Improve your network efficiency, reliability and safety

Natural Gas Smart Grid Management

Proven solutions to help you overcome your toughest challenges for process efficiency in your pressure reducing and metering stations

EMERSON™

A smart grid management can raise key performance parameters to world-class levels.

Gain full control of your natural gas transmission and distribution network and improve efficiency, reliability, and safety

Managing entire natural gas grids includes diversifying gas sources and expanding the customer base while balancing both ends to ensure reliable, safe and efficient operations. To satisfy this, transmission and distribution companies design redundant safety layers and oversized grids while operating them at the highest pressure levels which increases gas leaks.

Frequent on-site interventions are necessary to perform regular checks and set up pressure reducing equipment to accommodate seasonal service condition changes which is a challenge as valuable field engineering resources are scarce. This impacts gas utilities' financial bottom line while exposing them to environmental fines.

"Some pipelines are in transient operations over 60% of the time."

– Pipeline & Gas Journal, 2004

"In process plants, 50% of all maintenance work is not necessary and 10% is actually harmful."

– Gartner Group study, Expertune Inc., 2011

"Spending on HSE alone in the global O&G industry will jump 60% to hit $56 billion in 2030."

– Lux Research, 2013

Emerson's solutions for natural gas grid operational certainty

Remotely and automatically controlling your entire operations, from pressure reducing equipment up to your gas transmission and distribution network, would allow you to have a safer and more productive management of your operations while reducing your costs.

Emerson expertise and smart grid management solutions can help you achieve top quartile operational certainty.

Increase the entire grid integrity and personnel safety by reducing pipeline constrains and reaction time

- Avoid working at stress limits to satisfy worst operating conditions
- Real-time diagnostics of the grid and the interconnected stations
- Active monitoring of safety devices

Increase your financial bottom line by adapting production to your real-time customer needs

- Centralize data control to balance multiple injection and delivery points
- Pressure and flow control
- Increase metering accuracy, service quality and customer satisfaction

Avoid on-site regular checks, seasonal pressure balancing adjustments and emergency shut down

- Continuous equipment health monitoring to avoid unexpected failures
- Evolve from unplanned and planned to predictive maintenance
- Emergency gas odorization backup

Reduce unneeded natural gas injection, self-consumption and loss through leakage to the atmosphere

- Optimize grid pressure to accommodate real customer needs
- Reduce leaks and gas losses, in compliance with European legislation
- Reduce noise pollution

Remote Automated Flow system at the core of smart grid management

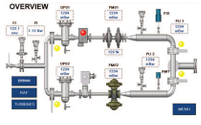
As in many industries, most innovation in natural gas production, transmission and distribution is aimed towards smarter management.

The Emerson Remote Automated Flow (RAF) allows such smart management.

Incorporating a control unit, customizable touch screen interface and smart software, it is highly scalable with the ability to automatically manage individual equipment, a complete pressure reducing and metering station and an entire grid. To facilitate this, it includes an extensive range of communication modes to allow all kinds of local and remote connections. The programmable logic developed by true industry experts offers a variety of features which simplify, optimize and secure the management of any natural gas installation.

RAF customization capabilities allows to manage any natural gas installation

Integrated Architecture



Main elements are a control unit, a touchscreen panel with I/O ports to communicate with a set of solenoid actuators, pressure, flow and temperature transducers.

Communication Capabilities

Local & remote communication: webserver, USB, Ethernet, GPRS, RS485 / Possibility to interface with existing SCADA system through MODBUS, TCP/UIP Protocols.

Scalable Integration

Ability to control single equipment, a complete pressure reducing and metering station and to assist in entire grid management.

RAF core functionalities

Pressure & Flow Control

Full control and monitoring of an entire pressure reducing and metering station. Allows the use of a regulator as a flow control valve.

Custody Transfer

In flow control mode, the RAF can be set to limit the capacity within the meter range to improve the invoicing accuracy.

Gas Heating Optimization

Optimization of the gas heating temperature by controlling the pre-heating boiler thermostat.

Odorant Injection

Control of the entire odorant injection system, from odorant ratio to odorant level monitoring.

Biomethane Injection

Ensure injected quality by monitoring the gas analysis results and redirecting the gas flow prior to injection, if necessary.

Pressure Profiling

Optimize downstream pressure to provide only the required gas quantity thus reducing leaks to the atmosphere.

