

3000 Series

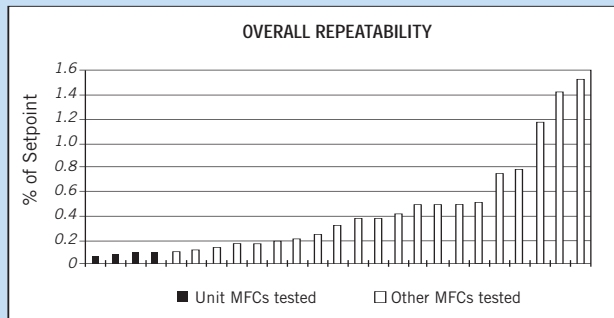
High Flow Mass Flow Controllers/Meters

- » High flow, 30 to 200 slm (N₂ equivalent)
- » Advanced design using proven technology for the high performance that is required for next generation semiconductor applications
- » Best performance and reliability in the industry
- » Available with analog, RS485, DeviceNet™ or PROFIBUS™ interfaces

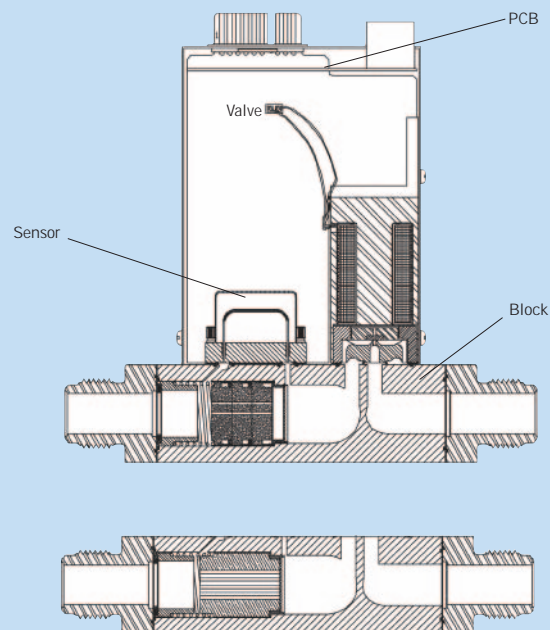


Features at a glance

- High 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
- Sealed with high leak integrity metal seals. Uses metal seals to produce a leak integrity of 1×10^{-10} atm-cc/sec (He)
- Designed to meet the SEMI standard for Sensor Actuator Network Communications for DeviceNet (SEMI E54-97), model 3165 is specifically designed for full ODVA compliance
- All performance tests per SEMI test methods
- 3 year warranty (models 3161 and 3165)



In independent testing, Unit MFCs had the best repeatability of those tested. Lower values indicate better performance.



The Celerity advantage

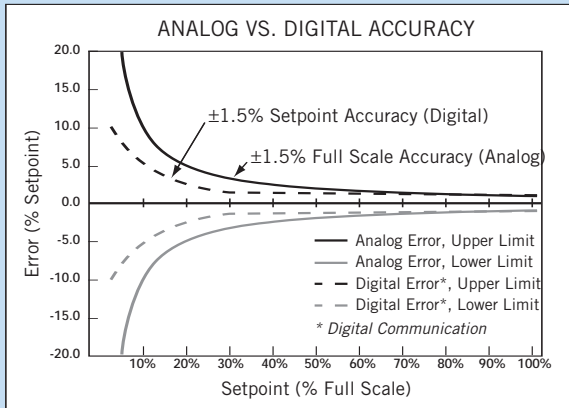
- Available on models 3161, and 3165
- Digital control
- Model 3161 is a drop-in replacement for analog MFCs. It has two analog connectors (a 20 pin cardedge and a 9 or 15 pin "D" connector option)
- Superior accuracy of $\pm 1.5\%$ of setpoint compared to $\pm 1.5\%$ of full scale for analog model. 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 3 seconds 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
- User-friendly Windows-based MultiFlo Virtual Interface Software available to monitor and control up to 32 MFCs daisy chained together

Description

The 3000 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 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.

