Leuze

Translation of original operating instructions

RDH 202
RFID read/write device

The Sensor People

We reserve the right to make technical changes
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1 About this document

Tab. 1.1: Warning symbols and signal words

	Symbol indicating dangers to persons
	Symbol indicating possible property damage
NOTE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injuries Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.

Tab. 1.2: Other symbols

	Symbol for tips Text passages with this symbol provide you with further information.
	Symbol for action steps Text passages with this symbol instruct you to perform actions.
	Symbol for action results Text passages with this symbol describe the result of the preceding action.

Tab. 1.3: Terms and abbreviations

AFI	Application Family Identifier 1-byte memory area that specifies the transponder's application area, e.g. medical, transportation, etc. The definition is given in ISO/IEC 15693-3.
CC	Capability Container Configuration memory, a specific memory area for NFC transponders
HF	High Frequency Radio frequency band on which data is transmitted between the read/write system and the transponder. Data is transmitted in accordance with ISO/IEC 15693 or ISO/IEC 14443 A worldwide on the 13.56 MHz frequency.
LSB	Least Significant Bit Bit with the lowest value
MSB	Most Significant Bit Bit with the highest value
RFID	Radio Frequency Identification Generic term for the contactless identification of objects equipped with transponders using radio waves.
PLC	Programmable Logic Control
UID	Unique identifier Unique, 64-bit transponder identification code. The UID is made up of the chip manufacturer number and the chip serial number.

2 Safety

This sensor was developed, manufactured and tested in line with the applicable safety standards. It corresponds to the state of the art.

2.1 Intended use

The RDH 100 and RDH 200 series RFID read/write systems are electronic devices for inductive data transmission to/from compatible code and data carriers. Commonly known as transponders or tags, they use radio frequency identification. The term transponder is used throughout this document.

Areas of application

The devices are designed for the following areas of application:

- Object detection in storage and materials-handling applications
- Flexible material flow control in assembly lines and interlinked production cells
- Production control

⚠ CAUTION

Observe intended use!

The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not complying with its intended use.

- ↳ Only operate the device in accordance with its intended use.
- ↳ Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use.
- ↳ Read these operating instructions before commissioning the device. Knowledge of the operating instructions is an element of proper use.

NOTICE

Comply with conditions and regulations!

- ↳ Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

2.2 Foreseeable misuse

Any use other than that defined under "Intended use" or which goes beyond that use is considered improper use.

In particular, use of the device is not permitted in the following cases:

- for medical purposes

NOTICE

Do not modify or otherwise interfere with the device!

- ↳ Do not carry out modifications or otherwise interfere with the device. The device must not be tampered with and must not be changed in any way.
- ↳ Repairs must only be performed by Leuze electronic GmbH + Co. KG.

2.3 Competent persons

Connection, mounting, commissioning and adjustment of the device must only be carried out by competent persons.

Prerequisites for competent persons:

- They have a suitable technical education.
- They are familiar with the rules and regulations for occupational safety and safety at work.
- They are familiar with the operating instructions for the device.
- They have been instructed by the responsible person on the mounting and operation of the device.

Certified electricians

Electrical work must be carried out by a certified electrician.

Due to their technical training, knowledge and experience as well as their familiarity with relevant standards and regulations, certified electricians are able to perform work on electrical systems and independently detect possible dangers.

In Germany, certified electricians must fulfill the requirements of accident-prevention regulations DGUV (German Social Accident Insurance) provision 3 (e.g. electrician foreman). In other countries, there are respective regulations that must be observed.

2.4 Disclaimer

Leuze electronic GmbH + Co. KG is not liable in the following cases:

- The device is not being used properly.
- Reasonably foreseeable misuse is not taken into account.
- Mounting and electrical connection are not properly performed.
- Changes (e.g., constructional) are made to the device.

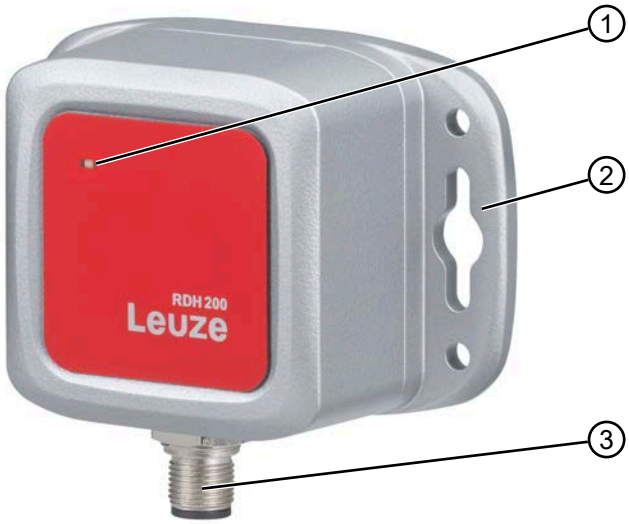
3 Device description

The RDH 100 and RDH 200 series RFID read/write systems are industrial-grade devices that operate in the HF frequency band at 13.56 MHz. They have an integrated decoder for the identification of common transponders (data carriers) in accordance with ISO/IEC 15693, ISO 14443 A and NFC Forum Type 2, 5.

In general, the RDH 202 RFID device is designed for applications in conveyor technology and production control with operating ranges of up to 10 cm. The device can be adapted to a variety of reading tasks using configuration software. The readable distance depends on the individual environmental conditions and the transponder types used.

The devices have an integrated RS 232 interface for direct host connection.

3.1 Device overview



1 LED indicator
2 Mounting strap
3 Connection

Fig. 3.1: RDH 202/242 RFID read/write system

3.2 Performance characteristics

- Reliable detection thanks to very homogeneous electromagnetic field
- Large beam spread (hemispherical shape), thus large reading field
- Compatible with HF transponders in accordance with ISO 15693 and ISO 14443 A
- Compact design, optimized for the operating range
- Safe detection of the transponder when stationary and in motion by activation (trigger). Transponder can be written to and read when stationary (static) and in motion (dynamic).
- Visualization of operating states via LED
- Heavy-duty housing with protection class IP 67
- Can be used at temperatures down to -32°C, ideal for deep-freeze storage applications
- Multi-tag capability, i.e. several transponders in the field can be detected simultaneously
- Configurable functions after trigger: Read with preset block area, write
- Online commands for quick individual access to data
- Advance transmission of write data to RDH 202 (*Preload* function)
- Support for transponder-specific functions
- Switching input for triggering a read/write process
- Switching output for signaling states
- RS 232 serial interface
- Convenient configuration software RDH ConfigTool

3.3 Device connection

The device connection is an M12 connector, 12-pin, A-coded with the functions:

- I/O
- PWR
- RS 232

3.4 Display elements

The device has an LED indicator that displays the device's operating status.

Tab. 3.1: LED indicator

Display	Meaning
Red, continuous light	Error / initialization
Green, continuous light	Ready for operation / antenna not active
Yellow, flashing, 4 Hz	Antenna active / transponder detected
Yellow, continuous light	Antenna active / no transponder detected
Off	No power supply / hardware defective

4 Functions

RFID devices with a working frequency of 13.56 MHz (HF) form a club-shaped, homogeneous electromagnetic field around the antenna. The operating range varies depending on the device type. The version of the transponder used also has a significant influence. The front of the device (red surface or active side, equipped with LED) must not be enclosed in metal. A metal surface in the reading field also reduces the operating range.

The device can be mounted directly on metallic surfaces. Depending on the installation situation, a slight reduction in the reading distance is then possible.

	NOTICE
	The antenna surfaces of the transponder and the read/write system should be aligned as parallel to each other as possible at the read/write position.

In principle, the detection range can be weakened by metallic structures in the vicinity of the transponder or the RDH housing, thus impairing its function. For this reason, we recommend the use of a metal-free spacer for standard transponders and metallic surfaces (e.g. Spacer 50 HT suitable for disk transponders with a diameter of 50 mm), whereby a 10 mm spacer height is sufficient for a operating range of approx. 50 mm.

For RFID read/write systems, it is recommended to keep the entire front area and an area on the side the size of “device dimensions + half the operating range” completely free of metal in order to be able to use the optimum performance (reading speed and operating range). If, for structural reasons, the device must be largely enclosed by a metallic surface, the metallic surface should have a slot on one side to interrupt the metallic short circuit for the detection field. This enables acceptable functionality and operating range even in metal.

With a dynamic read or write process, please note that the read and write speed depends on the amount of data to be read or written. The more data that needs to be read or written, the slower the RFID transponder’s movement should be. It is advisable to test the read or write process in motion in advance before productive use.

