

M-Series® M1000

Electromagnetic Flow Meter

DESCRIPTION

The Badger Meter M-Series® M1000 meter is the result of years of research and field use of electromagnetic flow meter technology. Designed, developed and manufactured under strict quality standards, the M1000 features sophisticated, processor-based signal conversion with accuracies of ± 0.3 percent.

The M1000 can be chosen for a broad spectrum of applications and the wide selection of liner and electrode materials help ensure maximum compatibility and minimum maintenance over a long operating period.

OPERATION

The operating principle of the electromagnetic flow meter is based on Faraday's law of magnetic induction: The voltage induced across any conductor, as it moves at right angles through a magnetic field, is proportional to the velocity of that conductor. The voltage induced within the fluid is measured by two diametrically opposed internally mounted electrodes. The induced signal voltage is proportional to the product of the magnetic flux density, the distance between the electrodes and the average flow velocity of the fluid.

ELECTRODES

When looking from the end of the meter into the inside bore, the two measuring electrodes are positioned at three o'clock and nine o'clock. As a conductive fluid flows through the magnetic fluid, a voltage is induced across the electrodes. This voltage is proportional to the average flow velocity of the fluid and is measured by the two electrodes. This induced voltage is then amplified and processed digitally by the converter to produce an accurate analog or digital signal. The signal can then be used to indicate flow rate and totalization or to communicate to remote sensors and controllers.

M1000 mag meter also have an "empty pipe" detection feature. This is accomplished with a third electrode positioned in the meter between twelve o'clock and one o'clock. If this electrode is not covered by fluid for a minimum of five-seconds, the meter will display an "empty pipe" condition. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

DETECTOR

The flow meter is a stainless steel tube lined with a non-conductive material. Outside the tube, two DC powered electromagnetic coils are positioned opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. Energized coils create a magnetic field across the whole diameter of the pipe. With no moving parts, open flow tube design there is no pressure lost and practically no maintenance required



APPLICATION

The M1000 has been specifically designed for industrial water/wastewater, machinery plants, vehicles and batching process applications. Available in sizes from 1/4...8 in. and nominal pressures up to PN100, the meter is best suited for bidirectional flow measurements of fluid $> 5 \mu\text{S/cm}$ ($> 20 \mu\text{S/cm}$ for demineralized water). The amplifier can be integrally mounted to the detector, or if necessary, mounted remotely. The amplifier is housed in a Type NEMA 4X (IP67) enclosure and the measuring pipes are lined with material approved for drinking water: KTW/DVGW, NSF-61, WRAS, ACS.

