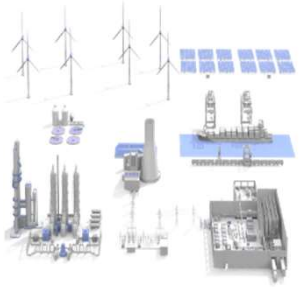
Communication Interfaces – Overview 2021

Products



Application references

NearFi Technology
Designed by Phoenix Contact

PROFIBUS

TRUSTED WIRELESS

Technologies

PoE

HART

5G

"PAVE THE WAY FOR FUTURE BUSINESS"
by addressing relevant trends

SPE & APL

5G

TSN

OPC UA

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INSPIRING INNOVATIONS

Communication Interfaces - Our product portfolio

Fieldbus Communication

Ethernet Infrastructure

Smart Camera Box

new

Wireless

new

Remote Communication

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Fieldbus Communication 1

Converter
Isolator

Repeater
Segment
Coupler

Fast
connectors
(SUBCON)

Fiber optic
converter

Modular hub

Extender
Serial/Profibus

Protocol
converter

Radioline
Multipoint-
Multiplexer

Terminator
resistor

Fieldbus
Communication 2

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Fieldbus Communication 2

Serial Device Server / Gateways

Foundation fieldbus Power

Fieldbus Device Coupler Zone 2

Fieldbus Device Coupler Zone 2

Fieldbus Device Coupler Zone 1

Fieldbus Device Terminal box

Profibus DP/PA Converter

Profibus PA I/O Multiplexer

Ethernet HART Multiplexer

Fieldbus Communication 1

Ethernet Infrastructure

Ethernet Infrastructure

Ethernet Extender

Media Converter

Ethernet Isolator

Ethernet HART Multiplexer

Patch Panel

PoE Injector

Serial Device Server / Gateways

Data connectors

TIME SERVER

Fieldbus communication 2

Wireless

INSPIRING INNOVATIONS

Wireless

Ethernet Infrastructure

Remote communication

Radioline

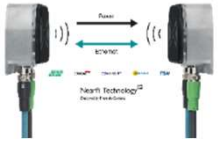
Wireless Multiplexer

Essential Wireless

Radioline Outdoor solution

WLAN 5110

WLAN 1100 / 2100



new

NearFi

Energy and data coupler

new

Bluetooth LowEnergy

new

WLAN 1010 / 2010

Bluetooth EPA

Remote communication

TC Mobile I/O

TC MGuard

new

TC Router

new

TC Cloud Client

mGuard Secure Remote Service

Wireless

Technologies

Technologies

HART Technology

PoE Power over Ethernet

TRUSTED WIRELESS

Remote communication

PROFIBUS

5G

new

NearFi Technology
Designed by Phoenix Contact

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- Basic Wireless
- Trusted Wireless
- Radioline
- Radioline Multipoint Multiplexer
- Applications
- Service and Support
- Tools of Radioline

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Selection topics

Basics

Antenna technology

Bluetooth Wi Fi TRUSTED WIRELESS WirelessHART

Wireless technology and coexistence

Products

Applications

References

Services

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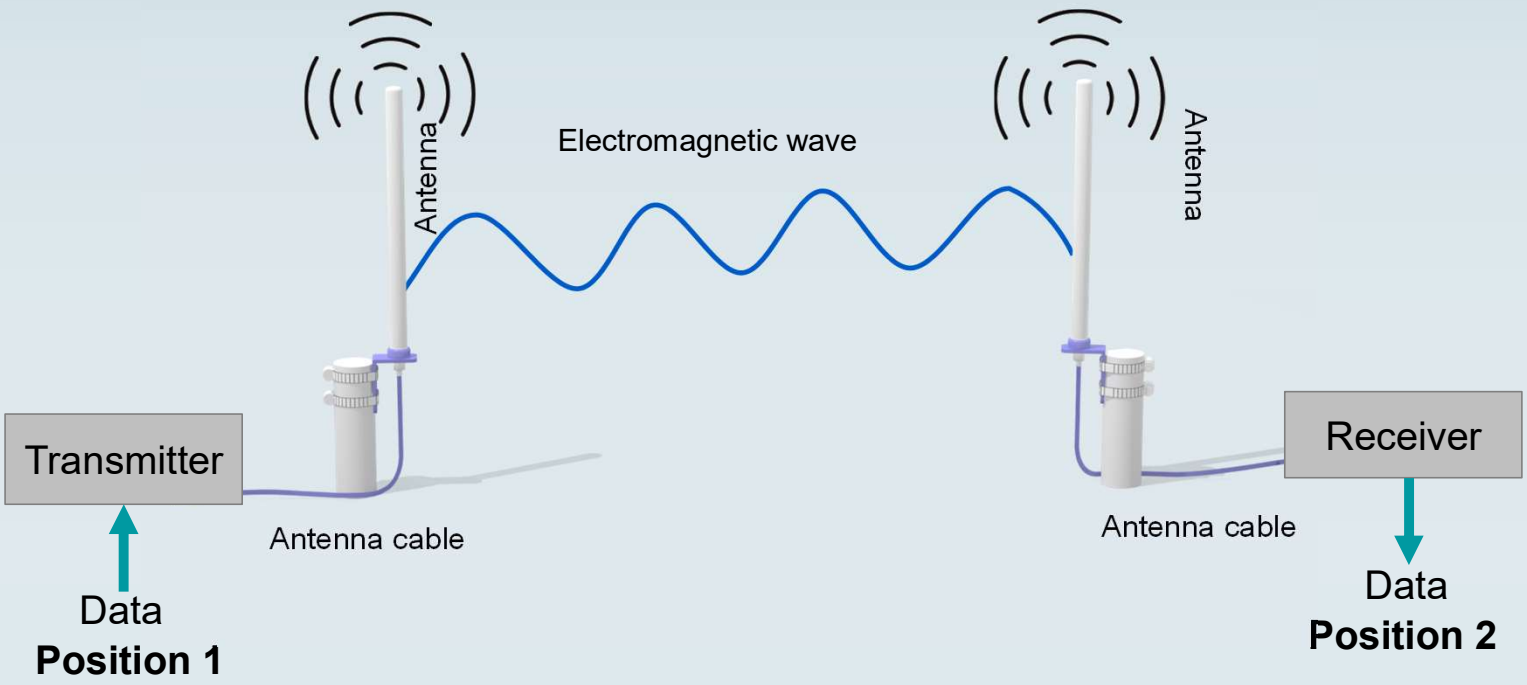
Wireless link



Dezibel (dB)

P_1/P_2	dB	Description
0,001	-30 dB	Attenuation
0,01	-20 dB	
0,1	-10 dB	
1	0 dB	1:1 transmission
10	10 dB	Gain
100	20 dB	
1000	30 dB	

- Decibel is a logarithmic value which describes the relation of Power P1 compare to power P2, e.g. 1 mW

$$L_P(\mathrm{dB}) = 10 \log_{10} \left(\frac{P_1}{P_2} \right)$$

Tip:
A change of 3 dB always corresponds to a doubling or halving.

Power rating in dBm

Power	dBm
1 fW	-120 dBm
1pW	-90 dBm
1 nW	-60 dBm
1 µW	-30 dBm
1 mW	0 dBm
10 mW	10 dBm
100 mW	20 dBm
1 W	30 dBm

- The unit decibel milliwatt (dBm) is a power level based on one milliwatt.
- The transmission power is regulated by regulatory authority

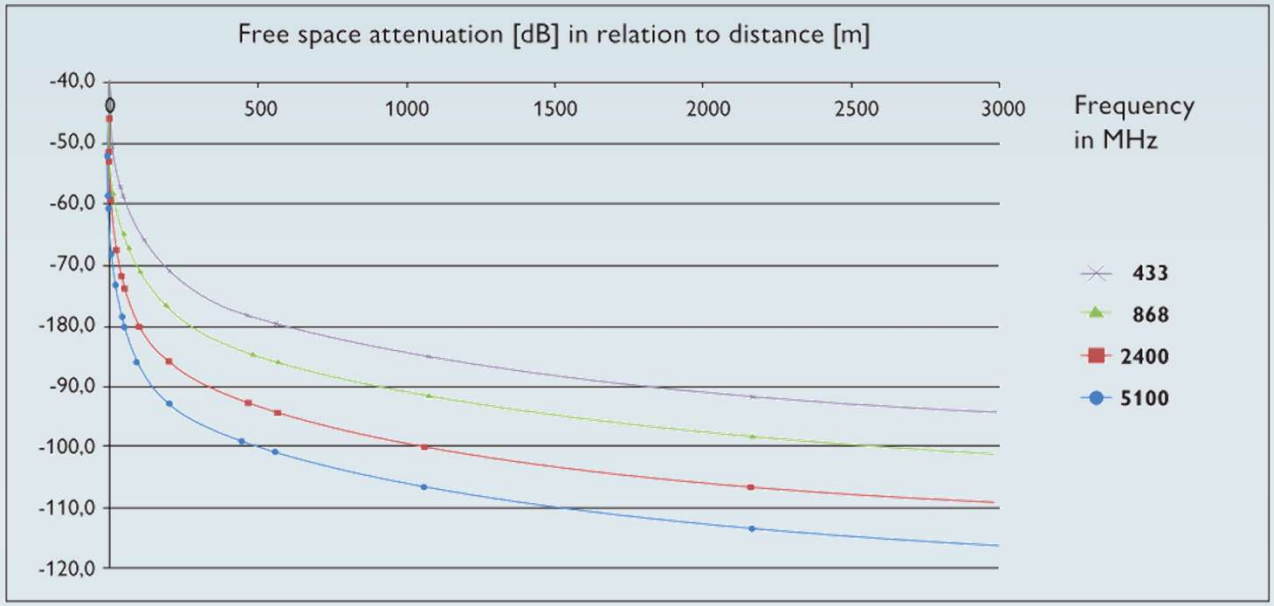
Receiver sensitivity and transmission power

Technology / Frequency band	Data rate	Receiver sensitivity	Transmission -power
WLAN	54 MBit/s	- 84 dBm	+ 19 dBm
Bluetooth	1 MBit/s	- 88 dBm	+ 14 dBm
Trusted Wireless 2,4 GHz	Max. 250 kBit/s	- 93 dBm	+ 20 dBm
Trusted Wireless 2,4 GHz	Min. 16 kBit/s	- 106 dBm	+ 20 dBm
Trusted Wireless 868 MHz	Max. 120 kBit/s	- 103 dBm	+ 27 dBm
Trusted Wireless 868 MHz	Min. 1,2 kBit/s	- 122 dBm	+ 27 dBm

- The lower the data rate, the higher the receiver sensitivity
- The higher the receiver sensitivity, the bigger the achievable distance

Example:
- The maximum transmission power is 100 mW / 20 dBm @ 2,4 GHz.
- The signal strength at the receiver should be better than the receiver sensitivity of the used radio module.

Free space loss



- The lower the frequency the lower the free space attenuation
- The lower the free space attenuation, the bigger the achievable distance

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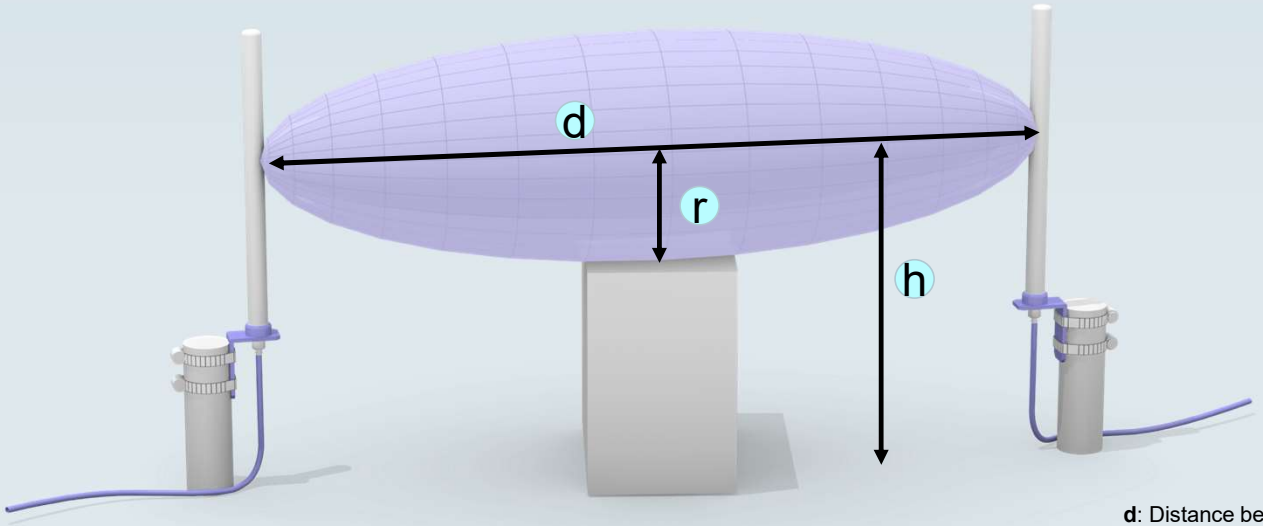
Material attenuation

Obstacles	Typ. attenuation @ 868/900 MHz	Typ. attenuation @ 2,4 GHz
Window	1 – 2 dB	3 dB
Sand-lime brick (24 cm)	5 – 6 dB	9 – 10 dB
Hedge (2 m)	8 dB	15 dB
Reinforced concrete wall (16 cm)	12 – 15 dB	20 – 25 dB
Forest (25 m)	20 dB	40 dB

- The lower the frequency, the lower the material attenuation
- The lower the material attenuation, the bigger the achievable distance

Fresnel Zone



The antenna height increases with the distance!

d: Distance between antennas
r: Radius of the Fresnel-Zone in the middle
h: Necessary total height of the antennas
(Obstacle height + radius Fresnel Zone)

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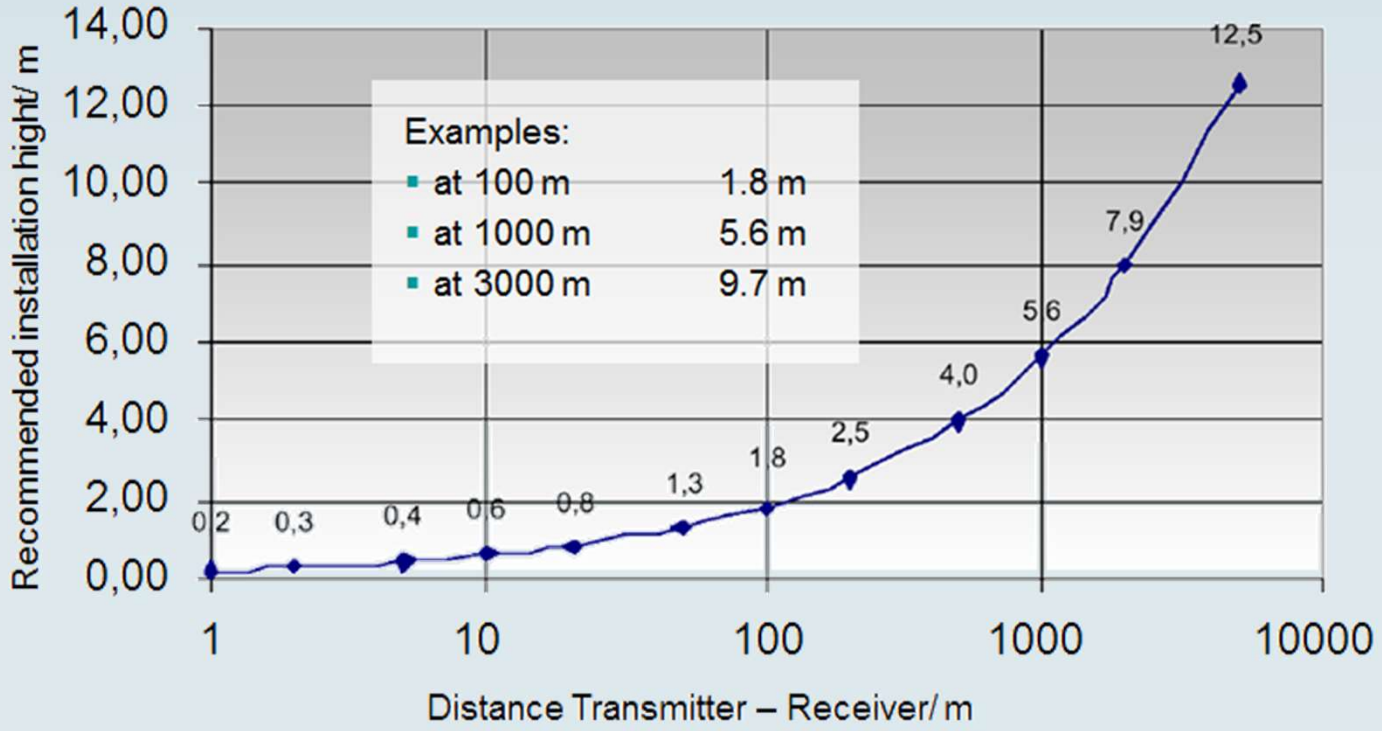
Antenna hight @ 2,4 GHz



- The higher the antenna, the bigger the achievable distance

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Affected by weathering

- Rain, snow have only minimal impact
  - Attenuation of 50 l / m²h is 0,02 dB / km
- Wind has no direct influence, but taken into account when fixing the antenna!

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Calculating with decibels (dB)

Transmit power	Attenuation cabel	Antenna gain	Free space loss	Antenna gain	Attenuation cable	Receiver sensitivity
+20 dBm	-2 dB	+2 dBi	- 80 dB	+2 dBi	-2 dB	**- 60 dBm**

EIRP: +20 dBm

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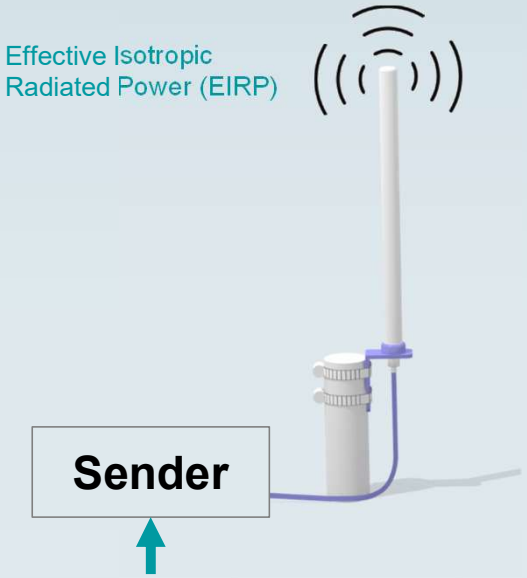
Max. permissible radiated power EIRP



Transmission power	Attenuation cable	Antenna gain	**EIRP**
+16 dBm	-2 dB	+6 dBi	**+20 dBm**
+20 dBm	-2 dB	+2 dBi	**+20 dBm**

For Europe:

- 868 MHz-Band: max. 27 dBm (EIRP)
- 2,4-GHz-Band: max. 20 dBm (EIRP)
- 5,150 GHz bis 5,350 GHz max. 23 dBm (EIRP)
- 5,470 GHz bis 5,725 GHz max. 30 dBm (EIRP)

The legally prescribed radiated power (EIRP) must not be exceeded.

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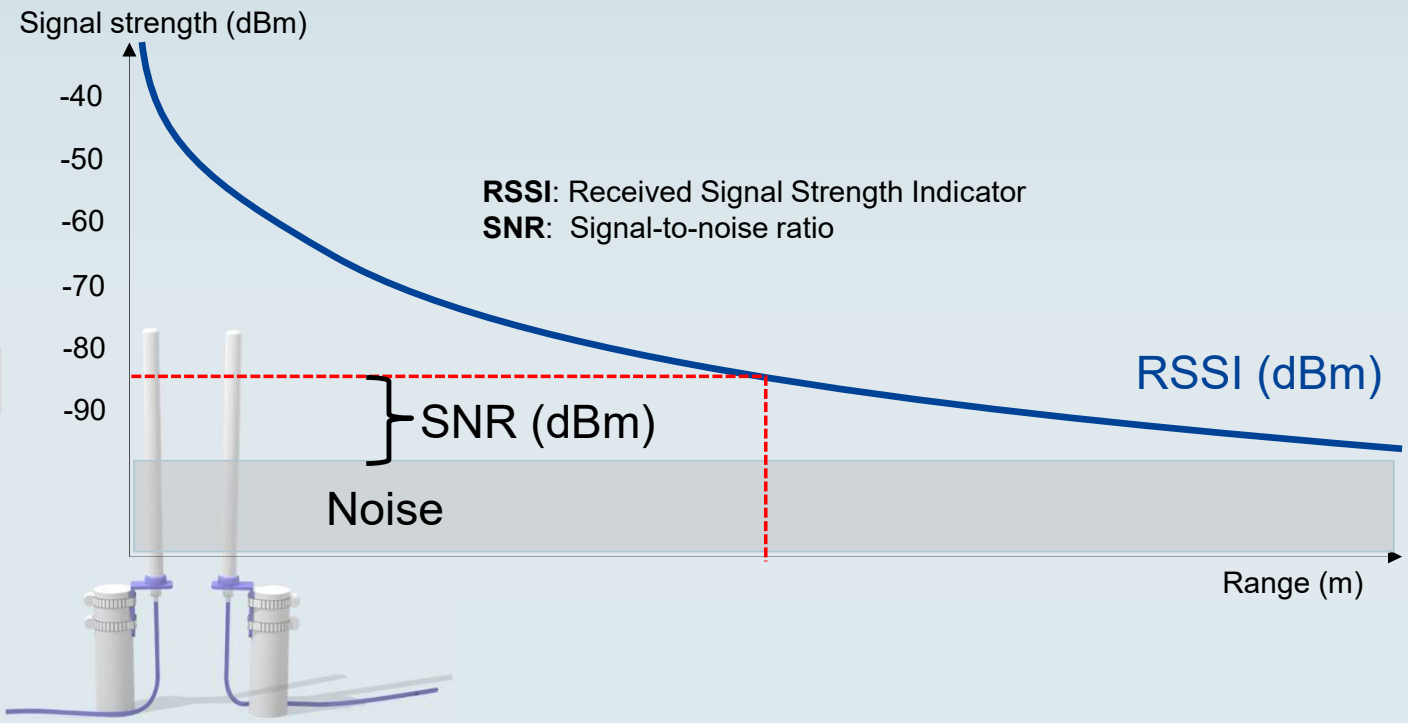
Indications of signal quality



- The lower the data rate, the more "robust" is the communication or the higher the achievable distance
- The lower the SNR, the poorer the signal quality, and transmission problems due to loss of frames must be expected

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Wireless Accessories

- More power for your application through coordinated accessories
- Ideal for industrial applications thanks to special antenna design
- Facilitated selection of the right components with helpful examples

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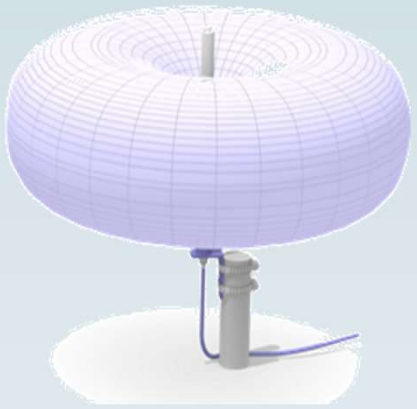
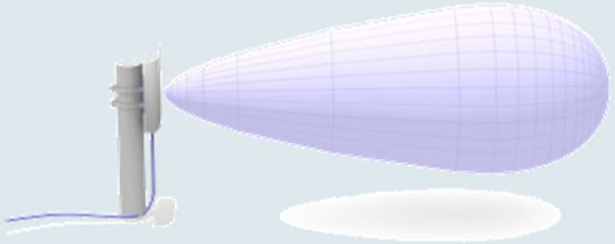
Antenna types

