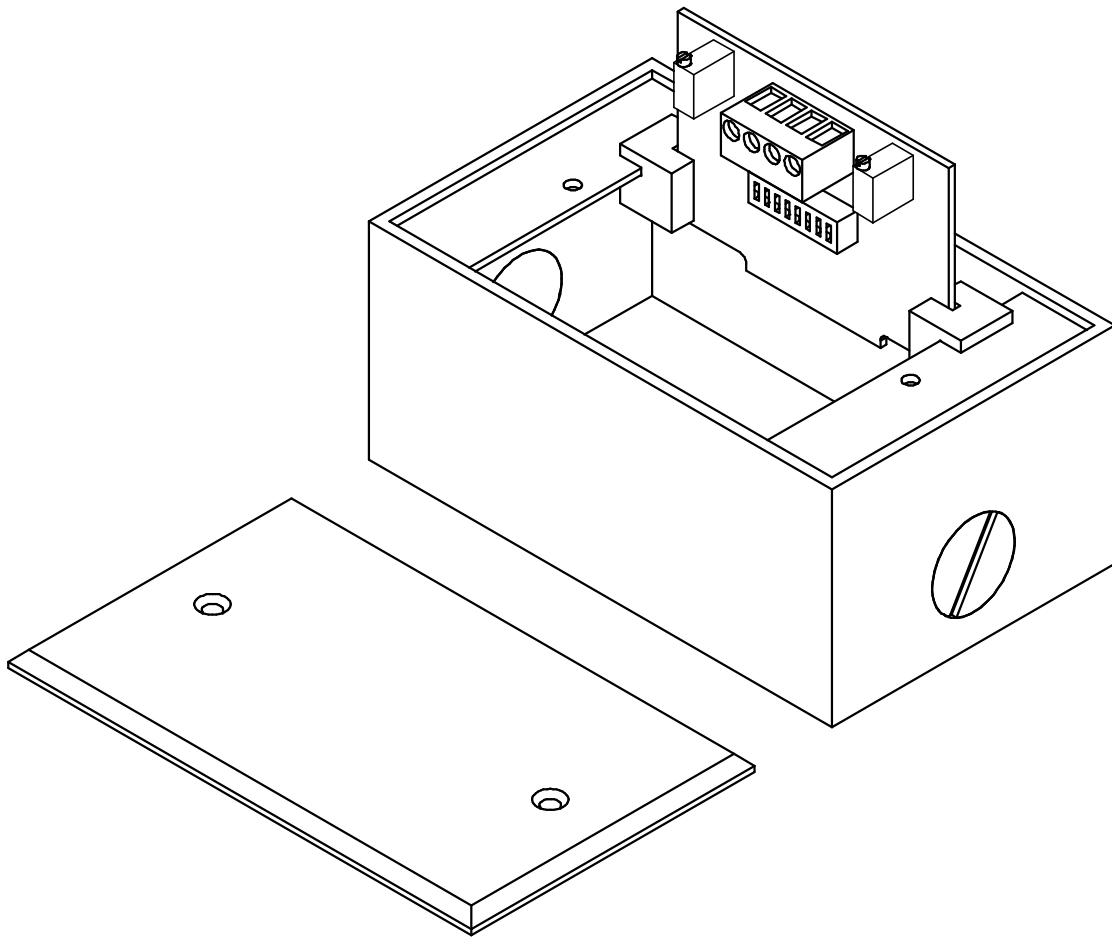




**TT809 Temptran™**  
**2-wire Temperature Transmitter and Housing**  
**Installation and Operating Instructions**



## Description

Model TT809 is a 2-wire temperature transmitter for RTD (Resistance Temperature Detector) thermometers. The Temptran™ converts the RTD's signal into a 4 to 20 mA current. The current changes according to the range in which the Temptran is calibrated: 4 mA at the lowest temperature of the range, rising to 20 mA at the top of the range. The leads that supply power also carry the current signal. The TT809 is FIELD RANGEABLE; the Zero and Span are adjustable over -50 to 212°F and 30 to 320°F respectively allowing for re-ranging by means of a simple calibration process. The gasketed metal housing provides excellent weather resistance and is easily installed using the attached mounting brackets. Request Minco Application Aid 15 for more general information on transmitters.

