

# RTD Transmitter Installation Instructions

## RTDT Series Models



Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install this unit and make sure it conforms to NEC and local codes.

### GENERAL INFORMATION

# WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.

### Description

The Murphy RTD transmitter is designed to accept a signal from an RTD sensing element, and to provide a linearized 4 to 20 mA output current. The output current is directly proportional to the temperature of the RTD temperature sensor. Since the temperature is converted to a current signal, voltage drops in the power supply leads to the transmitter have no effect on the integrity of the signal. As long as the transmitter has sufficient DC voltage at its terminals, it will produce a current linearly proportional to temperature. This means that the transmitter may be remote mounted but should be near the sensor, reducing the effects of noise and minimizing errors due to long leads on the RTD sensor. The RTD instruments have screw terminal connections and accept 2 or 3 wire RTD's\*. They include high resolution, 24-turn zero and span potentiometers and each unit is calibrated after a minimum of 48 hours burn-in and checkout time.

\*Three wire RTD's compensate for leadwire resistance.

### Specifications

- Sensor Input: Platinum RTD 100 ohms
- Output Span: 4 to 20 mA
- Loop Power Supply Voltage: Typically 24 VDC; when using Loop Resistance Graph 13 – 40 VDC.
- Temperature Span: 50°F (28°C) minimum; 1000°F (556°C) maximum
- Calibrated Accuracy: 0.1 %
- Conformity: 0.1 % of Span
- Ranges: -60 to 140°F; 0 to 400°F
- Ambient Temperature Limits: -30 to 165°F (-34 to 74°C)
- Power Supply Effect: 0.001% volt
- Current: 3.4 mA minimum; 30 mA maximum.
- Upscale Burnout: Standard
- Reversed Polarity Protection: Standard
- Nominal Zero and Span Adjustments: ±10%
- Connections: Screw Terminal

### Power Supply

Transmitters are designed for a nominal 24 VDC power supply. They will operate with a 13 to 40 VDC supply at the transmitter power supply terminals. Use the following formulas to determine maximum resistive loading (RL) allowed for the power supply used, or to determine minimum supply voltage (V) required for fixing resistive loads. Formulas assume a max. current of 20 mA.

**NOTE:** Devices such as Murphy's EMS Series controllers, 400 and 500 Series PLC controllers, and the RMU16 have 250 ohms resistors that add to the resistive loading.

### Power Supply Voltage (Minimum)

$$V = (0.02 \text{ A} \times \text{RL}) + 13 \text{ V}$$

**Example:**

550 ohm load

$$V = 0.02 \times 550 + 13$$

V = 24 VDC minimum power supply

### Resistive Load (Maximum)

$$\text{RL} = (V - 13) / 0.02$$

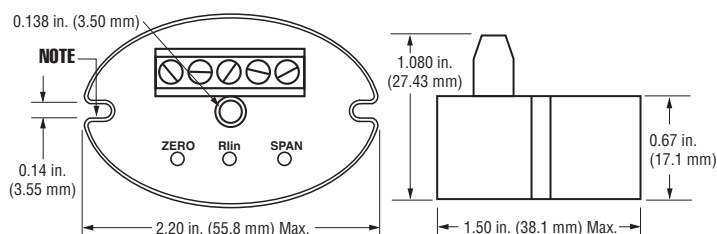
**Example:**

24 VDC power supply

$$\text{RL} = (24 \text{ V} - 13 \text{ V}) / 0.02$$

RL = 550 ohm maximum

### Dimensions

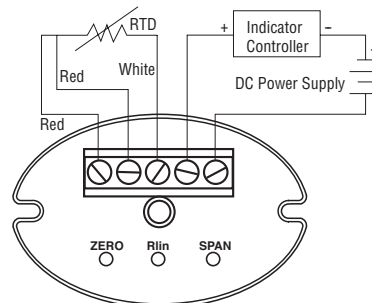


**NOTE:** Slot accepts 6-32 screw

### Wiring

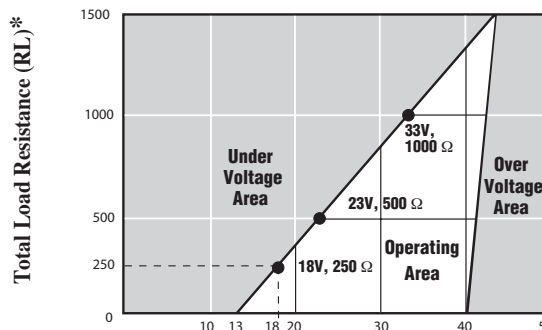
**CAUTION:** Do Not connect power to the RTD input. Do Not connect power to the RTD itself. Do Not use AC line power.

The terminal strip on the transmitter accepts 14 to 22 gauge wires. Copper wire is to be used since special compensation wire is not required. Route all transmitter wiring in separate conduit to isolate it from high voltage or high current carrying lines. It is also recommended that shielded wire be used for the 4-20 mA signal.



### Loop Resistance Graph

Supply voltage for the RTDT must be within 13-40 VDC. The figure below shows the minimum supply voltage (VDC) required for a given load resistance (RL).

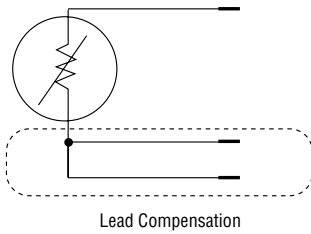


**Power Supply Voltage (VDC)**

\*NOTE: Cable resistance effect included in RL.

