

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

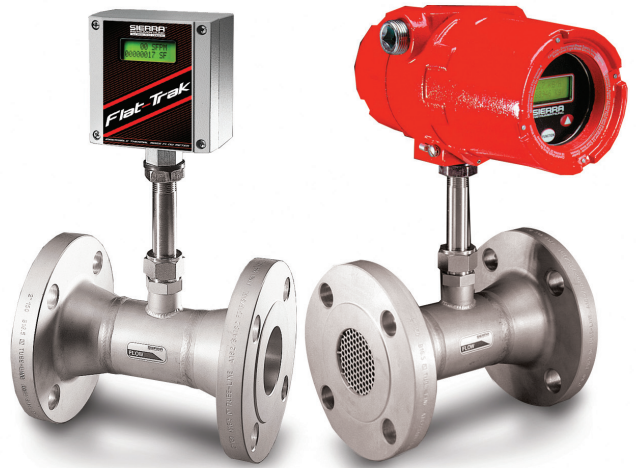


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FlatTrak™ 780S



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.

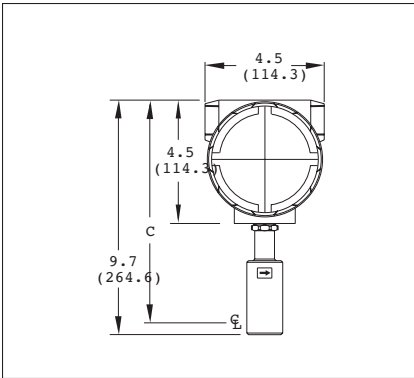
The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing. Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's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

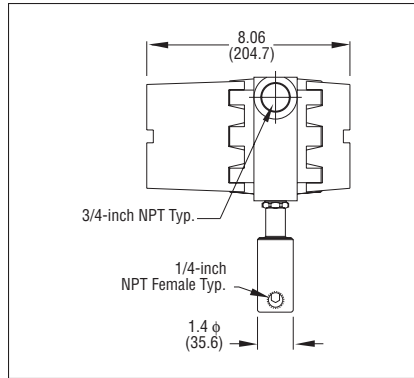
Sierra's Smart Interface™ software guides you through a procedure to fully validate instrument performance. The meter is available with a variety of input power, output signals, mounting and packaging options.

Dimensional Specifications

1/4-inch NPT—Front View (E2)



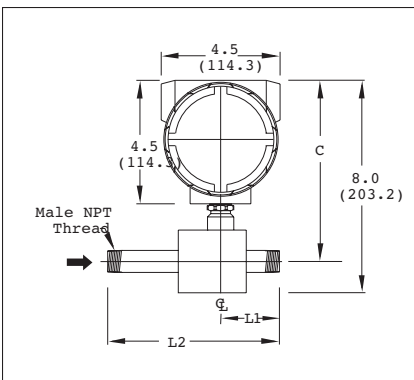
1/4-inch NPT—Side View (E2)



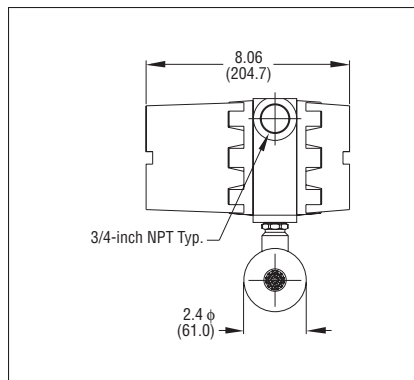
Sizes for NPT

| 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 (335.3) | 8.00 (203.2) | 24.00 (609.6) |

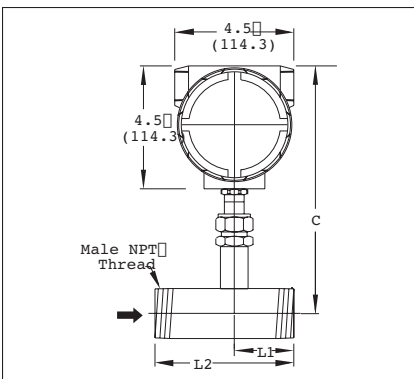
1/2-inch and 3/4-inch NPT—Front View (E2)



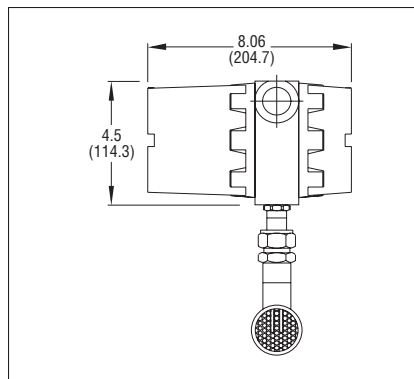
1/2-inch and 3/4-inch NPT—Side View (E2)



