Flow meters, Flow switches and Flow transmitters
A Medium Vane-Style
For Liquids

DESCRIPTION
These are variable area meters with a spring biased semi-circular vane that opens wider with more flow. They are installed in-line in any position. Straight pipe runs before or after the meter are not required. The simple mechanical connection directly drives pointers, switches and transmitters.

READOUTS
The flowmeter has outputs both visual and electronic. Visual displays are either pointer (with inscribed scale) or numeric (digital LCD). Electronic outputs can be mechanical switch closure, 4-20 mA analog, HART or some combination of switches with electronic outputs (for signal redundancy). The switches can be general purpose or rated for hazardous locations (all classes, groups and divisions).

CALIBRATION
All flow meters are individually calibrated for fluids with the viscosity you specify (up to 3000 SSU/650 Centistokes). We also compensate for your fluid's specific gravity. For NIST Traceability please consult factory.

CONSTRUCTION MATERIALS
The meter body, internal moving parts, and seals are offered in a variety of materials to suit a wide range of applications, such as: water, synthetic and petroleum based oils, paint, corrosives and solvents. See selections in the “How to Order” section.

LINE CONNECTION
Ports can be threaded or flanged. See selections in the “How to Order” section.

Fluid enters at A, passes around the semi-circular vane B, exits at outlet C. The vane resists the flow because of the spring D. The further the vane is pushed the larger the passageway E becomes. This minimizes the pressure drop. The vane shaft turns to operate the pointer F and remote signal devices such as the switch G.

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HOW TO ORDER  Select appropriate symbols and build a model code number, as in example shown:

EXAMPLE:  MN - B S  B 7ØGM - 8 -  32ØV.9 -

SERIES BY PRESSURE RATING

| Normal pressure (300 PSI) | MN     |
| Medium pressure (500 PSI) | MM     |
| High pressure (2000 PSI)  | MH     |

HOUSING MATERIAL  WHERE USED

| Aluminum with nylon flow chamber | Lube oil | A |
| Brass with nylon flow chamber   | Water    | B |
| Naval bronze with nylon flow chamber | Specialty | W |
| Aluminum                         | Lube oil | D |
| Aluminum (hard coated)           | Lube oil with exterior corrosion protection | E |
| Brass                           | Water    | F |
| Naval bronze                    | Sea water | U |
| Stainless steel (316)           | Chemicals, corrosives | I |
| Cast iron                      | Oil      | C |
| Cast iron, nickel plated        | Water, oil with exterior corrosion protection | N |
| Carbon steel                    | Oil      | M |
| Carbon steel, nickel plated     | Water, oil with exterior corrosion protection | J |

SEAL MATERIAL

| Buna N                           | Water, oil | B |
| EPR                              | Hot water, caustics | E |
| Viton                            | Acids, some caustics synthetic oil | F |
| Kalrez                           | Corrosives, solvents | J |
| Kalrez (dynamic) & Buna N (static) | Specialty | A |
| Kalrez (dynamic) and EPR (static) | Specialty | H |
| Kalrez (dynamic) and Viton (static) | Specialty | K |
| Kalrez (dynamic) and Teflon (static) | Corrosives, solvents | T |

INTERNAL MOVING PARTS

| Stainless steel (300 series)    | Standard for water, oil | S |
| Stainless steel (316 series)    | Chemicals and corrosives | I |
| Titanium                        | Sea water | T |
| Monel                            | Corrosives | L |

CHOOSE FROM THE MAXIMUM FLOW RATES SHOWN HERE

GPM 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160 = GM
LPM 40, 50, 60, 70, 80, 90, 100, 150, 200, 250, 300, 350, 400, 500, 600 = LM
CMH 2.25, 2.5, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30 = CMH
This is a dual scale that has both the gallons per minute and liters per minute scales = GLM
This option has two scales for two viscosities with flow shown in GPM = DGM

THREADED ATTACHMENT

<table>
<thead>
<tr>
<th>Pipe Size In Inches</th>
<th>NPT</th>
<th>SAE</th>
<th>BSPP</th>
<th>BSPT</th>
<th>Max Flow In GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>4</td>
<td>8T</td>
<td>8BP</td>
<td>8BT</td>
<td>25</td>
</tr>
<tr>
<td>3/4</td>
<td>6</td>
<td>12T</td>
<td>12BP</td>
<td>12BT</td>
<td>50</td>
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<tr>
<td>1</td>
<td>8</td>
<td>16T</td>
<td>16BP</td>
<td>16BT</td>
<td>70</td>
</tr>
<tr>
<td>1 1/4</td>
<td>10</td>
<td>20T</td>
<td>20BP</td>
<td>20BT</td>
<td>70</td>
</tr>
<tr>
<td>1 1/2</td>
<td>12</td>
<td>24T</td>
<td>24BP</td>
<td>24BT</td>
<td>100</td>
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<td>2</td>
<td>16</td>
<td>32B</td>
<td>32BP</td>
<td>32BT</td>
<td>160</td>
</tr>
</tbody>
</table>

