

A person wearing a white cleanroom suit, hairnet, and gloves is operating industrial machinery in a laboratory. The machinery is complex, with various cables and components. The person is looking at a monitor and holding a smartphone. The background shows a clean, bright laboratory environment.

**Proven technology with performance  
you can trust**

**Pharmaceutical Process Manufacturing and  
Utilities Solutions for Life Sciences**





Leverage critical process insights to produce with certainty using measurement technologies.

## Overcome measurement challenges while meeting process development goals

The life sciences industry is in a transformational period adjusting to new trends and influences. As the scope of your operations expands, you must ensure process consistency, product quality, and high productivity throughout bioprocessing.

Many operations are transitioning from dedicated to multiproduct manufacturing facilities requiring faster changeovers, shorter production runs, and increased flexibility. Stainless-steel batch and continuous single-use processing appeal to different volume requirements identified by Original Equipment Manufacturers (OEMs) or 3rd party Contract Development & Manufacturing Organizations (CDMOs). Monitoring shifts in technology is critical when quality, consistency, and time to market are on the line.

**“The biologic drug market is projected to reach \$390 billion within the next two years, and the need for efficiency and speed may be outpacing the market.”**  
– CPhI Pharma Insights Annual Report



**“Results Healthcare predicts drug manufacturing outsourcing will rise to over 26% by 2021. Having a strong manufacturing partner to manage costs and development risks is necessary.”**  
– AIChE, Pharmaceutical Manufacturing: Current Trends and What’s Next



**“The time, resources, and finances necessary to move a molecule from conception to commercialization is a staggering barrier [sic], but many organizations are up for the challenge.”**  
– AIChE, Pharmaceutical Manufacturing: Current Trends and What’s Next



# Achieve scalability and repeatability to facilitate time to market

Increasing process scalability and speed while improving quality and cost are common goals across the manufacturing sphere. As a trusted partner in the life sciences industry, Emerson understands this. We offer end users, CDMOs, and OEMs a wide array of unique solutions for measurement instrumentation and automation solutions that save time and costs. Our breadth of measurement and analytical technologies for batch manufacturing, utilities management, and continuous processing provide manufacturers increased collaboration, innovative technologies, and greater control over critical process parameters.



## Enhance workforce collaboration, development, and strategy in pharmaceutical manufacturing to remain competitive

- Small- and, in particular, Large-molecule drug manufacturing is becoming more complex and consequently evolving into a strategic function
- Increased cross-functional collaboration and process automation is driving efficiency to shorten time to market

**“New complexities in manufacturing have elevated [the need for collaboration] even further – manufacturing employees with some R&D perspective are becoming increasingly valuable.”**

– Deloitte, Advanced Biopharmaceutical Manufacturing: An Evolution Underway



## New technologies drive innovation, expediting market-entry of life-saving products

- Faster scale-up increases speed to market while enhancing manufacturing yields
- Decrease quality issues and improve economic impact enabling more research & development resources for future drug development opportunities

**“The need for high quality and readily available complex medicines is fueling innovation in biopharmaceutical manufacturing technologies,” which is driving industry changes and providing societal benefits.”**

