

# 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  $\pm 0.3$  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.

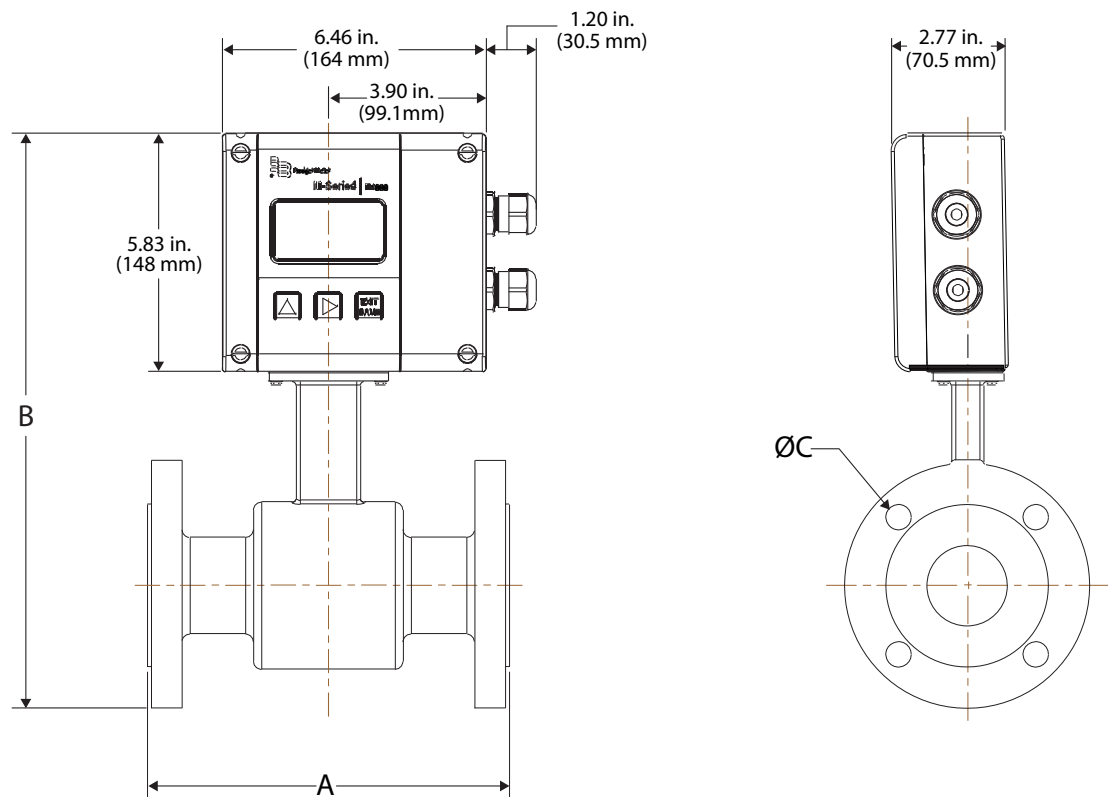
### FEATURES

- 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

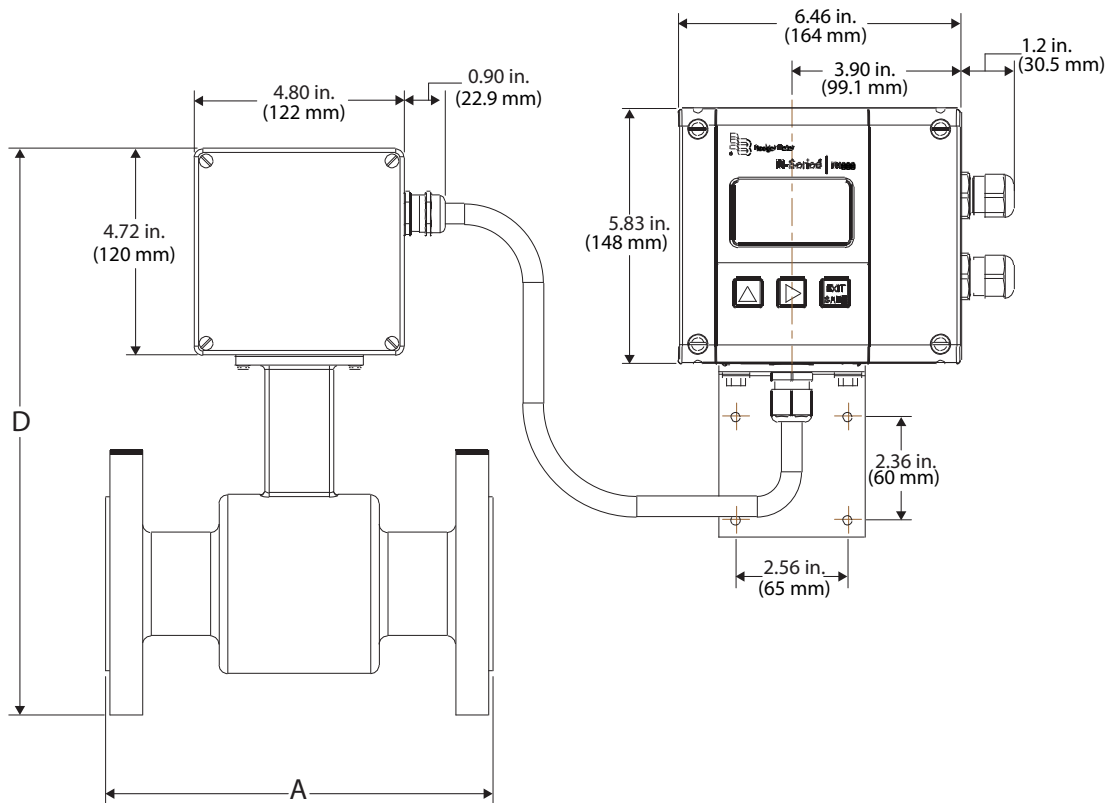
### APPROVALS

- 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

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