

RAD-EE-2400-RS485



2400 MHz wireless transceiver with RS-485 interface



Data sheet
108648_en_04

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1 Description

Using the **RAD-EE-2400-RS485** wireless modules, you can replace serial RS-485 cables with interruption-free wireless connections flexibly and easily.

Wireless communication is based on Trusted Wireless 2.0 technology.

The wireless module is addressed and configured using the PSI-CONF software. The software is available to download at phoenixcontact.net/product/1081818.

Automatic and manual coexistence mechanisms ensure that the stringent requirements for interference-free data transmission are met. The wireless modules use the license-free 2.4 GHz ISM band.

Features

- Flexible networking of wireless modules as a point-to-point, star or mesh connection
- Parallel operation of multiple PV arrays, thanks to comprehensive coexistence mechanisms
- Reliable, interference-free communication even over long distances, thanks to Trusted Wireless technology
- Intuitive startup, thanks to user-friendly software wizard
- License-free 2.4 GHz frequency band
- Reasonably-priced version

Technical data

- RS-485 interface
- Adjustable data rates for the wireless interface
- Up to 250 network devices
- Range up to 500 m
- International approvals



Make sure you always use the latest documentation.

It can be downloaded at: phoenixcontact.net/product/1081818

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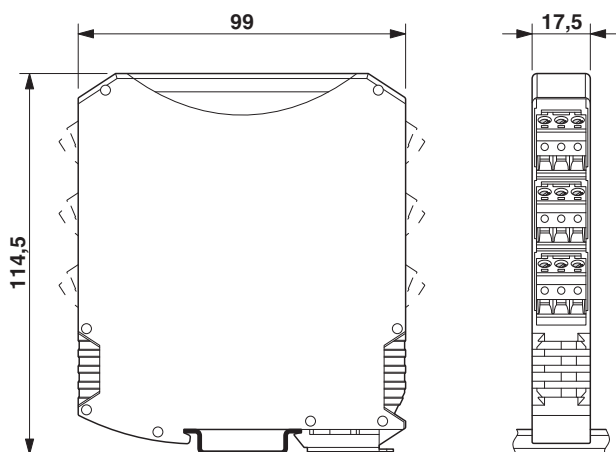
3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
2.4 GHz wireless transceiver with RS-485 interface, RSMA (female) antenna connection, point-to-point, star, and mesh networks up to 250 stations, range of up to 500 m (with a clear line of sight), for worldwide use	RAD-EE-2400-RS485	1081818	1
Accessories	Type	Item no.	Pcs./Pkt.
Radioline - USB data cable for communication between the PC and Radioline devices, energy supply for diagnostics and configuration via the USB port of the PC, cable length: 2 m / 6.5 ft	RAD-CABLE-USB	2903447	1
Shield connection clamp, number of positions: 1, connection method: Spring-cage connection, mounting type: NS 35/7,5, NS 35/15, color: black	SCC 10-NS35	1019440	20
Second generation FL COMSERVER UNI..., serial device server for converting a serial 232/422/485 interface to Ethernet, supports TCP, UDP, Modbus gateway, and PPP applications, incl. COM port redirector software and user documentation	FL COMSERVER UNI 232/422/485	2313452	1
Multiband omnidirectional antenna for freely mobile applications, compact design, frequency band: 2.4 GHz / 5 GHz / 6 GHz, gain: 2.0 dBi / 2.5 dBi / 3.0 dBi, degree of protection: IP68/IP69K, shock- and vibration-resistant, connection: N (male)	ANT-OMNI-2459-04	1284780	1
Omnidirectional antenna for wall mounting, frequency band: 2.4 GHz, gain: 2 dBi, degree of protection: IP65, connection: RSMA (male), incl. 1.5 m connecting cable, mounting bracket, and mounting material	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	2701362	1
Multiband omnidirectional antenna with protection against vandalism for control cabinet mounting, frequency band: 0.6 GHz ... 7.1 GHz, gain: 2 dBi ... 4 dBi, degree of protection: IP67, shockproof: IK10, seawater-resistant, connection: N (female)	ANT-OMNI-0671-02	1396318	1
Multiband omnidirectional antenna for wall or mast mounting, 0.6 GHz ... 7.1 GHz, gain: 1 dBi ... 3 dBi, degree of protection: IP67, seawater-resistant, connection: N (female), incl. mounting bracket and mast clamps	ANT-OMNI-0671-01	1396316	1
Omnidirectional antenna for wall or mast mounting, 2.4 GHz, gain: 6 dBi, degree of protection: IP67, saltwater-resistant, shock- and vibration-resistant, connection: N (female), incl. mounting bracket and mast clamps, ATEX and IECEx approval	RAD-ISM-2400-ANT-OMNI-6-0	2885919	1
Antenna cable for control cabinet feed-through, outside diameter: 3.2 mm (0.126 in.), inner conductor: stranded, attenuation: 0.6 / 0.9 / 1.4 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (female) -> RSMA (male), cable length: 0.5 m (1.6 ft.)	RAD-PIG-EF316-N-RSMA	2701402	1