5 Applications

Identification of containers on a conveyor line

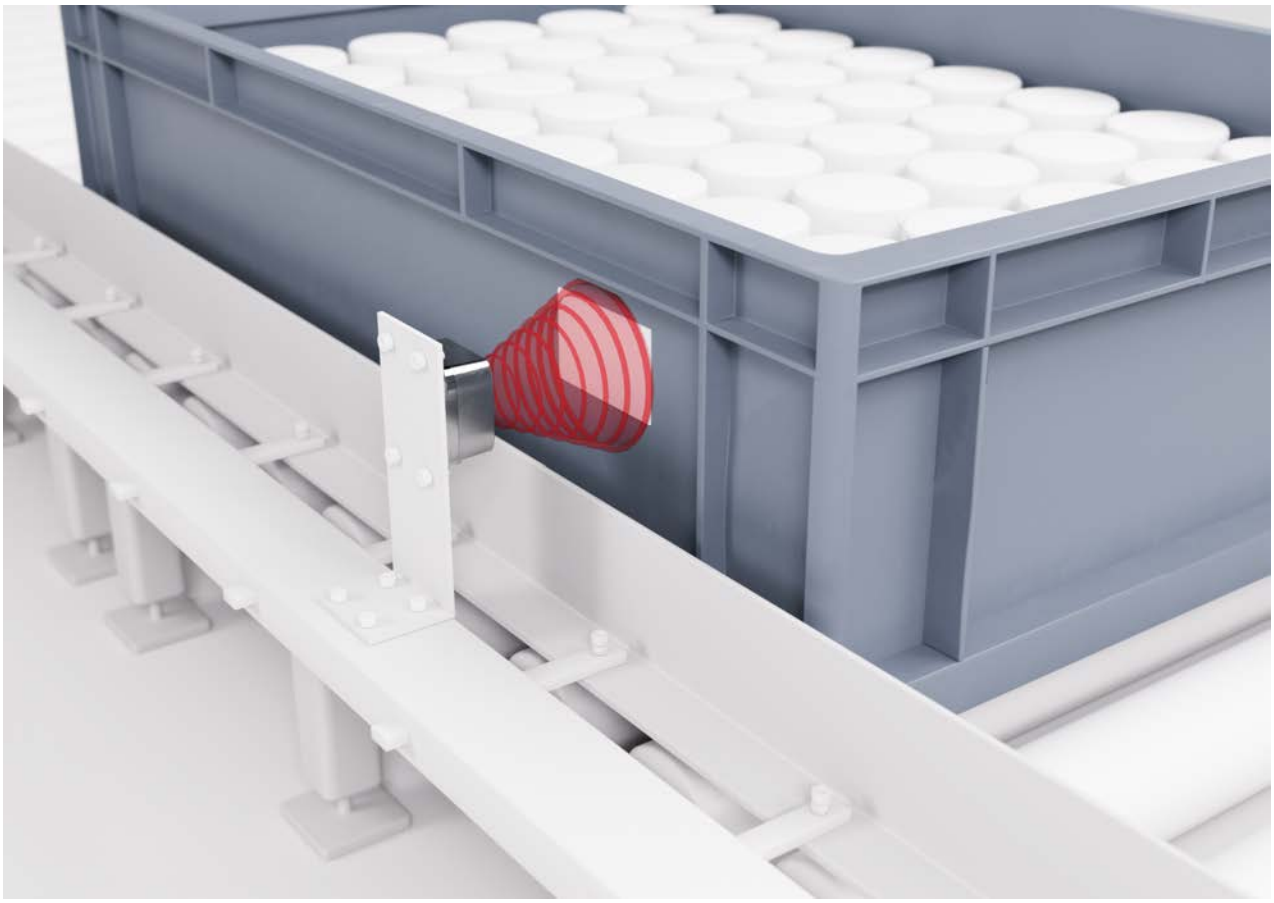


Fig. 5.1: Identification of containers on a conveyor line

Identification of automated guided vehicles

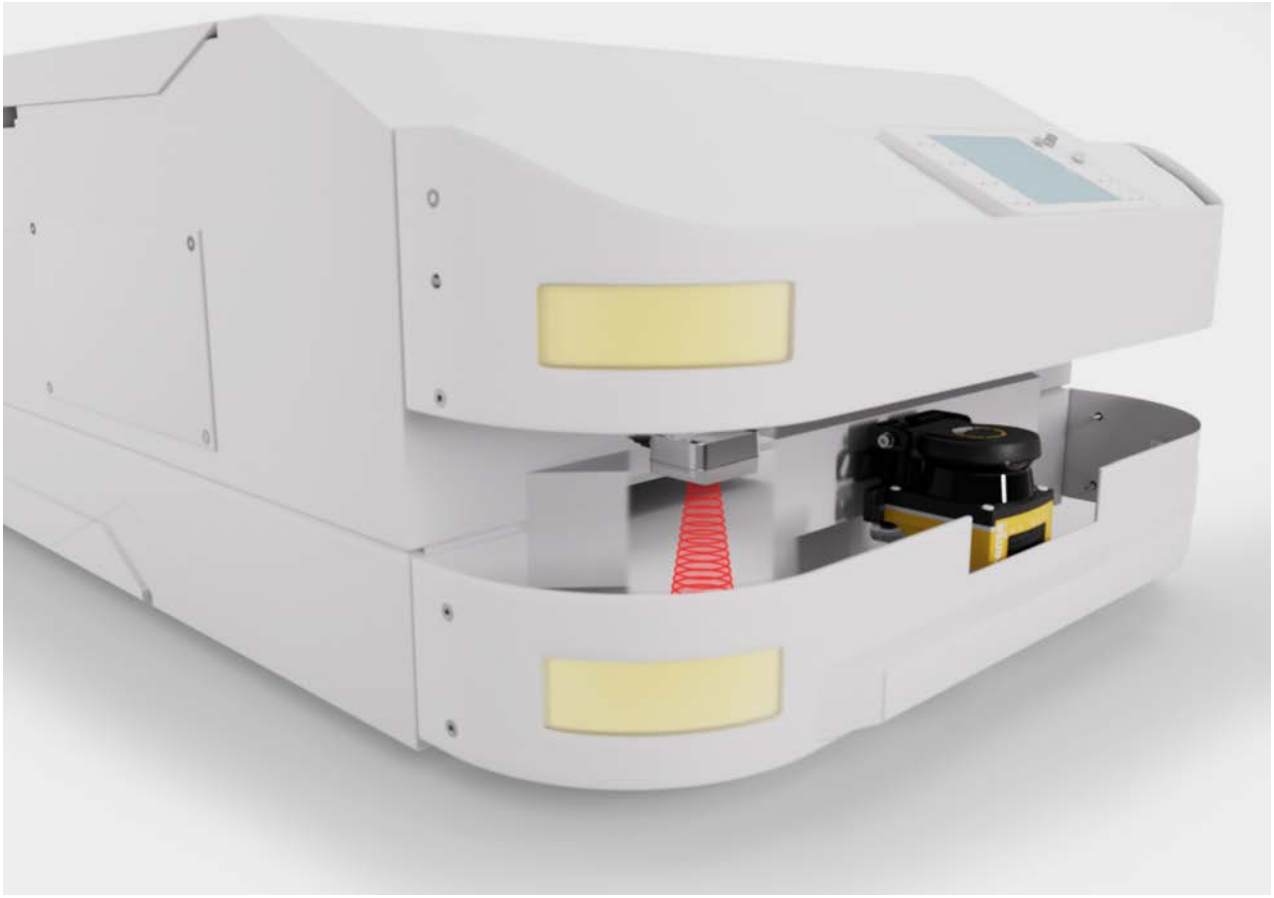


Fig. 5.2: Identification of automated guided vehicles

Production control in production cells

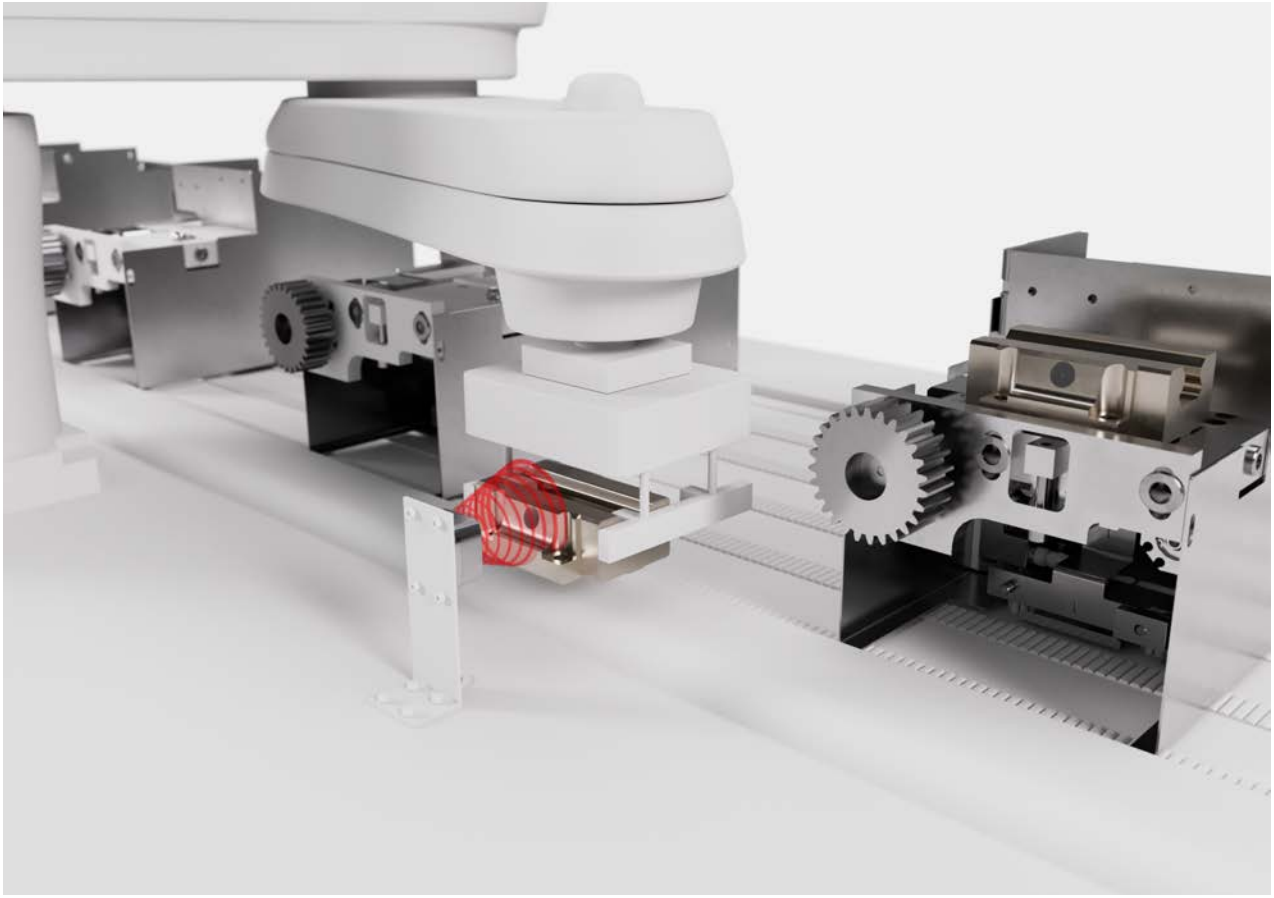


Fig. 5.3: Production control in production cells

User authentication at machines

Fig. 5.4: User authentication at machines

6 Mounting

6.1 Selecting a mounting location

Environmental conditions

Keep the device away from

- direct sunlight
- high air humidity
- extreme temperatures
- sources of electromagnetic disturbance

Any combination of these conditions may impair the device's performance or shorten its lifespan.

