RAD-PT100-4-IFS



I/O extension module, 4 temperature inputs (Pt 100)

Data sheet
105366_en_06

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1 Description

The **RAD-PT100-4-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-PT100-4-IFS** I/O extension module is used for processing four Pt 100 input signals.

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)
- 4 Pt 100 inputs (-50 ... 250°C)
- Approved for use in zone 2

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/2904035

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3 Ordering data

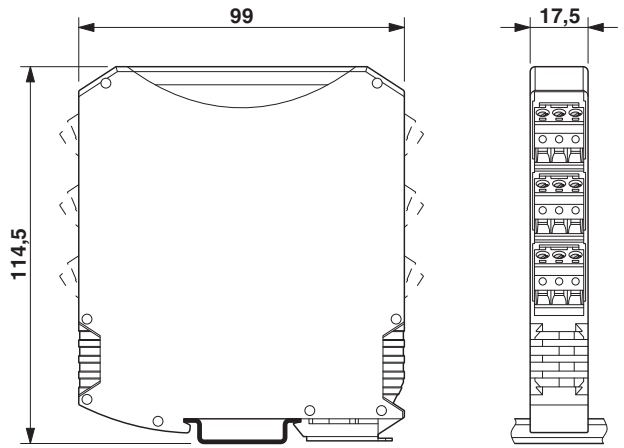
Description	Type	Item no.	Pcs./Pkt.
Radioline - I/O extension module, 4 Pt 100 inputs (-50°C ... +250°C / -58 °F ... 482 °F)	RAD-PT100-4-IFS	2904035	1

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, 4 analog current or voltage outputs (0/4 mA ... 20 mA, 0 V ... 10 V)	RAD-AO4-IFS	2901538	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%	1249 Years
SN 29500 standard, temperature 40°C, operating cycle 34.25%	506 Years
SN 29500 standard, temperature 40°C, operating cycle 100%	194 Years

Supply	
Supply voltage range	19.2 V DC … 30.5 V DC (DIN rail bus connector)
Max. current consumption	≤ 38 mA (at 24 V DC, at 25°C)
Transient surge protection	yes
Pt 100 input	
Number of inputs	4
Sensor input current	1 mA (constant)
Temperature measuring range	-50 °C … 250 °C
Connection technology	2-, 3-conductor
Max. permissible overall conductor resistance	25 Ω
Process data channel	16 bit (per channel)
Electrical isolation	
Pt 100 inputs	50 V (Rated insulation voltage, in each case between the Pt 100 inputs / TBUS supply, reinforced insulation in accordance with EN 61010)
Neighboring devices	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	
Pt 100	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)

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
KC-s	KTL 20-KA4BO-149X
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

Tolerances influenced by electromagnetic interference		
Type of electromagnetic interference	**Typical deviation of the measuring range final value (current input)**	
-	Relative	Absolute
Electromagnetic fields in accordance with EN 61000-4-3 / IEC 61000-4-3	< ±0.35 %	±0.6 °C
Conducted disturbances in accordance with EN 61000-4-6 / IEC 61000-4-6	< ±0.1 %	±0.3 °C
Fast transients (burst) in accordance with EN 61000-4-4 / IEC 61000-4-4	< ±0.1 %	±0.3 °C

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!

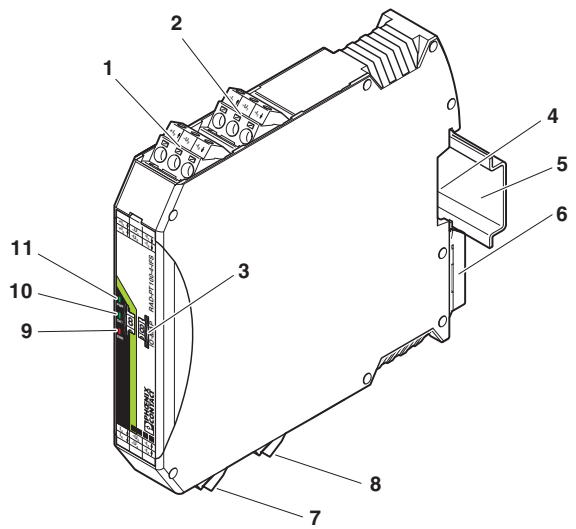
Electrostatic discharge can damage or destroy components.

