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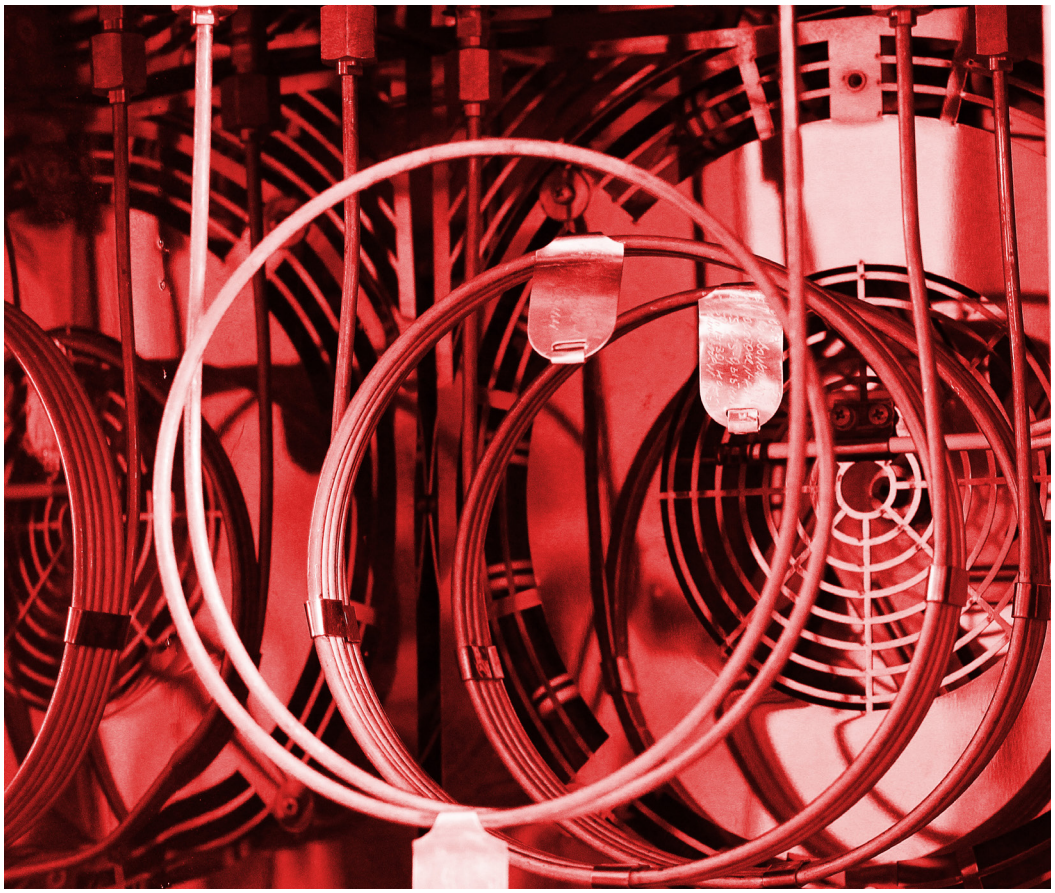

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Improving Control and Accuracy:

Flow and Pressure Control for Gas Chromatography

How to control flow and pressure of gases to achieve better process insights and decrease process variability.

Mike Zecchino

Accurate gas chromatography (GC) analysis depends upon the consistent flow/pressure of the sample and carrier gases through the apparatus.

Alicat instruments have numerous applications to ensure accurate measurement and control of flow and pressure in GC systems, for improved performance and simplicity.

For more on gas chromatography applications, see alicat.com/knowledge-base/in-house-check-of-gas-chromatograph-operation/.

