Real-Time Dynamic Compensation for Static Pressure Effects

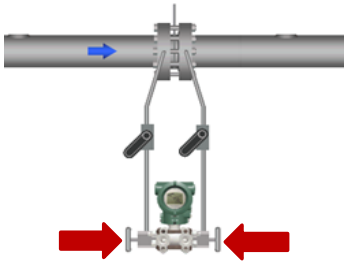
Performance under pressure - DP Transmitter

Accurate measurement is vital to efficient plant operation and plant safety. When selecting a transmitter, a lot of attention is paid to the ***Reference Accuracy*** noted in supplier's specification documents. Reference Accuracy gets its name because the accuracy is based on a set of reference conditions. The reference conditions dictate a certain temperature, humidity, and static pressure for the Reference Accuracy to be measured in a laboratory setting. In the real world, DP Transmitters are rarely installed in a laboratory and never under the rigid confines of those reference conditions; therefore, ***Real-world Performance*** (**RWP**) is always worse than the Reference Accuracy. To improve RWP, all smart transmitters on the market compensate for variations in temperature; but, Yokogawa's sensor used in the EJA-A series, EJX-A series, and EJX-B series is unique in the market place because it can compensate for effects in static pressure change as well. This ability is referred to ***Real-time Dynamic Compensation*** .

Static Pressure Effects

Using differential transmitters to measure flow and tank level are examples of applications where variations in static pressure can effect the differential pressure readings of a transmitter.

Flow Measurement



$\Delta P \approx \text{Flow}^2$

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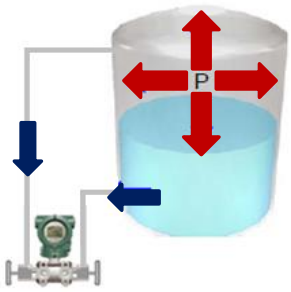
Level Measurement



$\Delta P \approx$ Process Level

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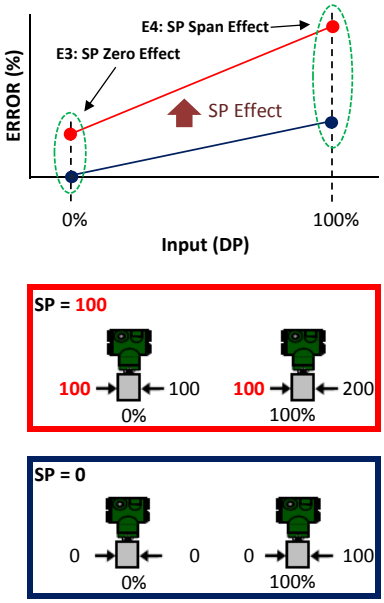
Static pressure (SP) is applied equally to both the high-pressure side and the low-pressure side of a DP transmitter and can vary the linear characteristics of the DP signal output. The effect is called ***Static Pressure Effect*** . This characteristic has both Zero Effect and Span Effect components.

Static Pressure Zero and Span Effect



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To quantify the impact, Real-world Performance (RWP) can be calculated per published specifications and process conditions. RWP is a combined error of Reference Accuracy (E1), Temperature Effect (E2), Static Pressure Zero Effect (E3) and Static Pressure Span Effect (E4).

Competitors state that the static pressure zero effect (E3) can be zeroed at line static pressure during the setup of the transmitter. In many flow measurements or process level applications, static pressure is not maintained at a constant value. As operational conditions change, the static pressure exerted on the DP transmitter varies. Hence, the static pressure zero effect (E3) cannot always be cancelled by zeroing at line static pressure during setup. This effect cannot be neglected when evaluating the real-world performance.

Yokogawa's Full Dynamic Compensation

Yokogawa's silicon resonant sensor is a true multi-sensing platform. It can measure differential pressure, static pressure, and temperature in one compact sensor chip. This multi-sensing sensor allows the transmitter to use correction coefficients stored in the sensor's ROM to compensate for fluctuations in static pressure and temperature to reduce the static pressure and temperature effects. The correction coefficients are unique to each sensor and are generated at the factory through rigorous testing (See **Figure 1**).

Alternate Sensor Technology

Capacitive sensor technology used in the marketplace is not capable of multi-sensing. It can only measure differential pressure. The DP transmitters using this type of technology incorporate a resistive temperature sensor near the capacitive sensor to compensate for temperature fluctuations; but, they do not add a separate sensor to measure static pressure for static pressure fluctuations. Therefore, these transmitters are not capable of minimizing the static pressure effect (See **Figure 2**).

