Industrial Wireless

Wireless from the sensor to the network
Our Industrial Wireless products for your automation infrastructure

Phoenix Contact is a leading international supplier for automation infrastructure. Industrial Wireless products from Phoenix Contact provide reliability and security for the transmission of data and signals.

Wireless systems enable you to easily and efficiently negotiate the many challenges faced in an industrial communication infrastructure.

Your advantages

- Flexibility, easy installation, and cost savings compared to cable-based installations
- Bypassing of obstacles
- Alternative to slip rings that are prone to wear, and to cable lines on mobile devices
- Reduced maintenance costs
- Monitoring and control of remote stations without cable access

Wireless I/O

Digital signals:
0 … 250 V AC/DC, NAMUR

Analog signals:
0 … 20 mA, 4 … 20 mA
0 … 10 V, HART
Wireless systems for all interfaces

Our comprehensive product range offers flexible options for implementing wireless industrial communication solutions. Suitable wireless systems are available for a wide range of interfaces.

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Wireless technologies

The key requirement for the use of wireless technologies in industrial applications is that the technology must be as robust and reliable as a cable connection, even under harsh conditions. With wireless communication, the data is transmitted with electromagnetic waves through free space that is not available exclusively. The wireless connection is therefore subjected to interference, such as electromagnetic interference fields, which can adversely affect transmission. In addition, reflections, fading, interference, and shadowing can occur. Despite the impacts described, the wireless systems work without interference.
## Wireless technologies

### Technologies

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- **Trusted Wireless 2.0 technology** is specifically designed for the reliable transmission of data and signals over long distances.
- **Bluetooth wireless technology** is standardized in accordance with IEEE 802.15.1.
- **WirelessHART wireless technology** is standardized in accordance with IEEE 802.15.4. It is used for the wireless networking of HART field devices in the process industry.
- **WLAN** is a wireless standard in accordance with IEEE 802.11 a/b/g/n for creating wireless local area networks.
- **Communication takes place via the mobile phone networks of the telecommunications provider.**

### Characteristics

- **868/900 MHz, 2.4 GHz**
- Extremely reliable transmission, thanks to redundant transmission channels
- High coexistence capability in unfamiliar wireless environments, parallel operation of several Bluetooth systems at one location thanks to efficient frequency usage
- Ranges of up to 200 m
- Short delay times

- **2.4 GHz**
- Extremely secure transmission protected against manipulation with 128 bit AES encryption
- High degree of reliability, thanks to full-mesh routing
- Very low energy consumption, thanks to time-synchronized communication

- **2.4 GHz, 5 GHz**
- High data rates of up to 54 Mbps or 300 Mbps
- Fast roaming
- Device mobility in wide area networks
- High degree of reliability, thanks to MIMO technology

- **Available worldwide**
- Use of international mobile network standards (GPRS, EDGE, UMTS, HSPA, LTE, etc.)
- Data rates of up to 150 Mbps on the LTE network
- Inexpensive alarm generation via SMS

### Applications

- **Wireless I/O:**
  - Analog, digital I/O signals (support modular expansion)
  - **Wireless Serial:**
  - Serial RS-232, RS-485 data

- **Wireless I/O:**
  - Analog, digital I/O signals
  - **Wireless Ethernet:**
  - Ethernet data

- **Wireless I/O:**
  - Analog, digital I/O signals
  - **Wireless Ethernet:**
  - Analog HART signals

- **Wireless Ethernet:**
  - High-speed Ethernet transmission

- **Wireless I/O:**
  - Analog, digital I/O signals
  - **Wireless Serial:**
  - Serial RS-232 data
  - **Wireless Ethernet:**
  - Ethernet data

- **Alarm generation:**
  - SMS, e-mail

### Industrial Wireless in process technology and production automation

Process technology systems often feature widely distributed outdoor system structures. Measured values only ever change very gradually. In contrast to process technology systems, systems used in production automation are often physically restricted in terms of space. Large amounts of data have to be transferred in a very short amount of time.

We offer the suitable wireless system for every application.
Wireless I/O

Radioline – Easy signal distribution with I/O mapping

Radioline is the 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.

Your advantages

- Easy startup without programming
- One device for a range of applications
- Integrated RS-232 and RS-485 interface
- Trusted Wireless 2.0 technology
- Adjustable data rates for the wireless interface
- 128-bit data encryption (AES)
Product overview Radioline front modules

868 MHz wireless module
RAD-868-IFS (Europe) Order No. 2904909
- Supply voltage: 19.2 … 30.5 V DC
- Adjustable transmission power of up to 500 mW
- Can be extended with I/O modules via DIN rail connectors
- Expanded temperature range: -40°C … +70°C
- Antenna connection: RSMA (female)
- Approvals: ATEX, IECEx
- Suitable for large distances with obstacles

900 MHz wireless module
RAD-900-IFS (America) Order No. 2901540
RAD-900-IFS-AU (Australia, New Zealand) Order No. 2702878
- Supply voltage: 10.8 … 30.5 V DC
- Adjustable transmission power of up to 1000 mW
- Can be extended with I/O modules via DIN rail connectors
- Expanded temperature range: -40°C … +70°C
- Antenna connection: RSMA (female)
- Approvals: UL 508, HazLoc, FCC
- Suitable for large distances with obstacles

2.4 GHz wireless module
RAD-2400-IFS (worldwide) Order No. 2901541
RAD-2400-IFS-JP (Japan) Order No. 2702863
- Supply voltage: 19.2 … 30.5 V DC
- Adjustable transmission power of up to 100 mW
- Can be extended with I/O modules via DIN rail connectors
- Expanded temp. range: -40°C … +70°C
- Antenna connection: RSMA (female)
- Approvals: ATEX, IECEx, UL 508, HazLoc, FCC (RAD-2400-IFS only)

Radioline accessories are to be found on page 33.

