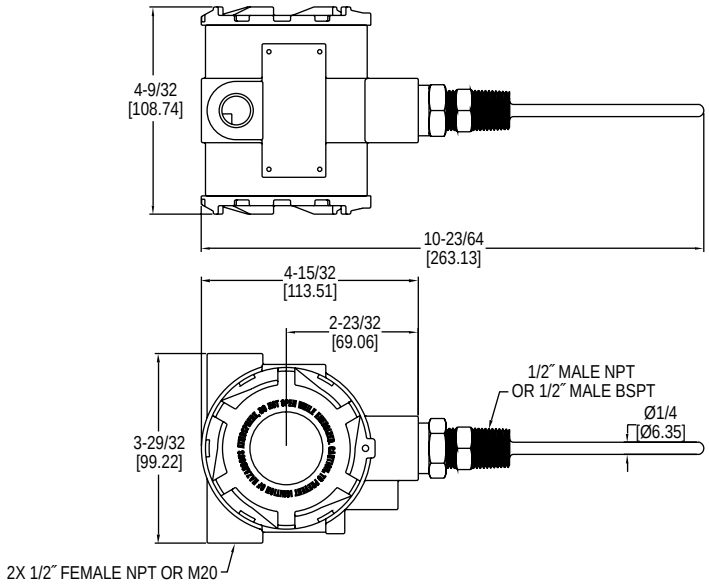
Series TTE Explosion-Proof RTD Temperature Transmitter

Specifications - Installation and Operating Instructions



The **Series TTE Explosion-Proof RTD Temperature Transmitter** is the ideal product for hazardous temperature measurement applications. The TTE series has seven pre-programmed temperature ranges that are selectable via an internal dip switch. For those applications that need a custom range, the transmitter can be easily configured for any range between -30 to 250°F with a minimum span of 40°F. The span and zero can be quickly adjusted with a simple push button design. This unit has optional listings of FM for use in Class I, Division 1, Groups B, C and D, Class II, Division 1, Groups E, F and G and Class III atmospheres or ATEX (Directive 2014/34/EU) for CE 2813 Ex II 2 G Ex db IIC T6...T4 Gb (-20°C ≤ Ta ≤ + 70°C), CE 2813 Ex II 1 D Ex ta IIIC T111°C Da (-20°C ≤ Ta ≤ + 70°C) and IECEx for Ex db IIC T6...T4 Gb (-20°C ≤ Ta ≤ + 70°C), Ex ta IIIC T111°C Da (-20°C ≤ Ta ≤ + 70°C). The compact housing allows for the transmitter to be mounted in virtually any application.

The Series TTE is ideally suited for refrigeration, building automation, commercial hot water heaters and boilers, and water chillers applications.

MODEL CHART

Example	TTE	1	04	W	LCD	Explosion-proof RTD temperature transmitter, FM rated, 4″ probe, with LCD display
Series	TTE					Explosion-proof RTD temperature transmitter
Agency		1				FM*
		2				ATEX/IECEx flameproof
Probe Length			02			2″ probe
			04			4″ probe
			06			6″ probe
			09			9″ probe
			12			12″ probe
			15			15″ probe
			18			18″ probe
Construction				W		Well probe
Options					Blank	No LCD display
					BSPT	1/2 male BSPT process connection
					C5	C5-M housing paint specification
					LCD	LCD display
					M20	Female M20 thread electrical connection

*Options that do not have ATEX and IECEx.

Attention: Units without the "2" suffix following "TTE" are not directive 2014/34/EU (ATEX) Complaint. These units are not intended for use in potentially hazardous atmospheres in the EU. These units may be CE marked for other directives of the EU.

