



INTERFACE
Wireless

Unidirectional
wireless data transmission

INTERFACE Wireless – The wireless signal transmission system for industrial measurement and control tasks

With the new RAD-ISM-2400-SET-UD, radio system, analog and digital sensor signals can be received and transmitted safely.

Planners and users thus have access to a very simple transmission path for industrial fields of application. Signals that could only previously be acquired with a great deal of effort or not at all are now fast and simple to acquire.

With the unidirectional RAD-ISM-2400-SET-UD radio system, point-to-point connections and multiple receiver systems can be implemented to multiply and split signals.



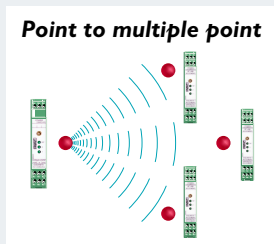
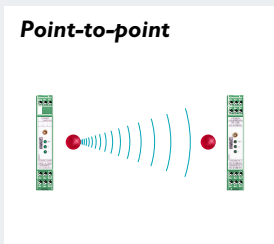
Receiver

The digital signals are made available at the receiver in the form of two relay contacts or a 4..20 mA current output. The state of the radio connection is diagnosed via a third relay (radio link).



Transmitter

The transmitter picks up two digital signals in the range of 10-30 V AC/DC, and an analog current signal (4..20 mA).



INTERFACE Wireless –
Opening up rough
terrain

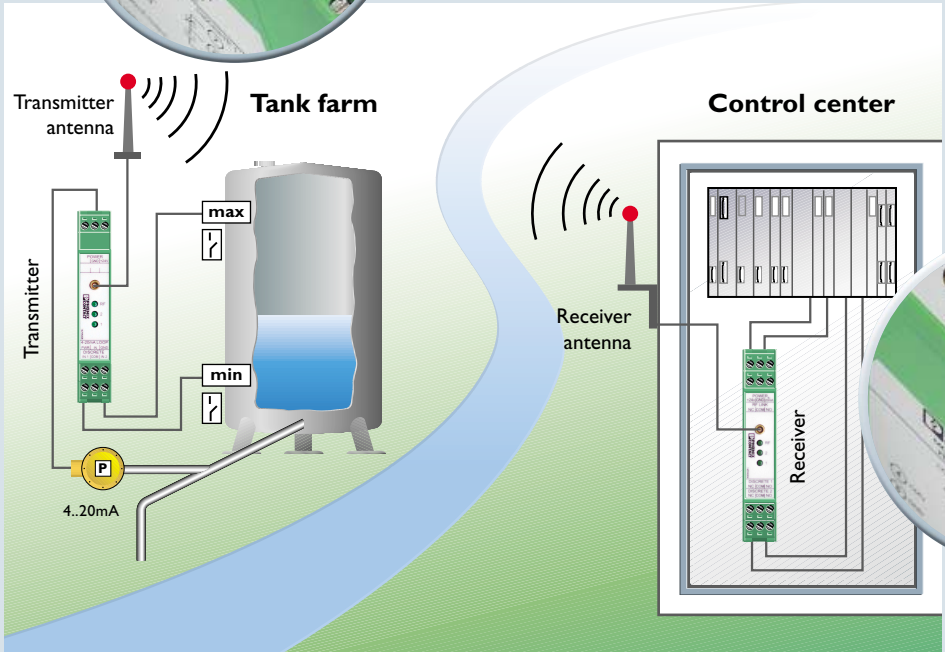
**INTERFACE Wireless –
A radio connection for industrial measurement and control purposes**

The advantages of a radio connection will quickly become apparent from an example from process engineering. Spread over a large site, levels and control commands must be measured and transmitted to a control system on the other side of the street. Digging trenches, laying cable routes and inserting the cables involves high costs. The costs of development and inspection, and the time and cost involved in obtaining permits occur before the start of the project which increases the costs further. A radio connection, on the other hand, is fast to install and can easily lead to a saving of several thousand Euros. Wherever obstacles such as streets, railway lines or rivers have to be crossed, the industrial radio connection creates new solutions at a fraction of other costs.

