.4.5 Grounding the device – mounting on a mounting plate

- ▶ For mounting onto a mounting plate: Fix the device with a metal screw through the lower mounting hole.
- ⇒ The module grounding is connected to the reference potential of the installation via the metal screw.
- ⇒ With mounted grounding clip: The shielding of the fieldbus and the module grounding are connected to the reference potential of the installation.

6 Connection



NOTICE

Intrusion of liquids or foreign bodies through leaking connections
Loss of protection class IP65/IP67/IP69K, device damage possible

- ▶ Tighten M12 connectors with a tightening torque of 0.6 Nm.
- ▶ Only use accessories that guarantee the protection class.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

6.1 Connecting the device in Zone 2 and Zone 22



DANGER

Potentially explosive atmosphere

Risk of explosion through spark ignition

When used in Zone 2 and Zone 22:

- ▶ Only disconnect and connect circuits when no voltage is applied.
- ▶ Only use connecting cables that are approved for use in potentially explosive atmospheres.
- ▶ Use all connectors or seal them with blind plugs.
- ▶ Observe requirements for Ex approval.

6.2 Connecting the device to the EtherCAT network

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

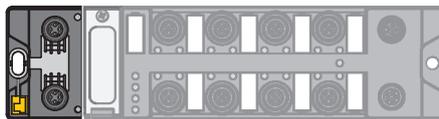


Fig. 9: M12 connector

- ▶ Connect the device to the EtherCAT network according to the pin assignment shown below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

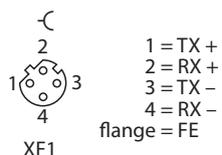


Fig. 10: Pin assignment EtherCAT IN

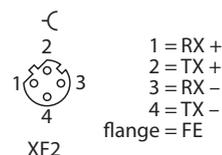


Fig. 11: Pin assignment EtherCAT OUT

6.3 Connecting the power supply

For the connection to the power supply, the device has two 5-pin, L coded M12 connectors. V1 and V2 are galvanically isolated. The maximum tightening torque is 0.6 Nm.

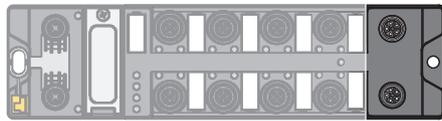


Fig. 12: M12 connector for connecting the supply voltage

- ▶ Connect the device to the power supply according to the pin assignment shown below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

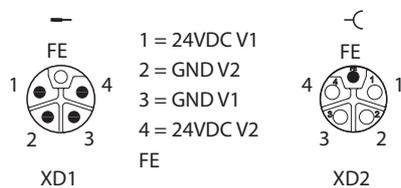


Fig. 13: Pin assignment power supply connectors

Connector	Function
XD1	Power feed
XD2	Continuation of the power to the next node

Voltage	Function
V1	System voltage: power supply 1 (incl. supply of electronics)
V2	Load voltage: power supply 2



NOTE

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

6.4 Connecting RFID read/write devices

The device has four 5-pin M12 female connectors for connecting RFID read/write devices. The maximum tightening torque is 0.6 Nm.

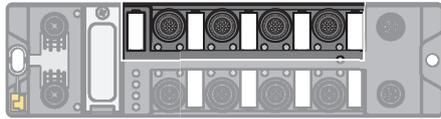


Fig. 14: M12 female connectors for connecting RFID read/write devices

- ▶ Connect the read/write devices to the device as per the pin assignment shown below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

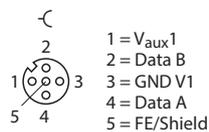


Fig. 15: RS485 – pin assignment of the read/write device connections



Fig. 16: .../S2500 connection cables – pin assignment of the read/write device connections



Fig. 17: .../S2501 connection cables – pin assignment of the read/write device connections

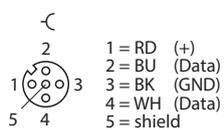


Fig. 18: .../S2503 connection cables – pin assignment of the read/write device connections

6.4.1 Connecting read/write heads for the HF bus mode

In HF bus mode up to 32 bus-capable read/write heads per RFID channel can be connected to the device. The user must determine by means of a power consumption analysis whether an additional power supply is required for the connected read/write heads (see information in the data sheet or tool at www.turck.com/hf-busmodus).

The maximum permissible length of the bus is 50 m.

Connecting read/write heads for HF bus mode in the non-Ex area

The following accessories are required for the bus mode in the non-Ex area:

- The VT2-FKM5-FKM5-FSM5 (ID 6930573) junction box for connecting several read/write heads to an RFID channel
- RSE57-TR2/RFID bus terminating resistor (ID 6934908)
- Optional: VB2-FKM5-FSM5.205-FSM5.305/S2550 junction box (ID 6936821) for feeding in an additional power supply
- RFID connection cables (e.g. RK4.5T-0.3-RS4.5T/S2503)
 - ▶ Connect the read/write head as per the figure below. The maximum length of the spur line is 2 m.
 - ▶ Take the power supply into account, particularly at switch-on (see data sheet), as well as the maximum current carrying capacity of the lines (4 A).
 - ▶ Take the voltage drop on the line into account. If necessary, provide an additional power supply between the read/write heads using junction box VB2-FKM5-FSM5.205-FSM5.305/S2550.
 - ▶ Connect a terminating resistor (e.g. RSE57-TR2/RFID) behind the last read/write head.

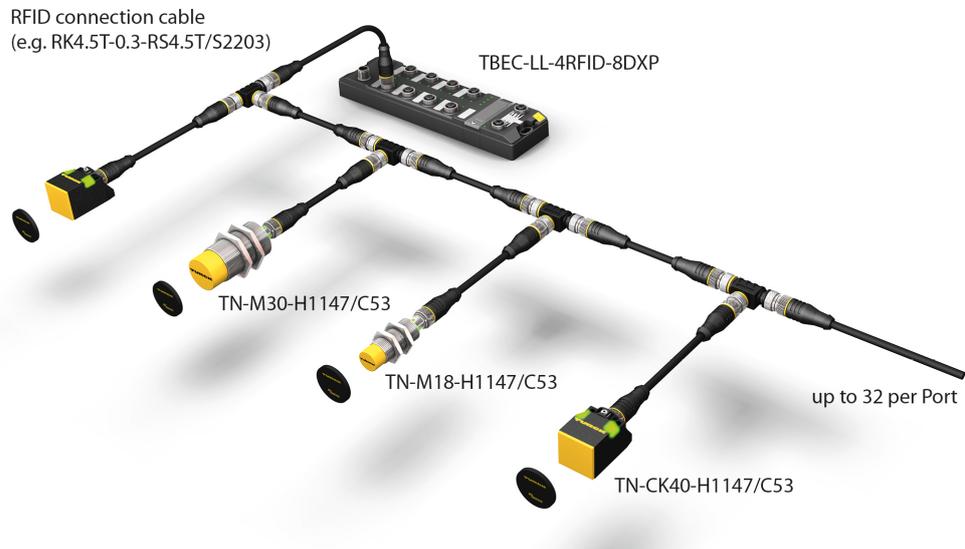


Fig. 19: HF bus mode setup

Connecting read/write heads for HF bus mode in the Ex area



NOTE

Information on the maximum cable lengths in the Ex area is provided in the data sheets of the connected read/write heads.

The following accessories are required for bus mode in the Ex area:

- TN-R42TC-EX/C53 read/write heads (ID 100020167)
- TN-R42TC-EX/C65 read/write head (ID 100028462) with integrated bus terminating resistor
- .../S2500 RFID connection cables
- Operation in Zone 2/22:
 - VT2-FKM5-FKM5-FSM5 (ID 6930573) junction box for connecting several read/write heads to an RFID port
 - SC-M12/3GD captive safety clip (ID 6900390)
 - Optional: VB2-FKM5-FSM5.205-FSM5.305/S2550 junction box (ID 6936821) for feeding in an additional power supply
- Operation in Zone 1/21:
 - Ex-e terminal boxes



DANGER

Potentially explosive atmosphere

Risk of explosion through spark ignition

Operation in Zone 2/22:

- ▶ Only connect the read/write heads if there is no potentially explosive atmosphere present or if the device is in a de-energized state.
- ▶ Protect the M12 male connector from accidental removal during operation using safety clip SC-PM12/3GD.
- ▶ Protect the M12 male connector from mechanical damage.



DANGER

Potentially explosive atmosphere

Risk of explosion through spark ignition

- ▶ When used in Zone 1/21 observe the instructions for use of the connected devices.

- ▶ Operation in Zone 2/22: connect the read/write heads via VT2-FKM5-FKM5-FSM5 junction boxes as per the figure below (max. tightening torque see data sheet of the cable used). The maximum length of the spur line is 2 m.
- ▶ Operation in Zone 1/21: connect the read/write heads via terminal boxes as per the figure below. The maximum length of the spur line is 2 m.
- ▶ Take the power supply into account, particularly at switch-on (see data sheet), as well as the maximum current carrying capacity of the lines (4 A).
- ▶ Take the voltage drop on the line into account. When used in Zone 2/22 provide an additional power supply between the read/write heads using junction box VB2-FKM5-FSM5.205-FSM5.305/S2550. Up to 20 read/write heads can be connected without an additional power supply.
- ▶ Use the TN-R42TC-EX/C65 read/write head with an integrated bus terminating resistor as the last device. Do not connect a separate bus terminating resistor.

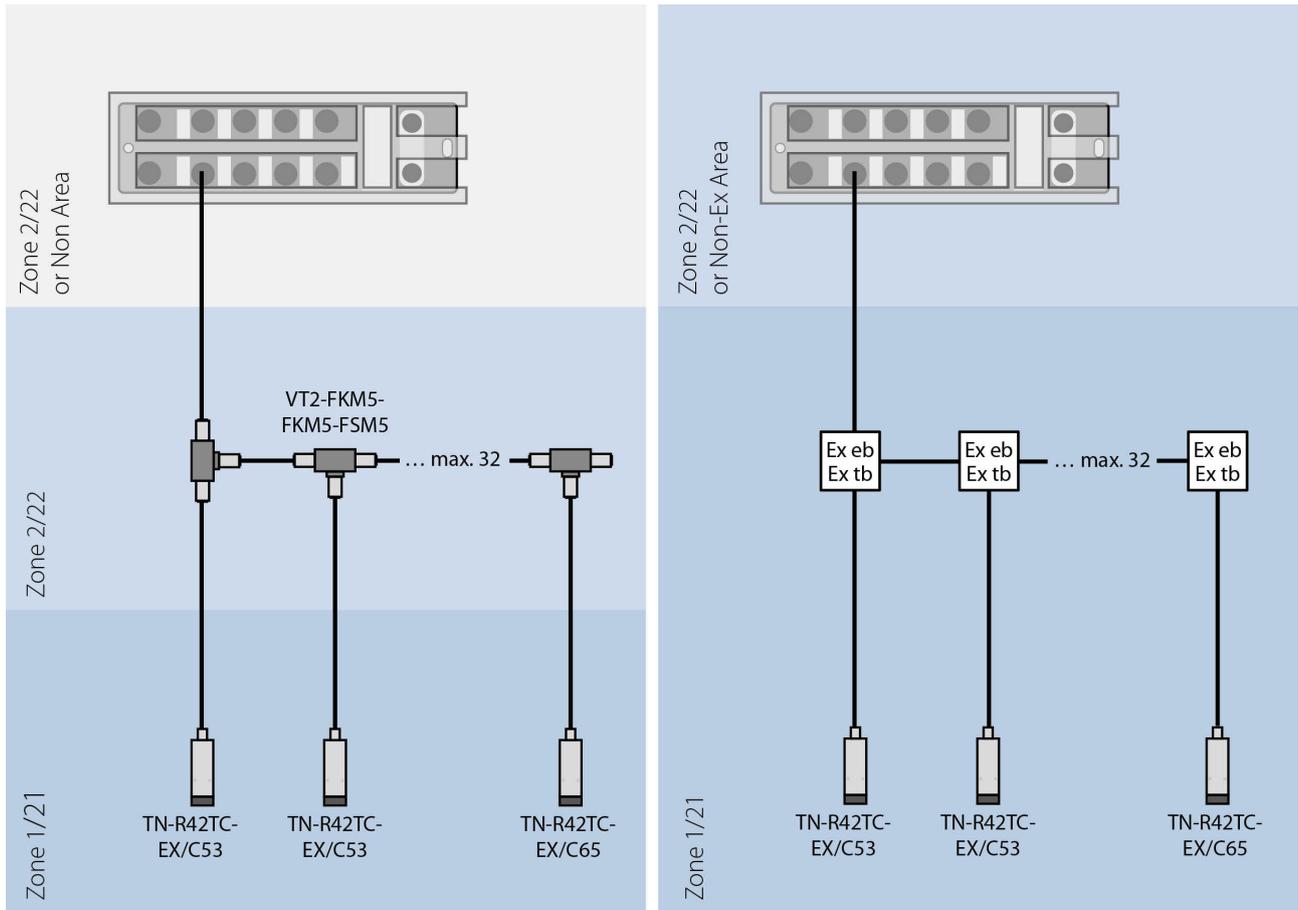


Fig. 20: System setup

6.5 Connecting digital sensors and actuators

The device has four 5-pin M12 female connectors for connecting digital sensors and actuators. The maximum tightening torque is 0.6 Nm.

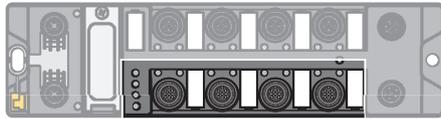


Fig. 21: M12 female connectors for connecting digital sensors and actuators

- ▶ Connect the sensors and actuators to the device as per the pin assignment below.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

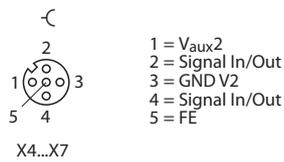


Fig. 22: Connections for digital sensors and actuators – pin assignment

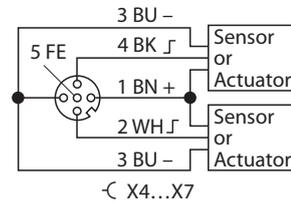


Fig. 23: Connections for digital sensors and actuators – wiring diagram

The channels are assigned to the slots as follows:

Channel	Slot	Pin
DXP8 (Ch8)	X4	4
DXP9 (Ch9)	X4	2
DXP10 (Ch10)	X5	4
DXP11 (Ch11)	X5	2
DXP12 (Ch12)	X6	4
DXP13 (Ch13)	X6	2
DXP14 (Ch14)	X7	4
DXP15 (Ch15)	X7	2

7 Commissioning

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

The device is operational automatically once the cables are connected and the power supply is switched on.

Connected HF read/write heads are switched on automatically. Connected UHF readers are switched off automatically and are activated automatically when a command is executed (apart from Idle mode).

The Idle command (0x0000) is active in the default configuration. If an HF read/write head is connected and a tag is located in the detection range of the read/write head, the **Tag present** bit is set and the UID is output in the input data.

- ▶ In order to execute other commands, establish communication with the EtherCAT master.

If a UHF reader is connected, the device must be set:

- ▶ Establish communication with the EtherCAT master.
- ▶ Activate EoE (see [▶ 78]).
- ▶ Configuring readers with the DTM

7.1 Addressing a device on EtherCAT

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

The device supports the following EtherCAT identification options for HotConnect applications:

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



NOTE

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

Explicit Device Identification

The Identification Value can be set via three hexadecimal rotary coding switches on the device. The switches are located together with the Reset button under a service window. The default setting of the rotary switches is "000".

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

Configured Station Alias

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

7.2 ESI files

Different ESI files must be used depending on the controller environment

Controller/ configuration software	ESI file
TwinCAT	Turck_TBEC-LL-4RFID-8DXP_R1_ESI_...xml
CODESYS	Example: Turck_TBEC-LL-4RFID-8DXP_R1_ESI_V1-3_20210930_8303.xml
SyMac Studio	Turck_TBEC-LL-4RFID-8DXP_R1_ESI_..._omron_...xml Example: Turck_TBEC-LL-4RFID-8DXP_R1_ESI_V1-3_Omron_20210930_8303.xml

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

7.3 Connecting a device to a Beckhoff controller with TwinCAT

Hardware used

This example uses the following hardware components:

- Block module TBEC-LL-4RFID-8DXP

Software used

This example uses the following software:

- TwinCAT Studio V3.1.0
- Microsoft Visual Studio 2013 or higher
- ESI file for TBEC-LL-4RFID-8DXP (available as a free download from www.turck.com)

7.3.1 Installing ESI files

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

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



Fig. 24: TwinCAT – storing an xml file in the installation directory

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

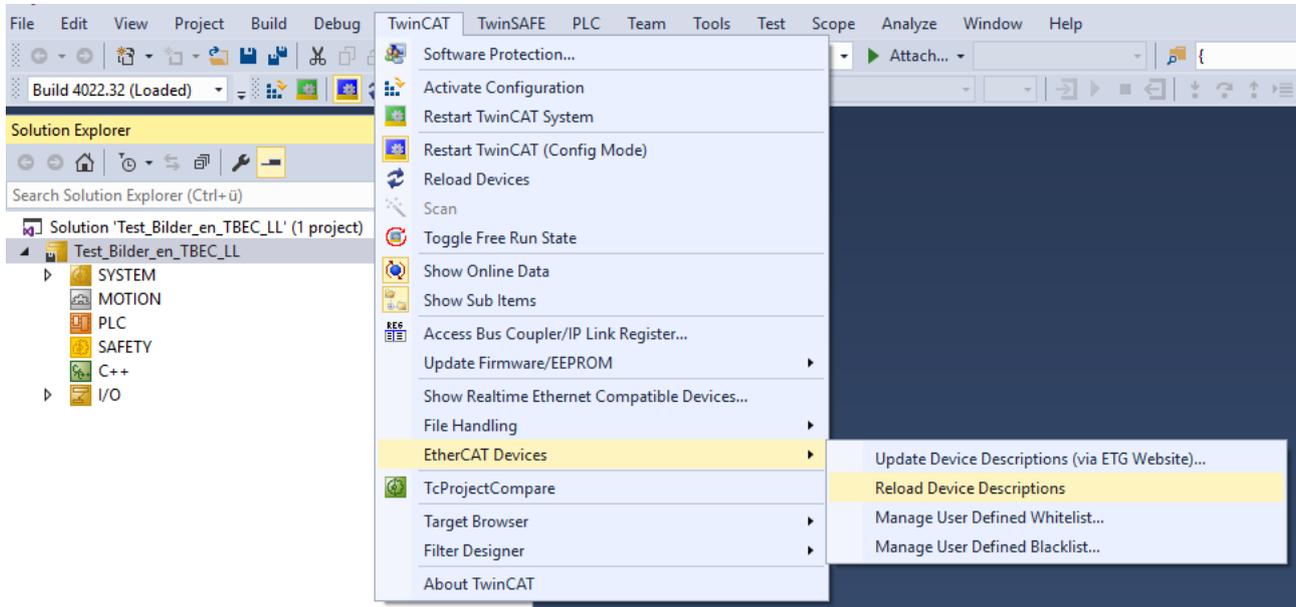


Fig. 25: TwinCAT – updating the device catalog

7.3.2 Connecting the device with the controller

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

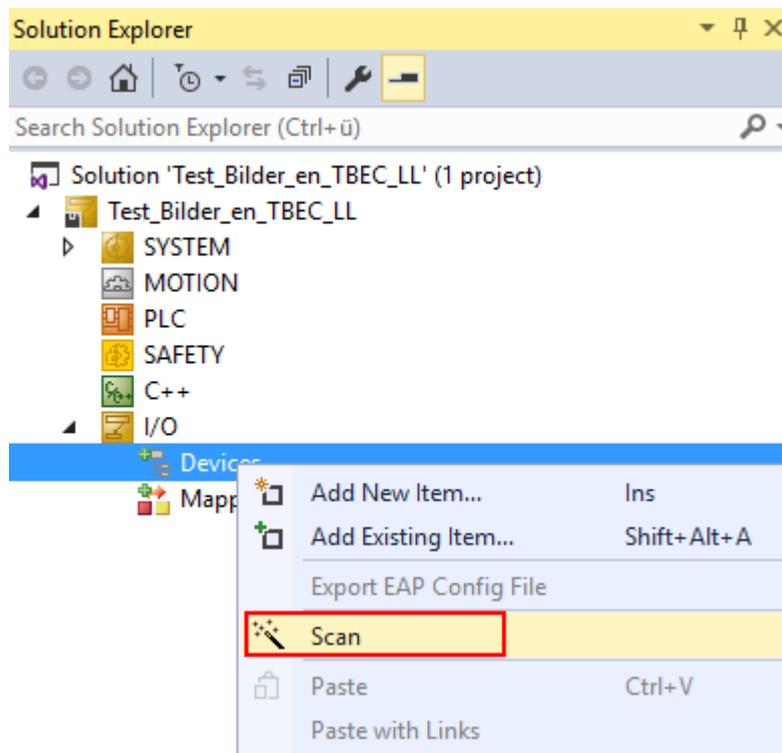


Fig. 26: Scanning for devices

- ⇒ All EtherCAT stations (master and slaves) are read in and automatically added to the I/O configuration. The TBEC-LL-4RFID-8DXP appears in the Solution Explorer under the EtherCAT master as **Box 1 (TBEC-LL-4RFID-8DXP)**.

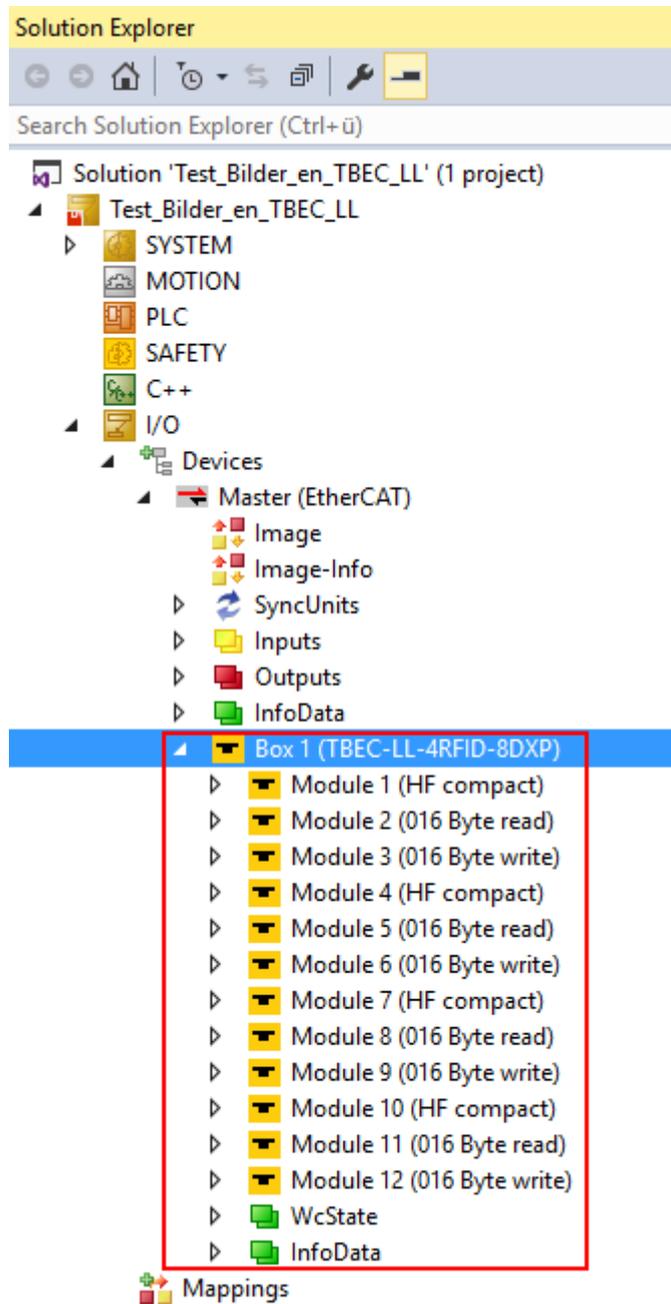


Fig. 27: EtherCAT device as Box 1 in the Solution Explorer

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

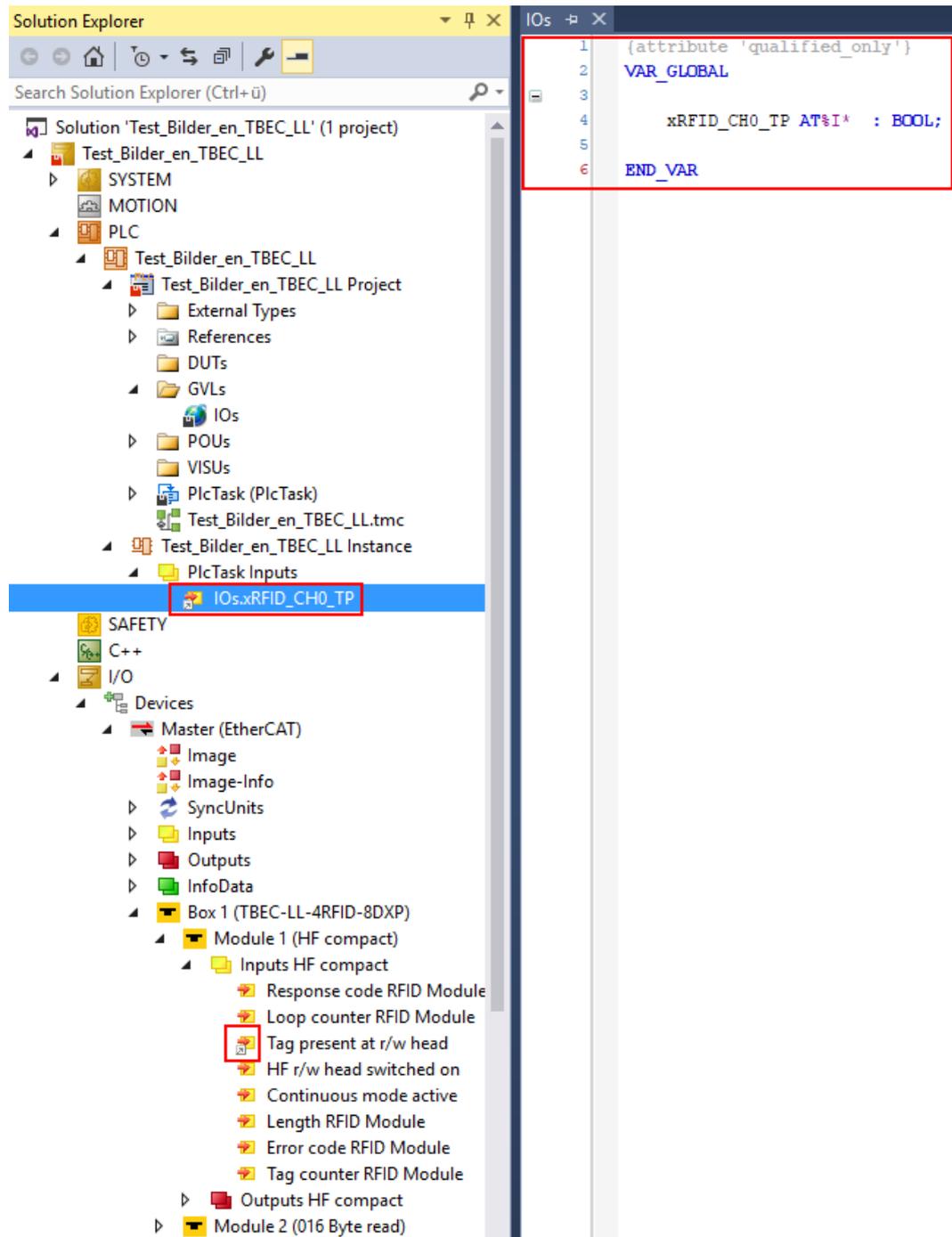


Fig. 28: Example of the linking of a variable

- ▶ Click the **Activate configuration** button.



Fig. 29: Activating the configuration

- ⇒ The device configuration is activated.
- ▶ Click the **Run mode** button.



Fig. 30: Run mode

- ⇒ The device is connected online with the EtherCAT master.
- ▶ Double click **Box 1 (TBEC-LL-4RFID-8DXP)**.
- ⇒ The current status (here: **OP**) as well as the data points and the link are shown on the **Online** tab

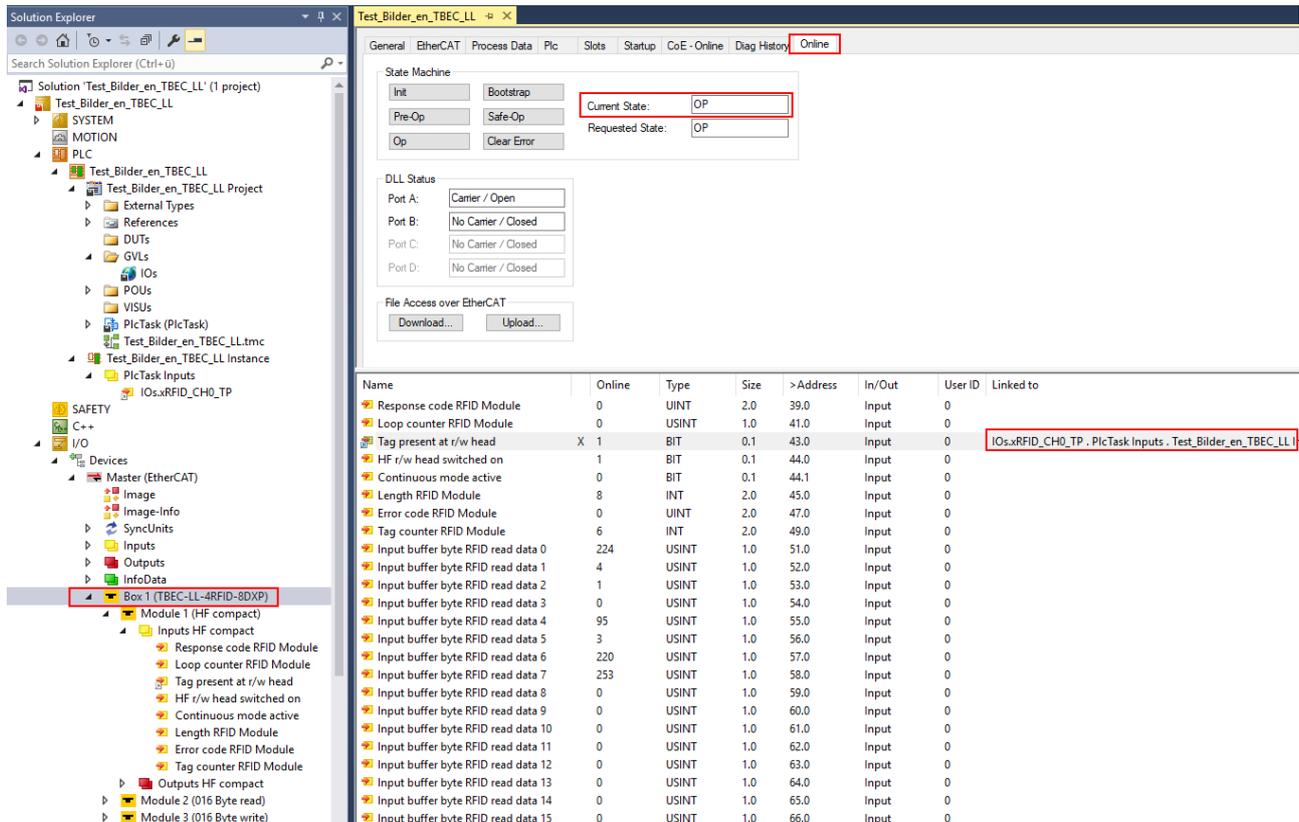


Fig. 31: EtherCAT Device – Online tab: status display (here: Operational), data points, link

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

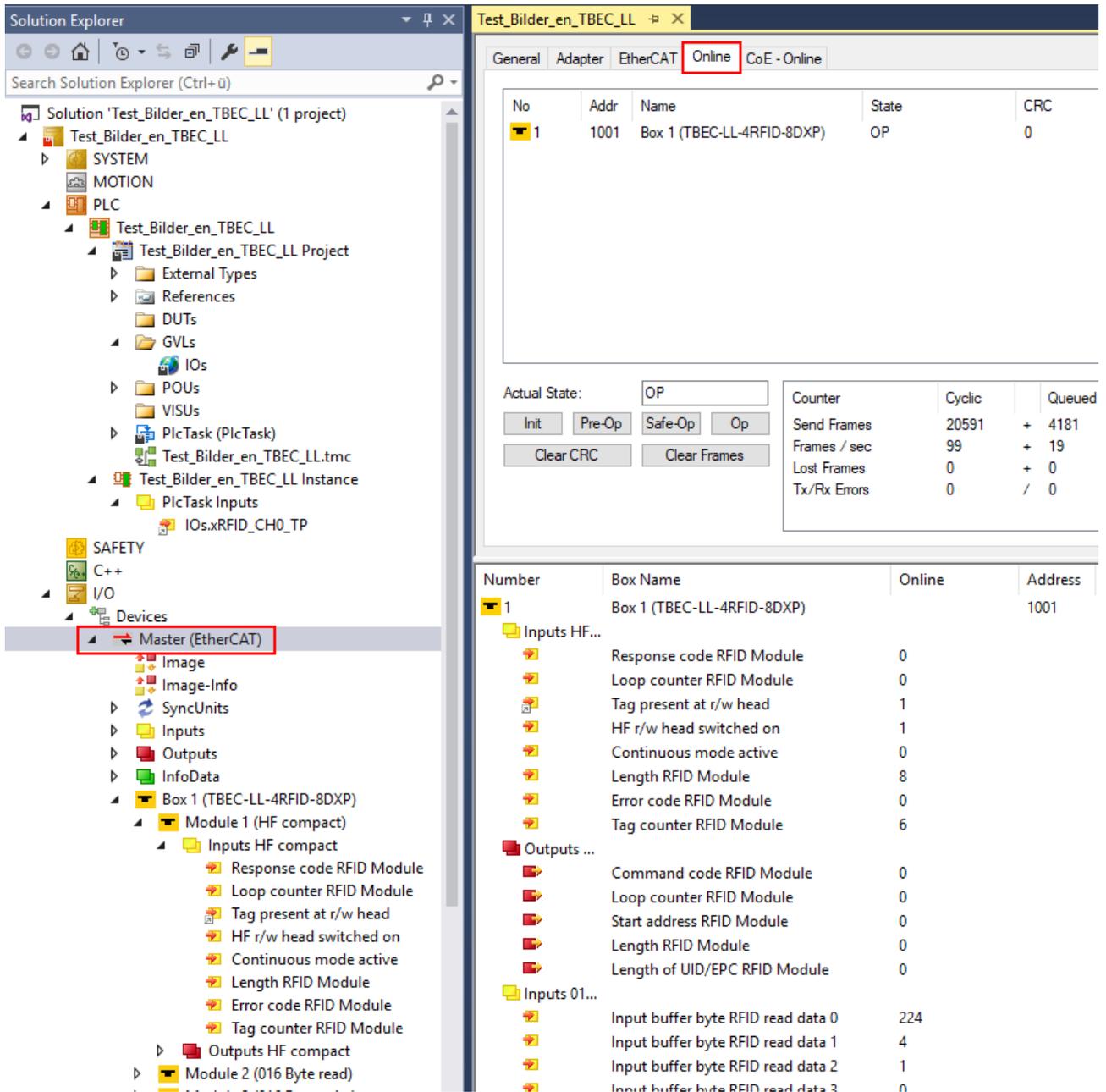


Fig. 32: EtherCAT Master – Online tab: status display of all connected devices

The following states are possible:

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

7.3.3 Configuring slots

The Slots tab enables functions to be assigned to the device slots and data sizes to be set.

Example: setting the HF bus mode for channel 3

- ▶ Double-click **Box 1 (TBEC-LL-4RFID-8DXP)** in the project tree.

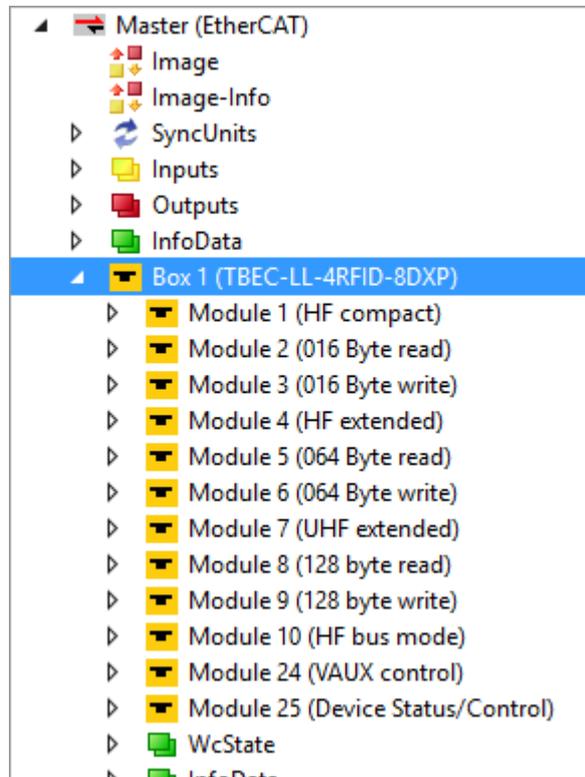


Fig. 33: Project tree

- ▶ Choose the **Slots** tab.
- ▶ Select on the left the channel to be set (here: **RFID control/status ch3**).
- ▶ Select on the right the required operation mode (here: **HF bus mode**)
- ▶ Click the Add button [**<**].

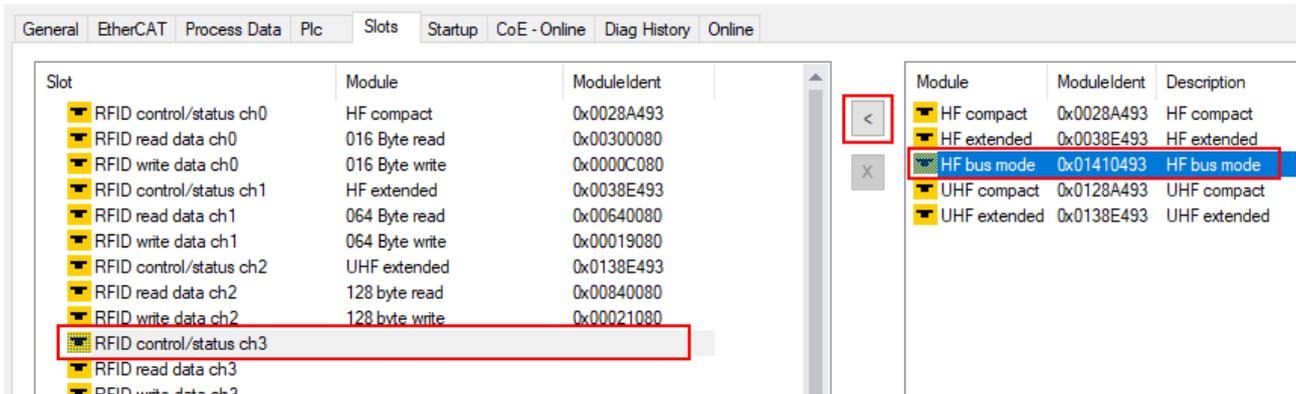


Fig. 34: Selecting HF bus mode for channel 3

⇒ HF bus mode is set for channel 3.

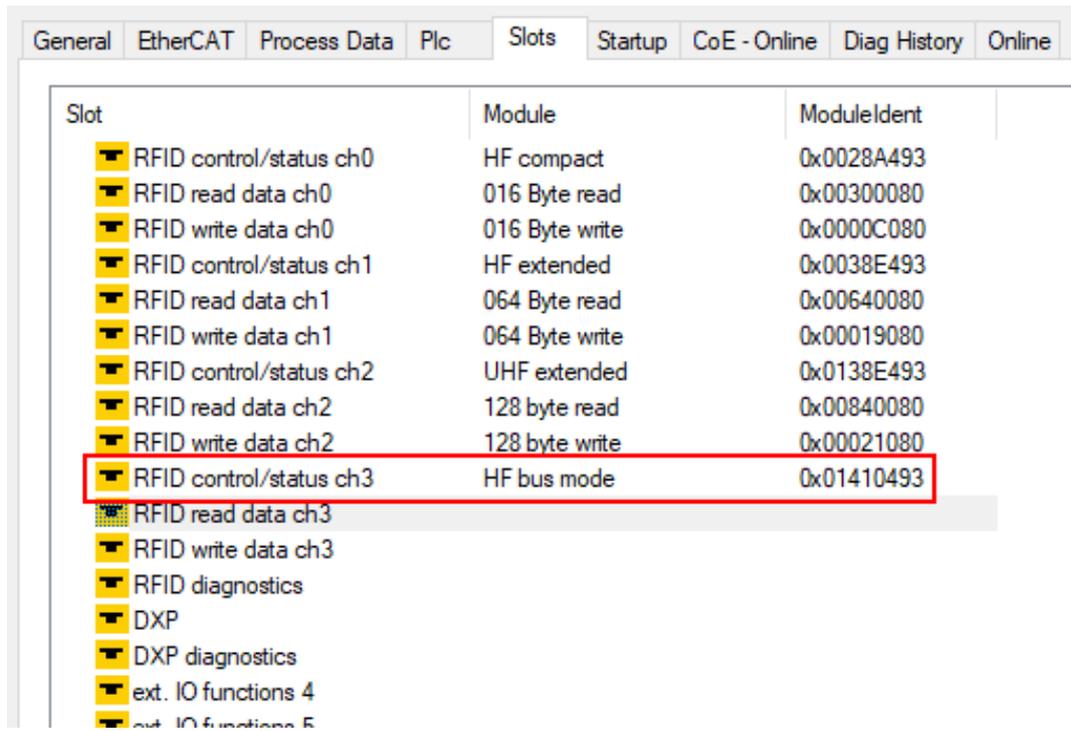


Fig. 35: HF bus mode is set for channel 3

7.3.4 Setting startup parameters

The parameters for the device that are permanently written at startup can be configured on the **Startup** tab. The parameters are independent of the set operation mode.



NOTE

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

Example: selecting tag type

- ▶ Double-click **Box 1 (TBEC-LL-4RFID-8DXP)** in the project tree.

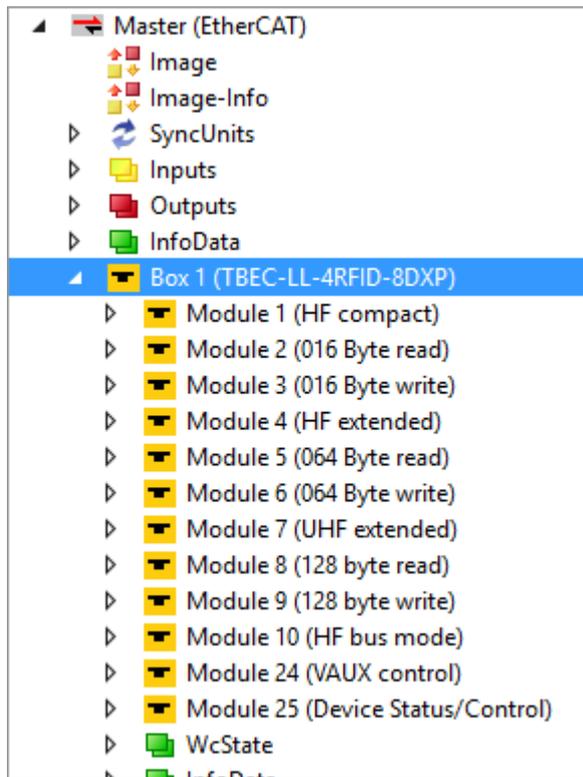


Fig. 36: Project tree

- ▶ Select the **Startup** tab.
- ▶ Double-click **HF: Select Tag type RFID Module**.
- ▶ In the **Edit CANopen Startup Entry** submenu double-click **HF: Select Tag type RFID Module**.

The screenshot shows the 'Startup' tab of a configuration tool. The main table lists CANopen entries with columns for Transition, Protocol, Index, Data, and Comment. The entry at index 8000:02 is highlighted in red and labeled 'HF: Select Tag type RFID Module'. An 'Edit CANopen Startup Entry' dialog box is open, showing the same entry selected in its parameter list. The dialog box includes fields for Transition, Index (hex), Sub-Index (dec), Data (hexbin), and Comment. The 'Index (hex)' field contains '8000' and the 'Sub-Index (dec)' field contains '2'. The 'Comment' field contains 'HF: Select Tag type RFID Module'. A red arrow points from the entry in the main table to the entry in the dialog box's parameter list.

Transition	Protocol	Index	Data	Comment
<IP, PS>	AoE	1/3	0A 11 6E 8C 09 02	AoE Init Cmd (download NetId)
PS	CoE	0x5000:00	0x0028A493 (2663571)	Configured Module ID
PS	CoE	0x8000:02	automatic tag detection HF (0)	HF: Select Tag type RFID Module
PS	CoE	0x8000:03	18632	HF: Bypass time (*1ms) RFID Module
PS	CoE	0x8000:0B	no (0)	HF: Autotuning read/write head RFID Module
PS	CoE	0x8000:0C	no (0)	Deactivate HF detuned diagnostic RFID Module
PS	CoE	0x8000:13	no (0)	
PS	CoE	0x8000:14	UID (0)	
PS	CoE	0x8000:1D	0x02 (2)	
PS	CoE	0x5010:00	0x00300080 (3145856)	
PS	CoE	0x5020:00	0x0000C080 (49280)	
PS	CoE	0x5030:00	0x0038E493 (3728531)	
PS	CoE	0x8030:02	automatic tag detection HF (0)	
PS	CoE	0x8030:03	18632	
PS	CoE	0x8030:08	0x00 (0)	
PS	CoE	0x8030:09	0x00 (0)	
PS	CoE	0x8030:0B	no (0)	
PS	CoE	0x8030:0C	no (0)	
PS	CoE	0x8030:13	no (0)	
PS	CoE	0x8030:14	UID (0)	
PS	CoE	0x8030:1D	0x02 (2)	
PS	CoE	0x8030:1E	0x01 (1)	
PS	CoE	0x8030:1F	0x08 (8)	
PS	CoE	0x8030:20	0x00 (0)	
PS	CoE	0x5040:00	0x00640080 (6553728)	
PS	CoE	0x5050:00	0x00019080 (102528)	
PS	CoE	0x5060:00	0x0138E493 (20505747)	
PS	CoE	0x8060:09	0x00 (0)	
PS	CoE	0x8060:13	no (0)	
PS	CoE	0x8060:1D	0x02 (2)	
PS	CoE	0x5070:00	0x00840080 (8650880)	
PS	CoE	0x5080:00	0x00021080 (135296)	

Index	Name	Flags	Value
8000:0	Parameter HF compact		> 46 <
8000:02	HF: Select Tag type RFID Module	RW	automatic tag detection HF (0)
8000:03	HF: Bypass time (*1ms) RFID Module	RW	2
8000:0B	HF: Autotuning read/write head RFID...	RW	no (0)
8000:0C	Deactivate HF detuned diagnostic RF...	RW	no (0)
8000:13	Deactivate diagnostics RFID Module	RW	no (0)
8000:14	HF: Idle mode RFID Module	RW	UID (0)
8000:1D	Command retries at failure RFID Module	RW	0x02 (2)
8000:A0	res.	RO	---

Fig. 37: HF: Select Tag type RFID Module

- ▶ In the **Set Value Dialog** submenu select the tag in the **Enum** drop-down menu (here: **Fujitsu MB89R112**).
- ▶ Confirm selection with **OK**.
- ⇒ The tag type is set.

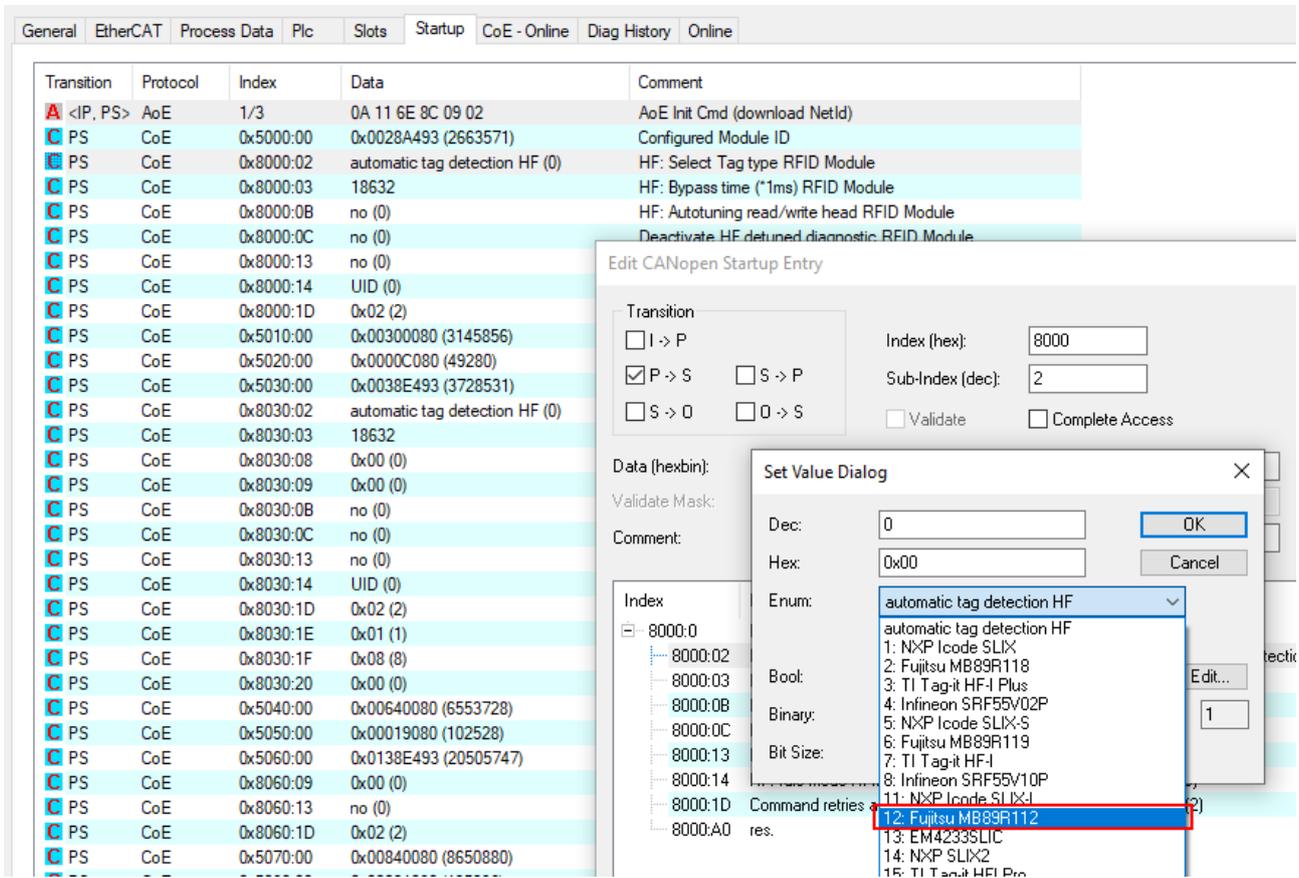


Fig. 38: Selecting a tag

7.3.5 Setting EtherCAT device parameters via the object dictionary



NOTE

Turck recommends only making changes in the startup parameters.

