control solutions

TERACOM



Industrial Modbus RTU RS-485 RFID Reader
ACR240-T / ACR240-T-O

USER MANUAL

1. Introduction

ACR240-T/ACR240-T-O is an IP65 Modbus RTU RFID reader designed for industrial identification, machine control and access control applications. The device reads 125 kHz EM4102-compatible RFID tags and makes their identifiers available to an external controller, PLC or computer through an RS-485 interface using Modbus RTU.

ACR240-T/ACR240-T-O can operate as an RFID terminal controlled by a Modbus RTU master or in Stand-alone mode using locally stored card UIDs. In Terminal mode, the master can read RFID tag data and control the available outputs and LED indication through Modbus registers.

ACR240-T provides a relay output, while ACR240-T-O provides two open-drain outputs: OUT for general-purpose control and BUZZER for controlling an external buzzer.

The device is housed in a rugged IP65 enclosure with fully encapsulated electronics for reliable operation in demanding industrial and outdoor environments. Its cylindrical body with an M32×1.5 mounting thread enables quick installation into control panels, machines and equipment.

2. Features

- 125 kHz RFID reader compatible with EM4102 RFID tags
- IP65 enclosure with fully encapsulated electronics for industrial and outdoor applications
- Standard M32×1.5 panel-mount design with integrated RFID antenna
- RS-485 interface with Modbus RTU protocol for PLC, computer and embedded controller integration
- RFID tag identifiers available through Modbus registers for host-based authentication and control
- Modbus control of outputs and LED indication for external control and user feedback

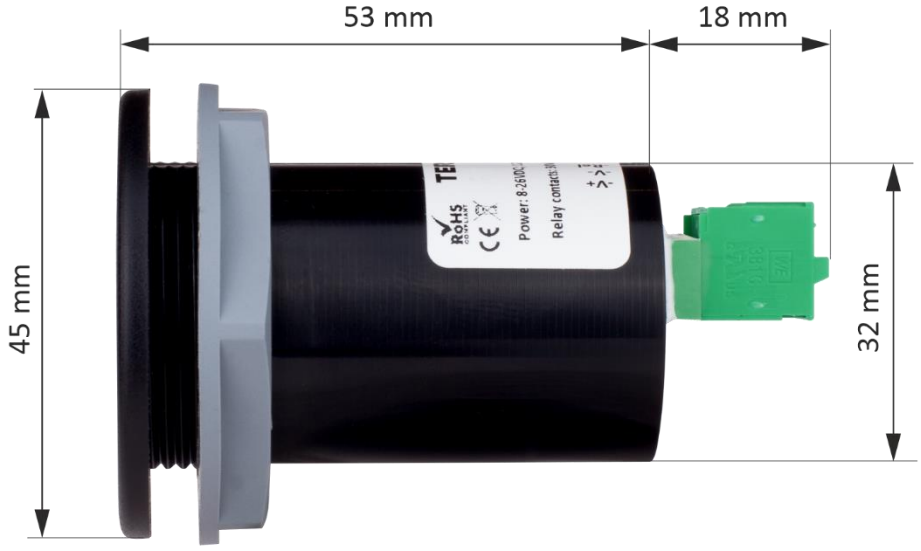
3. Specifications

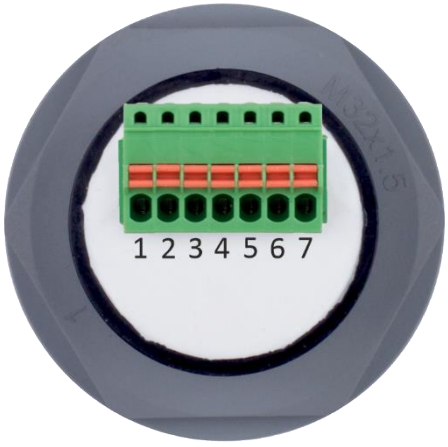
- Physical characteristics
  Dimensions: Ø45 × 71 mm
  Mounting hole diameter: Ø32 mm
  Connector: 2.5 mm pluggable screwless push-in
- Environmental limits
  Operating temperature range: -20 to +60 °C (-4 to +140 °F)
  Operating relative humidity range: 10 to 90 %RH (non-condensing)
- Ingress protection
  Device body: IP65
  Connector: IP20
- Power requirements
  Operating voltage range: 10 to 26 VDC
  Current consumption:
  ACR240-T (relay ON): 35 mA @ 12 VDC
  ACR240-T-O: 18 mA @ 12 VDC
- RFID characteristics
  Operating frequency: 125 kHz
  Supported RFID tags: EM4102 compatible
  Typical reading range: Up to 3 cm*
  * The actual reading distance depends on the RFID tag type, installation conditions, and surrounding environment.
- RS-485 interface
  Protocol: Modbus RTU

