Industrial wireless catalog

Wireless from the sensor to the network

PHOENIX CONTACT
INSPIRING INNOVATIONS

Communicating with customers and partners worldwide

Phoenix Contact is a leading manufacturer of electrical connections and industrial automation technology. Founded more than 90 years ago, the company now has 14,500 employees, more than 6,500 of whom are located in Germany. A sales network of more than 45 subsidiaries and more than 30 sales representatives guarantees proximity to our customer.

The product range includes high-grade components, systems and service across a wide variety of applications.

The selection ranges from modular terminal blocks to interface technology, PCB connection technology and solutions for the automation of industrial systems.

Global player with customer proximity

Phoenix Contact values in-house expertise. Our design and development departments continuously implement innovative product ideas and deliver special solutions to meet customer requirements. Numerous patents have resulted from products developed at Phoenix Contact.

Wireless technology for today's industrial challenges

Wireless technology is being adopted by a rapidly increasing number of industries, from simple monitoring and control to Supervisory Control and Data Acquisition (SCADA). Flexibility, simple installation and cost savings give wireless several advantages over traditional cable-based systems. Wireless technology from Phoenix Contact provides highly reliable data communication in harsh and interference-heavy environments.

As system complexity increases, relying on cable-based solutions results in high installation costs, as well as limited flexibility for system expansion. The wireless option overcomes these challenges by providing easy-to-alter permanent or temporary communication.

Benefits of industrial wireless

- Eliminates time and expenses associated with cable installations
- Ends dependence on expensive and potentially unreliable leased lines
- Offers an alternative to wiring harnesses and slip rings that wear out on moving devices
- Monitors and controls remote locations where cable installations are impractical and/or phone lines are unavailable

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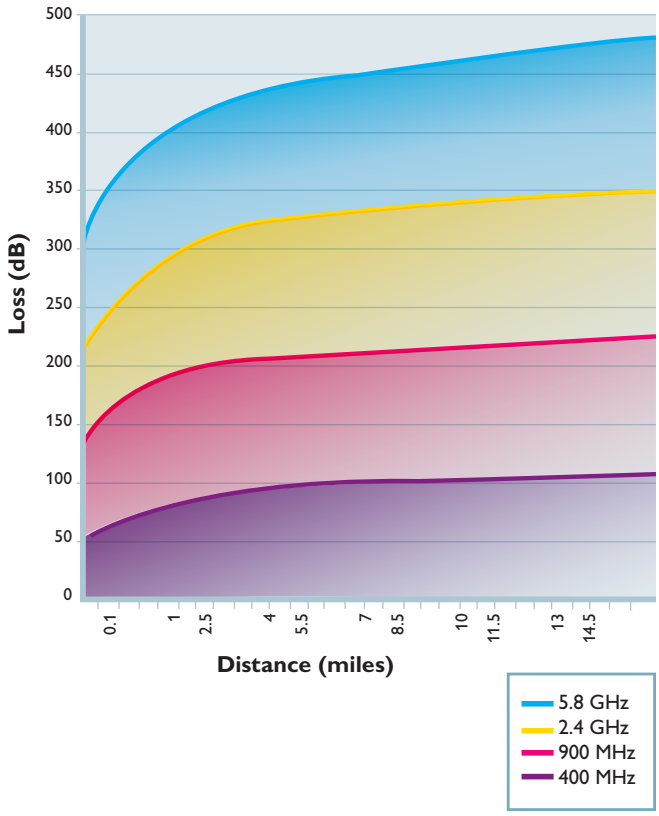
Choosing a wireless technology

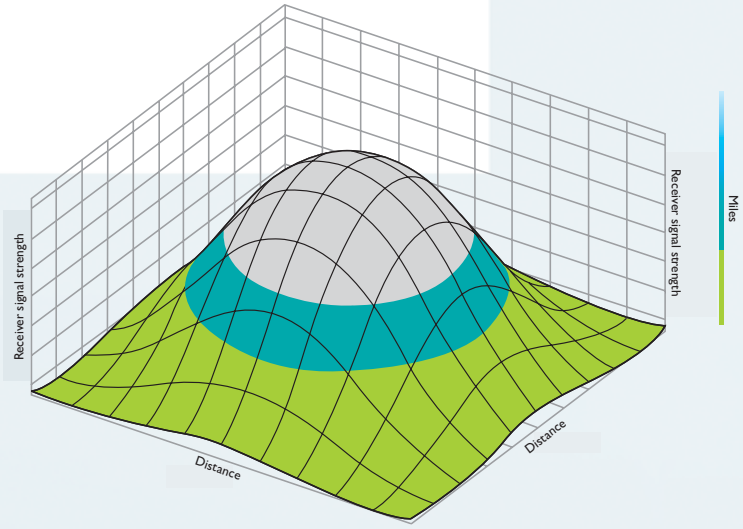
There are several key factors to consider when determining a wireless technology's performance in specific applications. Because each of the listed parameters impacts the others, users must find the correct balance when choosing a wireless device.

Transmission range

Transmission range is affected by operating frequency, transmission method, over-the-air speed and interference. High-gain antennas and good installation practices help achieve optimal range.

Free Space RF Attenuation





Circle of success

Achieving long-distance radio links with RF knowledge

No-worry zone -
- Works out of the box
- Wireless conduits up to 1/4 mile*

Common sense zone
- Success with experience
- Wireless links up to 1 mile*

Performance zone -
- Path engineering required
- Wireless links up to 20 miles*

** For 900 MHz*

Over-the-air speed

A radio's over-the-air speed depends on the transmission method as well as the application installation.

A high-speed radio uses a wider channel bandwidth regardless of the transmission method. Channel bandwidth refers to the amount of data that can be transmitted by radio signal and is measured in bytes transferred over a specific prescribed period of time (kbps or Mbps).

A radio using a wide bandwidth is more susceptible to interference due to an increased probability of existing interference over the utilized band and because there is less energy per data bit.

Energy per bit refers to the amount of available RF power to send each bit of data over the air. The slower the transmission rate, the higher the energy level per bit. The higher the energy per bit, the greater the achievable transmission range. Therefore, longer range and higher interference immunity result from reducing the transmission speed.

Interference and coexistence

Interference occurs when environmental circumstances or the superposition of additional waves interrupt, redirect, fade or terminate a wave pattern, resulting in data loss. Interference could be caused by physical obstructions, emissions from electronic devices or other radio devices operating nearby. Interference is overcome by transmitting multiple versions of the same signal, utilizing interference-tolerant technology and strategic antenna placement.

Practical wireless

- When installing antennas, always mount them higher than any obstructions in the radio path.
- Whenever possible, adjust the radio's over-the-air data rate to the slowest speed allowed by application.
- Select a radio with the lowest frequency band to maximize distance. If equivalent products are available in 2.4 GHz or 900 MHz, choose 900 MHz.
- Minimize interference with nearby systems by following antenna mounting height or gain regulations.

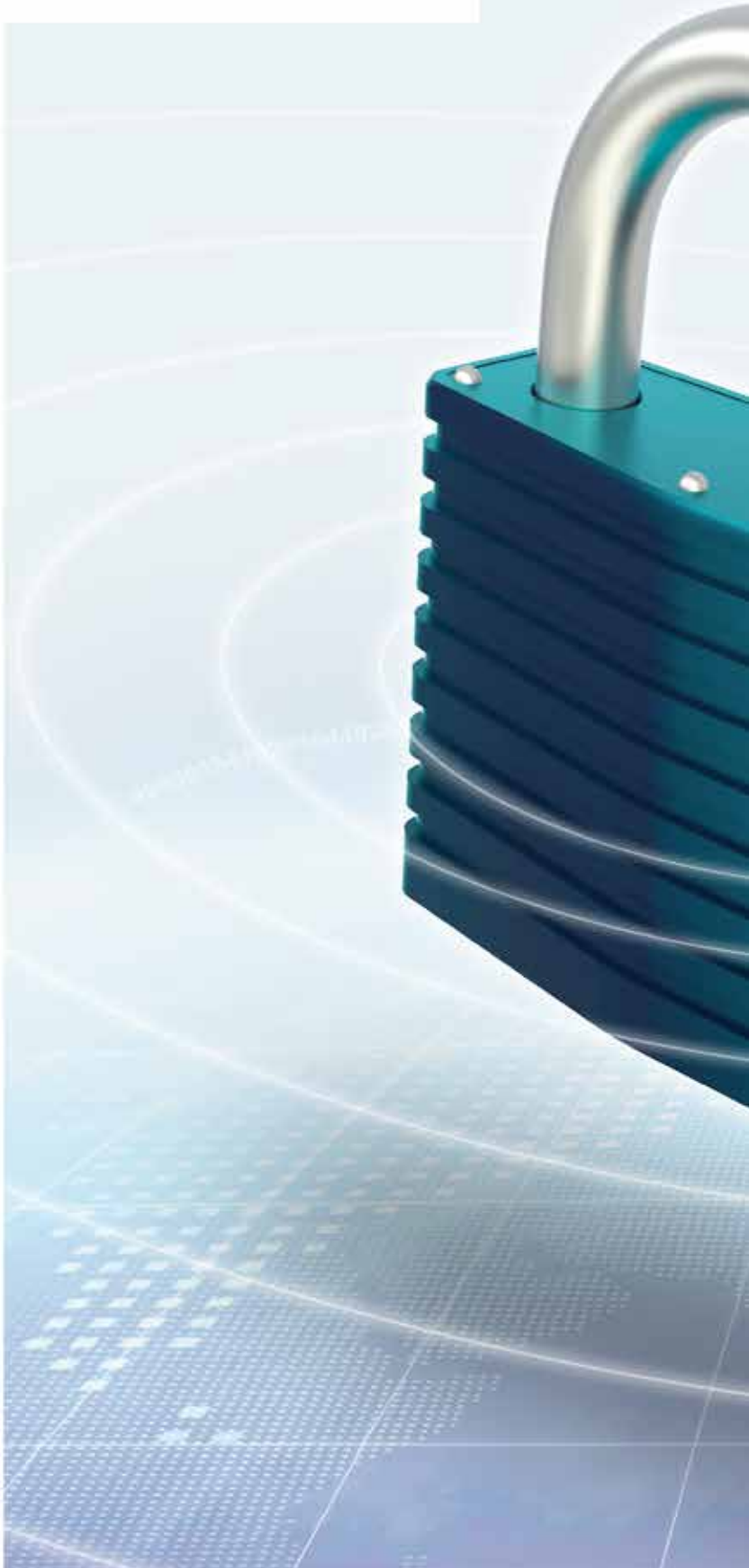
Security

Regardless of whether your network is wired or wireless, security is always a concern. Ensuring that your data can remain safe and private is a major point to consider when installing a new system.

Reducing accessibility to a wireless network can be achieved in three ways:

- **Transmission technology**
- **Encryption authentication**
- **Installation practices**

By combining these three methods, you can successfully prevent unwanted users from accessing information sent via any wireless network.



Transmission technology

There are several different ways in which a radio can utilize bandwidth and modulation techniques to transmit data. Each of these transmission technologies has different benefits and trade-offs, including range, security, data volumes and efficiency. This means that some technologies handle interference better with longer range, while others are meant for higher throughput applications over shorter distances. Using different transmission methods or technologies decreases the likelihood of a hacker stealing data or jamming signals.

Encryption/authentication

Encryption converts the actual data or information with the use of a key into a coded message for transmission. The coded message that is transmitted requires the key to decrypt, preventing unauthorized interception of data.

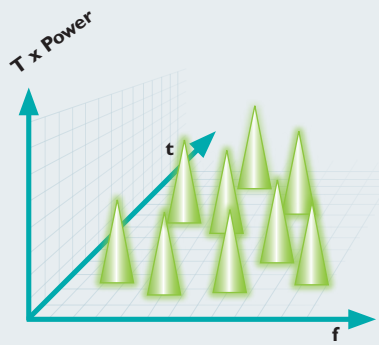
Authentication places a password on the network, allowing access only by authorized users. Encryption and authentication are the two most common practices for security in a wireless system.

Installation practices

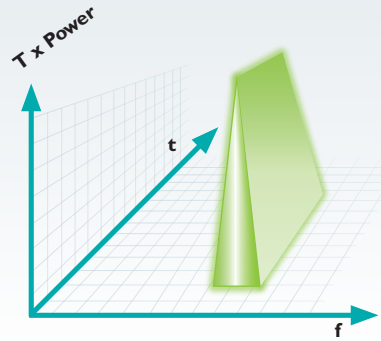
Wireless installers typically use the highest transmit power and gain antennas available, often creating a wireless network with a much greater range than is really needed. Wireless network security can be greatly enhanced with a minimalist installation. Limiting transmit power and antenna gain to only what is needed for adequate wireless coverage across a facility makes it inherently more difficult for an outside hacker, because the intruder would have to be physically located in or near the facility in order to detect the network.

Differentiating technologies

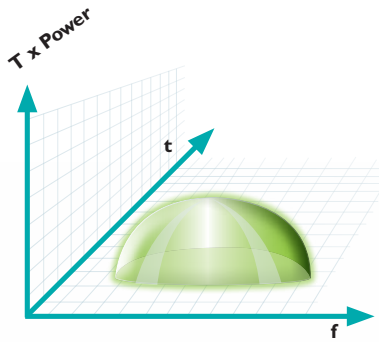
Comparing transmission methods



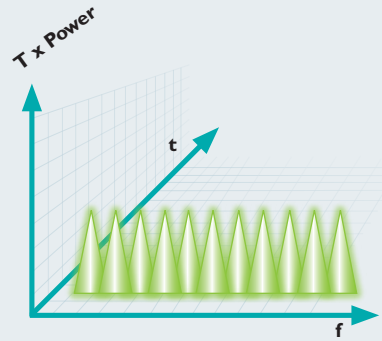
Frequency-Hopping Spread Spectrum (FHSS)
transmits radio signals by rapidly switching a carrier between many frequency channels using a pseudorandom sequence known to both transmitter and receiver. FHSS tolerates interference because a transmission will immediately resend on the next hop if it is blocked on a channel.



Fixed frequency
transmits a signal on a single frequency with a specific channel width (usually very narrow). Fixed-frequency radios typically have high-power transmitters and require a license to operate. Strong interference can affect a fixed-frequency transmitter in or near the channel. The licensing requirement prevents nearby systems from operating on the same channel and reduces the likelihood of interference.

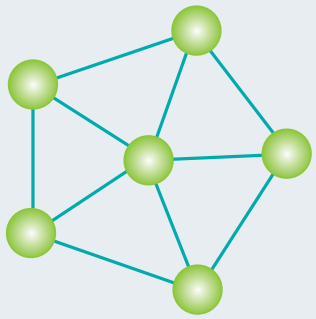


Direct Sequence Spread Spectrum (DSSS)
broadcasts transmission signals that spread over the full bandwidth of a device's transmitting frequency. User data combines with a spreading code before being sent over the air, creating a wide band transmission. Interference is suppressed during the demodulation process in the receiver. When the spreading code is removed to extract the user data, the noise signal is simultaneously suppressed.

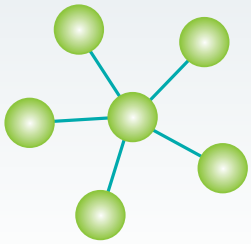


Orthogonal Frequency-Division Multiplexing (OFDM)
broadcasts simultaneously on multiple subcarrier frequencies. Each subcarrier is a narrow band transmission, summarily allowing high data rates to be achieved. OFDM is flexible in coping with severe channel conditions. Interference is handled with a variety of methods due to the higher complexity of OFDM transmission. Narrow band interference is tolerated because of the high number of interleaved subcarriers and channel coding mechanisms, similar to DSSS.

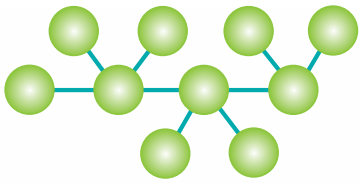
Network architectures



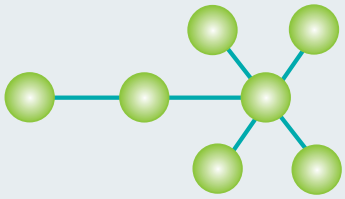
Mesh networking
A mesh network can route data between multiple nodes of receiver/transmitters. It supports self-healing, continuous connections and reconfiguration around broken or blocked paths by hopping from node to node until data reaches the designated destination.



Star/point-to-multipoint
A master control regulates the flow of information on a polled basis with remote sites. Store-and-forward repeater configurations are supported to extend the reach of the wireless network.



Trunk networking
Trunking uses break-off connection points to leverage existing infrastructures, add bandwidth capabilities and provide high availability at low cost. This allows data to flow only where needed, optimizing available bandwidth.



Repeaters
The signal is received and then retransmitted to cover longer distances or to avoid obstacles. Repeaters can be incorporated into point-to-point, point-to-multipoint, mesh and trunk networking architectures.

