

TEMPERATURE CONTROLS PTY LTD

ACN: 075 298 592 ABN: 76 075 298 592

SYDNEY: PH: (02) 9721 8644 FAX: (02) 9738 9339 EMAIL: sales@temperature.com.au
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THERMOCOUPLES * RTD SENSORS * THERMOWELLS * EXTENSION CABLES * LEVEL SWITCHES

OPERATING MAINTENANCE INSTRUCTION

RTD Sensors

A RTD Sensing element consists of a wire coil or deposited film of pure metal. The element's resistance increases with temperature in a known and repeatable manner. RTD's exhibit excellent accuracy over a wide temperature range.

- **Temperature range:** -200 to 700°C
- **Sensitivity:** the voltage drop across an RTD provides a much larger output than a thermocouple.
- **Linearity:** Platinum and copper RTD's produce a more linear response than thermocouples or thermistors. RTD non-linearities can be corrected through proper design of resistive bridge networks.

The most commonly used element material is platinum with a resistance of 100 ohms @ 0°C and a temperature coefficient (Alpha) of 0.00385 ohms/ohm/°C.

Other element materials also used are copper, nickel and nickel-iron. Platinum elements predominate because of their wider range, and because platinum is the most repeatable and stable of all metals.

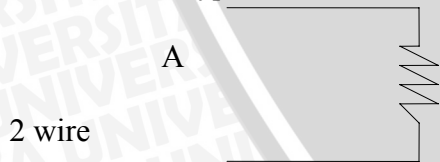
Tolerance of PT100 Ω (Alpha = 0.003850 @ 0°C)

CLASS 'B'	± 0.12 Ω	OR	± 0.30°C
CLASS 'A'	± 0.06 Ω	OR	± 0.15°C
1/3 DIN	± 0.04 Ω	OR	± 0.10°C
1/10 DIN	± 0.012 Ω	OR	± 0.03°C

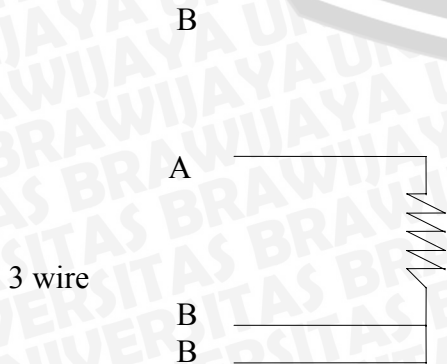
RTD sensors should be wired using a screened copper conductor cable to prevent Electromagnetic interference.

Connection / Wiring details

Different connection Types. Standard Colour code; A is white, B is red.



Basic connection where the lead is short. No lead wire compensation, introducing an error into the reading.



Most common connection 3 wire, the instrument measures the lead wire resistance in the B legs and allows for this in its reading.

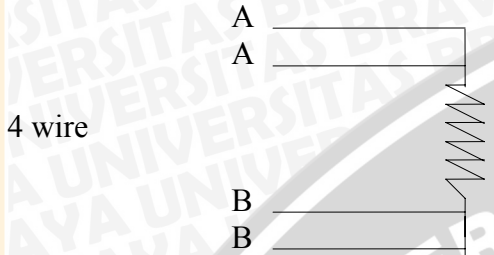
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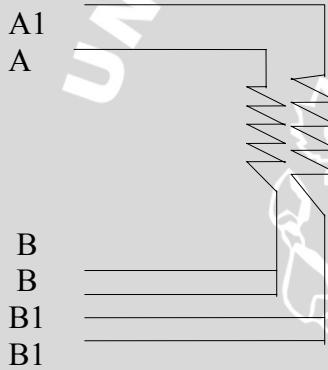


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4 wire

4 wire connection is the most accurate measurement. The instrument measures the lead resistance of all four lead wires removing these values for its reading



Duplex RTD

Duplex 3 wire RTD connection as per single RTD but two individual element windings.