## Open Sensor Indication

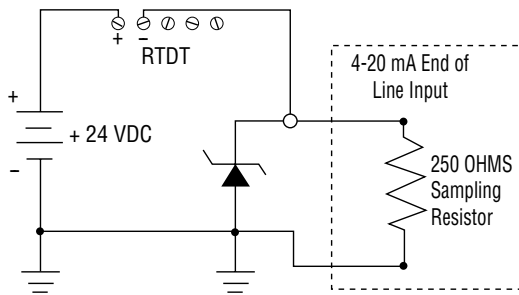
When an RTD has failed due to an open sensor (broken path in the element), the transmitter will indicate an error. The way the error is produced is by driving the current high, above 20 mA (upscale burnout). However, the burnout indication does not apply to breaks in the lead compensation loop.



## Application Hints

The calibrated output of the Murphy Transmitter is 4.0 to 20.0 mA. However, the lower and upper limit of output current is approximately 3.4 and 30 mA respectively. This means that for the system using a 250 ohm resistor (1 to 5 V), the maximum voltage could be as high as 7.5 volts (30 mA x 250 ohms) in the case of an open RTD. Some computer-based systems will not tolerate input voltages greater than approximately 5.5 volts. Instead of selecting a different scaling resistor (167 ohms for example gives 5 V for an open RTD), a 5.1 V zener diode in parallel with the scaling resistor will clamp the voltage across the scaling resistor to 5.1 V while still allowing the calibrated range to remain 1 to 5 volts. See figure below.

The transmitter dissipates power according to the formula: **Power = Volts x Amps**. The dissipated power is equal to the voltage at the transmitter's terminals multi-



plied by the operating current. A transmitter with 24 volts at its terminal and with maximum current (30 mA for an open RTD) will dissipate 0.7 watts of power. This can be significant if the RTD sensor can be affected by thermal gradients from the transmitter.

## RTDT Calibration

Murphy RTD transmitter modules are factory calibrated. Please DO NOT attempt to recalibrate unless the proper equipment is available. If recalibration is necessary, a Zero, Rlin, and Span adjustment can be made from the top of the unit. A precision RTD simulator with a traceable calibration must be used. Consult a book of tables for resistance values.

1. With a resistance value corresponding with the temperature at 4.0 mA, adjust the zero potentiometer for 4.0 mA output.
2. With a resistance value corresponding with temperature at 12.0 mA, adjust the Rlin potentiometer for 12.0 mA output.
3. With a resistance value corresponding with the temperature at 20.0 mA, adjust the span potentiometer for 20.0 mA output.
4. The zero, Rlin and span adjustments are interactive. Repeat steps 1, 2, and 3 as necessary.

### Example 1:

1. If range equals 50 -250°, then span equals 200°
2. Divide 200° by 2:  $200^\circ \div 2 = 100^\circ$
3. Add 100° to lower end of range:  $50^\circ + 100^\circ = 150^\circ$
4. 50° equals the **Zero** point (4 mA)
5. 150° equals 50% of the **Span** (12 mA) (Rlin)
6. 250° equals the **Span** point (20 mA)

### Example 2:

1. Set zero at 4.0 mA for -100°F (70.95 Ω)
2. Set Rlin at 12.0 mA for 0°F (93.01 Ω)
3. Set span at 20.0 mA for 100°F (114.68 Ω)

## Troubleshooting

### Problem

No current flow on signal loop

Current over 20 mA

Erratic readings

### Possible causes

Current loop open at some point.  
No voltage out at power supply.  
Wrong polarity on loop supply.

RTD is open.  
Current loop connections shorted.

Loose connection in RTD or signal loop.  
Damaged RTD.  
AC noise on loop connections.  
Exceeds loop resistance R.

## Warranty

A limited warranty on materials and workmanship is given with this FW Murphy product. A copy of the warranty may be viewed or printed by going to [www.fwmurphy.com/support/warranty.htm](http://www.fwmurphy.com/support/warranty.htm)



**FW Murphy**  
P.O. Box 470248  
Tulsa, Oklahoma 74147 USA  
+1 918 317 4100  
fax +1 918 317 4266  
e-mail [sales@fwmurphy.com](mailto:sales@fwmurphy.com)  
[www.fwmurphy.com](http://www.fwmurphy.com)

**CONTROL SYSTEMS & SERVICES DIVISION**  
P.O. Box 1819; Rosenberg, Texas 77471; USA  
+1 281 633 4500 fax +1 281 633 4588  
e-mail [sales@fwmurphy.com](mailto:sales@fwmurphy.com)

**MURPHY DE MEXICO, S.A. DE C.V.**  
Bld. Antonio Rocha Cordero 300, Fracción del Aguaje  
San Luis Potosí, S.L.P.; México 78384  
+52 444 8206264 fax +52 444 8206336  
Villahermosa Office +52 993 3162117  
e-mail [ventas@murphymex.com.mx](mailto:ventas@murphymex.com.mx)  
[www.murphymex.com.mx](http://www.murphymex.com.mx)

**FRANK W. MURPHY, LTD.**  
Church Rd.; Laverstock, Salisbury SP1 1QZ; U.K.  
+44 1722 410055 fax +44 1722 410088  
e-mail [sales@fwmurphy.co.uk](mailto:sales@fwmurphy.co.uk)  
[www.fwmurphy.co.uk](http://www.fwmurphy.co.uk)

**MURPHY SWITCH OF CALIFORNIA**  
41343 12th Street West  
Palmdale, California 93551-1442; USA  
+1 661 272 4700 fax +1 661 947 7570  
e-mail [sales@murphyswitch.com](mailto:sales@murphyswitch.com)  
[www.murphyswitch.com](http://www.murphyswitch.com)

**MACQUARRIE CORPORATION**  
1620 Hume Highway  
Campbellfield, Vic 3061; Australia  
+61 3 9358 5555 fax +61 3 9358 5558  
e-mail [murphy@macquarrie.com.au](mailto:murphy@macquarrie.com.au)

