

FLUKE®

Calibration

5618B

Small Diameter Industrial RTD

Users Guide

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Introduction

General

The Platinum Resistance Thermometer (PRT) model 5618B is designed to be a secondary standard interpolating instrument converting temperature to resistance. The 5618B may also be used as a temperature standard for calibration of industrial sensors. The PRT is used with a readout device to detect temperature changes or actual temperature.

Recalibration

Recalibration of the 5618B PRT should be scheduled according to the user's company Quality Assurance requirements. Normally, a PRT is recalibrated annually. Unless the PRT is used only over a limited range, calibration over the full range of the PRT is recommended. For information on recalibrating your PRT, contact Fluke for assistance (see "How to Contact Fluke").

















Depending on the user's Quality Assurance requirements, the PRT drift should be checked periodically at the Triple Point of Water (TPW). For information on drift with respect to mechanical shock and oxidation, refer to the "Troubleshooting" section of this manual.

Before You Start

Symbols Used

Table 1 lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

Table 1. International Electrical Symbols

Symbol	Description	Symbol	Description
	Electric Shock		Off
	Hot Surface (Burn Hazard)		On
	Read the Users Manual (Important Information)		Fuse
	AC (Alternating Current)		Battery
	AC-DC		C-TICK Australian EMC Mark
	DC		Canadian Standards Association
	Double Insulated		CE Complies with European Union Directives
	PE Ground		The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) Mark
CAT II	CAT II equipment is designed to protect against transients from energy-consuming equipment supplied from the fixed installation, such as TVs, PCs, portable tools, and other household appliances.		

Safety Information

Use this instrument only as specified in this manual. Otherwise, the protection provided by the instrument may be impaired.

The following definitions apply to the terms “Warning” and “Caution”.

- “Warning” identifies conditions and actions that may pose hazards to the user.
- “Caution” identifies conditions and actions that may damage the instrument being used.

⚠ Warning

To avoid personal injury, follow these guidelines:

- **DO NOT use this instrument to measure the temperature of any hazardous live component (>30 V ac rms, 42 V ac peak, or 60 V dc).**
- **Use of this instrument at high temperatures for extended periods of time can cause the handle to become hot.**
- **Follow all safety guidelines listed in the Users Guide.**
- **Calibration Equipment should only be used by trained personnel.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **DO NOT use the Product around explosive gas, vapor, or in damp or wet environments.**

⚠ Caution

To avoid possible damage to the instrument, follow these guidelines:

- **DO NOT drop or hit the probe in any way. This will cause damage to the probe internally and affect its calibration.**
- **Read “PRT Care and Handling Guidelines” before removing the PRT from the shipping box. Incorrect handling can damage the PRT and void the warranty.**
- **Keep the shipping container in case it is necessary to ship the PRT. Incorrect packaging of the PRT for shipment can cause irreparable damage.**

How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
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Or, visit Fluke’s website at www.fluke.com.

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Specifications

See Table 2 for a list of the specifications.

Table 2. Specifications

Parameter	Range
Temperature Range	–200 °C to 500 °C (–200 °C to 300 °C for 5618B-6-X)
Nominal Resistance at 0.01 °C	100 Ω
Temperature Coefficient	0.003923 $\Omega/\Omega/^\circ\text{C}$
Drift ^[1]	$\pm 0.1^\circ\text{C}$ at 0.010 °C
Hysteresis	$\pm 0.01^\circ\text{C}$ at 0 °C When Using –196 °C and 420 °C as the End Points.
Sheath Dimensions (Length x Diameter)	5618B-6: 152 mm x 3.2 mm (6 in x 0.125 in) 5618B-9: 229 mm x 3.2 mm (9 in x 0.125 in) 5618B-12: 305 mm x 3.2 mm (12 x 0.125 in)
Sheath Material	316 SST
Transition Junction Temperature Range ^[2]	–50 °C to 200 °C
Response Time ^[3]	9 Seconds Typical
Lead-wire Cable Type	22 AWG, Teflon™ Insulation
Thermal EMF	Less than 25 mV at 420 °C
Lead-wire Length	182.9 cm (72 in)
Calibration	Includes Manufacturer's NVLAP-Accredited Calibration
[1] After 100 hours at maximum temperature.	
[2] Temperatures outside this range will cause irreparable damage.	
[3] Per ASTM E 644	

Installation

Lead Wire Identification

The 5618B PRT is equipped with a four-wire cable (see Figure 1). Four lead wires are used to cancel lead wire resistance. For best results, the readout device should be equipped to handle four-terminal resistors. The lead wires are two different colors. Lead wire pairs attached to each end of the sensor are identified by red and white insulation.

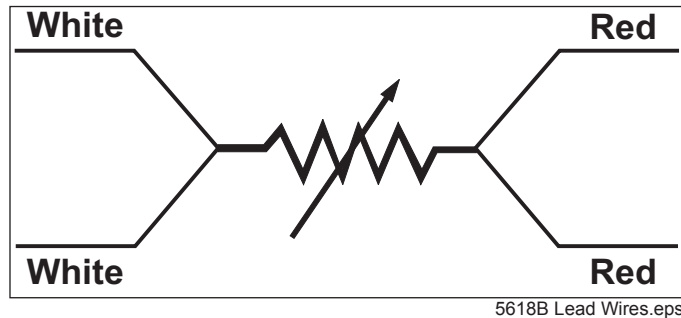


Figure 1. PRT Schematic

PRT Care and Handling Guidelines

⚠ Caution

Read this section before removing the PRT from the shipping box or case.

