

8160 Series

Ultra-High Purity Mass Flow Controllers/Meters

- » MultiFlo™ option for superior performance, reduced inventory and in situ support
- » Advanced design using proven technology for the high performance that is required for next generation semiconductor applications
- » Best performance and reliability in the industry
- » Popular ultra-high purity metal seal flow controller
- » Available with analog, RS485, DeviceNet™ or PROFIBUS™ interfaces

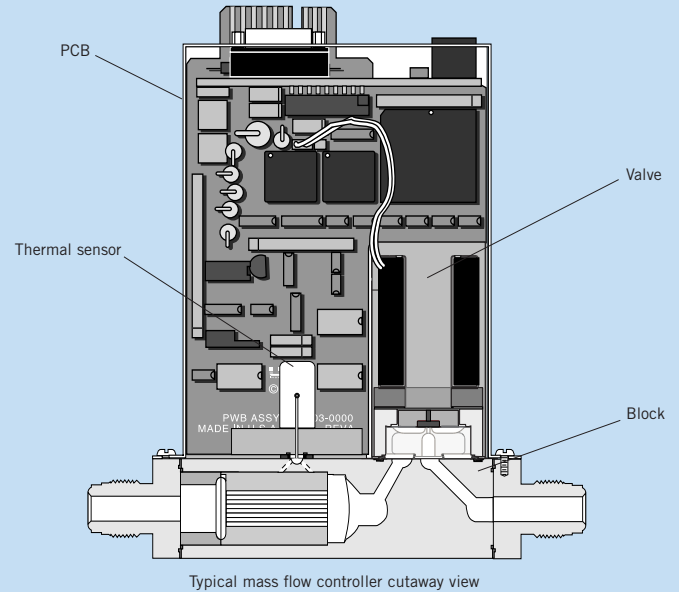
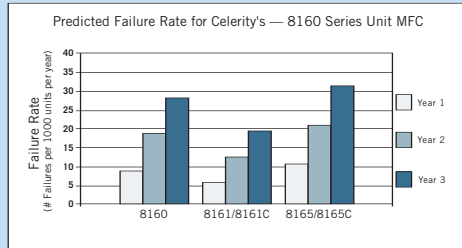
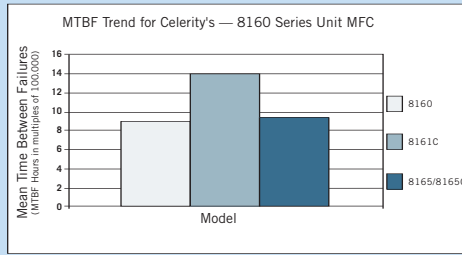


Features at a glance

- Advanced corrosion resistance via passivated Vim/Var steel (compliant with SEMI F19-95 and F-20-95)
- Ultra-high purity 4μ inch Ra surface finish
- 50% reduction in dry-down time compared to high-purity 1660 Series models. Dry-down is reduced because of better surface smoothness and chemistry. 8160 Series also have higher purge flows than conventional MFCs.
- Sealed with high leak integrity metal seals. Uses metal seals to produce a leak integrity of 1×10^{-11} atm-cc/sec (He)
- Higher reliability—MTBF of 550,000 hours and ultra-low drift of less than 0.6% per year to reduce year-to-year maintenance, increase uptime and reduce cost of ownership
- 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
- Designed to meet the SEMI standard for Sensor Actuator Network Communications for DeviceNet (SEMI E54-97). Model 8165 specifically designed for full ODVA compliance

The Celerity advantage

- Available on models 8161 and 8165
- Digital control
- Designed to operate on tools designed for analog MFCs
- Model 8161 are drop-in replacements for analog MFCs
- Accuracy of $\pm 1\%$. 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.
- Increased reliability with over 585,000 hours MTBF
- High resolution calibration control that utilizes a 32 point calibration table for each gas resulting in a ten-fold improvement in accuracy
- MultiFlo MFCs can be reconfigured for an unlimited number of configurations. They eliminate the need to purchase spares for each application, reducing inventory up to 90%.



- 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 8160 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. It was designed with fewer parts to enhance speed, responsiveness and long-term reliability.

8160 Series mass flow controllers are designed for superior corrosion resistance for the large number of corrosive and reactive gases used in semiconductor device manufacturing that can contribute to the microcontamination of the silicon wafer surface when they oxidize the steel of the gas distribution system. Enhanced corrosion resistance and moisture dry-down performance directly reduce wafer microcontamination. 8160 Series MFCs provide advanced corrosion resistance with Vim/Var steel material passivated with a highly effective proprietary environmentally-friendly organic/chelant passivation process.