SPECIFICATIONS

Temperature Sensor: Pt1000, 0.00385 DIN.
Output Temperature Ranges: User selectable – any range between -30 to 250°F with a minimum span of 40°F.
Temperature Limits: Ambient: -4 to 158°F (-20 to 70°C); Process: -30 to 250°F (-34.4 to 120°C).
Accuracy: Transmitter ±0.1% FS; Probe ±0.3% FS.
Thermal Drift Effects: ±0.02%/°C max.
Response Time: 250 ms.
Wetted Materials: 316 SS.
Process Connection: 1/2″ male NPT or 1/2 male BSPT.
Conduit Connection: 1/2″ female NPT or M20.
Probe Length: 2″ to 18″ (depending on model).
Pressure Limits: 2000 psi.
Power Requirements: 10-35 VDC.
Output Signal: 4-20 mA (2-wire loop powered).
Optional Display: 2 lines X 8 character LCD.
Enclosure Rating: Weatherproof and explosion-proof. Listed with FM for Class I, Division 1, Groups B, C and D, and dust-ignitionproof for Class II, Division 1, Groups E, F and G and Class III atmospheres.
ATEX Certified: CE 2813 Ex II 2 G Ex db IIC T6...T4 Gb, CE 2813 Ex II 1 D Ex ta IIIC T111°C Da, T6 Process Temp ≤80°C, Temperature Class T5 Process Temp ≤95°C, Temperature Class T4 Process Temp ≤120°C as defined on nameplate. EU-type Cerificate No.: EMT17ATEX0021 X.
ATEX Standards: EN 60079-0:2012+A11:2013; EN 60079-1:2015; EN 60079-31:2014.
IECEx Certified: For Ex db IIC T6...T4 Gb, Ex ta IIIC T111°C Da, T6 Process Temp ≤80°C, Temperature Class T5 Process Temp ≤95°C, Temperature Class T4 Process Temp ≤120°C as defined on nameplate.
IECEx Certificate of Conformity: Element IECEx EMT 17.0007X; IECEx Standards: IEC 60079-0:2011 (Edition 6); IEC 60079-1:2014 (Edition 7); IEC 60079-31:2013 (Edition 2).
Weight: 2 lb 8 oz (1134 g).
Agency Approvals: FM, CE, ATEX/IECEx.

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INSTALLATION

1. **Location:** Select a location where the temperature of the transmitter will be between -4 and 158°F. Distance from the receiver is limited only by total loop resistance.
2. **Position:** The transmitter is not position sensitive. Units with the optional display should be mounted for ease of viewing the display.
3. **Electrical Connection: Wire Length** - The maximum length of wire connecting the transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute more than 10% of the receiver resistance to total loop resistance. For extremely long runs (over 1000 feet), choose receivers with lower resistance to minimize the size and cost of connecting leads.

Current (4-20 mA) Output Operation

An external power supply is required. See Figure A for diagram of the connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistance (RL) for the DC power supply voltage available is expressed by the formula:

$$R_L = \frac{V_{ps} - 10}{20\ \text{mADC}}$$

Shielded cable is recommended for control loop wiring.

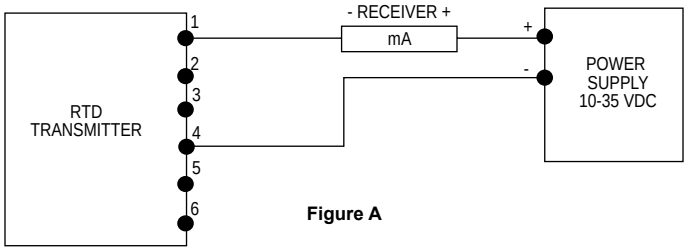


Figure A

CAUTION

FM Explosion-Proof Installation Notes:

1. Install in accordance with any applicable national electric code.
2. Plug unused conduit openings. Plug must engage a minimum of 5 threads.
3. Use a conduit seal within 18 inches of conduit entry.
4. Disconnect power before servicing.

Electrical connections to the RTD Transmitter are made to the terminal block located inside the housing. Unscrew and remove the cover. Wire as shown in Figure B.

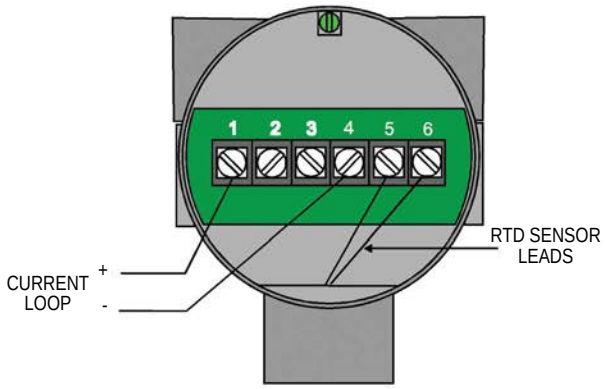


Figure B

Temperature Range Selection

The RTD Transmitter has 7 built in temperature ranges and a user settable range that are selectable by setting the Dip Switch located inside the housing (Figure C). Switches 2, 3, and 4 are used to set the range. To set the desired range, unscrew and remove the cover and set the Dip Switch according to the following table:

	Dip Switch		
Selectable Ranges	**2**	**3**	**4**
40 to 90°F (4.4 to 32.2°C)	OFF	OFF	OFF
-20 to 140°F (-28.9 to 60°C)	ON	OFF	OFF
0 to 100°F (-17.8 to 37.8°C)	OFF	ON	OFF
30 to 240°F (-1.1 to 115.6°C)	ON	ON	OFF
32 to 212°F (0 to 100°C)	OFF	OFF	ON
32 to 122°F (0 to 50°C)	ON	OFF	ON
-30 to 65°C (-1.1 to 18.3°C)	OFF	ON	ON
User ettable	ON	ON	ON

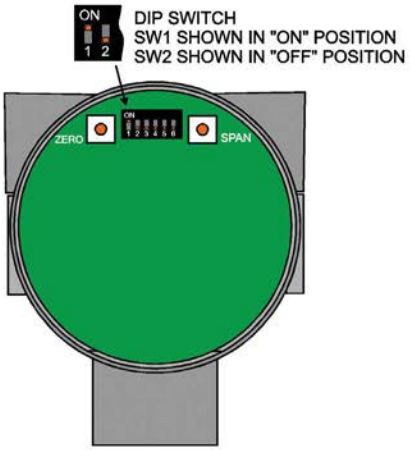


Figure C

Setting and Calibrating the User Settable Range
By setting SWITCH 2, 3, and 4 on, the RTD Transmitter may be adjusted to a custom user specified range. The range may be any values between –30°F and +250°F (-34 to +121°C) with a MINIMUM SPAN of 40°F (22°C).

Equipment Required
In order to calibrate the unit for a custom range, a precision RTD simulator that can simulate a 1000 OHM DIN type RTD or precision decade box is required. The device must be capable of generating the correct RTD resistance to 0.1% or better.

Calibration Procedure
1. Set DIP SWITCHES 2, 3 and 4 ON.
2. Remove the RTD sensor leads from terminals 5 and 6 (Figure B). Connect the precision RTD simulator or decade box to terminals 5 and 6.
3. Wire instrument as previously discussed. A current meter may be wired in series with the unit to verify the correct current output, but this is not necessary for calibration. Apply power to the unit.
4. If a precision RTD simulator is used, make sure it is set to simulate a 1000 OHM DIN 0.00385 RTD. Then set it to the desired minimum temperature. If a decade box is used refer to the table in Appendix A (°F) or Appendix B (°C) and set it to the resistance that represents the desired minimum temperature.
5. Press the ZERO button. If the unit has the optional LCD, the display will read ZERO OK momentarily. If a current meter is wired, it will read 4.00 mA.
6. Repeat step 4 using the value for the maximum desired temperature.
7. Press the SPAN button. If the unit has the optional LCD, the display will read SPAN OK momentarily. If a current meter is wired, it will read 20.00 mA.
8. Turn off power to the unit. Disconnect the RTD simulator or decade box and reconnect the RTD sensor to terminals 5 and 6. Calibration is complete.

Note: The calibration procedure does not effect the calibration of any of the built in ranges.

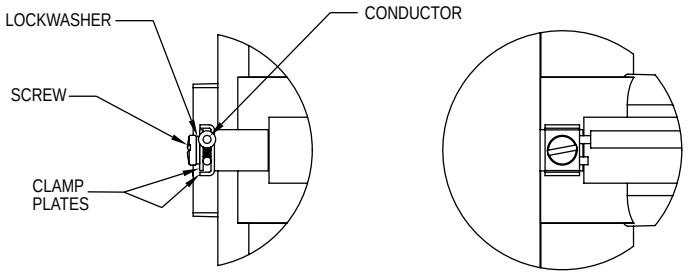
°F and °C Selection
If the unit has the optional LCD display, DIP SWITCH 1 sets the display to read in °F or °C. SWITCH 1 “OFF” = °F
SWITCH 1 “ON” = °C.

Output Current Display
If the unit has the optional LCD display, the lower display will show the output current if DIP SWITCH 5 is “ON”. Setting DIP SWITCH 5 “OFF” causes the lower display to be blank.

Open RTD Protection
Upon detecting an open RTD, the unit may be set to force the output to read 3.5 mA or 21mA based upon the setting of DIP SWITCH 6.
SWITCH 6 “OFF”, output forced to 3.5 mA
SWITCH 6 “ON”, output forced to 21 mA

Calibration
The unit requires no calibration. An internal precision resistor continually self calibrates the unit. Calibration may be verified by removing the sensor leads and testing the unit against a precision RTD simulator or a precision decade box. If the unit is found to be out of calibration it must be returned to the factory for service.

