

# RAD-DAIO6-IFS



I/O extension module, 1 analog input/output,  
2 digital wide-range inputs/outputs

Data sheet  
104832\_en\_02

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## 1 Description

The **RAD-DAIO6-IFS** I/O extension module can be used in conjunction with Radioline wireless modules and other Interface System (IFS) master devices. In a station structure, you can connect up to 32 I/O extension modules to a wireless module via the DIN rail connector.

The **RAD-DAIO6-IFS** analog/digital I/O extension module is used for processing two digital input/output signals, an analog input signal and an analog output signal.

### Features

- Easy and tool-free I/O mapping via thumb wheel on the front
- Modular design via TBUS DIN rail connector (hot-swap capable)
- Channel-to-channel electrical isolation
- 2 digital wide-range inputs/outputs (0 ... 250 V AC/DC)
- 1 analog input (alternatively 0/4 ... 20 mA)
- 1 analog output (alternatively 0/4 ... 20 mA, 0 ... 10 V)
- 16-bit resolution of the analog inputs/outputs (accuracy < 0.02%)
- DIP switches for HOLD/RESET behavior of the outputs
- Loop-power function for passive sensors
- International approvals



**WARNING: Explosion hazard when used in potentially explosive areas**

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



Make sure you always use the latest documentation.  
It can be downloaded from the product at [phoenixcontact.net/products](http://phoenixcontact.net/products).



This data sheet is valid for all products listed on the following page:

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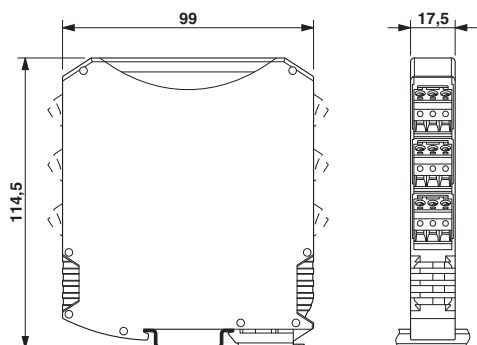
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### 3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Analog/digital I/O extension module with 2 digital inputs/outputs (0...250 V AC/DC) and 1 analog input (0/4...20 mA) and output (0/4 ... 20 mA, 0...10 V), with screw connection, incl. DIN rail connector	RAD-DAIO6-IFS	2901533	1
Accessories	Type	Order No.	Pcs. / Pkt.
2400 MHz wireless transceiver with RS-232, RS-485 2-wire interface, expandable with I/O extension modules, with screw connection, antenna connection: RSMA (female), including DIN rail connector, without antenna	RAD-2400-IFS	2901541	1
868 MHz wireless transceiver with RS-232, RS-485 2-wire interface, expandable with I/O extension modules, with screw connection, antenna connection: RSMA (female), including DIN rail connector, without antenna.	RAD-868-IFS	2904909	1
DIN rail connector for DIN rail mounting. Universal for TBUS housing. Gold-plated contacts, 5-pos. Header. Nominal current: 8 A, Articles with gold-plated contacts, bus connectors for connecting with electronic housings	ME 17,5 TBUS 1,5/ 5-ST-3,81 GN	2709561	10
Analog/digital I/O extension module with 2 digital inputs/outputs (0...250 V AC/DC) and 1 analog input (0/4...20 mA) and output (0/4 ... 20 mA, 0...10 V), with screw connection, incl. DIN rail connector	RAD-DAIO6-IFS	2901533	1
Bidirectional, Radioline 900 MHz transceiver for wireless transmission of serial and I/O data	RAD-900-IFS	2901540	1

### 4 Technical data

#### Dimensions (nominal sizes in mm)



Dimensions W / H / D	17.5 mm / 99 mm / 114.5 mm
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#### General data

Surge voltage category	II
Mounting position	any, on standard DIN rail NS 35 in accordance with EN 60715
Degree of protection	IP20
Pollution degree	2
Type of housing	PA 6.6-FR, green
Inflammability class according to UL 94	V0

