

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

### Features

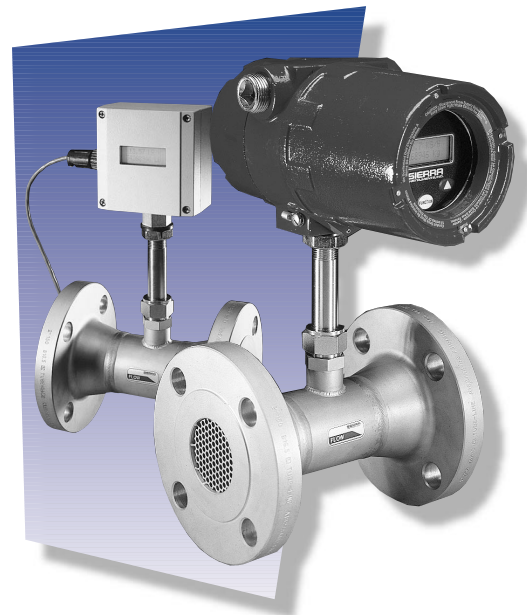
- Field adjustment of critical flow meter settings via on-board switches or Smart Interface™ (RS-232)
- Field validation of flow meter calibration
- Direct mass flow monitoring eliminates need for separate temperature and pressure inputs
- Greatly reduces upstream piping requirements
- Outstanding rangeability
- One-second response to changes in flow rate
- FM, CSA and EEx certified for hazardous areas
- CE approved

**SIERRA**  
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THE MASS FLOW COMPANY

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# 780S Series Flat-Trak™



### Description

**T**he 780S Flat-Trak™ 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 panel. The programmable transmitter is easily configured via RS-232 communication port and interface software, or via the display and membrane switches on the instrument panel.

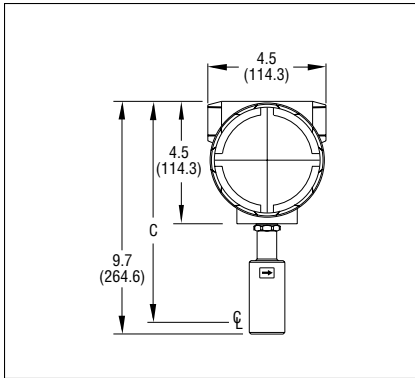
The Series 780S allows you to easily configure or change the following password protected parameters: flow range, totalizer, alarm settings, time response, zero flow cut-off and a calibration correction factor that compensates for flow profile variations.

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.

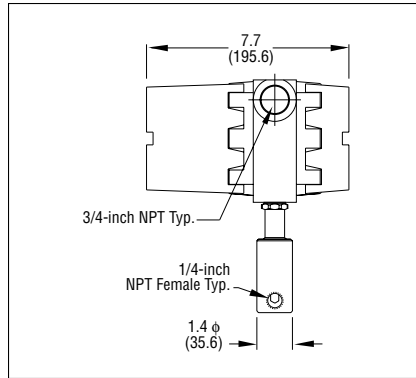
The information contained herein is subject to change without notice.