Vim/Var stainless steel has an intrinsic corrosion resistance because of its ability to form a protective chromium oxide (Cr_2O_3) or "passive" layer that protects the steel from oxidation. The corrosion resistance at the steel surface can be further enhanced by increasing the depth of the chromium oxide layer and the chromium enrichment level. Celerity uses an organic acid/chelate passivation process that produces higher oxide thickness, higher chromium-to-iron ratio and chromium oxide/iron oxide ratio and faster moisture challenge response than traditional electropolishing process.

8160 Series Ultra-High Purity Mass Flow Controller/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% F.S.	±0.35% full scale
> 35% F.S.	±1% setpoint

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 (N₂)

Ambient temp coefficient

Zero: 0.05% full scale per °C; Span: 0.1% full scale per °C

Leak integrity

1 x 10⁻¹¹ atm-cc/sec (He) (per SEMI E16-90)

Automatic zero

Standard on 8161/8165 (customer programmable)

Zero drift

≤ 0.6% per year without auto zero

Thermal siphoning
and attitude sensitivity

< 0.1% full scale (30 psi SF₆)

Operating limits

Standard flow range

3 sccm to 30 slm (N₂ equivalent)

Control range (full scale)

2-100%

Valve leak rate

≤ 1% full scale

Gases

All

Ambient temp. range

0-50°C (32-122°F)

Max. operating pressure

3,500 kPa (500 psi)

Proof pressure

10,500 kPa (1,500 psi)

Pressure differential range

6.65 to 350 kPa (50 torr to 50 psid¹)

¹Lower limit depends on gas density and flow range

Warm-up period

30 minutes

Mounting position

HOV or HOS

Valve

Normally closed or normally open 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:

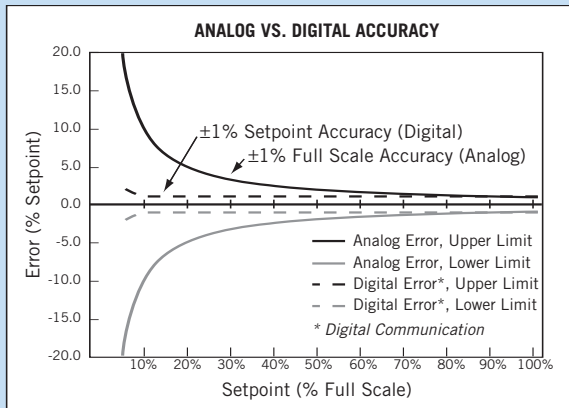
8161 (RS485)	+15 VDC (160 mA max.), -15 VDC (160 mA max.)
8165 (DeviceNet)	+11-25 VDC (per ODVA) 600 mA @ 12 VDC, 300 mA @ 24 VDC
8165 (PROFIBUS)	+15 VDC (500 mA max.), -15 VDC (500 mA max.)
Power meter (analog)	+15 VDC (50 mA max.), -15 VDC (50 mA max.)
Power consumption	8161 = 5 watts max., 8165 = 7.2 watts max.
CE certified	Immune to radiated energy 10 V/m, 30-850 mHz

Mechanical characteristics

Surface finish	4μ inch Ra
Fittings	1/4" VCR®, downported B, C, W or Z fittings
Valve position	Downstream or upstream (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)



Digital model 8161 and 8165 have an accuracy of ±1% of setpoint, while the analog model 8160 has an accuracy of ±1% of full scale. (Accuracy chart reflects primary standard calibration option.)

Model description

8161 MultiFlo	Digital control	Analog and RS485 interfaces
8165 MultiFlo	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

Specifications and features are subject to change without notice.

