Smart In-Line
Thermal Gas Mass
Flow Meter with
Flow Conditioner

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 MODBUS, Foundation Field BUS and Proibus PA available

Description

The 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.

For information online...
www.sierrainstruments.com
Dimensional Specifications

1/4-inch NPT—Front View (E2)

1/4-inch NPT—Side View (E2)

NEMA 4X Enclosure (EN2)

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)

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

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

### SIZES FOR NPT

<table>
<thead>
<tr>
<th>Size</th>
<th>H1</th>
<th>C</th>
<th>L1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4-inch</td>
<td>7.80</td>
<td>8.40</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1/2-inch</td>
<td>6.30</td>
<td>6.90</td>
<td>2.20</td>
<td>6.50</td>
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<tr>
<td>3/4-inch</td>
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<td>6.90</td>
<td>2.20</td>
<td>7.00</td>
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<tr>
<td>1-inch</td>
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<td>5.25</td>
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<td>3.50</td>
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<tr>
<td>8-inch</td>
<td>12.60</td>
<td>13.20</td>
<td>8.00</td>
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### SIZES FOR 150 LB ANSI FLANGES

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<th>A</th>
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<tr>
<td>1/2-inch</td>
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<td>6.94</td>
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<td>6.95</td>
<td>45*</td>
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<td>3/4-inch</td>
<td>7.79</td>
<td>6.94</td>
<td>2.78</td>
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</table>

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)

![Diagram](image1)

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

![Diagram](image2)

#### DN Flange—Front View (E2)

![Diagram](image3)

#### DN Flange—Side View (E2)

![Diagram](image4)

#### Remote Mounted with Junction Box (E4)

![Diagram](image5)

#### Remote Mounted with Junction Box (EN4)

![Diagram](image6)

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### SIZES FOR 150 LB ANSI FLANGES

<table>
<thead>
<tr>
<th>Size</th>
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<th>L1</th>
<th>L2</th>
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<td>9.10</td>
<td>3.60</td>
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<td>45°</td>
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<tr>
<td>1.5-inch</td>
<td>8.80</td>
<td>9.40</td>
<td>3.80</td>
<td>7.50</td>
<td>45°</td>
</tr>
<tr>
<td>2-inch</td>
<td>9.60</td>
<td>10.20</td>
<td>3.50</td>
<td>7.50</td>
<td>45°</td>
</tr>
<tr>
<td>3-inch</td>
<td>10.60</td>
<td>11.20</td>
<td>4.00</td>
<td>10.00</td>
<td>45°</td>
</tr>
<tr>
<td>4-inch</td>
<td>10.60</td>
<td>11.20</td>
<td>4.00</td>
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<td>22.5°</td>
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<tr>
<td>6-inch</td>
<td>11.60</td>
<td>12.20</td>
<td>6.00</td>
<td>18.00</td>
<td>22.5°</td>
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<tr>
<td>8-inch</td>
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<td>13.20</td>
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<td>24.00</td>
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### SIZES FOR PN16 DN FLANGES

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<td>7.10</td>
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<tr>
<td>DN80</td>
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<td>DN100</td>
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<td>4.57</td>
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<tr>
<td>DN150</td>
<td>11.80</td>
<td>12.40</td>
<td>6.77</td>
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<td>DN200</td>
<td>13.90</td>
<td>14.50</td>
<td>8.47</td>
<td>24.40</td>
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### SIZES FOR REMOTE MOUNTED

<table>
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<th>Size</th>
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<tbody>
<tr>
<td>1/4-inch</td>
<td>6.28 (159.5)</td>
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<td>1/2-inch</td>
<td>5.21 (132.3)</td>
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<td>3/4-inch</td>
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<tr>
<td>1-inch</td>
<td>6.41 (162.8)</td>
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<td>1.5-inch</td>
<td>6.41 (162.8)</td>
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<tr>
<td>2-inch</td>
<td>7.32 (185.9)</td>
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<tr>
<td>3-inch</td>
<td>8.32 (211.3)</td>
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<tr>
<td>4-inch</td>
<td>6.32 (160.5)</td>
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<tr>
<td>6-inch</td>
<td>8.32 (211.3)</td>
</tr>
<tr>
<td>8-inch</td>
<td>10.32 (262.1)</td>
</tr>
</tbody>
</table>

