

# 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.

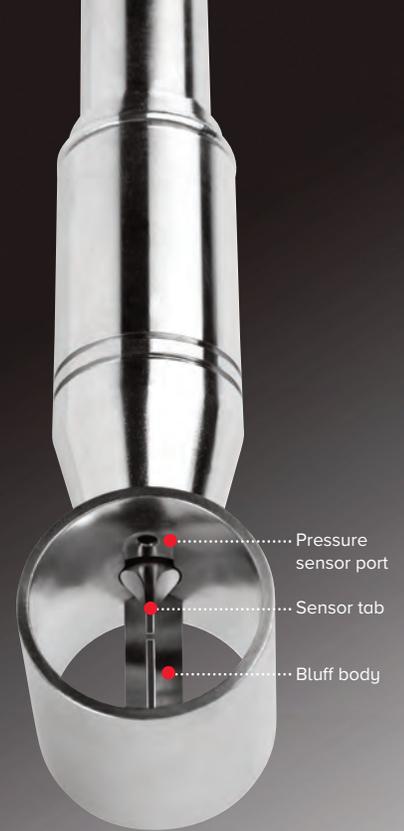
Change pipe sizes and measured fluid in the field with apps like Dial-A-Pipe™ and Dial-A-Fluid™.

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
<b>Mass Flow Rate</b>	+/- 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>
<b>Volumetric Flow Rate</b>	+/- 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>
<b>Temperature</b>	+/- 2°F (+/- 1°C)	+/- 2°F (+/- 1°C)	+/- 2°F (+/- 1°C)	+/- 2°F (+/- 1°C)
<b>Pressure</b>	0.5% of transducer full scale	0.5% of transducer full scale	0.5% of transducer full scale	0.5% of transducer full scale
<b>Density</b>	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.

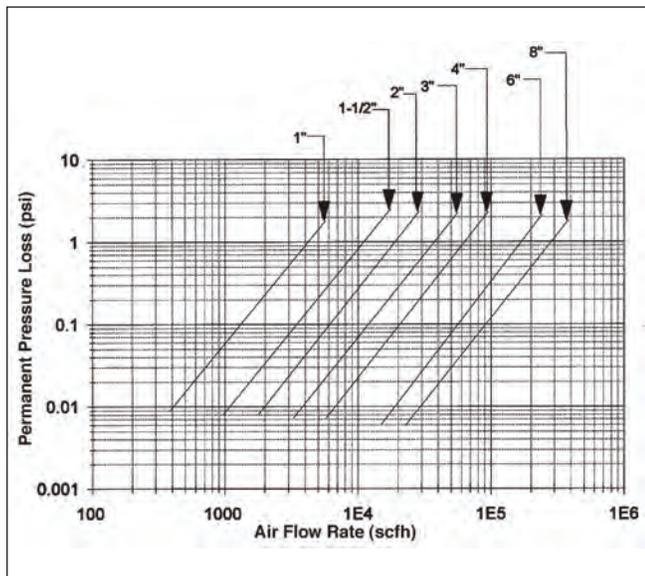


Figure 1

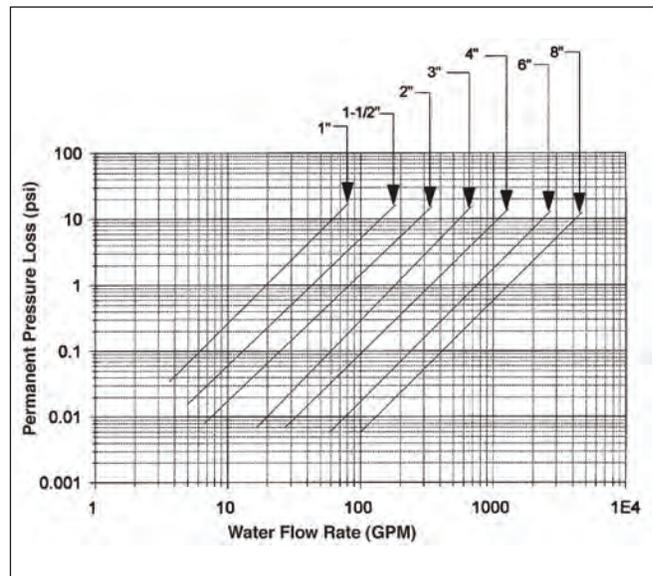


Figure 2

## 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) 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, Foundation Fieldbus, and BACnet

