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HPI INTEGRATION STRATEGIES

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Switch strategies for the hydrocarbon industries

Electromechanical switches have taken a back seat to their pressure and temperature transmitter cousins. New digital switch technologies have overcome many of the drawbacks of old electromechanical brethren. Electromechanical switches used in hydrocarbon processing, particularly in safety system applications, lost favor to intelligent transmitters due to their increased mean-time-between-failure (MTBF) and perceived improvement in reliability. In general applications, the poor cost-to-value ratio of maintenance-prone switches has resulted in declining adoption that continues. 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—a large percentage deployed in the hydrocarbon industries. Switches continue to be applied in safety system applications 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 hydrocarbon 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 industries, particularly in the hydrocarbon, chemical and water and 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 throwaway 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. This state of inactivity 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 the Houston area, where many hydrocarbon processing plants are located—it is likely that unattended switches are frozen, inhibiting their safety function and thus providing a false sense of security. The reduced workforce and the age of deployed equipment is compounding the problem. Switches are rarely tested and currently pose a significant threat in many process plants, particularly older ones, or where equipment is in a remote satellite location such as a pumping station. Without resolution, this dangerous situation can threaten plant safety, including operating personnel.

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 total cost of ownership (TCO) solution.

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 in a new era of pressure transmitter adoption, the same is beginning to happen with switches. 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 equipment health. 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 (Table 1).

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 determine the switch function health 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. This allows instrument technicians to forgo inspection and manage a much larger number of assets.

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

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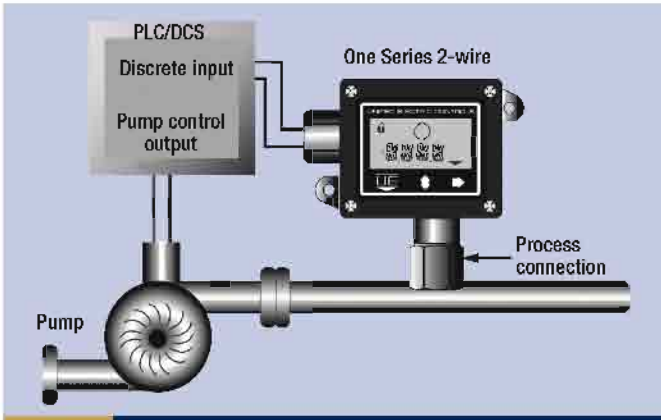

FIG. 1 Typical digital switch application.

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 plant safety and 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 outdated legacy control systems. It makes economical sense for manufacturers to upgrade to benefits of digital switches when implementing a control system or a control system upgrade especially when adopting a PAM system.

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 (Fig. 1). Electromechanical switches can be replaced without any changes to the wiring infrastructure since they mount and electrically connect the same way, reducing the 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. Once installed, they can be totally left alone. The combination of low initial purchase price and operating cost provides a very economical value proposition.

TABLE 1. Switch attributes

Attribute	Electromechanical	Digital
Reliability	Likely to jam	No moving parts
Configuration	Limited range	User resettable
Health status	None	Continuous self-checking
Communication	Limited	Expanding
Cost	Lowest	Attractive
TCO	High maintenance	No maintenance
Application	4-wire	2-wire and 4-wire
Power	Medium	Low

TABLE 2. Switches are suitable for a wide range of asset protection applications

Compressors	Turbines	Pumps
Fans	Safety systems	Motors
Transmissions/gearboxes	Reactors	Pressure vessels
Boilers		

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 the local 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 (Table 2).

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 users on the value of new digital switch technology and develop units for specific applications with appropriate industrial standards such as ATEX and SIL. HP

The author leads the field device consulting team at ARC covering process measurement technologies. He is responsible for pressure, flow, level, temperature and related markets. Mr. Chin also covers field device communication protocols, plant asset management (PAM) and laboratory information management systems (LIMS). He has nearly 30 years' experience in the areas of sales management, product marketing and engineering in industrial field instruments that utilize a vast array of technologies. Before joining ARC, Mr. Chin worked for Krohne Inc., The Foxboro Co., BIF and Stone & Webster Engineering.

Upgrading your Plant Instrumentation and Field Instruments?

Concerned about costs, complexity and reliability?

When upgrading plant instrumentation and control systems, UE's innovative One Series enables customers to improve the reliability of discrete field inputs, replacing mechanical pressure and temperature switches while retaining existing wiring and control schemes. With solid-state reliability, self-diagnostics, and minimal power requirements, the One Series is the cost-effective solution to increased reliability for critical on/off alarm and shutdown protection. Select from:

- **Model 2W**– 12-30 VDC or 90-130 VAC, requires extremely low current derived from the PLC or DCS discrete input and provides a switch signal using a simple 2-wire connection.
- **Model 4W**– 280 VAC, 10 A solid-state relay capable of switching contactor loads directly. Requires 115 VAC for power.

Why the One Series is the best choice for plant upgrades:

- Self-diagnostics and continuous health status, eliminating the "blind" mechanical switch issue
- 0.1% repeatability
- Deadband adjustment 0-100% of range for precise pump staging
- Set and check in place via digital display, protected from unauthorized access, eliminating trips to the instrument shop
- All solid-state extended life and reliability
- Meets Zone 2/Div 2 cUL and ATEX hazardous location approvals
- Pressure ranges from 0 to 4500 psi with welded 316L st/st sensors
- Temperature ranges from -300 to 1,000°F with local and remote sensor options
- Cost: $375, about one-half the installed cost of a process transmitter

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Installed Cost Analysis		
One Series vs. Transmitter	One Series	Process Transmitter
Self-diagnostics	Yes	Limited
Response Time	50 mS	300 mS
Local Display	Yes	Optional
Plug Port Detection	Yes	No
Instrument	$375	$795
DCS Input	$25	$125
Programming	$50	$150
Total Cost	**$450**	**$1,070**

Contact United Electric for the latest information on the One Series electronic pressure and temperature switches. Improve reliability. Contain Costs.

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*2W models only