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PLATINUM RESISTANCE THERMOMETER (PRT) SELECTION GUIDE

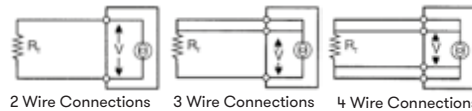


Practical Bridge Circuits For 2, 3 And 4 Wire Thermometers

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:

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

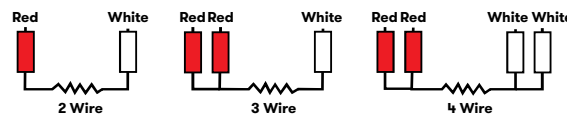
Where Δt = (indicated temperature) - (temperature of the medium)

R = Pt resistance

I = measurement current

Recommended Termination Colour Codes IEC 751(1995)

For dual sensors, IEC 60751(2008) specifies yellow & black(or grey) (instead of red & white as shown) to be introduced for the additional sensing resistor.



Resistance V Temperature and Tolerances for Platinum Resistors to IEC 751(1995)/BS EN60751(1996)

| Temp (°C) | Resistance (Ω) | Tolerance | | | |
|--------------|-------------------|-----------|------|---------|------|
| | | Class A | | Class B | |
| | | (±°C) | (±Ω) | (±°C) | (±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 class | Temperature range of validity °C | Tolerance class | Temperature range of validity °C | Tolerance value [°] °C |
| W 0.1 | -100 to +350 | F 0.1 | 0 - +150 | ± (0.1 + 0.0017 t) |
| W 0.15 | -100 to +450 | F 0.15 | -30 - +300 | ± (0.15 + 0.002 t) |
| W 0.3 | -196 to +660 | F 0.3 | -50 - +500 | ± (0.3 + 0.005 t) |
| W 0.6 | -196 to +660 | F 0.6 | -50 - +600 | ± (0.6 + 0.01 t) |

[°] | t | = modulus of temperature in °C without regard to sign. For any value of R[°]

New Tolerance Classes for Thermometers to IEC 60751(2008)

| Tolerance class | Temperature range of validity °C | | Tolerance values [°] °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) |

[°] | t | = modulus of temperature in °C without regard to sign. For any value of R[°]

COMPARISON OF SENSOR TYPES

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| | PLATINUM RESISTANCE THERMOMETER | THERMOCOUPLE | THERMISTOR |
|----------------------------------|--|---|---|
| Sensor | Platinum-wire wound or flatfilm resistor | Thermoelement, two dissimilar metals/alloys | Ceramic (metal oxides) |
| Accuracy (typical values) | 0.1 to 1.0°C | 0.5 to 5.0°C | 0.1 to 1.5°C |
| Long term Stability | Excellent | Variable, Prone to ageing | Good |
| Temperature range | -200 to 650°C | -200 to 1750°C | -100 to 300°C |
| Thermal response | Wirewound – slow Film – faster 1-50 secs typical | Sheathed – slow Exposed tip – fast 0.1 to 10 secs typical | generally fast 0.05 to 2.5 secs typical |
| Excitation | Constant current required | None | None |
| Characteristic | PTC resistance | Thermovoltage | NTC resistance (some are PTC) |
| Linearity | Fairly linear | Most types non-linear | Exponential |
| Lead resistance effect | 3 & 4 wire – low. 2 wire – high | Short cable runs satisfactory | Low |
| Electrical pick-up | Rarely susceptible | Susceptible | Not susceptible |
| Interface | Bridge 2,3 or 4 wire | Potentiometric input. Cold junction compensation required | 2 wire resistance |
| Vibration effects/ shock | wirewound – not suitable. Film – good | Mineral insulated types suitable | Suitable |
| Output/ characteristic | approx. 0.4 W/°C | From 10µV/°C to 40µV/°C depending on type | -4% / °C |
| Extension Leads | Copper | Compensating cable | Copper |
| Cost | Wirewound – more expensive Film – cheaper | Relatively low cost | Inexpensive to moderate |

Comments and values shown in this chart are generalised and nominal. They are not intended to be definitive but are stated for general guidance.

RTD SENSOR OR THERMOCOUPLE?

