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TURCK

TBEN-...RFID...

Use HF Bus Mode

Technical Support Document



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1 About these Instructions

These instructions describe the HF bus mode for TBEN-...RFID... block modules. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain these instructions for future use during the service life of the product. If the product is passed on, ensure that these instructions are handed over as well.

1.1 Target groups

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

1.2 Explanation of symbols used

The following symbols are used in these instructions:



DANGER

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



WARNING

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



CAUTION

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



NOTICE

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



NOTE

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



CALL TO ACTION

This symbol denotes actions that the user must carry out.



RESULTS OF ACTION

This symbol denotes relevant results of actions.

1.3 Other documents

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

- Operating instructions
- Data sheet
- Configuration manual

1.4 Naming convention

Common synonyms for "data carriers" include "tag", "transponder", and "mobile storage device". Read/write heads are also described as "transceivers" or "readers".

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 HF Bus Mode – Overview

In HF bus mode, up to 32 bus-compatible read/write heads per RFID channel can be connected to the TBEN module. Depending on the number of read/write heads connected and the power consumption of the connected heads, an additional power supply may be required. In order to determine whether an additional power supply is required, a power consumption analysis of the connected read/write heads must be performed. A tool to help calculate the power consumption of the read/write heads is available at www.turck.com/hf-busmodus.

Every connected read/write head supplies a "tag present" signal in HF bus mode. By default, a command can only be processed by one read/write head, making HF bus mode suitable for static applications and slow dynamic applications.

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



Fig. 1: 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
- TNSLR-Q42TWD-H1147/C53
- TB-Q08-0.15-RS4.47T/C53
- TB-Q08-0.15-RS4.47T/C53
- TN-Q14-0.15-RS4.47T/C53
- TNSLR-Q80WD-H1147/C53

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. On the TBEN-S2-2RFID-4DXP module, continuous HF bus mode requires firmware version V3.6.1.0 or later.

2.1 Compatible devices

The following modules support HF bus mode:

- TBEN-S2-2RFID-4DXP
- TBEN-L4-4RFID-8DXP
- TBEN-L5-4RFID-8DXP
- TBEN-L4-4RFID-8DXP-CDS
- TBEN-L5-4RFID-8DXP-CDS
- TBEN-L5-4RFID-8DXP-CDS-WV

3 Connecting Read/Write Heads for the HF Bus Mode

The maximum permissible length of the bus is 50 m.

The following accessories are required for the bus mode:

- The VT2-FKM5-FKM5-FSM5 (Ident-No. 6930573) junction boxes are required for connecting several read/write heads to an RFID port
 - RSE57-TR2/RFID bus terminating resistor (Ident-No. 6934908)
 - Optional: VB2-FKM5-FSM5.205-FSM5.305/S2550 junction box (Ident-No. 6936821) for feeding in an additional power supply
 - RFID connection cables (e.g. RK4.5T-0.3-RS4.5T/S2503)
- ▶ Connect the read/write head as per the figure below. The maximum length of the spur line is 2 m.
 - ▶ Take the power supply into account, particularly at switch-on (see data sheet), as well as the maximum current carrying capacity of the lines (4 A).
 - ▶ Take the voltage drop on the line into account. If necessary provide an additional power supply between the read/write heads using junction box VB2-FKM5-FSM5.205-FSM5.305/S2550.
 - ▶ Connect a terminating resistor (e.g. RSE57-TR2/RFID) behind the last read/write head.



Fig. 2: HF bus mode setup

4 HF Applications – Setting HF Bus Mode

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

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

Automatic addressing of read/write heads



NOTE

Turck recommends making the bus address of the read/write head visible on the device.

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.

Information on addressing the read/write heads via the RFID interface with the **Set HF read/write head address** command is provided in the operating instructions. With manual addressing via the **Set HF read/write head address** command, the read/write heads must not be activated until the addressing is completed.

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

Manually addressing read/write heads using the Turck Service Tool



NOTE

Turck recommends making the bus address of the read/write head visible on the device.