## Specifications

<b>Sensing Element:</b>	2-wire 1000 ohm @ 0°C platinum RTD, 0.00375 or 0.00385 ohm/ohm/°C TCR.
<b>Output:</b>	4 to 20 mA DC over specified range.
<b>Calibrated Accuracy:</b>	+/- 0.1% of span (0.75% span overall matched to sensor).
<b>Transmitter Linearity:</b>	+/- 0.1% of span.
<b>Rangeability:</b>	-50 ° to 212 °F (-45° to 100°C). Span: 30 ° to 320 °F (17° to 180°C)
<b>Housing:</b>	4.5" L x 2.75" W x 2.25" cast alloy, moisture-resistant housing with three 1/2" NPT integral conduit bosses, gasketed cover and adjustable mounting brackets. Suitable for outdoor use.
<b>Operating Environment:</b>	-40 to 185°F (-40 to 85°C).
<b>Storage Environment:</b>	67 to 212°F (-55 to 100°C).
<b>Ambient Temperature Effects:</b>	+/- 0.01% Span/°F (+/- 0.018% Span/°C).
<b>Warm-up Drift:</b>	+/- 0.1% of span max., assuming Vsupply = 24 VDC and Rloop = 250 ohms. Stable within 15 minutes.
<b>Supply Voltage:</b>	8.5 to 35 volts DC with no load.
<b>Input Voltage Effect:</b>	+/- 0.001% of span per volt.
<b>Maximum Load Resistance:</b>	The maximum allowable resistance of the signal-carrying loop is given by this formula: $R_{loop\ max} = (V_{supply} - 8.5) / .02\ amps$
<b>System Integration:</b>	Output "High" (22-25mA) with sensor open. Output "Low" (3.3-3.7mA) with sensor shorted.
<b>Zero and Span Adjustment:</b>	Non-interacting.
<b>Maximum Output Current:</b>	28 mA.
<b>Power Connections:</b>	Screw terminals, non-polar (connect either way).
<b>Sensor Connections:</b>	Screw terminals, non-polar (connect either way).
<b>Universal Spares:</b>	Temperature ranging via. dip switches. Spare transmitter will cover any range.
<b>Weight:</b>	9.3 oz. (263 grams) Transmitter and housing.

## Installation

Installation of the TT809 consists of mounting the transmitter and connecting it to power. The housing is mounted using two fold-out tabs on the bottom. Power and RTD wires are connected to the transmitter by 4 screw terminals located near the edge of the circuit board (Figure 1). The transmitter's power and RTD connections are designed for non-polar hook-up, so polarity is not important. Locate the Temptran near the RTD in an area where the ambient temperature stays between  $-40$  and  $85$  °C ( $-40$  and  $185$  °F). If calibration is necessary, set dip-switches before sliding transmitter circuit board into metal housing (See *Transmitter Ranging* section).

1. Connect a 1000 ohm RTD to the "RTD" terminals as shown below (Figure 1).
2. Connect a DC source, not exceeding 35 VDC, to the "PWR" terminals.