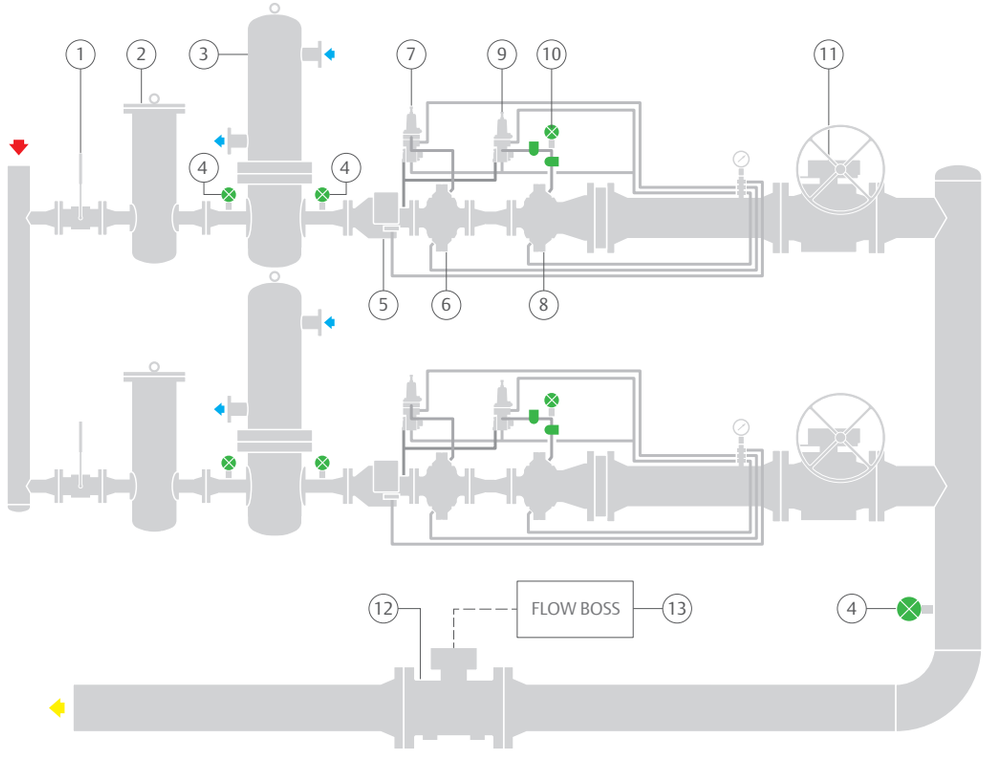
Emerson's technology for Smart Grid Management

Pressure and capacity management

RAF is a scalable modular system that can be used in natural gas transmission and distribution infrastructure to provide full control and monitoring of an entire pressure reducing and metering station (PRMS).

Acting directly on the pilot loading pressure, the RAF system can manage one or all of the regulating lines based on customer logic requirements; the operators will be able to select from different operating logics such as:

- outlet pressure remote control for grid balancing, seasonal adjustments, etc.
- on demand outlet pressure profiling to automatically adapt outlet pressure to daily consumption profile
- reducing lines operating mode management (full range, split range, remote shutdown, etc.)
- PRMS flow limitation, low flow management
- monitoring of all the operating parameters, such as inlet/outlet/loading pressure and flow rates



Legend

1. Inlet valve
2. Filter
3. Heat exchanger
4. Gas temperature transmitter for RAF control
5. Slam shut valve
6. Monitor regulator
7. Pilot for monitor regulator
8. Regulator
9. Pilot for regulator
10. Solenoid valves and pressure transmitter for RAF control
11. Outlet valve
12. Flow meter
13. Flow computer

Benefits

- Overcomes mechanical adjustment limitations
- Easy retrofit into existing stations
- No impact on existing safety systems
- Zero bleed to atmosphere
- Decreased noise level
- Continuous monitoring
- Remote operation and diagnostics

"The contemporary operation of gas pipelines is characterized by increasingly transient flow."

- RAMONA Annual meeting, 2008

Emerson's technology for Smart Grid Management

Custody transfer applications

Flow meters do not have the same accuracy level across the entire capacity range.