One device – A wide range of applications

Radioline is very versatile thanks to the fact that it can transmit I/O signals as well as serial data – the Trusted Wireless technology ensures reliable transmission even in harsh industrial environments, regardless of the protocol type. The Radioline function blocks for PC Worx, STEP 7 and TIA Portal enable easy I/O integration in the control system.

**PC Worx/STEP 7 function blocks**
- Free Radioline library
- Central monitoring of wireless stations in the control system

**I/O data mode**

**Serial data mode**

**PLC/Modbus RTU mode**

**PLC/Modbus RTU dual mode**
Wireless I/O

Radioline – I/O mapping now in wired format too

The popular, straightforward method of distributing I/O information using thumbwheels on the front of the equipment is now also available for RS-485 networks. Addressing the new RS-485 front module is quick and easy too – all it takes is a turn of the yellow thumbwheel. This enhances the Radioline system's flexibility, allowing you to use it for solutions in even more applications.

Alternative transmission media

To increase the range, you can of course replace the RS-485 line with alternative transmission media. Phoenix Contact offers a range of converters for fiber-optic cables, SHDSL, wireless, or Ethernet technology.
Product overview Radioline bus module

RS-485 bus module
RAD-RS485-IFS Order No. 2702184

- Expanded temperature range: -40°C ... +70°C
- RS-485 2-wire connection (screw terminal block)
- Worldwide use
- Range: 1200 m or more with converter or repeater
- Can be extended with I/O modules via DIN rail connectors
- Supply voltage: 19.2 ... 30.5 V DC

Signal transmission with the Radioline RS-485 bus module
A network may consist either entirely of wireless stations or entirely of RS-485 stations. Alternatively, it is also possible to combine a wireless network with RS-485 stations.

Connection to the wireless system
A Radioline wireless system on an existing master can be expanded to include new RS-485 stations. The wireless and RS-485 modules form a combined system.

Multipoint multiplexer
In an RS-485 network with up to 99 Radioline stations, you can now distribute I/O signals between stations entirely without the need for software configuration – all it takes is a turn of the thumbwheel.

Stand-alone operation as a Modbus slave
The new Radioline RS-485 stations can also be operated on any Modbus RTU master.
Radioline expansion modules

Various expansion modules are available for expanding the Radioline wireless system quickly and easily. They enable the transmission of digital and analog signals as well as temperature signals.

All expansion modules are certified in accordance with 94/9/EC (ATEX) directives and can therefore be used internationally in potentially explosive areas.

Your advantages

- I/O expansion modules can be used on all front modules (see page 7)
- Modular expansion possible
- Easy module replacement even during operation (hot swap-capable)
- Channel-to-channel electrical isolation
- Expanded temperature range: -40°C … +70°C
Product overview Radioline expansion modules

Digital expansion modules
RAD-DI4-IFS Order No. 2901535
RAD-DOR4-IFS Order No. 2901536
• 4 digital wide-range inputs:
  0 … 250 V AC/DC
• 4 digital relay outputs:
  24 V DC/250 V AC/5 A
RAD-DIB-IFS Order No. 2901539
RAD-DOB-IFS Order No. 2902811
• 8 digital inputs: 0 … 30.5 V DC
• 2 pulse inputs: 100 Hz, 32 bit
• 8 digital transistor outputs:
  30.5 V DC / 200 mA
RAD-NAM4-IFS Order No. 2316275
• 4 digital NAMUR inputs
• Line break detection
• Short-circuit detection
• Can be combined with RAD-DOB-IFS

Analog/Pt 100 expansion module
RAD-AI4-IFS Order No. 2901537
• 4 analog inputs:
  alternatively 0/4 … 20 mA
RAD-AI4-U-IFS Order No. 2702290
• 4 analog inputs: 0 … 5/10 V
RAD-AO4-IFS Order No. 2901538
• 4 analog outputs:
  alternatively 0/4 … 20 mA, 0 … 10 V DC
RAD-PT100-4-IFS Order No. 2904035
• 4 Pt 100 inputs
• Temperature measuring range:
  -50°C … +250°C
• 2-/3-conductor connection
• Can be combined with RAD-AO4-IFS

Analog/digital expansion module
RAD-DAIO6-IFS Order No. 2901533
• 1 analog input:
  alternatively 0/4 … 20 mA
• 1 analog output:
  alternatively 0/4 … 20 mA, 0 … 10 V DC
• 2 digital wide-range inputs/outputs:
  0 … 250 V AC/DC

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

Unique addresses for front modules
Set a unique address on the front module by simply turning the thumbwheel.

Distribute inputs and outputs
On the I/O module, the thumbwheel is used to assign the inputs and outputs by creating pairs, thereby easily distributing the I/O signals in the system (I/O mapping).
Wireless I/O

Radioline – Solutions for use in outdoor applications

The Radioline Outdoor boxes can be installed outdoors in order to remotely transfer I/O signals or serial data quickly and easily. The device combinations are freely selectable. This enhances the Radioline system’s flexibility, allowing you to use it for solutions in even more applications.

