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Transmitters: What are your choices?

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They boil down to three levels of sophistication– each of which comes with its own set of advantages and drawbacks.

Transmitter options continue to increase as new developments add more and more capabilities to these widely used devices. With so many choices, selection can be difficult. The following overviews the pluses and minuses of the three main transmitter types to help you decide which are most suitable for your applications.

The three types of transmitters are:

- Analog or hardware-based, which represent the low end on cost and performance;
- Smart fieldbus/intelligent transmitters, which represent the high end due to the many capabilities they offer, including communication with host control systems, computers, and programmable controllers;
- Microprocessor- or software-based models, which offer some of the features of the high end, but, like the simple 4-20 mA devices, lack the communication capabilities. *(For a comparison of the three types turn to the table on p. 64.)*

Analog devices: Still very popular

Conventional analog transmitters are still the biggest sellers *(Fig. 1)*. Why? Because basically, they're reliable and relatively inexpensive.

On the down side, they use potentiometers for adjustment and often require lengthy procedures for calibration and span adjustments. In addition, newer devices provide much better accuracy and aren't as susceptible to drift.

Conventional sealed analog transmitters have yet another potential problem: generally, their calibration and current output adjustment potentiometers are located inside a sealed enclosure, allowing the atmosphere (with all of the humidity and/or corrosive fumes that it might con-

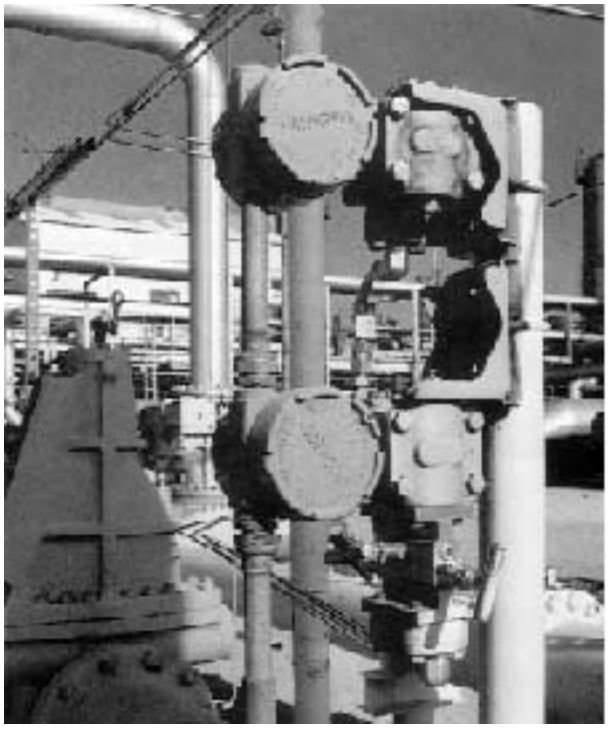

FIG. 1: Conventional transmitters, like the Rosemount 1151 Series shown, are the workhorses of the industry. They function in the worst of conditions and provide a 4-20 mA output. Their price advantage and reliability helps guarantee their long-term use in many applications and facilities.

FIG. 2: Intelligent transmitters, such as Johnson Yokogawa's UNIDELTA BRAIN and HART devices, support proprietary and open fieldbuses. They are configurable over a digital fieldbus and can report back failures.

tain) to enter the enclosure during calibration. On some models, the potentiometers may be located externally; these, however, may allow the atmosphere to enter around the potentiometer mounting screws.

Smart transmitters

At the high end of the cost and performance spectrum are the intelligent transmitters that work on a fieldbus network (*Fig. 2*). These are significantly more advanced than all of the other types, but require compatible interface equipment, including smart sensors and the correct fieldbus protocol (or language). Intelligent systems enable calibration and troubleshooting using simple computer interface equipment such as touchscreens or keyboards, or can be configured remotely from a host device. They have true bidirectional communication, providing measurement integration with the transmitter vendor's control system.

A problem faced by current users of these transmitters is that we are still waiting for a true fieldbus standard. Groups such as the new Fieldbus Foundation (which was formed through a merger of ISP and WorldFIP) and the ISA SP50/IEC committees are working hard to develop standard fieldbus protocols. And other fieldbus protocols, such as HART and PROFIBUS, already exist. But a single dominant international fieldbus standard for the industry has yet to be established. When such a standard is determined, measurement integration will be expanded to a multivendor environment.

However, in the meantime, while there are so many protocols vying for acceptance, many vendors have temporarily solved the problem by offering devices with a selection of protocols. If you are contemplating going with a specific protocol, it is important to ask beforehand if a vendor will continue to support that protocol should it become apparent that the protocol no longer fits in with the path that standards groups are taking.

