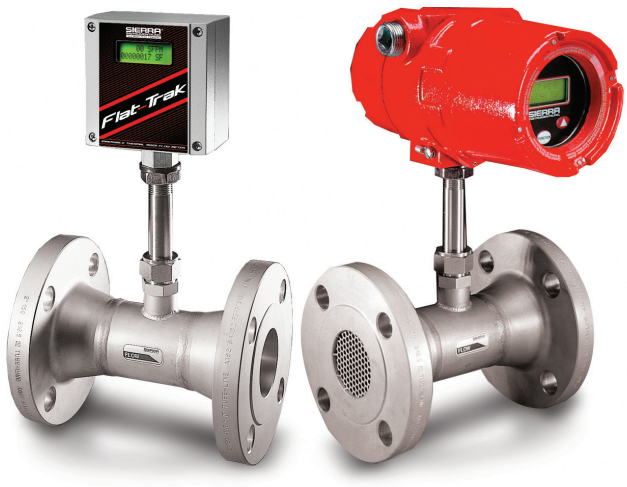
In-Line Immersible Thermal Gas Mass Flow Meter with Flow Conditioning

FlatTrak™ 780S

Features

- Direct mass flow monitoring eliminates need for seperate tem-perature 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



Description

The FlatTrak™ 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 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.

SIERRA®

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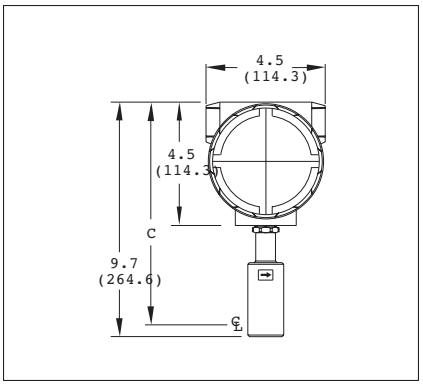
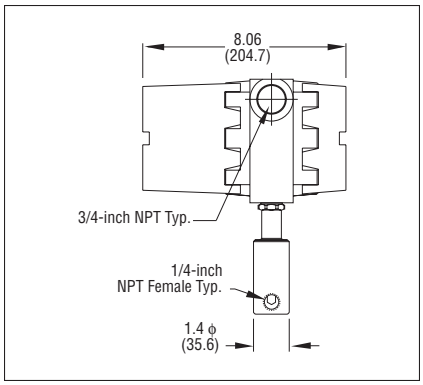
Dimensional Specifications

1/4-inch NPT—Front View (E2)



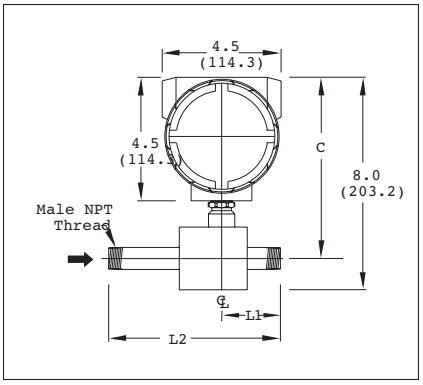
1/4-inch NPT—Side View (E2)



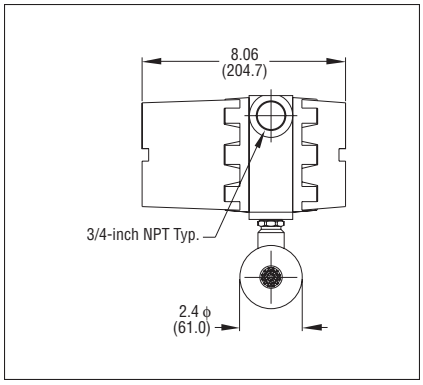
Sizes for NPT

SIZES FOR NPT			
Size	C	L1	L2
1/4-inch	8.40 (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 (335.3)	8.00 (203.2)	24.00 (609.6)

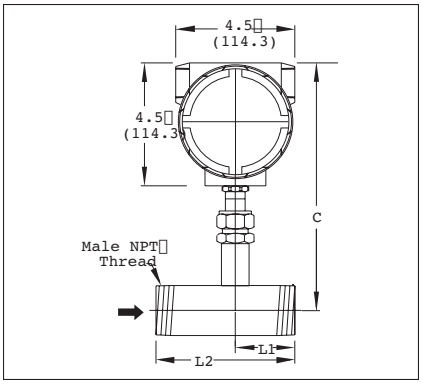
1/2-inch and 3/4-inch NPT—Front View (E2)



