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Unwired Switches Are Wireless Without Batteries

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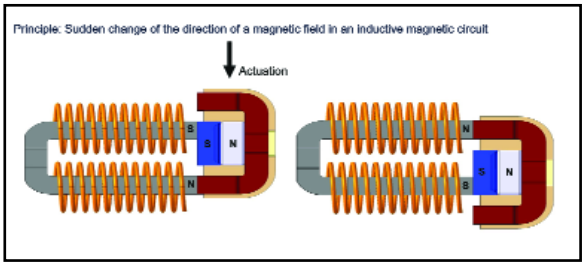
Switches that operate without wired connections or batteries are now available from Cherry, a brand of ZF Electronic Systems Pleasant Prairie, LLC. The switches use the physical actuation of the switch as the source of power, harvesting energy through an innovative penny-size micro-dynamo generator within the body of the switch. These components ease the implementation of remote switches without the need of running connecting wires, in the process simplifying product design and certification. These new switches do not require periodic battery checkups and changes, and do not suffer battery-related switch failures.

Inside the switch housing, the micro-dynamo magneto-electric generator is joined by a controller, a digital modulator, and a radio. The radio can be configured for a variety of different frequencies, including those common to home, office, and plant automation systems. The first of these switches are available in snap-action or rocker configurations and others can be produced to meet customer requirements. One under current discussion is a cylindrical plunger that can be installed in a simple bore-hole to indicate the open or shut status of doors or windows, for example.

The micro-dynamo generator will also be available separately from the switches. The generator is rated for a mechanical lifetime of 100,000 actuations with measured energy of 0.33mW (actuating and releasing). The RF transmission distance is rated to 300m in open space, and to 30m indoors with any type of obstruction.



Energy harvesting in Cherry switches.

Over the past year, Cherry has distributed an engineering kit to customers interested in evaluating these switches for their applications. Front-runners among these applications include home and industrial automation, door and window applications involving security and alarm functions, foot pedal applications, medical devices, remote door and gate access applications, and lighting control.

Two Receivers Offered

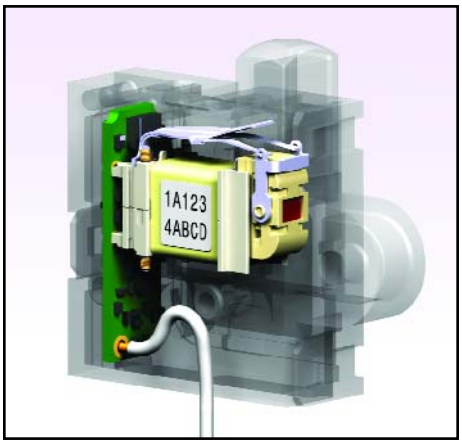
The company is initially offering two companion receivers: one is a simple module with a wire antenna and the other is more complete, with a housing and a transistor-transistor-logic (TTL) level, RS-232 output interface. The firm is supplying this product through authorized distributors with the following SKUs initially available:

- AFIS-5002, an energy harvesting snap switch.
- AFIS-5003, an energy harvesting rocker switch.
- AFIG-0007, an energy harvesting generator.
- AFIM-5002, an energy harvesting generator with RF electronics, ZF protocol, and wire antenna.
- AFZE-5004, a receiver module only, with wire antenna.
- AFZE-5003, a receiver module with housing, TTL level RS-232 output interface, and wire antenna.

Cherry plans to expand the product line to include lever and roller actu-

ators, a wall-mountable rocker for lighting control, and an embeddable plunger switch.

Wireless radio compatibility will expand beyond the proprietary ZF (the parent company of Cherry) company protocol for which receiver products are now available to include KNX, EnOcean, and potentially Zigbee and Z-Wave protocols; others are possible pursuant to customer requirements. While these switches are



Snap action energy harvesting switch. The wire hanging from the bottom is a short antenna.

almost entirely wireless — wiring is not used in any electrical sense for these switches —each switch sports a short length of insulated wire that extends from its case. This is an antenna, and it works best when not shielded by a surrounding grounded housing.

High Current Control

These wireless switches should be particularly appealing to designers of high-current control systems. There is no need to route high currents through the switches, and designs can place companion receivers conveniently close to high-current control points. For applications exposed to corrosive environments, including maritime applications, the sealed body of these switches and the absence of exposed contact points contribute to longer-term reliability than traditional switches. For applications requiring inherent safety, the extremely low currents and complete absence of arcing within these switches permit their placement away from safety-sealed controlled systems.

The total cost of ownership of systems implementing these wireless switches will benefit from the absence of batteries. Battery replacement costs will be much less of a factor than the costs of labor associated with battery status checks, battery maintenance, or battery replacement.

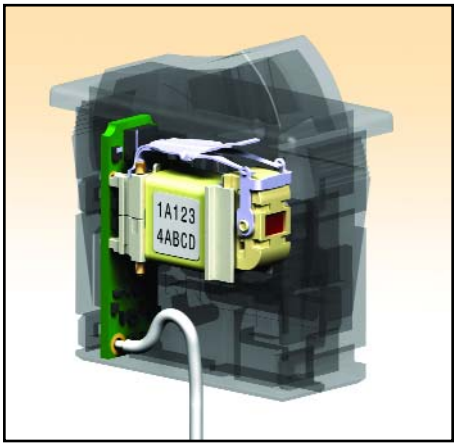
The lack of batteries can also eliminate user inattentiveness as a cause of system or product failure. With these systems, battery failures are eliminated as a cause of system or product failure, helping to reduce the number of conditions that might otherwise call for under-warranty or post-warranty service calls.

No Ganged Switches Needed

These wireless, batteryless switches also eliminate the need for multiple-gang, multipole or multithrow switches in most applications. Logic at or following a receiver can be implemented as any parallel operation as required with these switches. In more complex systems, a single switch can communicate with multiple receivers allowing a single switch activation to effect results across any number of systems or subsystems without requiring additional interconnections. This can be useful when needing to separately monitor and log switch activation or deactivation for security or other purposes.

Energy harvesting (EH) has been a goal for many designs including semiconductor-based components as a means of reducing energy requirements. The same priorities that increase product runtimes by decreasing energy drain create new opportunities for accomplishing EH even with very small-output energy sources.

While the EH concept is not new (the earliest radio receivers were crystal sets that would harvest energy from the radio transmissions they tuned in to allow them to be heard), the application of EH has been slow to take place in today's electronic systems. But these penny-sized Cherry generators may prove to be enablers for many more energy-harvesting products.



Rocker type energy harvesting switch. The wire hanging from the bottom is a short antenna.

The innovative new magneto-electric generators at the core of these switches rely on the long-running relationship of electric current and magnetism. The root technology is not very different from the T-bar detonators used with dynamite in mining. The tiny generators are a miniature version of the flip side of the technology used in magnetic-levitation trains.

The integration of these tiny power sources with low-demand controllers, modulators, and radio transmitters within the body of a normal-size switch marks one of those "sweet spots" in engineering where the pieces come together to simplify the design of systems and products for engineers while also doing it for their users.

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