Accessories	Type	Item no.	Pcs./Pkt.
Antenna cable, outside diameter: 5 mm (0.2 in.), inner conductor: solid, attenuation: 0.4 / 0.5 / 0.6 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (male) -> RSMA (male), cable length: 0.5 m (1.6 ft.)	RAD-PIG-RSMA/N-0.5	2903263	1
Antenna cable, outside diameter: 5 mm (0.2 in.), inner conductor: solid, attenuation: 0.5 / 0.8 / 1.1 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (male) -> RSMA (male), cable length: 1 m (3.3 ft.)	RAD-PIG-RSMA/N-1	2903264	1
Antenna cable, outside diameter: 5 mm (0.2 in.), inner conductor: solid, attenuation: 0.9 / 1.3 / 2.0 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (male) -> RSMA (male), cable length: 2 m (6.5 ft.)	RAD-PIG-RSMA/N-2	2903265	1
Antenna cable, outside diameter: 5 mm (0.2 in.), inner conductor: solid, attenuation: 1.2 / 2.0 / 3.0 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (male) -> RSMA (male), cable length: 3 m (10 ft.)	RAD-PIG-RSMA/N-3	2903266	1
Antenna cable, outside diameter: 5 mm (0.2 in.), inner conductor: solid, attenuation: 2.0 / 3.3 / 4.8 dB at 0.9 / 2.4 / 5.8 GHz, connection: N (male) -> RSMA (male), cable length: 5 m (16 ft.)	RAD-PIG-RSMA/N-5	2702140	1
Antenna cable, outside diameter: 10 mm (0.4 in.), inner conductor: stranded, attenuation: 1.0 / 1.8 / 3.1 dB at 0.9 / 2.4 / 5.8 GHz, connection: 2 x N (male), cable length: 3 m (10 ft.)	RAD-CAB-EF393- 3M	2867649	1
Antenna cable, outside diameter: 10 mm (0.4 in.), inner conductor: stranded, attenuation: 1.6 / 2.9 / 5.0 dB at 0.9 / 2.4 / 5.8 GHz, connection: 2 x N (male), cable length: 5 m (16 ft.)	RAD-CAB-EF393- 5M	2867652	1
Antenna cable, outside diameter: 10 mm (0.4 in.), inner conductor: stranded, attenuation: 2.9 / 5.6 / 9.9 dB at 0.9 / 2.4 / 5.8 GHz, connection: 2 x N (male), cable length: 10 m (32 ft.)	RAD-CAB-EF393-10M	2867665	1
Antenna cable, outside diameter: 10 mm (0.4 in.), inner conductor: stranded, attenuation: 4.3 / 8.3 / 14.8 dB at 0.9 / 2.4 / 5.8 GHz, connection: 2 x N (male), cable length: 15 m (50 ft.)	RAD-CAB-EF393-15M	2885634	1
Attachment plug with Lambda/4 technology as surge protection for coaxial signal interfaces. Connection: N connectors socket-socket	CN-LAMBDA/4-5.9-BB	2838490	1
Antenna adapter for control cabinet feed-through, frequency range: 0.3 GHz ... 6 GHz, degree of protection: IP65, connection: 2 x N (female)	RAD-ADP-N/F-N/F	2867843	1
Antenna adapter, frequency range: 0.3 GHz ... 6 GHz, connection: RSMA (male) -> RSMA (female), 90° angled	RAD-ADP-RSMA/M-RSMA/F-90	2904790	1
Vulcanizing sealing tape for external protection of adapters, cable connections, etc. against the effects of weather, roll length: 3 m	RAD-TAPE-SV-19-3	2903182	1

4 Technical data

Dimensions



Dimensions W/H/D	17.5 mm / 116 mm / 114.5 mm
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General data

Overvoltage category	II
Degree of protection	IP20
Degree of pollution	2
Material	
	Housing PA 6.6-FR
Color	
	Housing traffic grey B (7043)
Flammability rating according to UL 94	V0

MTTF (mean time to failure)

SN 29500 standard, temperature 25°C, operating cycle 21%	1064 Years
SN 29500 standard, temperature 40°C, operating cycle 34.25%	492 Years
SN 29500 standard, temperature 40°C, operating cycle 100%	196 Years

Supply

Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30.5 V DC
Max. current consumption	≤ 48 mA (at 24 V DC, at 25 °C)
Transient surge protection	Yes

System limits

Wireless module, Number of supported devices	≤ 250 (addressing via PSI-CONF software)
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Wireless interface

Antenna connection method	RSMA (female)
Direction	Bi-directional
Frequency	2400 MHz
Frequency range	2.4002 GHz ... 2.4785 GHz
Number of channel groups	8
Number of channels per group	55
Channel distance	1.3 MHz
Data transmission rate (adjustable)	16 kbps 125 kbps 250 kbps
Receiver sensitivity	-106 dBm (16 kbps) -96 dBm (125 kbps) -93 dBm (250 kbps)
Transmit capacity, maximum	≤ 18 dBm (can be set via software)

RS-485, 2-conductor

Connection method	COMBICON plug-in screw terminal block
Transmission speed	300 bps 600 bps 1.2 kbps 2.4 kbps 4.8 kbps 9.6 kbps 19.2 kbps 38.4 kbps 57.6 kbps 93.75 kbps 115.2 kbps
Transmission length	≤ 1200 m
Termination resistor (switchable via DIP switches)	390 Ω / 150 Ω / 390 Ω

Configuration interface

Connection method	S-PORT (socket)
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Connection data

