Honeywell

Technical Note

SmartLine Pressure Transmitter Total Response Time

SmartLine pressure transmitters deliver a new level of efficiency and safety throughout the plant lifecycle either when operating stand-alone or when integrated with a process control system. For example, to improve process control, SmartLine products offer industry-leading response time metrics to ensure fast reactions to process changes.

Transmitter Response Times

Overview

Some process control applications need the instrument's ability to provide fast reactions to process changes. Typically, faster response times mean better and tighter control. If an application needs a fast response measurement, it's important to understand what aspects of the transmitter's specifications are meaningful in calculating that response time.

Response Time - Industry Standard Definition

The response time of a pressure transmitter is the total time required to respond to an input step change in pressure. The step change is a 100% step change and the measurement of this step change is the total time from the start of the pressure change until the transmitter's 4-20mAdc output reaches 63.2% of the total change (1 time constant). To provide the most accurate results, these measurements are typically based on a pressure release versus a pressure build to minimize additional delays caused by system test equipment. Figure 1 provides a diagrammatic overview of response time measurement. Total device response time must include the following elements:

- Delay or Dead Time
- Update Rate (Electrical System Response Time)
- Mechanical System Response Time

Only when all three of the above are considered can the actual device response time be determined.

Using the calculation, SmartLine total response times are:

- Differential Pressure: 90ms
- Gauge & Absolute Pressure: 80ms

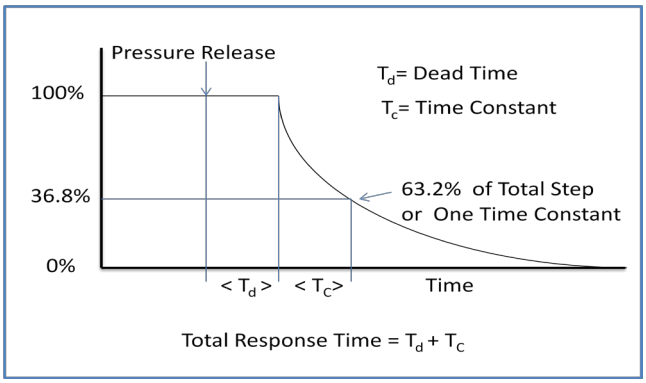

Figure 1. Response Time Curve

Delay Time or Dead Time

Before responding to an actual step change by adjusting its output, any digital transmitter must first determine the nature of the input change (noise or actual process change). The time necessary to do this is referred to as the transmitter's dead time or delay time. During this period, the transmitter exercises proprietary algorithms to ensure a real process step change has occurred before reacting with an output change. This is referred to as T_d in figure 1.

Update Rate

All digital transmitters have an update rate associated with the speed at which the internal microprocessor is operating. The speed of the processor in combination with the internal software algorithms execution times determines how fast the transmitter can complete all the necessary calculations and update all the associated transmitter parameters. Because there are additional system delays as indicated above, the update rate alone is not the transmitter's response time. The update rate is simply a measurement of how fast the internal algorithms and electrical system response can be completed. In addition to the update rate, other factors such as the previously discussed dead time aspect play a significant role in determining the transmitters total response time.

Mechanical System Response

In addition to the dead time and time the electrical system requires to update the output, the mechanical or hydraulic response of the transmitter must also be considered. When the process pressure changes, it results in forces on the transmitter's hydraulic system. Additional time is required to transmit these forces to the actual measurement sensor.

Summary

When considering response time as a meaningful comparison specification, ensure you use the **total** response time associated with the transmitters and not only one of the sub elements. Many times 'update rates' are inaccurately provided as the 'response time'. Remember that from a process perspective, it is the total response time that will impact your process performance. The other elements only support the transmitter's ability to provide that level of response.

For reference purposes, Honeywell SmartLine pressure transmitters provide the following performance:

- **Total Response Times**
  - Differential Pressure = 90ms
  - Gauge & Absolute = 80ms
- **Sub Elements of Response Time**
  - Dead Time = 40ms
  - Update Rate = 20 ms or 50 times/sec

For More Information
Learn more about how Honeywell's SmartLine Pressure Transmitters deliver value across the entire plant lifecycle, visit our website www.honeywellprocess.com/smartline or contact your Honeywell distributor or account manager.

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