TURCK

Your Global Automation Partner

TBEC-S2-4RFID
RFID Interface

Instructions for Use

Contents

1 About these instructions

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

1.1 Target groups

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

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

1.2 Explanation of symbols

The following symbols are used in these instructions:

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

1.3 Other documents

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

- Data sheet
- Declarations of conformity (current version)
- Approvals

1.4 Naming convention

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

1.5 Feedback about these instructions

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

2 Notes on the product

2.1 Product identification

These instructions apply for the following compact RFID interfaces:

- TBEC-S2-4RFID

2.2 Scope of delivery

The delivery consists of the following:

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

2.3 Turck service

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

For the contact details of our branches worldwide, please see page [▷ 225].

3 For your safety

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

3.1 Intended use

The TBEC-S2-4RFID block module is an RFID interface for use in the Turck RFID system. The device is connected between the controller and the read/write device and transmits commands from the controller to the read/write devices. The read data is relayed via the device to the controller.

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 Turck 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. The devices can be connected to the Ethernet-based EtherCAT fieldbus system.

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

3.2 General safety instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- Change the default password of the integrated web server after the first login. Turck recommends the use of a secure password.

3.3 Notes on Ex protection

- When using the device in Ex areas, the user must have knowledge of explosion protection (IEC/EN 60079-14 etc.).
- Observe national and international regulations for explosion protection.
- Only use the device within the permissible operating and ambient conditions (see certification data and Ex approval specifications).

3.4 Requirements for Ex approval

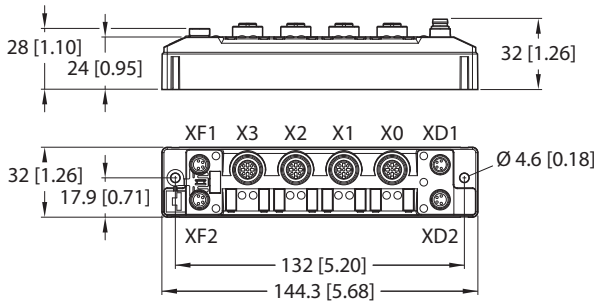
- Only disconnect and connect circuits when there is no potentially explosive atmosphere or when the power supply is switched off
- Connect the metal protective cover to the equipotential bonding in the Ex area (cable cross-section: 4 mm^2).
- Ensure impact resistance in accordance with EN IEC 60079-0 – alternative measures:
  - Install the device in the TB-SG-S protective housing (ID 100014866).
- Do not install the device in areas critically exposed to UV light.
- Prevent risks caused by electrostatic charge.
- Provide unused male connectors with suitable sealing or blanking caps in order to ensure degree of protection IP65, IP67 or IP69K The tightening torque for the M4 screws is 0.5 Nm.

4 Product description

The device is housed in a fully encapsulated plastic casing with degree of protection IP65/IP67/IP69K. Four RFID channels are provided for connecting read/write devices. The connections are designed as M12 female connectors. An M8 female connector is provided for connection to the Ethernet-based EtherCAT fieldbus system.

5-pin, L-coded M12 connectors are provided for connecting the supply voltage.

4.1 Device overview



mm [Inch]

Fig. 1: Dimensions

4.1.1 Indication elements

The device is provided with the following LEDs:

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

4.2 Properties and features

- EtherCAT slave according to Modular Device Profile (ETG.5001.1)
- Glass fiber-reinforced housing
- Shock and vibration tested
- Fully encapsulated module electronics
- Protection classes IP65, IP67, IP69K
- Integration in PLC systems without the use of a special function module
- Up to 128 bytes of user data per read/write cycle per channel as well as the use of fragments for larger data volumes with 16 kB FIFO memory
- Data interface for convenient use of the RFID functions
- Continuous HF bus mode with up to 32 HF read/write heads per channel
- 4 channels with M12 connection for RFID
- Mixed operation of HF and UHF read/write heads and UHF readers
- Integrated web server
- LEDs 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 have a fieldbus interface and fieldbus-independent I/O electronics with 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 data between the RFID level (read/write device and tag) and the control 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 to optimize the speed, for the system to self trigger as well as for backup and restore operations. In every write or read cycle, up to 128 bytes can be transferred on each channel to the controller. The data must be fragmented in order to transfer more than 128 bytes.

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 ■ 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

Various 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 command autonomously. In this case, the read data is stored in the internal memory of the device. 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 HF Continuous 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 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 multitag 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 under "Settings".

- 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 perma lock
- Kill UHF tag
- Restore settings UHF read/write head
- Backup settings UHF read/write head
- Reset
- Read AFI from HF tag
- Read DSFID from HF tag
- Write AFI to HF tag
- Write DSFID to HF tag
- Lock AFI in HF tag
- Lock DSFID in HF tag
- Delete Buffer (Cont. mode)

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

4.5 Technical accessories

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

5 Installing

The device can be mounted on a DIN rail according to EN 60715 (TS35) or screwed on a mounting plate. Both combined mounting as well as single mounting are possible.

5.1 Installing a device in zone 2 and zone 22

The devices can be used in combination with the TB-SG-S (ID 100014866) protective housing set in zone 2 and zone 22. Combined mounting is not possible in zone 2 and zone 22.

DANGER
Potentially explosive atmosphere
Risk of explosion due to spark ignition
Operation in zone 2 or zone 22:
- ▶ Only install the device if there is no potentially explosive atmosphere present.
- ▶ Observe the requirements for Ex approval.

- ▶ Screw on the housing. Use a Torx T8 screwdriver.
- ▶ Place the device on the base plate of the protective housing and fasten both together on the mounting plate, see [▷ 18].
- ▶ Connect the device, see [▷ 21].
- ▶ Fit the housing cover and screw on as shown in the following figure. The tightening torque for the Torx T8 screw is 0.5 Nm.

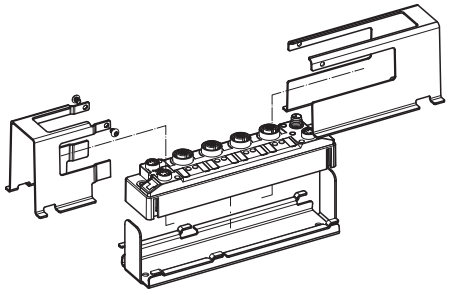


Fig. 3: Installing the device in the TB-SG-S protective housing

5.2 Mounting devices in combination

The TBNN-S0… connectors can be used to form groups of modules for mounting the devices in combination.

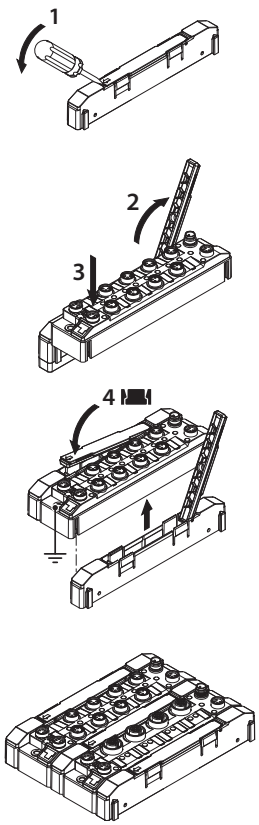


Fig. 4: Module groups for mounting on a mounting plate

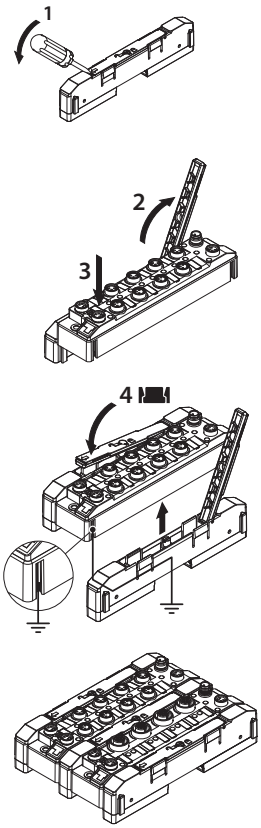


Fig. 5: Module groups for mounting on a DIN rail (TS35)

- ▶ Undo locking lever with a flat tool (e.g. screwdriver) (1).
- ▶ Fully open the locking lever (2).
- ▶ Connect the module and connector so that the spring of the connector engages with the groove of the module (3).
- ▶ Push down the locking lever and close until the locking lever engages with an audible click (4).
- ▶ Repeat steps 1 to 4 until the module group is complete.

5.3 Mounting plate fixing

The devices can be fastened with two M4 screws to a pre-drilled mounting plate. The maximum tightening torque for the M4 screws is 1.0 Nm.

- The module or module cluster is attached as shown in the following figure.

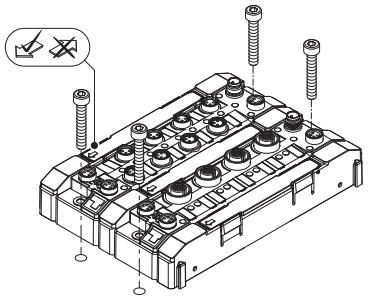


Fig. 6: Attaching the device to the mounting plate

5.4 DIN rail (TS35) mounting

The TBNN-S0-DRS adapters enable the device to be mounted individually or in a combination on a DIN rail (TS35).

NOTICE
Incorrect mounting
Incorrect grounding may cause malfunction

- Align the adapters so that the arrow on the locking lever points in the direction of the M8 Ethernet sockets.
- Connect the grounding contact of the adapter with the grounding contact of the module.

- Mount the adapters to the right and left of the module.
- Position the module or module combination on the DIN rail so that the recesses of the adapter surround the DIN rail (1).
- Close the rotating pin of the adapter with a screwdriver (2).
- Optional: Ground the device.

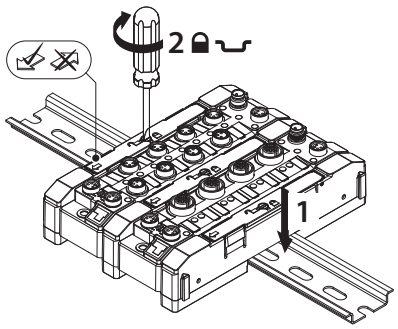


Fig. 7: Mounting the module combination on a DIN rail

NOTE
To increase stability on the DIN rail, end brackets can be mounted on the right and left of the module or the module combination.

5.5 Outdoor device installation

The device is UV resistant in accordance with DIN EN ISO 4892-2. Direct sunlight may cause material wear and changes in color. The mechanical and electrical properties of the device are not impaired.

- ▶ To prevent material wear and color changes: Protect the device from direct sunlight with protective panels.

5.6 Grounding the device

5.6.1 Grounding and shielding concept

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

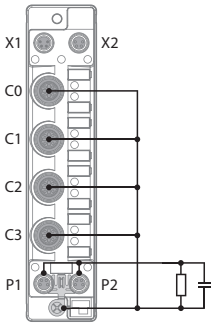


Fig. 8: Equivalent circuit diagram, shielding concept

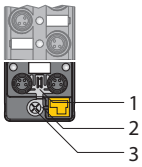


Fig. 9: Grounding clip (1), grounding ring (2) and metal screw (3)

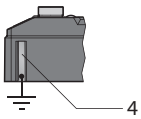


Fig. 10: Grounding contact

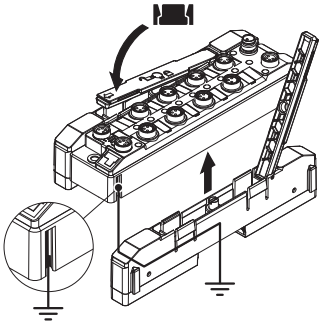


Fig. 11: Grounding the TBNN-S0-DRS… adapters

The grounding clip (1) on the M8 connectors for the fieldbus connection (P1, P2) connects the shield of the fieldbus lines.

The grounding ring (2) provides the shield on the flange of the M8 connectors for the fieldbus connection via an RC circuit.

When mounting on a mounting plate using the TBNN-S0-STD connectors, the module is automatically connected to the reference potential of the system via the metal screw (3) in the lower mounting hole. The type TBNN-S0-DRS connectors for mounting the modules on a DIN rail (TS 35) connect the grounding contact (4) of the modules with the DIN rail and therefore with FE.

5.6.2 Grounding the device (FG)

The grounding clip and the metal ring are connected to each other.

- ▶ If a common reference potential for I/O level and fieldbus level is not required: remove the grounding clip to disconnect the fieldbus shield.

Grounding the device – Mounting on DIN rail

- ▶ When mounting on a DIN rail with the TBNN-S0-DRS connectors, fasten the supplied metal screw to the lower mounting hole of the module.
- ⇨ The shield of the fieldbus connection and the M8 flange of the I/O level are connected via the DIN rail with the reference potential of the installation.

Grounding the device – Mounting on mounting plate

- ▶ When mounting on a mounting plate, fasten with an M4 metal screw.
- ⇨ The shield of the fieldbus connection and the M8 flange of the I/O level are connected via the DIN rail with the reference potential of the installation.

Removing the grounding clip

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

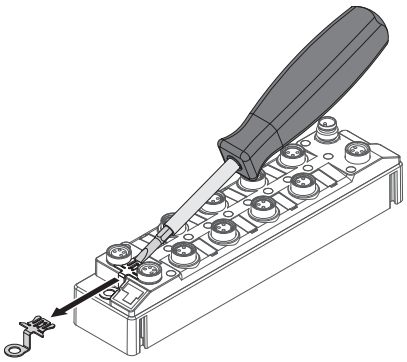


Fig. 12: Removing the grounding clip

Mounting the grounding clip

- ▶ Use a screwdriver to insert the grounding clip between the fieldbus connectors so that contact is made with the metal housing of the plug connectors.
- ⇨ The shield of the fieldbus lines lies flush to the grounding clip.

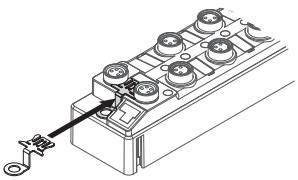


Fig. 13: Mounting the grounding clip

6 Connection

NOTICE
Penetration of liquids or foreign objects due to leaking connections
Loss of degree of protection IP65/IP67/IP69K possible

- Tighten M8 male connectors with a tightening torque of 0.4 Nm.
- Tighten M12 male connectors with a tightening torque of 0.6 Nm.
- Only use accessories that guarantee the protection class.
- Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws is 0.5 Nm.

6.1 Connecting a device in zone 2 and zone 22

DANGER
Explosive atmosphere
Explosion due to ignitable sparks
For use in Zone 2 and Zone 22:

- Only disconnect and connect circuits when there is no potentially explosive atmosphere or when the power supply is switched off
- Only use connecting cables that are approved for use in potentially explosive atmospheres.
- Use all connectors or seal them with screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.
- Observe requirements for Ex approval.

6.2 Connecting the device to the EtherCAT network

The device features two integrated Ethernet connections with 4-pin, A-coded M8 connectors for connection to the EtherCAT Ethernet-based fieldbus system.

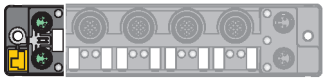


Fig. 14: EtherCAT connections

NOTICE
Non-tight connections can lead to ingress of water or foreign matter
Loss of IP65/IP67/IP69K protection class, possible damage to equipment

- Tighten M8 male connectors with a tightening torque of 0.4 Nm.

- Connect the device to the EtherCAT network as shown in the pin assignment below.
- Seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

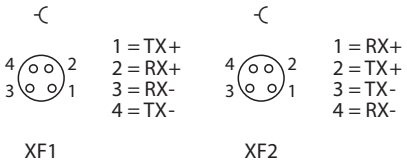


Fig. 15: EtherCAT pin assignment

6.3 Connecting the power supply

The device has two 4-pin, M8 connectors for connecting to the power supply. V1 and V2 are galvanically isolated from one another. The maximum tightening torque is 0.4 Nm.

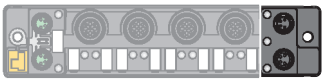


Fig. 16: Power supply connection

- ▶ Connect the device to the power supply according to the pin assignment shown below.
- ▶ Seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.
- ▶ Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws is 0.5 Nm.

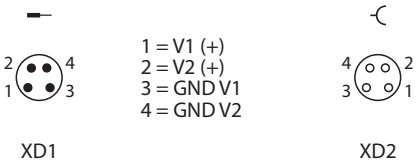


Fig. 17: Power supply connections pin assignment

Connection	Function
XD1	Power feed
XD2	Routing the power to the next unit

voltage	Function
V1	System voltage: Power supply 1 (includes supply to electronics)
V2	Load voltage: Supply voltage 2, passed through, not used in the device

NOTE
The system voltage (V1) and the load voltage (V2) are fed in and monitored separately. If the permitted voltage is not reached, the slots are switched off according to the supply concept for 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 is not reached, 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.

- ▶ Connect the read/write devices to the device as per the pin assignment shown below.
- ▶ Provide unused male connectors with suitable sealing or blanking caps. The tightening torque for the M4 screws is 0.5 Nm.

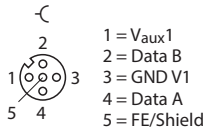


Fig. 18: RS485 — pin assignment of the read/write device connections

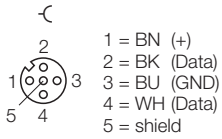


Fig. 19: …/S2500 connection cables — pin assignment of the read/write device connections

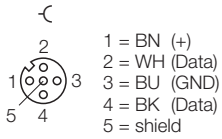


Fig. 20: …/S2501 connection cables — pin assignment of the read/write device connections

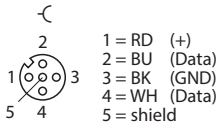


Fig. 21: …/S2503 connection cables — pin assignment of the read/write device connections

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 non-Ex areas

The following devices are required for bus mode in non-hazardous areas:

- VT2-FKM5-FKM5-FSM5 junction box (ID 6930573) 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 extension 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.

▶ Make allowance for the power supply, particularly at switch-on (see data sheet), as well as the maximum current carrying capacity of the lines (4 A).

▶ Make allowance for the voltage drop on the line. 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) after the last read/write head.

Fig. 22: HF bus mode setup

Connecting read/write heads for HF bus mode in Ex areas

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

The following devices are required for bus mode in hazardous areas:

- TN-R42TC-EX/C53 read/write head (ID 100020167)
- TN-R42TC-EX/C65 read/write head (ID 100028462) with integrated bus terminating resistor
- …/S2500 RFID extension 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 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 due to 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 against accidental removal during operation using safety clip SC-M12/3GD.
- ▶ Protect the M12 male connector against mechanical damage.

DANGER
Potentially explosive atmosphere
Risk of explosion due to spark ignition
- ▶ When used in Zone 1/21, observe the instructions for use for the connected devices.

- ▶ Operation in Zone 2/22: Connect the read/write heads via VT2-FKM5-FKM5-FSM5 junction boxes as shown in the figure below (for max. tightening torque see the data sheet of the cable used). The maximum permissible length of the spur line is 2 m.
- ▶ Operation in Zone 1/21: Connect the read/write heads via terminal boxes as shown in the figure below. The maximum permissible length of the spur line is 2 m.
- ▶ Make allowance for the power supply, particularly at switch-on (see data sheet), as well as the maximum current carrying capacity of the lines (4 A).
- ▶ Make allowance for the voltage drop on the line. 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 if necessary. 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.

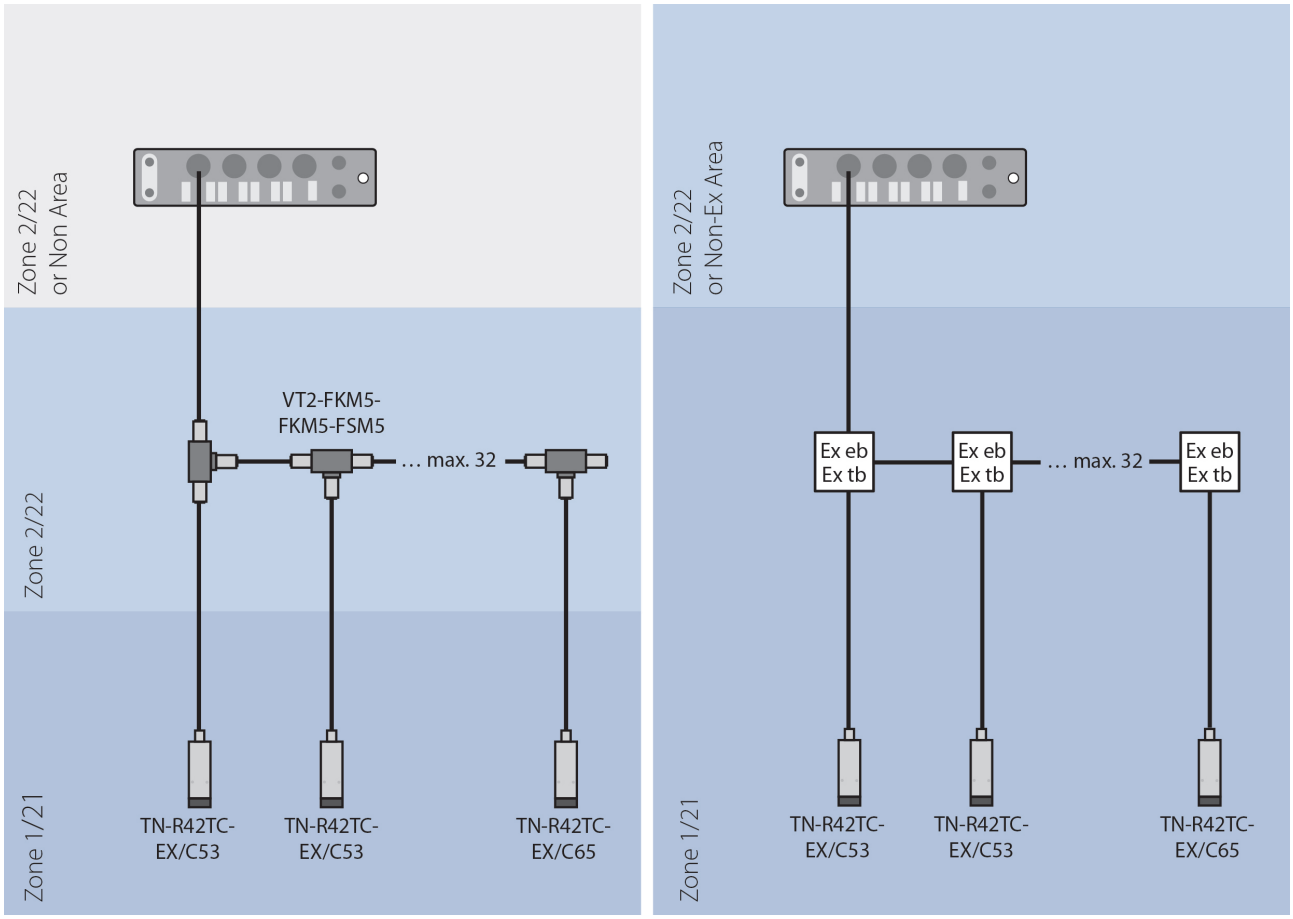


Fig. 23: System design

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.

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

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).

In the default configuration the idle command (0x0000) is active. 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 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 Assigning IP address for EoE).
- Configure reader via TAS (Turck Automation Suite), the device's web server or DTM.

7.1 Addressing a device on EtherCAT

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

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

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

7.2 ESI files

Different ESI files must be used depending on the controller environment

Controller/configuration software	ESI file
TwinCAT	Turck_TBEC-S2-4RFID_R1_ESI_….xml Example: Turck_TBEC-S2-4RFID_R1_ESI_1-3_20230915_9071.xml
CODESYS	Turck_TBEC-S2-4RFID_R1_ESI_….xml Example: Turck_TBEC-S2-4RFID_R1_ESI_1-3_20230915_9071.xml
Sysmac Studio	Turck_TBEC-S2-4RFID_R1_ESI_…_omron_….xml Example: Turck_TBEC-S2-4RFID_R1_ESI_1-3_omron_20230915_9071.xml

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

7.3 Connecting the device to an EtherCAT master with TwinCAT

Naming convention

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

Hardware used

This example uses the following hardware components:

- Example device "EtherCAT Device"

Software used

This example uses the following software:

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

7.3.1 Installing ESI files

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

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

⇨ The device description is loaded.

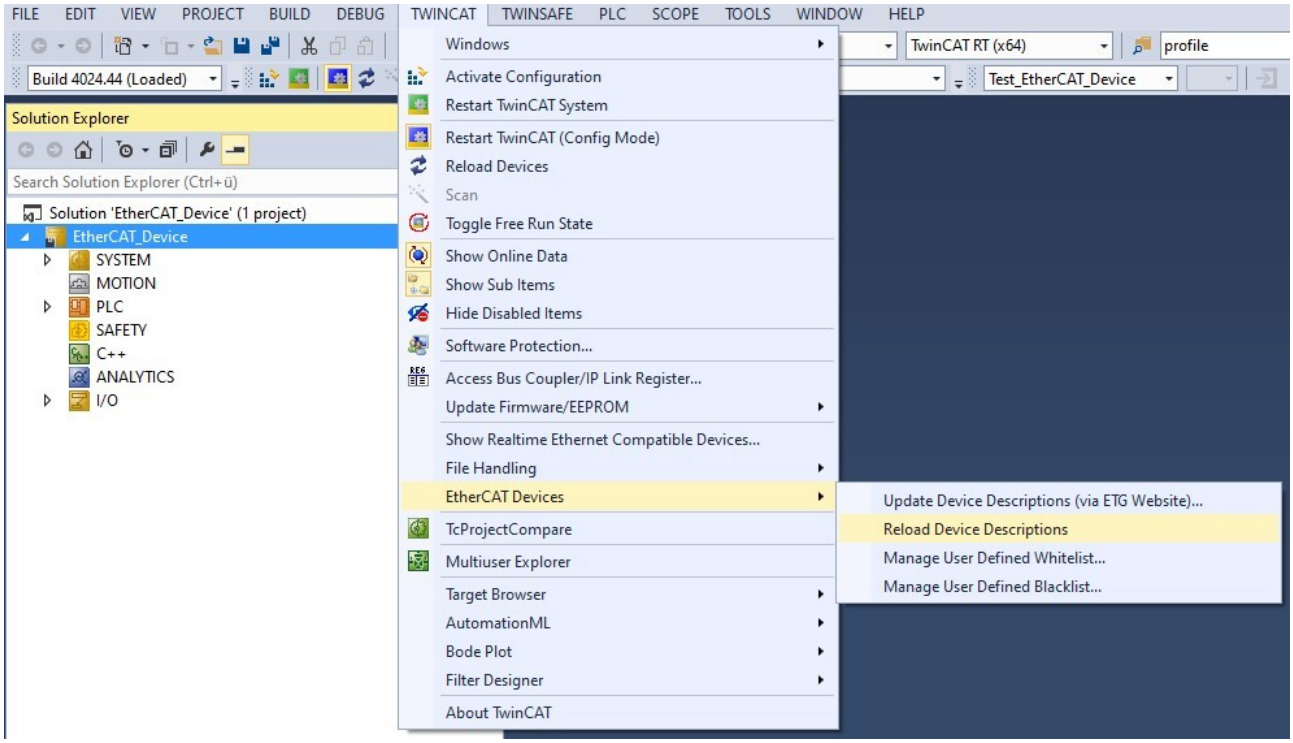


Fig. 24: Update the device catalog in TwinCAT

7.3.2 Connecting the device with the controller

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

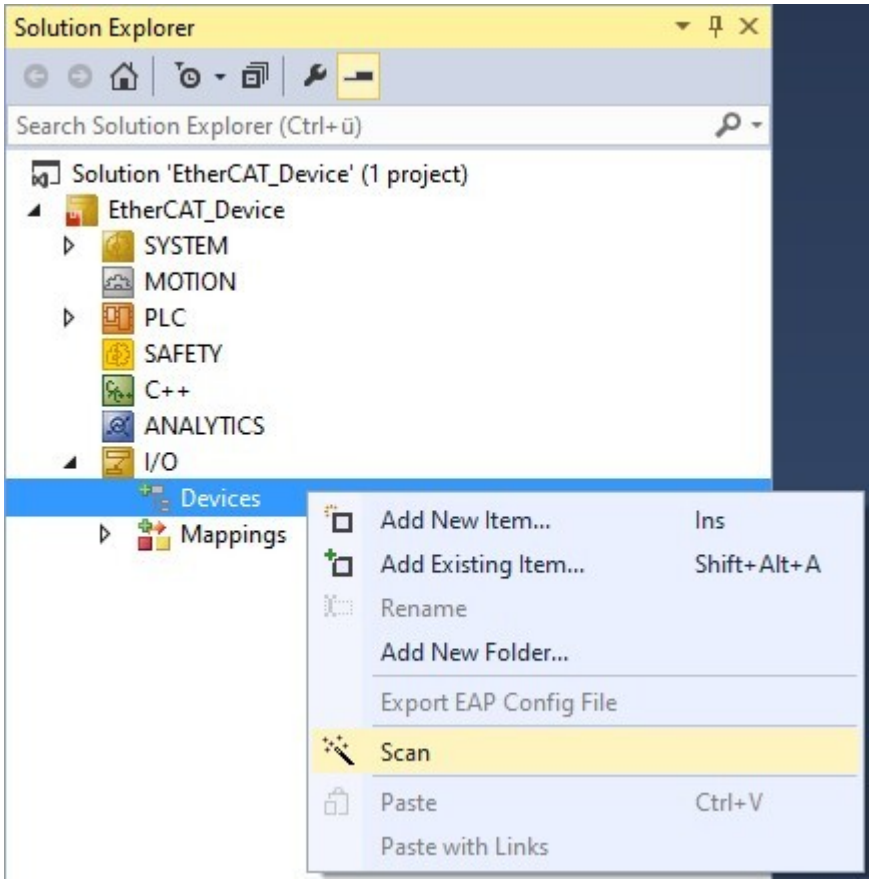


Fig. 25: Scan for devices in TwinCAT

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

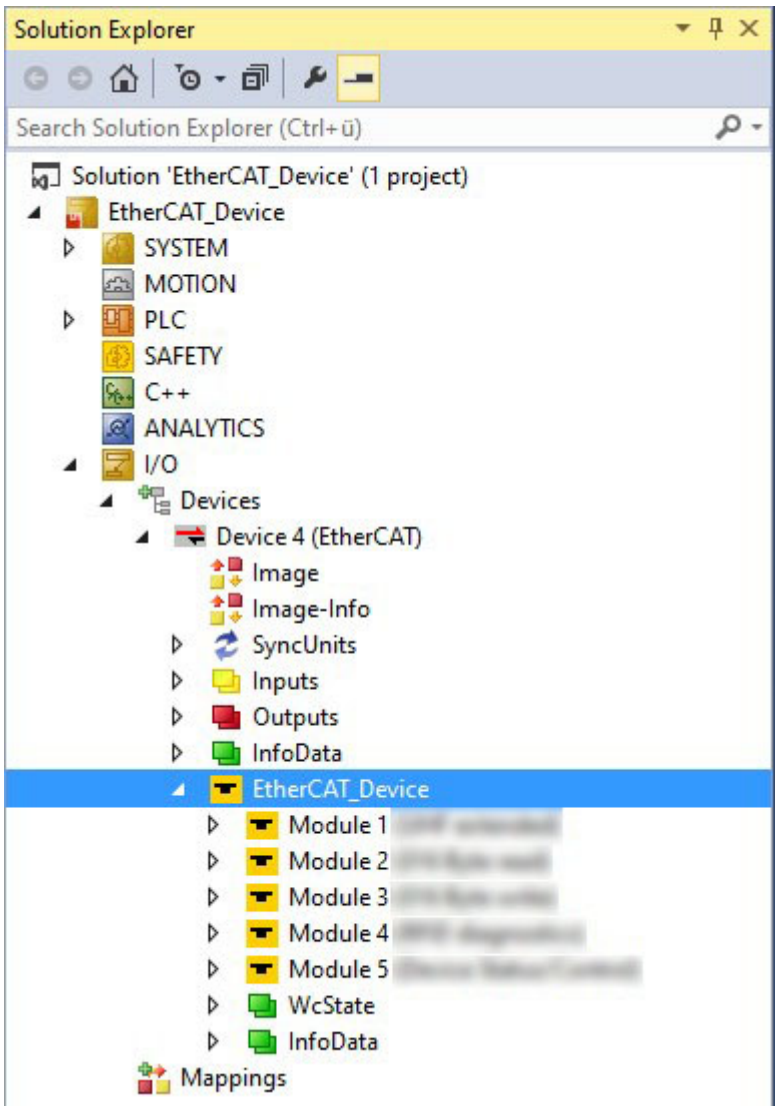


Fig. 26: EtherCAT Device in Solution Explorer

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

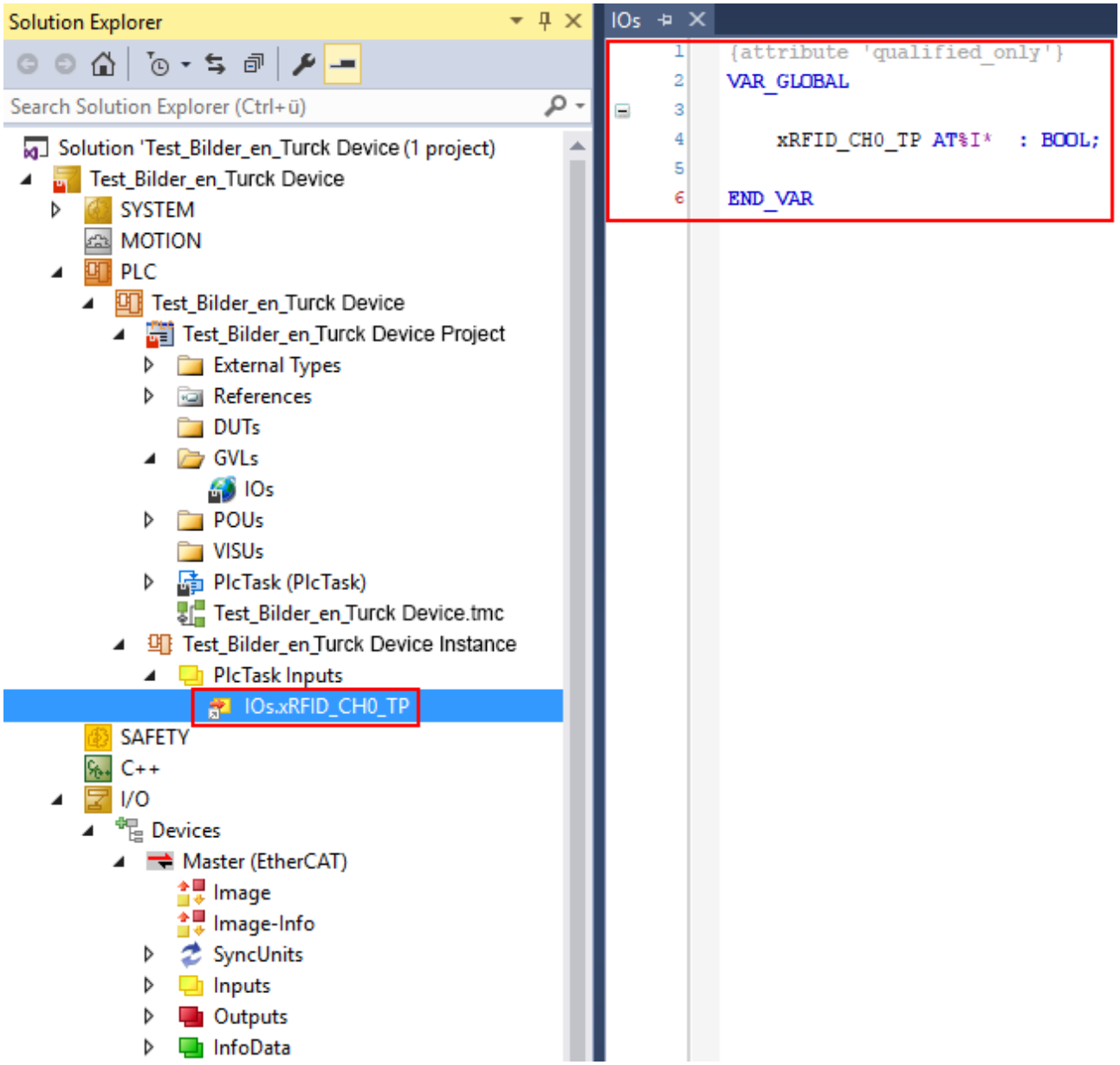


Fig. 27: Example of linking a variable

▶ Click the **Activate configuration** button.

