Ways to check your temperature

Jonathan Wolfe describes the latest trends in in-head temperature transmitter development.

ALTHOUGH at first glance it may appear that in-head temperature transmitters are basic, commodity products whose development is relatively static, nothing could be further from the truth. In fact, their technology has advanced significantly since the initial bulky analogue devices of the early 1960s.

Strong market pressures on manufacturers to reduce size and cost, whilst improving performance and flexibility, have had a major impact over the last few years, with customers ever-looking for a low 'cost of ownership' product. As a result, significant investment is now needed to stay ahead in this highly competitive market place. Some manufacturer of temperature transmitters are now pioneering innovative products which meet the dichotomy of lower prices and increased performance, especially in terms of legislative approval compliance such as EMC and CENELEC. Temperature transmitters fall broadly into two main categories: analogue and digital. Both types of transmitter offer their own specific advantages, primarily in terms of cost versus performance and features.

Analogue transmitters

These simple devices are still widely used in many industries and offer the user simple, reliable technology at low cost. Early analogue transmitters were necessarily bulky due to component size and technology and were 'hand built' using conventional components. Advances in surface mount technology and new component designs have allowed engineers to reduce the overall size allowing the transmitters to be manufactured to the same dimensions as a connecting block thus enabling them to fit within a standard temperature probe housing. This envelope has, in the majority of cases, remained unchanged and become the industry standard.

Unfortunately, standard analogue devices are limited in their flexibility. Typically, they are made to order or require individual set-up via solder links and potentiometers. What's more, units are specifically designed for particular temperature sensors only. These shortcomings increase stock holding and spare part inventory for distributors and users as well as increasing delivery times. Most manufacturers have tended to neglect analogue transmitter development in recent years, preferring to focus their efforts on digital technologies. Status, however, have recognised the importance of this market sector and made a significant breakthrough by combining the performance of a digital device with the simplicity of re-ranging resulting in a new low cost versatile transmitter.

Some new models use the latest surface mount technology and have a unique push button set-up feature. Instead of having to manually solder links inside the unit to select the temperature range and then adjust potentiometers, calibration is done simply and swiftly via an internal push button switch. The built-in LED indicates correct set-up. A thermocouple version achieves full galvanic isolation through the use of the internal transformer instead of relatively costly opto-isolators and has thus allowed price reductions over the analogue models with a much higher performance unit and an extremely simple calibration/set up procedure.

Digital

Modern digital 'smart' transmitters offer distinct advantages for both suppliers and users in terms of performance and product flexibility. One basic unit can be configured very quickly, via PC, for different sensor types, operating range and damping parameters - factors that significantly reduce stock holding requirements and virtually ensure ex-stock delivery. However, the increased sophistication in smart devices has significantly increased the electronic component count - a factor that places severe challenges on manufacturers.

Some companies have developed remarkable packaging skills to keep new designs within the standard in-head space envelope. In parallel, the designs must also meet the stringent EMC requirements for both immunity and emissions. Despite these restrictions, room has been found to incorporate physical barriers for the all important input-output isolation. Although some transmitter manufacturers rely on the probe itself to provide the isolation, Status Instruments is a firm advocate of integral isolation barriers within the transmitter, ensuring that none of its designs can malfunction through ground loop errors. Through skilful electronic design, Status has also retained its standard plastic enclosure with the products still meeting the most stringent EMC requirements. As with everything, advanced technology has its critics and some users question the reliability of modern digital transmitters. To help counter these negative impressions, Status offer a ten year warranty on parts and labour for its latest HART transmitters.

Information transfer

Temperature transmitters have retained their 4-20mA output across the range of designs. This faithful and reliable output has withstood the test of time throughout dynamic development changes and with digital devices it is now possible to define the failure mode as either 'hi' (upscale) or 'lo' (downscale) status.

Use of fully HART compatible devices has increased over the past decade. HART (Highway Addressable Remote Transducer) is a communications protocol used to 'talk' to field devices digitally whilst, at the same time, using the industry standard 4-20 mA analogue transmission. It is widely used in process industries such as chemical, oil refining, pulp and paper, food and pharmaceuticals. HART was developed by Rosemount in 1988 and then made the technology available to other vendors. It later formed a user group followed by the independent, non-profit making, HART Communications Foundation (HCF) of which Status Instruments is a member along with such 'blue chip' companies as; ABB, Endress and Hauser, Siemens, Yokogawa and many others. There are now over 100 members of the HCF and over two million installations. The HART Communications Foundation effectively manages the standard and ensures that all HART members offer compatible products that fully conform to the standard.

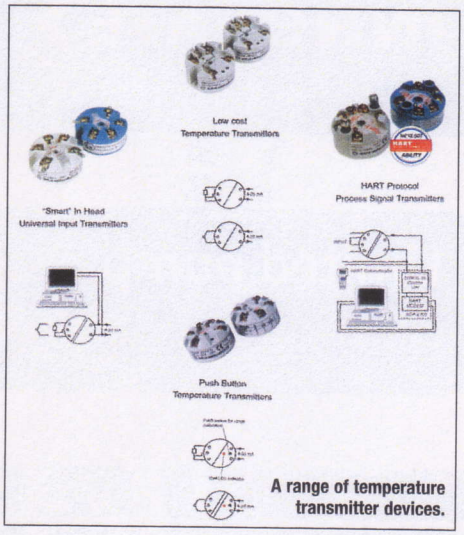
The HART protocol uses the Bell 202 frequency-shift-keying (FSK) standard to superimpose a sinusoidal signal on top of a 4-20 mA analogue signal. The FSK technique means that digital signals and the analogue4-20 mA can be used concurrently. Therefore HART provides bi-directional data interchange whilst maintaining compatibility with older 4-20 mA systems. Although it was originally conceived as master-slave, single loop implementation with up to two masters, there is also a multi-drop-operating mode accommodating up to 15 slave devices.

Such devices can be set up and calibrated via a PC or dedicated HART communicator. In order that customers can take full advantage of the facilities HART has to offer, Status have also invested in becoming AMS aware (Asset Management Solutions™). This AMS software package, which provides numerous benefits to the user including on-line calibration and predictive maintenance, interfaces to various devices through the use of Windows Resource Files

Hazardous area

Versions of both analogue and digital devices are available for use in hazardous areas. Due to the low power characteristics of transmitters, protection is provided by way of intrinsic safety, with products meeting both CENELEC and FM (Factory Mutual) requirements.

The advent of fieldbus has sparked both advancement and controversy in control instrumentation circles but, despite the appearance of the first fieldbus compatible devices, this technology has, so far, had little or no impact on the temperature transmitter market. Brian Turner, founder and MD of Status Instruments, firmly believes that it will take another 10-20 years before fieldbus becomes a realistic standard for devices such as temperature transmitters.



A range of temperature transmitter devices.

In the meantime he expects the low cost simple 'push button' devices for the low end applications and HART compatible digital transmitters for the more demanding applications, to enjoy continued growth and development. "The proprietary 'smart' devices are likely to become squeezed in the middle" Brian says." As the price versus performance continues to fall, manufacturers must continually adapt to keep pace with these demands."

Jonathan Wolfe is director of W & B Instruments, the Australian agent for Status Instruments (UK).

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