

# BROOKS<sup>®</sup>

## INSTRUMENT

### Advanced Flow Solutions Guide



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# Brooks: Your Partner In Advanced Flow Solutions

Every day, customers turn to Brooks Instrument for solutions to their flow, pressure, and level challenges. In industries as diverse as biopharmaceuticals, oil and gas, fuel cell, solar, chemicals, medical devices, analytical instrumentation, and semiconductors, Brooks provides the broadest array of flow products in the market. Our award-winning meters and controllers consistently rank at the top of their category for accuracy, reliability, and user preference, as judged by the audience that matters – users of flow instruments.

But Brooks' products are only half the story. Our customers are backed by Brooks' unsurpassed technical expertise in virtually every corner of the planet. The local Brooks product and application specialist is truly our customer's "partner in flow". They have been extensively trained to help you select the optimal solutions for your flow measurement or control needs, and offer years of experience solving application problems just like yours.

**When technology matters:** Brooks' revolutionary Quantim Coriolis instrument provides precise mass flow measurement and control down to ultra-low flow rates of 1 gram per hour!

**When quality matters:** A leading anesthesiology equipment supplier uses thousands of Brooks' needle valves annually because of precise, repeatable 'feel'.

**When precision matters:** A Big 5 chemical company uses Brooks' thermal mass and Quantim Coriolis products exclusively for their critical catalyst and process research.

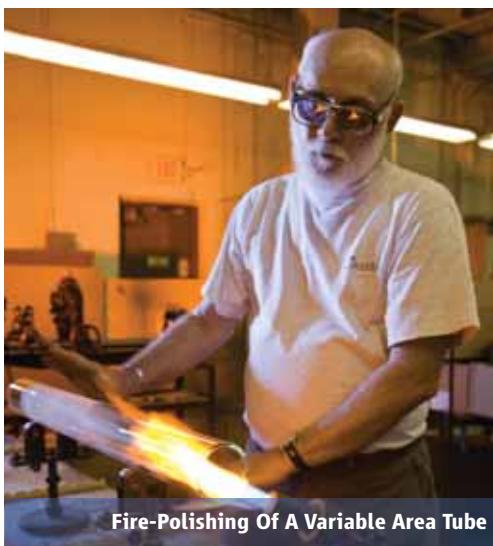
**When repeatability matters:** Many leading biotechnology companies use only Brooks thermal mass flow controllers on both bench-top reactors and full production units to ensure smooth scale-up.

**When consistent performance over a wide range of flows matters:** Leading fuel cell companies worldwide specify Brooks thermal mass flow controllers for their exceptional accuracy, wide turn-down and response time.

**When global reach matters:** Leading E&C contractors select Brooks' variable area meters for multi-national projects that require compliance with global standards because of Brooks' local experience and global support.

**When certifications matter:** Many Brooks products are available with national laboratory-traceable certification, third-party hazardous area approvals, CE, pressure boundary certification, NACE, lot material certification, and more.

So if you're serious about improving your process yields and product quality, choose Brooks.



Fire-Polishing Of A Variable Area Tube



Brooks Instrument Family Of Precision Flow Solutions



Readers Choice Award for best products in the "Flowmeter, Thermal Mass", "Flowmeter, Variable Area", and "Flowmeter, Positive Displacement" categories.



Gold Award Winner in the Golden Gas Award in the "Mass Flow Measurement & Control" category for the 4800 Series.

# Meet Your Application Experts



## As Long As You Know The Brooks Name, You Know The Answer To Your Flow Challenges.

At Brooks, we look at each customer's unique needs, apply the right combination of technologies, and provide turnkey installation and integration assistance on a global basis. If you're not sure which Brooks product is right for your application, we've provided several methods to help you make the right decision.

- MeterMatch Search Tool: Visit [BrooksInstrument.com/MeterMatch](http://BrooksInstrument.com/MeterMatch) and this online selection tool will guide you in the right direction
- Contact a local Brooks specialist: Visit [BrooksInstrument.com/RepLocate](http://BrooksInstrument.com/RepLocate) to find your local Brooks expert
- Call or email our regional customer service locations for fast, expert assistance (see back cover)
- Check your needs against detailed product data sheets at [BrooksInstrument.com](http://BrooksInstrument.com)

Brooks is prepared to assist with your unique flow measurement and control applications to help you get the most value from our products. Just contact us at the office location most convenient to you. As the leading provider of integrated low-flow technologies for precision applications, we know you'll find that Brooks is precisely what you need.



## You Trust Your Process To Brooks. Why Trust Anyone Else With Service?

Brooks is committed to assuring that our customers receive the ideal flow solution for their application, backed up by outstanding support. We make it easy to locate a sales representative, get technical assistance, training services, and more! Our flow meters and controllers are top in the industry, but it is our support services that set us apart from the competition. Here's what you can expect from Brooks:

- Brooks factory-trained support
- 24/7 telephone support
- Worldwide coverage
- Primary standard calibration equipment at every
- NIST and NMI traceability
- Service Center to ensure accuracy and reliability

**Start-Up Service** Need help getting your new flow products installed properly? Brooks' on-site start-up service will set-up, test, and make sure your flow products are operating perfectly in your application.

**Extended Warranties** For uninterrupted support and peace of mind, extended warranties may be purchased at any time within the original warranty period or after major repair in a Brooks Service Facility.

**Preventive Maintenance Programs** For on-going process accuracy and reliability, we offer a number of preventative maintenance programs. Brooks also offers annual calibration service for all devices and full rebuild/refurbishment.

**Advanced Replacement Options** To minimize operational down time, Brooks can provide advanced replacement devices for certain models in exchange for your existing device.

**Training Services** Brooks encourages customers to take advantage of our excellent training programs such as "The Basics of Flow Measurement", "Calibration" and "Maintenance". We also offer customized, hands-on programs to precisely fit your specific needs. Both factory and on-site training are available.



# Customized Systems & Integrated Solutions



Direct Liquid Injection System



Custom Manifold Solution



Custom Metal Tube VA Meter

## Custom Engineering For Special Applications.

Can't find the exact flow measurement or control instrument for your application? Let us make a custom solution for you. Our expertise in custom-engineered flow products for unique applications includes:

- Special ambient requirements
- High/low process temperature operation
- Exotic materials
- High process pressure capability
- Difficult process streams
- Custom physical dimensions
- Special process connections
- Material traceability
- Special testing requirements, such as dye penetrant, radiography, or positive material ID

If you have a unique application, contact Brooks or your local sales representative.

## Need A Comprehensive Solution Rather Than Individual Components?

Customers often seek engineering resources to design the complete system required to implement a new process or keep their existing process up-to-date and running smoothly. Brooks' Solutions-based approach to solving customer applications is ideal. Brooks will provide complete proposals that include design, integration, plumbing, electronics, enclosures, certifications, testing and more. Customers tight on resources and time will find these well thought out solutions from Brooks very appealing. Brooks' Solutions Group can provide various plans including expert application advice and engineering, ready to assemble "kits", and complete, integrated, turnkey systems. We have also developed unique direct liquid injection vaporization systems, manifold systems, precise measurement solutions for dosing applications, and more.