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RTD

Resistance Thermometers utilise a high precision sensing resistor, usually platinum, the resistance value of which increases with temperature. The dominant standard adopted internationally is the Pt100 which has a resistance value of 100.0 Ohms at 0°C and a change of 38.50 Ohms between 0 and 100°C (the fundamental interval).

The platinum sensing resistor is highly stable and allows high accuracy temperature sensing. Resistance thermometer sensing resistors are 2 wire devices but the 2 wires will usually be extended in a 3 or 4 wire configuration according to the application, the associated instrumentation and accuracy requirements.



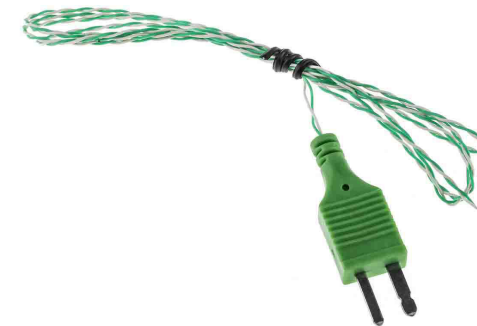
RTD's are, generally:

- More expensive
- More accurate
- Highly stable (if used carefully)
- Capable of better resolution
- Restricted in their range of temperature
- Stem, not tip sensitive
- Rarely available in small diameters (below 3mm)

Thermocouple

Thermocouples comprise a thermoelement which is a junction of two specific, dissimilar alloys and a suitable two wire extension lead. The junction is a short circuit only, the EMF is generated in the temperature gradient between the hot junction and the 'cold' or reference junction. This characteristic is reasonably stable and repeatable and allows for a family of alternative thermocouple types (e.g. J,K,T,N) to be used.

The alternative types are defined by the nature of the alloys used in the thermoelements and each type displays a different thermal EMF characteristic.



Thermocouples are, generally:

- Relatively inexpensive
- More rugged
- Less accurate
- More prone to drift
- More sensitive
- Tip sensing
- Available in smaller diameters
- Available with a wider temperature range
- More versatile

In both cases, the choice of thermocouple or RTD must be made to match the instrumentation and to suit the application.

COMPARISON OF SHEATH MATERIALS

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| SHEATH MATERIAL | MAX CONTINUOUS TEMPERATURE | NOTES | APPLICATIONS |
|---|----------------------------|---|--|
| Refractory Oxide recrystallised, e.g. Alumina Impervious | 1750°C | Good choice for rare metal thermocouples. Good resistance to chemical attack. Mechanically strong but severe thermal shock should be avoided. | Forging iron & steel, incinerators, carburizing and hardening in heat treatment, continuous furnaces and glass lehrs. |
| Silicon Carbide (Porous) | 1500°C | Good level of protection even in severe conditions. Good resistance to reasonable levels of thermal shock. Mechanically strong when thick wall is specified but becomes brittle when aged. Unsuitable for oxidising atmospheres but resists fluxes. | Forging iron & steel, incinerator, billet heating, slab heating, butt welding, soaking pits and ceramic dryers. |
| Impervious Mullite | 1600°C | Good choice for rare metal thermocouples under severe conditions. Resists Sulphurous and carbonaceous atmospheres. Good resistance to thermal shock should be avoided. | Forging iron & steel, incinerators, heat treatment, glass flues and continuous furnaces. |
| Mild Steel (cold drawn seamless) | 600°C | Good physical protection but prone to rapid corrosion. | Annealing up to 500°C, hardening pre-heaters and baking ovens. |
| Stainless steel 25/20 | 1150°C | Resists corrosion even at elevated temperature. Can be used in Sulphurous atmospheres. | Heat treatment annealing, flues, many chemical processes, vitreous enamelling and corrosion resistant alternative to mild steel. |
| Inconel 600/800* | 1200°C | Nickel-Chromium-Iron alloy which extends the properties of stainless steel 25/20 to higher operating temperatures. Excellent in Sulphur free atmospheres; superior corrosion resistance at higher temperatures. Good mechanical strength. | Annealing, carburizing, hardening, iron and steel hot blast, open hearth flue & stack, waste heat boilers, billet heating, slab heating, continuous furnaces, soaking pits, cement exit flues & kilns, vitreous enamelling, glass flues and checkers, gas superheaters and incinerators up to 1000°C. Highly sulphurous atmospheres should be avoided above 800°C. |
| Chrome Iron | 1100°C | Suitable for very adverse environments. Good mechanical strength. Resists severely corrosive and sulphurous atmospheres. | Annealing, carburizing, hardening, iron & steel hot blast, open hearth flue and stack, waste heat boilers, billet heating, slab heating, continuous furnaces, soaking pits, cement exit flues & kilns, vitreous enamelling, glass flues and checkers, gas superheaters and incinerators up to 1000°C. |
| Nicrobell* | 1300°C | Highly stable in vacuum and oxidising atmospheres. Corrosion resistance generally superior to stainless steels. Can be used in Sulphurous atmospheres at reduced temperatures. High operating temperature. | As Inconel plus excellent choice for vacuum furnaces and flues. |