3000 Series Standard High Flow Mass Flow Controllers/Meters



Digital model 3161 and 3165 have an accuracy of $\pm 1.5\%$ of setpoint, while the analog model 3101 has an accuracy of $\pm 1.5\%$ of full scale. (Accuracy chart reflects primary standard calibration option.)

Model description

3161	Digital control	Analog and RS485 interfaces
3165	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

Performance

Settling time (to within 2% of setpoint):

Fast start	≤ 3.0 sec (per SEMI E17-91)(0 to 100% setpoint)
Soft start	Linear 20% per sec (0 to 100% in 5 sec)

Accuracy:

Model 3161/3165	$\pm 1.5\%$ setpoint $> 35\%$; $\pm 0.5\%$ full scale $< 35\%$
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Repeatability

	$\pm 0.15\%$ full scale
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Linearity

	$\pm 0.9\%$ full scale per cal. gas
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Inlet pressure coefficient

	0.0025% full scale per psi (N_2)
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Ambient temp. coefficient

	Zero: 0.03% full scale per $^{\circ}C$; Span: 0.05% full scale per $^{\circ}C$
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Leak integrity:

Model 3161/3165	1×10^{-10} atm-cc/sec (He)
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Automatic zero:

Model 3161/3165	Standard (user-configurable by software)
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Zero drift

	$< 0.6\%$ per year without auto zero
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Operating limits

Standard flow range:

Model 3161/3165	30 slm to 100 slm
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Model 3161/3165 w/ CSR	100 slm to 200 slm
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Control range (full scale)

	2-100%
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Gases

	Please contact the factory for available gas list
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Ambient temp. range

	0-50 $^{\circ}C$ (32-122 $^{\circ}F$)
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Max. operating pressure

	35 kg/cm 2 (500 psi)
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Proof pressure

	105 kg/cm 2 (1,500 psi)
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Pressure differential range

	30 to 50 psi
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Warm-up period

	30 minutes
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Valve

	Normally closed or normally open solenoid
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Electrical characteristics

Input/Output signal:

Setpoint input	0-5 VDC proportional to required flow rate
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Output monitor	0-5 VDC linearly proportional to required flow rate
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Valve off	External: TTL signal
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Auto shut-off	Optional: Setpoint $< 2\%$ full commands off
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Power input

	+15 VDC (250 mA max.), -15 VDC (250 mA max.)
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Power consumption

	8 watts
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Mating connector:

Model 3161	Dual connector: 20 contact cardedge and choice of 9 or 15 pin "sub-D" connector
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Model 3161	RJ-12 for RS485 interface
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Model 3165 (DeviceNet)	+11-25 VDC per ODVA requirements:
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	600 mA @ 12 VDC, 300 mA @ 24 VDC
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Model 3165 (PROFIBUS)	+15 VDC (500 mA max.), -15 VDC (500 mA max.)
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Mechanical characteristics

Surface finish:

Model 3161/3165	10 μ inch Ra
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Fittings

	1/4" and 3/8" VCR $^{\circ}$, 1/4" and 3/8" VCO $^{\circ}$, 1/4" and 3/8" UnitLok*
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Valve position

	Downstream
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Materials:

Wetted components	316L SS/K-M43/304/7 Mo+
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Seal	Metal Z-Seal™
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Metal Weight	1.4 kg (3.08 lbs)
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Calibration references

Traceability National Institute of Standards and Technology (N.I.S.T.)

Standard temperature and pressure

0 $^{\circ}C$ and 760 mm Hg

Specifications and features are subject to change without notice.

