

Immersible Thermal Gas Mass Flow Meter

FEATURES

- Direct mass flow monitoring eliminates need for separate temperature and pressure inputs
- Accuracy +/- 1% of reading plus 0.5% of full scale
- Patented Dry-Sense™ technology eliminates sensor drift
- State-of-the-art calibration facility insures a highly accurate calibration that matches the application
- Field validation of meter electronics and sensor resistance verifies flow meter performance
- One-second response to changes in flow rate
- FM, CSA, PED, ATEX and GOST R/RTN certified for hazardous areas
- CE approved
- High temperature option to 750°F (400°C) available
- Multipoint options available
- Integrated self-cleaning purge option available for dirty flows
- Low and high pressure hot taps available
- Optional HART, Modbus and Profibus DP available, Foundation Fieldbus (pending)

SteelMass® 640S



DESCRIPTION

Sierra Instruments' SteelMass® Model 640S immersible thermal mass flow meter is designed for the toughest industrial gas flow measurement applications.

The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics in either a probe-mounted or remote housing. Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the optional 2 x 12 LCD display. The programmable transmitter is easily configured via an RS-232 communication port and Sierra's Smart Interface™ software, or via the display and magnetic switches on the instrument.

Sierra's state-of-the-art calibration facility insures that the calibration will match the application, and our patented Dry-Sense™ thermal sensor insures the Model 640S will hold this calibration over time. Sierra's Smart Interface™ software guides you through a procedure to fully validate instrument performance, thus field-verifying meter functionality. The meter is available with a variety of input power, output signal, mounting and packaging options.

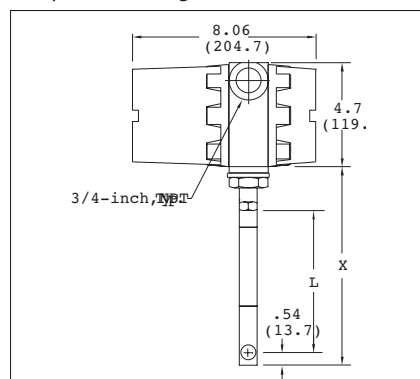


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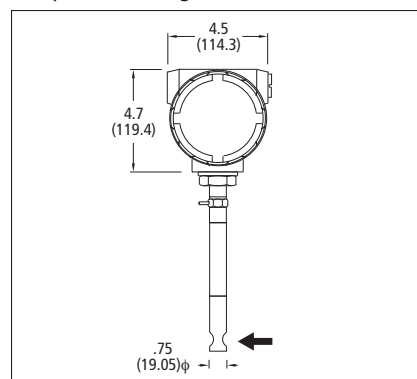
The information contained herein is subject to change without notice.

Hazardous-Area Location Enclosure Dimensional Specifications

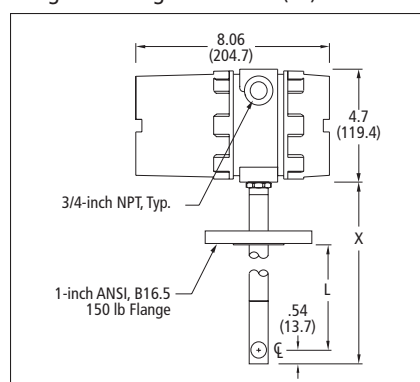
Compression Fitting—Side View (E2)



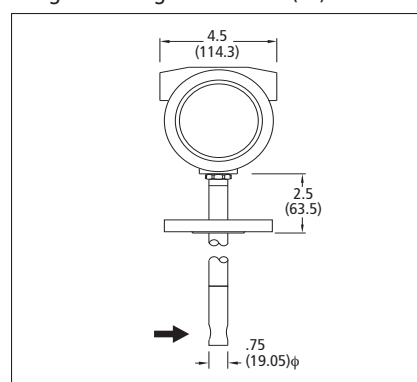
Compression Fitting—Front View (E2)



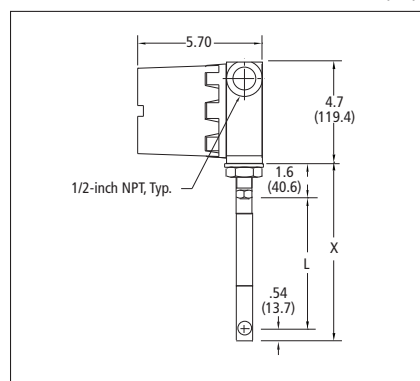
Flange Mounting—Side View (E2)