Mounting location

Consider the following factors:

- Size, parallel alignment to the RFID read/write system, and the transponder's position tolerance on the object to be detected.
- The minimum and maximum reading distances resulting from the devices' reading field are transponder-dependent.
- The reading point should be as free of metal as possible or at a defined distance from the metal. If you install a device close to or on metal, the read and write distance may be reduced.
- The transponder temperature at the reading point must be within the operating temperature range.
- The distance between two neighboring devices should be twice as large as the maximum operating range to avoid interference.
- The distance between the RFID read/write system and the host system with regard to the interface's permitted cable length.

The best read results are obtained

- if the transponder passes over the center of the antenna (device center) with an angular deviation of less than ±10 ... 15° to parallelism.
- if the transponder's temperature at the reading point is below 60°C and the transponder is not wet.
- if the reading distance is in the middle of the maximum possible reading field.
- if a single isolated transponder passes the device.

Reading range

The device generates a modulated electromagnetic field with a frequency of 13.56 MHz. The RFID antenna is integrated inside the housing.

An RFID system's reading range always depends on various factors, e. g,

- antenna size
- transponder size
- transponder IC type (sensitivity of the transponder)
- alignment between transponder and reading antenna
- position of the transponder relative to the reading antenna
- ambient noise due to external electromagnetic influences
- metallic environment

For this reason, all information on the reading range can only be typical values measured under laboratory conditions. In real applications, the reading range may deviate from the data specified in the data sheet.

Recommended distances

Tab. 6.1: Detection range

Read head distance to front	<120 mm, based on a 50x50 mm label tag, IC NXP ICODE SLIX2
Read head distance to side	<120 mm, based on a 50x50 mm label tag, IC NXP ICODE SLIX2

Interferences

To avoid interference with data communication, no other devices that emit interference in this frequency band may be operated in the vicinity of the RFID read/write system. Such devices include frequency inverters and switching power supply units.

- If there are other devices in the same frequency band in the vicinity, the mounting distances between the devices should be as large as possible.
- Use the devices in alternating operation.
- Switch the device's HF field on/off.

6.2 Mounting the RFID read/write system

Device and mounting dimensions see chapter 11.2 "Dimensions".

- Use the four existing holes in the mounting tabs and secure the device with four M4 screws. The required screws are not included in the device's scope of delivery.
- Use a spirit level to ensure that the device is mounted horizontally (electrical connections pointing downwards).
- Tighten the screws to a tightening torque of 1.35 Nm.

7 Electrical connection

CAUTION

- Before connecting the device, be sure that the supply voltage agrees with the value printed on the name plate.
- Only allow competent persons to perform the electrical connection.
- If faults cannot be rectified, take the device out of operation. Protect the device from accidentally being started.

CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

NOTICE

Protective Extra Low Voltage (PELV)!

The device is designed in accordance with protection class III for supply with PELV (Protective Extra-Low Voltage).

NOTICE

Protection class IP67

Protection class IP67 is achieved only if the connectors are screwed into place and caps installed.

NOTICE

The device is always active.

- Install a main switch between the power supply and the device to switch the device off if necessary.

The RFID read/write systems of the RDH 100 and RDH 200 series are equipped with an M12 connector.

- Connect the device with a suitable connection cable.
- Tighten the connector with a torque of 0.29-0.39 Nm.
- Supply the device with power via a suitable external power supply unit.

Suitable accessories see chapter 12 "Order guide and accessories".

NOTICE

To ensure trouble-free operation, the device must be connected to an external voltage-free earth potential.

7.1 Pin assignment

The connection is designed as a 12-pin M12 connector (A-coded). This connection provides the power supply, the serial RS 232 interface, as well as the inputs and outputs.

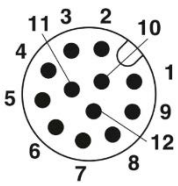


Fig. 7.1: 12-pin M12 connector, A-coded

Tab. 7.1: Pin assignment

Pin	Designation	Assignment	Core color
1	VCC	DC power supply	Brown
2	GND	DC power supply return line	Blue
3	SWIN 1	Digital switching input 1 PNP input (positive switching), opto-decoupled; the maximum permissible current is 8 mA. VCC = 24 ± 6 V DC	White
4	SWOUT 1	Digital switching output 1 The maximum permissible current is 60 mA. VCC = 24 ± 6 V DC	Green
5	FE	Functional earth	Pink
6	NC	Not connected	Yellow
7	NC	Not connected	Black
8	NC	Not connected	Gray
9	RXD	Serial RS 232 signal RXD (from host)	Red
10	TXD	Serial RS 232 signal TXD (to host)	Violet
11	SWIN 2	Digital switching input 2 PNP input (positive switching), opto-decoupled; the maximum permissible current is 8 mA. VCC = 24 ± 6 V DC	Gray/pink
12	SWOUT 2	Digital switching output 2 The maximum permissible current is 60 mA. VCC = 24 ± 6 V DC	Red/blue

7.2 Cable lengths and shielding

The maximum cable length for RFID read/write systems with an RS 232 interface is 10 m. Shielding is absolutely necessary.

8 Starting up the device

↳ Supply the device with power via a suitable external power supply unit.

⇨ As soon as the device is supplied with power, the boot sequence begins. This sequence is normally completed within 5 seconds. The device only accepts commands once the boot sequence has been completed.

↳ Configure the device via the RS 232 interface.

8.1 Configuration via host

The device can also be configured using corresponding ASCII commands via the serial process interface (host interface). The devices also use the process interface as a service interface. The baud rate may need to be adjusted for service access.

Factory setting of the serial interface

- 9600 Baud
- 1 start bit
- 8 data bits
- No parity
- 1 stop bit

In the case of direct access via a PLC or without the configuration software, a standard terminal program can be used with the information and commands described here. The described command structure must always be observed.

	NOTICE
	The data is hexadecimal coded. The amount of data must be specified in byte length (2 characters/byte), otherwise an error message (E02) will be displayed. The complete description of the command set and configuration can be found in the serial communication documentation. To make it easier to set parameters, corresponding menus are prepared in the *RDH ConfigTool* configuration software (see chapter 8.6 "Configuration via the RHD ConfigTool").

8.2 Device configuration

The setting parameters of this device are stored in 16 different registers, which can be read and written to. The following table shows a list of the configuration registers.

Tab. 8.1: Configuration register

Address	Parameters / functions
00h	AFI filter (Application Family Identifier)
01h	Function register 1
02h	Function register 2
03h	Transponder type MSB
04h	Transponder type LSB
05h	Trigger mode
06h	Trigger pulse duration (ms) MSB
07h	Trigger pulse duration (ms) LSB
08h	Output pulse duration (ms) MSB
09h	Output pulse duration (ms) LSB
0Ah	Read start address MSB
0Bh	Read start address LSB
0Ch	Number of blocks read operation
0Dh	Write start address MSB

Address	Parameters / functions
0Eh	Write start address LSB
0Fh	Number of blocks write operation
10h-57h	Write data (max. 9 x 8 bytes)
58h-FFh	Reserved

8.2.1 AFI filter configuration (address 00h)

The AFI filter (Application Family Identifier) serves as a transponder selection criterion for ISO 15693 transponders in a corresponding application: the transponder can only be read or written to if the AFI on the transponder and the data stored in this register match.

Default setting: 00h

8.2.2 Configuration functions register 1 (address 01h)

Tab. 8.2: Configuration functions register 1

Bit	Function	Value	Description
0…1	Operating mode	00	Write mode
		01	Scan mode
		10	Multiple read
2	Reserved	0	
3	Reserved	0	
4	Trigger	0	Permanently ready for reading
		1	Read on trigger pulse
5	Scan mode	0	Continuous reading and data output
		1	Single shot. Read once while in the field.
6	Write (preloaded)	0	Inactive, a write command must be sent if the transponder is in the reading field.
		1	Active, a write command can be sent before the transponder enters the field.
7	Reserved	0	

The parameter to be set is set via the bit sequence. The MSB is bit 7 in the first position.

Default setting: 71h

The operating mode defines which function a trigger pulse (or +) triggers. The factory setting is *Read* operating mode, so that the serial number or the data block is read after a trigger (addresses 0Ah to 0Ch). The response is the same as after entering the command ‘N’:

- Status. Block number (or @0), transponder type, data

In *Write* operating mode, the stored data (from address C10h) is written to each transponder after the trigger; the response is ‘Q5’.