* Tradenames

Sheath materials range from mild and stainless steels to refractory oxides (ceramics, so called) and a variety of exotic materials including rare metals. The choice of sheath must take account of operating temperature, media characteristics, durability and other considerations including the material relationship to the type of sensor.

THIN FILM DETECTORS & WIRE-WOUND DETECTOR ELEMENTS

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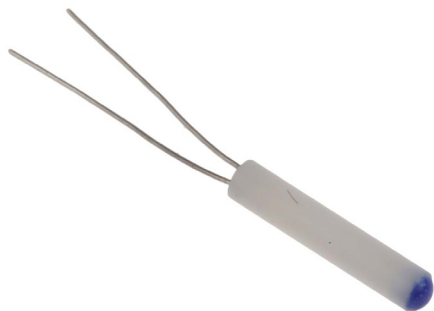


Thin Film Detectors



| RESISTANCE | DIMENSIONS (WIDTH X LENGTH) | TOLERANCE CLASS A | TOLERANCE CLASS B | TOLERANCE CLASS 1/3 DIN |
|------------|-----------------------------|-------------------|-------------------|-------------------------|
| Pt100 | 2 × 5mm | 611-7788 | 611-7801 | - |
| Pt100 | 2 × 10mm | 362-9799 | 237-1607 | 362-9812 |
| Pt100 | 2 × 2.3mm | 362-9834 | 362-9840 | 362-9856 |
| Pt1000 | 2 × 10mm | 362-9907 | 362-9913 | 814-0178 |
| Pt1000 | 1 × 3mm | - | 814-0171 | - |
| Pt1000 | 1.25 × 1.7mm | - | 814-0175 | - |

Wire-Wound Detector Elements



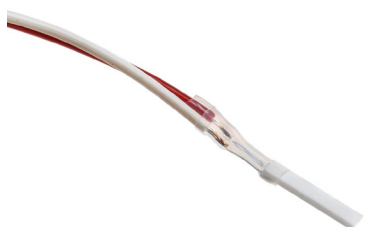
| RESISTANCE | DIMENSIONS (DIA X LENGTH) | TOLERANCE CLASS A | TOLERANCE CLASS B | DUEL ELEMENT (PT100 X2) TOLERANCE CLASS A |
|------------|---------------------------|-------------------|-------------------|---|
| Pt100 | 1.5 × 8mm | 611-7873 | 611-7851 | - |
| Pt100 | 1.5 × 15mm | 611-7839 | 611-7867 | 397-1595 |
| Pt100 | 2.8 × 15mm | 611-7845 | 611-7823 | - |
| Pt100 | 2.8 × 25mm | 611-7817 | 611-7794 | - |

PLATINUM RESISTANCE THERMOMETER WITH EXTENDED LEADS

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Platinum Resistance Pt100 & Pt1000 Detectors with Extended Leads



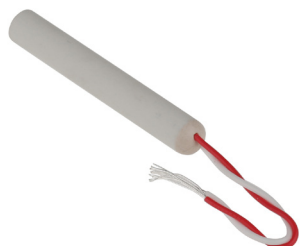
| TYPE | CLASS | DETECTOR (W X L) | CABLE LENGTH | AWG | CABLE TYPE | TERMINATION | STOCK NO |
|--------|-------|------------------|--------------|--------|-------------------|-------------|----------|
| Pt100 | B | 2 x 10mm | 300mm | 24 AWG | Teflon® insulated | 2 Wire | 891-9132 |
| Pt100 | A | 2 x 10mm | 1000mm | 26 AWG | Teflon® insulated | 4 Wire | 891-9145 |
| Pt1000 | B | 2 x 10mm | 500mm | 24 AWG | Teflon® insulated | 2 Wire | 891-9157 |

