

Smart-Trak[®] 2 Model 100

Technical Data Sheet

Next Generation High Performance Digital Gas Mass Flow Meters and Controllers

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
- With Dial-A-Gas[®] Technology, you select from up to ten pre-programmed gases or substitute your own
- Unique Pilot Module (mounted or hand-held) lets you view and change critical control functions including:
 - Gas type
 - Setpoint value
 - Zero value
 - Span value
 - Engineering units
 - Output signals
 - Full scale adjust
- All control functions are also available from your PC or workstation via supplied Smart-Trak 2 software
- 316 Stainless steel construction
- Choose from multiple analog or digital signals including: RS-232, RS-485, 4-20mA, 0-5, 1-5, 0-10 VDC
- 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
- Add Compod[™] for MODBUS RTU networking capability
- Single-sided 24 VDC input power reduces installation cost and complexity



Description

Smart-Trak[®] 2 is the next generation of Sierra's flagship Model 100. Building upon the unprecedented performance, user-friendliness and flexibility end-users have come to expect with the original Smart-Trak, Smart-Trak 2 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 doesn't have to be difficult to use.

Smart-Trak 2 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.

Smart-Trak 2 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 re-configure the instrument. With the Pilot Module, the user can set zero, span and full scale for each of 10 different gases independently to accommodate unexpected application or system design changes.

With the addition of Sierra's Compod[™], Smart-Trak 2 transforms into a fully network-enabled MODBUS RTU device.

Just like the award-winning original, Smart-Trak 2 delivers performance, flexibility and value.

Performance Specifications

Accuracy

Standard: $\pm 1.0\%$ of full scale including linearity at operating conditions ($\pm 2\%$ of full scale for 100M from 201-300 slpm)

Dial-A-Gas

$\pm 1.0\%$ of full scale in all 10 standard gases (see chart below)

Repeatability

$\pm 0.2\%$ of full scale

Temperature Coefficient

$\pm 0.025\%$ of full scale per $^{\circ}\text{F}$ ($\pm 0.05\%$ of full scale per $^{\circ}\text{C}$), or better

Pressure Coefficient

$\pm 0.01\%$ of full scale per psi ($\pm 0.15\%$ of full scale per bar), or better

Response Time

300 millisecond time constant; 2 seconds (typical) to within $\pm 2\%$ of final value (includes settling time), Faster or slower available upon request Valve response can be tuned on site using supplied software.

Operating Specifications

Mass Flow Rates

100L Low Flow: 0-10 sccm to 0-50 slpm

100M Medium Flow: 0-20 to 0-300 slpm (up to 400 slpm available--Consult Factory)

100H High Flow: 0-100 to 0-1000 slpm (higher flows available--Consult Factory)

Flow ranges specified are for an equivalent flow of nitrogen at 760 mm Hg and 21 $^{\circ}\text{C}$ (70 $^{\circ}\text{F}$); other ranges in other units are available (e.g., NLPM, SCFH, NM 3 /H, kg/H)

For measuring or controlling flows below 5 sccm, please consider Sierra's Model 101 Micro-Trak[™]. For measuring or controlling flows above 1000 slpm, please consider Sierra's Model 180 Max-Trak[®]

Gases

All clean gases including corrosives & toxics; specify when ordering

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

Dial-A-Gas Flow rates

Gas	Max Flow Rate (slpm)	Max Flow Rate (slpm)	Max Flow Rate (slpm)
	Low Flow Size	Medium Flow Size	High Flow Size
Air	50	300	1000
Argon (Ar)	72.5	435	1450
Carbon Dioxide (CO ₂)	37	220	740
Carbon Monoxide (CO)	50	302	1000
Methane (CH ₄)	36	227	720
Helium (He)	72.7	420	1454
Hydrogen (H ₂)	50	300	1000
Oxygen (O ₂)	50	300	1000
Nitrogen (N ₂)	50	300	1000
Nitrous Oxide (N ₂ O)	35.5	215	710



Operating Specifications (cont.)