Wireless signal transmission is also convincing in the field of mechanical and plant engineering. Flexible cable conduits and sliprings are cost-intensive elements susceptible to a high degree of wear in a plant or machine. Purchase, servicing and repair costs, as well as the costs resulting from downtimes make the slipring or flexible cable conduit expensive. A radio connection, on the other hand, is maintenance-free and thus cost-cutting.



The transmitter sends the process data every 27 ms.



The receiver generates the three sensor signals and the radio link signal. The state of the radio signal can be diagnosed using the radio link signal.





INTERFACE Wireless –
Overcomes obstacles
and measures signals
where it is almost
impossible to lay cables

▶ **The unidirectional system**



RAD-ISM-2400-SET-UD-ANT

Order No.: 28 67 283

- Set consisting of transmitter, receiver and two antennas
- For unidirectional signal transmission
- 2 digital signals 10-30 V AC/DC
- 1 analog current signal 4..20 mA
- Supply voltage 12-30 V DC
- Typical current consumption
Transmitter: 18 mA @ 24 V DC
Receiver: 80 mA @ 24 V DC

RAD-ISM-2400-Rx

Order No.: 28 67 308

- Receiver unit to expand to point to multiple point connections
- Supply voltage 12-30 V DC
- Typical current consumption:
80 mA @ 24 V DC

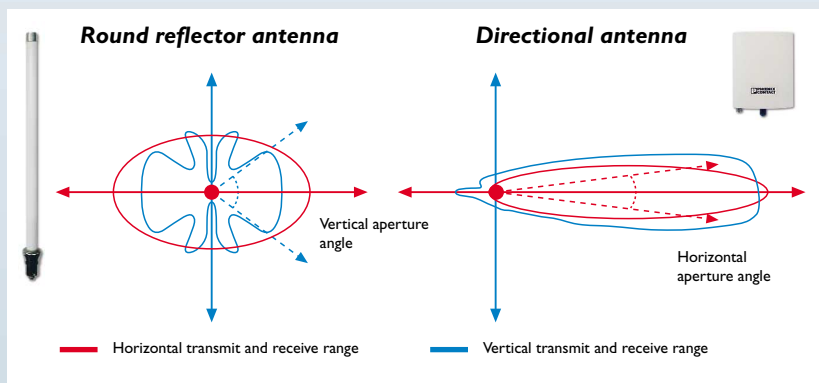
Range, antennas and dBs

The range of a radio system depends on several factors. Large objects can greatly restrict the range (e.g. concrete buildings) or positively influence the range as a result of reflection (e.g. large metallic surfaces, such as a metal tank, etc.). Antennas can increase the range by packing or radiating in a particular direction (gain antennas). In comparison, cables and other

connecting elements have a dampening effect. An antenna with gain does not radiate its transmission capacity equally in all directions, but instead focuses in one direction, similar to the light of a torch. This increases the range, while retaining the same transmission capacity. There are two main different types of antennas: The round (omnidirectional type) and the directional antenna (e.g. planar or yagi type). The so-called

aperture angle describes the transmit and receive range in a horizontal and vertical direction. A round reflector antenna transmits and receives horizontally 360° around its axis. A directional antenna, on the other hand, must be pointed in the direction of the counterpart. The focused transmit and receive area leads to significantly larger ranges. The following are average values for the RAD-ISM-2400-SET-UD-ANT unidirectional radio system:

- In machine halls: 50-100 m
 - Outside of buildings: 50-300 m
 - When using directional antennas (see accessories): Up to 3000 m
- All values apply to LOS (Line Of Sight)



► Accessories



1 Panel directional antenna

Order No.: 28 67 610

- For point-to-point systems
- Indoor and outdoor installation
- 8 dBi gain
- Aperture angle 70°v, 75°h
- Including mounting material



2 Omnidirectional round antenna

Order No.: 28 67 623

- For point-to-point systems
- For point to multiple point
- For mobile applications
- Indoor and outdoor installation
- 9 dBi gain
- Aperture angle 15°v, 360°h
- Including mounting material



