


# InnovaMass

 The iSeries Vortex Flow Meter  
for Precise Steam, Liquid, and Gas Flow Measurement





SIERRA

InnovaMass

2380.0 Lbs/hr  
370.00 F



# Reach **performance** levels you never believed achievable.

Industrial and manufacturing process control both rely on the highest accuracy steam, liquid, and gas flow measurement possible to optimize productivity, efficiency and cost savings.

In the 1990s, Sierra designed and introduced InnovaMass®, the first multivariable mass vortex flow meter in the world. Today, with the latest in firmware advancements, robust software applications, and Sierra's automated state-of-the-art calibration facility, the next generation InnovaMass iSeries—240i (inline) and 241i (insertion)—build on their predecessor's success to drastically exceed their performance.

## **Five Instruments in One**

Through a single process connection, InnovaMass continues to empower customers with mass and volumetric flow rate, density, temperature and pressure. Five instruments in one. As a result, total cost-of-ownership for customers plummets. Lower initial cost, less complex installation, and reduced maintenance costs contribute to significant savings.

## **The Flow Engine Behind it All**

At the heart of every 240i and 241i is advanced digital signal processing to enhance vortex shedding flow metering technology and fluid dynamic measurements.

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

Raptor manages all five process variables in real time and enhances the velocity signal for greater sensitivity at lower flows. The result is a proprietary, fundamentally different flow rate calculation using all pertinent variables for the most precise, stable and accurate flow measurement possible.

Raptor interfaces with Sierra's many software apps to read, adjust and even upgrade the meter firmware in the field.

## **High Accuracy Through Density and Reynolds Number Calculation**

Typical vortex flow meters measure the velocity of a flowing fluid and derive volumetric flow rate from that measurement.

Some meters take it a step further by using temperature and pressure measurements to calculate mass flow rate. This yields typical accuracies of +/- 2.0% of full scale over a flow range of 1 to 30 fps (0.3 to 9.0 mps).

InnovaMass has multivariable capability built-in. Raptor uses direct velocity, temperature and pressure measurements, coupled with an on-board fluid properties database, to calculate the fluid's density and Reynold's number in real time.

This is critical in real-world applications. For example, a 10% change in steam pressure (thus affecting density) will introduce a 10% error in mass flow measurement unless compensated. A corresponding change in the Reynold's number may dampen the flow signal enough to cause the meter to read no flow.

Employing the power of Sierra's Raptor OS, InnovaMass measures liquid flow rates to better than +/- 0.7% of reading at flows under 1.0 fps (0.3 mps).



241i insertion



240i inline

## 240i / 241i Highlights

- Accuracy of up to 0.7% of reading
- Fluids: Mass or volumetric flow metering of gases, liquids and steam
- Pipe/duct size:  
Insertion version: 2 inch (50.8mm) to 72 inches (1.8M)  
Inline version: 1 inch (DN25) to 8 inches (DN200)
- Hot-tap probe retractor
- 30:1 turndown
- Free user software
- Field firmware upgrades
- Multivariable: mass flow rate, volumetric flow rate, density, pressure, temperature
- Dynamic density calculation improves steam metering accuracy
- Flow Energy: steam enthalpy and AGA8 natural gas
- In-Situ calibration validation
- No moving parts
- Raptor OS "Brain" manages all inputs
- Sierra fluids library, improves over time
- Multi-language capable
- Three configurable 4-20 mA outputs
- Digital communications
- Removable SD card
- Hazardous area approvals

## Notable Apps

- ValidCal Diagnostics
- Datalogging
- Flow Totalizer
- MeterTuning
- Low flow signal tuning
- Dial-A-Pipe: Change pipe size
- Dial-A-Fluid: Change fluid type
- FloPro

## Insertion Vortex Flexibility

The 241i insertion vortex meter is an economical solution for applications from 2-inch (50.8 mm) pipes to 72 inches (1.8M) in diameter and larger. Measurement is possible with a single pipe insertion point, greatly reducing installation costs. The 241i can be hot tapped into applications with an optional probe retractor (see below). More compact probe lengths are available based on application requirements.

## It has Apps

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

Apps like the MeterTuning™ tool adjust inputs and outputs making the meter easy to tune in difficult applications.

Apps like ValidCal™ Diagnostics make field calibration validation easy.

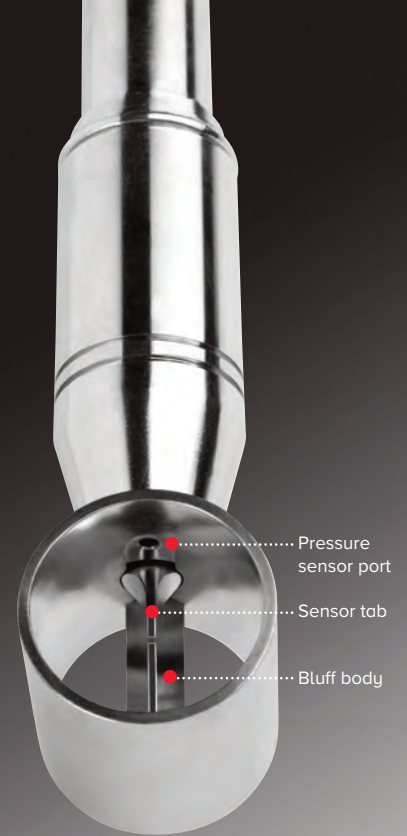
Change pipe sizes and measured fluid in the field with apps like Dial-A-Pipe™ and Dial-A-Fluid™.

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

## Know Your Flow Profile

The 241i insertion version has a vastly improved flow profile calculation using a proprietary application called FloPro.

Standard Insertion InnovaMass Sensor / Multivariable



InnovaMass 241i Insertion with Optional Flow Retractor



With all insertion point velocity flow meters, knowing the flow profile is key to stable and reliable accuracy.

FloPro improves flow profile knowledge by also calculating the transitional flow regime that occurs between laminar flow and turbulent flow. This all adds up to accuracy you can rely on.

## WaterLoop World Class Calibration

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

Rated at +/- 0.2% of reading, all calibrations follow the guidelines of ISO 17025 and are directly traceable to national standards such as NIST (US National Institute of Standards and Technology).

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

## 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. And they are backed up by technical experts in over

150 locations in more than 50 countries.

Sierra's team of engineers can commission your flow meter for 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.

## Sierra's Big-3 Technologies

InnovaMass is one of three advanced flow meter technologies Sierra has developed to help facility managers tackle tough energy management challenges.

For what we call our Big-3, Sierra has become a recognized expert in thermal mass (QuadraTherm®), vortex shedding (InnovaMass®), and transit-time ultrasonic (InnovaSonic®). Sierra is the only company in the USA to manufacture all three flow technologies.

The Big-3 are optimized to be a complete solution for flow energy measurement—facility flows that impact costs like compressed air, natural gas, steam, and hot or chilled water.

As new apps and improvements become available, all Big-3 technologies benefit and are field firmware upgradable.