Your advantages

- Robust, impact-resistant, UV-resistant, and splash-proof outdoor housing (IP66/NEMA 4X)
- Prewired box enables immediate installation
- Intuitive startup and configuration
- Flexible in physical terms, thanks to ranges covering several kilometers
Product overview Radioline Outdoor boxes

For worldwide use
RAD-RUGGED-BOX-CONF
Order No. 1091638
• Wireless module (selectable): 868 MHz, 900 MHz or 2,400 MHz
• Can be extended with up to three selectable I/O expansion modules
• Serial RS-232/RS-485 interface
• Including surge protection, antenna feed-through, and a pressure compensation element
• Ambient temperature: -25°C … 55°C
• Universal power supply unit: 100 … 240 V AC
• Degree of protection: IP66
• Antenna connection: N (female)
• Approvals: CE

For use in America
RAD-900-DAIO6
Order No. 2702877
• Integrated 900 MHz wireless module
• 6 integrated I/O channels (2 x DI/DO, 1 x AI/OA)
• Connection to RAD-900-IFS wireless modules possible
• Ambient temperature: -40°C … 65°C
• Universal power supply unit: 100 … 240 V AC / 10.8 … 30.5 V DC
• Degree of protection: NEMA 4X (IP66)
• Antenna connection: N (female)
• Approvals: ANSI/ISA/CSA 22.2 61010-2-201, UL 50E Type 4, Class I, Div. 2, Groups A, B, C, D T4, Class I, Zone 2, IIC T4

Radioline accessories are to be found on page 33.

Application examples for Radioline Outdoor boxes

Point-to-point with two Outdoor boxes
Point-to-point/star/mesh connection with standard wireless modules and Outdoor boxes
Mesh network with one Outdoor box as a simple repeater
Wireless I/O

The Wireless MUX wireless signal cable

The wireless multiplexer transmits 16 digital and two analog signals bidirectionally, i.e. in both directions, which means that it can replace a 40-wire signal cable. Also, the connection is monitored continuously. If there is gross interference in the link or it is interrupted, the outputs are reset to the defined LOW state. This is indicated on the module by a diagnostic LED. The link quality display provides the user with constant information on the quality of the link.

Your advantages

- Connections established and signals transmitted automatically based on fixed pairing
- No configuration or settings required
- Typical transmission time of less than 10 ms
- Extremely robust and reliable
- Interference-free operation alongside WLAN
Product overview wireless sets

Mobile set with antennas
ILB BT ADIO MUX-OMNI
Order No. 2884208
• Standard package consisting of two permanently paired modules, two omnidirectional antennas with 1.5 m cable
• Ranges between 50 and 100 m in halls and over 200 m outdoors
• Antenna connection: RSMA (female)
• Approvals: FCC, UL 508, MIC (Japan)

Wireless set without antennas
ILB BT ADIO MUX
Order No. 2702875
• Package consisting of two permanently paired modules
• Ranges of over 400 m with directional antennas with a free line of sight
• Antenna connection: RSMA (female)
• Approvals: FCC, UL 508, MIC (Japan)

Technical data for wireless sets:
• Current Bluetooth 4.0 technology
• Supply voltage: 19.2 V DC ... 30 V DC
• 16 digital inputs
• 16 digital outputs up to 500 mA
• 2 analog inputs/outputs 0 ... 20 mA or 0 ... 10 V

Possible areas of application
The Wireless MUX is used wherever a small number of digital or analog input and output signals need to be exchanged wirelessly with a remote or movable station.
Factory automation in particular is characterized by machine parts that are constantly in motion.

PLC
16 digital actuators
2 analog actuators
16 digital sensors
2 analog sensors

Ready to use: unpack, connect, and switch on

Dynamic applications
Wireless I/O

Expanding HART systems and establishing new applications

By using a WirelessHART adapter and the gateway, it is possible to adapt existing systems to new regulations, optimize maintenance schedules or acquire standard data. The gateway can communicate with the control system via Modbus/TCP, HART-IP, and FDT/DTM. Thanks to the use of HART-IP or FDT/DTM framework structures, remote devices can be fully configured via the wireless network.

Your advantages

- Use of the same maintenance and diagnostic tools as wired HART devices
- Integrated WLAN client enables the gateways to be installed directly in the field, thereby establishing a reliable network
- Lower material and installation costs compared to wired solutions
- Labor costs saved
Product overview HART systems

WirelessHART gateway
RAD-WHG/WLAN-XD
Order No. 2900178
• Enables HART data from field devices to be accessed via Modbus/TCP or HART-IP
• Supports up to 250 WirelessHART field devices
• Easy programming and diagnostics by means of integrated web server

WirelessHART adapter: RAD-WHA-1/2NPT
Order No. 2900100
• Up to four HART devices or one 4 … 20 mA non-HART device can be connected to one adapter
• Power supply: loop-powered or 24 V DC
• Removable antenna for connecting a coaxial cable and a high-gain antenna

Cable adapter
GW HART USB MODEM
Order No. 1003824
• Cost-effective alternative to hand-held programming devices
• Power supply via USB
• Fast configuration of HART devices and rapid diagnostics

The solution for retrofit and new installations

Retrofit installation
WirelessHART can:
• Meet new directives
• Increase efficiency
• Lower maintenance costs

New installation
WirelessHART can:
• Accelerate system extension
• Reduce start time
• Lower investment costs

Possible areas of application

Conventional analog field devices in the process industry which are connected to non-HART-compatible control systems can be expanded easily in terms of their function without needing to replace the existing controller hardware by using WirelessHART networks. A wide range of parameterization and diagnostic functions are integrated into the existing system without having to stop the process.

Applications in the process industry
Wireless I/O

TC Mobile I/O for monitoring sensors via the mobile phone network

Monitor analog and digital values easily and securely via the mobile phone network and switch relays remotely. TC MOBILE I/O sends your data as a text message and e-mail whenever an event arises, or continuously via ODP protocol. Thanks to the broad voltage range and the various inputs, the signaling system can be used in a wide range of applications.