Surge voltage protection

Order No.: 28 18 850

- **Type BB** (female/female):
CN-UB-280DC-BB

Order No.: 28 18 148

- **Type SB** (male/female):
CN-UB-280DC-SB

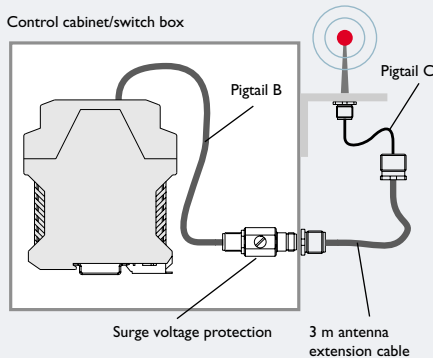
- With antennas installed outdoors



Antenna cable type: EF393

- 3 m Order No.: 28 67 649
- 5 m Order No.: 28 67 652
- 10 m Order No.: 28 67 665

► Pigtail¹⁾ selection list



Pigtail A:

MCX (m) ⇒ SMA (m) 100 cm
Order No.: 28 67 678

Pigtail B:

MCX (m) ⇒ N (m) 50 cm
Order No.: 28 67 681

Pigtail C:

N (f) ⇒ SMA (m) 30 cm
Order No.: 28 67 694

Pigtail D:

N (f) ⇒ N (m) 50 cm
Order No.: 28 67 704

Antenna type used	Is an antenna extension cable used?	Is surge voltage protection used?	The following pigtails are required:
1 Panel Antenna Order No. 28 67 610	Yes	Yes = Type BB	B + C
		–	2)
	No	Yes = Type SB	B + C
2 Omnidirectional Round Antenna Order No. 28 67 623	Yes	Yes = Type BB	B
		–	2)
	No	Yes = Type SB	B + D
		No	B

¹⁾ Pigtails are short adapter cables

²⁾ If an antenna extension cable is used, please cater for surge voltage protection!

◀ The declaration of conformity does not allow the use of any other components!

INTERFACE Wireless – A sturdy and reliable radio connection



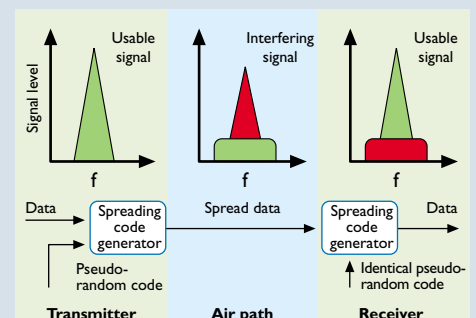
Radio technology for a long time was reserved for applications involving transmitting speech and image data. Many technologies and processes nowadays used in commercial products, have their origins in the military sector. For industrial applications, these radio systems represent a high savings potential.

*INTERFACE Wireless
– Covers widespread
systems*

The basic requirement for industrial applications is a stable and reliable radio connection. There are various approaches.

DSSS transmission technology

One approach is the so-called "Direct Sequence Spread Spectrum" process (DSSS). In this process, a pseudo-random codeword is generated for each information bit. This codeword generates a wideband signal from the narrow band usable signal. The signal strength in a particular frequency is reduced, since the transmission power is distributed as a result of the spread. This wideband signal is transmitted from the antenna and transformed back at the receiver using the same spreading code generator. The usable signal is now available again. If an interfering signal enters during transmission along the air path, this narrow band interfering signal will also pass through the spreading code generator in the receiver and be transformed into a wideband signal (noise). Using DSSS technology, the wideband signal makes it possible to transmit large volumes of data. The reliability of this technology depends largely on the signal strength of the interferer and whether the difference between signal and noise is still sufficiently great. If the threshold is exceeded, the radio connection fails immediately.



