RAD-DO8-IFS



I/O extension module, eight digital transistor outputs

Data sheet
105364_en_06

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1 Description

The **RAD-DO8-IFS** I/O extension module can be used in conjunction with Radioline front modules. In a station structure, you can connect up to 32 I/O extension modules to a front module via the DIN rail connector.

The **RAD-DO8-IFS** digital I/O extension module is used for processing eight digital signals that are switched using transistor outputs.

Features

- Easy startup via thumbwheel
- Channel-to-channel electrical isolation
- Extended temperature range of -40 °C … +70 °C
- Easy module replacement even during operation (hot swap)
- 8 transistor outputs (30.5 V DC/200 mA)
- Approved for use in zone 2
- DIP switches for Hold or Reset behavior of outputs

Observe these notes

WARNING: Explosion hazard when used in potentially explosive areas

The device is a category 3 item of electrical equipment. Follow the instructions provided here during installation and observe the safety notes.

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.com/product/2902811

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3 Ordering data

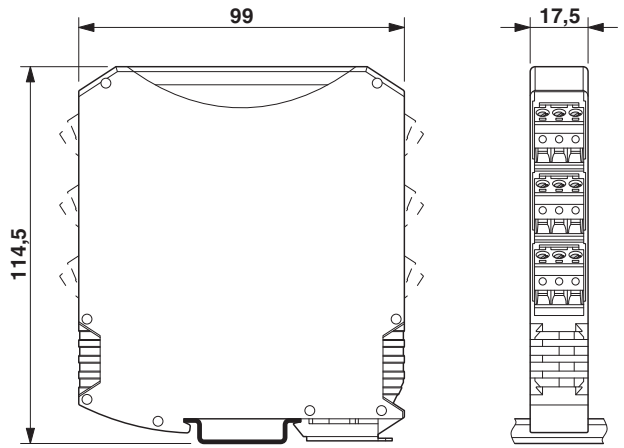
Description	Type	Item no.	Pcs./Pkt.
Radioline - I/O extension module, 8 digital transistor outputs (30.5 V DC/200 mA)	RAD-DO8-IFS	2902811	1

Set components	Type	Item no.	Pcs./Pkt.
DIN rail bus connector, color: light gray, nominal current: 8 A (parallel contacts), rated voltage (III/2): 125 V, number of positions: 5, product range: TBUS5-17,5.., pitch: 3.81 mm, mounting: DIN rail mounting, locking: without, mounting method: without, type of packaging: packed in cardboard, Item with gold-plated contacts, bus connectors for connecting with electronics housings, 5 parallel contacts	ME 17,5 TBUS 1,5/ 5-ST-3,81 KMGY	2713645	50

Accessories	Type	Item no.	Pcs./Pkt.
Radioline - I/O extension module, 8 digital inputs (0 ... 30.5 V DC) or 2 pulse inputs up to 100 Hz	RAD-DI8-IFS	2901539	1
Radioline - 2.4 GHz wireless transceiver with RS-232/ RS-485 interface, can be extended with I/O modules, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 250 stations, range of up to 5 km (with a clear line of sight), for worldwide use	RAD-2400-IFS	2901541	1
Radioline - 900 MHz wireless transceiver with RS-232/ 485 interface, can be extended with I/O modules, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 250 stations, range of up to 32 km (line of sight), use in North America	RAD-900-IFS	2901540	1
Radioline - 868 MHz wireless transceiver with RS-232/ RS-485 interface, can be extended with I/O modules, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 99 stations, range of up to 20 km (with a clear line of sight), for use in Europe	RAD-868-IFS	2904909	1
Radioline - RS-485 multipoint multiplexer, can be extended with I/O modules, can be used as Modbus/RTU bus coupler or can be combined with Radioline wireless system, up to 99 stations, range of up to 1.2 km on in-house copper cables	RAD-RS485-IFS	2702184	1
Radioline - 2.4 GHz wireless transceiver with RS-232/ RS-485 interface, can be extended with I/O modules, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 250 stations, range of up to 5 km (with a clear line of sight), for use in Japan	RAD-2400-IFS-JP	2702863	1
Radioline - 900 MHz wireless transceiver with RS-232/ 485 interface, can be extended with I/O modules, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 250 stations, range of up to 32 km (line of sight), for use in Australia.	RAD-900-IFS-AU	2702878	1