- ▶ In the project tree double-click **Box 1 (TBEC-LL-4RFID-8DXP)**.

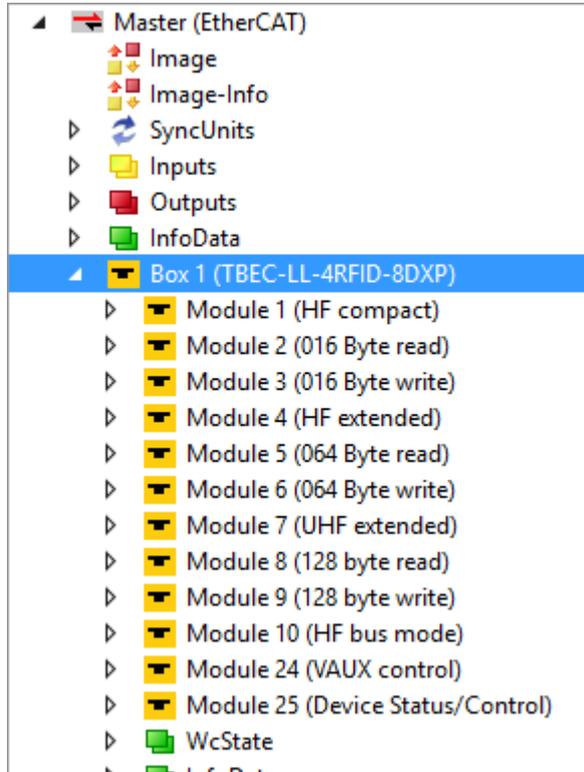


Fig. 39: Project tree

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

Index	Name	Flags	Value
1000	Device Type	RO	0x00001389 (5001)
1001	Error Register	RO	0x00 (0)
1008	Manufacturer Device Name	RO	TBEC-LL-4RFID-8DXP
1009	Manufacturer Hardware Version	RO	1
100A	Manufacturer Software Version	RO	V1.0.4.0
100B	Manufacturer Bootloader Version	RO	V1.0.1.0
+ 1018:0	Identity Object		> 4 <
+ 10F3:0	Diagnosis History		> 5 <
10F8	Timestamp Object	RO	0x74c5be55c0
+ 1600:0	Mapping RxPDO HF compact		> 21 <
+ 1620:0	Mapping RxPDO 016 Byte write		> 16 <
+ 1630:0	Mapping RxPDO HF extended		> 21 <
+ 1650:0	Mapping RxPDO 064 Byte write		> 16 <
+ 1660:0	Mapping RxPDO UHF extended		> 21 <
+ 1680:0	Mapping RxPDO 128 byte write		> 16 <
+ 1690:0	Mapping RxPDO HF bus mode		> 21 <
+ 1770:0	Mapping RxPDO VAUX control		
+ 1780:0	Mapping RxPDO Device Status/Control		
+ 1A00:0	Mapping TxPDO HF compact		> 29 <
+ 1A10:0	Mapping TxPDO 016 Byte read		> 16 <
+ 1A30:0	Mapping TxPDO HF extended		> 29 <
+ 1A40:0	Mapping TxPDO 064 Byte read		> 16 <
+ 1A60:0	Mapping TxPDO UHF extended		> 29 <
+ 1A70:0	Mapping TxPDO 128 byte read		> 16 <
+ 1A90:0	Mapping TxPDO HF bus mode		> 29 <
+ 1B80:0	Mapping TxPDO Device Status/Control		
+ 1C00:0	Sync manager Type		> 4 <
+ 1C12:0	Sync Manager 2 PDO Assignment		> 8 <

Fig. 40: CoE-Online – object dictionary

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



NOTE

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

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

7.3.6 Addressing a device via Explicit Device ID

- ▶ In the project tree double-click **Box 1 (TBEC-LL-4RFID-8DXP)**.
- ▶ Activate **Explicit Device Identification (ADO 0x0134): EtherCAT → Advanced Settings → General → Identification**.
- ▶ In the **Value** field enter the Identification Value (hex.) which must match the rotary coding switches on the device (see [▶ 30]).
- ▶ Confirm entries with **OK**.
- ▶ Carry out a voltage reset.

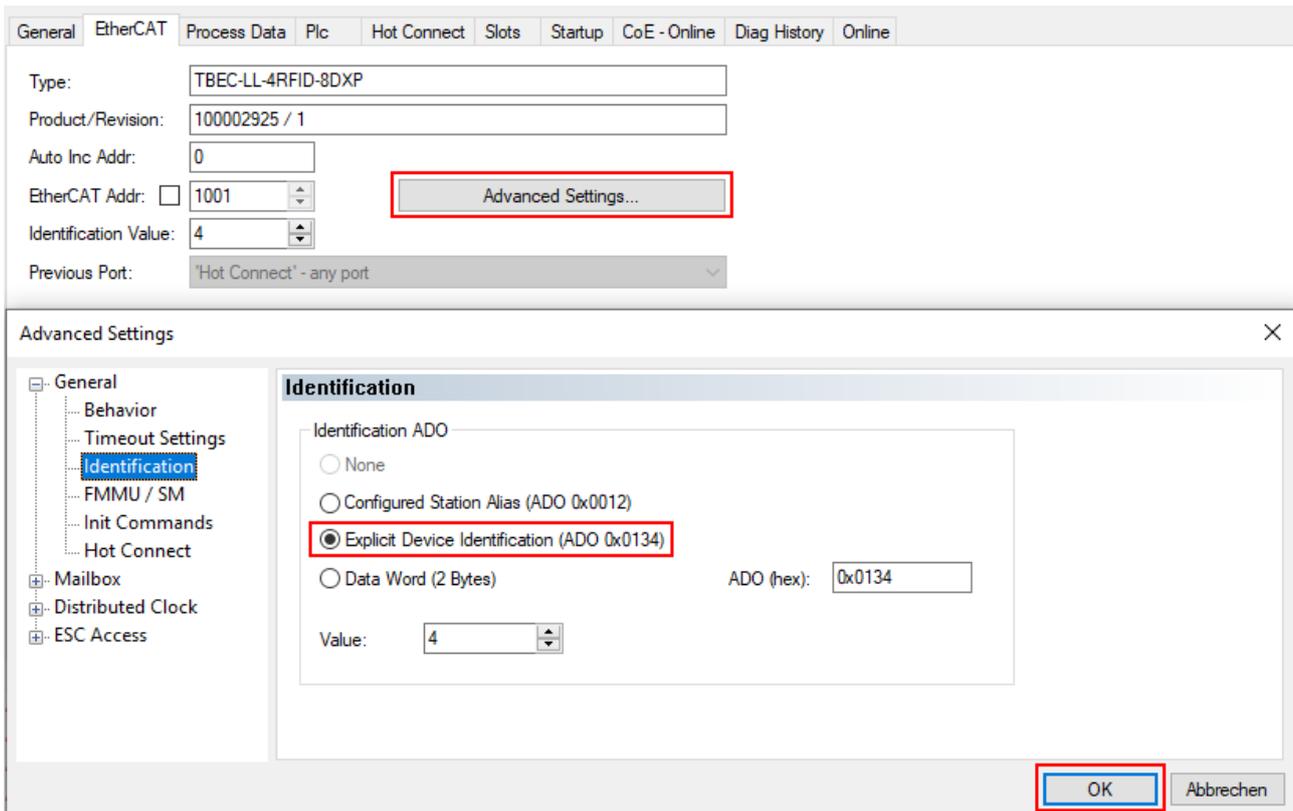


Fig. 41: TwinCAT – selecting Explicit Device Identification

7.3.7 Addressing a device via Configured Station Alias

- ▶ In the project tree double-click **Box 1 (TBEC-LL-4RFID-8DXP)**.
- ▶ Activate **EtherCAT** tab → **Advanced settings** → **General** → **Identification** → **Configured Station Alias (ADO 0x0012)**.
- ▶ Confirm the entry with **OK**.

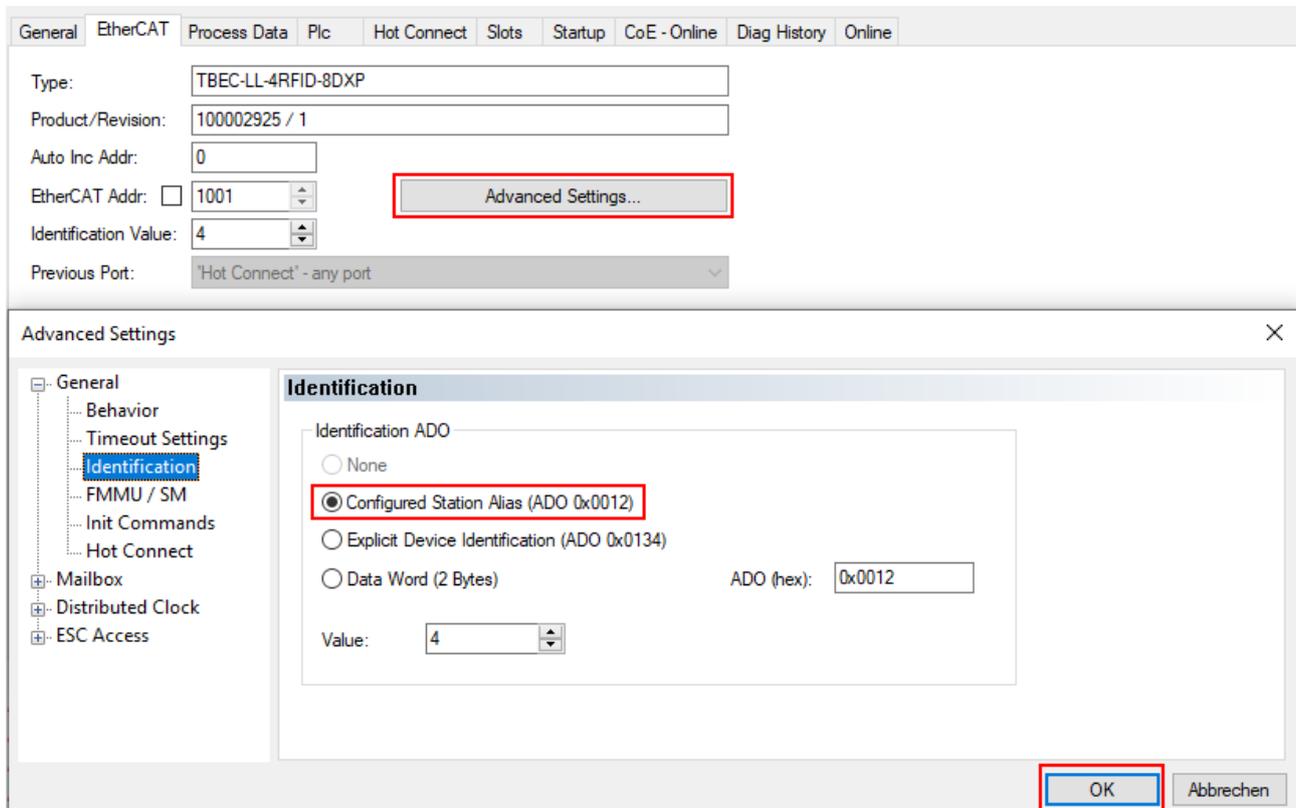


Fig. 42: TwinCAT – selecting Configured Station Alias

- ▶ Activate **EtherCAT** tab → **Advanced Settings** → **ESC Access** → **E²PROM** → choose **Configured Station Alias**.
- ▶ Enter the Identification Value under **New value** (here: 4).
- ▶ Click **Write to E²PROM**.
 - ⇒ The master writes the identification value into the device.
- ▶ Confirm with **OK**.

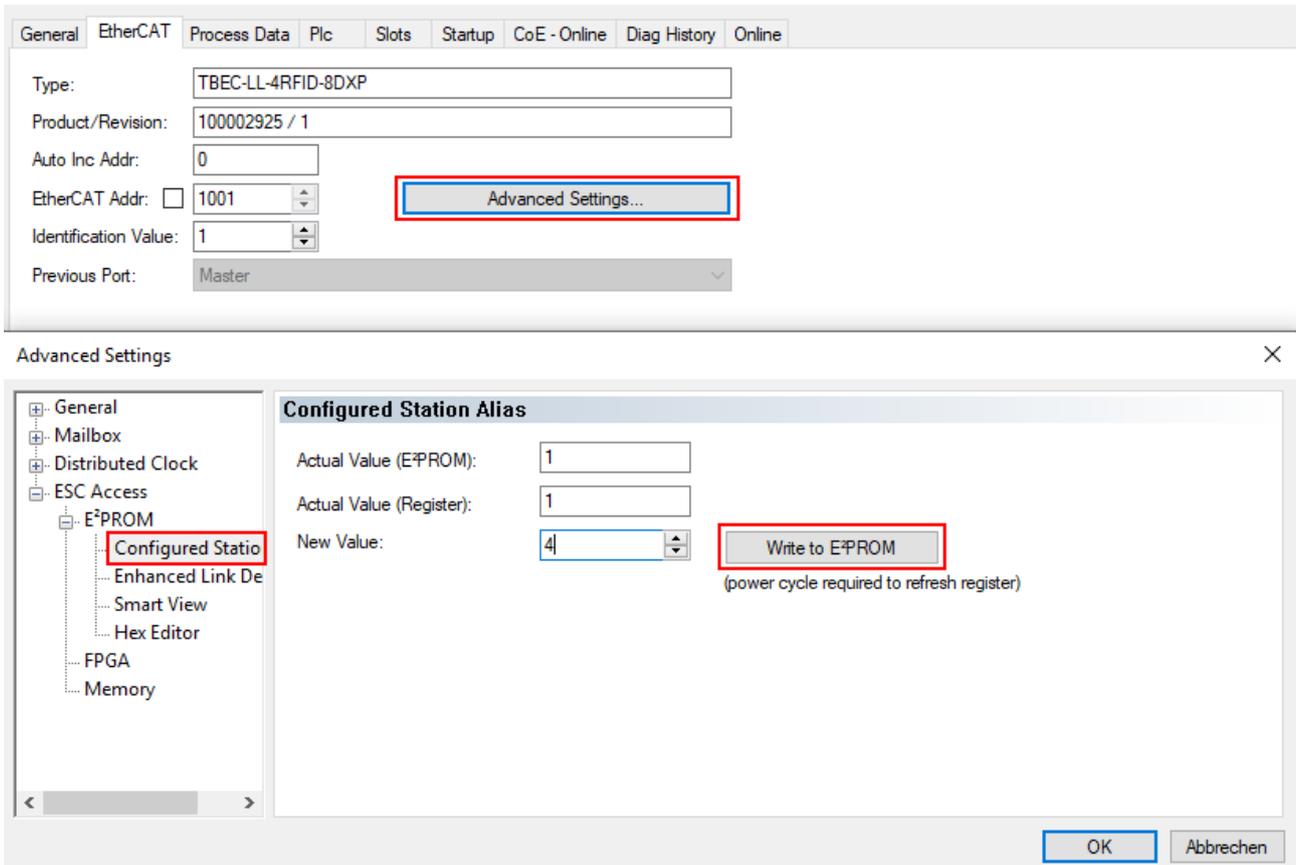


Fig. 43: TwinCAT – Configured Station Alias: entering the Identification Value

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

7.3.8 Activating HotConnect

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

- ▶ Right-click **Box 1 (TBEC-LL-4RFID-8DXP)** → **Add to HotConnect group**.

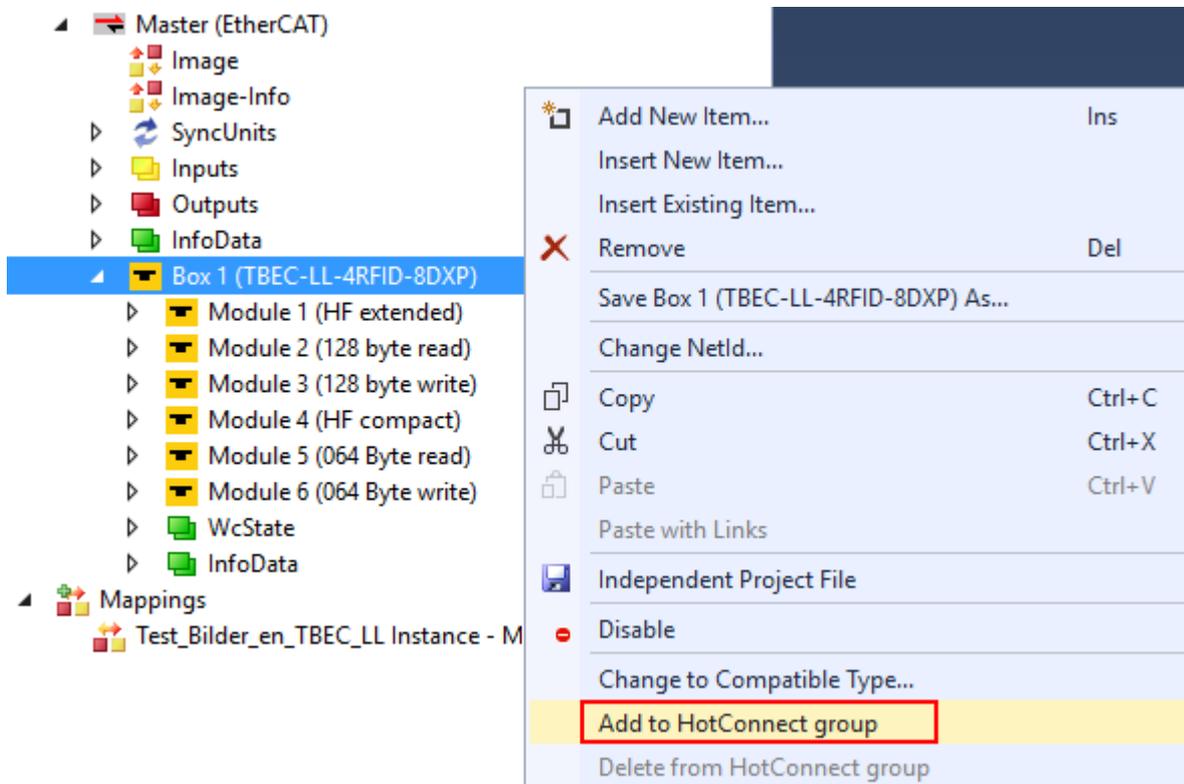


Fig. 44: TwinCAT – Add to HotConnect group

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

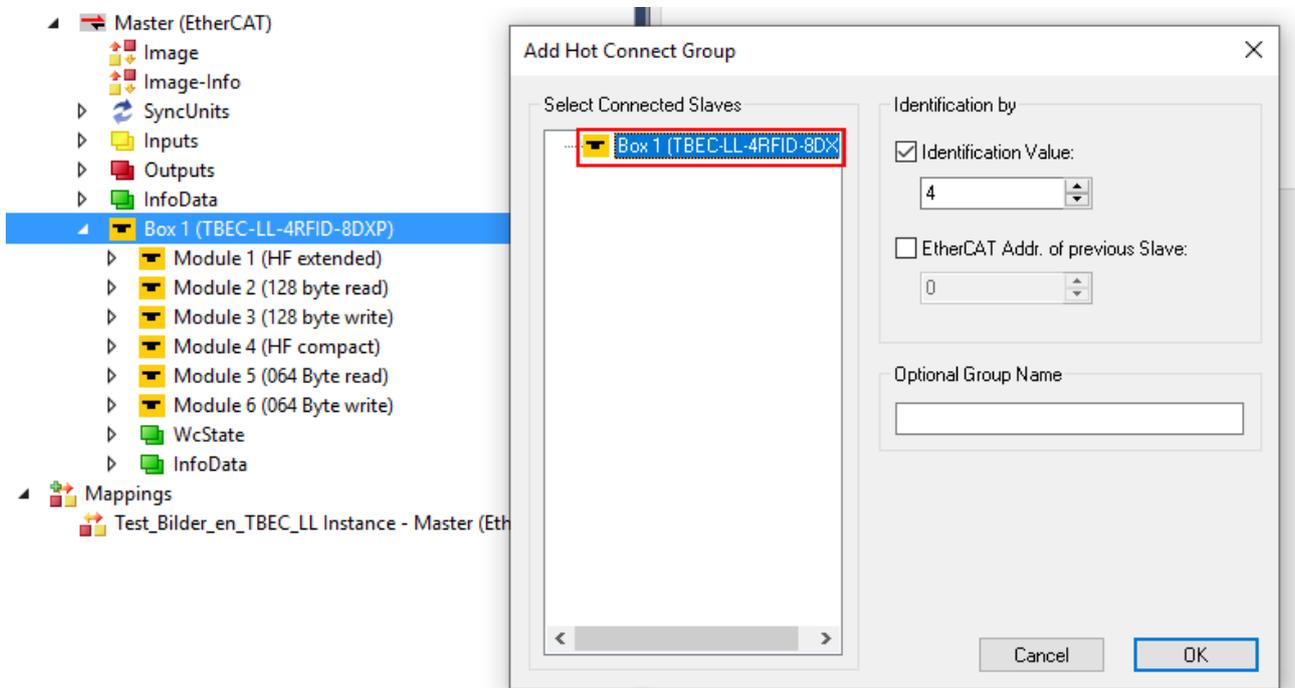


Fig. 45: TwinCAT – Add HotConnect Group

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

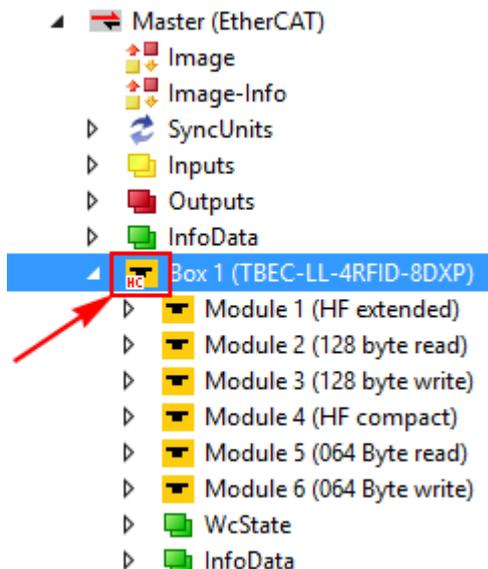


Fig. 46: TwinCAT – Hot Connect group successfully set up

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

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

- ▶ Right-click **Box 1 (TBEC-LL-4RFID-8DXP)** → **Delete from Hot Connect Group**.

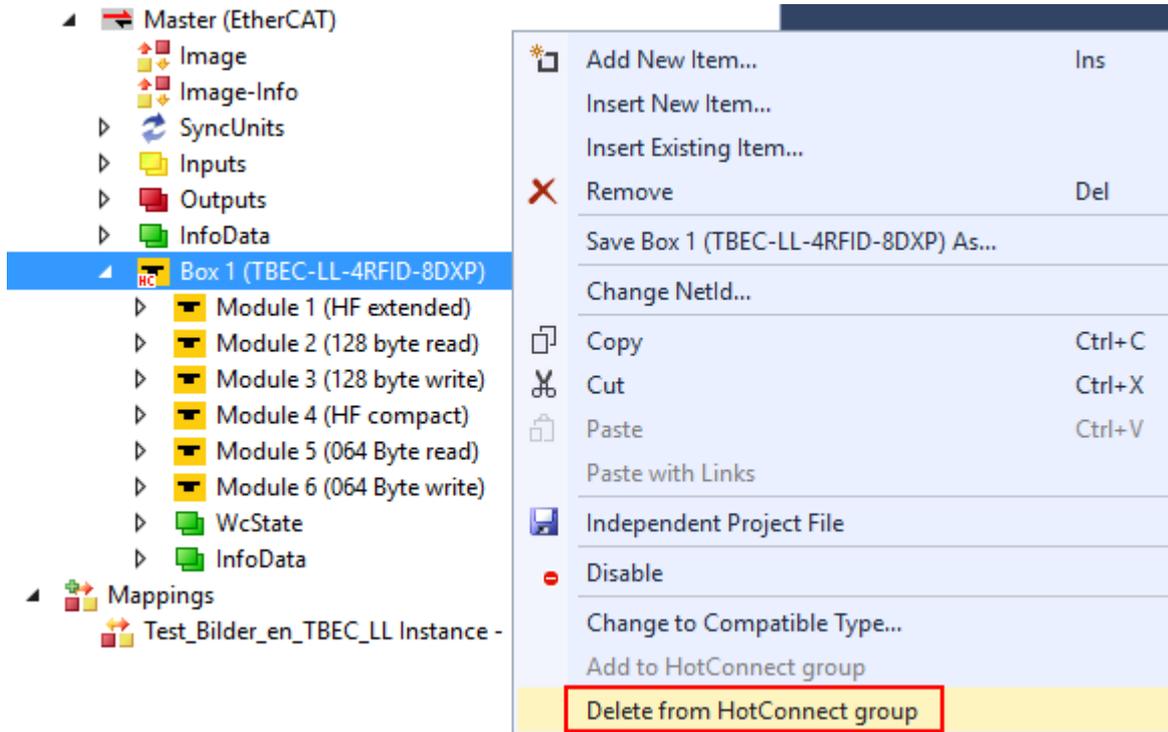


Fig. 47: Delete device from HotConnect group

7.3.9 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 linking a variable is described in the chapter “Incorporating the function block in TwinCAT” ([▶ 208]). 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 a device to controllers with CODESYS

Hardware used

This example uses the following hardware components:

- TBEC-LL-4RFID-8DXP block module
- WinPLC as EtherCAT master

Software used

This example uses the following software:

- CODESYS 3.5 SP14 (available as a free download at www.turck.com)
- ESI file for TBEC-LL-4RFID-8DXP (available as a free download at www.turck.com)

7.4.1 Installing ESI files

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

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

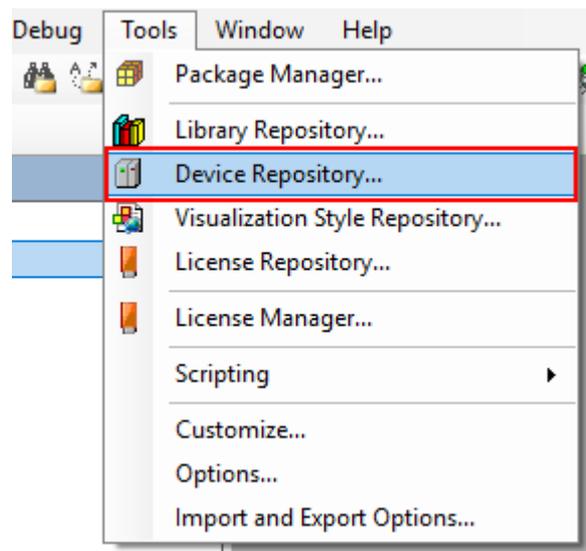


Fig. 48: Device Repository

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

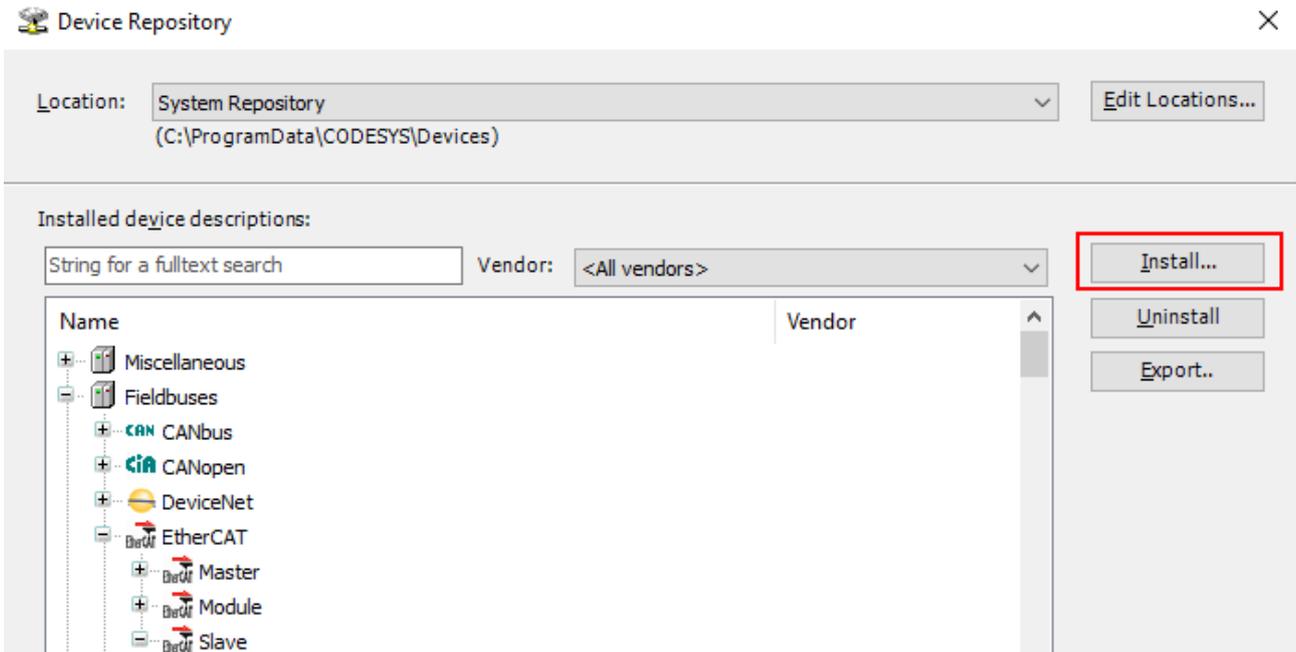


Fig. 49: Installing a device description file

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

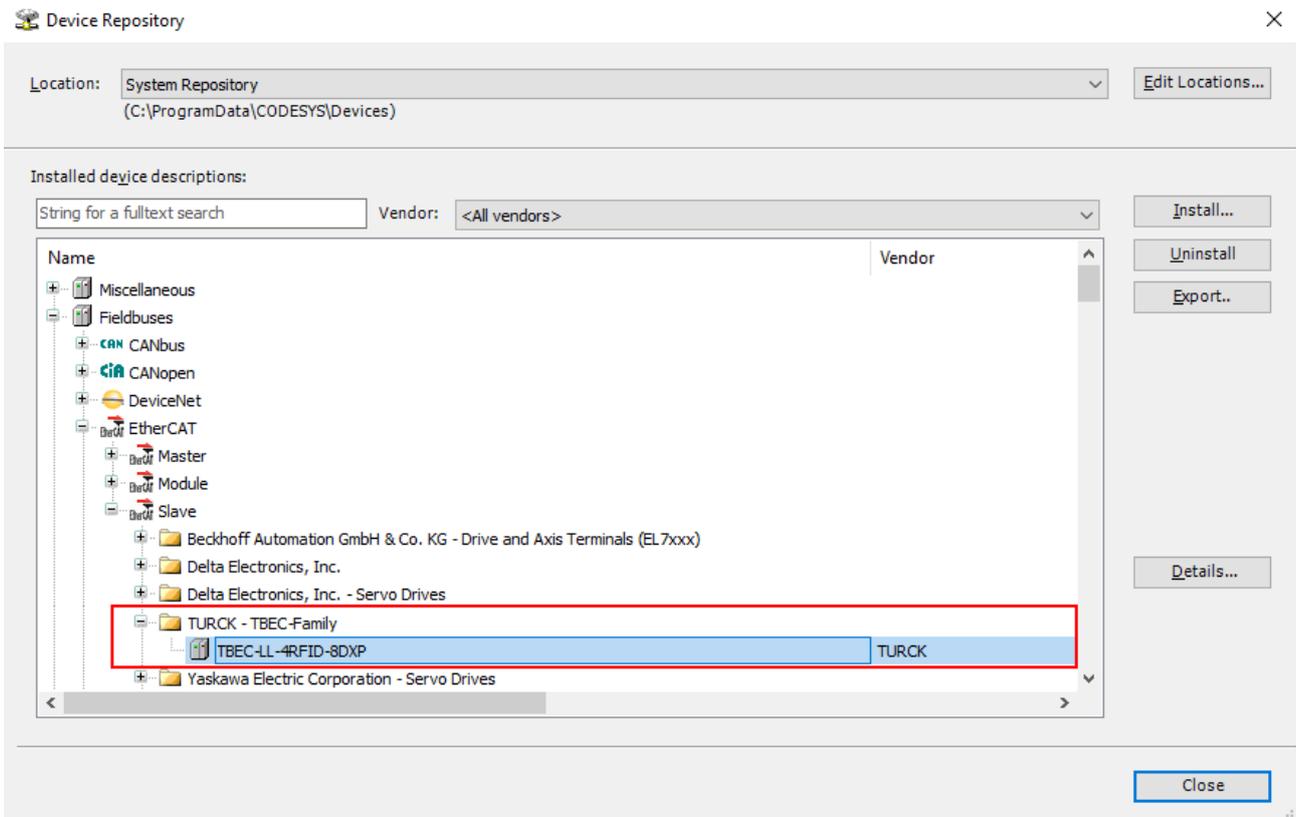


Fig. 50: Installed device description

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

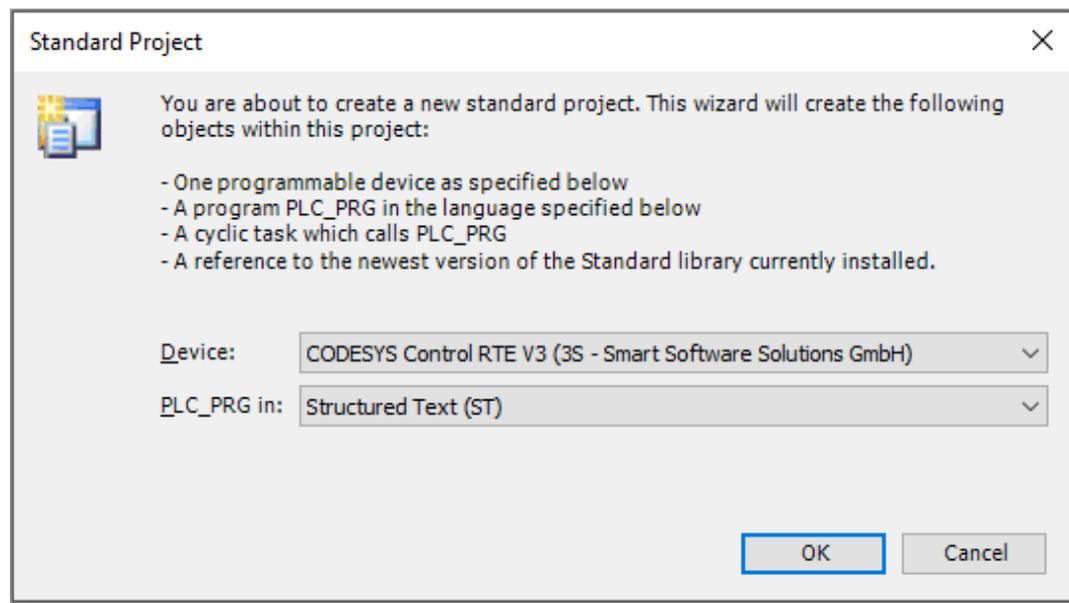


Fig. 51: Example: Creating a project

Adding an EtherCAT master

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

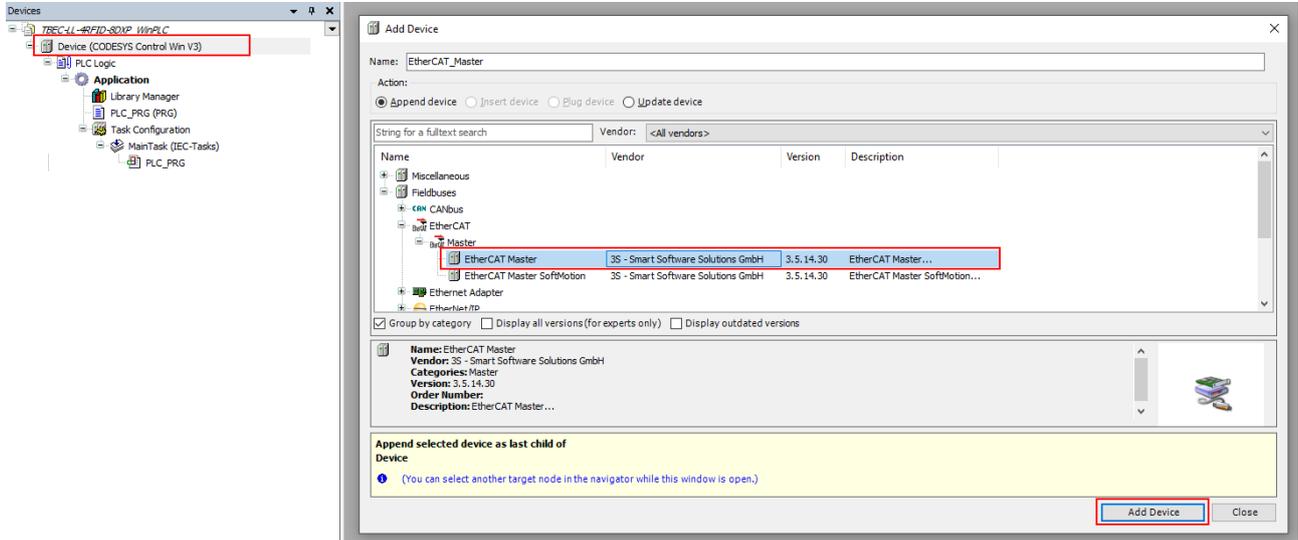


Fig. 52: Adding a device

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

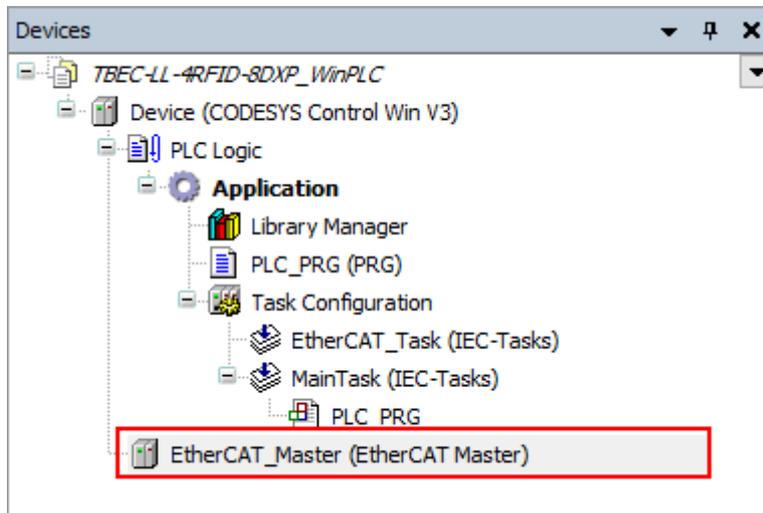


Fig. 53: Project tree

Selecting a network adapter

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

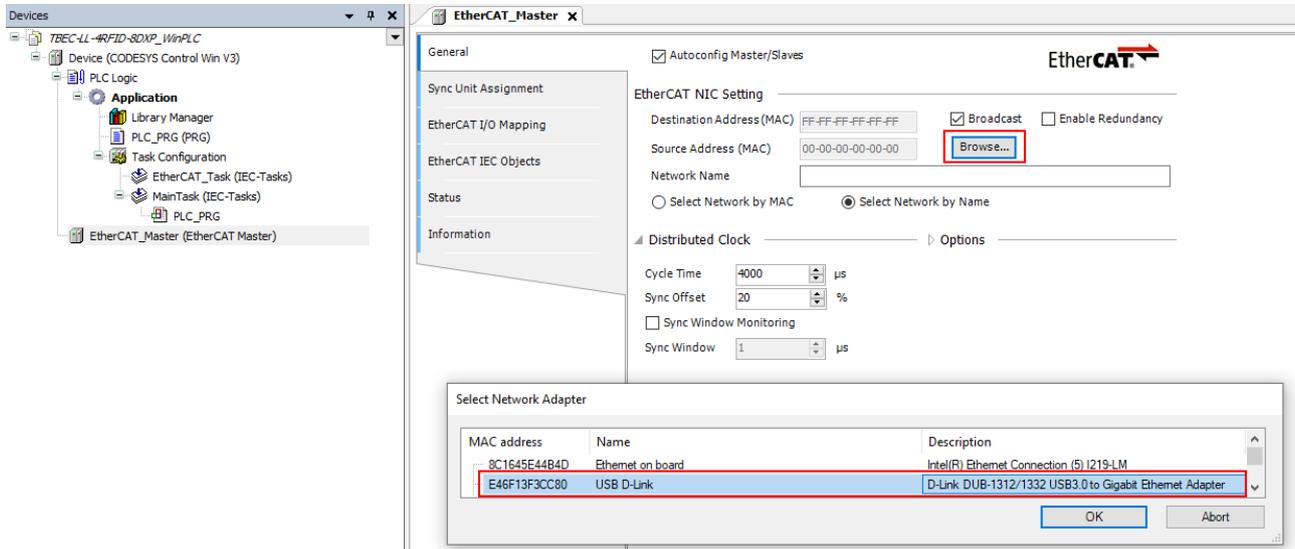


Fig. 54: Selecting a network adapter

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

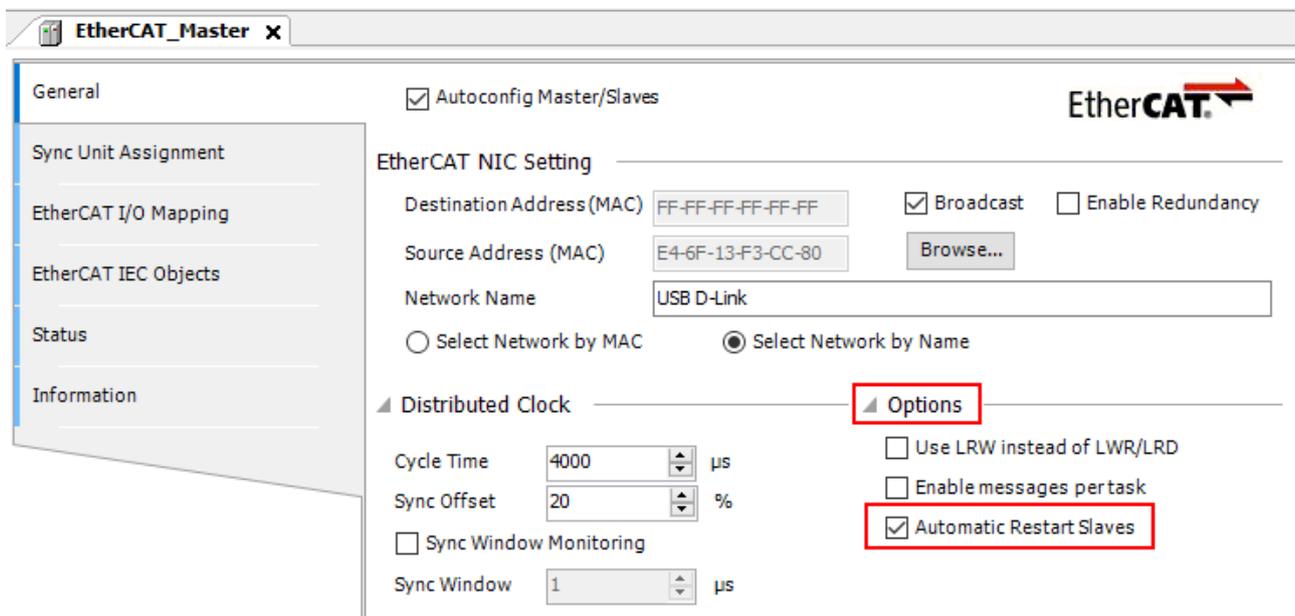


Fig. 55: Automatic Slaves Restart

- ▶ 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**.

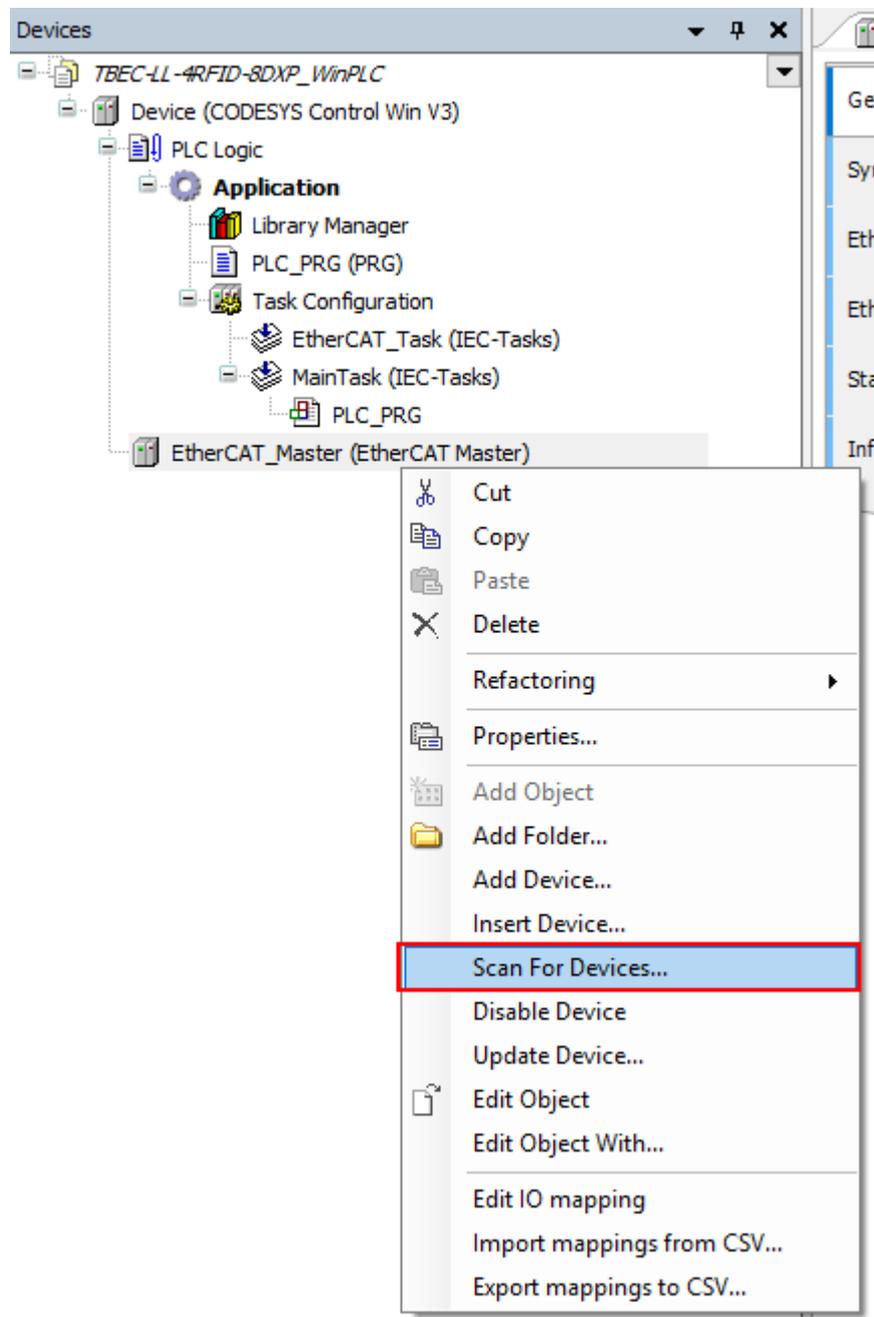


Fig. 56: Scan for devices

- ▶ Select an EtherCAT slave (here: **TBEC-LL-4RFID-8DXP**) in the following window and click **Copy to project**.

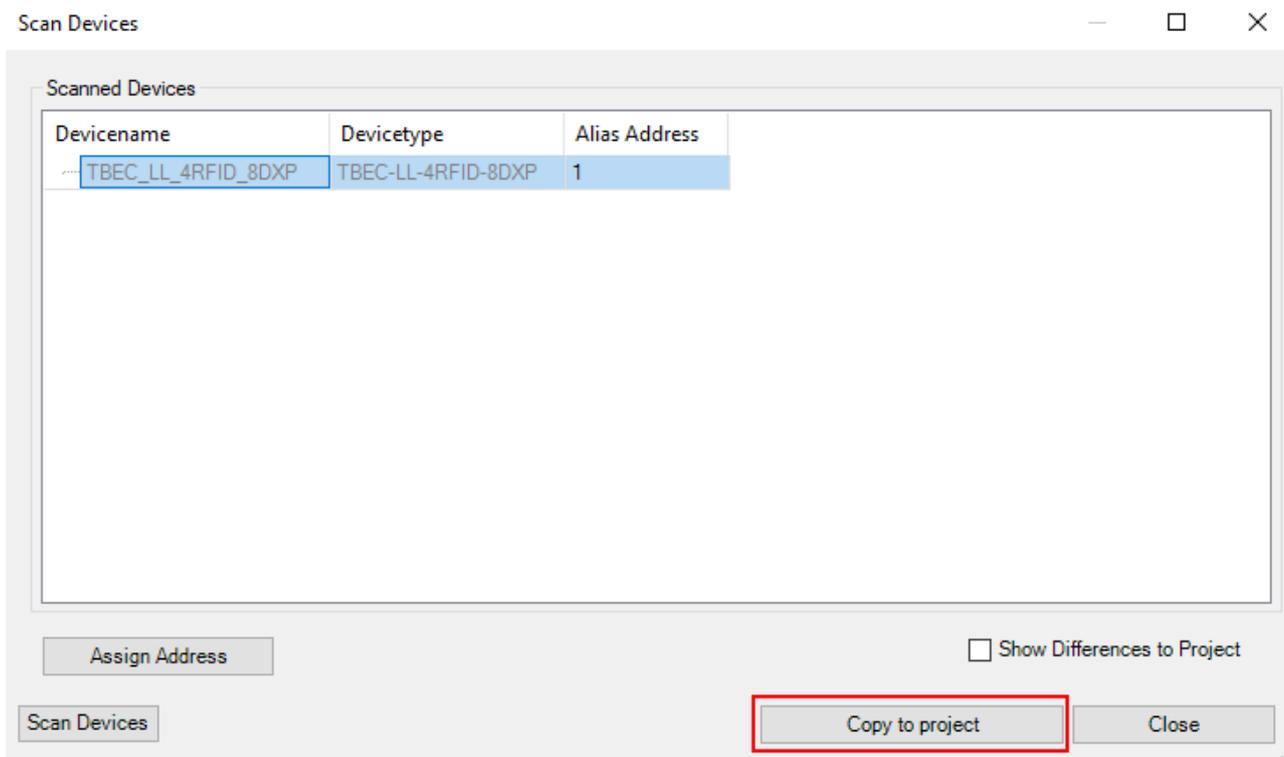


Fig. 57: Copying found devices to the project

- ⇒ The module appears with the standard settings from the ESI file (HF compact) in the project tree.

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 **TBEC_LL_4RFID-8DXP (TBEC-LL-4RFID-8DXP)**.
- ⇒ On the **General** tab → **Diagnostics** the **Operational** status indicates the active connection.