## Dimensional Specifications

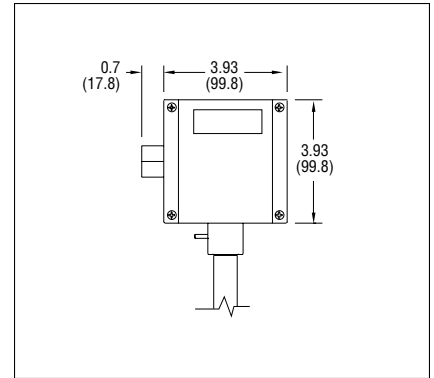
### 1/4-inch NPT—Front View



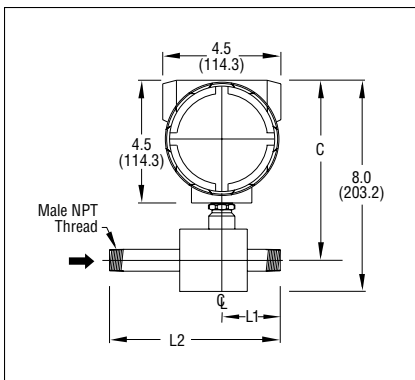
### 1/4-inch NPT—Side View



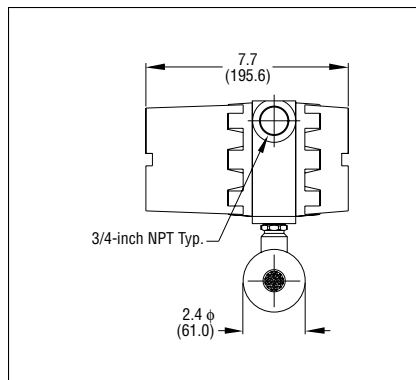
### NEMA 4X Enclosure



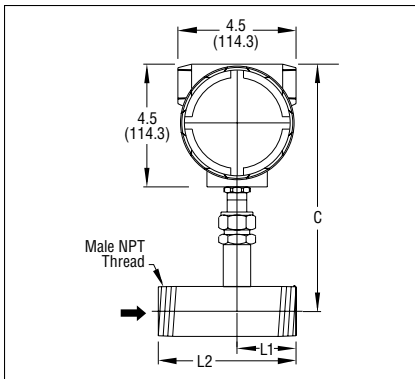
### 1/2-inch and 3/4-inch NPT—Front View



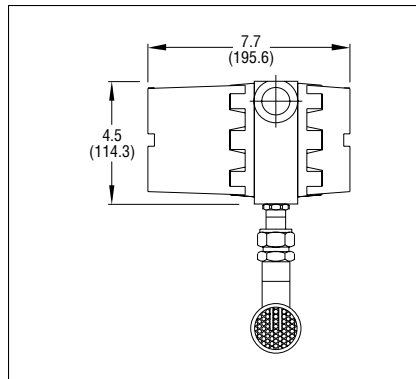
### 1/2-inch and 3/4-inch NPT—Side View



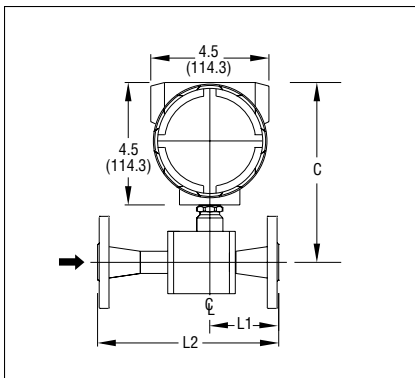
### 1-inch Through 8-inch NPT—Front View



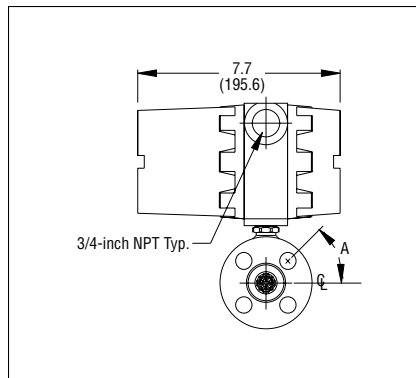
### 1-inch Through 8-inch NPT—Side View



### 1/2 and 3/4-inch 150 lb Flange—Front View



### 1/2 and 3/4-inch 150 lb Flange—Side View



SIZES FOR NPT				
Size	H1	C	L1	L2
1/4-inch	8.41 (213.6)	9.28 (235.7)	—	—
1/2-inch	7.79 (197.9)	6.94 (176.3)	2.20 (55.9)	6.50 (165.1)
3/4-inch	7.79 (197.9)	6.94 (176.3)	2.20 (55.9)	7.00 (177.8)
1-inch	8.97 (227.8)	9.00 (228.6)	1.50 (38.1)	3.50 (88.9)
1.5-inch	8.97 (227.8)	9.00 (228.6)	2.25 (57.2)	5.25 (133.4)
2-inch	8.97 (227.8)	10.45 (265.4)	3.50 (88.9)	7.50 (190.5)
3-inch	8.97 (227.8)	11.45 (290.8)	4.00 (101.6)	10.00 (254)
4-inch	8.98 (228.1)	11.45 (290.8)	4.00 (101.6)	12.00 (304.8)
6-inch	10.98 (278.9)	12.45 (316.2)	6.00 (152.4)	18.00 (457.2)
8-inch	12.98 (329.7)	13.45 (341.6)	8.00 (203.2)	24.00 (609.6)

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°



## Performance Specifications

### Accuracy

± 2% of reading from 10 to 100% of calibrated range  
± 0.5 % of full scale below 10% of calibrated range

### 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 (consult factory)

### Gas Pressure (2 limitations)

Mechanical design pressure:

Compression fittings: 500 psig (34.5 barg)

