



ANDERSON-NEGELE

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# Instruction Manual

## RTD's with Sealed Cable or Quick Disconnect Receptacle

### Section 1 - Introduction

This document has been designed to assist the end-user with the installation of Anderson RTD's with Sealed Cable or Quick Disconnect Receptacle to provide optimum performance with minimum maintenance. A properly installed sensor will provide years of trouble-free service.

#### SPECIFICATIONS

##### RTD's (SA or SW - 1/2 Series)

Accuracy:	+/- 0.5% of measuring range
Measuring Range:	-50 - 350°F
Alpha Coefficient:	0.00385 ohms/ohm/°C (100 ohm) 0.00375 ohms/ohm/°C (1000 ohm)
Ambient Temperature	
Range:	-50 - 170°F
Housing Material:	304 stainless steel
Fitting Material:	316 stainless steel

### Section 2 - Theory of Operation

An RTD or Resistance Temperature Detector converts the sensed temperature into a resistance signal. A 100 ohm RTD will measure 100 ohms at 0°C (32°F), and its resistance will increase as the temperature increases. The amount of change in resistance per degree Celsius is related to the RTD's alpha coefficient. Anderson 100 ohm RTD's have an alpha coefficient of 0.00385 ohms/ohm/°C (also referred to as a 385 coeff.), which is a DIN standard. For a 100 ohm RTD, for every degree Celsius increase in temperature, the resistance will increase 1.00385 times its current reading. These RTD curves are provided at the end of this manual.

For applications where longer cable runs are required, or a 4-20 mA signal is desired a CT-Series sanitary temperature transmitter is available. A temperature transmitter utilizes a 100 ohm RTD and an electronic circuit which converts the resistance signal to a 2-wire 4-20 mA signal.

### Section 3 - Sealed Cable Sensor Installation

The physical installation is the most important concern with regards to promoting sensor reliability. Sensors must be installed in such a way that the housing and cable are not subject to physical abuse, and moisture, or moist air is not allowed to enter the sensor housing or cable.

#### SENSORS

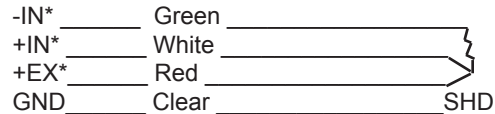
Sealed cable sensors should be mounted so that the end of the probe with the nylon strain relief does not protrude out into traffic areas or where it may be impacted by another object. The strain relief is permanently sealed to the sensor housing. Do not attempt to remove the strain relief, or the warranty will be voided. Splicing of the sensor cable should be avoided if possible. If the cable must be spliced, it should be done in a waterproof junction box. A splice in the cable will provide a path for water or water vapor to enter the sensor housing and cause premature sensor failure.

## CABLE

The cable provided with Anderson RTD's is 24 gauge, 4 conductor, shielded (Belden #9534). Four conductor cable is utilized for most sensors covered in this manual because of its roundness, which provides a suitable seal when used with strain reliefs. Irregular shaped cable does not allow for a watertight seal.

## RTD TO RECEIVER WIRING

Anderson 100 ohm RTDs are three wire, 0.00385 coeff. platinum film, and utilize the green as a signal wire and the white and red as common wires.

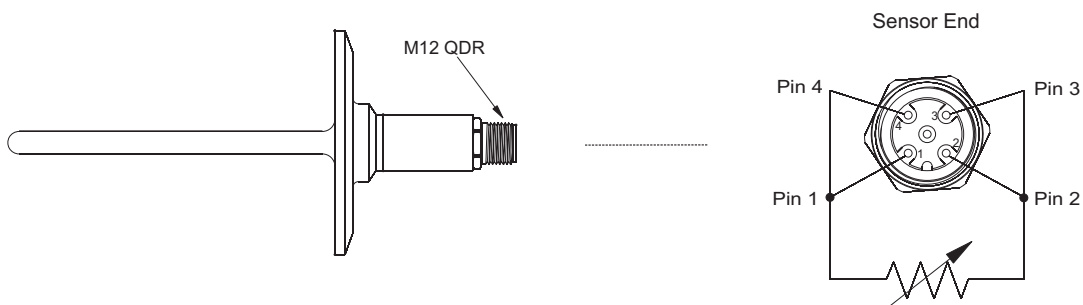


The clear shield wire should be connected to earth ground at the receiver end only.  
\*The connections are made to these terminals on many Anderson receivers.

