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RDR-485 RFID reader

TECHNICAL GUIDE

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REVISION HISTORY

REV	DATE	BY	SECTION	DESCRIPTION
1.01	**2025.02.19**	Evgeniy Vasyliev	All	First release

PURPOSE OF THE DOCUMENT

This Technical Guide is intended for studying of RDR-485 RFID reader. It contains basic information regarding its technical characteristics, connection scheme and configuration.

Due to a reason that RDR-485 RFID reader is constantly being developed in direction of improvements of their possibilities, changes are possible in its final version, which is not described in given Technical Guide.

During the system development process given Technical Guide will be also expanded and updated and new chapters will be added. Latest version of this Technical Guide can be downloaded from the RDR-485 RFID reader web-page: *https://www.technotrade.ua/rdr-485*.

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In case if you find any mistakes, omissions in this document or have any suggestions on improvements to this document, please feel free to e-mail them to our support mailbox: *support_1a@technotrade.ua*. We will be grateful to you for this valuable information.

All technical questions regarding the RDR-485 RFID reader are welcome to be asked on support mailbox: *support_1a@technotrade.ua*. Our support team will be glad to help you.

Also, you can call to us or visit us on:

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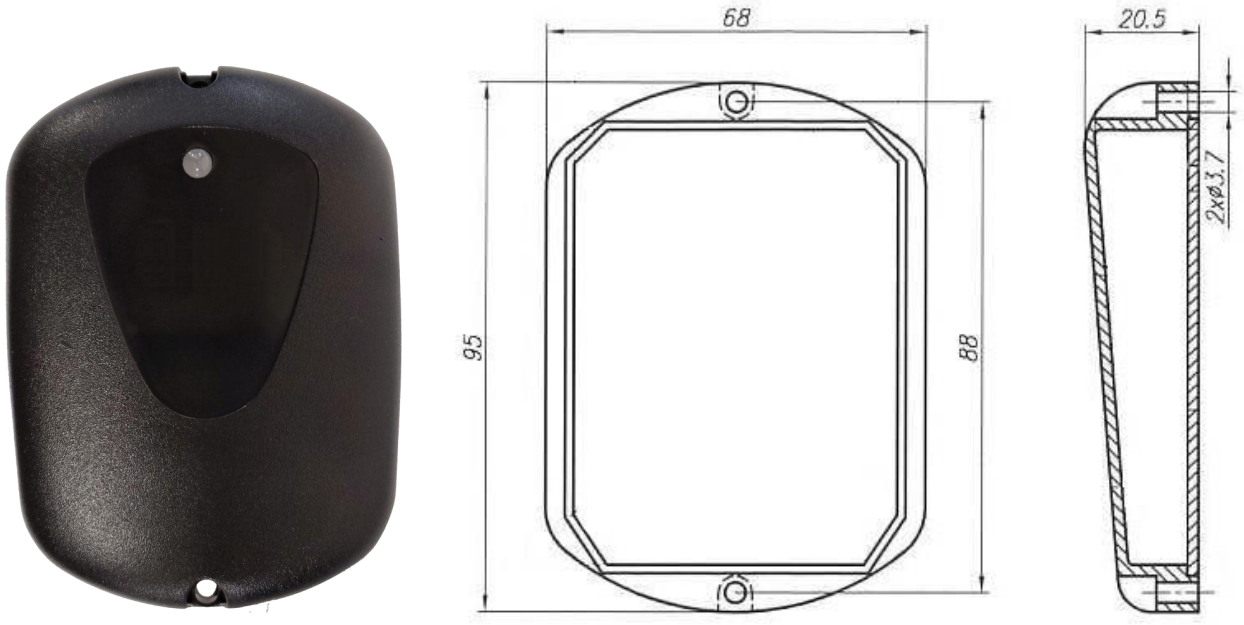
APPOINTMENT

RDR-485 RFID reader is intended for reading RFID contactless identifiers (cards, tags, bracelets, others) of EM-marine type (EM-4100) and Mifare type (UltraLight, Mifare One S50, Mifare One S70, others) and sending it over RS-485 interface. RDR-485 reader provides reading of the identifier from distance from 50 to 80 mm (depending on the conditions). Distance for reading is lowering at mounting of the reader on the metal surface and close to sources of electromagnetic interferences.