Your advantages

- Future-proof, thanks to 4G mobile network technology (LTE)
- Suitable for buildings and harsh industrial environments
- Monitoring of connected sensors (0/4 … 20 mA)
- Monitoring of voltages up to 60 V
- Relay switching via the mobile phone network
- SMS alert in the event of power failure
Product overview TC Mobile I/O

Mobile radio module, DC
TC MOBILE I/O X200-4G
Order No. 1038567
4G remote signaling system, SMS/e-mail
TC MOBILE I/O X200
Order No. 2903805
Remote signaling system, SMS/e-mail
TC MOBILE I/O X300 AC
Order No. 2903807
Remote control system, GPRS (ODP protocol)
• 4 digital inputs
• 4 relay outputs
• 2 analog inputs for current or voltage
• Voltage range: 10 V DC … 60 V DC

Mobile radio module, AC
TC MOBILE I/O X200-4G AC
Order No. 1038568
4G remote signaling system, SMS/e-mail
TC MOBILE I/O X200 AC
Order No. 2903806
Remote signaling system, SMS/e-mail
TC MOBILE I/O X300 AC
Order No. 2903808
Remote control system, GPRS (ODP protocol)
• 4 digital inputs
• 4 relay outputs
• Voltage range: 93 V AC … 250 V DC

Monitoring sensors via the mobile phone network
The TC Mobile I/O product range allows you to monitor analog current levels and analog voltage values and switch relays remotely. Communication takes place via SMS, e-mail or with an ODP server.

Possible areas of application:
• Machine, building, and system monitoring
• Pumps, wastewater treatment plants, and water supply
• Lighting control systems and remote switching devices
• Street lighting
• Elevators and gates
• Alarm technology and building services
• HVAC technology
• Battery monitoring up to 60 V
• Railway applications in accordance with EN 50121-4

TC Mobile I/O app
This app allows you to switch your outputs conveniently and easily check the status of your device at any time. The TC Mobile I/O app makes it even easier to handle the text message version and saves you from having to write a text message. You will receive the alarm as usual via SMS and e-mail. This ensures the best accessibility in the field.
Wireless Serial

Radioline for wireless networking of serial interfaces

The wireless module can be used to wirelessly network multiple controllers or serial I/O devices quickly and easily via RS-232 and RS-485 serial interfaces. Data transmission is transparent, which means that any protocols, such as Modbus, can be forwarded. Furthermore, various network structures can be realized: from a simple point-to-point connection through to complex mesh networks.

Your advantages

- Quick and easy startup
- Easy point-to-point or network connections (star, mesh)
- Can be extended with up to 32 I/O modules per station via DIN rail connectors (hot-swap capability)
- I/O-to-I/O, I/O-to-serial, serial-to-serial
- Trusted Wireless 2.0 technology
- Adjustable data rates for the wireless interface (16 … 500 kbps)
- 128-bit data encryption (AES)
Product overview Radioline

Wireless module
RAD-868-IFS (Europe) Order No. 2904909
RAD-900-IFS (Canada, North/South America) Order No. 2901540
RAD-2400-IFS (worldwide) Order No. 2901541
RAD-2400-IFS-JP (Japan) Order No. 2702863
• Integrated RS-232 and RS-485 interface
• Can be extended with I/O modules via DIN rail connectors
• Extended temperature range: -40°C … +70°C

I/O expansion modules
Digital IN:
RAD-DI4-IFS Order No. 2901535
RAD-DI8-IFS Order No. 2901539
RAD-NAM4-IFS Order No. 2316275
Digital OUT:
RAD-DOR4-IFS Order No. 2901536
RAD-DO8-IFS Order No. 2902811
Analog/digital IN/OUT:
RAD-DAIO6-IFS Order No. 2901533

Analog IN:
RAD-AI4-IFS Order No. 2901537
RAD-AI4-U-IFS Order No. 2702290
Analog OUT:
RAD-AO4-IFS Order No. 2901538
Temperature IN:
RAD-PT100-4-IFS Order No. 2904035

Radioline accessories are to be found on page 33.

Replacement for serial cabling
Connect your controller to serial field devices using wireless technology. The slaves are connected directly or via repeater slave intermediate stations. This means that you can connect up to 250 repeater slaves in series in order to extend the wireless path. Serial I/O devices and I/O expansion modules can be connected to the intermediate stations.

Convenient software diagnostics
All network devices can be monitored easily via the master:
• Online diagnostics:
  Network structure design, signal quality of each network station (RSSI), recording of RSSI signal and I/O status of each networked station
• Exclusion of up to two frequency bands (WLAN channels)
• Extended network settings

Wireless networking of serial devices

Comprehensive diagnostics
Wireless Ethernet

Industrial Bluetooth

The industrial Bluetooth modules allow you to wirelessly transmit control data to mobile or difficult to access automation devices quickly and easily. Bluetooth communication is characterized by particularly robust transmission under difficult ambient conditions.

The FL EPA 2 wireless modules enable you to transmit industrial protocols such as PROFINET without any problems. You can also realize functionally safe communication, via PROFIsafe or SafetyBridge Technology.

Your advantages

- Easy and safe installation
- Extremely reliable and robust data transmission, thanks to redundant transmission channels and integrated error correction
- Interference-free parallel operation between Bluetooth and WLAN wireless paths, thanks to the efficient use of frequency gaps
Product overview Industrial Bluetooth

Bluetooth Ethernet adapter
FL BT EPA 2  Order No. 1005869
- Internal antenna
- Bluetooth (PAN profile)

Wireless Ethernet adapter
FL EPA 2  Order No. 1005955
- Internal antenna
- Bluetooth (PAN profile)
- WLAN 80211 a/b/g/n (access point and client)

Wireless Ethernet adapter
FL EPA 2 RSMA  Order No. 1005957
- External, replaceable antenna (supplied, connection: RSMA (male))
- Bluetooth (PAN profile)
- WLAN 80211 a/b/g/n (access point and client)

Technical data:
- Frequency band: 2.4 GHz/5 GHz
- 128-bit data encryption, WLAN black channel list, low emission mode (LEM)
- Degree of protection IP65
- M12 connections for power and LAN
- Auto crossing, PROFINET prioritization, LLDP
- Power supply: 9 ... 30 V DC
- Temperature range: -40°C ... +65°C
- UL/cUL Class 1 Div 2 Hazardous location

Bluetooth applications
The Bluetooth BT EPA 2 modules replace individual Ethernet or PROFINET cables leading to automation devices with a reliable wireless connection.

