Energy Efficiency in Life Sciences Utilities

A practical guide to measurement instrumentation for achieving sustainability goals in the life sciences industry.

EMERSON

Integrating energy efficient measures in life sciences processes has significant potential to reduce worldwide greenhouse gas emissions. Acknowledging this fact, many companies in the industry are setting ambitious sustainability targets to reduce their environmental footprint, while keeping the health and safety of patients top of mind. For example, in 2022, Pharmaceutical-Technology.com surveyed 1,138 companies to analyze their emissions reduction targets. The results showed that companies in the pharmaceutical and biotech sector, on average, have committed to reducing 45.8% of emissions over the next 12 years.

To reduce overall energy consumption and meet sustainability goals, successful and profitable life sciences facilities must balance high energy intensity manufacturing processes and restrictive environmental regulations with decarbonization commitments. Adopting energy saving strategies that support uninterrupted operations, mitigate production risks, and maintain competitiveness in the face of these challenges has led the life sciences industry to investigate solutions across their operations. Innovative measurement instrumentation solutions are a crucial component to any life sciences facility's strategy to improve energy efficiency and reduce emissions across the value chain.

In this eBook, we will examine three major plant utility areas, and discuss ways manufacturers can take actionable steps to become more efficient while reducing emissions:

Steam Production and Distribution
Both utility grade and pure steam consume energy to produce

Thermal Energy
HVAC systems are highly energy intensive, as are heating and cooling fluids used in various processes

Compressed Gases
Air, clean air, and nitrogen 5.0 are energy intensive

Steam Production and Distribution

1 Steam Production and Distribution

Steam is an element commonly used in life sciences manufacturing, with universal challenges such as its energy intensity and resulting cost, but also its potential for waste with inefficient distribution. Steam is especially critical for life science environments, and utility-grade steam can be used in many applications. In the life sciences industries, there is an additional requirement for pure steam, which must be highly purified to remove minerals and other contaminants. This latter grade is regulated for applications where it could come into contact with the actual product, even including where it is used to clean and sterilize equipment between batches.

Specifications for steam will be included in the good manufacturing practice elements of product recipes where it is being added directly to a product stream, or when it is used to deliver heat via a heat exchanger or jacketed reactor. When producing pure water, steam specifications will be highly detailed, calling for extensive instrumentation to monitor its purity, pressure, temperature, etc., since these will be required in the batch record. Steam is also used for evaporators, distillation, drying, and crystallization—along with the preparation of semi-solid dosage forms, including creams, ointments, and pastes.

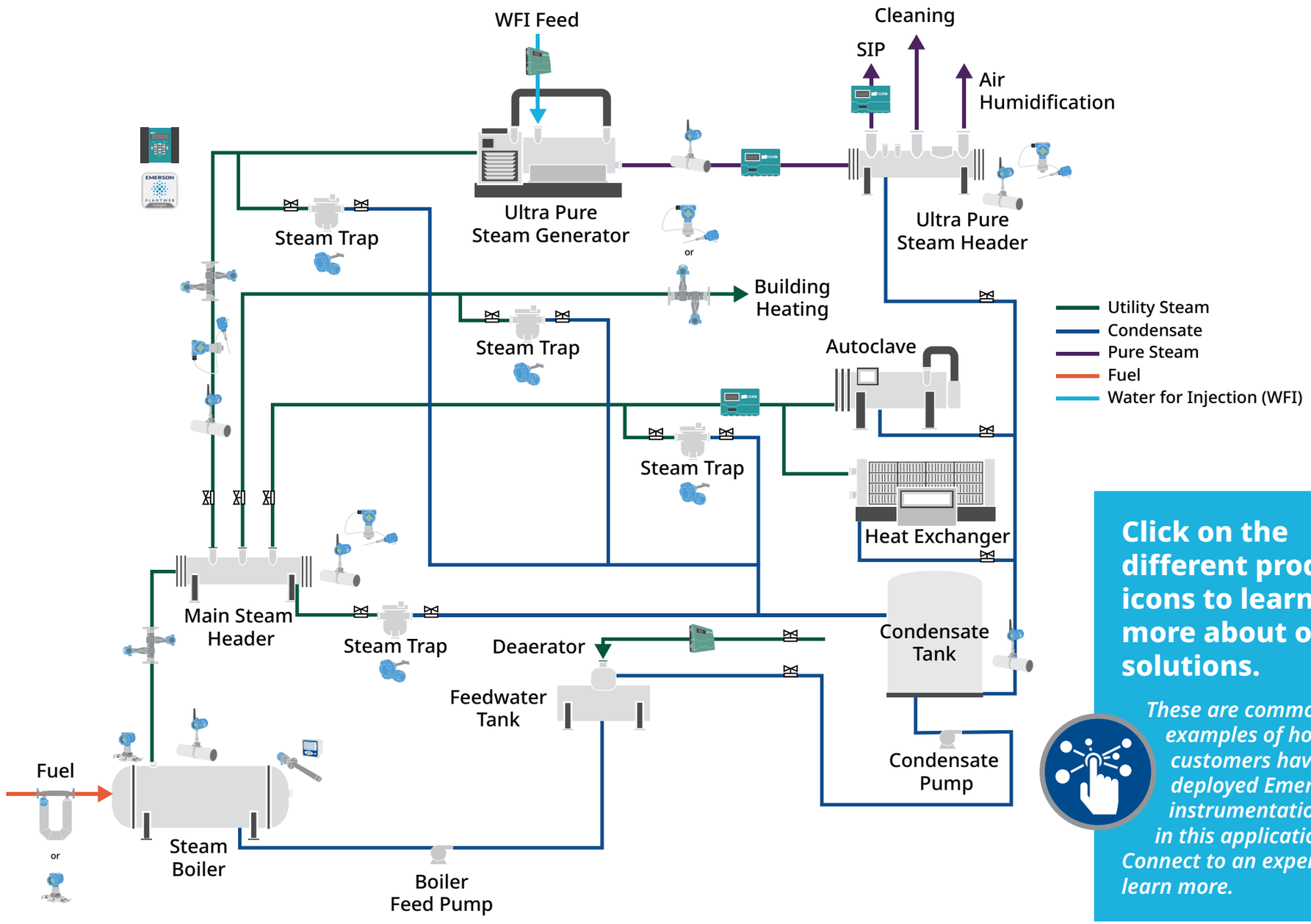
Let's look more closely at three areas: generating steam, distributing it throughout a facility, and using it effectively.