## Watch the Video

[sierrainstruments.com/innovamass-video](http://sierrainstruments.com/innovamass-video)



**Fluid Measured**

Mass or volumetric flow measurement of any gas, liquid, or steam  
 Dial-A-Fluid feature to change fluid in the field  
 Fluid Database to build complex fluid mixtures with qMix software

**Multivariable Outputs**

Measure five process variables with one process connection:  
 Mass flow rate, volumetric flow rate, density, pressure, and temperature  
 Totalized flow based on user-determined flow units, sixteen full digits

**Accuracy**

| Process Variables    | 240i Inline Meters                                   |   | 241i Insertion <sup>(1)</sup> Meters                 |   |
|----------------------|--|---|--|---|
|                      | Liquids  | Gas and Steam   | Liquids  | Gas and Steam   |
| Mass Flow Rate       | +/- 1.0% of reading over a 30:1 range <sup>(3)</sup> | +/- 1.5% of reading <sup>(2)</sup> over a 30:1 range <sup>(3)</sup> | +/- 1.2% of reading over a 30:1 range <sup>(3)</sup> | +/- 2.0% of reading <sup>(2)</sup> over a 30:1 range <sup>(3)</sup> |
| Volumetric Flow Rate | +/- 0.7% of reading over a 30:1 range <sup>(3)</sup> | +/- 1.0% of reading over a 30:1 range <sup>(3)</sup>                | +/- 1.0% of reading over a 30:1 range <sup>(3)</sup> | +/- 1.5% of reading over a 30:1 range <sup>(3)</sup>                |
| Temperature          | +/- 2°F (+/- 1°C)                                    | +/- 2°F (+/- 1°C)   | +/- 2°F (+/- 1°C)                                    | +/- 2°F (+/- 1°C)   |
| Pressure             | 0.5% of transducer full scale                        | 0.5% of transducer full scale                                       | 0.5% of transducer full scale                        | 0.5% of transducer full scale                                       |
| Density              | 0.3% of reading                                      | 1.0% of reading <sup>(2)</sup>                                      | 0.3% of reading                                      | 1.0% of reading <sup>(2)</sup>                                      |

Notes: (1) Accuracies stated are for the total mass flow through the pipe.  
 (2) Over 50% to 100% of the pressure transducer's full scale.  
 (3) Nominal rangeability is stated. Precise rangeability depends on fluid and pipe size.

**Repeatability**

Mass Flow Rate: +/- 0.2% of reading  
 Volumetric Flow Rate: +/- 0.1% of reading  
 Temperature: +/- 0.2°F (+/- 0.1°C)  
 Pressure: +/- 0.05% of full scale  
 Density: +/- 0.1 % of reading

**Stability Over 12 Months**

Mass Flow Rate: +/- 0.2% of reading maximum  
 Volumetric Flow Rate negligible error  
 Temperature: +/- 1.0°F (+/- 0.5°C) maximum  
 Pressure: +/- 0.1% of full scale maximum  
 Density: +/- 0.1% of reading maximum

**Differential Pressure Requirements, P**

Permanent pressure loss of inline meters for air at 68°F (20°C) and 14.70 psi (1.104 bara). See Figure 1. Permanent pressure loss of inline meters for water at 68°F (20°C). See Figure 2.

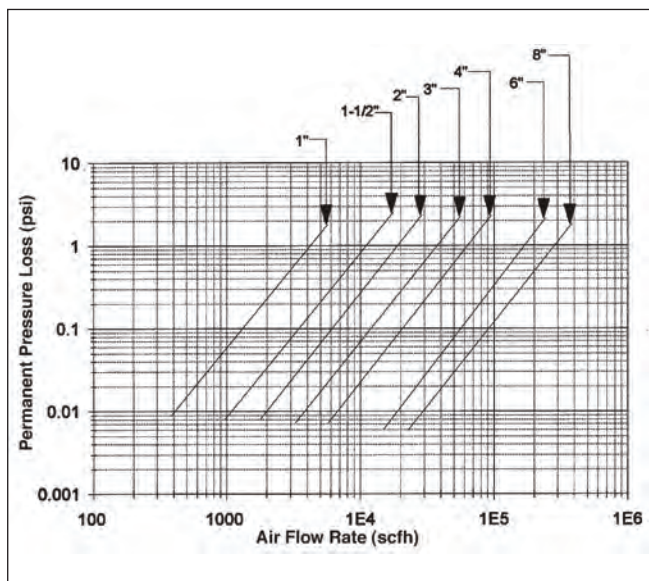


Figure 1

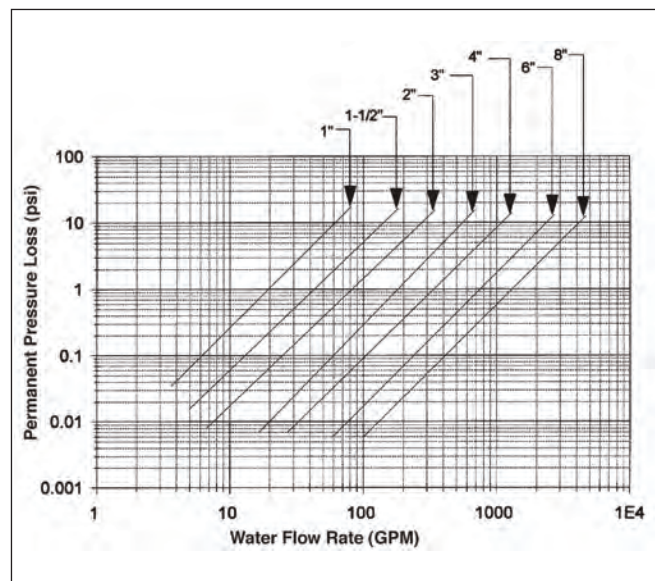


Figure 2

## PERFORMANCE SPECIFICATIONS (continued)

### Material Compatibility

240i: Any gas, liquid or steam compatible with 316L stainless steel. Not recommended for multi-phase fluids.

241i: Any gas, liquid or steam compatible with 316L stainless steel. Not recommended for multi-phase fluids.

Note: Units with the pressure option use Viton® elastomers.

### Linear Range

Smart electronics corrects for lower flow, down to a Reynolds number of 2,000. The Reynolds number is calculated using the fluid's actual temperature and pressure monitored by the meter. Rangeability depends on the fluid, process connections and pipe size (consult factory with your application). Velocity rangeability under ideal conditions is as follows:

#### Liquids 30:1

Minimum Velocity

1 foot per second  
(0.3 meters per second)

Maximum Velocity

30 feet per second  
(9.14 meters per second)

#### Gases 30:1

Minimum Velocity

$$\sqrt{\frac{25}{\rho}} \text{ ft/s} \quad \rho \text{ in lb}_m/\text{ft}^3$$

$$\sqrt{\frac{37}{\rho}} \text{ m/s} \quad \rho \text{ in kg/m}^3$$

where  $\rho$  = fluid density

Maximum Velocity

91 m/s velocity  
300 ft/s velocity

## OPERATING SPECIFICATIONS

### Flow Rates

Typical mass flow ranges are given in the following table. Precise flow ranges depend on the fluid and pipe size. 241i insertion meters are applicable to pipe sizes from 2 inches (DN50) and greater. Consult factory for sizing program:

[www.sierrainstruments.com/products/innovamass\\_sizing.html](http://www.sierrainstruments.com/products/innovamass_sizing.html)

| Water Minimum and Maximum Flow Rates (gpm) |     |        |          |        |        |        |        |        |
|--|-----|--------|----------|--------|--------|--------|--------|--------|
| Unit                                       |     | 1-inch | 1.5-inch | 2-inch | 3-inch | 4-inch | 6-inch | 8-inch |
| gpm  | Min | 2.3    | 5.5      | 9.2    | 21     | 36     | 81     | 143    |
|  | Max | 68     | 165      | 276    | 618    | 1080   | 2440   | 4280   |

| Water Minimum and Maximum Flow Rates (m <sup>3</sup> /hr) |     |      |      |      |      |       |       |       |
|---|-----|------|------|------|------|-------|-------|-------|
| Unit  |     | DN25 | DN40 | DN50 | DN80 | DN100 | DN150 | DN200 |
| m <sup>3</sup> /hr  | Min | 0.5  | 1.3  | 2.1  | 4.7  | 8.2   | 18    | 32    |
|   | Max | 15   | 38   | 63   | 140  | 245   | 553   | 971   |

| Air Minimum and Maximum Flow Rates (scfm) <sup>(1)</sup> |     |        |          |        |        |        |        |        |
|--|-----|--------|----------|--------|--------|--------|--------|--------|
| Pressure   |     | 1-inch | 1.5-inch | 2-inch | 3-inch | 4-inch | 6-inch | 8-inch |
| 0 psig   | Min | 5.52   | 13.5     | 22.5   | 50.4   | 87.8   | 199    | 349    |
|  | Max | 90.5   | 221      | 369    | 826    | 1440   | 3260   | 5720   |
| 100 psig   | Min | 15.1   | 36.9     | 61.8   | 138    | 241    | 545    | 956    |
|  | Max | 694    | 1690     | 2830   | 6330   | 11000  | 25000  | 43800  |
| 200 psig   | Min | 20.7   | 50.4     | 84.3   | 188    | 329    | 743    | 1300   |
|  | Max | 1300   | 3170     | 5300   | 11800  | 20600  | 46700  | 81900  |
| 300 psig   | Min | 25     | 61       | 102    | 228    | 397    | 899    | 1580   |
|  | Max | 1900   | 4640     | 7760   | 17300  | 30200  | 68400  | 120000 |
| 400 psig   | Min | 28.6   | 69.9     | 117    | 261    | 456    | 1030   | 1810   |
|  | Max | 2500   | 6110     | 10200  | 22800  | 39800  | 90100  | 158000 |
| 500 psig   | Min | 31.9   | 77.8     | 130    | 291    | 507    | 1150   | 2010   |
|  | Max | 3110   | 7580     | 12700  | 28300  | 49400  | 112000 | 196000 |

Note: (1) Standard conditions are 70° F and 1 atmosphere (21.1°C and 760 Torr).

| Air Minimum and Maximum Flow Rates (nm <sup>3</sup> /hr) <sup>(1)</sup> |     |      |       |       |       |       |        |        |
|---|-----|------|-------|-------|-------|-------|--------|--------|
| Pressure  |     | DN25 | DN40  | DN50  | DN80  | DN100 | DN150  | DN200  |
| 0 barg  | Min | 9.35 | 22.8  | 38.2  | 85.3  | 149   | 337    | 591    |
|   | Max | 154  | 375   | 628   | 1400  | 2450  | 5530   | 9710   |
| 5 barg  | Min | 22.8 | 55.6  | 92.9  | 208   | 362   | 819    | 1440   |
|   | Max | 912  | 2230  | 3730  | 8330  | 14500 | 32800  | 57600  |
| 10 barg   | Min | 28.2 | 68.7  | 115   | 257   | 448   | 1010   | 1780   |
|   | Max | 1530 | 3750  | 6270  | 14000 | 24400 | 55200  | 96900  |
| 20 barg   | Min | 42.5 | 104   | 173   | 387   | 676   | 1530   | 2680   |
|   | Max | 3190 | 7780  | 13000 | 29100 | 50700 | 115000 | 201000 |
| 30 barg   | Min | 51.5 | 126   | 210   | 470   | 820   | 1850   | 3250   |
|   | Max | 4710 | 11500 | 19200 | 42900 | 74900 | 169000 | 297000 |
| 40 barg   | Min | 59.2 | 145   | 242   | 540   | 942   | 2130   | 3740   |
|   | Max | 6220 | 15200 | 25400 | 56800 | 99000 | 224000 | 393000 |

Note: (1) Normal conditions are 32°F and 1 atmosphere (0°C and 760 Torr).

**OPERATING SPECIFICATIONS (continued)**

| Saturated Steam Minimum and Maximum Flow Rates (lb/hr) |     |        |          |        |        |        |        |        |
|--|-----|--------|----------|--------|--------|--------|--------|--------|
| Pressure   |     | 1-inch | 1.5-inch | 2-inch | 3-inch | 4-inch | 6-inch | 8-inch |
| 5 psig   | Min | 20     | 48.9     | 81.8   | 183    | 319    | 721    | 1270   |
|  | Max | 266    | 650      | 1090   | 2430   | 4240   | 9590   | 16800  |
| 100 psig   | Min | 45.9   | 112      | 187    | 418    | 730    | 1650   | 2900   |
|  | Max | 1390   | 3400     | 5690   | 12700  | 22200  | 50200  | 88100  |
| 200 psig   | Min | 61.9   | 151      | 253    | 565    | 985    | 2230   | 3910   |
|  | Max | 2540   | 6200     | 10400  | 23200  | 40400  | 91400  | 160000 |
| 300 psig   | Min | 74.6   | 182      | 304    | 680    | 1190   | 2680   | 4710   |
|  | Max | 3690   | 9000     | 15100  | 33600  | 58700  | 133000 | 233000 |
| 400 psig   | Min | 85.5   | 209      | 349    | 780    | 1360   | 3080   | 5400   |
|  | Max | 4840   | 11800    | 19800  | 44200  | 77100  | 174000 | 306000 |
| 500 psig   | Min | 95.3   | 233      | 389    | 870    | 1520   | 3430   | 6020   |
|  | Max | 6020   | 14700    | 24600  | 55000  | 95900  | 217000 | 381000 |

| Saturated Steam Minimum and Maximum Flow Rates (kg/hr) |     |      |      |       |       |       |        |        |
|--|-----|------|------|-------|-------|-------|--------|--------|
| Pressure   |     | DN25 | DN40 | DN50  | DN80  | DN100 | DN150  | DN200  |
| 0.5 barg   | Min | 11   | 26.8 | 44.8  | 100   | 175   | 395    | 693    |
|  | Max | 134  | 326  | 546   | 1220  | 2130  | 4810   | 8440   |
| 5 barg   | Min | 18.2 | 44.5 | 74.4  | 166   | 290   | 656    | 1150   |
|  | Max | 488  | 1190 | 1990  | 4450  | 7770  | 17600  | 30800  |
| 10 barg  | Min | 24.3 | 59.3 | 99.2  | 222   | 387   | 874    | 1530   |
|  | Max | 867  | 2120 | 3540  | 7910  | 13800 | 31200  | 54800  |
| 20 barg  | Min | 33.2 | 81.1 | 136   | 303   | 528   | 1200   | 2100   |
|  | Max | 1620 | 3960 | 6620  | 14800 | 25800 | 58300  | 102000 |
| 30 barg  | Min | 40.3 | 98.3 | 164   | 368   | 641   | 1450   | 2540   |
|  | Max | 2380 | 5820 | 9740  | 21800 | 37900 | 85800  | 151000 |
| 40 barg  | Min | 46.4 | 113  | 190   | 424   | 739   | 1670   | 2930   |
|  | Max | 3170 | 7740 | 12900 | 28900 | 50400 | 114000 | 200000 |



