What are RTD Sensors?
Why Use Them? How Do They Work?

What is an RTD?

Resistance Temperature Detectors (RTDs) are temperature sensors that contain a resistor that changes resistance value as its temperature changes. They have been used for many years to measure temperature in laboratory and industrial processes, and have developed a reputation for accuracy, repeatability, and stability.

Why use an RTD instead of a thermocouple or thermistor sensor?

Each type of temperature sensor has a particular set of conditions for which it is best suited. RTDs offer several advantages:

- A wide temperature range (approximately -200 to 850°C)
- Good accuracy (better than thermocouples)
- Good interchange ability
- Long-term stability

With a temperature range up to 850°C, RTDs can be used in all but the highest-temperature industrial processes. When made using metals such as platinum, they are very stable and are not affected by corrosion or oxidation.

Other materials such as nickel, copper, and nickel-iron alloy have also been used for RTDs. However, these materials are not commonly used since they have lower temperature capabilities and are not as stable or repeatable as platinum.

RTD standards

There are two standards for platinum RTDs: the European standard (also known as the DIN standard) and the American standard.

The **European standard**, also known as the DIN standard, is considered the world-wide standard for platinum RTDs. This standard, defined in a document known as IEC751, requires the RTD to have an electrical resistance of 100.00 Ω at 0°C and a temperature coefficient of resistance (TCR) of 0.00385 Ω/Ω/°C between 0 and 100°C.

The most common resistance specifications include the following: Class "A", which is 100.00 ±0.06 Ω at 0°C and Class "B", which is 100.00 ±0.12 Ω at 0°C. For more accurate measurements, some customers will also request 1/3 DIN accuracy, which is 100.00 ±0.04 Ω at 0ºC, and 1/10 DIN, which is 100.00 ±0.012 Ω at 0ºC.

The combination of resistance tolerance and temperature coefficient define the resistance vs. temperature characteristics for the RTD sensor. The higher the element tolerance, the more the sensor will deviate from a generalised curve, and the more variation there will be from sensor to sensor (interchange ability). This is important to users who need to know how to identify the sensor for their instrument or equipment so that it can determine temperature value from the sensor resistance.

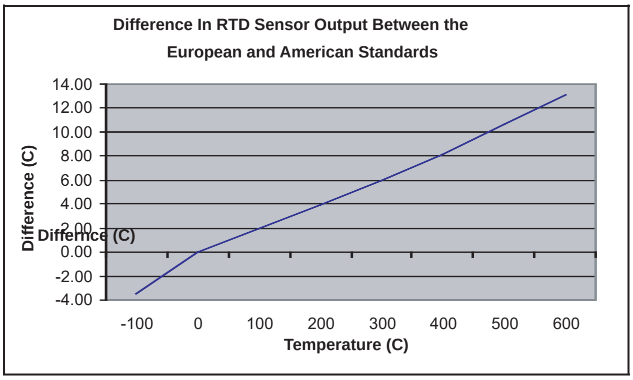
Section Z contains a resistance vs. temperature curve from -200 to 850°C with resistance values given for every degree Celsius. The following interchange ability table shows how the tolerance and temperature coefficient affect the indicated temperature of the sensor in degrees Celsius:

Interchangeability in ºC				
Temp °C	**Class A**	**Class B**	**1/3 DIN**	**1/10 Din**
-200	0.55	1.30	1.10	1.03
-100	0.35	0.80	0.60	0.53
0	0.15	0.30	0.10	0.03
100	0.35	0.80	0.60	0.53
200	0.55	1.30	1.10	1.03
300	0.75	1.80	1.60	1.53
400	0.95	2.30	2.10	2.03
500	1.15	2.80	2.60	2.53
600	1.35	3.30	3.10	3.03
700	—	3.80	3.60	3.53
800	—	4.30	4.10	4.03
850	—	4.55	4.35	4.28

At Omega, our standard RTD probes are based on the European standard.

The **American standard**, used mostly in North America, has a resistance of 100.00 ±0.10 Ω at 0°C and a temperature coefficient of resistance (TCR) of 0.00392 Ω/Ω/°C nominal (between 0 and 100°C). Section Z also includes a resistance vs. temperature curve from -100 to 457°C, with resistance values given every one degree Celsius. **At Omega, we provide the American standard as an option and designate it with an "A" in the model number.**

Example: PR-10-2-M60-150-A



Other resistance value options

RTD elements can also be purchased with resistances of 200, 500, 1000, and 2000 Ω at 0°C. These RTDs have the same temperature coefficients as previously described, but because of their higher resistances at 0°C, they provide more resistance change per degree, allowing for greater resolution.