Temperature measurement with resistance thermometers

General
Resistance thermometers are electrical measurement devices for temperature. They serve for the display, recording or closed-loop control of temperatures in connection with corresponding electrical equipment. They contain measuring resistors. These resistors are put in a protecting fitting.

Attention
During measuring with measuring resistor an electric current flows through itself. This current flow heated the resistor (joule effect). The warming changes the measurement result. This effect is named self-heating. The fault is dependent on the size of ampere flow. The heat transfer between resistor and the fitting also influences the result. Further faults arise from heat discharge to the medium to be measured.
The size of the measuring error is mainly on the following factors dependently:

- Density of the product
- Heat-transfer coefficient
- Flow rate and flow direction of the medium.

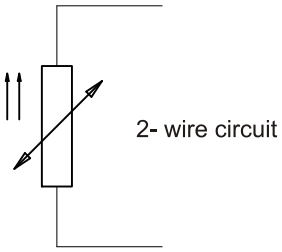
The transverse heat transfer is in static gaseous medium much worse than flowing liquid media.

By suitable control circuits the ampere flow has to be limited between 1mA and 3 mA .

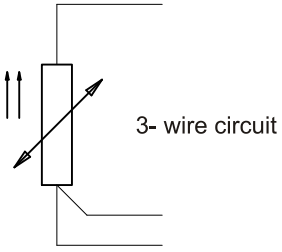
Measuring technology
The measured resistance is put in the relations to the measured temperature. It is important to know all additional resistances!
Including this:

- The resistance of extended external circuits at long thermometers,
- The supply of the control and/or measuring circuits
- Transverse resistances at the junction points.

There are three possibility methods to include the external resistance in the measurement result:
The two wire - technology (static balanced circuit)
The complete line is integrated to the measuring circuit. This means an additional and non-detachable resistor of predefined value is gauging line and meter. These external resistor only corrected all errors at OHM.
This external resistor is 10 Ohms at most circuits.



The three wire - technology (controlled circuit)
In case of long line the temperature coefficient makes errors to the measuring result by him. The method of line comparison includes only the ohms resistance of the wire, not but the change by temperature.
The three-wire method balanced both kinds of errors in the result. A controlled supply loop and balanced network makes themselves two metering circuits. One metering circuit will indicate deviation of line temperature. The other circuit indicates the temperature of sensing point and deviation of line temperature too. The arised signal of both circuits corresponds to the true temperature.



The four wire - technology
This technology is used mainly at laboratory measuring as well as at electronic measuring instruments. This procedure has great measurement accuracy. Four lines supplies the resistor, simultaneous each line forms a separate metering circuit. The transverse signal of three circuits corresponds to the true temperature. The length of the lines can be ignored.