Challenges

- Steam production is highly energy intensive, typically still requiring large amounts of fossil fuel, leading to respective CO_2 emissions.
- Boilers require extensive maintenance and control to retain efficiency, and they are often subject to environmental regulations.
- Inefficient distribution where steam condenses or leaks, leading to significant energy loss.
- Where steam consumption is highly variable, multiple boilers are often required, and these are started/stopped as needed to keep them running in their most efficient output range.
- Where steam production can't keep up with demand, flow, pressure, and temperature will sag, creating quality and cleanliness problems.

Steam

- Rosemount 6888A In Situ Oxygen Analyzer with Rosemount 6888 Xi Remote Transmitter
- Rosemount 708 Wireless Acoustic Transmitter
- Plantweb Insight Steam Trap Application
- Rosemount 8800 Series Vortex Flow Meters
- Flexim FLUXUS F721 Ultrasonic Liquid Flow Meters
- Flexim FLUXUS G722 ST-LT Ultrasonic Steam Flow Meters
- Micro Motion ELITE Coriolis Mass Flow and Density Meters
- Flexim FLUXUS G601 Portable Multi-Functional Flow Meters
- Rosemount 3051S Pressure Transmitter
- Rosemount 3051S MultiVariable Transmitter
- Rosemount X-Well Technology with the Rosemount 648 Temperature Transmitter



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These are common examples of how customers have deployed Emerson instrumentation in this application. Connect to an expert to learn more.

Steam Generation

Boilers in life sciences environments take many sizes and shapes depending on the applications they support. Steam is mainly used in various heating processes and for the sterilization of equipment. In most facilities, natural gas is the energy source, and hydrogen may be an option in the future.

To keep combustion processes efficient, it is critical to measure fuel and air flows to maximize heat production while minimizing emissions. The Rosemount™ 6888A sensor combined with the Rosemount 6888 Xi Remote Transmitter (Figure 1.1) helps reduce emissions by optimizing the fuel-to-air ratio of a boiler. By optimizing this ratio, the sensor ensures efficient fuel usage, which in turn minimizes emissions, maximizes steam production, and lowers operational costs. This is particularly important when the boiler is operating at less than full capacity.

FIGURE 1.1

The Rosemount 6888A In Situ Oxygen Sensor, combined with Rosemount 6888 Xi Remote Transmitter helps optimize the amount of steam being produced and the cost of running the boiler.

It is necessary to measure both what is going into the boiler in terms of fuel, as well as what is coming out, namely steam. Measuring steam production at the boiler provides the benchmark for determining system-wide efficiency in real time. Emerson's Rosemount 8800 Series Vortex Flow Meters (Figure 1.2) are ideal for steam applications due to their use of an integral temperature sensor feeding into the transmitter. When mounted on a steam output line in combination with a Rosemount 3051S MultiVariable™ Transmitter for high temperatures, the flow meter can provide compensated mass flow and corrected volume in steam applications. With this accurate picture of steam output, it is possible to determine how much energy is lost by comparing this data with the aggregated use of all the individual applications.

FIGURE 1.2

Emerson's Rosemount 8800 Series Vortex Flow Meters (left), working in conjunction with a Rosemount 3051S MultiVariable™ Transmitter (right), provides a comprehensive picture of steam production.

Monitoring feedwater flow is important to maintain proper level in the boiler, but also to determine how much condensate, and the energy it contains, is being recaptured. Emerson's Flexim FLUXUS® F721 Ultrasonic Liquid Flow Meter (Figure 1.3) can be mounted non-intrusively on the feedwater input pipe. When this type of flow meter is mounted on both the condensate return and make-up water sides of the feedwater, it is possible to determine how much condensate is being lost, especially if multiple flow meters are mounted at strategic points of the condensate return system. Constantly adding make-up water increases costs for energy and water treatment, and identifying problem areas using flow measurements is the first step to addressing these issues.

FIGURE 1.3

Emerson's Flexim FLUXUS F721 Ultrasonic Liquid Flow Meter can measure feedwater input non-intrusively for reduced energy costs.

Steam Distribution

As steam is generated in centralized boiler rooms, it must be distributed throughout the facility to the points of use. The efficiency of this distribution, particularly the rate of condensation and steam leakage through faulty steam traps, significantly impacts the overall efficiency of the entire system. Additionally, operators and energy managers need to be aware of the general distribution of steam to various processes and production areas.

Determining how much steam is being used by each application means measuring flow at strategic points. Emerson's Flexim FLUXUS® G722 ST-LT Ultrasonic Steam Flow Meter (Figure 1.4) is ideal for this purpose because it can be clamped to a pipe at any location and measure steam flow non-intrusively. Additionally, this technology is highly effective for ultra clean steam applications, where it provides enhanced efficiency and reliability. There is an option for temporary and portable steam flow measurement with the Flexim FLUXUS G601 Portable Multi-Functional Flow Meter.

FIGURE 1.4
Emerson's Flexim FLUXUS G722 ST-LT Ultrasonic Steam Flow Meter is a fixed flow meter while the Flexim FLUXUS G601 Portable Multi-Functional Flow Meter is ideal for temporary steam measurement applications.

Determining how well these transfer processes are working depends on monitoring strategic temperature measurements looking for desired changes. If sensors must be added to an equipment installation, this can be costly if using traditional wiring methods. Emerson's Rosemount X-well Technology (Figure 1.5) accurately measures internal process temperature without a thermowell or process penetration. This non-intrusive solution avoids cutting pipes, process shutdowns, or issues associated with thermowells. When combined with the Rosemount 648 Wireless Temperature Transmitter, there is no need for wiring since the power supply is internal, with data communication via WirelessHART®.

