QuadraTherm

SIERRA®

The Thermal Mass Flow Meter for High Accuracy Air, Gas, and Mixture Flow Measurement

QuadraTherm

10246.98 SCFM
69.46 F

Thermal mass flow accuracy you never imagined possible.

If your goal is to achieve maximum productivity, efficiency, and end-product quality in manufacturing and industrial process control, only the highest accuracy air, natural gas, and gas mixture flow measurements can get you there.

Today, Sierra's QuadraTherm® 640i and 780i deliver the world's most accurate thermal mass flow measurements. Accuracy is as good as, if not better than, Coriolis at a fraction of the price. Benefit from precise mass flow rate, temperature, and pressure measurement with a single device.

And with over ten years in the field, Quadratherm flow sensor technology has a proven track record of solid industrial performance you can trust.

Four Powerful Sensors

Unlike traditional two-sensor thermal mass flow meters, QuadraTherm has four sensors: three precision platinum temperature sensors and one patented no-drift DrySense™ mass velocity sensor.

As a result, performance improvements abound as unwanted heat-transfer components are calculated and eliminated. Components that show up as false flows that degrade accuracy, like stem conduction, sensor cross-talk, radiation, and even natural convection.

QuadraTherm's accuracy supercedes conventional thermal meters at +/-0.5% of reading. In addition, flow range capability has tripled from 20,000 to 60,000 sfpm (305 smps), and gas mixing and field compositional compensation is now possible.

A Revolutionary Algorithm

At the heart of every QuadraTherm mass flow meter is advanced digital signal processing to enhance thermal mass flow metering technology and thermodynamic measurements.

Sierra's Raptor™ operating system is the true "brain" of the instrument and includes a revolutionary, living, learning algorithm set made possible by today's powerful microprocessors.

Raptor manages changes in gas flow, temperature and pressure, as well as outside temperature, via a comprehensive heat-transfer model in the meter firmware. The result is a proprietary, fundamentally different mass flow rate calculation using all pertinent variables for the most precise, stable, and accurate flow measurement possible.

Through Sierra's Smart Interface Portal (SIP) software, QuadraTherm flow meters provide access to a wide range of critical data and re-configure the flow meter in the field without the nuisance and expense of returning it to the factory.

640i insertion

780i inline

640i / 780i Highlights

- Accuracy:
  +/- 0.5% of reading (inline);
  +/- 0.75% of reading (insertion)

- Gases: Air, natural gas, mixtures, flammables, inert gases

- Flow rates: Down to 0.03 smps (0.1 sfps) & up to 305 smps (60,000 sfpm)

- Pipe/duct sizes up to 72" (182 cm)

- Hot-tap probe retractor

- 100:1 turndown

- Free user software

- Multivariable: Mass flow rate, temperature & pressure

- In-Situ calibration validation

- Built in flow conditioning

- No moving parts, low pressure drop

- Patented QuadraTherm four-sensor design

- DrySense no-drift sensor with lifetime warranty

- Raptor OS "Brain" manages all inputs

- Sierra's fluid library, improves over time

- Multi-language capable

- Digital communications

- Hazardous area approvals

Notable Apps

- ValidCal Diagnostics

- Flow Totalizer

- Meter/Signal tuning

- Dial-A-Pipe: Change pipe size

- Dial-A-Gas: Change gas type

- qMix: Make & upload gas mixtures, retain accuracy

It Has Apps

QuadraTherm is the first thermal mass flow meter to come with comprehensive software apps for ease of use, field adjustment, and calibration validation.

Easily change pipe sizes and measured fluid in the field with apps like Dial-A-Pipe™ and Dial-A-Fluid™. (See center image)
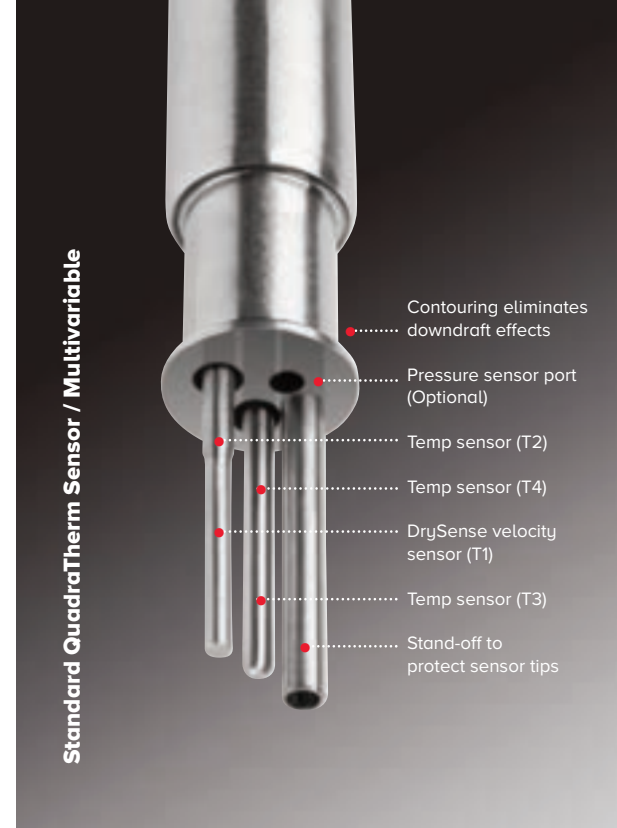
Field Calibration Validation

QuadraTherm features field calibration validation through its ValidCal™ Diagnostic software app. This is only possible with its DrySense no-drift velocity sensor. Costly shutdowns and annual factory recalibration charges are now eliminated.

Custom Gas Mixes

Each QuadraTherm comes with Sierra's proprietary qMix™ gas mixing software app that empowers you to create custom gas mixtures and perform meter updating in the field with no expensive factory recalibration equired.

Flare Gas Breakthrough

QuadraTherm is the only thermal mass flow meter that maintains accuracy, even when gas composition changes. The meter works with the qMix app to adjust and match real-time

Standard QuadraTherm Sensor / Multivariable

- Contouring eliminates downdraft effects
- Pressure sensor port (Optional)
- Temp sensor (T2)
- Temp sensor (T4)
- DrySense velocity sensor (T1)
- Temp sensor (T3)
- Stand-off to protect sensor tips

readings from a gas chromatograph (GC). This can be done automatically or manually. In auto mode, update frequency can be set by time or by percent change in composition. The user can also collect flow and composition trend analysis, flow alarming, and triggers.

Sierra has many more apps under development to enhance your product experience. When released, you can download and begin using them.

SierraLoop World Class Calibration

Designed by Sierra and located at our metrology headquarters in Monterey, California, SierraLoop™ is among the world's most accurate private gas flow calibration facilities.

Rated at +/- 0.3% of reading, all calibrations follow the guidelines of ISO 17025 and are traceable to national standards such NIST (United States National Institute of Standards and Technology).

Fully automated, once flow application data is programmed, SierraLoop automation software manages all aspects of flow calibration testing. It performs high-speed time-aligned data acquisition and performance analysis over the entire flow measurement range, and generates a calibration certificate documenting instrument performance.

Service, Commissioning & Training

The need to deliver fast, localized support to global customers has resulted in the establishment of dedicated Sierra Flow Centers on almost every continent with technical experts in over 150 locations in more than 50 countries. Sierra's team of engineers can commission your flow meter to assure optimal performance and train you to get the most out of your instrument.

We provide lifetime support for all Sierra products and will get on a plane to help you when necessary.

Measurably Different™

Our primary goal at Sierra is to help make you smarter and more productive with the precision flow measurement instruments we design, build and deliver to meet your unique needs.

Watch the Video

sierrainstruments.com /thermal-principle

PERFORMANCE SPECIFICATIONS

Gas Measured
All inert gases and all non-condensing clean gases
Flammable gases: methane, propane, hydrogen, digester gas, natural gas
Corrosive gases compatible with 316L stainless steel
qTherm Gas Library: most common gases and mixtures; air is standard; qTherm
Dial-A-Gas option for choice of three additional gases

Mass Velocity Range for Air
0 to 60,000 sfpm (0 to 305 smps) at 21.1°C (70°F), 1 atm

Multivariable Outputs
Mass flow rate (standard)
Temperature (standard)
Pressure (optional)
Totalized flow: totalized value is stored in non-volatile memory

Mass Flow Accuracy
780i Inline version accuracy (highest accuracy):*
+/- 0.5% of reading above 50% of the full scale flow
+/- 0.5% of reading plus 0.5% of full scale below 50% of full scale flow

640i Insertion version accuracy:*
+/- 0.75% of reading above 50% of the full scale flow
+/- 0.75% of reading plus 0.5% of full scale below 50% of full scale flow

See Table 1: qTherm Dial-A-Gas Selection Chart on next page for accuracy.
Gas pressure accuracy +/- 1.0% full scale
Totalize each gas independently with the flow totalizer

* Accuracy statements verified by an independent NIST and NVLAP
accredited metrology laboratory.

