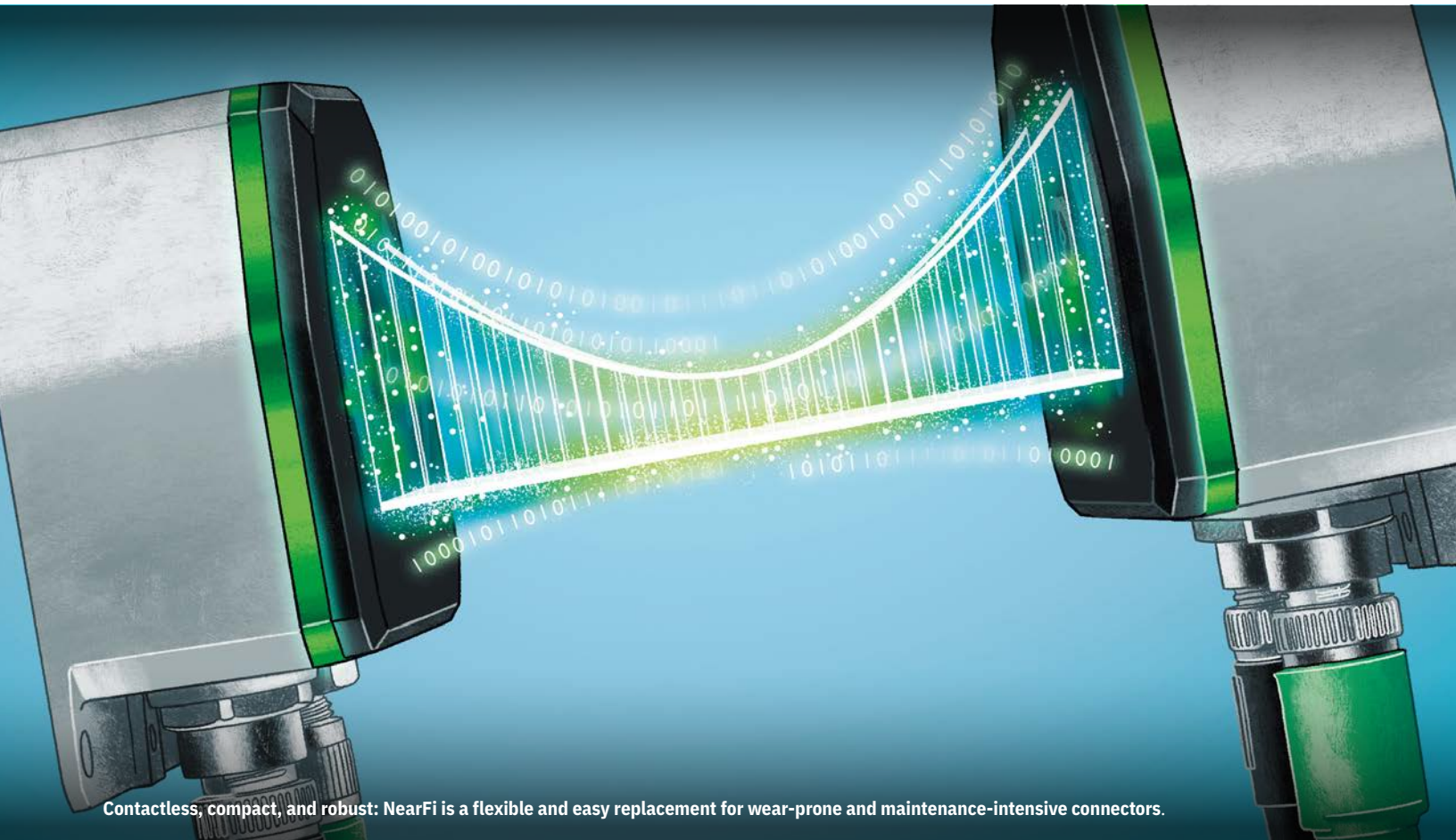




Contactless, compact, and robust: NearFi is a flexible and easy replacement for wear-prone and maintenance-intensive connectors.

