

**THE SYSTEM**

Johnson Controls computer-based systems are capable of monitoring all aspects of building operation. A large part of the computer's operation is dedicated to energy management with energy transferal, usually measured in Tons, kBtu/Hr, or kWh is calculated from flow and temperature differential data provided by sensors in the system. This data can be used to proportion energy costs based on actual usage, or monitor system performance.

**THE PROBLEM**

Computer systems require inputs from a large number of diverse data points. For HVAC energy management, these primarily include temperature and flow measurements. Although relatively inexpensive temperature sensors have been available for some time, cost effective, easy to install flow sensors that interface well with a computer have not been available.

**THE SOLUTION**

Badger Meter's Series 200 and SDI Series sensors are easy to install, with models available permitting installation and removal from fully pressurized, active piping systems. Their low impedance pulse signal permits long cable runs of up to 2000 feet.

Badger Meter provides a wide range of monitors and transmitters for both flow and energy. Outputs include 4-20mA, scaled pulse, and direct N2 Metasys protocol.

**SPECIFIC RECOMMENDATIONS**

Sensors: Specify Model 220B where pipe sizes are 3 inches or

larger, and valving permits easy isolation of sensors for installation and service without complete drain down of the entire system.

Specify Model 228 sensors for pipe sizes below 3".

Specify the Model 225B sensor for installations where pressures are below 200 psi, drain down is possible for installation, but valving causes drain down to be impractical for service once a system is put into operation. Specify the Model 226B sensor for installations where pressures are as great as 400 psi or installation is to be into fully pressurized, active pipe lines.

\* The above sensors, except for Model 225, are also available in 316 stainless steel - order with the suffix "SS".

Specify pulse output if the computer is being used to totalize flow or btu data, or if a higher degree of accuracy is required. The Badger Meter Model 320 scaled pulse transmitter can be used to provide pulses to the computer. Although many systems can accept pulse inputs, the resultant increase in loop time frequently restricts the number of pulse inputs a system can handle. As a result of this trade-off between computer speed and accuracy, many systems will have both pulse and analog inputs specified depending on system size and function.

**Sensors**

Product Series	Type		Output			Pipe Size				Pipe Material		Display	
	Direct	Hot Tap	Raw Pulse	Scaled Pulse	Analog	<2"	2"	3"	>4"+	Steel	Copper	Yes	No
220	X		X					X	X	X	X		X
250B			X			X				X	X		X
228	X		X				X			X	X		X
225B		X	X					X	X	X	X		X
226		X	X					X	X	X	X		X
SDI	X	X	X	X	X		X	X	X	X	X	X	X

**Transmitters**

Product Series	Power Source		Output							Display	
	Remote	Loop Powered	N2	Set Point	Scaled Pulse	4-20mA	0-1VDC	0-5VDC	0-10VDC	Yes	No
310	X	X				X					X
320	X				X						X
330	X			X							X
340	X				X						X
340N2	X		X		X						X
1550	X			X	X	X				X	
2300	X			X	X	X	X	X	X	X	
SDI	X				X	X				X	X

All the above products are designed for field calibration. Refer to product data sheets for details.



## EXAMPLES OF FLOW INPUTS

### I. Analog Input of 4-20 mA.

#### A. Equipment Required

1. Series 220 sensor.
2. Model 310-00 Transmitter.

#### B. Scaling/Calibration

1. Specify pipe ID or size and schedule, as well as full scale flow rate, and flow that 4 MA is to represent.

Example: 4" Sch 40 or 4.026 ID  
4 mA = 0 GPM  
20 mA = 400 GPM

As a rule of thumb, 20 mA is generally selected to represent a flow that is about 120% of the actual expected maximum flow to allow a margin of safety in case flow turns out to be slightly higher than predicted.

2. Use the Johnson Controls' calculated point program routine to enter slope and offset.

### II. Pulse Direct From Sensor

#### A. Equipment Required

1. 220 Series Sensor

#### B. Scaling/Calibration

1. The sensor output is an 8 VPP rectangular wave form. In brief, its frequency output is generated by an 8 V zener diode which is shunted by an NPN transistor for 5 ms, twice per revolution of the impeller. This relationship between the frequency and flow is a linear proportion over the sensors 1-30 ft/second operational range as described by the equation:

$$\text{FREQ} = (\text{GPM}/\text{K}) - \text{Offset or}$$
$$\text{GPM} = \text{K} (\text{FREQ} + \text{Offset})$$

A table of K and Offset values for standard pipe sizes and an application note describing the sensors interface characteristics is available. If you require copies, please contact Badger Meter.

2. Use User Programming Language (UPL) to enter calibration equation.

#### C. Connections

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Please see our website at [www.badgermeter.com](http://www.badgermeter.com)  
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