Devices that seek “a small revolution of temperature measurement”, plus other noteworthy products

Compiled by: Chris Warner, Executive Editor

Here’s an item that’s been sitting in my “interesting” folder for a while, but thankfully it will still be news for at least a couple more years. Did you know that changes are expected for kelvin? Physikalisch-Technischen Bundesanstalt (PTB) – the counterpart to NIST in the U.S. -- along with the General Conference on Weights and Measures (CGPM), are determining a new value of the Boltzmann constant, the conversion factor between thermal and mechanical energy. Research groups must rely on a fundamental constant in order to redefine the thermodynamic temperature scale kelvin. According to the PTB, “only if several groups obtain the same result with at least two independent methods will a "water-free" definition of the kelvin become possible.” This news came to my attention via the folks at Mahr Federal, whose MarForm MFU 110 WP reference formtester is being used in the project.

Here’s how Mahr Federal’s announcement describes the project:

“As part of their work to precisely determine the Boltzmann constant, PTB needed to define absolute helium pressures. These were realized with the help of a pressure balance, the essential components of which were piston-cylinder systems. For the precise calculation of pressure, the geometry of the pistons and cylinders at ambient pressure had to be known exactly: hence, PTB's use of the reference formtester from Mahr. This highly precise reference unit is the world's leading instrument for tactile distance and diameter measurements in the measuring range of up to 180 mm.

“PTB used the White Point optical stylus system on the MarForm MFU 110 WP to measure the pistons and cylinders. White Point is an optical (interferometrical) stylus system for form measuring machines which allows form and diameter measurements of precision mechanical parts with tolerances of less than 1 µm. The optical system is based on a novel concept of short coherence heterodyne interferometry working with two wavelengths. Typical parameters are roundness, straightness, parallelism, angle and diameter. The small optical probe allows fast non-contact measurements of very small and hard-to-access geometries, and provides optical contact at two different angles.

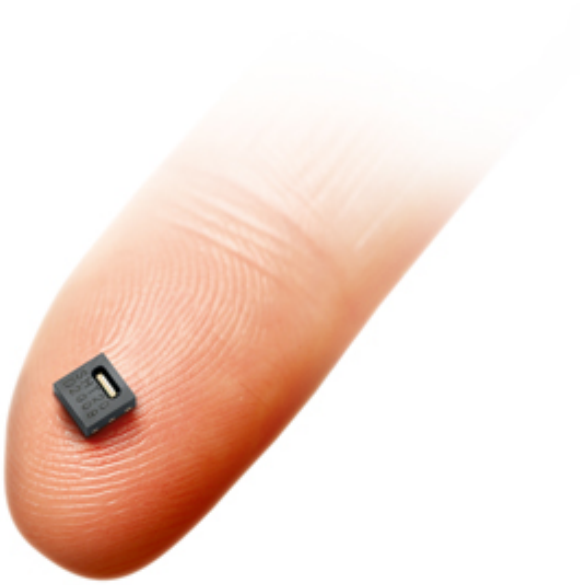
“The first approach to the calculation of the measurement uncertainty of the generated 3D geometry data showed that the dimensional 3D standard measurement uncertainties only amounted to 7 nm for the piston and 15 nm for the

cylinder. This results in a relative measurement uncertainty for the cross-sectional area of 0.7 x 10-6, which may well contribute to decreasing the measurement uncertainty for the Boltzmann constant as a whole.”

The project aims to bring about, as PTB puts it, “a small revolution in the field of worldwide temperature measurement“. With that in mind, here’s a look at some newly released products that are positioned to make a less lofty yet notable impact on temperature measurement in the more immediate future.

Mass airflow sensors use the latest MEMS and microelectronics technologies

POSIFA Microsystems’ PMF2000 Series of mass airflow sensors incorporate the latest MEMS and microelectronics innovations. The sensor die uses a pair of thermopiles to detect changes in temperature gradient caused by mass flow, delivering ultra-low noise-to-signal, and unsurpassed repeatability, according to the company. The "solid state" thermal isolation on the sensor die eliminates the need for surface cavities or fragile membranes, making the sensor resistant to clogging, pressure shock and mounting orientation. The PMF2000 series of mass airflow sensors covers the ranges from 10 sccm to 2000 sccm. The sensors are fully calibrated and compensated over the temperature range of 0 °C to 50°C (32°F to 122°F). The linearized analog output (1 V to 5 V) provides maximum flexibility and ease-of-use.



Humidity and temperature sensor suits high production volumes

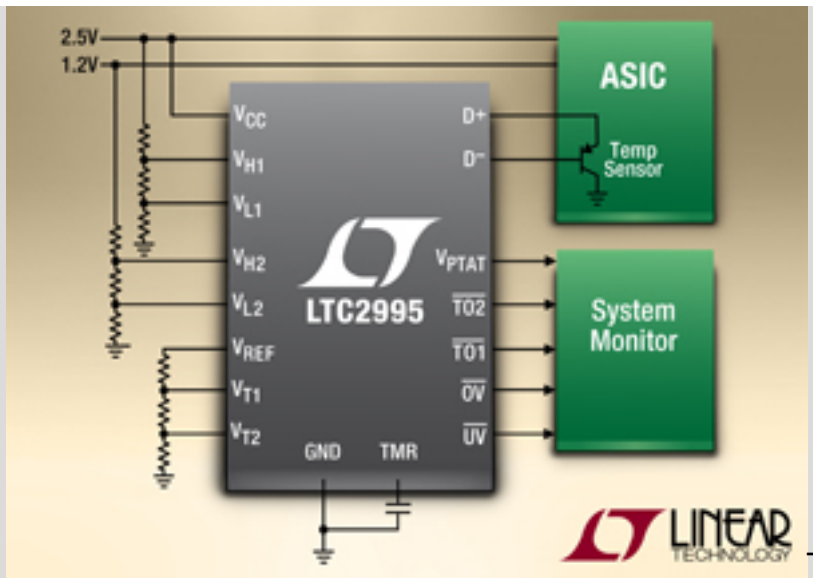
Sensirion’s low-cost SHT20 humidity and temperature sensor features a typical accuracy of 3 percent RH. The new sensor is suitable for price-sensitive applications, and it is distinguished by high long-term stability, full calibration and both digital and analog interfaces, according to the company. The sensor is based on the unique CMOSens technology, which is asserted to enable high production volumes with desirable value. The minimum order quantity is 1,500. Despite being less costly than its predecessor, depending on purchase volume, the sensor offers a temperature measurement accuracy of ±0.4°C and a measuring range of -40°C to +120°C. With a 3x3-mm footprint and 1.1-mm profile, it is presented as one of the smallest sensors in its class.

Medium temp dry block calibrators offer array of interchangeable multi-hole thermowell inserts

The new 350H and 350H2 medium temperature dry block calibrators from E Instruments are fast and reliable portable calibrators. These dry block calibrators offer an array of interchangeable multi-hole thermowell inserts. They are suitable for quick on-site calibration of resistance temperature detectors, T/C’s, bi-metal thermometers, temperature switches and temperature indicators. Features and characteristics include a temperature range from 10°C to 350°C, stability of ±0.3°C (350H) and ±0.4°C (350H2), accuracy of ± 1°C, and a display resolution of 0.1°C. Heating time for the 350 H is 20 minutes and 28 minutes for the 350 H2; cooling time is 45 minutes for the 350H and 60 minutes for the 350 H2. Stabilization time is 15 minutes, well diameter is 25 mm, and the well depth is 120 mm (350H) and 200 mm (350H2). NIST traceable calibration certificate is included.

Active pixel infrared thermometer array tackles costs associated with thermal imaging

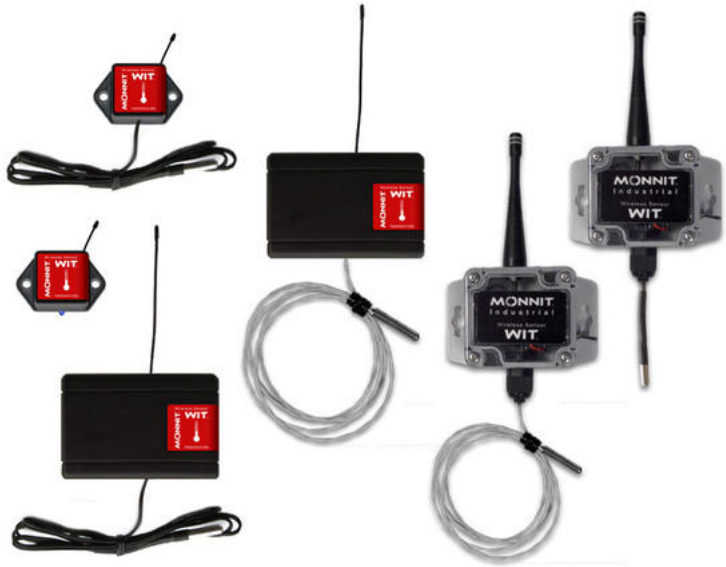
Melexis’ MLX90620 FIRray sensing device uses the company’s non-contact temperature measurement technology to create what it asserts is a highly cost-effective thermography solution. Covering a -20°C to 300°C temperature range, this 16 x 4 element far infrared (FIR) thermopile sensor array produces a map of heat values for the target area in real time, avoiding the need to scan the area with a single point sensor or to use of an expensive microbolometer device. The MLX90620 immediately captures 64 pixel images in 2D, thus keeping the price point in the range needed for high volume, low cost applications. By integrating an amplifier and ADC in every pixel, the array offers an adjustable frame rate from 0.5 Hz to 64 Hz. Accuracy levels of ±1.5°C are maintained when operating in the 0°C to 50°C range. Two field of view (FoV) options are available 60º x 15º and 40º x 10º. A high speed I2C compatible digital interface and a triggered mode for synchronization with a control unit mean that the MLX90620 can be used individually or combined in multiple devices to form an array with a larger imaging resolution.



Temperature and dual voltage monitor provides flexible alert outputs

Linear Technology’s LTC2995 temperature sensor and dual supply monitor for low voltage systems measures a remote diode’s temperature with ±1°C accuracy and its own die temperature with ±2°C accuracy, while rejecting errors due to noise and series resistance. Two voltage rails, one of which is required to be between 2.25 V and 5.5 V to power the device, are monitored with ±1.5 percent accuracy, minimizing the required system supply margins. The sensor provides a voltage-proportional-to-absolute-temperature (VPTAT) output, as well as individual undertemperature, overtemperature, undervoltage and overvoltage alert outputs defined by user-adjustable thresholds. No code is required to configure the device. The part combines the functionality of a temperature monitor and dual voltage monitor in a space-saving, micropower solution. The LTC2995 caters to a variety of applications such as system thermal control, energy harvesting, desktop and notebook computers, network servers and environmental monitoring. It draws only 220 ?A of supply current over the full operating temperature range.

Wireless temperature sensor offering includes RTD technology

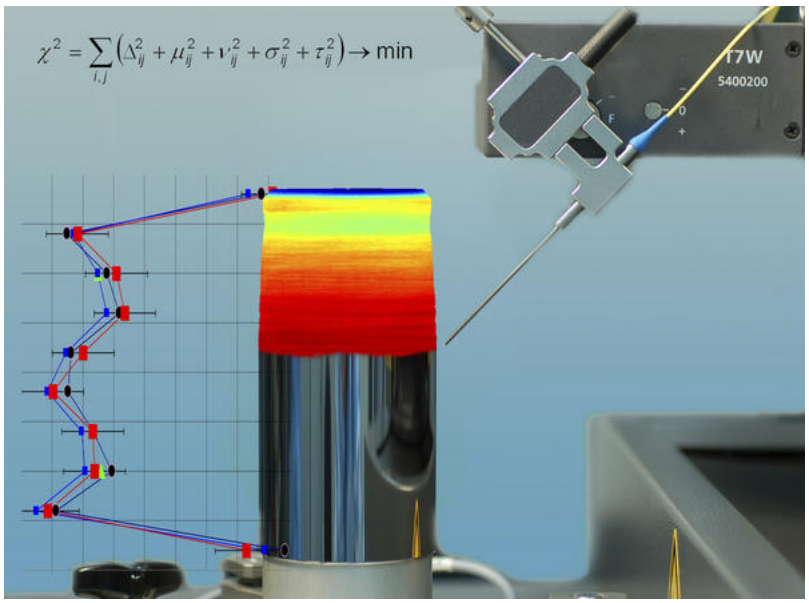


Monnit Corporation has extended its offering of wireless temperature sensors to include RTD technology. The full line of temperature sensors is available in both commercial and industrial (NEMA 4x weatherproof) grades. The company’s standard wireless temperature sensor uses a thermistor to accurately measure temperatures from -20°C to 60°C. It is desirable for slower changing temperatures and critical applications such as facilities or rooms. Monnit also offers a wireless temperature sensor that uses an external 3-foot sensor probe to measure temperature with more accuracy and greater thermal range in fast changing, temperature critical applications such as coolers or heaters. The wireless high-temperature RTD sensor can accurately measure temperatures from -50°C to +370°C (-58°F to 700°F). It is suitable for high temperature critical applications such as ovens, heaters, furnaces and boilers. The company’s wireless low temperature RTD sensor accurately measures temperatures from -200°C to +162°C (-328°F to +325°F) in critical applications such as freezers and coolers.

Data logger captures temperature, relative humidity and dew point

Electronic Assembly can supply a data logger to monitor and record ambient temperature, relative humidity and dew point. The EA SYLOG-USB-2 is appropriate for applications in the pharmaceutical and food industry, transportation and logistics and general laboratory use. The device can simply be inserted into a PC USB port for fast, uncomplicated analysis of the data which has been logged. Drivers for current versions of Windows are provided. The EA SYLOG-USB-2 captures temperature and relative humidity data simultaneously and can store up to 16,382 readings. It also calculates the dew point for each reading. The data logging intervals can be in the range between 10 seconds and 12 hours and are user selectable. The date and time when logging starts can also be pre-programmed. The data logger has an operating temperature range of -35°C to +80°C which is equivalent to -31°F - +176°F when the data logger is set to the Fahrenheit scale. The device also records the relative humidity between 0% and 100% and calculates the dew point.

Web-based tool calculates R/T characteristics of NTC thermistors



TDK-EPC announced a browser-based NTC R/T Calculation 5.0 tool for calculating the R/T characteristics of the company’s NT thermistors. The download and installation of special software are no longer necessary, and users always have access to the current EPCOS product database. R/T characteristics can be individually calculated and manipulated by adjusting the temperature range and the resistance tolerance and selecting the desired temperature intervals. The characteristics can be custom designed and fine tuned using a filter function. Results can be output as PDF files or exported in spreadsheet-compatible csv format. The tool’s product database covers the current portfolio of EPCOS NTC thermistors. In the product selection process users can now tell which EPCOS products are not recommended for new designs. A help option integrated in the tool explains its operation and functions. The new tool can be accessed via the link www.epcos.com/ntcrt [1]

Thin-film platinum RTDs operate in extreme conditions

Innovative Sensor Technology’s (IST) thin film platinum temperature sensors are presented as offering precision measurement in extreme conditions. The RTDs are designed to operate over a temperature range of -200°C to +1000°C. Standard DIN 60751 sensors are offered in class B (0.12 percent), class A (0.06%), 1/3 class B (0.04 percent). IST sensors are available in SMD and wired configurations, and in several different sizes including MiniSens (1.6 x 1.2 mm) and SlimSens (3 x 0.8 mm). Standard sensors can be customized with a variety of wire material, length, and configurations with user defined attributes such as nominal resistance, TCR value, and tolerance class.

Remote measurement display provides real-time “at a glance” HVAC/R conditions

Setra Systems’ Remote Measurement Display allows for clear and remote viewing capabilities of real-time “at a glance” HVAC/R conditions, ensuring effective climate control management within a variety of critical environments, according to the company. The CE-compliant Remote Measurement Display accepts 0-10 and 0-5 VDC analog signals from virtually any sensing technology, including temperature, humidity, CO2, pressure, and others. The unit visually displays sensor output with zero and span adjustment capabilities. Readings may be easily calibrated by the user. Its 1-inch, 3.5 digit LCD display may be clearly viewed from across a room with reduced glare. It is also wipedown capable, with no special maintenance requirements. These flush mount style units are easy to install and compatible with standard 4-11/16 electrical box configurations. The new Remote Measurement Display is designed for direct compatibility with Setra Systems Humidity Sensors (SRH) with temperature output.

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[1] http://www.epcos.com/ntcrt