

# Flow Sensors



## THORNTON

Leading Pure Water Analytics

### Flow Sensors

Economical Paddlewheel

Hi-Purity PFA Ultrasonic Vortex

Insertion-type Vortex



**Convenient, Reliable and Economical**  
Flow Measurement

METTLER TOLEDO

# Paddlewheel Flow Sensors

## Reliable and Economical

Inline Paddlewheel flow sensors provide continuous flow measurement at a low cost for a variety of solids-free liquid applications. The open cell rotor is made of PVDF and the shaft and bearing of ceramic material offering superior life and operating performance. The modular quarter-turn electronics assembly makes service and maintenance fast and easy and allows the removal of the electronics without removing the entire sensor body.



Insertion Sensor



SST NPT Thread



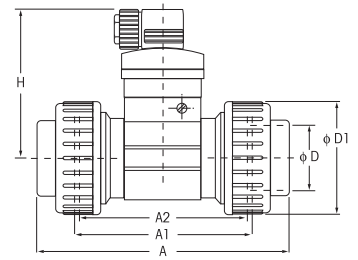
SST Tri-Clamp

### In-Line Paddlewheel Specifications

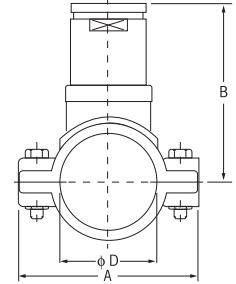
<b>Mounting Fitting:</b>	Included with sensor, materials as noted
<b>Straight Pipe Requirements:</b>	Pipe diameter: 10 x upstream, 3 x downstream
<b>Wetted Materials:</b>	PVC versions: PVC, PVDF, Ceramic, Viton Tri-Clamp SST versions: SS, PVDF, Ceramic, EPDM NPT Threaded SST version: SS, PVDF, Ceramic
<b>Flow Ranges:</b>	1 - 33 ft/s (0.3 - 10 m/s)
<b>Pressure:</b>	PVC versions: 140 psig at 122°F (10 bar at 50°C ), except insertion types: 85 psig at 122°F (6 bar at 50°C) SST versions: 230 psig at 212°F (16 bar at 100°C)
<b>Accuracy:</b>	± 0.5% of full scale, + 2.5% of reading with standard mean K-factor in reference conditions: water at 20°C (68°F)
<b>Linearity:</b>	≤ ± 0.5% of full scale, at 32.8 fps (10 m/s )
<b>Repeatability:</b>	0.4% of reading
<b>Ambient/Storage:</b>	PVC version: 32°F to 140°F (0°C to 60°C)
<b>Temperature:</b>	SST versions: 14°F to 176°F(-10°C to 80°C)
<b>Enclosure Rating:</b>	NEMA 4X and IP65
<b>Electronics Enclosure Material:</b>	Polycarbonate
<b>Wiring:</b>	Smart version uses standard 770MAX patch cables. Cable not provided for Pulse version. Use 3-conductor, 20 gauge shielded cable such as Belden 9364, or equivalent. Maximum recommended cable length is 160 ft (50 m)

Pipe Size of Included Fitting	International Part No.		US & Canada Part No.	
	Pulsed	Smart	Pulsed	Smart
<b>In-Line Paddlewheel Flow Sensors</b>				
<b>PVC, True Union Body Style - See Tables A and B</b>				
½"	58 034 601	58 034 151	33901	339-001
¾"	58 034 602	58 034 152	33902	339-002
1"	58 034 603	58 034 153	33903	339-003
1¼"	58 034 604	58 034 154	33904	339-004
1½"	58 034 605	58 034 155	33905	339-005
2"	58 034 606	58 034 156	33906	339-006
3" Insertion type w/saddle	58 034 607	58 034 157	33907	339-007
4" Insertion type w/saddle	58 034 608	58 034 158	33908	339-008
6" Insertion type w/saddle	58 034 609	58 034 159	33909	339-009
<b>SST Stainless Steel Body with NPT Threaded Connections - See Table C</b>				
½"	58 034 621		33921	
¾"	58 034 622		33922	
1"	58 034 623		33923	
1¼"	58 034 624		33924	
1½"	58 034 625		33925	
2"	58 034 626		33926	
<b>SST, ASME - BPE Tri-Clamp Body Style - See Table D</b>				
¾"	58 034 631		33931	
1"	58 034 632		33932	
1½"	58 034 633		33933	
2"	58 034 634		33934	
2½"	58 034 635		33935	