## Wiring Diagram

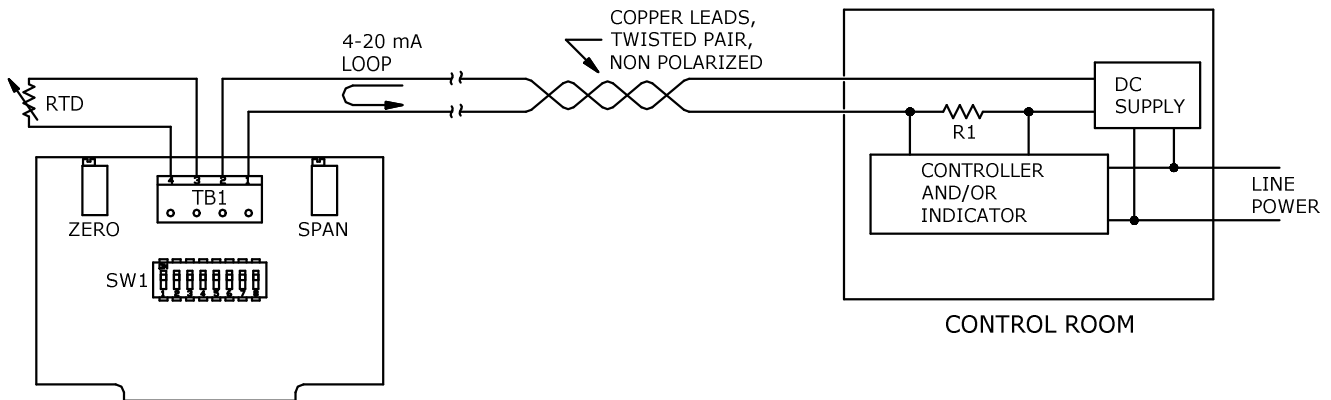


Figure 1

## Power Supply

DC power supply requirements are determined by the TT809 minimum voltage requirement and voltage drop across the load resistor and installation lead wires.

Example: The transmitter requires 8.5 Volts minimum. A typical 250 ohm load resistor drops 5.0 Volts @ 20 mA. Allowing a margin of 0.5 Volts for the supply permits 25 ohms of lead wire resistance for remote installation. Totaling these, we get a minimum power supply requirement of 14 VDC.

Using a 24 VDC power supply will take care of nearly all installations, but the TT809 will operate with as much as 35 VDC.

## Calibration Procedure

1. Connect the equipment as shown below (Figure 2) substituting a resistance decade box, with resolution of at least 0.01 ohm, in place of the RTD.

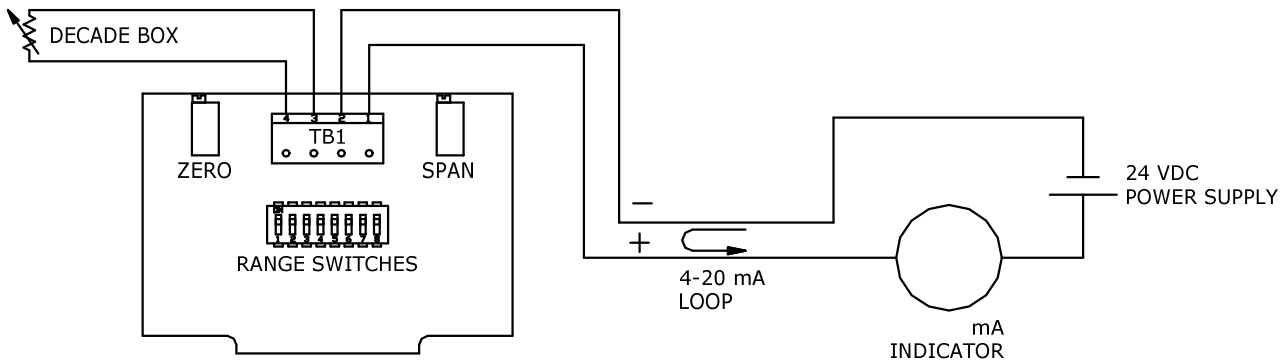


Figure 2

2. Determine sensor resistance corresponding to the lower and upper temperature range of the transmitter from Tables 3 and 4 (page 6). Using "RTD Calc" a more complete resistance vs. temperature chart can be printed; Download it from Minco's web site, [www.minco.com](http://www.minco.com).
3. Set the decade box to the resistance value corresponding to the lower temperature. Adjust the Zero pot until the milliammeter reads 4.0 mA  $\pm$  0.016 mA.
4. Set the decade box to the resistance value corresponding to the upper temperature. Adjust the Span pot until the milliammeter reads 20.0 mA  $\pm$  0.016 mA.
5. Set the decade box to the resistance value corresponding to the lower temperature and verify that the milliammeter still reads 4.0 mA  $\pm$  0.016 mA. Correct if necessary, then repeat steps 4 and 5.