Fig. 28: Activating the configuration

⇨ The device configuration is activated.

▶ Click the **Run mode** button.

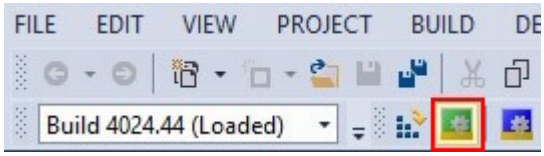


Fig. 29: Activating Run mode

⇨ The device is connected online with the EtherCAT master.

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

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

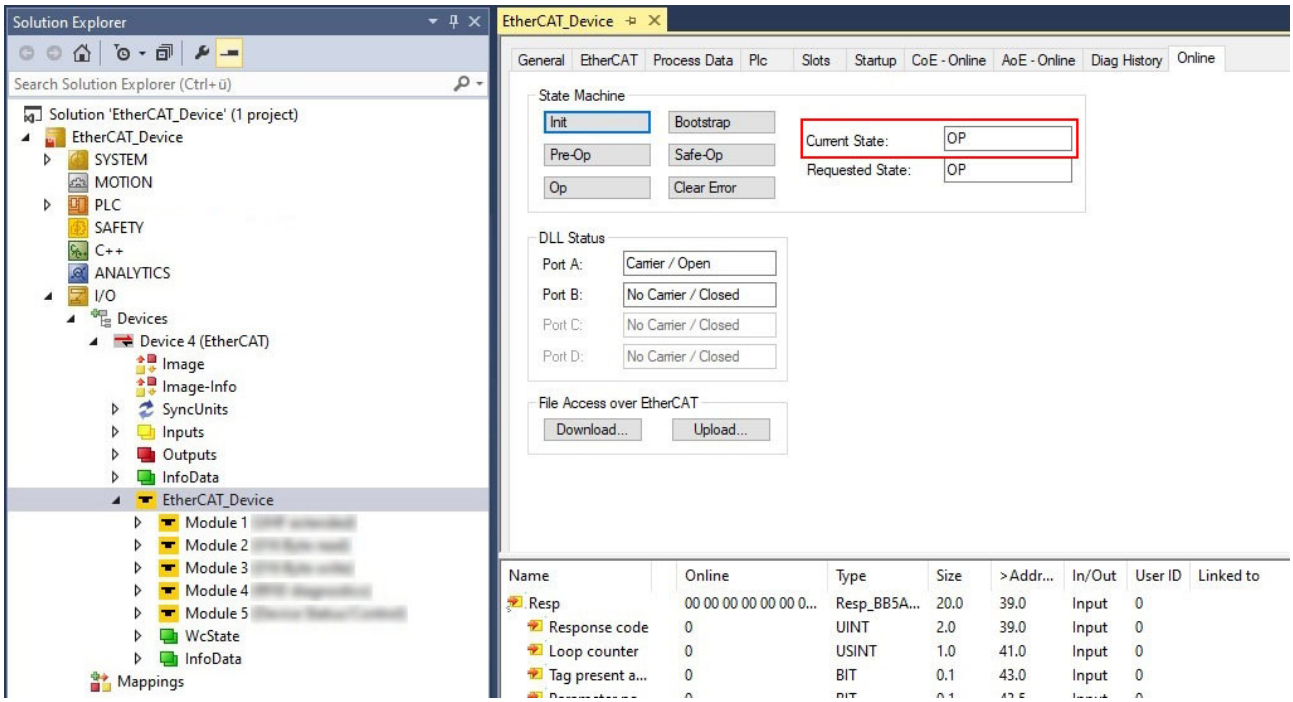


Fig. 30: Status of the EtherCAT device in TwinCAT

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

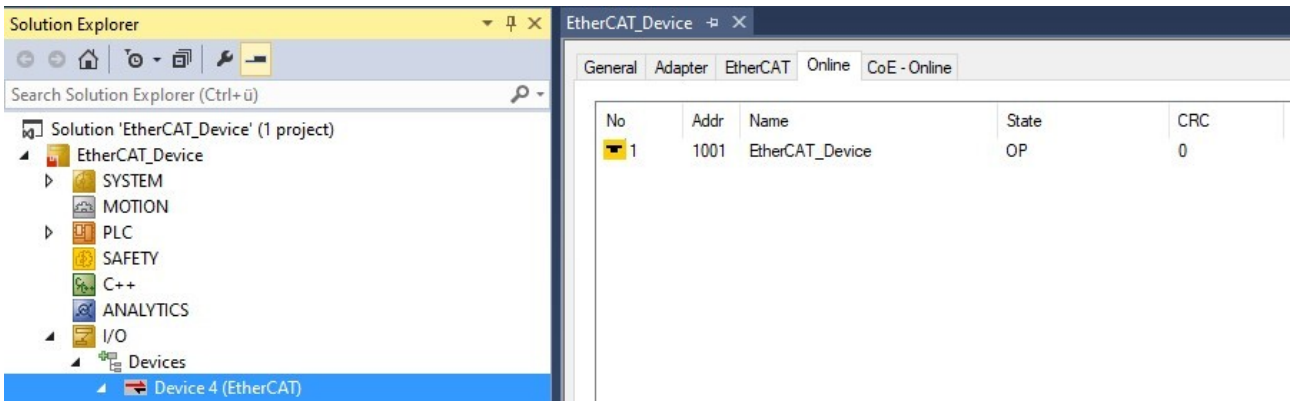


Fig. 31: Status of the EtherCAT master in TwinCAT

The following states are possible:

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

7.3.3 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 on **EtherCAT Device** in the 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 [<].

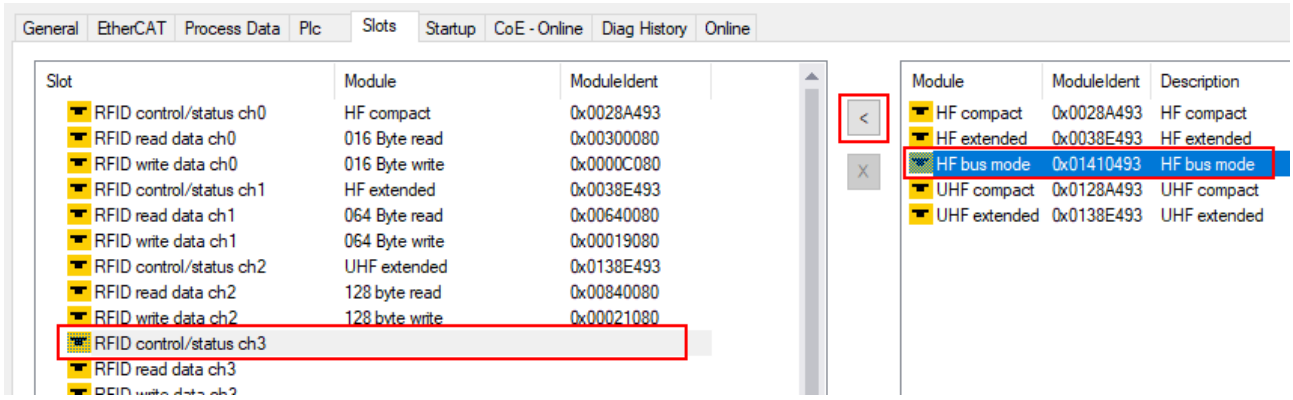


Fig. 32: Select HF bus mode for channel 3

⇨ 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: Select the HF tag type

- Double-click on **EtherCAT Device** in the 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**.
- In the **Set Value Dialog** submenu select the tag in the **Enum** drop-down menu (here: **Fujitsu MB89R112**).
- Confirm the selection with **OK**.

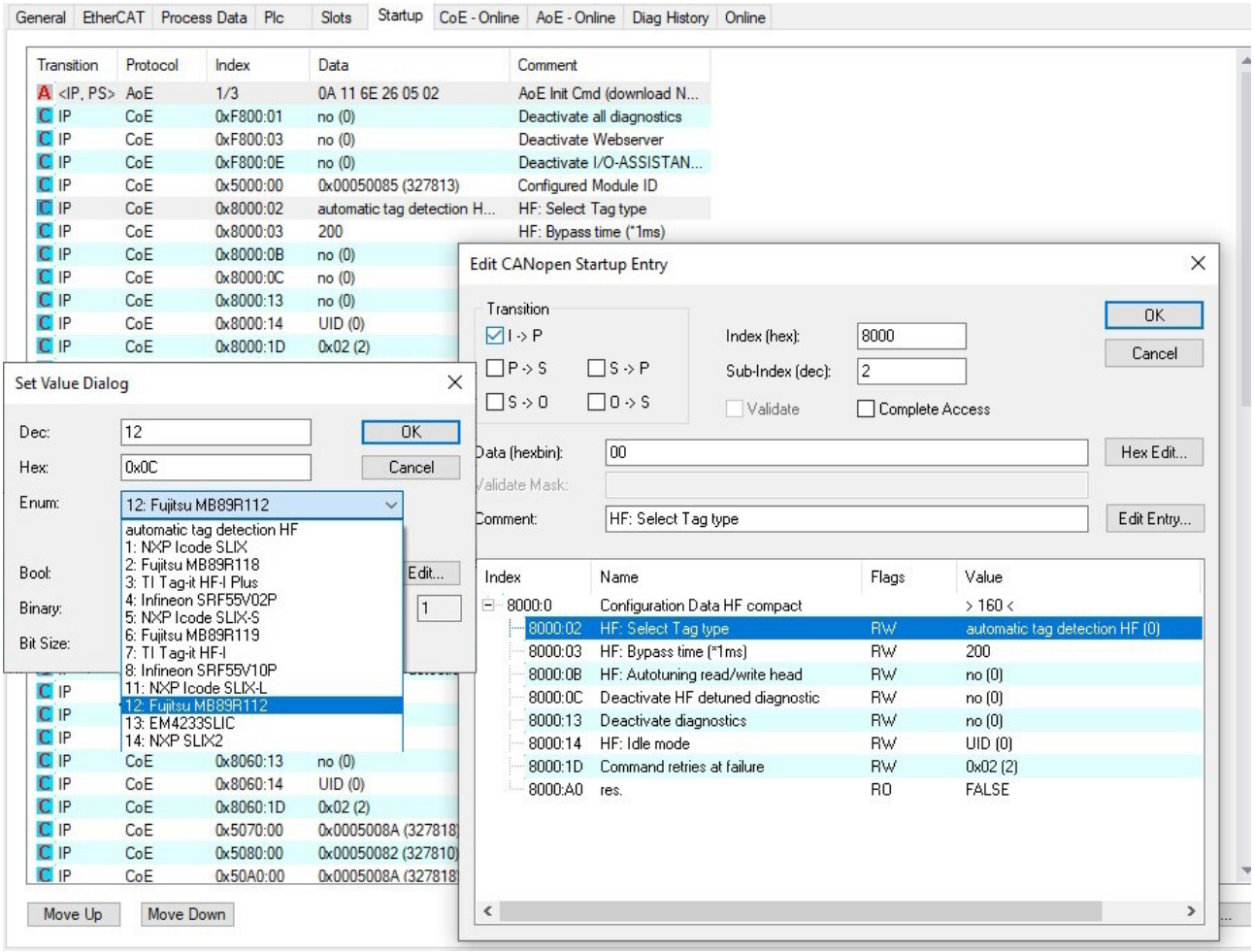


Fig. 33: Select the HF tag type

➪ The tag type is set.

7.3.5 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

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

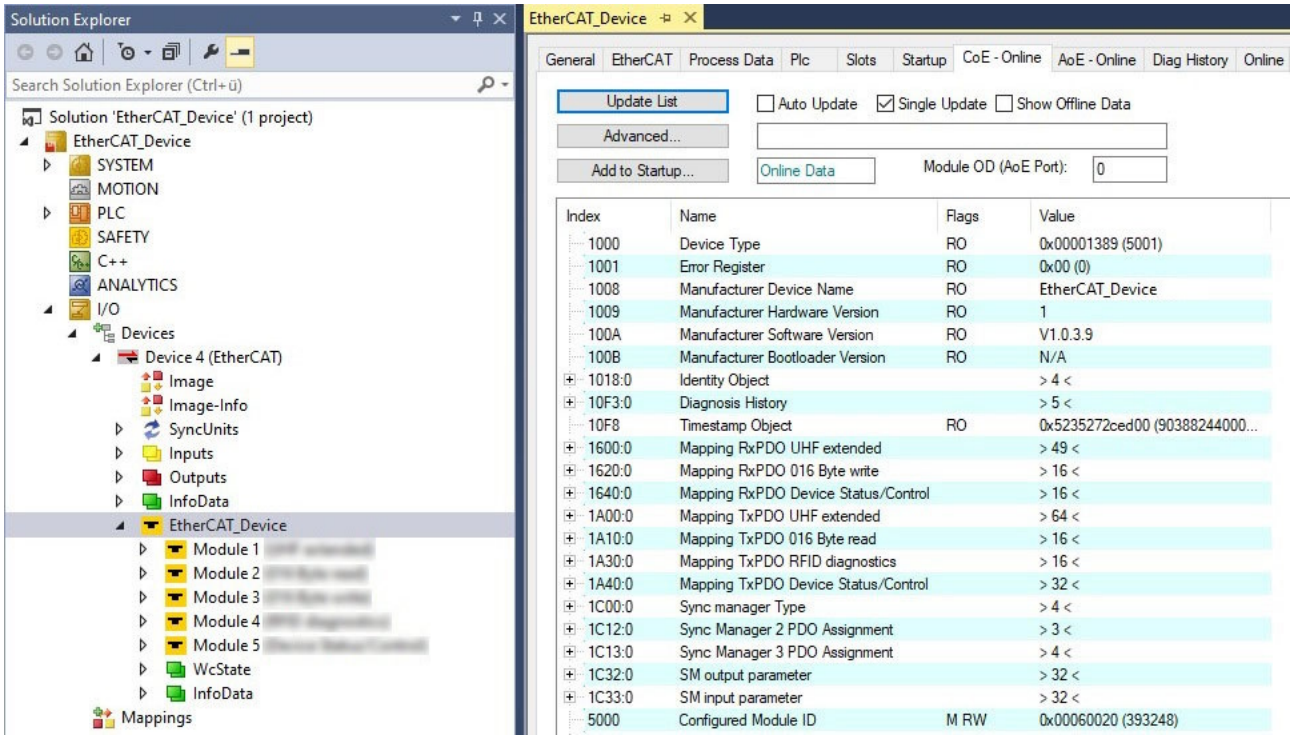


Fig. 34: Object Dictionary

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

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

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

7.3.6 Addressing a device via Explicit Device ID

- Double-click on **EtherCAT Device** in the project tree.
- On the tab **EtherCAT** → **Advanced Settings** → **General** → **Identification** → activate **Explicit Device Identification (ADO 0x0134)**.
- In the **Value** field, enter the Identification Value (hex.); this value must match the rotary coding switches on the device (see [▶ 27]).
- Confirm entries with **OK**.
- Carry out a voltage reset.

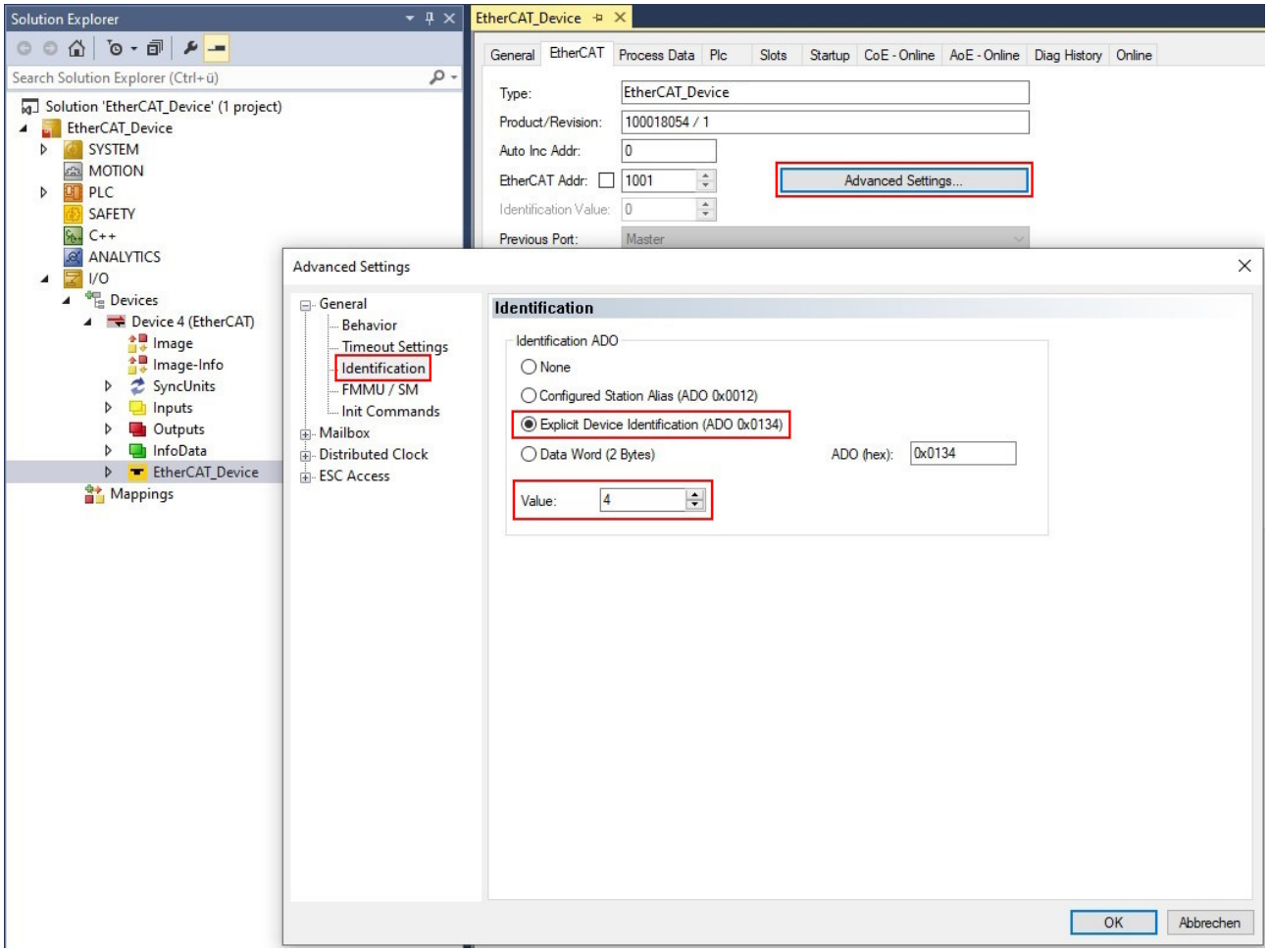


Fig. 35: Explicit Device Identification in TwinCAT

7.3.7 Addressing a device via Configured Station Alias

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

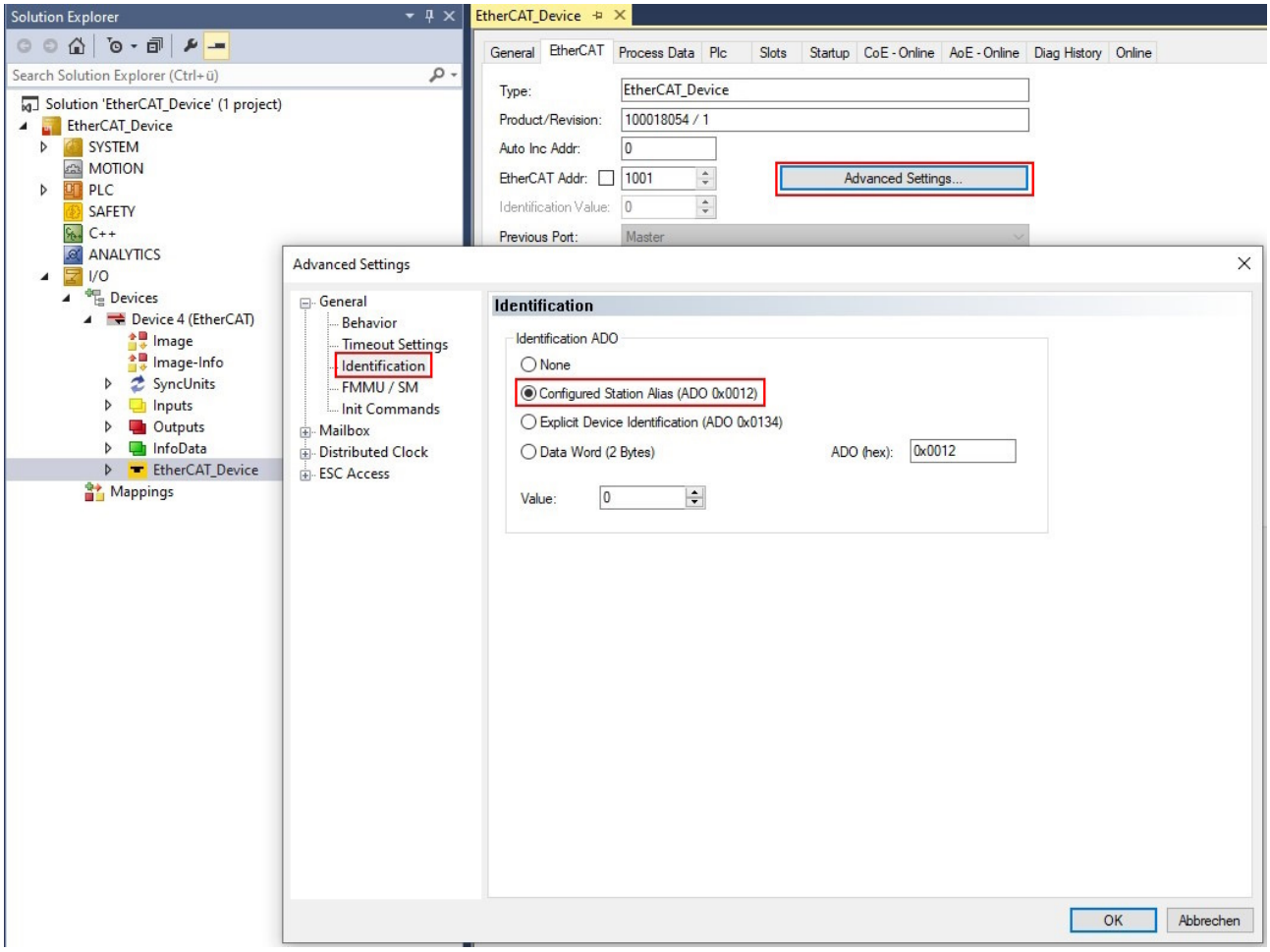


Fig. 36: Select Configured Station Alias in TwinCAT

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

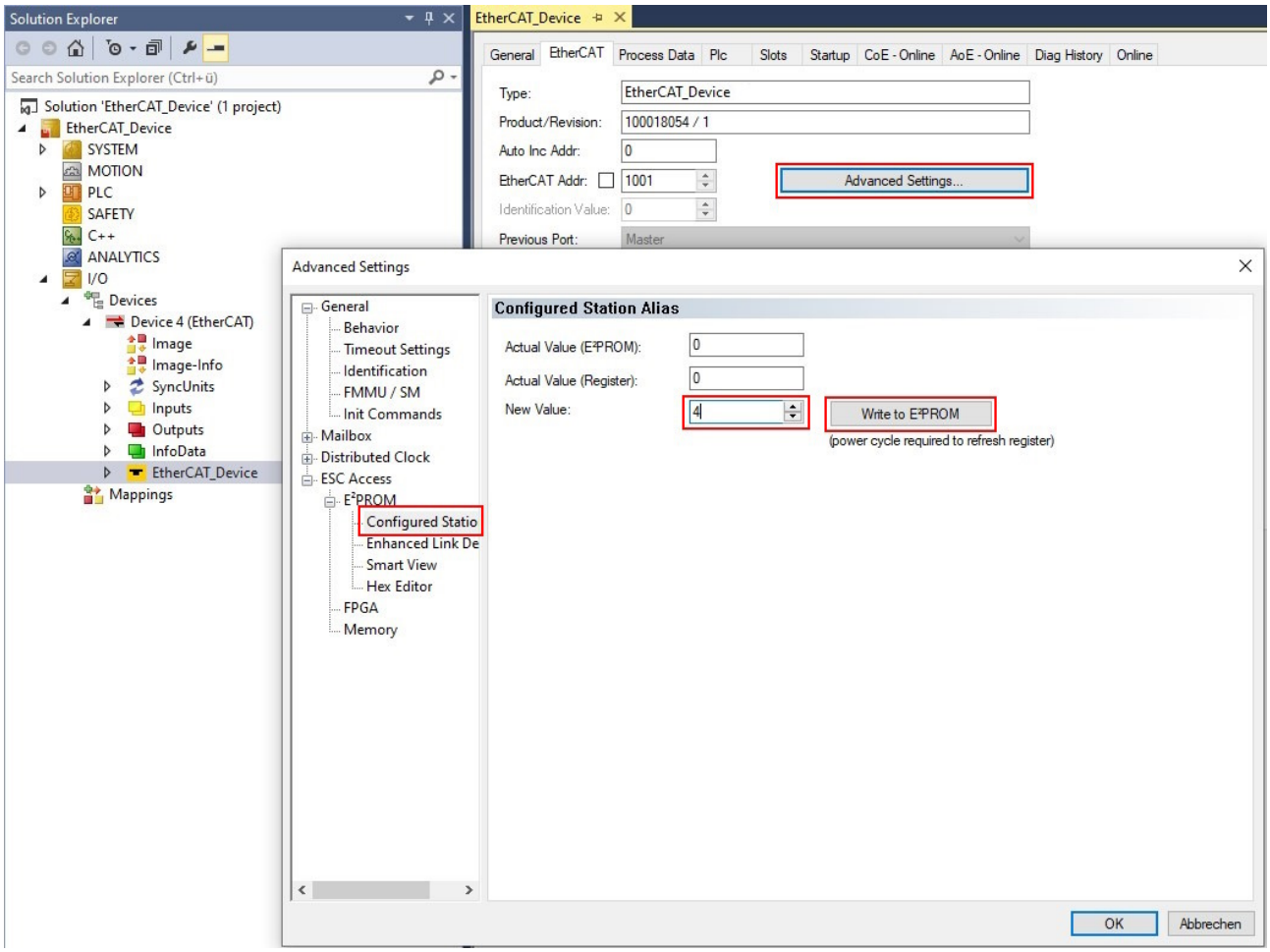


Fig. 37: Enter the Identification Value under Configured Station Alias in TwinCAT

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

7.3.8 Activating HotConnect

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

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

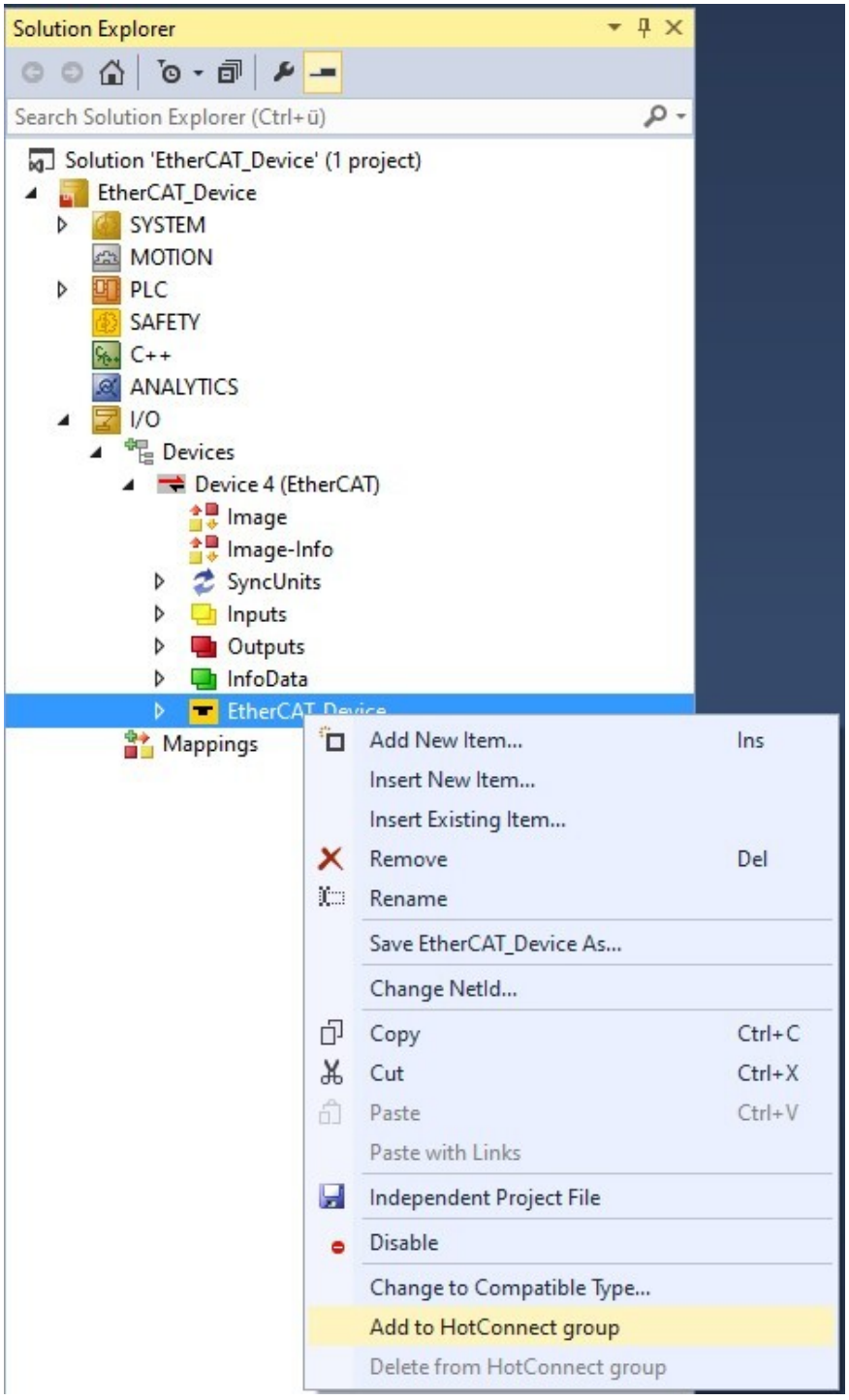


Fig. 38: Adding to HotConnect Group

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

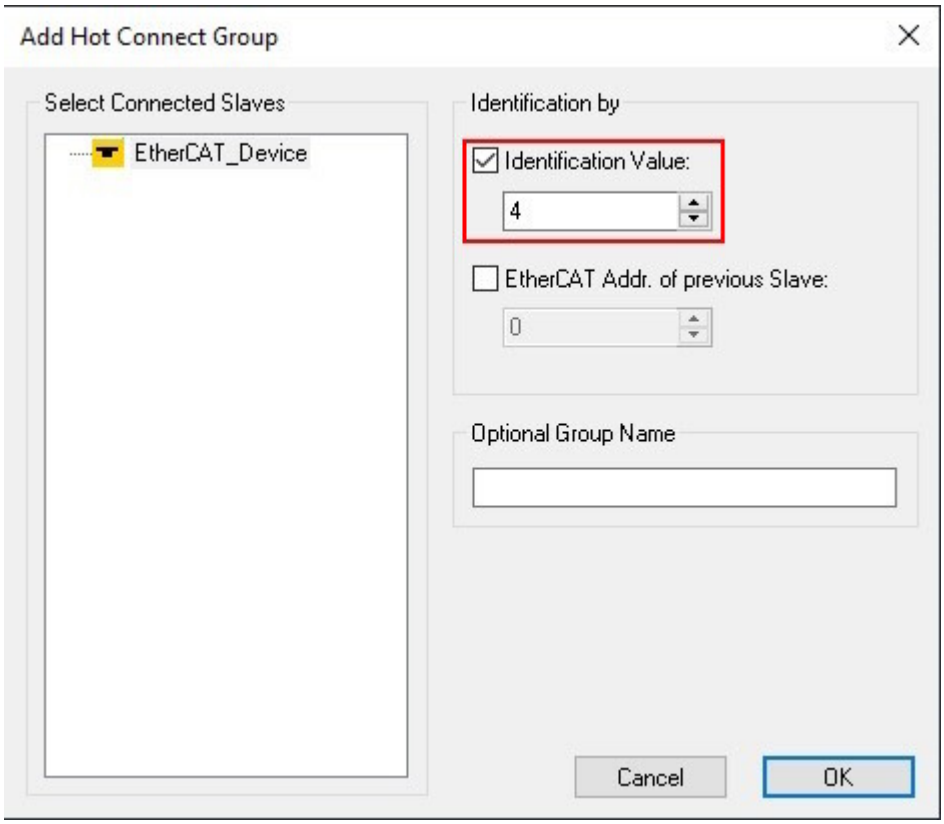


Fig. 39: Set the Identification Value for the HotConnect Group

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

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

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

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

7.3.9 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 variable linking is described in the section "Incorporating a function block in TwinCAT" (Using function blocks in CODESYS or TwinCAT). The structures of the TwinCAT library must be accessed for the linking. The library is available free of charge for download from www.turck.com.