Direct Sequence Spread Spectrum (DSSS)

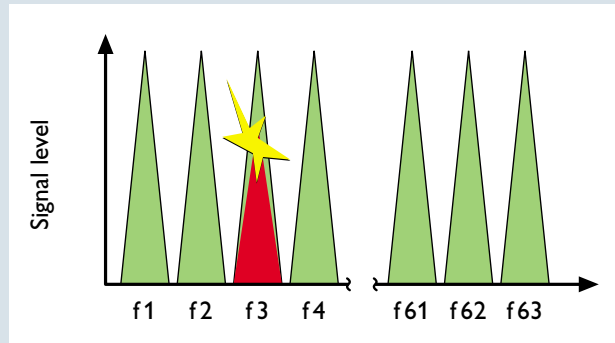
FHSS transmission technology

Military research into an extremely tap-proof transmission process led to the so-called "Frequency Hopping Spread Spectrum" method (FHSS). With frequency hopping, the transmitter and receiver constantly change the radio frequency, following a plan known only to themselves. The actual narrow band signal transmission takes place with conventional methods on the transmission frequency being used at that moment. It is therefore almost impossible to tap the information. In addition to the security aspect, this process also has excellent behavior toward interference sources. The FHSS system avoids the interference sources by constantly changing the transmission frequency. If there is a collision in a transmission frequency being used between usable signal and interferer, this data packet is destroyed and not used. However, since the data packets are very small and can be repeated very quickly, the loss of a transmission causes no problems. If the time between two transmissions (so-called dwell time) is small enough, this is known as redundant data transmission. The dynamic behavior of FHSS means that both existing interferers and potential future interferers can only cause minor influence to an FHSS radio connection.

Summary

The DSSS system fails completely when the threshold is reached. This is not acceptable for industrial applications. The FHSS system, on the other hand, can function until an interference appears over the whole frequency bandwidth, and that is most unlikely.

FHSS systems do not suppress the interferences, they tolerate them. Each transmission packet is checked and if it is damaged it is not used. The subsequent transmission on the next transmission frequency then supplies



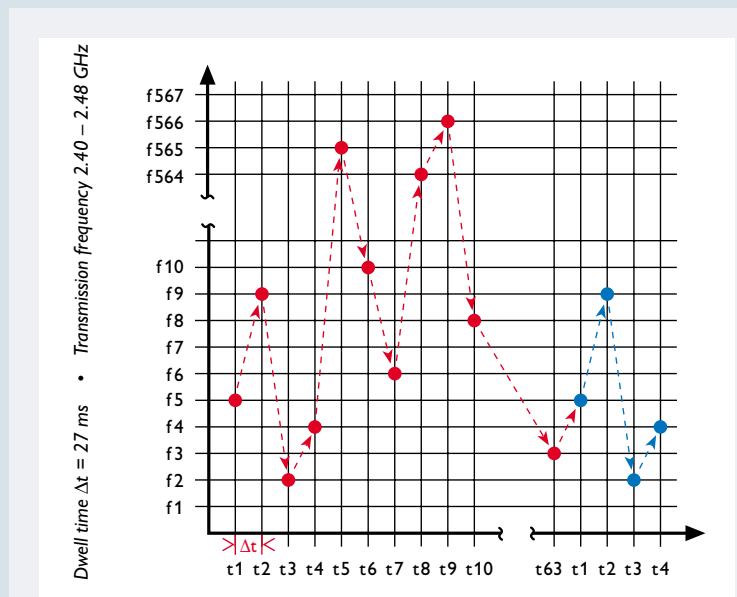
a correct data packet. This is why FHSS systems transmit their data more slowly, yet are secure and stable.

In an environment with little interference (with an interference signal below the threshold for the DSSS used), 100% of the DSSS data packets are transmitted, whereby the same interference when using FHSS would result in the loss of individual packets. In this case, the DSSS process is a good choice for large data packets.

In an environment with strong interference, however, where

interference signals are above the threshold for the DSSS, the DSSS process fails. An FHSS system only fails to function when the complete ISM frequency bandwidth is destroyed.

The immunity to interference, redundancy and smaller data packets clearly speak for the FHSS process in industrial radio systems for the transmission of simple analog and digital signals. Using this technology, it is possible to achieve a high degree of reliability, even where several such FHSS systems are used in close proximity.



The FHSS process used in RAD-ISM-2400-SET-UD-ANT can be described as very stable and secure. From over 500 individual transmission frequencies, each set uses 63 individual frequencies and hops between them in cycles. The order used is "unique". Every 27 ms (dwell time), data is transmitted and the radio hops to another transmission frequency.

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