ELECTRICAL CONNECTIONS
Connect wire leads in accordance with local electrical codes. For units supplied with both internal ground and external bonding terminals, the ground screw inside the housing must be used to ground the control. The external bonding screw is for supplementary bonding when allowed or required by local code. When external bonding conductor is required, conductor must be wrapped a minimum of 180° about the external bonding screw. See below.



BOTTOM VIEW DETAIL FRONT VIEW DETAIL

EU-Type Certificate, IECEx Installation Instructions:
Cable Connection
The cable entry device shall be certified in type of explosion protection flameproof enclosure “db”, suitable for conditions of use and correctly installed. For ta ≥ 70°C cable and cable gland rated ≥ 75°C (MIN.) shall be used.

Conduit Connection
An Ex db certified sealing device such as a conduit seal with setting compound shall be provided immediately to the electrical entrance of the transmitter housing. For ta ≥ 70°C wiring and setting compound, in the conduit seal, rated ≥ 75°C shall be used.

Unused entries shall be sealed with an Ex certified blanking device rated for the appropriate zone, equipment group and temperature classification and shall be installed per manufacturer instructions.

Note: For ATEX/IECEx units only: When employed in a Zone 1, EPL Gb (db) application, the temperature class is determined by the maximum ambient and or process temperature. Units are intended to be used in ambient of -20°C≤ Tamb ≤70°C. Units may be used in process temperatures up to 120°C providing the enclosure temperature do not exceed 70°C. The standard Temperature Class is T6 Process Temp ≤80°C. Remaining temperature classes are, Temperature Class of T5 Process Temp ≤95°C and Temperature Class T4 Process Temp ≤ 120°C. Refer to Certificate No: Element IECEx EMT17.0007X for conditions of safe use for IECEx compliant units. All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside enclosure. Electrical components must be kept dry at all times.

When employed in a Zone 20, EPL Da (ta) application, the equipment is to be used with a power source rated for a prospective short circuit current of 10 kA. If the power source is rated for a prospective short circuit current of less than 10 kA, the end user or installer must mark the equipment with the prospective short circuit current rating of the power supply it is used in conjunction with.

CAUTION To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

MAINTENANCE
Inspect and clean wetted parts at regular intervals. The cover should be in place at all times to protect, the internal components from dirt, dust and weather and to maintain hazardous location ratings. Disconnect device from the supply circuit before opening to prevent ignition of hazardous atmosphere. Repairs to be conducted by Dwyer Instruments, Inc (field repair should not be attempted and may void warranty).

⚠ WARNING Repairs to electrical connection, process connection and flameproof joints are prohibited to maintain safe use of the product.

Units in need of repair should be returned to the factory prepaid. Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number for shipping.

