innovations

in process control

Disruptive technologies enable improved business performance

One global manufacturer **supplying and servicing all valves everywhere**

Emerson is a world-leading manufacturer of valves, actuators, instrumentation and controls, with an extensive range of trusted brands designed to meet the most challenging applications throughout oil and gas, power, mining, chemical, food and beverage, and the building and construction industries.

Market leading product brands such as Fisher, Anderson Greenwood, Vanessa and Keystone create the most comprehensive global valve business. Emerson's final control portfolio now includes control valves, pressure relief, butterfly, gate, globe, ball and check valves, and digital valve controller and positioner instruments – leading technology that provides monitoring and diagnostic updates to customers.

This technology is supported by an extensive global network of more than 200 service centres, which offer the experience and expertise to help you maximise the return on your investment. From design, manufacturing, delivery and installation, Emerson works with you as a trusted partner, helping to take the complexity out of procurement and ensuring compatibility of all technologies across the process.

By combining a strong global presence, technological know-how and engineering expertise, with Emerson's broad range of industrial automation products including its valves portfolio, we help keep customer operations running smoothly, minimise downtime and enhance lifecycle performance.

To find out more about Emerson's extensive valve range go to Valves.Emerson.com

Welcome to **innovations**

'Disruptive Technology' can be defined as an innovation that creates a completely new way of solving a challenge, disrupting the status quo and displacing established solutions. Innovations such as the steam engine and digital photography for example, changed the marketplace forever and created huge user benefits.

Within industrial automation, the introduction of microprocessors and digital communications led to distributed control systems, digital plant architectures and the introduction of intelligence into field devices. These technological advances enabled users to gain far greater insight into their plants – not just more process variables, but also important information with respect to equipment health and performance. This additional data facilitates a step change in business performance through more flexible operations, increased safety and reduced cost.

Emerson was at the forefront of digital plant architectures and continues to launch ground-breaking technologies that drive improvements within the manufacturing and process industries. In this issue of 'Innovations in Process Control' we focus on five disruptive technologies developed by Emerson that are game-changers to solve tough challenges and create huge performance improvements: High-Integrity Pressure Protection Systems (HIPPS) solution, which increases safety and creates substantial savings; Rosemount™ X-well™ Technology, a non-intrusive solution to the toughest temperature measurement challenges; Rosemount QCL Analysers, which provide a quantum leap in gas analysis; Permasense corrosion monitoring systems that help improve your plant's bottom line and the Rosemount Wireless Pressure Gauge, the world's first in its kind which brings transformative improvements in safety and reliability.

If you would like to discuss how Emerson's disruptive technologies can provide critical advantages for your company, contact us today via **EmersonProcess.com/Europe**

Roel Van Doren
President Europe
Emerson Automation Solutions

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Business challenges create **disruptive technologies**

We asked Bob Karschnia, vice-president wireless at Emerson Automation Solutions to describe how wireless became a disruptive technology within the process industry and what are the next innovations that will help to create operational improvements.

Where does your passion for innovation come from?

I began my career in the US Air Force, where I was privileged to work on the Navstar programme, or GPS as it is now known. This was my first taste of cutting edge technology and I have wanted to be involved in developing innovation ever since. I joined Emerson 21 years ago, initially as a design engineer, but I am now heavily involved in driving wireless innovations within the company.

How did Smart Wireless innovation come about?

We began researching and developing ways in which wireless networks could be applied within the tough and hazardous environments of process plants 12 years ago. The result of this was the launch of Smart Wireless ten years ago, which has since seen widespread adoption and can be certainly considered a disruptive technology within the process industry.

Disruptive technologies really come into their own when a significant business problem and a need for change is combined with a corresponding technology leap. This was the case with wireless. Around the same time, the oil and gas industry was seeing new crudes emerging that created processing challenges. There was a need for more monitoring throughout the process to help overcome these problems and improve process efficiency.