## Section 4 - RTD with Quick Disconnect Receptacle Installation

The physical installation is the most important concern with regards to promoting sensor reliability. Sensors must be installed in such a way that the housing and cable are not subject to physical abuse, and moisture, or moist air is not allowed to enter the sensor housing or cable.

### Sensor Pin Out

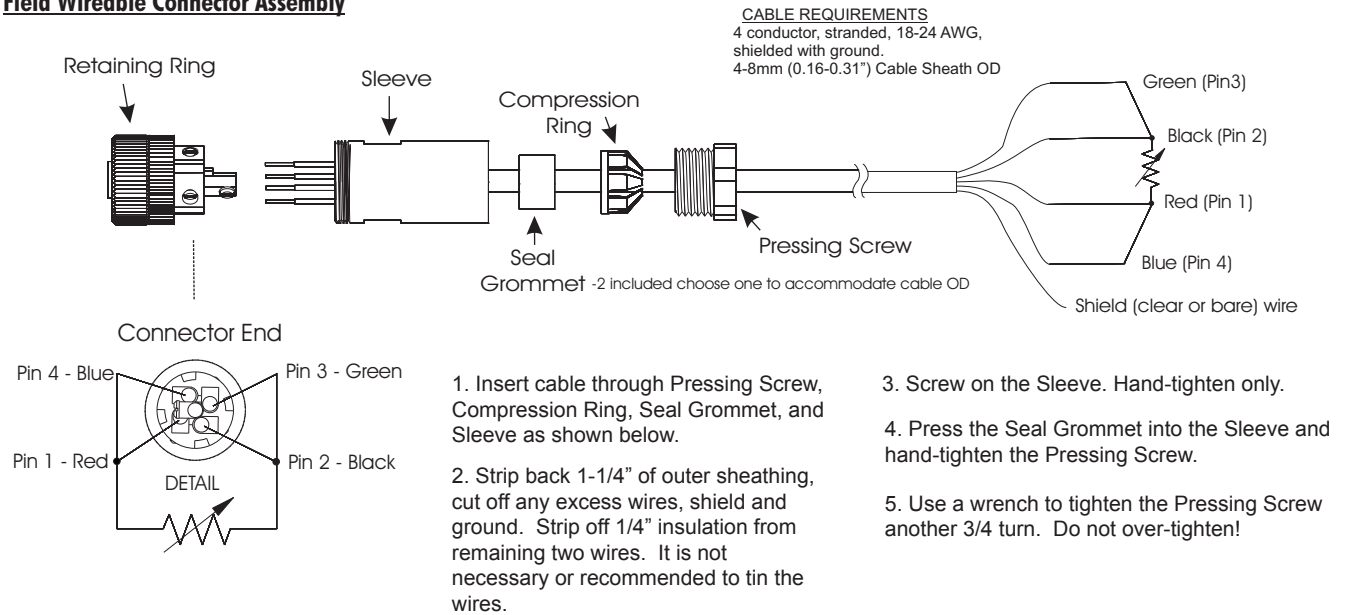


**NOTE:** Receptacle pins should be coated with USDA approved dielectric grease to minimize possibility of corrosion.

### **WARNING:**

The M12 QDR is permanently sealed to the sensor. DO NOT attempt to remove the QDR, or the warranty will be voided.

## Field Wireable Connector Assembly



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## Section 5 - Maintenance

Anderson electronic sensors require very little, if any, maintenance. We suggest that the sensors be inspected at 6 month intervals to ensure that they are not physically abused, moisture is not entering the housing, and that the wiring is sound.