FIGURE 1.5
Emerson's Rosemount X-well with Rosemount 648 Transmitter, can measure temperature without pipe penetrations.

Steam Usage

One of the often overlooked yet critical components in steam usage systems is the steam trap. Steam traps are essential for removing condensate and non-condensable gases from steam lines to maintain steam quality, but they are inherently labor-intensive to monitor and maintain. With hundreds, sometimes thousands, of steam traps dispersed throughout a facility, the task of ensuring each one is functioning correctly becomes a significant operational challenge.

U.S. Department of Energy (DOE) studies suggest 15% to 30% of steam traps are malfunctioning at any given time, so they must be checked frequently to ensure they are operating correctly. Steam traps may be associated with a specific heat exchanger or other piece of equipment, or they may be attached to a mobile production unit. Steam system designs assume all traps are functioning normally all the time, which is rarely the case. Since they have an internal valve mechanism with moving parts, they can malfunction in two ways (Figure 1.6).

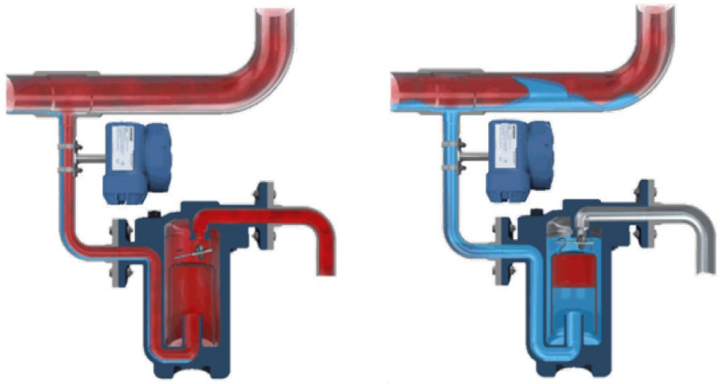


FIGURE 1.6

The steam trap (left) is stuck open, releasing live steam. The other (right) is completely closed, allowing condensate to accumulate in the piping.

First, some do not seal completely or can fail open, allowing condensate to sputter out, while also releasing live steam. DOE studies say 5% to 20% of steam traps fail annually in this manner, with the percentage of steam lost through trap opening equal from 33% up to 50% of line capacity, which can cost $10,000 worth of energy in a year.

Second, some mechanisms get stuck closed. Condensate then accumulates and does not release at all, backing up into the steam line, reducing the temperature and quality of the steam, and risking water hammer. This has different effects based on the steam trap's location. If it is attached to a heat exchanger, eventually it will fill with condensate and block steam flow, which can lead to heat exchanger stalls. Heating of the process fluid will slow and perhaps stop entirely if not corrected. This not only disrupts the production schedule but also risks having to scrap the entire batch leading to significant financial loss.

To address these challenges, Emerson's Rosemount 708 Wireless Acoustic Transmitter can be mounted permanently on the piping adjacent to a steam trap (Figure 1.7), continuously sensing its operation. It uses WirelessHART networks to send data to maintenance and reliability departments for analysis via Plantweb Insight™. This avoids the need for wiring of any kind, and these devices can be mounted with hose clamps to the outside of the pipe, so there is no need for a shutdown.

This combination of acoustic transmitter and analytical application provides a three-part system that senses key trap data, communicates it via WirelessHART, and presents interpreted trap states via a convenient dashboard. It classifies any style or brand of trap into its proper state (good, stuck open, stuck closed, inactive, etc.), with information for many steam traps visible at a glance. Plantweb Insight allows maintenance teams to track and report performance to energy and sustainability goals, send alerts, and integrate with enterprise systems to create work orders or perform analytics. The software estimates lost energy and resulting costs at any time, including the effect on carbon footprint.

FIGURE 1.7
Emerson's Rosemount 708 Wireless Acoustic Transmitter can be mounted adjacent to a steam trap, where it listens to its activity and measures temperature. It sends this data to Emerson's Plantweb Insight app for steam trap monitoring.

Thermal Energy

2 Thermal Energy

In life sciences utilities, thermal energy is crucial in various processes, from sterilization and heating to cooling and humidification. As the costs of energy continue to rise, there is a need for more efficient and effective energy management strategies. One aspect of optimizing thermal energy systems is accurately monitoring energy flows. By understanding how energy is generated, distributed, and consumed, facilities can identify inefficiencies and implement targeted improvements. This approach is crucial for minimizing energy waste and maximizing system efficiency.

Understanding where thermal energy is being used requires a wide array of instrumentation to ensure efficiency in these applications. Let's zero-in on three examples: clean room HVAC, chilled water system, and hot water system.

Challenges

- Thermal energy is a major utility cost for life science manufacturers.
- Costs are often not as transparent because facilities lack sufficient instrumentation capable of providing visibility into distribution and consumption of individual applications.
- Facilities struggle with finding the means to collect valuable data without compromising process and product quality, along with equipment availability.

Thermal Energy

Rosemount 3900
General Purpose
pH/ORP Sensor

Rosemount 3300HT
High Performance
pH/ORP Sensor

Rosemount 1058
Dual-Channel Transmitter

AMS Wireless
Vibration Monitor

Plantweb Insight
Analytics Software

Micro Motion G-Series Coriolis
Flow and Density Meters with
Micro Motion 1600
Field Mount Transmitter

