Maximize uptime, improve conversion efficiency, and prevent HSE incidents.

Fixed-Bed Reactors
Proven automation solutions and local expertise to help you overcome your toughest challenges.
Are you struggling to get more out of your reactors without compromising safety and reliability?

Reactor performance has never been more critical to the success of your operation. Competitors are modernizing and pushing their reactors closer to design limits, putting you under greater pressure to be more efficient. It’s a formidable challenge.

Catalyst health is difficult to measure and maintain. Equipment breakdowns can cause shutdowns that disrupt production schedules and drive up costs. Process upsets can erode profits and increase the risk of accidents. Getting ahead means having every tool at your disposal to ensure that your reactors run reliably and profitably.


Approximately two-thirds of control loops in manufacturing plants are poorly tuned, malfunctioning, or operating in manual. –Torres, B.S., Carvalho, F.B., de Oliveira Fonseca, M., Filho, C.S., 2006.

Costs to industry for catalyst replacement and process shutdown total tens of billions of dollars per year, a significant amount of which is avoidable. –Bartholomew, C., Argyle, M., 2015.

Reactors pose serious safety threats that can injure personnel and contaminate the environment.

Precise monitoring and control—for greater profitability

Emerson’s solutions give you the power to instantaneously analyze reactor performance, allowing you to operate at optimal set-points that can extend catalyst life. You’ll have accurate data from temperature sensors that last longer under extreme reactive conditions, and by reducing process variability with model predictive control, you’ll be able to maximize productivity and improve safety at the same time.

Meet your production goals, regardless of unexpected process events

• Stop sudden excursions from damaging equipment and causing breakdowns
• Minimize process upsets that can impact reaction efficiency
• Replace severe-service sensors less often and reduce maintenance costs

Lower the risk of safety and environmental incidents

• Receive alerts for temperature or pressure spikes in real time
• Run at closer-to-optimum levels without compromising safety margins
• Prevent leaks and explosions with more durable devices

Maintain the expected level of efficiency for the life of your reactor catalyst

• Monitor catalyst performance in real time
• Reduce process variability and improve conversion efficiency
• Prevent costly shutdowns and extend catalyst life

Cost of reactors with conveyor belt features

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Cost of reactors with conveyor belt features
With Emerson, you can overcome your fixed-bed reactor challenges

**Fixed Inlet**
- Detect feedstock changes and purges. Analyze ➤ p6
- Detect temperature and pressure excursions that can cause process upsets. Monitor ➤ p7
- Improve reactor control with more accurate measurements and less lag time. Control ➤ p5
- Quicker online emergency shutdowns to prevent runaway reactions. Control ➤ p6

**Catalyst Bed**
- Maximize conversion efficiency and extend catalyst life with advanced process control. Control ➤ p5
- Detect process upsets early to preserve catalyst integrity and increase uptime. Monitor ➤ p7
- Calculate and trend catalytic activity to make better operating decisions. Analyze ➤ p9

**Heating and Cooling**
- Get reliable data in corrosive high-pressure, and high-temperature reactor conditions. Monitor ➤ p6
- Cut maintenance costs and improve uptime with extended sensor life. Monitor ➤ p7
- Precisely control reactor temperature and reduce unwanted byproducts and accelerated catalyst deactivation. Control ➤ p6

**Product Outlet**
- Control product quality by analyzing composition. Analyze ➤ p9
- Maintain desired production conversion rate. Analyze ➤ p9
- Detect temperature and pressure excursions that can lead to unsafe conditions. Monitor ➤ p7
- Minimize process upsets that can affect downstream units. Monitor ➤ p7

**Process Control**
With model-based advanced process control you can reduce variability, mitigate risks, and improve the overall reliability of your reactor system. Learn more ➤ p5

**Temperature, Level, Pressure, and Flow Monitoring**
Having accurate, reliable process data is crucial to ensuring that your reactor runs efficiently and safely for the duration of a production run. Learn more ➤ p7

