High Performance Digital Gas Mass Flow Meters & Controllers

SmartTrak® 100

FEATURES

- Measure and control gas mass flow rates up to 1000 slpm
- Ideal for OEM, industry or research applications
- True linear performance provides high accuracy and great flexibility in multiple gases or substitute your own
- With Dial-A-Gas® Technology, you select from up to ten pre-programmed gases
- Unique Pilot Module (mounted or hand-held) lets you view and change critical control functions
- All control functions are also available from your PC or workstation via supplied SmartTrak 100 software
- 316 stainless steel construction
- Small footprint and great flexibility facilitates replacement of older MFM or MFC
- Factory calibration done with primary standards directly traceable to NIST
- Proprietary frictionless-hovering direct-acting control valve technology
- Single-sided 24 VDC input power reduces installation cost and complexity
- CE approved
- Choose from multiple analog or digital signals including: RS-232, RS-485, 4-20 mA, 0-5, 1-5, 0-10 VDC
- Digital communications protocols supported
  - Modbus

DESCRIPTION

SmartTrak® 100 Series features unprecedented performance, user-friendly features, and flexibility. The 100 Series gives users the world's most linear sensor, smoother valve performance, more robust electronics and even more control over a wide range of functions. The result is a series of mass flow meters and controllers that demonstrates premium flow instrumentation which is easy to use.

The 100 Series is designed so that the physics are correct. Excellent performance results from a patented, inherently linear Laminar Flow Element (LFE) design, advanced platinum sensor technology, and Sierra's proprietary frictionless-hovering control valve.

The 100 Series is available with an innovative and user-friendly Pilot Module, a front-mounted or hand-held control device that allows users to Dial-A-Gas, change flow rate, modify engineering units or reconfigure the instrument. With the Pilot Module, the user can set zero, span, and full scale for each of the 10 different gases independently to accommodate unexpected application or system design changes.

For the ultimate in performance, flexibility and value, SmartTrak is the smart choice.

SIERRA®

www.sierrainstruments.com

PERFORMANCE SPECIFICATIONS

Accuracy
Standard: ± 1.0 % of full scale including linearity under calibration conditions

Dial-A-Gas
± 1.0 % of full scale in all 10 standard gases (see chart below)

Repeatability
± 0.2% of full scale

Temperature Coefficient
± 0.025% of full scale per °F (± 0.05% of full scale per °C), or better

Pressure Coefficient
± 0.01% of full scale per psi (± 0.15% of full scale per bar), or better

Response Time
2 seconds (typical) to within ± 2% of final value (includes settling time), faster or slower available upon request (controllers only).

OPERATION SPECIFICATIONS

Mass Flow Rates
M100L Low Flow: 0-10 sccm to 0-50 slpm
M100M Medium Flow: 0-20 slpm up to 0-200 slpm
M100H High flow: 0-100 to 0-500 slpm full scale
M100H1 High flow: 0-501 to 0-800 slpm full scale
M100H2 High: 0-801 to 0-1000 slpm full scale
C100L Low Flow: 0-10 sccm to 0-50 slpm
C100M Medium Flow: 0-20 slpm up to 0-200 slpm
C100H High flow: 0-100 to 0-500 slpm
C100H1 High flow: 0-501 to 0-800 slpm full scale
C100H2 High flow: 0-801 to 0-1000 slpm full scale

Flow ranges specified are for an equivalent flow of nitrogen at 760 mm Hg and 21°C (70°F); other ranges in other units are available (e.g., nlpm, scfh, nm3/h, kg/h)

Gases
Measures and controls all clean gases including certain corrosives and toxics; specify when ordering.

The following ten gases make up the Dial-A-Gas® feature of every SmartTrak instrument; up to nine alternate gases may be substituted.