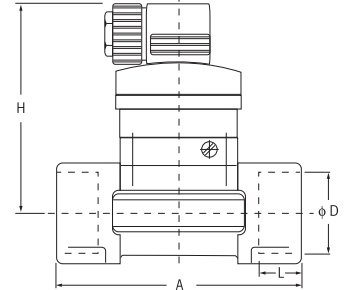
### True Union Body Style



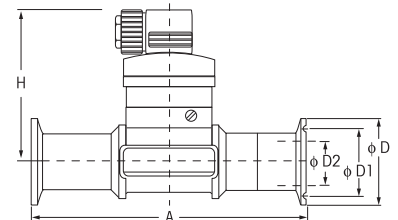
### Insertion Saddle



### NPT Threaded Body Style



### Tri-Clamp Body Style



**Table A – 8030 style Sensors True Union Nut with Solvent Ends (PVC) or Fusion Spigot Ends (PVDF)**

Orifice DN Inches (mm)	→ D	→ D1	A2	A1	A	H
0.59 (15)	0.79 (20)	1.69 (43)	3.55 (90)	3.78 (96)	5.04 (128)	3.62 (92)
0.79 (20)	0.99 (25)	2.09 (53)	3.94 (100)	4.18 (106)	5.67 (144)	3.51 (89)
0.99 (25)	1.26 (32)	2.36 (60)	4.33 (110)	4.57 (116)	6.30 (160)	3.52 (89.5)
1.26 (32)	1.57 (40)	2.91 (74)	4.33 (110)	4.57 (116)	6.62 (168)	3.66 (93)
1.57 (40)	1.97 (50)	3.27 (83)	4.73 (120)	5.00 (127)	7.41 (188)	3.82 (97)
1.97 (50)	2.48 (63)	4.06 (103)	5.12 (130)	5.36 (136)	8.35 (212)	4.10 (104)

**Table B – Saddle for 8020 Style Insertion Sensors**

Orifice DN Inches (mm)	→ D	A	B
3.00 (76)	3.54 (90)	5.66 (144)	4.48 (114)
4.00 (101)	4.33 (110)	6.53 (166)	4.67 (119)
6.00 (152)	6.29 (160)	8.50 (216)	5.17 (131)

Body Material: PP/PVC  
Seal Material: EPDM

**Table C – 8030 Style Female NPT Thread Stainless Steel (316L) Sensors**

Orifice DN Inches (mm)	→ D (NPT)	A	L	H
0.59 (15)	1/2"	3.35 (85)	0.67 (17)	3.62 (92)
0.79 (20)	3/4"	3.74 (95)	0.72 (18)	3.51 (89)
0.99 (25)	1"	4.13 (105)	0.72 (18)	3.52 (90)
1.26 (32)	1 1/4"	4.72 (120)	0.83 (21)	3.66 (93)
1.57 (40)	1 1/2"	5.12 (130)	0.79 (20)	3.82 (97)
1.97 (50)	2"	5.91 (150)	0.94 (24)	4.10 (104)

**Table D – 8030 Style Tri-Clamp Stainless Steel (316L) Sensors**

Body Size	Orifice DN Inches (mm)	→ D2	→ D1	→ D	A	H
¾"	0.79 (20)	0.62 (16)	0.79 (20)	0.99 (25)	4.69 (119)	3.51 (89)
1"	0.99 (25)	0.87 (22)	1.71 (44)	1.98 (51)	5.08 (129)	3.52 (90)
1 1/2"	1.57 (40)	1.37 (35)	1.71 (44)	1.98 (51)	6.34 (161)	3.82 (97)
2"	1.97 (50)	1.87 (48)	2.22 (57)	2.52 (64)	7.56 (192)	4.10 (104)
2 1/2"	2.56 (65)	2.37 (60)	2.78 (71)	3.05 (78)	8.50 (216)	4.41 (112)