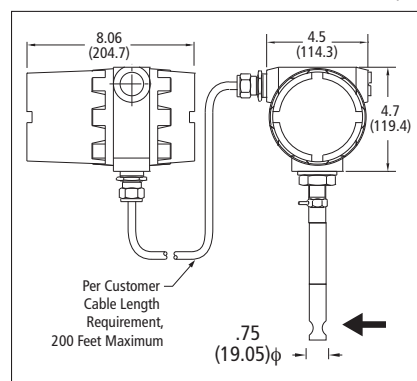
Flange Mounting—Front View (E2)



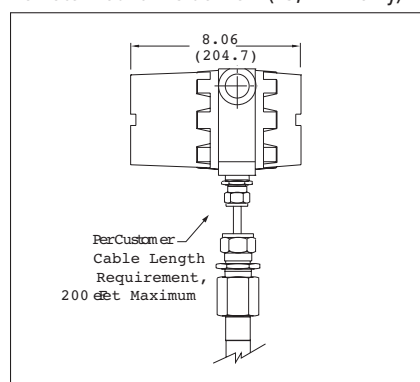
Remote Mount Junction Box—Side View (E4)



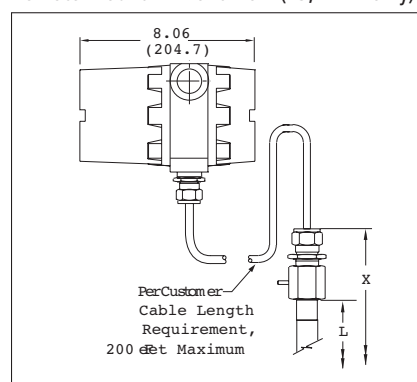
Remote Mount Junction Box—Front View (E4)



Remote Mount—Side View (E3, ATEX only)



Remote Mount—Front View (E3, ATEX only)



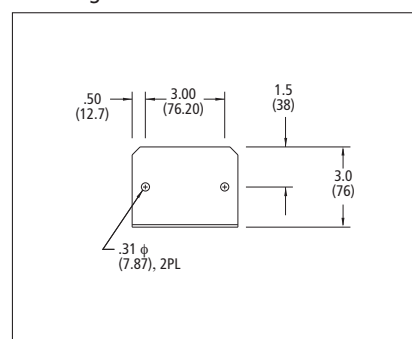
Tables

Length Chart (Compressions Fittings)		
Code	L	X
L06	6.0 (152.4)	7.5 (190.5)
L09	9.0 (228.6)	10.5 (266.7)
L13	13.0 (330.2)	14.5 (368.3)
L18	18.0 (457.2)	19.5 (495.3)
L24	24.0 (609.6)	25.5 (647.7)
L36	36.0 (914.4)	37.5 (952.5)

Length Chart (Flange Mounting)		
Code	L	X
L06	6.0 (152.4)	9.0 (228.6)
L09	9.0 (228.6)	12.0 (304.8)
L13	13.0 (330.2)	16.0 (406.4)
L18	18.0 (457.2)	21.0 (533.4)
L24	24.0 (609.6)	27.0 (685.8)
L36	36.0 (914.4)	39.0 (990.6)

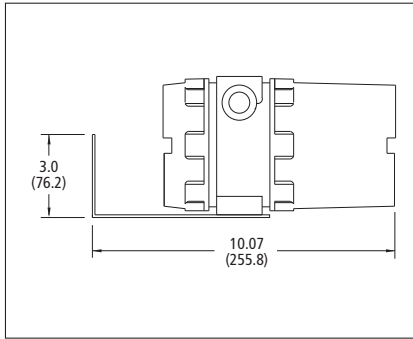
Length Chart (Remote Mount Junction Box)		
Code	L	X
L06	6.0 (152.4)	7.5 (190.5)
L09	9.0 (228.6)	10.5 (266.7)
L13	13.0 (330.2)	14.5 (368.3)
L18	18.0 (457.2)	19.5 (495.3)
L24	24.0 (609.6)	25.5 (647.7)
L36	36.0 (914.4)	37.5 (952.5)

Mounting Holes for Remote Bracket

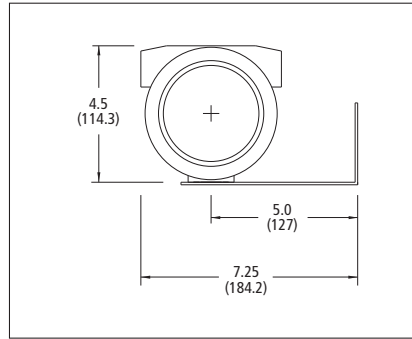


All dimensions are inches. Millimeters are in parentheses. All drawings have a +/- .25-inch (6.4 mm) tolerance. Certified drawings are available on request.

