Improving Control and Safety:

Intrinsically Safe Flow and Pressure Control

for Oil and Gas Analyzers

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Intrinsically Safe Flow and Pressure Control for Oil and Gas Analyzers

Analyzer systems are essential to the petroleum production ecosystem. Whether monitoring processes or providing feedback for environmental protection, analyzers must have accurate flow/pressure control to ensure that the measured results are meaningful and reliable.

For analysis systems that operate within explosive zones, designers must consider safety and reliability as well as analysis accuracy. Intrinsically safe instruments that combine metering with control of flow and pressure can ensure the reliability of analyzer data, and reduce failure points while providing greater flexibility in analyzer designs.

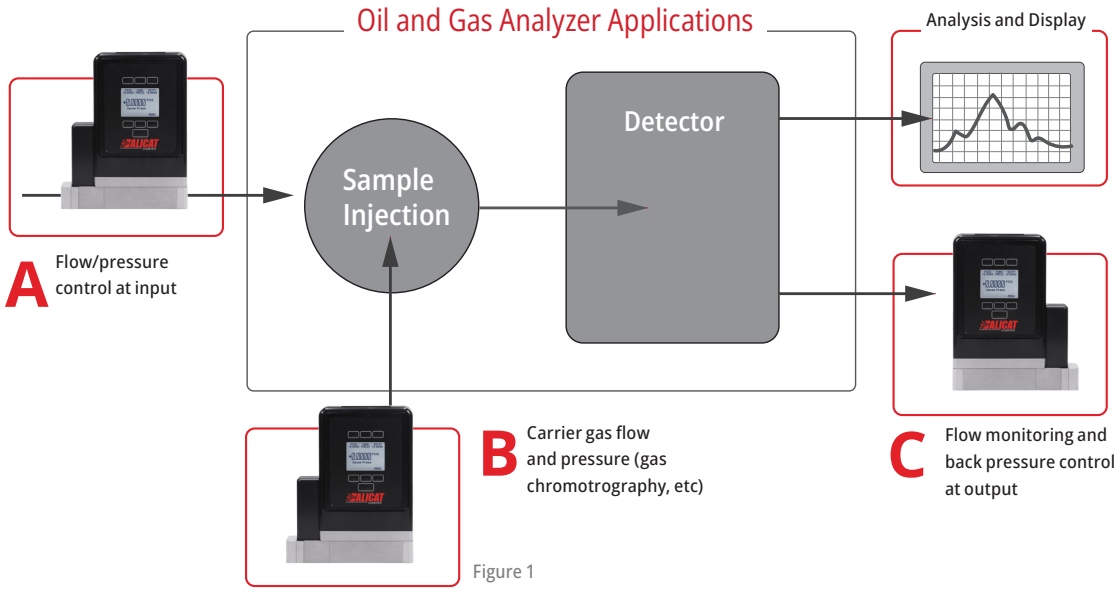

Figure 1

Considerations for Analyzers in Explosive Environments

While analyzer system designs vary, Figure 1 shows typical positions within analyzers where flow and pressure control may be implemented.

To generate reliable data, analyzer systems rely on well-controlled flow and pressure of the sample gases or liquids passing through them. For analyzers that are used in explosive environments, flow metering and control have traditionally been accomplished by separate, independent devices. Metering may be provided by a rotameter in an armored housing, with control accomplished via manual valves or binary pneumatic valves.

Such a system has significant drawbacks, however. A rotameter's mechanical sensor will tend to drift over time, leading to inaccuracy that will skew data or require manual adjustment from within the hazardous zone. A system like this also typically can only output a single process variable, such as volumetric flow or pressure, providing only minimal information about the system and environment. This level of process, with its manual adjustments for drift, and lack of feedback on conditions, can be optimized. A digital device that is a valve, actuator, flowmeter, pressure device, and temperature sensor—all in one—provides more insight, and reduces user intervention.

