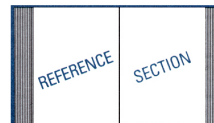
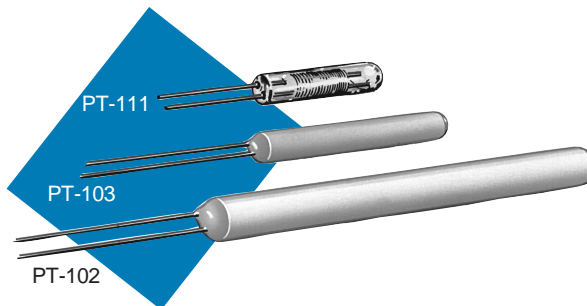


# PT-100 Platinum RTDs

- Follows Lake Shore extended standard curve from 30 K to 70 K
- High reproducibility
- Low magnetic field dependence above 40 K
- Low susceptibility to ionizing radiation
- Conforms to DIN 43760 and IEC 751 Standards down to 70 K
- Lake Shore provides individual calibrations from 14 K to as high as 800 K
- SoftCal™ calibration available

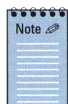
PT-100 platinum resistance thermometers (PRTs) are an excellent choice for use as cryogenic temperature sensing and control elements in the range from 30 K to 873 K (-243 °C to 600 °C). Over this temperature span, PRTs offer high repeatability and nearly constant sensitivity,  $dR/dT$ . Platinum resistors are also of use as control elements in magnetic field environments where errors approaching a degree can be tolerated. PRTs are interchangeable above 70 K. The use of controlled-purity platinum assures uniformity from device to device.

PRTs experience rapidly decreasing sensitivity below approximately 30 K. They should be calibrated in order to achieve maximum accuracy for use below 100 K. The plot below illustrates platinum sensor conformance to the DIN 43760:1980 curve.



See the Reference Section for a detailed description of

- Self-heating
- Installation
- Uncalibrated sensors
- SoftCal™
- Calibrated sensors
- CalCurve™
- Sensor packages



1. If your application requires more than one platinum resistor, up to five platinum resistors can be matched with one another to within  $\pm 0.1$  K at liquid nitrogen temperature with only one calibration being purchased. If absolute accuracy is required, one of these matched sensors can be calibrated. For larger quantities, or for different requirements, consult Lake Shore. At the time of order, add the suffix **-LN** to the sensor.

**Example:** PT-102-14D-LN is a PT-102-LN sensor with a calibration range of 14 K to 100 K that is matched with at least one other uncalibrated PT-102 to within  $\pm 0.1$  K at liquid nitrogen temperature.

2. For metrological applications below 30 K, use a germanium resistor (page 1-22). PT-100 sensors are not useful below 14 K for metrology and are of limited use below 30 K for temperature control due to rapid decline in sensitivity.

3. For high temperature use anneal at  $T_{max} + 10$  °C.

Typical Magnetic Field-Dependent Temperature Errors  $\Delta T/T$  (%) at B (magnetic induction)

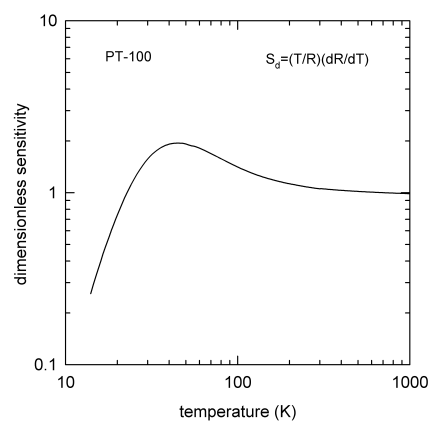
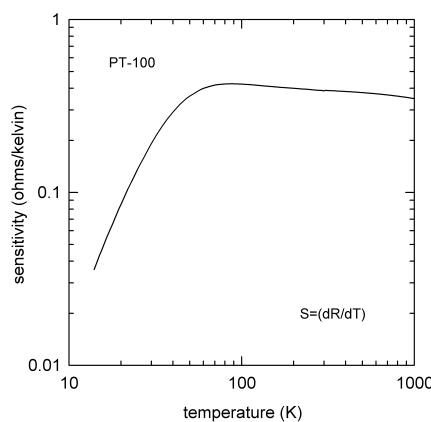
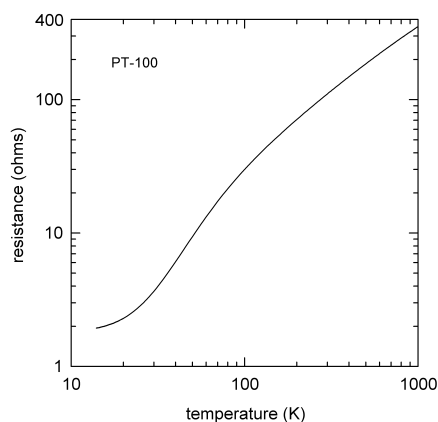
T(K)	B (tesla)				
	2.5	5	8	14	19
20	20	—	100	250	—
40	0.5	1.5	3	6	8.8
87	0.04	0.14	0.4	1	1.7
300	-0.01	0.001	0.02	0.07	0.13

Recommended for use when  $T \geq 30$  K.