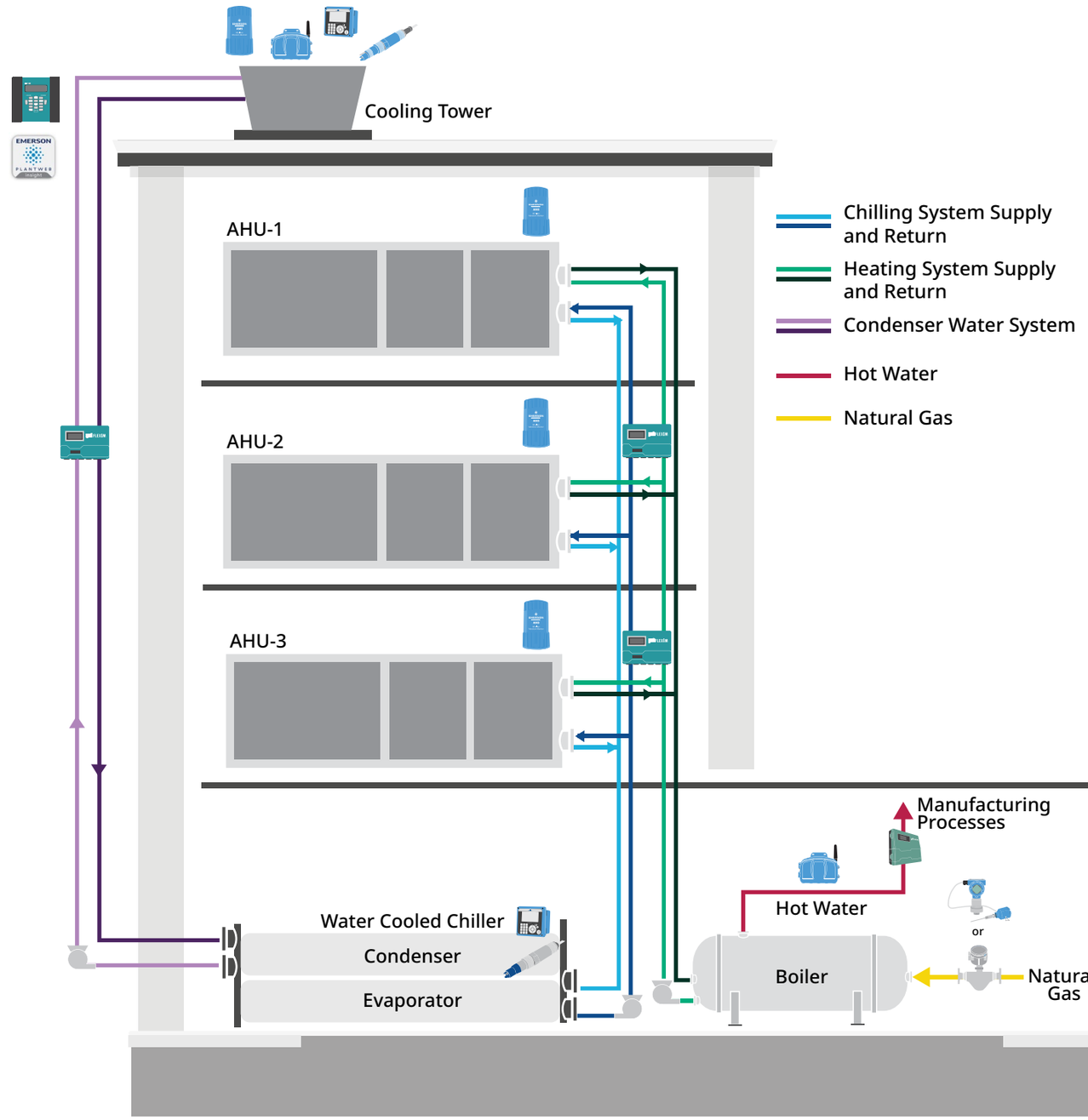
Flexim FLUXUS F721 TE Ultrasonic
Thermal Energy Meters

Flexim FLUXUS F601 Portable
Multi-Functional Flow Meters

Flexim FLUXUS F721 Ultrasonic
Liquid Flow Meters

Rosemount 848T Wireless
Temperature Transmitter

Rosemount 3051S
MultiVariable Transmitter



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These are common examples of how customers have deployed Emerson instrumentation in this application. Connect to an expert to learn more.

Clean Room HVAC

The temperature of a clean room must be maintained at the temperature specified in the recipe for a given campaign. This requires heating and cooling depending on the season, along with steam for humidification in some cases. Understanding energy consumption is critical for identifying efficiency and optimization opportunities, and Emerson offers three versatile instruments for this purpose.

Emerson's Flexim FLUXUS F721 TE Ultrasonic Thermal Energy Meter (Figure 2.1) is specially designed for heating and cooling thermal energy measurement—with flow and temperature measurement, and an energy calculator—contained in one device. All sensors mount non-intrusively, so there is no need for process shutdowns. Calculations are done in accordance with EN 1434 Thermal Energy meter standard. Temperature sensors must be attached at both the inlet and return lines of the system to accurately calculate thermal energy flow rate. This instrument works both in heating and cooling applications, and it provides a very accurate picture of how much energy is being used in a given application in real time.

FIGURE 2.1
Emerson's Flexim FLUXUS F721 TE Ultrasonic Thermal Energy Meter provides sensors for flow, temperature, and an energy calculator, all contained in one device.

Where there is no permanently installed flow meter, Emerson's Flexim FLUXUS F601 Portable Multi-Functional Flow Meter (Figure 2.2) can be mounted on a given pipe, from small tubing to huge pipelines, to take measurements in a matter of minutes. This approach is excellent for energy auditing and maintenance activities, and once mounted it can record readings for 14 hours, powered by its internal battery. Matched and paired transducers are supported by sophisticated algorithms, to provide reliable and highly accurate measurements under a variety of operating conditions.

FIGURE 2.2
Emerson's Flexim FLUXUS F601 Portable Multi-Functional Flow Meter can take thermal energy measurements in a matter of minutes.

An HVAC system uses large blowers and pumps that require substantial electric energy to effectively distribute air throughout an area, and suboptimal operations can result in millions of dollars in lost product and excess energy consumption. To optimize energy use and maintain efficient operations, an HVAC system can be equipped with sensors (Figure 2.3), such as Emerson's AMS Wireless Vibration Monitor mounted on rotating equipment, such as pumps and blowers to provide information about machinery health for operations and maintenance teams. Critical variables, including overall vibration, PeakVue measurements, temperature readings, and diagnostic data, can be displayed by AMS Device Manager or Plantweb Insight., allowing for proactive maintenance and improved energy efficiency.

