

### DESCRIPTION

The innovative design of the Badger Meter M-Series M4000 meter represents the next generation of electromagnetic flow meter technology. Incorporating the latest developments in micro processing signal conditioning, the advanced design of the M4000 allows an accuracy of better than  $\pm 0.25\%$  with a flow range of 300:1. Targeted to a variety of industrial and municipal applications, the M4000 is virtually unaffected by density, temperature, pressure, and viscosity changes and provides an accurate and reliable long term metering solution. This meter complies with ANSI/NSF Standard 61, Annex G.

### 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 field, 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.

M4000 meters 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 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 and open-flow design, there is no pressure lost and practically no maintenance required.



### APPLICATION

The M4000 is suited for use in applications where indication of rate and totalization is required. The ability to display flow parameters locally at the flow meter, or remotely by mounting the amplifier up to 100 feet away from the detector, provides a versatile solution for most industrial and municipal flow applications. Whether the fluid is water or something highly corrosive, very viscous, contains a moderate amount of solids, or requires special handling, the meter is able to accurately measure it. Housed in a Class 1, Division 1, NEMA 4X (IP66) enclosure, the M4000 design has been tested and approved by Factory Mutual (FM) in the United States and the Canadian Standards Association (CSA international) in Canada.

### FEATURES

- Sizes 1/4...12 in. (6...300 mm)
- Accuracy of  $\pm 0.25\%$
- Better than 0.1% repeatability
- Digital Signal Processor (DSP) based
- Automatic zero point stability
- No pressure loss for low operational costs
- Long life, corrosion-resistant liners
- Precise calibration
- Digital and analog outputs
- Detector or remote wall mount
- NEMA 4X (IP66) enclosure
- FM approved for Class I, Div 1 hazardous locations
- CE and FCC compliant
- CSA Certified