Connection method	Screw connection
Conductor cross section, rigid	0.2 mm ² ... 2.5 mm ²
Conductor cross section, flexible	0.2 mm ² ... 2.5 mm ²
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) LED yellow (reception quality, LINK) Green LED (receive data, RX) Green LED (transmit data, TX)
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Ambient conditions

Ambient temperature (operation)	-20 °C ... 70 °C -4 °F ... 158 °F
Ambient temperature (storage/transport)	-20 °C ... 70 °C -4 °F ... 158 °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
UKCA	UKCA-compliant
UL, USA/Canada	508 Listed
Wireless approval, Europe	RED 2014/53/EU
Wireless approval Australia, RCM	-
Wireless approval Brazil, ANATEL	06279-19-06497
Wireless approval India, WPC	NER-ETA/314
Wireless approval Mexico, IFT	RCPHRA20-0068
KC approval for South Korea	MSIP-CRI-PCK-2901541

Conformance with RED Directive 2014/53/EU**Immunity in accordance with EN 61000-6-2**

Electrostatic discharge	EN 61000-4-2	
	Contact discharge	± 6 kV (Test Level 3)
	Discharge in air	± 8 kV (Test Level 3)
	Indirect discharge	± 6 kV
	Comments	Criterion B
Electromagnetic HF field	EN 61000-4-3	
	Frequency range	26 MHz ... 3 GHz (Test Level 3)
	Field intensity	10 V/m
	Comments	Criterion A
Fast transients (burst)	EN 61000-4-4	
	Input	± 2 kV (Test Level 3)
	Signal	± 2 kV
	Comments	Criterion B
Surge current loads (surge)	EN 61000-4-5	
	Input	± 0.5 kV (symmetrical) ± 1 kV (asymmetrical)
	Signal	± 1 kV (asymmetrical)
	Comments	Criterion B
Conducted interference	EN 61000-4-6	
	Frequency range	0.15 MHz ... 80 MHz
	Voltage	10 V
	Comments	Criterion A

Criterion A Normal operating behavior within the specified limits.

Criterion B Temporary impairment to operational behavior that is corrected by the device itself.

Emitted interference in acc. with EN 61000-6-4

Emitted radio interference in acc. with EN 55011 EN 55016-2-3 Class A industrial applications

Conformance with RED Directive 2014/53/EU

EMC - immunity to interference (electromagnetic compatibility of wireless systems)	EN 61000-6-2 Generic standard for the industrial sector
Safety - protection of personnel with regard to electrical safety	EN 62368
Health - limitation of exposure of the population to electromagnetic fields	EN 62311
Radio - effective use of the frequency spectrum and prevention of radio interference	EN 300328

5 Safety regulations and installation notes

5.1 Intended use

The devices are intended for application in industrial environments.

The wireless system is Class A equipment and may cause radio interference in residential areas. In this case, the operator may be required to implement appropriate measures and to pay the costs incurred as a result.

Please note that, in combination with antennas, the maximum permissible transmission power may be exceeded. In this case, set the transmission power via the software.



Install the wireless module at least 1 m away from other devices using the 2.4 GHz frequency band (e.g., WLAN, Bluetooth, microwave ovens). Otherwise, both the transmission quality and data transmission rate will be reduced.

5.2 Safety notes



CAUTION:

Observe the following safety notes when using the device.

- Operation of the wireless system is only permitted when using accessories available from Phoenix Contact. The use of any other components can lead to the withdrawal of the operating license.
- Phoenix Contact hereby declares that this wireless system complies with the basic requirements and other relevant regulations specified in Directive 2014/53/EU.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, observe the applicable regulations and safety directives (including national safety directives), as well as the generally recognized technical regulations. The safety data is provided in the packing 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 degree of protection (IEC/EN 60529) specifies that the device is intended for use in a clean and dry environment. Do not subject the device 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.
- The device complies with the EMC regulations for industrial areas (EMC class A). When using the device in residential areas, it may cause radio interference.
- Only specified devices from Phoenix Contact may be connected to the 12-pos. S-PORT interface.

5.3 UL notes



INDUSTRIAL CONTROL EQUIPMENT 11AE

Ambient Temperature: -20°C ... 70°C

Wire range: 24-14 AWG

Torque: 5-7 (Lbs-In)

"Pollution Degree 2 Installation Environment"

5.4 Conformance

IFT, Instituto Federal de Telecomunicaciones México

The operation of this equipment is subject to the following two conditions: (1) it is possible that this equipment or device may not cause harmful interference, and (2) this equipment or device must accept any interference including interference that may cause its undesired operation.

This equipment has been designed to operate with antennas listed below and for an antenna's maximum gain of 19 dBi. Use of this equipment with antennas not included in this list or having a higher gain than 19 dBi is prohibited. The required antenna impedance is 50 ohms.

Certificate number:

IFT RCPPHRA20-0068

– Antennas: see "Ordering data" section

Brazil



06279-19-06497

"Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados."

6 Installation



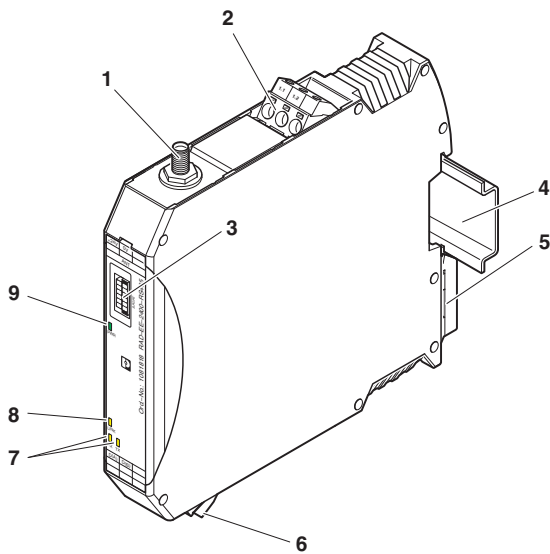
NOTE: electrostatic discharge!