Gas Temperature Accuracy
+/- 1°C (1.8°F)

Gas Pressure Ranges
30 psia (2.1 bara), 100 psia (6.9 bara), 300 psia (20.7 bara),
500 psia (34.5 bara), VTP only.

Repeatability
Mass flow rate: +/- 0.15% of full scale
Gas temperature: +/- 0.5°C (0.9°F)
Gas pressure: +/- 0.5% of full scale

Response Time
Three seconds to achieve 63% (one time constant) of final value

Mass Flow Rate Turndown
100:1 turndown

ANALOG AND DIGITAL OUTPUTS

Output Signals
4-20 mA flow, 4-20 mA temperature, 4-20 mA pressure (optional)
Alarm output (contact SPST/opto relays)
User definable pulse output for totalized flow

Optional Communications Modules
Modbus, HART

SOFTWARE

Smart Interface Program (SIP) Software
Use Dial-A-Gas and Dial-A-Pipe for easy field setup
Use Meter Tune to optimize performance
Use ValidCal to validate all meter functions
Use flow totalizer to totalize all four Dial-A-Gases independently
Use qMix gas mixing feature to create custom gas and gas mixtures

POWER REQUIREMENTS

Input Power
100 to 240 VAC (0.4 Amps RMS at 230 VAC)
24 VDC +/- 10%, 1.04 Amps

OPERATING SPECIFICATIONS

780i Inline Version Gas Pressure Requirements
NPT: 500 psia (34.5bara) maximum -1 NAA Only, 300 psig (20.7 barg) maximum
for -2 or -3 agency approved units

Flange process connections defined by the ASME B 16.5a – 1998 spec. group
rating of 316L stainless steel ANSI class 150 or 300 class flanges (special
request for -1 NAA units only)

316L stainless steel 150 class flanges:
230 psig at -20°F to 100°F; 195 psig at 200°F;
175 psig at 300°F; 160 psig at 400°F; and 145 psig at 500°F
Equivalent DN PN16 flanges are available (see page 10 for sizes)

316L stainless steel 300 class flanges (special request for -1 NAA units only):
600 psig at -20°F to 100°F; 505 psig at 200°F; 455 psig at 300°F;
415 psig at 400°F

640i Insertion Version Gas Pressure Maximums (or limits)
Compression fittings: 500 psia (34.5 bara)
1-inch 150 class flange (-40°F to 250°F) 185 psia (12.8 bara)
Low pressure hot tap: 150 psia (10.3 bara)
High pressure hot tap: 230 psia (15.9 bara)
Minimum pipe size 2 inches (50 mm)
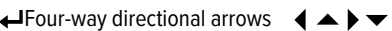
Gas Temperature Requirements (all versions)
-40°F (-40°C) to 392°F (200°C)
High temperature (HT) option to 750°F (400°C) available in 640S model only

Ambient Temperature (NAA and cFMus versions)
-40F° (-40°C) to 140°F (60°C)
ATEX/IECEx Versions -4°F(-20°C) to 140°F (60°C)

PHYSICAL SPECIFICATIONS

User Interface
Local keypad with a six-button interface
Exit ⊗ Enter ↵ Four-way directional arrows ◀ ▲ ▶ ▼
RS-232 with PC software for communication and programming

Digital Display
UltraBright, backlit, LCD digital display, 2 x 16, 2 x 32 scrolling

780i Inline Version Process Connections
See page 9 and 10 for NPT, ANSI class 150 flange and PN16 DN sizes.

640i Insertion Version Process Connections
See page 6 through 8 for insertion sizes.
ANSI 1-inch - ANSI class 150 flange (optional)
Low pressure hot tap rated to 150 psia (10.3 bara)
High pressure hot tap and retractor 230 psia (15.9 bara)

Wetted Materials
316 SS and 316L SS flow body and Pt/Ir (velocity sensor)
Viton® VTP Pressure Option
Neoprene®, Kal-Rez® optional

Leak Integrity
5 x 10⁻⁹ sccs of helium maximum

Approval Agencies
cFMus–Explosion proof for Class I, Div I, Groups B,C,D
CE–European Conformity
ATEX/IECEx

Enclosure
NEMA 4 (IP66), hazardous-area explosion proof, flow pointer, meter
information tag. NEMA 4X (E2 option only).

| TABLE 1: qTherm Dial-A-Gas Selection Chart				
	780i Accuracy		640i Accuracy	
Gas	Actual Gas[1]	qTherm Dial-A-Gas[2]	Actual Gas[1]	qTherm Dial-A-Gas[2]
Air[3]	±0.5%	N/A	±0.75%	N/A
Ammonia	N/A	±3.0%	N/A	±3.0%
Argon	±0.5%	±3.0%	±0.75%	±3.0%
Carbon Dioxide	±0.5%	±3.0%	±0.75%	±3.0%
Chlorine	N/A	±3.0%	N/A	±3.0%
Digester Gas (60% CH_4, 40% CO_2)	±0.5%	±3.0%	±0.75%	±3.0%
Helium	±0.5%	±3.0%	±0.75%	±3.0%
Hydrogen	±0.5%	±5.0%	±0.75%	±5.0%
Methane	±0.5%	±3.0%	±0.75%	±3.0%
Nitrogen	±0.5%	±3.0%	±0.75%	±3.0%
Oxygen	N/A	0.75% Reading + 0.5% Full Scale	N/A	0.75% Reading + 0.5% Full Scale
Propane	±0.5%	±3.0%	±0.75%	±3.0%
Other[4]—Consult Factory	Special Calibration Request (SCR)	Special Calibration Request (SCR)	Special Calibration Request (SCR)	Special Calibration Request (SCR)

Notes: (1) % of reading at >50% of full scale flow; add 0.5% of full scale below 50% of full scale flow
(2) % of full scale unless otherwise noted
(3) Air is standard on the instrument and cannot be removed
(4) The qTherm Gas Library is a proprietary gas property index that is continually updated and improved

TABLE 2: 640i/780i Straight Run Requirements				
Piping Condition	Upstream 640i Insertion	Upstream 780i Inline with Flow Conditioning[1]	640i Downstream[2]	780i Downstream[2]
Single 90° Elbow or T-Piece	15D	1D	1D	0D
Two Elbows (in the same plane)	20D	3D	3D	0D
Two Elbows (in different plane)	40D	3D	3D	0D
Reduction (4:1)	15D	3D	3D	0D
Expansion (4:1)	30D	3D	3D	0D
After Control Valve	40D	5D	5D	0D

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

780i INLINE PRESSURE DROP
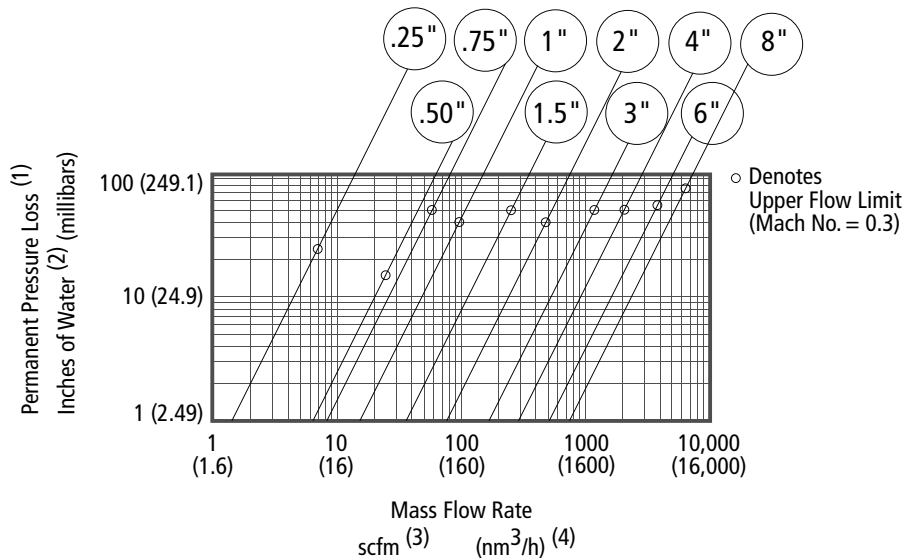
Notes: (1) For air and nitrogen at 20°C temperature and 1 atmosphere pressure
(2) 1 inch of water at 60°F = 0.0361 psi
(3) At base conditions of 21.1°C temperature and 1 atmosphere pressure
(4) At base conditions of 0°C temperature and 1 atmosphere pressure