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

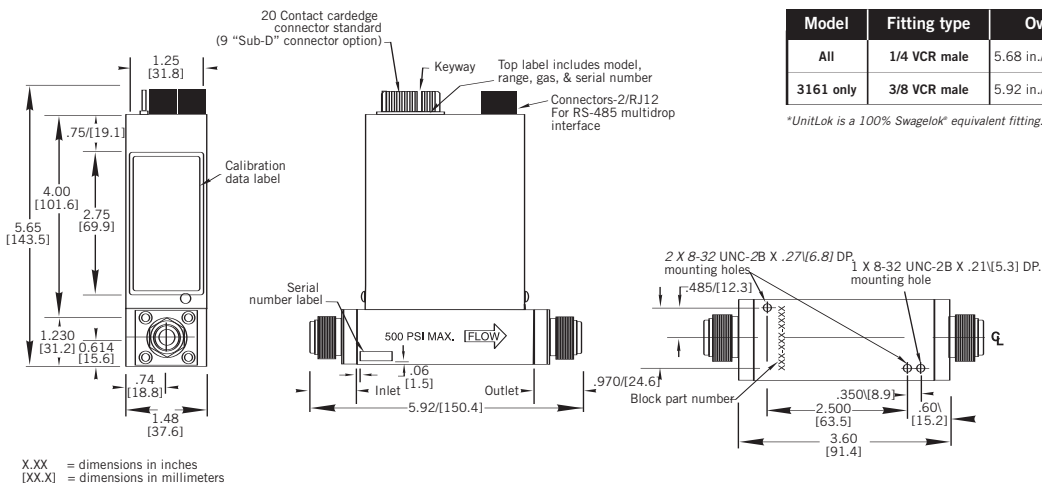
Calibration by primary standards and surrogate gases is available as an additional charge option.

CrossChek™ calibration methodology maintains SPC-verified calibration accuracy with **$\pm 3\sigma$** limit (99.7% confidence level).

3000 Series Product Configuration

C	3161	High Purity, Metal Seals, RS485 Digital and Analog Interface (Select Analog Connector Below)
M		High Purity, Metal Seals, RS485 Digital and Analog Interface (Select Analog Connector Below)
C	3165	High Purity, Metal Seals, Digital Interface (Select DeviceNet or PROFIBUS Below)
M		High Purity, Metal Seals, Digital Interface (Select DeviceNet or PROFIBUS Below)
	A	Auto Shut-off
	X	No Auto Shut-off
	F	Fast Start < 3 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 90 Liters per Minute = "090L")
	3R	3/8" VCR
	3S	3/8" Swagelok (3101 only)
	3O	3/8" VCO (3101 only)
	4R	1/4" VCR
	VIU	Vertical Inlet Up
	VID	Vertical Inlet Down
	HBD	Horizontal Base Down
	HLD	Horizontal Label Down
	HLU	Horizontal Label Up
	HUD	Horizontal Upside Down
	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—No Valve (Mass Flow Meter)
	X	Metal O-Ring—No Valve (Mass Flow Meter)
	B	15 Pin "D" Connector (UDB15) Brooks Pin-out 0-5 VDC (3101 and 3161 only)
	E	Cardedge Connector 0-5 VDC (3101 and 3161 only)
	D	DeviceNet Connector (3165 only)
	K	15 Pin "D" Connector (UDK15) MKS Pin-out 0-5 VDC
	L	Cardedge Lockdown Connector 0-5 VDC (3101 and 3161 only)
	P	PROFIBUS Connector (3165 only)
	S	9 Pin "D" Connector (UDS9) STEC Pin-out 0-5 VDC (3101 and 3161 only)
	T	9 Pin "D" Connector (UDU9) Unit 0-5 VDC (3101 and 3161 only)
	U	15 Pin "D" Connector (UDU15) Unit 0-5 VDC (Not Available on 3165)
	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
	10E	10µ inch Ra Finish
	00	0°C Reference Calibration (Standard)
	XX	Custom Reference Calibration (20°C=20)

Example: C 3101 A F 0013 090L 3S VIU A M M U XXXX C S X 32X 00



Model	Fitting type	Overall	Inlet	Outlet
All	1/4 VCR male	5.68 in./144.3 mm	1.04 in./26.4 mm	1.04 in./26.4 mm
3161 only	3/8 VCR male	5.92 in./150.4 mm	1.16 in./29.5 mm	1.16 in./29.5 mm

*UnitLok is a 100% Swagelok® equivalent fitting.



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