Pt100 Ceramic Wire-Wound



| TYPE | CLASS | DETECTOR (W X L) | CABLE LENGTH | AWG | CABLE TYPE | TERMINATION | STOCK NO |
|-------|-------|------------------|--------------|--------|-------------------|-------------|----------|
| Pt100 | B | 2.8 x 15mm | 300mm | 26 AWG | Teflon® insulated | 2 Wire | 110-4460 |
| Pt100 | B | 2.8 x 15mm | 500mm | 26 AWG | Teflon® insulated | 4 Wire | 891-9160 |
| Pt100 | B | 2.8 x 15mm | 1000mm | 26 AWG | Teflon® insulated | 4 Wire | 891-9163 |

Pt100 Tubular Ceramic Insert Elements with tail wires



| TYPE | CERAMIC DIAMETER | CERAMIC LENGTH | LEAD LENGTH | CABLE TYPE | CABLE TYPE | TERMINATION | STOCK NO |
|-------|------------------|----------------|-------------|--------------------|-------------------|-------------|----------|
| Pt100 | 5mm | 35mm | 50mm | 7/0.2mm SPC Teflon | Teflon® insulated | 2 Wire | 237-1641 |
| Pt100 | 5mm | 35mm | 450mm | 7/0.2mm SPC Teflon | Teflon® insulated | 4 Wire | 237-1657 |
| Pt100 | 5mm | 35mm | 10mm | 1/0.4mm Nickel | Teflon® insulated | 4 Wire | 237-1629 |

PLATINUM RESISTANCE PT100 SENSORS

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Pt100 Heavy Duty Sensor Probe, Class B



| TYPE | CLASS | PROBE DIAMETER | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | STOCK NO |
|-------|-------|----------------|--------------|--------------|---|----------|
| Pt100 | B | 6mm | 50mm | 2m | Flexible silicone rubber insulated, 7/0.2mm | 455-3968 |
| Pt100 | B | 6mm | 100mm | 2m | Flexible silicone rubber insulated, 7/0.2mm | 611-8264 |

Pt100 Sheathed Thin Film Strip Sensor



| TYPE | CLASS | STRIP DIMENSIONS (L X W X H) | CABLE LENGTH | CABLE TYPE | STOCK NO |
|-------|-------|------------------------------|--------------|---|----------|
| Pt100 | B | 35mm x 6mm x 2mm | 1m | 7/.02mm Teflon® insulated twin twisted lead | 237-1613 |

PT100 'Flat Tip' Probe



| TYPE | CLASS | PROBE DIAMETER | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | STOCK NO |
|-------|-------|----------------|--------------|--------------|---|----------|
| Pt100 | B | 4mm | 150mm | 1m | 7/0.2mm Teflon® insulated 2 twisted leads | 237-1663 |

PLATINUM RESISTANCE THERMOMETER PT100 PRECISION PROBES

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Platinum Resistance Thermometer Pt100 Precision Probe



| TYPE | CLASS | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | PROBE TEMPERATURE RANGE | STOCK NO |
|-------|-----------|--------------|--------------|---|-------------|-------------------------|----------|
| Pt100 | 1/5th Din | 250mm | 2m | 7/0.2mm PTFE insulated with silver plated copper screen | 4 Wire | -50°C to +250°C | 236-4299 |

Platinum Resistance Pt100 Dual Element Mineral Insulated Sensor Probe



| TYPE | CLASS | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | PROBE TEMPERATURE RANGE | STOCK NO |
|------------------------------|-------|--------------|--------------|--|-------------|-------------------------|----------|
| Mineral Insulated Duplex PRT | B | 150mm | 1m | 7/0.2mm flexible 6 core Teflon® insulated & screened | 2 x 3 wire | -50°C to +500°C | 397-1416 |

Platinum Resistance Pt100 Dual Element Industrial Sensor Probe



| TYPE | CLASS | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | PROBE TEMPERATURE RANGE | STOCK NO |
|-------|-------|--------------|--------------|--|-------------|-------------------------|----------|
| Pt100 | B | 150mm | 1m | 7/0.2mm flexible 6 core Teflon® insulated & screened | 2 x 3 wire | -50°C to +250°C | 397-1393 |

PLATINUM RESISTANCE THERMOMETER PT100 WITH STAINLESS STEEL SHEATH

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Platinum Resistance Pt100 Class B Sensors with Teflon Insulated lead in a Stainless-Steel Tube



| CLASS | PROBE DIAMETER | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | STOCK NO |
|-------|----------------|--------------|--------------|-------------------|-------------|----------|
| B | 3mm | 25mm | 1m | Teflon® insulated | 4 Wire | 762-1134 |
| B | 3mm | 100mm | 1m | Teflon® insulated | 4 Wire | 158-985 |
| B | 4mm | 90mm | 1m | Teflon® insulated | 4 Wire | 123-5610 |

Platinum Resistance Pt1000 Class B Sensor with Teflon insulated lead in a Stainless-Steel Tube



| CLASS | PROBE DIAMETER | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | STOCK NO |
|-------|----------------|--------------|--------------|-------------------|-------------|----------|
| B | 4mm | 40mm | 1m | Teflon® insulated | 2 Wire | 123-5612 |

Platinum Resistance Thermometer Pt100 Industrial Sensor Probe, Class B, in a Stainless-Steel Tube



| TYPE | CLASS | PROBE DIAMETER | PROBE LENGTH | CABLE LENGTH | CABLE TYPE | TERMINATION | STOCK NO |
|-------|-------|----------------|--------------|--------------|-----------------------------|-------------|----------|
| Pt100 | B | 3mm | 150mm | 1m | Teflon® insulated, Screened | 4 Wire | 362-9935 |
| Pt100 | B | 4mm | 25mm | 2m | Teflon® insulated, Screened | 4 Wire | 123-5588 |
| Pt100 | B | 4.5mm | 125mm | 2m | Teflon® insulated, Screened | 4 Wire | 123-5597 |
| Pt100 | B | 6mm | 300mm | 2m | Teflon® insulated, Screened | 4 Wire | 123-5606 |

PLATINUM RESISTANCE PT100 & PT1000 SILICONE PATCH SENSORS

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Pt100 Silicone Patch Sensor



| TYPE | CLASS | PATCH LENGTH | PATCH WIDTH | PATCH HEIGHT | CABLE LENGTH | CABLE TYPE | TERMINATION | STOCK NO |
|-------|-------|--------------|-------------|--------------|--------------|---------------------------|-------------|----------|
| Pt100 | B | 40mm | 13mm | 5mm | 2m | Teflon Insulated, 7/0.2mm | 4 Wire | 285-661 |
| Pt100 | B | 40mm | 13mm | 5mm | 5m | Teflon Insulated, 7/0.2mm | 4 Wire | 762-1137 |

Pt1000 Silicone Patch Sensor



| TYPE | CLASS | PATCH LENGTH | PATCH WIDTH | PATCH HEIGHT | CABLE LENGTH | CABLE TYPE | TERMINATION | STOCK NO |
|--------|-------|--------------|-------------|--------------|--------------|---------------------------|-------------|----------|
| Pt1000 | B | 30mm | 15mm | 4mm | 1m | Teflon Insulated, 7/0.2mm | 2 Wire | 762-1130 |

HYGIENIC PLATINUM RESISTANCE PT100 THERMOMETER

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Platinum Resistance Pt100 Hygienic Thermometer, 1.5" RJT style fitting



| SENSOR TYPE | SHEATH DIAMETER | SHEATH LENGTH | SUPPORT DIAMETER | SUPPORT LENGTH | TRANSMITTER FITTED (3 WIRE CONFIGURATION) | NO TRANSMITTER FITTED (4 WIRE CONFIGURATION) |
|-------------|-----------------|---------------|------------------|----------------|---|--|
| Pt100 | 6mm | 75mm | 8mm | 50mm | 872-2761 | 872-2764 |
| Pt100 | 6mm | 125mm | 8mm | 50mm | 872-2770 | 872-2767 |