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

- STW-RS485-USB interface converter (Ident-No. 7030354)
- STW-RS485-USB-PS plug-in power supply unit (Ident-No. 7030355)

- ▶ Connect the read/write head to the interface converter using a suitable connection cable (e.g. RK4.5T-2/S2500) according to the following color coding:

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

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

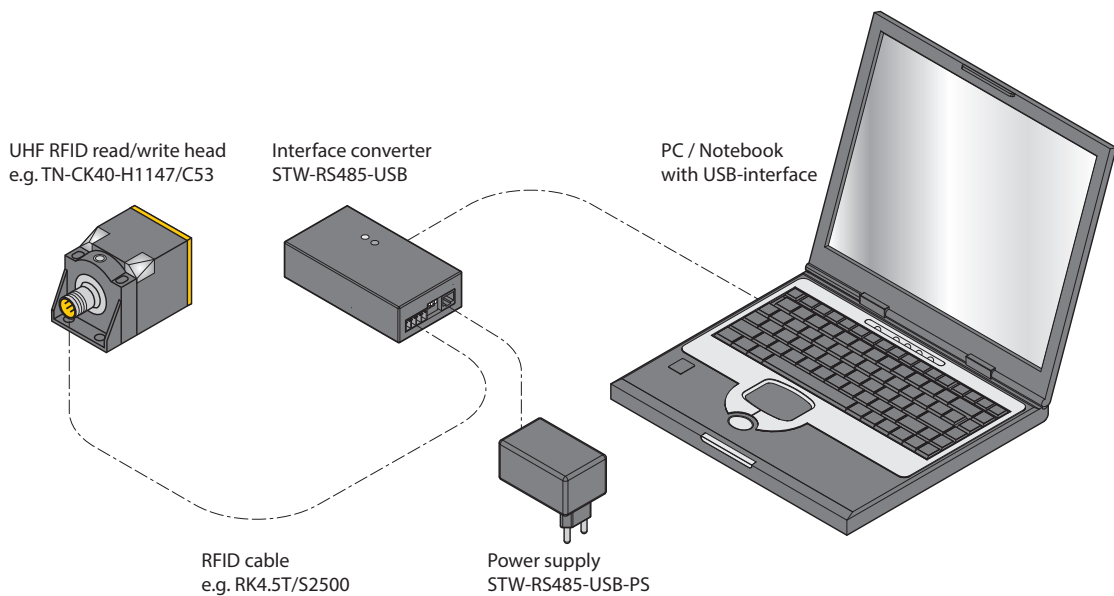


Fig. 3: Connecting the read/write head to a PC via the interface converter

- ▶ Open the Turck Service Tool.
- ▶ Click **Actions** or press [F4].
- ▶ Click **Set HF RFID reader bus address**.

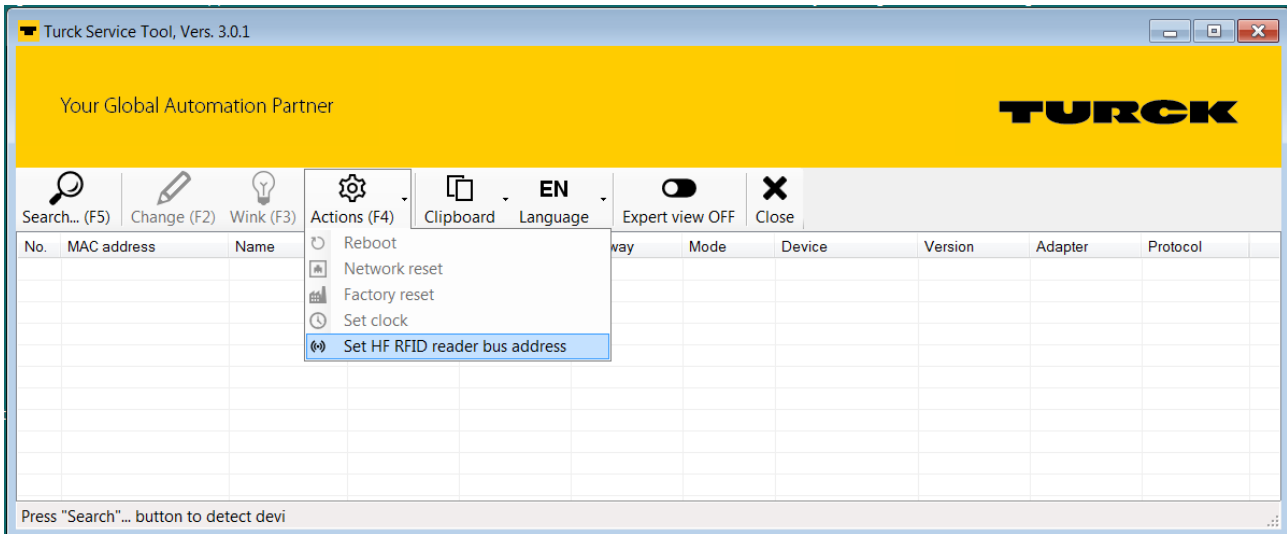


Fig. 4: Selecting a function — Set HF RFID reader bus address

The **HF RFID Reader Setup Tool** window opens.