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

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

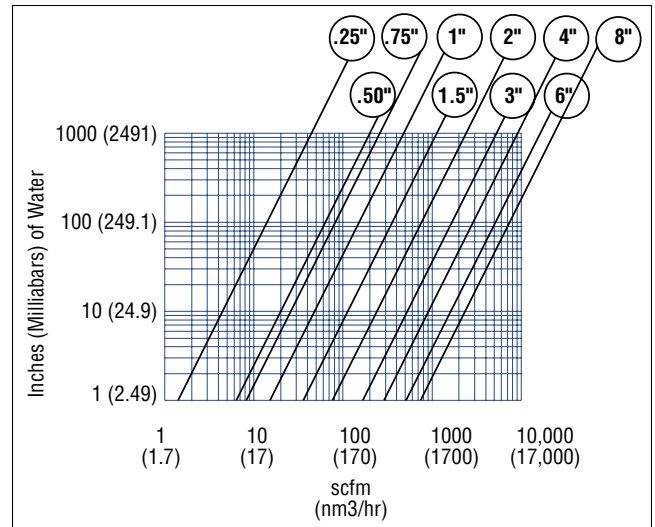
150 lb flange or PN16 DIN (250° F): 155 psig (10.7 barg)

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

Application gas pressure:

See mass flow range tables for maximum application gas pressures

### Pressure Drop



### Gas & Ambient Temperature

Gas . . . . . 15° F to 250° F (-10° C to 120° C) Gas dependent,  
see mass flow range tables for details  
Ambient . . . . . -5° F to 120° F (-20° 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)

### Alarms

Hard contact user-adjustable high and low  
Dead band adjustable with Smart Interface™ software  
Relay ratings . . . . . Maximum 42 VAC or 42 VDC, 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 95®-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  
Virtual recorder  
Data collection to Excel®  
Fully guided flow meter validation

## Physical Specifications

### Wetted Materials

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

### Enclosure

Hazardous-Area Location Enclosure (IP67) and NEMA 4X (IP65) are  
powder-coated cast aluminum

### Electrical Connections

Two 3/4 inch NPT . . . Hazardous-Area Location Enclosure (IP67)  
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)  
EEx (EEx d IIC T6 . . . T2) Cenelec  
FM (Explosion proof for Class I, Division 1, Groups B, C, D)

## Mass Flow Ranges

### 780S-Air - Gas Code 0

Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	20,000	9	15	120
standard accuracy	1/2"	0.00195	20,000	39	62	120
standard accuracy	3/4"	0.00355	20,000	71	112	120
standard accuracy	1"	0.00600	20,000	120	189	120
standard accuracy	1-1/2"	0.01420	20,000	284	448	120
standard accuracy	2"	0.02330	20,000	466	735	120
standard accuracy	3"	0.05130	20,000	1026	1618	120
standard accuracy	4"	0.08840	20,000	1768	2788	120
standard accuracy	6"	0.20100	20,000	4020	6340	120
standard accuracy	8"	0.34700	20,000	6940	10945	120

### 780S-Digester - Gas Code 4

Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	17,200	8	12	30
standard accuracy	1/2"	0.00195	17,200	34	53	30
standard accuracy	3/4"	0.00355	17,200	61	96	30
standard accuracy	1"	0.00600	17,200	103	163	30
standard accuracy	1-1/2"	0.01420	17,200	244	385	30
standard accuracy	2"	0.02330	17,200	401	632	30
standard accuracy	3"	0.05130	17,200	882	1392	30
standard accuracy	4"	0.08840	17,200	1520	2398	30
standard accuracy	6"	0.20100	17,200	3457	5452	30
standard accuracy	8"	0.34700	17,200	5968	9413	30

### 780S-Argon - Gas Code 1

Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	28,000	13	20	120
standard accuracy	1/2"	0.00195	28,000	55	86	120
standard accuracy	3/4"	0.00355	28,000	99	157	120
standard accuracy	1"	0.00600	28,000	168	265	120
standard accuracy	1-1/2"	0.01420	28,000	398	627	120
standard accuracy	2"	0.02330	28,000	652	1029	120
standard accuracy	3"	0.05130	28,000	1436	2265	120
standard accuracy	4"	0.08840	28,000	2475	3904	120
standard accuracy	6"	0.20100	28,000	5628	8876	120
standard accuracy	8"	0.34700	28,000	9716	15324	120

### 780S-Digester - Gas Code 5

Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
4% correlation	1/4"	0.00046	17,200	8	12	120
4% correlation	1/2"	0.00195	17,200	34	53	120
4% correlation	3/4"	0.00355	17,200	61	96	120
4% correlation	1"	0.00600	17,200	103	163	120
4% correlation	1-1/2"	0.01420	17,200	244	385	120
4% correlation	2"	0.02330	17,200	401	632	120
4% correlation	3"	0.05130	17,200	882	1392	120
4% correlation	4"	0.08840	17,200	1520	2398	120
4% correlation	6"	0.20100	17,200	3457	5452	120
4% correlation	8"	0.34700	17,200	5968	9413	120