TECHNICAL SPECIFICATIONS

PARAMETER	VALUE
Type of contactless identifiers read	EM-marine (125 kHz) and Mifare (13.56 MHz)
Power supply voltage	12 V DC
Average consumed current	50 mA
Peak consumed current	100 mA
Communication interface	RS-485
Communication protocol	Modbus
Maximal possible length of communication cable	1200 m
Dimensions	95 x 68 x 20 mm
Weight	100 g
Operation temperature range	-20…+85 deg. C



Reader general view and dimensions

CONNECTION

Reader is equipped with 4-wire colored cable for connection. Pinout of the cable:

WIRE COLOR	MARKING	DESCRIPTION
Red	+12 V DC	Power supply voltage
Black	Gnd	Power supply ground (common)
Yellow	RS485-A	RS-485 interface line A
Blue	RS485-B	RS-485 interface line B

NOTE! The power supply input is protected from misconnection of +12 V DC and ground wires.

Mounting of reader

1. Define a place for reader mounting. It is recommended to install readers on distance not closer of 30 cm to each other.
2. Perform marking of holes for mounting of the reader and laying of cables.
3. Lay the cable, fix it and perform required connections.
4. Check correctness of mounting and fix the reader in selected place using screws.
5. After complete check of reader operation install decorative caps in holes of screws.

NOTE! Avoid mounting of the reader directly on metal surfaces, use wooden or rubber spacers between metal surface and the reader with minimum 10 mm width.

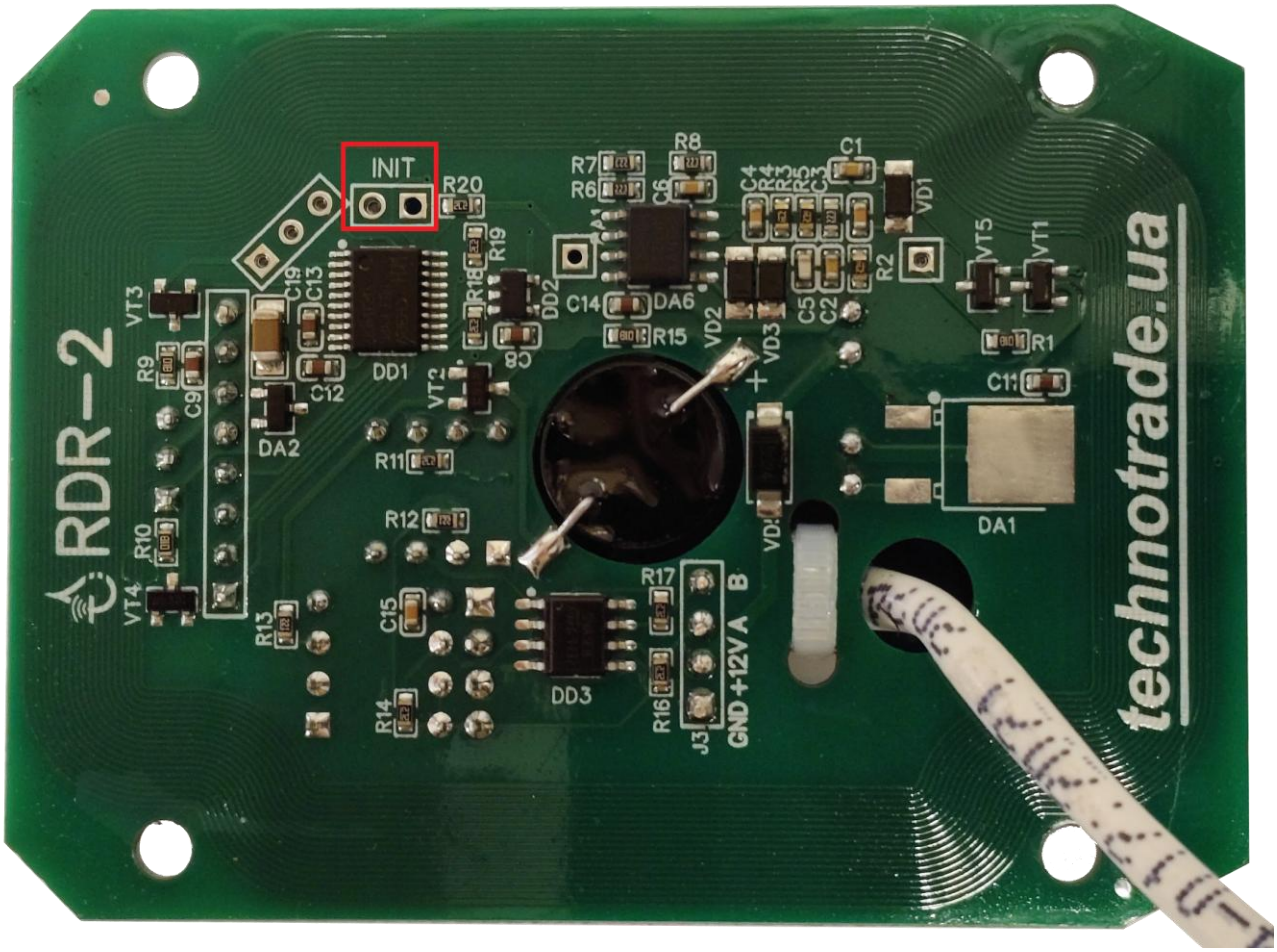
Reader allows to configure the buzzer and 2-colors LED for indication (green and red).

