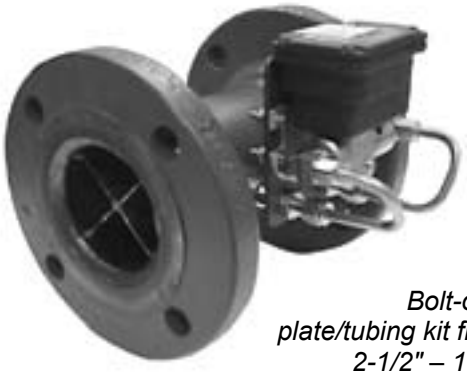

Bolt-on plate/tubing kit fits 2-1/2" – 18" venturi valves

SPECIFICATIONS *–subject to change without notice–*

Performance Data

Accuracy RSS* (at constant temp)	±0.25% FS
Non-Linearity, BFSL	±0.20% FS
Hysteresis	0.10% FS
Non-Repeatability	±0.05% FS
Thermal Effects °F (°C)	30 to 150 (-1 to 65)
Zero Shift %FS/°F (%FS/°C)	< ±0.02 (< ±0.04)
Span Shift %FS/°F (%FS/°C)	< ±0.02 (< ±0.04)
Line Pressure Effect	Zero shift approx. ±0.004% FS/psig line pressure
Resolution	Infinite, limited only by output noise level (0.02% FS)
Static Acceleration Effect	2% FS/g (most sensitive axis)
Natural Frequency	> 500 Hz (gaseous media)
Response Time	30 to 50 milliseconds (pressure measurand water)
Maximum Working Pressure	250 psig

* RSS consists of Non-Linearity, Non-Repeatability and Hysteresis

Electrical Data

Circuit	2-wire
Output at Zero Pressure	4mA (1V with filter)
Output at Full Range Pressure*	20mA (5V with filter)
Full Scale Output	16mA (4V with filter)
External Load	0 to 1000 Ω
Minimum Supply Voltage (Vdc)	9 + 0.02 x (Resistance of receiver plus line)
Maximum Supply Voltage (Vdc)	30 + 0.004 x (Resistance of receiver plus line)

* Calibrated at factory using a 250Ω load at 24Vdc. Variations in power supply cause less than 0.003mA change in the transmitter's current output, per volt change in the power supply. Ripple and noise content < 10 microamperes RMS (0Hz to 10kHz).

Environmental Data

Operating Temperature °F (°C)	0 to 175 (-22 to 80)
Storage Temperature °F (°C)	-65 to 250 (-54 to 126)
Vibration	5g from 5Hz to 500Hz
Acceleration	10g maximum
Shock	50g Operating
Case	Stainless Steel / Aluminum
Pressure Fittings	1/4" – 18 NPT internal
Electrical Connection	Barrier strip terminal block with conduit enclosure & 0.875 DIA conduit opening.
Weight (Approx.)	14.4 oz.
Sensor Cavity Volume	0.27 cubic in. Positive Port 0.08 cubic in. Negative Port

(With 1/4" NPT External fittings installed, does not include cavity volume of 1/4" NPT External fittings.)

Pressure Media

Gases or liquids compatible with 17-4 PH stainless steel, 300 series stainless steel, Buna-N O-Rings. All parts exposed to pressure media are stainless steel and elastomer seals.

DESCRIPTION

Griswold's 9680-89 high output, low differential pressure transducer (DPT) is designed for wet-to-wet differential pressure measurements of liquids or gases. It contains a fast-response capacitance sensor, and signal conditioning electronic circuitry necessary for providing a highly accurate, linear analog output proportional to pressure. The electronic circuit linearizes output vs. pressure, standardizes the output (zero and gain) and compensates for thermal effects on the sensor.

OPERATION

The Electronic Flow Transducer is designed to measure flow using a differential pressure transducer (DPT) that senses a pressure drop across a known venturi. The DPT is very sensitive and will tend to pick up minor pressure oscillations that exist in typical hydronic systems. These oscillations in pressure are generally produced by the pump impeller. An optional electronic filter for each venturi will eliminate the noise frequency that can develop and the turbulence that can be produced within the mechanical piping. The DPT is a true 2-wire 4-20mA transducer that, when connected to the filter, converts the signal to 1-5Vdc or 2-10 Vdc.