FIGURE 2.3
Monitoring blower and pump installations using WirelessHART sensors, including Emerson's AMS Wireless Vibration Monitor, can be combined with Plantweb Insight for analysis and reporting.

Chilled Water System

Just as some processes require heat, others must be cooled to regulate exothermic reactions or control fermentation. For other applications, some products must be stored in slightly cool environments, and chilled water may be used to reduce humidity. This is often overlooked for sustainability efforts since heating is often thought to be more energy intensive. However, getting insight into the entire system, both chilled water and tower water, is just as important as with hot water or steam systems.

Emerson's Flexim FLUXUS F721 TE Ultrasonic Thermal Energy Meter (Figure 2.4) can provide both volume and energy flow simultaneously on both sides of a chiller. Installing one meter for both measurement points can reduce installation costs and ensure complete monitoring. By using both flow and energy values, operators gain enhanced insight into chiller efficiency.

FIGURE 2.4
Emerson's Flexim FLUXUS F721 TE Ultrasonic Thermal Energy Meter provides sensors for flow, temperature, and an energy calculator, all contained in one device.

Since chilled water systems can breed undesirable microbes, it is critical to monitor water chemistry to determine if conditions are favorable for development of this problem.

Emerson's Rosemount 3900 pH/ORP sensor with the Rosemount 1058 Dual Channel Transmitter (Figure 2.5) uses a double junction reference that extends sensor life. The double junction protects the reference element from poisoning ions that may creep into a system—such as ammonia, chlorine, and sulfides—via leaks or operator error.

FIGURE 2.5
Emerson's Rosemount 3900 pH/ORP sensor with the Rosemount 1058 Dual Channel Transmitter can confirm the process is within specification.

Hot Water System

Hot water systems require various process measurements to maintain control and performance—such as temperature, pH, and flow measurements to ensure the system is operating at peak performance. Monitoring these parameters helps prevent inefficiencies and potential damage to the system. Additionally, regular data collection and analysis can facilitate predictive maintenance, extending the lifespan of the equipment.

Maintaining the temperature of hot water from these systems is critical because it can dissipate and waste energy. Efficient distribution depends on effective insulation, particularly when variable flow rates change residence time in the piping. Monitoring temperature at strategic points can indicate where heat is being lost and insulation should be improved. Emerson's Rosemount 848T Wireless Temperature Transmitter (Figure 2.6) addresses this issue by capturing data from up to four sensors, including a combination of RTDs and thermocouples. It aggregates readings and sends them via a single WirelessHART signal to a host system.

FIGURE 2.6

Emerson's Rosemount 848T Wireless Temperature Transmitter simplifies the process of adding multiple temperature sensors with its ability to send data from up to four sensors on one wireless signal.

In hot water systems, pH measurement is required to monitor water chemistry. Emerson's Rosemount 3300HT High Performance pH/ORP Sensor with the Rosemount 1058 Dual Channel Transmitter (Figure 2.7) features a robust design that prolongs sensor life in high-temperature and high-pressure processes. It resists fouling, coating, and poisoning to deliver faster and more accurate measurements, while decreasing drift and sensor replacement frequency.

FIGURE 2.7

Emerson's Rosemount 3300HT High Performance pH/ORP Sensor with the Rosemount 1058 Dual Channel Transmitter, shown with integral cable, delivers long sensor life in high-temperature processes.

Measuring flow at strategic points across a hot water distribution system can indicate which applications are using a majority of energy, or where energy is being lost. Emerson's Micro Motion™ G-Series Coriolis Flow and Density Meters (Figure 2.8) are ideally suited for process monitoring in hot water systems, offering easy selection with pre-configured models, along with simple installation due to its compact size. The mass flow measurement provided by this meter and the appropriate transmitter, when combined with its internal temperature measurement, can provide energy content readings. The G-Series also provides streamlined maintenance and calibration operations using Smart Meter Verification.

The G-Series can also be paired with a 1600 transmitter which features an intuitive design and can support HART®, RS-485 or a native Ethernet connection with optional power over Ethernet. A suite of powerful software solutions provides measurement confidence and valuable process insight in the most challenging applications. The transmitter's data historian feature captures rich information about process events, fluid quality, and measurement stability.

FIGURE 2.8

Emerson's Micro Motion G-Series Coriolis Mass flow meters can provide multiple readings, including temperature, to help calculate energy flow. The Micro Motion G-Series Coriolis Mass flow meter is pictured here with the Micro Motion 1600 Compact Transmitter.

Compressed Gases

3 Compressed Gases

Clean compressed air is costly as it must be filtered to remove oil, water, microbes, and other contaminants. Even minimally treated compressed air is expensive to generate due to the high energy consumption of compressors, which are required to maintain the necessary pressure and flow rates.

Additionally, compressed air systems are usually distributed through complex piping arrangements with numerous fittings, valves, and connectors, each a potential source of leaks. Collectively, these leaks can release significant amounts of costly gases, leading to energy waste and increased costs. To address this issue, it is essential to gather detailed consumption data to identify leaks throughout the system. Keeping in mind the sterile requirements of clean compressed air systems.

Picking the low-hanging fruit of a sustainability program often begins by improving compressed air systems. Let's take a closer look at two areas: compressed air distribution and pure gases.

Challenges

- Compressed gases are expensive to generate.
- Facilities rarely monitor compressed air use application by application, so it is difficult to identify high usage areas or where significant leaks exist.
- Consumption data must be gathered without compromising GMP.