Table for Platinum resistance elements.
 Resistance values in Ohms from 0°C to + 400°C.
 PT100 ohm RTD to DIN 43760 - IEC 751 – EN60 751
 R(0) = 100 ohm

°C	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12
100	138.50	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	144.93	145.31	145.68
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94
150	157.31	157.69	158.06	158.43	158.81	159.18	159.55	159.93	160.30	160.67

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160	161.04	161.42	161.79	162.16	162.53	162.90	163.27	163.65	164.02	164.39
170	164.76	165.13	165.50	165.87	166.24	166.61	166.98	167.35	167.72	168.09
180	168.46	168.83	169.20	169.57	169.94	170.31	170.68	171.05	171.42	171.79
190	172.16	172.53	172.90	173.26	173.63	174.00	174.37	174.74	175.10	175.47
200	175.84	176.21	176.57	176.94	177.31	177.68	178.04	178.41	178.78	179.14
210	179.51	179.88	180.24	180.61	180.97	181.34	181.71	182.07	182.44	182.80
220	183.17	183.53	183.90	184.26	184.63	184.99	185.36	185.72	186.09	186.45
230	186.82	187.18	187.54	187.91	188.27	188.63	189.00	189.36	189.72	190.09
240	190.45	190.81	191.18	191.54	191.90	192.26	192.63	192.99	193.35	193.71
250	194.07	194.44	194.80	195.16	195.52	195.88	196.24	196.60	196.96	197.33
260	197.69	198.05	198.41	198.77	199.13	199.49	199.85	200.21	200.57	200.93
270	201.29	201.65	202.01	202.36	202.72	203.08	203.44	203.80	204.16	204.52
280	204.88	205.23	205.59	205.95	206.31	206.67	207.02	207.38	207.74	208.10
290	208.45	208.81	209.17	209.52	209.88	210.24	210.59	210.95	211.31	211.66
300	212.02	212.37	212.73	213.09	213.44	213.8	214.15	214.51	214.86	215.22
310	215.57	215.93	216.28	216.64	216.99	217.35	217.70	218.05	218.41	218.76
320	219.12	219.47	219.82	220.18	220.53	220.88	221.24	221.59	221.94	222.29
330	222.65	223.00	223.35	223.70	224.06	224.41	224.76	225.11	225.46	225.81
340	226.17	226.52	226.87	227.22	227.57	227.92	228.27	228.62	228.97	229.32
350	229.67	230.02	230.37	230.72	231.07	231.42	231.77	232.12	232.47	232.82
360	233.17	233.52	233.87	234.22	234.56	234.91	235.26	235.61	235.96	236.31
370	236.65	237.00	237.35	237.70	238.04	238.39	238.74	239.09	239.43	239.78
380	240.13	240.47	240.82	241.17	241.51	241.86	242.20	242.55	242.90	243.24
390	243.59	243.93	244.28	244.62	244.97	245.31	245.66	246.00	246.35	246.69
400	247.04									

There is no maintenance required for RTD sensors however, scheduled calibration checks at ice point (0°C) are recommended.

RESISTANCE THERMOMETERS AND THEIR ELEMENTS

According to Australian Standard 2091 – 1981 - PT100 Ω DIN 43760 – EN60 751 ALPHA 0.00385

Method for Determining Ice-Point (°C) Resistance

- a. **Insulated container.** An insulated container at least 300 mm deep and with an internal diameter of 100 mm.

PROCEDURE. The procedure shall be as follows:

- (a) Fill the insulated container with finely divided ice made from distilled water.

Note: If ice water from distilled water is not available, the clear part of a block of commercial ice will suffice, provided that all surfaces are first washed with distilled water.

- b) Mix the ice with distilled water which has been pre-cooled, using the stirrer, and then drain off the excess water. The ice should be glassy-looking but there should be no free water remaining.

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- c) Connect the thermometer to an appropriate resistance measuring device and adjust so that the electrical power dissipated in the element does not exceed 1 m W.
- d) Immerse the thermometer in the ice so that the element is at a depth of at least 150 mm. Ensure that the lower tip of the thermometer is at least 30 mm clear of the bottom of the container.

Note: Thermometers with stem lengths less than 150 mm should be immersed to their maximum possible depth.

- e) When the element reaches equilibrium with the ice, measurements may be taken. Measurements carried out with direct current shall be made with the current in both the forward and reverse directions.

Note: The time taken for the element to reach equilibrium is normally about 3 minutes.

- f) Decrease the depth of immersion of the element by 50 mm or 20 percent of the stem length, whichever is the smaller.
- g) Repeat step (e). If the change in reading is more than on-third the appropriate tolerance given in Clause 2.2, the whole procedure shall be repeated with fresh ice.

Workshop certificate. The workshop certificate shall state the following information:

- a. Identify instrument ie PT100 Ω DIN 43760 – EN60 751 ALPHA 0.00385
- b. The measured resistance at 0⁰C.
- c. The difference between the nominal resistance and the measured resistance at 0⁰C.
- d. Uncertainty of Bath

Accuracy:

RTD Sensors PT100 Ω at 0 °C = Class **B** +/- 0.3 °C, Class **A** +/- 0.15 °C, **1/10 DIN** = +/- 0.03 °C