

# In-Line Immersible Thermal Gas Mass Flow Meter with Flow Conditioning

## Features

- Direct mass flow monitoring eliminates need for separate temperature and pressure inputs
- Built-in flow conditioner which eliminates velocity-profile distortions caused by upstream disturbances
- 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 and ATEX certified for hazardous areas
- CE approved
- Multipoint options available
- Integrated purge option available
- Optional HART, Modbus and Profibus DP available, Foundation Fieldbus (pending)



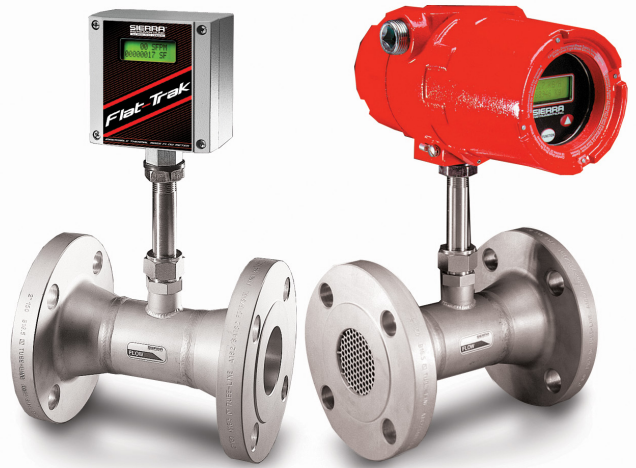
**SIERRA**  
EXPERIENCE OUR PASSION FOR FLOW!

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# Flat-Trak™ Model 780S



## Description

**T**he Flat-Trak™ Model 780S flow body eliminates velocity profile distortions, swirl and temperature stratifications in the gas stream and reduces the amount of upstream piping required for accurate flow measurement.

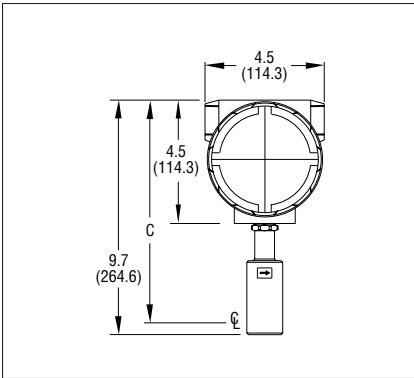
The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing. Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's 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 panel.

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.

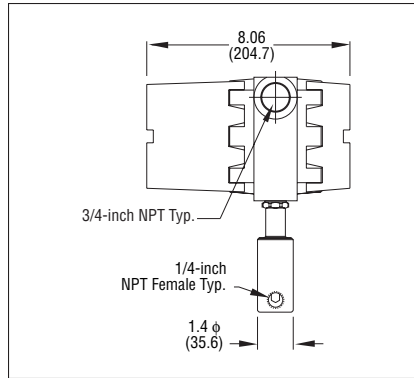
Sierra's Smart Interface™ software guides you through a procedure to fully validate instrument performance. The meter is available with a variety of input power, output signals, mounting and packaging options.

## Dimensional Specifications

1/4-inch NPT—Front View (E2)



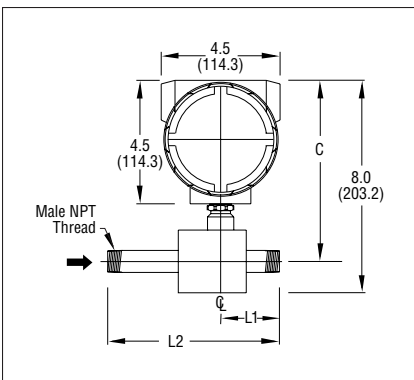
1/4-inch NPT—Side View (E2)



