Platinum

Cryogenic Temperature Sensors

For high-temperature use up to 873 K and interchangeable options—ideal for LN_2 transport lines

Product Overview

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

Product Features

Temperature range: 14 K to 873 K
Resistance range: 1 kΩ to 20 kΩ
Calibration curve: Calibrated and interchangeable options
Accuracy: ±10 mK at 30 K
Short-term stability: ±5 mK at 77 K
Magnetic fields: Fair above 30 K
Radiation: Recommended
Packages: Standard, AM
Temperature controller: 335, 336

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Accuracies

Calibrated platinum sensors deliver the highest accuracy across a broad temperature range. For applications at or above 70 K where ultra-high precision is not essential, SoftCal offers a practical alternative. This method uses a simplified calibration curve derived from either two (2-point SoftCal) or three (3-point SoftCal) temperature points. Each sensor calibrated with SoftCal has a unique temperature vs. resistance curve.

For applications requiring sensor interchangeability—where multiple sensors conform to a common temperature vs. resistance curve—two options are available: standard and matched. Standard interchangeable platinum are uncalibrated and conform to the default accuracy for 100 Ω Class B platinum sensors (refer to Figure 3). For improved accuracy at 77 K, matched platinum sensors are offered in sets of up to 50 sensors. Each set is aligned to a single, calibrated reference sensor—purchased with the batch—and all sensors in the group are individually verified to match the reference within ±0.1 K at 77 K, ensuring tight conformity across the set.

	Calibrated					Interchangeable	
	Cal to 325 K	Cal to 500 K	Cal to 800 K	2-point SoftCal	3-point SoftCal	Standard	Matched
30 K	±10 mK	±10 mK	±10 mK	—	—	—	—
77 K	±12 mK	±12 mK	±12 mK	±250 mK	±250 mK	±1200 mK	±125 mK
300 K	±23 mK	±23 mK	±23 mK	±900 mK	±250 mK	±500 mK	±500 mK
400 K	—	±41 mK	±210 mK	±1.3 K	±250 mK	—	—
500 K	—	±46 mK	±210 mK	±1.4 K	±1.4 K	—	—
800 K	—	—	±310 mK	—	—	—	—

Interchangeable matched sensors accuracy is ±0.1 K at 77 K for each matched group