7.4 Connecting the device to an EtherCAT master with CODESYS

Naming convention

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

Hardware used

This example uses the following hardware components:

- Block module TBEC-S2-4RFID
- WinPLC as EtherCAT master

Software used

This example uses the following software:

- CODESYS 3.5 SP18 (download free of charge from www.turck.com)
- ESI file für TBEC-S2-4RFID (download free of charge from www.turck.com)

7.4.1 Installing ESI files

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

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

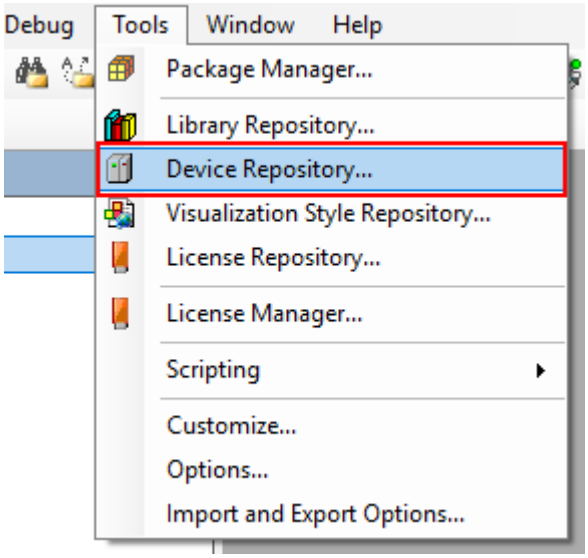


Fig. 40: Device repository

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

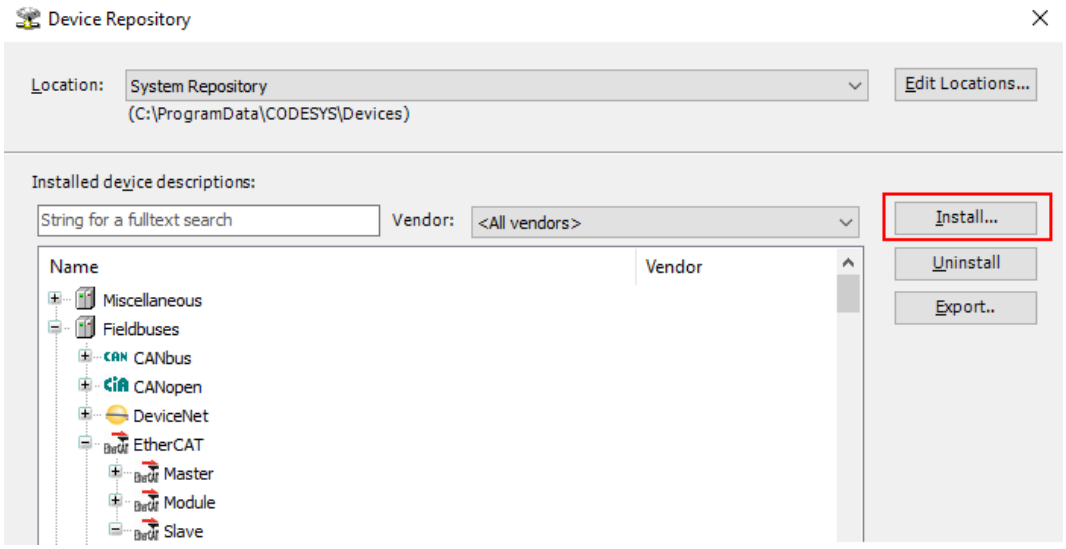


Fig. 41: Installing the device description file

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

7.4.2 Connecting the device with the controller

Requirements

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

Example: Creating a project with WinPLC

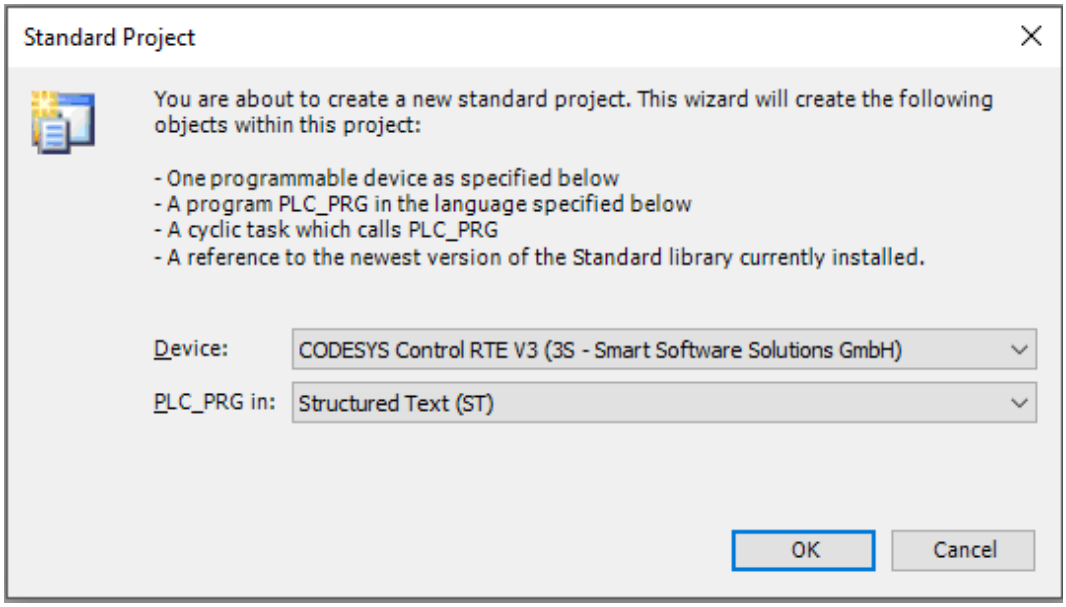


Fig. 42: Example: Create project

Adding an EtherCAT master

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

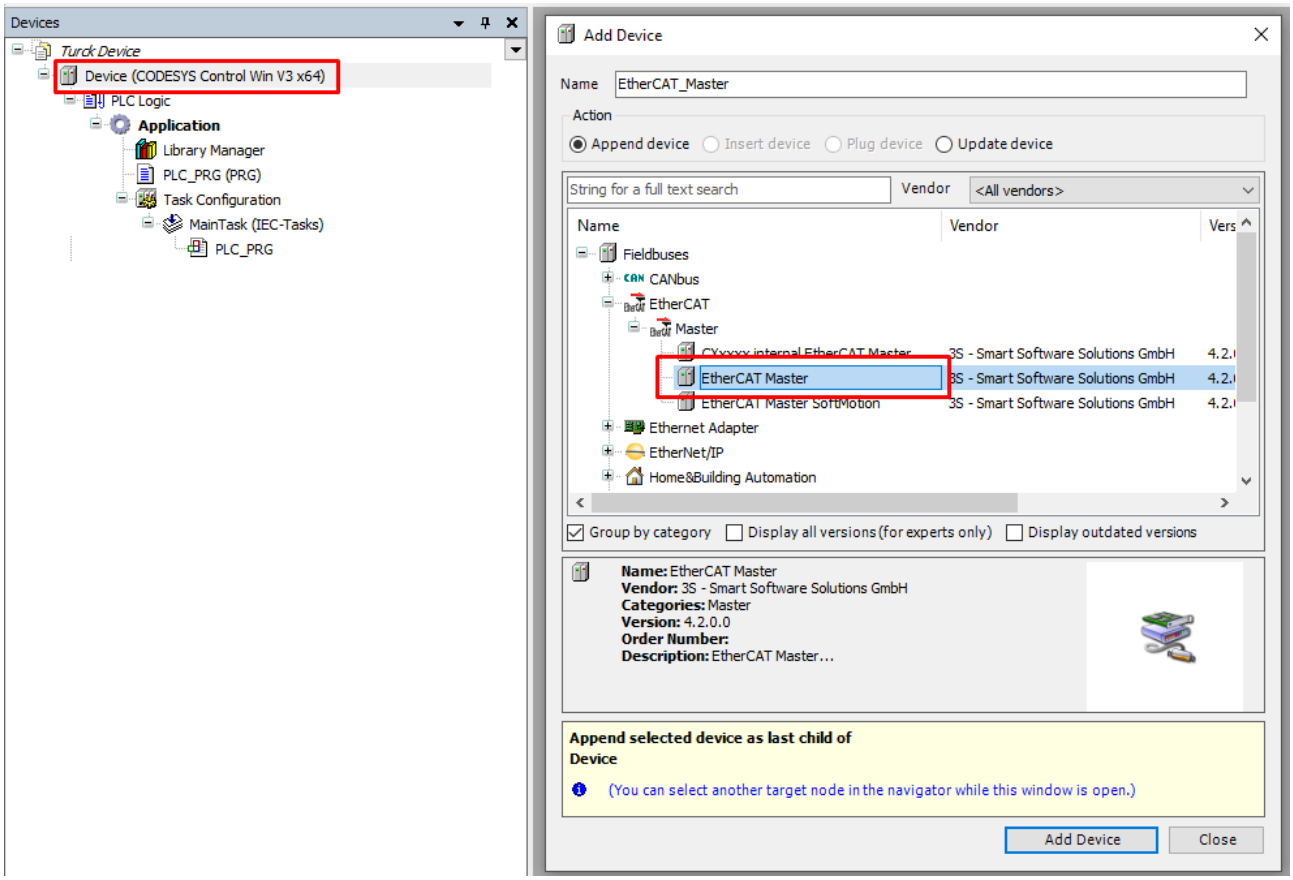


Fig. 43: Adding the device

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

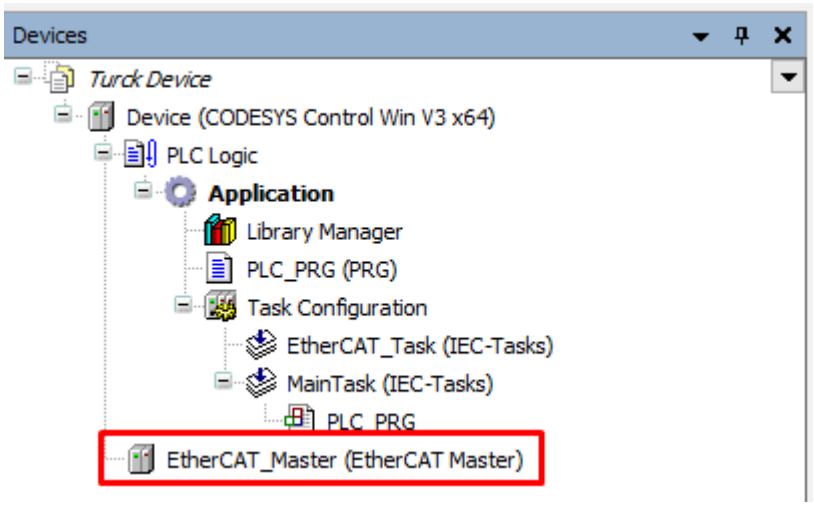


Fig. 44: Project tree

Selecting a network adapter

- ▶ Double-click **EtherCAT_Master (EtherCAT Master)** in the project tree.
- ▶ Select the network adapter and confirm with **OK**.

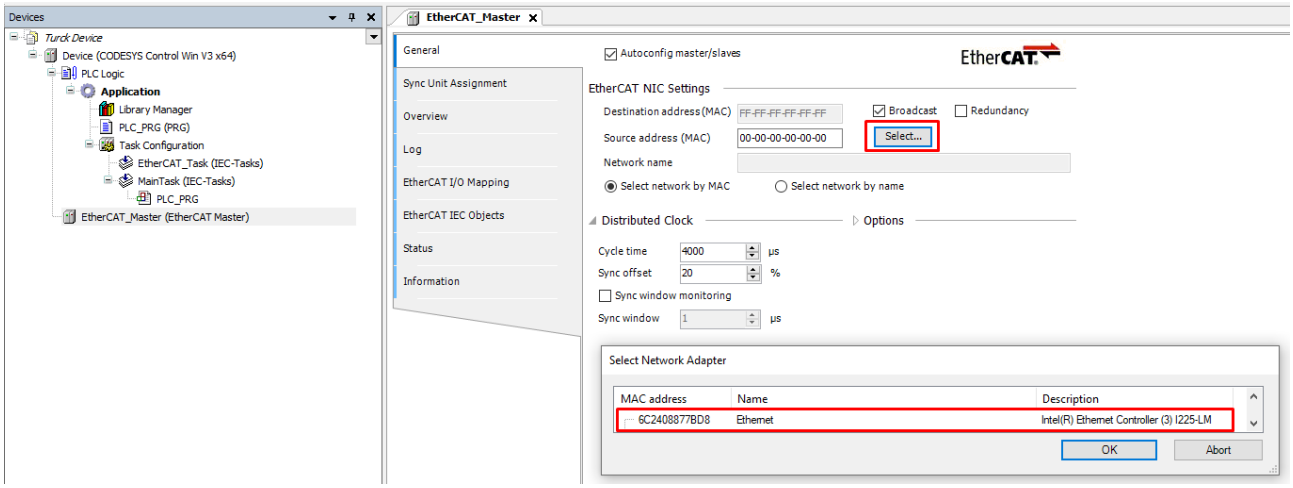


Fig. 45: Selecting a network adapter

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

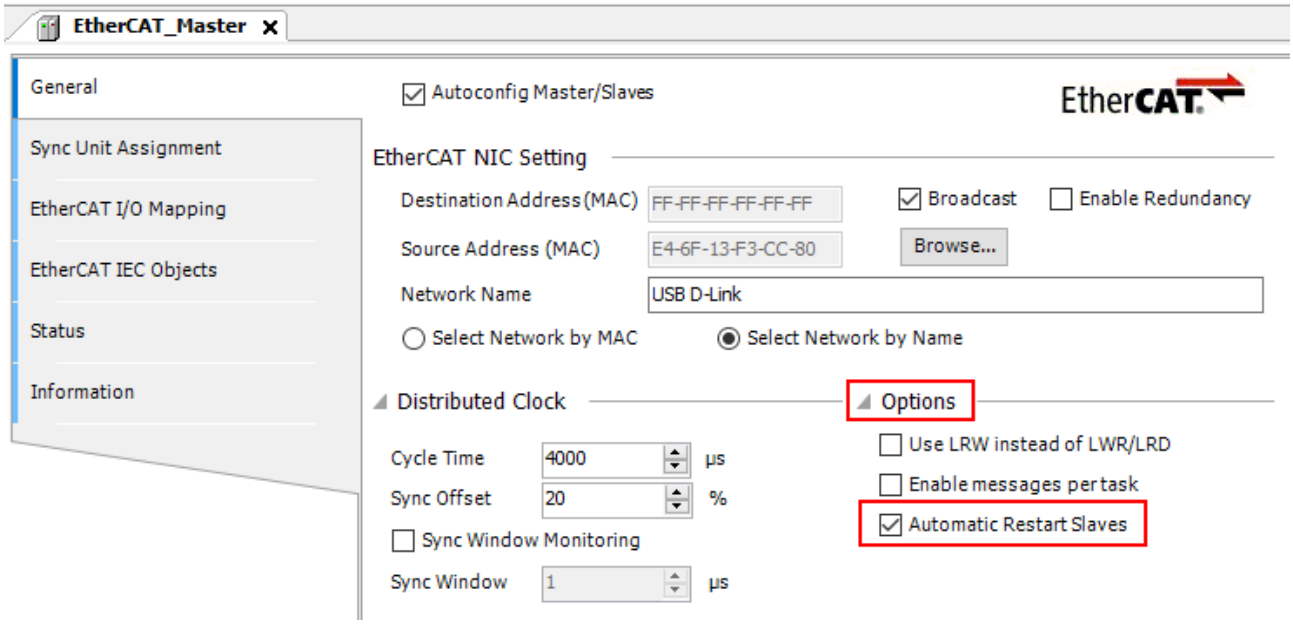


Fig. 46: Automatic Slaves Restart

- ▶ 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**.

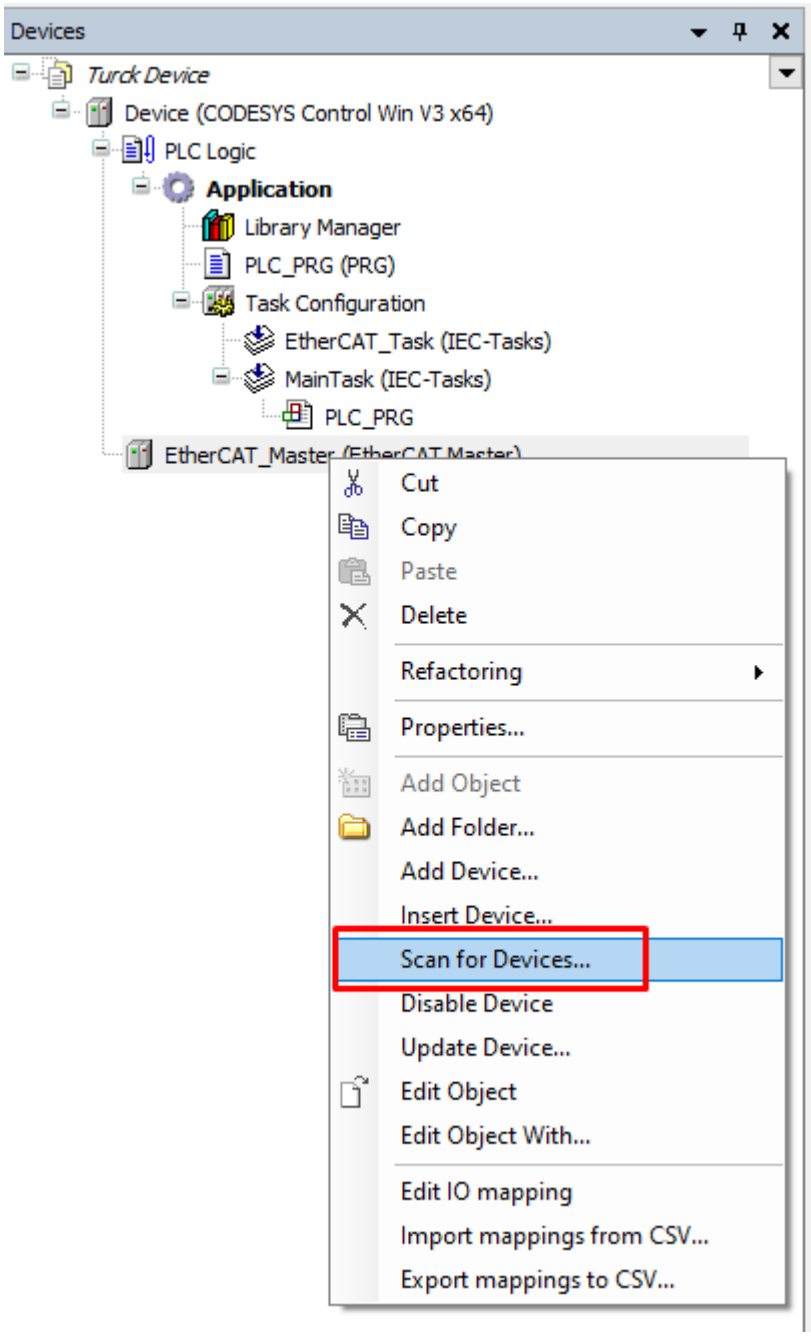


Fig. 47: Scanning for devices

- ▶ Select an EtherCAT slave (here: **TBEC-S2-4RFID**) in the following window and click **Copy to Project**.
- ⇨ The module appears in the project tree with the default settings from the ESI file.

Connecting the device online with the controller

- ▶ Click **Online** → **Login**.
- ⇨ The device is connected online with the PLC.
- ⇨ The green symbols in the project tree indicate the active connection.
- ▶ Double-click **TBEC_S2_4RFID (TBEC-S2-4RFID)**.
- ⇨ On the **General** tab → **Diagnostics**, the **Operational** status indicates the active connection.

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**.

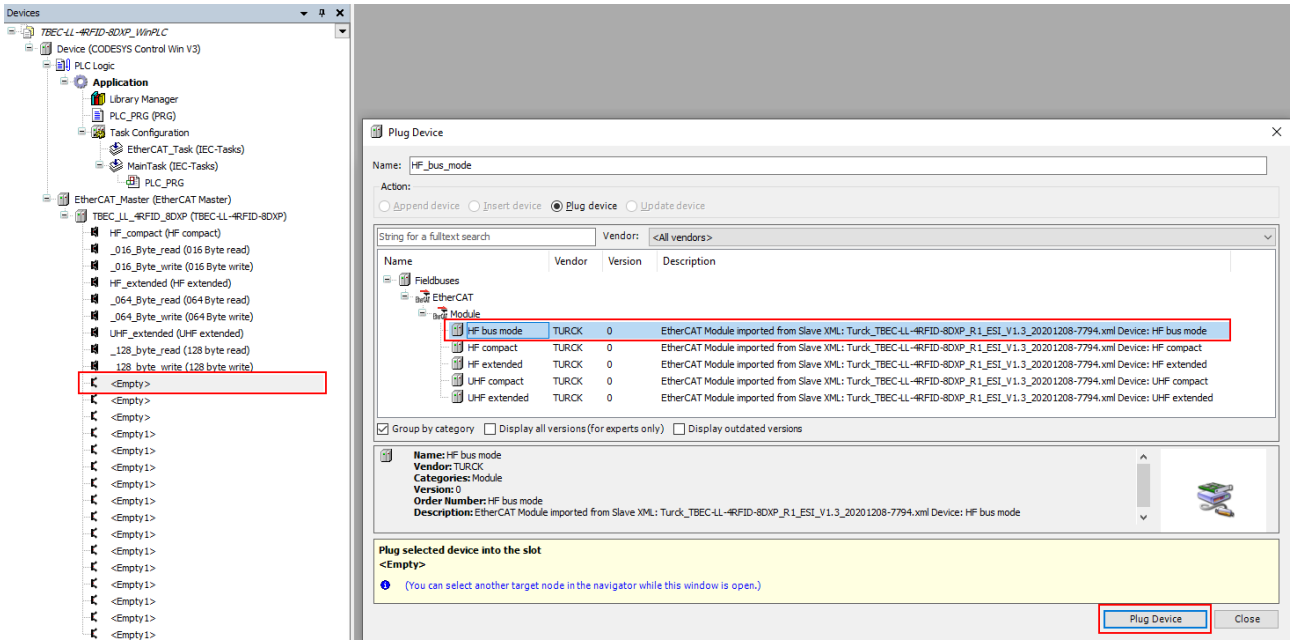


Fig. 48: Selecting HF bus mode

⇨ HF bus mode is set for channel 3.

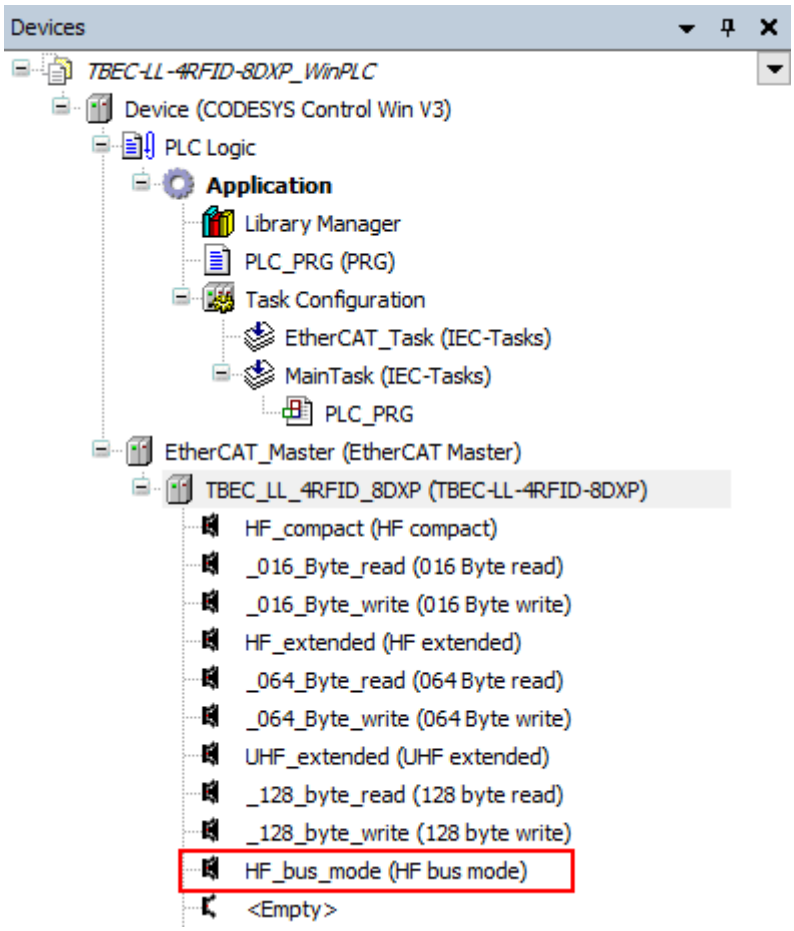


Fig. 49: HF bus mode is set for channel 3

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_S2_4RFID (TBEC-S2-4RFID)**.
- ▶ 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.

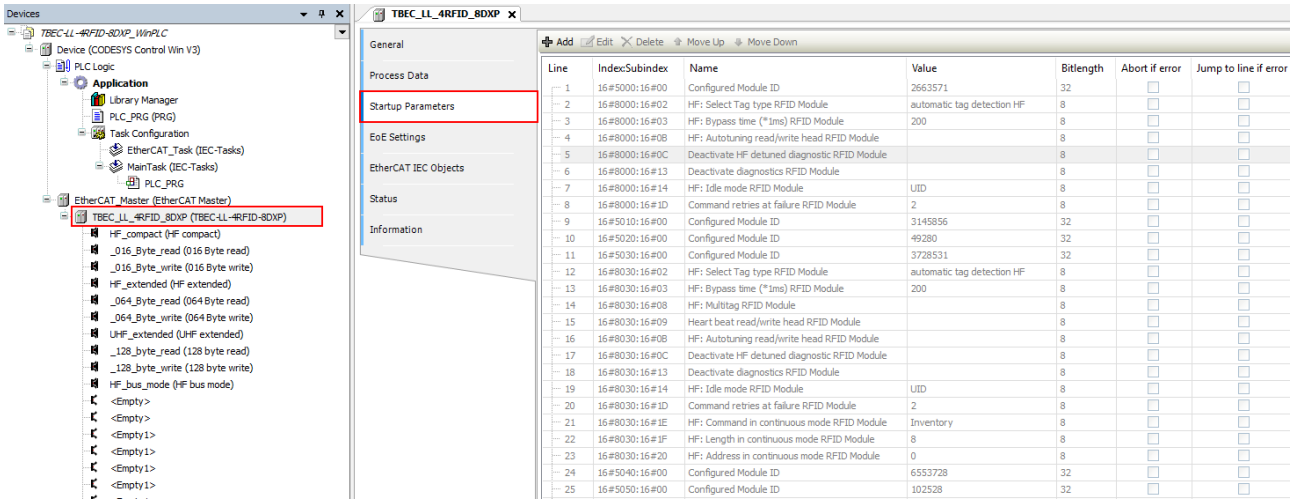


Fig. 50: Startup parameters of the module

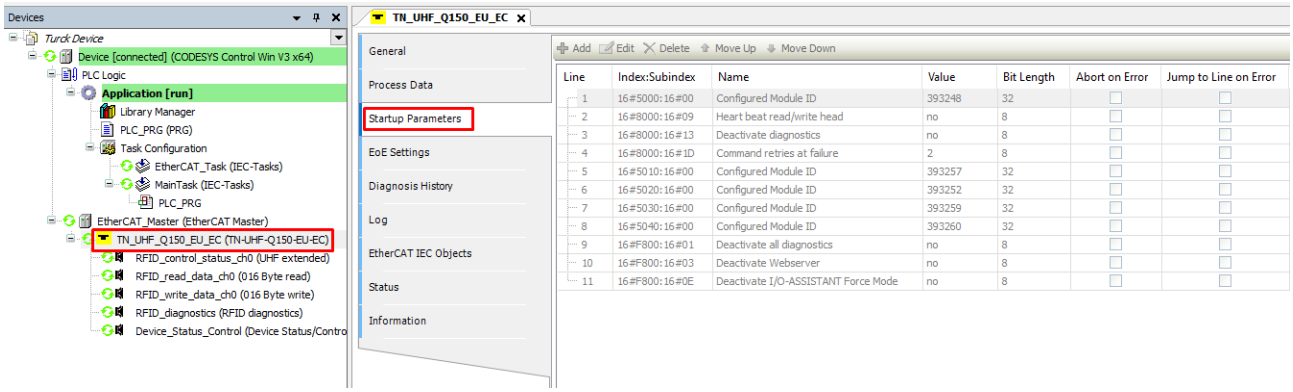


Fig. 51: Startup parameters of the module

7.4.5 Setting EtherCAT device parameters via the object dictionary

NOTE
Turck recommends only making changes in the startup parameters.

- Double-click **TBEC_S2_4RFID (TBEC-S2-4RFID)**.
- In the **General** tab, select the option **Activate expert settings**.

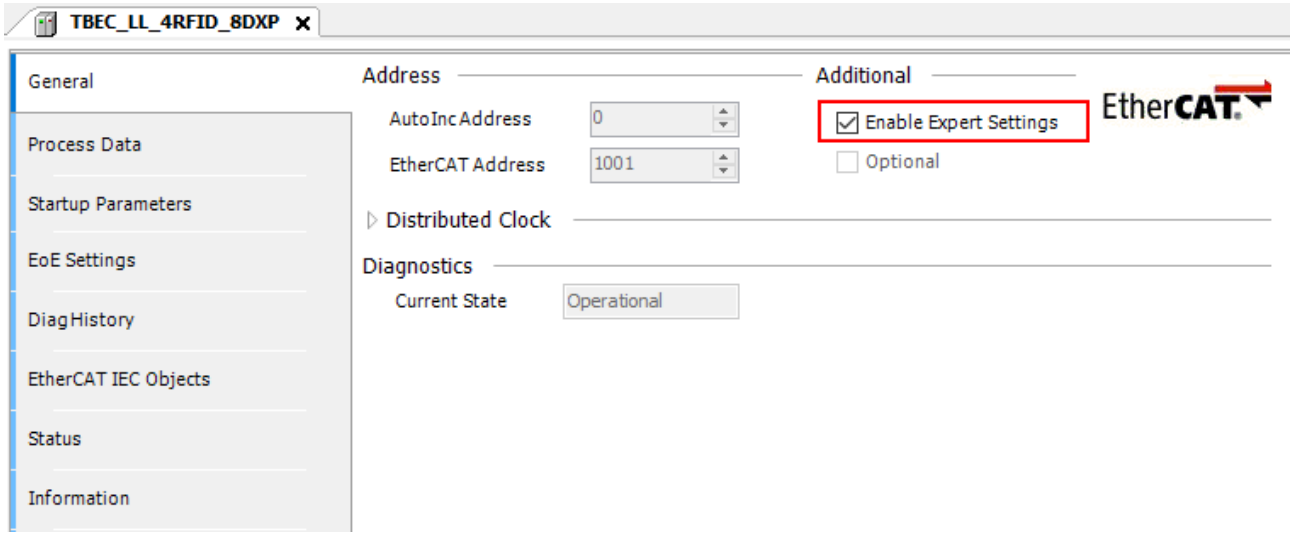


Fig. 52: Activating expert settings

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

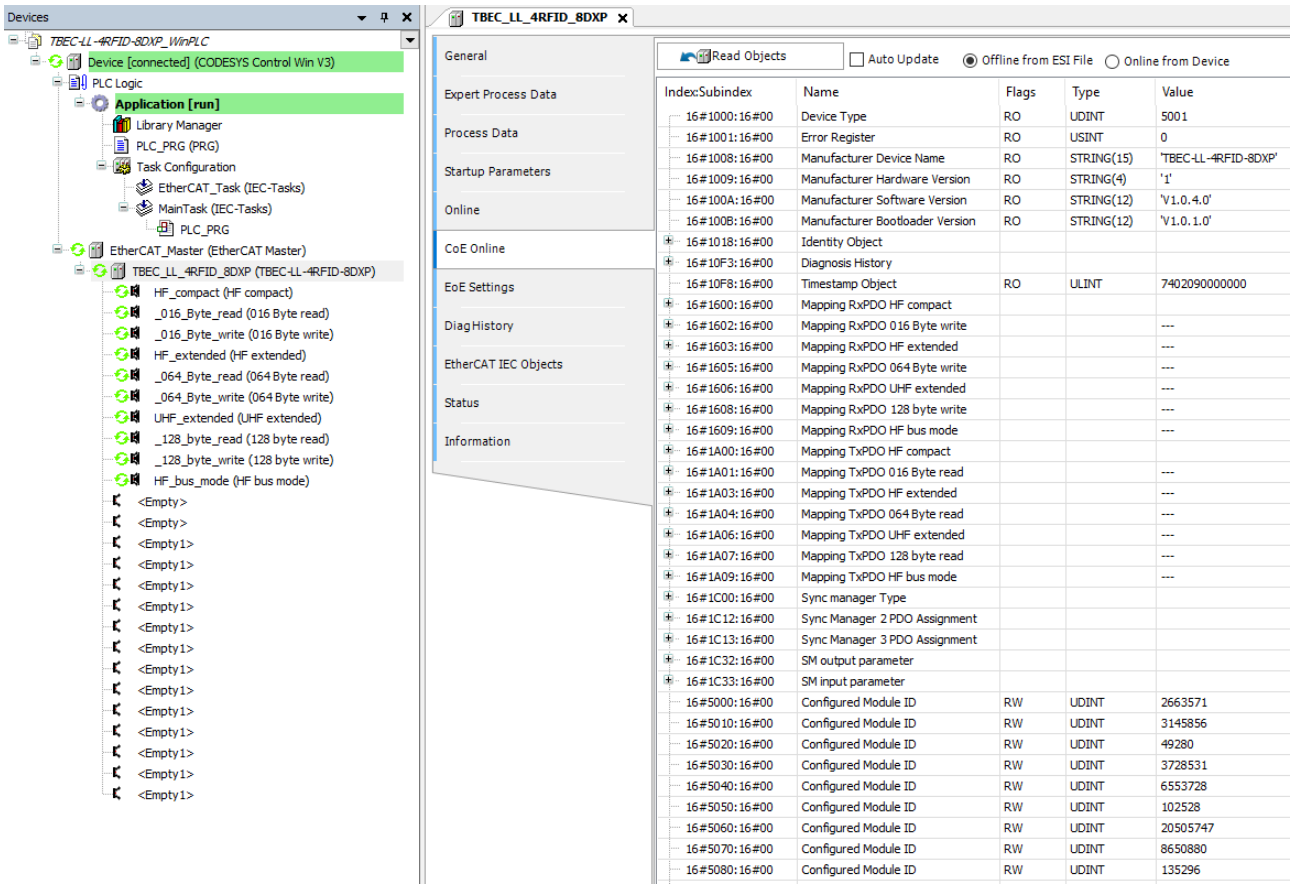


Fig. 53: Object dictionary

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

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

7.4.6 Addressing a device via Configured Station Alias

- ▶ Double-click **TBEC_S2_4RFID (TBEC-S2-4RFID)**.
- ▶ 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**.
- ▶ Confirm the following dialog with **OK**.

