

PR Series Platinum Resistance Temperature Detectors (RTD)

Style C

Introduction

The PR Series Platinum RTDs uses the change in electrical resistance of a platinum wire due to change in temperature. They are used to measure temperatures from -200 to +650°C (-320 to +1200°F) and are calibrated to either ASTM (IEC, DIN) or SAMA standard curves. The PR Series RTDs are either single or dual element and have either a general purpose or explosionproof connection head.

The model with a bare element construction (PR-##B) comes with a bushing for direct mounting to the process vessel. The PR-##N, PR-##P, PR-##U, and PR-##W, models are designed for mounting in a well. A spring-loaded device keeps the element tip pressed against the bottom of the well. This improves thermal response time and minimizes the effects of shock and vibration.

Warnings

—  **WARNING** —

RTD must be installed to meet all applicable local installation regulations, such as hazardous location requirements and electrical wiring codes. Persons involved in the installation must be trained in these code requirements.

RTD Identification

The following information about your RTD is located on the data plate attached to its connection head. A sample data plate is shown in Figure 1.

A: Certification Number

B: Electrical Certification

C: Environmental Protection (NEMA Type or IEC designation)

D: Model Number (see PL 008-108 for a complete explanation of the code)

E. Origin Code (area of manufacture and year and week of manufacture)

F: Model Style

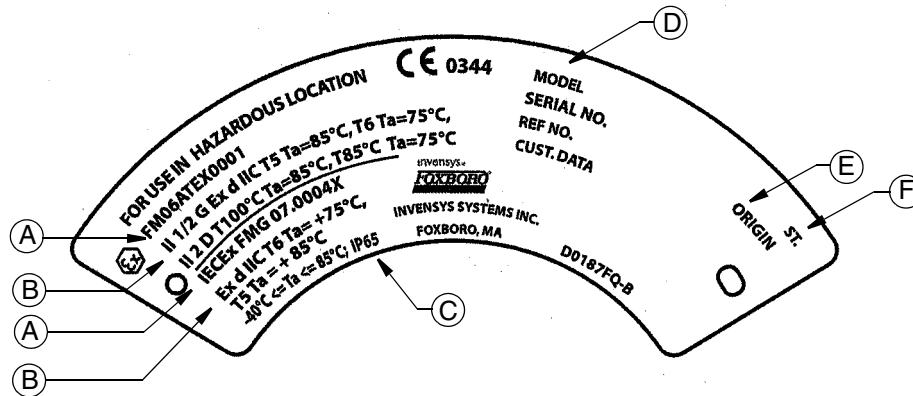


Figure 1. Sample RTD Identification

Standard Specifications

Sheath Temperature Limits

316 Stainless Steel: -200 and +480°C (-320 and +900°F)

Inconel: -200 and +650°C (-320 and +1200°F)

Length ('U'+ 'T' for well type or 'A' for bare sensor type)

90 mm (3.5 in) through 915 mm (36 in) in 12.7 mm (0.5 in) increments

Minimum Immersion: 90 mm (3.5 in)

External Pressure: The sheath can be exposed to an external pressure of 21 MPa (3000 psi) without a change in resistance of more than the amount equivalent to 0.05°C (0.1°F). There is no permanent change in the resistance at the ice point after this exposure.

Vibration: An RTD with 76 mm (3 in) of its sheathed length unsupported or overhanging can withstand 250 m/s² (25 "g") vibration from 20 to 2000 Hz in any axis for 15 minutes without damage.

Calibration Curve

SAMA: Per SAMA Standard RC 21-4-1966. Curves PR 279 (°C) and PR 278 (°F)

Alpha is 0.003923 Ω/Ω/°C. Resistance is 98.129 ±0.1 Ω at 0°C (32°F).

Refer to TI 5-27a.

ASTM: Per ASTM E1137-87. Alpha is 0.00385 Ω/Ω/°C.

Resistance is 100.00 ±0.10 Ω for ASTM-B; 100.00 ±0.05 Ω for ASTM-A.

Refer to TI 005-028.

Connection Head

Meets IEC IP65 and provides the environmental protection of NEMA Type 4.

Product Safety Specifications

The electrical certification is printed on the data plate. See Item A on the example shown in Figure 1. It is also included as part of the model code (Item D in Figure 1). See the following example. Also see Table 1.

PR-16UBS-008

└──────────┘ CONNECTION HEAD AND CERTIFICATION

where: 3 = Weatherproof, General Purpose

4 = Explosionproof, FM and FMc

5 = Explosionproof, CSA

6 = Flameproof, ATEX

7 = Flameproof IECEx

— NOTE

These RTDs have been designed to meet the electrical safety descriptions listed in Table 1. For detailed information or status of testing laboratory approvals/certifications, contact Invensys Process Systems (IPS).

Table 1. Electrical Safety Specifications

| Testing Laboratory, Types of Protection, and Area Classification | Application Conditions ^(a) | Connection Head Code |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| FM and FMc explosionproof for Class I, Division 1, Groups B, C, and D; dust-ignitionproof for Class II, Division 1, Groups E, F, and G; Class III Division 1. | Temperature Class T5. Ta = -50 to +85°C. | 4 |
| CSA explosionproof for Class I, Division 1, Groups B, C, and D; dust-ignitionproof for Class II, Division 1, Groups E, F, and G; Class III Division 1. | Temperature Class T5. Ta = -40 to +85°C. | 5 |
| ATEX flameproof; II 1/2 G Ex d IIC or II 2 G Ex d IIC or II 2 D | FM06ATEX0001. Construction Types N, P, W, and B only. Temperature Class T5 (T100°C) Ta = -40 to +85°C. T6 (T85°C) Ta = -40 to +75°C. | 6 |
| IECEx flameproof; Ex d IIC | IECEx FMG 07.0004X Construction Types N, P, W, and B only. Temperature Class T5; Ta = -40 to +85°C. T6; Ta = -40 to +75°C. | 7 |

(a) Only approved if assembled with thermowell at the factory.

Installation

— **! WARNING** —

In applications where an RTD is installed in a closed vessel under pressure or in an open vessel below the surface of the fluid, the RTD must not be removed during process operation unless it is installed in a thermowell.

Well Type, Nipple or Union Coupler (PR-##N, P, U, W)

When the RTD and thermowell are purchased together, they are fully assembled. The only mechanical assembly required is to install the thermowell into the process vessel. If the RTD is purchased without a thermowell, it is also necessary to insert the RTD into the thermowell and connect the nipple or union coupler to the well.

— **! CAUTION** —

When inserting an RTD into an existing thermowell, make sure that the internal depth of the well is correct for use with the RTD. The sensor sheath should contact the bottom of the well for proper thermal response time. However, if the internal depth of the well is too short, the RTD can be damaged if insertion exceeds the range of the spring that holds the sheath in contact with the bottom of the well.

When installing an RTD with a lagging well into an insulated vessel, add insulation after installation of the RTD to avoid error due to heat radiation. Refer to Figure 2.

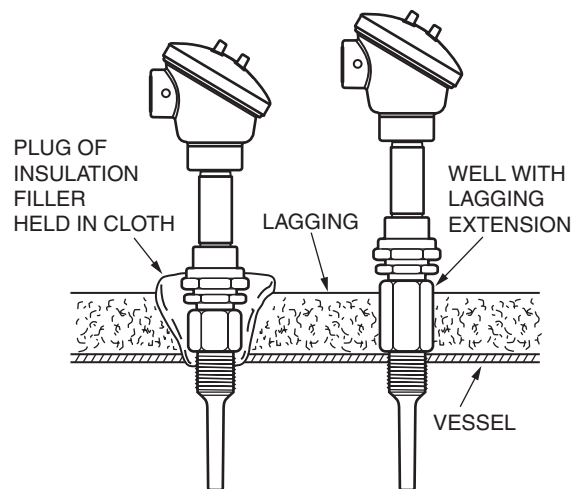


Figure 2. Installation of a Lagging Well Into an Insulated Vessel

Bare Element Assembly (PR-##B)

Three types of couplers are available for connecting a bare element assembly to the process vessel.