## Transmitter Ranging

The transmitter is initially calibrated to a specific temperature range, as shown on the label attached to the housing. Unless a different range is desired, ranging is not necessary. If the temperature range is changed, recalibrate the transmitter as described in the section, *Calibration Procedure*.

When a different temperature range is desired, Tables 1 and 2 (Page 5) provide range switch settings corresponding to the various temperature ranges. Switches 1 to 4 set the lower temperature limit (Zero) of the transmitter. Switches 5 to 8 set the upper minus lower temperature (Span) of the transmitter.

For example, a temperature range of 50 to 200°F has a Zero of 50°F and a Span of 150°F (200-50). Table 1 shows the closest Zero range is 58°F with switches 1 through 4, respectively, in the ON, OFF, OFF, and ON positions. Likewise, Table 2 shows the closest Span range is 155°F with switches 5 through 8, respectively, in the ON, OFF, ON, and OFF positions. Once the switches are set, the Zero and Span trim pots should provide sufficient adjustments to calibrate the transmitter.

In the event that the trim pots do not have sufficient adjustments, the switch settings should then be changed. In the above example, if the Zero trim pot cannot adjust the transmitter current up to 4mA with the 58°F Zero switch settings, then the Zero switch settings should then be changed to 38°F (ON, OFF, ON and OFF) which is the next lower range. Likewise if the Span trim pot does not have sufficient adjustment, then the Span switch settings should be changed.

### Zero Switch Settings

Z E R O					
Switch Settings				Center Point	
1	2	3	4	°F	°C
ON	ON	ON	ON	-60	-51
ON	ON	ON	OFF	-42	-41
ON	ON	OFF	ON	-22	-30
ON	ON	OFF	OFF	-2	-19
ON	OFF	ON	ON	18	-8
ON	OFF	ON	OFF	38	3
ON	OFF	OFF	ON	58	14
ON	OFF	OFF	OFF	78	26
OFF	ON	ON	ON	100	38
OFF	ON	ON	OFF	120	49
OFF	ON	OFF	ON	140	60
OFF	ON	OFF	OFF	160	71
OFF	OFF	ON	ON	181	83
OFF	OFF	ON	OFF	202	94
OFF	OFF	OFF	ON	223	106
OFF	OFF	OFF	OFF	244	118

Table 1

### Span Switch Settings (Upper Minus Lower Temperature Limits)

S P A N *					
Switch Settings				Center Point	
5	6	7	8	°F	°C
ON	ON	ON	ON	34	19
ON	ON	ON	OFF	58	32
ON	ON	OFF	ON	82	46
ON	ON	OFF	OFF	106	59
ON	OFF	ON	ON	131	73
ON	OFF	ON	OFF	155	86
ON	OFF	OFF	ON	178	99
ON	OFF	OFF	OFF	202	112
OFF	ON	ON	ON	224	124
OFF	ON	ON	OFF	247	137
OFF	ON	OFF	ON	270	150
OFF	ON	OFF	OFF	294	163
OFF	OFF	ON	ON	317	176
OFF	OFF	ON	OFF	339	188
OFF	OFF	OFF	ON	362	201
OFF	OFF	OFF	OFF	384	213

Table 2

\* Span = Upper - Lower Temperature.

