BURNS® ENGINEERING

RTD Installation Instruction Manual

Contents

Introduction

This manual covers Burns Engineering Platinum Resistance Thermometer products, (PRTs, commonly referred to as RTDs, Resistance Temperature Detectors). Following the guidelines in this Manual will help ensure that you get the most accurate measurement and longest service life from your Burns RTD.

Handling

RTDs are precision instruments and should be handled accordingly. Maximum service life can be expected in the absence of high vibration, extreme temperature, and rough handling. Unless specifically offered, RTDs are not field bendable.

Inspection - Physical

Examine the sheath and mounting surfaces for signs of shipping damage. Whenever "C" or "K" style RTDs are ordered with a thermowell, the product may be shipped unassembled (depending on the overall length) to prevent damage during shipment. Install the thermowell, extension, and connection head prior to installing the RTD to prevent lead wire damage. For Ex approved assemblies (Certified as Explosion Proof or Flame Proof) specific assembly details must be followed. See the "Safety" paragraph on page 3 for required installation and assembly instructions and manuals.

Inspection - Electrical

Insulation Resistance (IR):

Using a meter capable of measuring resistance in the range of 5 to 500 megohms (10^6 ohms), measure the insulation resistance between the lead wires and the sheath when the RTD is at room temperature. The insulation resistance should be greater than the value stated on the specific sensors specification drawing. As an alternative, the IR test criterion per ASTM is:

IR > 100 megohms when tested at approximately 50 vdc.

Element Resistance: (Figure 1)

Check element resistance using an ohmmeter with a test current of no more than 10 milliamps. Typical test current is 1 to 2 milliamps. Do not use an insulation resistance meter as these devices use voltage/current levels that may permanently damage the RTD.

Element resistance is determined by subtracting the compensation loop resistance (R2) from the element loop resistance (R1). The resulting resistance should be approximately equal the resistance given in the resistance vs. temperature tables for ambient temperatures on page 5 and 6.

For Resistance vs. Temperature Tables that cover -200°C to 500°C (-328°F to 932°F) for various element designs visit the Burns website under Technical Info/Technical Papers.

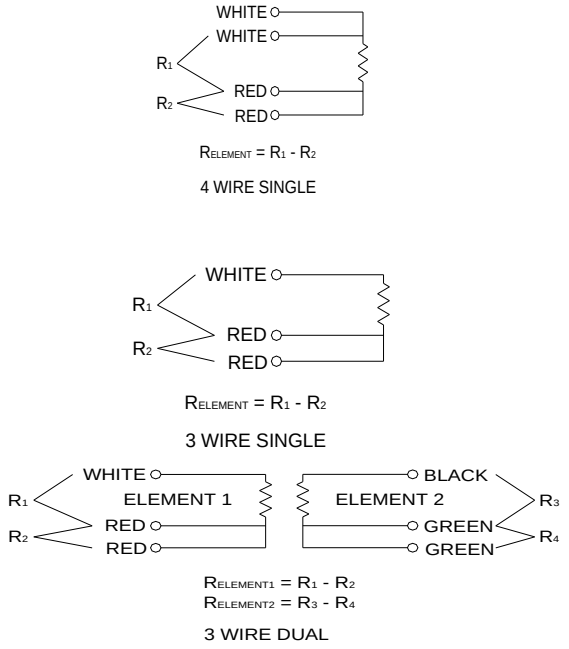

Figure 1
Sensor Resistance-Check Wiring

Installation & Field Wiring:

RTDs should be connected to the recorder, controller, transmitter or computer with copper wires. Do not use Thermocouple extension wire.

It is recommended that shielded wire be used whenever possible. Make sure that the field wiring and sensor lead style comply with the schematic for the signal conditioner in use. Lead wire resistance should not exceed the limitations of the signal conditioner.

Avoid electromagnetic fields. Never route sensor cables along side high voltage cables. When necessary, route cables inside a grounded metal conduit to provide shielding from electromagnetic fields, radio frequency or other electrical interference.

Sensor Wire Configuration:

3-Wire sensors (both single and dual element) with long leads may have a warning label that states “DO NOT CUT CABLE – MAY AFFECT ACCURACY”. To maintain the required accuracy of the temperature measurement Burns Engineering adjusts the individual resistances of the wires in the cable so that they are properly balanced. Cutting a cable that has been adjusted may negatively affect the resistance balance and subsequently the accuracy of the sensor.

Long cable/wire lengths (even several hundred feet) do not affect accuracy if 4-wire sensors and appropriate signal conditioners are used.

3-Wire Sensor; Wiring for Accuracy:

A label marked with the letter “E” has been attached to one compensation loop wire, and during calibration the labeled wire was used in the resistance measurement of the element. In the case of a single element sensor, this means that the element loop resistance was measured using the labeled red wire and the white wire, and the compensation loop resistance was measured between the labeled and non-labeled red wires. See Figure 2.