Dial -A-Gas Flow Rates			
Gas	Max Flow rate (slpm) Low Flow Size	Max Flow rate (slpm) Medium Flow Size	Max Flow rate (slpm) High Flow Size
Air	50	200	1000
Argon (Ar)	69.9	279.6	1398
Carbon Dioxide (CO_2)	36.8	147.4	737
Carbon Monoxide (CO)	50.1	200.4	1002
Methane (CH_4)	37.7	150.8	754
Helium (He)	69.9	279.8	1399
Hydrogen (H_2)	50	200.2	1001
Oxygen (O_2)	49.9	199.4	998
Nitrogen (N_2)	50.1	200.4	1002
Nitrous Oxide (N20)	35.8	143.2	716

Gas and Ambient Temperature
32 to 122°F (0 to 50°C)

Standard Gas Pressure
500 psig (34.5 barg) maximum, burst tested to 750 psig (51.7 barg)

Leak Integrity
5 X 10-9 atm cc/sec of helium or better

Power Requirements
(ripple should not exceed 100 mV peak-to-peak)

For Mass Flow Meters:
24 VDC ±10%, (230 mA, regulated)

For Mass Flow Controllers:
C100L: 24 VDC ±10% (500 mA, regulated)
C100M: 24 VDC ±10%, (800 mA, regulated)
C100H: 24 VDC ±10%, (1260 mA, regulated)

Control Range For Controllers
5–100% of full scale flow; zero-flow cut-off at 1.9%.

Output Signal
Analog:
Linear 4–20 mA, 500 ohms maximum loop resistance and one of the following (user selectable):
Linear 0–5 VDC, 1000 ohms minimum load resistance
Linear 0-10 VDC, 1000 ohms minimum load resistance
Linear 1-5 VDC, 1000 ohms minimum load resistance

Command Signal
Analog signal (Impedance) choice of one:
Linear 4–20 mA (110 Ohm), 0–5 VDC (22K Ohm), 0-10 VDC (15.3K Ohm), 1-5 VDC (22K Ohm)

Wetted Material
316 stainless steel or equivalent; 416 stainless steel;
Viton "O"-rings and valve seat standard;
other elastomers are available (consult factory)

DIGITAL SPECIFICATIONS

RS-232 is standard with all SmartTrak models

RS-485 communication with Modbus RTU protocol allows digital multidrop networks

Available with optional LCD display

Internal gas flow totalizer with adjustable pulse output (available with CMDD, CMNR option only)

One analog input can be configured by user with Modbus or included software for a wide variety of process controls

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® Nylon, Viton, Neoprene, Kalrez are registered trademarks of DuPont,
® Windows is a registered trademark of Microsoft

Pressure Drop Across a Meter

Pressure must be above the values in the table below. Note that pressure increases with flow rate.

Minimum Pressure Drop for Air, Mass Flow Meters					
Flow Rate (slpm)	Pressure Drop in PSI (mbar)				
	Low Flow ¼ inch fittings (Standard)	Low Flow ⅜ fittings (Optional)	Medium Flow ⅜ or ½ inch fittings	High Flow Small Bore (100H) (std up to 500 slpm) ½ comp fittings	High Flow Large Bore (H1, H2) (std 501-1000 slpm) ¾ comp fittings
0.1	0.36 (24.5)	N/A	N/A	N/A	N/A
0.5	0.36 (24.5)	N/A	N/A	N/A	N/A
1	0.37 (25.4)	N/A	N/A	N/A	N/A
10	0.46 (31.7)	0.41 (28.6)	N/A	N/A	N/A
20	0.66 (45.7)	0.47 (32.7)	0.5 (34)	N/A	N/A
30	N/A	0.59 (40.9)	0.5 (34)	N/A	N/A
40	N/A	0.77 (53.3)	0.5 (34)	N/A	N/A
50	N/A	1.00 (68)	0.5 (34)	N/A	N/A
100	N/A	N/A	1.0 (68)	1.0 (68)	0.5 (34)
150	N/A	N/A	2.0 (136)	1.2 (81.6)	0.5 (34)
200	N/A	N/A	3.0 (204)	1.5 (102)	0.5 (34)
250	N/A	N/A	N/A	1.8 (122.4)	0.5 (34)
300	N/A	N/A	N/A	2 (204)	0.9 (61.2)
350	N/A	N/A	N/A	2.5 (170)	0.7 (47.6)
400	N/A	N/A	N/A	3 (204)	0.9 (61.2)
450	N/A	N/A	N/A	3.5 (238)	1.1 (74.8)
500	N/A	N/A	N/A	4 (272)	1.3 (88.4)
750	N/A	N/A	N/A	6 (408)*	3.0 (204)
1000	N/A	N/A	N/A	10 (680)*	5.0 (340)

