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HARTING Ha-VIS RFID RF-R400

Assembly Manual

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Contents

1. About this manual

1.1 Subject

This book describes the assembly of the RFID reader Ha-VIS RF-R400 from HARTING.

The instructions given in this manual are based on advantageous boundary conditions.

HARTING does not give any guarantee promise for perfect function in cross environments and does not give any guaranty for the functionality of the complete system which incorporates the subject of this document.

HARTING call explicit attention that devices which are subject of this document are not designed with components and testing methods for a level of reliability suitable for use in or in connection with surgical implants or as critical components in any life support systems whose failure to perform can reasonably be expected to cause significant injury to a human. To avoid damage, injury, or death, the user or application designer must take reasonably prudent steps to protect against system failures.

Using the devices described in this document in the transportation market, the rights of third parties may be injured. HARTING can give no warranty that the rights of third parties are not infringed by the use of the devices. If you plan such usage, please contact us at HARTING, to clarify potential patent or intellectual property rights issues.

HARTING assumes no responsibility for the use of any information contained in this manual and makes no representation that they free of patent infringement. HARTING does not convey any license under its patent rights nor the rights of others.

1.2 Audience

This book is intended for application developers who want to develop applications with Ha-VIS RF-R400.

1.3 Before you begin

☞ **Attention**

Additional software is needed:

For configuration and upgrade purpose, you need to download additional software. You will find in our eCatalogue (https://b2b.harting.com), section RFID, the Ha-VIS RF-R400. At this product page, you could download a software-ZIP file, which is including the newest Firmware, the Ha-VIS RFID Config Tool and the Ha-VIS RFID Update Wizard.

With the Ha-VIS RFID Config Tool you could configure the overall reader and do the first tests of your RFID system

This book assumes familiarity with RFID.

1.4 Ha-VIS RFID documentation

This book is part of the Ha-VIS RFID documentation set. Visit http://www.HARTING-RFID.com to obtain the latest version of the Ha-VIS RFID documentation and additional information and resources.

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1.5 Safety instructions / warnings - read before start-up!

- The device may only be used for the purpose intended by the manufacturer

- When installing the device in areas covered under US 47 CFR Part 15 a minimum distance of 25 cm between antenna and the human body must be maintained.

- The operation manual should be kept readily available at all times for each user.

- Unauthorised changes and the use of spare parts and additional devices which have not been sold or recommended by the manufacturer may cause fire, electric shocks or injuries. Such unauthorised measures shall exclude the manufacturer from any liability.

- The liability-prescriptions of the manufacturer in the issue valid at the time of purchase are valid for the device. The manufacturer shall not be held legally responsible for inaccuracies, errors, or omissions in the manual or automatically set parameters for a device or for an incorrect application of a device.

- Repairs may only be undertaken by the manufacturer.

- Installation, operation, and maintenance procedures should only be carried out by qualified personnel.

- Use of the device and its installation must be in accordance with national legal requirements and local electrical codes.

- When working on devices the valid safety regulations must be observed.

- This device is not suitable to be used in places where children are present. Prevent children access to device.

- Equipment is intended for use only in restricted access area.

WARNING

Special advice for wearers of cardiac pacemakers:
Although this device doesn't exceed the valid limits for electromagnetic fields you should keep a minimum distance of 25 cm between the device and your cardiac pacemaker and not stay in the immediate proximity of the device's antenna for any length of time.
The Ha-VIS RF-R400 must only be operated with the approved frequency adjustment of the respective country of deployment.

Observe before beginning with installation procedures

- In accordance with EN 50 110-1 /-2 (VDE 0105 Part 100), qualified personnel only are allowed to carry out transport, installation, commissioning and maintenance tasks. Guidelines contained in IEC 60 364 and HD 384 (DIN VDE 0100) as well as national accident prevention regulations must be adhered to.

- Install connection and signal wires ensuring that the bus communication is not impaired by inductive or capacitive interferences.

- The electrical installation must be carried out in accordance with the relevant regulations and standards (protective earth connection, wire cross-sections and so forth).

- Ensure correct polarity when connecting the supply.

2. Performance features of reader family Ha-VIS RF-R400

2.1 Performance features

The reader has been developed for reading passive data carriers, using an operating frequency in the UHF range. The output power is configurable in the range between 0.1 Watt and 2 Watts. This allows read ranges of up to 12 m.