Figure 1 Yokogawa's Multi-sensing Resonant Sensor Technology

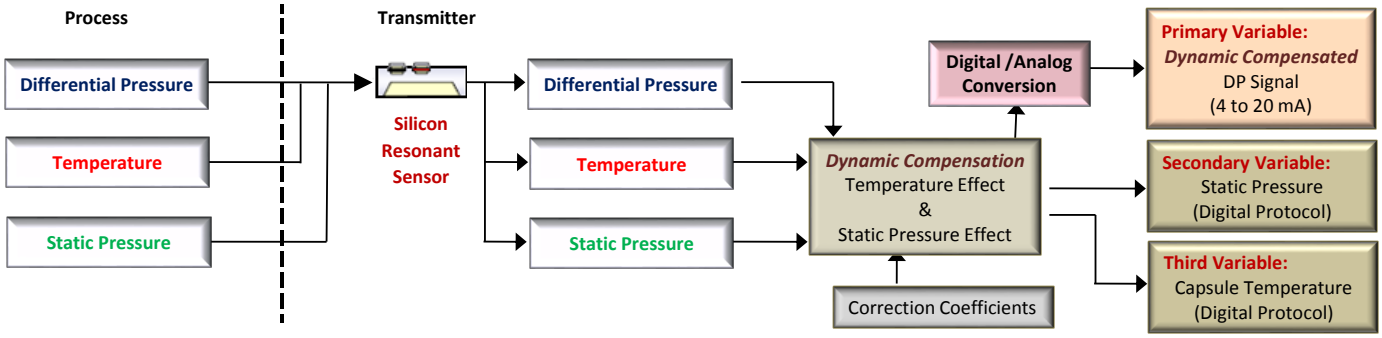

Figure 2 Capacitive Sensor Technology

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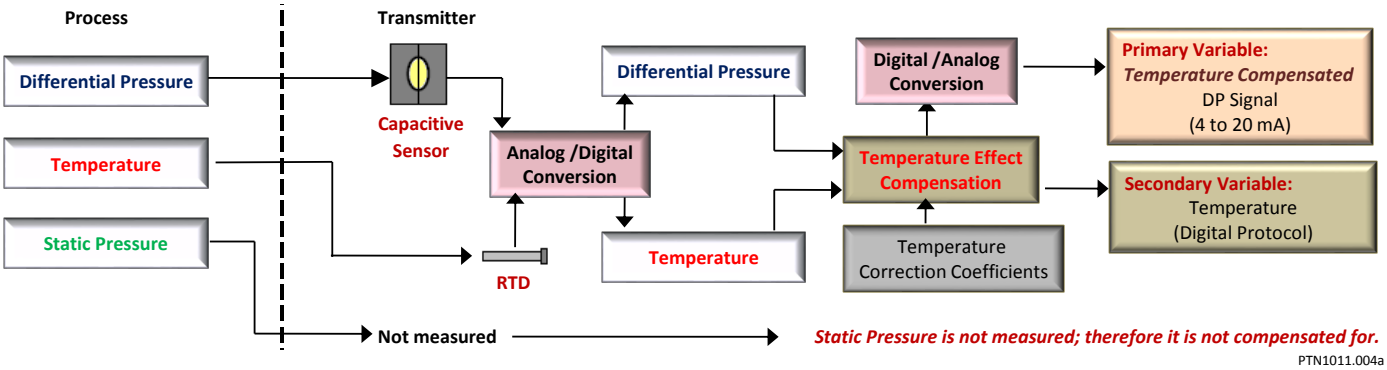

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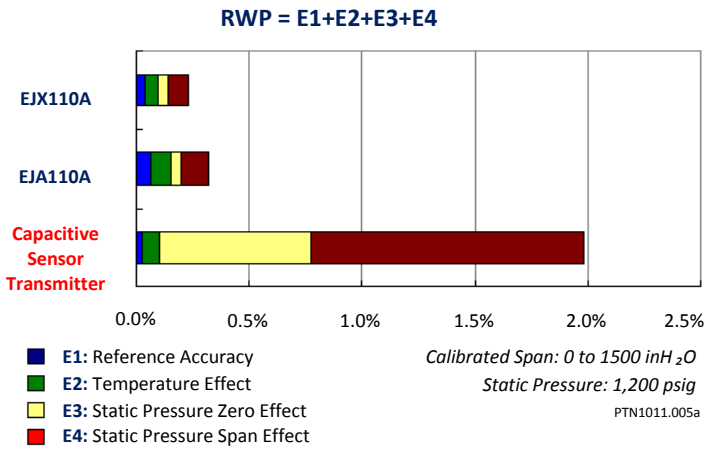
Figure 3 Comparison of Real-world Performance

Conclusion

Even in high static pressure applications, Yokogawa's EJA-A / EJX-A / EJX-B series dramatically reduces the static pressure effects and provides superior total performance. Using the published specifications, the Real-world Performance can be calculated for comparative estimates (See **Figure 3**). Note that the Reference Accuracy is the smallest component of the calculations.



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