Process Fluid Pressure

| 241i Insertion Pressure Ratings |                      |          |                      |               |
|---------------------------------|----------------------|----------|----------------------|---------------|
| Probe Seal                      | Process Connection   | Material | Rating               | Ordering Code |
| Compression Fitting             | 2-inch male NPT      | 316L SS  | 1500 psig (103 barg) | CM            |
|                                 | 2-inch 150 lb flange | 316L SS  | ANSI 150 lb          | CF            |
|                                 | 2-inch 300 lb flange | 316L SS  | ANSI 300 lb          | CG            |
|                                 | 2-inch 600 lb flange | 316L SS  | ANSI 600 lb          | CH            |
|                                 | DN50/PN16 flange     | 316L SS  | PN16                 | CFD           |
|                                 | DN50/PN40 flange     | 316L SS  | PN40                 | CGD           |
|                                 | DN50/PN64 flange     | 316L SS  | PN64                 | CHD           |
| Packing Gland                   | 2-inch male NPT      | 316L SS  | 500 psig (34.5 barg) | PM            |
|                                 | 2-inch 150 lb flange | 316L SS  | ANSI 150 lb          | PF            |
|                                 | 2-inch 300 lb flange | 316L SS  | ANSI 300 lb          | PG            |
|                                 | 2-inch 600 lb flange | 316L SS  | ANSI 600 lb          | PH            |
|                                 | DN50/PN16 flange     | 316L SS  | PN16                 | PFD           |
|                                 | DN50 PN40 flange     | 316L SS  | PN40                 | PGD           |
|                                 | DN50 PN64 flange     | 316L SS  | PN64                 | PHD           |

Process Fluid Pressure

| 240i Inline Pressure Ratings |          |                  |
|------------------------------|----------|------------------|
| Process Connection           | Material | Rating           |
| Flanged                      | 316L SS  | 150, 300, 600 lb |
| DN Flanged                   | 316L SS  | PN16, PN40, PN64 |

Pressure Transducer Ranges

| Pressure Sensor Ranges <sup>(1)</sup> psia (bara)<br>Full Scale Operating Pressure (FS) |                        |
|---|------------------------|
| psia  | (bara)                 |
| 15 to 30 [FS 30]  | 1.0 to 2.1 [FS 2.1]    |
| 30 to 100 [FS 100]  | 2.1 to 6.9 [FS 6.9]    |
| 100 to 300 [FS 300]   | 6.9 to 20.7 [FS 20.7]  |
| 300 to 500 [FS 500]   | 20.7 to 34.5 [FS 34.5] |

Note: (1) To maximize accuracy, specify the lowest full scale operating pressure range for the application. To avoid damage, the flow meter must never be subjected to "Full Scale Operating Pressure" shown above.

Process Fluid & Ambient Temperature

Standard Temperature Sensor: -40°F to 392°F  
(-40°C to 200°C)

Ambient Operating:

- NAA/cFMus: -40°F to 140°F (-40°C to 60°C)
- ATEX/IECEX: -4°F to 140°F (-20°C to 60°C)
- Storage: -40°F to 150°F (-40°C to 65°C)
- 0-98% relative humidity, non-condensing conditions

PHYSICAL SPECIFICATIONS

Wetted Materials

240i: 316L stainless steel standard  
Viton® O-ring used on pressure transducer

241i: 316L stainless steel standard  
Viton® packing gland  
Other packing gland materials available upon request  
Viton® O-ring used on pressure transducer

Enclosure

NEMA 4x (IP66) cast enclosure

Electrical Ports

Two 3/4-inch female NPT conduit ports

Mounting Connections

240i: 150, 300, 600 lb ANSI flange; PN16, 40, 64 DN flanges

241i: Permanent Installation  
Two-inch male NPT; 150, 300, 600 lb ANSI flange (PN16, 40, 64 DN flanges) with compression fitting probe seal

Hot Tap Installation:

Two-inch male NPT; 150, 300, 600 lb ANSI flange (PN16, 40, 64 DN flanges); and optional retractor with packing gland probe seal, removable under line pressure.

Mounting Position

240i: No effect

241i: Meter must be perpendicular within +/- 5° of the pipe centerline

## PHYSICAL SPECIFICATIONS (continued)

### Approvals

cFMus Approval  
ATEX Approval  
IECEX Approval  
CE Approval

### Optional Certifications

Construction and inspection (ANSI/ASME B31.3)  
Materials (NACE MR-01-75(90))

### Alarms<sup>(1)</sup>

Solid-state relay for high, low or window alarms  
Contact SPST / optical relay

## POWER REQUIREMENTS

24 VDC +/-10%, 0.4 amp maximum  
100 to 240 VAC, 50/60 Hz, 0.2 amps RMS at 12 W maximum

## ANALOG AND DIGITAL OUTPUTS

### Output Signals

#### Analog

Three field rangeable, simultaneous linear 4-20 mA output signals (500 ohms maximum loop resistance) for mass or volumetric flow rate, temperature, and pressure.

#### Pulse<sup>(1)</sup>

Relay capable of 1 Hz maximum user-definable pulse output for totalized flow

Note: (1) The pulse and alarm outputs are optically isolated and require external power for operation.

### Digital Communications

HART, Modbus, RS-232, USB, Profibus DP and Foundation Fieldbus

## USER INTERFACE & SOFTWARE

### Smart Interface Portal (SIP)

User-centered software program allows for easy configuration and field validation. Includes:

Meter Tune: Adjusts inputs and outputs to adjust to application  
ValidCal Diagnostics: Automatically diagnoses firmware and hardware and reports faults

### User Interface

Local, keypad with six-button interface  
Exit  $\otimes$ , and Enter  $\leftarrow$ , with four-way directional arrows  
RS-232 with PC software for communication and programming

### Display

Ultra-bright, backlit, LCD digital display, 2 x 32 scrolling

### Multi-Language

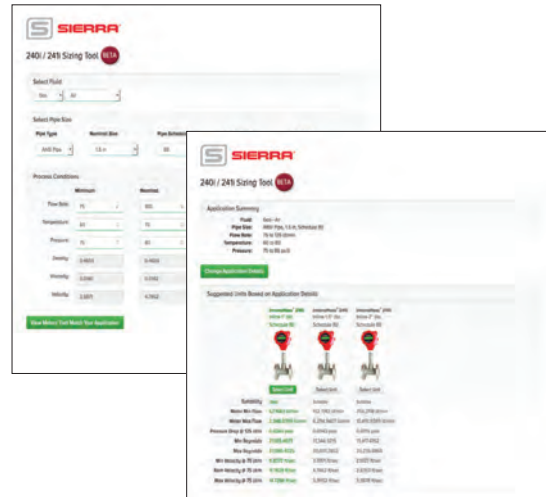
Supports English, Spanish, German and Mandarin; user can also add languages

### Field Adjustments

Change between engineering units, fluid, pipe size, language

## SIZING PROGRAM

Easy, web-based sizing program to input application details and generate correct meter specification. The sizing program is also available through the Smart Interface Portal if an internet connection is not available.



Visit [www.sierrainstruments.com/products/innovamass\\_sizing.html](http://www.sierrainstruments.com/products/innovamass_sizing.html) for more information on the sizing program.

## CALIBRATION

### High-Performance Calibration Facility

High-accuracy flow calibration, used according to ASME standards.

