

# LIQUID CONTROLS



## Series M and MA Positive Displacement Flow Meters



Liquid Controls M and MA Series rotary motion positive displacement (PD) meters offer the ultimate in measurement accuracy for custody transfer of petroleum products, aviation fuels, LPG, and a broad range of industrial liquids. LC meters incorporate a unique design, presenting minimal intrusion in a flowing stream of liquid, as well as minimal pressure drop through the meter.

The LC meter consists of a housing in which three synchronized rotors turn with no metal-to-metal contact. Hydraulic sealing is accomplished by a stationary boundary layer of liquid, not by the wiping action of mechanical parts.

### Superior performance features

- **Low pressure drop**—will operate on gravity flow or pump pressure.
- **Wide temperature range**—products can be metered accurately from  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) to  $160^{\circ}\text{F}$  ( $71^{\circ}\text{C}$ ).
- **Sustained accuracy**—no wear from metal-to-metal contact inside the measuring chamber means minimal deterioration in accuracy over time, fewer recalibrations, and longer service life. Meters conform to NIST and International Weights and Measures accuracy requirements.
- **Wide viscosity range**—LC meters can accurately meter products from less than 30 SSU (less than 1 centipoise) to 1,500,000 SSU (325,000 centipoise).
- **Maximum adaptability**—right angle design with choice of stock or custom elbows/fittings provides unequaled mounting flexibility to meet your installation requirements.



### Industries served

LC series M and MA meters are well-suited for use in industries requiring precise flow measurement and reliable, extended service life:

- Refined petroleum products
- Aviation fuels
- LPG
- Agricultural chemicals
- Paints and coatings
- Foods and beverages
- Petrochemicals
- Pharmaceuticals
- Cosmetics
- Printing Inks
- Textiles



*Liquid Controls' unique measuring chamber with no metal-to-metal contact minimizes wear and ensures precise and consistent measurements over a long service life.*

# Performance Specifications

Liquid Controls positive displacement meters are engineered to provide accurate performance and a long, trouble-free service life requiring minimal maintenance with few replacement parts. The unique cast-case construction of the M and MA Series meters results in low pressure drop for most liquids, delivering superior performance and minimal demand on system pumps. The exclusive LC metering element eliminates inaccuracies due to clearance changes, minimizes loads on bearings, eliminates axial thrust and performs with equal accuracy for forward or reverse flow. M and MA Series meters' compact design and multiple inlet/outlet flange configurations provide unmatched mounting versatility.

LC meters meet NTEP (NIST Handbook 44) and International Weights and Measures accuracy requirements as well as U.S. Military specifications. MA Series meters are UL listed for metering liquid propane gas (LPG).

## Accuracy/Performance<sup>a</sup>

### Repeatability

Capable of 0.02% or better at any flow rate over entire range

### Linearity

- Over 5:1 range  
Mech. registration: capable of  $\pm 0.125\%$  or better from max. nom. flow rate  
Elect. registration: capable of  $\pm 0.10\%$  or better from max. nom. flow rate
- Over 10:1 range  
Mech. registration: capable of  $\pm 0.22\%$  or better from max. nom. flow rate  
Elect. registration: capable of  $\pm 0.10\%$  or better from max. nom. flow rate
- Over 40:1 range  
Mech. registration: capable of  $\pm 0.5\%$  or better from max. nom. flow rate  
Elect. registration: capable of  $\pm 0.15\%$  or better from max. nom. flow rate

### Temperature range

-40° F to 160° F (-40° C to 71° C)

<sup>a</sup> Stated accuracy obtainable when all variables remain constant. Reading/measurements reflect a minimum of one minute of flow at selected rate(s). All accuracy statements based on metering safety solvent (aliphatic hydrocarbon), approximate viscosity 1 CPS. On higher viscosity products, the average deviation in accuracy will be less.