**General data**

MTTF (mean time to failure) Telcordia standard, 25°C temperature, 21% operating cycle (5 days a week, 8 hours a day)	889 Years
MTTF (mean time to failure) Telcordia standard, 40°C temperature, 34.25% operating cycle (5 days a week, 12 hours a day)	391 Years
MTTF (mean time to failure) Telcordia standard, temperature 40 °C, operating cycle 100 % (7 days a week, 24 hours a day)	151 Years

**Supply**

Supply voltage range	19.2 V DC ... 30.5 V DC (TBUS)
Max. current consumption	≤ 95 mA (At 24 V DC, at 25°C)
Transient surge protection	Yes

**Analog input**

Number of inputs	1
Current input signal	0 mA ... 20 mA (can be set via DIP switches) 4 mA ... 20 mA (can be set via DIP switches)
Max. current input signal	22 mA
Input resistance current input	< 70 Ω
Input frequency	approx. 30 Hz
Precision	≤ 0.02 % (@25°C)
Temperature coefficient, typical	typ. 0.0025 %/K (At -40°C...+70°C)
Supply voltage	≥ 12 V DC (For passive sensors (via terminal PWR1, +I1))
Resolution (bit)	16 (Bit)
Protective circuit	Overload protection, short-circuit protection
Max. current consumption	< 1 mA

**Digital input**

Number of inputs	2
Switching level "1" signal	10 V AC/DC ... 50 V AC/DC (Low-voltage input) 50 V AC/DC ... 250 V AC/DC (High-voltage input)
Switching level "0" signal	0 V AC/DC ... 4 V AC/DC (Low-voltage input) 0 V AC/DC ... 20 V AC/DC (High-voltage input)
Input frequency	≤ 2 Hz

**Analog output**

Number of outputs	1
Voltage output signal	0 V ... 10 V
Output signal maximum voltage	approx. 10.83 V
Load	≥ 10 kΩ
Precision	typ. 0.5 % (Voltage output)
Current output signal	0 mA ... 20 mA 4 mA ... 20 mA
Output signal maximum current	approx. 21.67 mA
Load	≤ 500 Ω
Precision	≤ 0.02 % (@25°C)
Resolution (bit)	16 bit
Temperature coefficient, typical	typ. 0.0025 %/K (At -40°C...+70°C)
Behavior of the outputs (adjustable via DIP switch)	Hold / Reset
Protective circuit	Transient protection of outputs

**Relay output**

Number of outputs	2
Contact type	PDT
Contact material	AgSnO <sub>2</sub>
Maximum switching voltage	250 V AC 24 V DC
Min. switching current	≥ 10 mA
Max. switching current	2 A
Mechanical service life	1 x 10 <sup>7</sup> cycles
Electrical service life	2 x 10 <sup>5</sup> cycles (At 2 A, 250 V AC, cosφ 0.4) 2 x 10 <sup>5</sup> cycles (At 1 A, 24 V DC, L/R = 48 ms)
Maximum switching frequency	2 Hz
Switching capacity	48 W (24 V DC) 60 W (30 V DC) 20 W (48 V DC) 18 W (60 V DC) 22 W (110 V DC) 40 W (220 V DC) 42 W (250 V DC)
Behavior of the outputs (adjustable via DIP switch)	Hold / Reset

**Electrical isolation**

Digital I/O	300 V (Rated insulation voltage (in each case between the digital inputs // digital outputs // TBUS supply, reinforced insulation according to EN 61010))
Analog I/O	50 V (Rated insulation voltage (in each case between the TBUS analog inputs / analog outputs / supply, reinforced insulation according to EN 61010))
Digital/Analog I/O	300 V (Rated insulation voltage (in each case between the digital inputs and outputs // analog inputs and outputs, reinforced insulation according to EN 61010))

**Test voltage**

Digital I/O	2.5 kV AC (50 Hz, 1 min.)
Analog I/O	1.5 kV AC (50 Hz, 1 min.)