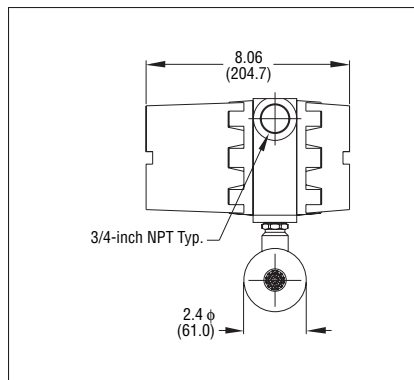
Sizes for NPT

SIZES FOR NPT			
Size	C	L1	L2
1/4-inch	8.40 (198.1)	— (213.4)	—
1/2-inch	6.90 (175.3)	2.20 (55.9)	6.50 (165.1)
3/4-inch	6.90 (175.3)	2.20 (55.9)	7.00 (177.8)
1-inch	9.10 (228.6)	1.50 (38.1)	3.50 (88.9)
1.5-inch	9.40 (238.8)	2.25 (57.2)	5.25 (133.4)
2-inch	10.20 (259.1)	3.50 (88.9)	7.50 (190.5)
3-inch	11.20 (284.5)	4.00 (101.6)	10.00 (254)
4-inch	11.20 (290.8)	4.00 (101.6)	12.00 (304.8)
6-inch	12.20 (309.9)	6.00 (152.4)	18.00 (457.2)
8-inch	13.20	8.00	24.00

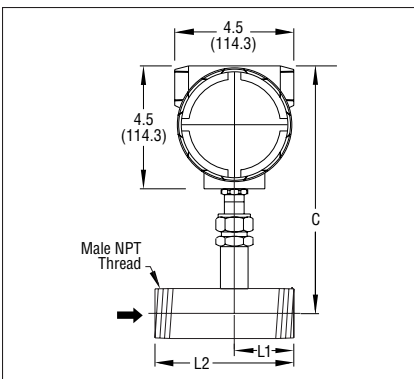
1/2-inch and 3/4-inch NPT—Front View (E2)



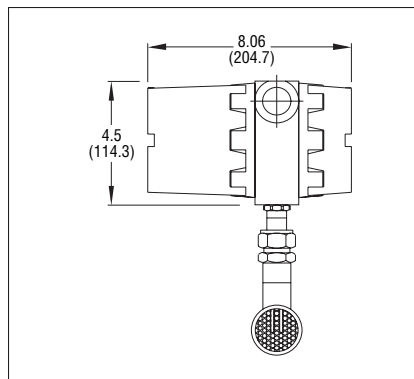
1/2-inch and 3/4-inch NPT—Side View (E2)



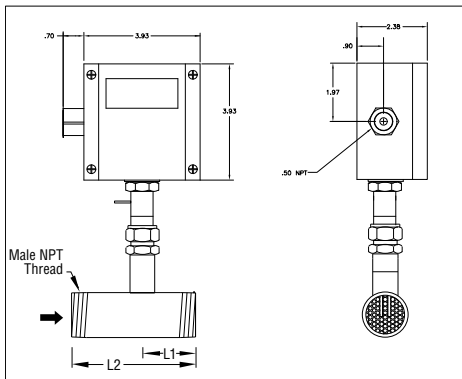
1-inch Through 8-Inch NPT—Front View (E2)



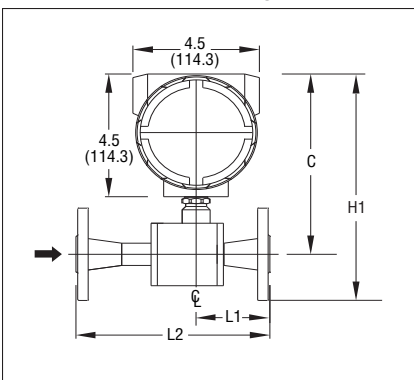
1-inch Through 8-Inch NPT—Side View (E2)