Gas & Ambient Temperature

32 to 122 $^{\circ}\text{F}$ (0 to 50 $^{\circ}\text{C}$)

Gas Pressure

500 psig (34.5 barg) maximum, burst tested to 750 psig (52 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:

15-24 VDC $\pm 10\%$, (230 mA, regulated)

For Mass Flow Controllers:

C100L: 24 VDC $\pm 10\%$ (500 mA, regulated)

C100M: 24 VDC $\pm 10\%$, (800 mA, regulated)

C100H: 24 VDC $\pm 10\%$, (1260 mA, regulated)

Control Range For Controllers

2-100% of full scale flow; automatic shut-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

Digital:

- RS-232 standard, RS-485 optional
- Pilot Module Display optional

Command Signal

Analog (choice of one):

- Linear 4-20 mA, 0-5 VDC, 0-10 VDC, 1-5 VDC

Digital:

- RS-232 standard, RS-485 optional
- Pilot Module Display optional

Wetted Material

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

Optional Compod

- RS-485 communication with MODBUS RTU protocol allows digital multi-drop networks
- Available with optional LCD display
- Internal gas flow totalizer with adjustable pulse output
- Two digital outputs and 1 analog input can be configured by user with MODBUS or included software for a wide variety of process controls



Operating Specifications

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 3/8 inch fittings (Optional)	Medium Flow 3/8 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	4.0 (272)	1.8 (122.4)	0.5 (34)
300	N/A	N/A	5.5 (374)	2 (136)	0.6 (408)
350	N/A	N/A	N/A	2.5 (170)	0.7 (476)
400	N/A	N/A	N/A	3 (204)	0.9 (612)
450	N/A	N/A	N/A	3.5 (238)	1.1 (748)
500	N/A	N/A	N/A	4 (272)	1.3 (884)
750	N/A	N/A	N/A	6 (408)*	3.0 (204)
1000	N/A	N/A	N/A	10 (680)*	5.0 (340)

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

*Larger fittings recommended for these flow rates, as small fittings reduce overall performance

Differential Pressure Requirement for Controllers (lower or higher available upon request)

Optimum: 30-60 psi (2-4 bar)

Minimum: See chart below. Note that required pressure increases with flow rate.

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 3/8 inch fittings (Optional)	Medium Flow 3/8 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	20 (1360)	5.5 (374)	1.5 (102)
300	N/A	N/A	25 (1700)	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 (272)
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)

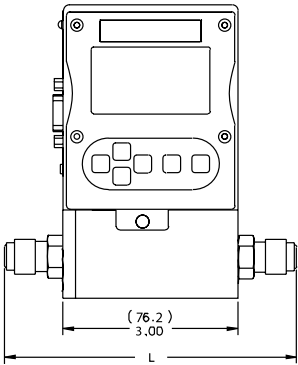
Note: Tested at 21°C, outlet at ambient pressure

*Larger fittings recommended for these flow rates as ¼ inch fittings reduce overall performance

