

THE CORE COMPONENTS OF A

Temperature Calibrator



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A *temperature calibration* consists of three key components: **temperature probes**, **temperature readouts**, and **temperature sources**. It's important to understand all three elements as they are interdependent and must be compatible to achieve accurate and reliable calibration.

A temperature calibrator combines all of these components and makes adjustments for the best accuracy. With Wika's new CTD/CTB/CTM9350 we also have the option to automate the process and generate a test profile without any software!

With this foundational knowledge in mind, let's now explore the significance of each category.

Probes Readout Source

Temperature Probes

THE SENSORS

The temperature probe is the sensor that directly interacts with the environment being measured. Different types of probes offer varying levels of accuracy, stability, and temperature ranges, making them suitable for different applications. Temperature probes can range from the thermocouple in your oven to the thermistor in your car engine, all of which measure the temperature and send signals to the control system.

So, what are the different types of temperature probes?

Thermocouples

These robust sensors operate on the Seebeck effect, meaning they generate a voltage that's proportional to the temperature difference between two dissimilar metals.

Thermocouples are known for their wide temperature ranges and ruggedness, making them suitable for harsh industrial environments.

Learn more in our FAQ.

Temperature Probes

THE SENSORS

Resistance Temperature Detectors (RTDs)

Also known as resistance thermometers, RTDs measure how a metal's electrical resistance changes with temperature.

Platinum RTDs are particularly popular due to their high accuracy and stability. They are commonly used in pharmaceutical manufacturing to establish drug production, storage, and transportation guidelines.

Thermistors

These semiconductor sensors show a significant change in resistance with temperature, providing high sensitivity in a narrow range. For example, thermistors are used in HVAC systems and environmental monitoring for accurate temperature control.

Temperature Readout

THE MEASUREMENT DEVICE

The temperature readout is the instrument that measures the signal from the temperature probe and converts it into a readable temperature value. One example is the digital meat thermometer you keep in your kitchen. After the probe sends signals to the readout, the digital display shows the current temperature.

Handheld Thermometers/ Multimeters

These portable devices are perfect for field calibration and quick temperature checks. For example, a *handheld thermometer* with a thermocouple input can verify a furnace's temperature on-site.

Resistance Thermometry Bridges

These *highly accurate instruments* are specifically designed for use with Resistance Temperature Detectors (RTDs). They measure the change in resistance of the RTD with extreme precision, providing very accurate temperature readings. These are often used in calibration labs and metrology settings.

Temperature Source

GENERATING STABLE TEMPERATURES

The temperature source provides a stable and uniform temperature environment for calibrating temperature probes.

Dry-block calibrators

Also known as *Dry Wells*, these portable devices utilize a heated or cooled metal block with precisely sized wells to calibrate temperature probes, offering quick heating and cooling rates for field use. They are handy for on-site calibration in industries such as manufacturing and the process industry.

Liquid Baths (Fluid Baths) These *calibrators* use a stirred liquid bath to create a highly stable and uniform temperature environment, making them ideal for calibrating temperature probes of different shapes and sizes. They are commonly used in laboratory settings for metrology and research applications.

Micro-baths

Compact calibrators that use a small volume of liquid to maintain a stable temperature for tiny sensors, making them ideal for calibrating small thermistors and surface temperature sensors in electronics manufacturing. Selecting the right temperature measurement equipment is crucial for accurate and reliable results.







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FAQ

▶ What are the differences between 2-wire, 3-wire, and 4-wire RTDs?

2-wire RTDs: Simple but susceptible to lead wire resistance errors, making them less accurate for long distances.

3-wire RTDs: Compensate for lead wire resistance, improving accuracy over 2-wire. Commonly used in industrial applications.

4-wire RTDs: Eliminate lead wire resistance errors entirely, providing the highest accuracy. Used in precision laboratory and metrology applications.

How does a thermoelement work?

The Seebeck effect is the principle behind thermocouples (thermoelements). It's the phenomenon where a voltage is generated at the junction of two different metals when there's a temperature difference between the junctions. This voltage is proportional to the temperature difference.

What is cold junction compensation (CJC)?

CJC is a technique used with thermocouples to account for the temperature of the connection point between the thermocouple wires and the readout device. Without CJC, the readout would only measure the temperature difference between the two junctions, not the absolute temperature.

How often should I calibrate my temperature probes?

Calibration frequency depends on the application, probe type, and industry standards. It's best to follow manufacturer recommendations and industry best practices. Regular calibration ensures accuracy and reliability.

► What are common sources of error in temperature measurement?

Common sources include lead wire resistance (especially with 2-wire RTDs), cold junction errors (thermocouples), sensor drift over time, environmental influences (ambient temperature, humidity), and improper probe immersion.

What should I look for on a temperature probe's datasheet?

Key specifications include temperature range, accuracy, stability, response time, material compatibility, and connection type.

► What are the advantages of a dry-block calibrator versus a liquid bath?

Dry-block calibrators are portable and offer faster heating/cooling times. Liquid baths provide higher stability and uniformity, especially for irregularly shaped probes.