4 Technical data

Dimensions



Dimensions W/H/D	17.5 mm / 113 mm / 114.5 mm

General data

Overvoltage category	II
Mounting position	any, on standard DIN rail NS 35 in accordance with EN 60715
Degree of protection	IP20
Degree of pollution	2
Material	
Housing	PA 6.6-FR
Color	
Housing	gray (7042)
Flammability rating according to UL 94	V0

MTTF (mean time to failure)

SN 29500 standard, temperature 25°C, operating cycle 21%	1594 Years
SN 29500 standard, temperature 40°C, operating cycle 34.25%	600 Years
SN 29500 standard, temperature 40°C, operating cycle 100%	230 Years

Supply	
Supply voltage range	19.2 V DC ... 30.5 V DC (DIN rail bus connector)
Max. current consumption	≤ 22 mA (at 24 V DC, at 25°C)
Transient surge protection	yes
Transistor output, active	
Number of outputs	8
Contact switching type	Transistor
Maximum switching voltage	30.5 V DC
Minimum switching voltage	12 V DC
Max. switching current	0.2 A (per channel)
Supply voltage range	12 V DC ... 30.5 V DC (for digital outputs)
Maximum switching frequency	10 Hz
Behavior of the outputs (adjustable via DIP switch)	Hold / Reset
Electrical isolation	
Digital I/O	50 V (Rated insulation voltage, in each case between channel groups 1...4 and 5...8 / TBUS supply, reinforced insulation in accordance with EN 61010)
	300 V (Rated insulation voltage, to adjacent devices, basic insulation in accordance with EN/IEC 61010)
Rated insulation voltage	60 V (in accordance with EN/IEC 60079-7)
Test voltage	
Digital I/O	1.5 kV AC (50 Hz, 1 min.)
Connection data	
Connection method	Screw connection
Conductor cross-section, rigid	0.2 mm² ... 2.5 mm²
Conductor cross-section, flexible	0.2 mm² ... 2.5 mm²
Conductor cross-section AWG/kcmil	24 ... 14
Stripping length	7 mm
Tightening torque	0.5 Nm ... 0.6 Nm 5 lb_f-in. ... 7 lb_f-in.
Status indication	
Status display	LED supply voltage, PWR (green) Green LED (bus communication, DAT) LED periphery error, ERR (red) Yellow LED (digital output, DO1) Yellow LED (digital output, DO2) Yellow LED (digital output, DO3) Yellow LED (digital output, DO4) Yellow LED (digital output, DO5) Yellow LED (digital output, DO6) Yellow LED (digital output, DO7) Yellow LED (digital output, DO8)

Ambient conditions	
Ambient temperature (operation)	-40 °C ... 70 °C -40 °F ... 158 °F
Ambient temperature (storage/transport)	-40 °C ... 85 °C -40 °F ... 185 °F
Permissible humidity (operation)	20 % ... 85 %
Permissible humidity (storage/transport)	20 % ... 85 %
Altitude	2000 m
Vibration (operation)	in accordance with IEC 60068-2-6: 5g, 10 Hz ... 150 Hz
Shock	16g, 11 ms
Conformance/Approvals	
CE	CE-compliant
ATEX	Ⓔx II 3 G Ex ec IIC T4 Gc IBExU 15 ATEX B008 X Please follow the special installation instructions in the documentation!
IECEx	Ex ec IIC T4 Gc IECEx IBE 13.0019X
UL, USA/Canada	508 Listed Class I, Div. 2, Groups A, B, C, D T4A Class I, Zone 2, IIC T4
CCC / China-Ex	Ex ec IIC T4 Gc 2022122310115625
Corrosive gas test	ISA-S71.04-1985 G3 Harsh Group A
Conformance	
EMC directive 2014/30/EU	EN 61000-6-2; EN 61000-6-4
Ex directive (ATEX)	EN 60079-0; EN 60079-15