Typical sensitivity Ω/K

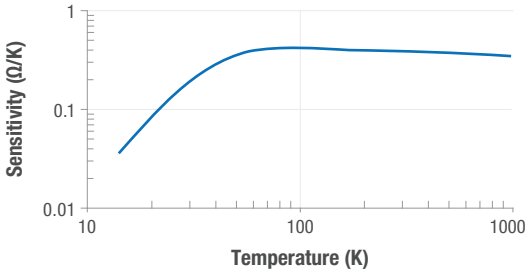


Figure 1
Typical sensitivity over temperature for platinum

Typical resistance Ω

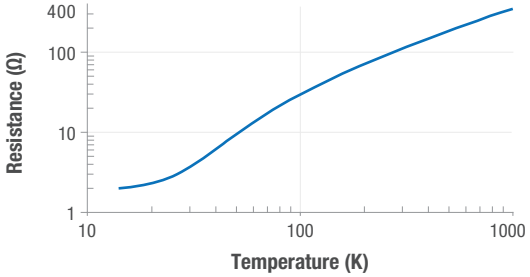


Figure 2
Typical resistance curve of a platinum sensor

Interchangeable standard platinum

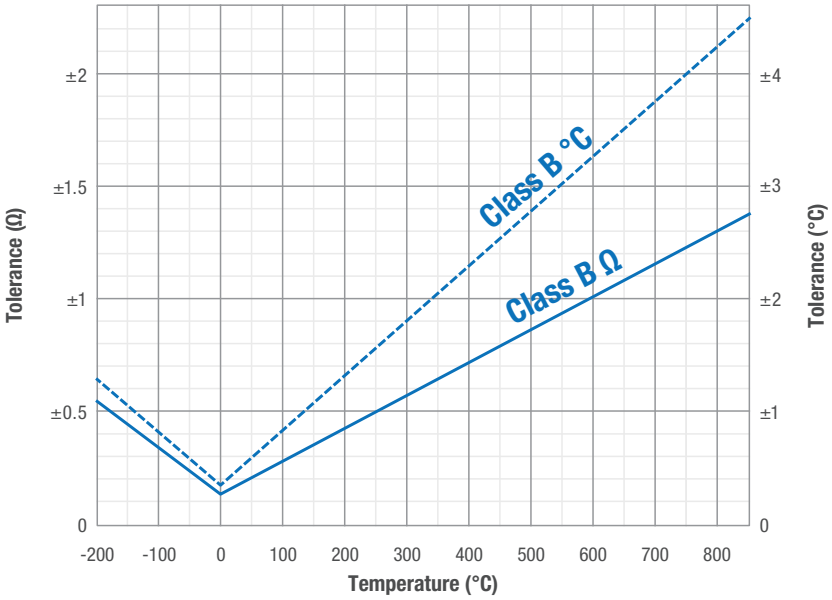


Figure 3
100 Ω accuracy for class B platinum sensors

Performance specifications

	PT-103	PT-111
Temperature range	14 K to 873 K	14 K to 673 K
Recommend excitation	1 mA	
Short-term stability[1]	±5 mK at 77 K	
Long-term stability[2]	±10 mK at 77 K	
Thermal response time	1.75 s at 77 K, 12.5 s at 273 K	2.5 s at 77 K, 20 s at 273 K
Dissipation at rated excitation (typical)	100 µW at 273 K	
Magnetic fields	Fair above 30 K	
Radiation	Recommended	
Maximum vacuum	1×10^{-4} Pa	1×10^{-7} Pa
Ferromagnetic	No	Yes
Standard curve (model-dependent)	IEC 751	

[1] Short-term reproducibility data is obtained by subjecting sensor to repeated thermal shocks from 305 K to 77 K
[2] If not heated above 475 K—long-term stability data is obtained by subjecting sensor to 200 thermal shocks from 305 K to 77 K

Physical specifications

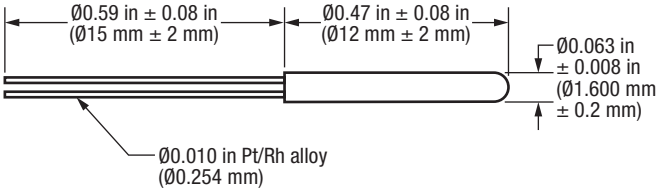
	PT-103	PT-111
Lead wire	2-lead, no polarity	
Package options	Standard, AM	Standard
Mass	120 mg	52 mg
Wire	95% platinum, 5% rhodium alloy	Platinum
Soldering standard	J-STD-001 Class 2	
Internal atmosphere	Fully-filled powder	Solid glass
Maximum vacuum	1×10^{-4} Pa	1×10^{-7} Pa
Nonmagnetic packaging	Yes	No

Typical magnetic field-dependent temperature errors[3] ΔT/T (%) at B (magnetic field)

	Package parallel to field B				
	2.5 T	**5 T**	**8 T**	**14 T**	**19 T**
20 K	20	—	100	250	—
40 K	0.5	1.5	3	6	8.8
87 K	0.04	0.14	0.4	1	1.7
300 K	0.01	0.001	0.02	0.07	0.13