In parallel there was a significant loss of expertise from the industry as senior engineers retired. Efficiency drives meant they were not always replaced, which meant there was a need for technology that was simple and cost effective to install, operate and maintain, which Smart Wireless provided.

With disruptive technologies, like Smart Wireless, customers must be willing to take a small risk, moving away from a tried and trusted solution to embrace the technology. Once that has occurred, it becomes very easy to show the true benefits in the form of quantifiable business results, confidence grows and then you have a successful solution on your hands.

What's next in terms of innovation?

In terms of wireless, there is currently a huge of amount of research and development in the area of power. We are going to see huge advances in power reduction technology that will enable wireless devices to provide far greater update rates. This will create a breadth of applications not currently possible.

"Disruptive technologies really come into their own when a significant business problem and a need for change is combined with a corresponding technology leap. At this point you have a successful solution on your hands."

Pervasive Sensing™, both in terms of wired and wireless devices, will continue to develop because end users want eyes and ears in every corner of their plants. Recently we have seen solutions that monitor pumps, steam traps and heat exchangers, and we will continue to see devices and applications launched that extend this reach. We are also going to see an increasing amount of non-intrusive technology introduced that will help to reduce the time and cost of installing additional measurement points.

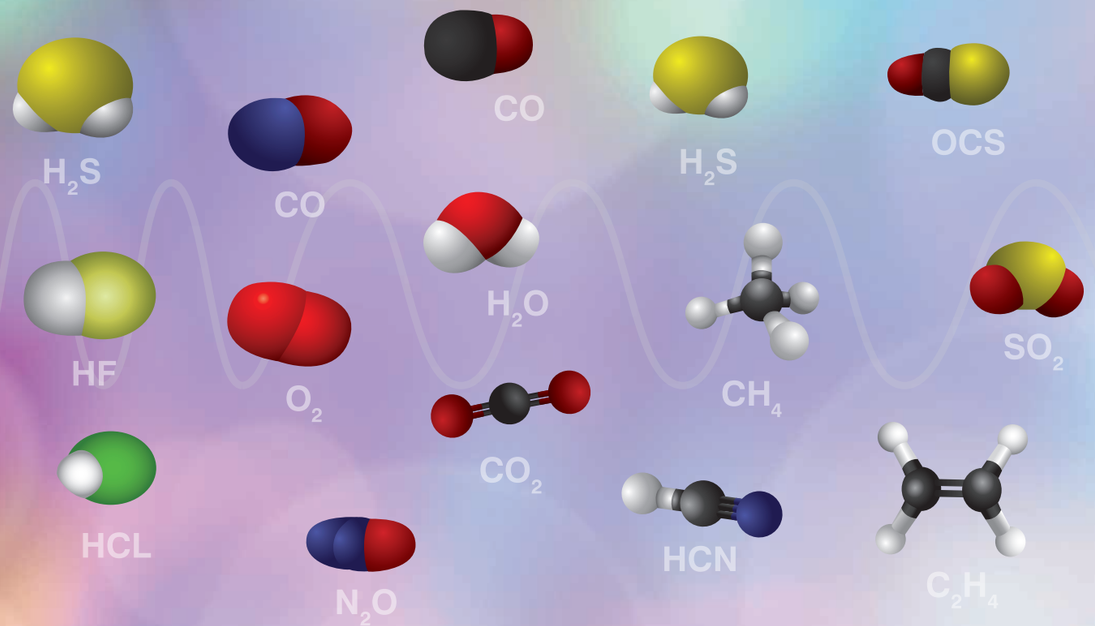
To correspond with the availability of all this additional data, new web server-based applications will make it easier and quicker to access and interpret the information.

