QM-Series® M4000

Electromagnetic Flow Meter

DESCRIPTION

The innovative design of the QSP+DJM ModMAG® QM4000 meter represents the next generation of electromagnetic flow meter technology. Incorporating the latest developments in micro processing signal conditioning, the advanced design of the QM4000 meter allows an accuracy of ± 0.20% with a flow range of 300:1. Targeted to a variety of oil and gas, industrial and municipal applications, the MQ4000 meter 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.

QM4000 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 QM4000 meter 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 QM4000 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 ± 0.20%
- 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

Product Data Sheet

DIMENSIONS

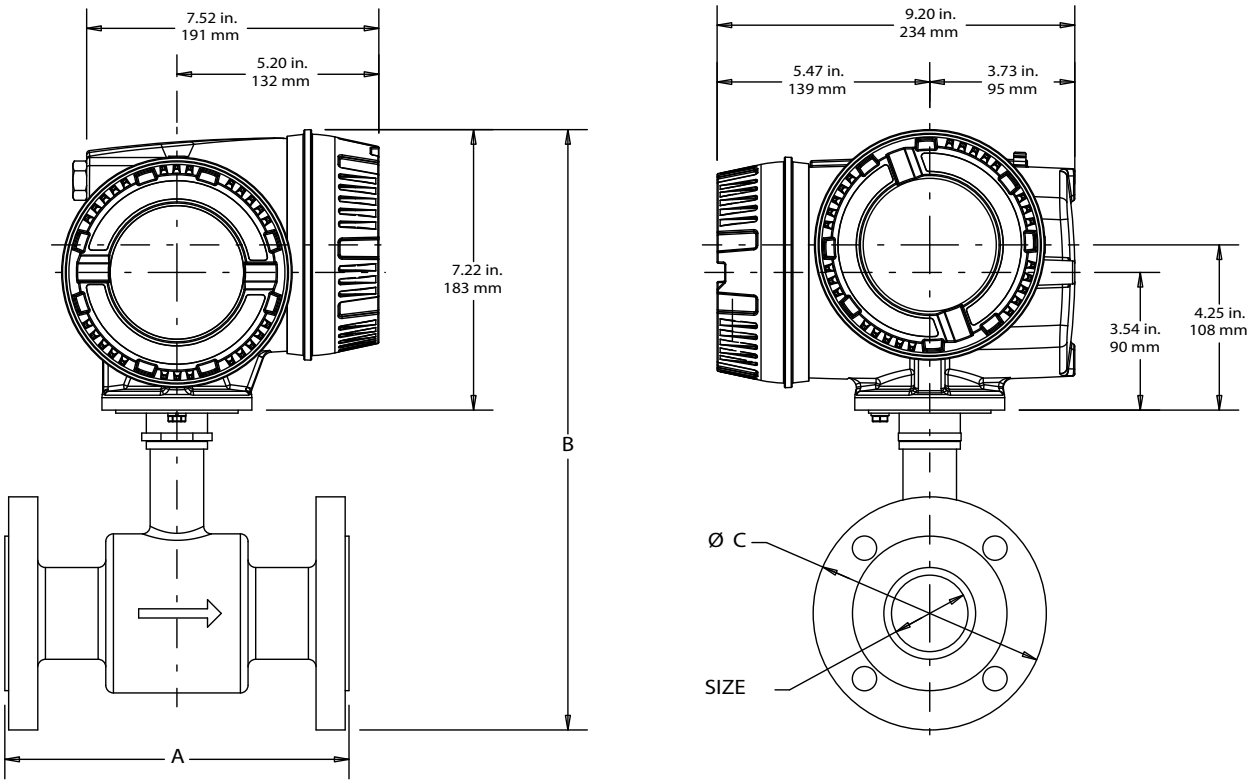

Figure 1: QM4000 meter mount amplifier on detector

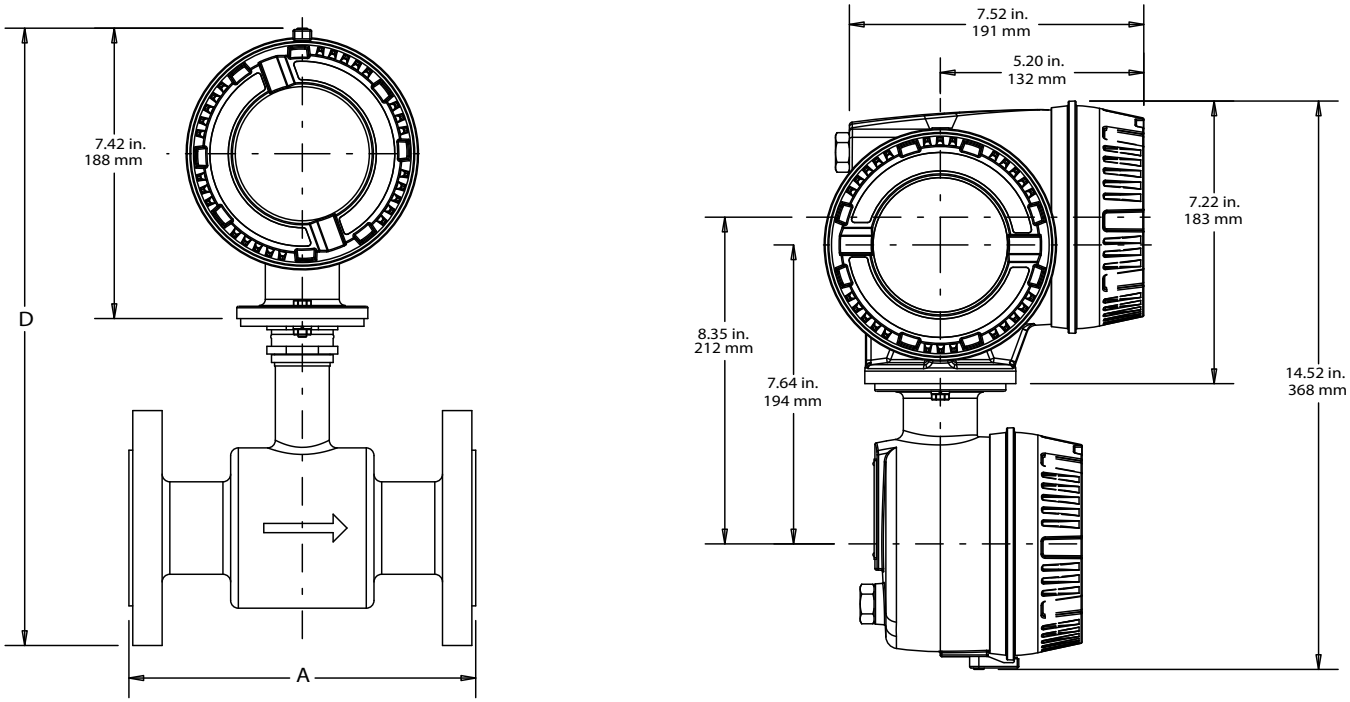

Figure 2: QM4000 remote mount junction box on detector

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

Sizes	1/4…12 in. (6…300 mm)	
Flow Range	0.1…39.4 ft/s (0.03…12 m/s)	
Accuracy	± 0.20% of rate ± 1 mm/s	
Repeatability	0.1% of rate	
Power Supply	85…240V AC, 45…65 Hz; 24V DC	
Analog Outputs	0…10 mA, 0…20 mA, 4…20 mA (programmable and scalable), Voltage sourced (18V DC) – isolated, max. loop resistance = 750 Ω	
Digital Outputs	(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	
Frequency Output	Open collector, max. full scale flow = 10 kHz	
Communication	RS232C serial, standard ANSI terminal compatible data stream	
Pulse Width	Open collector, 5 ms to 1 second (programmable) or automatic 50% duty cycle	
Min-Max Flow Alarm	Open collector or solid-state relay (programmable 0…100% of flow)	
Empty Pipe Detection	Field tunable for optimum performance based on specific application	
Excitation Frequency	Programmable 3.75 Hz, 7.5 Hz or 15 Hz	
Auxiliary Input	Max. 24V DC (programmable positive zero return, external totalizer reset or preset batch start)	
Power Consumption	20 W	
Noise Dampening	1…30 seconds (programmable)	
Low Flow Cutoff	0…100% of full scale (programmable)	
Zero-Point Stability	Automatic correction	
Galvanic Separation	500V	
Fluid Conductivity	Min. 5 µS/cm (Min. 20 µS/cm for demineralized water)	