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

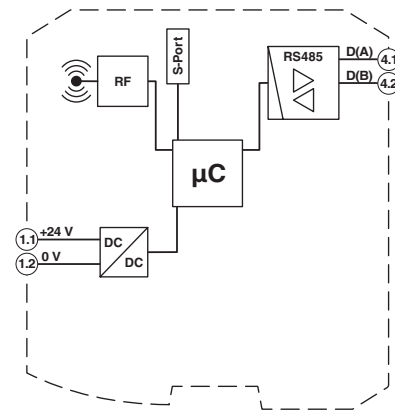
Figure 1 Function elements



Pos.	Terminal block	Designation
1	RSMA antenna connection (socket)	
2	1.1 / 1.2	Device supply (+24 V DC, GND)
3	12-pos. programming interface (S-PORT)	
4	DIN rail	
5	Metal foot catch for DIN rail fixing	
6	D(A) / D(B)	Connection terminal block RS-485 interface
7	RS-485 serial interface status LED (RX/TX)	
8	LINK LED, yellow (signal quality)	
9	PWR status LED, green (supply voltage)	

6.2 Basic circuit diagram

Figure 2 Basic circuit diagram



6.3 Topology

Figure 3 Point-to-point connection

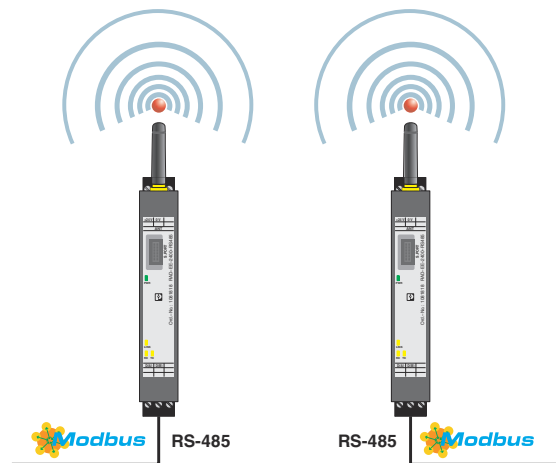


Figure 4 Mesh network

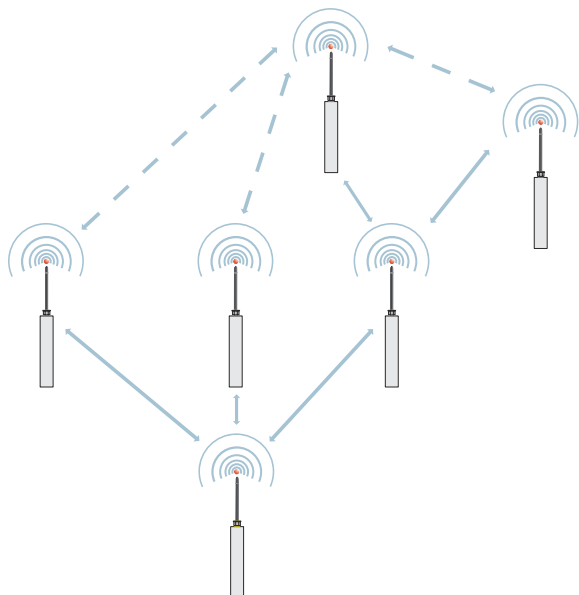
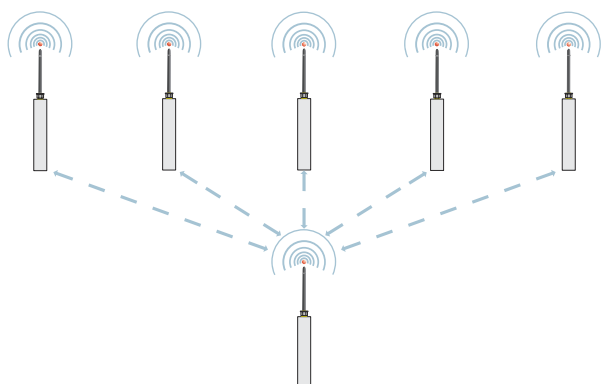


Figure 5 Star structure



6.4 Display and diagnostic elements

PWR-LED

The green PWR LED indicates the supply voltage status.

Off	no supply voltage
On	Supply voltage OK

LINK-LED

The yellow LINK LED indicates the wireless connection signal quality.

On	Connection with very good receive signal
Flashing	Connection with low receive signal
Off	No connection



The antenna is mounted outside the control cabinet/building. Observe the installation instructions for the antenna used. See also "5 Safety regulations and installation notes".

As the full transmission power and the reception amplifier are activated by default, signals may be superimposed. Increase the distance between devices.

TX-LED

The TX LED indicates communication (transmit data) with the RS-485 interface.

