

# 9000 Series

Thermal Mass Flow

## High Temperature Mass Flow Controllers/Meters

### Overview

Originally developed by Unit Instruments (later Celerity Inc.), the 9000 Series of high temperature mass flow controllers and meters continue to be manufactured using the same supply chain and copy exact process by Brooks Instrument who acquired the IP and assets of Celerity Inc. in 2009.

The 9000 Series remains the optimum choice for critical precursor and dopant vapor delivery in semiconductor and optical fiber manufacturing.

### Product Description

The 9000 Series are thermal mass flow controllers and meters designed for challenging high temperature delivery of condensable precursors and dopants.

A high purity, high leak integrity metal flow path ensures compatibility with all processes gases and vapors. The patented IsoSensor™ is a high stability flow sensor compatible with the elevated environmental temperatures found in heated gas lines and baking systems (temperature-controlled gas boxes). The ultra-low drift performance of the IsoSensor reduces the need for frequent re-zeroing and recalibration typical in high temperature applications.

For maximum flexibility and inventory reduction, the 9000 Series remote electronics come standard with two analog electrical connectors (a 20 pin card edge and a 9 or a 15 pin "D" connector option) and Semi industry standard RS485 digital communication enabling easy retrofit and standardization.

In mass flow controller models, a diaphragm free solenoid control valve provides a wide dynamic control range for superior precision and control. Designed for long-term reliability, the valve has been marathon tested to over 8 million cycles with no degradation in performance.

### Model Description

9861 Ultra-High Purity Digital Mass Flow Controller with Analog and RS485 interfaces

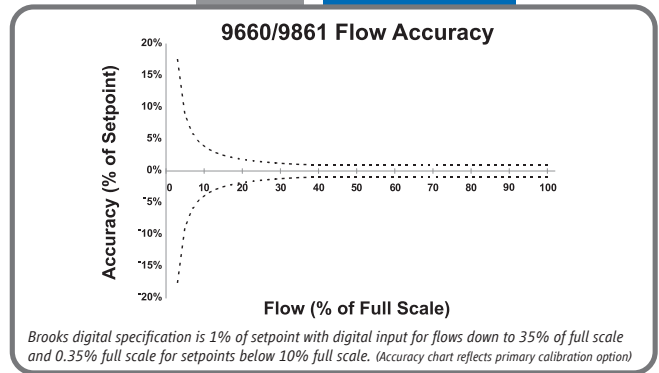
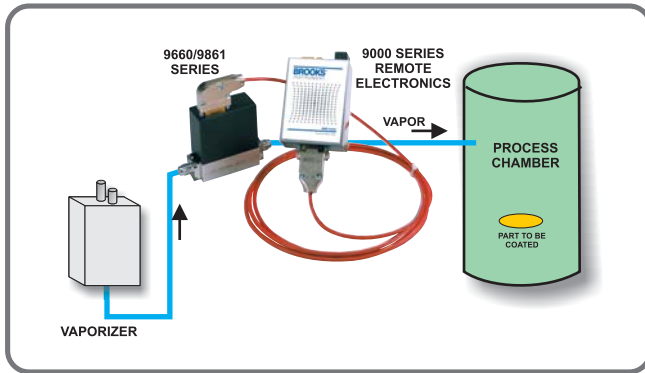
9660 High Purity Digital Mass Flow Controller or Meter with Analog and RS485 interfaces



9000 Series  
Mass Flow Controller/Meters

# Features and Benefits

Features	Benefits
High temperature mass flow controller	Reliable delivery of condensable gases and precursors
Digital measurement and control architecture	Enhanced accuracy and process control
Ultra-High purity flow path	Ensures integrity and purity of gas/vapor
Ultra-stable flow measurement sensor	Reduced maintenance for superior uptime and lowest cost of ownership
Upstream pressure buffering (optional)	Stable mass flow delivery under challenging supply conditions
All metal diaphragm free control valve	Enhanced long-term reliability
Dual I/O interfaces	Universal upgrade enabling standardization and inventory reduction