P2-DD—Side View

6.7 (170)
5.3 (135)
6.6 (168)

P3-DD—Side View

8.5 (216)
6.6 (168)
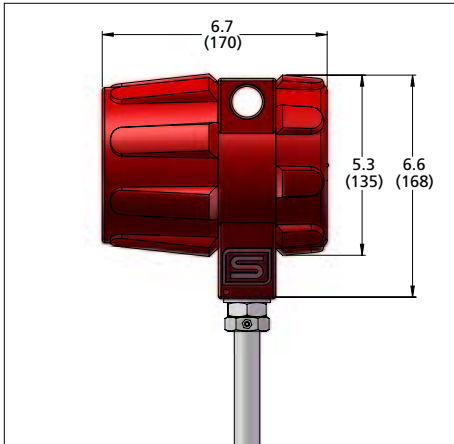
All Versions—Front View

5.5 (140)

P2-DD Compression Fitting—Side View

6.7 (170)
5.3 (135)
6.6 (168)
3/4-inch NPT, Typ
X
L
Ø0.75 (19.1)
0.50 (12.7)
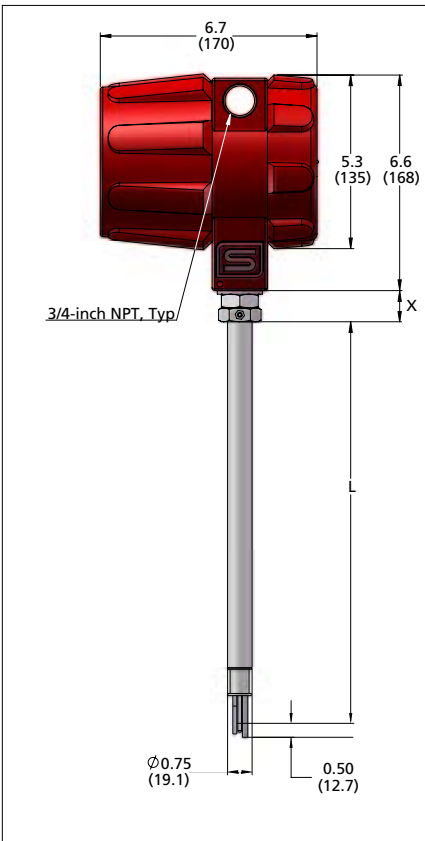
P2-DD Flange Fitting—Side View

6.7 (170)
5.3 (135)
6.6 (168)
3/4-inch NPT, Typ
X
L
0.50 (12.7)
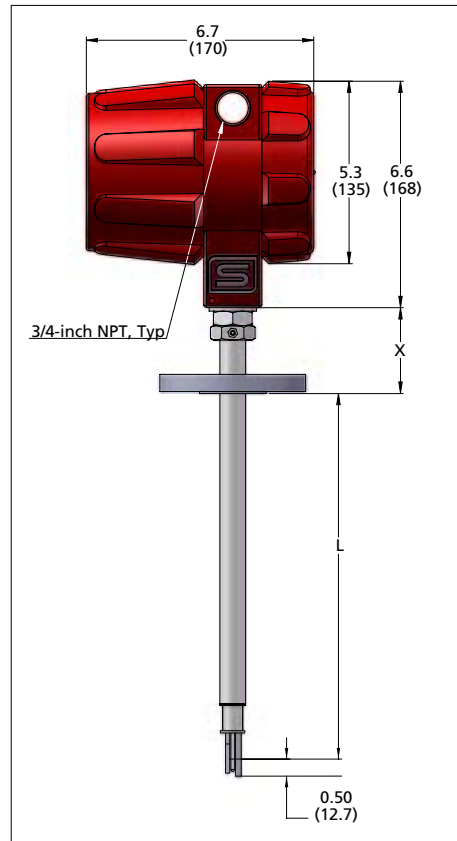
cFMus, ATEX, IECEx Approved Probes (> 13")
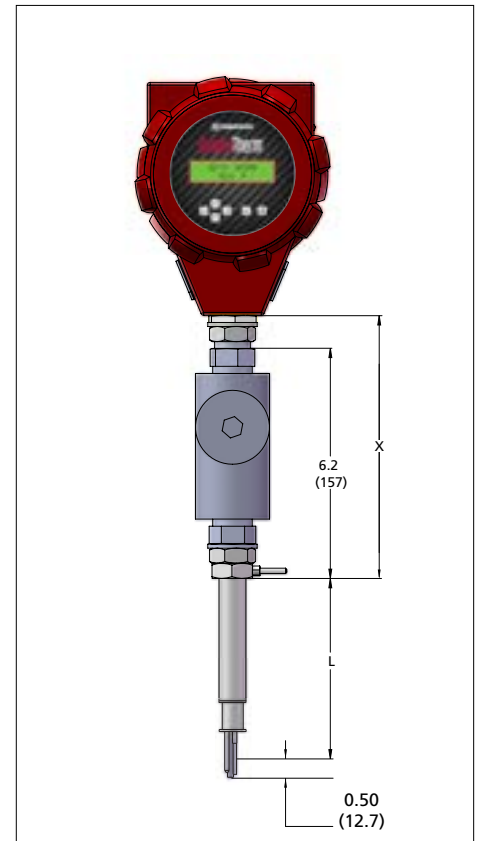
6.2 (157)
X
L
0.50 (12.7)

Note: All dimensions in inches with (mm) in brackets; certified drawings available upon request. All drawings have ± .25 inch (6.4 mm) tolerance.

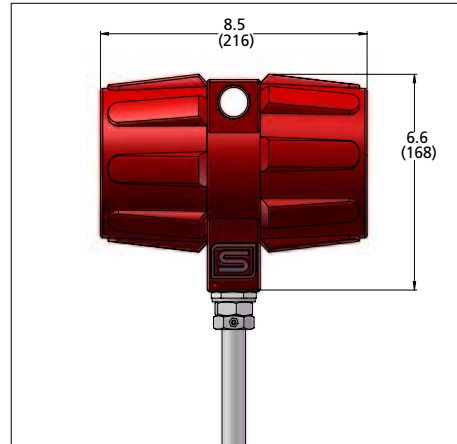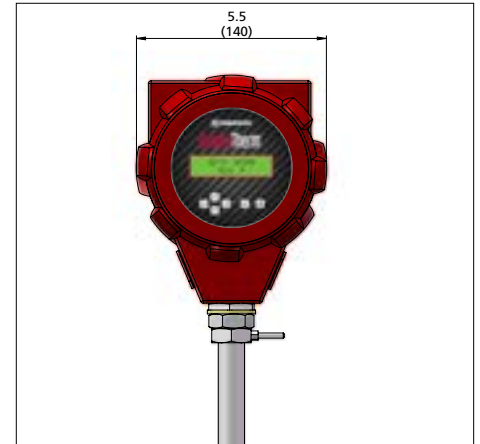| Length Chart 640i Compressions Fittings		
Code	L	X
L06	6.0 (152)	1.25 (31.75)
L09	9.0 (229)	1.25 (31.75)
L13	13.0 (330)	1.25 (31.75)
L18	18.0 (457)	1.25 (31.75)
L24	24 (610)	1.25 (31.75)
L36	36 (914)	1.25 (31.75)
L48	48 (1219)	1.25 (31.75)

Length Chart 640i Flange Mounting		
Code	L	X
L06	6.0 (152)	2.69 (68.33)
L09	9.0 (229)	2.69 (68.33)
L13	13.0 (330)	2.69 (68.33)
L18	18.0 (457)	2.69 (68.33)
L24	24 (610)	2.69 (68.33)
L36	36 (914)	2.69 (68.33)
L48	48 (1219)	2.69 (68.33)

Length Chart 640i FM Version		
Code	L	X
L06	6.0 (152)	10.25 (260.35)
L09	9.0 (229)	10.25 (260.35)
L13	13.0 (330)	10.25 (260.35)
L18	18.0 (457)	10.25 (260.35)
L24	24 (610)	10.25 (260.35)
L36	36 (914)	10.25 (260.35)
L48	48 (1219)	10.25 (260.35)

Remote Electronics VT, VTP—Side View

6.7
(170)

6.6
(168)