Example of reader installation on fuel dispensers

RESET OF CONFIGURATION

In order to perform reset of the reader's configuration (set default configuration to the reader) it is necessary to make the following:

1. Power off the reader.
2. Take away the reader's casing and get to its electrical board.
3. On electrical board of back side of the reader find 2 contact pads (shown on the image below), you need to short connect them with each other (using tweezers or some other tool).
4. While these pads are connected with each other power on the reader and wait for 5 seconds.
5. Disconnect the pads, the reader should be reset to default configuration.



Reader PCB board and contact pads for reset of configuration

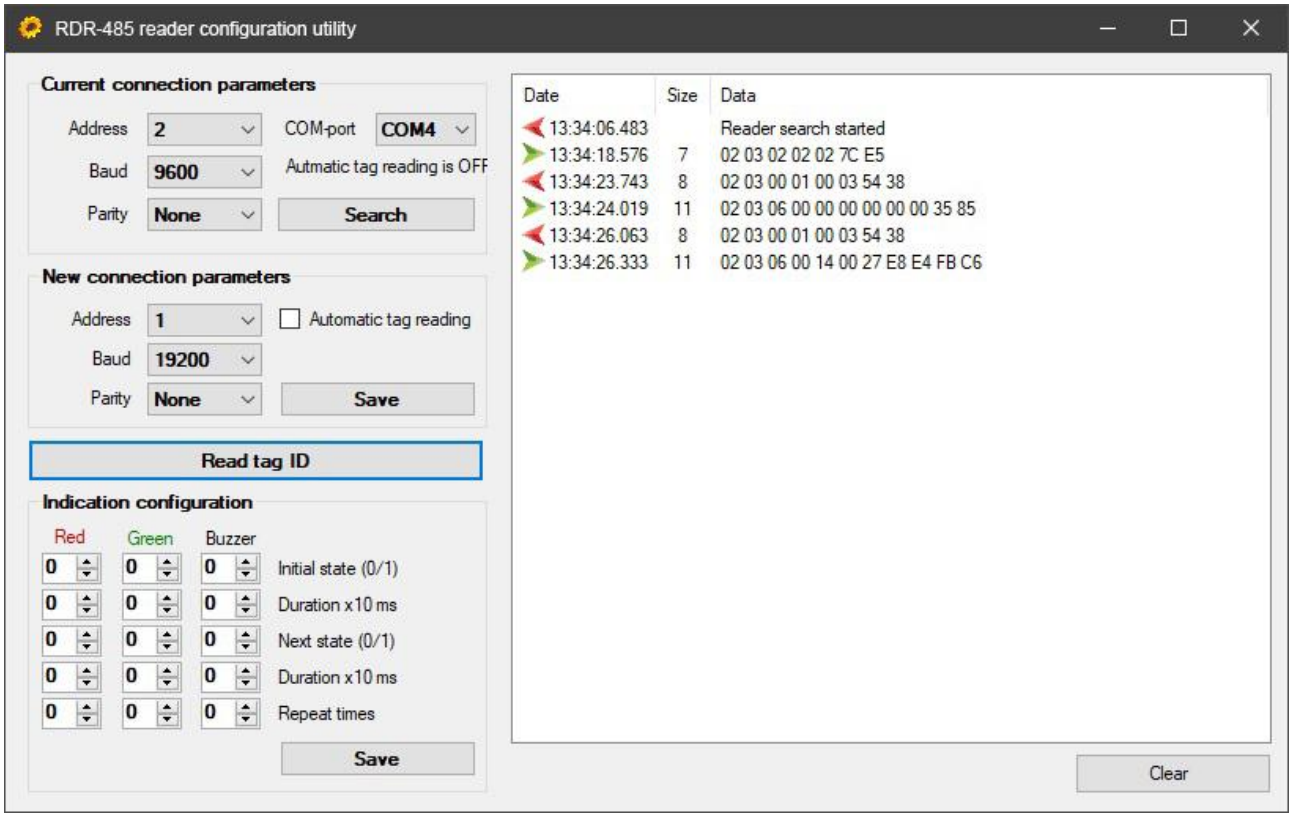
Reader default communication settings:

- baud rate is 9600 bits/s
- communication address is 1
- read tag code is stored for 2 seconds after the tag was removed from the reader
- timeout of Tx/Rx transmission change is 0 ms

CONFIGURATION UTILITY

RDR-485 readers have a configuration utility running under Windows OS, which allows to configure:

- to configure reader's communication address
- to configure reader's communication parameters
- to search for the reader in case if you forgot its communication address and communication parameters
- to enable and disable simplified mode of operation for automatic tag reading (in this case the reader automatically sends the ID of the tag read to the line, for this feature to work without collisions the reader should be only one on the line)
- to set indication of the reader by its LEDs and buzzer



RDR-485 reader configuration utility

OPERATION

Communication settings