Standard protocols or no standard protocols, if you decide to go with smart transmitters, you'll find that these devices can greatly simplify wiring and control strategies for large systems by allowing you to connect many transmitters in parallel on a single loop. This approach, which is known as multidropping, can enable the connection of up to 15 or more transmitters using just one two-wire loop. If you are retrofitting, you'll want to make sure that your existing wiring is compatible with whatever fieldbus you end up using. Otherwise, you may be in for a rewiring job. Of course, if it's a new facility, wiring won't be a problem.

In a smart fieldbus system, when a transmitter fails, a replacement can be installed, and the calibration information stored in the distributed control system (DCS) can be downloaded to the trans-

Comparison of transmitter types

	Traditional analog	Smart/intelligent transmitter*	Microprocessor-based
Cost to purchase/maintain	Medium	High	Low
Time to set up and calibrate	20 - 30 minutes	1 - 3 minutes	3 - 5 minutes
Equipment req'd for calibration	Signal generator/DMM	PLC or DCS	None
Sensor diagnostics	None	Yes	Some/varies from mfr to mfr
Output signal	4-20 ma	Digital, fieldbus, or serial	4-20 mA
Direct link to recorder/valve	Yes	No	Yes
Internet control strategy	No	Yes (varies from mfr to mfr)	No

*[illegible] output (e.g. HART or SP50) and devices with RS-232C or RS-485

mitter. While DCSs usually won't accept a smart signal using a different vendor's protocol, they will accept a 4-20 mA signal from any vendor's equipment (analog or µP-based). Thus, they are generally compatible and can be added to the system.

Microprocessor-based transmitters

Microprocessor-based transmitters don't offer fieldbus communications. As a result, remote configuration isn't possible, nor can you communicate the additional process parameters that can be conveyed over an intelligent fieldbus system.

The benefits of µP-based transmitters include push button programming of calibration and current output parameters, along with diagnostics. And they offer these features without the additional system programming and communications requirements of the intelligent fieldbus models.

Their fully isolated 4-20 mA, two-wire signal can be connected directly to an inexpensive recorder, a positioner on a control valve, a current-to-pulse converter, or even a data acquisition device or programmable controller *(Fig. 3)*. The 4-20 mA signal can also be verified, if necessary, using a standard multimeter.

Most microprocessor-based units have many of the same benefits of their higher-priced fieldbus counterparts. For example:

- They are calibrated by having an engineer or technician enter data into the microprocessor via a sealed push button on the front of the device.
- Surface-mount technology has helped to hold down manufacturing costs.
- Electronic filtering can be used to ensure protection from static discharge and electromagnetic fields.
- The long-term stability of the microprocessor enables the units to be sealed in epoxy for more environmental protection.

Microprocessor technology also enhances other functions. For example:

- On pH and ORP systems, it improves sensor recognition, and makes possible easy calibration using automatic buffer recognition. Basic sensor/system diagnostics are also possible.
- On flow systems, the microprocessor enables flexible, quick, push button calibration of range and a digital readout of flow in any engineering unit. Simple security code access can prevent tampering with calibration and range parameters.

FIG. 3: Microprocessor-based transmitters, such as George Fischer SIGNET's Compak™ flow, pH and ORP transmitter shown, provide push button programming of calibration and current output parameters, along with diagnostics.

The standalone microprocessor transmitter can provide simple system operation without digital communication interfaces to the sensor and data devices. For those wishing to establish a direct 4-20 mA current signal to a standalone device such as chart recorder or valve positioner, the microprocessor-based design offers simple installation and calibration, and basic diagnostic information. And the isolated 4-20 mA signal allows the unit to be retrofitted into any system in which a conventional analog transmitter is used.

Look at your application

Because of their bidirectional capability, fieldbus-based smart transmitters are gaining acceptance in the marketplace. But until a true standard fieldbus emerges, their higher initial cost may not be as easy to justify and, thus, their application could continue to be limited.

On the plus side, the lower maintenance costs and fewer on-site visits required by smart fieldbus-based devices do help to offset their higher initial investment. And, in a larger distributed control system, the information brought in by these devices would prove valuable in

keeping tighter control of the process.

A major advantage of 4-20 mA-based microprocessor-based transmitters is their ability to be calibrated and spanned without the use of external devices such as signal generators or ammeters. At the same time, they provide many of same advantages of their fieldbus-based siblings. In addition, they work with conventional I/O systems and multiplexers, and generally require less calibration than standard analog transmitters. For retrofits in existing applications in which analog units have been the norm, microprocessor-based devices can be directly substituted for aging analog devices without rewiring.

When it comes to cost effectiveness and simplicity, analog 4-20 mA transmitters will continue to be the sensing/communication device of choice for years to come. This especially will be true for applications in which devices can be easily accessed and replaced.

About the author

Lori McPherson is the analytical product manager with George Fischer, Inc. (formerly George Fischer Signet) on assignment in Baltimore, MD. Previously she held engineering positions at AT&T, Polyclad Laminates, and Eastman Kodak. She has a BSChE from Purdue University, and an MS degree in systems engineering from Virginia Polytechnic Institute.

For more information...

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