Max Flow: 143m<sup>3</sup>/h (.5in – 4in capabilities)

Pressure: Ambient

Temperature: Ambient

Liquid: Water

Uncertainty: 0.2% of the measured reading  
0.1% repeatability

Control: Cadet V14 Test Automation Software

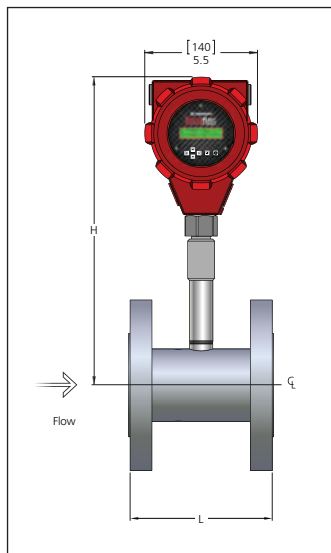
Data Collection: High speed data acquisition hardware and software

Calibration Interval: Annual (verified daily)

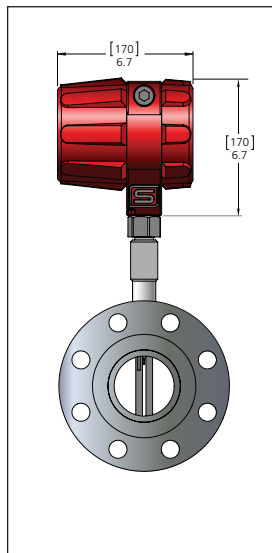


## 240i INLINE DIMENSIONAL DRAWINGS

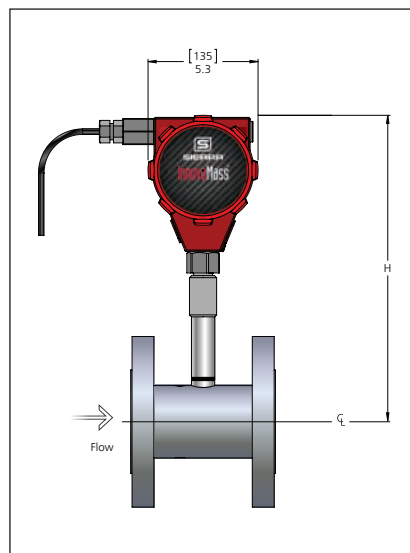
**240i Flanged Inline—Front**



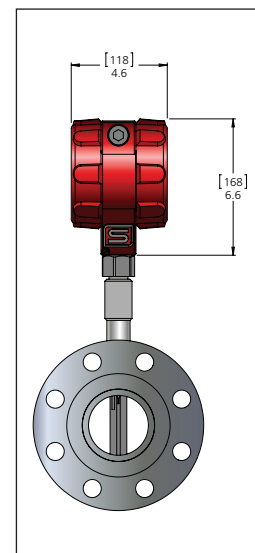
**240i Flanged Inline—Side (Outlet View)**



**240i Remote Inline Junction Box—Front**



**240i Remote Inline Junction Box—Side (Outlet View)**



Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request.

| 240i Inline Flange Sizes<br>SCH 80 Pipe, 150, 300 Flanges |             |            |
|---|-------------|------------|
| Flow Body Size  | L           | H          |
| 1-inch  | 5.00 (127)  | 15.0 (381) |
| 1.5-inch  | 5.50 (140)  | 15.1 (384) |
| 2-inch  | 6.00 (152)  | 15.3 (389) |
| 3-inch  | 7.00 (178)  | 15.8 (401) |
| 4-inch  | 8.00 (203)  | 16.2 (411) |
| 6-inch  | 9.00 (229)  | 17.3 (439) |
| 8-inch  | 10.50 (267) | 18.2 (462) |

Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request. 600 lb and PN64 meters have different L dimensions. Please contact Sierra for dimensions.

| 240i Inline Flange Sizes<br>PN16, 40 |             |            |
|--------------------------------------|-------------|------------|
| Flow Body Size                       | L           | H          |
| DN25                                 | 5.00 (127)  | 15.0 (381) |
| DN40                                 | 5.50 (140)  | 15.1 (384) |
| DN50                                 | 6.00 (152)  | 15.3 (389) |
| DN80                                 | 7.00 (178)  | 15.8 (401) |
| DN100                                | 8.00 (203)  | 16.2 (411) |
| DN150                                | 9.00 (229)  | 17.3 (439) |
| DN200                                | 10.50 (267) | 18.2 (462) |

Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request. 600 lb and PN64 meters have different L dimensions. Please contact Sierra for dimensions.

### 241i INSERTION SIZE OPTIONS

| 241i Variable Probe Dimensions |               |                  |                  |
|--------------------------------|---------------|------------------|------------------|
| 241i Probe Type                | Ordering Code | Meter Length (A) | Probe Length (B) |
| Standard Probe                 | LS            | 41.5 (1054.1)    | 32 (812.8)       |
| Compact Probe                  | LC            | 24.5 (622.3)     | 16.5 (419.1)     |

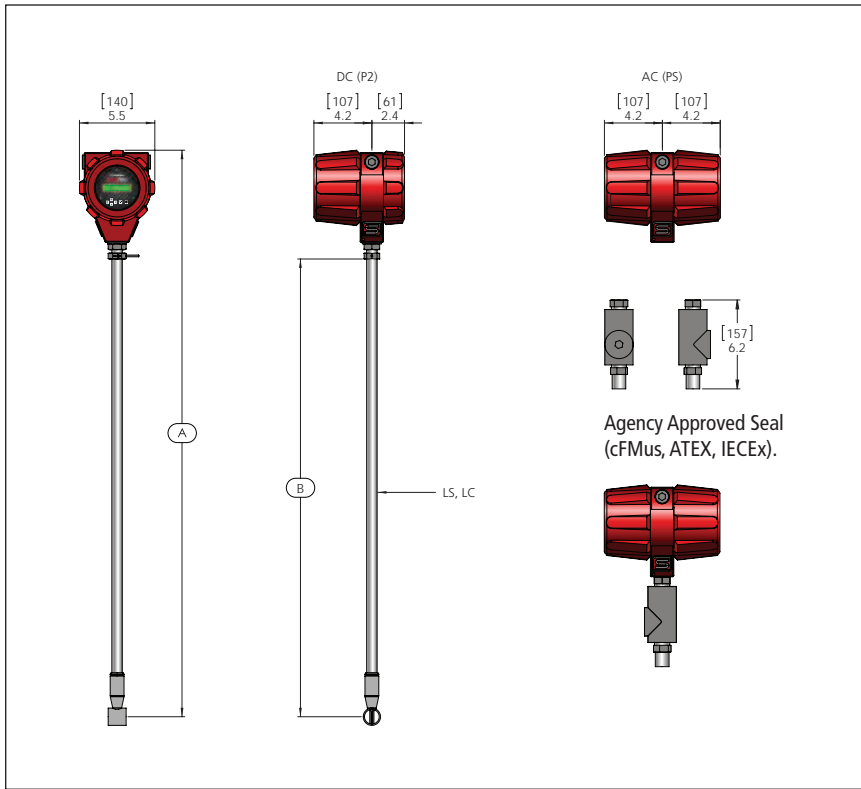
Note: For these cFmus and ATEX/IECEx approval types add killark seal dimension to dimension A (6.2-inches; 157 mm).