4850



1350 With Flow Controller



8601 Pressure Regulator



8504 Valve

## Brooks Offers A Variety Of Attractive Solutions For OEMs.

Many Brooks Instrument products are ideal for OEM customers, providing high-performing, cost effective solutions. Some of the OEM customers we serve include medical device equipment manufacturers, analyzer manufacturers, suppliers of gas blending equipment, vacuum pump makers, and industrial processing equipment suppliers. The products shown here are just a few examples of our more popular OEM products, but Brooks can customize any standard product to meet OEM requirements.

- Compact thermal mass flow meters and controllers
- Needle valves for precise flow control
- Compact pressure regulators
- Flow controllers for variable upstream or downstream pressures
- Custom variable area glass tube assemblies available for your unique flow application
- Customized variable area, thermal mass and Coriolis flow controllers and pressure products
- Private labeling available upon request

# Coriolis Mass Flow



## The First Coriolis Device With Built-In Control.

Quantim is the first miniaturized Coriolis mass flow *controller* that measures and *controls* flow directly, without any need to compensate for fluid properties or process conditions. Quantim's Coriolis technology, internal control valve and PID bring a new level of measurement accuracy and control all in one compact package.

The Coriolis principle is not new to process flow measurement. It is a proven technology that has been employed in a wide variety of markets and applications for over 30 years. Although Coriolis has been widely used in high flow processes, Quantim takes precise flow measurement and control to lower flow applications.

Quantim Coriolis controllers, meters, and sensors provide unsurpassed performance, reliability, repeatability and control in demanding low flow applications.



# Coriolis Mass Flow Devices



The Brooks Quantim Coriolis mass flow controller/meter and Quantim® Coriolis sensor offer unsurpassed accuracy and flexibility in critical low flow liquid and gas applications.

- Quantim Coriolis controllers combine the sensor, transmitter, control valve, and PID control electronics into one compact, integrated package, reducing space requirements, and simplifying purchase, installation, and start up
- Coriolis mass measurement, which is immune to fluid property variations, provides outstanding application flexibility
- Quantim provides repeatable mass flow measurement and control even under changing conditions
- Quantim measures mass flow (or volumetric flow) and density or temperature which adds diagnostics capabilities to your process and reduces the need for additional instrumentation
- Available in NEMA 1/IP40, NEMA 4X/IP65, and explosion proof configurations
- The Quantim sensor, combined with Brooks' newest transmitter, lets you access more data in your plant's process language (Modbus®, HART®, FOUNDATION™ Fieldbus)
- Perfect solution for rapid fill batch applications
- Available with stainless steel or Hastelloy sensor tube material
- Globally approved for a variety of service areas

## QUANTIM Mass Flow Measurement & Control

Type	Model	Tube Size	Nominal Flow <sup>1</sup>		Accuracy	Max. Pressure psig (bar)	Input/ Output
			Liquid (kg/hr)	Gas (lpm)			
Precision Mass Flow Controller Gas and Liquid	QMBC	2	0.15	1.05	±0.2%, 0.5%, or 1.0% Rate	1500 (100)	0-5 Vdc, 4-20 mA or HART
		3	0.78	2.96			
		4	9.32	29.1			
Precision Mass Flow Meter Gas and Liquid	QMBM	2	0.19	1.43	±0.2%, 0.5%, or 1.0% Rate	4500 (300)	0-5 Vdc, 4-20 mA or HART
		3	1.00	5.60			
		4	13.5	50.4			
Precision Mass Flow Sensor Gas and Liquid	QMBS	2	0.19	1.43	±0.2%, 0.5% or 1.0% Rate	4500 (300)	Modbus
		3	1.00	5.60			
		4	13.5	50.4			

Precision Flow Transmitters: A variety of remote and DIN rail transmitters is available to complement the QUANTIM Sensor Model QMBS. See [BrooksInstrument.com](http://BrooksInstrument.com)



<sup>1</sup> Higher flows may be possible depending on the fluid and process conditions.

<sup>2</sup> Pressure to 4500 psig (300 bar) with remote valve option.

# Thermal Mass Flow



## Brooks Mass Flow Controllers Feature Reliability, Multiple Capabilities And Many Firsts.

Brooks offers a broad range of thermal mass flow controllers (MFCs) and meters, assuring you that we will have exactly the right device for your application. Our mass flow controllers are the acknowledged industry leader in quality and reliability with many of our devices in operation for over 20 years.

Brooks' latest thermal mass flow devices provide significant advantages in response time, accuracy, repeatability, turndown, and self-diagnostics. The Brooks portfolio covers virtually every need you may have, including:

- FOUNDATION Fieldbus communications option (an industry first!)
- Ultra high purity devices for the vacuum thin film and semiconductor industry
- NEMA 4X / IP66 MFCs for wash down applications
- Downport MFCs
- Pressure and temperature insensitive MFCs
- Many, many more!

Our products also have an array of certifications and approvals for ingress protection and use in hazardous areas. Plus, we have the best trained and most responsive flow experts in the industry, all over the world. They make sure your thermal mass flow controller is selected correctly and maintained properly.

### Communications Options



Readers Choice Award for best products in the "Flowmeter, Thermal Mass" category.



Golden Gas Award winner in "Mass Flow Measurement & Control" for the 4800 Series.

# Thermal Mass Flow

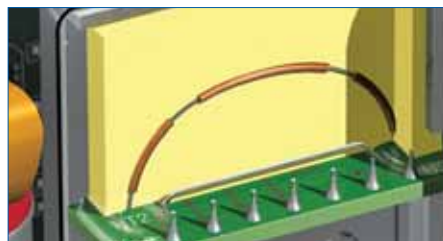


SLAMf Final Assembly

## At Brooks, It All Starts With The Best Sensor Technology.

Bypass thermal mass devices work by heating a sensor tube and measuring the temperature difference between two points on the bypass sensor tube. The Brooks sensor is made up of three wires (two unheated temperature sensor windings and a heater) while most of our competitors' sensors are made up of just two heated wires. Brooks' three-wire sensor design dramatically reduces the likelihood of drift over time (i.e. improving accuracy) because:

- The windings are not heated resulting in electrical stability over time
- Mechanical stability (e.g. resistance to sensor wire delamination) is also greatly improved by using unheated windings
- The Brooks three-wire sensor requires a single heater drive circuit; two-wire sensors require two heater circuits that can introduce measurement inaccuracies
- Three-wire technology increases "common mode rejection", meaning that non-flow related influences (e.g. ambient temperature changes) affect both windings similarly and are canceled out



Brooks' innovative three-wire sensor design dramatically reduces the likelihood of drift for improved accuracy.



# Compact Digital Mass Flow Controllers & Meters



**B950**



**SLA7950S**

Brooks offers three series of mass flow controllers/meters for applications requiring high leak integrity and/or ultra-high purity (UHP). These devices are designed with a 1.125" wide profile providing an efficient, space-saving footprint.

The B-Series is our newest addition to this product line. The B-Series is a pressure and temperature insensitive (PTI) device that dramatically improves flow measurement accuracy and control. The B-Series can simplify and reduce the cost of your gas panel by minimizing the need for separate pressure regulators and pressure transducers.

