Flow meters, Flow switches and Flow transmitters
A piston design for low flows of liquids

**DESCRIPTION**
These variable-area meters position an orifice over a tapered shaft to establish flow rate. Mounting is in-line and in any position. Straight pipe runs before or after this monitor are not required. The all-mechanical sensing system directly drives the pointer, 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**
Housings and seals are offered in a variety of materials to suit a wide range of applications, such as: water, oil, coolants, paint, solvents and some corrosive fluids. 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 flow causes a spring-loaded piston A having a circular opening at its center B to move along the axis of a precision-tapered shaft C. This creates a variable orifice in direct proportion to the flow rate. The piston is mechanically linked to the readout pointer D and actuates switch E or a transmitter (not shown).

MAX FLOW SIZES
FROM 5 GPH to 20 GPM
(20 LPH TO 75 LPM)

MAX LIQUID PRESSURE 300 PSI
(20.69 BAR)
LL SERIES

MAX LIQUID PRESSURE 500 PSI
(34.48 BAR)
LP SERIES

MAX LIQUID PRESSURE 1500 PSI
(103.45 BAR)
LH SERIES

Viton® and Kalrez™ are registered trademarks for DuPont Performance Elastomers.

NIST Traceable Calibration Certificate Available
HOW TO ORDER
Select appropriate symbols and build a model code number, as in example shown:

EXAMPLE: LL - B Z P S B  15GH - 4 U - 320V.9 -

SERIES BY PRESSURE RATING
Normal pressure (150 or 300 PSI) = LL
Medium pressure (500 PSI) = LP
High pressure (1500 PSI) = LH

HOUSING MATERIAL WHERE USED
Aluminum Lube oil = A
Cast iron, nickel plated Water, oil with exterior corrosion protection = N (B Z P S B 15GH - 4 U - 32ØV.9)
Brass Water = B
Cast iron Oil = C
Carbon steel Oil = M
Carbon steel, nickel plated Water, oil with exterior corrosion protection = J (H)
Stainless steel (316) Chemicals, corrosives = Z

PISTON MATERIAL
Brass Water, oil = B
Stainless steel (316) Corrosives, chemicals = Z

CAP MATERIAL
Metal (same as housing) use matches housing (300 PSI) = M
Polysulfone (150 PSI) (Not available for 10 GPH and below) = P (LL only)

INTERNAL MOVING PARTS
Stainless steel (300 series) Standard for oil = S
Stainless steel (316 series) Water, chemicals and corrosives = Z

SEAL MATERIAL
Buna N Water, oil = B
EPR Hot water, caustics = E
Viton Acids, some caustics = 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
Available only in metal "Cap Material" (option M) = T

MAX FLOW RATE LIQUIDS
SCALES
GPH: 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 90, 100, 120, 150, 200, 250 & 300 = GH
GPM: 0.25, 0.5, 0.75, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 9, 10, 15 & 20 = GM
LPH: 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900 & 1000 = LH
LPM: 5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70 & 75 = LM
CMH: 1, 2, 3 & 4 = CMH
GLM: Dual scale - gallons & liters per minute = GLM

THREADED ATTACHMENT
Pipe Size In Inches NPT SAE BSPP BSPT Max Flow
1/8 1 2T 2BP 2BT 2
1/4 2 4T 4BP 4BT 5
3/8 3 6T 6BP 6BT 10
1/2 4 8T 8BP 8BT 15
5/8 5 10T 10BP 10BT 15
3/4 6 12T 12BP 12BT 20

FLANGED
Ex: 2FWCS150RF = 1/4", Welded, Carbon steel, Class 150, Raised Face flange
Pipe Size In Inches Attachment Material Class Style
2 = 1/4" FW=Welded CS=Carbon Steel 15Ø RF=Ansi raised face 3Ø
3 = 3/8" FT=Threaded S=316 Stainless 3Ø
4 = 1/2" 6ØØ
6 = 3/4" 8ØØ
8 = 1"

INLET PORT POSITION
Upper inline (max. 2 GPM) = U
Lower offset = L

FLUID CHARACTERISTICS
Viscosity number followed by a ‘V’ (for SSU), ‘C’ (for centipoise), or ‘CS’ (for centistokes) followed by the specific gravity. Example: 320V.9 would indicate a fluid with a viscosity of 320 SSU with a specific gravity of .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