Platinum Resistance Pt100 Hygienic Thermometer, 1.5" Tri-Clamp fitting



| SENSOR TYPE | SHEATH DIAMETER | SHEATH LENGTH | SUPPORT DIAMETER | SUPPORT LENGTH | TRANSMITTER FITTED (3 WIRE CONFIGURATION) | NO TRANSMITTER FITTED (4 WIRE CONFIGURATION) |
|-------------|-----------------|---------------|------------------|----------------|---|--|
| Pt100 | 6mm | 75mm | 8mm | 50mm | - | 872-2773 |
| Pt100 | 5.7mm | 120mm | 8mm | 50mm | 896-8415 | - |

PT100 WALL-MOUNTED AIR BOXES

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Platinum Resistance Pt100 Indoor Air Temperature Sensor



| CLASS | LENGTH | WIDTH | HEIGHT | INDOOR/ OUTDOOR USE? | STOCK NO |
|-------|--------|-------|--------|-------------------------|----------|
| B | 85mm | 85mm | 30mm | Indoor Only | 338-9491 |

Platinum Resistance Thermometer Pt100 Outdoor/Cold Store Temperature Sensors



| CLASS | LENGTH | WIDTH | HEIGHT | ELEMENTS TYPE | PT100 CONNECTION | 4-20MA OUTPUT | INDOOR/ OUTDOOR USE? | STOCK NO |
|-------|--------|-------|--------|------------------|---------------------|------------------|-------------------------|----------|
| B | 80mm | 74mm | 54mm | Single | 4 Wire | No | Indoor or Outdoor use | 236-4283 |
| B | 80mm | 74mm | 54mm | Duplex | 2 x 4 Wire | No | Indoor or Outdoor use | 455-4208 |
| B | 80mm | 74mm | 54mm | Single | 3 Wire | Yes (2 Wire) | Indoor or Outdoor use | 455-4214 |

4-20mA remote wall mounted housing, Platinum Resistance Pt100 input with 1 metre lead



| CABLE GLANDS | CABLE LENGTH | CABLE INSULATION | TRANSMITTER FITTED? | TRANSMITTER RANGE | INDOOR/ OUTDOOR USE? | STOCK NO |
|--------------|--------------|---------------------|------------------------|----------------------|-------------------------|----------|
| M16 | 1000mm | PFA Teflon | Yes | -50°C to +150°C | Indoor Only | 872-2758 |
| M16 | 1000mm | F/G + SSOB | Yes | 0°C to + 400°C | Indoor Only | 872-2751 |

PLATINUM RESISTANCE PT100 WITH TERMINAL HEADS

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Platinum Resistance Pt100 4 wire class B Resistance Thermometer with DIN B Head



| SENSOR TYPE | PROBE DIAMETER | PROBE LENGTH | HEAD TERMINATION | STOCK NO |
|-------------|----------------|--------------|------------------|----------|
| Pt100 | 6mm | 100 | IP67 Din B Head | 872-2736 |
| Pt100 | 6mm | 200 | IP67 Din B Head | 872-2733 |
| Pt100 | 6mm | 500 | IP67 Din B Head | 872-2749 |

Platinum Resistance Pt100 4 wire class B Resistance Thermometer with Compact KNS Head



| SENSOR TYPE | PROBE DIAMETER | PROBE LENGTH | HEAD TERMINATION | STOCK NO |
|-------------|----------------|--------------|------------------|----------|
| Pt100 | 6mm | 150 | IP67 KNS Head | 872-2711 |
| Pt100 | 6mm | 250 | IP67 KNS Head | 872-2720 |
| Pt100 | 6mm | 300 | IP67 KNS Head | 872-2727 |