The SLA7900 Series has been the workhorse of the industry for several years. Both the B-Series and the SLA7900 Series feature an

all-metal flow path, electropolished to better than five micro-inch Ra. For customers who do not require an electropolished flow path, the all-metal SLA7800 Series is the ideal choice.

Additional features include:

- New Coplanar Valve offers improved performance to deliver fast, accurate and reliable response across a wide and varying range of differential pressures
- Proprietary valve control algorithm enhances response time
- High leak integrity, UHP, and metal seal options ensure clean flow paths for contamination sensitive processes
- Available with traditional analog or digital I/O

## Compact Digital Thermal Mass Flow

Type	Model	Full Scale Capacity	Accuracy	Max. Pressure psig (bar)	Input/ Output	Power Supply
PTI UHP Metal Seal Controller/Meter	B900 Series	3 ccm - 50 lpm	+/- 0.7% Rate	85 (6)	DeviceNet	11-25 Vdc
UHP Metal Seal Controller/Meter	SLA7900 Series	3 ccm - 50 lpm	1% Rate	1500 (100)	0-5 Vdc, 4-20 mA, RS485 DeviceNet	13.5-27 Vdc 11-25 Vdc
Metal Seal Controller/Meter	SLA7800 Series	3 ccm - 50 lpm	1% Rate	1500 (100)	0-5 Vdc, 4-20 mA, RS485 DeviceNet	13.5-27 Vdc 11-25 Vdc



# Digital Mass Flow Controllers & Meters



SLA5850S



SLAMF50



4850

Brooks' digital thermal mass flow controllers and meters, with over 150,000 installed around the world, offer faster response, better accuracy, and improved control over analog devices. The Smart Link Advantage (SLA) Series is Brooks' premier smart digital thermal mass flow series. SLA mass flow controllers and meters link to advanced service tools and offer the advantage of digital protocols. The SLA Series provides many advanced features such as enhanced temperature stability, zero drift diagnostics, Coplanar Valve for improved turndown, and more.

The SLA5800 Series are elastomer sealed controllers/meters that have become the staple in the industry. These devices have high pressure capability of up to 4500 psig (300 bar).

The SLAMf Series is designed specifically for use in harsh environments. These devices' unique NEMA4X/IP66 enclosures provide protection from dust and water making them ideal for indoor and outdoor use and perfect for washdown applications.

Both the SLA5800 and SLAMf Series are available with a variety of digital protocols including FOUNDATION Fieldbus communications – an all-digital, 2-way communications technology that improves efficiency with advanced diagnostics, decreases installation costs, and operates with any control system.

The 4800 Series features a broad flow range, compact size, a MEMS-based sensor that provides lightning fast response times, and many other benefits for a variety of applications. The optional Local Operator Interface provides a convenient user interface to view, control, and configure the 4800 Series devices.

Other Brooks digital mass flow benefits include:

- Industry leading repeatability for consistent process results
- Self diagnostics and alarms eliminate downtime
- Multiple communication protocols allows easy integration into many control systems
- Globally approved for a variety of service areas

## Digital Thermal Mass Flow

Type	Model	Full Scale Capacity	Accuracy	Max. Pressure psig (bar)	Input/Output	Power Supply
Elastomer Seal Controller/Meter	SLA5800 Series	3 sccm - 2500 lpm	1% Rate or 0.7% Rate 0.2% FS	4500 (300)	0-5 Vdc, 4-20 mA, RS485	13.5-27 Vdc
					DeviceNet	11-25 Vdc
					Profibus*	15-24 Vdc
					FOUNDATION Fieldbus	14-27 Vdc
Weatherproof Controller/Meter	SLAMf Series	3 sccm - 2500 lpm	1% Rate or 0.7% Rate 0.2% FS	1500 (100)	0-5 Vdc, 4-20 mA, RS485	13.5-27 Vdc
					DeviceNet	11-25 Vdc
					Profibus*	15-24 Vdc
					FOUNDATION Fieldbus	14-27 Vdc
Elastomer Seal Controller/Meter	4800 Series	50 sccm - 40 slpm	+/-1% of FS or +/-3% FS	150 (10)	0-5 Vdc, 4-20 mA	15-24 Vdc



\* Profibus available on S-Series product family.

# Analog Gas/Liquid Mass Flow Controllers & Meters



5850E



5881 Flomega™

For those that do not require the super high performance and accuracy of a Brooks digital mass flow controller, Brooks continues to offer reliable analog mass flow controllers and meters. Brooks' analog mass flow controllers and meters are designed to meet the rigorous demands of our customers' established and newly developing process applications and have proven to be very stable over time. These devices continue to add to their expansive installed base due to their good response, accuracy, and simple integration.

- Years of field-proven reliability
- Analog I/O allows for quick and easy system integration
- Elastomer seal option provides exceptional leak integrity and maximizes control valve shutoff dependability
- Ultra-high purity (UHP) and metal seal options ensure clean flow paths for contamination sensitive processes
- Globally approved for a variety of service areas
- Flomega™ liquid flow meters and controllers, for specialized applications, use thermal mass flow technology to accurately measure and control liquids and are weatherproof and certified for use in hazardous areas

## Analog Thermal Mass Flow

Type	Model	Full Scale Capacity	Accuracy	Max. Pressure psig (bar)	Input/ Output	Power Supply
Metal Seal Controller	5800EM Series	3 ccm - 30 lpm 10 - 100 lpm (200 lpm H <sub>2</sub> )	1% FS	1500 (100)	0-5 Vdc or 4-20 mA	+/- 15 Vdc
UHP Metal Seal Controller	5900 Series	3 ccm - 30 lpm 10 - 100 lpm (200 lpm H <sub>2</sub> )	1% FS	1500 (100)	0-5 Vdc	+/- 15 Vdc
Elastomer Seal Controller/Meter	5800E Series	3 ccm - 30 lpm 10 - 100 lpm 100 - 1000 lpm	1% FS	1500 (100)	0-5 Vdc	+/- 15 Vdc
Elastomer Seal Controller/Meter	5800i Series	3 ccm - 30 lpm 10 - 100 lpm 100 - 1000 lpm	1% FS	1500 (100)	0-5 Vdc or 4-20 mA	15-24 Vdc
Liquid Mass Flow Controller/Meter	5881/91 5882/92	30 - 100 grams/hr 200 - 1000 grams/hr	0.5% FS	5800 (400)	0-5 Vdc, 0-20 mA or 4-20 mA	15 or 24 Vdc



# Secondary Electronics/Software Tools



Brooks provides a variety of software and accessory options to simplify your installation and start-up and to ensure your mass flow controllers perform at their best. Calibration and control software allow customers to verify accuracy and repeatability.

- Brooks Service Suite provides access to tuning, alarms, and other basic functions

- Brooks Service Suite Pro is perfect for configuration, calibration, and advanced service

Brooks' 0254 secondary electronics provide power for up to four Brooks thermal, pressure, or Quantim mass flow instruments. Additionally, the 0254 can be used to generate flow setpoint commands, display flow rate, totalize flow, and for blending multiple flow streams.