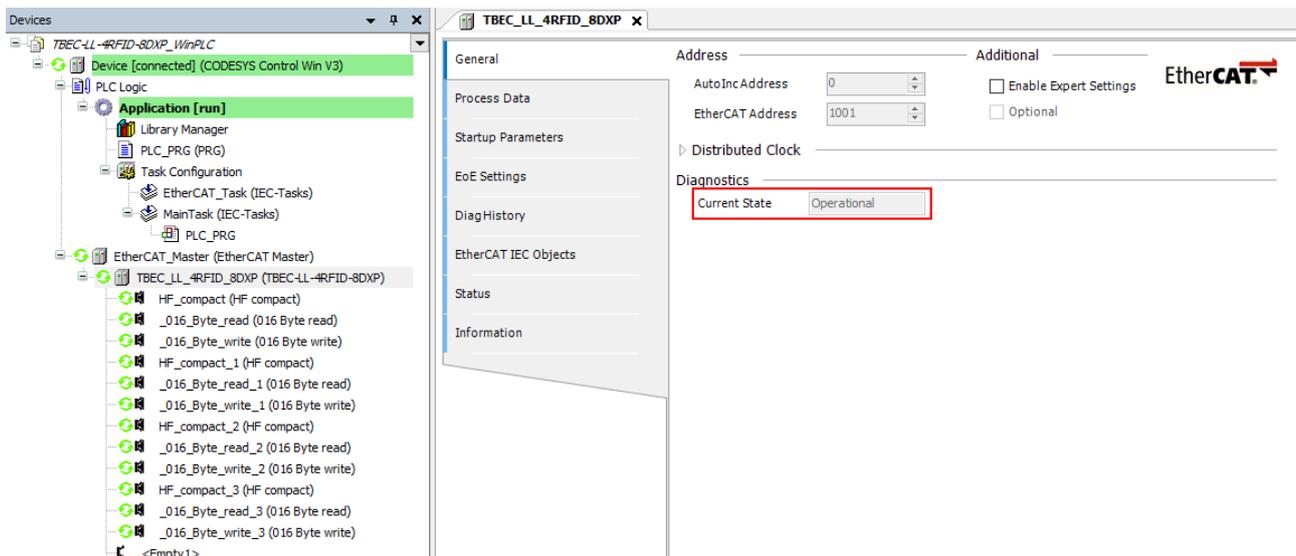


Fig. 58: Status: Operational

7.4.3 Configuring slots

The slots are configured via the Plug Device function.

- ▶ Click **Online** → **Logout**.
- ⇒ The configuration is possible in the logged out state.

Example: setting the HF bus mode for channel 3

- ▶ Right-click an empty slot in the project tree → select **Plug Device**.
- ▶ Select the operation mode.
- ▶ Click **Plug Device**.

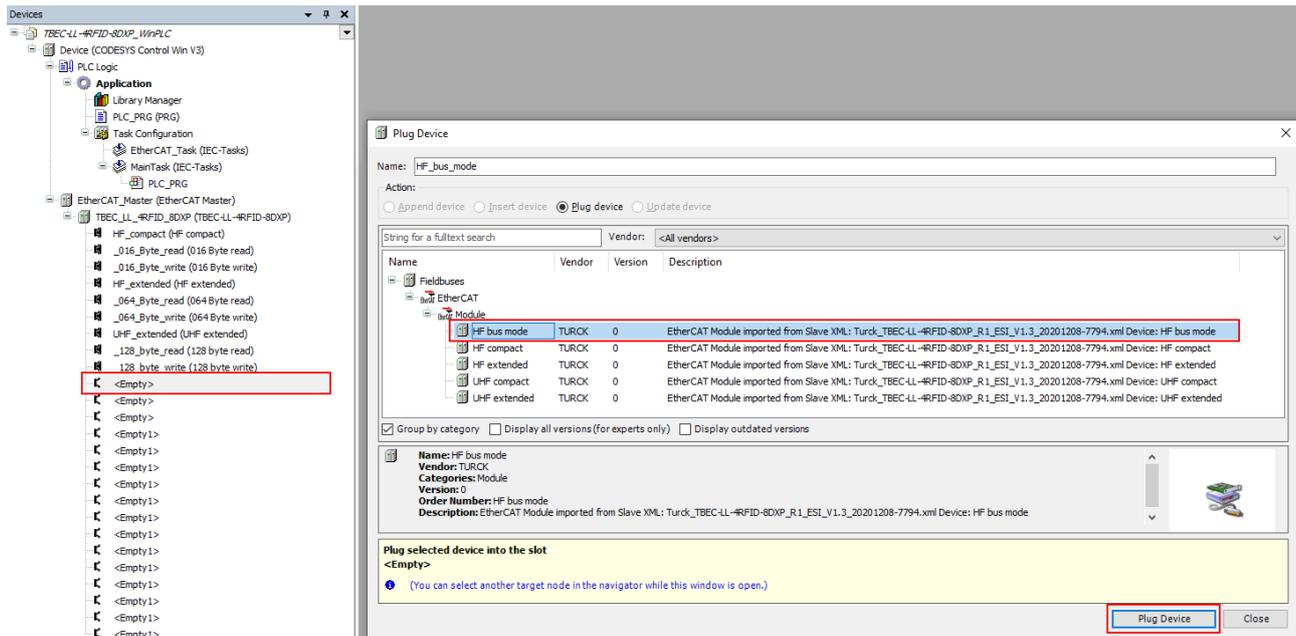


Fig. 59: Selecting HF bus mode

⇒ HF bus mode is set for channel 3.

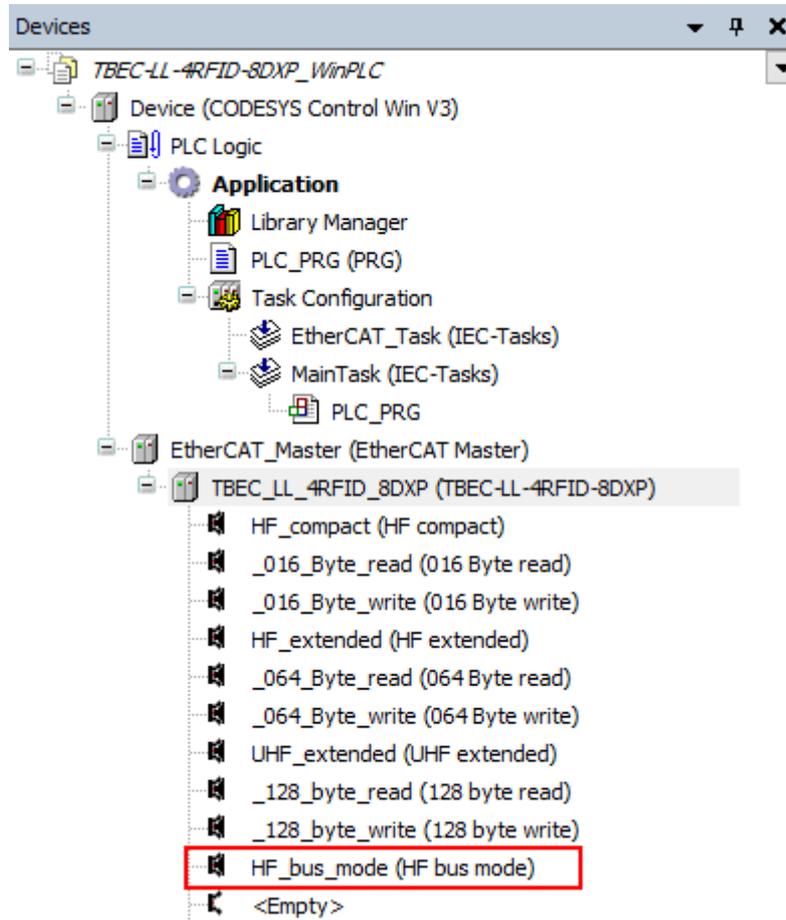


Fig. 60: HF bus mode is set for channel 3

7.4.4 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 TBEC_LL_4RFID-8DXP (TBEC-LL-4RFID-8DXP).
- ▶ 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.

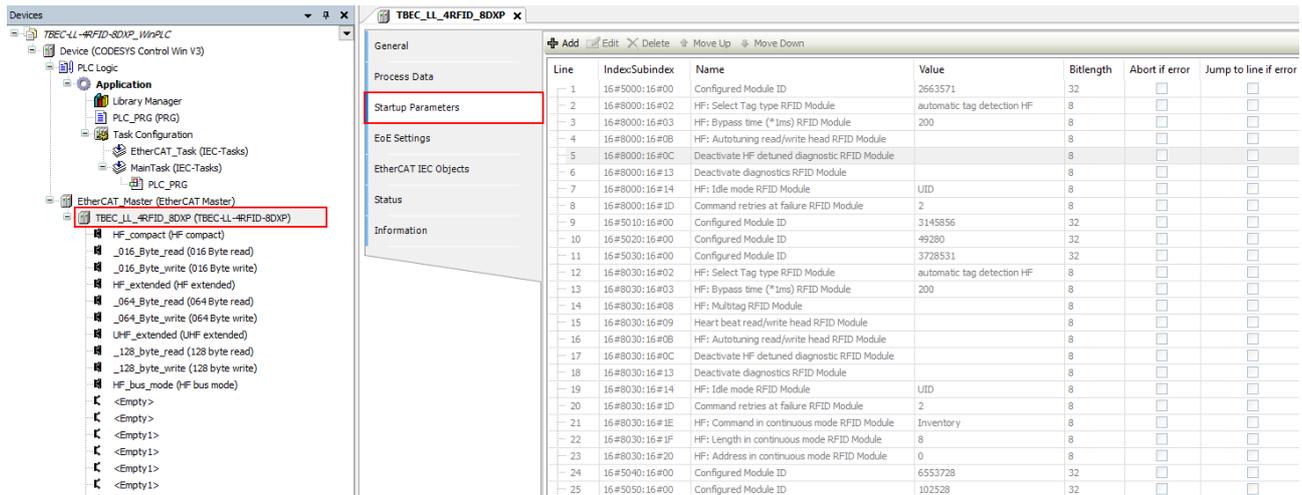


Fig. 61: Startup parameters of the module

Example: setting the tag type for channel 0

- ▶ Double-click channel 0 (**HF_compact**).
- ▶ Select the **Startup Parameters** tab.
- ▶ In line 2 **HF: Select Tag type RFID Module tag type** choose the required tag type from the drop-down menu **NXP Icode SLIX**.
- ⇒ The tag type for channel 0 is set.

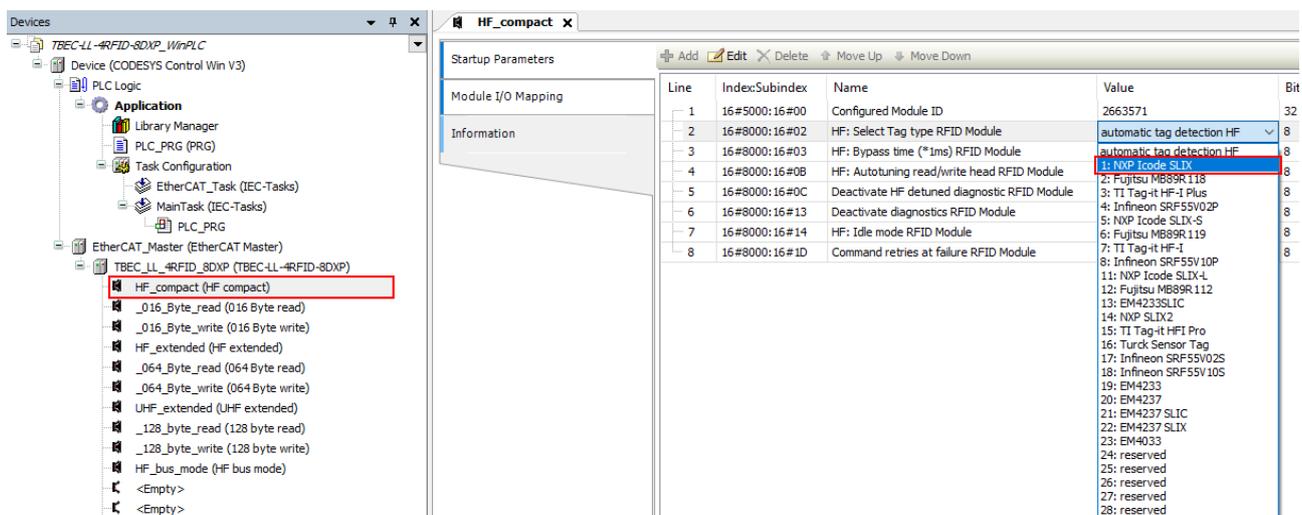


Fig. 62: Setting the startup parameters – example: setting the tag type for channel 0

7.4.5 Setting EtherCAT device parameters via the object dictionary



NOTE

Turck recommends only making changes in the startup parameters.

- ▶ In the project tree double-click **TBEC_LL_4RFID-8DXP** (TBEC-LL-4RFID-8DXP).
- ▶ In the **General** tab activate the **Expert Settings** option.

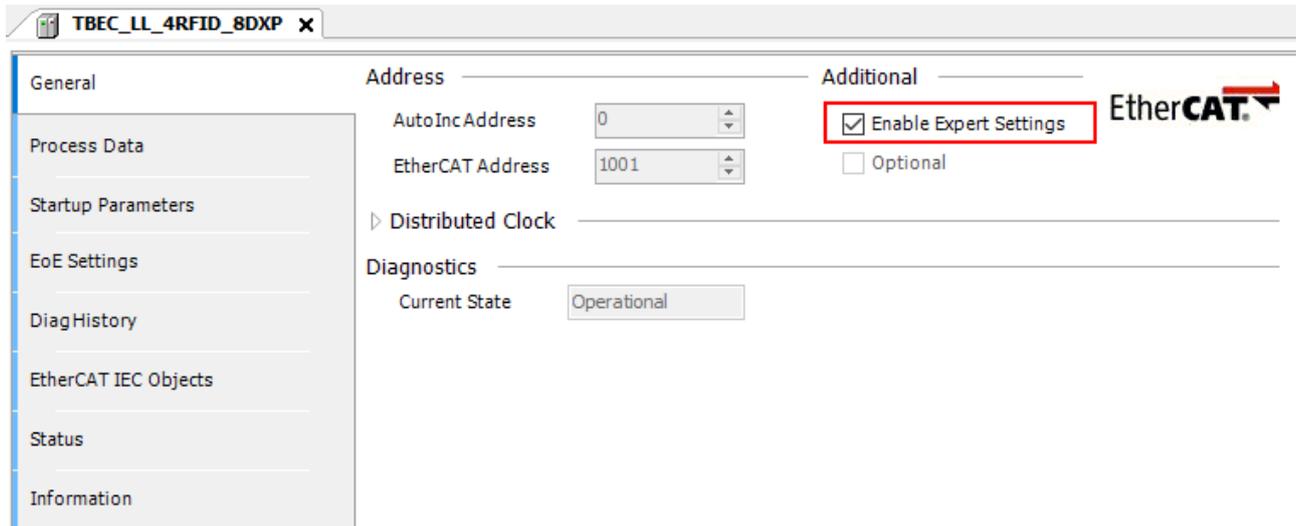


Fig. 63: Activating expert settings

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

Index/Subindex	Name	Flags	Type	Value
16#1000:16#00	Device Type	RO	UDINT	5001
16#1001:16#00	Error Register	RO	USINT	0
16#1008:16#00	Manufacturer Device Name	RO	STRING(15)	'TBEC-LL-4RFID-8DXP'
16#1009:16#00	Manufacturer Hardware Version	RO	STRING(4)	'1'
16#100A:16#00	Manufacturer Software Version	RO	STRING(12)	'V1.0.4.0'
16#100B:16#00	Manufacturer Bootloader Version	RO	STRING(12)	'V1.0.1.0'
16#1018:16#00	Identity Object			
16#10F3:16#00	Diagnosis History			
16#10F8:16#00	Timestamp Object	RO	ULINT	7402090000000
16#1600:16#00	Mapping RxPDO HF compact			
16#1602:16#00	Mapping RxPDO 016 Byte write			
16#1603:16#00	Mapping RxPDO HF extended			
16#1605:16#00	Mapping RxPDO 064 Byte write			
16#1606:16#00	Mapping RxPDO UHF extended			
16#1608:16#00	Mapping RxPDO 128 byte write			
16#1609:16#00	Mapping RxPDO HF bus mode			
16#1A00:16#00	Mapping TxPDO HF compact			
16#1A01:16#00	Mapping TxPDO 016 Byte read			
16#1A03:16#00	Mapping TxPDO HF extended			
16#1A04:16#00	Mapping TxPDO 064 Byte read			
16#1A05:16#00	Mapping TxPDO UHF extended			
16#1A07:16#00	Mapping TxPDO 128 byte read			
16#1A09:16#00	Mapping TxPDO HF bus mode			
16#1C00:16#00	Sync manager Type			
16#1C12:16#00	Sync Manager 2 PDO Assignment			
16#1C13:16#00	Sync Manager 3 PDO Assignment			
16#1C32:16#00	SM output parameter			
16#1C33:16#00	SM input parameter			
16#5000:16#00	Configured Module ID	RW	UDINT	2663571
16#5010:16#00	Configured Module ID	RW	UDINT	3145856
16#5020:16#00	Configured Module ID	RW	UDINT	49280
16#5030:16#00	Configured Module ID	RW	UDINT	3728531
16#5040:16#00	Configured Module ID	RW	UDINT	6553728
16#5050:16#00	Configured Module ID	RW	UDINT	102528
16#5060:16#00	Configured Module ID	RW	UDINT	20505747
16#5070:16#00	Configured Module ID	RW	UDINT	8650880
16#5080:16#00	Configured Module ID	RW	UDINT	135296

Fig. 64: Object dictionary

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



NOTE

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

7.4.6 Addressing a device via Explicit Device ID

- ▶ Double-click **TBEC_LL_4RFID-8DXP (TBEC-LL-4RFID-8DXP)** in the project tree.
- ▶ In the **General** tab activate the **Optional** checkbox.
- ▶ **General** → **Identification** → **Explicit Device Identification (ADO 0x0134)**: In the **Value** field enter the Identification Value (hex.) corresponding to the position of the rotary coding switches on the device.

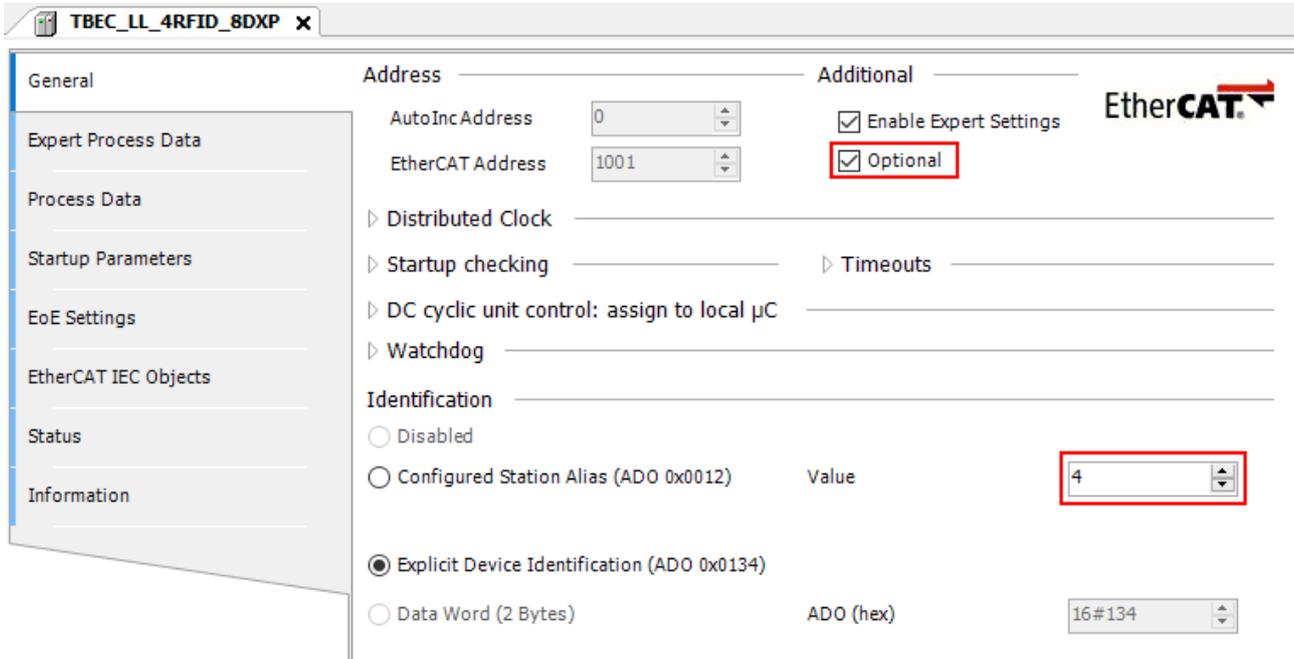


Fig. 65: CODESYS – Explicit Device ID: entering the Identification Value

- ▶ Click **Online** → **Login**.

7.4.7 Addressing a device via Configured Station Alias

- ▶ Double-click **TBEC_LL_4RFID-8DXP (TBEC-LL-4RFID-8DXP)** in the project tree.
- ▶ 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**.

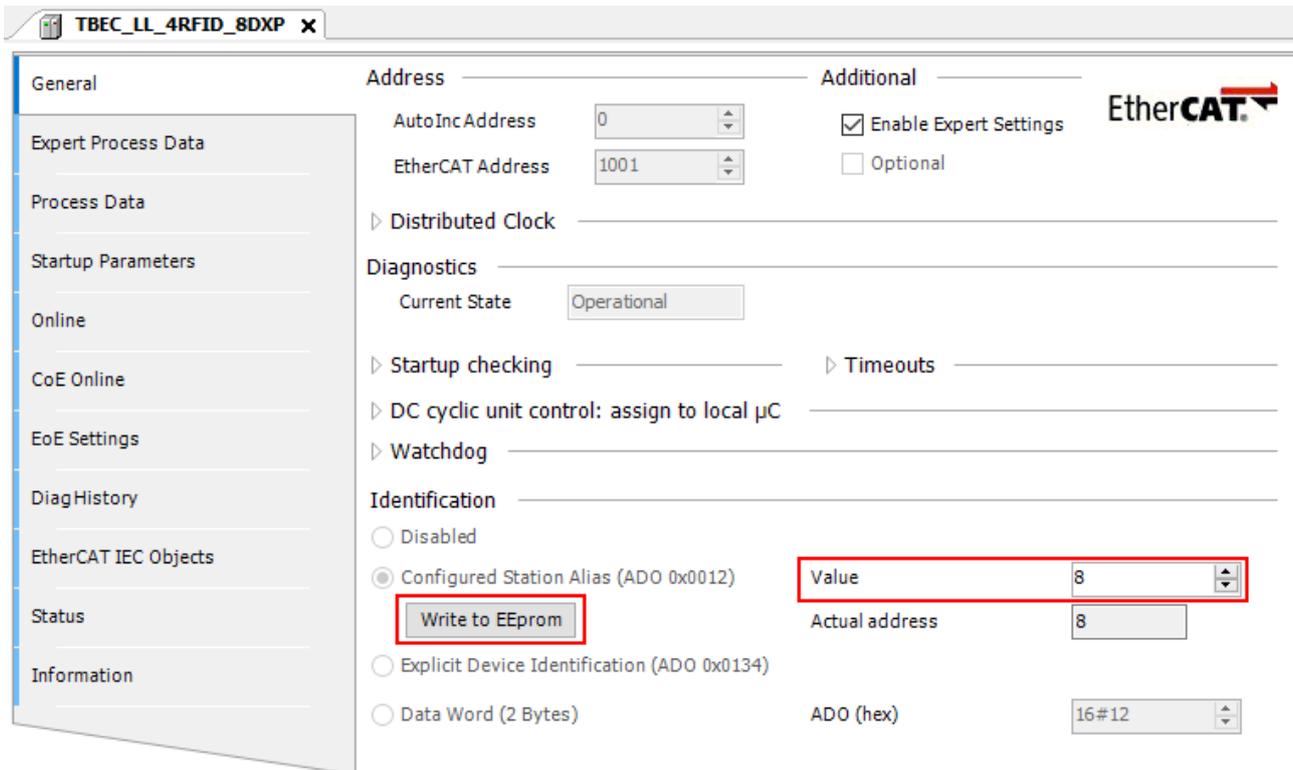


Fig. 66: CODESYS – Configured Station Alias: entering the Identification Value

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

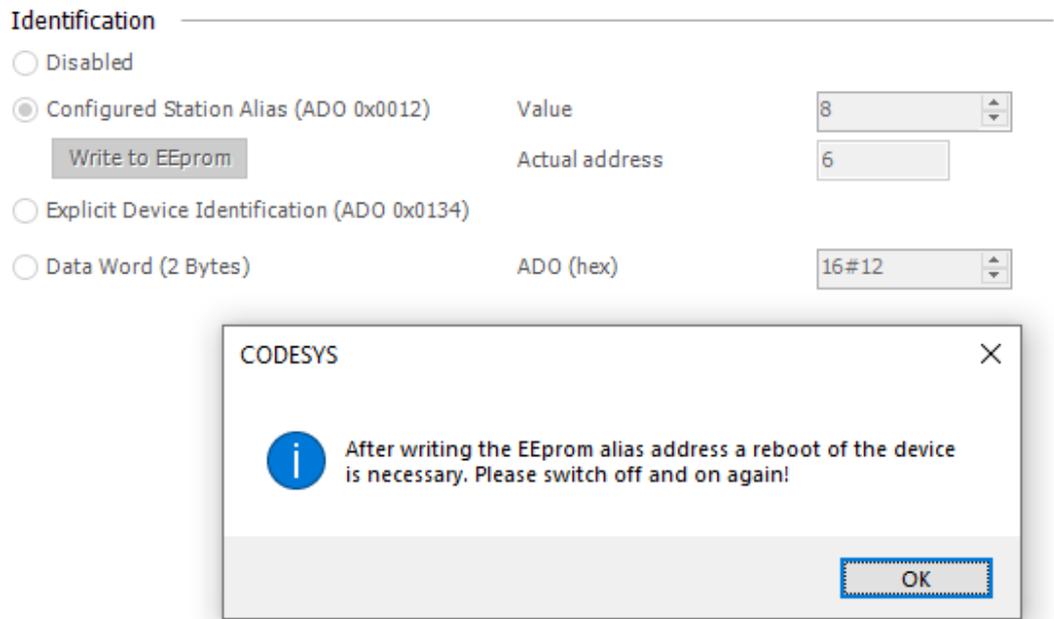


Fig. 67: CODESYS – restart required

- ⇒ 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 Connecting a device to an Omron controller

Hardware used

This example uses the following hardware components:

- Block module TBEC-LL-4RFID-8DXP
- Omron NX1P2-9024DT1, Version 1.41 (minimum requirements: Version \geq 1.40)

Software used

This example uses the following software:

- Omron Sysmac Studio Version 1.45 (minimum requirement: Version \geq 1.41)
- ESI file for TBEC-LL-4RFID-8DXP and Omron controllers

Requirements

- A new project has been created Sysmac Studio.
- The controller is integrated in the project.

7.5.1 Installing ESI files

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

The controller must be offline in order to install the ESI file.

- ▶ Right-click the controller in the Network configuration area (**Master**).
- ▶ Click **Display ESI library**.

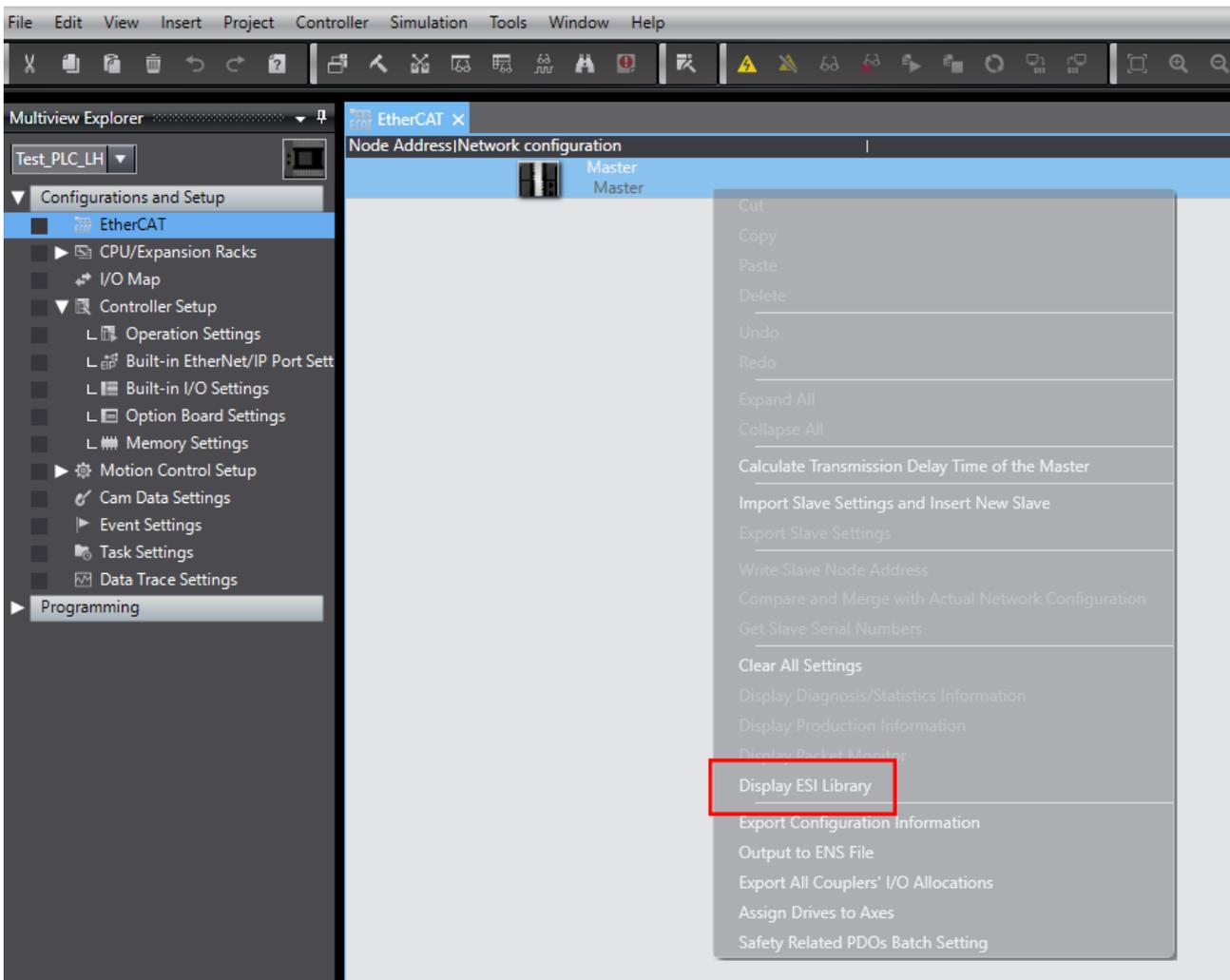


Fig. 68: Displaying an ESI library

- ▶ Select ESI file for TBEC-LL-4RFID-8DXP and Omron controllers.
- ▶ Click **Install (file)** to add the ESI file.

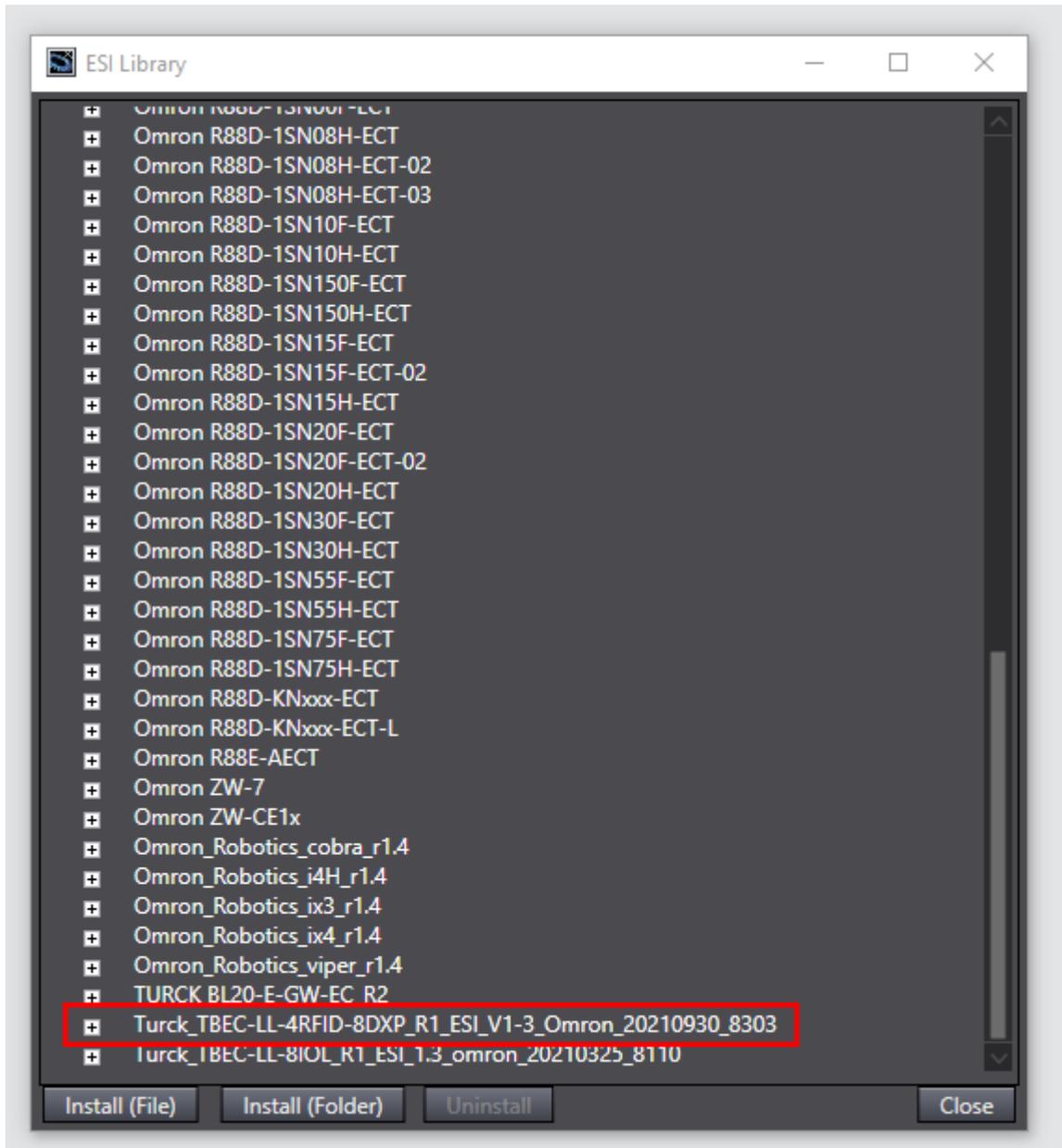


Fig. 69: Installing a ESI file

7.5.2 Connecting the device with the controller

Requirements

- The programming software has been opened.
- A new project has been created.
- The EtherCAT master was added to the project.

Adding TBEC-LL... as the EtherCAT device

The device can be connected to the master by drag and drop in offline mode or to the master in online mode.

- ▶ Offline mode: drag TBEC-LL-4RFID-8DXP onto the master.

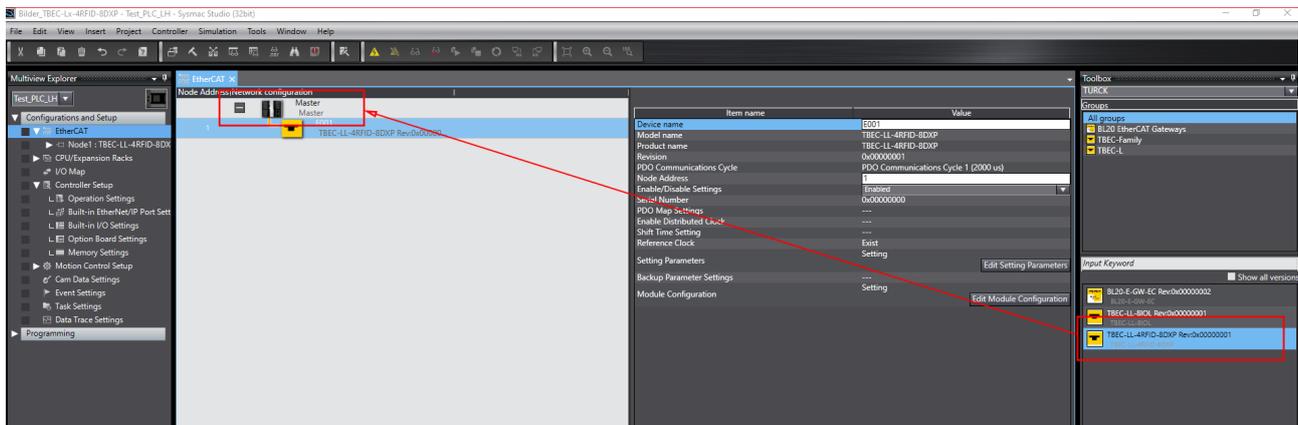


Fig. 70: Adding the device by drag and drop

Proceed as follows to add the device in online mode:

- ▶ Activate online mode of the master.
- ▶ Right-click **Master** → **Compare and Merge with the Actual Network Configuration**.
- ⇒ The connected device is automatically detected.

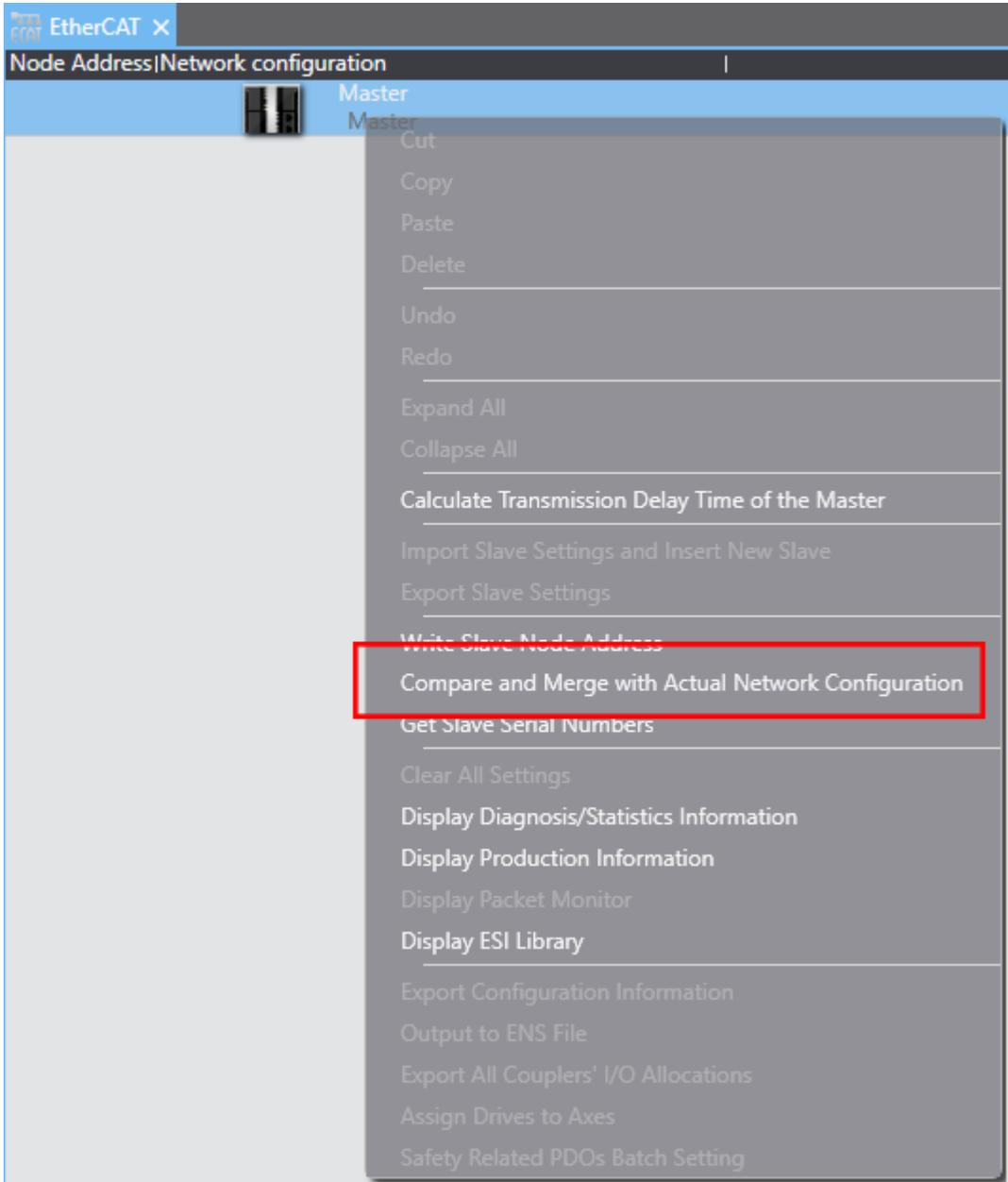


Fig. 71: Compare and merge with the actual network configuration

- ▶ Click **Accept actual network configuration**.

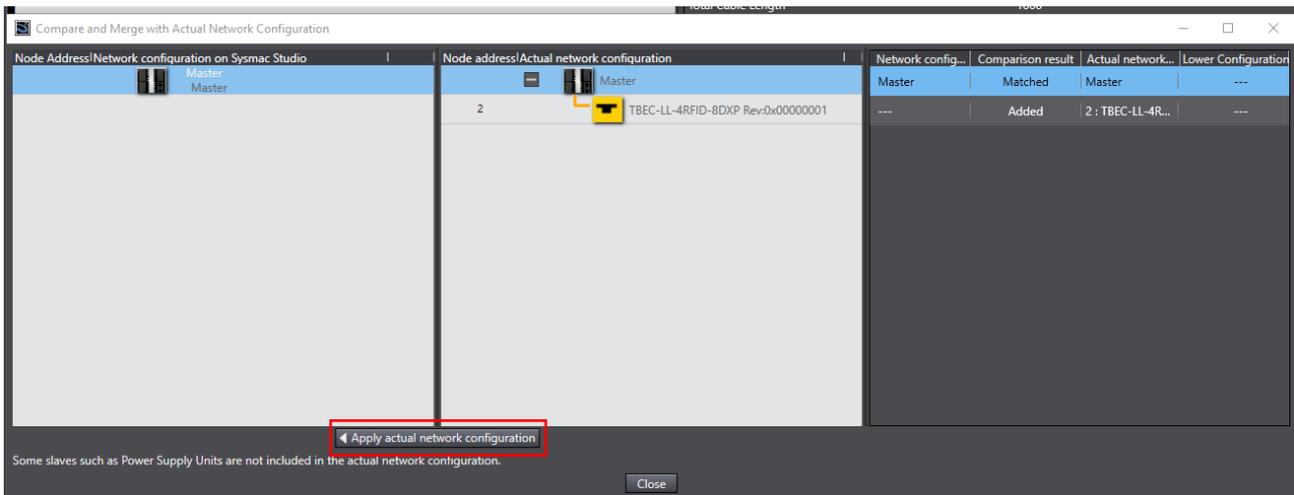


Fig. 72: Accepting the network configuration

- ▶ Confirm all the subsequent messages.
- ⇒ The network configuration is accepted.

7.5.3 Configuring slots

The slots can be configured in offline mode.

- ▶ Double-click the device in the project tree.

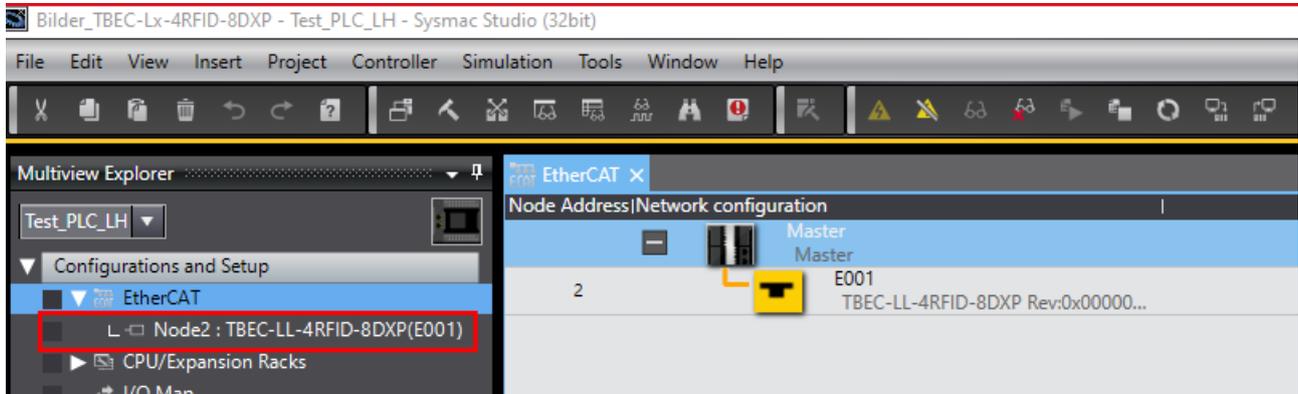


Fig. 73: Device in the project tree

- ▶ Add the required configuration by drag and drop. The channel assignments can only be made for the slots intended for this.
- ⇒ The selected channel assignments are displayed in the node view in the **Module** table column as well as the project tree.

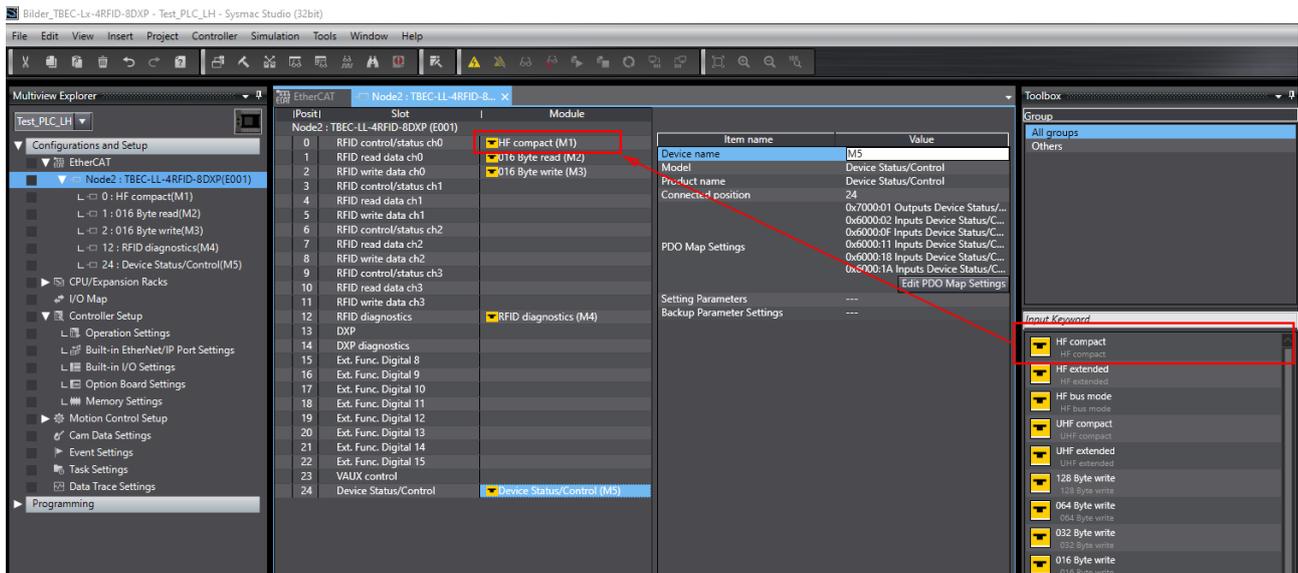


Fig. 74: Assigning channels

Transferring the configuration to the master

- ▶ Start Online mode.
- ▶ Click the **Synchronize** icon.



Fig. 75: Synchronize icon

- ▶ Click **Transfer to controller** in the **Synchronize** window.

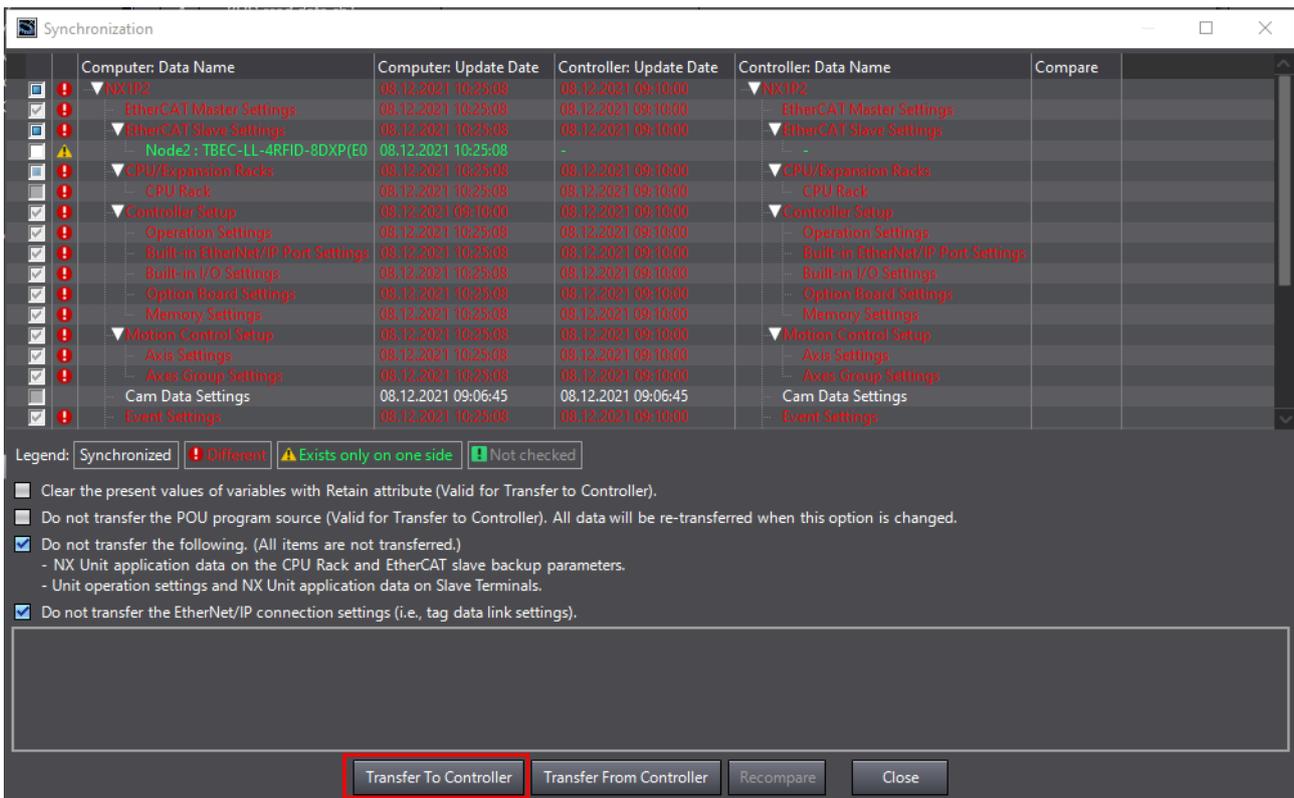


Fig. 76: Transferring a configuration to the controller

- ▶ Confirm all the subsequent messages.