– Deloitte, Advanced Biopharmaceutical Manufacturing: An Evolution Underway



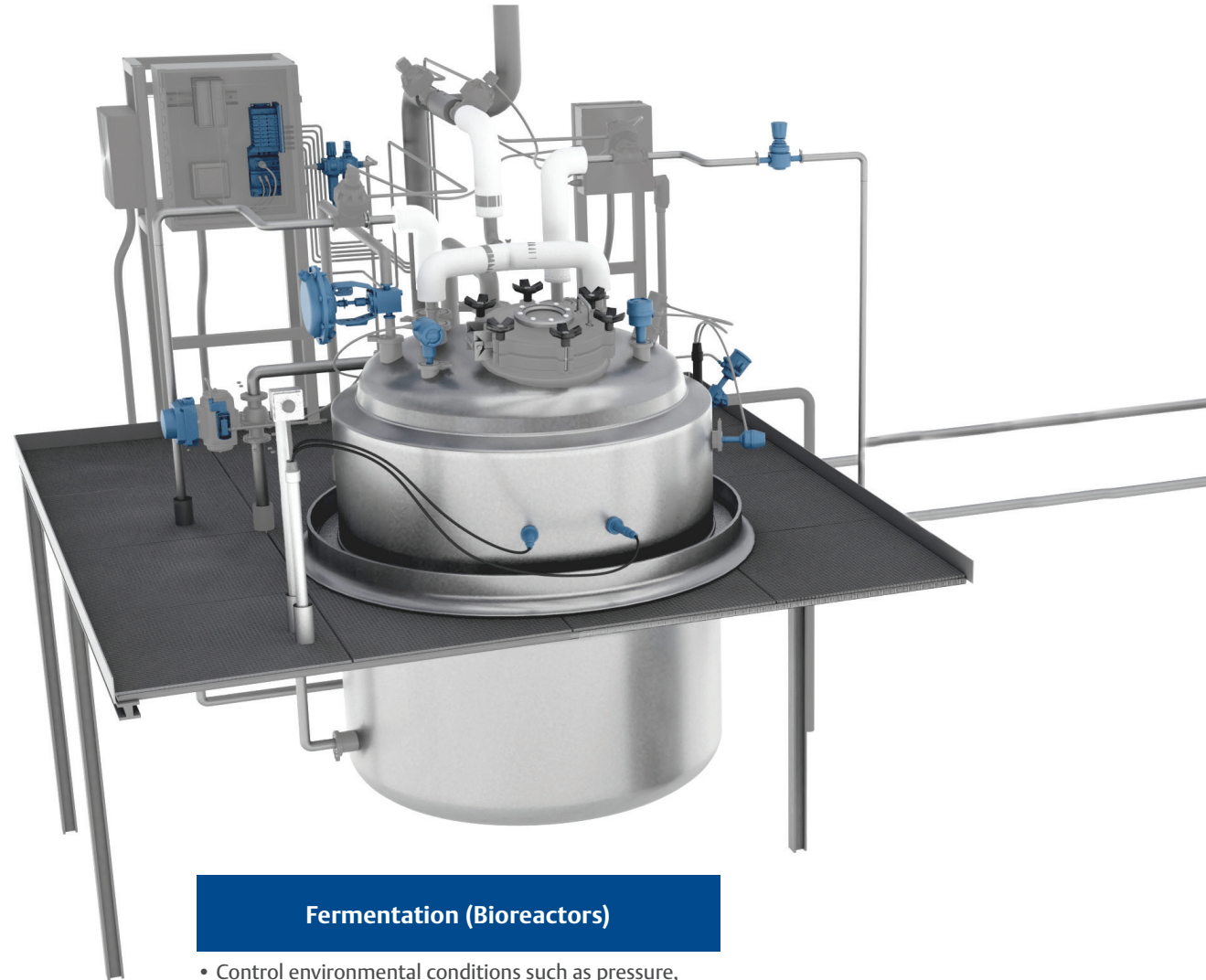
## Gain efficiency through increased flexibility, optimized changeover processes, and integrated automation procedures

- Continuous Single-Use Systems are smaller than batch systems and provide scalable production options, decreasing start-up complications
- Save on operating costs by increasing capacity and material utilization, decreasing offline quality control and analysis, and reducing maintenance time, energy use, and product loss

**“An estimated ≥85% of pre-commercial upstream bioprocessing now involves primarily or fully the use of single-use equipment for manufacturing. And the use of [Single-Use Systems] for large-scale, commercial manufacturing is just starting.”**

– BioPharm International, Single-use Bioprocessing Equipment Trends and Adoption by CMOs

**Emerson can help you overcome process and utility challenges with Stainless-steel Batch Processing and Continuous Single-Use Systems**



**Fermentation (Bioreactors)**

- Control environmental conditions such as pressure, temperature, level, and flow for batch consistency.
- Optimize production with scalable technologies.
- Increase safety and maintain regulatory compliance.
- Utilize advanced process control capabilities.

Product Portfolio ► p8-9



### Plant Utilities (Clean-in-Place and Steam-in-Place)

- Optimize chemical use.
- Minimize cleaning time for limited disruption.
- Achieve enhanced control.
- Advance thermal efficiency.
- Improve safety by reducing cross-contamination

Product Portfolio ► p10-11

### Purification and Filtration (Chromatography and Tangential Flow Filtration)

- Closely monitor complex processes like chromatography columns.
- Accurately control filtration skids.
- Keep pace with high-yield manufacturing processes.
- Prevent damage to products and equipment.

Product Portfolio ► p11



### Single-use Bioreactors

- Measure critical process parameters, such as pH and DO.
- Ensure process safety with accurate pressure measurement.
- Optimize production with scalable sensors.