– 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.

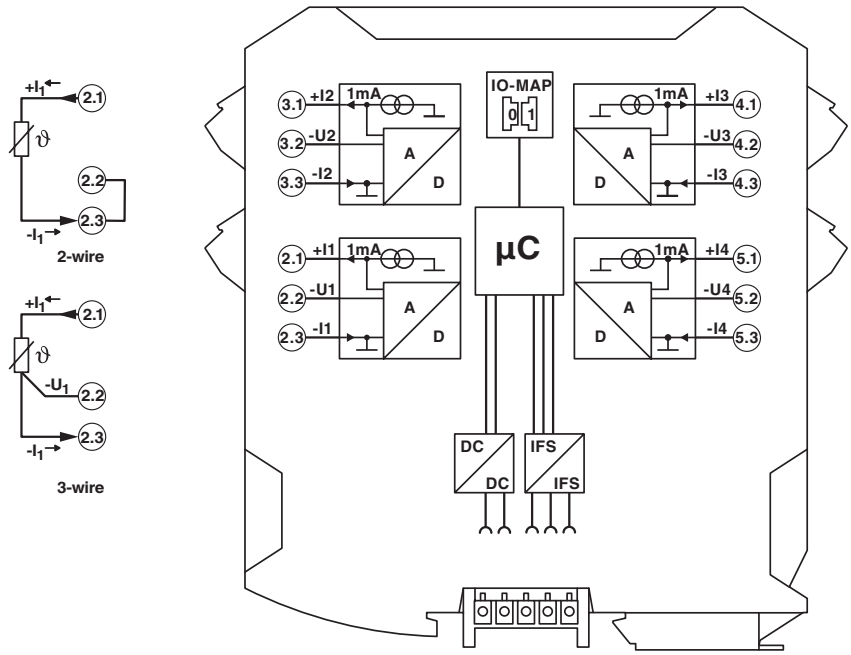
Figure 1 Function elements



Pos.	Terminal block	Designation
1	3.1 / 3.2 / 3.3	Pt 100 input 2 for 2- and 3-wire sensors
2	2.1 / 2.2 / 2.3	Pt 100 input 1 for 2- and 3-wire sensors
3	White thumbwheel for setting the I/O-MAP address	
4	Connection option for DIN rail connector	
5	DIN rail	
6	Metal foot catch for DIN rail fixing	
7	4.1 / 4.2 / 4.3	Pt 100 input 3 for 2- and 3-wire sensors
8	5.1 / 5.2 / 5.3	Pt 100 input 4 for 2- and 3-wire sensors
9	ERR status LED, red (communication error)	
10	DAT status LED, green (bus communication)	
11	PWR status LED, green (supply voltage)	

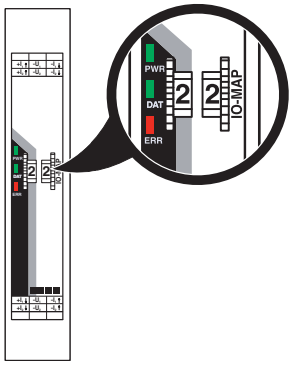
6.2 Basic circuit diagram

Figure 2 Basic circuit diagram



6.3 I/O MAP address in the Radioline wireless system

Figure 3 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.

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

The I/O MAP address of an input module may only appear once in the network.

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

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.

Radioline wireless module in I/O data mode

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

Example:	I/O MAP address
RAD-PT100-4-IFS	02
RAD-AO4-IFS	02

Only the RAD-AO4-IFS module can be assigned to the RAD-PT100-4-IFS module.