The figure below shows an example of a successful data transfer.

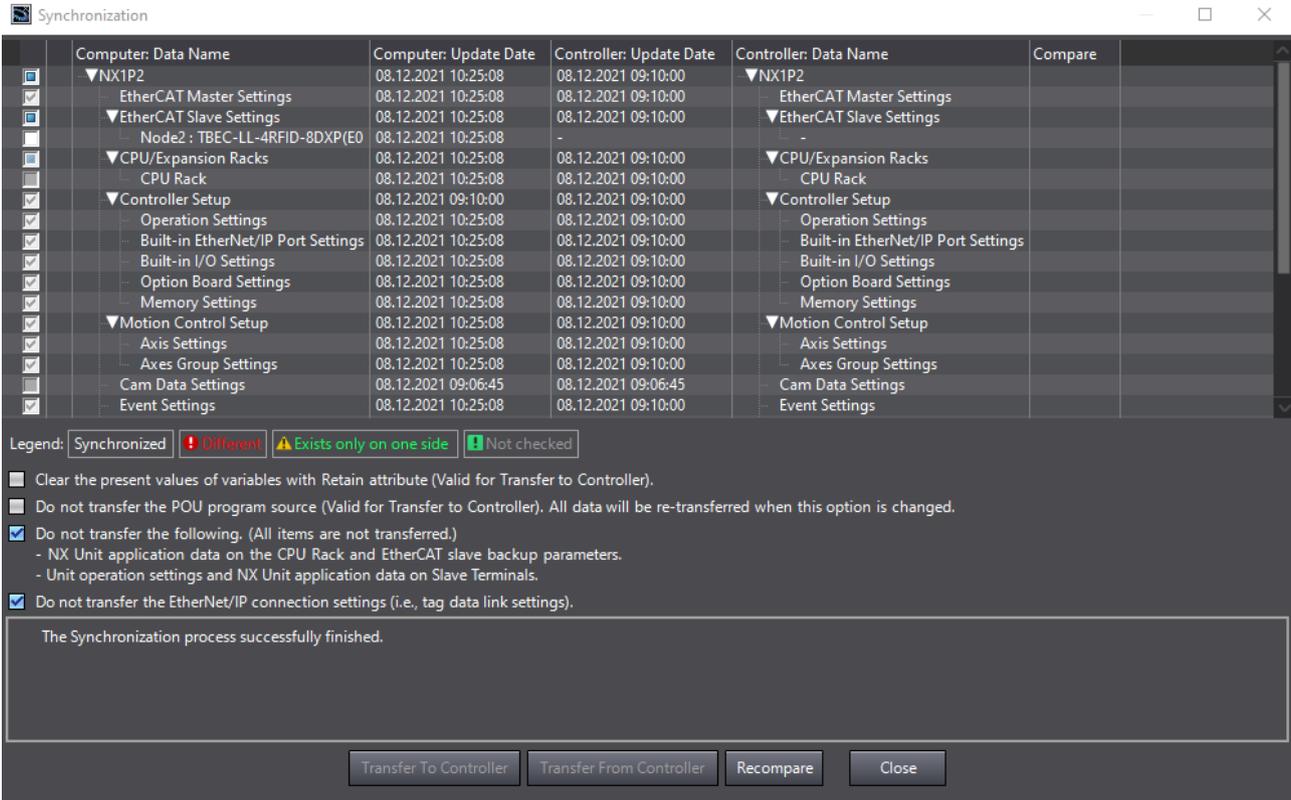


Fig. 77: Successful data transfer

The successful EtherCAT communication is displayed via a Play icon.

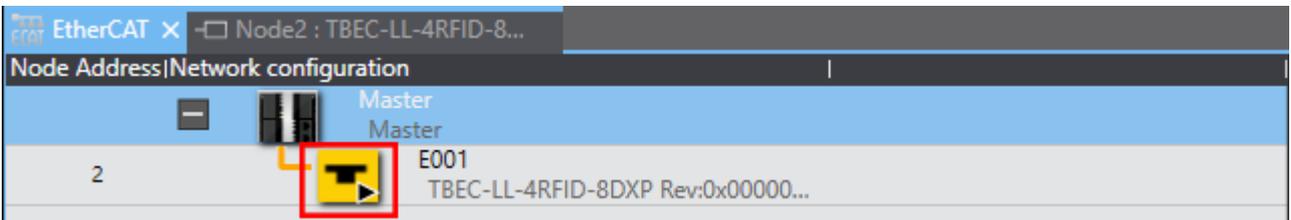


Fig. 78: Play icon

7.5.4 Reading out process data

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

- ▶ Start Online mode.
- ▶ Open the I/O image of the slave in the project tree.
- ⇒ The process data can be read out (example: HF read/write head connected to channel 0, tag present).

Position	Port	Description	R/W	Data Type	Value	Variable
EtherCAT Network Configuration						
Node2						
TBEC-LL-4RFID-8DXP						
Slot 0						
HF compact						
		Outputs HF compact_Command code_7000_01	W	UINT	0	
		Outputs HF compact_Loop counter_7000_02	W	USINT	0	
		Outputs HF compact_Start address_7000_0B	W	UDINT	0	
		Outputs HF compact_Length_7000_0C	W	UINT	0	
		Outputs HF compact_Length of UID/EPC_7000_0D	W	USINT	0	
		Inputs HF compact_Response code_6000_01	R	UINT	0	
		Inputs HF compact_Loop counter_6000_02	R	USINT	0	
		Inputs HF compact_Tag present at r/w head_6000_0B	R	BOOL	TRUE	
		Inputs HF compact_Antenna detuned at HF read/_6000_0F	R	BOOL	FALSE	
		Inputs HF compact_Parameter not supported by _6000_10	R	BOOL	FALSE	
		Inputs HF compact_Error reported by read/writ_6000_11	R	BOOL	FALSE	
		Inputs HF compact_Not connected to read/write_6000_12	R	BOOL	FALSE	
		Inputs HF compact_HF r/w head switched on_6000_13	R	BOOL	TRUE	
		Inputs HF compact_Continuous mode active_6000_14	R	BOOL	FALSE	
		Inputs HF compact_Length_6000_1B	R	UINT	8	
		Inputs HF compact_Error code_6000_1C	R	UINT	0	
		Inputs HF compact_Tag counter_6000_1D	R	UINT	3	
Slot 1						
016 Byte read						
		Inputs 016 Byte read_Read data byte 0_6000_01	R	USINT	224	
		Inputs 016 Byte read_Read data byte 1_6000_02	R	USINT	4	
		Inputs 016 Byte read_Read data byte 2_6000_03	R	USINT	1	
		Inputs 016 Byte read_Read data byte 3_6000_04	R	USINT	80	
		Inputs 016 Byte read_Read data byte 4_6000_05	R	USINT	39	
		Inputs 016 Byte read_Read data byte 5_6000_06	R	USINT	212	
		Inputs 016 Byte read_Read data byte 6_6000_07	R	USINT	9	
		Inputs 016 Byte read_Read data byte 7_6000_08	R	USINT	8	
		Inputs 016 Byte read_Read data byte 8_6000_09	R	USINT	0	
		Inputs 016 Byte read_Read data byte 9_6000_0A	R	USINT	0	
		Inputs 016 Byte read_Read data byte 10_6000_0B	R	USINT	0	
		Inputs 016 Byte read_Read data byte 11_6000_0C	R	USINT	0	
		Inputs 016 Byte read_Read data byte 12_6000_0D	R	USINT	0	
		Inputs 016 Byte read_Read data byte 13_6000_0E	R	USINT	0	
		Inputs 016 Byte read_Read data byte 14_6000_0F	R	USINT	0	
		Inputs 016 Byte read_Read data byte 15_6000_10	R	USINT	0	
Slot 2						
016 Byte write						
Slot 12						
RFID diagnostics						
Slot 24						
Device Status/Control						

Fig. 79: I/O image of the process data in Online mode

7.5.5 Setting parameters

The parameters can only be set if the master is in Offline mode.

- ▶ Open the module via the project tree.
- ▶ Click **Edit setting parameters**.

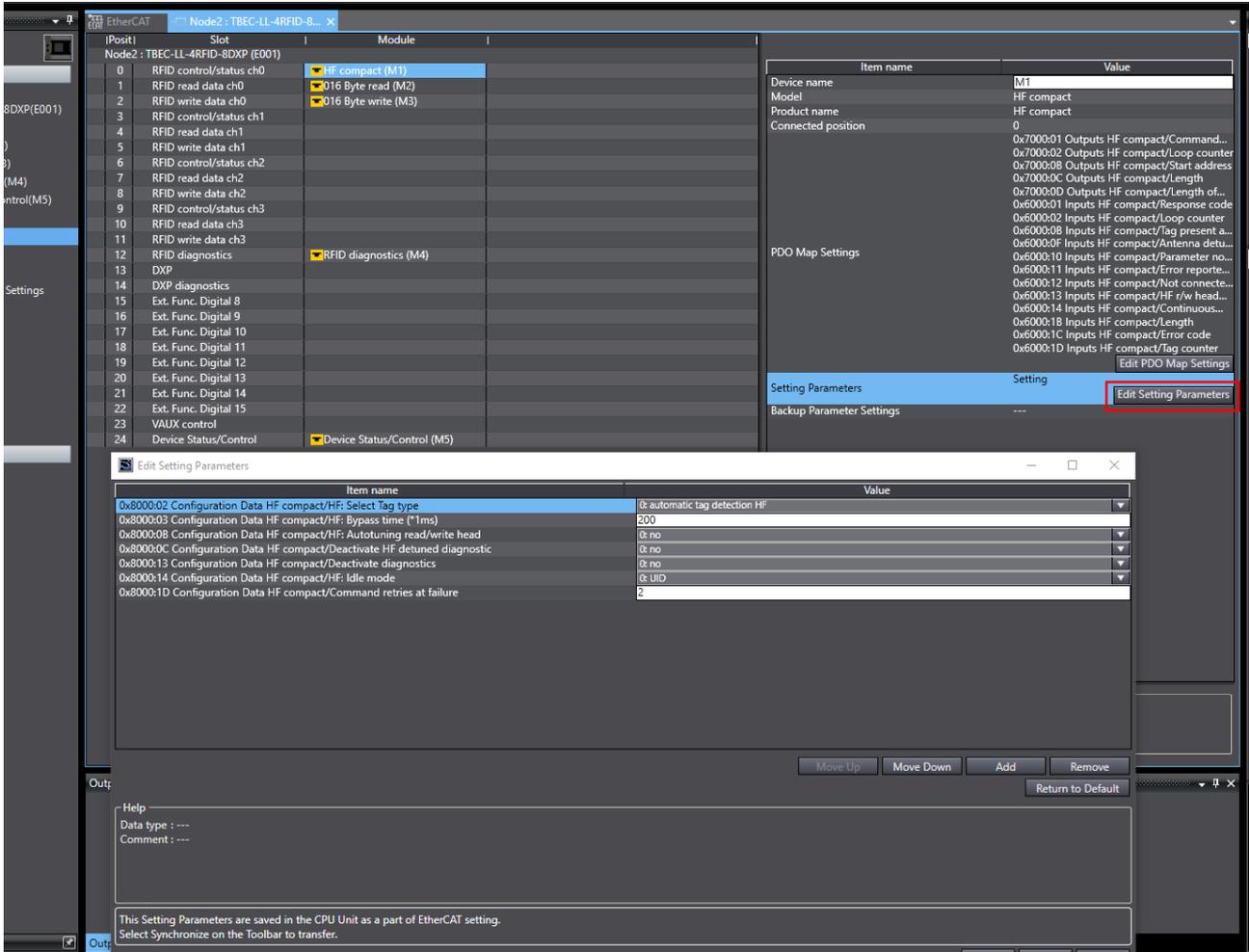


Fig. 80: Editing setting parameters

7.6 Assigning an IP address for EoE

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

Activating EoE in TwinCAT

The following steps are required to activate the EoE function:

- activating EoE in EtherCAT master
- activating EoE in EtherCAT slave

Activating EoE in the EtherCAT master:

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

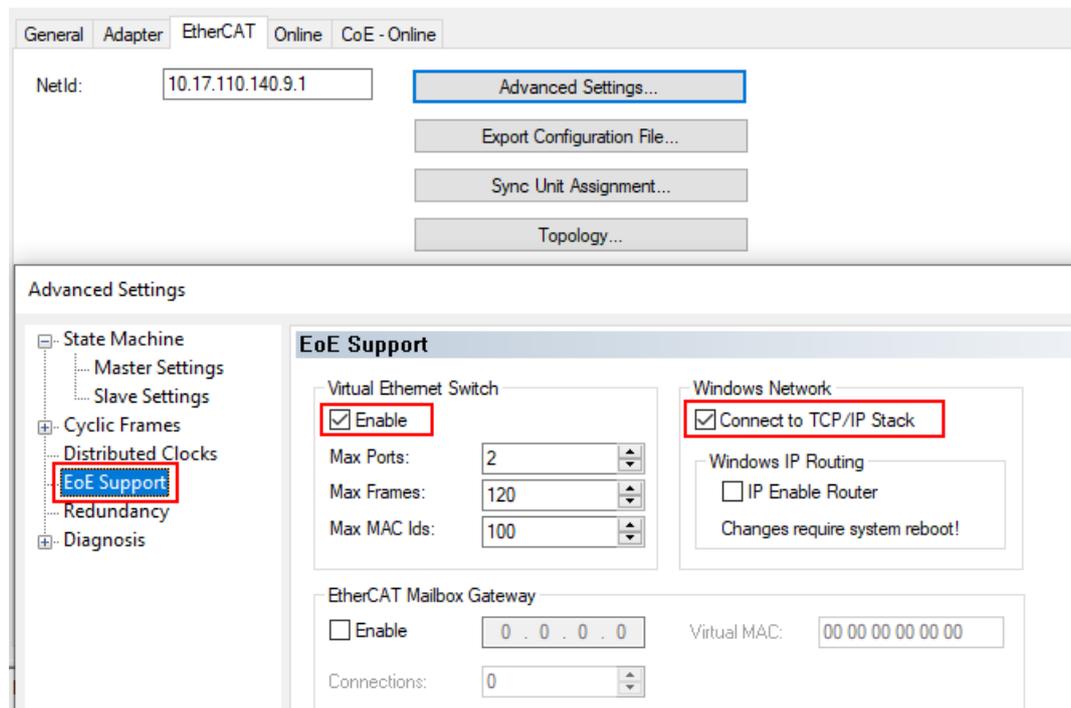


Fig. 81: TwinCAT – activating EoE in the master

Activating EoE in EtherCAT slave:

- ▶ In the project tree double-click **Box 1 (TBEC-LL-4RFID-8DXP)**.
- ▶ Click **EtherCAT** tab → **Advanced Settings**.
- ▶ In the **Advanced Settings** window select **Mailbox** → **EoE** on the left.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇒ The EoE function is activated in the EtherCAT slave.

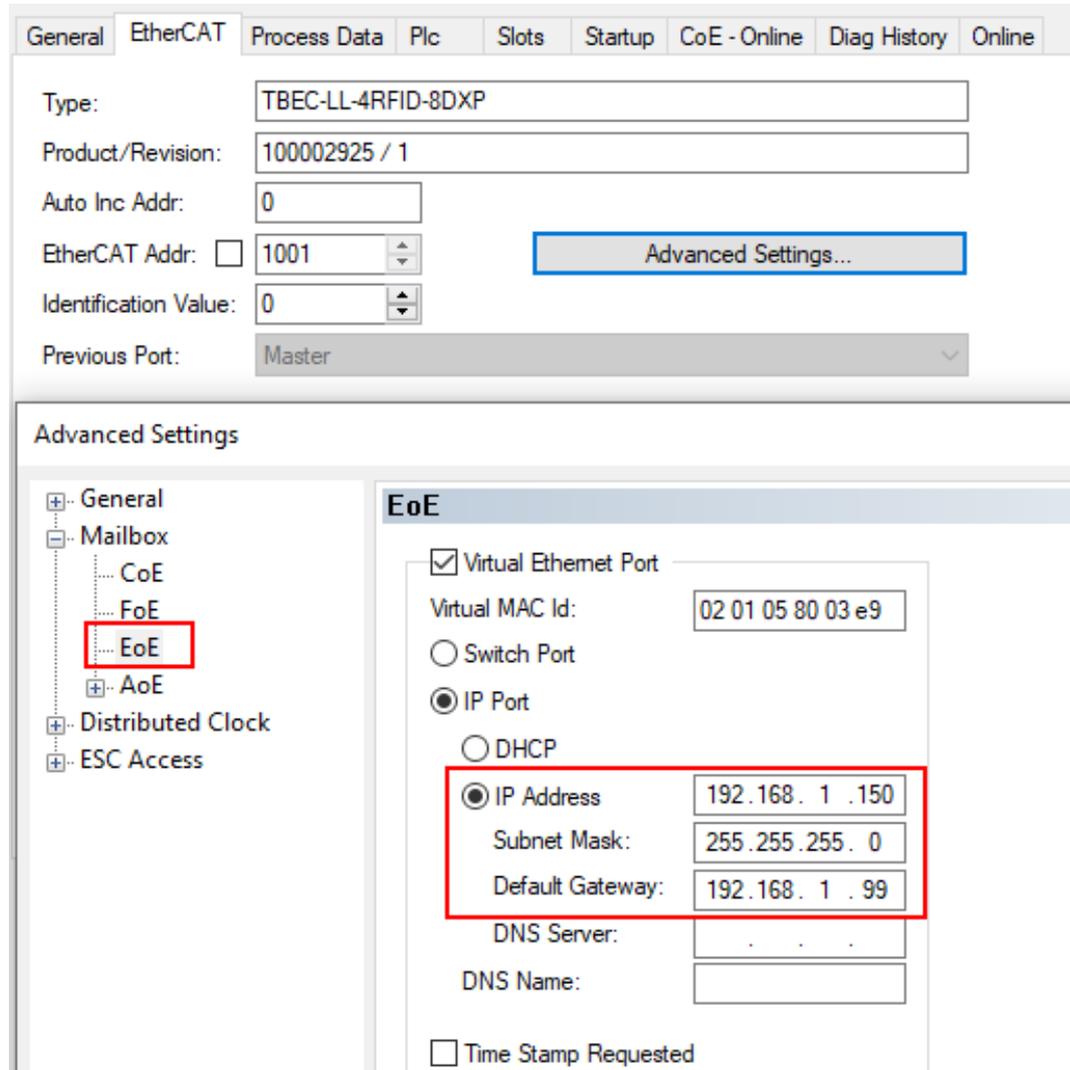


Fig. 82: TwinCAT – activating EoE in the EtherCAT slave



NOTE

DHCP is not supported by TBEC-LL-4RFID-8DXP.

Activating EoE in CODESYS

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

Activating EoE in EtherCAT slave:

- ▶ In the project tree double-click TBEC_LL_4RFID-8DXP (TBEC-LL-4RFID-8DXP).
- ▶ Select the **EoE Settings** tab.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇒ The EoE function is activated in the EtherCAT slave.

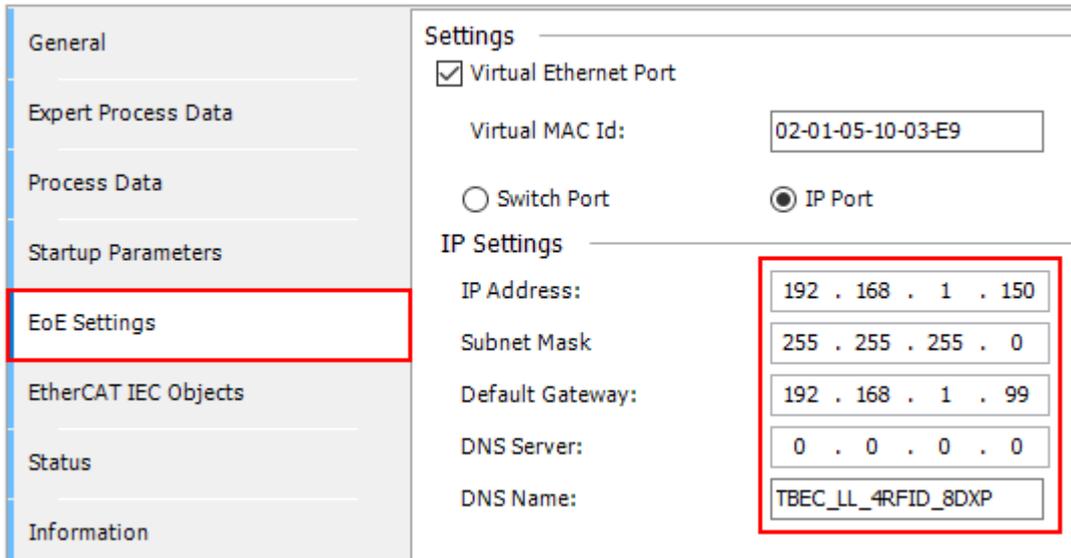


Fig. 83: CODESYS – activating EoE in the EtherCAT slave

Configuring the Device

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

Configuring the device in the DTM

Requirement: The TBEC-LL-4RFID-8DXP already has an IP address.

- ▶ Add the Ethernet interface **BL Service Ethernet** to the project.
- ▶ Use the **Add device** function to add the TBEC-LL-4RFID-8DXP to the interface.

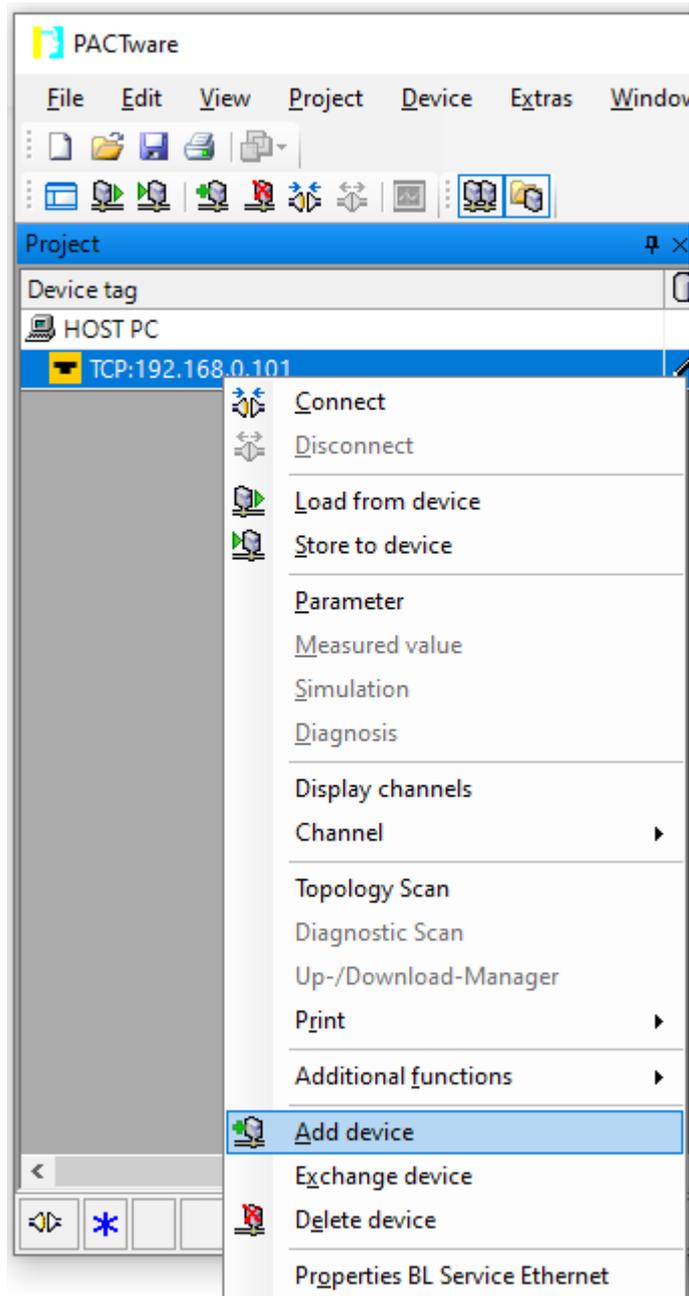


Fig. 84: DTM – Adding a device

- ▶ Select the TBEC-LL-4RFID-8DXP from the device catalog.
- ▶ Enter the IP address for TBEC-LL-4RFID-8DXP .
- ▶ Configure the device in the DTM.

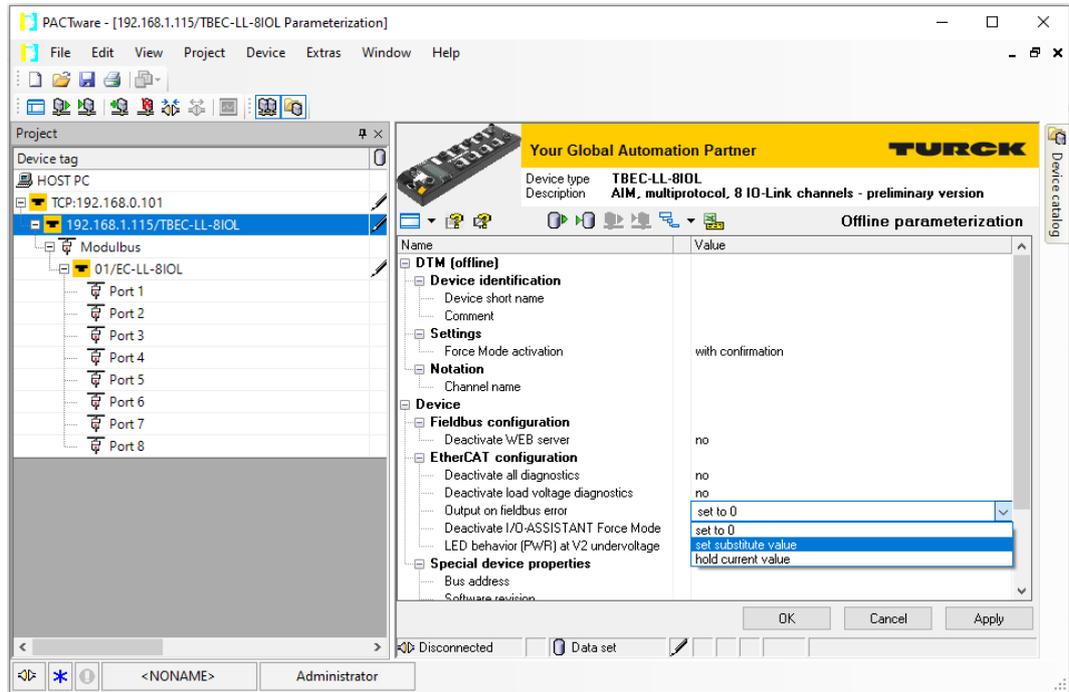


Fig. 85: DTM – Configuring the device

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	Parameters RFID	0...23	Input data RFID	0...23	Output data RFID	0...35	RFID diagnostics
2		32...33	Length of read data	24...151	Read data				
3		34...35	Length of write data			24...151	Write data		
4	1	36...67	Parameters RFID	152...175	Input data RFID	152...175	Output data RFID	36...71	RFID diagnostics
5		68...69	Length of read data	176...303	Read data				
6		70...71	Length of write data			176...303	Write data		
7	2	72...103	Parameters RFID	304...327	Input data RFID	304...327	Output data RFID	72...107	RFID diagnostics
8		104...105	Length of read data	328...455	Read data				
9		106...107	Length of write data			328...455	Write data		
10	3	108...139	Parameters RFID	456...479	Input data RFID	456...479	Output data RFID	108...143	RFID diagnostics
11		140...141	Length of read data	480...607	Read data				
12		142...143	Length of write data			480...607	Write data		
13	0			608...637	Diagnostics RFID channel 0				
	1			638...667	Diagnostics RFID channel 1				
	2			668...697	Diagnostics RFID channel 2				
	3			698...727	Diagnostics RFID channel 3				
14	8...15	144...147	Parameters DXP	728...729	Input data DXP	608...609	Output data DXP	144...147	DXP diagnostics
15	8...15			730...733	DXP diagnostics				

Slot	Channel	Parameter data		Process input data		Process output data		Diagnostic data	
		Bytes	Meaning	Bytes	Meaning	Bytes	Meaning	Bytes	Meaning
16	8	148...149	Extended DXP settings						
17	9	150...151	Extended DXP settings						
18	10	152...153	Extended DXP settings						
19	11	154...155	Extended DXP settings						
20	12	156...157	Extended DXP settings						
21	13	158...159	Extended DXP settings						
22	14	160...161	Extended DXP settings						
23	15	162...163	Extended DXP settings						
24		164...171	VAUX settings (VAUX Control)			610...611	VAUX output data (VAUX Control)		
25				734...737	Device Status (Device Status/Control)	612...613	Device Control (Device Status/Control)		

8.1 Modular device model/slot definition

The TBEC-LL-4RFID-8DXP appears in the configuration software as a modular EtherCAT slave 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	HF compact	Activates HF compact mode on RFID channel 0...3
...	HF extended	Activates HF extended mode on RFID channel 0...3
RFID control/status ch3	HF bus mode	Activates HF bus mode on RFID channel 0...3
	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	008 bytes read	Read data module with 8 bytes communication width on RFID channel 0...3
...		
RFID read data ch3	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	008 bytes write	Write data module with 8 bytes communication width on RFID channel 0...3
...		
RFID write data ch3	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 [▶ 218]
DXP	8DXP	Parameter data of the DXP channels [▶ 122]
DXP diagnostics	Diagnostics 8DXP	Diagnostic data of the DXP channels [▶ 221]
Ext. Func. Digital 8	DFI pulses	Extended parameters of the DXP channels 8...15 [▶ 123]
...		
Ext. Func. Digital15		
VAUX control	VAUX control	Activates the VAUX power supply [▶ 128]
Device Status/Control	Device Status/Control	Status and control for the entire module See Device Area [▶ 86]

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.	ARGEE							
	0x10... 0x09	1	res.	FCE	res.						
0xF110	0x08... 0x01	0	V2	res.	DIAG						
	0x10... 0x09	1	res.	V1	res.						

Meaning of the Device Status 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

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.	Wink							
	0x10... 0x09	1	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-index	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF800	0x07... 0x01	0	DEV2	V2LED	-	-	DEWEB	FFB		DDI
	0x0F... 0x08	1	-	DEFC	-	-	-	-	-	-

Meaning of 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.
FFB Output behavior on communication loss	00: Set to 0 The DXP channels are set to 0 if EtherCAT communication fails. 01: Substitute value The DXP channels are set to 0 if EtherCAT communication fails. 10: Hold current value The DXP channels retain the current value if EtherCAT communication fails.
DEWEB Deactivate web server	(the webservice 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.
V2LED LED behavior (PWR) at V2 undervoltage	0: Red The PWR LED is red in the event of undervoltage at V2. 1: Green The PWR LED flashes in the event of undervoltage at V2.
DEV2 Deactivate load voltage diagnostics	0: No The load voltage diagnostics are activated. 1: Yes The load voltage diagnostics are 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	Operation mode (OMRFID)							
	0x02	1	HF: Select Tag type (TAGTYPE)							
	0x03	2	Bypass time (BYPASS)							
		3								
	0x0B... 0x04	4	AT	TERM	HB	ANTI				
	0x13... 0x0C	5	DDI							DXD
	0x14	6	HFIDLEMODE							
	0x1C... 0x15	7	Reserved							
	0x1D	8	Command retries (CRET)							
	0x1E	9	HF: Command in Continuous mode (CCM)							
	0x1F	10	HF: Length in Continuous mode (LCM)							
		11								
	0x20	12	HF: Address in Continuous mode (ACM)							
		13								
		14								
		15								
	0x28... 0x21	16	Reserved							
		17	...							
		18								
		19								
20										
21										
22										
23										
24										
25										
26										
0x80... 0x79	27	Reserved								
0x88... 0x81	28	XCVR8	XCVR7	XCVR6	XCVR5	XCVR4	XCVR3	XCVR2	XCVR1	
0x90... 0x89	29	XCVR16	XCVR15	XCVR14	XCVR13	XCVR12	XCVR11	XCVR10	XCVR9	
0x98... 0x91	30	XCVR24	XCVR23	XCVR22	XCVR21	XCVR20	XCVR19	XCVR18	XCVR17	
0xA0... 0x99	31	XCVR32	XCVR31	XCVR30	XCVR29	XCVR28	XCVR27	XCVR26	XCVR25	

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0x8010	0x01	0	Length of read data (RDS)							
		1								
0x8020	0x01	0	Length of write data (WDS)							
		1								
Channel 1										
0x8030	0x01... 0xA0	0...31	Assignment identical to channel 0 (0x8000)							
0x8040	0x01	0	Assignment identical to channel 0 (0x8010)							
		1								
0x8050	0x01	0	Assignment identical to channel 0 (0x8020)							
		1								
Channel 2										
0x8060	0x01... 0xA0	0...31	Assignment identical to channel 0 (0x8000)							
0x8070	0x01	0	Assignment identical to channel 0 (0x8010)							
		1								
0x8080	0x01	0	Assignment identical to channel 0 (0x8020)							
		1								
Channel 3										
0x8090	0x01... 0xA0	0...31	Assignment identical to channel 0 (0x8000)							
0x80A0	0x01	0	Assignment identical to channel 0 (0x8010)							
		1								
0x80B0	0x01	0	Assignment identical to channel 0 (0x8020)							
		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: HF compact 2: HF extended 3: HF bus mode 4: UHF compact 5: UHF extended
TAGTYPE Tag type	0: Automatic tag detection HF 1: NXP Icode SLIX 2: Fujitsu MB89R118 3: TI Tag-it HF-I Plus 4: Infineon SRF55V02P 5: NXP Icode SLIX-S 6: Fujitsu MB89R119 7: TI Tag-it HF-I 8: Infineon SRF55V10P 9: Reserved 10: Reserved 11: NXP Icode SLIX-L 12: Fujitsu MB89R112 13: EM4233SLIC Read/write heads with firmware from Vx.91 also support: 14: NXP SLIX2 15: TI Tag-it HFI Pro 16: Turck sensor tag 17: Infineon SRF55V02S 18: Infineon SRF55V10S 19: EM4233 20: EM4237 21: EM4237 SLIC 22: EM4237 SLIX 23: EM4033
BYPASS Bypass time	Bypass time in ms, adjustable from 4...1020 ms, default setting: 200 ms
ANTI HF: Multitag	0: No (Multitag mode off) 1: Yes (Multitag mode on)
HB HF: Heartbeat read/write head	The device confirms its operational readiness with a signal sent at regular intervals to the controller. NOTE: A heartbeat slows down the system since a heartbeat and another command cannot be executed simultaneously. 0: No (heartbeat read/write head off) 1: Yes (heartbeat read/write head on)
TERM Termination active	0: Yes (bus terminating resistor activated) 1: No (bus terminating resistor deactivated) In HF bus mode bus termination is activated by default.

Designation	Meaning
AT HF: Autotuning read/write head	0: No (automatic tuning off) 1: Yes (automatic tuning on)
DXD Deactivate HF read/write head detuned diagnostic	0: No (diagnostic messages of the read/write head on) 1: Yes (diagnostic messages of the read/write head off)
DDI Deactivate diagnostics	0: No (all diagnostic messages on) 1: Yes (all diagnostic messages off)
HFIDLEMODE HF: Idle mode	Defines which data is to be displayed in Idle mode 0: UID 1: 8 bytes user memory 2: UID + 8 bytes user memory 3: UID + 64 bytes user memory 4: Deactivated
CRET Command retries at failure	Number of command repetitions after an error message, default setting: 2
CCM HF: Command in continuous mode	0x01: Inventory 0x02: Read 0x03: Tag info 0x04: Write
LCM HF: Length in continuous mode	Number of bytes that still have to be read or written in Continuous mode, default setting: 8
ACM HF: Address in continuous mode	Start address of the UID or USER memory area on the tag to be read or written, default setting: 0
XCVR0...XCVR31 HF bus mode: Activate read/ write head address ...	0: No (deactivate read/write head) 1: Yes (activate read/write head) In HF bus mode all connected and addressed read/write heads are deactivated by default and must be activated in the parameters.
RDS Length of read data	Size of the read data, default setting depends on the selected interface and field- bus
WDS Length of write data	Size of the write data, default setting depends on the selected interface and field- bus

8.3.2 HF applications – selecting the tag type

- ▶ In multitag applications select a tag type for executing the **read** and **write** commands. The automatic tag detection is not supported for the **read** and **write** commands in multitag mode.

The tag types that can be selected depends on the firmware of the connected read/write head. The firmware version of the read/write head can be read with the **Read/write head identification** command.

If a tag is selected that is not supported by the firmware of the connected read/write head, the RFID interface outputs the **Length out of tag specification** error.

The tag type does not have to be selected in single tag applications and for inventory commands in multitag applications if the read/write head detects the tags automatically.

Tag	Firmware status Read/write head	Selectable	Automatic detection possible	Adjustable in the DTM and via the configuration file (ESI file or xml device description)
1: NXP Icode SLIX	≥ V1.91	x	x	x
	≤ V1.90	x	x	x
2: Fujitsu MB89R118	≥ V1.91	x	x	x
	≤ V1.90	x	x	x
3: TI Tag-it HFI Plus	≥ V1.91	x	x	x
	≤ V1.90	x	x	x
4: Infineon SRF55V02P	≥ V1.91	x	x	x
	≤ V1.90	x	x	x
5: NXP Icode SLIX-S	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
6: Fujitsu MB89R119	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
7: TI Tag-it HF-I	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
8: Infineon SRF55V10P	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
11: NXP Icode SLIX-L	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
12: Fujitsu MB89R112	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
13: EM4233SLIC	≥ V1.91	x	x	x
	≤ V1.90	x	–	x
14: NXP SLIX2	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
15: TI Tag-it HFI Pro	≥ V1.91	–	x	x
	≤ V1.90	–	–	–
16: Turck sensor tag	≥ V1.91	x	x	x
	≤ V1.90	–	–	–

Tag	Firmware status Read/write head	Selectable	Automatic detection possible	Adjustable in the DTM and via the configuration file (ESI file or xml device description)
17: Infineon SRF55V02S	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
18: Infineon SRF55V10S	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
19: EM4233	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
20: EM4237	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
21: EM4237 SLIC	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
22: EM4237 SLIX	≥ V1.91	x	x	x
	≤ V1.90	–	–	–
23: EM4033	≥ V1.91	x	x	x
	≤ V1.90	–	–	–

8.3.3 HF applications – setting the bridging time (bypass time)

Due to the expansion of the HF transmission zone the tag may drop out momentarily during a write or read operation and then later return again. The period between the drop out and the return to the transmission zone must be bridged so that the write or read operation is completed. The bridging time is the time between the dropout and the return to the detection range. The **Bypass time** parameter takes up one word in the parameter data image and is stated in ms.

The bridging time can be set between 4...1020 ms. The bridging time parameter depends on the components used, the write/read distances, the speed of the tag to the read/write head and other external factors.

The following figure shows the typical characteristics of the sensing range and the path covered by the read/write head. **A** shows the section to be bridged:

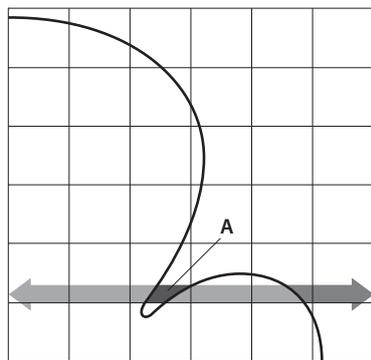


Fig. 86: Detection range of a read/write head

Retaining the default setting

The default setting for the bridging time is 200 ms. In HF bus mode the default value is 48 ms.

- ▶ Retain the default setting: If the commissioning is successful, the parameter does not have to be adjusted to the application. If the commissioning is not successful, an error message will appear.
- ▶ If the error message appears, adjust the bridging time. If the bridging time cannot be adjusted, reduce the speed or the data volume.

The “recommended” and “maximum distance” entries are shown in the product specific data sheet.

Adapting the bridging time to the application

- ▶ Measure the required bridging time directly on location. The LEDs of the read/write head and the TP status bit of process input data indicate whether the tag is in the sensing range or not.
- ▶ Enter the required bridging time.

8.3.4 HF applications – setting HF bus mode



NOTE

In HF bus mode a command is only meant for one read/write head. While the command is being executed, there is no data communication with other read/write heads.

If Continuous mode is used in HF bus mode, the command and the set parameters apply to all activated read/write heads.

HF bus mode supports the HF read/write heads from firmware version Vx.90. Continuous HF bus mode supports HF read/write heads from firmware version Vx.93. The read/write heads can be addressed as follows:

- Automatic addressing
- Manual addressing via the **Set HF read/write head address** command
- Manual addressing via the Turck Service Tool

The addresses must be assigned per channel from 1 to 32.

Addressing read/write heads automatically



NOTE

Turck recommends making the bus address of the read/write head visible on the device. The label on the cable can be used to mark the address on the read/write head. The appropriate labels can be ordered with ID 6936206.

Read/write heads with the default bus address 68 can be automatically addressed. For this the corresponding XCVR bit must be set in the parameter data.

- ▶ Switch on the RFID interface power supply.
- ▶ Activate the required read/write heads in the parameter data via the appropriate XCVR bit.
- ▶ Connect the read/write heads to the interface in a line one by one.
- ⇒ The read/write heads are automatically assigned addresses in ascending order in the order of connection. The lowest address is automatically assigned to the next connected read/write head with the default address 68.
- ⇒ The addressing is successful if the LED of the read/write head is permanently lit.

Manually addressing read/write heads – Setting a read/write head address



NOTE

Turck recommends making the bus address of the read/write head visible on the device. The label on the cable can be used to mark the address on the read/write head. The appropriate labels can be ordered with ID 6936206.

For information on addressing the read/write heads via the RFID interface with the **Set HF read/write head address** command see page [▶ 164]. With manual addressing via the **Set HF read/write head address** command, the read/write heads must not be activated until the addressing is completed.

- ▶ Activate the required read/write heads in the parameter data via the appropriate XCVR bit.

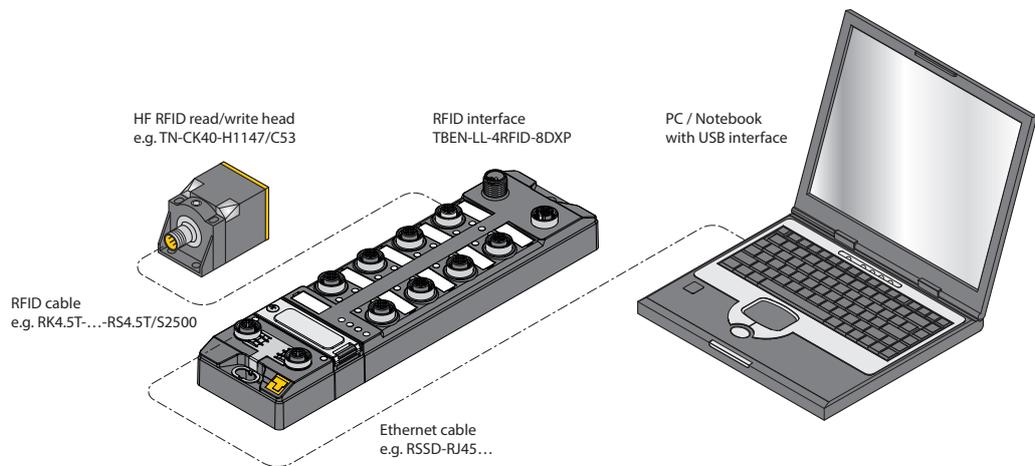


Fig. 87: Connecting read/write heads via the RFID interface with a PC

Addressing read/write heads manually via the Turck Service Tool



NOTE

Turck recommends making the bus address of the read/write head visible on the device. The label on the cable can be used to mark the address on the read/write head. The appropriate labels can be ordered with ID 6936206.

The following accessories are required to address the read/write heads in HF bus mode via the Turck Service Tool. Accessories are not supplied with the device and must be ordered separately.

- STW-RS485-USB interface converter (ID 7030354)
- STW-RS485-USB-PS power supply unit (ID 703035)
- ▶ Connect the read/write head to the interface converter using a suitable connection cable (e.g. RK4.5T-2/S2500) according to the following color coding:

STW-RS485-USB	.../S2500 plug connectors	.../S2501 plug connectors	.../S2503 plug connectors
VCC	Brown (BN)	Brown (BN)	Red (RD)
GND	Blue (BU)	Blue (BU)	Black (BK)
RS485-A	White (WH)	Black (BK)	White (WH)
RS485-B	Black (BK)	White (WH)	Blue (BU)

- ▶ Connect a USB cable to the interface converter (USB1.1 type B).
- ▶ Connect the open end of the USB cable to a free USB port on the PC (USB1.1 type A).
- ▶ Set the switches on the side of the interface converter for the termination to [ON].
- ▶ Connect the interface converter via the STW... power supply unit to a power supply.

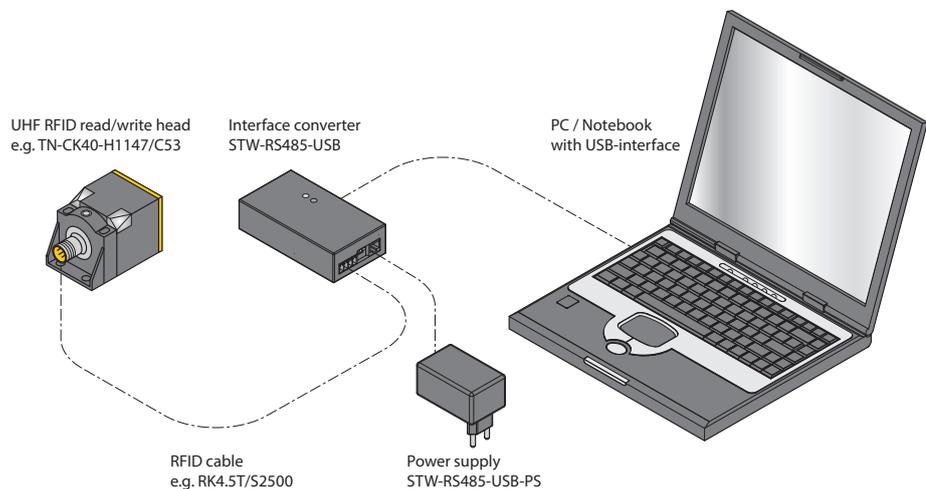


Fig. 88: Connecting the read/write head via the interface converter with a PC

- ▶ Launch the Turck Service Tool.
- ▶ Click **Actions** or press [F4].
- ▶ Click **Set HF RFID Reader Bus Address**.

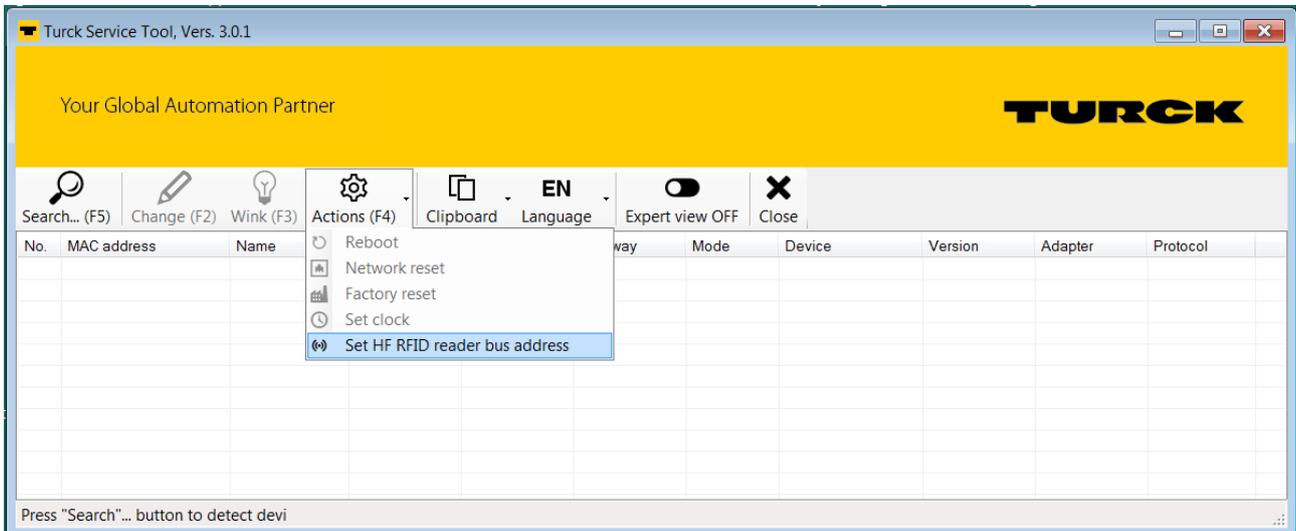


Fig. 89: Function selection – Set HF RFID reader bus address

The HF-RFID Reader Setup Tool window opens.

- ▶ Select the **COM port** to which the interface converter is connected.
- ▶ Click **Read**.
- ⇒ The found read/write head is displayed in the **status message**.

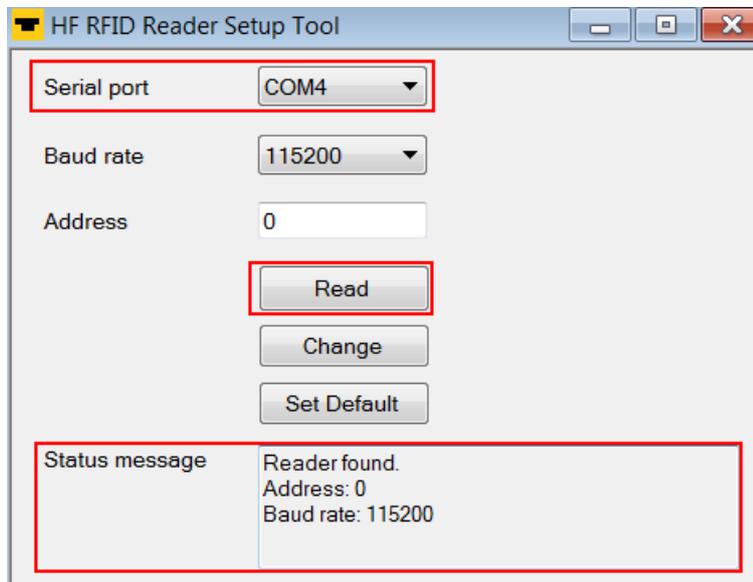


Fig. 90: Window – HF-RFID Reader Setup Tool

- ▶ Enter the required **address**.
- ▶ Click **Change**.
- ⇒ The new set address is displayed in the **status message**.