Remote Rear Bracket Mounted Electronics

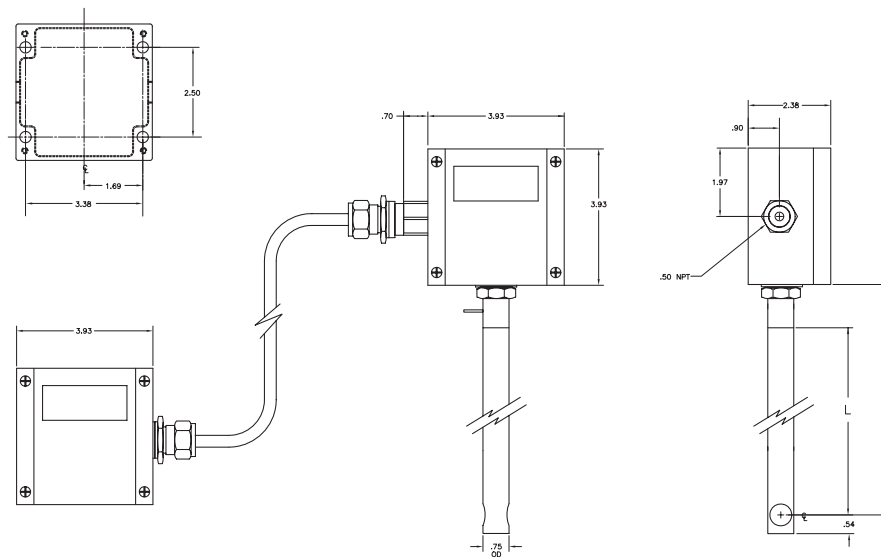


Remote Side Bracket Mounted Electronics



Length Chart (NEMA 4X)		
Code	L	X
L06	6.0 (152.4)	7.25 (184.1)
L09	9.0 (228.6)	10.25 (260.3)
L13	13.0 (330.2)	14.25 (361.9)
L18	18.0 (457.2)	19.25 (488.9)
L24	24.0 (609.6)	25.25 (641.3)
L36	36.0 (914.4)	37.25 (946.1)

NEMA 4X Dimensional Specifications



SELF-CLEANING PURGE OPTION

- Maximum process pressure 100 Psi
- Maximum process temperature 500 F.
- Max pressure purge air: 150 Psi
- Process connection Purge air 1/4" NPTF
- Wetted Process Parts: all 316SS
- The purge gas must be clean and dry. Do not use a liquid to clean the sensor inline
- The purge system is only available with E4 and E2 housings
- The purge system is NOT available with FM, ATEX or CSA approval or the high temperature option

Warning: During the purge cycle there will be a high flow over the sensor. This will drive the output of the flow meter to the maximum flow (Output will be 20-26 mA (load dependent) during the purge. Insure that this temporally high output does not effect any alarms or process control systems.

Operation: This is not a continous flow of air, but a blast purge option. The purge nozzle creates a jet stream wich blows deposits from the sensors. The frequency and intensity of the purge is determined by the end user. It can be done with a suitable manual, pneumatic or electric valve (Solenoid). It is also possible to control the purge system automatically (f.i. timer, PLC or HMI).

Note: There is a check valve built Inside the flow meter to prevent the return flow of process gasses into the purge system. Replacement of this valve can only take place in the factory.

Note: Only a 24 VDC power input is available when ordering an internal purge option.