| 241i Process Connection Variable Dimensions |               |                              |                               |
|---|---------------|------------------------------|-------------------------------|
| 241i Connection Options                     | Ordering Code | Process Connection Width (X) | Process Connection Height (Y) |
| Compression Fitting 2-inch NPT              | CM            | 2.8 (72.2)                   | 2.7 (68.6)                    |
| Compression Fitting 2-inch 150 lb flange    | CF            | 6.0 (152.4)                  | 2.3 (58.4)                    |
| Compression Fitting 2-inch 300 lb flange    | CG            | 6.5 (165.1)                  | 2.4 (61.0)                    |
| Compression Fitting 2-inch 600 lb flange    | CH            | 6.5 (165.1)                  | 2.5 (63.5)                    |
| Packing Gland 2-inch NPT                    | PM            | 2.5 (63.5)                   | 7.0 (177.8)                   |
| Packing Gland 2-inch 150 lb flange          | PF            | 6.0 (152.4)                  | 7.3 (185.4)                   |
| Packing Gland 2-inch 300 lb flange          | PG            | 6.5 (165.1)                  | 6.5 (165.1)                   |
| Packing Gland 2-inch 600 lb flange          | PH            | 6.5 (165.1)                  | 7.5 (190.5)                   |

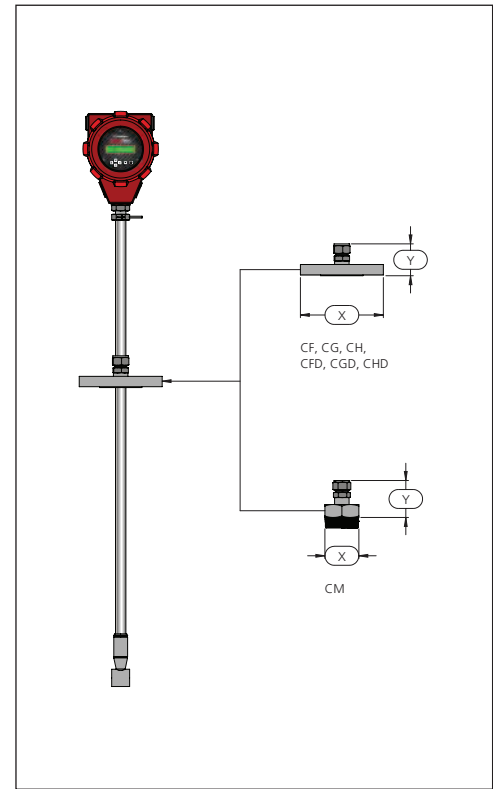
Note: Dimensions are measured from the center of the flow tube. For DN equivalent process connections use the same dimensions.

Note: Reference 241i Variable Probe Dimensions on page 13 to see length dimensions for A and B.

Overall Dimensions

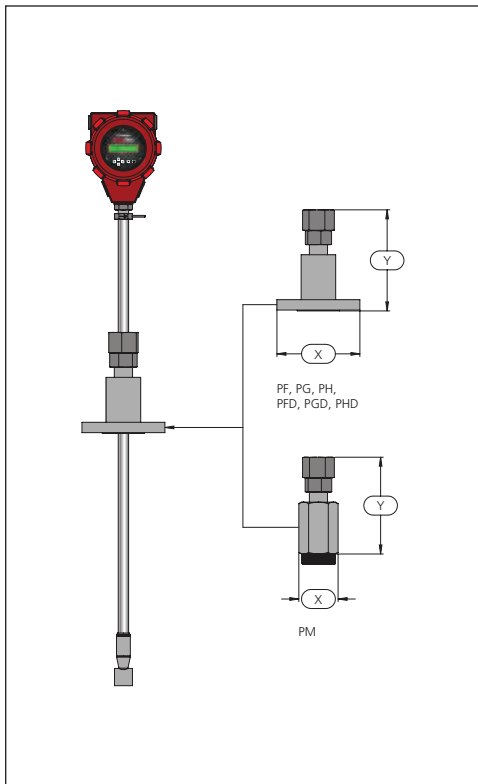


Flange and Compression Fittings

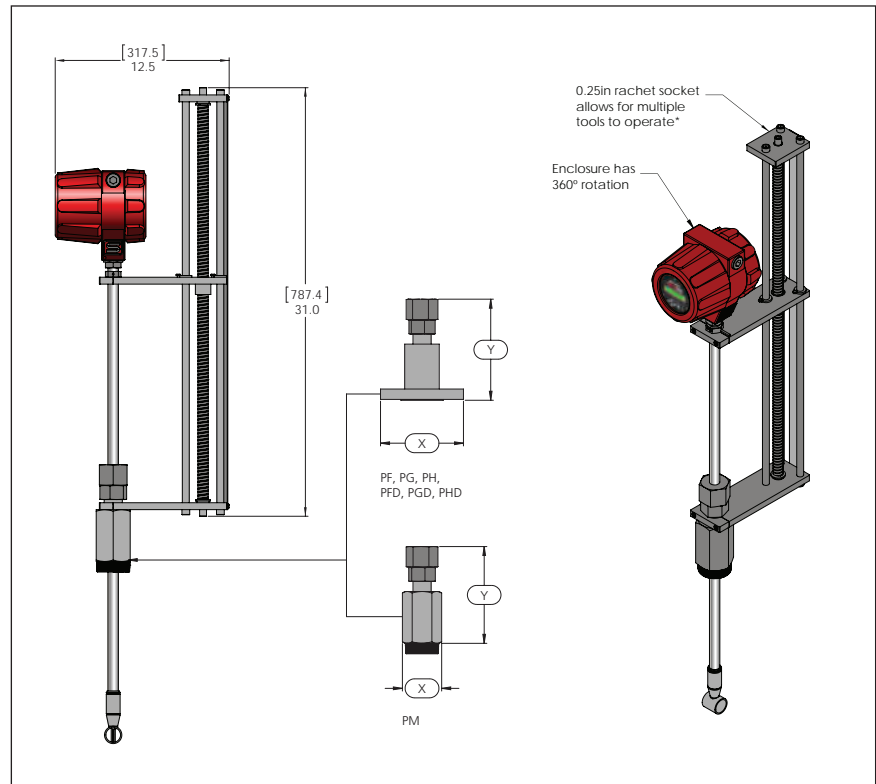


Note: Killark seal adds 6.2 inches (157 mm) to total meter length for agency approval devices.

Packing Glands



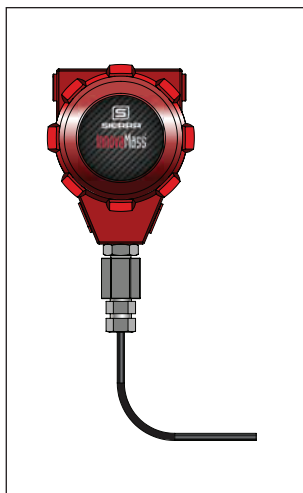
Adjustable, Rotatable & Removable Sensor Probe Retractor System



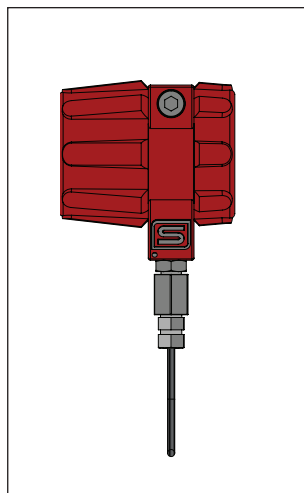
Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request.

