

The Difference with DIFFERENTIAL PRESSURE

Understanding the True Value of DP Flowmeters

By Jesse Yoder

Differential pressure flowmeters present a unique challenge. Whereas most flowmeters include a sensor, transmitter, amplifier, transducer, and display, DP flowmeters rely on a constriction in the flow stream (i.e., primary element) to generate a measurement. Also, in order to read the difference in line pressure upstream and downstream from the constriction, a separate DP transmitter may be necessary. The value of the primary element is part of the cost of making the flow measurement. But users often purchase the primary element from a different supplier than the DP transmitter; so tracking the cost of the primary element can be difficult.

DP transmitters that measure gas or steam flow may also use a pressure or temperature transmitter. In addition, they may use a flow computer to calculate mass flow. Yet the value of peripheral instrumentation is not always included in the cost figure for DP flowmeters. As a result, the DP flowmeter market is sometimes undervalued.

DP flow is important because of its large installed base, its versatility, and



Multivariable DP Transmitter with Integrated Primary Element

because it is one of the most studied and best understood flow technologies. DP flowmeters can be used to measure gas, steam, and liquid flows. They have been around for more than 100 years and have been studied by groups such

Venturi Tube for Large Pipe Size



Table 1. Primary Element Pros & Cons

Flowmeter Type	Liquid, Steam, or Gas	Line Size	Advantages	Disadvantages	Comment
DP-Orifice Plate	Liquid, Steam, Gas	½" and up	Low purchase price; Easy to install; Well understood; Industry approvals	Limited rangeability; Creates permanent pressure drop; Uses square root method to calculate flow rate	Most traditional meter
DP-Venturi Tube	Liquid, Gas	2-30 inches	Can be used for both clean and dirty liquids	Can be difficult to install due to size	Larger sizes for gas
DP-Pitot Tube	Liquid, Gas	> 1 inch	Low cost; Very little pressure drop	Low accuracy; Limited sampling of flow rate	Measures flow only at one point
DP-Averaging Pitot Tube	Liquid, Gas	> 1 inch	Higher accuracy than single Pitot tube; Virtually no pressure drop	Limited rangeability; Not designed for dirty fluids	Also available as Annubar
DP Flow Nozzle	Steam	2-30 inches	Handles high velocity fluids well; Performs better with dirty fluids than orifice plate	High purchase price; Not easily removed for inspection and cleaning	Widely used for steam measurement

as the American Gas Association (www.aga.org) and the American Petroleum Institute (www.api.org). While some DP flowmeters are being replaced by new-technology meters, end-users who prefer tried-and-true concepts are continuing to order DP meters. And companies such as Emerson Rosemount (www.rosemount.com), Honeywell (www.honeywell.com), Foxboro (www.foxboro.com), Siemens (www.siemens.com), ABB (www.abb.com), and others are continuing to bring out new and improved pressure transmitters.

Recognizing the true value of the DP flowmeter market provides a more realistic understanding of where end-users are spending their flowmeter dollars (Figure 1). Further, it shows how DP flow really stacks up against competing flowmeter types. That said, there are some technology trends afoot that are making it easier to ascertain the real value of the DP flowmeter market.

Multivariable Transmitters

The introduction of multivariable DP transmitters is changing the way some DP transmitters are sold. Multivariable transmitters measure more than one process variable. The first multivariable

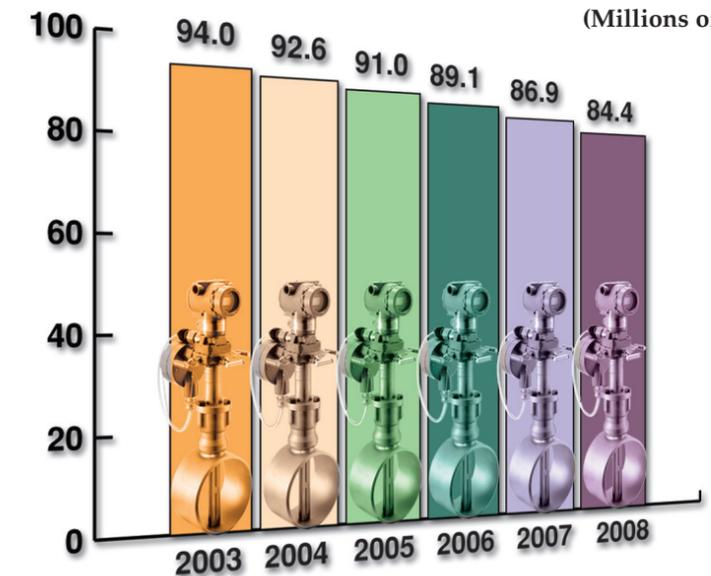
pressure transmitters were introduced by Bristol Babcock (www.bristolbabcock.com) in 1992. Multivariable DP transmitters typically measure differential pressure, static pressure, and temperature. They use these values to compute mass flow, or they send these values to a flow computer, which performs the flow computation.

Some companies, such as Emerson

Rosemount, are also selling multivariable DP transmitters with an integrated primary element, which contains all the elements required to make a flow measurement. Multivariable DP transmitters are popular with many end-users because they cost less than a DP system where the components are purchased separately.

Multivariable DP transmitters run

Figure 1. Total Shipments of Differential Pressure Gas Flowmeters Worldwide (Millions of Dollars)



in the \$2,000 range, which is a considerably lower price point than piecemeal DP systems. Multivariable transmitters sold with an integrated pri-

mary element are also advantageous because they can be precalibrated.

Still, while multivariable DP transmitters represent an important trend

in DP flow measurement, they account for only a small percentage of the total DP transmitters sold. So they don't, by themselves, solve the problem of determining how much money customers are spending on DP flow measurement.

Primary Elements

Therefore, stand-alone primary elements remain an important part of the picture, not only because of their cost, but also because they greatly add to the versatility of DP flow measurement. There are many different types of orifice plates, for example, that have different shaped orifices with different locations. Flow nozzles are widely used for steam flow measurement. And Venturi tubes are suited for measuring high-speed gas flows, especially in larger pipe sizes.

Anyone who wants to understand DP flow measurement should be aware of the different types of primary elements available and should also be aware of the advantages and disadvantages of each. Table 1 summarizes different primary element types, their applications, and their advantages and disadvantages.^{FC}

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The DP Flowmeter Market

A complete statement of the DP flowmeter market should include the following:

- The value of DP transmitters
- The value of primary elements

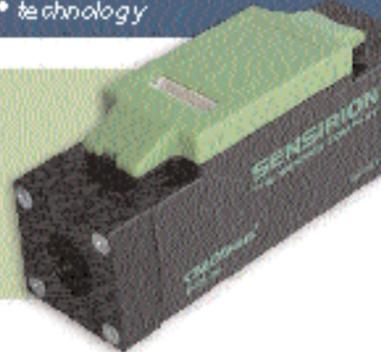
- The value of any additional pressure or temperature sensors or transmitters
- The value of any flow computers

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