2.2 Available reader types

The following readers are available:

Part Number	Reader type	Description
20911071101	Ha-VIS RF-R400-EU	Device version for Europe
20911071102	Ha-VIS RF-R400-US	Device version for North America (and Asia)

Table 2-1: Available reader Types

Ha-VIS RFID RF-R400 – Assembly Manual

3. Installation

☞

Attention

Additional software is needed:

For configuration and upgrade purpose, you need to download additional software. You will find in our eCatalogue (https://b2b.harting.com), section RFID, the Ha-VIS RF-R400. At this product page, you could download a software-ZIP file, which is including the newest Firmware, the Ha-VIS RFID Config Tool and the Ha-VIS RFID Update Wizard.

With the Ha-VIS RFID Config Tool you could configure the overall reader and do the first tests of your RFID system

The reader is designed for wall-mount, including outdoors. Outdoors the reader should be mounted like shown in the picture below to ensure the watertightness of the device.

Holes for mounting on a wall with countersunk head screws are provided in the enclosure. The maximum head screw diameter should not exceed 8.0 mm. The thread diameter is 5.3 mm (M5 screws). The screws must have a minimum length of 45 mm depending on the installation situation. It is not necessary to open the reader enclosure for installation.
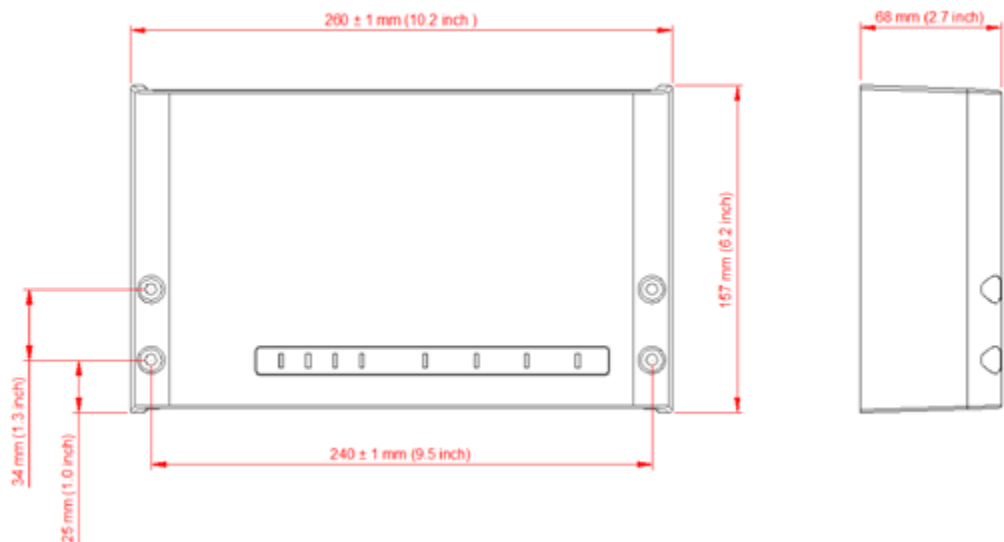

Figure 3-1: Installation drawing

4. Terminals

On the lower side of the reader enclosure different connectors are positioned. Figure 2 shows the arrangement of the connectors and table 4-1 "Connection terminals" gives an overview of the available interfaces and signals. Table 4-2 "Push button function" shows the available push buttons.

Figure 4-1: Connection overview

Connector	Description
ANT 1-4	Connection for external antennas (input impedance 50 Ω)
LAN	10/100Tbase network connection with M12
VCC	Power supply 24V DC ± 20%
USB	USB Mini Interface
IO	Digital inputs and digital output
RS232 RELAY	Relay output and RS232 interface

Table 4-1: Connection terminals

Push button	Description
T1	Internal push button for complete configuration reset

Table 4-2: Push button function

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4.1 Antenna connection

The external SMA antenna connectors are positioned on the lower side of the reader.

The maximum tightening torque for the SMA sockets is 0.45 Nm (4.0 lbf in).

CAUTION

Exceeding the tightening torque will destroy the plug:

For supplying a DC voltage to external components, it is possible to enable a 24 V DC / max. 500 mA on the antenna cable. This needs to be configured in the reader.