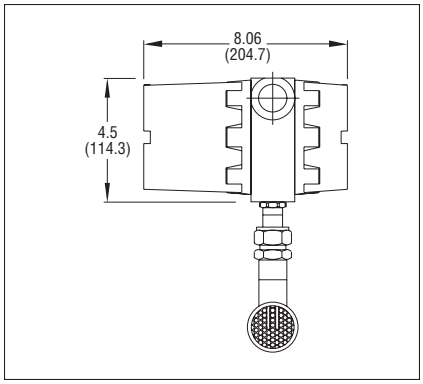
1/2-inch and 3/4-inch NPT—Side View (E2)



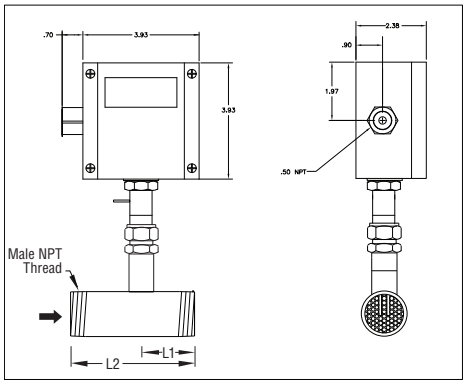
1-inch Through 8-Inch NPT—Front View (E2)



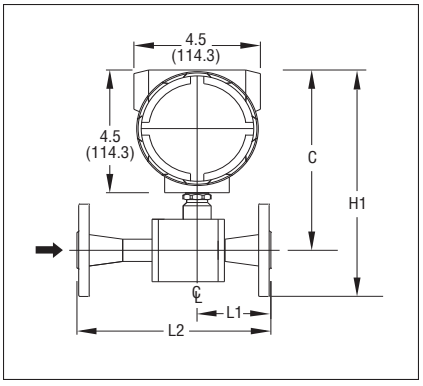
1-inch Through 8-Inch NPT—Side View (E2)



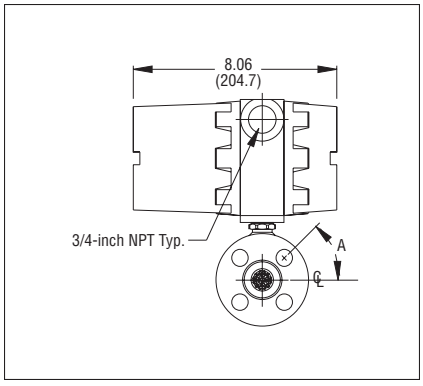
1-inch to 8-Inch NPT—Front/Side View (EN2)



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



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



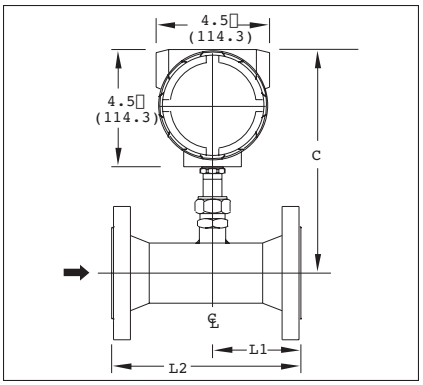
Sizes for 150 lb ANSI Flange

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°

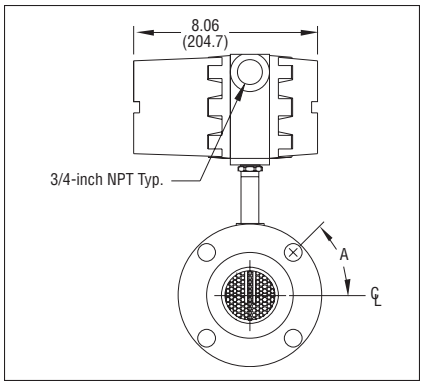
All dimensions are inches. Millimeters are in parentheses. All drawings have a +/-.25-inch (6.4 mm) tolerance. Certified drawings are available on request.