**Connection data**

Connection method	Screw connection
Conductor cross section, solid	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>
Conductor cross section, stranded	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>
Conductor cross section AWG/kcmil	24 ... 14
Stripping length	7 mm
Tightening torque	0.6 Nm

**Status indication**

Status display	Green LED (supply voltage, PWR) Green LED (bus communication, DAT) Red LED (periphery error, ERR) Yellow LED (digital input, DI1) Yellow LED (digital input, DI2) Yellow LED (digital output, DO1) Yellow LED (digital output, DO2)
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### Ambient conditions

Ambient temperature (operation)	-40 °C ... 70 °C (>55°C Derating) -40 °F ... 158 °F (>131 °F derating)
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: 5 g, 10 Hz - 150 Hz
Shock	16 g, 11 ms

### Operating conditions for the extended temperature range (+55 °C ... 70 °C)



No function restrictions for the extended temperature range if you keep a minimum distance of 17.5 mm between the modules. The minimum distance is the width of a DIN rail connector.  
 Otherwise please observe the following restrictions:  
 - Do not use the analog loop-powered output (PWR1).  
 - Only use the analog voltage output (U1).  
 - Use two of the four possible digital inputs/outputs, maximum.  
 Individual operating conditions on request.

### Certification

Conformance	CE-compliant
ATEX	Ex II 3 G Ex nA nC IIC T4 Gc X
IECEX	Ex nA nC IIC T4 Gc
UL, USA / Canada	UL 508 Listed Class I, Div. 2, Groups A, B, C, D T4A Class I, Zone 2, IIC T4

### Conformance

EMC directive 2004/108/EC	EN 61000-6-2; EN 61000-6-4
Ex directive (ATEX)	EN 60079-0; EN 60079-15

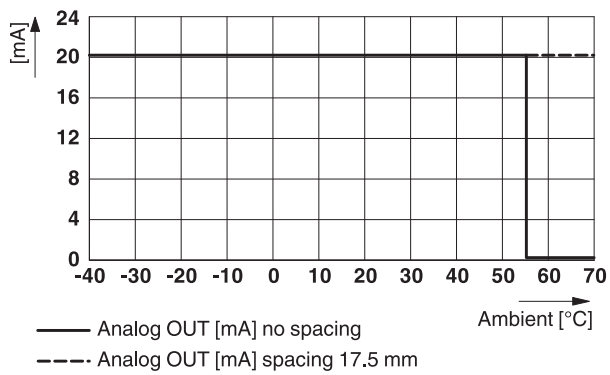
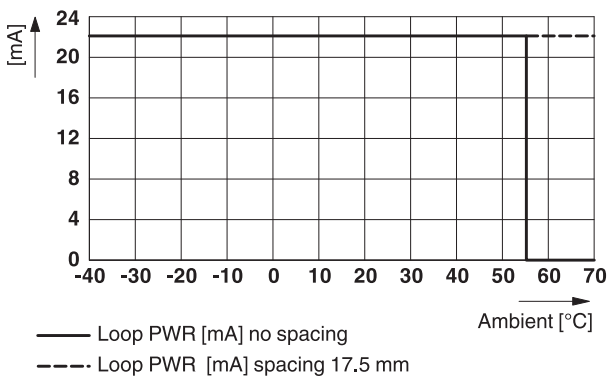
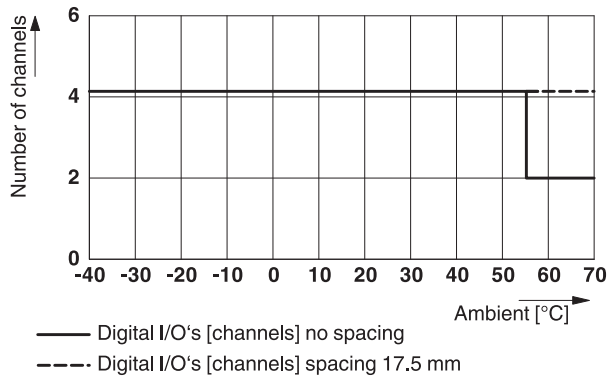
### Tolerances influenced by electromagnetic interference