5 Safety regulations and installation notes

WARNING: Risk of electric shock

– Provide a switch/circuit breaker close to the device, which is labeled as the disconnect device for this device or the entire control cabinet.
– Disconnect the device from all power sources during maintenance work and configuration (the device can remain connected to SELV or PELV circuits).
– The housing of the device provides a basic insulation against the neighboring devices, for 300 V eff. If several devices are installed next to each other, this has to be taken into account, and additional insulation has to be installed if necessary. If the neighboring device is equipped with basic insulation, no additional insulation is necessary.

5.1 Installation notes

WARNING:

Observe the following safety notes when using the device.

- The category 3 device is designed for installation in zone 2 potentially explosive areas.
- The device satisfies the requirements of the following standards:

– EN/IEC 60079-0, EN/IEC 60079-7
– Comprehensive details are to be found in the EU Declaration of Conformity which is enclosed and also available on our website in the latest version.

- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed. The safety-relevant data is listed in this document.
- Observe the specified conditions for use in potentially explosive areas! Also observe the requirements of EN 60079-14.
- The device must not be opened or modified. Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
- Do not subject the product to mechanical and/or thermal stress that exceeds the specified limits.
- To protect the device against mechanical or electrical damage, install it in a suitable housing with appropriate degree of protection as per IEC 60529.

5.2 Installation in Zone 2

WARNING: Explosion hazard when used in potentially explosive areas
Please make sure that the following notes and instructions are observed.

- The device should be installed so that at least IP54 degree of protection is achieved in accordance with EN 60529. To this end, a suitable, approved housing that meets the requirements of EN 60079-7 should be used.
- CCC approval: Install the device in suitable approved housing (with at least IP54 degree of protection) that meets the requirements of GB 3836.1-2010. Use the device in an environment that does not exceed pollution degree 2 in accordance with GB/T 16935.1-2008.
- Only devices that are designed for operation in Ex Zone 2 and the conditions at the installation location may be connected to the circuits in Zone 2.
- In potentially explosive areas, only snap the device onto or off of the DIN rail connector and connect and disconnect cables and connectors when the power is disconnected.
- For safe operation, lockable plug connections must have a functional interlock (e. g. locking clip, screw connection etc.). Insert the interlock. Repair any damaged connectors immediately.
- Only operate the device in Ex zone 2 when all plugs are fully inserted.
- Only connect one cable per terminal point.
- Use the device in an environment that does not exceed pollution degree 2 in accordance with EN/IEC 60664-1.
- Use transient protection so that short-term surge voltages do not exceed 119 V.
- The switches of the device that can be accessed may only be actuated when the power supply to the device is disconnected.
- The device must be stopped and immediately removed from the Ex area if it is damaged, was subject to an impermissible load, stored incorrectly or if it malfunctions.
- The product is not designed for use in potentially dust-explosive atmospheres.

5.3 UL notes

WARNING: Explosion hazard when used in potentially explosive areas
Please make sure that the following notes and instructions are observed.

INDUSTRIAL CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 45FP

A) This equipment is suitable for use in Class I, Zone 2, IIC T4 and Class I, Division 2, Groups A, B, C,D T4A hazardous locations or non-hazardous locations only.
B) WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
C) WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.
D) These devices are open-type devices that are to be installed in an enclosure suitable for the environment that is only accessible with the use of a tool.
E) WARNING - Exposure to some chemicals may degrade the sealing properties of materials used in relays within this device.

6 Installation

NOTE: Electrostatic discharge!