Omnidirectional antenna (OMNI)

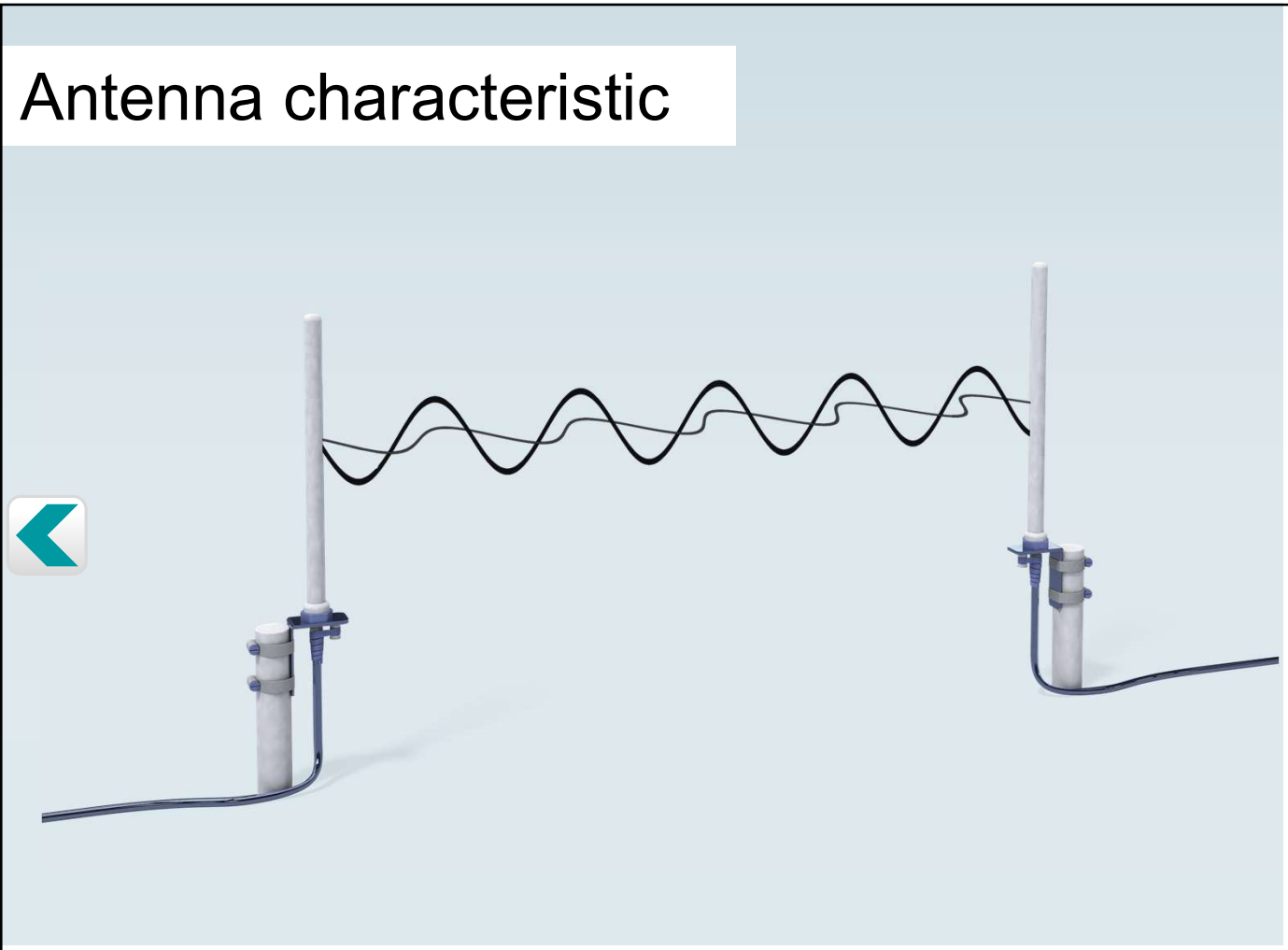


Directional antenna (Yagi)



- The larger the opening angle, the easier the antenna alignment
- The smaller the opening angle the greater the antenna gain

Antenna characteristic



- The characteristic of an antenna can be compared with various light sources :
  - Light bulb → Omni antenna
  - Pocket lamp → Directional antenna
  - Laser pointer → Strong directional antenna e. g. Yagi
- You can also combine omnidirectional and directional antennas. Ensure the same polarization of the antennas.

Tip: You can also combine circular and vertical polarized antennas in certain applications! Example: Antenna installation near the ground.

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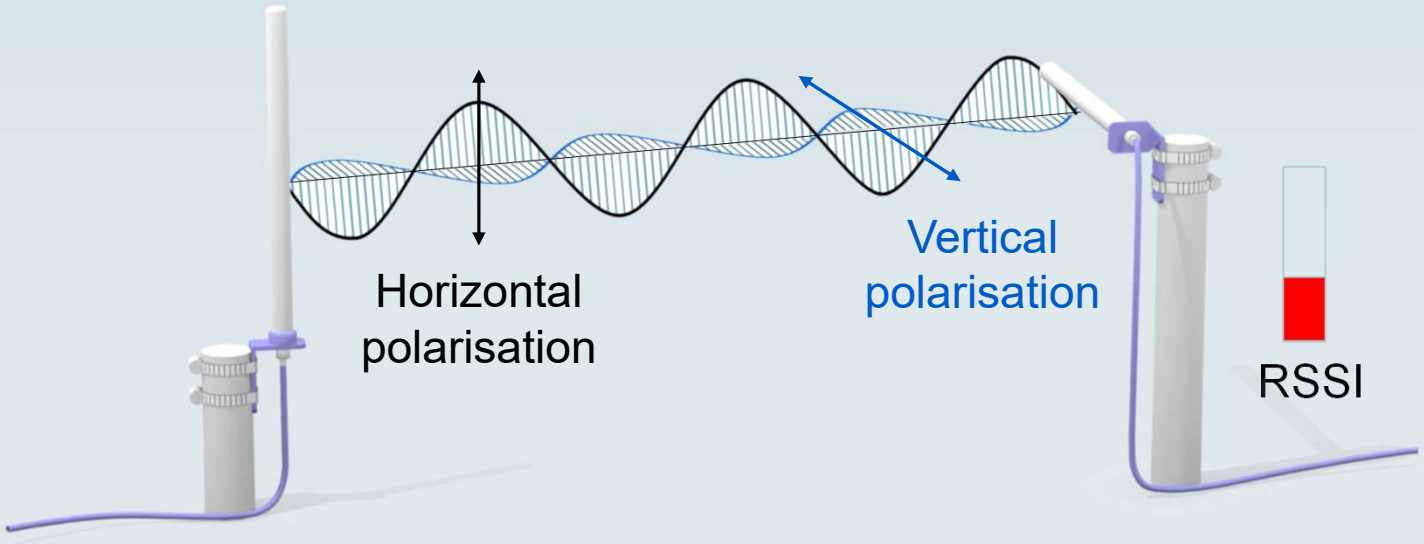
Polarisation



At 90 ° theoretically no reception possible.

Selection of the right antenna

Omnidirectional antenna

- Wireless modules facing different directions
- Mobile applications
- Applications without sight (reflective environments)

Directional antenna

- Cover large distances
- Point-to-point connections
- Stationary or linearly movable applications
- Decoupling due to directivity in the case of multiple point-to-point paths

Omnidirectional antenna

Article	RAD-ISM-2400-ANT-OMNI-2-1-RSMA	RAD-ISM-2400-ANT-VAN-3-0-RSMA	ANT-OMNI-2459-02	RAD-ISM-2400-ANT-OMNI-6-0	ANT-OMNI-5900-01	RAD-ISM-2459-ANT-FOOD-6-0	RAD-900-ANT-OMNI-2-N	ANT-OMNI-868-01
Article No.	2701362	2701358	2701408	2885919	2701347	2692526	2904802	2702136
Picture								
Frequency	2.4 GHz	2.4 GHz	2.4 + 5 GHz	2.4 GHz	5 GHz	2.4 + 5 GHz	868 MHz	868 MHz
Gain	2 dBi	3 dBi	2.5 / 5 dBi	6 dBi	5 dBi	>3 / >5 dBi	2 dBi	4 dBi
Polarization	vertical	vertical	vertical	vertical	vertical	vertical	vertical	vertical
Beamwidth horizontal	 360°	 360°	 360° (2.4 / 5 GHz)	 360°	 360°	 360°	 360°	 360°
Beamwidth vertical	 75°	 85°	 30°(2.4 GHz) 16° (5 GHz)	 30°	 25°	 30°(2.4 GHz) 25° (5 GHz)	 50°	 30°
Connector	RSMA (m)	RSMA (m)	N (m)	N (f)	N (f)	N (f)	N (f)	N (f)
Protection class	IP 65	IP 55	IP 68	IP 65	IP 64	IP 68	IP 65	IP 65
Temperature range	-20…+65°C	-40…+80 °C	-40…+70°C	-40…+75°C	-45…+70°C	-40…+80°C	-45…+70°C	-40…+75°C
Dimension	82,5x7,8 mm	86 x 43 mm	180 x 23 mm	250 x 22 mm	16 x 160 mm	92 x 52 mm	84 x 36 mm	620 x 20 mm
	Incl. 1,5m cable	Incl. 1,5m cable	Enclosure fitting	Wall & pole fitting	Wall & pole fitting	Enclosure fitting	Enclosure fitting	Wall & pole fitting

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Directional antenna

Article	ANT-DIR-2459-01	ANT-DIR-5900-01	RAD-ISM-5200-ANT-PAR-18-N	RAD-ISM-5200-ANT-PAR-22-N	ANT-DIR-868-01	RAD-ISM-900-ANT-YAGI-6.5-N	RAD-ISM-900-ANT-YAGI-10-N
Article No.	2701186	2701348	5606613	5606174	2702137	2867814	5606614
Picture							
Frequency	2.4 + 5 GHz	5 GHz	5 GHz	5 GHz	868 MHz	868 MHz	868 MHz
Gain	9 / 9 dBi	9 dBi	18 dBi	22 dBi	3,5 dBi	8.5 dBi	12.15 dBi
Polarization	vertical	+/- 45° dual slant	vertical	vertical	circular	vertical	vertical
Beamwidth horizontal	75°(2.4 GHz) 55° (5 GHz)	70°	18°	12°	135°	100°	56°
Beamwidth vertical	55°(2.4 GHz) 55° (5 GHz)	60°	18°	12°	90°	62°	46°
Connector	N (f)	2 x N (f)	N (f)	N (f)	N (f)	N (f)	N (f)
Protection class	IP 67	IP 67	IP 55	IP 55	IP67	IP65	IP65
Temperature range	-40…+80°C	-40…+80°C	-40…+70 °C	-40…+70°C	-40…+80°C	-40…+80°C	-40…+70°C
Dimension	80x101x35 mm	80x101x35 mm	152,4x152,4 mm	304 mm diam.	80 x 101 x 35 mm	170 x 60 mm	172 x 60.5 mm
	Wand & Mast Montage	Wand & Mast Montage	Wand&Mast Montage	Wand & Mast Montage	Wand & Mast Montage	Wand & Mast Montage	Wand & Mast Montage

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Antenna connector

RSMA

Cable side

Radio side

SMA

N

Antenna cabel and accessories






	Antenna cable for the control cabinet lead through	Antenna cable	Antenna cable	Surge protection 2,4 / 5 GHz	Surge protection 868 / 900 MHz	Antenna barrier
Frequency range	0,3 … 6 GHz	0,3 … 6 GHz	0,3 … 6 GHz	2,4 … 5,9 GHz	0,8 … 2,25 GHz	0,3 … 6 GHz
Connector	RSMA (m) -> N (m)	RSMA (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)
Characteristics	Easy install through flexible inner conductor, UV-resistant, oil-resistant	Solid inner conductor, low attenuation, UV-resistant	Easy install through flexible inner conductor, UV-resistant, oil-resistant	Overvoltage protection for coaxial signal interfaces with Lambda / 4 technology		Antenna barrier for control cabinet operation, type of protection: Ex i, installation barrier: zone 2, installation antenna: zone 0, 1 or 2
Length / Article No.	0,5 m / 2701402	0,5 m / 2903263 1 m / 2903264 2 m / 2903265 3 m / 2903266 5 m / 2702140	3 m / 2867649 5 m / 2867652 10 m / 2867665 15 m / 2885634	2838490	2801057	2702198

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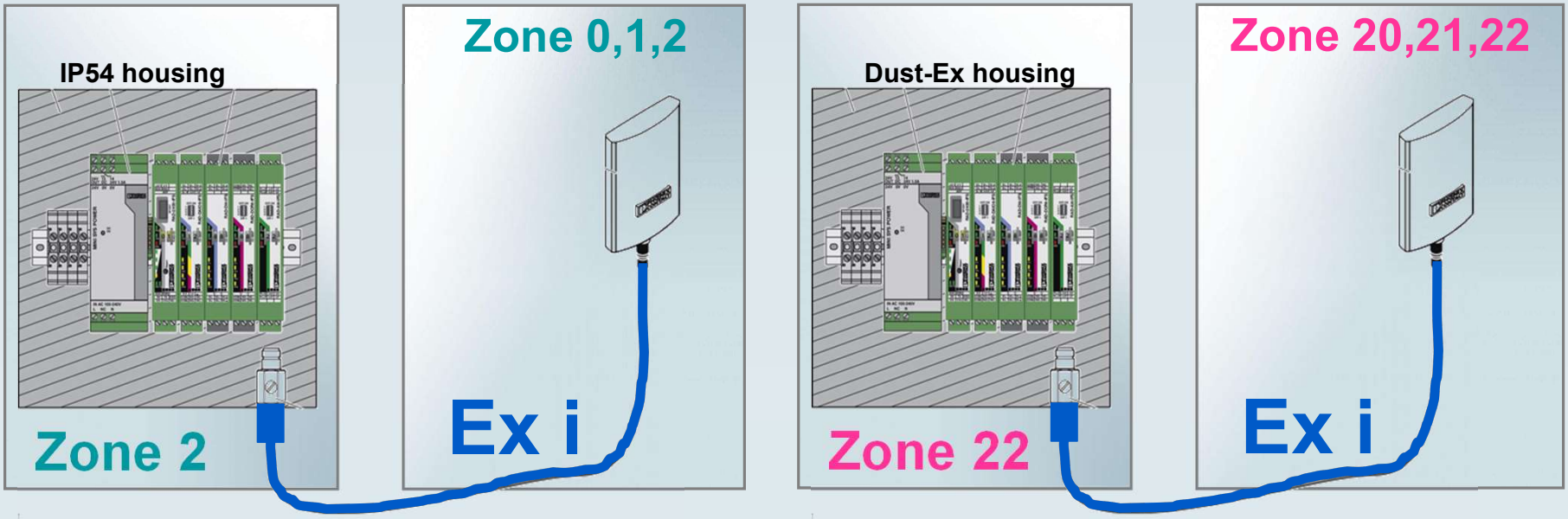
Antenna installation in Ex areas

new



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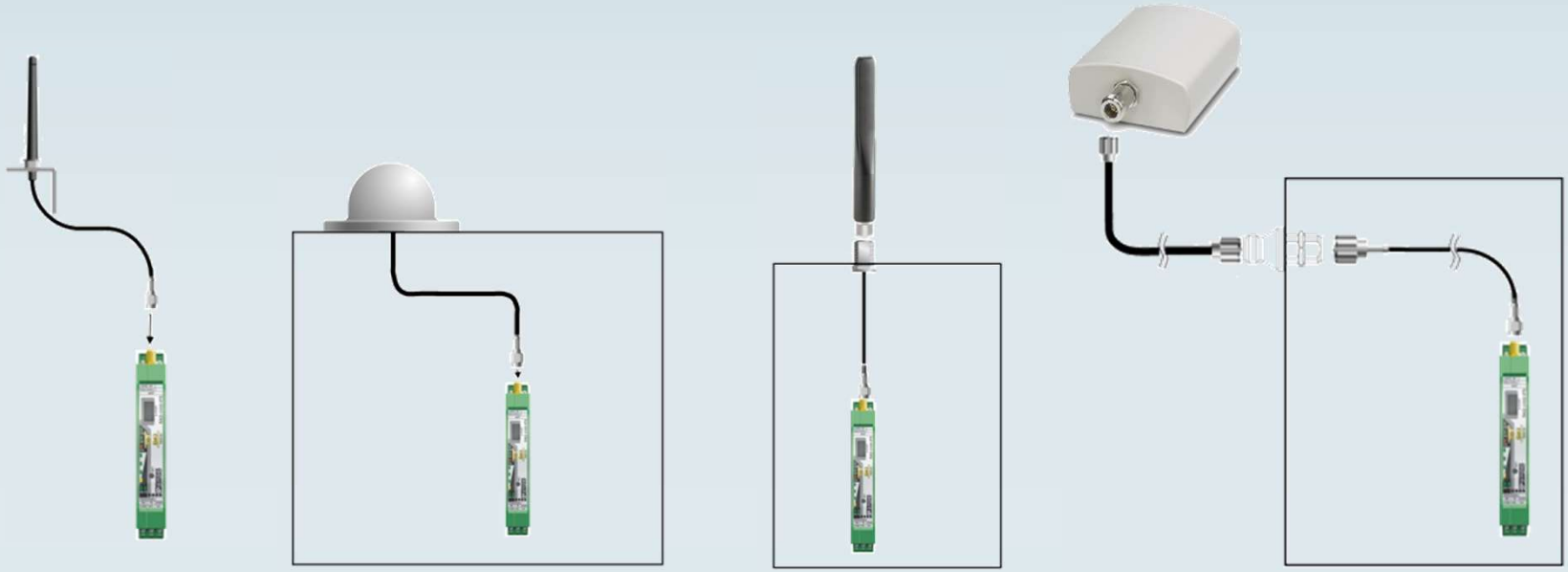
Installation examples



Tip: Use an antenna overvoltage protection outdoors!

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Wrong antenna installation

Wrong !

Better

Best solution!

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The right distance between antennas

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

Tip: The best way is to mount the antenna on top of each other!

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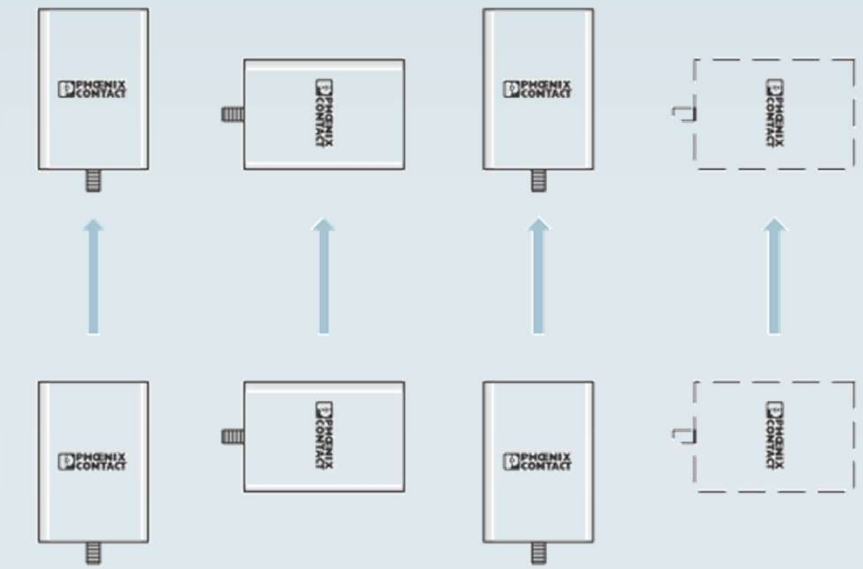
Decoupling of wireless links



- Decoupling of spark gaps by directivity and different polarisation planes
- The Signals of different radio links are decoupled

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The right installation

- An omnidirectional antenna must always be installed with enough distance to an obstacle (mast, building wall or metallic wall)
- An antenna should be installed, especially outdoors, as high as possible position. With it you can improve the range. Keep the Fresnel zone free.
- The antenna cable should be as short as possible so that there are as few losses on the cable. Attach the wireless module closer to the antenna, e.g. in a small box.
- Always protect connections on the outside cables, junctions and antennas with protective tape.