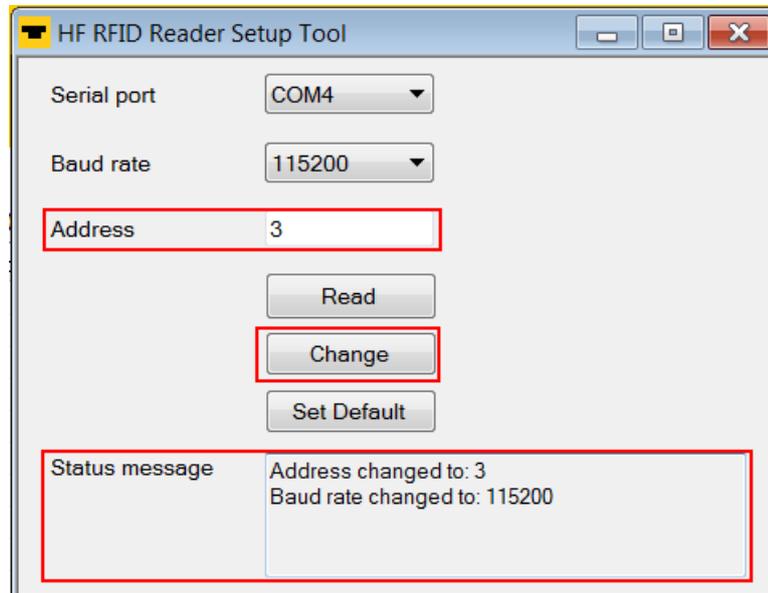


Fig. 91: Changing the read/write head

- ▶ Activate the required read/write heads in the parameter data via the appropriate XCVR bit.

8.3.5 UHF applications – setting Continuous presence sensing mode

- ▶ Set adaptations 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 recorded again, only the counter incremented in the header)
- ▶ Execute the **Continuous presence sensing mode** command.
- ⇒ The UHF reader is switched to Presence sensing mode and sends all received data to the interface as soon as at least one tag is located in the detection range.
- ⇒ The data received from the UHF reader is stored in the FIFO memory of the interface.
- ▶ Send the **Idle** command (0x0000) in order to 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, it is no longer used for grouping.



NOTE

If grouping is active: Only read data from the buffer if the number of available bytes is stable. If stable data was fetched, the command can be terminated by means of a reset since the grouping is no longer based on the fetched data and therefore old EPCs can be detected again.

- ▶ Do not carry out the reset until the data has been successfully read from the buffer.
- ▶ To end Continuous presence sensing mode and clear the FIFO memory of the interface, send the **Reset** command (0x0800).

8.3.6 UHF applications – transferring reader settings

The **Backup** function enables the settings of a UHF reader to be transferred, e.g. when swapping a device.

- ▶ 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 – HF compact and 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 (RCNT)							
		0x0A... 0x03	3	Reserved							
		0x12... 0x0B	4	TNC1	TRE1	PNS1	XD1				TP
		0x1A... 0x13	5							CMON	TON
		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							
Channel 1											
Resp	0x6030	0x01... 0x1D	0...11	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6040	0x01... 0x80	0...127								
Channel 2											
Resp	0x6060	0x01... 0x1D	0...11	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6070	0x01... 0x80	0...127								

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Channel 3											
Resp	0x6090	0x01	0	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x60A0	0x01	0								

Process input data – HF extended and 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 (RCNT)							
		0x0A... 0x03	3	Reserved							
		0x12... 0x0B	4	TNC1	TRE1	PNS1	XD1				TP
		0x1A... 0x13	5							CMON	TON
		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 No. (RFN)							
		0x20	15	Write fragment No. (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							

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Channel 1											
Resp	0x6030	0x01... 0x40	0...19	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6040	0x01... 0x80	0...127								
Channel 2											
Resp	0x6060	0x01... 0x40	0...19	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6070	0x01... 0x80	0...127								
Channel 3											
Resp	0x6090	0x01... 0x40	0...19	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x60A0	0x01... 0x80	0...127								

Process input data – HF bus 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 (RCNT)							
		0x0A... 0x03	3	Reserved							
		0x12... 0x0B	4	TNC1	TRE1	PNS1	XD1				TP
		0x1A... 0x13	5							CMON	TON
		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 No. (RFN)							
		0x20	15	Write fragment No. (WFN)							
		0x28... 0x21	16	Reserved							
		0x30... 0x29	17	Reserved							
		0x38... 0x31	18	Reserved							
		0x40... 0x39	19	Reserved							
0x48... 0x41	20	TP8	TP7	TP6	TP5	TP4	TP3	TP2	TP1		
0x50... 0x49	21	TP16	TP15	TP14	TP13	TP12	TP11	TP10	TP9		
0x58... 0x51	22	TP24	TP23	TP22	TP21	TP20	TP19	TP18	TP17		
0x60... 0x59	23	TP32	TP31	TP30	TP29	TP28	TP27	TP26	TP25		

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
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							
Channel 1											
Resp	0x6030	0x01... 0x60	0...23	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6040	0x01... 0x80	0...127								
Channel 2											
Resp	0x6060	0x01... 0x60	0...23	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x6070	0x01... 0x80	0...127								
Channel 3											
Resp	0x6090	0x01... 0x60	0...23	Assignment identical to channel 0 (0x6000...0x6010)							
RD	0x60A0	0x01... 0x80	0...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	0x60C0	0x08... 0x01	0	VAUX	PRMER	DTM	FIFO				
		0x10... 0x09	1	Reserved							
		0x18... 0x11	2	Reserved							
		0x20... 0x19	3	Reserved							
Dg1C0	0x60C1	0x08... 0x01	0	TNC1	TRE1	PNS1	XD1				
Dg2C0		0x10... 0x09	1	TNC2	TRE2	PNS2	XD2				
Dg3C0		0x18... 0x11	2	TNC3	TRE3	PNS3	XD3				
...					
Dg16C0		0x80... 0x79	15	TNC16	TRE16	PNS16	XD16				
Dg17C0	0x60C2	0x08... 0x01	0	TNC17	TRE17	PNS17	XD17				
...						
Dg32C0		0x80... 0x79	15	TNC32	TRE32	PNS32	XD32				
Diagnostics RFID channel 1											
DgC1	0x60C3	0x20... 0x01	0...3	Assignment identical to diagnostics RFID channel 0 (0x60C0... 0x60C2)							
Dg1C1... Dg16C1	0x60C4	0x80... 0x01	0...15								
Dg32C1	0x60C5	0x80... 0x01	0...15								
Diagnostics RFID channel 2											
DgC2	0x60C6	0x20... 0x01	0...3	Assignment identical to diagnostics RFID channel 0 (0x60C0... 0x60C2)							
Dg1C2... Dg16C2	0x60C7	0x80... 0x01	0...15								
Dg32C2	0x60C8	0x80... 0x01	0...15								

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Diagnostics RFID channel 3											
DgC3	0x60C9	0x20... 0x01	0...3	Assignment identical to diagnostics RFID channel 0 (0x60C0... 0x60C2)							
Dg1C3... Dg16C3	0x60CA	0x80... 0x01	0...15								
Dg32C3	0x60CB	0x80... 0x01	0...15								

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 present at read/write head) 1: Yes (tag in detection range of read/write head) Tag in detection range of at least one read/write head
XD1 Antenna detuned at HF read/write head	0: No (no error) 1: Yes (read/write head detuned (HF bus mode: at least one of the read/write heads detuned))
PNS1 Parameter not supported by read/write head	0: No (no error) 1: Yes (parameter not supported by read/write head) (HF bus mode: Parameter not supported by at least one read/write head)
TRE1 Error reported by read/write head	0: No (no error) 1: Yes (error message of the read/write head) (HF bus mode: Error message of at least one read/write head)
TNC1 Not connected to read/write head (expected read/write head not connected)	0: No (read/write head expected by system connected) 1: Yes (read/write head expected by the system not connected (HF bus mode: at least one read/write head expected by system not connected))
TON1 HF read/write head switched on	0: No (read/write head switched off) 1: Yes (HF read/write head switched on (HF bus mode: at least one read/write head switched on))
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	<p>Display of the detected tags. With HF multitag applications and UHF the rising edges of the tags are counted that are read with an Inventory command. In HF single-tag applications all tags are counted that are detected by the read/write head. A tag that moves along the read/write head is not counted again if it only leaves and re-enters the detection range (within the set bypass time). If a tag continuously stays within the detection range, it is also only counted once.</p> <p>Exceptions: Continuous mode in Bus mode is active or Continuous mode with start address = 3 is active.</p> <p>The tag counter is reset by the following commands:</p> <ul style="list-style-type: none"> ■ Inventory (exception: HF single-tag applications) ■ Continuous mode ■ Continuous presence sensing mode ■ Reset
BYFI Data (bytes) available	<p>Number of bytes in the FIFO memory of the interface (only available with HF extended and UHF extended modes)</p> <p>Ascending: New data from a tag read or received by the device</p> <p>Descending: Execution of a command completed</p> <p>Error message 0xFFFF: Memory overfilled, data loss of new data likely</p>
RFN Read fragment No.	<p>In Idle mode the size of the fragments is stated. With a read command the number of fragments containing data is stated. (only available with HF extended and UHF extended modes)</p> <p>0: No fragmentation</p> <p>If the data to be read exceeds the size of the read data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1...255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the read fragment number appears in the process input data. After the confirmation the next fragment is read.</p>
WFN Write fragment No.	<p>In Idle mode the size of the fragments is stated. With a write command the number of fragments containing data is stated.</p> <p>0: No fragmentation</p> <p>If the data to be written exceeds the size of the write data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1...255. From fragment number 256 numbering starts again at 1.</p> <p>The sending of a fragment is confirmed by the device if the write fragment number appears in the process input data. After the confirmation the next fragment is written.</p>
TP1...TP32 Tag present at read/write head ... (tag in detection range on the read/write head ...)	<p>Tag in detection range of the connected read/write head (only available in HF bus mode)</p>
Read data, byte 0...127	Read data

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

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

Apart from with some variants of Continuous mode, the bit in HF applications is set by default in all operation modes and in Idle mode.

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



NOTE

If the HF read/write head detects a new tag in the detection range, the **Tag present bit** (TP) and the data (UID and/or read data) are set via the **HF: Idle mode** (UID and/or read data) are displayed simultaneously. If two tags are detected in quick succession, the TP bit may remain set. The data of the second tag (UID and/or read data) is displayed.

8.5 RFID channels – process output data

Process output data – HF compact and 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 (LCNT)							
				3								
		0x0B	0x04	4	Start address (ADDR)							
				5								
				6								
				7								
0x0C	0x05	8	Length (LEN)									
		9										
0x0D	0x06	10	Length of UID/EPC (SOUID)									
		11									Reserved	
WD	0x7020	0x01	0x01	0	Write data, Byte 0							
		0x02	0x02	1								
		0x03	0x03	2								
		0x04	0x04	3								
		0x05	0x05	4								
		0x06	0x06	5								
		0x07	0x07	6								
		0x08	0x08	7								
									
0x80	0x80	127	Write data, Byte 127									
...	
Channel 1												
Cmd	0x7030	0x01... 0x0D	0x01... 0x06	0...11	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7050	0x01... 0x80	0x01... 0x80	0...127								
Channel 2												
Cmd	0x7060	0x01... 0x0D	0x01... 0x06	0...11	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7080	0x01... 0x80	0x01... 0x80	0...127								

Prefix for variable link	CoE index	CoE subindex		Byte no.	Bit							
		HF	UHF		7	6	5	4	3	2	1	0
Channel 3												
Cmd	0x7090	0x01... 0x0D	0x01... 0x06	0...11	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x70B0	0x01... 0x80	0x01... 0x80	0...127								

Writing process output data – HF extended and 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 (LCNT)							
				0x03	3	Memory area (DOM) – only available with UHF applications						
		0x0B	0x04	4	Start address (ADDR)							
				5								
				6								
				7								
		0x0C	0x05	8	Length (LEN)							
				9								
		0x0D	0x06	10	Length of UID/EPC (SOUID)							
				11	Reserved							
		0x16	0x0F	12	Command timeout (TOUT)							
				13								
		0x17	0x10	14	Read fragment No. (RFN)							
		0x18	0x11	15	Write fragment No. (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							
Channel 1												
Cmd	0x7030	0x01... 0x18	0x01... 0x11	0...19	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7050	0x01... 0x80	0x01... 0x80	0...127								

Prefix for variable link	CoE index	CoE subindex		Byte no.	Bit							
		HF	UHF		7	6	5	4	3	2	1	0
Channel 2												
Cmd	0x7060	0x01	0x01	0	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7080	0x01	0x01	0								
Channel 3												
Cmd	0x7090	0x01	0x01	0	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x70B0	0x01	0x01	0								

Writing process output data – HF bus mode 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											
Cmd	0x7000	0x01	0	Command code (CMDC)							
			1								
		0x02	2	Loop counter (LCNT)							
			3	Memory area (DOM) – only available with UHF applications							
		0x0B	4	Start address (ADDR)							
			5								
			6								
			7								
		0x0C	8	Length (LEN)							
			9								
		0x0D	10	Length of UID/EPC (SOUID)							
			11	Reserved							
		0x16	12	Command timeout (TOUT)							
			13								
		0x17	14	Read fragment No. (RFN)							
		0x18	15	Write fragment No. (WFN)							
			16	Reserved							
			17	Reserved							
			18	Reserved							
		0x39	19	Reserved							
			20	Read/write head address (ANTN) – only available with HF applications							
			21	Reserved							
			22	Reserved							
23	Reserved										
WD	0x7020	0x01	0	Write data, Byte 0							
		0x02	1	Write data, Byte 1							
		0x03	2	Write data, Byte 2							
		0x04	3	Write data, Byte 3							
		0x05	4	Write data, Byte 4							
		0x06	5	Write data, Byte 5							
		0x07	6	Write data, Byte 6							
		0x08	7	Write data, Byte 7							
								
		0x80	127	Write data, Byte 127							

Prefix for variable link	CoE index	CoE subindex	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Channel 1											
Cmd	0x7030	0x01... 0x39	0...23	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7050	0x01... 0x80	0...127								
Channel 2											
Cmd	0x7060	0x01... 0x39	0...23	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x7080	0x01... 0x80	0...127								
Channel 3											
Cmd	0x7090	0x01... 0x39	0...23	Assignment identical to channel 0 (0x7000 and 0x7020)							
WD	0x70B0	0x01... 0x80	0...127								

8.5.1 Meaning of the command bits

Description	Meaning
CMDC Command code	Enter the command code
LCNT Loop counter for fast processing	Loop counter for repeated processing of a command 0: Loop counter off
DOM Memory area – only useful for UHF applications (with HF applications the setting has no effect)	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	Enter the length of the data to be read or written in bytes
SOUID Length of UID/EPC in bytes	Inventory command: 0: The actual length (bytes) of the transferred UID or EPC is transferred with an inventory. > 0 in HF applications: ■ 8: Return message 8 bytes UID ■ 1...7: Return message of an abbreviated UID ■ > 8: Error message > 0 in UHF applications: EPC completely output. -1: NEXT mode (only available in HF single-tag applications): An HF tag is always only read, written or protected if the UID is different to the UID of the last read or written tag. Other commands: Enter UID or EPC size in bytes, if a particular tag is read, written or protected. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/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 to be read, written or protected if an EPC is present in the write data. -1: NEXT mode (only available in HF single-tag applications): A tag is always only read, written or protected if the UID/EPC is different to the UID/EPC of the last read or written tag.
TOUT Command timeout	Time in ms in which one command is to be executed. If a command is not executed within the entered time, the device outputs an error message. 0 (HF applications): No timeout, command stays active until it is executed 0 (UHF applications): No timeout, command stays active until the first tag was read 1: Command is executed once (if there is already a tag in the detection range) > 1...65535: Time in ms HF inventory: Command executed once in the specified time (exception: Continuous mode) UHF inventory: Command active for the entire specified time

Description	Meaning
RFN Read fragment No.	<p>If the data to be read exceeds the size of the read data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1...255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the read fragment number appears in the process input data. After the confirmation the next fragment is read.</p> <p>0: No fragmentation</p> <p>In Idle mode the size of the fragments is stated. With a read command the number of fragments containing data is stated.</p>
WFN Write fragment No.	<p>If the data to be written exceeds the size of the write data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1...255. From fragment number 256 numbering starts again at 1.</p> <p>The sending of a fragment is confirmed by the device if the write fragment number appears in the process input data. After the confirmation the next fragment is written.</p> <p>0: No fragmentation</p> <p>In Idle mode the size of the fragments is stated. With a write command the number of fragments containing data is stated.</p>
ANTN Read/write head address	<p>HF bus mode: Address of the read/write head, if several bus-capable read/write heads are connected</p> <p>UHF: Values are ignored or set automatically.</p>
Write data byte 0...127	<p>User-defined write data or entry of a UID or EPC to select a specific tag for the command execution (if Length of UID/EPC (SQUID) command parameter is greater than 0)</p>

8.6 Digital channels – setting parameter data

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0x80D0	0x08... 0x01	0	Reserved							
	0x10... 0x09	1	SRO15	SRO14	SRO13	SRO12	SRO11	SRO10	SRO9	SRO8
	0x18... 0x11	2	Reserved							
	0x20... 0x19	3	OE15	OE14	OE13	OE12	OE11	OE10	OE9	OE8

8.6.1 Meaning of the parameter bits

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

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

8.7 Digital channels – setting extended parameters (ext. I/O functions)

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
Channel 8 – ext. I/O functions 4										
0x80F0	0x02... 0x01	0	DIFT	DMOD (Byte 1...7)						
	0x03	1	IST (Byte 0...8)							
Channel 9 – ext. I/O functions 5										
0x8100	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 10 – ext. I/O functions 6										
0x8110	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 11 – ext. I/O functions 7										
0x8120	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 12 – ext. I/O functions 8										
0x8130	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 13 – ext. I/O functions 9										
0x8140	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 14 – ext. I/O functions 10										
0x8150	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								
Channel 15 – ext. I/O functions 11										
0x8160	0x02... 0x01	0	Assignment identical to channel 8							
	0x03	1								

8.7.1 Meaning of the parameter bits

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

Designation	Meaning
DMOD Extended digital mode	0: Deactivated 1: Digital filter and impulse stretch
DIFT Input filter	An input filter makes it possible to set how long a change in the input has to be present until it is transferred to the input data. 0: 0.2 ms 1: 3 ms
IST Impulse stretch	Impulse stretch: 0...2550 ms (adjustable in 10 ms steps), default value: 10 ms

8.8 Digital channels – process input data



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
DI	0x60D0		0	Reserved							
			1	DXP15	DXP14	DXP13	DXP12	DXP11	DXP10	DXP9	DXP8
DXP diagnostics											
DgDX	0x60E0	0x08... 0x01	0	VEr-rV2P1X 7Ch14 Ch15	VEr-rV2P1X 6Ch12 Ch13	VEr-rV2P1X 5Ch10 Ch11	VEr-rV2P1X 4Ch8C h9	res.	res.	res.	res.
		0x10... 0x09	1	res.							
		0x18... 0x11	2	res.							
		0x20... 0x19	3	ERR15	ERR14	ERR13	ERR12	ERR11	ERR10	ERR9	ERR8

8.8.1 Meaning of the status bits

Designation	Meaning
DXP8	0: Off (digital channel 1 not active) 1: On (digital channel 1 active)
DXP9	0: Off (digital channel 2 not active) 1: On (digital channel 2 active)
DXP10	0: Off (digital channel 3 not active) 1: On (digital channel 3 active)
DXP11	0: Off (digital channel 4 not active) 1: On (digital channel 4 active)
DXP12	0: Off (digital channel 5 not active) 1: On (digital channel 5 active)
DXP13	0: Off (digital channel 6 not active) 1: On (digital channel 6 active)
DXP14	0: Off (digital channel 7 not active) 1: On (digital channel 7 active)
DXP15	0: Off (digital channel 8 not active) 1: On (digital channel 8 active)
VErrV2P1X4Ch8Ch9 Overcurrent VAUX2 Pin1 X4 (Ch8/9)	Overvoltage at power supply terminal VAUX2 at socket 4 (channels 8 and 9)
VErrV2P1X5Ch10Ch11 Overcurrent VAUX2 Pin1 X5 (Ch10/11)	Overvoltage at power supply terminal VAUX2 at socket 5 (channels 10 and 11)

Designation	Meaning
VErrV2P1X6Ch12Ch13 Overcurrent VAUX2 Pin1 X6 (Ch12/13)	Overvoltage at power supply terminal VAUX2 at socket 6 (channels 12 and 13)
VErrV2P1X7Ch14Ch15 Overcurrent VAUX2 Pin1 X7 (Ch14/15)	Overvoltage at power supply terminal VAUX2 at socket 7 (channels 14 and 15)
ERR... Output overcurrent	Error on channel ...

8.9 Digital channels – process output data



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
DO	0x70D0	0x08... 0x01	0	Reserved							
		0x10... 0x09	1	DXP15	DXP14	DXP13	DXP12	DXP11	DXP10	DXP9	DXP8

8.9.1 Meaning of the command bits

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

Designation	Meaning
DXP8	0: Off (switch off digital channel 1) 1: On (switch on digital channel 1)
DXP9	0: Off (switch off digital channel 2) 1: On (switch on digital channel 2)
DXP10	0: Off (switch off digital channel 3) 1: On (switch on digital channel 3)
DXP11	0: Off (switch off digital channel 4) 1: On (switch on digital channel 4)
DXP12	0: Off (switch off digital channel 5) 1: On (switch on digital channel 5)
DXP13	0: Off (switch off digital channel 6) 1: On (switch on digital channel 6)
DXP14	0: Off (switch off digital channel 7) 1: On (switch on digital channel 7)
DXP15	0: Off (switch off digital channel 8) 1: On (switch on digital channel 8)

8.10 Digital channels – setting switchable VAUX power supply

8.10.1 VAUX switchable power supply – parameter data

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0x8170	0x08... 0x01	0	Reserved							
	0x10... 0x09	1	Reserved							
	0x18... 0x11	2	Reserved							
	0x20... 0x19	3	Reserved							
	0x27... 0x21	4	Reserved						VAUX2P1X4 Ch8Ch9	
	0x2E... 0x28	5	Reserved						VAUX2P1X5 Ch10Ch11	
	0x35... 0x2F	6	Reserved						VAUX2P1X6 Ch12Ch13	
	0x3C... 0x36	7	Reserved						VAUX2P1X7 Ch14Ch15	

Meaning of the parameter bits

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

Designation	Meaning
VAUX2P1X4Ch8Ch9	0: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 switchable via the process data
VAUX2P1X5Ch10Ch11	0: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 switchable via the process data
VAUX2P1X6Ch12Ch13	0: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 switchable via the process data
VAUX2P1X7Ch14Ch15	0: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 switchable via the process data

8.10.2 VAUX switchable power supply – output data



NOTE

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

Prefix for variable link	CoE index	CoE sub-index	Byte no.	Bit							
				7	6	5	4	3	2	1	0
Vaux	0x7170	0x08... 0x01	0	VAUX2 P1X7Ch 14Ch15	VAUX2 P1X6Ch 12Ch13	VAUX2 P1X5Ch 10Ch11	VAUX2 P1X4Ch 8Ch9	Re- served	Re- served	Re- served	Re- served
		0x10... 0x09	1	Re- served	Re- served	Re- served	Re- served	Re- served	Re- served	Re- served	Re- served

Meaning of the command bits

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

Designation	Meaning
VAUX2P1X4Ch8Ch9	0: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 8 and channel 9 switchable via the process data
VAUX2P1X5Ch10Ch11	0: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 10 and channel 11 switchable via the process data
VAUX2P1X6Ch12Ch13	0: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 12 and channel 13 switchable via the process data
VAUX2P1X7Ch14Ch15	0: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 off 1: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 on 2: VAUX2 24 VDC power supply at Pin 1 of channel 14 and channel 15 switchable via the process data

8.11 RFID channels – overview of 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.	HF compact	HF extended	HF bus mode	UHF compact	UHF extended
Idle	0x0000	0	x	x	x	x	x
Inventory	0x0001	1	x	x	x	x	x
Inventory with loop counter	0x2001	8193	x	x	x	x	x
Read	0x0002	2	x	x	x	x	x
Read with loop counter	0x2002	8194	x	x	x	x	x
Write	0x0004	4	x	x	x	x	x
Write with loop counter	0x2004	8196	x	x	x	x	x
Change EPC length and write new EPC (UHF)	0x0007	7	–	–	–	x	x
Write and verify	0x0008	8	x	x	x	x	x
Continuous mode	0x0010	16	–	x*	x***	–	x
Read buffer (Cont. mode)	0x0011	17	–	x	x***	–	x
Read buffer (Cont. mode) with loop counter	0x2011	8209	–	x	x***	–	x
Stop Continuous (Presence Sensing) mode	0x0012	18	–	x*	x***	–	x
UHF continuous presence sensing mode	0x0020	32	–	–	–	–	x
HF read/write head off	0x0040	64	x	x	x	–	–
Read/write head identification	0x0041	65	x	x	x	x	x
Get UHF read/write head status/error	0x0042	66	–	–	–	x	x
Read error/status of UHF read/write head with loop counter	0x2042	8258	–	–	–	x	x
Tag info	0x0050	80	x	x	x	x	x
Tag info with loop counter	0x2050	8272	x	x	x	x	x
Direct read/write head command	0x0060	96	x	x	x	x	x
Direct read/write head command with loop counter	0x2060	8288	x	x	x	x	x
Get HF read/write head address	0x0070	112	–	–	x	–	–
Set HF read/write head address	0x0071	113	–	–	x	–	–
Tune HF read/write head	0x0080	128	x	x	x	–	–
Set read/write head password	0x0100	256	x**	x**	x**	x	x
Reset read/write head password	0x0101	257	x**	x**	x**	x	x

Command	Command code		Possible for				
	hex.	dec.	HF compact	HF extended	HF bus mode	UHF compact	UHF extended
Set tag password	0x0102	258	x**	x**	x**	x	x
Set tag protection with loop counter	0x2102	8450	x**	x**	x**	x	x
Set tag protection	0x0103	259	x**	x**	x**	x	x
Set tag protection with loop counter	0x2103	8451	x**	x**	x**	x	x
Get HF tag protection status	0x0104	260	x**	x**	x**	x	x
Set permanent lock	0x0105	261	x	x	x	x	x
Set permanent lock with loop counter	0x2105	8453	x	x	x	x	x
Kill UHF tag	0x0200	512	-	-	-	x	x
Kill UHF tag with loop counter	0x2200	8704	-	-	-	x	x
Restore settings UHF read/write head	0x1000	4096	-	-	-	x	x
Backup settings of the UHF read/write head	0x1001	4097	-	-	-	x	x
Reset	0x8000	32768	x	x	x	x	x

* With automatic tag type detection Continuous mode only supports the Inventory command.

** The command is only supported by the chip types EM42 and NXP SLIX2 tags.

*** The command is supported in HF continuous bus mode.

8.11.1 Command: Idle

The **Idle** command switches the interface to Idle mode. The command execution is aborted. If a tag is in the detection range of an HF read/write head and single-tag mode is set, the **Tag in detection range** bit is set and the UID of the tag is indicated by default in the read data area. The DTM (via EoE) and the configuration file (ESI file or xml device description) make it possible to set which data is read from the tag and displayed. The following options are possible:

- UID
- 8 bytes of user data memory
- UID and 8 bytes of user memory
- UID and 64 bytes of user memory
- Deactivated

The read data is overwritten with the next tag in the detection range.

In UHF applications the EPC is indicated if the reader is set directly in Presence sensing mode via the DTM (via EoE).

In HF bus mode, the address of the read/write head that read the data is also output.

**NOTE**

If the HF read/write head detects a new tag in the detection range, the **Tag present bit** (TP) and the data (UID and/or read data) are set via the **HF: Idle mode** (UID and/or read data) are displayed simultaneously. If two tags are detected in quick succession, the TP bit may remain set. The data of the second tag (UID and/or read data) is displayed.

Request	
Loop counter	Not required
Command code	0x0000 (hex.), 0 (dec.)
Read/write head address	Not required
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0000 (hex.), 0 (dec.)
Length	Length of the UID/EPC of the tag in the detection range
Error code	See description of the input data
Tag within the 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 fragments
Read fragment No.	Size of the fragments
Read data, Bytes 0...n	UID/EPC of the tag in the detection range

Example: UID, grouping deactivated, HF bus mode

Type	Name	Meaning
uint8_t	Data [8]	uint8_t UID [8]
uint8_t	Reserved	Reserved
uint8_t	Address	Address of the read/write head

Example: Successful read command (64 bytes), HF bus mode

Type	Name	Meaning
uint8_t	Data [64]	uint8_t Read data [64]
uint8_t	Reserved	Reserved
uint8_t	Address	Address of the read/write head

8.11.2 Command: Inventory

The **Inventory** command causes the read/write device to search for tags in the detection range and read the UID, EPC or RSSI of the tags if activated in the UHF reader. The Inventory command can be executed in Single-tag mode and in Multitag mode. NEXT mode is only possible in Single-tag mode.

**NOTE**

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

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Not required
Start address	1: Grouping of the EPCs active (only UHF) 0: Grouping of the EPCs inactive (only UHF)
Length	0: The actual length (bytes) of the transferred UID or EPC is transferred with an inventory. > 0 in HF applications: <ul style="list-style-type: none"> ■ 8: Return message 8 bytes UID ■ 1...7: Return message of an abbreviated UID ■ > 8: Error message -1: NEXT mode (only available in HF single-tag applications): An HF tag is always only read, written or protected if the UID is different to the UID of the last read or written tag. > 0 in UHF applications: EPC completely output.
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

See description of the input data, p. [▶ 111].

Response (HF)	
Loop counter	See description of the input data
Response code	0x0001 (hex.), 1 (dec.)
Length	Length of the read data in bytes
Error code	See description of the input data
Tag within the 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	UID

Response (UHF)	
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 within the 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 means of a header. The header has the following structure:

Type	Name	Meaning
uint8_t	Size	Data size
uint8_t	Block type	1: UID/EPC/RSSI etc. 2: Read data Other values: reserved
uint8_t	Data [size]	EPC/RSSI etc. or read data

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

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	12
uint8_t	Block type	1
uint8_t	Data [14]	uint8_t EPC [12]

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

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 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 [18]	uint8_t EPC [12] uint16_t RSSI [2] uint16_t Number of the read operations (LSB → MSB) [2]

Byte	Content	Meaning
0	Data size (EPC + number of read operations)	2 bytes header
1	UHF memory range	
3...13	EPC	12 bytes EPC
14	LSB	2 bytes RSSI
15	MSB	
16	LSB	2 bytes Number of read operations
17	MSB	

Example: UHF read data (header, EPC, grouping with RSSI, socket, 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 Socket (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of the read operations (LSB → MSB)

8.11.3 Command: Read

The **Read** command causes the read/write device to read the data of tags in the detection range. 128 bytes are transferred in a read operation by default. Larger data volumes can be transferred in fragments. If a particular UID or EPC is entered, the read/write device only reads the appropriate tags. All other tags in the detection range are ignored in this case.



NOTE

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

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Enter UID or EPC size in bytes, if a particular tag is to be read. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/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 to be read if an EPC is present in the write data -1: NEXT mode: A tag is always only read if the UID/EPC is different to the UID/EPC of the last read or written tag.
Start address	Start address of the memory area on the tag to be read (entry 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...(size of the UID/EPC - 1)	UID or EPC of the tag to be read
Write data, Byte (size of the EPC)...127	Not required

See description of the input data, p. [▶ 111].

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 within the 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, Bytes 0...n	Read data

8.11.4 Command: Write

The **Write** command causes the read/write device to write data to tags in the detection range. 128 bytes are transferred in a write operation by default. Larger data volumes can be transferred in fragments. If a particular UID or EPC is entered, the read/write device only writes the appropriate tags. All other tags in the detection range are ignored in this case.



NOTE

▶ With multitag applications enter the UID or EPC of the tag to be written.



NOTE

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

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Enter UID or EPC size in bytes, if a particular tag is to be written. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/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 to be written if an EPC is present in the write data -1: NEXT mode: A tag is always only written if the UID/EPC is different to the UID/EPC of the last read or written tag.
Start address	Start address of the memory area on the tag to be written (entry in bytes)
Length	Length of the data to be written in bytes
Command timeout	See description of the output data
Write fragment No.	1: Use fragmentation 0: Do not use fragmentation
Read fragment No.	0
Write data, Byte 0...(size of the UID/EPC - 1)	UID or EPC of the tag to be written
Write data, Byte (size of the EPC)...127	Write data

See description of the input data, p. [▶ 111].

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 within the 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

8.11.5 Command: Change EPC length and write new EPC (UHF)



NOTE

The maximum EPC length of a tag depends on the chip type. Refer to the appropriate data sheet for the length.

The **Change EPC length and write new EPC (UHF)** command causes the RFID module to automatically adapt the length for the EPC response set in the tag (change of the PC in the tag) and writes the EPC with this length to the tag. If a particular EPC is entered, the UHF reader only writes the appropriate tags. All other tags in the detection range are ignored in this case.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0007 (hex.), 7 (dec.)
Read/write head address	See description of the output data
Length of UID/EPC	Reserved bytes in the write data for the EPC 0: Do not address the tag, read any tags in the air interface
Start address	Not required
Length	Length of the data to be written in bytes; must be even and ≤ 62
Command timeout	Not required
Write fragment No.	See description of the output data
Read fragment No.	0
Write data, byte 0...(length of the UID/EPC - 1)	EPC of the tag to be written
Write data, byte (length of the UID/EPC)...127	New EPC with new length

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0007 (hex.), 7 (dec.)
Length	0
Error code	See description of the input data
Tag within the 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.	See description of the input data
Read fragment No.	See description of the input data
Read data, Byte 0...127	Not required

8.11.6 Command: Write and verify

The **Write and verify** command writes a number of bytes defined by the user. The written data is also sent back to the interface and verified. Up to 128 bytes are transferred by default in a write operation. Larger data volumes can be transferred in fragments. The written data is only verified in the interface and is not sent back to the controller. If the verification fails, an error message is output. If the command is processed without an error message, the data was verified successfully.

**NOTE**

▶ With multitag applications enter the UID or EPC of the tag to be written.

**NOTE**

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

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Enter UID or EPC size in bytes, if a particular tag is to be written. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/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 to be written if an EPC is present in the write data -1: NEXT mode: A tag is always only written if the UID/EPC is different to the UID/EPC of the last read or written tag.
Start address	Start address of the memory area on the tag to be written (entry in bytes)
Length	Length of the data to be written in bytes
Command timeout	See description of the output data
Write fragment No.	1: Use fragmentation 0: Do not use fragmentation
Read fragment No.	0
Write data, Byte 0...(size of the UID/EPC - 1)	Optional: UID or EPC of the tag to be written
Write data, Byte (size of the EPC)...127	Write data

See description of the input data, p. [▶ 111].

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 within the 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

8.11.7 Command: Continuous mode

**NOTE**

Continuous mode is only available in HF applications for single-tag applications. Automatic tag detection cannot be used in Continuous mode and a specific tag type must be selected.

In Continuous mode, a user-defined command is sent to the read/write device and saved in the read/write device. The command is executed continuously if a tag enters the detection field of the read/write device (self-triggered). In HF bus mode, all activated bus-capable read/write heads continuously execute the command simultaneously. With HF the following commands can be set in the parameters: **Write, Read, inventory, Tag info**. With UHF the commands **Write, read** and **Inventory** can be executed in Continuous mode. With UHF applications the parameters for Continuous mode must be set via the DTM directly in the UHF reader.

The command is continuously executed until the user terminates Continuous mode. Continuous mode can be terminated with a reset command.

**NOTE**

The reset command resets all read data. After Continuous mode is restarted, all data of the already running Continuous mode is deleted.

Read/write devices in Continuous mode send all command related 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 buffer (Cont. Mode)** command.

Commands in Continuous mode are triggered if the read/write device detects a tag. If there is a tag in the detection range of the read/write device when Continuous mode is started, the command sent in Continuous mode will not be executed until the next tag is present.

In Continuous mode the **Tag present at read/write head** signal is updated in the following cases:

- In Continuous mode (HF), if 3 is set as the start address
- In HF Continuous bus mode, if 0 or 1 is set as the start address

The **Tag present at read/write head** signal is not updated in Continuous mode for UHF readers.

**NOTE**

The HF parameters: Address in Continuous mode (ACM) and HF: Length in Continuous mode (LCM) cannot be changed when Continuous mode is running.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Not required
Start address	<p>UHF Inventory 0: Grouping of the EPCs inactive, continuous detection 1: Grouping of the EPCs active, continuous detection >1: Not defined</p> <p>HF Inventory 0: Grouping of the UIDs or USER data inactive, edge-triggered detection 1: Grouping of the UIDs or USER data active, edge-triggered detection 2: Not defined 3: Grouping of the UIDs or USER data active, continuous detection (time-triggered via bypass time), tag in detection range supported > 3: Not defined</p> <p>HF bus mode 0: Grouping of the UIDs or USER data inactive, continuous detection (time-triggered via bypass time), tag in detection range supported 1: Grouping of the UIDs or USER data active, continuous detection (time-triggered via bypass time), tag in detection range supported >2: Not defined</p>
Length	Not required
Command timeout	Not required
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

See description of the input data, p. [▶ 111].

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 within the detection range	See description of the input data
Data (bytes) available	Increases during command execution
Tag counter	Increases with each read or written UID/EPC
Write fragment No.	0
Read fragment No.	See description of the input data
Read data	See description of the input data

8.11.8 Command: Read buffer (Cont. mode)



NOTE

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

The **Get data from buffer (Cont. mode)** command can pass on data stored in the interface to the controller. Up to 16 Kbyte of data can be stored in a ring memory. Fetched data is deleted from the ring memory. 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 UID or EPC is not divided by fragment limits. If a UID or EPC does not fit completely in a fragment, it is automatically moved to the next fragment.



NOTE

The **Get data from buffer (Cont. mode)** command does not end Continuous mode.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Not required
Start address	Not required
Length	Max. length of the data to be read by the device (\leq 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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0011 (hex.), 17 (dec.)
Length	Length of the read data. The data is stated in complete blocks.
Error code	See description of the input data
Tag within the detection range	See description of the input data
Data (bytes) available	Is automatically decreased after the execution of the command
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 means of a header. The header has the following structure:

Type	Name	Meaning
uint8_t	Size	Data size
uint8_t	Block type	1: UID/EPC/RSSI etc. 2: Read data Other values: reserved
uint8_t	Data [size]	EPC/RSSI etc. or read data

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

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

Type	Name	Meaning
uint8_t	Size	12
uint8_t	Block type	1
uint8_t	Data [14]	uint8_t EPC [12]

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

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 read operations (LSB → MSB) [2]

Example: UHF read data (header, EPC, grouping with RSSI, socket, 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 Socket (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of the read operations (LSB → MSB)

Data format in HF applications

In HF applications the data is not formatted by means of a header. Some examples of HF data are listed below.

Example: UID, grouping deactivated

Type	Name	Meaning
uint8_t	Data [8]	uint8_t UID [8]

Example: UID, grouping activated

Type	Name	Meaning
uint8_t	Data [10]	uint8_t UID [8] uint16_t Number of the read operations

Example: Successful read command (64 bytes)

Type	Name	Meaning
uint8_t	Data [64]	uint8_t Read data [64]

Example: Successful write command

Type	Name	Meaning
uint8_t	Data [2]	uint16_t Error code 0x0000

Example: Error when writing data

Type	Name	Meaning
uint8_t	Data [2]	uint16_t Error code 0x0201

Example: UID, grouping deactivated, HF bus mode

Type	Name	Meaning
uint8_t	Data [8]	uint16_t UID [8]
uint8_t	Reserved	Reserved
uint8_t	Address	Address of the read/write head

Example: UID, grouping deactivated, HF bus mode

Type	Name	Meaning
uint8_t	Data [64]	uint16_t UID [64]
uint8_t	Reserved	Reserved
uint8_t	Address	Address of the read/write head

8.11.9 Command: Stop Continuous (presence sensing) mode

Continuous and presence sensing mode can be stopped via the **Stop Continuous (presence sensing) mode** command. The data stored in the buffer memory of the interface is not deleted and can still be queried by the controller via the **Read buffer (Cont. mode)** command.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0012 (hex.), 18 (dec.)
Read/write head address	Not required
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.10 Command: UHF continuous presence sensing mode

In Continuous presence sensing mode, a user-defined command (**Write, Read, Inventory**) can be sent to the UHF reader and saved there. 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 scan interval and the on time can be adjusted in the settings of the UHF reader. The command is continuously executed until the user terminates Continuous presence sensing mode by executing a reset command.

**NOTE**

The **Reset** command resets all read data.

Readers in Continuous presence mode send all command related data to the interface. The data is stored in the FIFO memory of the interface and can be queried by the controller via the **Read buffer (Cont. mode)** command. In Continuous presence sensing mode the **Tag in detection range** signal is not permanently updated.

See description of the output data, p. [▶ 120].

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 UID/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

See description of the input data, p. [▶ 111].

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 within the detection range	See description of the input data
Data (bytes) available	Increases during command execution
Tag counter	Increases with each read or written UID/EPC
Write fragment No.	0
Read fragment No.	See description of the input data
Read data	See description of the input data

8.11.11 Command: HF read/write head off

The **HF read/write head off** command enables HF read/write heads to be switched off until a write or read command is present. The switching on and off of the read/write heads may be necessary if the devices are mounted very closely together and the detection ranges overlap. When a command is executed the read/write heads are automatically reactivated. After the command is executed, the read/write head must be switched off again.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0040 (hex.), 64 (dec.)
Read/write head address	See description of the output data
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0040 (hex.), 64 (dec.)
Length	Not required
Error code	See description of the input data
Tag present at read/write head	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

8.11.12 Command: Read/write head identification

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

- ID
- Serial number
- Hardware version
- Firmware status

The parameters are contained in the read/write head in the identification record.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Not required
Start address	Start address in the identification record, stated in bytes
Length	Length of the data to be scanned 0: Read complete parameter set
Command timeout	Not required
Write fragment No.	Not required
Read fragment No.	See description of the output data
Write data	Not required

See description of the input data, p. [▶ 111].

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 within the 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 UID/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

8.11.13 Command: Get UHF read/write head status/error



NOTE

The command is only available for UHF applications.

The **Query error/status of UHF read/write head** command enables error/status messages of a connected UHF reader to be read.



NOTE

The command code for fast processing with the loop counter is 0x2042 (hex.) or 8258 (dec.).

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0042 (hex.), 66 (dec.)
Read/write head address	Not required
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x042 (hex.), 66 (dec.)
Length	See description of the input data
Error code	See description of the input data
Tag within the detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data

Response

Read data, Byte 0...(Length - 1)	<ul style="list-style-type: none"> ■ 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, returned 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	Read/write head was reset (after reset).
6	Read/write head 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

8.11.14 Command: Tag info



NOTE

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

The **Tag info** command enables the chip information of an HF tag to be queried. For HF applications the command is only available with automatic detection. In UHF applications the allocation class identifier, tag mask designer identifier and tag model number are queried. The data is queried from the GSI record of the tag.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response (HF)	
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 present at read/write head	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...7	UID, MSB (always 0xE0)
Read data, Byte 8	DSFID (data storage format identifier)
Read data, Byte 9	AFI (application identifier)
Read data, Byte 10	Memory size: Block number (0x00...0xFF)
Read data, Byte 11	Memory size: Byte/block (0x00...0x1F)
Read data, Byte 12	IC reference

See description of the input data, p. [▶ 111].

Response (UHF)	
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 present at read/write head	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...3	First 32 bytes of the TID (tag class, manufacturer and chip type)
Read data, Bytes 4...n	EPC (length variable)

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

8.11.15 Direct read/write head command



NOTE

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

A direct command enables commands from the read/write head log to be sent directly to the read/write device. The commands are defined and interpreted by the entries in the write and data.



NOTE

The read/write head protocol is not part of this documentation and must be requested from Turck and specially released. Send any inquiries about the read/write head protocol to Turck.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	0
Start address	Not required
Length	Length of the description of the direct command in the write data, entry 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

See description of the input data, p. [▶ 111].

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 within the 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 HF applications (query read/write head version)

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
Length of UID/EPC	0
Start address	0
Length	2
Command timeout	200
Write fragment No.	0
Read fragment No.	0
Write data	0xE0 (CC), 0x00 (CI) – see BL ident protocol
Response	
Loop counter	0
Response code	0x0060
Length	6
Error code	0
Tag within the detection range	0
Data (bytes) available	0
Tag counter	0
Write fragment No.	0
Read fragment No.	0
Read data	0xE0 (CC), 0x00 (CI), 0x04, 0x06, 0xA1, 0x77

The BL ident protocol enables the following information to be scanned with the described bytes:

- Byte 5 – read/write head ID: 4
- Byte 6 – Hardware version: 6
- Byte 7 – Software version : x.y, x (A1)
- Byte 8 – Software version x.y, y (0x77)
- The entire software version information consists of Byte 7 and Byte 8 (A1v77).

Example: Direct command in UHF applications (query read/write head version)

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
Length of UID/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 debug protocol
Response	
Loop counter	0
Response code	0x0060
Length	12
Error code	0
Tag within the 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 debug protocol enables the read data to be interpreted 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

Example: Direct command in UHF applications (set output power)

- ▶ Read the set power from the RAM of the reader.

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
Length of UID/EPC	0
Start address	0
Length	5
Command timeout	200
Write fragment No.	0
Read fragment No.	0
Write data	0x09 8A 4A 03 01

- ▶ Change output power: Write “30 dBm” power in the RAM and flash memory of the reader. The sixth byte of the write data sets the power in dBm as a hexadecimal value.

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
Length of UID/EPC	0
Start address	0
Length	6
Command timeout	200
Write fragment No.	0
Read fragment No.	0
Write data	0x09 8A 3C 03 01 1E

The following table provides assistance in converting the power values from dBm to mW.

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

8.11.16 Command: Get HF read/write head address



NOTE

The command is only available in HF bus mode.

The interface can query the addresses of all connected HF read/write heads via the **Get HF read/write head address** command. If a non-bus-compatible read/write head is connected, the device outputs an error message.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0070 (hex.), 112 (dec.)
Read/write head address	Not required
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0070 (hex.), 112 (dec.)
Length	Not required
Error code	See description of the input data
Tag present at read/write head	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...[number of the connected read/write heads]	Addresses of the connected read/write heads (uint8_t)
Read data, Byte [number of the connected read/write heads]...127	Not required

8.11.17 Command: Set HF read/write head address



NOTE

The command is only available in HF bus mode.
Only one single bus-compatible read/write head can be connected to the interface during command execution.
Deactivate read/write heads before manual addressing via the parameter data so that automatic address assignment is not executed.

The address of HF bus-compatible read/write heads can be set via the **Set HF read/write head address** command. Command execution does not depend on activation or an already set address of a read/write head. An already existing read/write head address is overwritten.

Permissible values are 0, 1...32, 68.

If a non-bus-compatible read/write head is connected, the device outputs an error message.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0071 (hex.), 113 (dec.)
Read/write head address	Not required
Length of UID/EPC	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	New read/write head address (uint8_t), permissible values: 0, 1...32, 68
Write data, Byte 1...127	Not required

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0071 (hex.), 113 (dec.)
Length	Not required
Error code	See description of the input data
Tag within the 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

8.11.18 Command: Tune HF read/write head



NOTE

The command is only available for the TNLR-... and TNSLR-... HF read/write heads.

The **Tune HF Read/write head** command enables HF read/write heads to be tuned automatically to their ambient conditions. The tuning values are saved until the next voltage reset in the read/write head.

HF read/write head tuning is carried out automatically by default after each voltage reset.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0080 (hex.), 128 (dec.)
Read/write head address	See description of the output data
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0080 (hex.), 128 (dec.)
Length	2
Error code	See description of the input data
Tag present at read/write head	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	Tuning value: TNLR-...: 0x00...0x0F TNSLR-...: 0x00...0x1F
Read data, Byte 1	Received voltage value (0x00...0xFF)

8.11.19 Command: Set read/write head password



NOTE

The command is only available for applications with UHF tags and the HF tags with chip types EM42... and NXP SLIX2.

The **Set read/write head password** command directly sets a password for write access, read access or a kill command. The password is stored temporarily in the memory of the read/write device. After the voltage of the read/write device is reset, the password must be set again in the read/write device. With UHF applications, the password is stored in the memory of the interface. The password stored in the read/write device is automatically sent with a write command, a read command or a kill command so that the command can be carried out on a protected tag.

The password function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag to 0: Set Multitag mode off**. In order to use the password function in HF applications, the password in the tag and the read/write head must match. The default password is 0000 and must be set first of all in the read/write head before a new password can be assigned ([▶ 169]). The command is supported for chip type NXP SLIX2 of HF read/write heads from firmware version Vx.98.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.20 Command: Reset read/write head password

**NOTE**

The command is only available for applications with UHF tags and the HF tags with chip types EM42... and NXP SLIX2.

The **Reset read/write head password** command directly resets the password for a write access, read access or kill command in the read/write device. The password function is switched off, there is no password exchange between the read/write device and the password.

The password function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag** to **0: Multitag mode off**.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.21 Command: Set tag password



NOTE

The command is only available for applications with UHF tags and the HF tags with chip types EM42... and NXP SLIX2.



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. Tag protection is not activated until the **Set tag protection** command has also been carried out. When sending the command, only one tag can be located in the detection range of the read/write device. 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.

The password function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag to 0: Set Multitag mode off**. In order to use the password function in HF applications, the password in the tag and the read/write head must match. The default password is 0000 and must be set first of all in the read/write head before a new password can be assigned ([▶ 166]). The command is supported for chip type NXP SLIX2 of HF read/write heads from firmware version Vx.98.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Enter UID or EPC size in bytes, if a particular tag is to be protected. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/EPC for executing the command. Only one tag can be located in the detection range of the read/write head. > 0: EPC length of the tag to be protected if an EPC is present in the write data -1: NEXT mode: A tag is always only protected if the UID/EPC is different to the UID/EPC of the last read or written tag.
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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.22 Command: Set tag protection

**NOTE**

The command is only available for applications with UHF tags and the HF tags with chip types EM42... and NXP SLIX2.

**NOTE**

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

The **Set tag protection** command defines password protection for the tag with a direct command. For this it has to be specified whether a write protection or a read protection should be set and the area of the tag to which 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 read/write device.

The password function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag to 0: Set Multitag mode off**.

Write protection is always also contained in a read protection.

The following restrictions apply to NXP-SLIX2 tags:

- The bits for the read and write protection must either be the same for the particular page or all read protection bits must be zero or all write protection bits must be zero.
- The bits must be set contiguously from any bit or any page to the last bit or last page (page 19).

Example: Bit 4 in the first byte to bit 3 in the third byte are set, i.e. page 4...19 (Block 16...79) are protected, page 0...3 (Block 0...15) are not protected.

Examples: FF FF 0F 00 FF FF 0F 00: all protected, FE FF 0F 00 FE FF 0F 00: all protected apart from page 0, 00 00 08 00 00 00 08 00: only last page protected

- Page size: 1 page = 4 blocks = 128 bits, exception: Page 19 only has 3 blocks = 96 bits (Block 79 is excluded from protection).

The error code 0x2502 is sent if the restrictions are not observed.