NOTE: Installation fittings conform to BS 4825 / ASME BPE Standard

### 325-Series Compact Sanitary Turbine Flow Sensors

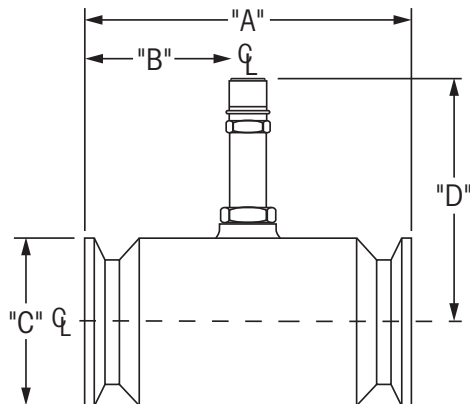
Another choice for applications demanding ASME-BPE-2009 Standard and efficient flow measurement. 325-series flow sensors feature a compact flow sensor body with Tri-Clamp type connections and a magnetic variable reluctance type coil.

- Wetted Parts:** Body 316 SS, Ra 32 microinch (0.8 micrometer) finish; 17.4 pH SS rotor; 15.7 MO pH SS retaining rings; hard carbon composite bearings.
- Certification:** ASME-BPE 2009 Rated, manufacturers calibration and materials certificates included.
- Pressure:** 500 psi (35 bar) maximum
- Temperature:** 450 °F (232 °C) maximum
- Electrical Connection:** Smart models have 1.5 ft (0.5 m) cables and require patch cords, maximum length 300 ft (91 m). Pulse input models have 20 ft (6.1 m) twisted cable with 1/2" NPTM conduit connector. Wiring may be run up to 2,000 ft (610 m) with 3 conductor, 20 gauge, shielded cable, such as Belden 9364.
- Process Connections:** To achieve optimum performance, maintain the ASME standard and to protect the bearings from excess turbulence and damage, a minimum of 10 pipe diameters upstream and 5 pipe diameters downstream of turbine size pipe must be used. For example, the 1/4" turbine with 1-1/2" Tri-Clamp fittings must have 1/4" inlet and discharge piping. In addition, proper inside diameter flange gasket must be used. Consult Thornton for installation kit if needed.
- Linearity:** ±0.5% of reading\*\*
- Repeatability:** ±0.1% of reading\*\*