*All dimensions are inches. Millimeters are in parentheses. All drawings have a ±1/32-inch (0.4 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

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**Operating Specifications**

**Gases**
Most gases compatible with 316 L stainless steel (consult factory)

**Gas Pressure (2 limitations)**
Mechanical design pressure:
- Compression fittings: 500 psig (34.5 barg)
- 150 lb flange or PN 16 DN (-40° F to 100° F): 230 psig (15.9 barg)
- 150 lb flange or PN 16 DN (250° F): 185 psig (12.8 barg)
- 150 lb flange or PN 16 DN (450° F): 155 psig (10.7 barg)
- NPT (-40° F to 250° F): 500 psig (34.5 barg)

**Pressure Drop**

![Diagram of pressure drop](image)

**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.
3. 1 millibar = 0.001 bar = 100 pascal = 0.0145 psi.
4. Mass Flow Rate
   - scfm (3)        (nm3/h) (4)
   - (1.6) (249.1)
   - (16) (1000)
   - (16000)

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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

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,
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)
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
Foundation Fieldbus (read only; flow and totalized flow)
Profibus PA (read only; flow and totalized flow)
MOBDBUS RTU (read/write most parameters)
RS 232 (standard; command set available)

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 Atmosphere

<table>
<thead>
<tr>
<th>Piping Condition</th>
<th>Upstream (1)</th>
<th>Downstream (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single 90° Elbow or T-Piece</td>
<td>1D</td>
<td>0D</td>
</tr>
<tr>
<td>Reduction (4:1)</td>
<td>3D</td>
<td>0D</td>
</tr>
<tr>
<td>Expansion (4:1)</td>
<td>3D</td>
<td>0D</td>
</tr>
<tr>
<td>After Control Valve</td>
<td>3D</td>
<td>0D</td>
</tr>
<tr>
<td>Two 90° Elbows (in Same Plane)</td>
<td>3D</td>
<td>0D</td>
</tr>
<tr>
<td>Two 90° Elbows (Different Planes)</td>
<td>5D</td>
<td>0D</td>
</tr>
</tbody>
</table>

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)
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)
IP66, NEMA 4X T6 -40° C to 70° C ambient
PED optional

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Ordering the Model 780S

Parent MODEL Number
780S Flat-Trak™ Industrial 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
ANSI Flange DIN Flange
NPT 150 lb PN16 PN40 Size
N1 N/A 1/4-inch
N2 F2 1/2-inch
N3 F3 3/4-inch
N4 F4 D4 DD4 1-inch (DN25)
N5 F5 D5 DD5 1.5-inch (DN40)
N6 F6 D6 DD6 2-inch (DN50)
N7 F7 D7 DD7 3-inch (DN80)
N8 F8 D8 DD8 4-inch (DN100)
N9 F9 D9 DD9 6-inch (DN150)
N10 F10 D10 DD10 8-inch (DN200)

ENCLOSURES
E2 Hazardous-Area Location Enclosure
E3(ft) Remote Hazardous-Area Location Enclosure (Only with EEx Meters)
E4(ft) Remote Hazardous-Area Location Enclosure with Junction Box
EN2 NEMA 4X
EN4(ft) Remote NEMA 4X 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 18–30 VDC
P3 100–240 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 CO₂
3 Chlorine (Correlation)
4 Digester
5 Digester (Correlation)
6 Helium
7 Hydrogen
8 CH₄
9 CH₄ (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)
FF Foundation Fieldbus (E2/P2 only)
PB Profibus (E2/P2 only)

OPTION 2 (PURGE)
PURGE Includes valve, tube and purge nozzle.

OPTION 3 (CERTIFICATES)
PT Pressure Test Certificate
CC Certificate of Conformance
NC NACE Certificate
MC Materials Certificate
NC NACE Certificate