Low Pressure Hot Tap to 150 psig (10 barg)

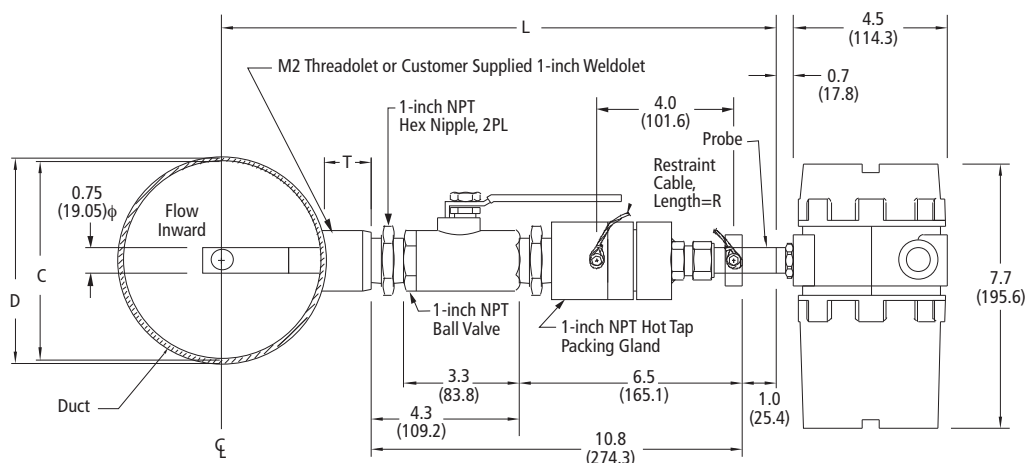
Side View

VARIABLES

L = Nominal Probe Length
 D = Duct O.D.
 C = Duct I.D.
 T = Height of "Threadolet"
 or Customer Provided
 Weldolet
 R = Restraint Cable Length

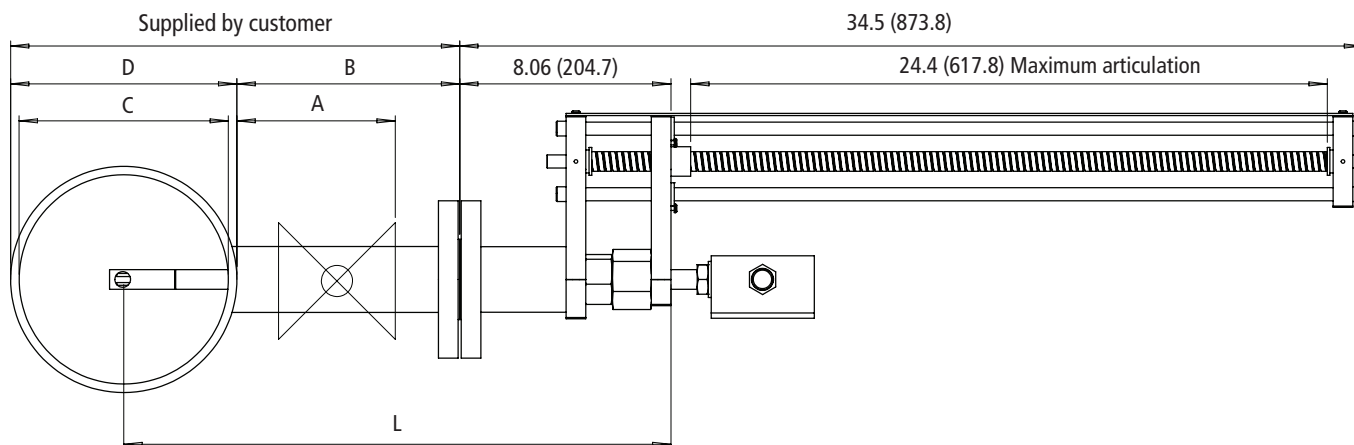
FORMULA

$L \geq 12 + D/2 + T$
 So L must be equal or greater
 than 12-inches
 plus the height of the
 "Threadolet" plus half
 the duct O.D.
 $R = D/2 + T + 8.8$



All dimensions are inches. Millimeters are in parentheses. All drawings have a +/- .25-inch (6.4 mm) tolerance. Certified drawings are available on request.

High Pressure Hot Tap is flange dependent up to 400 psig (27.6 barg)



Unobstructed Flow Requirements

Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor. If you cannot meet these requirements please refer to the Flat-Trak™ Model 780S with flow conditioning plates (flow conditioning plates reduce upstream requirements to as little as 2 diameters).