Per customer
cable length
requirement
200 feet maximum
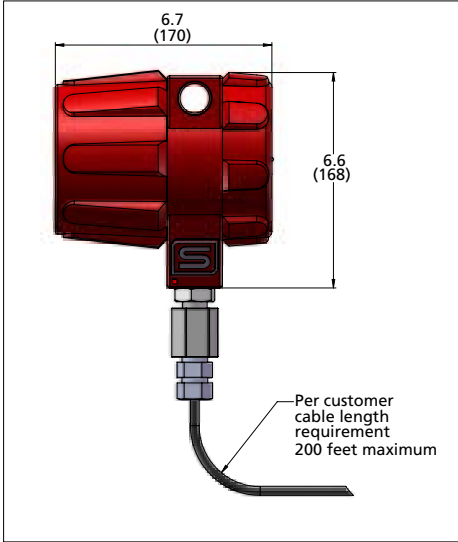
Remote Probe VT—Front View

4.6
(117)

∅ 0.75
(19.1)
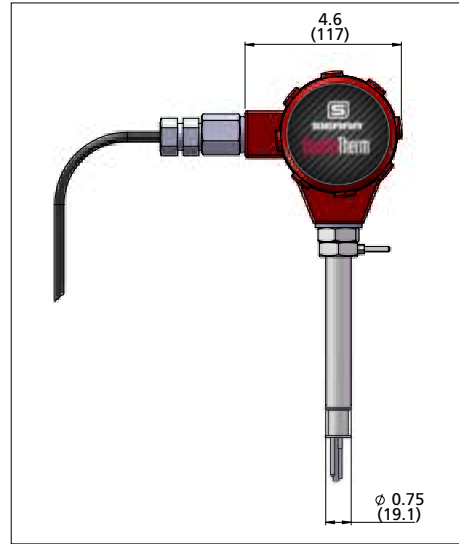
Remote Probe VT—Side View

2.6
(66)

4.5
(114)

3/4-inch NPT

X

L

0.50
(12.7)
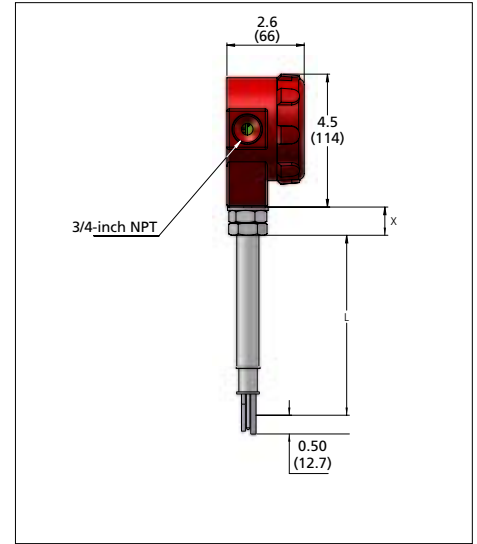
Remote Probe VTP—Front View

5.5
(140)

Remote Probe VTP—Side View

4.7
(120)

6.6
(167)
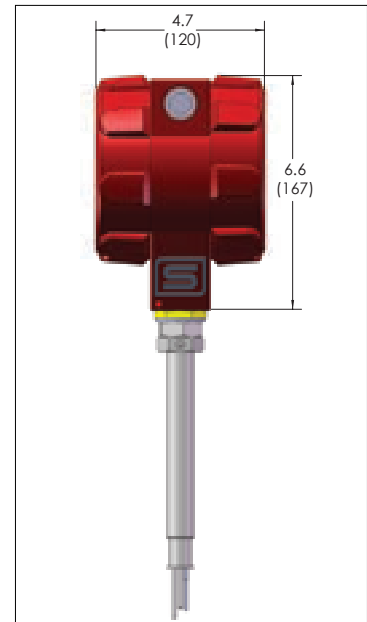
P3-DD Remote Bracket—Side View

8.9
(226)

3.0
(76)
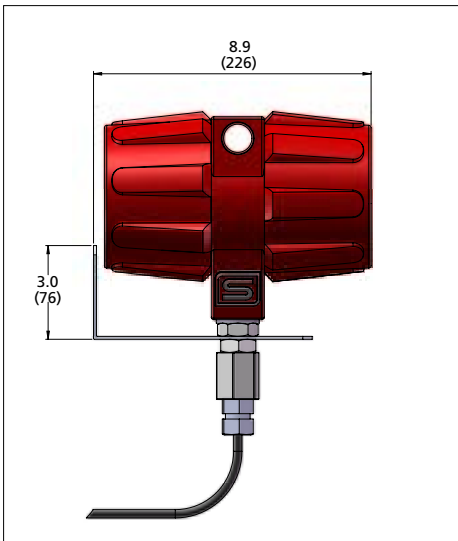
P2-DD Remote Bracket—Side View

8.9
(226)

3.0
(76)
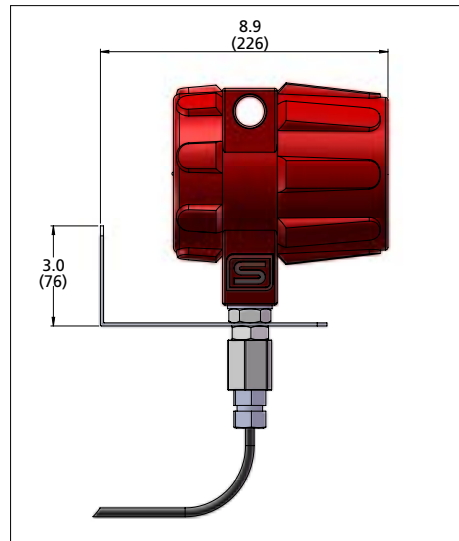
Remote Bracket—Front View
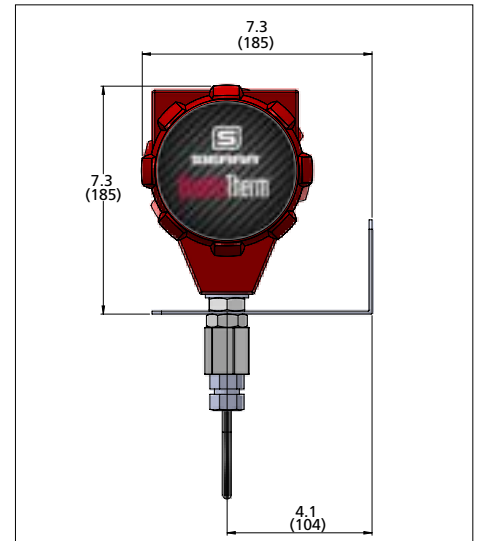
7.3
(185)

7.3
(185)

4.1
(104)

Note: All dimensions in inches with (mm) in brackets; certified drawings available upon request. All drawings have ± .25 inch (6.4 mm) tolerance.

8   **Mounting Holes for Remote Bracket**

.50 (12.7)   3.00 (76.20)   1.5 (38)

3.0 (76)

.31 φ (7.87), 2PL
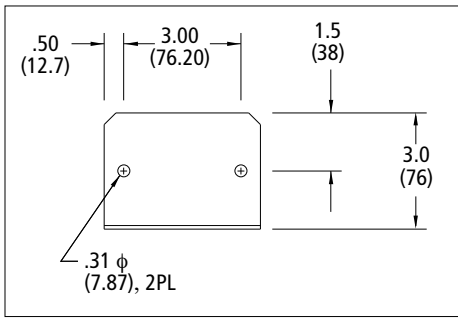
Length Chart 640i Remote Mount Junction Box		
Code	L	X
L06	6.0 (152)	1.25 (37.75)
L09	9.0 (229)	1.25 (37.75)
L13	13.0 (330)	1.25 (37.75)
L18	18.0 (457)	1.25 (37.75)
L24	24 (610)	1.25 (37.75)
L36	36 (914)	1.25 (37.75)
L48	48 (1219)	1.25 (37.75)

640i INSERTION LOW PRESSURE HOT TAP to 150 psig (10.3 barg)

L

7.6 (193)

M2 Threadolet or customer supplied 1-inch weldolet

0.50 (12.7)

1-inch NPT hex nipple, 2PL

4.0 (101.6)

Probe

0.75 (19.05)φ   Flow inward

T

Restraint cable, length=R

C

D

6.7 (170)

1-inch NPT ball valve

1-inch NPT hot tap Teflon packing gland

Duct

3.3 (83.8)   6.5 (165.1)   1.0 (25.4)

4.3 (109.2)

10.8 (274.3)

