

# 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
- Integrated self-cleaning purge option available for dirty flows
- Low and high pressure hot taps available
- Optional Modbus

# SteelMass® 640S



## DESCRIPTION

**S**ierra 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.

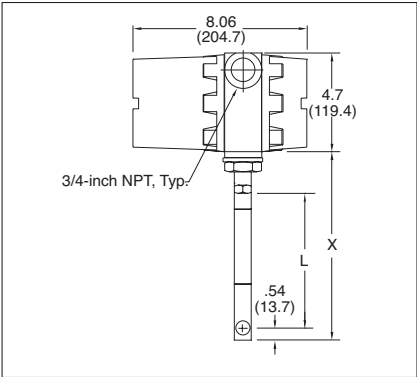
The meter is available with a variety of input power, output signal, mounting and packaging options.



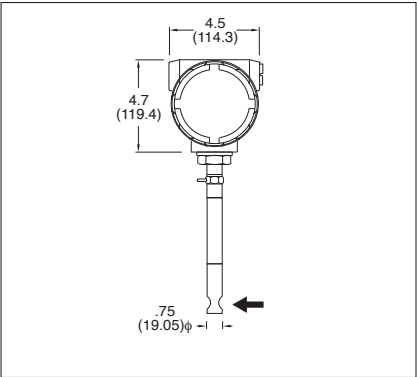
[www.sierrainstruments.com](http://www.sierrainstruments.com)

HAZARDOUS-AREA LOCATION ENCLOSURE DIMENSIONAL SPECIFICATIONS

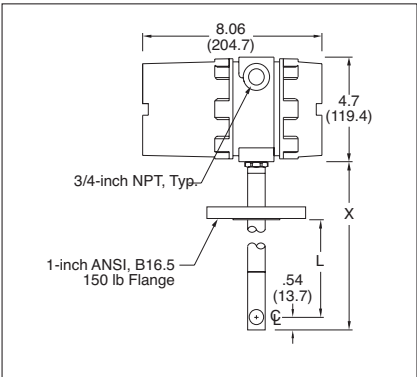
Compression Fitting—Side View (E2)



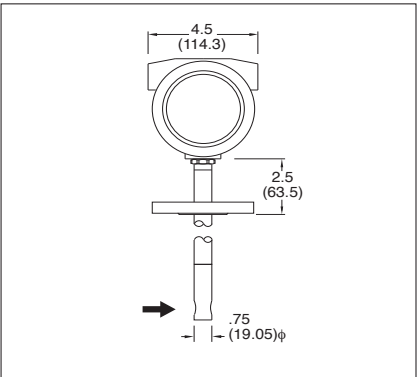
Compression Fitting—Front View (E2)



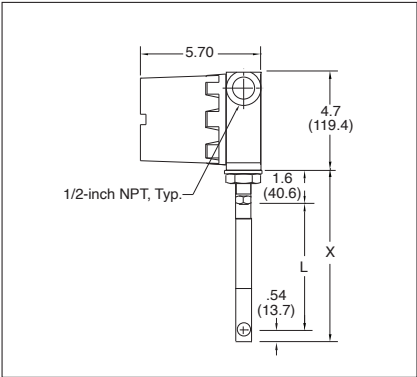
Flange Mounting—Side View (E2)



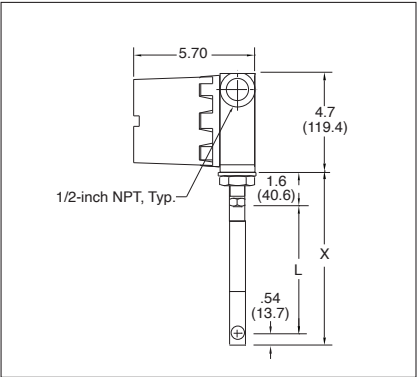
Flange Mounting—Front View (E2)



