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FM APPROVED

Technical User Guide

TT881

Explosionproof Temperature Sensor Assembly

MINCO

Table of Contents

Table of Contents 2
Introduction 3
Installation 4
Installation of Connection Head, Sensor, and Temptran™ 4
Configuration 5
Transmitter Calibration Procedure 5
Changing the Transmitter Temperature Range 6
Troubleshooting 8
Frequently Asked Questions (FAQ) 9
How do I install a TT881 to maintain hazardous area certification? 9
Why wasn't the RTD wired to the transmitter when I received it? 9
Specifications 10
Dimensions 11
Transmitter: 11
Probe Assembly: 11
How to Order 12
Warranty 12

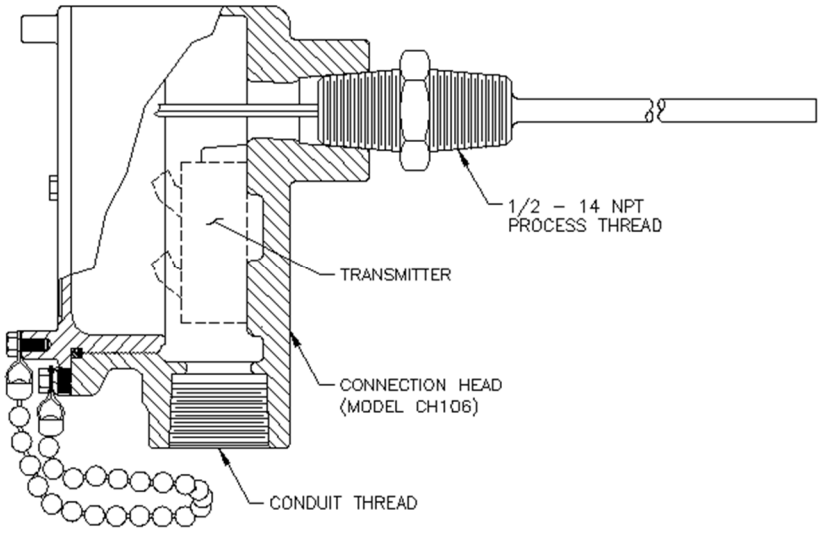
Introduction

Minco model TT881 is an FM and CSA certified temperature transmitter assembly for use in hazardous areas. The platinum sensing element provides optimum stability, and the Temptran™ 4-20mA transmitter can be reconfigured for a variety of temperature ranges.

Installation

Installation of Connection Head, Sensor, and Temptran™

1. Unscrew the connection head from the fitting.
   NOTE: It is hand-tight and should not require tools.
   NOTE: The sensor fitting is factory welded in the correct position and cannot be removed from or repositioned on the probe.



2. Slide the probe, tip first, into position and thread the fitting into the process connection. Tighten using a 7/8” open-end or adjustable wrench.

3. Screw the connection head onto the back of the fitting and thoroughly tighten by hand.

4. Connect the Temptran™ as shown in Figure 1, observing the +/- polarity of the current loop. Maximum DC supply voltage = 35 VDC. The RTD leads of the same color should be connected to terminal block positions “2” and “3” for the transmitter to function properly.

