

9800 Series

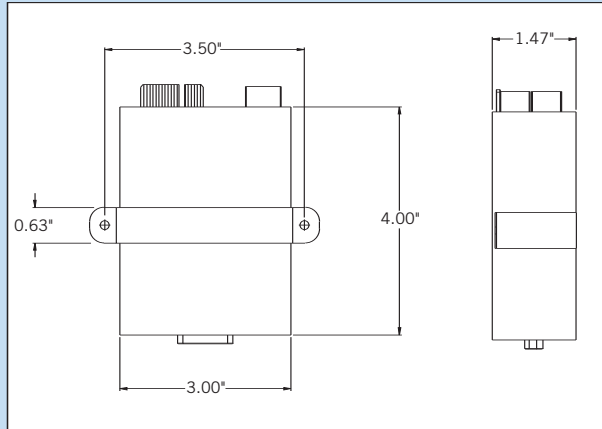
High Temperature Mass Flow Controllers/Meters

- » High temperature metal sealed flow controller, operates from 0°C to 150°C
- » MultiFlo™ option for superior performance, reduced inventory and in situ support
- » Advanced design using proven technology for the high performance required in next generation semiconductor processes
- » Best performance and reliability in the industry
- » Available with analog, RS485, DeviceNet™ or PROFIBUS™ interfaces



Features at a glance

- High-purity 10μ inch Ra standard (4μ inch Ra optional)
- Sealed with high leak integrity metal seals. Uses metal seals to produce a leak integrity of 1×10^{-10} atm-cc/sec (He).
- Higher reliability and ultra-low drift of less than 0.6% per year to reduce year-to-year maintenance, increase uptime and reduce cost of ownership
- Better than 0.15% full scale repeatability to provide the same quality run-after-run
- Statistically verified accuracy. Allows you to easily replicate processes from tool-to-tool and fab-to-fab and to use a single MFC over a wider range of flows.
- Minimized dead space for increased accuracy and faster response time under all turn-on conditions
- Valve designed with fewer parts to enhance speed, responsiveness, and long-term reliability
- Upstream pressure buffering available for applications with fluctuating inlet pressures
- Designed to meet the SEMI standard for Sensor Actuator Network Communications for DeviceNet (SEMI E54-97), Model 9865 specifically designed for full ODVA compliance
- All performance tests per SEMI test methods
- 3 year warranty MultiFlo benefits



9000 Series remote electronics dimensional drawing

The Celerity advantage

- Digital control
- Model 9861 is a drop-in replacement for analog MFCs. It has two analog connectors (a 20 pin cardedge and a 9 or a 15 pin "D" connector option).
- Accuracy of $\pm 1\%$ of setpoint. This allows the use of MultiFlo MFCs over a wider range of conditions while maintaining accuracy. It is specifically designed to handle low and high flow of the same gas with the identical accuracy and stability.
- High resolution calibration control that utilizes a 32 point calibration table for each gas resulting in a ten-fold improvement in accuracy
- Programmable turn-on response time from less than 1 second up to 20 seconds to meet your process requirements
- Real time in situ reranging, monitoring, diagnostics, and trouble-shooting to reduce equipment downtime and cost of ownership
- Alarm-ready with zero drift warning

Description

The 9800 Series mass flow controllers are integrated devices that control gas flows using a high precision electromagnetic valve responding to flow measurements through a sensor using the thermal properties of gases. Since the thermal mass flow measurement is independent of pressure and temperature, this method provides a stable measurement with changing process conditions.

The patented IsoSensor™ is a high stability sensor that produces ultra-low drift, reducing the need for frequent recalibration. It also eliminates thermal siphoning effects.

The precision electromagnetic control valve has a wide dynamic range that provides superior precision and control. It has been subjected to over 8 million cycles with no degradation in performance. It has proven to have superior reliability to piezo actuators and can also operate over a larger pressure range.