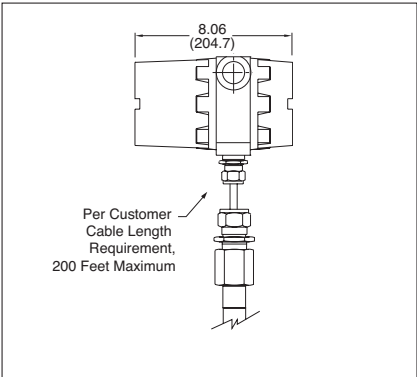
Remote Mount Junction Box—Side View (E4)



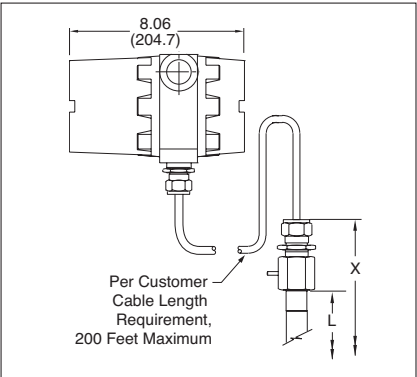
Remote Mount Junction Box—Front View (E4)



Remote Mount—Side View (E3, ATEX only)



Remote Mount—Front View (E3, ATEX only)



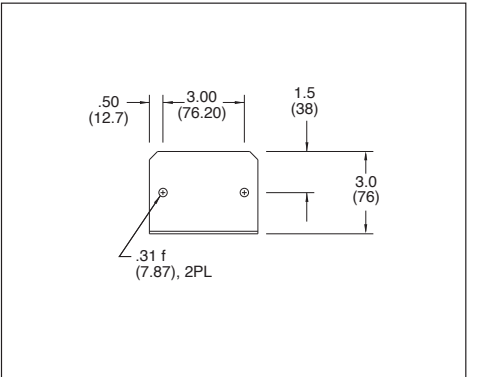
TABLES

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)

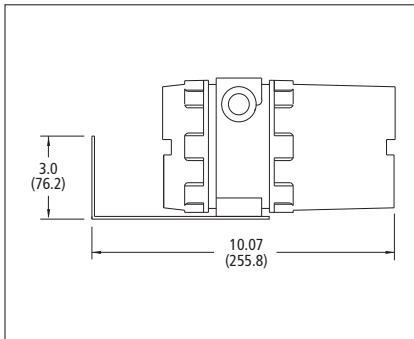
Mounting Holes for Remote Bracket



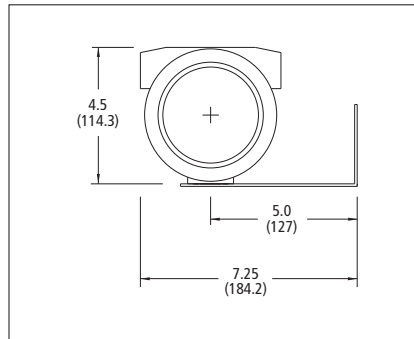
All dimensions are inches. Millimeters are in parentheses. All drawings have a +/- .25-inch (6.4 mm) tolerance. Certified drawings are available on request.