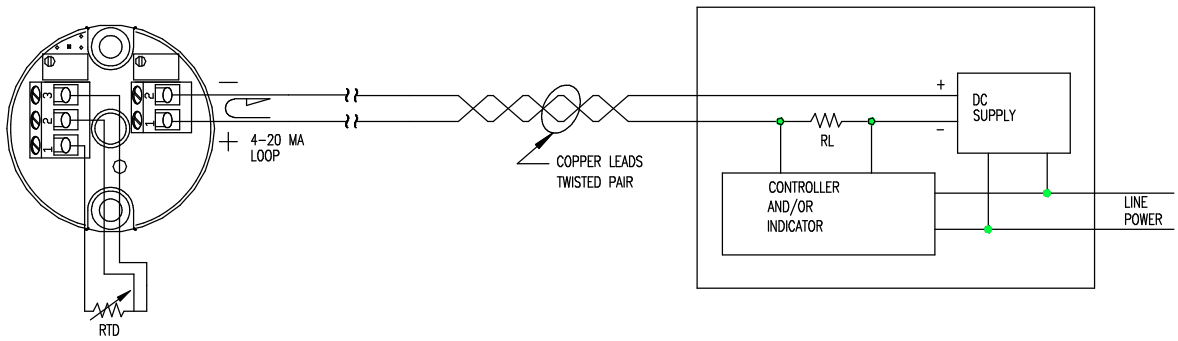


Figure 1

Configuration

Transmitter Calibration Procedure

1. Connect a 24 VDC power supply and a digital milliammeter (5-1/2 digit preferred) as shown in Figure 2, or use a loop calibrator instead of the DC power supply and milliammeter.

> Leads 1, 2, 3, and A are used for coarse adjustment of the temperature range. See **Changing the Transmitter Temperature Range** on page 5.

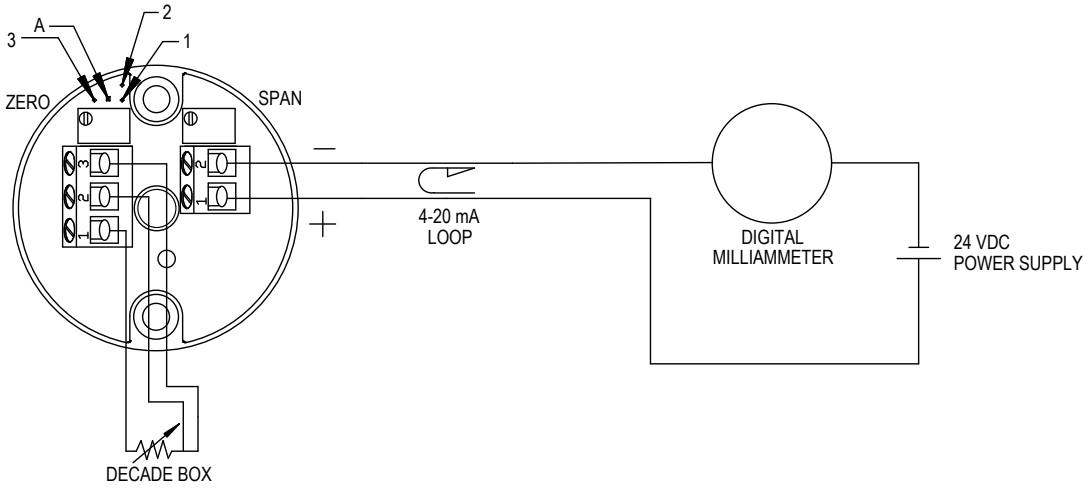


Figure 2

2. Connect a resistance decade box with a resolution of at least .01 ohms to the input of the transmitter. If unsure or concerned about the decade box's accuracy, measure the zero and span resistance settings using a known-accurate ohmmeter and record decade box settings before connecting the decade box to the transmitter.

3. Determine the temperature range by reading the label information on the side of the transmitter. For example, if the label reads “4mA = -20°F” and “20mA = 140°F”, then your temperature range is -20 to 140°F.

4. Set decade box resistance to emulate the RTD resistance at the 4 mA temperature. For the given example, the decade box should be set to emulate the RTD resistance at -20°F.

5. Adjust ZERO potentiometer on the transmitter until the milliammeter reads 4 mA.

6. Set decade box resistance to emulate the RTD resistance at the 20 mA temperature. For the given example, the decade box should be set to emulate the RTD resistance at 140°F.

7. Adjust SPAN potentiometer on the transmitter until the milliammeter reads 20 mA.

8. Repeat steps 4 - 8 until no further adjustment is necessary.

Changing the Transmitter Temperature Range

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

Changing the temperature range of the TT881 may require a coarse adjustment in addition to a fine adjustment. To perform the coarse adjustment (or determine if it's necessary), please follow these steps:

1. There is a limit to how much you can adjust the temperature range of the transmitter, based on the initial temperature range ordered from the factory. To determine the limits of adjustability, you must first calculate the temperature span, and then use Table 1 to find the adjustability limit code. The original (factory set) temperature range information can be found on the label of the transmitter. Calculate the temperature span by subtracting the 4mA temperature from the 20mA temperature.

