White Paper

7 Ways to Improve Productivity and Process Operations with Pressure Instrumentation

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EMERSON
Process Management

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To achieve operational goals, processing facilities must consistently produce at optimal throughput levels. Successfully meeting the challenges of minimizing equipment maintenance, maximizing uptime, accounting for process variability and achieving faster startups can make the difference between achieving production and revenue goals and missing deadlines and losing business.

Pressure is a foundational measurement at the heart of any process control and monitoring strategy, providing critical insight into the health and productivity of an operation. Pressure technology continues to advance from traditional analog-only measurement devices to smart transmitters that provide more reliable and accurate measurements, enhanced diagnostics coverage, and new capabilities that reduce maintenance, outages, and process variability.

This paper will offer seven ways to leverage the advances in pressure transmitter technology to gain greater control over your process and improve productivity.

1. Utilize diagnostics coverage to increase uptime

Pressure transmitters are used to take simple pressure readings that inform operators about the state of a process at any time. With this information, engineers can make any adjustments needed to keep the process running within required specifications.

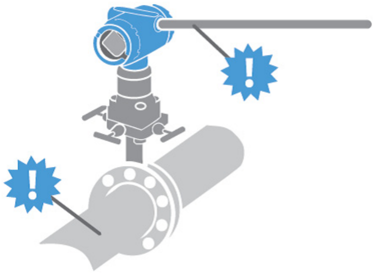
Most pressure transmitters include a basic set of diagnostics that notify the operator when the device is broken or needs to be serviced. While this information is useful, it only enables a reactive maintenance strategy that can result in unplanned downtime and lost productivity.

Today's more advanced transmitters can provide additional diagnostic insights not only into the state of the transmitter, but also into the electrical loop and process itself, issuing proactive alerts so operators can respond immediately and avoid downtime. New advancements in diagnostics capabilities include:

- Process monitoring – Pressure transmitters can listen to the background noise of a process and detect deviations from normal operation that could signify plugged impulse lines or more serious issues with the process itself such as distillation column flooding, flame instability, or pump cavitation and cause shutdowns.
- Loop monitoring – Diagnostics can monitor the integrity of the electrical loop that connects a field device to the control room to notify operators of any irregularities; conditions such as water in housings and junction boxes, wire corrosion, unstable power supplies or environmental or human errors can

create additional current paths or increase electrical loads and lead to on-scale failures.

Figure 1. Use advanced diagnostics data to make proactive decisions

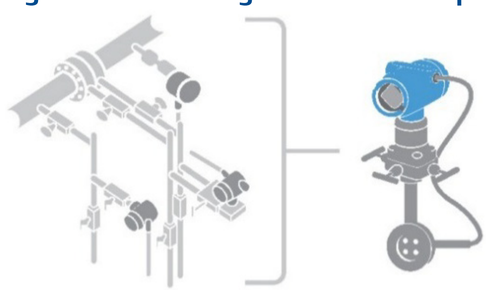


2. Simplify process connections to improve reliability

The way in which a pressure transmitter is physically connected to the process can greatly impact the overall accuracy and reliability of the measurement. Simple installations often use impulse piping that is prone to leaking, plugging, freezing, and other maintenance challenges. More complex applications, including those on tanks and meter runs, can require multiple components, pipe penetrations and connections that can increase the amount of impulse piping required by tenfold.

Newer pressure transmitters are available in compact assemblies that utilize fewer components, are simpler to install and require less ongoing maintenance. These solutions permit close-coupling, a best-practice installation procedure that results in more accurate measurements.

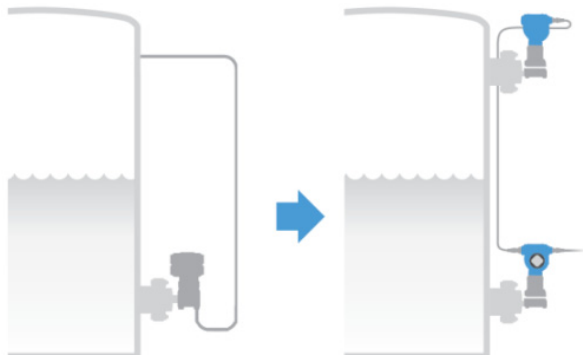
Figure 2. Eliminating mechanical components greatly reduces maintenance costs and time



In traditional differential pressure (DP) flow applications, for example, integrated flowmeter assemblies eliminate a significant amount of impulse piping. These flowmeters can replace up to ten components including multiple transmitters, many mechanical parts and pipe penetrations, all of which contribute to leaking, plugging, freezing and inaccurate process measurements. The complete assemblies are easier and faster to install, leak-checked and drop-in ready.