They enable up to seven Bluetooth modules to be connected to the Ethernet network at the same time.

Possible areas of application
Bluetooth enables mobile devices to be integrated into industrial control networks wirelessly, thereby eliminating the need for expensive cable runs that are prone to wear:
- Robots and traveling robots
- Handling machines, packaging machines, pallet wrapping machines
- Moving machine parts
- Cranes and lifting equipment

Industrial Bluetooth on cranes
Wireless Ethernet

Industrial WLAN

Use industrial WLAN components for wireless machine access with smart devices or as a robust communication with mobile machine parts. Industrial wireless systems also provide for more flexibility and efficiency for reliable communication between controller and autonomous transport systems, warehouse shuttles or carry systems. The industrial WLAN components WLAN 5110 and WLAN 1100 support you with the implementation of high performance and modern MIMO technology.

Your advantages

- Create industrial WLAN networks easily and reliably
- Particularly secure, thanks to the latest security standards and encryption
- Ideal for networks with a large number of devices
- Maximum mobility, with fast roaming functions
- Suitable for time-critical applications, such as PROFINET or safety
Product overview Industrial WLAN

WLAN 1100 wireless module
IP54:
FL WLAN 1100 (EU) Order No. 2702534
FL WLAN 1101 (USA, CAN) Order No. 2702538

• IEEE 802.11 a/b/g/n, WLAN access point, client, repeater, frequency band 2.4 GHz and 5 GHz, MIMO technology 2x2:2, up to 300 Mbps, cluster management

WLAN 5110 access point
FL WLAN 5110 (EU) Order No. 1043193
FL WLAN 5111 (USA, CAN) Order No. 2988162
SD-FLASH 2 GB Order No. 1043201

• IEEE 802.11 a/b/g/n, WLAN access point, client, repeater, frequency band 2.4 GHz and 5 GHz, MIMO technology 2x2:2, up to 300 Mbps, cluster management

Possible areas of application
Wireless LAN is particularly suitable for implementing a system-wide wireless infrastructure:
• Mobile maintenance
• Electric monorail systems
• Automated guided vehicle systems and forklift trucks
• Storage and retrieval machines and warehouse shuttles
• Video monitoring

Typical WLAN network structure
The powerful WLAN 5110 and the compact WLAN 1100 are the perfect complements for wireless communication in the machine environment.

Connecting smart devices
The WLAN 1100 allows an easy connection of smart devices to machines and systems.

Wireless machine communication with industrial WLAN
Wireless machine operation and service with wireless LAN
Wireless Ethernet

Mobile routers for worldwide network access

Mobile routers enable high-performance remote connections to industrial Ethernet networks. This makes it possible to transmit sensitive data securely over networks from machines and systems. The integrated firewall and VPN (Virtual Private Network) support protect against unauthorized access.
Product overview 4G mobile routers

4G mobile routers (LTE)
TC ROUTER…
… 3002T-4G Order No. 2702528
… 2002T-4G Order No. 2792530
… 3002T-4G VZW Order No. 2702532
… 3002T-4G ATT Order No. 2702533
- Worldwide high-speed data links and alarm generation via 4G mobile phone networks
- Fallback to UMTS/HSPA and GPRS/EDGE
- Support for IPsec and OpenVPN (TC Router 3002T)

Industrial VPN gateways
TC CLOUD CLIENT…
… 1002-4G Order No. 2702886
… 1002-4G VZW Order No. 2702887
… 1002-4G ATT Order No. 2702888
- High security, thanks to a VPN tunnel to the mGuard Secure Cloud
- Pluggable configuration memory
- Can be used in Europe and North America
- Connection for key switch
- Cloud-based device configuration

Security routers 4G (LTE)
TC MGUARD…
… RS4000 4G VPN Ord. No. 2903586
… RS2000 4G VPN Ord. No. 2903588
… RS4000 4G VZW VPN Ord. No. 1010461
… RS2000 4G VZW VPN Ord. No. 1010462
… RS4000 4G ATT VPN Ord. No. 1010463
… RS2000 4G ATT VPN Ord. No. 1010464
- Easy configuration via central management tool
- Easy integration, thanks to integrated Ethernet switch
- Compatible with mGuard Secure Cloud

Data links
- Worldwide Internet data link via mobile phone networks at up to 150 Mbps
- Flexible use in small machines to larger system networks
- Secure VPN communication
- Mobile routers also available as cost-effective 3G versions

Remote maintenance via the Cloud
The mGuard Secure Cloud securely connects service personnel and remote maintenance locations via the Internet in the framework of an encrypted VPN complete solution. Service personnel connect quickly and securely to machines, industrial PCs, and controllers via a simple web interface. In addition, secure remote maintenance can be performed at any location and any time without requiring specialist IT knowledge.

VPN communication via the mobile phone network
Antenna installation – Basics and technology

Indoor applications

Directional antenna

The use of directional antennas is recommended at permanently installed, remote stations when large distances need to be covered with a line of sight. Directional antennas emit the transmission power in a specific direction. This increases the range and reduces the chances of interference from other users outside of the field of transmission. The higher the gain of a directional antenna, the smaller its field of transmission (opening angle). This means that the antennas need to be precisely aligned with one another.