# Zero ranges overlap next adjacent range.

**Resistance vs. Temperature for 1000 Ohm Platinum Sensors (°F)**

**PW = 0.00375 ohm/ohm/°C, PF = 0.00385 ohm/ohm/°C**

Temp. (°F)	Sensor	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
0	PW	932.07	910.76	889.41	868.01	846.58	825.09	-----	-----	-----	-----
	PF	930.33	908.49	886.60	864.67	842.71	820.70	-----	-----	-----	-----
Temp. (°F)	Sensor	0	10	20	30	40	50	60	70	80	90
0	PW	932.07	953.34	974.57	995.77	1016.92	1038.04	1059.12	1080.17	1101.18	1122.15
	PF	930.33	952.15	973.92	995.66	1017.36	1039.03	1060.66	1082.25	1103.81	1125.33
100	PW	1143.08	1163.98	1184.84	1205.66	1226.45	1247.19	1267.90	1288.58	1309.21	1329.81
	PF	1146.82	1168.28	1189.69	1211.07	1232.42	1253.73	1275.00	1296.24	1317.44	1338.61
200	PW	1350.38	1370.90	1391.39	1411.84	1432.25	1452.63	1472.97	1493.27	1513.54	1533.76
	PF	1359.74	1380.84	1401.90	1422.93	1443.91	1464.87	1485.79	1506.67	1527.51	1548.33
300	PW	1553.95	1574.11	1594.22	1614.30	1634.34	1654.35	1674.32	1694.25	1714.14	1734.00
	PF	1569.10	1589.84	1610.54	1631.21	1651.84	1672.44	1693.00	1713.53	1734.02	1754.47
400	PW	1753.82	1773.60	1793.34	1813.05	1832.72	1852.36	1871.95	1891.51	1911.03	1930.52
	PF	1774.89	1795.28	1815.62	1835.93	1856.21	1876.45	1896.66	1916.83	1936.96	1957.06
500	PW	1949.96	1969.37	1988.75	2008.08	2027.38	2046.64	-----	-----	-----	-----
	PF	1977.12	1997.15	2017.14	2037.09	2057.01	2076.90	-----	-----	-----	-----

**Table 3**

**Resistance vs. Temperature for 1000 Ohm Platinum Sensors (°C)**

**PW = 0.00375 ohm/ohm/°C, PF = 0.00385 ohm/ohm/°C**

Temp. (°C)	Sensor	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
0	PW	1000.00	980.93	961.84	942.71	923.55	904.36	885.13	865.87	846.58	827.24
	PF	1000.00	980.44	960.86	941.24	921.60	901.92	882.22	862.48	842.71	822.90
Temp. (°C)	Sensor	0	5	10	15	20	25	30	35	40	45
0	PW	1000.00	1019.04	1038.04	1057.02	1075.96	1094.88	1113.76	1132.62	1151.44	1170.24
	PF	1000.00	1019.53	1039.03	1058.49	1077.94	1097.35	1116.73	1136.08	1155.41	1174.70
50	PW	1189.01	1207.74	1226.45	1245.12	1263.76	1282.38	1300.96	1319.52	1338.04	1356.54
	PF	1193.97	1213.21	1232.42	1251.60	1270.75	1289.87	1308.97	1328.03	1347.07	1366.08
100	PW	1375.00	1393.44	1411.84	1430.21	1448.56	1466.87	1485.15	1503.41	1521.63	1539.82
	PF	1385.05	1404.00	1422.93	1441.82	1460.68	1479.51	1498.32	1517.10	1535.84	1554.56
150	PW	1557.99	1576.12	1594.22	1612.30	1630.34	1648.35	1666.33	1684.29	1702.21	1720.10
	PF	1573.25	1591.91	1610.54	1629.15	1647.72	1666.27	1684.78	1703.27	1721.73	1740.16
200	PW	1737.96	1755.80	1773.60	1791.37	1809.11	1826.82	1844.51	1862.16	1879.78	1897.37
	PF	1758.56	1776.93	1795.28	1813.59	1831.88	1850.13	1868.36	1886.56	1904.73	1922.87
250	PW	1914.93	1932.46	1949.96	1967.44	1984.88	2002.29	2019.67	-----	-----	-----
	PF	1940.98	1959.06	1977.12	1995.14	2013.14	2031.11	2049.05	-----	-----	-----