Flow Range GPM (LPM)	Tri-Clamp® Fitting	Turbine Size	Dimensions (in.)				US & Canada		International	
			A	B	C	D	Pulse Input* Part No.	Smart Input Part No.	Pulse Input* Part No.	Smart Input Part No.
0.35-3.5 (1.3-13)	3/4"	1/4"	3.56	1.78	0.99	3.0	<b>33336</b>	<b>325-001</b>	<b>58 034 270</b>	<b>58 034 070</b>
0.35-3.5 (1.3-13)	1-1/2"	1/4"	3.56	1.78	1.98	3.0	<b>33337</b>	<b>325-002</b>	<b>58 034 271</b>	<b>58 034 071</b>
0.75-7.5 (2.8-28)	3/4"	3/8"	3.56	1.78	0.99	3.0	<b>33338</b>	<b>325-003</b>	<b>58 034 272</b>	<b>58 034 072</b>
0.75-7.5 (2.8-28)	1-1/2"	3/8"	3.56	1.78	1.98	3.0	<b>33339</b>	<b>325-004</b>	<b>58 034 273</b>	<b>58 034 073</b>
1.25-9.5 (4.7-36)	3/4"	1/2"	3.56	1.78	0.99	3.0	<b>33340</b>	<b>325-005</b>	<b>58 034 274</b>	<b>58 034 074</b>
1.25-9.5 (4.7-36)	1-1/2"	1/2"	3.56	1.78	1.98	3.0	<b>33341</b>	<b>325-006</b>	<b>58 034 275</b>	<b>58 034 075</b>
1.75-16 (6.6-60)	3/4"	5/8"	3.56	1.78	0.99	3.0	<b>33342</b>	<b>325-007</b>	<b>58 034 276</b>	<b>58 034 076</b>
1.75-16 (6.6-60)	1-1/2"	5/8"	3.56	1.78	1.98	3.0	<b>33343</b>	<b>325-008</b>	<b>58 034 277</b>	<b>58 034 077</b>
2.5-29 (9.5-110)	1-1/2"	3/4"	3.25	1.63	1.98	3.0	<b>33344</b>	<b>325-009</b>	<b>58 034 278</b>	<b>58 034 078</b>
4-60 (15-227)	1-1/2"	1"	3.56	1.78	1.98	3.0	<b>33345</b>	<b>325-010</b>	<b>58 034 279</b>	<b>58 034 079</b>
6-93 (23-352)	1-1/2"	1-1/4"	4.59	2.30	1.98	3.0	<b>33346</b>	<b>325-011</b>	<b>58 034 280</b>	<b>58 034 080</b>
8-130 (30-492)	1-1/2"	1-1/2"	4.59	2.30	1.98	3.0	<b>33347</b>	<b>325-012</b>	<b>58 034 281</b>	<b>58 034 081</b>
15-225 (57-852)	2"	2"	6.06	3.03	2.52	3.0	<b>33348</b>	<b>325-013</b>	<b>58 034 282</b>	<b>58 034 082</b>
25-400 (95-1,514)	3"	2-1/2"	10.00	5.00	3.58	3.0	<b>33376</b>	<b>325-014</b>	<b>58 034 303</b>	<b>58 034 103</b>
40-650 (151-2,460)	4"	3"	10.00	5.00	4.68	3.0	<b>33377</b>	<b>325-015</b>	<b>58 034 304</b>	<b>58 034 104</b>

\* Pulse input flow sensors for use with M300 FLOW and 770MAX (channels 5 and 6 only) do not include Smart Sensor communication and do not use patch cables. A separate isolated 12 VDC power supply 58 079 000 (1000-65 for US & Canada) is required when sensor is used with 770MAX. Refer to 770MAX and M300 FLOW operating manuals for respective wiring instructions.

\*\* Based on manufacturer's calibration in water at 70°C



# PFA Vortex Flowmeters

## Superior low flow rate performance

- Display:** 4-digit LED plus high & low alarm indicators
- Straight tube requirements:** 10 x diameter upstream and 2 x diameter downstream.
- Wetted materials:** PFA Perfluoroalkoxy
- Temperature:** 32-212 °F (0-100 °C)
- Viscosity:** For liquids more viscous than water, consult Thornton.
- Electrical connections:** 6.5 ft (2 m) cable may be extended with 22 gauge 6-conductor shielded cable up to 325 ft. (100 m) for 770MAX pulse input only.
- Enclosure:** NEMA 4X, IP65
- Power supply:** One external 12 VDC isolated power supply (P/N 58 079 000, or 1000-65 for US and Canada) is required for one or two pulse input sensors.
- Certification:** CE rated, certificate of accuracy included