## Construction

### Meter housing and rotors

Cast aluminum, cast-iron (available for M-7 and M-30), or stainless steel (available for M-5 and M-7)

### Internal components

Aluminum, Ni-Resist, stainless steel

### Seal materials

UL recognized component: Buna-N, Viton®, PTFE

### Bearings

Carbon, PTFE®, Ni-Resist

Viton® is a registered trademarks of DuPont Corporation.

Victaulic® is a registered trademark of Victaulic Company.

Model	Flange size	Max. nom. flow rate	Working pressure	Net weight <sup>b</sup>
M-5®	1½" or 2"	60 GPM 227 L/min	150 PSI 10.5 BAR	14 lbs 6.4 kg
M-7®	1½" or 2"	100 GPM 380 L/min	150 PSI 10.5 BAR	19 lbs 8.6 kg
M-10®	2"	150 GPM 550 L/min	150 PSI 10.5 BAR	19 lbs 8.6 kg
M-15®	3" or 3" in, 2" out	200 GPM 760 L/min	150 PSI 10.5 BAR	37 lbs 16.8 kg
M-25®	3"	300 GPM 1100 L/min	150 PSI 10.5 BAR	37 lbs 16.8 kg
M-30®	3" or 4"	350 GPM 1325 L/min	150 PSI 10.5 BAR	120 lbs 54.4 kg
M-40®	4"	450 GPM 1700 L/min	150 PSI 10.5 BAR	120 lbs 54.4 kg
M-60®	4" or 6"	600 GPM 2270 L/min	275 PSI 19 BAR	201 lbs 91.2 kg
M-80®	4" or 6"	800 GPM <sup>c</sup> 3228 L/min	275 PSI 19 BAR	201 lbs 91.2 kg
MA-5®	1½" or 2"	60 GPM 227 L/min	350 PSI 25 BAR	14 lbs 6.4 kg
MA-7®	1½" or 2"	100 GPM 380 L/min	350 PSI 25 BAR	19 lbs 8.6 kg
MA-15®	3" or 3" in, 2" out	200 GPM 760 L/min	350 PSI 25 BAR	37 lbs 16.8 kg

<sup>b</sup> Meter only (aluminum body). Consult factory for weights of cast iron or stainless steel body meters.

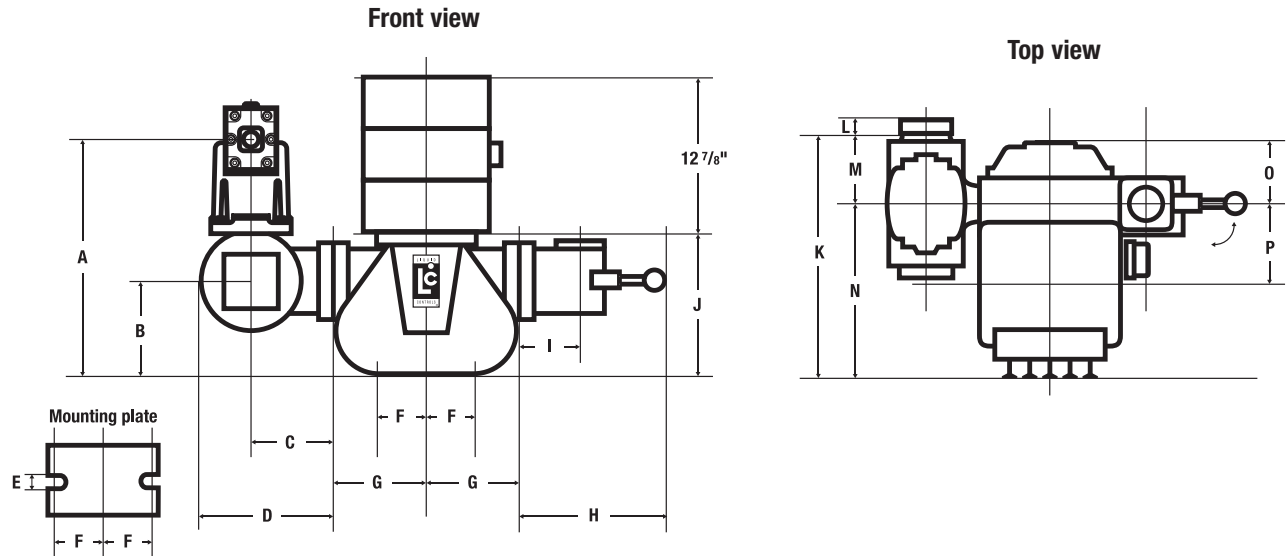
<sup>c</sup> M-80 meter capable of momentary overload operation at 125% of maximum rated capacity in either direction without damage to mechanism (applies to Class 2 meters only, on jet fuel only). 125% overload operation (1,000 GPM) requires 6" ANSI or 6" Victaulic® connections.