Care must be taken in handling the PRT to maintain calibration accuracy. Care should still be used when handling the PRT even though the Inconel sheath is durable and provides good protection for the sensor. Correct handling of the PRT will prolong the life expectancy. When not in use, the PRT should be stored in an optional protective case that can be purchased by contacting Fluke (see “How to Contact Fluke”). The handle is not designed to be immersed.

PRT Handling Guidelines

- Keep the thermometer as clean as possible.
- Immerse the thermometer in the appropriate liquid for the temperature range. If a dry block is used, the well diameter should allow the PRT to comfortably slip in and out without excess movement. For best results, immerse the thermometer as deep as possible to avoid “stem effect” (the temperature error caused by the conduction of heat away from the sensor).
- Allow sufficient time for the thermometer to stabilize before making measurements. This allows for the best accuracy.
- Use the correct drive current with the thermometer to prevent error in temperature or resistance. Fluke recommends 1 mA.
- Use the protective shipping box provided or other protection when the thermometer is not in use.
- **DO NOT** subject the thermometer to any physical shock or vibration.
- **DO NOT** use pliers or other devices to squeeze the sheath. This action can permanently damage the PRT.
- **DO NOT** subject the thermometer to temperatures above the highest specified operating temperature.
- **DO NOT** expose the thermometer’s handle or cables to extreme temperatures.
- **DO NOT** screw a clamp down so tight that it dents the sheath. This can permanently damage the PRT.

Operation

For best results, be familiar with the operation of the heat source and the readout instrument. Be sure to follow the manufacturer's instructions for the readout instrument and the heat source.

Immersion Requirements

Stem effect can cause measurement errors for any thermometer. This error is due to heat lost or gained by the sensing element through the thermometer stem. In addition, heat losses occur due to radiation losses from the sensing element to the housing.

The immersion depth for standards is dependent on several factors including accuracy requirements and type of liquid. However, remember the handle limitations.

The handle is not designed to be immersed. The exact immersion depth required can be determined by performing a gradient test taking measurements approximately every 1.27 cm (0.5 in) until there is a significant difference in readings. Allow the thermometer to stabilize at each new depth. Plot the results to see the stem effect.

Thermal EMF

Two factors contribute to thermal EMF, chemical consistency and physical consistency. Variations in chemical structure due to impurities can contribute to thermal EMF. Also discrepancies in crystal structure can contribute to thermal EMF. These factors are minimized by annealing the full length of wire before construction of the PRT.

Likewise, connection to extension lead wires and readout instruments can be a source of thermal EMF. The thermal EMF is caused by a difference in temperature between two connections. If the two connections are the same temperature, there will be little or no thermal EMF effects.

However, if there is a substantial temperature difference between connections, the thermal EMF effects will be significant. Therefore, cover or insulate any exposed bridge or galvanometer terminals to lessen the source of error. The effects of thermal EMF can be canceled by using an ac bridge or a dc bridge with reversible current.

Transition Junction

The transition junction has the appearance of a probe handle but functions as a transition point from sensor wire to lead wire. Lead wires pass through an epoxy seal and are soldered or welded to the sensor wires. Exceeding the temperature range of the transition junction will cause a breach in the seal of the instrument (see Transition Junction Temperature Range in Table 2) Maintaining the seal is critical to preventing moisture from entering the device. If moisture penetrates the seal, the PRT's short term repeatability, hysteresis, and insulation resistance may be adversely affected. Insulation resistance also decreases rapidly as the transition junction temperature increases, even if the seal is not broken. When the insulation resistance becomes sufficiently low, performance suffers.

Troubleshooting

In the event that the probe appears to function abnormally, this section may be of use in solving the problem. Several possible problem conditions are described along with likely causes and solutions. If a problem arises, please read this section carefully and attempt to understand and solve the problem. If the probe seems faulty or the problem cannot otherwise be solved, contact Fluke for assistance (see “How to Contact Fluke”). Be sure to have the model number and serial number of your probe available.

Table 3. PRT Troubleshooting

Problem	Solution
Data changes greater than 0.1 °C are observed.	Mechanical shock can cause temperature errors as great as 0.5 °C. If this is observed, first measure and record the R_{tpw} .
Data changes less than 0.1 °C.	Slight mechanical shock can cause temperature errors less than 0.1 °C.
Data unstable.	<p>If the data is unstable at the Triple Point of Water (TPW), check connections for evidence of a bad connection. If the connector appears to be in good condition and the connections are good, the PRT may be damaged. Contact Fluke for assistance (see “How to Contact Fluke”).</p> <ul style="list-style-type: none"> • If the data is unstable at high temperatures, it may be due to electrical noise in the system. Reduce the temperature and observe the data. If it is stable, electrical noise is interfering with the measurements at high temperatures. Also, this is usually due to low shunt resistance. The resistance between the leads and the sheath (shunt resistance or insulation resistance) as measured by a resistance meter should be greater than 500 MΩ at room temperature. Check the grounding of the readout device and the heat source. A faulty ground on either device could interfere with high temperature measurements. A ground wire attached to the metal sheath of the PRT may help to reduce electrical noise interference.
Temperature readout is different than expected. For example, the heat source is set at 150 °C, the PRT measures 125 °C.	<p>Measure the PRT resistance at TPW.</p> <ul style="list-style-type: none"> • If the resistance of the PRT is less than the rated resistance. For example, 98 Ω for a 100 Ω PRT indicates there may be a short in the sensor. • If the resistance of the PRT is only a few ohms, there may be a short in the four lead-wires. • If the PRT is open, the resistance will be “Out of Limits” or in the kilohm or megohm range. <p>For more information or assistance, Contact Fluke (see “How to Contact Fluke”).</p>

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