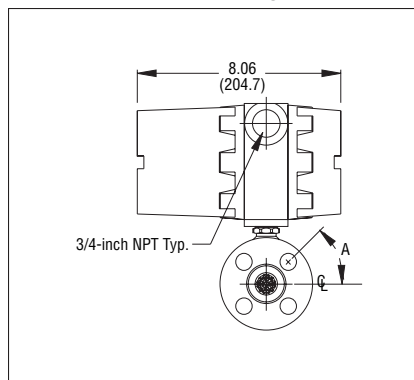
1-inch to 8-Inch NPT—Front/Side View (EN2)



1/2 and 3/4-inch 150 lb Flange—Front View (E2)



1/2 and 3/4-inch 150 lb Flange—Side View (E2)

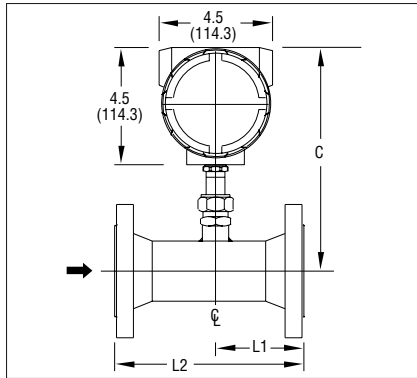


Sizes for 150 lb ANSI Flange

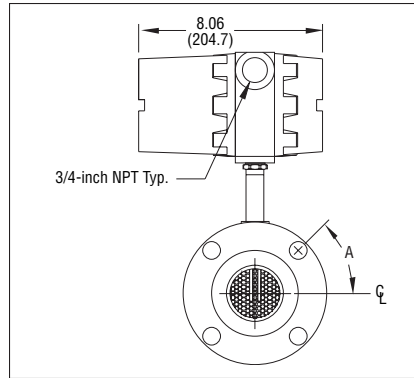
SIZES FOR 150 LB ANSI FLANGES					
Size	H1	C	L1	L2	A
1/2-inch	7.79 (197.9)	6.94 (176.3)	2.60 (66.0)	6.95 (176.5)	45°
3/4-inch	7.79 (197.9)	6.94 (176.3)	2.78 (70.6)	7.56 (192.0)	45°

## Dimensional Specifications

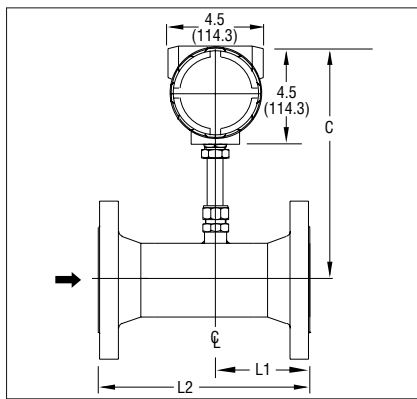
1" Through 8" 150 lb Flange—Front View (E2)



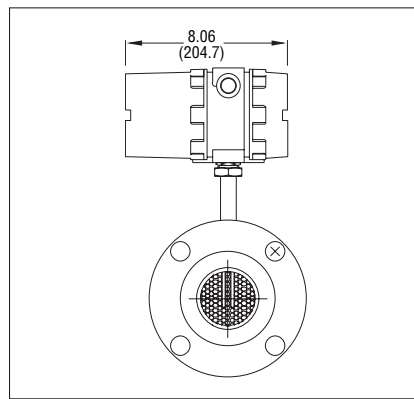
1" Through 8" 150 lb Flange—Side View (E2)



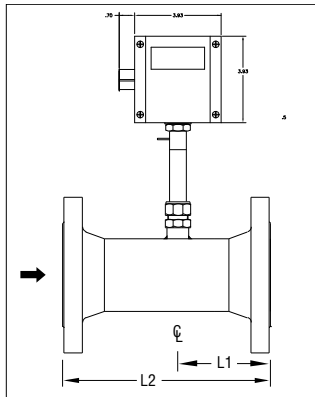
DN Flange—Front View (E2)