The *Multiple read* operating mode outputs all transponder data with the trigger pulse. This operation takes about twice as long as reading a block.

8.2.3 Configuration functions register 2 (address 02h)

Tab. 8.3: Configuration functions register 2

Bit	Function	Value	Description
0	Serial number (command ‘W’ and ‘N’)	0	Not active, no transmission
		1	Active, serial number must be transferred

Bit	Function	Value	Description
1	Anticollision (bulk detection)	0	Inactive, only one transponder in the field
		1	Active, several transponders in the field
2	Reserved	0	
3	Filter (AFI)	0	Inactive
		1	Active, AFI code in address 00h
4	Switching output	0	Inactive
		1	Automatically activated, address 05h
5	Data block size	0	4 bytes
		1	8 bytes
6	Large amounts of data	1	Further data is sent automatically (> 256 bytes)
7	Reserved	0	

The parameter to be set is set via the bit sequence. The MSB is bit 7 in the first position.

Default setting: 50h

8.2.4 Configuration of the transponder type (addresses 03h to 04h)

Tab. 8.4: Configuration of the transponder type, address 03h

Bit	Description
0	Reserved
1	NXP I-CODE 1
2	STM LRI 512
3	Reserved
4	NXP I-CODE SLI NXP I-CODE SLI-S NXP I-CODE SLI-L
5	Infineon my-d (02P) Infineon my-d (10P)
6	EM EM4135
7	Tag-It HF-I Standard Tag-It HF-I Plus

The parameter to be set is set via the bit sequence. The MSB is bit 7 in the first position.

Each bit can have the value 1 or 0. If the value is 1, the device operations for the corresponding transponder type are activated.

Default setting: 12h

Tab. 8.5: Configuration of the transponder type, address 04h

Bit	Description
0	NXP I-CODE SLIX NXP I-CODE SLIX-S NXP I-CODE SLIX-S
1	NXP I-CODE SLIX2
2	Fujitsu MB89R118C

Bit	Description
3	NXP MIFARE Classic 1k NXP MIFARE Classic 4k
4	NXP MIFARE Ultralight C NXP NTAG 210 NXP NTAG 212 NXP NTAG 213 NXP NTAG 215 NXP NTAG 216
5	Reserved
6	Reserved
7	Reserved

The parameter to be set is set via the bit sequence. The MSB is bit 7 in the first position.

Each bit can have the value 1 or 0. If the value is 1, the device operations for the corresponding transponder type are activated.

Default setting: 00h

8.2.5 Trigger / switching outputs configuration (addresses 05h to 09h)

The trigger is a combination of the trigger function and the trigger pulse duration. It is similar for the output: Function and output pulse duration.

- The output and trigger functions are combined at address 05h.
- Address 06h/07h contains the trigger pulse duration.
- Address 08h/09h contains the output pulse duration.

Trigger mode configuration (address 05h)

Only bits 0/1 of this byte are used for the trigger and bits 3 to 5 for the output functionality. Other bits are set to ‘0’. This results in the following possible combinations:

Tab. 8.6: Trigger mode configuration

Value	Description
00	Trigger: Read as long as ‘High’ level at input Output: Successful reading with ‘Low’ level
01	Trigger: Read with defined duration after positive edge Output: Successful reading with ‘Low’ level
02	Trigger: Read after positive edge, with fixed duration after negative edge Output: Successful reading with ‘Low’ level
08	Trigger: Read as long as ‘High’ level at input Output: No reading (No-Read) with ‘Low’ level
09	Trigger: Read with defined duration after positive edge Output: No reading (No-Read) with ‘Low’ level
0A	Trigger: Read after positive edge, with fixed duration after negative edge Output: No reading (No-Read) with ‘Low’ level
20	Trigger: Read as long as ‘High’ level at input Output: Successful reading with ‘High’ level
21	Trigger: Read with defined duration after positive edge Output: Successful reading with ‘High’ level

Value	Description
22	Trigger: Read after positive edge, with fixed duration after negative edge Output: Successful reading with ‘High’ level
28	Trigger: Read as long as ‘High’ level at input Output: No reading (No-Read) with ‘High’ level
29	Trigger: Read with defined duration after positive edge Output: No reading (No-Read) with ‘High’ level
2A	Trigger: Read after positive edge, with fixed duration after negative edge Output: No reading (No-Read) with ‘High’ level
03	Trigger: Reading in multi-tag mode Output: Successful reading with ‘Low’ level
0B	Trigger: Reading in multi-tag mode Output: No reading (No-Read) with ‘Low’ level
23	Trigger: Reading in multi-tag mode Output: Successful reading with ‘High’ level
2B	Trigger: Reading in multi-tag mode Output: No reading (No-Read) with ‘High’ level

Default setting: 20h

Trigger pulse duration configuration (addresses 06h to 07h)

These registers save the time value after the trigger pulse in the hexadecimal system. The time value can be between 0 and 9000 ms.

Default setting: 0000h

Examples:

- 500 ms: 01F4h
- 1000 ms: 03E8h

Output pulse duration configuration (addresses 08h to 09h)

These registers save the value of the activation time after a successful or unsuccessful read in the hexadecimal system. The time value can be between 30 and 9000 ms.

Default setting: 012Ch (300 ms)

Examples:

- 500 ms: 01F4h
- 1000 ms: 03E8h

8.2.6 Read start address configuration (addresses 0Ah to 0Bh)

These registers save the address of the first block read by the transponder after the trigger in *Read* operating mode.

Default setting: 0000h

Example:

- Block 05: 0005h

8.2.7 Read number of blocks configuration (address 0Ch)

These registers save the number of data blocks that were read from the transponder after the trigger in *Read* operating mode. The number of blocks can be set between 1 and 9.

Default setting: 01h (1 block)

Examples:

- 5 blocks: 05h

- 9 blocks: 09h

8.2.8 Write start address configuration (addresses 0Dh to 0Eh)

These registers save the address of the first block written to the transponder after the trigger in *Write* operating mode.

Default settings: 0005h

Example:

- Block 10: 00A0h

8.2.9 Write number of blocks configuration (address 0Fh)

This register saves the number of data blocks that were written to the transponder after the trigger in *Write* operating mode. The number of blocks can be set between 1 and 9.

Default setting: 01h

Examples:

- 5 blocks: 05h
- 9 blocks: 09h

8.2.10 Write data configuration (addresses 10h to 57h)

These registers save the data that is written to the transponder's data blocks after the trigger in *Write* operating mode.

8.3 Device telegram structure

For the data interface, the Leuze protocol provides a baud rate of 9600, 1 start bit, 8 data bits, 1 stop bit and no parity bits. The telegrams have the following structure:

STX user data CR LF

Whereby:

STX	0x02, start of telegram
User data	Telegram user data
CR/LF	0x0D 0x0A, end of telegram

The data from and to the device is always sent in ASCII hex encoding and is always read or written in complete data blocks. All characters in the ASCII table can be used as user data.

Telegrams are detected in both upper and lower case letters. Several command codes (in the standard telegram structure described above) are defined to address the device.

Command codes

Tab. 8.7: Command codes

Code	Command
V/v	Retrieve firmware version
R/r	Reset to default value
H/h	Reset software
+	Trigger on
-	Trigger off
I/i	Detection of all transponders in the field (inventory)
A/a	Define switching outputs
F/f	Change field
G/g	Read configuration
C/c	Write configuration
N/n	Read block data

Code	Command
M/m	Read transponder
W/w	Write block data
D/d	Firmware upgrade

8.4 Device response structure

After receiving a command, the device sends back a telegram with information about the result of the operation. The responses have the following structure:

STX user data CR LF

Whereby:

STX	0x02, start of telegram
User data	Telegram user data
CR/LF	0x0D 0x0A, end of telegram

Various confirmation and error codes (in the standard response structure specified above) are defined for receiving confirmations for certain commands and for detecting transmission errors.

Confirmation codes

Tab. 8.8: Confirmation codes

Code	Description/meaning
Q0	Command could not be executed
Q1	Configuration change carried out
Q2	Action carried out
Q4	Write command understood
Q5	Data successfully written

Error codes

Tab. 8.9: Error codes

Code	Description/meaning
E01	Invalid command
E02	Invalid parameter
E04	Data frame error
E08	CRC checksum error
E10	Conflicting configuration settings
E20	Firmware invalid

8.5 Telegram definitions of the device

8.5.1 Retrieve firmware version

You can use this command to query the current version of the firmware installed in the device.

Command code: V

Response: RDH 202 00 V x.y.z yyyy-mm-dd

Whereby:

RDH 202 00	Device name (unchangeable field)
V x.y.z	Version of the release in the format major.minor.release, for example V 1.0.0
yyyy-mm-dd	Publication date, for example 2024-02-16

8.5.2 Reset to default value

This command is used to perform a restart and reset the device to the factory configuration.

Command code: R

Response: Q2 and S

Whereby:

Q2	Action carried out
S	Ready

8.5.3 Reset software

This command is used to restart the software, whereby all current settings are retained.

Command code: H

Response: Q2

Whereby:

Q2	Action carried out

8.5.4 Switch on trigger

This command switches the trigger on and, depending on the configuration, initiates a read or write operation. If you only use the command itself, you will not receive a response from the device. The device sends a response when a transponder enters the device's read/write range and the process is completed. As soon as the transponder enters the read/write range and the process is completed, the trigger switches off.

