Platinum resistance thermometer

Platinum Resistance Thermometer

How it works: The simplest resistance thermometer configuration uses two wires. It is only used when high accuracy is not required as the resistance of the connecting wires is always included with that of the sensor leading to errors in the signal. Using this configuration you will be able to use 100 meters of cable. This applies equally to balanced bridge and fixed bridge system.

Temperature range: Operating Range -200 °C to 1200 °C

Advantage: It has a wide range and is very accurate. It is best for small steady temperatures.

Disadvantages: Unsuitable for rapidly changing temperature. Slow to respond.

Optical Pyrometer

How it works: A pyrometer has an optical system and detector. The optical system focuses thermal radiation onto the detector. The output signal of the detector (Temperature T) is related to the thermal radiation or irradiance of the target object through the Stefan-Boltzmann law, the constant of proportionality, called the Stefan-Boltzmann constant and the emissivity of the object.

This output is used to infer the object’s temperature. Thus, there is no need for direct contact between the pyrometer and the object, as there is with thermocouple and Resistance temperature detector (RTDs).

Uses: The optical pyrometer is widely employed for accurate measurement of the temperature of furnaces, molten metals and other heated materials. It is primarily used in the range of 1000 to 50008F. Most optical pyrometers are manually operated and thereby are somewhat limited in their application. Pyrometers are suited especially to the measurement of moving objects or any surfaces that cannot be reached or cannot be touched.

Temperature range: Optical Pyrometers with a range of 700C – 1250C have an accuracy better than ± 58C while those having a range of 1100 -1900 have an accuracy better than ±108C. Temperature ranges can be measured between approximately 1, 300 to 5, 800oF (700 to 3, 200oC), and with appropriate filters, the disappearing-filament pyrometer temperature ranges can be ex-tended to approximately 18, 000oF (10, 000oC).

Advantages: Measures high temperatures.

Thermocouple

How it works: It consists of two dissimilar metals, joined together at one end, which produce a small unique voltage at a given temperature. This voltage is measured and interpreted by a thermocouple thermometer.

Uses: A thermocouple is a sensor for measuring temperature. However, thermocouples have a wide temperature range (-200 to 2000 °C) and are often needed simply because alternative devices do not operate at the desired temperature. In addition, they are relatively low-cost and versatile.

Temperature range: Operating Range -200 °C to 2000 °C

Advantages: Wide range, robust and compact and good for rapidly changing temperatures.

Disadvantage: For good quality a milli voltmeter is needed.

When to use RTDs or thermocouples

The two most common ways of measuring industrial temperatures are with resistance temperature detectors (RTDs) and thermocouples. But when should control engineers use a Thermocouple and when should they use an RTD? The answer is usually determined by four factors: Factors: – Temperature, time, size, and overall accuracy requirements.

- If process temperatures fall from -328 to 932°F (-200 to 500°C), then an industrial RTD is the preferred option. Thermocouples have a range of -180 °C to 1300 °C (-300 to 2300 °F) so for extremely high temperatures they are the only contact temperature measurement choice.
- If the process requires a very fast response to temperature changes-fractions of a second as opposed to seconds (i. e. 2. 5 to 10 s)-then a thermocouple is the best choice. Keep in mind that time response is measured by immersing the sensor in water moving at 1 m/s (3 ft/s) with a 63. 2% step change.
- A standard RTD sheath is 3. 175 to 6. 35mm (0. 125 to 0. 25 in.) in diameter, while sheath diameters for thermocouples can be less than 1. 6mm (0. 062 in.).
- If the process only requires a tolerance of 2 °C or greater, then a thermocouple is appropriate. If the process needs less than 2 °C

tolerance, then an RTD is sometimes the only choice. Keep in mind, unlike RTDs that can maintain stability for many years, thermocouples can drift within the first few hours of use.