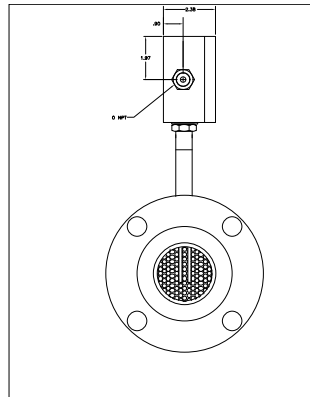
DN Flange—Side View (E2)



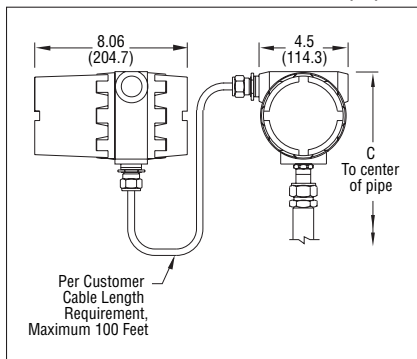
NEMA 4X Enclosure - Front View (EN2)



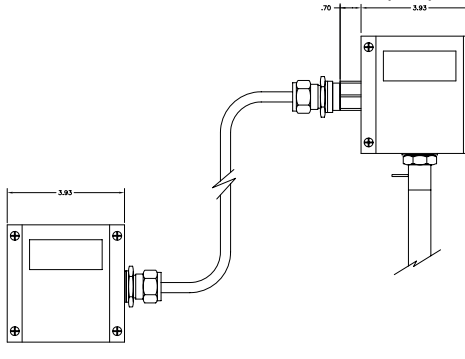
NEMA 4X Enclosure—Side View (EN2)



Remote Mounted with Junction Box (E4)



Remote Mounted with Junction Box (EN4)



SIZES FOR 150 LB ANSI FLANGES

Size	C	L1	L2	A
1-inch	9.10 (238.8)	3.60 (91.4)	7.40 (188.0)	45°
1.5-inch	9.40 (238.8)	3.80 (96.5)	7.50 (190.5)	45°
2-inch	10.20 (259.1)	3.50 (88.9)	7.50 (190.5)	45°
3-inch	11.20 (284.5)	4.00 (101.6)	10.00 (254.0)	45°
4-inch	11.20 (284.5)	4.00 (101.6)	12.00 (304.8)	22.5°
6-inch	12.20 (309.9)	6.00 (152.4)	18.00 (457.2)	22.5°
8-inch	13.20 (335.3)	8.00 (203.2)	24.00 (609.6)	22.5°

SIZES FOR PN16 DN FLANGES

Size	C	L1	L2
DN25	8.88 (225.6)	3.18 (80.8)	7.40 (188.0)
DN40	9.50 (241.3)	3.61 (91.7)	7.40 (188.0)
DN50	10.70 (271.8)	3.34 (84.8)	7.10 (180.3)
DN80	10.50 (266.7)	4.14 (105.2)	10.20 (259.1)
DN100	10.60 (269.2)	4.57 (116.1)	12.60 (320.0)
DN150	12.40 (315.0)	6.77 (172.0)	18.90 (480.1)
DN200	14.50 (368.3)	8.47 (215.1)	24.40 (619.8)

SIZES FOR REMOTE MOUNTED

Size	C
1/4 - inch	8.4 (198.1)
1/2-inch	6.9 (175.3)
3/4-inch	6.9 (175.3)
1-inch	9.10 (231.1)
1.5-inch	9.40 (238.8)
2-inch	10.20 (259.1)
3-inch	11.20 (284.5)
4-inch	11.20 (284.5)
6-inch	12.20 (309.9)
8-inch	13.20 (335.3)

## Performance Specifications

### Accuracy

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

### 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 L stainless steel

### Gas Pressure (2 limitations)

Mechanical design pressure:

Compression fittings: 500 psig (34.5 barg)