RX-LED

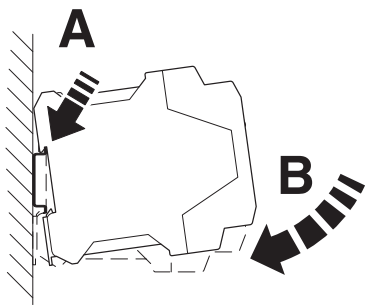
The RX LED indicates communication (receive data) with the RS-485 interface.

6.5 Unpacking

- Check the delivery for visible damage caused by transportation.
- Submit claims for any transport damage immediately. Inform Phoenix Contact or your supplier as well as the shipping company without delay.
- Read the complete packing slip carefully.
- Retain the packing slip.
- Keep the packaging for a possible later transport.

6.6 Mounting

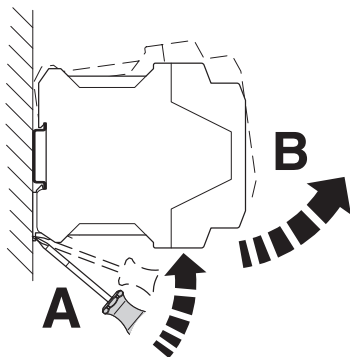
Figure 6 Mounting on a DIN rail



- Place the device onto the DIN rail from above. Push the device from the front toward the mounting surface until it audibly engages.

6.7 Removal

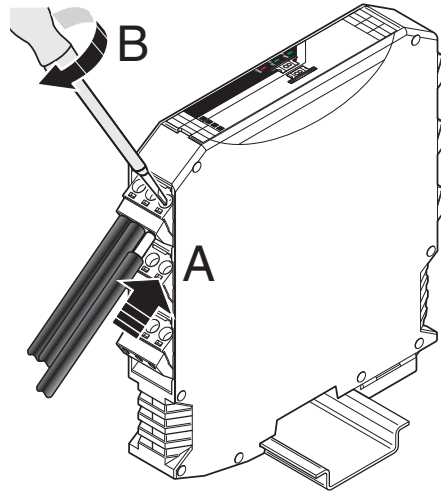
Figure 7 Removal



- 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: 0.6 Nm

6.9 RS-485 interface

Connect the I/O device to the wireless module via the required serial interface.

Shielding

- Connect the shield connection of the RS-485 bus line correctly via an external shield-connection clamp (e.g., SCC 10-NS35, item no. 1019440).



NOTE: damage to the interface

A faulty connection of the shield in combination with permanent external interferences can cause damage to the RS-485 interface.

- Observe the polarity of the RS-485 2-wire cable and ensure that the shield connection is connected correctly.

Choose the type of shield connection according to the type of interference expected:

- Firstly, connect the shield on one side. This suppresses electrical fields.
- To suppress disturbances caused by alternating magnetic fields, connect the shield on both sides. When doing so, the ground loops must be taken into account: galvanic disturbances along the reference potential can interfere with the useful signal, and the shielding effect is reduced.
- If several devices are connected to a single bus, the shield must be connected to each device (e.g., by means of clamps).
- Connect the bus shield to a central PE point using short, low-impedance connections with a large surface area (e.g., by means of shield connection clamps).

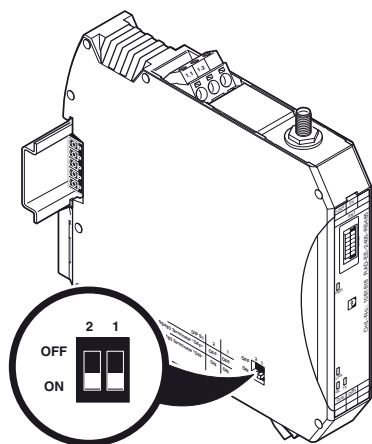
Termination network

The wireless module is operated on a 2-wire bus line. For correct operation of the bus system, termination networks are required for the RS-485 bus connection.

- Terminate an RS-485 bus cable at both bus ends. To do so, verify the position of the wireless module on the RS-485 bus cable and set the required operating mode via the DIP switch.

Operating mode	Termination network	DIP	
		1	2
RS-485 termination device	On	ON	ON
RS-485 device	Off	OFF	OFF

Figure 9 DIP switches

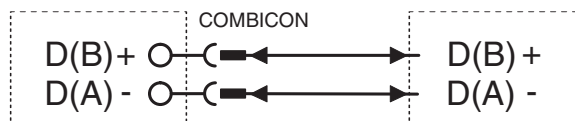


Pin assignment

In RS-485 mode, an RS-485 network with several I/O devices can be created. Use a twisted pair bus cable to connect the I/O devices. Fit this bus cable with a termination network at the two furthest points of the RS-485 network.

- Connect the individual conductors of the data cable to the COMBICON plug-in screw terminal block.
- Make sure the signal assignment is correct.

Figure 10 RS-485 interface pin assignment

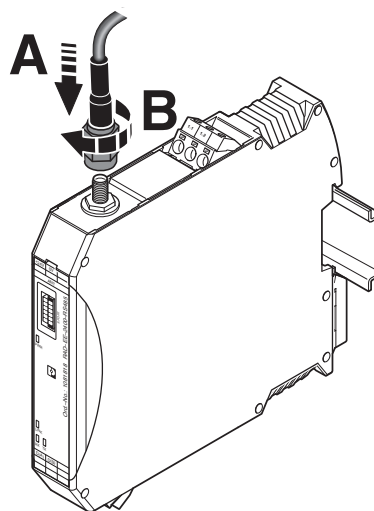


Antenna connection

The wireless module has an RSMA antenna connection (socket) for connecting an external antenna.

