TT859 Temptran™
2-wire Temperature Transmitter for RTD Thermometers
Installation and Operating Instructions

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Description

Model TT859 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 DC 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 TT859 is FIELD RANGEABLE; the Zero and Span are adjustable over -10 to 60°F and 35 to 150°F respectively allowing for re-ranging by means of a simple calibration process.

Specifications

Sensing Element:	1000 ohm @ 0°C platinum RTD, 0.00375 ohm/ohm/°C TCR or 0.00385 ohm/ohm/°C TCR.
Output:	4 to 20 mA DC over specified range.
System Accuracy:	± 0.5°F (± 0.3°C) @ room temp or ± 0.8% of span operating @ 24 VDC.
Transmitter Linearity:	± 0.1% of span.
Rangeability:	Zero: -10° to 60°F (-23° to 15°C). Span: 35° to 150°F (19° to 83°C).
Housing:	2.75" W x 4.50" H x 1.56" D. Bone white plastic cover and baseplate with anodized aluminum endplates. Suitable for indoor use only.
Operating Environment:	-40° to 185°F (-40° to 85°C), non-condensing.
Storage Environment:	67° to 212°F (-55° to 100°C), non-condensing.
Ambient Temperature Effects:	± 0.01% Span/°F (± 0.018% Span/°C).
Warm-up Drift:	± 0.1% of span max., assuming Vsupply = 24 VDC and Rloop = 250 ohms. Stable within 15 minutes.
Supply Voltage:	9.4 to 35 volts DC, non-polarized.
Input Voltage Effect:	± 0.001% of span per volt from 9.4 to 35 VDC.
Maximum Load Resistance:	The maximum allowable resistance of the signal-carrying loop, including extension wires and load resistance, is given by this formula: Rloop max = (Vsupply-9.4)/.02 amps. For example, if the supply voltage is 24 VDC, the loop resistance must be less than 730 Ω.
System Integration:	Output "High" (22-25mA) with sensor open. Output "Low" (3.3-3.7mA) with sensor shorted.
Zero and Span Adjustment:	Non-interacting.
Maximum Output Current:	28 mA.
Power Connections:	Screw terminals, non-polar (connect either way).
Sensor Connections:	Screw terminals, non-polar (connect either way).
Weight:	3.0 oz. (84 grams) Transmitter and housing.

Installation

Installation of the TT859 consists of mounting the transmitter to a wall and connecting it to power. The housing is mounted using two countersink screws to secure the base plate to a wall. Access the mounting holes by separating the plastic base plate from the cover. Then secure the base plate to the wall, long edge to the vertical (observing the directional arrow marked on the base plate). 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. If calibration is necessary, set dip-switches before assembling housing (See *Transmitter Ranging* section).

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

Wiring Diagram

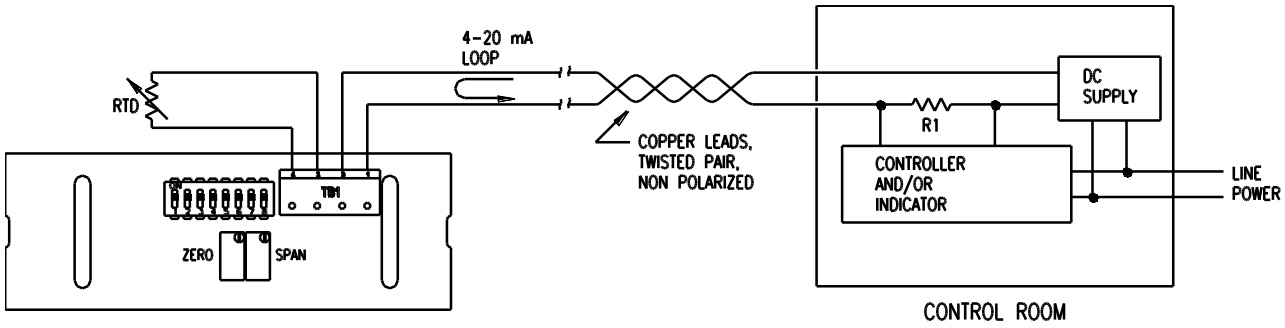

Figure 1

Power Supply

DC power supply requirements are determined by the TT859's minimum voltage requirement and voltage drop across the load resistor and installation lead wires.