C̵L
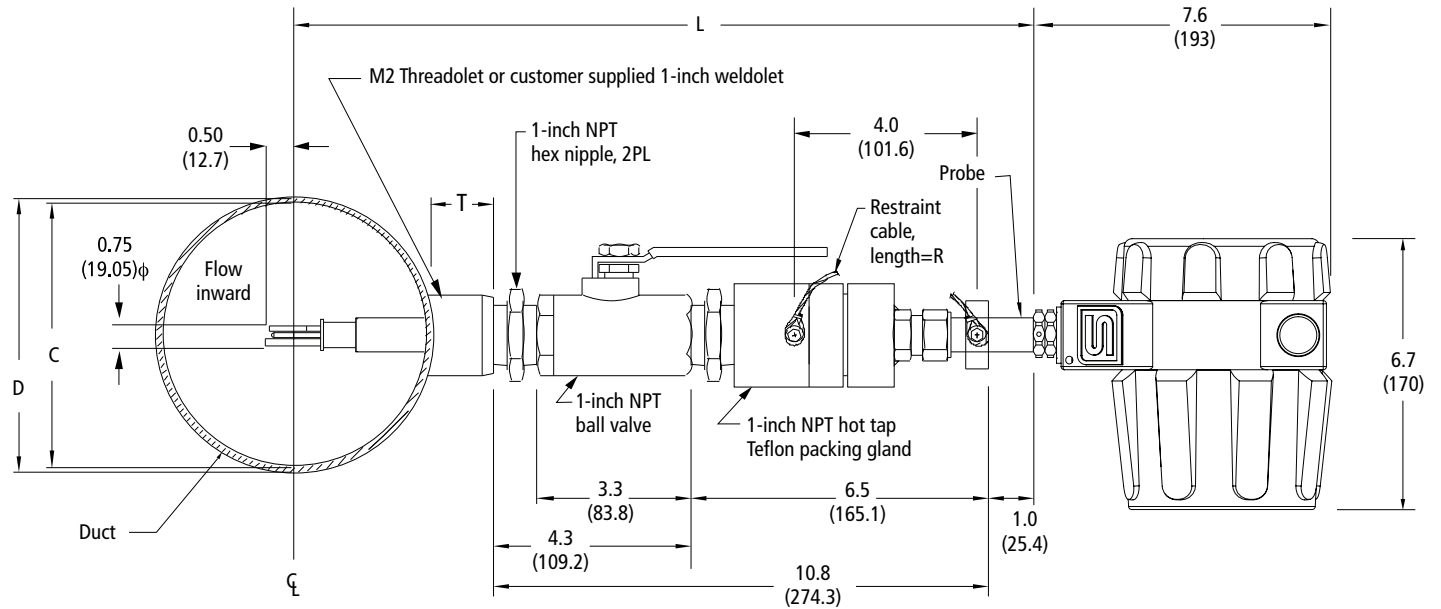
Variables
L = Nominal Probe Length
D = Duct O.D.
C = Duct I.D.
T = Height of "Threadolet"
or Customer Provided Weldolet
R = Restraint Cable Length

Formula
L > 12.3 + T + D/2
So L must be equal
or greater than 12.3-inches
plus the height of the
"Threadolet" plus half the duct O.D.
R = D/2 + T + 7.3

640i HIGH PRESSURE HOT TAP is flange dependent up to 400 psig (27.6 barg)

Supplied by customer

34.5 (873.8)

D

B

8.06 (204.7)

24.4 (617.8) Maximum articulation

C

A

L
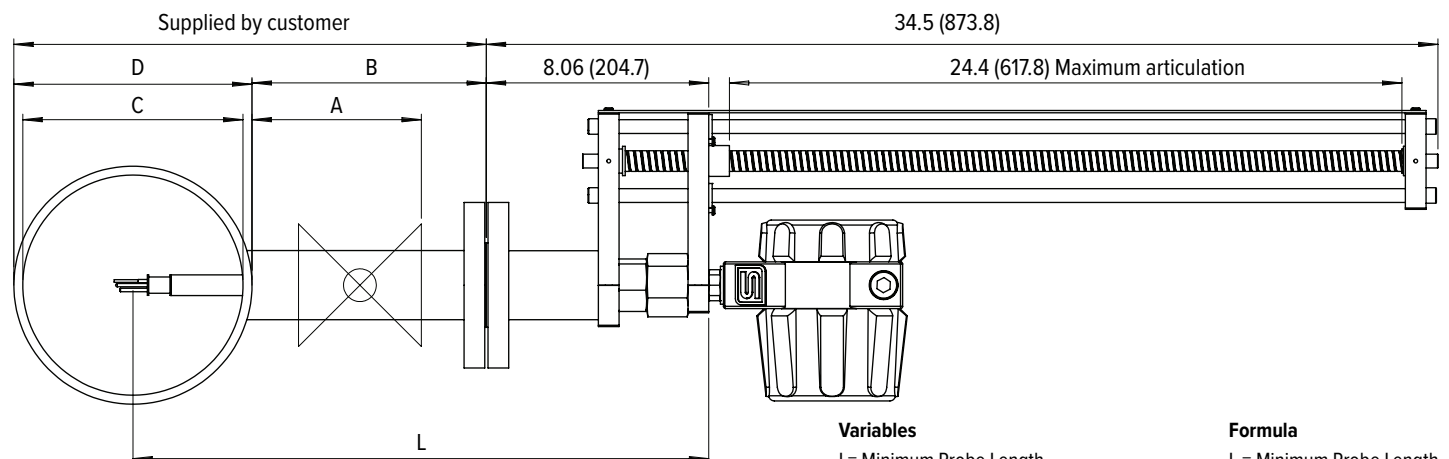
Variables
L= Minimum Probe Length
A= Distance From Duct OD To Valve Outlet
B= Distance From Duct OD To Flange Face
C= Duct Inner Diameter
D= Duct Outer Diameter

Formula
L = Minimum Probe Length
L = 8 + B + 1/2 D
D/2 + A ≤ 24.4

Note: All dimensions in inches with (mm) in brackets; certified drawings available upon request

1/2" Through 1 1/2" NPT–Side View

6.7
(170)

3/4-inch NPT Typ.
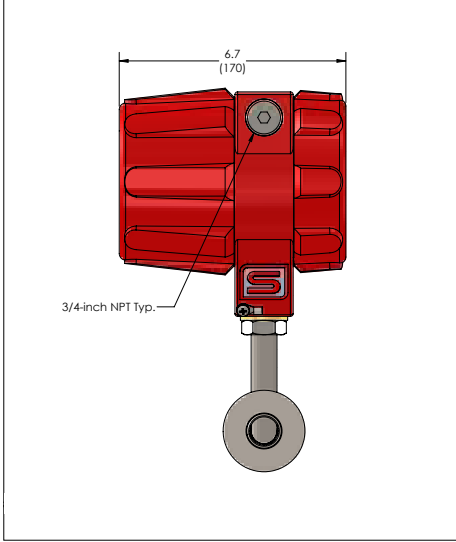
1/2" Through 1 1/2" NPT–Front View

5.5
(140)

6.6
(168)

C

H

L2

MALE NPT THREAD
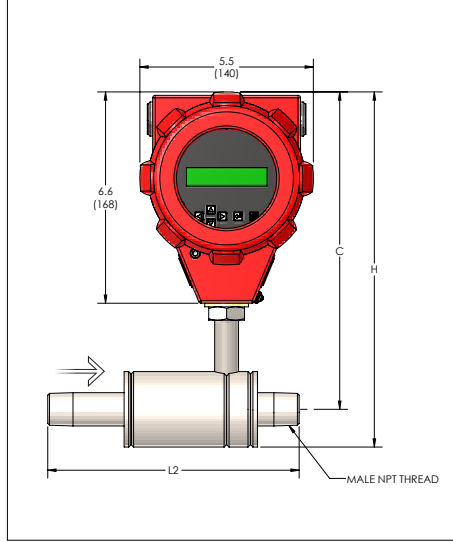
Sizes for NPT			
Size	H	C	L2
1/2-inch	10.5 (267)	9.9 (251)	7.5 (191)
3/4-inch	10.8 (274)	9.9 (251)	7.9 (201)
1-inch	11.2 (284)	9.9 (251)	8.3 (211)
1 1/2-inch	11.5 (292)	9.9 (251)	9.5 (241)

1/2" Through 1 1/2" 150 Class Flange–Side View

6.7
(170)

3/4-inch NPT Typ.