Wireless technologies

- Rugged, industrial products create high-speed Ethernet links in plant floor and SCADA applications using this technology
- Capable of high data throughputs up to 54 Mbps
- Common in the consumer market for wireless Ethernet applications

- First wireless standard specifically for industrial applications
- 2.4GHz global technology for process-monitoring applications

- Industrial products use Bluetooth technology to send I/O, serial or Ethernet data over short distances
- Short-range frequency-hopping technology for global use
- Used in phones, printers, headsets, and other consumer products

- Proprietary, unlicensed frequency-hopping technology for harsh industrial environments
- Used for transferring Ethernet, serial, and I/O data over distances up to 20 km/12 miles or more
- Proven high data reliability

- Known as cell phone technology and operates on a cellular network
- Globally available
- Requires a service plan

Industrial wireless usage

	Enterprise Ethernet network	SCADA Ethernet network	Serial data	Analog digital I/O
WirelessHART Frequency: 2.4 GHz Speed: 250 kbps Range: < 250 m/800 feet				■
Trusted Wireless Frequency: 900 MHz/2.4 GHz Speed: Varies, < 1 Mbps Range: Varies, > 32 km/20 miles		■	■	■
Cellular Frequency: 850/900/ 1800/1900 MHz Speed: 7 Mbps Range: < Cellular service		■	■	
Bluetooth Frequency: 2.4 GHz Speed: 1 Mbps Range: < 100 m			■	■
WLAN (802.11 a/b/g/n) Frequency: 2.4/5 GHz Speed: Up to 300 Mbps Range: 600 ft.	■	■		

Wireless Network Planner

Wireless planning made easy

The Wireless Network Planner (WNP) from Phoenix Contact is a unique tool that assists with the selection of a specific product line. It also serves as a basic planning tool, allowing a user or integrator to evaluate whether to use a specific wireless protocol for a project.

The WNP also allows for selection of different accessories (i.e., cables, antennas, expansion modules, adapter cables, etc.) and uses the alterations in the link budget calculations.

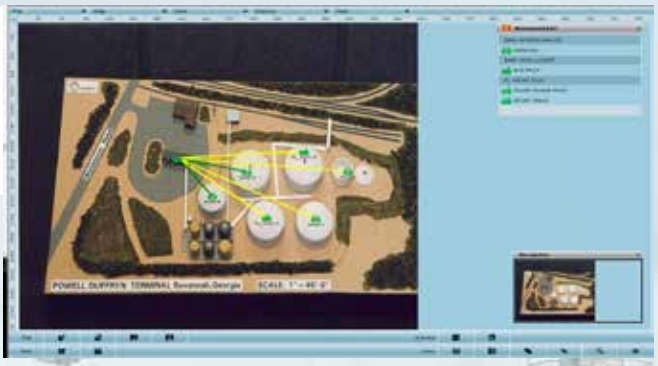
To learn more and to download the free software, please visit:
www.phoenixcontact.com/radioline

1 Select the region where the wireless network will be installed.

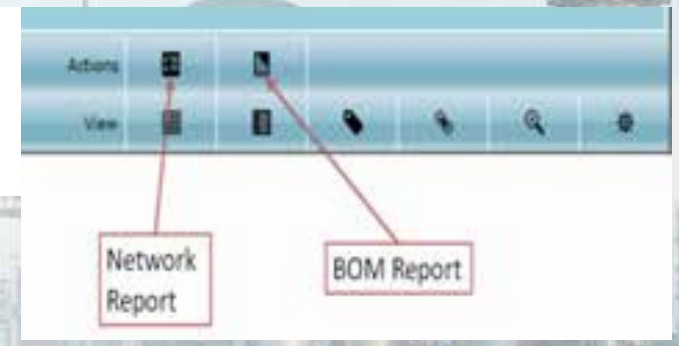
2 Choose the product line or types of radios that will be in the network.

3 Import images and set overall dimensions to increase map accuracy when planning the network.

4 Place devices onto the map to verify how robust the network actually is.



5 The WNP has built-in capabilities to generate a network report and a Bill of Materials (BOM) report.



Our industrial wireless product portfolio for your applications

Phoenix Contact is a leading global provider of industrial wireless solutions. Today, with more than 50,000 installed units, Phoenix Contact's wireless products provide dependability and security while monitoring and controlling signals such as level, temperature, frequency and digital alarms.

Phoenix Contact strives to meet customer needs with both standard and application-specific wireless products designed to effectively endure and operate in an extensive variety of industrial environments. Cable-based circuits create increasingly high installation costs and limit alteration flexibility. Wireless solves these challenges with easy-to-alter permanent or temporary communication.

Whether serial or I/O data, fieldbus or Ethernet communications, Phoenix Contact offers the solution for every application, utilizing technologies ranging from Bluetooth to WLAN, GSM/GPRS, proprietary Trusted Wireless or WirelessHART.

WIRELESS PORTFOLIO

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Each section above is indicated by the colored sidebar on each page – indicated below.

Wireless I/O – Transmission of I/O signals

With wireless IO, analog and digital signals are transmitted without using a signal cable via the following technologies:

- **Trusted Wireless**
- **Bluetooth**
- **Cellular**
- **WirelessHART**

Wireless serial – Serial data transmission

For the wireless transmission of signals from serial interfaces, the following technologies are utilized:

- **Trusted Wireless**
- **Bluetooth**
- **Cellular**

Wireless Ethernet – Transmission in Ethernet networks

In order to integrate devices in the Ethernet network, these technologies are optimized:

- **Trusted Wireless**
- **Bluetooth**
- **Cellular**
- **WLAN**

Wireless accessories – For indoor and outdoor use

For a wireless network to operate properly, additional accessories may be needed. These include not only various antennas and cables, but also adapters, splitters and surge protection. These accessories and many others are all part of our extensive wireless portfolio.

Wireless I/O

Radioline – easy start-up with I/O mapping

Radioline is the new wireless system for large systems and networks. Special features include extremely easy assignment of inputs and outputs by simply turning the thumbwheel – without any programming.

Radioline transmits I/O signals as well as serial data and is therefore very versatile. In addition, you can implement various network structures, from a simple point-to-point connection to complex networks.

I/O mapping

I/O mapping simplifies signal distribution in your system. Assign inputs and outputs quickly by simply turning the thumbwheel.
In this way, you can distribute and multiply I/O signals freely in your network – without the need for any complex programming.

Class I, Division 2
Groups A, B, C, D

TRUSTED WIRELESS

900 MHz wireless module

RAD-900-IFS
Order no. 2901540

- **Supply voltage: 10.8 – 30.5 V DC**
- **Can be extended with the I/O modules via T_BUS**
- **Extended temperature range: -40°C – 70°C**
- **Antenna connection: RSMA (female)**

2.4 GHz wireless module

RAD-2400-IFS
Order no. 2901541

- **Supply voltage: 19.2 – 30.5 V DC**
- **Can be extended with I/O modules via T-BUS**
- **Extended temperature range: -40°C – 70°C**
- **Suitable for ATEX zone 2**
- **Antenna connection: RSMA (female)**

Accessories

RAD-900-CONF-RF1 (RF band 1)
Order no. 2702122

RAD-CONF-RF3 (RF band 3)*
Order no. 2902814

RAD-CONF-RF5 (RF band 5)*
Order no. 2902815

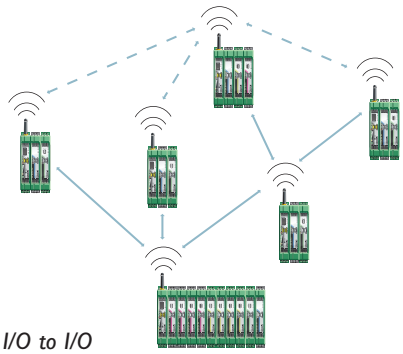
RAD-CONF-RF7 (RF band 7)*
Order no. 2902816

RAD-MEMORY (freely configurable)
Order no. 2902828

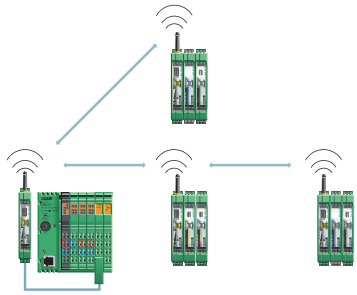
- **Unique network addressing via plug-in configuration memory for secure, parallel operation of multiple networks (different RF bands)**

** RAD-2400-IFS only*

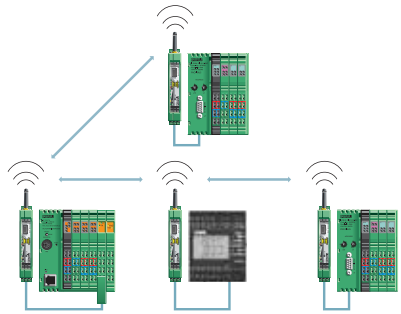
Signal transmission with the Radioline wireless system:



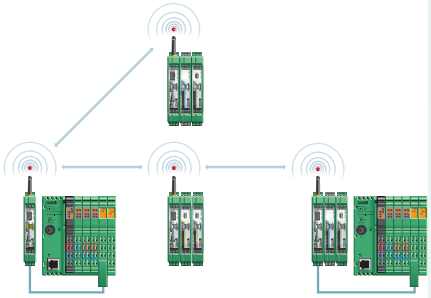
I/O to I/O



I/O-to-serial (Modbus RTU)



Serial-to-serial (transparent)



I/O and serial dual mode

The Radioline wireless system features:

- Quick and easy start-up without programming
- Easy point-to-point or network connections (star, mesh)
- Can be extended with up to 32 I/O modules per station via T-BUS (hot-swappable)
- Applications: I/O-to-I/O, I/O-to-serial, serial-to-serial
- Integrated RS-232 and RS-485 interface
- Trusted Wireless 2.0 technology
- Adjustable data rates for the wireless interface (16 – 500 kbps)
- 128-bit data encryption (AES)

Wireless I/O

Radioline – I/O extension modules

Various extension modules are available for extending the Radioline wireless system quickly and easily; the number and type of signals can be adapted to the special requirements of the specific applications.

High-density digital expansion module

RAD-DI8-IFS
Order no. 2901539

RAD-D08-IFS
Order no. 2902811

- **Eight digital inputs/outputs (0 – 30.5 V DC or 2x32 bit counter)**

It could not be simpler:

1. Easy installation

Create a modular wireless station in the control cabinet and extend or replace it easily during operation.

Class I, Division 2
Groups A, B, C, D

TRUSTED WIRELESS

Digital extension modules

RAD-DI4-IFS
Order no. 2901535

RAD-DOR4-IFS
Order no. 2901536

- **Four digital wide-range inputs (0 – 250 V AC/DC)**
- **Four digital relay outputs (24 V DC/250 V AC/6 A)**

Analog/digital extension module

RAD-DAIO6-IFS
Order no. 2901533

- **One analog input (0/4 – 20 mA)**
- **One analog output (0/4 – 20 mA, 0 – 10 V)**
- **Two digital wide-range inputs/ outputs (0 – 250 V AC/DC)**

Analog extension modules

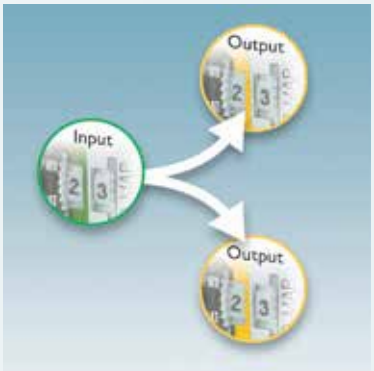
RAD-AI4-IFS
Order no. 2901537

RAD-AO4-IFS
Order no. 2901538

- **Four analog inputs (0/4 – 20 mA)**
- **Four analog outputs (0/4 – 20 mA, 0 – 10 V DC)**

2. Easy addressing

Set the address on the wireless module by simply turning the thumbwheel.



3. Easy distribution

On the I/O module, the thumbwheel is also used to assign the inputs and outputs, thereby easily distributing the I/O signals in the system.

Pt100 extension module

RAD-PT100-4-IFS
Order no. 2904035

- **Four Pt100 inputs**
- **Temperature measuring range: -50°C to 250°C**
- **Two- or three-wire connection**

900 MHz Wireless I/O

For unidirectional signal transmission

Two digital switching signals (5 – 30 V) as well as an analog sensor signal (4 – 20 mA) can be accommodated and transmitted from the transmitter to the receiver with the unidirectional system. In addition to point-to-point connections, multiple receiver systems can be used for multiplying and dividing signals.

All modules listed are for use in Class I, Division 2 hazardous areas.

Long-haul wireless communication with Trusted Wireless

The Trusted Wireless technology serves to transmit data volumes of just a few bytes over distances of several kilometers without cables. Thanks to the FHSS method, the technology attains proper ruggedness: Communication takes place on 63 channels in the 902–928 MHz frequency bandwidth, hopping from one channel to another according to a pseudorandom hopping algorithm. This hopping pattern makes it possible for sources of interference to be tolerated and for several hundred systems to be operating in the same area at the same time.

Diagnostics included

The floating RF-Link contact and the analog RSSI signal allow continuous monitoring of the wireless path in the control cabinet and outdoor variants.

Class I, Division 2
Groups A, B, C, D

Reliable signal output

The signals transmitted by wireless link are made available at the receiver in the form of two floating relay contacts and an analog current output.

Unidirectional wireless set

RAD-ISM-900-SET-UD-ANT
Order no. 2867102

- **Consists of one DIN rail-mountable transmitter, one DIN rail-mountable receiver and two omnidirectional antennas with connecting cables**
- **Two digital signals: 5 V AC/DC – 30 V AC/DC**
- **One analog current signal 4 – 20mA**
- **Supply voltage: 12 V DC – 30 V DC**

Spare transmitter

RAD-ISM-900-TX
Order no. 2867076

- **For replacement parts only**
- **One analog: 4 – 20 mA**
- **Two digital: 5 – 30 V DC inputs**
- **Contains a replacement hop key for pairing a receiver**

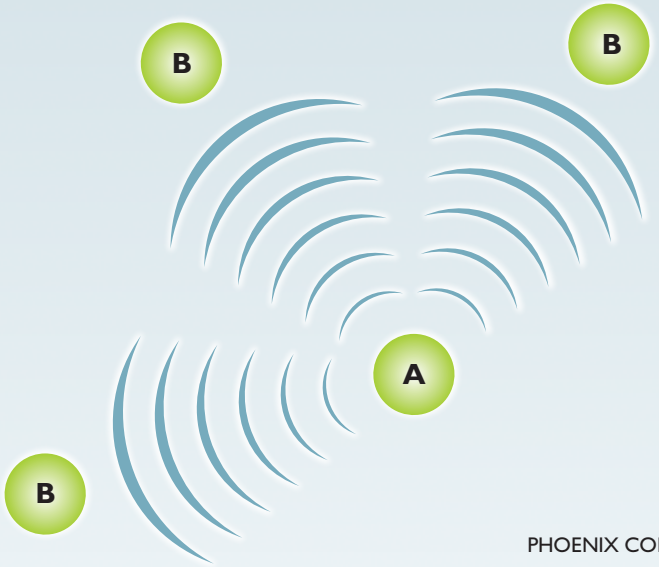
Spare receiver

RAD-ISM-900-RX
Order no. 2867047

- **For replacement or signal-splitting applications**
- **One analog: 4 – 20 mA**
- **Two digital: 5 – 30 V DC inputs**

Point-to-point

Signal duplication using multiple receivers with one transmitter



900 MHz Wireless I/O

Outdoor versions for unidirectional signal transmission

The unidirectional outdoor modules open up new possibilities in process control and monitoring. The devices can be directly installed outdoors without a control cabinet. By mounting them at the height of the antenna, the additional attenuating antenna extension and adapter cables can be omitted, and the radio transmitter can be mounted directly to an instrument or conduit.

Unidirectional wireless set

RAD-ISM-900-SET-DC-UD
Order no. 2867034

- **Consists of one DIN rail-mountable receiver, an outdoor transmitter and two omnidirectional antennas**
- **Two digital signals: 5 V AC/DC – 30 V AC/DC**
- **One analog current signal: 4 – 20 mA**
- **Supply voltage/transmitter: 12 V DC – 30 V DC**

Spare DC receiver

RAD-ISM-900-RX
Order no. 2867047

- **Supply voltage: 12 – 30 V DC**
- **Two digital outputs: 5 – 30 V DC**
- **One analog output: 4 – 20 V DC**

Spare outdoor transmitter

RAD-ISM-900-TX-(AC)
Order no. 2867335

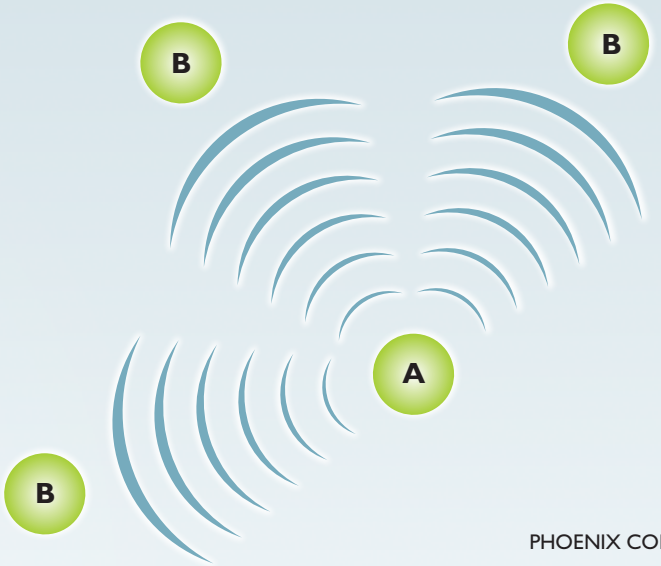
- **Supply voltage: 100 – 240 V DC**
- **Two digital inputs: 5 – 30 V DC**
- **One analog input: 4 – 20 mA**

RAD-ISM-900-TX-(DC)
Order no. 2867348

- **Supply voltage: 12 – 30 V DC**
- **Two digital inputs: 5 – 30 V DC**
- **One analog input: 4 – 20 mA**

Point-to-point

Signal duplication using multiple receivers with one transmitter



Wireless I/O

Wireless-MUX, the wireless signal cable

The Wireless-MUX transmits 16 digital and two analog signals bidirectionally so that it can replace a 40-wire signal cable. The connection is monitored at all times. If it is severely disturbed or interrupted, the outputs are reset to the defined status LOW. This is displayed on the module via the diagnostics LED. The link quality display also provides the user with constant information on the connection quality.