Example - Upstream Requirements (A)

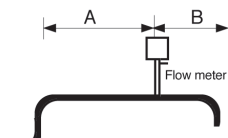
1	15D
2	20D
3	40D
4	15D
5	30D
6	40D

Example - Downstream Requirements (B)

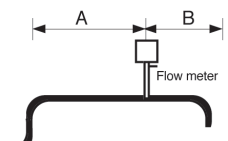
1	5D
2	5D
3	10D
4	5D
5	10D
6	5D



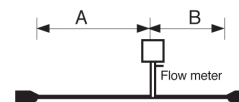
Example 1.
One 90° elbow before meter



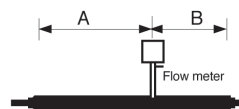
Example 2.
Two 90° elbows before meter in one plane



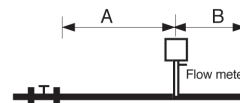
Example 3.
Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)



Example 4.
Reduction before meter



Example 5.
Expansion before meter



Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

PERFORMANCE SPECIFICATIONS

Accuracy of Point Velocity

+/- 1% of reading + 0.5% of full scale.

Note: Overall accuracy of HT meters may be de-rated due to temperature and velocity conditions.

Repeatability

+/- 0.2% of full scale

Temperature Coefficient

+/- 0.02% of reading per °F within +/- 50° F of customer specified conditions

+/- 0.03% of reading per °F within +/- 50° F to 100° F of customer specified conditions

+/- 0.04% of reading per °C within +/- 25° C of customer specified conditions

+/- 0.06% of reading per °C within +/- 25° C to 50° C of customer specified conditions

Pressure Coefficient

.02% per psi for air, consult factory for other gases

Response Time

One second to 63% of final velocity value

OPERATING SPECIFICATIONS

Gases

Most gases compatible with 316 stainless steel

Hastalloy® available

Gas Pressure (2 limitations)

Mechanical design pressure:

Compression fittings: 500 psig (34 barg)

1-inch 150 lb flange (-40° to 250° F): 185 psig (12.8 barg)

Low Pressure Hot Tap: 150 psig (10 barg)

High Pressure Hot Tap: 275 psig (18 barg)

Pressure Drop

Negligible for pipes three inches in diameter or larger

Gas & Ambient Temperature

Gas: -40° F to 350° F (-40° C to 177° C) Gas dependent.

Ambient -40° F to 120° F (-40° C to 50° C)

Leak Integrity

5 x 10⁻⁹ cc/sec of helium maximum

Power Requirements

18 to 30 VDC (regulated), 625 mA maximum

100 to 240 VAC, 50/60 Hz, 15 watts maximum

625 mA maximum operating current at 24 VDC and full scale flow

Maximum in rush current of 2 Amps at 24 VDC

Consult factory for other conditions

HIGH TEMPERATURE OPTION

Up to 750° F (400° C) air only; consult factory for other gases

DIGITAL COMMUNICATIONS OPTIONS

Pulse (not available with E2-NR)

Modbus RTU (not available with P3 option)

Profibus DP (available E2/E4-P2 configuration only)

HART universal commands (available E2/E4-P2 configuration only)

Foundation Fieldbus (available E2/E4-P2 configuration only) pending

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Output Signal

Linear 0–5 VDC or 0-10 VDC, 1000 ohms minimum load resistance or

Linear 4–20 mA proportional to mass flow rate,

700 ohms maximum resistance power supply dependent

User-selectable: Active non-galvanically separated or Passive

galvanically separated (loop power required)

Alarms

Hard contact user-adjustable high and low

Dead band adjustable with Smart Interface™ software

Relay ratings: Maximum 400 VDC or VAC (peak), 140 mA

Displays

Alphanumeric 2 x 12 digit backlit LCD

Adjustable variables via on-board switches (password protected)

or with Smart Interface™ software

Adjustable variables: Full scale (50 to 100 %)

Time Response (1 to 7 seconds)

Correction factor setting (0.5 to 5)

Zero and span

High and low alarm settings

Totalizer

Eight digits (99,999,999) in engineering units

Resettable by software, on-board switches or external magnet

Software

Smart Interface™ Windows®-based software

Minimum 8 MB of RAM, preferred 16 MB of RAM

RS-232 communication

Additional features: Alarm dead band adjustment

Zero cut-off adjustment

Linearization adjustment

Save / Load configurations

Flow meter validation

PHYSICAL SPECIFICATIONS

Wetted Materials

316 stainless steel

Enclosure

Hazardous-Area Location Enclosure (IP66) or NEMA 4X (IP65)