Product Portfolio ► p12-14



## Improve repeatability and reduce maintenance with stainless-steel batch processing

Improve economics without sacrificing volume or product quality with scalable batch processing solutions. Learn more. ► [p8](#)

## Effectively clean process equipment with enhanced procedures

Maximize efficiency during cleaning and sanitization processes to protect the health and safety of consumers with accurate, reliable, and long-lasting solutions to ensure equipment is clean/sterile. Learn more. ► [p10](#)

## Increase scalability and reduce costs with continuous Single-Use Systems

Achieve operational flexibility to scale your process up or down without the constraints of fixed infrastructure with Single-Use Systems. ► [p12](#)



## Optimize manufacturing with transformational control technology

Eliminate complexity and dramatically improve the performance and efficiency of the project and operational lifecycle. Learn more. ► [p14](#)

## Global service capabilities and resources from a trusted partner

Dependably define, execute, and support your service strategy throughout the lifecycle of your operation while ensuring your workforce is up to the task. Learn more. ► [p15](#)

# Improve repeatability and reduce maintenance with stainless-steel batch processing

Improve economics without sacrificing volume or product quality. Batch processing applies fixed-asset stainless-steel technology (SST) such as bioreactor tanks, piping, and processing skids with scalable configurations from small laboratories to large manufacturing sites.

When it comes to measurement and analytical products, our range of technologies provides you with the best solutions to meet the requirements of your bioprocessing applications. We can help you improve time to market, reduce costs, and maximize your manufacturing footprint.



## What's your opportunity?

- Achieve high levels of reliability and agility required to ensure process consistency, product quality, and high productivity
- Maintain production efficiency and reduce downtime with reliable measurement instrumentation



## Produce with certainty using Emerson measurement and analytical instrumentation.

Increase your cost savings by accessing repeatable, accurate, and robust measurement and analytical technologies. Keep your bioprocessing systems online with technology designed to improve product quality and reliability in real-time.



## Services offered...

- Batch-to-batch stability for critical process measurements
- Flexible design to support process variability needs
- Reduce downtime with instruments designed to withstand cleaning and sterilization processes



## Process Critical Solutions



Receive accurate process temperature data without thermowells or process penetration with [Rosemount X-Well™ Technology](#).

- Simplify measurement point specification, installation, and maintenance
- Eliminate risk of process contamination with no process contact or leak points



The [Rosemount Hx338+ Steam Sterilizable pH Sensor](#) is equipped with a unique pre-pressurized pH reference technology to stop contamination between batches, preventing extractables and leachables.

- Reference features a triple barrier junction to maintain a drift-free pH signal and fight poisoning ions



The [Rosemount Hx438 Steam Sterilizable DO Sensor](#) is a membrane-covered amperometric sensor designed to meet demanding biotechnology requirements.

## Process Solutions to Optimize Every Point



Developed specifically for hygienic applications, the [Rosemount 3051HT Pressure Transmitter](#) delivers accurate, repeatable measurements for increased batch quality and consistency.

- Proven stability reduces downtime and operating costs with fewer calibrations
- Robust, durable design withstands harsh washdown conditions for long-term performance



Better understand your process conditions with the [Rosemount 2120 Level Switch - Vibrating Fork](#). It is easy to install and does not require calibration.

- Fast drip fork design gives a quicker response time, especially with viscous liquids
- Adjustable switching delay enables easy handling of turbulent and splashing applications



The [Rosemount 5408 Level Transmitter - Non-Contacting Radar](#) delivers accurate and reliable measurements in applications where there can be agitation, foaming, and condensation, as well as high temperatures and pressures.

### Additional products

- [Rosemount 1199 Diaphragm Seal System](#)
- [Rosemount 68Q Sanitary Temperature Sensor](#)



For more information, visit [www.Emerson.com/RosemountLifeSciences](http://www.Emerson.com/RosemountLifeSciences)

# Effectively clean process equipment with enhanced procedures

Maximize efficiency during sterilization processes to protect the health and safety of consumers. Clean-in-Place (CIP), Clean-out-of-Place (COP), or Steam-in-Place (SIP) processes can present measurement challenges which induce energy loss and create waste that ultimately lead to higher operating costs.

Emerson's process equipment and control systems provide solutions to increase efficiency, improve safety, and offer greater assurance of product quality. Ensure equipment is clean/sterile and ready for the next process to be run. CIP, COP, or SIP operations must be able to control temperature, pressure, and/or flow of steam to ensure adequate sterilization.



## What's your opportunity?

- Ensure effective sterilization with accurate, repeatable instrumentation that withstands harsh conditions
- Integrate distributed control systems with CIP/COP/SIP demand to manage the sequencing of lines and vessels for cleaning while optimizing production



## Let Emerson help you ensure your equipment is clean and sterile for your next process.

Effective sterilization of a facility's lines and vessels is largely dependent on CIP/COP/SIP processes reaching and maintaining specific measurement controls. Reduce cross-contamination, ensure regulation compliance, and keep personnel safe with precise instrumentation.