More Details

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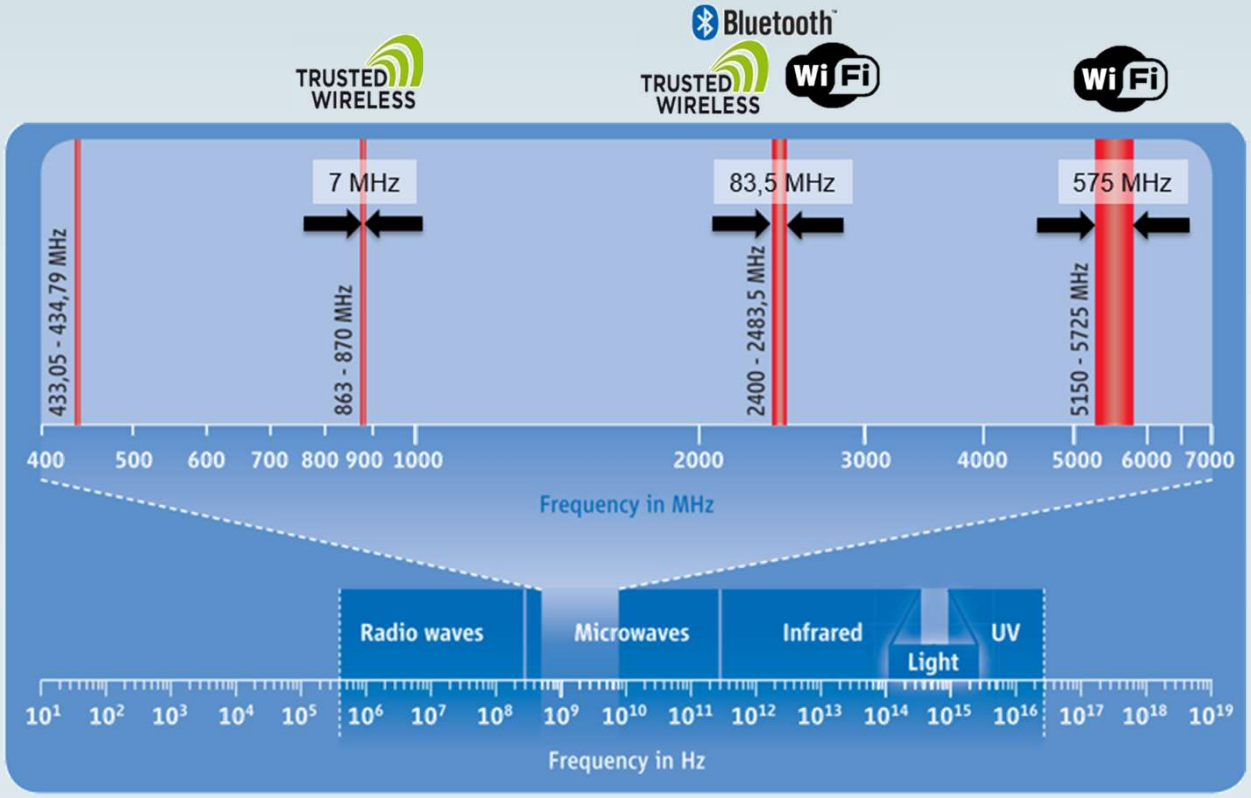
License free frequency bands



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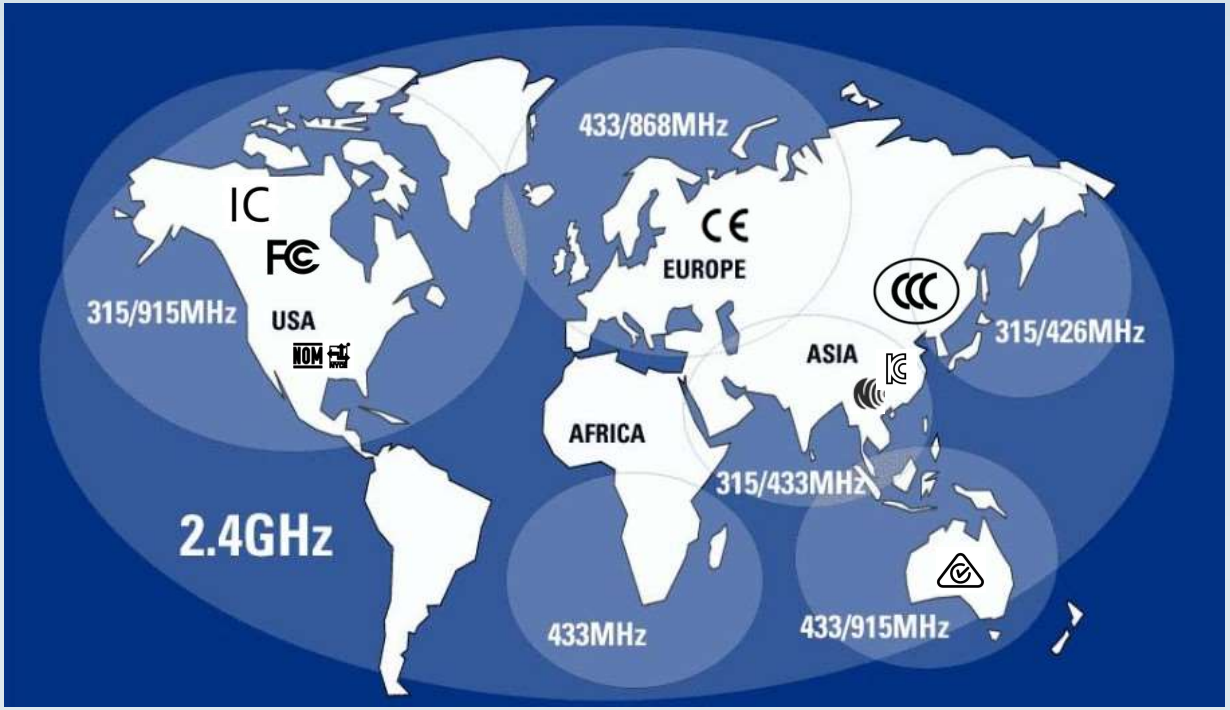
Country approval / notification



Germany

- Radio applications can be used on the shared frequencies without application and formal approval
- The user does not incur any costs in the form of fees or contributions due to the frequency usage

International

- Country specific
- Registration with the regulatory authority

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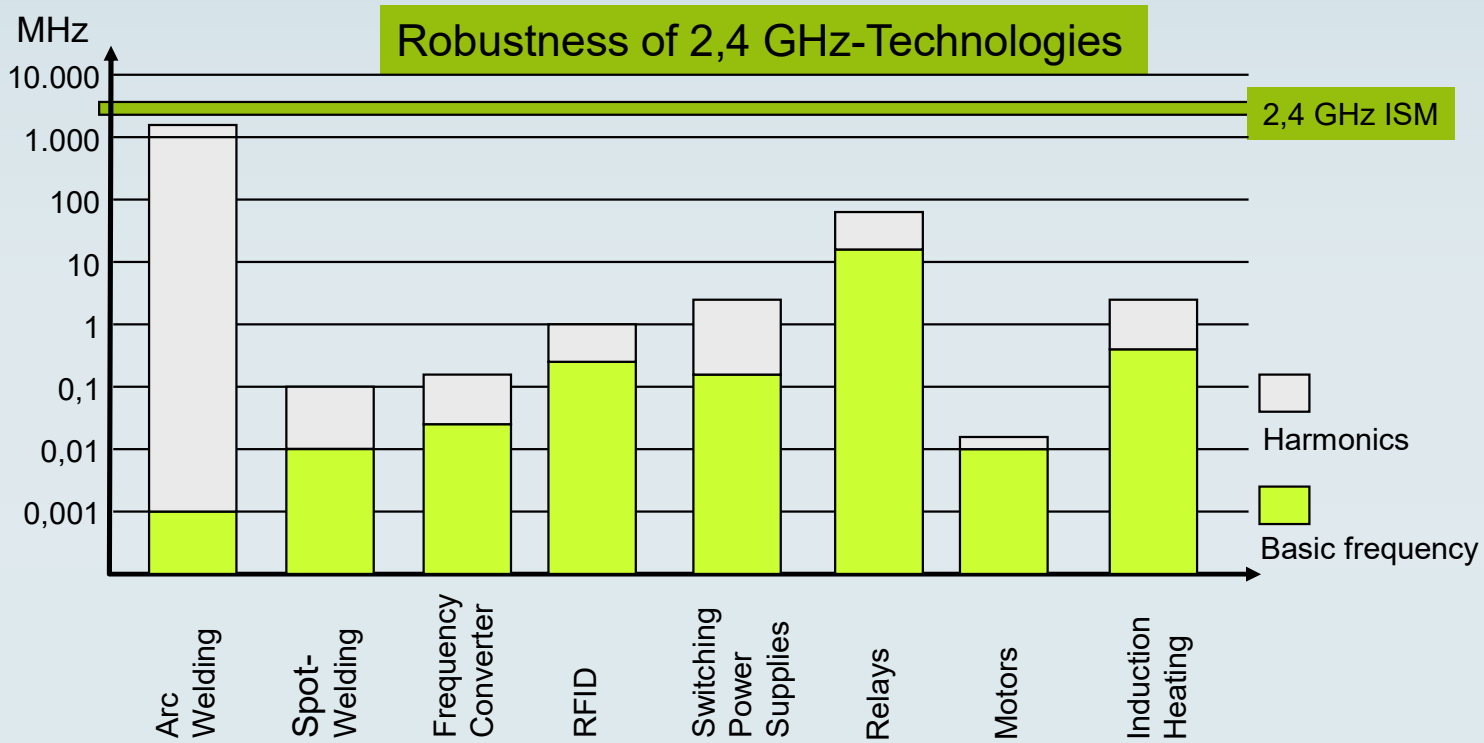
Spectrum of typical industrial applications



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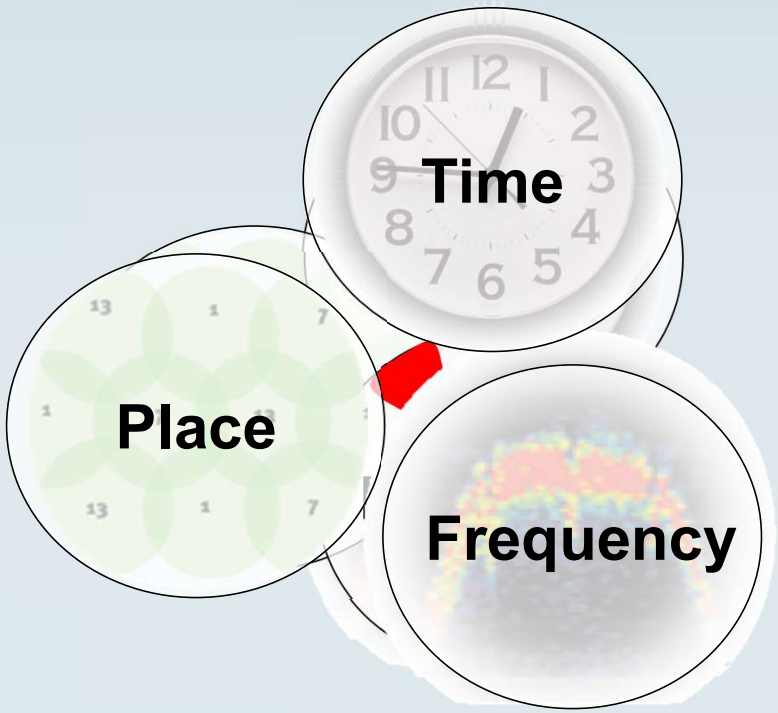
Wireless Technologies

	Bluetooth	WLAN (Wireless Local Area Network)	Trusted Wireless 2.0	Wireless HART
Network structure	Star structure - 1 Master up to 7 Slaves	Access point can handle endless clients	Mesh network – 1 Master up to 249 Slaves	Full-Mesh network – 1 Master up to 249 Slaves
Standard	IEEE 802.15.1	IEEE 802.11	Propritär by Phoenix Contact	IEEE 802.15.4 HART 7
Transmission method	Frequency hopping (FHSS)	Direct Sequence Spread Spectrum (DSSS)	Frequency hopping (FHSS)	Frequency hopping (FHSS)
Application	fast, small networks	Fast, high data volume, Ethernet	Low/medium data rate, large networks, best for infrastructure application	HART signal, Process industry, short distances
Frequency	2,4 GHz	2,4 GHz, 5 GHz,	868 MHz, 900 MHz, 2,4 GHz	2,4 GHz
Latency time (typical)	>10 ms (IO) > 50ms (Serial)	>16 ms (depending on the data rate / Distance)	0,1 – > 2 s, depending on the OTA data rate / network structure	> 3 s up to serveral minutes
Distance (free line of sight)	Typ. <= 150 m	Typ. <= 150 m	<= 5 km (2,4 GHz) <= 20 km (868 MHz) <= 32 km (900 MHz)	Typ. <= 250 m

Coexistence – Interference



Influencing of radio operation only happens if several radio systems are transmitting …

- …at the same place
- …at the same time
- …at the same frequency

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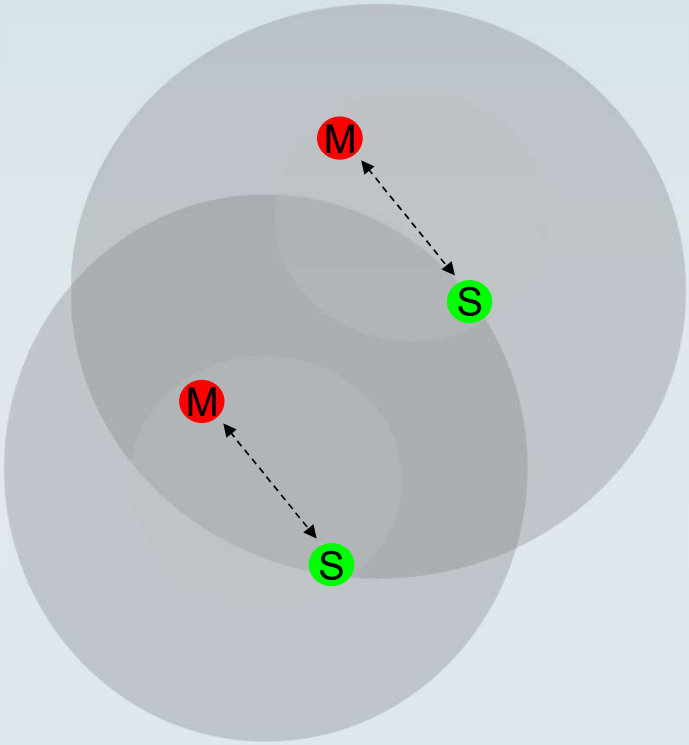
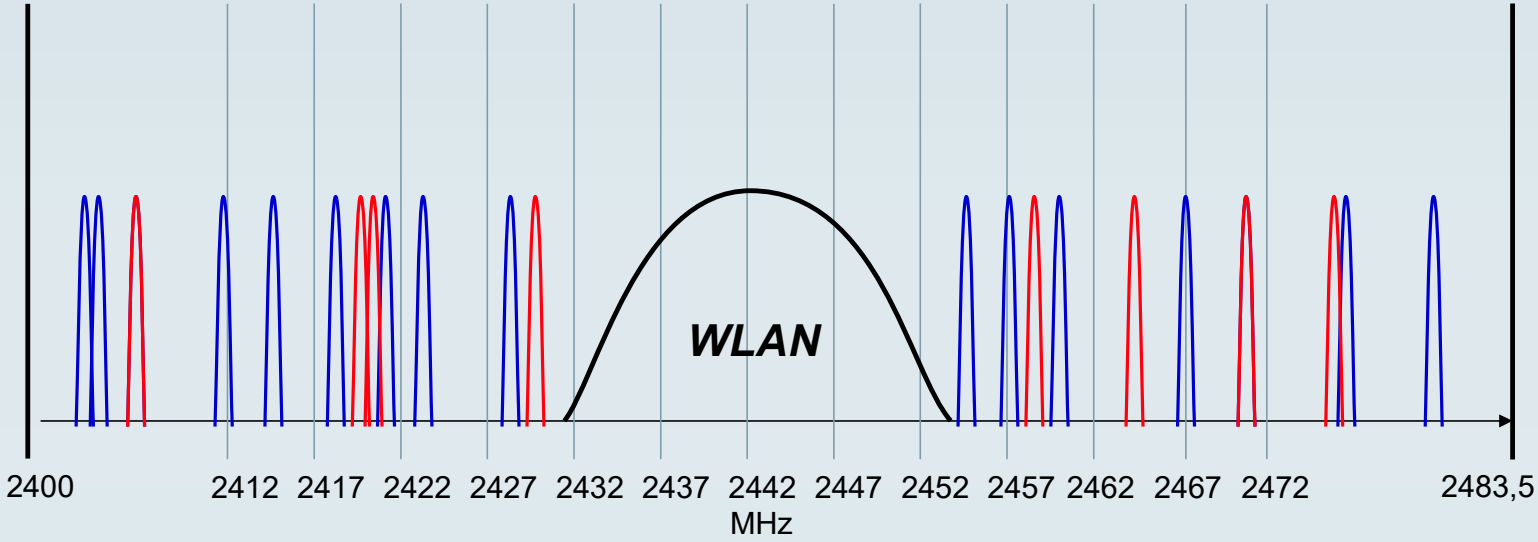
Coexistence – spatial decoupling



- Transmission power determined spatial extent
- Reduction of transmission power enables use of the same frequency bands
- Optimization of the spatial extent by directional antennas

Coexistence – Inteference-free parallel operation

Bluetooth
TRUSTED WIRELESS
WLAN



Tip: WLAN channels can be hidden in Bluetooth and Trusted Wireless systems (blacklisting)

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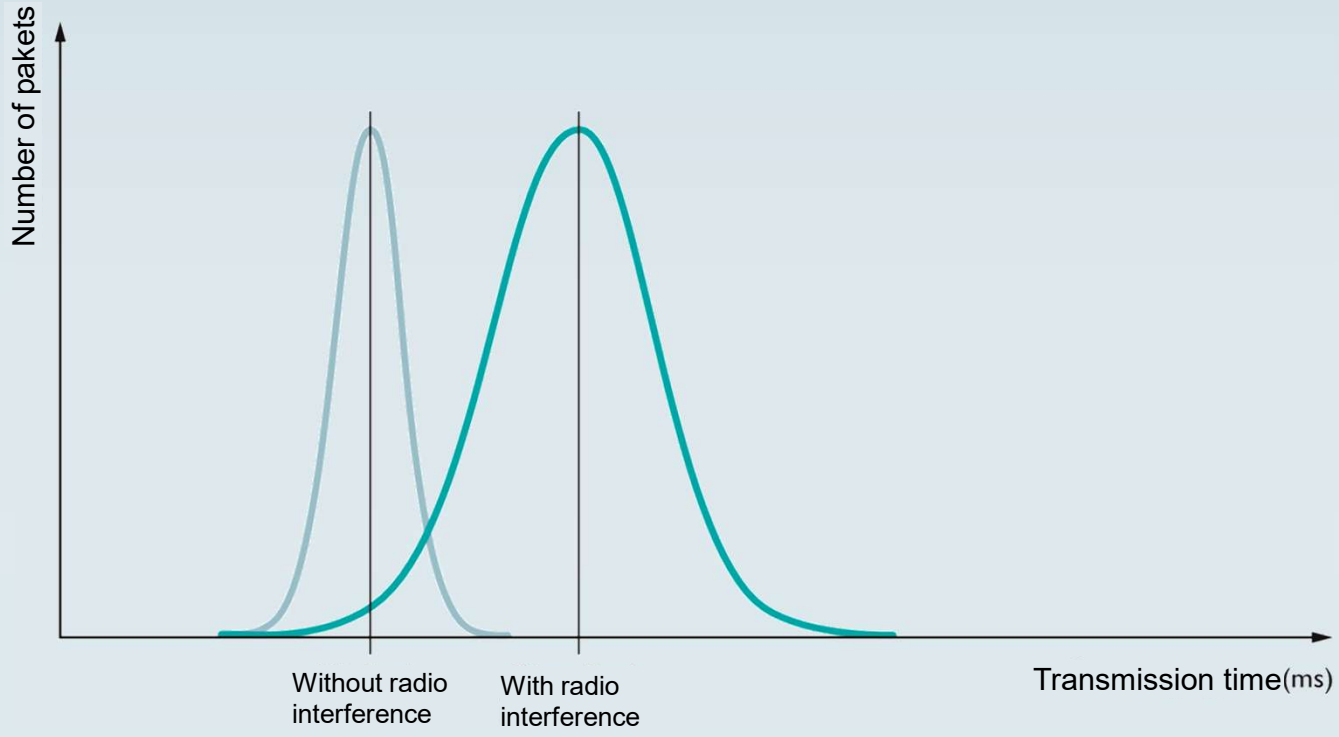
Impact of radio interference



Reduce earthworks, thanks to wireless technology!

- No complicated cable laying
- Bridging problematic distances and areas
- More flexibility
- Mobility and freedom of movement of participants
- Disturbance-free communication, no electromagnetic influences

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Trusted Wireless 2.0

TRUSTED WIRELESS

Global RF Technology

2.4 GHz, 900 MHz, 868 MHz license-free ISM- Band

Increase distance by adjustable data rates

Optimal adaption to the respective application

Secure data communication

Proprietary, „not-open“ Technology

Encryption: 128-Bit AES

Authentication / Integrity check: Unique encryption key for each message verifies the validity of the transmitter

Flexible network structures

Automatic network formation

Self-organizing and self-healing

Point-to-Point, Star, Mesh- and Line structures

Robust data communication

Coexistence mechanism: FHSS, WLAN-Blacklist, adjustable RF bands

Unique NET-ID via CONF-Stick

Multiple transmissions

PHOENIX CONTACT
INSPIRING INNOVATIONS

Trusted Wireless 2.0

Areas of application for Trusted Wireless 2.0

Trusted Wireless is a wireless technology which has been developed especially for the industrial use!

- Rugged communication thanks to FHSS
- Automatic and manual coexistence mechanismus
- Secure communication thanks to 128 bit AES encryption and authentication
- Long range thanks to high reciever sensitivitiy and variable sata transmission rates
- Flexible networks with automatic connection management
- Distributed network maintenance makes things easier and faster
- Extensive diagnostic properties
- Adaptable to the desired application

Radioline

Easy startup

- Without programming
- Adjustable via thumbwheel
- I/O mapping

Universal applications

- I/O-to-I/O cable replacement
- Serial cable replacement RS-232/485
- I/O integration in Modbus RTU PLCs
- RS-485 extension possible

Worldwide use

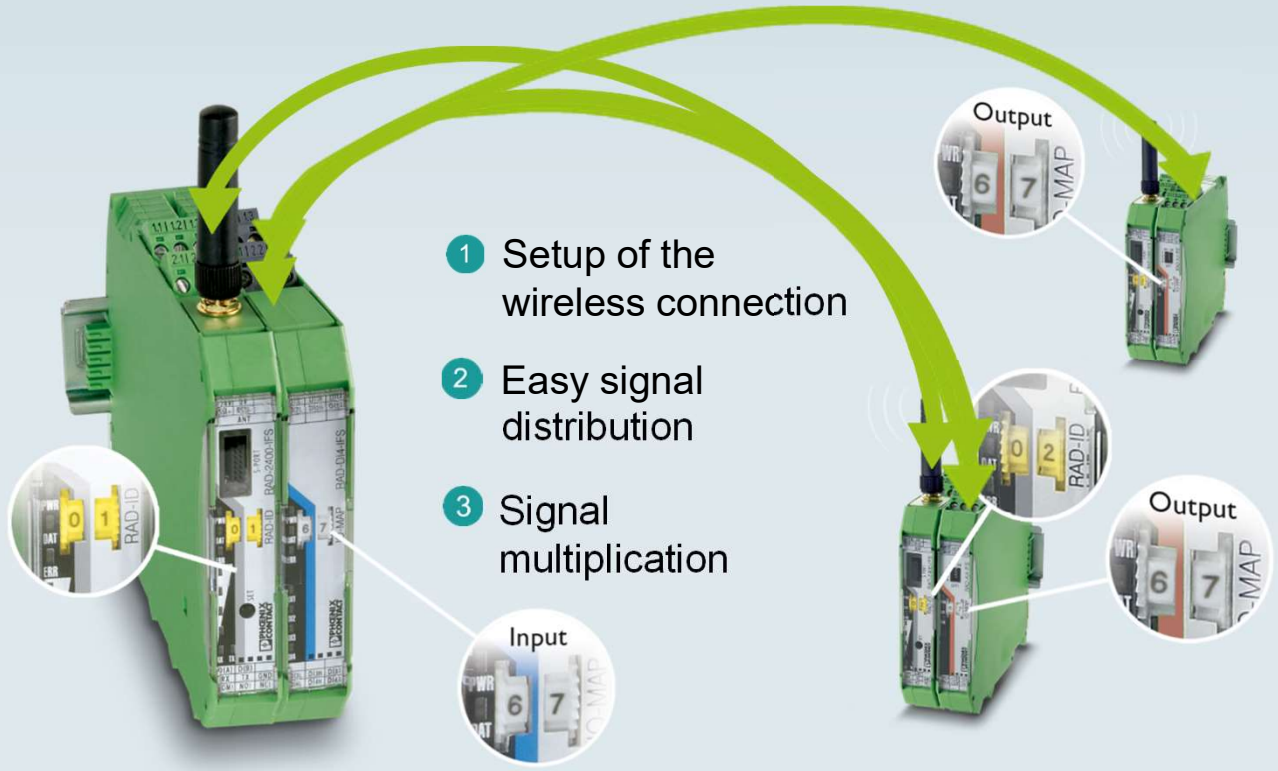
- 2,4 GHz, 868 MHz, 900 MHz and wired head stations
- Adjustable baud rates
- Ranges up to 5, 20 or 32 km

Flexibly expandable

- Up to 250 Stations in a network
- Up to 32 I/O modules per station
- Various digital and analog extension modules
- Hot-Swapping
- Galvanic channel-to-channel isolation

Radioline

TRUSTED WIRELESS

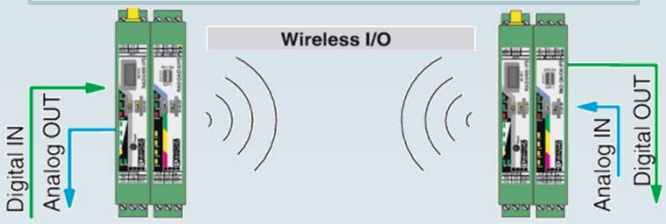


1. Setup of the wireless connection
2. Easy signal distribution
3. Signal multiplication

PHOENIX CONTACT
INSPIRING INNOVATIONS

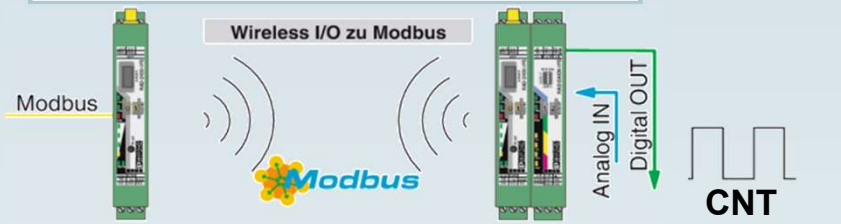
Radioline - One System for different applications