9800 Series High Temperature Mass Flow Controllers/Meters

Performance

Settling time (to within 2% of setpoint):	
Fast start	≤ 1.0 sec (per SEMI E17-91)
Soft start	Linear 20% per sec (0 to 100% in 5 sec)
Accuracy:	
35% to 100% F.S.	±1% setpoint (±3σ per SEMI E56-96)
< 35% F.S.	±0.35% full scale (±3σ per SEMI E56-96)
Repeatability (full scale)	±0.15% (per SEMI E56-96)
Linearity (full scale)	±0.5% (per SEMI E27-92)
Inlet pressure coefficient	0.007% per psi (N ₂)
Ambient temp. coefficient:	
Zero	0.05% full scale per °C
Span	0.1% full scale per °C
Leak integrity	1 x 10 ⁻¹⁰ atm-cc/sec (He) (per SEMI E16-90)
Automatic zero	Standard on 9861/9865 (customer programmable); optional on 9660/9860
Zero drift	≤ 0.6% per year without auto-zero
Thermal siphoning and altitude sensitivity	< 0.1% full scale (30 psi SF ₆)

Operating limits

Standard flow range	3 sccm to 10 slm (N ₂ equivalent)
Control range (full scale)	2-100%
Valve leak rate	≤ 1% full scale
Gases	All
Ambient temp. range	0-150°C (32-366°F)
Max. operating pressure	3,500 kPa (500 psi)
Proof pressure	10,500 kPa (1,500 psi)
Differential operating pressure	1.33-350 kPa typical (10 torr—50 psid typical)
Warm-up period	30 minutes
Mounting position	HOV or HOS
Valve	Normally closed solenoid

Electrical characteristics

Input/Output signal:	
Setpoint input	0-5 VDC linearly proportional to required flow
Output monitor	0-5 VDC linearly proportional to flow rate
Valve off	External: TTL signal
Auto shut-off	Setpoint < 2% full scale commands valve off
Power:	
Controller (RS485)	+15 VDC (160 mA max.), -15 VDC (160 mA max.)
Controller (DeviceNet)	+11-25 VDC (per ODVA) 600 mA @ 12 VDC, 300mA @ 24 VDC
Meter (Analog)	+15 VDC (50 mA max.), -15 VDC (50 mA max.)
Power consumption	9861 = 5 watts max., 9865 = 7.2 watts max.
CE marked	Immune to radiated energy 10 V/m, 30-850 mHz

Mechanical characteristics

Surface finish	10μ inch Ra (model 9660), 4μ inch Ra (model 9860/9861/9865)
Fittings	1/4" VCR [®] , downported B, C, W
Valve position	Downstream (buffered optional)
Materials:	
Wetted components	316L SS/K-M45/304/7MO+
Weight	1.2 kg (2.65 lbs)

Calibration references

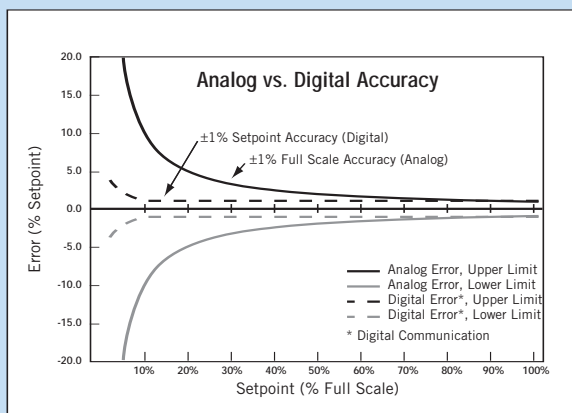
Traceability	National Institute of Standards and Technology (N.I.S.T.)
Standard temperature and pressure	0°C and 760 mm Hg per (SEMI E12-96)

Specifications and features are subject to change without notice.

All specifications reflect nitrogen calibration using Molbloc/Molbox™ transfer standards.

Calibration by primary standards and surrogate gases is available as an additional charge option.

CrossChek™ calibration methodology maintains SPC-verified calibration accuracy with **±3σ** limit (99.7% confidence level).



Celerity digital specification is 1% of setpoint with digital input for flows down to 10% of full scale and 0.1% full scale for setpoints below 10% full scale. (Accuracy chart reflects primary calibration option.)