Size	Flow rate GPM (L/min.)	Maximum Pressure psig (bar)		US & Canada Part No.	International Part No.
		At 68°F (20°C)	At 212°F (100°C)		
<b>Straight tube end - connections</b>					
3/8 in.	0.1-1 (0.4-3.5)	100 (7)	58 (4)	<b>317-100</b>	<b>58 034 400</b>
1/2 in.	0.5-5 (2-20)	145 (10)	100 (7)	<b>317-101</b>	<b>58 034 401</b>
3/4 in.	2.7-19 (10-70)	100 (7)	58 (4)	<b>317-102</b>	<b>58 034 402</b>
1 in.	4-40 (15-150)	70 (5)	43 (3)	<b>317-103</b>	<b>58 034 403</b>
<b>Male Flaretek end - connections</b>					
3/8 in.	0.1-1 (0.4-3.5)	100 (7)	58 (7)	<b>317-200</b>	<b>58 034 410</b>
1/2 in.	0.5-5 (2-20)	145 (10)	100 (7)	<b>317-211</b>	<b>58 034 411</b>
3/4 in.	2.7-19 (10-70)	100 (76)	58 (4)	<b>317-222</b>	<b>58 034 412</b>
<b>Female Flaretek end - connections</b>					
3/8 in.	0.1-1 (0.4-3.5)	100 (7)	58 (7)	<b>317-300</b>	<b>58 034 420</b>
1/2 in.	0.5-5 (2-20)	145 (10)	100 (7)	<b>317-311</b>	<b>58 034 421</b>
3/4 in.	2.7-19 (10-70)	100 (7)	58 (4)	<b>317-322</b>	<b>58 034 422</b>

### Straight Tube-End

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

### Flaretek-End

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

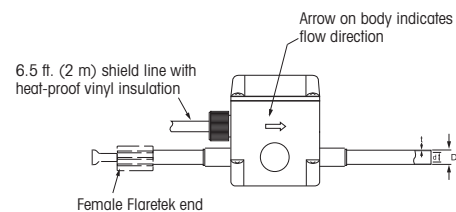
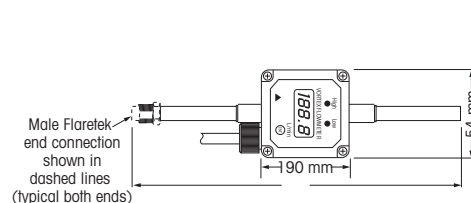
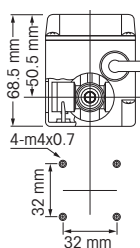
### Flowrate Range for PFA Vortex Flowmeters

Size	Minimum Flowrate (L/min)					Max Flowrate (L/min)				
	0.3	0.5	0.7	1*	2	3	4	5	7	
cp**										
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 centipoise)

### Mounting Dimensions

(for all models)



# Forward-Swept Impeller Sensors with Fittings

## Economical non-magnetic measurement

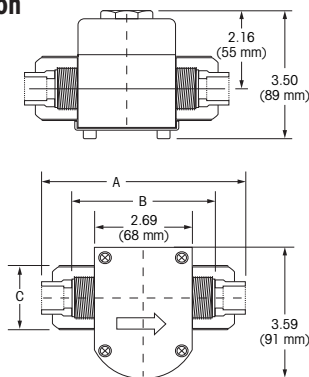
- Mounting fitting:** Included with insertion sensor (flow-thru and socket union type sensors do not require fitting), wetted parts as noted.
- Straight pipe requirements:** 10 x diameter upstream and 5 x diameter downstream.
- Electrical connections:** Smart models have 1.5 ft (0.5 m) cable and smart connector and use patch cords up to 300 ft (91 m). Pulse input models have 20 ft (6.1 m) cables and may be extended up to 2,000 ft (610 m) using 20 gauge, shielded cable: 2-conductors for socket tee models, 3-conductors for other models.
- Power supply:** One external 12 VDC isolated power supply 1000-65 is required for one or two pulse input sensors. One kit 1000-67 is required for each 1-1/2" and larger pulse input sensor.
- Accuracy:** ± 1% of full scale over operating range
- Repeatability:** ± 0.5% of full scale over operating range