Command code: +

Response, read mode, serial number: F@0TagtypeSNR

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for data output of more than 256 bytes)
@0	Designator for subsequent serial number
Tag type	Transponder type
SNR	Transponder serial number

Response, read mode, block data: FB#TagtypeData

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for more than 256 bytes of data)
B#	Number of the first block read
Tag type	Transponder type
Data	1 to 9 blocks of the transponder starting with the first block read

Response, read mode, multiple reading: FB#TagtypeData

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for more than 256 bytes of data)
B#	Number of the first block read
Tag type	Transponder type
Data	All blocks of the transponder starting with the first block read

Response, write mode with Write Forward: Q5

Whereby:

Q5	Data successfully written

8.5.5 Switch off trigger

This command is used to end the read process.

Command code: -

Response: No response. If no transponder was read, ‘NO READ’ (0x18) is output.

8.5.6 Detection of all transponders in the field (inventory)

This command is used to retrieve the serial number of the transponders in the device reading field. Normally, only one transponder is detected each time the command is used. If several transponders are to be detected in the reading field, anti-collision (bulk detection) must be activated.

Command code: I

Response: F@0TagtypeSNR

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for data output of more than 256 bytes)
@0	Designator for subsequent serial number
SNR	Transponder serial number

If no transponder was read, ‘NO READ’ (0x18) is output.

8.5.7 Define switching outputs

This command is used to permanently define the switching outputs.

Command: Anxx

Whereby:

A	Command code
n	• 0, switching output 1 • 1, switching output 2
xx	• FF, switching output on • 00, switching output off

Response: None

8.5.8 Switch on field

This command is used to switch the RF field on and off. The RF field is normally switched off. It switches on automatically after a new trigger.

Command: Fx

Whereby:

F	Command code
x	• 1, field on • 2, field off • 3, reset field

Response: Q2

Whereby:

Q2	Action carried out

8.5.9 Read configuration

This command can be used to read the content of the configuration registers.

Command: Gxxxx

Whereby:

G	Command code

xxxx	• FF00: read out complete configuration • 1000: only addresses 00h to 0Fh • 01xx: only one address

Response: 0Gxxyy

Whereby:

xx	Register (if only one address is queried)
yy	Configuration read from the device

8.5.10 Write configuration

This command is used to write the device's configuration data.

Command: Cyyzz

Whereby:

C	Command code
yy	Address of the configuration register to be written
zz	Configuration data that is written

Response: Q1

Whereby:

Q1	Configuration change carried out

8.5.11 Read block

This command is used to read one or more data blocks of a transponder.

Command: NB#TagtypeNOBSNR

Whereby:

N	Command code
B#	Number of the first block to be read
Tag type	Transponder type
NOB	Number of blocks to be read from 1 to 9
SNR	Serial number of the transponder to be read. Required for several transponders in the field.

Response: FB#TagtypeData

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for more than 256 bytes of data)
B#	Number of the first block to be read
Tag type	Transponder type
Data	Content of the data blocks specified by the command

NOTICE	
	It is essential that a read process is first carried out using a trigger and that the transponder remains in the field.

NOTICE	
	If anti-collision is activated, serial number transmission must be activated and the serial number of the desired transponder must be specified in the command. An average response time of 50 ms can be assumed per data block.

8.5.12 Read transponder

This command is used to read a transponder's entire data blocks.

Command: MTagtype

Whereby:

M	Command code
Tag type	Transponder type

Response: FTagtypeData

Whereby:

F	Telegram flag: • 0: only 1 telegram is output • 1: several telegrams are output (for more than 256 bytes of data)
Tag type	Transponder type
Data	All data starts at block 0

NOTICE

It is essential that a read process is first carried out using a trigger and that the transponder remains in the field.

NOTICE

This command only works if there is a single transponder in the reading field. If the transponder contains more than 256 bytes of data, the response is split. This command is not provided with the EM4135 transponder IC (tag type).

8.5.13 Write block

This command is used to write one or more data blocks to the transponder.

Command: WB#TagtypeNOBSNRData

Whereby:

W	Command code
B#	Number of the first block to be written
Tag type	Transponder type
NOB	Number of blocks to be written from 1 to 9
SNR	Serial number of the transponder to be written. Required for several transponders in the field.
Data	Data to be written (hexadecimal) for 1 block

Response: yy

yy	• Q4: Command understood (with activated writing (preloaded)) • Q5: Write operation successful (after trigger) • Q0: Write operation failed

NOTICE

If Write (preloaded) is deactivated in the configuration registers, a trigger process must first take place and the transponder must remain in the antenna field. If Write (preloaded) is activated, the command is received even if the transponder is not in the antenna field and the data is written after a trigger.

8.5.14 Firmware download

This command is used to download the firmware to the device.

Command: DBlockData

Whereby:

D	Command code

Block	Block number of the firmware image (0000h for the first block, FFFFh for the last)
Data	Data of the block (64 bytes). Leave empty for the last block FFFFh.

Response: yy

Whereby:

Q2	Action carried out
Q0	Command could not be executed
E02	Invalid parameter
E20	Firmware invalid

8.6 Configuration via the RHD ConfigTool

Configuration software *RHD ConfigTool*

The *RHD ConfigTool* provides a Windows-based graphical user interface for configuring the RDH 202.

Supported operating systems: Windows 10 and 11

Installation

Proceed as follows to download the *ROD ConfigTool* configuration software and install it on your PC:

- Call up the Leuze website: **www.leuze.com**.
- Enter the type designation or part number of the device as the search term.
- The configuration software can be found on the product page for the device under the *Downloads* tab.

The devices can be configured clearly and simply at the click of a mouse using the *RDH ConfigTool* configuration software. All parameters and functions can be set via the menu on the user interface.

8.6.1 Transponder type

In the *Transponder* tab in the configuration menu, transponder types can be selected, for example.

	NOTICE
	Please note that the different transponder types have different memory sizes and memory areas. The default setting is to enable ICODE 1 and ICODE SLI transponders.

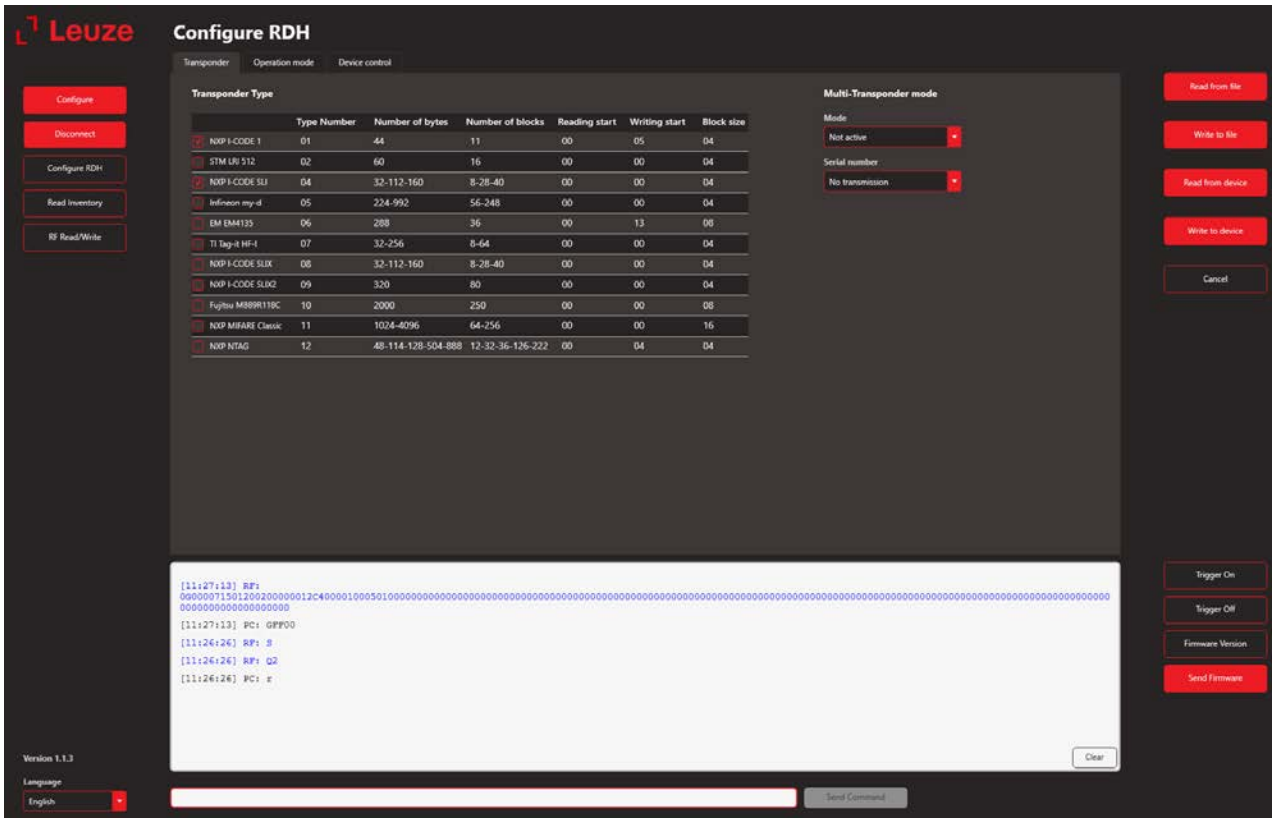


Fig. 8.1: Configuration menu: Transponder tab

Tab. 8.10: Supported transponder types

Tag type	Transponder type	Number of bytes	Start block / pages (when writing)	Number of blocks / pages	Block / page size
01h	NXP I-CODE 1	44	5	11	4
02h	STM LRI 512	60	0	16	4
03h	Reserved	-	-	-	-
04h	NXP I-CODE SLI	112	0	28	4
	NXP I-CODE SLI-S	160	0	40	4
	NXP I-CODE SLI-L	32	0	8	4
05h	Infineon my-d (02P)	224	0	56	4
	Infineon my-d (10P)	992	0	248	4
06h	EM EM4135	288	13	36	4
07h	TI Tag-it HF-I Standard	32	0	8	4
	TI Tag-it HF-I Plus	256	0	64	4
	TI Tag-it HF-I Pro	32	0	8	4
08h	NXP I-CODE SLIX	112	0	28	4
	NXP I-CODE SLIX-S	160	0	40	4
	NXP I-CODE SLIX-L	32	0	8	4
09h	NXP I-CODE SLIX2	320	0	80	4
0Ah	Fujitsu MB89R118C	2000	0	250	8
0Bh	NXP MIFARE Classic 1k	1024	0	64	16