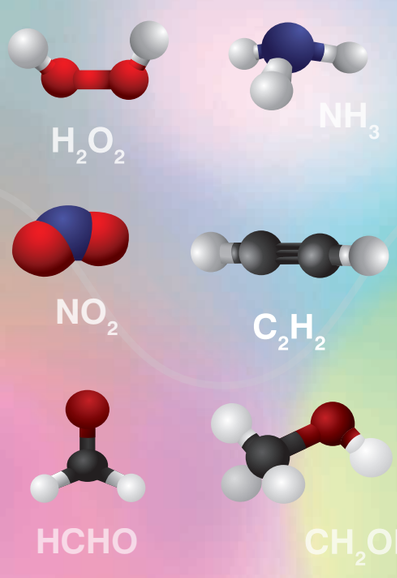
Disruptive technologies such as wireless are helping process companies improve operational and financial performance.

Emerson's Plantweb Insight™ for example facilitates improvements in safety, reliability and efficiency by enabling critical plant data to be interpreted through a suite of applications. We are developing more than a dozen applications that focus on monitoring specific pieces of equipment such as pressure relief devices and heat exchangers. Because these applications can run on any device with access to a web browser, they can be visualised wherever you are in the world.

Disruptive innovation will provide more actionable data, that is easier to access and interpret leading to improvements in process and financial performance.

To find out how Pervasive Sensing and Plantweb Insight can help create operational improvements go to Emerson.com/IM1101 and Emerson.com/IM1102





The measurement speed and sensitivity of Emerson's Rosemount QCL Analyzers is vastly superior to that of traditional technology.

A quantum leap in **gas analysis technology**

Plant managers are challenged with reducing operating costs, improving plant efficiency and complying with the latest environmental legislation. Amanda Gogates, Global Product Manager Cascade, explains how a major step forward in gas analysis provided by Emerson's Rosemount™ QCL Analyzers can play a key role in meeting these challenges.

Gas analysis technology plays a vital role in supporting process optimisation to help maximise plant efficiency and ensuring compliance with emissions monitoring environmental guidelines. However, many companies still rely on decades-old analysis technology that lacks the sensitivity, speed and flexibility required to meet these goals. The limitations of traditional gas analysis results in production inefficiencies and when combined with excessive lifecycle and maintenance costs, this is leading to hundreds of thousands of euros being lost each year.

Plant managers are therefore seeking a powerful but easy-to-use solution that can reduce the burden of gas analysis and help support operational improvements. To meet these requirements a quantum leap in technology is required and Emerson's Rosemount™ Quantum Cascade Laser (QCL) Analyzers provide it, offering fast, reliable, real-time gas analysis data, without the complexity of multiple solutions or the high lifecycle costs of traditional technology.

The most advanced analysers on the market, Rosemount QCL Analyzers combine the power of QCL and tunable diode laser (TDL) technology to improve measurement speed and sensitivity by 100x that of traditional technology. This enables even trace levels of gas to be identified, which is required in applications such as NOx reduction (DeNox), ethylene purity and hydrogen sulphide monitoring in natural gas. Real-time, interference-free measurements at up to 1,000 times per second creates much greater and faster process insight, which supports both process efficiency improvements and emissions monitoring compliance.

Rosemount QCL Analyzers are also the only solution able to analyse up to 12 components simultaneously in a single instrument, at parts per billion sensitivity levels. The accurate, reliable measurement of multiple gases provides broad application flexibility. Implementing a Rosemount QCL Analyzer eliminates the need for multiple analysers to be installed, greatly reducing installation and operational complexity, overall equipment footprint and points of failure.

Another advantage of the Rosemount QCL Analyzers is their ability to measure hot/wet samples instantaneously. This enables gases to be kept above their dew point, which reduces the possibility of corrosion and eliminates the need for conditioning and cooling prior to analysis.

This is particularly advantageous for all combustion related applications.

Rosemount QCL Analyzers also deliver major reductions in lifecycle and maintenance costs compared to traditional technology. Typically, gas analysers require regular calibration, which can be laborious and time-consuming. Because the QCL technology is inherently stable, this results in minimal long-term drift and creates long calibration intervals.