## Services offered...

- Accurate measurements for valuable steam and Water-for-Injection (WFI)
- Conductivity measurements save time and resources during CIP processes

## Featured Solutions



Robust construction and powerful built-in diagnostics from the [Rosemount 2130 Level Switch - Vibrating Fork](#) allow you to focus on your process. It is easy to install and does not require calibration.

- Fast drip fork design gives a quicker response time, especially with viscous liquids
- Adjustable switching delay enables easy handling of turbulent or splashing conditions



[Micro Motion™ H-Series Hygienic Coriolis Flow and Density Meters](#) provide the most accurate flow measurement available. Monitor mass flow, volume, temperature and product concentration from a single, compact, and drainable instrument with a cleanable design.

- Smart Meter Verification (SMV) available to check the meter integrity can be used to extend calibration intervals



Reduce variability by providing compensated mass flow measurements of saturated steam with the [Rosemount 3051S MultiVariable™ Flow Transmitter](#).

- Smart Meter Verification (SMV) available to check the meter integrity can be used to extend calibration intervals

## Related products



The [Rosemount 708 Wireless Acoustic Transmitter](#) provides accurate acoustic level and temperature data, device data, event status, and leak detection via the *WirelessHART®* network.

- Ensures energy is not being wasted and save on energy costs and maintenance hours with effective steam trap health monitoring



[Plantweb™ Insight Steam Trap Insight Application](#) provides real-time information about steam trap conditions, energy usage, emissions and leak detection.

- Prioritize maintenance with calculated insights from a steam trap status algorithm
- Solution seamlessly integrates with your existing infrastructure



Enhance water purification system performance with the [Rosemount 403 PUR-Sense™ Conductivity Sensor](#). Designed for WFI conductivity measurements, it adheres to USP guidelines and NIST calibration standards with surface finishes <16 Ra.

- Ensure fast response to conductivity changes between CIP clean and rinse cycles to conserve costs and optimize processes



The advanced [Rosemount 56 Dual Channel Transmitter](#) is equipped with a large, customizable screen and at-a-glance view of two liquid measurements, diagnostics, and temperature readings.

- Intuitive design reduces configuration, installation, and maintenance time

### Additional products

- [Rosemount 225 PUR-Sense™ Toroidal Conductivity Sensor](#)



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# Increase scalability and reduce costs with continuous Single-Use Systems

Single-Use Systems provide end users additional flexibility to scale their process up or down without the constraints of fixed infrastructure. Shifting from stainless-steel to single-use production reduces time, costs, and contamination risks by integrating single-use equipment and measurement technologies in your process. Adopting Single-Use Technology (SUT) minimizes the need for cleaning and sterilization as well as any associated cost of chemicals, energy usage, and supporting infrastructure.

Increase efficiency and optimize production by improving product quality, reliability, and operating costs with SUT.



## What's your opportunity?

- Leverage the same accuracy and stability as SST methods, without sacrificing performance.
- Single-use sensors can be used intuitively; enabling faster start-up time, reducing chances for error, and eliminating the need for experienced operators on the job



## Emerson can help you overcome measurement challenges while meeting process development goals.

Manufacturers can standardize their operations, increase efficiency, and uptime with single-use products while optimizing production and improving product quality. Single-use instrumentation can interface with control systems to provide a seamless single-use offering.



## Services offered...

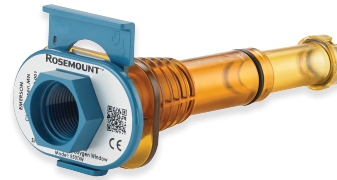
- Reduce batch turnaround and start-up time with easily integrated sensors
- Improve measurements and reduce maintenance during runs

## Single-Use Measurement Solutions



Designed to provide high measurement stability in single-use bioprocessing applications, the [Rosemount 550pH Single-Use Sensor](#) is easy to setup with an integrated buffer solution and eliminates installation and sterilization time.

- One-point calibration at the start of the batch
- 2-year shelf life due to wet storage, which enables immediate verification and calibration eliminating the initial stabilization process



Compatible with standard stainless-steel DO sensors, the [Rosemount 550DW Dissolved Oxygen Single-Use Sensor Adapter](#) is currently validated with the [Rosemount Hx438 DO Sensor](#) and enables placement into the bioreactor single-use equipment.