Couplers for contactless power and data transmission

Protocol-independent communication in real time

Key takeaways:

- Traditional power and data connectors in automation can wear out from repeated plugging and unplugging
- NearFi, a new contactless technology, can transmit both power and data across an air gap
- These contactless couplers prevent the damage caused by connectors, which eliminates maintenance costs and increases system availability



Introduction

In industrial automation, connectors transmit most power and data. As these connectors are frequently unplugged and plugged back in, their contacts become misshapen and worn, reducing their service life. This leads to unplanned or unforeseeable production stoppages and regular maintenance intervals. Contactless real-time communication systems, such as the NearFi couplers developed by Phoenix Contact, can now solve many of these problems.

Automotive production is one example of the type of wear that connectors experience. Each day, hundreds of insertion cycles are performed between a robot arm and its interchangeable tools. This is due to the increasing automation of processes.

Robotic arms need more advanced capabilities and the ability to control a wide range of tools automatically. Due to the high insertion cycles associated with tool changes, the utilization period of connectors is significantly reduced because the contacts become burnt, dirty, or misshapen with the constant interchange of tools. The resulting stoppages cannot be foreseen or planned. The costs of regular maintenance intervals, used as a preventive measure, can quickly add up to a seven-figure sum.

Connectors are also often used in automated guided vehicle systems, rotating and rotary tables, and applications involving slip rings. Until now, the available solutions have either performed inadequately, been prone to errors, or required intensive maintenance, making operation expensive (Figure 1).

Contactless power and data transmission across an air gap is the perfect solution here. This approach enables wear- and maintenance-free connections while allowing transmission through glass or other non-conductive media. This technology opens up a wide range of possible applications. One example is the contactless inclusion of inaccessible and hard-to-reach areas such as enclosed control cabinets, high-voltage areas, or cleanrooms. ■

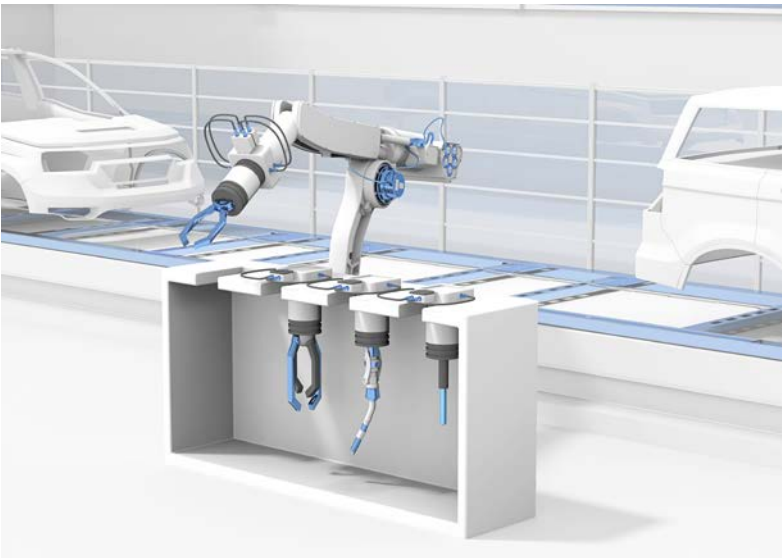


Figure 1: Tool change on an industrial robot.

Bit-oriented full duplex communication

Most data transmission in industrial automation is based on Ethernet (100 Mbps). Some protocols, like PROFINET IRT, Sercos, and EtherCAT®, are referred to as “real-time protocols,” and they require communication with very low latency. This development is driven by the challenges associated with digital production and the goal of cost-effective manufacturing in a batch size of one. In addition, companies need to ensure global competitiveness and efficiency across the entire value-added chain, from development to the end user.