Compressed Gases

Flexim FLUXUS G721 CA
Ultrasonic Compressed Gases
Flow Meters

Micro Motion H-Series Coriolis
Mass Flow Meters with
Micro Motion 5700
Field Mount Transmitter

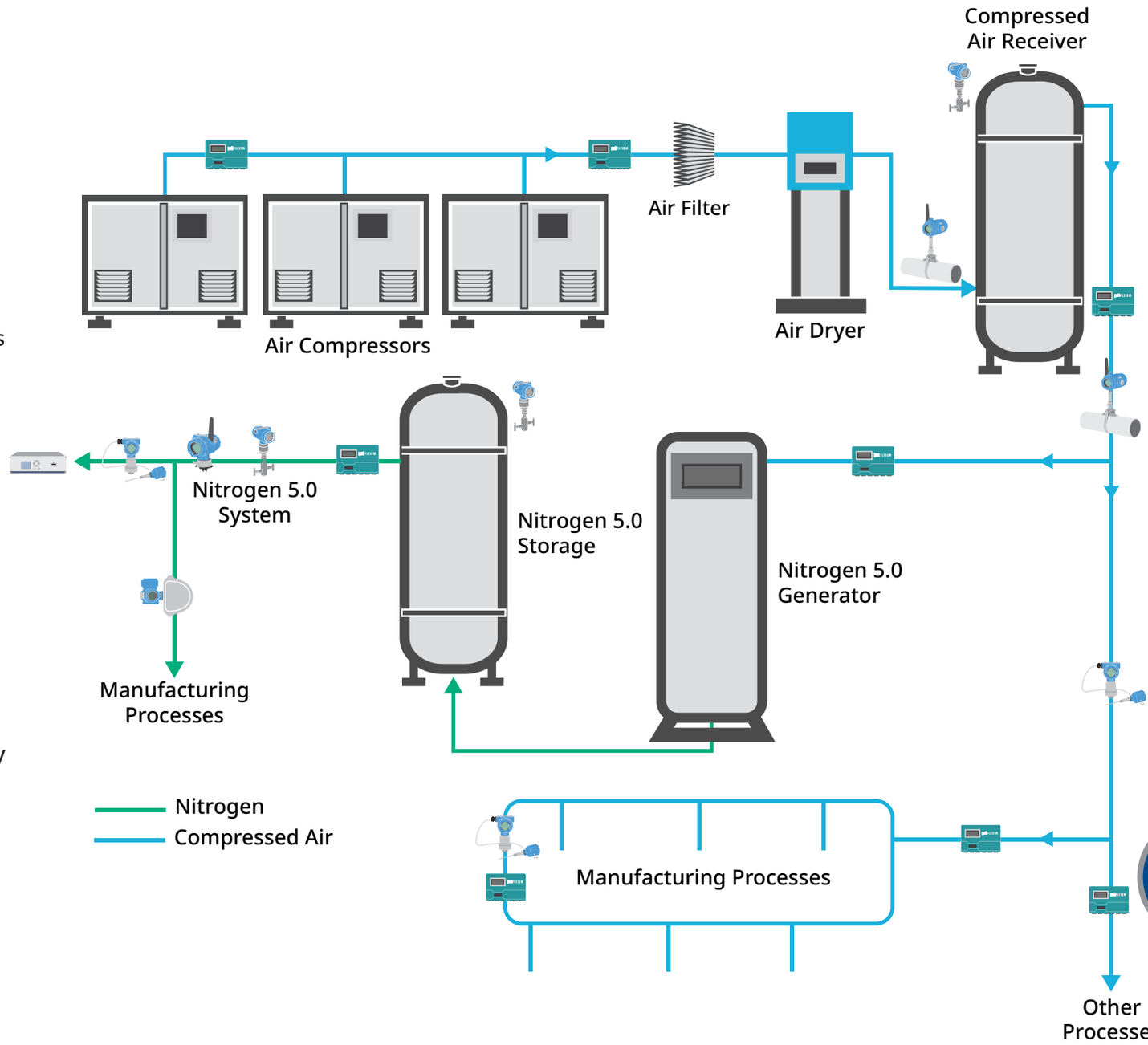
Rosemount 3051S
Pressure Transmitter

Rosemount 3051S
MultiVariable Transmitter

Rosemount X-STREAM
Enhanced XEGP Continuous
Gas Analyzer

Rosemount X-Well Technology
with the Rosemount 648
Temperature Transmitter

Rosemount 928 Wireless
Gas Monitor



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Compressed Air Distribution

Identifying leaks within compressed air systems presents a significant challenge for manufacturers. Every compressed air systems, to some degree, struggle with this issue, as leaks are an inevitable occurrence. These breaches can result in the loss of 20% to 50% of the compressed air, leading to a substantial waste of energy. To locate the critical leaks, it is essential to integrate accurate pressure and flow instrumentation to trace leaks and address the most significant points of air loss.

Emerson's Rosemount 3051S Pressure Transmitter (Figure 3.1) is a solid choice for any pressure application, especially compressed air and gas. This scalable platform offers a wide range of configurations, available with either wired or WirelessHART transmitters. It integrates seamlessly with manifolds, primary elements, and seal solutions to optimize performance for accurate differential, gauge, and absolute pressure measurements.

FIGURE 3.1

Emerson's Rosemount 3051S Pressure Transmitter is available in many configurations so it can be adapted to virtually any application.

Adding conventional flow meters requiring system shutdown is not very practical for life science manufacturers, but there is an alternative. Emerson's Flexim FLUXUS G721 CA Ultrasonic Compressed Gases Flow Meter (Figure 3.2) is a non-intrusive clamp-on ultrasonic technology that can measure compressed air flow rates, even at pressures down to 45 psi (3 bar). This technology allows operators to easily set up a monitoring system to continuously check compressed air generation, distribution, and leakage rates. Additionally, it can be installed on the sterile side of a process without compromising air quality.

FIGURE 3.2

Emerson's Flexim FLUXUS G721 CA Ultrasonic Compressed Gases Flow Meter can measure high and low flow ranges.

Pure Gases

The use of pure gases, such as nitrogen 5.0 and medical oxygen, is critical for various applications in life sciences. Pure gases are often the most expensive type in a facility due to the extensive and energy-intensive treatment required to remove all types of contaminants. Minimizing their consumption not only reduces costs, it also conserves the energy and resources involved in their production. Advanced instrumentation is essential for understanding energy savings potentials for example leakage rates.