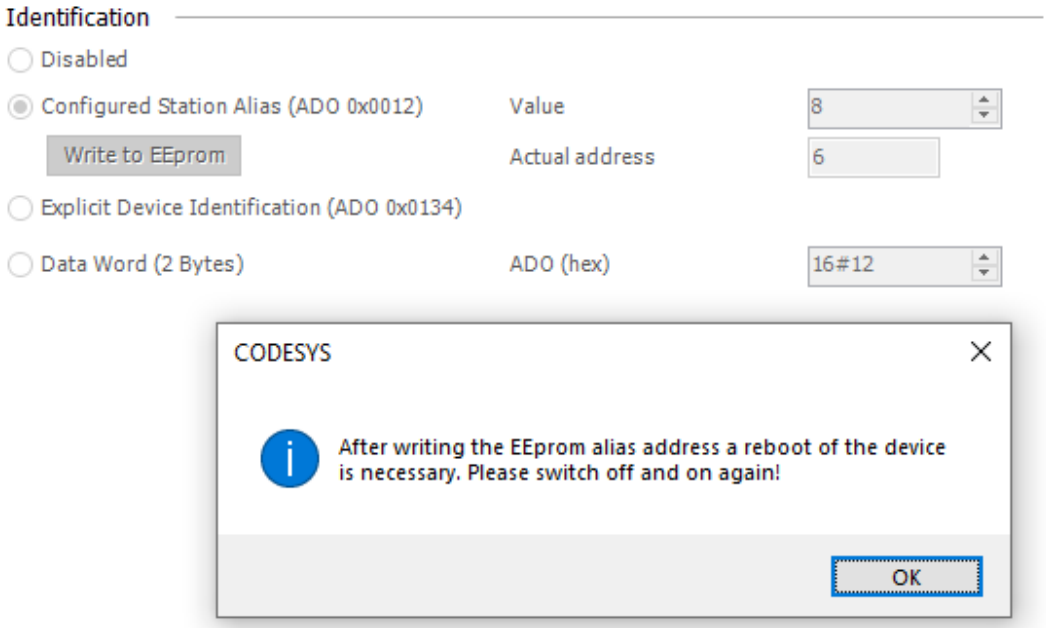


Fig. 54: CODESYS: Restart required

⇨ 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 the device to an EtherCAT master with Sysmac Studio

Naming convention

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

Hardware used

This example uses the following hardware components:

- Block module TBEC-S2-4RFID
- Omron NX1P2-9024DT1, Version 1.41 (minimum requirements: Version ≥ 1.40)

Software used

This example uses the following software:

- Omron Sysmac Studio Version 1.45 (minimum requirement: Version ≥ 1.41)
- ESI file for TBEC-S2-4RFID 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**.

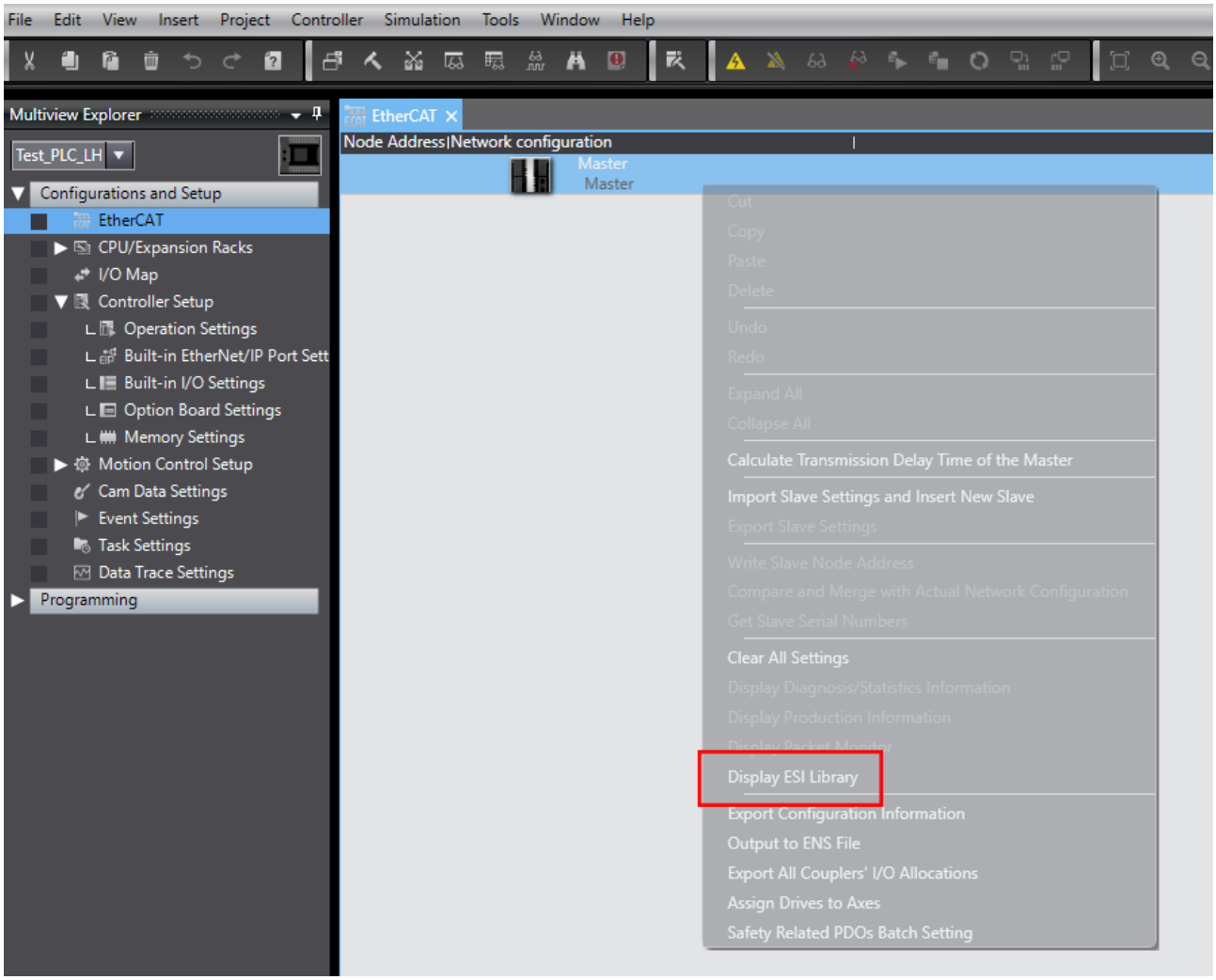


Fig. 55: Displaying an ESI library

- Select ESI file for TBEC-S2-4RFID and Omron controllers.
- Click **Install (file)** to add the ESI file.

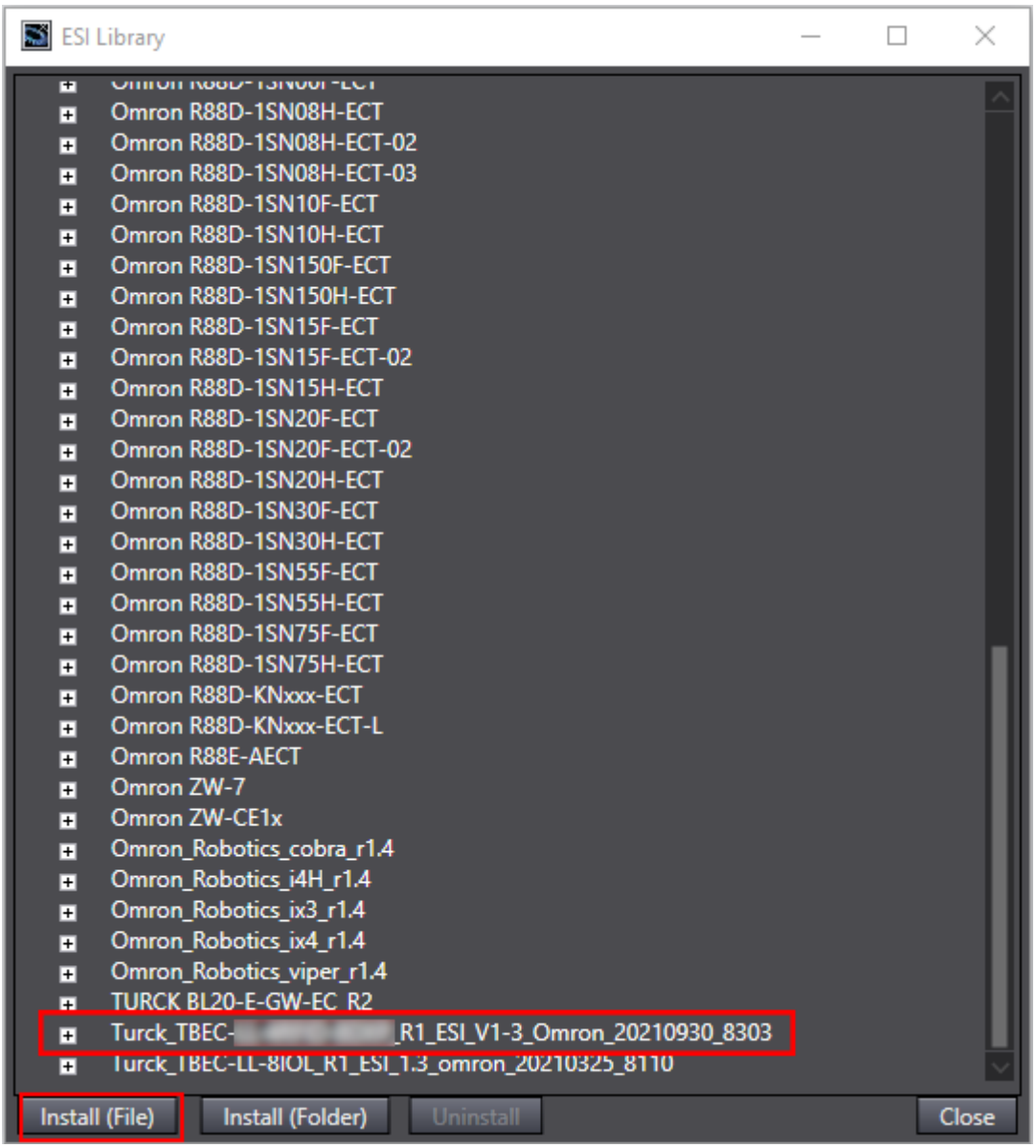


Fig. 56: Installing a ESI file

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.

Add a device as an 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-and-drop TBEC-S2-4RFID to the master.

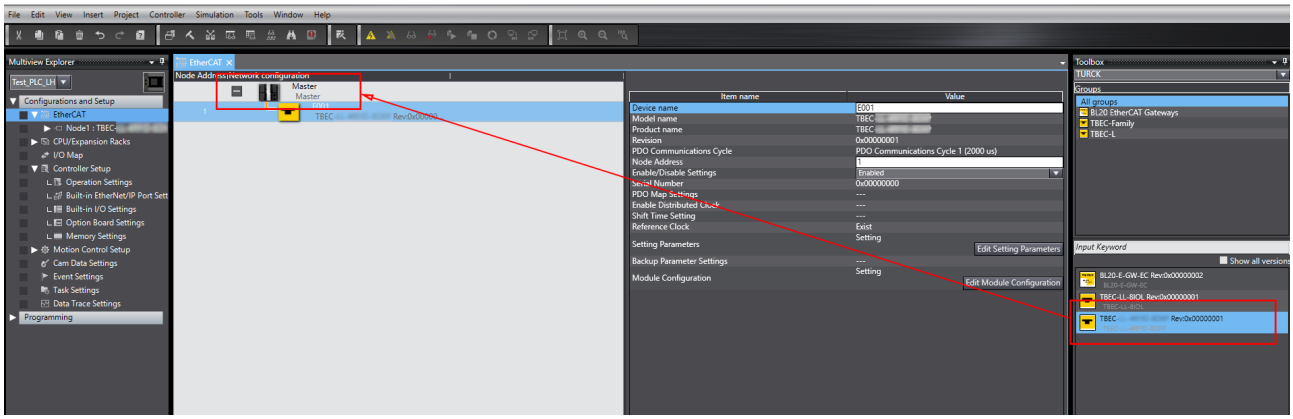


Fig. 57: Add the device by drag and drop

Proceed as follows to add the device in online mode:

- ▶ Activate online mode of the master.
- ▶ Right-click **Master** → click **Compare and merge with the actual network configuration**.
- ⇨ The connected device is automatically detected.

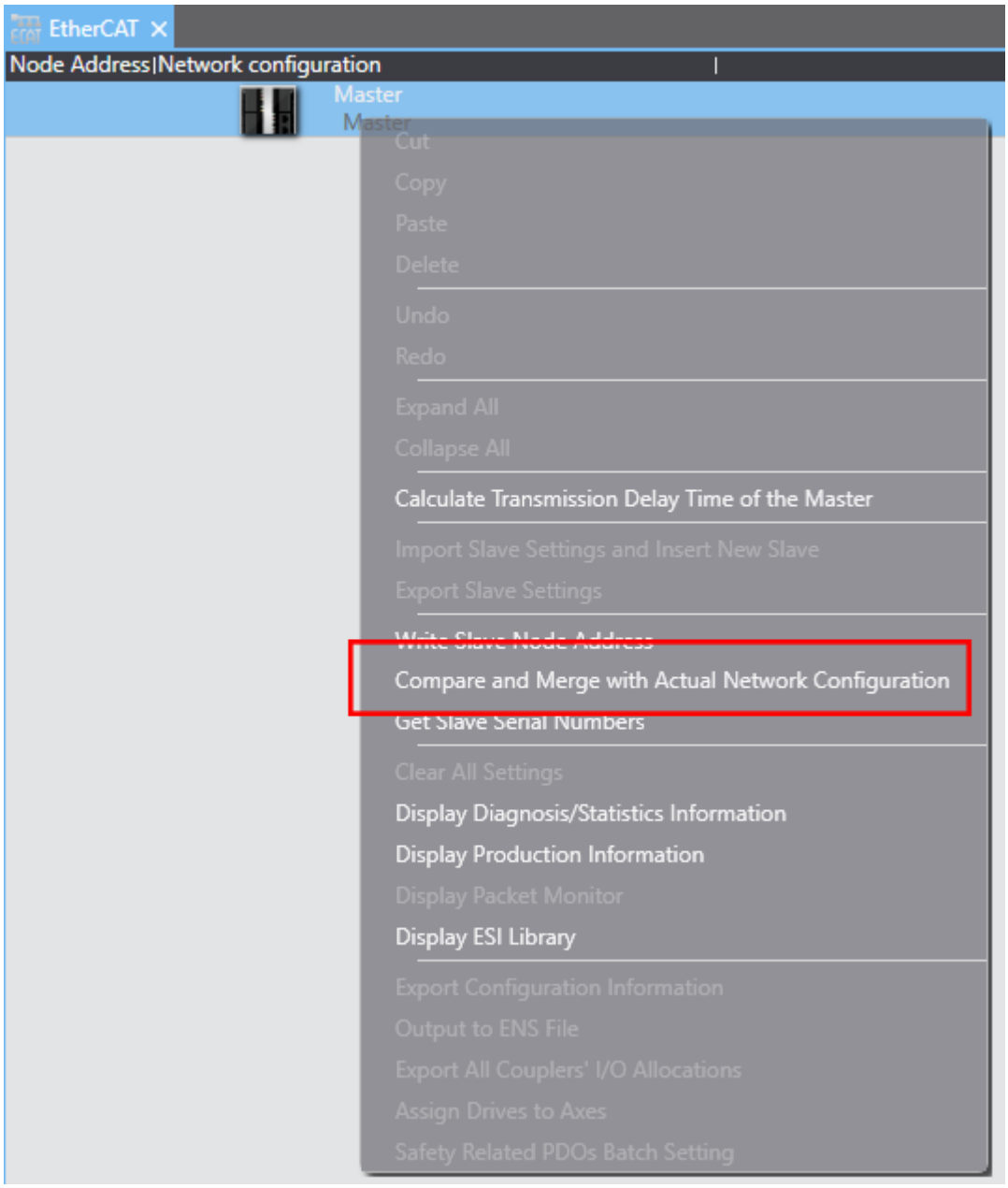


Fig. 58: Compare and merge with the actual network configuration

▶ Click **Accept actual network configuration.**

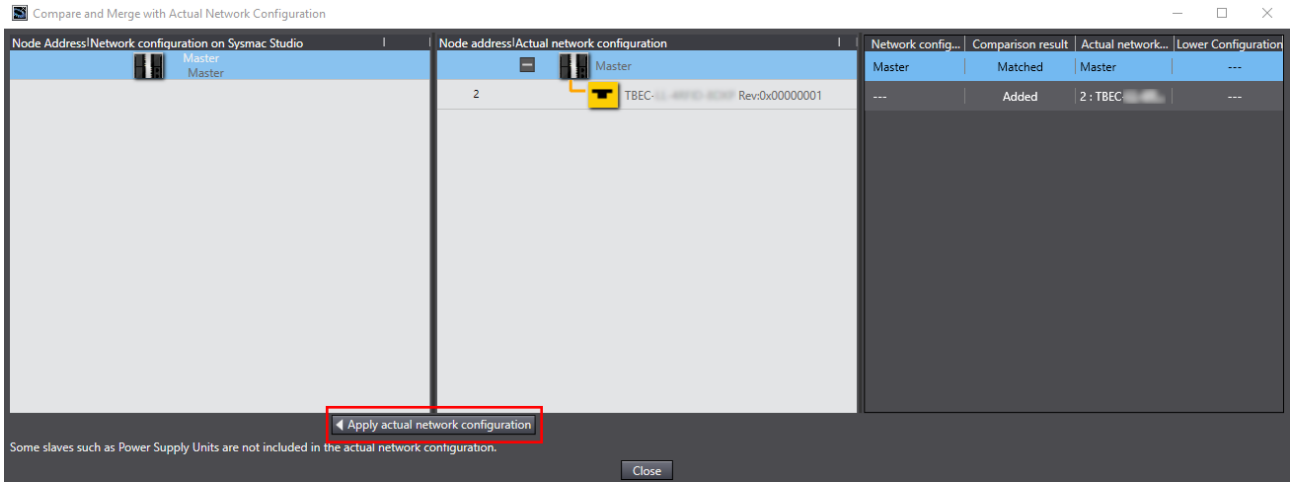


Fig. 59: Accepting the network configuration

▶ 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.

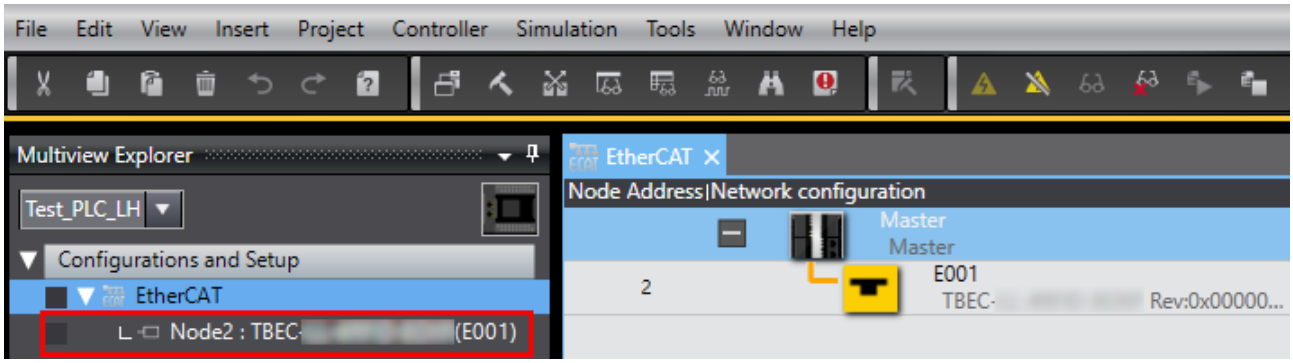


Fig. 60: Device in the project tree

- ▶ 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.

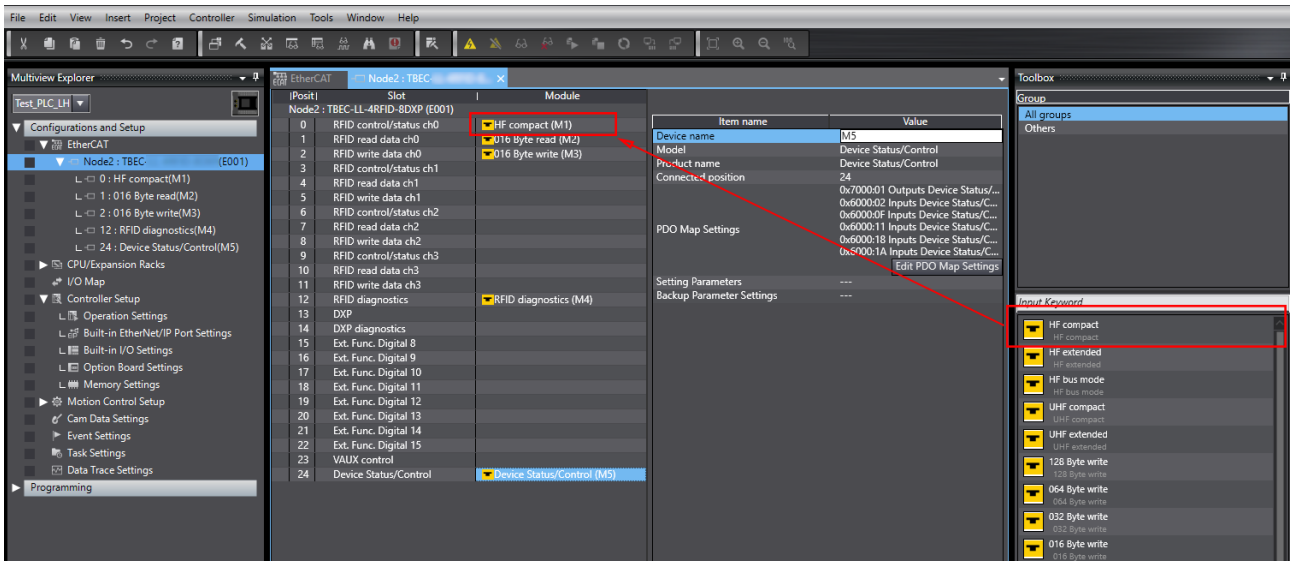


Fig. 61: Assigning channels

Transferring the configuration to the master

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

Fig. 62: Synchronize icon

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

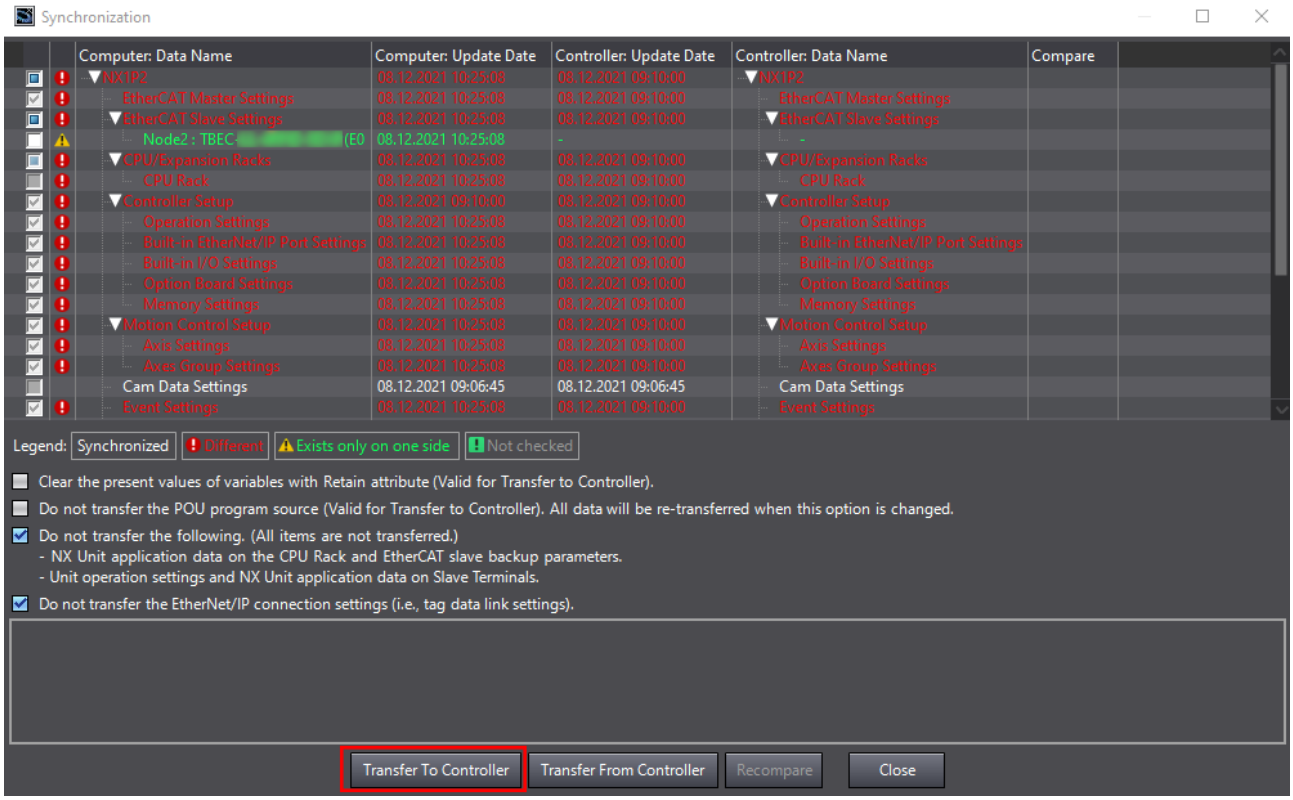


Fig. 63: Transferring a configuration to the controller

- Confirm all the subsequent messages.

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

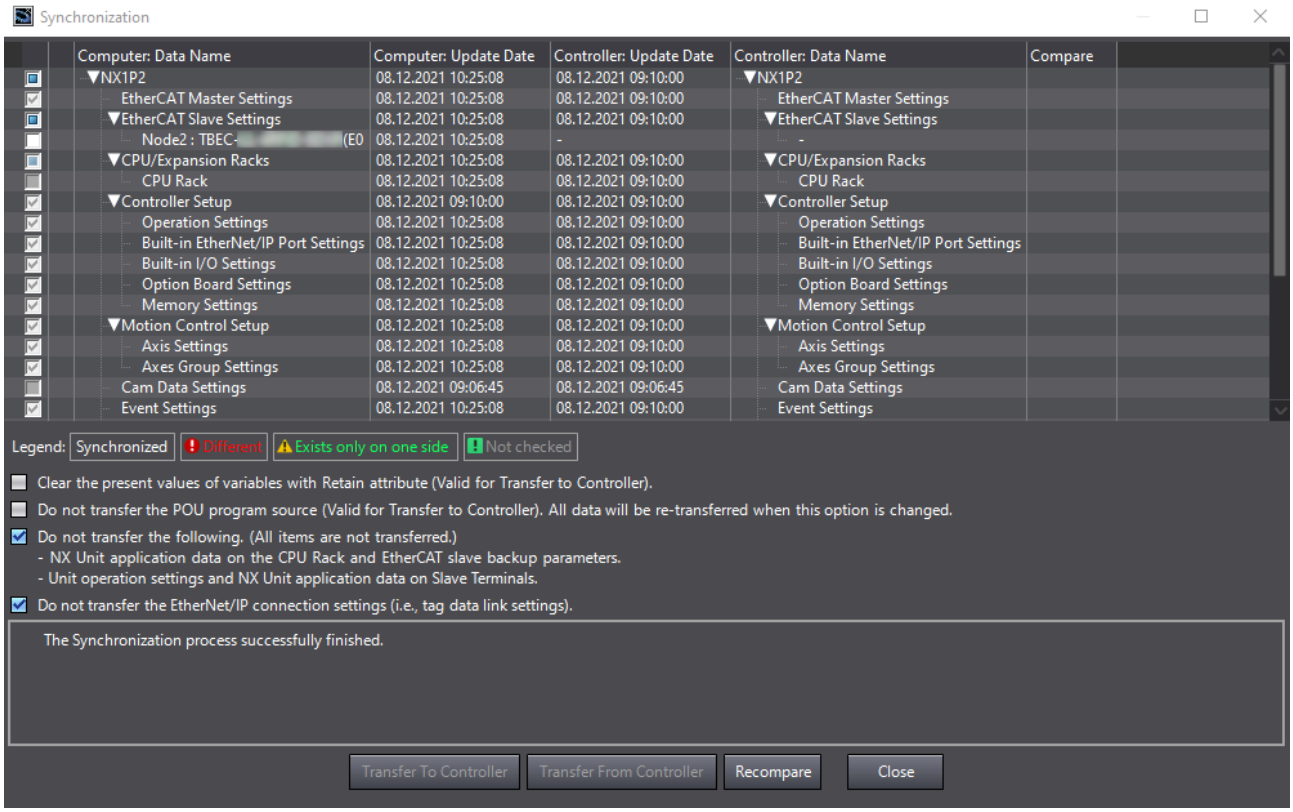


Fig. 64: Successful data transfer

The successful EtherCAT communication is displayed via a Play icon.

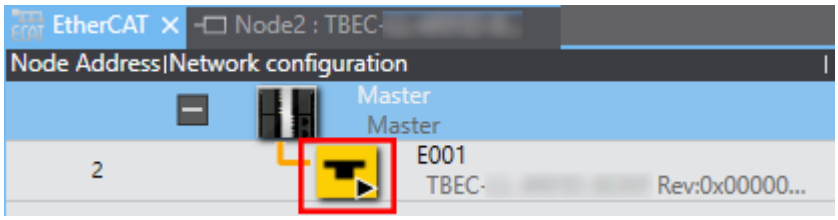


Fig. 65: Play icon

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).

EtherCAT | Node2 : TBEC- | I/O Map

Position	Port	Description	R/W	Data Type	Value	Variable
	EtherCAT Network Configuration					
Node2	TBEC-					
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. 66: 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**.

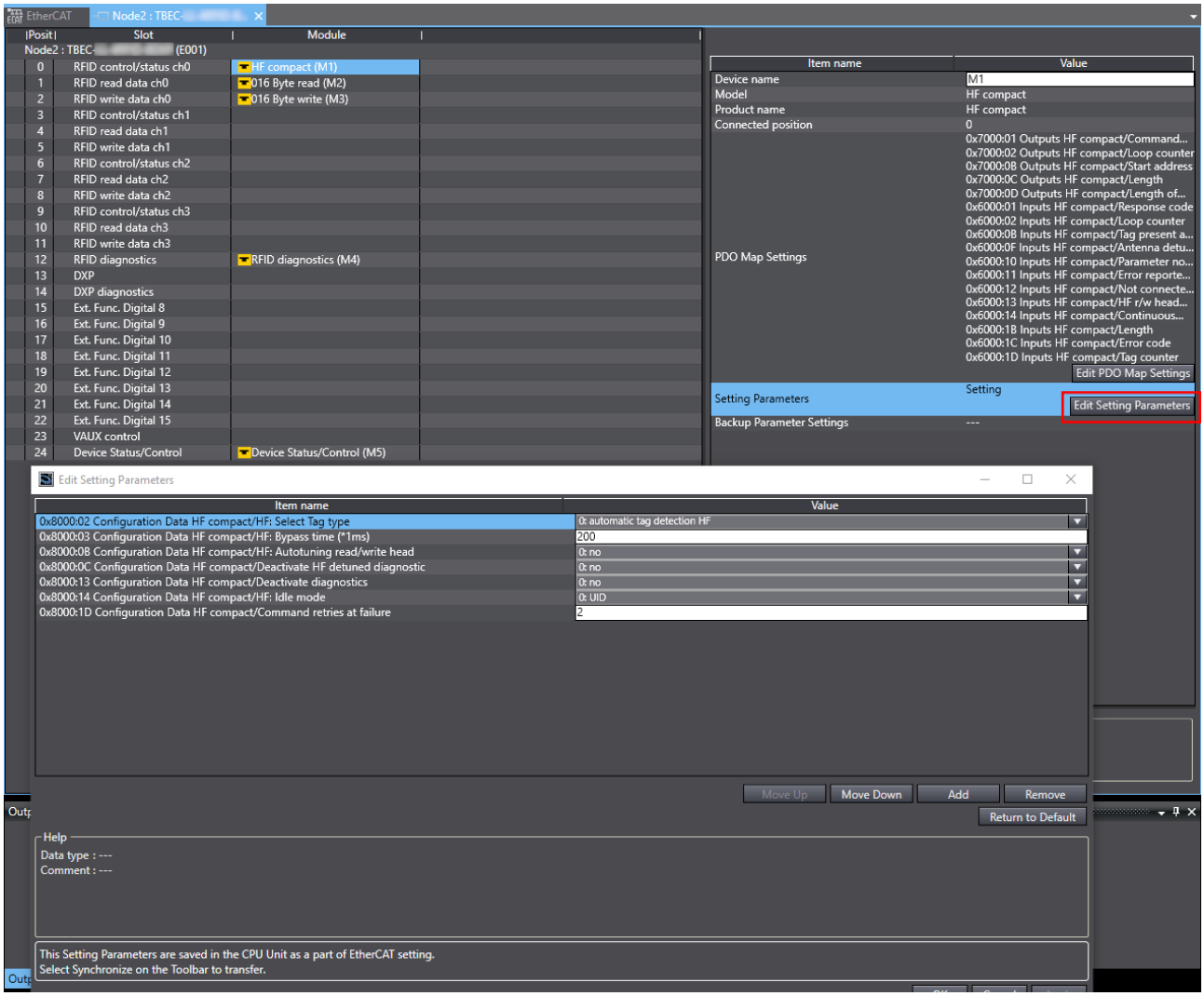


Fig. 67: Editing setting parameters

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, TAS or 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 the EtherCAT master:

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

⇨ The EoE function is activated in the master.

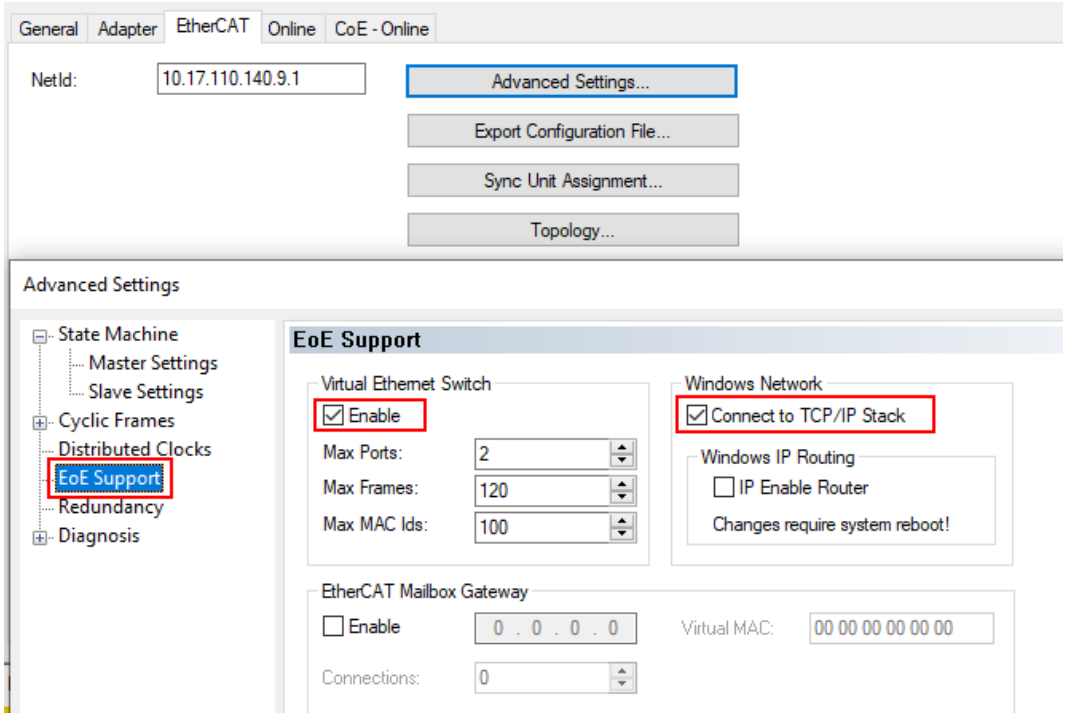


Fig. 68: TwinCAT – activating EoE in the master

Activating EoE in the EtherCAT slave:

- ▶ Double-click **Box 1 (TBEC-S2-4RFID)**.
- ▶ Click on the **EtherCAT** tab → **Advanced Settings**.
- ▶ In the **Advanced Settings** window, select **EoE** under **Mailbox** on the left.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇨ The EoE function is activated in the EtherCAT slave.

