

# Fluidic Flowmeters, LLC

## Model 141 Fluidic Flowmeter – Cryogenic Flow Measurement

### **Problem:**

Optimize the operation of freezing or chilling processes despite the presence of some two phase (liquid and vapor) content in the process. Liquid Nitrogen and liquid CO<sub>2</sub> are typically used in cryogenic applications, and two phase flow due to heat leak, pressure drop, or elevation change can damage many flowmeters. This results in increased maintenance and the need to replace the flowmeter in order to maintain an effective measurement of the process flow.

### **Solution:**

Utilize a Model 141 Fluidic Flowmeter for all cryogenic flow measurement applications. The Model 141 is not damaged by two phase flow due to the geometric design of the meterbody and the unique characteristics of its sensor technology. Managing the control loop with a Fluidic Flowmeter can insure a proper cryogenic flow for the process, and help reduce process loop maintenance.

The Model 141 is a rugged, reliable flowmeter that can handle a wide variety of fluid measurement applications. Its meterbodies can be selected for a broad range of flow rates, pipe sizes, and pressure ratings. The geometric design of the meterbody produces a continuous, self induced oscillation at a frequency corresponding to the velocity of the fluid passing through the flowmeter. The oscillations are sensed, and an output proportional to the flow is generated.

Because these flowmeters are based on the Coanda Effect, there are no moving parts to damage or wear. The Model 141 will continue to perform within specification even after being subjected to flow over-ranges as high as 400%. These flowmeters can withstand harsh industrial environments, and are highly immune to vibration and shock (both pipe and fluid induced).

The Model 141 consists of a meterbody and an output signal converter. The meterbody includes a self contained sensor for direct in-line installation into new or existing process piping.

The Model 141 Flowmeter contains **no moving parts**, which minimizes maintenance and service needs. This design eliminates the need for costly, periodic meter recalibration. In addition, there are no gears that can bind or jam, resulting in interruption of flow.



The Model 141 offers a **wide operating temperature range** for cryogenic applications: -196° to 176° C (-320° F to 350° F), when the optional cryogenic sensor is specified. The Model 141 also offers a **wide dynamic range**: Reynolds numbers from 10,000 to 1,000,000 and a high turndown (typically 15:1). The design of the meterbody combined with the sensor technology makes the flowmeter highly immune to the effects of sensor buildup or coating.

The Model 141 will not be damaged by **two phase flow**, common in cryogenic applications. Its design avoids wear issues that might change the characteristics of the flowmeter, thereby avoiding the need for recalibration or replacement.

- \* Accurate and repeatable flow measurement
- \* High turndown (typically 15:1)
- \* No moving parts to damage or wear
- \* Withstands over-ranges of up to 400% of full scale
- \* Effectively handles two-phase flow
- \* Output linear with flowrate
- \* Rugged and reliable sensors
- \* Highly immune to shock and vibration
- \* Wide operating temperature range
- \* No meterbody calibration shifts

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## SPECIFICATIONS

### Flow Rates

Meter Size	Minimum Flow Rate (GPM)
1"	3.25
1 1/2"	7.6
2"	10.5
3"	23.0

Listed Flow ratings are for water at 60°F, 1 centistoke. To determine flow rates of other fluids, divide the value listed above by the square root of the fluid's specific gravity.

### Capacity

Meter Size	Full Scale Calibration Range	
	Minimum GPM	Maximum GPM
1"	0-10	0-55
1 1/2"	0-22	0-130
2"	0-40	0-210
3"	0-125	0-460

### Pressure Rating

Maximum working pressure equals connecting flange rating per ANSI B 16.5

Meter Size	Connecting Range
1"	150, 300, 600 lb.
1 1/2"	150, 300, 600 lb.
2"	150, 300, 600 lb.
3"	150, 300 lb.

### Temperature

Meterbody: -320° to 350°F (-196° to 176°C)  
Signal Converter: - 40° to 185°F (-40° to 85°C)

### Materials Of Construction:

Meterbody: Cast Stainless Steel 1" size, type 316 SS (ASTM A296 grade CF8M); 1 1/2" 2" & 3" sizes, type 316L SS (ASTM A296 grade CF3M)  
Sensor: Stainless steel, type 316L SS, and Hastelloy® C-276  
Gasket: Teflon®, O-Ring: Viton®

### Electrical Connections

Meter Body: 1/2" NPT connection  
Signal Converter: Terminal block

## PERFORMANCE SPECIFICATIONS

### Accuracy

1.25% of flowrate. Includes the combined effects of conformity, hysteresis, deadband, and repeatability errors (typical).

Meters can be supplied calibrated for a specific flow range. This typically results in accuracies better than 0.75% of rate.

### Repeatability

0.20% of flowrate

### Ambient Temperature Effect

1% of flowrate per 148°C (300°F)

### Flow Over-range Protection

Flow over-ranges of up to 400% of full scale will not damage the meter body or the sensor.

### Position Effect

The flowmeter can be mounted in horizontal, vertical or inclined pipelines having an upward direction of flow with no effect on performance. It is important that the pipeline be kept full of fluid for accurate flow measurement.

### Minimum Pipe Requirements

Ten pipe diameters upstream and five pipe diameters downstream of straight piping.

### Meterbody Weights

METER SIZE in (mm)	1 (25)	1 1/2 (38)	2 (50)	3 (76)
WEIGHT lb (kg)	7 (3.2)	26 (7.3)	19 (8.6)	36 (16.3)

### Size (Dimensions in Inches)

Meter Size	Length
1"	5.50
1/1/2"	7.63
2"	8.06
3"	11.72

Note: Meterbody only; does not include flanges; if required, consult factory.

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