Data transmission with the RDR-485 reader is performed through the RS-485 interface. The reader control protocol is Modbus RTU.

Communication settings are:
- 1 start bit
- 8 data bits
- 1 stop bit
- parity can be configured (none parity by defaults)
- baud rates can be configured from 2400 to 115200 bit/s (9600 bits/s by defaults)
- communication address: 01 – 99 (01 by defaults)

Communication protocol

Communication is done using requests sent by the control system and responses from the reader. It is also possible to operate the reader in a simplified mode, in which it transmits the code of the read RFID identifier without any request sent to it (this is done to simplify the work of programmers when a complex solution to a simple problem is not required).

Communication is done by reading/writing the Holding Registers in accordance with the Modbus RTU protocol description. The following commands are used:
- 0x03 – read holding registers
- 0x06 – write single register
- 0x10 – write multiple registers

Registers contain various information and settings:
- configuration of the RS-485 interface
- indication settings

Reading the tag

After bringing of the tag to the reader its code is written to a certain memory region. Codes for Mifare and EM-marine tags are stored in different memory regions. The read tag code is stored for 2 seconds more after the tag was removed from the reader. The timeout of additional tag storage in memory can be configured and set in region from 0 to 25.5 seconds.

EM-marine tags take 5 bytes in memory (3 registers). At this 1 byte is appointed for storing an identifier of the tag manufacturer and 4 bytes are appointed for storing the tag code.