The Wireless-MUX is sold as a "ready to use" package: You take the device out, connect it, switch it on, and you have your wireless path!

Bluetooth

Possible usage ranges

The Wireless-MUX is used wherever fewer digital or analog input and output signals are to be exchanged with a remote or a mobile station without using cables. The wireless components are offered as cable replacement in various packages:

- **As a standard package with omnidirectional antenna, which can be used to realize ranges* between 50 and 100 m in halls and those of more than 200 m in outdoor areas**
- **As a package with panel antenna, which can be used to bridge distances* of more than 400 m outdoors with free line of sight**
- **Versions with reduced transmission power**

** The range can be considerably exceeded or undercut and depends on the environment, antenna technology and the product used.*

Omni wireless set

ILB BT ADIO MUX-OMNI
Order no. 2884208

- **Consisting of two fixed-pair modules, two omnidirectional antennas with 1.5 m cable and a DIN rail adapter**

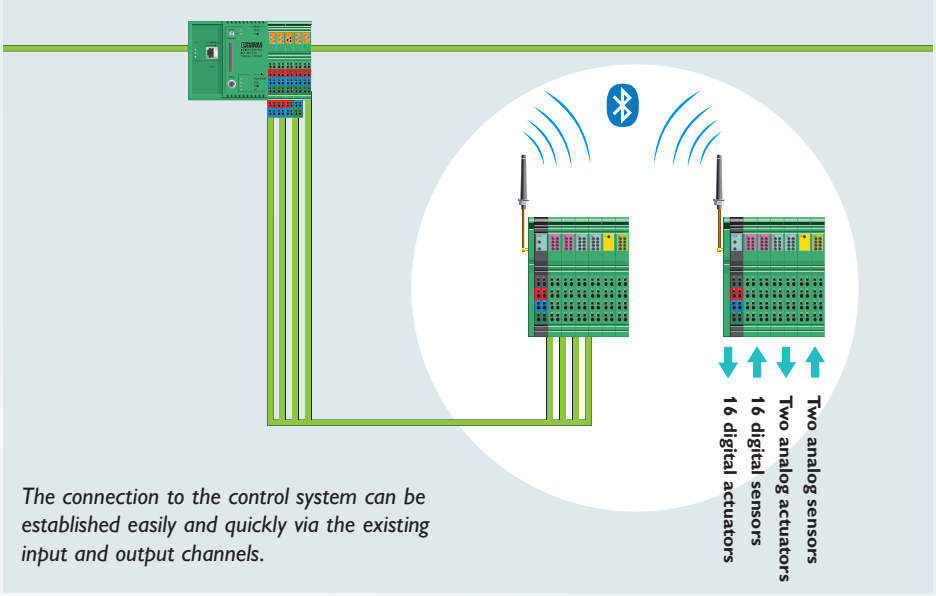
Panel antenna wireless set

ILB BT ADIO MUX
Order no. 2702875

- **Consisting of two paired modules, no antennas, RSMA (F) antenna connector**

Omni wireless set

World's first Bluetooth module with marine approval
Further information on request.



The connection to the control system can be established easily and quickly via the existing input and output channels.

Our Wireless-MUX system convinces with the following features:

- The fixed pairing automatically takes care of setting up the connection and transmitting the signals
- No configuration or settings
- Typically transmission time of less than 10 ms
- Technical data:
  - Supply voltage: 19.2 V DC – 30 V DC
  - 16 digital inputs and two analog inputs
  - 16 digital outputs with an output current of max. 500 mA and two analog outputs with 0 mA – 20 mA or 0 V – 10 V

Factoryline Bluetooth is the industrial Bluetooth technology from Phoenix Contact for transmission of control data in factory automation.

- Extremely rugged and reliable
- Can be operated together with WLAN without any interference
- Parallel operation of several Bluetooth systems
- Manipulation and tap-proof

Wireless I/O

Factoryline Bluetooth for wireless fieldbus expansion

The Fieldline installation system from Phoenix Contact can have up to three Fieldline Modular Wireless I/O modules distributed in the field and added to it via a Bluetooth-based local bus. The base station controls communication with the wireless components automatically and transmits the time-critical process signals, typically in 10 ms per module.

Configuration of the devices is a simple matter: The base station writes the connection data to an ID plug that is then plugged into the wireless modules. The base station can be integrated in all common fieldbus systems using various Fieldline bus couplers.

Possible usage ranges

The Fieldline Modular Wireless I/O system is particularly suitable for use in moving temporarily installed or inaccessible machine units in all industrial sectors when time-critical process signals are to be transmitted.

- **Fast data transmission, typically in 10 ms per module**
- **Short range* of 20 to 50 m in industrial halls and more than 100 m outdoors**

* *The range can be considerably exceeded or undercut and depends on the environment, antenna technology and the product used.*

Bluetooth

Fieldline Modular Wireless I/O base station

FLM BT BS 3
Order no. 2736770

- **Base station for up to three Fieldline Modular Wireless I/O modules**
- **IP65 protection**

Fieldline Modular Wireless I/O module

FLM BT DIO 8/8 M12
Order no. 2736767

- **Eight digital inputs and outputs**
- **IP65 protection**

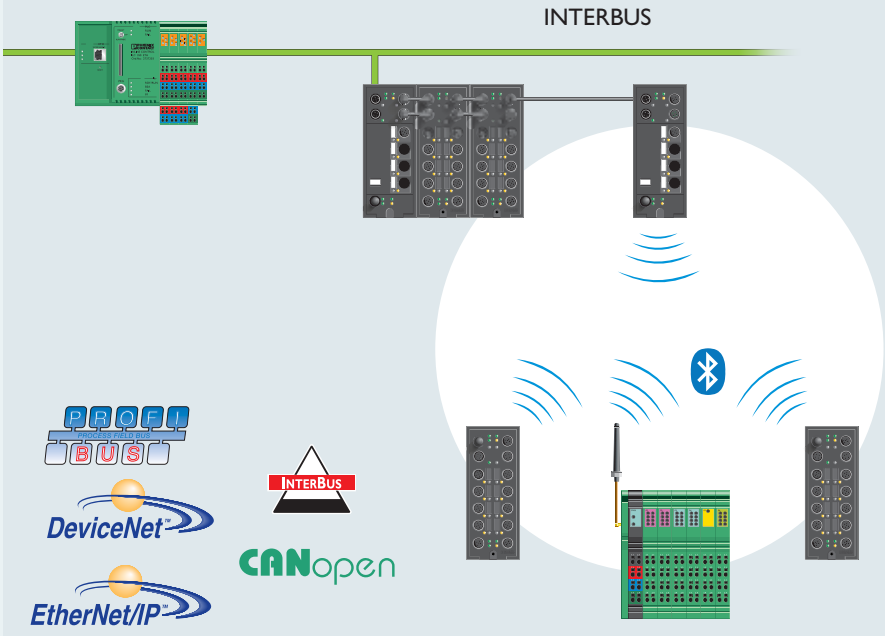
FLM BT DI 16 M12
Order No. 2693208

- **16 digital inputs**
- **IP65 protection**

Fieldline Modular Wireless I/O module

ILB BT ADIO 2/2/16/16
Order no. 2884282

- **16 digital inputs and outputs, two analog input and outputs**
- **IP20 protection**



Installation close to the machines

The Fieldline Modular Wireless I/O modules can be mounted directly on the machine or plant. The wiring of the "last meter" to the sensors and actuators is done in a conventional star shape, using our preassembled M12 connectors, for example.

Features:

- Automatic establishment of communication
- Communication interruptions are identified and reported

Factoryline Bluetooth is the industrial Bluetooth technology from Phoenix Contact for transmission of control data in factory automation.

- Extremely rugged and reliable
- Simple and fast start-up
- Can be operated together with WLAN without any interruptions due to the Black Channel Listing, Low Emission Mode and AFH
- Parallel operation of several Bluetooth systems
- Manipulation and tap-proof

WirelessHART

Enable new applications by leveraging smart devices

Stranded I/O points and diagnostics can be integrated into a process without decommissioning an existing system by connecting a WirelessHART adapter (RAD-WHA-1/2NPT) to HART devices. The WirelessHART gateway (RAD-WHG/WLAN-XD) connects to the host system via Modbus TCP, HART IP or FDT/DTM.

Remote configuration of instruments can be completed utilizing FDT/DTM frameworks or HART IP over the WirelessHART network. WirelessHART uses the same maintenance and diagnostic tools as traditional wired HART devices. Requiring little additional training, there's little to no need for extensive RF planning.

Class I, Division 2
Groups A, B, C, D

The RAD-WHG/WLAN-XD WirelessHART gateway comes with a fully integrated WLAN and may be used as a backhaul connection. This allows the gateway to be installed in the field, closer to the devices. This also allows the user to create a "clustered" network topology. Clustered topology reduces demand on battery-powered nodes for routing, which increases battery life.

The WLAN transceiver can also be disabled, and the host connection can still be made via the standard Ethernet port.

RETROFIT INSTALLATION

WirelessHART gateway

RAD-WHG/WLAN-XD
Order no. 2900178

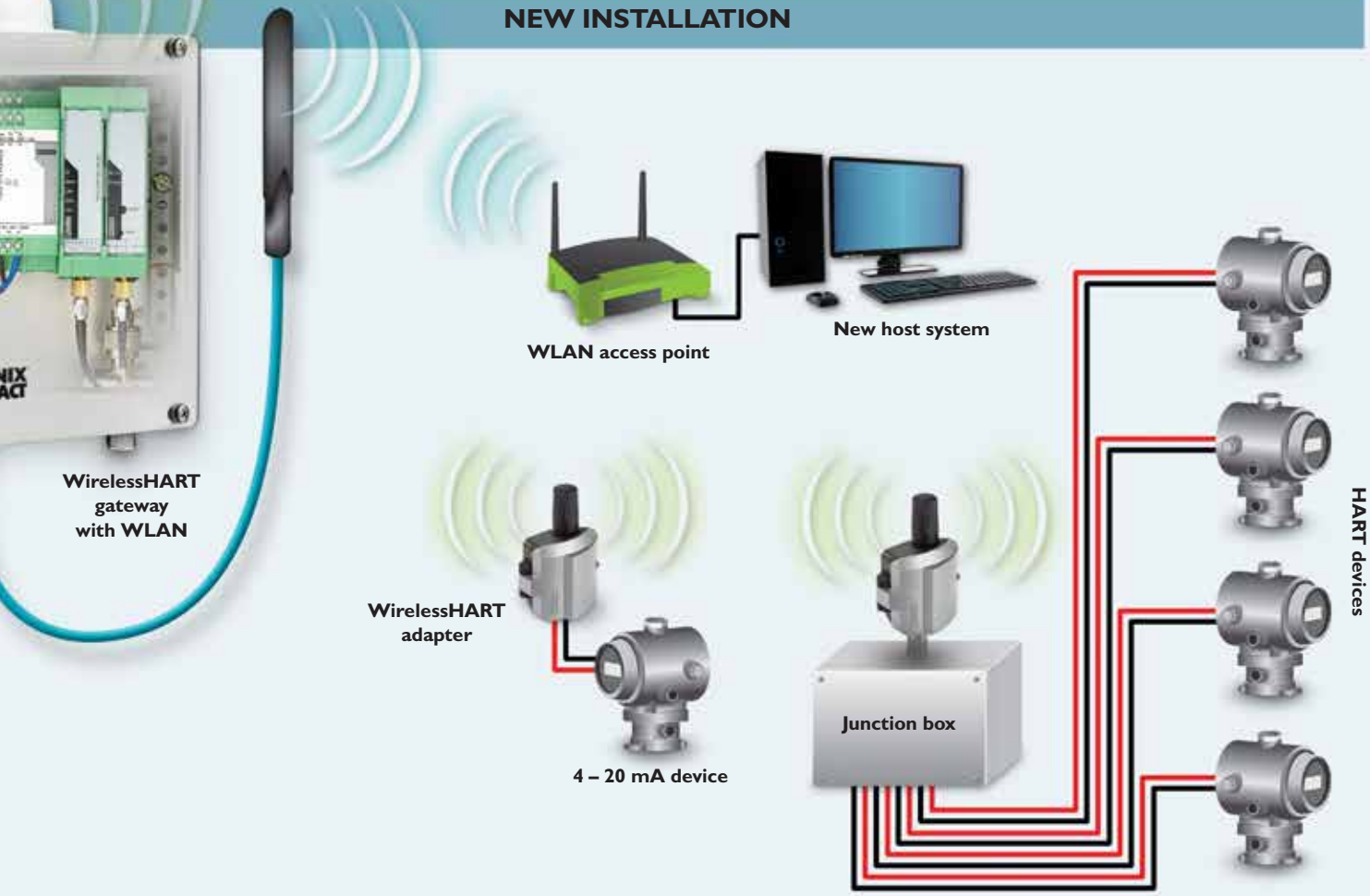
- **Connect up to 250 WirelessHART devices**
- **Converts HART data to Modbus TCP**
- **Simple programming via embedded Web server**
- **HART IP enhancement allows programming remotely via FDT/DTM**

WirelessHART adapter

RAD-WHA-1/2NPT
Order no. 2900100

- **Connect up to four HART devices or one 4 – 20 mA legacy device**
- **May be loop- or line-powered**
- **IP67 rated**
- **HART modem loops allow for an easy connection point for configuration of adapter**

NEW INSTALLATION



Wireless Serial

Radioline – wireless networking of serial interfaces

The Radioline wireless modules can be used to wirelessly network multiple controllers or serial I/O devices quickly and easily via RS-232 and RS-485 serial interfaces using either the 900 MHz or 2.4 GHz bands.

Data transmission is transparent, which means that any protocols, such as Modbus, can be forwarded. In addition, various network structures can be implemented, from a simple point-to-point connection to complex mesh networks.

User-friendly software diagnostics:

All network devices can be monitored easily via the master.

- Quick and easy setup without programming
- Can be extended up to 32 I/O modules per station
- Online diagnostics:
  - Network structure
  - Signal quality of each network station (RSSI)
  - Status display of I/O extension modules at each network station
  - Recording of RSSI signal and I/O status of each network station

Class I, Division 2
Groups A, B, C, D

TRUSTED WIRELESS

900 MHz wireless module

RAD-900-IFS
Order no. 2901540

- **Supply voltage: 10.8 – 30.5 V DC**
- **Can be extended with the I/O modules via T-BUS**
- **Extended temperature range: -40°C – 70°C**
- **Antenna connection: RSMA (female)**

Refer to pages 18-19 for the expansion modules.

2.4 GHz wireless module

RAD-2400-IFS
Order no. 2901541

- **Supply voltage: 19.2 – 30.5 V DC**
- **Integrated RS-232 and RS-485 interface**
- **Extended temperature range: -40°C – 70°C**
- **Antenna connection: RSMA (female)**
- **Suitable for ATEX zone 2**

Refer to pages 18-19 for the expansion modules.

Programming tools

RAD-900-CONF-RF1 (RF band 1)
Order no. 2702122

RAD-CABLE-USB
Order no. 2903447

- **USB cable for diagnostics and configuration**

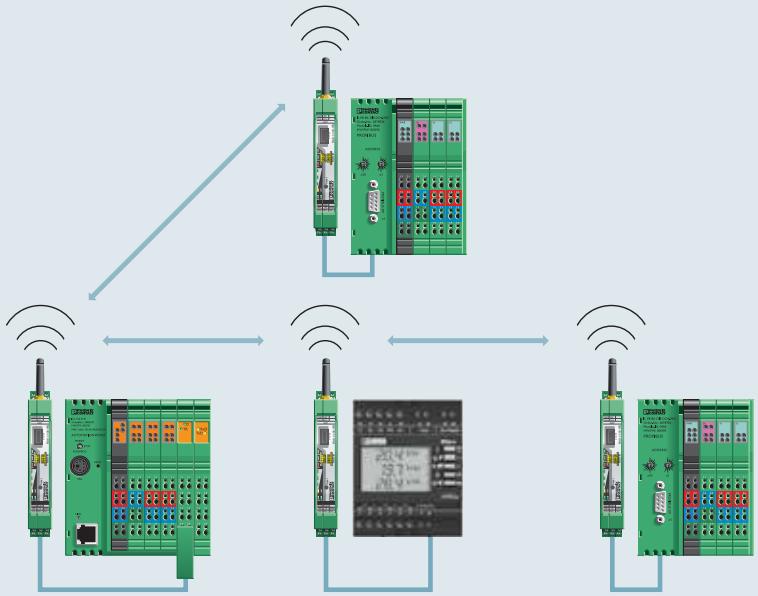
RAD-CONF-RF3 (RF band 3)*
Order no. 2902814

RAD-CONF-RF5 (RF band 5)*
Order no. 2902815

RAD-CONF-RF7 (RF band 7)*
Order no. 2902816

RAD-MEMORY (freely configurable)
Order no. 2902828

** RAD-2400-IFS only*



Replacement for serial cabling

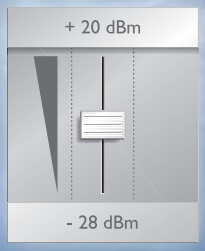
The slaves are connected directly or via repeater slave intermediate stations. Up to 250 repeater slaves can be connected one after the other in order to extend the wireless path or to integrate several (repeater) slaves. Serial I/O devices can also be connected to the repeater slave intermediate stations, and data can be received and forwarded.

