High Performance Capillary Digital Gas Mass Flow Meters & Controllers

SmartTrak® 100

FEATURES

- Measure and control gas mass flow rates up to 1000 ln/min
- Pressure up to 35 barg
- 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. (Define at ordering)
- Unique Pilot Module (mounted on MFM/MFC or remote) lets you view and change critical functions
- All functions are also available from your PC or workstation via the free SmartTrak 100 software
- 316 stainless steel wetted materials
- Factory calibration done with primary standards directly traceable to national standards
- Proprietary frictionless-hovering direct-acting control valve technology
- Choose from multiple analog or digital signals including: RS-232, RS-485, 4-20 mA, 0-5, 1-5, 0-10 VDC
- Supports RS232 and Modbus

DESCRIPTION

SmartTrak® 100 Series features 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 capillary MFM/MFC 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 Vögtlin's proprietary frictionless-hovering control valve.

The 100 Series is available with an innovative and user-friendly Pilot Module, a front-mounted or remote mounted 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 the 10 different gases independently to accommodate unexpected application or system design changes.

The optional Compod modules add features like Modbus communication, alarm points, analogue and i/o inputs, totalizers and pulse output.

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

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PERFORMANCE SPECIFICATIONS

Accuracy
Standard: ± 1.0 % of full scale including linearity under calibration conditions (optional 0.5% FS for limited 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
± 0.05% of full scale per °C, or better

Pressure Coefficient
± 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
100L Low Flow: 0-10 mln/min to 0-50 ln/min
C100L High Pressure: 100 mln/min to 20 ln/min
100M Medium Flow: 0-20 to 0-200 ln/min
100H High Flow: 0-100 to 0-1000 ln/min

Flow ranges specified are for an equivalent flow of nitrogen at 0°C/1013.25 mbara; other ranges in other units are available (e.g., slpm, scfh, nm3/h, kg/h)

For measuring or controlling flows below 4 mln/min, please consider Vögtlin's MicroTrak™ 101.

Gases
Measures and controls all clean gases including 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.

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

Examples are: EPDM, Neoprene ®, Kalrez ®

Dial-A-Gas Flow Rates

Gas	Max Flow Rate ln/min Low Flow Size	Max Flow rate ln/min Medium Flow Size	Max Flow Rate ln/min High Flow Size
Air	50	200	1000
Argon (Ar)	69.9	279.6	1398
Carbon Dioxide (Co2)	36.8	147.4	737
Carbon Monoxide (CO)	50.1	200.4	1002
Methan (CH4)	37.7	150.8	754
Helium (He)	69.9	279.8	1399
Hydrogen (H2)	50	200.2	1001
Oxygen (O2)	49.9	199.6	998
Nitrogen (N2)	50.1	200.4	1002
Nitrous Oxide (N2O)	35.8	143.2	716

Gas and Ambient Temperature
0 to 50°C

Maximum operating Pressure
Standard units: max. 35 barg operating pressure (test pressure 40barg)

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 ±10%, (230 mA, regulated)
For Mass Flow Controllers:

C100L: 24 VDC ±10% (500 mA, regulated)
C100L High Pressure: 24 VDC ±10% (500 mA, regulated)
C100M: 24 VDC ±10%, (800 mA, regulated)
C100H: 24 VDC ±10%, (1260 mA, regulated)

Dynamic range
Controllers: 2-100% of full scale. Automatic shut-off below a setpoint of 1.9% of FS.

Meters: 1-100% of full scale. Reading goes to zero blow a flow of 0.9% of FS.

COMMUNICATION

Analogue output signals
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

Analog setpoint signals
Analog (choice of one):
Linear 4–20 mA, 0–5 VDC, 0-10 VDC, 1-5 VDC

Digital Communication

Standard RS232

Optional:

Compod module:
The compod is an addition to the 100 series MFC/MFM that can be added to a new or already supplied unit (upgrade).
Ex.: Modbus communications, Totalizer, Alarm functions, 2 digital i/o outputs, 2 analogue inputs, pulse output

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 output relays and one input can be configured by user with MODBUS or included software for a wide variety of process controls