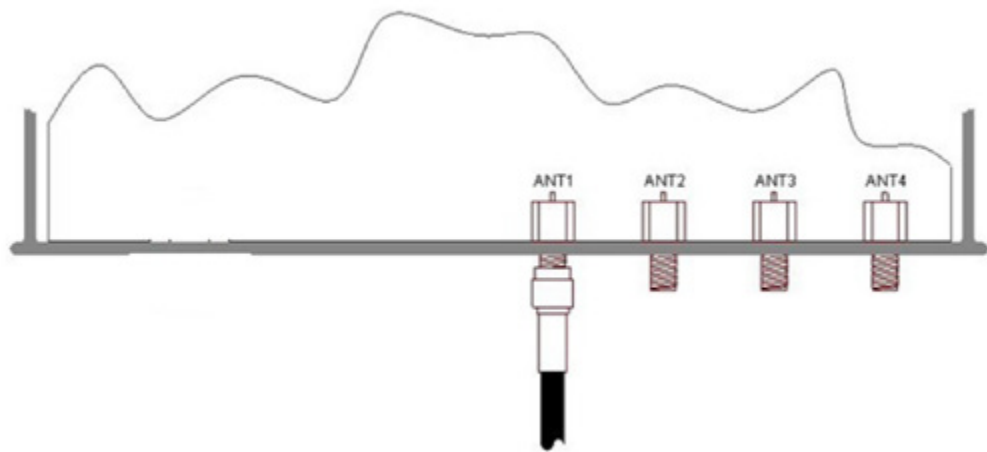| Terminal	Description
ANT 1-4	Connection of the external antennas (Impedance 50 Ω)

Table 4-3: External antenna connection

Figure 4-2: External antenna connection ANT1-4

Note

The activation of the DC voltage on the antenna cable can damage the antennas. Please do not activate the DC output power if an antenna is connected to the antenna port.

4.2 Power supply

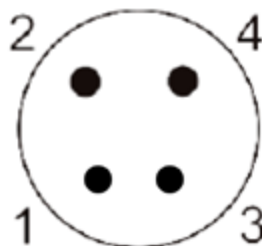The supply voltage of 24 V DC has to be connected to Terminal VCC.

Figure 4-3: Connector X2 Pin assignment for power supply

Terminal	Abbreviation	Description
VCC / Pin 1	VDC	Supply voltage 24 V DC ±20%
VCC / Pin 2	VDC	Supply voltage 24 V DC ±20%
VDC / Pin 3	GND	Ground – supply voltage
VDC / Pin 4	GND	Ground – supply voltage

Table 4-4: Pin assignment for power supply

CAUTION

The reader has to be supplied by a limited power supply according IEC EN 62368-1 Chapter Q, or with a NEC Class 2/LPS certified power supply.
Each reader has to be supplied by a separate external power supply.
Both VDC pins (pin 1 and pin 2) and both GND (pin 3 and pin 4) should be used in parallel.
Reversing the polarity of the supply voltage on VCC may destroy the device.

External wiring for the power supply must fulfil the following norms / validation procedure:

Conductor cross-section	Validation procedure
from 0.5 mm^2 or bigger	IEC 60332-1-2 and IEC 60332-1-3
smaller than 0.5 mm^2	IEC 60332-2-1 and IEC 60332-2-2

4.3 Interfaces

4.3.1   Ethernet interface on connector LAN

The reader has an integrated 10 / 100 base-T network port for an d-coded M12. Connection is made on LAN and has an automatic "Crossover Detection" according to the 100BASE-T Standard.

With structured cabling STP Cat. 5 cables should be used. This ensures a reliable operation at 10 Mbps or 100 Mbps.

The prerequisite for using TCP/IP protocol is that each device has a unique IP address on the network. All readers have a factory set IP address.

Network	Address
IP address	192.168.10.10
Subnet mask	255.255.0.0
Port	10001
DHCP	OFF

Table 4-5: Standard factory configuration of the Ethernet connection

☞ **Note**

The reader is equipped with a DHCP ready Ethernet Interface.

4.3.2   USB Mini interface on connector USB

The reader is equipped with a USB on-the-go interface. This can either be used to connect the reader to a host system or by means of a special on-the-go adaptor for connection of a USB memory stick to the reader. In both cases the connection is carried out via terminal USB. The pinout is standardised.

Figure 4-4: USB interface for host communication

A standard shielded USB-cable can be used for connection of the reader to a host system. The data rate is reduced to 12 Mbit (USB full speed).

☞ **Note**

The length of the USB-cable can have a max. of 5 m (20 inch). It is not allowed to use longer cables.

4.3.2.1 USB stick service-functions

Via an optionally available USB on-the-go adapter, the interface can be converted to a USB host interface. The adapter allows the connection of a USB memory stick to the reader. By means of the USB stick various service functions can be carried out e.g. the read-out of log and service files and uploading of a configuration file.