Compression Coupler

This coupler is for permanently setting the insertion (U) length. It contains an internally mounted ferrule. The external thread of the bushing is 1/4 or 1/2 NPT. The material of the coupler is Brass or 316 ss. Position the bushing to the desired point on the sensor sheath and tighten the compression nut.

⚠ CAUTION

Once the compression coupler has been tightened onto the RTD sheath, it cannot be relocated.

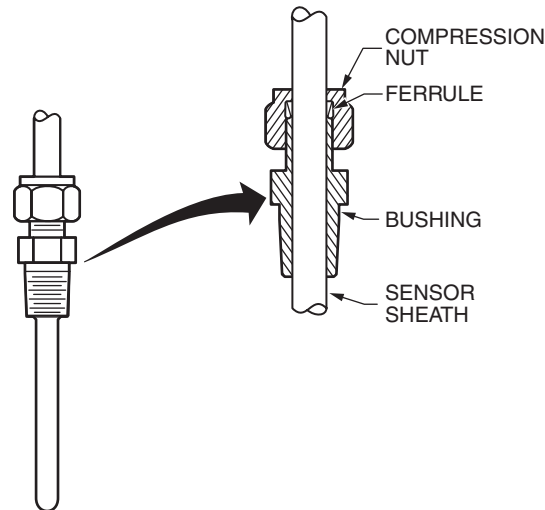


Figure 3. Compression Coupler

Spring-Loaded Coupler

This coupler is for use with a bare element assembly installed in a well. It provides for spring-loading the sensor sheath against the bottom of the well. The jam nut thread is 1/2 or 3/4 NPT. The material of the coupler is cadmium-plated carbon steel. Referring to Figure 4, install the RTD using this coupler as follows:

1. Insert the sensor sheath into the thermowell and press down firmly. Pencil mark the sheath at the location where the jam nut first engages the well threads,
2. Remove the RTD. With the jam nut and spring sliding freely on the upper portion of the sheath, install the split nut so that the upper edge of the nut is at the marked location.
3. Reinsert the sensor sheath into the thermowell. Tighten the jam nut with moderate force to ensure firm seating of the sheath against the bottom of the well.

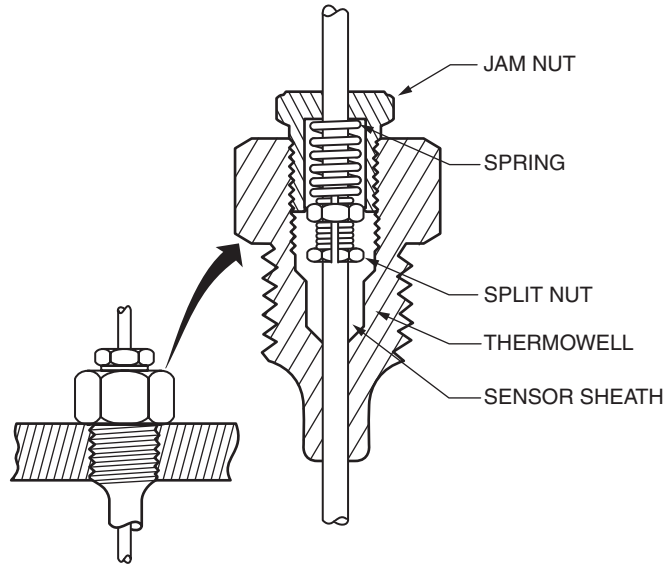


Figure 4. Spring-Loaded Coupler

Packing-Gland Coupler

This coupler is for setting the insertion (U) length. It differs from the compression coupler in that it may be reset. The external thread of the bushing is 1/2, 3/4, or 1 NPT. Referring to Figure 5, install the RTD using this coupler as follows:

1. Install the bushing into the process vessel or thermowell.
2. Moderately tighten the jam nut.
3. Loosen the gland nut and slide the sensor sheath to the desired position.
4. Tighten the gland nut to secure the RTD in place.