45°
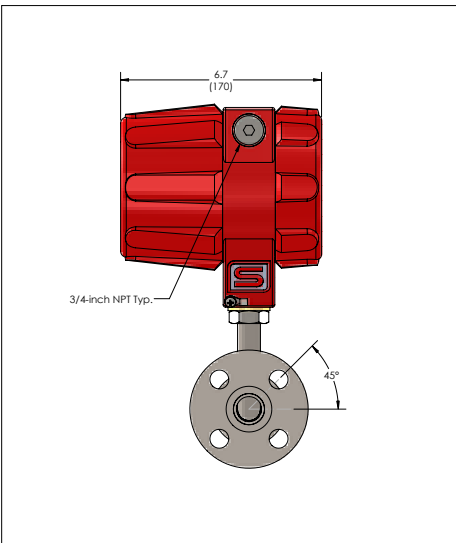
1/2" Through 1 1/2" 150 Class Flange–Front View

5.5
(140)

6.6
(168)

C

H

L2
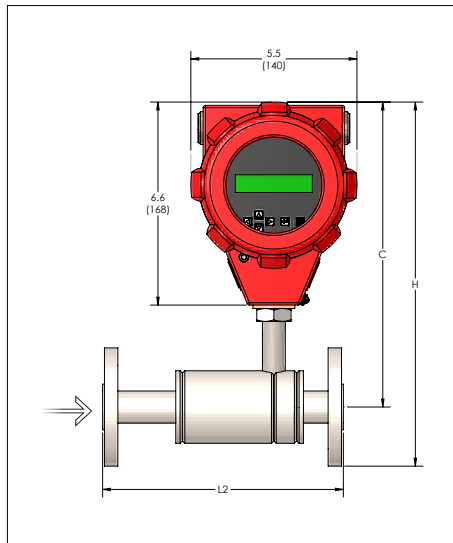
Sizes For ANSI Class 150 Flange			
Size	H	C	L2
1/2-inch	11.6 (295)	9.9 (251)	7.5 (191)
3/4-inch	11.8 (300)	9.9 (251)	7.9 (201)
1-inch	12.0 (304)	9.9 (251)	8.3 (211)
1 1/2-inch	12.2 (310)	9.9 (251)	9.5 (241)

NPT Remote Electronics–Side View

8.8
(224)

9.8
(249)
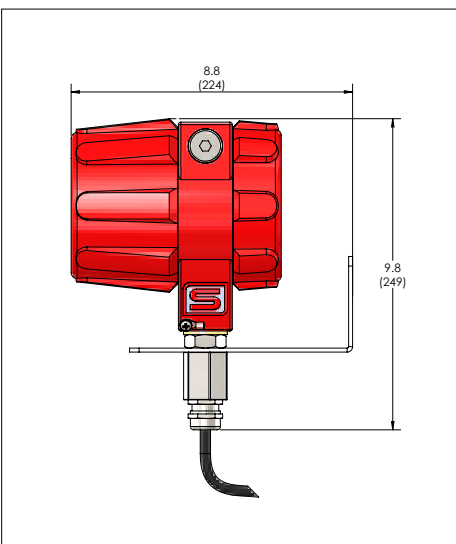
NPT, VTP Remote–Front View

6.7
(170)

4.50
(114)

7.8
(198)

9.0
(227)
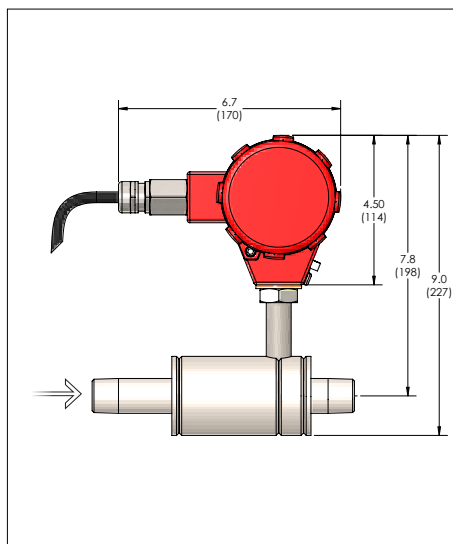
150 Class Flange Remote–Front View
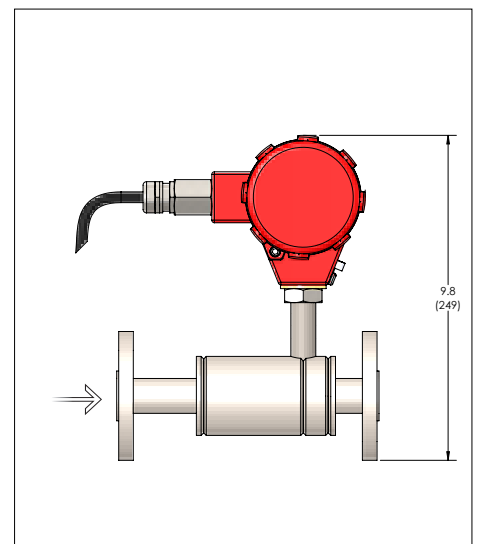
9.8
(249)

Note: All dimensions in inches with (mm) in brackets; certified drawings available upon request

2" Through 8" 150 Class Flange—Side View

6.7 (170)
6.6 (168)
A

Flow Conditioning Element
(see TABLE 2, page 5)
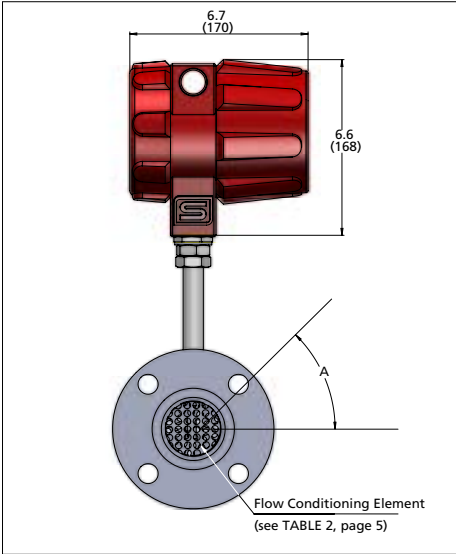
2" Through 8" 150 Class Flange—Front View

5.5 (140)
H C
L2 L1
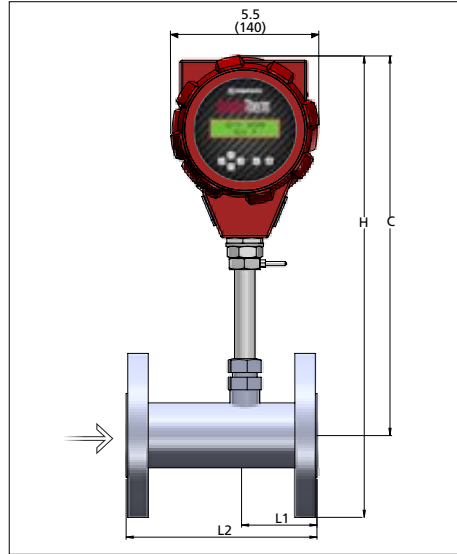
Sizes for ANSI Class 150 Flanges

Size	H	C	L1	L2	A
2-inch	17.0 (432)	14.0 (356)	2.6 (66)	7.0 (178)	45
3-inch	17.7 (450)	14.0 (356)	2.6 (66)	10.0 (254)	45
4-inch	18.5 (470)	14.0 (356)	3.6 (91)	12.0 (305)	22.5
6-inch	19.5 (495)	14.0 (356)	5.6 (142)	18.0 (457)	22.5
8-inch	20.7 (526)	14.0 (356)	7.6 (193)	24.0 (610)	22.5

2" Through 8" NPT—Side View

6.7 (170)
6.6 (168)
3/4-inch NPT Typ
Flow Conditioning Element
(see TABLE 2, page 5)
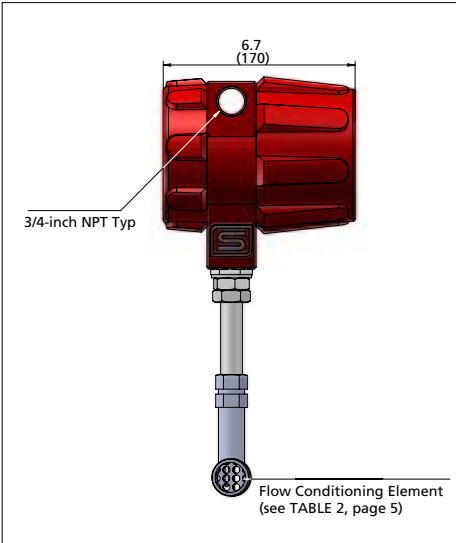
2" Through 8" NPT—Front View

