When to Use NTC Thermistor Probes and Why Its Necessary

NTC thermistor probes have long been employed to measure liquid levels and temperature in industries that extend from automotive electronics to medical technology to green energy. Their applications are endless, and their purpose is significant.

A thermistor probe is otherwise identified as a bead thermistor manufactured as a bare bead encapsulated with epoxy or glass that is usually potted in a metal or plastic housing with two high temperature insulated wires.

These devices can be found in all the places that we live and work, from the moment we wake up and make coffee until the end of the day when we arrive home and relax in front of the television. They are indispensable to the cars we drive to work, the computers necessary to do our jobs, and the appliances we use to prepare food at the end of the day.

Understanding the impact of thermistor probes

Because of their prevalence, it is important to understand how thermistor probes operate, in what capacity, and what their potential is. Part of this understanding includes taking into account the electrical properties of probes that abide by certain operating principles, including electrical resistance, capacitance, ultrasonics, radioactivity, and pressure and thermal conductance.

Given their pervasiveness and range of applications, and despite the large amount of thermistor sizes and shapes, it is impossible to manufacture a universal thermistor probe. The type of thermistor used in automobiles to measure coolant temperature is vastly different from the type of thermistor used to measure temperature for wind turbines.

Thermistor probes in automotive innovation

Without thermistor probes many automobiles, appliances, industrial equipment, and anything that requires electricity essentially would not function properly, or at all. Engineers depend on these devices as a design consideration for any product that generates energy, hot or cold, and requires temperature measurement, control, and accuracy.

In 1966, automotive vehicles used around two thermistors per unit to report to various gauges and electronic control modules. In the 1970s that number grew to 15, in the 1980s to 40 thermistors, and in the 90s there were 60 thermistors in vehicles. Today, automotive vehicles use between 80 to 100 thermistors.

This exponential increase in thermistors has mainly been fueled over time by the complexity and refinement of technology in automotive vehicles. As automotive technology has increased and improved, so has the demand for thermistors. The need to detect, regulate, and control temperature in vehicles can be seen in car seat heaters and air conditioners, oil temperature gauges, defrosters for windows and mirrors, li-ion batteries in electric vehicles, and even just the heating and cooling systems that regulate and control cabin temperature of vehicles.

Additionally, more features and processes require sensing to improve vehicle performance, driver convenience, automotive safety, and reduce or control emissions. Vehicles today exhibit more artificial intelligence, part of which is the need to sense and regulate temperature. As an example, thermostats that in the past were used to measure coolant temperature and control cabin climate temperature now have been replaced with a thermistor, which has a faster response time as well as being more accurate. Another indispensable application of thermistors in automobiles is the ability to detect oil levels and viscosity and then alert the driver or operator when to change it.

Green energy, medical technology and other applications for thermistor probes

In the medical field thermistor temperature sensing probes are critical because of these devices' high sensitivity, high accuracy, and interchangeability. A good example is a respirator. Air entering a patient's lungs must be exactly 37 °C, the same as body temperature. A thermistor senses the air temperature and sends a signal to the respirator to regulate and compensate as needed.

In our homes, thermistors are everywhere in microwave ovens, toasters, dishwashers, air conditioning units, portable heaters, washers and dryers, bidets, hot tubs, saunas, refrigerators, electric kettles, to name a few. Without a thermistor to sense heat, a microwave oven is prone to overheating. Same with portable heaters, which also use thermistors, could possibly get too hot and start a fire.

Green energy is an area where the use of thermistors is making great strides. Wind turbines are a great example where the use of thermistor probes is essential. Wind turbines in colder countries or environments are prone to freezing. A thermistor probe used on the fan blade with two very long leads regulates and senses the air temperature to control the on/off actions of the wind turbine's heater so that the blades won't freeze. If the blades freeze, this creates inefficiencies and makes the entire unit inoperable.

How to select and integrate thermistor probes into different applications

Similar to the limitless applications requiring thermistor probes, so too exist the endless methods to mount them, adhere them, and apply them. Some thermistors can get very sophisticated in the ways that they are housed and the methods in which they are mounted.

When talking about a probe, this actually is referring to the metal or plastic assembly housing that covers the bead thermistor for different applications and functions. These probes come in all shapes, sizes, and mounting options. Some probes are long and narrow with a stainless steel housing that are used in vehicles for measuring oil or water temperature. Other thermistor probes integrate a threaded tube that are used in engines or medical equipment to detect and monitor temperature. Probes with a design that features a ring lug are often used together with heatsinks or lithium-ion batteries.

Each thermistor probe starts out as a chip that is then encapsulated in either glass or epoxy. Depending on the application, this bead thermistor is then potted in a metal or plastic housing that is customized according to very specific requirements.

When used with an application such as a lithium-ion battery, a thermistor probe with a ring lug can be easily mounted securely to the battery terminal. This thermistor probe can then effectively monitor the battery temperature so it does not rise above a certain degree.

In our chart below, we illustrate different thermistors and the housing with which they are compatible.

	Thermal Time Constant	Dissipation Constant	Max Power	Type of Housing	Description
 PANR	40	3	125	Metal Ring Lug	Epoxy dip coated NTC thermistor potted in tinned copper ring lug
 PANT	40	3	125	Threaded Tip & Hex	NTC thermistor potted inside aluminum hex screw with straight threads
 PANW	25	10	125	Threaded Metal Tubing & Hex	NTC thermistor potted at the tip of durable stainless steel alloy tube with tapered thread hex screw
 PANE	10	3	125	Probe Assembly with Epoxy	Epoxy dip coated NTC thermistor soldered between jacketed Teflon / PVC wires
 PANH	10	3	125	Closed End Metal Tubing	NTC thermistor inside durable stainless steel alloy tube and epoxy filled
PANG	3	3	125	Glass Bead	Glass encapsulated bead thermistor with teflon coated wires