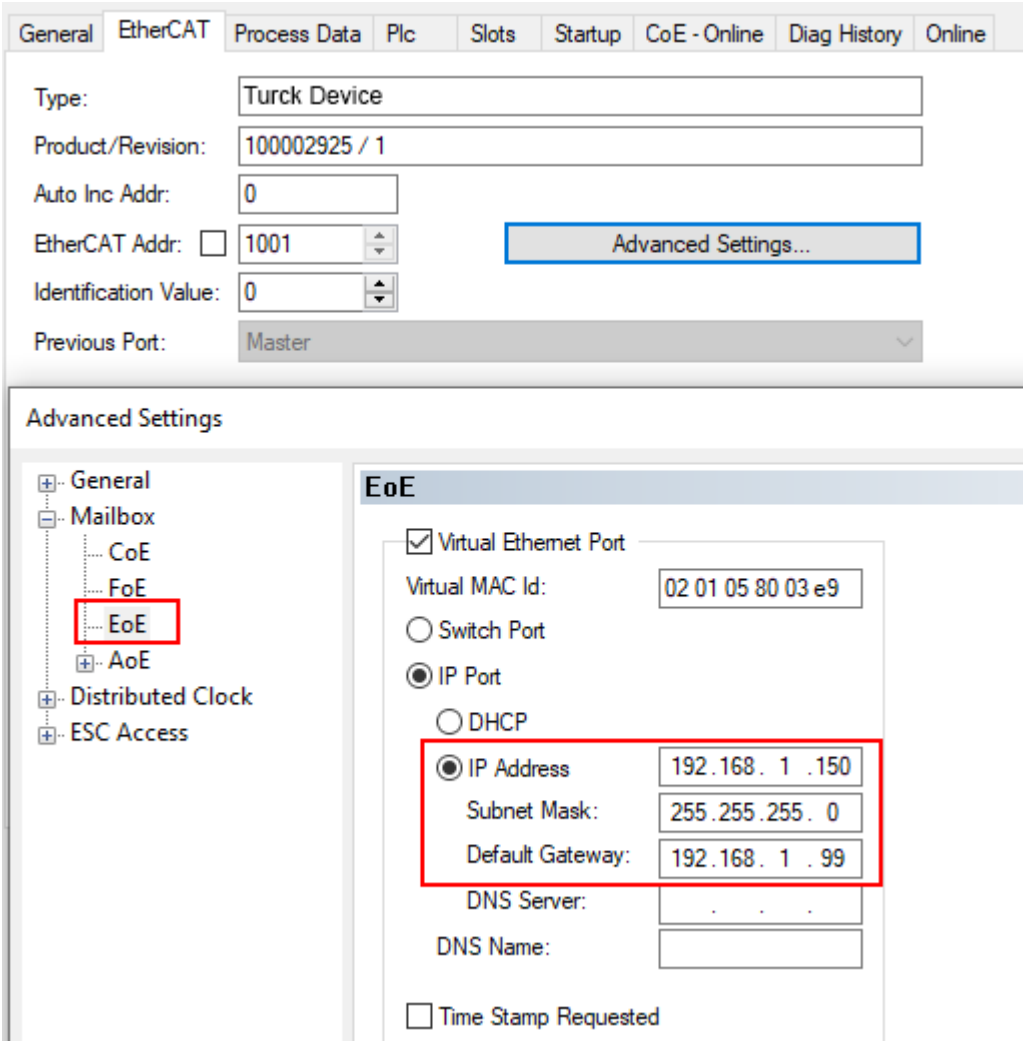


Fig. 69: TwinCAT – Activate EoE EtherCAT-SubDevice

NOTE
DHCP is not supported by TBEC-S2-4RFID.

Activating EoE in CODESYS

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

Activating EoE in the EtherCAT slave:

- ▶ Double-click **TBEC_S2_4RFID (TBEC-S2-4RFID)**.
- ▶ Select the **EoE Settings** tab.
- ▶ Enter the **IP Address**, **Subnet Mask** and **Default Gateway**.
- ⇨ The EoE function is activated in the EtherCAT slave.

Configuring a device

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

Configuring the device in the DTM

Requirement: The TBEC-S2-4RFID already has an IP address.

- Add the Ethernet interface **BL Service Ethernet** to the project.
- Add the TBEC-S2-4RFID to the interface via **Add device**.

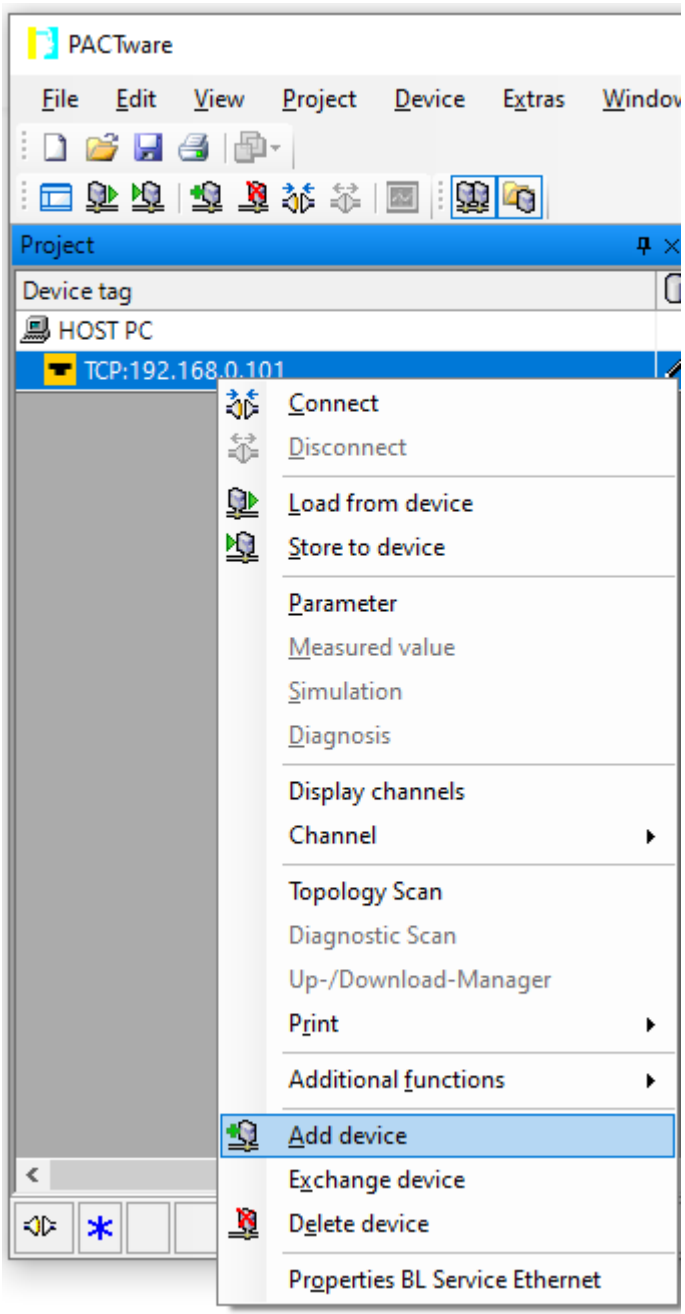


Fig. 70: DTM: Adding a device

- Select TBEC-S2-4RFID from the device catalog.
- Enter the IP address for TBEC-S2-4RFID .
- Configure the device in the DTM.

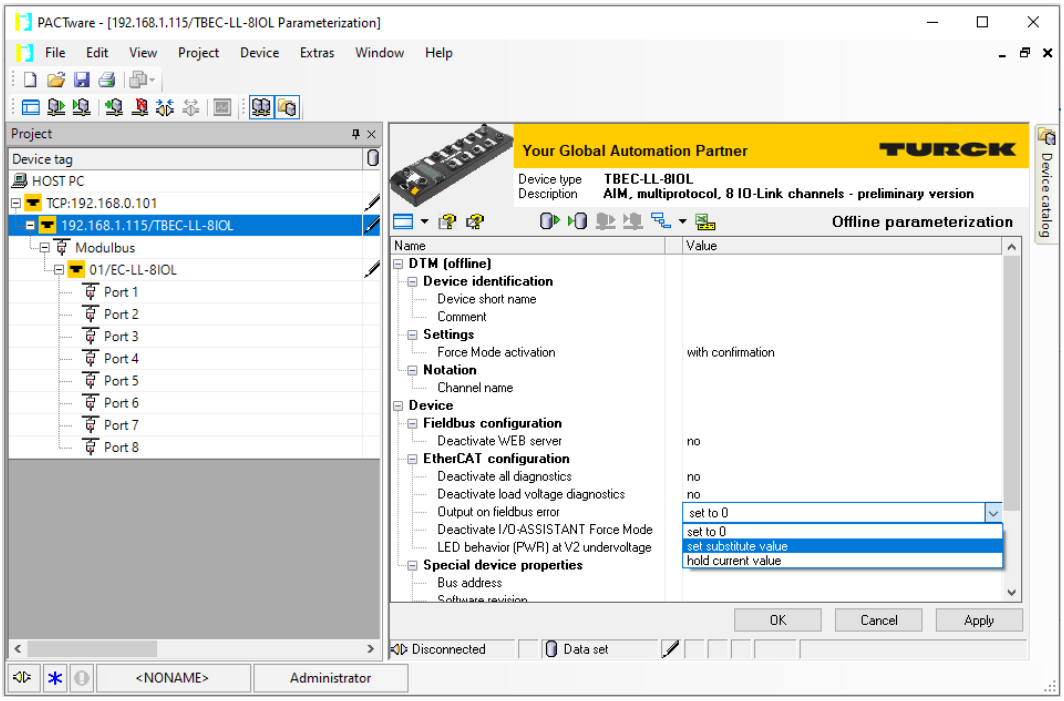


Fig. 71: DTM: Configuring the device

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	RFID parameters	0…23	RFID input data	0…23	RFID output data	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	RFID parameters	152…175	RFID input data	152…175	RFID output data	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	RFID parameters	304…327	RFID input data	304…327	RFID output data	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	RFID parameters	456…479	RFID input data	456…479	RFID output data	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		144…151	VAUX settings (VAUX Control)			608…609	VAUX output data (VAUX Control)		

Slot	Channel	Parameter data		Process input data		Process output data		Diagnostic data	
		Bytes	Meaning	Bytes	Meaning	Bytes	Meaning	Bytes	Meaning
15				728…731	Device Status (Device Status/Control)	610…611	Device Control (Device Status/Control)		

8.1 Modular device model/slot definition

The TBEC-S2-4RFID 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 … RFID control/status ch3	HF compact	Activates HF compact mode on RFID channel 0…3
	HF extended	Activates HF extended mode on RFID channel 0…3
	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 … RFID read data ch3	008 bytes read	Read data module with 8 bytes communication width on RFID channel 0…3
	016 bytes read	Read data module with 16 bytes communication width on RFID channel 0…3
	032 bytes read	Read data module with 32 bytes communication width on RFID channel 0…3
	064 bytes read	Read data module with 64 bytes communication width on RFID channel 0…3
	128 bytes read	Read data module with 128 bytes communication width on RFID channel 0…3
RFID write data ch0 … RFID write data ch3	008 bytes write	Write data module with 8 bytes communication width on RFID channel 0…3
	016 bytes write	Write data module with 16 bytes communication width on RFID channel 0…3
	032 bytes write	Write data module with 32 bytes communication width on RFID channel 0…3
	064 bytes write	Write data module with 64 bytes communication width on RFID channel 0…3
	128 bytes write	Write data module with 128 bytes communication width on RFID channel 0…3
RFID diagnostics	RFID diagnostics	Diagnostic data of the RFID channels [▶ 189]
VAUX control	VAUX control	Activates the VAUX power supply VAUX switchable power supply – parameter data
Device Status/Control	Device Status/Control	Status and control for the entire module See Device Area [▶ 73]

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 subindex	Byte no.	Bit							
			7	6	5	4	3	2	1	0
0xF100	0x08…0x01	0	res.	res.	res.	res.	res.	res.	ARGEE	res.
	0x10…0x09	1	res.	FCE	res.	res.	res.	res.	res.	res.
0xF110	0x08…0x01	0	V2	res.	res.	res.	res.	res.	res.	DIAG
	0x10…0x09	1	res.	res.	res.	res.	res.	res.	V1	res.

Meaning of the Device Status bits

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

8.2.2 Device Control (0xF200)

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

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

Meaning of the Device Control bits

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

8.2.3 Device parameters (0xF800)

CoE index	CoE subindex	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.
DEWEB Deactivate web server	(the webserver is not yet supported by firmware version 1.0.4.0.) Note: The activation or deactivation of the web server requires a device restart. **0: No** **The web server in the device is activated.** 1: Yes The web server in the device is deactivated.
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.
AT HF: Autotuning read/write head	**0: No (automatic tuning off)** 1: Yes (automatic tuning on)

Designation	Meaning
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. 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.

Tags	Firmware version Read/write head	Selectable	Automatic detection possible	Can be set 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 HF-I 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	–	–	–
17: Infineon SRF55V02S	≥ V1.91	x	x	x
	≤ V1.90	–	–	–

Tags	Firmware version Read/write head	Selectable	Automatic detection possible	Can be set in the DTM and via the configuration file (ESI file or xml device description)
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 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 bypass 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 bypass time can be set between 4…1020 ms. The bypass 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:

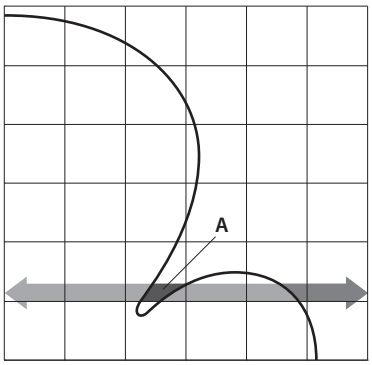


Fig. 72: Detection range of a read/write head

Retaining the default setting

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

NOTE
The default setting for the bypass time is 200 ms.

- Retaining the default setting: If startup is successful, the parameter does not have to be adjusted to the application. If startup is not successful, a fault signal appears.
- If the fault signal appears, adjust the bypass time. If it is not possible to adjust the bypass time, reduce the speed or data volume.

The information "Recommended distance" and "Maximum distance" is provided in the product-specific data sheet.

Adapting the bypass time to the application

- Measure the required bypass time on site. 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 bypass time.

8.3.4 HF applications — setting HF bus mode

NOTE
In HF bus mode a command is always only meant for one read/write head. While the command is being executed, there is no data communication with other read/write heads.
If HF Continuous Mode is used, 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 the 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 addressed automatically. For this to happen, 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 one after the other in a line.
- ⇨ Addresses are allocated in ascending order to the read/write heads in the order in which the heads were connected. The lowest address is automatically assigned to the next read/write head with the default address 68 that is connected.
- ⇨ The addressing is successful if the LED of the read/write head is permanently lit.

Manually addressing read/write heads — setting the HF read/write head address command

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 [▷ 133]. 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.

NOTE
For manual addressing, only one read/write head may be connected to each RFID channel at a time.

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

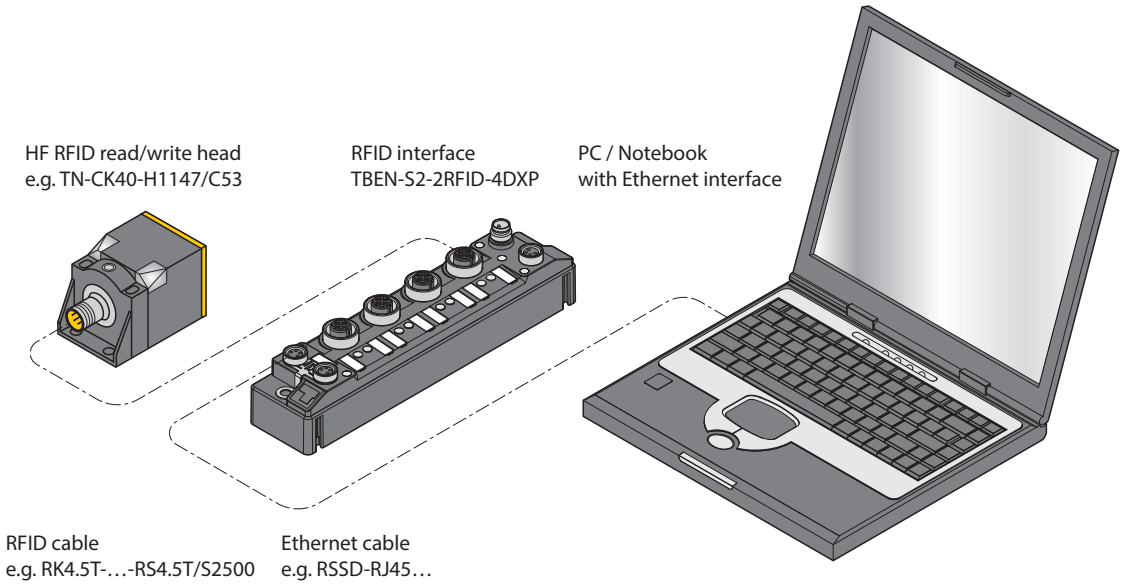


Fig. 73: Connecting the read/write head to a PC via the RFID interface

8.3.5 UHF applications — setting Continuous Presence Sensing Mode

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

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

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

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

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

8.3.6 UHF applications — transferring reader settings

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

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

8.4 RFID channels — process input data

Process input data – 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 the 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: fault signal from 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	Display of the detected tags. With HF multi-tag applications and UHF, the rising edges of the tags that are read by an Inventory command are counted. In HF single-tag applications, all tags that are detected by the read/write head are counted. A tag that moves along the read/write head is not counted again if it only leaves the detection range momentarily and re-enters it (within the set bypass time). If a tag continuously stays within the detection range, it is also only counted once. Exceptions: Continuous mode in bus mode is active or continuous mode with start address = 3 is active. The tag counter is reset by the following commands: ■ Inventory (exception: HF single-tag applications) ■ Continuous Mode ■ Continuous presence sensing mode ■ Reset
BYFI Data (bytes) available	Number of bytes in the FIFO memory of the interface (only available with HF extended and UHF extended modes) Ascending: new data read by a tag or received by the device Descending: command execution completed Fault signal 0xFFFF: memory overfilled, risk of loss of new data
RFN Read fragment no.	In idle mode, the size of the fragments is specified. With a read command, the number of fragments that contain data is specified. (available with HF Advanced and UHF Advanced only) 0: No fragmentation If the data to be read exceeds the size of the read data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the read fragment no. appears in the process input data. After the confirmation, the next fragment is read.
WFN Write fragment no.	In idle mode, the size of the fragments is specified. With a write command, the number of fragments that contain data is specified. 0: No fragmentation If the data that is to be written exceeds the size of the write data memory, the data is split into max. 256 fragments. The fragments are numbered consecutively from 1 to 255. From fragment number 256, numbering begins again at 1. The sending of a fragment is confirmed by the device if the write fragment no. appears in the process input data. Following confirmation, the next fragment is written.
TP1…TP32 Tag present at read/write head … (tag in detection range on the read/write head …)	Tag in the detection range of the connected read/write head (available in HF bus mode only)
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 as well as in idle mode.

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)							
			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							
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… 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							
			19	Reserved							
		0x39	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.	If the data to be read exceeds the size of the read data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the read fragment number appears in the process input data. After the confirmation the next fragment is read. 0: No fragmentation In Idle mode the size of the fragments is stated. With a read command the number of fragments containing data is stated.
WFN Write fragment No.	If the data to be written exceeds the size of the write data memory, the data is divided in max. 256 fragments. The fragments are numbered consecutively from 1…255. From fragment number 256 numbering starts again at 1. The sending of a fragment is confirmed by the device if the write fragment number appears in the process input data. After the confirmation the next fragment is written. 0: No fragmentation In Idle mode the size of the fragments is stated. With a write command the number of fragments containing data is stated.
ANTN Read/write head address	HF bus mode: Address of the read/write head, if several bus-capable read/write heads are connected UHF: Values are ignored or set automatically.
Write data byte 0…127	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 (SOUID)** command parameter is greater than 0)

8.6 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
Delete Buffer (Cont. mode)	0x0013	19	-	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
Get UHF read/write head error/status 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	–	–
Read AFI from HF tag	0x0090	144	x	x	x	-	-

Command	Command code		possible for				
	hex.	dec.	HF compact	HF extended	HF bus mode	UHF compact	UHF extended
Write AFI to HF tag	0x0091	145	x	x	x	-	-
Lock AFI in HF tag	0x0092	146	x	x	x	-	-
Read DSFID from HF tag	0x0094	148	x	x	x	-	-
Write DSFID to HF tag	0x0095	149	x	x	x	-	-
Lock DSFID in HF tag	0x0096	150	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
Set tag password	0x0102	258	x**	x**	x**	x	x
Set tag password 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 perma 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 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.

8.6.1 Command: Idle

Overview of output data

For a description of the output data, see [▶ 100].

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

Overview of input data

For a description of the input data, see [▶ 92].

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

8.6.2 Command: Inventory

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

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

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 UID/EPC	Not required
Start address	1: Grouping of the EPCs active (UHF only) 0: Grouping of the EPCs inactive (UHF only)
Length	0: The actual length (bytes) of the transferred UID or EPC is transferred with an inventory. > 0 in HF applications: ■ 8: 8-byte UID feedback ■ 1…7: Feedback of an abbreviated UID ■ > 8: Fault signal -1: NEXT mode (only available in HF single-tag applications): A HF tag is always only read, written or protected if the UID is different from the UID of the last read or written tag. > 0 in UHF applications: EPC is output in full.
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	Ascending
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, bytes 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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	Ascending
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, bytes 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 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 read operations (LSB → MSB) [2]

Status bit	Contents	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 Slot (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of read operations (LSB → MSB)

8.6.3 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.).

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 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 UID/EPC length is dependent 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
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

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

8.6.4 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.).

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 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 UID/EPC length is dependent 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
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

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

8.6.5 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.

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 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
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

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	See description of the input data
Read fragment No.	See description of the input data
Read data, bytes 0…127	Not required

8.6.6 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.).

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 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 UID/EPC length is dependent 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
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

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

8.6.7 Command: Continuous Mode

NOTE
In HF applications, Continuous mode is only available for single-tag applications. Automatic tag detection cannot be used in Continuous Mode. A specific tag type must be selected in the parameters.

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 **Write**, **Read** and **Inventory** commands can be executed in Continuous Mode. For UHF applications, the parameters for Continuous Mode must be set via the DTM directly in the UHF reader.

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

NOTE
The reset command resets all read data. After Continuous Mode is restarted, all data from the Continuous Mode already running 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 **Read 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 in detection range** 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 in detection range** 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 while Continuous Mode is running.

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 UID/EPC	Not required
Start address	**UHF inventory** 0: Grouping of the EPCs inactive, continuous detection 1: Grouping of the EPCs active, continuous detection >1: not defined **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 **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
Length	Not required
Timeout	Not required
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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

8.6.8 Command: Read buffer (Cont. mode)

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

The **Read data from buffer (cont. mode)** command can pass on data stored in the interface to the controller. Up to 16 Kbytes of data can be stored in a ring memory. Retrieved 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 **Read data from buffer (cont. mode)** command does not stop continuous mode.

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
UID/EPC length	Not required
Start address	Not required
Length	Max. length of the data to be read by the device (≤ size of the data that the device has actually stored), entered in bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

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

Data format in UHF applications

The UHF read data is formatted by 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 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 Slot (LSB → MSB) uint32_t Time (LSB → MSB) uint16_t Phase (LSB → MSB) uint16_t Number of read operations (LSB → MSB)

Data format in HF applications

In HF applications, the data is not formatted by a header. Several 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 read processes

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

8.6.9 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.

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

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

8.6.10 Command: Delete Buffer (Cont. mode)

Using the **Delete buffer (cont. mode)** command, all data stored in the interface can be deleted.

NOTE
The **Delete buffer (cont. mode)** command does not stop continuous mode.

Request	
Loop counter	See description of the output data
Command code	0x0013 (hex.), 19 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Response	
Loop counter	See description of the input data
Response code	0x0013 (hex.), 19 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.11 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.

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 UID/EPC	Not required
Start address	0: Grouping inactive 1: Grouping active >1: not defined
Length	Not required
Timeout	Not required
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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

8.6.12 Command: HF read/write head off

The **Switch off HF read/write head** command enables HF read/write heads to be switched off until a write or read command is present. It may be necessary to switch the read/write heads on and off to save energy or if the devices are fitted very close to one another and the detection ranges overlap. When a command is executed, the read/write heads are reactivated automatically. After the command has been executed, the read/write head needs to be switched off again.

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
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.13 Command: 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 summarized in the read/write head in the identification record.

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
UID/EPC length	Not required
Start address	Start address in the identification record, specification in bytes
Length	Length of the data to be queried 0: Read 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

Response	
Loop counter	See description of the input data
Response code	0x0041 (hex.), 65 (dec.)
Length	See description of the input data
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	increases with each read or written 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

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

NOTE
The command is only available for UHF applications.

The **Get 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.).

Request	
Loop counter	See description of the output data
Command code	0x0042 (hex.), 66 (dec.)
Read/write head address	Not required
Length 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
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, Byte 0…(Length - 1)	■ Status general: 1 byte general status ■ RF status: 1 byte status of the RF module ■ Device status: 1 byte device-specific status information ■ RF mode: 1 byte, defines the reason for starting the read operation ■ Trigger status: 1 byte, trigger number of the RF mode ■ I/O status: 1 byte, status of the inputs and outputs (0 = low, 1 = high) ■ Ambient temperature: 1 byte, ambient temperature in °C (data format: 8 bit, two's complement) ■ PA temperature: 1 byte, PA temperature in °C (data format: 8 bit, two's complement) ■ RF antenna temperature: 1 byte, antenna temperature in °C (data format: 8 bit, two's complement) ■ Transmit power: 2 bytes, output power of the reader in 1/10 dBm steps, LSB…MSB (data format: 16 bit, two's complement) ■ Reverse power: 2 bytes, 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), Timeout
0x04	Trigger is a command
0x08	Reserved
0x10	DCU controlled read operation
0x20	Continuous Mode
0x80	Automatic trigger (Presence Sensing Mode)

Evaluating read data — I/O status

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

8.6.15 Command: Tag info

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

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

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 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.
Timeout	Not required
Write fragment No.	Not required
Read fragment No.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, bytes 0…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

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, bytes 0…3	First 32 bytes of the TID (tag class, manufacturer and chip type)
Read data, bytes 4…n	EPC (variable length)

Chip information on the UHF tags

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

8.6.16 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 can be used to send commands directly to the read/write device from the read/write head protocol. The commands are defined and interpreted via specifications in the read and write data.

NOTE
The read/write head protocol is not part of this documentation and has to be requested from and specially released by Turck. Questions on the read/write head protocol should be addressed to Turck.

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
UID/EPC length	0
Start address	Not required
Length	Length of the description of the direct command in the write data, specification in bytes
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Description of the direct command

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

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

Request	
Loop counter	0
Command code	0x0060
Read/write head address	0
UID/EPC length	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 in 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 can be used to query the following information with the bytes written to:

- 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 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 debus protocol

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

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

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

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

8.6.17 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 a fault signal.

Request	
Loop counter	See description of the output data
Command code	0x0070 (hex.), 112 (dec.)
Read/write head address	Not required
Length UID/EPC	Not required
Start address	Not required
Length	Not required
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data, byte 0…[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

8.6.18 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 **Set HF read/write head address** command can be used to set the address of bus-compatible HF read/write heads. Command execution is independent of the activation of or the address set for a read/write head. Any existing read/write head addresses are overwritten.

Permissible values are 1, 2…32, 68.

NOTE
68 is the default address of the read/write head.
A bus-compatible read/write head with this address cannot be activated.

If a non-bus-compatible read/write head is connected, the device outputs a fault signal.

Request	
Loop counter	See description of the output data
Command code	0x0071 (hex.), 113 (dec.)
Read/write head address	Not required
Length UID/EPC	Not required
Start address	Not required
Length	Not required
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, bytes 1…127	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data	Not required

8.6.19 Command: Tune HF read/write head

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

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

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

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
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0	Tuning value: TNLR-…: 0x00…0x0F TNSLR-…: 0x00…0x1F
Read data, byte 1	Received voltage value (0x00…0xFF)

8.6.20 Command: Read AFI from HF tag

The AFI (Application Family Identifier) byte of an HF tag can be read out using the **Read AFI from HF tag** command.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

Request	
Loop counter	See description of the output data
Command code	0x0090 (hex.), 144 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Response	
Loop counter	See description of the input data
Response code	0x0090 (hex.), 144 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0	AFI
Read data, bytes 1…(length -1)	Not required

8.6.21 Command: Write AFI to HF tag

The **Write AFI to HF tag** command writes an AFI (Application Family Identifier) byte to an HF tag.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

NOTE
It is not possible to write a locked AFI byte.
The fault signal 0xF102 will appear
(air interface error: timeout).

Request	
Loop counter	See description of the output data
Command code	0x0091 (hex.), 145 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0	AFI
Write data, byte 1…(length -1)	Not required

Response	
Loop counter	See description of the input data
Response code	0x0091 (hex.), 145 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.22 Command: Lock AFI in HF tag

The **Lock AFI in HF tag** command locks the AFI (Application Family Identifier) byte on an HF tag.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

NOTE
It is not possible to lock an already locked AFI byte.
The fault signal 0xF102 will appear
(air interface error: timeout).

Request	
Loop counter	See description of the output data
Command code	0x0092 (hex.), 146 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Response	
Loop counter	See description of the input data
Response code	0x0092 (hex.), 146 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.23 Command: Read DSFID from HF tag

The **Read DSFID from HF tag** command can be used to read the DSFID (Data Storage Format Identifier) byte of an HF tag.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

Request	
Loop counter	See description of the output data
Command code	0x0094 (hex.), 148 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Response	
Loop counter	See description of the input data
Response code	0x0094 (hex.), 148 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0	DSFID
Read data, bytes 1…(length -1)	Not required

8.6.24 Command: Write DSFID to HF tag

The **Write DSFID to HF tag** command writes a DSFID (Data Storage Format Identifier) byte to an HF tag.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

NOTE
It is not possible to write a locked DSFID byte.
The fault signal 0xF102 will appear
(air interface error: timeout).

Request	
Loop counter	See description of the output data
Command code	0x0095 (hex.), 149 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data, byte 0	DSFID
Write data, byte 1…(length -1)	Not required

Response	
Loop counter	See description of the input data
Response code	0x0095 (hex.), 149 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.25 Command: Lock DSFID in HF tag

The **Lock DSFID in HF tag** command locks the DSFID (Data Storage Format Identifier) byte on an HF tag.

NOTE
The command is supported by HF read/write heads of revision xV99 or later.

NOTE
It is not possible to lock a DSFID byte that has already been locked.
The fault signal 0xF102 will appear
(air interface error: timeout).

Request	
Loop counter	See description of the output data
Command code	0x0096 (hex.), 150 (dec.)
Read/write head address	See description of the output data
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

Response	
Loop counter	See description of the input data
Response code	0x0096 (hex.), 150 (dec.)
Length	Not required
Error code	See description of the input data
Tag in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data	Not required

8.6.26 Command: Set read/write head password

NOTE
The command is only available for applications with UHF tags and HF tags with chip types EM42… and NXP SLIX2.
It is supported for chip type NXP SLIX2 of HF read/write heads with firmware version Vx.98 or higher.

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

The **Set read/write head password** command is a direct command used to set a password for read access, write 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 executed on a protected tag.

In HF applications, the password function is available in single-tag mode only. A fault signal is output with multi-tag applications. To troubleshoot, set the **HF: Multi-tag** parameter to **0: Multi-tag 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 in the read/write head before a new password can be assigned ([▶ 144]).

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 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, bytes 0…3	Password: ARRAY [0…3] OF BYTE
Write data, bytes 4…127	Not required

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

8.6.27 Command: Reset read/write head password

NOTE
The command is only available for applications with UHF tags and HF tags with chip types EM42… and NXP SLIX2.
It is supported for chip type NXP SLIX2 of HF read/write heads with firmware version Vx.98 or higher.

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

In HF applications, the password function is available in single-tag mode only. A fault signal is output with multitag applications. To troubleshoot, set the **HF: Multitag** parameter to **0: Multi-tag mode off**.

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
UID/EPC length	Not required
Start address	Not required
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

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

8.6.28 Command: Set tag password

NOTE
The command is only available for applications with UHF tags and HF tags with chip types EM42… and NXP SLIX2.
It is supported for chip type NXP SLIX2 of HF read/write heads with firmware version Vx.98 or higher.

NOTE
The command is only available for applications with 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.

In HF applications, the password function is available in single-tag mode only. A fault signal is output with multi-tag applications. To troubleshoot, set the **HF: Multi-tag** parameter to **0: Multi-tag 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 in the read/write head before a new password can be assigned ([▶ 141]).

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 UID/EPC	The UID or EPC size should be entered 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 may be 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 only ever protected if the UID/EPC differs from the UID/EPC of the tag last read or written to.
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, bytes 0…3	Password: ARRAY [0…3] OF BYTE
Write data, bytes 4…127	Not required

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

8.6.29 Command: Set tag protection

NOTE
The command is only available for applications with UHF tags and HF tags with chip types EM42… and NXP SLIX2.
It is supported for chip type NXP SLIX2 of HF read/write heads with firmware version Vx.98 or higher.

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

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

In HF applications, the password function is available in single-tag mode only. A fault signal is output with multitag applications. To troubleshoot, set the **HF: multitag** parameter to **0: multi-tag mode off**.

Read protection also always includes write 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 ensuring that there are no gaps between the bits or pages until 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
Write protection for UHF tags cannot be reversed.

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 UID/EPC	The UID or EPC size should be entered 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 UID/EPC length is dependent on the command used. 0: The command is executed for the tag which is located in the detection range of the read/write device. > 0: EPC length of the tag to be protected if an EPC is present in the write data -1: NEXT mode: A tag is only ever protected if the UID/EPC differs from the UID/EPC of the tag last read or written to.
Start address	Not required
Memory area	Possible values: ■ HF: USER memory (memory areas 1 and 3) ■ UHF: PC and EPC (memory area 1), USER memory (memory area 3) UHF: The entire memory area selected is protected with a password. HF: Specification of memory area not required. The pages of the memory area are selected via byte 0…7 of the write data. A page consists of 4 blocks (16 bytes).
Length	UHF: 0 byte HF: 8 byte
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data, byte 0	HF: EM4233 SLIC/NXP SLIX2: ■ 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

Request	
Write data, byte 1	HF: EM4233 SLIC: 0 NXP SLIX2: ■ 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
Write data, byte 2	HF: EM4233 SLIC: 0 NXP SLIX2: ■ 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
Write data, byte 3	0
Write 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
Write 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

Request	
Write 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
Write data, byte 7	0
Write data, bytes 8…127	Not required

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

8.6.30 Command: Get HF tag protection status

NOTE
The command is only available for applications with 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 may be in the detection range of the read/write head.

In HF applications, the password function is available in single-tag mode only. A fault signal is output with multitag applications. To troubleshoot, set the **HF: Multitag** parameter to **0: Multi-tag mode off**.