In tank level applications, an electronic remote sensor system, which is a DP level technology, replaces impulse piping with two gage or absolute pressure transmitters installed on the top and bottom of the vessel and connected electronically. One of the devices calculates differential pressure and transmits it back to the control system using a standard 4-20 mA HART signal. The remote sensors eliminate impulse piping and associated environmental effects to minimize variability, reduce maintenance, and improve measurement accuracy and operational productivity.

Figure 3. Improve reliability by replacing mechanical components with digital communications



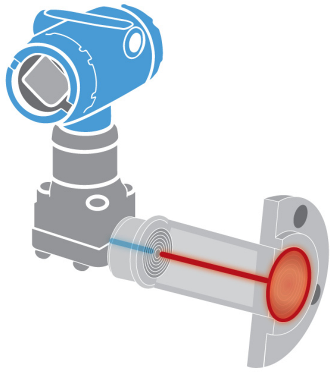
3. Eliminate heat tracing to increase accuracy and reduce costs

Obtaining accurate and reliable process level measurements with applications involving extremely hot processes, cold ambient temperatures, or both can be difficult. In hot processes, heat tracing is commonly installed to keep the high-temperature, high-viscosity fluids used with impulse lines or capillary at elevated temperatures. In cold environments, heat tracing ensures fill fluid response time does not slow down, and that impulse lines and capillary do not freeze.

Heat tracing can add considerable cost and complexity to any process and requires a great deal of maintenance to keep it operational. Because of these challenges, applications using heat tracing often suffer from frequent and unplanned process shutdowns, sub-optimal performance leading to lower throughput, degraded product quality, and cost overruns.

A new DP level solution is available and utilizes specialized remote seals with an expanded temperature operating range to address these operational challenges.

Figure 4. Specialized remote seals and fill fluids increase measurement accuracy



The remote seals can operate in hotter or colder temperatures than traditional transmitters can handle. In this solution, an intermediate diaphragm seal in the transmitter separates two different fill fluids with different optimal operating temperatures. For example, on a high temperature application, the high temperature fill fluid is only used immediately next to the hot process, and a general-use fluid fills the remainder of the connected capillary. The solution is not dependent on heat tracing and produces more reliable, accurate and faster process measurements when conditions get extreme.

4. Easily and economically add measurement points to increase process insight

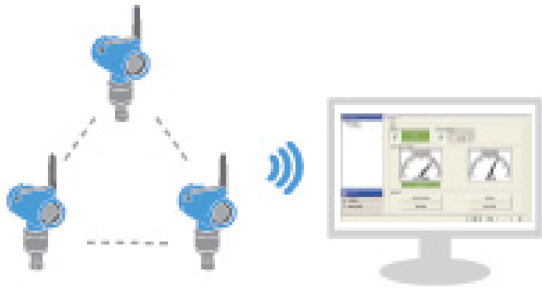
"You can't manage what you don't measure" is a common phrase in the business world that is equally true in the industrial process world. However, in any given operation, the degree to which a process is automated and can be measured will vary: in some areas, measurements may not be made at all; in other areas, measurements may be made manually and only updated on a weekly basis; in other cases, variables may be assumed to be constant even if the process is dynamic and variables are known to constantly change.

There are a number of factors why an operation may knowingly or unknowingly run at a sub-optimal level of automation, including:

- Space constraints – Adding transmitters or sensors requires available I/O in the controller
- Budget concerns – Running cable, trays, conduit and other required infrastructure adds cost
- Geography – Remote locations are too difficult to access or wire
- Design – Moving or rotating equipment creates challenges for wired instrumentation

Wireless technology breaks down these traditional barriers, allowing installation of additional measurement points quickly and economically, and providing the precise and stable measurements needed to reduce variability and maximize throughput. Paul Kinne, a Head Operator with Chevron who was able to implement wireless technology in his operation in just three hours, gained reliable steam injection measurement at eight stations and eliminated excess steam usage.

