

## Digital Switches Expand Back to the Future

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### Keywords

Digital Switches, PAM, O&G, Chemical, W&WW

### Summary

Electromechanical switches have taken a back seat to their pressure and temperature transmitter cousins. Switches used in safety system applications lost favor to intelligent transmitters with increased Mean Time Before Failure (MTBF) and their perceived improvement in reliability. In general applications, the poor cost-to-value ratio of maintenance-prone switches has resulted in declining adoption that continues today. The high cost of routinely checking problematic mechanical switches is forcing users to leave them unattended, opting to direct limited resources to critical and more costly equipment.

Despite the declines in switch adoption, millions of installed switches are still in use today. Switches continue to be applied in safety system applications

Digital temperature and pressure switches are emerging from the brink of obsolescence and retaking their rightful place as an important component of automation. Innovative switch technologies are providing better reliability and the capability of assessing their own health while offering a significantly reduced TCO solution.

where fast response is paramount, albeit in much smaller quantities. However, the effects of workforce reductions and the increasing age of plant equipment are coalescing into a perfect storm that is increasingly becoming a threat to plants employing electromechanical switches. Reliable digital switches that can automatically validate the health of switch operation may provide an answer for this looming problem while reducing total cost of ownership.

### Analysis

Pressure and temperature switches are used throughout the process industry, particularly in the oil & gas, chemical and water & waste water industries. Despite the relatively small market size of switches for the process market, totaling roughly \$350 million due to their low cost, a huge



volume is shipped every year. Millions of switches are shipped annually, exceeding the number of pressure transmitter shipments. Due to their low cost, switches are considered throw-away devices that typically receive little if any maintenance attention.

Because of their function to protect equipment and the plant in an abnormal event, switches can sit quietly for years in a state of inactivity that promotes switch failures due to corrosion from environmental effects such as heat and humidity. If the plant is in a high humidity region such as in the Houston area, it is very likely that unattended switches are frozen, inhibiting their safety function and thus providing a false sense of security. The reduction in workforce and the age of deployed equipment is compounding the problem. Switches are rarely tested and currently pose significant threat in many process plants, particularly older ones, or where equipment is in a remote satellite location. Without resolution, this dangerous situation can threaten the safety of the plant including the operating personnel.

Attribute	Electromechanical	Digital
Reliability	Likely to Jam	No Moving Parts
Configuration	Limited Range	User Re-settable
Health Status	None	Continuous Self-Checking
Communication	Limited	Expanding
Cost	Lowest	Attractive
TCO	High Maintenance	No Maintenance
Application	4-wire	2-wire & 4-wire
Power	Medium	Low

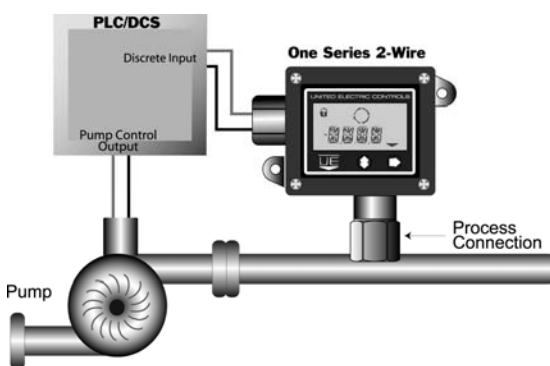
#### Comparison of Switch Attributes

#### Evolving Demand Is Driving Enhanced Switch Solutions

Electromechanical switches are typically range constrained, lack digital communications and have no intelligence. However, just as embedded intelligence and information ushered a new era of pressure transmitter adoption, the same is beginning to happen with switches. Today, instrumentation must do much more than measure parameters or in case of switches, react to a specific condition. Information from field devices and switches are needed to enable Plant Asset Management (PAM) systems to perform their function such as predictive management of plant assets. Emerging drivers expanding the growth of PAM systems will do the same

for switches that detect destructive equipment conditions. These occurrences should be documented in PAM systems to provide a better insight into the health of the equipment. An asset that continually trips due to high pressure or temperature should warrant close inspection. Additionally, advances in measurement and electronic technology are improving switching technology that more than overcomes the previous shortcomings of older electromechanical devices.

Switch suppliers such as United Electric (UE) are responding to these demands with the introduction of the One Series intelligent digital pressure and temperature switches. Both switches come standard with the patented I AM Working (IAW) diagnostics that determines the health of switch function dynamically in real-time. This feature continuously monitors the switch to ensure a switch trip when required and alerts operators of potential problems. With this functionality equipment will be protected allowing instrument technicians can forgo inspection and manage a much larger number of assets.



**Typical Digital Switch Application**

The One Series pressure switch also addresses one of the most common failures of pressure switches, plugged pressure ports. This patent pending feature, Plugged Port Detection, notifies personnel that the pressure measurement has been compromised disabling the switch function. This and the switch health information can help maintenance, operations and scheduling to proactively consider the effects and plan appropriate actions. This could involve scheduling a maintenance work order, ordering replacement parts or disregarding the signal from a defective switch based on overriding circumstances. By using intelligent information from switches, significantly better operating decisions can be made without ever leaving the safe confines of the control room.

### **Improve Safety Reduce TCO**

The unique features of digital switches will improve user perception and expand adoption in new applications while replacing old legacy electromechanical devices. Digital switches fit perfectly in today's competitive landscape as manufacturers begin the process of upgrading the estimated \$65 billion of old outdated legacy control systems. It makes economical

Compressors
Turbines
Pumps
Fans
Safety Systems
Motors
Transmissions/Gearboxes
Reactors
Pressure Vessels
Boilers

**Switches Are Suitable for a Wide Range of Asset Protection Applications**

sense for manufacturers to upgrade to benefits of digital switches when implementing a control system or a control system upgrade.

Upgrading to no maintenance self-checking digital switches increases reliability and TCO. Digital switches can easily be installed in a DCS or PLC system by connecting the 2-wire loop power version of the switch to discrete input cards. Electromechanical switches can be replaced without any changes to the wiring infrastructure since they mount and electrically connect the same way reducing cost of switching to this new technology to zero. For the more ambitious user, digital switches with an analog output can possibly take the place of pressure and temperature transmitters in applications primarily used in a switching mode at a fraction of the cost of transmitters. The self-

contained units are assembled, tested and calibrated at the factory and once installed can be totally left alone. The combination of low initial purchase price and operating cost provides a very economical value proposition.

As safety systems increasingly become more complex, users may find the simplicity and advances in switch technology attractive for use even in these critical applications. The fast reaction time of local the control of digital switches combined with the ability to ensure the reliability of its operation may reinvigorate the use of switches for safety instrumented systems.

## Recommendations

- Manufacturers should audit their deployment of electromechanical switches and consider upgrading to digital switches. Upgrades should be implemented at the same time as control system upgrades or separately as a precaution if dangerous conditions exist.
- Suppliers should educate manufacturers the value of new digital switch technology and develop units for specific applications with appropriate industrial standards such as ATEX and SIL.

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