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 (ln/min)	Pressure Drop in mbar				
	Low Flow 1/4'' fittings (Standard)	Low Flow 3/8'' fittings (Optional)	Medium Flow 3/8'' or 1/2'' fittings	High Flow Small Bore (100H) (std up to 500 ln/min) 1/2'' comp fittings	High Flow Large Bore (H1, H2) (std 501-1000 ln/min) 3/4'' comp fittings
0.1	24.5	N/A	N/A	N/A	N/A
0.5	24.5	N/A	N/A	N/A	N/A
1	25.4	N/A	N/A	N/A	N/A
10	31.7	28.6	N/A	N/A	N/A
20	45.7	32.7	34	N/A	N/A
30	N/A	40.9	34	N/A	N/A
40	N/A	53.3	34	N/A	N/A
50	N/A	68	34	N/A	N/A
100	N/A	N/A	68	68	34
150	N/A	N/A	136	81.6	34
200	N/A	N/A	204	102	34
250	N/A	N/A	272	122.4	34
300	N/A	N/A	374	136	40.8
350	N/A	N/A	N/A	170	47.6
400	N/A	N/A	N/A	204	61.2
450	N/A	N/A	N/A	238	74.8
500	N/A	N/A	N/A	272	88.4
750	N/A	N/A	N/A	408*	204
1000	N/A	N/A	N/A	680*	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

Minimum Differential Pressure Requirement for Air, Mass Flow Controllers					
Flow rate (ln/min)	Pressure required in mbar				
	Low Flow 1/4'' fittings (Standard)	Low Flow 3/8'' fittings (Optional)	Medium Flow 3/8 or 1/2'' fittings	High Flow Small Bore (100H) (std up to 500 ln/min) 1/2 comp fittings	High Flow Large Bore (H1, H2) (std 501-1000 ln/min) 3/4 comp fittings
0.1	68	68	N/A	N/A	N/A
1	102	87	N/A	N/A	N/A
10	408	258	N/A	N/A	N/A
20	816	449	N/A	N/A	N/A
30	1020	639	82	N/A	N/A
40	2040	830	110	N/A	N/A
50	2720	1020	136	N/A	N/A
100	N/A	N/A	340	102	68
150	N/A	N/A	680	136	68
200	N/A	N/A	1020	306	68
250	N/A	N/A	1360	374	102
300	N/A	N/A	1700	442	136
350	N/A	N/A	N/A	578	204
400	N/A	N/A	N/A	714	272
450	N/A	N/A	N/A	884	340
500	N/A	N/A	N/A	1020	408
750	N/A	N/A	N/A	N/A	1020
1000	N/A	N/A	N/A	408*	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.

SmartTrak 100
High Pressure with display

SmartTrak 100

Hand-Held Pilot Module

SmartTrak 100
with Compod and display

PHYSICAL DIMENSIONS

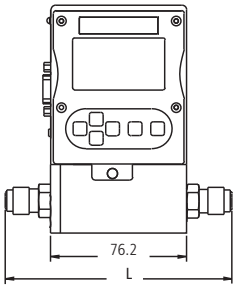
All dimensions are in mm.

Dimension L							
Fittings	Length with Fittings in mm						
	C100L, M100L	C100M	M100M 100 High Pressure	M100H	M100H1, H2	C100H	C100H, H2
1/8 compression	123	N/A	N/A	N/A	N/A	N/A	N/A
1/4 compression	128	167	154	N/A	N/A	N/A	N/A
3/8 compression	132	170	157	N/A	N/A	N/A	N/A
1/2 compression	135	174	162	229	N/A	266	N/A
1/4 VCO	117	155	143	N/A	N/A	N/A	N/A
1/2 VCO	128	167	154	220	N/A	257	N/A
3/4 VCO	N/A	N/A	N/A	N/A	225	N/A	287
1/4 VCR	125	164	151	N/A	N/A	N/A	N/A
1/2 VCR	133	171	158	230	N/A	267	N/A
6 mm compression	129	168	155	N/A	N/A	N/A	N/A
10 mm compression	133	172	159	N/A	N/A	N/A	N/A
12 mm compression	138	176	164	228	N/A	265	N/A
1/4 FNPT	124	163	150	N/A	N/A	N/A	N/A
3/8 FNPT	128	167	154	N/A	N/A	N/A	N/A
1/2 FNPT	N/A	N/A	N/A	234	N/A	272	N/A
3/4 FNPT	N/A	N/A	N/A	N/A	238	N/A	300
3/4 compression	N/A	N/A	N/A	237	235	274	297
1" compression	N/A	N/A	N/A	N/A	244	N/A	306

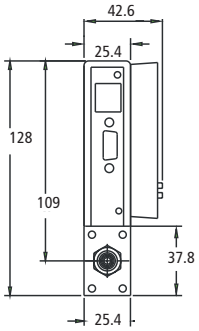
PHYSICAL DIMENSIONS (continued)

All dimensions are in mm.

