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RELIABLE WIRELESS TECHNOLOGIES FOR INDUSTRIAL APPLICATIONS

Cabled communication may be the industrial standard and yet many different applications exist where cables can be a nuisance, or more of an effort, or simply not an option. In such cases, a good alternative is “on air” communication, in other words remote control. This white paper describes typical applications where the question “Cabled or wireless?” requires serious thought. And it presents some wireless systems which have been developed for just such applications.

Remote devices in private households and industry

In the electronics consumer market, local remote applications have become the norm. Examples include: TV remotes, Wi-Fi, remote car keys, garage door openers, non-contact payment... Different standards are available: Wi-Fi, Bluetooth, RFID, NFC and more.

In industry, standards of e.g. availability are naturally higher than in private households, and with good reason. Interference is also more of a problem, longer ranges are necessary, and the coexistence of different wireless systems must also be guaranteed.

Then there are demands specific to certain branches of industry, e.g. short response times and low power consumption. Depending on the customer profile, explosion protection and/or machine safety could also be important criteria.

Point-to-point connection or wireless network?

One major decision when implementing wireless technology in industry is that between a point-to-point connection, suitable for a relatively small number of end devices, or a wireless network incorporating many participating devices. This white paper concentrates on wireless switching devices designed for point-to-point connections. Selection criteria for wireless networks in industry are described in more detail in a different white paper:

https://www.nexy.net/de/service/whitepapers.htmln.

Typical applications for wireless switchgear

Experience gained by the steute business unit "Wireless" has shown that the range of industrial applications for its wireless switching devices using sWave® technology is exceptionally broad, but also that the applications fall into "clusters" or typical profiles. These profiles will be described further below.

Rotating elements

sOn the turntables of machine tools, both the tensioning elements and the work pieces must be monitored to ensure correct tensioning. Using wireless switches (e.g. to detect the end position of a tensioning element) makes it possible to eliminate slip rings, which are susceptible to wear and tear.

Wireless switches can similarly detect the position of materials on a turntable, or the position of the turntable itself.

Multi-dimensional moving elements

TWith robot arms and other moving three-dimensional handling equipment, the cabling to the grabber, tool or load handling attachment is particularly complex. External cable bundles (subject to wear and tear) with 3D chain guides are required – or a wireless solution.

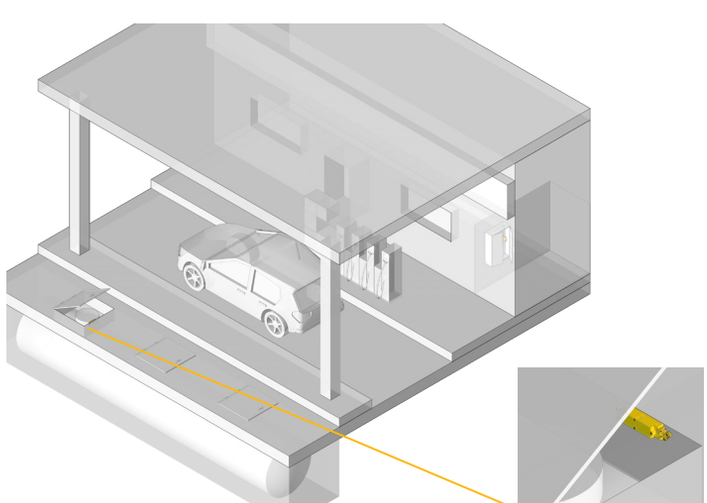
Companies already opting for wireless switches and sensors in this field include manufacturers of loading systems and mobile cranes, as well as of assembly and handling systems.

High cost of indoor installations

Sometimes the cost of installing a cabled industrial switch is far higher than the cost of the switch itself. A simple example is a pull wire switch mounted from the ceiling and used by factory workers and forklift drivers to open and close a rolling gate. And it is often the case for switchgear installed along lengthy assembly lines. In contrast, a wireless switch can be installed quickly and easily anywhere.

Extensive outdoor distances

The mismatch between installation and device costs can be even more extreme outdoors, e.g. in applications such as alarms for fuel depots or access controls for outdoor plants. Here wireless systems present a much simpler and more affordable solution.

