

Resistance thermometers

Temperature measurement with resistance thermometers

General

Resistance thermometers are electrical measuring elements for temperature and are, together with an appropriate electrical device, used to display, register or regulate temperatures. They contain temperature-sensitive resistors housed within an armature appropriate for the intended use.

Please note

In case you would like to measure a temperature-dependent resistor, it is necessary to send an electrical current through the resistor to be measured. However, this current generates Joule's heat, which distorts the actual temperature measuring result. This is called **self-heating error**. This heating error depends on the strength of the current flowing through, and, additionally, on the heat generated between the measuring resistor and the fitting plus between the fitting and the medium to be measured. In the case of stagnant gaseous mediums, the transition is worse than with flowing liquid mediums.

Using the relevant evaluation switches and circuits, it is necessary to ensure the measuring current amounts to 1 to 3 mA.

Measure arrangement

As the temperature measurements involving measuring resistances is proportioned to the resistance measured to the measured temperature, it is important to know the resistance values of all additional resistors!

This includes the inner line with longer thermometers, the feed line for the evaluation switch / circuit and the transition resistors at the connection points.

There are 3 options to be able to include the outer resistor in the measuring result:

2-wire technique

Here, the entire feed line to the measuring unit is adjusted to the predefined value using an additional resistor. This predefined value is then calibrated in the evaluation circuit. With most of the systems the outer resistor has a resistance value of 10 Ohm.

3-wire technique

With feed lines to the measuring unit that are very long the temperature coefficient of the line plays a decisive role (cannot be determined using the method of adjusting the lines). Here, we use the 3-wire technique, whose two feed lines to the measuring resistor are located within different bridge circuits of the evaluation circuit and, thus, cancel each other out.

4-wire technique

This technique is primarily used for laboratory measurements and, recently, with electronic measuring units. Based on this so-called current/voltage measurement, which involves four lines to be fed to the measuring resistor, it is possible to achieve very exact measuring results. The length of the feed line is not important here.