**Table 4**

**How to Order:**

TT809	Model Number: TT809
PW	Resistance thermometer type: RTD Temptran PF = 1000 Ω Platinum (.00385) PW = 1000 Ω Platinum (.00375)
80	LLL in .1" increments 40 = 4.0", 120 = 12.0", 000 for "W" with out sensor
E	Mount type: E = Duct mount V = Duct averaging O = Outside air P = Immersion W = Wall mount
1	4 to 20 mA DC Output
S	Temperature Range (4 mA Temp/20 mA Temp): EN = -20 to 140°F (-29 to 60°C) S = 0 to 100°F (-18 to 38°C) A = 20 to 120°F (-7 to 49°C) BI = 30 to 130°F (-1 to 54°C) N = 32 to 122°F (0 to 50°C) H = 40 to 90°F (4 to 32°C) C = 32 to 212°F (0 to 100°C) SX = Special range as defined on job order – must fall within adjustment limits of Transmitter. Consult factory for current list of available ranges.
1	Calibration: 1 = No calibration data, sensor or transmitter 2 = Sensor/Transmitter matched at 0°C with NIST cert 3 = Sensor/Transmitter matched at 0, 100, & 260°C with NIST cert
TT809PW80E1S1 ← Sample Part Number	

**Dimensions:** All dimensions are in inches (millimeters)

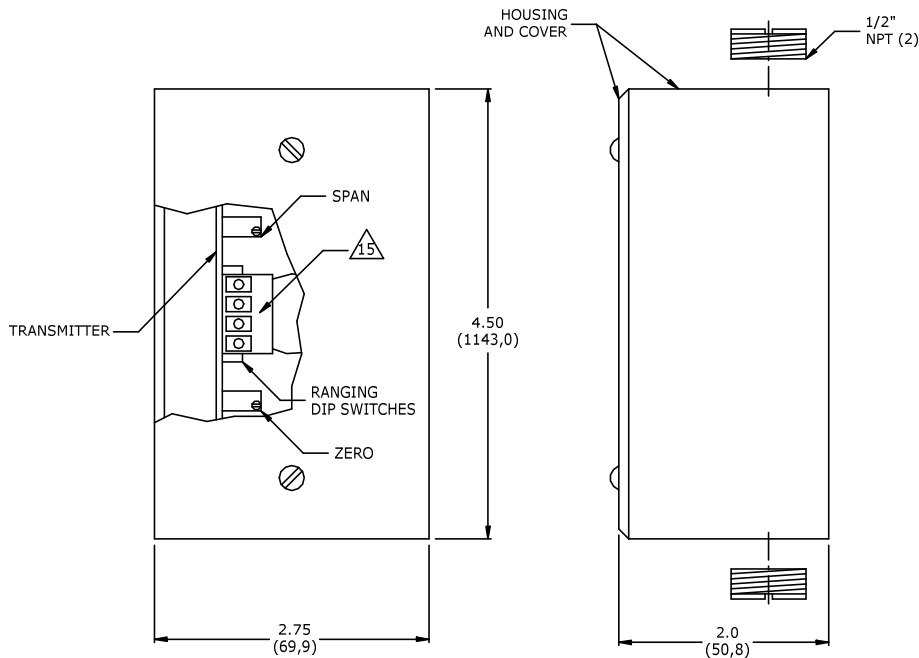


Figure 3

## Warranty

Items returned within one year from the date of sale, transportation prepaid, which Minco Products, Inc. (The "Seller") reasonably determines to be faulty by reason of defective materials or faulty workmanship will be replaced or repaired at the Seller's discretion, free of charge. This remedy is to be the sole and exclusive remedy available to the buyer in the event of a breach by the Seller. Items that show evidence of mishandling or misapplication, may be returned by the Seller at the customer's expense. Furthermore, the Seller is not to be held responsible for consequential damages caused by its product except as required under Minnesota Statutes, Section 336.1-719 (3). This warranty is expressly in lieu of any other expressed warranty or implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of the Seller or its employees or agents.

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