## 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 ⓧ, and Enter ↵, 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

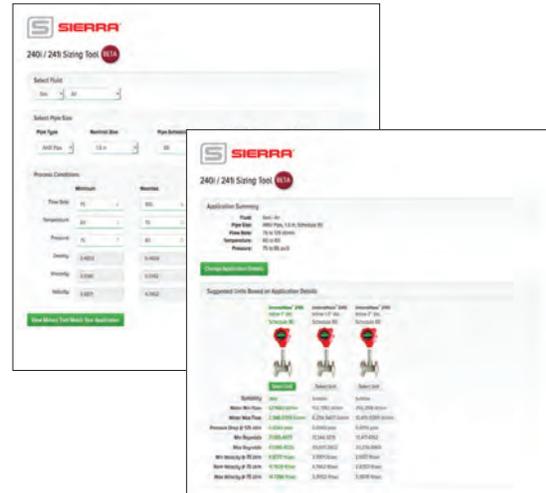
Supports English, Spanish, German and Mandarin; user can also add languages

### 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

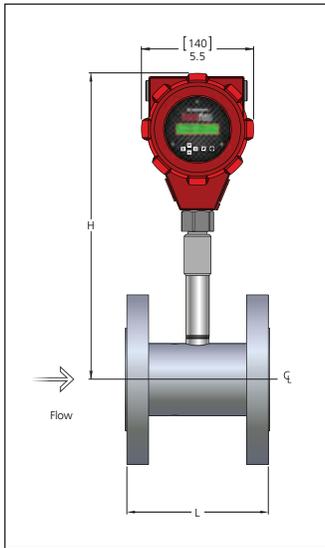
Control: Cadet V14 Test Automation Software

Data Collection: High speed data acquisition  
hardware and software

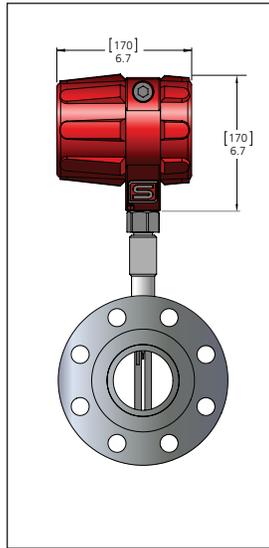
Calibration Interval: Annual (verified daily)



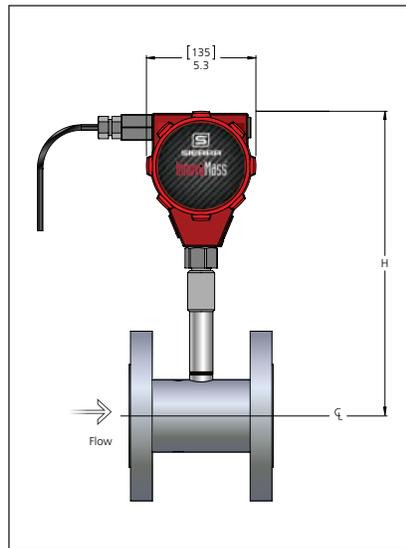
240i Flanged Inline—Front



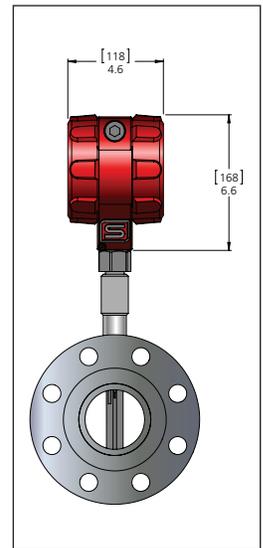
240i Flanged Inline—Side (Outlet View)



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 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 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)