Software Tools	
Type	Functionality (See data sheet for applicable models)
Brooks Service Suite	Provides access to I/O tuning, alarm indication/configuration, diagnostics, selected response tuning, control and monitor
Brooks Service Suite Pro	Provides access to I/O tuning, alarm indication/configuration, diagnostics, selected response tuning, control and monitor, plus calibration and accuracy reporting capabilities

Secondary Electronics					
Model	Channels	Additional Functions	Control I/O	Power Input	Power Output
0254	4	Totalizer & Blending RS-232 I/O for remote control	0 (1)-5 Vdc, 0 (2)-10 Vdc 0 (4)-20 mA	100-240 Vac, 50/60 Hz	+/-15 Vdc, 24 Vdc

# Pressure Controllers



The Brooks line of electronic pressure controllers utilizes Brooks' superior mass flow designs to control process pressure. We also brought the same great benefits of our SLA Series to our pressure controllers for those customers looking for advanced features and functions. The 5866 model is also a great option for those customers that do not need the superior performance that the SLA Series products provide. With a wide variety of control and configuration options, Brooks is certain to have the right pressure instrument for your application.

- Pressure controllers that accurately control upstream or downstream pressure
- Remote transducer products control pressure based on input from an external pressure device while simultaneously measuring mass flow
- 1.125" and 1.5" footprint models
- Ultra high purity (UHP), metal seal, or elastomer seal options
- Available with analog or digital I/O
- Globally approved for a variety of service areas

Pressure Controllers						
Type	Model	Full Scale Capacity	Accuracy	Max. Pressure psig (bar)	Input/Output	Power Supply
<b>Pressure Controllers</b>						
Metal Seal, 1.125"	SLA7810/20	0-20 bar/290 psi	0.5% FS	290 (20)	0-5 Vdc DeviceNet	15 Vdc 11-25 Vdc
Elastomer Seal	SLA5810/20	0-300 bar/4350 psi	0.5% FS	1500 (100)	0-5 Vdc DeviceNet FOUNDATION Fieldbus	15 Vdc 11-25 Vdc 14-27 Vdc
Elastomer Seal	5866E	0-300 bar/4350 psi	0.5% FS	4500 (300)	0-5 Vdc 4-20 mA	+/-15 Vdc
<b>Remote Transducer/Pressure Controllers/Flow Meters</b>						
Metal Seal, 1.125"	SLA7840	3 ccm-30 lpm	1% Rate	1500 (100)	0-5 Vdc DeviceNet	15 Vdc 11-25 Vdc
Elastomer Seal	SLA5840	3 ccm-30 lpm	1% Rate	1500 (100)	0-5 Vdc DeviceNet	15 Vdc 11-25 Vdc
Elastomer Seal	5866RT	3 ccm-30 lpm	1% FS	1500 (100)	0-5 Vdc	+/- 15 Vdc



# Pressure Regulators & Transmitters



**8601 Pressure Regulator**



**SFP33**

Brooks precision mechanical pressure regulators feature a direct-acting, non-relieving design for outstanding resolution and control. They are ideal for critical pressure control applications, such as medical devices and analytical instrumentation. Brooks assembles, cleans and tests these devices in clean-room conditions, ensuring precise, reliable operation.

- Bubble-tight shut off to 100 psi
- Non-bleeding
- Exceptionally precise control
- Compact design
- Suitable for in-line or panel mounting
- UL listed

The unique Brooks Seal Free Pressure (SFP) transmitter provides excellent pressure measurement on high purity fluids. Unlike other high purity pressure transmitters, the SFP is constructed using a single piece perfluoroalkoxy (PFA) sensing chamber that does not use any seals. Because the only fluid-wetted surface is PFA, the possibility of fluid contamination is eliminated.

- No-seal design eliminates fluid contamination sources
- All PFA flow path
- Extremely strong sensor/PFA bond
- Versions available for UHP water, chemicals, acids, and bases
- Single-ended and flow-through versions available
- Integrated vapor leak indicator
- Not damaged by sub-atmospheric process conditions
- Temperature compensated output

## Mechanical Pressure Regulator

Model	Capacity Air	Maximum Pressure	Temperature		Construction
			°C	°F	
8601	3 to 1000 ccm	17 bar, 250 psig	1 to 177	33 to 350	Aluminum or 316 SS

## UHP Pressure Transmitters

Type	Model	Full Scale Capacity	Accuracy	Temperature	Output	Power Supply
Flow Through – Ultra Pure Water	SFP33WA	0-15 psig	+/-1% Full Scale	15-40 °C	4-20 mA	24 Vdc
Flow Through – Chemicals, Acids, Bases	SFP33CA	up to		59-104 °F	0-5 V, 1-5 V, 0-10 V	12-24 Vdc
Single Ended – Ultra Pure Water	SFP32WA	0-150 psig				
Single Ended – Chemicals, Acids, Bases	SFP32CA					



# Variable Area Technology



Variable Area Tubes Being Prepared

## Over Sixty Years Of Variable Area Meter Expertise.

Brooks started designing and manufacturing Variable Area (VA) meters, also referred to as rotameters, in 1946. Throughout these six decades of experience, we have helped customers with VA solutions in just about every industry. Our solutions have come from our standard portfolio as well as custom-designed products incorporating special materials and pressure ratings. The Brooks line of glass tube and metal tube VA meters ensures measurement repeatability, which provides dependable flow monitoring and consistency. External power is not required for operation; therefore, they provide a fail-safe flow indication under any circumstance. Brooks VA meters can be provided with a variety of wetted materials for high pressure, high temperature conditions, and hazardous locations.

**Armored VA Meters:** The Brooks line of rugged metal tube VA flow meters is ideal for high pressure, high temperature, and other demanding flow applications where safety is a concern. HART and 4-20mA outputs provide for remote flow monitoring.

**Glass Tube VA Meters:** The Brooks line of reliable glass tube VA meters is ideal for gas and liquid flow measuring applications where viewing the process is desirable.

**Purgemeters:** The Brooks Sho-Rate™ brand of VA meters delivers industry-leading performance for gas or liquid flows. Robust engineering ensures reliable indication and unsurpassed service life.



Readers choice award for best products in the "Flowmeter, Variable Area" categories.

# Low Flow Glass & Plastic Tube Variable Area Meters



1350 Sho-Rate™



1358 Sho-Rate™



1510

The Brooks Model 1350 and 1355 Sho-Rate™ variable area meters deliver industry-leading performance for gas or liquid flows. Their robust, proven engineering ensures reliable indication and unsurpassed service life. Sho-Rate meters pioneered the concept of field-replaceable tube and float kits. If necessary, the tube and float can be replaced in-line in a matter of minutes. Brooks also offers low cost meters in glass, acrylic, and polycarbonate tube configurations

for less critical applications.