Dimensional Specifications

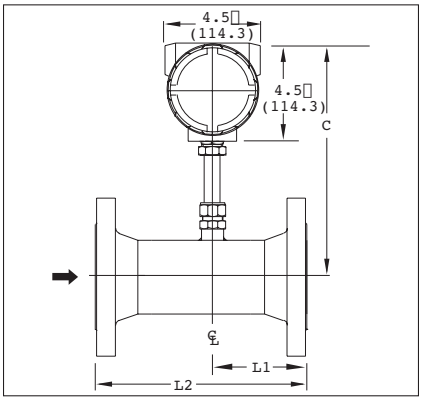
1" Through 8" 150 lb Flange—Front View (E2)



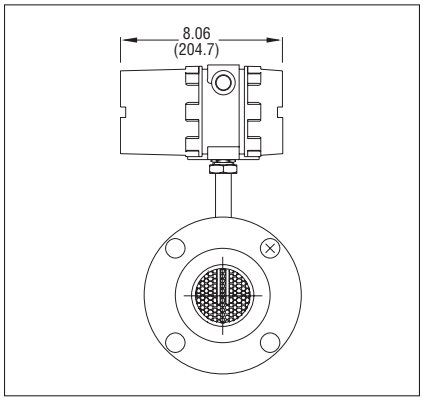
1" Through 8" 150 lb Flange—Side View (E2)



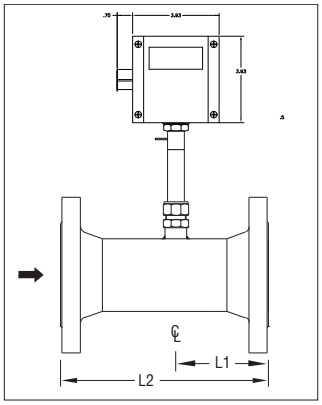
DN Flange—Front View (E2)



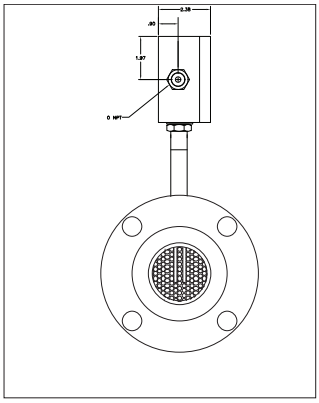
DN Flange—Side View (E2)



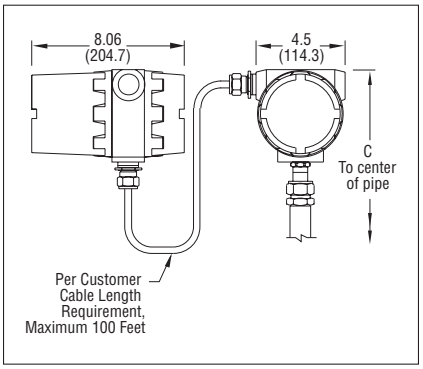
NEMA 4X Enclosure - Front View (EN2)



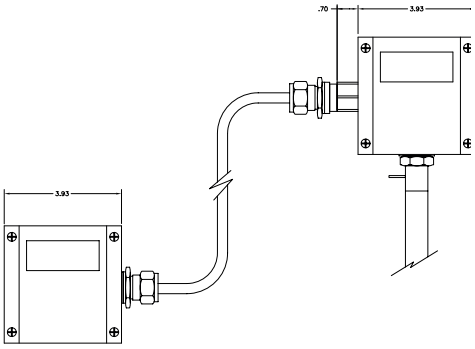
NEMA 4X Enclosure—Side View (EN2)



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)

