

Wireless Switches Offer Unlimited Benefits

A Honeywell Whitepaper

Global limit switches are an essential element of industrial controls, monitoring position and presence of doors, booms, valves, and the like. Conventional wired switches, however, present installation and maintenance challenges, especially in installations that are subject to harsh environments or involve movement in the wiring. Honeywell's new Limitless™ Series of wireless switches frees applications from the restrictions of wired installations while offering higher reliability and lower lifetime cost for a wide range of industrial monitoring applications.

Wireless Technology Opens the Door

During the last decade the telecommunications industry has made phenomenal advances toward replacing wired connectivity with wireless. As the technology evolved, it overcame both technical challenges and political barriers to deployment. A variety of fully defined and robust networking protocols emerged that function well over these wireless technologies. Government agencies worldwide settled frequency allocations and regulatory issues to allow worldwide operation of those wireless networks.

These advances in wireless telecommunications have opened the door for applications beyond telecommunications to “cut the cord” and to go wireless.

For instance, one of the protocols that arose, the IEEE 802.15.4 standard, fully defines a robust wireless personal area network (PAN) that specifically targets low-power, low-bandwidth signaling from switches such as those commonly utilized in industrial monitoring and control. Further, wireless telecommunications spurred semiconductor design and manufacturing to develop highly integrated, low-power RF components for wireless communications.

As a result of these achievements it is now possible to cost-effectively convert to wireless a basic component in industrial monitoring: the limit switch.



Limit switches are used in everything from crane booms to gates, lifts to storage tanks — anywhere there is a need to sense the presence, absence or position of a moving object. Making these switches wireless addresses an unserved customer need for lowered cost and increased installation options for limit switches, giving early adopters a competitive advantage in the design of next-generation industrial equipment.

Benefits of Wireless Switching

Wireless limit switches can lower equipment costs in a variety of ways. For one, the cost of manufacturing and installation is reduced. Not only is the expense of wiring eliminated, there are no conduits, clips or connectors required to place a limit switch where it is needed. There are no wire routing problems to solve, no need for pulling wire during installation and fewer restrictions on location and placement of the limit switch.

Wireless limit switches can also reduce maintenance costs. Equipment wiring is less complex with the elimination of wired switches from the mix, simplifying troubleshooting and reducing commissioning time. Further, going wireless increases system reliability by eliminating the potential for having issues with switch wiring or connectors. Switches also become simpler to replace, with no need to disconnect and re-attach wiring and no risk of incorrect wire attachment.

The advent of wireless limit switches also provides equipment developers with an expanded range of applications. By using wireless, designers can now place switches in locations where it is impractical or impossible to run wires back to the control console. They also can increase their design's flexibility by allowing switch positioning to adapt to installation requirements, even if that position must be modified over time. Wireless connectivity even simplifies the retrofit of existing systems with additional limit switches as needed for improved functionality or to meet new regulatory requirements.

Honeywell's Limitless™ Switch Overview

Such wireless limit switches have now become available — Honeywell's Limitless™ Series. The first members of the family are IEC Type WGLA switches based on Honeywell's proven MICRO SWITCH™ products that are fully-integrated with intelligent RF transceivers in industrial, environmentally-sealed enclosures.

The switches operate by communicating their position changes to a monitoring receiver that handles multiple switches in a star-configuration network. Every network, and each switch within the network has a unique identification number. These identification numbers allow a switch and its associated monitor to encode their signals so that the communications link between them is both private and virtually immune to crosstalk from other switches or networks.

Limitless™ Switch enclosures are designed for ease of installation and support multiple head and lever options to serve a wide variety of position and actuation requirements. Side rotary, top plunger, top roller and top roller lever versions are available with mechanical and switching characteristics similar to corresponding MICRO SWITCH™ devices.

The antenna connection also offers several options. Antennas can connect directly to the enclosure using either a straight or adjustable-elbow mounting. Antennas can also be mounted remotely via a coaxial cable (up to 11 foot) so that the switch and antenna can both be mounted in optimum locations. Antennas are available in a variety of gain configurations to support different operating ranges.