Outdoor applications

Omnidirectional antenna

Omnidirectional antennas are used when the wireless modules are facing different directions or are mobile. As a result of their lower gain, they are more suitable for short to medium distances. In reflective indoor environments where there is no line of sight, the signal may be reflected from the sender to the receiver. In such cases, it is important to ensure that the omnidirectional antenna is not mounted immediately in front of reflective (metallic) surfaces.

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. In the case of multiple omnidirectional antennas, these should be installed with sufficient spacing.

Directional antenna

The use of directional antennas is recommended at permanently installed, remote stations when large distances need to be covered with a line of sight. Directional antennas emit the transmission power in a specific direction. This increases the range and reduces the chances of interference from other users outside of the field of transmission.

The higher the gain of a directional antenna, the smaller its field of transmission (opening angle). This means that the antennas need to be precisely aligned with one another.
Cables and adapters

Simplified antenna connection
All wireless modules with an RSMA connection are connected directly to the N connection of the antennas via a cable. Various cable lengths between 50 cm and 5 m are available.

Installation in an IP54 control box
A wireless module is connected with the SPD surge protection via an RSMA to N adapter cable. The SPD is used as the panel feed-through. The SPD is connected to the antenna with the N to N extension cable.

Installation in the Ex area
The impeding device makes the HF outputs of the wireless modules intrinsically safe (Ex i). It limits the ignition energy in the event of an error.

Planning a radio link
There should be a line of sight, especially in the event of longer distances, between the antennas of the wireless devices. To keep the Fresnel zone free from any obstacles, it may be necessary to mount the antennas a few meters high. This area should also be free from any other obstacles.

Obstacles outside or inside buildings
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 this case, it is recommended that you perform test measurements.

Inside buildings, in conventional automation environments, there is a predominance of reflections, which do not occur outdoors. They contribute to a good wireless connection even if the Fresnel zone is not free from obstacles.

The radius of the Fresnel zone corresponds to the desired antenna height. It depends on the frequency and the distance between the antennas.

Necessary antenna height depending on the distance

<table>
<thead>
<tr>
<th>Wireless path distance (d)</th>
<th>Antenna height (r) 868/900 MHz</th>
<th>Antenna height (r) 2.4 GHz</th>
<th>Antenna height (r) 5 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 m</td>
<td>4 m</td>
<td>2.5 m</td>
<td>1.5 m</td>
</tr>
<tr>
<td>500 m</td>
<td>6.5 m</td>
<td>4 m</td>
<td>2.5 m</td>
</tr>
<tr>
<td>1,000 m</td>
<td>9 m</td>
<td>5.5 m</td>
<td>4 m</td>
</tr>
<tr>
<td>2,000 m</td>
<td>13 m</td>
<td>8 m</td>
<td>5.5 m</td>
</tr>
<tr>
<td>4,000 m</td>
<td>18.5 m</td>
<td>11 m</td>
<td>8 m</td>
</tr>
<tr>
<td>10,000 m</td>
<td>29 m</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>20,000 m</td>
<td>41.5 m</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>30,000 m</td>
<td>50 m (900 MHz only)</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Note: Due to the laws of physics, the range and material penetration of obstacles for 868 MHz radio waves is twice as good as for 2.4 GHz.

Radius of the Fresnel zone depending on the frequency and distance. This gives the mounting height for wireless devices (antennas).
## Antennas

### 868 MHz

<table>
<thead>
<tr>
<th>Description</th>
<th>Gain</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>2 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2904802</td>
</tr>
<tr>
<td>Omnidirectional antenna, vandalism proof</td>
<td>2.5 dBi</td>
<td>N (female)</td>
<td>Temperature range: -40°C … +75°C, degree of protection: IP65, including mounting bracket</td>
<td>1090616</td>
</tr>
<tr>
<td>Omnidirectional antenna, salt water resistant</td>
<td>4 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2702136</td>
</tr>
<tr>
<td>Directional antenna for panel, saltwater-resistant</td>
<td>3.5 dBi</td>
<td>N (female)</td>
<td>Temperature range: -40°C … +75°C, degree of protection: IP65, including mounting bracket</td>
<td>2702137</td>
</tr>
<tr>
<td>Yagi directional antenna</td>
<td>8.5 dBi</td>
<td>N (female) with 0.6 m cable</td>
<td>N/A</td>
<td>2867814</td>
</tr>
<tr>
<td>Yagi directional antenna</td>
<td>12 dBi</td>
<td>N (female) with 0.6 m cable</td>
<td>N/A</td>
<td>5606614</td>
</tr>
</tbody>
</table>

### 900 MHz

<table>
<thead>
<tr>
<th>Description</th>
<th>Gain</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>2 dBi</td>
<td>N (female)</td>
<td>Temperature range: -40°C … +80°C, degree of protection: IP65, including mounting bracket</td>
<td>2904801</td>
</tr>
<tr>
<td>Omnidirectional antenna</td>
<td>2 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2904802</td>
</tr>
<tr>
<td>Omnidirectional antenna</td>
<td>5 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2867791</td>
</tr>
<tr>
<td>Omnidirectional antenna</td>
<td>7 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2867199</td>
</tr>
<tr>
<td>Yagi directional antenna</td>
<td>5 dBi</td>
<td>N (female) with 0.6 m cable</td>
<td>N/A</td>
<td>2867801</td>
</tr>
<tr>
<td>Yagi directional antenna</td>
<td>8.5 dBi</td>
<td>N (female) with 0.6 m cable</td>
<td>N/A</td>
<td>2867814</td>
</tr>
<tr>
<td>Yagi directional antenna</td>
<td>12 dBi</td>
<td>N (female) with 0.6 m cable</td>
<td>N/A</td>
<td>5606614</td>
</tr>
</tbody>
</table>