Wireless Serial

PSI-Line Bluetooth converters translate serial interfaces to Bluetooth

With the PSI-Line Bluetooth converters, it is possible to convert the RS-232, RS-422 and RS-485 two-wire serial interfaces to Bluetooth, whereby operation with point-to-point or multipoint connection is possible. The worldwide open Bluetooth standard allows wireless, flexible and safe data transmission with every Bluetooth-compatible termination device.

The PSI-Line component can be used everywhere to convert interfaces in connection with corresponding Bluetooth adapters or for connecting serial devices in RS-485 networks. The device is particularly suited for wireless access to controllers for programming or diagnostics and for wireless communication in the field; e.g., Modbus, Profibus, etc.



Scalable transmission power
The transmission capacity of the PSI-Line Bluetooth converter can be set from -28 to +20 dBm using the software tool included. The coverage of the wireless cell can therefore be adapted to individual requirements.

Modbus

RS 232

RS 422

RS 485

Factoryline Bluetooth Modbus I/O access point

PSI-WL-RS232-RS485/BT/2DO
Order no. 2313805

PSI-WL-RS232-RS485/BT/HL
Order no. 2313795
For hazardous locations

- **For wireless transmission of RS-232, RS-422 and RS-485 two-wire interfaces**
- **Point-to-point and multipoint connections (up to seven slaves)**
- **Range: 80 m to 150 m**

PSI Bluetooth PROFIBUS-SET

PSI-WL-PROFIB/BT-SET
Order no. 2313876

- **Preconfigured for an invisible, password-protected and point-to-point Profibus connection with a transmission speed of 187.5 kbps**
- **Consists of two paired PSI Bluetooth converters and two OMNI omnidirectional antennas**
- **Range: 80 m to 150 m**

Wireless programming access and networking of mobile devices (point-to-point and multipoint connections)

The PSI Bluetooth converter can be operated with:

Wireless transmission of serial interfaces up to 150 m

Easy installation

- Operation with all controllers; no driver installation
- Diagnostics of the transmission quality integrated directly via bar graph

Flexible parameterizing options

- Universally applicable for RS-232, RS-422 and RS-485 two-wire interfaces up to 187.5 kbps
- Scalable transmission power

High transmission reliability

- 128-bit data encoding
- Password protection
- Permanent device pairs

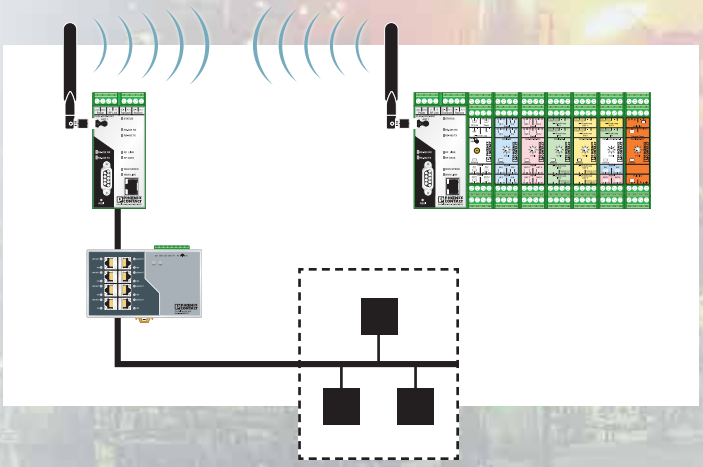
Wireless Ethernet

Trusted Wireless – flexibility and robustness combined

The RAD-ISM-900-EN-BD series radios incorporate a one-watt, frequency-hopping spread spectrum (FHSS) transceiver while operating on the 902 – 928 MHz ISM band. With configurable speeds up to 500 kbps and adjustable packet sizes, this line of radios is designed to maximize speed and minimize latency in your network. The RAD-ISM-900-EN-BD... also features 128/192/256-bit AES encryption to prevent intrusion and keep data secure.

The RAD-ISM-900-EN-BD... supports TCP/IP, UDP and IP v4 protocols, with all programming and radio diagnostics accessible via a simple integrated Web server. Trusted Wireless supports up to 4,096 radios on a single network.

Class I, Division 2
Groups A, B, C, D



Trusted Wireless Ethernet

RAD-ISM-900-EN-BD
Order no. 2900016

- **Functions as master, repeater or slave**
- **Up to 256-bit AES encryption**
- **RS232/485 serial port allows legacy devices to be incorporated onto Ethernet network**
- **IP and MAC address filtering**

Trusted Wireless Ethernet with I/O

RAD-ISM-900-EN-BD-BUS
Order no. 2900017

- **Functions as master, repeater or slave**
- **Same features as the -EN-BD plus:**
  - **Up to eight expandable I/O modules per radio**

See pages 36-37 for expansion modules.

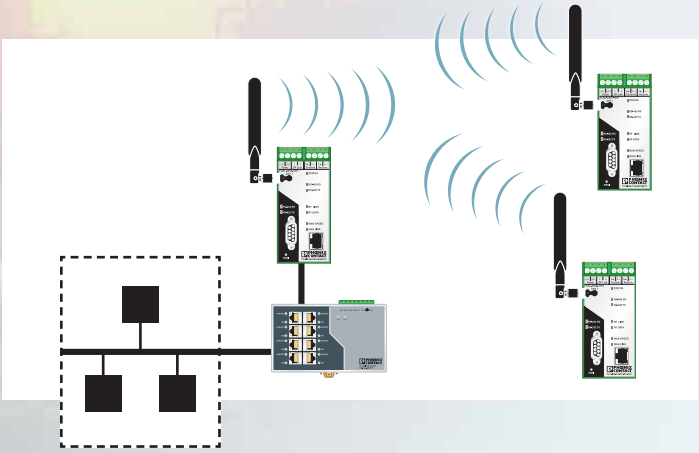
Trusted Wireless Ethernet Basic

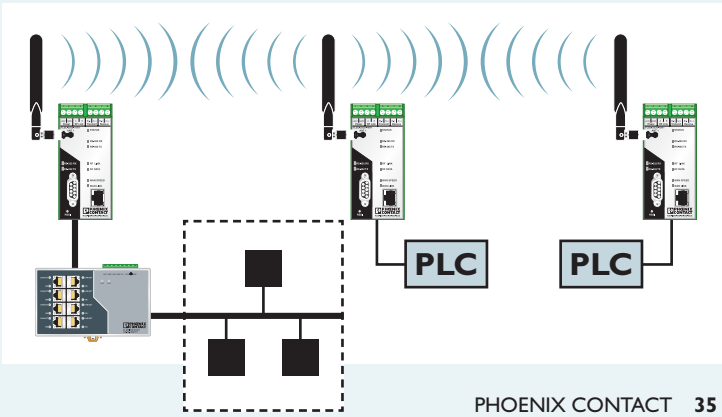
RAD-ISM-900-EN/B
Order no. 2901205

- **Functions as slave**
- **Same features as the -EN-BD without the serial ports**

Trusted Wireless Ethernet applications:

- SCADA systems
- PLC/RTU extensions
- Pump controls
- Tank level/pressure/temperature monitoring
- Water/wastewater treatment
- Petroleum and chemical processing





I/O extension modules

There are a variety of different extension modules available to expand the bidirectional Trusted Wireless I/O system quickly and simply, and with which the number and type of signals can be adapted to the special requirements of the particular application. With up to eight modules, the system can be expanded to a maximum of 32 analog or 64 digital signals.

Digital modules

RAD-IN-8D
Order no. 2867144

RAD-OUT-8D-REL
Order no. 2867157

- **8 x digital input: 5 – 30 V AC/DC**
- **8 x digital output, floating N/O contact**

Class I, Division 2
Groups A, B, C, D

Analog/digital modules

RAD-IN+OUT-2D-1A-I
Order no. 2867322

- **Per 1 x analog input/output 4 – 20 mA**
- **2 x digital input: 5 – 30 V AC/DC**
- **2 x digital output floating N/O contact**
- **Resolution: 16-bit**
- **Accuracy: 0.2 percent**

Analog modules

RAD-IN-4A-I
Order no. 2867115

RAD-OUT-4A-I
Order no. 2867128

- **Per 4 x analog input/output: 4 – 20 mA**
- **Resolution: 16-bit**
- **Accuracy: 0.2 percent**

Measuring and counter modules

RAD-IN-2D-CNT
Order no. 2885223

RAD-OUT-2D-CNT
Order no. 2885236

- **2 x digital input: 3.6 – 30 V AC/DC**
- **Two passive transistor outputs max. 30 V DC**
- **Input/output frequency: 0.1 – 32 kHz (50 percent duty cycle)**
- **Min. pulse length: 10 µs**

Integrated bus foot

The signal data and the supply voltage are routed through via the bus foot integrated at the side. No parameterization or programming is necessary for start-up.

Counting frequencies and measuring pulses

RAD-IN-2D-CNT and RAD-OUT-2D-CNT serve to measure and to output counterpulses and frequency measured values. The relevant operating mode (frequency/counter) and the necessary clock frequency (low-max. 10 Hz/high-max. 32 kHz) are set via dip switch.

The modules can be used to measure flow rates and as power meters or for speed monitoring.

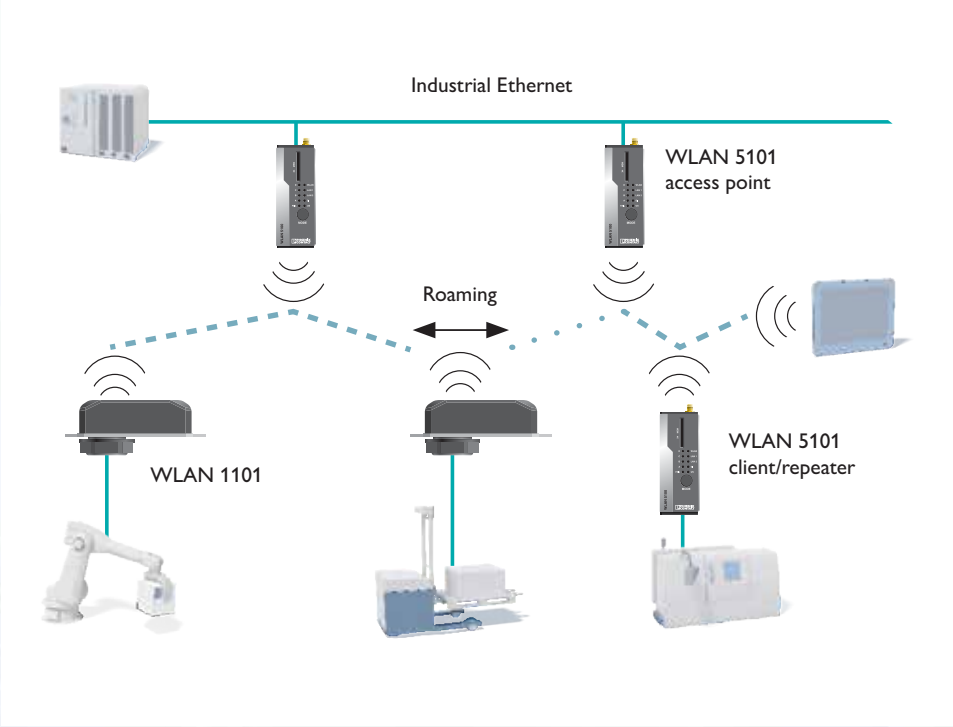
Wireless Ethernet

Industrial WLAN access points

The latest generation of FL WLAN modules offers maximum reliability, data throughput and range. In an extremely compact metal housing, the FL WLAN family combines rugged industrial technology with high 802.11n performance and modern MiMo technology. The central cluster management makes configuration and maintenance of WLAN networks considerably faster and easier.

Properties of the FL WLAN family

- **Faster** – High-speed WLAN modules bring WLAN 802.11n to industrial applications, along with a data rate of up to 300 Mbps modules, which is up to four times greater
- **Farther** – The range of the WLAN is due to its excellent receiver technology and higher transmission power
- **More reliable** – MiMo technology with three antennas significantly increases the ruggedness, speed and range of wireless communication



FL WLAN 1101

FL WLAN 1101
Order no: 2702538

- **802.11 a/b/g/n**
- **IP54 housing**
- **AP, repeater, client**
- **M40 mounting hole**
- **Internal MiMo antennas**

FL WLAN 5101

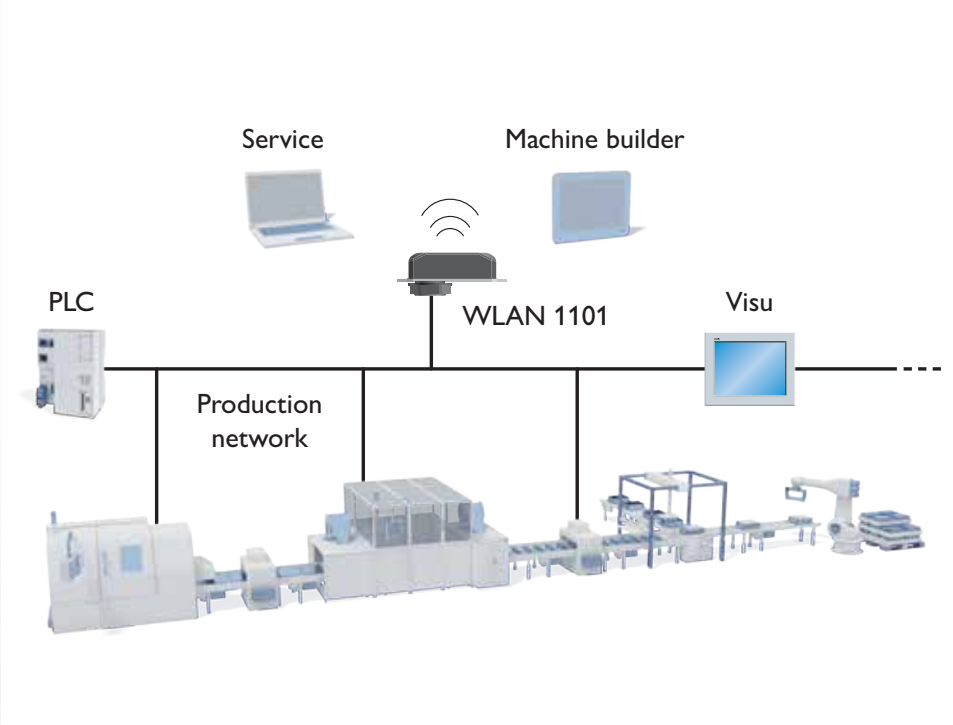
FL WLAN 5101
Order no: 2701093

- **802.11 a/b/g/n**
- **AP, Repeater, client**
- **SD card slot for programming**
- **two-port unmanaged switch**
- **Antenna connections RSMA (F)**

POE WLAN

POE Wireless Access Point
Order no. 2400496

- **FL WLAN 5101 radio in IP66 box**
- **POE splitter allows FL WLAN 5101 radio to be powered from POE switch or injector**



Wireless Ethernet

Cellular routers – worldwide network access

Cellular routers support high-performance remote connections to industrial Ethernet networks, which can be used to transmit sensitive data securely over cellular networks. The integrated firewall and Virtual Private Network (VPN) support reliably protect the application against unauthorized access.

The Ethernet connection can be used for system-wide remote maintenance of all connected components in the network, such as drives, controllers, control panels or visualization PC.

Features:

- mGuard Secure Cloud compatible
- Support for Verizon and AT&T with one part number
- Firewall and VPN reliably protect the application against unauthorized access
- Alarm generation via SMS and e-mail
- Integrated serial server

Cellular routers for Verizon, AT&T and global carriers

TC mGuard RS2000 3G VPN
Order no. 2903441

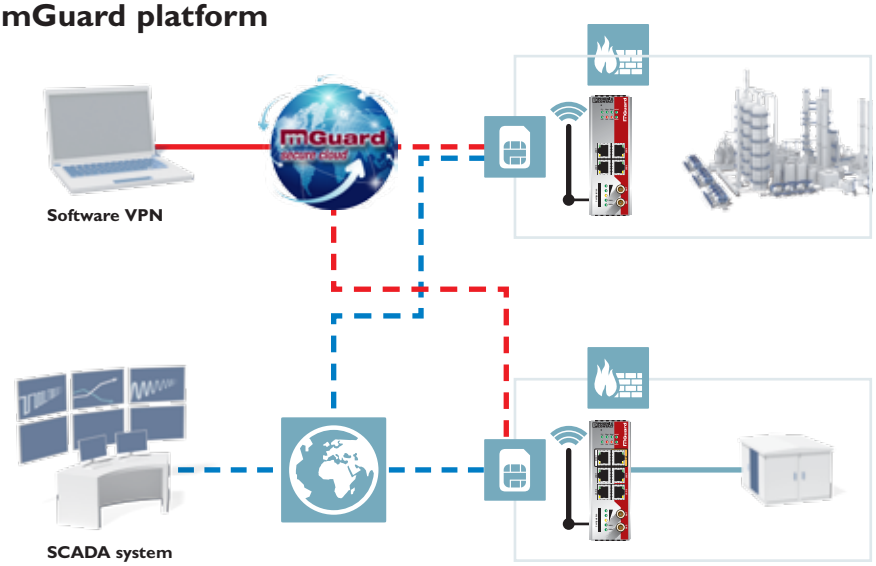
- **Cellular access via 3G networks for GSM and CDMA**
- **Four-port unmanaged switch**
- **Data rates of 7.2 Mbps**

Cellular routers for Verizon, AT&T and global carriers

TC mGuard RS4000 3G VPN
Order no. 2903440

- **Cellular access via 3G networks for GSM and CDMA**
- **Redundancy fail-over from wired to cellular connection**
- **DMZ port for multiple network access**
- **Four-port managed switch**
- **Data rates of 7.2 Mbps**

SCADA and remote communication via mGuard platform



Remote maintenance and support
Obtain access to your remote machines utilizing the Phoenix Contact mGuard Secure Cloud infrastructure. For tech to machine applications to support your customers more easily and securely.