The Pt 100 inputs, T1 ... T4, can be configured to the analog outputs I1/U1 ... I4/U4 of the RAD-AO4-IFS extension module.

Pt 100 input	Analog output
-50 °C	0 mA or 0 V
+250 °C	20 mA or 10 V

Radioline wireless module in PLC/Modbus RTU mode

The I/O MAP address of an input module may only appear once in the network.

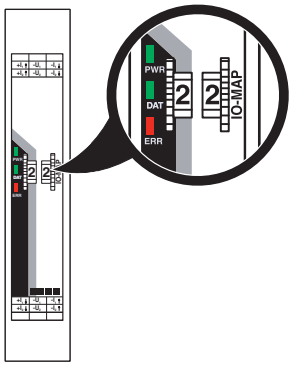
The input data is saved in a Modbus memory map in the Radioline base station.

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).

6.5 Display and diagnostic elements

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

Figure 4 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	Slow (1.4 Hz)	I/O-MAP address changed
	Fast (2.8 Hz)	No bus communication
On		Critical internal error

6.6 Temperature input (Pt 100)

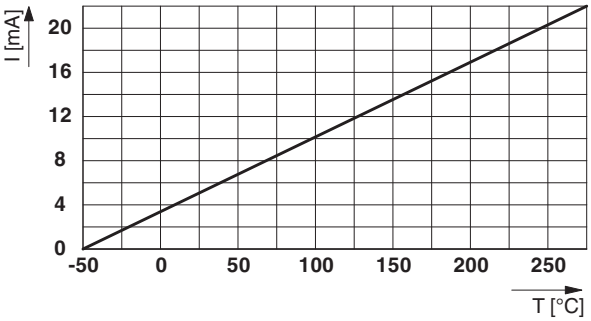
The Pt 100 inputs of the extension module can process temperatures from -50 °C ... +250 °C.

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

Pt 100 resistance thermometers can be connected to the RAD-PT100-4-IFS I/O extension module. The thermometers change their resistance depending on the temperature. The Pt 100 input signals are acquired by the RAD-PT100-4-IFS and can be mapped to proportional, analog voltage or current signals of the RAD-AO4-IFS output module. Thus, conclusions can be made about the temperature via the standard analog signal.

1 °C ≙ 66.66 µA

Figure 5 Current strength [mA] depending on the temperature [°C]



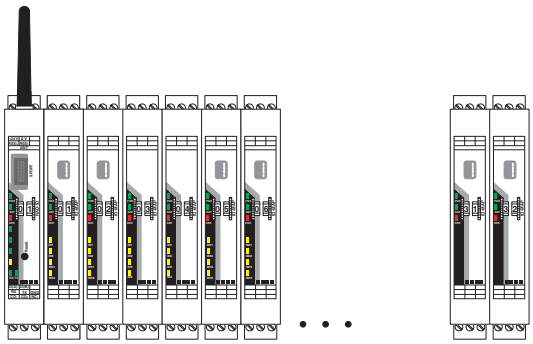
6.7 Mounting and removing

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

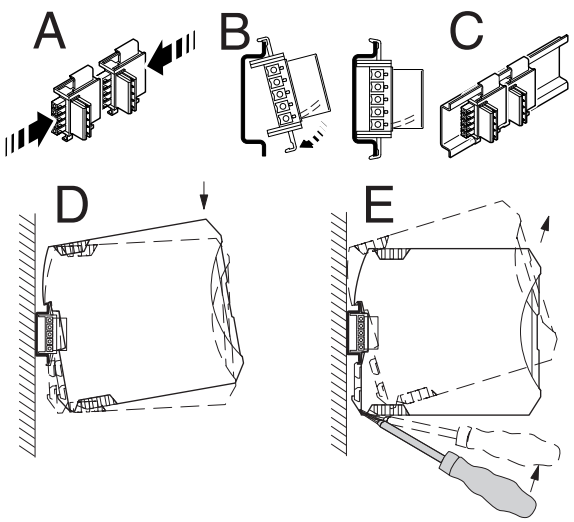


NOTE: device damage

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.