- Non-invasive solution designed for use with conventional DO sensors; only the gamma-irradiated adapter touches the process solution, allowing the reuse for multiple batches



The [Rosemount 550PT Pressure Transmitter](#) for single-use bioprocessing applications is designed to work in conjunction with the Rosemount 551 Single-Use Process Connector.

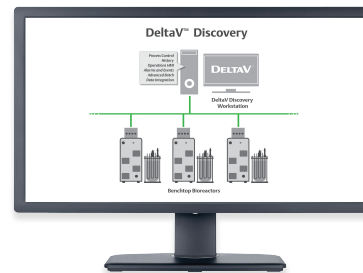
- Increase process uptime with immediate start-up and easy integration using the Rosemount 551
- Isolated diaphragm connection provides a sterile barrier to protect the Rosemount 550PT Pressure Transmitter from contacting the process

## Single-Use Systems for Control Solutions



Prevent “islands of automation” with the fit-for-purpose [DeltaV™ PK Controller](#) that can be scaled down for skid units or scaled up to be natively merged into DeltaV Distributed Control System (DCS).

- Standalone control that includes DCS features, such as advanced batch production, recipe management, execution, and historization



Automate laboratory control activities and accelerate new product introduction by streamlining product lifecycles with [DeltaV Discovery](#).

- Smaller footprint with powerful capabilities including batch management and integrated historians



Prevent contamination and ensure maximum purity of liquids with hermetic separation of control mechanisms using the [ASCO™ Series 273 Pneumatic Pinch Valve](#).

### Additional products

- [ASCO 580 CHARM Communication Node](#)
- [ASCO G3 Electronic Fieldbus Platform](#)
- [Rosemount 56 Dual Channel Transmitter](#)



For more information, visit [www.Emerson.com/RosemountLifeSciences](http://www.Emerson.com/RosemountLifeSciences)

# Optimize manufacturing with transformational control technology

Life Sciences manufacturers strive to create safe and effective drugs that help people lead healthier lives. Emerson provides the control expertise and technology to solve your greatest manufacturing challenges for improving your data management, real-time product quality, reliability, and operating costs.

From bringing in the broadest variety of Input/Output (I/O) and data sources, to embedding advanced control, to modeling the process and equipment, and to fulfilling electronic batch records, Emerson can help create effective solutions to improve inventory management, eliminate variability, and deliver cost effective compliance with repeatable production.



## What's your opportunity?

- Leverage analytics and embedded expertise to provide actionable insights that reduce complexity and enable higher quality, faster decision making
- Enable easy patch management to keep your system secure, current and supported
- Streamline combining your audit trail with overall electronic batch records



## Emerson gives you the power and versatility to handle the toughest demands no matter the scale of your operations.

With Emerson, it's faster, simpler, and easier to bring in a new process. Start with a bench-scale process, which seamlessly merges new equipment using plug and play capabilities, then expand to commercial scale with the same control building blocks, reducing changeover and setup time.



## Innovation offered...

- Drive setup with equipment state management and electronic workflows
- Facilitate easy and advanced control system integrating batch and equipment analytics
- Reduce implementation time and leverage best practices with Starter Kits and standard DeltaV building blocks

# Global service capabilities and resources from a trusted partner

Emerson's measurement & analytical portfolio applies industry expertise and innovative solutions to your business challenges. Our global network of resources and service capabilities is the partner of choice for companies like yours. We have the expertise to help you dependably define, execute, and support your service strategy throughout the lifecycle of your operation while ensuring your workforce is up to the task.



## Consulting Services

- Envision the value of innovative technologies
- Accelerate a sustainable competitive edge



## Lifecycle Services

- Extensive global channel to support you anytime, anywhere
- Leverage technical expertise to operate safely, improve asset reliability, and optimize process capabilities



## Project Services

- Improve project performance to meet or exceed start-up and long-term goals
- Increase competitive advantage through cost-effective modernization



## Training Services

- Empower new and existing workforce with training opportunities
- Courses are available online, on-site, or hands-on



Emerson can employ innovative solutions to help you maintain your competitive edge and empower your workforce in your plant operations.

## Get started



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Whether you use stainless-steel batch processing or Single-Use Systems, Emerson delivers time-tested and innovative processing solutions designed to help you improve process consistency, quality, and productivity. Optimize your process through real-time measurement and analytical solutions.

Contact us for world-class technologies and post-sales support through our services to increase scalability and reliability, while improving quality and cost. Getting started is easy.

Visit us: [Emerson.com/RosemountLifeSciences](https://www.emerson.com/RosemountLifeSciences)

Your local contact: [Emerson.com/ContactUs](https://www.emerson.com/ContactUs)



## CONSIDER IT SOLVED™