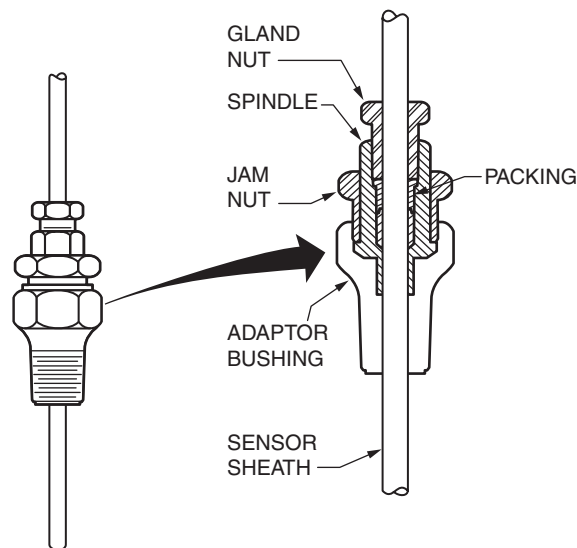


Figure 5. Packing-Gland Coupler

Wiring

— **⚠ CAUTION** —
 Run RTD external connecting wiring entirely independent of other wiring in a separate conduit isolated from earth (ground) and situated so that water or other fluids cannot enter the conduit to cause leakage currents, short circuits, or earthing (grounding). Do not run power wires in the same conduit with RTD extension wires.

— **⚠ CAUTION** —
 Connection wiring material must be able to withstand temperatures up to 85°C.

— **⚠ CAUTION** —
 To protect the RTD assembly from vibration and strain, do not connect rigid conduit to the connection head. Use flexible conduit if a conduit connection is required.

Connect external wiring to terminal board in connection head per Figure 6.

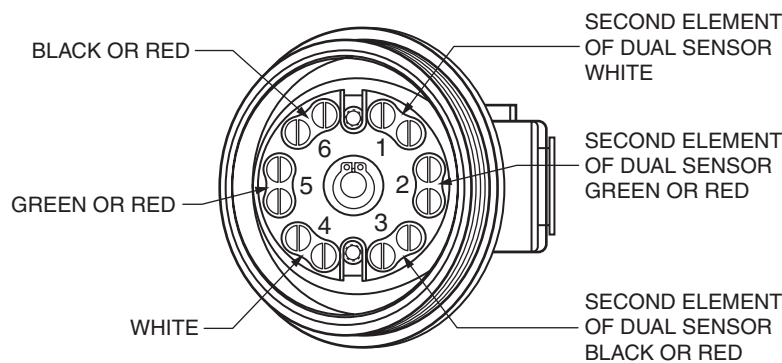


Figure 6. External Wiring Connections

Field Test

Your RTD has been tested at the factory. However, if you ever want to field test the functional operation of the RTD, perform the following procedure:

1. Immerse at least 90 mm (3.5 in) of the sensor sheath into a medium of known temperature, such as an ice bath or room temperature.
2. Connect an ohmmeter to the terminals listed in Table 2 and compare the readings to the values in TI 5-27a (for a SAMA calibration) or TI 005-028 (for an ASTM calibration).