<sup>d</sup> M-60, M-80 "G" and "B" dimensions vary depending upon flange type.

M-5®, M-7®, et al. are registered trademarks of Liquid Controls, A Unit of IDEX Corporation.

## Dimensions: flow meters with mechanical registration

Note: Dimensions shown are not for construction use. Consult factory when certified engineering prints are required.



Dimensions	A <sup>e</sup>	B	C <sup>f</sup>	D <sup>g</sup>	E	F	G	H	I	J	K	L	M	N	O	P
in	14.2	5.3	4.1	6.8	.56	1.9	4.9	11.7	2.5	8.6	15.3	0.9	4.7	16.8	3.2	4.6
mm	360	135	105	172	14	48	125	297	64	219	387	24	119	428	81	116
in	14.3	5.4	4.1	6.8	.56	2.8	4.2	11.7	2.5	9.5	16.3	0.9	4.7	16.5	4.2	5.6
mm	362	137	105	171	14	71	106	297	64	241	413	24	119	421	106	141
in	14.3	5.4	4.1	6.8	.56	2.8	4.2	11.7	2.5	9.5	16.3	0.9	4.7	16.5	4.2	5.6
mm	362	137	105	171	14	71	106	297	64	241	413	24	119	421	106	141
in	17	7.5	5	7.7	.69	3.8	5.5	12.6	5.1	10.8	17.5	1.3	5	16.9	5.1	6.5
mm	432	191	127	195	17	95	140	321	129	273	445	32	127	430	129	165
in	17	7.5	5	7.7	.69	3.8	5.5	12.6	5.1	10.8	17.5	1.3	5	16.9	5.1	6.5
mm	432	191	127	195	17	95	140	321	129	273	445	32	127	430	129	165
in	20.5	10.6	5.6	9.1	.87	4.8	7.9	15.9	6.2	13.8	20.9	1.4	7.1	19	6.6	7.7
mm	521	270	143	230	22	122	200	405	157	351	530	36	181	482	167	195
in	20.5	10.6	5.6	9.1	.87	4.8	7.9	15.9	6.2	13.8	20.9	1.4	7.1	19	6.6	7.7
mm	521	270	143	230	22	122	200	405	157	351	530	36	181	482	167	195
in	25.4	15.5 <sup>d</sup>	5.6	9.1	1/2"-13 thd	1.5	13.3 <sup>d</sup>	15.9	6.2	19.6	22.6	1.4	7.1	23	8.4	9.5
mm	645	394 <sup>d</sup>	143	230	1/2"-13 thd	38	337 <sup>d</sup>	405	157	498	575	36	181	583	213	241
in	n/a	16.6 <sup>d</sup>	n/a	n/a	1/2"-13 thd	1.5	14.3 <sup>d</sup>	n/a	n/a	19.6	n/a	n/a	n/a	18.8	8.4	9.5
mm	n/a	421 <sup>d</sup>	n/a	n/a	1/2"-13 thd	38	362 <sup>d</sup>	n/a	n/a	498	n/a	n/a	n/a	479	213	241
in	14.2	5.3	4.1	6.8	.56	1.9	4.9	7.4	4.1	8.6	25.8	0.9	4.7	12.6	3.2	4.6
mm	360	135	105	172	14	48	125	189	105	219	657	24	119	320	81	116
in	14.3	5.4	4.1	6.8	.56	2.8	4.2	7.4	4.1	9.5	27.7	0.9	4.7	13.5	4.2	5.6
mm	362	137	105	171	14	71	106	189	105	241	705	24	119	343	106	141
in	17	7.5	5	7.7	.69	3.8	5.5	7.4	6.8	10.8	15.6	1.3	5	14.4	5.1	6.6
mm	432	191	127	195	17	95	140	189	174	273	395	32	127	366	129	167