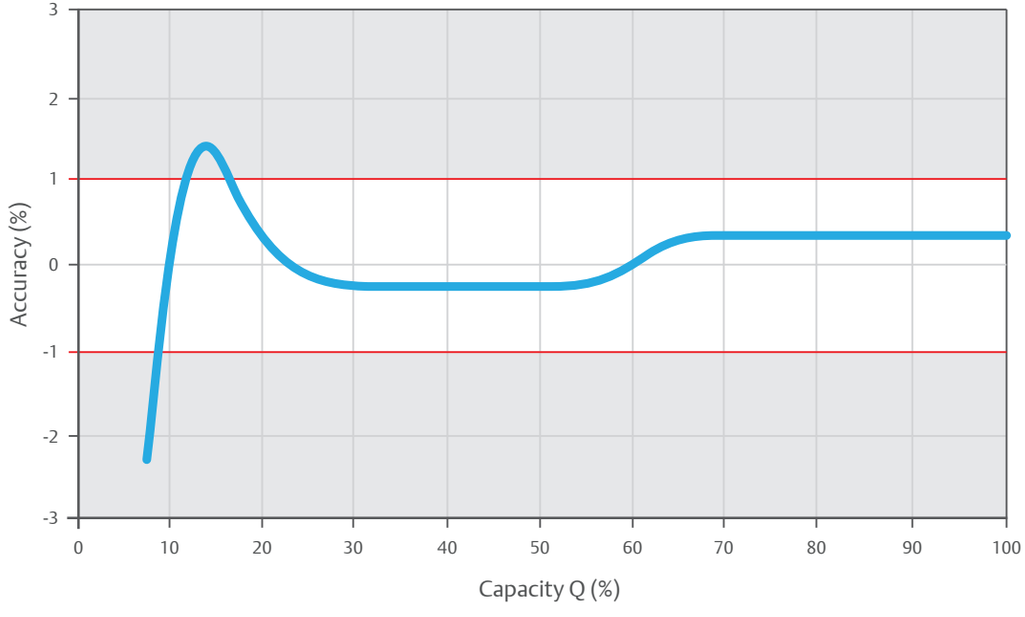
A typical accuracy range between 20% and 100% of the flow rate is acceptable. Lower flow rates do not fall into this accuracy range and therefore are unacceptable.

In custody transfer applications the high level of accuracy required across the entire range can be problematic.

RAF can control these types of situations by limiting the capacity to a minimum value to guarantee an acceptable level of accuracy.

RAF also permits meter protection in the case of overflow/overspeed situations.

Typical accuracy curve of a gas flow meter



Benefits

- On-going accuracy and repeatability
- Compliance to regulations
- Reduced internal/external audits

"A very large custody transfer system can meter $2.2 billion of NG per year. A measurement error of 0.25% would potentially result in $ 5.5 million of lost revenue."

- Control Engineering, 2010

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Gas heating management

Another strong feature of the RAF system is the optimization of the gas heating system, used when necessary to increase the gas temperature. This will allow considerable savings in terms of energy consumption, as well as reducing GHG emissions.

The electronic control unit receives the gas and water inlet/outlet temperatures and, by acting on the thermostats of the pre-heating boilers, the system maintains the gas temperature at the minimum requested value.

RAF heating system control can be used with other heating media or electric heaters.

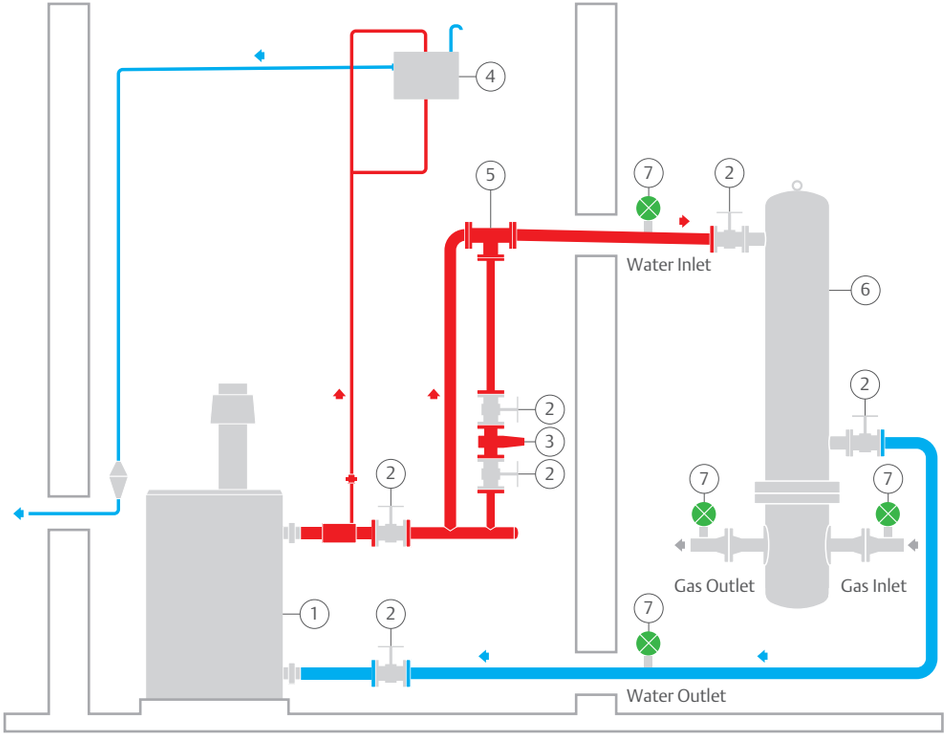
It also provides direct control of circulating pumps or any other device included in the heating system loop.