Platinum Resistance Pt100 3 wire class B Resistance Thermometer with KNE Head and Fitted Transmitter



| SENSOR TYPE | PROBE DIAMETER | PROBE LENGTH | HEAD TERMINATION | TRANSMITTER FITTED? | TRANSMITTER RANGE | STOCK NO |
|-------------|----------------|--------------|------------------|---------------------|-------------------|----------|
| Pt100 | 6mm | 150 | IP67 KNS Head | Yes | -50°C to +150°C | 872-2708 |
| Pt100 | 6mm | 150 | IP67 KNS Head | Yes | 0°C to 100°C | 872-2701 |
| Pt100 | 6mm | 150 | IP67 KNS Head | Yes | 0°C to 200°C | 872-2705 |
| Pt100 | 6mm | 150 | IP67 KNS Head | Yes | 0°C to 400°C | 872-2714 |

PLATINUM RESISTANCE PT100 INDUSTRIAL PROBE WITH LAGGING EXTENSION

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4 wire sensor with 1/2" BSPP process connection



| TYPE | CLASS | PROBE DIAMETER | PROBE LENGTH BELOW 1/2" BSPP PROCESS CONNECTION | LAGGING LENGTH | TERMINATION | STOCK NO |
|-------|-------|----------------|---|----------------|-------------|----------|
| Pt100 | B | 8mm | 250mm | 75mm | KNE Head | 455-3980 |

L200 Digital Thermometer & Data Logger



The L200 Pt100 thermometer can be used in conjunction with a PC to provide accurate, Pt100 temperature measurement, scanning and logging of measured values. It can also be used as a “stand alone” indicator/logger and incorporates a digital display of measured temperature.

Self-calibration of Pt100 ranges is simple and uses plug-in precision resistors.

The L200 is designed to provide exceptional stability with high measurement resolution and represents an ideal crossover between plant practicality and laboratory performance at a very competitive price.

STOCK NO

910-6826

L300 USB TC & PT Digital Thermometer/Alarm/Logger Controller



The L300 Pt100 thermocouple temperature alarm on/off controller can be used in conjunction with a PC providing accurate monitoring. The alarm on/off control covers up to 8 zones simultaneously. The temperature monitor can also be used as a stand-alone indicator and logger incorporating a digital display of the measured temperature. The system has a self-calibration facility which is built in for the thermocouple version and is a rapid and extremely convenient method for on-site calibration.

The L300 does not need any additional equipment other than a special external link. The self-calibration of this series of digital temperature thermometers is just as simple and uses plug in precision resistors. The L300 series is designed to provide you with exceptional stability, high measurement resolution and is the perfect crossover between plant practicality and laboratory performance.

The PC software supplied with the thermometer allows control, configuration, logging, measurement, charting, alarm, relay configuration and calibration functions via a PC.

STOCK NO

910-6829

Information given here is for general guidance only and is not definitive – it is not intended to be the basis for product installation or decision making.

Q. How accurately can I measure temperature using a standard sensor?

A. To published internationally specified tolerances as standard, typically $\pm 2.5^{\circ}\text{C}$ for popular thermocouples, $\pm 0.5^{\circ}\text{C}$ for PRT. Higher accuracy sensors can be supplied to order, e.g. $\pm 0.5^{\circ}\text{C}$ for type T thermocouple, $\pm 0.2^{\circ}\text{C}$ for PRT. All of these values are temperature dependent. A close tolerance, 4-wire PRT will give best absolute accuracy and stability.

Q. How do I choose between a thermocouple and a PRT?

A. Mainly on the basis of required accuracy, probe dimensions, speed of response and the process temperature.

Q. What is the difference between a RTD and PRT sensor?

A. Nothing. RTD means resistance thermometer detector (the sensing element) and PRT means Platinum resistance thermometer (the whole assembly) i.e. a PRT uses a RTD!

Q. What is a Pt100?

A. An industry standard Platinum RTD with a value of 100 Ohms @ 0°C to IEC751; this is used in the vast majority of PRT assemblies in most countries.

Q. Are there other types of temperature sensor apart from thermocouple and PRT Types?

A. Several, but these two groups are the most common. Alternatives include thermistors, infra-red (non-contact), conventional thermometers (stem & dial types) and many others.

Q. Why offer 2,3 or 4 wire PRT probes?

A. Because all 3 are encountered. Two-wire should be avoided, three-wire is widely used and four-wire gives optimum accuracy. Your instrument will be configured for 2,3 or 4 wire.