Example: The transmitter requires 9.4 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 14.9 VDC.

Using a 24 VDC power supply will take care of nearly all installations, but the TT859 will operate at voltages up to 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.

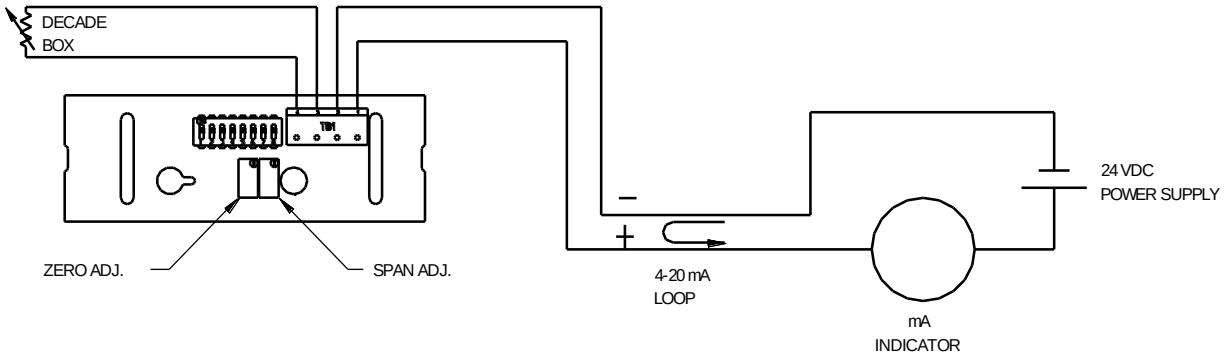

Figure 2

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.
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 +/- 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 +/- 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 +/- 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 30 to 90°F has a Zero of 30°F and a Span of 60°F (90-30). Table 1 shows the closest Zero range is 30°F with switches 1 through 4, respectively, in the OFF, ON, ON, and OFF positions. Likewise, Table 2 shows the closest Span range is 57°F with switches 5 through 8, respectively, in the ON, ON, OFF, 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 down to 4mA with the 30°F Zero switch settings, then the Zero switch settings should then be changed to 37°F (OFF, ON, OFF and ON) which is the next higher range. Likewise if the Span trim pot does not have sufficient adjustment, then the Span switch settings should be changed.

Zero Switch Settings

ZERO Switch Settings				Center Point	
1	2	3	4	°F	°C
ON	ON	ON	ON	-13	-25
ON	ON	ON	OFF	-8	-22
ON	ON	OFF	ON	-2	-19
ON	ON	OFF	OFF	3	-16
ON	OFF	ON	ON	9	-13
ON	OFF	ON	OFF	12	-11
ON	OFF	OFF	ON	18	-8
ON	OFF	OFF	OFF	25	-4
OFF	ON	ON	ON	28	-2
OFF	ON	ON	OFF	34	1
OFF	ON	OFF	ON	39	4
OFF	ON	OFF	OFF	45	7
OFF	OFF	ON	ON	50	10
OFF	OFF	ON	OFF	55	13
OFF	OFF	OFF	ON	61	16
OFF	OFF	OFF	OFF	66	19

Table 1

Span Switch Settings
(Upper Minus Lower Temperature Limits)

SPAN * Switch Settings				Center Point	
5	6	7	8	°F	°C
ON	ON	ON	ON	31	17
ON	ON	ON	OFF	40	22
ON	ON	OFF	ON	47	26
ON	ON	OFF	OFF	56	31
ON	OFF	ON	ON	65	36
ON	OFF	ON	OFF	74	41
ON	OFF	OFF	ON	81	45
ON	OFF	OFF	OFF	90	50
OFF	ON	ON	ON	99	55
OFF	ON	ON	OFF	106	59
OFF	ON	OFF	ON	115	64
OFF	ON	OFF	OFF	122	68
OFF	OFF	ON	ON	131	73
OFF	OFF	ON	OFF	139	77
OFF	OFF	OFF	ON	148	82
OFF	OFF	OFF	OFF	155	86

Table 2

* Span = Upper - Lower Temperature. Zero ranges overlap next adjacent range.