The radio link in Honeywell's Limitless™ Switches targets single-room and outdoor installations with a relatively open line-of-sight between switch and monitor. A 35 dB link margin ensures that minor obstacles or even intense precipitation will not compromise communications, and that the link can penetrate intervening walls in some installations.

The link's allowable operating range is more than 1000 feet in North America and Canada. Signal restrictions in Australia and the European Union yield an operating range in those environments of 304 meters. Heavy precipitation, rain or snow, can reduce range by approximately 75 feet (23m).



To ensure reliable operation, Honeywell's Limitless™ Switches operate under battery power rather than depending on situation-dependent and expensive energy scavenging. The widely available, industry-standard batteries provide switches with an average operating lifetime of one to two years depending on use. When required, battery replacement is a simple operation.

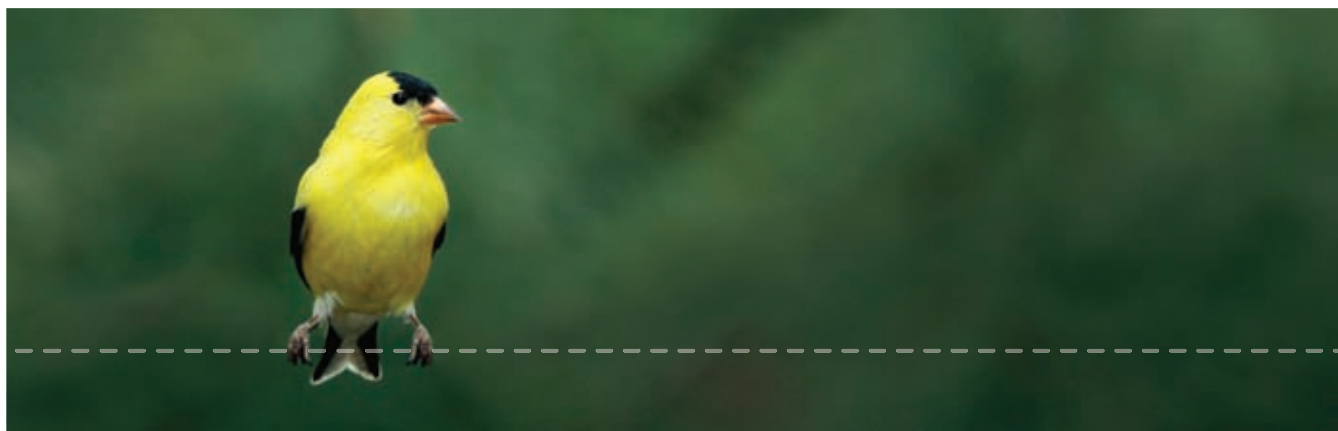
The WGLA Series is the first in the planned family of Limitless™ Switches and support products, many of which are already in development and scheduled for release during 2010. The scheduled introductions include the WHDLS family for heavy-duty use and the WBX series for use in hazardous environments.

The monitor/receiver unit that forms the other half of a Limitless™ Switch installation can support multiple switches, which are easy to add, delete or reconfigure. The unit is available in either DIN Rail receiver or panel-mounted monitor options and provides audible buzzer, LED visual, and NPN transistor-driven electronic indications of switch behavior to a user or control system. Monitored behaviors include switch activation, loss of switch signal, and low-battery conditions for all switches.

Making Wireless Worry-Free

The design of the Limitless™ Switch family provides developers with worry-free wireless operation.

For example, the communications protocol used in the Limitless™ Switch family is based on the internationally accepted IEEE 802.15.4 wireless PAN standard, which defines a low-duty wireless signaling scheme targeting basic instrumentation and control applications. The standard has been in place for a number of years with several generations of RF devices already deployed. As a result, the IEEE 802.15.4 specifications are both robust and field proven to eliminate crosstalk between network links as well as being resistant to interference from out-of-network users in the same frequency band such as Bluetooth™ and portable phones.



