THORNTON

Leading Pure Water Analytics

- Contamination-free molded PFA body
- Flow range - 0.1 to 40 GPM (0.4 to 150 L/min)
- High accuracy ultrasonic vortex design
- Compact size
- Outputs - 4-20mA or pulse
- Local LED display

Flowrate

317 PFA Vortex Flowmeter

METTLER TOLEDO

Highest Purity Requirements with Chemical Compatibility and Reliability

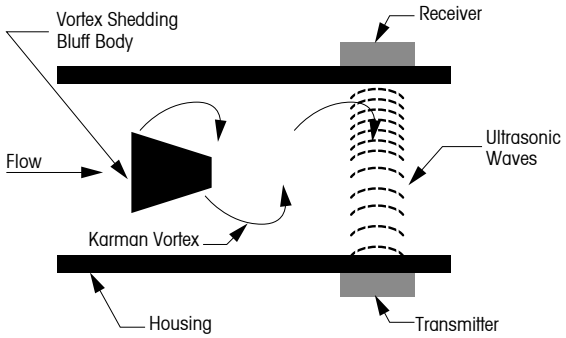
The Thornton PFA Vortex Flowmeter is designed for the demanding requirements of high purity chemicals and ultrapure water used in the semiconductor manufacturing process. Molded from high purity PFA, its flow path has no moving parts, ensuring reliability and freedom from particle generation.

Contamination-Free

Eliminating sources of potential contamination is of paramount importance. The PFA Flowmeter's molded unibody chamber is free of crevices, seals, and moving parts that could contribute to system contamination. Further, PFA has excellent chemical resistance to a variety of aggressive reagents and ultrapure water.

Accuracy and Range

Thornton's PFA Flowmeter combines the vortex shedding principle with an advanced ultrasonic detection system.



As fluid passes through the flow chamber, Karman vortices are created, with frequency proportional to flow velocity. Ultrasonic waves are transmitted through the side wall, perpendicular to the flow, to detect these vortices. The sensitive ultrasonic signals are selectively measured by the detector, unaffected by environmental noise such as low frequency vibration from the system or pipes.

The PFA Flowmeter is available in four sizes (3/8″, 1/2″, 3/4″ and 1″ O.D.), covering a range from 0.4 to 150 L/min (0.1 to 40 GPM) with accuracy of ±1% F.S. (3/8″ ±5% F.S.). When used with a Thornton 200FLOW with linearization capabilities, higher accuracy can be achieved.

Process System Design

The Flowmeter's compact size 2.1 x 2.1 x 2.7″ (54 x 54 x 68.5 mm) allows placement into even the most space-limited system. In addition, it can be mounted in any orientation to accommodate system design requirements. The IP65 (NEMA 4X) case is constructed of PPS polymer and assembled with PEEK screws, for excellent resistance in corrosive environments.

The installation should have a minimum of 10 pipe diameters of straight pipe before and 2 diameters after the flowmeter.

Indicators and output signals provide flexibility and redundancy. The outputs include 4-20 mA and pulse for flow rate, as well as high and low alarms. The Flowmeter's case features a 4-digit local display to show the current flowrate measurement and red warning lights to visually indicate high and low flowrate alarms.

Flowrate Range

Size	Minimum Flowrate (L/min)									Max Flowrate (L/min)
cp**	0.3	0.5	0.7	1*	2	3	4	5	7	
3/8	0.2	0.2	0.3	0.4	0.8	1.2	1.6	2.0	2.8	3.5
1/2 in.	0.6	1	1.4	2	4	6	8	10	14	20
3/4 in.	3	5	8	10	20	30	40	50	70	70
1 in.	4.5	7.5	10.5	15	30	45	60	75	105	150

* Viscosity of water at 20 °C

** cp = Viscosity of measurement fluid (in centipoises)

Pressure Loss Calculation

$\Delta P = C \times \partial$

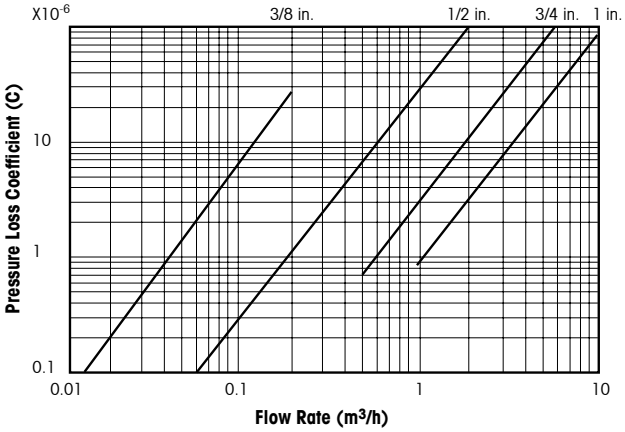
- ΔP: Pressure loss (MPa)
- C: Pressure loss coefficient
- ∂: Density of fluid (kg/m^3 or g/L)

Maintain line pressure greater than the computed Pd value at the exit side of the flowmeter to prevent cavitation:

$Pd = 2.7 \times \Delta P + 1.3 \times Po$

- Pd: Downstream side pressure
- ΔP: Pressure loss (MPa)
- Po: Vapor pressure of fluid at measuring temperature (MPa abs, absolute pressure)

Graph 1- Pressure Loss Characteristics



Sample calculation: Fluid: Deionized Water @ 25 °C
Flowrate: 25 GPM (5.678 m^3/hr)

From Pressure Loss Characteristic Chart (Graph 1): $C = 27 \times 10^{-6}$ (uses 1" flow sensor)

∂ = Density of DI water @ 25 °C = 0.997 g/ml or 997g/l

$\Delta P = C \times \partial = (27 \times 10^{-6}) \times 997$ g/l = 0.03 MPa (or 4.4 psi)

Po = Vapor pressure of DI water @ 25 °C = 3.17 kPa or .0032 MPa

$Pd = 2.7 \times \Delta P + 1.3 \times Po$ = (2.7 x 0.03 MPa) + (1.3 x .0032 MPa) = .085 MPa or 12.3 psi

Electrical Installation Information

For best performance, care should be taken to separate cable from power lines and high voltage or high current sources. The flowmeter is supplied with a 6.5 ft. (2 m) cable. For longer distances, use a terminal junction strip with 6-conductor, shielded cable:

- wire cross-sectional area of 0.3 mm^2 or greater (22-gauge or heavier)
- recommended cable – CVVS
- distance – 100 meters/325 ft. maximum.

Cable	
Red	Power Supply (+12 to 24 V)
White	Common
Purple	Pulse (open collector)
Green	Analog (4-20mA)
Blue	High flowrate alarm
Yellow	Low flowrate alarm

6.5 ft. (2 m) cable with tinned leads for use with Thornton 200FLOW or user's controller directly.

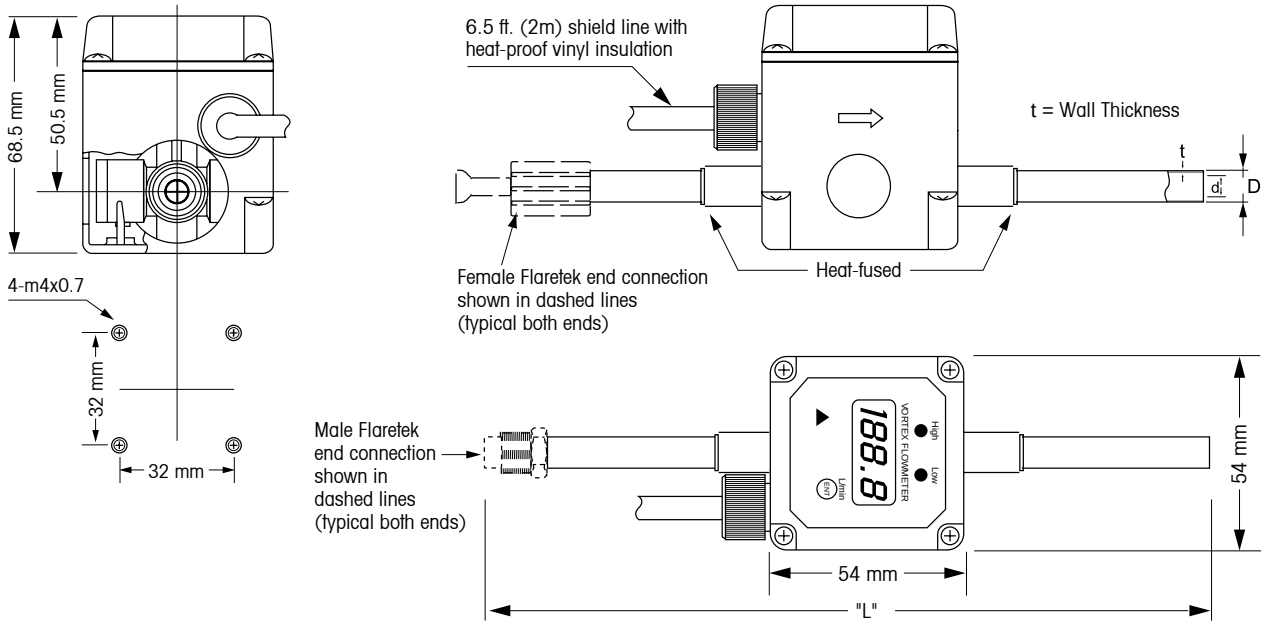
With Tube-Ends

Size	Dimensions (mm)			
	+ 0.30	+ 0.30		
	D - 0.10	d - 0.10	t ± 0.15	L
3/8 in.	ϕ 9.52	ϕ 6.35	1.59	190
1/2 in.	ϕ 12.7	ϕ 9.52	1.59	190
3/4 in.	ϕ 19.05	ϕ 15.88	1.59	190
1 in.	ϕ 25.4	ϕ 22.22	1.59	190