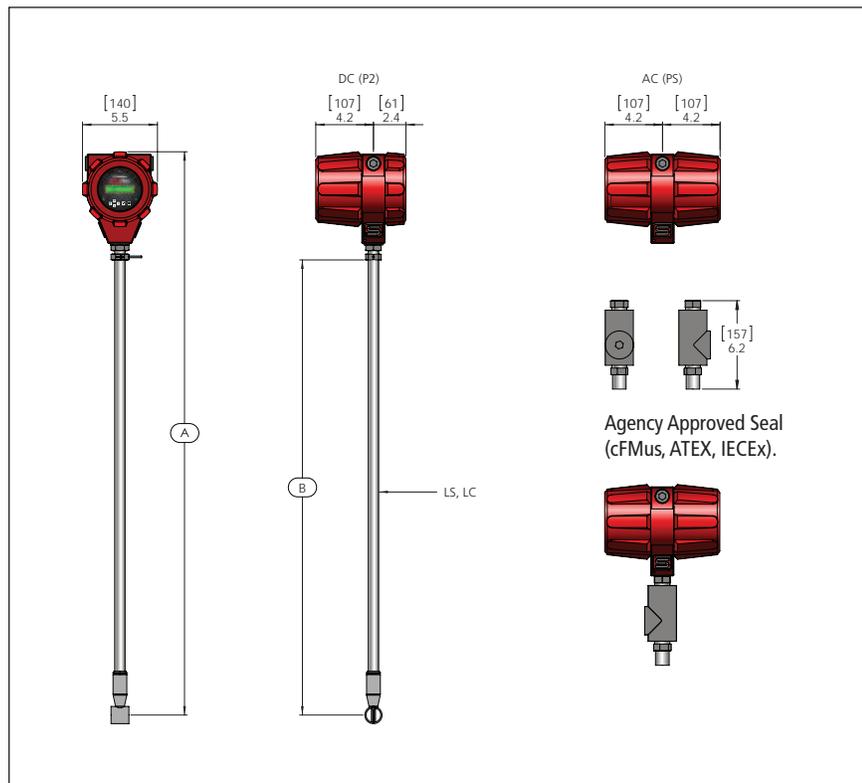
Note: For these cMus and ATEX/IECEx approval types add killark seal dimension to dimension A (6.2-inches; 157 mm).

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)

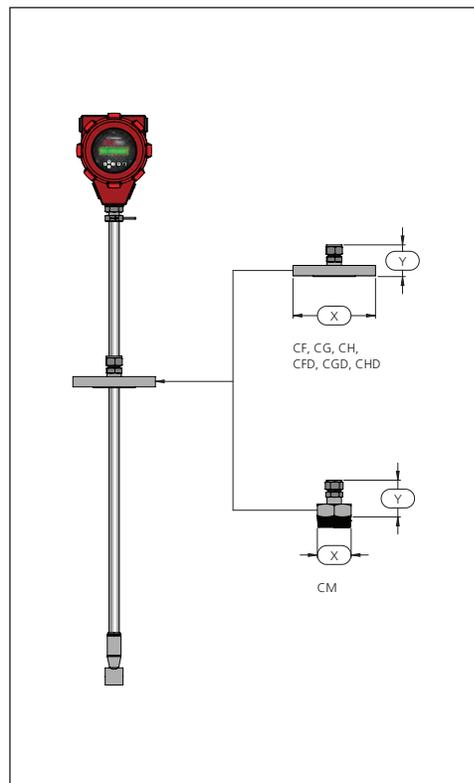
Note: Dimensions are measured from the center of the flow tube. For DN equivalent process connections use the same dimensions.