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

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

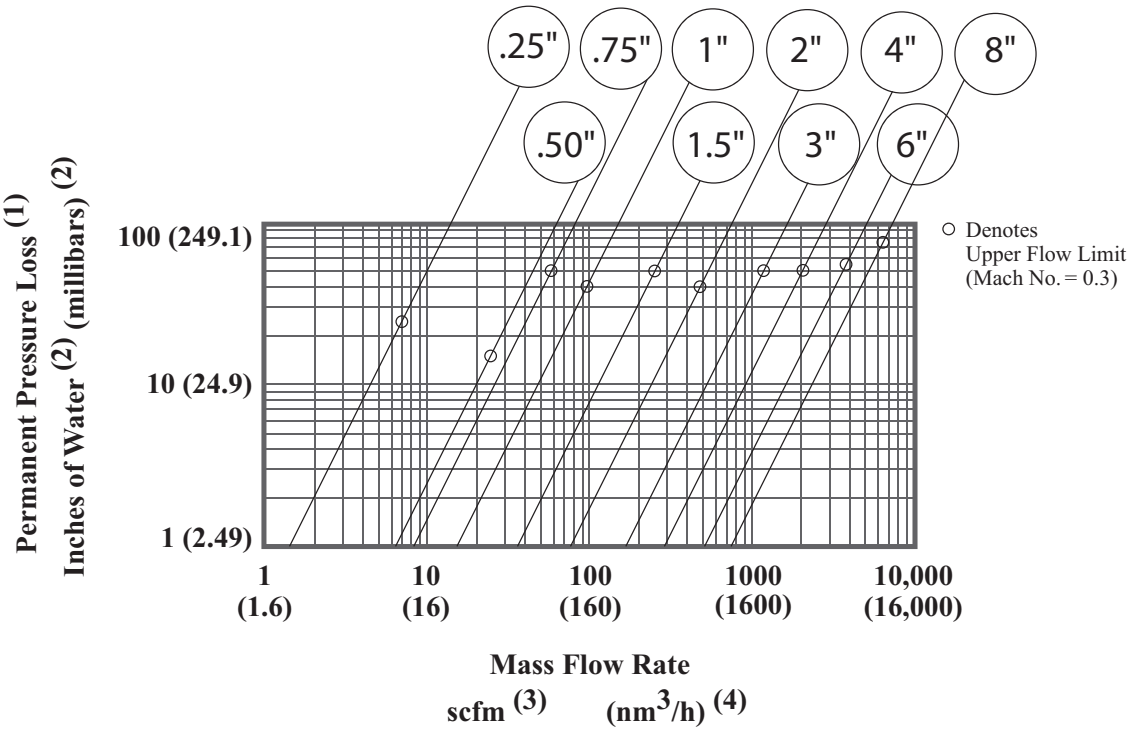
Response Time
One second to 63% of final velocity value

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^{-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

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 (1Hz max, 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)

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			
	780S FlatTrak™		Orifice Plate[3]
Piping Condition	Upstream[1]	Downstream[2]	
Single 90° Elbow or T-Piece	1D	0D	28D
Same Plane	3D	0D	14D
Different Plane	3D	0D	30D
Reduction	3D	0D	32D
Expansion	3D	0D	36D
After Control Valve	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 780S

								List Options

PARENT NUMBER

780S	FlatTrak™ In-line Mass Flow Meter with Flow Conditioner.

AGENCY APPROVALS

NAA	Non-agency approved meter
ATEX	780S with II 2 GD Ex d IIC T2...T6 ATEX Approval. Requires E2 or E3 enclosure. Note: ATEX units have circuit energy limitations that limit maximum flows to approx. 50% of non-ATEX units. Consult gas tables for details.
FM	780S with FM approval. Requires E2 or E4 enclosure
CSA	780S with CSA approval. Requires E2 or E4 enclosure

FLOW BODY—STAINLESS STEEL

	ANSI Flange	DN Flange		
NPT	150 lb	PN16	PN40	Size
N1	N/A	FD6	GD4	1/4-inch
N2	F2	FD7	GD5	1/2-inch
N3	F3	FD8	GD6	3/4-inch
N4	F4	FD9	GD7	1-inch (DN25)
N5	F5	FD10	GD8	1.5-inch (DN40)
N6	F6		GD9	2-inch (DN50)
N7	F7		GD10	3-inch (DN80)
N8	F8			4-inch (DN100)
N9	F9			6-inch (DN150)
N10	F10			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	8	Methane
1	Argon	9	Methane[1]
2	Carbon dioxide	10	Nitrogen
3	Chlorine[1]	11	Oxygen[1]
4	Digester gas	12	Propane
5	Digester gas[1]	13	Propane[1]
6	Helium	14	Ammonia[1]
7	Hydrogen	99	Other--Consult Factory Gas Table

[1]Correlation calibration - consult Gas Table for accuracy.

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 (CERTIFICATES)

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

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