- Integral needle valves on inlet or outlet
- Integral flow controller that compensates for varying inlet or outlet pressures
- 316 stainless or brass construction
- Compact, space saving size

## Low Flow Glass & Plastic Tube Variable Area Meters

Model	Capacity – Water		Capacity – Air		Accuracy	Max Pressure	Construction
	lph	gph	m³n/hr	scfm		psig (bar)	
1350/ 1355	0.032 to 114	0.006 to 30	0.002 to 3.7	0.001 to 2.33	10% (1350) FS 5% (1355) FS	200 (14)	Glass Tube w/ Brass or 316 SS
1358	182 to 1136	48 to 300	5.4 to 23.6	3.4 to 15	10% FS	200 (14)	Glass Tube w/ Brass or 316 SS
1510	0.032 to 114	0.006 to 30	0.002 to 3.7	0.001 to 2.33	10% FS	200 (14)	Glass Tube w/ 316 SS
2001	1 to 1020	0.25 to 270	NA	0.03 to 15	10% FS	100 (7)	Acrylic Tube w/ 316 SS
2700	1.5 to 80	0.4 to 20	0.88 to 2.5	0.05 to 1.7	10% FS	100 (7)	Polycarbonate Tube w/ 316 SS

## Optional Needle Valves & Flow Controllers

FC8800/ 8900 Series Flow Controllers	0.025 to 1820	0.025 to 480	0.52 to 56	0.02 to 35		1000 (68)	Brass or 316 SS
8500 Series Needle Valves	0.24 to 110	0.02 to 10	0.008 to 2.5	0.005 to 0.77		1000 (68)	Brass or 316 SS

# High Flow Glass Tube Variable Area Meters



**GT1000**



**GT1100**



**GT1305**

The Brooks line of reliable glass tube variable area meters (rotameters) is ideal for many gas and liquid flow measuring applications where viewing the process is important.

- Tube and float can be re-ranged in line, minimizing process down time
- Rotatable connections for easy installation at any angle
- Packing gland or O-ring sealing to meet piping requirements or customer preference
- Globally approved for use in hazardous environments
- Reliable – only one moving part
- No power required which reduces installation cost and provides flow measurement in hazardous areas
- Low-pressure drop allows for economical pump selection
- Flow alarms available on some models
- Rugged, vented polycarbonate enclosure available on most models

## High Flow Glass Tube Variable Area Meters

Model	Capacity – Water		Capacity – Air		Accuracy	Max Pressure	Output
	lph	gpm	m <sup>3</sup> n/hr	scfm		psig (bar)	
GT1000	0.024 to 22000	0.0001 to 98	0.002 to 440	0.001 to 270	2% FS	500 (34)	Alarm (IS)
GT1100 Series	0.032 to 22000	0.0001 to 98	0.002 to 342	0.001 to 217	2% FS	500 (34)	Local Indication
GT1307	39 to 20900	0.17 to 92	1.5 to 342	0.9 to 217	2% FS	350 (24)	Local Indication
GT1306	31 to 2205	0.14 to 9.7	1.2 to 66	0.8 to 42	3% FS	350 (24)	Local Indication
GT1305	182 to 11355	0.8 to 50	4.7 to 79	3 to 50	10% FS	200 (14)	Alarm

# Armored Variable Area Meters



MT3809



MT3750C Ar-Mite™

The Brooks line of rugged metal tube variable area meters (rotameters) is ideal for high pressure, high temperature, and other demanding flow applications where safety is a concern.

- Globally approved for use in hazardous environments
- Needle valves available for flow control
- Multiple connection options to match your existing system and provide easy installation
- Many corrosion resistant material options for the metering of aggressive fluids
- Alarm and 4-20mA with HART options provide for remote flow monitoring
- Excellent meter repeatability provides consistent batch and/or process production
- No power required which reduces installation cost and provides flow measurement in hazardous area
- Low-pressure drop

## Armored Variable Area Meters

Model	Capacity – Water		Capacity – Air		Accuracy	Max Pressure psig (bar) <sup>1</sup>	Output
	lph	gpm	m <sup>3</sup> n/hr	scfm			
MT3809	25 to 100,000	0.11 to 440	0.78 to 1404	0.49 to 888	2% FS	1500 (103)	Alarm and/or 4-20 mA, HART FOUNDATION Fieldbus (IS or X-Proof)
MT3819	110 to 15,000	0.48 to 66	3.2 to 435	2 to 275	2% FS	275 (19)	Alarm and/or 4-20 mA, HART (IS or X-Proof)
MT3810	25 to 20,000	0.11 to 88	0.78 to 620	0.49 to 392	5% FS	1500 (103)	Alarm and/or 4-20 mA, HART (IS or X-Proof)
MT3750	0.8 to 100	0.003 to 0.44	.04 to 3.1	.02 to 2	5% FS	4000 (275)	Alarm and/or 4-20 mA FOUNDATION Fieldbus (IS or X-Proof)
3600 Series	18 to 11,355	.08 to 50	0.65 to 43	0.38 to 28	10% FS	1500 (103)	Alarm (IS or X-Proof)



<sup>1</sup> Special designs for up to 15,000 psi (1000 bar) are available. Consult your local representative for more information.



# Level Products



## Reliable Magnetic Level Gauges.

Robust Brooks magnetic level gauges provide reliable liquid level measurement through the use of a proven magnetic float technology which does not require external power. As a result, plant personnel can continue to monitor material levels despite planned or unplanned power cuts. Optional alarms and transmitters are available to permit remote monitoring as well.

The Brooks model 810 series magnetic level gauges are direct-reading level gauges that permit users to easily verify product level, even corrosive or hazardous liquids, in vessels and tanks. The 810 was designed to ensure outstanding accuracy, excellent reliability, and safe use.

# Level Products

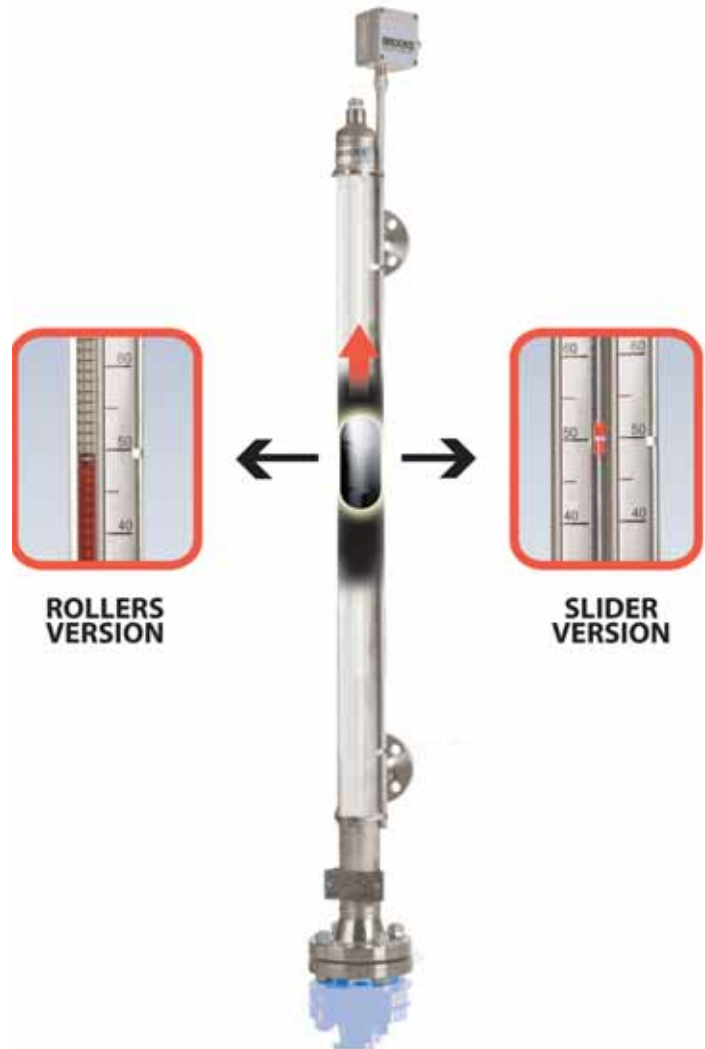
A float equipped with a 360° permanent magnet follows the level variation of the liquid to be measured.

