RTD Basics

Why Choose Riedon (a Resistor Company) For Your Special RTD Requirements

Riedon has manufactured high-precision wirewound resistors for OEM industries since 1960. These precision resistors have tolerances as small as 0.005%. They are extremely stable over time, and operate over wide operating temperatures.

Resistors this precise and stable require unusual design and manufacturing skills that absolutely manage the desirable properties of the resistor element wire, while minimizing undesirable characteristics that cause unpredictable errors and instabilities. These same design and manufacturing skills are as critical in RTDs as they are in precision resistors!

RTD Basics

A fundamental physical property of a metal is that its resistivity changes with temperature. For many metals, this relationship is quite linear over wide temperature ranges making them ideal for measuring temperatures.

The relationship between the temperature and resistivity of a material is its temperature coefficient (TC) or temperature coefficient of resistance (TCR). TC or TCR is usually stated as a constant; parts per million per degree per Centigrade (ppm/ C). This property is the basis for designing RTDs.

A **Resistance Temperature Detector** (RTD) is a resistor designed to measure temperature using the known resistance vs. temperature relationship of metals. An RTD element is the actual temperature-sensing unit. It is typically unprotected and offers only the element leads for terminations. An RTD probe is an assembly composed of an element, a sheath or tube to protect the element and provide a thermal path to the measurement, lead wires, and a termination or connection.

RTDs are often made with platinum, nickel or nickel alloy wire as their sensing resistance element. Platinum is a popular choice; it can withstand high temperatures and maintain excellent stability. It has relatively high resistivity, and is highly linear with temperature. Copper has low resistivity, requiring a larger element, but its excellent linearity and low-cost make it an economical alternative in some applications. Balco is nickel-iron alloy with a TC similar to nickel but twice its resistivity.

The resistance of metals is also affected by other factors. This creates some difficult design and manufacturing challenges for RTD products (and precision resistors.) Perhaps the most important is the change in resistance as the resistance element wire is stressed.

As wire is strained, its cross sectional area diminishes and its length increases resulting in an increase in resistance. Although this principle is used in some sensors (strain gages), the characteristic is very undesirable in precision resistors and RTDs.

The change in resistance with stress must be properly managed in designing and manufacturing precision resistors. A precision resistor must be highly stable in its operating environment, and with time, to maintain its precision tolerance. Designs and manufacturing methods must minimize these internal stress conditions.

These same considerations are equally important For RTDs. The usefulness of an RTD depends upon its resistance changing only as a result of its TCR; if the resistance changes because of other factors such as internal stress, the temperature measurement calibration will be seriously compromised and complicated.

Alloy	TCR (ppm/C)
Nickel 99.9%	+6000
Nickel 99.5%	+5000
Balco	+4500
Copper	+3900
Platinum	+3850

For TCR Calculator click here:

http://riedon.com/technical/technical-calculator/