Default communication settings: 19200 bps, 8 data bits, even parity, 1 stop bit (E81)
Supported baud rates: 2400, 4800, 9600, 19200, 38400, 57600 bps
Supported serial formats: E81, O81, N81

- Relay output (ACR240-T)
  Contacts: NO and COM
  Maximum switching voltage: 24 VDC / 30 VAC
  Maximum switching current: 0.5 A
  Caution! The device does not contain any internal overcurrent protection facilities on the relay contact lines. External fuses or short circuit current limiting circuit breakers, rated to 0.5 A, are to be used for overcurrent protection of the connecting lines.
  Caution! In case of switching an inductive load, an RC snubber or a diode is to be used for relay contact protection (arc suppression).
- Open-drain OUT (ACR240-T-O)
  Maximum switching voltage: 26 VDC
  Maximum switching current: 0.5 A
- Open-drain BUZZER (ACR240-T-O)
  Maximum switching voltage: 26 VDC
  Maximum switching current: 0.5 A

4. Dimensions and Pinout





Pin	ACR240-T	ACR240-T-O
1	Positive power supply	
2	GND	
3	Relay NO contact	Open-drain OUT
4	Relay COM contact	Open-drain BUZZER
5	RS-485 485-	
6	RS-485 485+	
7	Factory default (active low)	

5. Device operation

During normal operation, both LEDs flash simultaneously once per second, indicating that the device is ready to read RFID tags. If there is no communication, both LEDs flash simultaneously once every 3 seconds.

When an EM4102-compatible RFID tag is detected, the tag UID is made available through the Modbus registers.

The Modbus RTU master can read RFID tag data and control the available outputs and LED indication. ACR240-T provides a built-in relay output, while ACR240-T-O provides two open-drain outputs: OUT for external control and BUZZER for driving an external buzzer.

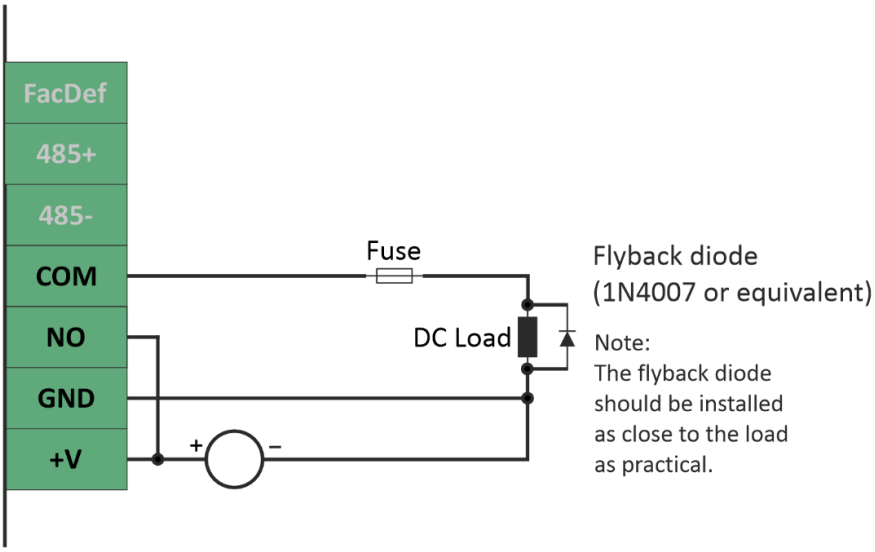
Both variants use the same Modbus RTU communication interface.