Fluid Temperature	**With remote mounted amplifier**	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)
	With meter mounted amplifier	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)
Ambient Temperature	– 4…122° F (–20…50°C)	
Altitude	Maximum 6500 ft (2000 m)	
Flow Direction	Uni-directional or Bi-directional	
Totalization	3 separate displayable totalizers, 10 digits (programmable forward, reverse and net)	
Units of Measure	U.S. gallons, imperial gallons, million gallons per day, cubic feet, cubic meters, liters, oil barrels, pounds, ounces, acre feet	
LCD Display	4 lines x 16 character alphanumeric, backlight; actively displays 3 totalizer values, flow rate, alarm status, output status, error / diagnostic messages	
Programming	Internal 3-button or external magnetic wand	
Field Wiring Entry Ports	(3) 1/2 in. NPT, internal thread	
Housing	Amplifier enclosure and remote junction enclosure: cast aluminum (powder-coated paint)	
Housing Rating	Amplifier enclosure and remote junction enclosure, NEMA 4X (IP66)	
Pipe Spool Material	304 stainless steel	
Spool Housing Material	Carbon steel, welded, NEMA 4 (IP66)	
Electrode Materials	Alloy C (standard), 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium	
Liner Material	PFA from 1/4…3/8 in. (6…10 mm), PTFE from 1/2…12 in. (15…300 mm), Hard rubber from 1…12 in. (25…300 mm)	
Flange Material	Carbon steel or 316 stainless steel; In Accordance with ANSI/ASME, B16.5 Class 150 Flange Rating	
Coil Power	Pulsed DC	
Pressure Limits	In Accordance with ANSI/ASME, B16.5 Class 150 Flange Rating	
Locations	Indoor and outdoor	
Mounting	Direct detector mount or remote wall mount, bracket included. For remote mount, max. cable distance = 100 ft (30 m)	
Junction Enclosure Material	(For remote mounted amplifier option) cast aluminum (powder coated paint), NEMA 4X (IP66)	
Grounding Electrode Material (optional)	Alloy C, 316 stainless steel, gold/platinum plated, tantalum, or platinum/rhodium	
Grounding Ring Material (optional, 2 required)	316 stainless steel (standard) or alloy C	
	Meter Size	**Thickness (one ring)**
	1/4…10 in. (6 …250 mm)	0.135 in. (3.43 mm)
	10…12 in. (250…600 mm)	0.187 in. (4.75 mm)
Electrical Classification	FM approved for Class I, Div 1 Groups C-D, Class II, Div 1 Groups E, F & G – CSA Certified	
NSF Listed	Models with hard rubber liner, size 4 in. and larger; PTFE liner, all sizes	