Secure SCADA
When networking with critical infrastructure, a higher level of security and reliability is necessary. The TC mGuard provides an active firewall, VPN technology and vulnerability updates to support applications where it becomes necessary to address these security concerns.

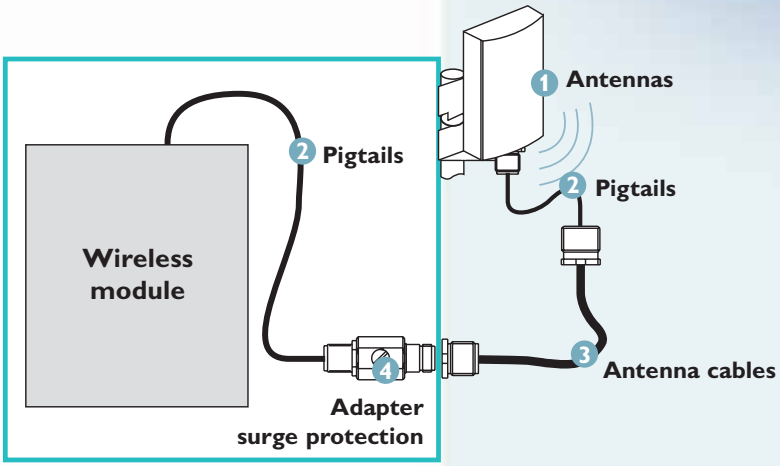
Wireless accessories

Cables and adapters

A wireless system is only as strong as its weakest component. High-quality antennas, cables and adapters are a necessity to ensure a reliable wireless link.

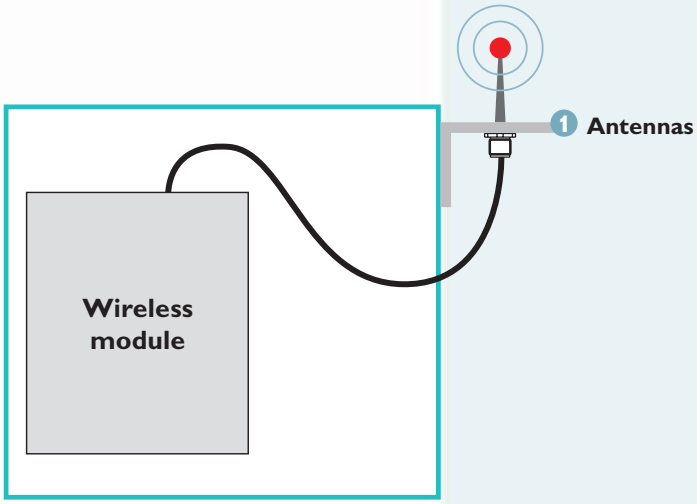
Control cabinet/ control box

For antennas with extension cable



Control cabinet/ control box

For antennas without extension cable and without surge protection

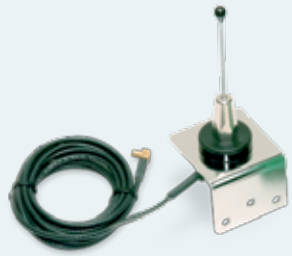


GSM

GSM omnidirectional antenna

PSI-GSM/UMTS-QB-ANT
Order no. 2313371

- **Quad band antenna for 850, 900, 1800, 1900 and 2100 MHz ranges**
- **Gain: 1 dBi**
- **SMA(M) connector**



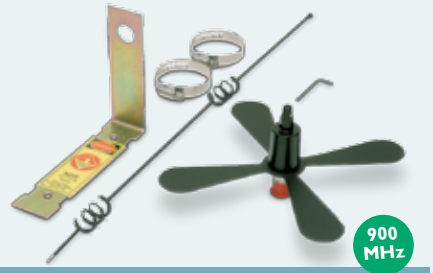
900 MHz

Omnidirectional antenna

RAD-ISM-900-ANT-OMNI-0-6
Order no: 2867160
MCX (M) connector

RAD-900-ANT-OMNI-2-2-RSMA
Order no: 2904801
RSMA (M) connector

- **1/4 wave antenna**
- **Gain: 2 dBi**
- **2 m cable**



900 MHz

Omnidirectional antenna

RAD-ISM-900-ANT-OMNI-5
Order no. 2867199

- **Gain: 7.15dBi**
- **N(F) connector**

900 MHz

Omnidirectional fiberglass antenna

RAD-ISM-900-ANT-OMNI-FG-3-N
Order no. 2867791

- **Gain: 5.15dBi**
- **N(F) connector**

RAD-ISM-900-ANT-OMNI-FG-6-N
Order no. 2885579

- **Gain: 8.00dBi**
- **N(F) connector**

2.4 GHz

Omnidirectional antenna

RAD-ISM-2400-ANT-OMNI-2-1
Order no. 2867461

- **Gain: 2 dBi**
- **MCX(M) connector with 1.5 m cable**

RAD-ISM-2400-ANT-OMNI-2-1-RSMA
Order no. 2701362

- **Gain: 2dBi**
- **RSMA connector with 1 m cable**

2.4 GHz

Omnidirectional antenna

RAD-ISM-2400-ANT-OMNI-6-0
Order no. 2885919

- **Gain: 6 dBi**
- **N(F) connector**

RAD-ISM-2400-ANT-OMNI-9-0
Order no. 2867623

- **Gain: 9 dBi**
- **N(F) connector with mounting brackets**

2.4 GHz

Low-profile omnidirectional antenna

RAD-ISM-2400-ANT-VAN-3-0-RSMA
Order no. 2701358

- **Gain: 3 dBi**
- **RSMA (M) connector with 1.5 m cable**

RAD-ISM-2459-ANT-FOOD-6-0-N
Order no: 2702898

- **Gain: 6 dBi at 2.4 GHz, 8 dBi at 5 GHz**
- **N(F) connector (no cable)**

5 GHz

Omnidirectional antenna

RAD-ISM-5250-ANT-OMNI-10-N
Order no. 5606761

- **Lower 5 GHz band only**
- **Gain: 10 dBi**
- **N(F) connector**

RAD-ISM-5800-ANT-OMNI-10-N
Order no. 5606762

- **Upper 5 GHz band only**
- **Gain: 10 dBi**
- **N(F) connector**

Wireless accessories

Antennas

Yagi antenna

RAD-ISM-900-ANT-YAGI-3-N
Order no. 2867801

- **Gain: 5.15 dBi**
- **N (F) connector with 0.6 m of cable and mounting brackets**

Yagi antenna

RAD-ISM-900-ANT-YAGI-6.5-N
Order no. 2867814

- **Gain: 8.5 dBi**
- **N (F) connector with 1.5 m cable**

Yagi antenna

RAD-ISM-900-ANT-YAGI-10-N
Order no. 5606614

- **Gain: 12.15 dBi**
- **N (F) connector with 2-foot cable**

Yagi antenna

ANT-DIR-2459-01
Order no. 2701186

- **Gain 9 dBi**
- **N (F) connector with mounting brackets**

Yagi antenna

RAD-ISM-2400-ANT-PAR-19-0
Order no. 2867885

- **Gain: 19.0 dBi**
- **N (F) connector with mounting brackets**

5 GHz

Directional panel antenna

RAD-ISM-5000-ANT-PAR-18-N
Order no. 5606613

- **Gain: 18 dBi**
- **N (F) connector with mounting brackets**

5 GHz

Parabolic dish antenna

RAD-ISM-5000-ANT-PAR-22-N
Order no. 5606174

- **Gain: 22 dBi**
- **N (F) connector with mounting brackets**

Engineering insight

Contact us during the first phase of planning your project, and get the combined benefit of Phoenix Contact's technological know-how and extensive experience.

Detailed information about this and other services can be found on our website: **www.phoenixcontact.com**

Wireless accessories

Pigtails

RAD-PIG-RSMA/…
…N-0.5; Order no. 2903263 – 0.5 m
…N-1; Order no. 2903264 – 1 m
…N-2; Order no. 2903265 – 2 m
…N-3; Order no. 2903266 – 3 m

- **Connections: N (M) to RSMA (M)**
- **Compatible with 900 MHz, 2.4/5.2/5.8 GHz**

RAD-CON-MCX90-N-SS
Order no. 2885207

- **Connections: MCX (M) to N (M)**
- **Compatible with 900 MHz, 2.4/5.2/5.8 GHz**

Antenna cables

RAD-CAB-LMR…
…240-10; Order no. 5606124 - 10 foot
…400-20; Order no. 5606125 - 20 foot
…500-25; Order no. 5606126 - 25 foot

- **Connections: N (M) at both ends**
- **Compatible with 900 MHz, 2.4/5.2/5.8 GHz and UHF**

RAD-CAB-PFP…
...400-80; Order no. 2867393 - 80 foot
...400-100; Order no. 2867238 - 100 foot

For a full list of cable lengths, contact your Phoenix Contact representative.

- **Connections: N (M) at both ends**
- **Compatible with 900 MHz and UHF**

Weather protection tape

RAD-TAPE-SV-19-3
Order no. 2903182

- **Self-vulcanizing**
- **For outside protection of adapters, splitters or cable connections; waterproof**

Adapters

(1) RAD-ADP-N/F-N/F
Order no. 2867843
- **N (F) > N (F)**

(2) RAD-ADP-N/M-SMA/F
Order no. 2917036
- **N (M) > SMA (F)**

(3) RAD-ADP-RSMA/F-SMA/F
Order no. 2884538
- **RSMA (F) > SMA (F)**

(4) RAD-ADP-SMA/F-SMA/F
Order no. 2884541
- **SMA (F) > SMA (F)**

(5) RAD-ADP-SMA/F-SMA/M-90
Order no. 2917324
- **SMA (F) > SMA (M)**

900 MHz/UHF

Surge suppressor

CN-UB-70DC-6-SB
Order no. 2803153

- **N (M) to N (F) 0 Hz to 6 GHz**

CN-UB-70DC-6-BB
Order no. 2803166

- **N (F) to N (F) 0 Hz to 6 GHz**

2.4/5.2/5.8 GHz

Surge suppressor

CN-LAMBDA/4-5,9-BB
Order no. 2838490

- **N (F) to N (F) connector**
- **2.4/5.2/5.8 GHz frequency compatible**

4-way antenna splitter

RAD-ISM-900-ANT-4
Order no. 2867050

- **Allows one antenna to be used when using several receivers paired to different transmitters in the field**
- **Can be cascaded together to connect a maximum of 64 receivers to one antenna**

Prewired enclosure

RAD-SYS-NEMA4X-900
Order no. 2917188

- **Includes a mini UPS, power distribution and surge suppression for radio systems**

Pole mounting kit
Order no. 2900038

- **Pole mounting kit for RAD-SYS-NEMA4X-900**

Wireless technology for today's industrial challenges

Phoenix Contact is a leading global provider of industrial wireless solutions. Our 12+ years of experience in providing industrial data and I/O communication products, combined with the most robust, reliable and advanced wireless technologies available, translates to wireless success in the harshest of industrial applications. Today, with more than 50,000 installed units, Phoenix Contact's wireless products provide dependability and security while monitoring and controlling signals such as level, temperature, frequency and digital alarms.

Whether serial data, I/O data, fieldbus or Ethernet communications, Phoenix Contact offers the solution for every application, utilizing technologies ranging from Bluetooth to WLAN, cellular or proprietary Trusted Wireless. Additionally, our award-winning technical support is available 24/7 to assist with product selection, RF surveys, start-up assistance and system troubleshooting to ensure your wireless connections are always as strong as wire!

STEP 1

Determining your technology *(Page 49)*
Use the application criteria and the distance over which the wireless system must communicate to determine the best Phoenix Contact wireless technology.

STEP 2

Determining the right product *(Pages 50-54)*
Locate the technology found in Step 1 and select a radio within the technology group that is best suited for your application.

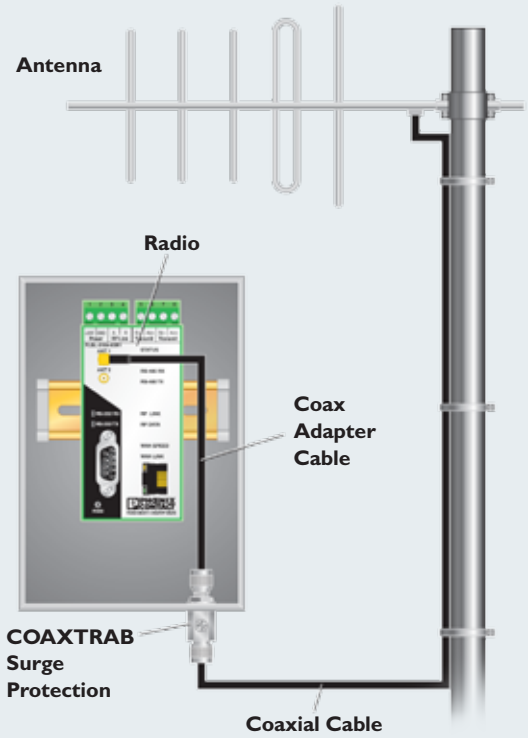
STEP 3

Determining the accessories *(Pages 50-54)*
Select the appropriate adapter cables, antenna surge protection, antenna cables and antennas for the distance that the system must communicate.

STEP 4

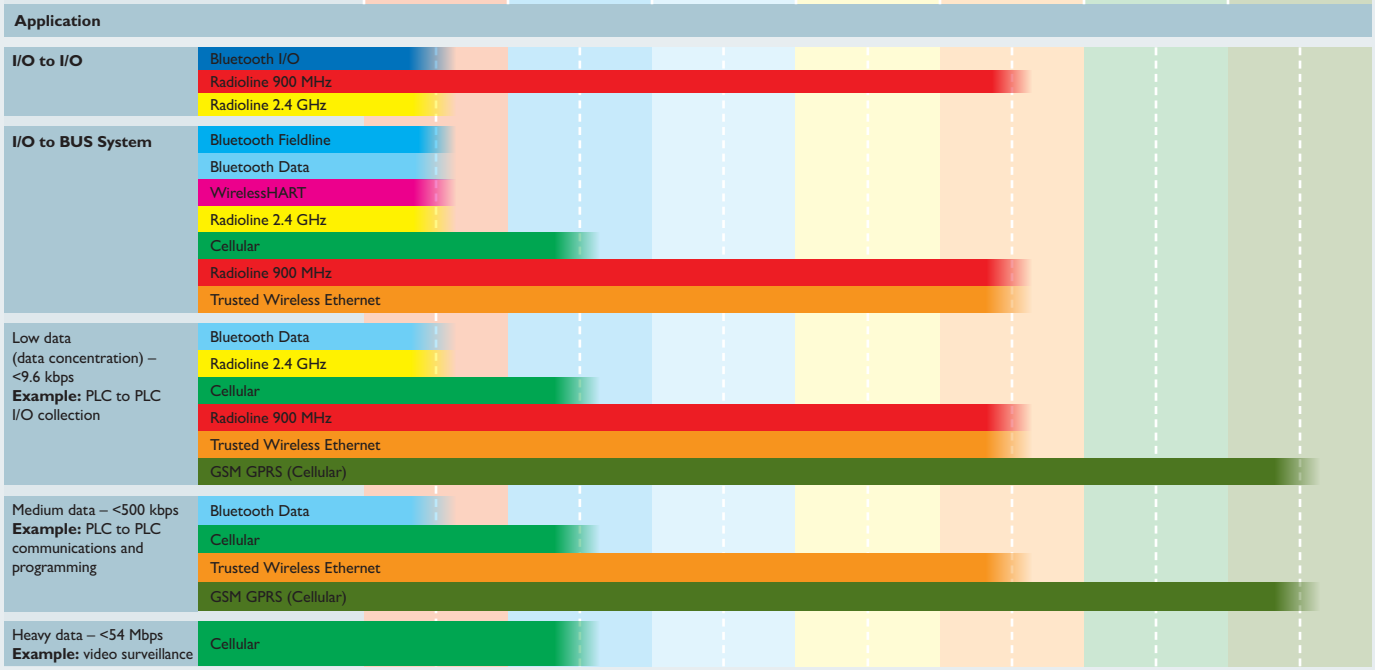
System planning *(Page 55)*
Using the selected products, create a system and a diagram, and define system topology.

