

## Selecting the right temperature measurement system

### 1. Contact or non-contact measurement?

There are basically two main methods used to measure the temperature of objects. Only contact probes can be used for

- penetration/immersion measurements or
- air temperature measurements.

There are some applications where contact measurement is the most suitable method for measuring surface temperatures while there are other applications where non-contact temperature measurement has proven to be more suitable. A combination of both methods in one instrument is often found to be ideal.

#### Classical contact applications

##### 1. Objects with high heat capacity

- Metals
- Large metal masses

##### 2. Objects with smooth surfaces

- Polished steel plate
- Polished heating pipes

### 2. Selecting the right probe

The probe type is determined by the measuring task. The suitable temperature sensor is selected according to the following criteria:

- Measuring range
- Accuracy
- Location design
- Response time
- Resistance

Testo has a range of sensor elements and thermometers available in order to be able to supply the probes needed for your applications:

- Thermocouple sensor
- Resistance sensor (PT 100)
- Thermistors (NTC)

#### Thermocouples

Temperature measurement using thermocouples is based on the thermoelectric effect.

Thermocouples consist of two wires welded together. The wires are made of different metals or metal alloys. The basic values of the thermoelectric voltages and the maximum tolerances in thermocouples are defined in the IEC 584 standards. The most common thermocouple is NiCr-Ni (type designation K).

#### Resistance sensors (Pt100)

When measuring temperature, use is made of the temperature sensitive resistance change in the platinum "resistance". The measurement resistance is supplied with a constant current and the voltage drop, which changes with the resistance value via the temperature, is measured. Basic values and tolerances for resistance thermometers are defined in the IEC 751.

#### Thermistors (NTC)

Temperature measurement with thermistors is also based on a temperature sensitive change in the resistance of the sensor element. Unlike resistance thermometers, thermistors have a negative temperature coefficient (resistance decreases with increasing temperature). Properties and tolerances are not standardised.

#### Rule-of-thumb

Thermocouple probes are quick and have a wide measuring range. Resistance and NTC probes are slower but more accurate. The wider the measuring range the more universal the applications.

#### Measuring range

First cross off the probe type which does not apply to your measuring range. The diagram below shows the application range of different temperature sensors.

