

## Pentronic's miniature transmitter – the two-year track record Stable and very accurate

Pentronic's miniaturised PAT1101 transmitter has been in production since 2009. It is supplied as an OEM component to machine builders. In practical use it has proven to deliver on its promises: easier installation and significantly improved accuracy.

The transmitter is supplied integrated with a Pt100 temperature sensor. The entire unit is calibrated and then adjusted, which means that the total measurement error is far lower than is the case with a separate sensor and signal transmitter.

"In addition, the probe tip and the sensor as a whole are designed for the specific measurement task, thereby further improving performance," says Pentronic's sales manager, Roland Gullqvist.

The transmitter itself is no larger than a thumb, measuring Ø16 x 60 mm including the M12 connector. Size, though, has nothing to do with performance. The printed circuit board contains high-performance electronics with high resolution and a wide measuring range from -200 to +800 °C.

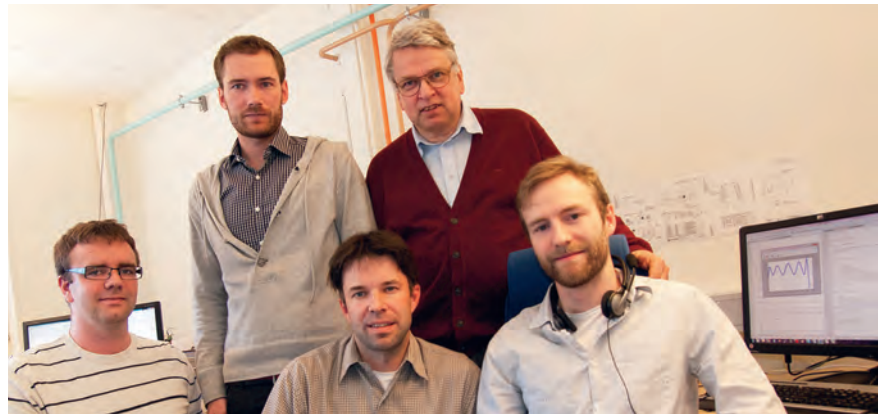
### Only as a unit

First-class electronics, though, are not enough by themselves. The measuring range and the accuracy of the readings, which come in the form of a 4-20 mA process signal, are determined by two factors: the temperature sensor's design and the post-calibration adjustment. That is why Pentronic does not supply the transmitter separately but only together with a temperature sensor.

"However," Roland explains, "there are two versions of the sensor – one with the transmitter built into the sensor, and the other with the transmitter supplied as a separate unit connected to the sensor by a four wire signal cable. In both cases the entire assembly is adjusted prior to delivery."

### Tougher requirements

Customers' demands for the transmitter are not being driven primarily by a desire for accurate electronics alone, but rather by increasingly tough industry requirements for better total measurement accuracy. Not long ago, it was often sufficient to keep a measurement error within whole degrees. As quality demands and energy costs have



Kurt Eriksson (in the red sweater) with some of the team who are developing the new transmitter series.

increased, accuracy requirements have expanded down into tenths of degrees. This level of accuracy is extremely difficult to achieve in real-life conditions when using traditional equipment. That is why Pentronic developed not only a new transmitter but also an entire measurement system.

Final measurement accuracy depends on factors such as the measuring environment and temperature range. It is therefore important to adapt the probe tip to the task. For instance, the insertion depth into the measurement medium should be as long as possible. This reduces losses from the protective tube – that is, the dissipation to the surroundings of heat or cold, depending on what is being measured.

### Tenths of a degree


The increasing demands for accuracy are also due to an understanding of how the applicable standards for temperature sensors function. For example: A Pt100 IEC 60751 class A sensor must remain within  $\pm 0.15$  °C at 0 °C. This measurement uncertainty increases with the distance away from 0 degrees. At 150 °C the standardised tolerance is already  $\pm 0.45$  °C. On top of that come error contributions from the associated cabling and electronic systems. Even at relatively low temperatures the measurement uncertainty can shoot up to whole degrees or even more, when using a traditional measurement chain consisting of a separate three-wire connected sensor, a transmitter and a PLC.

"In contrast, by using system calibration, and by using this new miniature transmitter in ideal conditions, we can get down to tolerances of less than one-tenth of a degree," Roland says. (See "Straight from the lab" in this issue plus [\[Ref 1\]](#)).

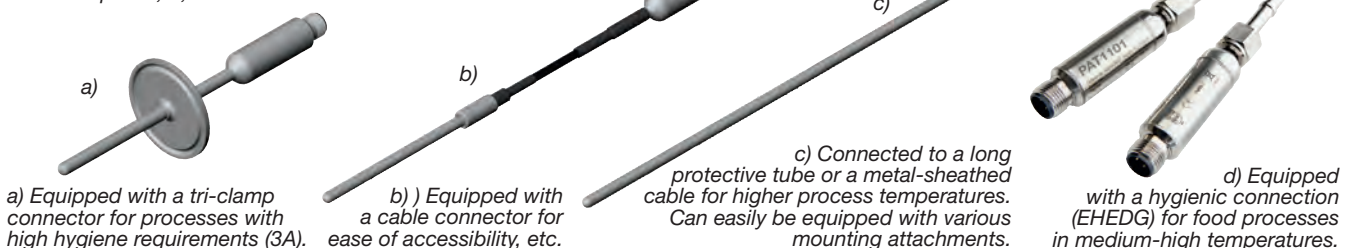
Some of the industries leading the way in adopting the new measurement technology are energy production, pharmaceuticals, food (with a sensor certified in accordance with 3A and EHEDG) and the vehicle industry. In addition to high requirements for accuracy, other factors driving this adoption are demanding environments with high ambient temperatures, corrosive substances, or extremely high or low process temperatures.

### Extensive testing

Pentronic has done long-term testing of sensors equipped with the new transmitter – and, as a curiosity, also installed in an old car, where the sensor was mounted in the engine compartment and was exposed to varying ambient temperature, road salt and vibrations. Since the sensor tests, the car has passed three official Swedish motor vehicle annual inspections and the transmitter and sensor are still measuring within their specification range.

In the autumn of 2011 the company will present a digital version of the transmitter. The measurement uncertainty of the digital version is equivalent to that of the analog version now in production; the differences lie in the transmitters' functions. 

The transmitter can be integrated with many different designs of Pt100 probe tips for measuring ranges within -200 to 800 °C. See examples a, b, c and d.



[Ref 1] See Pentronic News 2011-1, s. 4