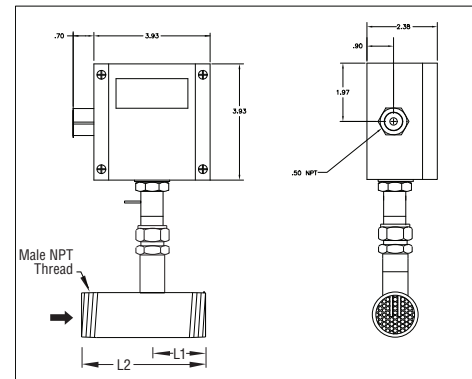
1-inch Through 8-Inch NPT—Front View (E2)



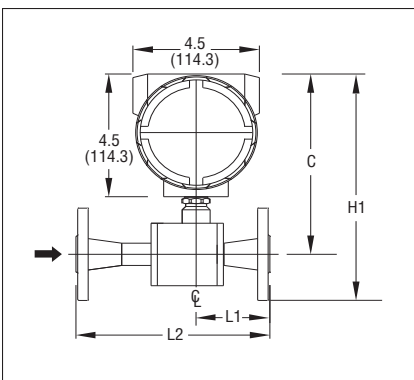
1-inch Through 8-Inch NPT—Side View (E2)



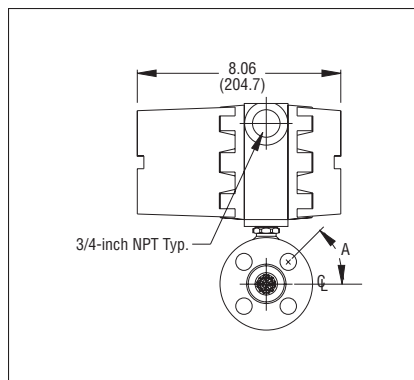
1-inch to 8-Inch NPT—Front/Side View (EN2)



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



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

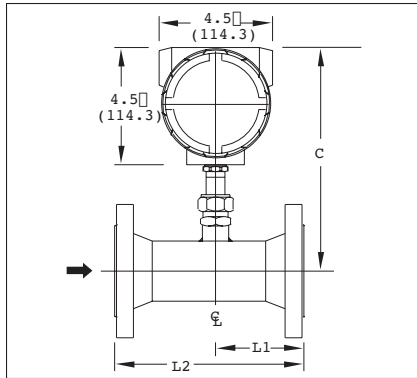


Sizes for 150 lb ANSI Flange

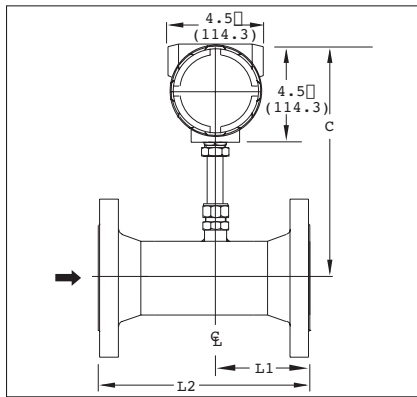
| SIZES FOR 150 LB ANSI FLANGES | | | | | |
|-------------------------------|-----------------|-----------------|----------------|-----------------|-----|
| Size | H1 | C | L1 | L2 | A |
| 1/2-inch | 7.79 (197.9) | 6.94 (176.3) | 2.60 (66.0) | 6.95 (176.5) | 45° |
| 3/4-inch | 7.79 (197.9) | 6.94 (176.3)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

Dimensional Specifications

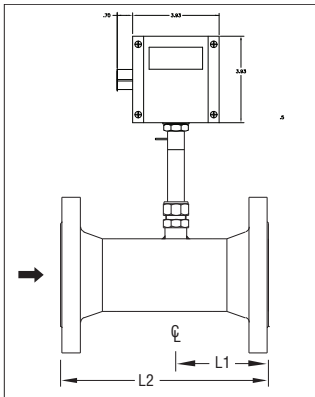
1" Through 8" 150 lb Flange—Front View (E2)