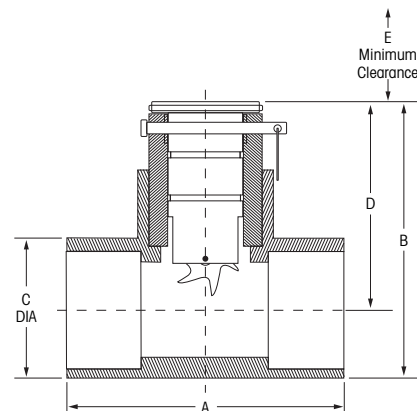
Pipe Size of Included Fitting	Wetted Materials	Flow Range	Pressure at Temperature PSIG (bar) °F (°C)		Ref. No	US & Canada Pulse Input Part No.	US & Canada Smart Input Part No.	International Pulse Input Part No.	International Smart Input Part No.
1-1/2" Socket tee	PVC tee, PPS, Nylon, tungsten carbide, EPDM	1-30 ft/s			228PV1505-1211	<b>33142</b>	<b>335-911</b>	<b>58 034 201</b>	<b>58 034 001</b>
2" Socket tee	PVC tee, PPS, Nylon, tungsten carbide, EPDM	1-30 ft/s			228PV2005-1211	<b>33143</b>	<b>335-211</b>	<b>58 034 202</b>	<b>58 034 002</b>
3" Socket tee	PVC tee, PPS, Nylon, tungsten carbide, EPDM	1-30 ft/s	100 (7)	68 (20) & 140 (60)	228PV3005-1211	<b>33144</b>	<b>335-311</b>	<b>58 034 203</b>	<b>58 034 003</b>
4" Socket tee	PVC tee, PPS, Nylon, tungsten carbide, EPDM	1-30 ft/s			228PV4005-1211	<b>33145</b>	<b>335-411</b>	<b>58 034 204</b>	<b>58 034 004</b>
1/2" Socket union	PVDF, Viton, ceramic, Tefzel	1-20 GPM			400500-0022	<b>33172</b>	<b>335-521</b>	<b>58 034 207</b>	<b>58 034 007</b>
3/4" Socket union	PVDF, Viton, ceramic, Tefzel	1.74-34 GPM	275 (19)	65 (18) & 140 (10)	401500-0022	<b>33174</b>	<b>335-721</b>	<b>58 034 208</b>	<b>58 034 008</b>
1" Socket union	PVDF, Viton, ceramic, Tefzel	2.8-56 GPM			402500-0022	<b>33171</b>	<b>335-121</b>	<b>58 034 226</b>	<b>58 034 006</b>
1-1/2" to 6" Repl. Sensor for PVC Pipe, fitting not included*		1-30 ft/s	NA	NA	813107-1211	<b>33191</b>	<b>335-041</b>	<b>58 034 217</b>	<b>58 034 017</b>
1-1/2" to 6" Repl. Sensor for PVDF Pipe, fitting not included*		1-30 ft/s	NA	NA	813003-0022	<b>33192</b>	<b>335-051</b>	<b>58 034 216</b>	<b>58 034 017</b>

\*Requires field configuration for pipe size.

### PVDF Socket Union



### PVC Socket Tee



PVC Size Inches(mm)	1/2"	3/4"	1"
A	5.58 (142)	6.12 (155)	1.85 (47)
B	3.54 (90)	3.92 (100)	2.24 (57)
C	1.85 (47)	4.32 (110)	2.52 (64)

Inches(mm)	1.5"	2"	3"	4"
A	5.00 (127)	0.63 (143)	6.50 (165)	7.38 (187)
B	5.16 (131)	5.64 (143)	6.83 (173)	7.83 (199)
C	2.38 (60)	2.88 (73)	4.23 (107)	5.38 (137)
D	3.97 (101)	4.20 (107)	4.68 (119)	5.10 (130)
E	5.00 (127)	5.00 (127)	5.00 (127)	5.00 (127)