Resistance vs. Temperature for 1000 Ohm Platinum Sensors
PW = 0.00375 ohm/ohm/°C, PF = 0.00385 ohm/ohm/°C

Temp. (°F)	Sensor	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
0	PW	932.07	921.42	910.76	900.09	------	------	------	------	------	------
	PF	930.33	919.41	908.49	897.55	------	------	------	------	------	------
Temp. (°F)	Sensor	0	5	10	15	20	25	30	35	40	45
0	PW	932.07	942.71	953.34	963.96	941.57	985.17	995.77	1006.35	1016.92	1027.49
	PF	930.33	941.24	952.14	963.04	973.92	984.79	995.66	1006.51	1017.36	1028.20
50	PW	1038.04	1048.59	1059.12	1069.65	1080.17	1090.68	1101.18	1111.67	1122.15	1132.62
	PF	1039.03	1049.85	1060.66	1071.46	1082.25	1093.04	1103.81	1114.58	1125.34	1136.08
100	PW	1143.08	1153.54	1163.98	1174.41	1184.84	1195.25	1205.66	1216.06	1226.45	1236.82
	PF	1146.82	1157.55	1168.28	1178.99	1189.69	1200.39	1211.07	1221.75	1232.42	1243.08
150	PW	1247.19	1257.55	1267.90	1278.25	1288.58	1298.90	1309.21	1319.52	1329.81	1340.10
	PF	1253.73	1264.37	1275.00	1285.63	1296.24	1306.85	1317.45	1328.03	1338.61	1349.18
200	PW	1350.38	1360.64	1370.90	------	------	------	------	------	------	------
	PF	1359.74	1370.30	1380.84	------	------	------	------	------	------	------

Table 3

Resistance vs. Temperature for 1000 Ohm Platinum Sensors
PW = 0.00375 ohm/ohm/°C, PF = 0.00385 ohm/ohm/°C

Temp. (°C)	Sensor	0	-2	-4	-6	-8	-10	-12	-14	-16	-18
-20	PW	923.55	915.88	908.20	900.52	------	------	------	------	------	------
	PF	921.60	913.73	905.86	897.99	------	------	------	------	------	------
0	PW	1000.00	992.38	984.75	977.12	969.48	961.84	954.19	946.54	938.88	931.24
	PF	1000.00	992.18	984.36	976.53	968.70	960.86	953.02	945.17	937.32	929.46
Temp. (°C)	Sensor	0	2	4	6	8	10	12	14	16	18
0	PW	1000.00	1007.62	1015.23	1022.84	1030.44	1038.04	1045.64	1053.23	1060.81	1068.39
	PF	1000.00	1007.81	1015.62	1023.43	1031.23	1039.03	1046.82	1054.60	1062.39	1070.16
20	PW	1075.93	1083.53	1091.10	1098.66	1106.21	1113.76	1121.31	1128.85	1136.39	1143.92
	PF	1077.94	1085.70	1093.47	1101.23	1108.98	1116.73	1124.47	1132.22	1039.95	1147.68
40	PW	1151.45	1158.97	1166.48	1174.00	1181.50	1189.01	1196.50	1204.00	1211.48	1218.97
	PF	1155.41	1163.13	1170.85	1178.56	1186.27	1193.97	1201.67	1209.36	1217.05	1224.74
60	PW	1226.45	1233.92	1241.39	1248.85	1256.31	1263.77	1271.21	1278.66	1286.10	1293.53
	PF	1232.42	1240.10	1247.77	1255.43	1263.09	1270.75	1278.40	1286.05	1293.70	1301.33
80	PW	1300.96	1308.39	1315.81	1323.23	1330.64	1138.04	1345.44	1352.84	1360.23	1367.62
	PF	1308.97	1316.60	1324.22	1331.84	1339.50	1347.07	1354.68	1362.28	1369.88	1377.47
100	PW	1375.00	------	------	------	------	------	------	------	------	------
	PF	1385.06	------	------	------	------	------	------	------	------	------

