ModMAG®
M-Series® | B-MAG Electromagnetic Flow Meters

M-Series® M2000

Electromagnetic Flow Meter

DESCRIPTION

The Badger Meter ModMAG® M2000 is the result of years of research and field use of electromagnetic flow meter technology. Based on Faraday's law of induction, these meters can measure water, wastewater, water-based fluids and other liquids that meet minimum electrical conductivity.

Designed, developed and manufactured under strict quality standards, this meter features sophisticated, processor-based signal conversion with accuracies of ±0.20% of rate ±1 mm/s. The wide selection of liner and electrode materials helps ensure maximum compatibility and minimum maintenance over a long operating period.

OPERATION

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.

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. The M2000 amplifier receives the detector's analog signal, amplifies that signal and converts it into digital information. At the processor level, the signal is analyzed through a series of sophisticated software algorithms. After separating the signal from electrical noise, it is converted into both analog and digital signals that are used to display rate of flow and totalization.

With no moving parts in the flow stream, there is no pressure lost. Also, accuracy is not affected by temperature, pressure, viscosity or density and there is practically no maintenance required.

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. M2000 mag meters have an "empty pipe detection" feature. This is accomplished with a third electrode positioned in the meter at twelve o'clock.

If this electrode is not covered by fluid for a minimum five-second duration, the meter will display an "empty pipe detection" condition, send out an error message, if desired, and stop measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

As an option to using grounding rings, a grounding electrode (fourth electrode) can be built into the meter during manufacturing to assure proper grounding. The position of this electrode is at six o'clock.

APPLICATION

The M2000 amplifier can be integrally mounted to the detector or can be remote-mounted, if necessary and has many advantages over other conventional technologies. The meter targets a variety of applications and is well suited for the diverse water and wastewater treatment industry. The M2000 meter can accurately measure fluid flow—whether the fluid is water or a highly corrosive liquid, very viscous, contains a moderate amount of solids, or requires special handling. Today, magnetic meters are successfully used in industries including building automation, oil and gas, food and beverage, pharmaceutical, water and wastewater, and chemical.

FEATURES

- Available in sizes 0.25…78 in. (6…2000 mm)
- Pulsed DC magnetic field for zero point stability
- Integral and remote signal converter availability
- Corrosion resistant liners for long life
- Measurement largely independent of flow profile
- User friendly programming procedure
- Empty pipe detection
- Power loss totalization
- Digital signal processor (32-bit)
- Non-volatile programming memory
- Rotating cover
- Calibrated in state-of-the-art facilities
- NSF listed
- CSA certified

Badger Meter

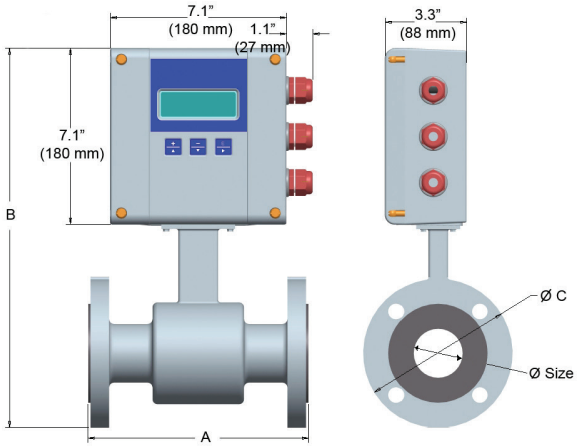
MAG-DS-01047-EN-11 (January 2020)