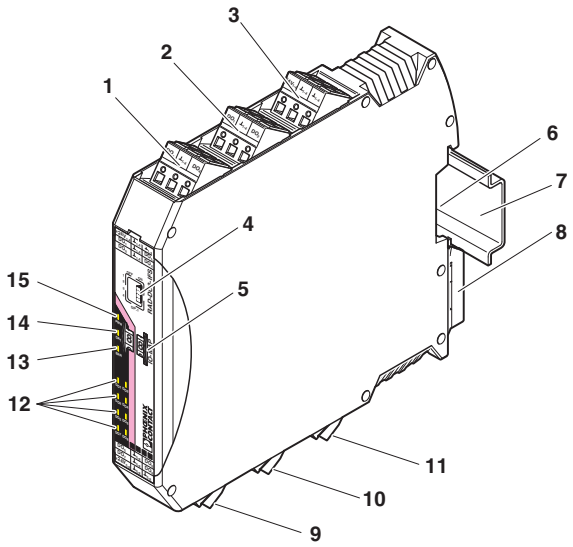
Electrostatic discharge can damage or destroy components.

– When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

6.1 Product description

The product can be snapped onto all 35 mm DIN rails in accordance with EN/IEC 60715. The ME17,5 TBUS 1,5/5-ST-3,81 GN DIN rail connector bridges the supply voltage and supports communication with up to 32 different I/O extension modules.

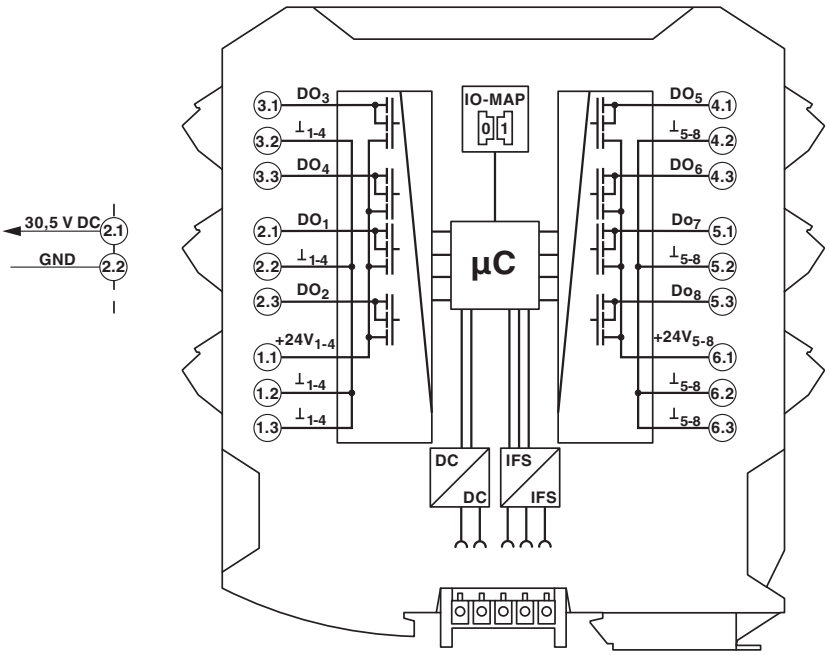
Figure 1 Function elements



Pos.	Terminal block	Designation
1	3.1 / 3.2 / 3.3	Transistor outputs 3 + 4
2	2.1 / 2.2 / 2.3	Transistor outputs 1 + 2
3	1.1 / 1.2 / 1.3	Supply voltage for outputs 1 ... 4
4	DIP switches for configuring the output behavior (hold/reset) of the transistor outputs	
5	White thumbwheel for setting the I/O-MAP address	
6	Connection option for DIN rail connector	
7	DIN rail	
8	Metal foot catch for DIN rail fixing	
9	4.1 / 4.2 / 4.3	Transistor outputs 5 + 6
10	5.1 / 5.2 / 5.3	Transistor outputs 7 + 8
11	6.1 / 6.2 / 6.3	Supply voltage for outputs 5 ... 8
12	Status LEDs of transistor outputs DO1 ... DO8	
13	ERR status LED, red (communication error)	
14	DAT status LED, green (bus communication)	
15	PWR status LED, green (supply voltage)	

6.2 Basic circuit diagram

Figure 2 Basic circuit diagram



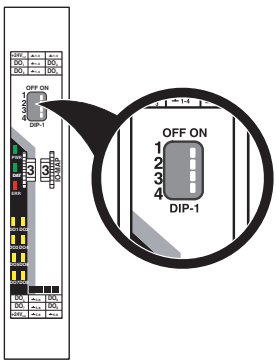
6.3 Setting the DIP switches

The DIP switches on the front can be used to set the behavior of the outputs in the event of an error (e.g., interruption of the bus communication by interruption of the wireless connection).