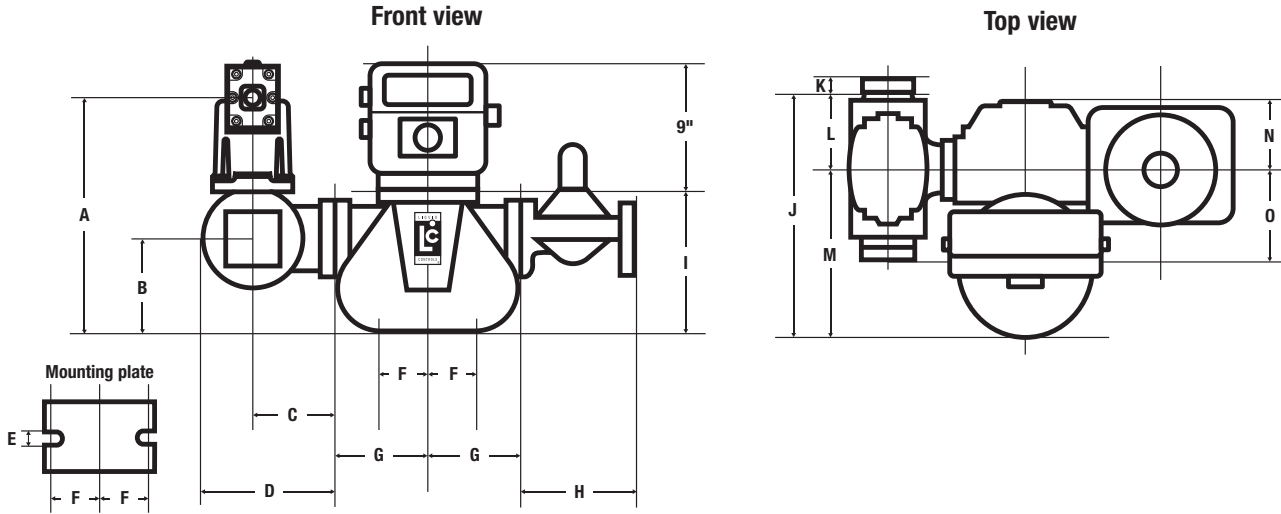
<sup>e</sup> Dimension "A" for 2" high capacity strainer is  
Dimension "A" for 3" high capacity strainer is

<sup>f</sup> Dimension "C" for 2" high capacity strainer is 7.1".  
Dimension "C" for 3" high capacity strainer is 8".

<sup>g</sup> Dimension "D" for 2" high capacity strainer is 11.7".  
Dimension "D" for 3" high capacity strainer is 12.6".

## Dimensions: flow meters with electronic registration

Note: Dimensions shown are not for construction use. Consult factory when certified engineering prints are required.