Product Data Sheet

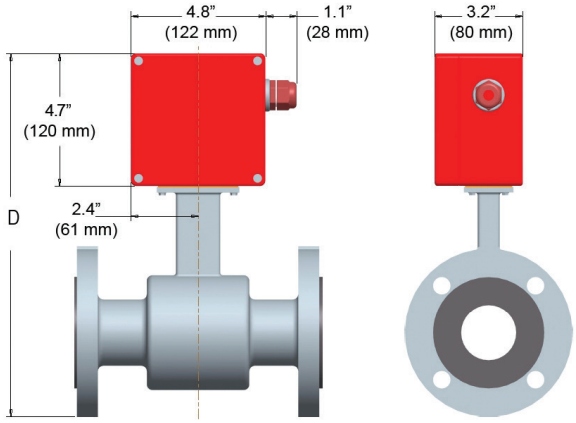
SPECIFICATIONS

Flow Range	0.10…39.4 ft/s (0.03…12 m/s)
Accuracy	± 0.20% of rate ± 1 mm/s
Repeatability	± 0.1%
Power Supply	**AC Power Supply:** 85…265V AC; Typical Power: 20V A or 15W; Maximum Power: 26V A or 20W **Optional DC Power Supply:** 10…36V DC; Typical Power: 10W; Maximum Power: 14W
Analog Output	4…20 mA, 0…20 mA, 0…10 mA, 2…10 mA (programmable and scalable) Voltage sourced 24V DC isolated. Maximum loop resistance < 800 ohms.
Digital Output	Four total, configurable 24V DC sourcing active output (up to 2),100 mA total, 50 mA each; sinking open collector output (up to four), 30V DC max, 100 mA each; AC solid-state relay (up to 2), 48V AC, 500 mA max
Digital Input	Max 30V DC (programmable – positive zero return, external totalizer reset or preset batch start)
Frequency Output	Scalable up to 10 kHz, open collector up to 1 kHz, solid-state relay
Misc Output	High/low flow alarm (0…100% of flow), error alarm, empty pipe alarm, flow direction, preset batch alarm, 24V DC supply, ADE
Communication	RS232 Modbus RTU; RS485 Modbus RTU, HART, Profibus DP require separate daughterboards
Pulse Width	Scalable up to 10 kHz, passive open collector up to 10 kHz, active switched 24V DC. Up to two outputs (forward and reverse). Pulse width programmable from 1…1000 ms or 50% duty cycle.
Processing	32-bit DSP
Empty Pipe Detection	Field tunable for optimum performance based on specific application
Excitation Frequency	1 Hz, 3.75 Hz, 7.5 Hz or 15 Hz (factory optimized to pipe diameter)
Noise Dampening	Programmable 0…30 seconds
Low Flow Cut-Off	Programmable 0…10% of maximum flow
Galvanic Separation	250V
Fluid Conductivity	Minimum 5.0 µS/cm (minimum 20 µS/cm for demineralized water)
Fluid Temperature	**With Remote Amplifier:** PFA, PTFE & Halar 302° F (150° C) **With Meter-Mounted Amplifier:** Rubber 178° F, (80° C), PFA, PTFE & Halar 212° F (100° C)
Ambient Temperature	– 4…140° F (–20…60° C)
Relative Humidity	Up to 90 percent non-condensing
Flow Direction	Unidirectional or bidirectional two separate totalizers (programmable)
Totalization	Programmable/resettable
Units of Measure	Ounce, pound, liter, US gallon, imperial gallon, barrel, hectoliter, mega gallon, cubic meter, cubic feet, acre feet
Display	4 x 20 character display with backlight
Programming	Three-button, external manual or remote
Amplifier Housing	Cast aluminum, powder-coated paint
Detector Housing	**Standard:** Carbon steel welded; **Optional:** 316 or 304 stainless steel
Pipe Spool Material	316 stainless steel
Flanges	**Standard:** ANSI B16.5 Class 150 RF forged carbon steel; **Optional:** 300 lb forged carbon steel, 316 or 304 stainless steel
Pressure Rating	Line sizes up through 24 in: In accordance with ASME B16.5 Class 150 or Flange Rating Class 300 Line sizes greater than 24 in. and through 72 in: AWWA C-207 Class D or Class E Flange Rating
Liner Material	PFA up to 3/8 in., PTFE 1/2…24 in., soft and hard rubber from 1…54 in., Halar® from 14…40 in.
Electrode Materials	**Standard:** Hastelloy C22; **Optional:** 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium
Mounting	Meter mount or remote wall mount (bracket supplied)
Locations	Indoor and outdoor
Meter Enclosure Classification	**Standard:** NEMA 4X (IP66); **Optional:** Submersible NEMA 6P (IP67) or IP68, remote amplifier required
Junction Box Enclosure Protection	For remote amplifier option: powder-coated die-cast aluminum, NEMA 4 (IP66)
Cable Entries	1/2 in. NPT cord grip (3)
Optional Stainless Steel Grounding Rings	**Meter Size** — **Thickness (of one ring)** Up through 10 in. — 0.135 in. 12…78 in. — 0.187 in.
NSF Listed	Models with hard rubber liner, 4 in. size and larger; PTFE liner, all sizes
Token Features	Data Logging (Blue token); Store/Restore (Red token); Firmware Upgrade (Black token)