For this application, Micro Motion H-Series Hygienic Coriolis Flow and Density Meters (Figure 3.3) are available in a wide range of sizes, especially important for the small diameters that may be used to monitor gas flow for single applications. Combining the H-Series meter with the Micro Motion 5700 Field Mount Transmitter provides a mass flow reading, that makes it easy to determine the amount of gas used, even if the flow, temperature, and pressure are variable. Micro Motion H-Series sensors are available with EHEDG certified, 3-A authorized designs, plus Smart Meter Verification to simplify maintenance and calibration.

FIGURE 3.3

Emerson's Micro Motion H-Series Coriolis Mass Flow Meters are excellent for compressed gases measurements, and they are available in hygienic configurations. These meters are highly compatible with the Micro Motion 5700 Field-Mount Transmitter.

Where an application calls for analysis of the compressed air or gas to verify composition and absence of specific contaminants, Emerson's Rosemount X-STREAM Enhanced XEGP Continuous Gas Analyzer (Figure 3.4) measures up to five components simultaneously in various combinations using NDIR/UV/VIS photometer, paramagnetic, electrochemical, thermal conductivity, and moisture sensors. A given unit can be configured to look for specific components as the application demands.

FIGURE 3.4

Emerson's Rosemount X-STREAM Enhanced XEGP Continuous Gas Analyzer can determine if specific contaminants are contained in a gas flow.

Compressed gases used or stored in an enclosed space can create a hazardous atmosphere due to displacement of oxygen. The Rosemount 928 Wireless Gas Monitors (Figure 3.5) can measure oxygen depletion, warning operators of unsafe conditions.

FIGURE 3.5

Emerson's Rosemount 928 Wireless Gas Monitor continuously monitors the oxygen content in the air to enhance worker safety where a leak of pure gases may displace the air. It is battery powered and uses WirelessHART to communicate making it very easy to deploy.

WirelessHART Sensors for Fast and Easy Deployments

A key issue with adding measurement sensors to existing production environments is wiring them to power and into existing control systems that may already be at capacity for I/O. Also, in batch operations where vessels and assets may be moved around based on the product being produced, wireless sensors reduce the work needed to rearrange equipment. Many of the Emerson range of sensors are available in WirelessHART versions that are battery powered and communicate with the secure encrypted WirelessHART protocol to gateways that connect to control systems with common industrial digital protocols (including HART-IP, Modbus, OPC, and Ethernet IP). For devices that require power (such as the Flexim Flow Meters, a THUM device can be used to convert the wired signal to a WirelessHART signal to simplify the integration to the control system and reduce the installation cost. Many asset monitoring applications can also bypass the control system completely, allowing for the monitoring software (such as Plantweb Insight, and Machinery Health Monitor) to be installed on the corporate network where the data is available across the enterprise.

FIGURE 3.6

The Emerson 1410S Series of WirelessHART Gateways and 781S Smart Antennas can connect up to 400 WirelessHART devices (with 2 antennas and 30 second update rates) and devices can communicate as fast as 1 second update rates using a self-organizing and self-healing mesh network.

Your Partner for Sustainability

Utilities such as water, air, gas, electricity, and steam are vital for the operation of life sciences facilities. With Emerson's specialization in instrumentation, process control, and sustainability, we can help improve and optimize various aspects of your utility operations. We are positioned to support our customers, suppliers and partners with their sustainability goals as automation continues to provide the critical foundation for progress. In this eBook, we explore several opportunities for sustainability and operational improvement in utility management. We provide insights on how to enhance performance, improve energy efficiency, and reduce emissions. Connect with our experts to see how we can help you achieve your sustainability goals.

Flow Measurement

Flexim FLUXUS® F721 Ultrasonic Liquid Flow Meters

- Non-intrusive flow measurement without touching the medium
- 1% accuracy for liquid flow with 0.15% repeatability
- Perfectly suitable for ultra-pure media and non-critical applications
- Standard temperature range up to 130°C – SIP safe. 240°C and above possible

Rosemount™ 8800 Series Vortex Flow Meters

- Gasket free all cast and welded design delivers a no leak point solution
- Multivariable option integrates temperature sensor and external pressure input to dynamically compensate for changes in steam density
- SIL-rated single, dual and quad meter configurations for critical measurements
- Non crevice design avoids clogging or particulate build-up
- Isolated sensor prevents process contamination plus on-line replacement without bypass piping or process shutdown

Flexim FLUXUS® G722 ST-LT Ultrasonic Steam Flow Meters

- Non-intrusive flow measurement of steam up to 180°C
- Perfectly suitable for ultra-pure steam - no contact with the medium
- Superior flow range without the need for pipe diameter reduction and zero pressure loss
- Easy installation and maintenance without shut down, reduced operational costs

Flexim FLUXUS® F721 TE Ultrasonic Thermal Energy Meters

- Non-intrusive thermal energy flow rate meter with integrated energy / BTU calculator
- Applicable for all kinds of heating and cooling application
- Easily tracking energy flow within chiller and hot water systems, as well as on cleanroom HVAC supply
- Easy installation without any shutdowns, not disturbing cleanroom availability at any time

Flow Measurement

Flexim FLUXUS® F/G601 Portable Multi-Functional Flow Meters

- Non-intrusive, battery powered flow meter for liquids, thermal energy, gases and steam
- The perfect multi-tool for energy managers, process engineers and maintenance crews
- Quick installation and measurement results
- Integrated data logger and powerful software FluxDiag for readouts and comprehensive reporting

Micro Motion™ G-Series Coriolis Flow and Density Meters with Micro Motion™ 1600 Field Mount Transmitter

- Ultra-compact, lightweight sensor design enables installation flexibility
- Easy installation, integration, and remote monitoring with trusted Micro Motion electronics and advanced diagnostics
- Power over Ethernet reduces wiring complexity with the 1600 Transmitter
- Cleanable, self-draining design
- Laser-etched tagging for sterile applications and longevity in demanding environments