Minimum Differential Pressure Requirement for Air, Mass Flow Controllers					
Flow Rate (slpm)	Pressure Drop in PSI (mbar)				
	Low Flow ¼ inch fittings (Standard)	Low Flow ⅜ fittings (Optional)	Medium Flow ⅜ or ½ inch fittings	High Flow Small Bore (100H) (std up to 500 slpm) ½ comp fittings	High Flow Large Bore (H1, H2) (std 501-1000 slpm) ¾ comp fittings
0.1	1 (68)	1 (68)	N/A	N/A	N/A
1	1.5 (102)	1.28 (87)	N/A	N/A	N/A
10	6 (408)	3.8 (258)	N/A	N/A	N/A
20	12 (816)	6.6 (449)	1 (68)	N/A	N/A
30	15 (1020)	9.4 (639)	1.2 (82)	N/A	N/A
40	30 (2040)	12.2 (830)	1.6 (110)	N/A	N/A
50	40 (2720)	15 (1020)	2 (136)	N/A	N/A
100	N/A	N/A	5 (340)	1.5 (102)	1.0 (68)
150	N/A	N/A	10 (680)	2 (136)	1.0 (68)
200	N/A	N/A	15 (1020)	4.5 (306)	1.0 (68)
250	N/A	N/A	N/A	5.5 (374)	1.5 (102)
300	N/A	N/A	N/A	6.5 (442)	2.0 (136)
350	N/A	N/A	N/A	8.5 (578)	3.0 (204)
400	N/A	N/A	N/A	10.5 (714)	4.0 (408)
450	N/A	N/A	N/A	13 (884)	5.0 (340)
500	N/A	N/A	N/A	15 (1020)	6.0 (408)
750	N/A	N/A	N/A	N/A	15 (1020)
1000	N/A	N/A	N/A	N/A	20 (1360)

Note: Tested at 21°C, outlet at ambient pressure

*Larger fittings recommended for these flow rates as 1/4 inch fittings reduce overall performance

PHYSICAL DIMENSIONS

Hand-Held Pilot Module

SmartTrak 100

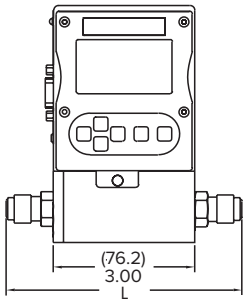
SmartTrak 100 with Compod

All dimensions are in inches with (mm) in brackets. Certified drawings are available on request.

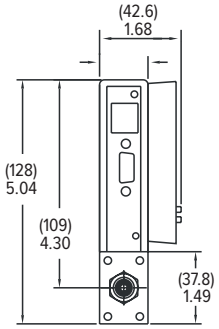
Dimension L							
Fittings	Length with Fittings in Inches (mm)						
	C100L, M100L	C100M	M100M 100 High Pressure	M100H	M100H1, H2	C100H	C100H1, H2
1/8 compression	4.8 (123)	N/A	N/A	N/A	N/A	N/A	N/A
1/4 compression	5.02 (128)	6.52 (167)	6.02 (154)	N/A	N/A	N/A	N/A
3/8 compression	5.14 (132)	6.64 (170)	6.14 (157)	N/A	N/A	N/A	N/A
1/2 compression	5.3 (135)	6.80 (174)	6.30 (162)	8.29 (229)	N/A	10.37 (266)	N/A
1/4 VCO	4.56 (117)	6.06 (155)	5.56 (143)	N/A	N/A	N/A	N/A
1/2 VCO	5.0 (128)	6.50 (167)	6.00 (154)	8.56 (220)	N/A	10.01 (257)	N/A
3/4 VCO	N/A	N/A	N/A	N/A	8.78 (225)	N/A	11.28
1/4 VCR	4.88 (125)	6.38 (164)	5.88 (151)	N/A	N/A	N/A	N/A
1/2 VCR	5.18 (133)	6.68 (171)	6.18 (158)	8.98 (230)	N/A	10.43 (297)	N/A
6 mm compression	5.04 (129)	6.54 (168)	6.20 (155)	N/A	N/A	N/A	N/A
10 mm compression	5.20 (133)	6.70 (172)	6.38 (164)	N/A	N/A	N/A	N/A
12 mm compression	5.38 (138)	6.88 (176)	6.38 (164)	8.90 (288)	N/A	10.35 (265)	N/A
1/4 FNPT	4.85 (124)	6.35 (163)	5.85 (150)	N/A	N/A	N/A	N/A
3/8 FNPT	5.00 (128)	6.50 (167)	6.00 (154)	N/A	N/A	N/A	N/A
1/2 FNPT	N/A	N/A	N/A	9.14 (234)	N/A	10.59 (272)	N/A
3/4 FNPT	N/A	N/A	N/A	N/A	9.30 (238)	N/A	11.80
1/3 compression	N/A	N/A	N/A	9.24 (237)	9.18 (274)	10.69 (274)	11.68
1 inch compression	N/A	N/A	N/A	N/A	9.52 (244)	N/A	12.02