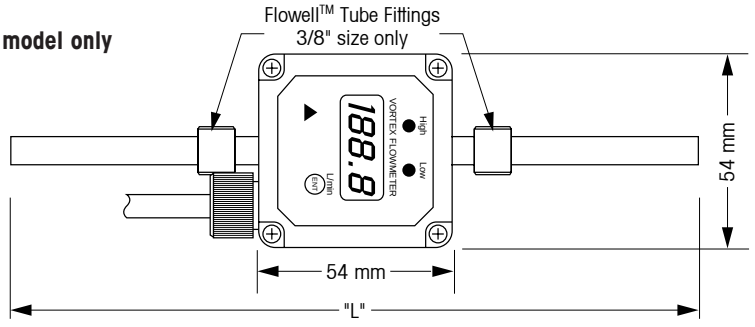
With Flaretek-Ends

Size	Dimensions (mm)	
	L (male-ends)	L (female-ends)
3/8 in.	259	190
1/2 in.	267	190
3/4 in.	277	190

1/2", 3"4" and 1" models



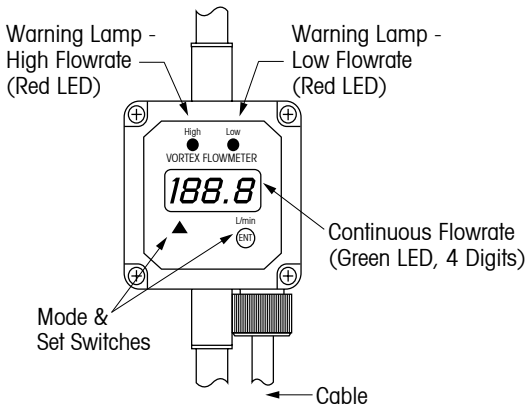
3/8" model only



NOTE: Arrow on body indicates flow direction.

Display & Output Specifications

Characteristic		Specification
Display	Flowrate	4-digit green LED
	Resolution	0.1 L/min
	Hi/Lo Limits	Red LEDs
Pulse Output	Type	Pulse
	Signal	Open collector
	Capacity	30 VDC, 150 mA
	Width	Approximately 50%
Analog Output	Type	Continuous flowrate
	Signal	4-20 mA
	Capacity	0-500 Ω
Warning Output	Setting	Upper and lower flowrate limits
	Signal	Open collector (photo coupler isolation)
		Normally open, closed on alarm
	Capacity	30 VDC, 150 mA max
Ext. Power Supply	12-24 VDC; 150 mA maximum	
Protection Structure	IP65/NEMA 4X	
Attached Cable	6.5 ft. (2 m) 6-conductor, shielded, vinyl insulation (4.8 mm O.D.)	
Ambient Temperature	0 - 60 °C	
Humidity	5 - 80%	



NOTE: Display may be rotated ±90°

Measurement & Mechanical Specifications

Size	3/8 in.	1/2 in.	3/4 in.	1 in.
Applicable Fluids Liquid (including corrosive chemicals, ultrapure water, etc.)				
Accuracy	±5% F.S	±1% F.S.	±1% F.S.	±1% F.S.
Flowrate	0.1-1 GPM	0.5-5GPM	2.7-19 GPM	4-40 GPM
Range	0.4-3.5 L/min	2-20 L/min	10-70 L/min	15-150 L/min
Fluid Temperature	0-100 °C	0-100 °C	0-100 °C	0-100 °C
Max Pressure				
@20 °C	100 psig (7 bars)	145 psig (10 bars)	100 psig (7 bars)	70 psig (5 bars)
@100 °C	58 psig (4 bars)	100 psig (7 bars)	58 psig (4 bars)	43 psig (3 bars)
Tube Size	9.52 x 6.35 mm	12.7 x 9.52 mm	19.05 x 15.88 mm	25.4 x 22.22 mm
Materials for all models				
Housing	Virgin PFA Resin			
Indicator Case	PPS (Polyphenylene Sulfide)			
Screw	PEEK (Polyetheretherketone) Resin			
Seal	Fluoroelastomer			

Ordering Information

Size	Flow rate GPM (L/min.)	Maximum Pressure At 68°F (20°C)	Maximum Pressure At 212°F (100°C)	Part No.
Straight tube end - connections				
3/8 in.	0.1-1 (0.4-3.5)	100psig (7bar)	58psig (4bar)	**317-100**
1/2 in.	0.5-5 (2-20)	145psig (10bar)	100psig (7bar)	**317-101**
3/4 in.	2.7-19 (10-70)	100psig (76bar)	58psig (4bar)	**317-102**
1 in.	4-40 (15-150)	70psig (5bar)	43psig (3bar)	**317-103**
Male Flaretek end - connections				
3/8 in.	01-1 (0.4-3.5)	100psig (7bar)	58psig (7bar)	**317-200**
1/2 in.	0.5-5 (2-20)	145psig (10bar)	100psig (7bar)	**317-211**
3/4 in.	2.7-19 (10-70)	100psig (76bar)	58psig (4bar)	**317-222**
Female Flaretek end - connections				
3/8 in.	01-1 (0.4-3.5)	100psig (7bar)	58psig (7bar)	**317-300**
1/2 in.	0.5-5 (2-20)	145psig (10bar)	100psig (7bar)	**317-311**
3/4 in.	2.7-19 (10-70)	100psig (76bar)	58psig (4bar)	**317-322**

ISO 9001 certified

For the most current product information visit:

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