9500 Series

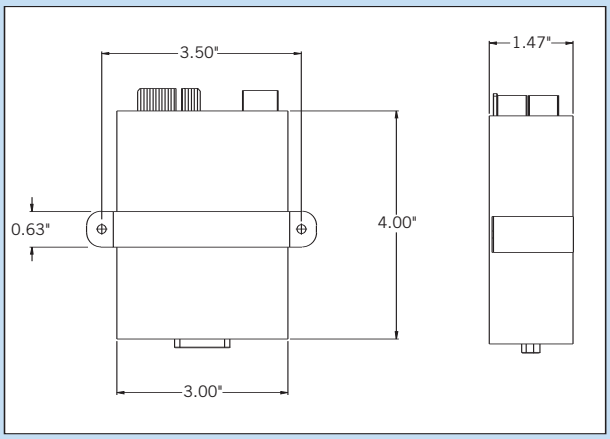
1-1/8” Wide High Temperature Mass Flow Controllers/Meters for Modular Surface Mount Gas Delivery Systems

» High temperature metal sealed flow controller, operates from 0°C to 150°C
» Advanced design using proven technology for high perform ance required for next generation semiconductor applications
» 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)
- Uses metal seal to produce a leak integrity of 1 x 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 (F.S.) 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
- 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

CELERITY



9000 Series remote electronics dimensional drawing

Description

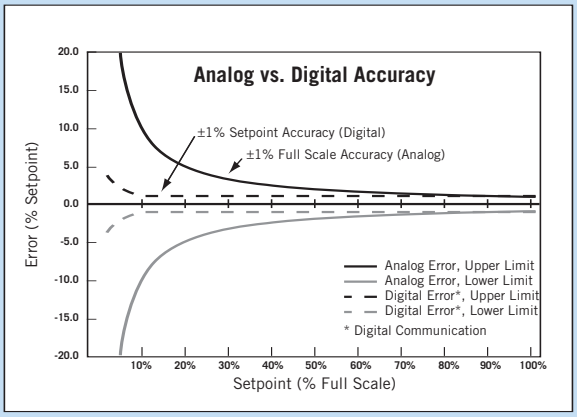
The 9000 Series mass flow controllers are integrated devices that control gas flows using a high precision electromagnetic valve responding to flow measurements through a sensor using the thermal properties of gases. Since the thermal mass flow measurement is mostly independent of pressure and temperature, 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.

The Celerity advantage

- Available on models 9561 and 9565
- Digital control
- Model 9561 drop-in replacement for analog MFCs has two analog connectors (a 20 pin cardedge and a 9 or a 5 pin “D” connector option)
- Accuracy of ±1% of setpoint compared to ±1% of full scale for model 9660/9860. 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
- Stores gas and range configurations and can be re-programmed for an unlimited number of configurations
- 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 Zero drift warning



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 standard calibration option.)

Model description

9561 Digital control
Analog and RS485 interfaces, 4µ inch Ra

9565 Digital control
DeviceNet or PROFIBUS interface, 4µ inch Ra

CrossChek™ metrology system

CrossChek™

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

9500 Series High Temperature Mass Flow Controllers/ Meters for 1-1/8" Wide Modular Surface Mount Gas Delivery Systems

Performance

Settling time (to within 2% of setpoint):	
Fast start	< 2 Secs (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
Zero drift	≤ 0.6% per year without auto zero
Thermal siphoning and attitude sensitivity	< 0.1% full scale (30 psi SF_6)

Operating limits

Standard flow range	2 sccm to 10 slm (N_2 equivalent)
Control range (full scale)	2-100%
Valve leak rate	< 1% full scale
Ambient temperature range	0-150°C (32-366°F)
Maximum operating pressure	3,500 kPa (500 psi)
Proof pressure	10,500 kPa (1,500 psi)
Differential operating pressure	1.33-350 kPa typ. (10 torr to 50 psid typ.)
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	9561 = 5 watts max., 9565 = 7.2 watts max.
CE marked	Immune to radiated energy 10 V/m, 30-850 mHz

Mechanical characteristics

Surface finish	4µ inch Ra
Fittings	For W seal
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).