For digital outputs DO1 ... DO4 and DO5 ... DO8 you can choose between:

– Reset
– Hold last valid state (Hold)

Figure 3 DIP switches



	DIP switch				
Output	**Configuration**	**1**	**2**	**3**	**4**
Digital OUT 1 ... 4	Reset	OFF		n. c.	n. c.
	Hold	ON		n. c.	n. c.
Digital OUT 5 ... 8	Reset		OFF	n. c.	n. c.
	Hold		ON	n. c.	n. c.
n. c. = not connected, DIP switches 3 + 4 have no function					

6.4 Network applications (operating mode)

You can set the network application of the wireless module with the PSI-CONF software. All Radioline wireless modules are set to I/O data mode (wire in/wire out) by default.

Wireless module in I/O data mode

In an I/O-to-I/O network, only the I/O signals of the connected analog and digital I/O extension modules are transmitted. Assign the inputs and outputs of the extension modules quickly using the white thumbwheel.

In this mode, the serial RS-232 and RS-485 interfaces on the wireless module are deactivated.

Wireless module in PLC/Modbus RTU mode

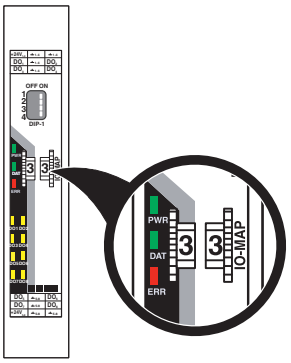
In PLC/Modbus RTU mode, the Radioline base station operates as a Modbus server. The Modbus client (PLC) controls all commands and initiates all data requests.

The input and output data is saved in a Modbus memory map in the Radioline base station.

In this mode, you can access process and diagnostic data for the individual network devices via a Modbus controller.

6.5 I/O MAP address in the Radioline wireless system

Figure 4 Thumbwheel



Use the thumbwheel to set the I/O MAP address. The extension module in the Radioline wireless system is addressed using the I/O MAP address.

Thumbwheel	Description
01 - 99	I/O MAP address
00	Delivery state
**, 1* - 9*, *1 - *9	Setting not permitted

Wireless module in I/O data mode

The output device must be provided with the same I/O MAP address as the assigned input device at the other wireless station (I/O mapping).

Output modules with the same I/O MAP address may appear several times in the network at different stations.

Example:	I/O MAP address
RAD-DO8-IFS	02
RAD-DI8-IFS	02

Only the RAD-DI8-IFS module can be assigned to the RAD-DO8-IFS module.

Wireless module in PLC/Modbus RTU mode

The I/O MAP address may only appear once in the network.

Exception: Output modules with the same I/O MAP address may appear several times in the network at different stations.

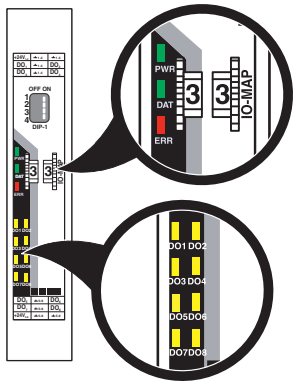
The output data is saved in a Modbus memory map in the Radioline base station.

You can read or write the process data via the serial interface of the Radioline base station (RAD ID = 01) using Modbus RTU commands (see Section 7).

6.6 Display and diagnostic elements

The I/O extension module uses a total of eleven LEDs to indicate the operating states.