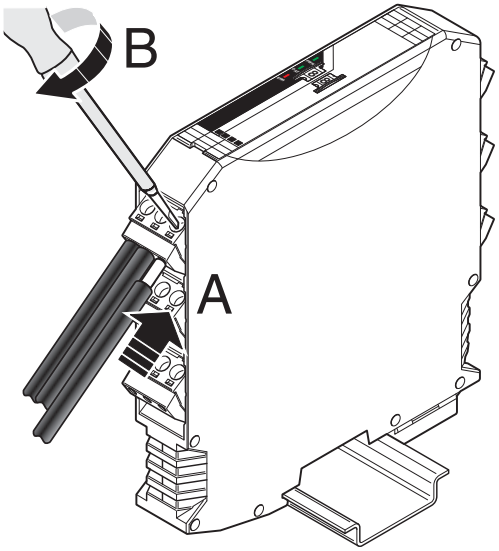
- Connect the DIN rail connectors together to form a joining station.
- Push the connected DIN rail connectors into the DIN rail.
- Place the device onto the DIN rail from above. Ensure the device and DIN rail connector are aligned correctly.
- Holding the device by the housing cover, carefully push 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.

6.8 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

6.9 Connecting the sensors

You can connect 2-conductor or 3-conductor sensors to the extension module. The measuring errors associated with the various measuring methods should be taken into consideration.

2-conductor connection technology

For 2-conductor connection technology, you need an insertion bridge between terminals x.2 and x.3.

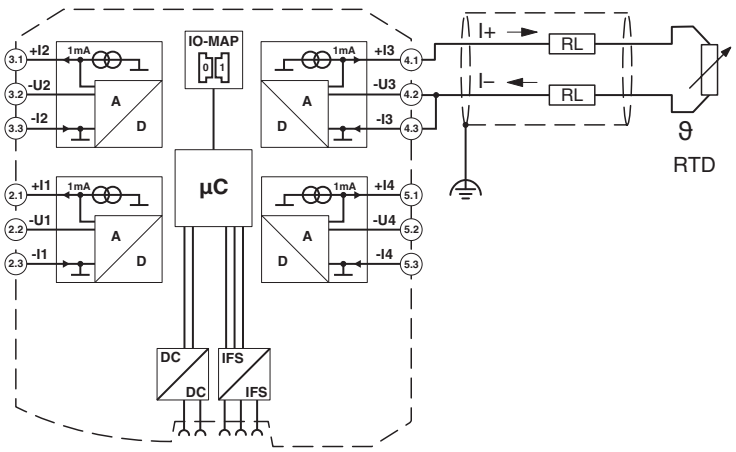
For short distances (< 10 m).

- Connect the Pt 100 sensor to terminals x.1 and x.3.
- Bridge the terminals x.2 and x.3.

2-conductor connection technology is the most cost-effective connection technology. The temperature-related voltage is not measured directly at the sensor and is therefore falsified by the two cable resistances. The measuring errors that occur may render the entire measurement useless.

Cable resistances R_{L1} and R_{L2} are incorporated in the measurement result directly and falsify the result accordingly.