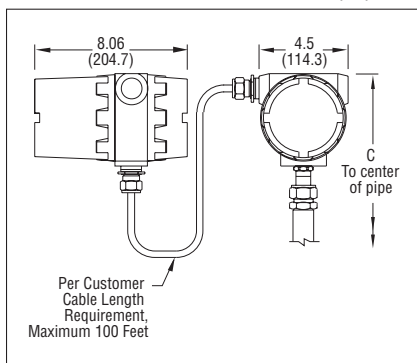
DN Flange—Front View (E2)



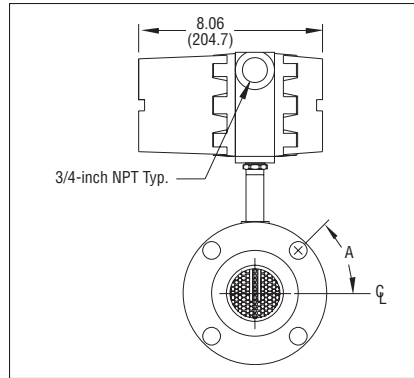
NEMA 4X Enclosure - Front View (EN2)



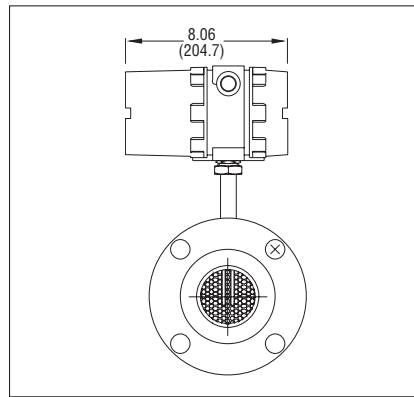
Remote Mounted with Junction Box (E4)



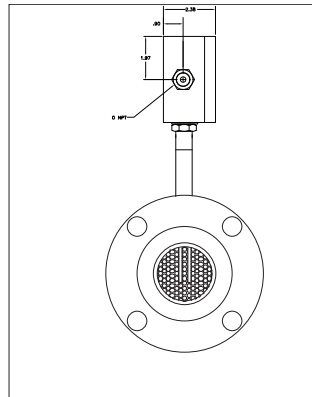
1" Through 8" 150 lb Flange—Side View (E2)



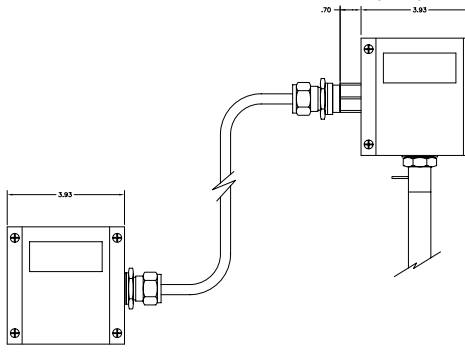
DN Flange—Side View (E2)



NEMA 4X Enclosure—Side View (EN2)



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)

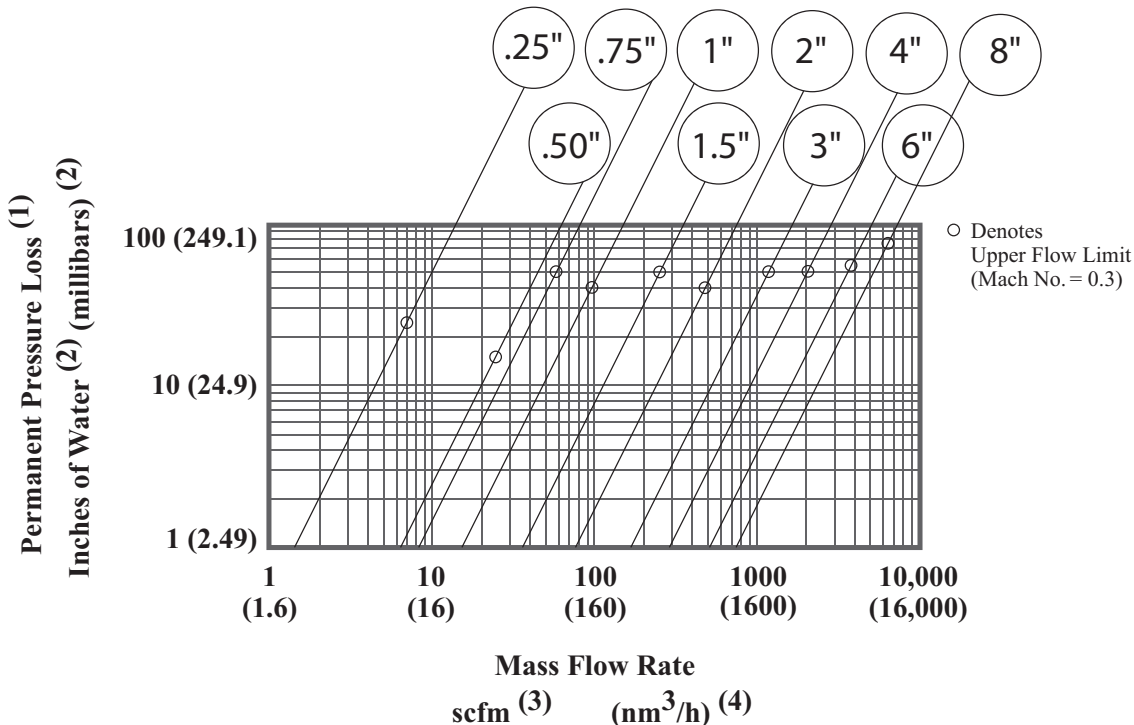
150 lb flange or PN16 DN (-40° F to 100° F): 230 psig (15.9 barg)