Model description

9861	Digital control	Analog and RS485 interfaces
9865	Digital control	DeviceNet or PROFIBUS interface

CrossChek™ metrology system



Celerity's world-class CrossChek calibration methodology maintains SPC-verified calibration accuracy with ±3 sigma limit (99.7% confidence level) compared to ±1 or 2 sigma limits (67% to 95% confidence level) for other manufacturers.

CrossChek calibration methodology provides ongoing verification of production calibration standards. This ensures consistent and repeatable accuracy performance within ±3 sigma of published specifications. No other flow control company offers the same guarantee.

Warranty

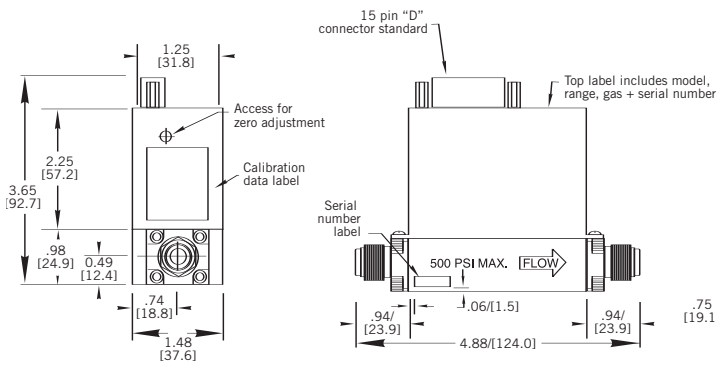
- 3 year standard warranty
- Extended warranty option available

9800 Series Product Configuration

C	Mass Flow Controller
M	Meter
9861	High Purity, Metal Seal, RS485 Digital and Analog Interface (Select Analog Connector Below) 4μ inch Ra Finish
9865	High Purity, Metal Seal, Network Interface (Select DeviceNet or PROFIBUS Below) 4μ inch Ra Finish
A	Auto Shut-off
X	No Auto Shut-off
F	Fast Start 1 Second Response
S	5 Second Linear Soft Start
T	6-10 Second Soft Start
X	No Valve (Mass Flow Meter)
====>	Specify Pre-programmed Gas and Full Scale Range (example: Nitrogen = "0013" and 90 sccm = "090C")
4R	1/4" VCR
DB	Downported—C Seal
DW	Downported—W Seal
HOV	Horizontal or Vertical Mounting Attitude (Standard)
HOS	Horizontal or Side
A	Atmospheric Downstream Pressure
V	Vacuum Downstream Pressure
M	Metal O-Ring/Metal Seat
M	Metal O-Ring—No Valve (Mass Flow Meter)
M	X
D	DeviceNet Connector (9865 only)
E	Cardedge Connector 0-5 VDC
L	Cardedge Lockdown Connector 0-5 VDC
P	PROFIBUS Connector (9865 only)
T	9 Pin "D" Connector (UDU9) Unit 0-5 VDC
U	15 Pin "D" Connector (UDU15) 0-5 VDC
XXXX	Customer Special Request (CSR) Consult Factory
C	Normally Closed (Standard)
X	No Valve (Mass Flow Meter)
S	Standard (Valve Downstream)
X	No Valve (Mass Flow Meter)
A	Auto-Zero Enabled
X	Auto-Zero Disabled
04E	4μ inch Ra Finish Model 9861, 9865
00	0°C Reference Calibration (Standard)
XX	Custom Reference Calibration (20°C=20)

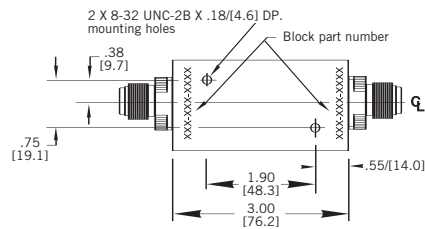
Example:

C	9861	A	F	0013	090C	4R	HOV	A	M	M	U	XXXX	C	S	X	04E	00
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X.XX = dimensions in inches
[XX.X] = dimensions in millimeters

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



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