**FLOOR BOXES & READOUT**

<table>
<thead>
<tr>
<th>A Box</th>
<th>L Box</th>
<th>Z Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-20 mA transmitter (intrinsically safe with approved barriers)</td>
<td>AX0</td>
<td>LX0</td>
</tr>
<tr>
<td>HART with programmable switch points</td>
<td>AH0</td>
<td>LH0</td>
</tr>
<tr>
<td>Display only</td>
<td>A0</td>
<td>L0</td>
</tr>
<tr>
<td>One SPDT (3 wire)</td>
<td>A1</td>
<td>L1</td>
</tr>
<tr>
<td>One high vibration SPDT (3 wire)</td>
<td>A1B</td>
<td>L1B</td>
</tr>
<tr>
<td>Two SPDT (3 wire)</td>
<td>A2</td>
<td>L2</td>
</tr>
<tr>
<td>Two high vibration SPDT (3 wire)</td>
<td>A2B</td>
<td>L2B</td>
</tr>
<tr>
<td>One SPDT (4 wire)</td>
<td>A3</td>
<td>L3</td>
</tr>
<tr>
<td>Two SPDT (4 wire)</td>
<td>A4</td>
<td>L4</td>
</tr>
<tr>
<td>One SPDT (3 wire) high temperature</td>
<td>A61</td>
<td>L61</td>
</tr>
<tr>
<td>Two SPDT (3 wire) high temperature</td>
<td>A62</td>
<td>L62</td>
</tr>
<tr>
<td>One SPDT (3 wire) gold contact</td>
<td>A71</td>
<td>L71</td>
</tr>
<tr>
<td>Two SPDT (3 wire) gold contact</td>
<td>A72</td>
<td>L72</td>
</tr>
<tr>
<td>One SPDT (3 wire) hermetically sealed</td>
<td>A53</td>
<td>L53</td>
</tr>
<tr>
<td>Two SPDT (3 wire) hermetically sealed</td>
<td>A54</td>
<td>L54</td>
</tr>
</tbody>
</table>

**“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).

**“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.

**“R” Box**

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

**SPECIAL OPTIONS (See explanations below)**

- High-temp: 400°F (300°F for transmitter options) = HT
- High accuracy (+/-3%) ref. page 4 = HA
- Stainless steel ID tag = ST
- CSA enclosure / PVC window = C
- Safety Glass window ref. page 4 = TG
- Wall mounting bracket ref. page 4 = W
- Foot mounting bracket ref. page 4 = F

**SWITCH SETTING**

No symbol = Lowest possible setting (usually 10% of maximum flow)

Desired set point is assumed to be in flow units already selected (GPH). Give flow rate followed by a “D” for flow going down (flow failure) or a “U” for flow going up.

Example, 5D indicates a setting of 5 GPH in declining flow.

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ENGINEERING DATA

Maximum fluid temperature: 200°F (93°C)
Optional max. fluid temperatures: 300 & 400°F (148 & 204°C) (option HT)
Maximum ambient temp: 150°F (65°C) CSA listed only to 105°F (41°C)
Series LL max. operating pressures:
With plastic cap: (3:1 safety factor): 150 PSI (10.34 BAR)
With metal cap: (3:1 safety factor): 300 PSI (20.69 BAR)
Series LP max. operating pressures: (2:1 safety factor): 500 PSI (34.48 BAR)
Series LH max. operating pressures: (2:1 safety factor): 1500 PSI (103.45 BAR)
Pressure drop: 5 PSI (.35 BAR) at full scale
Readout accuracy, full scale: ±5%
Switch repeatability is 1% of actual flow

INSTALLATION

Flow monitors mount in-line or offset and are typically supported by rigid pipe. For additional support when using tubing or flexible hose, order special options W (wall) or F (foot) mounting brackets.

SPECIAL OPTIONS

High temperature: (option HT) requires all-metal construction (M Cap material) 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.

High Accuracy: (option HA)
Modification of full scale to +/-3%. HA not available with transmitter or R7, R17, R18, R19 switch options. Requires flow rates of 1 GPM or greater.

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 Z97.1 and CPSC 1601 CFR 1201.
CONTROL BOX SELECTION GUIDE

“A”, “L” and “Z” Boxes

Maximum installation dimensions

“R” Box

Maximum installation dimensions
“T” Box

Maximum installation dimensions

Flanged Face to Face Dimensions for In-Line and Offset Installation

With 150 lb R.F. flanges
(for other flanges consult factory)

<table>
<thead>
<tr>
<th>Port Size (inches)</th>
<th>A (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>3.50</td>
</tr>
<tr>
<td>3/4</td>
<td>3.88</td>
</tr>
<tr>
<td>1</td>
<td>4.25</td>
</tr>
</tbody>
</table>