**Composition Analysis**
By analyzing feedstock and product composition in real time, you’ll have a better understanding of how catalyst health and reactor performance affect your operation. Learn more ➤ p9
Process Control

Fixed-bed reactors involve highly complex, multi-variable processes. Maintaining optimum conditions inside the catalyst bed requires precise and instantaneous response to temperature excursions, feedstock impurities, and other potential upsets. Emerson's model-based advanced process control solution allows you to run in a more stable, optimum manner, maximizing conversion efficiency over the full lifespan of your catalyst and curbing upsets that can lead to breakdowns or HSE incidents. This will give you confidence to operate control loops in automatic mode, reducing variability while enhancing the overall safety and reliability of your reactor systems at the same time.

What's your opportunity?

- Maintain optimum weighted average bed temperatures to maximize conversion efficiency and extend catalyst life.
- Compile and display historicized process data to predict future conditions and minimize deadtime.
- Prevent cycling and temperature excursions that can deactivate catalyst and lead to potentially dangerous events.

Featured process control solutions

Increase visibility of your reactor’s performance to give you confidence that you’re always operating in a safe manner.

- Built-for-purpose function blocks include cause-and-effect matrix and voting strategies that help reduce engineering complexity in decision-critical areas
- Logic solvers’ native capability to manage field diagnostics helps avoid spurious trips and allows operators to make informed decisions
- Partial stroke tests ensure that valves operate properly in emergency situations
- Applications include both batch and continuous reactor operations

Improve reactor control with an integrated application that allows you to monitor, analyze, diagnose, and enhance control loop performance.

- Continuous performance monitoring identifies abnormal reactor control conditions that lead to cycling and temperature excursions
- Adaptive and on-demand loop tuning minimizes temperature variability, extending the life of your reactor catalyst
- Integrated application requires no configuration or maintenance, resulting in faster start-ups and sustained performance benefits

DeltaV SIS™

- DeltaV Visions for situational awareness during commissioning, start-up, and post-startup phases
- Comprehensive, 24/7 on-demand technical support
- Live site planning
- Life cycle evaluation services to assess DCS performance across your site
- User training

DeltaV Insight

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AMS Device Manager

- Capture predictive diagnostics that enable you to address instrumentation issues before they impact the safety and reliability of your reactors
- Calibration management maintains high level of instrument accuracy to operate at optimum temperatures
- Security permissions reduce safety risks by ensuring no accidental changes on devices
- Real-time alerts allow operation to act quickly to prevent reactor upsets

Elevate your reactors’ performance to the next level.

Emerson experts can help you find ways to implement process control strategies that are tailored for solving your most pressing reactor challenges.

- Global and local support during commissioning, startup, and post-startup phases
- Comprehensive, 24/7 on-demand technical support
- Lifecycle planning
- Life cycle evaluation services to assess DCS performance across your site
- User training

DeltaV™ PredictPro

- Achieve exceptional control performance and immediate reactor disturbances with model predictive control (MPC) modules embedded in your DeltaV Distributed Control System
- Multi-variable control and optimization provides stable operation while maintaining a desired reactor temperature profile and protecting process constraints
- Dynamic process response models minimize temperature cycling and disturbances that can cause temperature excursions
- Fully embedded MPC function blocks provide easy implementation and maintenance of reactor control strategies

Related products

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For more information, visit EmersonProcess.com/Chemical

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Operating at a profit means being able to precisely measure several key reactor process variables, including temperature and pressure inside the catalyst bed and level and flow along the product streams. In addition to delivering accurate process data, Emerson's severe-service measurement solutions can withstand extreme conditions throughout the reactor that pose safety and environmental risks. Greater durability enables you to operate longer without needing to shut down to replace failed or damaged devices. You’ll have the critical data you need to ensure the safety and efficiency of your reactor at all times.

What’s your opportunity?

• Get accurate process data in high-temperature, high-corrosion environments.
• Reduce maintenance costs and maximize uptime with durable sensor probe construction that extends device life.
• Prevent fugitive emissions and sudden pressure drops with redundant safety design.

Services offered...