All dimensions are in inches with [mm] in brackets. Certified drawings are available on request.

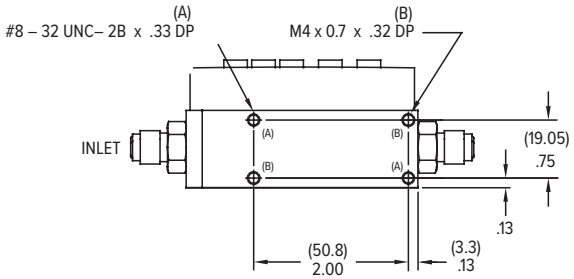
M100L & C100L Front



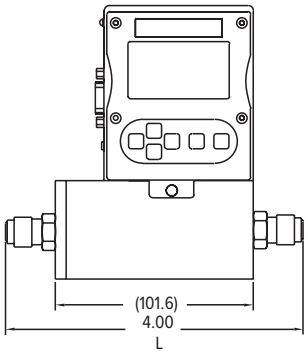
M100L & C100L Inlet



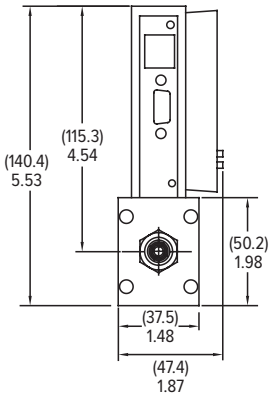
M100L & C100L Bottom



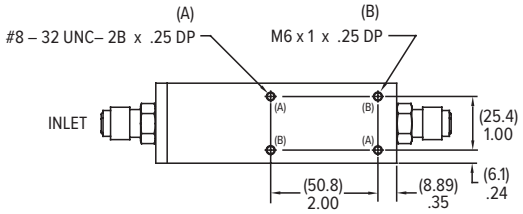
M100M Front View



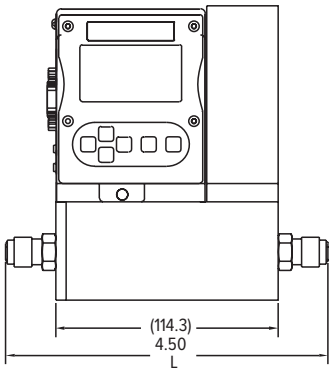
M100M Inlet



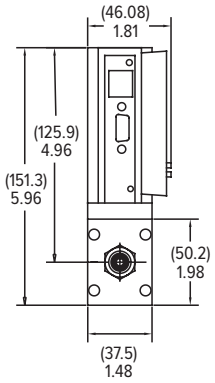
M100M Bottom



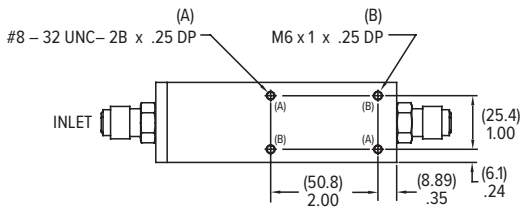
C100M Front



C100M Inlet



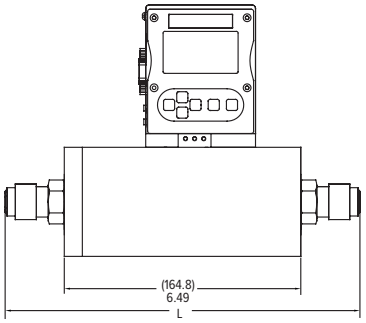
C100M Bottom



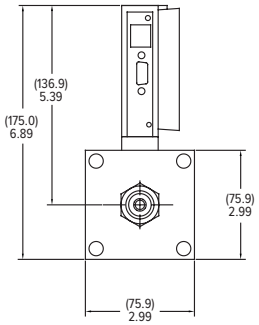
PHYSICAL DIMENSIONS (continued)

All dimensions are in inches with [mm] in brackets. Certified drawings are available on request.