5.5 (140)
6.6 (168)
C H
Male NPT Thread
L2 L1
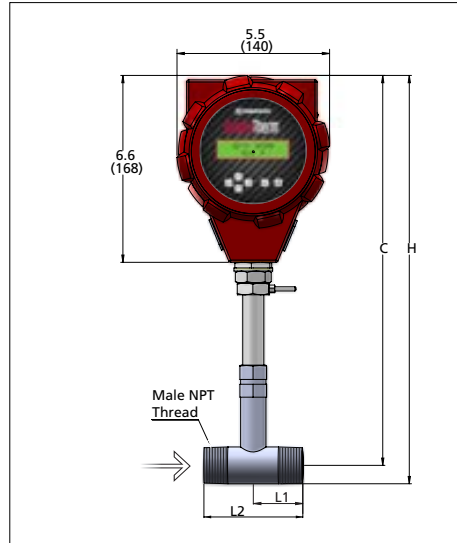
Sizes for 1-inch Through 8-inch NPT

Size	H	C	L1	L2
2-inch	15.1 (384)	14.0 (356)	3.50 (89)	7.50 (191)
3-inch	15.7 (399)	14.0 (356)	4.00 (102)	10.00 (254)
4-inch	16.2 (411)	14.0 (356)	4.00 (102)	12.00 (305)
6-inch	17.3 (439)	14.0 (356)	6.00 (152)	18.00 (457)
8-inch	18.3 (465)	14.0 (356)	8.00 (203)	24.00 (610)

NPT Remote—Front View

4.6 (117)
4.6 (117)
C

Flange Remote—Front View

4.6 (117)
4.6 (117)
C
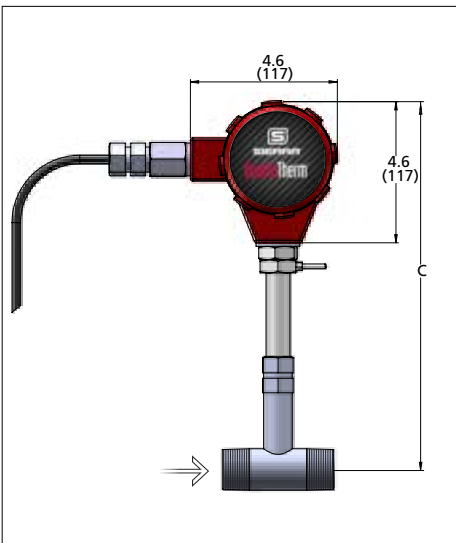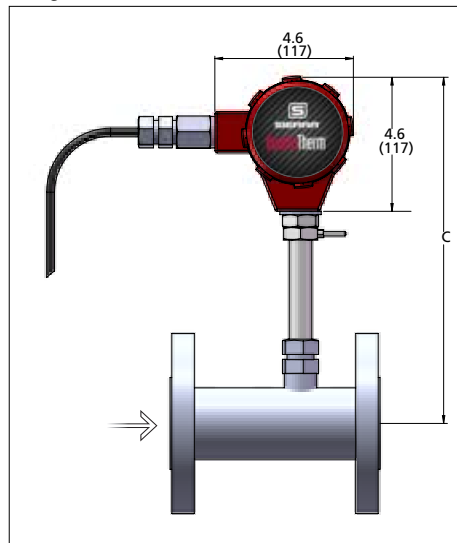
Sizes for PN16 DN Flanges

Size	H	C	L1	L2
DN50	17.2 (437)	14.0 (356)	3.34 (85)	7.10 (180)
DN80	17.9 (455)	14.0 (356)	4.14 (105)	10.20 (259)
DN100	18.3 (465)	14.0 (356)	4.57 (116)	12.60 (320)
DN150	19.6 (498)	14.0 (356)	6.77 (172)	18.90 (480)
DN200	20.7 (526)	14.0 (356)	8.47 (215)	24.40 (620)

640i - ☐ **-** ☐ **-** ☐ **-** ☐ **-** ☐ **-** ☐ **-** ☐ **-** ☐ **-** 0 **-** ☐ **-** ☐ **-** ☐ ☐

┌─── Dial-A-Gas Selection ───┐   Option 1

Feature   1   2   3   4   5   6   7   8   *9   10   11   12
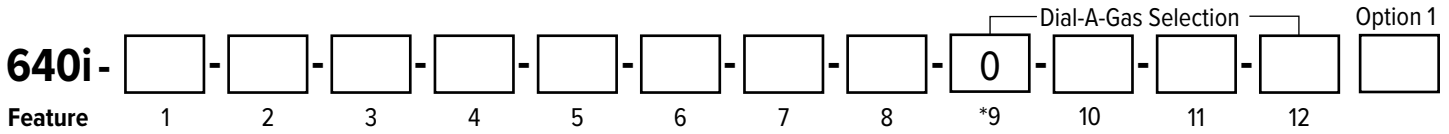
Instructions: To order a 640i, please fill in each feature number block by selecting the codes from the corresponding features below and following pages.

*Feature 9 is air (always included)

Feature 1: Multivariable	
640i VT	Thermal Insertion Mass Flow Meter; all 316L stainless steel construction; linear 4-20 mA output signals for Mass Flow Velocity and Temperature, temperatures -40°F to 392°F (-40°C to 200°C); pressure to 500 psig (34.5 barg); standard accuracy (air) +/- 0.75% of reading above 50% of full scale flow and +/- 0.75% of reading plus 0.5% of full scale below 50% of full scale flow; includes qTherm™ Electronics with PC configuration software; 24 VDC +/- 10.0% or 100-240 VAC input power with a 3/4-inch (2 cm) diameter 316 SS insertion sensor probe; configurable alarm and pulse outputs; CE, cFMus, ATEX, IECEx approved
640i VTP	Add a pressure output to the 640i VT version; three 4-20 mA linear outputs for mass flow velocity, temperature, and pressure; includes pressure sensor to 500 psia (34.5 bara)

Note: Minimum pipe size for insertions is 2 inches (50 mm) diameter.

Feature 2: Approvals	
1	**NAA.** Non-agency approved.
2	**cFMus.** Process Temperature Range: -40°C to 200°C (-40°F to 392°F). Class I, Division 1, Groups B,C, and D T3C Ta = -40°C to 60°C (-40°F to 140°F). Type 4x. Maximum probe length is 48 inches (1.22 m). Note: Requires Killark seal for probes >L13, see Note 1
3	**ATEX and IECEx.** II 2 G Ex d IIC T3 Gb. II 2 D Ex tb IIIC T200°C Db. Ta = -20°C to 60°C (-4°F to 140°F). Process Temperature Range: -40°C to 200°C (-40°F to 392°F). Maximum probe length is 48 inches (1.22 m)

Feature 3: Probe Length	
L06	6-inch (15 cm)
L09	9-inch (23 cm)
L13	13-inch (33 cm)
L18	18-inch (46 cm) If agency approved, see Note 1.
L24	24-inch (61 cm) If agency approved, see Note 1.
L36	36-inch (91 cm) If agency approved, see Note 1.
L48	48-inch (122 cm) If agency approved, see Note 1.
L( ) M5	Probe with 1 inch, class 150 Flange welded to probe. Specify length between flange face and center of pipe in parenthesis. Include M5 option Diagram with ADS. Don't select a probe length from Feature 2. Note 1: Killark seal is required for agency approved meters greater than L13 (33 cm). Adds 6.2 in (157 mm) to probe length listed above.

Note 1: Killark seal is required for agency approved meters with >L13. Adds 6.2 in (157 mm) to probe length listed above.

Feature 4: Mounting Options: Standard 3/4" (19.1mm) Diameter Sensor Probe	
M0	Customer to supply own mounting hardware
M1	Compression fitting, 3/4-inch (2 cm) with 1-inch (2.5 cm) male NPT
M2( )	Threadolet 1-inch Female NPT; specify pipe O.D. in parenthesis
M1-M2( )	Compression fitting plus Threadolet. 3/4-inch probe feed through by 1-inch male NPT. Threads into 1-inch Female NPT, which is welded to the pipe. Specify pipe O.D. in parenthesis. **We strongly advise to purchase this as a set, since we've seen non compatible NPT threads in the past.**
M3	Flat duct bracket, 3/4-inch (2 cm) tube compression fitting
M4( )	Curved duct bracket, 3/4-inch (2 cm) tube compression fitting; specify duct O.D. in parentheses
M8( )	**Low pressure hot tap,** includes ball valve and packing gland; maximum 150 psig (10.3 barg); specify duct O.D. in parenthesis. **Note: M8 option not available for probes less than 18 inches**
L( )M9	High pressure hot-tap with removable retractor kit assembly includes probe (probe length L in parentheses, MINIMUM length is process connection dependent), removable retractor assembly, packing gland probe seal with a 2-inch ANSI class 150 process connection (other classes available, contact factory) and Conax fitting. Max pressure flange dependent or 500 psig (34.5 barg). Available for probe lengths listed in Feature 3
M15	Quick removal hot-tap, includes ball valve and compression fitting rated for 40 psig (2.8 barg)

Feature 5: Electronics Enclosure	
E2	Hazardous-area location enclosure NEMA 4X (IP66) mounted directly on probe
E4(10)	10 feet away from the probe with junction box mounted on probe. Note: Customer may cut cable length with no effect on accuracy.
E4(25)	25 feet away from the probe with junction box mounted on probe. Note: Customer may cut cable length with no effect on accuracy.
E4(50)	50 feet away from the probe with junction box mounted on probe.
E4(100)	100 feet away from the probe with junction box mounted on probe. Note: Customer may cut cable length with no effect on accuracy.
E4 (CUSTOM LENGTH)	Custom length away from the probe with junction box mounted on probe. ≤100 feet. Note: Customer may cut cable length with no effect on accuracy.