Option 1



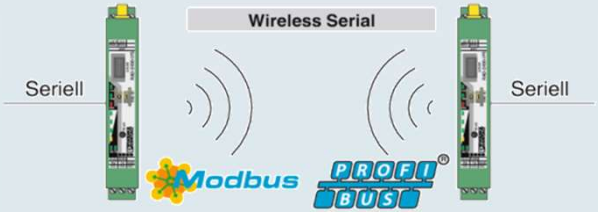
I/O to I/O

Option 2



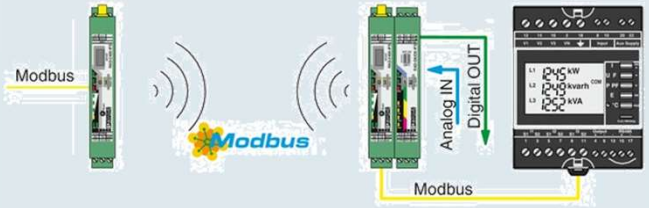
I/O to Modbus RTU

Option 3



Serial to Serial (RS 232/485)

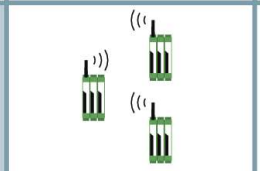
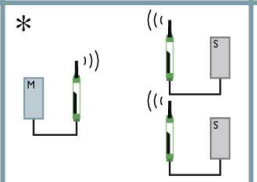
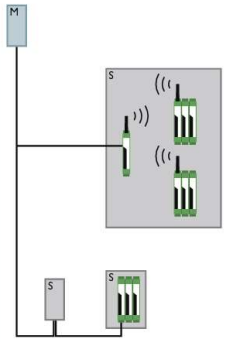
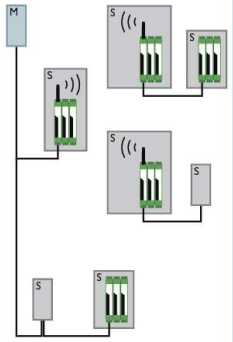
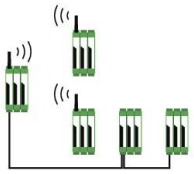
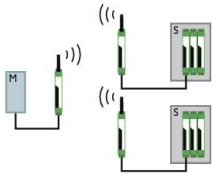
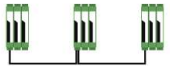
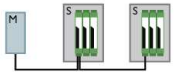
Option 4



I/O and Modbus parallel

PHOENIX CONTACT
INSPIRING INNOVATIONS

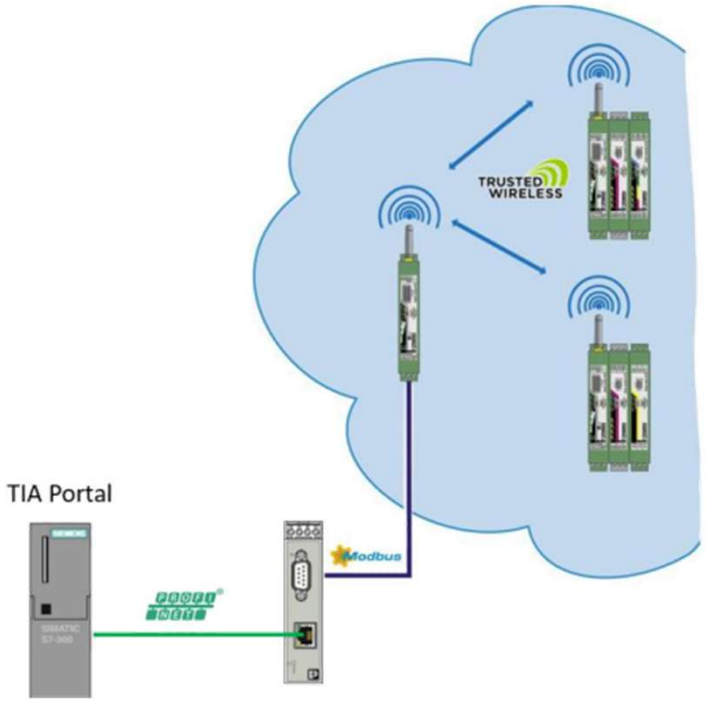
Radioline System – Application overview

Application overview for the Radioline system	I/O to I/O	Serial to Serial	I/O to Serial	
	I/O data mode	Serial data mode	PLC/Modbus RTU mode	PLC/Modbus RTU **Dual** mode
Communication between wireless stations				
Combined communication between wireless- and RS-485 stations				
Communication between RS-485 stations				

Explanation

Radioline – IO Integration in TIA Portal

- Radioline IO Integration into PROFINET networks via PROFINET / MODBUS protocol converter
- Integration in TIA-Portal via GSDML files
- Simple reading of process data, status and diagnostic parameters of the individual radio stations



GW PN/MODBUS 1E/1DB9
Article No.: 1105707

Radioline

Region	Worldwide	Japan	America	Australia	Europe	Worldwide (no radio)
Type	RAD-2400-IFS (Radio)	RAD-2400-IFS-JP (Radio)	RAD-900-IFS (Radio)	RAD-900-IFS-AU (Radio)	RAD-868-IFS (Radio)	RAD-RS485-IFS (RS485 bus module)
Frequency range	2,4002 ... 2,4785 GHz		902 ... 928 MHz	915 ... 928 MHz	869,4 ... 869,65 MHz	-
Range up to	< 5 km (suitable for big mesh networks with line of sight)		< 32 km (suitable for big distances with obstacles)		< 20 km (suitable for big distances with obstacles)	< 1,2 km (over existing 2-wire copper lines or more with converter or repeater)
Transmit power	20 dBm		30 dBm		27 dBm	-
Air data rate	16…250 kBit/s		16…500 kBit/s		9,6 … 120 kBit/s	-
Transmission time (typ.)	> 200 ms (I/O mode) > 25 ms (Serial mode)		> 200 ms (I/O mode) > 25 ms (Serial mode)		> 2 s (I/O mode) > 390 ms (Serial mode)	> 80 ms (I/O mode)
Article No.	2901541	2702863	2901540	2702878	2904909	2702184

PHOENIX CONTACT
INSPIRING INNOVATIONS

Radioline

	Outdoor box for use in America	Outdoor box for worldwide use (configurable)
Type	RAD-900-DAIO6	RAD-RUGGED-BOX-CONF
Integrated	900 MHz radio, 6 integrated IO channels (2 x digital IN and OUT, 1 x analog IN and OUT), power supply	Fully pre-wired box with integrated power supply, over-voltage protection, selectable radio module and up to three selectable IO extension modules
Degree of protection	**NEMA 4X (IP 66)**	**IP 66**
Range up to	**32 km**	**Depends on selected radio**
Supply voltage	10,8 …30,5 V DC, 100 … 240 V AC	100 … 240 V AC
Temperature range	-40°C…+70°C	-25°C…+55°C
Order number	2702877	1091638

PHOENIX CONTACT
INSPIRING INNOVATIONS

Radioline – I/O Extension modules

										
	Digital In 4 channel	**Digital Out 4 channel**	**Digital In 8 channel**	**NAMUR In 4 channel**	**Digital Out 8 channel**	**Analog In 4 channel**	**Analog In 4 channel**	**Analog Out 4 channel**	**Analog / digital 6 channel**	**PT 100 4 channel**
Type	RAD-DI4-IFS (Input)	RAD-DOR4-IFS (Output)	RAD-DI8-IFS (Input)	RAD-NAM4-IFS (Input)	RAD-DO8-IFS (Output)	RAD-AI4-IFS (Input)	RAD-AI4-U-IFS (Input)	RAD-AO4-IFS (Output)	RAD-DAIO6-IFS (Input / Output)	RAD-PT100-4-IFS (Input)
Details	4 digital wide range inputs 0…250V AC/DC	4 digital relay outputs 0 … 250 V AC/DC / 5 A	8 digital inputs 0…30,5 V DC	4 digital NAMUR inputs, Line break / short circuit detection	8 digital transistor outputs 30,5 V DC / 200 mA	4 analog inputs 0/4…20 mA, Line break / short circuit detection	4 analog inputs 0…10 V	4 analog outputs 0/4…20 mA, 0…10 V DC	1 analog In-/outputs 0/4…20 mA 2 digital In-/outputs 0…250 V AC/DC	4 Pt100 inputs Temperature measuring range: -50°C…+250°C
Related IO module	RAD-DOR4-IFS	RAD-DI4-IFS	RAD-DO8-IFS	RAD-DO8-IFS	RAD-DI8-IFS	RAD-AO4-IFS	RAD-AO4-IFS	RAD-AI4, RAD-AI4-U, RAD-PT100-4-IFS	RAD-DAIO6-IFS	RAD-AO4-IFS
Order No.	2901535	2901536	2901539	2316275	2902811	2901537	2702290	2901538	2901533	2904035

PHOENIX CONTACT
INSPIRING INNOVATIONS

Radioline – accessories



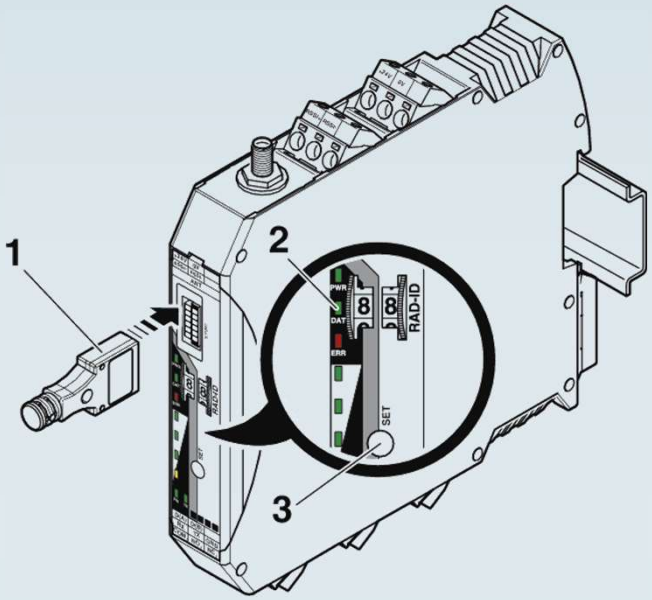




	RAD-CONF-RF3	RAD-CONF-RF5	RAD-CONF-RF7	RAD-CONF-RF1	RAD-CONF-RF1	RAD-MEMORY	RAD-CABLE-USB
Frequency	**2,4 GHz**	**2,4 GHz**	**2,4 GH**	**868 MHz**	**900 MHz**	For all Radioline front modules	For all Radioline front modules
Description	Configuration stick for the 2,4 GHz wireless module unique network ID, RF band 3	Configuration stick for the 2,4 GHz wireless module unique network ID, RF band 5	Configuration stick for the 2,4 GHz wireless module unique network ID, RF band 7	Configuration stick for the 868 MHz wireless module unique network ID, RF band 1	Configuration stick for for the 900 MHz wireless module, unique network ID, RF band 1	Memory stick for saving custom configuration data	Data cable for communication between the PC and Radioline devices
Features	For easy and secure network addressing with unique network ID					Freely configurable	for diagnostics and configuration, 2m cable
Order No.:	2902814	2902815	2902816	2702197	2702122	2902828	2903447

PHOENIX CONTACT
INSPIRING INNOVATIONS

Radioline – Configuration sticks



1. CONFIGSTICK RAD-CONF-RF….
2. Status LEDs
3. SET button

Using a CONFIGSTICK, you can configure a **unique and secure** network. This enables the parallel operation of multiple networks (using different RF bands).

Reading in the device configuration using the CONFSTICK

- Insert the CONFSTICK into the S-PORT of the wireless module.
- Press and hold down the SET button on the wireless module for 1 second.
- Parameter read in is started
- Read-in has been completed when the DAT LED lights up once. The new parameters are activated.
- Remove the CONFIGSTICK from the wireless module.

Wireless Accessories

Cable and adapter
- Cable length 0,5 … 15 m
- Frequency range 0 … 6 GHz

Surge protection
- 2,4 GHz & 5 GHz
- 868 MHz & 900 MHz

Antenna barrier (Ex-i)
- Use of standard antennas in areas (Zone 0,1,2)
- Installation as enclosure lead-through in Zone 2
- Frequency range 0,7 … 6 GHz
- Protection class IP65

Omnidirectional antenna
- For short and medium distances
- Numerous devices in different directions
- Versatile applications

Directional antenna
- Bridging large distances
- Point-to-point connections
- Stationary or linear applications
- Decoupling due to directivity in the case of multiple point-to-point paths

PHOENIX CONTACT
INSPIRING INNOVATIONS

Antenna cabel and accessories

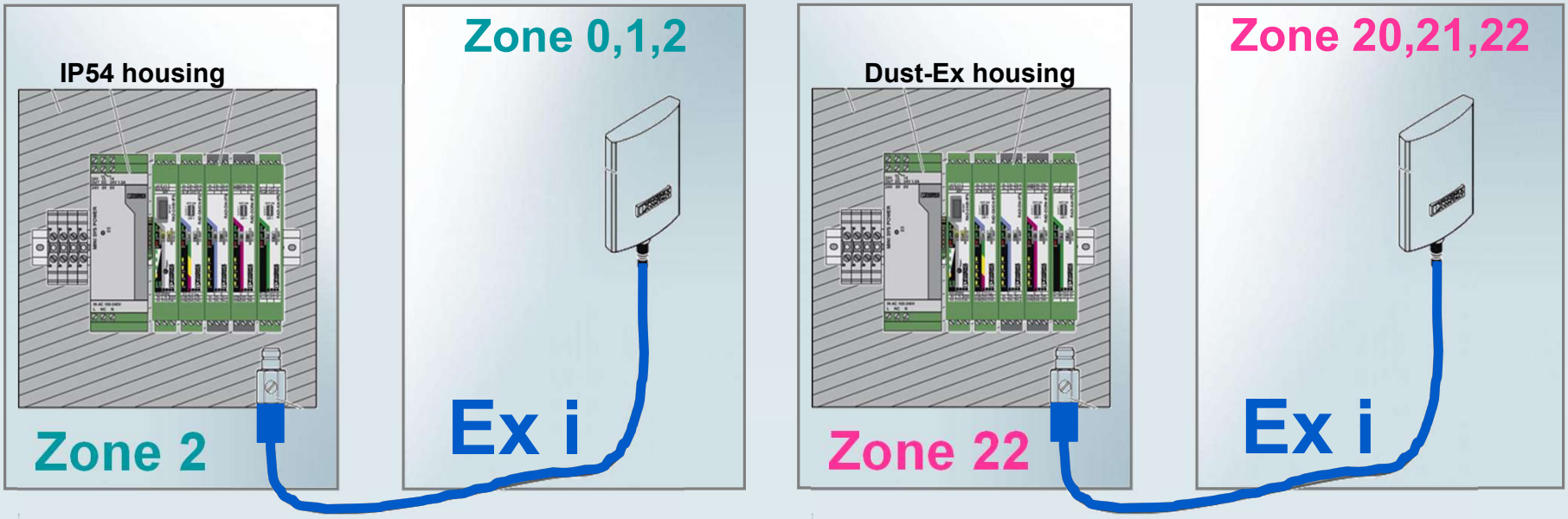





	Antenna cable for the control cabinet lead through	Antenna cable	Antenna cable	Surge protection 2,4 / 5 GHz	Surge protection 868 / 900 MHz	Antenna barrier
Frequency range	0,3 … 6 GHz	0,3 … 6 GHz	0,3 … 6 GHz	2,4 … 5,9 GHz	0,8 … 2,25 GHz	0,3 … 6 GHz
Connector	RSMA (m) -> N (m)	RSMA (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)	N (m) -> N (m)
Characteristics	Easy install through flexible inner conductor, UV-resistant, oil-resistant	Solid inner conductor, low attenuation, UV-resistant	Easy install through flexible inner conductor, UV-resistant, oil-resistant	Overvoltage protection for coaxial signal interfaces with Lambda / 4 technology		Antenna barrier for control cabinet operation, type of protection: Ex i, installation barrier: zone 2, installation antenna: zone 0, 1 or 2
Length / Article No.	0,5 m / 2701402	0,5 m / 2903263 1 m / 2903264 2 m / 2903265 3 m / 2903266 5 m / 2702140	3 m / 2867649 5 m / 2867652 10 m / 2867665 15 m / 2885634	2838490	2801057	2702198

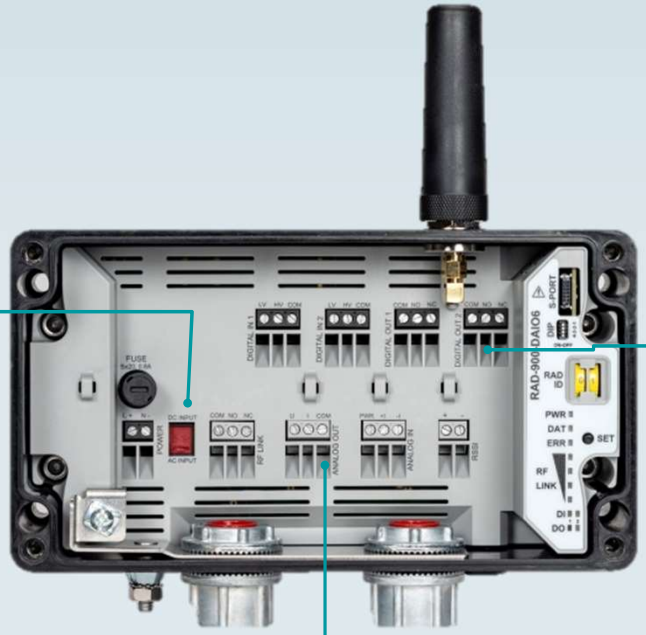
PHOENIX CONTACT
INSPIRING INNOVATIONS

Antenna installation in Ex areas



PHOENIX CONTACT
INSPIRING INNOVATIONS

Radioline – RAD-900-DAIO6



Fused AC/DC
Power selection

Six built-in I/O points
2DI, 2DO, 1AI,1AO

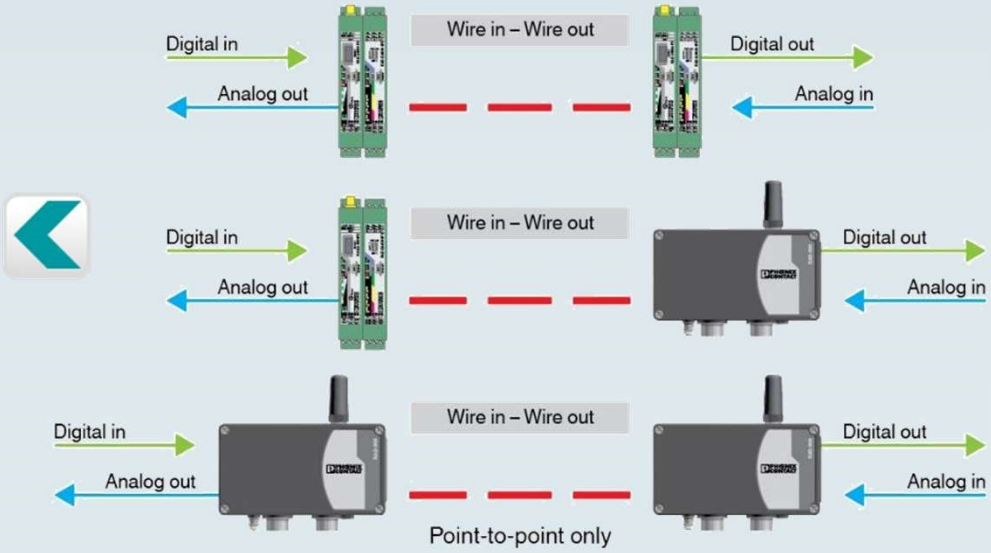
Dual half-inch NPT fittings for
power and data isolation

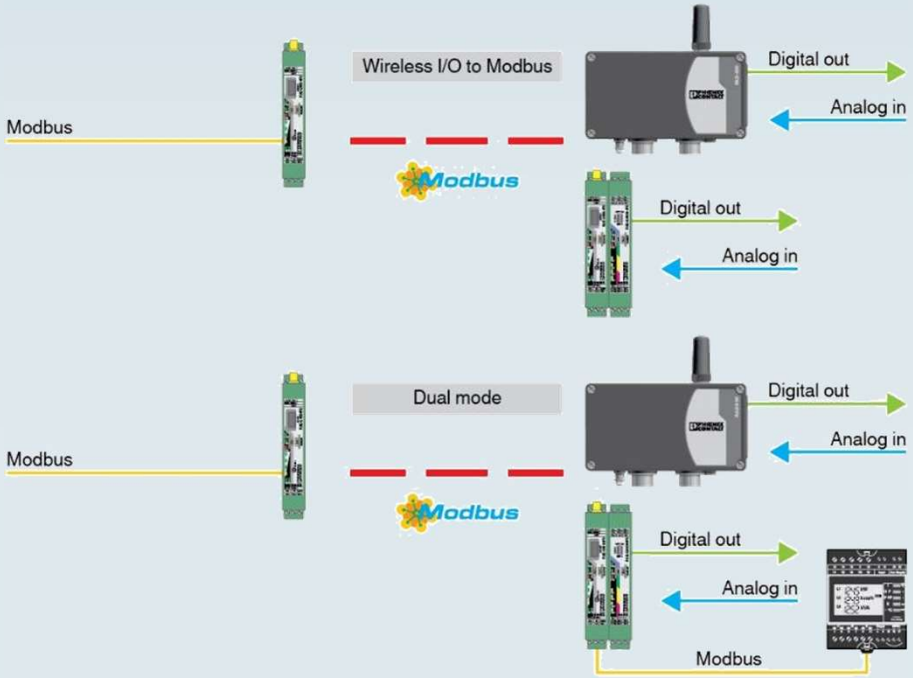
Seperated terminals and wire-tie
loops for cable management

- Compact NEMA4X housing
- Compatible with existing RAD-900-IFS installations
- Class I Division 2
- Up to 1000 ft out of the box
- Software-free installation for I/O-to-I/O applications
- **Only for North and South America and Canada**

Radioline – RAD-900-DAIO6

Modes of operation





Radioline – RAD-RUGGED-BOX-CONF

Outdoor box solution (configurable)

- Fully pre-wired control box with integrated 230V power supply, over-voltage protection, selectable radio module and up to three selectable IO extension modules
- Quick and easy connection of power supply and IO signals
- Outdoor use thanks to robust UV-resistant and impact-resistant IP-66 housing