### 2.4 GHz

<table>
<thead>
<tr>
<th>Description</th>
<th>Gain</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>2 dBi</td>
<td>RSMA (male) with 1.5 m cable</td>
<td>Temperature range: -40°C … +70°C, degree of protection: at least IP65, including mounting bracket</td>
<td>2701362</td>
</tr>
<tr>
<td>Omnidirectional antenna, vandalism proof</td>
<td>3 dBi</td>
<td>RSMA (male) with 1.5 m cable</td>
<td>Temperature range: -40°C … +70°C, degree of protection: at least IP65, including mounting bracket</td>
<td>2701358</td>
</tr>
<tr>
<td>Bracket for wall mounting</td>
<td>–</td>
<td>For antennas with protection against vandalism</td>
<td>N/A</td>
<td>2885870</td>
</tr>
<tr>
<td>Omnidirectional antenna, salt water resistant</td>
<td>6 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2885919</td>
</tr>
</tbody>
</table>

### 5 GHz

<table>
<thead>
<tr>
<th>Description</th>
<th>Gain</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>5 dBi</td>
<td>N (female)</td>
<td>Temperature range: -40°C … +70°C, degree of protection: at least IP65, including mounting bracket</td>
<td>2701347</td>
</tr>
<tr>
<td>Directional antenna, dual slant</td>
<td>9 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2701348</td>
</tr>
</tbody>
</table>

### 2.4 GHz and 5 GHz

<table>
<thead>
<tr>
<th>Description</th>
<th>Gain</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>2.5 dBi at 2.4 GHz</td>
<td>N (male)</td>
<td>Temperature range: -40°C … +70°C, degree of protection: at least IP65, including mounting bracket</td>
<td>2701408</td>
</tr>
<tr>
<td>Omnidirectional antenna, vandalism proof</td>
<td>Up to 6 dBi at 2.4 GHz</td>
<td>N (female)</td>
<td>N/A</td>
<td>2702898</td>
</tr>
<tr>
<td>Directional antenna for panel, saltwater-resistant</td>
<td>9 dBi</td>
<td>N (female)</td>
<td>N/A</td>
<td>2701186</td>
</tr>
</tbody>
</table>
### Antenna cable

#### N (male) > N (male)

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m</td>
<td>0.3 … 6 GHz</td>
<td>2700677</td>
</tr>
<tr>
<td>3 m</td>
<td>0.3 … 6 GHz</td>
<td>2867649</td>
</tr>
<tr>
<td>5 m</td>
<td>0.3 … 6 GHz</td>
<td>2867652</td>
</tr>
<tr>
<td>10 m</td>
<td>0.3 … 6 GHz</td>
<td>2867665</td>
</tr>
<tr>
<td>15 m</td>
<td>0.3 … 6 GHz</td>
<td>2885634</td>
</tr>
<tr>
<td>6 m</td>
<td>900 MHz</td>
<td>5606125</td>
</tr>
<tr>
<td>15 m</td>
<td>900 MHz</td>
<td>2867225</td>
</tr>
<tr>
<td>30 m</td>
<td>900 MHz</td>
<td>2867238</td>
</tr>
</tbody>
</table>

#### RSMA (male) > N (male)

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m</td>
<td>0.3 … 6 GHz</td>
<td>2701402</td>
</tr>
<tr>
<td>1 m</td>
<td>0.3 … 6 GHz</td>
<td>2903263</td>
</tr>
<tr>
<td>2 m</td>
<td>0.3 … 6 GHz</td>
<td>2903264</td>
</tr>
<tr>
<td>3 m</td>
<td>0.3 … 6 GHz</td>
<td>2903265</td>
</tr>
<tr>
<td>5 m</td>
<td>0.3 … 6 GHz</td>
<td>2903266</td>
</tr>
</tbody>
</table>

### Accessories

#### Adapters and antenna splitters

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapters</td>
<td>0.3 … 6 GHz</td>
<td>N (female) &gt; N (female)</td>
<td>For the control cabinet feed-through</td>
<td>2867843</td>
</tr>
<tr>
<td>Adapter, 90° angled</td>
<td>0.3 … 6 GHz</td>
<td>RSMA (male) &gt; RSMA (female)</td>
<td>For control cabinets with little room</td>
<td>2904790</td>
</tr>
<tr>
<td>Antenna splitter</td>
<td>0.3 … 6 GHz</td>
<td>3 x N (female)</td>
<td>2-way splitter</td>
<td>2702293</td>
</tr>
</tbody>
</table>

#### Surge protection

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge protection</td>
<td>868 MHz, 900 MHz</td>
<td>N (female) &gt; N (female)</td>
<td>For the control cabinet feed-through</td>
<td>2803166</td>
</tr>
<tr>
<td>Surge protection, with Lambda/4 technology</td>
<td>2.4 GHz, 5 GHz</td>
<td>N (female) &gt; N (female)</td>
<td>For the control cabinet feed-through</td>
<td>2838490</td>
</tr>
</tbody>
</table>
# Product overview for antennas and accessories