Figure 4-5: USB on-the-go adapter

4.3.2.2 Reading of log- and service-data

After plug-in of the USB stick on the running Ha-VIS RF-R400 the reader will generate a subdirectory with the DeviceID of the connected reader (see reader label) and will store the Device information like firmware version and IP-address in the INFO.LOG file. If there exist already a file for the same reader device the log files will be updated with the current date and time.

Additionally the files ACTION.LOG and SERVICE.LOG will be generated for service purposes and stored on the USB stick. The function of the CONFIG.LOG will be described in the next chapter.

The green and red status LED of the Ha-VIS RF-R400 are permanently lit as long as the USB stick is actively used by the reader. When the USB actions are completed successfully, only the green status LED of the reader starts flashing. The USB stick can be removed after the red LED switch off. If the USB actions failed the red status LED remains lit permanently for about 2s.

☞ **Note**

After plug-in of the USB stick the status LEDs of the reader shall be monitored.
The USB stick shall only be removed from the reader if the USB actions have been completed and the stick is disabled.

4.3.2.3 Storing the reader configuration on a USB stick

While connecting the USB stick on a running reader, the reader will store the configuration file as an editable and readable CSV-file on the USB stick. This file will be stored in the main directory for easy coping the configuration (Copy the configuration onto the reader (config-cloning)). Additionally the same file will be stored in the subfolder with the according Device-ID (printed on the reader label). Thereby it is possible to store several configuration files on the same USB stick.

All not locked configuration pages including the interface parameter will be copied from the reader onto the USB stick.

After connecting the USB stick to a running reader the green and red LED will be continuously on. After the copy process has been finished the green LED will start flashing and the red LED goes off. After the red LED goes off the USB stick can be disconnected.

☞ **Note**

If there exists already a CSV-file on the main directory of the USB stick, the old file will be overwritten by the new configuration file.
CFG configuration pages which are protected by a password (see CFG0) will be not stored on the USB stick. No error message will appear.
After connecting the USB stick on the reader USB port, the reader LED's should be observed. The USB stick must not be removed while the copy process is still active!

4.3.2.4 Copy the configuration onto the reader (config-cloning)

In order to connecting the USB stick on the reader USB port and copy the configuration from the USB stick onto the reader, it is necessary to switch off the reader first.

After switching on the reader the boot process will look for a connected USB stick and will copy the CSV configuration file onto the reader EEPROM.

After the copy process has been finished the green LED will start flashing and the red LED goes off. After the red LED goes off the USB stick can be disconnected.

☞ **Note**

Connecting the USB stick on a running reader will always store the configuration on the USB stick and an old configuration file will be overwritten. See Storing the reader configuration on a USB stick RS232 Interface on connector RS232/RELAY

The RS232 interface is connected on RS232/RELAY. The transmission parameters can be configured by means of software protocol.
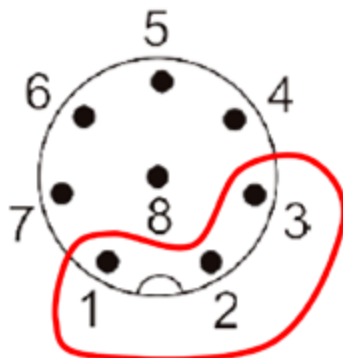

Figure 4-6: RS232 interface pin-outs on RS232/RELAY

Pin Number at connector RS232/RELAY	Pin assignment
1	RS232 – RxD
2	RS232 – TxD
3	GND

Table 4-6: Standard factory configuration of the Ethernet connection
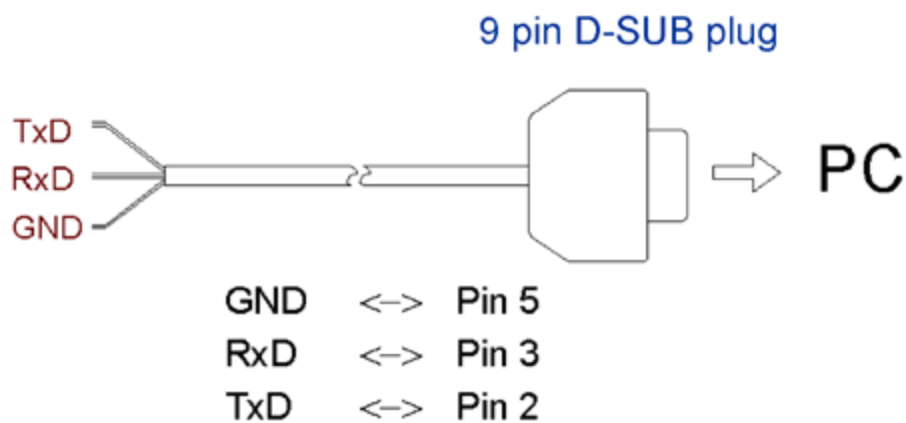
Figure 4-7: Wiring example for connecting the RS232 interface to a 9 pin D-SUB plug