**DIMENSIONS**

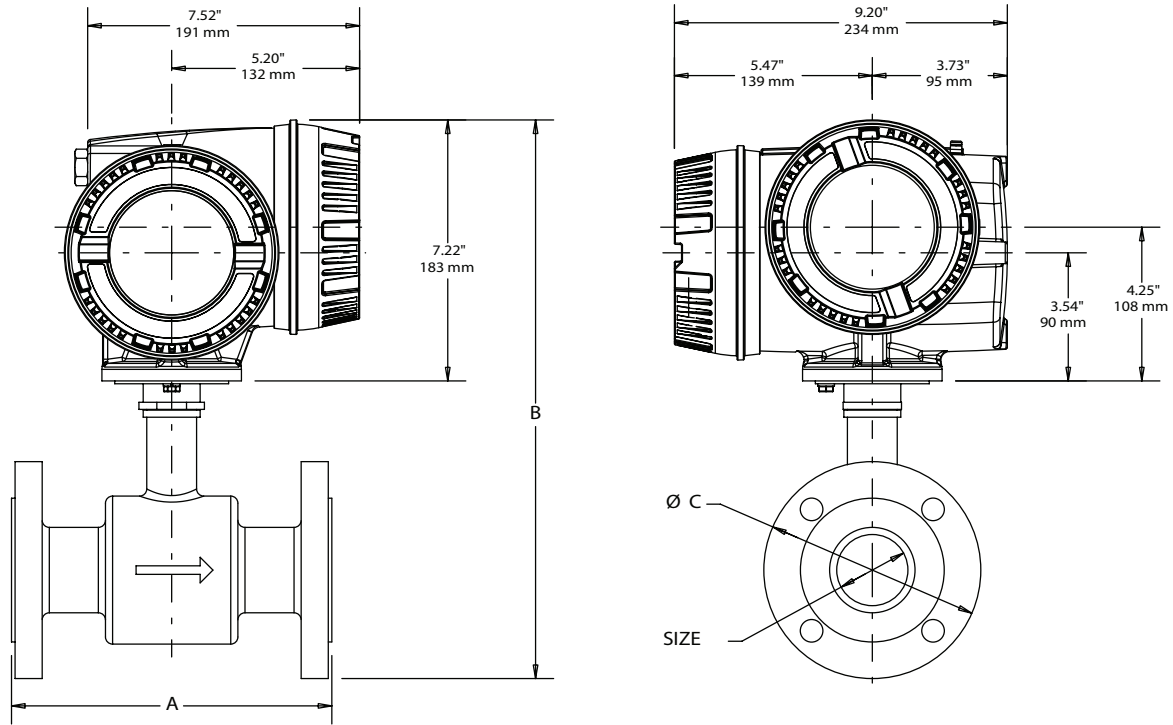


Figure 1: M4000 meter mount amplifier on detector

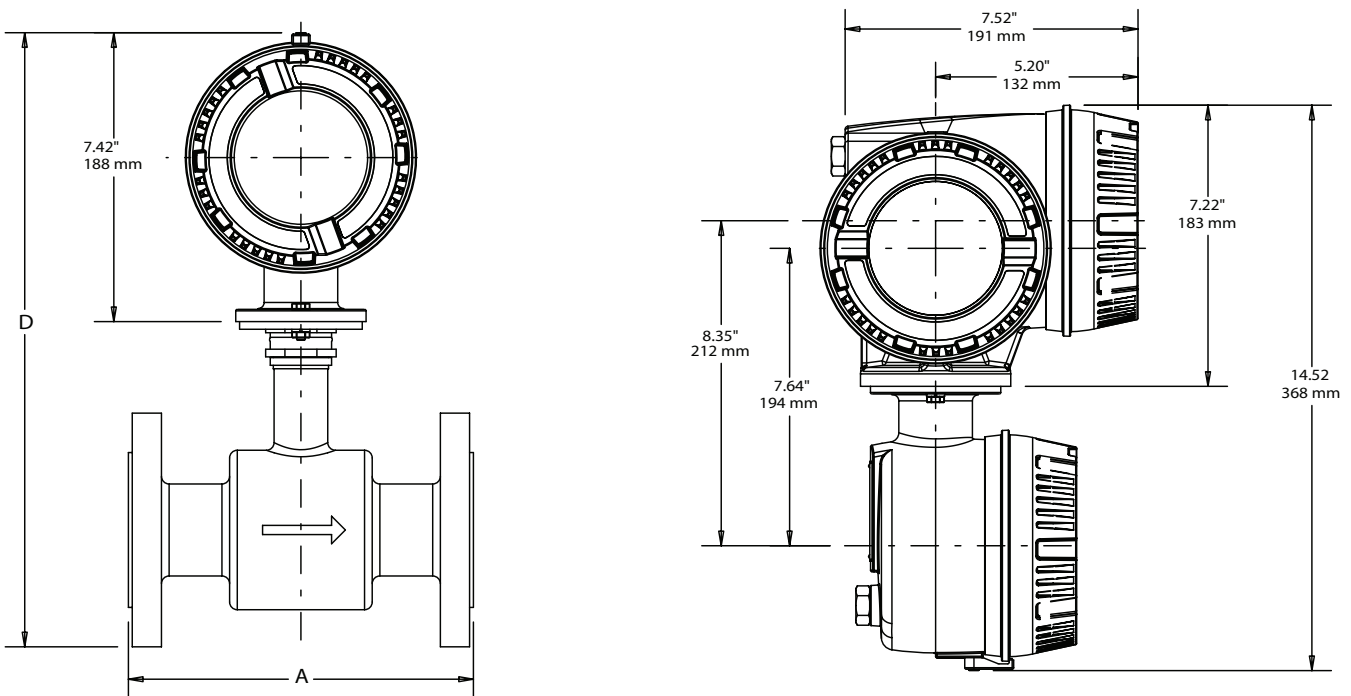


Figure 2: M4000 remote mount junction box on detector

**Detector Dimensions and Specifications**

Size		A		B		C		D		Est. Weight w/ Amplifier		Flow Range			
												gpm		lpm	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg	min	max	min	max
1/4	6	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.01	5	0.05	20
5/16	8	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.02	10	0.09	36
3/8	10	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.04	15	0.14	57
1/2	15	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.08	34	0.32	127
3/4	20	6.7	170	13.6	347	3.9	99	14	356	17	7.7	0.12	48	0.46	183
1	25	8.9	225	13.8	352	4.3	108	14.2	361	18	8.8	0.21	84	0.79	318
1-1/4	32	8.9	225	14.6	372	4.6	117	15	381	20.3	9.2	0.39	157	1.5	594
1-1/2	40	8.9	225	14.8	376	5.0	127	15.2	386	22	10	0.55	220	2.1	834
2	50	8.9	225	15.3	389	6.0	152	15.7	398	26	11.7	0.94	378	3.6	1431
2-1/2	65	11.0	280	16.5	420	7.0	178	16.9	429	35	15.7	1.63	653	6.2	2471
3	80	11.0	280	16.7	426	7.5	191	17.2	435	38	17.1	2.21	883	8.4	3344
4	100	11.0	280	17.8	452	9.0	229	18.2	461	49	22.1	3.30	1320	12	4997
5	125	15.8	400	19	484	10.0	254	19.4	493	60	27.1	5.29	2115	20	8008
6	150	15.8	400	20	510	11.0	279	20.4	519	71	32.1	7.85	3141	30	11890
8	200	15.8	400	21.9	558	13.5	343	22.9	583	95	43.1	15.69	6278	59	23765
10	250	19.7	500	26.2	677	16.0	406	26.6	676	130	59.1	25.05	10021	95	37934
12	300	19.7	500	28.3	720	19.0	483	28.7	729	219	99.3	33.61	13445	127	50894

## SPECIFICATIONS

<b>Sizes</b>	1/4...12" (6...300 mm)	
<b>Flow Range</b>	0.1...39.4 ft/s (0.03...12 m/s)	
<b>Accuracy</b>	± 0.25% of rate for velocities greater than 1.64 ft/s (0.50 m/s) ± 0.004 ft/s (± 0.001) m/s for velocities less than 1.64 ft/s (0.50 m/s)	
<b>Repeatability</b>	0.1% of rate	
<b>Power Supply</b>	85...265V AC, 45...65 Hz	
<b>Analog Outputs</b>	0...10 mA, 0...20 mA, 4...20 mA (programmable and scalable), Voltage sourced (18V DC) – isolated, max. loop resistance = 750 Ω	
<b>Digital Outputs</b>	(2) Open collector, (programmable scaled pulse, flow alarm, status, or frequency output), max. 24V DC, 0.5 W (2) AC solid-state relay (programmable flow alarm or status), max. 24V DC @ 0.5 A	
<b>Frequency Output</b>	Open collector, max. full scale flow = 10 kHz	
<b>Communication</b>	Standard ANSI terminal compatible data stream	
<b>Pulse Width</b>	Open collector, 5 ms to 1 second (programmable) or automatic 50% duty cycle	
<b>Min-Max Flow Alarm</b>	Open collector or solid-state relay (programmable 0...100% of flow)	
<b>Empty Pipe Detection</b>	Field tunable for optimum performance based on specific application	
<b>Excitation Frequency</b>	Programmable 3.75 Hz, 7.5 Hz or 15 Hz	
<b>Auxiliary Input</b>	Max. 24V DC (programmable positive zero return, external totalizer reset or preset batch start)	
<b>Power Consumption</b>	20 W	
