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.

EMERSON™

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

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.

Between 1980 and 2001, 167 serious accidents involving uncontrolled chemical reactions occurred in the U.S. Forty-six of those incidents led to fatalities.
–U.S. Chemical Safety and Hazard Investigation Board, 2002.

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.

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 slowdowns and shutdowns and extend catalyst life

"Production is more predictable and better controlled now because operators can confidently increase rates for certain products. The plant's availability is 99% and annual production has risen by 3% to 5%—to 66,000 tons of high impact and crystal."
– Polystyrene Manufacturer, South America

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

"There is virtually no reason, other than replacing a field-mounted device, to send a maintenance technician out in the field."
– Valdir Jose Caobianco, Ultrafertil

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

"Access to smart diagnostics enables devices to be worked on before trips occur."
– I&E Supervisor, major North American fertilizer producer

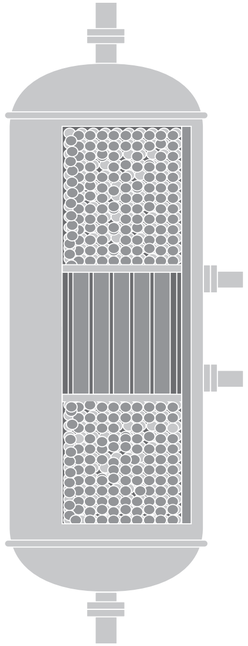
With Emerson, you can overcome your fixed-bed reactor challenges

Feed Inlet

- Detect feedstock changes and impurities. Analyze ▶ p9
- 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
- Quickly initiate emergency shutdowns to prevent runaway reactions. Control ▶ p5

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 catalyst activity to make better operating decisions. Analyze ▶ p9



Heating and Cooling

- Get reliable data in corrosive high pressure, and high-temperature reactor conditions. Monitor ▶ p7
- Cut maintenance costs and improve uptime with extended sensor life. Monitor ▶ p7
- Precisely control reactor temperature and reduce unwanted reaction byproducts and accelerated catalyst deactivation. Control ▶ p5

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 risk, and improve the overall reliability of your reactor system. Learn more. ▶ p5

Composition Analysis

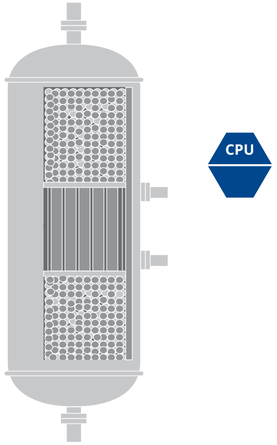
By analyzing feedstock and product composition in real time, you'll have a better understanding of how catalyst health and reactor performance affect your operation. Learn more. ▶ p9

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

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 dead time.
- Prevent cycling and temperature excursions that can deactivate catalyst and lead to potentially dangerous events.

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.

Services offered...

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

Featured process control solutions

DeltaV™ PredictPro

Achieve exceptional control performance and response to reactor disturbances with model predictive control (MPC) modules embedded in your DeltaV Distributed Control System.

- Multivariable 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

DeltaV SIS™

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

DeltaV Insight

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

AMS Device Manager

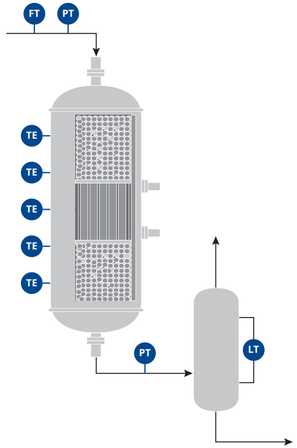
Capture predictive diagnostics that enable you to address instrumentation issues before they impact the safety and reliability of your reactors.

- Calibration management maintains high level of instrumentation accuracy to operate at optimum temperatures
- Security permissions reduce safety risks by ensuring no accidental changes on devices
- Real-time alerts allow operators to act quickly to prevent reactor upsets

For more information, visit Emerson.com/Chemical

Temperature, Level, Pressure, and Flow Monitoring

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 stream. 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.

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.

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

Featured temperature, level, pressure, and flow monitoring solutions

Rosemount™ Sapphire High Pressure Temperature Sensors

Measure temperature in extreme conditions with durable sensors that last longer between required replacements.
- Gas-tight T-IZR 8 sapphire crystal probe rated at 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 seal design protects against leaks and fugitive emissions

Related products

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 advanced diagnostics warn operators of plugged impulse lines, anomalous process conditions and device status
- Flexible design allows integration with HART™, WirelessHART®, and 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.
- Multivariable capability for mass flow and density allows for detection of liquid contaminants before they impact catalyst integrity
- Wide turndown capability ensures accurate measurement of liquid (± 0.05%) and gas (± 0.25%) during startup and normal operating conditions
- Improved mass balance helps optimize reaction

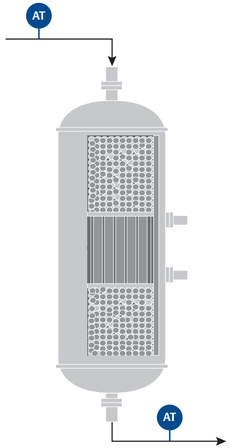
Rosemount Guided Wave Radar

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 tests 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 re-calibration
- Predictive diagnostics enable pro-active scheduling of maintenance

For more information, visit Emerson.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 to 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.

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

Receive consultation on control strategies and process conditions and how they affect analyzer measurement. Call an Emerson expert today.

Services offered...

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

Featured composition analysis solutions

Cascade Technologies Quantum Cascade Laser Process Gas Analyzers

Analyze product stream gas composition in real time for enhanced reactor control and improved conversion efficiency.
- Measure up to 20 different reactant gases including NOx, SO_x, CO, CO_2, CH_4, and NH_3 using IR absorption spectroscopy at rates of up to 10 hz
- Interchangeable modular configuration
- Certified for use in hazardous areas

Related products

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 feedstock 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

Get started

Emerson 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 **Emerson.com/Chemical**

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