Mifare tags take 9 bytes in memory (5 registers). At this, 2 bytes are appointed for storing the tag type (Mifare tags can be of different types) and 7 bytes are appointed to store the tag code. If the tag code is 7 bytes – then it takes all the 7 bytes, if the tag code is 4 byte – then the highest 3 bytes are filled with zeroes.

Control over indication

Control over indication includes control over red and greed LEDs and control over the buzzer. Control allows to set the initial state and the following states after it with specification of duration of each state and a number of repeats. For example, if you need to blink the red LED twice – then you need to write the following combination to control registers:

- initial state – 1 (switched on)
- duration of stay – 50 (500 msec)
- next state – 0 (switched off)
- duration of stay – 50 (500 msec)
- number of repeats – 2

At such configuration the red LED will shine for 0.5 sec, then will not sine for 0.5 sec and will again shine for 0.5 sec.

If you need to have the same state all the time, then you need to set the initial and next state to the same value. For example, if you need to have the green LED always shining – then you need to write the following combination to control registers:

- initial state – 1 (switched on)
- next state – 1 (switched on)

The default reader address is 0x01, the baud rate is 19200 baud, none parity.

If there is no RFID identifier within the reader's field of action, the value of the read RFID identifier is filled with zeroes.

COMMUNICATION PROTOCOL

Modbus registers

ADDRESS	BYTE	DEFAULT VALUE	ALLOWED VALUES	DESCRIPTION
0x0000	High	0x01	0x00 … 0xFF	**Reader address**
	Low	0x02	0x00 … 0x26	**8/9 bits:** - 0x0X: 8 bits, none parity - 0x1X: 8 bits, even parity - 0x2X: 8 bits, odd parity **Baud rate:** - 0xX0: 2400 baud - 0xX1: 4800 baud - 0xX2: 9600 baud - 0xX3: 19200 baud - 0xX4: 38400 baud - 0xX5: 57600 baud - 0xX6: 115200 baud
0x0001	High	0x00	0x00 … 0xFF	Response delay in RS-485 interface in 100 µsec intervals
	Low	0x14	0x00 … 0xFF	Times to hold the read tag code in 100 msec intervals
0x0002	High	0x00	-	Not used
	Low	0x00	0x00 … 0xFF	**Code of EM-marine tag manufacturer identifier**
0x0003	High	0x00	0x00 … 0xFF	**Code of EM-marine tag identifier**
	Low	0x00		
0x0004	High	0x00		
	Low	0x00		
0x0005	High	0x00	0x0000 … 0xFFFF	**Mifare tag type**
	Low	0x00		
0x0006	High	0x00	-	Not used
	Low	0x00		**Code of Mifare tag identifier**
0x0007	High	0x00		
	Low	0x00		
0x0008	High	0x00		
	Low	0x00		
0x0009	High	0x00		
	Low	0x00		
0x000A	High	0x00	0x00 … 0xFF	**Red LED** Initial state: 1 – ON, 0 - OFF
	Low	0x00		Duration of state x 10 msec
0x000B	High	0x00		Last state: 1 – ON, 0 – OFF
	Low	0x00		Duration of state x 10 msec
0x000C	High	0x00		Number of cycles for value change

	Low	0x00	0x00 … 0xFF	**Green LED** Initial state: 1 – ON, 0 - OFF
0x000D	High	0x00		Duration of state x 10 msec
	Low	0x00		Last state: 1 – ON, 0 – OFF
0x000E	High	0x00		Duration of state x 10 msec
	Low	0x00		Number of cycles for value change
0x000F	High	0x00	0x00 … 0xFF	**Buzzer** Initial state: 1 – ON, 0 - OFF
	Low	0x00		Duration of state x 10 msec
0x0010	High	0x00		Last state: 1 – ON, 0 – OFF
	Low	0x00		Duration of state x 10 msec
0x0011	High	0x00		Number of cycles for value change
	Low	0x00	-	Not used

Response delay in RS-485 interface in 100 µsec can have a value from 0 to 255 meaning from 0 to 25.5 msec. This can be needed when the control system switches off transmission on its port not immediately after sending the request, but with some delay. So, the response from the reader is sent with some delay when this parameter is activated (has a value different from 0).