Because the Limitless™ Switches use a PAN standard, their operation is distinct from and independent of familiar wireless LAN systems. There is no exchange of information or other interaction between a PAN and the LAN, so there is no need for corporate IT department involvement. Further, the PAN systems are independent of one another. So, for example, if two construction cranes instrumented with Limitless™ Switches work the same site, there is no risk of interference or interaction.

Limitless™ Switches operate in the 2.4 GHz band using low-power, short-duration signaling as specified in IEEE 802.15.4. Because the radio spectrum and power levels are approved for unlicensed operation worldwide, system developers do not need to be concerned with such things as compliance testing. The RF components in Limitless™ Switches possess FCC, IC, ACMA and CE certification.

The Limitless™ Switch network structure is a simple star configuration with each switch in the network communicating with a single monitor/receiver. Communications links are point-to-point between switch and monitor; there is no signaling between switches. This network architecture keeps the switches isolated from one another so there is no opportunity for the behavior of one switch to affect the behavior of any other.

To enforce the isolation of their communications links, Limitless™ Switches require registration with their network monitor. The registration or “pairing” process is simple and needs be performed only once to establish the linkage. Once established, the “pairing” persists even through power loss to the monitor or battery replacement in the switch. This not only keeps system maintenance simple, it ensures that the network is self-healing. The monitor is able to automatically re-establish any dropped link to a registered switch.

The registration process pairs the switch and the monitor, establishing both the communications link’s uniqueness and its security. To create a pairing, the switch installer must have physical possession of both the switch and its monitor unit. The installer first presses a tactile switch on the monitor housing.

Then, within a 30-second window, the installer presses a tactile switch within the Limitless™ Switch housing to complete the pairing process.

Security Assures Reliable Operation

This pairing follows the security techniques outlined in IEEE 802.15.4. When registration is activated the monitor provides the switch with several pieces of information. The first is the monitor’s individual 16-bit network identification number, which the monitor chooses at power-up to avoid conflict with other networks in the vicinity. The second is a unique 16-bit address for the switch, which the monitor creates. The third piece of information is a 128-bit encryption key that the pair will use to encode their future communications. Once the information is exchanged, the switch and monitor use it to address and encode the signals they exchange.

The combination of addressing and encryption ensures the uniqueness and security of each switch’s communications channel. No two monitors have the same network address, so monitors and switches will not respond to signals originating in other networks. No two switches have the same address, so a monitor cannot confuse signals within its network nor can switches respond to signals intended for other switches. No switch has another switch’s address, so switches will not react to one another’s signals.

Even if an addressing error occurs somewhere, the network will not react to the erroneous signal because the encryption keys for decoding the message will not match. The use of encryption further ensures that no unregistered node can successfully insert erroneous signals into a network or decode signals from a network, making the network secure from both eavesdropping and sabotage.

Once a switch and monitor have been paired, the two continually exchange information as long as both have power. The switch sends a switch position message to the monitor each time the position changes, accompanied by a “health”

status message that indicates battery level and RF signal strength. In addition, the switches send out "health status" messages at regular intervals. This interval is typically 30 seconds but is configurable to meet specific installation needs; however shorter intervals can reduce battery life.

Honeywell's Limitless™ Switches series thus frees industrial equipment developers and users from the costs and restrictions of wired switch solutions and expands the range of possible uses and placement of switches. The commissioning and lifetime cost of switches drops while reliability and integrity rise.

And this is only a beginning. The world is becoming wireless in its telecommunications, and the signaling of switches and sensors in industrial systems will surely follow the same path. The time for developers to start moving along that path is now, with Honeywell's Limitless™ Switches.



Find Out More

To learn more about Limitless™ wireless limit switches, contact a Honeywell representative today at **1-800-537-6545** or visit **www.honeywell.com/limitless**

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