Electronic Switches

Create New Efficiency Opportunities In Industrial Plants

Technology Brief

UNITED ELECTRIC CONTROLS
LEADERS IN SAFETY, ALARM & SHUTDOWN

Electronic Switches Create New Efficiency Opportunities In Industrial Plants

The roots of switches in industrial instrumentation run to the 1930s. More than 80 years later, the technology remains integral to instrumentation.

Use of electromechanical switches extends around the globe and across a wide range of industries. Some 1,000 switches typically are found at large plants and at plants of average size, approximately 100. Latin America's 5,000 plants calculate to well over 500,000 switches.

Plants typically spend four to 12 hours annually maintaining each switch.

Those devices are critical in controlling and monitoring processes in plants like sugar processing, bio-ethanol distillation, mining, cement manufacturing, water and wastewater treatment and countless other industrial processes. Equipment such as crushers, cookers, washers, mixers and separators all rely on electromechanical switches. But the technology's essential and enduring value and utility comes at a cost.

Plants typically spend four to 12 hours annually maintaining each switch. Inspecting, testing, calibrating and setting the devices accounts for significant workload and cost. Instrumentation failure can add additional cost in the form of equipment replacement and plant downtime. Depending on the switch, functionality could be severely limited. Operational control sometimes is poor and some devices struggle to withstand the rigors of an industrial environment.

This can pose a quandary: Should switches be left in place despite their high maintenance cost or should an investment be made in new technology in pursuit of greater efficiencies?

Strengths and Weaknesses of Switches

Working in conjunction with Programmable Logic Controllers (PLCs), Electromechanical switches still dominate the market, monitoring pressure, differential pressure or temperature. These switches respond quickly, are easily wired, simple to use and are relatively inexpensive.

There are some drawbacks.

Electromechanical switches frequently provide no intelligence on process variable extremes such as temperature or pressure. Nor do the devices indicate whether they will operate when signaled to activate. Getting switches to function properly requires delicate adjustments. Inspecting, testing, calibrating, setting and performing other maintenance necessitates taking the devices out of service.

Aging plants with decades-old designs are being increasingly burdened to meet higher operating efficiencies while relying on outdated switches incapable of meeting the demands of the data age. Further, many mechanical switches are vulnerable to vibration, shock and other stresses common in industrial settings.

Switch Environments

Four decades after Ford Motor Company popularized the concept of mass production, a rival automaker confronted a problem plaguing large plants of all types.

The hard-wired electromechanical systems upon which the facilities relied were strong, rugged and reliable but virtually inadaptable to modification or alteration. In 1969, General Motors unveiled an answer: a programmable logic controller. The rugged industrial digital computer was built to provide the control so badly needed in the manufacturing process. As the technology evolved, its utility increased exponentially. Adjustments in designs and processes could be made with relative ease. The system allowed for operations monitoring. Programming of PLCs in ladder logic lightened training burdens for technicians already knowledgeable in relay logic. Distributed Control Systems (DCS) and input/output I/O cards followed.

Today, these technologies are common in production, connected to more than 90% of switches. Thirty years ago, switches largely controlled only the final element.

Industries' need for simplicity, reliability and data clearly signal the need of a middle ground solution that combines the benefits of electromechanical switches and transmitters.

Transmitters – an Occasional Overkill

Transmitters also play a strong part, converting measurement parameters into signals sent to PLCs. The array of benefits transmitters deliver in certain applications include self-diagnostics, accuracy within 0.1%, high reliability (requiring recalibration just once every one or two years) and minimal maintenance cost.

But making the conversion from switches to transmitters is another matter. In most applications, replacing a switch with a transmitter is overkill. Installing transmitters costs two to three times more per unit than electromechanical switches. Transmitters sometimes need a separate power supply. Most importantly, connecting a transmitter to a PLC requires reprogramming of switch set points lost in the transition, into the ladder logic of the PLC.

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An Electronic Alternative

Electronic or digital switches featuring innovative designs aimed at meeting the vast needs and high demands of an industrial environment can provide all the advantages of transmitters and electromechanical switches without the burden of their downsides.

A general purpose electronic switch is especially relevant for industrial plant upgrades, offering ease of maintenance and accompanying low costs, electronic switches can be installed in existing two-wire mechanical switch infrastructure. Upgrades to ruggedly reliable and state-of-the-art technology are simple, swift and inexpensive. Unlike other options, which necessitate the reprogramming of set points or other adjustments making the transition complicated and costly, electronic switches offer an easy alternative.

What modern industrial environments demand, electronic switches can deliver – sky-high reliability, simple operability and tight cost control.