• Global service centers with factory-trained and certified technicians
• Diagnostics, repair, and calibration services
• Consulting services to help you optimize your process
• Simulated plant training

Rely on highly-trained service technicians when and where you need them. Make sure that you’re getting the maximum performance from your process monitoring devices. Reach out to a local expert today.

Related products

Rosemount™ Sapphire High Pressure Temperature Sensors

Measure temperature in extreme conditions with durable sensors that last longer between required replacements.
• Can withstand up to 1,700°C (3,272°F) and 65 bar (943 PSIG)
• Life span ranging up to 18,000 hours of safe operating time—three times longer than conventional thermocouples
• Dual safety and design protects against leaks and fugitive emissions

Rosemount 3051S Transmitters

Maintain correct temperature, pressure, and flow measurements in high-temperature, high-corrosion environments to ensure safe and steady production.
• Wide range of specially suited construction materials and fill fluids available for withstanding extreme conditions
• All-welded hermetic stainless steel design keeps sensors safe from corrosion, ensuring long-term reliability
• Built-in diagnostic test warns operators of plugged impeller lines, automatic pressure condition and device status
• Flexible design allows integration with HART™, WirelessHART®, and Rosemount Foundation fieldbus protocols

Micro Motion™ Coriolis Flow Meters

Precisely measure feed and product stream mass flow rates in order to optimize conversion of reactants and extend catalyst life.
• Multi variable capability for mass flow and density allows for detection of liquid contaminants before they impact catalyst integrity
• Wide turndown capability ensures accurate measurement of liquids (± 0.05%) and gas (± 0.25%) during startup and normal operating conditions
• Improved mass balance helps optimize reaction

Rosemount Guided Wave Radar

Measure tank levels in processes requiring downstream gas-to-liquid separation, ensuring safe operating conditions.
• Safety certified to IEC 61508 for SIL2 applications to prevent risks such as overfill
• Verification Reflector test measurement integrity without removing the device or changing tank levels
• Device unaffected by media density, conductivity, temperature, pressure, or viscosity, ensuring dependable measurement without the need for recalibration
• Predictive diagnostics enable pre-active scheduling of maintenance

For more information, visit EmersonProcess.com/Chemical
Composition Analysis

To fully understand how well your reactor is performing, it’s essential to closely monitor the chemical composition of your product stream—from the feed entering the catalyst bed to the output from the reactor vessel. Emerson’s advanced gas analyzers let you do this in real time, offering an unprecedented level of insight into your process and control over conversion efficiency and catalyst health. Continuous gas composition analysis also makes it possible to quickly detect and alleviate sudden process changes that can lead to unscheduled shutdowns and increased risk of accidents.

What’s your opportunity?

- Prevent costly process upsets by detecting variability with greater precision and minimal lag-time.
- Make better long-term production decisions with increased process insight into catalyst performance.

For more information, visit EmersonProcess.com/Chemical

Make the most of your process data to maintain reactor performance. Call an Emerson expert today.

Services offered...

- Installation, setup, and troubleshooting
- Recommendations on spare parts and maintenance schedules
- User training on principles of analyzers and sample handling systems

Rosemount Analytical Gas Chromatographs

Analyze feed stream quality to enable adjustments for improved conversion efficiency.

- Single device can measure up to 20 streams and up to 25 components per stream
- Installation possible without analyzer shelter for reduced capital and operating costs
- Standardized applications for a wide range of feedstocks offer greater production flexibility

Micro Motion Specific Gravity Meters

Detect changes in composition of feed or product stream gases to monitor conversion efficiency and measure catalyst performance.

- Real-time, in-line measurement of specific gravity or molecular weight for improved reactor control
- Design prevents temperature and pressure changes from affecting measurements
- Internal diagnostics allow fast verification of meter health, reducing maintenance costs
Emerson Process Management delivers time-tested and innovative fixed-bed reactor solutions designed to help you improve your operation’s overall efficiency, reliability, and safety. Contact us now for world-class technologies, and services that can maximize your reactor’s performance. Getting started is easy. Visit EmersonProcess.com/Chemical