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 10⁻⁹ 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

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 | | | |
|--|-------------------------|---------------------------|------------------------------|
| Piping Condition | 7805 FlatTrak™ | | Orifice Plate ⁽³⁾ |
| | Upstream ⁽¹⁾ | Downstream ⁽²⁾ | |
| 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 780S

| | 780S | | | | | | | | List Options | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------|--|-----------|------|--|--|--|--|-----------------|-----|-------------|--|-----------|--|------|--------|--|------|------|----|-----|--|--|--|----------|----|----|--|--|--|----------|----|----|--|--|--|----------|----|----|--|----|-----|---------------|----|----|--|----|-----|-----------------|----|----|--|----|-----|---------------|----|----|--|----|-----|---------------|----|----|--|----|-----|----------------|----|----|--|----|-----|----------------|-----|-----|--|-----|------|----------------|
| PARENT NUMBER 780S FlatTrak™ 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 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">NPT</th> <th colspan="2">ANSI Flange</th> <th colspan="2">DN Flange</th> <th rowspan="2">Size</th> </tr> <tr> <th>150 lb</th> <th></th> <th>PN16</th> <th>PN40</th> </tr> </thead> <tbody> <tr><td>N1</td><td>N/A</td><td></td><td></td><td></td><td>1/4-inch</td></tr> <tr><td>N2</td><td>F2</td><td></td><td></td><td></td><td>1/2-inch</td></tr> <tr><td>N3</td><td>F3</td><td></td><td></td><td></td><td>3/4-inch</td></tr> <tr><td>N4</td><td>F4</td><td></td><td>D4</td><td>GD4</td><td>1-inch (DN25)</td></tr> <tr><td>N5</td><td>F5</td><td></td><td>D5</td><td>GD5</td><td>1.5-inch (DN40)</td></tr> <tr><td>N6</td><td>F6</td><td></td><td>D6</td><td>GD6</td><td>2-inch (DN50)</td></tr> <tr><td>N7</td><td>F7</td><td></td><td>D7</td><td>GD7</td><td>3-inch (DN80)</td></tr> <tr><td>N8</td><td>F8</td><td></td><td>D8</td><td>GD8</td><td>4-inch (DN100)</td></tr> <tr><td>N9</td><td>F9</td><td></td><td>D9</td><td>GD9</td><td>6-inch (DN150)</td></tr> <tr><td>N10</td><td>F10</td><td></td><td>D10</td><td>GD10</td><td>8-inch (DN200)</td></tr> </tbody> </table> | | | | | | | | | | 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) |
| 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 ₂ 3 Chlorine (Correlation) 4 Digester 5 Digester (Correlation) 6 Helium 7 Hydrogen 8 CH ₄ 9 CH ₄ (Correlation) 10 Nitrogen 11 Oxygen (Correlation) 12 Propane 13 Propane (Correlation) 99 Other | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OPTION 1 (DIGITAL COMMUNICATIONS) PULSE Totalizer pulse output (1 Hz max, not available with E2-NR) MB Modbus communications (not available with P3 option) FF Foundation Fieldbus output with full device description (DD) (available E2/ E4–P2 config only) DP1 Profibus DP using an M12 connector (available E2/ E4–P2, NAA config only) DP2 Profibus DP using a 2-wire terminal block connection (available E2/ E4–P2 config only) HART HART universal commands (available E2/ E4–P2 config only) | | | | | OPTION 2 (CERTIFICATES) PT Pressure Test Certificate CC Certificate of Conformance NC NACE Certificate MC Materials Certificate LT Leak Test Certificate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |