



TEMPERATURE SENSORS— NOW YOU SEE THEM, NOW YOU DON'T

You may not know it, but temperature sensors are present throughout many of the daily tasks in our lives. Thinking back on your day today – did you turn on the kettle for a cup of coffee or take the milk out of the refrigerator? Did you take the train to work or have you charged your phone battery? These tasks, and more, all use temperature sensors – even the computer you may be using now depends on a temperature sensor!



Monitoring and regulating temperature is clearly fundamental to human life, and creating the technology to achieve this has been the work of many great scientists. Galileo invented the first documented thermometer in 1592, using a simple air system in a glass bulb. It wasn't until the 18th century that Daniel Gabriel Fahrenheit created the more accurate mercury thermometers, and Anders Celsius introduced the 0-100 degrees calibration references that we all know of today. Fast forward to now, and we see many types of advanced temperature sensors available with different technologies and designs. New inventions such as the thermistor, thermocouple, thermopile, digital and platinum sensors all offer a wide range of benefits for different situations and environments. They have become highly sophisticated devices that help people throughout many facets of life: in factories, hospitals, schools, homes and more.



Nowadays, there is a huge market for temperature sensors: it was valued at USD 5.13 billion in 2016 and is estimated to grow by 4.8% until 2022, reaching USD 6.79 billion for the entire temperature sensor market. This is fueled by changing consumer and industrial trends, and technological shifts that place new demands on temperature sensors and drive innovation. Many producers, such as in the high-tech automotive and semi-conductor sectors, need advanced temperature sensors to better run their production facilities, such as for energy efficiency and automated process control. To manage this, temperature sensors must be smarter with precise communication and self-diagnostic functions. Meanwhile, as electronic devices become slimmer and more portable, it is a challenge for engineers to create corresponding designs for temperature sensors.



Standing at the center of this dynamic industry is TE Connectivity – one of the largest sensor technology companies in the world. With a broad product portfolio and an experienced team of engineers, they are well-placed to meet the needs of the marketplace. While TE Connectivity's sensor technology is undoubtedly impressive, what gives them most pride is seeing how this technology is applied across multiple industries, and how it helps people every day in their jobs and in their lives. When looking at TE Connectivity's product portfolio, you'll find that there really is something for all scenarios.

NTC THERMISTOR

There has been a greater demand in recent years for light-weight products with high efficiency and low-cost. TE Connectivity's NTC Thermistor meets exactly these criteria. With thermo-sensitive materials, its resistance decreases as temperature increases, meaning it is extremely sensitive to temperature movement without causing thermal load. What's more, although NTC Thermistors are small, they can operate at -150°C , and are very useful across many fields. They are typically used in medical devices such as dialysis equipment, DNA sequencers and blood analyzers as well as home appliances such as the stove. One of its key applications is in the automotive industry, where it monitors the temperature of batteries in electric cars, preventing battery overheating.

THERMOCOUPLE

Like the NTC Thermistor, the Thermocouple sensor is light-weight and competitively priced. The thermocouple sensor is made of two different metal wires connected at one point. When one end is exposed to a heat source, potential differences are generated within the circuit. The thermocouples use this measurable electrical potential difference to calculate the temperature and activate the HVAC device, for example, to regulate the ambient temperature. The core benefit of the Thermocouple sensor is that it can be used in very high temperature conditions or harsh environments, with some models operating at up to 1700°C .

PLATINUM TEMPERATURE

As the name suggests, one of core materials for the Platinum Temperature sensor is platinum. Platinum is best known by many for its use in wedding rings, however, in the eyes of TE Connectivity, platinum is the best material for producing a stable and reliable temperature sensor. Its resistance is perfectly linear under different temperatures, allowing for highly precise and stable temperature monitoring. The operating temperature range is quite wide, and can run from -200°C to $+1000^{\circ}\text{C}$. The applications for RTD sensors are extremely broad, including uses in food processing, stoves and grills. They are prominently used in the tough environment of space rockets, where TE's sensors monitor changes that reach extremely high temperatures in several stages of the rocket launch, thus ensuring a regular performance of the rocket's journey from launch through to orbit. Moreover, Platinum temperature sensors are particularly common in exhaust gas temperature measurement, where they can be placed in a car to monitor pollution and optimize fuel consumption.



THERMOPILE

Thermopiles are leader in the non-contact category of sensors. What that means is that it can effectively measure physical objects from a far range, even several meters away. Thermopiles have been used in a broad range of applications ranging from industrial process monitoring to occupancy and motion sensing to medical temperature readers such as the Ear Thermometer. Other applications include home appliances such as microwave ovens, fire and heat alarms, automotive seat occupancy and road and highway ice detection. TE Thermopile not only measures temperature, but can also be used for gas concentration measurement such CO₂ and other gases.

DIGITAL TEMPERATURE SENSORS

Digital Temperature sensors can convert temperature physical quantity and humidity quantity into a digital sensor through a temperature and corresponding circuit. In addition, it can be directly read by computer, plc, intelligent instruments and other data acquisition devices. It is commonly used in thermostats and as board mounted sensors in many electronic devices such as home appliances, medical devices and consumer electronics. Digital temperature sensors are used in all IoT systems, like smart home applications. The digital temperature sensor can trigger home heating or air-conditioning systems, helping to maintain a comfortable home temperature and optimizing energy consumption.



SUMMARY

Temperature sensors are one of the most widely applied technological devices in the world – helping people in many unique ways. Whether you are sipping your coffee while reading newspaper in your home, or navigating your car through the city to get to your office or even simply sitting in your office comfortably enjoying the “right” temperature

as you type through your daily work, you may not always notice them in your life because they secretly monitor all temperature around you to ensure everything will function properly with appropriate temperature range, but you would certainly notice them if they were gone! TE Connectivity is proud to be a part of this story, and to offer a wide range of temperature sensor products to meet your needs.

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