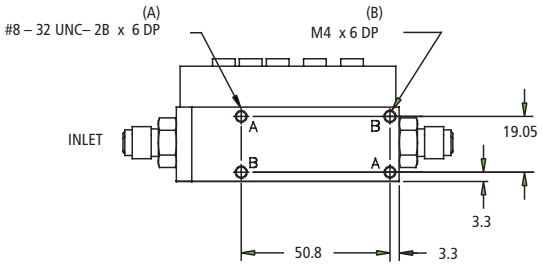
M100L & C100L Front View



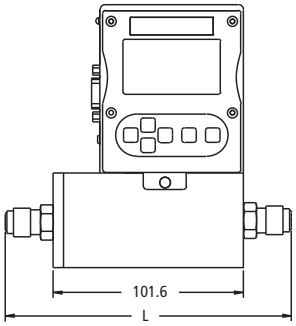
M100L & C100L Inlet View



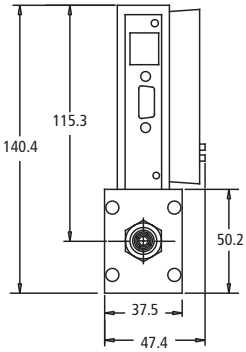
M100L & C100L Bottom View



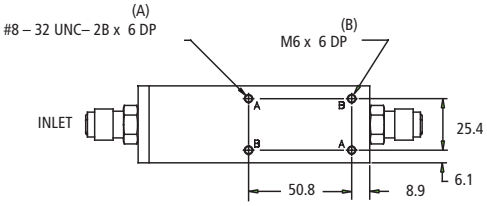
M100M Front View



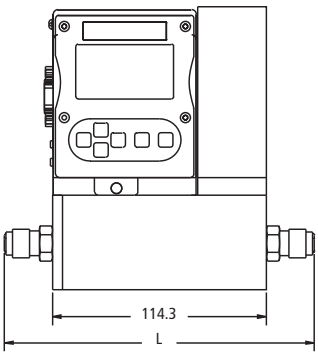
M100M Inlet View



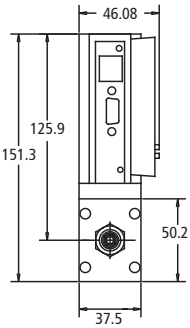
M100M Bottom View



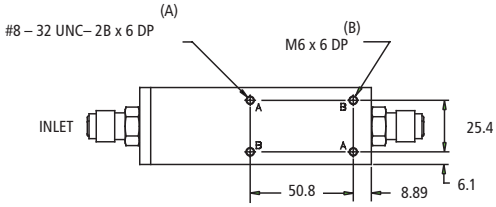
C100M Front View



C100M Inlet View



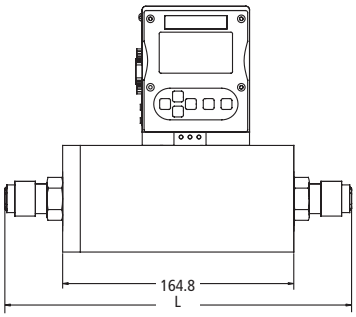
C100M Bottom View



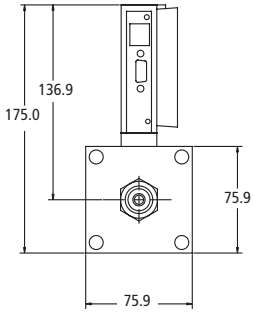
PHYSICAL DIMENSIONS (continued)

All dimensions are in mm.