**Slider Version:** The float drives a magnetic slider which slides in a Pyrex tube mounted on a graduated scale.

**Rollers Version:** The float reverses magnetically locked bi-colored rollers. The red zone indicates the level of liquid in the tank.

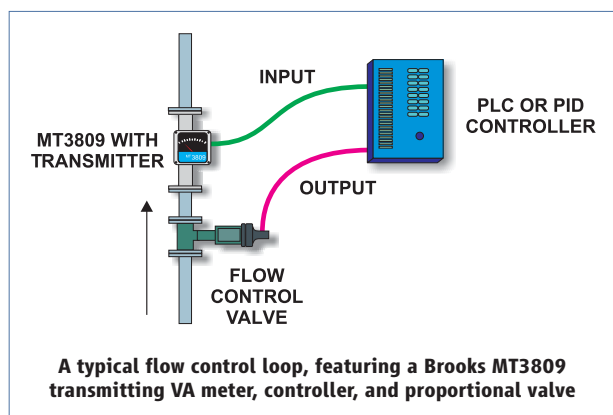
Brooks magnetic level gauges feature sealed measurement chambers constructed from stainless steel, PVC, PPH, PVDF, PTFE, or any non-magnetic material that enables reliable level measurement of a wide assortment of liquids, including those that are corrosive, toxic, or hazardous. Because the only moving part in contact with the fluid is the float, these instruments are highly rugged and durable. Many process connection options are available to enhance application flexibility.

Brooks magnetic level gauges measure liquid level over ranges from as short as 1 foot (0.3 m) to as long as 20 feet (6 m), and longer with multiple sections of instruments if needed. Designs are available to handle fluid temperatures from -256° F (-160° C) to 750° F (400° C) and pressures as high as 3480 psi (240 bar), and fluid-specific gravity as low as 0.4. Applications include product tank monitoring, feed water heaters, condensate and separator systems, cryogenic gases, effluent tanks, and more.



# Applications

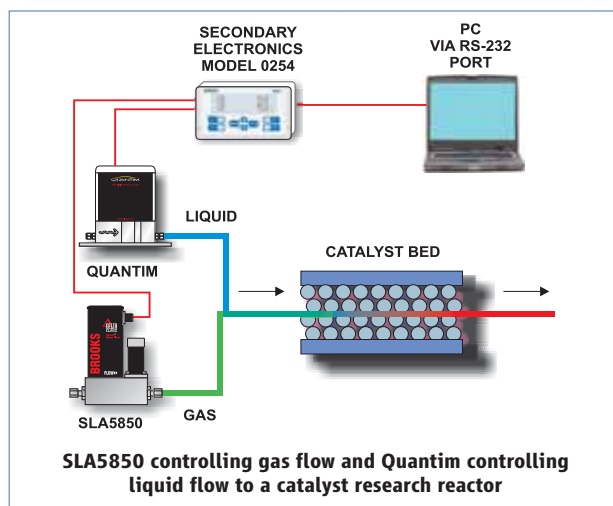
Brooks' extensive line of flow, level, and pressure products are in use around the globe in a wide variety of industries and applications. The following are some illustrative applications.



## Basic Flow Control

Many industrial processes require reliable, accurate, and repeatable gas and liquid flow measurement and control. Brooks' exceptionally versatile variable area meters find wide use in many industries for monitoring process flow, instrument impulse lines, purge gas flows, flows of flushing or cooling media, make-up flows, and reactor gas and liquid feeds.

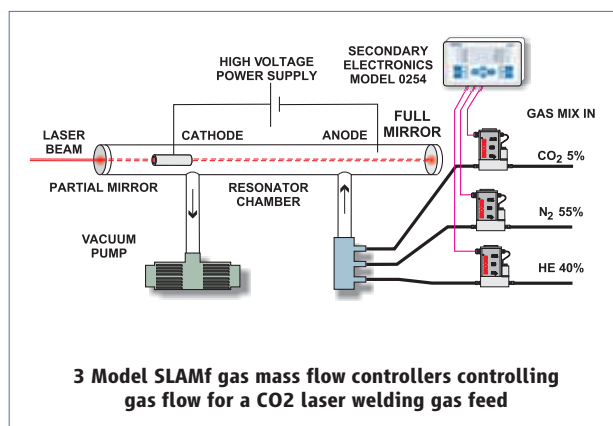
Many Brooks variable area meters are offered with flow switches, alarms, or continuous electronic output to allow flow conditions to be monitored and controlled remotely. A variety of valves is also available for setting a flow set-point, and pressure controllers are offered to provide constant flow under varying pressure conditions.



## Catalyst Research

The challenge is scaling up the catalyst process from the laboratory to the pilot plant and, ultimately, to production levels. It is imperative that the amount of feed flowing through the research catalyst bed be precisely measured so that the conversion rate and selectivity can be accurately calculated and scaled up successfully.

Brooks' Quantim Series Coriolis mass flow controllers and SLA Series thermal mass flow controllers have been selected by many companies involved in catalyst research because these instruments provide exceptional precision, wide dynamic range, and super stability. The Quantim Series utilizes coriolis technology making them extremely well suited for critical measurements where the composition or thermal properties of feeds vary. Both series are available for extremely high pressure service, have appropriate area classifications, and are offered with a variety of wetted materials. The 0254 secondary electronics may be used to provide power, set point, and local display.

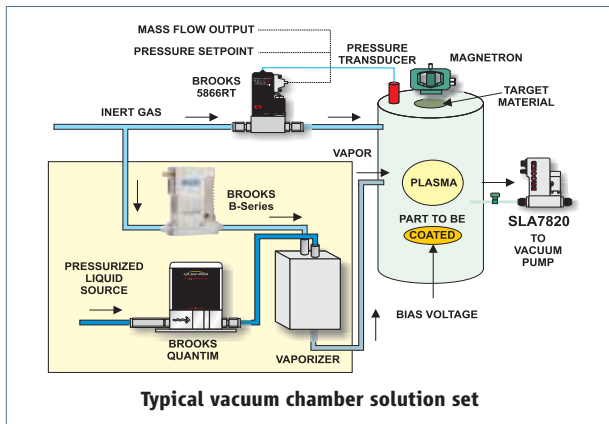


## Heat Treating, Cutting/Welding, And Other Thermal Processes

The thermal process market is diverse, but the application demands are similar: reliable, accurate control of inert shielding gases and excellent control of O2 to ensure that the desired outcome is achieved time after time.