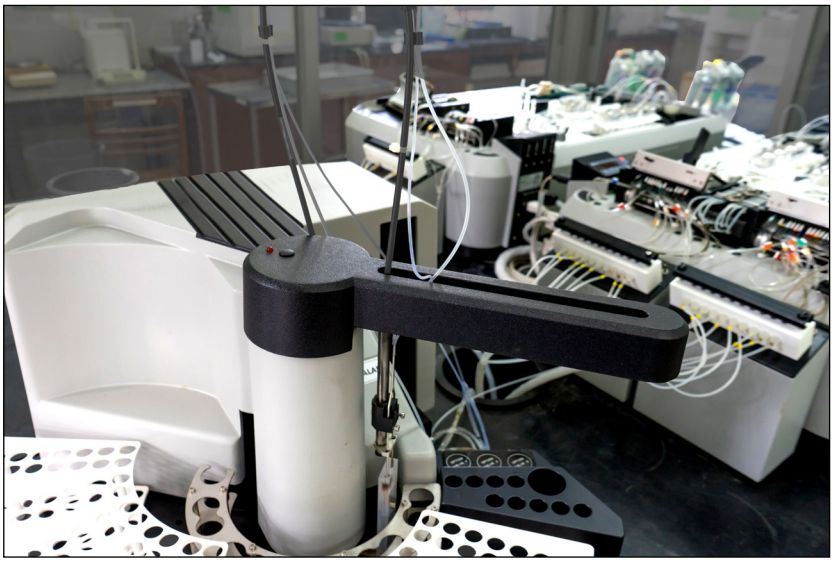

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Figure 1. *A gas chromatography system.*

Flow and Pressure Control in a GC

Gas chromatography systems vary in design. In general, however, most GC systems consist of the components shown in **Figure 2**. Typical applications for flow control devices are also shown, and each is described in the following text.