For worldwide use

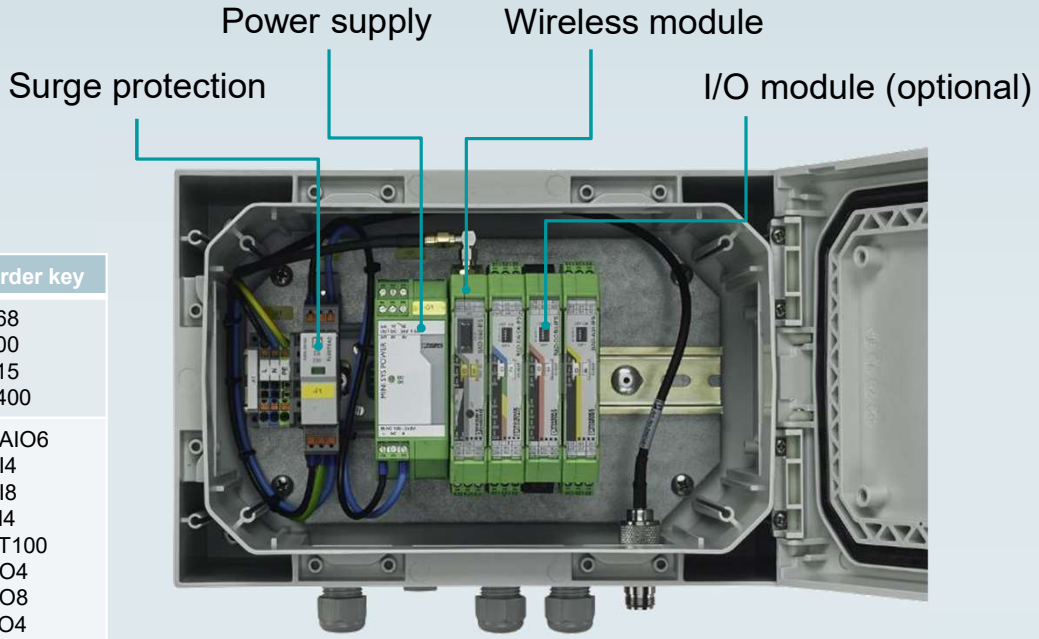
868 MHz | 900 MHz | 2,4 GHz | 915 MHz

Radioline – RAD-RUGGED-BOX-CONF

Order key (example)

Order No.	Wireless module	I/O module (optional) 1	2	3
1091638	2400	DI4	AI4	DO8

	Selection	Order key
Frequency band	868 MHz 900 MHz 915 MHz 2,4 GHz	868 900 915 2400
Type of I/O extension module (optional, up to 3 units)	2 digital inputs/outputs and 1 x analog input/output 4 digital inputs 8 digital inputs 4 analog current inputs 4…20 mA 4 Pt 100 inputs 4 digital relay outputs 8 digital transistor outputs 4 analog current outputs 4…20 mA 4 analog voltage inputs 0…10 V 4 digital NAMUR inputs	DAIO6 DI4 DI8 AI4 PT100 DO4 DO8 AO4 AIU4 NAM4



For worldwide use

868 MHz | 900 MHz | 2,4 GHz | 915 MHz

INSPIRING INNOVATIONS

ESSENTIAL Wireless

TRUSTED WIRELESS

Intuitive start-up

- Thanks to comfortable software wizards

Universal use

- Fully transparent cable replacement for serial RS-485 interfaces

Modbus

Article information

- RAD-EE-2400-RS485
- Art-No. 1081818

Worldwide use

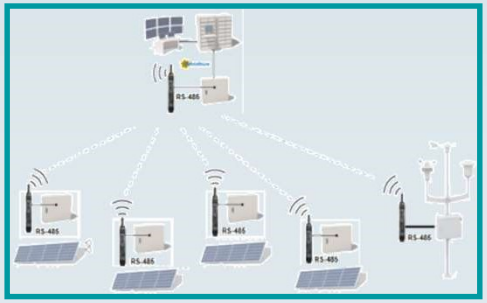
- Special radio module with reduced functionality for price-sensitive PV applications
- License- free 2,4-GHz band
- CE, FCC, UL approval
- Adjustable data rates
- Range up to 500 m

Reliable communication

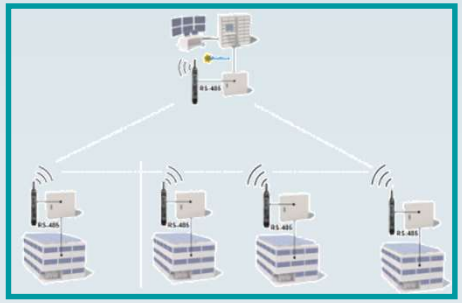
- Interference-free communication through automatic and manual coexistence mechanisms
- Immune to electromagnetic interference
- Mesh network with up to 250 nodes

PHOENIX CONTACT
INSPIRING INNOVATIONS

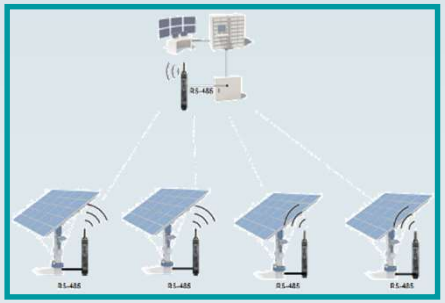
ESSENTIAL Wireless – Application examples



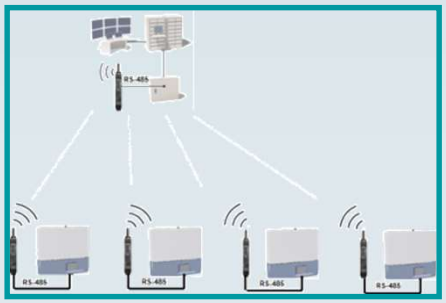
Wireless string monitoring in open field installations



Wireless monitoring of rooftop systems

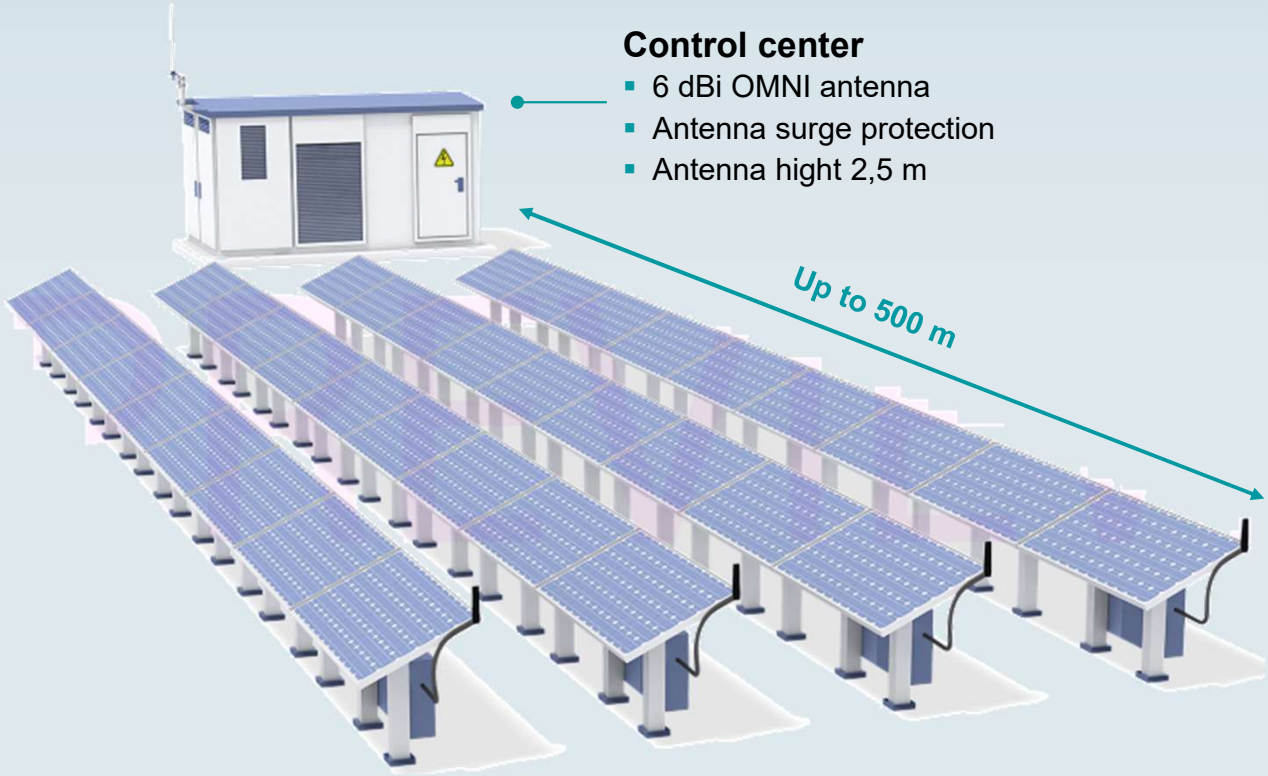


Wireless monitoring of tracking systems



Wireless monitoring of inverters

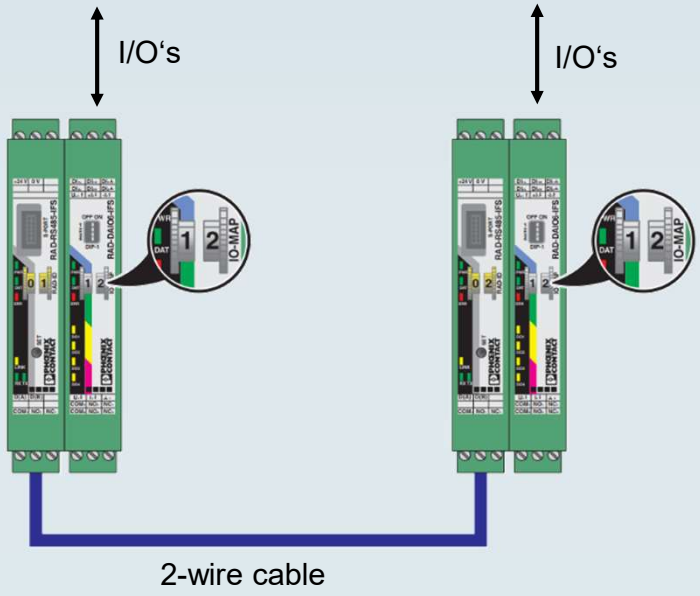
ESSENTIAL Wireless - Application



Control center
- 6 dBi OMNI antenna
- Antenna surge protection
- Antenna hight 2,5 m

String monitoring box
- 2 dBi OMNI antenna
- Can be sticked directly to control cabinet or PV module
- Antenna hight 1,5 m

Radioline Multipoint Multiplexer



- Multipoint multiplexer (I/O to I/O)
- Multipoint multiplexer and Wireless
- Modbus RTU slave (I/O to serial)
- Modbus RTU slave and Wireless

Radioline Multipoint Multiplexer

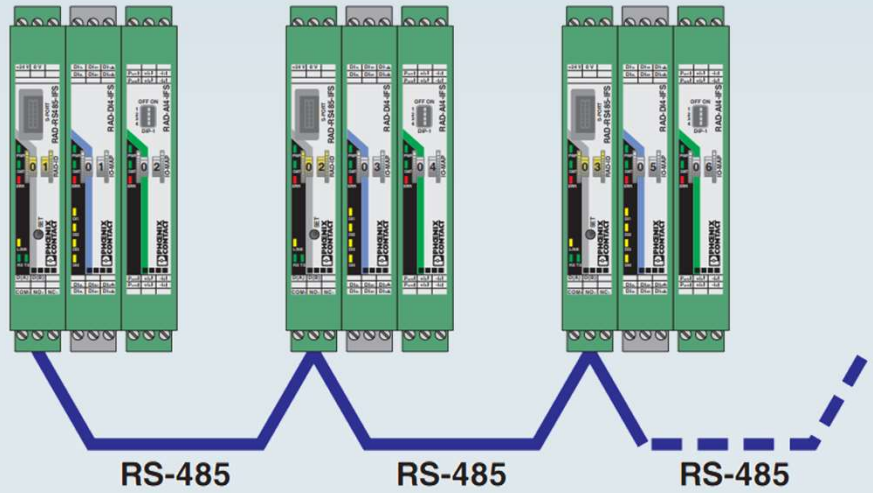
I/O-Mapping via 2-wire-cables

Stand-Alone as Modbus-Slave
Operation on any Modbus/RTU-Master

Multipoint-Multiplexer
Distribution of I/O signals via existing 2-wire-cables

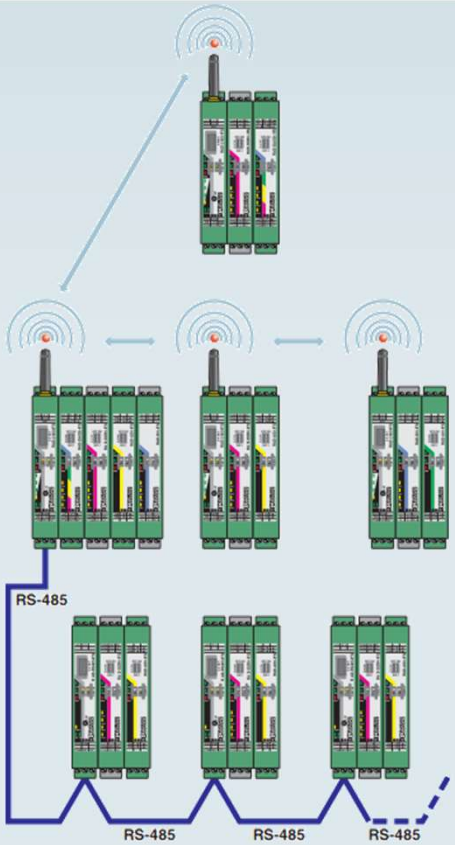
Intermedia communication
Wireless and wired modules form a combined system.

Radioline Multipoint Multiplexer I/O to I/O



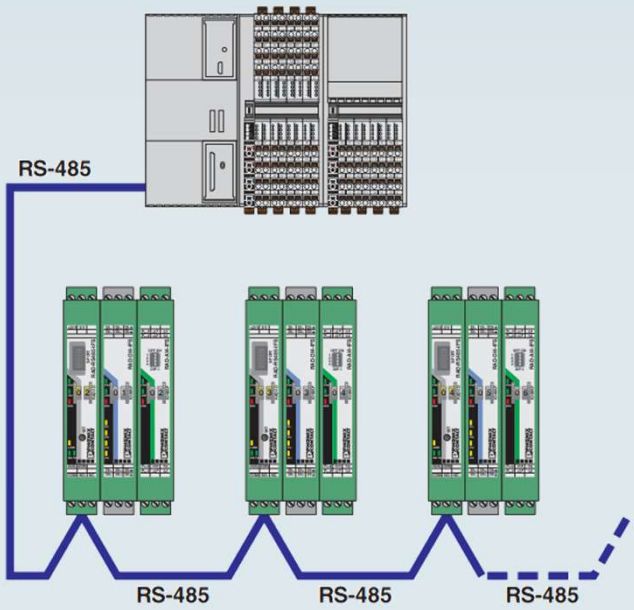
- Multipoint multiplexer – easy I/O distribution between multiple stations
- Up to 99 stations via RS-485
- Addressing using yellow thumbweel
- Easy I/O mapping using white thumbwheel on the extention modules
- Fast startup via Plug and Play

Radioline Multipoint Multiplexer and Wireless



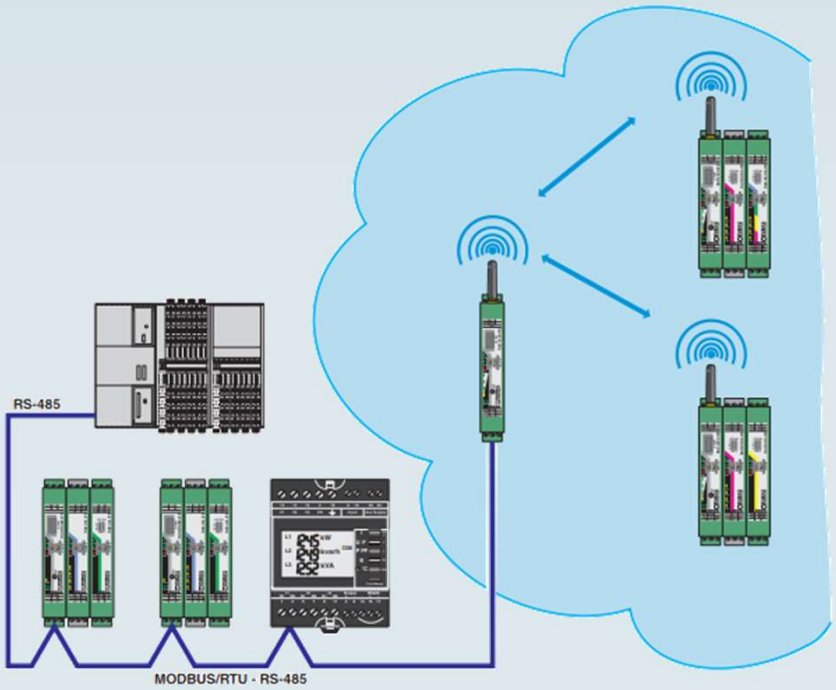
- Cross-media distribution of I/O signals
- Up to 250 stations in total:
  - 98 RS-485 stations and
  - 152 wireless stations
- Easy I/O mapping using white thumbwheel on the extention modules
- Fast startup via Plug and Play

Radioline Modbus RTU slave (I/O to serial)



- Operation as a bus coupler for Modbus RTU with Radioline extendsion modules
- As a Modbus slave to any master
- Up to 98 stations per Modbus newtork
- Integration in existing Modbus newtorks
- Fast startup via Plug and Play
- Default setting of the RS-485 interface: 19.2/8/E/1

Radioline Modbus RTU slave (I/O to serial)



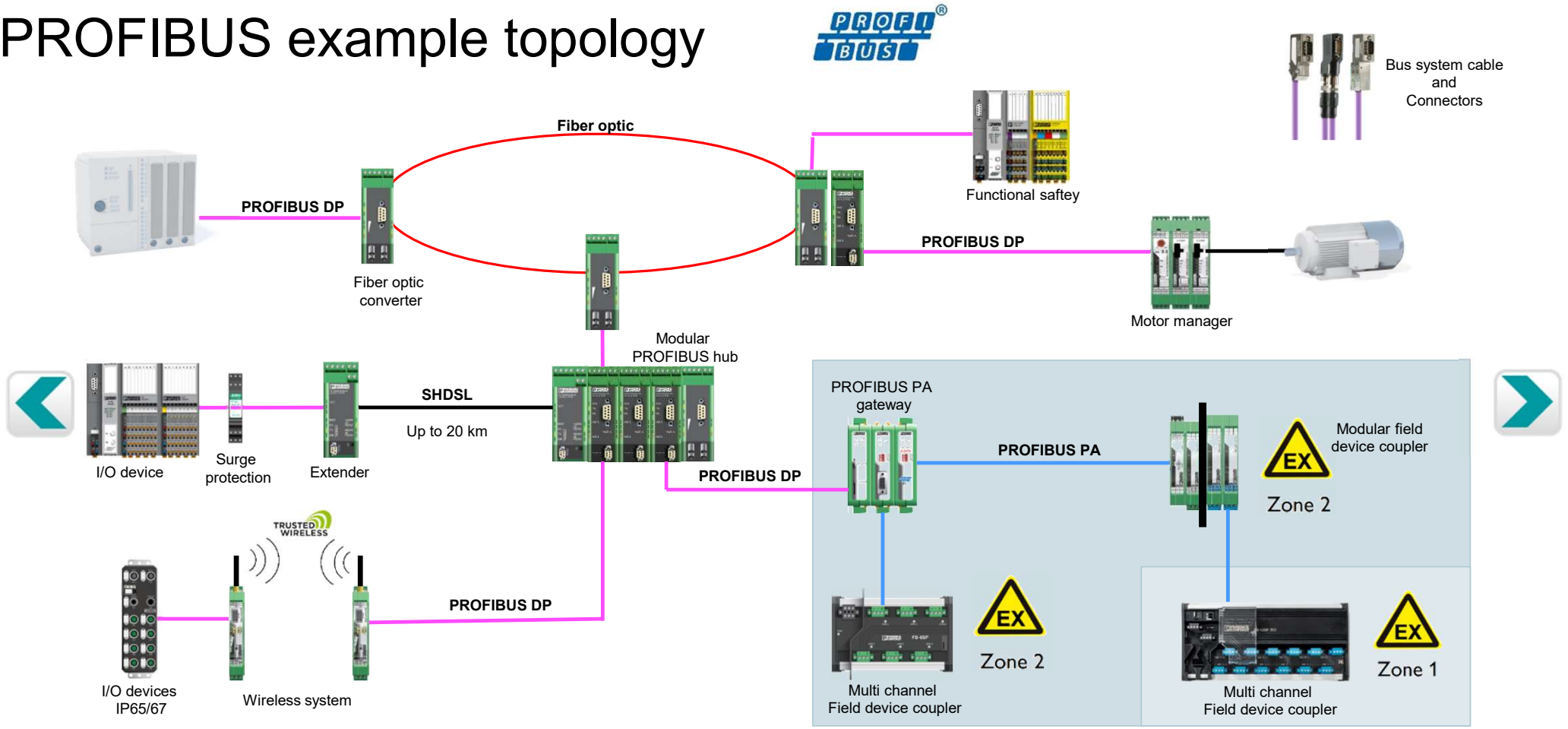
- Radioline wireless system and RS-485 stations at a Modbus master (I/O to serial)
- Support for all Radioline wireless systems (2,4 GHz, 868 MHz, 900 MHz)
- Up to 98 RS-485 stations and up to 250 wireless stations
- The wireles network acts like a single Modbus RTU slave
- All devices in the RS-485 network are standard Modbus RTU slaves
- Integration in existing Modbus networks