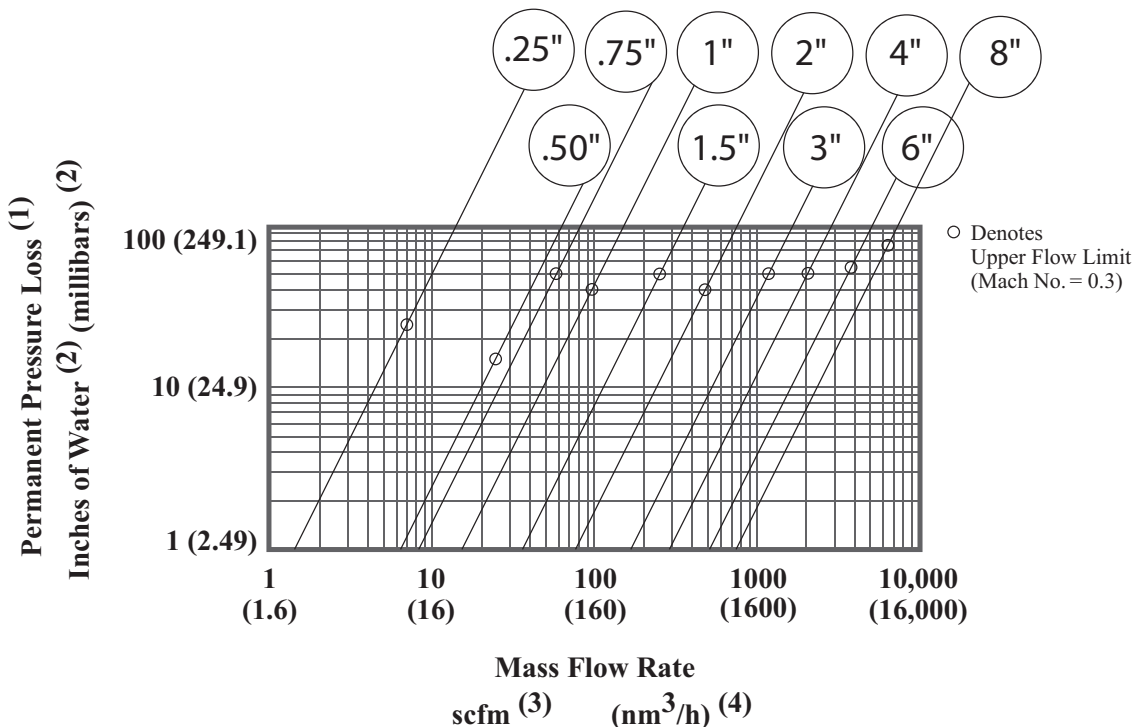
150 lb flange or PN16 DN (-40° F to 100° F): 230 psig (15.9 barg)

150 lb flange or PN16 DN (250° F): 185 psig (12.8 barg)

150 lb flange or PN16 DN (450° F): 155 psig (10.7 barg)

NPT (-40° F to 250° F): 500 psig (34.5 barg)

## Pressure Drop



### Notes:

(1) For air and nitrogen at 20 °C temperature and 1 atmosphere pressure.

(2) 1 inch of water at 60 °F = 0.0361 psi.

1 millibar = 0.001 bar = 100 pascal = 0.0145 psi.

(3) At base conditions of 21.1 °C temperature and 1 atmosphere pressure.

(4) At base conditions of 0 °C temperature and 1 atmosphere pressure.

(5) Built-in flow conditioner consists of two separate perforated plates in series.