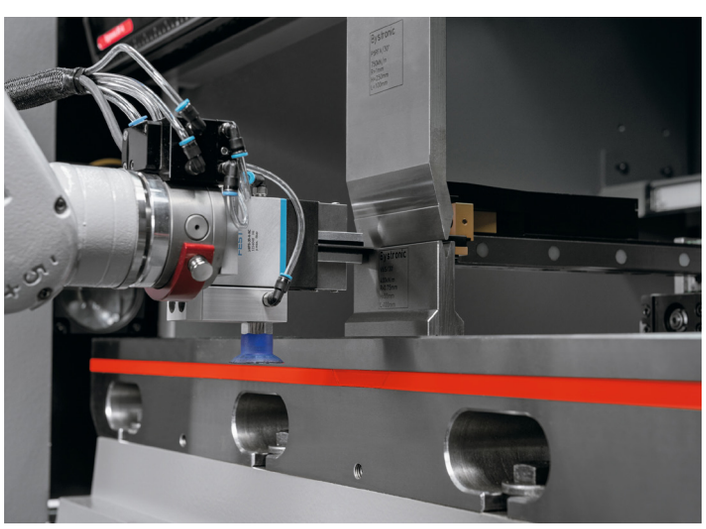


Mobile applications

Wireless control panels have become established in intralogistics. Operators can carry them around and use them to confirm consignments, for example. Or they are mounted on forklift trucks to open gates, or also to confirm orders. Other application examples include wireless wheel chocks to stabilise lorries on ramps and – moving away from intralogistics – mobile control panels for the flexible setting up of machines.

Modular machinery

Increasingly, the design of new machines is modular. One example: a leading press brake manufacturer has designed its machines with the extra option of being driven by a handling device (robot) with its own tool magazine, making it possible to run some shifts without human operators. The magazine is locked into place mechanically and communication with the machine is by remote control.



Risk of cable damage

In hot working environments, such as foundries or welding stations, foot switch cables can be damaged by boiling splashes or weld spatter – a frequent occurrence in practice. Sheet metal processing involves the additional risk of a cable being sliced by a falling sheet of metal. In cases such as these, wireless foot controls minimise the risk of interrupted production due to damaged cables.

Ergonomic comfort and safety

When foot controls are used to operate large-scale machines (e.g. press brakes), wireless switches improve both ergonomic comfort and operational safety. There is no risk with a wireless control that an operator walking beside the machine could trip over a cable, and the controls can also be positioned far more freely and easily.

Counting

Production lines are often fitted with counters which continuously communicate the number of parts produced or used. Wireless position switches with tactile springs or wireless sensors are a good choice here. They can be mounted anywhere, as required.

Less accessible areas inside buildings

BNumerous applications for wireless switching devices exist inside industrial and administrative buildings – for example the monitoring of ventilation flaps, the position monitoring of emergency exits, or the position monitoring of overhead lights. The advantage of remote communication is the simple and flexible installation of the switches and sensors: no cables need to be laid.

Applications without power supply or signals

The monitoring of valves and accessories in chemical production plants or energy management (oil & gas) facilities is often impeded by the fact that there is no power supply nearby. The same is true for inspection shafts at fuel depots and mooring systems in ports. In all such cases, wireless switches and sensors – often in "Extreme" versions because of the adverse ambient conditions – offer considerable advantages over cabled variants.

System structure: wireless switching device plus wireless receiver

In simple terms, the sWave® wireless system used in these applications comprises three components:

- a wireless switching device
- a wireless receiver inside the control cabinet
- an antenna.

The wireless switching device is in turn made up of a basic switching device (usually a derivative of a cabled switch) and a radio module.

These wireless switching devices are available in different designs and cover the entire range typically found within industry:

- position switches
- pull wire switches
- foot switches
- sensors
- command devices.

The receiver units differ, for example according to the number of wireless switching devices connected to the central control unit.

Radio module: integrated or separate?

In most wireless switching devices from steute, the radio module is integrated in the housing. Elimination of e.g. cable entries creates the space necessary for the antenna.

In addition, however, steute also offers compact wireless universal transmitters which enable conventional switches, e.g. position switches (also from other manufacturers), to be made suitable for radio transmission. The transmitter makes the connection to the sWave® receiver unit via an external floating contact.

Wireless technologies also differ

Depending on the application profile, different sWave® wireless technologies are available, all of which have been adapted to industrial conditions and requirements. They differ with regard to e.g.:

- range
- frequency (868/915 MHz, 2.4 GHz, etc.)
- power supply (disposable/rechargeable batteries, self-sufficient)
- transmission/response times
- communication protocol (bidirectional with and without keep-alive signal)
- special requirements (machine safety, explosion protection).

