1. Accuracy limits

1.1 Thermometer resistors Pt100

Norm PN-EN-60751 specify the resistance value ranges in the function of temperature and specify two classes for accuracy limits: A and B class. We supply also resistors in in 1/3 B, not covered by this norm. Accuracy limit specify max. accuracy in °C or in Ω comparing with norm values. Class „A" should not be used in platinum resistors Pt100 100Ω when operating temperatures higher than 650°C.

Accuracy limits for resistors Pt100						
Temperature °C	Class A		Class B		Class 1/3B	
	°C	Ω	°C	Ω	°C	Ω
-200	±0.55	±0.24	±1.3	±0.56	-	-
-100	±0.35	±0.14	±0.8	±0.32	-	-
0	±0.15	±0.06	±0.3	±0.12	±0.1	±0.04
100	±0.35	±0.13	±0.8	±0.30	±0.26	±0.1
200	±0.55	±0.20	±1.3	±0.48	±0.4	±0.16
300	±0.75	±0.27	±1.8	±0.64	±0.6	±0.21
400	±0.95	±0.33	±2.3	±0.79	-	-
500	±1.15	±0.38	±2.8	±0.93	-	-
600	±1.35	±0.43	±3.3	±1.06	-	-
700	-	-	±3.8	±1.17	-	-
800	-	-	±4.3	±1.28	-	-
900	-	-	±4.6	±1.34	-	-

1.2 Thermocouples

Norm PN-EN-60854-2 specify three classes and values of thermoelectric force in the function of temperature.

Accuracy limits acc. to norm PN-EN-60854-2						
Type	Class 1		Class 2		Class 3	
	Temperature range [°C]	Temperature range [°C]	Temperature range [°C]	Temperature range [°C]	Temperature range [°C]	Temperature range [°C]
Type T	-40 to +125	±0.5	-40 do +133	±1.0	-67 do +40	±1.0
	+125 to +350	±0.004 x t	+133 do +350	±0.0075 x t	-200 do -67	±0.015 x t
Type E	-40 to +375	±1.5	-40 do +333	±2.5	-167 do +40	±2.5
	+375 to +800	±0.004 x t	+333 do +900	±0.0075 x t	-200 do -167	±0.015 x t
Type J	-40 to +375	±1.5	-40 do +333	±2.5	-	-
	+375 to +750	±0.004 x t	+333 do +750	±0.0075 x t	-	-
Type K	-40 to +375	±1.5	-40 do +333	±2.5	-167 do +40	±2.5
	+375 to +1000	±0.004 x t	+333 do +1200	±0.0075 x t	-200 do -167	±0.015 x t
Type R+S	0 to +1100	±1.0	0 do +600	±1.5	-	-
	+1100 to +1600	±[1+0.003 (t –1100)]	+600 do +1600	±0.0025 x t	-	-
Type B 400	-	-	-	-	+600 do +800	±4.0
	-	-	+600 do +1700	±0.0025 x t	+800 do +1700	±0.005 x t

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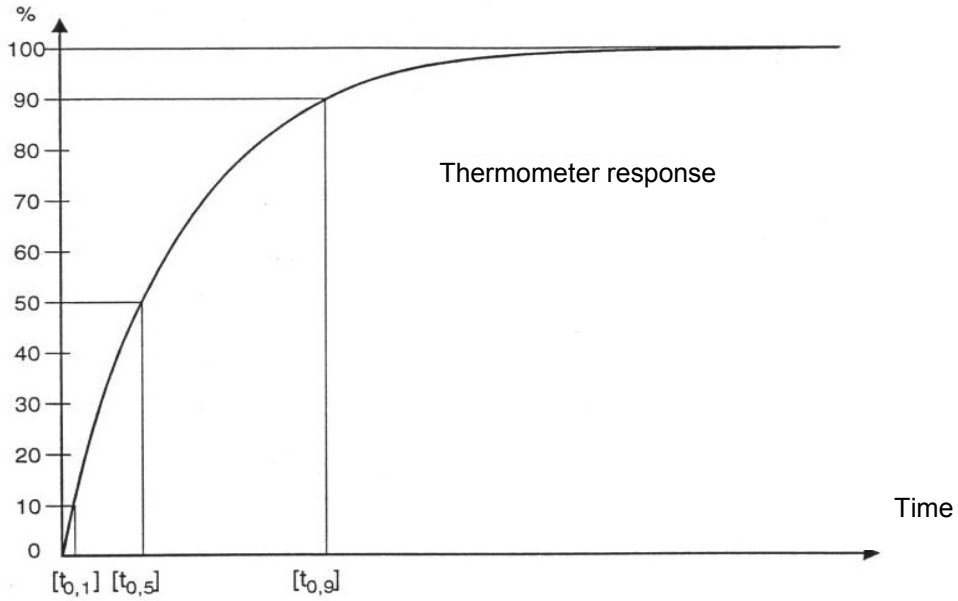
2. Dynamic parameters