DIMENSIONS IN INCHES (MILLIMETERS)



Meter with M2000 Amplifier



Meter with Junction Box for Remote M2000 Amplifier

Size		A		B		C		D		Est. Weight with M2000		Flow Range			
												LPM		GPM	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg	min	max	min	max
1/4	6	6.7	170	14.0	356	3.5	89	11.4	288	8	3.5	0.06	20	0.02	5.3
5/16	8	6.7	170	14.0	356	3.5	89	11.4	288	8	3.5	0.10	36	0.03	9.5
3/8	10	6.7	170	14.0	356	3.5	89	11.4	288	8	3.5	0.15	56	0.04	14.9
1/2	15	6.7	170	14.0	356	3.5	89	11.4	288	10	4.5	0.32	127	0.09	33
3/4	20	6.7	170	14.2	361	3.9	99	11.5	293	10	4.5	0.57	226	0.15	59
1	25	8.9	225	14.4	366	4.3	108	11.7	298	11	5	0.89	353	0.24	93
1-1/4	32	8.9	225	15.2	386	4.6	117	12.5	318	13	6	1.5	579	0.04	152
1-1/2	40	8.9	225	15.4	390	5.0	127	12.7	322	15.5	7	2.3	904	0.06	238
2	50	8.9	225	15.9	403	6.0	152	13.2	335	19	8.5	3.6	1413	1.0	373
2-1/2	65	11.0	280	17.1	434	7.0	178	14.4	366	27.5	12.5	6.0	2389	1.6	630
3	80	11.0	280	17.3	440	7.5	191	14.7	372	31	14	9.1	3619	2.4	955
4	100	11.0	280	18.4	466	9.0	229	15.7	398	42	19	15	5654	3.8	1492
5	125	15.8	400	19.6	498	10.0	254	16.9	430	53	24	23	8835	5.9	2332
6	150	15.8	400	20.6	524	11.0	279	17.9	456	60.5	27.5	32	12,723	8.4	3358
8	200	15.8	400	22.5	572	13.5	343	20.4	518	87	39.5	57	22,619	15.0	5971
10	250	19.7	500	26.8	681	16.0	406	24.1	613	129	58.5	89	35,342	23.4	9330
12	300	19.7	500	28.9	734	19.0	483	26.2	666	204	92.5	128	50,893	33.6	13,435
14	350	19.7	500	30.8	782	21.0	533	28.2	716	262	119	174	69,272	45.8	18,287
16	400	23.6	600	33.7	856	23.5	597	31.0	788	344	156	227	90,477	59.8	23,886
18	450	23.6	600	35.0	890	25.0	635	32.4	822	397	180	287	114,510	75.6	30,230
20	500	23.6	600	38.2	969	27.5	699	35.5	901	470	213	354	141,371	93.4	37,322
22	550	23.6	600	39.6	1005	29.5	749	36.9	937	549	249	428	171,059	112.9	45,159
24	600	23.6	600	42.2	1071	32.0	813	39.5	1003	617	280	509	203,575	134.4	53,743
28	700	23.6	600	46.2	1173	36.5	927	44.0	1118	930	422	693	277,088	182.9	73,151
30	750	31.5	800	48.3	1228	39.0	984	45.7	1161	1171	531	796	318,085	210.0	83,974
32	800	31.5	800	52.2	1325	41.4	1015	49.5	1257	1378	625	905	361,911	238.9	95,544
36	900	31.5	800	55.3	1405	46.0	1168	54.1	1374	1788	811	1146	458,043	302.4	120,923
40	1000	31.5	800	60.0	1525	50.2	1230	57.4	1457	2112	958	1414	565,486	373.3	149,288
42	1050	39.4	1000	66.0	1675	53.0	1346	63.4	1610	2339	1061	1559	623,448	411.5	164,590
48	1200	39.4	1000	69.9	1775	59.4	1455	67.2	1707	3219	1460	2036	814,300	537.5	214,975
54	1350	39.4	1000	75.4	1915	66.2	1681	73.0	1927	4101	1860	2577	1,030,598	680.2	272,078

For larger sizes, contact the factory.

IMPORTANT

Flange Sizes ≤ 24 in., Standard: ANSI B16.5 Class 150 RF forged carbon steel; Optional: 300 lb forged carbon steel, 316 or 304 stainless steel
Flange Sizes > 24", Standard: AWWA Class D Flanges RF forged carbon steel

Control. Manage. Optimize.

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