The modular design of the wireless switching devices means that the different switch types can be freely combined with the different wireless technologies, described in more detail below. This construction principle also means that cabled switches from other manufacturers can be retrofitted with the steute radio module, considerably broadening the range of applications for wireless switches and sensors in combination with steute wireless technology.

Brief overview: wireless technologies

sWave® 868/915 MHz B (battery operation)

This standard offers long ranges of up to 50 m indoors and 700 m outdoors. It permits bidirectional communication with high transmission reliability: there is no interference with DECT, WiFi, PMR or other systems, and its brief duty cycle (-> short telegrams) means that the signal collision probability is extremely low. An integrated long-life battery guarantees a long period without any battery changing.

The licence-free radio frequency has been adapted to meet the stipulations of individual countries/markets, meaning that this wireless technology can be used all over the world – in combination with electromechanical switching devices, command devices and also non-contact sensors.

sWave® 868/915 MHz E (self-sufficient)

With electromechanical switching devices, the sWave®-868/915-MHz wireless technology can also be implemented self-sufficiently. An electrodynamic energy generator converts the kinetic energy produced when actuating the plunger into electrical energy.

sWave® 2,4 GHz

With sWave® 2.4 GHz, steute has developed a wireless system which guarantees extremely robust and reliable signal transmission in shorter ranges (up to approx. 15 metres). With regard to coexistence, e.g. alongside WiFi Bluetooth, the system has been adapted to industrial requirements. Additional features include low power consumption (and thus longer battery lifetimes), short connection times after “power on” (< 200 ms), as well as short data exchange times (20 ms).

A special "pairing" procedure facilitates disturbance-free parallel operation of multiple transmitter and receiver units. "Frequency hopping" using the FSK (frequency shift keying) procedure with eight channels in four frequency groups is one of the technologies which ensure high reliability of the wireless signal transmission. A typical application using sWave® 2.4 GHz is communication between foot controls and their assigned receivers.

sWave® 2,4 GHz-safe

The wireless system sWave® 2.4 GHz on the licence-free 2.4 GHz waveband has been augmented for machine safety applications. It is suited to e.g. the integration of safety foot switches in SIL 2 safety circuits acc. to IEC 62061, and PL d acc. to ISO EN 13849.

"Wireless Ex" with sWave® 868/915 MHz

In order to exploit the advantages of wireless technology in explosive zones, steute has also had its sWave®-868/915-MHz wireless system tested and approved for gas-Ex zones 1 and 2, as well as dust-Ex zones 21 and 22. In Ex zones, wireless technology has even more advantages because the complex Ex-approved cable entries can be eliminated, and because the Ex switch transmits to a receiver located outside the Ex zone, which means that the receiver does not have to be an Ex device. For maintenance the battery can be changed inside the Ex zone.

In addition to multiple Wireless Ex switchgear series (position, foot and pull wire switches, as well as command devices) with integrated radio modules, the steute Ex range also includes Wireless Ex sensors with a separate Wireless Ex universal transmitter (Ex RF ST). The sensors are supplied with power via the transmitter unit. A typical application for wireless position switches and wireless sensors with "Wireless Ex" technology is the position monitoring of valves and other accessories and instruments in process engineering plants and energy management facilities.

Third-party devices in the wireless system

The modular design of the steute switching devices permits not only an almost unlimited combination of switch and radio module; it also facilitates the integration of switches from other manufacturers in the wireless system, made possible by the universal transmitter units.

Alternative: a wireless network

BIn addition to the wireless technologies described here for point-to-point connections in industrial applications, there is also the possibility of an industrial wireless network. Such networks are ideal when many participating devices need to communicate remotely. Typical examples include AGV (automated guided vehicle) fleets and eKanban systems.

Such networks can also be realised on the basis of sWave® technology. Special features of "nexy" wireless networks include simple connection to the superordinate IT infrastructure via a Sensor Bridge and the possibility to operate multiple applications (e.g. AGV fleets and eKanban) in one and the same network.

Conclusion: the right solution for many different applications

This overview shows: wireless systems can be the right solution for many different industrial applications. Wireless standards, systems and components exist which have been developed especially with industrial tasks in mind. Users have the choice between different systems designed for particular fields and environments.

Faced with the question "Cabled or wireless?", users should not be put off by the apparent complexity of a wireless solution. Setting up a point-to-point wireless connection is very easy and – as shown in this white paper – offers many advantages in practice. By investing just a minimum of planning effort, users can profit from these benefits long-term.

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