Radioline Multipoint Multiplexer – Extension modules

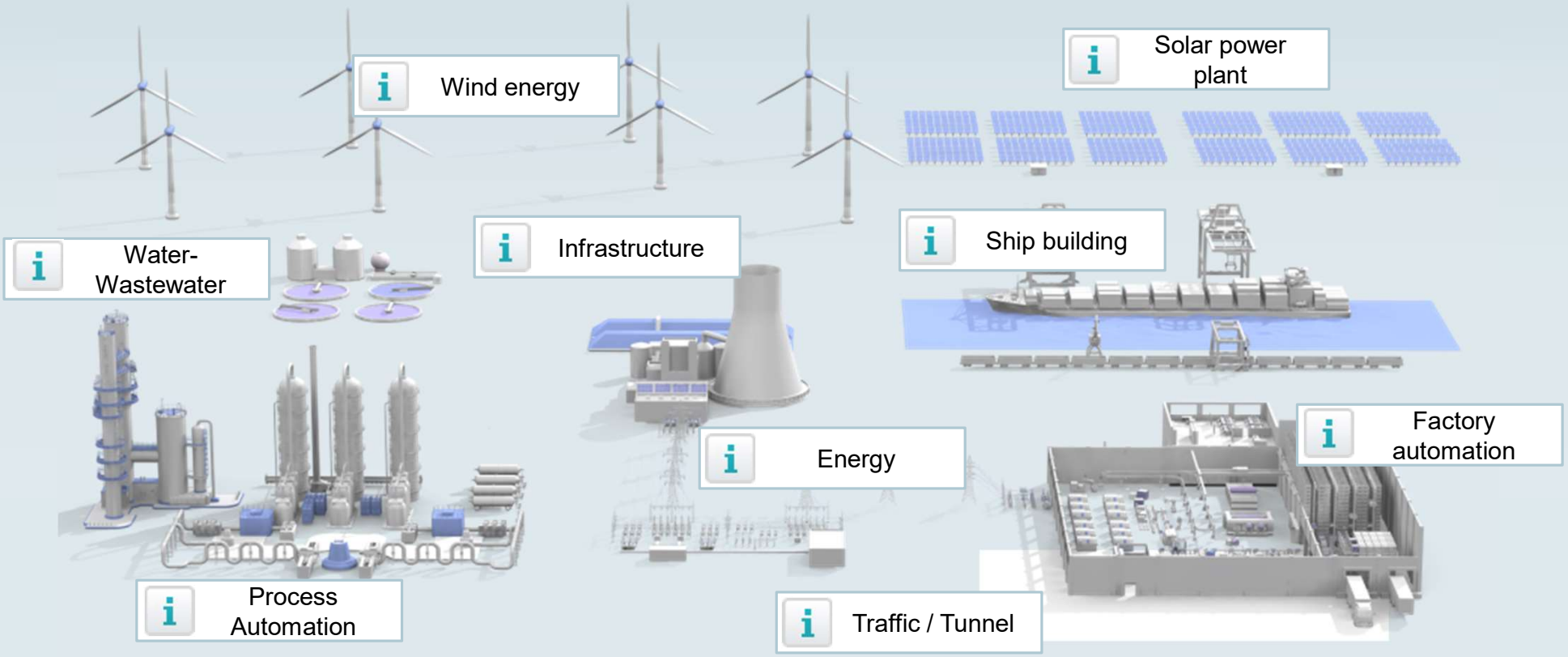
									
	Communication module	**Digital In 4 channel**	**Digital Out 4 channel**	**Digital In 8 channel**	**Digital Out 8 channel**	**Analog In 4 channel**	**Analog Out 4 channel**	**Analog / digital**	**PT 100 4 channel**
Type	RAD-RS485-IFS	RAD-DI4-IFS (Input)	RAD-DOR4-IFS (Output)	RAD-DI8-IFS (Input)	RAD-DO8-IFS (Output)	RAD-AI4-IFS (Input)	RAD-AO4-IFS (Output)	RAD-DAIO6-IFS (Input / output)	RAD-PT100-4-IFS
Description	RS-485 multipoint multiplexer, can be extended with I/O modules	4 digital wide range inputs 0…250V AC/DC	4 digital relay outputs 24 V DC / 250 V AC / 5 A	8 digital inputs 0…30,5 V DC	8 digital transistor outputs 30,5 V DC / 200 mA	4 analog input 0/4…20 mA	4 analog outputs Alternatively 0/4…20 mA or 0…10 V DC	1 analog input/output 0/4…20 mA 2 digital wide range inputs/outputs 0…250 V AC/DC	4 Pt100 inputs Temperature measuring range: -50°C…+250°C
Order number	2702184	2901535	2901536	2901539	2902811	2901537	2901538	2901533	2904035

INSPIRING INNOVATIONS

PROFIBUS example topology



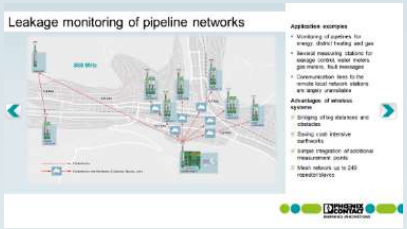
Application references

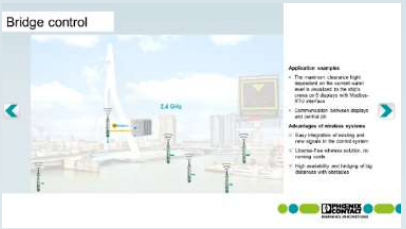


Infrastructure applications

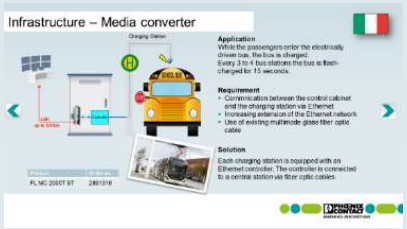
Click on image!

Radioline

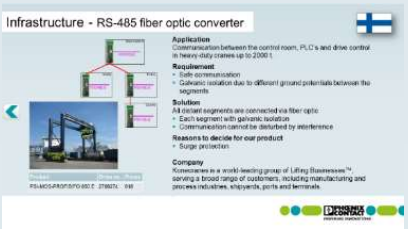




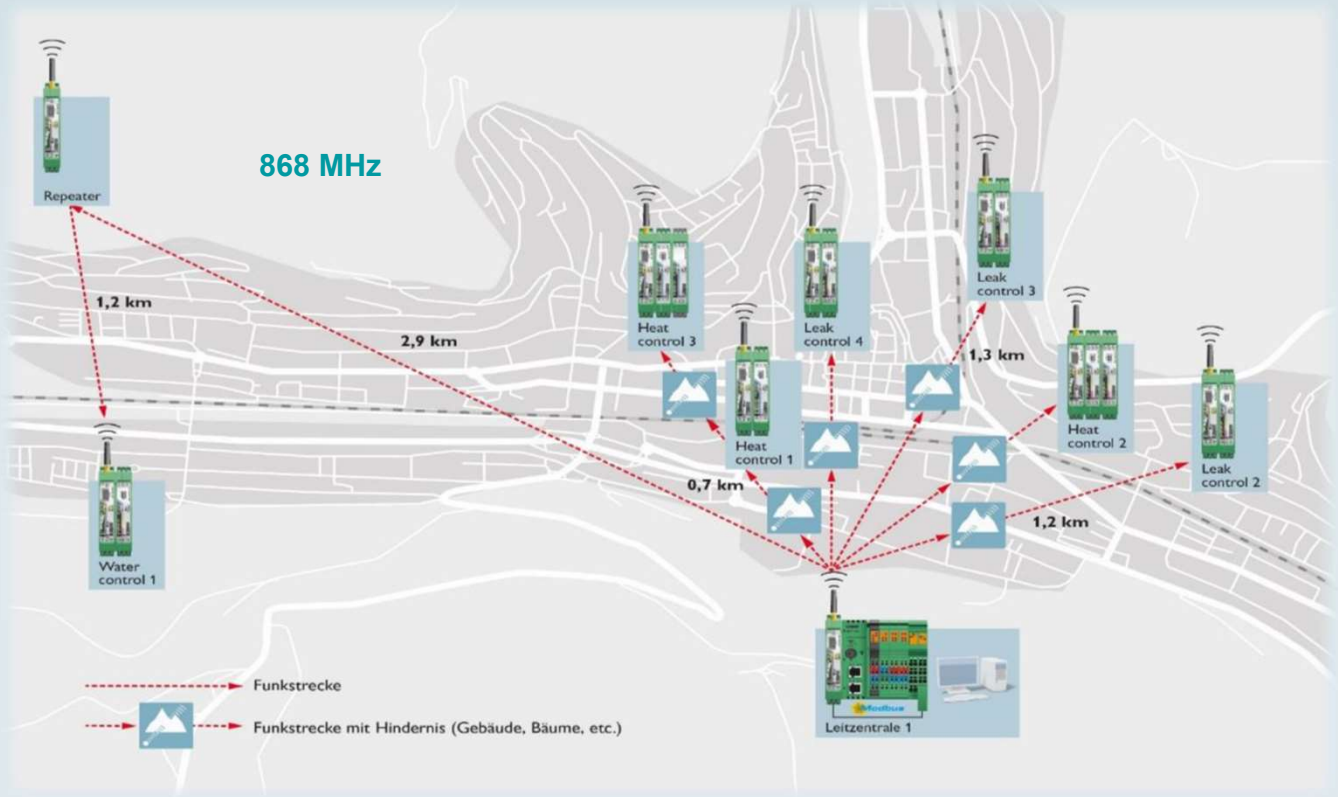
Media Converter



PSI-MOS Profibus



Leakage monitoring of pipeline networks



Application examples

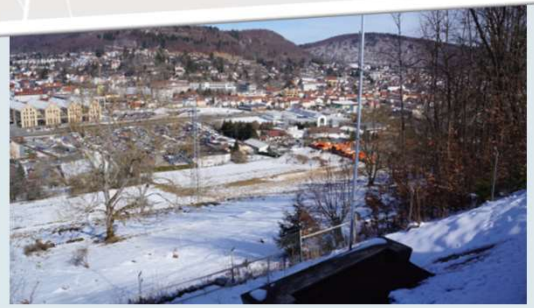
- Monitoring of pipelines for energy, district heating and gas
- Several measuring stations for leakage control, water meters, gas meters, fault messages
- Communication lines to the remote local network stations are largely unavailable

Advantages of wireless systems

- ☑ Bridging of big distances and obstacles
- ☑ Saving cost- intensive earthworks
- ☑ Simple integration of additional measurement points
- ☑ Mesh network up to 249 repeater/slaves

PHOENIX CONTACT
INSPIRING INNOVATIONS

Leakage monitoring „Albstadtwerke“



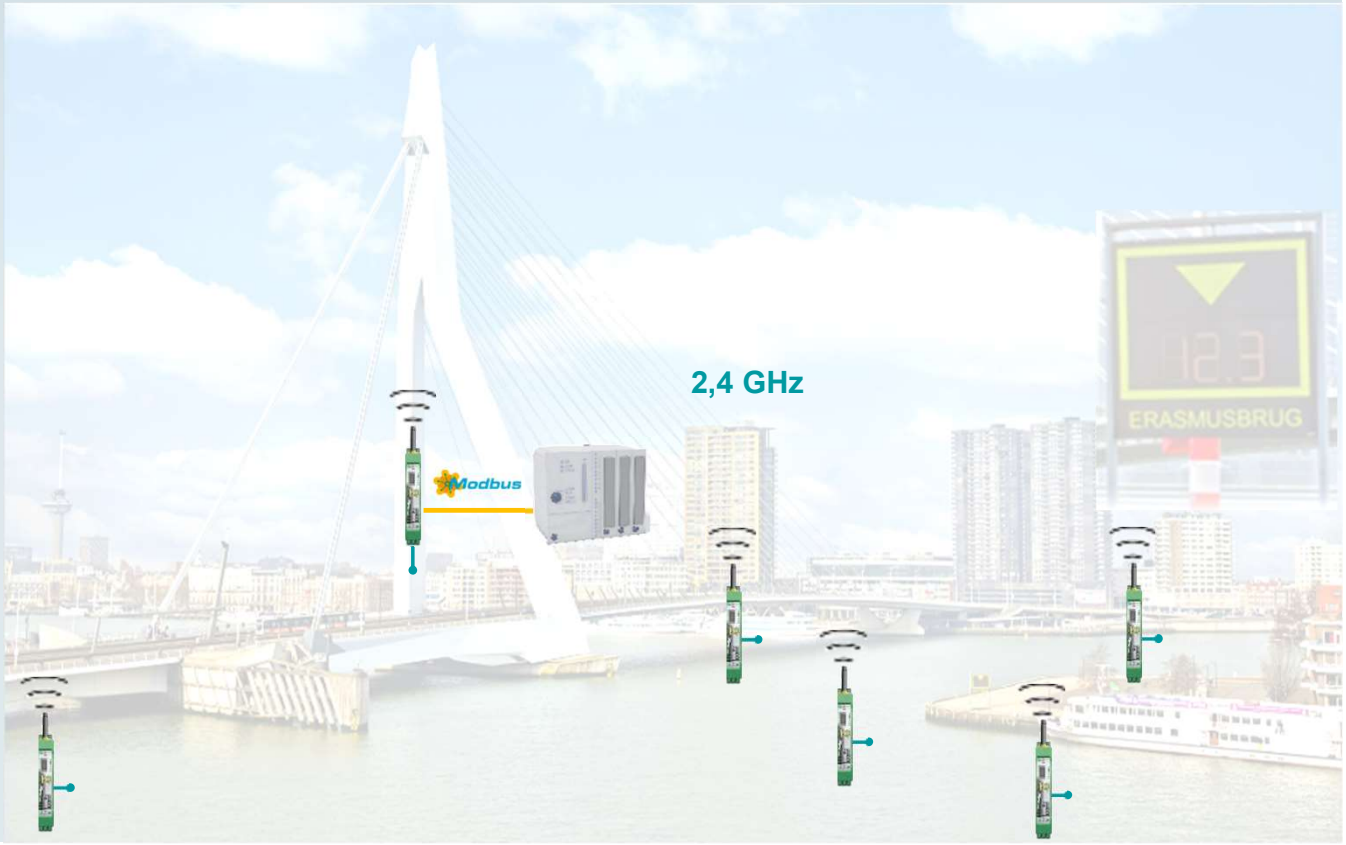
"New underground cables could not be laid due to the available budget and local conditions. A mobile communication solution was also out of the question, since we need to be able to exert influence in the event of a fault”, sums up Thomas Haas.

To ensure that the pipelines required for the energy supply (district heat and water) always function perfectly, they must be continuously monitored.

By using Radioline, all measurements can now be recorded continuously and obstacles can be passed.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Bridge control



Application examples

- The maximum clearance hight dependent on the current water level is visualized to the ship's crews on 6 displays with Modbus-RTU interface
- Communication between displays and central plc

Advantages of wireless systems

- ☑ Easy integration of existing and new signals in the control system
- ☑ License-free wireless solution, no running costs
- ☑ High availability and bridging of big distances with obstacles

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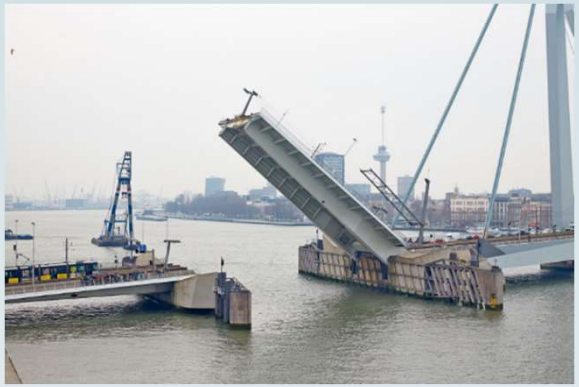
INSPIRING INNOVATIONS

Erasmus Bridge Rotterdam



Due to the tides of the North Sea, not every ship can pass under the Erasmus Bridge in Rotterdam at any time.

To prevent damage to the ships and the bridge, six scoreboards visualize the current maximum headroom.

The corresponding analog values are obtained by the display boards of a small AXC 1050 controller via the Radioline wireless system.

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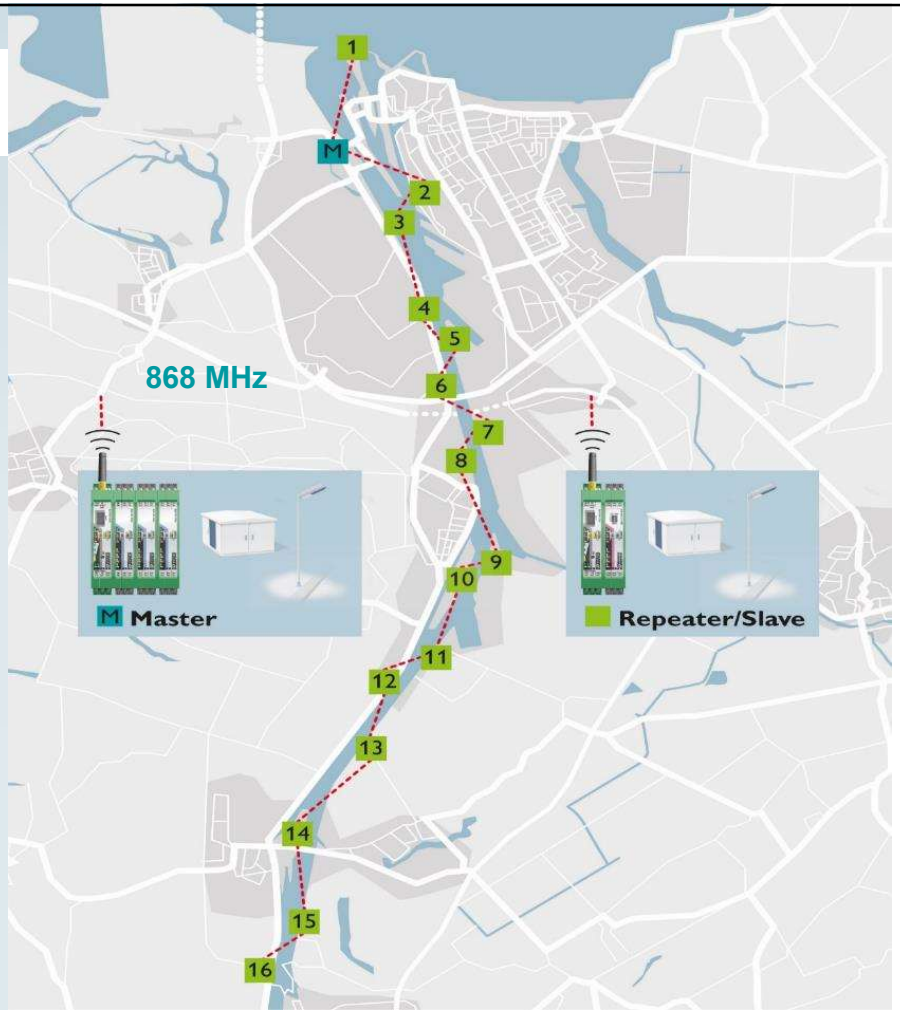
INSPIRING INNOVATIONS

Canal light control



Application examples

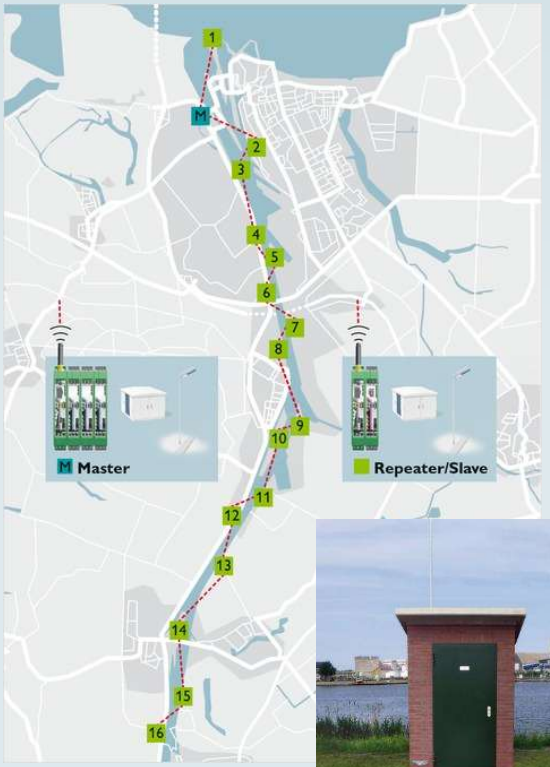
- For the conduct of shipping, lighting is available on 300 masts on both sides of the canal
- The network is divided into 3 sections with 17 switching stations, so that part of the lighting can also be switched by bridge keepers or from the central traffic control center

Advantages of wireless systems

- ☑ Easy integration of existing and new signals in the control system
- ☑ Time and cost savings compared to the cable laying
- ☑ High availability and coverage of large distances

PHOENIX CONTACT
INSPIRING INNOVATIONS

Lighting Gent-Terneuzen canal



The lighting of the Dutch section of the canal Gent-Terneuzen should be switched centralized and decentralized.

Along the canal are a total of 17 control boxes for switching the lighting.

To transmit the control commands, each control box includes a Radioline 868 MHz module and an I/O extension module.

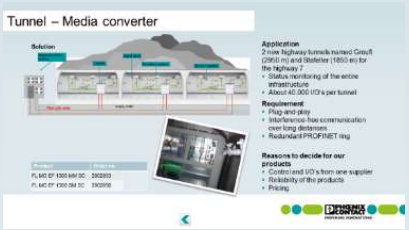
PHOENIX CONTACT
INSPIRING INNOVATIONS

Traffic / Tunnel applications

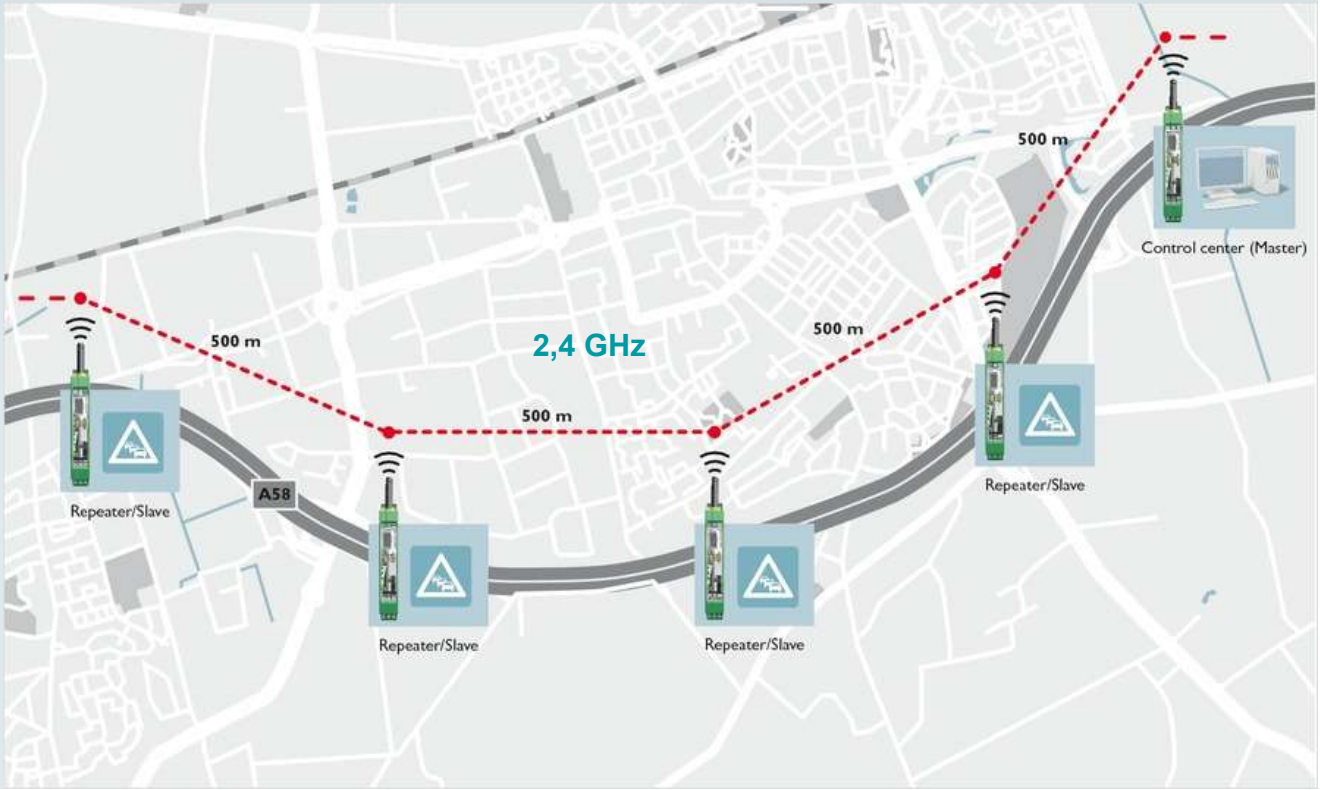
Click on image!

Radioline

Media Converter



Traffic control



Application examples

- Control of sign boards for traffic jam information
- Cable installation impossible during highway traffic
- Power supply via solar system
- Distance between sign boards, each 500 – 1000 m

Advantages of wireless systems

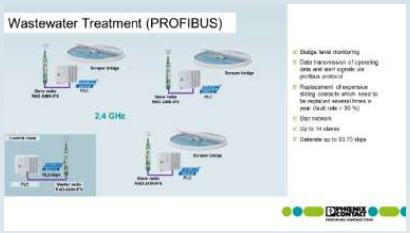
- ☑ Easy integration of existing and new signals in the control system
- ☑ Time and cost savings compared to the cable laying
- ☑ High availability and coverage of large distances
- ☑ Installation during highway traffic

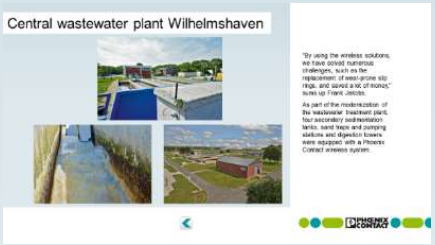
PHOENIX CONTACT
INSPIRING INNOVATIONS

Water & Wastewater applications

Click on image!