Type of electromagnetic interference	Typical deviation of the measuring range final value (current input)	
	Relative	Absolute
-		
Electromagnetic fields according to EN 61000-4-3/IEC 61000-4-3	< ±0.2 %	±40 µA
Conducted interference according to EN 61000-4-6/IEC 61000-4-6	< ±0.2 %	±40 µA
Fast transients (burst) according to EN 61000-4-4/IEC 61000-4-4	< ±0.2 %	±40 µA

### Tolerances influenced by electromagnetic interference

Type of electromagnetic interference	Typical deviation of the measuring range final value (current output)	
	Relative	Absolute
-		
Electromagnetic fields; 10 V/m according to EN 61000-4-3/IEC 61000-4-3	< ±2.5 %	±500 µA
Electromagnetic fields; 3 V/m according to EN 61000-4-3/IEC 61000-4-3	< ±0.2 %	±40 µA
Conducted interference according to EN 61000-4-6/IEC 61000-4-6	< ±0.2 %	±40 µA
Fast transients (burst) according to EN 61000-4-4/IEC 61000-4-4	< ±0.2 %	±40 µA

## 5 Derating



## 6 Safety regulations and installation notes



### **WARNING: Risk of electric shock**

During operation, certain parts of this device may carry hazardous voltages. Disregarding this warning may result in damage to equipment and/or serious personal injury.

- For applications with high operating voltages, ensure sufficient distance or insulation and provide shock protection.
- 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.
- Always use the same phase for digital inputs and digital outputs.  
Maximum isolating voltage: 300 V.

### 6.1 Installation notes



#### **WARNING:**

Observe the following safety notes when using the device.

- The category 3 device is suitable for installation in potentially explosive area zone 2. It fulfills the requirements of EN 60079-0:2009 and EN 60079-15:2010.
- 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 technical data is provided in the package slip and on the certificates (conformity assessment, additional approvals where applicable).
- 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.
- The IP20 protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. The device must not be subject to mechanical strain and/or thermal loads, which exceed the limits described.
- To protect the device against mechanical or electrical damage, install it in a suitable housing with appropriate degree of protection as per IEC 60529.
- The device is not designed for use in atmospheres with a danger of dust explosions.
- If dust is present, it is necessary to install into a suitable approved housing, whereby the surface temperature of the housing must be taken into consideration.



## 6.2 Installation in Zone 2

**WARNING: Explosion hazard when used in potentially explosive areas**

Please make sure that the following notes and instructions are observed.

- Observe the specified conditions for use in potentially explosive areas! Install the device in a suitable approved housing (with a minimum of IP54 protection) that meets the requirements of EN 60079-15. Observe the requirements of EN 60079-14.
- In zone 2, only connect devices to the supply and signal circuits that are suitable for operation in the Ex zone 2 and the conditions at the installation location.
- In potentially explosive areas, terminals may only be snapped onto or off the DIN rail connector and wires may only be connected or disconnected when the power is switched off.
- 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.