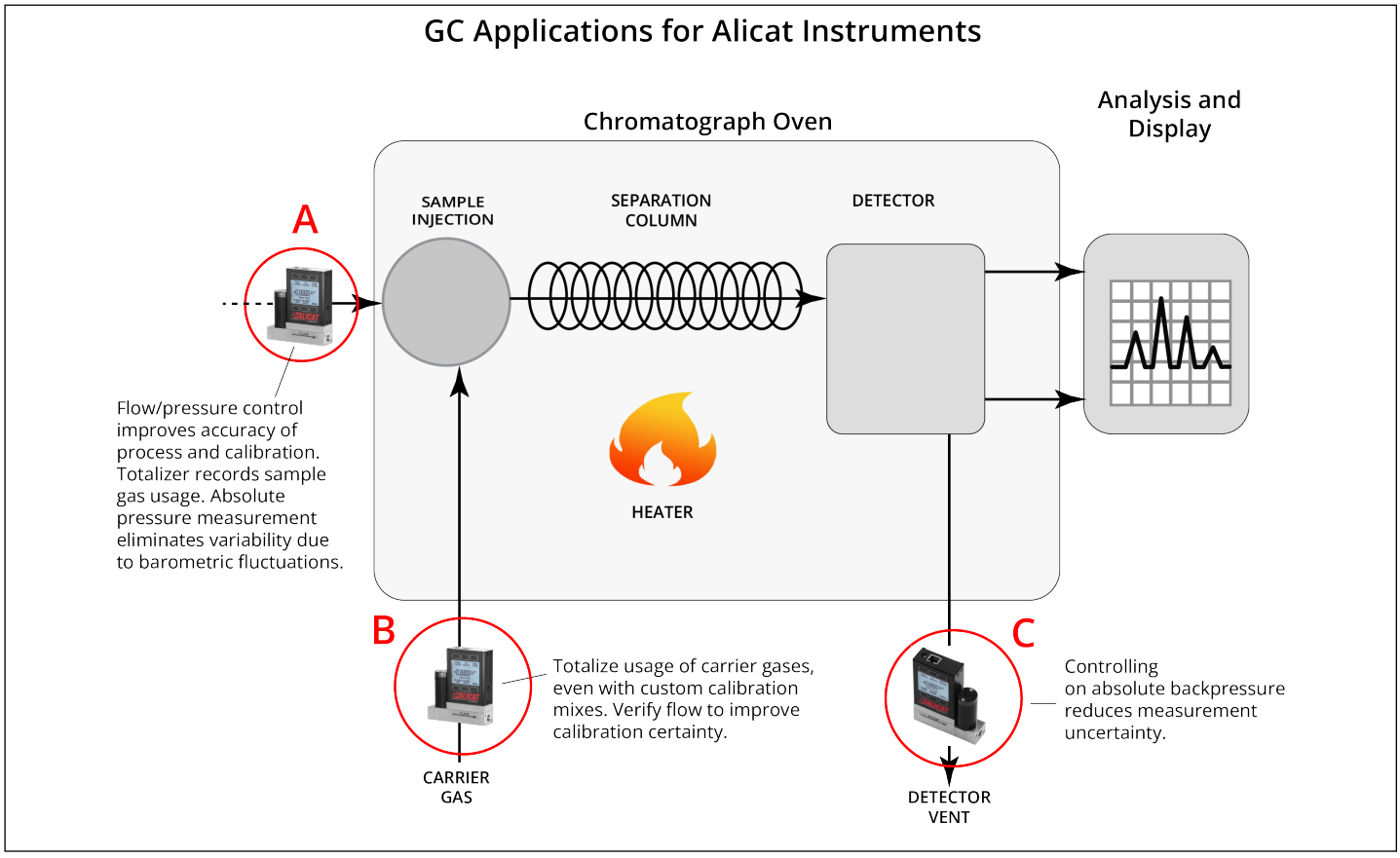

Figure 2. *Applications for Alicat meters and controllers in a gas chromatography system.*

Upstream Flow Control

A GC system is calibrated for specific pressure and temperature conditions, gas types, and column length. To achieve accurate results, the gas flow rate or gas velocity through the GC must be precisely controlled.

An Alicat MC mass flow controller upstream of the GC (**Figure 2 A**) can regulate the process gas or batch a specific amount of gas volume on the sample line. Automatic batch dispensing can improve repeatability and simplify the analysis process.

The controller's totalizer function can continuously log gas usage over time, both for record keeping and as valuable diagnostic data to interpret anomalies or unexpected results.

In an explosive environment, an intrinsically safe IS-Max controller can maintain consistent flow control. Using a single device for metering and control simplifies the GC system design and improves safety by eliminating additional sensors, wiring, and valves.

Carrier Gas

As with the sample gas, the carrier gas flow and pressure must be precisely controlled for accurate GC readings. Alicat instruments (**Figure 2 B**) can control carrier gas flow with an accuracy of ± 0.5% of reading or ± 0.1% of full scale (whichever is greater), providing repeatable and verifiable results. The instruments can also improve calibration certainty.

The totalizer function on Alicat instruments records carrier gas usage, even for custom calibration mixes. The totalizer function can also retain flow history, which can be useful both for record keeping and for diagnosing process anomalies.

Downstream Flow Control

A mass flow meter located after the GC sensor can monitor the quantity of vented gas (**Figure 2 C**), to provide a constant validation of the GC. With a response rate of under 10 milliseconds, Alicat flow meters can detect sudden changes in vented gas that may indicate a problem with the setup or an unintended reaction, such as condensation.

Absolute and Gauge Pressure Control

An Alicat controller downstream of the GC oven can control absolute back pressure on the column. Control based on absolute pressure eliminates the variability associated with the pressure and temperature measurements required for gauge pressure control. It provides a simple reference point for GC calculations that is not affected by changes in atmospheric pressure during the run.

The ability to switch between gauge pressure and absolute pressure makes Alicat instruments much more flexible than other metering and control options.