Another considerable benefit of QCL technology is that it has no consumable parts that require regular replacement. There are no moving parts, such as pumps, internal motors or choppers, which are typically the main cause of equipment health problems.

These significant benefits make Rosemount QCL Analyzers an ideal choice to perform accurate and reliable analysis in a range of applications, such as continuous emission monitoring, DeNOx, ethylene manufacturing and hydrogen sulphide measurement.

Rosemount QCL Analyzers are a key element of Emerson's extensive gas analysis portfolio. To learn how Emerson's analysers can solve your toughest gas analysis challenges visit Emerson.com/IM1103

Corrosion monitoring **helps maximise plant potential**

Upstream oil and gas, refining and chemical industries present extreme challenges for corrosion monitoring. Jake Davies, Global Marketing Director Permasense, describes how Emerson's Permasense® monitoring systems provide unrivalled data generation, retrieval and analysis, enabling plant operators to make better-informed operating decisions and improve profitability.

The cost of corrosion is staggering. In 2016, NACE International – the worldwide corrosion authority – published the results of a two-year global study which estimated the cost of corrosion to businesses and industries to be US$2.5 trillion. That figure starkly emphasises the extent to which corrosion affects operational performance and underlines the critical importance of effective monitoring systems. However, in industries such as oil and gas, refining and chemical, obtaining measurements is challenging due to the extreme temperatures of equipment being monitored and hazardous and inaccessible locations involved.

There are also many variables that affect the rate of corrosion – such as feedstock changes, temperature and process adjustments and flow rates – and these can alter every day. If plant operators are unaware of the true extent of corrosion damage, large safety factors must be applied to operational decisions, to avoid excessive damage. This results in the process being run below its maximum capability and potential profit being lost. If the corrosion is more aggressive than anticipated, leaks and unplanned outages can occur, incurring extreme financial and safety ramifications.

Emerson's market-leading solution to these challenges is its Permasense non-intrusive corrosion and erosion monitoring systems. These unique wireless systems, which form part of Emerson Pervasive Sensing strategies, deliver wall thickness measurements with unparalleled accuracy and frequency, providing operators with real-time insight into how their plant is coping with the ever-changing demands placed upon it.

At the heart of Permasense monitoring systems are compact, non-intrusive, ultrasonic wall thickness measuring sensors that monitor areas at elevated risk of internal corrosion or erosion. The systems use two sensor types, both of which are very quick and easy to install. WT sensors employ unique stainless steel waveguides that hold the ultrasonic transducers and electronics away from the pipeline or vessel surface and guide the ultrasonic waves from the transducer to the pipe wall and back. This enables the sensor to operate without degradation of performance, even when mounted on locations operating at extremely high process temperatures, such as those found within refineries. ET sensors attach directly to the pipe or vessel and can measure metal wall thickness even through external protective coatings. This makes them ideally suited to upstream oil and gas applications where process temperatures are lower, but it is important to maintain coating integrity.

The sensors communicate via a *Wireless*HART® network, which enables cost effective installations even in remote and hard to reach areas. Data is transmitted twice a day by default via a gateway to the user's desk where data visualisation and analysis software enables enhanced decision-making to be performed, leading to increased plant safety, availability, reliability and operational performance.

Permasense systems enable measurements that were traditionally taken manually on a temporary basis, perhaps as infrequently as once every two to five years, to now be provided permanently. This provides much greater visibility into the condition of the plant. If excessive corrosion is identified, then maintenance can be scheduled appropriately, for example during periods of planned downtime, helping to avoid costly leaks and shutdowns. Crucially, the regularly updated data provides much greater understanding of the effects of variations to the feedstock, process conditions and chemical inhibition strategies are having on the condition of the asset.

This provides operators with the information and confidence to run their plant more aggressively and closer to its maximum capacity, but within safe limits, therefore increasing profitability.