### 780S-CO<sub>2</sub> - Gas Code 2

Application Temp. = 50-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	19,800	9	14	120
standard accuracy	1/2"	0.00195	19,800	39	61	120
standard accuracy	3/4"	0.00355	19,800	70	111	120
standard accuracy	1"	0.00600	19,800	119	187	120
standard accuracy	1-1/2"	0.01420	19,800	281	443	120
standard accuracy	2"	0.02330	19,800	461	728	120
standard accuracy	3"	0.05130	19,800	1016	1602	120
standard accuracy	4"	0.08840	19,800	1750	2760	120
standard accuracy	6"	0.20100	19,800	3980	6277	120
standard accuracy	8"	0.34700	19,800	6871	10836	120

### 780S-Helium - Gas Code 6

Application Temp. = 50-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	12,400	6	9.5	120
standard accuracy	1/2"	0.00195	12,400	24	38	120
standard accuracy	3/4"	0.00355	12,400	44	70	120
standard accuracy	1"	0.00600	12,400	74	117	120
standard accuracy	1-1/2"	0.01420	12,400	176	278	120
standard accuracy	2"	0.02330	12,400	289	456	120
standard accuracy	3"	0.05130	12,400	636	1003	120
standard accuracy	4"	0.08840	12,400	1096	1729	120
standard accuracy	6"	0.20100	12,400	2492	3931	120
standard accuracy	8"	0.34700	12,400	4303	6786	120

### 780S-Chlorine - Gas Code 3

Application Temp. = 50-90° F

Spec (%FS)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
5% correlation	1/4"	0.00046	3,261	1.5	2	120
5% correlation	1/2"	0.00195	3,333	6.5	10	120
5% correlation	3/4"	0.00355	3,380	12.0	19	120
5% correlation	1"	0.00600	3,333	20.0	32	120
5% correlation	1-1/2"	0.01420	3,169	45.0	71	120
5% correlation	2"	0.02330	3,219	75.0	118	120
5% correlation	3"	0.05130	3,411	175.0	276	120
5% correlation	4"	0.08840	3,394	300.0	473	120
5% correlation	6"	0.20100	3,483	700.0	1104	120
5% correlation	8"	0.34700	2,017	700.0	1104	120

## Mass Flow Ranges

### 780S-Hydrogen - Gas Code 7 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	9,600	4.4	6.9	135
standard accuracy	1/2"	0.00195	9,600	18.7	29.3	135
standard accuracy	3/4"	0.00355	9,600	34	53	135
standard accuracy	1"	0.00600	9,600	58	91	135
standard accuracy	1-1/2"	0.01420	7,042	100	158	135
standard accuracy	2"	0.02330	4,290	100	158	135
standard accuracy	3"	0.05130	1,950	100	158	135
standard accuracy	4"	0.08840	1,130	100	158	135
standard accuracy	6"	0.20100	500	100	158	135
standard accuracy	8"	0.34700	290	100	158	135
See chart below for flows greater than 100 SCFM						
standard accuracy	1-1/2"	0.01420	9,600	136	215	85
standard accuracy	2"	0.02330	9,600	224	354	85
standard accuracy	3"	0.05130	4,873	250	395	85
standard accuracy	4"	0.08840	2,828	250	395	85
standard accuracy	6"	0.20100	1,243	250	395	85
standard accuracy	8"	0.34700	720	250	395	85
See chart below for flows greater than 250 SCFM						
standard accuracy	3"	0.05130	7,797	400	630	ambient
standard accuracy	4"	0.08840	4,525	400	630	ambient
standard accuracy	6"	0.20100	1,990	400	630	ambient
standard accuracy	8"	0.34700	1,153	400	630	ambient

### 780S-CH<sub>4</sub> - Gas Code 8 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	16,000	7	12	30
standard accuracy	1/2"	0.00195	16,000	31	49	30
standard accuracy	3/4"	0.00355	16,000	57	90	30
standard accuracy	1"	0.00600	16,000	96	151	30
standard accuracy	1-1/2"	0.01420	16,000	227	358	30
standard accuracy	2"	0.02330	16,000	373	588	30
standard accuracy	3"	0.05130	16,000	821	1295	30
standard accuracy	4"	0.08840	16,000	1414	2231	30
standard accuracy	6"	0.20100	16,000	3216	5072	30
standard accuracy	8"	0.34700	16,000	5552	8756	30