Improving Metering for Explosive Zones

Electronic metering can greatly improve flow and pressure measurement accuracy, either upstream or downstream of the analyzer (positions A and C in Figure 1). Most meters, however, are not suitable or certified for use in hazardous areas. The lack of options may limit system designers' choices, because powering a valve, or changing its setpoint add complexity. Obtaining critical flow data beyond volume—to relative pressures, temperatures, humidity or more—means additional sensors and still more components and power supplies.

Intrinsically safe meters, such as Alicat's IS-Pro pressure meters and IS-Max mass flow meters, were developed specifically for use in environments where the possibility of an explosive level of gases may exist all the time, every day. Unlike a rotameter's mechanical ball float, the electronic sensors account for differences over time in temperature, pressure and humidity. This ensures accurate, repeatable readings and outcomes.

An IS-Pro instrument can report absolute, gauge, barometric or differential pressure, while the IS-Max instrument can output mass flow, volumetric flow, temperature, barometric, gauge and absolute pressure. With full options, the devices can report dew-point and relative humidity. These additional variables, recorded concurrently, provide a more complete picture of the process and environment that can be used to validate analyzer data and to diagnose system anomalies. The data can be logged by a monitoring station outside of the hazard zone via various digital protocols or an analog output.

Consolidating Control and Metering

When designing analyzers for explosive environments, system engineers reduce risk and cost by minimizing the equipment within the hazard zone. Any reduction of components, connections, cable harnesses, or electrical barriers limits the number of potential failure points and lowers the overall system cost.

Alicat IS-Max controllers are the first instruments— for use in Class 1 Division 1 (Zone 0 or Zone 1) environments —to combine flow metering and control in one intrinsically safe component. By consolidating the metering and control functions into a single device, these instruments reduce the component count, system complexity, physical space requirements, and overall system cost. The built-in PID control loop in IS-Max means you don't have to build a loop from scratch. Their autotune function can keep your process well in control, even if operating circumstances change.

In addition to the metering benefits described above, IS instruments open up a number of design possibilities for new analyzer systems and retrofits. At the system input, an IS-Max instrument can meter flow and provide precise sample batches to the analyzer. At the outlet, an IS-Max instrument may meter on mass flow while simultaneously controlling backpressure and recording humidity, barometric pressure, etc. In a gas chromatography system, an IS instrument can also control carrier gas flow (position B in Figure 1) with an accuracy of ± 0.5% of reading or ± 0.1% of full scale (whichever is greater) for greater analyzer accuracy.

An automated meter/controller can be monitored and adjusted remotely via MODBUS RTU digital protocol, or Alicat ASCII serial commands, as well as via a keypad display screen or analog signals. The ability to monitor and maintain flow remotely reduces the need for humans to interact directly with the equipment within the hazard zone.

Conclusion

As production costs increase and environmental regulations become more stringent, the need to validate analysis results and control emissions grows. Alicat IS instruments provide intrinsically safe flow metering and simultaneous pressure/flow control, to improve the breadth, depth and precision of analyzer data while improving the safety and reliability of the analyzer system.

IS Intrinsically Safe Instruments

In the oil and gas industry, GC sample collection and analysis may involve explosive sample and carrier gases, and sample collection may be completed in hazardous locations. Alicat Intrinsically Safe (IS) instruments provide fast, accurate, repeatable flow and pressure metering and control, for use in Class 1 Division 1 (Zone 0 or Zone 1) environments. Their IS rating means you can save on the expense and weight of an Ex Proof enclosure. Because they form laminar flow internally, they don't require straight runs before or after, saving space. The IS-Max flow and IS-Pro pressure instruments enable remote monitoring and control via analog I/O or digital I/O options without entering a hazardous area.

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Ex ia IIC T4 Ga
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IS-Max 3000 SLPM mass flow meter

IS-Pro dual valve pressure controller

IS-Max mass flow controller

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