Times to hold the read tag code in 100 msec intervals can have a value from 0 to 255 meaning from 0 to 25.5 sec. Value by defaults is 20 meaning that once the tag is removed from the reader – then it will be still stored in the reader for 2 seconds after this.

Mifare tag type allows to receive information on a type of used Mifare tag:

- 0x4400 – UltraLight
- 0x0400 – Mifare One S50
- 0x0200 – Mifare One S70

Code of Mifare tag identifier contains:

- 7 bytes for 7-byte tags
- 4 bytes for 4-byte tags in registers 8 and 9, registers 6 and 7 are filled with zeroes

Command 03 'Read Holding Registers'

This command is used for reading registers in range 0x0000 … 0x0011.

Request:

Request code	**1 byte**	**0x03**
Start register	2 bytes	0x0000 … 0x0011
Registers quantity	2 bytes	0x0001 … 0x0012

Response:

Response code	**1 byte**	**0x03**
Quantity of following data bytes	1 byte	N x 2
Data (registers values)	N x 2 bytes	

N – quantity of registers

Example:

REQUEST		**RESPONSE**	
Request code	0x03	**Response code**	0x03
Start register High number	0x00	**Quantity of data bytes**	0x04
Start register Low number	0x03	**Most significant byte of RFID identifier value**	0xA4
Quantity of High registers	0x00	**Next byte of RFID identifier value**	0x1E
Quantity of Low registers	0x02	**Next byte of RFID identifier value**	0x45
		Least significant byte of RFID identifier value	0xC6

In this example there is a request for identifier code, which is stored in 2 registers (total size 4 bytes) at address 0x0003. If there is no RFID identifier within the area of the reader action – then the returned values will contain zeroes.

Response in case of the request error:

Response code	**1 byte**	**0x83**
Error code	1 byte	0x02 – start register number is more than 0x0011 0x03 – quantity of requested registers is bigger than memory bounds 0x0011

Command 06 'Write Single Register'

This command is recommended for setting the reader address and baud rate.

Request:

Request code	**1 byte**	**0x06**
Register number	2 bytes	0x0000 … 0x0011
Value (for example address (High) and baud rate (Low))	2 bytes	0xXXXX

Response:

Response code	**1 byte**	**0x06**
Register number	2 bytes	0x0000 … 0x0011
Value (for example address (High) and baud rate (Low))	2 bytes	0xXXXX

Example:

REQUEST		**RESPONSE**	
Request code	0x06	**Response code**	0x06
Register High number	0x00	Register High number	0x00
Register Low number	0x00	Register Low number	0x00
Reader address 27	0x1B	Reader address 27	0x1B
Baud rate 9600	0x02	Baud rate 9600	0x02

In this example address of the reader is set to 27 and its baud rate is set to 9600.

Note! If the baud rate value is not within the range 1 … 6 – then the least possible baud rate is set (2400).

Response in case of the request error:

Response code	**1 byte**	**0x86**
Error code	1 byte	0x02 – start register number is more than 0x0011

Command 10 'Write Multiple Registers'

This command is recommended for setting the indication and zeroing the RFID identifier value.

Request:

Request code	**1 byte**	**0x10**
Register start number	2 bytes	0x0000 … 0x0011
Quantity of registers	2 bytes	0x0001 … 0x0012
Quantity of data bytes	1 byte	0x0002 … 0x0024
Values	16 bytes	

Response:

Response code	**1 byte**	**0x10**
Register start number	2 bytes	0x0000 … 0x0011
Quantity of registers	2 bytes	0x0001 … 0x0012

Response in case of the request error:

Response code	**1 byte**	**0x90**
Error code	1 byte	0x02 – start register number is more than 0x0011 0x03 – quantity of requested registers is bigger than memory bounds 0x0011