Moving from mechanical to digital switches measuring pressure, differential pressure and temperature is a snap. A two-wire drop-in brings an affordable performance upgrade with a slight increase in per-unit expense buoyed by reduced annual maintenance and replacement costs. No plant retrofitting or rewiring is needed. And digital switches provide additional intelligence as well.

UE Excela™

Features include:

- Liquid crystal displays
- LED multi-color process condition indicator
- Local process variable measurements
- Internal diagnostics that allow the devices to monitor themselves
- Increased uptime as a result of the intelligence the switches provide
- Higher reliability because of no moving parts unlike mechanical switches
- Improved plant safety

From a Management of Change (MoC) perspective, the ability to drop in electronic switches to existing two-wire switch infrastructure makes management of change simple and hassle-free. No new documents are needed. No drawing changes are required. The move is as easy as it is logical.

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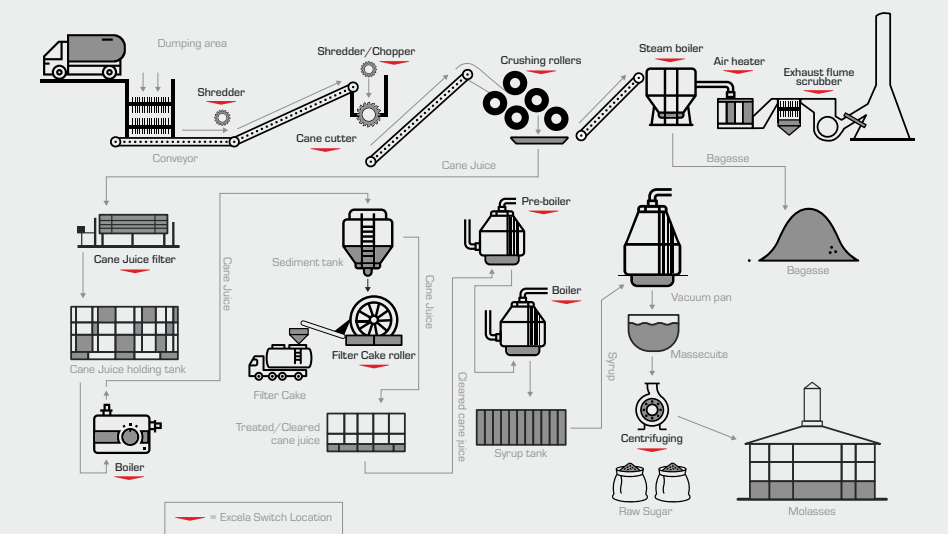
Application

Sugar is one of nature's purest ingredients and one of its most ubiquitous, produced through photosynthesis in all green plants and a natural carbohydrate in nuts, fruits and vegetables. Sugarcane is the world's largest volume crop at nearly 2 billion tons annually. In addition to sucrose, processing provides bagasse, molasses and filter cake.

Demand is increasing. According to market research firm, Reports and Data, the market is forecast to climb to $45.6 billion by 2027 with compound annual growth rates predicted at 6.5% over the next seven years. That is heightening pressures on producers, many operating from aged plants.

Processing is rigorous and complex, involving as many as 30 steps. The demands on manufacturing plants are high. Cane stalks are harvested, delivered to mills, washed and cut into shreds. Massive rollers press stalks to extract cane juice that is then clarified, concentrated and crystalized. A small plant can process 8,500 tons of sugarcane daily.



Each of the presses relies on at least 10 switches. Shredders, boilers, cookers, washers and other equipment also use the devices. The conditions are rugged. Canes are wet and muddy. Mills are set in locales where humidity and temperatures run high. Vibration and shock are intense in the machines that perform the processes.

Given the intensity of expectations in an industry where achieving maximum plant uptime during the harvest season is critically important, switches play an essential role, controlling line flow and monitoring critical temperatures in heaters and evaporators. The production environment only makes the job more difficult for electromechanical switches with their array of moving parts already susceptible to breakdown as the machines around them rumble and grind.

Electronic switches can succeed where other technology falters. Equipped with LEDs, digital switches can efficiently monitor conditions (including temperatures, pressure and differential pressure) and deliver intelligence on switch and setpoints. The devices also can diagnose themselves, monitoring sensors, power and microprocessors, alerting in red LEDs to problems and green to indicate all is in order.

About Us

Founded in 1931 United Electric Controls (UEC), and its divisions, Applied Sensor Technologies, and Precision Sensors is a privately held corporation headquartered in Watertown, Massachusetts, USA.

UEC is a manufacturer of durable and reliable sensors and switches to various industries, including petrochemical, power, water, cement, and sugar processing plants. UEC products perform industrial alarm and emergency shutdown functions for global customers, while others provide critical sensor inputs into control systems.

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