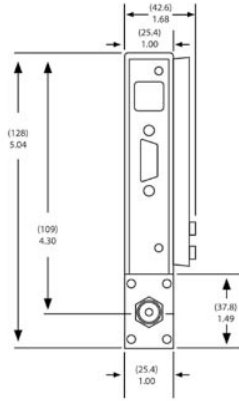
Physical Dimensions

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

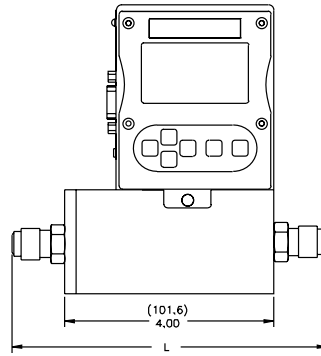
M100L & C100L Front View



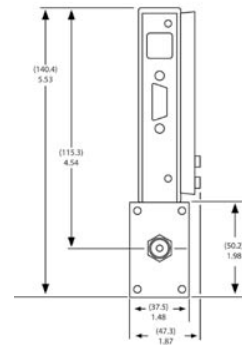
M100L & C100L Inlet View



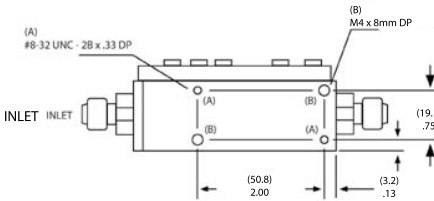
M100M Front View



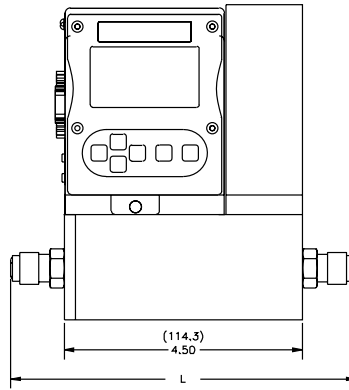
M100M Inlet View



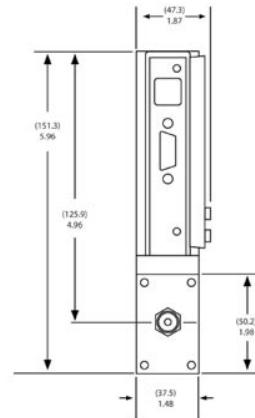
M100L & C100L Bottom View



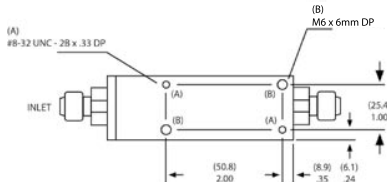
C100M Front View



C100M Inlet View



M100M & C100M Bottom View



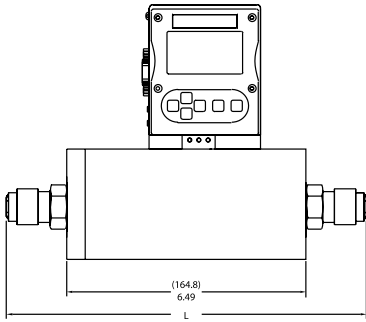
Notice that 2 of the mounting holes on the bottom are SAE and 2 of the holes are metric.

Fittings	Dimension L						
	Length with fittings in inches (mm)						
	C100/M100L	C100M	M100M	M100H	M100H1, H2	C100H	C100H1, H2
1/8 compression	4.84 (124)	NA	NA	NA	NA	NA	NA
1/4 compression	5.02 (129)	6.52 (167)	6.02 (154)	NA	NA	NA	NA
3/8 compression	5.14 (132)	6.64 (170)	6.14 (157)	NA	NA	NA	NA
1/2 compression	5.3 (135)	6.80 (174)	6.30 (162)	8.29 (229)	NA	10.37 (266)	NA
1/4 VCO	4.56 (117)	6.06 (155)	5.56 (143)	NA	NA	NA	NA
1/2 VCO	5.00 (128)	6.50 (167)	6.00 (154)	8.56 (220)	NA	10.01 (257)	NA
3/4 VCO	NA	NA	NA	NA	8.78 (225)	NA	11.28
1/4 VCR	4.88 (125)	6.38 (164)	5.88 (151)	NA	NA	NA	NA
1/2 VCR	5.18 (133)	6.68 (171)	6.18 (158)	8.98 (230)	NA	10.43 (267)	NA
6 mm compression	5.04 (129)	6.54 (168)	6.04 (155)	NA	NA	NA	NA
10 mm compression	5.20 (133)	6.70 (172)	6.20 (159)	NA	NA	NA	NA
12 mm compression	5.38 (138)	6.88 (176)	6.38 (164)	8.90 (228)	NA	10.35 (265)	NA
1/4 FNPT	4.85 (124)	6.35 (163)	5.85 (150)	NA	NA	NA	NA
3/8 FNPT	NA	6.50 (167)	6.00 (154)	NA	NA	NA	NA
1/2 FNPT	NA	NA	NA	9.14 (234)	NA	10.59 (272)	NA
3/4 FNPT	NA	NA	NA	NA	9.30 (238)	NA	11.80
3/4 compression	NA	NA	NA	9.24 (237)	9.18 (235)	10.69 (274)	11.68
1 inch compression	NA	NA	NA	NA	9.52 (244)	NA	12.02