4.4 Inputs and outputs

4.4.1 24 V DC voltage on connector RS232/RELAY

A 24 V DC voltage can be received on Pin 4 of connector RS232/RELAY. It can be used e.g. to drive the digital inputs and outputs of the reader.
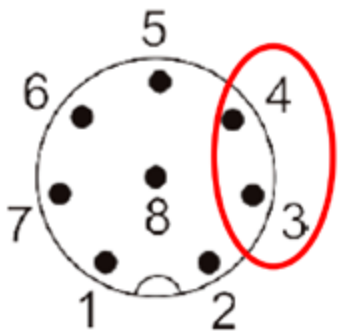

Figure 4-8: 24 V DC voltage

Pin Number at connector X4	Pin assignment
3	GND
4	24 V DC

Table 4-7: Pin assignment 24 V DC voltage

CAUTION
The maximum current is limited to 750 mA.

4.4.2   Digital inputs on connector IO

The optocouplers on terminal IO are galvanically isolated from the reader electronics and must therefore be externally supplied.
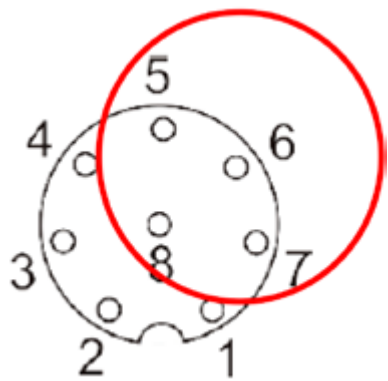

Figure 4-9: Optocoupler pin-outs IN1-2

Pin Number at connector X4	Pin assignment
5	IN1 -
6	IN1 +
7	IN2 -
8	IN2 +

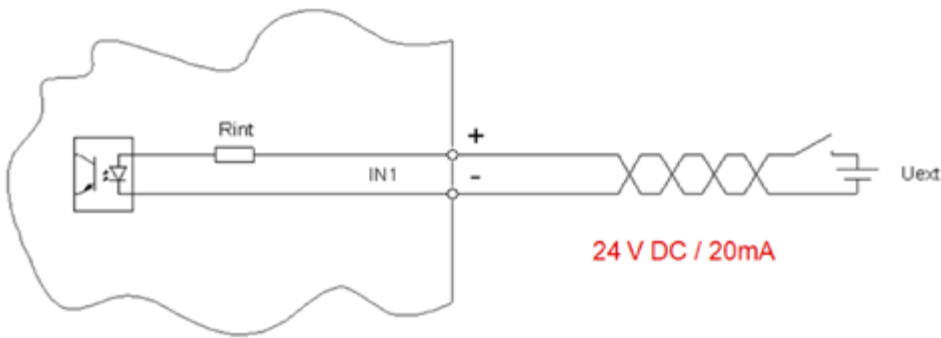Table 4-8: Pin assignment digital Inputs IN1-2

Figure 4-10: Internal and possible external wiring of the optocoupler pin-out IN1

Note

The inputs are configured for a maximum input voltage of 24 V DC and an input current of max. 20 mA.
Polarity reversal or overload on the input will destroy it.

4.4.3 Digital outputs on connector IO

The transistor connections, collector and emitter, of the optocoupler output are galvanically isolated from the reader electronics and are carried to the outside without any internal ancillary circuitry on terminal IO. The output must therefore be powered by an external power supply.
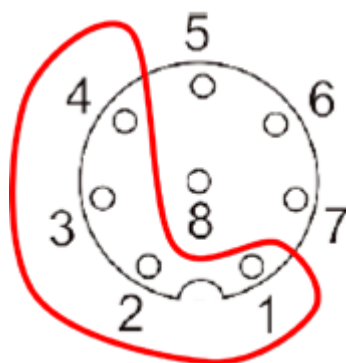