A wide selection of antennas and antenna cables can be found in the "Ordering data" section on page 3.

Figure 11 Antenna connection



7 Startup and configuration

The wireless module is addressed and configured using the PSI-CONF software. The software is available to download at phoenixcontact.net/product/1081818.

A PC with a Windows operating system is required for configuration.

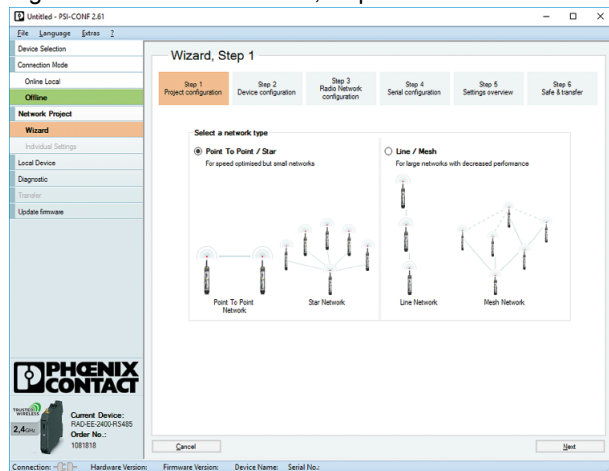
Use the RAD-CABLE-USB USB cable (Item No. 2903447) for configuration and diagnostics.

- Install the software and the USB driver for the RAD-CABLE-USB cable.
- Select "Wireless, RAD-EE-2400-RS485".
- Follow the software wizard.
- Once you have run through all steps of the wizard, save the project and transmit it to the wireless modules.



The devices do not have any factory-preset RAD ID settings, so doing a test transmission at first startup is not an option. You can use the test transmission after the first setup. You can then transmit subsequent changes to the devices in the wireless network.

Figure 12 Software wizard, step 1



7.1 Setting the station address (RAD-ID)

- Set the wireless module address using the PSI-CONF software.

If two wireless modules in a network have the same address, the network will not function correctly.



Each address in a network must be unique.

7.2 Coexistence

If you operate several wireless systems in parallel at a short distance from each other: in order to separate the wireless systems, you should select various RF bands and network IDs. You can set these parameters using the PSI-CONF software.

Network ID (net ID)

Value range: 1 ... 127

The wireless modules are uniquely identified via the network ID. Only wireless modules with the same network ID can connect to one another.

RF band

Value range: 1 ... 8

An RF band is a group of frequencies made up of individual frequencies from the entire frequency band. Different RF bands use different frequencies.

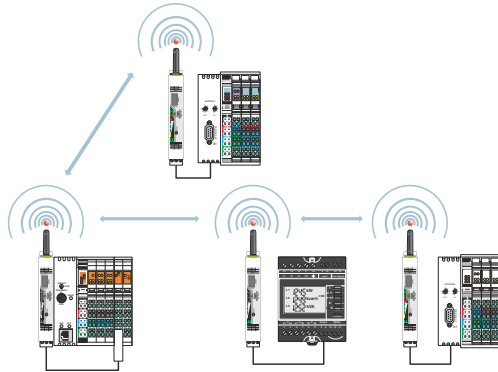
If you wish to operate several wireless systems in parallel, you should select different RF bands.

Denylist

A denylist means that certain frequencies are specifically faded out. For example, this method allows you to operate several WiFi systems in parallel with Trusted Wireless 2.0 systems without any performance limitations.

7.3 Serial data transmission

Figure 13 Serial data mode



For serial data communication, you must set the following interface parameters in the PSI-CONF software:

- Data rate
- Parity
- Stop bits
- Data bits

Figure 14 Software wizard, step 3

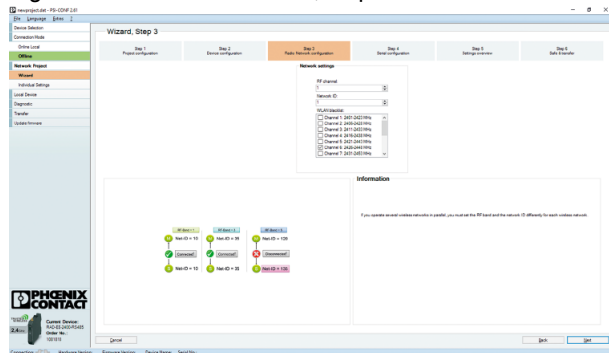
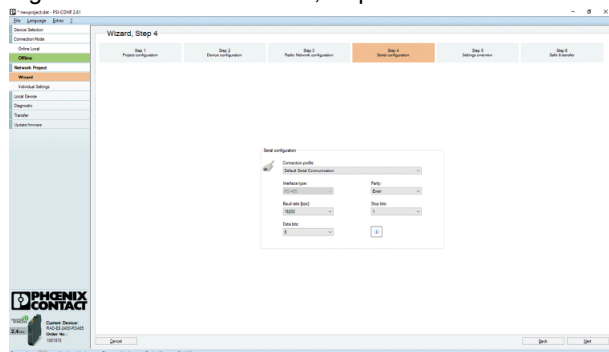


Figure 15 Software wizard, step 4

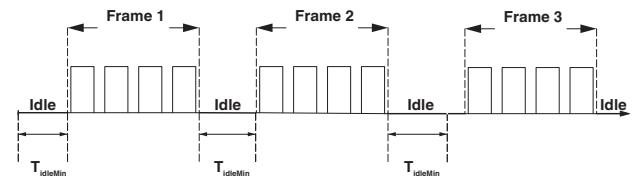


7.4 Frame-based data transmission

$T_{IdleMin}$ parameter (minimum pause between two frames)

The $T_{IdleMin}$ parameter refers to the minimum pause that must elapse between two frames on the output side (wireless module is transmitting data via the serial interface).