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

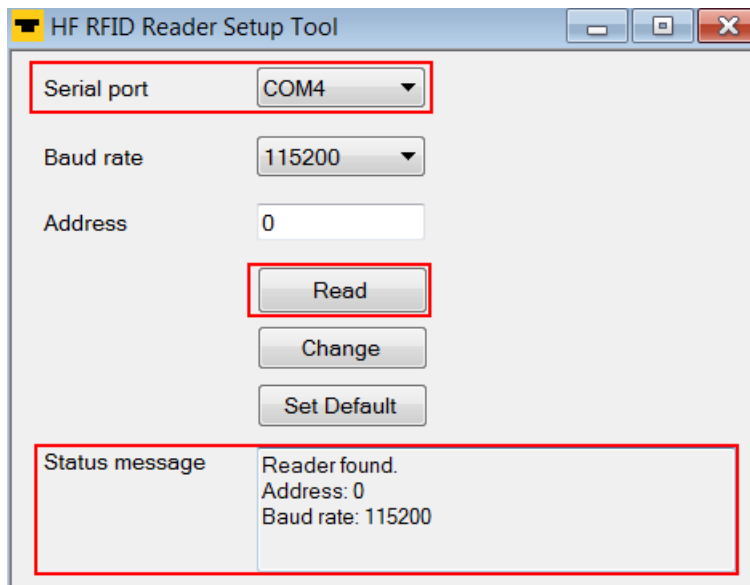


Fig. 5: Window — HF RFID Reader Setup Tool

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

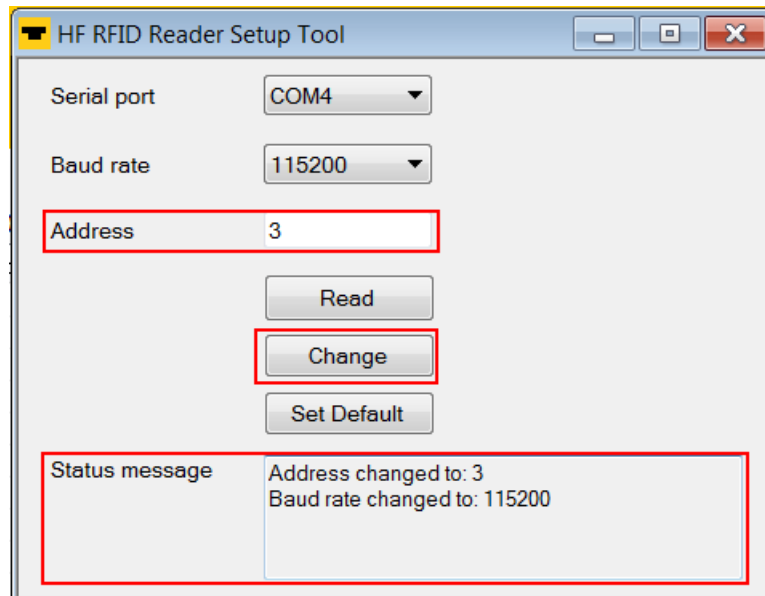


Fig. 6: Changing the read/write head address

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

5 Operation

5.1 Executing commands in HF bus mode

- ▶ Set the parameter data.
- ▶ Select the **HF Bus Mode** operating mode.
- ▶ Activate the connected read/write heads.
- ▶ Set the input data.
- ▶ Specify the command code.
- ▶ Set the start address for the command.
- ▶ Set the required read/write head address.
- ▶ Send the command to the read/write head.

5.2 HF applications — Using continuous HF bus mode

In Continuous mode (HF), the read/write head can read or write up to 64 bytes (see table "User data areas for the HF tag").

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
- ▶ For Read or Write commands: Enter the tag type. Automatic 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 start address must be a multiple of the block size of the tag used.
 - ▶ 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 block size of the tags can be found in the table below. Odd bytes cannot be addressed.
 - ▶ Optional: Set the grouping via the **Start address parameter in the process output** data: Set the value for the **Start address** parameter to 1. If the grouping is activated and there is still a UID saved in the FIFO memory of the module, a UID is no longer saved as a new reading after it is first read. For subsequent readings, only the address of the read/write head that was last read by the tag and the number of readings are 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 executed for all active read/write heads as soon as a tag is in the field.
 - ▶ When executing the Read command and retrieving UIDs, the data received from the read/write head is retrieved cyclically and stored in the FIFO memory of the interface as follows:

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 readings (only if grouping is activated)

- ▶ Execute the **Idle** (0x0000) command. The **Idle** command does not end Continuous mode.