Figure 4-11: Optocoupler outputs OUT1-2

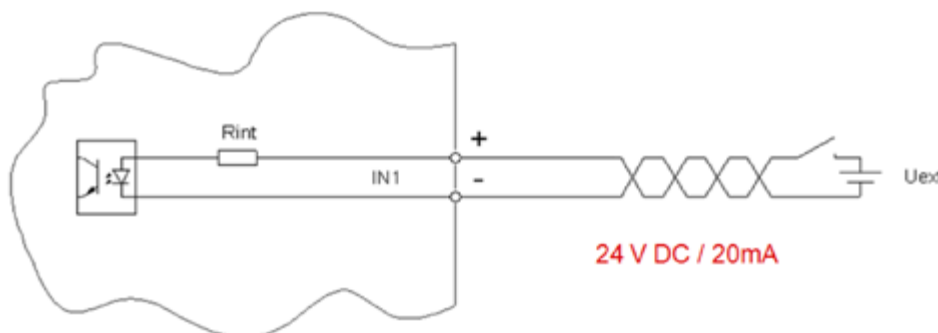| Pin Number at connector X4	Pin assignment
1	OUT1-E
2	OUT1-C
3	OUT2-E
4	OUT2-C

Table 4-9: Pin assignment digital output OUT1 / OUT2

Figure 4-12: Internal and possible external wiring of the optocoupler outputs OUT1-2

CAUTION

The output is configured for max. 24 V DC / 20 mA.
Polarity reversal or overload on the output will destroy it.
The output is intended for switching resistive loads only.

4.4.4 Relay output on connector RS232/RELAY

There are 2 relay outputs (normally open) available on connector RS232/RELAY.

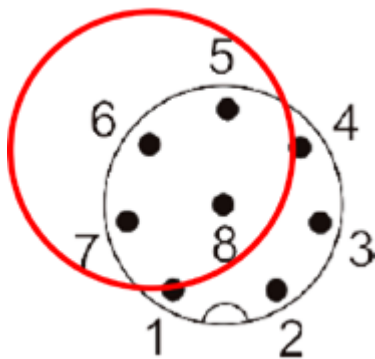*Figure 4-13: Relay output pin-outs REL1 and REL2*

Pin Number at connector X4	Pin assignment
5	REL1-NO
6	REL1-COM
7	REL2-NO
8	REL2-COM

Table 4-10: Pin assignment relay outputs REL1 and REL2

CAUTION

**The relay outputs are configured for max. 24 V DC / 2 A constant load.
The switching current must not exceed 1 A.
The relay outputs are intended for switching resistive loads only. If an inductive load
is connected, the relay contacts must be protected by means of an external protection
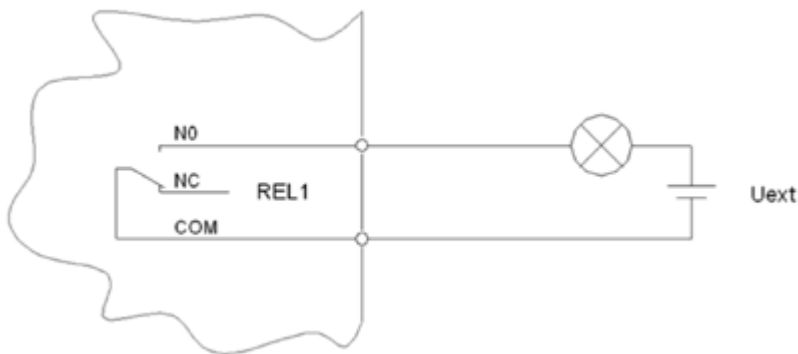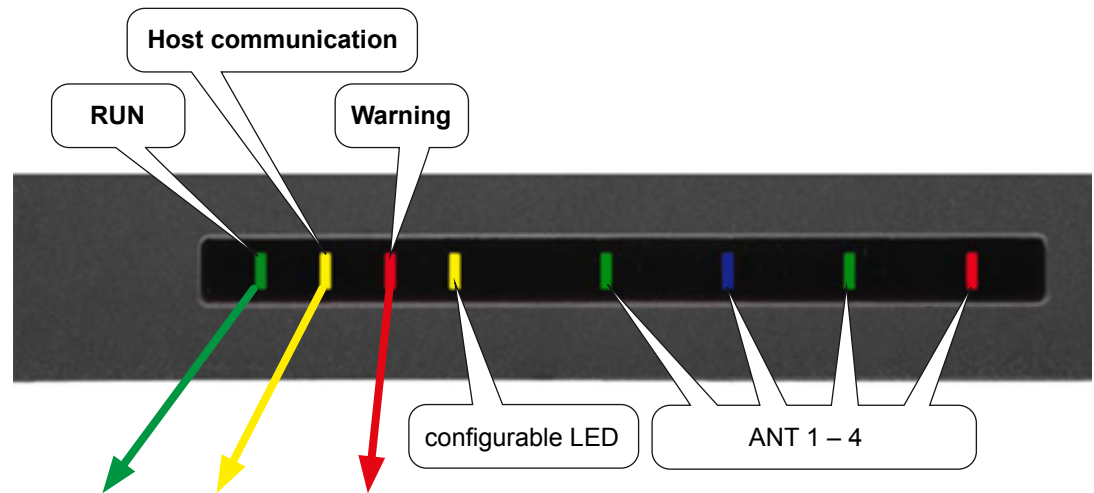circuit.**