Radioline

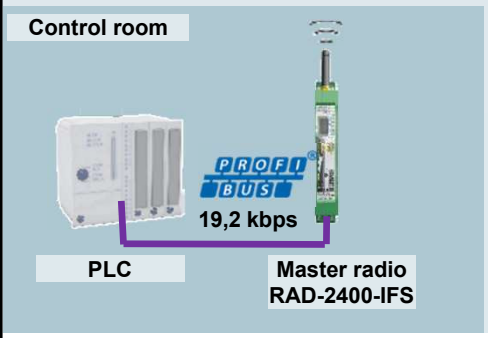




PHOENIX CONTACT
INSPIRING INNOVATIONS

Wastewater Treatment (PROFIBUS)

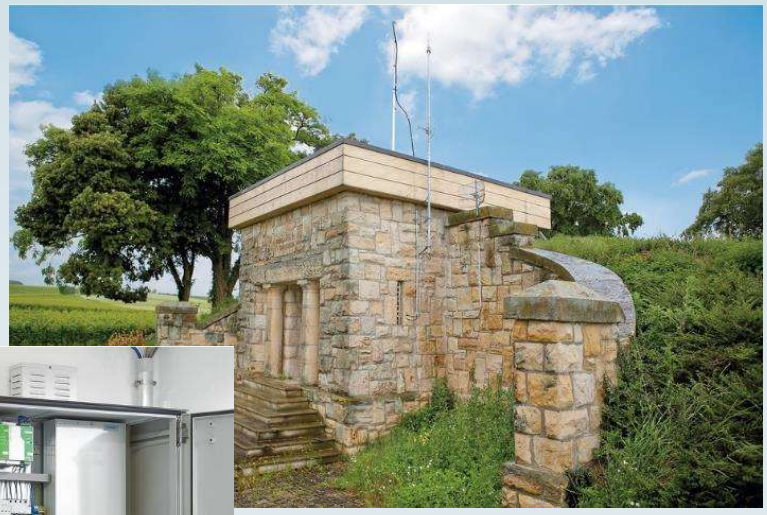
2,4 GHz



- Sludge level monitoring
- Data transmission of operating data and alert signals via profibus protocol
- Replacement of expensive sliding contacts which need to be replaced several times a year (fault rate > 30 %)
- Star network
- Up to 14 slaves
- Datarate up to 93,75 kbps

PHOENIX CONTACT
INSPIRING INNOVATIONS

Water Supply „Zweckverband Seebachgebiet“

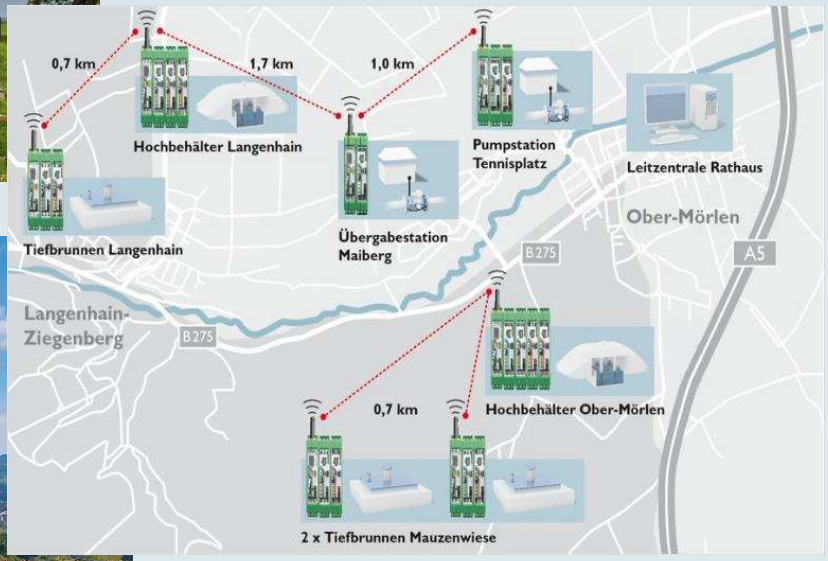


„We have saved a lot of time and money by using the Radioline wireless system“, says Hermann-Josef Hofmeister from the waterworks Osthofen.

The water supplier “Zweckverband Seebachgebiet” uses an industrial wireless solution based on the Radioline system from Phoenix Contact for communication between the various substations.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Water Supply „Stadtwerke Obermörlen“



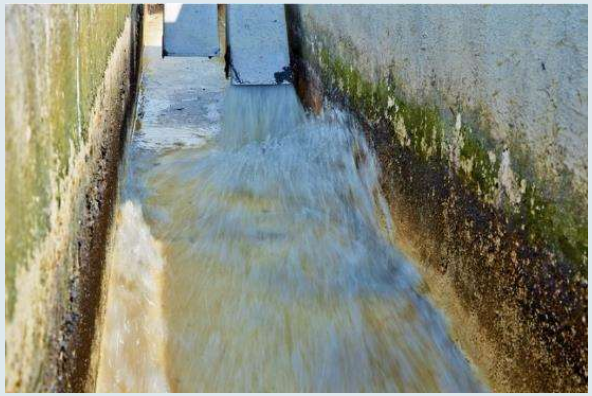
„ The radio links are stable and have not even failed since the first day”, says Karlheinz König.

Most of the substations are controlled by a telephone network whose cables have decayed over the years.

This is why the Radioline wireless system now reliably links the distant outdoor structures to the control system.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Central wastewater plant Wilhelmshaven



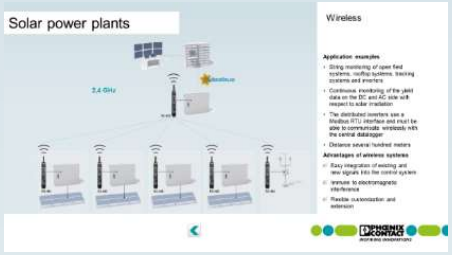
"By using the wireless solutions, we have solved numerous challenges, such as the replacement of wear-prone slip rings, and saved a lot of money," sums up Frank Jakobs.

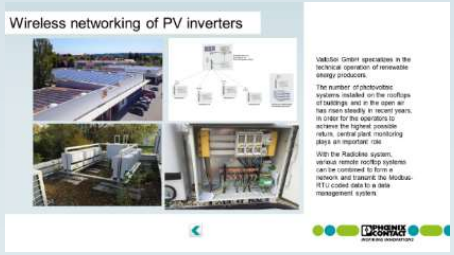
As part of the modernization of the wastewater treatment plant, four secondary sedimentation tanks, sand traps and pumping stations and digestion towers were equipped with a Phoenix Contact wireless system.

Solar applications

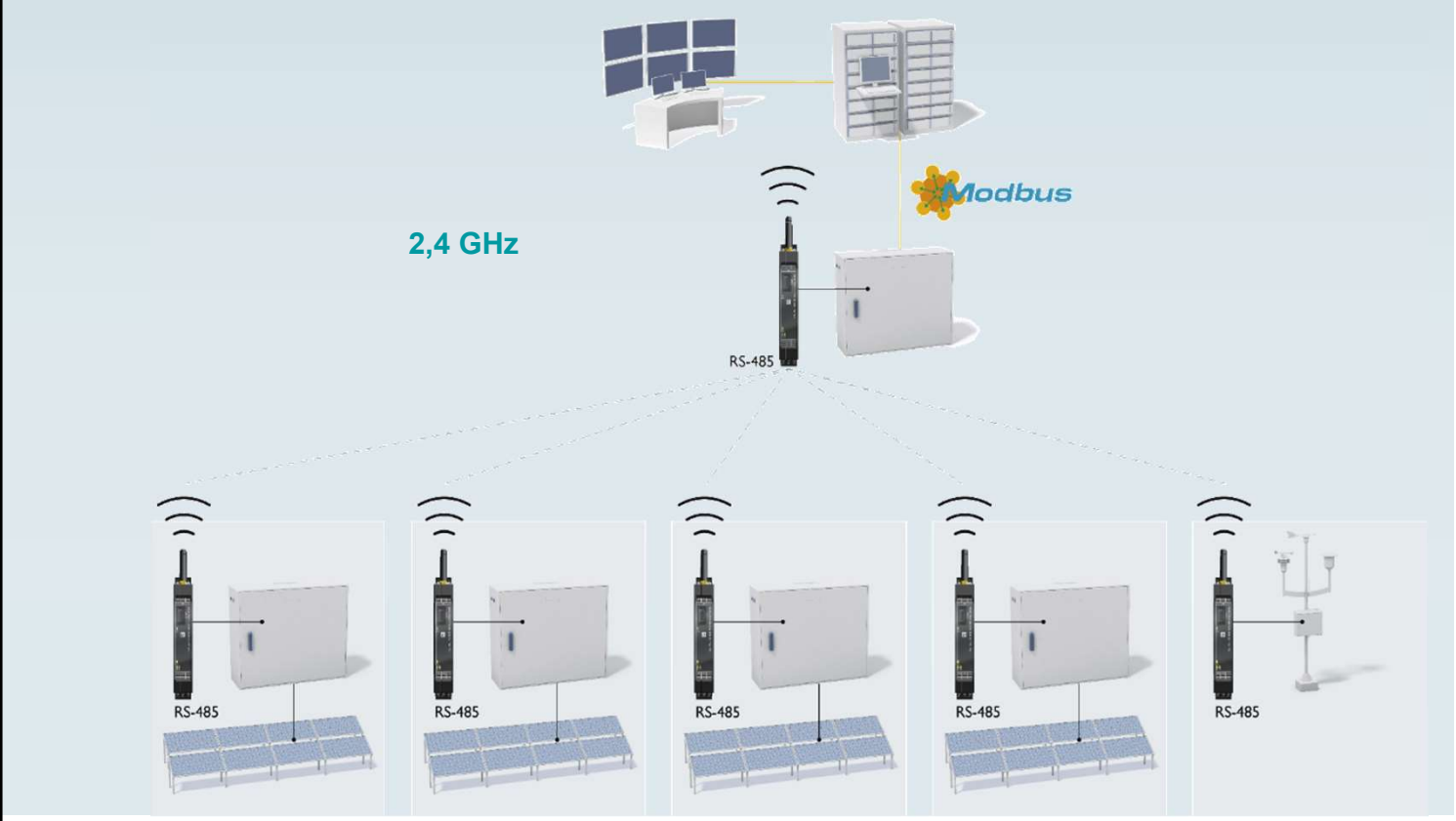
Click on image!

Radioline





Solar power plants



Wireless

Application examples

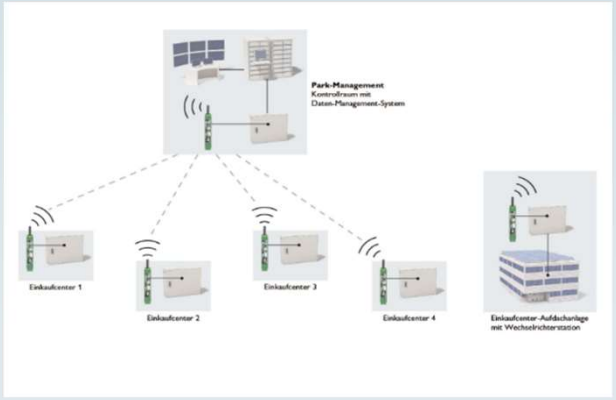
- String monitoring of open field systems, rooftop systems, tracking systems and inverters
- Continuous monitoring of the yield data on the DC and AC side with respect to solar irradiation
- The distributed inverters use a Modbus RTU interface and must be able to communicate wirelessly with the central datalogger
- Distance several hundred meters

Advantages of wireless systems

- ☑ Easy integration of existing and new signals into the control system
- ☑ Immune to electromagnetic interference
- ☑ Flexible customization and extension

PHOENIX CONTACT
INSPIRING INNOVATIONS

Wireless networking of PV inverters



ValloSol GmbH specializes in the technical operation of renewable energy producers.

The number of photovoltaic systems installed on the rooftops of buildings and in the open air has risen steadily in recent years. In order for the operators to achieve the highest possible return, central plant monitoring plays an important role

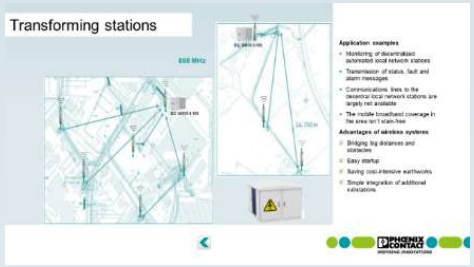
With the Radioline system, various remote rooftop systems can be combined to form a network and transmit the Modbus-RTU coded data to a data management system.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Energy applications

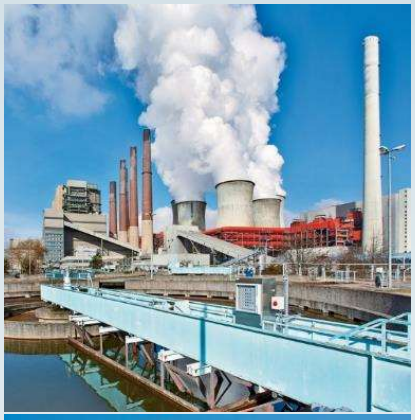
Click on image!

Radioline



JB1

Wastewater plant RWE Power Neurath



"The commissioning of the Radioline modules has proven to be really easy“, sums up Stefan Strasser from RWE.

As part of a modernization, the treatment plant should be able to be operated via a remote control operation.

Wireless technology and other components from Phoenix Contact contribute to the flexible and reliable operation of the system.

Slide 99

JB1 Jörg Brasas, 02/09/2019

RWE power plant Westfalen

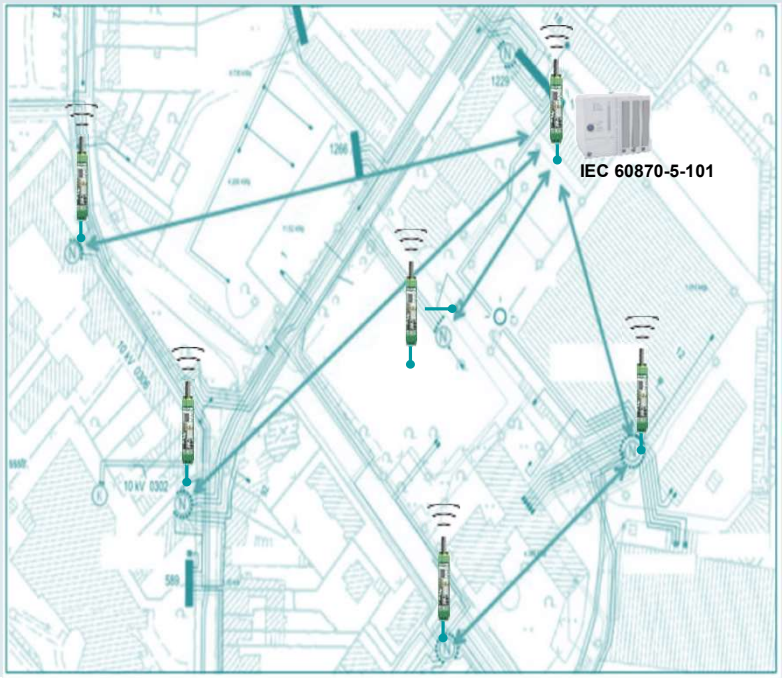
In extensive infrastructure facilities, data often has to be transmitted from remote outstations to the control center.

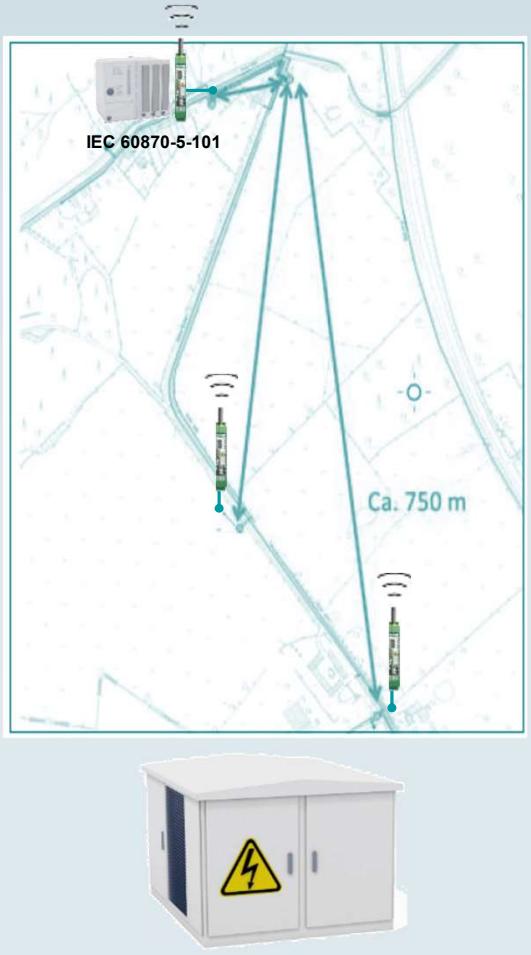
In this way, the measured values recorded for documentation can be easily and economically transferred to the control system.

For this purpose, RWE uses the industrial wireless system Radioline from Phoenix Contact.

Transforming stations

868 MHz





Application examples

- Monitoring of decentralized automated local network stations
- Transmission of status, fault and alarm messages
- Communications lines to the decentral local network stations are largely not available
- The mobile broadband coverage in the area isn´t stain-free

Advantages of wireless systems

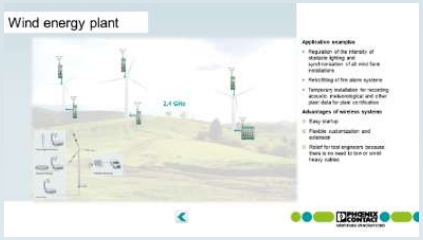
- ☑ Bridging big distances and obstacles
- ☑ Easy startup
- ☑ Saving cost-intensive earthworks
- ☑ Simple integration of additional substations

PHOENIX CONTACT
INSPIRING INNOVATIONS

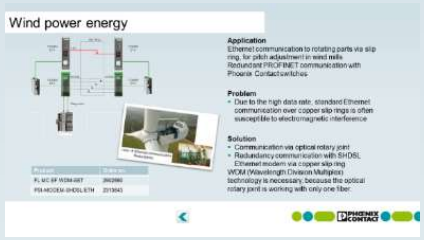
Wind applications

Click on image!

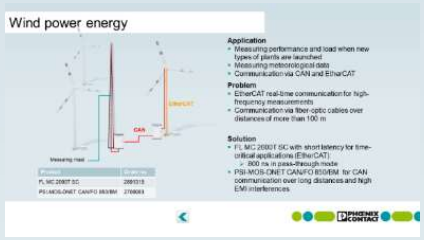
Radioline



Media Converter / SHDSL



Media Converter / PSI MOS



Wind energy plant

Application examples

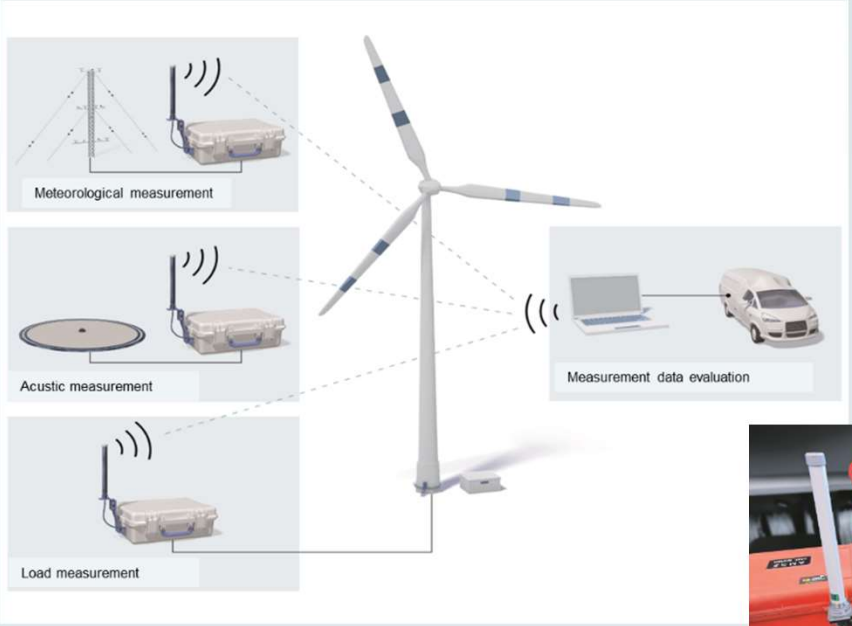
- Regulation of the intensity of obstacle lighting and synchronization of all wind farm installations
- Retrofitting of fire alarm systems
- Temporary installation for recording acoustic, meteorological and other plant data for plant certification

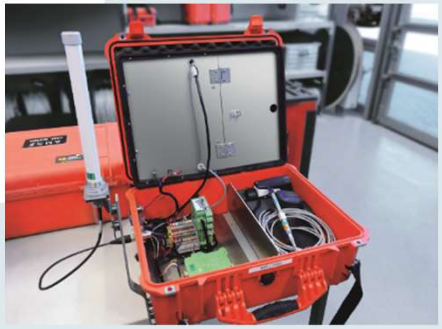
Advantages of wireless systems

- ☑ Easy startup
- ☑ Flexible customization and extension
- ☑ Relief for test engineers because there is no need to tow or unroll heavy cables

PHOENIX CONTACT
INSPIRING INNOVATIONS

Generation plants certification - MOE





"By using the autonomous wireless measuring boxes, we save a lot of wiring time during installation“, sums up Christoph Thiel from Moeller Operating Engineering GmbH.

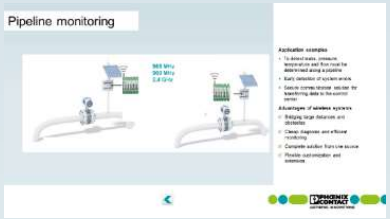
In total, three measuring boxes will be placed around the wind turbine. A box is placed on the acoustic sensor, one near the plant control and the last finally on the meteorological sensor mast.

Radioline pass the recorded data wirelessly to their remote stations in the parked vehicle, which they transfer to the computer. There, the data is archived and processed.

Process applications

Click on image!