## HAZARDOUS-AREA LOCATION ENCLOSURE DIMENSIONAL SPECIFICATIONS

Remote Rear Bracket Mounted Electronics



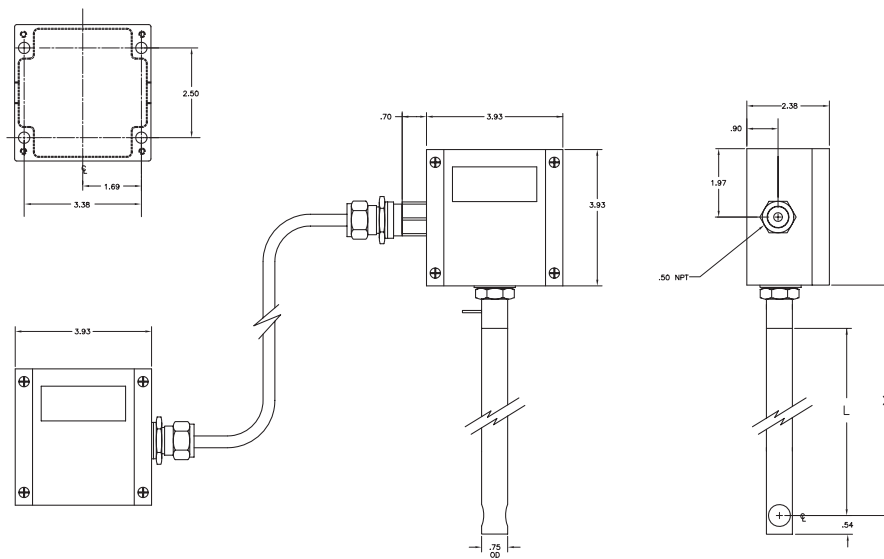
Remote Side Bracket Mounted Electronics



## TABLES

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 continuous flow of air, but a blast purge option. The purge nozzle creates a jet stream which 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.

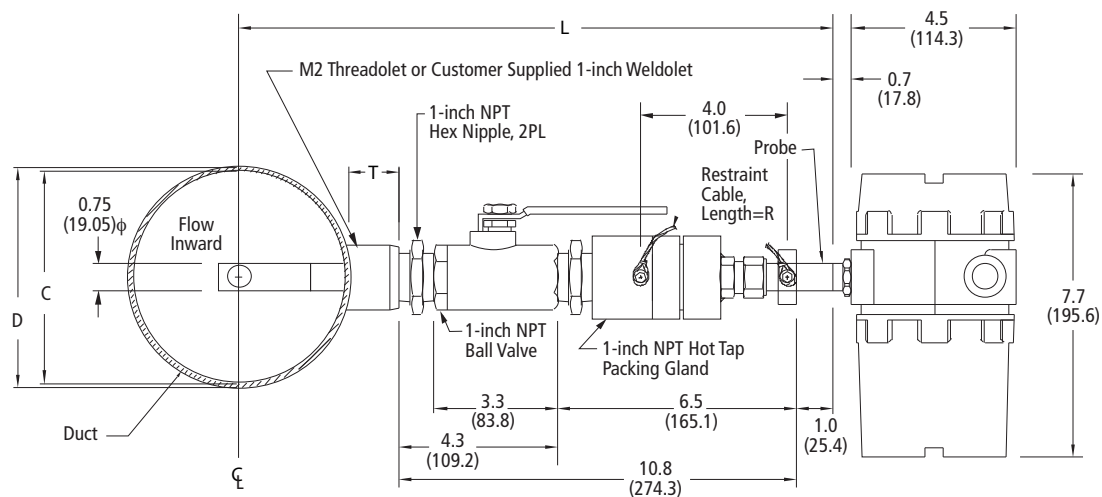
**Note:** Only a 24 VDC power input is available when ordering an internal purge option.

LOW PRESSURE HOT TAP TO 150 PSIG (10 BARG)