Figure 16 $T_{IdleMin}$



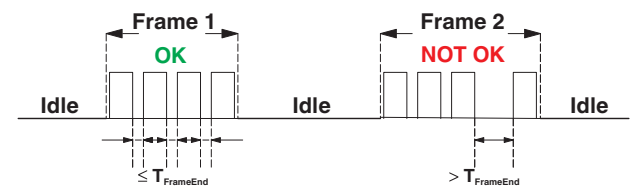
$T_{FrameEnd}$ parameter

$T_{FrameEnd}$ is the time observed by the transmitting wireless module between two frames.

If the wireless module receives data then for a certain period of time receives no further data, the wireless module assumes that the whole frame has arrived. The frame is then transmitted. This period of time is referred to as $T_{FrameEnd}$.

$T_{FrameEnd}$ must be shorter than the minimum interval between two frames ($T_{FrameEnd} < T_{IdleMin}$). $T_{FrameEnd}$ must, however, also be greater than the maximum interval that is permitted between two characters in a frame. Otherwise the frame might be fragmented.

Figure 17 $T_{FrameEnd}$



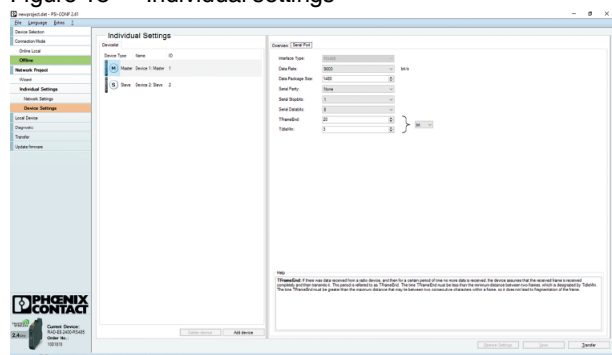
7.5 Setting telegram pauses, using the Modbus/RTU as an example

A frame is also referred to as a telegram. The length of the transmission pause between the telegrams depends on the data rate that has been set. The beginning and end of a telegram is recognized by means of a time condition. A pause of 3.5 characters means that the telegram is complete and the next character is to be interpreted as the server address. A telegram must therefore be sent as a continuous data flow. If there is an interruption of more than 1.5 characters within a telegram, the data will be discarded by the recipient.

If the Radioline base station is not able to transmit the successive characters quickly enough and communication is aborted, you must increase the minimum pause time ($T_{FrameEnd}$) between the individual characters of a telegram.

- You can adapt the data transmission to other protocols by adjusting the T_{FrameEnd} and T_{IdleMin} parameters. Set the interface parameters under “Individual Settings”.

Figure 18 Individual settings



Verified parameters for frame-based data transmission				
Manufacturer	Product	Protocol	T _{IdleMin} [bits]	T _{FrameEnd} [bits]
-	-	PROFIBUS	11	7
-	-	Modbus/ RTU	39	20
Phoenix Contact	EMPro	Modbus/ RTU	56	12
Phoenix Contact	SOLAR- CHECK	Modbus/ RTU	56	12
DELTA	RPI-M20A	Modbus/ RTU	3	20



Not all of the I/O devices available on the market are verified. In this case, the parameters must be determined by tests based on the connected I/O device and on the protocol. As precise protocol knowledge is required, you may need to ask an expert for support.

7.6 Transmission power



Observe the maximum permissible radiated transmission power at the antenna (EIRP, see table).

This is determined based on:

Device transmission power

+ antenna gain

- cable attenuation.

Reduce the device transmission power via the PSI-CONF software, if necessary.

- If you have run through the software wizard and saved the project, if necessary, reduce the transmission power under "Individual Settings, Device Settings".

7.7 Data transmission speed of the wireless interface

The range is an important parameter in industrial wireless applications, especially in outdoor applications.

Even in cases where long ranges do not have to be covered, good receiver sensitivity enables transmission in harsher outdoor conditions, e.g., when there is no direct line of sight.

The receiver sensitivity determines the signal amplitude which can just about be received by the wireless module.

The lower the data transmission speed of the wireless interface, the higher the receiver sensitivity and thereby the bandwidth.

Data transmission speed [kbps]	Typical receiver sensitivity [dBm]	EIRP: max. radiated power [dBm]	Potential distance that can be covered with line of sight and a system reserve of 12 dB [m]
250	-93	18	<300 m
125	-96	18	<500 m
16	-106	11	>500 m

Specifying ranges is very difficult due to the influence of various factors. Based on practical tests, it is possible to provide the following guide values. They may be significantly higher or lower depending on the actual application.

The range depends on the following:

- Set data rate
- Length of the antenna cable
- Antenna used
- Line of sight
- Adherence to the Fresnel zone

7.8 Delay time

The delay time refers to the delay until a serial telegram is completely output at the second wireless module via RS-485 using the serial interface.