9500 Series Product Configuration

C	9561	A	F	0013	005L	DB	H0V	A	M	M	D	XXXX	C	S	X	04E	00
M	9565	X	S	===>	===>	DW	H0S	V	M	X	T	XX	O	X	S	X	A	X	04E	00

C Mass Flow Controller
M Mass Flow Meter

9561 High Purity Metal Seal—RS485 Digital and Analog Interface (Select Analog Connector Below)
9565 High Purity Metal Seal—Network Protocol (DeviceNet)

A Auto Shut-off
X No Auto Shut-off

F Fast Start less than 2 seconds
S 5 Second Linear Soft Start
T 6–10 Second Soft Start
V 10–15 Second Soft Start
X No Valve (Mass Flow Meter)

===> ===> Specify Pre-programmed Gas and Full Scale Range (example: Nitrogen = "0013" and 5 Liters per Minute = "005L")

DB Downported—C Seal
DW Downported—W Seal

H0V Horizontal or Vertical Mounting Attitude (Standard)
H0S Horizontal or Side

A Atmospheric Downstream Pressure
V Vacuum Downstream Pressure

M M Metal O-Ring/Metal Seat
M X Metal O-Ring—No Valve (Mass Flow Meter)

D DeviceNet (8165 only)
T 9 Pin "D" Connector (UDU9) Unit 0-5 VDC

XXXX Customer Special Request (CSR) Consult Factory

O Normally Open
C Normally Closed (Standard)
X No Valve (Mass Flow Meter)

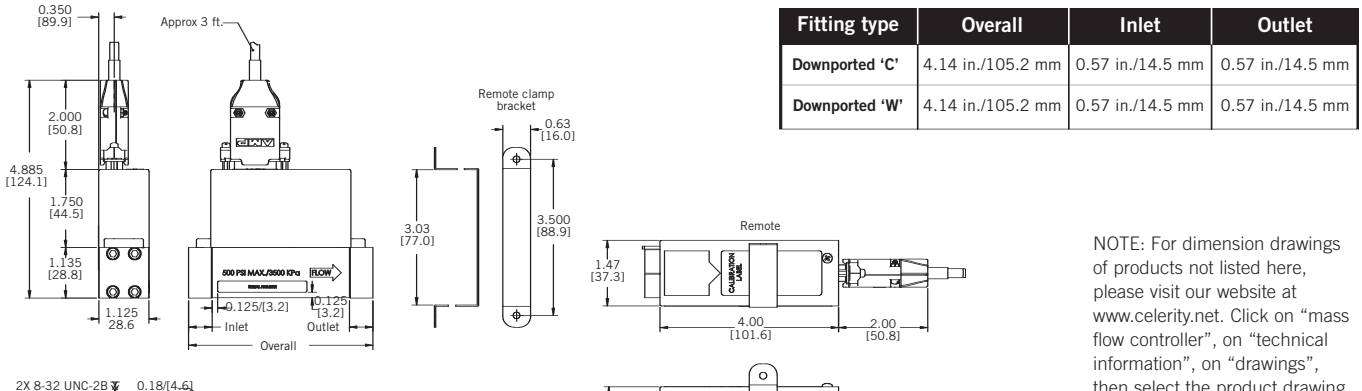
S Standard (Valve Downstream)
X No Valve (Mass Flow Meter)

A Auto-Zero Enabled
X Auto-Zero Disabled

04E 4µ inch Ra Finish

00 0°C Reference Calibration (Standard)
XX Custom Reference Calibration (20°C=20)

Example:



Fitting type	Overall	Inlet	Outlet
Downported 'C'	4.14 in./105.2 mm	0.57 in./14.5 mm	0.57 in./14.5 mm
Downported 'W'	4.14 in./105.2 mm	0.57 in./14.5 mm	0.57 in./14.5 mm

NOTE: For dimension drawings of products not listed here, please visit our website at www.celerity.net. Click on "mass flow controller", on "technical information", on "drawings", then select the product drawing file to download the pdf.

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

CELERITY

UNIT

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