Tag type	Transponder type	Number of bytes	Start block / pages (when writing)	Number of blocks / pages	Block / page size
	NXP MIFARE Classic 4k	4096	0	256	16
	NXP MIFARE Ultralight C	144	4	36	4
	NXP NTAG 210	48	4	12	4
	NXP NTAG 212	128	4	32	4
	NXP NTAG 213	144	4	36	4
	NXP NTAG 215	504	4	126	4
	NXP NTAG 216	888	4	222	4
…	…	…	…	…	…
FEh	Reserved	-	-	-	-
FFh	Reserved	-	-	-	-

Furthermore, the operating mode for several transponders simultaneously can be activated in the *Multi transponder mode* field and the serial number transmission can be added to the telegram.

8.6.2 Operating mode

The operating mode setting is important for the device's automatic operation. This is where you set the function after activation/trigger (operating mode) and the memory access (block number).

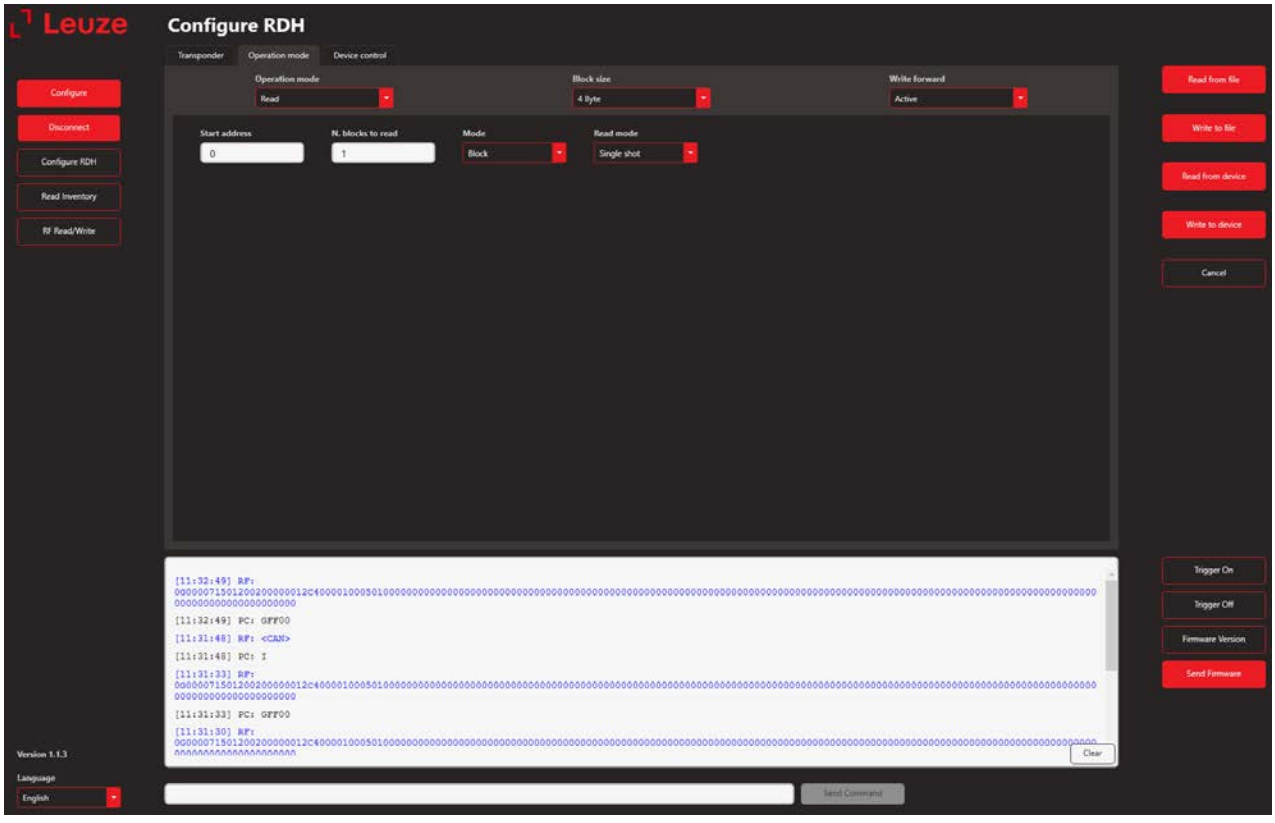


Fig. 8.2: Configuration menu: Operating mode tab

Start block, number of blocks and block size are transponder-dependent. If selected and not available, you will receive an error message. The *Preload* function can also be set for the *Write* online command. The write data is already transferred to the read/write system before the transponder to be written to is in the field. If the transponder then enters the field, it is automatically written with the preloaded data.

8.6.3 Device control

The options for controlling the device are summarized on this tab.

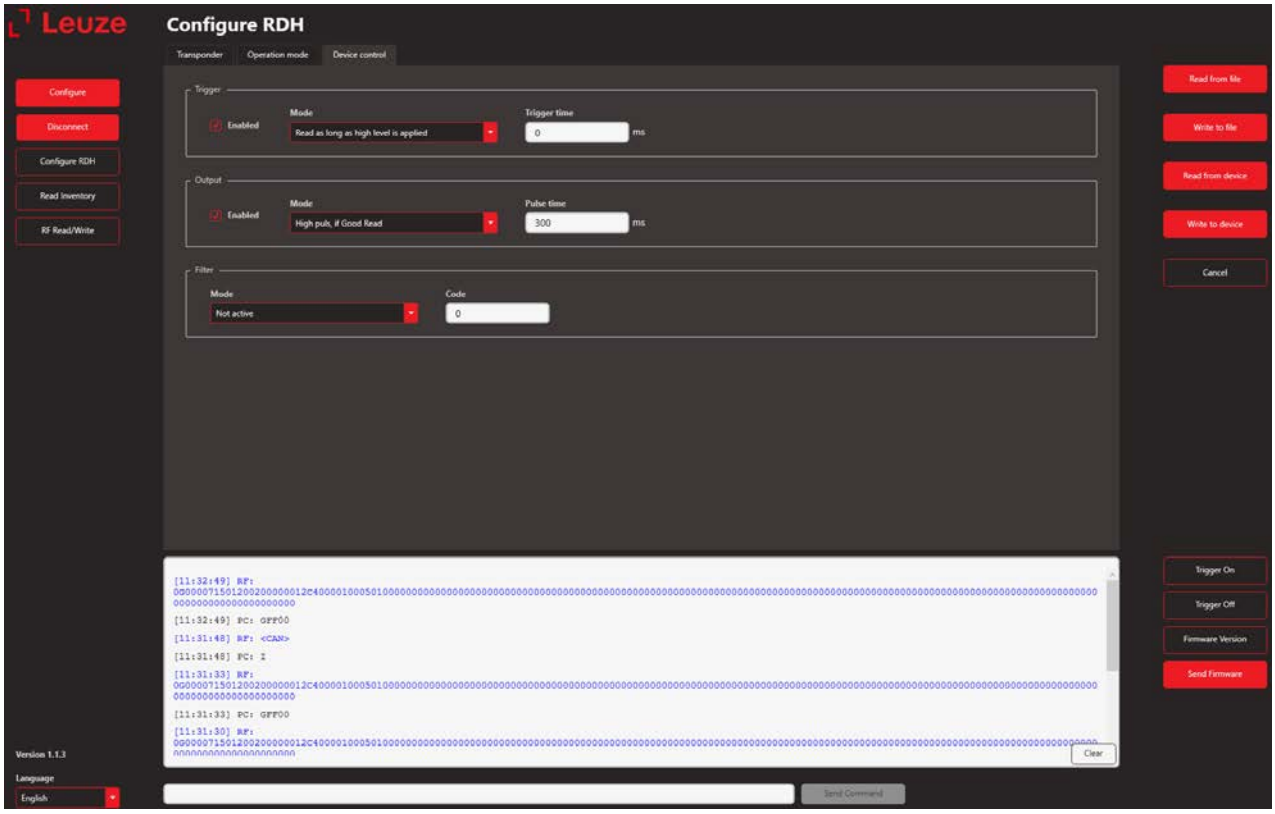


Fig. 8.3: Configuration menu: Device control tab

You have the following setting options:

- Trigger activation
- Type of trigger activation
- Switching output function
- Setting a code filter

NOTICE	
	Some parameters and functions are dependent on others, others are mutually exclusive.

The most important constellations in the configuration in which such dependencies exist are listed below:

- If the *Preload* function = active (address 01h, bit 6), *Trigger* must also = active (address 01h, bit 4).
- If the *Read type/read mode* = Continuous reading (address 01h, bit 5), *Trigger* must = not active (address 01h, bit 4) and *Preload* must = not active (address 01h, bit 6).

If these dependencies are not or only partially observed, the device returns the error message “E10” without the device configuration having been changed.

NOTICE	
	No transponder can be read during the output signal’s runtime (if activated).