Figure 5 Display and diagnostic elements



PWR-LED	
The green PWR LED indicates the supply voltage status.	
Off	no supply voltage
On	Supply voltage OK

DAT-LED	
The green DAT LED indicates the bus communication status.	
Off	No communication
Flashing	Configuration and addressing mode
On	Cyclic data communication

ERR-LED	
The red ERR LED indicates the error status, e.g., no corresponding output module found, incorrect addressing.	
Off	no error
Flashing	**Wireless module in I/O data mode** Missing input module, no bus communication
	Wireless module in PLC/Modbus RTU mode No Modbus communication, short circuit at one or more outputs
On	Critical internal error

Digital outputs	
The yellow DO1 ... DO8 LEDs indicate the state of the digital outputs.	
DO1 ... DO4	
Flashing	Short circuit at one output or several outputs 1 ... 4
DO5 ... DO8	
Flashing	Short circuit at one output or several outputs 5 ... 8

6.7 Digital outputs

The eight outputs are arranged in two groups of four outputs each with a common electrical supply.

The two output groups are electrically isolated from one another, from the supply voltage (via bus foot), and from other electronic components.

The digital outputs must be externally supplied.

Outputs DO1 ... DO4 are supplied using terminals 1.1 and 1.2/1.3.

Outputs DO5 ... DO8 are supplied using terminals 6.1 and 6.2/6.3.

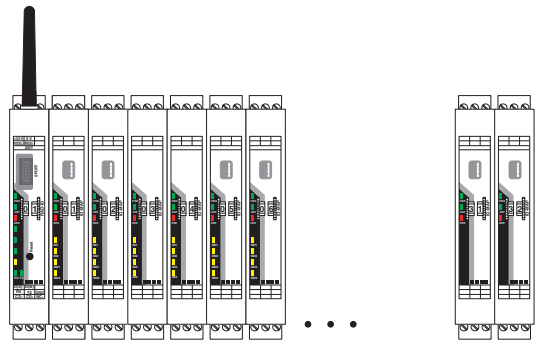
6.8 Mounting and removing

Joining station with I/O extension modules

Up to 32 different I/O extension modules can be connected to every wireless module via the DIN rail connector (see accessories). Data is transmitted and power is supplied to the I/O extension modules via the bus foot.

Only mount the I/O extension modules to the right of the wireless module.

Figure 6 Radioline joining station with up to 32 I/O extension modules

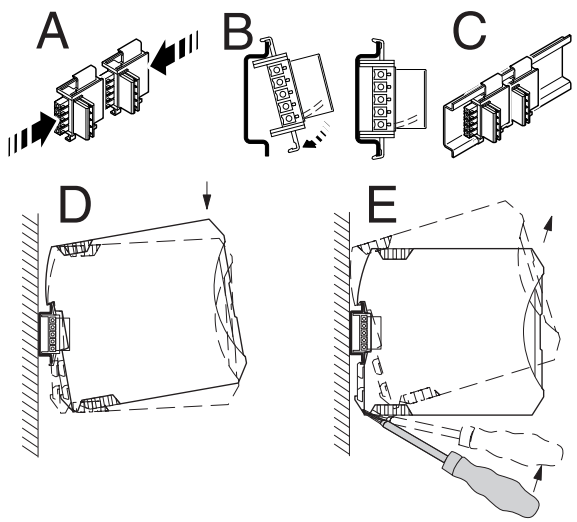


NOTE: device damage

Only connect Radioline devices and the QUINT4-SYS-PS/1AC/24DC/2.5/SC power supply together via the DIN rail connector.

Other devices may be damaged as the pin assignments differ.

Figure 7 Mounting and removing



Mounting

When using the device in a joining station, use the supplied 17.5 mm DIN rail connector. Only use the DIN rail connector in conjunction with 24 V DC devices.

Outside the Ex area, module extension or module replacement is also possible during operation.