# Product Dimensions

Fitting type	Overall	Inlet	Outlet
1/4" VCR Male	4.88 in./124.0 mm	0.94 in./23.9 mm	0.94 in./23.9 mm

X.XX = dimensions in inches  
[XX.X] = dimensions in millimeters

**9000 Series Remote Electronics Dimensions**

\* Standard cable length = 3 ft.  
The following lengths are available with a special request:  
6.7 ft., 8 ft. & 16.5 ft.

## Product Specifications

Performance Specifications	
<b>Settling Time (to within 2% of setpoint)</b>	
Fast Start	≤ 1.0 sec (per SEMI E17-91)
Soft Start	Linear 20% per sec (0 to 100% in 5 sec)
<b>Accuracy (N<sub>2</sub> equivalent)</b>	
35% to 100% F.S.	±1% setpoint (per SEMI E56-96)
< 35% F.S.	±0.35% full scale (per SEMI E56-96)
<b>Repeatability (full scale)</b>	±0.15% (per SEMI E56-96)
<b>Linearity (full scale)</b>	±0.5% (per SEMI E27-92)
<b>Inlet Pressure Coefficient</b>	0.007% per psi (N <sub>2</sub> )
<b>Ambient Temperature Coefficient</b>	
Zero	0.05% full scale per °C
Span	0.1% full scale per °C
<b>Leak Integrity</b>	1 x 10 <sup>-10</sup> atm-cc/sec (He) (per SEMI E16-90)
<b>Automatic Zero</b>	Optional (customer programmable)
<b>Zero Drift</b>	≤ 0.6% per year without auto-zero
<b>Thermal Siphoning and Attitude Sensitivity</b>	< 0.1% full scale (30 psi SF <sub>6</sub> )
<b>Operating Limits</b>	
<b>Standard Flow Range</b>	3 sccm to 10 slm (N <sub>2</sub> equivalent)
<b>Control Range (full scale)</b>	2-100%
<b>Valve Leak Rate</b>	≤1% full scale
<b>Gases</b>	All
<b>Ambient Temperature Range</b>	0-150°C (32-302°F)
<b>Maximum Operating Pressure</b>	1,050 kPa (150 psi)
<b>Differential Operating Pressure (Typical)</b>	1.33-350 kPa (10 torr - 50 psia)
<b>Warm-up Period</b>	30 minutes
<b>Mounting Position</b>	HOV or HOS
<b>Valve</b>	Normally closed solenoid
<b>Electrical Characteristics</b>	
<b>Input/Output Signal</b>	
Setpoint Input	0-5 Vdc linearly proportional to required flow
Output Monitor	0-5 Vdc linearly proportional to flow rate
Digital Input/Output	RS485L (via RJ11 ports)
Valve Off	External: TTL signal
Auto shut-off	Setpoint < 2% full scale commands valve off
<b>Power</b>	
Controller (RS485)	+15 Vdc (160 mA max.), -15 Vdc (160 mA max.)
Meter (Analog)	+15 Vdc (50 mA max.), -15 Vdc (50 mA max.)
<b>Power Consumption</b>	9660 = 5 watts, 9861 = 5 watts max.
<b>Mechanical Characteristics</b>	
<b>Surface Finish</b>	10μ inch Ra (Model 9660), 4μ inch Ra (Models 9861)
<b>Fittings</b>	1/4" VCR®, 3/8" VCR®
<b>Valve Position</b>	Downstream
<b>Materials</b>	Wetted Components: 316L SS/KM-45/304/7MO+
<b>Weight</b>	1.2 kg (2.65 lbs)
<b>Calibration References</b>	
<b>Traceability</b>	National Institute of Standards and Technology (N.I.S.T.)
<b>Standard Temperature and Pressure</b>	0°C and 760 mm Hg per (SEMI E 12-96)

Specifications and features are subject to change without notice.