Radioline



Comserver

PSI-MOS Profibus

Pipeline monitoring

Application examples

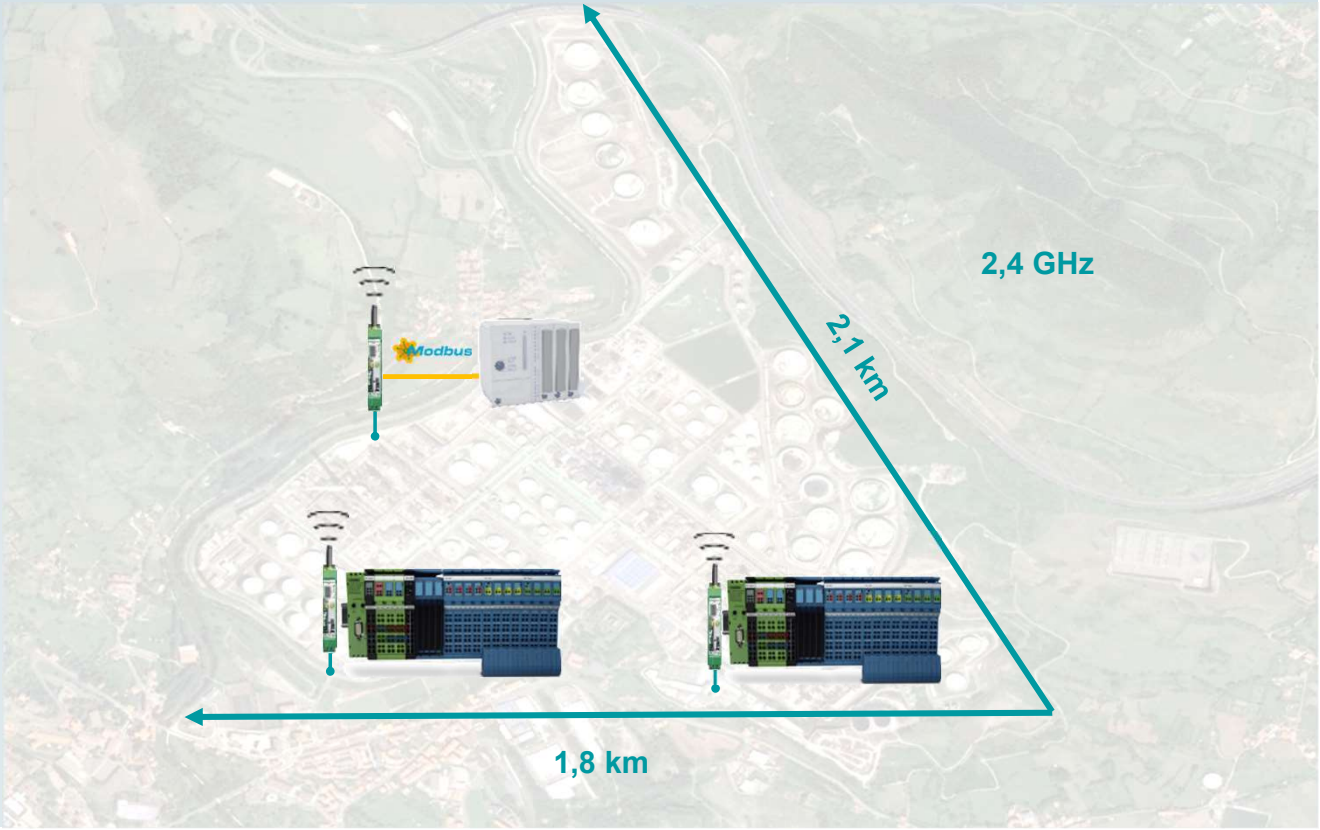
- To detect leaks, pressure, temperature and flow must be determined along a pipeline
- Early detection of system errors
- Secure communication solution for transferring data to the control center

Advantages of wireless systems

- ☑ Bridging large distances and obstacles
- ☑ Cheap diagnosis and efficient monitoring
- ☑ Complete solution from one source
- ☑ Flexible customization and extension

PHOENIX CONTACT
INSPIRING INNOVATIONS

Tank farms



Application examples

- VPI is a valve position detection system for manual valves
- Automatic recognition of the valve position and message to the control system
- To keep costs down, management was looking for alternatives to cable laying

Advantages of wireless systems

- ☑ Thanks to Radioline, the process components can be networked at drastically reduced costs
- ☑ The high flexibility and reliability of Radioline and the excellent experience of users from other industrial sectors were convincing
- ☑ Complete solution from a single source

PHOENIX CONTACT
INSPIRING INNOVATIONS

Oil refinery Petronor

A refinery utilizes hundreds of thousands of barrels of oil every day. Between the individual process steps, liquids and gases are produced, which are constantly pumped back and forth between the process plants and storage tanks via pipelines.

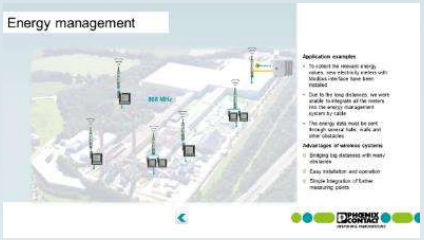
At the Petronor refinery in Muskiz, Spain, the Radioline wireless system provides remote monitoring of valve positions, pump status and system pressures.

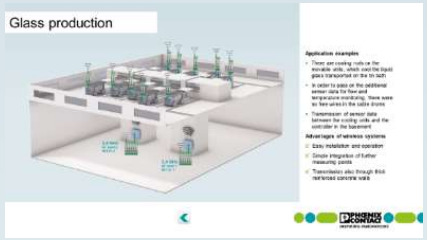
Factory automation applications

Click on image!

Wireless MUX

Radioline

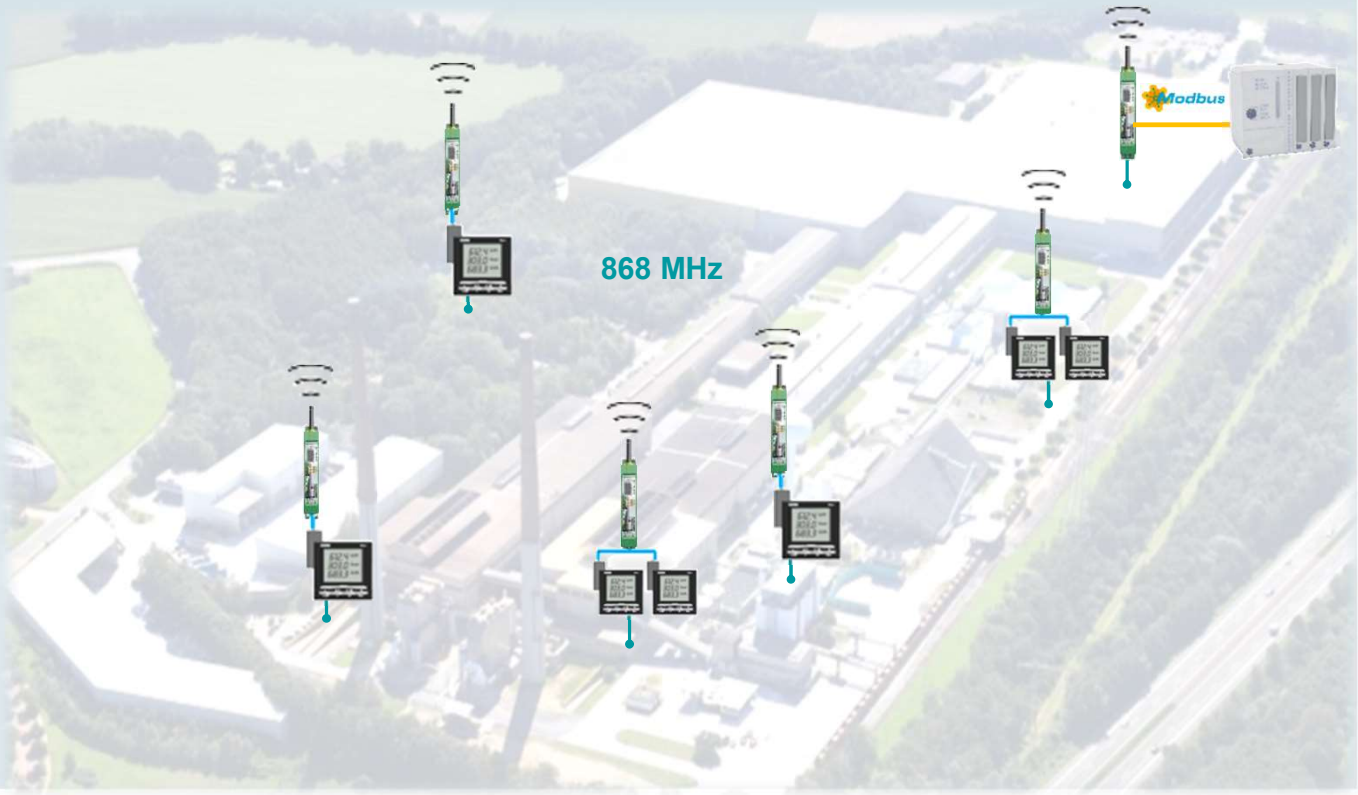




Comserver

JB [2]1

Energy management



Application examples

- To collect the relevant energy values, new electricity meters with Modbus interface have been installed
- Due to the long distances, we were unable to integrate all the meters into the energy management system by cable
- The energy data must be sent through several halls, walls and other obstacles

Advantages of wireless systems

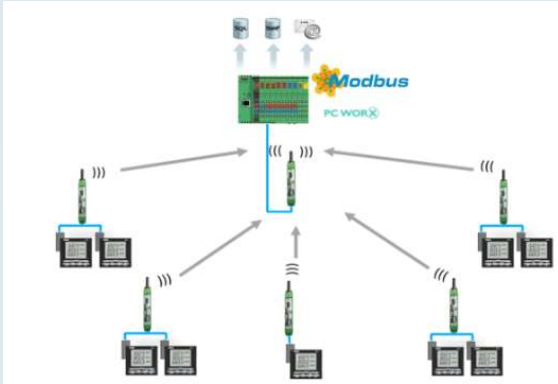
- ☑ Bridging big distances with many obstacles
- ☑ Easy installation and operation
- ☑ Simple integration of further measuring points

PHOENIX CONTACT
INSPIRING INNOVATIONS

Slide 110

JB [2]1 Jörg Brasas, 05/09/2019

Metal production Walter Mester

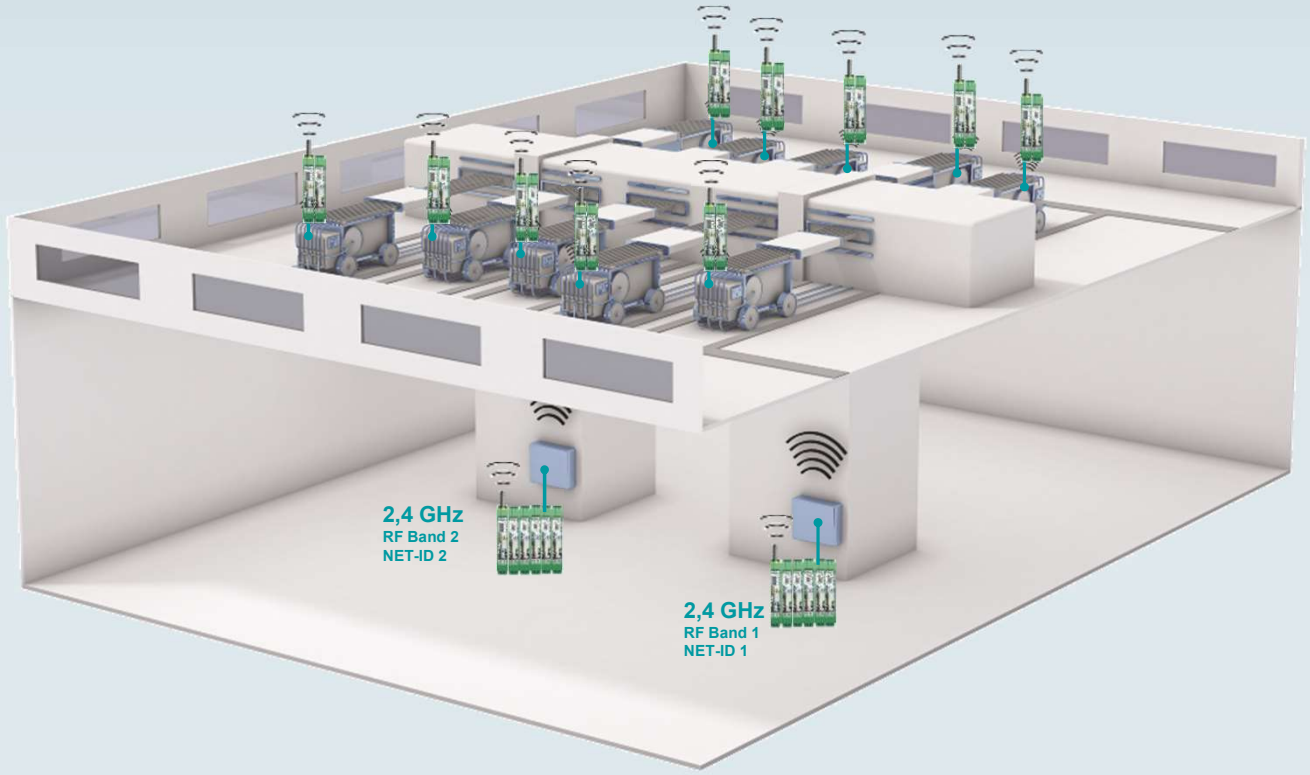


"We were not sure that wireless communication always works reliably in the harsh environment of a forge. But after the implementation of a similar application in another forge, all doubts are dispelled“, sums up Thomas Besbes from Isertech GmbH.

In order to benefit from tax deductions for energy-intensive businesses, energy consumption must be recorded transparently.

The implemented solution shows how the energy consumption can be determined transparently by means of measuring devices systematically installed at the energy focal points in combination with a reliable Radioline wireless transmission.

Glass production



Application examples

- There are cooling rods on the movable units, which cool the liquid glass transported on the tin bath
- In order to pass on the additional sensor data for flow and temperature monitoring, there were no free wires in the cable drums
- Transmission of sensor data between the cooling units and the controller in the basement

Advantages of wireless systems

- ☑ Easy installation and operation
- ☑ Simple integration of further measuring points
- ☑ Transmission also through thick reinforced concrete walls

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Glas production Saint-Gobain

"We could hardly believe that Radioline could transmit data even through the rather thick reinforced concrete ceiling. The setup was a child´s play, with just one turn on the wheel, the inputs and outputs are assigned to each other“, explains Wilfried Brepols.

The windows installed in cars are heated to more than 600° C in the furnace during their production and then tempered by mobile refrigeration units due to the rapid cooling.

The Radioline system transmits the signals from the cooling units through a ceiling to the controller in the building basement.

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- **Professional path study**
  Give us the coordinates of the stations to be networked, we check the feasibility for you
- **Configuration and start-up**
  We help you put your network into operation and show you how to increase performance
- **Maintenance and support**
  We assist you with troubleshooting and provide assistance and recommendations
- **Trainings and workshops**
  We offer individually tailored training courses

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Wireless Tool Software

WNP Wireless Network Planner

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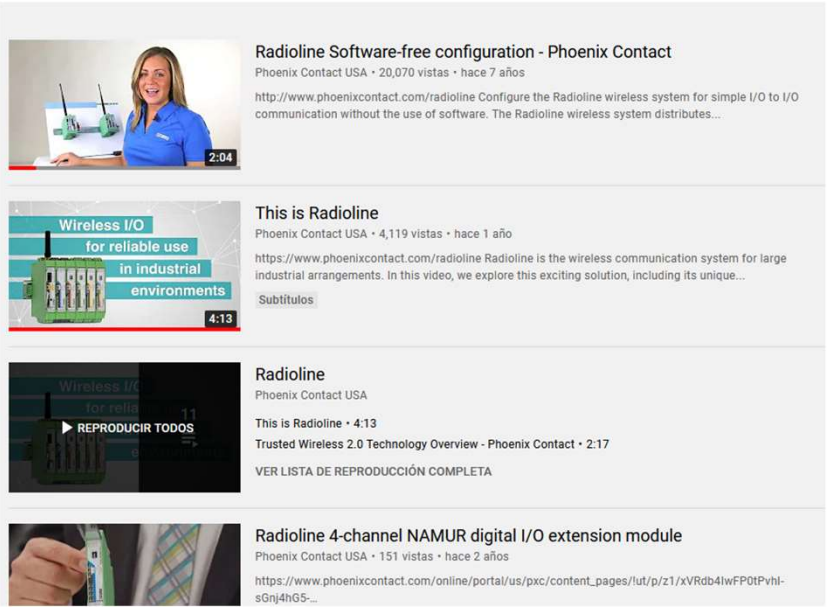
Wireless Configuration and Diagnostic Tool

PSI-CONF

Youtube 11 Radioline Videos

Radioline



Youtube Radioline Phoenix Contact USA Tool for learning

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Radioline application

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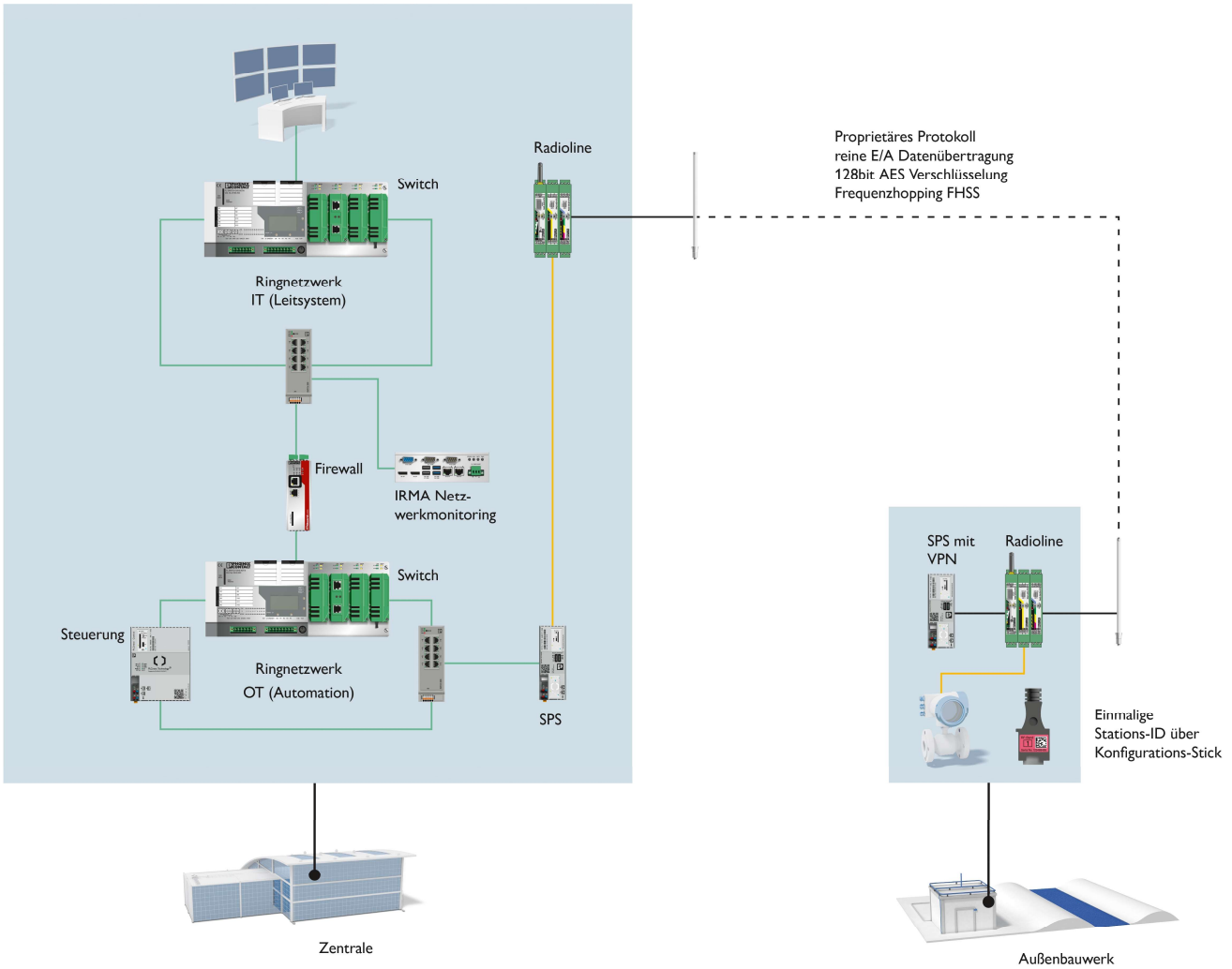
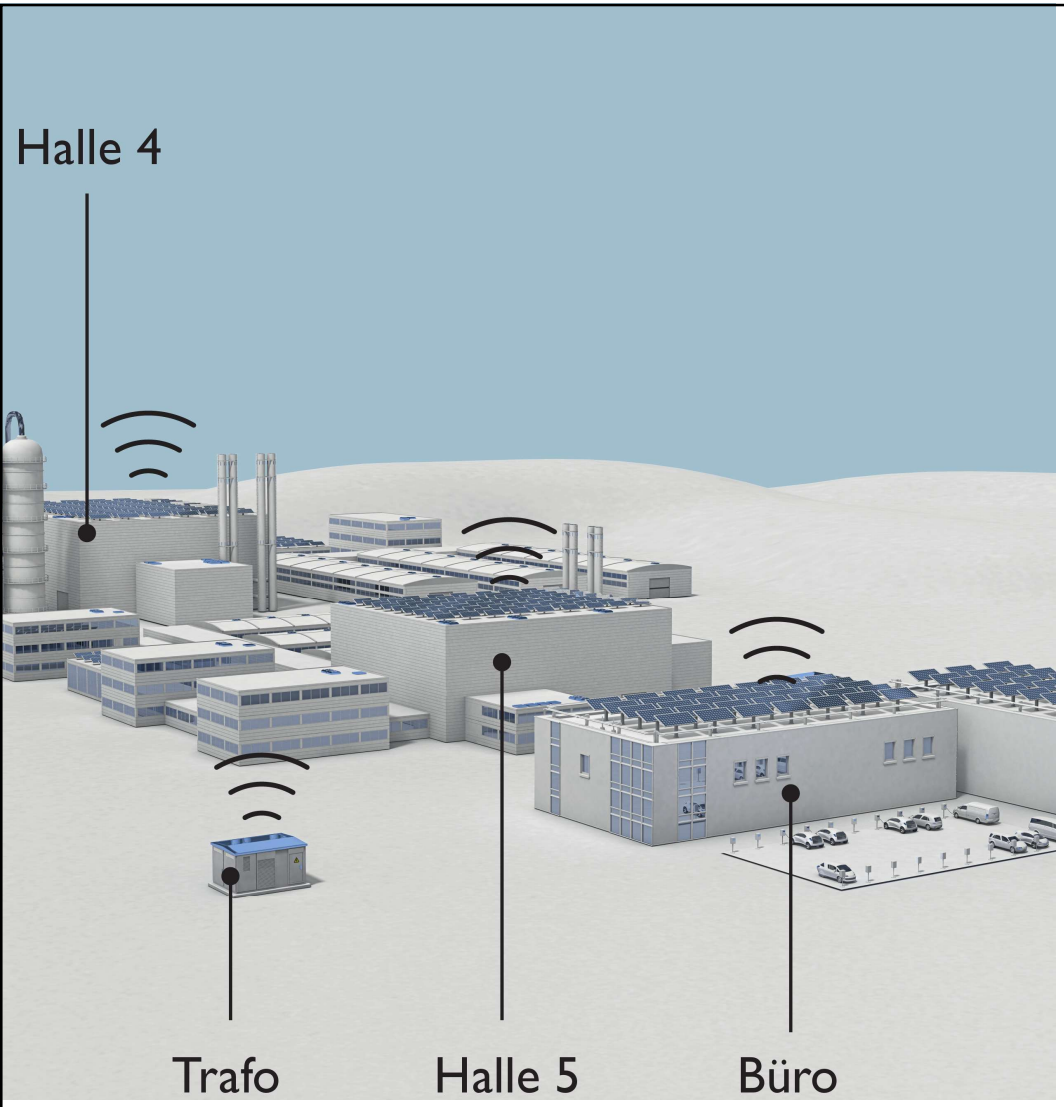
Radioline

Typical application





Thank you

Basic Wireless Radioline

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