Brooks Model 1350 and 1355 Sho-Rate variable area meters are examples of simple, reliable flow measurement products optimized for applications requiring 2-5% gas flow accuracy. Both can be supplied with Model 8800 flow controllers that hold flow constant despite changes in feed pressure. The new Model 4850 provides economical thermal mass flow control at flows up to 40 slpm and a convenient local operator interface for changing flow parameters and setpoint. Leading thermal spray equipment suppliers often select the MF series mass flow controllers because their NEMA-4X/IP66 ingress protection prevents damage from dust and water.

# Applications

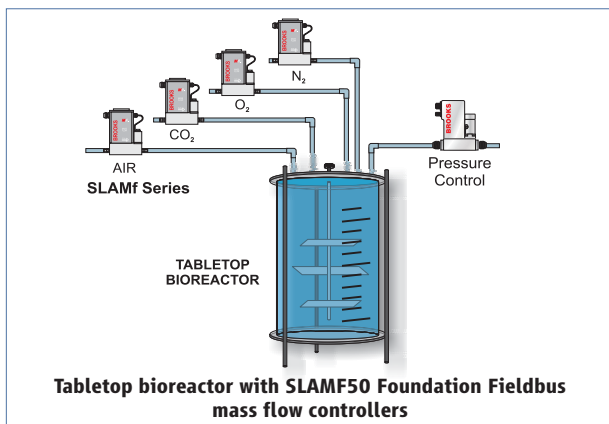


## Vacuum Processes

Brooks offers many exceptionally performing products for CVD, ALD, etch, diffusion and other vacuum operations. For gas flow control, our wide assortment of gas mass flow controllers permits excellent alignment between application requirements and MFC performance. For example, our B-Series mass flow controllers incorporate active pressure compensation to maintain constant flow despite pressure fluctuations. Brooks also offers electronic pressure controllers, models SLA7810 and SLA7820 for example, for precise chamber pressure control.

Brooks Quantim Series Coriolis mass flow controller provides precision, accuracy, and repeatability for liquid precursor applications.

For vaporizing liquid precursors, Brooks has a wide assortment of liquid-to-vapor solutions that provide thorough vaporization without creating particles or other undesirable by-products.

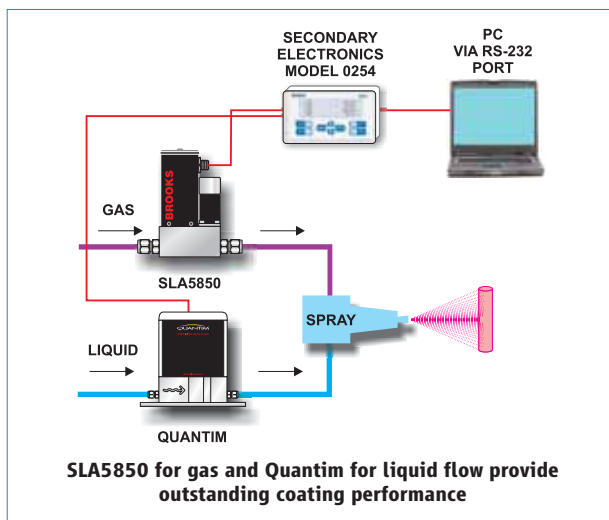


## Bioreactors

Brooks has a well-deserved leadership position in measuring and controlling gas flows for bioreactor applications.

The Model 1350 and 1355 Sho-Rate variable area meters with integral needle valves are ideal for small systems with manual gas adjustment.

For automatic control, Brooks offers a wide range of solutions: from the value-engineered Model 4850 mass flow controllers to the extremely accurate and repeatable digital mass flow controllers with optional advanced digital communication protocols like Profibus, Device Net, and Foundation Fieldbus. Our range of mass flow controllers encompasses gas flow ranges from sub-slp to over 2,500 slpm. Many models can be provided with a NEMA-4X/IP66 enclosure to prevent instrument damage in wash-down applications.



## Precision Coatings

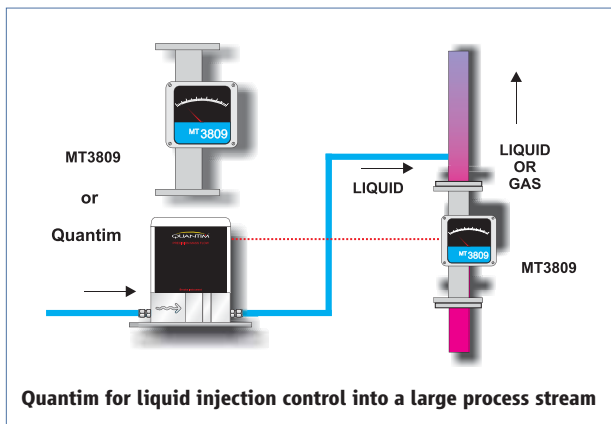
Many coating processes use liquids that are sprayed onto substrates. The liquid delivery rate to the spray nozzle controls the film thickness on the substrate, while gas flow determines droplet size and spray pattern.

The Quantim Series Coriolis mass flow controller is perfect for controlling the liquid flow rate to the spray nozzle. In addition, the instantaneous density output available from the Quantim Series can be employed diagnostically to detect the presence of gas bubbles in the liquid stream. The SLA Series gas flow controller is often selected for this application because of its very fast response and highly accurate, repeatable flow control.

The 0254 secondary electronics may be used to provide power, local display, and setpoint for both flow devices. The liquid density measurement, used for quality control, is also displayed. A totalizer function may be used to track liquid inventory to ensure that the process supply does not run low.



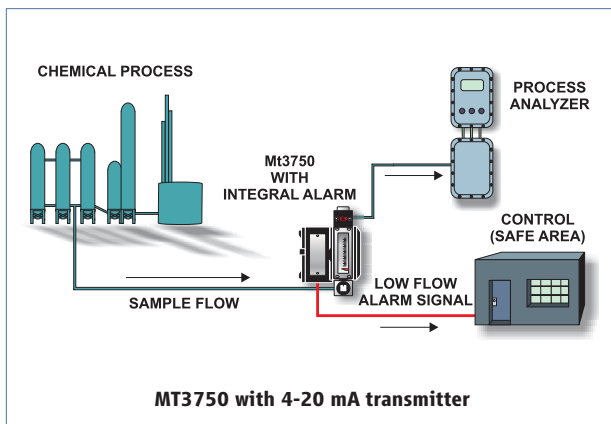
# Applications



## Chemical Injection/Dosing Systems

Injecting a relatively small flow of chemical liquid into a larger stream is a common control challenge. Example injectants are anti-foaming agents, corrosion inhibitors, descalers, biocides, oxygen scavengers, odorants, dyes, and neutralizing agents. Brooks' metal tube variable area meters, such as the MT3809 shown, are widely used for these applications in a variety of industries because they offer flow rates and materials of construction to solve many challenges. Of special note is Brooks' very high pressure variable area capability (1000 bar/15,000 psi), especially useful for well-head injection applications.