For more on how Permasense monitoring systems can help you maximise your plant's potential, visit Emerson.com/IM1104

Permasense non-intrusive corrosion and erosion monitoring systems provide real time insight.

Rosemount X-well Technology eliminates the challenges associated with thermowells, but matching their accuracy and repeatability.

Game-changing temperature **measurement solution**

There are various means of performing process temperature measurement, but each presents its own complex challenges. Martin Adshead, Product Manager, Temperature, reveals how Emerson's unique Rosemount™ X-well™ Technology provides accurate, repeatable, non-intrusive measurement and reduces the cost of each measurement point added by 29%.

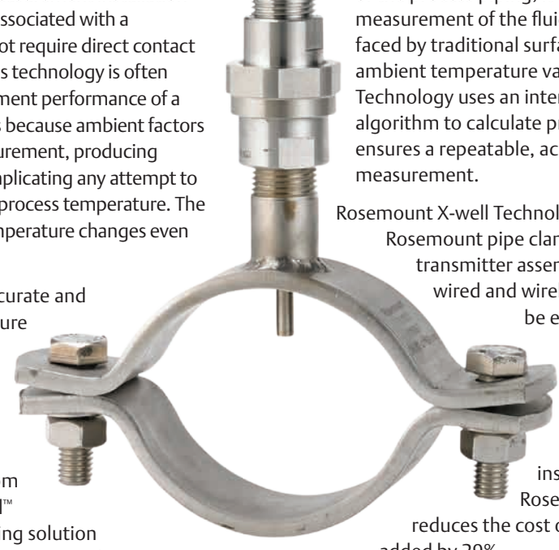
Temperature is the most commonly measured variable in the process industry and is often a critical factor in determining process efficiency and product quality. There are various means of performing these measurements to gain greater process insight, but each presents its own difficult challenges.

A thermowell and temperature sensor assembly is the industry's most frequently used technology. Thermowells enable sensors to be directly immersed into the process where they might not otherwise survive harsh conditions such as flow-induced stresses, high pressure and corrosive or erosive fluids. Although thermowells provide an accurate measurement, they also present various design and installation challenges. Complex wake frequency calculations are required to ensure accurate measurements, and material compatibility must be carefully considered to guarantee that the thermowell can withstand the effects of corrosive or abrasive process fluids. By penetrating the process, thermowells also create a potential leak point, which introduces risks and raises safety concerns.

A traditional surface sensor measurement installation eliminates many of the pains associated with a thermowell, because it does not require direct contact with the process. However, this technology is often unable to match the measurement performance of a thermowell installation. This is because ambient factors can severely impact the measurement, producing unpredictable results and complicating any attempt to relate surface temperature to process temperature. The environment and ambient temperature changes even impact insulated installations.

For applications requiring accurate and repeatable process temperature measurement, but without process penetration, a 'best of both worlds' solution is needed. This is provided by a unique new surface sensor innovation from Emerson. Rosemount™ X-well™ Technology is a game-changing solution that eliminates the challenges associated with thermowells, while also matching their accuracy and repeatability of measurement. Rosemount X-well Technology reduces engineering design time by 65%, lowers long-term maintenance costs and cuts installation time by 70% by eliminating wake frequency calculations, thereby reducing start-up times and lowering project risk.

Rosemount X-well Technology measures both the pipe surface temperature and the ambient temperature. Using an understanding of the thermal conductivity properties of the process piping, it can provide an accurate measurement of the fluid. To overcome the challenges faced by traditional surface sensors in terms of ambient temperature variation, Rosemount X-well Technology uses an internal thermal conductivity algorithm to calculate process temperature. This is what ensures a repeatable, accurate process temperature measurement.



Rosemount X-well Technology is implemented via a Rosemount pipe clamp sensor and temperature transmitter assembly, which is available in both wired and wireless formats. The assembly can be easily installed, enabling users to quickly add new temperature measurement points without the need for welding or process interruptions. By eliminating the need to design, purchase, install and maintain thermowells, Rosemount X-well Technology reduces the cost of each measurement point added by 29%.