Table 4

How to Order

TT859	Model Number: TT859
PW	Resistance thermometer type: RTD Temptran PF = 1000 Ω Platinum (.00385) PW = 1000 Ω Platinum (.00375)
1	4-20 mA DC Output
S	Temperature Range (4 mA Temp/20 mA Temp): EN = -20 to 140°F (-29 to 60°C) S = 0 to100°F (-18 to 38°C) A = 20 to120°F (-7 to49°C) BI = 30 to130°F (-1 to54°C) N = 32 to122°F (0 to50°C) H = 40 to90°F (4 to32°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
TT859PW1S1 ← Sample part number	

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 this product except as required under Minnesota Statutes, Section 336.1-719 (3).

This warranty is 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 of the seller or its employees or agent.

Dimensions

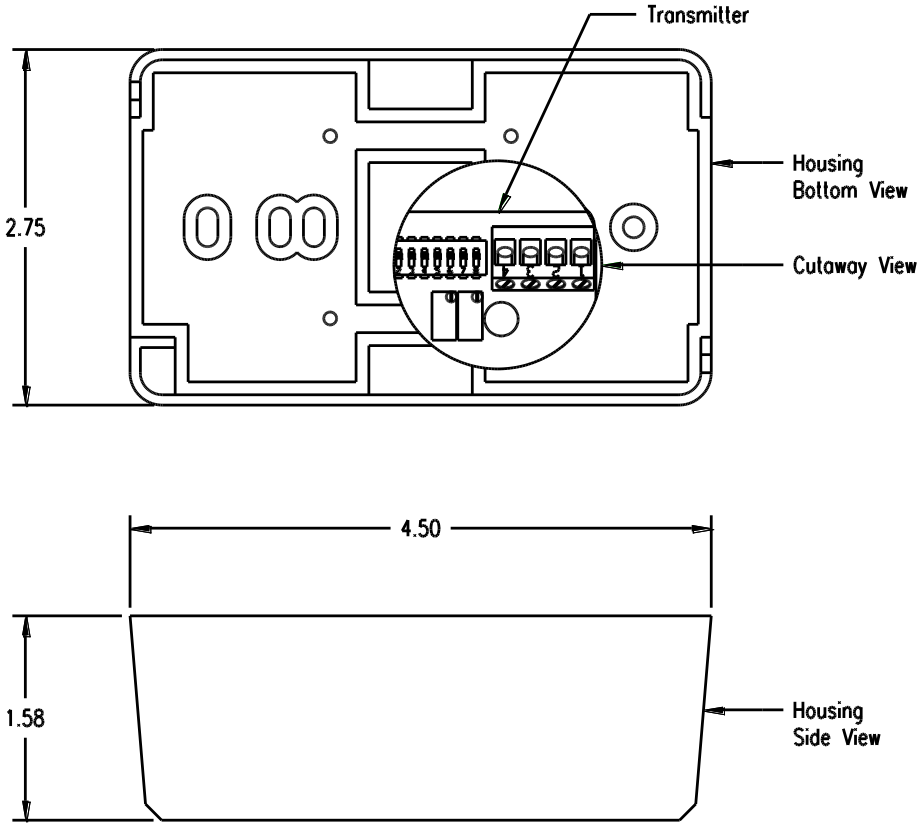

Figure 3

Minco (Main Office)
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