6. Typical output connections

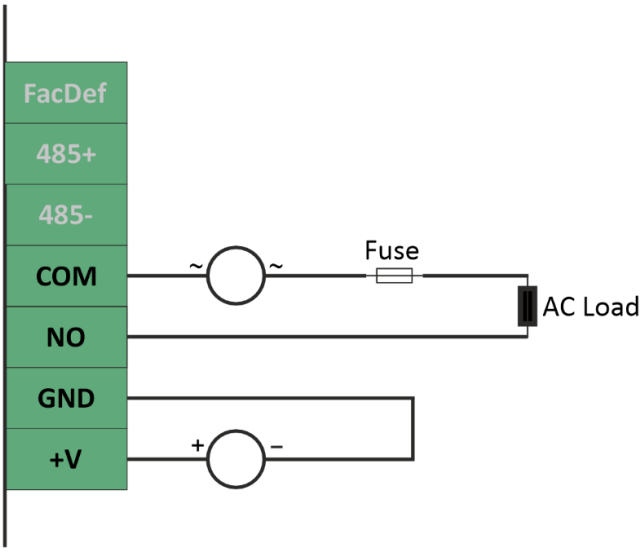
6.1. Relay output connections (ACR240-T)

The relay output can be used to switch DC and AC loads within the electrical ratings specified in this manual. Typical connection examples are shown below.

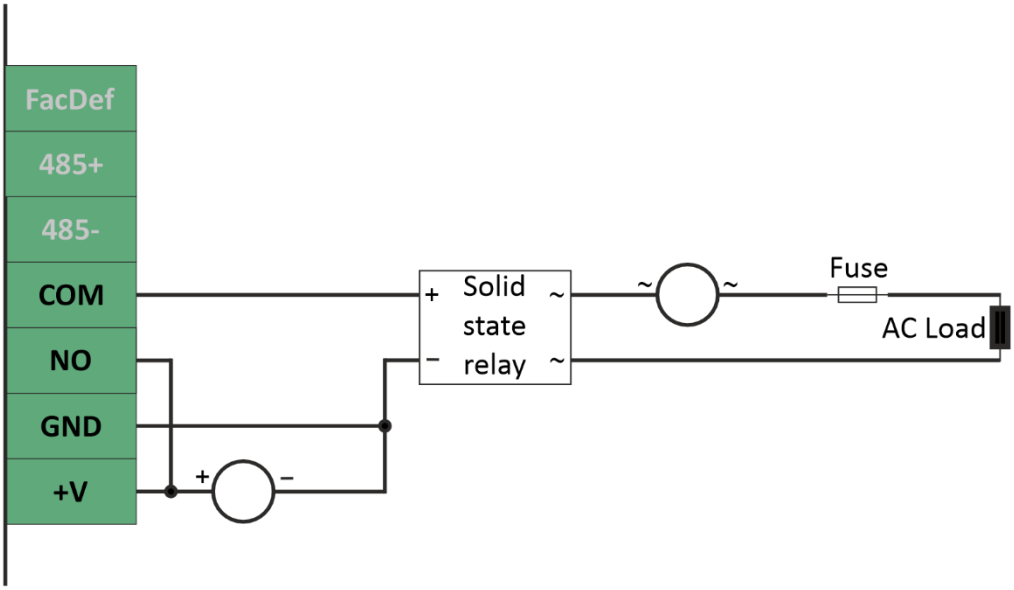
When switching an inductive DC load, install a flyback diode (for example, 1N4007 or equivalent) across the load. To provide effective protection, the diode should be installed as close to the load as practical.



When switching AC loads, protect the output circuit with an appropriately rated fuse. For inductive AC loads, additional suppression components may be required depending on the application.