Q. What is the minimum immersion depth for a PRT probe?

A. Usually 150mm or more; increase the immersion until the reading is unchanged.

Q. What is the practical difference between wire-wound and film RTDs?

A. Wire-wound type provides greater accuracy and stability but is vulnerable to shock; film type is resistant to shock and has quicker thermal response.

Q. Is a sensor with a calibration certificate more accurate than an uncalibrated one?

A. No. However, the errors and uncertainties compared with a reference sensor are published and corrected values can be used to obtain better measurement accuracy.

Q. How long will my sensor last in the process?

A. Not known but predictable in some cases; this will be a function of sensor type, construction, operating conditions and handling.

Q. What is the longest thermocouple I can have without losing accuracy?

A. Try to ensure a maximum sensor loop resistance of 100 Ohms for thermocouples and 4 wire PRTs. Exceeding 100 Ohms could result in a measurement error. Note By using a 4-20mA transmitter near the sensor, cable runs can be much longer and need only cheaper copper wire. The instrument must be suitable for a 4-20mA input though.

Q. Do I need a power supply when using a transmitter, and what length of extension lead can I run with a transmitter fitted?

A. A 24Vdc, 20mA supply will be needed if this is not incorporated in the measuring instrument. Long runs of copper cable can be used.

FREQUENTLY ASKED QUESTIONS

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Q. What accuracy will I get at a certain temperature using a Pt100 detector; if a better grade detector is used what effect will this have to the accuracy?

A. Refer to this Labfacility Temperature Handbook for Pt100 tolerance information.

Q. What accuracy loss will I get using a transmitter in line?

A. This depends on the accuracy of the specified transmitter; there will always be some degradation.

Q. As most instrumentation only takes 2 or 3 wire Pt100s, if I took the correction made on the 3 wire system and incorporated that on to the single leg could I achieve a 4 wire system?

A. No; cable length and ambient temperature variations come into play.

Q. What is the difference between a flat film and wire wound Pt100 element?

A. Film uses platinum deposition on a substrate; wire wound uses a helically wound Pt wire in ceramic. Wire-wound type provides greater accuracy and stability but is vulnerable to shock; film type is resistant to shock and has quicker thermal response.

COLOUR CODES FOR THERMOCOUPLE EXTENSION & COMPENSATING WIRES/CABLES

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| Type | CONDUCTORS +/- | FORMER STANDARD | | | IEC 60584-3(2007) BS ENG60584-3(2008) | CABLE CODE |
|------|---|---------------------|-----------------------|------------------------|--|------------|
| | | BRITISH BS1843:1952 | AMERICAN ANSI/MC 96.1 | GERMAN DIN 43713/43714 | | |
| EX | Nickel chromium/Constantan (Nickel, Chromium/Copper Nickel, Chromel/Constantan, T1/Advance, NiCr/Constantan) | | | | | EX |
| J | Iron*/Contantan (Iron/Copper Nickel, Fe/Konst Iron/Advance, Fe/Constantan I/C) | | | | | JX |
| K | Nickel Chromium/Nickel Aluminium* (NC/NA, Chromel/Alumel, C/A, T1/T2, NiCr/Ni, NiCr/NiAl) | | | | | KX |
| N | Nicrosil/Nisil | | | | | NX NC |
| T | Copper/Constantan (Copper/Copper Nickel, Cu/Con, Copper/Advance) | | | | | TX |
| Vx | Copper/Constantan (Low nickel) (Cu/Constantan) Compensating for K (Cu/Constantan) | | | | | KCB |
| U | Copper/Copper Nickel Compensating for Platinum 10% or 13% Rhodium/Platinum (Codes S & R respectively) Copper/Cupronic Cu/CuNi, Copper/No. 11 alloy) | | | | | RCA SCA |

*Magnetic For Thermocouple connectors body colours are similar to outer sheath colours

THERMOCOUPLE COLOUR CODES FOR CONNECTOR BODIES

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| Type | J | K | T | E | N | R/S | B | Cu (Copper) |
|------|---|---|---|---|---|-----|---|-------------|
| IEC | | | | | | | | |
| ANSI | | | | | | | | |
| JIS | | | | | | | | |

All connectors use true thermocouple alloys for optimum accuracy, except for types R, S & B which use compensating alloys.