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
UID/EPC length	The UID or EPC size should be entered 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 or EPC depends on the command used. 0: The command is executed for the tag that is in the detection range of the read/write head. > 0: EPC length of the tag to be protected if an EPC is present in the write data -1: NEXT mode: A tag is only ever protected if the UID/EPC is different from the UID/EPC of the last read or written tag.
Start address	Not required
Length	8 byte
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

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment no.	0
Read fragment no.	See description of the input data
Read data, byte 0	HF: EM4233 SLIC/NXP SLIX2: ■ 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: ■ 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: ■ 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

8.6.31 Command: Set perma lock

NOTE
The command code for rapid 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. A fault signal is output with multitag applications. To troubleshoot, set the **HF: multitag** parameter to **0: multitag mode off**.

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 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 only ever protected if the UID/EPC differs from the UID/EPC of the tag last read or written to.
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: ■ 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
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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 in detection range	See description of the input data
Data (bytes) available	See description of the input data
Tag counter	See description of the input data
Write fragment No.	0
Read fragment No.	See description of the input data
Read data	Not required

8.6.32 Command: Kill UHF tag

NOTE
The command is only available for UHF applications.

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

The **Kill UHF tag** command makes the tag memory unusable. After a kill command, the tag can neither be read nor written. A kill command cannot be reversed. A Kill password must be set beforehand in order to execute a Kill command (see [▶ 169]).

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 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 UID/EPC length is dependent 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
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data, bytes 0…3	Password: ARRAY [0…3] OF BYTE
Write data, bytes 4…127	Not required

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

8.6.33 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.

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 UID/EPC	Not required
Start address	Not required
Length	Not required
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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

8.6.34 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.

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 UID/EPC	Not required
Start address	Not required
Length	Not required
Timeout	See description of the output data
Write fragment No.	0
Read fragment No.	See description of the output data
Write data	Not required

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

8.6.35 Command: Reset

The **Reset** command is used to reset the read/write device and interface. The input data, output data and the buffer are cleared.

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
UID/EPC length	Not required
Start address	0: Software reset 1: Voltage reset
Length	Not required
Command timeout	See description of the output data
Write fragment no.	0
Read fragment no.	See description of the output data
Write data	Not required

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

9 Operation

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

9.1 Executing a command and calling data

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

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

9.1.1 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: Enter 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 **Read buffer (Cont. mode)** command (0x0011). The length of the data must equal the value of the available data bytes (BYFI).
- ▶ To stop Continuous Mode, execute the **Stop Continuous Mode** command (0x0012).

or

- ▶ To stop 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 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 stop Continuous Mode.

- To pass on data from the FIFO memory of the interface to the controller, execute the **Read 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 stop Continuous Mode, execute the **Stop Continuous Mode** command (0x0012).

or

- To stop 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	316	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 a command 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 a new read/write head with the default address 68 or 0 (factory setting …/C53).
- ▶ If multiple read/write heads are being replaced: Connect the read/write heads in the order of the connection, i.e. connect the read/write head with the lowest address first.
- ⇨ Addresses are allocated in ascending order to the read/write heads in the order in which the heads were connected. The lowest address is automatically assigned to the next read/write head with the default address 68 that is connected.
- ⇨ If the LED on the read/write head is permanently lit, this indicates that the addressing is complete.

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
- Arrange the read/write heads over four channels or over several modules
- 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**	■ No command via the controller required ■ UID and/or data with read/write head address is automatically displayed in the input data.	■ 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	■ Commands must be sent to a read/write head individually. ■ UID or data are displayed in the input data.	■ 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**	■ 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 **Read buffer (Cont. Mode)** command transfers the data to the controller.	■ 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. A HF tag is always only read, written or protected if the UID is different from 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 have a different UID.

▶ Set the 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 in the detection range of the read/write head. The controller sends a read command to the RFID interface in NEXT mode.
The read command is transmitted from the interface to the read/write head. The read/write head reads data from tag A once.

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

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

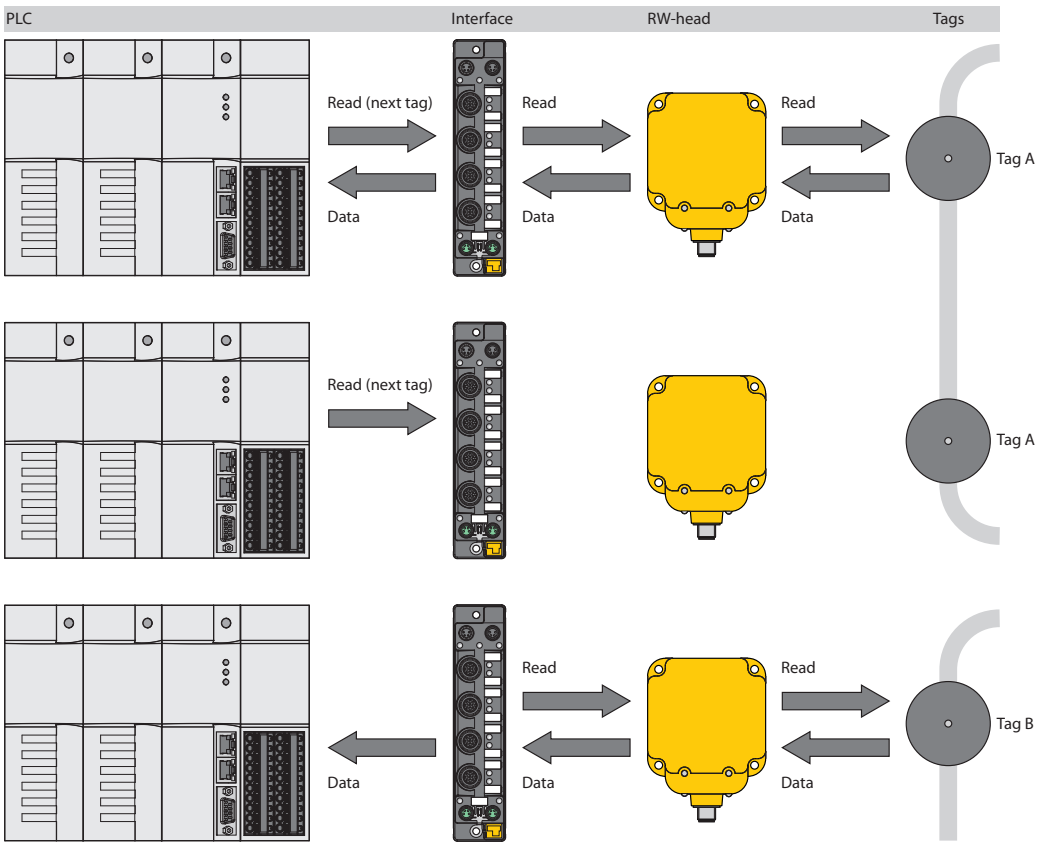


Fig. 74: NEXT mode (layout)

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

An access password can be used to set a temporary or permanent write protection for the EPC and USER memory areas.

Setting temporary write protection for the EPC and USER memory areas

- Write an access password with the following parameters to the tag:
  - Command code 0x0102 (**Set tag password**)
  - Password: 4 bytes in the output data
- Set an 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 the access password from read access:
  - Command code 0x0105 (**Set perma lock**)
  - Memory area: Access

NOTE
If an incorrect access password is used during write attempts, the corresponding area cannot be written because the tag will not respond to the write command. The device does not output a fault signal.

Setting permanent write protection for the EPC and USER memory areas

- Write an access password with the following parameters to the tag:
  - Command code 0x0102 (**Set tag password**)
  - Password: 4 bytes in the output data
- Set an 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:

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

  - Command code 0x0105 (**Set perma lock**)
  - Memory area: EPC or USER
- Protect the access password from read access:
  - Command code 0x0105 (**Set perma lock**)
  - Memory area: Access

9.9.2 Setting the Kill password

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

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

NOTE
The tag can also be protected with an access password [▷ 168], 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

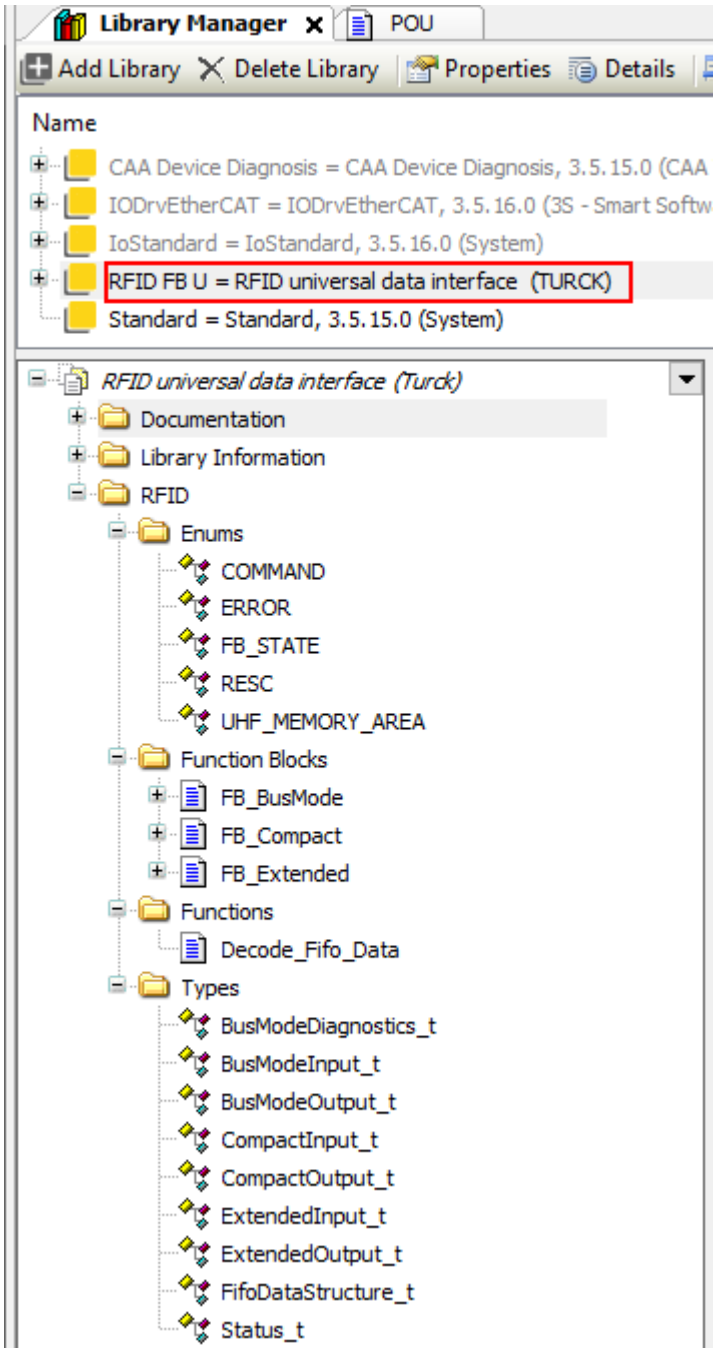


Fig. 75: CODESYS library

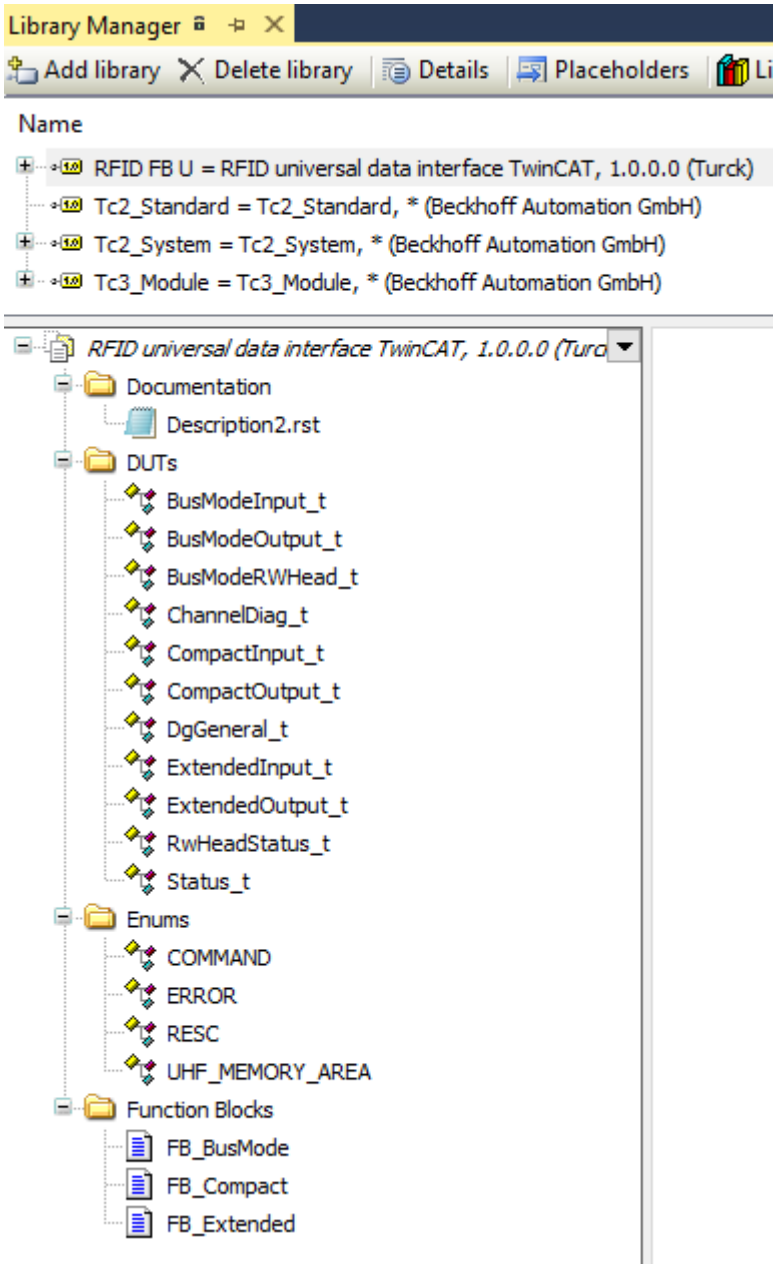


Fig. 76: TwinCAT library

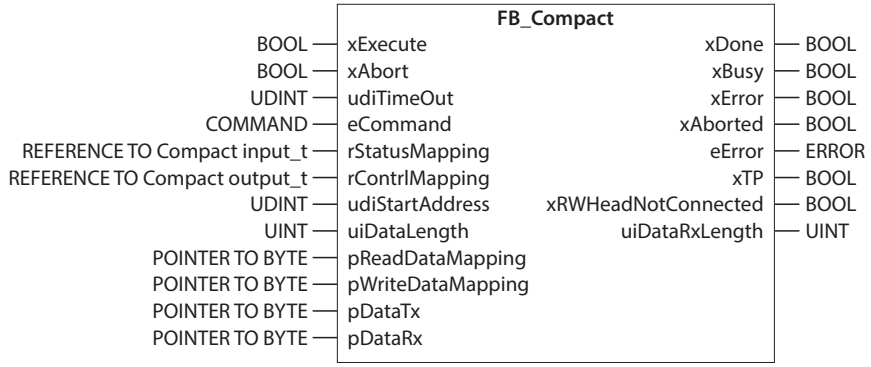


Fig. 77: FB_Compact function block

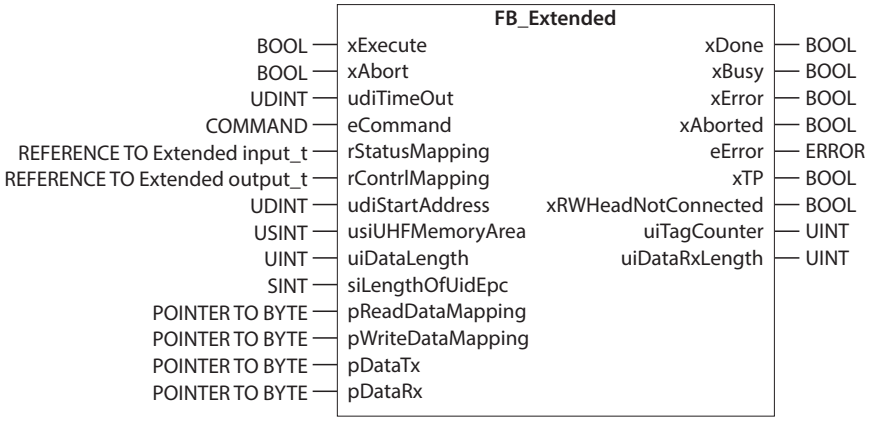


Fig. 78: FB_Extended function block

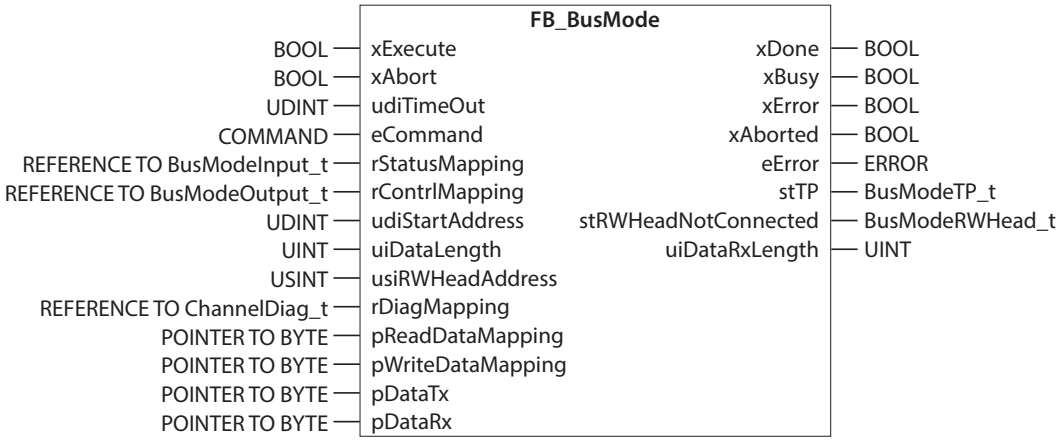


Fig. 79: FB_BusMode function block

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 stopped, aborted by the user or if an error occurred beforehand.
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 stops command execution
eCommand	COMMAND	Command code in hexadecimal format, [▶ 102]
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: ■ Domain 0…5: User area of the tag ■ Other: Reserved UHF applications: ■ 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
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

Name	Data type	Meaning
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 from 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 but not yet completed; system is waiting for execution, e.g. on tag in the detection area 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, [▶ 200]
xTP	BOOL	1: Tag in detection range 0: No tag within the detection range
stTP	BusModeTP_t	1: Tag in 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	Displays 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: ■ 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 from 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

Example: Incorporating the function block

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**.

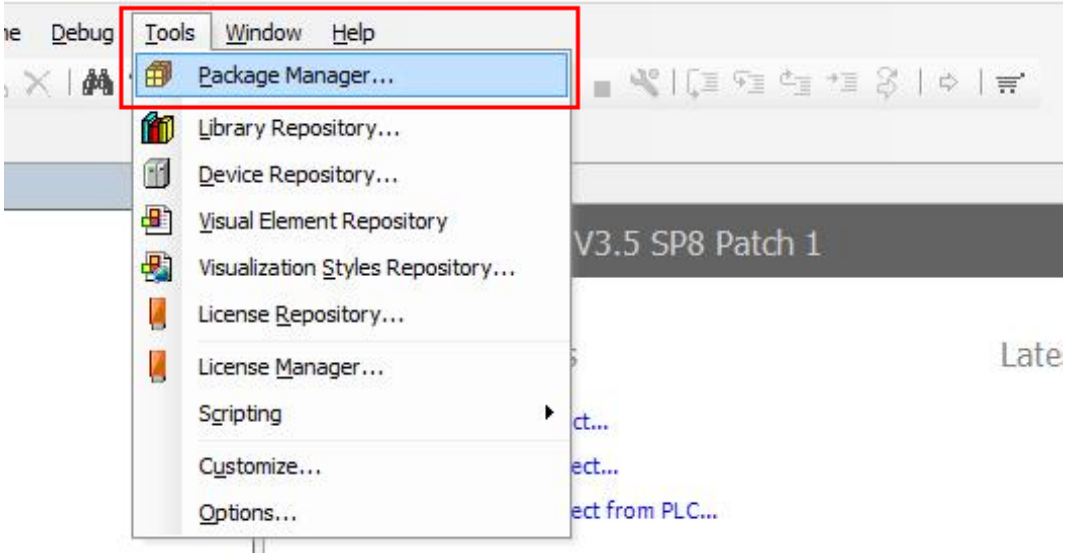


Fig. 80: Opening the Package Manager

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

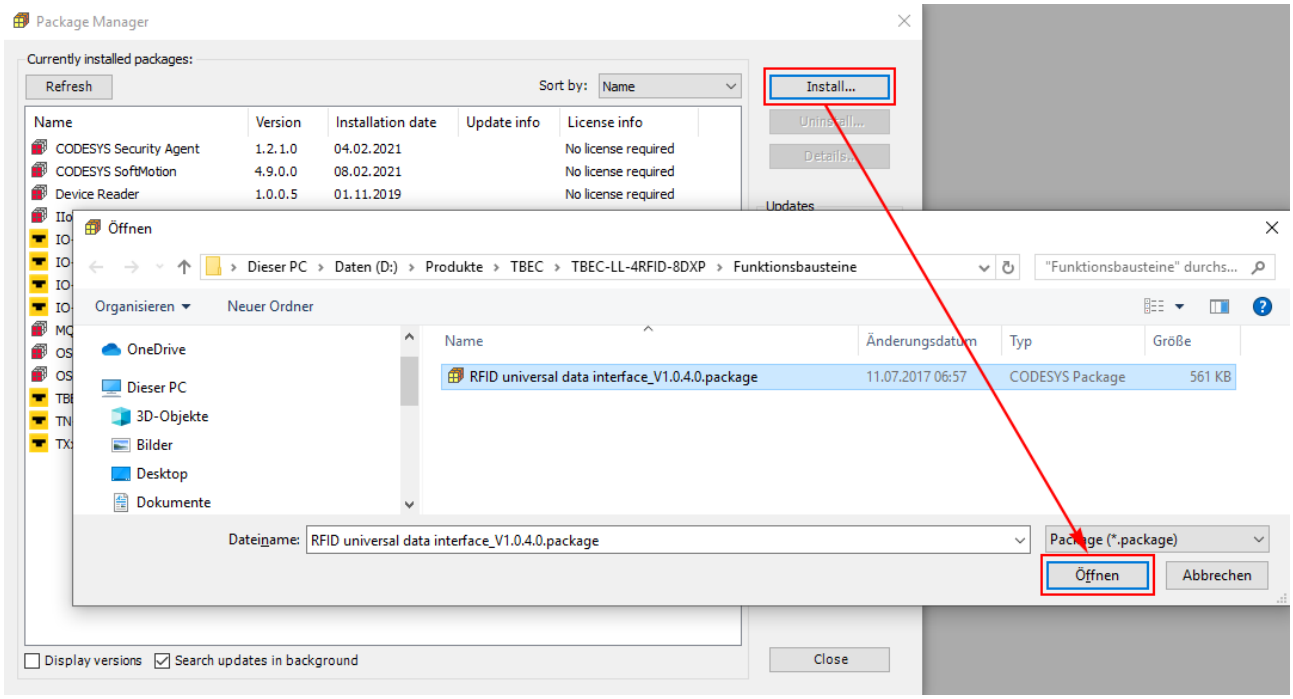


Fig. 81: Installing a Package file

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

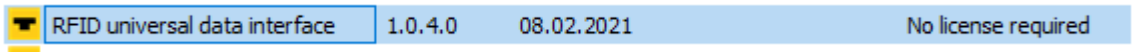


Fig. 82: Display of the Package file in the Package Manager

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

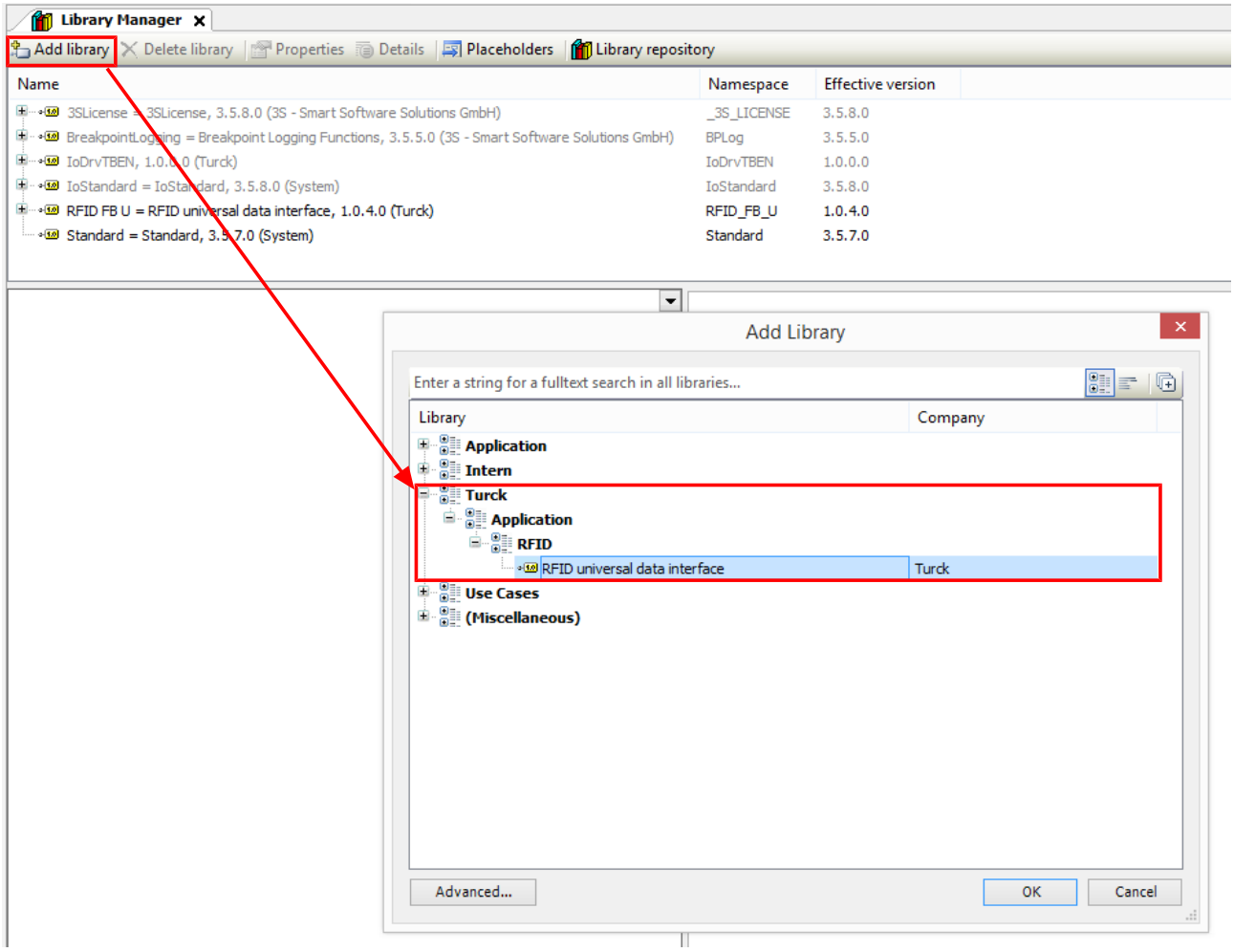


Fig. 83: Installing a CODESYS library

- 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.

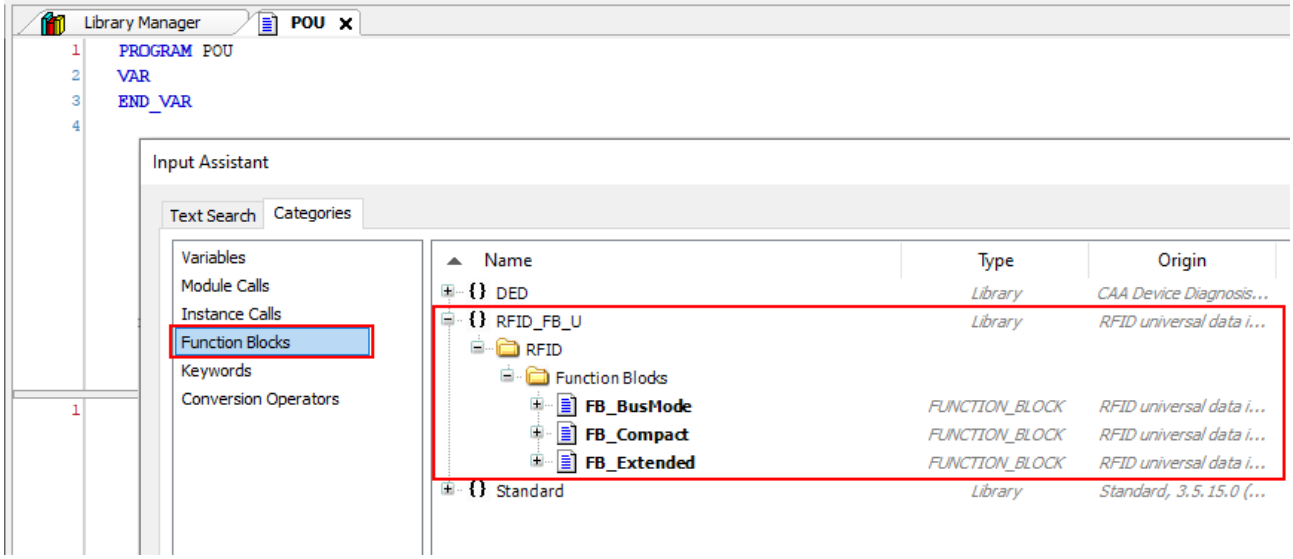


Fig. 84: Calling the CODESYS function block

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:

Status bit	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

PRG_RFID_CH0

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

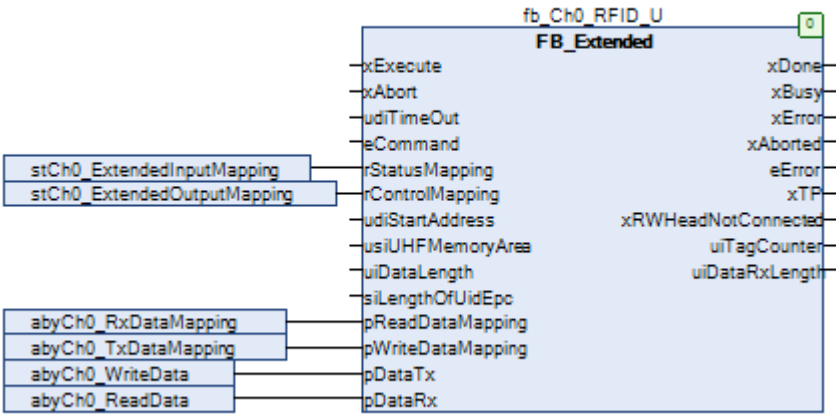


Fig. 86: FB_Extended function block — overview of inputs and outputs

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**.

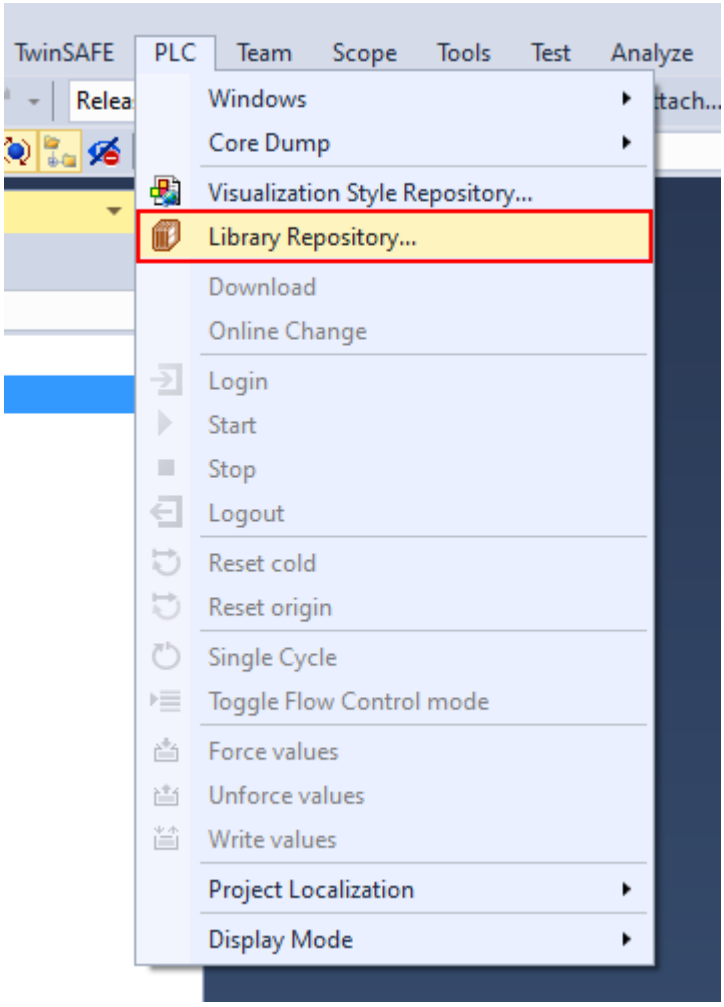


Fig. 87: Opening the Library Repository

▶ Select the library file for RFID interfaces and install.

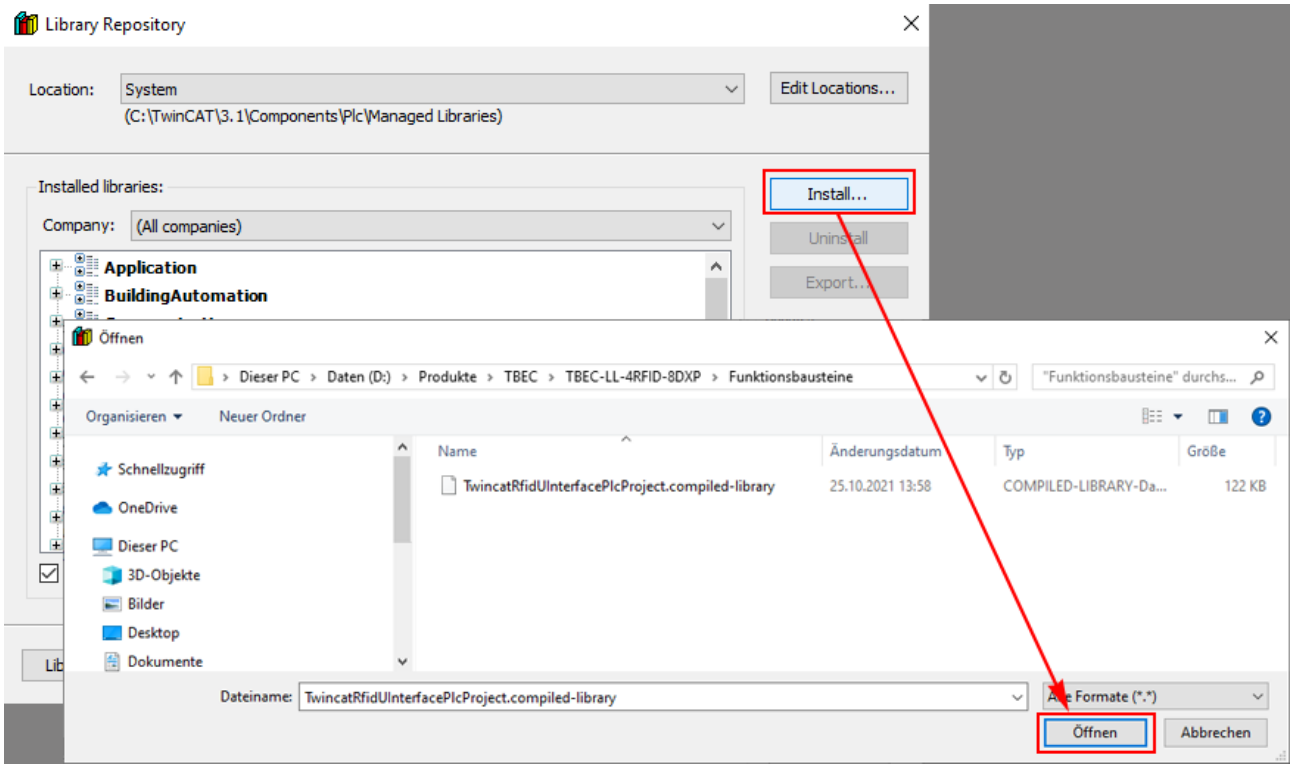


Fig. 88: Installing the Library file

- 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.