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

Overall Dimensions

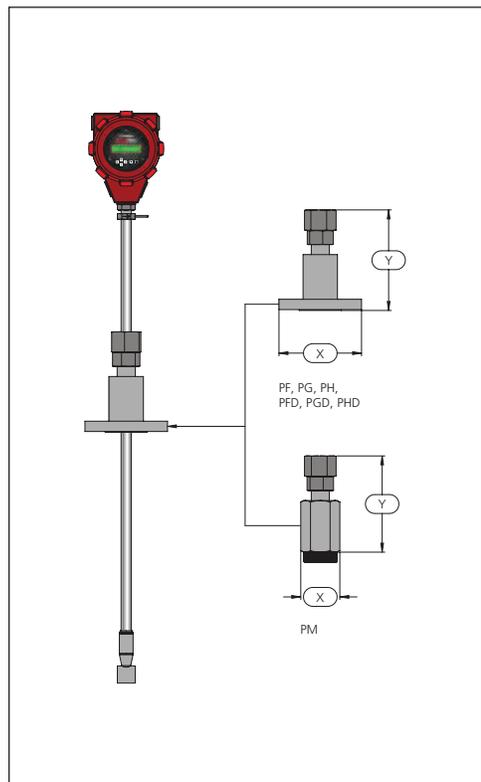


Flange and Compression Fittings

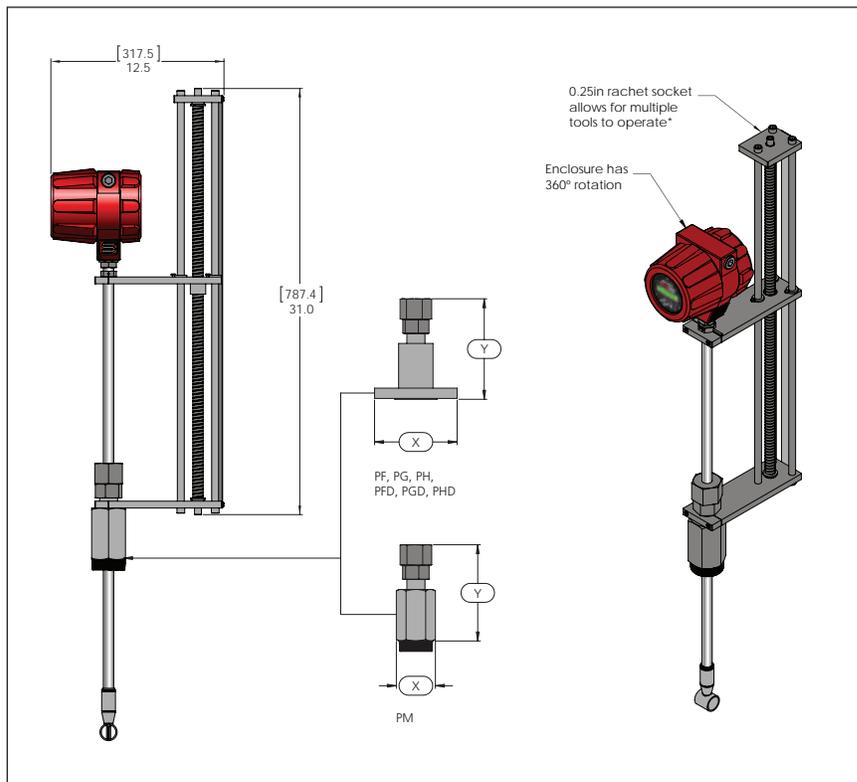


Note: Killark seal adds 6.2 inches (157 mm) to total meter length for agency approval devices.

Packing Glands

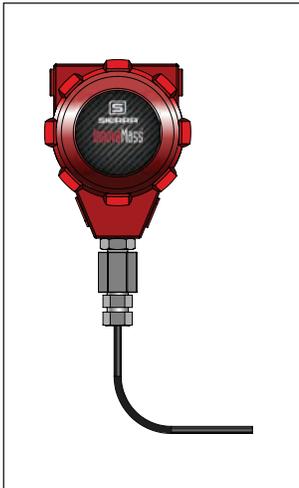


Adjustable, Rotatable & Removable Sensor Probe Retractor System

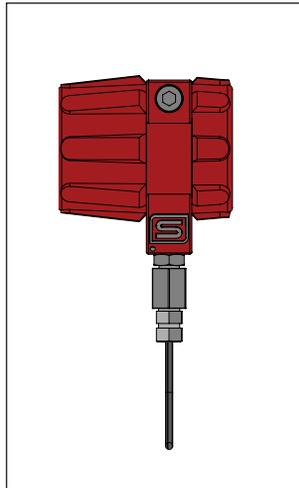


Note: All dimensions are inches (+/- .25-inch significant value). Millimeters are in parentheses. Certified drawings are available on request.