FLANGED

Ex: 4F4G5C5F15SRF = 1/2’’ threaded, Carbon Steel, Class 150, Raised Face flange

<table>
<thead>
<tr>
<th>Pipe Size In Inches</th>
<th>Attachment</th>
<th>Material</th>
<th>Class</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>FW=Welded, FT=Threaded</td>
<td>Carbon Steel</td>
<td>15Ø</td>
<td>RF=Ansi raised face</td>
</tr>
<tr>
<td>6</td>
<td>3/4’’</td>
<td>S=316 Stainless</td>
<td>30Ø</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1’’</td>
<td></td>
<td>60Ø</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1 1/4’’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1 1/2’’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>2’’</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Manual Override Option (E) is required (by UFM manufacturing) on welded medium flanged vane meters.

FLUID CHARACTERISTICS

Viscosity number followed by a ‘V’ (for SSU), ‘C’ (for centipoise), or ‘CS’ (for centistokes) followed by the specific gravity. Example: 32ØV.9 would indicate a fluid with a viscosity of 320 SSU with a specific gravity of 0.9. For dual viscosities (where there is a start up viscosity or where there may be a range) put in both values with a slash. Example: 320/150V.9.
**SERVICE**
Oil and dust tight (Type 12) Available on 'A', 'L' and 'Z' only = N
Weatherproof (Type 4) Available on all boxes = W
Weatherproof, corrosion proof (Type 4X) Available on all boxes = X

**FLOW DIRECTION**
Left to right = R
Right to left = L
Up = U
Down = D

**CONTROL BOX & READOUT**

“A”, “L” and “Z” Boxes
“A”, “L” and “Z” boxes are small, simple and cost effective. Available with analog display, mechanical switches or transmitters (HART or 4-20mA).

A, L and Z small control box in the following configurations and materials: Polysulfone Aluminum 316 SS
4-20 mA transmitter (Intrinsically safe with approved barriers) AXØ LXØ ZXØ
HART with programmable switch points AHØ LHØ ZHØ
Display only AØ LØ ZØ
One SPDT (3 wire) A1 L1 Z1
One high vibration SPDT (3 wire) A1B L1B Z1B
Two SPDT (3 wire) A2 L2 Z2
Two high vibration SPDT (3 wire) A2B L2B Z2B
One SPDT (4 wire) A3 L3 Z3
Two SPDT (4 wire) A4 L4 Z4
One SPDT (3 wire) high temperature A61 L61 Z61
Two SPDT (3 wire) high temperature A62 L62 Z62
One SPDT (3 wire) gold contact A71 L71 Z71
Two SPDT (3 wire) gold contact A72 L72 Z72
One SPDT (3 wire) hermatically sealed A53 L53 Z53
Two SPDT (3 wire) hermatically sealed A54 L54 Z54

“T” Box
“T” box always has a transmitter (4-20 mA or HART) and can be in combination with a mechanical switch for redundancy. It has two junction boxes to separate wiring for switches and transmitters. The display can be analog or digital LCD.

**T Box**

LCD readout, 4-20mA plus option:
No switches (Intrinsically safe with approved barriers) TXØ
One SPDT (3 wire) TX1
One SPDT (4 wire) TX2
One SPDT (3 wire) high temperature TX3
Two SPDT (3 wire) TX4
Two SPDT (4 wire) high temperature TX5

HART, pointer, scale plus option:
Two programmable HART switches TH1
One SPDT (3 wire) TH2
One SPDT (4 wire) TH3
Two SPDT (4 wire) TH4
One SPDT (3 wire) high temperature TH5

**R Box**

“R” box is selected for greater visual resolution. It holds switches (general purpose and hazardous location all classes, groups and divisons) and transmitters (HART or 4-20 mA). Switch (standard service) and transmitter are offered in this control box together when signal redundancy is desired.

Flow rate display plus:
Display only R0
One SPDT (3 wire) R1
One high vibration SPDT (3 wire) R18
Two SPDT (3 wire) R2
Two high vibration SPDT (3 wire) R28
One SPDT (4 wire) R3
Two SPDT (4 wire) R4
One SPDT (3 wire) high temperature R61
Two SPDT (3 wire) high temperature R62
One SPDT (3 wire) gold contact R71
Two SPDT (3 wire) gold contact R72

Flow rate display, Hazardous location switches as follows:
For < 1 amp circuits
One SPDT hazardous location R7
One DPDT hazardous location R17
Two SPDT hazardous location R18
Two DPDT hazardous location R19

For > 5 amp circuits
One SPDT hazardous location R20
One DPDT hazardous location R21
Two SPDT hazardous location R22
Two DPDT hazardous location R23
One SPST hazardous location proximity R30
Two SPST hazardous location proximity R31

Flow rate display, 4-20 mA transmitter plus options as follows:
Display and transmitter only (Intrinsically safe with approved barriers) RXØ
One SPDT (3 wire) RX1
Two SPDT (3 wire) RX2
One SPDT (4 wire) RX3
Two SPDT (4 wire) RX4
One SPDT (3 wire) high temperature RX5