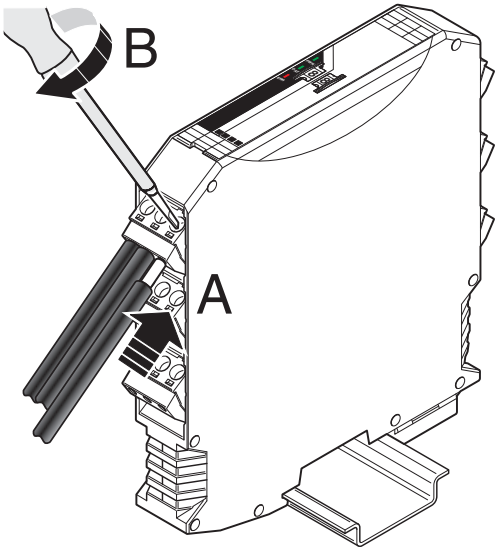
- Connect the DIN rail connectors together to form a joining station.
- Push the connected DIN rail connectors into the DIN rail.
- Place the device onto the DIN rail from above. Ensure the device and DIN rail connector are aligned correctly.
- Holding the device by the housing cover, carefully push the device towards the mounting surface so that the device bus connector is securely fixed onto the DIN rail connector.
- Once the snap-on foot has been audibly snapped onto the DIN rail, check that it is fixed securely. The device is only mechanically secured via the DIN rail.
- Connect the desired number of I/O extension modules to the wireless module via the DIN rail connector.
- In order to meet the requirements for the protection class, install the device in suitable housing.
- During startup, check that the device is operating, wired, and marked correctly.
- You can establish a connection between two DIN rail connectors using MINI COMBICON connectors.
  - MC 1,5/5-ST-3,81 (female, 1803604)
  - IMC 1,5/5-ST-3,81 (male, 1857919)

Removing

- Use a suitable screwdriver to release the locking mechanism on the snap-on foot of the device.
- Hold onto the device by the housing cover and carefully tilt it upwards.
- Carefully lift the device off the DIN rail connector and the DIN rail.

6.9 Connecting cables

Figure 8 Connecting cables



- Crimp ferrules to the wires.
  Permissible cable cross section: 0.2…2.5 mm².
- Insert the wire with ferrule into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.
  Tightening torque: 0.5 Nm … 0.6 Nm

7 Process data

You can read the process data via the serial interface of the Radioline base station (RAD ID = 01) using Modbus RTU commands.

With the PSI-CONF software, you can set the wireless module's network application to “PLC/Modbus RTU mode”.

I/O module	RAD-DO8-IFS	RAD-DO8-IFS
Module type	11_{hex}	11_{hex}
Number of registers	02_{hex}	02_{hex}
	Outputs	Short-circuit detection
Address range	40xx0 ... 40xx1	30xx0 ... 30xx1
Modbus function code	fc 03, 16	fc04

xx = I/O MAP address set using the white thumbwheel

30xx0, 40xx0	Module type and currentness of data															
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
							Y	Module type							

Register values:

Module type: If the module type in the register is invalid or unavailable, then the register value is 0

Currentness of data: Y = Currentness of data, bit 8

If the data in the register is not up-to-date, then the register value is 1.

If process data has been written to one of the registers, bit 8 in 40xx0 is set to 0. The value in register 40xx0 then remains 0 for the entire operating time of the device.

However, in register 30xx0 bit 8 is reset to 1 as soon as the status of short-circuit detection is not up-to-date.

This is the case, for example, if the wireless connection or communication with an input module fails. In this case, the IN process data is retained in the Modbus table, but is no longer updated.

30xx1	Short-circuit detection at the digital outputs															
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Reserved														X	X

Bit 0 = 1: short circuit at one output or several outputs 1 ... 4

Bit 1 = 1: short circuit at one output or several outputs 5 ... 8

30xx2 ... 30xx9	Reserved

40xx1	Digital outputs															
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Reserved								DO 8	DO 7	DO 6	DO 5	DO 4	DO 3	DO 2	DO 1
Terminal point															
								5.x		4.x		3.x		2.x	

40xx2 ... 40xx9	Reserved

8 Disposal



The symbol with the crossed-out trash can indicates that this item must be collected and disposed of separately. Phoenix Contact or our service partners will take the item back for free disposal. For information on the available disposal options, visit www.phoenixcontact.com.