**NOTE**

A write protection for UHF tags cannot be undone.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	<p>Enter UID or EPC size in bytes, if a particular tag is to be protected. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used.</p> <p>0: The command is executed for the tag which is located in the detection range of the read/write device.</p> <p>> 0: EPC length of the tag to be protected if an EPC is present in the write data</p> <p>-1: NEXT mode: A tag is always only protected if the UID/EPC is different to the UID/EPC of the last read or written tag.</p>
Start address	Not required
Memory area	<p>Possible values:</p> <ul style="list-style-type: none"> ■ HF: USER memory (memory areas 1 and 3) ■ UHF: PC and EPC (memory area 1), USER memory (memory area 3) <p>UHF: The entire memory area selected is protected with a password.</p> <p>HF: Entry of the memory area not necessary. The pages of the memory area are selected via Byte 0...7 of the write data. A page consists of 4 blocks (16 bytes).</p>
Length	<p>UHF: 0 bytes</p> <p>HF: 8 bytes</p>
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	<p>HF:</p> <p>EM4233 SLIC/NXP SLIX2:</p> <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 0 ■ Bit 1: Write protection, Page 1 ■ Bit 2: Write protection, Page 2 ■ Bit 3: Write protection, Page 3 ■ Bit 4: Write protection, Page 4 ■ Bit 5: Write protection, Page 5 ■ Bit 6: Write protection, Page 6 ■ Bit 7: Write protection, Page 7 <p>UHF: Not required</p>

Request	
Write data, Byte 1	<p>HF: EM4233 SLIC: 0 NXP SLIX2:</p> <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 8 ■ Bit 1: Write protection, Page 9 ■ Bit 2: Write protection, Page 10 ■ Bit 3: Write protection, Page 11 ■ Bit 4: Write protection, Page 12 ■ Bit 5: Write protection, Page 13 ■ Bit 6: Write protection, Page 14 ■ Bit 7: Write protection, Page 15 <p>UHF: Not required</p>
Write data, Byte 2	<p>HF: EM4233 SLIC: 0 NXP SLIX2:</p> <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 16 ■ Bit 1: Write protection, Page 17 ■ Bit 2: Write protection, Page 18 ■ Bit 3: Write protection, Page 19 ■ Bit 4: Reserved ■ Bit 5: Reserved ■ Bit 6: Reserved ■ Bit 7: Reserved <p>UHF: Not required</p>
Write data, Byte 3	0
Write data, Byte 4	<p>HF: EM4233 SLIC/NXP SLIX2:</p> <ul style="list-style-type: none"> ■ Bit 0: Read protection, Page 0 ■ Bit 1: Read protection, Page 1 ■ Bit 2: Read protection, Page 2 ■ Bit 3: Read protection, Page 3 ■ Bit 4: Read protection, Page 4 ■ Bit 5: Read protection, Page 5 ■ Bit 6: Read protection, Page 6 ■ Bit 7: Read protection, Page 7 <p>UHF: Not required</p>
Write data, Byte 5	<p>HF: EM4233 SLIC: 0 NXP SLIX2:</p> <ul style="list-style-type: none"> ■ Bit 0: Read protection, Page 8 ■ Bit 1: Read protection, Page 9 ■ Bit 2: Read protection, Page 10 ■ Bit 3: Read protection, Page 11 ■ Bit 4: Read protection, Page 12 ■ Bit 5: Read protection, Page 13 ■ Bit 6: Read protection, Page 14 ■ Bit 7: Read protection, Page 15 <p>UHF: Not required</p>

Request	
Write data, Byte 6	HF: EM4233 SLIC: 0 NXP SLIX2: <ul style="list-style-type: none">■ Bit 0: Read protection, Page 16■ Bit 1: Read protection, Page 17■ Bit 2: Read protection, Page 18■ Bit 3: Read protection, Page 19■ Bit 4: Reserved■ Bit 5: Reserved■ Bit 6: Reserved■ Bit 7: Reserved UHF: Not required
Write data, Byte 7	0
Write data, Byte 8...127	Not required

See description of the input data, p. [▶ 111].

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 within the 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

8.11.23 Command: Get HF tag protection status

**NOTE**

The command is only available for applications with the HF tags with chip types EM42... and NXP SLIX2.

The **Get HF tag protection status** command queries with a direct command whether a specific area of the tag is password protected. When sending the command only one tag can be located in the detection range of the read/write head.

The password function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag to 0: Multitag mode off**.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0104 (hex.), 260 (dec.)
Read/write head address	See description of the output data
Length of UID/EPC	Enter UID or EPC size in bytes, if a particular tag is to be protected. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: The command is executed for the tag which is located in the detection range of the read/write head. > 0: EPC length of the tag to be protected if an EPC is present in the write data -1: NEXT mode: A tag is always only protected if the UID/EPC is different to the UID/EPC of the last read or written tag.
Start address	Not required
Length	8 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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0104 (hex.), 260 (dec.)
Length	Not required
Error code	See description of the input data
Tag within the 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	HF: EM4233 SLIC/NXP SLIX2: <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 0 ■ Bit 1: Write protection, Page 1 ■ Bit 2: Write protection, Page 2 ■ Bit 3: Write protection, Page 3 ■ Bit 4: Write protection, Page 4 ■ Bit 5: Write protection, Page 5 ■ Bit 6: Write protection, Page 6 ■ Bit 7: Write protection, Page 7 UHF: Not required
Read data, Byte 1	HF: EM4233 SLIC: 0 NXP SLIX2: <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 8 ■ Bit 1: Write protection, Page 9 ■ Bit 2: Write protection, Page 10 ■ Bit 3: Write protection, Page 11 ■ Bit 4: Write protection, Page 12 ■ Bit 5: Write protection, Page 13 ■ Bit 6: Write protection, Page 14 ■ Bit 7: Write protection, Page 15 UHF: Not required
Read data, Byte 2	HF: EM4233 SLIC: 0 NXP SLIX2: <ul style="list-style-type: none"> ■ Bit 0: Write protection, Page 16 ■ Bit 1: Write protection, Page 17 ■ Bit 2: Write protection, Page 18 ■ Bit 3: Write protection, Page 19 ■ Bit 4: Reserved ■ Bit 5: Reserved ■ Bit 6: Reserved ■ Bit 7: Reserved UHF: Not required
Read data, Byte 3	0

Response

Read data, Byte 4

HF:

EM4233 SLIC/NXP SLIX2:

- Bit 0: Read protection, Page 0
- Bit 1: Read protection, Page 1
- Bit 2: Read protection, Page 2
- Bit 3: Read protection, Page 3
- Bit 4: Read protection, Page 4
- Bit 5: Read protection, Page 5
- Bit 6: Read protection, Page 6
- Bit 7: Read protection, Page 7

UHF: Not required

Read data, Byte 5

HF:

EM4233 SLIC: 0

NXP SLIX2:

- Bit 0: Read protection, Page 8
- Bit 1: Read protection, Page 9
- Bit 2: Read protection, Page 10
- Bit 3: Read protection, Page 11
- Bit 4: Read protection, Page 12
- Bit 5: Read protection, Page 13
- Bit 6: Read protection, Page 14
- Bit 7: Read protection, Page 15

UHF: Not required

Read data, Byte 6

HF:

EM4233 SLIC: 0

NXP SLIX2:

- Bit 0: Read protection, Page 16
- Bit 1: Read protection, Page 17
- Bit 2: Read protection, Page 18
- Bit 3: Read protection, Page 19
- Bit 4: Reserved
- Bit 5: Reserved
- Bit 6: Reserved
- Bit 7: Reserved

UHF: Not required

Read data, Byte 7

0

8.11.24 Command: Set permanent lock



NOTE

The command code for fast processing with the loop counter is 0x2105 (hex.) or 8453 (dec.).

The **Set perma lock** command permanently sets a complete memory block of the tag with a direct command and permanently locks it. When sending the command, only one tag can be located in the detection range of the read/write device.

The function is only available in HF applications in single-tag mode. An error message is output with multitag applications. To troubleshoot set the **HF: Multitag to 0: Set Multitag mode off**.

See description of the output data, p. [▶ 120].

Request	
Loop counter	See description of the output data
Command code	0x0105 (hex.), 261 (dec.)
Read/write head address	See description of the output data
Length of UID/EPC	0: The command is executed for the tag which is located in the detection range of the read/write device. > 0: EPC or UID length of the tag to be locked if an EPC or UID is present in the write data -1: NEXT mode: A tag is always only protected if the UID/EPC is different to the UID/EPC of the last read or written tag.
Start address	UHF: Not required HF: Address of the first bit in the block to be locked (EEPROM tag: 0, 4, 8, ..., FRAM tag: 0, 8, 16, ...)
Memory area	Possible values: <ul style="list-style-type: none"> ■ HF: USER memory (memory areas 1... 4) ■ UHF: Kill password (memory area 1), PC and EPC (memory area 1), USER memory (memory area 3) Access password (memory area 4) UHF: The entire memory area selected is locked irrevocably from write access. Kill password and access password are also locked irrevocably from read access. HF: Entry of the memory area not necessary
Length	HF: Length of the data to be locked in bytes. Only multiples of the block size can be specified. 0: 1 Lock block UHF: 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

See description of the input data, p. [▶ 111].

Response	
Loop counter	See description of the input data
Response code	0x0105 (hex.), 261 (dec.)
Length	Not required
Error code	See description of the input data
Tag within the 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

8.11.25 Command: Kill UHF tag



NOTE

The command is only available for UHF applications.



NOTE

The command code for fast 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 undone. A Kill password must be set beforehand in order to execute a Kill command (see [▶ 197]).

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	Enter UID or EPC size in bytes if a particular tag is to be deleted. The UID or EPC must be defined in the write data. (start byte: 0). The function of the length of the UID/EPC depends on the command used. 0: No entry of a UID/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 to be deleted if an EPC is present in the write data -1: NEXT mode: A tag is always only deleted if the UID/EPC is different to the UID/EPC of the last read or written tag.
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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.26 Command: Restore settings UHF read/write head



NOTE

The command is only available for UHF applications.

The **Restore settings UHF read/write head** command restores the parameters of a connected UHF reader from a backup (e.g. after a device swap). Type and firmware version must be identical for both readers. To execute the command, a backup must be created beforehand via the **Backup settings UHF read/write head** command.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.27 Command: Backup settings UHF read/write head



NOTE

The command is only available for UHF applications.

The **Backup settings UHF read/write head** command saves the current settings of the connected reader in the memory of the interface. The backup is retained also after the voltage of the interface is reset. The **Restore settings UHF read/write head** command can restore the backup data when a device is swapped. Type and firmware version must be identical for both readers.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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

8.11.28 Command: Reset

The **Reset** command resets the read/write device and the interface. The input, output data and the buffer are cleared.

See description of the output data, p. [▶ 120].

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
Length of UID/EPC	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

See description of the input data, p. [▶ 111].

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 within the 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 module 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.

9.1.1 Typical times for command processing by the controller

The values shown in the following table are approximate values. The typical times for command execution depend on the following factors:

- Hardware configuration
- Software configuration
- Number of bus stations
- Bus cycle times

HF applications

Command	System cycle time	Required time	Dependence on factors such as protocol, system etc.
Read 8 bytes	4 ms	10 ms	≤ 20 %
Write 8 bytes	4 ms	10 ms	≤ 20 %
Read 128 bytes	4 ms	40 ms	≤ 20 %
Write 128 bytes	4 ms	50 ms	≤ 20 %
Read 1 Kbyte	4 ms	700 ms	≤ 20 %
Write 1 Kbyte	4 ms	800 ms	≤ 20 %
Inventory (4 tags)	4 ms	300 ms	≤ 10 %

HF bus mode

The time required for the cyclical processing of a command depends on the time in which the tag is located in the detection range of the read/write head (bypass time). The default setting is 48 ms. The bypass time can be set by the user. If a different bypass time is set, the difference to the time required for processing the command must be added to or deducted from it.

The time in which all read/write heads can be addressed once by the interface is calculated as follows:

Number of read/write heads × bypass time

This time corresponds to the update rate for the **Tag in detection range** bit and must be taken into account when calculating the total time for processing the command.

The Inventory command must be executed separately for all read/write heads.

Command	System cycle time	Required time	Dependence on factors such as protocol, system etc.
Read UID at a read/write head when rising edge TP, tag in detection range	4 ms	24 ms	The bypass time must be added, depending on the system cycle time.
Read 112 bytes of different read/write heads sequentially, default bypass time (48 ms)	4 ms	180 ms per read/write head	The time for accessing the individual read/write heads varies.

UHF applications

Command	System cycle time	Required time	Dependence on factors such as protocol, system etc.
Read 12 bytes EPC	4 ms	120...220 ms	Not detectable
Write 12 bytes EPC	4 ms	260...400 ms	Not detectable
Read 1 kByte	4 ms	2500 ms	≤ 20 %
Write 1 kByte	4 ms	7300 ms	≤ 20 %
Inventory (100 tags, read/write head in report mode, dynamic application)	4 ms	5500 ms	≤ 20 %

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 supported for fast execution commands.

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

9.4 HF applications – using Continuous mode

In Continuous mode (HF) the read/write head can read or write up to 64 bytes (see the table for user data areas of the HF tags).

The following parameters must be set in Continuous mode:

- Tag type
 - Command in Continuous mode
 - Length in Continuous mode
 - Start address
 - Optional: Start address in the process output data for activating the grouping
- ▶ With read or write command: Enter the tag type. Automatic tag detection is not possible.
 - ▶ Select the command in Continuous mode (CCM): Inventory, read, tag info and write are possible.
 - ▶ Enter the length in Continuous mode (LCM): Enter the length of the data to be read in bytes. The length must be a multiple of the block size of the tag used. The addressing of an odd byte number is not possible.
 - ▶ Enter the start address for the command in Continuous mode (ACM). The start address must be a multiple of the block size of the tag used. The addressing of an odd byte number is not possible.
 - ▶ For a write command enter the data to be written in the write data area.
 - ▶ Execute the **Continuous mode** command.
 - ⇒ The set command is preloaded and carried out for all active read/write heads as soon as a tag is in the field.
 - ▶ The data received from the read/write head is queried cyclically and stored in the FIFO memory of the interface.
 - ▶ Execute the **Idle** command (0x0000).
 - ▶ To pass on data from the FIFO memory of the interface to the controller, execute the **Get data from buffer (Cont. Mode)** command (0x0011). The length of the data must equal the value of the available data bytes (BYFI).
 - ▶ To end Continuous mode, execute the **End Continuous mode** command (0x0012).
- or
- ▶ To end Continuous mode and clear the FIFO memory of the interface, send the **Reset** command (0x0800).

9.5 HF applications – using HF Continuous bus mode

In HF Continuous bus mode, the read/write head can read or write up to 64 bytes (see the table for user data areas of the HF tags).

The following parameters must be set in Continuous mode:

- Tag type
- Command in Continuous mode
- Length in Continuous mode
- Start address for the command in Continuous mode
- Optional: Start address in the process output data for activating the grouping
 - ▶ With read or write command: Enter the tag type. Automatic tag detection is not possible.
 - ▶ Select the command in Continuous mode (CCM): Inventory, read, tag info and write are possible.
 - ▶ Enter the length in Continuous mode (LCM): Enter the length of the data to be read in bytes. The length must be a multiple of the block size of the tag used. Odd bytes cannot be addressed.
 - ▶ Enter the start address for the command in Continuous mode (ACM). The start address must be a multiple of the block size of the tag used. Refer to the table below for the block size of the tags. Odd bytes cannot be addressed.
 - ▶ Set the grouping function via the **Start address in the process output data** parameter if required: Set the value for the **Start address** parameter to 1. If the grouping function is activated and a UID or user data is still stored in the FIFO memory of the module, a UID or the same user data after the first read is no longer stored as a new read. With subsequent read operations only the address of the read/write head that has last read the tag and the number of read operations is updated.
 - ▶ For a write command enter the data to be written in the write data area.
 - ▶ Execute the **Continuous mode** command.
- ⇒ The set command is preloaded and carried out for all active read/write heads as soon as a tag is in the field.
- ▶ With the read command and when querying UIDs, the data received by the read/write head is polled cyclically and stored in the FIFO memory of the interface:

Type	Name	Meaning
uint8_t	data[8]	uint8_t UID [8]
uint8_t	Reserved	
uint8_t	Address	Read/write head address
uint16_t		Number of read operations (only if grouping is activated)

- ▶ Execute the **Idle** command (0x0000). The **Idle** command does not end Continuous mode.
- ▶ To pass on data from the FIFO memory of the interface to the controller, execute the **Get data from buffer (Cont. Mode)** command (0x0011). The address of the read/write head used is also transferred in addition to the read data. The length of the available data in the FIFO memory is displayed in the input data at **Data (bytes) available (BYFI)**. The length of the data must be consistent. Example: If UID, reserved byte and read/write head address are written to the FIFO memory for each tag, at least 10 bytes of data must be read from the buffer.



NOTE

Data in the FIFO memory is not overwritten until it was transferred to the controller. New read operations are appended in the FIFO memory of the interface.

- ▶ To end Continuous mode, execute the **End Continuous mode** command (0x0012).
- or

- ▶ To end Continuous mode and clear the FIFO memory of the interface, send the **Reset** command (0x0800).



NOTE

The data must be passed on regularly from the device to the parent level. No other data can be stored if the 16 Kbyte ring memory is full. The device outputs an error message.

User data areas of HF tags

Refer to the data sheets of the tags for the relevant chip types.

Chip type	User data area			Access	Bytes per block
	First block	Last block	Total memory in bytes		
NXP SLIX2	0x00	0x4E	320	Read/write	4
NXP Icode SLIX	0x00	0x1B	112	Read/write	4
NXP Icode SLIX-S	0x00	0x27	160	Read/write	4
NXP Icode SLIX-L	0x00	0x07	32	Read/write	4
Fujitsu MB89R118 Fujitsu MB89R118B	0x00	0xF9	2000	Read/write	8
Fujitsu MB89R112	0x00	0xFF	8192	Read/write	32
TI Tag-it HF-I Plus	0x00	0x3F	256	Read/write	4
TI Tag-it HF-I	0x00	0x07	32	Read/write	4
Infineon SRF55V02P	0x00	0x37	224	Read/write	4
Infineon SRF55V10P	0x00	0xF7	992	Read/write	4
EM4233	0x00	0x33	208	Read/write	4
EM4233 SLIC	0x00	0x1F	128	Read/write	4

9.6 Using HF bus mode

9.6.1 Executing commands in HF bus mode

Set parameter data:

- ▶ Select **HF Bus Mode**.
- ▶ Activate connected read/write heads.

Set the output data:

- ▶ Set the start address for the command.
- ▶ Set the required read/write head address.
- ▶ Enter the command code.
- ▶ Send the command to the read/write head.

9.6.2 Replacing bus-capable read/write heads

- ▶ Remove the faulty read/write head.
- ▶ Connect the new read/write head with the default address 68 and 0 (factory setting .../ C53).
- ▶ If multiple read/write heads are exchanged: connect the read/write heads in the order of the connection, i.e. connect the read/write head with the lowest address first.
- ⇒ The read/write heads are automatically assigned addresses in ascending order in the order of connection. The lowest address is automatically assigned to the next connected read/write head with the default address 68.
- ⇒ The addressing is successfully completed if the LED of the read/write head is permanently lit.

9.6.3 HF Continuous bus mode – data query and speed

All activated read/write heads are triggered within a bypass time + wait time. The command is permanently stored once in the activated read/write heads. The set command (e.g. Inventory, Read, Write) in Continuous mode is processed within this time. Only one read/write head sends data to the RFID interface during command execution of all activated read/write heads. The other read/write heads store the read data for a later query within the bus cycle of Continuous mode. When the same read/write head detects a new tag, the data in the buffer of a read/write head is overwritten if it was not yet sent to the RFID interface. The time must therefore be allowed until the data of all read/write heads has been fetched. The maximum time required for this is based on the formula **(bypass time + wait time) × number of activated read/write heads**.

Possibilities of optimizing the speed of HF Continuous bus mode:

- Reduce the bypass time to suit the application
- Reduce the data to the relevant part



NOTE

The repeated reading of the same tag is time-triggered. The grouping in the process output data can be activated in order to prevent the storing of the same UID or user data multiple times.

The read/write heads do not detect any tags between two queries and when sending data to the RFID interface. The following table describes the required wait times:

Command	Wait time
Inventory	15 ms
Read	25 ms
Write	35 ms

The default bypass time in HF Continuous bus mode is 48 ms.

The following table shows when commands (CMD) are executed and data is exchanged (DATA).

- CMD: Command is executed.
- DATA: Data exchange
- DATA or CMD: If data is stored on the read/write head, the data is sent to the RFID module. If no data is stored on the read/write head, the command is executed.

Read/write head	Pass 1	Pass 2	Pass 3	Pass n				
Address 1	DATA or CMD	No action	CMD	No action	CMD	No action	CMD	No action
Address 2	CMD	No action	DATA or CMD	No action	CMD	No action	CMD	No action
Address 3	CMD	No action	CMD	No action	DATA or CMD	No action	CMD	No action
Address n	CMD	No action	CMD	No action	CMD	No action	DATA or CMD	No action
Time	Bypass time	Wait time	Bypass time	Wait time	Bypass time	Wait time	Bypass time	Wait time

9.7 Possibilities for command execution in HF bus mode

There are three ways of querying the UID in HF bus mode.

- Using HF bus mode in Idle
- Using HF bus mode with any command
- Use HF Continuous bus mode with **Inventory**, **Read** or **Write**

The following tables describe the benefits of the particular applications.

Application	Functions	Notes
Using HF bus mode in Idle mode Inventory and/or Read	<ul style="list-style-type: none"> ■ No command via the controller required ■ UID and/or data with read/write head address is automatically displayed in the input data. 	<ul style="list-style-type: none"> ■ If the cycle time of the controller is the longer than the time until a new tag is in the detection range of a read/write head: Data loss possible. ■ Grouping of UIDs or user data only possible via the controller ■ Read/write heads are active in succession
Using HF bus mode with any command	<ul style="list-style-type: none"> ■ Commands must be sent to a read/write head individually. ■ UID or data are displayed in the input data. 	<ul style="list-style-type: none"> ■ Can only be used for static applications because only one read/write head can execute a command. ■ Grouping of UIDs or user data only possible via the controller ■ No overwriting of data: Only one read/write head performs the particular command. ■ Fragmenting of the data possible (max. 128 bytes per fragment)
Use HF Continuous bus mode with Inventory , Read or Write	<ul style="list-style-type: none"> ■ The command must be activated once by the controller. The read/write heads then execute the command simultaneously and continuously. ■ The read data is stored with the read/write head address in the 16 Kbyte ring memory of the RFID module ■ The Get data from buffer (Cont. Mode) command transfers the data to the controller. 	<ul style="list-style-type: none"> ■ The bus cycle time in Continuous mode must be shorter than the time until a new tag is in the detection range of the same read/write head. If a tag enters the detection range of a different read/write head, this has no effect. ■ Grouping in the RFID interface possible as long as the data was not yet sent to the controller ■ All read/write heads are activated and save data (max. 64 bytes per read/write head).

9.8 Using NEXT mode

NEXT mode can only be used in HF single-tag applications. An HF tag is always only read, written or protected if the UID is different to the UID of the last read or written tag.

9.8.1 Example: using NEXT mode for a read command

- ✓ Requirement: Tag A and tag B must have a different UID.
- ▶ Set read command in the process output data.
- ▶ Set NEXT mode: Enter the value -1 in the process output data at **Length UID/EPC**.

Tag A is located in the detection range of the read/write head. The controller sends a Read command in NEXT mode to the RFID interface.

The read command is transferred from the interface to the read/write head. The read/write head reads the data of tag A once.

The controller sends a second read command in NEXT mode to the RFID interface. The read command is not transferred from the interface to the read/write head as long as tag A is in the detection range of the read/write head.

The read command is transferred from the interface to the read/write head if tag B is in the detection range of the read/write head. The read/write head reads the data of tag B.

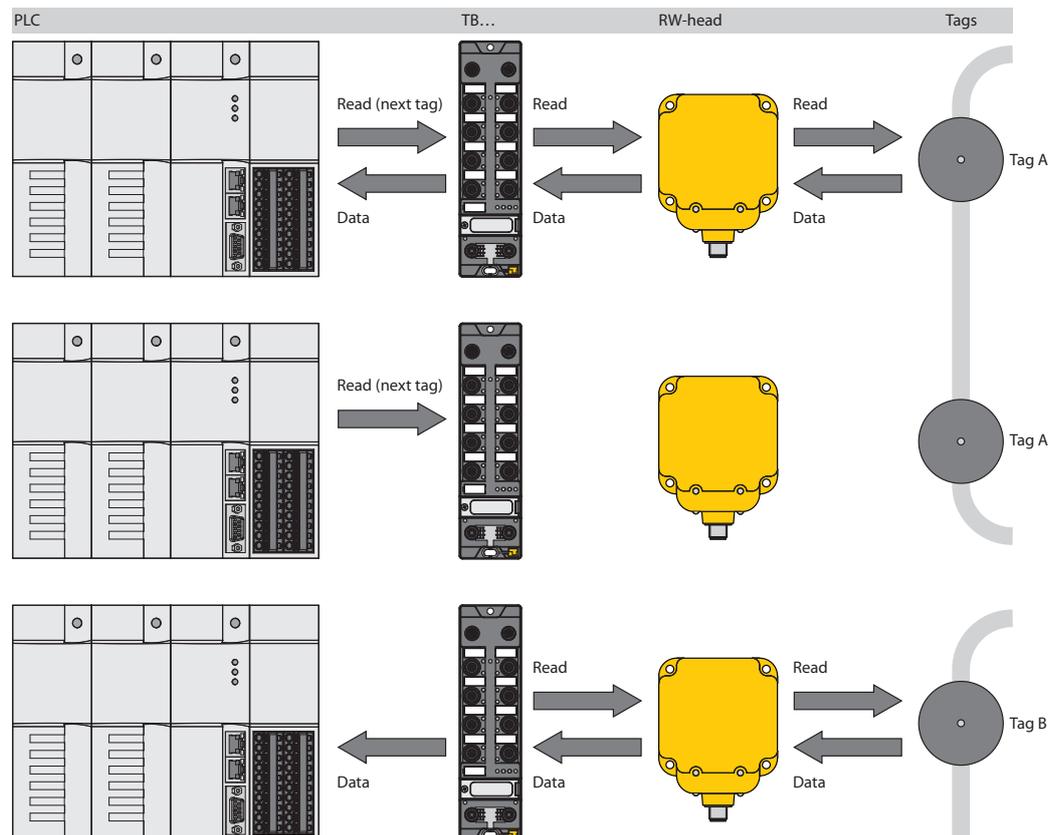


Fig. 92: NEXT mode (layout)

9.9 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.

9.9.1 Setting the access password

A temporary or permanent write protection for EPC and USER memory area can be set with an access password.

Setting temporary write protection for EPC and USER memory area

- ▶ Write access password with the following parameters to the tag:
 - Command code 0x0102 (**Set tag password**)
 - Password: 4 bytes in the output data
- ▶ Set access password with the following parameters in the UHF reader:
 - Command code 0x0100 (**Set read/write head password**)
 - Password: 4 bytes in the output data
- ▶ Protect individual memory areas with the following parameters:
 - Command code 0x0103 (**Set tag protection**)
 - Memory area: EPC or USER
- ▶ Protect access password from read access:
 - Command code 0x0105 (**Set permanent lock (Lock)**)
 - Memory area: Access



NOTE

If an incorrect access password is used for write attempts, the appropriate area cannot be written since the tag does not respond to the write command. The device does not output an error message.

Setting permanent write protection for EPC and USER memory area

- ▶ Write access password with the following parameters to the tag:
 - Command code 0x0102 (**Set tag password**)
 - Password: 4 bytes in the output data
- ▶ Set access password with the following parameters in the UHF reader:
 - Command code 0x0100 (**Set read/write head password**)
 - Password: 4 bytes in the output data
- ▶ Permanently protect EPC or USER memory with the following parameters:
 - Command code 0x0105 (**Set permanent lock (Lock)**)
 - Memory area: EPC or USER
- ▶ Protect access password from read access:
 - Command code 0x0105 (**Set permanent lock (Lock)**)
 - Memory area: Access



NOTE

After the **Lock** (0x0105) command is set to the EPC or USER memory area, the data can no longer be changed.

9.9.2 Setting the Kill password

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 undone. 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
- ▶ Kill tag:
 - Command code 0x0200 (**Kill**)



NOTE

The tag can also be protected with an access password [▶ 196], so that a Kill command can only be executed with a valid access password in tag and reader.

9.10 Using function blocks in CODESYS or TwinCAT

Three function blocks are provided for the simple integration in (existing) CODESYS or TwinCAT programs:

- FB_Compact
- FB_Extended
- FB_BusMode

Function block	Operation mode
FB_Compact	HF compact UHF compact
FB_Extended	HF extended UHF extended
FB_BusMode	HF bus mode

The CODESYS and TwinCAT library contain the following elements:

- Documentation
- Function blocks
- Enums
- Types/DUTs

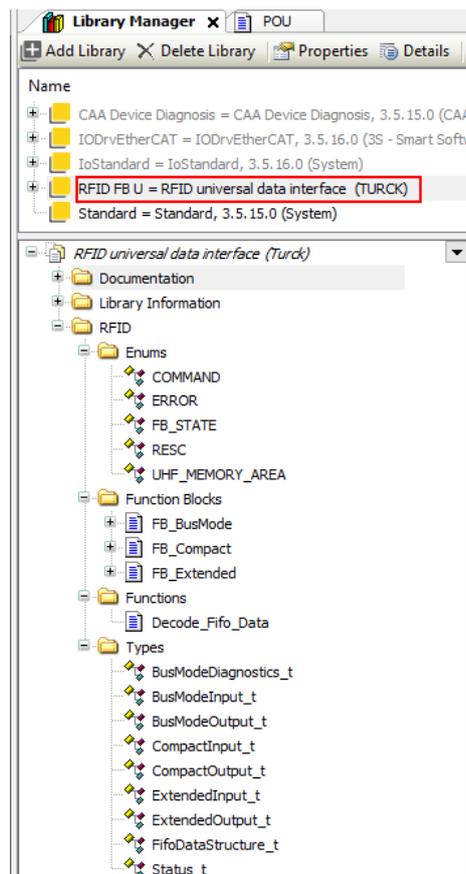


Fig. 93: CODESYS library

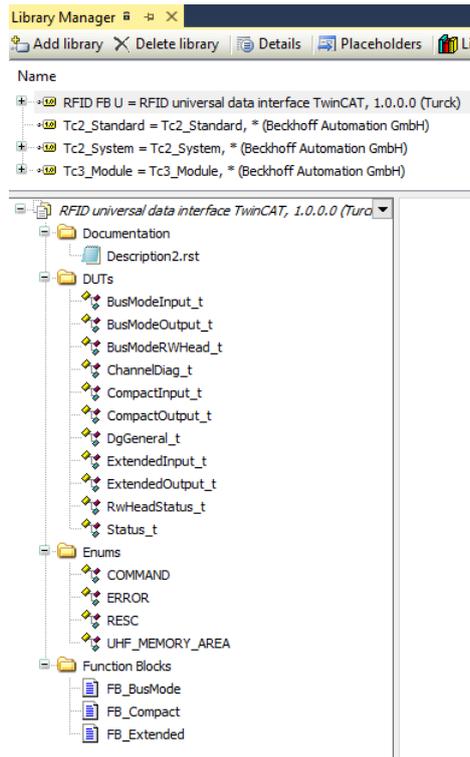


Fig. 94: TwinCAT library

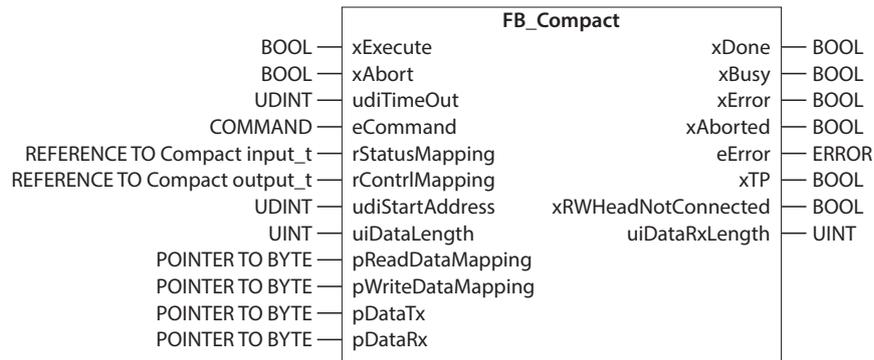


Fig. 95: FB_Compact function block

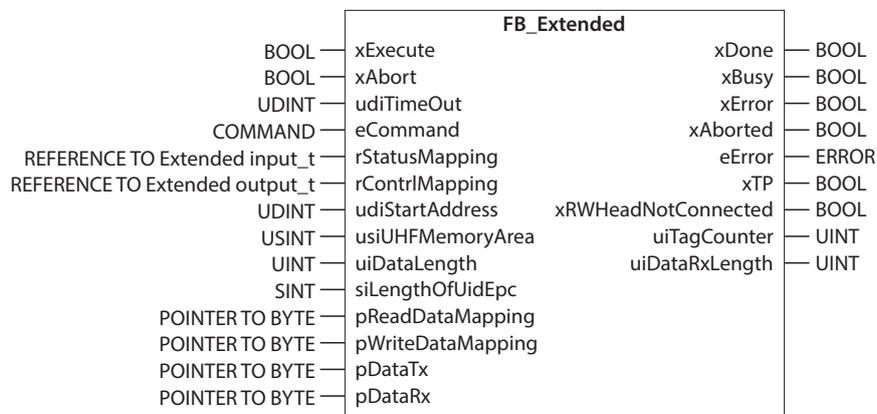


Fig. 96: FB_Extended function block

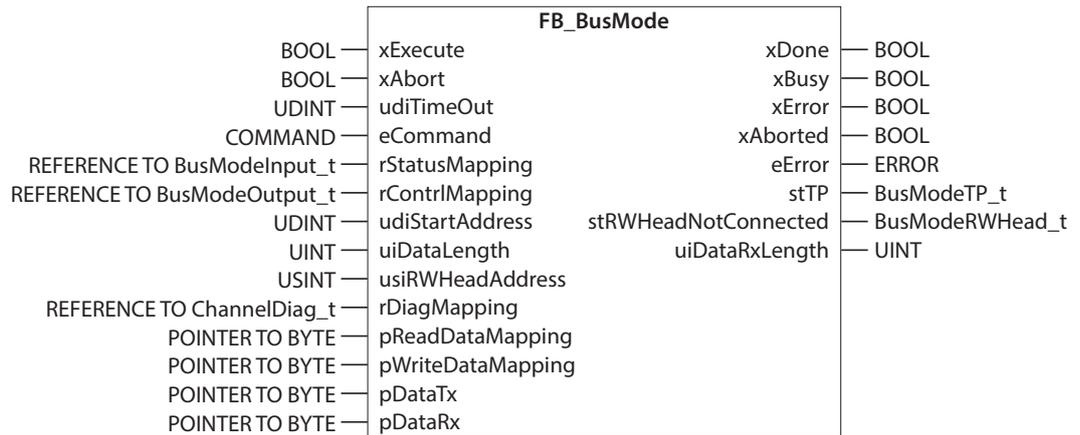


Fig. 97: FB_BusMode function block

Function blocks – Input variables

Name	Data type	Meaning
xExecute	BOOL	0 → 1 → 0: Execute command 1 → 0 → 1: Reset outputs The outputs can only be reset if an action was ended beforehand or aborted by the user or if an error occurred.
xAbort	BOOL	0 → 1 → 0: Abort command execution. All outputs are reset to the initial value.
udiTimeOut	UDINT	Time in μS, after which the function block automatically ends command execution
eCommand	COMMAND	Command code in hexadecimal format, [▶ 130]
rStatusMapping	REFERENCE TO Compact Input_t or Extended Input_t or BusMode Input_t	Start address of the process input data
rContrlMapping	REFERENCE TO Compact Output_t or Extended Output_t or BusMode Output_t	Start address of the process output data
udiStartAddress	UDINT	Start address for the selected command, e.g. start address in the memory of the tag
usiUHFMemoryArea	USINT	HF applications: <ul style="list-style-type: none"> ■ Domain 0...5: User area of the tag ■ Other: Reserved UHF applications: <ul style="list-style-type: none"> ■ Domain 0: Kill password ■ Domain 1: EPC ■ Domain 2: TID ■ Domain 3: User memory ■ Domain 4: Access password ■ Domain 5: PC (size of EPC) ■ Other: Reserved

Name	Data type	Meaning
uiDataLength	UINT	Length for the selected command, e.g. length of the data to be read or written
usiRWHeadAdress	USINT	Address of the read/write head that executes the command
siLengthOfUidEpc	SINT	Entry for the EPC or UID length for addressing a specific tag to be read or written. The UID or EPC must be defined in the write data. 0: Size of the EPC or UID not checked -1: NEXT mode: A tag is always only read if the UID or EPC is different to the UID or EPC of the last read or written tag. Only the values 0, -1 and 8 are possible in HF applications.
rDiagMapping	REFERENCE TO ChannelDiag_t	RFID diagnostic data
pReadDataMapping	POINTER TO BYTE	Start address in the input data (ARRAY[..] OF BYTE)
pWriteDataMapping	POINTER TO BYTE	Start address in the output data (ARRAY[..] OF BYTE)
pDataTx	POINTER TO BYTE	Write data (ARRAY[..] OF BYTE)
pDataRx	POINTER TO BYTE	Read data (ARRAY[..] OF BYTE)

Function blocks – Output variables

Name	Data type	Meaning
xDone	BOOL	1: Command successfully executed 0: Command not executed
xBusy	BOOL	1: Command active 0: No command active
xError	BOOL	1: Error detected, command execution aborted 0: No error detected
xAborted	BOOL	1: Command execution aborted by user 0: Command execution not aborted
eError	ERROR	Error code, [► 235]
xTP	BOOL	1: Tag within the detection range 0: No tag within the detection range
stTP	BusModeTP_t	1: Tag within the detection range 0: No tag within the detection range Each bit corresponds to a tag on an individual read/write head (max. 32 tags simultaneously).
xRWHeadNotConnected	BOOL	1: No read/write head connected 0: Read/write head connected
stRWHeadNotConnected	BusModeRW-Head_t	1: No read/write head connected 0: Read/write head connected Each bit corresponds to a read/write head (max. 32 read/write heads simultaneously).

Name	Data type	Meaning
uiTagCounter	UINT	Shows the number of detected tags. In HF multitag applications and in UHF applications, tags are only counted with an inventory command. In HF single-tag applications all tags are counted by the detected read/write head. The tag counter is reset after the following commands: <ul style="list-style-type: none"> ■ Inventory (exception: single-tag applications) ■ Continuous mode ■ Continuous presence sensing mode ■ Reset
uiDataRxLength	UINT	Length for the selected command, e.g. length of the data read or written
siLengthOfUidEpc	SINT	Entry for the EPC or UID length for addressing a specific tag to be read or written. The UID or EPC must be defined in the write data. 0: Size of the EPC or UID not checked -1: NEXT mode: A tag is always only read if the UID or EPC is different to the UID or EPC of the last read or written tag. Only the values 0, -1 and 8 are possible in HF applications.
pReadDataMapping	POINTER TO BYTE	Start address in the input data (ARRAY[..] OF BYTE)
pWriteDataMapping	POINTER TO BYTE	Start address in the output data (ARRAY[..] OF BYTE)
pDataTx	POINTER TO BYTE	Write data (ARRAY[..] OF BYTE)
pDataRx	POINTER TO BYTE	Read data (ARRAY[..] OF BYTE)

9.10.1 Incorporating a function block in CODESYS

In order to run the function block, the package file for RFID interfaces must be installed.

- ▶ Call the Package Manager in CODESYS: Click **Tools** → **Package Manager**.

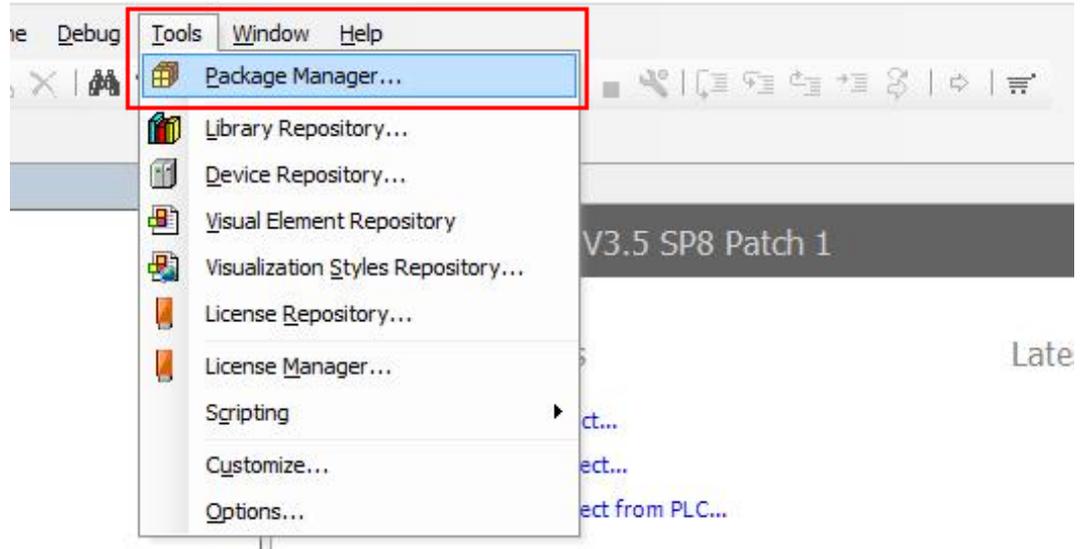


Fig. 98: Opening the Package Manager

- ▶ Select the package file for RFID interfaces and install.

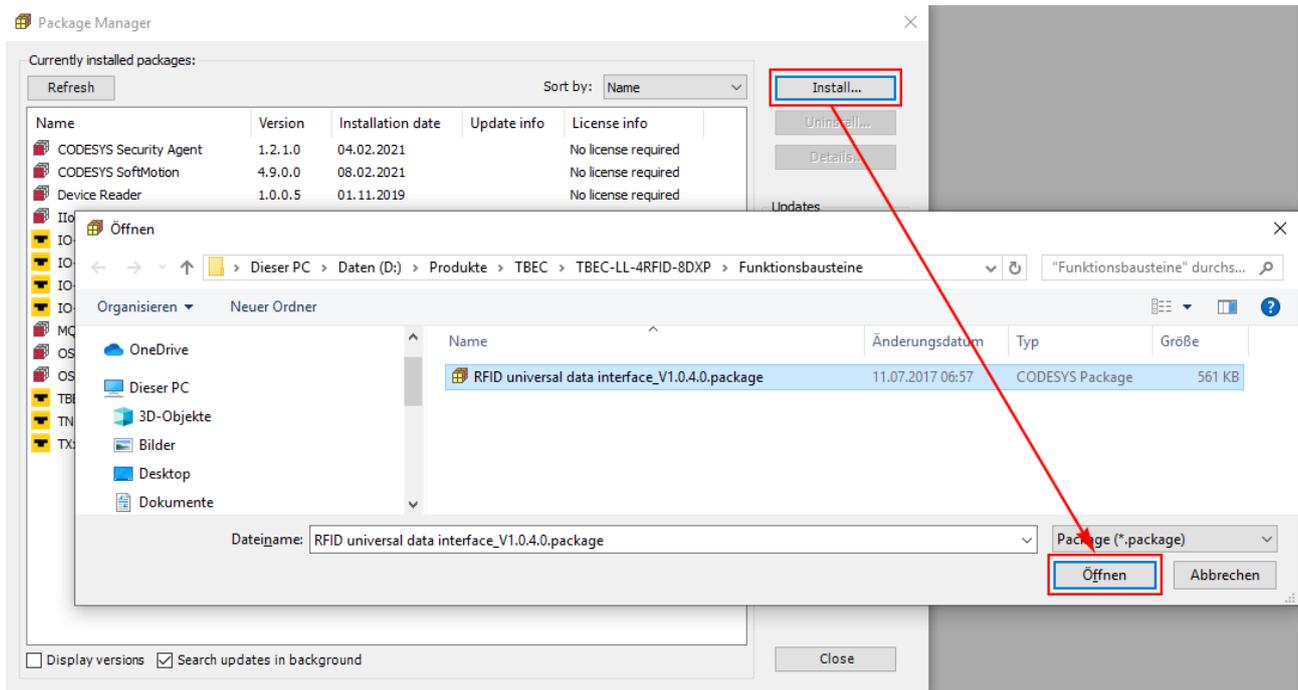


Fig. 99: Installing a Package file

After the installation has been successfully completed, the Package file is displayed as follows in the Package Manager:

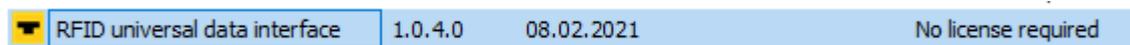


Fig. 100: Display of the Package file in the Package Manager

- ▶ Add the CODESYS library: Choose **Add Library** → **Turck** → **Application** → **RFID** → **RFID universal data interface**.
- ▶ Click **OK** to add the library to the project.

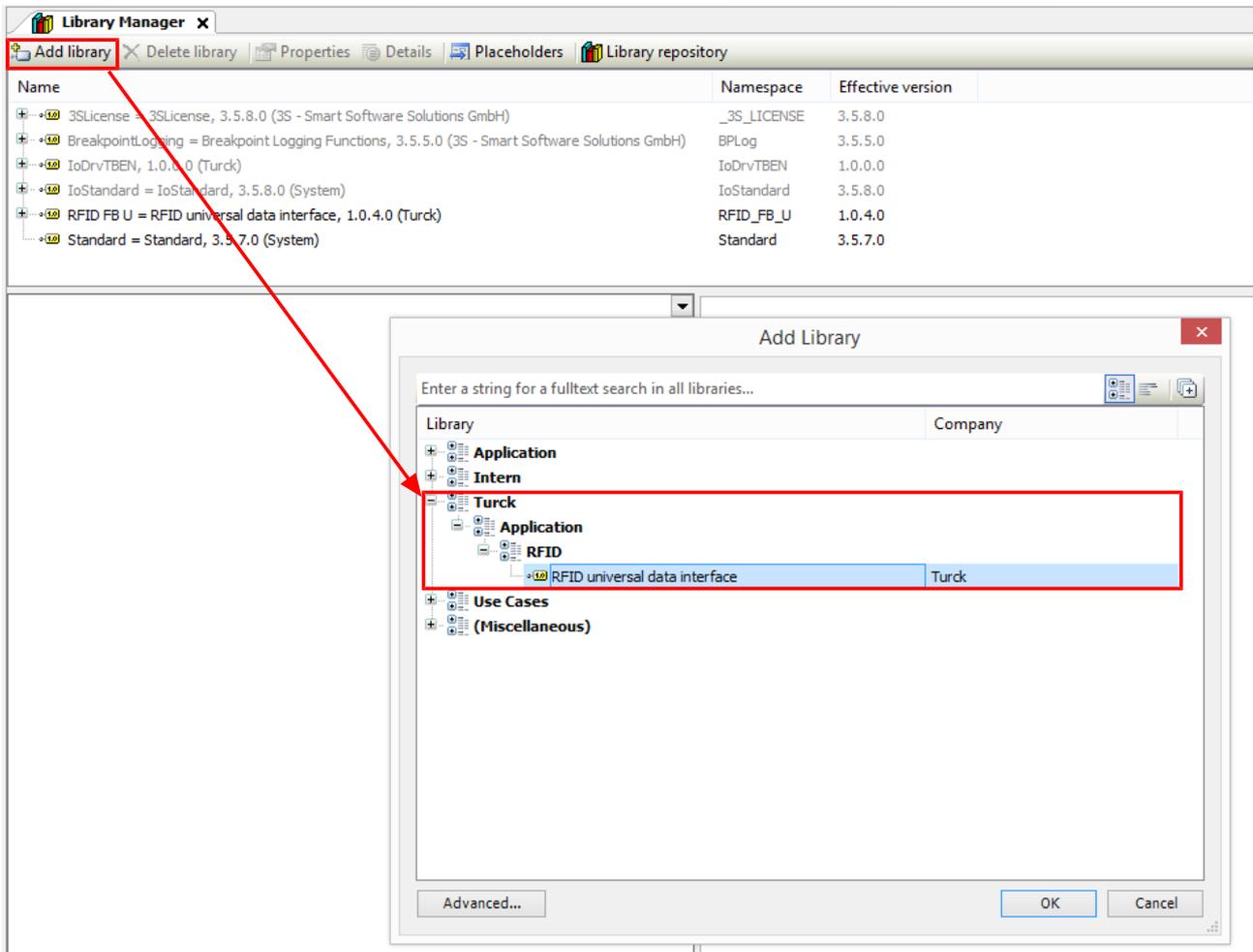


Fig. 101: Installing a CODESYS library

- ▶ Create program in which the function block can be called.
- ▶ Add **Box** from the CODESYS ToolBox to the project.
- ▶ Add **FB_BusMode**, **FB_Compact** or **FB_Extended** function block.

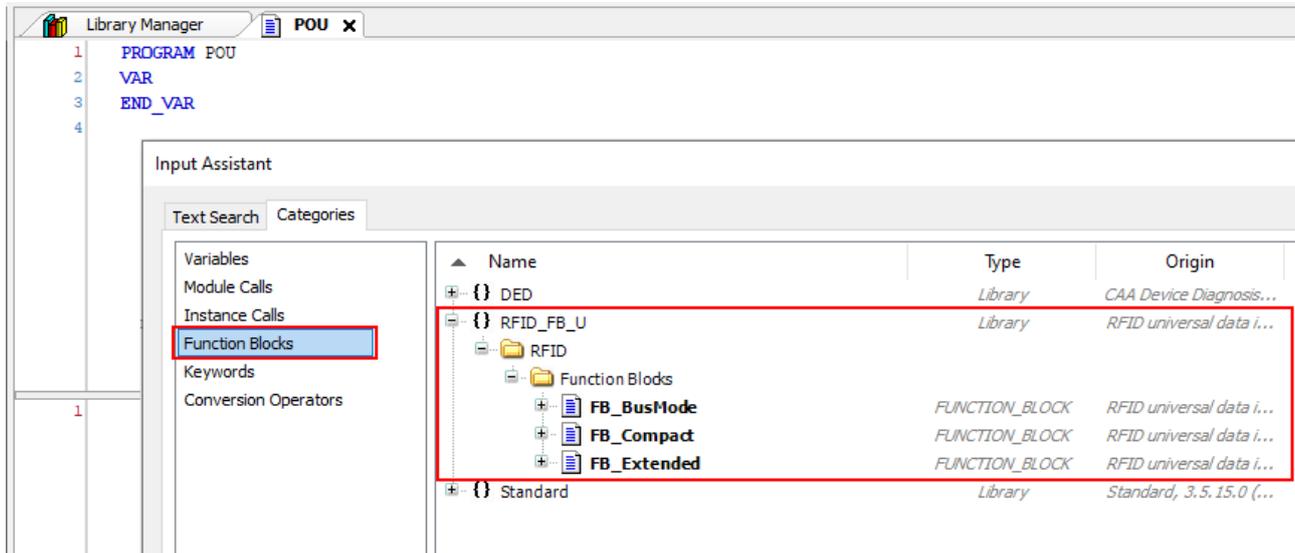


Fig. 102: Calling the CODESYS function block

Example: Connecting the FB_Extended function block (Ch0, read or write 128 bytes)

- ▶ Create the required instances for the function block: Map inputs and outputs directly to the addresses of the corresponding module registers.
- ▶ Activate the function block.