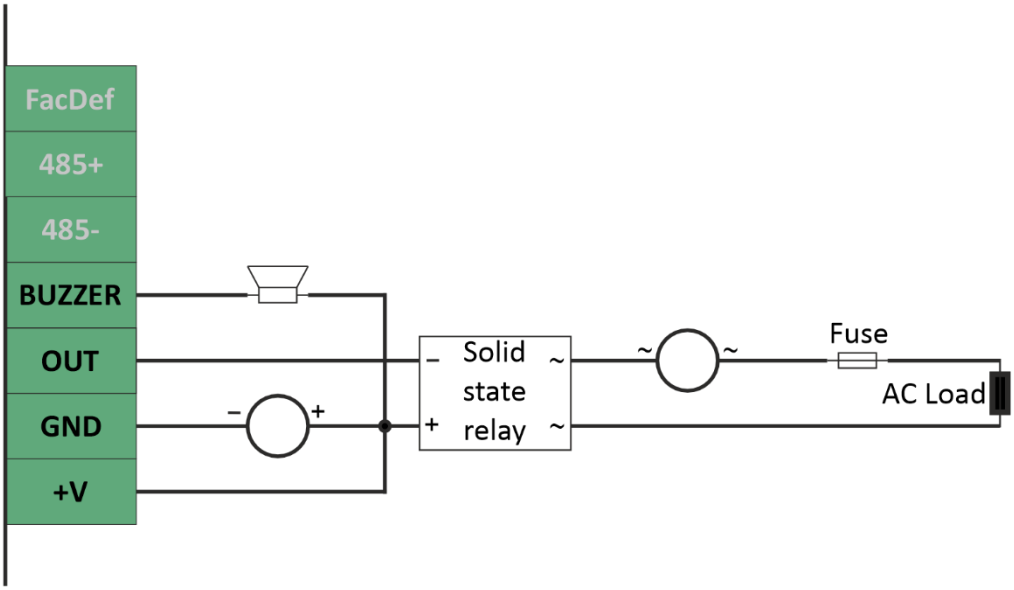
For applications requiring frequent switching, higher load currents, or extended relay service life, the relay output may be used to drive a solid-state relay (SSR) instead of switching the load directly.



6.2. Open-drain output connections (ACR240-T-O)

ACR240-T-O provides two open-drain outputs: OUT for external control and BUZZER for driving an external buzzer. Both outputs switch the connected load to GND and require an external power supply for the load.

The diagram below shows a typical application where the OUT output controls a solid-state relay (SSR) for switching an AC load, while the BUZZER output drives an external buzzer. The connected loads must remain within the electrical ratings specified in this manual.



7. RS-485 interface

The RS-485 interface is not galvanically isolated from the power supply.

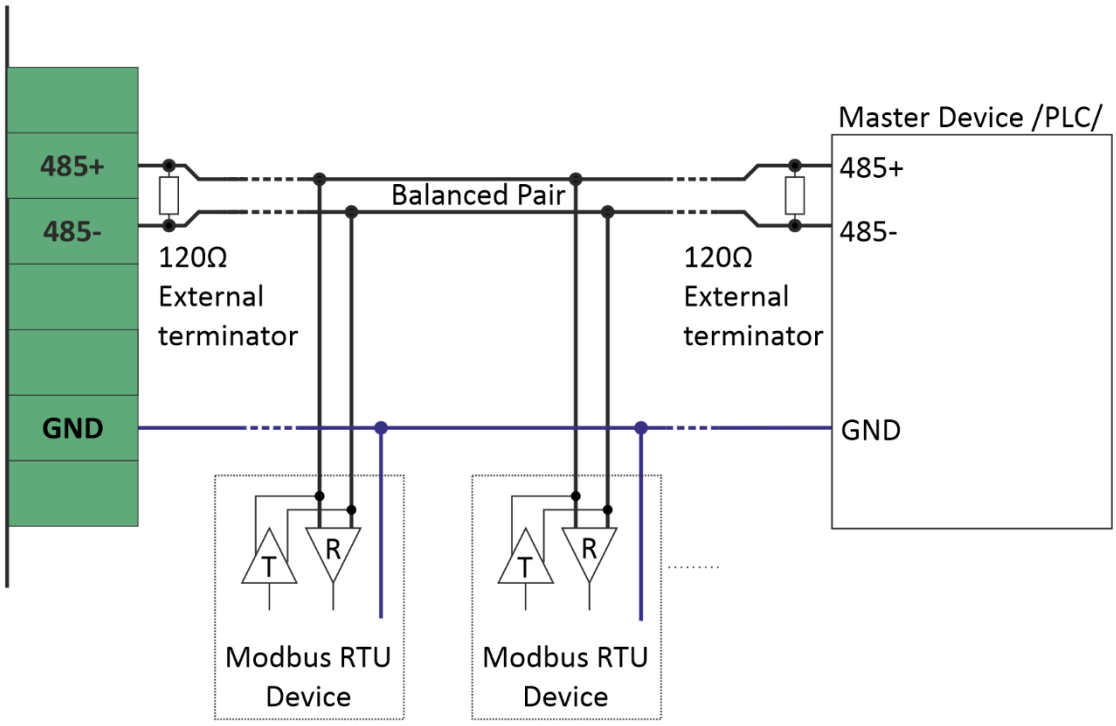
ACR240-T/ACR240-T-O is designed for installation in multidrop RS-485 networks. Connect all devices in a linear (daisy-chain) topology. Star and branched connections are not recommended.