Flexim FLUXUS® G721 CA Ultrasonic Compressed Flow Meters

- Non-intrusive flow measurement of compressed air, nitrogen 5.0 or medical oxygen
- 2% accuracy for gas flow with 0.15% repeatability
- Perfectly suitable for pure air and gases and non-critical applications
- Very high turndown ration enables leak monitoring

Flow Measurement

Micro Motion™ H-Series Coriolis Mass Flow Meters with Micro Motion™ 5700 Field Mount Transmitter

- Ensure product consistency and quality with superior density measurement
- Enable fast product change-over with self-draining design and superior temperature stability
- Choose from options including highly polished 316L stainless steel with a surface finish up to 15 Ra
- Capture valuable process data with the 5700 on board data historian

Micro Motion™ ELITE CMFS Coriolis Mass Flow and Density Meters

- Best-in-class liquid and gas flow and density measurement for critical process control applications
- Drainable geometry
- Offered in nine line sizes and three compact footprint options
- Hygienic process connections available, and selected models are 3A-authorized and EHEDG-compliant

Rosemount™ 3051S MultiVariable™ Transmitter

- Measures multiple variables and standardizes on a single model number for streamline process and cost-efficiency
- Reduces costs by eliminating the need for stacked transmitters and additional wiring
- Primary elements available as assemble-to options for simple installation and commissioning

Liquid Analysis Measurement

Rosemount™ 6888A In Situ Oxygen Analyzer with Rosemount™ 6888 Xi Remote Transmitter

- Improve process efficiency by optimizing the fuel-to-air ratio of boilers and furnaces
- Minimize emissions by maintaining your combustion process within a specific excess Oxygen range
- Keep personnel safe by utilizing remote interface options with the 6888Xi transmitter

Rosemount™ 1058 Dual Channel Transmitter

- Each sensor channel is independently configurable to support a wide selection of digital or analog liquid analysis sensors
- Predictive pH sensor health diagnostics let you know when your pH sensor is nearing the end of its life
- IP66 / Type 4X rated engineered polymer enclosure with universal mounting options provides confident and easy installation indoors or outdoors

Rosemount™ 3900 General Purpose pH/ORP Sensor

- Enhanced performance and extended sensor life with cracking-resistant glass, rugged polyphenylene sulfide body, and double junction reference
- Reliable pH/ORP measurements with versatile installation options to meet a wide variety of your application needs

Rosemount™ 3300HT High Performance pH/ORP Sensor

- Each sensor features a long-lasting rebuildable reference junction that allows sensors to be rebuilt and repurposed instead of replaced
- Customizable reference electrolytes allow sensors to be used in a wide range of applications, including high temperature and high pressure processes

Pressure and Temperature Measurement

Rosemount™ 3051S Pressure Transmitter

- Best-in-class, scalable architecture enhances performance, functionality and process connections
- All-welded hermetic SST SuperModule platform resists overpressure and line pressure effects to ensure 0.025% accuracy
- Integrates seamlessly with 4-20 mA HART™, WirelessHART®, FOUNDATION™ fieldbus protocols for application flexibility

Rosemount™ X-well™ Technology with the Rosemount™ 648 Wireless Temperature Transmitter

- Accurately measures internal process temperature without a thermowell or process penetration
- Avoid cutting pipes, calculating wake frequency or process shutdowns with this non-intrusive solution
- Reduce total cost of product ownership by 30% with decreases in design, engineering, installation, and maintenance costs

Rosemount™ 848T Wireless Temperature Transmitter

- Accepts up to four independently configurable inputs, dramatically reducing your installation and operational costs per point through the use of the secure and reliable WirelessHART® network
- Utilizes a field-hardened enclosure, which allows for installation close to any process, even in hazardous areas
- Designed with up to eight configurable alerts for advanced measurement monitoring

Gas Analysis

Rosemount™ X-STREAM Enhanced XEGP Continuous Gas Analyzer

- Measures up to five impurities in the N_2 stream simultaneously in various combinations such as NDIR/UV photometer, paramagnetic and electrochemical O_2, and moisture sensors
- Response time (T90) is <30 seconds from zero to span or sample
- Excellent repeatability (<0.5%) and linearity (<1%) across the measurement range

Rosemount™ 928 Wireless Gas Monitor

- High-accuracy O_2 detection helps assure safety of personnel
- Replaceable battery provides >2 years of service, reducing operational expenses
- Ratings for intrinsic safety help assure a safe environment
- WirelessHART communications offer >99% data reliability without the expense of running wires

Wireless Technology

Rosemount™ 708 Wireless Acoustic Transmitter

- Measures the ultrasonic acoustic noise and surface temperature to monitor steam traps, pressure relief valves, and other assets
- Easy, intuitive and non-intrusive installation enables a quick method to automate without the cost of wiring
- Rugged and robust transmitter design ensures consistent performance even in harsh environments

Plantweb Insight™ Steam Trap Application

- Monitors steam traps for blow-through or blocked failure conditions, and calculates the lost energy and CO_2 emissions from failed steam traps to provide sustainability KPIs
- Better prioritize maintenance with calculated insights from a steam trap status algorithm based on decades of process experience and analytics
- Easy-to-use visual dashboard display offers in-depth and continuous monitoring of steam traps

AMS Wireless Vibration Monitor

- Embedded prescriptive analytics deliver fast, accurate diagnostic information
- Easy installation for fast deployment and ROI
- Standard long-life battery means less maintenance and fewer trips to the field
- Hazardous area ratings extend monitoring across the plant while keeping personnel safe
- Fully compatible with existing WirelessHART® networks and AMS 9420 Wireless Vibration Transmitter installations

Plantweb Insight™ Analytics Software

- Digitally transform your operations with an industrial analytics solution that offers instant visibility to key assets, enabling better, faster decision making
- Seamlessly integrates into existing systems by connecting to WirelessHART® gateways and OPC enabled I/O systems
- Avoid potential safety hazards and better prioritize maintenance with real-time actionable analysis of your asset health

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