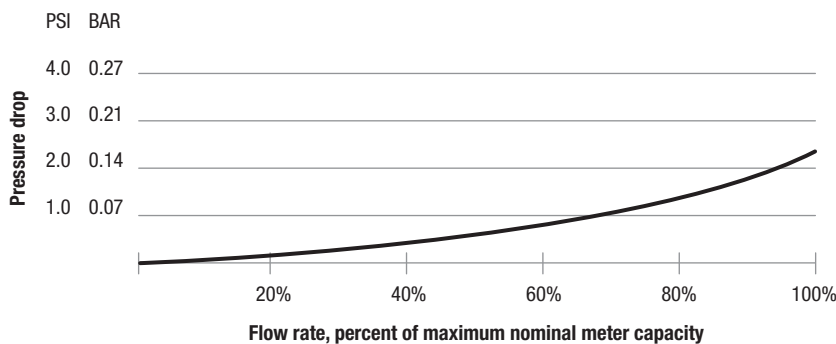
A <sup>ø</sup>	B	C <sup>f</sup>	D <sup>ø</sup>	E	F	G	H	I	J	K	L	M	N	O
14.2 360	5.3 135	4.1 105	6.8 172	.56 14	1.9 48	4.9 125	8.3 213	8.6 219	13.9 352	0.9 24	4.7 119	9.2 233	3.2 81	4.6 116
14.3 362	5.4 137	4.1 105	6.8 171	.56 14	2.8 71	4.2 106	8.3 213	9.5 241	14.9 378	0.9 24	4.7 119	10.2 259	4.2 106	5.6 141
14.3 362	5.4 137	4.1 105	6.8 171	.56 14	2.8 71	4.2 106	8.3 213	9.5 241	14.9 378	0.9 24	4.7 119	10.2 259	4.2 106	5.6 141
17 432	7.5 191	5 127	7.7 195	.69 17	3.8 95	5.5 140	11.5 291	10.8 273	16.1 410	1.3 32	5 127	11.1 283	5.1 129	6.5 165
17 432	7.5 191	5 127	7.7 195	.69 17	3.8 95	5.5 140	n/a n/a	10.8 273	16.1 410	1.3 32	5 127	11.1 283	5.1 129	6.5 165
20.5 521	10.6 270	5.6 143	9.1 230	.87 22	4.8 122	7.9 200	n/a n/a	13.8 351	19.4 494	1.4 36	7.1 181	12.3 313	6.6 167	7.7 195
20.5 521	10.6 270	5.6 143	9.1 230	.87 22	4.8 122	7.9 200	n/a n/a	13.8 351	19.4 494	1.4 36	7.1 181	12.3 313	6.6 167	7.7 195
25.4 645	16.6 <sup>d</sup> 421 <sup>d</sup>	5.6 143	9.1 230	1/2"-13 thd 1/2"-13 thd	1.5 38	13.3 <sup>d</sup> 337 <sup>d</sup>	n/a n/a	19.6 498	21.3 540	1.4 36	7.1 181	14.2 359	8.4 213	9.5 241
25 645	16.6 <sup>d</sup> 421 <sup>d</sup>	5.6 143	9.1 230	1/2"-13 thd 1/2"-13 thd	1.5 38	14.3 <sup>d</sup> 362 <sup>d</sup>	n/a n/a	20 498	21 540	1.4 36	7 181	14 359	8 213	10 241
14.2 360	5.3 135	4.1 105	6.8 172	.56 14	1.9 48	4.9 125	8.3 213	8.6 219	16.4 418	0.9 24	4.7 119	11.7 297	3.2 81	4.6 116
14.3 362	5.4 137	4.1 105	6.8 171	.56 14	2.8 71	4.2 106	8.4 213	9.5 241	17.4 443	0.9 24	4.7 119	12.6 320	4.2 106	5.6 141
17 432	7.5 191	5 127	7.7 195	.69 17	3.8 95	5.5 140	8.7 221	10.8 273	16.2 411	1.3 32	5 127	13.5 343	5.1 129	6.6 167

## Relationship of meter pressure drop to flow rate and viscosity

With Liquid Controls' unique design, the bearing surfaces of the meter element are internally and externally subjected to the same system pressure. Due to the low pressure drop inherent to the LC meter, it is often possible to satisfactorily meter higher viscosity products through a smaller LC meter than its competitive equivalent.

Pressure drop through a meter depends on product temperature, viscosity and flow rate. When metering a liquid, the pressure drop will increase as viscosity increases. Illustrated below is the pressure loss vs. flow rate curve for an M-60 meter at 600 GPM on safety solvent. (For additional pressure loss data, consult factory.)

### Average meter pressure drop vs. flow rate (M-60 at 600 GPM)<sup>h</sup>



<sup>h</sup> Based on metering safety solvent, approximate viscosity 30 SSU (1 centipoise). When meter is operated at 100% capacity, the average pressure drop on safety solvent at 30 SSU (1 centipoise) will be approximately 2.3 PSI. When operated at 50% capacity, average pressure drop will be approximately 0.6 PSI (0.04 BAR).