## 6.3 UL Notes

**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.**

## 7 Installation



**NOTE: electrostatic discharge!**

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

### 7.1 Structure

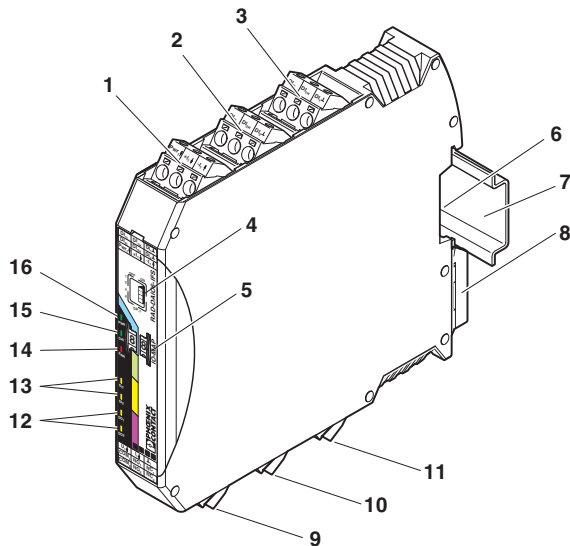


Figure 1 RAD-DAIO6-IFS structure

Pos.	Designation
1	Analog inputs for 2-, 3-, 4-wire measuring transducers
2	Digital input as wide-range input
3	Digital input as wide-range input
4	DIP switches for input/output configuration
5	White thumbwheel for setting the I/O-MAP address
6	Connection option for TBUS DIN rail connector
7	DIN rail
8	Metal foot catch for DIN rail fixing
9	Analog output, alternatively current/voltage
10	Relay output with PDT contact (floating)
11	Relay output with PDT contact (floating)
12	Status LEDs for the digital outputs DO1...DO2
13	Status LEDs for the digital inputs DI1...DI2
14	ERR status LED, red (communication error)
15	DAT status LED, green (BUS communication)
16	PWR status LED, green (supply voltage)

### 7.2 Basic circuit diagram

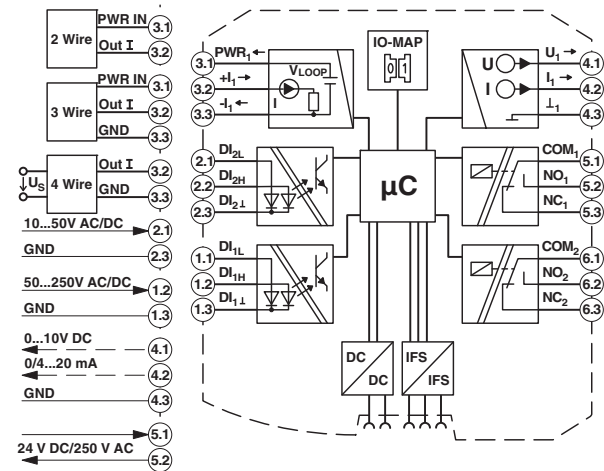


Figure 2 RAD-DAIO6-IFS basic circuit diagram

### 7.3 Configuration

The DIP switches on the front can be used to configure the input signal ranges (0...20 mA or 4...20 mA) and 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 the analog output you can either select the "reset" option (output value set to 0 = "RESET") or the "hold last value" option ("HOLD"). For the digital outputs you can select the "reset" option (relay drops out = "RESET") or the "hold last valid value" option ("HOLD").

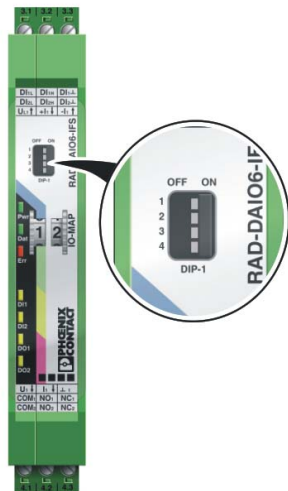


Figure 3 DIP switches

Input/output	Configuration	DIP switch			
		1	2	3	4
Analog IN	0...20 mA	OFF			
Analog IN	4...20 mA	ON			
Analog OUT	RESET		OFF		
Analog OUT	HOLD		ON		
Digital OUT1	RESET			OFF	
Digital OUT1	HOLD			ON	
Digital OUT2	RESET				OFF
Digital OUT2	HOLD				ON

### I/O MAP address

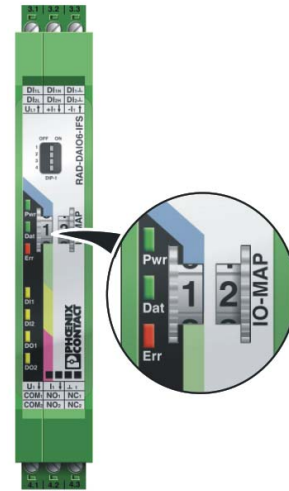


Figure 4 Thumb wheel

Use the thumb wheel to set the I/O MAP address. The address is used to address the I/O module for use in the Radio-line wireless system.

The following conditions must be met:

On the entire wireless network, addresses 1 to 99 (I/O MAP) (maximum) may be assigned for the I/O extension modules.