Flow rate display, HART output plus options as follows:
HART output only RHØ
One SPDT (3 wire) RH1
Two SPDT (3 wire) RH2
One SPDT (4 wire) RH3
Two SPDT (4 wire) RH4

**SPECIAL OPTIONS (See explanations below)**
High-temp- 400°F, 300°F for transmitter options = HT
Stainless steel ID tag for customer supplied information = ST
CSA enclosure / PVC window = C
Safety Glass window ref. page 4 = TG
Manual override ref. page 4 = E
Dual spring for reading lower flow rates on high flow units = D5
(see ‘Flow and pressure drop’ section page 4)
Clearance vane for (4-20 mA) = Z86
316 SS external bolts on MH-I but limits pressure max to 1500 PSI = Z67MH

**Switch Setting**
No symbol = Lowest possible setting (usually 10% of maximum flow)
Desired set point is assumed to be in flow units already selected (GPM). Give flow rate followed by a "D" for flow going down (flow failure) or a "U" for flow going up.
Example, 1ØD indicates a setting of 10 GPM in declining flow.
**ENGINEERING DATA**

Maximum fluid temperature: 200°F (95°C)
Optional max. fluid temperature: 300 & 400°F (150 & 205°C) (option HT)
Maximum ambient temperature: 150°F (65°C)
Readout accuracy, full scale: ±2%

Series MN max. operating pressures: (3:1 safety factor): 300 PSI (20.69 BAR)
Series MM max. operating pressures: (3:1 safety factor): 500 PSI (34.48 BAR)
Series MH max. operating pressures: (3:1 safety factor): 2,000 PSI (137.93 BAR)
Repeatability of switches 1% of actual flow rate

<table>
<thead>
<tr>
<th>MAX FLOW RATE</th>
<th>BYPASS ONLY</th>
<th>DUAL SPRING*</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPM/LPM</td>
<td>Minimum Flow</td>
<td>Max Pressure Drop</td>
</tr>
<tr>
<td></td>
<td>GPM/LPM</td>
<td>PSI</td>
</tr>
<tr>
<td>90/340</td>
<td>20/75</td>
<td>4.5</td>
</tr>
<tr>
<td>100/380</td>
<td>30/100</td>
<td>4.5</td>
</tr>
<tr>
<td>110/400</td>
<td>30/100</td>
<td>5.0</td>
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<tr>
<td>120/450</td>
<td>40/150</td>
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<tr>
<td>130/500</td>
<td>40/150</td>
<td>5.8</td>
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<tr>
<td>140/550</td>
<td>50/170</td>
<td>6.5</td>
</tr>
<tr>
<td>150/570</td>
<td>50/170</td>
<td>6.5</td>
</tr>
<tr>
<td>160/600</td>
<td>50/170</td>
<td>6.5</td>
</tr>
</tbody>
</table>

*When dual-spring is ordered you must specify special option DS. Some dual-spring units also have partial bypass to achieve high flow ranges.

**FLOW & PRESSURE DROP**

Units with max flows to 80 GPM (300 LPM) impose a pressure drop that increases with flow from 1.9 to 3.8 PSI. Higher flow-rated models are made possible by having either a partial bypass (which raises minimum indicated flow), dual springs (which raises the pressure drop), or both. The table shows minimum flow rates and pressure drops (PSI) (at max flow rates) for models rated from 100 to 160 GPM.

**SPECIAL OPTIONS**

High temperature: (option HT) requires all-metal construction of housing/orifice cover with seals of Viton, EPR, Kalrez or Teflon (compatible with fluid). A thermal barrier (heat-resistant cloth) is added between the housing and the control box, which must be used with service option "W" (weatherproof) or "X" (corrosion resistant). A metal scale is provided.

Identification tag: (option ST) customer-supplied information is stamped on a stainless steel tag that is attached to the nameplate.

Safety Glass window: (option TG) replaces the standard window with "Laminated Safety Glass" ANSI 297.1 and CPSC 1601 CFR 1201.

Manual override: (option E) provides an extended shaft you can manipulate to clear debris, simulate flow, adjust switch settings, etc. Same material as internals specified.

Clearance vane: (option Z86) the swing vane is modified to provide extra clearance for liquids that contain particulate. Available for maximum flow range of 16 GPM or greater, this reduces the turndown to a minimum of 4 GPM.
CONTROL BOX INSTALLATION DRAWINGS

“A”, “L” and “Z” Boxes

Maximum installation dimensions

“R” Box

Maximum installation dimensions
**“T” Box**

Maximum installation dimensions

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**With 150 lb R.F. flanges**

(for other flanges consult factory)

<table>
<thead>
<tr>
<th>Port Size (inches)</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>3-1/2</td>
</tr>
<tr>
<td>3/4</td>
<td>3-7/8</td>
</tr>
<tr>
<td>1</td>
<td>4-1/4</td>
</tr>
<tr>
<td>1-1/2</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

“Flow up” or “Flow down” dimensions are the same. Scale numbers are turned 90° to be right reading.