Appendix A - RTD Table, ˚F Plt 1000 DIN 0.00385
Values are in ohms

TEMP, °F	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-30	864.7									
-20	886.6	884.4	882.2	880.0	877.8	875.6	873.5	871.3	869.1	866.9
-10	908.5	906.3	904.1	901.9	899.7	897.6	895.4	893.2	891.0	888.8
0	930.3	928.2	926.0	923.8	921.6	919.4	917.2	915.0	912.9	910.7
TEMP, °F	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	930.3	932.5	934.7	936.9	939.1	941.2	943.4	945.6	947.8	950.0
10	952.1	954.3	956.5	958.7	960.9	963.0	965.2	967.4	969.6	971.7
20	973.9	976.1	978.3	980.4	982.6	984.8	987.0	989.1	991.3	993.5
30	995.7	997.8	1000.0	1002.2	1004.3	1006.5	1008.7	1010.9	1013.0	1015.2
40	1017.4	1019.5	1021.7	1023.9	1026.0	1028.2	1030.4	1032.5	1034.7	1036.9
50	1039.0	1041.2	1043.4	1045.5	1047.7	1049.9	1052.0	1054.2	1056.3	1058.5
60	1060.7	1062.8	1065.0	1067.1	1069.3	1071.5	1073.6	1075.8	1077.9	1080.1
70	1082.3	1984.4	1086.6	1088.7	1090.9	1093.0	1095.2	1097.4	1099.5	1101.6
80	1103.8	1106.0	1108.1	1110.3	1112.4	1114.6	1116.7	1118.9	1121.0	1123.2
90	1125.3	1127.5	1129.6	1131.8	1133.9	1136.1	1138.2	1040.4	1142.5	1144.7
TEMP, °F	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
100	1146.8	1149.0	1151.1	1153.3	1155.4	1157.6	1159.7	1161.8	1164.0	1166.1
110	1168.3	1170.4	1172.6	1174.7	1176.9	1179.0	1181.1	1183.3	1185.4	1187.6
120	1189.7	1191.8	1194.0	1196.1	1198.3	1200.4	1202.5	1204.7	1207.0	1208.9
130	1211.1	1213.2	1215.4	1217.5	1219.6	1221.8	1223.9	1226.0	1228.2	1230.3
140	1232.4	1234.6	1236.7	1238.8	1241.0	1243.1	1245.2	1247.3	1249.5	1251.6
150	1253.7	1255.9	1258.0	1260.1	1262.2	1264.4	1266.5	1268.6	1270.8	1272.9
160	1275.0	1277.1	1279.3	1281.4	1283.5	1285.6	1287.8	1289.9	1292.0	1294.1
170	1296.2	1298.4	1300.5	1302.6	1304.7	1306.9	1309.0	1311.1	1313.2	1315.3
180	1317.5	1319.6	1321.7	1323.8	1325.9	1328.0	1330.2	1332.3	1334.4	1336.5
190	1338.6	1340.7	1342.8	1345.0	1325.9	1349.2	1351.3	1353.4	1355.5	1357.6
TEMP, °F	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
200.0	1359.7	1361.9	1364.0	1366.1	1368.2	1370.3	1372.4	1374.5	1376.6	1378.7
210.0	1380.8	1383.0	1385.1	1387.2	1389.3	1391.4	1393.5	1395.6	1397.7	1399.8
220.0	1401.9	1404.0	1406.1	1408.2	1410.3	1412.4	1414.5	1416.6	1418.7	1420.8
230.0	1422.9	1425.0	1427.1	1429.2	1431.3	1433.4	1435.5	1437.6	1439.7	1441.8
240.0	1443.9	1446.0	1448.1	1450.2	1452.3	1454.4	1456.5	1458.6	1460.7	1462.8
250.0	1464.9									

Appendix B - RTD Table, ˚C Plt 1000 DIN 0.00385
Values are in ohms

TEMP, °C	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-30	888.2	878.3	874.3	870.4	866.4					
-20	921.6	917.7	913.7	909.8	905.9	901.9	898.0	894.0	890.1	886.2
-10	960.9	956.9	953.0	949.1	945.2	941.2	937.3	933.4	929.5	925.5
0	1000.0	996.1	992.2	988.3	984.4	980.4	976.5	972.6	968.7	964.8
TEMP, °C	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	1000.0	1003.9	1007.8	1011.7	1015.6	1019.5	1023.4	1027.3	1031.2	1035.1
10	1039.0	1042.9	1046.8	1050.7	1054.6	1058.5	1062.4	1066.3	1070.2	1074.1
20	1077.9	1081.8	1085.7	1089.6	1093.5	1097.4	1101.2	1105.1	1109.0	1112.9
30	1116.7	1120.6	1124.5	1128.3	1132.2	1136.1	1140.0	1143.8	1147.7	1151.5
40	1155.4	1159.3	1163.1	1167.0	1170.9	1174.7	1178.6	1182.4	1186.3	1190.1
50	1194.0	1197.8	1201.7	1205.5	1209.4	1213.2	1217.1	1220.9	1224.7	1228.6
60	1232.4	1236.3	1240.1	1243.9	1247.8	1251.6	1255.4	1259.3	1263.1	1266.9
70	1270.8	1274.6	1278.4	1243.9	1286.1	1289.9	1293.7	1297.5	1301.3	1305.2
80	1309.0	1312.8	1316.6	1320.4	1324.2	1328.0	1331.8	1335.7	1339.5	1343.3
90	1347.1	1350.9	1354.7	1358.5	1362.3	1366.1	1369.9	1373.7	1377.5	1381.3
TEMP, °C	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
100	1385.1	1388.9	1392.6	1396.4	1400.2	1404.0	1407.8	1411.6	1415.4	1419.1
110	1422.9	1426.7	1430.5	1434.3	1438.0	1441.8	1445.6	1449.4	1453.1	1456.9
120	1460.7	1464.5								

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