8.6.4 Confirmations and error codes

Several confirmation and error codes are defined in order to receive feedback on certain commands and to detect erroneous transmissions.

Confirmations

Tab. 8.11: Possible command confirmations

Code	Meaning
Q0	Command could not be executed
Q1	Configuration changes executed
Q2	Action executed
Q4	Write command understood (only with *Preload* function)
Q5	Write data successfully (including the control read)

Error codes

An error occurs if a command or transmitted command parameters are incomplete or are sent with incorrect characters.

Tab. 8.12: Possible error codes

Code	Meaning
E01	Invalid command
E02	Invalid parameter
E04	Frame error (transmission)
E08	CRC checksum error
E10	Conflicting settings activated (e.g. continuous reading and trigger)

NOTICE

If error code “E08” occurs, a CRC check has probably been activated by mistake.

↳ To reset, send the command “R” and “0xD2” via the interface.

9 Care, maintenance and disposal

The RDH 100 and RDH 200 series RFID read/write systems do not require any maintenance by the operating company.

Maintenance

Clean the device with a cloth if it is dirty. Interference can only be caused by metallic dust or liquid pooling on the device.

NOTICE	
	**Do not use aggressive cleaning agents!** ↳ Do not use aggressive cleaning agents such as thinner or acetone for cleaning the device.

Repairs

Repairs may only be carried out by the manufacturer, see chapter 10 "Service and support".

Disposing

NOTICE	
	For disposal observe the applicable national regulations regarding electronic components.

10 Service and support

Service hotline

You can find the contact information for the hotline in your country on our website **www.leuze.com** under **Contact & Support**.

Repair service and returns

Defective devices are repaired in our service centers competently and quickly. We offer you an extensive service packet to keep any system downtimes to a minimum. Our service center requires the following information:

- Your customer number
- Product description or part description
- Serial number or batch number
- Reason for requesting support together with a description

Please register the merchandise concerned. Simply register return of the merchandise on our website **www.leuze.com** under **Contact & Support > Repair Service & Returns**.

To ensure quick and easy processing of your request, we will send you a returns order with the returns address in digital form.

11 Technical data

11.1 General specifications

Tab. 11.1: Basic data

Working frequency	13.56 MHz

Tab. 11.2: Read data

Reading/writing range, max.	120 mm
Transponder, readable	ISO/IEC 14443 A ISO/IEC 15693 NFC types 2, 5

Tab. 11.3: Electrical data

Supply voltage U_B	24 ± 6 V DC
Power consumption, max.	2 W
Memory access	Read/Write
Number of digital switching inputs	1x
Number of digital switching outputs	1x

Tab. 11.4: Connection

Number of connections	1x
Function	I/O PWR RS 232
Type of connection	Connector
Thread size	M12

Tab. 11.5: Mechanical data

Design	Cubic
Dimensions (W x H x L)	99 mm x 42 mm x 68 mm
Housing material	Plastic
Net weight	120 g
Housing color	Red/silver
Type of fastening	Through-hole mounting

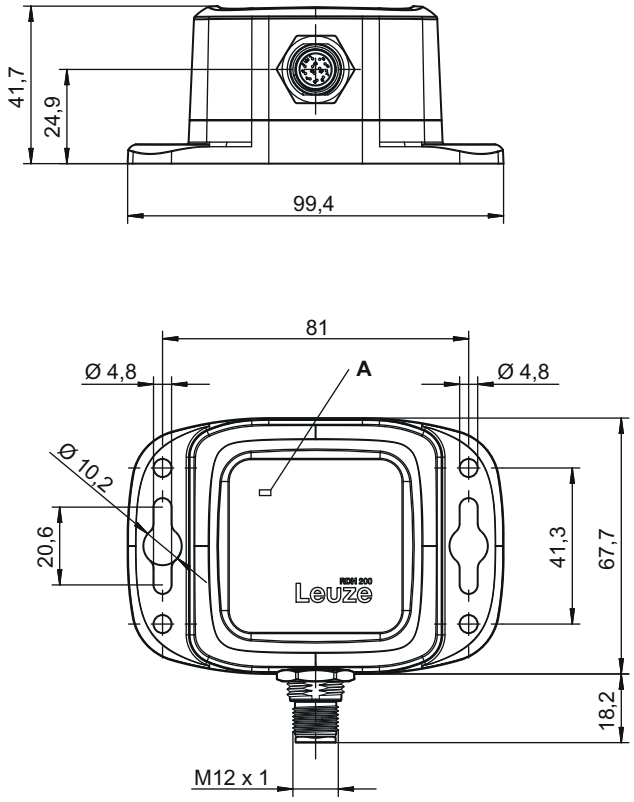
Tab. 11.6: Environmental data

Ambient temperature, operation	-32 … 60°C
Ambient temperature, storage	-40 … 85°C
Relative humidity (non-condensing)	0 … 90%

Tab. 11.7: Certifications

Protection class	IP67
Certifications	EU

11.2 Dimensions



All dimensions in mm

A LED indicator

Fig. 11.1: RSL 202 dimensions

12 Order guide and accessories

RFID read/write systems

Tab. 12.1: Type overview

Part no.	Article	Description
50150661	RDH 202 00	RFID read/write system with RS 232 interface

NOTICE
A list of all available device types and suitable accessories can be found on the product page of the Leuze website **www.leuze.com**.

13 Declaration of Conformity

The RDH series' RFID read/write systems, including the associated TFM and RTH transponders, have been developed and manufactured in compliance with applicable European standards and directives.

	NOTICE
	You can download the EC Declaration of Conformity from the Leuze website. ↳ Call up the Leuze website: *www.leuze.com*. ↳ Enter the type designation or part number of the device as the search term. The article number can be found on the name plate of the device under the entry "Part. No.". ↳ The documents can be found on the product page for the device under the *Downloads* tab.

14 Appendix

14.1 Transponder specific information

14.1.1 NXP I-CODE 1 memory organization

Tab. 14.1: NXP I-CODE 1 memory organization

Block	Byte 0	Byte 1	Byte 2	Byte 3	Description
0	SNR0	SNR1	SNR2	SNR3	Serial number (low)
1	SNR4	SNR5	SNR6	SNR7	Serial number (high)
2	F0	FF	FF	FF	Write access
3	x	x	x	x	Special functions
4	x	x	x	x	Filter code / app ID / user data
5	x	x	x	x	User data
6	x	x	x	x	User data
…	…	…	…	…	…
14	x	x	x	x	User data
15	x	x	x	x	User data

14.1.2 NXP I-CODE SLI memory organization

Tab. 14.2: NXP I-CODE SLI memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
26	32	User data
27	32	User data

Unique serial number (UID) NXP I-CODE SLI

Tab. 14.3: Unique serial number (UID) NXP I-CODE SLI

64	57	56	49	48	41	40									1
E0		04		01		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘00’ to distinguish them from the other I-CODE transponder types.

14.1.3 NXP I-CODE SLI-S memory organization

Tab. 14.4: NXP I-CODE SLI-S memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
38	32	User data
39	32	User data

Unique serial number (UID) NXP I-CODE SLI-S

Tab. 14.5: Unique serial number (UID) NXP I-CODE SLI-S

64	57	56	49	48	41	40									1
E0		04		02		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘00’ to distinguish them from the other I-CODE transponder types.

14.1.4 NXP I-CODE SLI-L memory organization

Tab. 14.6: NXP I-CODE SLI-L memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
7	32	User data
8	32	User data

Unique serial number (UID) NXP I-CODE SLI-L

Tab. 14.7: Unique serial number (UID) NXP I-CODE SLI-L

64	57	56	49	48	41	40									1
E0		04		03		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘00’ to distinguish them from the other I-CODE transponder types.

14.1.5 NXP I-CODE SLIX memory organization

Tab. 14.8: NXP I-CODE SLIX memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…

Block	Bits	Description
26	32	User data
27	32	User data

Unique serial number (UID) NXP I-CODE SLIX

Tab. 14.9: Unique serial number (UID) NXP I-CODE SLIX

64	57	56	49	48	41	40									1
E0		04		01		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘10’ to distinguish them from the other I-CODE transponder types.

14.1.6 NXP I-CODE SLIX-S memory organization

Tab. 14.10: NXP I-CODE SLIX-S memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
38	32	User data
39	32	User data

Unique serial number (UID) NXP I-CODE SLIX-S

Tab. 14.11: Unique serial number (UID) NXP I-CODE SLIX-S

64	57	56	49	48	41	40									1
E0		04		02		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘10’ to distinguish them from the other I-CODE transponder types.

14.1.7 NXP I-CODE SLIX-L memory organization

Tab. 14.12: NXP I-CODE SLIX-L memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
6	32	User data
7	32	User data

Unique serial number (UID) NXP I-CODE SLIX-L

Tab. 14.13: Unique serial number (UID) NXP I-CODE SLIX-L

64	57	56	49	48	41	40									1
E0		04		03		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘10’ to distinguish them from the other I-CODE transponder types.

14.1.8 NXP I-CODE SLIX2 memory organization

Tab. 14.14: NXP I-CODE SLIX2 memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
77	32	User data
78	32	User data
79	32	Counter

Unique serial number (UID) NXP I-CODE SLIX2

Tab. 14.15: Unique serial number (UID) NXP I-CODE SLIX2

64	57	56	49	48	41	40									1
E0		04		03		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

Bits 37 and 36 are programmed to ‘01’ to distinguish them from the other I-CODE transponder types.