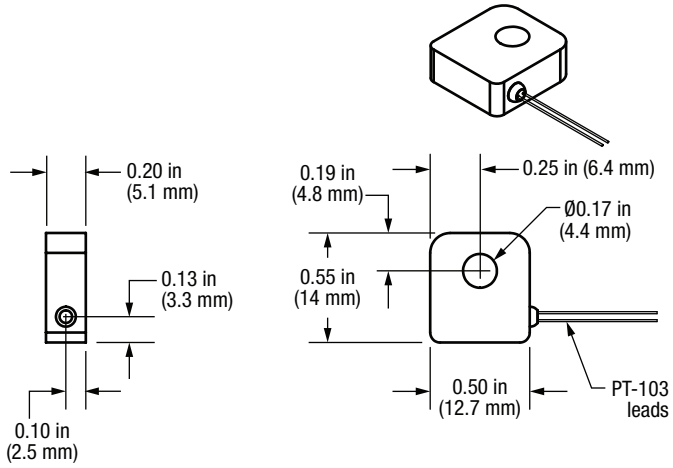
[3] Recommended for use when T ≥ 30 K

PT-103



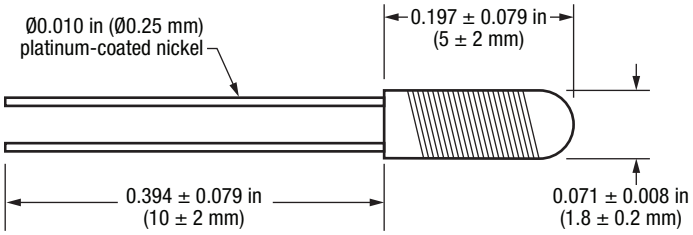
General tolerance of ±0.010 in (±0.254 mm) unless otherwise noted

PT-103-AM



General tolerance of ±0.010 in (±0.254 mm) unless otherwise noted

PT-111



Ordering information

Interchangeable standard platinum

PT-103	
PT-103-AM	
PT-111	

Interchangeable matched platinum

Order up to 50 interchangeable sensors matched to a single calibrated reference sensor.

PT-103-14L-LN
Calibrated reference—
14 K to 325 K

PT-103-LN
Interchangeable matched—
Order 2 to 50 matched
sensors per reference

PT-103-AM-14L-LN
Calibrated reference—
14 K to 325 K

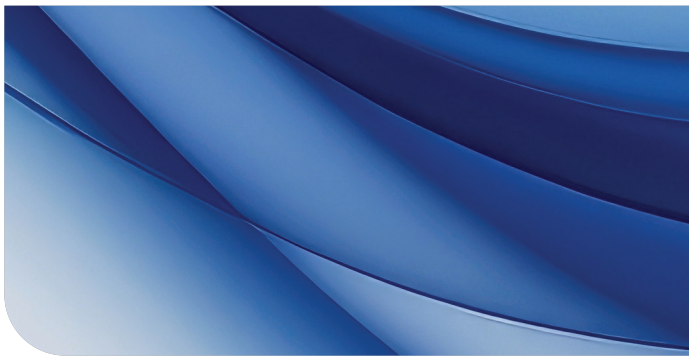
PT-103-AM-LN
Interchangeable matched—
Order 2 to 50 matched
sensors per reference

PT-111-14L-LN
Calibrated reference—
14 K to 325 K

PT-111-LN
Interchangeable matched—
Order 2 to 50 matched
sensors per reference

Calibrated platinum

PT-103-2S		2-point SoftCal
PT-103-3S		3-point SoftCal
PT-103-14L		Calibrated 14 K to 325 K
PT-103-14H		Calibrated 14 K to 500 K
PT-103-14J		Calibrated 14 K to 800 K
PT-103-AM-2S		2-point SoftCal
PT-103-AM-3S		3-point SoftCal
PT-103-AM-14L		Calibrated 14 K to 325 K
PT-103-AM-14H		Calibrated 14 K to 500 K
PT-103-AM-14J		Calibrated 14 K to 800 K
PT-111-2S		2-point SoftCal
PT-111-3S		3-point SoftCal
PT-111-14L		Calibrated 14 K to 325 K
PT-111-14H		Calibrated 14 K to 500 K



Temperature controllers

Platinum sensors can be used with both the 336 and the 335 cryogenic temperature controllers.

336	Cryogenic temperature controller with 4 inputs (expandable to 8)
335	Cryogenic temperature controller with 2 inputs

Lead extensions

Platinum sensors come standard with approximately 25 mm (1 in) lead wires. Extensions can be added to your device to extend lead length, with a variety of wire types available to suit your application. Below are the most common configurations. Refer to the Lead Extensions datasheet for the complete list.

-QT	Quad-Twist™, 36 AWG, 2 m
-QL	Quad-Lead™, 32 AWG, 2 m