   For example, model TT881PD1EN1 has an "EN" range code, which represents a temperature range of -20 to 140°F (4mA = -20°F, 20mA = 140°F). The calculated temperature span is 140°F – (-20°F) = 160°F. Using Table 1, the adjustability limits for this temperature span are: Zero: -60 to 125°F; Span: 90 to 360°F, and the adjustability limit code is "RB". The TT881PD1EN1 cannot be adjusted outside of these limits.

   Now suppose you want a temperature range of 20°F to 120°F. According to Table 1, this is a valid temperature range for the "RB" adjustability limits, since 20°F is within the zero range (-60 to 125°F), and 100°F (= 120°F – 20°F) is within the span range (90 to 360°F).

TT881 Adjustability Limit Codes for Coarse Adjustment of Temperature Range			
Temperature Span	**Zero Range (4 mA)**	**Span Range (20 mA – 4 mA)**	**Adjustability Limit Code**
Span ≤ 150°F	-15 to 75°F	45 to 180°F	RA
150°F < Span ≤ 300°F	-60 to 125°F	90 to 360°F	RB
Span > 300°F	-150 to 390°F	270 to 1080°F	RC

Table 1

2. Coarse adjustment is controlled by soldering one of the leads designated 1, 2, or 3, to lead A. Figure 2 on page 3 shows the location of these leads. First, calculate the temperature span of the desired range. Then, use Table 2 to determine the required solder connection for that temperature range.

   In our example, the span of our desired temperature range is 100°F. From step 1, we know our adjustability limit code is "RB". Table 2 shows us that a 100°F temperature span and "RB" limit code requires lead "1" to be connected to lead "A". Clearly this is different than the current connection (2-A), so it is necessary to unsolder lead "2" from lead "A", and solder lead "1" to lead "A".

Lead Connection	Span Range (20mA – 4mA)		
	RA Limit Code	RB Limit Code	RC Limit Code
1 – A	45 to 65°F	90 to 125°F	270 to 360°F
2 – A	65 to 90°F	125 to 180°F	360 to 540°F
3 – A	90 to 180°F	180 to 360°F	540 to 1080°F
Zero Range (4 mA)	-15 to 75°F	-60 to 125°F	-150 to 390°F

Table 2

3. Perform fine adjustment per the **Transmitter Calibration Procedure** on page 4.

Troubleshooting

Symptom	Cause	Solution	Page
Temperature reading is “stuck” below minimum temperature (less than 4 mA output)	Measured temperature is below calibrated 4 mA temperature	Change the transmitter temperature range and calibration	4-6
	RTD wired incorrectly	Connect red RTD wire to terminal block position 1, and white wires to terminal positions 2 and 3	3
	RTD short circuited (resistance less than 80Ω)	Replace RTD probe or entire assembly	n/a
	Less than 10 VDC supply voltage	Increase power supply voltage and/or reduce loop resistance	6
	Polarity reversed	Switch power supply leads	3
Temperature reading is “stuck” above maximum temperature (more than 20 mA output)	Measured temperature is above calibrated 20 mA temperature	Change the transmitter temperature range and calibration	4-6
	Poor RTD connection	Connect red RTD wire to terminal block position 1, and white wires to terminal positions 2 and 3	3
	RTD open circuited (resistance more than 2kΩ)	Replace RTD probe or entire assembly	n/a
Temperature reading is significantly different than expected	Controller is programmed to a different temperature range than transmitter	Program the controller to the same temperature range as the transmitter	n/a
	Improper calibration	Change the transmitter temperature range and calibration	4-6
	Less than 10 VDC supply voltage	Increase power supply voltage and/or reduce loop resistance	6
	Damaged RTD	Replace RTD probe or entire assembly	n/a

Frequently Asked Questions (FAQ)

How do I install a TT881 to maintain hazardous area certification?
Assemble and install per installation instructions herein, and follow appropriate electrical codes for the hazardous area classification and protection method.

Why wasn't the RTD wired to the transmitter when I received it?
Installation herein requires removal of the connection head. The RTD wires would have to be disconnected anyway, to avoid twisting.