Because the RS-485 interface is not galvanically isolated, all devices connected to the RS-485 bus, including the Modbus RTU master, must share a common signal ground (GND). This common reference is required for reliable communication.

Some manufacturers use opposite polarity for the A and B signal names. Always connect the bus according to the signal polarity rather than relying only on the A/B labels. The ACR240-T/ACR240-T-O RS-485 lines are identified as 485+ and 485-.

A 120 Ω termination resistor should be installed at both ends of the RS-485 bus. Proper termination reduces signal reflections and improves communication reliability, especially on longer cables and at higher baud rates.

Do not install termination resistors on devices located between the two ends of the RS-485 bus.



Shielded twisted-pair cable is recommended. To minimize ground-loop currents and improve noise immunity, connect the cable shield to protective earth at a single point, preferably near the Modbus RTU master device.

Keep the RS-485 cable away from power cables and other sources of electrical interference.

8. Modbus addressing

Modbus RTU uses PDU (Protocol Data Unit) addresses, which are zero-based register addresses transmitted in every Modbus request. These are the only register addresses used during communication.

Many PLCs, SCADA systems and Modbus tools display logical register addresses instead of PDU addresses. Logical addresses are created by adding an offset to the PDU address. For example, holding register PDU address 0 is commonly displayed as 40001, while PDU address 13 may appear as 40014.

The offset and address format are not defined by the Modbus protocol and may vary between software applications and manufacturers. A commonly used convention applies an offset of 00001 to coils, 10001 to discrete inputs, 30001 to input registers, and 40001 to holding registers. Other systems may use different offsets or expect the zero-based PDU address directly.

For this reason, all register addresses in this manual are presented as PDU addresses. When configuring your Modbus master, always use the addressing convention required by your software.

For a detailed explanation of Modbus addressing and address conversion, see Demystifying Modbus RTU addressing.