Substantial energy savings occur when these operations are used, allowing a return on investment for the complete system within 18 to 24 months.

Benefits

- Reduce energy consumption
- Optimize gas outlet temperature

For a City Gate supplying 5 MScm/year, RAF heating system control can save a minimum of 17,500 € per year. This corresponds to a ROI from 18 to 24 months.



Legend

1. Boiler with temperature probe
2. On-off valve
3. Pump
4. Expansion tank
5. Three way non-return water valve
6. Heat exchanger
7. Gas temperature transmitter for RAF control
8. Water temperature transmitter for RAF control

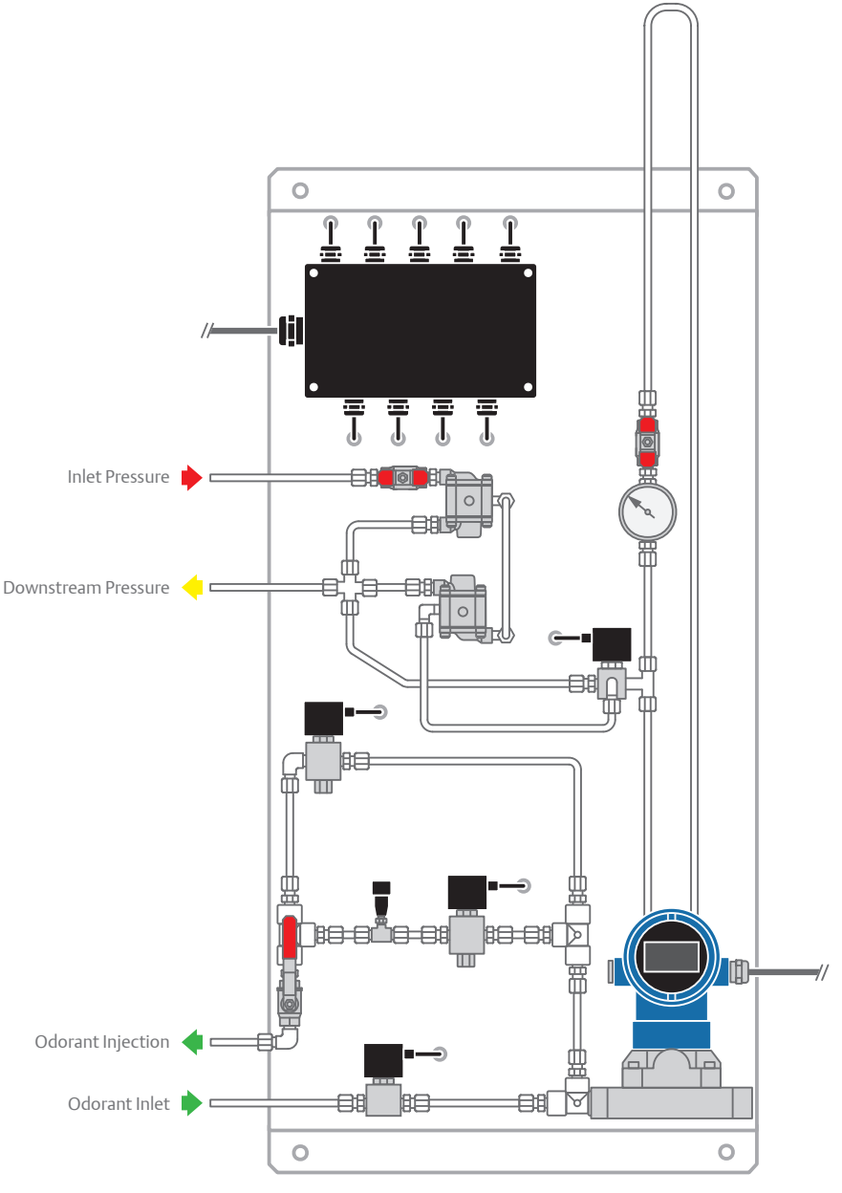
Emerson's technology for Smart Grid Management