The sensor should be wired in this manner while in service and during calibration verification to ensure the most accurate comparison to the calibration report.

When a calibration report is not requested, the sensor will be within the stated interchangeability regardless of wiring method.

Figure 2:
Wiring for Calibrated Sensors

3 Wire Single, α=0.003850Ω/Ω/°C

Installation in Hazardous Locations:
Hazardous environments require specific installation methods based on the type of approval. See the "Safety" section for installation information.

Output

The RTD output is most commonly based on 100 ohm resistance at the ice point and a temperature coefficient (alpha) of 0.00385 ohms/ohms/°C. For complete Resistance vs. Temperature tables for various element designs, visit the Burns website under "Technical Info/Technical Papers".

Safety

When used in their intended applications RTDs are inherently safe passive electrical devices that pose no significant safety risk. Follow the guidelines below to ensure safe operation.

- Never connect an RTD to a high voltage electrical supply. RTDs are designed to be used with a small excitation current (typically 1 mA). Connecting to a high voltage electrical supply will damage the sensor and could significantly increase the risk of electrocution.
- Explosive Environment use. Many sensors are not designed or approved for use in an explosive environment.

  For assemblies that are labeled and approved for use in hazardous environments, verify the installation requirements are in accordance to the type of approval.

  Note: Ex Installation Manual is available on the Burns Web Site at: http://www.burnsengineering.com/local/uploads/files/EX_Assembly-Installation_Manual.pdf
  Burns EX Configuration Control drawing is available on the Burns Web Site at: http://www.burnsengineering.com/local/uploads/content/files/18938_Dwg.pdf

  There are various Hazardous Locations approvals, certified by FM Approvals. The available certifications and their region of appropriate use include:

  Explosion Proof (Class/Div) in the USA;
  Code: "/AFM"
  Flame Proof in the USA;
  Code: "/AFP"
  Flame Proof in Canada;
  Code: "/FMC"
  ATEX in the EU & UK;
  Code: "/ATEX"
  IECEx in World Regions per IEC Standards;
  Code: "/IEC"

For the details regarding these approvals and various combinations of these approvals, refer to the FM Approved assembly definition and installation drawing #18938 and the Ex Instruction Manual available on the Burns website. (Web links on page 3) www.BurnsEngineering.com

- Warnings:

  The following warnings should be obeyed:
  - WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
  - WARNING: DO NOT OPEN WHEN ENERGIZED
  - WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD—SEE NOTE
    - To minimize an electrostatic charging hazard on the exterior of the enclosures both the main and remote (If ordered) enclosures should be connected to earth ground, see the Ex instruction manual for more details.
    - External surfaces should be wiped down using a damp cloth.
- Earth Grounding: Most enclosures (connection heads) incorporate both an internal and external grounding point. All assemblies should be grounded to an effective earth ground See the "Safety" paragraph for the instruction / installation manuals for all Explosive Environment applications.
- Handle with Care. Depending on the specific model the temperature range can be as wide as -196°C to 500°C. When the sensor is being used at extreme temperatures (both high and low) the user should wear the appropriate personal protection equipment when handling the sensor. The sensor, after removal from the application, may remain at a dangerous temperature for a period of time.
- Supply Power: When the assembly incorporates a transmitter, the power to the transmitter should be shut off prior to removal or maintenance.

Periodic Verification

As with most high accuracy measurement devices, it is prudent to make periodic accuracy performance checks of an RTD against a known standard/specification to ensure that the integrity of the measurement is maintained. Taking a resistance reading at 0ºC (R_0) is the most efficient way to determine the accuracy of the probe. Fortunately, it is a relatively easy and low cost task to create an ice/water bath that provides a sufficiently accurate 0ºC temperature point. By monitoring the R_0 value of the sensor over subsequent verification intervals it is possible to build a history that can be used to predict the future performance of the sensor. (For more information view this technical paper on the Burns Engineering Website at: http://www.burnsengineering.com/local/uploads/files/RTD_Calibration_Verification.pdf

Responsible Disposal

When the time comes to replace the sensor it should be taken to a collection point for the recycling of electronic and electrical equipment to ensure the product is recycled properly.
The Series 200 & 300 assemblies are intended for installation in large-scale stationary industrial tools and / or large-scale fixed installations. According to the exemptions stated in the WEEE and RoHS2 Directives Burns Engineering is not responsible to manage the proper disposal of the product.

Approvals - ATEX

The Burns Engineering Series 200 and 300 RTDs have been certified by FM Approvals as complying with the European Parliament Directive 2014/34/EU (ATEX) regarding use in Hazardous Environments as Flame Proof. Consequently the CE mark has been applied to the Burns Engineering Series 200 and 300 RTD assemblies for compliance to the ATEX directive 2014/34/EU.