Note: *When selecting parts for a radio system be sure to select an antenna for all locations.*



STEP 1 Determining your technology

Typical applications	0' - 300'	1000' - 3000'	3000' - 1 mile	1 - 2 miles	2 - 5 miles	5 - 8 miles	Around the World
Max distance clear LOS	1000'	1 mile	2 miles	15 miles	20 miles	40 miles	
Minor obstructions	150'	500'	1000'	1.5 mile	3 miles	7 miles	
Heavy obstructions	100'	250'	500'	1 miles	2 miles	5 miles	



Technologies

Radioline 900 MHz/2.4 GHz and Trusted Wireless Ethernet *(page 50)*

Trusted Wireless is a proprietary wireless technology offering a high degree of reliability and security. Trusted wireless is designed to communicate simple I/O reliably over long distances in noisy environments. This is done by using FHSS in the 900 MHz and 2.4 GHz ISM band.

WLAN *(page 51)*

WLAN uses the IEEE 802.11 (Wi-Fi) public standard for high-speed connections that increases productivity, heightens safety and lowers cabling costs. The 802.11 standard operates in the 2.4 GHz and 5 GHz license-free ISM bands and utilizes the highest level of security, WPA2.

Bluetooth *(page 54)*

Bluetooth (IEEE 802.15.1) is a standardized wireless technology capable of high-speed serial and I/O communications. Following the frequency-hopping spread-spectrum method (FHSS) in the 2.4 GHz ISM band, Bluetooth has high transmission reliability. It is suitable for worldwide use in applications where cable-based circuits are too costly to install or to change.

Cellular *(page 54)*

GSM and CDMA are technologies used to send data over the cellular network. Cellular is a great medium for applications where panels are located in remote locations. Cellular takes advantage of infrastructure built by carriers to provide access to processes traditionally incommunicable.

WirelessHART *(page 54)*

WirelessHART is a wireless sensor network technology that works on the 2.4 GHz frequency band based on the Highway Addressable Remote Transducer Protocol (HART). WirelessHART uses a time-synchronized, self-organizing, self-healing architecture that was developed as a multi-vendor interoperable wireless standard.

Note: *Distances are intended as an achievable guideline with minimal RF path engineering and design required.*

Radioline

STEP 2
Determining the right product

Radioline modules	Part number	Description	Product details
	2901540	RAD-900-IFS	Radio module for 900 MHz communication with expandable I/O BUS, RSMA(f) connection
	2901541	RAD-2400-IFS	Radio module for 2.4 GHz communication with expandable I/O BUS, RSMA(f) connection
	2902828	RAD-Memory	900 MHz/2.4 GHz – CONFSTICK – blank
	2702122	RAD-900-CONF-RF1	900 MHz RF band 1 CONFSTICK
	2902814	RAD-CONF-RF3	2.4 GHz RF band 3 CONFSTICK
	2903447	RAD-CABLE-USB	Programming cable

Expansion IO modules	Part number	Description	Product details
	2901533	RAD-DAIO6-IFS	2-channel digital in/out, 1 channel analog in/out
	2901537	RAD-AI4-IFS	4-channel analog input
	2901538	RAD-AO4-IFS	4-channel analog output
	2901535	RAD-DI4-IFS	4-channel digital input
	2901536	RAD-DOR4-IFS	4-channel digital (relay) output
	2901539	RAD-DI8-IFS	8-channel digital input
	2902811	RAD-DO8-IFS	8-channel transistor output
	2904035	RAD-PT100-4-IFS	4-channel PT100 input

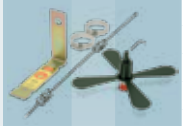
STEP 3
Determining the right accessories

Adapter cables	Part number	Description	Product details
	2903263	RAD-PIG-RSMA/N-0.5	0.5 meter RSMA(m) to N(m) adapter cable
	2903264	RAD-PIG-RSMA/N-1	1.0 meter RSMA(m) to N(m) adapter cable
	2903265	RAD-PIG-RSMA/N-2	2.0 meter RSMA(m) to N(m) adapter cable

Surge arrestors	Part number	Description	Product details
	2803166	CN-UB-70DC-6-BB	Antenna surge protection for 0-6 GHz N(f)-N(f)

Antenna cables	Part number	Description	Length	Connector type	Cable loss	
					900 MHz	2.4 GHz
900 MHz/2.4 GHz	5606124	RAD-CAB-PFP240-10	10 feet	N(m)-N(m)	0.8 dB	1.3 dB
	5606125	RAD-CAB-PFP400-20	20 feet	N(m)-N(m)	0.8 dB	1.3 dB
	5606126	RAD-CAB-PFP500-25	25 feet	N(m)-N(m)	0.8 dB	1.4 dB
900 MHz	2867380	RAD-CAB-PFP400-60	60 feet	N(m)-N(m)	2.4 dB	
	2867393	RAD-CAB-PFP400-80	80 feet	N(m)-N(m)	3.1 dB	
	2867238	RAD-CAB-PFP400-100	100 feet	N(m)-N(m)	3.9 dB	
	2885171	RAD-CAB-PFP600-125	125 feet	N(m)-N(m)	3.2 dB	
	2885184	RAD-CAB-PFP600-150	150 feet	N(m)-N(m)	3.8 dB	

Determining the right antennas



Antennas	Master/Repeater				
900 MHz	Part number	Description	Distance	Connector type	Gain
	2904801	RAD-900-ANT-OMNI-2-2-RSMA	< 0.5 mile	RPSMA(m)	2 dBi
	2904802	RAD-900 ANT-OMNI-2-N	< 0.5 mile	N(f)	2 dBi
	2867199	RAD-ISM-900-ANT-OMNI-5	3 miles	N(f)	7 dBi
	2885579	RAD-ISM-900-ANT-OMNI-FG-6-N	> 5 miles	N(f)	8 dBi
2.4 GHz	Part number	Description	Distance	Connector type	Gain
	2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 1,500 feet	RPSMA(m)	2 dBi
	2885919	RAD-ISM-2400-ANT-OMNI-6-0	< 3,000 feet	N(f)	6 dBi
	2867623	RAD-ISM-2400-ANT-OMNI-9-0	> 1 mile	N(f)	9 dBi
	Remote/Slave				
900 MHz	Part number	Description	Distance	Connector type	Gain
	2904801	RAD-900-ANT-OMNI-2-2-RSMA	< 0.5 mile	RPSMA(m)	2 dBi
	2904802	RAD-900 ANT-OMNI-2-N	< 0.5 mile	N(f)	2 dBi
	2867801	RAD-ISM-900-ANT-YAGI-3-N	3 miles	N(f)	5 dBi
	2867814	RAD-ISM-900-ANT-YAGI-6.5-N	5 miles	N(f)	8.5 dBi
	5606614	RAD-ISM-900-ANT-YAGI-10-N	> 10 miles	N(f)	12 dBi
2.4 GHz	Part number	Description	Distance	Connector type	Gain
	2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 1,500 feet	RPSMA(m)	2 dBi
	2701186	ANT-DIR-2459-01	> 1 mile	N(f)	9 dBi

For more accessory options, please visit: **www.phoenixcontact.com/wireless**
For help selecting accessories, please contact technical service at 800-322-3225.

Trusted wireless I/O and Ethernet

STEP 2
Determining the right product

Trusted Wireless IO Uni-directional Radios	Part number	Description	Product details
	2867102	RAD-ISM-900-SET-UD-ANT	Set of radios: 1 transmitter and 1 receiver, 1-watt 900 MHz Trusted Wireless IO, 2 digital and 1 analog, antennas included
	2867021	RAD-ISM-900-SET-AC-UD	NEMA 4X conduit-mount transmitter (AC powered), set of radios: 1 transmitter and 1 receiver, 1-watt 900 MHz Trusted Wireless IO, 2 digital and 1 analog, antennas included
	2867034	RAD-ISM-900-SET-DC-UD	NEMA 4X conduit-mount transmitter (DC-powered), set of radios: 1 transmitter and 1 receiver, 1-watt 900 MHz Trusted Wireless IO, 2 digital and 1 analog, antennas included
	2867047	RAD-ISM-900-RX	Spare UD receiver radio
	2867076	RAD-ISM-900-TX	Spare UD transmitter radio DIN mount
	2867335	RAD-ISM-900-TX-AC	Spare UD transmitter radio AC-powered conduit mount
	2867348	RAD-ISM-900-TX-DC	Spare UD transmitter radio DC-powered conduit mount

Trusted Wireless Ethernet Radios	Part number	Description	Product details
	2900016	RAD-ISM-900-EN-BD	1-watt, 900 MHz Trusted Wireless Ethernet radio, Ethernet, RS-232/485 serial ports
	2900017	RAD-ISM-900-EN-BD-BUS	1-watt, 900 MHz Trusted Wireless Ethernet radio, Ethernet, RS-232/485 serial ports, busable I/O
	2901205	RAD-ISM-900-EN-BD/B	1-watt, 900 MHz Trusted Wireless Ethernet radio, Ethernet port only, slave radio only

Expansion I/O modules (Trusted Wireless Ethernet only)	Part number	Description	Product details
	2867322	RAD-IN+OUT-2D-1A-I	2-channel digital in/out, 1 channel analog in/out
	2867144	RAD-IN-8D	8-channel digital input
	2867157	RAD-OUT-8D-REL	8-channel digital (relay) output
	2867115	RAD-IN-4A-I	4-channel analog input
	2867128	RAD-OUT-4A-I	4-channel analog output
	2885223	RAD-IN-2D-CNT	2-channel frequency/pulse input
	2885236	RAD-OUT-2D-CNT	2-channel frequency/pulse output

STEP 3
Determining the right accessories

Adapter cables	Part number	Description	Product details
	2885207	RAD-CON-MCX90-N-SS	90 degree MCX(m) to N(m) adapter, 4 ft
	2867254	RAD-CON-MCX-N-SS	MCX(m) to N(m) adapter, 4 ft

Surge arresters	Part number	Description	Product details
	2803166	CN-UB-70DC-6-BB	0-6 GHz...

Antenna cables	Part number	Description	Cable length	Connector type	Cable Loss 900 MHz
	5606124	RAD-CAB-PFP240-10	10 feet	N(m)-N(m)	0.8 dB
	5606125	RAD-CAB-PFP400-20	20 feet	N(m)-N(m)	0.8 dB
	5606126	RAD-CAB-PFP500-25	25 feet	N(m)-N(m)	0.8 dB
	2867380	RAD-CAB-PFP400-60	60 feet	N(m)-N(m)	2.4 dB
	2867393	RAD-CAB-PFP400-80	80 feet	N(m)-N(m)	3.1 dB
	2867238	RAD-CAB-PFP400-100	100 feet	N(m)-N(m)	3.9 dB
	2885171	RAD-CAB-PFP600-125	125 feet	N(m)-N(m)	3.2 dB
	2885184	RAD-CAB-PFP600-150	150 feet	N(m)-N(m)	3.8 dB

Antennas	Master/Repeater				
	Part number	Description	Distance	Connector type	Gain
	2867160	RAD-ISM-900-ANT-OMNI-0-6	< 0.5 mile	Mcx(m)	2.15 dBi
	2867199	RAD-ISM-900-ANT-OMNI-5	3 miles	N(f)	7 dBi
	2885579	RAD-ISM-900-ANT-OMNI-FG-6-N	5 miles	N(f)	8 dBi
	Remote/Slave				
	Part number	Description	Distance	Connector type	Gain
	2867160	RAD-ISM-900-ANT-OMNI-0-6	< 0.5 mile	Mcx(m)	2.15 dBi
	2867801	RAD-ISM-900-ANT-YAGI-3-N	3 miles	N(f)	5 dBi
	2867814	RAD-ISM-900-ANT-YAGI-6.5-N	5 miles	N(f)	8.5 dBi
	5606614	RAD-ISM-900-ANT-YAGI-10-N	> 10 miles	N(f)	12 dBi

For more accessory options, please visit: **www.phoenixcontact.com/wireless**
For help selecting accessories, please contact technical service at 800-322-3225.

WLAN

STEP 2
Determining the right product

Wireless Ethernet radios	Part number	Description	Product details	Operation mode
	2701093	FL WLAN 5101	200 mW, 802.11 a/b/g/n radio, up to 300 Mbps, 24 V DC; cluster management, SD card slot,	Access point, repeater, client
	2702538	FL WLAN 1101	200 mW, 802.11 a/b/g/n radio, up to 300 Mbps, 24 V DC; dual internal antennas	Access point, repeater, client

STEP 3
Determining the right accessories

Adapter cables	Part number	Description	Product details
	2903263	RAD-PIG-RSMA/N-0.5	0.5 meter RSMA(m) to N(m) adapter cable
	2903264	RAD-PIG-RSMA/N-1	1.0 meter RSMA(m) to N(m) adapter cable
	2903265	RAD-PIG-RSMA/N-2	2.0 meter RSMA(m) to N(m) adapter cable
	2903266	RAD-PIG-RSMA/N-3	3.0 meter RSMA(m) to N(m) adapter cable

Surge arresters	Part number	Description	Product details
	2838490	CN-LAMBDA/4-5.9-BB	Antenna surge protection fof 2.4-5.9 GHz; N(f)-N(f)
	2800023	CN-LAMBDA/4-5.9-SB	Antenna surge protection fof 2.4-5.9 GHz; N(m)-N(f)

Antenna cables	Part number	Description	Cable length (ft)	Connector type	Cable Loss	
					2.4 GHz	5 GHz
	5606124	RAD-CAB-PFP240-10	10	N(m)-N(m)	1.3 dB	1.9 dB
	5606125	RAD-CAB-PFP400-20	20	N(m)-N(m)	1.3 dB	2.1 dB
	5606126	RAD-CAB-PFP500-25	25	N(m)-N(m)	1.4 dB	2.1 dB

FL Rugged box	Part number	Product details
	2701204	IP66 rated box for FL WLAN 5101 radio complete with grommets and din rail
	2701430	Includes three 0.5 m adapter cables and three 5 dB omni antennas
	2701439	Includes three 0.5 m adapter cables and three 5 dB omni antennas, power supply and terminal blocks
	2701440	Includes one 0.5 m adapter cable, and one 9 dB panel antenna, power supply and terminal blocks

For more accessory options, please visit: **www.phoenixcontact.com/wireless**
For help selecting accessories, please contact technical service at 800-322-3225.

WLAN

STEP 3
Determining the right accessories

Antennas

2.4 GHz 100 mW radios

Master/Repeater				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 500 feet	RPSMA(m)	2 dBi
2867461	RAD-ISM-2400-ANT-OMNI-2-1	< 500 feet	N(f)	2 dBi
2885919	RAD-ISM-2400-ANT-OMNI-6-0	0.5 mile	N(f)	6 dBi
2867623	RAD-ISM-2400-ANT-OMNI-9-0	1 mile	N(f)	9 dBi

Remote/Slave				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 500 feet	RPSMA(m)	2 dBi
2867461	RAD-ISM-2400-ANT-OMNI-2-1	< 500 feet	MCX(m)	2 dBi
2701186	ANT-DIR-2459-01	1 mile	N(f)	9 dBi
2867885	RAD-ISM-2400-ANT-PAR-19-0	> 1 mile	N(f)	19 dBi

2.4 GHz 200/400 mW radios

Master/Repeater				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 500 feet	RPSMA(m)	2 dBi
2867461	RAD-ISM-2400-ANT-OMNI-2-1	< 500 feet	MCX(m)	2 dBi
2885919	RAD-ISM-2400-ANT-OMNI-6-0	0.5 mile	N(f)	6 dBi
2867623	RAD-ISM-2400-ANT-OMNI-9-0	> 1 mile	N(f)	9 dBi

Remote/Slave				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
2701362	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	< 500 feet	RPSMA(m)	2 dBi
2867461	RAD-ISM-2400-ANT-OMNI-2-1	< 500 feet	MCX(m)	2 dBi
2701186	ANT-DIR-2459-01	1 mile	N(f)	9 dBi
2867885	RAD-ISM-2400-ANT-PAR-19-0	> 1 mile	N(f)	19 dBi

5 GHz

Master/Repeater				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
5606761	RAD-ISM-5250-ANT-OMNI-10-N	0.5 mile	N(f)	10 dBi

Remote/Slave				
Part number	**Description**	**Distance**	**Connector type**	**Gain**
2701186	ANT-DIR-2459-01	0.5 mile	N(f)	9 dBi
5606174	RAD-ISM-5000-ANT-PAR-22-N	> 1 mile	N(f)	22 dBi

For more accessory options, please visit: **www.phoenixcontact.com/wireless**
For help selecting accessories, please contact technical service at 800-322-3225.