Among other things, the delay time depends on the following factors:

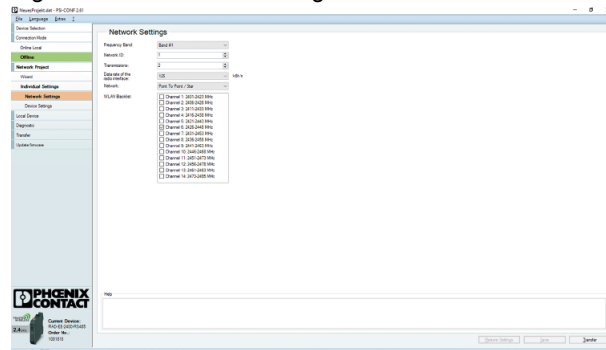
- Capacity of the frequency band
The more wireless networks operating in the same frequency band, the higher the delay time.
- Network structure (e. g. star or mesh network)
- Distance and set data rate of the wireless interface
- Telegram length

The table below shows typical delay times that have been determined under laboratory conditions for frequency bands without any interference. The delay times may be higher or lower in practice. The delay time is roughly doubled with each repeater in the network.

Data rate of the serial interface [kbps]	Data rate of the wireless interface [kbps]	Typical delay time	Telegram length [bytes]
19.2	250	20 ms	49
	125	25 ms	
	16	120 ms	

- If you have run through the software wizard and saved the project, if necessary, reduce the transmission data rate of the wireless interface under "Individual Settings, Network Settings"

Figure 19 Individual settings



8 Troubleshooting

- First, ensure a good wireless signal: LINK LED remains solidly lit on all wireless modules.
- Check the status of the individual stations:
 - If the PSI-CONF software is installed, check the device status of all network devices via online diagnostics. When connecting the Radioline base module to a PC, you can read out the RSSI values for the entire wireless network.
 - If the PSI-CONF software has not been installed, check the LINK LEDs on each device.
- Avoid contact between the antennas of two wireless modules, otherwise the receiver might become overloaded.
- If two antennas are located in the same place, the distance between them should be at least 0.6 m in the vertical direction and 1 m in the horizontal direction.
- Ground loops are caused by grounding of the antenna via the antenna fixing unit, grounding of the power supply and grounding of the serial interface. To avoid ground loops, connect these components to a single ground point.

LED	Error	Solution
-	Cannot be configured using the PSI-CONF software.	Make sure power is supplied to the wireless module. Make sure that you are using the correct cable: – RAD-CABLE-USB (Item No. 2903447), energy supply via the USB port on the PC – IFS-USB-DATACABLE (Item No. 2320500), external energy supply Install the USB driver. The driver is installed automatically during the PSI-CONF software installation.
PWR off	No power	Switch the mains on, restore the power supply.
LINK LED flashes	Connection with low receive signal	Check whether the antennas are connected and aligned properly. Make sure that the antenna connections are tight and free from corrosion. Install the antenna at a higher point. Adhere to the Fresnel zone. Use a different antenna with higher antenna gain or shorter cables with lower signal attenuation. Check whether there is another transmitting antenna in close proximity. Position the antenna further away from all other antennas. Make sure that the power supply is sufficiently high. Make sure that there is no connection between the core and the shield of the cable in the connected antenna system.

LED	Error	Solution
LINK LED off	No wireless connection, even though the wireless modules are not far away from each other	Make sure that, in a network, only one wireless module is configured as the base station (RAD ID = 01) and all other wireless modules are remote stations or repeaters. Reconfigure the wireless network, if necessary.
		Check the PSI-CONF software to make sure that each RAD ID only occurs once in the network.
		There may be an overload problem: upon delivery, the receive preamplifier is activated. The transmission power is set so that the devices can cover the greatest possible distances. When operating the devices directly next to one another, the receiver may therefore become overloaded. In this case, remove the antennas, increase the distance between the devices and antennas or reduce transmission power using the PSI-CONF software.
		Using the PSI-CONF software, check whether the network parameter settings are the same on all wireless modules (network ID, RF band, wireless interface data rate, network type).
	No wireless connection, the wireless modules are far apart	Check whether the antennas are connected and aligned properly.
		Make sure that the antenna connections are tight and free from corrosion.
		Install the antenna at a higher point. Adhere to the Fresnel zone.
		Use a different antenna with higher antenna gain or shorter cables with lower signal attenuation.
		Check whether there is another transmitting antenna in close proximity. Position the antenna further away from all other antennas.
		Make sure that the power supply is sufficiently high.
		Make sure that there is no connection between the core and the shield of the cable in the connected antenna system.
RX, TX off	Wireless connection present, but application does not transmit any data	Check the wiring of the RS-485 connections on the wireless modules.
		Check the serial interface settings (baud rate, parity, data bits and stop bits) for the wireless modules and serial termination devices.
Base station: TX flashing, RX off Remote station: RX flashes, TX off	Wireless connection is present, but the connected serial terminal device is not responding.	Check the wiring of the RS-485 connections on the wireless modules.
		Check the serial interface settings (baud rate, parity, data bits and stop bits) for the wireless modules and serial termination devices.
Base station: TX flashing, RX flashing Remote station: RX flashes, TX flashes		See section "7.4 Frame-based data transmission"

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.