Feature 6: Input Power	
P2	24 VDC +/- 10.0%
P3	100-240 VAC

Feature 7: Output	
V4	Two linear 4-20mA outputs for mass flow velocity and temperature
V6 (VTP only)	Three linear 4-20mA outputs for mass flow velocity, temperature and pressure (only available with Feature 1: Multivariable 640i VTP)

Feature 8: Display	
DD	Digital Display: UltraBright LCD indicates mass flow velocity, T, P, alarms and totalized mass flow in engineering units; 6-push button user interface makes selection easy: Dial-A-Gas, Dial-A-Pipe, change units, change language, set alarms and much more...
DD-NRT	Totalizer cannot be reset in the field.
SS	Sun shield

Feature 9: Pressure (VTP only)	
MP1	30 psia (2.1 bara), VTP only
MP2	100 psia (6.9 bara), VTP only
MP3	300 psia (20.7 bara), VTP only
MP4	500 psia (34.5 bara), VTP only

Feature 9 : qTherm Dial-A-Gas Selection
*Select three additional gases to be programmed into the instrument; Air is standard on the instrument and cannot be removed. qTherm gas is +/- 3.0% of full scale for all qTherm gases unless otherwise noted. Derated to 5% for 1" shroud option

qTherm Gas Code	Gas	Actual Gas Calibration Code
0	Air (Standard)	0
1	Argon	1A
2	Carbon Dioxide	2A
3	Chlorine	N/A
4	Digester Gas	4A
6	Helium	6A
7	Hydrogen	7A
8	Methane	8A
10	Nitrogen	10A
11	Oxygen (0.75% reading plus 0.5% full scale qTherm accuracy)	N/A
12	Propane	12A
14	Ammonia[1]	N/A
99	Other[1]–Consult Factory	99A

[1]Correlation calibration - consult Gas Table for accuracy.
Note: Accessories must be entered as separate line items on your order.

Option 1: Digital Communications	
MB	Modbus RTU full device registers
HART	HART with full device description

Note: Available with cFMus, ATEX/IECEx, and in P2 only.

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

780i - [ ]1 - [ ]2 - [ ]3 - [ ]4 - [ ]5 - [ ]6 - [ ]7 - [ ]8 - **0***9 - [ ]10 - [ ]11 - [ ]12   Option 1

Dial-A-Gas Selection (spanning features 10, 11)

Feature — 1 2 3 4 5 6 7 8 *9 10 11 12

Instructions: To order a 780i, please fill in each feature number block by selecting the codes from the corresponding features below and following pages.

*Feature 9 is air (always included)

Feature 1: Multivariable

VT	Inline Thermal Mass Flow Meter with Flow Conditioning; all 316L stainless steel construction; linear 4-20 mA output signals for Mass Flow Rate and Temperature; temperature range -40°F to 392°F (-40°C to 200°C) and pressure to 500 psia (34.5bara) maximum (-1 NAA Only, 300 psig (20.7 barg) maximum for -2 or -3 agency approved units); standard accuracy +/- 0.5% of reading above 50% of full scale flow and +/- 0.5% of reading plus 0.5% of full scale below 50% of full scale flow; configurable alarm and pulse outputs; CE, cFMus, ATEX, and IECEx approved
VTP	Add a pressure output to the 780i VT version; three 4-20 mA linear outputs for mass flow velocity, temperature, and pressure; includes pressure sensor to 500 psia (34.5 bara)

Feature 2: Approvals

1	**NAA.** Non-agency approved.
2	**cFMus.** Process Temperature Range: -40°C to 200°C (-40°F to 392°F). Class I, Division 1, Groups B,C, and D T3C Ta = -40°C to 60°C (-40°F to 140°F). Type 4x.
3	**ATEX and IECEx.** II 2 G Ex d IIC T3 Gb. II 2 D Ex tb IIIC T200°C Db. Ta = -20°C to 60°C (-4°F to 140°F). Process Temperature Range: -40°C to 200°C (-40°F to 392°F).

Feature 3: Inline Flow Bodies with Flow Conditioning

N2	1/2-inch (1 cm) NPT male 316 SS
N3	3/4-inch (2 cm) NPT male 316 SS
N4	1-inch (2.5 cm) NPT male 316 SS
N5	1.5-inch (4 cm) NPT male 316 SS
N6	2-inch (5 cm) NPT male 316 SS
N7	3-inch (8 cm) NPT male 316 SS
N8	4-inch (10 cm) NPT male 316 SS
N9	6-inch (15 cm) NPT male 316 SS
N10	8-inch (20 cm) NPT male 316 SS

F2	1/2-inch ANSI class 150 flange 316 SS
F3	3/4-inch ANSI class 150 flange 316 SS
F4	1-inch ANSI class 150 flange 316 SS
F5	1.5-inch ANSI class 150 flange 316 SS
F6	2-inch ANSI class 150 flange 316 SS
F7	3-inch ANSI class 150 flange 316 SS
F8	4-inch ANSI class 150 flange 316 SS
F9	6-inch ANSI class 150 flange 316 SS
F10	8-inch ANSI class 150 flange 316 SS

FD6	DN50, PN16, flange
FD7	DN80, PN16, flange
FD8	DN100, PN16, flange
FD9	DN150, PN16, flange
FD10	DN200, PN16, flange

GD4	DN25, PN40, DIN flange
GD5	DN 40, PN40, DIN flange
GD6	DN50, PN40, DIN flange
GD7	DN80, PN40, DIN flange

Feature 4: Electronics Enclosure

E2	Hazardous-area location enclosure NEMA 4X (IP66) mounted directly on probe
E4(10)	10 feet away from the probe with junction box mounted on probe.
E4(25)	25 feet away from the probe with junction box mounted on probe.
E4(50)	50 feet away from the probe with junction box mounted on probe.
E4(100)	100 feet away from the probe with junction box mounted on probe.
E4 (CUSTOM LENGTH)	Custom length away from the probe with junction box mounted on probe. ≤100 feet.

Note: Customer may cut cable length with no effect on accuracy.

Feature 5: Input Power

P2	24 VDC +/- 10.0%
P3	100-240 VAC

Feature 6: Output

V4	Two linear 4-20mA outputs for T and mass flow rate
V6 (VTP only)	Three linear 4-20mA outputs for T, P, mass flow rate (only available with Feature 1: Multivariable 780i VTP)

Feature 7: Display

DD	UltraBright LCD indicates Mass Flow Velocity, T, P, Alarms and Totalized Mass Flow in engineering units
DD-NRT	Totalizer cannot be reset in the field.
SS	Sun shield

Feature 8: Pressure

MP1	30 psia (2.1 bara), VTP only
MP2	100 psia (6.9 bara), VTP only
MP3	300 psia (20.7 bara), VTP only
MP4	500 psia (34.5 bara), VTP only

Note: Put N/A in feature block 9 for VT or E4 meters.

Maximum operating pressure must not exceed the full scale of the pressure transducer if the VTP option is ordered or damage may occur.

Feature 9: qTherm Dial-A-Gas Selection

*Select three additional gases to be programmed into the instrument; Air is standard on the instrument and cannot be removed. qTherm gas is +/- 3.0% of full scale for all qTherm gases unless otherwise noted. Derated to 5% for 1" shroud option

qTherm Gas Code	Gas	Actual Gas Calibration Code
0	Air (standard)	0
1	Argon	1A
2	Carbon Dioxide	2A
3	Chlorine	N/A
4	Digester Gas	4A
6	Helium	6A
7	Hydrogen	7A
8	Methane	8A
10	Nitrogen	10A
11	Oxygen (0.75% reading plus 0.5% full scale less than 50% qTherm accuracy)	N/A
12	Propane	12A
14	Ammonia[1]	NA
99	Other[1]–Consult Factory	99

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

Option 1: Digital Communications	
MB	Modbus RTU
HART	HART with full device description

Note: Available with cFMus, ATEX/IECEx, and P2 only.

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