## Construction/application classes

LC PD meters are suitable for metering a broad range of products as listed below. The appropriate meter class can be used to specify a desired meter by using the table on the back page of this publication.

Class	Description	Bearing Material
1	Refined petroleum products	Ni-Resist <sup>i</sup>
2	Aviation and jet fuel	Ni-Resist <sup>i</sup>
3	Variety of products includes: liquid sugars, sweeteners, syrups, vegetable oils	Ni-Resist
4	Treated waters and solvents where no red metals are allowed	Carbon
7	Chlorinated solvents	Carbon
8	Acid pH liquids includes: nitric, phosphoric, glacial acetic acids, citric juices, vinegar	Carbon <sup>j</sup>
10	Liquid propane gas	Carbon
14	Crude oil	Ni-Resist
15	Oil- or water-based latex products, polyester resins, adhesives, herbicides, nitrogen fertilizers	PTFE
16	General solvents	Carbon
20	Batch process water meter service	Carbon
27	Alkaline pH liquids: latex products, adhesives, liquid fertilizers	PTFE
30	Herbicides	Carbon
37	Sodium hydroxide solutions, high sulfur crude oil, alkaline pH liquids	Ni-Resist
47	Mildly abrasive liquids	Ceramic <sup>k</sup>

<sup>i</sup> Carbon bearings are standard on some meter sizes of this class. Consult factory.

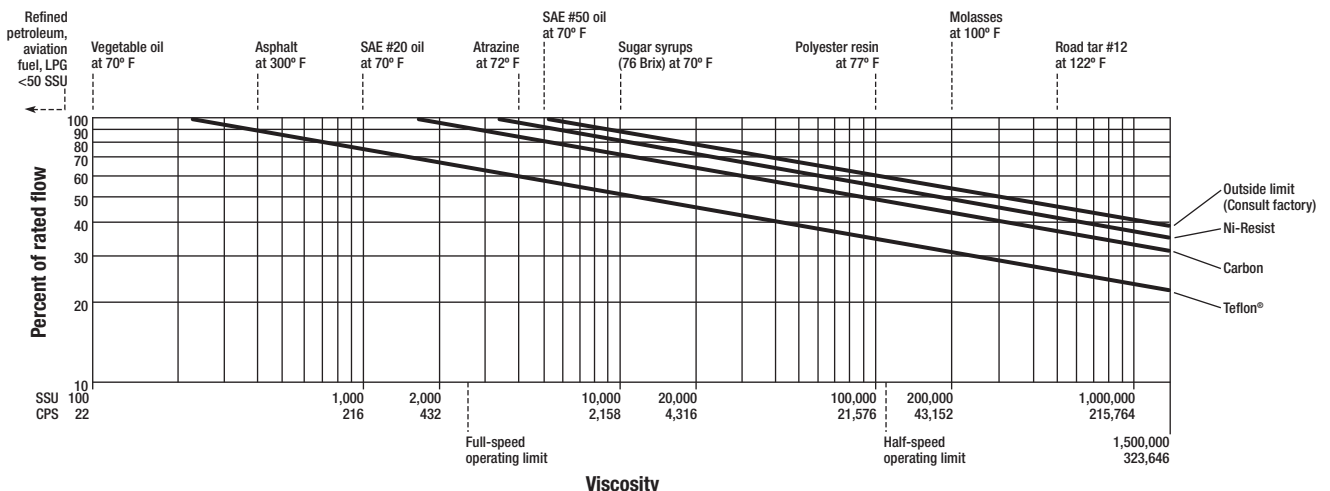
<sup>j</sup> PTFE bearings optional on some meter sizes. Consult factory.

<sup>k</sup> Consult factory.

