Certificata ISO 9002
Centro taratura SIT

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Technical Data

Thermocouple and RTD features

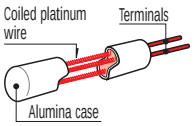
The most common temperature sensors used in industrial applications are:

- Resistance thermometers **(RTDs)**
- Thermoelectric couple thermometers, **thermocouples**

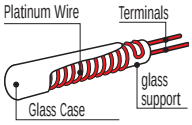
RTDs

They are made of a metal wire wound on an insulating support. They change resistance with temperature.
Due to its high resistivity, best time stability as to temperature and great reproducibility, platinum is the most used wire in many applications.
Most common resistance thermometers are Pt100 [ohm] @ 0°C with a change of about 0.385 [ohm] /°C.
Conversion tables [ohm] /°C are at page 9 together with tolerance ratings.
Most common manufacturing techniques are:

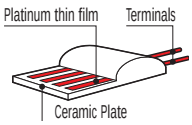
Ceramic, 750°C max.
Coiled wire is sealed and cemented in an alumina case.



Glass, 550°C max.
The wire is wound on a glass support and covered with glass.

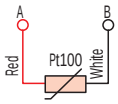


Thin film, 250°C max.
Platinum thin film applied on a ceramic plate.

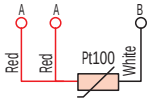


RTD connection according to IEC 751.

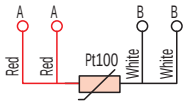
2-wire conn.
Not very common, as it might cause measurement errors.



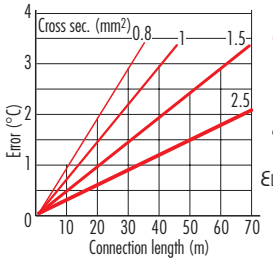
3-wire conn.
The most common one in industrial applications.

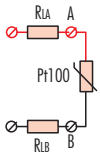


4-wire conn.
Suitable for great accuracy measurements.



In the event that a 2-wire connection be used, here is the ...line measurement error diagram depending on the cross section of the used wire length.

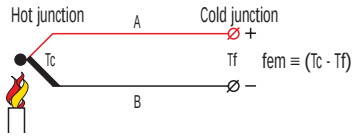




$\varepsilon_{Line} = R_{LA} = R_{LB}$

Thermocouples

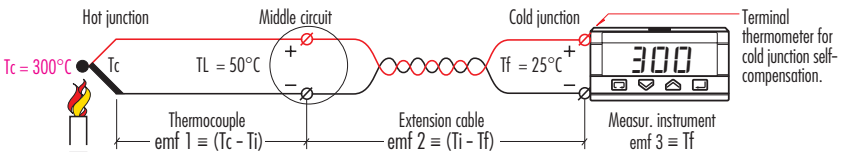
They are made by 2 wires of different alloys (A, B,) joined at the tip. Due to a thermoelectric effect, an electromotive force (EMF) is generated. It is proportional to the difference between hot junction temperature (measurement) and cold junction one (reference).



Thermocouple Operating Features

Type	Suggested temperature range	fem µV/°C	Stability and Reproducibility	Atmosph.	Operating Limits
T - U	-200...200°C	10...60	Excellent: -200 +200 Poor over 300	Oxidating over 0°C	Brittle and oxidating at high temperatures
E	-200...400°C	25...80	Good up to 400°C. Poor over	Oxidating	Hysteresis events
J - L	0...600°C	50...64	Good up to 600°C	Oxidating and scarsely reducing	Poorly homogeneous. Brittle
K	-50...1100°C	15...40	Good under 400°C. Poor over	Oxidating	Chromel oxidation in a scarsely oxidating atmosphere. Brittle
N	0...1100°C	30...40	Good over the whole range	Oxidating	Unknown, as new
S - R	0...1500°C	10...13	Excellent under 1200°C. Good over	Oxid. and vacuum	Sensitive to metal steam, carbon, sulphus and phosphorus contamination
B	500...1700°C	9...11,5	Excellent under 1500°C. Good over		

In the most varied industrial applications, the measurement circuit is:



Thus: emf (tot) = emf 1 * emf 2 + emf 3
emf 250°C + emf 25° + emf 25° = emf 300°
The connection between middle and cold junction has to be made by means of a compensating extension wire, which will generate the same EMF as a thermocuple in the connection point (80°C max.).

Warning: when connecting the extention cable, respect polarity, otherwise an important error will occur:
Ex.: emf 250° - emf 25 + emf 25 = emf 250 (error 50°C)

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