Both are powder-coated cast aluminum

Electrical Connections

Two 3/4 inch NPT: Hazardous-Area Location Enclosure (IP66)

One 1/2 inch NPT: NEMA 4X Enclosure (IP65)

Mounting (optional)

ANSI 1-inch 150 lb flange

3/4-inch tube compression fitting with 1-inch male NPT

Hot tap systems

Certifications

CE (All enclosures)

CSA (Explosion proof for Class I, Division 1, Groups B, C, D)

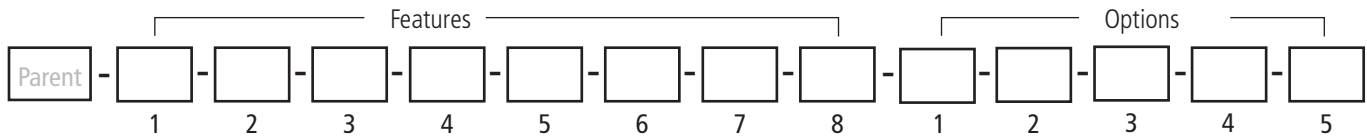
ATEX (II 2 GD Ex d IIC T6 ... T2; IP 66 T70 °C ... T280 °C)

FM (Explosion proof for Class I, Division 1, Groups B, C, D; dust-ignition proof for Class II, III, Division 1, Groups E, F, G)

IP65, NEMA 4X T6 -40° C to 70° C ambient

Chinese pattern approval

GOST R/RTN (1ExdIIC T6...T2)



Instructions: To order a 640S please fill in each number block by selecting the codes from the corresponding features below and following pages.

Parent Number	
640S	SteelMass Industrial Insertion Mass Flow Meter. 18-30 VDC or 100-240VAC input power with 3/4-inch diameter 316SS probe. Includes "Smart Electronics" with PC configuration software. Calibration temperatures up to 350°F (176°C) and pressure to 500 psig (34.5 barg). HT option to 750°F (400°C) available (contact factory). CE, FM, CSA, ATEX approvals. Linear 0-5 VDC, 0-10 VDC or 4-20 mA output signals. Lifetime warranty on Fast Response (FR) sensor

Feature 1: Approvals

NAA	Non-agency approved meter
ATEX	640S with II 2 GD Ex d IIC T2...T6 ATEX Approval. Requires E2 or E3 enclosure. E3 required for probe lengths greater than 13 inches. Maximum probe length is 36 inch (92 cm). Note: ATEX units have circuit energy limitations that limit maximum flows to approx 50% of non-ATEX units. Consult gas tables for actual values
FM	640S with FM Approval. Requires E2 or E4 enclosure. Maximum probe length is 72 inches (1.83 m)
CSA	640S with CSA Approval. Requires E2 or E4 enclosure. Maximum probe length is 72 inches (1.83 m)

Feature 2: Probe Length

L06	6 inch (15 cm)
L09	9 inch (23 cm)
L13	13 inch (33 cm)
L18	18 inch (46 cm)
L24	24 inch (61 cm)
L36	36 inch (92 cm)
L ()	Specify length in parentheses. Maximum probe length 72 inches (2 m). Minimum length 6 inches (15 cm)
L () M5	Probe with 1 inch, class 150 Flange Specify length in parentheses. Include M5 option Diagram with ADS
L () M9	High pressure hot-tap with removable retractor kit assembly includes probe (probe length L in parentheses, MINIMUM length is process connection dependent, maximum as desired), removable retractor assembly, packing gland probe seal with a 2-inch ANSI class 150 process connection (other classes available, contact factory) and Conax fitting. Max pressure flange dependent or 400 psig (27.6 barg). Contact factory for 1000 psig (68.9 barg) option.

Feature 3: Mounting Accessories

M0	None. Customer to supply own mounting hardware
M1	Compression fitting 3/4-inch with 1-inch NPT Male
M2 ()	Threadolet 1-inch Female NPT; specify pipe O.D. in parenthesis
M1-M2 ()	Compression fitting plus Threadolet. 3/4-inch probe feed through by 1-male NPT. Threads into 1-inch Female NPT, which is welded to the pipe. Specify pipe O.D. in parenthesis. We strongly advise to purchase this as a set, since we've seen non compatible NPT threads in the past.
M3	Flat duct bracket. 3/4-inch tube compression fitting
M4 ()	Curved duct bracket. 3/4-inch tube compression fitting. Specify duct O.D. in parentheses
M8 ()	Low pressure hot tap. Includes ball valve and packing gland. Specify duct O.D. in parentheses. Maximum 150 psig (10.3 barg)
M15	Quick removal Hot-Tap. Includes ball valve and compression fitting. Rated for 40 psig (2.8 barg)

Note 1: Killark seal is required for agency approved meters greater than L13 (33 cm). Adds 6.2 in (157 mm) to probe length listed above.