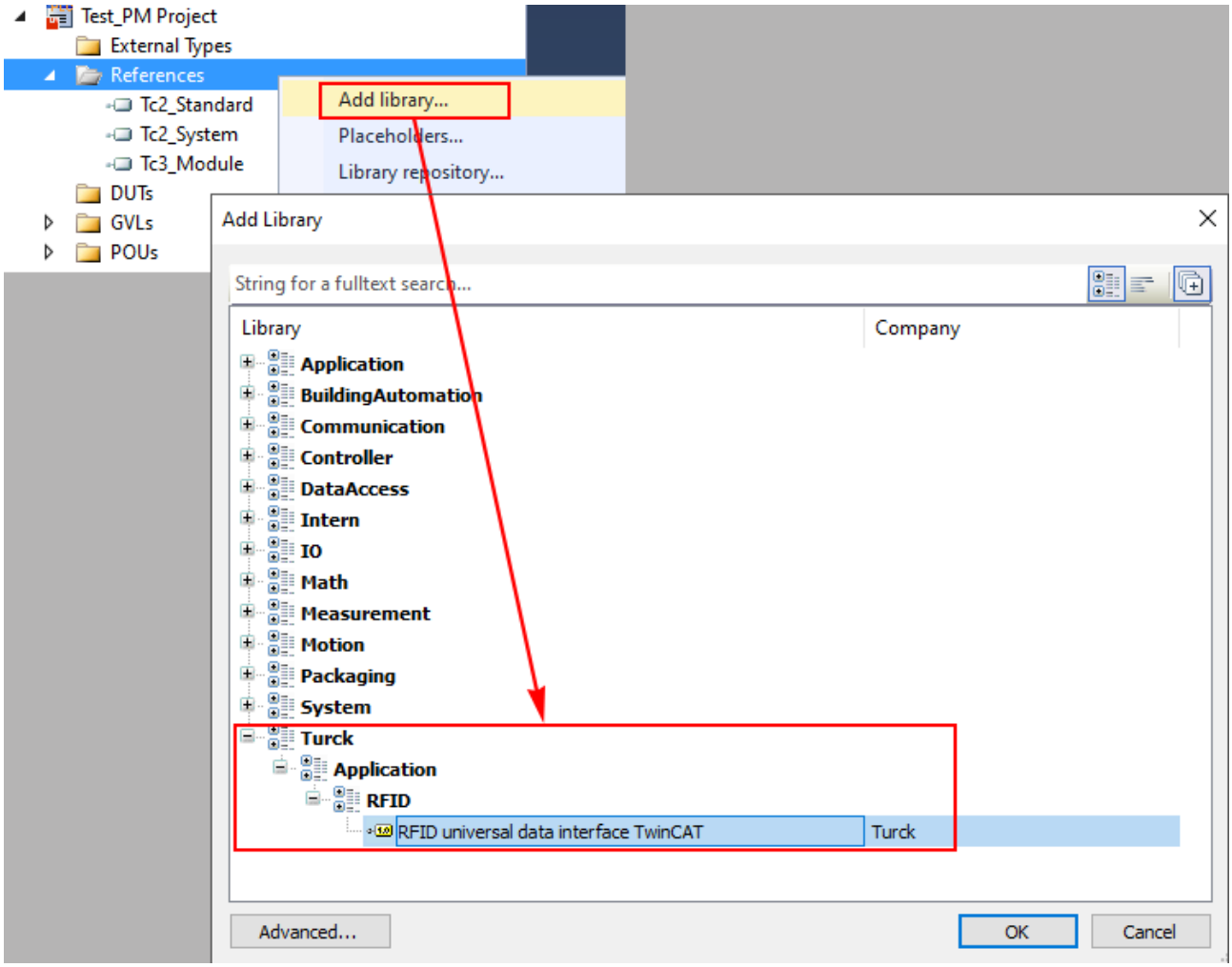


Fig. 89: Adding TwinCAT Library to the project

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

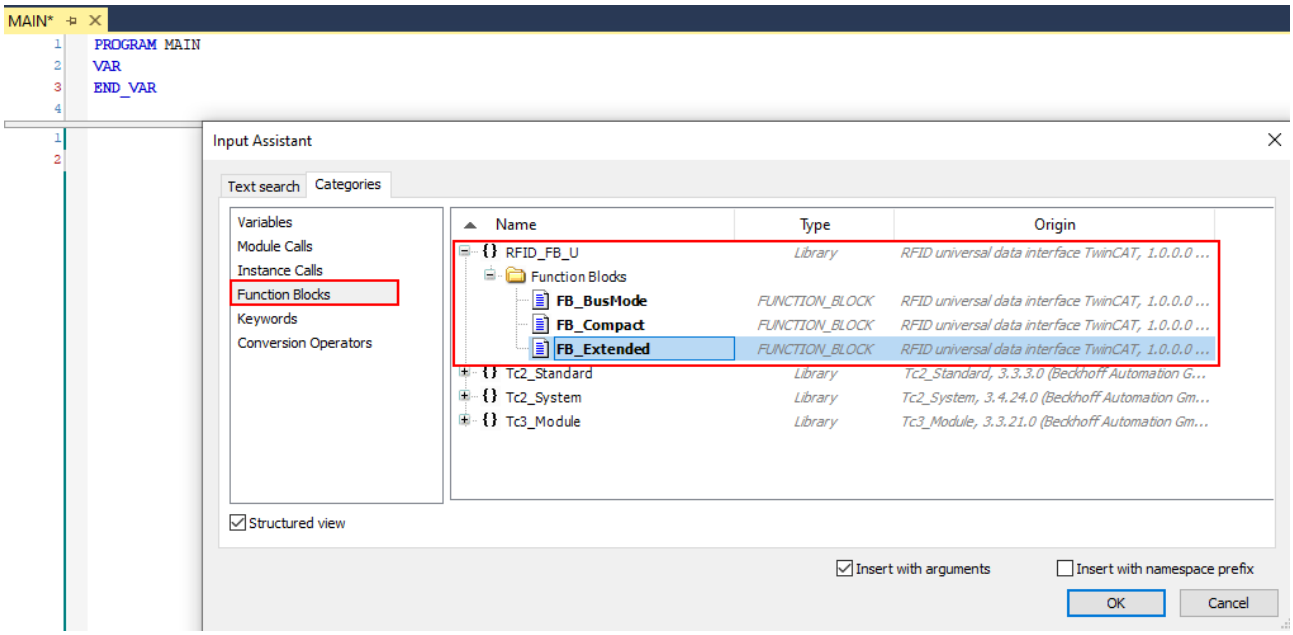


Fig. 90: Calling the TwinCAT function block

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

- Create the required instances for the function block.

```
MAIN
PROGRAM MAIN
VAR
    // initialise object of function block
    fb_Ch0_RFID_U: FB_Extended;

    // create arrays for read/write data
    abyCh0_ReadData                 : ARRAY[0..127] OF BYTE;
    abyCh0_WriteData                : ARRAY[0..127] OF BYTE;

    // create mapping to the I/O data of the corresponding channel
    stCh0_ExtendedInputMapping      AT %I*      :   RFID_FB_U.ExtendedInput_t;
    stCh0_ExtendedOutputMapping     AT %Q*      :   RFID_FB_U.ExtendedOutput_t;
    abyCh0_RxDataMapping            AT %I*      :   ARRAY[0..127] OF BYTE;
    abyCh0_TxDataMapping            AT %Q*      :   ARRAY[0..127] OF BYTE;

END_VAR
```

Fig. 91: Creating instances for the FB_Extended function block

- ▶ Compile the program.
- ⇨ The instances are created in the project tree.

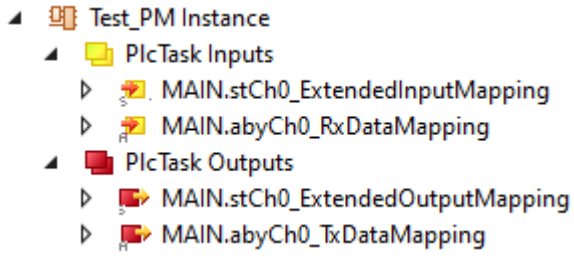


Fig. 92: Instances in the project tree

- ▶ 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**.

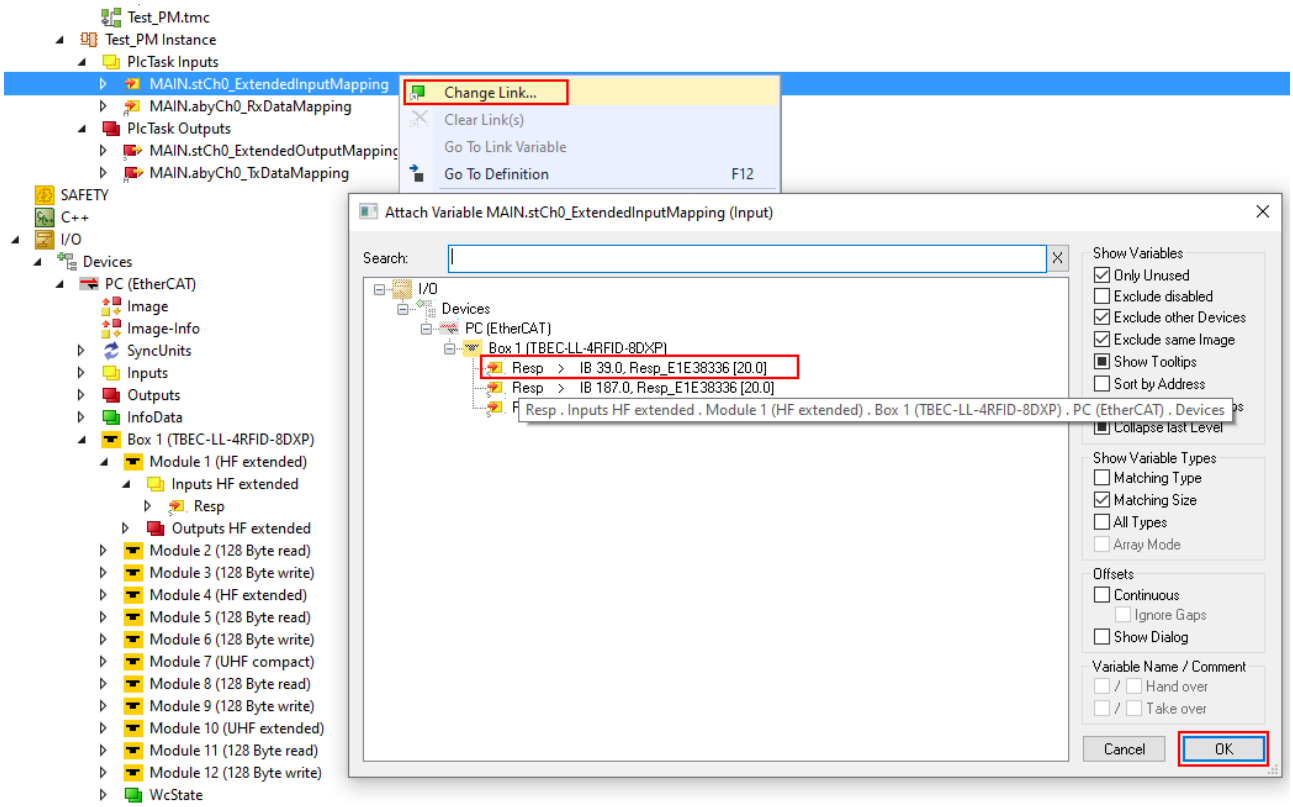


Fig. 93: Example: Linking an instance with the module register

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

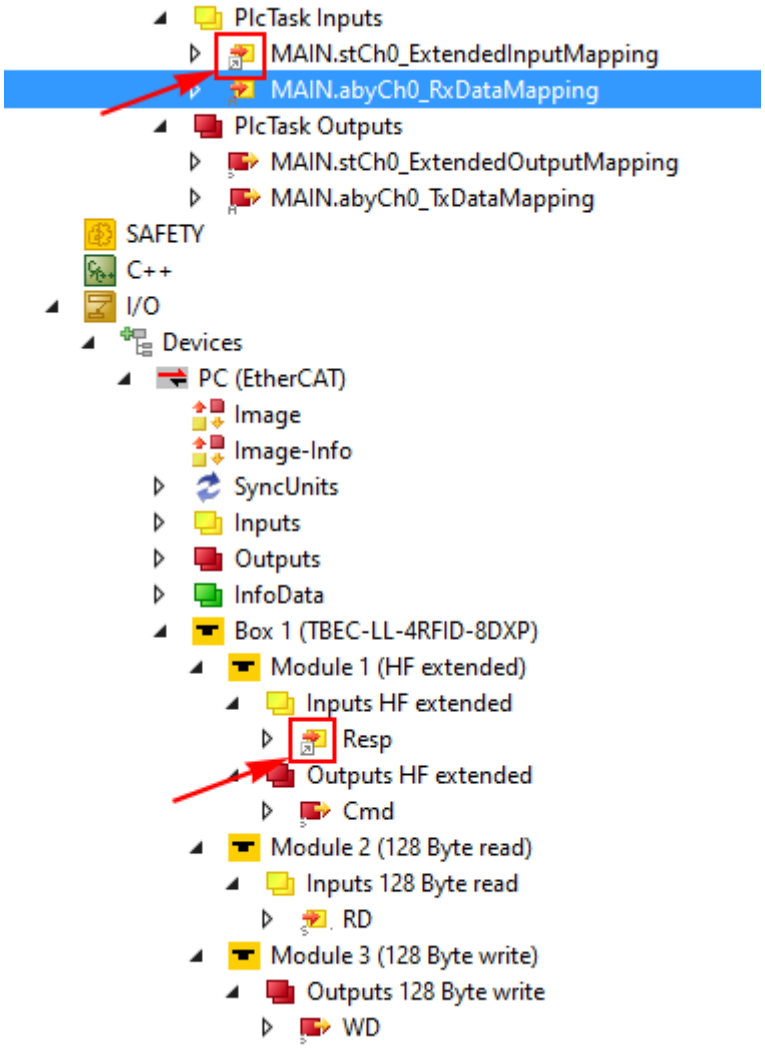


Fig. 94: Example: Successful linking between **stCh0_ExtendedInputMapping** and **Resp**

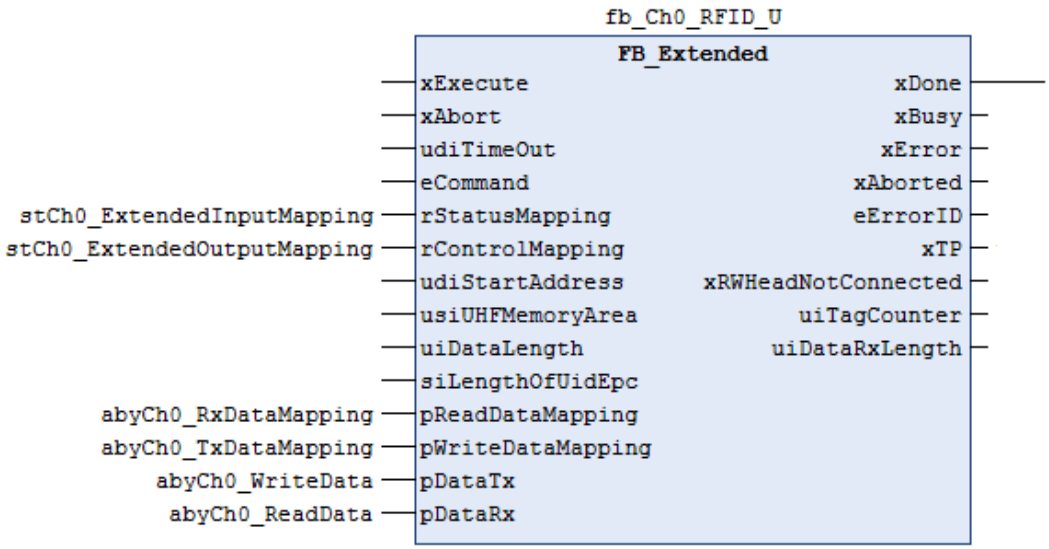


Fig. 95: Connecting an FB_Extended function block – overview of the inputs and outputs

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

Inventory	**Continuous Mode**	**Continuous presence sensing mode**
Triggered reading of UIDs or EPCs	■ Repeated reading of UIDs or EPCs ■ Automatic repetition of the same command (e.g. inventory, read, write)	■ UHF reader switches on as soon as a tag is detected ■ Repeated reading of 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 is provided with the following LEDs:

- Power supply voltage
- Group and bus error
- 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 “Maintenance”)

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	Auxiliary power overload
TP… and CMD… flash alternately	Parameter error

9.13 Diagnostic data

9.13.1 Diagnostic data — RFID channels

If the **RFID diagnostics** module is fitted in the configuration software (see Mapping diagnostics data to the process input data), the diagnostics data of the RFID channels are also mapped to the process input data (CoE index 0x60C0…0x60CB, see [▶ 85]).

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 — device status

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

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

Meaning of the diagnostic bits

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

9.14 Mapping diagnostic data to the process input data

Activating diagnostic data mapping in TwinCAT

- ▶ In Solution Explorer, double-click on **Box 1 (TBEC-S2-4RFID)**.
- ▶ On the **Slots** tab, select the slot for **RFID diagnostics**.
- ▶ In the right-hand window, select **RFID diagnostics** and click the Add button.
- ▶ On the **Slots** tab, select the slot for **Device Status/Control**.
- ▶ In the right-hand window, select **Device Status/Control** and click the Add button.
- ⇨ The mapped diagnostics are displayed under the **Slots** tab.

Activating diagnostic data mapping in CODESYS

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

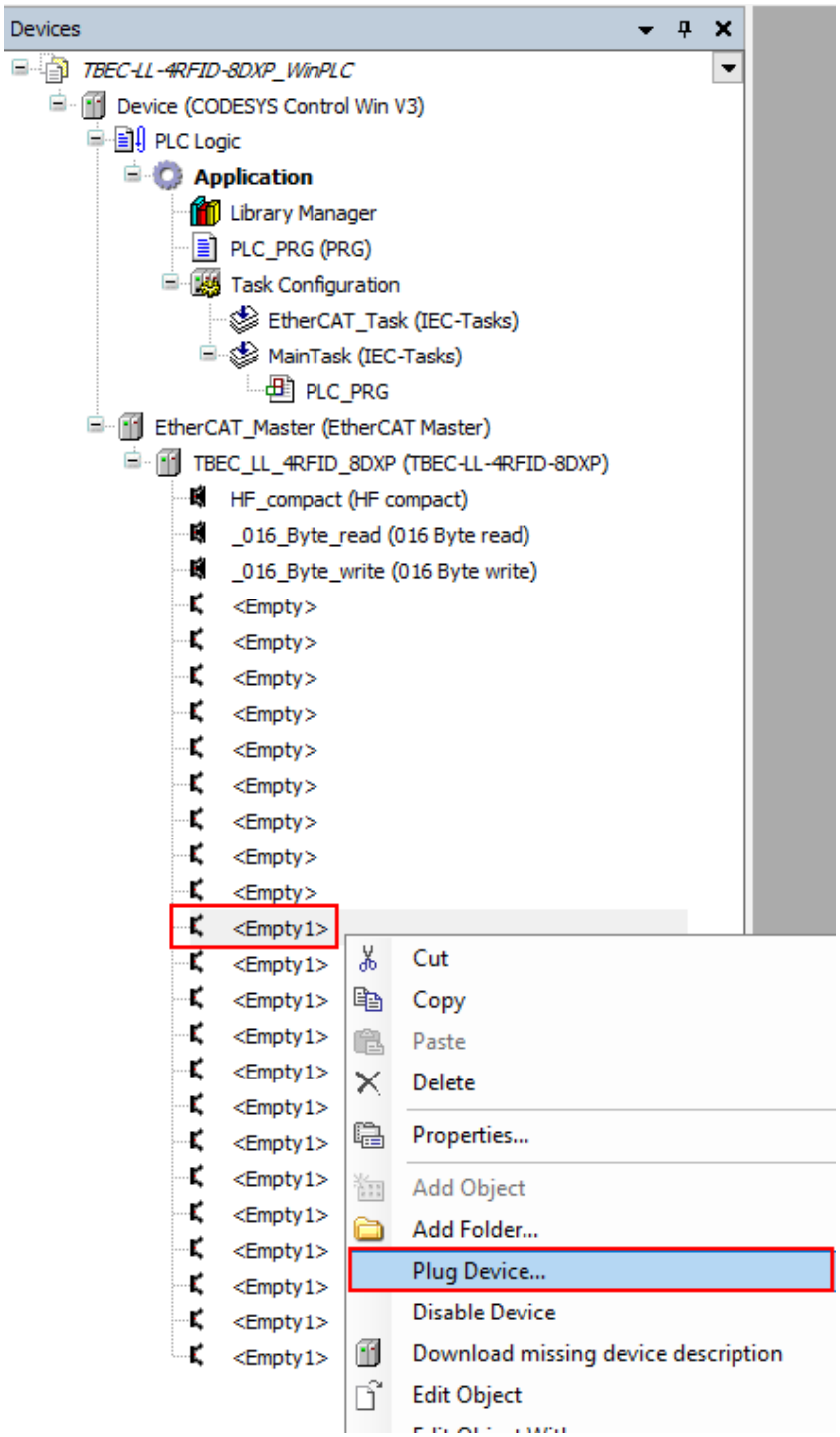


Fig. 96: CODESYS – selecting slot 13 for RFID diagnostics

- Click **RFID diagnostics**.

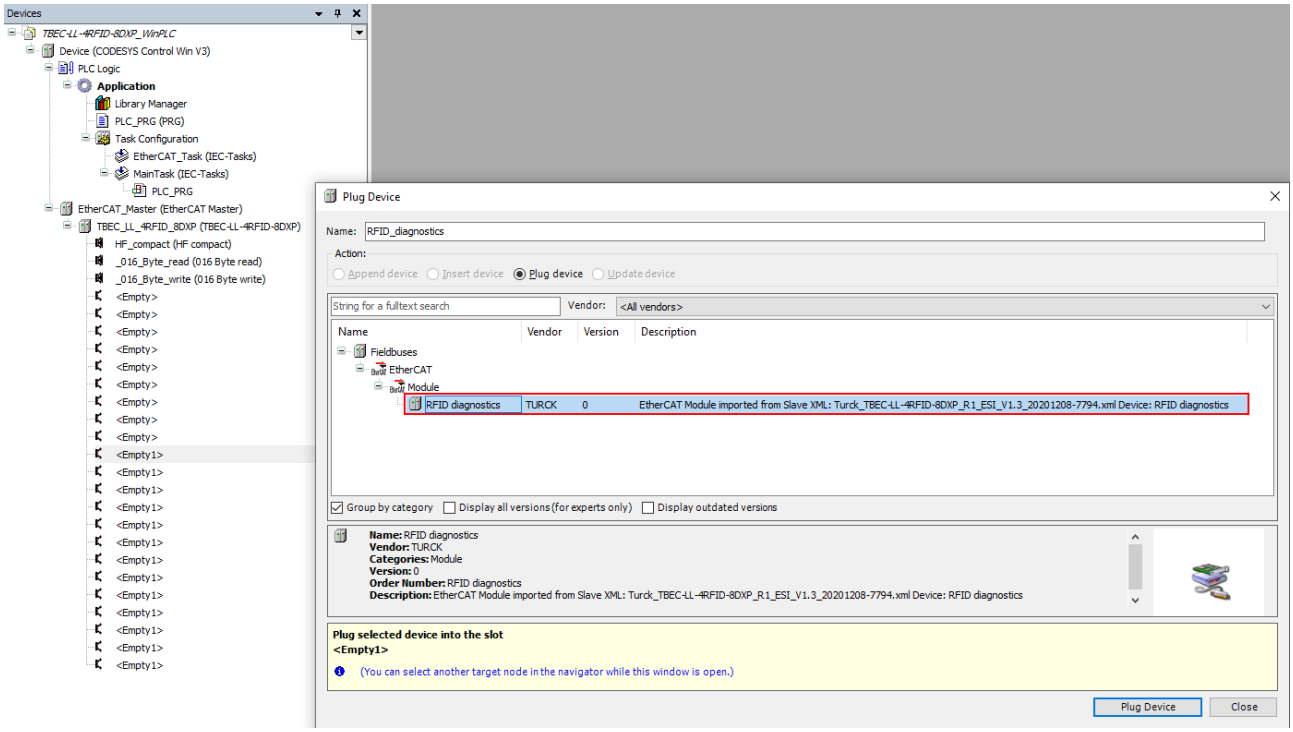


Fig. 97: CODESYS – selecting RFID diagnostics

- Do not close the window.
- Select the last slot for Device Status/Control.
- Select **Device Status/Control** and confirm with **Insert Device**.

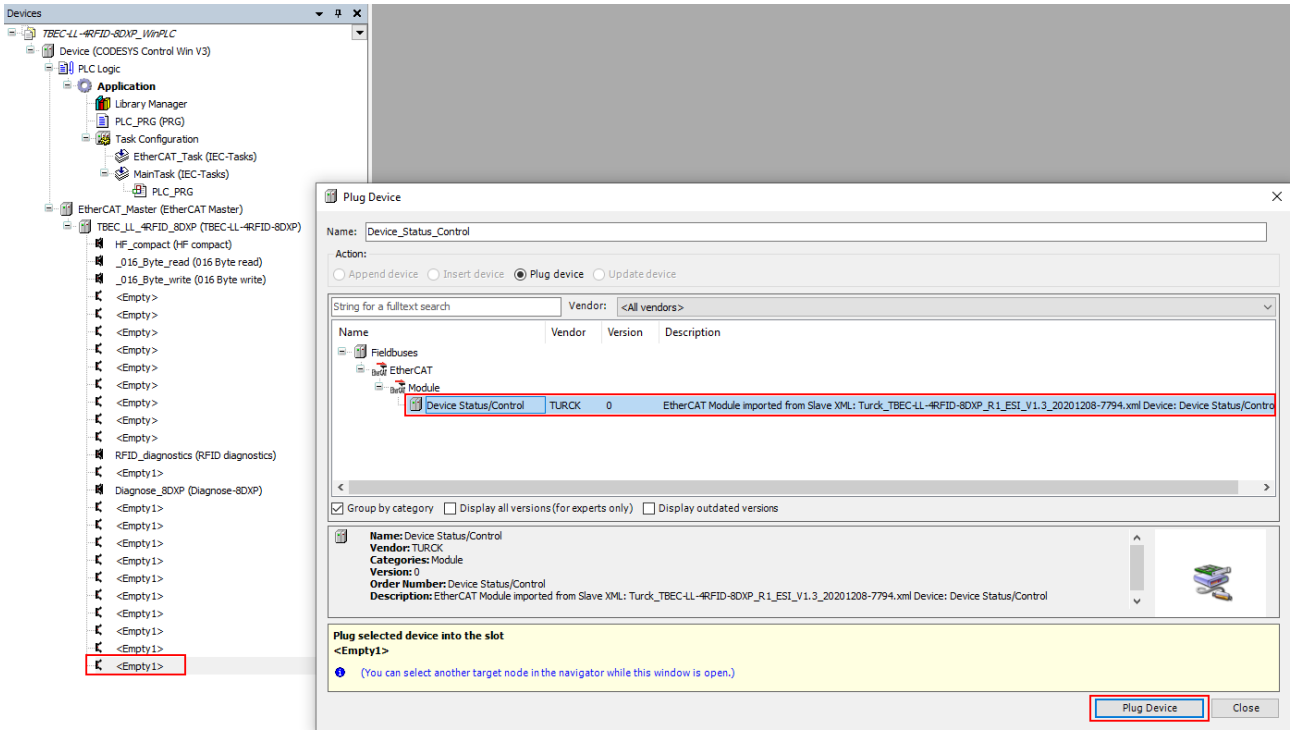


Fig. 98: CODESYS – selecting Device Status/Control

➪ The mapped diagnostics are displayed in the project tree and can be read out via the control program.

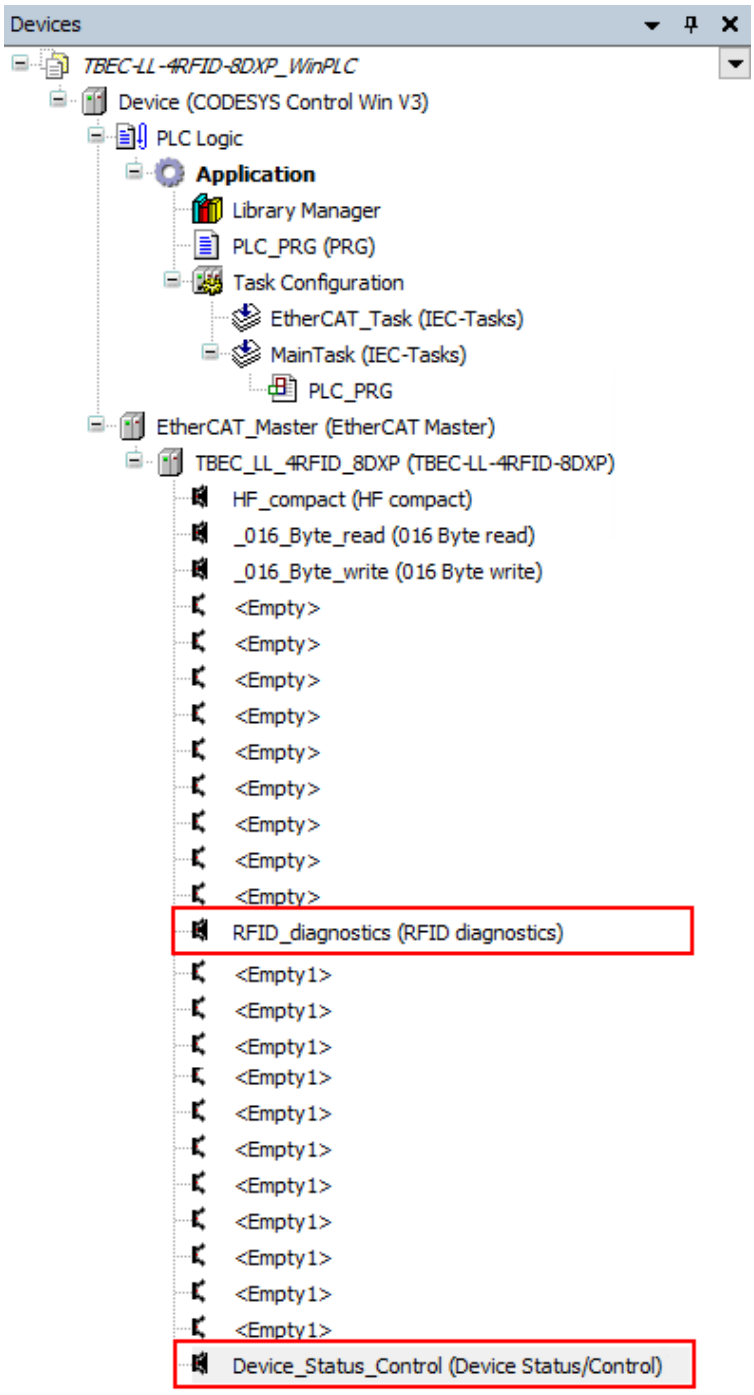


Fig. 99: CODESYS — mapped diagnostics

Example: Reading out Device Status/Control

- In the project tree, double-click on **Device_status_control (Device Status/Control)**.
- Select the **Module I/O Mapping** tab.

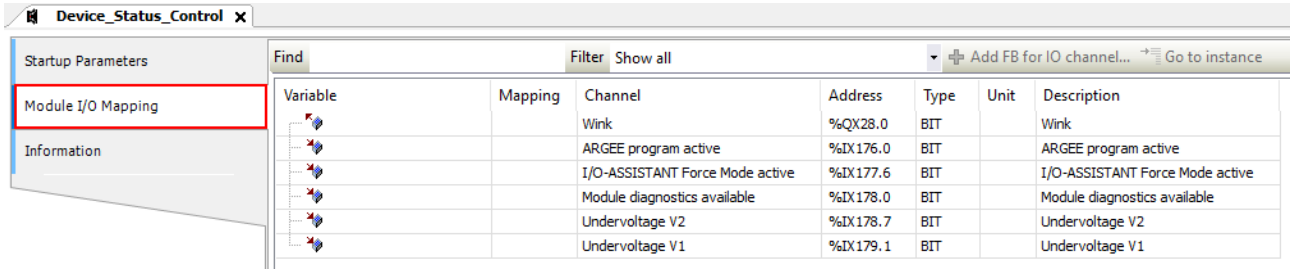


Fig. 100: Example: reading Device Status/Control

9.15 Diag History Object (0x10F3)

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

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

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

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

Diagnostic message (from subindex 6)

Parameter	Data type	Description		
Diag Code	UNSIGNED32	Diagnostic code to identify the diagnostic message		
		Bit 0…15	0x0000…0xDFFF	Reserved
			0xE000…0xE7FF	Bit 16…31: can be used for specific manufacturers
			0xE800	Bit 16…31: Emergency Error Code as defined in DS301 or DS4xxx
			0xE801…0xEDFF	Reserved
			0xEE00…0xEFFF	Bit 16…31: profile specific
			0xF000…0xFFFF	Reserved
Flags	UNSIGNED16	Bit 0…3		Diagnostic type: 00 = Info message 01 = Warning message 10 = Error message
Text ID	UNSIGNED16	Text ID, reference to diagnostic text as per ESI file		
		0		No text ID
		1…65535		Text ID, manufacturer-specific text IDs, see: [▶ 198]
Time stamp	UNSIGNED64	Time stamp in ns		
		0		No time stamp
		≠ 0		Timestamp

Text IDs

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

9.16 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 [▶ 198]		

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	Fragmentation must always start with write fragment No. 1
0x8009	32777	Fragmentation 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	The command is not implemented in this device
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 for read commands
0x8304	33540	Grouping not supported for 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	Verify after write operation failed
0x2000	8192	Kill command not successful
0x2200	8704	Autotuning active
0x2201	8705	Autotuning failed
0x2202	8706	Antenna detuned at HF read/write head
0x2500	9472	Password function of the tag not supported
0x2501	9473	Password function not supported by read/write head
0x2502	9474	Tag protection bit pattern not supported
0x2900	10496	Address outside of the block limits
0x2901	10497	Length outside of the block limits
0xC000	49152	Internal error (response of the read/write head too short)
0xC001	49153	Command not supported by read/write head version
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 advanced 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 advanced read/write head version
0xB0F1	45297	Error with automatic read/write head tuning
0xB0F8	45304	Error when resetting a command in Continuous Mode
0xB0FA	45306	Error when outputting the response code
0xB0FF	45311	Error when resetting the read/write head
0xB0B3	45235	Error when setting the tag password
0xB0B6	45238	Error when setting the write or read protection
0xB0B8	45240	Error when reading the protection status of the memory area on the tag
0xB0C3	45251	Error when setting the password in the read/write head
0xD0…	53…	UHF read/write head reports error
0xD001	53249	Error when resetting the UHF read/write head
0xD002	53250	Error when reading the read/write head version
0xD003	53251	Error when reading the read/write head version when a tag is in the detection range
0xD004	53252	Error when setting the read/write head address
0xD009	53257	Error with the parameter setting of the UHF read/write head
0xD00A	53258	Error setting the transfer speed and the operating mode of the UHF read/write head
0xD00B	53259	Error when polling
0xD00D	53261	Error when reading the device status
0xD00E	53262	Error when resetting the internal status bit
0xD00F	53263	Error when setting the read/write head outputs and/or LEDs
0xD011	53265	Error when reading the internal malfunctions
0xD014	53268	Diagnostics error
0xD016	53270	Error with the heartbeat message
0xD017	53271	Error when outputting the user settings
0xD01B	53275	Error when emptying the message memory in Polling mode
0xD081	53377	Error when switching turning on/off UHF-carrier
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: The command is not implemented in this device
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 window, 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: The command is not implemented in this device
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: Verify after write operation failed
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: No tag type specified in the command
0xF883	63619	Write command to a block failed
0xFFFE	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 transmission of data to a controller is not taken into account.