Figure 5. Wireless technology installation costs are 40-60 percent lower than wired installation costs



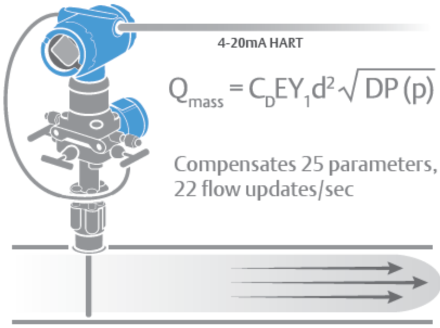
Installing and implementing wireless devices takes 75 percent less time than wired devices and the capital costs associated with wireless technology are 42 percent less. In addition, the insights gained from added pressure monitoring points help extend the life of assets, creating an even greater return on investment.

5. Compensate flow measurements to protect profits

Differential pressure is a common method of measuring the flows of gas, steam, and compressible liquids. However, differential pressure measurements alone do not take into account dynamically changing process conditions which can decrease the accuracy and repeatability of flow measurements and lead to process upsets. This can be especially problematic in critical applications such as material balance, custody transfer and energy steam flow.

A multivariable transmitter allows compensation for changing process conditions by measuring absolute or gage pressure and temperature in addition to differential pressure. The transmitter measures flow 22 times per second and dynamically compensates for over 25 different parameters, giving greater control over the process and significantly improving flow measurement accuracy to ensure your product transfers get recorded & billed properly.

Figure 6. Multivariable transmitters calculate fully compensated mass or energy flow

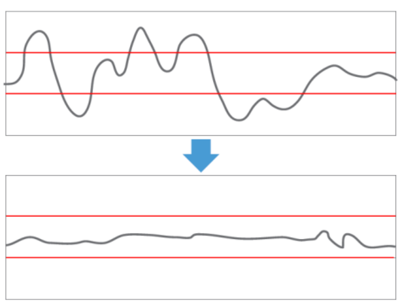


6. Operate closer to set point to control for process variability

No process operates in a perfectly steady state. Fluctuations in operating conditions, variations in feedstock, and daily and seasonal environmental changes can all lead to a control strategy that has wider than desired tolerances around the desired set point of the loop. This can result in reduced efficiency and decreased productivity of operating units.

Using high-accuracy instrumentation, dynamic process changes can be accurately measured and responded to, to consistently operate closer to the desired set point.

Figure 7. A stability specification of 0.15% and 15 years means fewer calibrations and better measurement repeatability over time



Three key transmitter capabilities that help determine the accuracy and repeatability of pressure measurements include:

- Reference accuracy describes the best-case accuracy of a device under perfect laboratory conditions where pressure and temperature are constant. Pressure transmitters today are available with up to 0.025% reference accuracy. Specialized pressure transmitters are also available for flow applications that are designed to maintain accuracy over a wider flow turndown.

- Total probable error describes the installed accuracy of the pressure transmitter based on the reference accuracy, and any error from changes in static pressure and ambient temperature.
- Stability describes the amount a transmitter's measurement output may drift over a set period of time. For example, a pressure transmitter with a stability specification of 0.15% and 15 years will experience less than 0.15% shift in output over a 15-year interval, resulting in fewer calibrations and better measurement repeatability over time.

Using high accuracy pressure transmitters, you will get less process variation in your measurement, operate closer to set point, and reduce waste and rework.

7. Standardize on a common instrument platform to optimize budget

The range of pressure measurement technologies that facility operators have to choose from to operate at an optimal production level can be overwhelming, especially for the instrumentation and engineering personnel responsible for keeping the various instruments up and running. Each instrument may need to be uniquely specified, installed, calibrated, operated, maintained and serviced. In general, the more distinct devices an operation deploys, the more it needs to invest in training, tools and inventory. Maintaining multiple instrument platforms is not only expensive, but it also creates the kind of complexity that can lead to human error and process disturbances and shutdowns.

When a facility harmonizes its design, procurement, installation, commissioning, as well as training and maintenance procedures by standardizing on one technology platform, it gains efficiency and lowers its costs. Advanced platforms are scalable and allow economization on devices: One series of instrumentation can offer equipment with wide range down or turn down specifications, devices that measure pressure as well as level and flow, advanced diagnostics, wireless communication and transmitters that fit the needs of multiple applications.

Summary

Advanced pressure measurement technology gives more control over the operation by providing additional insights at measurement points and extending visibility even further into the process and connectivity. Today's highly reliable pressure transmitters offer greater confidence in pressure measurement and more informed process decisions; minimize process variability, extend the life of assets, increase uptime with better installation practices and utilize new technology to help the operation meet its productivity and revenue goals.