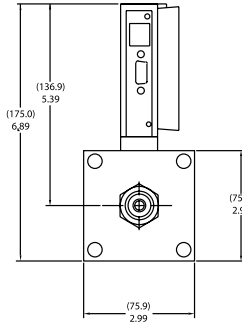
Physical Dimensions

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

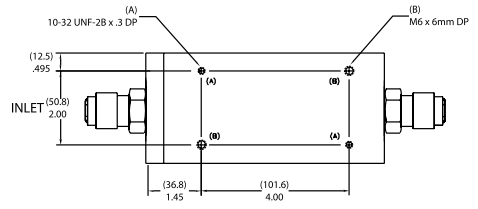
M100H,H1,H2 Front View



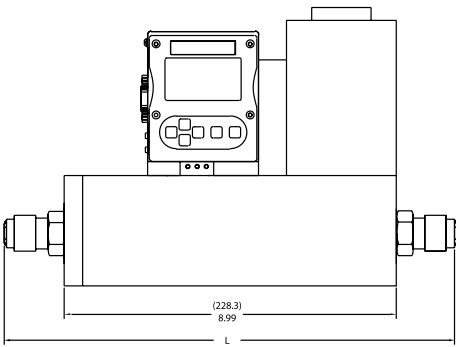
M100H,H1,H2 Side View



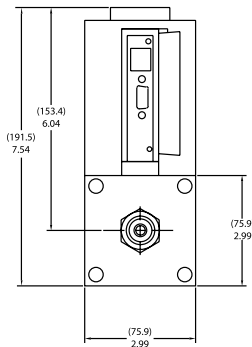
M100H,H1,H2 Bottom View



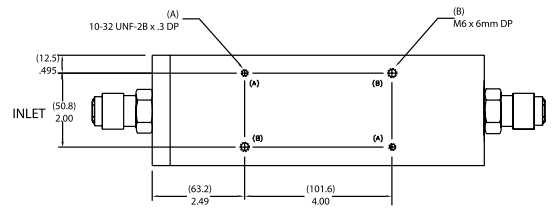
C100H1,H2 Front View



C100H1,H2 Side View



C100H1,H2 Bottom View



Ordering the Smart-Trak®

PARENT NUMBER

- M 100** Smart-Trak Mass Flow Meter
- C 100** Smart-Trak Mass Flow Controller

FLOW RANGE

- L** Flows from 0-10 sccm to 0-50 slpm
- M** Flows from 0-20 slpm to 0-200 slpm
- M1** Flows from 0-201 slpm to 0-300 slpm
- H** Flows from 0-100 slpm to 0-500 slpm
- H1** Flows from 0-501 slpm to 0-800 slpm
- H2** Flows from 0-801 slpm to 0-1000 slpm

PILOT MODULE DISPLAY/INTERFACE

- NR** No Display/Interface
- DD** Pilot Module Display/Interface
- RD** Remote Pilot Module Display/Interface

INLET/OUTLET FITTINGS

- | | |
|---|--|
| 1 1/8 compression (max 5 slpm) | 10 6mm compression (max 30 slpm) |
| 2 1/4 compression (Std to 30 slpm) | 11 10mm compression (max 300 slpm) |
| 3 3/8 compression (Std 30 to 300 slpm) | 12 12 mm compression (max 500 slpm) |
| 4 1/2 compression (max 500 slpm) | 13 1/4 FNPT (max 300 slpm) |
| 5 1/4 VCO (max 50 slpm) | 14 3/8 FNPT (max 300 slpm) |
| 6 1/2 VCO (max 500 slpm) | 15 1/2 FNPT (max 500 slpm) |
| 7 3/4 VCO (max 1000 slpm) | 16 3/4 FNPT (max 1000 slpm) |
| 8 1/4 VCR (max 50 slpm) | 17 3/4 compression (max 1000 slpm) |
| 9 1/2 VCR (max 500 slpm) | 18 1 inch compression |

FLOW BODY ELASTOMERS

- OV1** Viton or equivalent (**Standard**)
- ON1** Neoprene or equivalent

VALVE SEAT (C100 Flow Controllers Only)

- SV1** Viton or equivalent
- SN1** Neoprene or equivalent
- SK1** Kalrez or equivalent (100L)
- SK2** Kalrez or equivalent (100M)
- SK3** Kalrez or equivalent (100H)

INPUT POWER

- PV1M** 15-22 VDC, linear (Flow Meters Only)
- PV1C** 15-22 VDC, linear (C100L Only)
- PV2** 24 VDC, linear (Standard)

OUTPUT SIGNAL

- V1** 4-20 mA and 0-5 VDC, Linear
- V2** 4-20 mA and 1-5 VDC, Linear
- V3** 4-20 mA and 0-10 VDC, Linear

EXTERNAL SETPOINT SIGNAL (Flow Controllers Only)

- S0** Pilot Module/RS-232 (Standard for DD, RD)
- S1** 0-5 VDC (Standard for NR)
- S2** 1-5 VDC
- S3** 0-10 VDC
- S4** 4-20 mA

ELECTRICAL CONNECTION

- C0** 15 PIN mating connector with no cable
- C1** 6 inch (150mm) cable
- C3** 3 foot (1m) cable
- C10** 10 foot (3m) cable
- C ()** Custom length cable

OPTIONS

- GS** Gas Substitution (Replace up to 9 Dial-A-Gas Gases)
- LF** Low Flow Calibration (required for 0-20 sccm and below)

GAS FLOW RATE

FOR ACCESSORIES AND ADDITIONAL CABLES PLEASE CONTACT YOUR LOCAL SIERRA DISTRIBUTOR

SIERRA INSTRUMENTS, NORTH AMERICA • 5 Harris Court, Building L • Monterey, California • (800) 866-0200 • (831) 373-0200 • Fax (831) 373-4402 • www.sierrainstruments.com
 SIERRA INSTRUMENTS, EUROPE • Bijlmansweid 2 • 1934RE Egmond aan den Hoef • The Netherlands • +31 72 5071400 • Fax: +31 72 5071401
 SIERRA INSTRUMENTS, ASIA • Rm.618, Tomson Centre, Bldg. A • 188 Zhang Yang Road • Pu Dong New District • Shanghai, P.R. China 200122 • +8621 5879 8521/22 • Fax: +8621 5879 8586