14.1.9 TI Tag-it HF-I Standard memory organization

Tab. 14.16: TI Tag-it HF-I Standard memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
6	32	User data
7	32	User data

Unique serial number (UID) TI Tag-it HF-I Standard

Tab. 14.17: Unique serial number (UID) TI Tag-it HF-I Standard

64	57	56	49	48	41	40									1
E0		07		C1		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.10 TI Tag-it HF-I Plus memory organization

Tab. 14.18: TI Tag-it HF-I Plus memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
62	32	User data
63	32	User data

Unique serial number (UID) TI Tag-it HF-I Plus

Tab. 14.19: Unique serial number (UID) TI Tag-it HF-I Plus

64	57	56	49	48	41	40									1
E0		07		01		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.11 TI Tag-it HF-I Pro memory organization

Tab. 14.20: TI Tag-it HF-I Pro memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
6	32	User data
7	32	User data

Unique serial number (UID) TI Tag-it HF-I Pro

Tab. 14.21: Unique serial number (UID) TI Tag-it HF-I Pro

64	57	56	49	48	41	40									1
E0		07		C5		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.12 STM LRI 512 memory organization

Tab. 14.22: STM LRI 512 memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
14	32	User data
15	32	User data

Unique serial number (UID) STM LRI 512

Tab. 14.23: Unique serial number (UID) STM LRI 512

64	57	56	49	48											1
E0		02		IC manufacturer serial number											
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.13 Infineon my-d (02P) memory organization

Tab. 14.24: Infineon my-d (02P) memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
54	32	User data
55	32	User data

Unique serial number (UID) Infineon my-d (02P)

Tab. 14.25: Unique serial number (UID) Infineon my-d (02P)

64	57	56	49	48	41	40									1
E0		05		40		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.14 Infineon my-d (10P) memory organization

Tab. 14.26: Infineon my-d (10P) memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	32	User data
1	32	User data
…	…	…
246	32	User data
247	32	User data

Unique serial number (UID) Infineon my-d (10P)

Tab. 14.27: Unique serial number (UID) Infineon my-d (10P)

64	57	56	49	48	41	40									1
E0		05		00		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.15 EM EM4135 memory organization

Tab. 14.28: EM EM4135 memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
13	64	User data
14	64	User data
…	…	…
47	64	User data
48	64	User data

Unique serial number (UID) EM EM4135

Tab. 14.29: Unique serial number (UID) EM EM4135

64	57	56	49	48											1
E0		16		IC manufacturer serial number											
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.16 Fujitsu MB89R118C memory organization

Tab. 14.30: Fujitsu MB89R118C memory organization

Block	Bits	Description
UID	64	Unchangeable serial number
0	64	User data
1	64	User data
…	…	…
248	64	User data
249	64	User data

Unique serial number (UID) Fujitsu MB89R118C

Tab. 14.31: Unique serial number (UID) Fujitsu MB89R118C

64	57	56	49	48	41	40									1
E0		08		01		IC manufacturer serial number									
UID 7		UID 6		UID 5		UID 4		UID 3		UID 2		UID 1		UID 0	

14.1.17 NXP MIFARE Classic 1k memory organization

Tab. 14.32: NXP MIFARE Classic 1k memory organization

Sector	Block	Bits	Description
0	0	128	Manufacturer block
	1	128	User data
	2	128	User data
	3	128	Sector trailer (last block)

Sector	Block	Bits	Description
1	0	128	User data
	1	128	User data
	2	128	User data
	3	128	Sector trailer (last block)
	…	…	…
15	0	128	User data
	1	128	User data
	2	128	User data
	3	128	Sector trailer (last block)

14.1.18 NXP MIFARE Classic 4k memory organization

Tab. 14.33: NXP MIFARE Classic 4k memory organization

Sector	Block	Bits	Description
0	0	128	Manufacturer block
	1	128	User data
	2	128	User data
	3	128	Sector trailer (last block)
…	…	…	…
31	0	128	User data
	1	128	User data
	2	128	User data
	3	128	Sector trailer (last block)
32	0	128	User data
	1	128	User data
	2	128	User data
	3	128	User data
	…	…	…
	13	128	User data
	14	128	User data
	15	128	Sector trailer (last block)
…	…	…	…
39	0	128	User data
	1	128	User data
	2	128	User data
	3	128	User data
	…	…	…
	13	128	User data
	14	128	User data
	15	128	Sector trailer (last block)

NXP MIFARE Classic 1k / 4k manufacturer block

Tab. 14.34: NXP MIFARE Classic 1k / 4k manufacturer block

128 – 49	48 – 1
Manufacturer data	UID (32 bit if NUID)

NXP MIFARE Classic 1k / 4k sector trailer (last block)

Tab. 14.35: NXP MIFARE Classic 1k / 4k sector trailer (last block)

128 – 81	80 – 49	48 – 1
Key B (optional)	Access bits	UID (32 bit if NUID)

14.1.19 NXP MIFARE Ultralight C memory organization

Tab. 14.36: NXP MIFARE Ultralight C memory organization

Page	Byte	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16 – 31	Lock bytes
3	0 – 3	32	Uniquely programmable
4	0 – 3	32	User memory
…	…	…	…
39	0 – 3	32	User memory
40	0 – 1	16	Lock bytes
	2 – 3	16	Reserved
41	0 – 1	16	16-bit counter
42	0 – 4	32	Authentication configuration
43	0 – 4	32	Authentication configuration
44	0 – 4	32	Authentication key
45	0 – 4	32	Authentication key
46	0 – 4	32	Authentication key
47	0 – 4	32	Authentication key

Unique serial number NXP MIFARE Ultralight C

Tab. 14.37: Unique serial number NXP MIFARE Ultralight C

Page	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1

14.1.20 NXP NTAG 210 memory organization

Tab. 14.38: NXP NTAG 210 memory organization

Page	Bytes	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16	Lock bytes
3	0 – 3	32	Configuration memory (CC)
4	0 – 3	32	User memory
…		…	…
15	0 – 3	32	User memory
16	0 – 3	32	CFG 0 configuration page
17	0 – 3	32	CFG 1 configuration page
18	0 – 3	32	PWD configuration page
19	0 – 1	16	PACK configuration page
	2 – 3	16	RFUI configuration page

Unique serial number NXP NTAG 210

Tab. 14.39: Unique serial number NXP NTAG 210

Page	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1

14.1.21 NXP NTAG 212 memory organization

Tab. 14.40: NXP NTAG 212 memory organization

Page	Bytes	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16	Lock bytes
3	0 – 3	32	Configuration memory (CC)
4	0 – 3	32	User memory
…	…	…	…
35	0 – 3	32	User memory
36	0 – 2	24	Dynamic lock bytes
	3	8	RFUI dynamic lock bytes
37	0 – 3	32	CFG 0 configuration page
38	0 – 3	32	CFG 1 configuration page

Page	Bytes	Bits	Description
39	0 – 3	32	PWD configuration page
40	0 – 1	16	PACK configuration page
	2 – 3	16	RFUI configuration page

Unique serial number NXP NTAG 212

Tab. 14.41: Unique serial number NXP NTAG 212

Page	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1

14.1.22 NXP NTAG 213 memory organization

Tab. 14.42: NXP NTAG 213 memory organization

Page	Bytes	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16	Lock bytes
3	0 – 3	32	Configuration memory (CC)
4	0 – 3	32	User memory
…		…	…
39	0 – 3	32	User memory
40	0 – 2	24	Dynamic lock bytes
	3	8	RFUI dynamic lock bytes
41	0 – 3	32	CFG 0 configuration page
42	0 – 3	32	CFG 1 configuration page
43	0 – 3	32	PWD configuration page
44	0 – 1	16	PACK configuration page
	2 – 3	16	RFUI configuration page

Unique serial number NXP NTAG 213

Tab. 14.43: Unique serial number NXP NTAG 213

Page	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1

14.1.23 NXP NTAG 215 memory organization

Tab. 14.44: NXP NTAG 215 memory organization

Page	Bytes	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16	Lock bytes
3	0 – 3	32	Configuration memory (CC)
4	0 – 3	32	User memory
…		…	…
129	0 – 3	32	User memory
130	0 – 2	24	Dynamic lock bytes
	3	8	RFUI dynamic lock bytes
131	0 – 3	32	CFG 0 configuration page
132	0 – 3	32	CFG 1 configuration page
133	0 – 3	32	PWD configuration page
134	0 – 1	16	PACK configuration page
	2 – 3	16	RFUI configuration page

Unique serial number NXP NTAG 215

Tab. 14.45: Unique serial number NXP NTAG 215

Page	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1

14.1.24 NXP NTAG 216 memory organization

Tab. 14.46: NXP NTAG 216 memory organization

Page	Bytes	Bits	Description
0	0 – 3	32	Serial number
1	0 – 3	32	Serial number
2	0	8	Serial number
	1	8	Internal
	2 – 3	16	Lock bytes
3	0 – 3	32	Configuration memory (CC)
4	0 – 3	32	User memory
…		…	…
225	0 – 3	32	User memory
226	0 – 2	24	Dynamic lock bytes
	3	8	RFUI dynamic lock bytes

Page	Bytes	Bits	Description
227	0 – 3	32	CFG 0 configuration page
228	0 – 3	32	CFG 1 configuration page
229	0 – 3	32	PWD configuration page
230	0 – 1	16	PACK configuration page
	2 – 3	16	RFUI configuration page

Unique serial number NXP NTAG 216

Tab. 14.47: Unique serial number NXP NTAG 216

Pages	Byte 3	Byte 2	Byte 1	Byte 0
0	Check byte 0	Serial number part 1		
1	Serial number part 2			
2	Lock bytes		Internal	Check byte 1