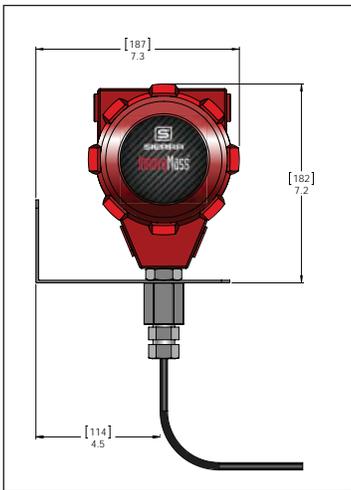
Remote Electronics—Front (Inline and Insertion Versions)



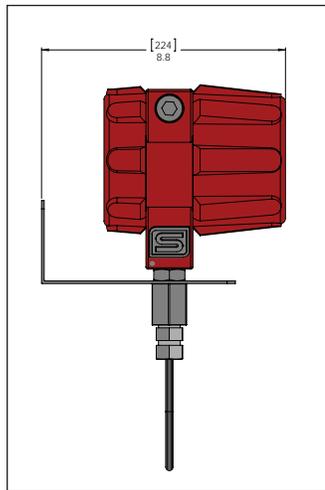
Remote Electronics—Side (Inline and Insertion Versions)



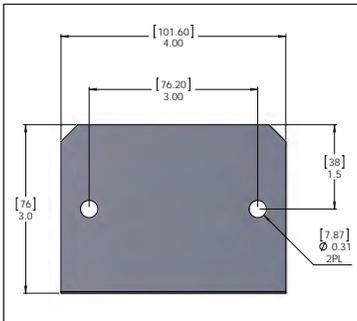
Remote Electronics with Bracket—Front (Inline and Insertion Versions)



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)

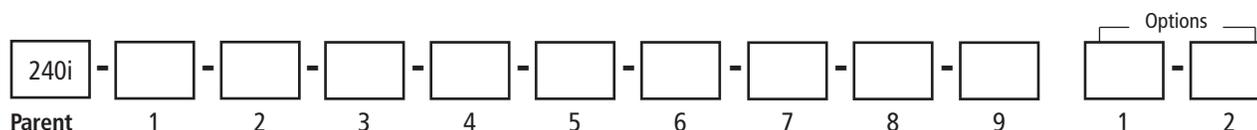
Upstream Plumbing	Upstream	Downstream
One 90° elbow before meter	10 D	5 D
Two 90° elbows before meter	15 D	5 D
Two 90° elbows before meter out of plane (If three 90° bends present, double recommend length)	25 D	10 D
Reduction before meter	10 D	5 D
Expansion before meter	20 D	5 D

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



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. Process Temperature Range: -40°C to 218°C (-40°F to 425°F)
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). ATEX: II 2 G Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66 II 2 D Ex tb IIIC T200°C Db Ta = -20°C to +60°C (-4°F to 140°F), IP66  IECEx : Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66 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	
<b>E2</b>	NEMA 4X IP 66 enclosure
<b>E4( )</b>	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	
<b>DD</b>	Digital display with push buttons
<b>NR</b>	No readout/display

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

Feature 7: Output	
<b>V4</b>	One analog output (4-20 mA), one alarm, one pulse
<b>V6</b>	Three analog outputs (4-20 mA), one alarm, one pulse
<b>V4M</b>	One analog output (4-20 mA), one alarm, one pulse, Modbus
<b>V6H</b>	Three analog outputs (4-20 mA), one alarm, one pulse, HART
<b>V6M</b>	Three analog outputs (4-20 mA), one alarm, one pulse, Modbus
<b>V6B</b>	Three analog outputs (4-20 mA), one alarm, one pulse, BACnet
<b>V6DP1</b>	Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with external M12 connection. Not available with AC power; Available only NAA
<b>V6DP2</b>	Three analog outputs (4-20 mA), one alarm, one pulse, Profibus DP with terminal block connection. Not available with AC power
<b>V6FF</b>	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