9. Modbus register table

Register name	R/W	FC	Decimal address		Data format	Default	Valid values
			PDU	Logical			
Holding registers							
RS-485 address	R/W	3, 6, 16	10	40011	uint16	1	1 to 247
Baud rate *	R/W	3, 6, 16	11	40012	uint16	19200	2400, 4800, 9600, 19200, 38400, 57600
Parity, Data bits, Stop bits *	R/W	3, 6, 16	12	40013	uint16	1	1=E81, 2=O81, 3=N81
Device code	R	3	14	40015	uint16		0x00DB
FW version	R	3	15	40016	uint16		
Vendor URL	R	3	18	40019	UTF-8 string (64 bytes)		teracomsystems.com
Float test value (MSW)	R	3	82	40083	float32		-9.9(0xC11E6666)
Float test value (LSW)	R	3	84	40085	float32		-9.9(0xC11E6666)
Signed integer test value	R	3	86	40087	int16		-999(0xFC19)
Signed integer test value (MSW)	R	3	87	40088	int32		-99999(0xFFFE7961)
Signed integer test value (LSW)	R	3	89	40090	int32		-99999(0xFFFE7961)
Unsigned integer test value	R	3	91	40092	uint16		999(0x03E7)
Card UID word 0 (MSB)	R	3	100	40101	uint16	0	0 to 65535
Card UID word 1	R	3	101	40102	uint16	0	0 to 65535
Card UID word 2	R	3	102	40103	uint16	0	0 to 65535
Card UID word 3 (LSB)	R	3	103	40104	uint16	0	0 to 65535
Relay state	R/W	3, 6	200	40201	uint16	0	0 - OFF 1 - ON
Relay pulse width [x100 ms]	R/W	3, 6	201	40202	uint16	30	0 to 6000
Green and Red LED State	R/W	3, 6	300	40301	uint16	0	0 - Both LEDs OFF 1 - Red LED ON 2 - Green LED ON 3 - Both LEDs ON
LED pulse width [x100 ms]	R/W	3, 6	301	40302	uint16	30	0 to 6000
LED pulse duty [x100 mS]	R/W	3, 6	302	40303	uint16	5	0 to 6000
Buzzer state	R/W	3, 6	400	40401	uint16	0	0 – OFF 1 – ON PULSE 2 – ON PWM (1 kHz)
Buzzer pulse width [x100 ms]	R/W	3, 6	401	40402	uint16	30	0 to 6000
Buzzer pulse duty [x100 ms]	R/W	3, 6	402	40403	uint16	5	0 to 6000
Card keep-alive time [x100 ms]	R/W	3, 6	500	40501	uint16	30	0 to 6000
Modbus no-communication timeout [s]	R/W	3, 6	510	40511	uint16	3	0 - Watchdog disabled 1 to 255 - Timeout [s]
Operating mode	R/W	3, 6	520	40521	uint16	0	0 – Terminal 1 – Stand-alone
Card format	R/W	3, 6	530	40531	uint16	0	0 – 8 bytes 1 – 5 bytes
Card1 UID word 1 (MSB)	R/W	3, 6	1000	41001	uint16	65535	0 to 65535
Card1 UID word 2	R/W	3, 6	1001	41002	uint16	65535	0 to 65535
Card1 UID word 3	R/W	3, 6	1002	41003	uint16	65535	0 to 65535
Card1 UID word 4 (LSB)	R/W	3, 6	1003	41004	uint16	65535	0 to 65535
Card2 UID word 1 (MSB)	R/W	3, 6	1005	41006	uint16	65535	0 to 65535
Card2 UID word 2	R/W	3, 6	1006	41007	uint16	65535	0 to 65535

Card2 UID word 3	R/W	3, 6	1007	41008	uint16	65535	0 to 65535
Card2 UID word 4 (LSB)	R/W	3, 6	1008	41009	uint16	65535	0 to 65535
Card3 UID word 1 (MSB)	R/W	3, 6	1010	41011	uint16	65535	0 to 65535
Card3 UID word 2	R/W	3, 6	1011	41012	uint16	65535	0 to 65535
Card3 UID word 3	R/W	3, 6	1012	41013	uint16	65535	0 to 65535
Card3 UID word 4 (LSB)	R/W	3, 6	1013	41014	uint16	65535	0 to 65535
Card4 UID word 1 (MSB)	R/W	3, 6	1015	41016	uint16	65535	0 to 65535
Card4 UID word 2	R/W	3, 6	1016	41017	uint16	65535	0 to 65535
Card4 UID word 3	R/W	3, 6	1017	41018	uint16	65535	0 to 65535
Card4 UID word 4 (LSB)	R/W	3, 6	1018	41019	uint16	65535	0 to 65535
Card5 UID word 1 (MSB)	R/W	3, 6	1020	41021	uint16	65535	0 to 65535
Card5 UID word 2	R/W	3, 6	1021	41022	uint16	65535	0 to 65535
Card5 UID word 3	R/W	3, 6	1022	41023	uint16	65535	0 to 65535
Card5 UID word 4 (LSB)	R/W	3, 6	1023	41024	uint16	65535	0 to 65535
Discrete outputs							
Relay	R/W	1, 5	1	2	bit	0	0 or 1

* Communication setting changes take effect after restarting the device by powering it off and on.

