*Bolt-on plate/tubing kit fits
2-1/2" – 20" venturi valves*

SPECIFICATIONS   *–subject to change without notice–*

Performance Data

Accuracy RSS[1] (at constant temp)	±0.5% FS
Non-Linearity, BFSL	±0.20% FS
Hysteresis	0.5% FS
Non-Repeatability	±0.05% FS
Thermal Effects °F (°C)	Compensated 14 to 140 (-10 to 60)
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
Maximum Working Pressure	250 psig

Electrical Data

Circuit	2-wire
Output at Zero Pressure	4mA (1V with filter)
Output at Full Range	20mA (5V with filter)
Pressure[2]	0-16 Bar (0-401.8"WC)
Full Scale Output	16mA (4V with filter)
External Load	0 to 1000 Ω
Minimum Supply Voltage (Vdc)	12 + 0.02 x (Resistance of receiver plus line)
Maximum Supply Voltage (Vdc)	30 + 0.004 x (Resistance of receiver plus line)

Environmental Data

Operating Temperature °F (°C)	-4 to 185 (-20 to 85)
Storage Temperature °F (°C)	-22 to 185 (-30 to 85)
Vibration	5g from 5Hz to 500Hz
Acceleration	10g maximum
Shock	50g Operating
Case	Stainless Steel / Aluminum
Pressure Fittings[3]	1/4" – 18 NPT internal
Electrical Connection	Flying Leads

Pressure Media

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

DESCRIPTION

Griswold's 9680-100 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. The DPT is a true 2-wire 4-20mA transducer converts the signal to 1-5Vdc or 2-10 Vdc depending on which resistor is used.

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

NOTES

[1] RSS consists of Non-Linearity, Non-Repeatability and Hysteresis

[2] Calibrated at factory at 24Vdc.

[3] With 1/4" NPT External fittings installed, does not include cavity volume of 1/4" NPT External fittings

Replaces form F-4218
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provided on the high and low pressure ports to allow for pressure isolation during startup and serviceability during normal operation.
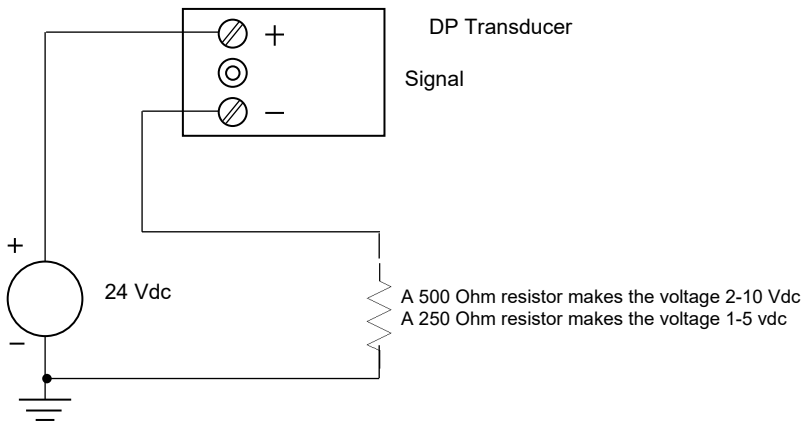
APPLICATIONS

- 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.
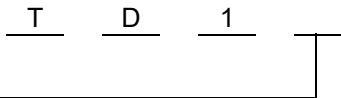
FEATURES

- 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

DP Transducer

+

Signal

−

+

24 Vdc

−

A 500 Ohm resistor makes the voltage 2-10 Vdc
A 250 Ohm resistor makes the voltage 1-5 vdc

MODEL NUMBER

T   D   1

Insert S=standard, P=Phone Compatible

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TECHNICAL INFORMATION

Pressure Differential/Flow Rate Relationship

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

$$Q = Fc\sqrt{\frac{\Delta P}{SG}}$$
(eq. 2.0)   (where ΔP 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 = 17.3025 and B = -69.21
therefore:
$\Delta P = 17.3025i - 69.21$ (eq. 3.0) ΔP (Inches W.C.)

401.8

ΔP
(in. WC)

4   mA   20

Transducer Current Output Graph
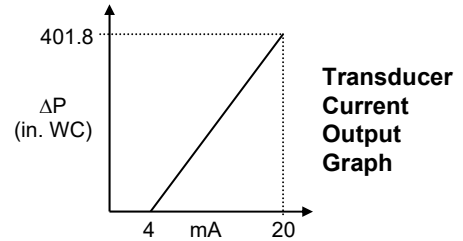
Current/Flow Rate Relationship

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

$$Q = Fc\sqrt{\frac{|17.3025i - 69.21|}{SG}}$$
(eq. 4.0)   (where $4 \le i \le 20$)

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 $|17.3025i - 69.21|$ 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 = 69.21 and B = -69.21
therefore:
$\Delta P = 69.21 (V - 1)$ (eq. 5.0) ΔP (Inches W.C.)

401.8

ΔP
(in. WC)

1   Volts   5

Transducer Voltage Output Graph
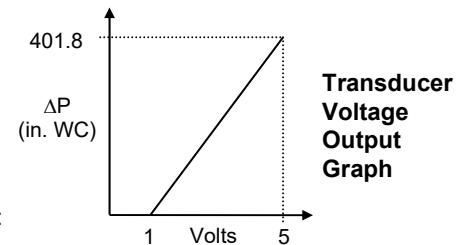
Voltage/Flow Rate Relationship

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

$$Q = Fc\sqrt{\frac{|69.21(V - 1)|}{SG}}$$
(eq. 6.0)   (where $1 \le V \le 5$)

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 $|75V-1|$ 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

Valve Size (Inches)	Flow Constants – Straight Pipe	Flow Constants – Piped at Elbow	Flow Constants – Piped at Control Valve
2-1/2	8.70	8.70	8.70
3	14.70	14.70	15.60
4	26.00	26.00	27.30
5	37.00	36.00	41.00
6	62.00	64.00	66.00
8	118.00	120.00	115.00
10	161.00	171.00	164.00
12	278.00	261.00	259.00
14	343.00	348.00	349.00
16	553.00	548.00	516.00
18	741.00	763.00	770.00

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