Long axis parallel to  $B_z$ ; orientation effects exist.

B.L. Brandt, L.G. Rubin and H.H. Sample, Low-Temperature Thermometry in High Magnetic Fields. VI. Industrial-grade Pt resistors above 66 K; Rh-Fe and Au-Mn resistors above 40 K, Rev. Sci. Instrum. 59, 642 (1988).

Typical Resistance and Sensitivity values for PT-100s. See page A-57 for tabular data.



## Specifications

	PT-102	PT-103	PT-111
<b>Temperature</b>			
<b>Useful range</b>			
Minimum	14 K	14 K	14 K
Maximum	873 K	873 K	673 K
Maximum storage temperature	500 K	500 K	400 K
Standard curve	DIN 43760	DIN 43760	DIN 43760
Resistivity (typical)	See plots on previous page	See plots on previous page	See plots on previous page
Sensitivity (typical)	See plots on previous page	See plots on previous page	See plots on previous page
Dimensionless sensitivity (typical)	See plots on previous page	See plots on previous page	See plots on previous page
Repeatability	± 10 mK (77 K to 305 K)	± 10 mK (77 K to 305 K)	± 10 mK (77 K to 305 K)
Accuracy (interchangeability)	See figure on previous page	See figure on previous page	See figure on previous page
<b>Accuracy (SoftCal™)</b>			
2-point (77, 305)	± 250 mK (70 K to 325 K)	± 250 mK (70 K to 325 K)	± 250 mK (70 K to 325 K)
3-point (77, 305, 480)	± 250 mK (70 K to 480 K)	± 250 mK (70 K to 480 K)	± 250 mK (70 K to 480 K)
Accuracy (calibrated)	± 20 mK at 100 K; ± 35 mK at 300 K	± 20 mK at 100 K; ± 35 mK at 300 K	± 20 mK at 100 K; ± 35 mK at 300 K
<b>Stability</b>			
Short-term	± 10 mK (77 K to 305 K)	± 10 mK (77 K to 305 K)	± 10 mK (77 K to 305 K)
Long-term (per year) <sup>(1)</sup>	± 10 mK at 77 K ± 10 mK at 30 K to 273 K	± 10 mK at 77 K ± 10 mK (30 K to 273 K)	± 10 mK at 77 K ± 10 mK (30 K to 273 K)
Thermal response time	1.75 S at 77 K; 12.5 S at 273 K	1.75 S at 77 K; 12.5 S at 273 K	2.5 S at 77 K; 20 S at 273 K
Recommended recalibration schedule	Annual	Annual	Annual
<b>Excitation</b>			
Recommended	1 mA	1 mA	1 mA
Maximum power before damage	5 mW, 3 mA or 1 V, whichever is less (all models)		
Dissipation at rated excitation	100 μW at 273 K	100 μW at 273 K	100 μW at 273 K
Units range (ohms)	0 Ω to 300 Ω	0 Ω to 300 Ω	0 Ω to 300 Ω
Lead wire configuration (polarity)	Platinum, no polarity	Platinum, no polarity	Platinum, no polarity
<b>Physical Specifications</b>			
Materials in the sensor/construction	High stability of the PT-100 PRTs is achieved through production techniques that provide nearly strain-free, securely mounted elements rigidly encapsulated in ceramic or glass. All devices are carefully annealed after assembly (all models).		
Size in millimeters	2 mm diameter x 20.3 mm long	1.6 mm diameter x 12 mm long	1.8 mm diameter x 5 mm long
Mass	250 milligrams	120 milligrams	52 milligrams
<b>Leads</b>			
Size	0.25 mm diameter x 15 mm long	0.25 mm diameter x 15 mm long	0.25 mm x diameter 10 mm long
Number	Two (2)	Two (2)	Two (2)
Material	Platinum	Platinum	Platinum/Nickel Alloy
Insulation	None	None	None
Internal atmosphere	Solid	Solid	Solid
<b>Environmental</b>			
Radiation effects	Recommended for use in radiation environments (all models). See Reference Section.		
Magnetic fields	Because of their relatively low magnetic field dependence above 30 K, platinum sensors are useful as control elements in magnetic field applications when some error can be tolerated (all models).		
Vacuum vs. liquid differences	Not applicable	Not applicable	Not applicable
ESD sensitivity	None	None	None
Noise sensitivity	None	None	None

(1) If not heated above 475 K

(2) The leads are moderately robust, but care should be taken when handling.