Bluetooth, Cellular and WirelessHART

STEP 2
Determining the right product

Bluetooth radios	Part number	Description	Product details
I/O	2884208	ILB BT ADIO MUX-OMNI	Paired Bluetooth I/O radios, 2 dBi Omni antennas (up to 650-ft transmission distance), 1.5 m antenna cable, 16 digital (In/Out) and 2 analog (In/Out)
	2702875	ILB BT ADIO MUX	Paired Bluetooth I/O radios, no antennas, 16 digital (In/Out) and 2 analog (In/Out) Consisting of two paired modules, no antennas, RSMA (F) antenna connector
Bluetooth Fieldline	2736770	FLM BT BS 3	Bluetooth I/O base station radio, IP67, antenna included, connects up to 3 Bluetooth I/O remote radios, requires Phoenix Contact bus coupler
	2736767	FLM BT DIO 8/8 M12	Bluetooth I/O remote radio, IP67, antenna included, 8 digital (in/out) M12 connection
	2884282	ILB BT ADIO 2/2/16/16	Bluetooth I/O remote radio, antenna included, 16 digital (in/out) and 2 analog (in/out)
Bluetooth data	2313805	PSI-WL-RS232-RS485/BT/2DO	Bluetooth serial radio, DIN mount, RS-232/422/485 serial

Cellular modems	Part number	Description	Product details
	2903440	TC MGUARD RS4000 3G VPN	Security device, with mobile phone interface, SD card slot, 10 VPN tunnels, intelligent firewall, router with NAT/1:1 NAT, optional CIFS integrity monitoring, 4-port managed switch, GPS receiver
	2903441	TC MGUARD RS2000 3G VPN	Security device with mobile phone interface, SD card slot, 2 VPN tunnels, 2-click firewall for easy configuration, router with NAT/1:1 NAT, 4-port switch, GPS receiver

WirelessHART	Part number	Description	Product details
	2900178	RAD-WHG/WLAN-XD	WirelessHART gateway with integrated 802.11 b/g WLAN transceiver and Ethernet connection
	2900100	RAD-WHA-1/2NPT	WirelessHART adapter with removable antenna, supports line or loop power and up to four subdevices

STEP 3
Determining the right accessories

Adapter cables	Part number	Description	Product Details
PSI-WL-RS232-RS485/BT/2DO and mGuard 3G	2885207	RAD-CON-MCX90-N-SS	90 deg MCX(m) to N(m) adapter, 4 ft
	2867254	RAD-CON-MCX-N-SS	MCX(m) to N(m) adapter, 4 ft
	2867403	RAD-CON-SMA-N-SS	SMA(m) to N(m), 4 ft
FL BT EPA and WirelessHART gateway	2903263	RAD-PIG-RSMA/N-0.5	0.5 meter RSMA(m) to N(m) adapter cable
	2903264	RAD-PIG-RSMA/N-1	1.0 meter RSMA(m) to N(m) adapter cable
	2903265	RAD-PIG-RSMA/N-2	2.0 meter RSMA(m) to N(m) adapter cable
	2903266	RAD-PIG-RSMA/N-3	3.0 meter RSMA(m) to N(m) adapter cable

Surge arrestors	Part number	Description	Product details
	2803166	CN-UB-70DC-6-BB	Antenna surge protection for 0-6 GHz N(f)-N(f)

Antenna cables	Part number	Description	Cable length (ft)	Connector type
	5606124	RAD-CAB-PFP240-10	10	N(m)-N(m)
	5606125	RAD-CAB-PFP400-20	20	N(m)-N(m)
	5606126	RAD-CAB-PFP500-25	25	N(m)-N(m)

Bluetooth antennas	Part number	Description	Distance	Connector type	Gain
	2867461	RAD-ISM-2400-ANT-OMNI-2-1	<500	MCX(m)	2 dBi
	2885702	RAD-ISM-2400-ANT-VAN- 3-1-MCX	750'	MCX(m)	3 dBi
	2885867	RAD-ISM-2400-ANT-VAN- 3-0-SMA	750'	SMA(m)	3 dBi
	2885919	RAD-ISM-2400-ANT-OMNI-6-0	1000'	N(f)	6 dBi

Cellular antennas	Part number	Description	Product details
	2313371	PSI-GSM/UMTS-QB-ANT	Onmidirectional panel mount antenna, 2 meters of cable, SMA(m) connector
	2702273	TC ANT Mobile Wall 5M	Outdoor pipe mounting antenna, 5 meters of cable, SMA(m) connector
	2903590	TC ANT Mobile/GPS	Onmidirectional panel mount antenna with GPS, 2 meters of cable, SMA(m) connector
	2901561	RAD-ANT-GSM/UMTS-QB-YAGI-8	Directional high-gain antenna, with N(f) connector

WirelessHART antennas	Part number	Description	Distance	Connector type	Gain
	2885919	RAD-ISM-2400-ANT-OMNI-6-0	<150'	N(f)	6 dBi
	2867623	RAD-ISM-2400-ANT-OMNI-9-0	<300'	N(f)	9 dBi
	2701186	ANT-DIR-2459-01	<300'	N(f)	9 dBi

For more accessory options, please visit: **www.phoenixcontact.com/wireless**
For help selecting accessories, please contact technical service at 800-322-3225.

STEP 4 System planning

Wireless solutions

Turnkey prewired NEMA 4x enclosure system, including MINI UPS, power distribution and surge protection for wireless systems

Part number	Description
2917188	RAD-SYS-NEMA4X-900

Common rail assembly used with wireless radios includes power supply, TMC breaker and 120 V AC surge protection

Part number	Description
5607321	Common wireless rail

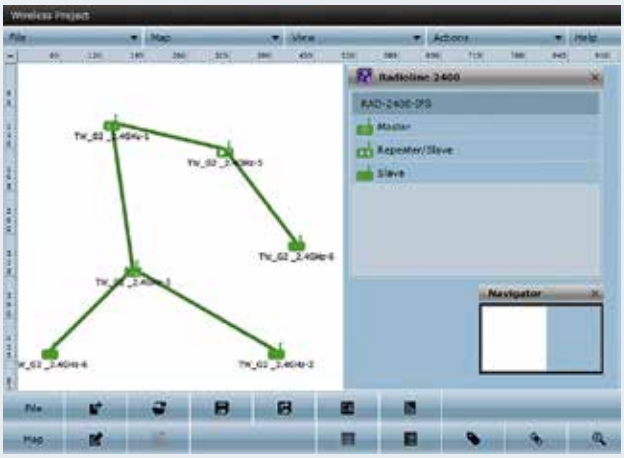
Wireless network planner

The wireless network planner from Phoenix Contact is an easy solution for user-friendly planning of a wireless network. You can create a simple basis for planning your wireless network in just a few steps.

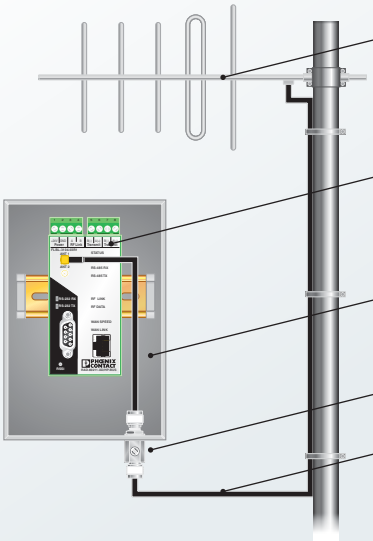
Your advantages:

- All Phoenix Contact wireless products are implemented
- Selection guide for wireless modules and accessories such as cables and antennas
- Creation of material lists in PDF format or CSV format
- Importing of images
- User guidance via a wizard
- Free download

Download free at: **www.phoenixcontact.com/WNP**



Site name:



Antenna: _____

Radio: _____

Adapter: _____

Surge protection: _____

Cable: _____

Industrial applications

As wireless technology continues to develop in the industrial world, the number of transmission protocols and network topologies grows. Once only a point-to-point cable replacement device, wireless now has increasing capabilities in speed, distance, cost, transmission method and networking. End-device connectivity now ranges from the network component to the sensor level.

Oil refinery – Radioline 900 MHz

A major oil refinery needed wireless technology to increase timer monitoring capabilities and overall efficiency.

Technicians measured the water level at the selected testing location using an ultrasonic level meter with an analog 4-20 mA output and a high-level digital alarm. They installed a RAD-IFS-900 radio transceiver with a connected I/O module to communicate with both the level meter and another radio transceiver in the control room. The master radio was tied into the plant's Honeywell TDC3000 DCS system via an RS-232 connection. The remote radio was programmed for Modbus emulation mode, which allows the DCS system to poll the remote radio's connected I/O as if it were a conventionally hard-wired remote I/O block.

Following this successful installation, 15 crude oil tanks in the plant were fitted with similar radio transceivers, and additional wireless systems were installed at several other company-owned plants.

Water/wastewater management – Wireless I/O monitoring

A large water facility had several applications requiring signal readings and indication notifications from remote well sites back to the control center. In one application, the facility used a RAD-ISM-900-SET-AC-UD wireless I/O transceiver set and, as a result, avoided the high cost and delays associated with cutting into the streets to install conduit and signal wiring.

Several other applications at the facility included remote tanks that needed to send level indication, suction pressure and well flow information from various remote sites back to the central control center.

Natural gas storage – Radioline 900 MHz

A natural gas organization installed Phoenix Contact's Trusted Wireless IO system to transmit pressure values from remote well sites to a main control center. By installing two unidirectional radio paths between the control center and the remote sites, the need to manually measure pressure values by taking trips to the remote wells was eliminated.

Trusted Wireless IO increased reliability by constantly monitoring crucial data transmission. The installation saved time by eliminating trips to the well sites.

Landfill – 802.11 Wireless Interface

Due to recent expansion, the owners of a landfill needed increased communications between leachate control systems and the central control system. It also needed to replace the original buried cable communication system.

The landfill company installed Phoenix Contact's RAD-80211-XD radio transceivers. The wireless technology easily transmitted the signal more than 400 feet, through multiple obstructions between the pump stations and the control room. As a result of the wireless installation, the company avoided the high costs of traditional conduit and wire installation and experienced significant time savings.

Best practices for antenna installation

1. Antenna gain
A high antenna gain does not automatically mean a better connection. The high gain generates a small angle of radiation, which requires a more precise alignment.

2. Antenna selection
Think about selecting the correct antenna characteristics, particularly on the receiver side. While doing so, pay attention to the correct polarization.

3. Assembly height
An antenna, particularly outside, should be positioned as high as possible. This allows you to improve the range. This keeps the Fresnel zone clear – the higher, the better.

4. Antenna cable as short as possible
The antenna cable should be as short as possible to keep signal loss on the cable as low as possible. Bring the radio module closer to the antenna; e.g., in a small box.

5. Correct protection of antenna connections
Always protect connections on the outside cables, junctions and antennas with protective tape.

6. Antennas are not lightning arresters
Antennas on buildings are not used as lightning arresters. Select the position of the antenna carefully, use surge protection and do not route the antenna cable parallel to the lightning arrester.

7. Correct mounting
In the case of insufficient stability, the quality of your antenna alignment can be reduced. When mounting the antenna, also think about wind and other outside influences.

8. The right distance
Install the antenna in an open area, as far away as possible from any obstacles such as buildings, trees, other antennas or metal objects.

9. Connection to antenna from below
Outdoor antenna cables should always be connected to the antenna from below. Also use a conduit, if necessary.

10. Weather influences
Fog and rain have nearly no influence on the wireless path.
In the case of ice and snow, on the other hand, you must make sure that the antennas are not covered with ice.

Note on installation in potentially explosive areas: *When using antennas in potentially explosive areas, set up an antenna barrier.*

Establish a sufficient ground connection to the pole, the devices, the antenna and surge protection.

Best practices for antenna installation

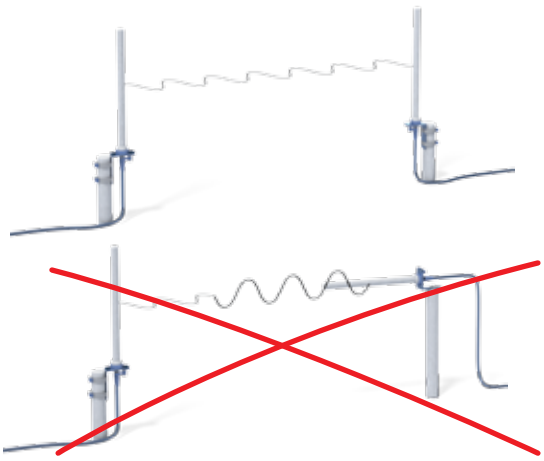
For 2: Antenna selection:

Areas of application for omnidirectional antennas

- Numerous devices in different directions (repeater or mesh networks)
- Versatile applications
- Applications without visual communication (in the case of a reflective environment, the signal can be received via alternate lines)

Areas of application for directional antennas

- Bridging large distances
- Point-to-point connections
- Stationary or linear applications
- Decoupling due to directivity and different polarization planes in the case of multiple point-to-point paths



Make sure the antennas have a uniform polarization plane.

Tip:

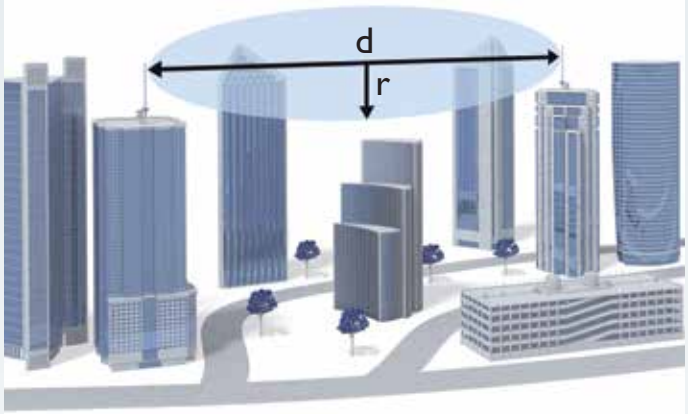
The characteristics of an antenna can be compared with various light sources:

- Bulb → OMNI antenna
- Flashlight → Directional antenna
- Laser pointer → Strong directional antenna; e.g., Yagi or parabolic

You can also combine omnidirectional and directional antennas. While doing so, make sure the antennas have a uniform polarization plane.

For 3: The assembly height (Fresnel zone)

The wireless path may also work if obstacles are within the Fresnel zone (house, tree, etc.). The decisive factor is the number of obstacles and the area they occupy in this zone. In practice, lower frequencies (e.g., 868 MHz) are better at penetrating obstacles.



Tip:

Use antennas with circular polarization in a strongly reflective environment. This type of antenna prevents polarization loss, allowing you to achieve higher gain in this environment. To improve the signal strength, you can also combine circularly and vertically polarized antennas.

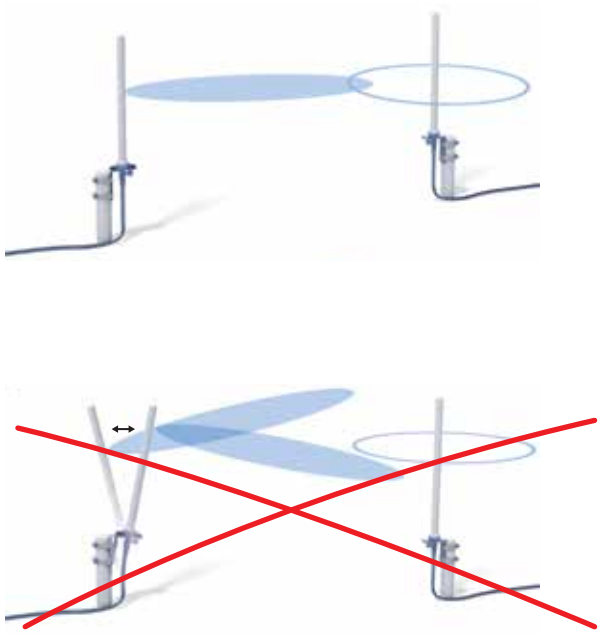
Wireless path distance (d)	Antenna height (r)		
	868/900 MHz	2.4 GHz	5 GHz
200 m	4.0 m	2.5 m	1.5 m
500 m	6.5 m	4.0 m	2.5 m
1000 m	9.0 m	5.5 m	4.0 m
2000 m	13.0 m	8.0 m	5.5 m
4000 m	18.5 m	11.0 m	8.0 m
10,000 m	29.0 m	–	–
20,000 m	41.5 m	–	–
30,000 m	50 m (900 MHz only)	–	–

Radius of the Fresnel zone depending on the frequency and distance. This yields the mounting height for antennas.

For 7: The correct mounting

Note: Always tighten all screw connections so they are secure, ideally using a torque spanner. In particular, when using directional antennas with a small apex angle, you should ensure that the antenna cannot be shifted by the wind.

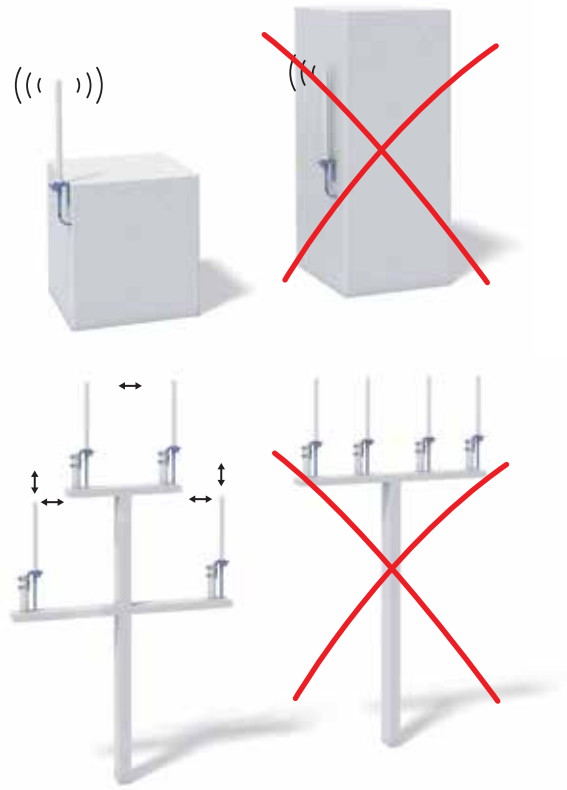
If the antenna is moved by just one cm from its original position, this may result in a partial loss of the wireless signal, especially in the case of a long transmission path.



For 8: The right distance

An omnidirectional antenna must always be installed at a sufficient distance from obstacles (poles, building walls or metal walls).

If multiple radio modules are used, you have to make sure the antennas are spread out at sufficient distances from one another.



