Temperature transmitters: Analog is still in, but smart is making its move

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Temperature transmitters are widely used in the process industries to convert input from temperature sensors to a form suitable for transmission over long distances. Without temperature transmitters, it would be very difficult to send temperature signals accurately from thermocouples (T/Cs) and RTDs (resistance temperature detectors) to a distributed control system (DCS) or controller located in a control room.

This article looks at the latest developments in the temperature transmitter field as revealed by a recent marketing study. But we'll begin with a quick look at where and when transmitters are required.

The direct-connect solution

In applications where a temperature sensor signal does not have to tra vel more than fifty to one hundred feet, en gi neers of ten fore go the use of a trans mitter and di rectly connect the sensor to the monitoring or controlling device. While this simple direct-connect approach can sometimes be quite cost effective, there are disadvantages that must be considered. For starters, when the typically weak temperature sensor signal is not converted to a 4-20 mA or digital output form, it is more susceptible to being degraded or corrupted during the transmission process- either due to the distance involved, or to interference from other signals.

Also, the cost of the connecting wire can be substantial, both in material and labor costs. If the sensor is a thermocouple, the transmitting wire must match the type of thermocouple. This might not be an issue if the thermocouple is located only five or ten feet from the monitor or controller. But if the signal has to travel any distance, the cost of the wire and the labor cost can be significant. These costs must be weighed against the cost of a temperature transmitter. Since some temperature transmitters are available for less than $100, and other good-quality analog temperature transmitters can be purchased for several hundred dollars, temperature transmitters can be an attractive op tion. In larger process plants that use digital field devices and consider temperature values to be critical, end-users may also decide on a "smart" or even a fieldbus transmitter.

Temperature transmitter types

There are five main types of temperature transmitters: low-cost, analog, programmable, smart, and high-tier. The chief differences are as follows:

- Low-cost temperature transmitters sell for $100 or less, and have fixed ranges;

- Analog transmitters have a 4-20 mA output and cost over $100;

- Programmable transmitters have a 4-20 mA output, are microprocessor-based, and are locally configurable;

- Smart transmitters are microprocessor-based, have digital output, and are capable of two-way communication;

- High-tier transmitters accept input from more than one temperature sensor, and have a higher degree of accuracy than smart units.

Installed base

Installed base has to do with how many products are already out there in the marketplace, as opposed to how many are sold in a given year. The question of installed base is important because there is a strong tendency for users to order instruments or sensors of the same type when ordering replacements-"replacing like with like." For this reason, installed base has a strong impact on end-user purchasing patterns.

Flow Research and Ducker Research, in cooperation with I&CS, conducted an extensive survey of end users of temperature transmitters and sensors. One question pertained to the installed base of temperature transmitters. The survey results (Fig. 1) show that analog transmitters account for 54 percent of the total temperature transmitters currently in use by participants. Smart transmitters account for 26 percent, and 14 percent of temperature transmitters currently in use are programmable. Low-cost transmitters account for five percent of the total, while fieldbus temperature transmitters make up less than one percent. Other temperature transmitters make up the remaining one percent. Fieldbus transmitters are a subset of high-tier transmitters. High-tier products, as well as HART transmitters, are included in the "smart" category.

FIG. 2. Rosemount's Model 3244 temperature transmitter.

Even though the market as a whole is moving toward programmable and smart transmitters, the large installed base of analog transmitters means that this shift will occur as a slow migration rather than a headlong rush. Given the tendency of end-users to replace like with like, users will, in many cases, order an analog transmitter to replace an analog transmitter, even if they could, in theory, replace that analog transmitter with a programmable or smart device.

FIG. 3. Honeywell's STT 350 temperature transmitter.

A look back at the history of smart

In this context, it is useful to look at the history of smart instrumentation. Honey well introduced the first smart transmitter (for pressure) in 1983. It took at least eight years until users started buying smart transmitters in any kind of quantity. It wasn't until the mid-1990s-12 years after the technology was introduced-that shipments of smart pressure transmitters began to outnumber other types.

IG. 4. Accutech's AI-1500 temperature transmitter.

The adoption rate for smart temperature transmitters lags the adoption rate of smart pressure transmitters by about ten years. Reasons for this include:

- The first smart transmitter was a pressure transmitter, not a temperature transmitter.

- Measuring pressure is inherently more complex than measuring temperature, increasing the average selling price of pressure transmitters. Adding smart features to a pressure transmitter results in a smaller incremental cost than adding smart features to a temperature transmitter.

- The category of programmable temperature transmitters enables users to upgrade to advanced features without stepping up all the way to smart. Even though functionally there are parallels, there

FIG. 6. ABB's TH 202 temperature transmitter.

is no generally recognized category of "programmable" pressure transmitters. There is a trend to add microprocessors to pressure transmitters, even in the low-cost category. Some of these microprocessor-based pressure transmitters might get classified as "smart" even though they do not have full-fledged smart features. In temperature, because there is a separate category of programmable transmitters, microprocessor-based transmitters that do not have additional smart features, such as the ability to handle two-way communication, get classified as programmable rather than smart.

A look ahead

. 5. Moore Industries' TDZ temperature transmitter.

The growth of high-tier temperature transmitters is one of the most exciting new developments in this market. Some of the companies with market entries include Rosemount (Fig. 2), Honeywell (Fig. 3), and Accutech (Fig. 4). Companies bringing out new products include Moore Industries (Fig. 5), and ABB (Fig. 6). Pro grammable transmitters will continue to be popular for those analog users who want to upgrade without going all the way to smart. Despite their large installed base, sales of analog temperature transmitters can be expected to decline over the next several years.

About the author

Jesse Yoder, PhD, has thirteen years of experience as an analyst and writer in the process control field. He specializes in flowmeters and other field devices, including level, pressure, and temperature products. Prior to founding Flow Research, Yoder served as an analyst for several other market research companies. He has written more than twenty five market research studies on various segments of the industrial automation and process control field. His most recent study is titled The Market for Temper ature Sensors and Transmitters in the Americas. The author, will be available to answer any questions you may have about this article. He can be reached at (781) 224-7550 during normal business hours, or by e-mail at jesse@flowresearch.com.

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