## ADDITIONAL DIMENSIONAL DRAWINGS

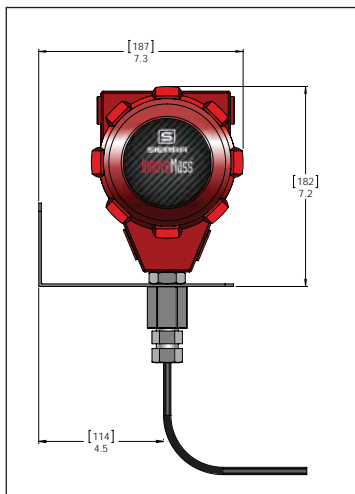
**Remote Electronics—Front  
(Inline and Insertion Versions)**



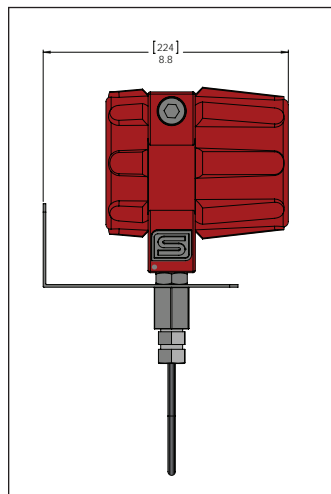
**Remote Electronics—Side  
(Inline and Insertion Versions)**



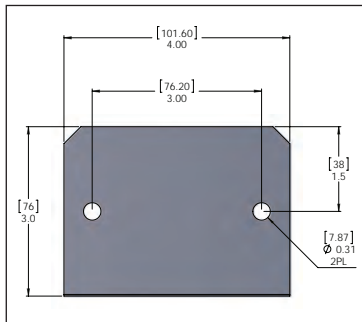
**Remote Electronics with  
Bracket—Front (Inline and  
Insertion Versions)**



**Remote Electronics with  
Bracket—Side (Inline and  
Insertion Versions)**



**Bracket—Size and Mounting**



All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request.

**Straight Pipe Length Requirements (in number of internal diameters, D)**

| Upstream Plumbing  | Upstream | Downstream |
|--|----------|------------|
| One 90° elbow before meter   | 10 D     | 5 D        |
| Two 90° elbows before meter  | 15 D     | 5 D        |
| Two 90° elbows before meter out of plane (If three 90° bends present, double recommend length) | 25 D     | 10 D       |
| Reduction before meter   | 10 D     | 5 D        |
| Expansion before meter   | 20 D     | 5 D        |

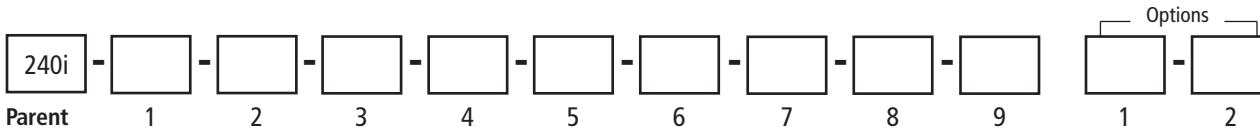
**240i Inline Meter Weight**

| Connection Size | ANSI 150 lb |      | ANSI 300 lb |      | ANSI 600 lb |      |
|-----------------|-------------|------|-------------|------|-------------|------|
|                 | lb          | kg   | lb          | kg   | lb          | kg   |
| 1-inch Flange   | 13.5        | 6.1  | 16.4        | 7.4  | 16.4        | 7.4  |
| 1.5-inch Flange | 14.6        | 6.6  | 22.7        | 10.3 | 24.0        | 11.2 |
| 2-inch Flange   | 19.5        | 8.8  | 26.9        | 12.2 | 33.2        | 15.1 |
| 3-inch Flange   | 27.5        | 12.5 | 39.5        | 17.9 | 56.3        | 25.3 |
| 4-inch Flange   | 43.5        | 19.7 | 60.5        | 27.4 | 96.2        | 43.6 |
| 6-inch Flange   | 48.4        | 22.0 | 96.2        | 43.6 | 178         | 80.8 |
| 8-inch Flange   | 71.0        | 32.2 | 149         | 67.4 | 300         | 136  |

**241i Insertion Meter Weight**

| Connection Size                    | lb   | kg   |
|------------------------------------|------|------|
| Compression Fitting, Male NPT      | 16.4 | 7.4  |
| 1.5-inch Flange                    | 22.7 | 10.3 |
| Compression Fitting, 150 lb Flange | 26.9 | 12.2 |
| Compression Fitting, 300 lb Flange | 39.5 | 17.9 |
| Packing Gland, Male NPT            | 60.5 | 27.4 |
| Packing Gland, 150 lb Flange       | 10.4 | 4.7  |
| Packing Gland, 300 lb Flange       | 24.8 | 11.3 |
| Packing Gland, 600 lb Flange       | 26.8 | 12.2 |

ORDERING THE 240i INLINE



Instructions: To order a 240i, please fill in each number block by selecting the codes from the corresponding features below and following pages.

| Parent Model Number |   |
|---------------------|---|
| 240i                | InnovaMass® iSeries Inline Vortex Flow Meter   Raptor II OS |

| Feature 1: Multivariable Options |   |
|----------------------------------|---|
| V                                | Volumetric flow meter for liquid, gas and steam   |
| VT                               | Velocity and temperature sensors; mass measurement with temperature compensation                        |
| VTP                              | Velocity, temperature and pressure sensors; mass measurement with pressure and temperature compensation |

| 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, T6; Ta = -40°C to 60°C (-40°F to 140°F). Type 4x.  |
| 3                    | ATEX and IECEx. Process Temperature Range: -40°C to 200°C (-40°F to 392°F).<br>ATEX:<br>II 2 G Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66<br>II 2 D Ex tb IIIC T200°C Db Ta = -20°C to +60°C (-4°F to 140°F), IP66<br><br>IECEx :<br>Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66<br>Ex tb IIIC T200°C Db Ta = -20°C to +60°C (-4°F to 140°F), IP66 |

| Feature 3: Flow Body (ANSI 316L) |  |     |  |     |  |
|----------------------------------|--|-----|--|-----|--|
| F4                               | 1-inch ANSI class 150 lb flanged, 316L   | G4  | 1-inch ANSI class 300 lb flanged, 316L   | H4  | 1-inch ANSI class 600 lb flanged, 316L   |
| F5                               | 1.5-inch ANSI class 150 lb flanged, 316L | G5  | 1.5-inch ANSI class 300 lb flanged, 316L | H5  | 1.5-inch ANSI class 600 lb flanged, 316L |
| F6                               | 2-inch ANSI class 150 lb flanged, 316L   | G6  | 2-inch ANSI class 300 lb flanged, 316L   | H6  | 2-inch ANSI class 600 lb flanged, 316L   |
| F7                               | 3-inch ANSI class 150 lb flanged, 316L   | G7  | 3-inch ANSI class 300 lb flanged, 316L   | H7  | 3-inch ANSI class 600 lb flanged, 316L   |
| F8                               | 4-inch ANSI class 150 lb flanged, 316L   | G8  | 4-inch ANSI class 300 lb flanged, 316L   | H8  | 4-inch ANSI class 600 lb flanged, 316L   |
| F9                               | 6-inch ANSI class 150 lb flanged, 316L   | G9  | 6-inch ANSI class 300 lb flanged, 316L   | H9  | 6-inch ANSI class 600 lb flanged, 316L   |
| F10                              | 8-inch ANSI class 150 lb flanged, 316L   | G10 | 8-inch ANSI class 300 lb flanged, 316L   | H10 | 8-inch ANSI class 600 lb flanged, 316L   |