In the following example 128 bytes can be read or written from or to Ch0 via the function block. The input and output data and the write and read data is assigned in the example as follows:

Byte	Meaning
IB0	Start address of the process input data
QB0	Start address of the process output data
IB20	Address of the read data as array
QB20	Address of the write data as array

```

1  PROGRAM PRG_RFID_CH0
2  VAR
3      // initialise object of function block
4      fb_Ch0_RFID_U          : FB_Extended;
5      fb_Ch0_RFID_Error     : fbRfidErrCodeMessage;
6
7      //create arrays for read/write data
8      abyCh0_ReadData       : ARRAY[0..127] OF BYTE;
9      abyCh0_WriteData      : ARRAY[0..127] OF BYTE;
10
11     //create mapping to the I/O data of the corresponding channel
12     stCh0_ExtendedInputMapping  AT %IB0 : ExtendedInput_t;
13     stCh0_ExtendedOutputMapping AT %QB0 : ExtendedOutput_t;
14     abyCh0_RxDataMapping        AT %IB20 : ARRAY[0..127] OF BYTE;
15     abyCh0_TxDataMapping        AT %QB20 : ARRAY[0..127] OF BYTE;
16
17 END_VAR
18

```

Fig. 103: Activate the FB_Extended function block (example: Ch0, read or write 128 bytes)

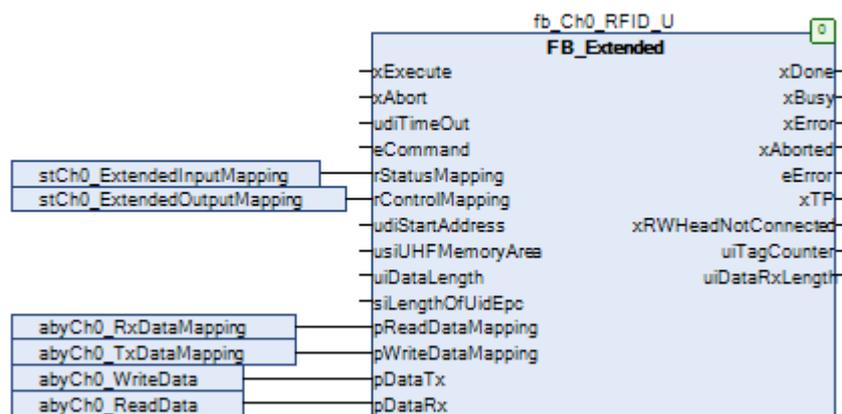


Fig. 104: FB_Extended function block – Overview of the inputs and outputs

**NOTE**

When using function blocks, the UID is not automatically displayed in Idle mode. The device does not have to be reset to Idle mode between two identical commands.

The FB_BusMode and FB_Compact function blocks must be connected in the same way as the FB_Extended function block. Further information is provided in the documentation in the CODESYS package.

9.10.2 Incorporating a function block in TwinCAT

To execute the function block, the library must be added in TwinCAT.

- ▶ Call Library Repository in TwinCAT: Click **PLC** → **Library Repository**.

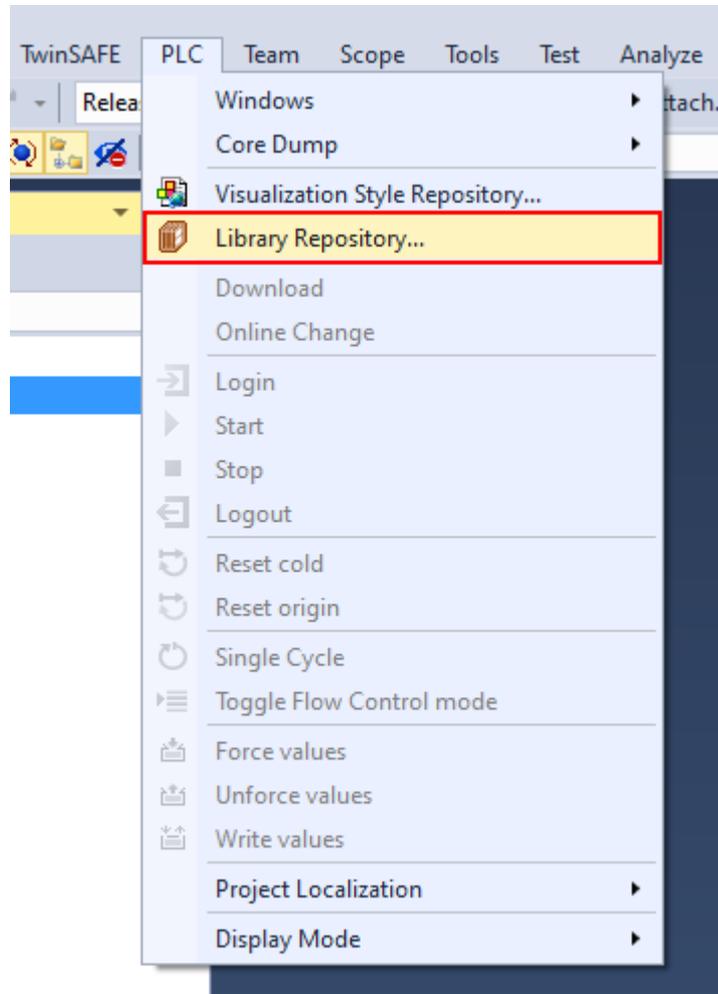


Fig. 105: Opening the Library Repository

- ▶ Select the library file for RFID interfaces and install.

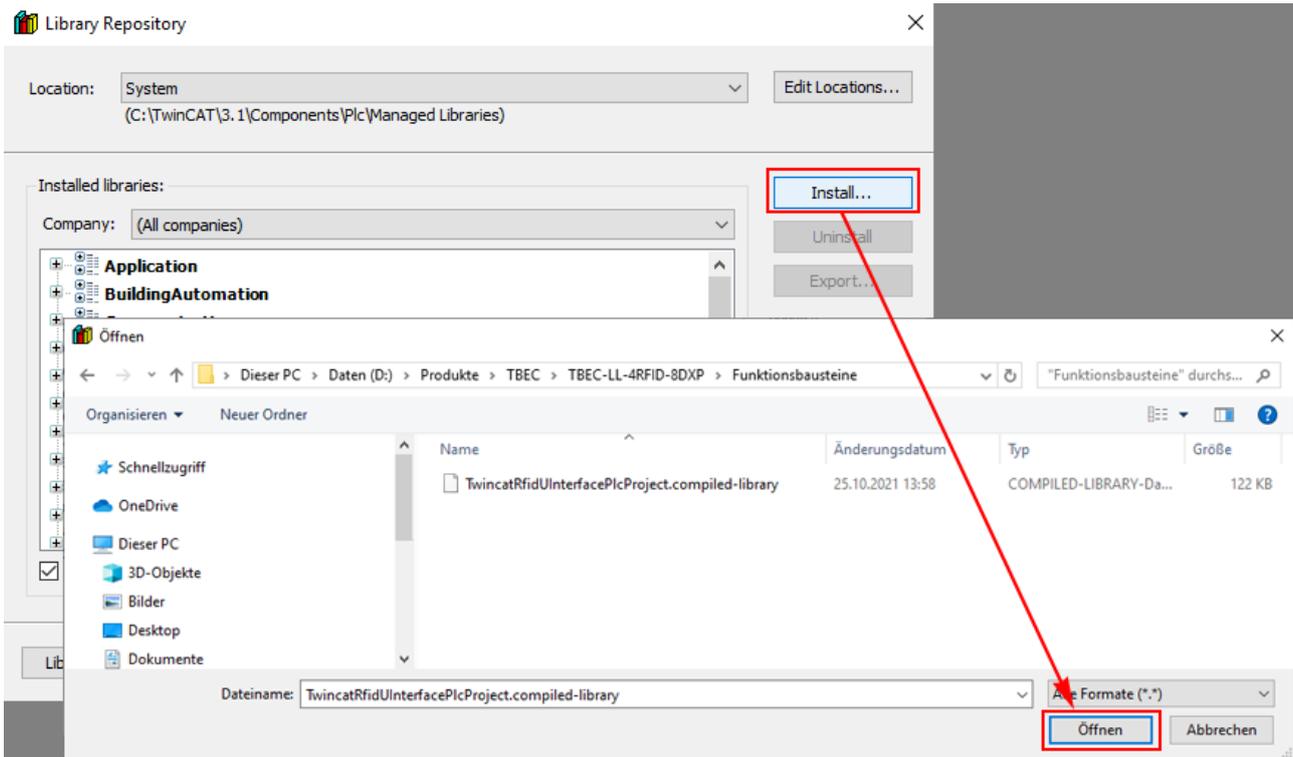


Fig. 106: Installing the Library file

- ▶ Add TwinCAT Library to the project: Right-click and select **References** → **Add Library** → **RFID universal data interface TwinCAT**.
- ▶ Click OK to add the library to the project.

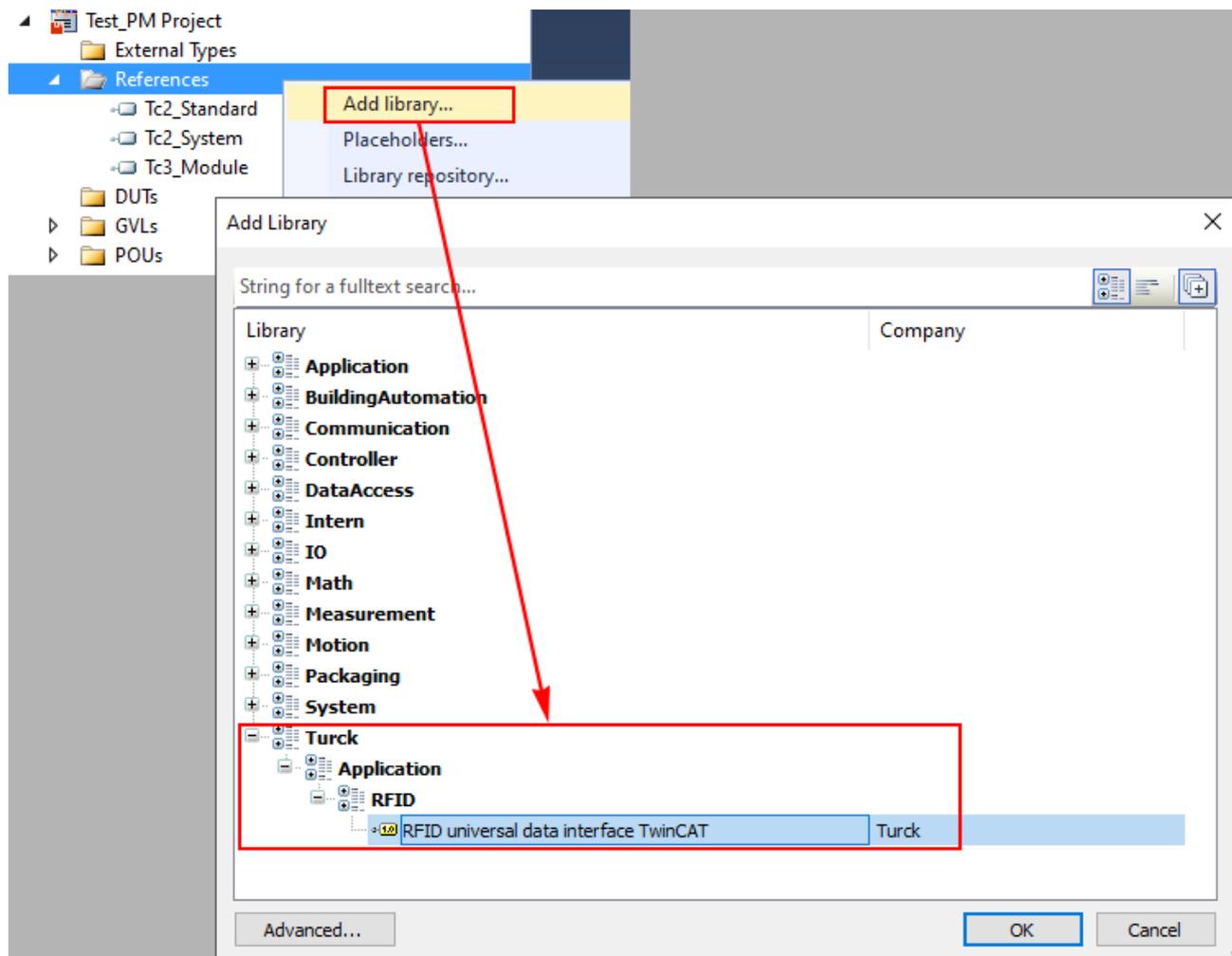


Fig. 107: Adding TwinCAT Library to the project

- ▶ Create program in which the function block can be called.
- ▶ Add FB_BusMode, FB_Compact or FB_Extended function blocks.

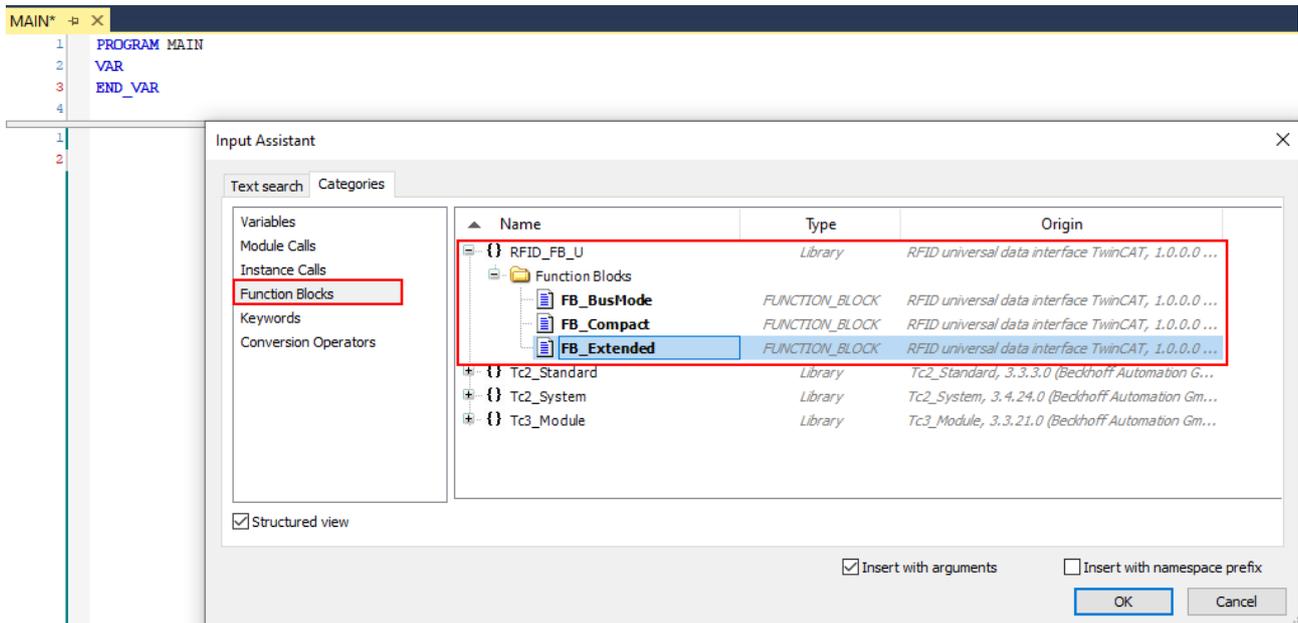


Fig. 108: Calling the TwinCAT function block

Example: Connecting the FB_Extended function block (Ch0, read or write 128 bytes)

- ▶ Create the required instances for the function block.

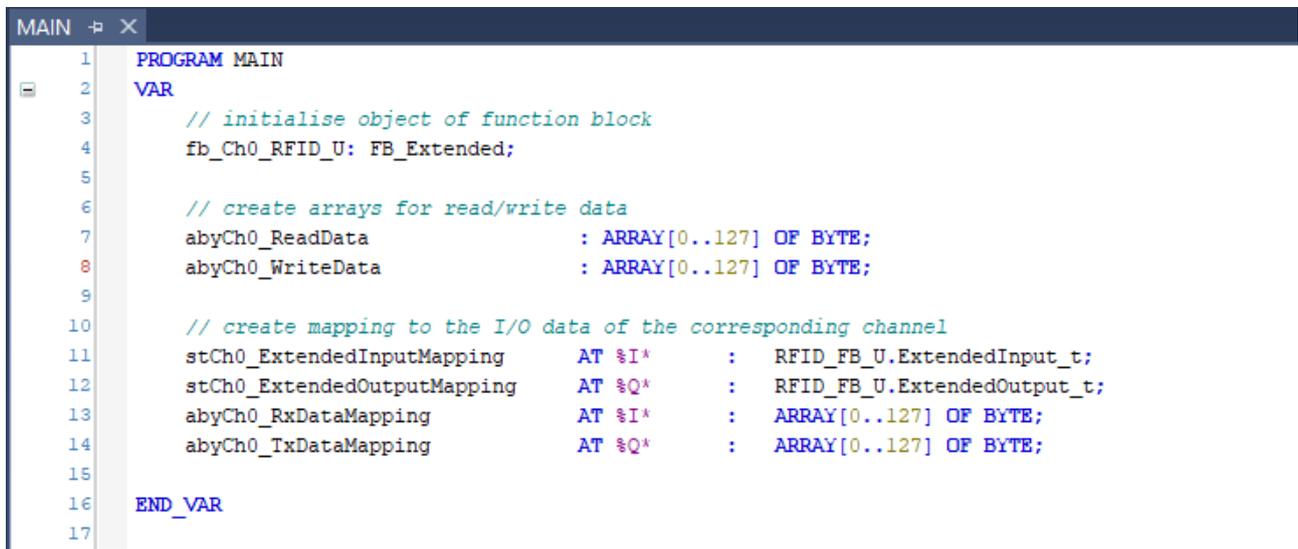


Fig. 109: Creating instances for the FB_Extended function block

- ▶ Compile the program.
- ⇒ The instances are created in the project tree.
- ▲ **Test_PM Instance**
 - ▲ **PlcTask Inputs**
 - ▶ MAIN.stCh0_ExtendedInputMapping
 - ▶ MAIN.abych0_RxDataMapping
 - ▲ **PlcTask Outputs**
 - ▶ MAIN.stCh0_ExtendedOutputMapping
 - ▶ MAIN.abych0_TxDataMapping

Fig. 110: Instances in the project tree

- ▶ Map instances with the module register: Right-click instance (here: **stCh0_ExtendedInputMapping**) → **Change Link**.
- ▶ in the **Attach Variable** window select the module to be linked (here: **Module 1**). The complete module address is visible with a mouse over.
- ▶ Confirm with **OK**.

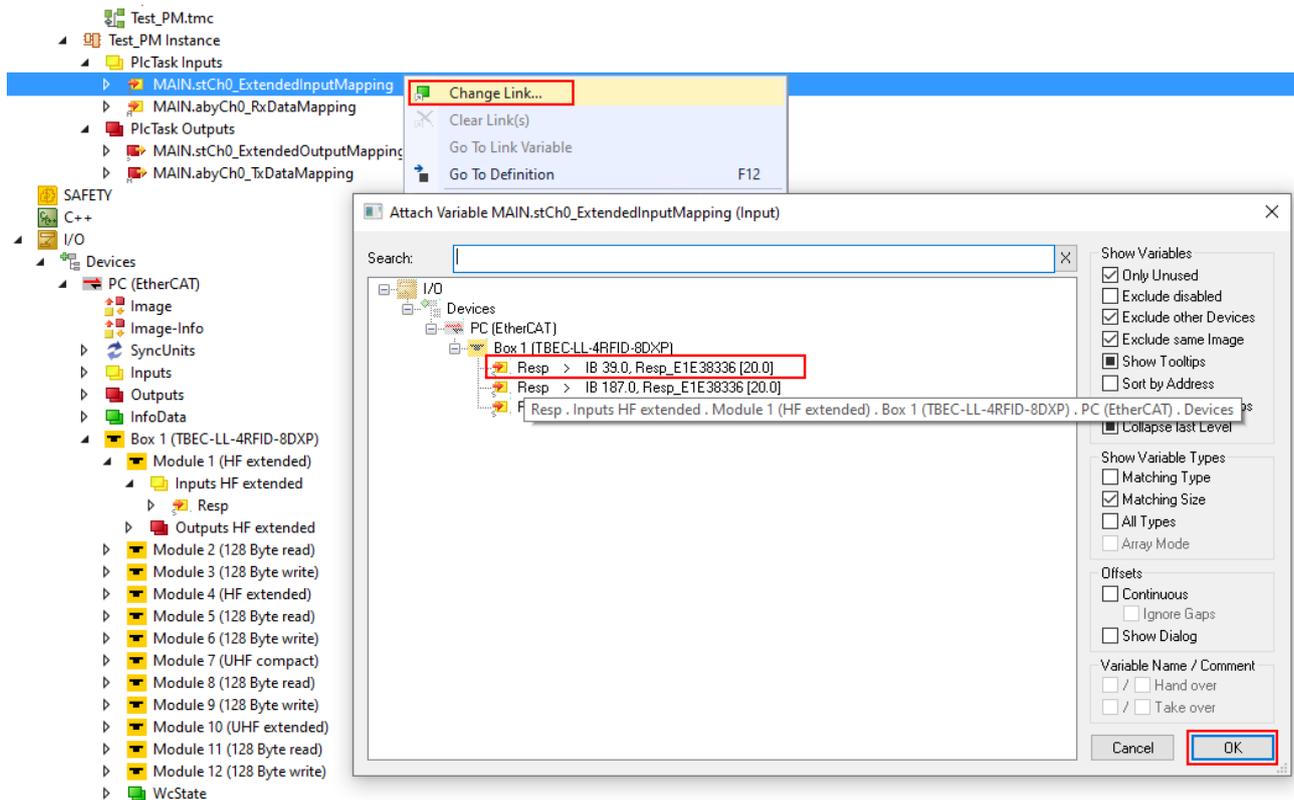


Fig. 111: Example: Linking an instance with the module register

The successful linking of the instance with the module is indicated by a small white arrow.

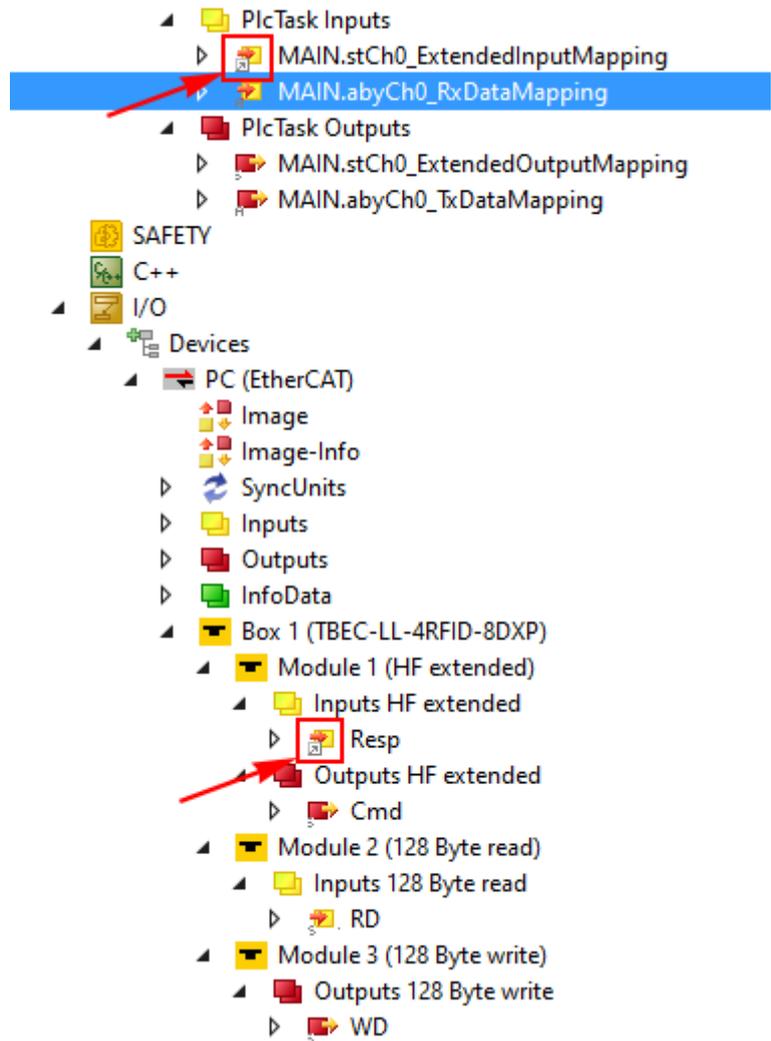


Fig. 112: Example: Successful linking between stCh0_ExtendedInputMapping and Resp

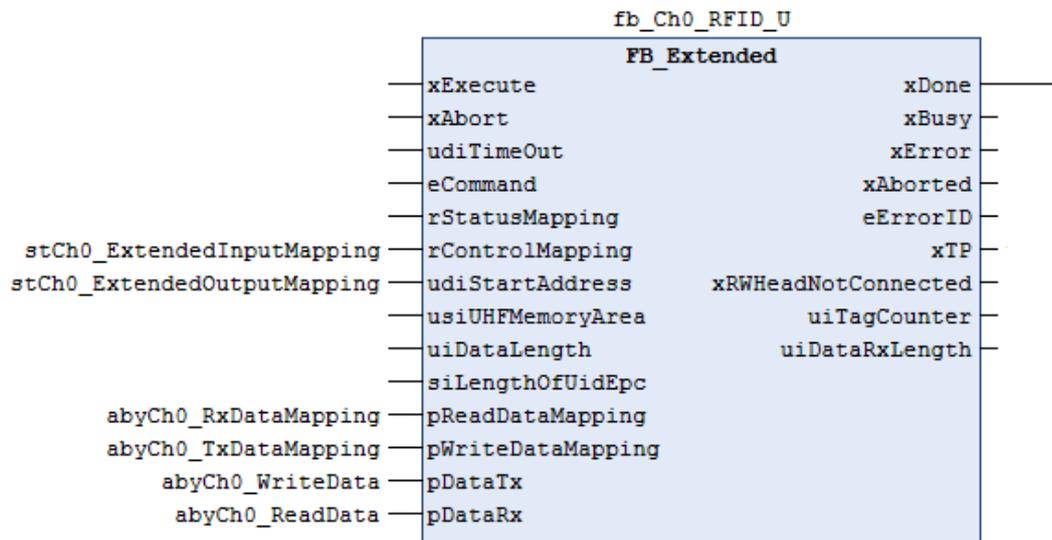


Fig. 113: Connecting an FB_Extended function block – overview of the inputs and outputs



NOTE

When using function blocks, the UID is not automatically displayed in Idle mode. The device does not have to be reset to Idle mode between two identical commands.

The FB_BusMode and FB_Compact function blocks must be connected in the same way as the FB_Extended function block. Refer to further information provided in the documentation in the TwinCAT Library.

9.11 Using Inventory command and Continuous (presence sensing) mode

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

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

Inventory	Continuous mode	Continuous presence sensing mode
Triggered reading of UIDs or EPCs	<ul style="list-style-type: none"> ■ Repeated reading of UIDs or EPCs ■ Automatic repetition of the same command (e.g. inventory, read, write) 	<ul style="list-style-type: none"> ■ UHF reader switches on as soon as a tag is detected ■ Repeated reading of UIDs or EPCs ■ Automatic repetition of the same command (e.g. inventory, read, write)
Data is displayed in the read data after the command has ended.	Data must be read from the memory of the interface with a separate command.	Data must be read from the memory of the interface with a separate command.
Grouping of EPCs possible	Grouping of EPCs possible	Grouping of EPCs possible
No buffering on the read/write device	No buffering on the read/write device	No buffering on the read/write device
Terminate command: 1. Timeout 2. Automatically after command execution	Terminate command: 1. Timeout 2. Terminating the Continuous (Presence Sensing) mode command or Reset	Terminate command: 1. Timeout 2. Terminating the Continuous (Presence Sensing) mode command or Reset

9.12 LEDs

The device has the following LED indicators:

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

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

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

LED INFO	Meaning
Off	No voltage connected
Red	Diagnostic message available
Green	No diagnostics
Orange	Firmware update running (see [▶ 245]“)

LED WINK	Meaning
White flashing	Wink command active

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

TP0...TP3 LEDs	Meaning
Off	No tag within the detection range
Green	Tag present at read/write head
Green flashing	Tag present at read/write head, command is processed
Red/green flashing (1 Hz)	Connection with DTM. No connection to controller active.
Red	Diagnostics present

CMD0...CMD3 LEDs	Meaning
Off	Read/write head off
Green	Read/write head on
Green flashing	BUSY (command active)
Red flashing	Interface memory full
Red	Error in the data interface

RFID channel LEDs	Meaning
TP... and CMD... flash simultaneously	Overload of the auxiliary voltage
TP... and CMD... flash alternately	Parameter error

DXP channel LEDs	Meaning (input)	Meaning (output)
Off	No input signal	Output not active
Green	Input signal present	Output active (max. 2 A)
Red	–	Actuator overload
Red flashing (1 Hz)	Overload of sensor supply	

9.13 Diagnostic data

9.13.1 Diagnostic data – RFID channels

If the **RFID diagnostics** module is fitted in the configuration software (see [▶ 223]), the diagnostics data of the RFID channels are also mapped to the process input data (CoE index 0x60C0...0x60CB, see [▶ 103]).

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				
Channel 1										
0xA030	0x20... 0x01	0...3	Assignment identical to channel 0 (0xA000...0xA002)							
0xA031	0x80... 0x01	0...15								
0xA032	0x80... 0x01	0...15								
Channel 2										
0xA060	0x20... 0x01	0...3	Assignment identical to channel 0 (0xA000...0xA002)							
0xA061	0x80... 0x01	0...15								
0xA062	0x80... 0x01	0...15								

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
Channel 3										
0xA090	0x20... 0x01	0...3	Assignment identical to channel 0 (0xA000...0xA002)							
0xA091	0x80... 0x01	0...15								
0xA092	0x80... 0x01	0...15								

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
TNC1...16 TNC17...32	Not connected to read/write Expected read/write head not connected (only functions in bus mode or with activated parameter HF: Heartbeat read/write head)
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 ...
XD1...16 XD17...32	Antenna detuned at HF read/write head ... HF read/write head ... detuned

9.13.2 Diagnostic data – digital channels

If the **DXP diagnostics** module is fitted in the configuration software (see [▶ 223]), the diagnostics data of the DXP channels are also mapped to the process input data (CoE index 0x60E0, [▶ 125]).

CoE index	CoE subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xA0D0	0x08... 0x01	0	VErrV2P1 X7Ch14 Ch15	VErrV2P1 X6Ch12 Ch13	VErrV2P1 X5Ch10 Ch11	VErrV2P1 X4Ch8 Ch9	Reserved	Reserved	Reserved	Reserved
	0x10... 0x09	1	Reserved							
	0x18... 0x11	2	Reserved							
	0x20... 0x19	3	ERR15	ERR14	ERR13	ERR12	ERR11	ERR10	ERR9	ERR8

Meaning of the diagnostic bits

Designation	Meaning
VErrV2P1X4Ch8Ch9	Overcurrent VAUX2 Pin1 X4 (Ch8/9) Overvoltage at power supply terminal VAUX2 at socket 4 (channels 8 and 9)
VErrV2P1X5Ch10Ch11	Overcurrent VAUX2 Pin1 X5 (Ch10/11) Overvoltage at power supply terminal VAUX2 at socket 5 (channels 10 and 11)
VErrV2P1X6Ch12Ch13	Overcurrent VAUX2 Pin1 X6 (Ch12/13) Overvoltage at power supply terminal VAUX2 at socket 6 (channels 12 and 13)
VErrV2P1X7Ch14Ch15	Overcurrent VAUX2 Pin1 X7 (Ch14/15) Overvoltage at power supply terminal VAUX2 at socket 7 (channels 14 and 15)
ERR...	Output overcurrent Ch... Overcurrent output K...

9.13.3 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.	ARGEE							
		0x10... 0x09	1	res.	FCE	res.						
		0x18... 0x11	2	V2	res.	DIAG						
		0x20... 0x19	3	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

9.14 Mapping diagnostics data in the process input data

Activating diagnostics data mapping in TwinCAT

- ▶ Double-click **Box 1 (TBEC-LL-4RFID-8DXP)** in the project folder explorer.
- ▶ Select the slot for RFID diagnostics (**RFID diagnostics**) on the **Slots** tab.
- ▶ Select **RFID diagnostics** in the right-hand window and click the Add button.

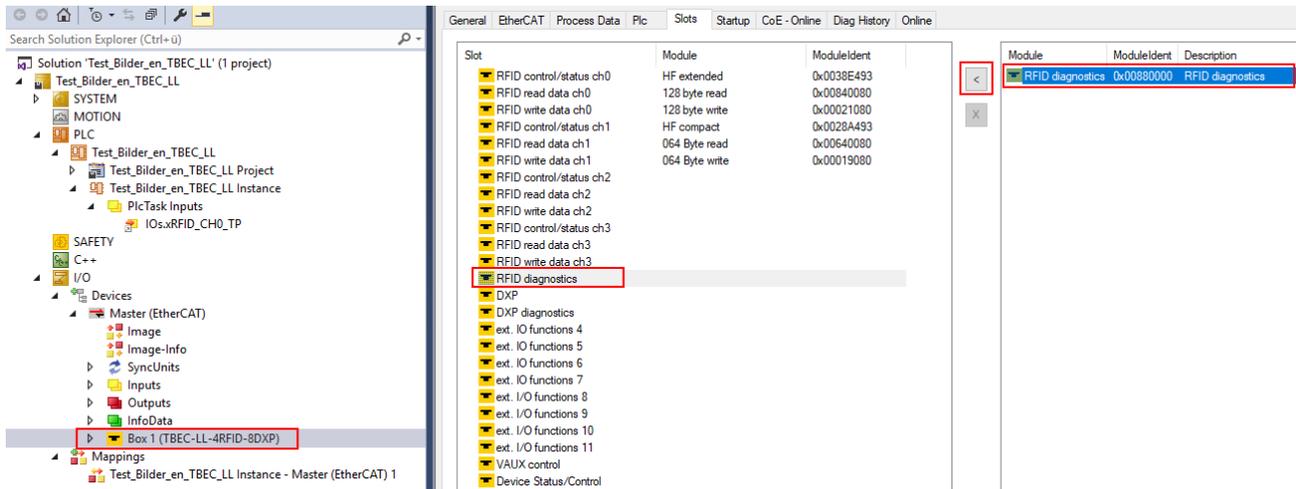
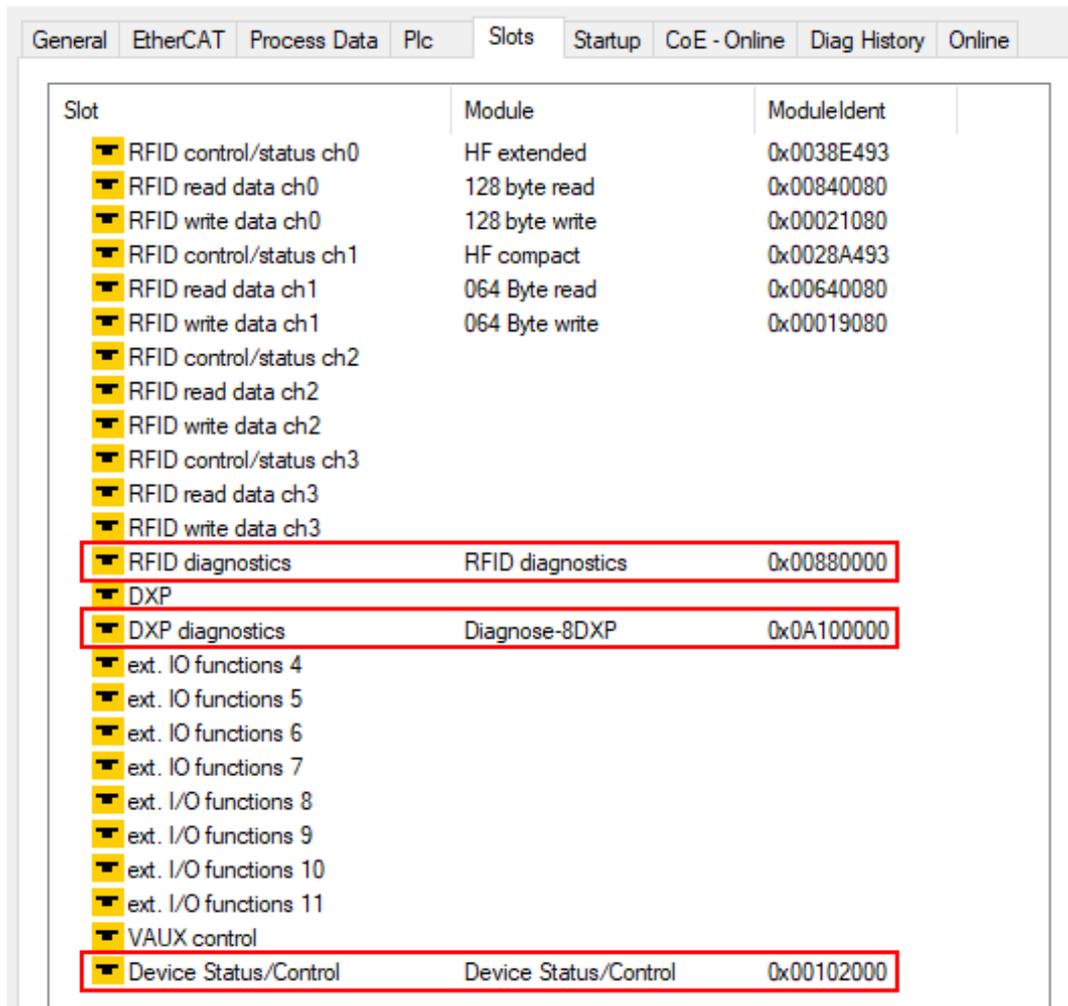


Fig. 114: TwinCAT – activating RFID diagnostics

- ▶ Select the slot for DXP diagnostics (**DXP diagnostics**) on the **Slots** tab.
- ▶ Select **DXP diagnostics** in the right-hand window and click the Add button.
- ▶ Select the slot for device status (**Device Status/Control**) on the **Slots** tab.
- ▶ Select **Device Status/Control** in the right-hand window and click the Add button.

⇒ The mapped diagnostics are displayed on the **Slots** tab.



Slot	Module	ModuleIdent
RFID control/status ch0	HF extended	0x0038E493
RFID read data ch0	128 byte read	0x00840080
RFID write data ch0	128 byte write	0x00021080
RFID control/status ch1	HF compact	0x0028A493
RFID read data ch1	064 Byte read	0x00640080
RFID write data ch1	064 Byte write	0x00019080
RFID control/status ch2		
RFID read data ch2		
RFID write data ch2		
RFID control/status ch3		
RFID read data ch3		
RFID write data ch3		
RFID diagnostics	RFID diagnostics	0x00880000
DXP		
DXP diagnostics	Diagnose-8DXP	0x0A100000
ext. IO functions 4		
ext. IO functions 5		
ext. IO functions 6		
ext. IO functions 7		
ext. I/O functions 8		
ext. I/O functions 9		
ext. I/O functions 10		
ext. I/O functions 11		
VAUX control		
Device Status/Control	Device Status/Control	0x00102000

Fig. 115: TwinCAT – mapped diagnostics

Activating diagnostics data mapping in CODESYS

- ▶ Include the device in an existing project and connect to the controller (example: CODESYS Control Win V3).
- ▶ Right-click slot 13 for the RFID diagnostics.
- ▶ Click **Plug device**.

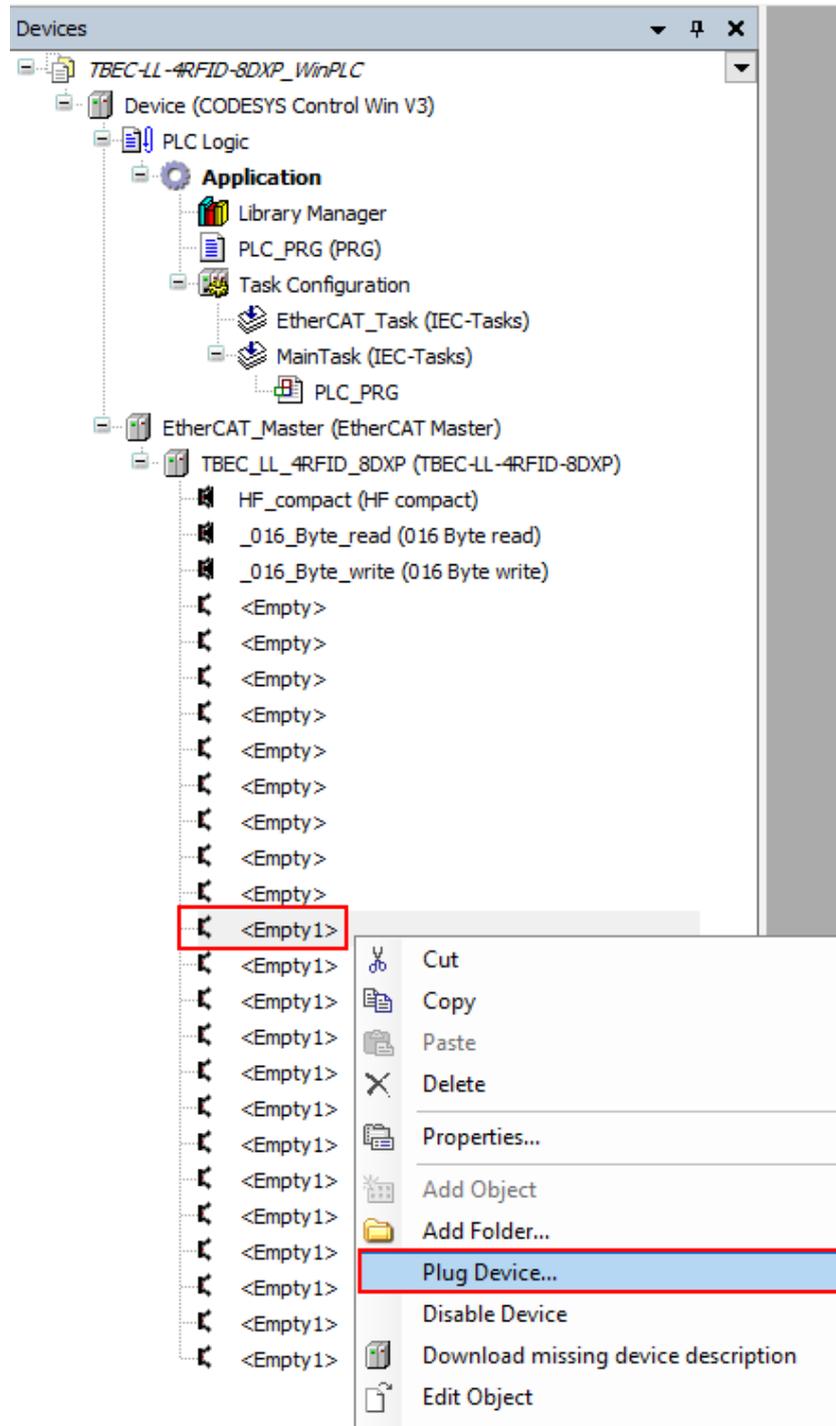


Fig. 116: CODESYS – selecting slot 13 for RFID diagnostics

- ▶ Click RFID diagnostics.

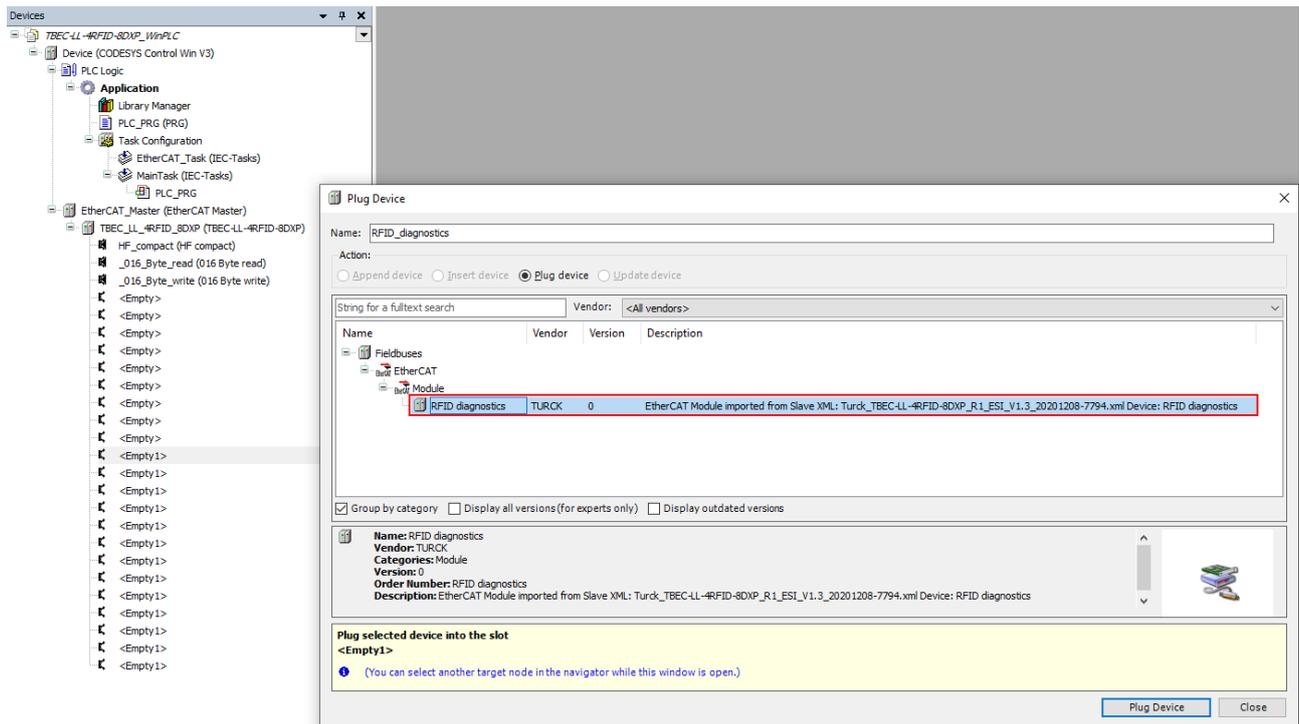


Fig. 117: CODESYS – selecting RFID diagnostics

- ▶ Do not close the window.
- ▶ Select slot 15 for DXP diagnostics.
- ▶ Select DXP diagnostics and confirm with **Plug device**.

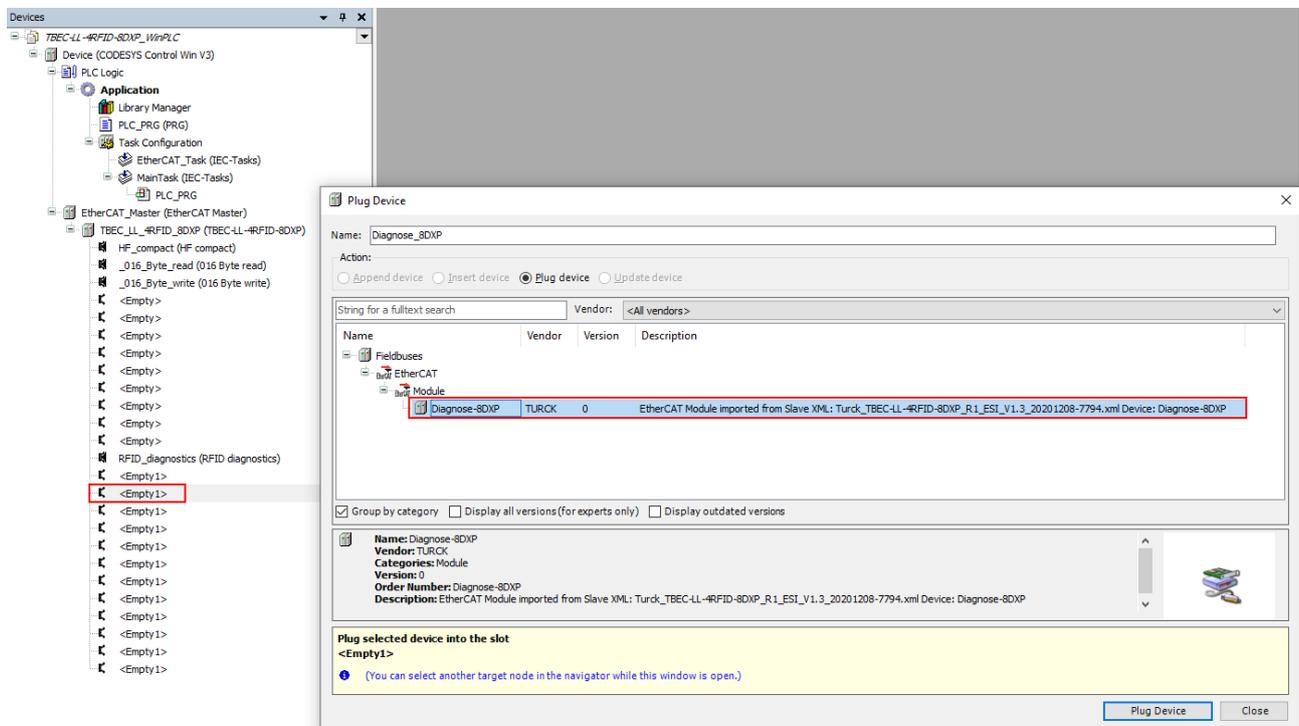


Fig. 118: CODESYS – selecting DXP diagnostics

- ▶ Do not close the window.
- ▶ Select the last slot for device status/control.
- ▶ **Select Device Status/Control** and confirm with **Plug device**.