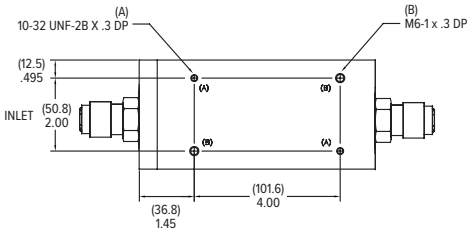
M100H Front View



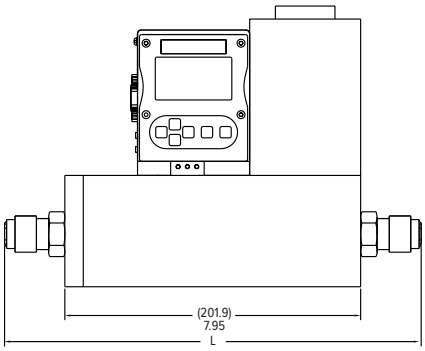
M100H Side View



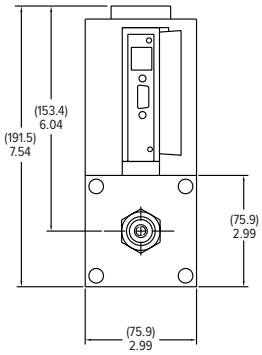
M100H Bottom View



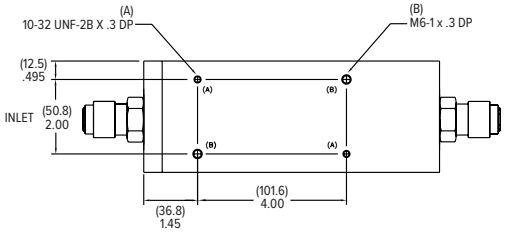
C100H Front Veiw



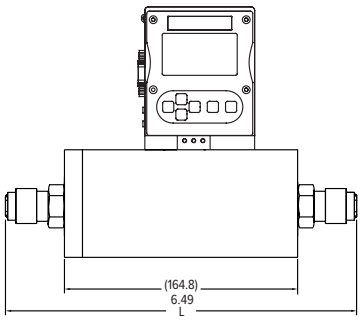
C100H Side View



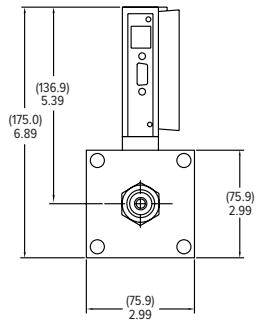
C100H Bottom View



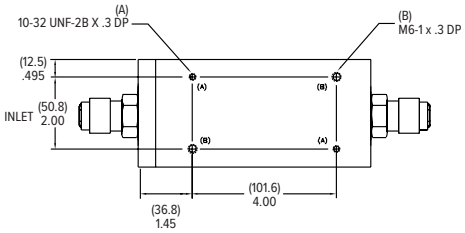
M100H1, H2 Front View



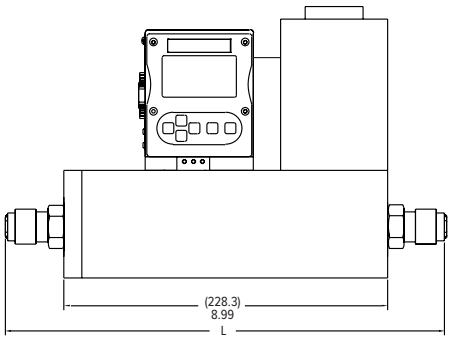
M100H1, H2 Side View



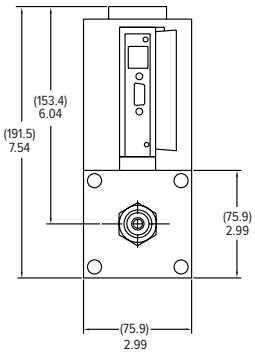
M100H1, H2 Bottom View



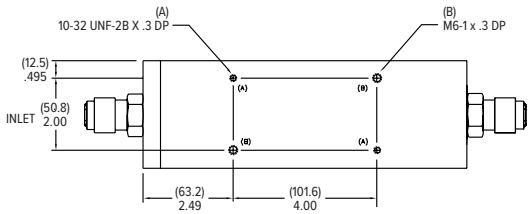
C100H1, H2 Front View



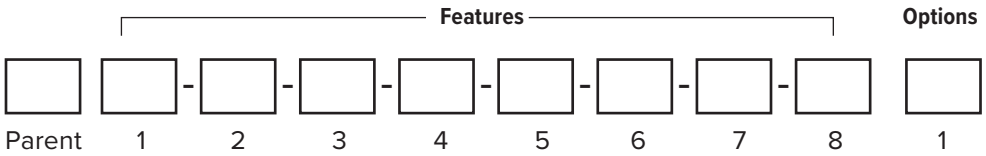
C100H1, H2 Side View



C100H1, H2 Bottom



ORDERING THE SMART TRAK 100



Instructions: To order a 100 please fill in each number block by selecting the codes from the corresponding features below and following pages.

Parent Number	
M100	Mass Flow Meter, Digital High Performance with Multiple Gas Capability (Dial-A-Gas®)
C100	Mass Flow Controller, Digital High Performance with Multiple Gas Capability (Dial-A-Gas®)

Feature 1:Flow Body Size*			
M100L	Low flow meter: 0-10 sccm up to 0-50 slpm	**C100L**	Low flow controller: 0-10 sccm up to 0-50 slpm.
M100M	Medium flow meter: 0-20 slpm up to 0-200 slpm	**C100M**	Medium flow controller: 0-20 slpm up to 0-200 slpm