PART NUMBER CONSTRUCTION

M4000 for hazardous class 1, division 1 environments

M4	-		-			-		-			-		-	XX		

M4000	Meter Type	Detector					Electrodes & Grounding	Amplifier	Remote Cable Length	Communications/ Outputs	Wiring Method	Unit of Measure Totalizer/ Flow Rate	Testing & Tagging
		HARD RUBBER C-Steel 150# flanges	HARD RUBBER Stainless Steel 150# flanges	PTFE C-Steel 150# flanges	PTFE Stainless Steel 150# flanges	PFA Stainless Steel 150# Flanges							
Meter Type- Standard LL		**R1**	**R4**	**P1**	**P4**	**PA**							
1/4"	002	N/A	N/A	N/A	N/A	—							
5/16"	003	N/A	N/A	N/A	N/A	—							
3/8"	004	N/A	N/A	N/A	N/A	—							
1/2"	005	N/A	N/A	—	—	N/A							
3/4"	007	N/A	N/A	—	—	N/A							
1"	010	—	—	—	—	N/A							
1-1/4"	012	—	—	—	—	N/A							
1-1/2"	015	—	—	—	—	N/A							
2"	020	—	—	—	—	N/A							
2-1/2"	025	—	—	—	—	N/A							
3"	030	—	—	—	—	N/A							
4"	040	—	—	—	—	N/A							
5"	050	—	—	—	—	N/A							
6"	060	—	—	—	—	N/A							
8"	080	—	—	—	—	N/A							
10"	100	—	—	—	—	N/A							
12"	120	—	—	—	—	N/A							
Electrodes & Grounding													
Alloy C with 316 Stainless Steel Grounding Rings							A						
Stainless Steel with 316 Stainless Steel Grounding Rings							S						
Platinum Plated with 316 Stainless Steel Grounding Rings							P						
Tantalum with 316 Stainless Steel Grounding Rings							T						
Platinum/Rhodium with 316 Stainless Steel Grounding Rings							R						
Alloy C Electrode and Grounding Electrode							C						
Stainless Steel Electrode and Grounding Electrode							D						
Platinum Plated Electrode and Grounding Electrode							G						
Tantalum Electrode and Grounding Electrode							L						
Platinum/Rhodium Electrode and Grounding Electrode							H						
Amplifier Type													
110/220V AC; Meter Mounted								M					
110/220V AC; Remote Mounted								R					
24V DC; Meter Mounted								E					
24V DC; Remote Mounted								F					
Remote Cable Length													
None									WW				
5 ft. Standard Cable									AA				
10 ft. Standard Cable									AB				
15 ft. Standard Cable									AC				
30 ft. Standard Cable									AF				
50 ft. Standard Cable									AK				
75 ft. Standard Cable									AR				
100 ft. Standard Cable									BW				
Communications/Outputs													
Standard Output										S			
Wiring Method													
None											XX		
Unit of Measure Totalizer/ Flow Rate													
Gallons/gallons per minute												G	
Gallons/cubic feet per minute												B	
Gallons/cubic meters per second												D	
Cubic Meters/gallons per minute												C	
Cubic Meters/cubic meters per second												E	
Cubic Meters/cubic meters per minute												T	
Cubic Meters/cubic meters per hour												H	
Cubic Feet/gallons per minute												F	
Cubic Feet/cubic feet per minute												J	
Cubic Feet/cubic meters per hour												K	
Liters/gallons per minute												L	
Liters/liters per second												N	
Liters/liters per minute												P	
Liters/liters per hour												Q	
Million Gallons/gallons per minute												M	
Gallons/millions gallons per day												R	
Barrels/Barrels per day												U	
Acre Feet/gallons per minute												A	
Second-Foot Day/cubic feet per second												S	
Custom Units												Z	
Testing & Tagging													
Factory Calibrated													F
3rd Party Calibrated													3
Factory Calibrated/Stainless Steel Tag													S
3rd Party Calibrated w/ Stainless Steel Tag													T