Odorant injection

National energy authorities take odorization into consideration when performing quality of service evaluations and they conclude that poor odorization can have a significant impact on operational costs. Traditional technologies, such as absorption and pump systems, produce several issues including uneven odorant distribution, unplanned downtime, and a subsequent increase in the time maintenance engineers must spend visiting units that are often located remotely.

The RAF control panel manages the odorant injection system, which is configured with solenoid valves, thus keeping track of the quantity of liquid injected and automatically adjusts the injection rate to maintain the odorant concentration ratio constant. This results in increased ease of use, reduced maintenance and remote access and control facility. The solenoid injectors maintain accuracy over the entire flow range of the system, approaching infinite turn down.

The RAF continually monitors the odorant level in the tank, reducing system complexity and probability of errors during tank refilling and odorant injection.



Benefits

- Ease of use and reduced maintenance
- Reduced system complexity and possibility of failures
- Increased system accuracy and reliability
- Decreased operating costs

"Odorant injection is considered the easiest form of leak detection."
- PHMSA, 2002

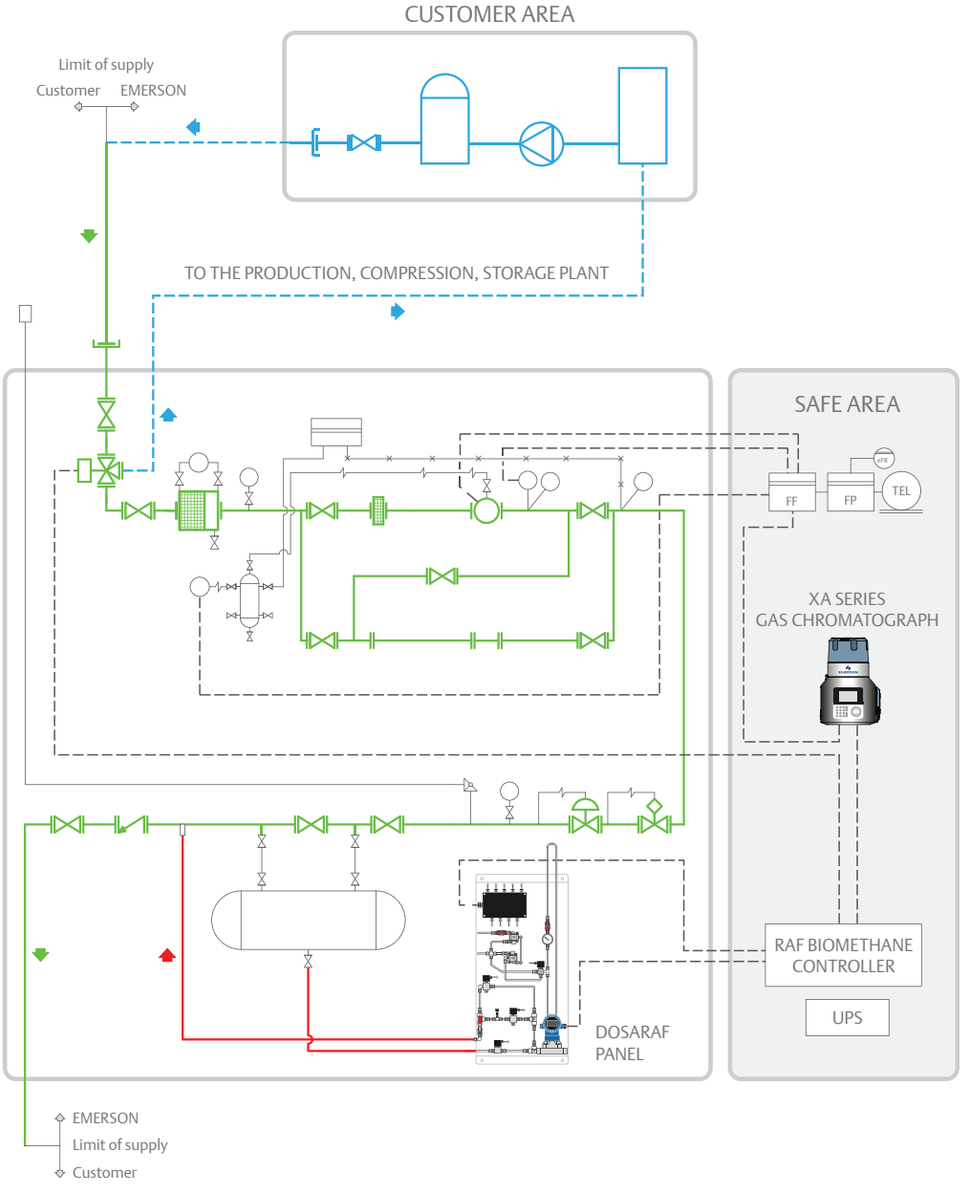
Emerson's technology for Smart Grid Management