Air must be bled from the DPT. Three screws on the side of the DPT must be loosened approximately 1-1/2 to 2 turns and allowed to leak until all air is removed. This should take no longer than 1 minute. Two quarter-turn isolation ball valves are provided on the high and low pressure ports to allow for pressure isolation during startup and serviceability during normal operation.

Replaces form F-4218C 12/05

F-4218D

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APPLICATIONS

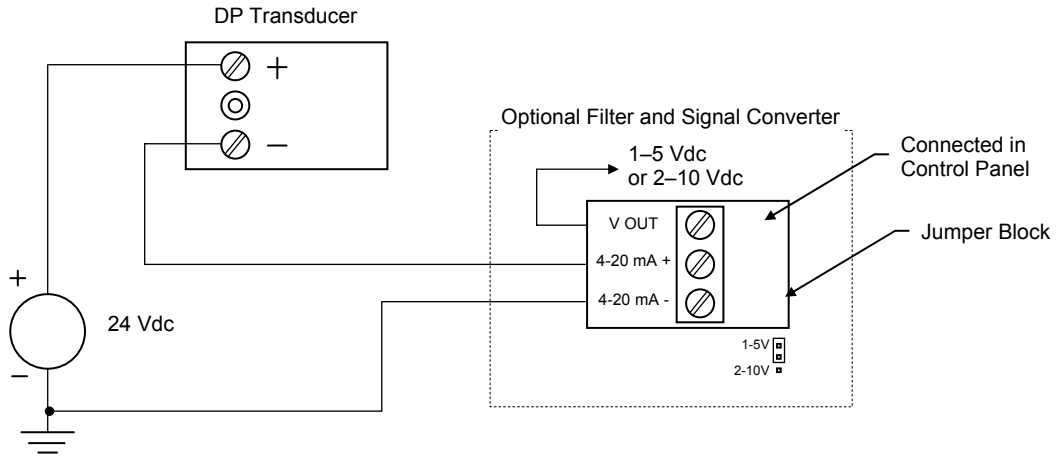
- General Process Control
- Used to monitor flow on chilled and hot water HVAC systems.
- Provides flow feedback to Building Automation Controllers that monitor and regulate Energy Management Systems.
- Provides flow feedback for modulated pump systems.
- Monitors flow and provides alarm capability for evaporator and condenser water loops on central chiller plants.

FEATURES

- Analog (4–20mA/1–5Vdc or 2-10 Vdc) signal output capability with 2-1/2" – 18" QuickSet and Metering Stations.
- NEMA 4/IP65 rated package withstands environmental effects.
- Bolt-on mounting kit for upgrading standard QuickSet and Metering Stations.
- Isolation Ball Valves are provided for start-up pressure isolation and transducer serviceability.

WIRING

WARNING! Improper connection of 24V supply can permanently damage the DPT



MODEL NUMBER

9 6 8 0 - 8 7

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TECHNICAL INFORMATION

Pressure Differential/Flow Rate Relationship

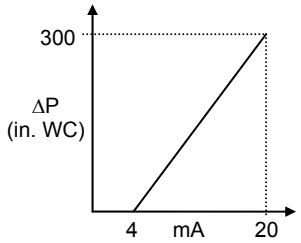
$$Q = Cv\sqrt{\frac{\Delta P}{SG}} \qquad \text{(eq. 1.0)} \qquad \text{(where } \Delta P \text{ is in PSID and SG is the Specific Gravity)}$$

$$Q = Fc\sqrt{\frac{\Delta P}{SG}} \qquad \text{(eq. 2.0)} \qquad \text{(where } \Delta P \text{ has been converted into inches of water column)}$$

Current/Pressure Differential Relationship

$\Delta P = Ai + B$ (where i is the signal current in milliamps and
ΔP is the differential pressure in inches of water column)
A = 18.75 and B = -75
therefore:

$\Delta P = 18.75i - 75$ (eq. 3.0) ΔP (Inches W.C.)