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

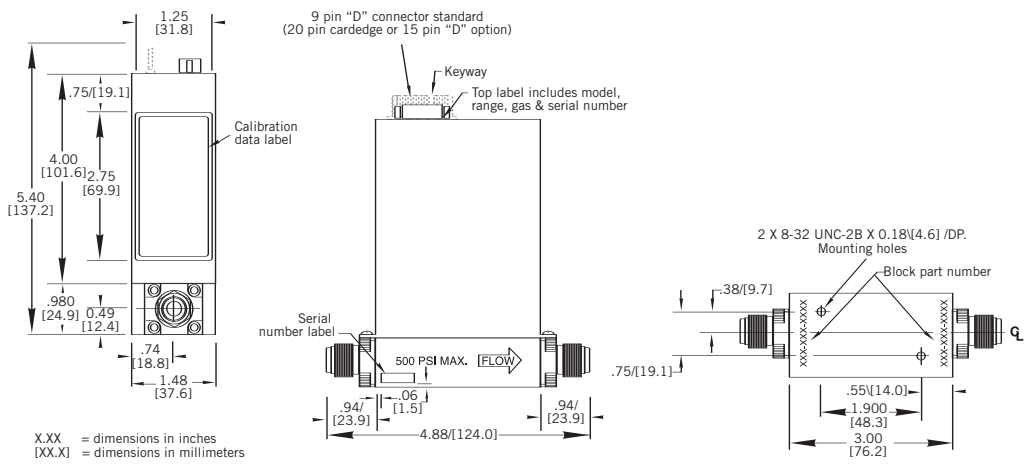
Calibration by primary standards and surrogate gases is available as an additional charge option.

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

8160 Series Product Configuration

C	8161	High Purity, Metal Seals, RS485 Digital and Analog Interface (Select Analog Connector Below)
C	8161C	High Purity, Metal Seals, Configurable MultiFlo, RS485 Digital and Analog Interface (Select Analog Connector Below)
M		High Purity, Metal Seals, RS485 Digital and Analog Interface (Select Analog Connector Below)
C	8165	High Purity, Metal Seals, Network Interface (Select DeviceNet or PROFIBUS Below)
C	8165C	High Purity, Metal Seals, Configurable MultiFlo, Network Interface (Select DeviceNet or PROFIBUS Below)
M		High Purity, Metal Seals, Network Interface (Select DeviceNet or PROFIBUS Below)
	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
	V	10-15 Second Soft Start
	X	No Valve (Mass Flow Meter)
	SC10 010C	Configurable MultiFlo. 3-10 sccm N ₂ Equivalent
	SC11 030C	Configurable MultiFlo. 11-30 sccm N ₂ Equivalent
	SC12 090C	Configurable MultiFlo. 31-90 sccm N ₂ Equivalent
	SC13 250C	Configurable MultiFlo. 91-250 sccm N ₂ Equivalent
	SC14 750C	Configurable MultiFlo. 251-750 sccm N ₂ Equivalent
	SC15 002L	Configurable MultiFlo. 751-2,000 sccm N ₂ Equivalent
	SC16 006L	Configurable MultiFlo. 2,001-6,000 sccm N ₂ Equivalent
	SC17 015L	Configurable MultiFlo. 6,001-15,000 sccm N ₂ Equivalent
	SC18 030L	Configurable MultiFlo. 15,001-30,000 sccm N ₂ Equivalent
	4R	1/4" VCR
	DW	Downported—W Seal
	DB	Downported—C Seal
	H0V	Horizontal or Vertical Mounting Attitude (Standard)
	H0S	Horizontal or Side
	A	Atmospheric Downstream Pressure
	V	Vacuum Downstream Pressure
	M	Metal O-Ring/Kel-F Seat
	F	Metal O-Ring/Metal Seat
	M	Metal O-Ring/Metal Seat
	X	Metal O-Ring—No Valve (Mass Flow Meter)
	D	DeviceNet (8165 only)
	E	Cardedge Connector 0-5 VDC
	L	Cardedge Lockdown Connector 0-5 VDC (8160 only)
	P	PROFIBUS (8165 only)
	S	9 Pin "D" Connector (UDS9) 0-5 VDC
	T	9 Pin "D" Connector (UDU9) 0-5 VDC
	U	15 Pin "D" Connector (UDU15) 0-5 VDC
	XXXX	Customer Special Request (CSR) Consult Factory
	0	Normally Open
	C	Normally Closed (Standard)
	X	No Valve (Mass Flow Meter)
	S	Standard (Valve Downstream)
	B	Buffered (Valve Upstream)
	X	No Valve (Mass Flow Meter)
	A	Auto-Zero Enabled
	X	Auto-Zero Disabled
	04E	4μ inch Ra Finish (Standard)
	00	0°C Reference Calibration (Standard)
	XX	Custom Reference Calibration (20°C=20)

Example: **C 8161 A F 0013 100C 4R H0V A M M U XXXX C S X 04E 00**



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