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## Section 6 - Calibration

RTD's cannot be calibrated. They can, however, be checked for an accurate reading. At the end of this manual there is table including temperature versus resistance for 100 ohm RTD's. See the section above on wiring to determine where to take the resistance measurement. If the RTD is a three wire, the resistance added by the cable should be subtracted from the total resistance reading. To determine the resistance added by the cable, measure between the two common wires.

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## Section 7 - Troubleshooting

If a problem arises with an instrument, we typically confirm that the sensor is functioning properly before spending too much time on the receiving instrument. A DMM (digital multimeter) is an invaluable tool when troubleshooting electronic sensors.

Using a DMM on the ohms scale, measure between the signal wire and one of the common wires. Do this at the instrument end of the cable with the sensor disconnected from the instrument. At room temperature, a 100 ohm RTD reading should be about 108 ohms. See the included table for the proper readings at other temperatures. Then measure between the two common wires and look for a 1 to 3 ohm reading. Finally, there should be an open circuit between all three wires and the stainless steel sensor housing.

Please feel free to contact Anderson Technical Services Department at 1-800-833-0081 for further assistance troubleshooting.

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# Appendix A - Anderson 100 ohm RTD DIN Curve

0.00385 ohms/ohm/°C

<u>Degrees Fahrenheit</u>	<u>Degrees Celsius</u>	<u>Ohms</u>
0	-17.78	93.04
5	-15.00	94.12
10	-12.22	95.21
15	-9.44	96.31
20	-6.67	97.39
25	-3.89	98.48
30	-1.11	99.57
32	0.00	100.00
35	1.67	100.65
40	4.44	101.73
45	7.22	102.82
50	10.00	103.90
55	12.78	104.98
60	15.56	106.07
65	18.33	107.15
70	21.11	108.22
75	23.89	109.31
80	26.67	110.38
85	29.44	111.45
90	32.22	112.53
95	35.00	113.61
100	37.78	114.68
105	40.56	115.76
110	43.33	116.83
115	46.11	117.90
120	48.89	118.97
125	51.67	120.04
130	54.44	121.11
135	57.22	122.17
140	60.00	123.24
145	62.78	124.31
150	65.56	125.37
155	68.33	126.44
160	71.11	127.50
165	73.89	128.56
170	76.67	129.62
175	79.44	130.68
180	82.22	131.74
185	85.00	132.80
190	87.78	133.86
195	90.56	134.91
200	93.33	135.97
212	100.00	138.50
225	107.22	141.24
250	121.11	146.48
275	135.00	151.70
300	148.89	156.90

# Appendix B - Technical Notes

## RTD CONFIGURATIONS

There are 3 major RTD wiring schemes, two wire, three wire, and 4 wire.

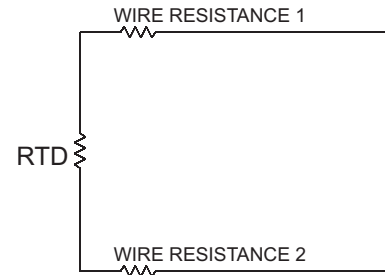
### Two Wire RTD

Figure 1 shows a two wire RTD configuration. A current source is applied to one of the wires and the circuit ground is connected to the other. The voltage generated is a function of the total resistance and the current (I) going through it.

$$V = I \times (RTD + \text{Wire Resistance 1} + \text{Wire Resistance 2})$$
$$\text{Temperature} = f(V)$$

It can be seen in the calculation that the length of the wires connecting to the RTD affects the overall resistance, which will add an offset error to the temperature measurement.

2 WIRE RTD



### Three Wire RTD

A 3 wire RTD is used to negate the errors created by wire resistances (Figure 2). This design requires two current sources (I1, I2), one applied to wire 1 and one applied to wire 3. The sum of the two current sources flow through wire 2.