- ▶ To transfer data from the FIFO memory of the interface to the controller, execute the **Read data from the buffer** (0x0011) command. In addition to the read data, the address of the read/write head that is being used is also transferred. The length of the data available in the FIFO memory is displayed in the input data under **Data (bytes) available** (BYFI). The length of the data must be consistent. Example: If the UID, reserved byte and read/write head address for each tag are being written to the FIFO memory, at least 10 bytes of data must be read from the buffer.



NOTE

Data in the FIFO memory is not overwritten until it has been transferred to the controller. New readings are stored in the FIFO memory.

- ▶ To end Continuous mode, **execute the End Continuous mode** (0x0012) command.
- or
- ▶ To end Continuous mode and clear the FIFO memory of the interface, send the **Reset** (0x0800) command.



NOTE

The data must be transferred from the device to the higher level on a regular basis. If the 16-KB ring buffer is full, no further data can be saved and the device displays an error message.

User data areas for the HF tag

Chip type	User data area		Total memory [byte]	Access	Bytes per block
	First block	Last block			
NXP SL2 SLI	0x00	0x1B	112	read/write	4
NXP SL2 SLI-S	0x00	0x27	160	read/write	4
NXP SL2 SLI-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 HFI Plus	0x00	0x3F	256	read/write	4
TI Tag-it HFI	0x00	0x07	32	read/write	4
Infineon SR-F55V02P	0x00	0x37	224	read/write	4
Infineon SR-F55V10P	0x00	0xF7	992	read/write	4
EM4233	0x00	0x33	208	read/write	4
EM4233 SLIC	0x00	0x1F	128	read/write	4

5.3 Replacing bus-capable read/write heads

- ▶ Remove the faulty read/write head.
- ▶ Connect the new read/write head with the default address 68 (delivered with .../C53).
- ▶ If multiple read/write heads are being replaced: Replace the read/write heads in the order in which they were connected.
- ⇒ 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.

5.4 Typical times for processing a command (HF bus mode)

The time required to cyclically process the command depends on how long the tag is in the detection range of the read/write head (bypass time). The bypass time is set at 48 ms by default. The bypass time can be set by the user. If the bypass time is set differently, the difference from the time taken to process a command must be added or deducted.

The time taken for all read/write heads to 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 also be taken into account when calculating the total time taken to process a command.

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

Command	System cycle time	Time required	Dependence on factors such as protocol, system, etc.
Read UID on a read/write head with rising edge at TP, tag within the detection range	4 ms	24 ms	Depending on the system cycle time, the bypass time must be added.
Read UID on a read/write head with rising edge at TP, tag within the detection range	20 ms	80 ms	
Read 112 bytes from different read/write heads one after the other, default bypass time (48 ms)	4 ms	180 ms per read/write head	The length of time for which the individual read/write heads are accessed varies.

5.5 Continuous HF bus mode — Data retrieval

All activated read/write heads are triggered within a time frame of bypass time + 10 ms. Within this time frame, the set command (e.g. inventory, read, write) is processed in Continuous mode. While a command is being executed by all activated read/write heads, only one read/write head sends data to the RFID interface. The other read/write heads store the read data for subsequent retrieval. When a new tag is detected by the same read/write head, any data in the buffer of the read/write head that has not yet been transferred to the RFID interface is overwritten.

During the time between two requests and when sending data to the RFID interface, the read/write heads do not recognize any tags. The required waiting times are given in the following table:

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

By default, the bypass time in HF bus mode is 48 ms.

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

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

Read/write head	Sequence 1		Sequence 2		Sequence 3		Sequence n	
Address 1	DATA or CMD	None Action	CMD	None Action	CMD	None Action	CMD	None Action
Address 2	CMD	None Action	DATA or CMD	None Action	CMD	None Action	CMD	None Action
Address 3	CMD	None Action	CMD	None Action	DATA or CMD	None Action	CMD	None Action
Address n	CMD	None Action	CMD	None Action	CMD	None Action	DATA or CMD	None Action
Time	Bypass time	Waiting time	Bypass time	Waiting time	Bypass time	Waiting time	Bypass time	Waiting time

5.6 LED displays on read/write heads in HF bus mode

In HF bus mode, the LEDs on the read/write heads have the following display functions:

LED	Condition	Function
Green	Flashes 3x, 0.5-s break (recurring)	Incorrect read/write head address or no read/write head address assigned
	Flashing (1 Hz)	Read/write head not activated

The yellow LED has no specific function in HF bus mode.

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