Feature 4: Electronics Enclosure

E2	Hazardous-area location enclosure (IP66) Mounted directly on probe
E3 ()	Remote hazardous-area location enclosure (IP66). Requires E2 or E3 enclosure. E3 required for probe lengths greater than 13 inches. Specify cable length in parenthesis. Maximum 200 feet (61m). Hazardous-Area Location Enclosure (IP66) housing mounted up to 200 feet (61m) from flow body; includes strain relief on end of probe and mounting bracket.
E4 ()	Remote Hazardous-Area Location Enclosure (IP66) with Junction Box. Specify cable length in parenthesis. Maximum 200 feet (61m) hazardous-area location enclosure (IP66) housing mounted up to 200 feet (61m) from flow body; includes (IP66) junction box mounted on probe and mounting bracket for remote electronics enclosure.
EN2	NEMA 4X (IP65) enclosure. Mounted directly on probe
EN4 ()	Remote NEMA 4X (IP65) Enclosure with Junction Box. Specify cable length in parenthesis. Maximum 200 feet (61m) Mounted up to 200 feet (61m) away from the probe with junction box mounted on probe. Includes remote electronics enclosure mounting bracket and 1/2-inch Female NPT connection.

Feature 5: Input Power

P2	18–30 VDC
P3	100–240 VAC. Not available with EN enclosures

Feature 6: Output

V1	0-5 VDC, linear
V3	0-10 VDC, linear
V4	4-20 mA, linear

Feature 7: Display

NR	No readout
DD	Digital display 2 x 12 digit, backlit, LCD display indicates flow rate and totalized mass in engineering units. Simplifies configuration settings and provides system status information

Feature 8: Gas

0	Air
1	Argon
2	Carbon dioxide
3	Chlorine ¹
4	Digester gas
5	Digester gas ¹
6	Helium
7	Hydrogen
8	Methane
9	Methane ¹
10	Nitrogen
11	Oxygen ¹
12	Propane
13	Propane ¹
14	Ammonia ¹
99	Other--Consult Factory Gas Table

Option 1 : Digital Communications

Pulse	Totalizer pulse output (Only available with E2/E3/E4 enclosures WITH DD. Available on ALL EN2 Enclosures)
DP1	Profibus DP using an M12 connector (available E2/ E4–P2, NAA only) with full device description
DP2	Profibus DP using a 2-wire terminal block connection (available E2/ E4–P2 config only) with full device description; FM approval available
MB	Modbus RTU with full device description (P2 only); ATEX and FM approvals available
FF	Foundation Fieldbus with full device description (available E2/ E4–P2 config only); FM approval available
HART	HART universal variables; flow totalizer, K-factor, user full scale, and instantaneous flow (available E2-P2 / E4-P2) config only). FM approval available.
Note: P2 only	

Option 2: Purge

PURGE	Includes non-return valve, tube and purge nozzle option for cleaning of probe tips. 30-120 psig (2.1 - 8.3 barg) external compressed air source required. Uses 1/4-inch compression fitting on purge tube process connection. Available with E2 only. Not available with HT option (Contact factory in this case for external purge solution). Does not include on/off valve. NAA only. NOTE: Only a 24 VDC power input is available when ordering an internal purge option.
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Option 3: High Temperature

HT	HT option to 750°F (400°C). Requires remote (E4 or EN4). Contact factory for probe length (limited lengths available)
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Note: ¹Correlation calibration - consult Gas Table for accuracy.

Option 4: Certificates

MC	Material certificates--US Mill certs on all wetted parts
CC	Certificate of conformance
NACE	NACE certificate for sour gas
LT	Leak test certificate
PT	Pressure test certificate

Option 5: O2 Cleaning

O2C	O2 Cleaning. Meters up to 4 inches (DN100). Includes certification. Product cleaned for O2 service. Inspected with Ultra-Violet light only, double-bagged prior to shipment.
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