Side View

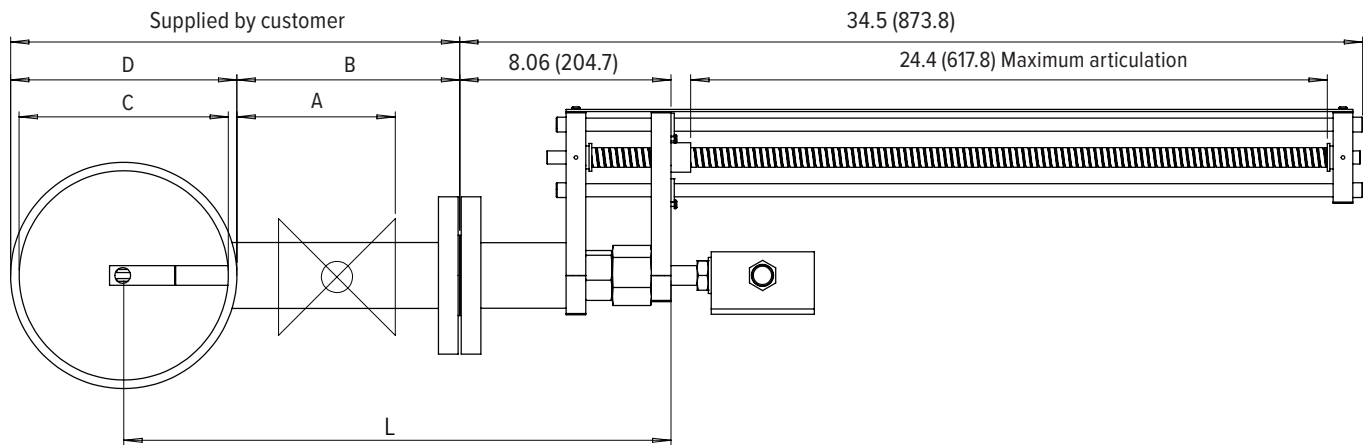
**Variables**  
L = Nominal Probe Length  
D = Duct O.D.  
C = Duct I.D.  
T = Height of "Threadolet" or Customer Provided Weldolet  
R = Restraint Cable Length

**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)

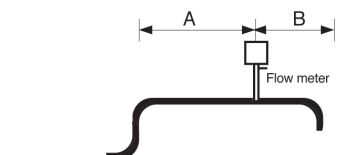
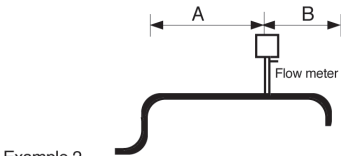
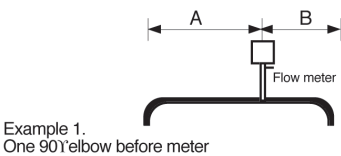


UNOBSTRUCTED FLOW REQUIREMENTS

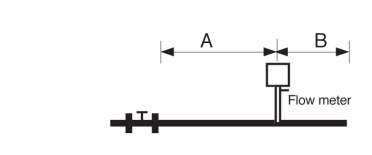
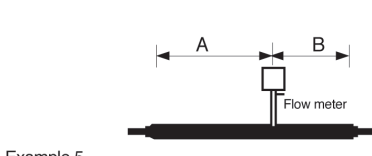
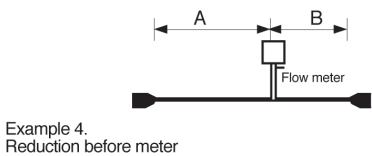
Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance 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 3. Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)



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

## DESCRIPTION

### 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<sup>-9</sup> 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

## 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)

### 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 50° C ambient

Chinese pattern approval

GOST R/RTN (1ExdIICT6...T2)

Features								Options						
640S	-		-		-		-		-		-		-	
Parent		1		2		3		4		5		6		7

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

Parent Number	
<b>640S</b>	Steel Mass 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). See gas table for pressure limits. 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	
<b>NAA</b>	Non-agency approved meter
<b>ATEX</b>	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
<b>FM</b>	640S with FM Approval. Requires E2 or E4 enclosure. Maximum probe length is 72 inches (1.83 m)
<b>CSA</b>	640S with CSA Approval. Requires E2 or E4 enclosure. Maximum probe length is 72 inches (1.83 m)

Feature 2: Probe Length			
<b>L06</b>	6 inch (15 cm)	<b>L24</b>	24 inch (61 cm)
<b>L09</b>	9 inch (23 cm)	<b>L36</b>	36 inch (92 cm)
<b>L13</b>	13 inch (33 cm)	<b>L42</b>	42 inch (122 cm)
<b>L18</b>	18 inch (46 cm)		
<b>L ( ) M5</b>	Probe with 1 inch, class 150 Flange Specify length between flange face and center of pipe in parentheses. Include M5 option Diagram with ADS. Don't select a probe length from Feature 2. Note 1: Killark seal is required for FM and CSA agency approved meters greater than L13 (33 cm). Adds 6.2 in (157 mm) to probe length listed above.		
<b>L ( ) M9</b>	High pressure hot-tap with removable retractor kit assembly includes probe (probe length L in parentheses. Available in lengths per feature. 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 500 psig (34.5 barg). Not available with ATEX, FM, CSA or EN enclosure.		