Today, a contactless Ethernet connection with no appreciable latency is possible. Data exchange is based on wireless 60 GHz communication in the near field. This enables bit-oriented transmission, also used in fiber-optic communication.

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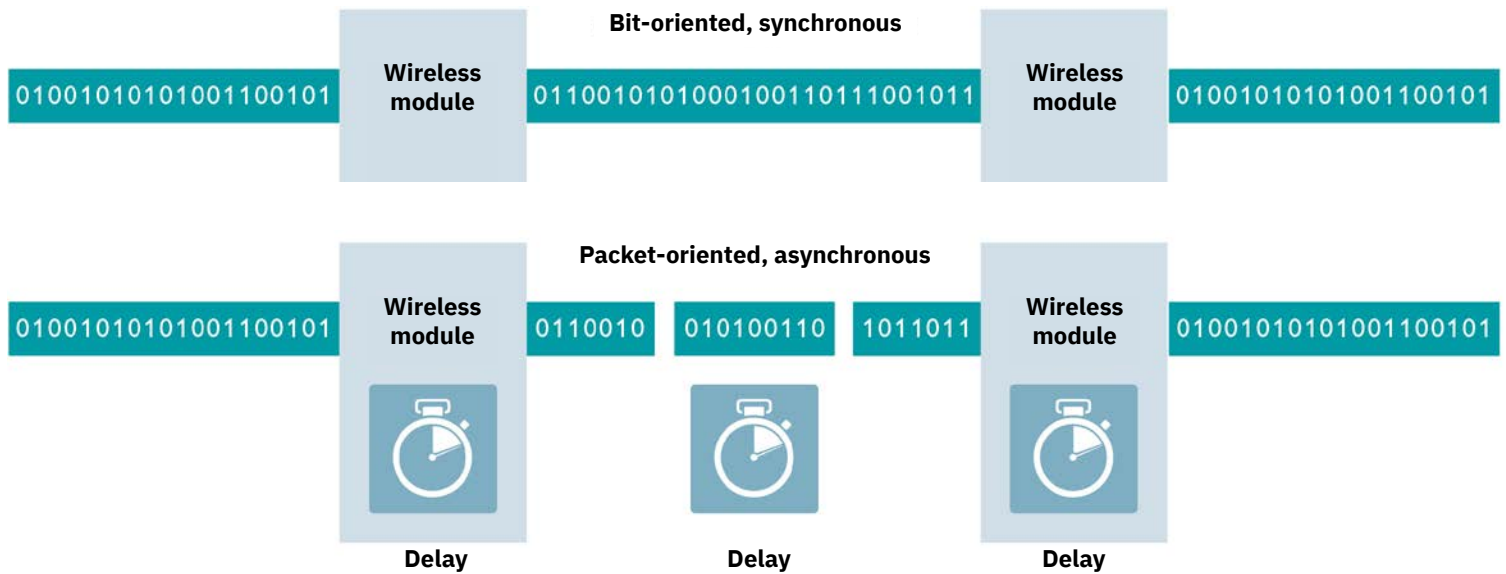


Figure 2: Bit-oriented synchronous transmission versus packet-oriented asynchronous transmission.

All other established wireless transmission technologies use a packet-oriented method to forward data, resulting in considerable latency. Packets first need to be received, repackaged, and sent wirelessly. It's a similar process at the receiver end, where the packets need to be received, unpackaged, and output again. This process involves many asynchronous and latency-causing operations, which the new communication technology completely eliminates. Transmitting real-time Ethernet protocols requires full duplex forwarding, or simultaneous data exchange in both directions. This also presents a problem for many wireless technologies, such as WLAN or 5G (Figure 2). ■

Less than 1 μ s latency

In the new contactless solution, two 60 GHz connections (an uplink and a downlink) are used in parallel on separate frequency bands to enable full-duplex operation. For comparison, WLAN generates a latency of around 10 to 20 ms (10,000 to 20,000 μ s) for Ethernet communication. 5G is aiming for 1 ms (1000 μ s) in the future.