### 780S-CH<sub>4</sub> - Gas Code 9 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
4% correlation	1/4"	0.00046	16,000	7	12	120
4% correlation	1/2"	0.00195	16,000	31	49	120
4% correlation	3/4"	0.00355	16,000	57	90	120
4% correlation	1"	0.00600	16,000	96	151	120
4% correlation	1-1/2"	0.01420	16,000	227	358	120
4% correlation	2"	0.02330	16,000	373	588	120
4% correlation	3"	0.05130	16,000	821	1295	120
4% correlation	4"	0.08840	16,000	1414	2231	120
4% correlation	6"	0.20100	16,000	3216	5072	120
4% correlation	8"	0.34700	16,000	5552	8756	120

### 780S-Nitrogen - Gas Code 10 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
standard accuracy	1/4"	0.00046	19,800	9	14	120
standard accuracy	1/2"	0.00195	19,800	39	61	120
standard accuracy	3/4"	0.00355	19,800	70	111	120
standard accuracy	1"	0.00600	19,800	119	187	120
standard accuracy	1-1/2"	0.01420	19,800	281	443	120
standard accuracy	2"	0.02330	19,800	461	728	120
standard accuracy	3"	0.05130	19,800	1016	1602	120
standard accuracy	4"	0.08840	19,800	1750	2760	120
standard accuracy	6"	0.20100	19,800	3980	6277	120
standard accuracy	8"	0.34700	19,800	6871	10836	120

### 780S-Oxygen - Gas Code 11 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
4% correlation	1/4"	0.00046	19,800	9	14	120
4% correlation	1/2"	0.00195	19,800	39	61	120
4% correlation	3/4"	0.00355	19,800	70	111	120
4% correlation	1"	0.00600	19,800	119	187	120
4% correlation	1-1/2"	0.01420	19,800	281	443	120
4% correlation	2"	0.02330	19,800	461	728	120
4% correlation	3"	0.05130	19,800	1016	1602	120
4% correlation	4"	0.08840	19,800	1750	2760	120
4% correlation	6"	0.20100	19,800	3980	6277	120
4% correlation	8"	0.34700	19,800	6871	10836	120

### 780S-Propane - Gas Code 12 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIGG
standard accuracy	1/4"	0.00046	13,200	6	10	30
standard accuracy	1/2"	0.00195	13,200	26	41	30
standard accuracy	3/4"	0.00355	13,200	47	74	30
standard accuracy	1"	0.00600	13,200	79	125	30
standard accuracy	1-1/2"	0.01420	13,200	187	296	30
standard accuracy	2"	0.02330	13,200	308	485	30
standard accuracy	3"	0.05130	13,200	677	1068	30
standard accuracy	4"	0.08840	13,200	1167	1840	30
standard accuracy	6"	0.20100	13,200	2653	4184	30
standard accuracy	8"	0.34700	13,200	4580	7224	30

### 780S-Propane - Gas Code 13 Application Temp. = 15-250° F

Spec (%rdg)	Pipe Size	Area (SqFt)	Max Vel (SFPM)	Max (SCFM)	Max nm3/hr	Max PSIG
4% correlation	1/4"	0.00046	13,200	6	10	120
4% correlation	1/2"	0.00195	13,200	26	41	120
4% correlation	3/4"	0.00355	13,200	47	74	120
4% correlation	1"	0.00600	13,200	79	125	120
4% correlation	1-1/2"	0.01420	13,200	187	296	120
4% correlation	2"	0.02330	13,200	308	485	120
4% correlation	3"	0.05130	13,200	677	1068	120
4% correlation	4"	0.08840	13,200	1167	1840	120
4% correlation	6"	0.20100	13,200	2653	4184	120
4% correlation	8"	0.34700	13,200	4580	7224	120

# Ordering the Model 780S

**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  
**EEx** EEx d IIC T6...T2 Cenelec  
**FM** Explosion Proof for Class I, Division 1, Groups B, C, D

**FLOW BODY—STAINLESS STEEL**

NPT	ANSI Flange		DIN 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	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)

**FLOW BODY—CARBON STEEL**

N/A	FC6				2-inch
N/A	FC7				3-inch
NC8	FC8				4-inch
NC9	FC9				6-inch
NC10	FC10				8-inch

**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** 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)

**OPTION 1**

**PT** Pressure Test Certificate  
**CC** Certificate of Conformance  
**NC** NACE Certificate  
**MC** Material Certificate

**ACCESSORIES (Consult Factory)**