Figure 9 2-conductor connection technology



3-conductor connection technology

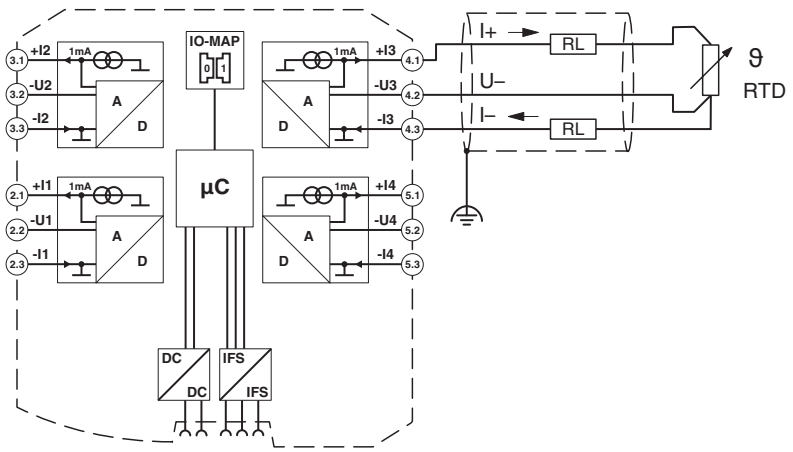
For long distances between the PT 100 sensor and the extension module. To compensate the wire resistances, all wire resistances must have exactly the same values ($R_{L1} = R_{L2} = R_{L3}$).

- Connect the Pt 100 sensor to terminals x.1, x.2, and x.3.

With 3-conductor connection technology, the temperature-related voltage is measured several times. Corresponding calculations additionally reduce the effect of the cable resistance on the measurement result. The results are almost as good as those achieved using the 4-conductor connection technology.

The cable resistances R_L at terminals +I and -I must have the same value. This allows you to subtract the established cable resistance from the measurement result and to get the Pt 100 platinum resistance value.

Figure 10 3-conductor connection technology

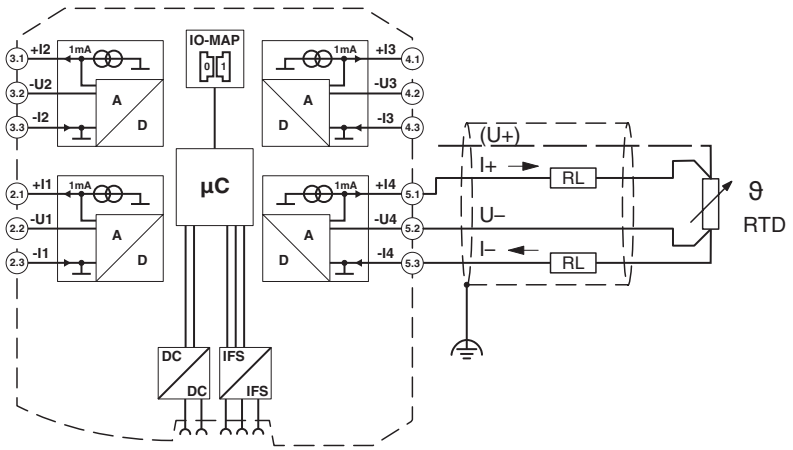


4-conductor connection technology

The extension module does not support 4-conductor connection technology.

- If you want to use a 4-conductor sensor, only connect three of the four conductors.
- The fourth wire should be left unwired. Otherwise there will be a different resistance in the +I and -I cables owing to the parallel connection of two cable resistances.

Figure 11 4-conductor connection technology•



7 Process data

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

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

I/O module	Module type	Number of registers	Address range	Function code
RAD-PT100-4-IFS	21_{hex}	06_{hex}	30xx0 ... 30xx5	fc04

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

30xx0			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.

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	Reserved

30xx2			Pt 100 input 1, terminal point 2.x													
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
T1																

30xx3			Pt 100 input 2, terminal point 3.x													
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
T2																

30xx4			Pt 100 input 3, terminal point 4.x													
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
T3																

30xx5			Pt 100 input 4, terminal point 5.x													
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
T4																

30xx6 ... 30xx9	Reserved

8 Error codes and formats for Pt 100 values

Data word		Pt 100 input	RAD-AO4-IFS, analog output		
hex	dec/error code	-50 °C ... +250 °C	0 mA ... 20 mA	0 V ... 10 V	Possible cause
0000	0	-50 °C	0 mA	0 V	
7530	30000	+250 °C	20 mA	10 V	
7F00	32512	+275.12 °C	21.67 mA	10.84 V	
8001	Overrange				
8002	Wire break				Sensor wired incorrectly, measuring line too long, cable resistance too high
8080	Underrange				

9 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.