Table 2. Field Temperature-Resistance Test

| From | To | Measurement Should Be |
|-----------------------|------------|-----------------------------------|
| Single Element | | |
| Terminal 4 | Terminal 5 | Value from TI 5-27a or TI 005-028 |
| Terminal 4 | Terminal 6 | Value from TI 5-27a or TI 005-028 |
| Terminal 4 | Sheath | Open circuit indication |
| Dual Element | | |
| Terminal 1 | Terminal 2 | Value from TI 5-27a or TI 005-028 |
| Terminal 1 | Terminal 3 | Value from TI 5-27a or TI 005-028 |
| Terminal 1 | Sheath | Open circuit indication |
| Terminal 4 | Terminal 5 | Value from TI 5-27a or TI 005-028 |
| Terminal 4 | Terminal 6 | Value from TI 5-27a or TI 005-028 |
| Terminal 4 | Sheath | Open circuit indication |

Cover Lock

A cover lock, shown in Figure 7, is provided as standard with ATEX certified RTDs. To lock the cover, screw the cover onto the housing as far as possible and then screw the set screw into place. Make sure that the set screw is located between any two of the eight small tabs on the cover.

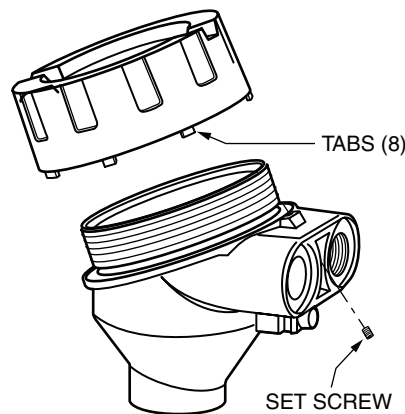


Figure 7. Cover Lock

Sensor Replacement

Well Type, Nipple or Union Coupler (PR-##N, P, U, W)

1. Remove the connection head cover.
2. Disconnect the field and sensor wiring from the terminal board.
3. Remove the terminal board screws and withdraw the terminal board and sensor.

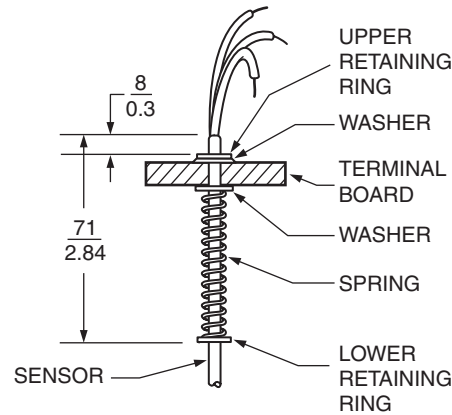


Figure 8. Sensor/Terminal Board Assembly

4. Using retaining ring pliers, remove the upper retaining ring. Slide the terminal board, spring, and washers off of the sensor. Remove the lower retaining ring.
5. Install lower retaining ring on the sheath of the new RTD at the dimension shown in Figure 8.
6. Slide the spring, washer, terminal board, and second washer onto the sensor.
7. Install upper retaining ring on the sheath of the new RTD at the dimension shown in Figure 8.
8. Insert the sensor through the connection head into the thermowell.
9. Fasten the terminal board in place using the two screws removed in Step 3.
10. Reconnect the field and sensor wiring disconnected in Step 2. Refer to “Wiring” on page 7.
11. Reinstall the connection head cover.

Bare Element Assembly (PR-##B)

1. Remove the connection head cover.
2. Disconnect the field and sensor wiring from the terminal board.
3. Unscrew and remove the sensor from the connection head.
4. Insert the wires of the new sensor through the bottom port of the connection head and screw the sensor into the connection head.
5. Reconnect the field and sensor wiring disconnected in Step 2. Refer to “Wiring” on page 7.
6. Reinstall the connection head cover.

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IPS Corporate Headquarters
5601 Granite Parkway Suite 1000
Plano, TX 75024
www.ips.invensys.com

Foxboro Global Client Support
Inside U.S.: 1-866-746-6477
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