M100H	High flow meter: 0-100 to 0-500 slpm full scale	**C100H**	High flow controller: 0-100 to 0-500 slpm
M100H1	High flow meter: 0-501 to 0-800 slpm full scale	**C100H1**	High flow controller: 0-501 to 0-800 slpm full scale
M100H2	High flow meter: 0-801 to 0-1000 slpm full scale	**C100H2**	High flow controller: 0-801 to 0-1000 slpm full scale

Note: All slpm flow ranges also available in nlpm *Flow bodies are sized for Air flow rates. Other gases must be converted to equivalent air flow. Use K-Factor and size accordingly. **You must select Low Flow Calibration under "Options" for 0-20 sccm full scale flow range or less.

Feature 2: Pilot Module Display	
NR	No display/interface.
DD	Pilot Module Display/Interface mounted on the enclosure
RD	Remote Display Pilot Module Display/Interface. Includes 10 foot (3 meter) CAT 5 cable. Optional cables up to 50 feet may be used. May be used with digicomms but not simultaneously
CMNR	Compod with RS-485 Modbus communication mounted on the enclosure
CMDD	Compod with RS-485 Modbus communication and Display mounted on the enclosure

Note: Only one option may be selected for Feature 2.
For all options in Feature 2, no pilot module with Compod.

Feature 4: Body Elastomers	
OV1	Viton® (standard)
ON1	Neoprene®
90D-L	90D Viton® for CO_2 only
90D-M	90D Viton® for CO_2 only
90D-H	90D Viton® for CO_2 only

Note: Consult factory for other elastomers.