# Flat Paddlewheel Flow Sensors

## Low cost measurement

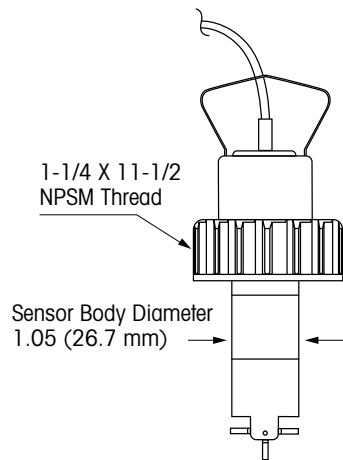
- Mounting fitting:** Must be obtained separately except for 1/4" NPT models.
- Straight pipe requirements:** 10-50 x diameter upstream and 5 x diameter downstream.
- Electrical connections:** Smart models have 1.5 ft (0.5 m) cable and smart connector and use patch cords up to 300 ft (91 m). Pulse input models have 25 ft (7.6 m) cables and may be extended up to 200 ft (61 m) for magnetic type and 1,000 ft (305 m) for Hall effect type, using 2-conductor, 22 gauge, shielded cable.
- Linearity:** 1% FS
- Repeatability:** ± 0.5% of full scale, except ± 0.25% of full scale for 1/4" NPT models
- Certification:** CE rated, certificate of accuracy included where indicated.



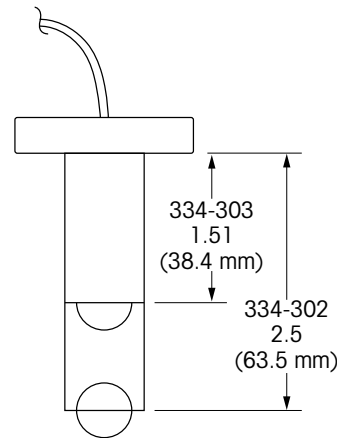
Pipe Size	Wetted Materials	Cert. Incl.	Flow Ranges	Pressure at Temperature		Ref No.	US & Canada	US & Canada	International	International
				PSIG (bar)	°F (°C)		Pulse Input Part No.	Smart Input Part No.	Pulse Input Part No.	Smart Input Part No.
<b>Hall Effect</b>										
0.5 - 4"	Polypropylene, titanium, PVDF	Y	0.3-20 ft/s	180 (12.4)	68 (20) &	3-2536-P0	<b>33298</b>	<b>334-210*</b>	<b>58 034 233</b>	<b>58 034 033</b>
5 - 8"	Polypropylene, titanium, PVDF	N	(0.1-6 m/s)	25 (1.7)	194 (90)	3-2536-P1	<b>33299</b>	<b>334-211*</b>	<b>58 034 234</b>	<b>58 034 034</b>
10" & Up	Polypropylene, titanium, PVDF	N				3-2536-P2	<b>33300</b>	<b>334-212*</b>	<b>58 034 235</b>	<b>58 034 035</b>
<b>Magnetic</b>										
0.5 - 4"	Polypropylene, titanium, PVDF	Y	1-20 ft/s	180 (12.4)	68 (20) &	P51530-P0	<b>NA**</b>	<b>334-203*</b>	<b>NA**</b>	<b>58 034 021</b>
5 - 8"	Polypropylene, titanium, PVDF	N	(0.3-6 m/s)	25 (1.7)	194 (90)	P51530-P1	<b>NA**</b>	<b>334-204*</b>	<b>NA**</b>	<b>58 034 022</b>
0.5 - 1"	316SS, CD4Mcu, Fluoroloy B	N	1-20 ft/s	1500 (103)	300 (149)	P525-1	<b>NA</b>	<b>334-303*</b>	<b>NA</b>	<b>58 034 109</b>
1.25 - 12"	316SS, CD4Mcu, Fluoroloy B	N	(0.3-6 m/s)			P525-2	<b>NA</b>	<b>334-302*</b>	<b>NA</b>	<b>58 034 108</b>

\* Specify pipe material, size, and schedule or inside diameter to enable Smart calibration.  
 \*\* Not for use with 770MAX Smart or Pulsed input. For M300 and 200Flow only.

### 0.5 - 8" Plastic



### Metal



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MLO116 Rev.F 11/12



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