Note 1: Killark seal is required for FM and CSA agency approved meters greater than L13 (33 cm).

Adds 6.2 in (157 mm) to probe length listed above.

Feature 3: Mounting Accessories	
<b>M0</b>	None. Customer to supply own mounting hardware
<b>M1</b>	Compression fitting 3/4-inch with 1-inch NPT Male
<b>M2 ( )</b>	Threadolet 1-inch Female NPT; specify pipe O.D. in parenthesis
<b>M1-M2 ( )</b>	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.
<b>M3</b>	Flat duct bracket. 3/4-inch tube compression fitting
<b>M4 ( )</b>	Curved duct bracket. 3/4-inch tube compression fitting. Specify duct O.D. in parentheses
<b>M8 ( )</b>	Low pressure hot tap. Includes ball valve and packing gland. Specify duct O.D. in parentheses. Maximum 150 psig (10.3 barg). Maximum temperature 425°F (218°C).
<b>M15</b>	Quick removal Hot-Tap. Includes ball valve and compression fitting. Rated for 40 psig (2.8 barg)

Feature 4: Electronics Enclosure	
<b>E2</b>	Hazardous-area location enclosure (IP66) Mounted directly on probe
<b>E3 ( )</b>	Remote probe and flow body 10, 25, 50, 100 feet (select one) away from the probe.
<b>E4 ( )</b>	Remote Hazardous-Area Location Enclosure (IP66) with Junction Box
<b>EN2</b>	NEMA 4X (IP65) enclosure. Mounted directly on probe
<b>EN4 ( )</b>	Remote NEMA 4X (IP65) Enclosure with Junction Box.

Note: E4, EN4: 10, 25, 50, 100 feet (select one) away from the probe with junction box mounted on probe. Customer may cut cable length with no effect on accuracy.

Feature 5: Input Power	
<b>P2</b>	18–30 VDC
<b>P3</b>	100–240 VAC. Not available with EN enclosures

Feature 6: Output	
<b>V1</b>	0-5 VDC, linear
<b>V3</b>	0-10 VDC, linear
<b>V4</b>	4-20 mA, linear

Feature 7: Display	
<b>NR</b>	No readout
<b>DD</b>	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
<b>DD-NRT</b>	Totalizer cannot be reset in the field.

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

Option 1: Digital Communications	
<b>Pulse</b>	Totalizer pulse output (Only available with E2/E3/E4 enclosures WITH DD. Available on ALL EN2 Enclosures)
<b>MB</b>	Modbus RTU with full device description (P2 only); ATEX and FM approvals available

Note: Only MB require DC power (P2).

Option 2: Purge	
<b>PURGE</b>	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 or E4 only (NAA only). Not available with HT option (Contact factory in this case for external purge solution). Does not include on/off valve. Note: Only a 24 VDC power input is available when ordering an internal purge option.

Option 3: High Temperature	
<b>HT</b>	HT option to 750°F (400°C). Requires remote (E4 or EN4). Contact factory for probe length. Note: Overall accuracy of HT may be de-rated due to temperature and velocity conditions. <b>NAA only.</b>

Note: <sup>1</sup>Correlation calibration - consult Gas Table for accuracy.

Option 4: Certificates	
<b>MC</b>	Material certificates--US Mill certs on all wetted parts
<b>CC</b>	Certificate of conformance
<b>NACE</b>	NACE certificate for sour gas
<b>LT</b>	Leak test certificate
<b>PT</b>	Pressure test certificate
<b>CO</b>	Stamped Certificate of Origin

Option 5: O2 Cleaning	
<b>O2C</b>	O2 Cleaning. Includes certification. Product cleaned for O2 service. Inspected with Ultra-Violet light only, double-bagged prior to shipment.



## North America

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