Figure 4-14: Internal and possible external wiring of the relay output

5. Operating and display elements

5.1 Status LEDs

Green	Yellow	Red	Description
ON	OFF	ON	Boot sequence (ca.10s) after power on
FLASH	OFF	OFF	Normal reader operation (without host communication)
FLASH	FLASH	OFF	Reader receives a valid protocol from host
FLASH	OFF	ON	RF warning [0x84] (without host communication)
FLASH (alternating)	OFF	FLASH (alternating)	Firmware activation necessary [0x17] / Wrong firmware [0x18]
FLASH (synchronous)	OFF	FLASH (synchronous)	RFC Hardware error [0xF1]
OFF	FLASH (synchronous)	FLASH (synchronous)	Hardware warning (EEPROM error / RFC not detected)
Firmware update:			
FLASH	FLASH	FLASH	Firmware transfer from host to reader (Please do not switch off the reader or disconnect the interface cable)
	(light in sequence)		
Configuration reset:			
FLASH	FLASH	FLASH	While T1 is pushed and hold for maximal 5 s
	(light in sequence)		
ON	ON	ON	After T1 has been pushed and hold for 5 s. Configuration reset has been finished.
ANT 1 – 4:			
Green			HF power switched on
Blue			Tag-Detect
Red			Antenna impedance error (> 50 Ω or < 50 Ω)

Table 5-1: Configuration of the LEDs

5.2 Reset push button T1

Figure 5-1 shows the position of the reset push button T1.

The push button T1 is positioned in the middle between the antenna connectors ANT3 and ANT4. It is located inside the reader enclosure. With the push button T1 a complete reset of the reader configuration to factory default can be performed. To press the reset button T1 you should use a paper clip. To reset the reader back to factory default push it for at least 5 s until the 3 status LED's (left side) are switched on continuously, see Status LEDs, Table 5-1: Configuration of the LEDs"
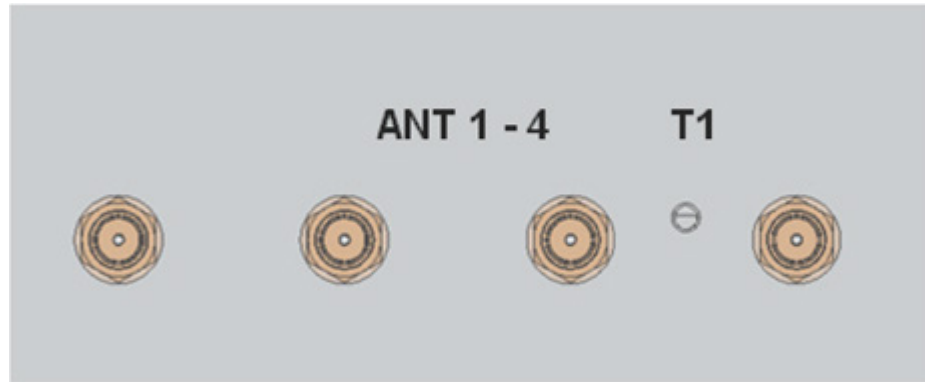

Figure 5-1: Position of the reset button T1

To finish the hardware configuration reset a reboot of the reader is mandatory. This can either be performed by plugging off the power supply or by sending the command System Reset [0x64] in Mode [0x00] RF-Controller to the reader.
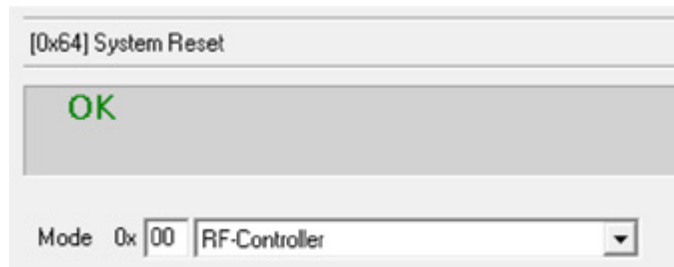

Figure 5-2: System Reset [0x64]

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5.3 Reader power adjustment

To achieve the optimum reading performance it is necessary to set the reader output power to the highest allowed value. This depends on the used reader type (EU / FCC) and the regulation in the country were the reader is used.