Specifications

Temperature range:	Probe: -50 to 260°C (-58 to 500°F). Transmitter Operating: -40 to 85°C (-40 to 185°F). Transmitter Storage: -55 to 100°C (-67 to 212°F).
Material:	Probe/fitting: 316 stainless steel. Connection head: 316 stainless steel.
Pressure rating:	200 psi (13.8 bar).
Agency Approvals:	National and Canadian Electrical Code (FM and CSA): XP: Class I, Divisions 1 and 2, Groups B, C, and D, DIP: Class II, Groups E, F, and G, T6 (Ta = 40°C), T2 (Ta = 260°C), Ta limited to 160°C for CSA Class II. National Electrical Code (Article 505): Class I, Zones 1 and 2, AEx d IIC, T6 (Ta = 40°C), T2 (Ta = 260°C). Canadian Electrical Code (IEC 60079): Zones 1 and 2, Ex d IIC, T6 (Ta = 40°C), T2 (Ta = 260°C).
Transmitter Input:	3-wire 100 ohm, 1000 ohm platinum RTD.
Output:	4 to 20 mA DC over specified range.
Calibrated Accuracy:	±0.1% of span when factory calibrated.
Linearity:	±0.2% of span.
Adjustments:	Per Table 1 and Table 2.
Ambient Temperature Effects:	±0.018% of span/°C (±0.01% of span/°F).
Warmup Drift:	±0.1% of span max., assuming V_{SUPPLY} = 24 VDC and R_{LOOP} = 250 ohms. Stable within 15 minutes
Supply Voltage:	10 to 35 volts DC with no load. Reverse polarity protected.
Voltage Effect:	±0.001% of span per volt.
Lead Wire Compensation (3-wire RTD):	±0.05% of span per ohm, up to 25 ohms in each leg.
Maximum Load Resistance:	The maximum allowable resistance of the signal-carrying loop is given by this formula: $$R_{LOOP\ MAX} = \frac{(V_{SUPPLY} - 10)}{0.02\ amps}$$ Example: With supply voltage 24 VDC, maximum loop resistance is 700 ohms
Minimum Output Current:	2.2 mA.
Maximum Output Currrent:	28 mA.
Connections:	Terminal blocks accept wires from AWG 22 to AWG 14.
Physical:	Epoxy potted for moisture resistance.
Weight:	2.5 lbs (1145 g).

Dimensions

All dimensions are in inches (millimeters).

Transmitter:

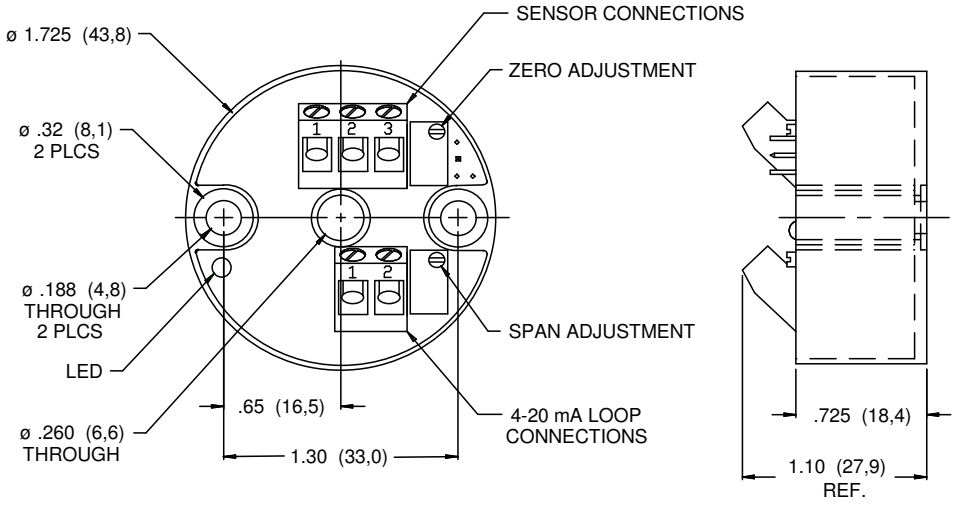


Figure 3

Probe Assembly:

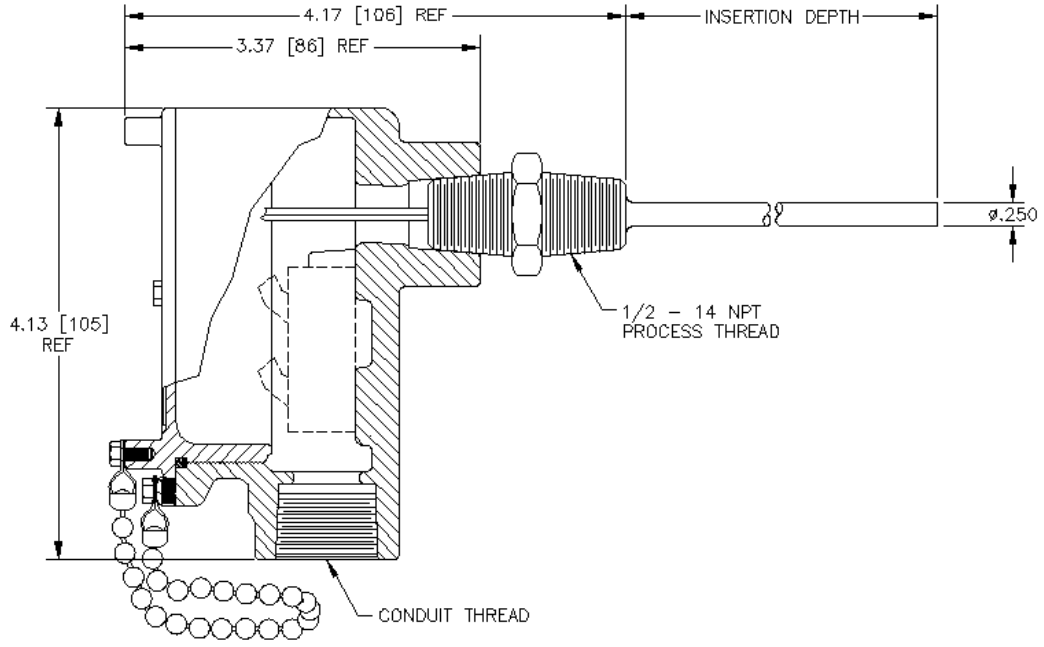


Figure 4

How to Order

TT881	**Model Number:** TT881 = RTD Temperature Transmitter in Explosionproof Housing
PW	**RTD Element Code:** PA = 100 Ω platinum (0.00392 Ω/Ω/°C) PB = 100 Ω platinum (0.00391 Ω/Ω/°C) PD = 100 Ω platinum (0.00385 Ω/Ω/°C) PE = 100 Ω platinum (0.00385 Ω/Ω/°C) PF = 100 Ω platinum (0.00385 Ω/Ω/°C) PW = 100 Ω platinum (0.00375 Ω/Ω/°C)
080	**Probe Length:** LLL in 0.1" increments (040 = 4.0"; 120 = 12.0"; 000 for "W" without sensor
E	**Form:** E = Duct mount P = Immersion W = Wall mount
1	**Output:** 1 = 4 to 20 mA DC
S	**Transmitter Temperature Range:** EN = -20°F to 140°F S = 0°F to 100°F A = 20°F to 120°F BI = 30°F to 130°F N = 32°F to 122°F (0°C to 50°C) H = 40°F to 90°F C = 32°F to 212°F (0°C to 100°C) BW = 32°F to 482°F (0°C to 250°C) SX = Special range as defined on job order – must fall within adjustment limits on transmitter. Consult factor for current list of available ranges.
1	**Calibration:** 1 = No calibration data, sensor or transmitter 2 = Sensor/Transmitter matched at 0°C with NIST/SI cert 3 = Sensor/Transmitter matched at 0, 100, & 260°C with NIST/SI cert
TT881PW080E1S1 ← Sample part number	

Warranty

Minco's warranty policy is specified in our Terms and Conditions, available at www.minco.com.