

LABFACILITY PLATINUM RESISTANCE THERMOMETRY INFORMATION - AT A GLANCE

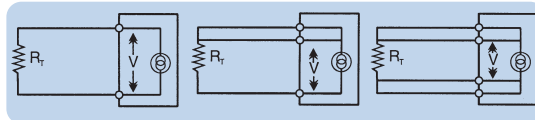
PRACTICAL BRIDGE CIRCUITS FOR 2, 3 AND 4 WIRE THERMOMETERS

The connection between the thermometer assembly and the instrumentation. The cabling introduces electrical resistance which is placed in series with the resistance thermometer. **The two resistances are therefore cumulative and could be interpreted as an increased temperature if the lead resistance is not allowed for.** The longer and/or the smaller the diameter of the cable, the greater the lead resistance will be and the measurement errors could be appreciable. In the case of a **2 wire connection**, little can be done about this problem and some measurement error will result according to the cabling and input circuit arrangement.

For this reason, a **2 wire arrangement is only suitable for short cable lengths.** If it is essential to use only 2 wires, ensure that the largest possible diameter of conductors is specified and

that the length of cable is minimised to keep cable resistance to as low a value as possible.

The use of 3 wires, when dictated either by probe construction or by the input termination of the measuring instrument, will allow for a good level of lead resistance compensation. **However the compensation technique is based on the assumption that the resistance of all three leads is identical** and that they all reside at the same ambient temperature; this is not always the case. **Optimum accuracy is therefore achieved with a 4 wire configuration.**



STEM CONDUCTION

This is the mechanism by which heat is conducted from or to the process medium by the probe itself; an apparent reduction or increase respectively in measured temperature results. The **immersion depth** (the length of that part of the probe which is directly in contact with the medium) must be such as to ensure that the "sensing" length is exceeded (double the sensing length is recommended). Small immersion depths result in a large temperature gradient between the sensor and the surroundings which results in a large heat flow.

The ideal immersion depth can be achieved in practice by moving the probe into or out of the process medium incrementally; with each adjustment, note any apparent change in indicated temperature. The correct depth will result in no change in indicated temperature. For calibration purposes 150 to 300mm immersion is required depending on the probe construction.

SELF-HEATING

In order to measure the voltage dropped across the Pt sensing resistor, a current must be passed through it. The measuring current produces heat dissipation in the sensor. This results in an increased temperature indication. It is necessary to minimise the current flow as much as possible; 1mA or less is usually acceptable.

If the sensor is immersed in flowing liquid or gas, the effect is reduced because of more rapid heat removal. Conversely, in still gas for example, the effect may be significant. The self-heating coefficient E is expressed as:

$$E = \Delta t / (R - I^2)$$

Where Δt = (indicated temperature) - (temperature of the medium)

R = Pt resistance

I = measurement current

RESISTANCE V TEMPERATURE AND TOLERANCES FOR PLATINUM RESISTORS TO IEC 751(1995)/BS EN60751(1996)

Temp (°C)	Resistance (Ω)	Tolerance			
		(±°C)	Class A (±Ω)	Class B (±°C)	Class B (±Ω)
-200	18.52	0.55	0.24	1.3	0.56
-100	60.26	0.35	0.14	0.8	0.32
0	100.00	0.15	0.06	0.3	0.12
100	138.51	0.35	0.13	0.8	0.30
200	175.86	0.55	0.20	1.3	0.48
300	212.05	0.75	0.27	1.8	0.64
400	247.09	0.95	0.33	2.3	0.79
500	280.98	1.15	0.38	2.8	0.93
600	313.71	1.35	0.43	3.3	1.06
650	329.64	1.45	0.46	3.6	1.13
700	345.28	-	-	3.8	1.17
800	375.70	-	-	4.3	1.28
850	390.48	-	-	4.6	1.34

NEW TOLERANCE CLASSES FOR RESISTORS TO IEC 60751(2008)

For wire wound resistors		For film resistors		Tolerance value ^a °C
Tolerance class	Temperature range of validity °C	Tolerance class	Temperature range of validity °C	
W 0.1	-100 to +350	F 0.1	0 to +150	± (0.1 + 0.0017 t)
W 0.15	-100 to +450	F 0.15	-30 to +300	± (0.15 + 0.002 t)
W 0.3	-196 to +660	F 0.3	-50 to +500	± (0.3 + 0.005 t)
W 0.6	-196 to +660	F 0.6	-50 to +600	± (0.6 + 0.01 t)

^a | t | = modulus of temperature in °C without regard to sign. For any value of R₀.

NEW TOLERANCE CLASSES FOR THERMOMETERS TO IEC 60751(2008)

Tolerance class	Temperature range of validity °C		Tolerance values ^a °C
	Wire wound resistors	Film resistors	
AA	-50 to +250	0 to +150	± (0.1 + 0.0017 t)
A	-100 to +450	-30 to +300	± (0.15 + 0.002 t)
B	-196 to +600	-50 to +500	± (0.3 + 0.005 t)
C	-196 to +600	-50 to +600	± (0.6 + 0.01 t)

^a | t | = modulus of temperature in °C without regard to sign. For any value of R₀.

RECOMMENDED TERMINATION COLOUR CODES IEC 751(1995)