Figure 3. *Alicat MC 50 SCCM mass flow controller.*

Figure 4. *Alicat IS-Max 1 SLPM intrinsically safe mass flow controller.*

Humidity

In some GC applications, the amount of humidity is an important consideration for verifying the makeup of the sample gas. Alicat meters and controllers can include an optional, relative humidity sensor with an accuracy of ± 1.8% RH at + 23 °C. The internal sensor provides an in-process check, simplifying the setup while accounting for humidity in flow calculations.

Gas chromatography results can be affected by any changes in operating conditions, etc. Alicat instruments can control mass flow or volumetric flow while also monitoring temperature, absolute pressure, gauge pressure, humidity, and other variables. The instruments can be configured using the built-in display or using a variety of industrial communication protocols. By providing accurate data and combining metering and control, Alicat instruments simplify GC setups while improving their accuracy, calibration, and safety.

GC system in a laboratory environment.

Summary

- **Improve measurement accuracy**
- **Remove variability due to barometric fluctuations**
- **Reduce calibration uncertainty**
- **Simultaneous humidity monitoring**
- **Monitoring/control throughout the GC for design simplicity**
- **Intrinsically safe options for use in explosive environments**

IS Intrinsically Safe Instruments

GC sample collection sometimes occurs in hazardous locations, and analysis may involve explosive sample and carrier gases. 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. 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.

DEKRA 22ATEX0075 X
IECEx DEK 22.0078 X
II 1 G Ex ia IIC T4 Ga
Ex ia IIC T4 Ga
T_{amb} −20°C to +70°C

Small Electronic Pressure Controllers and Transducers

EPC Pressure Controllers and Transducers offer fast and accurate gauge or absolute pressure measurement and control in compact, highly customizable packages for easy integration into OEM applications. Valves, ports, sensors, and communications can be customized to precisely suit your product design and application requirements.

MB Series Mass Flow Meter

The battery-powered MB Series portable mass flow meter is perfect for verifying GC flow rates. With ±0.8% reading accuracy, the handheld meter brings laboratory-class accuracy to field flow verification and validation in environmental, manufacturing and metrology applications.

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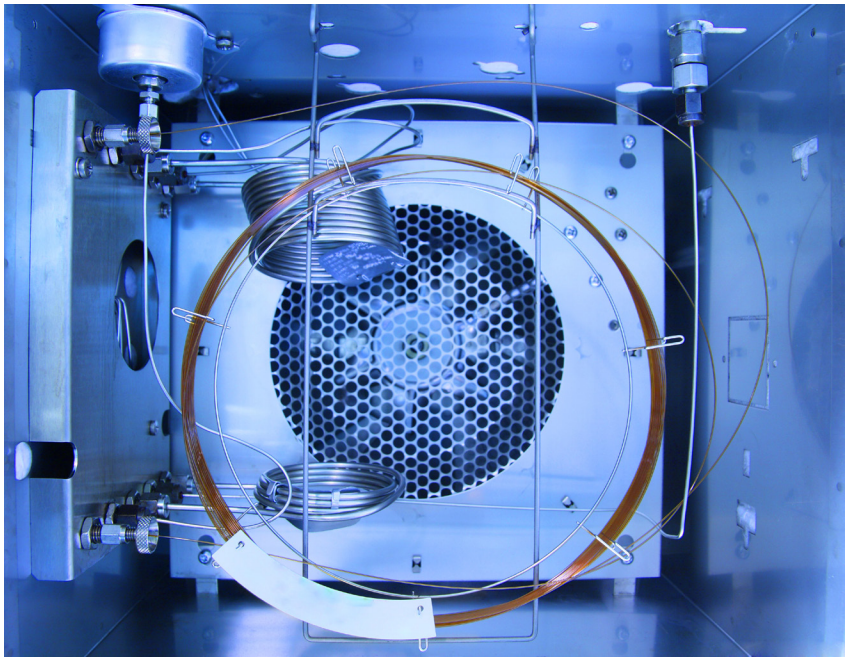

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