<b>Noise Dampening</b>	1...30 seconds (programmable)	
<b>Low Flow Cutoff</b>	0...100% of full scale (programmable)	
<b>Zero-Point Stability</b>	Automatic correction	
<b>Galvanic Separation</b>	500V	
<b>Fluid Conductivity</b>	Min. 5 micromhos/cm	
<b>Fluid Temperature</b>	<b>With remote mounted amplifier</b>	PFA & PTFE: – 4...248° F (–20...120° C) @ max. ambient temp. of 122° F (50° C) Hard rubber: 32...178° F (0...80° C) @ max. ambient temp. of 122° F (50° C)
	<b>With meter mounted amplifier</b>	PFA & PTFE: – 4...212° F (–20...100° C) @ max. ambient temp. of 122° F (50° C) Hard rubber: 32...178° F (0...80° C) @ max. ambient temp. of 122° F (50° C)
<b>Ambient Temperature</b>	– 4...122° F (–20...50° C)	
<b>Altitude</b>	Maximum 6500 ft (2000 m)	
<b>Flow Direction</b>	Uni-directional or Bi-directional	
<b>Totalization</b>	3 separate displayable totalizers, 10 digits (programmable forward, reverse and net)	
<b>Units of Measure</b>	U.S. gallons, imperial gallons, million gallons per day, cubic feet, cubic meters, liters, oil barrels, pounds, ounces, acre feet	
<b>LCD Display</b>	4 lines x 16 character alphanumeric, backlight; actively displays 3 totalizer values, flow rate, alarm status, output status, error / diagnostic messages	
<b>Programming</b>	Internal 3-button or external magnetic wand	
<b>Field Wiring Entry Ports</b>	(3) 1/2" NPT, internal thread	
<b>Housing</b>	Amplifier enclosure and remote junction enclosure: cast aluminum (powder-coated paint)	
<b>Housing Rating</b>	Amplifier enclosure and remote junction enclosure, NEMA 4X (IP66)	
<b>Pipe Spool Material</b>	316 stainless steel	
<b>Spool Housing Material</b>	Carbon steel, welded, NEMA 4 (IP66)	
<b>Electrode Materials</b>	Alloy C, 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium	
<b>Liner Material</b>	PFA from 1/4...3/8" (6...10 mm), PTFE from 1/2...12" (15...300 mm), Hard rubber from 1...12" (25...300 mm)	
<b>Flange Material</b>	Carbon steel or 316 stainless steel (ANSI B16.5 Class 150 RF)	
<b>Coil Power</b>	Pulsed DC	
<b>Pressure Limits</b>	Max. 150 psi (10 bar)	
<b>Locations</b>	Indoor and outdoor	
<b>Mounting</b>	Direct detector mount or remote wall mount, bracket included. For remote mount, max. cable distance = 100 ft (30 m)	
<b>Junction Enclosure Material</b>	(For remote mounted amplifier option) cast aluminum (powder coated paint), NEMA 4X (IP66)	
<b>Grounding Electrode Material (optional)</b>	Alloy C, 316 stainless steel, gold/platinum plated, tantalum, or platinum/rhodium	
<b>Grounding Ring Material (optional, 2 required)</b>	316 stainless steel or alloy C	
	<b>Meter Size</b>	<b>Thickness (one ring)</b>
	1/4...10" (6...250 mm)	0.135" (3.43 mm)
10...12" (250...600 mm)	0.187" (4.75 mm)	
<b>Electrical Classification</b>	FM approved for Class I, Div 1 Groups C-D, Class II, Div 1 Groups E, F & G – CSA Certified	
<b>NSF Listed</b>	Models with hard rubber liner, size 4" and larger; PTFE liner, all sizes	