Thumbwheel	Description
01 - 99	I/O MAP address
00	Delivery state
** , 1* - 9*	Setting not permitted
*1 - *9	Interface System slave address, for use with other Interface System (IFS) master devices

### Wireless module in I/O data mode

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

Each I/O-MAP address must only be assigned to one device pair.

Example:	I/O MAP address
RAD-DAIO6-IFS	02
RAD-DAIO6-IFS	02

Only the RAD-DAIO6-IFS module can be assigned to the RAD-DAIO6-IFS module.

**Wireless module in PLC/Modbus RTU mode**

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

Input and output data is stored in a Modbus Memory Map in the master wireless module.

You can read the process data via the serial interface of the RAD-2400-IFS master wireless module (RAD-ID = 01) using the Modbus RTU command (see Section 8).

**7.4 Display and diagnostic elements**

7 LEDs on the RAD-DAIO6-IFS I/O extension module in total indicate the operating states.

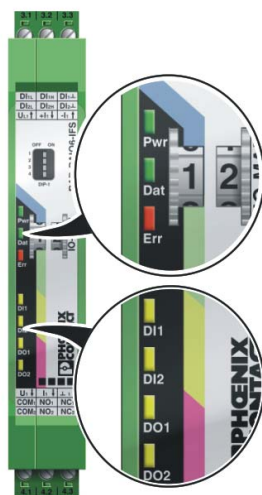


Figure 5 Display and diagnostic elements

**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/addressing mode
- ON Cyclic data communication

**ERR LED**

The red ERR LED indicates the error status, e.g., no corresponding output module found (e.g., incorrect addressing).

- OFF No error
- Flashing Slow (1.4 Hz) I/O-MAP address changed
- Fast (2.8 Hz) **Wireless module in I/O data mode (wire in/wire out)**

**Wireless module in I/O data mode (wire in/wire out)**

Missing input module, no bus communication

**Wireless module in PLC/Modbus RTU mode**

No Modbus communication (safe state of outputs, depending on DIP switch setting)

ON Critical internal error

**DI1 / DI2**

The yellow DI1/DI2 LEDs indicate the status of the digital inputs.

**DO1 / DO2**

The yellow DO1/DO2 LEDs indicate the status of the digital outputs.

### 7.5 Analog input

The analog input of the extension module is able to process standard signals (0/4...20 mA).

All the inputs are electrically isolated from one another, from the supply voltage (via bus foot), and from other electronic components.

A supply voltage of 12 V DC, minimum, is available at the connection terminal block (PWR<sub>1</sub>) for the use of passive sensors (1 in Figure 1, for connection assignment see Figure 2).

### 7.6 Analog output

The analog output of the extension module (9 in Figure 1) is designed as an active output.

All the outputs are electrically isolated from one another, from the supply voltage (via bus foot), and from other electronic components.

The output signal can be selected either as a current signal (0/4...20 mA) or as a voltage signal (0...10 V).

### 7.7 Digital inputs

The digital inputs are electrically isolated (safe isolation) from one another, from the supply voltage (via bus foot), and from other electronic components.

The two digital inputs of the extension module (2/3 in Figure 1) can process voltages from (LV: 0...50 V AC/DC, HV: 0...250 V AC/DC).

### 7.8 Digital outputs

The two digital outputs of the extension module (10, 11 in Figure 3) are designed as floating relay contacts (PDT).  
Switching capacity: 2 A at 250 V AC / 24 V DC.

The digital outputs are electrically isolated (safe isolation) from one another, from the supply voltage (via bus foot), and from other electronic components.

## 7.9 Assembly/removal

### Connection station with I/O extension modules

Up to 32 different I/O extension modules can be connected to each RAD-2400-IFS wireless module via the TBUS DIN rail connector (see accessories). Data is transmitted and power is supplied to the I/O extension modules via the bus foot.