| Feature 3: Flow Body (DN 316L) |                          |      |                          |      |                          |
|--------------------------------|--------------------------|------|--------------------------|------|--------------------------|
| FD4                            | DN25/PN16 flanged, 316L  | GD4  | DN25/PN40 flanged, 316L  | HD4  | DN25/PN64 flanged, 316L  |
| FD5                            | DN40/PN16 flanged, 316L  | GD5  | DN40/PN40 flanged, 316L  | HD5  | DN40/PN64 flanged, 316L  |
| FD6                            | DN50/PN16 flanged, 316L  | GD6  | DN50/PN40 flanged, 316L  | HD6  | DN50/PN64 flanged, 316L  |
| FD7                            | DN80/PN16 flanged, 316L  | GD7  | DN80/PN40 flanged, 316L  | HD7  | DN80/PN64 flanged, 316L  |
| FD8                            | DN100/PN16 flanged, 316L | GD8  | DN100/PN40 flanged, 316L | HD8  | DN100/PN64 flanged, 316L |
| FD9                            | DN150/PN16 flanged, 316L | GD9  | DN150/PN40 flanged, 316L | HD9  | DN150/PN64 flanged, 316L |
| FD10                           | DN200/PN16 flanged, 316L | GD10 | DN200/PN40 flanged, 316L | HD10 | DN200/PN64 flanged, 316L |

| Feature 4: Electronics Enclosure |  |
|----------------------------------|--|
| E2                               | NEMA 4X IP 66 enclosure  |
| E4( )                            | NEMA 4X IP 66 remote electronics on probe; specify cable length in parentheses, maximum 50 feet (15.24 m); includes cable glands |

| Feature 5: Display Option |                                   |
|---------------------------|-----------------------------------|
| DD                        | Digital display with push buttons |
| NR                        | No readout/display                |

| Feature 6: Input Power |  |
|------------------------|--|
| P2                     | 24 VDC +/- 10% 0.4 amps, 12 watts maximum          |
| PS                     | 100-240 VAC, 50/60 Hz line power, 12 watts maximum |

| Feature 7: Output |   |
|-------------------|---|
| V4                | One analog output (4-20 mA), one alarm, one pulse   |
| V6                | Three analog outputs (4-20 mA), one alarm, one pulse  |
| V4M               | One analog output (4-20 mA), one alarm, one pulse, Modbus   |
| V6H               | Three analog outputs (4-20 mA), one alarm, one pulse, HART  |
| V6M               | Three analog outputs (4-20 mA), one alarm, one pulse, Modbus  |
| V6DP1             | Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with external M12 connection. Not available with AC power; Available only NAA |
| V6DP2             | Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with terminal block connection. Not available with AC power                   |
| V6FF              | Three analog outputs (4-20 mA), one alarm, one pulse, Foundation Fieldbus with terminal block connections                                       |

Note: AC power (Feature 6) not available with V6DP1, V6DP2

| Feature 8: Process Temperature |  |
|--------------------------------|--|
| ST                             | Standard process temperature -40°F to 392°F (-40°C to 200°C) |

| Feature 9: Process Pressure |   |
|-----------------------------|---|
| MP0                         | No pressure sensor; used with V and VT option             |
| MP1                         | Maximum 30 psia (2.1 bara), proof 60 psia (4.1 bara)      |
| MP2                         | Maximum 100 psia (6.9 bara), proof 200 psia (13.8 bara)   |
| MP3                         | Maximum 300 psia (20.7 bara), proof 600 psia (41.4 bara)  |
| MP4                         | Maximum 500 psia (34.5 bara), proof 1000 psia (69.0 bara) |

| Option 1: Certificates |   |
|------------------------|---|
| MC                     | Material certificates—US Mill certs on all wetted parts |
| PT                     | Pressure test certificate                               |
| CC                     | Certificate of conformance                              |
| NC                     | NACE certification                                      |

| Option 2: Oxygen Cleaning |   |
|---------------------------|---|
| O2C                       | Cleaned for O <sub>2</sub> service (includes certification). Meter must include O <sub>2</sub> cleaning, if meter is to be used for oxygen service. Size limit for O <sub>2</sub> service 4 inches (101.6 mm) |

| Accessories: Manuals |                    |
|----------------------|--------------------|
| 240i-IM              | Instruction Manual |





| Feature 7: Output (continued) |   |
|-------------------------------|---|
| V6DP1                         | Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with external M12 connection. Not available with AC power; Available only NAA |
| V6DP2                         | Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with terminal block connection. Not available with AC power                   |
| V6FF                          | Three analog outputs (4-20 mA), one alarm, one pulse, Foundation Fieldbus with terminal block connections                                       |

| Feature 8: Process Temperature |  |
|--------------------------------|--|
| ST                             | Standard process temperature -40°F to 392°F (-40°C to 200°C) |

| Feature 9: Process Pressure |   |
|-----------------------------|---|
| MP0                         | No pressure sensor: used with V and VT option             |
| MP1                         | Maximum 30 psia (2.1 bara), proof 60 psia (4.1 bara)      |
| MP2                         | Maximum 100 psia (6.9 bara), proof 200 psia (13.8 bara)   |
| MP3                         | Maximum 300 psia (20.7 bara), proof 600 psia (41.4 bara)  |
| MP4                         | Maximum 500 psia (34.5 bara), proof 1000 psia (69.0 bara) |

| Feature 10: Process Connection ANSI |   |
|-------------------------------------|---|
| CO                                  | No fitting (customer to supply); Available NAA only (see Feature 2: Approvals Code 1)   |
| CM                                  | Compression fitting 2-inch Male NPT, 1500 psig (103 barg) pressure rating   |
| CF                                  | Compression fitting on 2-inch class 150 lb flange   |
| CG                                  | Compression fitting on 2-inch class 300 lb flange   |
| CH                                  | Compression fitting on 2-inch class 600 lb flange   |
| PM                                  | Packing gland* on 2-inch Male NPT, 50 psig (3.4 barg) maximum process pressure for live insertion/removal without a retractor. Packing gland itself rated to 500 psig process pressure. Packing gland live insertion/removal up to 500 psig (34.5 barg) must use a retractor. |
| PF                                  | Packing gland on 2-inch class 150 lb flange   |
| PG                                  | Packing gland on 2-inch class 300 lb flange   |
| PH                                  | Packing gland on 2-inch class 600 lb flange   |

| Feature 10: Process Connection DN |   |
|-----------------------------------|---|
| CFD                               | Compression fitting on DN50/PN16 flange |
| CGD                               | Compression fitting on DN50/PN40 flange |
| CHD                               | Compression fitting on DN50/PN64 flange |
| PFD                               | Packing gland on DN50/PN16 flange       |
| PGD                               | Packing gland on DN50/PN40 flange       |
| PHD                               | Packing gland on DN50/PN64 flange       |

Note: Maximum pressure is dependent on temperature plus flange rating.

| Accessories (A1): Retractor |  |
|-----------------------------|--|
| 241i-Removable Retractor    | Removable Retractor for use with packing gland PM, PF, PG, PH, PFD, PGD, PHD. Use with iSeries only. |

| Option 1: Certification Documents |   |
|-----------------------------------|---|
| MC                                | Material certificates—US Mill certs on all wetted parts |
| PT                                | Pressure test certificate                               |
| CC                                | Certificate of conformance                              |
| NC                                | NACE certification                                      |

| Accessories: Manuals |                    |
|----------------------|--------------------|
| 241i-IM              | Instruction Manual |





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