Biomethane applications

Biomethane presents a great new opportunity for Europe in terms of a low cost, eco-friendly form of energy and the market for this product is growing rapidly. New regulations within many European countries not only enables biomethane to be added to natural gas networks, but also incentivizes the increase in the amount of biomethane added to the grid.

In order to inject biomethane into the natural gas grid, dedicated injection skids are built. They consist of several sections: gas analysis, a 3-way valve, filtration, metering, pressure reducing and odorization.

All these sections must work together seamlessly to ensure the optimum performance of the system. The RAF system can manage all of these devices, gather feedback from them, and take the necessary actions to safely inject into the grid a precise quantity of biomethane of the required quality.



Benefits

- Manage all the components and system from a single source
- Ensure compliance to standards and regulations
- Deliver continued, reliable, efficient, and safe operations

"Europe has a potential of biomethane production of between 151 and 246 billions of cubic meters per year; by 2025 new biogas plant will be built across the world to produce approximately 2.600 MW."

- Biofuels Digest, 2016

Emerson's technology for Smart Grid Management

Smart pressure profiling modulations

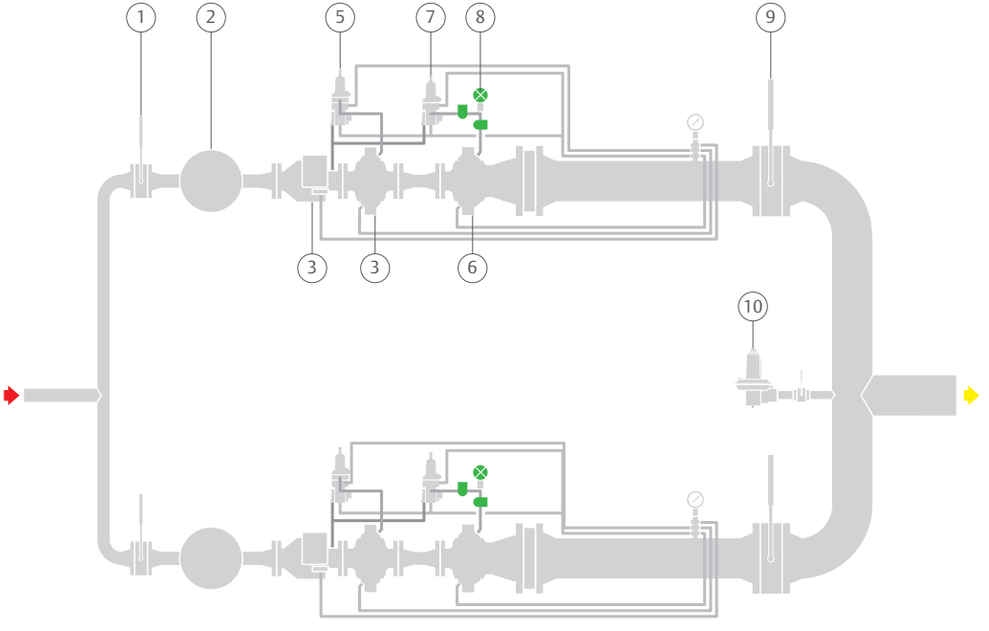
Managing a low pressure grid at the minimum possible pressure in fully automated mode is one of the main objectives of utility companies, in order to optimize resources and operational activities of their natural gas distribution system.