Feature 3: Inlet / Outlet Fittings			
0	Customer supplies fittings	**9**	1/2-inch VCR. For all flow bodies up to 500 slpm. Above 500 slpm contact factory.
1	1/8-inch compression. For low flow bodies. (maximum 5 slpm)	**10**	6 mm Compression. For low flow bodies. (maximum 50 slpm)
2	1/4-inch compression (standard up to 30 slpm). For low flow bodies (maximum 50 slpm)	**11**	10 mm Compression. For low and medium bodies. (maximum 300 slpm)
3	3/8-inch compression (standard for 30 to 300 slpm). For low and medium bodies. (maximum 300 slpm)	**12**	12 mm Compression. For all flow bodies up to 500 slpm. Above 500 slpm contact factory.
4	1/2-inch compression For all flow bodies	**13**	1/4-FNPT adapter bushing (maximum 200 slpm). For low and med flow bodies.
5	1/4-inch VCO. For low flow bodies (maximum 50 slpm)	**14**	3/8-FNPT. For low and med flow bodies only.
6	1/2-inch VCO. For low and medium flow bodies	**15**	1/2 -FNPT. For high flow bodies up to 500 slpm.
7	3/4-inch VCO. For H, H1, and H2 high flow bodies only	**16**	3/4-FNPT. For H1 and H2 high flow bodies only
8	1/4-inch VCR. For low flow bodies. (maximum 50 slpm)	**17**	3/4-inch compression. For H, H1, and H2 flow bodies only
9	1/2-inch VCR. For all flow bodies up to 500 slpm. Above 500 slpm contact factory.	**18**	1-inch compression. For H1 and H2 high flow bodies only

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Feature 5: Valve Seat (MFC only)			
SV1	Viton®	**SK3**	Kalrez® (or equivalent for high flow bodies)
SN1	Neoprene® (or equivalent)	**VX1 (low flow only)**	ValFlex™ required for CO_2
SK1	Kalrez® (or equivalent for low flow bodies)	**VX2 (medium flow only)**	ValFlex™ required for CO_2
SK2	Kalrez® (or equivalent for medium flow bodies)	**VX3 (high flow only)**	ValFlex™ required for CO_2

Note: VX1, VX2, VX3; Consult factory, use CO2 Elastomer Compatibility Concentration vs. Pressure application tool to determine required elastomers for MFC valve seat.

Leak-By Disclaimer: Valflex valve seats will have leak-by rates outside of the normal C100 specifications, but should not exceed 3-5%FS, dependent on orifice size.

Feature 6: Input Power	
PV2	24 VDC for all instruments (standard)

Feature 7: Output Signal	
V1	0-5 VDC and 4-20 mA linear output signals
V2	1-5 VDC and 4-20 mA linear output signals
V3	0-10 VDC and 4-20 mA linear output signals

Note: Alternate among V1, V2, V3 with Pilot Module display/interface or SmartTrak Software

Feature 8: External Setpoint Signal (MFC only)	
S0	Pilot Module/RS-232 (standard for Pilot Module/digital operation)
S1	0-5 VDC, linear
S2	1-5 VDC, linear
S3	0-10 VDC, linear
S4	4-20 mA, linear

Note: Alternate among S0, S1, S2, S3, and S4 with Pilot Module display/interface or SmartTrak Software.

Option 1: Special Cals		
A1	High accuracy calibration, +/- 0.5% of FS at calibration conditions A1 Accuracy Statement Highest Accuracy Calibration; +/- 0.5% of F.S. (at operating conditions) only applies to the single gas used during calibration; Also includes 10 point linearization on actual gas. A1 Operating Conditions: Flow range: up to 50 slpm or nlpm (valid from 10 to 100% of the calibrated range)	Gases: Air, Nitrogen, Helium, or Argon Pressure: up to 10.3 barg (150 psig) Temperature range: 10°C to 30°C (50°F to 86°F) Orientation: horizontal only
GS	Gas substitution: One or more gases or mixtures may be substituted for 9 of the standard Dial-A-Gas gases. See application data sheet for specifics.	
LF	Low flow calibration for all C100L and M100L; required for 0 to 10 sccm -0 to 20 sccm full scale calibrations or less.	

Note: A1 option only available on a low flow body (M100L or C100L).
For other operating conditions contact factory.

Measurably Different™

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