## Meter flow rate limit (percent of rated flow vs. viscosity)

Use the chart below to determine maximum meter flow rate relative to meter bearing material and product viscosity: (1) determine the percent of rated capacity at which the meter will be required to operate; (2) determine product viscosity at system operating temperature; (3) plot the point on the chart where the two lines intersect; (4) determine the meter bearing material from construction/application table above and locate the corresponding slope on the chart.

If the plotted point is above the bearing material slope, you are outside the allowable pressure loss for the specified meter and bearing. You should either chose a larger meter, reduce flow rate or consider alternative bearing materials.



## Purchase specifications

To make certain you receive a meter with the many installation, operating and maintenance advantages of a Liquid Controls product, please include the following statement in your engineering and purchase specifications.

"Meter shall be of the positive displacement design having rotary motion without axial thrust or flow impingement. No eccentric, sliding, reciprocating or oscillating parts to induce excess liquid shear or liquid compressibility within meter element. Rotary parts to be horizontally supported on both sides by solid support bearings and rotor journals of materials compatible with product to be metered. No ball bearings, springs or cams. Rotary drive and meter adjustment output to all readout devices shall be non-cyclic without pulsation and capable of meter accuracy adjustment of 0.02% or better. Meter calibration adjustment device must be externally accessible, not requiring removal of any readout equipment for calibration or replacement. Meter measuring element shall have a minimum braking torque and shall immediately respond to product low flow movement."

## Ordering information (please refer to chart at right for LC model naming system)

Model: \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ Description: \_\_\_\_\_

Flow rates: Max. \_\_\_\_\_ Normal \_\_\_\_\_ Min. \_\_\_\_\_

Operating temperatures: Max. \_\_\_\_\_ Normal \_\_\_\_\_ Min. \_\_\_\_\_

Maximum non-shock operating pressure: \_\_\_\_\_

Maximum viscosity: \_\_\_\_\_ @ \_\_\_\_\_ (Temp°/F or C)

Specific gravity: \_\_\_\_\_ @ \_\_\_\_\_ (Temp°/F or C)

Construction class: (1, 2, etc.) \_\_\_\_\_ Seal material:  Standard Buna/Viton  All Viton  All PTFE

Direction of flow:  L to R  R to L Read out:  Gallons  Liters  Pounds  Other \_\_\_\_\_

Mechanical counter and printer:  Zero/Face up  Zero/Face down  Accumulative

Strainer basket:  40M  80M  100M  Other \_\_\_\_\_

Flange size: \_\_\_\_\_ Flange type:  NPT  BSPT  Slip weld  ANSI  DIN  Other \_\_\_\_\_

Options: \_\_\_\_\_

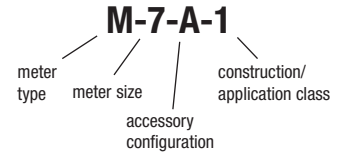
## Mounting arrangements

LC meters may be mounted in a variety of configurations, as shown below. Do not mount with cover plate face down or up. Note: regardless of meter mounting configurations, accessories such as the air/vapor eliminator must always be mounted in a vertical orientation to permit proper operation of the float-actuated apparatus.



\* ONLY AVAILABLE ON DIRECT MOUNT PULSER MODELS OR MODELS LESS RESET COUNTER.

## Product model numbering system:



## -Standard accessory configurations (A, C, I, K): M-7 meter shown

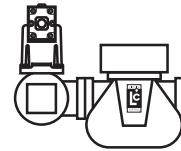
### M/MA-7-A

A = Meter with counter



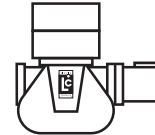
### M/MA-7-C

C = Meter with counter, strainer and air eliminator



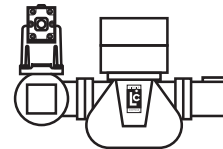
### M/MA-7-I

I = Meter with counter, preset counter and preset valve



### M/MA-7-K

K = Meter with counter, preset counter, preset valve, strainer and air eliminator



**Backed by our world-wide reputation for quality, accuracy and advanced design.**



## LIQUID CONTROLS

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 Pub. MS100-00 (7/13)