The Series 200 and 300 products have been self certified for European Parliament Directive 2001/95/EC on General Product Safety.

The CE mark below applies to the following Burns Engineering part numbers when tagged with the ATEX approval information:

200A-***/ATEX/**, 200B-***/ATEX/**,
200C-***/ATEX/**, 200K-***/ATEX/**,
200L-***/ATEX/**,
300A-***/ATEX/**, 300B-***/ATEX/**,
300C-***/ATEX/**, 300K-***/ATEX/**,
300L-***/ATEX/**,

Where the '***' portions represent various other details of the model configuration such as accuracy, enclosure, wire style and length variables. See the Series 200 and 300 catalog for complete details. (http://www.burnsengineering.com/local/uploads/files/series_200-300_rtds.pdf)

These parts are manufactured by

Burns Engineering, Inc.
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Minnetonka, MN 55343
UNITED STATES OF AMERICA

CE

European Parliament Directive 2014/34/EU on use in Hazardous Environments as Flame Proof (ATEX).

Additional Information

Burns Engineering is available to answer your questions regarding RTD applications. Call toll free 1-800-328-3871.

Or send your questions to:
info@BurnsEngineering.com

Resistance vs. Temperature Values:
Ambient Temperature Range
Sensor with R_0 = 100 ohms

Resistance vs. Temperature Table **(Alpha = 0.00385)**										
R_0 = 100.00 ohms								Resolution = 1 degree		
°C	0	1	2	3	4	5	6	7	8	9
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.41
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29

Resistance vs. Temperature Table **(Alpha = 0.00385)**										
R_0 = 100.00 ohms								Resolution = 1 degree		
°F	0	1	2	3	4	5	6	7	8	9
60	106.07	106.28	106.50	106.71	106.93	107.15	107.36	107.58	107.79	108.01
70	108.23	108.44	108.66	108.87	109.09	109.30	109.52	109.73	109.95	110.17

Resistance vs. Temperature Table **(Alpha = 0.003902)**										
R_0 = 100.00 ohms								Resolution = 1 degree		
°C	0	1	2	3	4	5	6	7	8	9
10	103.96	104.35	104.75	105.14	105.54	105.93	106.32	106.72	107.11	107.51
20	107.90	108.29	108.69	109.08	109.47	109.87	110.26	110.65	111.05	111.44

Resistance vs. Temperature Table **(Alpha = 0.003902)**										
R_0 = 100.00 ohms								Resolution = 1 degree		
°F	0	1	2	3	4	5	6	7	8	9
60	106.15	106.37	106.59	106.81	107.02	107.24	107.46	107.68	107.90	108.12
70	108.34	108.56	108.78	108.99	109.21	109.43	109.65	109.87	110.09	110.30

For more detailed R Vs T tables - access:
http://www.burnsengineering.com/local/uploads/files/Resistance_vs_Temperature_Tables_and_Usage.pdf

Resistance vs. Temperature Values:
Ambient Temperature Range
Sensor with R0 = 200 ohms

Resistance vs. Temperature Table
(Alpha = 0.00385)

R_0 = 200.00 ohms — Resolution = 1 degree

°C	0	1	2	3	4	5	6	7	8	9
10	207.80	208.58	209.36	210.14	210.92	211.70	212.48	213.26	214.04	214.82
20	215.58	216.36	217.14	217.92	218.70	219.46	220.24	221.02	221.80	222.58

Resistance vs. Temperature Table
(Alpha = 0.00385)

R_0 = 200.00 ohms — Resolution = 1 degree

°F	0	1	2	3	4	5	6	7	8	9
60	212.14	212.56	213.00	213.42	213.86	214.30	214.72	215.16	215.58	216.02
70	216.46	216.88	217.32	217.74	218.18	218.60	219.04	219.46	219.90	220.34

Resistance vs. Temperature Table
(Alpha = 0.003902)

R_0 = 200.00 ohms — Resolution = 1 degree

°C	0	1	2	3	4	5	6	7	8	9
10	207.92	208.70	209.50	210.28	211.08	211.86	212.64	213.44	214.22	215.02
20	215.80	216.58	217.38	218.16	218.94	219.74	220.52	221.30	222.10	222.88

Resistance vs. Temperature Table
(Alpha = 0.003902)

R_0 = 200.00 ohms — Resolution = 1 degree

°F	0	1	2	3	4	5	6	7	8	9
60	212.30	212.74	213.18	213.62	214.04	214.48	214.92	215.36	215.80	216.24
70	216.68	217.12	217.56	217.98	218.42	218.86	219.30	219.74	220.18	220.60

For more detailed R Vs T tables - access:
http://www.burnsengineering.com/local/uploads/files/Resistance_vs_Temperature_Tables_and_Usage.pdf