## Control. Manage. Optimize.

M-SERIES is a registered trademark of Badger Meter, Inc. Other trademarks appearing in this document are the property of their respective entities. Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists. © 2015 Badger Meter, Inc. All rights reserved.

[www.badgermeter.com](http://www.badgermeter.com)

The Americas | Badger Meter | 4545 West Brown Deer Rd | PO Box 245036 | Milwaukee, WI 53224-9536 | 800-876-3837 | 414-355-0400  
 México | Badger Meter de las Americas, S.A. de C.V. | Pedro Luis Ogazón N°32 | Esq. Angelina N°24 | Colonia Guadalupe Inn | CP 01050 | México, DF | México | +52-55-5662-0882  
 Europe, Middle East and Africa | Badger Meter Europa GmbH | Nurtinger Str 76 | 72639 Neuffen | Germany | +49-7025-9208-0  
 Europe, Middle East Branch Office | Badger Meter Europe | PO Box 341442 | Dubai Silicon Oasis, Head Quarter Building, Wing C, Office #C209 | Dubai / UAE | +971-4-371 2503  
 Czech Republic | Badger Meter Czech Republic s.r.o. | Mařikova 2082/26 | 621 00 Brno, Czech Republic | +420-5-41420411  
 Slovakia | Badger Meter Slovakia s.r.o. | Racianska 109/B | 831 02 Bratislava, Slovakia | +421-2-44 63 83 01  
 Asia Pacific | Badger Meter | 80 Marine Parade Rd | 21-04 Parkway Parade | Singapore 449269 | +65-63464836  
 China | Badger Meter | 7-1202 | 99 Hangzhong Road | Minhang District | Shanghai | China 201101 | +86-21-5763 5412

Legacy Document Numbers: ITB-140, ITB-142