Rosemount X-well Technology is ideally suited for pipeline applications, high velocity flows, slurries, heavy particulate fluids, wellheads, clean-in-place processes, high viscosity fluids and harsh processes in the oil and gas, chemical, refining, life sciences, metals and mining, and pulp and paper industries.

For more about how game-changing Rosemount X-well Technology can solve your process temperature measurement challenges, visit Emerson.com/IM1105

Unique HIPPS offering **reduces cost and risk**

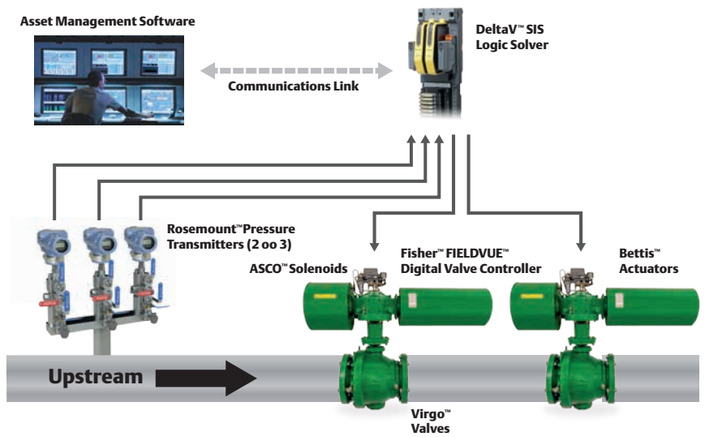
High-Integrity Pressure Protection Systems (HIPPS) provide the most dependable protection against potentially catastrophic overpressure events. Carsten Thøgersen, Technical Sales Manager/SME Safety Solutions, reveals how Emerson's combination of HIPPS technology and products provides a unique holistic solution that delivers optimal pressure protection.

Protecting equipment, personnel and the environment against an overpressure event is critical for refineries, chemical plants and oil and gas assets. The consequences of such an event – a ruptured vessel or piping system and subsequent hazardous material leakage – could be catastrophic if not suitably managed. Traditionally, this has been performed using mechanical relief systems, opening to disposal systems such as flares or holding tanks. However, with chemical, oil and gas producers facing increased pressure from regulatory bodies to reduce greenhouse gas emissions, they are increasingly turning to modern technologies to optimise their pressure protection.

Typically, operators will now choose High-Integrity Pressure Protection Systems (HIPPS), which are part of a safety instrumented system and comprise pressure sensors, a logic solver, actuators, block valves and controls. Unlike traditional systems, when HIPPS sense increased upstream pressure, they rapidly close block valves before downstream process equipment becomes over-pressurised. HIPPS not only reduce risk levels and increase environmental protection, they also enable the number of relief valves to be reduced by 20% and deliver significant CAPEX and OPEX savings. They can be installed with minimal CAPEX, compared to a flare system expansion project and they enable testing to be performed automatically from a control room, rather than on-site, saving significant time and improving safety by keeping workers away from hazardous environments.

There are many challenges in analysing, designing, building and testing HIPPS, including the lack of standards outlining design parameters, resulting in a high level of interaction between end users, engineering and contractors during the analysis and design phase. Sourcing the different components for HIPPS can be time-consuming, but the greater challenge lies in the validation and verification of the systems to ensure that they comply with the Safety Requirements Specification and that the SIL level is maintained throughout the installation's safety lifetime.

HIPPS have traditionally required components to be sourced from multiple suppliers. The project management of numerous vendors is complex, but until recently no single supplier had all the right products in their portfolio to provide a true one-stop-shop approach.



Emerson offers a unique one-stop-shop approach to HIPPS.