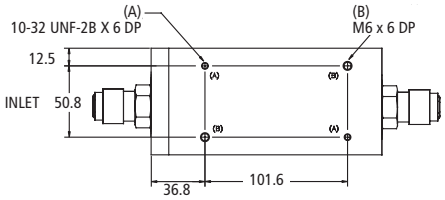
M100H Front View



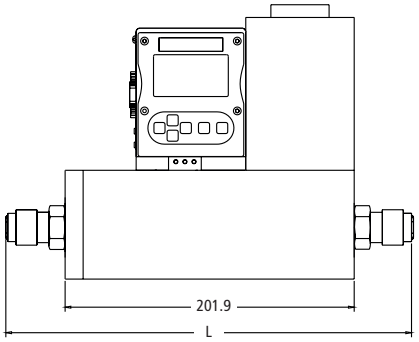
M100H Side View



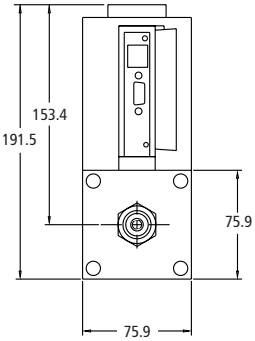
M100H Bottom View



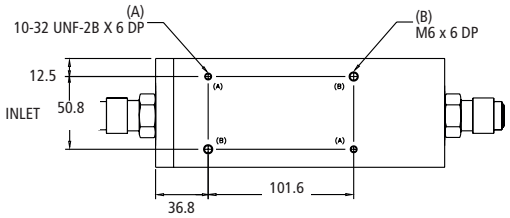
C100H Front View



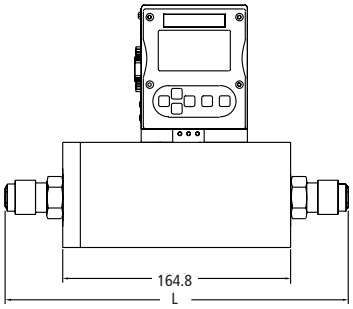
C100H Side View



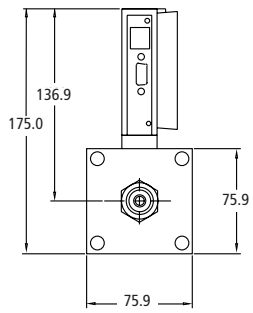
C100H Bottom View



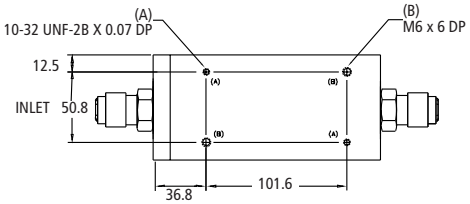
M100H1, H2 Front View



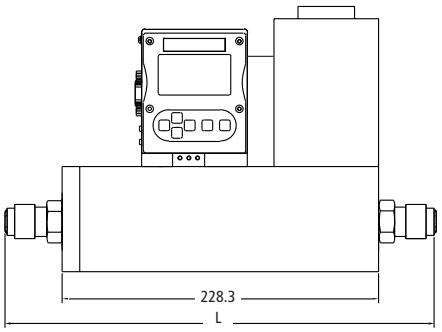
M100H1, H2 Side View



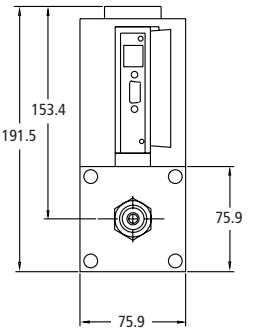
M100H1, H2 Bottom View



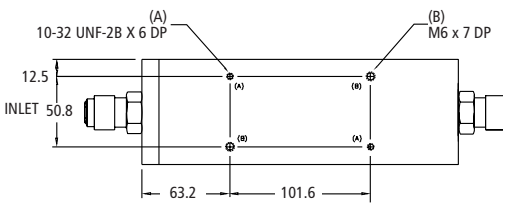
C100H1, H2 Front View



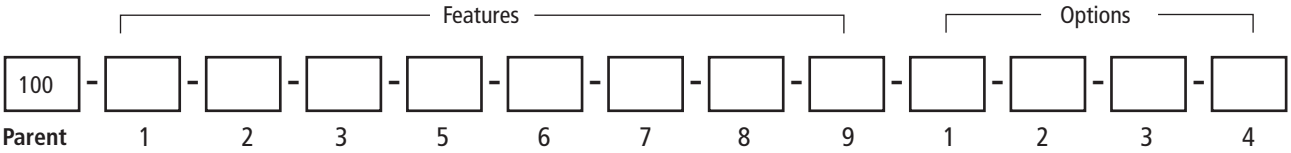
C100H1, H2 Side View



C100H1, H2 Bottom View



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*			
M101	MicroTrak mass flow meter. Full scale flow = 4 mln/min, range = 0.1 to 4.0 mln/min**	**C101**	MicroTrak mass flow controller. Full scale flow = 4 mln/min, range = 0.1 to 4.0 mln/min.
M100L	Low flow meter: 0-10 mln/min up to 0-50 ln/min**	**C100L**	Low flow controller: 0-10 mln/min up to 0-50 ln/min.**
M100M	Medium flow meter: 0-20 ln/min up to 0-200 ln/min	**C100M**	Medium flow controller: 0-20 ln/min up to 0-200 ln/min
M100H	High flow meter: 0-100 to 0-500 ln/min full scale	**C100H**	High flow controller: 0-100 to 0-500 ln/min
M100H1	High flow meter: 0-501 to 0-800 ln/min full scale.	**C100H1**	High flow controller: 0-501 to 0-800 ln/min full scale.
M100H2	High flow meter: 0-801 to 0-1000 ln/min full scale.	**C100H2**	High flow controller: 0-801 to 0-1000 ln/min full scale.

Note: All ln/min flow ranges also available in nlpm *Flow bodies are sized for Nitrogen flow rates. Other gases must be converted to equivalent Nitrogen flow. Use K-Factor and size accordingly. **You must select Low Flow Calibration under "Options" for 0-20 mln/min full scale flow range or less.
For high pressure unit see seperate data sheet (SmartTrak100HP)

Feature 2: Pilot Module Display	
NR	No display/interface. If option 2 digital communications are selected, NR must be selected.
DD	Pilot Module Display/Interface mounted on the enclosure
RD	Remote Display Pilot Module Display/Interface. Includes 3 meter CAT 5 cable. Optional cables up to 15 meter 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

Feature 3: Inlet / Outlet Fittings			
1	1/8-inch compression. For low flow bodies and 101. (maximum 5 ln/min)	**10**	6 mm Compression. For low flow bodies and 101. (maximum 50 ln/min)
2	1/4-inch compression (standard up to 30 ln/min). For low flow bodies and 101 (maximum 50 ln/min)	**11**	10 mm Compression. For low and medium bodies. (maximum 300 ln/min)