It is best to install the antennas above each other on a pole.

Frequency	Minimum distance (vertical and horizontal)
868/900 MHz	1.5 – 2.5 m
2.4 GHz	0.5 – 1.0 m
5 GHz	0.5 – 0.8 m

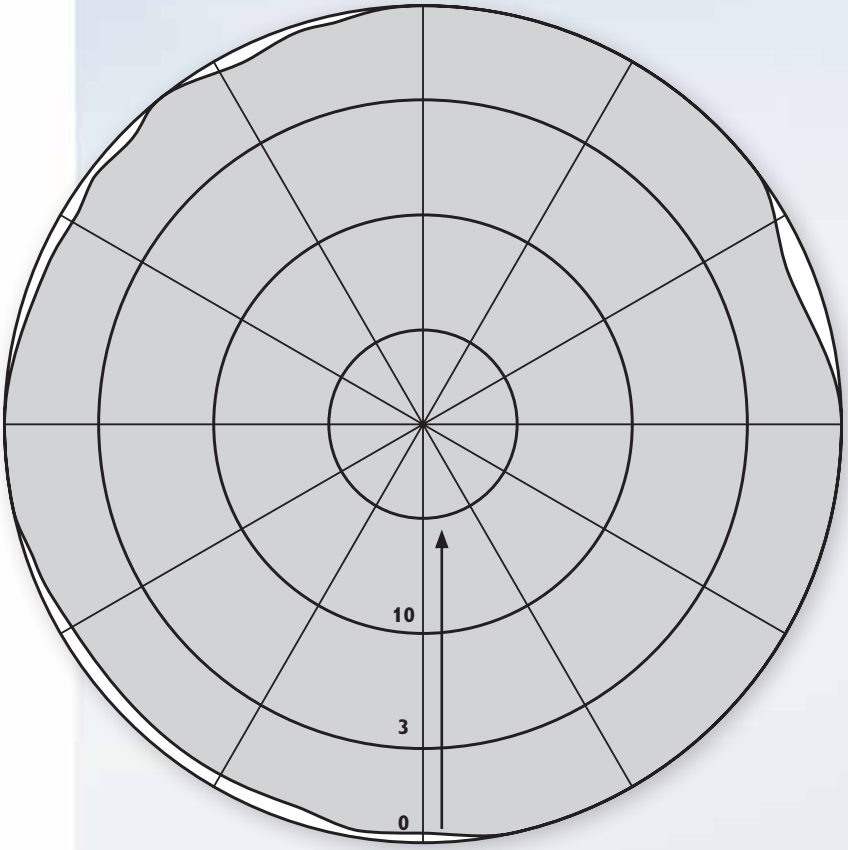
Best practices for antenna installation

The single most important item affecting radio performance is the antenna system. Careful attention must be given to this part of an installation or the performance of the entire system will be compromised. Antennas are specifically designed for use at the intended frequency of operation and with matching impedance. Select an antenna with an appropriate gain for the intended path.

Omnidirectional antennas

Omnidirectional antennas (known as rod antennas) are typically used if the position between the transmitter and the receiver can change, as in moving applications. The use of omnidirectional antennas is also recommended for applications with no line of sight. In such cases, the signal travels from the transmitter to the receiver via reflections, and their path and direction cannot be predicted.

The ideal installation location is the top of a mast or on a control cabinet so that the antenna has the greatest possible free space in all directions.



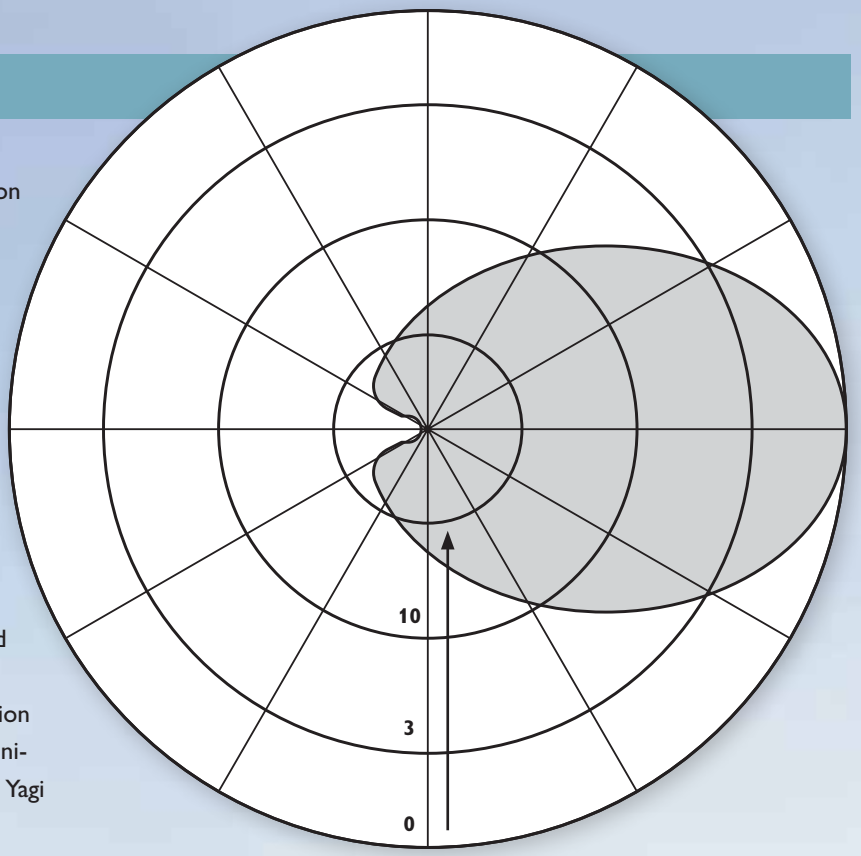
This is a typical omnidirectional antenna coverage area.

Yagi directional antennas

Yagi antennas emit the transmission power in a preferred direction, allowing greater communication range and reducing the chances of interference from other users outside the pattern. A sample radiation pattern is shown to the right. The existing transmission power of a radio does not need to be amplified, but simply focused to gain distance. It is necessary to aim these antennas in the desired direction of communication; that is, at the master station.

The use of a directional antenna is recommended at remote fixed stations when covering large distances with line of sight. The end of the antenna (farthest from the support mast) should face the associated station. A master location with multiple slave radios must always have an omni-directional antenna, and the slave radios may have Yagi antennas to increase distance possibilities.

Final alignment of the antenna heading can be accomplished by orienting it for maximum signal strength; as the gain of a Yagi antenna increases, the beam width decreases, making proper alignment more critical.



This is a typical Yagi antenna coverage area.

Wireless warranty extension

All Phoenix Contact Wireless Products carry a standard factory warranty of one year from the date of purchase against manufacturer defects. With the purchase and installation of the recommended Phoenix Contact power supplies and surge suppression devices, Phoenix Contact will extend the warranty of the radio hardware to five years from the date of purchase.

SERIAL PROTECTION		
Part number	**Description**	**Product use**
2803069	DT-UFB-V24/S-9-SB	RS 232 protection
2920612	DT-UFB-485/BS	RS 485 protection
2838775	PT 5-HF-12 DC-ST	RS 422/485 protection plug
2839208	PT 2X2-BE	RS 422/485 protection base

ETHERNET PROTECTION		
Part number	**Description**	**Product use**
2881007	DT-LAN-CAT.6+	Ethernet protection

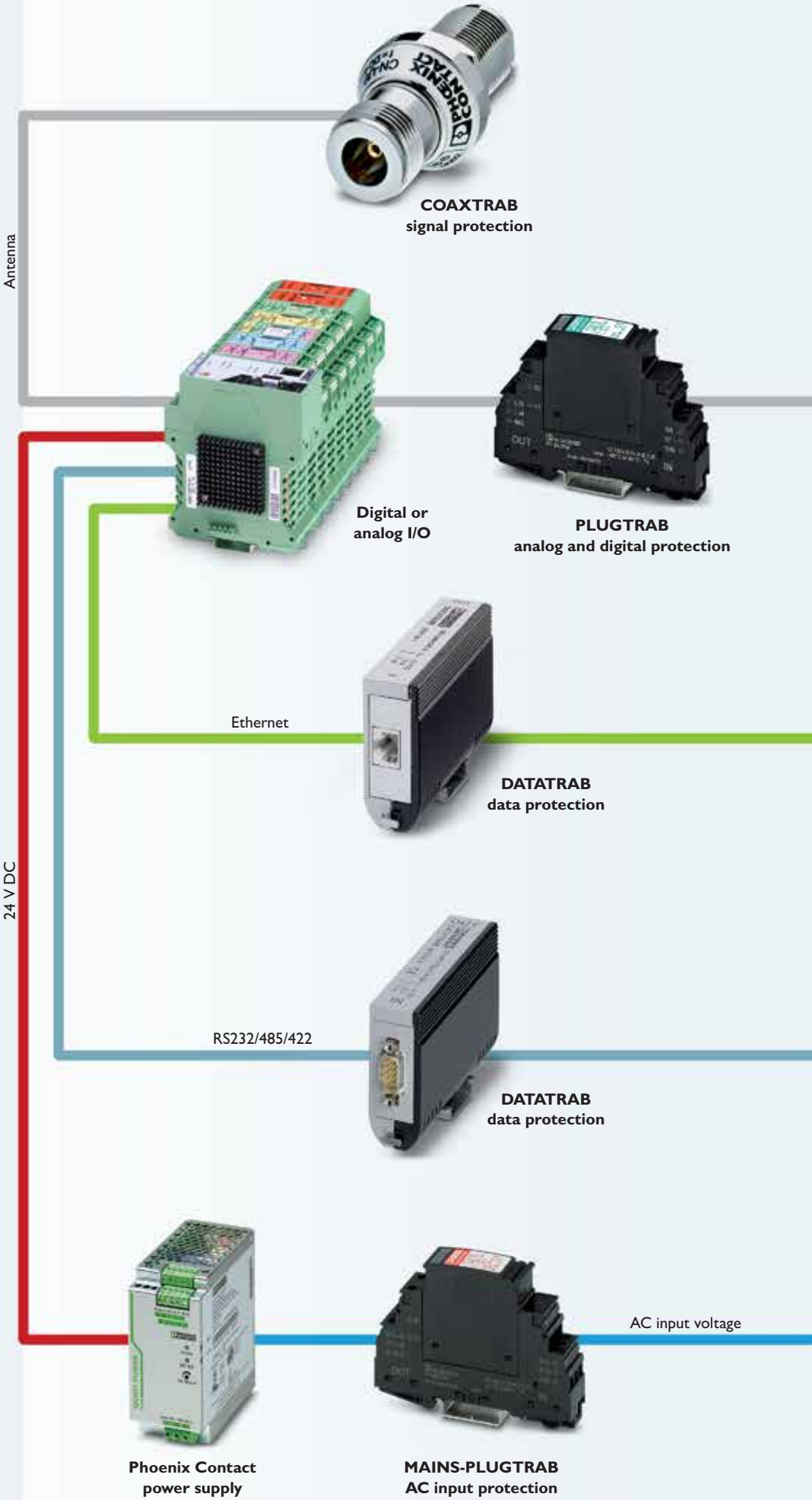
ANTENNA PROTECTION		
Part number	**Description**	**Product use**
2803166	CN-UB-70DC-6-BB	Antenna protection for 900 MHz system
2838490	CN-LAMBDA/4-5.9-BB	Antenna protection for 2.4/5 GHz

I/O PROTECTION		
Part number	**Description**	**Product use**
2838228	PT 2X2-24DC-ST	Analog protection plug
2839224	PT 2X2+F-BE	Base for analog plug
2838322	PT 4X1-24DC-ST	Digital protection plug

Wireless products eligible for a warranty extension are listed on the following pages.

As a turnkey option, using Phoenix Contact's RAD-SYS-NEMA4X-900 box (2917188) will instantly extend the warranty to five years for any Phoenix Contact wireless radio.

This enclosure consists of a NEMA 4X box with pre-wired power supply, UPS, power and antenna surge protection, which provides quick and easy installation.



Wireless warranty selector guide

	Part number	Description	Power supply	Power supply protection	Serial protection	Ethernet protection	Antenna protection	IO protection
TRUSTED WIRELESS I/O – Unidirectional radios (1 analog, 2 digital one-way)								
	2867102	RAD-ISM-900-SET-UD-ANT	✔	✔			✔	✔
	2867021	RAD-ISM-900-SET-AC-UD		✔			✔	✔
	2867034	RAD-ISM-900-SET-DC-UD	✔	✔			✔	✔
	2867047	RAD-ISM-900-RX	✔	✔			✔	✔
	2867076	RAD-ISM-900-TX	✔	✔			✔	✔
	2867335	RAD-ISM-900-TX-AC		✔			✔	✔
	2867348	RAD-ISM-900-TX-DC	✔	✔			✔	✔
TRUSTED WIRELESS I/O AND SERIAL – Unidirectional radios (1 analog, 2 digital one-way)								
	2901540	RAD-900-IFS	✔	✔	✔		✔	
	2901541	RAD-2400-IFS	✔	✔	✔		✔	
	2901533	RAD-DAIO6-IFS						✔
	2901535	RAD-DI4-IFS						✔
	2901536	RAD-DO4-IFS						✔
	2901537	RAD-AI4-IFS						✔
	2901538	RAD-AO4-IFS						✔
	2901539	RAD-DI8-OFS						✔
	2902811	RAD-DO8-IFS						✔
	2904035	RAD-PT100-4-IFS						✔
WIRELESSHART								
	2900178	RAD-WHG/WLAN-XD	✔	✔		✔	✔	
	2900100	RAD-WHA-1/2NPT	✔				✔	✔
TRUSTED WIRELESS ETHERNET								
	2900016	RAD-ISM-900-EN-BD	✔	✔	✔	✔	✔	
	2900017	RAD-ISM-900-EN-BD-BUS	✔	✔	✔	✔	✔	✔
	2901205	RAD-ISM-900-EN/B	✔	✔		✔	✔	

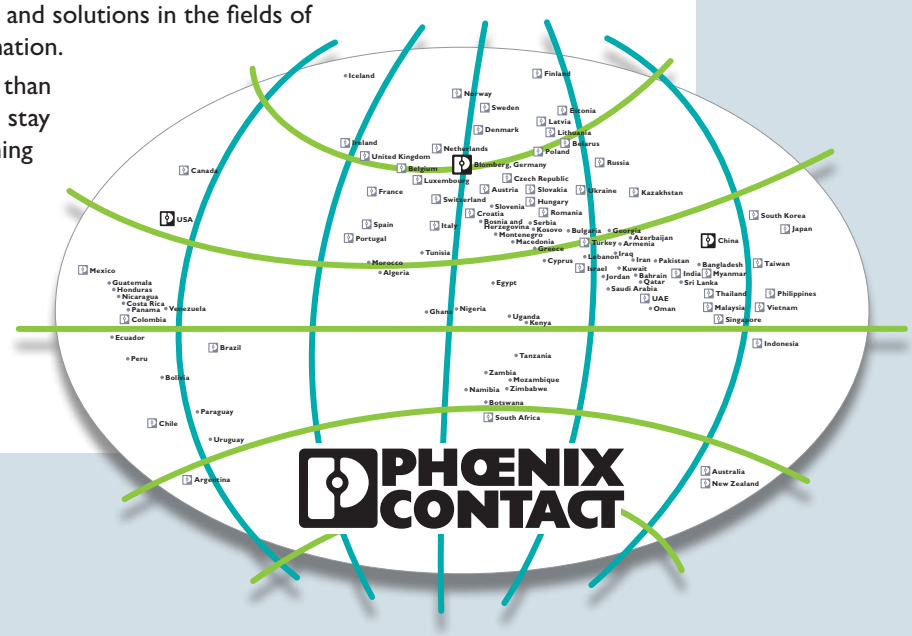
The above tables show an overview of the types of SPDs that may be needed for that particular radio.
The actual SPDs needed will vary from application to application.

	Part number	Description	Power supply	Power supply protection	Serial protection	Ethernet protection	Antenna protection	I/O protection
FL WLAN								
	2701093	FL WLAN 5101	✔	✔		✔	✔	
	2702538	FL WLAN 1101	✔	✔				
BLUETOOTH I/O								
	2884208	IL BT ADIO MUX-OMNI	✔	✔			✔	✔
	2702875	ILB BT ADIO MUX	✔	✔			✔	✔
BLUETOOTH FIELDLINE								
	2736770	FLM BT BS 3	✔	✔	✔			
	2736767	FLM BT DIO 8/8 M12	✔	✔				✔
	2884282	ILB BT ADIO 2/2/16/16	✔	✔				✔
BLUETOOTH DATA								
	2313805	PSI-WL-RS232-RS485/BT/2DO	✔	✔	✔		✔	
CELLULAR								
	2903441	TC MGUARD RS2000 3G VPN	✔	✔		✔	✔	
	2903440	TC MGUARD RS4000 3G VPN	✔	✔		✔	✔	

Ongoing communication with customers and partners worldwide

Phoenix Contact is a global, market leader based in Germany. Our group is known for its future-oriented components, systems, and solutions in the fields of electrical engineering, electronics, and automation.

With a global network reaching across more than 100 countries and 14,500 employees, we can stay in close contact with our customers, something we believe is essential to success. The wide variety of our innovative products makes it easy for our customers to find future-oriented solutions for multiple applications and industries. We especially focus on the fields of energy, infrastructure, process, and factory automation.



You will find our complete product range at:

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