Transducer Current Output Graph

Current/Flow Rate Relationship

Substituting eq. 3.0 into eq. 2.0 and simplifying results in the following equation:

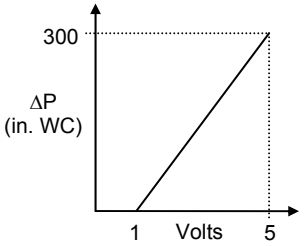
$$Q = Fc\sqrt{\frac{|18.75i - 75|}{SG}} \qquad \text{(eq. 4.0)} \qquad \text{(where } 4 \le i \le 20\text{)}$$

Equation 4.0 demonstrates the relationship between signal current (mA) and flow rate (GPM) where i ranges from 4 to 20 mA. In the real world, current can drop below 4 mA Therefore the absolute value of $|18.75i - 75|$ is taken to avoid computation of the square root of a negative number. Computer control systems that use equation 4.0 should assume that flow equals zero if i is less than or equal to 4 mA.

Voltage/Pressure Differential Relationship

$\Delta P = AV + B$
(where V is the signal current in Volts and
ΔP is the differential pressure in inches of water column)
A = 75 and B = -75
therefore:

$\Delta P = 75\ (V - 1)$ (eq. 5.0) ΔP (Inches W.C.)



Transducer Voltage Output Graph

Voltage/Flow Rate Relationship

Substituting eq. 5.0 into eq. 2.0 and simplifying results in the following equation:

$$Q = Fc\sqrt{\frac{|75(V - 1)|}{SG}} \qquad \text{(eq. 6.0)} \qquad \text{(where } 1 \le V \le 5\text{)}$$

Equation 6.0 demonstrates the relationship between signal Volts (V) and flow rate (GPM) where V ranges from 1 to 5 Volts. In the real world, voltage can drop below 1 V, hence the absolute value of $|75V\text{-}1|$ is taken to avoid computation of the square root of a negative number. Furthermore, any computer program that uses equation 6.0 should assume that flow equals zero if V is less than or equal to1 V.

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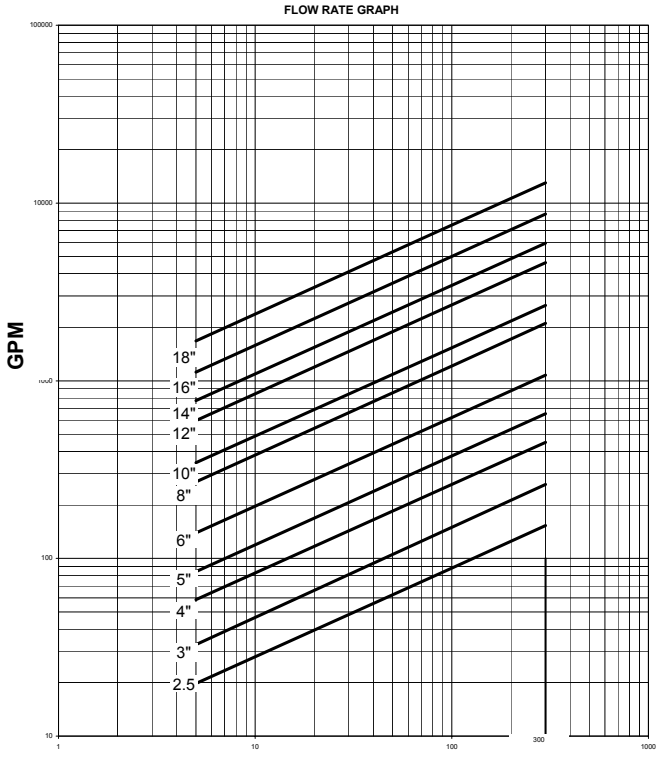
FLOW CHARACTERISTICS

Flow Constant Table

Valve Size (Inches)	Flow Constants	Max Flow (GPM)
2.5	8.83	153
3	15.00	260
4	26.00	450
5	36.60	634
6	62.00	1074
8	121.50	2104
10	153.00	2650
12	266.60	4618
14	343.30	5946
16	565.42	9793
18	760.23	13168



Flow through the venturi produces a pressure differential at the High Side/Low Side fittings on the QuickSet venturi housing. This differential is proportional to the flow rate as shown in the graph at left. The minimum flow rate should be such that 5" differential pressure is produced and the maximum flow rate is limited to a differential pressure of 300" at the venturi.

The sensor reads the fluid pressure differential signal via two tubes. The sensor converts the pressure signal into a 4-20mA electrical signal. The sensor is calibrated so that it will produce 20mA when the differential pressure signal from the venturi is 300 inches of water column. At this value, the flow can be read from the graph for any valve size.

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