REFERENCE
SECTION

### What is SoftCal™?

SoftCal™ is a 2-point or 3-point calibration which offers improved accuracy without the cost of a full calibration. SoftCal™ is available for silicon diodes and platinum sensors.

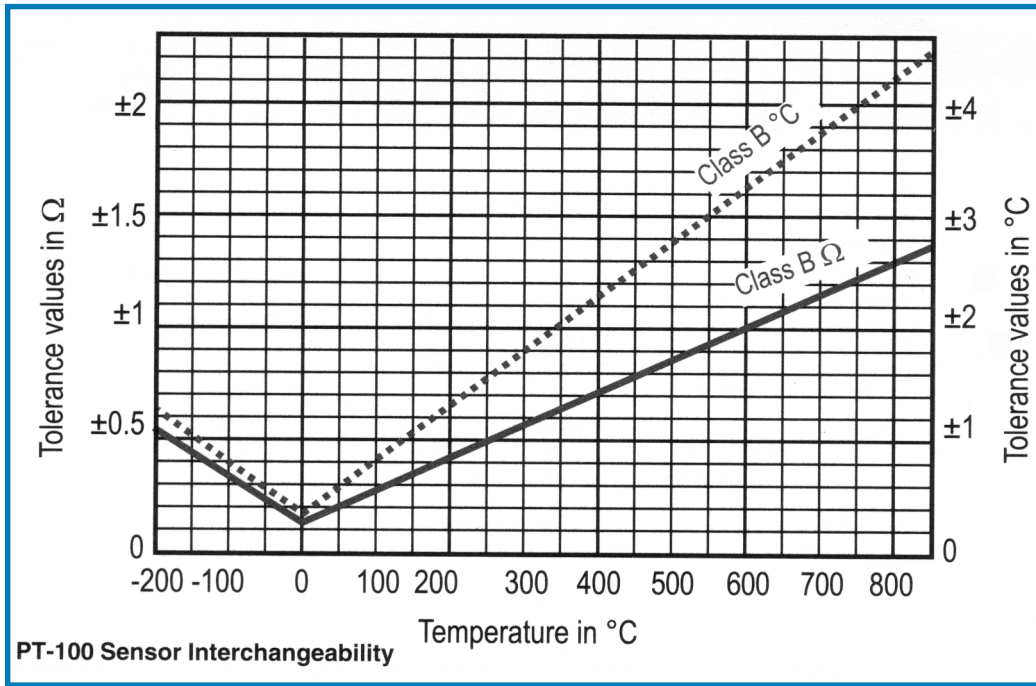
For detailed information on SoftCal™, CalCurve™ and Curve 10, see the Reference Section.

Note

Using a 2-point SoftCal™ with fixed temperature points taken at 77 K and 305 K, Lake Shore can generate a temperature table for a platinum sensor which is accurate to ±250 mK from 70 K to 325 K. Using a 3-point SoftCal™ with fixed temperature points taken at 77 K, 305 K, and 480 K, Lake Shore can generate a temperature table for a platinum sensor which is accurate to ±250 mK from 70 K to 480 K.

**For information on Packages for Sensor Installation, see pages 1-40 to 1-42.**

**Adding lead length to sensors - see page 1-43.**



## Ordering Information

### Uncalibrated sensor

Specify the Model number in the left column only, for example PT-103.

### Calibrated sensor

Add Calibration Range Suffix Code to the end of the Model number, for example PT-103-14L.

### Accessories suggested for installation (see Section 3)

- Stycast® Epoxy
- Apiezon® Grease
- IMI-7031 Varnish
- 90% Pb, 10% Sn Solder
- CryoCable™
- Manganin Wire
- Indium Solder
- Phosphor-Bronze Wire

Platinum RTD	Calibration Range Suffix Codes								
	Numeric figure is the low end of the calibration. Letters represent the high end: D = 100 K, L = 325 K, H = 475 K, J = 800 K.								
	SoftCal™								
Model number	2S	3S	14D	14L	14H	14J	70L	70H	70J
PT-102	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT-103	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT-111	✓	✓	✓	✓	✓		✓	✓	

### Accessories available for sensors

- ECRIT Expanded interpolation table
- SCR Special calibration report
- 8000 Calibration report on floppy disk
- COC-SEN Certificate of conformance