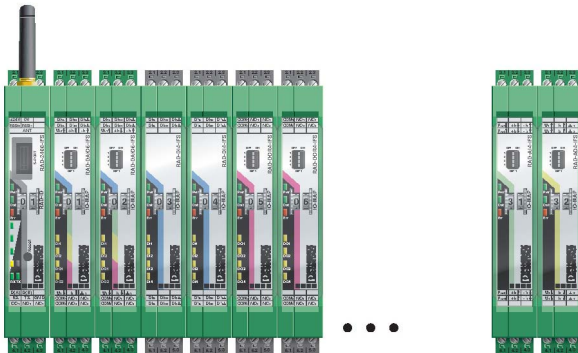


Figure 6 Radioline connection station with up to 32 I/O extension modules



The I/O extension modules must only be mounted to the right of the wireless module.

To mount on the DIN rail connector, proceed as follows:

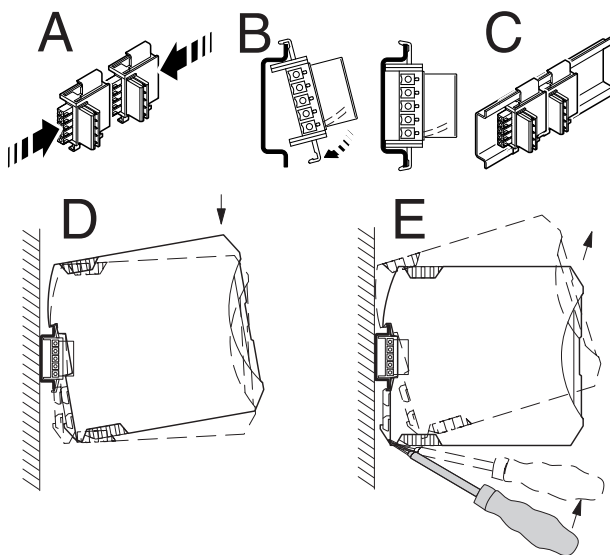


Figure 7 Mounting and removing

When using the device in a connection station, use the 17.5 mm wide DIN rail connector supplied. Only use the DIN rail connector in connection 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 for a connection 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.
- Install the device in suitable housing to meet the requirements for the protection class.
- 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).

To remove, proceed as follows:

- 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.

## 7.10 Connecting the cables

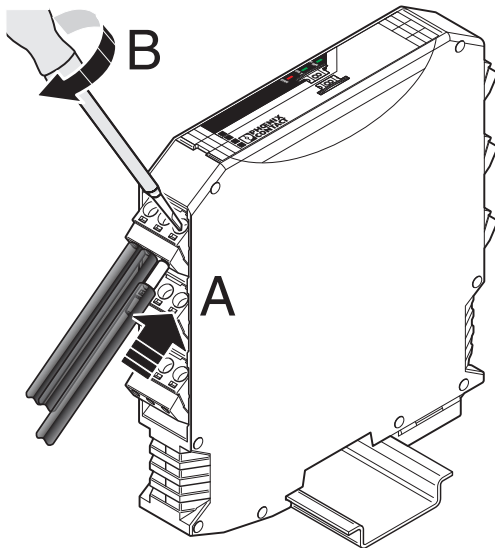


Figure 8 Connecting the cables

- Crimp ferrules to the wires.  
Permissible cable cross section: 0.2...2.5 mm<sup>2</sup>.
- 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: 0.6 Nm

## 8 Application example

### 8.1 Level measurement

Level measurement and passive PLC input card:

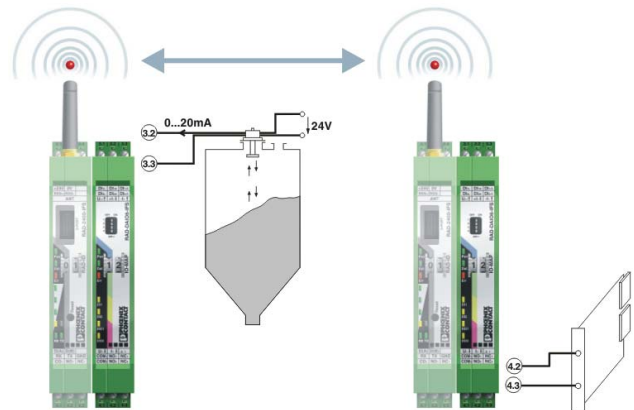


Figure 9 Example, level measurement