The voltage at wire 1 will be:

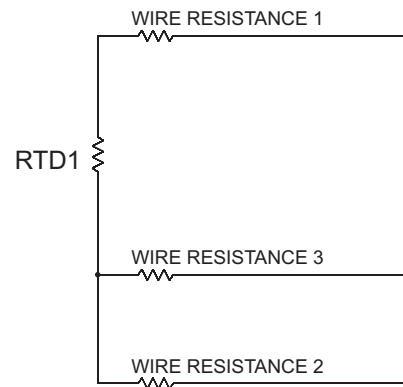
$$V_{W1} = (I_1 \times WR_1) + (I_1 \times RTD) + ((I_1 + I_2) \times WR_3)$$

The voltage at wire 3 will be:

$$V_{W3} = (I_2 \times WR_3) + ((I_1 + I_2) \times WR_3)$$

This method requires that the resistance of wire 1 and its connections is the same as wire 3 and its connections;  $V_{RTD}$  is equal to  $V_{W3} - V_{W1}$ . The effect of wire and connection resistance has been canceled. Therefore this is a good choice for sensors with longer but equal lead lengths and good circuit connections.

3 WIRE RTD

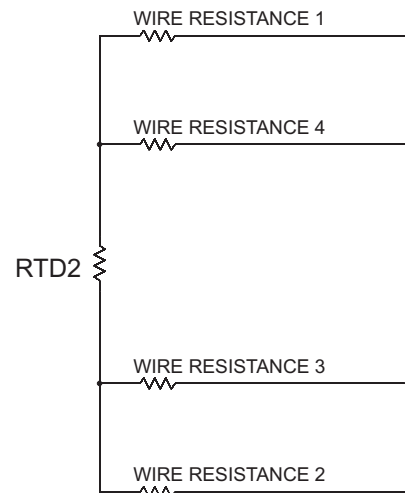


### Four Wire RTD

The 4 wire RTD uses only 1 current source. A current is injected through WR1, the RTD and WR2. WR4 and WR3 is connected to a very high impedance differential amplifier. Because there is no current flowing through WR3 and WR 4, there is no voltage drop across them and the amplifier inputs sees only the voltage directly across the RTD.

This method is not affected by the difference in wire and connection resistances. Therefore this is a good choice for sensors with non-equal lead lengths or with connections resistances that could change over time.

4 WIRE RTD



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## Warranty and Return Statement

These products are sold by the Anderson Instrument Company (Anderson-Negele) under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Anderson or from an Anderson distributor, representative or re-seller, and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

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### Warranty

These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the Anderson factory and to conform at that time to the specifications set forth in the relevant Anderson instruction manual or manuals, sheet or sheets, for such products for a period of one year.

*THERE ARE NO EXPRESSED OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREIN AND ABOVE SET FORTH. ANDERSON MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCTS.*

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### Limitations

Anderson shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses with the exception of the cost or expense of repair or replacement as described above.

Products must be installed and maintained in accordance with Anderson instructions. Users are responsible for the suitability of the products to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specifications or other operating conditions beyond our control. Claims against carriers for damage in transit must be filed by the buyer.

This warranty is void if the purchaser uses non-factory approved replacement parts and supplies, or if the purchaser attempts to repair the product themselves, or through a third party, without Anderson authorization.

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### Returns

Anderson's sole and exclusive obligation and buyer's sole and exclusive remedy under the above warranty is limited to repairing or replacing (at Anderson's option), free of charge, the products which are reported in writing to Anderson at its main office indicated below.

Anderson is to be advised of return requests during normal business hours, and such returns are to include a statement of the observed deficiency. The buyer shall prepay shipping charges for products returned, and Anderson, or its representative, shall pay for the return of the products to the buyer.

Approved returns should be sent to:

ANDERSON INSTRUMENT COMPANY INC.  
156 AURIESVILLE ROAD  
FULTONVILLE, NY 12072 USA

ATTN: REPAIR DEPARTMENT