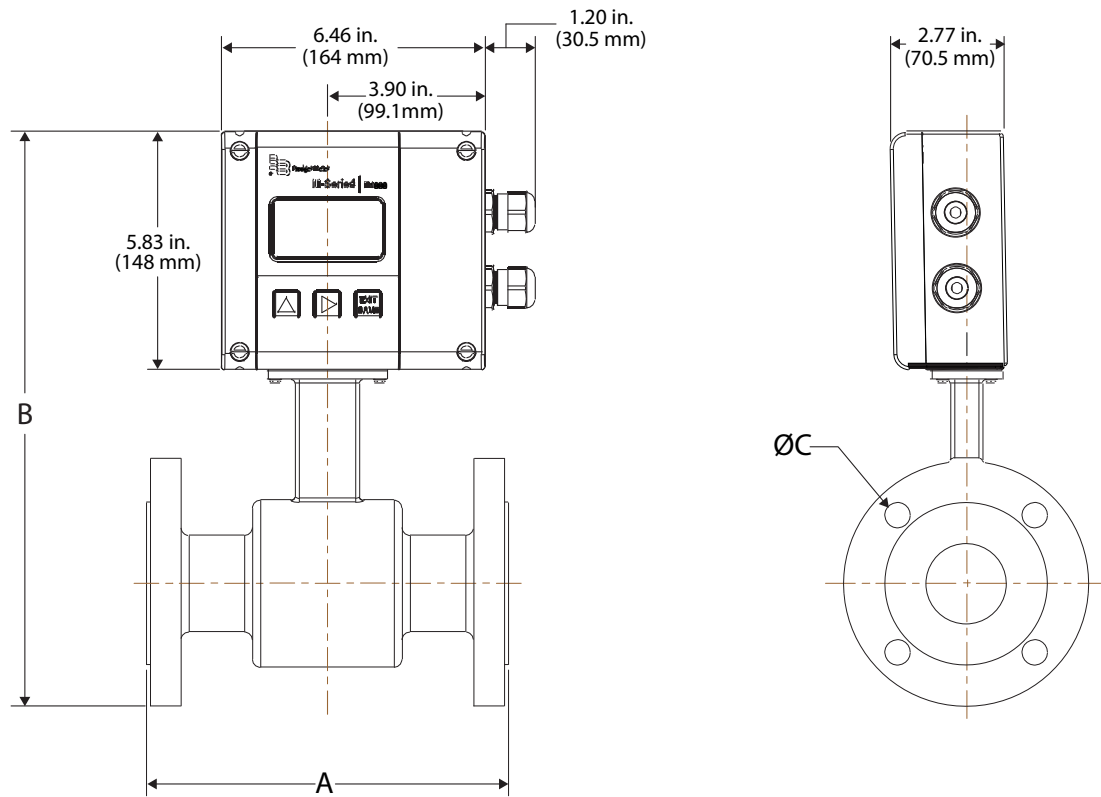
FEATURES

- Accuracy $\pm 0.3\%$
- Flow range 0.03...12 m/s
- Sizes 1/4 ... 8 in. (6...200 DN)
- LCD display
- Power supply 92...275V AC, 9...36V DC

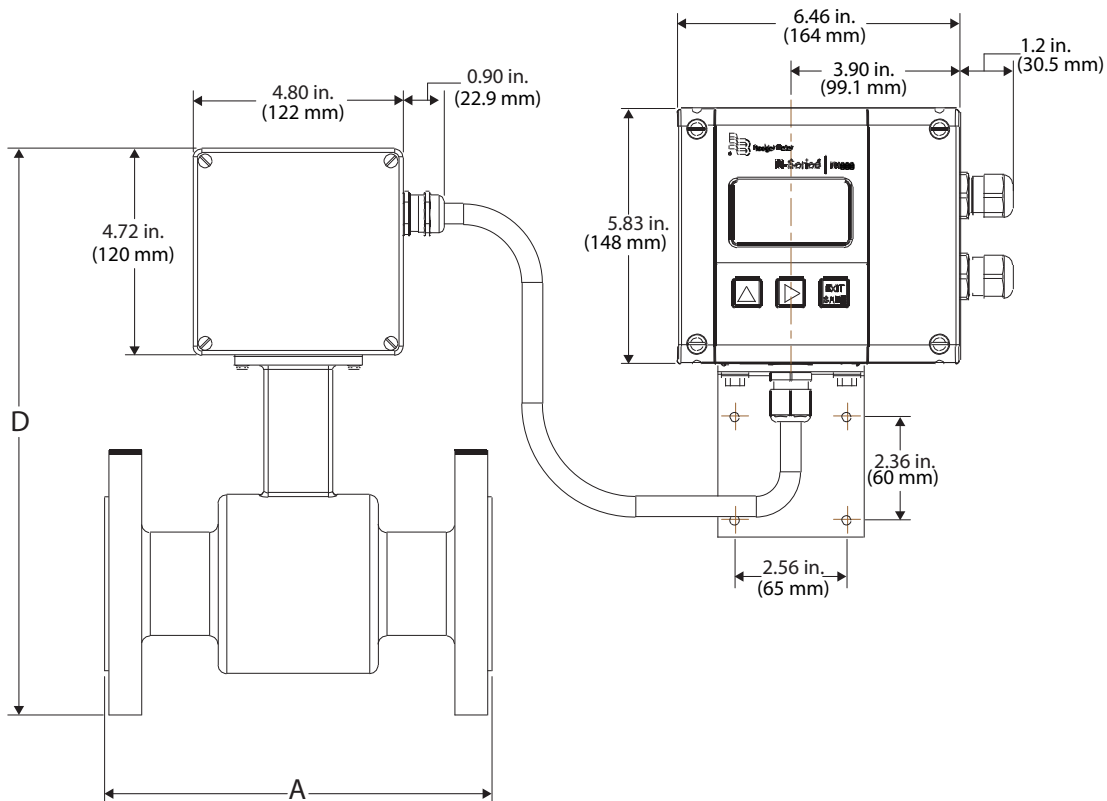
APPROVALS

- UL Std. No. 61010-1 (2nd Edition)
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements

DIMENSIONS



Meter mounted



Remote mounted with mounting bracket

Size		A		B		ØC		D		Finish Est. Wt.		Flow Range			
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg	LPM		GPM	
												min.	max.	min.	max.
1/4	6	6.7	170	8.98	228	3.50	89	10.08	256	9.04	4.1	0.05	20.36	0.01	5.38
3/10	8	6.7	170	8.98	228	3.50	89	10.08	256	9.04	4.1	0.09	36.19	0.02	9.56
3/8	10	6.7	170	8.98	228	3.50	89	10.08	256	90.4	4.1	0.14	56.55	0.04	14.94
1/2	15	6.7	170	9.37	238	3.50	89	10.47	266	9.04	4.1	0.32	127.26	0.08	33.62
3/4	20	6.7	170	9.37	238	3.90	99	10.47	266	11.24	5.1	0.46	183.24	0.12	48.41
1	25	8.9	225	9.37	238	4.25	108	10.47	266	16.76	7.6	0.79	317.65	0.21	83.91
1-1/4	32	8.9	225	9.96	253	4.61	117	11.06	281	18.96	8.6	1.48	593.63	0.39	156.82
1-1/2	40	8.9	225	9.96	253	5.00	127	11.06	281	20.06	9.1	2.08	833.83	0.55	220.28
2	50	8.9	225	9.96	253	5.98	152	11.06	281	24.47	11.1	3.58	1430.71	0.94	377.95
2-1/2	65	11.0	280	10.67	271	7.01	178	11.77	299	50.92	23.1	6.18	2470.80	1.63	652.72
3	80	11.0	280	10.67	271	7.52	191	11.77	299	53.13	24.1	8.36	3344.16	2.21	883.43
4	100	11.0	280	10.94	278	9.02	229	12.05	306	55.34	25.1	12.49	4996.67	3.30	1319.98
5	125	15.7	400	11.73	298	10.00	254	12.83	326	56.44	25.6	20.02	8007.72	5.29	2115.42
6	150	15.7	400	12.20	310	10.98	279	13.31	338	58.64	26.6	29.72	11889.52	7.85	3140.88
8	200	15.7	400	13.31	338	13.50	343	14.41	366	85.10	38.6	59.41	23764.77	15.69	6277.99

SPECIFICATIONS

Flow Range	0.03...12 m/s	
Accuracy	± 0.3% of reading, ± 2 mm/s	
Conductivity	Min. 5 µS/cm (20 µS/cm for demineralized water)	
Fluid Temperature	With Remote Amplifier: PTFE 302° F (150° C), Hard rubber 178° F (80° C)	With Meter-Mounted Amplifier: PTFE 212° F (100° C), Hard rubber 178° F (80° C)
Ambient Temperature	-4...140° F (-20...60° C)	
Flow Direction	Uni-directional or bi-directional	
Analog Output	0/4...20 mA / 0...10 mA, flow direction is displayed on a separate status output	
Pulse Output	2 open collectors, passive 32V DC, 0...100 Hz 100 mA, 100...10,000 Hz 20 mA, optional active	
Frequency Output	Max. 10 kHz (open collector)	
Communication	RS232, RS422, RS485 Modbus RTU	
Empty Pipe Detection	Field-tunable for optimum performance based on specific application	
Min-Max Flow Alarm	Programmable outputs 1...100% of flow	
Low Flow Cutoff	Programmable 0...10% of maximum flow	
Galvanic Separation	Functional 500 volts	
Pulse Width	Programmable 5...2000 ms	
Coil Power	Pulsed DC	
Repeatability	0.1%	
Display	Two lines x 15 characters (7 on top + 8 on bottom), LCD display	
Programming	3 external buttons	
Units of Measure	Gallons, ounces, MGD, liters, cubic meters, cubic feet, imperial gallon, barrel, hectoliter and acre feet	
Power Supply	92...275V AC (50 / 60 Hz), <13 VA optional 9...36V DC, 4W	
Amplifier Housing	Powder-coated aluminium die cast	
Detector Housing	Carbon steel	
Linear Materials	Hard Rubber, PFA, PTFE	
Electrodes Materials	Standard: Hastelloy C	
Grounding Rings	Stainless steel	
Mounting	Detector-mount or remote wall mount	
Approvals	NSF Listed: Models with hard rubber liner 4" size and up; PTFE liner, all sizes	
Cable Insertion	2 x M 20	
Process Connection	Flange: DIN, ANSI, JIS, AWWA	
Nominal Pressure	Up to 232 psi (16 bar)	
Protection Class	Standard: NEMA 4X (IP67); Optional: NEMA 6P	
Pollution Degree	2	
Installation Category	II	
Altitude	2500 m	
Humidity	90% R.H. max.	
Electrical Supply	100...240V AC (±10%). 50/60 Hz, 15 Watts	
	NOTE: Mains supply voltage fluctuations are not to exceed ±10% of the nominal voltage supply.	

Control. Manage. Optimize.

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