3	3/8-inch compression (standard for 30 to 300 ln/min). For low and medium bodies. (maximum 300 ln/min)	**12**	12 mm Compression. For all flow bodies up to 500 ln/min. Above 500 ln/min contact factory.
4	1/2-inch compression For all flow bodies up to 500 ln/min. Above 500 ln/min contact factory.	**13**	1/4-FNPT adapter bushing (maximum 200 ln/min). For low and med flow bodies, and 101 only.
5	1/4-inch VCO. For low flow bodies and 101. (maximum 50 ln/min)	**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 ln/min.
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 and 101. (maximum 50 ln/min)	**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 ln/min. Above 500 ln/min contact factory.	**18**	1-inch compression. For H1 and H2 high flow bodies only.

Feature 4: Flow Body Elastomers	
OV1	Viton® or equivalent (standard)
OV1-F	Viton® (For phosphine only)
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
OE-1	EPDM O-rings (all body sizes)

Note: Consult factory for other elastomers.

ORDERING THE SMART TRAK 100 (continued)

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
		SE1	EPDM Valve seat

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

Feature 6: Input Power	
PV1M	15-24 VDC for meters (optional)
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 Smart-Trak Software

Feature 8: External Setpoint Signal (MFC only)			
S0	Pilot Module/RS-232 (standard for Pilot Module/ digital operation)	**S3**	0-10 VDC , linear
S1	0-5 VDC, linear, standard for analog operation	**S4**	4-20 mA , linear
S2	1-5 VDC, linear	**S5**	0-20 mA , linear

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

Feature 9: Electrical Connection			
C0	15-pin mating connector with no cable	**C25**	100-Analog Cable 8 meter: 15 conductor cable with D-connector on one end, fly leads on the other. 8 meter

Note: All communications, both analog and digital, go through the cable on Smart-Trak 2 instruments

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 ln/min (valid from 10 to 100% of the calibrated range)	Gases: Air, Nitrogen, Helium, or Argon Pressure: up to 10 barg Temperature range: 10°C to 30°C Orientation: horizontal only Note: Not available for MicroTrak For other operating conditions contact factory.
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 mln/min - 0 to 20 mln/min full scale calibrations or less; not required for 101 Series	

Option 2: Certificates	
MC	Material Certificates--US Mill certs 3.1 on all wetted flow body parts
CC	Certificate of Conformance

Option 3: O2 Cleaning	
O2C	O2 Cleaning. Includes certification. Product cleaned for O2 service. Inspected with Ultra-Violet light and double-bagged prior to shipment

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