Brooks Quantum Series Coriolis mass flow controller is an excellent solution when the injectant mass is very low or when extremely accurate addition measurements are required. For example, users injecting mercaptan into propane can achieve far tighter control than with other addition technologies, ensuring compliance with regulations while eliminating the expense of excess addition.

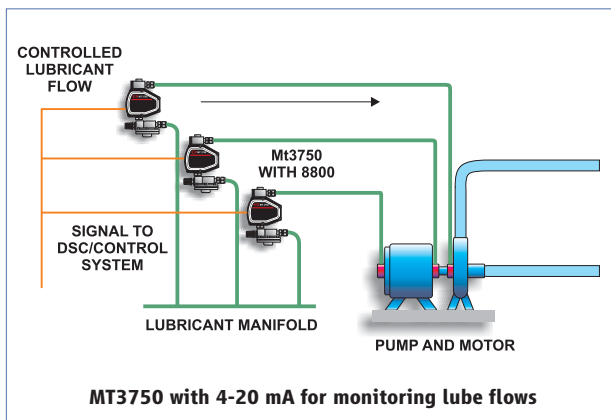


## Process Analyzer Sample Flow

Process analyzers are designed to accurately and continuously measure a target analyte in a process stream. Sampling is the single most critical issue for process analysis, and sampling system plugging is one of the worst problems that a customer can encounter when it causes unscheduled maintenance.

Unlike a flow alarm or flow switch, the Model MT3750 variable area meter with 4-20mA output continuously monitors sample flow to the analyzer. When flow starts to drop, indicating the onset of plugging, but before the analyzer is starved of sample, users can schedule maintenance to clear the problem.

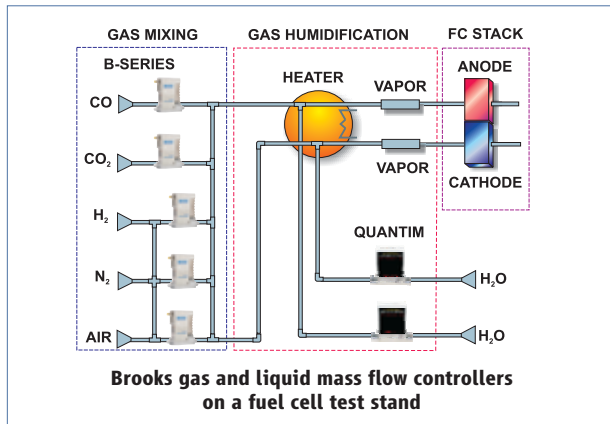
Many analyzer sample systems use a "fast loop" bypass flow to rapidly move sample to the analyzer. It is frequently useful to instrument this line with a continuously transmitting variable area meter as well.



## Rotating Equipment

Large rotating equipment requires effective and reliable flow monitoring on a number of fluid supplies to ensure the equipment's efficient and safe operation. Examples are lubrication fluids, coolants, and dry gas seal gases.

Brooks metal tube variable area meters, such as the MT3750 shown, are commonly used to monitor lube oil and coolant flows. The optimum solution is using a 4-20 mA transmitting variable area meter so that flow can be continuously monitored. Glass tube or plastic body variable area meters are frequently used to ensure proper flow to dry gas seals, while some customers, to achieve superior flow accuracy, employ Brooks' latest thermal mass flow meters and controllers, such as the SLAMf series.

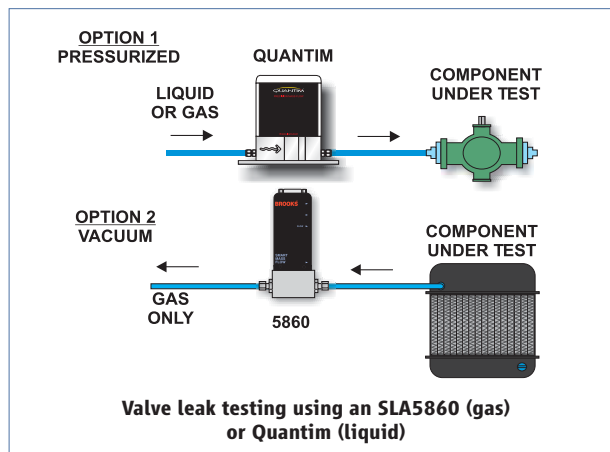


## Fuel Cell Test Stand

Fuel cell test stands used to measure the efficiency of the fuel cell rely on accurate, fast responding, stable mass flow controllers with wide turndown.

Brooks digital gas mass flow controllers feature sub-1 second response to a setpoint change. The B-Series can achieve sub-500 msec response and additionally provides flow immunity to pressure spikes and temperature changes. The 4800 Series also provides excellent response with an easy to use local operator interface. All the Brooks gas MFCs feature extremely stable, low drift operation, and wide dynamic range.

Brooks Quantim Series Coriolis mass flow controllers are ideal for cell stack humidification or other liquid flow control applications requiring a high degree of flow control precision.

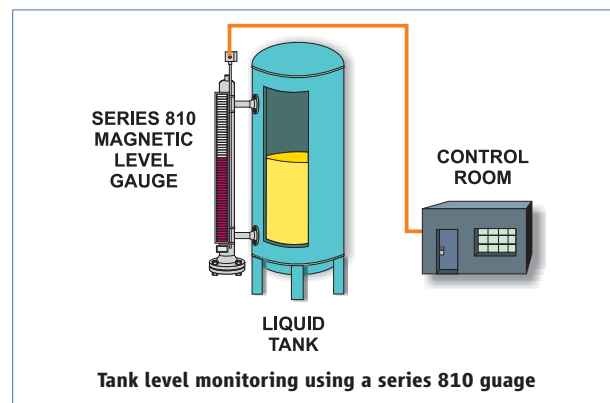


## Device Testing And Metrology

Components and assemblies that are designed against leaks during use can be tested quickly and reliably using Brooks flow meters. This is accomplished by simply applying pressure or vacuum to the device under test and confirming the absence of flow using a Brooks variable area, thermal, or Coriolis flow meter. Examples include valves, radiators, hydraulic and pneumatic assemblies, plumbing fixtures, and more.

Components designed to deliver a certain flow rate at a given set of pressure conditions (orifices and nozzles); to have a certain pressure drop at a given flow rate (filters); to have a minimum power output at a given fuel consumption (engines) can also be tested using Brooks flow meters.

Fluid handling equipment like pumps, injectors, dispense heads, and even other flow meters can be periodically verified using Brooks flow meters because the accuracy of the Brooks meter is usually far greater than the device under test.



## Level Measurement

Brooks robust magnetic level gauges provide reliable liquid level measurement through the use of a proven magnetic float technology which does not require external power. As a result, plant engineers can continue to monitor material levels despite planned or unplanned power cuts. Optional alarms and transmitters are available to permit remote monitoring.

Brooks magnetic level gauges feature sealed measurement chambers constructed from stainless steel, PVC, PPH, PVDF, or PTFE that enable reliable level measurement of a wide assortment of liquids including those that are corrosive, toxic, or otherwise hazardous. Because the only moving part in contact with the fluid is the float, these instruments are exceptionally rugged and durable. Many process connection options are

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