The new contactless Ethernet technology, on the other hand, offers a latency of less than 1 μ s, making it around 1,000 times faster than 5G. In addition, it allows contactless and almost latency-free Ethernet transmission up to 100 Mbps in real time and works independently of a protocol. This makes the technology suitable for future developments (Figure 3).

Wireless communication in the near field takes place over a very small distance, so there is virtually no interference

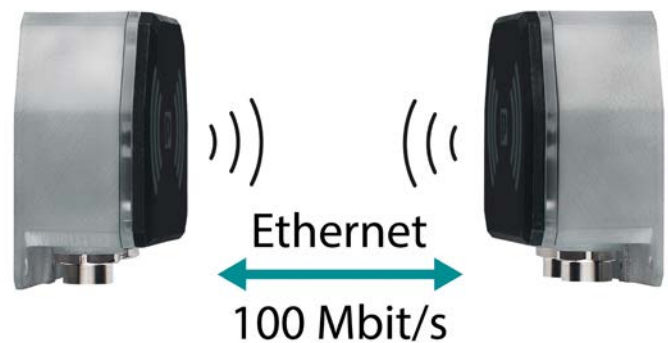


Figure 3: Real-time communication.

spectrum in the vicinity of the devices. Numerous systems can be used in parallel and coexist with existing wireless technologies, such as WLAN or Bluetooth. Industrial interference spectrums, such as those that occur with arc welding, likewise cannot influence the contactless technology.

The first use of this new technology is available in contactless couplers that can transmit 50 W of power (24 V, 2 A) and real-time Ethernet data across an air gap of up to a few centimeters. Due to the robust IP65 housing with M12 Ethernet and power connections, the couplers can also be used in demanding environments (Figure 4). ■



Figure 4: The contactless couplers also resist dust and dirt.

Constant power of 50 W

Power transmission is inductive. The base coupler generates a magnetic field via a coil, which is induced in the coil of the remote coupler. Active closed-loop control always selects the best possible parameters for power transmission. This means that the power is kept at a constant 50 W over the entire operating range. End devices, such as I/O stations or switches, can therefore be supplied with power without contact. Coupling is automatic, eliminating the need for configuration or programming.

In contrast to standard connector solutions, base and remote couplers can be positioned to face each other from any direction and even rotate relative to each other. The user does not need to center the devices exactly; they can face each other with an offset or at a tangential angle. This greatly reduces the degree of precision required for the mechanical movement of two independent system parts. In the case of a connector, the positioning of the male and female connectors must be extremely precise. Otherwise, the sensitive pins can quickly become damaged.

Rotating applications occasionally use slip rings or optical rotary transformers. Both systems involve significant mechanical wear. In addition, they must be manufactured to a very precise standard, which drives up costs and failure rates.

With contactless couplers, the straightforward, flexible positioning of the base and the remote device is enough to ensure reliable, wear-free transmission. The couplers are secured directly or using mounting brackets from three different sides with M5 or M6 screws. This enables universal and flexible mounting. ■

Decreasing expenditure with optimized production processes

Phoenix Contact's contactless NearFi couplers can reduce the number of service call-outs required, and eliminate maintenance costs. Lower costs and optimized production processes significantly shorten the devices' amortization period. The end result is higher system availability. ■

More information: <https://www.phoenixcontact.com/en-us/products/industrial-communication/industrial-wireless/near-fi-coupler>

About Phoenix Contact

Since 1923, Phoenix Contact has created products to connect, distribute, and control power and data flows. Our products are found in nearly all industrial markets. Sustainability and responsibility guide every action we take, and we are proud to collaborate with our customers to empower a smarter and better world for future generations. Together, we are creating a sustainable world based on our passion for technology and innovation.

For more information about Phoenix Contact or its products, visit www.phoenixcontact.com, call technical service at **800-322-3225**, or email us-info@phoenixcontact.com.



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