## Model Code - 9800 Series

<b>9861</b>	Ultra-High Purity, Metal Seal, RS485 Digital and Analog Interface														
<b>C</b>	Mass Flow Controller														
<b>M</b>	Mass Flow Meter														
<b>A</b>	Auto Shut-off														
<b>X</b>	No Auto Shut-off														
<b>F</b>	Fast Start 1 Second Response														
<b>S</b>	5 Second Linear Soft Start														
<b>T</b>	6-10 Second Soft Start														
<b>X</b>	No Valve (Meter)														
<b>XXXX XXXX</b>	Specify Pre-programmed Gas and Full Scale Range (example: Nitrogen = "0013"; 90sccm= "090C")														
<b>4R</b>	1/4" VCR														
<b>3R</b>	3/8" VCR														
<b>HOV</b>	Horizontal or Vertical Mounting Attitude (Standard)														
<b>HOS</b>	Horizontal or Side														
<b>A</b>	Atmospheric Downstream Pressure														
<b>V</b>	Vacuum Downstream Pressure														
<b>MM</b>	Metal O-Ring/ Metal Seat														
<b>MX</b>	Metal O-Ring- No Valve (Meter)														
<b>T</b>	9 Pin "D" Connector & 20 Pin Card Edge Connector & Dual RJ11 ports, 0-5 VDC														
<b>U</b>	15 Pin "D" Connector & 20 Pin Card Edge Connector & Dual RJ11 ports, 0-5 VDC														
<b>XXXX</b>	Customer Special Request (CSR)														
<b>C</b>	Normally Closed (Standard)														
<b>X</b>	No Valve (Meter)														
<b>S</b>	Standard (Valve Downstream)														
<b>X</b>	No Valve (Meter)														
<b>A</b>	Auto-Zero Enabled														
<b>X</b>	Auto-Zero Disabled														
<b>04E</b>	4μ inch Ra Finish														
<b>00</b>	0°C Reference Calibration (Standard)														
<b>XX</b>	Custom Reference Calibration (20°C=20)														

### Sample Model Code

9861	C	A	F	XXXX XXXX	4R	HOV	A	MM	T	XXXX	C	S	A	04E	00
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## Model Code - 9600 Series

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<b>X</b>	No Valve (Meter)														
<b>A</b>	Auto-Zero Enabled														
<b>X</b>	Auto-Zero Disabled														
<b>10E</b>	10μ inch Ra Finish														
<b>00</b>	0°C Reference Calibration (Standard)														
<b>XX</b>	Custom Reference Calibration (20°C=20)														

### Sample Model Code

9660	C	A	F	XXXX XXXX	4R	HOV	A	MM	U	XXXX	C	S	A	10E	00
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## Brooks Service and Support

Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support (All Brooks products including Tylan, Tylan General, Millipore, Mykrolis, UNIT and Celerity branded products). We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local weights and measures authorities and traceable to the relevant international standards.

Visit [www.BrooksInstrument.com](http://www.BrooksInstrument.com) to locate the service location nearest to you.

### START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required. For some process applications, where ISO-9001 quality certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

### CUSTOMER SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users and maintenance persons.

Please contact your nearest sales representative for more details.

### HELP DESK

In case you need technical assistance:

Americas     ☎ 1 888 554 FLOW  
Europe        ☎ +31 (0) 318 549 290  
Asia            ☎ +81 3 (0) 5633 7100

Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

### TRADEMARKS

Brooks ..... Brooks Instrument, LLC  
Celerity ..... Brooks Instrument, LLC  
IsoSensor ..... Brooks Instrument, LLC  
Tylan ..... Brooks Instrument, LLC  
Tylan General ..... Brooks Instrument, LLC  
UNIT ..... Brooks Instrument, LLC  
VCR ..... Swagelok Company



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