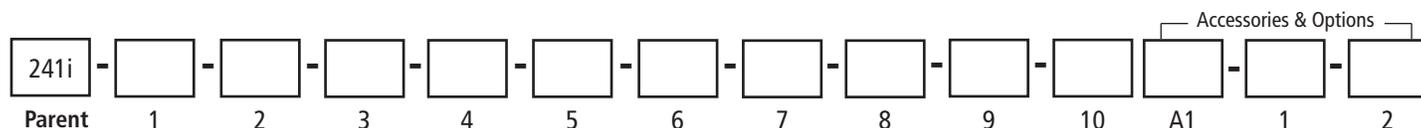
Feature 8: Process Temperature	
<b>ST</b>	Standard process temperature -40°F to 392°F (-40°C to 200°C). Note: for NAA meters (code 1 above) ST can be used to 425°F (218°C)

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

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

Option 2: Oxygen Cleaning	
<b>O2C</b>	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	
<b>240i-IM</b>	Instruction Manual



Instructions: To order a 241i, please fill in each number block by selecting the codes from the corresponding features below and following pages.

Parent Model Number	
241i	InnovaMass® iSeries Insertion Vortex Flow Meter   Raptor II OS   FloPro

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 and automatic flow profile compensation by calculating the Reynolds Number

Feature 2: Approvals	
1	NAA. Non-agency approved. Process Temperature Range: -40°C to 218°C (-40°F to 425°F)
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. See Note 1.
3	ATEX and IECEx. Process Temperature Range: -40°C to 200°C (-40°F to 392°F). ATEX: II 2 G Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66 II 2 D Ex tb IIIC T200°C Db Ta = -20°C to +60°C (-4°F to 140°F), IP66  IECEX : Ex db IIC T3 Gb Ta = -20°C to +60°C (-4°F to 140°F), IP66 Ex tb IIIC T200°C Db Ta = -20°C to +60°C (-4°F to 140°F), IP66 Requires Killark seal. See Note 1.

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

Feature 3: Probe Length	
LS	Standard probe 32 inches (812.8 mm). If agency approved, see Note 1.
LC	Compact probe 16.5 in (419.1 mm) available only for connections CM, CF, CG, CH; If agency approved, see Note 1.
LE	Extended probe longer than 33.5 inches (850.9 mm)(consult factory if for PMR, PFR, PGR or PHR). If agency approved, see Note 1

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

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

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

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
V4M	One analog output (4-20 mA), one alarm, one pulse, Modbus
V6	Three analog outputs (4-20 mA), one alarm, one pulse
V6H	Three analog outputs (4-20 mA), one alarm, one pulse, HART
V6M	Three analog outputs (4-20 mA), one alarm, one pulse, Modbus
V6B	Three analog outputs (4-20 mA), one alarm, one pulse, BACnet

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

Feature 8: Process Temperature	
<b>ST</b>	Standard process temperature -40°F to 392°F (-40°C to 200°C). Note: for NAA meters (code 1 above) ST can be used to 425°F (218°C)

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

Feature 10: Process Connection ANSI	
<b>CO</b>	No fitting (customer to supply); Available NAA only (see Feature 2: Approvals Code 1)
<b>CM</b>	Compression fitting 2-inch Male NPT, 1500 psig (103 barg) pressure rating
<b>CF</b>	Compression fitting on 2-inch class 150 lb flange
<b>CG</b>	Compression fitting on 2-inch class 300 lb flange
<b>CH</b>	Compression fitting on 2-inch class 600 lb flange
<b>PM</b>	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.
<b>PF</b>	Packing gland on 2-inch class 150 lb flange
<b>PG</b>	Packing gland on 2-inch class 300 lb flange
<b>PH</b>	Packing gland on 2-inch class 600 lb flange

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

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

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

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

Accessories: Manuals	
<b>241i-IM</b>	Instruction Manual





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