## Accessories

### Leaky wave cable (LCX)

<table>
<thead>
<tr>
<th>Description</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaky wave cable 2.4 GHz</td>
<td>Longitudinal loss: 14.7 dB/100 m, coupling attenuation 95%; 60 dB, temperature range: -40°C … +85°C</td>
<td>2702553</td>
</tr>
<tr>
<td>Leaky wave cable 5 GHz</td>
<td>Longitudinal loss: 19.1 dB/100 m, coupling attenuation 95%; 71 dB, temperature range: -40°C … +85°C</td>
<td>2702860</td>
</tr>
<tr>
<td>Assembly tool</td>
<td>Planing tool for precise mounting of the connectors on the leaky wave cable</td>
<td>2702519</td>
</tr>
<tr>
<td>Connector</td>
<td>Connector for leaky wave cables N (female)</td>
<td>2702518</td>
</tr>
<tr>
<td>Cable tie</td>
<td>Mounting clamp for securing the leaky wave cable</td>
<td>2702520</td>
</tr>
<tr>
<td>Termination resistor</td>
<td>N (male) required for capping the open leaky wave cable end</td>
<td>2884978</td>
</tr>
<tr>
<td>Termination resistor</td>
<td>RSMA (male) for capping the open antenna port of the WLAN APs</td>
<td>2702702</td>
</tr>
</tbody>
</table>

### Antenna impeding device for the Ex area

<table>
<thead>
<tr>
<th>Description</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N connector, double-sided, 0.7 … 6 GHz</td>
<td>N (female) &gt; N (female)</td>
<td>Installation in the Ex zone 2, installation of standard antennas in zones 0, 1, 2</td>
<td>2702198</td>
</tr>
</tbody>
</table>

## Mobile communication accessories

### Omnidirectional antennas

<table>
<thead>
<tr>
<th>Description</th>
<th>Technology</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omnidirectional antenna</td>
<td>GSM/UMTS</td>
<td>2 m antenna cable with SMA round plug</td>
<td>2313371</td>
<td></td>
</tr>
<tr>
<td>Combined omnidirectional antenna with GPS</td>
<td>GSM/UMTS/GPS</td>
<td>2 m antenna cable, SMA for mobile communication, RSMA for GPS</td>
<td>2903590</td>
<td></td>
</tr>
<tr>
<td>Omnidirectional antenna</td>
<td>GSM/UMTS/LTE</td>
<td>5 m antenna cable with SMA circular connector</td>
<td>2702273</td>
<td></td>
</tr>
<tr>
<td>Omnidirectional antenna</td>
<td>GSM/UMTS</td>
<td>SMA circular connector (without antenna cable)</td>
<td>2313342</td>
<td></td>
</tr>
</tbody>
</table>

### Antenna cable

<table>
<thead>
<tr>
<th>Description</th>
<th>Attenuation</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 m</td>
<td>0.23 … 0.44 dB/m</td>
<td>SMA (male) &gt; SMA (female)</td>
<td>Impedance: 50 Ohm</td>
<td>2900980</td>
</tr>
<tr>
<td>10 m</td>
<td></td>
<td></td>
<td></td>
<td>2900981</td>
</tr>
</tbody>
</table>
### Mobile communication accessories

#### Angle adapter

<table>
<thead>
<tr>
<th>Description</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>90° adapter</td>
<td>SMA (female) &gt; SMA (male)</td>
<td>For connecting the GSM/UMTS antenna cable where space is restricted</td>
<td>2917324</td>
</tr>
</tbody>
</table>

#### Surge protection set

<table>
<thead>
<tr>
<th>Description</th>
<th>Connection</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment plug</td>
<td>SMA connector/socket</td>
<td>With Lambda/4 technology as surge protection for coaxial signal interfaces</td>
<td>2800491</td>
</tr>
</tbody>
</table>

#### Sealing tape

<table>
<thead>
<tr>
<th>Description</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 m</td>
<td>Self-vulcanizing, for external protection of adapters, splitters or cable connections, watertight</td>
<td>2903182</td>
</tr>
</tbody>
</table>

### Control box sets

#### For outdoor mounting

<table>
<thead>
<tr>
<th>Description</th>
<th>Features</th>
<th>Property</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set for constructing wireless systems</td>
<td>For industrial applications, IP65, with DIN rail, plugs, and screw connections, without devices</td>
<td>With omnidirectional antennas</td>
<td>1088098</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With omnidir. antennas and power supply unit</td>
<td>1088095</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With omnidirectional antennas and PoE splitter</td>
<td>1088097</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Without antenna accessories</td>
<td>2701204</td>
</tr>
</tbody>
</table>

### Radioline accessories

#### Configuration memory, memory stick, and USB cable

<table>
<thead>
<tr>
<th>Description</th>
<th>Connection</th>
<th>Frequency</th>
<th>Features</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration memory RF band 3</td>
<td>S-PORT</td>
<td>2.4 GHz</td>
<td>For easy and secure network addressing with unique network ID</td>
<td>2902814</td>
</tr>
<tr>
<td>Configuration memory RF band 5</td>
<td>S-PORT</td>
<td>2.4 GHz</td>
<td>For easy and secure network addressing with unique network ID</td>
<td>2902815</td>
</tr>
<tr>
<td>Configuration memory RF band 7</td>
<td>S-PORT</td>
<td>2.4 GHz</td>
<td>For easy and secure network addressing with unique network ID</td>
<td>2902816</td>
</tr>
<tr>
<td>Configuration memory RF band 1</td>
<td>S-PORT</td>
<td>868 MHz</td>
<td>For all Radioline front modules</td>
<td>2702197</td>
</tr>
<tr>
<td>Configuration memory RF band 1</td>
<td>S-PORT</td>
<td>900 MHz</td>
<td>For all Radioline front modules</td>
<td>2702122</td>
</tr>
<tr>
<td>Memory stick</td>
<td>S-PORT</td>
<td></td>
<td>Freely configurable</td>
<td>2902828</td>
</tr>
<tr>
<td>USB cable</td>
<td>USB / S-PORT</td>
<td></td>
<td>For diagnostics and configuration</td>
<td>2903447</td>
</tr>
</tbody>
</table>
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If your network is not working in accordance with your expectations, we will eliminate any faults. We will analyze your network and assist you and provide recommendations.

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