If a particular tag is selected in the **HF: Select tag type** parameter, the time measurement for the write command is already started when it is activated. 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 for advanced diagnostics and system tests. Actual as well as minimum and maximum values are available.

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

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

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

Example: Opening extended diagnostics in the web server

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

9.19 HF applications — firmware update of connected HF read/write heads via TwinCAT

The firmware file is available free of charge at turck.com.

NOTE
The firmware update file must have the file extension ".efw" (e.g. "HF_RFID_….efw"). Other firmware update file formats are not supported for updating the firmware of the read/write heads in TwinCAT.

- Open the **Online** tab.
- Set the status to **Pre-Op**.
- Open the firmware file via **Download...**.

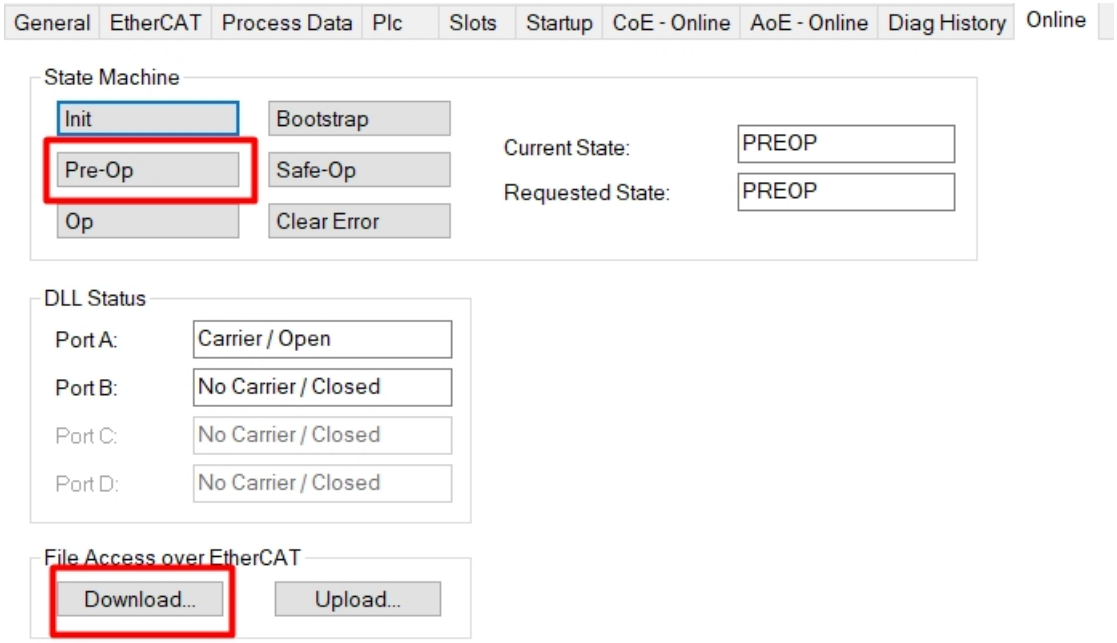


Fig. 101: Set the TwinCAT status and select the file

- Open the file path of the firmware file.
- Load the file into TwinCAT by clicking on **Open**.

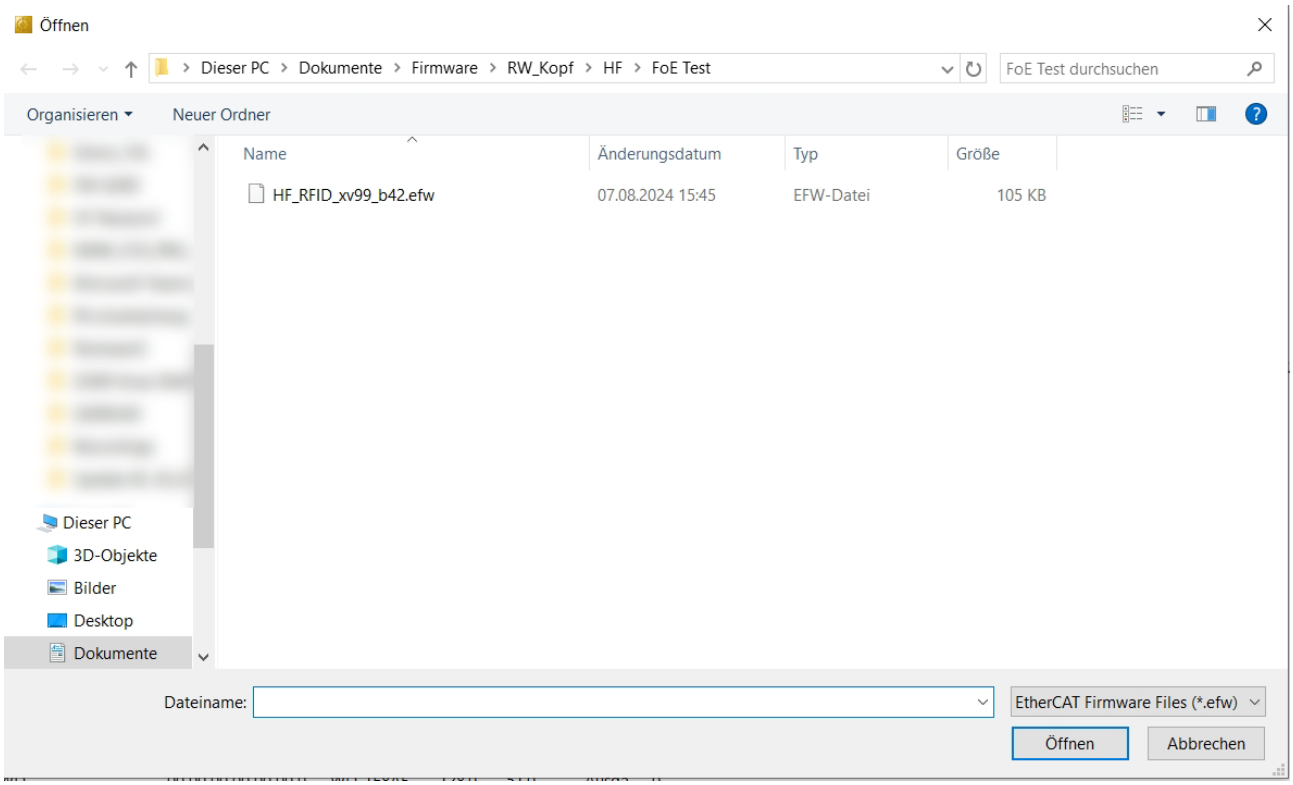


Fig. 102: Open the TwinCAT firmware file

- Click **OK** in the next window.

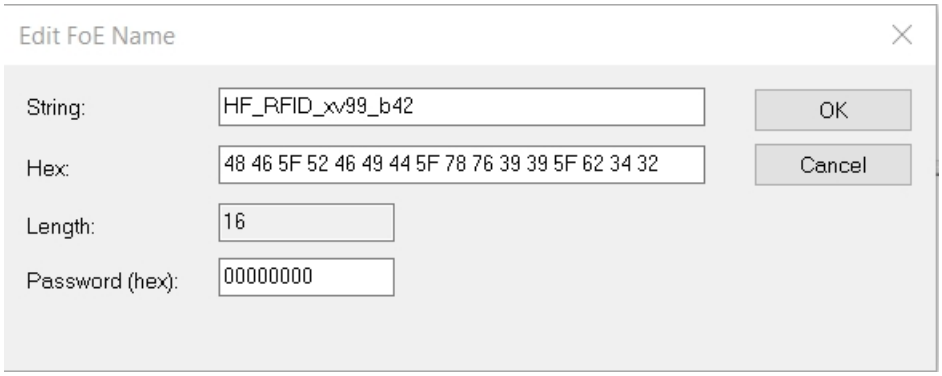


Fig. 103: Edit the TwinCAT FoE name

▶ Open the **Diag History** tab.

⇨ The window displays the status of the firmware update on the various channels.

⇨ The completion of the firmware update is confirmed by the message **Firmware update: Process finished.**.

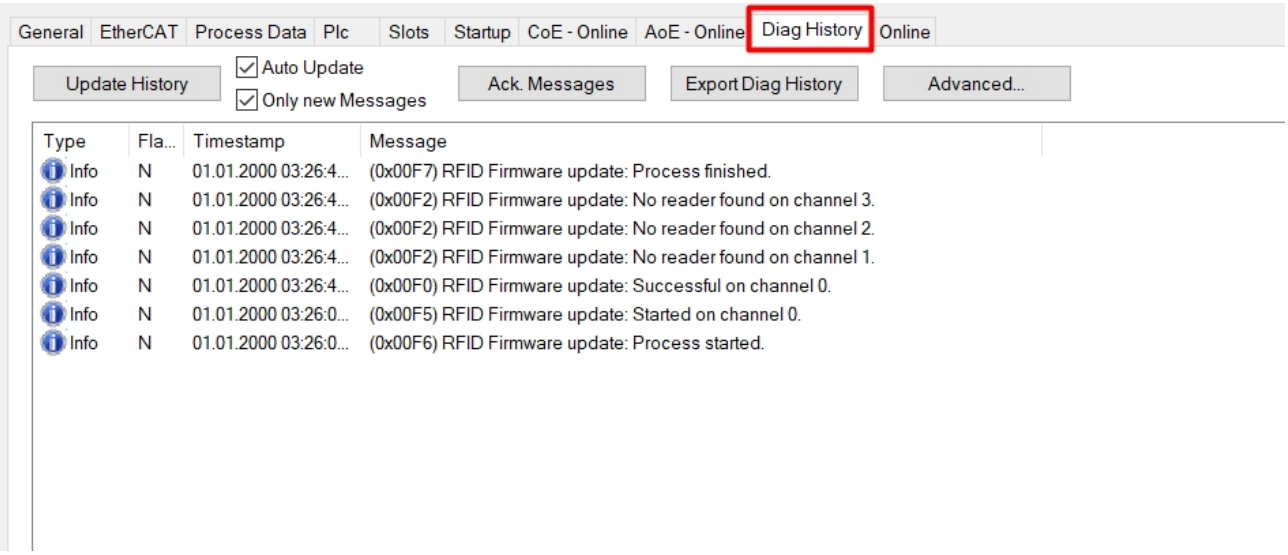


Fig. 104: TwinCAT firmware update status

Select specific read/write heads for a firmware update

Once the firmware file has been selected, the **Password (hex)** text box can be used to select specific read/write heads connected to the TBEC-… on which the firmware update will be carried out.

The hexadecimal number is converted to a binary code corresponding to the channel selection on the TBEC-… module.

Example:

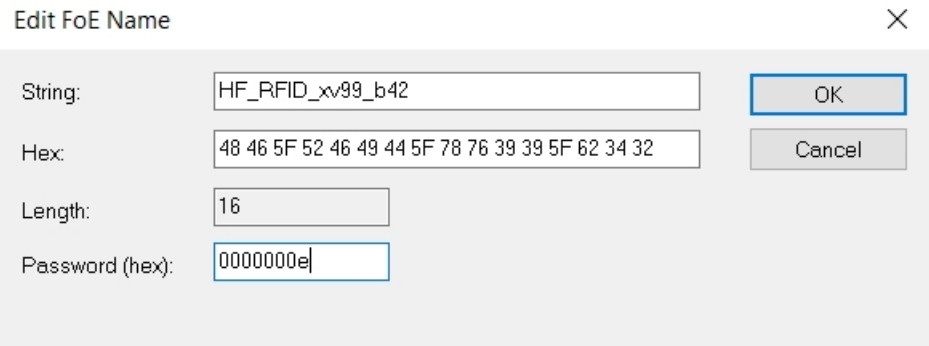


Fig. 105: Select specific TwinCAT read/write heads

The hexadecimal number 0000000e corresponds to binary code 1110.

The assignment of the binary code corresponds to the channels on the TBEC-… module as follows:

Binary code:	1	1	1	0
Channel on the TBEC-… module	Channel 4	Channel 3	Channel 2	Channel 1

1 means that the firmware update should be performed on the channel.

0 means that no firmware update should be performed on the channel.

In this example, the connected read/write head on channel 1 would not receive a firmware update.

The connected read/write heads on channel 2, channel 3 and channel 4 would receive a firmware update.

9.20 Reset device (Reset)

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

- Reset button
- via FDT/DTM
- Via CoE index 0xFBF0 "Device Reset Command"

9.20.1 Resetting the device via Object Dictionary

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

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

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

⇨ The device is reset to factory settings.

10 Troubleshooting

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

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

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

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-S2-4RFID)**.
- ▶ Click **Online** tab → **Status Machine** → **Bootstrap**.
- ▶ Click **File access over EtherCAT** → **Download…**.

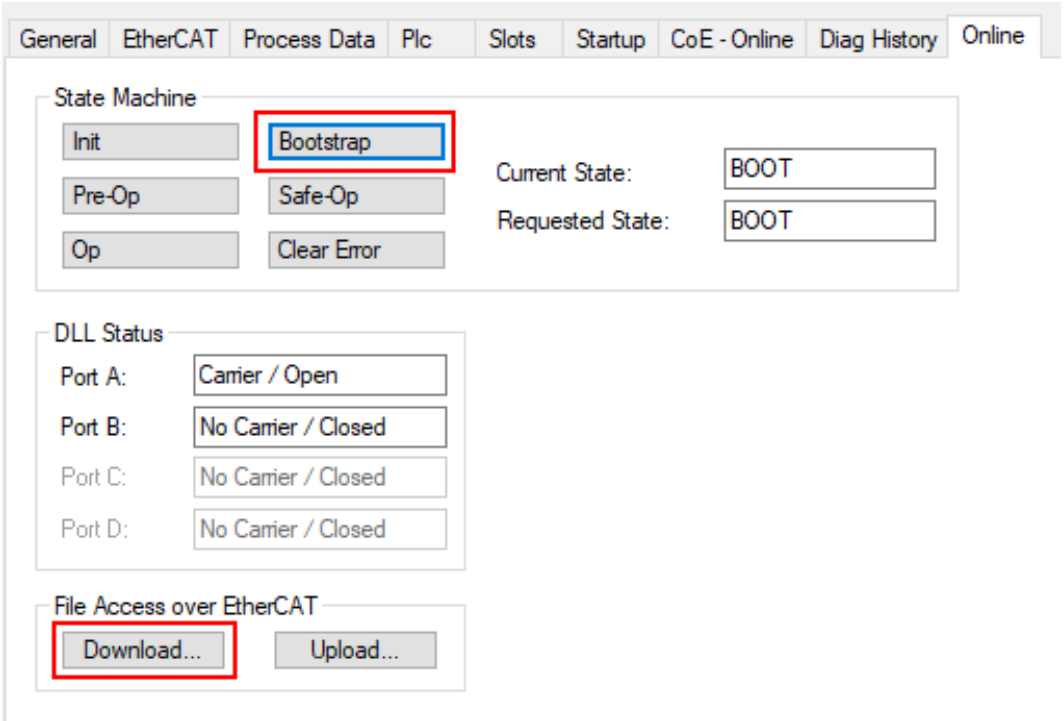


Fig. 107: Starting the firmware update

- ▶ In the new window select the firmware file.
- ▶ Confirm with **OK**.
- ⇨ The firmware file is loaded in the flash memory of the device.
- ⇨ TwinCAT displays a progress bar at the bottom of the screen to indicate the download of the firmware file.

Carrying out an update

- ▶ Click **Online** tab → **Status Machine** → **Init**.
- ⇨ The update is carried out.
- ⇨ When the update is complete, the device switches to normal operating mode.

11.2 Updating the firmware via CODESYS

Prerequisites

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

Downloading the firmware file

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

- ▶ In the project tree double-click **TBEC_S2_4RFID (TBEC-S2-4RFID)**.
- ▶ 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.
- ⇨ CODESYS 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.
- ⇨ If the update is completed the device switches to normal operating mode.
- ▶ Activate the option **Automatically restart slaves** on the **General** tab.

12 Repair

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

12.1 Returning devices

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

13 Disposal

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

14 Technical data

Technical data	
Type designation (ID)	TBEC-S2-4RFID (100047139)
Supply	
Power supply	24 VDC
Admissible range	18…30 VDC
Total current	V1 max. 4 A, V2 max. 4 A, passed through, not used in the device at 70 °C per module
Voltage supply connection	2 × M8, 4-pin, A-coded
Operating current	V1: max. 120 mA
RFID power supply V_{AUX1}	Slots X0…X3 from V1 Short-circuit proof, 2 A per channel at 70 °C, total current for RFID supply max. 3.8 A
Potential separation	Galvanic isolation of V1 and V2 voltage group Voltage proof up 500 VDC
Power dissipation, typ.	≤ 5 W
System data	
Fieldbus connection technology	2 × M8, 4-pin, A-coded
Service interface	EoE via XF1 or XF2
EtherCAT	
CAN over EtherCAT	acc. to modular device profile (ETG.5001.1)
Diagnostics	CoE Emergencies, DiagnosisHistory
Addressing	Automatic/Configured Station Alias
RFID	
Number of channels	4
Connection technology	M12
Supply	2 A per channel at 70 °C, short-circuit proof, total current for RFID supply max. 3.8 A
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
Standard/Directive conformity	
Vibration testing	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
Electromagnetic compatibility	Acc. to EN 61131-2
Approvals and certificates	CE FCC UV resistant acc. to DIN EN ISO 4892-2A (2013)

Technical data	
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 humidity	100 % acc. to IEC 61131-2
Pollution degree	4
General information	
Dimensions (W × L × H)	32 × 144 × 32 mm
Operating temperature	-40…+70 °C
Storage temperature	-40…+85 °C
Operating height	max. 5000 m
Protection class	IP65/IP67/IP69K
MTTF	234 years acc. to SN 29500 (Ed. 99) 20 °C
Housing material	PA6-GF30
Housing color	Black
Male connector material	nickel-plated brass
Material label	Polycarbonate
Halogen free	yes
Mounting	2 mounting holes, Ø 4.6 mm

Note on FCC

NOTE
This device complies with the limit values for a Class A digital device in accordance with Part 15 of the FCC regulations. Operation of this device in a residential area may cause harmful interference. In this case users must rectify the interference at their own cost.

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

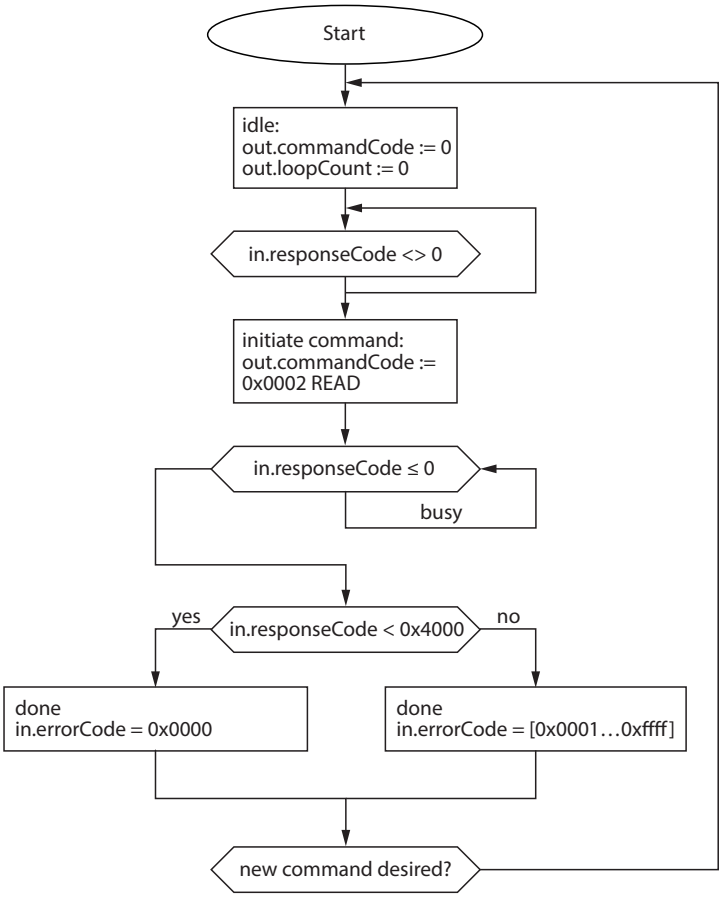


Fig. 108: Flow chart for command processing

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

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

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

commandCode:= 0x0002; (* READ *)

(* … PLC cycle … *)

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

15.2 Flow chart: rapid command processing with loop counter

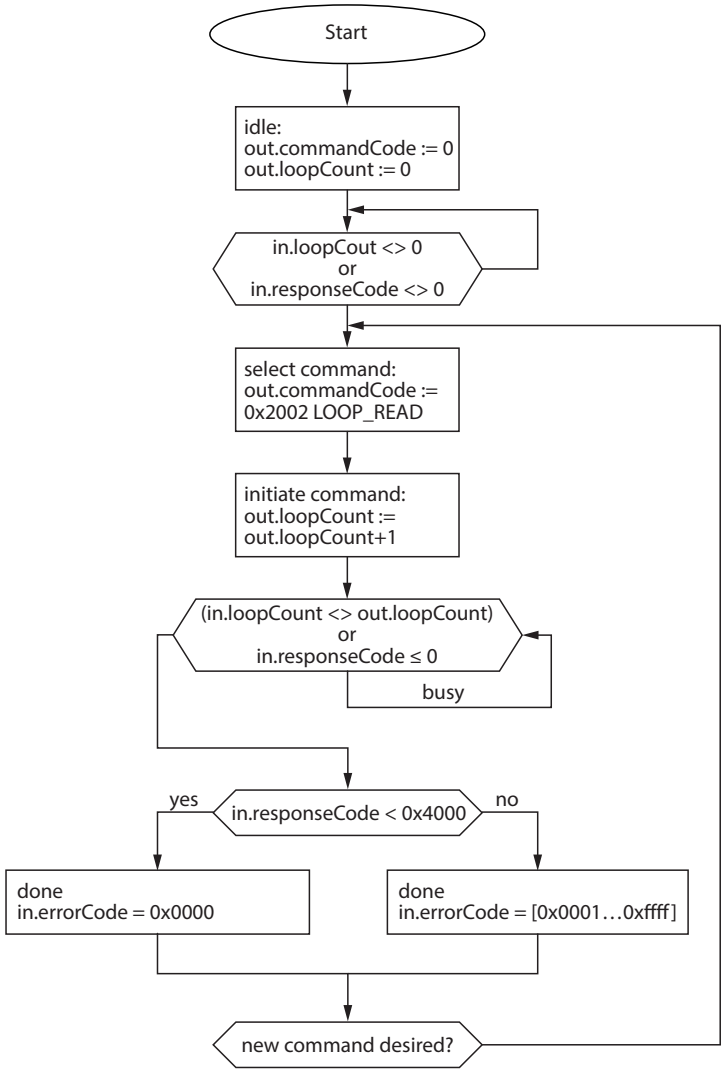


Fig. 109: Flow chart for fast command processing with loop counter

15.3 Flow chart: command processing with fragmentation

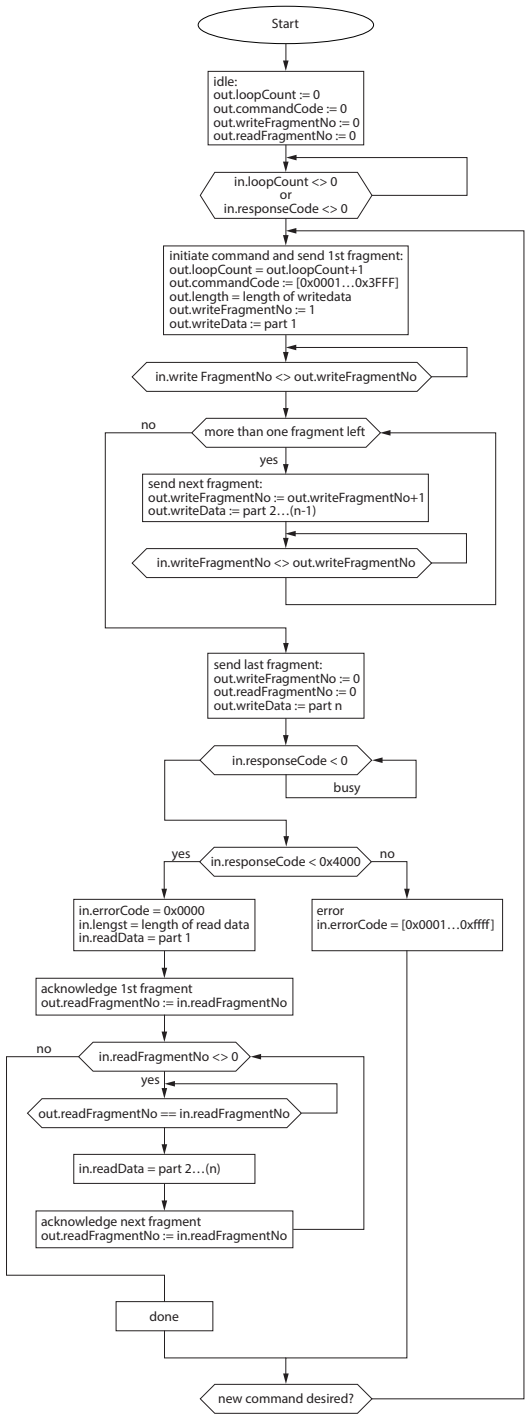


Fig. 110: Flow chart for command processing with fragmentation

15.4 Flow chart: Continuous Mode with interruption before reading data

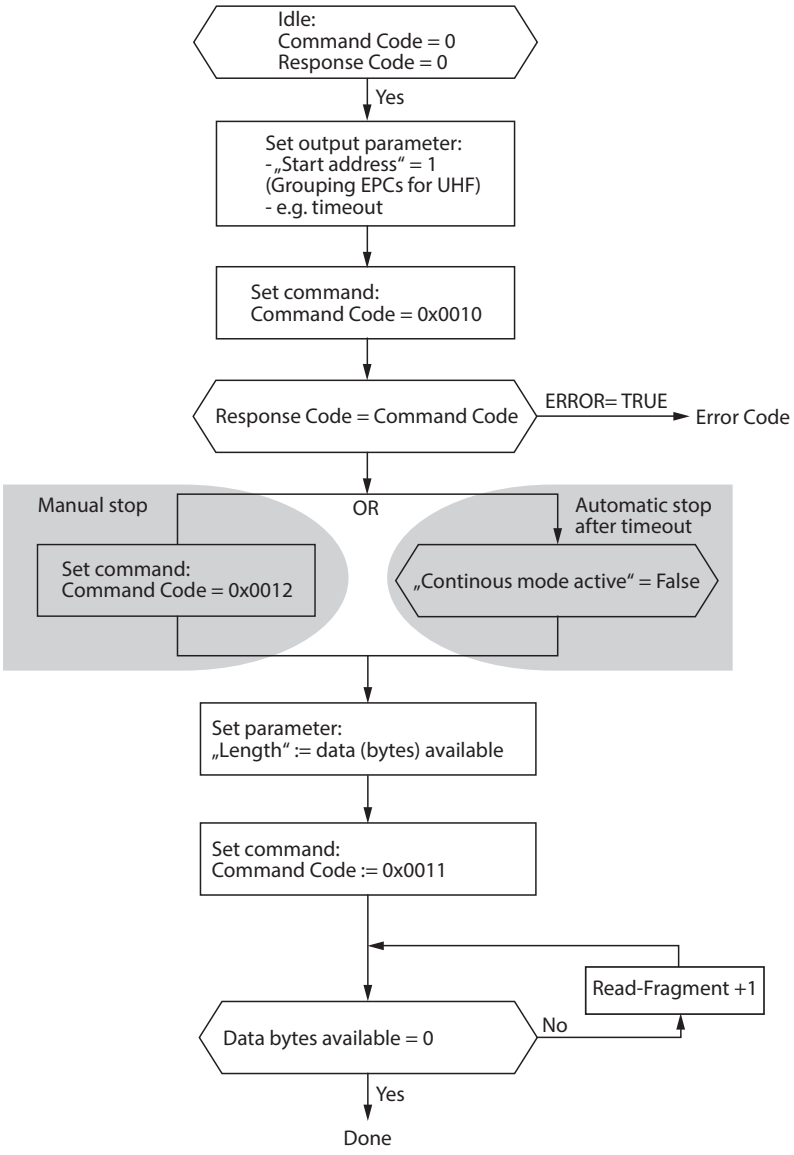
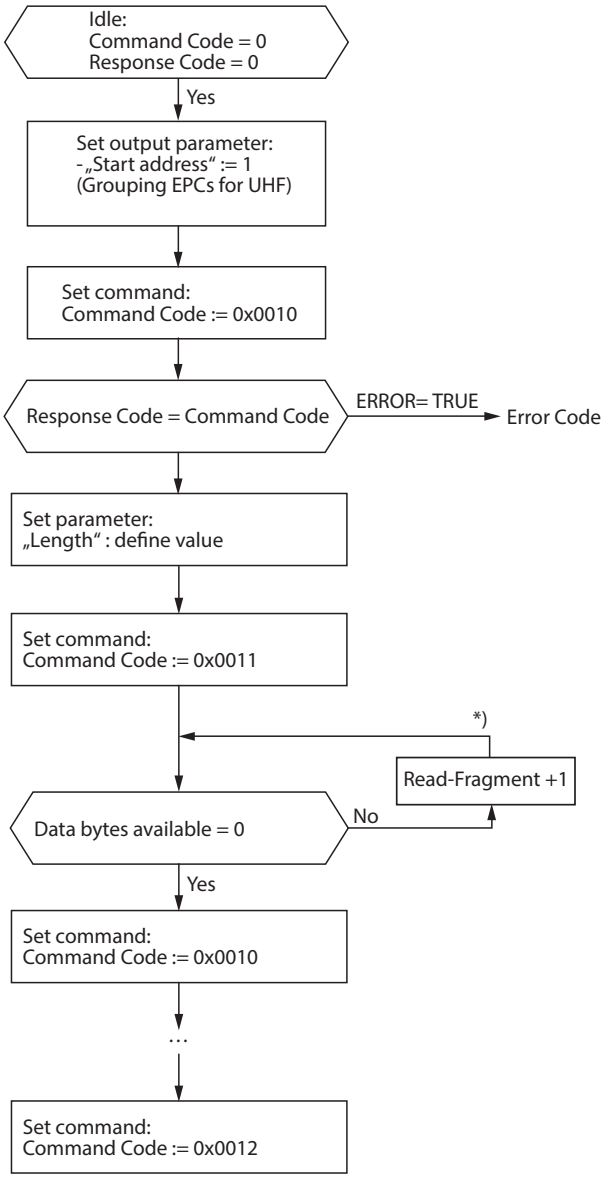


Fig. 111: Flow chart for Continuous Mode with interruption before reading data

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

15.6 Flow chart: programming tags with a password

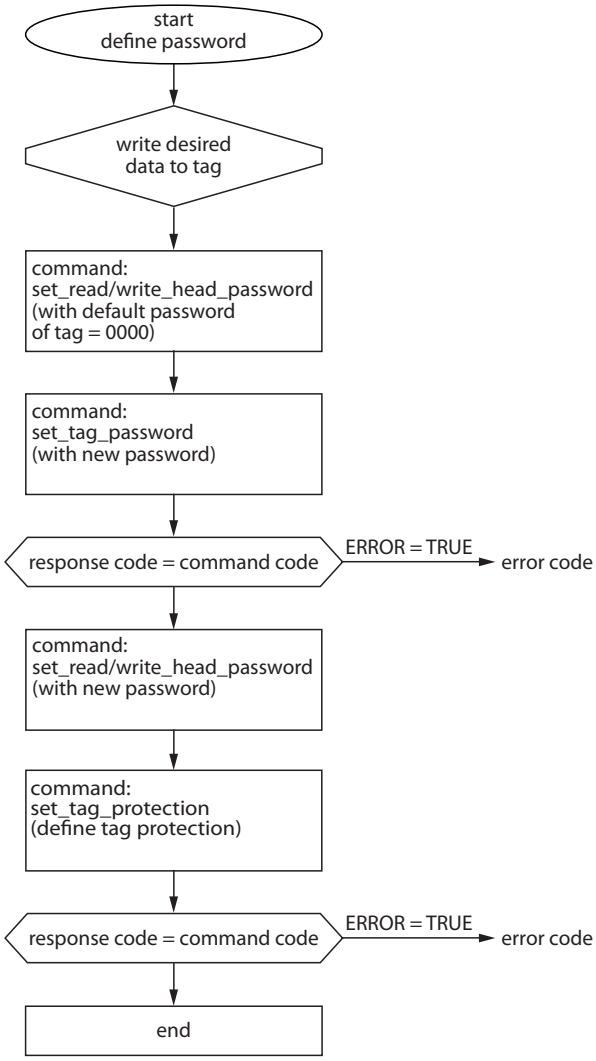


Fig. 113: programming tags with a password

16 Appendix: EU Declaration of Conformity

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

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:
Compact I/O modules in IP20/IP67:
FDN20-*, FNDL-*, FDNP-*,FDP20-*, FGDP, FGEN-*, FLDP-*, FLIB-*, FXEN-*, TBDP-*, 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

Weitere Normen, Bemerkungen:
additional standards, remarks:

Zusätzliche Informationen:
Supplementary infomation:

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 infomation:

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

17 Turck branches — contact data

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

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

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