Due to the 'grid' layout, the delivery pressure can fluctuate and require several manual field adjustments to operate at the required pressure levels and fulfill variable demand requirements from users. This activity is time consuming and requires dedicated personnel to be on site. This is even more true and challenging as gas grids are designed to satisfy the maximum demand in the most extreme operating conditions, which might only happen once or twice a year (sometimes never) and for a limited time frame. This means that gas grids are normally operated at the highest pressure level to ensure gas availability during high demand periods.

The RAF system provides smart modulation of distribution pressure based on real daily consumption profiles, allowing a reduction in the average distribution pressure. To put this into context, an average reduction of 3 mbar in the outlet pressure of a low pressure distribution grid can bring up to 30% reduction of technical grid natural gas losses.

Benefits

- Real-time diagnostics of the grid and interconnected district stations performance
- Correct balance of the grid pressure level
- Increase service quality and customer satisfaction
- Increase distribution grid safety level
- Parallel working of regulating lines, allowing active safety operational mode, incremented flow capability, reduced noise emission, and increased lifecycle



Legend

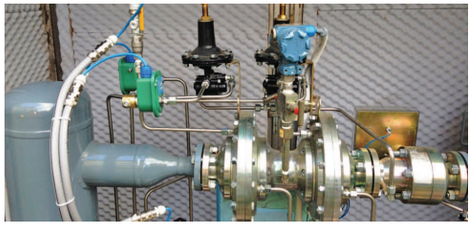
1. Inlet butterfly valve
2. Filter
3. Slam Shut valve
4. Monitor regulator
5. Pilot for monitor regulator
6. Regulator
7. Pilot for regulator
8. Solenoid valves and pressure transmitter for RAF control
9. Outlet butterfly valve
10. Relief valve

"Methane is accountable for the 16% of global greenhouse gases and, thus is shorter-lived than CO2, it has a much more powerful warming effect."

- IPCC, 2014

Emerson solutions

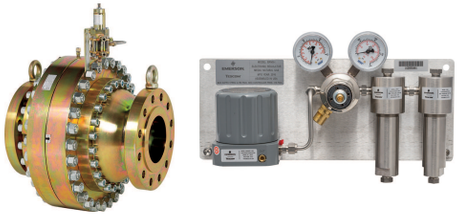
RAF Technology



"One box" solution for 'Smart' PRMS and grid management applications.

- Applicable to all existing pilot operated regulators
- Open/Expandable modular architecture
- Low installation impact (does not affect existing installation layout)
- Online troubleshooting

Pressure Control



Regulators, valves and systems ensure accurate, safe and reliable pressure control operations.

- Pressure and backpressure regulators for precise pressure reducing operations
- Precision natural gas electro-pneumatic control system for extremely accurate set point adjustment

ASCO® Solenoid Valves

Where flow control meets pneumatics to create fluid automation solutions that maximize efficiencies, optimize applications, and enable customers to fulfill their true potential.

FISHER™ 4320

The Fisher 4320 wireless position monitor eliminates the need for wiring to an on/off, pneumatically actuated valve. It provides a precise wireless feedback signal to indicate equipment position with a percent of span plus on/off indication.

Systems and data management

Odorant Injection

Automatic and completely configurable system that ensures very high dosing accuracy and safe operations.

- Improve HSE performance
- Meet regulatory requirements
- Reduced maintenance and operating costs

Control & Data Management

Devices and systems to completely overlook and control your system.

- Flow Computers, RTU, SCADA system
- Seamless integration with centralized control networks
- Intuitive/configurable platforms and application software

Pressure, Flow and Temperature Transmitters

Pressure, flow, and temperature transmitters with industry-leading performance help improve operations in a wide range of applications. Instrumentation provide solutions for critical measurement challenges even in the harshest environments.

Complete Systems

Complete pressure reducing and metering systems for optimized and cost effective solutions for each application.

- Compliance to local/global regulations standards
- Reduce vendor complexity and unclear responsibilities

Solving the process industry's challenges, with predictable success, any time, any place

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