However, with its unique combination of technology and products, Emerson can provide a holistic solution, being able to manage the entire process of designing, building, installing and operating HIPPS.

Emerson's hardware package comprises Virgo™ valves, Bettis™ actuators, Fisher™ FIELDVUE™ Digital Valve Controllers, ASCO™ solenoids, DeltaV™ SIS logic solvers, and Rosemount™ pressure transmitters. Final control elements account for more than 50% of random failures in HIPPS. By providing pre-engineered and fully tested automated valve solutions, Emerson reduces random and systematic failures and improves reliability. Additionally, proof-test and inspection plans are provided, to ensure that the safety lifecycle is addressed. Choosing Emerson's HIPPS solution over one offered by a systems integrator enables customers to eliminate their dependence on multiple suppliers and therefore support schedule certainty by reducing the risk of delays and project overruns.

For more about how Emerson's HIPPS solution can optimise your pressure protection, visit Emerson.com/IM1106

The world's first wireless pressure gauge enables pressure to be monitored in real time.

Pressure gauge **technology transforming safety and reliability**

The reliability issues suffered by mechanical pressure gauges have long been a challenge for manufacturing and process plants. Tim Milarch, Product Manager Pressure, explains how the world's first wireless pressure gauge has brought about transformative improvements in not only reliability, but also plant and worker safety.

Ensuring the safety of personnel and assets is always the number one priority for process plant owners and operators. Reliable technology that helps to reduce manual operator rounds, preventing workers from being exposed to potentially dangerous environments, is therefore extremely desirable.

In critical pressure monitoring applications, the traditional technology for taking readings has been mechanical gauges. However, these devices are prone to failure in harsh process environments and can compromise the safety of personnel by requiring them to make additional field trips to perform readings.

Plants need pressure readings to verify correct process operation, to make adjustments that will optimise processes, and to ensure safe operations. Failed gauges can cause a plant to base vital maintenance and production decisions on unreliable information, therefore negatively affecting plant safety and productivity. Damaged devices can also suffer process media leakage, causing a safety risk to both the asset and the personnel sent to repair the problem.

Emerson's game-changing solution to these challenges is the Rosemount™ Wireless Pressure Gauge – part of its Pervasive Sensing™ portfolio which is expanding the use of sensor and analytics technology. Built with *Wireless*HART® communication capabilities, this is the industry's first wireless pressure gauge and it enables pressure to be monitored remotely in real-time, therefore reducing manual operator rounds and improving personnel safety. Reliable field data can be delivered to the control room as often as once per minute – much more frequently than manual readings. For some users, the ability to take readings both remotely and locally is desirable, so in addition to its remote monitoring capability the Emerson gauge has a faceplate with an analogue display.

The high failure rate of mechanical gauges, which are based on bourdon tube technology, is due to them having several moving parts which are prone to breaking down. When subjected to vibration, overpressure, extreme temperatures and corrosion, bourdon tubes can stretch, freeze and break, and these gauges may need to be replaced several times a year in the worst cases. The Emerson gauge eliminates the need for bourdon tubes and mechanical parts by utilising innovative and field-proven piezoresistive sensor technology. This delivers greater accuracy and reliability. This technology provides up to 150x overpressure protection compared to mechanical gauges, and the device has a 10-year installed life, further enhancing reliability and reducing maintenance costs and time. The gauge also enhances safety by providing a double layer of process isolation, eliminating the risk of leakage.

As mechanical gauges are simple reading devices, they are unable to communicate device health data that can predict and prevent problems. However, the digital electronics of the Emerson gauge enable it to report device health status directly to the control room, as well as through local status indication via a flashing LED light on the gauge face.

With all these advances, the Rosemount Wireless Pressure Gauge is truly transforming the task of pressure monitoring, and is setting new standards in both reliability and safety.

To learn more about how Emerson's Rosemount Wireless Pressure Gauge can help you improve reliability and safety, visit Emerson.com/IM1107

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