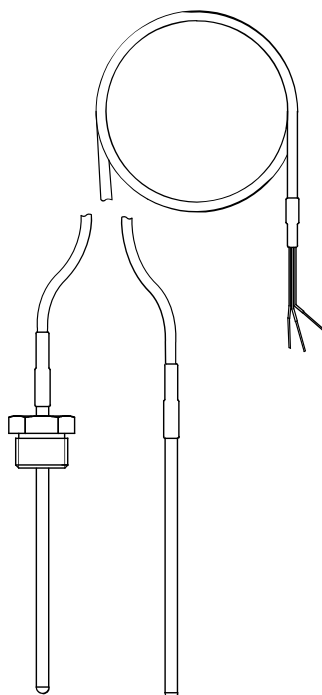
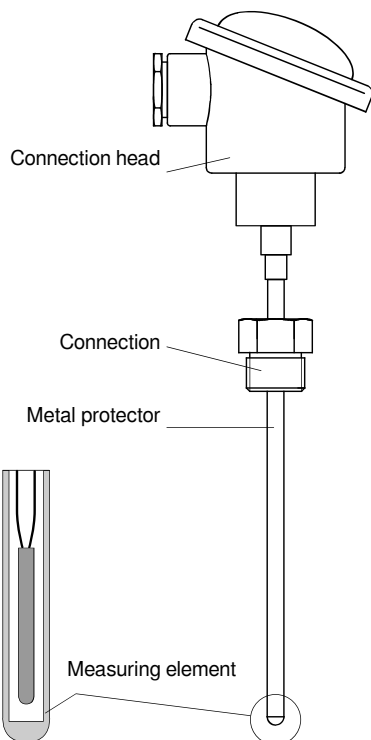


Pt100 probes GENERALITIES



Pt 100 probes Cable outlet

PRINCIPLE

The measuring principle of resistance temperature detectors (RTDs) is based on the variation of electrical resistance in metal wires as a function of temperature. Platinum offers excellent linearity, accuracy, stability, and reliability, with the added advantage of being drawable into very fine wires. For this reason, the platinum resistance sensor—designated as Pt—is widely used in industrial environments.

DESCRIPTION

A Pt100 temperature probe is a mechanical assembly consisting of a sensing element, a conductor wire, and a wire termination (either on a terminal block or connector). This assembly is housed within a protective or mounting support to form the complete sensor.

Various configurations are available depending on needs and applications: stainless steel, plastic support, etc. Connections can be made via: standard heads, DIN connectors, miniature connectors, etc.

- The Pt100 element (the most commonly used) has a resistance of 100 Ω at 0 $^{\circ}\text{C}$.
- The Pt500 sensor has a resistance of 500 Ω at 0 $^{\circ}\text{C}$.
- At 100 $^{\circ}\text{C}$, the corresponding resistance is 138.51 Ω .

STANDARD & ACCURACY CLASSES

The international standard IEC 751, derived from DIN 43 760, defines the nominal values and permissible deviations for platinum resistance sensors. The resistance tables are based on a value of 100 Ω at 0 $^{\circ}\text{C}$, hence the designation Pt100 for a platinum sensor with this nominal resistance. At 100 $^{\circ}\text{C}$ the resistance is 138.51 Ω .

The standard defines two accuracy classes:

- Class B tolerance: $\pm(0.30 + 0.005 \times |t|)$ from -200 $^{\circ}\text{C}$ to +850 $^{\circ}\text{C}$
- Class A tolerance: $\pm(0.15 + 0.002 \times |t|)$ from -200 $^{\circ}\text{C}$ to +600 $^{\circ}\text{C}$

(where $|t|$ is the absolute value of temperature in $^{\circ}\text{C}$)

Class A provides approximately twice the accuracy of Class B. In general, Class B is used for industrial applications, while Class A is intended for laboratory use. Even tighter tolerances are sometimes used, such as 1/3 Class B, also referred to as 1/3 DIN.

Excerpt from the correspondence table according to IEC 751 standard, Amendment 2 of 1995 (based on E.I.T. 90):

			Tolerance Class B		Tolerance Class A	
T $^{\circ}\text{C}$	Rt Ω	Temp.coef. $\Omega/^{\circ}\text{C}$	T $^{\circ}\text{C}$	Rt Ω	T $^{\circ}\text{C}$	Rt Ω
-200	18.52	0.44	± 1.3	± 0.56	± 0.55	± 0.24
-100	60.26	0.41	± 0.8	± 0.32	± 0.35	± 0.14
0	100.00	0.39	± 0.3	± 0.12	± 0.15	± 0.06
100	138.51	0.38	± 0.8	± 0.30	± 0.35	± 0.13
200	175.86	0.37	± 1.3	± 0.48	± 0.55	± 0.20
300	212.05	0.35	± 1.8	± 0.64	± 0.75	± 0.27
400	247.09	0.34	± 2.3	± 0.79	± 0.95	± 0.33
500	280.98	0.33	± 2.8	± 0.93	± 1.15	± 0.38

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Pt100 probes
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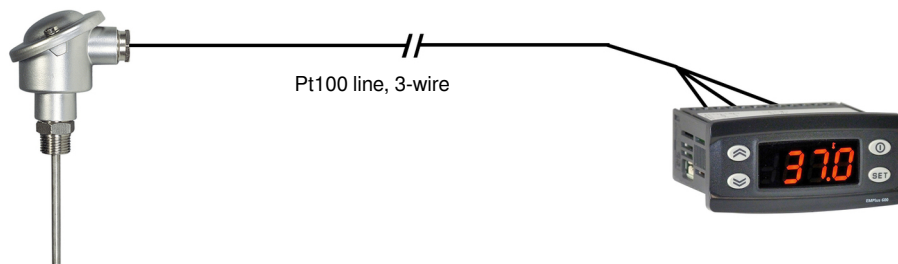
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MEASUREMENT METHOD AND ELECTRICAL WIRING

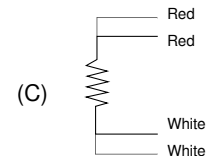
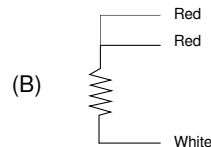
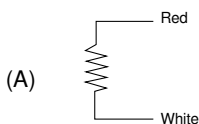
The measurement accuracy is particularly affected by the line resistance of the connecting cable, which is why different wiring configurations are used depending on the required level of precision. Measurement is typically performed using a Wheatstone bridge with a 2-wire, 3-wire, or 4-wire configuration. The 3-wire configuration is the most commonly used in industrial applications. The 4-wire configuration is intended for laboratory use and test benches. In the 2-wire configuration, the error caused by the cable is approximately $0.06\text{ }^{\circ}\text{C}$ per meter for a 1 mm^2 wire cross-section.



Pt 100, connected directly to a temperature controller

Assembly and connection:

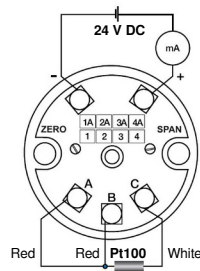
There are different types of connections for a resistance probe.



(A): 2-wire setup, simple but accuracy is affected by line resistance.

(B): 3-wire configuration, commonly used in industry, minimizes systematic errors due to line resistance.

(C): Precise 4-wire connection, allowing total elimination of errors due to line resistance and conductor temperature variations. (Connection used in laboratories)



Pt 100 with 4-20 mA transmitter



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