The register table uses zero-based PDU addresses. Logical addresses shown by some Modbus software may use an offset such as 40001 for holding registers.

MSW - Most Significant Word; LSW - Least Significant Word.

MSB - Most Significant Byte; LSB - Least Significant Byte.

10. Configuration

ACR240-T/ACR240-T-O can be configured through the RS-485 interface using Modbus RTU. Communication settings and device functions are available through the registers described in the table above.

The default Modbus address is 1 and the default communication settings are 19200 bps, 8 data bits, even parity and 1 stop bit (E81).

The Modbus registers provide access to the main operating functions of the device:

- RFID card identification – The UID of the detected RFID card is available through dedicated registers. The card keep-alive time defines how long the detected card UID remains available in the Modbus registers.
- Output and indication control – The relay/OUT output, red and green LEDs, and buzzer output can be controlled through Modbus. Pulse duration and pulse timing can also be configured, allowing the master to generate temporary output activation and visual or audible indication.
- Communication watchdog – A configurable Modbus no-communication timeout can be used to monitor communication with the master. While communication is active, both LEDs flash simultaneously once per second. If communication is interrupted and the configured timeout expires, both LEDs begin flashing simultaneously once every 3 seconds. The watchdog can be disabled when this function is not required.
- Terminal and Stand-alone operation – In Terminal mode, card identification and output control can be handled by the Modbus master. In Stand-alone mode, the device can use locally stored card UIDs for autonomous operation.
- Card UID format – The device supports selectable 8-byte, 5-byte and 4-byte card UID formats.
- Local card storage – Dedicated registers are provided for storing card UIDs used for Stand-alone operation.

11. Factory default

The factory default function restores all device settings to their factory default values. It can also be used to regain access to the device when the Modbus address or RS-485 communication settings are no longer known.

To restore the factory default settings:

- Power off the device.
- Connect the Factory default input to GND.
- Power on the device while keeping the Factory default input connected to GND.
- Both LEDs remain continuously lit for 3 seconds.
- Both LEDs flash for 7 seconds.
- Both LEDs then remain continuously lit.
- Disconnect the Factory default input from GND.

After the procedure, all device settings, including communication parameters, operating mode, timing parameters and stored card UIDs, are restored to their factory default values.

12. Operating environment

The device is intended for operation in a Pollution Degree 2 environment, at altitudes up to 2000 meters above sea level.

When the device is integrated into a larger system, all other system components must comply with applicable EMC (Electromagnetic Compatibility) requirements and be suitable for operation under the same environmental conditions.

13. Safety precautions

The device must not be used for medical, life-support, or life-saving applications, or in any system where a failure of the device could result in serious injury or loss of life.

To reduce the risk of fire, only flexible stranded conductors with a minimum cross-sectional area of 0.5 mm^2 must be used for wiring.

To prevent electric shock and fire hazards, the device must not be exposed to liquids, rain, or excessive moisture. Objects containing liquids must not be placed on or near the device.

Ensure adequate ventilation around the device. Failure to maintain the recommended free space around the device may result in overheating and potential damage. Sufficient space must also be provided to allow safe connection and disconnection of cables.

The device must be operated strictly within the limits specified in this documentation. Operation outside the specified conditions may impair the protection provided by the device and lead to unreliable operation.

Teracom OOD does not guarantee correct operation of the product if it is used under conditions that differ from those specified by the manufacturer. In no event shall Teracom OOD be held responsible or liable for indirect or consequential damages resulting from the use or application of this product.

14. Maintenance

The device does not require routine maintenance during normal operation.

Periodically inspect the device to ensure that it is in good operating condition, that all electrical connections are secure, and that there are no signs of mechanical damage.

Clean the device using a dry cloth only. Do not use liquid or aerosol cleaners. Magnetic or electrostatic cleaning devices, as well as abrasive materials, must not be used.

Following these maintenance guidelines helps ensure reliable operation and extends the service life of the device.

15. Disposal and recycling

Please recycle all applicable materials in accordance with local regulations.



Do not dispose of the device as regular household waste.

Electronic components should be properly recycled to minimize environmental impact.