## Operating Specifications (cont.)

### Gas & Ambient Temperature

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

### 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)  
 See Digital Communications options below

### 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

Seven digits (9,999,999) 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  
     Fully guided flow meter validation

## 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

## Physical Specifications

### Wetted Materials

316L stainless steel  
 Carbon steel flow bodies available in some sizes

### Enclosure

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

### Piping Requirements

STRAIGHT PIPE LENGTH REQUIREMENTS AT 1 ATM			
Piping Condition	780S Flat-Trak™		Orifice Plate <sup>(3)</sup>
	Upstream <sup>(1)</sup>	Downstream <sup>(2)</sup>	
Single 90° Elbow or T-Piece	1D	0D	28D
Reduction (4:1)	3D	0D	14D
Expansion (4:1)	3D	0D	30D
After Control Valve	3D	0D	32D
Two 90° Elbows (In Same Plane)	3D	0D	36D
Two 90° Elbows (Different Planes)	5D	0D	62D

- Notes: (1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.  
 (2) Number of diameters (D) of straight pipe required downstream of the flow meter.  
 (3) For comparison purposes only. Table shows number of diameters (D) of upstream straight pipe length required for an ISO Standard 5167 Orifice Plate with a Beta Ratio of 0.7.  
 (4) Consult factory for pressure effects.

### 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  
 PED optional

# Ordering the Model 780S

**780S**

List Options

**PARENT MODEL NUMBER**  
**780S** Flat-Trak™ Immersible Thermal In-Line Meter

**AGENCY APPROVALS**  
**NAA** Non-Agency Approved Meter  
**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

**FLOW BODY—STAINLESS STEEL**

NPT	ANSI Flange	DN Flange		Size
	150 lb	PN16	PN40	
N1	N/A			1/4-inch
N2	F2			1/2-inch
N3	F3			3/4-inch
N4	F4	D4	GD4	1-inch (DN25)
N5	F5	D5	GD5	1.5-inch (DN40)
N6	F6	D6	GD6	2-inch (DN50)
N7	F7	D7	GD7	3-inch (DN80)
N8	F8	D8	GD8	4-inch (DN100)
N9	F9	D9	GD9	6-inch (DN150)
N10	F10	D10	GD10	8-inch (DN200)

**ENCLOSURES**  
**E2** Hazardous-Area Location Enclosure  
**E3(ft)** Remote Hazardous-Area Location Enclosure (Only with ATEX Meters)  
**E4(ft)** Remote Hazardous-Area Location Enclosure with Junction Box  
**EN2** NEMA 4X (IP65)  
**EN4(ft)** Remote NEMA 4X (IP65) with Junction Box  
 Specify Cable Length in Parentheses, Maximum 200 feet (60 m), Length in Feet using 5 ft. increments to 20 ft., 10 ft. increments to 200 ft.

**INPUT POWER**  
**P2** 18 to 30 VDC  
**P3** 100 to 240 VAC (Not Available on EN enclosures)

**OUTPUT SIGNAL**  
**V1** 0–5 VDC, Linear  
**V3** 0–10 VDC, Linear  
**V4** 4–20 mA, Linear

**DISPLAY**  
**NR** No Readout  
**DD** Digital Display

**GAS CODE**

0	Air
1	Argon
2	CO <sub>2</sub>
3	Chlorine (Correlation)
4	Digester
5	Digester (Correlation)
6	Helium
7	Hydrogen
8	CH <sub>4</sub>
9	CH <sub>4</sub> (Correlation)
10	Nitrogen
11	Oxygen (Correlation)
12	Propane
13	Propane (Correlation)
99	Other

**OPTION 1 (DIGITAL COMMUNICATIONS)**  
**PULSE** Pulse (not avail. w/ E2-NR)  
**MB** Modbus (not avail. w/ P3)  
**DP** Profibus DP (available E2/E4-P2 config only)  
**HART** Universal Commands (available E2/E4-P2 config only)  
**FF** Foundation Fieldbus (available E2/E4-P2 config only) Pending

**OPTION 2 (CERTIFICATES)**  
**PT** Pressure Test Certificate  
**CC** Certificate of Conformance  
**NC** NACE Certificate  
**MC** Materials Certificate  
**LT** Leak Test Certificate