FLUKE®
Hart Scientific®

5615

Platinum Resistance Thermometer User's Guide

Rev. 731501

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1 Before You Start

1.1 Symbols Used

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

Table 1 *International Electrical Symbols*

Symbol	Description
	AC (Alternating Current)
	AC-DC
	Battery
	CE Complies with European Union Directives
	DC
	Double Insulated
	Electric Shock
	Fuse
	PE Ground
	Hot Surface (Burn Hazard)
	Read the User's Manual (Important Information)
	Off
	On
	Canadian Standards Association

Symbol	Description
CAT II	OVERVOLTAGE (Installation) CATEGORY II, Pollution Degree 2 per IEC1010-1 refers to the level of Impulse Withstand Voltage protection provided. Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation. Examples include household, office, and laboratory appliances.
	C-TIC Australian EMC Mark
	The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) mark.

1.2 Safety Information

Use this instrument only as specified in this guide. 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.

1.2.1 ⚠ Warnings

To avoid personal injury, follow these guidelines.

- DO NOT use this instrument to measure the temperature of any hazardous live component.
- 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 user's guide.
- Calibration Equipment should only be used by Trained Personnel.

1.2.2 ⚠ Cautions

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

- DO NOT drop or bang the probe in any way. This will cause damage to the probe internally and affect its calibration.
- Read Section entitled "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.

1.3 Authorized Service Centers

Please contact one of the following authorized Service Centers to coordinate service on your Hart product:

Fluke Corporation, Hart Scientific Division

799 E. Utah Valley Drive
American Fork, UT 84003-9775
USA

Phone: +1.801.763.1600
Telefax: +1.801.763.1010
E-mail: supporthartscientific.com

Fluke Nederland B.V.

Customer Support Services
Science Park Eindhoven 5108
5692 EC Son
NETHERLANDS

Phone: +31-402-675300
Telefax: +31-402-675321
E-mail: ServiceDeskfluke.nl

Fluke Int'l Corporation

Service Center - Instrimpex
Room 2301 Sciteck Tower
22 Jianguomenwai Dajie
Chao Yang District
Beijing 100004, PRC
CHINA

Phone: +86-10-6-512-3436
Telefax: +86-10-6-512-3437
E-mail: xingye.hanfluke.com.cn

Fluke South East Asia Pte Ltd.

Fluke ASEAN Regional Office
Service Center

60 Alexandra Terrace #03-16
The Comtech (Lobby D)
118502
SINGAPORE

Phone: +65 6799-5588
Telefax: +65 6799-5588
E-mail: antngsinga.fluke.com

When contacting these Service Centers for support, please have the following information available:

- Model Number
- Serial Number
- Complete description of the problem

2 Introduction

2.1 General

The Platinum Resistance Thermometer (PRT) model 5615 is designed to be secondary standard interpolating instruments converting temperature to resistance. The 5615 may also be used as temperature standards for calibration of industrial sensors. The PRT is used with a readout device to detect temperature changes or actual temperature.

2.2 Recalibration

The recalibration of the 5615 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 5615, contact an Authorized Service Center for an RMA number and current pricing (see Section 1.3, Authorized Service Centers).

Depending on the user's Quality Assurance requirements, the PRT drift should be checked periodically at the Triple Point of Water (TPW). Section 7, Troubleshooting, provides information on drift with respect to mechanical shock and oxidation.

3 Specifications

Temperature range	**5615-6**: –200 °C to 300 °C **5615-9 and 5615-12:** –200 °C to 420 °C
Nominal resistance at 0 °C	100 Ω ± 0.10 Ω
Temperature coefficient	0.0039250 Ω/Ω/°C
Short-term repeatability[1]	± 0.013 °C at 0.010 °C
Drift[2]	± 0.01 °C at 0.010 °C
Sensor length	28 mm (1.1 in)
Sensor location	6.9 mm ± 3.3 mm from tip (0.27 in ± 0.13 in)
Sheath dimensions, length x dia	**5615-6:** 152 mm x 4.76 mm (6.0 in x 0.188 in) **5615-9:** 229 mm x 4.76 mm (9.0 in x 0.188 in) **5615-12:** 305 mm x 6.35 mm (12.0 in x 0.250 in)
Sheath diameter tolerance	± 0.127 mm (±0.005 in)
Sheath material	Inconel™ 600
Minimum insulation resistance	1000 MΩ at 23 °C
Transition junction temperature range[3]	–50 °C to 200 °C
Transition junction dimensions	71 mm x 13 mm dia(2.8 in x 0.5 in)
Maximum immersion length	**5615-6:** 102 mm (4 in) **5615-9:** 178 mm (7 in) **5615-12:** 254 mm (10 in)
Response time[4]	9 seconds typical
Self heating (in 0 °C bath)	50 mW/°C
Lead-wire cable type	Teflon™ insulated with Teflon™ jacket, 22 AWG
Lead-wire length	183 cm (72 in)
Lead-wire temperature range	–50 °C to 200 °C
Calibration	NVLAP-accredited calibration included

[1]Three thermal cycles from min to max temp, includes hysteresis
[2]After 100 hours at maximum temperature
[3]Temperatures outside this range will cause irreparable damage. For best performance, transition junction should not be too hot to touch.
[4]Per ASTM E 644

4 Installation

4.1 Lead Wire Identification

The 5615 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.

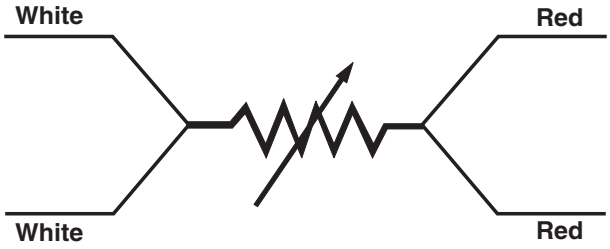

Figure 1 *PRT Schematic*

5 PRT Care and Handling Guidelines

5.1 PRT Care

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 an Authorized Service Center (see section 1.3, Authorized Service Centers).

The handle is not designed to be immersed.

5.2 PRT Handling Guidelines

- DO keep the thermometer as clean as possible.
- DO 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).
- DO allow sufficient time for the thermometer to stabilize before making measurements. This allows for the best accuracy.
- DO use the correct drive current with the thermometer to prevent error in temperature or resistance. Hart Scientific recommends 1mA.
- DO 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.

6 Operation

6.1 General

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.

6.2 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 (.5 inches) 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.

6.3 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.

6.4 Transition Junction

Exceeding the temperature range of the transition junction will cause a breach in the seal of the instrument. 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. A good rule of thumb is that the transition junction is too hot when it is hot enough to burn your thumb.

7 Troubleshooting

7.1 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 an Authorized Service Center (see Section 1.3) for assistance. Be sure to have the model number and serial number of your probe available.

Problem	Causes and Solutions
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 Rtpw.
Data changes less than 0.1°C	Slight mechanical shock can cause temperature errors less than 0.1°C.
Data unstable	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 an Authorized Service Center (see Section 1.3). • 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 megohms 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 different than expected, e.g. the heat source is set at 150°C, the PRT measures 125°C.	Measure the PRT resistance at TPW. • If the resistance of the PRT is less than the rated resistance, e.g. 98 ohms for a 100 ohm PRT, 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. For more information or assistance, contact an Authorized Service Center (see Section 1.3).