Application

ABB Flow Measurement
ABB Compact Dp Flow Meters

Industry: General

Bi-Directional and Dual (Stacked) Range DP Flow Systems

The selection process for bidirectional and wide range flow metering can be limited by both application requirements and physical design constraints of a flow meter itself. Using proven concepts, ABB Compact DP Flow Meters can be employed while offering a reliable solution to these unconventional applications.

Bidirectional Flow

The need to measure flow rates within the same flow loop in opposite directions can be accomplished in two ways:
- Employ two meters with each having a different flow direction (Vortex/Swirl Meter, Orifice Plate, Turbine Meter, and Pitot tube).
- Install one meter capable of bidirectional flow by design. (Coriolis Meter, Wedge Meter, Pitot tube, Magnetic Flow Meter)

With the employment of two distinct meters, disadvantages of additional hardware costs, meter installation requirements (piping lengths), and the complexity of signal switching needs consideration. The maintenance aspect alone can be some times neglected but is an important factor when considering the total cost of operation. By using a meter that has been designed with bidirectional capabilities, cost aspects of procurement, operation and maintenance can be greatly reduced. Within the differential pressure flow meters category, technology advancements have been made that now allow easy set up of bidirectional signal processing within the pressure secondary itself.

Certain ABB Compact DP Flow meters take advantage of technologies that allow bidirectional flow to occur within one measurement device. Fig 1 depicts a typical compact wedge flow meter showing (insert) the concept of it's restriction in a symmetrical relationship to its pressure measurement ports. This allows one flow meter to be used in both the forward or reverse flow direction.

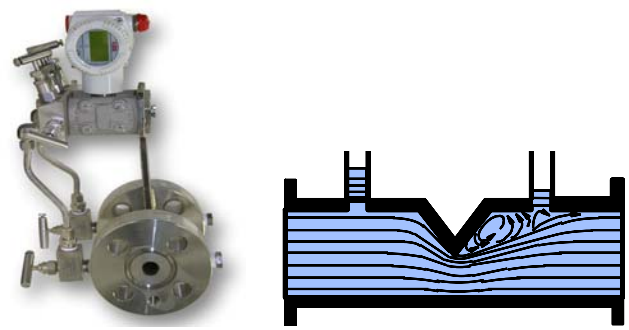

Figure 1 – ABB Wedge Flow Meter

ABB's Torbar Pitot Tube (Fig 2) is also capable of two way flow when suitably configured.

When coupled to a DP secondary, these flow meters can employ a split range output signal scheme that allows the receiving equipment (PLC, DCS etc.) to determine the flow direction and rate.

Figure 2 ABB Torbar – Bidirectional Configuration

Under this arrangement, the zero flow point is established based on the range of forward and reverse flow (Fig 3). For equal flow rates this becomes 12mA or 50% of the normal 4-20mA full scale electrical output. The flow direction is then indicative of the output value (4-12mA = reverse/12-20mA=forward) while the flow value is determined by the absolute value of the DP reading. (xx.x inches of water). For unequal ranges the "zero flow point" is a calculated value based on the DP reading of each flow direction

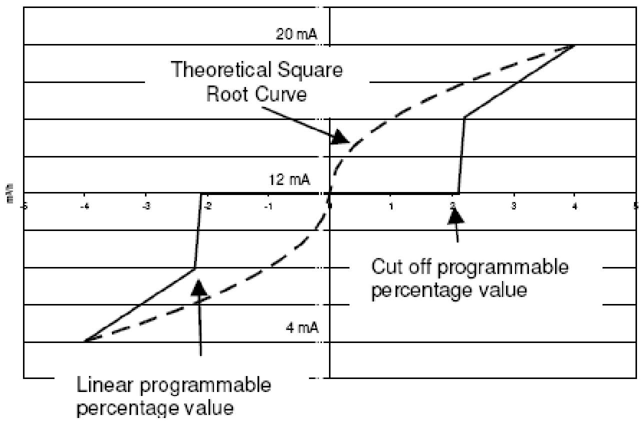

Figure 3 – Bidirectional Signal Output

Two examples of this type of range splitting would be as follows:

Example 1.
The desired flow range is 100 GPM in both directions and given the selected meter type, 80"W.C. represents 100GPM. The URV would be set to 80"w.c and the LRV a negative (-) 80"w.c. This positions the "zero flow point" at 12mA as indicated in Fig 3.

Example 2.
The desired flow range is 100 GPM in the forward direction and 22 GPM in the reverse directions. Using the same meter as in example 1 above, 80"W.C. again represents 100GPM. However for 22 GPM, the equivalent DP would be 5.0" w.c. The URV would be set to 80"w.c and the LRV as a negative (-) 5.0"w.c. This positions the "zero flow point" at 4.9mA.

By employing one of the above examples, operators have the ability to monitor both the flow rate and direction while keeping installed equipment to a minimum.

Dual Range (Stacked) Flow Systems

Many flow metering devices are susceptible to reduced performance at low flow rates or as commonly expressed - high turn down ratios. This can be especially true for Differential pressure flow meters, but can be easily overcome when other technologies having expanded capabilities are not suitable for a particular application.

Stacking involves two or more transmitters coupled to a single flow device, each having a different flow range, and continuous monitoring of all signals. At a predetermined set point, the flow reading will switch from one transmitter to the other using a simple algorithm in the PLC, DCS, or computing device. This change over set point is optimized to achieve the best performance possible from each transmitter as seen in the example below. Here the table shows the value of DP vs. flow rate at the point of Upper Range Value (span setting) and Lower Range Value (low end cutoff) for each transmitter and the expected flow system error assuming an ABB Wedge meter as the primary device.

	Xmtr. No 1 URV	Turn Down Ratio	Xmtr. No 2 LRV	Xmtr. No 2 URV	Turn Down Ratio	Xmtr. No 2 LRV
Trans Value "w.c.	109	7.3	15.0	15.6	7.1	212
Flow Range GPM	1500	2.7	525	566	2.6	212
Flow Error	.51%		0.71%	.51%		0.68%

Had this application use only a single transmitter to cover the full flow range, the expected flow error at the LRV of 212GPM would be in excess of 3.3%.

This same principle can be applied to all ABB Primary DP Flow solutions and is able to be enhanced further when using multivariable transmitters for compensation of compressible fluid flow (gas or vapor).

For further information and support in employing these application principles please contact your local ABB Sales representative or visit www.abb.com/flow

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