5.3.1 EU-Reader according to EN302 208

According to the standard EN 302 208 the maximum radiated power is 2 W e.r.p. (Effective Radiated Power) in countries of the European Union. The in the reader configured output power Pout depends on the antenna gain in dBi and the attenuation of the antenna cable. If a circular polarised antenna is used the antenna gain [dBic] can be reduced by 3 dB. At a linearly polarised antenna the maximum linear antenna gain [dBi] must be used.

$$P_{Out} = P_{erp} - \text{Antenna Gain} + \text{Cable loss} + 2{,}1\ dB^{**}$$

** Correction Factor to convert the radiated power from e.r.p to e.i.r.p.

For the calculation of the reader output power P_{Out} an Excel file „Calc-RF-Power.xls" can be used. Available from HARTING.

5.3.2 FCC-Reader according to FCC 47 Part 15

According to the FCC approval, Title 47, Part 15 the maximum output power of the reader is limited to 1 W (30 dBm). The maximum radiated power of the antenna should not increase more than 4 W e.i.r.p. Due to these fact the antenna Ha-VIS RF-ANT WR80-30 (8 dBi) must be used with at least 8 m of cable type Belden H155 (0.27 dB/m) or at least 10 m cable of type RG213 (0.22 dB/m).

Atenna Type	Permitted Cable
Ha-VIS RF-ANT WR80-30-US	Min. 8 m of cable type Belden H155 (0.27 dB/m) or min. 10 m cable of type RG213 (0.22 dB/m)
Ha-VIS RF-ANT WR30-US	-/-
Ha-VIS RF-ANT WR24-t-US	-/-
Ha-VIS RF-ANT MR20-US	-/-
Ha-VIS RF-ANT LR10	-/-
Ha-VIS LOCFIELD®	-/-

6. Radio approvals

6.1 Europe (CE)

Hereby, HARTING IT Software Development GmbH & Co. KG declares that the radio equipment type Ha-VIS RF-R400 is in compliance with Directive 2014/53/EU.

Performance Classification according to ETSI EN 301 489: Class 2

6.2 USA (FCC) and Canada (IC)

6.2.1 USA (FCC) and Canada (IC) warning notices

Product name:	**Ha-VIS RF-R400-US**
FCC ID:	**Z4NRF-R400**
IC:	**9941A-RFR400**

Notice for USA and Canada

This device complies with Part 15 of the FCC Rules and with

RSS-210 of Industry Canada.

Operation is subject to the following two conditions.

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received,

including interference that may cause undesired operation.

Unauthorised modifications may void the authority granted under Federal communications Commission Rules permitting the operation of this device.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

⚠️ **WARNING**

Changes or modification made to this equipment not expressly approved by HARTING IT Software Development GmbH & Co. KG may void the FCC authorization to operate this equipment.

6.2.2 Label information

The following information must be placed at the outer side of the enclosure in which the reader is mounted.

Contains FCC ID: Z4NRF-R400
Contains IC: 9941A-RFR400

6.2.3 Installation with FCC / IC Approval

FCC-/IC-NOTICE: To comply with FCC Part 15 Rules in the United States / with IC Radio Standards in Canada, the system must be professionally installed to ensure compliance with the Part 15 certification / IC certification. It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States / Canada.

6.2.4 USA (FCC) and Canada (IC) approved antennas

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with maximum permission gain and required antenna impedance for each antenna type indicated. Antenna types, not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

The antennas used for this transmitter must be installed to provide a separation distance of at least 34 cm from all persons and must not be located or operating in conjunction with any other antenna or transmitter, except as listed for this product's certification.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne 'énoncé ci-dessus et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Les antennes utilisées pour cet émetteur doivent être installées pour fournir une distance de séparation d'au moins 34 cm de toutes les personnes et ne doivent pas être situées ou opérer en conjonction avec une autre antenne ou un autre émetteur, sauf dans les cas énumérés à la certification de ce produit.

Following antennas are approved by FCC according FCC Part 15 and IC Canada according RS210

- Ha-VIS RF-ANT WR30-US (5.5 dBi)

- Ha-VIS RF-ANT WR80-30-US (8 dBi)

- Ha-VIS RF-ANT MR20-US (-0.5 dBi)

- Ha-VIS RF-ANT LR10

- Ha-VIS RF-ANT WR24-t-US (5 dBi)

- Ha-VIS LOCFIELD®

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