2.1 Time of response [t]

Time of response [t], this is a time, which thermometer needs, after temperature step change, to show specified percentage of a change. Time of response [$t_{0.5}$], this is the time, after which the thermometer show 50% of value of the temperature step change. There can be specified times of response for 10% [$t_{0.1}$] or for 90% [$t_{0.9}$].
Times of response can be specified for circulated air or water.

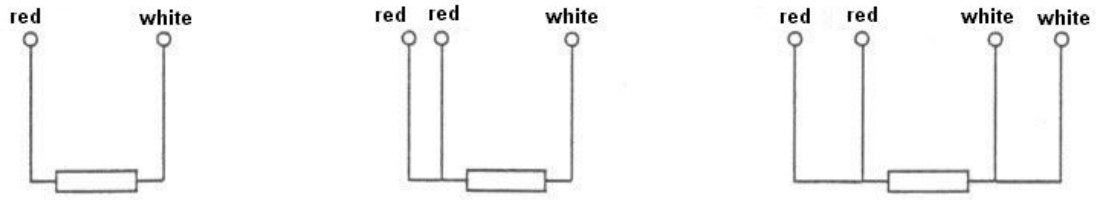


3. Wire configuration.

Norm PN-EN- 60751+A2 specify the following cable configuration:

Thermometers with only 2-wire configuration, which are used with 2 outer connecting cables only, should not be applied to class A (pkt3.3.1 PN-EN-60751+A2).

3.1 Configuration symbols



2-wire 3-wire 4-wire

Cable resistance Cu: R = (L x 0.0175) / s

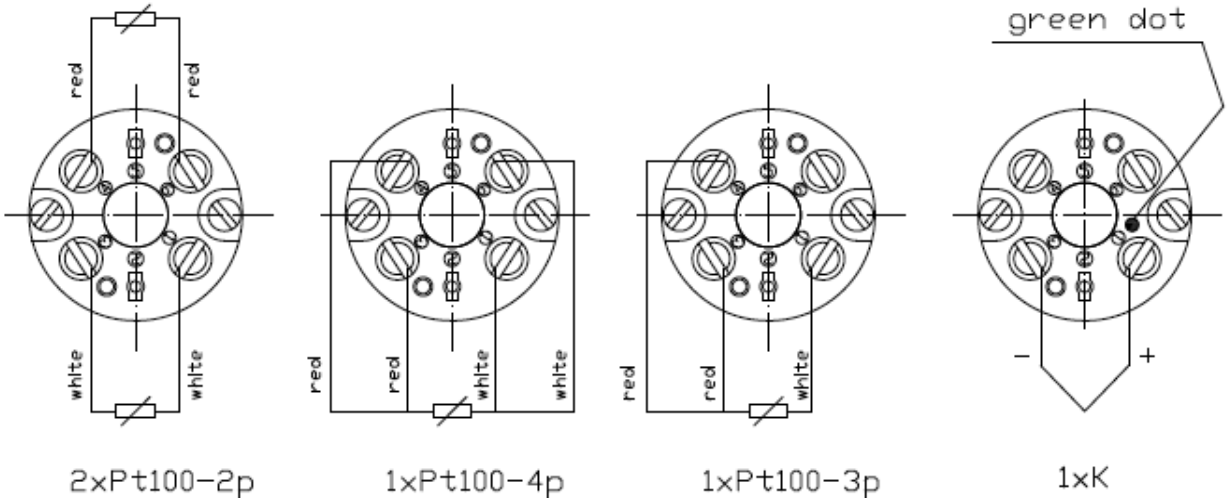
where:

L = cable length [m]

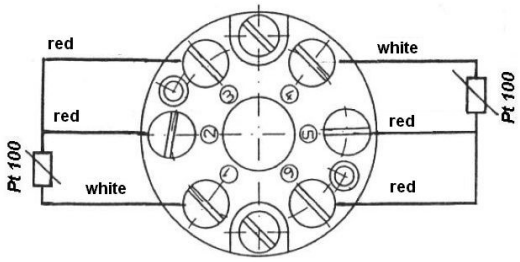
s = cable diameter [mm^2]

0.0175 = Cu material resistance

3.2 Resistance thermometers connection



Connecting diagram of terminal block with 6 connections (Configuration 3-wire 2xPt-100)



2xPt100-3p

4. Products quality control

Each manufactured product is quality controlled in our laboratory in compliance with norm requirements.

The quality control of manufactured by us platinum resistors was also made by Certified Laboratory DKD-K-06701 of Ludwig Schneider Messtechnik GmbH.

4.1 Resistance thermometer quality control

This procedure is made for the following sensors: Pt-100/1.3850, Ni-100/1.617, Cu-100/1.426 and also for of unusual resistance in $0^{o}C$ sensors (Pt-50, Pt-500, Ni-200, Cu-50, itp.) and resistance thermometers equipped with these sensors.
There is also possibility of checking the parameters of equipment used for measuring resistance and voltage of sensors.

4.2 Thermocouple quality control

Procedure is done for the following thermocouples PtRh10-Pt (S), NiCr-NiAl (K), Fe-NiCu (J),Cu-CuNi (T) itp., and sensors equipped in above thermocouples.

4.3 Measuring accuracy

- Temperature from $0^{o}C$: ±0.03 ^{o}C (by confidence level 95%)
- Temperature from $0^{o}C$ to 100 ^{o}C : ±0.10 ^{o}C (by confidence level 95%)
- Temperature from $100^{o}C$ to 500 ^{o}C : ±0.30 ^{o}C (by confidence level 95%)
- Temperature from $500^{o}C$ to 1200 ^{o}C : ±1.3 ^{o}C (by confidence level 95%)

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4.4 Control and measuring instruments used in the laboratory

- Control platinum resistant thermometer type PW-EZ100 Heraeus Sensor GmbH (Certification No. DKD-K 05601).
- Platinum resistant laboratory sensors of LSM brand (Certification No. DKD-K 05701).
- Control platinum thermometers II class PtRh10-Pt (Certification of Regional Measuring Department in Cracow)
- Standard resistors of 10Ω ,100Ω , 1000Ω kl. 0,01 of ZIP brand (Certification of Regional Measuring Department in Cracow)
- Resistance decades class. 0,01 (Certification of Regional Measuring Department in Cracow)
- Measurer of insulation in the range of 1MΩ to 10GΩ voltage 0÷1000V.
- Digital multimeters type 6001 (Certification of Regional Measuring Department in Cracow)
- Thermometer bridge 5840E.
- PC for measurements MC8047.
- Pipe furnace type TPK 500 up to 1200 ^{o}C.
- Pipe furnace ROF 7/75 up to 1300 ^{o}C, with measuring blocks made form aluminum, nickel steel and ceramic.
- Liquid thermostat up to 300 ^{o}C.
- Ebullioscope for boiling water point measurements.
- Deware instrument for melting water point measurements.

In our laboratory we issue certificates of quality control of resistors and sensors in given measuring range.