

## ▶ Gas flow calibration

### **What is gas flow calibration?**

Gas flow calibration refers to the calibration of a flow sensing device such as a flow meter or flow controller by comparing its measurement against a flow measurement reference. Typically, the device, or unit under test (UUT), is pneumatically connected in series with the flow reference so they measure the same gas flow; then the indications of the two devices are compared.

### **molbloc™/molbox™ system components**

Fluke Calibration's molbloc/molbox gas flow calibration system consists of molbloc flow elements that connect to a flow terminal (either molbox1+ or molbox RFM) so the terminal can use pressure and temperature measurements from around the flow element, combined with gas properties and prior molbloc calibration data, to determine and display the gas flow rate.

### **Mass flow vs. volume flow**

A frequent topic of discussion and confusion surrounding gas flow measurement is that of mass flow versus volume flow. Flow meters and flow units used for flow measurements are used to measure and express either the amount of volume of gas or the amount of mass (number of moles or molecules) passing through the device. When performing a gas flow calibration, it is nearly always beneficial to use a mass flow reference measurement, because the mass flow rate stays constant throughout a flow system in steady state. Since gas is compressible, the volume flow rate varies at different locations in a flow system due to changes in density caused by changing temperature and pressure. molblocs are mass flow standards, which allow reliable comparisons to other flow devices. The molbox terminal is also able to calculate and express the flow rate in terms of volume flow at another point in the system to allow testing of volume-based devices.



## Gas Flow Standards

### molbox1+ Flow Terminal

0.125 % of reading—lowest uncertainty for gas flow calibration.



- Allows coverage of flow range from less than 1 sccm to over 5000 slm with a single user interface and transportable system
- Real-time flow measurements makes adjusting analog flow devices fast and easy
- No moving parts that cause pressure/flow fluctuations or threaten reliability
- Perform fully-automated flow calibrations using molbox terminal with COMPASS for Flow software
- Updated design with advanced features and even more robust internal pneumatic design

### molboc-L Laminar Flow Element

Laminar flow elements for flow from 1 sccm to 100 slm.



- Traceable to primary gravimetric mass flow measurements
- Multiple gases supported
- Useable with existing molbox1+ and molbox RFM mass flow terminals and COMPASS software
- Integrated filter to protect against contamination
- Integral gas temperature conditioning and measurement

### molboc-S Sonic Nozzle Flow Element

Sonic nozzle based molblocs for gas flow up to 5,000 slm.



- Covers ranges up to 5,000 slm in N<sub>2</sub> and air
- Multiple gases supported
- Useable with molbox1+, or existing molbox1 and molbox RFM mass flow terminals and COMPASS software
- Proven critical flow venturi (sonic) nozzle operating principle supported by primary gravimetric calibration

### molbox RFM Reference Flow Monitor

Compact terminal for making mass flow measurements using molboc-L and molboc-S flow elements.



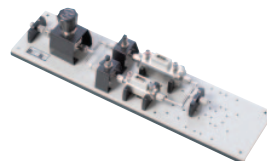
- Traceable to primary gravimetric mass flow measurements
- Economical alternative to molbox1+ terminal
- ± 0.5 % of reading uncertainty
- Covers the flow range of 1 sccm to 100 slm with molboc-L, and up to 5000 slm with molboc-S

### molstic Mounting Systems

Used to conveniently mount and protect molboc elements, connect to units under test and provide flow and pressure control.

#### molstic-L used for molboc-L mass flow elements.

- Quick connector input for convenient connection to the gas supply
- 2 micron (0.5 micron for low flow) filter to protect the downstream components
- Adjustable regulator protects the molbox transducers against accidental overpressure



#### molstic-S used for molboc-S mass flow elements.

- Available in either 1/2 inch or 1/4 inch system plumbing sizes
- Integrated flow shut-off/metering valves



### Gas Flow Automation Accessories

#### MFC-CB™ Control Box

- Stand-alone unit for setting/reading analog mass flow controllers (MFCs) and mass flow meters (MFMs).
- Set and read 0 to 5 V or 4 to 20 mA on two (2) channels simultaneously
- Complete front panel local control and remote operation via RS-232 and IEEE-488 interfaces



#### MFC Switchbox™

- Supplies power and switches between up to five MFCs or MFMs on one molbox1+ or MFC-CB channel.
- Duplicates MFC channel without switching cables



## Primary Gas Flow Standard

### GFS Dynamic Gravimetric Mass Flow Standard

GFS™ is a true Primary Mass Flow Standard and makes the fundamental measurement of low gas mass flow rates practical.

- Covers the range of 0.2 to 200 mg/s in various gases (10 sccm to 10 slm N<sub>2</sub>)
- Measurements can be transferred higher flow ranges using Successive Addition method
- Flow measurement uncertainty as low as ± 0.013 % of reading