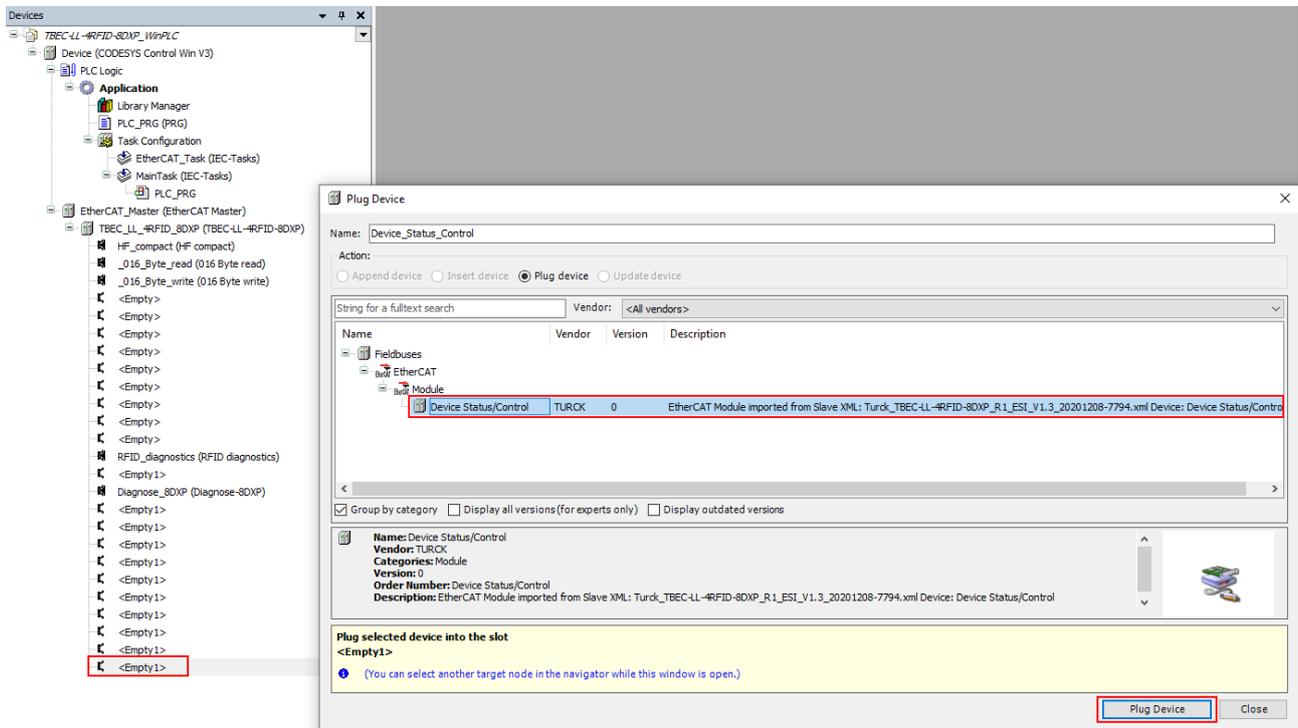


Fig. 119: CODESYS – selecting Device Status/Control

- ⇒ The mapped diagnostics are displayed in the project tree and can be read out via the PLC program.

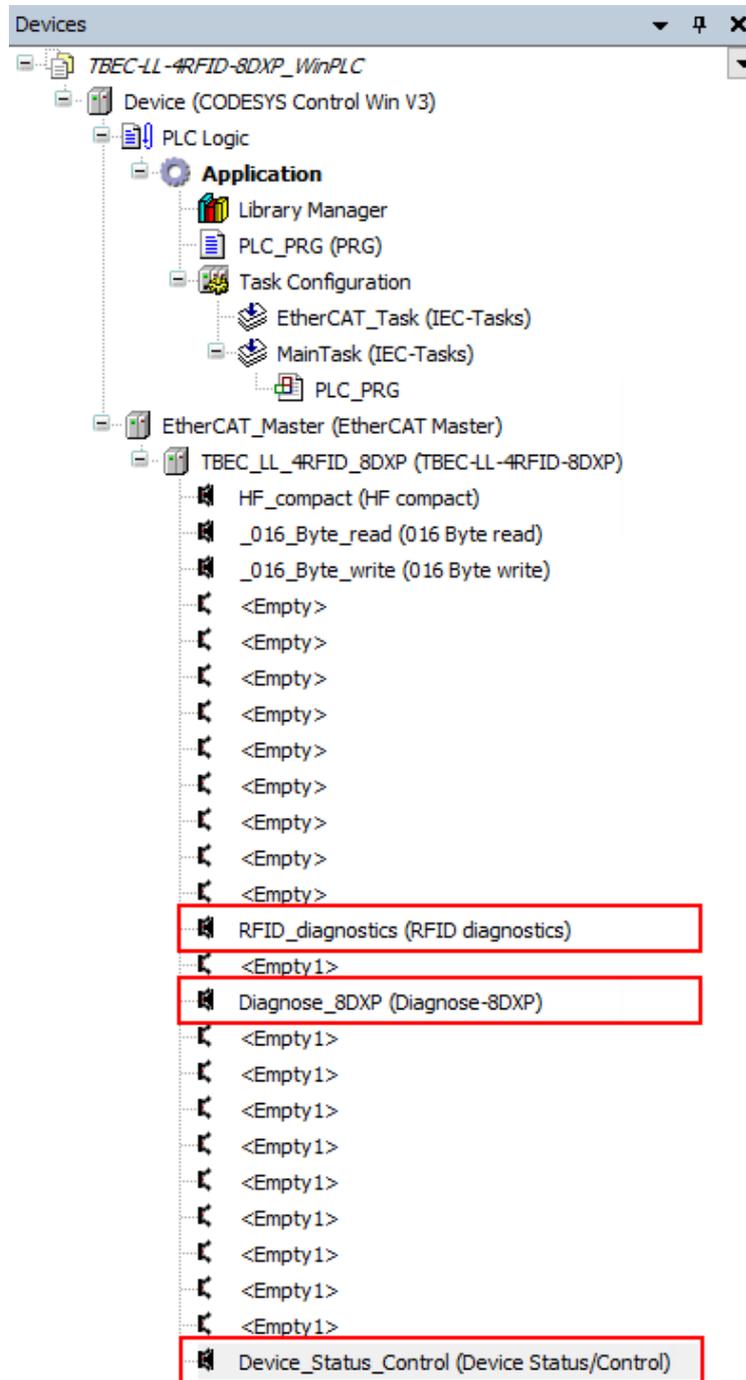


Fig. 120: CODESYS – mapped diagnostics

Example: reading Device Status/Control

- ▶ In the project tree double-click **Device_status_control** (Device Status/Control).
- ▶ Select the **Modules I/O image** tab.

Variable	Mapping	Channel	Address	Type	Unit	Description
Wink			%QX28.0	BIT		Wink
ARGEE program active			%IX176.0	BIT		ARGEE program active
I/O-ASSISTANT Force Mode active			%IX177.6	BIT		I/O-ASSISTANT Force Mode active
Module diagnostics available			%IX178.0	BIT		Module diagnostics available
Undervoltage V2			%IX178.7	BIT		Undervoltage V2
Undervoltage V1			%IX179.1	BIT		Undervoltage V1

Fig. 121: Example: reading Device Status/Control

9.15 Diag History Object (0x10F3)

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

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

Subindex	Name	Data type	Access	PDO mapping	Description
0x01	Maximum messages	UNSIGNED8	R	no	Read: Number of diagnostic messages that can be saved in the diagnostic history (see from subindex 6)
0x02	Newest message	UNSIGNED8	RO	no	Subindex of the newest diagnostic message (6...255), Default value = 0
0x03	Newest acknowledged message	UNSIGNED8	RW	no	<p>Overwrite mode (subindex 5, Bit 4 = 0)</p> <ul style="list-style-type: none"> ■ 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) <hr/> <p>Acknowledge mode (subindex 5, bit 4 = 1)</p> <ul style="list-style-type: none"> ■ 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	<p>Overwrite mode</p> <ul style="list-style-type: none"> ■ 0: Newest message was read ■ 1: Newest message was not read <hr/> <p>Acknowledge mode</p> <ul style="list-style-type: none"> ■ 0: No unacknowledged message ■ 1: Diagnostic messages present that can be acknowledged

Subindex	Name	Data type	Access	PDO mapping	Description
0x05	Flags	UNSIGNED16	RW	no	<p>Flag for controlling sending and storing of diagnostic messages.</p> <hr/> <ul style="list-style-type: none"> ■ Bit 0: Enable sending of Emergencies see, "Sending Emergencies" <ul style="list-style-type: none"> – 0: Deactivated – 1: New diagnostic messages are set as Emergencies <hr/> ■ Bit 1: Deactivate Info messages <ul style="list-style-type: none"> – 0: Info messages are stored in the diagnostic buffer. – 1: Info messages are not stored in the diagnostic buffer. <hr/> ■ Bit 2: Deactivate warning messages <ul style="list-style-type: none"> – 0: Warning messages are stored in the diagnostic buffer. – 1: Warning messages are not stored in the diagnostic buffer. <hr/> ■ Bit 3: Deactivate error messages <ul style="list-style-type: none"> – 0: Error messages are stored in the diagnostic buffer (default) – 1: Error messages are not stored in the diagnostic buffer. <hr/> ■ Bit 4: Mode for handling diagnostic history <ul style="list-style-type: none"> – 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. <hr/> ■ Bit 5: Overwrite/discard information <ul style="list-style-type: none"> – 1: in Overwrite mode: unacknowledged messages were overwritten (=buffer overflow) (subindex 3 is likewise set to 0) – 1: in Acknowledge mode: message buffer full with unconfirmed messages, a new message is discarded
0x06	Diagnostic message	OCTET STRING	RO	no	<p>Buffer for diagnostic messages</p> <p>The EtherCAT slave 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 slave overwrites the subindices, starting with subindex 6. This makes the maximum number of newest messages (in subindex 1) accessible for the EtherCAT master.</p>

Diagnostic message (from subindex 6)

Parameter	Data type	Description	
Diag Code	UN-SIGNED32	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	UN-SIGNED16	Bit 0...3 Diagnostic type: 00 = Info message 01 = Warning message 10 = Error message	
Text ID	UN-SIGNED16	Text ID, reference to diagnostic text as per ESI file	
		0	No text ID
		1...65535	Text ID, manufacturer specific text IDs, see: [▶ 232]
Time stamp	UN-SIGNED64	Time stamp in ns	
		0	No time stamp
		≠ 0	Time stamp

Text IDs

Text ID	Meaning
0x10...0x21	State change request from x to y
0x11	Sync Manager x invalid address (y)
0x12	Sync Manager x invalid size (y)
0x13	Sync Manager x invalid settings (y)
0x0F	Calculate bus cycle time failed (Local timer too slow)
0x20	DC activation register is invalid
0x21	Configured SyncType (0x1C32.1 or 0x1C33.1) not supported. Check DC registers and supported SyncTypes (0x1C32.4 and 0x1C33.4)

Manufacturer specific text IDs

Meaning of the text IDs, see diagnostic data (Diagnostic data, 0xA000...0xFFFF)

Bit 15 = 0: incoming message (Appear), Example: 0x0101

Bit 15 = 1: outgoing message (Disappear), Example: 0x8101

Text ID	Meaning
0x...101	Output Overcurrent Ch...
0x...102	Undervoltage V...
0x...104	Overcurrent supply VAUX1 X...
0x...110	Parameterization error Ch...
0x...2A0	Overcurrent PWM output Ch...
0x...480...0x...49F	Antenna detuned at HF read/write head 1...32 Ch... (HF read/write head 1...32 K... detuned)

Text ID	Meaning
0x...4A0...0x...4BF	Error reported by read/write head 1...32 Ch...
0x...4C0...0x...4DF	Parameter not supported by read/write head 1...32 Ch...
0x...4E0...0x...4FF	Not connected to read/write head 1...32 Ch...
0x...504	Buffer full
0x...505	Configuration via DTM active
0x...734	Overcurrent VAUX2 Pin1 X4 (Ch8/9)
0x...735	Overcurrent VAUX2 Pin1 X5 (Ch10/11)
0x...736	Overcurrent VAUX2 Pin1 X6 (Ch12/13)
0x...737	Overcurrent VAUX2 Pin1 X7 (Ch14/15)

9.16 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 [▶ 232]			
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			

9.17 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
0x8006	37774	Read/write head does not support HF bus mode
0x8007	32775	Only one read/write head should be connected for addressing.
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 permissible range
0x8200	33280	Command code unknown
0x8201	33281	Command not supported
0x8202	33282	Command not supported in HF applications
0x8203	33283	Command not supported in UHF applications
0x8204	33284	Command for multitag 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 multitag application
0x8208	33288	Command not supported in HF bus mode
0x8209	33289	Length parameter 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 multitag 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

Error code (hex.)	Error code (dec.)	Meaning
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
0x8216	33302	Command only possible in HF bus mode
0x8217	33303	HF read/write head address invalid
0x8300	33536	Continuous mode command not activated
0x8301	33537	Grouping not supported in HF applications
0x8302	33538	Grouping not supported with read commands
0x8304	33540	Grouping not supported with write commands
0x8305	33541	HF: Length in Continuous mode violates the block limits
0x8306	33542	HF: Address in Continuous mode violates the block limits
0x8307	33543	HF: Length in Continuous mode outside of the permissible range
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 detuned
0x2500	9472	Password function not supported by tag
0x2501	9473	Password function not supported by read/write head
0x2502	9474	Bit pattern for tag protection 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
0xB0...	45...	HF read/write head reports error
0xB048	45128	Error when switching on the HF read/write head
0xB049	45129	Error when switching off the HF read/write head
0xB060	45152	Error with the extended parameter setting of the HF read/write head
0xB061	45153	Error with the parameter setting of the HF read/write head
0xB062	45154	Read/write head error when executing an Inventory command
0xB067	45159	Read/write head error when executing a lock block command
0xB068	45160	Read/write head error when executing a read multiple block command
0xB069	45161	Read/write head error when executing a write multiple block command
0xB06A	45162	Error when reading the system information
0xB06B	45163	Error when reading the protection status of the tags
0xB0AD	45229	Error when setting the read/write head address

Error code (hex.)	Error code (dec.)	Meaning
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 extended 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 when setting the transfer speed and the operation 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 or 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 according to EPC Class1 Gen2
0xD100	53504	Error with the Backup function
0xD101	53505	Error with the Backup function (required memory not available)
0xD102	53506	Error when restoring a backup
0xD103	53507	Error when restoring a backup (no backup present)
0xD104	53508	Error when restoring a backup (backup data damaged)
0xD105	53509	Error when restoring the default settings

Error code (hex.)	Error code (dec.)	Meaning
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
0xF104	61699	Air interface error: HF tag error
0xF108	61704	Air interface error: HF tag outside of the detection range, before all commands could be executed
0xF110	61712	Air interface error: Tag does not have the expected UID.
0xF201	61953	HF read/write head faulty
0xF202	61954	HF read/write head: Error in command execution
0xF204	61956	HF read/write head: Transmission error, check syntax
0xF208	61960	Power supply of the HF read/write head too low
0xF20A	61962	HF read/write head: Command code unknown
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 operation not possible (e.g. invalid tag)
0xF825	63525	UHF read/write head: Write operation not possible (e.g. tag can only be read)
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 range)
0xF828	63528	UHF read/write head: The data to be sent is not valid.
0xF82A	63530	UHF read/write head: The command requires a long time for execution.
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.

Error code (hex.)	Error code (dec.)	Meaning
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	Write command to a block failed
0xFFFF	65534	Timeout on the RS485 interface
0xFFFF	65535	Command aborted

9.18 Using extended diagnostics – time measurement for commissioning an application

The time of the transmission from the tag to the interface is taken as the time measurement. The data transmission to a controller is not included.

If a particular tag is selected in the **HF: Select tag type parameter**, the time measurement for the write command is already started with its activation. The time measurement is carried out irrespective of whether a tag is present in the detection range. The time measurement function is available for read/write heads from firmware version Vx.91.

The following values can be displayed in the following extended diagnostics and for 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
- Cycle time of HF bus mode
- Cycle time of HF Continuous bus mode

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

In order to use extended diagnostics with PACTware, the EoE function must be activated in the EtherCAT master and in the EtherCAT slave.

- ▶ Open Diagnosis 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.

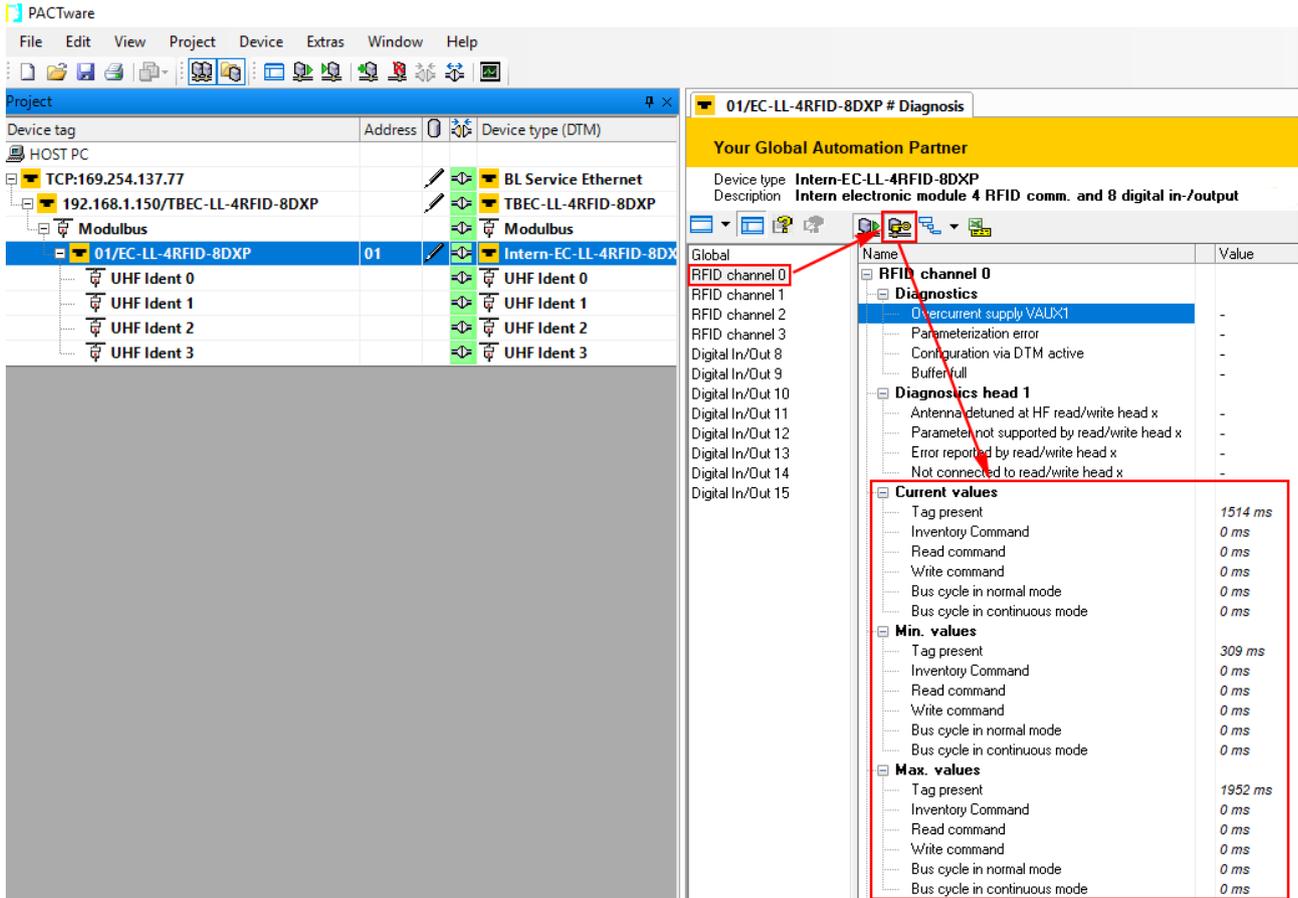


Fig. 122: Time measurement in the DTM

9.19 Reset device (Reset)

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

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

9.19.1 Resetting the device with Turck Service Tool

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



NOTE

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

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

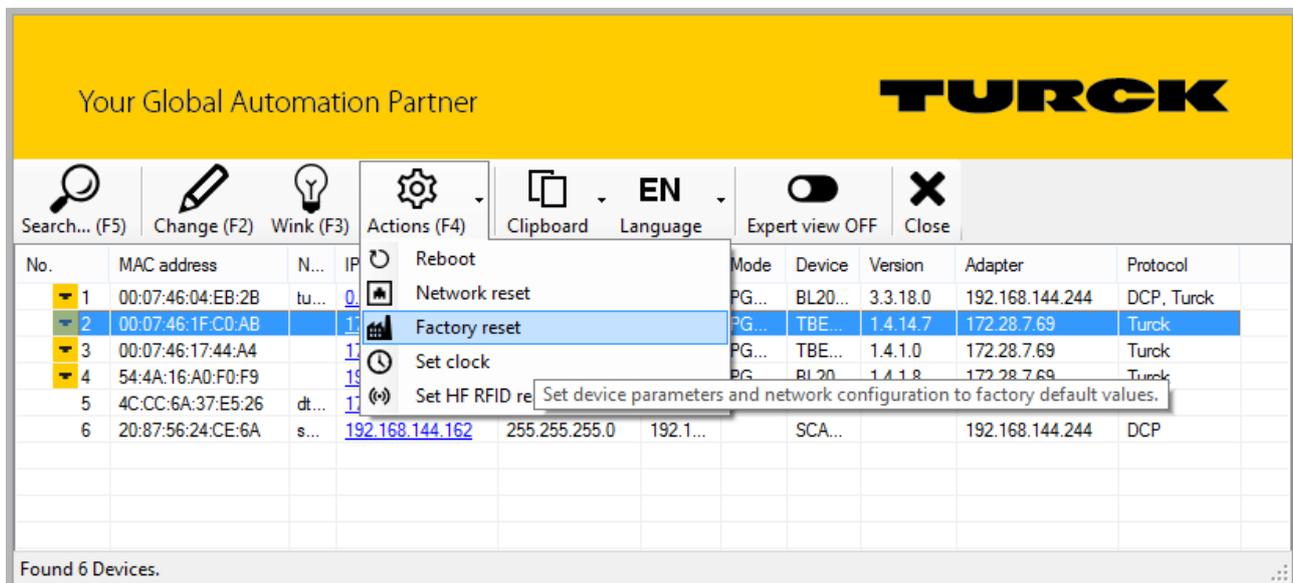


Fig. 123: Turck Service Tool – resetting the device to factory settings

⇒ The device is reset to factory settings.

9.19.2 Resetting the device via Object Dictionary

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

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

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

Fig. 124: TwinCAT (example) - Resetting the device to factory settings via CoE index

- ⇒ The device is reset to factory settings.

10 Troubleshooting

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

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

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

10.1 Eliminating parameterization errors

DXP channels

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

11 Maintenance

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



NOTICE

Interruption of data connection and power supply during the firmware update

Risk of device damage due to faulty firmware update

- ▶ Do not interrupt the power supply of the device during the firmware update.
-

11.1 Updating the firmware via TwinCAT

Downloading the firmware file

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

- ▶ In the project tree double-click **Box 1 (TBEC-LL-4RFID-8DXP)**.
- ▶ Click **Online** tab → **State Machine** → **Bootstrap**.
- ▶ Click **File Access over EtherCAT** → **Download...**

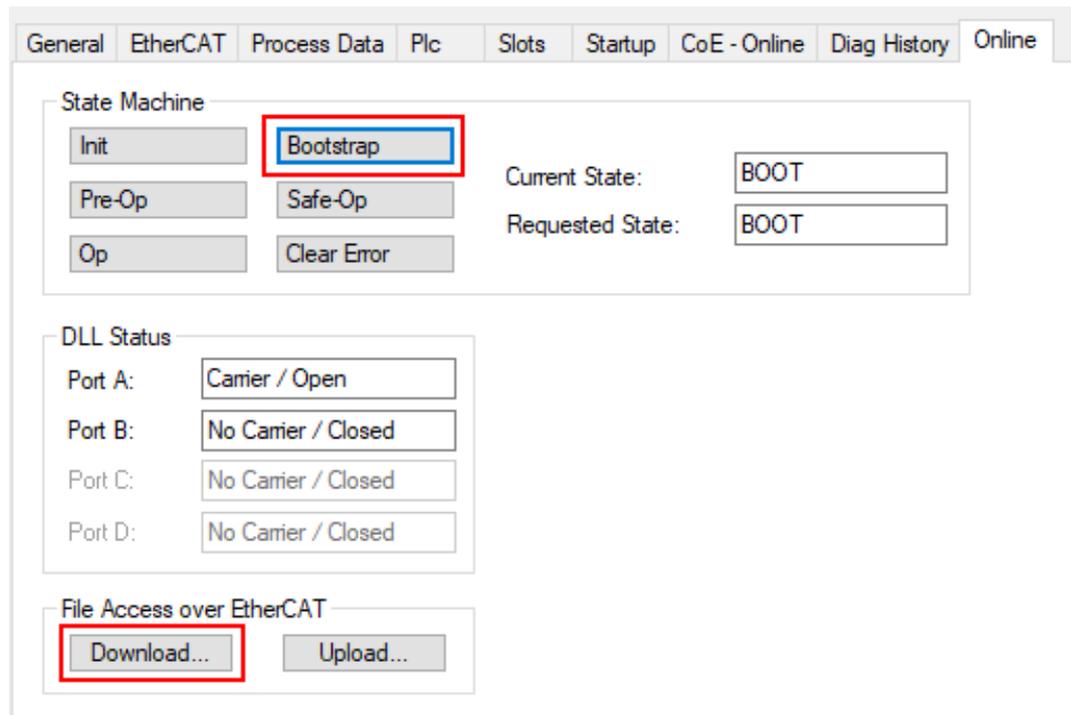


Fig. 125: Starting the firmware update

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

Carrying out an update

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

11.2 Updating the firmware via CODESYS

Prerequisites

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

Downloading the firmware file

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

- ▶ In the project tree double-click **TBEC_LL_4RFID-8DXP** (TBEC-LL-4RFID-8DXP).
- ▶ Click **Online** tab → **State Machine** → **Bootstrap**.
- ▶ Click **File access over EtherCAT** → **Download...**
- ▶ In the new window select the firmware file and click → **Open**.
- ⇒ The firmware file is loaded in the flash memory of the device.
- ⇒ The STAT LED flickers green.
- ⇒ CODESYS displays a progress bar at the bottom of the screen to indicate the download of the firmware file.

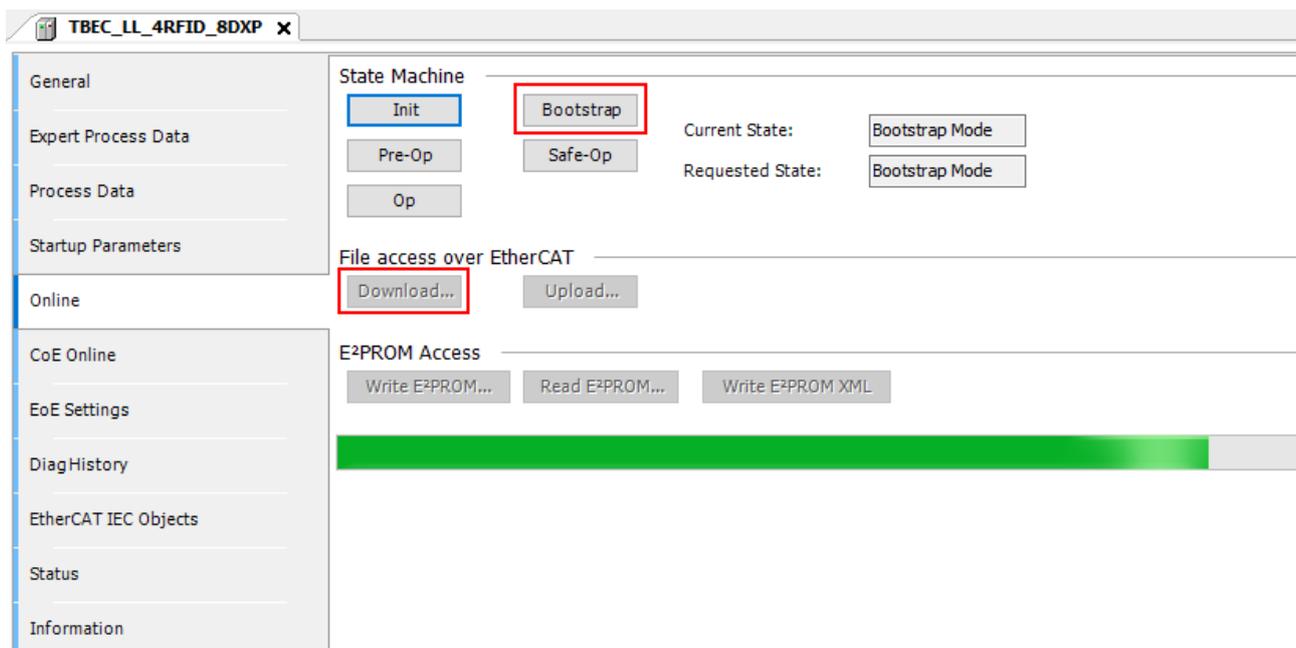


Fig. 126: Download of the firmware file

Carrying out an update

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

12 Repair

The device must not be repaired 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

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from <https://www.turck.de/en/retoure-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 correctly and must not be included in general household garbage.

14 Technical data

Technical Data	
Type designation (ID)	TBEC-LL-4RFID-8DXP (100002925)
Power supply	
Power supply voltage	24 VDC
Permissible range	18...30 VDC
Total current	V1 max. 8 A, V2 max. 9 A at 70 °C (UL: 55 °C) per module
Voltage supply connection	M12 male connector, L-coded
Operating current	V1: max. 150 mA V2: max. 100 mA
RFID power supply V_{AUX1}	Connectors X0..X1 from V1 Short-circuit-proof, 2 A per channel at 70 °C (UL: 55 °C)
Sensor/actuator supply V_{AUX2}	Connectors X4..X7 from V2 Power supply pin 1 switchable per socket Short-circuit-proof, 2 A per channel at 70 °C (UL: 55 °C)
Potential isolation	Potential isolation of V1 and V2 voltage group Voltage proof up to 500 VDC
Heat dissipation, typical	≤ 5 W
System data	
Fieldbus connection technology	2 × M12, 4-pin, D-coded
Service interface	EoE
EtherCAT	
CAN over EtherCAT	In accordance with the Modular Device Profile (ETG.5001.1)
Diagnostics	CoE Emergencies, DiagnosisHistory
Addressing	Automatic/Explicit Device Identification
RFID	
No. of channels	4
Connection technology	M12
Power supply	2 A per channel at 70° C (UL: 55 °C), short-circuit-proof
Operation per channel	1 × HF or read/write head or UHF reader, up to 32 bus-capable HF read/write heads with suffix / C53 (if necessary, additional power feed required)
RFID data interface	HF and UHF
Cable length	max. 50 m
Digital inputs	
No. of channels	8
Connection technology	M12, 5-pin
Input type	PNP
Type of input diagnostics	Channel diagnostics

Technical Data	
Switch threshold	EN 61131-2 Type 3, PNP
Signal voltage Low signal	< 5 V
Signal voltage High signal	> 11 V
Signal current Low signal	< 1.5 mA
Signal current High signal	> 2 mA
Potential isolation	Galvanic isolation from the fieldbus Voltage proof up to 500 VDC
Digital outputs	
No. of channels	8
Connection technology of outputs	M12, 5-pin
Output type	PNP
Type of output diagnostics	Channel diagnostics
Output voltage	24 VDC from potential group
Output current per channel	2.0 A, short-circuit proof, max. 4.0 A per socket
Utilization factor	0.56
Load type	EN 60947-5-1: DC-13
Short-circuit protection	Yes
Potential isolation	Galvanic isolation from the fieldbus Voltage proof up to 500 VDC
Conformity with standard/directive	
Vibration test	Acc. to EN 60068-2-6 Acceleration up to 20 g
Shock testing	Acc. to EN 60068-2-27
Drop and topple	Acc. to IEC 60068-2-31/IEC 60068-2-32
EMC (electromagnetic compatibility)	Acc. to EN 61131-2
Approvals and certificates	CE UKCA FCC UV resistant acc. to DIN EN ISO 4892-2A (2013)
UL certificate	cULus LISTED 21 W2, Encl.type 1 IND.CONT.EQ.
UL cond.	
Load type	Resistive load, DC Pilot Duty (24 VDC, 2 A) connectable
Relative air humidity	100 % acc. to IEC 61131-2
Pollution degree	4
General information	
Dimensions (W × L × H)	60.4 × 230.4 × 39 mm
Operating temperature	-40...+70 °C (UL: 55 °C)
Storage temperature	-40...+85 °C
Operating height	max. 5000 m
Protection type	IP65/IP67/IP69K (not UL approved)
MTTF	89 years acc. to SN 29500 (Ed. 99) 20 °C
Housing material	PA6-GF30
Housing color	Black

Technical Data	
Material of window	Lexan
Material of screw	303 stainless steel
Material of label	Polycarbonate
Halogen-free	Yes
Mounting	2 fixing holes, Ø 6.3 mm

FCC declaration



NOTE

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

15 Appendix: flow charts showing the operation of the device

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

15.1 Flow chart: command processing

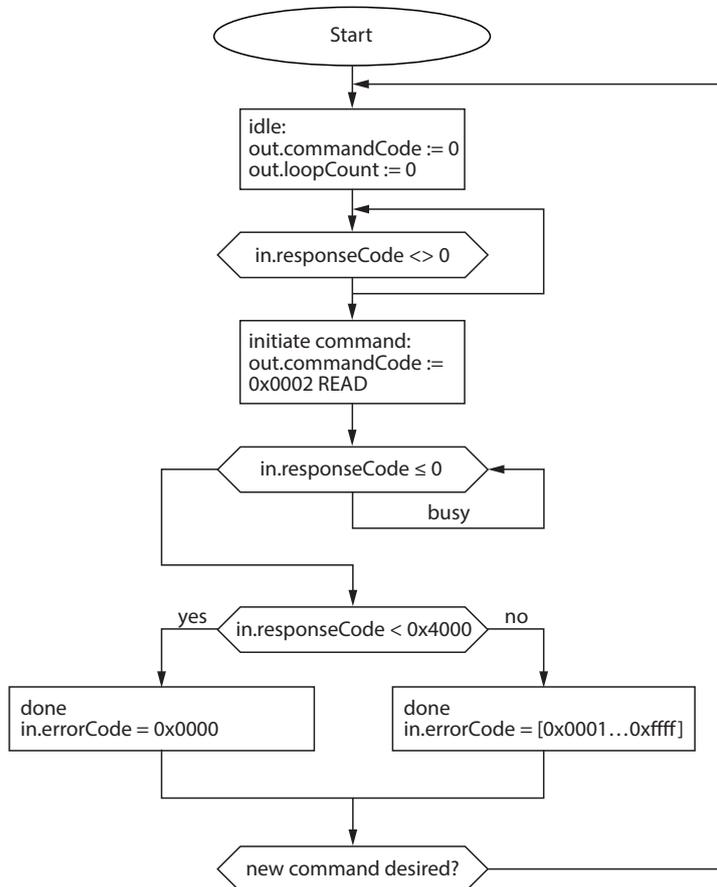


Fig. 127: Flow chart for command processing

15.2 Flow chart: rapid command processing with loop counter

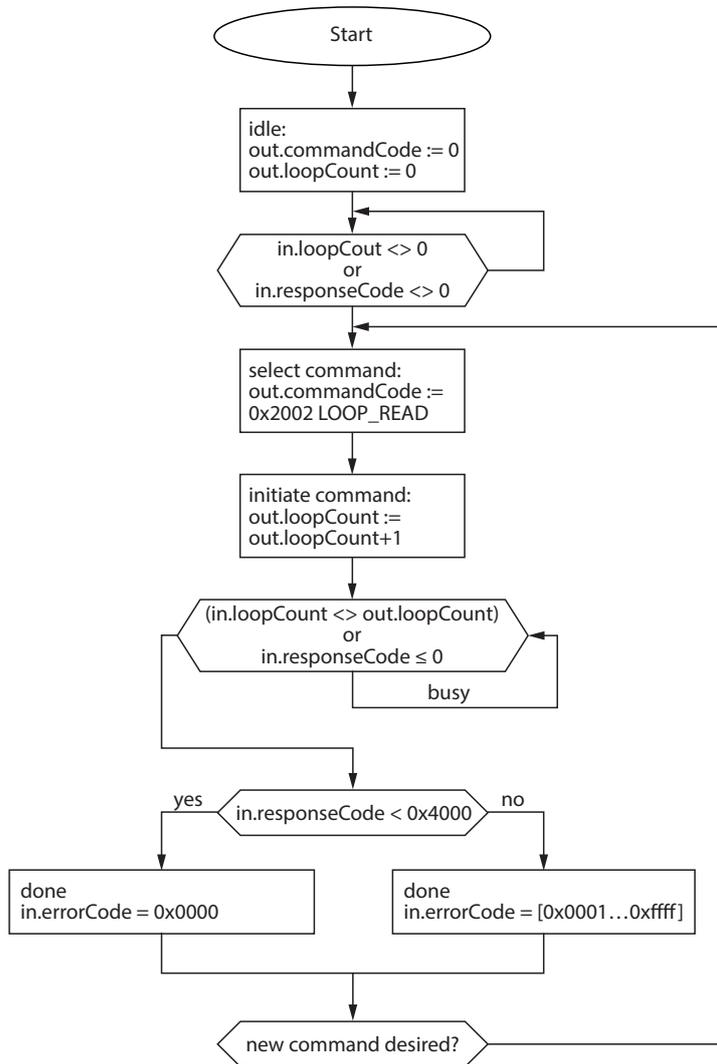


Fig. 128: Flow chart for fast command processing with loop counter

15.3 Flow chart: command processing with fragmentation

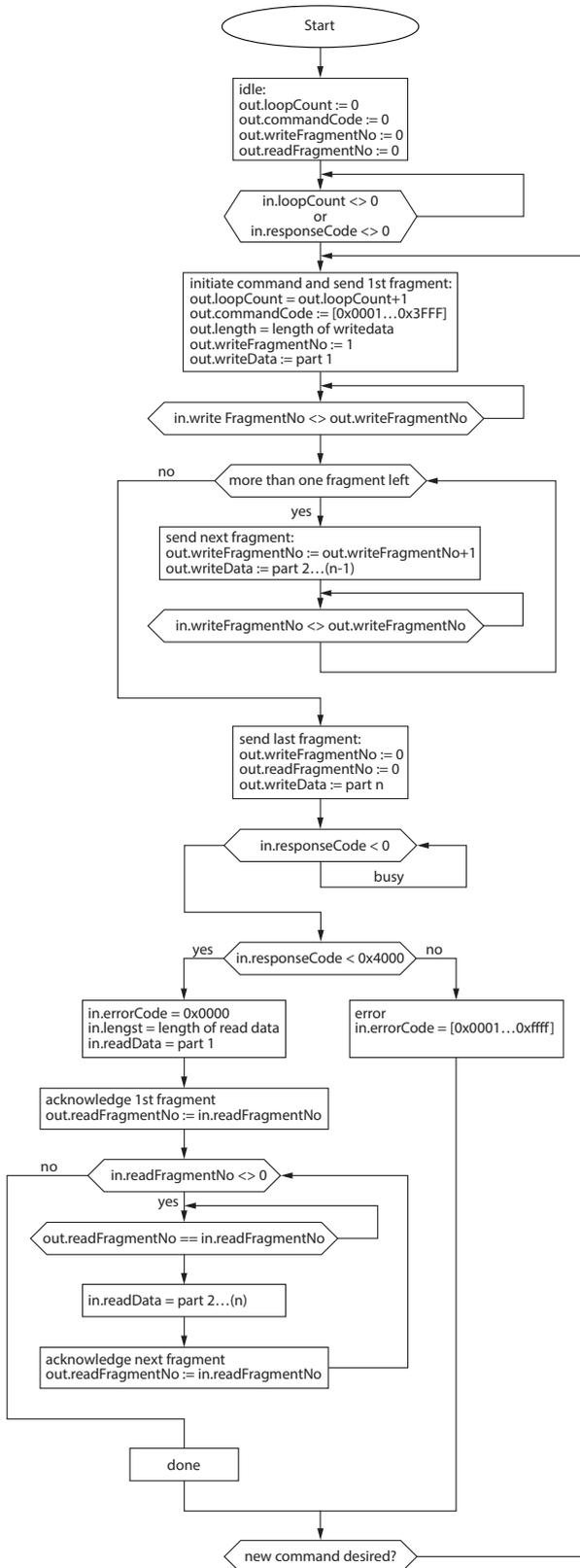


Fig. 129: Flow chart for command processing with fragmentation

15.4 Flow chart: Continuous mode with interruption before reading data

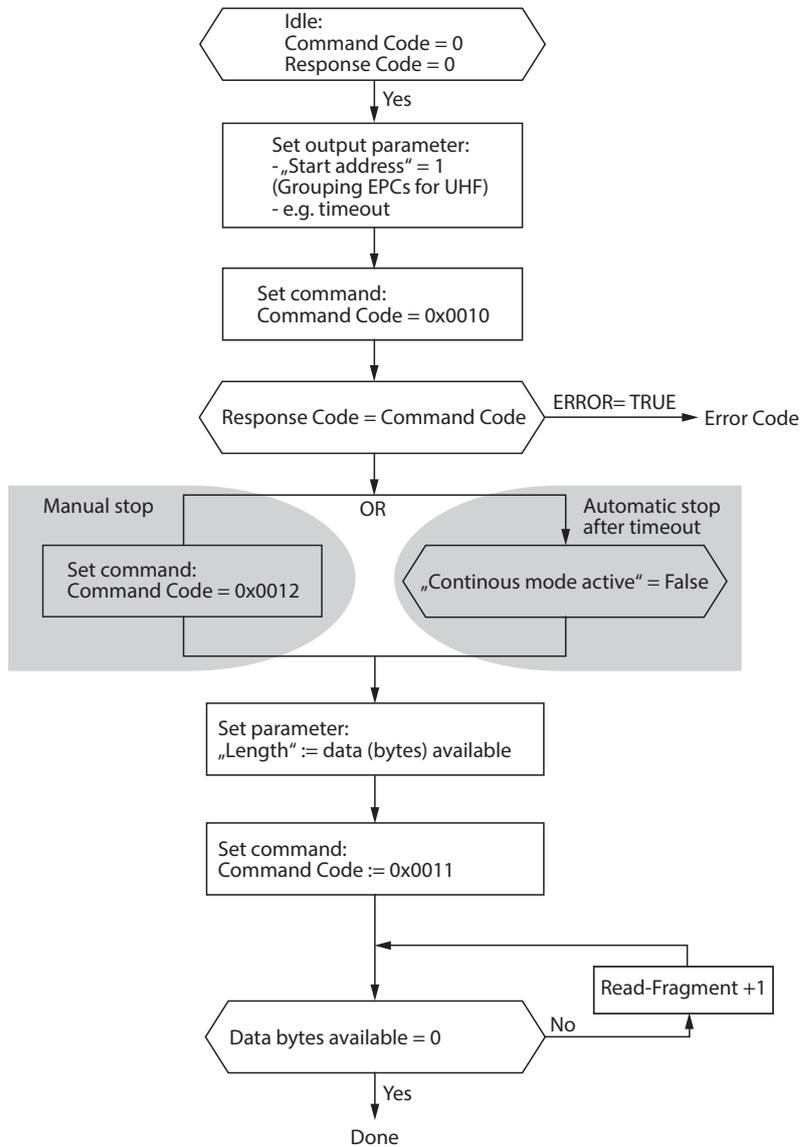
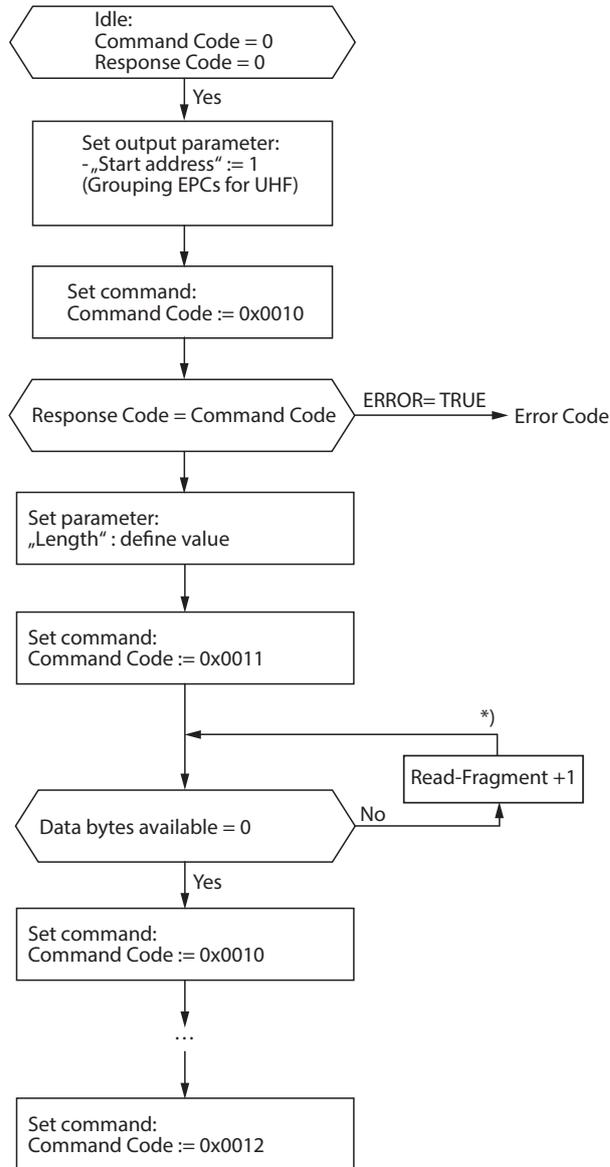


Fig. 130: Flow chart for Continuous mode with interruption before reading data

15.5 Flow chart: Continuous mode without interruption before reading data



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

Fig. 131: Flow chart for Continuous mode without interruption before reading data

15.6 Flow chart: programming tags with a password

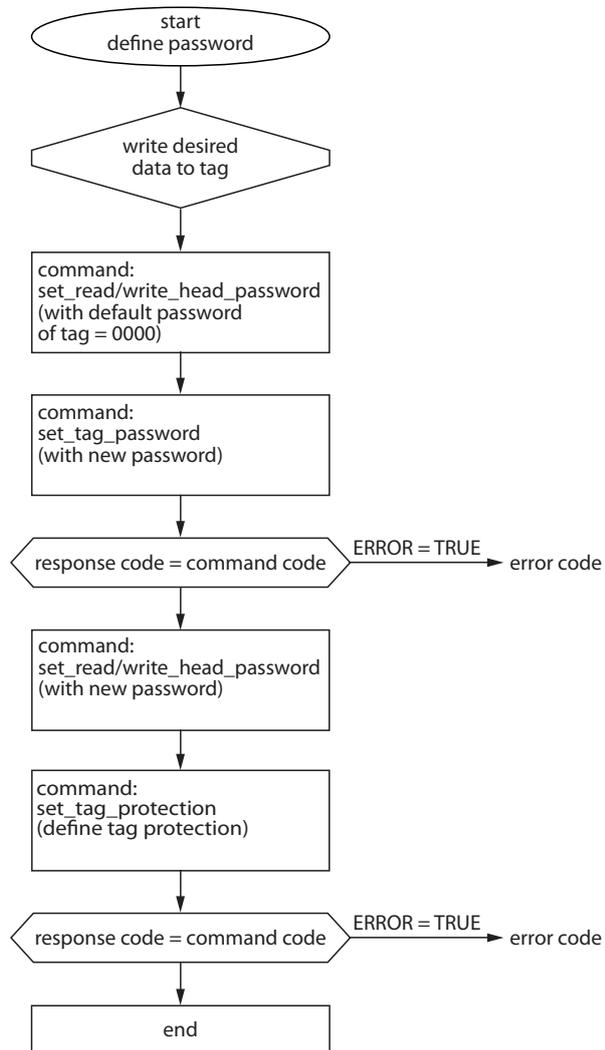


Fig. 132: Flow chart for programming tags with a password

16 Appendix: EU Declaration of Conformity

EU-Konformitätserklärung Nr.: 5035-4M
 EU Declaration of Conformity No.:

TURCK

Wir/We: HANS TURCK GMBH & CO KG
 WITZLEBENSTR. 7, 45472 MÜLHEIM A.D. RUHR

erklären in alleiniger Verantwortung, dass die Produkte
 declare under our sole responsibility that the products

Kompakte I/O Module in IP20/IP67: FDN20-*, FNDL-*, FDNP-*, FDP20-*, FGDP,
 Compact I/O modules in FGEN-*, FLDP-*, FLIB-*, FXEN-*, TBDP-*,
 IP20/IP67: TBEN-*, TBIL-*, TBEC-*, FEN20-*

auf die sich die Erklärung bezieht, den Anforderungen der folgenden EU-Richtlinien durch Einhaltung der
 folgenden Normen genügen:
 to which this declaration relates are in conformity with the requirements of the following EU-directives by compliance with the following
 standards:

EMV - Richtlinie /EMC Directive EN 61131-2:2007 (Abschnitte / section 8, 9, 10)	2014 / 30 / EU	26.02.2014
--	----------------	------------

RoHS – Richtlinie /RoHS Directive EN IEC 63000:2018	2011 / 65 / EU	08.06.2011
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Weitere Normen, Bemerkungen:
 additional standards, remarks:

Zusätzliche Informationen:
 Supplementary information:

Mülheim a. d. Ruhr, den 29.09.2020

Ort und Datum der Ausstellung /
 Place and date of issue



i.V. Dr. M. Linde, Leiter Zulassungen /Manager Approvals
 Name, Funktion und Unterschrift des Befugten /
 Name, function and signature of authorized person

EU-Konformitätserklärung Nr.: E5000M

EU Declaration of Conformity No.:

TURCK

Wir/ We: HANS TURCK GMBH & CO KG
WITZLEBENSTR. 7, 45472 MÜLHEIM A.D. RUHR

erklären in alleiniger Verantwortung, dass die Produkte
declare under our sole responsibility that the products

Block I/O Module: TB**-L*(M1, S*)-****-(****)(****)
Block I/O Modules:

auf die sich die Erklärung bezieht, den Anforderungen der folgenden EU-Richtlinien durch Einhaltung der
folgenden Normen genügen:
to which this declaration relates are in conformity with the requirements of the following EU-directives by compliance with the following
standards:

ATEX - Richtlinie /Directive ATEX 2014 / 34 / EU 26.02.2014
EN IEC 60079-0:2018 EN 60079-7:2015 EN 60079-31:2014

Weitere Normen, Bemerkungen:
additional standards, remarks:

Die EU-Konformitätserklärung E5000M ergänzt die EU-Konformitätserklärungen 5035-4M; 5126-2; 5238M;
5353M; 5354M.

The EU declaration of conformity E5001M complements the EU declarations of conformity 5035-4M; 5126-2; 5238M; 5353M; 5354M.

Zusätzliche Informationen:

Supplementary information:

Angewandtes ATEX-Konformitätsbewertungsverfahren: Modul A /module A
ATEX - conformity assessment procedure applied:

Baumusterprüfbescheinigung: TÜV 20 ATEX 264795 X
examination certificate:

ausgestellt: TÜV NORD CERT GmbH,
issued by: Langemarckstraße 20, 45141 Essen
Kenn-Nr. /number: 0044

Mülheim a. d. Ruhr, den 01.03.2020

Ort und Datum der Ausstellung /
Place and date of issue


i.V. Dr. M. Linde, Bereichsleiter Zulassungen /Head of Approvals
Name, Funktion und Unterschrift des Befugten /
Name, function and signature of authorized person

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